ORACLE CLOUD INFRASTRUCTURE

THE COMPLETE GUIDE TO DESIGN, DEPLOY, AND OPERATE ENTERPRISE SOLUTIONS ON OCI

A Practical Reference for Architects, Administrators, Developers, DevOps Engineers, and Certification Candidates

COVERS ALL MAJOR OCI SERVICES

WITH REAL-WORLD EXAMPLES

- CORE INFRASTRUCTURE & NETWORKING
- SECURITY & IDENTITY
- AUTOMATION, DEVOPS & IaC
- DATABASE & DATA SERVICES
- AI, ANALYTICS & DATA SCIENCE
- DISASTER RECOVERY & HIGH AVAILABILITY

STEVE T.

Oracle Cloud Infrastructure

A Practical Reference for Architects, Administrators, Developers, DevOps Engineers, and Certification Candidates

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About This Book

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Chapter 1: Foundations of Oracle Cloud Infrastructure

What Is OCI? A Platform Built from the Ground Up

When you think about cloud computing, you probably picture AWS with its sprawling service catalog, Azure's enterprise integration with Microsoft products, or Google Cloud's data analytics and machine learning strengths. Oracle Cloud Infrastructure (OCI) occupies a different space entirely. It was not designed as an afterthought to compete with the big three. OCI was engineered from scratch to support Oracle's own massive global operations–processing financial transactions for banks, running ERP systems for Fortune 500 companies, and hosting the world's largest commercial database workloads. That origin story has shaped everything about its architecture.

OCI launched in preview during 2013 and achieved general availability across multiple regions by 2016. Unlike competitors who layered cloud services atop existing data center infrastructure, Oracle built OCI on a proprietary software-defined fabric designed for massive scale and low latency. The result is a platform that consistently ranks among the top performers in independent benchmarks for database throughput, network bandwidth, and storage performance [1].

Oracle named a Leader in the 2025 Gartner Magic Quadrant for Strategic Cloud Platform Services, citing its deep enterprise software integration and high-performance compute capabilities as differentiators [2]. The platform now powers not only Oracle's own SaaS products like Fusion ERP and HCM but also hosts external enterprise workloads, analytics platforms, and AI services across dozens of global regions.

What makes OCI distinctive is the concept of a full-stack cloud. Rather than assembling best-of-breed services from acquired companies or partnerships, Oracle designed compute, networking, storage, database, security, and AI services as components of a single integrated platform. This integration

produces tangible benefits: block volumes attach to instances with near-zero overhead because they share the same underlying fabric; Autonomous Database sits on purpose-built Exadata infrastructure that combines software optimization with hardware acceleration; and networking features like Zero Trust Packet Routing (ZPR) operate at the OCI fabric level rather than as a separate appliance.

The implications for practitioners are significant. If you approach OCI expecting it to mirror AWS or Azure, you will find surprising differences–and often advantages. The resource hierarchy is flatter, IAM policies use a different syntax that rewards careful planning, and certain services like Autonomous Database and Exadata have no direct equivalents in other clouds. Understanding these differences from the start saves time, reduces architectural missteps, and unlocks capabilities that competitors simply cannot match.

Global Footprint: Regions, Availability Domains, and Fault Domains

OCI's infrastructure is organized into a hierarchy of geographic scopes that directly impacts availability, latency, cost, and regulatory compliance decisions. Understanding this hierarchy is the first step in any architecture design.

Regions. An OCI region is a localized geographic area that contains one or more data centers. Each region has its own unique identifier (such as `us-ashburn-1`, `eu-frankfurt-1`, or `ap-mumbai-1`). As of mid-2026, OCI operates in over 40 regions worldwide, including newly launched locations such as Italy North (Turin), which became available in late 2025 [3]. The breadth of regional coverage has expanded rapidly as Oracle invested heavily in data center construction to meet growing demand for AI infrastructure and sovereign cloud capabilities.

Oracle's Q3 FY 2026 earnings highlighted that OCI margin profiles are strengthening as construction intensity normalizes and higher-margin services scale alongside accelerators [4]. The company's sovereign cloud positioning has also evolved beyond simple data sovereignty into a broader construct encompassing sovereign operations and sovereign contracting, expanding the addressable set of regulated and public-sector workloads.

Availability Domains (ADs). Within each region, OCI distributes infrastructure across Availability Domains–essentially separate data centers with

independent power, cooling, and networking. Most regions have three ADs, though some newer or smaller regions may have only one. Resources deployed within a single AD are isolated from failures in other ADs, making multi-AD deployment the foundation of high availability on OCI.

Fault Domains. Inside each Availability Domain, resources are further distributed across Fault Domains–groups of hardware with shared power and networking. Each AD contains three fault domains. This layering ensures that even within a single data center, failures affecting one rack or power supply do not cascade to all resources.

