

Oracle Cloud Infrastructure

*Build cloud-native applications with
Oracle Cloud Infrastructure (OCI)*

Vijay Kumar



www.bpbonline.com

First Edition 2024

Copyright © BPB Publications, India

ISBN: 978-93-55516-312

All Rights Reserved. No part of this publication may be reproduced, distributed or transmitted in any form or by any means or stored in a database or retrieval system, without the prior written permission of the publisher with the exception to the program listings which may be entered, stored and executed in a computer system, but they can not be reproduced by the means of publication, photocopy, recording, or by any electronic and mechanical means.

LIMITS OF LIABILITY AND DISCLAIMER OF WARRANTY

The information contained in this book is true to correct and the best of author's and publisher's knowledge. The author has made every effort to ensure the accuracy of these publications, but publisher cannot be held responsible for any loss or damage arising from any information in this book.

All trademarks referred to in the book are acknowledged as properties of their respective owners but BPB Publications cannot guarantee the accuracy of this information.

To View Complete
BPB Publications Catalogue
Scan the QR Code:



www.bpbonline.com

[Kup książkę](#)

Dedicated to

*My wonderful mother **Sushila***

and

*My loving wife **Preeti***

About the Author

Vijay Kumar has been working in IT industry for more than 12 years and have played different roles in multiple projects as IT Analyst, Consultant and project lead. He has delivered IT Modernization, Automation and Migration projects using VMware and cloud technologies for Financial Institutions, Government agencies, Telecom and Enterprise customers in India, Europe and the United States.

Currently he is working as a Cloud Solution Architect at Oracle with a focus on leveraging Oracle Cloud VMware Solution for DC evacuation and modernization. He is a Bachelor of Technology and is currently pursuing his post-graduate in Machine Learning and Artificial Intelligence with a focus on Generative AI.

He also holds multiple professional architect certifications from AWS, GCP, Oracle and VMware and is a Certified Kubernetes Administrator, Application Developer and Security Specialist. Furthermore, He takes part in multiple online forums dedicated to cloud technologies and also writes a personal IT blog dedicated to all things in cloud.

About the Reviewers

- ❖ **Abhishek Sirohi** is a seasoned backend engineer with over 7 years of expertise in designing and developing scalable fintech, ecommerce, and cloud applications. Currently, he plays a pivotal role in the Identity team at Oracle Cloud Infrastructure, overseeing critical resources such as User, Groups, and Policies.

During his leisure time, Abhishek indulges in non-fiction literature and is an avid enthusiast of TV series, with a particular passion for Game of Thrones.

- ❖ **Naresh Kumar Miryala**, a distinguished engineering leader at Meta, possesses an extensive background in cloud and platform engineering honed over nearly two decades in the field. His deep understanding of both technical and business intricacies empowers him to pioneer innovative solutions spanning diverse domains such as database systems, large-scale backend infrastructure, multi-cloud environments (AWS/GCP/OCI/Azure), automation, cloud infrastructure, DevOps, Kubernetes, and Elasticsearch.

He is an adept engineering executive and technologist with extensive experience in working with cloud migrations, infrastructure implementation, database management, ERP solutions, DevOps deployments.

Naresh is highly experienced in cloud migrations, particularly involving databases (Oracle/Exadata/MySQL/Postgres) and applications (EBS/Fusion/EPM/GTM). He played a pivotal role in ensuring their seamless execution. His experience in implementing infrastructure, databases, ERP solutions, and deployments has granted him a comprehensive understanding of the multifaceted technical and business challenges intrinsic to such projects.

His affiliations include membership in IEEE, OATUG, AIM leadership council, and fellowship at RSA. He holds certifications as a professional in Cloud and Database platforms, and actively engages as a blogger, tech reviewer, and frequent speaker in international conferences.

Acknowledgement

I want to express my deepest gratitude to my family and friends for their unwavering support and encouragement throughout this book's writing, especially my mother, wife and kids. They have been a rock throughout this journey.

Moreover, I am also grateful to BPB Publications for their guidance and expertise in bringing this book to fruition and giving me a chance to share my knowledge with a wider audience.

I would also like to acknowledge the valuable contributions of my colleagues and co-worker during many years working in the tech industry, who have taught me so much and provided valuable feedback on my work.

Finally, I would like to thank all the readers who have taken an interest in my book and for their support in making it a reality. Your encouragement has been invaluable.

Preface

Cloud Native Applications are at the heart of every agile, fast paced, and adaptive organization. These applications greatly reduce the time to market for a new business idea, can be quickly modified based on user feedback and evolve over time to meet the changing business requirements.

However, building cloud native applications is quite different than building traditional applications. These need extensive experience on public cloud services, application architecture and at time can be quite expensive to start with.

