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DISTRIBUTED COMPUTER SYSTEMS

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300

**QUESTIONS**

Write on the following cloud terminologies

a) AWS

b) Google Cloud Platform

c) Microsoft Azure

**ANSWERS**

**a) AWS (Amazon Web Services)**

AWS (Amazon Web Services) is a cloud computing platform offered by Amazon. It is a cloud computing platform that provides a wide range of services including computing power, storage, networking, security, databases, and more, allowing organizations to access and manage IT resources on demand via the internet, on a pay-as-you-go basis. AWS is widely used by businesses, developers, and organizations to build and scale applications. It helps businesses scale without investing in expensive physical infrastructure.

Amazon, as an online retailer, faced growing challenges in managing its IT infrastructure. Engineering teams were spending excessive time building and maintaining computing, storage, and database resources rather than focusing on innovation.

Amazon discovered that they had unintentionally built an efficient internal platform that could be standardized and offered as a service to others. They realized that businesses of all sizes could benefit from renting computing power, storage, and networking on demand rather than building their own costly data centers.

AWS officially launched in March 2006 with a few core services:

* S3 (Simple Storage Service) – Scalable cloud storage.
* EC2 (Elastic Compute Cloud) – Virtual computing power.
* SQS (Simple Queue Service) – Message queuing for distributed systems.

AWS expanded with more services, including databases (RDS, DynamoDB), machine learning, and server less computing (Lambda). Companies like Netflix, Airbnb, and NASA adopted AWS for their cloud needs. Today, AWS dominates the cloud market, competing with Microsoft Azure and Google Cloud.

AWS transformed the tech industry by making scalable computing accessible to everyone, from startups to Fortune 500 companies.

***Key Features of AWS***

* Scalability – Scale resources up or down as needed.
* Pay-as-you-go Pricing – Pay only for what you use.
* Security & Compliance – Built-in security features with global compliance certifications.
* Global Reach – Data centers in multiple regions worldwide.
* High Availability & Reliability – Redundant infrastructure minimizes downtime.

***Key AWS services***

1. EC2 (Elastic Compute Cloud) – Virtual servers.

2. S3 (Simple Storage Service) – Scalable object storage.

3. RDS (Relational Database Service) – Managed databases.

4. Lambda – Serverless computing.

5. VPC (Virtual Private Cloud) – Network isolation.

6. IAM (Identity and Access Management) – Security and access control.

7. CloudFront – Content delivery network (CDN).

8. DynamoDB – NoSQL database.

9. ECS & EKS – Container management.

10. SNS & SQS – Messaging services.

***What is AWS used for?***

AWS (Amazon Web Services) is used for a wide range of applications across industries, thanks to its scalable cloud computing services.

**1**. Website & Application Hosting

* Host websites, blogs, and enterprise applications.
* Example: Netflix runs its streaming service on AWS.

**2.** Cloud Storage & Backup

* Store, retrieve, and backup large amounts of data using S3, Glacier, EBS.
* Example: Dropbox and other cloud storage providers use AWS.

**3**. Databases & Big Data Analytics

* Managed databases with RDS, DynamoDB, Redshift.
* Data analytics with Athena, EMR (Hadoop), QuickSight.

**4.** Machine Learning & AI

* Build AI models with SageMaker, Recognition (image recognition), Polly (text-to-speech).

**5.** Internet of Things (IoT)

* Connect and manage IoT devices with AWS IoT Core.

**6.** Serverless Computing

* Run applications without managing servers using AWS Lambda.

**7.** DevOps & CI/CD Pipelines

* Automate deployments with CodePipeline, CodeDeploy.

**8.** Enterprise IT & Virtual Desktops

* Run corporate IT infrastructure on AWS WorkSpaces, Directory Service.

**9.** Gaming & Media Streaming

* Game hosting and cloud rendering using AWS GameLift, CloudFront.
* Live video streaming using AWS Media Services.

**10.** Security & Compliance

* Secure cloud infrastructure with AWS IAM, Shield, WAF.

***Why Use AWS?***

* Cost-Efficient – No upfront investment; pay for what you use.
* Flexibility – Supports multiple OS, programming languages, and frameworks.
* Security – Industry-leading security and compliance.
* Global Reach – 30+ regions and 100+ availability zones worldwide.
* Integration – Works seamlessly with other AWS services.

