AWS Cloud

-Karan Gupta

Instructor

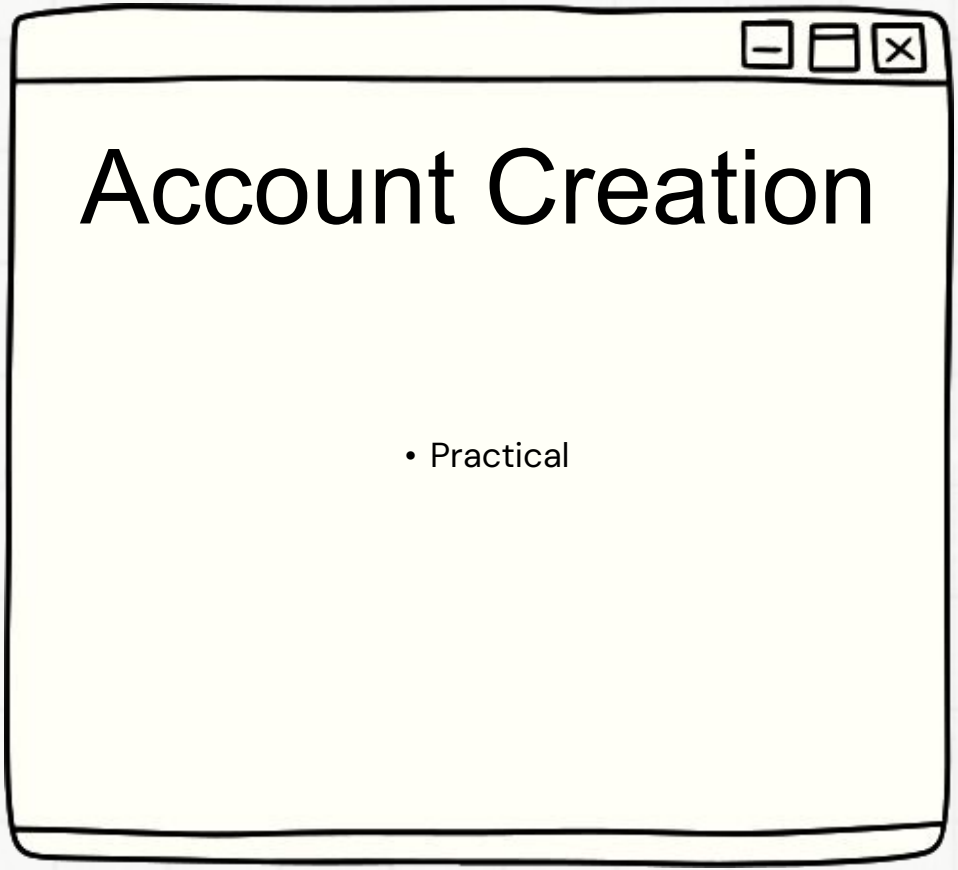
- 5x AWS Certified
- (AWS Certified Solution Architect Professional)
- Worked with MNCs, Startups, Mid-size
- Published Over 10+ Research Papers
- Corporate Trainer

