Cloud Computing Fundamental: Break the Limit

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1 Introduction

Cloud computing is a combination of the use of computer technology and Internet-based development. Based on cloud computing technology, all data is located and stored on servers and internet applications or the software that users usually need is on the server computer. Recently, interested entrepreneurs realized that cloud computing is an absolute necessity for applications in the current work environment.

1.1 History of Amazon EC2, Google Cloud Platform and Microsoft Azure

In July 2002, Amazon announced Amazon web services (AWS), and 19th of March 2006 Amazon has re-launched amazon web services combining the three initial service offerings of Amazon S3 cloud storage, SQS, and EC2 [1]. All three types of cloud computing are available, for the IaaS it contains the basic building blocks for cloud IT and typically provide access to networking features. For the PaaS it removes the need for organizations to manage the underlying infrastructure and allow to focus on the deployment and management of your applications. As for the SaaS it provides the user with a completed product that is run and managed by the service provider [1].

On April 7, 2008, Google announced a preview release of App Engine which a first developer tool that allowed users to run their web applications on Google infrastructure. Why Google releases App Engine? Paul McDonald, Product Manager said, “Make it easy to get started with a new web app, and then make it easy to scale when that app reaches the point where it's receiving significant traffic and has millions of users.” [2]. Then, this service become fully supported Google product in November 2011 [3]. Since the announcement of App Engine, Google added multiple cloud services to the Google Cloud Platform.

In October 2008, Microsoft announced Windows Azure and Azure Services Platform at Microsoft’s Professional Developers Conference (PDC) [4] and formally released in February 2010. On March 25, 2014, Windows Azure being renamed to Microsoft Azure. Steven Martin, General Manager, Microsoft Azure said, “This change reflects Microsoft’s strategy and focus on Azure as the public cloud platform for customers” [5].

2 Comparative Evaluation

2.1 Service Model

Amazon EC2, Google, and Azure support PaaS, IaaS, and SaaS compute services. An example of PaaS is AWS Elastic Beanstalk, Google App Engine, Azure Cloud Service respectively. For SaaS, is AWS Elastic Search, Google Workspace, Microsoft office 365 respectively. For IaaS, is AWS Elastic Compute Service, Compute Engine, Virtual Machine respectively [6] [7] [8].

2.2 Virtual Machine (VM)

VM are under IaaS. The instances of VM are offered by the Cloud services. The three services have some similar features that are creating instances from stored disk images, managing our instances without any sorts of troubles, installing different operating systems on our instance, to be able to tag our instance [9]. Different predefined instance configurations are provided by Amazon, Google and Microsoft. Predefined instances are of different types such as General Purpose, Compute Optimized, Memory Optimized and GPU [10]. These different types of instances provide different types of CPU to Memory relations.

2.3 Storage

For Amazon EC2, the archive storage are Amazon S3 Glacier and S3 Glacier Deep Archive. For Google Cloud Platform and Microsoft Azure archive storage are Cloud Storage Archive and Azure Archive Storage. For object storage Amazon has Amazon S3, Google cloud has Cloud Storage and for Azure it is Blob storage. Amazon EC2 has reduced redundancy storage whereas Google cloud storage and Azure has reduced availability storage. For these 3 services the Data transfer is done by AWS Cloud Data Migration Services, Transfer Appliance, Azure Data Box. File storage are Amazon EFS, Filestore and Azure Files. Block storages are Amazon EBS, persistent disk, local SSD (Google Cloud) and Azure Managed Disk (Azure) [10] [11].

2.4 OS Environments Offered

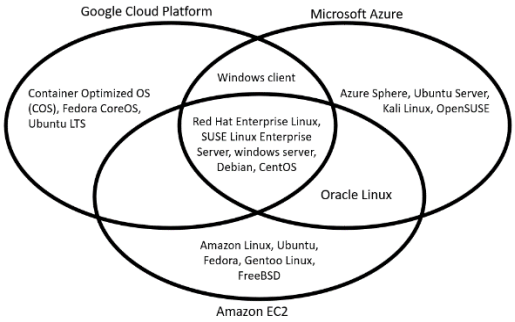

Fig. 1. OS supported by cloud services provider

2.5 Security

Google offers the customer a choice between allowing Google Cloud to manage your profile keys or allowing you to manage your own and enabling two-factor authentication. Azure is using advanced encryption standard and Azure's multi-layer authentication system. Amazon EC2 system is fine-tuned to deter threats, detect any unusual behavior, respond rapidly and efficiently to events, and remediate the AWS environment [12].

