Comparison of Cloud Services Offered by Cloud Leaders: AWS, Azure and Google Cloud

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ABSTRACT

The impact of COVID-19 are felt around the world and all sectors specially technology sector. In today's era we can say that every business are completely depend upon Information technology. Cloud Technology is the most prominent technology by which company manage their resource that is required to perform computing and share the information with security through Internet. Toady's every company want to migrate on cloud computing but selecting the right cloud service vender which meet the company's requirement is most important. In this paper n this Paper, the main three cloud computing service provider namely Microsoft Azure, and Amazon Web Services and Google Cloud, were studied. Also, we compare the services they offer. This study main aims of this research paper to helping those organization who want to migrate to cloud computing and choose the correct service provider which meets their business requirement.

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Introduction

The word "cloud Computing" nowadays becomes most popular among the technical giants and companies. However, there is a need to understand the meaning of the word cloud-computing. The persons have the different-different answer while they are asked about what cloud is computing. Some of them said on-demand computing-service, some said remote computing, grid computing, while some of them also said infrastructure on rent. However, they all have the common core meaning computing service over the internet from the remote location on their computer, smartphone, and other devices. Cloud computing term is described by different Researcher and Group different ways. The table below shows some of the famous definition.

Gartner "A style of computing where massively scalable IT-enabled capabilities are delivered 'as a service' to external customers using Internet technologies." [1]

NIST "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." [2]

Wikipedia "Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user. The term is generally used to describe data centers available to many users over the Internet. Large clouds, predominant today, often have functions distributed over multiple locations from central servers. If the connection to the user is relatively close, it may be designated an edge server." [3]

The University of California, Berkeley Reliable Adaptive Distributed Systems Laboratory "Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the Data Canters that provide those services. The services themselves have long been referred to as Software as a Service (SaaS), so we use that term. The Data Centre hardware and software is what we call a Cloud" [4]

Features of Cloud Computing

Cloud computing has lots of features and some of them are in figure 1:

Fig 1. Features of Cloud Computing.

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• **Agility**: Cloud computing is an agility version due to the fact Cloud computing has the cap potential to quick supply superior era sources to the person through any cloud offerings issuer.[5]

• **Cost-Effective**: Because cloud computing offers all offerings over the internet, so the person has no want to put money into IT infrastructure, licensing, manpower for servers administration, protection and different offerings which might be required on bodily IT infrastructure [5] Cloud Technology is use-based, i.e., pay to the offerings issuer handiest for what's without a doubt used, simply whilst needed.

• **Scalability and Elasticity**: All sources which might be required for computing are imparting r in nearly real-time, without customers desiring long-time period through cloud computing. Cloud computing helps companies to develop while not having to make high priced modifications to the existing system. With a cloud platform, client can increases and descries computer resources their companies as needed[6]

• **Remote Access:** Cloud Computing offer facility for Remote Access, It way the person can use there aid from everywhere thru any tool through the use of the internet. It offers region independence for the ones IT region community.

• **Virtualization Technology**: "Virtual Computing allows to the sharing of garage gadgets and servers, similarly to the cap potential emigrate programs from one server to any other easily"[7].

• **Performance:** "Cloud Computing Allows to optimize and manage the usage of sources mechanically with a excessive degree of transparency for each the carrier issuer and the customer".

• **Built-in Security**: Security is usually a key challenge in cloud computing. "Security with inside the cloud is visible as same to, as or maybe higher than that of different conventional systems. This is in component because of the cap potential of carrier carriers to dedicate sources to fixing protection troubles that clients can't afford.[8]"

• **Simplified IT Management and Maintenance**: The want for inner IT body of workers is decrease due to the fact the hardware is owned through the carrier issuer and saved externally. If the hardware desires to be repaired or updated, it's far the duty of the carrier issuer and they, in turn, will do it. It charges customers neither time nor money[6] [8].

Types of Cloud Computing

Selection of cloud model for the business is a complicated decision and it is depend upon business nature. As per the nature of cloud user community and nature of requirement, cloud can be characterized into four category named Public, Private, Hybrid and community cloud.

