



DevKTOps



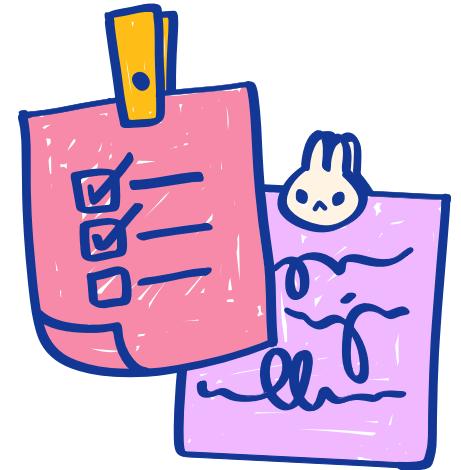
# ARCHITECTING ON aws

The AWS logo, which consists of a thick orange curved arrow pointing to the right.

Module 4: Compute Layer



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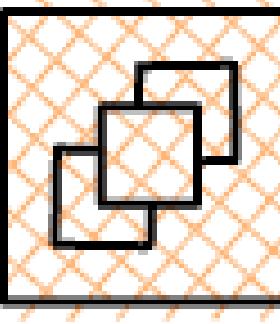
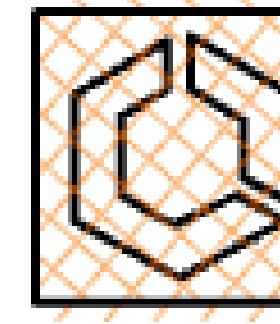
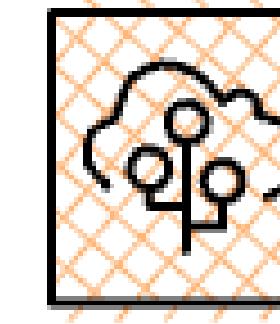
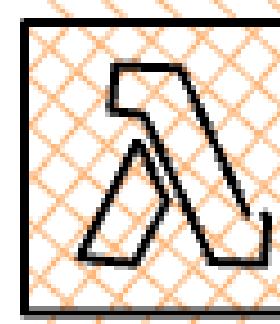
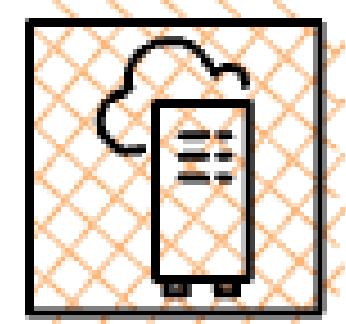
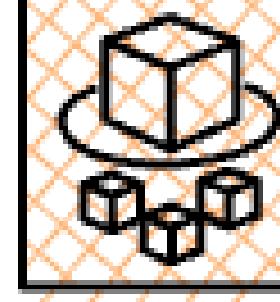
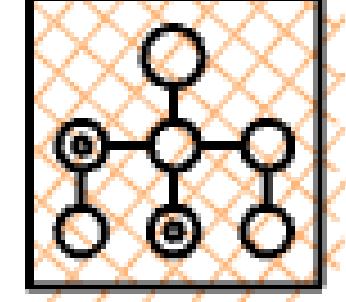
# Module Overview

- What is Amazon EC2?
- Instance types and families
- What is Amazon EBS?



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# Amazon Compute Services

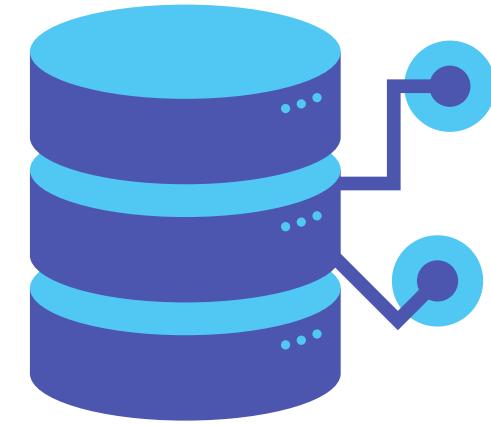
Virtual Machines (VMs)	Containers	Platform as a Service	Serverless	Specialized Solutions
 Amazon EC2	 Amazon ECS	 AWS Elastic Beanstalk	 AWS Lambda	 AWS Outposts
 Amazon Lightsail			 AWS Fargate	 AWS Batch



# What is Amazon EC2?



Web Hosting



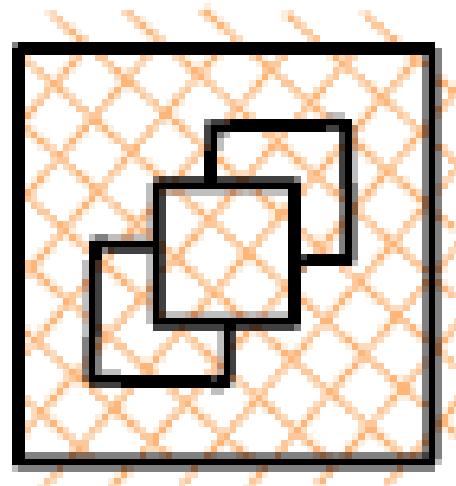
Databases



Anything a sever can  
do



# Amazon EC2



Amazon Elastic Compute Cloud

- Provides Virtual Machines (Servers)
- Can provision servers in minutes
- Automatically scale capacity as needed
- Pay only for the used capacity



