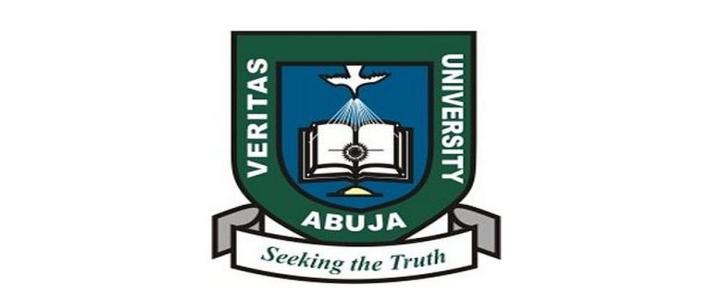
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Question:

Write extensively on the following Cloud terminologies

1. AWS

2. Google cloud plattorm

3. Microsoft Azure

What is the Cloud?

The cloud is a collection of servers and data centers located around the globe that store and manage data, applications, and other computing resources. Instead of storing data and running applications on your own computer or physical servers, you access them through the internet from a cloud provider's servers.

AWS (Amazon Web Services), GCP (Google Cloud Platform), and Microsoft Azure are all categorized as public cloud platforms. They offer a wide range of cloud computing services, including Infrastructure as a Service (laaS), Platform as a Service (PaaS), and Software as a Service (SaaS), accessible over the internet.

1. AWS (Amazon Web Services):

Amazon Web Services (AWS) is the world’s most comprehensive and broadly adopted cloud, offering 200 fully featured services from data centers globally. Millions of customers, including the fastest growing startups, largest enterprises, and leading government agencies are using AWS to lower costs, become more agile and innovate faster.

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 has the largest and most dynamic community, with millions of active customers and tens of thousands of partners globally. Customers across virtually every industry and of every size, including startups, enterprises, and public sector organizations, are running every imaginable use case on AWS. The AWS Partner Network (APN) includes thousands of systems integrators who specialize in AWS services and tens of thousands of independent software vendors (ISVs) who adapt their technology to work on AWS.

AWS is architected to be the most flexible and secure cloud computing environment available today. It’s core infrastructure is built to satisfy the security requirements for the military, global banks, and other high-sensitivity organizations. This is backed by a deep set of cloud security tools, with over 300 security, compliance, and governance services and features. AWS supports 143 security standards and compliance certifications, and all 117 AWS services that store customer data offer the ability to encrypt that data.

With AWS, you can leverage the latest technologies to experiment and innovate more quickly. They are continually accelerating their pace of innovation to invent entirely new technologies you can use to transform your business. For example, in 2014, AWS pioneered the serverless computing space with the launch of AWS Lambda, which lets developers run their code without provisioning or managing servers. And AWS built Amazon SageMaker, a fully managed machine learning service that empowers everyday developers and scientists to use machine learning-without any previous experience.

AWS has unmatched experience, maturity, reliability, security, and performance that you can depend upon for your most important applications. For over 17 years, AWS has been delivering cloud services to millions of customers around the world running a wide

variety of use cases. AWS has the most operational experience, at greater scale, of any cloud provider.

AWS has the most extensive global cloud infrastructure. The AWS Region and Availability Zone model has been recognized by Gartner as the recommended approach for running enterprise applications that require high availability.

AWS pros and benefits

As far as strengths, because AWS had such a large head start on current competitors, AWS has the most robust and comprehensive offering. There are currently 175 services and counting. New features, enhancements, and services come out weekly. Many of these new features are the direct results of customer requests.

Additionally, AWS has a long history of price reductions and provides many tools and programs to help companies really optimize their spend.

Abundant Services and Technology

AWS provides such a wide variety of services that almost any use-case fits right in. Services range from the basic storage and compute all the way to the more specialized niche services like streaming media, robotics, and even quantum computing. They even have a service that lets you control your fleet of space satellites, should you have a need for that.

In addition to the usual disaster recovery and remote data center use cases, organizations are increasingly leveraging AWS as an investment in machine learning and data analytics to help them make sense out of all their data.

Many organizations have gone all-in, moving their entire IT operations into AWS and have realized great gains in agility, efficiency, and reliability. Now, obviously, we've just scratched the surface here and if you'd like to dig in a little deeper into that next layer, we have some great resources.

