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Course Presentation

A Practical Guide to Configuring

AWS

(Amazon Web Services)

Cloud Platform

Course Presentation

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Introduction

We are pleased to release the practical guide to configuring AWS (Amazon Web Services). This lab manual can be used as a standalone guide or in conjunction with the AWS course taught at Zoom Technologies.

The list of exercises ranges from the basic to the advanced, with each exercise building over the one before it. All the steps are clearly outlined with screenshots so that students can practically work through the manual by themselves.

Each of the exercises is divided into four sections:

1. Objective
2. Prerequisite
3. Topology
4. Tasks

We hope this practical guide will be a useful addition to an IT professional's collection, providing reliable step by step how-tos for general AWS configuration. Any feedback or suggestions to improve this would be gratefully accepted.



DAY 1
Introduction to Cloud Computing
with
Amazon Web Services

AWS

Introduction to Cloud Computing
with
Amazon Web Services

AWS

Agenda



What is cloud ?

Cloud Deployment Model

Cloud Service Model

Advantage of Cloud

Cloud Market and scope

AWS certification

Course content of AWS

AWS

Cloud Definition



What is cloud ?

- **IBM**

Cloud computing, often referred to as simply “the cloud,” is the delivery of on-demand computing resources—everything from applications to data centers—over the Internet on a pay-for-use basis.

- **NIST**

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

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Cloud Definition

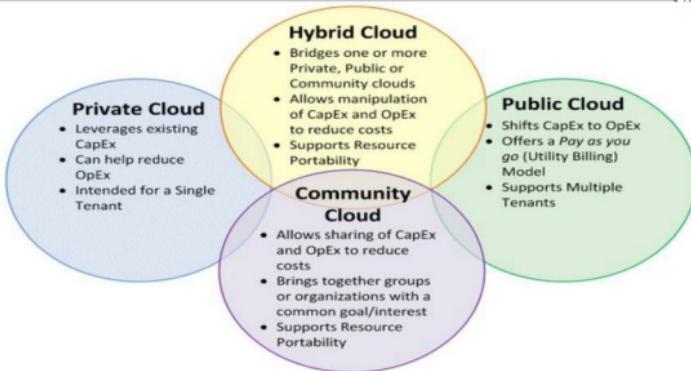


Definitions:

In the simplest terms, cloud computing means it provides services to access programs, application, storage, network, servers over the Internet through browser or client-side application on your PC or Laptop, Mobile, TAB, or Smart TV , by the end user without installing, updating and maintaining them.

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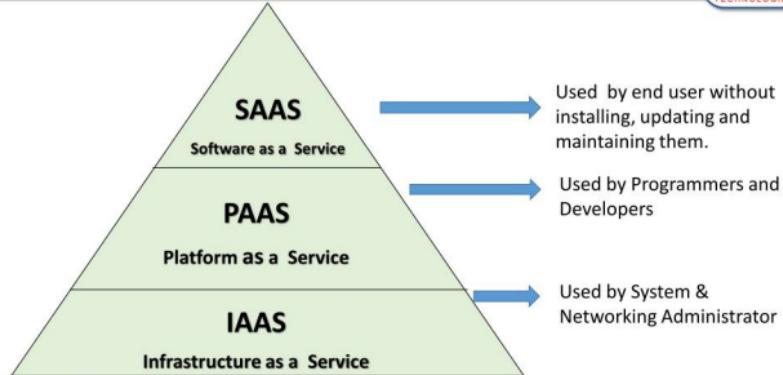
Cloud Deployment Models



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Cloud Services Models

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Software as a Service (SaaS)

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Software as a Service (SaaS) is software distribution model in which applications are hosted by a vendor over the Internet for the end users freeing end users from complex software and hardware management.

Users can subscribe to the service and use the app, normally through a web browser or by installing a client-side app.

SaaS Providers

- Google – Mail,
Calendar, docs,
presentation etc..
- Microsoft - Mail,
MSword, paint
- Twitter,
•Facebook
•Flipkart
•Paypal
•Gotomeeting
•Pixlr (image editor)
•Jaycut (video editor),
Aviary (photo editor)



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Platform as a Service (PaaS)

Platform as a service (PaaS) is a category of cloud computing that provides a platform and environment to allow developers to build applications. It frees developers without going into the complexity of building and maintaining the infrastructure.

With PaaS, developers and organizations can create highly scalable custom apps without having to provision and maintain hardware and operating system resources.

PaaS Providers

- AWS beanstalk
- Google App Engine
- Windows Azure
- Force.com from salesforce
- IBM Bluemix
- RedHat OpenShift open source PaaS
- Pivotal CF from VMware

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Infrastructure As A Service (IaaS)

Infrastructure as a service (IaaS) is a form of cloud computing that provides virtualized computing resources, over the internet. Like CPU, harddisk, memory, switches, routers, firewall, DNS, DHCP, Load Balancer, Autoscaling etc...

IaaS Providers

- Amazon AWS.
- Windows Azure.
- Google Compute Engine.
- Rackspace Open Cloud.
- IBM SmartCloud Enterprise.
- HP Enterprise Converged Infrastructure.
- GoGrid,
- Joyent,
- AppNexus

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Advantages of Cloud Computing



- Scalability/Elasticity
 - Demand on cloud infrastructures
- Cost saving
 - Reducing up-front IT cost by buying server machines, no need for hiring/training manpower.
 - Pay as you go , charges are applied hourly, monthly and yearly basis.
- Disaster recovery and Back up
 - Cloud Services have very high availability of ~99.9999%, by proactively taking backups, having stand-by virtual resources in place and moving failed instances of Virtual resources across seamlessly

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Cloud examples



For Example

DropBox	https://www.dropbox.com/home
Google drive	https://drive.google.com/drive/my-drive
Google Docs	https://docs.google.com/document/u/0/
Google presentation	https://docs.google.com/presentation/u/0/
Google Calendar	https://calendar.google.com/calendar

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AWS Certification

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Course Content of AWS



Compute

EC2

- Launch Instance
- AMI
- Elastic Block Storage
- Networking & Security
- Load Balancer
- Autoscaling

Elastic BeanStack

Networking & Content Delivery

VPC

- Subnet
- Route Table
- Internet Gateways
- Elastic IP
- Nat Gateway
- Peering Connection

Route53

CloudFront

Security

- Network ACLs
- Security Group

VPN Connection

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Course Content of AWS



Storage

S3 (Simple Storage Service)

EFS (Elastic File System)

Glacier

Security, Identity & Compliance

IAM

Database

RDS

Dynamodb

Amazon Redshift

Management Tools

CloudWatch

CloudFormation

CloudTrail

AWS

Course Content of AWS



Application Integration

Simple Queue Service

Simple Notification
Service

Simple WorkFlow
Service (SWF)

Advance Topics

Active Directory Integration

Server Migration

Integration with Devops

Customer Engagement

Simple Email Service

AWS

AWS future and Job Scope



<http://www.financialexpress.com/industry/tech/what-the-future-holds-for-india-in-cloud-computing/108207/>

<http://www.zdnet.com/article/predictions-2017-three-reasons-businesses-cant-ignore-the-rapidly-growing-cloud-market/>

<http://www.cxotoday.com/story/global-public-cloud-market-to-reach-over-200-bn-in-2016-gartner/>

<https://www.quora.com/What-is-the-future-of-cloud-computing-in-India>

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DAY 2

AWS Infrastructure

Launching of Windows and Linux instance

AWS

What is AWS ?

Amazon Web Services (AWS) is a secure cloud services platform, offering compute power, database storage, content delivery and other functionality to help businesses scale and grow.

The first AWS offerings were launched in 2006 with S3 storage service.

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How did Amazon... get into cloud computing?

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AWS global infrastructure over the map

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AWS Global Infrastructure



- 16 Geographic Regions

Name	Code Name
US East (N. Virginia)	us-east-1
US East (Ohio)	us-east-2
US West (N. California)	us-west-1
US West (Oregon)	us-west-2
Canada (Central)	ca-central-1
EU (Ireland)	eu-west-1
EU (Frankfurt)	eu-central-1
EU (London)	eu-west-2
Asia Pacific (Tokyo)	ap-northeast-1
Asia Pacific (Seoul)	ap-northeast-2
Asia Pacific (Singapore)	ap-southeast-1
Asia Pacific (Sydney)	ap-southeast-2
Asia Pacific (Mumbai)	ap-south-1
South America (São Paulo)	sa-east-1

- 44 Availability Zones

- Coming soon 17 more Availability Zones and six more Regions in Bahrain, China, France, Hong Kong, Sweden, and a second AWS GovCloud Region in the US.
- 90 Edge Location by November 6, 2017

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AWS Region, Availability Zones, Edges



Regions

An independent collection of AWS resources in a defined geography

A solid foundation for meeting location-dependent privacy and compliance requirements



Availability Zones

Designed as independent failure zones

Physically separated within a typical metropolitan region

Edge Locations

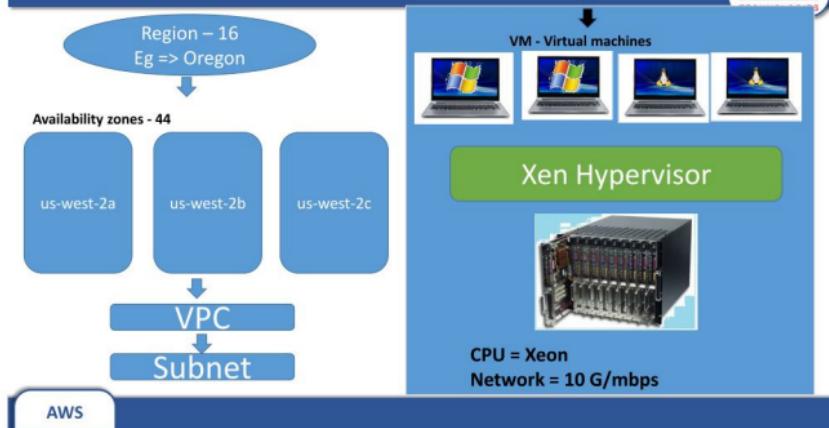
To deliver content to end users with lower latency

A global network of edge locations

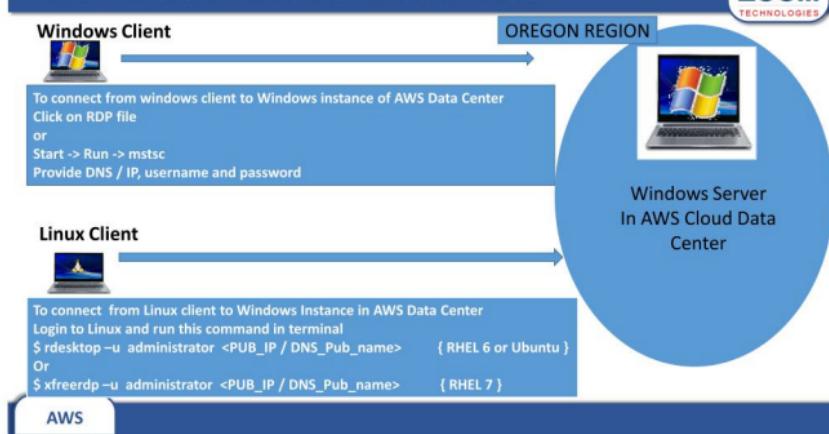
Supports global DNS infrastructure (Route53) and CloudFront CDN

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AWS infrastructure in a Region



To launch Windows Server instance in AWS and connect



To launch Linux Server instance in AWS and connect



Linux Client



Download *.pem file
Open terminal follow the syntax
\$ chmod 400 <*.pem>
\$ ssh -i <*.key> <DNS_name / Public_IP>

OREGON REGION



Linux Server
In AWS Cloud Data
Center

Windows Client



Download putty.exe/puttygen.exe from putty.org
Connect through
1. putty.exe/puttygen.exe
2. mobaxterm

AWS

Amazon Elastic Block Storage



DAY 3

Amazon Elastic Block Storage

AWS

Amazon Elastic Block Storage

AWS

Types of Storage

- Direct-attached storage (DAS)
- Network attached storage (NAS)
- Storage area network (SAN)
- Cloud Storage i.e. storage over Internet

AWS

Direct attached storage (DAS)

- **Direct-attached storage (DAS)**

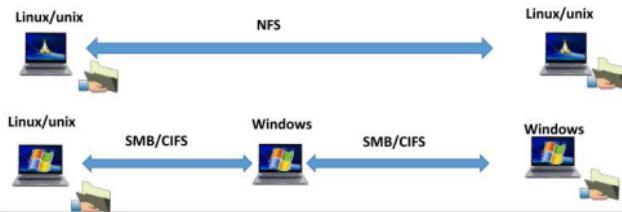
Direct-attached storage (DAS) is attached directly to the computer system mother board connectors or through usb. Examples of DAS include hard drives, CDROM/DVD , external hard drives, optical disc drives, pendrive etc.

Amazon provide these facility through **EBS (Elastic Block Storage service)**

Network-attached storage (NAS)

- **Network-attached storage (NAS)**

- NAS uses file-based protocols for sharing folders using NFS for Linux/UNIX, SMB/CIFS for windows.
- It is a shared folder over the network.
- Amazon provide these facility through **EFS (Elastic File system)** service.
- A shared folder cannot be formatted.



Storage Area Network (SAN)

• Storage Area Network (SAN)

A storage-area network (SAN) is a dedicated high-speed network block level data storage, It can be formatted.

It provide shared pools of storage devices to multiple servers in the form of LUN.

Fiber cable, bus adapters (HBAs) and fiber switches are used to provide SAN storage.

ISCSI target make use of normal network over cat5/6 cables to provide LUN over SAN storage.



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Cloud Storage

• Cloud storage

Cloud storage is a storage over internet provided by cloud service venders.

It is not a block level storage i.e. cannot be formatted.

Eg.

Google drive

One drive

Dropbox

Amazon provides this services through

- S3 (Simple storage service)
- Glacier service

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Elastic Block Storage



- Elastic Block Store (EBS)

Amazon Elastic Block Store (EBS) is a block level storage volumes which can be formatted according to required filesystem, for e.g. In Windows FAT32, NTFS, in Linux ext3, ext4, resirfs etc.

Data on EBS volume are persistence, they are not lost if a instance is started/stopped or restarted.

When an instance is launched by default it contains an EBS volume which is called as root volume, where operating system is installed.

These EBS root volumes are highly available because AWS by default automatically creates a snapshot of launched instance which are used to recover if any disaster or failover occurs.

The AWS logo, consisting of the letters "AWS" in a white, sans-serif font inside a rounded rectangular box with a drop shadow.

Elastic Block Storage



With Amazon EBS, you can scale your usage up or down within minutes.

Software's like Oracle, SAP, Big Data workloads, Data warehouses, Log processing, Boot Volume are used on EBS volumes.

EBS volumes are 99.9999% Availability, with 0.1% to 0.2% Annual Failure Rate (AFR)

The AWS logo, consisting of the letters "AWS" in a white, sans-serif font inside a rounded rectangular box with a drop shadow.