The book starts off with an introduction to Oracle Cloud Infrastructure and takes you through OCI cloud native services which can help you easily navigate the build of your first cloud native applications. The book also covers the *Why* of cloud native applications and talks about traditional application development methods and contrasts these with rapidly growing DevOps methodology. Additionally, the book covers No Code/ Low Code, AI and Data Solutions available to developers on OCI.

The book introduces you to the exciting world of cloud native applications, helps you understand why these applications are the need of the hour, how the cloud native applications help businesses drive and adopt to changes at a faster rate. By going through the book, you will understand the key component of OCI and Service available on the cloud to build, manage and run Cloud Native apps.

This book is intended for application developers, operators and architects who are starting to look at the cloud as an increasingly viable option to build and run business applications. The book is also helpful for cloud experts and introduces them to the core concepts of Oracle Cloud and dives deep into different Oracle Cloud Native services.

Chapter 1: Oracle Cloud Infrastructure: Overview and Getting Started - Oracle Cloud Infrastructure or simply OCI is an enterprise cloud service, tailored to run any application be it Traditional or Cloud Native. In this chapter we are going to learn about Oracle Cloud Infrastructure, how it is different from any other public cloud and how to get started with **Oracle Cloud Infrastructure (OCI)**. We will see how to create an account on OCI, explore the cloud UI and understand different cloud service categories ie IaaS, PaaS and SaaS.

Chapter 2: Introduction to Cloud-Native Applications – This chapter outlines what is a cloud native application. We will look at the evolution of application development methodologies from Waterfall to Agile to DevOps. The chapter also outlines the why and how of Cloud Native apps – why we need cloud native apps and their popularity. The difference between cloud native apps different and traditional applications.

Every breakthrough or trend in technology can be traced back to business challenges and requirements. We will see what are some business and technological challenges that cloud native applications solve and how these applications can fuel business growth.

Chapter 3: Cloud-Native Services in Oracle Cloud Infrastructure – This chapter gives you a sneak peek into all the cloud native services the OCI has to build, run and manage your applications. This chapter provides a brief description of major Platform services that we are going to dive deeper into in the upcoming chapters. We will also talk about different use cases where these services can be used and some alternatives to these services.

Chapter 4: Infrastructure as Code with OCI – One of the fundamental principles of DevOps is to treat underlying infrastructure as application resource and manage it with the same principles. This chapter introduces the imperative and declarative method to building and managing infrastructure required to run cloud applications. The chapter also covers Terraform for resource management and OCI Resource Manager, which can be used to define, manage and maintain Oracle Cloud resources using Terraform code. The chapter also provides example code to deploy Virtual Machines and Networks to get started with Resource Manager.

Chapter 5: Containers and Container Instances in OCI – This chapter goes into details of Containers, we look at the brief history of how containers came to be synonymous with agile, scalable and highly performant systems. We also go into details of how to build and run containers.

The chapter also outlines Container Instance service on OCI and how you can use Container Instances to run containers on serverless compute without the hassle of setting up infrastructure, networking and security for your application containers.

Chapter 6: OCI Container Registry – In this chapter we focus on Container Registry, understand how you can use this service to store, manage and secure application images. We will also understand the basics of repositories, tagging, image management, updates and security best practices when working with a public or private container registry.

Chapter 7: OCI Container Engine for Kubernetes – With the popularization of Containers, Kubernetes has become synonymous with Cloud Native applications. This chapter provides a brief overview of Kubernetes and how it is being used to fuel the growth of cloud native applications. We will see how Kubernetes lets you build platform independent, self-healing and scalable applications irrespective of underlying infrastructure.

We will also learn about Container Engine for Kubernetes, this service from Oracle Cloud Infrastructure lets you build, run and manage Kubernetes clusters on demand. We will learn how to create these clusters, how to control access, build pod networks, manage security, updates and upgrades.

Chapter 8: Serverless with OCI Functions – This chapter focuses on Oracle Cloud Infrastructure Functions service. Functions service lets you run your application code without building the underlying infrastructure or platform. We will explore different runtimes supported by OCI functions, build a test function, explore the management, access control and observability for the functions. We will also look at how you can integrate the functions with OCI Events to automate the application execution.

Chapter 9: APIs and OCI API Gateway – API's gives the developers freedom to build their application in small, standardized parts and seamlessly integrate those parts by abstracting the underlying code. This chapter sheds light on what are API's, what are the benefits of using APIs in your application and how can you use API Gateway on OCI to host and manage your API's. We also look at how to create and manage API Gateways and Resources in the cloud along with securing the resources.