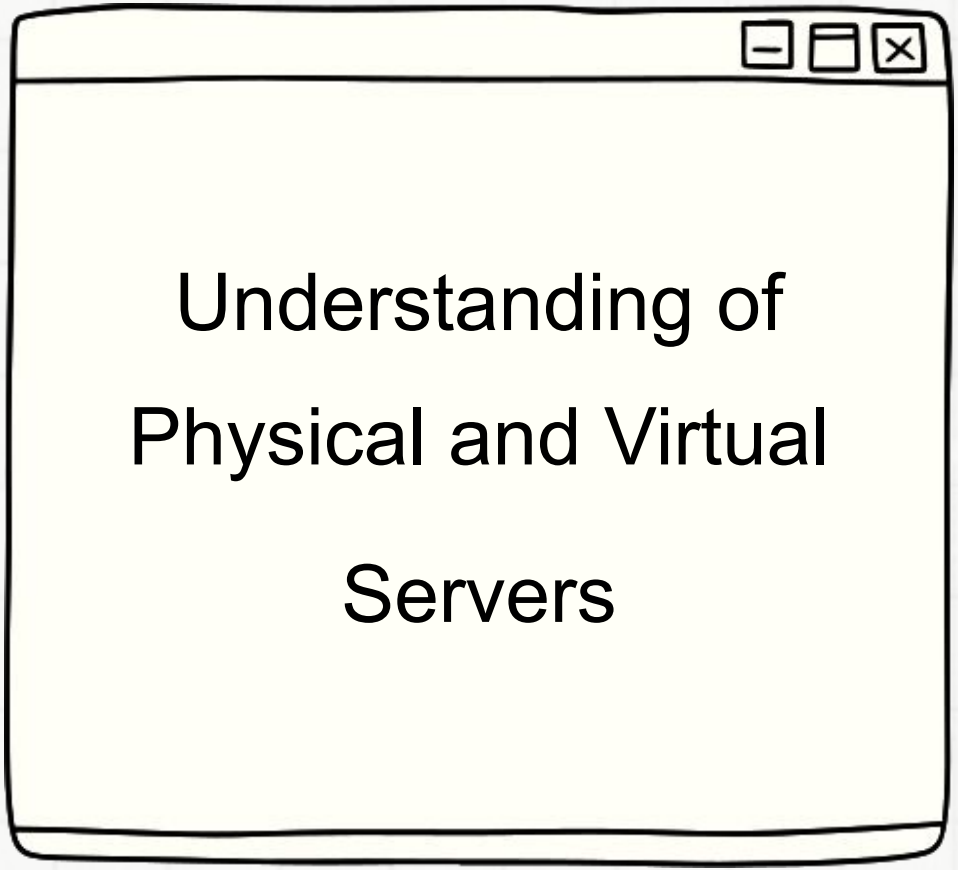
Course Plan

- Prepare for Market
- Q/A
- Interview Based Prep
- AWS certification POV
- Will give practical based scenarios

Account Creation

- 12 months free – Limited
- Will cost if used excessively


Account Creation
• Practical


Understanding of
Physical and Virtual
Servers


aws

What is Server?

- Normal computer or device who hosts website can be considered server.
- Including data centers, offices

Problems in Traditional

- **Cost of physical assets**
- **Requirement of power supply, place, cooling, maintenance**
- **Manpower needed**
- 24*7 monitoring
- **Rent of office, data centers**
- **Issue in scaling**
- **Disaster issues**

Rise of Cloud Computing

- **On demand delivery**
- **Pay as u go**
- **Choose your preference of machine**
- Instant
- **Go global**
- **One click**

Some services you already use

- **Gmail**
- **Hotstar**
- **Netflix**
- Dropbox

Types of Cloud

Public

That is available for everyone.

AWS, AZURE, GCP

Private

- Not exposed to everyone
- Complete control in ur hand
- Security specific

Hybrid

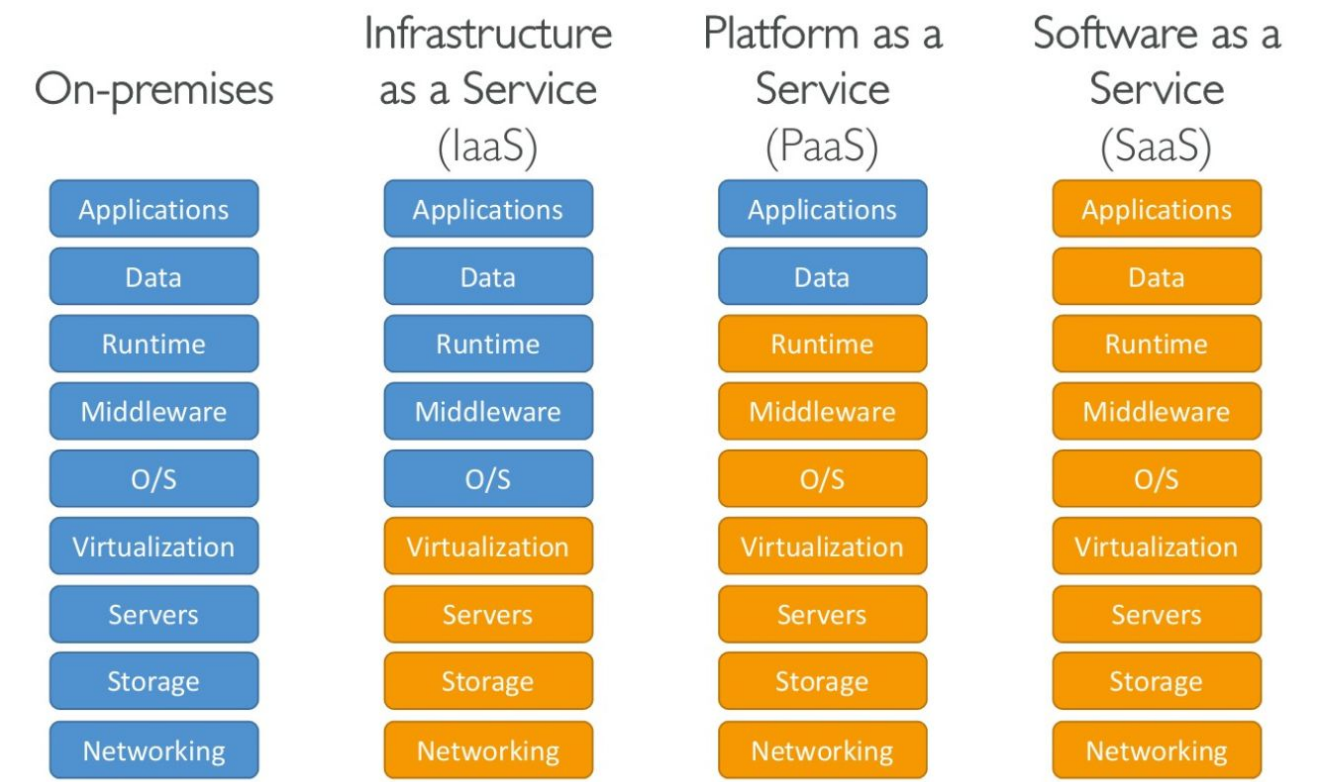
Public + Private

- Sensitive info in private

Need/Benefits of Cloud

- **Flexibility**
- **Scalability**
- **Cost Effective**
- Elasticity
- **High Availability**