Elastic Block Storage



EBS volumes are specific to their Availability Zones

An instance can have Multiple EBS volume attached.

These EBS volumes can be attached as well as detached from an instance without any data loss.

EBS volumes at one particular time can be attached to only one instance, it cannot be used with two or more instance at the same time.

EBS volume can be attached to an instance which is in same Availability zone, it cannot be attached to an instance which is another availability zone.

Each EBS volume will have a volume id, which will be used by cloudwatch and other services.

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EBS snapshot



EBS Snapshot

Snapshot are used to take EBS point-in-time backup.

Snapshot are incremental back up of the EBS volume.

Snapshots are region specific, where as volumes are specific to availability zones.

EBS volumes cannot be increased directly through volumes.

To increase the size of EBS Volumes first create the snapshots, then from this snapshot create the required size of volume.

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EBS snapshot



EBS Snapshot

Volume size cannot be decrease lesser than the snapshot size

Volumes in another Availability zones can be created using snapshot

To have the same volume in another region, first copy the snapshot in other region, then from this snapshot create the volume in required availability zones .

Volumes are not deleted if snapshots are removed, similarly snapshots are not deleted if volumes are removed

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IOPS / Throughput



IOPS

Input/output operations per second (#)

After ~33 GB adds 3 IOPS for each GB in general purpose volume

Throughput

Read/write rate to storage (MB/s)

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Types of EBS Volumes

Volume Types	Hardware Type	Minimum Size	Maximum Size	Max IOPS/Vol's	Max Throughput MB/s	Price
EBS Provisioned IOPS SSD (io1)	SSD	4 GB	16 TB	20,000	Not applicable	\$0.125/GB-month \$0.065/provisioned IOPS
EBS General Purpose SSD (gp2)*	SSD	1 GB	16 TB	10000	Not applicable	\$0.10/GB-month
Throughput Optimized HDD (st1)	HDD	500 GB	16 TB	500	500 MB/s	\$0.045/GB-month
Cold HDD (sc1)	HDD	500 GB	16 TB	250	250 MB/s	\$0.025/GB-month
Magnetic	HDD	1GB	1 TB	Not applicable	Not applicable	\$0.05/GB-month

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Costing of EBS snapshot

Snapshot are charged around the same as storage for your EBS volumes

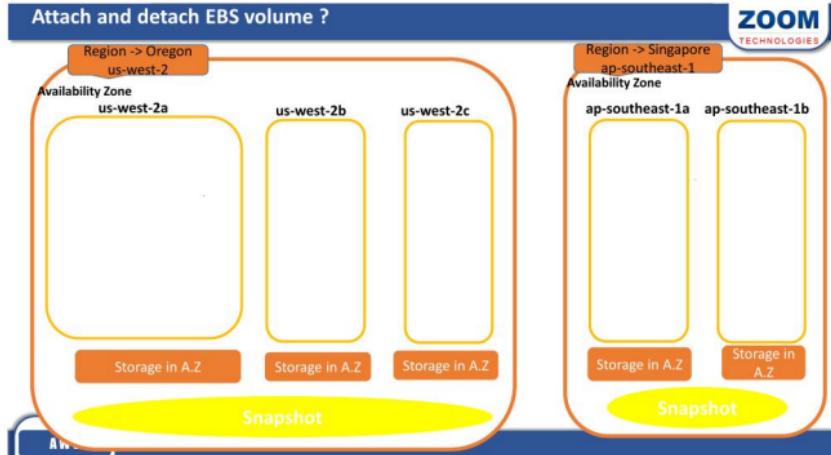
Prices are calculated depending on the type of Volumes.

Scenario

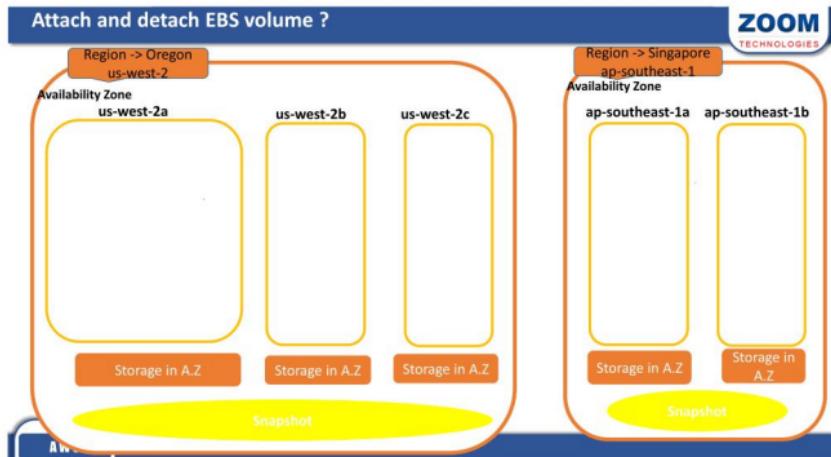
If you take 1TB of local snapshots every day for one month with 3% daily increment changes and a 30-day retention period, it will cost you the same as snapshots for 2TB per month. With \$0.10 per GB-month of snapshots, it will cost around \$200 (\$0.1/GB x 2TB) per disk.

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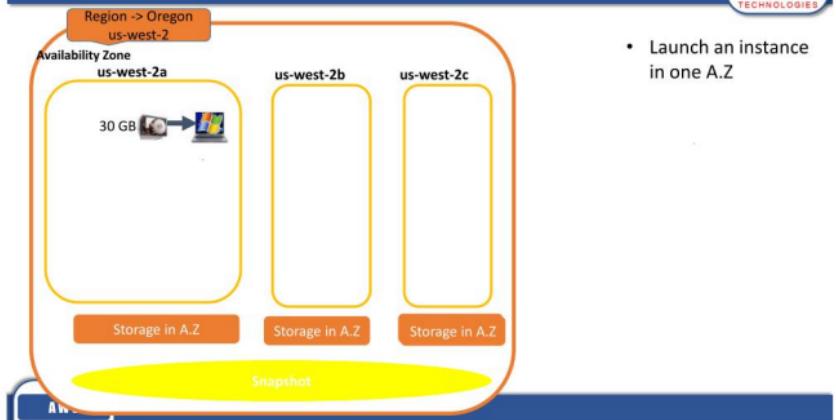
Attach and detach EBS volume ?



Attach and detach EBS volume ?

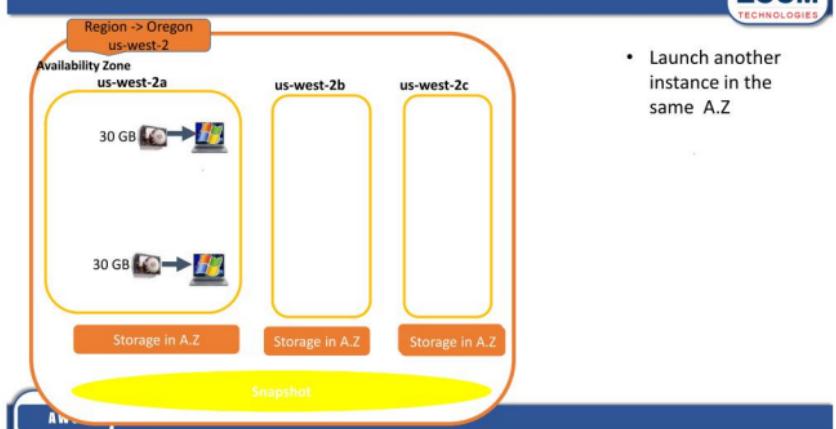


Attach and detach EBS volume ?



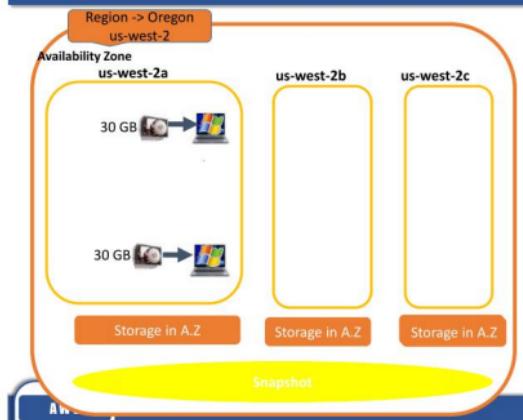
- Launch an instance in one A.Z

Attach and detach EBS volume ?



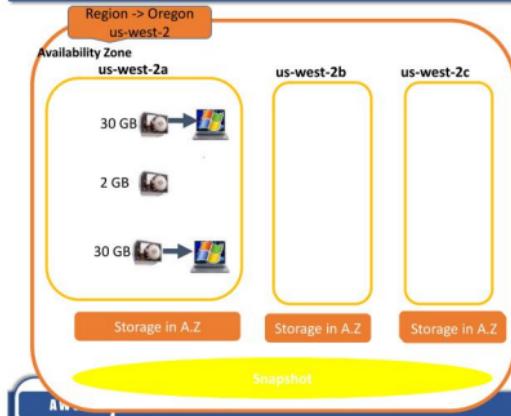
- Launch another instance in the same A.Z

Attach and detach EBS volume ?



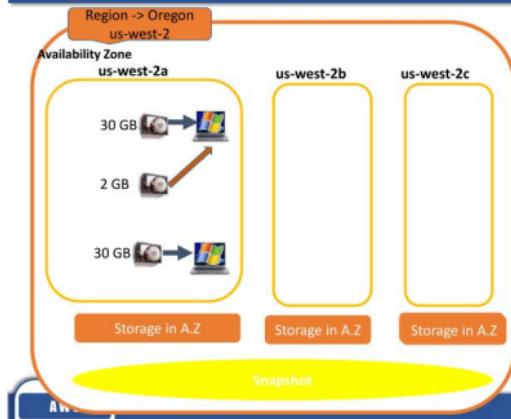
- Create a volume of 2 GB

Attach and detach EBS volume ?



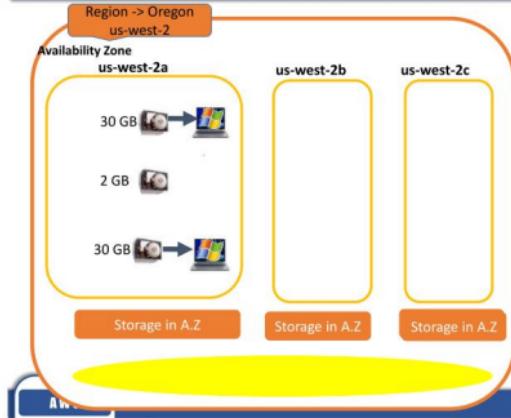
- 2 GB volume got created

Attach and detach EBS volume ?



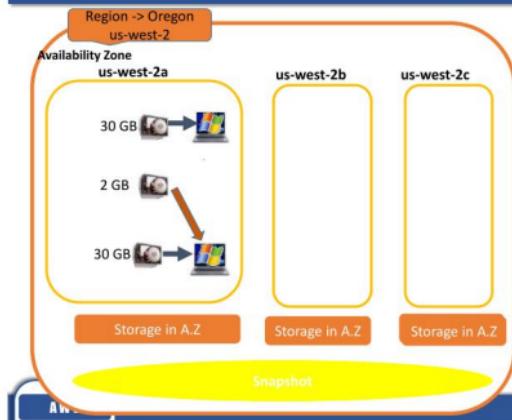
- Attach the volume to an instance
- EBS volume can be attached to only one instance at one time
- Same volume if u want to use with other instance then, first detach from existing instance and attach to another instance.

Attach and detach EBS volume ?



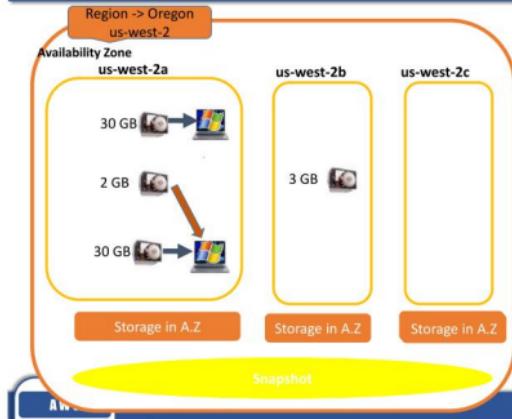
- Now volume is detached.
- Now it could be attached to another instance.

Attach and detach EBS volume ?



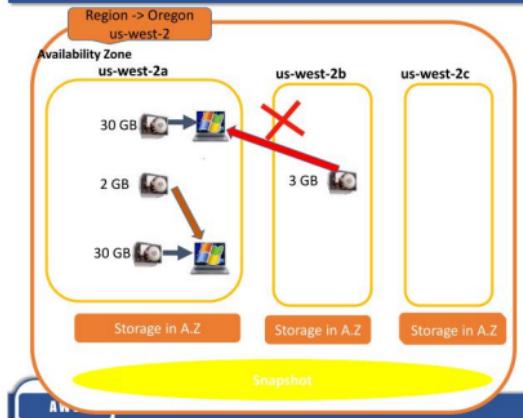
- Attached to another instance.

Attach and detach EBS volume ?



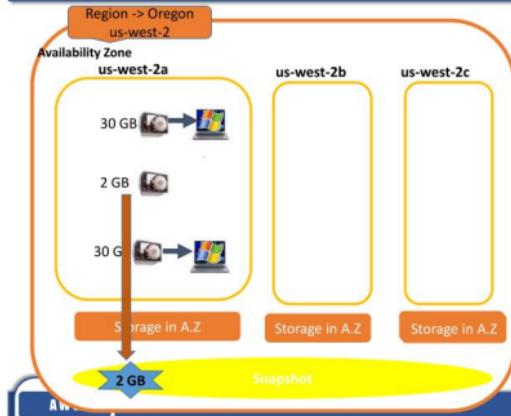
- Create a volume in another A.Z
- A volume of one A.Z cannot be attached to instance in another A.Z

Attach and detach EBS volume of other region S?