Chapter 10: OCI Events and Streaming Service – This chapter focuses on the Event and Streaming services in OCI. We look at different type of events generated by OCI services and resources, go through the filters available for these rules and discuss how you can use the event rules to automate parts of your application.

We will also get an overview of Streaming service, understand the pub-sub model, how you can build and use streams for your applications and see how Streaming service integrates with Apache Kafka.

Chapter 11: Low Code/No Code Platform in OCI – OCI provides many low code/no code services to build your next application. We start by looking at Visual Builder, see how to setup visual builder instances and manage these instances. Then we get to Visual Builder Studio, look at how to setup Visual Builder studio, integrate it with CI/CD tools and pipelines and manage the deployments.

Chapter 12: AI Services for Developers – In this chapter, we look at different pretrained and customizable models available on OCI for the application developers. We'll see how to use Digital Assistant to integrate chatbots to you applications, use Vision to detect, classify and extract text from images and use Forecasting to predict future trends from gathered data.

Chapter 13: Database Solutions Overview for Developers – This chapter goes into details of OCI Data Solutions and focuses on Autonomous databases, build, run and management of these databases along with NoSQL services to work with applications dealing with large amount of unstructured data.

Code Bundle and Coloured Images

Please follow the link to download the
Code Bundle and the *Coloured Images* of the book:

<https://rebrand.ly/x0zw0fz>

The code bundle for the book is also hosted on GitHub at
<https://github.com/bpbpublications/Oracle-Cloud-Infrastructure>.

In case there's an update to the code, it will be updated on the existing GitHub repository.

We have code bundles from our rich catalogue of books and videos available at
<https://github.com/bpbpublications>. Check them out!

Errata

We take immense pride in our work at BPB Publications and follow best practices to ensure the accuracy of our content to provide with an indulging reading experience to our subscribers. Our readers are our mirrors, and we use their inputs to reflect and improve upon human errors, if any, that may have occurred during the publishing processes involved. To let us maintain the quality and help us reach out to any readers who might be having difficulties due to any unforeseen errors, please write to us at :

errata@bpbonline.com

Your support, suggestions and feedbacks are highly appreciated by the BPB Publications' Family.

Did you know that BPB offers eBook versions of every book published, with PDF and ePub files available? You can upgrade to the eBook version at www.bpbonline.com and as a print book customer, you are entitled to a discount on the eBook copy. Get in touch with us at :

business@bpbonline.com for more details.

At **www.bpbonline.com**, you can also read a collection of free technical articles, sign up for a range of free newsletters, and receive exclusive discounts and offers on BPB books and eBooks.

Piracy

If you come across any illegal copies of our works in any form on the internet, we would be grateful if you would provide us with the location address or website name. Please contact us at **business@bpbonline.com** with a link to the material.

If you are interested in becoming an author

If there is a topic that you have expertise in, and you are interested in either writing or contributing to a book, please visit **www.bpbonline.com**. We have worked with thousands of developers and tech professionals, just like you, to help them share their insights with the global tech community. You can make a general application, apply for a specific hot topic that we are recruiting an author for, or submit your own idea.

Reviews

Please leave a review. Once you have read and used this book, why not leave a review on the site that you purchased it from? Potential readers can then see and use your unbiased opinion to make purchase decisions. We at BPB can understand what you think about our products, and our authors can see your feedback on their book. Thank you!

For more information about BPB, please visit **www.bpbonline.com**.

Join our book's Discord space

Join the book's Discord Workspace for Latest updates, Offers, Tech happenings around the world, New Release and Sessions with the Authors:

<https://discord.bpbonline.com>



Table of Contents

1. Oracle Cloud Infrastructure: Overview and Getting Started.....	1
Introduction.....	1
Structure.....	1
Objectives.....	2
Overview of Oracle Cloud Infrastructure.....	2
<i>Off-box virtualization</i>	2
<i>Non-blocking networks</i>	3
<i>Remote direct memory access cluster networking</i>	3
<i>Flexible infrastructure</i>	3
Getting started with Oracle Cloud.....	4
OCI regions.....	4
Availability domains.....	4
Fault domains.....	4
Tenancy.....	5
Compartment.....	5
Subscription.....	5
Identity domains.....	5
Identity policies.....	6
Virtual cloud network.....	6
Creating an account with Free Tier.....	6
First time login and multi-factor authentication setup.....	8
Cloud portal walkthrough.....	9
Understanding service categories.....	10
Compute.....	10
Storage.....	10
Networking.....	11
Oracle database.....	11
Databases.....	11
Analytics and artificial intelligence.....	11