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# VM vs Physical

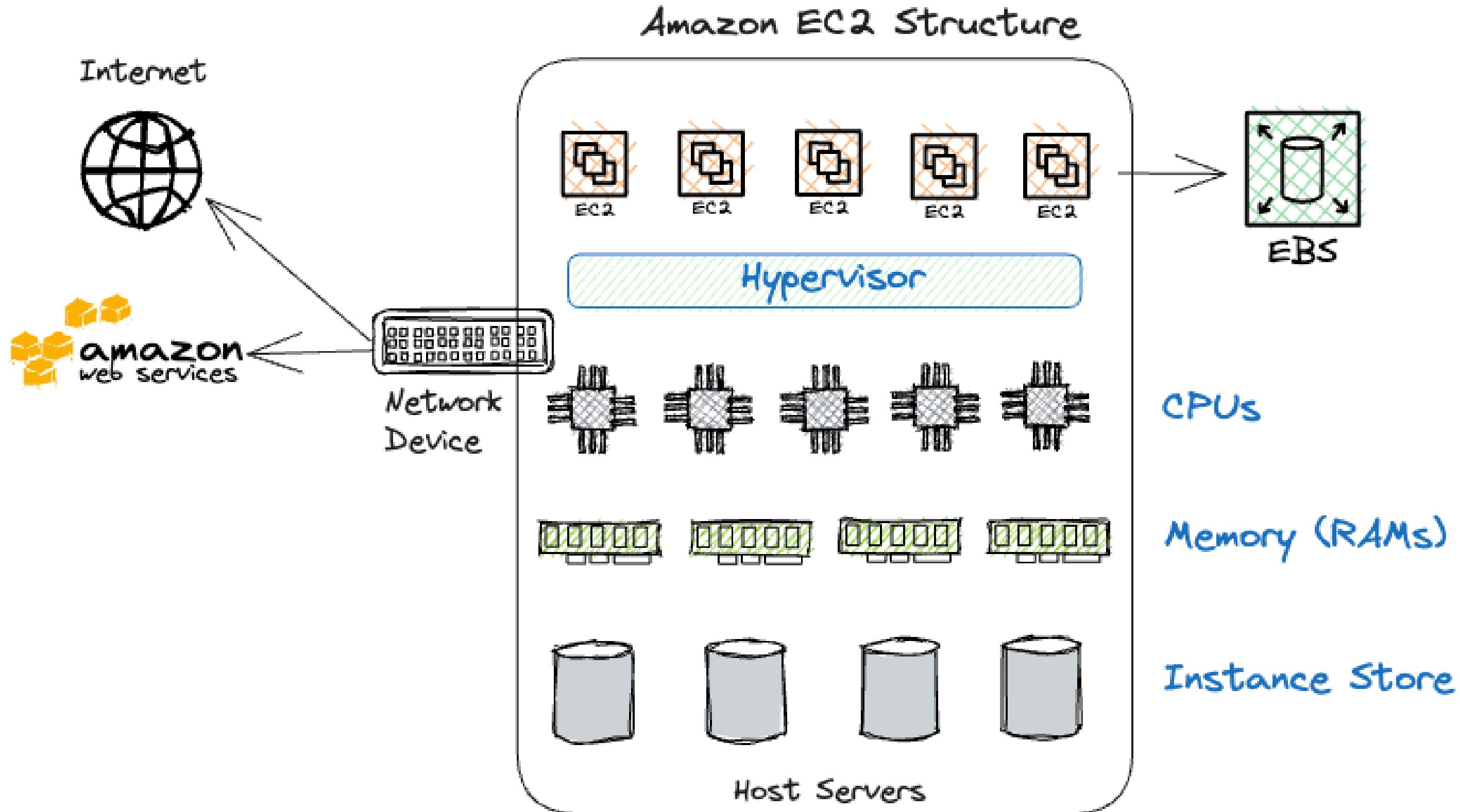


Free to Make Mistakes  
Instantiated within seconds



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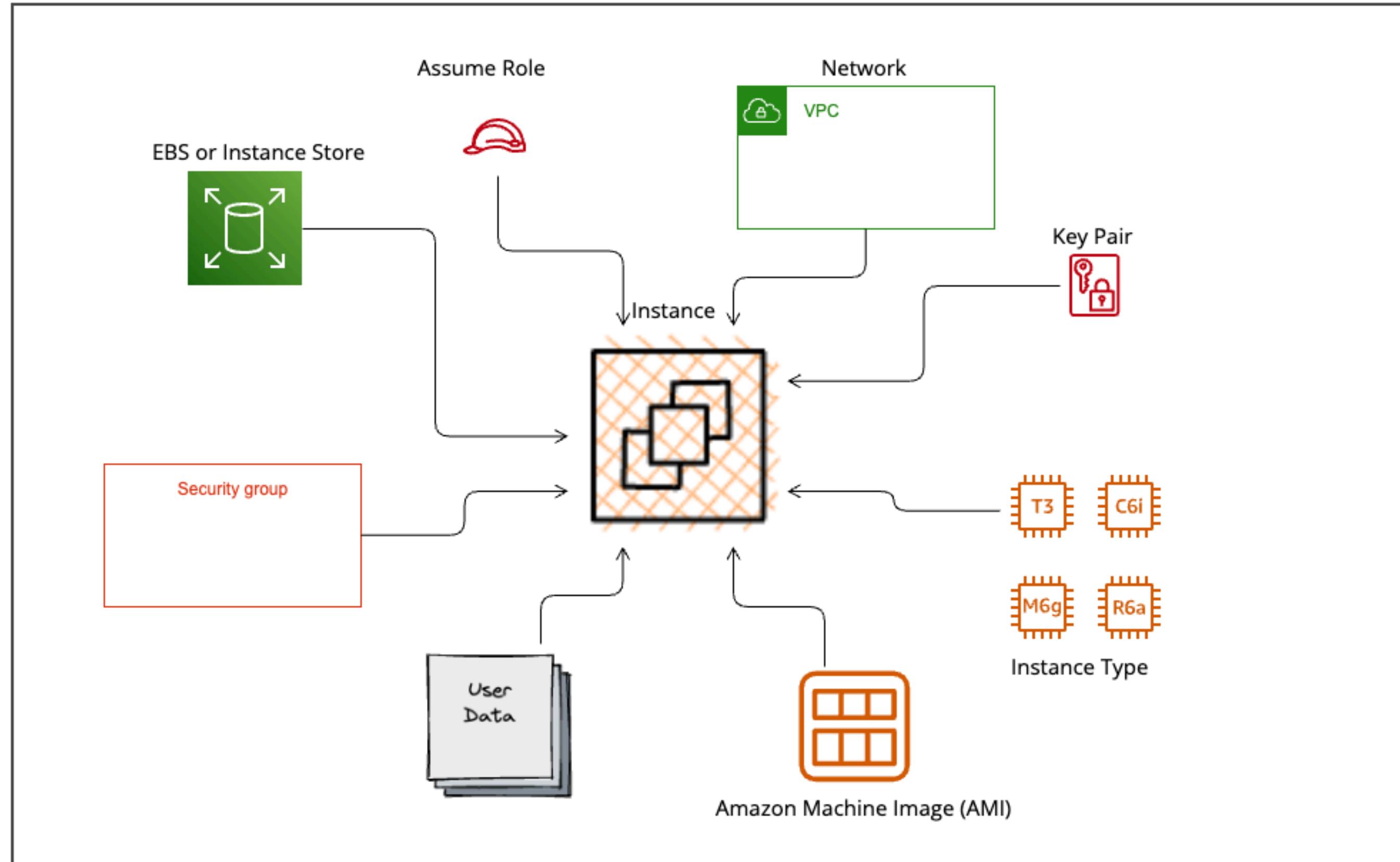
# EC2 Instances





