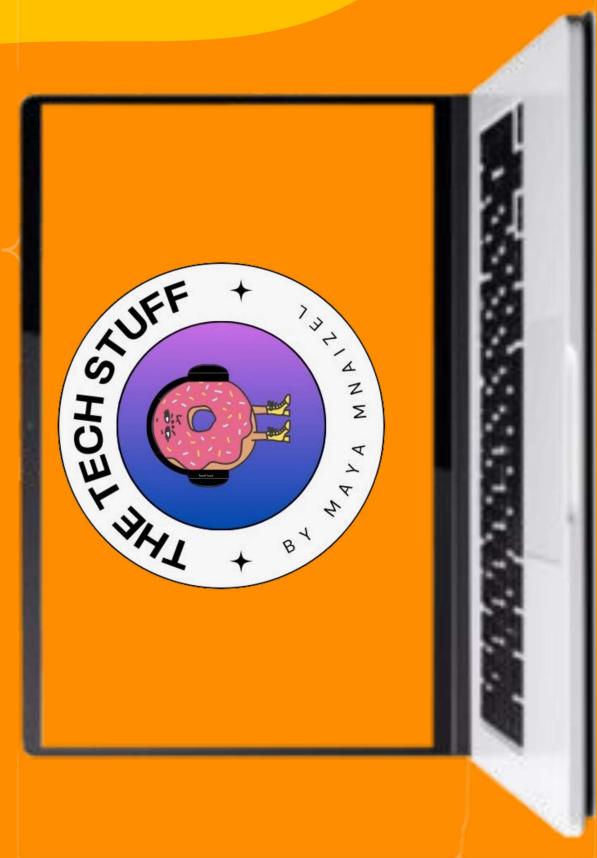


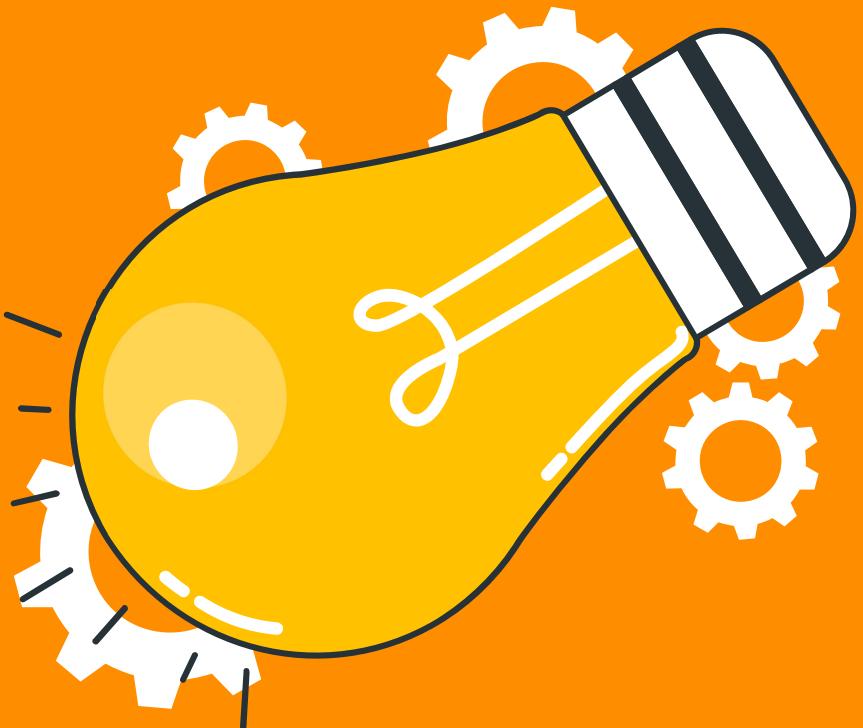
# Elastic compute cloud (EC2)

Overview of compute  
service



# TABLE OF CONTENTS

- ★ **Introduction**
- ★ **Instance Types**
- ★ **Security & Networking**
- ★ **IP Address & Elastic IPs**
- ★ **Storage Options**
- ★ **Monitoring & Management**
- ★ **Pricing & Cost Management**
- ★ **Best Practices**



01

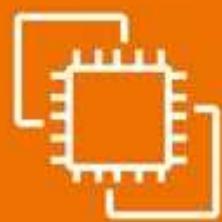
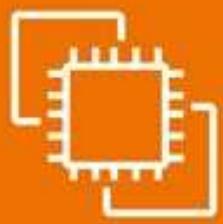
## Introduction

Configuration, User Data, AMI

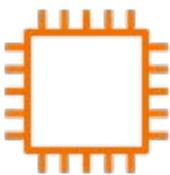
# Introduction

A web service that provides resizable compute capacity in the cloud. It is designed to make web-scale cloud computing easier for developers by allowing them to obtain and configure virtual servers, known as instances, quickly and easily.

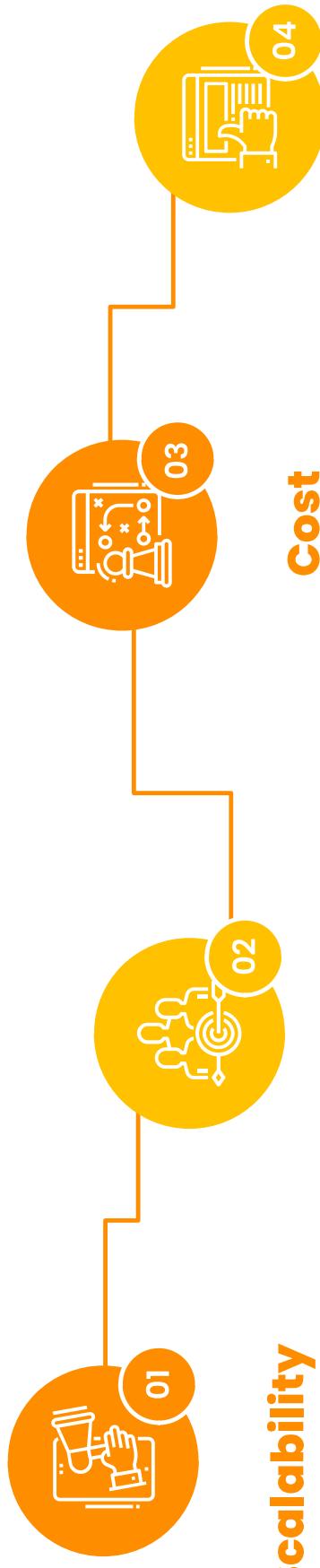
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## Benefits of EC2



Easily scale up or down to handle changes in requirements or spikes in popularity.

