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Module 2 : Core Services

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Amazon Virtual Private Cloud (VPC)

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Introduction

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Private, virtual network in the AWS Cloud
Similar constructs as on-premises network
Complete control of network configuration

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Features

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Characteristics

- Allows you to provision virtual networks

Logically isolated

Configurable key features

- IP ranges
- Routing
- Network gateways
- Security settings

Route Tables

- Control traffic going out of the subnets

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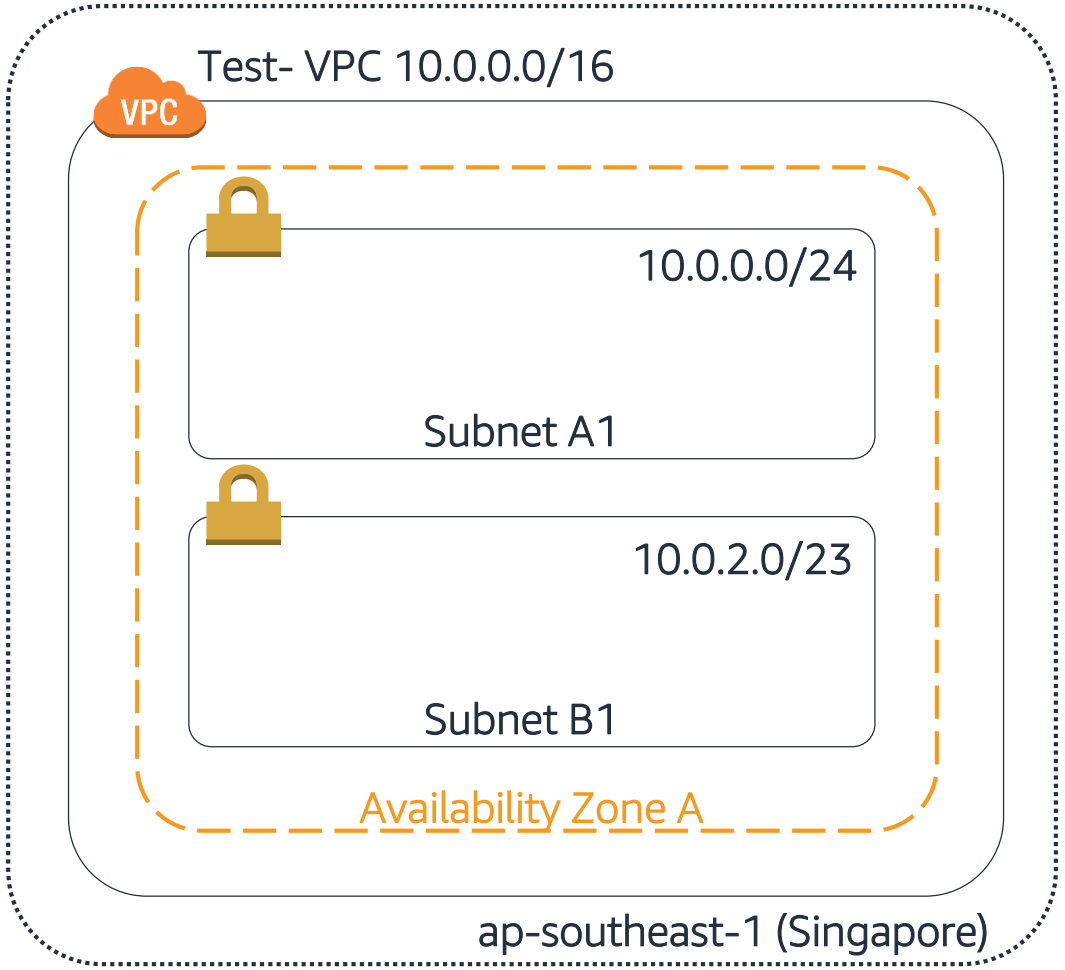
Example



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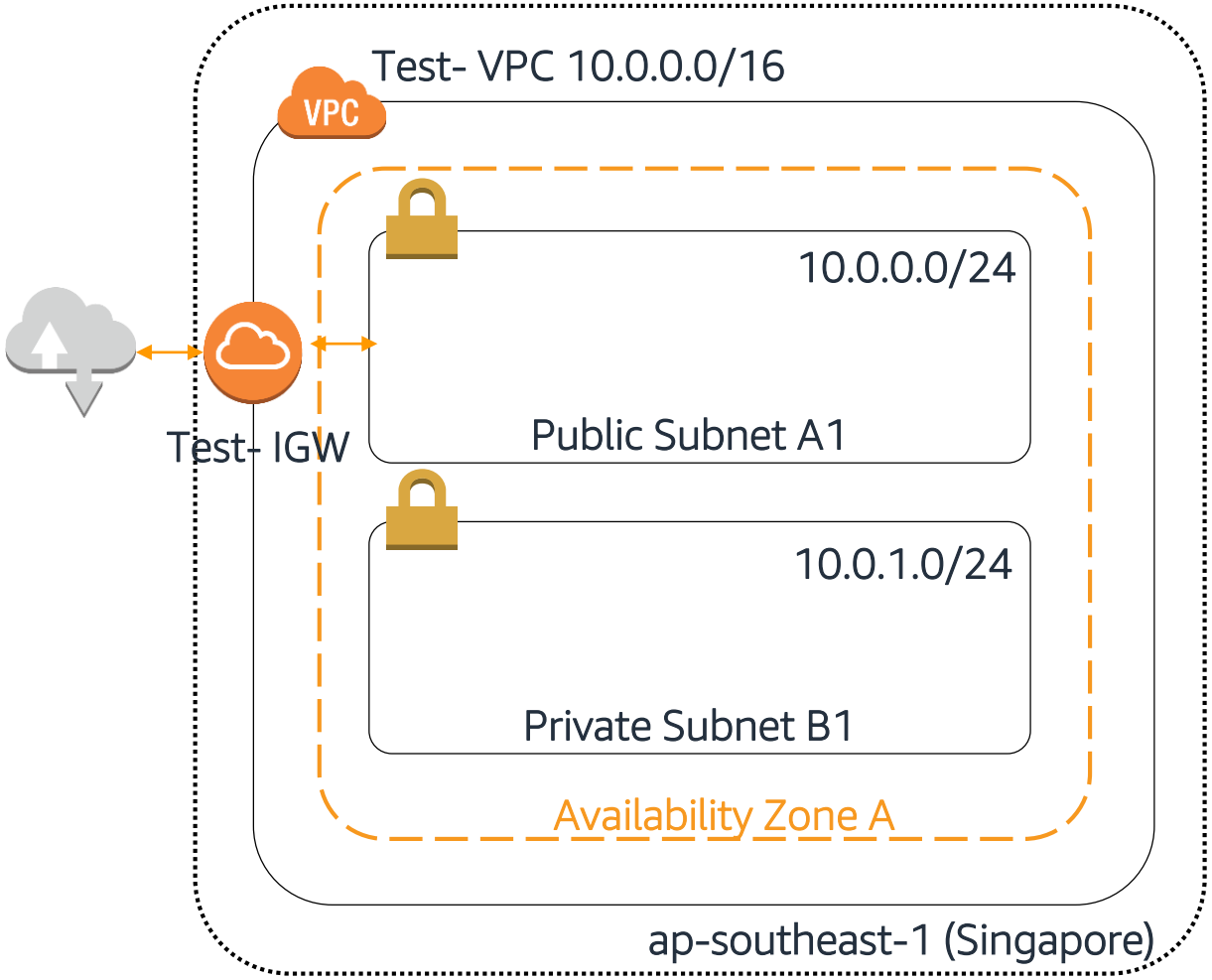
Example



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Summary

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VPC concepts:

- Region Scope
- An internet gateway
- Public subnet
- Private subnet

Learn More

- Route tables and isolation methods
- Other Amazon VPC features (e.g., VPC endpoints and VPC peering connections)