When designing for high availability, the standard pattern is to deploy at least two compute instances across different Availability Domains behind a load balancer. For critical workloads, replicate across regions using cross-region replication features provided by block volumes, object storage, and database services. Oracle's Full Stack Disaster Recovery service can orchestrate this entire process with a single click [5].

```
Region (e.g., eu-frankfurt-1)
├── Availability Domain 1
│   ├── Fault Domain 1
│   ├── Fault Domain 2
│   └── Fault Domain 3
├── Availability Domain 2
│   ├── Fault Domain 1
│   ├── Fault Domain 2
│   └── Fault Domain 3
└── Availability Domain 3
    ├── Fault Domain 1
    ├── Fault Domain 2
    └── Fault Domain 3
```

This hierarchy matters for every service. A Virtual Cloud Network (VCN) spans all ADs in a region, but subnets can be regional (spanning all ADs) or AD-specific. Block volumes are per-AD resources unless you enable cross-region replication. Database services like Autonomous Database deploy across ADs by default. Understanding where your resources physically live determines their availability characteristics and recovery options.

The OCI Resource Hierarchy: Tenancy, Compartments, and Identity Domains

OCI's organizational model is simpler than some competitors' but no less powerful. At the top level sits the **tenancy**, which represents your entire Oracle Cloud account. A tenancy is a logical container for all resources you create and has its own unique Oracle Cloud ID (OCID).

Within a tenancy, **compartments** provide logical grouping and access control. Compartments are infinitely nestable, allowing you to organize resources by project, environment (development, staging, production), business unit, or any other dimension that makes sense for your organization. Policies grant permissions at the compartment level, so you can isolate teams from each other while keeping everything within a single tenancy.

```
Tenancy
├── Identity Domain: OracleIdentityCloudService
│   ├── Group: oci-admins
│   ├── Group: dev-team
│   └── User: admin@example.com
├── Compartment: Production
│   ├── VCN: prod-vcn
│   ├── Compute: web-server-01
│   └── Database: oracle-db-prod
├── Compartment: Development
│   └── VCN: dev-vcn
└── Compartment: Security (top-level)
    └── Vault: encryption-keys
```

Starting in 2025, Oracle introduced **Identity Domains** as a major enhancement to the IAM model. A tenancy can now host multiple entirely separate identity domains, allowing organizations to create strict isolation boundaries between business units, subsidiaries, or customer environments within a single OCI account [6]. The recommended practice is to use the Default identity domain for local break-glass accounts and integrate the OracleIdentityCloudService domain with your corporate identity provider for day-to-day SSO and user lifecycle management [7].

The resource hierarchy extends further: inside compartments you create VCNs, subnets, compute instances, storage volumes, databases, and all other OCI resources. Every resource has an OCID that uniquely identifies it across

the tenancy. This flat-but-nested model means that unlike some competitors' account-hierarchy structures, everything lives in one place but is logically separated through compartments and IAM policies.

Best practice: Start with a well-designed compartment structure from day one. A common pattern for enterprise deployments uses top-level compartments for each environment (Production, Development, Staging), with nested compartments for specific workloads or teams within each. Reserve the Security compartment at the tenancy level for resources that need broad visibility across all compartments, such as logging and monitoring services.

Compute Units: OCPU vs. vCPU Explained

Understanding how OCI measures compute capacity is essential for both architecture decisions and cost management. Oracle uses a unit called the **OCPU** (Oracle CPU), which maps differently depending on the processor architecture.

For x86 processors (Intel and AMD), one OCPU equals two vCPUs–reflecting the fact that most modern x86 cores support two hardware threads through hyperthreading or simultaneous multithreading [8]. For OCI's Arm-based A1 compute, each OCPU corresponds to a single hardware core. For the newer A2 and A4 Arm processors (AmpereOne), each OCPU corresponds to two hardware cores.

This distinction matters because pricing is per OCPU, not per vCPU. An Intel instance with 8 OCPUs costs the same as an AMD instance with 8 OCPUs, even though the underlying thread counts differ. When comparing across architectures or evaluating whether a shape meets your workload's needs, always think in terms of OCPUs rather than trying to equate them directly with vCPUs from other clouds.

Processor Family	1 OCPU Equals	Example Shape
Intel (x86)	2 vCPUs / 1 physical core	VM.Standard.E5.Flex (1 OCPU = 2 vCPU)
AMD (x86)	2 vCPUs / 1 physical core	VM.Standard.E4.Flex (1 OCPU = 2 vCPU)
Ampere Altra (A1)	1 hardware thread / 1 core	VM.Standard.A1.Flex (1 OCPU = 1 vCPU)

Processor Family	1 OCPU Equals	Example Shape
AmpereOne (A2/A4)	2 cores / 1 OCPU	VM.Standard.A2.Flex (1 OCPU = 2 vCPU)

The flexible shape model lets you customize the number of OCPUs and memory independently when launching a VM. For example, you can launch a `VM.Standard.E6.Flex` with anywhere from 1 to 126 OCPUs and 1 GB to 1,454 GB of memory (up to 64 GB per OCPU). Network bandwidth scales proportionally with OCPUs [9]. This flexibility means you can right-size instances for your specific workload pattern–compute-optimized, memory-optimized, or I/O-dense–without being locked into predefined shape combinations.