### Flexibility

Pay only for the resources used

### Scalability

### Cost

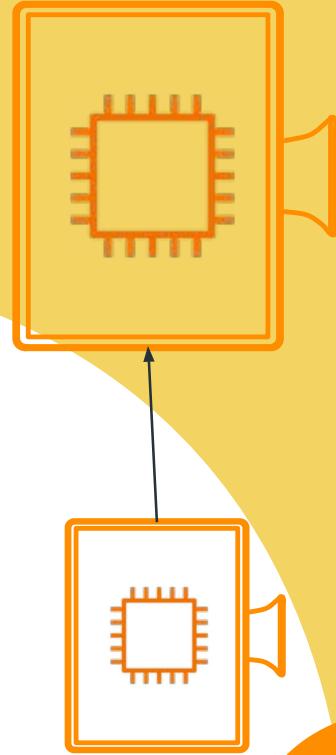
### Security

Integrated with AWS security services like IAM and VPC

# Scaling

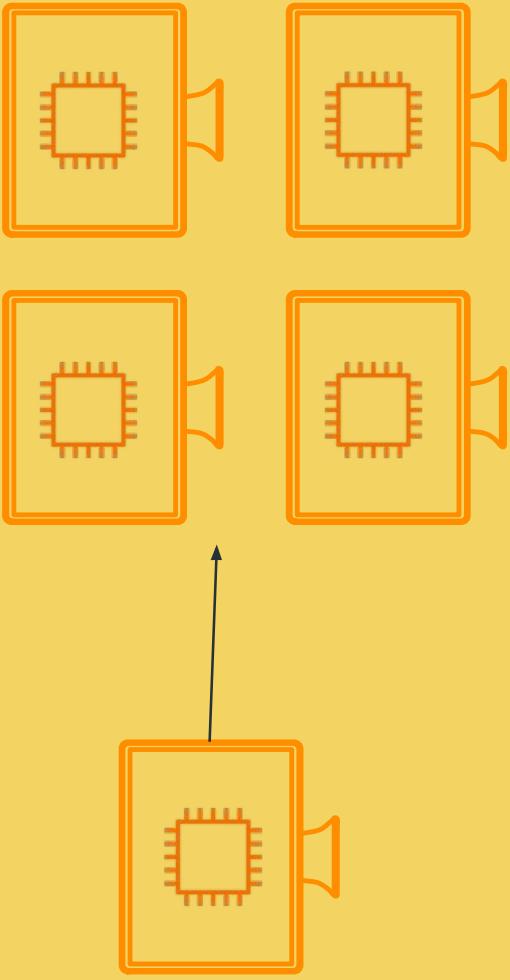
## Vertical Scaling

- Increasing or decreasing the resources (CPU, RAM) of a single server or instance.
- Upgrade the hardware of the existing server or instance.



## Horizontal Scaling

- Adding or removing instances to/from your system
- Distribute the load across multiple servers or nodes.

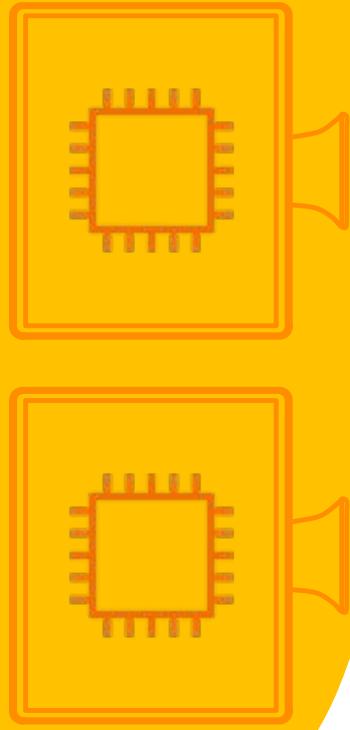
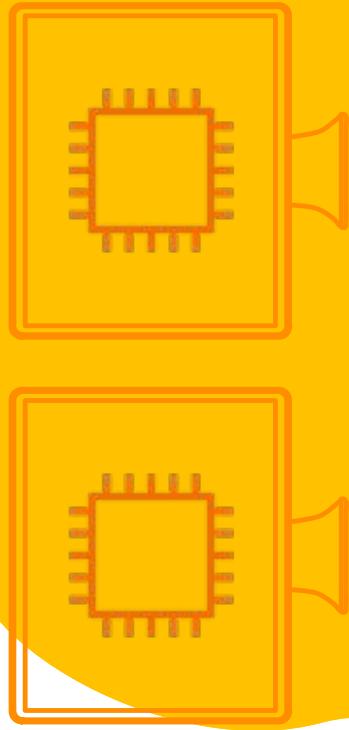


# High Availability

High Availability (HA) refers to systems that are designed to be operational and accessible without interruption for a very high percentage of time. This is achieved through redundancy, failover mechanisms, and eliminating single points of failure.

Zone A

Zone B



# Configurations

EC2 Configurations on the console



# Terminal Configurations

```
aws ec2 run-instances \
  --image-id ami-0abcdef1234567890 \# Replace with your
chosen AMI ID
  --count 1 \
  --instance-type t2.micro \
  --key-name MyKeyPair \
  --security-group-ids sg-123abc45 \# Replace with your security
group ID
  --subnet-id subnet-6e7f829e \# Replace with your subnet ID
```

# EC2 AMIs



A master image used to create instances (virtual servers) within the Amazon Elastic Compute Cloud (EC2). It contains the information required to launch an instance.

