**Summer Internship Course – Amazon Web Services**

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# Introduction

Amazon web services is a cloud computing platform that provides on-demand computational services, databases, storage space, and many more services. AWS allows its user to choose products from its wide variety of services, such as computing power, storage and databases, on an as-needed basis instead of buying, owning and maintaining physical data centers and servers that may cost expensive due to its overall management and maintenance.

Cloud computing platforms like AWS are being widely used by organizations of every type, size, and industry to manage functionalities such as data backup, disaster recovery, email, virtual desktops, software development and testing, big data analytics, and customer-facing web applications. AWS has infrastructure all over the world, so we can deploy our application in multiple physical locations with just a few clicks. AWS provides a comprehensive portfolio of solutions that help us solve common problems and build faster using the AWS platform. Every AWS Solution comes with detailed architecture, a deployment guide, and instructions for both automated and manual deployment.

In this internship program, the detailed functionalities and features of AWS were explained with real-time examples of industrial scenarios. This internship program included topics like block storage, IAM users and roles, VPC peering and endpoint, application load balancer, autoscaling, RDS, route53, database migration and many more, followed by hands-on practices, which demonstrated the various benefits of cloud computing like elasticity, cost savings, agility and the property to deploy it globally in minutes.

# Objectives

* To understand the basic concepts of Cloud Computing and its real life applications.
* Acknowledge the three cloud computing models available on AWS - Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
* Traverse through various services offered by Amazon Web Services like Amazon EC2 (Elastic Compute Cloud) for scalable computing capacity, Amazon S3 (Simple Storage Service) for object storage, Amazon RDS (Relational Database Service) for controlled relational databases, Amazon Lambda for server-less computing and many more.
* Getting hands-on experience with cloud service platforms that would provide practical experience on the topics.
* Gaining practical knowledge of some examples of industrial scenarios, shared by industrial experts.
* To be able to create and handle cloud-based infrastructure.
* To acknowledge the various benefits of using cloud computing services.

# Contents of the Program

This internship program basically focused on learning the concepts of Amazon web services, its various functionalities and features that made AWS the world’s most comprehensive and broadly adopted cloud.

## Block Storage

In Amazon Web Services (AWS), block storage refers to a type of storage solution that is used to store data in discrete blocks or chunks. Block storage can be easily scaled up or down based on your storage requirements.

## Elastic Block Store (EBS)

Elastic Block Store (EBS) is a block storage service provided by Amazon Web Services (AWS) for use with EC2 (Elastic Compute Cloud) instances. EBS volumes are essentially virtual hard drives that can be attached to EC2 instances to provide additional storage, which is designed to offer scalable, high-performance block-level storage for various types of workloads.

## Elastic File System (EFS) and Ephemeral storage

Amazon Elastic File System (EFS) and ephemeral storage are two different types of storage solutions in Amazon Web Services (AWS), each serving distinct purposes. EFS is a fully managed file storage service that allows multiple Amazon EC2 instances to share a common file system whereas ephemeral storage, also known as instance store or instance storage, is temporary, block-level storage that is directly attached to the underlying EC2 instance.

## EC2 Instances

Amazon Elastic Compute Cloud (EC2) is a web service provided by Amazon Web Services (AWS) that enables users to rent virtual servers in the cloud. These virtual servers are known as EC2 instances. EC2 instances are a fundamental building block of AWS, allowing users to run applications, host websites, and perform various computing tasks in a scalable and flexible manner.

## AWS IP Address

In AWS, Elastic IP addresses (EIP) are static IP addresses designed for dynamic cloud computing. They can be associated with instances in an AWS Virtual Private Cloud (VPC).

AWS instances, both in EC2 (Elastic Compute Cloud) and within a VPC, are assigned private IP addresses and, if associated with an Elastic IP, a public IP address. The private IP addresses are used for communication within the VPC, while the public IP addresses are used for communication over the Internet.

## 3.6 Open-VPN

Open-VPN is an open-source software application that implements virtual private network (VPN) techniques to create secure point-to-point or site-to-site connections in routed or bridged configurations and remote access facilities.

## 3.7 IAM Users and Roles

In Amazon Web Services (AWS), Identity and Access Management (IAM) is a service that enables us to securely control access to AWS services and resources. IAM allows us to manage users, groups, and roles to define who can do what within your AWS environment.