# EC2 Provisioning

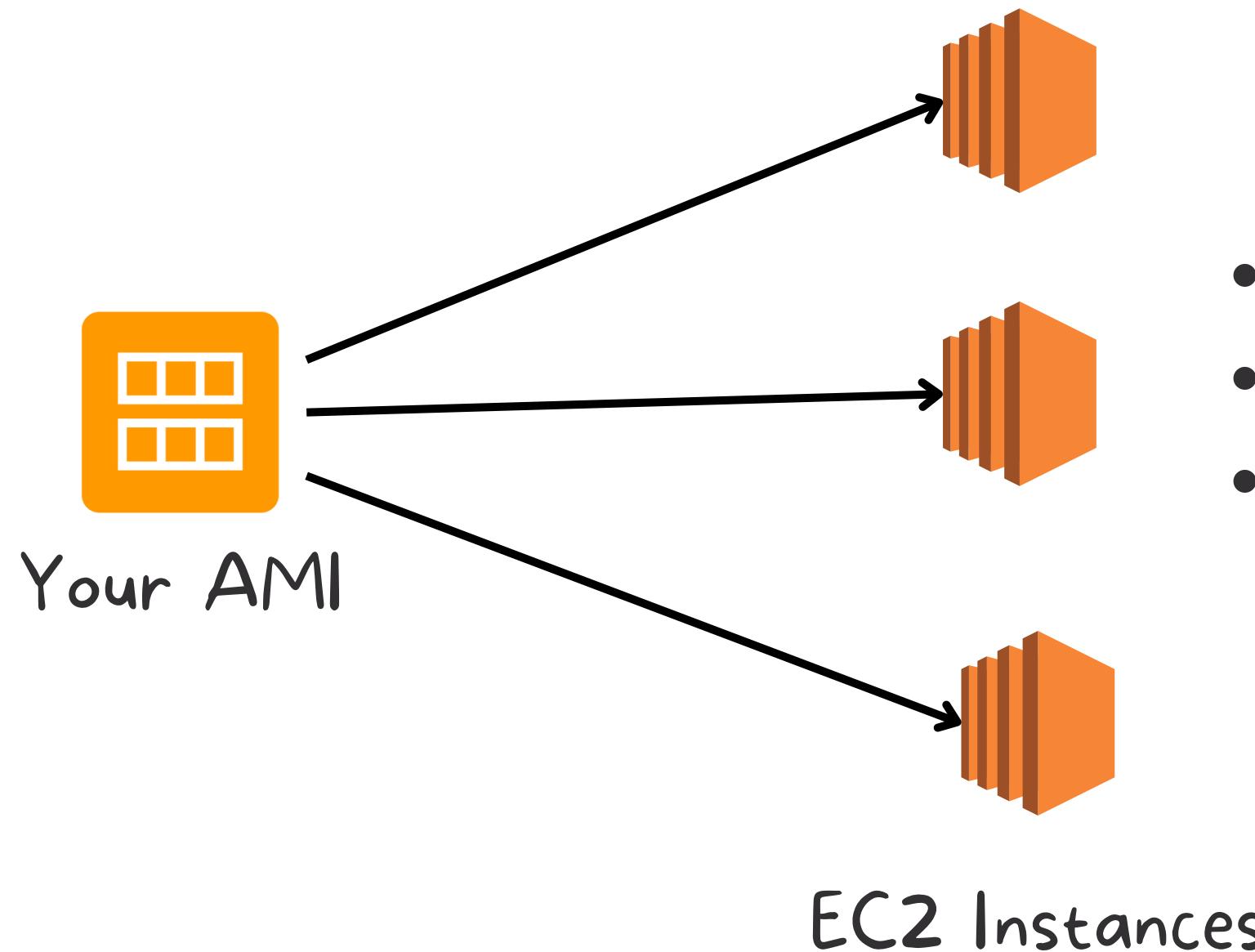
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# Amazon AMI



- Must specify a source AMI
- Can Launch multiple instances from a single AMI
- Can use different AMIs to launch different type of instances



# What is Include in AMI?



Provides the information required to launch an instance

An AMI includes the following:

- Root Volume Template
  - Full operating system
  - Everything installed into this OS
- Launch Permissions - Control AMI that can be used from which AWS Accounts
- A block device mapping - attach specific volumes to the instance



# How to get AMI?



Pre Built



AWS Marketplace



Own Created



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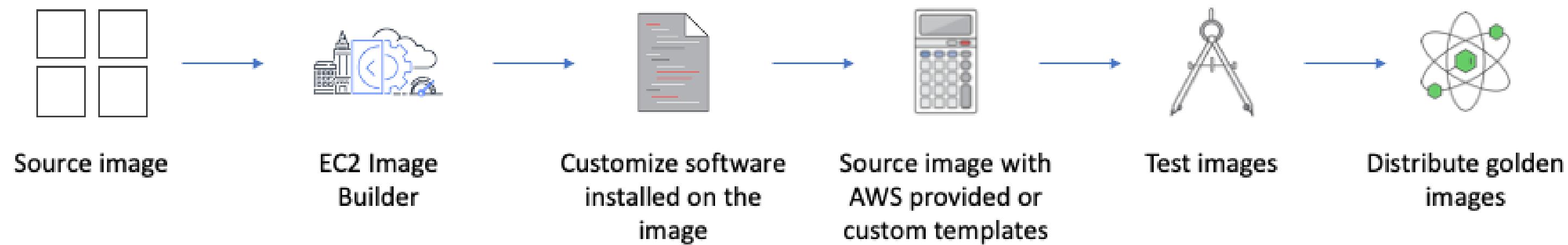
# Benefits of AMI

- 1 Repeatability
- 2 Reusability
- 3 Recoverability
- 4 Marketplace Solutions
- 5 Backups



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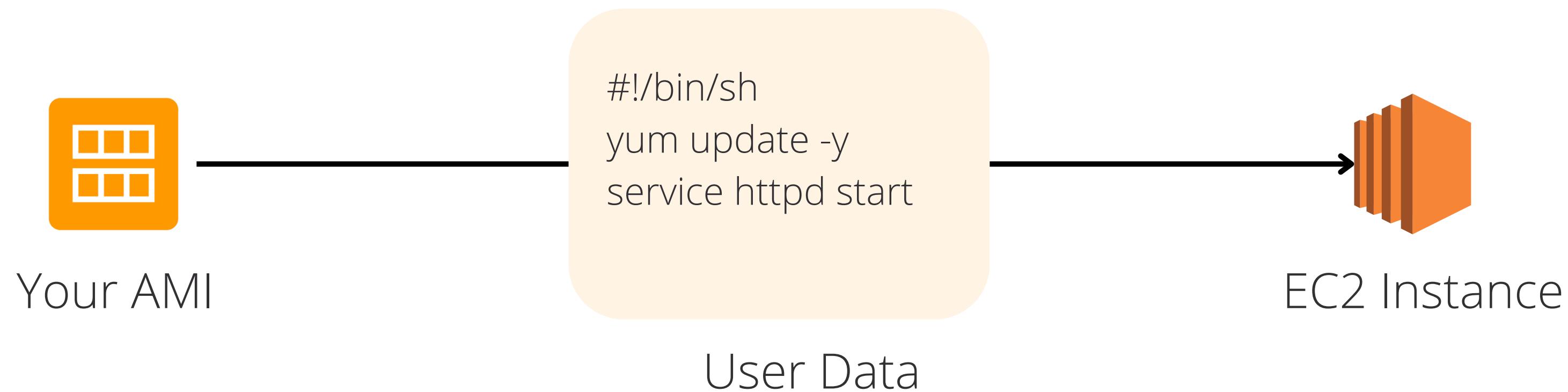
# EC2 Image Builder



EC2 Image Builder simplifies the building, testing, and deployment of Virtual Machine and container images for use on AWS or on-premises.



# User Data in EC2





# Why EBS Volume need for EC2?

Block-level storage

Persist Data  
through shutdown

Instance store is  
ephemeral

Multiple EBS Volumes can be on the same instance, but each volume can be attached to only one instance at a time.



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# Instance Store

An instance store provides temporary block-level storage. This storage is located on disks that are physically attached to the host computer. Instance store is idea for temporary storage of information that changes frequently.

# EBS Volumes

Amazon EBS volumes provide durable, detachable, block-level storage for your EC2 instances. Can be used to run a database, to backup your instances into AMI.