***Main AWS Services & Categories***

**1.** Compute Services (Processing Power)

* EC2 (Elastic Compute Cloud) – Virtual servers on demand.
* Lambda – Serverless computing (run code without managing servers).
* ECS & EKS – Container orchestration for Docker and Kubernetes.

**2.** Storage & Databases

* S3 (Simple Storage Service) – Scalable object storage.
* EBS (Elastic Block Store) – Block storage for EC2 instances.
* RDS (Relational Database Service) – Managed databases (MySQL, PostgreSQL, etc.).
* DynamoDB – NoSQL database for high-performance applications.

**3.** Networking & Content Delivery

* VPC (Virtual Private Cloud) – Isolated network setup.
* CloudFront – Content delivery network (CDN) for fast loading speeds.
* Route 53 – Scalable domain name system (DNS).

**4.** Security & Identity

* IAM (Identity and Access Management) – User authentication & access control.
* AWS Shield & WAF – Protection against DDoS attacks.

**5.** AI & Machine Learning

* SageMaker – Build, train, and deploy ML models.
* Recognition – Image and facial recognition.
* Polly – Text-to-speech conversion.

**6**. DevOps & Automation

* Cloud Formation – Infrastructure as Code (IaC).
* CodeDeploy, CodePipeline – CI/CD automation.

***Challenges & Problems Faced When Using AWS***

**1.** Cost Management Issues

Problem: AWS follows a pay-as-you-go model, but unexpected costs can arise due to incorrect configurations, unused resources, or data transfer charges.

Solution:

* Use AWS Cost Explorer and Budgets to monitor spending.
* Set up alerts and cost limits to avoid surprises.
* Optimize resource usage with Reserved Instances or Savings Plans.

**2**. Complexity in Configuration & Management

Problem: AWS offers 200+ services, making it overwhelming for beginners. Configuring VPCs, IAM policies, and networking correctly can be challenging.

Solution:

* Use AWS Well-Architected Framework for best practices.
* Utilize managed services like RDS, Elastic Beanstalk, and Lambda to simplify operations.
* Leverage AWS Training and Certifications to upskill.

**3.** Security & Compliance Risks

Problem: Misconfigured security settings (e.g., public S3 buckets, weak IAM policies) can lead to data breaches. AWS follows the Shared Responsibility Model, meaning security.

***Step-by-Step guide to getting started with AWS***

**1. Create an AWS Account**

* Go to AWS website and click "Create an AWS Account."
* Enter your email, create a password, and provide payment details (AWS offers a Free Tier with limited services).
* Verify your identity using a phone number and credit card.

**2. Navigate the AWS Management Console**

* After logging in, you’ll see the AWS Management Console, where you can access all AWS services.
* Use the search bar to find services like EC2 (virtual servers) or S3 (storage).

**3. Set Up Key AWS Services**

* Compute: Launch a Virtual Machine (EC2)

1. Go to EC2 (Elastic Compute Cloud) in the AWS console.
2. Click "Launch Instance" → Choose an OS (Linux/Windows).
3. Select an instance type (e.g., t2.micro is free-tier eligible).
4. Configure networking & security settings.
5. Click Launch and connect via SSH (Linux) or RDP (Windows).

* Storage: Create an S3 Bucket

1. Go to S3 in the AWS console.
2. Click "Create Bucket" → Enter a unique bucket name.
3. Set permissions (private or public).
4. Upload files and access them via a URL.

* Database: Set Up a Managed Database (RDS)

1. Go to RDS (Relational Database Service).
2. Click "Create Database" → Choose MySQL, PostgreSQL, or another option.
3. Select an instance size and storage type.
4. Set database credentials and launch.

**4. Secure Your AWS Account**

* Use IAM (Identity and Access Management) to create users with limited permissions.
* Enable Multi-Factor Authentication (MFA) for extra security.
* Use AWS Cloud Trail to monitor account activity.

**5. Learn AWS with Hands-On Practice**

* Try AWS Free Tier to experiment with services.
* Follow AWS tutorials on AWS Training & Certification.
* Explore Infrastructure as Code (IaC) tools like AWS CloudFormation or Terraform.