2.6 Performance and Scalability

The network performance of Google Cloud and Azure is very much stable in Asia than Amazon EC2. For connecting Europe to Singapore, Azure is the best but Amazon EC2 is dependent on public internet whereas. Google Cloud and Azure have their own networks which gives them an extra advantage. So, geographical location is a big factor for the performance of different cloud services. All cloud services have higher latency depends on the location [13].

2.7 Pricing Model

Amazon EC2 is the most affordable compare to Microsoft Azure and Google. They use methods pay-as-you-go which can start and stop the service anytime and with no upfront cost but Azure and Google use bills per minute while Amazon uses bills per hour [10]. Next, azure has a reservation method that uses bills per month and offers a 72% discount to the long-term user [14]. Google also offers a discount to long-running workload users. Next, they provide a free tier with basic service. For a new customer, Google provides $300 [15] and Azure provides $200 credits to try other paid services.

2.8 Auto-Scaling / Elasticity

The feature of auto-scaling in Amazon EC2 called Auto Scaling groups that maintain the availability of applications and gives us a chance to add or remove its instances as we want to [16]. In Google Cloud, the equivalent feature is called instance groups that Automatically adjust the number of VM instances that are hosting your application, allowing your application to adapt to varying amounts of traffic [17] and in Azure, it is called Virtual Machine Scale Sets to adjust the capacity of your scale set and to ensure that your application performs well when demand change [18].

2.9 Monitoring Tools / Service Provided

These three cloud computing platforms have their own cloud monitoring to review, observe and manage the operational workflow. The monitoring tools by Amazon EC2 is Amazon CloudWatch. It monitors your resources and the application the clients run on EC2 in real time [16]. For Google Cloud Platform, it is called Cloud Monitoring that collects metrics, events, and metadata from Google Cloud [19]. Azure Monitor as monitoring tools by Microsoft Azure helps user maximize the availability and performance of their applications and services [20].

3 Best of the Best

Table 1. Advantages and disadvantages every company provider.

Cloud Computing	Advantages	Disadvantages
Amazon EC2	Easy to use, no capacity limit, provides speed and agility, secure and reliable, enterprise-ready provider, and recommended for all use cases that run well in a virtualized environment. [12] [21]	Limitations of Amazon EC2, security limitations, technical support fee, general cloud computing issues, and poor support hybrid cloud. [12] [21]
Google Cloud Platform	Great reputation in the open-source community, deep investments in analytics and machine learning, good prices and high durability, Easy to integrate with other Google Cloud Services, many regions available to store data and one of the best free layers. [12]	Support fee is quite hefty, web interface can be confusing, SDKs API appears unstable, complex pricing schema, small partner ecosystem, and limited range of services for larger companies. [12]
Microsoft Azure	High availability and up time guarantee of 99.95%, cost-effective, strong security profile, integrations with other Microsoft product and services, and ideal for hybrid infrastructure. [22] [12]	Requires management and need human resources, require advanced technical expertise and have poor support for large-scale implementations. [22] [12]

Based on table 1, we select Amazon EC2 because given the practical and professional base on which Amazon is based on, here where Amazon EC2 consider as the most optimized cloud computing service provider whether for individual or companies. Is it important to mention the reason of choosing and preferring Amazon EC2 from others is due to its ability to start and stop various instances at predetermined times for instances, the ability to schedule services such as Elastic Compute Cloud (EC2) and relational database service (RDS) means they will not have to run during off hours or weekends.

4 Conclusion

In sum, cloud computing contributes a lot of benefits to users due to its myriad of advantages. The use of cloud computing has eased the community, benefitted the schools, and helped many businesses to grow and sustain. Considering the Covid-19 pandemic, the world has switched to using cloud computing. Not to mention the fact that cloud computing has played an important part in allowing companies and schools to continue to function properly by enabling them to complete the given tasks at remote places due to the stay-at-home orders. In the future, cloud technology will continue to develop, accelerate, and improve so that it is able to cater the needs of the community.

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