<i>Developer services</i>	11
<i>Identity and security</i>	11
<i>Observability and management</i>	12
<i>Hybrid</i>	12
<i>Migration and disaster recovery</i>	12
<i>Billing and cost management</i>	12
Conclusion.....	12
2. Introduction to Cloud-Native Applications	13
Introduction.....	13
Structure.....	13
Objectives.....	13
Introduction to cloud-native applications	14
Cloud-native application foundation	17
<i>Cloud infrastructure</i>	17
<i>Application containers</i>	17
<i>Microservices</i>	18
<i>Supporting services</i>	19
<i>Automation and DevOps</i>	19
Benefits of Cloud-native applications	20
<i>Business benefits</i>	20
<i>Adaptability</i>	20
<i>Scalability</i>	21
<i>Time to market</i>	21
<i>Reduced cost of ownership</i>	22
<i>Avoid vendor lock-in</i>	22
<i>Improved customer experience</i>	22
<i>Technical benefits</i>	23
<i>High availability and reduced downtimes</i>	23
<i>Streamlined operations and management</i>	23
<i>Portability</i>	24
Conclusion.....	24
References	24

3. Cloud-Native Services in Oracle Cloud Infrastructure	25
Introduction.....	25
Structure.....	25
Objectives.....	26
Introduction to cloud-native services.....	26
Containers, platform, and serverless services.....	27
<i>Container instances</i>	<i>27</i>
<i>Container registry</i>	<i>28</i>
<i>Container engine for Kubernetes</i>	<i>29</i>
<i>Cloud functions</i>	<i>31</i>
Events, streaming, and API services.....	31
<i>Events service</i>	<i>32</i>
<i>Streaming service.....</i>	<i>33</i>
<i>API gateway and API management</i>	<i>34</i>
Database and AI/ML services	35
<i>Autonomous database</i>	<i>35</i>
<i>Exadata database service.....</i>	<i>35</i>
<i>Oracle Base database service.....</i>	<i>36</i>
AI/ML services.....	36
<i>OCI digital assistant</i>	<i>36</i>
<i>OCI language</i>	<i>36</i>
<i>OCI speech.....</i>	<i>36</i>
<i>OCI vision</i>	<i>37</i>
<i>OCI anomaly detection.....</i>	<i>37</i>
IaC, DevOps, and low code/no code	37
<i>Resource manager</i>	<i>37</i>
<i>DevOps</i>	<i>38</i>
<i>Oracle APEX and Visual Builder Studio</i>	<i>39</i>
Conclusion.....	40
References	40
4. Infrastructure as Code with OCI	41
Introduction.....	41
Structure.....	41

Objectives.....	42
Introduction to Infrastructure as Code.....	42
<i>Imperative approach to Infrastructure as Code</i>	43
<i>Declarative approach to Infrastructure as Code</i>	44
Benefits	44
<i>Repeatable infrastructure</i>	45
<i>Speed</i>	45
<i>Versioning</i>	45
<i>Reusable components</i>	45
Introduction to Terraform	46
<i>Terraform providers</i>	47
Getting started with Terraform	47
<i>Terraform with OCI Cloud Shell</i>	48
<i>Accessing Cloud Shell</i>	48
<i>Installing Terraform on workstations</i>	49
<i>Deploying OCI resources with Terraform</i>	51
Introduction to OCI Resource Manager	58
Getting started with Resource Manager	59
<i>Creating Resource Manager stack</i>	59
<i>Edit Terraform configuration</i>	61
<i>Drift detection in Resources Manager</i>	65
Conclusion.....	67
References	67
5. Containers and Container Instances in OCI.....	69
Introduction.....	69
Structure.....	70
Objectives.....	70
Introduction to containers	70
Benefits of containers	72
<i>Speed</i>	72
<i>Portability</i>	72
<i>Scale</i>	72
<i>Modularity</i>	73

Security and isolation	73
Getting started with containers	73
Installing Docker	74
Dockerfile for a sample container	75
Docker image management	76
Building Docker image	76
Container repository for centralized storage	78
Lifecycle of a container	80
Running docker container	80
Stopping a container	81
Securing the containers	81
Reduce image attack surface	82
Manage container privileges	82
Secure registries	82
Secure the infrastructure platform	83
Overview of container instances	83
Container instances shapes	84
Ephemeral storage	85
Getting started with container instances	86
Creating container instance	86
Managing container instance lifecycle	93
Stopping a container instance	93
Starting a container instance	93
Restarting a container instance	93
Deleting a container instance	93
Monitoring container instances	93
Conclusion	94
6. OCI Container Registry	95
Introduction	95
Structure	95
Objectives	96
Overview of container registry	96
Container registry concepts	96