# EC2 AMIs

Basically an image of a virtual machine that captures the Operating System (os), and the machine's configuration

# TYPES OF AMI



## Public

Provided by AWS or third parties, available to any AWS user

Created and owned by an individual AWS account, not shared by default.



## Private



## Market Place

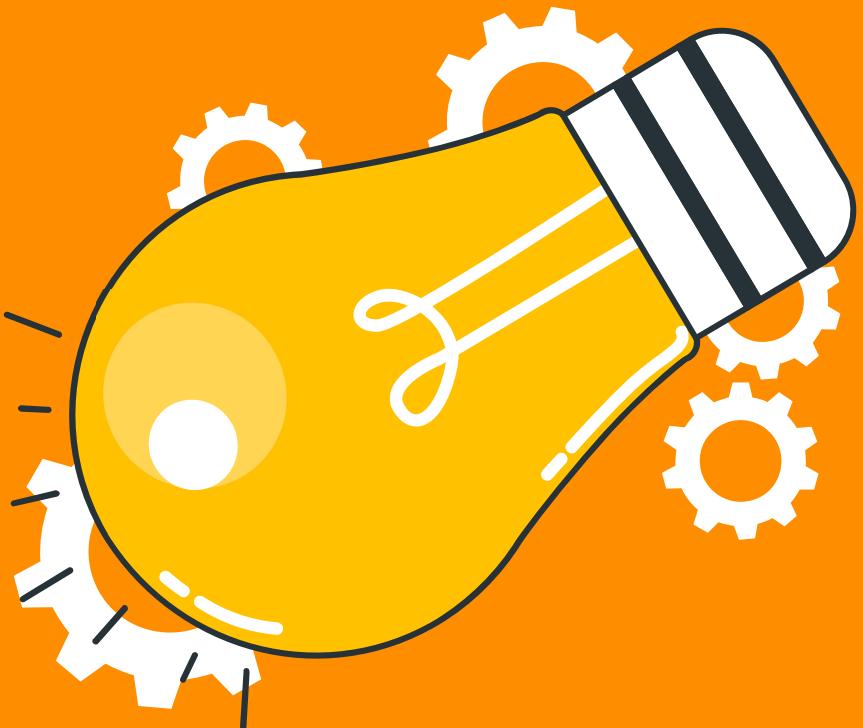
Provided by AWS Marketplace vendors, typically include pre-configured software.

## User Data

A mechanism to run scripts or commands on your instance at the time of launch. This feature allows you to automate the setup of your instance, such as installing software, configuring settings, or running any initialization tasks. User data is executed by the cloud-init process on the instance when it first starts.

## User Data

```
#!/bin/bash  
  
yum update -y  
  
yum install -y httpd  
  
systemctl start httpd  
  
systemctl enable httpd  
  
echo "<h1>Apache Server Installed</h1>" > /var/www/html/index.html
```



02

## Instance Types

EC2 Instance Types

**1)**

## **General Purpose**

For workloads that require a balance of compute, memory, and networking resources.

Use Cases: Web Servers, Microservices, Test and Development Environments

M and T class

**2)**

## **Compute Optimized**

Suitable for compute-bound applications that benefit from high-performance processors.

Use Cases: High Performance Web Servers, batch processing, Gaming Servers

C Class

**3)**

## **Memory Optimized**

Designed to deliver fast performance for workloads that process large datasets in memory.

Use Cases: High Performance Databases, Real time Data analytics, In-memory caches

R, U and X class

# 4)

## Storage Optimized

Designed for workloads that require high, sequential read and write access to large datasets on local storage.

Use Cases: NoSQL Database, Data warehousing,  
Distributed file systems

D, H and I class

**5)**

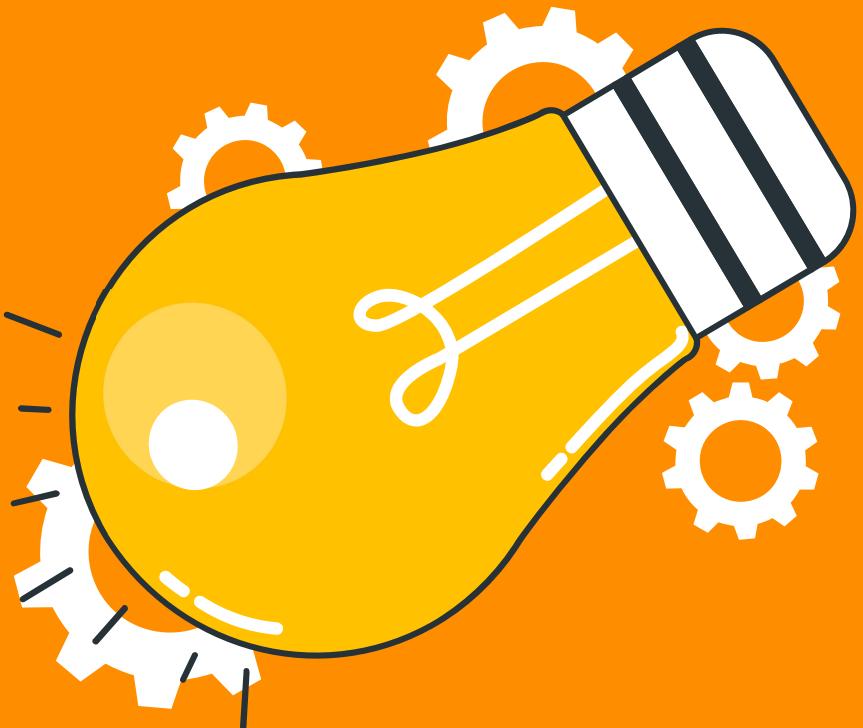
## **Accelerated Computing**

They use hardware accelerators, or co-processors, to perform functions such as floating-point number calculations, graphics processing, or data pattern matching more efficiently than software running on general-purpose CPUs.

