

AWS, GCP AND AZURE- COMPARATIVE STUDY OF CLOUD SERVICE PROVIDERS

Parul V. Bakaraniya

Sardar Vallabhbhai Patel Institute Of Engg. & Technology
Vasad, Gujarat, India

Shrina M. Patel

Sardar Vallabhbhai Patel Institute Of Engg. & Technology
Vasad, Gujarat, India

Abstract: The adoption of cloud computing is on the rise as businesses today are moving their applications from on-premise data centers to the cloud in a bid to innovate, reduce costs, and boost agility. According to Gartner, the IaaS market is estimated to be worth a total of \$64.3 billion in 2021, up from \$50.4 billion in 2020. The concerns over security and data sovereignty have been resolved by the prominent public cloud vendors- Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform. They differ from each other in terms of services they offer, compatibility with specific business models, budget, company sizes, and so on. To help the Enterprise organization to select the right cloud computing platform, here are detailed features, pros, cons, and comparison of the top 3 business cloud services, AWS, Azure, and GCP. Picking up public cloud service providers is now becoming a harder task in an enterprise organization. This paper will help in reducing more hesitation to choose a public cloud service provider. This paper is highlighting computation, storage, and infrastructure is important to service features that have an impact when choosing cloud service providers.

Keywords: AWS, Microsoft, Azure, Google Cloud

I. INTRODUCTION

Cloud computing has taken the market by storm and for good reasons too. Companies now don't have to waste money and time buying and maintaining their own servers and instead can directly use the ready-made professional infrastructure provided by cloud service providers. While there are many companies fighting to gain dominance in the public and enterprise cloud sector, three companies: Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform (GCP) hold the commanding position both for Infrastructure as a service (IaaS) and platform as a service (PaaS). Azure is generally bought by new-gen and small- to-medium-size enterprises. Google Cloud is being used mostly by developers working on enterprise applications and AWS is being bought by everybody else—about one-third of the market (exactly 33 percent as of Q2 2019, according to Synergy Research), no less. [11]. Due to the increasing amount of data worldwide, most organisations today are adopting cloud technology. Most of the consumers and businesses are using the cloud because it is convenient, scalable, adaptable and secured in nature. Amazon AWS is the oldest player in the cloud services market and is also one of the leading ones. Although these cloud computing platforms offer almost similar properties, there are certain differences which are helping them to keep hold of their positions. In this paper, we have compared the leading cloud computing vendors, Amazon AWS, Microsoft Azure and Google Cloud Platform[12]. As all clouds have some different features, storage capacities, billing systems and different methods to provide the services from other clouds. The recent problem is that the people are not aware that which cloud is suitable according to their requirements, they cannot able to choose the appropriate cloud for their services among the different clouds managed by different cloud providers. So to facilitate these kinds of situations, this paper helps in defining the comparison of some most popular clouds keeping in mind its all important aspects which can help a normal customer, business organizations and academics to choose the particular cloud according to their needs.

II. MAJOR CLOUD COMPUTING SERVICE-PROVIDERS

There are several cloud-computing service-providers available in industry. Few leading companies are listed below as per Gartner's Magic Quadrant 4:[1]

1. Amazon Web Services – Launched in 2006
2. Microsoft Azure - Launched in 2010
3. Google Cloud Platform - Launched in 2008
4. Alibaba Cloud - Launched in 2009
5. Oracle Cloud- Launched in 2012
6. IBM Cloud- Launched in 2011

Brief Description about AWS, Microsoft Azure and Google Cloud Platform.

A. AWS

“Amazon Elastic Compute Cloud” also known as Amazon EC2 offers scalable computing in the “Amazon Web Services (AWS)”. It provides “as and when required” computing resources and services and that too in the cloud, with “pay-as-you-go” costs. It allows users to manage the scale in order to handle the fluctuations in needs or spikes in popularity, thus we do not need to forecast traffic.

Some common uses of AWS are as follows:

- Public or Private data storage.
- Static or a Dynamic website hostage.
- Support for students to do online training programs like MOOCs.
- Processing business and scientific data.
- Handling peak loads with ease[10].

Strengths: AWS has been the leader in cloud IaaS based on market share for the past decade. Thus market dominance is its biggest strength. The reason for this huge popularity is due to its massive scope of operations. With an extensive and mature catalogue of available services and a huge comprehensive network of data centers worldwide, it has become the favorite for enterprise users due to its capabilities for governing a large number of users and resources.

Weakness: The biggest weakness of Amazon is its cost structure which not only is difficult to understand but difficult to manage too when dealing with huge chunks of data. Also the number of services available can be overwhelming to some customers who then become skeptical of it[12].

