

AWS (Practitioner Essentials).Pricing basics:

- * Using AWS we pay only for individual service which we need &
- * AWS allows you to replace large expenses in advance with lower variable costs & provide flexibility to get services needed

aws.amazon.com/pricing.

Pricing details.

Fundamentals: Compute capacity, Storage, Outbound data transfer (aggregated).

No charge for Inbound data transfer
i.e., data transfer btwn other services

- * Outbound data transfer within same region.
 - EC2, S3, RDS, Simple DB, SQS, SNS & VPC.
- * Commonly used AWS products are:
 - 1. Amazon EC2 (Elastic Cloud compute)
 - 2. Amazon Simple Storage Service (S3)
 - 3. Amazon EBS (Elastic Block Store).
 - 4. Amazon RDS (Relational Database Service).
 - 5. Amazon Cloud Front.

Glacier, Decoupling

EFS

Trusted Advisor

Amazon EC2: It is a web-service.

- Provides resizable compute capacity in the cloud
- Allows the configuration of capacity with minimal friction.
- Provides complete control.
- Charges only for the capacity used i.e., only when running
- * When EC2 instances are ^{launched} started till ^{the} end then they are charged or By the time EIP is allocated till it is deallocated
- * Machine configuration consider physical capacity of the instance
- ~~Cost factors~~ Instance pricing varies by region, OS, instance type & instance size.
- * With on-demand instances, we will pay for computing capacity by the hour without a mandatory min. commitment.
- * Reserved instances will give an option to make a 1-time payment or even without payment in advance at all. For each instance that you want to backup then as a result we will receive a huge discount at same hourly usage fee for that instance.

With local instances, you can bid on EC2 capacity that you don't use.

- * Several EC2 & EBS resource instances which allows you to handle surge loads.
- * Elastic Load Balancer ^(ELB) can be used to distribute traffic among your EC2 instances.
- * Total duration of ELB running

* On-demand instances:

- Compute capacity by the hour & second.
- Min. of 60 sec.

Instance type

Purchase types

* Reserved instances:

- Low or no up-front payment instances reserved.
- Discount on hourly charge for that instance.

* Spot instances:

- Bid for unused Amazon EC2 capacity.

* No. of instances:

Other considerations

- Provision multiple instances to handle peak loads

* Load Balancing:

- Use Elastic Load Balancing to distribute traffic.
- Monthly cost based on:
 - hourly load balancer runs
 - data load balancer processes.

Product options:

* Monitoring:

- Use Amazon Cloud Watch to monitor instances.
- Basic monitoring (default)
- Detailed monitoring (fixed rate; prorated partial months).

* Auto scaling:

- Automatically adjusts no. of instances
- No additional charge.

* Elastic IP Addresses:

- No charge when associated with a running instance

+ For elastic IP addresses, we can have one elastic IP address which is connected to an instance that runs at no additional cost

OS & Software:

* OS prices included in instance prices.

* Software:

- Partnership with other vendors

- Vendor licences required

- Existing licences accepted through specific vendor programs

How:

EC2 enables us to scale up & down to handle changes in requirements reducing your need to forecast traffic.

Where it lets users launch & manage server instances, at any time & for as long as one needs.

→ It is an object storage
It is consistency model.

2. Amazon S3 (Simple Storage Service).

- * Used to store any amount of data anytime & anywhere on the web. (Object storage build to store & retrieve any amount of data from anywhere.)

* It provides:

- durability, availability & scalability.
- Comprehensive security & compliance capabilities.
- Query in place
- Flexible management & data transfer
- Compatibility - supported by partners, vendors & AWS services.

Storage Classes:

- Standard Storage: 99.999999999% durability
cheaper to access, meaning, upload & download. 99.99% availability.
- Standard - Infrequent Access: (S-IA) : 99.9999999999% durability
cheaper for storage & more expensive for retrieval. 99.9% availability.
- Storage cost: No. & size of objects

Type of Storage

Cost factors:

- * Requests: No. of requests

Type of requests - diff. rates for GET requests.