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# Amazon EBS Volumes Type

## Solid-State Drive

Volume Type	General Purposed SSD	Provisioned IOPS SSD
Description	General purpose SSD volume that balances price and performance for a wide variety of workloads	Highest-performance SSD volume for mission-critical low-latency or high-throughput workloads
Use Cases	<ul style="list-style-type: none"><li>• Transactional workloads</li><li>• Virtual desktops</li><li>• Medium-sized, single-instance databases</li><li>• Low-latency interactive applications</li><li>• Boot volumes</li><li>• Development and test environments</li></ul>	<ul style="list-style-type: none"><li>• Critical business applications that require sustained IOPS performance</li><li>• Large database workloads</li></ul>



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# Amazon EBS Volumes Type

## Hard-Disk Drive

Volume Type	Throughput Optimized HDD	Cold HDD
Description	Low cost HDD volume designed for frequently accessed, throughput-intensive workloads	Lowest cost HDD volume designed for less frequently accessed workloads
Use Cases	<ul style="list-style-type: none"><li>• Big data</li><li>• Data warehouses</li><li>• Log processing</li><li>• Cannot be a boot volume</li></ul>	<ul style="list-style-type: none"><li>• Throughput-oriented storage for data that is infrequently accessed</li><li>• Scenarios where the lowest storage cost is important</li><li>• Cannot be a boot volume</li></ul>



# Shared File Systems



Amazon EBS only  
attaches to one instance



Amazon S3 is an  
option but is not ideal

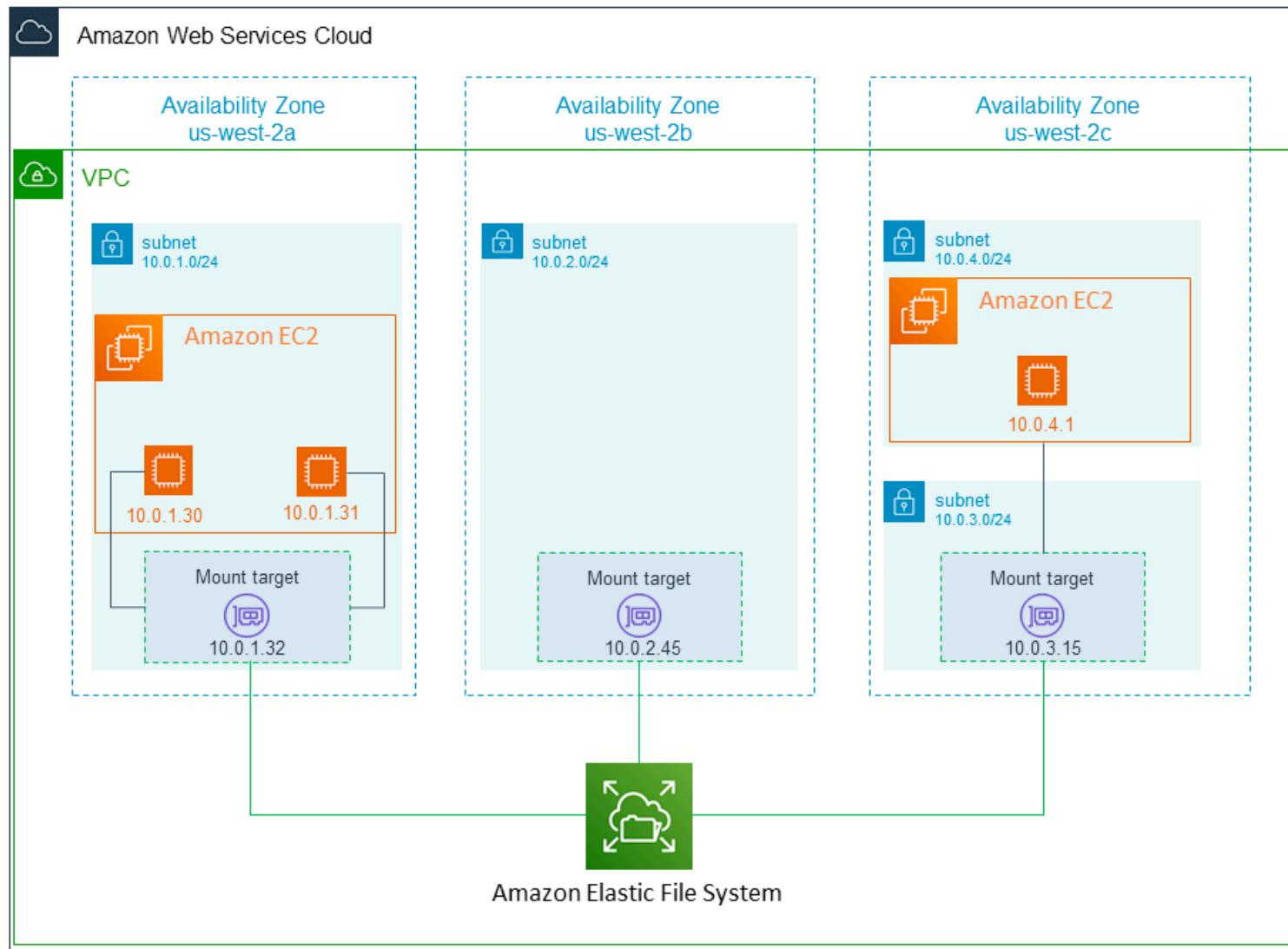


Amazon EFS and  
Amazon FSx are perfect



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# Amazon EFS



Amazon EFS provides a simple, scalable, elastic file system for Linux-Based workloads with NFSv4 protocol

## Share Across

- Availability Zones
- Regions
- VPCs
- Account



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# Amazon FSx



## Amazon FSx for NetApp ONTAP

Fully managed shared storage  
built on NetApp's popular  
ONTAP file system.



## Amazon FSx for OpenZFS

Fully managed shared storage  
built on the popular OpenZFS  
file system.



## Amazon FSx for Windows File Server

Fully managed shared storage  
built on Windows Server.



## Amazon FSx for Lustre

Fully managed shared storage  
built on the world's most  
popular high-performance file  
system.