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AWS Security Groups

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AWS Security

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Is the highest priorities

Security groups

- Act as built-in firewalls
- Control accessibility to instances

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AWS Security

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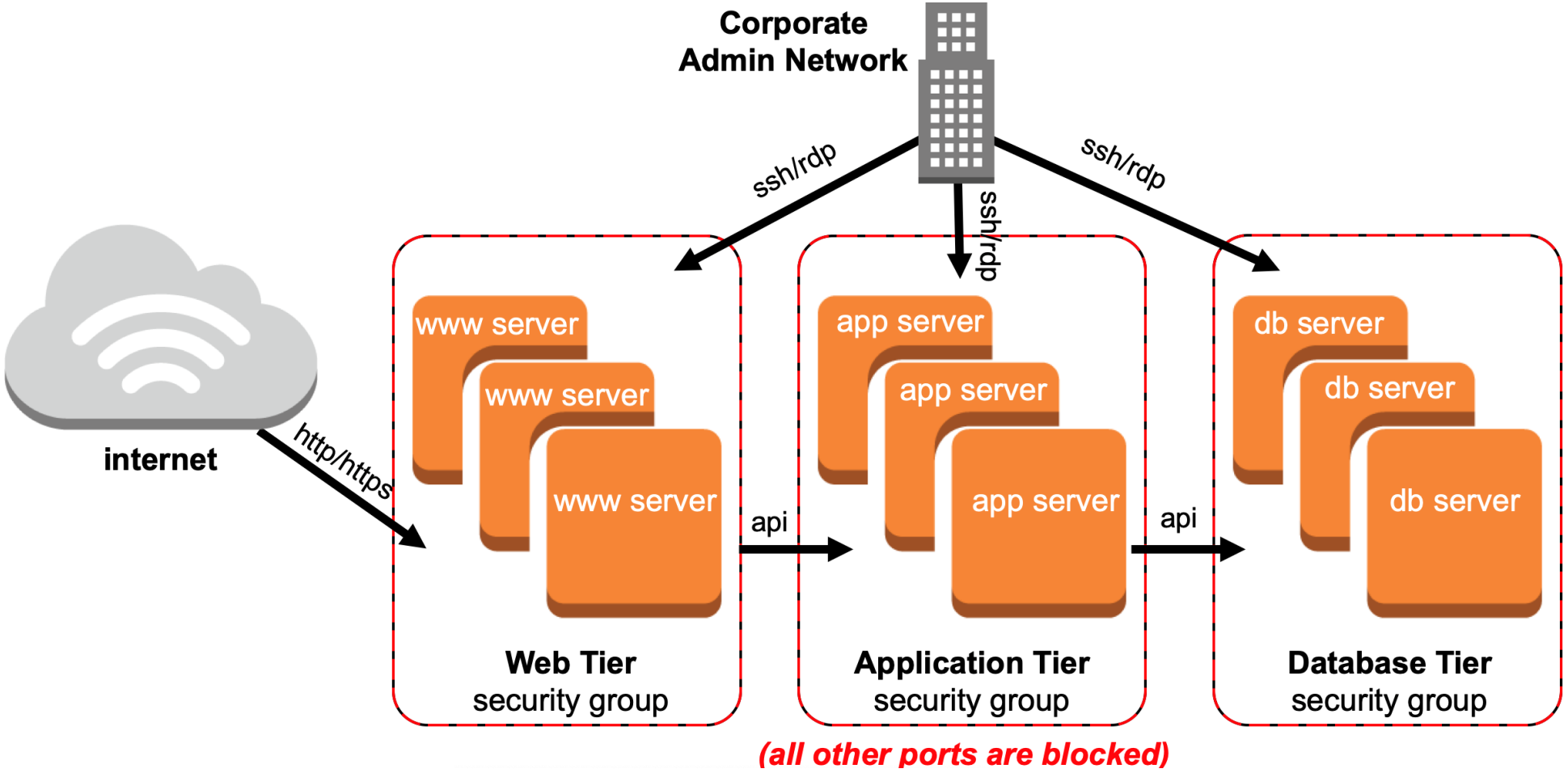

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Compute Services

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Compute Services

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AWS

- Flexible
- Cost effective

Amazon EC2

- Flexible configuration and control

AWS Lambda

- Pay only for what you use
- No administration

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Compute Services

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Amazon Lightsail

- Launch virtual private server
- Manage simple web and application servers

Amazon ECS

- Managed containers
- Highly scalable, high performance

AWS Fargate

Amazon EKS

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Amazon Elastic Compute Cloud (EC2)

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Amazon Elastic Compute Cloud

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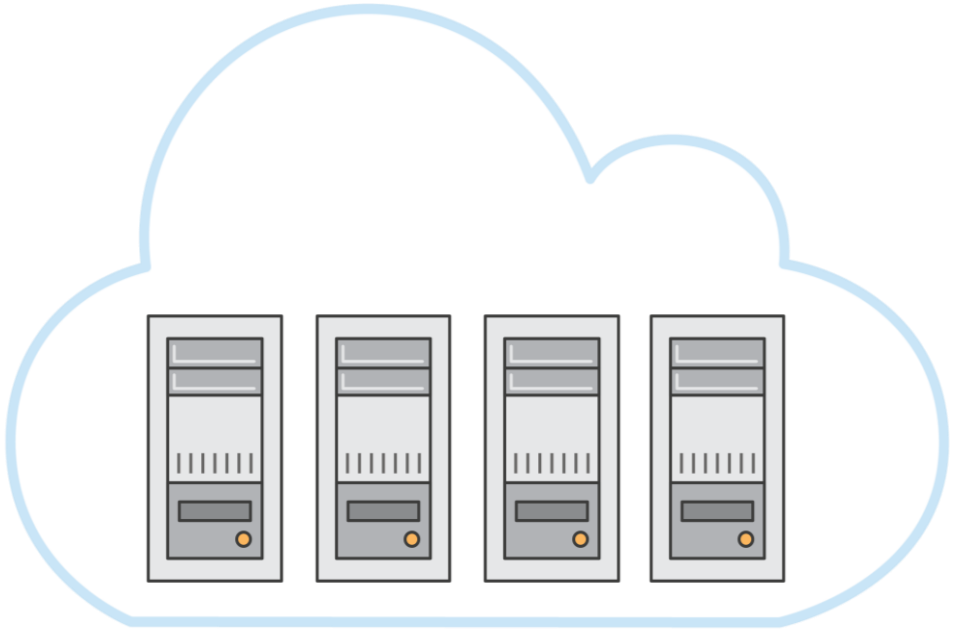

- ✓ Application Server
- ✓ Web Server
- ✓ Database Server
- ✓ Game Server
- ✓ Mail Server
- ✓ Media Server
- ✓ Catalog Server
- ✓ File Server
- ✓ Computing Server
- ✓ Proxy Server

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What is Amazon EC2?

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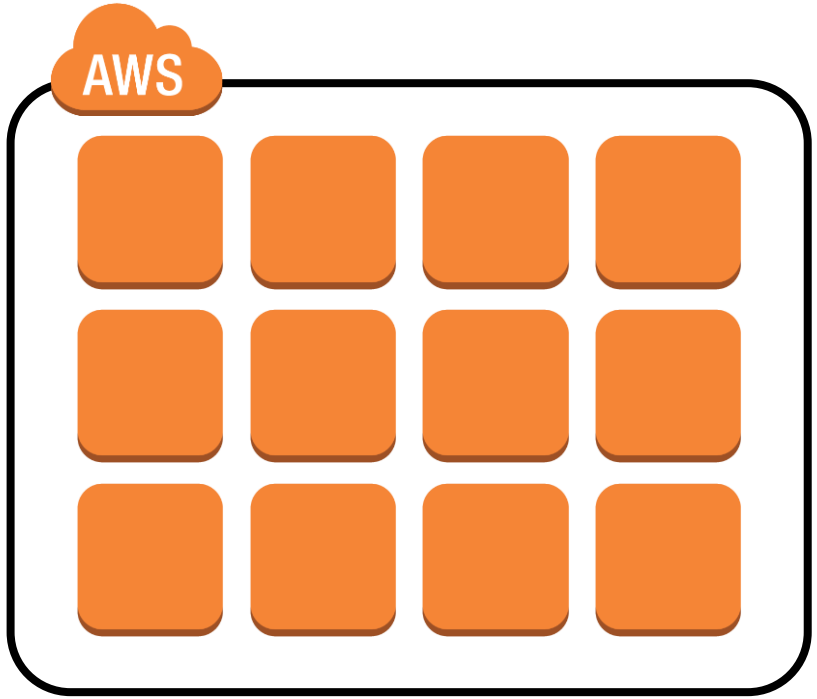
Amazon EC2 Instances

- Pay as you go
- Broad selection of HW/SW
- Global hosting
- *Much more (*aws.amazon.com/ec2)



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Instance Types

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Families	Description	Example Use Cases
t2, m3, m4, m5	**General Purpose** Balanced Performance	Websites, web applications, Dev, code repos, micro services, business apps
c3, c4, c5, cc2	**Compute Optimized** High CPU Performance	Front-end fleets, web-servers, batch processing, distributed analytics, science and engineering apps, ad serving, MMO gaming, video-encoding
g2, p2	**GPU Optimized** High-end GPU	Amazon AppStream 2.0, video encoding, machine learning, high perf databases, science
r3, r4, r5, x1, cr1	**Memory Optimized** Large RAM footprint	In-memory databases, data mining
d2, i2, i3, hi1, hs1	**Storage Optimized** High I/O, High density	NAS, data warehousing, NoSQL

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Choosing the Right Amazon EC2 Instances

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- EC2 Instance types are optimized for different use cases, workloads & come in multiple sizes. This allows you to optimally scale resources to your workload requirements.
- AWS utilizes Intel® Xeon® processors for EC2 Instances providing customers with high performance and value.
- Consider the following when choosing your instances: core count, memory size, storage size & type, network performance, I/O requirements & CPU technologies.
- Hurry Up & Go Idle - A larger compute instance can save you time and money, therefore paying more per hour for a shorter amount of time can be less expensive.