Cloud Computing Model



Examples of Each

- IaaS
  - EC2
- PaaS
  - Elastic Beanstalk
- SaaS
  - DropBox, Gmail

Aws Global Infra

- AWS Regions
- AWS AZ
- AWS Data Centers
- Edge Locations

AWS Region

- What are these
- How to select region

AWS AZ

- What are AZ

AWS DC

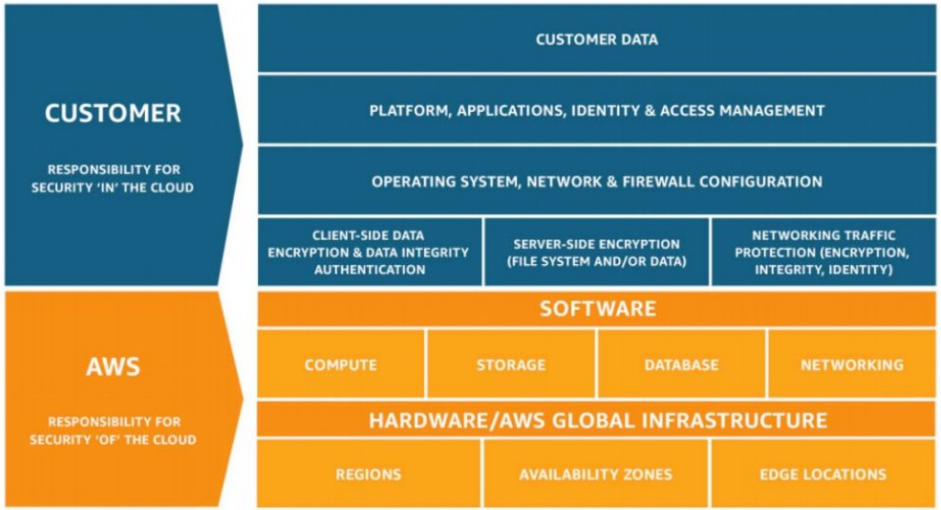
-

Shared Responsibility Model

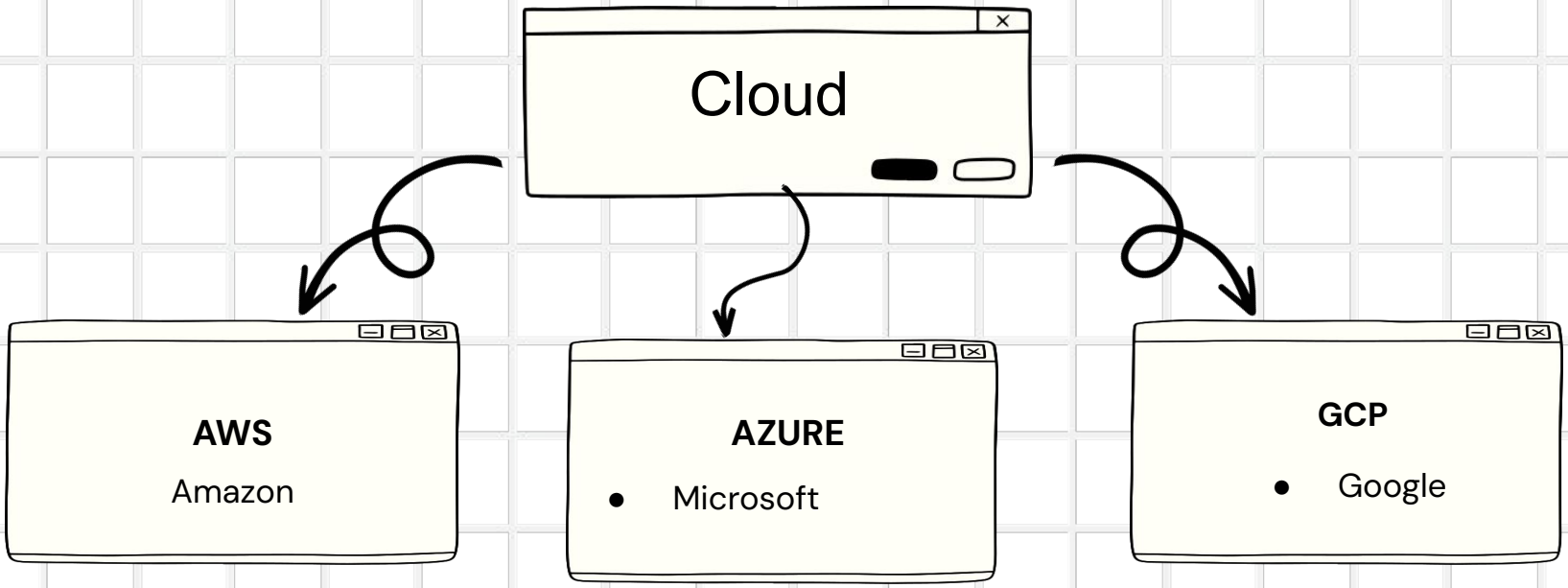
Shared Responsibility Model diagram

CUSTOMER = RESPONSIBILITY FOR THE SECURITY **IN** THE CLOUD

AWS = RESPONSIBILITY FOR THE SECURITY **OF** THE CLOUD



AWS vs Azure vs GCP



AWS vs Azure vs GCP

- https://cloud.google.com/docs/get-started/aws-azure-gcp-service-comparison
- In 2019, AWS – 35$ BILLION revenue
- 47% aws, 22%azure