Use cases: Machine Learning, Graphic Processing, Scientific Computing

# EC2 Instance Types

Category	Example	Use Case
General Purpose	t3.micro, m5.large	Web servers, development environments, microservices
Compute Optimized	c5.large, c6g.medium	High-performance web servers, batch processing, gaming servers
Memory Optimized	r5.large, x1e.xlarge	High-performance databases, real-time big data analytics, in-memory caches
Storage Optimized	i3.large, d2.xlarge	NoSQL databases, data warehousing, distributed file systems
Accelerated Computing	p3.2xlarge, g4dn.xlarge	Machine learning, graphics processing, scientific computing



03

## Security & Networking

Security group, key pairs, VPC  
and Subnets

# Security Groups



## scope

Instance level



## Stateful

Stateful like Door  
Man, asks when  
entering only not  
existing



## Default Behavior

Denies all inbound traffic  
by default, allows all  
outbound traffic by  
default



## Support

Supports only "allow"  
rules

# Key Pairs

## Public Key

Stored by AWS and associated  
with your EC2 instance.

## Private Key

Kept by you and used to access  
your instances securely.

# **VPC & Subnet**



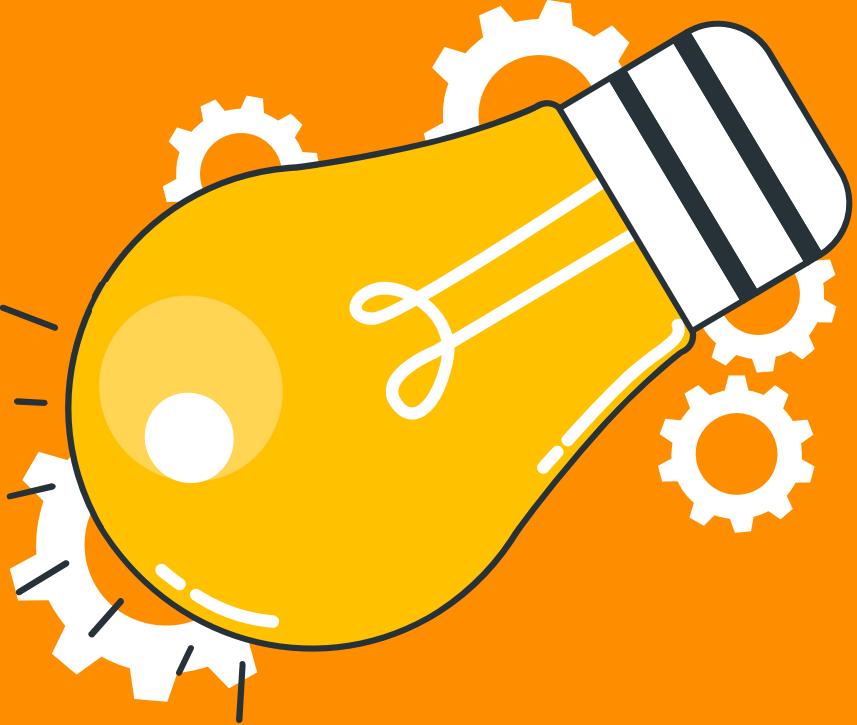
## **VPC**

Virtual Private Cloud that allows you to launch AWS resources into a virtual network.



## **Subnet**

Segment your VPC for organizational purposes and security.



**04**

## IP Address

IP Addresses and Elastic IPs

# IP Addresses

EC2 instances can have both private and public IP addresses. Understanding the different types of IP addresses and their use cases is critical for configuring and managing network connectivity.

## Private IP Address

Used for communication between instances within the same VPC (Virtual Private Cloud). These addresses are not routable over the internet.



## Public IP Address

Allow EC2 instances to communicate with the internet. These addresses are routable over the internet.

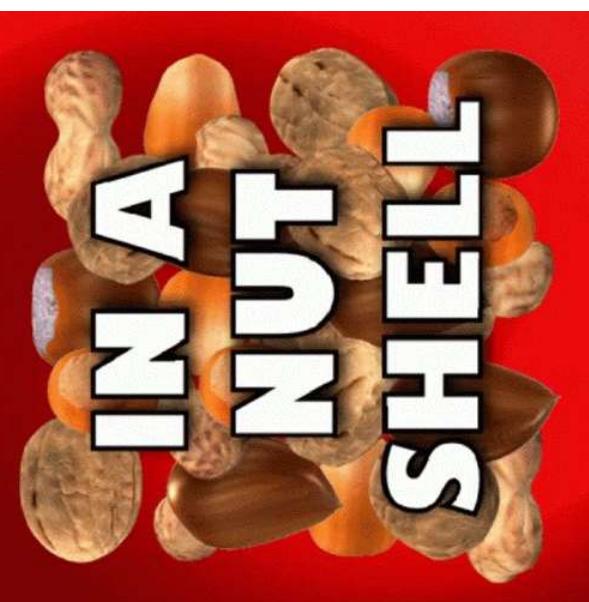


**Static public IPv4 addresses designed  
for dynamic cloud computing**





## Key Features



- **Static**  
Unlike regular public IP addresses, EIPs are static and do not change.
- **Reassociation**  
can be reassigned to another instance or network interface in your account
- **Cost**  
AWS charges for EIPs when they are not associated with a running instance