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EC2 Instances Powered by Intel Technologies

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EC2 Instance Type	Compute Optimized		General Purpose			Memory Optimized			Storage Optimized		
	C5n	C5	M5	T3	T2	X1	X1e	R4	H1	I3	D2
Intel Processor	Xeon Platinum 8175M	Xeon Platinum 8175M	Xeon Platinum 8175M	Xeon Platinum 8175M	Xeon Family	Xeon E7 8880 v3	Xeon E7 8880 v3	Xeon E5 2686 v4	Xeon E5 2686 v4	Xeon E5 2686 v4	Xeon E5 2676 v3
Intel Processor Technology	Skylake	Skylake	Skylake	Skylake	Yes	Haswell	Haswell	Broadwell	Broadwell	Broadwell	Haswell
Intel AVX	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intel AVX2	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes
Intel AVX-512	Yes	Yes	Yes	Yes	-	-	-	-	-	-	-
Intel Turbo Boost	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Storage	EBS-only	EBS-only	EBS-only	EBS-only	EBS-only	SSD EBS-Opt	SSD EBS-Opt	-	HDD	SSD	HDD

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C5n: Compute Optimized Instances

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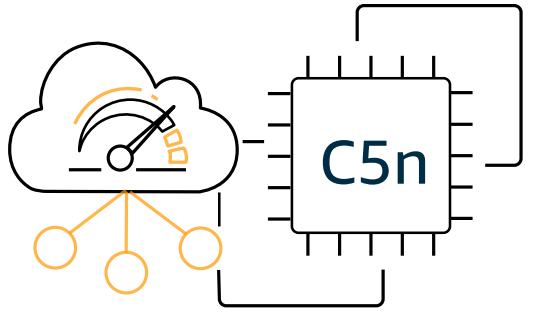
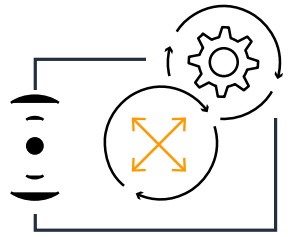
- Featuring Intel Xeon Scalable processors
- 100 Gbps network bandwidth on largest instance sizes
- 25 Gbps peak bandwidth on smaller instance sizes
- 33% Increased memory footprint over C5 instances



Faster analytics and
big data workloads

Lower costs for
network-bound workloads



All of the elasticity, security,
and scalability of AWS

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R5: Memory-Optimized Instances

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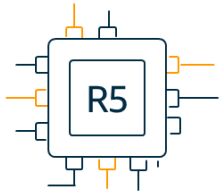
- 2.5 GHz Intel Xeon Scalable processors (Skylake)
- Memory-optimized instances with 8:1 GiB to vCPU
- Up to 25 Gbps NW bandwidth
- R5d instances include up to 3.6 TB of local NVMe SSD



r5.large	6 sizes	r5.24xlarge
16 GiB	●●●	768 GiB
2 vCPU		96 vCPU

In-memory caches

High performance databases

Big data analytics

R5a: Now available with AMD EPYC 7000 processor

R5.metal Bare Metal instances coming soon on Intel Xeon Scalable processors

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z1d: High Frequency for Specialized Workloads

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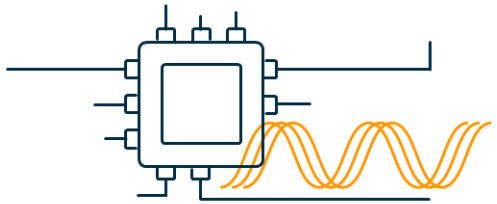
- High Frequency instances with custom Intel Xeon Scalable processors running at sustained 4 GHz all core turbo
- 8:1 GiB to vCPU ratio
- Up to 25 Gbps network bandwidth and up to 1.8 TB of local NVMe storage

z1d.large	6 sizes	z1d.12xlarge
16 GiB	● ● ●	384 GiB
2 vCPU		48 vCPU

Electronic Design Automation



Relational databases

Gaming

z1d.metal Bare Metal instances coming soon

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M5: Next-Gen General Purpose Instance

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- Powered by 2.5 GHz Intel Xeon Scalable Processors (Skylake)
- New larger instance size—m5.24xlarge with
  96 vCPUs and 384 GiB of memory
  (4:1 Memory:vCPU ratio)
- Improved network and EBS performance on smaller instance sizes
- Support for Intel AVX-512 offering up to twice the performance for vector and floating point workloads

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T3: Next-Gen General Purpose Instance

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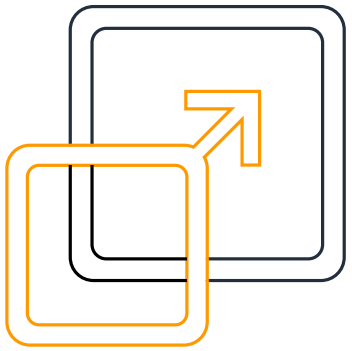
- Balance of compute, memory, and network
- Baseline level of CPU performance with the ability to burst CPU usage when needed at any time for as long as required
- Lowest cost instance at $0.0052 per hour and up to 30% better price performance over T2 using Intel Xeon Scalable Processors

t3.nano	7 sizes	t3.2xlarge
0.5 GiB	● ● ●	32 GiB
2 vCPU		8 vCPU
Base perf 5%		Base perf 40%



With T3 Unlimited bursting over baseline is only $0.05 per vCPU-hour, averaged over 24 hours

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Elastic Load Balancing (ELB)

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Introduction to Elastic Load Balancing

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Managed load balancing service

Distributes loads between instances

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Elastic Load Balancing Products

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Application Load Balancer (ALB)	Network Load Balancer (NLB)	Classic Load Balancer (CLB)
HTTP HTTPS	TCP	PREVIOUS GENERATION for HTTP, HTTPS, and TCP
• Flexible application management • Advanced load balancing of HTTP and HTTPS traffic • Operates at the request level (Layer 7)	• Extreme performance and static IP for your application • Load balancing of TCP traffic • Operates at the connection level (Layer 4)	• Existing application that was built within the EC2-Classic network • Operates at both the request level and connection level

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Application Load Balancer Use Cases

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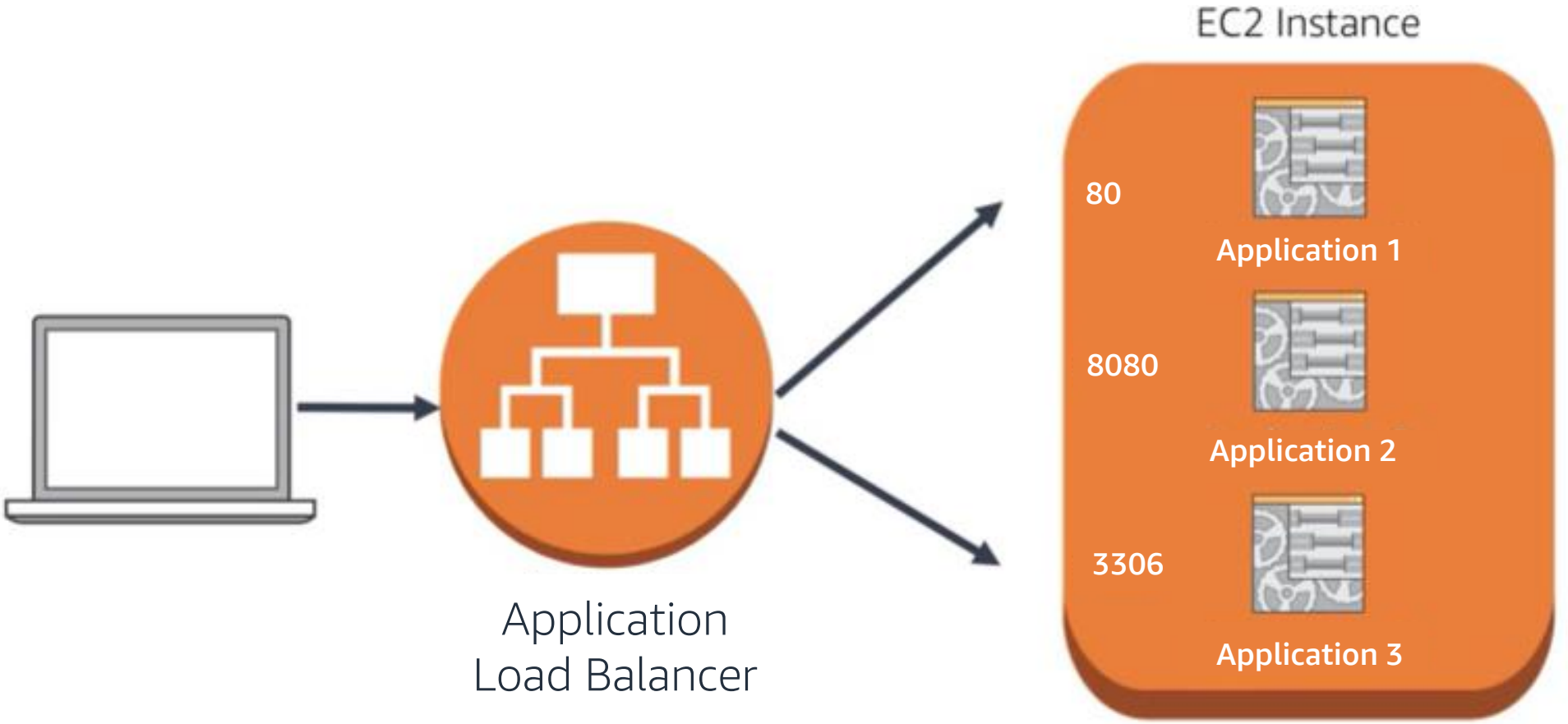