AWS cons and weaknesses

As far as downsides, when you're as big as Amazon, you're bound to step on some toes. Many retail companies view Amazon as a direct competitor and simply can't bring themselves to give their rival any money whatsoever. (Imagine if you're doing business with Walmart. They're likely not going to be eager to give you money if it means giving money to Amazon. This is one of the reasons many companies who have customers that may view Amazon as a competitor take a multi-cloud approach.) This will probably get even more complicated as Amazon expands its reach into other industries.

Additionally, while AWS does not charge you to put your data into their cloud, you do have to pay a little bit to get that data back out. These are called "egress charges." It's not very much given the potential value, but it is something to note.

AWS (Amazon Web Services): Expanded Horizons

* Cost Optimization and Management

Beyond basic price reductions, AWS offers granular cost management tools like AWS Cost Explorer, which provides detailed insights into spending patterns and allows for forecasting. AWS Budgets enables setting custom budgets and receiving alerts when costs exceed defined thresholds. Savings Plans offer significant discounts (up to 72%) in exchange for a commitment to a consistent amount of compute usage (measured in $/hour) for a 1- or 3-year term. Further optimizing costs involves right-sizing instances, leveraging spot instances for fault-tolerant workloads, and automating resource scheduling with tools like AWS CloudWatch Events.

* Architectural Patterns and Best Practices

AWS advocates for well-architected frameworks encompassing operational excellence, security, reliability, performance efficiency, and cost optimization. Reference architectures such as the three-tier web application and microservices-based designs are widely adopted. Serverless architectures utilizing AWS Lambda and API Gateway are gaining prominence for their scalability and cost-effectiveness. Event-driven architectures leveraging Amazon SNS and SQS facilitate decoupling and asynchronous communication between services.

* Containers and Orchestration

AWS offers a comprehensive suite of container services, including Amazon Elastic Container Service (ECS) for orchestrating containers on AWS infrastructure and Amazon Elastic Kubernetes Service (EKS) for managing Kubernetes clusters. AWS Fargate provides serverless compute for containers, eliminating the need to manage underlying EC2 instances. These services enable organizations to modernize applications, improve resource utilization, and accelerate deployment cycles.

* Data Lakes and Advanced Analytics

AWS provides a robust platform for building data lakes using Amazon S3 as the central repository for structured and unstructured data. AWS Glue simplifies data discovery, cataloging, and ETL (Extract, Transform, Load) processes. Amazon Athena enables querying data directly from S3 using standard SQL. Amazon EMR provides a managed Hadoop and Spark environment for large-scale data processing and analytics. These tools enable organizations to derive actionable insights from their data, power data-driven decision-making, and develop advanced analytics applications.

* Future Trends and Innovations

AWS is at the forefront of emerging technologies such as artificial intelligence, machine learning, and quantum computing. Amazon SageMaker provides a comprehensive platform for building, training, and deploying machine learning models. AWS offers a range of AI services, including Amazon Rekognition for image and video analysis, Amazon Comprehend for natural language processing, and Amazon Lex for building conversational interfaces. In the realm of quantum computing, AWS offers Amazon Braket, a service that allows researchers and developers to experiment with different quantum computing hardware and algorithms.

1. Google Cloud Platform(GCP):

Google Cloud Platform is a public cloud vendor like competitors, Amazon Web Services and Microsoft Azure. With GCP and other cloud vendors, customers are able to access computer resources housed in Google’s data centers around the world for free or on a pay-per-use basis. GCP offers a suite of computing services to do everything from GCP cost management  to data management to delivering web and video over the web to AI and machine learning tools.

GCP first came online in 2008 with the launch of a product called App Engine. In April 2008, Google announced a preview release of App Engine, a developer tool that allowed customers to run their web applications on Google infrastructure. (For perspective, this was two years after Amazon had launched its cloud computing service, starting with the release of S3 cloud storage and EC2.) According to Google, the goal of App Engine was to “make it easy to get started with a new web app, and then make it easy to scale when that app reaches the point where it’s receiving significant traffic and has millions of users. To source the feedback needed to make improvements to this preview release, App Engine was made available to 10,000 developers.

These early-adopter developers could run apps with 500 MB of storage, 200 million megacycles of CPU per day, and 10 GB of bandwidth per day. By late 2011, Google pulled App Engine out of preview mode and made it an official, fully supported Google product. In the decade since, Google has built and acquired more services and products to enhance the user experience of its cloud platform. Today, Google Cloud Platform is one of the top public cloud vendors in the world. Google Cloud customers include Nintendo, eBay, UPS, The Home Depot, Etsy, PayPal, 20th Century Fox, and Twitter.

