

# **Cloud Computing Fundamentals: Comparative Evaluation and Opinions Between Different Types of Cloud Computing Services Providers**

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## **1 Introduction**

Now a days, the need for cloud computing services is on high demand due to its benefits. Cloud computing is the on-request accessibility of PC framework assets, particularly information stockpiling and processing power, without direct dynamic administration by the client. The term is commonly used to depict server farms accessible to numerous clients over the Internet. Huge mists, overwhelming today, frequently have capacities conveyed over various areas from local servers.

delivering hosted services over the web. These services are divided into 3 main types: platform as a service (PaaS), infrastructure as a service (IaaS), and software as a service (SaaS). The clouds are often non-public or public. The goal of cloud computing is to produce straightforward, simple, ascendable access to computing resources and technology services.

Cloud computing works by permitting consumer devices to access information over the web, from isolated far databases, servers, and computers. Connections between the front and back ends are managed by a central server. The central server depends on protocols to facilitate the exchange of knowledge. In this report we will discuss more about the differences between famous cloud computing services providers to know the best one to use, and get the most benefit from it.

## **2 Comparative Evaluation**

Comparing is a high order method to ensure and achieve the best explanation about any topic, in our case we will compare between famous cloud computing service providers which are, Amazon EC2, Google Cloud Platform, and Microsoft Azure from nine important points such as, storage, security, and performance.

**Amazon EC2** starting with Amazon Elastic Compute Cloud, (AWS) is a web service that gives secure, resizable compute capability within the cloud. it's designed to create web-scale cloud computing easier and efficient for developers. It uses IaaS (Infrastructure as a Service) as a service model thus, it can provide services such as,

payment storage, virtualization, and networking. When it comes to virtual machine (VM) Amazon EC2 offer many tiers to choose from, included in the table below.

**Table 1.** (VM) Types or tiers offered by Amazon EC2.

Tiers	Requests or per month	Description
Amazon EC2	750 Hours	Resizable compute capacity in the Cloud.
AWS Lambda	1 Million	Compute service that runs code in response to events.
Amazon LightSail	750 Hours	Virtual Private Servers everything you need to jumpstart your project.

It provides also, storage and OS environments offered. Storage in (AWS) is implemented by store data using instance store method, this method. Amazon EC2 offers two main OS platform Windows, and Linux, Linux is more efficient to use in the case of cloud computing due to its performance compared to Windows.

Moving to the security part, security is one of the advantages using Amazon EC2 it is very secure to use and using very powerful firewalls. In performance and scalability (AWS) provides a very good performance and scalable in all aspects and very reliable to use now a days putting other companies that provide the same service in comparison.[1]

Pricing model here is not well presented and need hard work to understand. Amazon EC2 provides auto-scaling advantage, Auto Scaling helps fixing application availability and provides you to automatically add or remove or enhance EC2 instances according to orders defined by you. Lastly, one of the most important parts in the system is monitoring tools and services provided, (AWS) provides network traffic monitoring, disk I/O, and CPU utilization.

**Google Cloud Platform** is a suite of public cloud computing services offered by Google to provides infrastructure tools and services for users to build applications and services. Google provides GCP services in (IaaS), and (PaaS) models to support developers by AI, Big data analytics, IoT, and other important services. Storage options are standard nearline, cold line and archive separated based on different workloads as default classes have ability to change using OOP method, they share features like unlimited storage with no minimum object size, worldwide storage locations, low latency and other high-performance features.[3]

OS environments are customized images derived from standard ones that come directly from the operating system vendor to run on Compute Engine. Standard images are different in open or closed source, client usage or server usage and so on. GCP provides a lot of security products to allow clients to create policy based on your security needs, ask for showing access justifications the reason for access, use built-in security controls and use authentication & identification methods. Google Cloud's platform provides managed compute, database, and other services that scale quickly from zero to high request volumes with high performance.[2]

It uses only pay for what you use as professional way to serve clients, you can discover it by Google Cloud Pricing Calculator. (VMs) in GCP combined in families based on workload types, for example, memory-optimization.