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Application Load Balancer Use Cases

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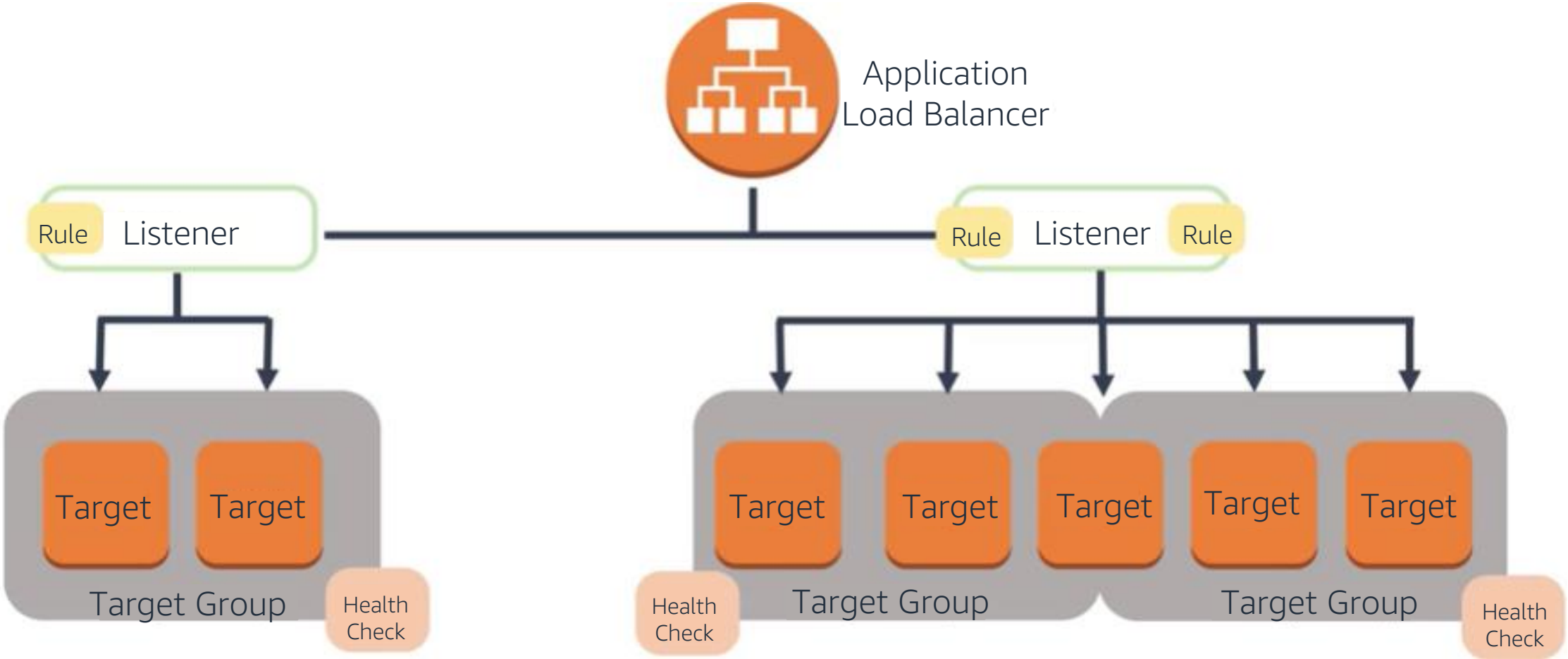

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Network Load Balancer Use Cases

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Sudden and volatile traffic patterns

Single static IP address per Availability Zone

Ideal for applications that require extreme performance

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AWS Auto Scaling

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What Is AWS Auto Scaling?

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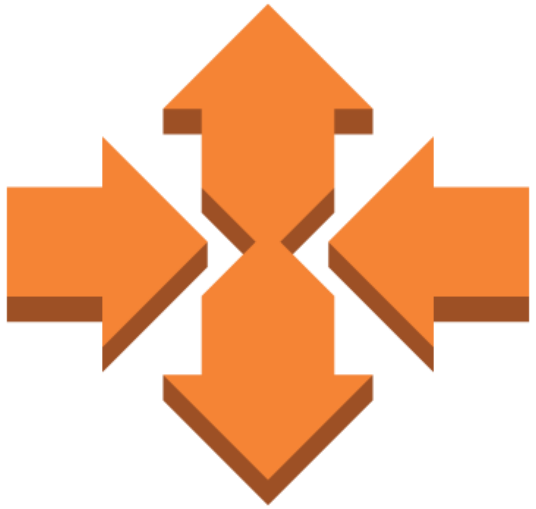
Helps you verify that you have the correct number of Amazon EC2 instances available to handle the load for your application



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Monitoring Resource Performance

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Amazon CloudWatch to monitor performance

AWS Auto Scaling to add or remove Amazon EC2 instances

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Capacity Management

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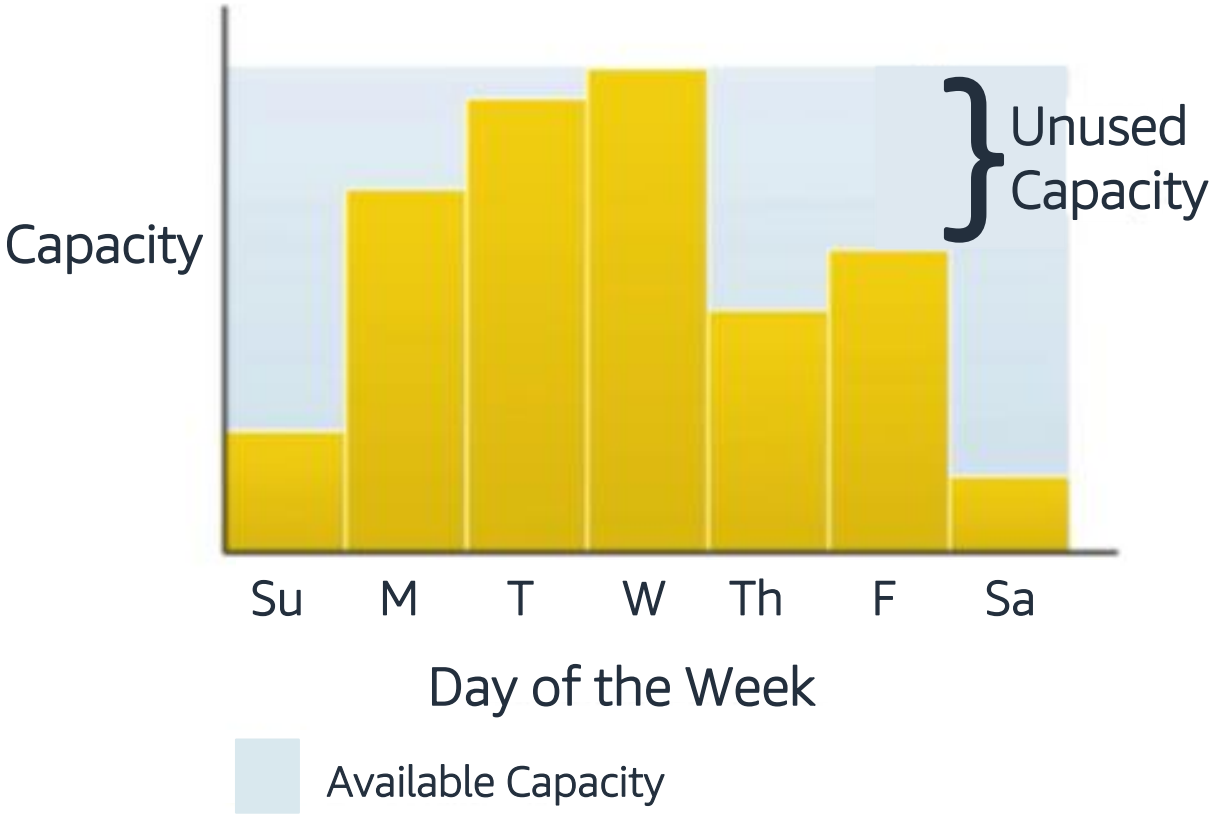