1. **Public Cloud**: A Public cloud atmosphere is managed by cloud services supplier and it's accessed by in public by net on a pay as you go model. [9] Primarily public cloud are best for tiny and medium size business with an oversized range of services. Public cloud is most well liked varieties as a result of its straightforward scalability, it's no geographical restrictions, price effective, straightforward to manage and extremely responsibility however on the opposite hand it has a cons which is, Public cloud isn't thought of the safest possibility for sensitive knowledge.

2. **Private Cloud:** A private cloud be a reserved infraslucture owned by one business. Each business needed an additional management led atmosphere throughout that access to that resources are more centralised and this can be often doable through solely a non-public cloud. Personal clouds are often

managed and hosted by the consumer in an exceedingly house environment. [10]

3. **Hybrid Cloud:** A hybrid cloud be a combination of public and private clouds. For those organizations that are seeking the advantages of public and private clouds, a hybrid model is that the most suitable choice for such business clients. The hybrid model provides increased security, extremely climbable and versatile services on the terribly cost-efficient ground[10][8].
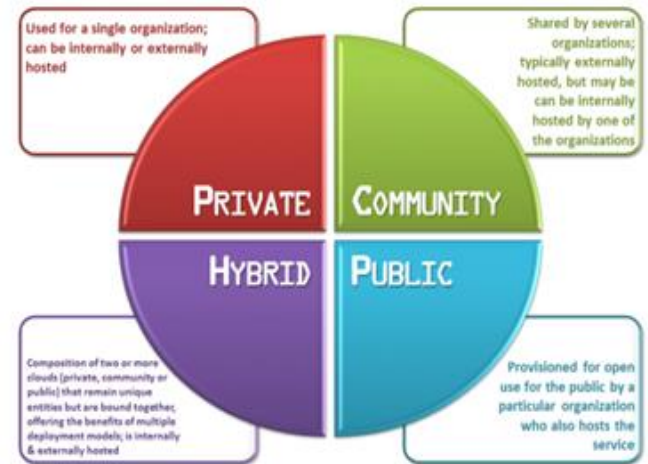

Fig 2. Types of cloud computing
("Source:http://bigdataguide.blogspot.com/2014/01/types-of-cloud-computing-public-private.html")

1. **Community Cloud:** The community cloud is little bit same to the public cloud. The only difference is – Community cloud only for those business organization who have same business object and same requirement. Community cloud is hosted and managed on premises or by a cloud vendor. However, client can take the advantage of all above types.[8]

Cloud computing Deployment model

All Cloud computing venders offered there services under three different deployment model named Infrastructure as a Services, Platform as a Services and Software as a Services.

1. **Infrastructure as a Services (IaaS):** Through IaaS services, Cloud services provider offered Cloud infrastructure to clients. IaaS provide of highly scalable and automated computing resources and it is fully self-services for controlling and accessing computers, storage, networking and other services which is necessary for computing.[11]

IaaS delivers all core computing infrastructure include network, servers, storage, operating system, and other resources by using virtualization Technology. In this model, services provider is completely responsible for the computing equipment's administration and security.

2. **Platform as a Services (PaaS):** PaaS is the most popular services in cloud computing in which cloud service provider delivers computing resource along with the application development tool to user by using internet. Organization use PaaS services for Development framework, Analytics or business intelligence and other services that enhance applications, such as workflow, directory, security and scheduling. Basically these tools are used for application development like Microsoft Visual Studio, Compilers, AppFog, Openshift and App Engine etc.[12]

3. **Software as a Services (SaaS):** SaaS is a specialized application services which is used by end user without installing any software over physical machine. Software as a service (SaaS) allows client to connect to and use cloud-based applications over the Internet. Common examples are email, calendaring and office tools. Through SaaS services provider

