



Comparative Study Of Various Cloud Initiatives

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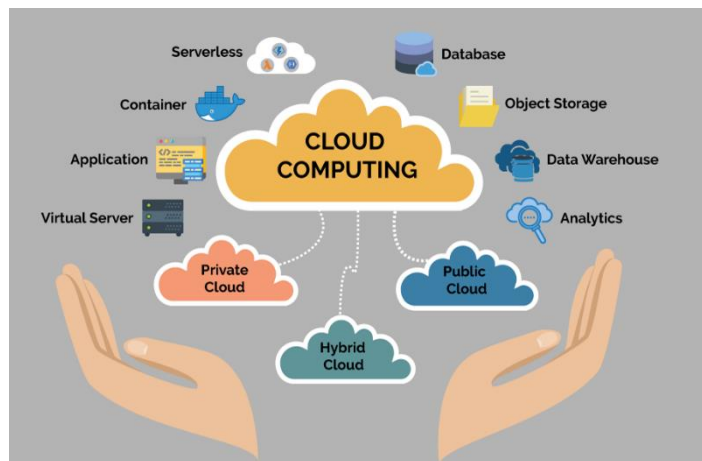
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Cloud Computing:

Cloud Computing is the on-demand delivery of IT resources over the internet. To access the services, we need to pay. Instead of buying, owning and maintaining own computing infrastructure or data centres, Companies can rent access to anything from applications to storage from a cloud service provider.

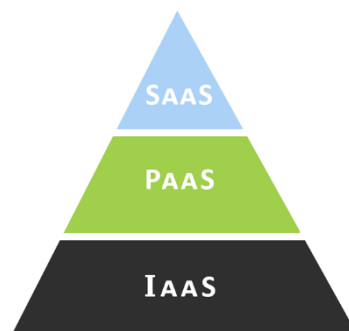
In today's world cloud computing is used by many organizations of every type for wide variety of purpose such as for software development and testing, big data analytics, data backup, etc. Major benefits of using cloud computing are that it gives access to a range of technologies so that we can create, build faster than we imagine, it provides elasticity to grow and shrink the resources according to the situation of the business and only pay for that. Moreover, it reduces the cost and deploy work globally.



Categories of Cloud Computing:

There are three main categories of cloud computing: **Software as a service**, **Platform as a service** and **Infrastructure as a service**. Each of them differs in terms of control, flexibility and management.

1. **Software as a Service (SaaS):** SaaS is on the top of the stack because users interact primarily with software hosted on the cloud, and not the platform or infrastructure on which it runs.
2. **Platform as a Service (PaaS):** It allow users/organizations to create and deploy applications.
3. **Infrastructure as a Service (IaaS):** It is simple infrastructure and hardware that powers the cloud.



There are many cloud service providers who offer a cloud-based platform for cloud computing such as:

- Amazon Web Services (AWS)
- Microsoft Azure
- IBM Cloud
- Google Cloud Platform

Amazon Web Service (AWS):



It is founded in 2006 by Amazon, AWS is the most comprehensive cloud service provider with a wide range of products and services. AWS is a mixture of Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). It provides tools such as database storage, computer power and content delivery services. Amazon was the first one to introduce pay-as-you-go cloud computing model. It offers services efficiently to everyone from small organizations to large organizations which has made the AWS best cloud-based platform, leader in cloud computing market.

AWS provides all the latest and trending technological innovation such as Machine Learning, Blockchain, Virtual Reality (VR), Internet of Things (IOT), Big Data Management etc. Some of its IaaS and PaaS services are EC2 (Elastic Cloud Compute), S3 (Simple Storage Service), RDS (Relational Database Service). Basically, AWS provides more than 100 services.