Pricing

- On aws account
- Cost calculator
- Billing
- budgets
-

Regional vs Global service

- Global –
  - IAM
  - Organisations
  - Route 53
  - ACM
  - Cloudfront

IAM

- Identity and Access Management

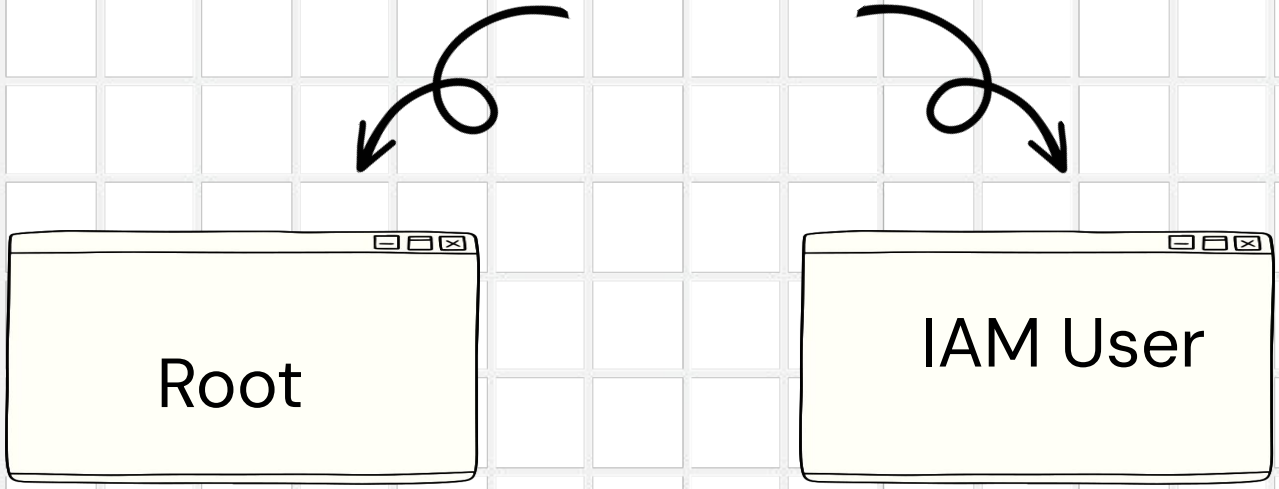
What is IAM

- •Fine-grained control of who can do what
- Eg -user Bob can launch server

IAM Characteristics

- free
- centralized AWS service
- default scope is AWS account
- deny by default

IAM Users



Root User

- Root User
  - the identity used to create AWS account
  - complete access

- Best practices
  - don’t use this account for the everyday
  - setup physical MFA and lock it away
  - don’t use your Amazon.com shopping account

IAM User

- IAM Users
  - an identity with assigned permissions
  - can have username/password access to AWS console
  - can have (secret) key-based access to AWS APIs

- Best Practices
  - rotate credentials (keys, passwords)
  - MFA
  - password policy

IAM Groups

- collection of IAM users
- operates like you'd think
- Best practices
  - manage permissions with groups
  - i.e., assign policies to groups instead of users

IAM Policies

- set of permissions to be granted or denied
- JSON documents
- can be assigned directly to IAM users

```
{
  "Version": "2012-10-17",
  "Statement": [ {
    "Effect": "Allow",
    "Action": "s3:ListAllMyBuckets",
    "Resource": "arn:aws:s3:::*"
  }, {
    "Effect": "Allow",
    "Action": [
      "s3:ListBucket",
      "s3:GetBucketLocation"],
    "Resource":
     "arn:aws:s3:::EXAMPLE-BUCKET-NAME"
  }, {
    "Effect": "Allow",
    "Action": [
      "s3:PutObject",
      "s3:GetObject",
      "s3:DeleteObject" ],
    "Resource":
      "arn:aws:s3:::EXAMPLE-BUCKET-NAME/*"
  } ] }
```

IAM Role

- a 2nd type of AWS identity
  - also has assigned permissions
  - similar to IAM users
- designed to be temporarily assumed
  - e.g. by an EC2 instance
- no associated credentials
- Instance Profiles
  - assigned to EC2 instance
  - container for one or more IAM roles

Best Practice

- **Users** – Create individual users.
- **Permissions** – Grant least privilege.
- **Groups** – Manage permissions with groups.
- **Conditions** – Restrict privileged access further with conditions.
- **Password** – Configure a strong password policy.
- **Rotate** – Rotate security credentials regularly.
- **MFA** – Enable MFA for privileged users.
- **Roles** – Use IAM roles for Amazon EC2 instances.
- **Root** – Reduce or remove use of root.

EC2

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud.

Access reliable, scalable infrastructure on demand. Scale capacity within minutes with SLA commitment of 99.99% availability.