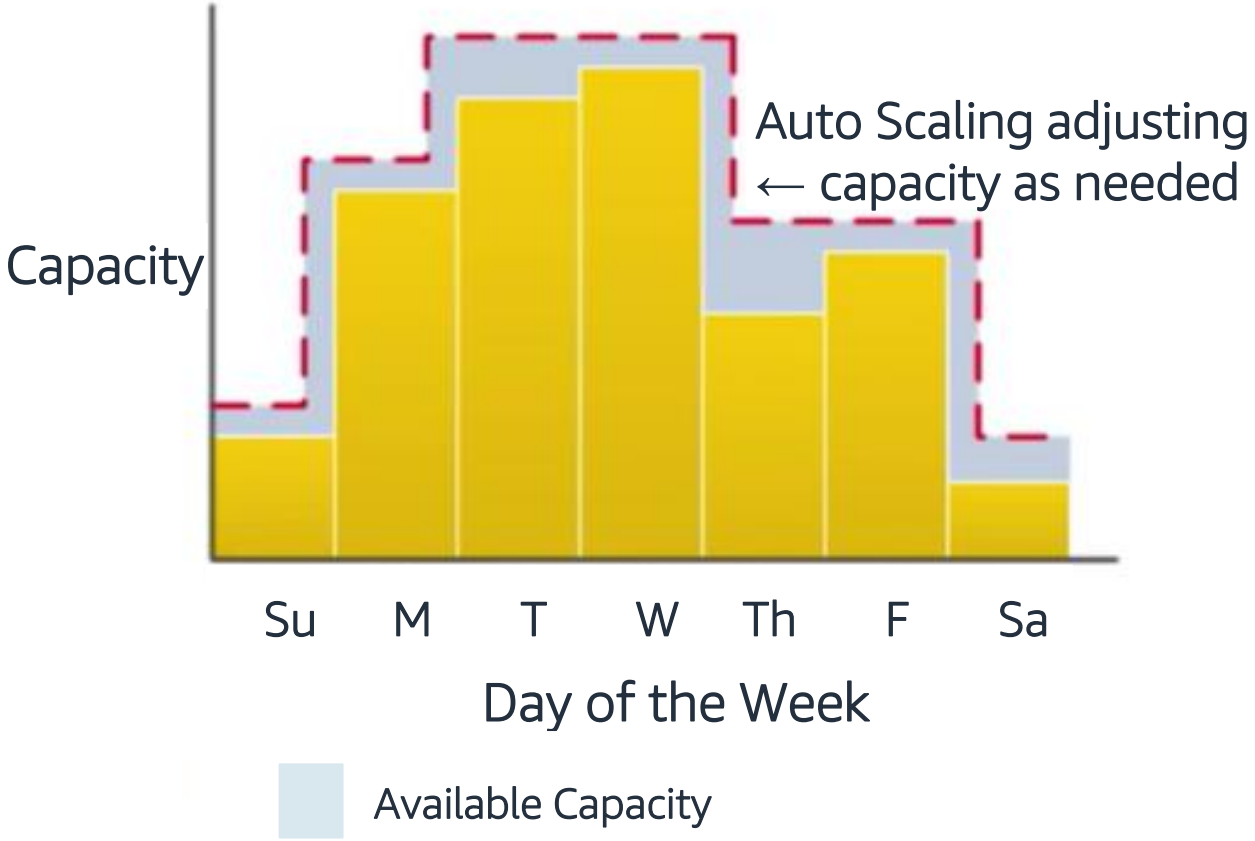

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Critical Questions

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How can I make sure that my workload has enough Amazon EC2 resources to meet fluctuating performance requirements?

Scalability

How can Amazon EC2 resource provisioning to occur on-demand?

Automation

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Scaling Out and Scaling In

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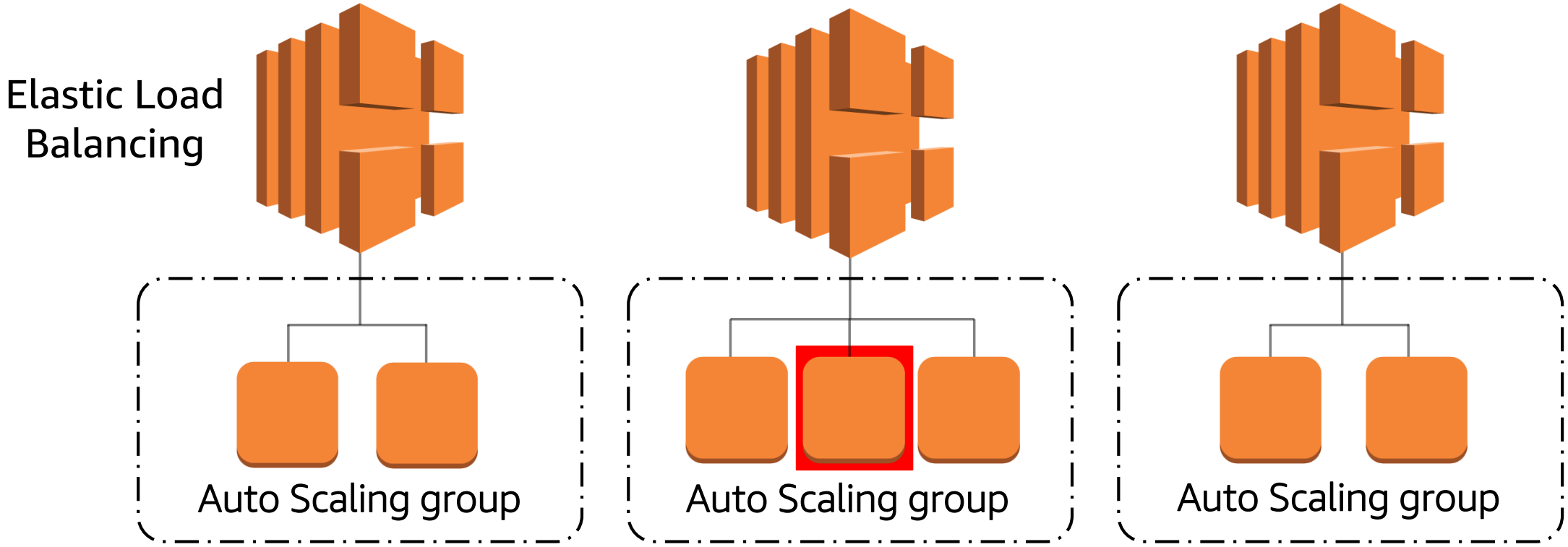

Base Configuration

Scaling Out
Launch Instances

Scaling In
Terminate Instances

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Auto Scaling Components

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Launch Configuration
Auto Scaling groups
Auto Scaling Policy

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Auto Scaling Components

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Launch Configuration: *What will be scaled?*

Launch settings

- AMI
- Instance type
- Security groups
- Roles

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Auto Scaling Components

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Auto Scaling Group: ***Where will it take place?***

Deployment settings

- VPC and subnets
- Load balancer
- Minimum instances
- Maximum instances
- Desired capacity

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Auto Scaling Components

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Auto Scaling Policy: *When will it take place?*

Policy settings

- Scheduled
- On-demand
- Scale-out policy
- Scale-in policy

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Dynamic Auto Scaling

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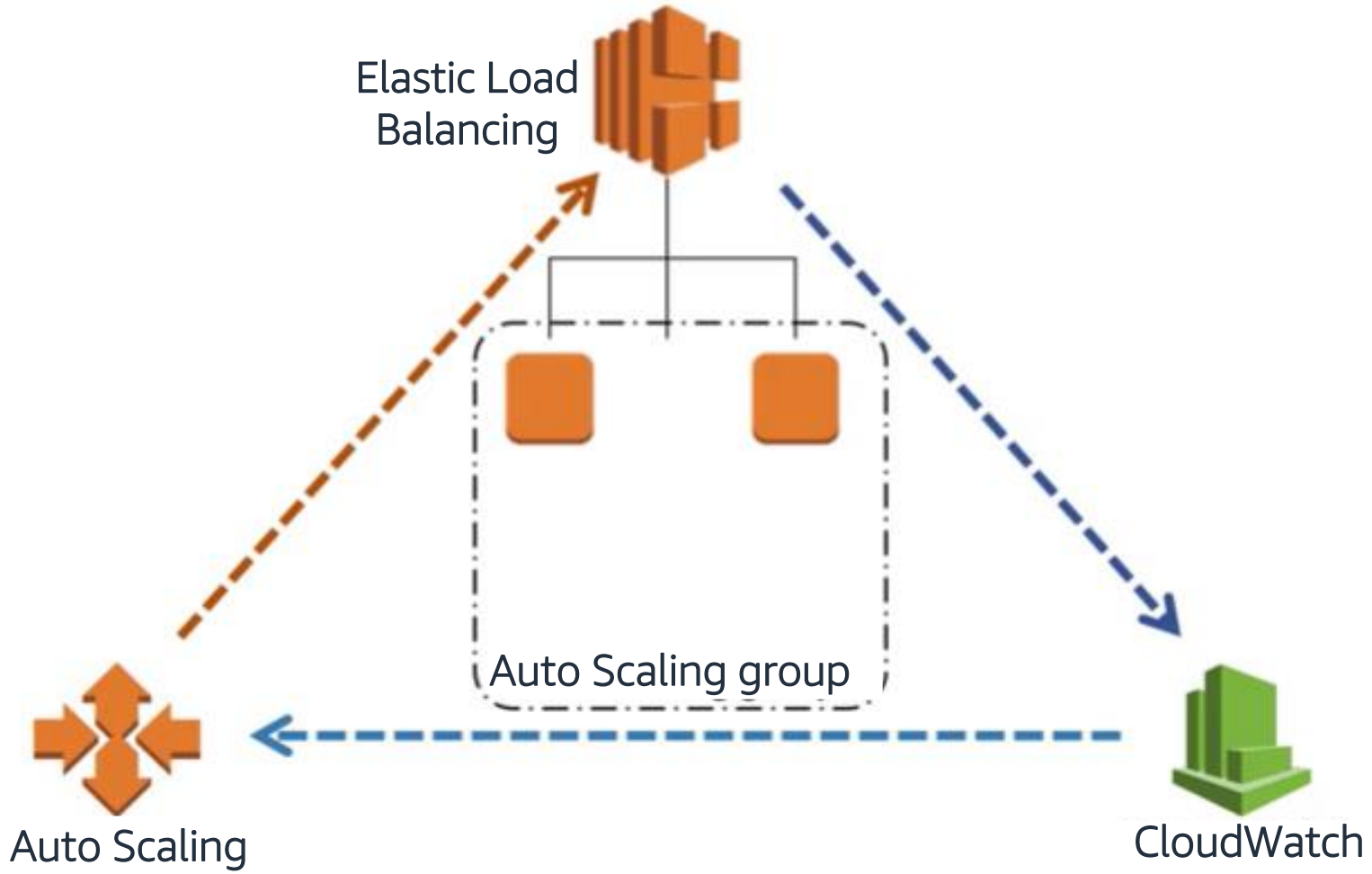