Google Cloud Platform infrastructure, regions, and zones

Google’s global infrastructure currently has 24 locations around the world where Google Cloud Platform resources are offered.  Locations start with a region and within a region are availability zones. These zones are isolated from a single point of failure. Some resources such as the HTTP global load balancer are global and can receive requests from any of the Google edge locations and regions. Other resources, like storage, can be regional. The storage is distributed across multiple zones within a region for redundancy.

And finally zonal resources, including compute instances, are only available in one specific zone within one specific region. When deploying applications on GCP, you must select the locations depending on the performance, reliability, scalability, and security needs of your organization.

Each GCP region offers a category of services. Some services are limited to specific regions. Major services of Google Cloud Platform include:

* Computing and hosting
* Storage and database
* Networking
* Big Data
* Machine learning

Pros and Cons:

* When it comes to strengths, Google Cloud Platform documentation is second to none. A crowd favorite is how Google incorporates the actions into GCP's documents. They're divided into an overview section, followed by a hands-on section, walking the reader through an implementation of the feature or service.
* Another strength for GCP is the global backbone network that uses advanced software-defined networking and edge-caching services to deliver fast, consistent, and scalable performance. Yes, the premium-tier global network costs a little more, but in my opinion, designing architectures using a virtual private cloud (VPC) that automatically routes traffic on a global network is worth it.

Weaknesses:

* Google Cloud Platform has far fewer services than those offered by AWS and Azure.
* In addition to that, GCP has an opinionated model of how their cloud services should be used, and that's geared towards software developers.

Google Cloud Platform use cases:

Here's a few of the ideal GCP scenarios.

* If you're a large organization that needs to set a lot of permissions while working on projects, Google has an excellent organizational hierarchy that allows you to set policy at the top level and forget it. This enables departments to move fast yet remain bound to organizational constraint.  
  In GCP, all resources belong to a specific GCP project. And when that project is deleted, all the resources are removed from the platform preventing left behind resources that lead to increased costs.

In addition, there's an excellent feature that allows projects to be assigned to different billing accounts over time.

* Another ideal use case for using GCP is for organizations that need the benefits of advanced Big Data, machine learning and analytics.

Businesses can ingest the data into GCP and then data mine the key performance indicators for their products — or gather customer data to recommend additional purchase suggestions based on buying history.

Google Cloud Platform (GCP): Expanding the Scope

* Networking Capabilities and Global Infrastructure

GCP's software-defined networking (SDN) capabilities provide advanced features such as custom virtual private clouds (VPCs), global load balancing, and traffic management. Cloud Interconnect offers dedicated private network connections to GCP, enabling hybrid cloud scenarios. Cloud DNS provides a scalable and reliable DNS service. Google's global fiber optic network ensures low latency and high bandwidth connectivity to its data centers around the world.

* Data Governance and Compliance

GCP offers a suite of tools for data governance and compliance, including Cloud Data Loss Prevention (DLP) for identifying and protecting sensitive data, Cloud Security Scanner for identifying vulnerabilities in web applications, and Access Approval for controlling access to customer data by Google personnel. GCP complies with a wide range of industry standards and regulations, including GDPR, HIPAA, and PCI DSS.

* Application Development and Modernization

GCP provides a comprehensive platform for application development and modernization, including Cloud Build for continuous integration and continuous delivery (CI/CD), Cloud Source Repositories for version control, and Cloud Code for developing and debugging applications directly from IDEs. Google Kubernetes Engine (GKE) enables organizations to modernize applications by containerizing them and deploying them to Kubernetes clusters.

* Serverless Computing and Event-Driven Architectures

GCP offers a range of serverless computing options, including Cloud Functions for running event-driven code, Cloud Run for deploying containerized applications without managing infrastructure, and App Engine for building scalable web applications. Eventarc provides a centralized event bus for building event-driven architectures. These services enable organizations to develop and deploy applications quickly, scale automatically, and pay only for what they use.

* AI/ML Leadership and Innovation

GCP is recognized as a leader in artificial intelligence and machine learning. TensorFlow, an open-source machine learning framework developed by Google, is widely used for building and training machine learning models. Google Cloud AI Platform provides a comprehensive platform for developing, deploying, and managing machine learning models. GCP offers a range of pre-trained AI models for vision, speech, language, and translation.