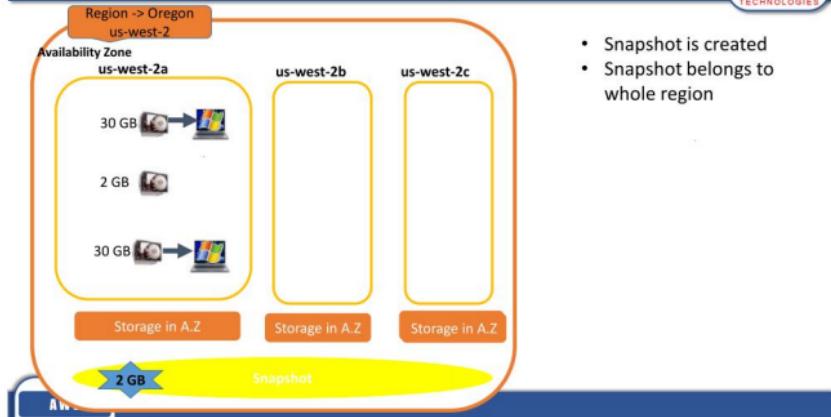
- A volume of one A.Z cannot be attached to instance in another A.Z

To Increase the size of the Volume



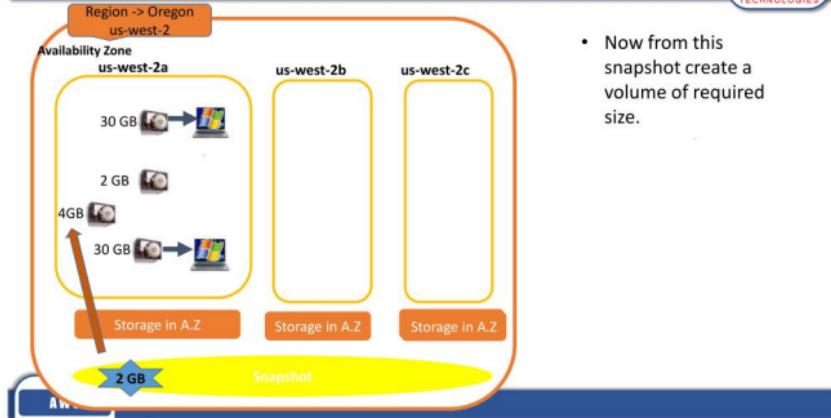
- Snapshots are specific to the region
- To increase the size of the volume first take the snapshot
- Now from this snapshot create a volume of required size.

To Increase the size of the Volume



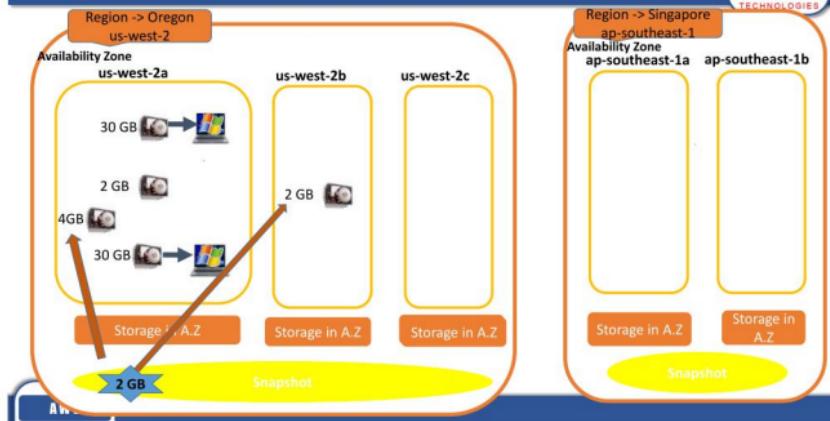
- Snapshot is created
- Snapshot belongs to whole region

Attach and detach EBS volume ?

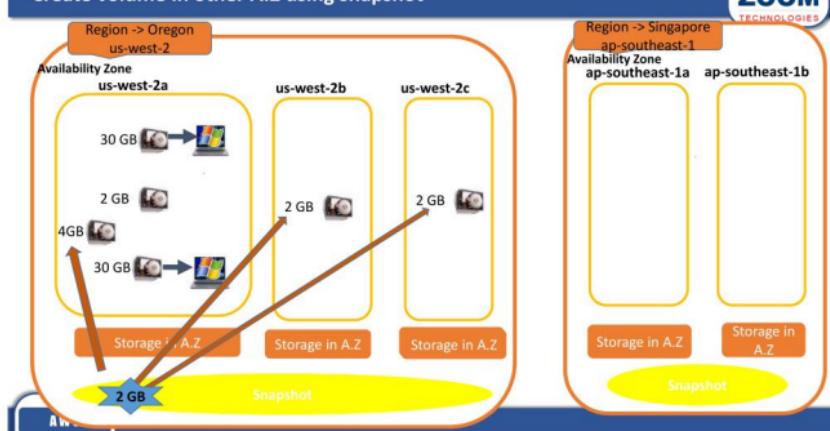


- Now from this snapshot create a volume of required size.

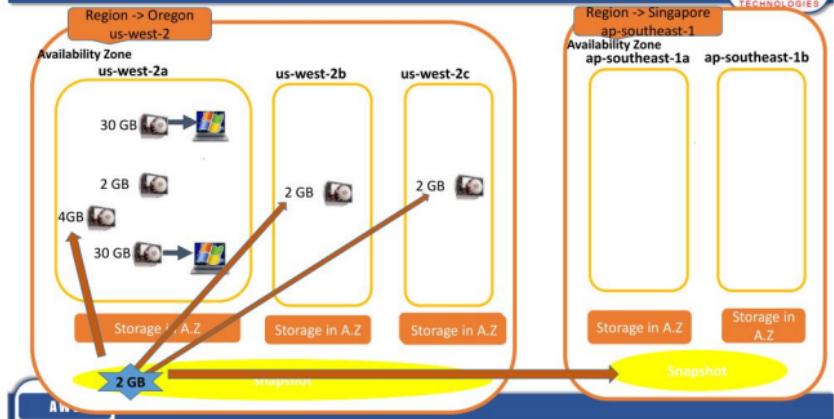
Create volume in other A.Z using snapshot



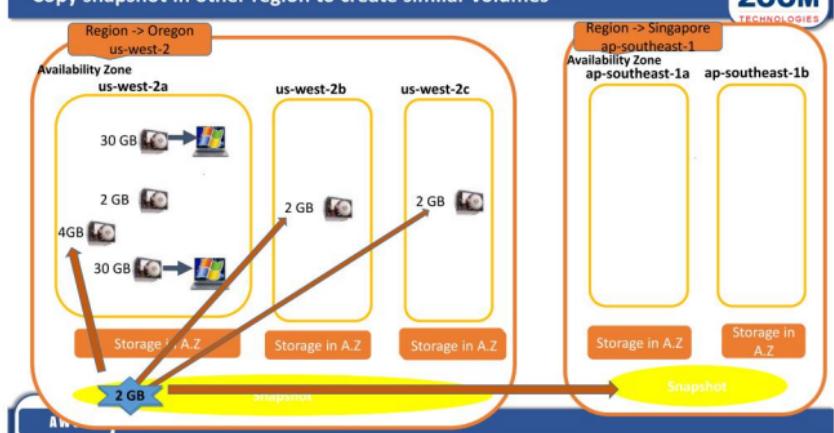
Create volume in other A.Z using snapshot



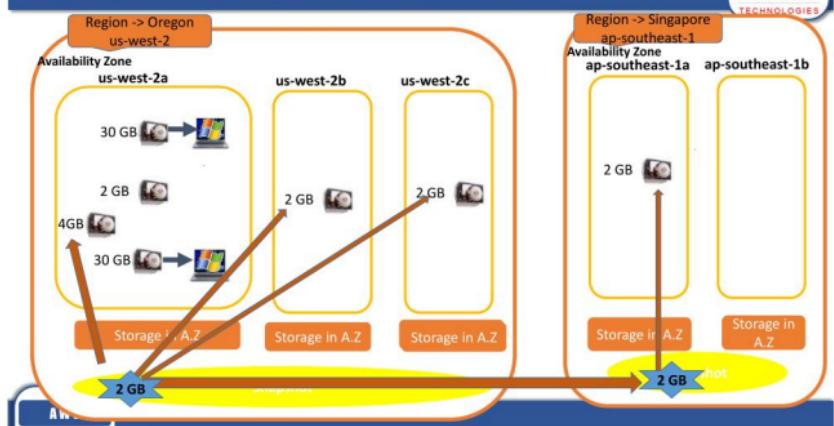
Copy snapshot in other region to create similar volumes



Copy snapshot in other region to create similar volumes



Copy snapshot in other region to create similar volumes



Managing partitions

- In windows by using diskmgmt.msc drives and partitions can be managed.
- In linux to manage drive and partition use fdisk.

DAY 4

Identity and Access Management (IAM)

AWS

Identity and Access Management (IAM)

AWS

Agenda



IAM (Identity and Access Management)

IAM Users

IAM Groups

IAM Roles

IAM Policies

Multi-Factor Authentication

AWS

What is IAM ?



- What is IAM ?

- By default when AWS account is created it treats that user as a root user who has the access to all AWS services and resources, but to give the access to AWS services to other users, group members, applications, or instances IAM users, groups and roles are created.
- (IAM) is a web service that helps you securely control access to AWS resources
- IAM is a global service, it's free.
- A primary use for IAM users is to give people the ability to sign in to the AWS Management Console for interactive tasks and to make programmatic requests to AWS services using the API or CLI.

AWS

Main components of IAM

- The main components of IAM

- IAM Users
- IAM Groups
- IAM Roles
- IAM Policies

AWS

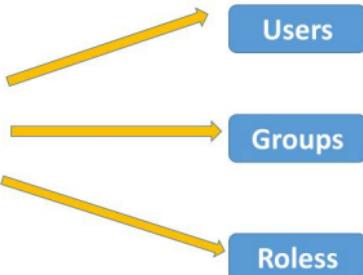
IAM

Working of IAM

Examples of Policies :

- AmazonEC2ReadOnlyAccessAWS
- AmazonS3FullAccess
- AmazonS3ReadOnlyAccess
- AmazonRDSFullAccess
- AmazonRDSReadOnlyAccess

Policies



AWS

- **IAM users**

- IAM users can manage AWS service and resources either through Console access or programmatic Access.
- If an IAM user is not having any policy attached then that user cannot do any task that means an IAM user without policy is of no use.
- IAM user requires a username/password to login to console or access/secret key to connect programmatically to use AWS services.
- An IAM User with only AWS creds can be created so the creds can be used by an application to make API calls into AWS.
- Multiple policies can be attached to a Single IAM users
- An IAM user can belong to multiple Groups

- **IAM Groups**

- An IAM group is a collection of IAM users.
- Groups let you specify permissions (policy) for multiple users, which can make it easier to manage the permissions for those users
- Permissions assigned to groups are inherited to all the users in that group
- Groups can't be nested; they can contain only users, not other groups.
- IAM user can be a member of 10 Groups

- **IAM Roles**

- When a policies are applied on an AWS ec2 instance or AWS application or service then it is called as roles.

- An IAM role is very similar to a user, in that it is an identity with permission policies that determine what the identity can and cannot do in AWS.

- Roles do not use username and password but they use access key and secret key in order to use the services like ec2, lambda, s3, RDS, autoscaling etc.

- Scenario

- Suppose you had configured any server and now u want to upload the data to s3 without any user interaction then if that EC2 instance is having a role of s3 then it can automatically upload with the help of script without users interaction.

- **IAM Policy**

- Permissions that we grant to users, groups, and roles are called as policies.

- These policies will give the access to that service or resource to read, write, or fullaccess.

- IAM Policies are JSON formatted

Elements of IAM policy



- Elements of IAM policy
 - Version
 - Statement
 - Contains an array of statements
- Each statement defines whether permissions are allowed or denied
 - These are defined by the values of the following elements in each statement:
 - Effect – Allow or Deny
 - Action – array of service actions
 - Resource – array of ARNs that actions can occur on
 - Principal – identifies who/what is allowed/denied access

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Example Policies



- Allows an Amazon EC2 instance to attach or detach volumes

```
{  
    "Version": "2012-10-17",  
    "Statement": [  
        {  
            "Effect": "Allow",  
            "Action": [  
                "ec2:AttachVolume",  
                "ec2:DetachVolume"  
            ],  
            "Resource": [  
                "arn:aws:ec2:<REGION>:<ACCOUNTNUMBER>:volume/*",  
                "arn:aws:ec2:<REGION>:<ACCOUNTNUMBER>:instance/<INSTANCE-ID>"  
            ],  
            "Condition": {  
                "ArnEquals": {  
                    "ec2:SourceInstanceId": "  
                }  
            }  
        }  
    ]  
}
```

AWS

Security firsts for new AWS accounts



- For AWS root account:
 - Store username/password somewhere safe and secure
 - Setup multi-factor authentication
- Create IAM User(s) with "[least privileges](#)" necessary
 - Least privilege = only the permissions necessary to accomplish needed tasks

AWS

Multi factor authentication (MFA)



- MFA provides added security for AWS resources and account settings.
- It is a two factor authentication
- First factor i.e. it asks for username and password, and the second factor is it ask for MFA code.
- If a user logs in to AWS account he will be prompted for username, password and Multi factor authentication code.
- AWS does not charge any additional fees for using MFA.

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Multi factor authentication (MFA)



Virtual MFA applications are available for smartphones including Android, iOS and Windows.

- ❑ These are the list of authenticated mobile application

Android	Google Authenticator; Authy 2-Factor Authentication
iPhone	Google Authenticator; Authy 2-Factor Authentication
Windows Phone	Authenticator
Blackberry	Google Authenticator



Limits of IAM



Limits :

- User name 64 characters
- Group name 128 characters
- Role name 64 characters
- Policy name 128 characters

- Groups in an AWS account 300
- Roles in an AWS account 1000
- Users in an AWS account 5000



DAY 5

Amazon S3 (Simple Storage Service) & Glacier

Amazon S3 (Simple Storage Service) – Object storage

Amazon Simple Storage service (S3)

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TECHNOLOGIES

- Agenda

Cloud Storage

S3

Object

Bucket

Keys

Static Web Hosting

Versioning

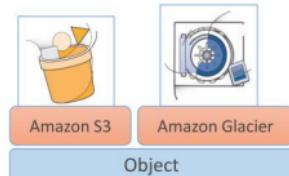
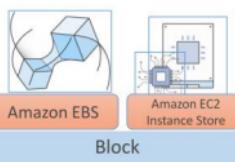
Replication

AWS

Cloud Storage

ZOOM
TECHNOLOGIES

Storage is a platform: AWS Storage



Data Transfer

AWS

Cloud Storage



- **Cloud Storage**

Storage over the internet is called as Cloud storage or Object Storage.

Every file on cloud storage is called an object.

Cloud storage differs from block storage (i.e. cannot be formatted) and file storage (i.e. shared folders.)

It is a model in which data is maintained, managed, backed up remotely and made available to users over network (typically the Internet).

The AWS logo, consisting of a white rectangular badge with rounded corners containing the letters "AWS" in a white serif font.

Cloud Storage



Cloud storage is based on a virtualized infrastructure with accessible interfaces, elasticity and scalability, multi-tenancy and metered resources.

Under hood architecture is used to provide highest reliability by replicating objects across multiple servers and hardware and disk drives form the same or different locations.

To configure Cloud storage minimum 3 to 5 nodes are required to maintain multiple copies across the nodes.

The AWS logo, consisting of a white rectangular badge with rounded corners containing the letters "AWS" in a white serif font.

Example of Cloud Storage



Examples of Cloud or Object storage services

Amazon S3 EMC Atmos, EMC ECS

Google Drive Hitachi Content Platform

One Drive OceanStore

DropBox VISION Cloud

Microsoft Azure Storage

Openstack Swift

AWS

Amazon Simple Storage service (S3)



- S3 (Simple Storage Service)

Amazon S3 is a cloud or object storage service, started in 2006 as a first service.