## 3.8 VPC Peering and Endpoint

VPC Peering is a networking connection between two Virtual Private Clouds (VPCs) in Amazon Web Services (AWS). It allows resources within the peered VPCs to communicate with each other as if they were on the same network whereas a VPC Endpoint allows us to privately connect your VPC to supported AWS services without traversing the public internet. This enhances security and can improve data transfer performance.

## 3.9 Amazon S3

Amazon Simple Storage Service (Amazon S3) is a scalable object storage service provided by Amazon Web Services (AWS), designed to store and retrieve any amount of data from anywhere on the web. Amazon S3 is often used for web hosting, backup and restore, content distribution, data storage for applications, and archival.

## 3.10 Application Load Balancer

An Application Load Balancer (ALB) is a service provided by Amazon Web Services (AWS) that distributes incoming application traffic across multiple targets, such as Amazon EC2 instances, containers, and IP addresses, within one or more Availability Zones. Application Load Balancers play a crucial role in ensuring the availability, scalability, and fault tolerance of applications by distributing incoming traffic across multiple backend resources.

## 3.11 Cloud Watch

Amazon Cloud-Watch is a monitoring and observability service provided by Amazon Web Services (AWS). It allows users to collect and track metrics, collect and monitor log files, set alarms, and automatically react to changes in AWS resources.

## 3.12 Virtual Hosting

Virtual hosting typically refers to a method of hosting multiple domain names (websites) on a single server or a group of servers. This allows multiple websites to share the same physical hardware resources while appearing as distinct entities to users on the internet.

## 3.13 Auto Scaling

Auto Scaling in Amazon Web Services (AWS) is a feature that allows you to automatically adjust the capacity of your computing resources to maintain application availability and performance, while optimizing costs. With Auto Scaling, you can dynamically scale the number of Amazon EC2 instances or other resources based on the changing demand for your applications.

## 3.14 RDS (Relational Database Service)

Amazon RDS is a fully managed service, which means AWS handles routine database tasks such as backups, software patching, monitoring, and scaling. It simplifies the setup, operation, and scaling of relational databases, making it easier for developers to focus on building applications rather than managing database infrastructure.

## 3.15 Route 53

Amazon Route 53 is a highly available and scalable Domain Name System (DNS) web service, basically used to perform three main functions in any combination: domain registration, DNS routing, and health checking.

## 3.16 AWS MGN

AWS Migration Hub (MGN) is a service provided by Amazon Web Services (AWS) that helps customers plan and execute large-scale migrations to the AWS Cloud. AWS Migration Hub enables users to discover their existing servers and applications, group them into applications, and track the migration progress for each application.

## 3.17 Database Migration

Database migration in AWS refers to the process of moving a database from one environment to another, typically from an on-premises data center or another cloud provider to the Amazon Web Services (AWS) Cloud. AWS provides several tools and services to facilitate database migration, ensuring a smooth and efficient transition. It supports both homogeneous (e.g., Oracle to Oracle) and heterogeneous (e.g., Microsoft SQL Server to Amazon Aurora) migrations.

## 3.18 AWS Data Analytics

AWS Data Analytics refers to a set of services and tools provided by Amazon Web Services (AWS) to help organizations analyze and derive insights from their data in a scalable and cost-effective manner. These services are designed to handle various aspects of the data analytics lifecycle, from collecting and storing data to processing and analyzing it for business intelligence, reporting, and machine learning purposes.

## 3.19 AWS Glue, Amazon Athena and AWS Lambda

AWS Glue, Amazon Athena, and AWS Lambda are distinct services in Amazon Web Services (AWS) that serve different purposes within the cloud ecosystem.

AWS Glue is a fully-managed extract, transform, and load (ETL) service, designed for users to prepare and load their data for analysis, whereas Amazon Athena is a server-less, interactive query service that allows us to analyze data stored in Amazon S3 using standard SQL and AWS Lambda is a server-less compute service that allows us to run code without provisioning or managing servers.