1. Microsoft Azure:

Microsoft Azure is a public cloud platform with more than 200 products and services accessible over the public internet. Like other public cloud vendors, Azure manages and maintains hardware, infrastructure, and resources that can be accessed for free or pay-per-use, on-demand basis. Azure is the number two public cloud provider. Since its creation in 2008, Microsoft Azure has grown to become the second-largest of the top three public cloud platforms — just behind market leader Amazon Web Services (AWS) and ahead of Google Cloud Platform (GCP).

As of the second quarter of 2021, AWS controlled 31% of the market, Microsoft Azure took 22%, and Google Cloud sat at 8% market share, according to Statista. Microsoft Azure is a popular pick in the enterprise space, with Microsoft claiming that 95% of Fortune 500 companies use Azure.  Over the past few years, Microsoft has made moves that play to its unique strengths, using legacy footholds in organizations to ease reluctant organizations to the cloud. As a result, Azure adoption is increasing in enterprises while AWS adoption remains relatively flat, according to Flexera.

Historically, Azure has been the preferred choice for hybrid deployments. It is also well-regarded for its ability to sync well with legacy Microsoft solutions — the kind many businesses have been using for decades. Today, Microsoft Azure serves millions of applications, integrations, and customers. But its humble origins can be traced back to 2008 when it was announced as Project Red Dog. The name “Azure”, for those who never got too deep into the jumbo-sized crayon box, is taken from a lovely shade of sky blue.

At the time of publishing, Azure has 67 available and announced regions globally, more than 160 physical data centers, numerous availability zones, and millions of users. When talking about cloud infrastructure, Azure has a global network of regions, availability zones, and data centers. Azure regions are placed strategically all over the world to cover as large a percentage of the potential cloud customer as possible. Regions include Central U.S., Norway West, Brazil South, West India, South Africa North, Australia East, and everywhere in between.

Each region consists of one or more data centers and availability zones, which are made up of one or more data centers equipped with independent power cooling and networking. This means that a service in an availability zone will keep running if one of the parts of the zone becomes unavailable. Azure also has geographies. These usually contain more than a single region and allow customers with specific data residency and compliance needs to keep the data and applications close. Geography is defined as a discreet market for doing just that. Azure services are not all created equally either. Some require more resources than others and some just aren't as popular. For this reason, not all services are offered in all regions.

However, apart from the aforementioned government regions and newly established regions, most regions will have most of the Azure service catalog on offer. A few exotic services like Azure Machine Learning are sometimes only offered in one region within each geography.

Comparing Azure to the other cloud providers, Azure falls in the top three of most popular alongside AWS and GCP. AWS has the most market share, but Azure has the most regions, and GCP is growing rapidly. The documentation for Azure to learn from is decent. Documenting a whole cloud computing platform is a large task and maintaining it is a constant exercise.

Pros and cons:

Pros:

* First, Azure has a lot of data centers, and they keep expanding. This means services and your applications will be closer to users. It also means specific legal requirements for certain countries when it comes to cloud computing are more likely to be met.
* Because Microsoft has been supporting on-premises customers for 40-plus years, they have an extensive hybrid cloud offering to get all of their existing customers into cloud. They also have a very good integration with existing tools and technologies such as Visual Studio, Active Directory, and File Storage.

If you have applications written in the .NET framework, Azure is almost a no-brainer as well. Azure has the most industry certifications of any cloud provider, and this can be useful for certain countries or industries when having to adhere to these.

Cons:

While there aren't many drawbacks or areas of improvement for Azure, there are a couple.

* Since Azure is trying to be all things to all cloud-computing crowds, at times some services just don't get enough attention. This can mean that the new data analytics service you have made that uses a certain Azure feature might fall behind a bit as the feature disappears.
* Azure will try and keep up with every single trend in cloud computing, so the number of new services and renamed services can be overwhelming. The key is to focus on just the ones you need for your project.

Azure services and project use cases:

Let’s look at a couple of well-suited real-world use cases for Azure:

**Hybrid cloud**

Let’s start with the wonderful world of hybrid cloud. Microsoft has a long history of supplying on-premises compute systems, and a ton of those customers are still around. Are they going to throw all that they have away and buy it again because someone's written "cloud" on it? Of course not! But there is value in some of the Azure services for most companies. Azure is making it increasingly easy to implement a hybrid cloud strategy.  For example, using Azure Sentinel, you can monitor both your cloud assets and your on-prem services. Inadequate security is often a concern with hybrid setups, but with Sentinel express route and VPN gateways, this is just not an issue.