**6. Deploy an Application (Optional)**

* Use AWS Elastic Beanstalk to deploy a web app without managing servers.
* Use AWS Lambda for serverless applications.
* Use AWS Lightsail for a simple, pre-configured cloud environment.

**b) Google Cloud Platform (GCP)**

Google Cloud Platform (GCP) is a cloud computing service provided by Google. It offers a range of cloud-based solutions, including computing, storage, databases, networking, AI/ML, and security. GCP enables businesses to build, deploy, and scale applications on Google's infrastructure.

***Key Features of GCP***

* Scalability – Auto-scaling resources for high availability.
* Global Reach – Data centers across multiple regions worldwide.
* Security & Compliance – Industry-leading security and encryption.
* AI & Machine Learning – Advanced AI/ML tools for automation.
* Integration – Works with Google services (BigQuery, Kubernetes, TensorFlow).

***Main GCP Services & Categories***

**1.** Compute Services (Processing Power)

* Compute Engine – Virtual machines (VMs) for hosting applications.
* App Engine – Fully managed platform for web applications.
* Kubernetes Engine (GKE) – Managed Kubernetes for containerized apps.
* Cloud Functions – Serverless computing for event-driven apps.

**2.** Storage & Databases

* Cloud Storage – Scalable object storage (similar to AWS S3).
* Persistent Disks – Block storage for VMs.
* BigQuery – Serverless data warehouse for analytics.
* Cloud SQL & Firestore – Managed relational and NoSQL databases.

**3.** Networking & Security

* VPC (Virtual Private Cloud) – Secure networking.
* Cloud Load Balancing – Distributes traffic across resources.
* Cloud Armor – DDoS protection.
* IAM (Identity and Access Management) – Secure access control.

**4.** AI & Machine Learning

* Vertex AI – Unified AI/ML development platform.
* AutoML – Build ML models without coding.
* Cloud Vision API – Image recognition.
* Natural Language API – Text analysis & sentiment detection.

**5.** DevOps & Automation

* Cloud Build – CI/CD automation for app deployment.
* Cloud Deployment Manager – Infrastructure as Code (IaC).
* Cloud Run – Serverless computing for containerized applications.

***What is Google Cloud Platform (GCP) used for?***

**1.** Hosting Websites & Web Applications

* Host dynamic or static websites with Compute Engine, App Engine, or Cloud Run.
* Deploy scalable web apps with Google Kubernetes Engine (GKE).
* Example: Spotify runs its music streaming platform on GCP.

**2.** Cloud Storage & Backup

* Store and manage files using Cloud Storage (similar to AWS S3).
* Backup data with Persistent Disk and Coldline Storage for long-term archiving.
* Example: Snapchat stores user media using GCP’s storage services.

**3.** Big Data Analytics & Data Warehousing

* Process large datasets using BigQuery (Google’s fully managed data warehouse).
* Use Dataflow (Apache Beam) for real-time data processing.
* Example: Twitter uses GCP for real-time analytics.

**4.** Machine Learning & AI

* Train and deploy AI models with Vertex AI and AutoML.
* Analyze images and videos with Cloud Vision API.
* Convert speech to text with Speech-to-Text API.
* Example: Google Assistant relies on GCP’s AI services.

**5.** DevOps & Application Deployment

* Automate CI/CD pipelines using Cloud Build.
* Deploy microservices with Cloud Functions (serverless computing).
* Manage infrastructure using Terraform or Cloud Deployment Manager.

**6.** Hybrid & Multi-Cloud Solutions

* Use Anthos to manage workloads across AWS, Azure, and on-premises.
* Connect cloud and on-prem systems using Cloud VPN and Interconnect.

**7.** Gaming Backend & Media Streaming

* Host game servers using Google Kubernetes Engine (GKE).
* Stream videos with Cloud CDN and Transcoder API.
* Example: YouTube uses GCP for video storage and delivery

**8**. IoT (Internet of Things) Solutions

* Connect and manage IoT devices with Cloud IoT Core.
* Process sensor data in real-time with Pub/Sub and Dataflow.

**9.** Enterprise IT & Security

* Secure identity management with IAM & Cloud Identity.
* Monitor and protect cloud resources with Security Command Center.