provides complete software solution on the basis of pay-as-you-go model. By using SaaS services you can Access app data from anywhere, Mobilise your workforce easily, Use free client software. [11]
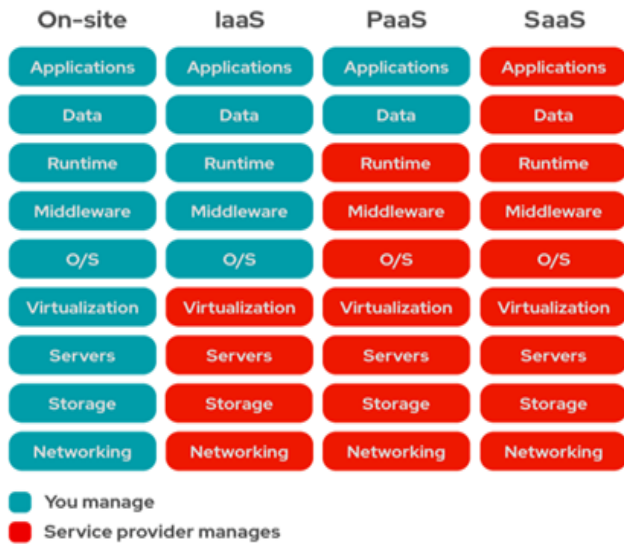
Fig 3. Cloud Computing Delivery Model (Source: https://www.redhat.com/en/topics/cloud-computing/iaas-vs-paas-vs-saas).

Cloud Services Providers

There are lots of IT companies like however Microsoft, Amazon, Google, IBM Alibaba Cloud. Oracle, Salesforce, SAP and many more which provide cloud computing services, however Microsoft, Amazon, Google are the main leaders in the cloud computing market. In the research paper we will review only Microsoft, Amazon, and Google services one by one.

Google Cloud Platform

According to Google "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 centers around the globe. Each data center 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. For example, zone a in the East Asia region is named asia-east1-a."

Microsoft Azure Platform

[13] "Microsoft Azure (Windows Azure) is Microsoft's public cloud computing service platform. It provides a wide range of cloud services, [13] including analytics, networking, compute, storage and many more. Client can pick and choose

Table 1. Comparison of Above Cloud Service Provider's Platforms

	Microsoft Azure Cloud	Amazon web services	Google cloud Plateform
Year of launching	01-Feb-10	March 19,2006	April 7,2008
Cloud service models	PaaS SaaS IaaS	PaaS SaaS IaaS	PaaS SaaS IaaS
Billing	Pay per hour except virtual machine(per minute) Discounts on contracts of 1 or 3 years	Payment per hour or per second, with a one -minute minimum.Discounts an controcts of 1 or 3 years(Only for Reserved instances).	Pay per hour or month. Discounts proportional to consumption hours(on average a 24% discount)
World wide availability	54 regions world wide 140 countries	25 regions world wide.206 countries.	20 regions worldwide. More than 200 countries
Volume type	Standard HDD , can be customized to SSD	The default: General purpose SSD, it can be customized to highest performance SSD or HDD	Net work-attached HDD Localiy-attached SSD or net work-attached SSD
Back ups	Make 3 copies in the same geographical area, possibility of duplicating	Make 3 copies in the same geographical are, Possibility of duplicating copies to other areas.	Mack on-demand backups or Automated back ups copies around the world.
Support	24x7 free support (access to knowledge center). 8 hours response time:$29/month via email.2 hours response time:$100/month via. email	Free support (access to knowledge center). Contact by email during office hours: $29/month. 24x7 phone, email and chat contact with 1-hour response time:$100/month	24x7 Free Support (access to knowledge center). 4 hours response time: $ 100 per month 1-hour response time: $ 250 per month.
Stability	99.95% month availability. Between 99.00% and 99.99%:10% penalty. Between 95.00% and 99.00%:30% penalty. Below 95%:100% penalty	99.99% monthly availability. Between 99.99% and 99%: 10% penalty Between 99% and 95%: 30% penalty Below 95%: 100% penalty.	99.989%/monthly availability.Between 99.00% and 99.99%:10% penalty. Between 95.00% and 99.00%: 25% penalty. Below 95%: 50% penalty.
Security	87 Certifications	25 Certifications	40 Certifications
VM types	195	170	59
Other cloud Service	Computing, Al and machine learning, Storage, Data bases, office 365, inter net of Things, Data Analytics, Management and Governance, Net working security	Data analytics, storage, Data bases, computing, internet of things, machine learning net working and content delivery, security.	Computing and hosting net working, Storage, Databases, AL and Machine learning, API management, data Analytics, Internet of Things, Networking Security
Server Migration	Accept Hyper-V-VMware, and physical servers in most cases, no cost	Accept VMware and Hyper V servers-no Cost.	Accept VMware. No cost.

any service these services to develop and scale new applications, or execute applications in the public cloud. The main aim of Microsoft azure platform to help businesses organization to manage challenges and meet their organizational goals. It offers tools that support all industries and is compatible with open source technologies. This provides users with the flexibility to use their preferred tools and technologies."