## Use Cases

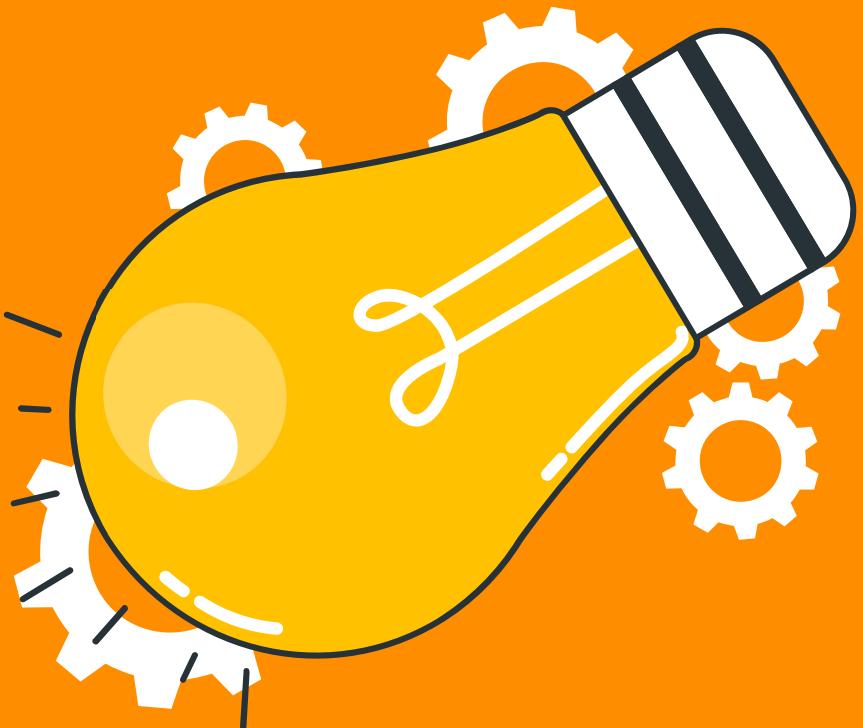
### **Failover Scenarios**

Reassign EIPs to standby instances to quickly recover from instance failures.

### **Consistent Addressing**

Maintain the same public IP address even when the underlying instance changes, which is useful for DNS configurations.

# **10 Minute Break**



**05**

## Storage Options

Overview on Storage Options

# Storage Options



# 1)

## Instance Store

Instance Store provides temporary block-level storage for your Amazon EC2 instances. This storage is physically attached to the host computer that is running the instance.

Instance Store is Ephemeral

Use cases:

**Temporary Data Storage:** Ideal for temporary data that can be recreated, such as buffers, caches, and scratch data.

**High I/O Performance:** Suitable for applications requiring low-latency storage



## Instance Store Limitations

### Non-persistent

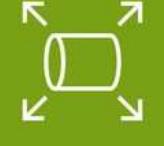
Data is lost when the instance is stopped, terminated, or if the underlying disk fails.

### Size Limitation

Limited by the instance type's physical storage capacity.

## 2) EBS

A persistent block storage volumes for use with Amazon EC2 instances. EBS volumes are automatically replicated within their Availability Zone to protect from component failure, offering high availability and durability.



## Elastic Block Storage (EBS)



Snapshots: Incremental Backups



Use Cases: Persistent Storage, Boot Volumes



Best Practices:

- Regular Snapshots
- Encryption
- Performance Monitoring



# EBS Volume

# Types



Volume Type	Description	Use Case	Durability	Throughput, I/O	Cost
General Purpose SSD (gp2)	Balanced price and performance. Ideal for a broad range of workloads.	System boot volumes, small to medium-sized databases, dev/test	99.999%	Up to 16,000 IOPS	\$\$
General Purpose SSD (gp3)	Lower cost than gp2 with consistent baseline performance.	General-purpose workloads	99.999%	Up to 16,000 IOPS	\$
Provisioned IOPS SSD (io1)	Designed for I/O intensive applications. Provides high performance and low latency.	Large databases, critical applications	99.999%	Up to 64,000 IOPS	\$\$\$\$
Provisioned IOPS SSD (io2)	Higher durability than io1 with same high performance.	Enterprise applications, large databases	99.9999%	Up to 64,000 IOPS	\$\$\$\$

Volume Type	Description	Use Case	Durability	Throughput, I/O	Cost
Throughput Optimized HDD (st1)	Low-cost HDD volume designed for frequently accessed, throughput-intensive workloads.	Big data, data warehouses, log processing	99.999%	Up to 500 MB/s	\$
Cold HDD (sc1)	Lowest cost HDD volume designed for less frequently accessed workloads.	Infrequent access data, backups	99.999%	Up to 250 MB/s	\$

## Notes

- Only gp2/gp3 and io1/io2 can be used as boot volumes
- You can Attach io1/io2 EBS Volumes to multiple EC2 Instances  
**if they are in the same AZ (Multi Attach)**
- Up to 16 instance at a time

You can create Encrypted EBS Volumes

- They use Key such as (AES - 256)
- Snapshot from **encrypted volumes** -> encrypted

## **EBS Best Practices**

**Regular Snapshots:** Schedule regular snapshots to ensure data protection.

**Encryption:** Use encryption for sensitive data.

**Performance Monitoring:** Monitor and adjust volume type based on performance requirements.

### 3) **EFS**



A fully managed, scalable file storage service for use with Amazon EC2. It provides a simple, scalable, elastic file system for Linux-based workloads.

# EFS

- Compatible for Linux AMI not Windows
- POSIX File System
- Mount upto 100 instances across AZs
- Uses EC2 NIC's to mount

Use Cases:

**Big Data and Analytics:** Store and process large amounts of data.

**Content Management:** Serve large-scale content to users.

**Web Serving and Content Management:** Share common files among multiple instances.

## Performance Modes

### General Purpose

Latency: Low latency.

Use Cases: Ideal for latency-sensitive use cases such as web serving environments, content management systems, and development environments.



## Performance Modes

### Max I/O

Latency: Higher latency.

Throughput: Higher aggregate throughput.

Use Cases: Suitable for highly parallelized applications and workloads such as big data analysis, media processing, and genomics analysis.



# Throughput Mode

## Bursting

It automatically adjusts the throughput performance based on the size of your file system. This mode is designed to handle varying levels of activity and provides higher throughput levels during periods of heavy activity by accumulating burst credits.