***Why Use GCP?***

1. Scalability – Auto-scaling infrastructure for global reach.

2. Security – Google-grade security and compliance.

3. AI/ML Leadership – Advanced AI tools for automation.

4. Cost Efficiency – Per-second billing and sustained use discounts.

***Problems Faced When Using Google Cloud Platform (GCP) & Solutions***

**1.** Complex Pricing & Unexpected Costs

Problem:

* GCP pricing can be complicated, and users may face unexpected charges due to misconfigured services.
* Data transfer fees between regions can add up quickly.

Solution:

✔ Use Google Cloud Pricing Calculator to estimate costs before deploying services.

✔ Set up Budgets & Alerts to monitor spending in the Billing section.

✔ Choose Sustained Use Discounts and Committed Use Contracts for cost savings.

**2.** Steep Learning Curve for Beginners

Problem:

* GCP has over 200+ services, making it difficult for beginners to navigate.
* Setting up Virtual Private Cloud (VPC), IAM roles, and security policies requires technical expertise.

Solution:

✔ Start with Google Cloud Free Tier to test services before committing.

✔ Follow Google Cloud Training & Certification courses.

✔ Use Google Cloud Marketplace for pre-configured solutions.

**3.** Security & Access Management Risks

Problem:

* Misconfigured IAM permissions can expose sensitive data.
* Publicly accessible Cloud Storage buckets can lead to data leaks.

Solution:

✔ Follow Principle of Least Privilege (PoLP) in IAM roles.

✔ Use Cloud Audit Logs to track user activities.

✔ Enable VPC Service Controls for enhanced security.

4. Networking & Connectivity Issues

Problem:

* Configuring firewalls, VPNs, and hybrid cloud connections can be challenging.
* Poorly optimized network settings can cause slow performance.

Solution:

✔ Use Cloud Load Balancing for efficient traffic distribution.

✔ Optimize VPC Peering & Interconnect for hybrid cloud setups.

✔ Monitor network performance using Cloud Monitoring.

**5.** Limited Multi-Region Availability for Some Services

Problem:

* Some GCP services are not available in all regions, leading to latency issues.
* Moving workloads between regions can be expensive.

Solution:

✔ Check Google Cloud Region & Zone Availability before deployment.

✔ Use Cloud CDN to reduce latency for global users.

**6**. Migration Challenges from AWS/Azure

Problem:

* Migrating existing workloads from AWS or Azure to GCP requires refactoring applications.
* Differences in IAM roles, networking, and API structures can cause compatibility issues.

Solution:

✔ Use Google Cloud Migrate for VM and database migrations.

✔ Leverage Anthos for hybrid and multi-cloud management.

**7.** Customer Support Can Be Costly & Slow

Problem:

* GCP's free support is limited, and premium support is expensive.
* Response times for non-enterprise customers can be slow.

Solution:

✔ Use Google Cloud Community Forums for common issues.

✔ Opt for Basic Support Plan if full enterprise support isn’t needed.

***How to Use Google Cloud Platform (GCP)***

**1.** Create a Google Cloud Account

* Go to Google Cloud Console.
* Click "Get Started for Free" (Google offers a $300 Free Trial).
* Sign in with your Google account and enter payment details (you won’t be charged unless you exceed the free limits).

**2.** Set Up a New Project

* In the Google Cloud Console, click the Project Selector at the top.
* Click "New Project" → Enter a name → Click Create.
* Projects help organize cloud resources for different applications.

**3.** Enable Billing & Free Tier Usage

* Navigate to Billing in the Console.
* Enable Billing Account (required even if using the free tier).
* Monitor costs with Budgets & Alerts.

**4.** Use Key GCP Services

* Compute: Deploy a Virtual Machine (VM) with Compute Engine

1. Go to Compute Engine → Click "Create Instance".
2. Choose a machine type (e.g., e2-micro for free tier).
3. Select an OS (Ubuntu, Windows, etc.).
4. Click Create and connect via SSH.

* Storage: Create a Cloud Storage Bucket

1. Go to Cloud Storage → Click "Create Bucket".
2. Enter a unique bucket name.
3. Choose a storage class (Standard, Nearline, Coldline).
4. Upload files and set access permissions.