## 3.20 ETL Pipeline setup

Setting up an ETL (Extract, Transform, Load) pipeline involves designing and implementing a series of processes to extract data from source systems, transform it into the desired format, and load it into a target data store. Here, we can use services like AWS Glue, AWS Lambda, and others to create a scalable and efficient ETL pipeline.

## 3.21 WAR (Web Application Archive)

"WAR" typically refers to a Web Application Archive. A Web Application Archive is a packaged file format used to distribute and deploy Java web applications. A WAR file contains the necessary components of a web application, including servlets, Java-Server Pages (JSP), HTML files, class files, libraries, and configuration files. It allows developers to package their web applications into a single archive, making it easier to distribute and deploy.

# Methodology

Various methodologies had been adopted for conceptual understanding of the course , few of them are listed below :-

## Foundational Learning :-

Initially, the basic concepts of cloud computing were focused, including AWS’s role in the industry. Navigating the AWS portal and understanding the pricing model were also included.

## Hands-on labs :-

This course was mainly engaged in hands-on labs for real-time experience, beginning from Account creation and MFA set-up to VPC Peering and Endpoints that implemented core AWS services to reinforce theoretical knowledge.

## Case Studies :-

Analyzing the case studies that showcased different applications of AWS in different real-world scenarios were the essential part of the course. This helped us to gain insights into practical challenges and solutions.

## Project Work :-

We were engaged to apply AWS skills in our won project according to our own interests and goals, to tackle and prepare ourselves for the problems faced by an industrial trainee.

## Assessments and Certificates:-

The participants were given regular assessments to gauge understanding and track progress. Guidance on AWS certifications for future career development were also provided.

## Community Engagement :-

Connecting with a community of AWS learners enhances our knowledge and extend our networking with like-minded people. Sharing experiences and insights through forums and discussion platforms helps to build a strong community.

## Feedback Loop :-

Collecting feedback for course improvement plays a vital role for the successful coordination of the participants. This also includes iterative updates based on participant suggestions.

## Real-time Support :-

This course provides immediate query resolution and even offers real-time support which helps to solve any queries coming up, ensuring that the participants feel supported throughout their learning journey.

# Details of Works done during the Internship (on daily basis)

## IT Process Management – Introduction to networking

The first session of this program consists of the real-world problems with on-premise server like high cost and high maintenance fees for increasing or decreasing its size. To overcome this problem, we have cloud computing platforms like AWS, Azure, Google Cloud and others. We learnt that AWS is a cloud computing platform provided by Amazon that includes a mixture of – Infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS) and software-as-a-service (SaaS) offerings.

## Introduction to Cloud Computing and AWS

In this session, we were asked to further explore how cloud computing is essential in IT industries to manage servers, data storage, databases and networking. We also discussed about different types of cloud deployment like public, private and hybrid cloud.

## Setting up AWS account and configuring MFA

We created our own AWS account in the AWS sign in web page and even set up the MFA (Multi-factor authentication) for our own security. This enhanced our knowledge about multi-step account login process, in addition to user name and password sign-in credentials.

Further, we installed and configured different cloud service tools like XShell, Putty and MobaXterm which are essential part of the practical applications in the upcoming sessions.

## Block Storage

Here, we learnt about the basic steps involved in configuring the storage. We discussed about the different types of Block Storage, which include EBS(Elastic Block Storage), EFS (Elastic File System) and Ephemeral Storage or, Instance Storage or, Temporary Storage.

## EBS (Elastic Block Storage)

We discussed about EBS in detail, and its types like SSD (gp2, gp3, IO1, IO2), HDD (sc1 and st1) and magnetic disk. This session included the lab work to perform the operations, like delete on termination, adding extra disk and extending volume in EBS. We also performed extra task given to us to run Ubuntu on GUI using Xrdp.

## EFS (Elastic File System) and Ephemeral Storage

Here, we continued our discussions on Block Storage, including EFS (Elastic File Storage) and Ephemeral storage. We performed the task on operations like, attaching volume to different instance, concept of snapshots and reading further documentation on volume. We also discussed about a service in AWS called Lifecycle Manager. Further, we discussed about different commands like, sudo su, lsblk, df-h. We got to know that to attach a disc, we first need to format it and then mount the storage.