**Table 2.** VMs families in Google Cloud Platform

E2 General purpose	N2, N2D, N1 General purpose	M2, M1 Memory-Optimized	C2 Compute-Optimized	A2 Accelerator-Optimized
Day-to-day computing at a lower cost	Balanced price/performance across a wide range of VM shapes	Ultra high-memory workloads	Ultra high performance for compute-intensive workloads	Optimized for high performance computing workloads
<ul style="list-style-type: none"> <li>• Web serving</li> <li>• App serving</li> <li>• Back office applications</li> <li>• Small-medium databases</li> </ul>	<ul style="list-style-type: none"> <li>• Web serving</li> <li>• App serving</li> <li>• Back office applications</li> <li>• Medium-large databases</li> <li>• Cache</li> <li>• Media/streaming</li> </ul>	<ul style="list-style-type: none"> <li>• Large in-memory databases like SAP HANA</li> <li>• In-memory analytics</li> </ul>	<ul style="list-style-type: none"> <li>• HPC</li> <li>• Electronic Design Automation (EDA)</li> <li>• Gaming</li> <li>• Single-threaded applications</li> </ul>	<ul style="list-style-type: none"> <li>• High performance computing (HPC)</li> <li>• Machine learning (ML)</li> <li>• Massive parallelized computation</li> </ul>

Auto-scaler, global load-balancing, internal load-balancer, auto-healing and auto-updating to reduce latency, improve performance and provide high environment elasticity. Manage instance group used to monitor VMs and other GCP products among different region zones using previous tools.

**Microsoft Azure** is a cloud computing service created by Microsoft for building, testing, deploying, and managing applications and services through Microsoft-managed data centers. Provides (SaaS), (PaaS), and (IaaS) models. Azure supports many different programming languages, tools, and frameworks. VMs option sets in Azure used to avoid physical failures in different levels, they are single VM, availability set, availability zone and region pairs regional protection within data residency boundaries. Azure VM instances grouped based on sizes, workloads and apps needed. Azure provides storage for structured, semi-structured and unstructured data in disks, files, containers, tables and queries whatever data formatted looks like.

Various versions and types of window and Linux OSs supported as instances on VMs like windows server 2012. Previously we mention physical protection in VM option set, Azure also has logical security, it provides identity checking tools like authentication, authorization, and MFA. Azure Security Center, information Protection and Advanced Threat Protection are advanced security tools used to protect from malware and DDoS attacks. Azure uses auto-scaling to achieve highly efficient performance to consider how applications scale and to implement PaaS offerings that have built-in scaling operations. Policy, managed desktop, blueprint, managed application center and management groups are highly strong monitoring tools allow users to create, define, combine and manage different VMs, containers, applications and services in the most efficient manner among cloud service providers.[4]

### 3. Opinions

Discussing about our opinion on the cloud computing service providers that can be found recently in the market. These services providers are, Amazon EC2, Google cloud platform, and Microsoft Azure. Actually, this procedure well helps us identifying the best one to use, if we need to choose one of them, we should also describe each one advantages and disadvantages.

#### **Starting with Amazon EC2 Advantages:**

It has a high level of security and a really helpful control board from the net, easy to use due to its amazing control panel, can select memory size, very fast processing units, and high-speed internet connections.

**Amazon EC2 Disadvantages:**

Many options can confuse the developer to make decision, cannot control server down times, Servers regions not that good, User interface not easy to use usually.

Moving to Google cloud platform, this platform used by many developers around the world so it is very famous among developers. **Here is some of its advantages:**

Very good prices, durability is the main advantage using Google platform (data hardly lost), server regions well distributed, can connect easily to other Google services, many types of storage classes, good documentation using API guide.

**Google cloud services Disadvantages:**

Maintenance and support are expensive, user interface not easy to use, getting and downloading data back is expensive, and pricing in some plans not clear enough.

Lastly, we need to talk about Microsoft Azure which one of the best service providers now a days. **Advantages of Azure are:**

Security of data is very good, almost no downtimes (very durable), cost effective, very good in scalability part, can use AI services, can automate tasks, can access many data centers around the world, and servers are good to use almost anywhere.

**Azure Disadvantages:**

Speed may vary from one country to another, need experience to use efficiently, need management and monitoring usually, and it can be confusing for the normal user to understand and use.

As a group, if we required to choose one of them, we will choose Microsoft Azure due to its advantages that we discussed about. The main reason for choosing Azure was that plans are very clear and neat to understand. More than that, pricing is very reasonable in compare to Google cloud platform and Amazon EC2 without having quality or performance issues related to the cost.

## 4 Conclusion

In conclusion, we can say that Cloud computing services providers are considered now a days as one of the most important online services around the world. Being knowledgeable about huge companies that provide these services is very important to establish any business recently. So, definitely Azure will be our choice to choose as we discussed before in opinions section.

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