## Provisioned

Provisioned Throughput mode allows you to specify the throughput of your file system independently of its size. This mode provides consistent performance for applications with high and steady throughput requirements.

## Storage Classes

### **Standard**

Designed for frequently accessed data

Highly durable and available across multiple Availability Zones (AZs)..

### **Infrequent Access (IA)**

Designed for files that are not accessed every day

Lower storage cost but higher retrieval cost compared to the Standard class

## **EFS Life Cycle Management**

EFS can automatically transition files between Standard and Infrequent Access classes based on the last access time. This feature helps optimize costs by storing infrequently accessed files in the lower-cost IA storage class.

## 4) FSX

Amazon FSx provides fully managed third-party file systems optimized for a variety of workloads.

# FSx For Lustre

FSx for  
Lustre

## Key Features

- High Performance (low latency, high throughput)
- Integration with S3
- Scalability
- POSIX Compliance
- Bursting Performance



FSxForLustre

## Use Cases

- Machine learning
- High-performance computing
- Big data analytics
- Media rendering
- Genomics analysis

# FSX For Windows File Server



## Key Features

- SMB Protocol (SMB 2.0 and 3.0)
- Active Directory Integration
- DFS Namespace
- File System Auditing
- Automatic Backups
- High Availability (Multi-AZ)

# FSX For Windows File Server



## Use Cases

- Enterprise applications requiring shared file storage
- Home directories
- File sharing
- Microsoft SQL Server databases
- Backup and disaster recovery

# FSX for NetApp ONTAP

FSx<sup>N</sup>

## Key Features

- Multi-Protocol Access (NFS, SMB, iSCSI)
- NetApp ONTAP Features
- High Availability (Multi-AZ)
- Data Protection
- Efficient Storage (deduplication, compression)

# FSX for NetApp ONTAP

FSx<sup>N</sup>

## Use Cases

- Enterprise applications requiring shared file and block storage
- Hybrid cloud workloads
- Databases and DevOps environments
- Backup and disaster recovery

# FSX For Windows File Server



## Use Cases

- Enterprise applications requiring shared file storage
- Home directories
- File sharing
- Microsoft SQL Server databases
- Backup and disaster recovery

# FSX for NetApp ONTAP

FSx<sup>N</sup>

## Key Features

- Multi-Protocol Access (NFS, SMB, iSCSI)
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- High Availability (Multi-AZ)
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# FSX for NetApp ONTAP

FSx<sup>N</sup>

## Use Cases

- Enterprise applications requiring shared file and block storage
- Hybrid cloud workloads
- Databases and DevOps environments
- Backup and disaster recovery

# FSX for openZFS

FSX<sub>ZFS</sub>

## Key Features

- High Performance (low latency, high throughput)
- Snapshots and Clones
- Data Integrity
- Scalability
- Multi-Protocol Access (NFS, SMB, iSCSI)

# FSX for openZFS

FSX<sub>ZFS</sub>

## Key Features

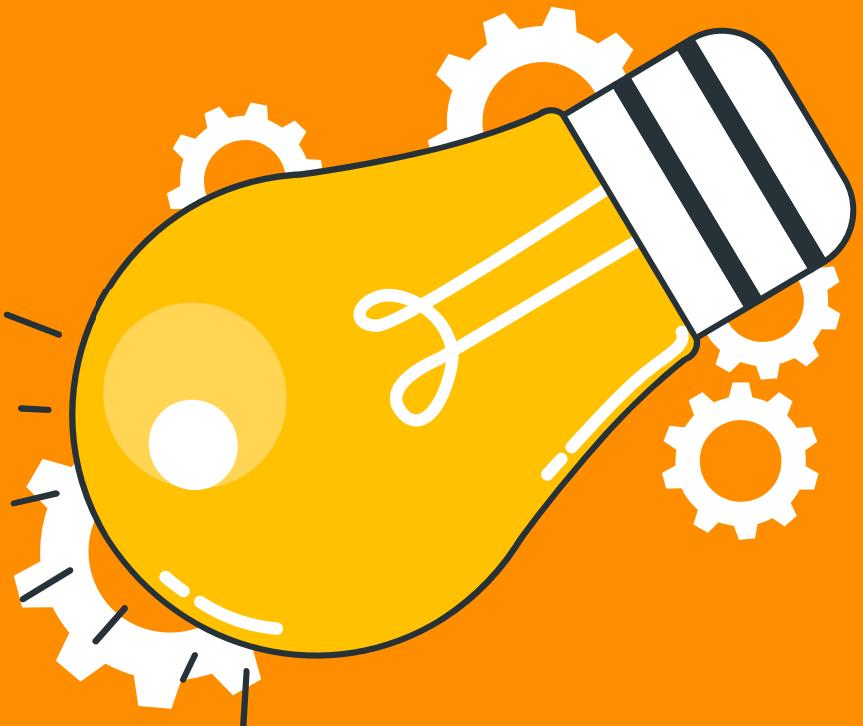
- High Performance (low latency, high throughput)
- Snapshots and Clones
- Data Integrity
- Scalability
- Multi-Protocol Access (NFS, SMB, iSCSI)

# FSX for openZFS

FSX\_ZFS

## Use Cases

- High-performance applications
- Development and testing environments
- Data protection
- Content management
- Big data analytics



06

## Monitoring

Cloudwatch, ELB, & ASG



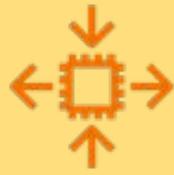
# cloudwatch

Monitor your EC2 instances and other AWS resources in real-time.



# ELB

Distributes incoming application traffic across multiple EC2 instances.



# ASG

Automatically adjusts the number of EC2 instances in response to changes in demand.