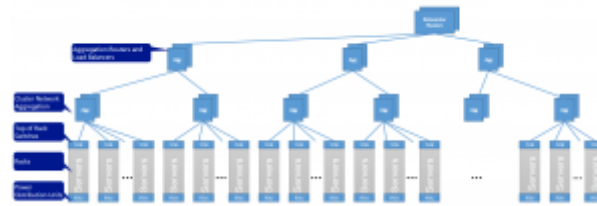
Microsoft Azure:



Azure is the second largest cloud-based platform provided by Microsoft. It is a public and private cloud platform. Microsoft Azure also includes all three major categories of cloud computing Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). It also provides same services as AWS such as Big Data, Virtual Reality, etc. Moreover, Azure provides organizations to create applications in such a way which ensure high data security. Azure Migration Centres has the capability to perform cloud transfer faster and quicker. Furthermore, to provide more opportunities to the users they have partnership with other organizations such as Adobe, Cisco, etc.

Microsoft Azure uses a technology called virtualization. “Virtualization separates the close coupling between a computer’s CPU or server and its operating system by means of an abstraction layer called a hypervisor. The hypervisor emulates all the functions of a real computer or server and its CPU in a

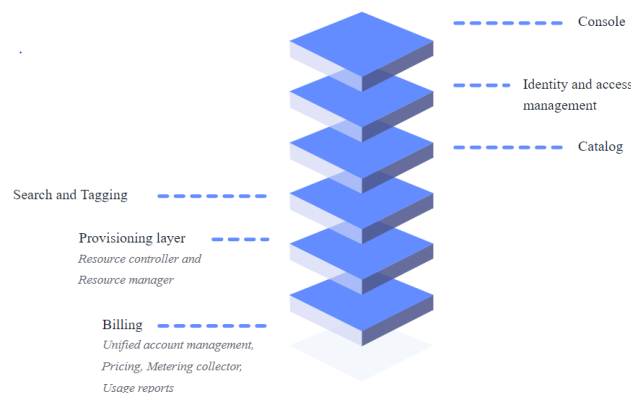
virtual machine.”¹ So, multiple virtual machines can run at the same time and on each machine can run different compatible operating system. With the help of this virtualization technology, Azure rethinks it on a massive scale in Microsoft data centres around the world.



IBM Cloud:

IBM cloud is a mixture of Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). The platform scales and supports both small development teams and organizations, and large enterprise businesses. It has data centres all around the world, it is fast and performs reliably in a tested and supported environment.

It is made up of multiple components that works together consistent and better experience.



At the top it has a robust console which provide the GUI (Front End) for viewing, creating and managing the cloud resources. Then it has an identity and access management component which allow users to control access of resources across cloud and also allow platform services. The next component is Catalog which has hundreds of supported products. Search and Tagging mechanism are for filtering and identifying resources. Last is Account and Billing Management System which is used for credit card fraud protection and to provide exact usage for pricing plans to customers (Organizations).

Google Cloud Platform:



“Google Cloud consists of a set of physical assets, such as computers and hard disk drives, and virtual resources, such as virtual machines (VMs), that are contained in Google's data centres around the globe.

1. Melon. Raul, “How does Microsoft Azure work?”, 2018

Each data centre location is in a region. Regions are available in Asia, Australia, Europe, North America, and South America. Each region is a collection of *zones*, which are isolated from each other within the region. Each zone is identified by a name that combines a letter identifier with the name of the region.”² Google cloud platform allow us to do computing and hosting. We can choose whether to work in a serverless environment or to build our own cloud-based infrastructure so that the person has more control and flexibility or to use a managed application platform.

As there is a distribution of resources on google cloud platform it provides several benefits to the organization which also includes redundancy in case of failure, but there are some rules to be followed how resources can be used together.

Comparative Study of Amazon Web Service (AWS), Microsoft Azure and Google Cloud Platform

- **In terms of Storage Services:**

AWS provide a hybrid platform through its storage gateway. This gateway provides a secondary storage option with backup feature. Organizations can also use single object storage with S3 for large containers. Moreover, file storage expands the capability as we create files. AWS also provides SQL supported database, ElastiCache for additional memory and data migration service.

