

NAME: AWARITOMA ACHOMAKOGHENE OGHENETEGA

MATRIC NO: VUG/CSC/22/7278

COURSE CODE: CSC 302 (DISTRIBUTED SYSTEMS)

COMPUTER SCIENCE DEPARTMENT

ASSIGNMENT: WRITE EXTENSIVELY ON AWS, GCP AND MICROSOFT AZURE

AWS (Amazon Web Services), GCP(Google Cloud Platforms), and Microsoft Azure are all **cloud computing platforms** that provide on-demand computing resources, storage, and services to help business build, deploy and manage applications and infrastructure in the cloud.

They all offer similar services in functionalities such as networking, computing, storage, database, AI and ML and Global reach. The following provides basic information on each of them.

A Cloud platform is a suite of cloud computing services that provides on-demand access to computing resources, storage, networking, and other IT infrastructure over the internet.

About Amazon Web Services (AWS)

The AWS is the worlds most comprehensive and broadly adopted cloud that offers over 200 fully featured service from data centers globally. The AWS was founded by Amazon.com, Inc., by a team lead by Jeff Bezos (Amazon founder)and Andy Jassy (CEO of Amazon) which was officially launched in 2006 .

The development of AWS began earlier as an internal project to improve Amazon's own infrastructure. Over time Amazon realized the potential to offer these cloud computing services to external customers, leading to the creation of AWS. Now, AWS is the leading cloud computing platform globally.

AWS Functionality

AWS has significantly more services, and more features within those services, than any other cloud provider—from infrastructure technologies like compute, storage, and databases—to emerging technologies, such as machine learning and artificial intelligence, data lakes and analytics, and Internet of Things. This makes it faster, easier, and more cost effective to move your existing applications to the cloud and build nearly anything you can imagine.

AWS also has the deepest functionality within those services. For example, AWS offers the widest variety of databases that are purpose-built for different types of applications so you can choose the right tool for the job to get the best cost and performance.

AWS is architect-ed to be the most flexible and secure cloud computing environment available today. The core infrastructure is built to satisfy the security requirements for the military, global banks, and other high-sensitivity organizations.

Key Functionalities

1. Computing Service

- Amazon EC2 (Elastic Compute Cloud): Provides scalable virtual servers (instances) for running applications.
- AWS Lambda: Allows running code without provisioning servers (server-less computing).
- Elastic Beanstalk: Automates application deployment and management.

2. Storage Services

- Amazon S3 (Simple Storage Service): Scalable object storage for data backup, archiving, and analytics.
- Amazon EBS (Elastic Block Store): Block storage for EC2 instances.
- Amazon Glacier: Low-cost storage for long-term data archiving.

3. Database Services

- Amazon RDS (Relational Database Service): Managed relational databases (e.g., MySQL, PostgreSQL).
- Amazon DynamoDB: Fully managed NoSQL database for high-performance applications.
- Amazon Redshift: Data warehousing for analytics.

4. Networking

- Amazon VPC (Virtual Private Cloud): Isolated cloud resources with customizable networking.
- AWS Cloud-front: Content delivery network (CDN) for fast content delivery.
- Elastic Load Balancing: Distributes incoming traffic across multiple targets.

5. Machine Learning and AI

- Amazon SageMaker: Build, train, and deploy machine learning models.
- Recognition: Image and video analysis using AI.
- Polly: Text-to-speech service.

Other key functionalities include, Analytics, Security and Identity, Developer tools, Management and Monitoring, and IOT (Internet of Things)

Importance of AWS

1. Scalability: It easily scales its resources based on demand
2. Cost effective Pay-as-you-go pricing model reduces upfront costs.
3. Global reach: Availability worldwide
4. Reliability: High fault tolerance
5. Flexibility: It accommodates a wide range of programming languages, OS's and frameworks.