**Cosmos DB**

I can't talk about Azure and not mention Cosmos DB, one of the most impressive services on Azure. This single-digit-millisecond latency, automatic and instantly scalable global secure SQL database is about as cloudy as you can get. A company that is looking to scale globally or to several regions can provide an exceptional experience for the end-user by plugging Cosmos DB into the front-end application. You are guaranteed speed at any scale. It's super easy to plug into your application. It's fully managed, so no servers or maintenance to do. And it's cost-effective when used correctly with Azure cost management.

Microsoft Azure: Broadening the Perspective

Hybrid Cloud and Edge Computing

Azure excels in hybrid cloud scenarios with Azure Arc, which extends Azure management and services to on-premises, multi-cloud, and edge environments. Azure Stack Hub allows organizations to run Azure services on their own hardware. Azure IoT Edge enables edge computing scenarios by deploying AI and analytics workloads to edge devices. These services enable organizations to extend the benefits of the cloud to their existing infrastructure and develop new edge computing applications.

Security and Identity Management

Azure provides a comprehensive suite of security and identity management services, including Azure Active Directory (Azure AD) for identity and access management, Azure Security Center for threat detection and security management, and Azure Sentinel for security information and event management (SIEM). Azure Key Vault provides secure storage for secrets, keys, and certificates. Azure complies with a wide range of industry standards and regulations, including GDPR, HIPAA, and PCI DSS.

Database and Data Management

Azure offers a wide range of database and data management services, including Azure SQL Database for relational databases, Azure Cosmos DB for NoSQL databases, and Azure Synapse Analytics for data warehousing and big data analytics. Azure Data Factory provides a cloud-based ETL service for data integration. Azure Purview provides a unified data governance solution. These services enable organizations to manage and analyze their data effectively.

Developer Tools and Productivity

Azure provides a comprehensive set of developer tools and productivity services, including Visual Studio for developing applications, Azure DevOps for CI/CD, and GitHub for version control. Azure Logic Apps provides a serverless workflow automation service. Power Platform enables citizen developers to build low-code/no-code applications. These tools empower developers to build and deploy applications quickly and easily.

Emerging Technologies and Innovation

Microsoft is investing heavily in emerging technologies such as artificial intelligence, blockchain, and quantum computing. Azure Cognitive Services provides pre-trained AI models for vision, speech, language, and decision-making. Azure Blockchain Service provides a managed blockchain platform. Azure Quantum provides a platform for developers to experiment with and build quantum solutions.

**Differences Between AWS, GCP, and Azure**

Amazon Web Services (AWS) is the most mature and widely adopted cloud platform, offering the broadest range of services and the most extensive global infrastructure. It is preferred by enterprises that require a highly scalable, feature-rich environment with extensive third-party integrations.

Google Cloud Platform (GCP) stands out for its strengths in artificial intelligence, machine learning, and big data analytics. It offers superior networking and high-performance computing services, making it the best choice for organizations heavily involved in data science, analytics, and AI-driven applications.

Microsoft Azure is best known for its strong hybrid cloud capabilities, making it the preferred option for enterprises already using Microsoft products such as Windows Server, Active Directory, and Office 365. It is also ideal for businesses with strict compliance and security requirements, particularly in regulated industries such as healthcare and finance.

While AWS offers the most comprehensive service catalog, GCP excels in AI/ML innovation, and Azure provides the best hybrid cloud integration. The choice of platform depends on specific business needs, existing infrastructure, and long-term strategic goals.

In conclusion, the cloud computing landscape is dominated by three major players: AWS, Google Cloud Platform (GCP), and Microsoft Azure. Each platform offers a comprehensive suite of services, ranging from basic compute and storage to cutting-edge technologies like machine learning, AI, and quantum computing. While AWS currently holds the largest market share with the most extensive service catalog, Azure boasts the most global regions and excels in hybrid cloud solutions, and GCP distinguishes itself with its strengths in data analytics and innovative open-source contributions. Organizations choose between these platforms based on factors like existing IT infrastructure, specific application requirements, data governance needs, and long-term strategic goals. The cloud continues to evolve rapidly, driving innovation and enabling businesses to achieve greater agility, scalability, and cost-efficiency.