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Amazon CloudWatch Alarms for Auto Scaling

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Whenever: CPUUtilization
is: >= 80
for: 1 consecutive period(s)

AutoScaling Action — Delete

Whenever this alarm: State is ALARM
From resource type: AutoScaling
From the: IREASG
Take this action: Increase Group Size – Add 2 instances

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Summary

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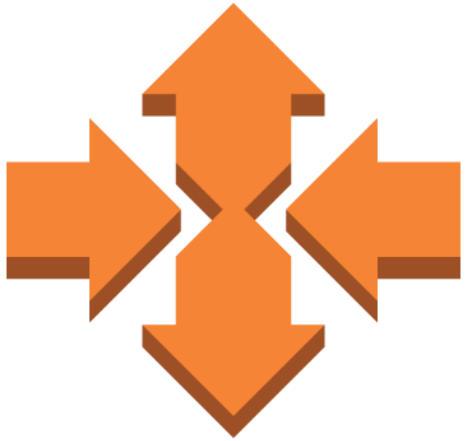
Created

- A launch configuration
- Auto Scaling group
- Auto Scaling policy

Triggered Auto Scaling



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Amazon Elastic Block Store (EBS)

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Amazon EBS Volumes

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Characteristics

- Persistent and customizable block storage for Amazon EC2 instances
- HDD and SSD types
- Use Snapshots for backups
- Easy and transparent encryption
- Elastic

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Amazon EBS Volumes

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Availability

- Durable and automatically replicated

Drive Types

- Storage that best fits your needs
- Magnetic or SSD
- Performance and price requirements

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Amazon EBS

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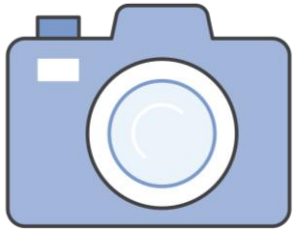
Snapshots

- Point-in-time snapshots
- Recreate a new volume at any time



Encryption

- Encrypted EBS volumes
- No additional cost

Elasticity

- Increase capacity
- Change to different types

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Summary

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Features

- Persistent and customizable block storage for Amazon EC2 instances
- HDD and SSD types
- Replicated in the same Availability Zone
- Easy and transparent encryption
- Elastic volumes
- Back up using snapshots

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Amazon
Simple Storage Service (S3)

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Amazon S3

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- **Features**
  - Fully managed cloud storage service
  - Rich security controls

- **Functionality**
  - Store virtually unlimited number of objects
  - Access any time, from anywhere

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Getting Started with Amazon S3

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welcome.mp4

my-bucket-name

med welcome.mp4

Key

Object

my-bucket-name

Example - http://**my-bucket-name**.s3.amazonaws.com/**welcome.mp4**

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Access the Data Anywhere

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AWS Management console
AWS CLI
AWS SDKs

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Common Use Cases

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Storing application assets
Static web hosting
Backup and disaster recovery (DR)
Staging area for big data

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Summary

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- Fully managed cloud storage service
- Store virtually unlimited number of objects
- Access any time, from anywhere
- Rich security controls
- Common use cases

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Let's take a look at an Amazon S3 Demo

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Amazon S3 Demo

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Amazon Relational Database Service (RDS)

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Challenges of Relational Databases

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Server maintenance and energy footprint
Software installation and patches
Database backups and high availability
Limits on scalability
Data security
OS install and patches

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Amazon RDS

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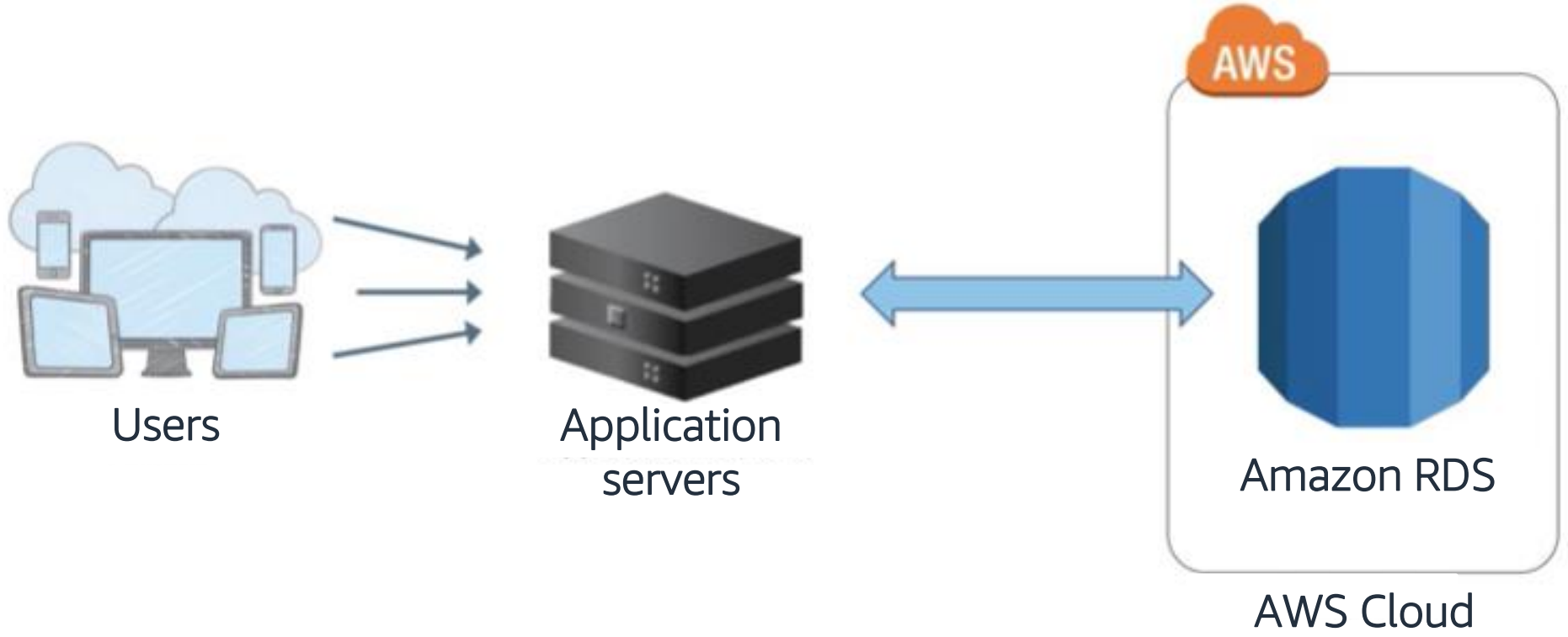
Managed service that sets up and operates a relational database in the Cloud



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Amazon RDS

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Customer manages

- Application Optimization
- Database schema
- Data

AWS manages

- OS installation and patches
- Database software installation and patches
- Database backups
- High availability
- Scaling
- Power, rack and stack
- Server maintenance

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Amazon RDS DB Instances

Amazon RDS

RDS DB master instance

DB Instance Class

- CPU
- Memory
- Network Performance

DB Instance Storage

- Magnetic
- General Purpose (SSD)
- Provisioned IOPS

DB Engines

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High Availability with Multi-AZ