B. Microsoft Azure

As Microsoft Azure is built upon Windows server, it is easy to migrate virtual machines on public cloud because of many similar software and applications between local data centers and Microsoft Azure. Custom image creation is also an easy task using Virtual Hard Disks. It supports a huge number of OS including Ubuntu, Windows server, CentOS, CoreOS and many more. For scaling purpose, Microsoft has a Scale page in Azure interface that be handled manually or automatically. Azure can have virtual networks in it and it can also be connected to corporate network using VPN. Storage requirements can be handled category wise- standard (makes use of rotational HDD) and premium (makes use of Secondary Storage Disk). Multiple disks per virtual machine (up to 32 TB per virtual machine) can be used. Microsoft also provides regional support and has 17 different regions for Azure at various locations like Australia, Asia, Europe and US [7].

Strengths: Microsoft wasn't an early player in the cloud computing sector but it did a lot of things correctly to establish itself as a dominant player. By repurposing it's on premises software already a standard in the industry like Windows Server, Office, SQL Server, Sharepoint, Dynamics Active Directory, .NET etc. it gave itself a big jumpstart. The integration of Azure with industry standard tools also by Microsoft meant that enterprise users naturally opted for Azure as their platform of choice to keep things familiar and under one ecosystem. Special discounts and offers for existing enterprise users also attracted many customers.

Weakness: Though Azure is an enterprise ready platform, Gartner Client reported that its service felt less enterprise ready than their expectations. Issues with technical support, improper documentation, training and breadth of the ISV partner ecosystem leaves room for much more improvement[12].

C. Google Cloud Platform

Google cloud platform is a set of cloud services which operates on the same infrastructure that Google uses internally for end-user products as for instance, YouTube, Google Maps, and Google Search. One of the services offered by Google is Google App Engine or also more commonly known as GAE or App Engine. It is Google-managed cloud computing platform for developing and hosting web applications, it was launched on April 7, 2008 as a cloud service. App Engine allows to build scalable web applications in any programming language on Google's infrastructure. With GAE, applications can be created, maintained and updated easily. Through the appspot.com domain, applications can be published using a free domain name. Applications can be shared with everyone or they come with a limited access to individuals of organization.

Google App Engine provides two types of environment; flexible and standard environments. User can run applications using the flexible or standard environment. Flexible environment automatically scales up and down application while balancing the load, whereas standard environment uses preconfigured container instances[3]. With standard environment, Google App Engine service allows to create a free account with some usage limits. Google App Engine service offers another option, that is "free trial". This free trial gives the user the opportunity to get to free resources to use Google Cloud Platform (GCP) for a specified period of time and within a specified amount of credit. Free trial ends when user spends all of the credit, or at the end of the specified period. After that, user must upgrade to a paid account to continue using Google Cloud Platform. Google App Engine is a high-performance Platform as a Services that works with a variety of storage options, including Cloud SQL, Blobstore, and Datastore. In addition, the engine also provides access to the search API[3].

Strengths: The name itself says much for Google Cloud Platform. It is designed for the cloud native businesses. Not only it specializes in high compute offerings like Big Data, Analytics and machine learning, it also offers considerable scale

and load balancing. Google knows how data centers work and how to increase the response time. Businesses which compete with the eCommerce giant Amazon tend to prefer Google as it is more open source centric and Dev-Ops centric. An interesting fact to note here is that the Kubernetes standard that AWS and Azure use was developed by Google.

Weakness: Google was fairly late in the market when AWS and Azure were already dominating. Compared to AWS and Azure it doesn't provide that many services and also doesn't have as many data centers like its competitors. It is often chosen by businesses as a secondary provider rather than a strategic provider[12].

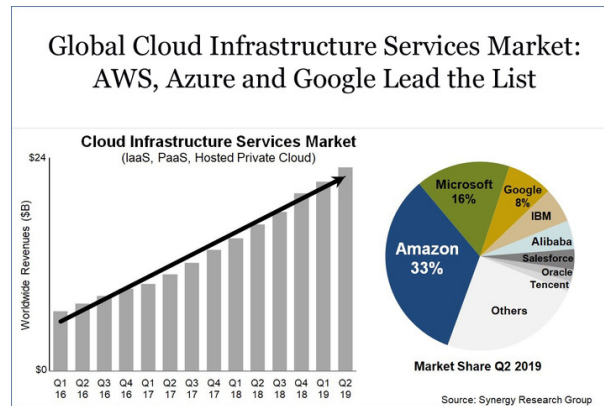


Fig.: Cloud Infrastructure services market[11]

III.COMPARISON BETWEEN THREE DIFFERENT CLOUDS

There are many cloud service providers available in the market space to select from, such as: Amazon, Microsoft, Google, IBM, Oracle, Red Hat, CloudWare, ZippyCloud, exosclae, e24Cloud etc. Many of them are giant names in IT. They provide different services at different cost. In this section, we will compare only three popular Cloud Service Providers, namely- (i) Amazon Web Services (ii) Microsoft Azure (iii) Google Cloud Platform