Benefits of EC2

* **Scalability:** Easily **scale up or down** resources based on demand.

* **Flexibility:** Choose from various **instance types** optimized for different workloads (compute, memory, GPU).

* **Cost-effectiveness: Pay-as-you-go** pricing model for only the resources you use.

* **Global Availability:** Available in multiple **AWS regions** worldwide.

Different types of EC2

https://aws.amazon.com/ec2/instance-types/

Size n Conf of EC2

- OS
- CPU
- RAM
- Space
- Network Card
- Firewall

Use Cases of EC2

* Hosting websites and applications.
* Running batch jobs.
* Building and deploying cloud-native applications.
* Setting up development, testing, and staging environments.

Key Pair

- AWS uses public-key cryptography to encrypt and decrypt login information.
- AWS only stores the public key, and the user stores the private key.

Generate Key Pair

1. Open the Amazon EC2 console at http://console.aws.amazon.com/ec2/
2. On the navigation bar select region for the key pair
3. Click **Key Pairs** in the navigation pane to display the list of key pairs associated with the account
4. Click **Create Key Pair**
5. Enter a name for the key pair in the **Key Pair Name** field of the dialog box and click **Create**
6. The private key file, with .pem extension, will automatically be downloaded by the browser.

Steps of creating EC2

Step 1: Sign up for Amazon EC2

Step 2: Create a key pair

Step 3: Launch an Amazon EC2 instance

Step 4: Connect to the instance

Step 5: Customize the instance

Step 6: Terminate instance and delete the volume created

Connecting to EC2

- There are several ways to connect to an EC2 instance once it’s launched.
- **Remote Desktop Connection** is the standard way to connect to Windows instances.
- An **SSH client** (standalone or web-based) is used to connect to Linux instances.

Features of EC2

- Virtual Computing Environments, known as instances
- Preconfigured template for your instance is known as AMI
- Various configuration of CPU, memory, storage and network capacity is Instance type
- Secure login information for your instance using Key pairs

More Features of EC2

- Storage volumes for temporary data that's deleted when hardware fails or terminate your instance, known as instance store volumes
- Persistent storage volumes for your data using Amazon Elastic Block Store (Amazon EBS), known as Amazon EBS volumes
- A firewall that enables you to specify the protocols, ports, and source IP ranges that can reach your instances using security groups
- Metadata, known as tags, that you can create and assign to your Amazon EC2 resources

Intro to SG

A security group in the context of Amazon EC2 is essentially a virtual firewall that controls the traffic for one or more instances.

It acts as a virtual firewall for your EC2 instances to control incoming and outgoing traffic.

Key Points – SG

1. Traffic Control
2. Stateful
3. Flexible rule
4. Layer of Defense
5. Only allowed rules

EC2 Purchasing Option

1. On-Demand
2. Reserved
3. Spot
4. Dedicated

EC2 Purchasing Option

On-Demand

- Charged per second or hour of usage, offering maximum flexibility.
- **No upfront commitment:** Ideal for short-term workloads, testing, or unpredictable usage patterns.
- **Scalability:** Easily scale instances up or down based on real-time needs.
- **Availability:** Guaranteed instance availability within your chosen AWS region.

EC2 Purchasing Option

Reserved

- Offer significant discounts (up to 75%) compared to On-Demand pricing through a prepaid reservation for a specific instance type, region, and term (1 or 3 years).
- **Benefits:**
  - **Significant cost savings** for predictable, sustained workloads.
  - **Guaranteed capacity:** Ensures availability of the specified instance type during your reservation term.

EC2 Purchasing Option

Spot:

- Bid on spare EC2 capacity at significantly lower prices (up to 90% discount) compared to On-Demand Instances. The price fluctuates based on supply and demand.
- **Benefits:**
    - **Lowest cost option** for workloads that can tolerate interruptions.

EBS volume

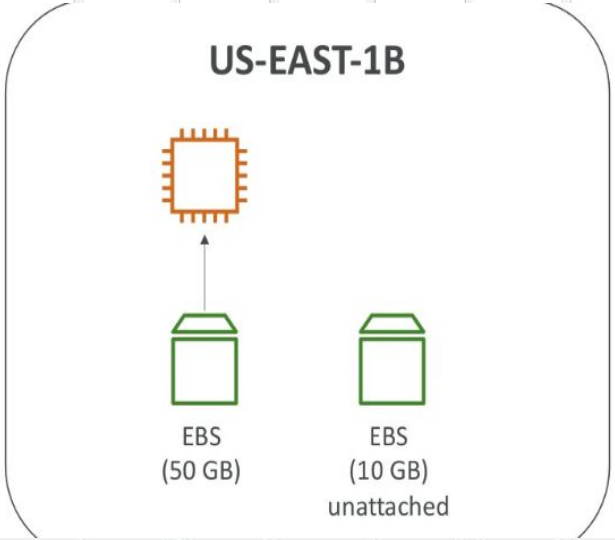
- EBS is drive that you attach when you run the machine/instance.
- Persist even after machine termination
- Can be mounted to one instance at a particular time
- Bound to AZ.