<i>Images</i>	97
<i>Repository</i>	97
<i>Tenancy namespace</i>	98
<i>Region key</i>	98
<i>Repository path</i>	98
<i>Image path</i>	98
Getting started with Oracle container registry	99
Create an auth token	99
Create repository using OCI console	101
Container registry login	102
Pushing an image to container registry	102
Pulling an image from Oracle registry	104
Image management with Oracle container registry	105
View image details	105
Deleting and unversioning an image	105
Delete an image	106
Unversioning an image	106
Image retention policies	106
Edit the global image retention policy	106
Define, assign, and remove custom retention policy	107
Securing images	107
Access control with IAM policies	108
Signing images	108
Generate a master encryption key	109
Sign the image with MEK	109
Vulnerability scanning	111
Conclusion	112
7. OCI Container Engine for Kubernetes	113
Introduction	113
Structure	114
Objectives	114
Overview of Kubernetes	114
Scalability	115

<i>High availability</i>	115
<i>Portability</i>	115
<i>Cost effectiveness</i>	115
<i>Increased agility and productivity</i>	116
Kubernetes concepts	116
<i>Nodes</i>	117
<i>Pods</i>	117
<i>Deployments</i>	117
<i>Scheduling</i>	118
<i>Networking</i>	118
<i>Storage</i>	119
<i>Services</i>	119
<i>Namespace</i>	120
Introduction to Container Engine for Kubernetes	121
Building and managing OKE clusters	123
<i>OKE OCI pre-requisites</i>	123
<i>Quota or service limits</i>	123
<i>Networking</i>	123
<i>Creating OKE clusters</i>	128
<i>Accessing OKE cluster</i>	130
<i>Scaling OKE cluster</i>	131
<i>Scale cluster by adding node pools</i>	131
<i>Scaling existing node pools</i>	132
<i>Pod networking with OKE</i>	132
<i>VCN-native pod networking</i>	133
<i>Flannel overlay</i>	133
<i>Storage for OKE clusters</i>	134
<i>Running a sample application on OKE</i>	134
Conclusion	138
8. Serverless with OCI Functions	139
Introduction	139
Structure	140
Objectives	140

Overview of serverless	140
<i>Reduced time to market</i>	141
<i>Cost effective</i>	141
<i>Scalability</i>	141
<i>Automation</i>	142
Introduction to OCI Functions	142
Build and run OCI Functions.....	144
<i>Creating an application</i>	145
<i>Configuring Cloud Shell dev environment</i>	146
<i>Deploying test function with OCI Functions</i>	149
<i>Decoding the hello-world function</i>	149
<i>Review deployed function</i>	150
<i>Managing function configurations</i>	151
<i>Changing default timeout and memory settings</i>	151
<i>Using provisioned concurrency</i>	152
<i>Custom configuration parameters</i>	153
Logs and traces in OCI Functions	154
Security with OCI Functions.....	156
<i>Securing the Functions image</i>	156
<i>Securing the Docker container</i>	156
<i>Securing access with IAM policies</i>	157
Conclusion.....	157
9. APIs and OCI API Gateway	159
Introduction.....	159
Structure.....	160
Objectives.....	160
Overview of APIs	160
REST	161
SOAP	161
RPC.....	162
<i>External APIs</i>	162
<i>Private APIs</i>	162
<i>Partner APIs</i>	163

Introduction to OCI API gateway	163
<i>Centralized management</i>	164
<i>Scalability</i>	164
<i>Security</i>	165
<i>API gateway</i>	165
<i>API deployments and deployment specification</i>	166
<i>Backend</i>	166
<i>Routes</i>	166
<i>Policies</i>	166
Building and managing API gateway	166
<i>Creating deployment</i>	167
<i>IAM policy details</i>	169
<i>Creating deployment with multiple backend</i>	170
Backends and policies in API gateway	174
<i>HTTP/S backend</i>	174
<i>OCI Function backend</i>	174
<i>Stock response</i>	175
<i>Logout backend</i>	175
<i>Dynamic backend selection</i>	175
<i>Request limiting policy</i>	176
<i>Response caching</i>	176
<i>Modifying request and responses</i>	176
<i>Request header transformation</i>	177
<i>Response header transformation</i>	177
<i>Query parameter transformation</i>	177
Usage plans and subscribers	177
<i>Update API deployment specification</i>	178
<i>Create usage plans</i>	179
<i>Creating subscribers</i>	180
Monitoring and logging in API gateway	181
<i>API gateway metrics</i>	181
<i>API deployment metrics</i>	182
<i>Enable logging for API deployments</i>	183