By the end of 2012, 1.3 trillion objects were stored in Amazon S3, the world's largest and most widely known object storage system. Now, that number was growing faster, so the 2 trillion mark is right around the corner.

S3 is a Global service.

S3 enables a customer to upload, store and download practically any file or object .

AWS

Globally Unique



Bucket Name + Object Name (key)

Amazon S3

bucket

object

object

object

object

bucket

object

object

AWS

Bucket

- **Bucket**

A bucket is a logical unit of storage in Amazon Web Services (AWS) object storage service,

Instead of organizing files in a directory hierarchy, object storage systems store files in a flat organization of containers (called "buckets" in Amazon S3) and use unique IDs (called "keys" in S3) to retrieve them.

Buckets are used to store objects, which consist of data and metadata that describes the data.

There is no limit to the number of objects a customer can store in a bucket, but each AWS account can only have 100 buckets at one time.

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Object Keys & Metadata



- **Object Keys**

When you create an object, you specify the key name, which uniquely identifies the object in the bucket. These names are the object keys.

The name for a key is a sequence of Unicode characters (UTF-8 encoding) is at most 1024 bytes long.

- **Object Metadata**

For each object stored in a bucket, Amazon S3 maintains a set of system metadata, which contains object creation date and size, last modified date, etc and uses this information as part of object management.

S3 Standard and IA



Amazon S3 comes in two storage classes:

- S3 Standard and ,
- S3 Infrequent Access.

Amazon S3 Standard – Any time could be retrieved or uploaded,

Infrequent Access (Standard - IA) is an Amazon S3 storage class for data that is accessed less frequently, but requires rapid access when needed, retrieval of data should be at least after 30 days.

Amazon does not impose a limit on the number of items that a subscriber can store.

A subscriber can choose to keep data private or make it publicly accessible

Pricing of S3 Standard



Services

Estimate of your Monthly Bill (\$ 2.18)

Choose region: US-East / US Standard (Virginia) Inbound Data Transfer is Free and Outbound Data Transfer is 1 GB free per region per month
Amazon S3 is storage for the Internet. It is designed to make web-scale computing easier for developers. Please check the [Amazon S3 Storage Classes](#) page details. [Clear Form](#)

Standard Storage:

Storage: 100 GB
PUT/COPY/POST/LIST Requests: 2 Requests
GET and Other Requests: 2 Requests

Standard - Infrequent Access Storage:

Storage: 0 GB
PUT/COPY/POST/LIST Requests: 2 Requests
GET and Other Requests: 2 Requests
Lifecycle Transitions: 0 Transitions
Data Retrieval: 0 GB

AWS

Pricing of S3 Infrequent Access storage



Services

Estimate of your Monthly Bill (\$ 1.25)

Choose region: US-East / US Standard (Virginia) Inbound Data Transfer is Free and Outbound Data Transfer is 1 GB free per region per month
Amazon S3 is storage for the Internet. It is designed to make web-scale computing easier for developers. Please check the [Amazon S3 Storage Classes](#) page details. [Clear Form](#)

Standard Storage:

Storage: 0 GB
PUT/COPY/POST/LIST Requests: 2 Requests
GET and Other Requests: 2 Requests

Standard - Infrequent Access Storage:

Storage: 100 GB
PUT/COPY/POST/LIST Requests: 2 Requests
GET and Other Requests: 2 Requests
Lifecycle Transitions: 0 Transitions
Data Retrieval: 0 GB

AWS

Key features of S3



- Data Management
 - Cost monitoring and controls
 - Lifecycle management
- Ease of use
 - Programmatic access using AWS SDKs & REST APIs
 - Management Console, AWS CLI
- Event Notifications
 - Delivered using SQS, SNS, or Lambda

AWS

Key features of S3



- Data protection
 - Versioning
 - Cross-region replication
- Security
 - Flexible access control mechanisms
 - Time-limited access to object
 - Access logs

AWS

Static Website Hosting



- Static Website Hosting

Amazon allow to configure static website on Amazon s3.

It can contains client-side scripts comprised of only HTML, CSS, and/or JavaScript at client side, but Amazon S3 does not support server-side scripting.

To configure Static website first create a bucket , then upload all your website code into that bucket.

Add a bucket policy so that all folders, files and subfolders in that bucket can have access.

Enable Static Website Hosting providing index document and error document page.

Provide Endpoint url in brower and check the site.

Bucket Policy



----- To create Bucket policy-----

```
{  
    "Version": "2012-10-17",  
    "Statement": [  
        {  
            "Sid": "PublicReadForGetBucketObjects",  
            "Effect": "Allow",  
            "Principal": "*",  
            "Action": "s3:GetObject",  
            "Resource": "arn:aws:s3:::www.indiahymeerpet.com/*"  
        }  
    ]  
}
```

Versioning is S3



- Versioning offers an additional level of protection.
- Once versioning is enabled on s3 bucket, then it allows you to preserve, retrieve, and restore every version of every object stored.
- It protects from unintended user actions and application failures,

AWS

Cross-region Replication



With cross-region replication, every object uploaded to an S3 bucket is automatically replicated to a destination bucket in a different AWS region that you choose.

Copies of replicated objects inside a bucket are identical to the ones in the destination bucket.

Versioning is required

AWS

S3 in CLI mode



- 1) First create IAM user with S3fullaccess policy.

Select AWS access type

Programmatic access

AWS Management Console access

- 2) In windows install AWSCLI64.msi

- 3) Configure aws cli providing IAM user access key & secret key

c:> aws configure

Access Key : *****

Secret Key : *****

Region : us-west-2

Note : o/p format are's

a) text

b) table

c) json

AWS

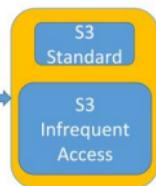
Transferring data to S3 then to Glacier



On Premises

EMC
Netapp
Hitachi
Veritas

Amazon Storage



Using 3rd party s/w
FastGlacier
Blackberry

AWS

Amazon Glacier

- **Agenda**

- Glacier
- Vault
- Archive
- Tools to use Glacier

Transferring data to Glacier



On Premises

EMC
Netapp
Hitachi
Veritas

Amazon Storage

S3 Standard
S3 Infrequent Access

Lifecycle Rule



Using 3rd party s/w
FastGlacier
Blackberry

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Glacier Definition



- Glacier is extremely low cost cloud storage, with average annual durability of 99.999999999%.
- It also stores data on multiple facilities before running success on uploaded archives similar to s3, it has built in mechanism for data integrity check.
- It reduces burdens of operating and scaling storage to AWS, without having to worry about capacity planning, hardware provisioning, data replication, hardware failure detection and recovery, or time-consuming hardware migrations.

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Glacier Definition



- Data which are not used frequently should be uploaded in glacier, minimum retention period is 90 days, If any data is retrieved or deleted before 90 days extra charges are applied.
- When the data is uploaded it cannot be accessed immediately it takes minimum 3 to 5 hr. to retrieve data from standard Glacier.
- Amazon does not provides direct access to glacier storage, either should be uploaded from s3 using lifecycle properties or use third party software's like fastglacier or blackberry.

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Components of Glacier



- Components of Glacier

- Vault

- Archive

AWS

Vault



- Vault

It is logical container where data i.e. archives are stored, similar to bucket in s3.

It is region specific.

Max 1000 vaults can be created per account

The largest archive that can be uploaded in a single Upload request is 4 gigabytes. For items larger than 100 megabytes, customers should consider using the Multipart upload capability.

Vault can be deleted, but before deleting remove all archives in it.

The AWS logo, which consists of the letters "AWS" in a white, sans-serif font inside a dark blue rounded rectangular box.

Archives



- Archives

A file or object stored in Vault is called as archive.

The total volume of data and number of archives you can store are unlimited.

Individual Amazon Glacier archives can range in size from 1 byte to 40 terabytes

The AWS logo, which consists of the letters "AWS" in a white, sans-serif font inside a dark blue rounded rectangular box.

S3 vs Glacier



Reference Point	S3	Glacier
Data are stored in.	Bucket	Vault
Object	Key	Archive
Total number	100 Bucket per account	1000 Vault per account
Redundancy	99.99999999 %	99.99999999 %
Object size	128 KB	Not applicable
Minimum storage retrieval	Immediate	3-5 hrs.
Cost	\$0.005 per GB put \$0.004 per GB get	\$0.005 per GB put \$0.012 per GB get
Max file size in single upload	Earlier 5 GB now 5 TB	4 GB up to 40 TB (multipart upload 4 GB)
Free tier	5GB	10GB

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Elastic Load Balancer (ELB)



DAY 6

Elastic Load Balancer (ELB)

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Elastic Load Balancer (ELB)

Agenda

- Cluster
- Types of Cluster
- What is Elastic Load Balancer (ELB)
- Types of Load Balancer
- Features
- Advantage of Load Balancer

Cluster

- In a computer system, a cluster is a group of servers and other resources that act like a single system and enable high availability and load balancing or parallel processing

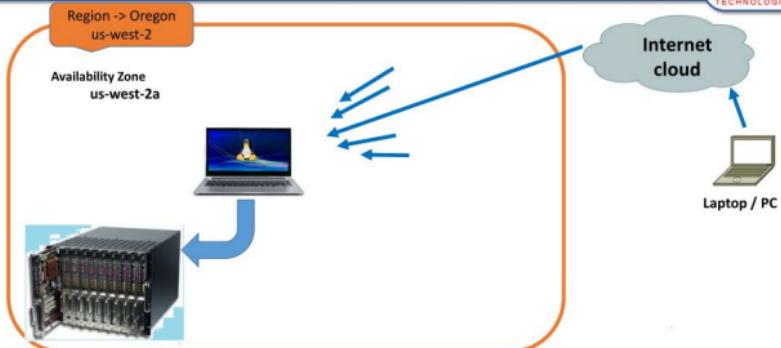
Type of Cluster

Types of Cluster

- **Load Balancing**
 - Multiple Nodes are added and scales horizontally
 - Used with Front End Application servers i.e web servers
 - IIS, Apache, NginX, Wordpress, Tomcat , MiddleWare
- **High Availability**
 - More Compute and Memory is added scales vertically
 - Used with Backend Application servers i.e data base servers
 - Oracle , MS-SQL, mysql, mariadb, PostgreSQL etc.

Elastic Load Balancer (ELB)

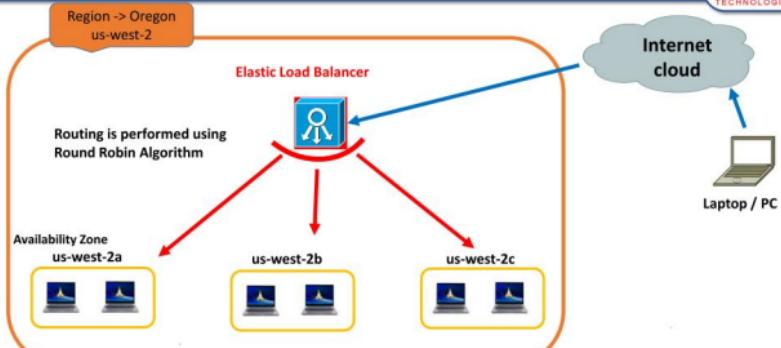
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Elastic Load Balancer (ELB)

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Definition



Elastic Load Balancer

- Elastic Load Balancer (ELB) is one of the key architecture component inside the AWS cloud.
- Elastic Load Balancing automatically distributes incoming web traffic across multiple applications and containers hosted on Amazon EC2 instances
- With Elastic Load Balancing, you can add and remove EC2 instances as your needs change without disrupting the overall flow of information

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Definition



- Scaling up and down can be automated by integrating with AutoScaling
- If an EC2 instance fails, ELB automatically reroutes the traffic to the remaining running healthy EC2 instances.
- If a failed EC2 instance is restored, Elastic Load Balancing restores the traffic to that instance.
- It is elastic, which means that it will automatically scale to meet your incoming traffic.
- Load Balancers only work across AZs within a region

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Type of Load Balancer

- **Internet Load Balancer**
 - An Internet-facing load balancer takes requests from clients over the Internet and distributes them across the EC2 instances that are registered with the load balancer
- **Internal Load Balancer**
 - Internal load balancer routes traffic to EC2 instances in private subnets

Routing Algorithm

- Routing is performed using the round robin routing algorithm

Features of ELB



Main Features of Load Balancer

- **Failover Handling**
 - Avoid single point of failure by hosting multiple instances of a given service.
- **Auto-scaling**
 - Manage number of instances of an application according to the incoming traffic.

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Advantage of ELB



Advantage of Load Balancer

- Optimize resource usage
 - Start and stop resources on demand.
- Maximize the throughput
 - Increase the average rate of successful message delivery.
- Minimize the response time
 - Reduce the time it takes to process a message and send a response back

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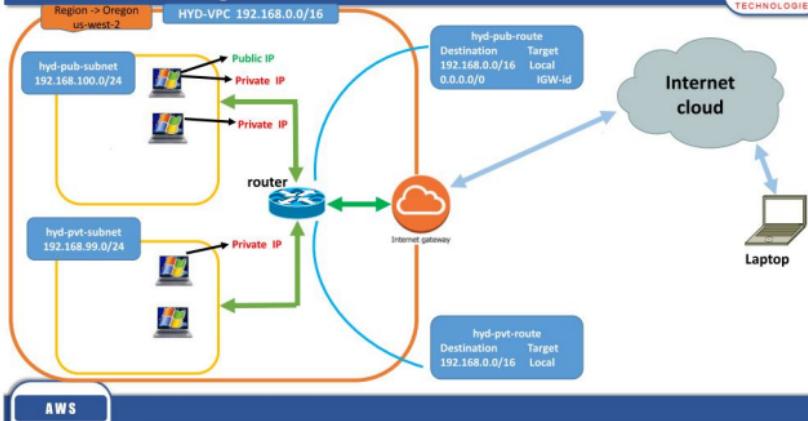
DAY 7,8

Amazon VPC (Virtual Private Cloud)

Introduction to Amazon Virtual Private Cloud (VPC)

VPC Architecture Diagram

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VPC Definition

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- Amazon VPC is a network infrastructure architecture within the AWS cloud, which closely resembles a traditional network. It isolates your network infrastructure under your account from others account, otherwise all network will conflict with each other.
- It is Based on CIDR/ VLSM subnet networking concept.
 - CIDR [Classless Inter Domain Routing]
 - VLSM [Variable Length Subnet Mask]
- A user can create his own VPC which is highly customizable.
- By default every Region will have Default VPC with predefined subnets in each zone.
- As an extension of the corporate network – access through a VPN

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- Subnet
- Route tables
- Internet Gateway
- Nat Gateway
- Network ACLs
- Security Groups
- Peering Connections
- VPN

Subnet

A range of IP addresses in your VPC

Type of Subnet

Public Subnet

If a subnet has a route to an AWS Internet Gateway it is called a *public subnet*.