# EC2 Instance Name

m5.large

m is the family name

5 is the generation number

large is the size of the instance



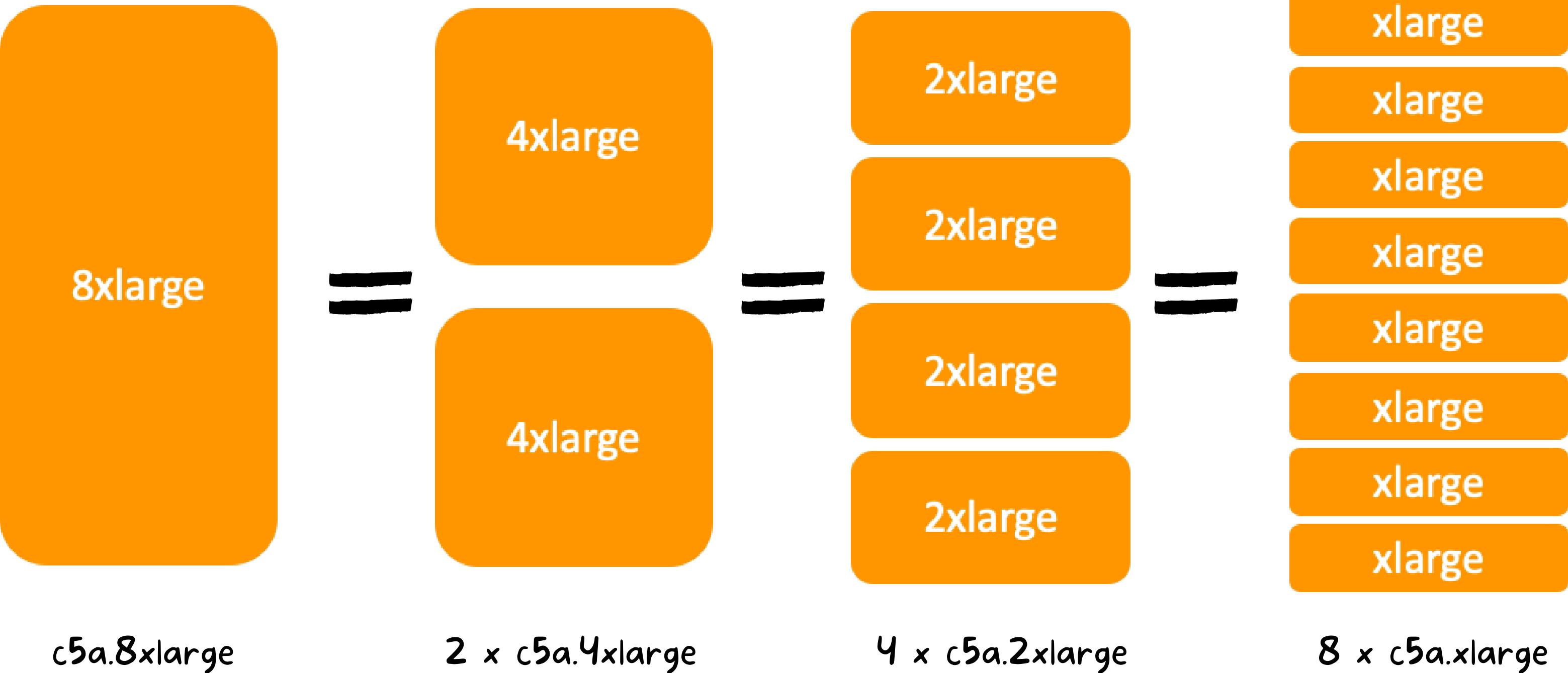
# EC2 Instance Sizes

Model	vCPU
m5.large	2
m5.xlarge	4
m5.2xlarge	8
m5.4xlarge	16
m5.8xlarge	32

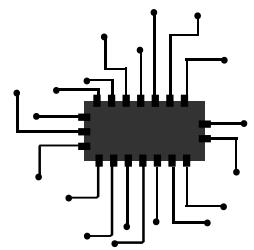


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# Instance Sizing

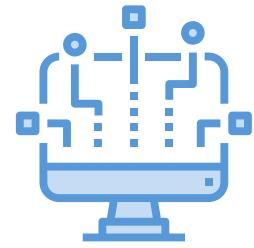


# EC2 Instance Types



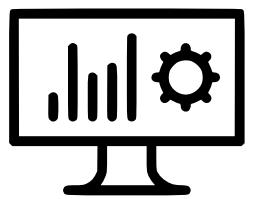
General Purposed

AI, T4g, T3, T3a, T2, M6g, M5, M5a, M4



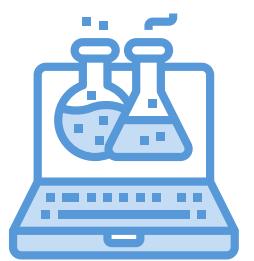
Compute Optimized

C7g, C6g, C5, C5a, C4



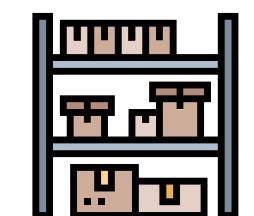
Memory Optimized

R6g, R5, R5a, R4, X2gd, Xle



Accelerated Computing

P4, P3, P2, G5, G5g, G3



Storage Optimized

Iam4gn, I4i, I3, D2, D3



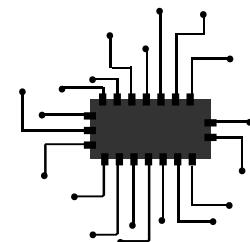
HPC Optimized

Hpc7g, Hpc7a, Hpc6id

# EC2 Instance Type Example

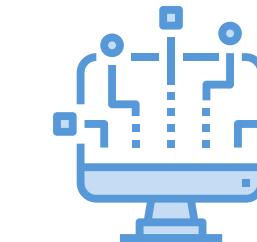


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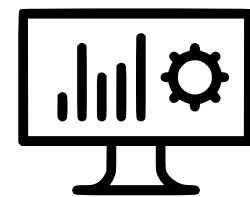
## General Purposed

Good for burstable workloads like website and web applications



## Compute Optimized

Optimized for compute-intensive workloads like high-performance web servers, batch processing



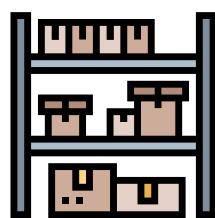
## Memory Optimized

Memory heavy applications like high-performance databases, data mining and analysis, etc...



## Accelerated Computing

GPU-Based instances, commonly used for machine/deep learning



## Storage Optimized

Data Store heavy applications with high disk throughput



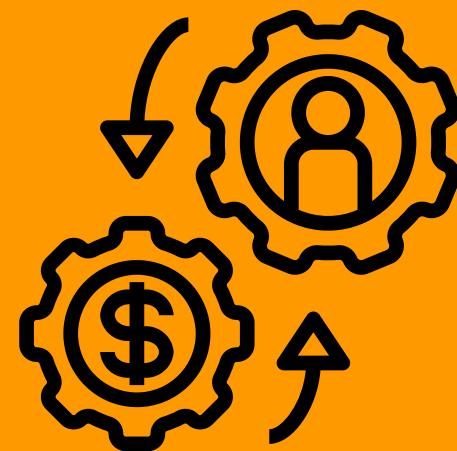
## HPC Optimized

Ideal for High Performance processors like large, complex simulations and deep learning workloads