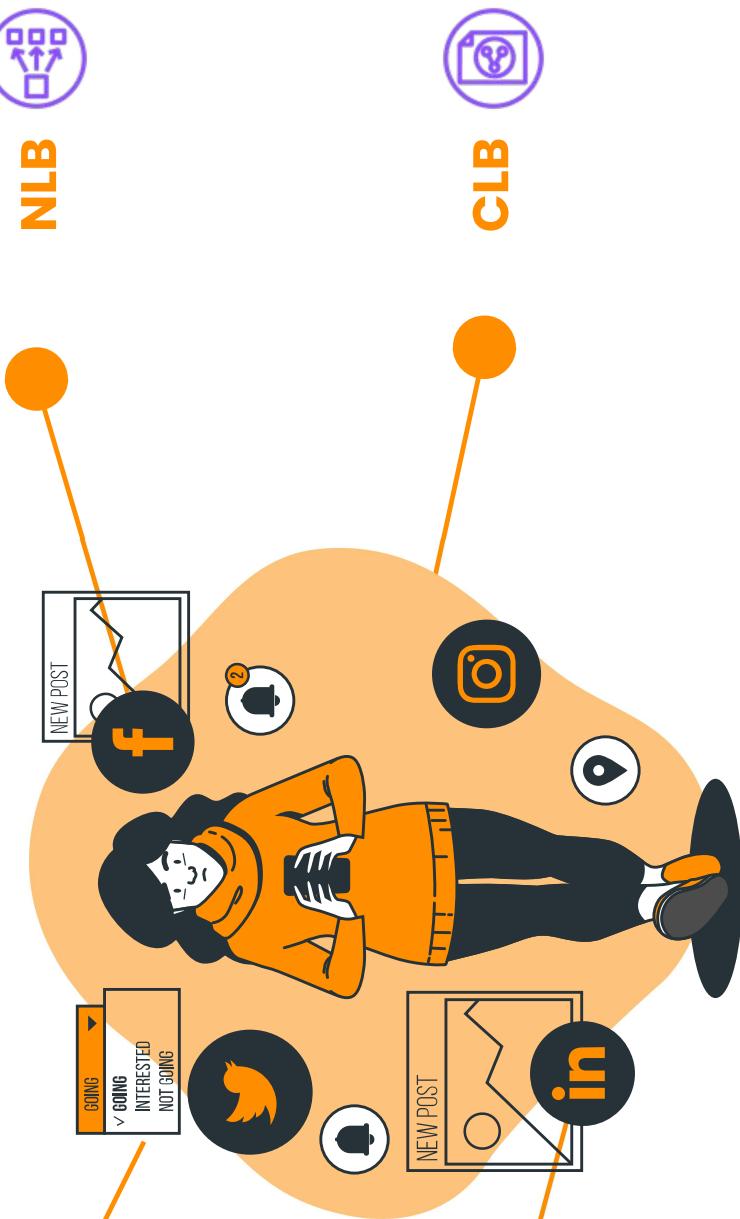


ALB



NLB

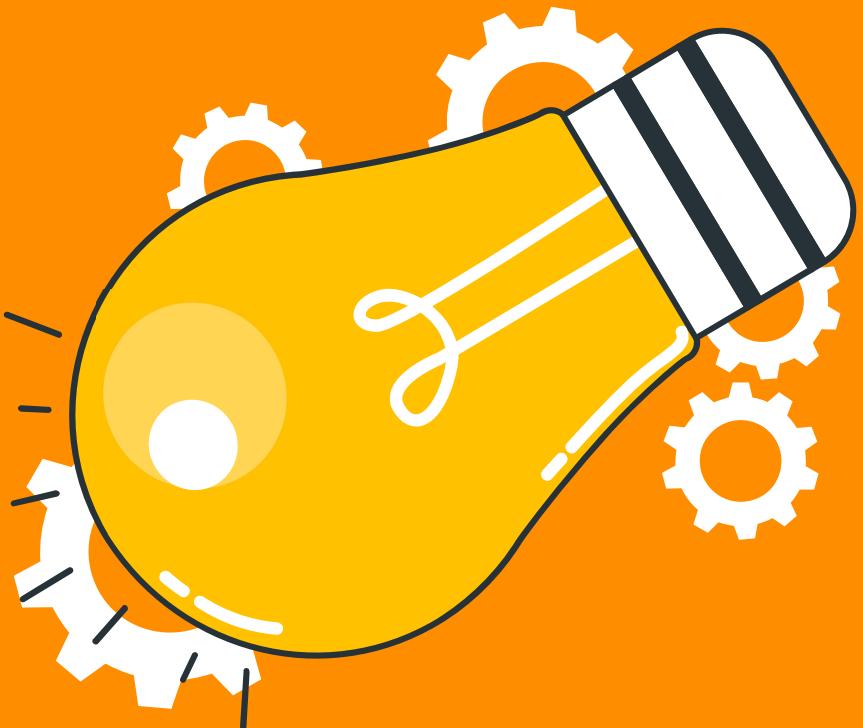
# Elastic Load Balancers



CLB



GLB

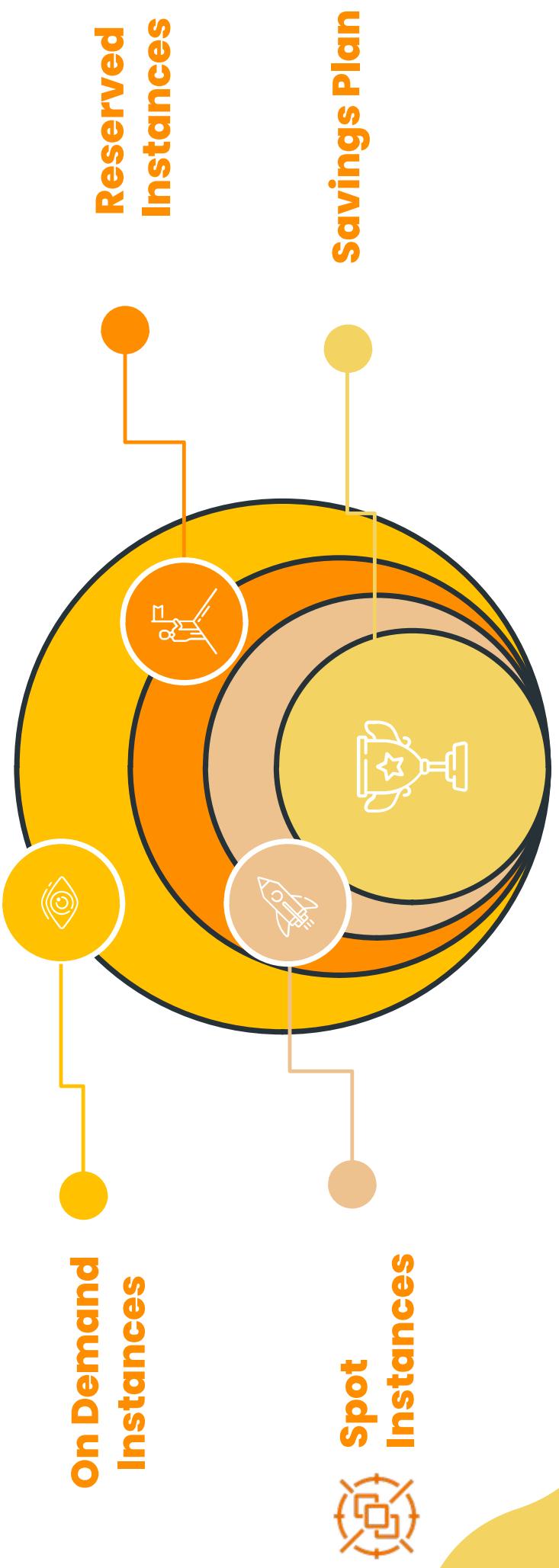


**07**

## Pricing and Cost

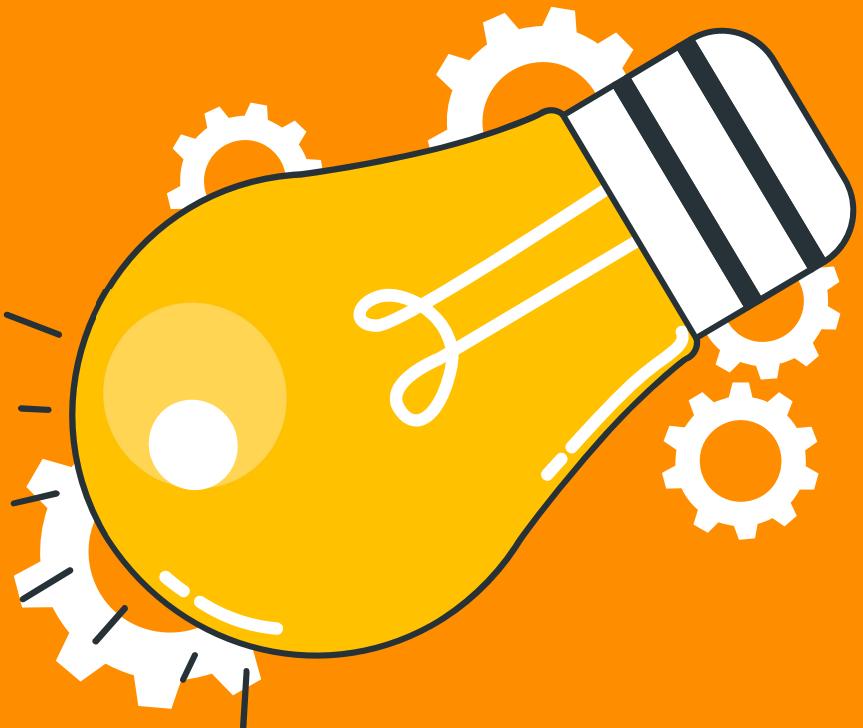
Instance pricing options

# Purchasing options



Purchasing Options	Description	Use Cases	Billing	Commitment	Flexibility
On Demand	Pay for compute capacity by the hour or second with no long-term commitments.	Short-term, spiky, or unpredictable workloads that cannot be interrupted.	Per-second billing (min of 60 sec).	No commitment.	Full.
Reserved	Up to 75% discount compared to On-Demand pricing. Requires a commitment of 1 or 3 years.	Steady-state or predictable usage.	Upfront, Partial, or No Upfront.	1-year or 3-year commitment	Less
Saving Plans	Up to 72% discount compared to On-Demand pricing. Applies to EC2 and Fargate usage.	Steady-state or predictable usage with more flexibility compared to RIs.	Commitment to a consistent amount of usage (\$/hour) for a 1-year or 3-year term.	1-year or 3-year commitment.	Flexible across instance families, sizes, AZS, regions, OS, and tenancy

Purchasing Options	Description	Use Cases	Billing	Commitment	Flexibility
Spot Instance	Up to 90% discount Suitable for flexible, fault-tolerant workloads.	Applications with flexible start and end times, or applications	Per-second billing (min of 60 sec).	No commitment.	Most flexible, but can be interrupted.
Dedicated hosts	Physical servers dedicated for your use. Can help you meet compliance requirements	Workloads requiring a dedicated physical server, regulatory requirements.	Hourly, daily, or monthly.	1-year or 3-year commitment	Flexible, but limited to specific use cases.
Dedicated Instances	Instances that run on hardware dedicated to a single customer.	Workloads requiring isolation from other customers.	Hourly billing.	No commitment.	Flexible



**08**

## **Best Practices**

Recommendations

## **Security Best Practices**

- 1)** Use IAM roles to control access.
- 2)** Regularly update your AMIs and patches.
- 3)** Use security groups effectively.

## Performance Best Practices

- 1) Choose the right instance type.
- 2) Use Auto Scaling.
- 3) Monitor with Cloudwatch

## **Cost Best Practices**

- 1)** Use Reserved and Spot Instances.
- 2)** Take advantage of Savings Plans.
- 3)** Regularly review and adjust resources.



# THANKS!



Do you have any questions?

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