* Database: Set Up a Managed Database with Cloud SQL

1. Go to Cloud SQL → Click "Create Instance".
2. Choose a database type (MySQL, PostgreSQL, or SQL Server).
3. Set credentials and configure resources.
4. Connect to your app using the provided connection string.

* Networking: Set Up a Virtual Private Cloud (VPC)

1. Go to VPC Network → Click "Create VPC Network".
2. Configure subnets and firewall rules.
3. Secure access using IAM and Cloud Armor.

* Deploy a Web App with App Engine

1. Install Google Cloud SDK (CLI tool for GCP).
2. Run gcloud app create to initialize App Engine.
3. Deploy your app with gcloud app deploy.

5. Secure Your GCP Account

* Set up IAM (Identity & Access Management) to manage permissions.
* Enable Cloud Logging & Monitoring to track usage.
* Use Cloud Security Scanner to check for vulnerabilities.

6. Learn GCP with Hands-On Practice

* Try Google Cloud Free Tier services.
* Explore Google Cloud Training & Certifications.
* Follow GCP Quickstart Guides for different services.

**c) Microsoft Azure**

Microsoft Azure is a cloud computing platform that provides a wide range of services, including computing, storage, networking, databases, artificial intelligence (AI), and security. Azure enables businesses to build, deploy, and manage applications through Microsoft's global network of data centers.

Azure competes with AWS (Amazon Web Services) and GCP (Google Cloud Platform) and is widely used by enterprises due to its strong integration with Microsoft products (Windows, Office 365, Active Directory, etc.).

***Key Features of Microsoft Azure***

* Scalability – Easily scale resources up or down as needed.
* Hybrid Cloud Capabilities – Seamless integration with on-premises data centers.
* Security & Compliance – Advanced security features & global regulatory compliance.
* AI & Machine Learning – Built-in AI services for automation & analytics.
* Integration with Microsoft Products – Works with Windows, SQL Server, Office 365.

***Main Azure Services & Categories***

**1.** Compute Services (Processing Power)

* Azure Virtual Machines (VMs) – Cloud-based virtual servers.
* Azure App Services – Fully managed platform for web apps.
* Azure Kubernetes Service (AKS) – Managed Kubernetes for containerized applications.
* Azure Functions – Serverless computing for event-driven applications.

**2**. Storage & Databases

* Azure Blob Storage – Scalable object storage (similar to AWS S3).
* Azure SQL Database – Fully managed relational database.
* Cosmos DB – Globally distributed NoSQL database.
* Azure Files & Disk Storage – Managed file and block storage.

**3**. Networking & Security

* Azure Virtual Network (VNet) – Private cloud networking.
* Azure Load Balancer – Distributes traffic across resources.
* Azure Firewall & DDoS Protection – Cloud security solutions.
* Azure Active Directory (AD) – Identity management & authentication.

**4.** AI & Machine Learning

* Azure AI Services – Prebuilt AI models for vision, speech, and language processing.
* Azure Machine Learning – Custom AI model training and deployment.
* Cognitive Services – AI-powered APIs for natural language processing (NLP), facial recognition, and chatbots.

**5.** DevOps & Automation

* Azure DevOps – CI/CD pipeline automation for app deployment.
* Azure Monitor & Application Insights – Monitoring and logging services.
* Azure Logic Apps – Workflow automation.

**6.** Hybrid & Multi-Cloud Solutions

* Azure Arc – Manage on-premises, multi-cloud, and edge environments.
* Azure Stack – Extends Azure services to on-premise data centers.

***Key Use Cases of Microsoft Azure***

**1️.** Cloud Hosting & Virtual Machines (VMs)

Use Case: Running applications, websites, and virtual desktops in the cloud.

* Deploy Windows & Linux Virtual Machines (VMs)
* Scale applications using Azure Kubernetes Service (AKS)
* Example: Businesses use Azure VMs to run ERP systems, customer portals, and remote desktops.

**2️.** Cloud Storage & Backup

Use Case: Storing files, databases, and backups securely.

* Use Azure Blob Storage for unstructured data (like images, videos, and logs)
* Backup critical data using Azure Backup
* Example: Media companies use Azure for video streaming storage.