# EC2 Pricing Options

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On-Demand



Reserved



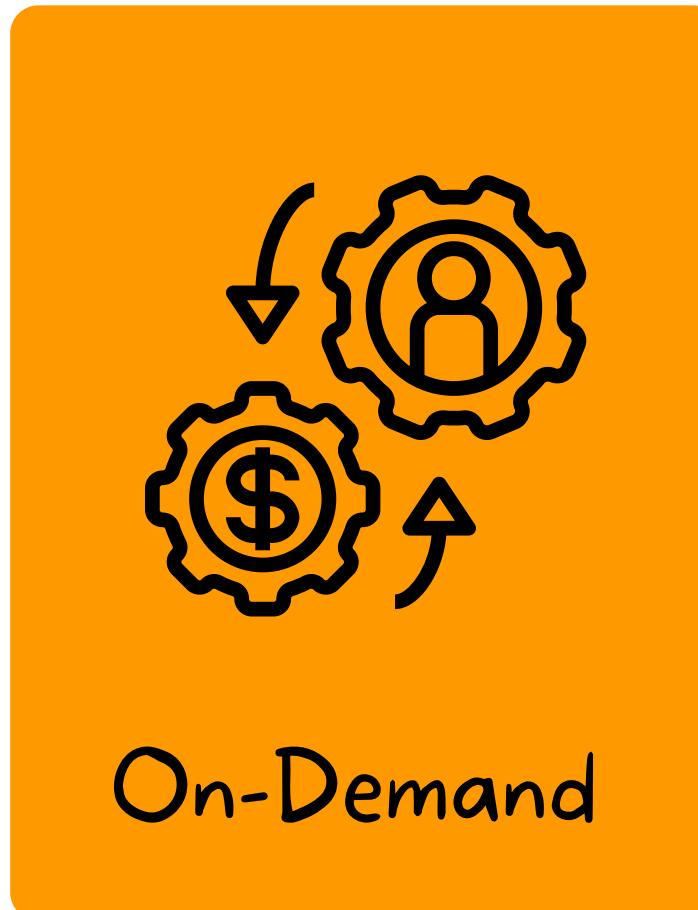
Savings Plans



Spot



# On-Demand Instances

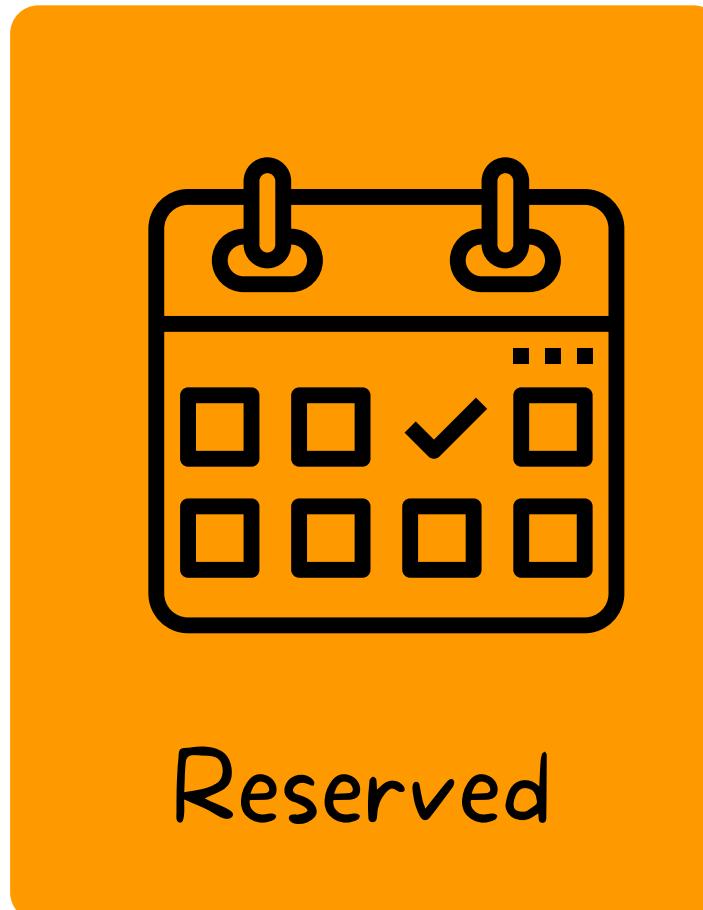


- Pay for compute capacity per hour
- No long-term commitments
- No upfront payments
- Easily increase or decrease capacity based on your demands



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# Reserved Instances

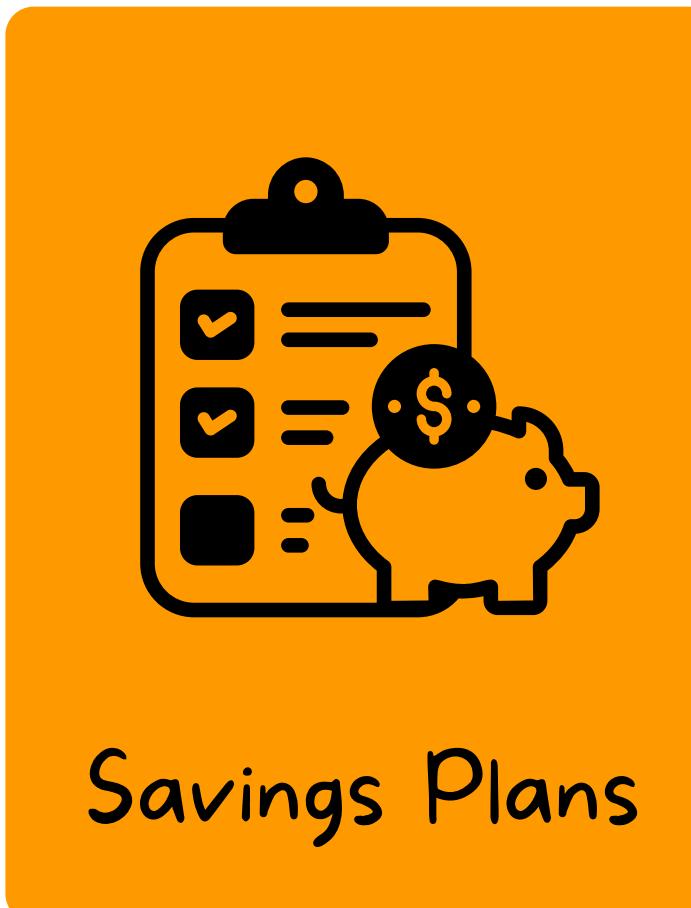


- Get significant discount
- Pre-pay for capacity
- Standard RI, Convertible RI, Scheduled RIs
- Three upfront payment methods
  - No Upfront
  - Partial Upfront
  - All Upfront
- Can be shared between multiple accounts of same billing family



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# Savings Plans



- Compute Savings Plans
  - Provide the most flexibility and discount up to 66%
  - Can change region, family, size, AZ, OS, or tenancy
  - Can be applied to EC2 and Fargate,
- EC2 Savings Plans
  - Less flexible but lowest prices
  - Must commit to individual instance family in a region
  - Can change usage within a family in a region

