



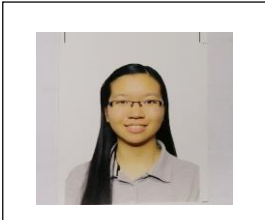
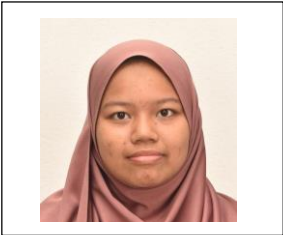
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Cloud Computing Fundamentals- Cloud Computing Service Providers, Advantages and Disadvantages

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1 Introduction

Cloud computing is a buzzword that means different things to different people. For some, it's just another way of describing IT (information technology), for others it means storing data, but in fact, Cloud computing is simply the ease and availability of computer services over the internet. Furthermore, this article is going to discuss three of the biggest cloud service providers in the 21st century which are Amazon, Google and Microsoft's cloud computing service.

1.1 Comparative Evaluation

Service Models: Infrastructure as a Service (IaaS) supplies pay-as-you-go access such as Amazon EC2, Virtual Machines and Google Compute Engine. Platform as a Service (PaaS) helps develop and deploy software such as AWS Elastic Beanstalk, Azure App and Cloud Services, and Google App Engine. Software as a Service (SaaS) is developed for users to connect such as Amazon Web Services, Microsoft Office 365, and Google Workspace.

Virtual Machine: Amazon EC2 and Microsoft Azure provide instances from nano to large sizes in general-purpose, compute-optimized, memory-optimized, storage optimized, and accelerated optimized [9, 10]. Google Cloud Platform provides f1-micro, g1-small, e2-micro, e2-small, and e2-medium [8].

Storage: Amazon EC2 storage offers EBS as block-level storage volumes while EC2 instance store introduces temporary block-level storage. EFS file system gives file storage while S3 provides object data storage. Glacier is for cold storage. Google Cloud Storage is for object storage, Persistent Disks for block-level storage, Nearline for cold storage and Google ZFS for file system. Microsoft Azure storage provides Blobs for unstructured data while Tables for structured data. Files helps in file system storage while Queues for large volume workloads. Disks is for block-level storage [9, 10].

OS Environment: Three of them have CentOS, Debian, RHEL, and Ubuntu. Amazon EC2 supports Amazon Linux, Windows G7 Server, SUSE Linux Enterprise Server, openSUSE Leap, Fedora, Fedora CoreOS, Gentoo Linux, Oracle Linux, and FreeBSD. Meanwhile, Google Cloud Platform supports Container-Optimized OS (COS), SQL, SUSE Linux Enterprise Server (SLES), Windows client, and Windows Server. Microsoft Azure has Windows 7, 8/8.1 and 10, Windows Server 2008, 2008 R2, and 2016.

According to Amazon [1] by controlling network access to your instances. It also helps in managing the credentials used to connect your instances, and managing the guest operating system and software deployed to the guest operating system. According to Google Cloud [3, 4] Web App and API Protection (WAAP) exist to protect your applications and against threats and fraud to help ensure availability and compliance. For Microsoft Azure [6, 7] it asceses and visualizes the security state of your resources in Azure, on- premises, and in other clouds with Azure Secure Score.

In Amazon EC2 using method lift-and-shift to avoid a potentially expensive application rewrite but can result in a less optimal workload than a cloud native solution .and to scale up to compute is vertical scalability [5]. Google Cloud releasing these two tools as open source which are PerfKit Benchmarker and PerfKit Explorer. Google Cloud’s serverless platform provides management that controls computing, database, and other services that scale quickly from zero to high request volumes and only pay for what you use [3, 4]. There is some pattern for Microsoft Azure in performance and scalability such as Cache-Aside that load data on demand into a cache from a data store and deployment stamps that deploy multiple independent copies of application components, including data stores [6, 7].