Comparison of Compute Services : AWS vs AZURE vs GCP[1]

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Compute Service	Elastic Compute Cloud (EC2)	Compute Engine	Virtual machine Virtual machine scale sets
Paas	Elastic Bean Stalk	App Engine Standard/ Flexible Environment	Cloud services
VPS	LightSail		Virtual machine images
Docker/ Kubernetes containers	EC2 Container Service Kubernetes(EKS)	Kubernetes Engine Container engine	Container Service(AKS)
Integrate systems and run backend logic processes	Lambda	Cloud Functions(Beta)	Functions Event Grid
Automatically scale instances	Auto scaling	Instance groups	Virtual machine scale sets Auto scaling

Comparison of Storage Services: AWS vs AZURE vs GCP

This is yet another important function and is related to data storage. On the basis of services, the comparisons are enlisted below [13]:

Storage service	AWS	Azure	GCP
Hybrid storage	Storage gateway	StorSimple	Egnyte Sync
Bulk data transfers	Snowball edge,	Data Box &	Storage transfer

	Import/Export disk & Snow Mobile	Import/Export	service
Back-up solutions	Cold Archive storage & Storage gateway	Backup	–
Disaster recovery	Disaster recovery	Site recovery	–

Comparison of Database Services : AWS vs AZURE vs GCP[13]:

A Database comparison is essential for database workloads. The below table provides the perfect comparison of the database domain.

Database services	AWS	Azure	GCP
Caching	ElastiCache	RedisCache	CloudCDN
Object Storage	S3	Blobs and files	Cloud storage block
Block storage	EBS	Page Blobs	Persistent disks
Indexed NoSQL	DynamoDB	Cosmos DB	Datastore, Big table
Database migration	Database migration services	Database migration services	–

Comparison of Networking Services : AWS vs AZURE vs GCP[1]:

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Isolated , private cloud private networking	Virtual Private Cloud	Virtual Private Cloud	Virtual Network
Cross-premises connectivity	API Gateway	Cloud VPN	VPN Gateway
Manage DNS names and records	Route 53	Google cloud DNS	Azure DNS Traffic Manger
Global content delivery networks	CloudFront	Cloud Interconnect Cloud CDN	Content Delivery Network
Dedicated , Private network connection	Direct connect	Cloud Interconnect	ExpressRoute
Load balancing configuration	Elastic Load Balancing	Cloud Load Balancing	Load Balancer Application Gateway

Comparison of Security Services : AWS vs AZURE vs GCP[1]:

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Authentication and authorization	Identity and Access Management(IAM)	Cloud IAM	Active Directory Active Directory Premium
Protect and safeguard with	Key Management Service		Storage Service Encryption

data encryption			
Hardware-based security modules	CloudHSM	Cloud Key Management Service	Key Vault
Firewall	Web Application Firewall		Application Gateway
Directory Services	AWS directory service		Active Directory Domain Services
Identity Management	Cognito		Active Directory B2C
Cloud services with protection	Shield		DDos protection Service

Pricing Models : AWS vs AZURE vs GCP [13]:

Machine Type	AWS	Azure	GCP
Smallest Instance	2 virtual CPUs and 8 GB of RAM will cost nearly US\$69 per month	Instance with 2 vCPUs and 8 GB of RAM, in Azure, costing US\$70/month	2 virtual CPUs and 8 GB of RAM at a 25 percent cheaper rate costing US\$52/month
Largest Instance	3.84 TB of RAM and 128 vCPUs will cost around US\$3.97/hour	3.89 TB of RAM and 128 vCPUs. It costs around US\$6.79/hour	3.75 TB of RAM and 160 vCPUs. It will cost close to US\$5.32/hour

Very recently, AWS started offering pay-per-minute billing which Azure already is using while Google charges with the Pay-per-second billing model letting users save more compared to AWS and Azure.

Availability Zones [13]:

AWS is the oldest hence it has had more time to expand its network. AWS is hosting in multiple locations along with GCP and Azure but there is a difference in the availability zones:

- At present, AWS has 66 availability zones with 12 on the anvil.
- Azure caters to 54 regions worldwide and is available in 140 countries.
- GCP is available in 20 regions around the world with 3 more on their way.

IV. Which Cloud Provider is Best for My Business?

While AWS is the choice for most businesses due to its sheer number of tools and services, it is difficult to have a personal bond if you are a small business owner. AWS has recurring intense training programs and conferences around the year for its partners and consultants and hence they have a wide network of partners and consultants in the world. AWS is the go-to choice of several startups and enterprises.

