TASK 6: Cloud Computing

Do a comparative study of various cloud initiatives such as AWS, Azure and other flavours and write a small report.

Cloud computing is the delivery of on-demand computing services -- from applications to storage and processing power -- typically over the internet and on a pay-as-you-go basis.

How does cloud computing work?

Instead of owning their own computing infrastructure or data centers, companies can rent access to anything from applications to storage from a cloud service provider. Benefit is that firms can avoid the upfront cost and complexity of owning and maintaining their own IT infrastructure, and instead simply pay for what they use, when they use it. In turn, providers of cloud computing services can benefit from significant economies of scale by delivering the same services to a wide range of customers.

Cloud computing strengthens several services such as consumer services like Gmail or the cloud back-up of the photos smartphones. Also includes services which allow large enterprises to host all their data and run all of their applications in the cloud. Netflix relies on cloud computing services to run its video streaming service and its other business systems too, and have a number of other organisations.

Which are the big cloud computing companies?

When it comes to IaaS and PaaS, there are three players competing for market share. These are Amazon Web Services, followed by Microsoft's Azure, Google, IBM, and Alibaba. While the following pack might be growing fast, their combined revenues are still less than those of AWS, according to data from the Synergy Research Group.

All these Cloud Service Providers have different strengths and priorities. AWS is particularly strong in IaaS and PaaS. Microsoft in contrast has a particular emphasis on SaaS thanks to Office 365 and its other software largely aimed at end user productivity. Google Cloud Platform (GCP) (which also offers office productivity tools) is somewhere between the two. IBM and Oracle's cloud businesses are also made up of a combination of Saas and more infrastructure based offerings. So it is better to say that it’s not about choosing the best cloud providers, rather choosing the best-suited cloud provider as per individual organizational needs.

In this report ,I have tried to identify what sets these three major cloud providers apart on several parameters. These include general characteristics and some service specific ones.