- * Data transfer: amount of data transfer out of Amazon S3 region

- * It gives strong consistency for new objects & eventual consistency for updates.
 - * Encryptⁿ (at REST) : SSE-S3, SSE-KMS, SSE-C (Server side Encryptⁿ)
Encryptⁿ (in TRANSIT) : HTTPS.
 - * S3 enables versioning in a bucket.
 - * S3 access is controlled by IAM.
 - * S3 supports multi-part upload & has unlimited capacity.
 - * It is internet-API accessible & has regional availability.
 - * It is highly-durable - 99.999999999% (119's).
- * Glacier: Encrypts data by default.
It is a solutⁿ for data backup & archive storage.
Vaults are the collectⁿ of archive.
- * Retrievals - Expedited - faster & costliest
Bulk - cheapest ; takes long time.
Standard
 - * It has regional availability & has durability - 99.99999999999999%
- Decoupling:

Single AZ is not highly available

3* Amazon EBS (Elastic Block Store):

- * Provide Block level Storage volumes for use in ur EC2 instance
- * EBS volumes are durable storage
- * Block-level Storage for instances
- * Volumes persist independently from the instance.
- * Analogous to virtual disks in the cloud
- * 3 volume types:
 - a) General Purpose (SSD) → Included in price (100/00)
 - b) Provisioned IOPS (SSD) (32,000)
 - c) Magnetic. → Charged by no. of requests
- * Cost factors:
 - i) Throughput Optimized HDD (500)
 - ii) Cold HDD (250) charged by amount you provision in IOPS
- * Volumes: All types charged by the amount per month.
- * IOPS: Above mentioned
- * Snapshots: Added cost per GB-month of data stored
- * Data-transfer: Inbound data transfer has no charge.
Outbound data transfer charges are tiered.
- * It supports Encryption & snapshots.
- * Some support Provisioned IOPS.
- * It has independent lifecycle than EC2 instance.
- * We can attach multiple volumes to a single instance.
Only 1 volume is attached to EBS volume. Redo & stripe
- * SSD is good for random access. (expensive)
- HDD is good for sequential access

4. Amazon RDS (Relational Database Service):

- * Relational database in the cloud.
- * Provides cost-efficient & resizable capacity.
- * Management of time-consuming administrative tasks.
 - Cost factors:
 - a) Clock-hour billing: Resources incur charges when running.
 - b) DB characteristics: Engine, size & memory class impact cost.
 - c) DB purchase type:
 - On-demand db instances are charged by the hour.
 - Reserved db instances require up-front payment for db instances reserved.
 - Provision multiple db instances to handle peak loads.
 - d) Provisioned storage:
 - No charge for backup storage of terminated upto 100% of db storage.
 - Backup storage for terminated DB instances billed at GB/month.
 - e) Additional Storage: Backup storage in addition to provisioned storage billed at GB/month.
 - f) Deployment type:
 - Storage & I/O charges variable
 - Single AZs
 - Multiple AZ's
 - g) Data transfer:
 - No charge for inbound data transfer
 - Tiered charges for outbound data transfer

5. Amazon CloudFront:

- * It is a web-service for content delivery.
- * Integrates with other AWS services:
 - a) low latency
 - b) High data transfer speeds
 - c) No min. commitments

Cost factors: a) Prices varies across geographic regions.
b) Based on: Requests + Data transferout

Module 1: Design Resilient Architectures

- 1.1. Choose reliable/resilient storage
- 1.2. Determine how to design decoupling mechanism using AWS services
- 1.3. Determine how to design a multi-tier architecture solut'.
- 1.4. Determine how to design high availability &/or fault tolerant solut'.

EC2 instance Store: a) Ephemeral volumes

b) only certain EC2 instances

c) Fixed capacity

d) Disk type & capacity depends on EC2 instance type.

e) Application-level durability.

Elastic Block Stores: Repeat

Elastic File System

- * Multiple EC2 instances can act as a EFS.
- * It has ^{scale} elastic capacity & is a shared storage.
- * Peta-byte ^{File System}.
- * EFS can be attached to single VPC at a time & in that VPC we have mount point.

S3: Repeat

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Amazon CloudFormation: It's like system's DNA.

If we wanna create a large deployment with many EC2 instances, S3 buckets, RDS databases, dynamodb table, snapshots etc... then we use cloudFormation.

It stores multiple copies in multiple places for further use.

It describes the template in JSON format & then it converts them into infrastructure which is called as stack. & It promotes resilient feature.

AWS Lambda:

- * It does not allow SSH access
- * It does not write all output to S3.
- * Print statements are not ignored in Lambda



RTD - Recovering Time Objective

RPO - Recovery Point Objective.