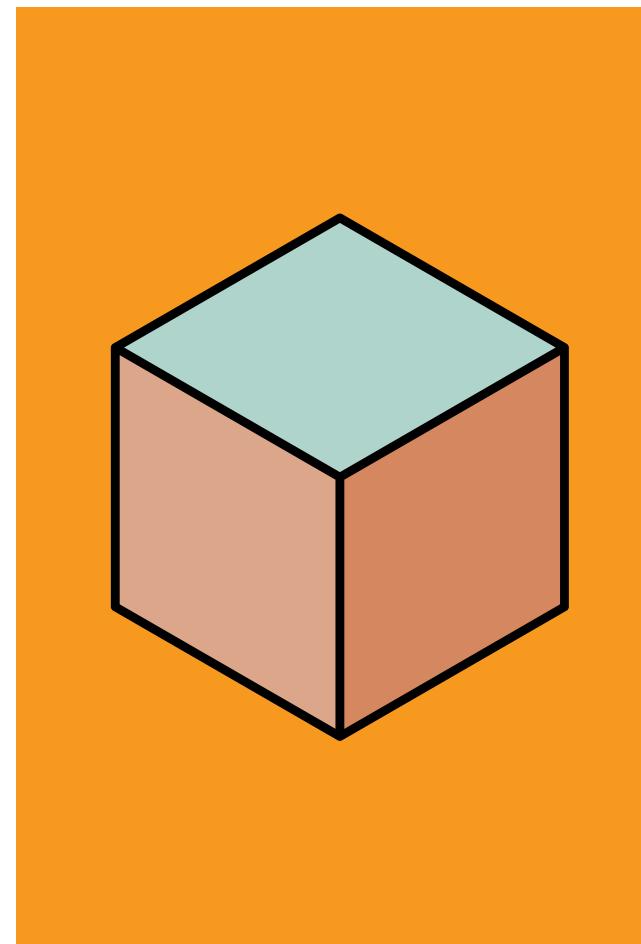


# Spot Instances

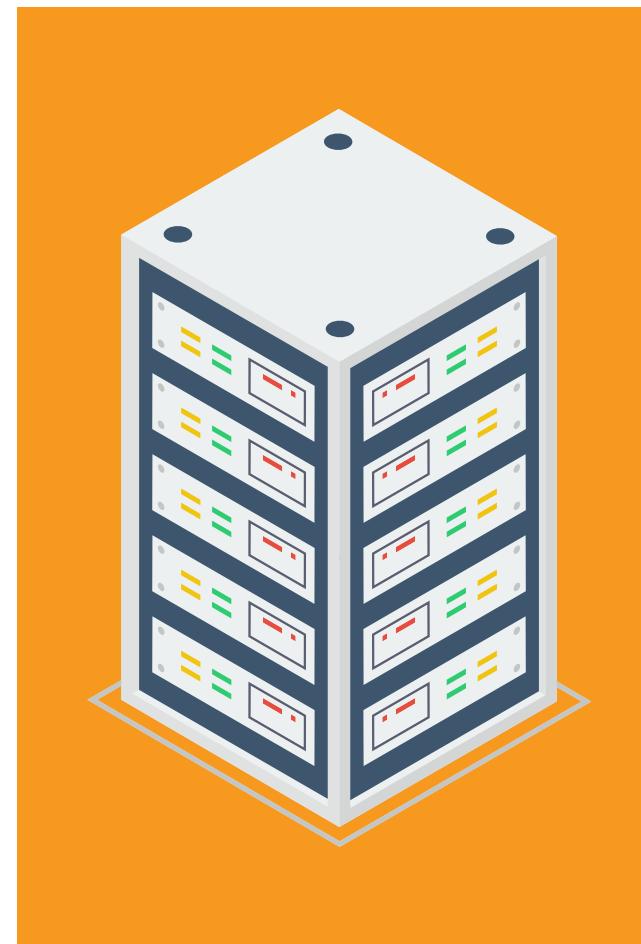


- Purchase unused Amazon EC2 capacity
- No more bidding - prices based on long term trends of supply & demand
- 2 minutes interruption notice for termination
- Flexibility is the key to success
- 90% off on-demand pricing - appropriate for stateless, fault-tolerant workloads

# Amazon EC2 Dedicated Options



Dedicated Instances

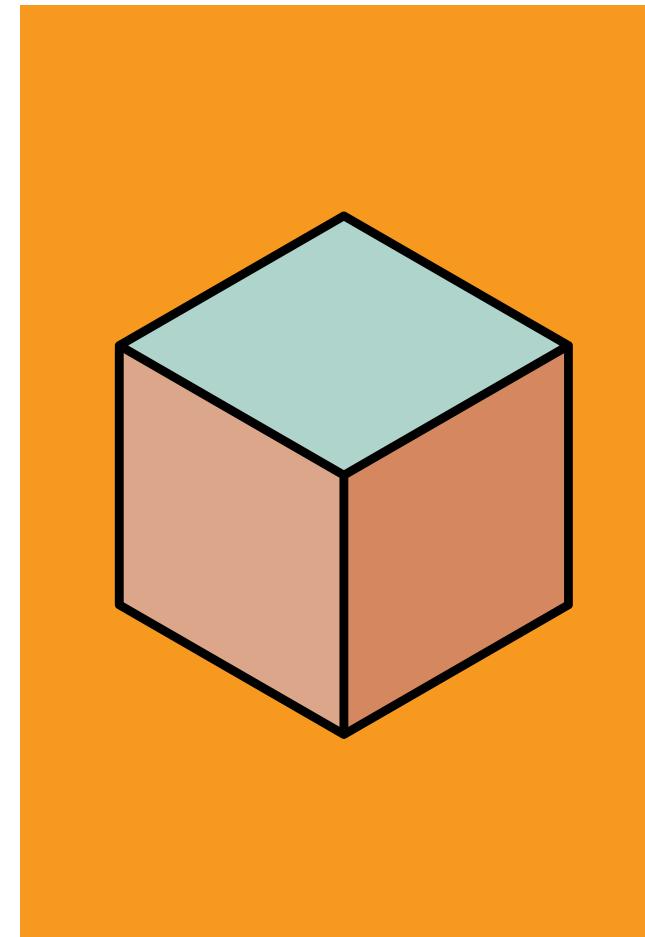


Dedicated Hosts

# Amazon EC2 Dedicated Instances



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Dedicated Instances

Dedicated instances are physically isolated from other AWS Accounts.

Run VPC on hardware that's dedicated to a single customer.

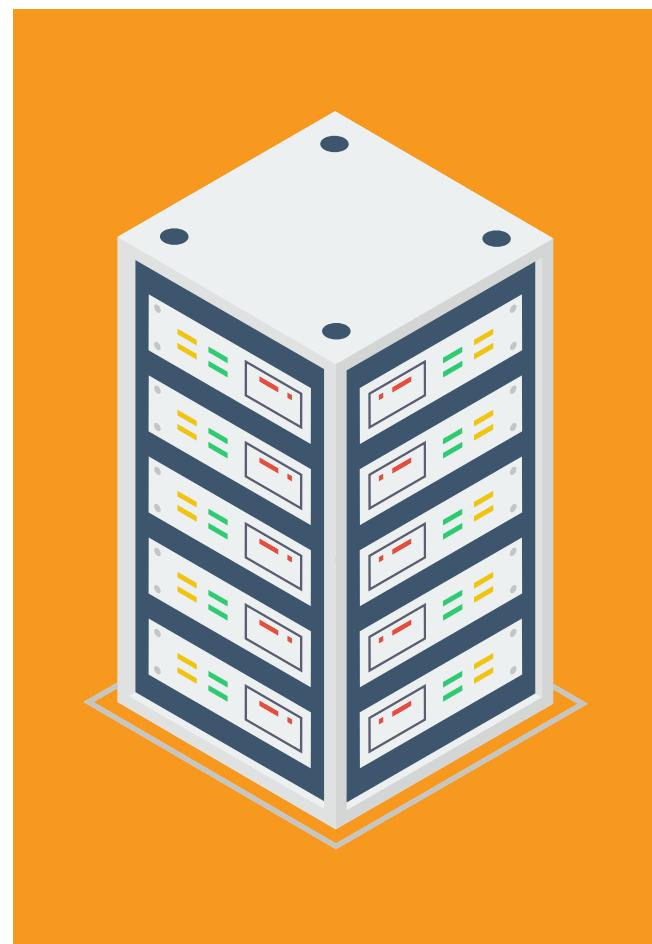
Two components in pricing:

1. An hourly per instance usage fee
2. A dedicated per-region fee

# Amazon EC2 Dedicated Hosts



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Dedicated Hosts

A dedicated host is a full physical server with EC2 instance capacity fully dedicated to your use.