**3️.** Database Management

Use Case: Hosting relational & NoSQL databases in the cloud.

* Azure SQL Database – Managed relational databases (like MySQL, PostgreSQL).
* Cosmos DB – NoSQL database for global-scale applications.
* Example: E-commerce sites use Azure SQL for managing product data.

**4️.** Website & Web App Hosting

Use Case: Deploying websites & web applications without managing servers.

* Azure App Service – Deploy web apps using .NET, Python, Node.js, etc.
* Azure Functions – Run serverless applications on demand.
* Example: Startups use Azure App Service to launch websites quickly.

**5️.** Artificial Intelligence (AI) & Machine Learning (ML)

Use Case: Automating tasks, chatbots, and predictive analytics.

* Azure AI Services – Prebuilt AI models for speech, vision, and language processing.
* Azure Machine Learning – Train & deploy custom AI models.
* Example: Banks use Azure AI for fraud detection and customer service chatbots.

**6️.** Internet of Things (IoT) Solutions

Use Case: Connecting and analyzing data from IoT devices.

* Azure IoT Hub – Manage smart devices & sensors.
* Azure Digital Twins – Simulate real-world environments.
* Example: Smart cities use Azure IoT for real-time traffic monitoring.

***Why Use Microsoft Azure?***

* Enterprise-Friendly – Seamless integration with Microsoft tools (Windows, SQL Server, Office 365).
* Strong Hybrid Cloud Capabilities – Works well with on-premises infrastructure.
* Security & Compliance – Advanced security tools and compliance for regulated industries.
* AI & Big Data Advantage – Built-in analytics and AI services
* Multi-Cloud & Hybrid Support – Works with AWS, GCP, and on-premise systems.

Companies like BMW, Coca-Cola, and Samsung use Azure for cloud computing, AI, and analytics.

***Problems Faced When Using Microsoft Azure & Solution***

**1.** Complex Pricing & Unexpected Costs

Problem:

* Azure’s pricing model is complex, with different pricing tiers for compute, storage, networking, and AI services.
* Hidden costs such as outbound data transfer, storage transactions, and auto-scaling charges can lead to high bills.

Solution:

✔ Use the Azure Pricing Calculator to estimate costs before deploying.

✔ Set up Azure Cost Management & Budgets to track and control spending.

✔ Use Reserved Instances & Hybrid Benefit to save costs for long-term workloads.

**2.** Steep Learning Curve for Beginners

Problem:

* Azure has a vast number of services (over 200+), making it difficult for new users to navigate.
* Configuring Azure Virtual Networks (VNet), IAM roles, and security groups can be overwhelming.

Solution:

✔ Start with Azure Free Tier and try hands-on labs.

✔ Follow Microsoft Learn for structured training.

✔ Use Azure Quickstart Templates for pre-configured deployments.

**3.** Service Downtime & Reliability Issues

Problem:

* Outages & downtime have occasionally affected Azure services in certain regions.
* Not all Azure services have multi-region availability by default.

Solution:

✔ Use Azure Status Page to monitor outages.

✔ Deploy resources across multiple regions for redundancy.

✔ Use Azure Site Recovery and Backup for disaster recovery.

**4.** Security & Access Management Challenges

Problem:

* Misconfigured Azure Active Directory (AD) roles can expose sensitive data.
* Publicly accessible storage accounts can lead to security breaches.

Solution:

✔ Follow the Principle of Least Privilege (PoLP) when assigning IAM roles.

✔ Enable Multi-Factor Authentication (MFA) for better security.

✔ Use Azure Security Center to detect and prevent vulnerabilities.

**5.** Networking & Performance Issues

Problem:

* Latency problems when deploying workloads far from users.
* Configuring firewalls, VPNs, and ExpressRoute connections can be complex.

Solution:

✔ Use Azure Traffic Manager and Azure CDN to reduce latency.

✔ Optimize network performance using Azure Front Door for global traffic routing.

**6.** Challenges with Hybrid & Multi-Cloud Integration

Problem:

* Managing on-premises and Azure environments together can be difficult.
* Multi-cloud deployments (Azure + AWS + GCP) require extra configurations.

Solution:

✔ Use Azure Arc for unified multi-cloud and hybrid management.