Azure provides a dedicated storage option called Blob Storage. Azure also provides users with the largest array of databases, which support three different types of SQL-based formats. Their Server Stretch database is a hybrid that offers on- and off-premises storage for companies that use Microsoft SQL Server for their enterprise, but might utilize other protocols on the cloud. This is the only company of the three that has a backup recovery system, which is in addition to their archival and standard system backups.

Google Cloud provides basic storage and database support. It provides both NoSQL and SQL database support.

- **In terms of Computation:**

There are several components that AWS, Azure and GCP have in common, including a high degree of scalability, per-second billing, speed, security, and agility. The main difference is their computational service.

AWS primary compute service is Amazon Elastic Compute Cloud (E2C). E2C integrates with almost all amazon web services which provides a high degree of flexibility and allow database administrators to optimize the cost. Moreover, it a ability to deploy thousands of server in seconds. Some others AWS compute features are AWS Batch, VMware Cloud for AWS, AWS Fargate, AWS Lambda, Amazon Lightsail, AWS Outposts.

AZURE compute features rely on a network of virtual machines so, that provide a range of computing solutions such as development, testing, etc. It is based on an open source platform which is compatible with Windows, Linux, SQL Server, Oracle. Other compute features of Azure include Azure Batch, Service Fabric, Paas and FaaS (Function as a Service).

2. Google, “Google Cloud Overview”

Google Cloud use Kubernetes containers, this is the most popular platform and it is their main service model. Although GCP supports Docker containers also. Cloud functions is still in beta phase but organizations can allow the services to manage resources, automatically scale according to the traffic, deploy code from google cloud. Other GCP compute features include Google App Engine, Knative, Docker Container Registry.

- **In terms of Key Tool:**

AWS has three key tools AI/ML, IOT and Serverless. Their key tools allow organizations to utilize SageMaker for staff training and deploying machine learning. It is also used to power Alexa. Another is Lambda serverless computing environment which allow to deploy all the apps from their serverless repository.

Azure has fewer AI tools compare to AWS and the developed once are designed to perform specific function for an organization. Their Cognitive Services is a suite of API-supported tools that integrate with on-premises Microsoft software and business apps. Their serverless platform allows to manage complex workloads.

Google key tools are good in algorithms and in SEO and also has a strong AI/ML specially when it comes to developing an enterprise applications/solution. Their cloud-based enterprise features run the gamut from natural language, translation, and speech that's ideal for transitioning into global enterprise coordination to ML app development. GCP has large open source library called TensorFlow which is used by AWS.

- **In terms of Price:**

AWS pricing structure is very complex, it does not provide better transparency, third party app should be used to see the costing. They offer 750 hours of EC2 service per month for up to 12 months as part of their free tier.

Azure offers 750 hours of the Windows or Linux B1S addition of their primary compute platform, Virtual Machines, per year (it's free to try, which is nice for any business who wants to test the cloud).

Google is the one which differs in terms of pricing structure. It is more customer friendly. They strive to beat the list prices offered by most cloud services providers and give steep discounts and other incentives to win business. If you're looking for an easy to navigate, budget-friendly service that shows promising growth potential, this is the platform for you.

Pros and Cons to decide which is best:

Pros and Cons of AWS

This company has the benefit of age and experience when it comes to cloud-based enterprise solutions. Although their pricing structure is difficult. They offer various types of services regardless of the type or size of your organization.

Amazon seems perched to dominate based on sheer size and variety, notably from their flagship offering, Elastic Compute Cloud (EC2). In every computing function and service, scale dominates all. This might be considered the department store of cloud-based enterprise solutions, with lots to choose from but not a lot of personalized service.

If the organization is looking for range and options for on- and off-premises storage and databases. Although AWS only provides a basic system backup service, the range of storage solutions offer several innovations. They don't offer a true hybrid model, but their server Gateway allows you to create one.