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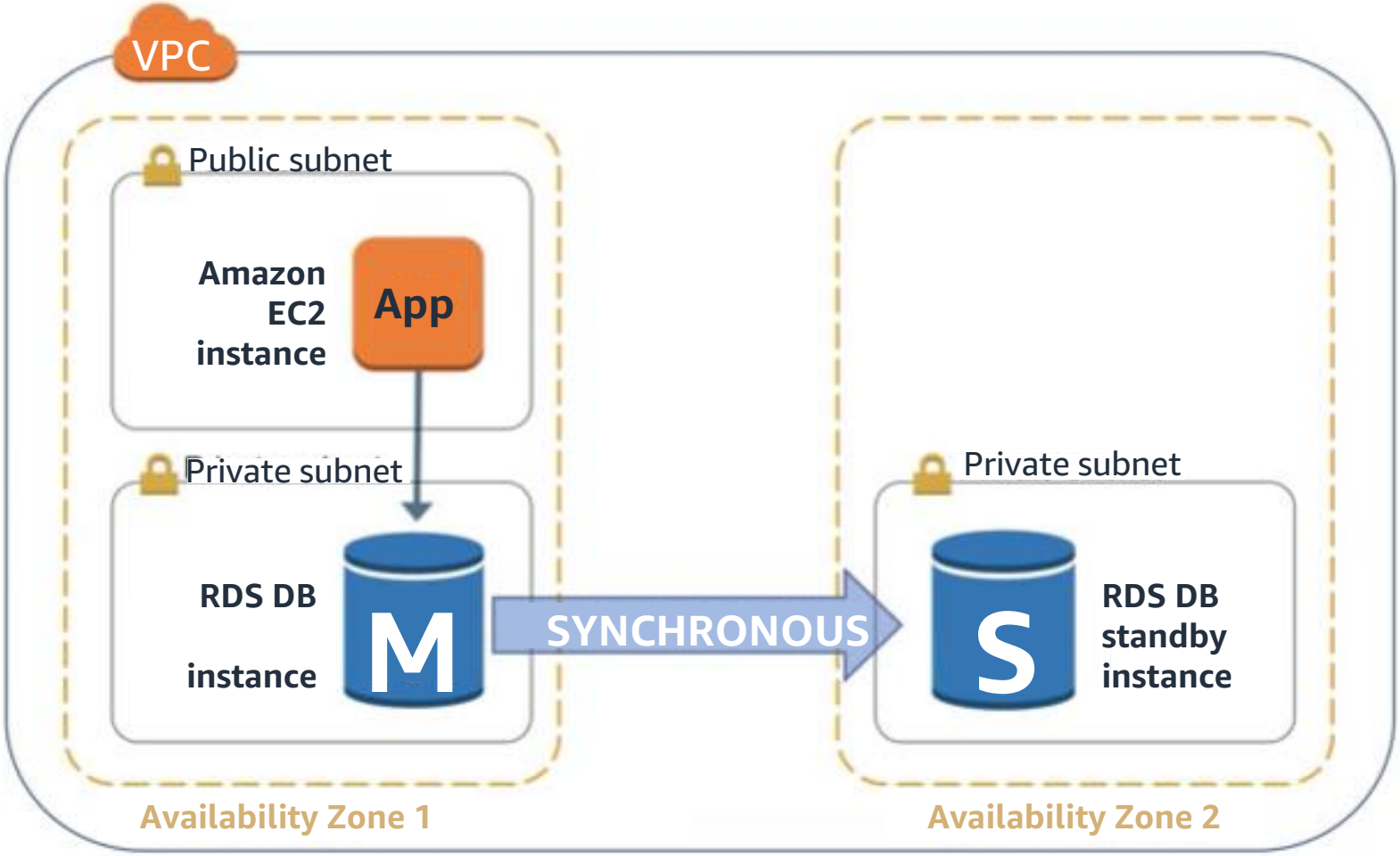

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High Availability with Multi-AZ

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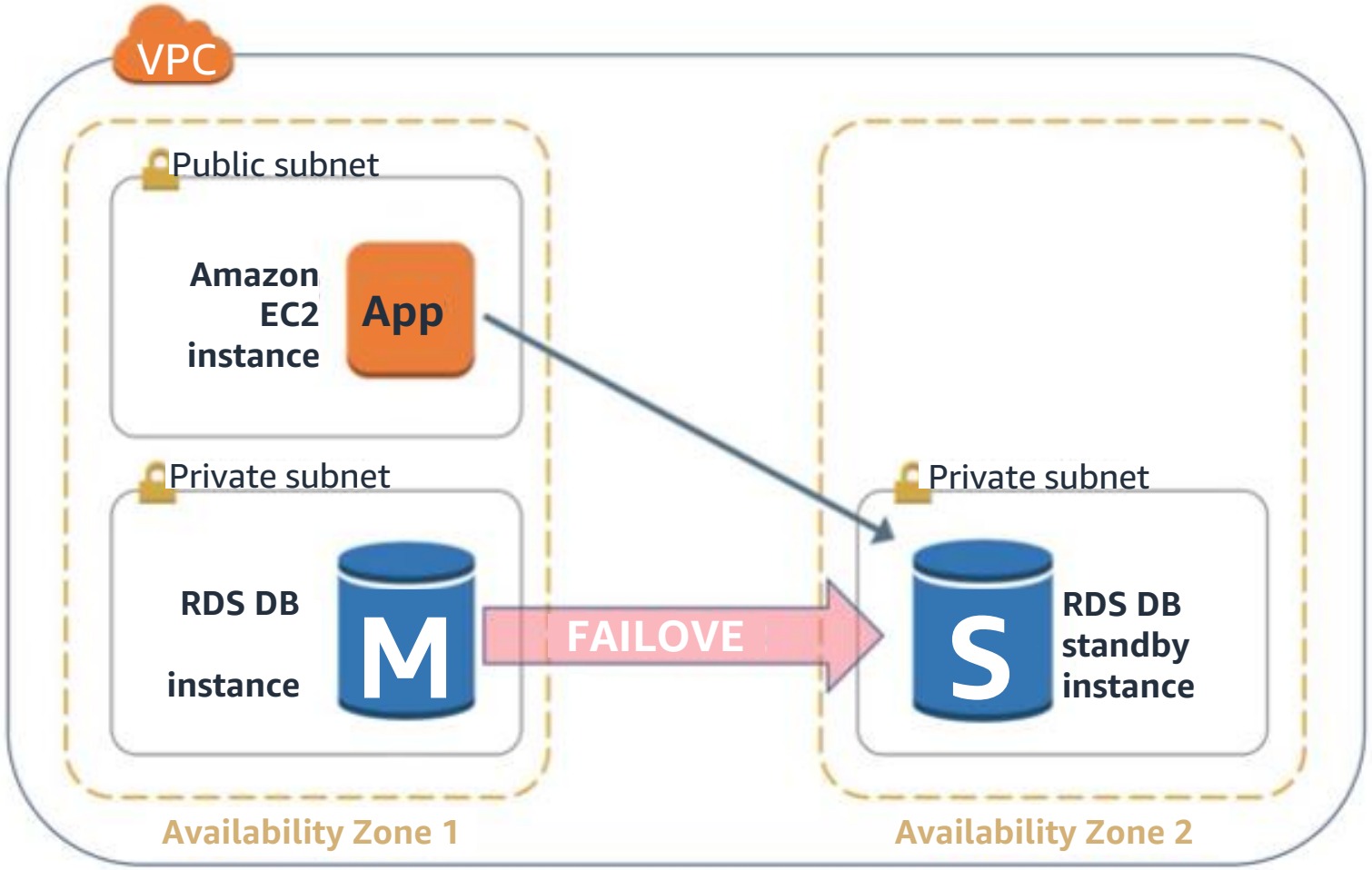

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Amazon RDS Read Replicas

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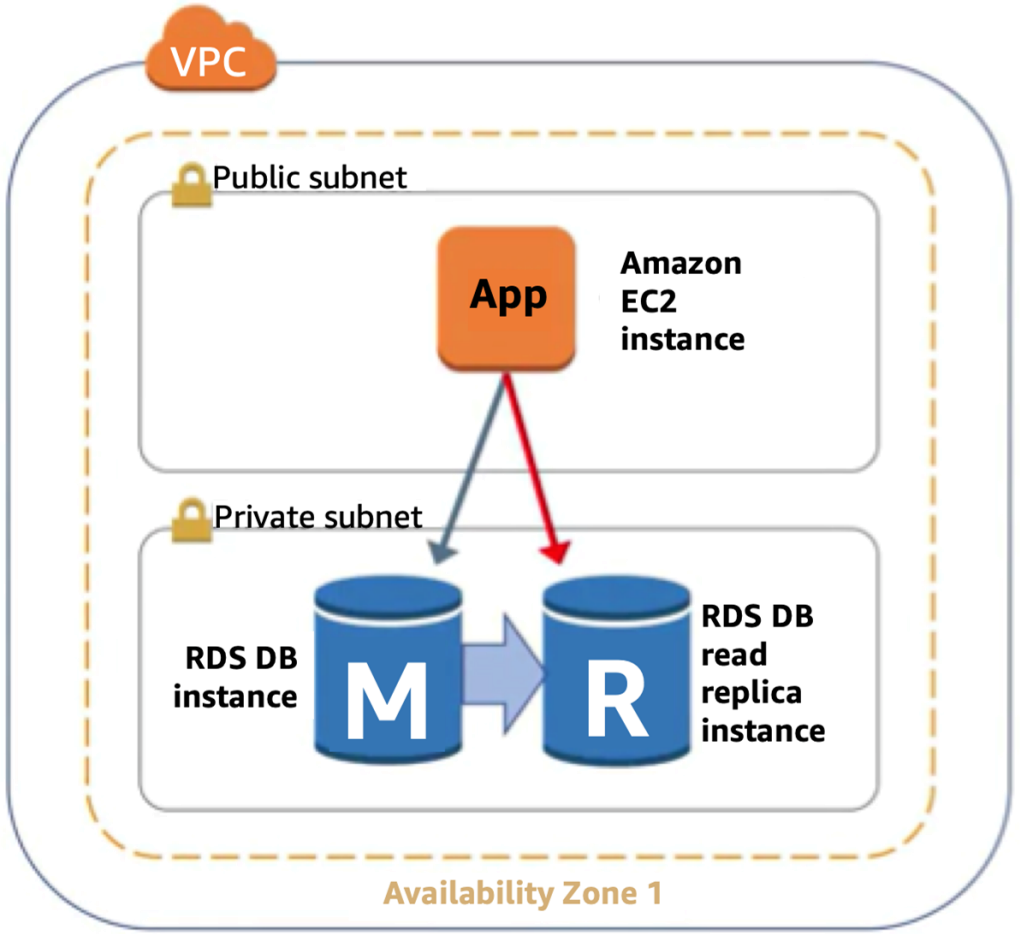
Features