There are four pricing models for Amazon EC2 instances such as On-Demand Instances, Reserved Instances, Spot Instances, and Dedicated Hosts. For Google Cloud pricing model is usage-based pricing, customers will pay software based on measurements that customer choose. Next, according to Microsoft [6, 7], Microsoft Azure itself offer a multiplex of offerings that consider the currency of the underlying CPU, the number of virtual cores or virtual CPUs, the amount of RAM and storage required, and the associated payment terms. Amazon EC2 is auto scaling to help you to maintain application availability and allows you to automatically add or remove EC2 instances [1]. Google Cloud said [3, 4] Compute Engine offers autoscaling to automatically add or remove VM instances from a managed instance group. One of the great features of Azure service is its ability to auto scale according demands of the application usage [6, 7].

Monitoring tools for Amazon EC2 is Amazon CloudWatch is a monitoring and observability service built and provide you data and actionable insights to your applications, respond to system-wide performance changes, optimize resource utilization, and get a unified view of operational health. Meanwhile for Google Cloud it has Cloud Monitoring to collect metrics, events, and metadata from Google Cloud, Amazon Web Services. Azure Monitoring tools performs end-to-end monitoring and detects issues in applications or infrastructure. It also can detect bottlenecks and collect data on a large of other tasks.

1.2 Opinions

Table 1. The advantages and disadvantages of cloud platforms

CLOUD PLATFORMS	ADVANTAGES	DISADVANTAGES
Amazon Web Services (AWS)	• Easy to use =Because AWS have well organized and documented web services that very helpful for a new applicant even for an existing applicant. • No capacity limits =AWS offers a low cost capacity and the applicants can increase their capacity whenever they want unlike other cloud platforms. • Secure and Reliable =Provides high security at a lower cost. AWS will store the applicant’s data in AWS data centers. AWS also will secure the data no matter how big the data is.	-Common technical issues =AWS have general cloud computing problems such as network problem, downtime, and backup protection. Since, they are common technical issues, it can be overcome and solve after sometime.

Google Cloud Platform	• High productivity =Google system always notifies users about updates efficiently. So that, users can use new innovations from time to time. • Allows quick collaborations =The data of the users stored in the cloud instead of their computers, so allows many users to access it same time without any interruption.	-Lack of managed services -Only limited and outdated versions offers
Microsoft Azure	• Provides high security =Azure has a strong focus on data security of the users and also provides user friendly services. Azure security center: -Provides security recommendations -Detect and block malware -Analyze and identify potential attacks • Pro-scalability = With a single click of button, Azure can solve user's reports. With the help of this function, business only pay for what they uses.	-Need management and more expertise in platform =Azure requires more expertise in managing and monitoring the servers. As it can help to avoid mistake which may lead server down.

Assuming I am required to select one of the cloud service providers for my software development, I would like to choose Google Cloud Platform for my development. This is because the platform can provide more services to users compared to others. The productivity of this platform is higher when owing to quick access to innovation. The updates of Google's system is delivered efficiently and it is weekly. When there is a new function adopted by the user, the disruption is less using the Google Cloud platform because it delivers manageable improvements in a continuous stream [11]. I am more convenient as I can work anywhere and anytime I needed, I can gainfully access information via web-based apps. The data used to store on vulnerable devices is fewer that may get compromised after I stop to use web-based apps on the Google cloud platform. I spend less and save money on this platform because of Google's Economies of scale [12]. Overheads are minimized and a small number of configuration is consolidated by using Google cloud platform. The investments of Google in security give protection to me. Furthermore, if my software development is related to the business scope, I can use some of the exclusive services like Live migration in the Google cloud platform, which is not available in AWS and Azure platforms [13]. These are the reasons why I choose Google Cloud Platform as the cloud service provider for my software development.

2 Conclusion

In conclusion, the three services have many differences and they each have their own pros and cons. But in the end it's up to the consumer to decide what best fits him at the end of the day.

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