EBS volume- Benefits

- Data Persistence
- Scalability
- Backup and Recovery
- High Availability
- Performance

EBS volume- Key Info

- Restricted to 1 AZ
- It's a N/W drive
- Costly as compared to other Storage services



EBS volume- Attach

- When you just wanna take the add volume which is available in nature.

EBS volume- Detach

- When you just wanna take the backup of data with volume being available then you can detach the volume.

EBS volume- Size Increase

- You can change size of EBS volume
- Only INCREASE possible
- Not decrease
- 1:1

Snapshot

- It acts like a frozen image of your data at a specific moment, allowing you to restore your data or create new EBS volumes from that saved state.
- Make a backup of EBS volume at that point of time
- Can be shared among AZ or Region.

Snapshot - Benefits

- Data Backup and Recovery
- Disaster Recovery
- Data Archiving
- Data Migration

Types of EBS volumes

Amazon EBS provides the following volume types, which differ in performance characteristics and price.

• SSD-backed volumes optimized for transactional workloads involving frequent read/write operations with small I/O size, where the dominant performance attribute is IOPS

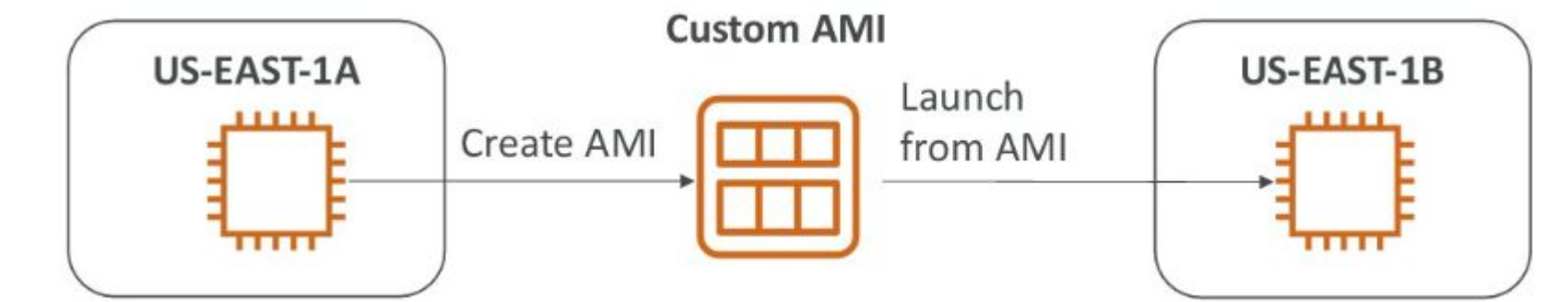
• HDD-backed volumes optimized for large streaming workloads where throughput (measured in MiB/s) is a better performance measure than IOPS

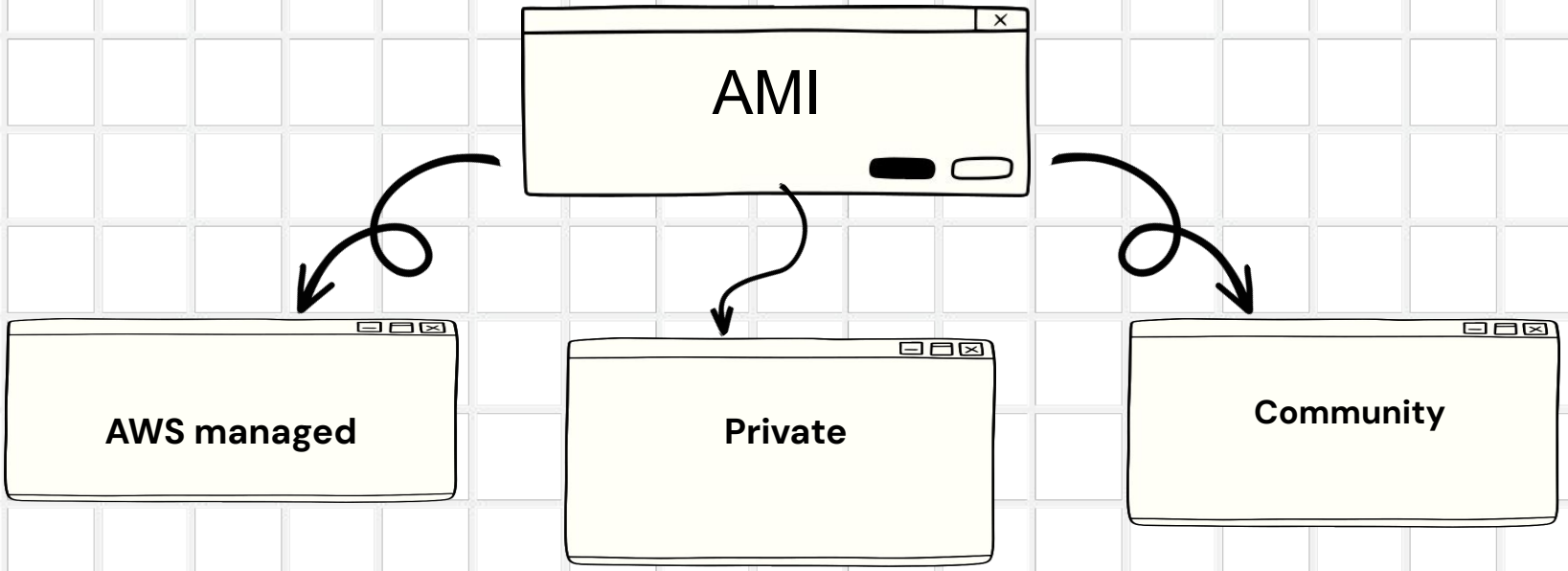
AMI

In Amazon Web Services (AWS), an Amazon Machine Image (AMI) acts as a template for creating virtual servers known as EC2 (Elastic Compute Cloud) instances. It essentially encapsulates the configuration of a server, including the operating system, applications, and settings.