- * RTD means the max. length of time after an outage that the company is willing to wait for the recovery process to finish. (time taking to recover) (sec, min, hours - measured)
- * RPO means the max. amount of data loss your company is willing to accept as measured in time. (measured in MB or GB) & also measured in sec., min, hours)

+ CloudWatch: Using this, you can collect & access all your performance & operational data in the form of logs & metrics from a single platform. ("Easily Stored & Collect Logs")

- This allows you to overcome the challenge of monitoring individual systems & applicatn's in network idb etc.,
- It also allows you to monitor the complete stack & reduce Mean Time to ResolutP(MTTR).

- It provides 1-sec of visibility & 15 months of retention
- It collects all the info required to help the DevOps engineer to isolate issues & resolve them quickly.

In short: It is a monitoring service for AWS cloud resources the applicatn's you run on AWS. It is used to collect & track metrics, collect & monitor log files & alarms.

It can monitor resources like; EC2 instances, DynamoDB tables, RDS.

With Cloud Watch Log, you can monitor your logs, in real time, for specific phrases, values or patterns.

Cloud Watch Alarms are created to monitor any CloudWatch metric in your account.

* Within SSD provisioned is expensive & within HDD
Throughput is more expensive

1 General Purpose SSD: (gp2)

- * Use cases: Recommended for most workloads.
 - a) System boot volumes
 - c) Virtual desktops
 - d) Low-latency interactive apps.
 - e) Dev & test environments.

* Volume sizes: 1 GiB - 16 TiB

* Max. IOPS/volume: 10000

* Max. Throughput/volume: 160 MiB/s

* Dominant Performance Attribute: IOPS.

2 Provisioned IOPS SSD (io1)

* Use cases: Critical business applicatns that require sustained IOPS performance, or more than 10000 IOPS or 160 MiB/s of throughput per volume

b) Large db workloads.

* Volume size: 4 GiB - 16 TiB

* Max. IOPS/volume: 32000

* Max. Throughput/volume: 500 MiB/s

* Dominant Performance Attribute: IOPS.

3. Throughput Optimized HDD (ST1)

Use cases: a) Streaming workloads requiring consistent, but throughput at a low price

- b) Big data.
- c) Data warehouses.
- d) Log processing.
- e) Cannot be a boot volume.

Max IOPS/volume: 500

Volume size: 500 GiB - 16 TiB

Max throughput/volume: 500 MiB/s

Dominant Performance Attribute: MiB/s

4. Cold HDD (SC1)

Use cases: a) Throughput-oriented storage for large volumes of data that is infrequently accessed.

- b) Scenarios where the lowest storage cost is important.
- c) Cannot be a boot volume.

Volume size: 500 GiB - 16 TiB

Max. IOPS/volume: 250

Max. Throughput/volume: ~~250~~ 200 MiB/s

Dominant Performance Attribute: MiB/s

AWS CloudFormation: This helps to model & setup up AWS services resources so that u can spend less time managing those resources & more time focusing on your applicat's that run in AWS.

- You create a template that describes all AWS resources (like EC2 instances or RDS DB instances) & this takes care of provisioning & configuring those resources. We don't have to create individually & configure what is depended on what. This handles those all.
- Templates: To describe AWS resources & properties.
- Whenever you create a stack, this provisions resources that are described in your template.
- Stacks

* SQS: (Simple Queue Service): FIFO is supported
It is a queuing service which makes work easier.
It is used by distributed applicat's to exchange messages through a polling models and can be used to decouple sending & receiving components.

5. Amazon CloudFront: (Content Delivery Network(CDN))

- * It receives data from S3 bucket & distributes it to multiple datacenter locations
- * It is a web-service for content delivery.
- * Integrates with other AWS services:
 - a) low latency
 - b) High data transfer speeds
 - c) No min. commitment

Cost factors: a) Prices varies across geographic regions.

b) Based on: Requests + Data transferout

- * It speeds up distribution of your static & dynamic web content to your users. It delivers content through a world wide network of data centers called edge locations.
- * It speeds up the distribution of ur content by routing each user request through the AWS backbone n/w to the edge locn.
- * You also get increased reliability & availability bcz copies of files are now held at multiple locations around the world.

Test Axioms for Modules

- * Expect "Single AZ" will never be a right answer.
- * Using AWS managed services should always be preferred.
- * Fault tolerant & high availability are not the same thing.
- * Expect that everything will fail at some point & design accordingly.