Private Subnet

If there is no route from a subnet to an AWS Internet Gateway it is a *private subnet*.

- *Instances in a VPC communicate based on Route Table, VPC Security Groups and Access Control Lists*

VPC components



Route tables

Applied to subnet(s) specifying route policies.

VPC automatically comes with a main route table.

Every route table contains a local route for communication within the VPC over IPv4.

IGW

Internet gateway is attached to a VPC.

It provides access to the internet for instances in a VPC subnet.

NAT Gateway

NAT gateway provides Internet to your private instances

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VPC components



Security groups

Specify inbound and outbound access policies for an Amazon EC2 instance

Network ACLs

Network access control lists acts as a firewall for controlling traffic in and out of one or more subnets within the VPC

VPC peering

Enables you to route traffic between two or more VPC within the same region

VPN

Bridge your VPC and your onsite IT infrastructure with private connectivity

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VPC Architecture Scenarios



- VPC with a Public Subnet Only
- VPC with Public and Private Subnets
- VPC with Public and Private Subnets and VPC Peering Access
- VPC with Public and Private Subnets and VPN Access
- VPC with a Private Subnet Only and VPN Access

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Amazon VPC Products



Products currently available in Amazon VPC are

- Amazon EC2
- Amazon RDS
- Auto Scaling
- Elastic Load Balancing
- Elastic Beanstalk
- ElastiCache

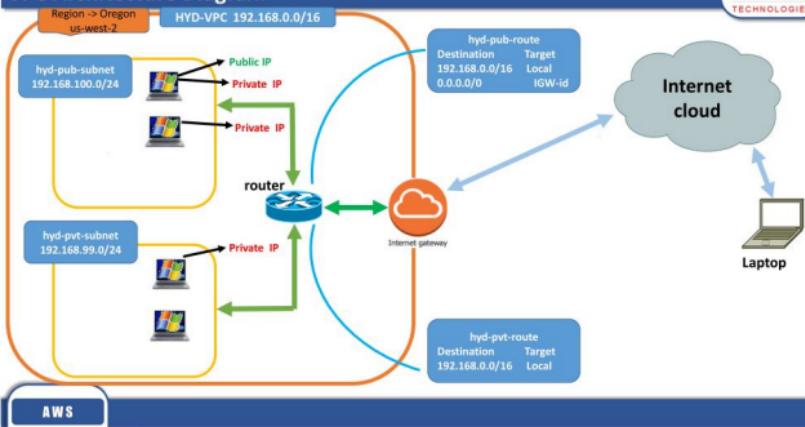
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Steps to Create VPC infrastructure

- Step 1) Create VPC with a particular subnet range (max 16 to 28 bit)
- Step 2) Create public subnet
- Step 3) Create private subnet
- Step 4) Create IGW and attach to your VPC
- Step 5) Create pub route and Associate respective subnet and add route to IGW
- Step 6) Create private route and Associate respective subnet Don't add IGW,
Nat-GW or NAT-instance can be added.
- Step 7) Launch VM in Public subnet
- Step 8) Launch VM in Pvt subnet
- Step 9) Check connectivity

VPC Architecture Diagram



Step 1) Create VPC with CIDR block 192.168.0.0/16

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Region -> Oregon
us-west-2

HYD-VPC 192.168.0.0/16

1

AWS

Step 2) Create public subnet

ZOOM
TECHNOLOGIES

Region -> Oregon
us-west-2

HYD-VPC 192.168.0.0/16

1

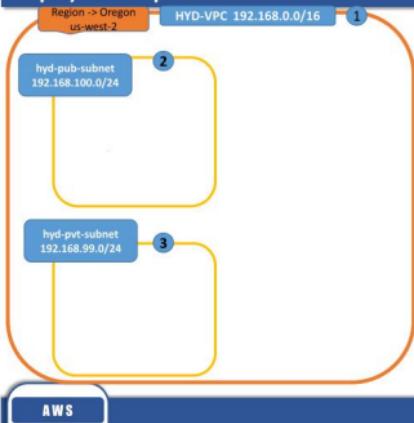
hyd-pub-subnet
192.168.100.0/24

2

AWS

Step 3) Create pvt subnet

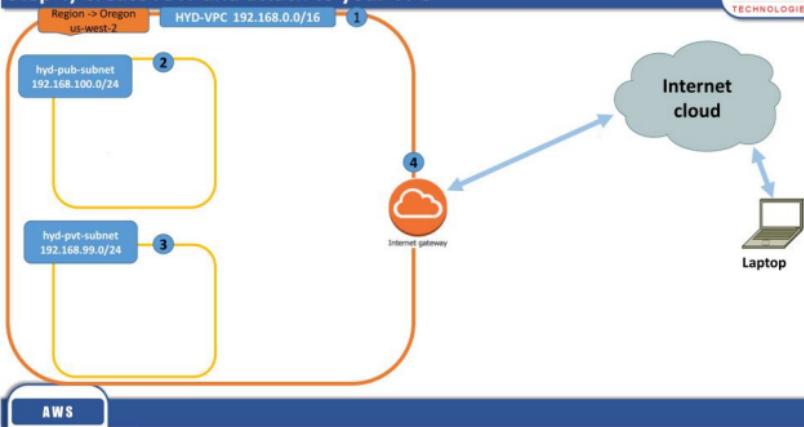
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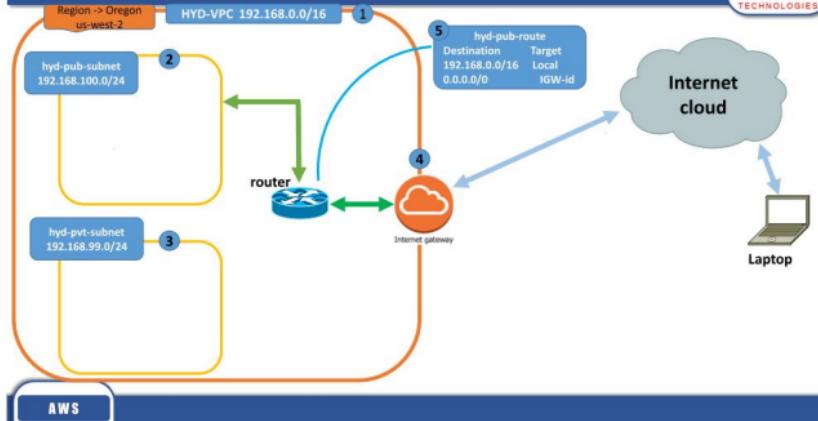
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Step 4) Create IGW and attach to your VPC

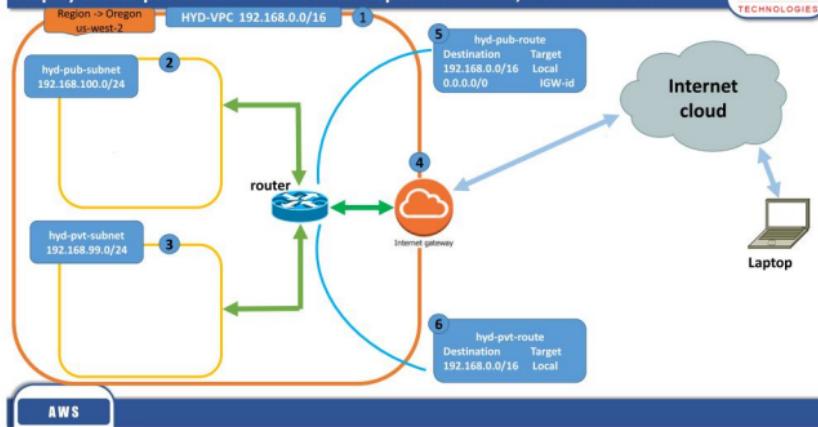
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Step 5) Create pub route and Associate respective subnet and add route to IGW

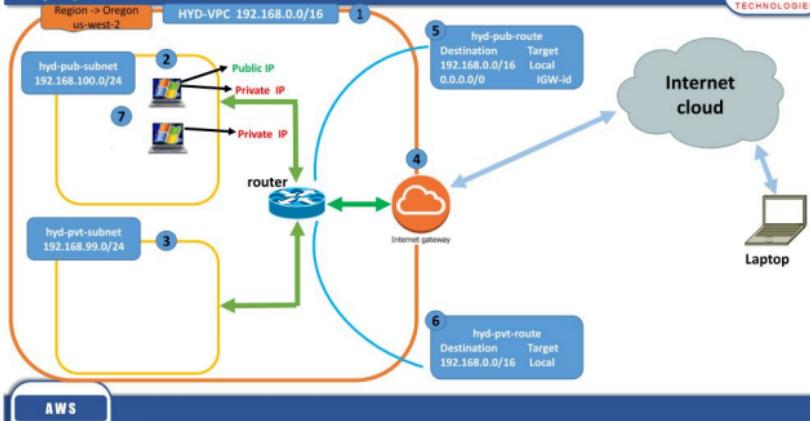


Step 6) Create pvt route and Associate respective subnet, Don't add IGW



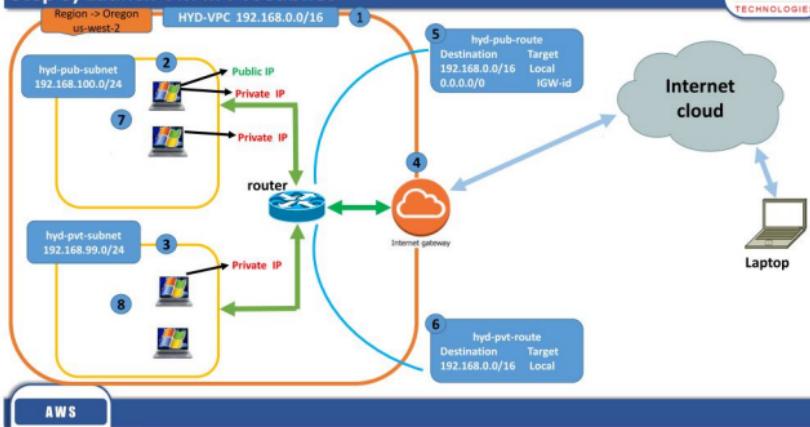
Step 7) Launch VM in Public subnet

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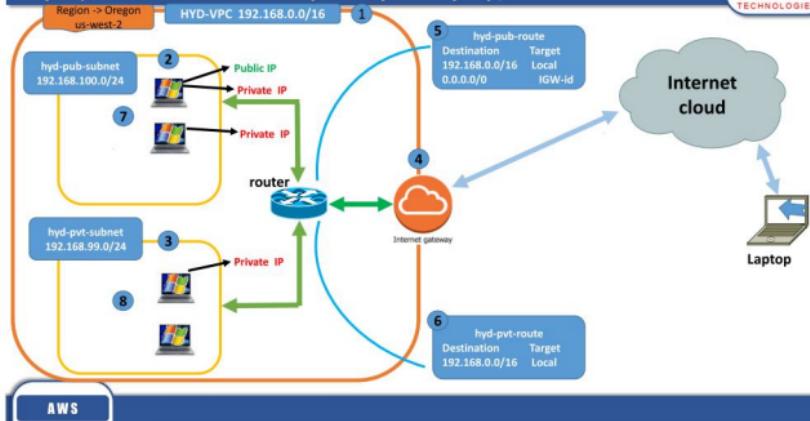
Step 8) Launch VM in Pvt subnet

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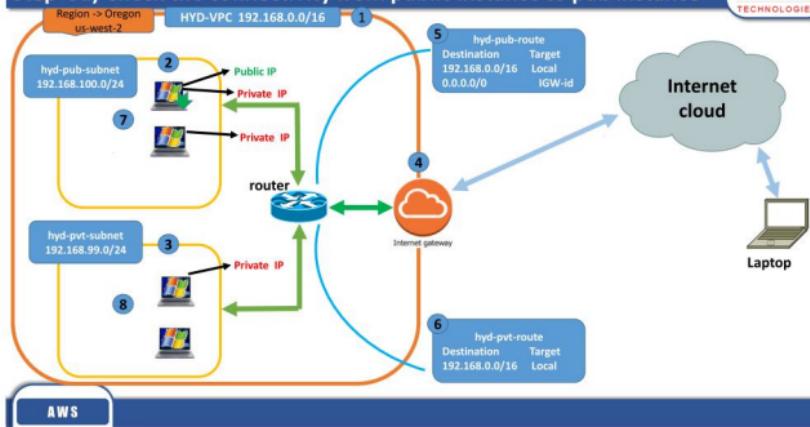
Step 9) Check the connectivity from your Laptop/PC

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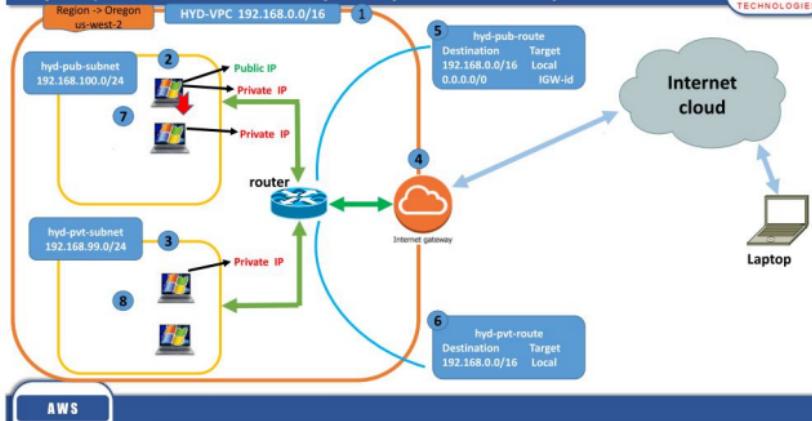
Step 9a) Check the connectivity from public instance to pub instance

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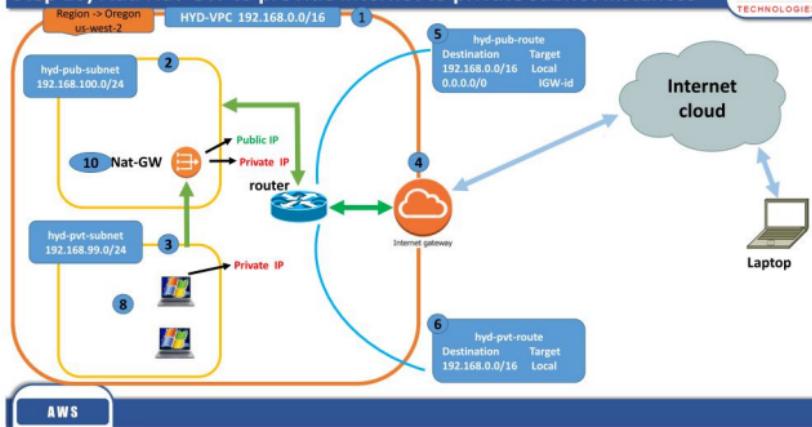
Step 9b) Check the connectivity from pub instance to pvt instance