Benefits

- Faster Deployments
- Consistency
- Repeatability
- Improved Manageability




AMI
AWS managed
Private
Community

Finding an Instance type

- Region
- The architecture: 32-bit (i386), 64-bit (x86_64)
- Compute
- Memory
- Storage
- Network performance

Changing the Instance type

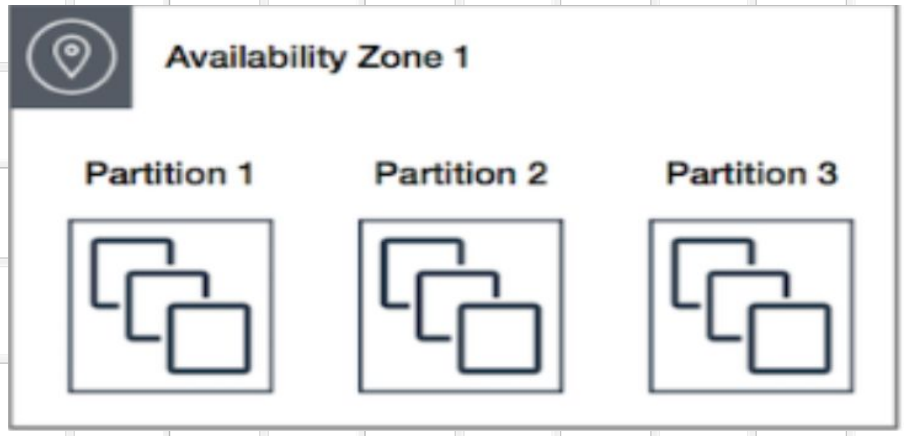
- As your needs change, you might find that your instance is over-utilized or underutilized.
- For example, if your t2.micro instance is too small for its workload, you can change it to another instance type that is appropriate for the workload.
- You might also want to migrate from a previous generation instance type to a current generation instance type to take advantage of some features; for example, support for IPv6.

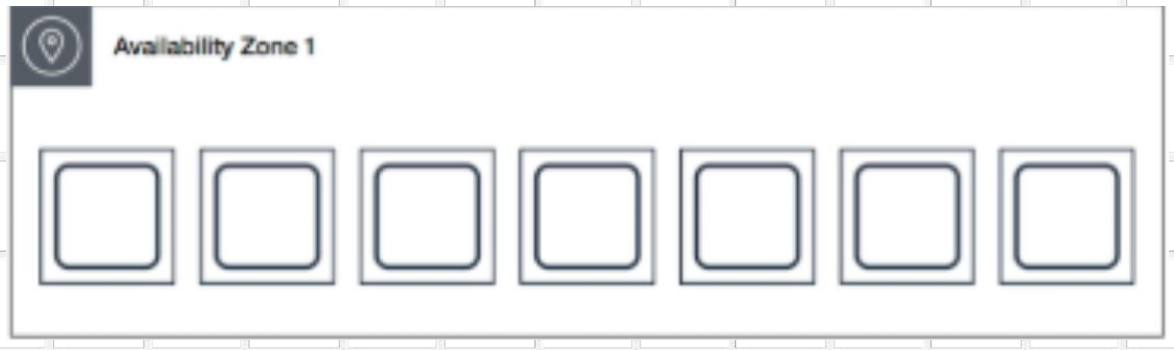
Placement Groups

You can launch or start instances in a placement group, which determines how instances are placed on underlying hardware. When you create a placement group, you can create one of the following strategies for the group:

- Cluster – clusters instances into a low-latency group in a single Availability Zone
- Partition – spreads instances across logical partitions, ensuring that instances in one partition do not share underlying hardware with instances in other partitions
- Spread – spreads instances across distinct underlying hardware