## Instance Type and Pricing Model

In this session, we were given the task to read the AWS documentation about AWS pricing models and its instance types. We even discussed about pricing models like on-demand pricing model, reserved instances, scheduled reserved instances and spot instance pricing model. Further we discussed about features provided by AWS known as on-demand capacity reservation.

## AWS IP & Elastic IP, Networking devices

In this portion, we explored about IP addresses. When we launched the instance, we noticed two IPs were allocated, Public and Private. When we stopped it and again started the instance, we noticed the public IP was changed. This becomes problematic to access a particular server so to tackle this problem AWS provides us Elastic IP address.

We even discussed about the various different types of networking devices such as, switch, hub, routers and repeaters and also about Internet Protocols.

## Webserver deployment

In this class, we learnt the instructions about how to configure instance as a web-server and deploy a sample website in that instance. We learnt a few basic command for Linux example, #yum install httpd. We got to know about keyword ‘apt’ which is the package manager for Ubuntu and few basic commands for Ubuntu. We used the WinSCP application to transfer files from our local device to any server.

## IAM users, groups and AWS CLI

In this session, we discussed about IAM users & groups. IAM stands for Identity and Access Management, which are basically used to manage the access given to someone. We also learnt about AWS CLI, which stands for Command Line Interface.

In the practical session, we followed the steps to create an IAM user & group. We downloaded and launched the AWS CLI for windows. A task was given to create an IAM user which had the feature for EC2 Full Access. We launched and terminated the EC2 Instance via AWS CLI.

## IAM Role & Python for AWS basics

This portion include the basics for the creation of IAM Role. We learnt that sharing of access key ID and server key ID is not advisable which had the chance of security breach, so we create IAM Roles for better security. We also learnt about cross account role to give access to user having different AWS account. Further we learnt few basic concepts of Python to automate the above mentioned process.

## VPC (Virtual Private Cloud)

VPC is a networking feature provided by AWS that allows to connect two virtual private clouds together. We have created two subnets under a VPC, which is a private (containing DB-server) and a public subnet(containing web-server). The public subnet contain a route table which has the access to internet, but we cannot give direct internet access to private subnet. To access internet from DB-server, we first created a NAT-gateway within public subnet and then connected it to route table of private subnet. It was great experience for us to create the above mentioned tasks.

## VPC -Peering and Endpoints

In this portion we have discussed, why do we need VPC Peering. VPCs are isolated networks within a cloud provider infrastructure where we can launch and manage our resources so, to enable direct communication between two instances in different VPCs we use VPC Peering.

Further more, we discussed that data travelling from S3- bucket to instance, then to the VPC and then back to the computer is not feasible because of latency and security issues, so to overcome this problem we establish VPC Endpoints.

## S3 Buckets

In this class, we discussed in details about the steps to create a S3-bucket and the methods to store objects in it. We were given the task to mount S3- bucket on Windows and Linux servers and even automate the process to copy files from server to S3. We also hosted a web-site using S3-bucket.

## Application Load Balancer

This session demonstrated the use of application load balancer in place of running multiple servers for a web-page or any application. Here, we have deployed a sample website and saw how traffic is handled by a load balancer. We also learnt about domain registering through different websites such as, GoDaddy, Hostinger and DNS hosting through AWS.We deployed a server to perform the above mentioned task.

## Cloud Watch

This session mainly consists of detailed explanation about Cloud-watch which monitors and manages our all other AWS services. We have created a dashboard with different matrices, such as CPU-Utilization and many more. We have also created an alarm and enabled notification to us when alarm goes on through SNS (Simple Notification Service).

## Virtual Hosting

This portion of the topic contained discussions about how multiple web applications can be hosted in a single server through virtual hosting. We have also mapped it with a domain name purchased fro m above mentioned websites and configure a SSL certificate. We used WinSCP to deploy the sample server.

## Auto-scaling

In this class, we explored the dynamic functioning of a special feature in AWS, which is Auto-scaling. Auto-scaling refers to the capabilities of adjusting the number of resources allocated based on the changes in demand. We were given the task to execute auto-scaling, by creating load balancer, target groups and launch templates. We even created alarms for scaling in and scaling out process, and applied dynamic scaling policy.