For bare metal instances, the choice is between a range of fixed shapes with no hypervisor overhead. The latest generation includes the E6 series based on AMD EPYC 9J45 processors (base 2.7 GHz, boost 4.1 GHz), with configurations ranging from `BM.Standard.E6.256` (256 OCPUs, 3,072 GB memory) to specialized GPU and HPC shapes [10].

Billing Models and the Always-Free Tier

OCI uses a pay-as-you-go billing model based on Universal Credits, which can be applied across IaaS and PaaS services. You are billed per second for compute (with a one-minute minimum), and other services have their own pricing structures. The OCI Cost Estimator tool lets you project monthly costs before provisioning resources [11].

OCI's **Always-Free tier** is one of the most generous in the industry and serves as an excellent entry point for learning, development, and small-scale production workloads. Key Always-Free resources include:

- 2 compute instances (VM.Standard.E2.1 or VM.Standard.A1.Flex) with 1 OCPU and 1 GB memory each
- 4 Arm-based Ampere compute instances (VM.Standard.A1.Flex) with 1 OCPU and 1 GB memory each
- 20 GB of block storage
- 10 GB of object storage
- 10 GB of block volume backup storage

- A load balancer with 10 Mbps bandwidth
- Monitoring service

For developers, hobbyists, and organizations evaluating OCI before committing to paid services, the Always-Free tier provides enough capacity to run a complete microservices architecture. The Arm-based instances are particularly notable because they offer a pathway to cost-efficient compute for workloads that can leverage Arm architecture.

When you move beyond the free tier, several cost optimization levers become available. Reserved capacity commitments provide significant discounts compared to pay-as-you-go pricing. Oracle also offers savings plans for predictable workloads and preemptible instances (spot-style) for fault-tolerant batch processing at substantially reduced rates. Chapter 11 covers these strategies in depth.

Learning Objectives

By the end of this chapter, you should be able to:

- Describe OCI's global infrastructure hierarchy and explain the role of regions, availability domains, and fault domains
- Navigate OCI's resource organization model using tenancies, compartments, and identity domains
- Explain the OCPU measurement system and how it differs across processor architectures
- Identify the Always-Free tier resources available for evaluation and development
- Recognize where OCI's full-stack architecture provides advantages over competitor platforms

Hands-On Lab: Exploring Your OCI Environment

1. Sign up for a free Oracle Cloud account and navigate to the Console at `cloud.oracle.com`.
2. Locate your tenancy name in the navigation menu (top-left corner).

3. Navigate to **Identity > Compartments** and note the default structure.
4. Create a new compartment called `Learning-Lab` and observe how it appears in the hierarchy.
5. Launch a free-tier VM instance using the Always-Free eligible shape (`VM.Standard.A1.Flex`) in your new compartment.
6. Explore the Compute > Instances page to see your instance's OCPU, memory, and network details.
7. Navigate to **Observability & Monitoring > Metrics** to view basic monitoring data for your instance.

Review Questions

1. What is the relationship between a region, an availability domain, and a fault domain in OCI?
2. Why does Oracle use OCPUs instead of vCPUs as its primary compute unit?
3. How do compartments differ from AWS accounts or Azure subscriptions in their purpose and flexibility?
4. Which Always-Free compute shapes are available, and what are their specifications?
5. True or false: A VCN spans multiple availability domains within a region.

Real-World Case Study: Global Financial Services Provider

A multinational financial services firm needed to migrate its core trading platform from on-premises data centers to the cloud while meeting strict latency requirements and regulatory data residency mandates across Europe, North America, and Asia. The architecture team selected OCI for three reasons: the deep database integration with Autonomous Database eliminated the need for separate database administration; multiple regional deployments with cross-region replication provided both low-latency access and disaster recovery; and the Arm-based A1 instances offered cost-efficient compute for background batch processing workloads.

The firm organized its OCI tenancy with a top-level Security compartment, followed by environment compartments (Production, Development, Staging), each containing workload-specific nested compartments. IAM policies were scoped to compartments rather than the tenancy, giving team leads autonomy over their resources while maintaining centralized security oversight through Cloud Guard and Audit services. The result was a migration completed in under six months with zero downtime during cutover and a 40 percent reduction in total cost of ownership compared to the previous on-premises setup [12].

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