Security with API gateway.....	184
<i>Cross-origin resource sharing</i>	184
<i>Custom domains and certificates</i>	185
<i>Mutual TLS and custom trust stores</i>	186
Conclusion.....	188
10. OCI Events and Streaming Service	189
Introduction.....	189
Structure.....	190
Objectives.....	190
Event-driven architecture.....	190
Introduction to OCI Events service.....	192
Automation with OCI Events.....	194
<i>Creating Events rules</i>	195
<i>Access control for Events and Event service</i>	196
<i>Modifying event rules</i>	197
<i>Validating Event rule</i>	198
OCI streaming service overview.....	199
Working with OCI streaming service.....	201
<i>Publishing messages to OCI stream</i>	202
<i>Consuming messages from stream</i>	204
<i>Streaming with Kafka</i>	205
Conclusion.....	206
11. Low Code/No Code Platform in OCI.....	207
Introduction.....	207
Structure.....	208
Objectives.....	208
Introduction to low code/no code.....	208
<i>Speedy delivery</i>	209
<i>Increased productivity</i>	209
<i>Reduced cost</i>	209
<i>Scalability</i>	210
Introduction to Oracle APEX.....	210

Getting Started with Oracle APEX.....	211
<i>Creating APEX instance in Oracle cloud</i>	211
<i>Creating workspaces</i>	212
<i>Deploy sample APEX application</i>	214
Introduction to Visual Builder Studio	217
<i>Create Visual Builder Studio instance</i>	217
<i>Creating a new project</i>	218
<i>Creating a workspace and Web app</i>	219
Conclusion.....	220
12. AI Services for Developers	221
Introduction.....	221
Structure.....	222
Objectives.....	222
Overview of AI and ML.....	222
<i>Supervised learning</i>	223
<i>Classification algorithms</i>	224
<i>Regression algorithm</i>	224
<i>Unsupervised learning</i>	225
<i>Clustering</i>	225
<i>Association</i>	226
<i>Reinforcement learning</i>	226
<i>Deep learning</i>	227
Overview of AI services in OCI.....	227
<i>Overview of OCI speech</i>	228
<i>Transcribing a file</i>	229
<i>Overview of vision</i>	231
<i>Overview of language service</i>	235
<i>Text translation example</i>	236
<i>Text analytics example</i>	236
<i>Overview of document understanding</i>	238
<i>Text extraction example</i>	239
<i>Table extraction example</i>	240
<i>Key value extraction example</i>	241

Document classification example	242
Overview of digital assistant	243
Overview of anomaly detection	244
Conclusion.....	245
13. Database Solutions Overview for Developers.....	247
Introduction.....	247
Structure.....	248
Objectives.....	248
Introduction to cloud databases	248
Core concepts and fundamentals	249
Self-managed solutions.....	249
Managed solution.....	250
Relational databases	250
Non-relational databases	251
Benefits of cloud database solutions.....	251
Simplified operations	251
Lower TCO	252
Secure and reliable	252
Scalability and higher agility.....	252
Newer features	253
Overview of Oracle cloud database services.....	253
OCI base database service	254
OCI base database editions.....	254
OCI base database deployment options	255
Licensing options.....	255
Deploying a base database in OCI	256
Exadata database on dedicated infrastructure overview.....	259
Exadata architecture.....	260
OCI Exadata service.....	261
Billing and metering	261
Licensing and supported database versions	262
Autonomous database serverless service	262
Autonomous database characteristics.....	263

Self-driving 263

Self-securing..... 263

Self-repairing..... 263

Supported workload types 264

Billing and metering 265

Conclusion..... 267

Index.....269-278

CHAPTER 1

Oracle Cloud Infrastructure: Overview and Getting Started

Introduction

We will start this chapter with an introduction to **Oracle Cloud Infrastructure (OCI)**. We will understand how OCI differs from other public cloud offerings and how you can start with OCI. We will then set up our first account on OCI and look at OCI Free Tier, and at last, we will understand how OCI categorizes different services that the platform offers.

Structure

The chapter covers the following topics:

- Overview of Oracle Cloud Infrastructure
- Getting started with Oracle Cloud
- Creating an account with Free Tier
- First time login and multi-factor authentication setup
- Cloud portal walkthrough
- Understanding service categories

Objectives

At the end of this chapter, you will understand what OCI is and what makes OCI different from other public cloud offerings like **Amazon Web Services (AWS)**, **Google Cloud Platform (GCP)**, or Azure. You will also have an OCI Free Tier account that you can use to launch and utilize different OCI services.

Overview of Oracle Cloud Infrastructure

OCI is a public cloud platform for running any and every kind of application. OCI is built from the ground up to support enterprise-grade applications with built-in high-performance, low latency, high availability, and security. OCI is a relatively new cloud platform launched in October 2016 as Oracle Bare Metal Cloud Services with only a single global region and core infrastructure services across computing, networking, and storage. It was rebranded as OCI and dubbed Oracle's Second-Generation Cloud.