## RDS, Route53, Beanstalk, Cloud-front and Cloud-formation

This session consists of the discussions about RDS (Relational Database Service), elastic beanstalk, cloud-front and cloud-formation. We have created a Database server (DB-server) using database engines like MYSQL, Maria DB and others. We have deployed elastic beanstalk which is a platform-as-a-service (PaaS) offered by AWS that simplifies the deployment and management of web-applications and servers.

## AWS MGN

In this session, we have collaborated with one member of the class to migrate database from one server to another. In this process, we were guided step-by-step by our volunteers for smooth execution of the process.

## Database Migration from on-prem to cloud or cloud to cloud

In this class, we discussed more about DMS which is Database Migration Service, where we learnt how to migrate database from one server to another. We have first created a data-base using RDS (Relational Database Service) and then steps were performed for the process. It even included features like Route53, domain registration and DNS hosting.

## Introduction to AWS Data analytics

In this class, we deep dived into the world of AWS Data Analytics, where we discussed about various types of data forms such as, CSV, JSON, XML, HTML, PDF, parquet, Excel and many more. We also discussed about their features in more details. We got to know that the most common format of data in industries is CSV, JSON and parquet.

## Glue, Athena and Lambda

In this section, we discussed about a simple ETL (Extract, Transform, Load) pipeline, which is done by the application of AWS Glue. Further, we used the application of Athena for querying data in S3 using SQL and the use of Lambda for server-less computing and event-driven functions in AWS.

## SQS, SNS, ETL Pipeline set-up

In this session, we used various tools like SQS, SNS, S3, Glue, Lambda, Cloud-watch, event-bridge, redshift and Athena to set up a simple pipeline which automates the various processes like, extractions, transformation, loading (ETL), data querying, event-driven automation and data analysis within AWS.

## WAR, Compliance in AWS

Here, we discussed about AWS shared responsibility model which depicts the responsibilities that fall on customers and the service providers. We even discussed about DDOS, which stands for Distributed Denial of Service. We also discussed about AWS Shield including WAF, i.e., Web Application Framework. This also contained discussion about AWS prohibited activities and difference in data at rest and data in transit, followed by detailed discussion about AWS configuration and its rules.

# Outcomes of the program

This internship program aims to provide students with real-world experience and insightful knowledge. This also provides a exposure to the edge-cutting technologies, offers networking opportunities and a chance to contribute to meaningful projects. The outcomes of the program may include:-

## Skill Development:-

This course provides a great opportunity for the participants to enhance their technical knowledge with hands-on practices and develop skills to their field of study.

## Networking:-

Building connections with professionals in the industry, including mentors and peers, can be a valuable outcome for the participants to boast up their knowledge through discussions and team works.

## Learning Experience:-

Exposure to the work environment, team dynamics, and the industry itself provides valuable insights and a better understanding of career paths. This also helps the participants to acknowledge their field of interests.

## Team Building:-

Successful team works helps to build a dynamic project, sharing their experiences and knowledge.

## Project Making:-

After the completion of the course, projects were allocated to the participants. This provides an opportunity to apply our own knowledge and build up a real-world experience of the technical field, providing an exposure of the scenarios in the industries.

## Resume Enhancement:-

Internship experience at any industry will significantly enhance a student's resume and open doors for future opportunities.

# Conclusions

The successful completion of this AWS (Amazon Web Services) internship course is a commendable achievement that opens up a myriad of opportunities in the rapidly evolving field of cloud computing. This accomplishment signifies not only the acquisition of technical knowledge but also the development of skills crucial for navigating the modern IT landscape.

This AWS internship course marks a significant milestone in one’s professional journey. With the comprehensive understanding of AWS services, infrastructure and best practices, we are well-equipped to harness the power of the cloud to drive innovation, efficiency and scalability.

This achievement is not merely about mastering a set of technologies, but also about representing the ability to develop robust and secure cloud solutions that meet the demands of today's dynamic business environment. The knowledge gained through the AWS course empowers individuals to contribute meaningfully to design scalable applications to manage data with cutting-edge tools and to develop transformation initiatives.

The AWS certification earned through the course serves as a tangible testament to the expertise acquired which stands as a recognized credential in the industry, opening doors to diverse career opportunities such as cloud architect, solutions architect or developer. The skills acquired during the course lay a solid foundation for on-going professional growth.