- Asynchronous replication
- Promote to master if necessary

Functionality

- Read-heavy database workloads
- Offload read queries



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Summary

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Highly scalable
High performance
Easy to administer
Available and durable
Secure and compliant

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Amazon DynamoDB

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What Is Amazon DynamoDB?

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NoSQL database tables
Virtually unlimited storage
Items may have differing attributes
Low-latency queries
Scalable read/write throughput

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Common Use Cases

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Web
Mobile apps
Internet of Things
Ad tech
Gaming

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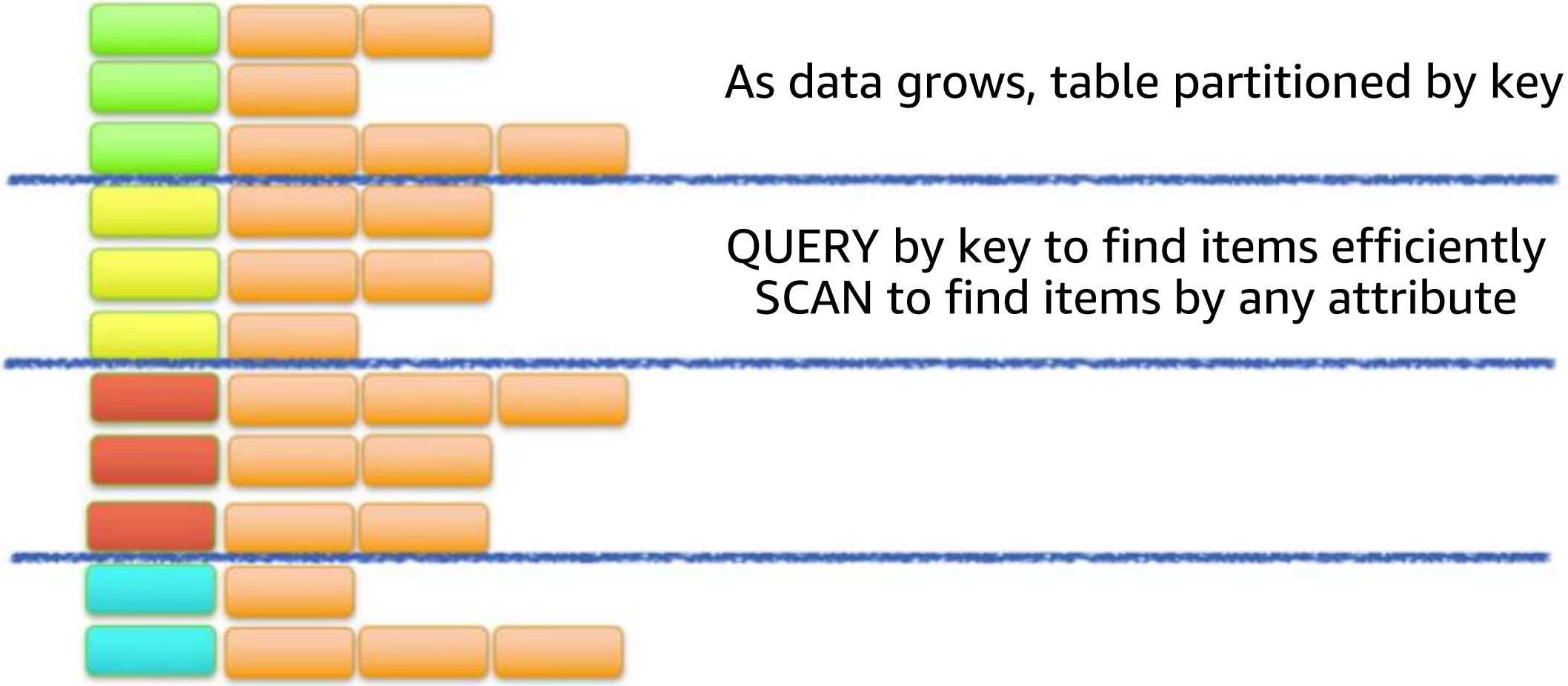
Partitioning



As data grows, table partitioned by key

QUERY by key to find items efficiently
SCAN to find items by any attribute

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Items in a Table Must Have a Key

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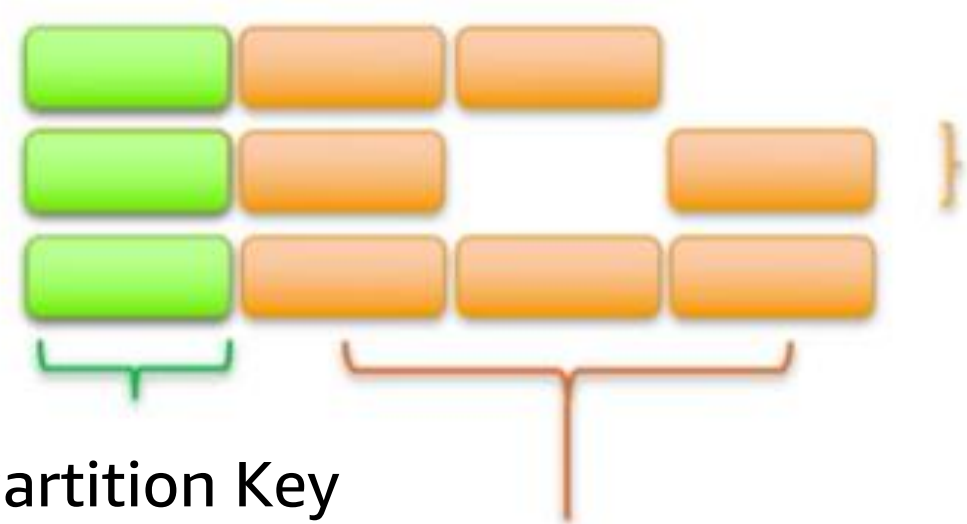
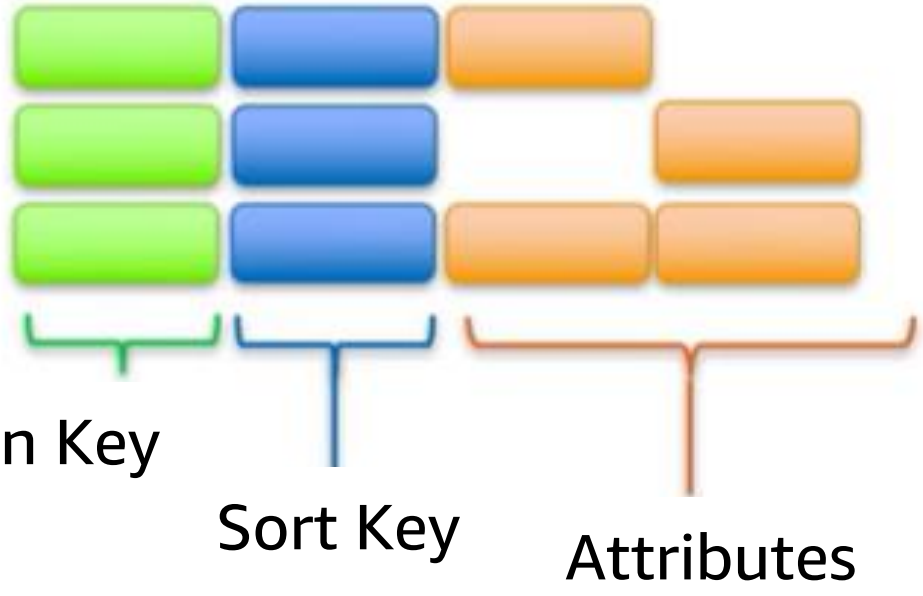
Single Key



Item

Compound Key



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Summary

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Managed NoSQL database service

Data store for applications

- Store large amounts of data
- Support high request volume
- Require low-latency query performance

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End of Module 2
Test Your Knowledge

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