## Benefits

1. Save money on licensing costs
2. Help meet compliance and regulatory requirements



# AWS Compute Optimizer

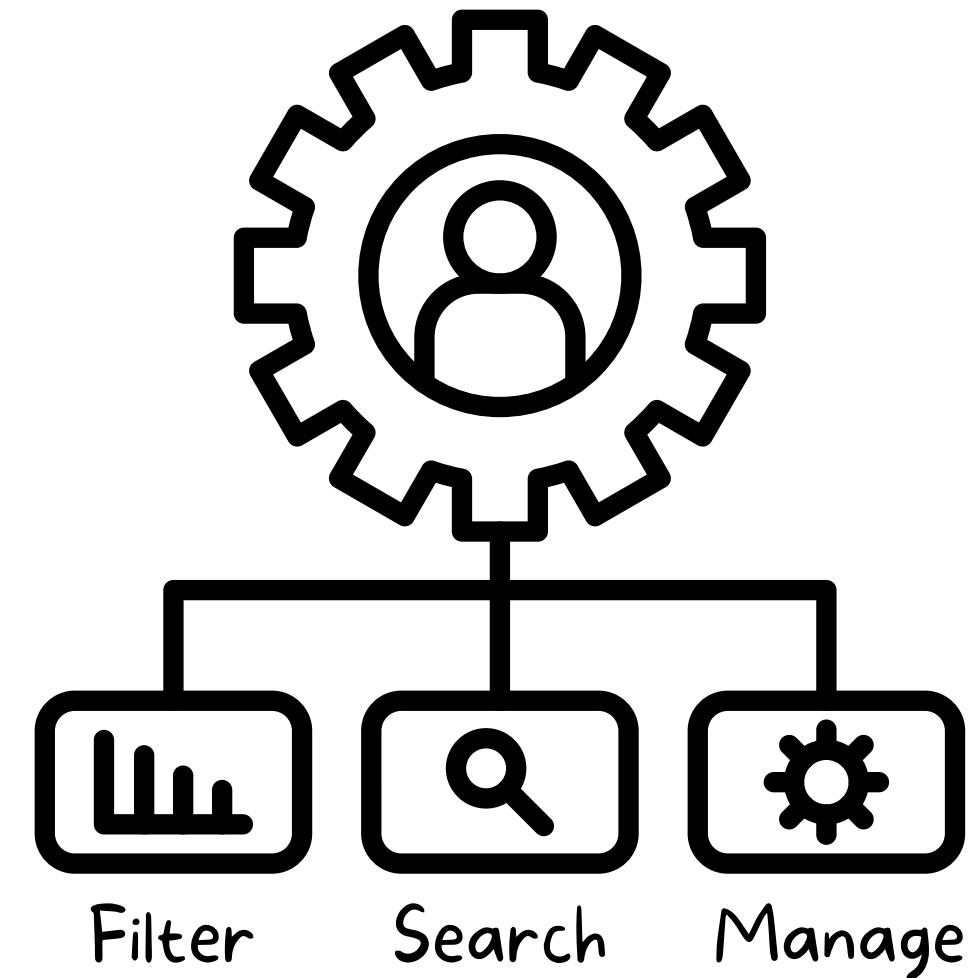


AWS Compute Optimizer recommends optimal AWS resources for your workloads to reduce costs and improve performance by using machine learning to analyze historical utilization metrics.

# Using Tags to Track Your Instances

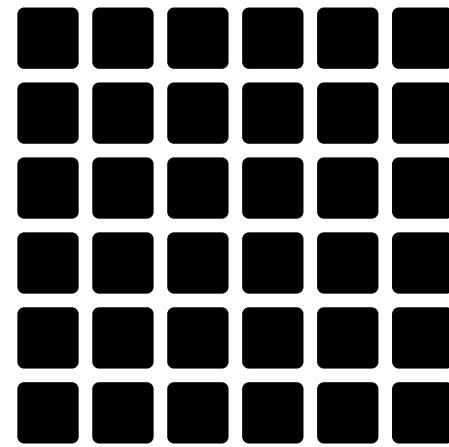


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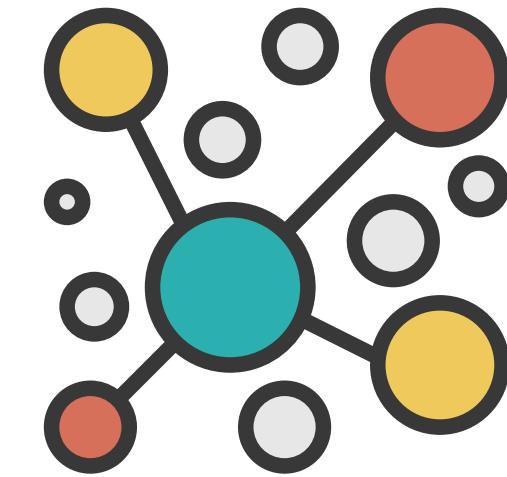




# Placement Groups



Cluster Placement



Spread Placement

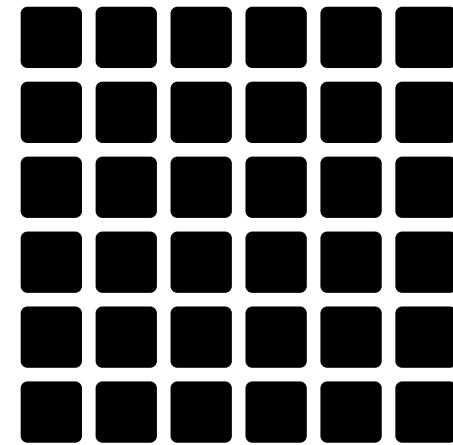


Partition Placement

# Cluster Placement Groups



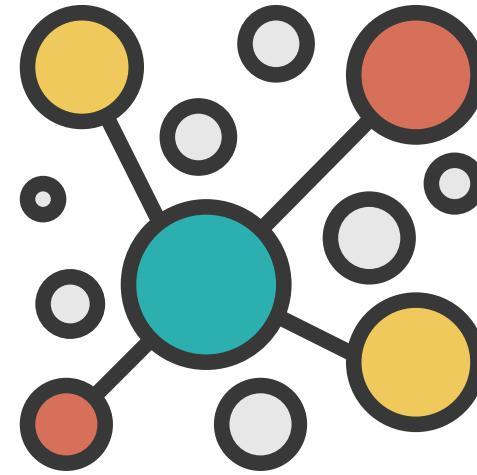
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- A logical grouping of instances within a single Availability Zone.
- Aim for lowest latency and highest packet-per-second network performance



# Spread Placement Groups

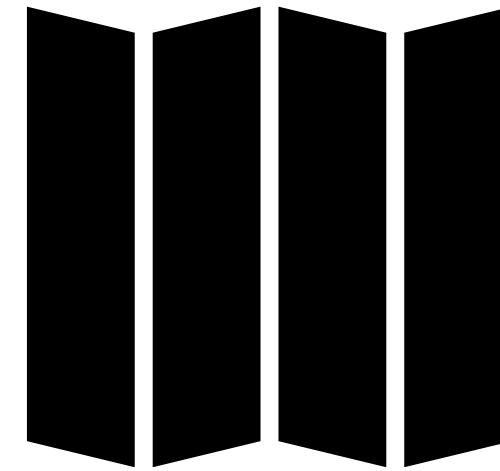


- A grouping of instances that are purposely positioned on distinct underlying hardware
- Critical instances that should be kept separate
- Can span multiple Availability Zones, up to a maximum of seven instances per AZ pre group



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# Partition Placement Groups



- Spread EC2 instances across logical partitions and ensure that instances in different partitions do not share the same underlying hardware
- Using for large distributed and replicated workloads

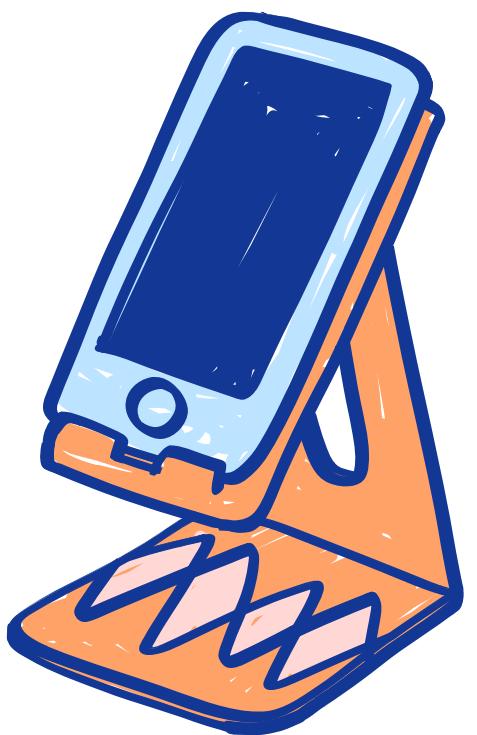


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# Amazon Lightsail



- A virtual private server (VPS) provider
- The easiest way to get started with AWS
- Fixed Pricing Model
- Include Load Balancer, Block Storage, CDN, Managed Databases, Containers, Object Storage



# THANK YOU

See you in next lecture!