At the time of writing this book, OCI has grown to support 48 cloud regions, including commercial, government, and private cloud regions, and has expanded the service catalog to over 100 services across infrastructure, platform, and software.

While other public cloud platforms, or Gen-1 clouds, were built with public applications with a scale-out architecture in mind, Oracle had the late movers advantage in the cloud space and took this opportunity to design OCI to support all kinds of enterprise applications from traditional monolithic applications running on relational databases, large data processing application requiring **High-Performance Compute (HPC)** or cloud-native applications built on containers, Kubernetes, functions and microservices. To support this wide range of applications on a single cloud platform with reliant performance, Oracle had to innovate at every stage of the designing process. Let us discuss some of those differentiated design decisions.

Off-box virtualization

To run a virtual machine instance on a physical server requires a hypervisor that controls the compute allocation along with virtual machine network processing, and because the network processing happens inside the hypervisor kernel, this process takes a toll on the overall infrastructure performance. OCI was the first public cloud vendor to offer off-box virtualization, which offloads the network processing task to a dedicated network interface card, a Smart NIC. Using Smart NICs, OCI can derive better performance from the underlying hardware, provide isolated networks, and avoid noisy neighbors. The following figure showcases off-box virtualization with OCI:

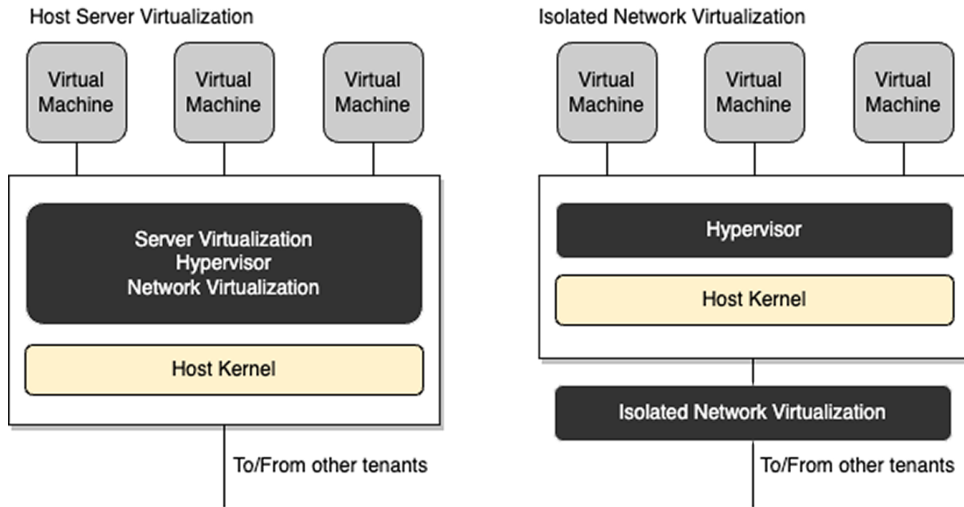


Figure 1.1: Off-box virtualization with OCI

Non-blocking networks

Generally, whenever we think of the cloud, the first thing that comes to mind is Compute, how to spin up an instance, databases, and how to manage these. However, the underlying network plays a vital role in the scalability and performance of the applications that you run in the cloud. OCI physical network has been designed keeping this thing in mind. OCI Services run on a non-blocking, non-oversubscribed, flat network for faster access to services with predictable performance. OCI is also the first in industry to offer performance SLAs for select services over and above Availability SLAs.

Remote direct memory access cluster networking

Remote Direct Memory Access (RDMA) allows two compute hosts on a network to access each other's memory content without the CPU overhead of traditional networks. Latency and jitter-sensitive applications that cannot tolerate packet losses over traditional networks are the best candidates for RDMA networks. While most RDMA network implementations relied on InfiniBand, OCI uses **RDMA over converged ethernet (RoCE)** for its purpose-built and dedicated RDMA network.

Flexible infrastructure

Let us start this section by stating the obvious: all applications are built differently and have different compute and storage requirements. It is hard to map these requirements in clearly defined compute boxes or t-shirt sizes. This is why OCI has no fixed compute capacity shapes or t-shirt sizes. While deploying your application instances, you can

customize the CPU, memory, and storage independently to meet your requirements. This avoids performance challenges due to a smaller compute shape and avoids resource wastage by selecting a larger compute shape.