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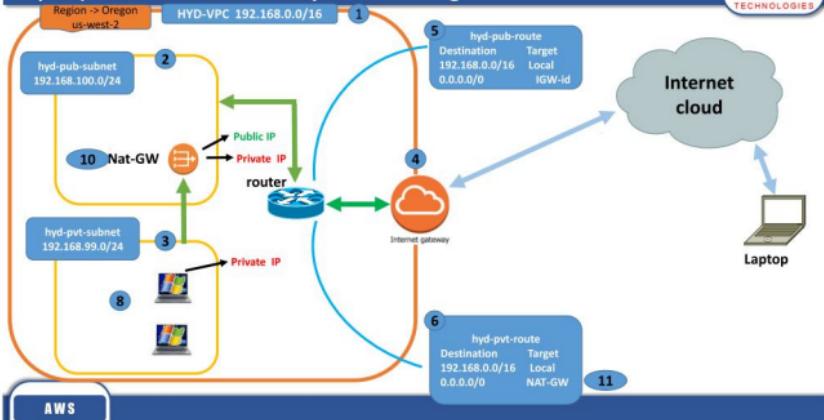
Step 10) Add Nat-GW to provide internet to private subnet instances

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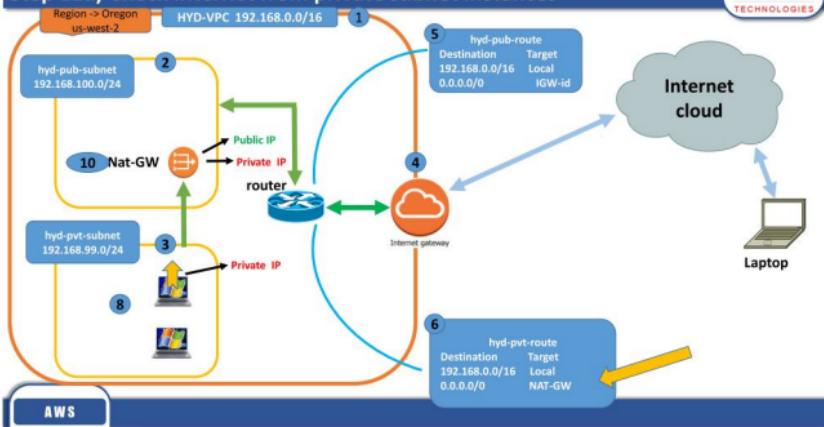
Step 11) Add Nat-GW route to private routing table

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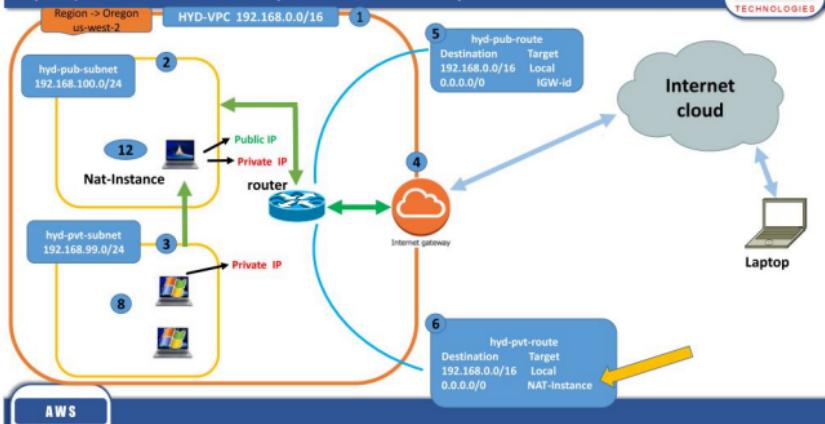
Step 11a) Check internet from private subnet instances

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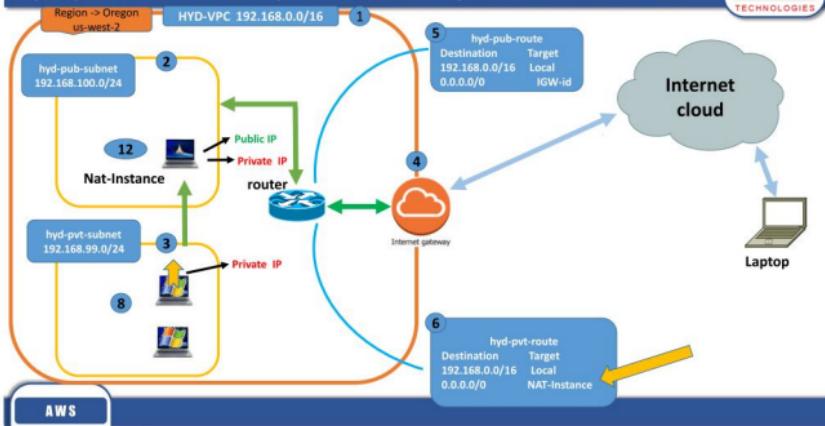
Step 12) Add Nat-Instance to provide internet to private subnet instances

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Step 12) Add Nat-Instance to provide internet to private subnet instances

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VPC Peering



- VPC peering is used to have communication across multiple VPC's within the same or different region.
- Peering can be done within your own account or other AWS account.
- Transitive peering is not supported.

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VPC Inter Region Peering



Region -> Oregon
us-west-2

VPC B

VPC C

VPC A

Internet
cloud



Internet gateway

AWS

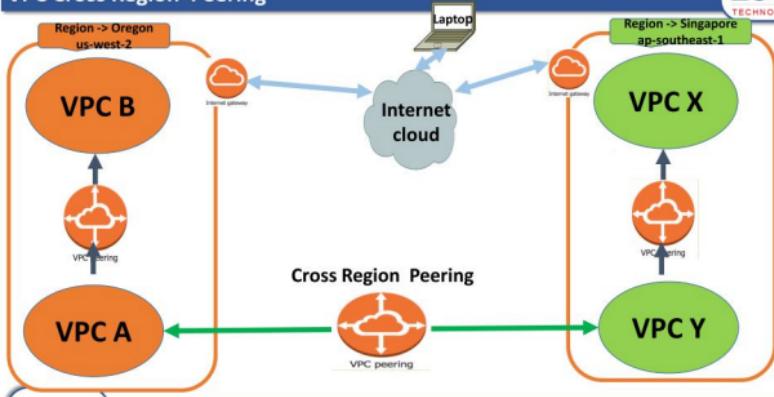
VPC Cross Region Peering



- Cross Region peering is used to have communication across multiple VPC's across two or more different regions.

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VPC Cross Region Peering



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DAY 9

Amazon Route53

Amazon Route53

- What is Route53
- Key Features
- Routing Policies

Amazon Route53 ?

- DNS is a client/server network communication systems.
- The Domain Name System (DNS) translates Internet domain and host names to IP addresses and vice versa.
- Amazon route 53 is a DNS service Provided by AWS.
- It is an authoritative DNS service.
- **Route 53 is built using AWS's highly available and reliable, global infrastructure of amazon.**
- Improves your availability and application performance at lower cost with Amazon Route 53

- It uses a global anycast network of DNS servers around the world.
- Anycast is a networking and routing technology that helps your end users' DNS queries get answered from the optimal Route 53 location given network conditions. As a result, your users get high availability and improved performance with Route 53.
- Amazon Route 53 is designed to propagate updates within 60 seconds under normal conditions
- Amazon also supports Private DNS, that lets you have authoritative DNS within your VPCs without exposing your DNS records (including the name of the resource and its IP address(es) to the Internet.

- Amazon Route 53 DNS record types:
 - A (address record)
 - AAAA (IPv6 address record)
 - CNAME (canonical name record)
 - MX (mail exchange record)
 - NS (name server record)
 - PTR (pointer record)
 - SOA (start of authority record)
 - SRV (service locator)
 - TXT (text record)

Health Check

- To route the traffic to the end points amazon can perform health checks.
- A health check tells Amazon Route 53 how to send requests to the endpoint.
- A health check is performed using (HTTP, HTTPS, or TCP) protocols, over IP address and ports.
- Amazon Route 53 cannot check the health of endpoints for which the IP address is in local, private, nonroutable, or multicast ranges.

- Reliable
- Fast
- Integrated with AWS
- Easy to use
- Cost Effective
- Flexible

- **Simple Routing:**

- With simple routing, Amazon Route 53 responds to DNS queries based only on the values in the resource record set (i.e., the IP).

- **Weighted routing policy**

- Weighted routing policy is used when multiple resources performs the same function, and you want Amazon Route 53 to route traffic to those resources in proportions that you specify. For example, sending 30% of queries to one server, and 70% to the other.

- For example while testing new versions of software or under load balancer

- **Latency routing policy**

- Use when you have resources in multiple locations and you want to route traffic to the resource that provides the best latency.

- **Failover Routing:**

- In Failover routing Route 53 performs the health check , and route traffic to a primary and secondary resource record set.
- If Primary resource is down the it sends the traffic to secondary resource record set.

- **Geolocation Routing**

- Geolocation works by mapping IP addresses to locations from where the DNS queries originated from.
- Example If you have a website on different language then from that region that website can be access
- To improve the accuracy of geolocation routing, Amazon Route 53 supports the edns-client-subnet extension of EDNS0 (Extension Mechanisms for DNS (EDNS0)).

- \$0.50 per hosted zone / month for the first 25 hosted zones
- \$0.10 per hosted zone / month for additional hosted zones

Standard Queries

- \$0.400 per million queries – first 1 Billion queries / month
- \$0.200 per million queries – over 1 Billion queries / month

Steps to host a domain in Route 53

Step 1) Register your domain name with local ISP.

Eg. godaddy.com

Step 2) Host your domain name in Route 53, it adds minimum 4 AWS DNS server of amazon.

Step 3) Remove the DNS NS record from local ISP and replace with AWS DNS NS record.

Step 4) Now configure a instance with web server and elastic IP.

Step 5) Now add your record set (A record, CNAME record) in Route 53.

Step 6) Check the site with name instead of IP.

Hosting domain in Route 53

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Godaddy.com

cloudskillindia.com

Dns
Server

NS1

Dns
Server

NS1



Amazon
Route 53

AWS

Register Domain name with some local ISP

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Godaddy.com

cloudskillindia.com

Dns
Server

NS1

Dns
Server

NS1



Amazon
Route 53

AWS

Host Domain name in Amazon Route 53

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Godaddy.com

cloudskillindia.com

Dns
Server

NS1

Dns
Server

NS1



Amazon
Route 53

AWS

Route 53 add's your domain name in it DNS server

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TECHNOLOGIES

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cloudskillindia.com

Dns
Server

NS1

Dns
Server

NS1



Amazon
Route 53

ns-
596.aw
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53.com.

ns-
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06.org.

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61.co.uk.

AWS

Remove DNS entries from Local ISP

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Dns
Server

NS1

Dns
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NS1



Amazon
Route 53

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Amazon
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Add DNS server name from Route 53 in your local DNS server



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Amazon VPC (Virtual Private Cloud)



Day 10

SNS (Simple Notification Service) Cloudwatch Autoscaling

AWS

AWS SNS (Simple Notification Service)

- SNS service is used to deliver or sending notification to subscribed endpoints or clients by using push messaging mechanism.
- Service like CloudWatch, Load Balancer, RDS, dynamodb and other aws services uses SNS to send alerts and alarms to the endpoints i.e. through API, HTTP/HTTPS, SQS, EMAIL, AWS Lambda, Mobile Push Notifications, Email, Email-JSON.

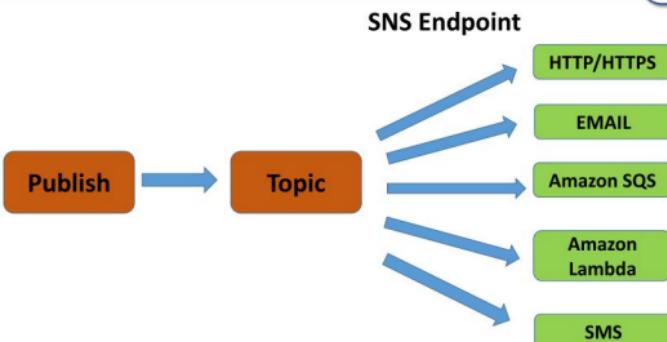
AWS Simple Notification Service(SNS)



- Topics are created which is a logical access point.
- Defines Subscriber to whom messages should be published.
- SNS can only guarantee a single delivery to each subscriber of a given topic. This means that if there was a bug or a problem processing the message and there was no specific code to save it somewhere, then the message lost.

AWS

SNS WORK FLOW



AWS

AWS Simple Notification Service(SNS)



- Topic names are limited to 256 characters.
- By default, SNS offers 10 million subscriptions per topic, and 100,000 topics per account.
- Amazon SNS messages can contain up to 256 KB of text data, including XML, JSON and unformatted text.
- Each 64KB chunk of published data is billed as 1 request.
- Each SMS message can contain up to 140 bytes,

AWS

Amazon SNS Pricing



Endpoint Type	Free Tier	Price
Mobile Push Notifications	million	\$0.50 per million
Worldwide SMS	100 (US)	Learn more [Charges are applied countries wise]
email/email-JSON	1,000	\$2.00 per 100,000
HTTP/s	100,000	\$0.60 per million
Simple Queue Service (SQS)	No charge for deliveries to SQS Queues	
Lambda functions	No charge for deliveries to Lambda	

AWS

Amazon CloudWatch

What CloudWatch cannot do ?

Cloud watch is not going to monitor your on premises Data Center infrastructure. For that we use traditional monitoring tools like :

- Nagios
- Zabbix
- Bigbrother
- MRTG , CACTI
- Airwatch
- Wireshark
- Zenoss
- ps, kill, nice, renice
- vmstat, iostat , Syslog
- Iptraf, netcool
- HPserviceManager
- Windows Task Manager

What Cloud Watch is going to do ?



- Cloud watch is going to monitor only Service and Resource of AWS infrastructure.
- Monitoring is done based on Metrics.
- Metrics is collection of data through which amazon keeps track of all services and resources.
- Each region contains its own metrics, and are stored for only 14 days, then it gets expire automatically.