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| Parameter for Comparison | Amazon Web Services | Microsoft Azure | Google Cloud Platform |
| Establishment | AWS was publicly launched in 2006 with service offerings such as EC2, Amazon S3, etc. By 2009, Elastic Block Store was made public and services such as Amazon CloudFront, Content delivery network (CDN), and more formally joined the AWS Cloud Computing Service offerings. | Microsoft Azure(initially Azure) was launched in 2010 to provide a competent Cloud Computing platform for businesses. Azure was renamed as ‘Microsoft Azure’ in 2014, though the name ‘Azure’ is still commonly used. | Google Cloud Platform began its journey in 2011. The initial resolve of Google Cloud was to strengthen Google’s own products such as Google Search engine and YouTube. But now, they have also introduced their enterprise services. |
| Availability Zones | AWS has 66 availability zones with 12 more on the way. | Azure has 54 regions worldwide and is available in 140 countries all around the world. | Google Cloud Platform has been made available in 20 regions around the world with 3 more on their way. |
| Market Shares | AWS is leading with around 30 percent of public cloud share in its name. | Microsoft Azure is on the second place, owning around 16 percent of the worldwide market share. | Google, on the third place, owns up to 10 percent of the market share worldwide. |
| Growth Share | AWS, at the third place, with 41 percent of growth rate. | Microsoft Azure is at the second place with 75 percent of growth rate. | As of 2019, GCP has shown a growth rate of 83 percent. |
| High Profile Customer Base | Since AWS is the oldest player in the cloud market, it has bigger community support and user base. Therefore, AWS has more high-profile and well-known customers like Netflix, Airbnb, Unilever, BMW, Samsung, MI, Zynga, etc. | Azure is also gaining its share of high-profile customers with time. As of now, Azure has almost 80 percent of Fortune 500 companies as its customers. Some of its major customers are Johnson Controls, Polycom, Fujifilm, HP, Honeywell, Apple, etc. | Google shares the same infrastructure as that of Google Search and YouTube due to which many high-end companies have put their faith in Google Cloud. Major clients of Google Cloud are HSBC, PayPal, 20th Century Fox, Bloomberg and Dominos among others. |
| Number of Services Offered | AWS offers around 200+ services.  With the added advantage of five years of head start, AWS computing services are by far the most evolved and functionally rich. | Azure offers up to 100+ services. | Google Cloudis catching up with Azure and AWS offering around 60+ services. |
| Caching | Elastic Cache | Redis Cache | Cloud CDN |
| Processor | In AWS, 128 can be the maximum processor in VM | In Azure, it can be 128 | In Google cloud, it is only 96. |
| Marketplace | In this, AWS marketplace | Azure Marketplace | G suite Marketplace |
| App Testing | In AWS, device farm is being used. | In Azure, DevTest labs are being used | Cloud Test lab is being used in this. |
| GIT Repositories | AWS source repositories | Azure source repositories. | Cloud source repositories. |
| Storage of Object | S3 | Block Blob | Cloud Storage |
| Managed data warehouse | Redshift | SQL warehouse | Big Query |
| Kubernetes Management | EKS | Kubernetes service | Kubernetes engine |
| File Storage | EFS | Azure Files | ZFS and Avere |
| Virtual Server Disks | Amazon Elastic Block Store | Managed Disks | Google Compute Engine Persistent Disks |
| Cold Storage | Amazon Glacier | Azure Archive Blob Storage | Google Cloud Storage Nearline |
| Serverless computing | Lambda is being used for serverless computing | In Azure, Azure functions are used. | In google cloud, Cloud functions are used. |
| API management | Amazon API Gateway | Azure API gateway | Cloud endpoints |
| Media services | Amazon Elastic Transcoder | Azure media services | Cloud video intelligence API |
| VM Deployment Manner | AWS provides the instances of virtual servers and virtual machines. | Azure provides the virtual hard disks | Google cloud provides the virtual machine instances. |
| Service Model | AWS instance can be purchased in any of the following models from On-demand, reserved and spot. | An azure instance can be bought in any of the models from on demand and short termed commitments. | For Google cloud, it can be from On-demand and sustain use. |
| Pricing | AWS used to charge its users Per hour. AWS recently started offering pay-per-minute billing It uses pay as you go model. | Azure already offers pay-per-minute billing. | Google Cloud offers pay-per-second billing models which let users save way more than using AWS or Azure. Google also offers various discounts to help customers save up to 50 percent in some cases when compared to AWS. |
| Docker Management Tool | In AWS, ECS is being used as Docker management. | Container service is being used for Azure for the same. | Google container engine is being used for docker management in google cloud. |
| Archive Storage | In AWS, the glacier is being used for archive storage. | In Azure, archive storage is used. | Cold line provides archive storage in GCP. |
| Search Services | In AWS, Amazon cloud search is being used for search service. | In Azure, Azure search is being used. | For google cloud, it’s not there. |
| Smallest Instance(Machine Type) | In the case of AWS, a very basic instance that includes 2 virtual CPUs and 8 GB of RAM will cost you around US$69 per month. | For the same type of instance, i.e., an instance with 2 vCPUs and 8 GB of RAM, in Azure, will cost you around US$70/month. | Compared to AWS, GCP will provide you the most basic instance, containing 2 virtual CPUs and 8 GB of RAM at a 25 percent cheaper rate. So, it will cost you around US$52/month. |
| Largest Instance(Machine Type) | The largest instance offered by AWS that includes 3.84 TB of RAM and 128 vCPUs will cost you around US$3.97/hour. | The largest instance offered by Azure includes 3.89 TB of RAM and 128 vCPUs. It costs around US$6.79/hour. | GCP takes the lead here with its largest instance that includes 3.75 TB of RAM and 160 vCPUs. It will cost you around US$5.32/hour |
| Networking Services | | | |
| Virtual Network | Amazon Virtual Private Cloud (VPC) | Virtual Networks (VNets) | Virtual Private Cloud |
| Elastic Load Balancer | Elastic Load Balancer | Load Balancer | Google Cloud Load Balancing |
| Peering | Direct Connect | ExpressRoute | Google Cloud Interconnect |
| DNS | Amazon Route 53 | Azure DNS | Google Cloud DNS |
| Database Services | | | |
| RDBMS | Amazon Relational Database Service | SQL Database | Google Cloud SQL |
| NoSQL: Key–Value | Amazon DynamoDB | Table Storage | Google Cloud Datastore  Google Cloud Bigtable |
| NoSQL: Indexed | Amazon SimpleDB | Azure Cosmos DB | Google Cloud Datastore |
| Compute Services | | | |
| PaaS | AWS Elastic Beanstalk | App Service and Cloud Services | Google App Engine |
| Containers | Amazon Elastic Compute Cloud Container Service | Azure Kubernetes Service (AKS) | Google Kubernetes Engine |
| Serverless Functions | AWS Lambda | Azure Functions | Google Cloud Functions |
| Analytics | In AWS Amazon Kinesis is being used for Analytics. | For Azure, Azure stream analytics is being used. | For the Google cloud platform, Cloud dataflow and cloud data prepare being used for analytics. |
| Automation | In AWS, AWS ops work and config used for automation. | For Azure, Azure automation is being used. | For google cloud, compute engine management with the puppet, chef etc. |
| Compliance | AWS cloud HSM is being used for Compliance | Azure trust center is being used by Azure . | Google cloud platform security for compliance is used. |
| Strengths | AWS is the the market leader among cloud providers can boast the breadth and depth of the services in a database, compute, analytics, storage, networking, management, mobile, developer tools, machine learning, IoT, security, and enterprise applications with 200+ services.  Another advantage is the maturity of the IaaS and the entire AWS ecosystem.  AWS has an all-in global coverage and a secure network that guarantees that you will find what you need even for the most sensitive applications. | Microsoft offers significant discounts on Azure which is attractive to new customers and has good customer retention.  Larger enterprises need true hybrid cloud setups, which Azure offers.  Besides, if you are using other services provided by Microsoft (like .NET) they integrate easily with existing infrastructure. | Even with small market share, GCP is a viable IaaS competitor.  Intuitive simplicity and easy to use interface.  An expertise Google has with big data analytics and ML applications enables customers to easily leverage that expertise from within Google Cloud Services.  It also allows users to enjoy high-quality networking, storage, computing, and databases with GCP. |
| Weakness | The vast number of AWS services and options is something that attracts customers and at the same time scares a bit.  Many companies see that employees need decent training on the AWS ecosystem to manage it appropriately.  AWS does not have specific “hybrid cloud” solution like Microsoft offers. | Although Azure is the best option for Microsoft ecosystem users, its support for other operating systems is limited.  AWS wins in this battle because of the customization potential. | Google Cloud platform is a B2C business and large enterprises find it’s challenging to work with their cloud services.  Being the newest cloud out of the big three, Google is the least mature concerning offerings variety. |

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