Getting started with Oracle Cloud

Before deploying any application or service on OCI, we need to be familiar with some key concepts on OCI. We will be looking at the following concepts as the parts of this section:

- OCI regions
- Availability domains
- Fault domains
- Tenancy
- Compartment
- Subscription
- Identity policies
- Virtual cloud network

OCI regions

Regions are physical locations globally where OCI services are deployed and made available for public consumption. An OCI region can have one or multiple **Availability Domains (ADs)**. OCI regions provide a highly available, performant, and scalable environment for OCI services. Most OCI services are regional, which means they are confined to the region where they are deployed. As of writing this book, OCI has 48 global regions, including commercial, GovCloud, and dedicated cloud regions. Oracle is constantly adding more regions, so expect this number to increase.

Availability domains

Every OCI region can have one or multiple availability domains. Availability domains are physical data centers that host the compute, storage, and networking components necessary to run the OCI services. Availability domains have isolated infrastructure components. Failure of one availability domain does not impact the services in another availability domain inside a region. They are connected over a low-latency network to facilitate seamless service communications.

Fault domains

Fault domains are a collection of hardware, including compute, networking, and storage. They provide an additional layer of protection against hardware failures. The failure of a fault domain hardware does not impact the instances running in other fault domains, so

while deploying your application, you can distribute your application instances across different fault domains for higher availability and resiliency against hardware failures.

Tenancy

Tenancy within the OCI is equivalent to your account on OCI. However, it also provides a secure and isolated way to deploy, manage, and run your application instances in OCI. When you sign up for an OCI account, your tenancy is created inside the first region you subscribe to, also called your home region. Tenancy is sometimes also referred to as root compartment. Later, you can subscribe your tenancy to as many regions as needed.

Compartment

Compartments are logical groupings of related components. Every resource that you create in OCI must be placed inside a compartment. Compartments also allow you to manage resource access using identity and access policies. When you sign up for an OCI account, the root compartment is created by default for your account and holds all of your OCI resources. You can create more compartments based on your organization's requirements and even create nested compartments. OCI currently supports up to six levels of nested compartments.

Subscription

Oracle Cloud services are available with different pricing and service levels. When you sign up for an individual Oracle Cloud account, you start with a Free Tier subscription, which you can upgrade to a pay-as-you-go model, and these two are the most common subscription types. However, Oracle offers several other subscription types to suit your application and organization requirements. These subscription types are as follows:

- Universal credit services
- **Bring Your Own License (BYOL)**
- Metered services – prepaid
- Nonmetered services

Identity domains

An identity domain in OCI, is a collection of users, groups, their roles, security policies, that is, MFA, SSO, and so on. An identity domain in OCI represents a group of users, who share similar authentication requirements and security settings.

Identity domains are treated as any other OCI resource and can be created, moved, managed and tagged as needed. You can also use IAM policies defined in the next section to control who can create, manage, read or control the Identity domains.

A default identity domain is created when you subscribe to a new OCI cloud account. The default identity domain is created in the root compartment and holds the initial administrative user account and administrator group, the default administrator account holds the permissions to manage any resource within the OCI tenancy. This account can never be deleted until the tenancy itself is deleted.

You can create additional domains based on your requirements. You can build the domains based on application environments, user types, security policies etc.

Identity policies

Identity policies are the primary mechanism within OCI to control who has access to which resources within which compartment. In OCI, cloud users are members of certain groups inside an identity domain. Identity domains are a logical representation of users, roles, identity providers, and security settings like **Multi Factor Authentication (MFA)** and **Single-Sign On (SSO)** for the users.

Policies can be applied to a group and grant the members of that group access to specific resources inside a compartment. Permissions assigned to the tenancy/root compartment are automatically propagated to all child compartments.

Virtual cloud network

Virtual Cloud Network (VCN), is a software-defined network inside OCI. It is one of the first resources you deploy after setting up your tenancy. A VCN can have multiple non-overlapping IPV4 CIDR blocks, or you can enable IPv6 for the VCN, and a /56 prefix will be automatically allocated to the VCN. The CIDR blocks defined while creating the VCN are then used to create network subnets that provide connectivity to the compute instances. A VCN is always tied to a region. However, while defining the subnets inside the VCN, you can select whether the subnet will be regional or AD-specific.

You can also define different types of gateways inside a VCN to provide connectivity to the outside world or OCI services. Network security policies or network security groups govern access to the resources connected to the VCN or subnet.

Creating an account with Free Tier

Oracle offers a Cloud Free Tier account with Always Free Services. You can use these services to build, test, and run cloud applications for as long as you want without any time limitations. When you create an Oracle Cloud Account and sign up for Free Tier, you also get US\$300 cloud credit that you can use to try services not included in the Free Tier; this cloud credit must be utilized within 30 days of signing up for the account.

The following *Table 1.1* is a list of OCI services eligible for Always Free Tier. Although you can use these services, there are certain limitations around the service configuration.