AWS

Retention period changed



- From November 1, 2016 retention period of all metrics changed from 14 days to 15 months.
- Data points with a period of
 - Less than 60 sec 3 hrs.
 - 1 min 16 days
 - 5 min 63 days
 - 1 hr 455 days (15 months)

AWS

Metrics frequency and charges



Monitored AWS resources	Frequency	Charge
EC2 instance (basic)	every 5 mins	free
EC2 instance (detail)	every 1 min	additional
EBS volumes	every 5 mins	free
Elastic Load Balancers	every 5 mins	free
RDS DB instance	every 1 min	free
SQS queues	every 5 mins	free
SNS topics	every 5 mins	free

AWS

Default Metrics



- EC2 instance

- CPUUtilization
- DiskReadBytes
- DiskReadOps
- DiskWriteBytes
- DiskWriteOps
- NetworkIn
- NetworkOut

- RDS

- BinLogDiskUsage
- CPUUtilizati
- DatabaseConnection
- DiskQueueDepth

- S3

- BucketSizeBytes
- NumberOfObjects

AWS

Metrics Description



Metrics Name	Description	Units
CPUUtilization	The percentage of allocated EC2 compute-units	Percent
DiskReadOps	Completed read operations from all ephemeral disks available to the instance	Count
DiskWriteOps	Completed write operations to all ephemeral disks available to the instance.	Count
DiskReadBytes	Bytes read from all ephemeral disks available to the instance	Bytes
DiskWriteBytes	Bytes written to all ephemeral disks available to the instance.	Bytes
NetworkIn	The number of bytes received on all network interfaces by the instance.	Bytes
NetworkOut	The number of bytes sent out on all network interfaces by the instance.	Bytes

AWS

CloudWatch Alarm



- Alarms exist only in the region in which they are created.
- Alarm actions must reside in the same region as the alarm
- Alarm watches a single metric over a specified time period.
- Based on the value of the metric relative to a given threshold over a number of time periods takes Action.
- Action can be a
 - SNS notification
 - Auto Scaling policies
 - EC2 action – stop or terminate EC2 instances

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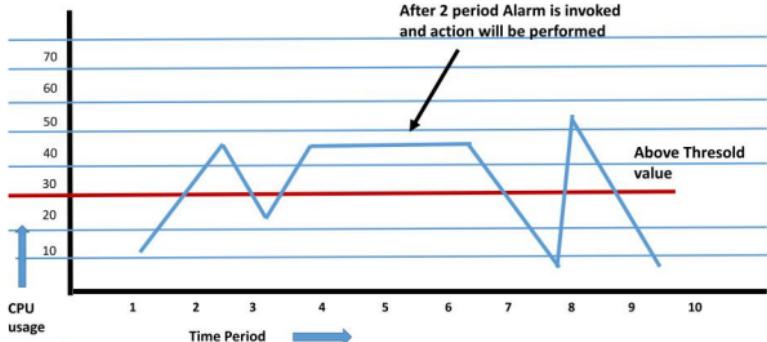
Alarm State



- **OK**
 - The metric is within the defined threshold
- **ALARM**
 - The metric is outside of the defined threshold
- **INSUFFICIENT_DATA**
 - the metric is not available, alarm started
 - not enough data is available for the metric to determine the alarm state
 - Can create up to 400 alarms per AWS account

AWS

CloudWatch Graph



AWS

Amazon Autoscaling

Agenda

- What is Autoscaling ?
- Autoscaling supported application
- Benefits of Autoscaling
- Pricing of Autoscaling
- Autoscaling Implementation

Autoscaling ?

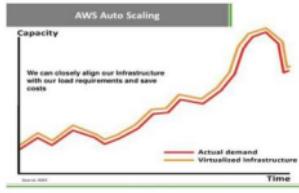
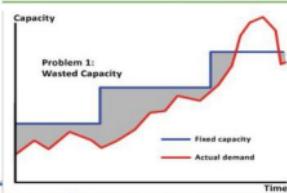
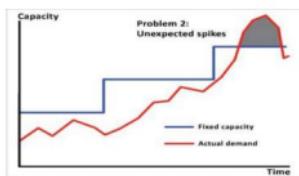
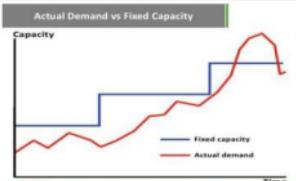
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- Whenever load increase on the server related with compute power, network, or storage then to balance that load or distribute the load technologies like clustering, load balancing, high availability are implemented.
- These loads can be managed by using either vertical scaling or horizontal scaling, both type of scaling have there pros and cons.
- Autoscaling is one of the tool provided by amazon which is broadly and widely used in cloud computing.
- In amazon cloud computing it is one of the best tool to scale up or down the resources based on load patterns.

AWS

Load pattern

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- Amazon Auto scaling uses Horizontal scaling to add number of ec2 instances (i.e. number of nodes) dynamically whenever the load on your application increases.
- It is fully designed to launch or terminate the correct number of EC2 instances to handle the load of your application
- Amazon Autoscaling uses Fleet management technique
 - Fleet management is a functionality that checks the health of EC2 instances and automatically replaces unhealthy instances with new instance
 - If any instance faces any problem then instead of recovering or restoring that instance a new instance is launched.

- Autoscaling takes the advantage of amazon infrastructure where it can span ec2 instances across multiple AZs.
- It can add or terminate the ec2 instances in the period of 30 seconds to 180 secs.
- If the AZs are not available or unhealthy then it redistributes the traffic across all the healthy AZs
- Autoscaling is Region specific means it can scale only within the regions.
- Cross region scaling is not supported by Autoscaling.

Autoscaling supports



- Autoscaling supports only frontend application like
 - ✓ Apache
 - ✓ IIS
 - ✓ Nginx
 - ✓ Wordpress
 - ✓ Tomcat or middleware applications (Jboss)

AWS

Autoscaling does not supports



- Autoscaling does not supports backend application, i.e. cannot used with database application.
 - Oracle
 - Mysql
 - Mariadb,
 - MS-SQL
 - NoSQL (mongodb, rediss)

AWS

Benefits of Auto Scaling



- **Better fault tolerance.**

It automatically terminates or launches an ec2 instance when an instance or AZs are unhealthy

- **Better availability**

Always ensures the right amount of capacity to handle the current traffic demands.

- **Better cost management.**

Saves money by launching or terminating instances when they are actually needed.

The AWS logo, which consists of the letters "AWS" in a white, sans-serif font inside a dark blue rounded rectangular box.

Pricing for Auto Scaling



- **Pricing for Auto Scaling**

- Auto Scaling carries no additional fees.
- Autoscaling depends on Cloudwatch services, so Cloudwatch billing will be applied.
- Ec2 instance charges will be applied.

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Components of Autoscaling

- **Launch Configuration**

➤ It creates a template containing following information :

Amazon Machine Image (AMI)

Instance type

Key pair

Security groups

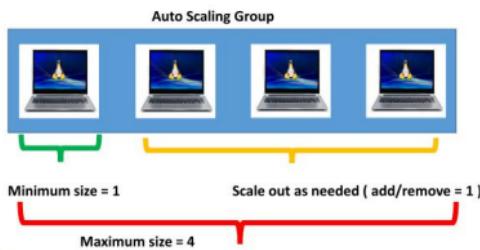
Block device mapping.

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Autoscaling Group

- **Autoscaling group**

➤ Auto Scaling group you can specify the minimum and maximum number of instance to ensure that instance in the group never goes above or below the required size



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Autoscaling Policy

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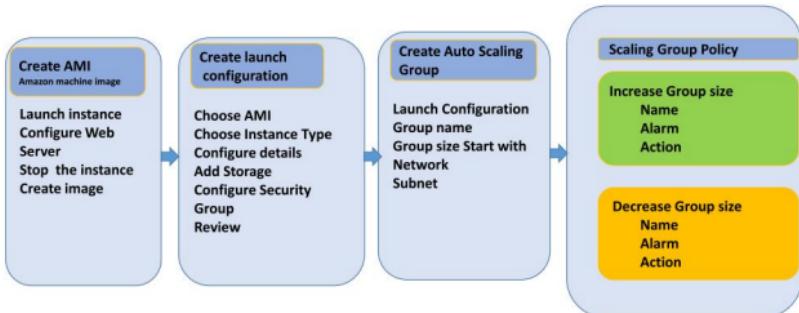
- **Autoscaling Policy**

- Autoscaling Policy defines rules for dynamically increase or decrease the EC2 instance count based on Cloudwatch Alarms.

AWS

AWS Autoscaling Configuration

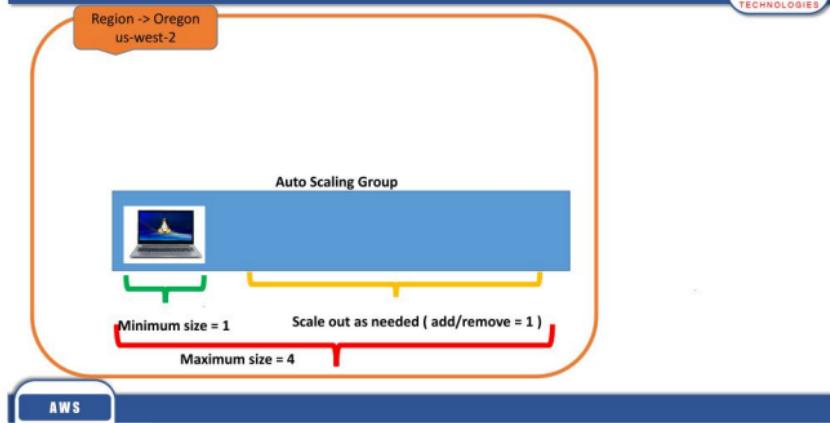
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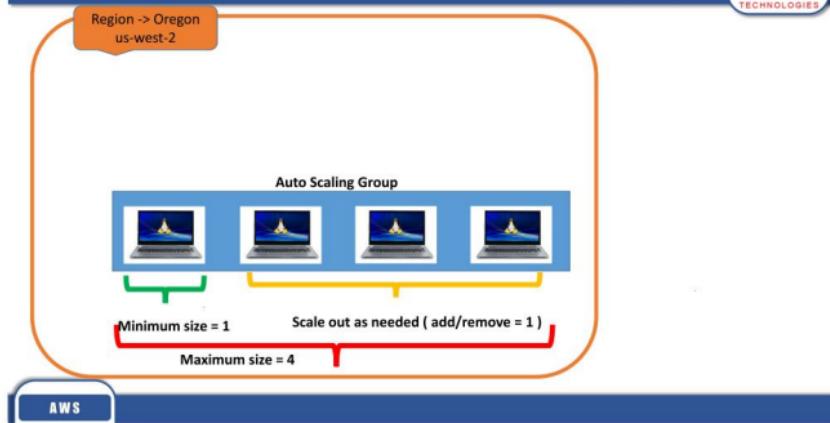
Auto Scaling with Elastic Load Balancer (ELB)

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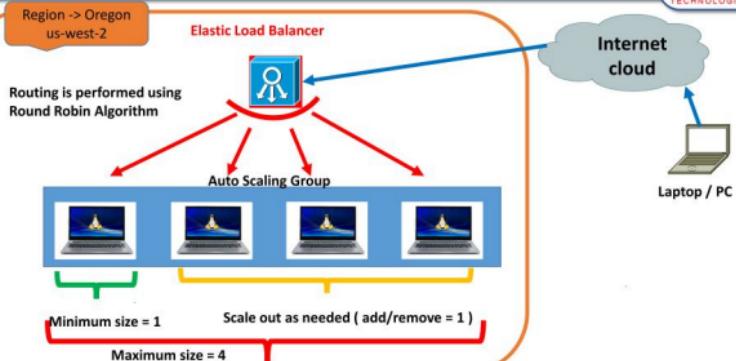


Auto Scaling with Elastic Load Balancer (ELB)

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Auto Scaling with Elastic Load Balancer (ELB)



Amazon RDS, Dynamodb, Redshift



DAY 11

RDS, Dynamodb, Redshift

Amazon RDS Relational Database Service

AWS

- Overview RDS
- RDS Engine
- Benefits
- Backup
- Multi Availability Zones
- Storage Type

AWS

- To configure Database over AWS cloud you have two options:
 - a) Launch an instance and install database software over the instance from scratch where you are responsible of software, backups, high availability and all.
 - b) Amazon provides database service where instance, software, updates, patches, scalability, high availability all will be maintained by amazon.
- Amazon provides these database services through RDS, dynamodb and Redshift, these are PAAS service.

What is RDS ?

- Amazon Relational Database Service (or Amazon RDS) is a distributed relational database service
- Amazon RDS was first released on 22 October 2009, supporting MySQL databases.
- It simplifies the setup, operation, and scaling of a relational database for use in applications.
- It automatically manages and updates patches, backups and enabling point-in-time recovery.
- You do not have access to the operating system, access is given to only Relational Database, which can be managed by console or client application or AWS-cli.

What is RDS ?



- CPU, memory, storage, and IOPS can be scaled independently.
- In addition to the security in the database package, IAM users and permissions can help to control who has access to the RDS databases
- Amazon RDS supports Amazon Aurora, MySQL, MariaDB, Oracle, SQL Server, and PostgreSQL database engines.

AWS

Currently Supported Database Engines



- Amazon Aurora
- MySQL
- MariaDB
- Oracle
- SQL Server
- PostgreSQL

AWS

Amazon RDS engines

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Commercial

ORACLE



Open source



PostgreSQL



MariaDB

Amazon Aurora

Amazon
Aurora

AWS

Benefits of RDS

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- No infrastructure management
- Cost-effective
- Application compatibility
- Instant provisioning
- Scale up/down
- Automatic minor updates
- Automatic backups
- Not required to manage operating system
- Multi-AZ with 1 click
- Automatic recovery in event of failover

AWS

Backups



- Daily Automated Backups
- RDS provides backup storage up to 100% of the provisioned database storage at no additional charge for e.g., if you have 10 GB-months of provisioned database storage, RDS provides up to 10 GB-months of backup storage at no additional charge.
- Most databases require less raw storage for a backup than for the primary dataset, so if multiple backups are not maintained, you will never pay for backup storage.

AWS

Multi-AZ Deployment



- Automatically replicates data to a secondary AZ
- During maintenance or "Unavailable" times AWS automatically routes traffic to the secondary instance and replicates the data back to primary

AWS

Storage type



- Standard : Utilizes AWS EBS Volumes
- Provisioned IOPS: Optimized EBS volumes and optimized for IOP

AWS

Client Application



- To connect to RDS database

Using mysql-client for mysql database.

```
# mysql -h <rds_endpoint> -u <username> -p<password>
mysql > show databases;
      > use <database_name>
      > show <tables>
```

- Using WorkBench

AWS

Selected RDS customers



AWS

Amazon Dynamodb



Amazon DynamoDB

AWS

- Relational (SQL) vs. non-relational (NoSQL)
- Dynamodb

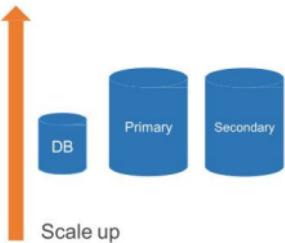
Relational (SQL) vs. non-relational (NoSQL)

SQL	NoSQL
SQL databases are primarily called as Relational Databases (RDBMS)	NoSQL database are primarily called as non-relational or distributed database
Represent data in form of tables which consists of n number of rows	Collection of key-value pair, documents, graph databases or wide-column , without standard schema
Vertically scalable (increasing the hardware)	Horizontally scalable increasing the databases servers in the pool of resources
MySQL, Oracle, Sqlite, Postgres and MS-SQL	MongoDB, BigTable, Redis, RavenDb, Cassandra, Hbase, Neo4j and CouchDb.
SQL databases are good fit for the complex query	NoSQL databases are not good fit for complex queries

Vertical and Horizontal Scaling

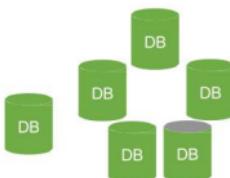


Traditional SQL



Scale up

NoSQL



Scale out

AWS

Amazon Dynamodb



- Amazon DynamoDB is a fully managed NoSQL database service that provides fast and predictable performance with seamless scalability.
- DynamoDB makes it simple and cost-effective to store and retrieve any amount of data.
- Serves any level of request traffic.
- Hardware provisioning, setup and configuration, replication, software patching, or cluster scaling is taken care by Amazon.