If you already heavily indulged in Microsoft's software, then it is best to go with Azure. All your apps will be fully compatible and will be able to use enhanced and new features almost instantaneously. Microsoft Azure is the sweetheart of banking, financial companies, NBFCs and BFSIs.

Google Cloud Platform: It has something for everyone. It is for those people who are looking for options outside Azure and AWS. Being late in the market and an underdog, it sure had a slow start but has caught up pretty quickly. If you looked at Google's services a year back and were unimpressed, then you surely will be impressed this time around.

V. CONCLUSION AND FUTURE WORK

After reviewing or studying the number of journals, white papers, cloud computing articles and case studies, I come to know that cloud computing is the largest buzz in the world of computer now a days. It gains popularity in almost every field like in industry and in educational systems. This paper gives the knowledge of cloud computing introduction, and also discussed the comparison of three popular clouds of cloud computing names- Amazon AWS, Google cloud and Microsoft Azure cloud in the form of a table. No doubt cloud computing has a vast future scope but still it suffers from number of security issues. Now the next step is to propose a model or a architecture which can detect and prevent the various threats, attacks and other security related issues which continuously depletes the efficiency and the productivity of the cloud. However, choosing a cloud over the other entirely depends upon the needs of an individual or the organisation's workload.

REFERENCES

- [1] Pranay Dutta, Prashant Dutta, Comparative Study of Cloud Services Offered by Amazon, Microsoft & Google, International Journal of Trend in Scientific Research and Development (IJTSRD) Volume: 3 | Issue: 3 | Mar-Apr 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470
- [2] Amit Sharma, Dr. Sohan Garg, Comparative Study of Cloud Computing Solutions, International Journal of Computer Science And Technology, IJCST Vol. 6, Issue 4, Oct - Dec 2015, ISSN : 0976-8491 (Online) | ISSN : 2229-4333 (Print)
- [3] Ghazwan Khalid auda, Cloud computing service providers: A comparative study, Samarra Journal of Pure and Applied Science, Samarra J. Pure Appl. Sci., 2020; 2(1): 76-89, ISSN:2663-7405
- [4] Dr. Rajesh Keshavrao Deshmukh, Ashutosh Mishra, Mukesh Dewangan, COMPARATIVE STUDY BETWEEN EXISTING CLOUD SERVICE PROVIDERS, International Journal of Advanced Research in Computer Science, Volume 9, No. 2, March-April 2018, ISSN No. 0976-5697, DOI: <http://dx.doi.org/10.26483/ijarcs.v9i2.5722>, Volume 9, No. 2, March-April 2018
- [5] Satish Kumar, Vishal Thakur, Ashok kumar Kashyap, A comparative study of different cloud services, cloud security issues and cloud providers, International Journal of Latest Trends in Engineering and Technology (IJLTET), Special Issue RICSIT-2016, ISSN: 2278-621X
- [6] Muhammad Ayoub Kamal, Hafiz Wahab Raza, Muhammad Mansoor Alam, Mazliham Mohd Su'ud, Highlight the Features of AWS, GCP and Microsoft Azure that Have an Impact when Choosing a Cloud Service Provider, International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-5, January 2020
- [7] Dr. Richa Purohit, Comparative Analysis of Few Cloud Service Providers Considering Their Distinctive Properties, Volume 8, No. 5, May – June 2017 International Journal of Advanced Research in Computer Science, ISSN No. 0976-5697
- [8] Kimmy, A COMPARATIVE STUDY OF CLOUDS IN CLOUD COMPUTING, International Journal of Computer Science & Engineering Technology (IJCSET), Vol. 4 No. 06 Jun 2013, ISSN : 2229-3345
- [9] Abdulelah Almishal, Ahmed E. Youssef, Cloud Service Providers: A Comparative Study, International Journal of Computer Applications & Information Technology Vol. 5, Issue II April May 2014 (ISSN: 2278-7720)
- [10] Sumit Kumar, Sunil Kumar, Manpreet Singh Bajwa, Himani Sharma, A Comparative Study of Various Cloud Service Platforms, Journal of Advanced Database Management & Systems, ISSN: 2393-8730 (Online) Volume 6, Issue 1, www.stmjournals.com, JoADMS (2019) 7-12 © STM Journals 2019.
- [11] <https://www.eweek.com/cloud/at-a-high-level-aws-vs-azure-vs-google-cloud>
- [12] <https://www.eiosys.com/aws-vs-azure-vs-google-cloud-full-comparision/#chapter-2>
- [13] <https://www.chapter247.com/blog/aws-vs-azure-vs-google-cloud-a-detailed-comparison-of-the-cloud-services-giants/>
- [14] <https://dzone.com/articles/aws-vs-azure-vs-google-cloud-a-comparison-guide-of>
- [15] <https://www.datamation.com/cloud/aws-vs-azure-vs-google-2020-cloud-comparison/>