AWS is second to none when it comes to the depth and breadth of tools and technology. They're at the forefront of addressing AI and machine learning tech issues and pushing the boundaries of face, voice, and object recognition further.

Pros and Cons of Azure

Azure's commitment to advancing the open-source community and integration with the software and apps that many companies are already using makes it ideal for start-ups and developers. This means that the configuration and integration are effortless, and there are fewer concerns about compatibility.

Moreover, this is currently the only platform of the big three to offer a hybrid cloud model. That gives companies the best of both worlds when it comes to scalability and security. They are best known for the Virtual Machines service and AI optimization that's incorporated into almost every feature and function. Also, the best advantage of hybrid cloud platforms is demonstrated in its storage solutions. Companies are able to take advantage of off-site storage for non-essential functions and some applications. It's also the only platform among the three that offers more than one backup service and a website recovery function and it has the highest number of SQL-supported databases.

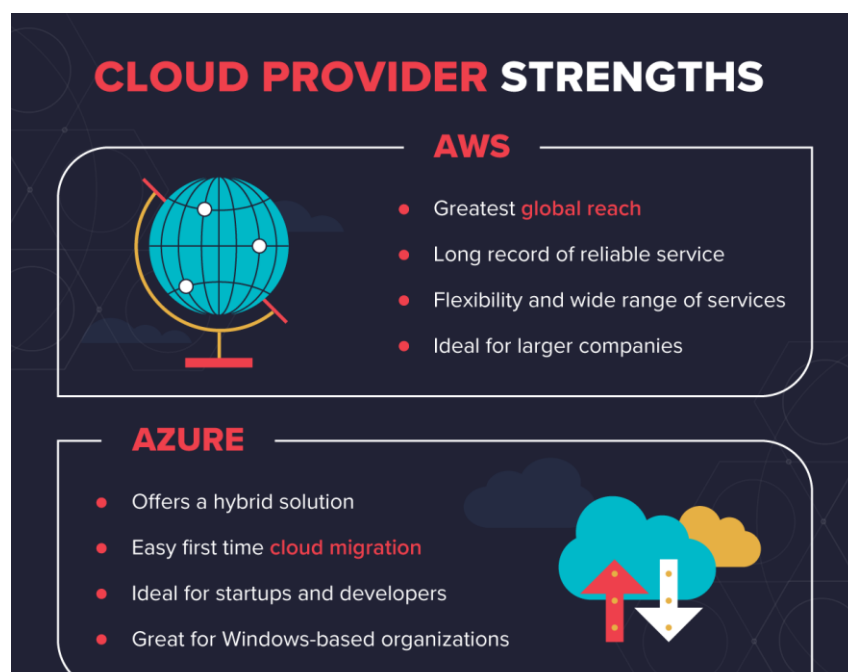
Pros and Cons of Google


Google Cloud is still growing, and a number of their basic features are still in the beta phase. Their basic compute platform, creatively called Google Compute, is most important and famous for their roster of services. They support both Windows and Linux, and organization can custom configure your platform. The focus of GCP is on Kubernetes deployment, which is an area of expertise for Google.

If we talk about in terms of Storage solutions it is lacking, mainly due to an absence of backup options. However, they do offer both SQL and NoSQL support. Moreover, the available tools and functions seem to be a work in progress.

Conclusion:

The things that all three platforms have in common are on-demand pricing, a free tier, great support, and an emphasis on security.





GOOGLE

- Complete container-based model
- For sites in a hyperscale networking environment
- Most **cost-efficient and eco-conscious** option
- Ideal for creators of cloud-based apps and software

If the organizations perform all its operation on Microsoft product then Microsoft Azure is the best option and the organizations that need less reach and more innovation can go for Google Cloud Platform. So, basically it depends on the needs and requirement of the organization which cloud to use.

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