AWS

Amazon Dynamodb



- DynamoDB enforces replication across three availability zones in one or more global geographic locations for high availability, durability and read consistency , which creates backup copy of a DynamoDB table.
- There are two types of indexes in DynamoDB, a
 - Local Secondary Index (LSI)
In an LSI, a range key is mandatory.
 - Global Secondary Index (GSI)
GSI you can have either a hash key or a hash+range key

AWS

Amazon Dynamodb



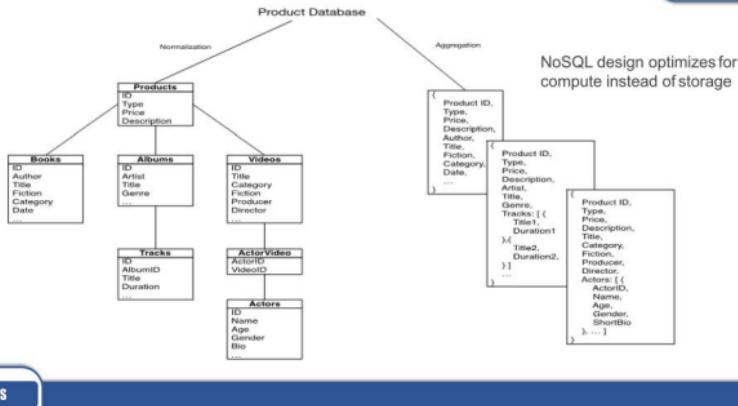
DynamoDB uses three basic data model units.

- Tables
Tables are collections of Items, and tables do not have fixed schemas associated with them.
- Attributes
Attributes are basic units of information, like key-value pairs.
- Items
Items are collections of Attributes they are like rows in an RDBMS table, except that DynamoDB requires a Primary Key.

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SQL vs. NoSQL schema design

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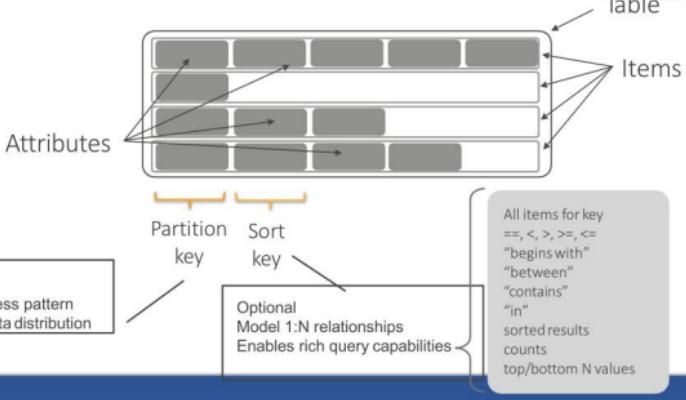
Benefits of Dynamodb

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- Fully managed
- Fast, consistent performance
- Highly scalable
- Flexible
- Event-driven programming
- Fine-grained access control

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Dynamodb Table Structure



AWS

Amazon Redshift



Amazon RedShift

AWS

Amazon Redshift



- Amazon Redshift gives you fast querying capabilities over structured data using familiar SQL-based clients and business intelligence (BI) tools using standard ODBC and JDBC connections.

- Columnar Data Storage

Instead of storing data as a series of rows, Amazon Redshift organizes the data by column.

- Unlike row-based systems, which are ideal for transaction processing, column-based systems are ideal for data warehousing and analytics, where queries often involve aggregates performed over large data sets.



Amazon Redshift



- Since only the columns involved in the queries are processed and columnar data is stored sequentially on the storage media, column-based systems require far fewer I/Os, greatly improving query performance.
- Queries are distributed and parallelized across multiple physical resources.
- uses replication and continuous backups to enhance availability and improve data durability and can automatically recover from node and component failures.
- Redshift only supports Single-AZ deployments



Redshift Single vs Multi-Node Cluster



- Single Node

Enables getting started quickly and cost-effectively & scale up to a multi-node configuration as the needs grow

- Multi-Node

Requires a leader node that manages client connections and receives queries, and two or more compute nodes that store data and perform queries and computations.

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Redshift Clients



- Amazon does not provide any SQL client tools, but they recommend SQL Workbench/J.
- Though you can connect to your cluster using psql or any SQL IDE that supports PostgreSQL JDBC or ODBC drivers.

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DAY 12

EFS (Elastic File System)
SQS (Simple Queue Service)
SES (Simple Email Service)

AWS

Amazon EFS (Elastic File system)

AWS

AWS Elastic File system (EFS)



Amazon EFS is a NAS file system i.e. Network file system.

With Amazon EFS, storage capacity is elastic, growing and shrinking automatically as you add and remove files, so your applications have the storage they need, when they need it.

AWS

Amazon EFS



Can scale up to petabytes.

Can support thousands of concurrent NFS connections.

Amazon EFS supports the Network File System versions 4.0 and 4.1 (NFSv4).

With Amazon EFS, you pay only for the storage used by your file system

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Amazon EFS



It can only be used with EC2 instances in your VPC.

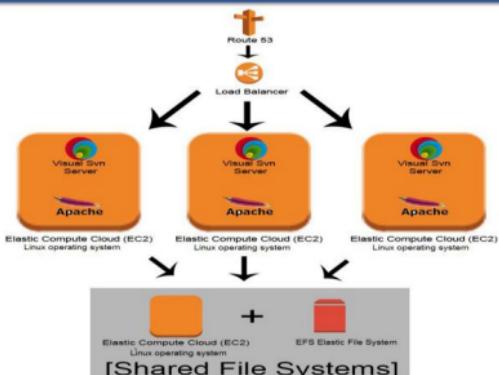
It cannot be used with on premises Data Center server.

If EFS is created in particular A.Z then the instances of that zone can only mount it.

It provides a endpoint with DNS name through which it can be mounted.

AWS

Amazon EFS



AWS

AWS SQS Simple Queue Service

AWS

- Amazon Simple Queue Service (SQS) is a fast, reliable, scalable & affordable message queuing service.
- Message queues are software-engineering components used for inter-process communication, or for inter-thread communication within the same process.
- Many implementations of message queues function internally within an operating system or within an application.

AWS

AWS Simple Queue Service (SQS)



- It is a temporary repository for messages waiting for processing and acts as a buffer between the component producer and the consumer.
- SQS ensures delivery of each message at least once
- Queues can be configured to retain messages for 1 minute to 14 days after the message has been sent.
- Your messages can be up to 256 KB in size

AWS

Type of Queue SQS



- Standard Queue
A message is delivered at least once
- FIFO Queue
First-In-First-Out Delivery – The order in which messages are sent and received is strictly preserved.

AWS

Other Queue service providers



- IBM WebSphere MQ
- Oracle Advanced Queuing (AQ)
- Microsoft Message Queuing
- Apache Qpid
- RabbitMQ

AWS

Amazon Simple Email Service (SES)



Amazon SES SIMPLE EMAIL SERVICE

AWS

Amazon Simple Email Service (SES)



- SES is a SMTP/MTA server provided by amazon which is designed to send bulk mails to customers in a quick and cost-effective manner.
- SES does not allow to configure mail server.
- It also does not allow public email accounts like gmail.com, yahoo.com, rediff.com ... to send bulk mails through SES.

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Amazon Simple Email Service (SES)

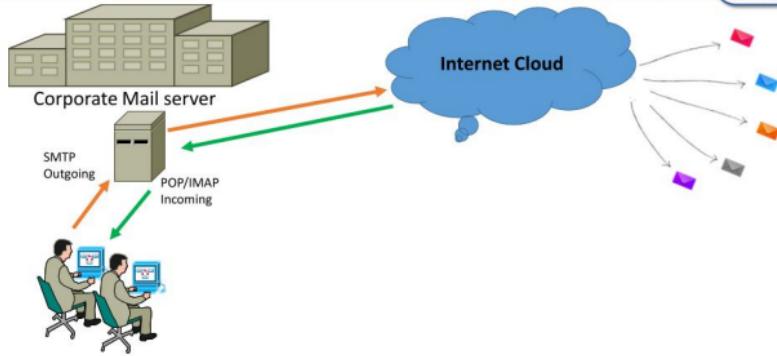


- Companies or corporate should have their own mail server in order to use SES, then SES will work as Outgoing mail server on behalf of your Domain name
- Applications can send email using a single API call in Java, .NET, PHP, Perl, or HTTPS
- Mail clients like Outlook, Thunderbird, Evolution, SendBlaster then can be integrated with SES to send mails.

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Amazon Simple Email Service (SES)

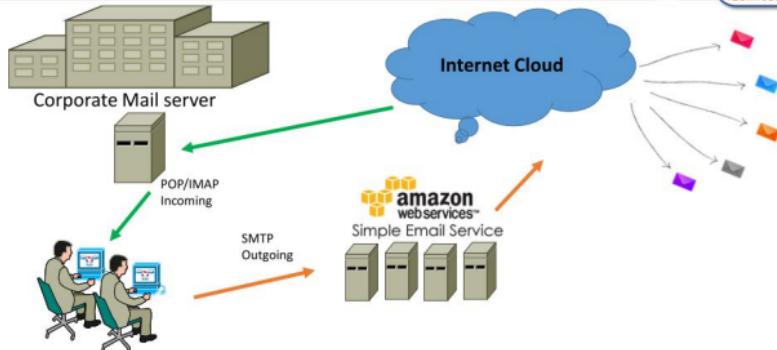
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Amazon Simple Email Service (SES)

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DAY 13

**CloudFormation
CloudFront
CloudTrail**

AWS

AWS Cloud Formation

AWS

AWS CloudFormation



- AWS CloudFormation is a service which creates the AWS infrastructure using code.
- It is also referred as code as a service.
- It helps to reduce time for managing resources so that you can focus more on application rather than managing Amazon infrastructure and their resources.
- CloudFormation uses a template that describes all the AWS resources that you want (like Amazon EC2 instances or Amazon RDS DB instances), and AWS CloudFormation takes care of provisioning and configuring those resources for you.

AWS

AWS CloudFormation



- Cloud Formation provisions AWS resources in order using CloudFormation stack, this model removes opportunities for manual error, increases efficiency, and ensures consistent configurations over time.
- It provisions AWS resources based on dependency needs gets integrated with development and management tools such as version control and continuous integration (CI/CD), devops etc.

AWS

- CloudFormation consists of Template and Stack
 - **Template**
It is a JSON or YAML-format, text-based file that describes all the AWS resources you need to deploy to run your application
 - **Stack**
Stack is the set of AWS resources that are created and managed as a single unit when CloudFormation instantiates a template.

- Simplify Infrastructure Management
- Quickly Replicate Your Infrastructure
- Easily Control and Track Changes to Your Infrastructure
- You don't need to individually create and configure AWS resources and figure out what's dependent on what, AWS CloudFormation handles all of that.

CloudFormation Designer JSON Editor



Ctrl+Space : Within the Properties key of a resource, lists all the available properties for the resource

Ctrl+F : Search for a value in the JSON editor.

Ctrl+\ : Formats the text with proper indentation and new lines

Ctrl+Shift+\ : Removes all white space

```
Properties Metadata CreationPolicy DeletionPolicy ...  
l43XA7  
1: {  
2: "Resources": {  
3: "I43XA7": {  
4: "Type": "AWS::EC2::Instance",  
5: "Properties": {  
6: }  
7: }  
8: }  
AvailabilityZone  
BlockDeviceMappings  
UserDataTermination  
EbsOptimized  
ImageInstanceId  
ImageId  
InstanceInitiatedShutdownBehavior  
InstanceType
```

AWS

CloudFront



AWS CloudFront

AWS

- To provide faster access to website to the end user, websites contents are globally distributed at different geographical location.
- Route53 and cloudfront services are added at multiple location through a worldwide network of amazon data centers called edge locations.
- Web contents are replicated across multiple edge location of Amazon infrastructure by cloudfront service.

- It helps businesses and web application developers an easy and cost effective way to distribute content with low latency and high data transfer speeds across the globe.
- It also increases the reliability and availability by copying the web content across multiple edge location.
- CloudFront keeps persistent connections with the origin servers so that those files can be fetched from the origin servers as quickly as possible.

- If a user wants to download any web content like images, videos etc. it could be accessed very fastly because they are near to edge location.
- In India Mumbai is a region, but Delhi and Chennai are working as a edge location.
- Cloudfront only replicates the website content if website is hosted under s3 bucket as a static website or through Elastic load balancer.
- Cloudfront cannot be configured to provided directly website if website are running over Ec2 instances.

Delivery Methods

- Web distributions
 - for e. g. *html, css, js, images etc.* using HTTP or HTTPS.
- RTMP distributions
 - Supports streaming of media files using Adobe Media Server and the Adobe Real-Time Messaging Protocol (RTMP)

Amazon CloudTrail

- AWS CloudTrail is an AWS service that allows to track actions taken by a user, role, AWS Management Console, AWS Command Line Interface, AWS SDKs, APIs or an AWS service.
- CloudTrail is used to view, search, download, archive, analyze, and respond to account activity across your AWS infrastructure.
- CloudTrail Event History will only show the results for the current region you are viewing for the last 90 days.

Amazon CloudTrail



- For a complete record of account activity, including all management events, data events, and read-only activity, you'll need to configure a CloudTrail trail.
- 5 Trails per region can be configured in your account by default, this limit cannot be increased.
- CloudTrail delivers log files to your S3 bucket approximately every 5 minutes. CloudTrail does not deliver log files if no API calls are made on your account.

AWS

Amazon CloudTrail



- Amazon SNS notifications can be turned on so that you can take immediate action on delivery of new log files.
- There is no charge from AWS CloudTrail for creating a CloudTrail trail and the first copy of management events within each region is delivered to the S3 bucket specified in your trail free of charge.
- Once a CloudTrail trail is setup, Amazon S3 charges apply based on your usage.

AWS

Amazon CloudTrail



- Log management tools available in the market to read the logs stored by Cloudtrail.
 - Loggy
 - SumoLogic
 - CloudTrailViewer
 - Splunk

AWS

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