Use Cases of AWS

1. Web hosting
2. Big Data Analytics
3. Machine Learning
4. Disaster Recovery
5. Enterprise Applications

GCP(Google Cloud Platform)

About GCP

Google Cloud Platform is a suite of cloud computing services offered by Google. It provides a wide range of tools and infrastructure for building, deploying, and managing applications and services in the cloud. GCP leverages Google's global infrastructure, which powers popular services like Google Search, YouTube, and Gmail, to offer scalable, reliable, and high-performance cloud solutions.

GCP was developed and launched by Google in 2008 by the co-founders of google Larry Page and Sergey Brin and the former CEO of Google Eric Schmidt. Urs Hölzle also played a significant role in shaping GCP.

Key Functionalities

1. Compute Services
 - a) Compute Engine: Virtual machines (VMs) for running workloads.
 - b) App Engine: Platform for building and deploying scalable web applications.
 - c) Cloud Functions: Serverless functions for event-driven computing.

2. Storage and Database:

- a) Cloud Storage: Scalable object storage for data and backups.
- b) Cloud SQL: Managed relational databases (MySQL, PostgreSQL, SQL Server).
- c) Firestore: NoSQL document database for real-time applications.
- d) Bigtable: High-performance NoSQL database for large-scale applications.

3. Big Data Analytics:

- a) BigQuery: Serverless data warehouse for fast SQL queries.
- b) Dataflow: Stream and batch data processing.
- c) Pub/Sub: Messaging service for event-driven systems.

4. AI and Machine Learning:

- a) Vertex AI: Platform for building and deploying ML models.
- b) AutoML: Automated machine learning for non-experts.
- c) Vision AI, Speech-to-Text, Natural Language API: Pre-trained AI models for specific tasks.

5. Networking:

- a) Virtual Private Cloud (VPC): Isolated network for resources.
- b) Cloud CDN: Content delivery network for fast content delivery.
- c) Cloud Load Balancing: Distributes traffic across resources.

Other key functionalities include, DevOps and Developer tools, and Security.

Importance of GCP

- 1. Global infrastructure: Data centers in multiple regions for low latency and high availability.
- 2. Scalability: Automatically scales resources to meet demand.
- 3. Cost-Effective: Pay-as-you-go pricing and sustained use discounts.
- 4. AI/ML Integration: Strong focus on AI and machine learning tools.
- 5. Open Source Friendly: Supports Kubernetes, TensorFlow, and other open-source technologies.

Use cases of GCP

- 1. Data Analytics
- 2. Machine Learning
- 3. Web Applications
- 4. IoT
- 5. Enterprise Solutions

Microsoft Azure

About Microsoft Azure

Microsoft Azure was developed and launched by the Microsoft Corporation in 2010 as a cloud computing platform. It was developed under the leadership of the Microsoft executives including Satya Nadella (Microsoft CEO) and Ray Ozzie (former Chief Software Architect at Microsoft).

Microsoft Azure is a comprehensive cloud computing platform that provides a wide range of services for building, deploying, and managing applications and infrastructure. It is designed to support businesses of all sizes, from startups to enterprises, and offers tools for computing, storage, networking, AI, analytics, and more. Below is a brief discussion of its key functionalities:

Key Functionalities

1. Compute Services:

- a) Virtual Machines (VMs): Scalable virtual servers for running applications.
- b) Azure Functions: Serverless computing for event-driven tasks.
- c) App Services: Platform for building and hosting web apps.

2. Storage and Databases:

- a) Blob Storage: Scalable object storage for unstructured data.
- b) Azure SQL Database: Managed relational database service.
- c) Cosmos DB: Globally distributed NoSQL database.

3. AI and Machine Learning:

- a) Azure Machine Learning: Platform for building and deploying ML models.
- b) Cognitive Services: Pre-trained AI models for vision, speech, and language.
- c) Bot Service: Build and deploy intelligent bots.

4. Networking:

- a) Virtual Network (VNet): Isolated network for resources.
- b) Azure CDN: Content delivery network for fast content delivery.
- c) Load Balancer: Distributes traffic across resources.