Amazon Web Services

[14] "AWS is a comprehensive, evolving cloud computing platform provided by Amazon that includes a mixture of infrastructure as a service (IaaS), platform as a service (PaaS) and packaged software as a service (SaaS) offerings. AWS services can offer an organization tools such as compute power, database storage and content delivery services. AWS launched in 2006 from the internal infrastructure that Amazon.com built to handle its online retail operations. AWS was one of the first companies to introduce a pay-as-you-go cloud computing model that scales to provide users with compute, storage or throughput as needed. AWS offers many different tools and solutions for enterprises and software developers that can be used in data centers in up to 190 countries. Groups such as government agencies, education institutions, non-profits and private organizations can use AWS services.

Comparison of Above Cloud Service Provider's Platforms Conclusion

"Cloud computing has come back to ascertain itself a lot of and more formally, contributively with solutions that are increasing during a manner that creates more users integrate to the current way of working. There are many major suppliers who offer cloud computing services. The 3 most well-liked cloud computing platforms are Google, Microsoft, and Amazon. During this paper, these suppliers were studied and compared from completely different aspects. In general, all platforms have excellent documentation, several manuals, and free trial account to start out victimization them from scratch. Every cloud service supplier offers multiple services, tools, functionalities, and applications."

References

[1]D. S. Thomas Bittman , David Cearley , Daryl Plummer , Tom Austin, "No Title," 2008, [Online]. Available: https://www.gartner.com/en/documents/697413/cloud-computing-defining-and-describing-an-emerging-pheno.

[2] P. Mell and T. Grance, "The NIST definition of cloud computing," in Cloud Computing and Government: Background, Benefits, Risks, 2011.

[3]"https://en.wikipedia.org/wiki/Cloud_computing," https://en.wikipedia.org/wiki/Cloud_computing. .

[4] M. Armbrust, A. Fox, and R. Griffith, "Above the clouds: A Berkeley view of cloud computing," Univ. California, Berkeley, Tech. Rep. UCB, 2009, doi: 10.1145/1721654.1721672.

[5] R.A.P. Rajan, "Evolution of Cloud Storage as Cloud Computing Infrastructure Service," IOSR J. Comput. Eng., vol. 1, no. 1, 2012, doi: 10.9790/0661-0113845.

[6] W.L. Encalada and J.L. Castillo Sequera, "Model to implement virtual computing labs via cloud computing services," Symmetry (Basel)., vol. 9, no. 7, 2017, doi: 10.3390/sym9070117.

[7]S.Shilpashree, R.R.Patil, and C.Parvathi, "'Cloud computing an overview,'" Int. J. Eng. Technol., vol. 7, no. 4, 2018, doi: 10.14419/ijet.v7i4.10904.

[8]C. Bhurani and S. K. Sharma, "An Analysis of Security Issues Associated with Cloud Computing Paradigm," J. Comput. Sci. Eng. Softw. Test., vol. 7, no. 1, 2021, doi: 10.46610/jocses.2021.v07i01.005.

[9]N. B. Ruparelia, "Types of Cloud Computing," in Cloud Computing, 2016.

[10]Blair Felter, "The Different Types of Cloud Computing and How They Differ," vXchnge, 2020. .

[11]R. Shankar and S. Duraisamy, "Different Service Models and Deployment Models of Cloud Computing : Challenges," Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol. © 2018 IJSRCSEIT, vol. 3, no. 7, 2018.

[12]A. Asmaa, D. El Abbassia, B. A. EL Hassan, and B. Djilali, "Model-based application deployment on cloud computing," Int. J. Distrib. Syst. Technol., vol. 10, no. 2, 2019, doi: 10.4018/IJDST.2019040106.

[13] "Microsoft Windows Azure: Developing Applications for Highly Available Storage of Cloud Service," Int. J. Sci. Res., vol. 4, no. 12, pp. 662–665, 2015, doi: 10.21275/v4i12.nov151864.

[14]R. Saini and R. Behl, "An Introduction to AWS—EC2 (Elastic Compute Cloud)," in Proceedings of the International Conference on Research in Management & Technovation 2020, 2020, vol. 24, doi: 10.15439/2020km4.