✔ Use ExpressRoute for secure hybrid cloud connections.

**7.** Limited Customer Support (Expensive for Small Businesses)

Problem:

* Azure's free support is limited, and premium support plans can be expensive.
* Slow response times for non-enterprise users.

Solution:

✔ Use Microsoft Q&A and Azure Community Forums for common issues.

✔ Opt for Basic Support Plan instead of premium if full enterprise support isn’t needed.

***How to Use Microsoft Azure***

**1.** Create a Microsoft Azure Account

* Go to Azure Portal.
* Click "Start free" (Azure offers a $200 Free Credit for 30 days).
* Sign in with your Microsoft account or create a new one.
* Enter payment details (you won’t be charged unless you exceed the free limits).

**2.** Access the Azure Portal

Once signed in, you'll land on the Azure Portal (the web-based dashboard where you manage cloud resources).

Key Features in the Azure Portal:

✔ Home Dashboard – View all resources and services

✔ Resource Groups – Organize resources by project or application

✔ Azure Marketplace – Find pre-built solutions (like VMs, databases, and AI models)

**3.** Create a Virtual Machine (VM) – Compute Service

Azure Virtual Machines (VMs) let you run applications, host websites, and perform computing tasks.

Steps to Deploy a VM:

1️. In the Azure Portal, go to Virtual Machines

2️. Click "Create" → "Azure Virtual Machine".

3️. Select an OS (Windows, Ubuntu, etc.).

4️. Choose a VM size (e.g., B1s for small workloads, D2s for high performance).

5️. Configure networking (public/private IP, firewall rules).

6️. Click Review + Create.

**4.** Store & Manage Data – Storage Services

Azure provides different types of cloud storage, including Blob, File, and Disk storage.

Steps to Create a Storage Account:

1. In the Azure Portal, go to Storage Accounts.

2️. Click "Create".

3️. Choose a name and region.

4️. Select a storage type (Blob Storage for unstructured data, File Storage for shared access).

5️. Click Review + Create.

**5.** Set Up a Database – Azure SQL Database

Azure SQL Database is a fully managed relational database (similar to MySQL or PostgreSQL).

Steps to Create a SQL Database:

1️. In the Azure Portal, go to Azure SQL.

2️. Click "Create SQL Database".

3️. Select an existing Resource Group or create a new one.

4️. Choose a Server Name and Authentication Mode.

5️. Click Review + Create.

**6.** Deploy a Web App – Azure App Service

Azure App Service lets you deploy websites and web apps without managing infrastructure.

Steps to Deploy a Web App:

1️. In the Azure Portal, go to App Services.

2️. Click "Create".

3️. Choose a Web App Name and Runtime (Node.js, Python, .NET, etc.).

4️. Select a Pricing Plan (F1 Free Tier is available).

5️. Click Review + Create.

**7.** Secure & Manage Access – Azure Active Directory (AD)

Azure AD provides identity and access management for users and applications.

Steps to Set Up Azure AD:

1️. In the Azure Portal, go to Azure Active Directory.

2️. Add Users & Groups to manage access.

3️. Set up Multi-Factor Authentication (MFA) for security.

4️. Configure Roles & Permissions for granular access control.

**8.** Monitor & Optimize Resources – Azure Monitor

Azure Monitor helps track resource performance and detect issues.

Steps to Use Azure Monitor:

1️. In the Azure Portal, go to Azure Monitor.

2️. Set up Alerts & Logs for tracking events.

3️. Use Application Insights for monitoring web apps.

4️. Optimize costs with Azure Cost Management.

**9.** Automate Tasks – Azure Functions (Serverless Computing)

Azure Functions lets you run code without managing servers (like AWS Lambda).

Steps to Create an Azure Function:

1️. In the Azure Portal, go to Azure Functions.

2️. Click "Create"

3️. Select a Trigger Type (HTTP, Timer, Queue, etc.).

4️. Deploy your function using Visual Studio Code or the Azure CLI.

**10.** Learn More & Get Certified

Resources to Learn Azure:

✔ Microsoft Learn – Free official training from Microsoft.

✔ Azure Free Tier – Try services without charges.

✔ Microsoft Certifications – Get certified in Azure Fundamentals (AZ-900).