5. Analytics:

- a) Azure Synapse Analytics: Data warehouse for big data analytics.
- b) HDInsight: Big data processing with Hadoop, Spark, and more.
- c) Data Lake Storage: Scalable storage for big data analytics.

Other key functionalities include, DevOps and Developer tools, IOT, and Security.

Importance of Microsoft Azure

1. Hybrid Cloud: Strong integration with on-premises systems.
2. Enterprise Focus: Deep integration with Microsoft products like Windows Server, Office 365, and Active Directory.
3. Global Reach: Data centers in multiple regions worldwide.
4. Scalability: Easily scale resources up or down based on demand.
5. AI/ML Capabilities: Robust tools for artificial intelligence and machine learning.

Use cases of Microsoft Azure

1. Enterprise applications
2. Data analytics
3. AI and Machine learning
4. Hybrid cloud
5. IoT

Major comparisons between AWS, GCP, and Microsoft Azure

1. Market Share and Popularity:
 - AWS: The largest and most established cloud provider with a significant market share.
 - Azure: Gaining ground rapidly, especially due to its integration with Microsoft enterprise products.
 - GCP: Popular for data analytics and machine learning but has a smaller market share.
2. Service Offerings:
 - AWS: Offers a comprehensive range of services, including compute power (EC2), storage (S3), and database solutions (RDS, DynamoDB).
 - Azure: Strong in hybrid cloud solutions and integrates seamlessly with Windows Server and other Microsoft services like Office 365 and Active Directory.
 - GCP: Excels in data analytics (BigQuery), machine learning (TensorFlow), and Kubernetes (GKE).
3. Pricing Model:
 - AWS: Flexible pricing with on-demand, reserved, and spot instances.
 - Azure: Competitive pricing with discounts for enterprises that already use Microsoft products.

- GCP: Known for sustained use discounts and more cost-effective options for big data and analytics.

4. Compute Power and Storage:

- AWS: EC2 instances, Elastic Block Store (EBS), and S3 for object storage.
- Azure: Virtual Machines (VMs), Azure Blob Storage, and Azure Files.
- GCP: Google Compute Engine, Cloud Storage, and Persistent Disks.

5. Machine Learning and AI:

- AWS: SageMaker and Rekognition for AI/ML tasks.
- Azure: Azure Machine Learning Studio and Cognitive Services.
- GCP: TensorFlow, AutoML, and Vertex AI.

6. Networking and Security:

- AWS: Virtual Private Cloud (VPC), AWS Shield, and AWS Identity and Access Management (IAM).
- Azure: Virtual Network (VNet), Azure Firewall, and Azure Active Directory.
- GCP: Virtual Private Cloud (VPC), Cloud Armor, and IAM.

7. Compliance and Security:

- All three platforms offer robust security measures and compliance certifications (e.g., GDPR, HIPAA, and SOC 2).

8. Global Reach:

- AWS: Most extensive global network of data centers.
- Azure: Strong global presence with data centers in more than 60 regions.
- GCP: Fewer regions but focuses on high-speed networking and low-latency infrastructure.

9. User Interface and Ease of Use:

- AWS: Rich feature set but can be complex for beginners.
- Azure: Familiar for organizations using Microsoft tools.
- GCP: User-friendly and developer-centric.

Summary

AWS, Azure, and GCP are the top cloud service providers, each excelling in different areas. AWS, being the pioneer, dominates the market with the most extensive service offerings and global infrastructure, making it ideal for businesses seeking scalability and versatility. Azure stands out in the enterprise world due to its seamless integration with Microsoft products and strong support for hybrid cloud environments. GCP, backed by Google's expertise in data analytics and machine learning, is favored for data-driven projects and containerization. While AWS is known

for its breadth, Azure for its enterprise-friendly ecosystem, and GCP for innovation, the best choice depends on the specific needs of the business.