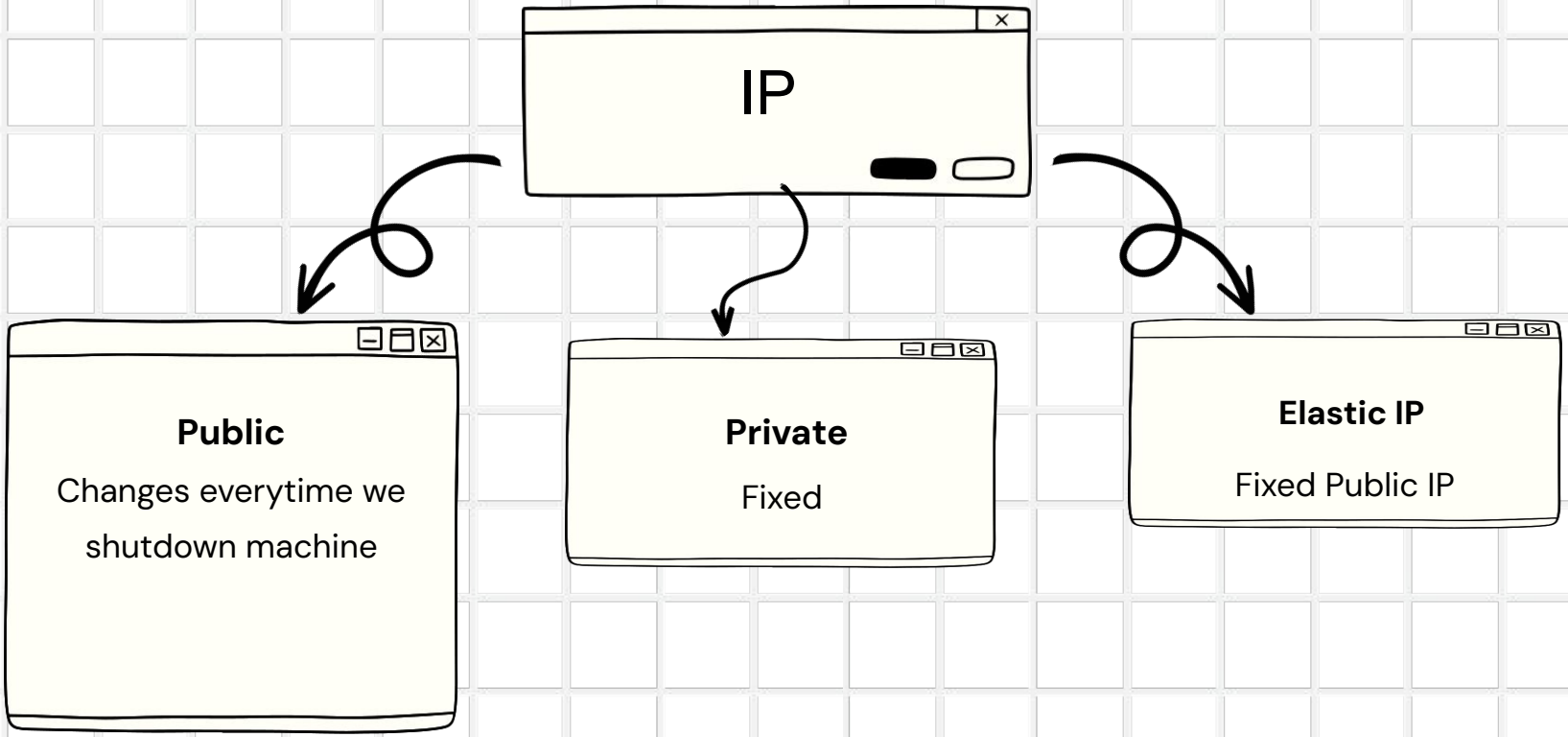

Availability Zone


Availability Zone 1
Partition 1
Partition 2
Partition 3


Availability Zone 1

Other Compute Services

- AWS LAMBDA
- AWS FARGATE


IP
Public
Changes everytime we shutdown machine
Private
Fixed
Elastic IP
Fixed Public IP

Public IP

- A public IP address is an IPv4 address that's reachable from the Internet. You can use public addresses for communication between your instances and the Internet.
- Each instance that receives a public IP address is also given an external DNS hostname; for example,ec2-203-0-113-25.compute-1.amazonaws.com.
- Changes on restart

Private IP

When EC2 instances are launched, the primary IP is assigned a reserved private IP address

- The private IP address stays assigned to the network interface until it is deleted.
- It is not possible to remove or change the private IP address of the primary network interface

Elastic IP

An Elastic IP address is a static IPv4 address designed for dynamic cloud computing.

- An Elastic IP address is associated with your AWS account.
- With an Elastic IP address, you can mask the failure of an instance or software by rapidly remapping the address to another instance in your account.
- An Elastic IP address is a public IPv4 address, which is reachable from the internet.

QUIZ-1 -IAM

1. What IAM is used for ?
2. Define the following
- IAM User
- IAM Group
- IAM Policy
- IAM Role
2. What is MFA (Multi-Factor Authentication)

QUIZ-1 -ec2

1. What is EC2 ?
2. Key pair ?
3. What is AMI?
4. What is Instance type ?
5. Types of Instance families ?
6. What is placement group ?
7. Difference between Stop and Terminate in EC2?
8. Different purchasing options in EC2 ?
9. Security Group rules ?

QUIZ-2

1. Define EBS ?
2. What are the volume types for EBS ?
3. Difference between AMI and EBS snapshots ?
4. Can an EBS volume attach to 2 or more instances at a time ?
5. Can EBS volume can be attached to an EC2 instance which are in different availability zone ?
6. Once you define volume size (e.g. 10 GB), is it possible to decrease the volume to 8 GB or less ? And is it possible to Increase to 12 GB or more ?
7. Is it possible to detach the root volume from the instance ?
8. Public IP , Private IP & Elastic IP
9. What is IAM user