Cloud Computing Fundamentals Literature Review : Cloud Computing Service Providers

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Abstract- Amazon AWS, Microsoft Azure, and Google Cloud Platform are the top three cloud service providers. Their services have different kinds of features, advantages, and disadvantages. For this report, we will first introduce the comparison between these three major providers, focusing on Iaas, Paas, and Saas. Next, the different instance types of virtual machines (VM), the storage, the OS environment, security, performance, and scalability of each service, the pricing model-which pricing is effective, automatic scaling and monitoring tools of each service.

Keywords: Iaas, Paas, Saas, VM,storage, OS environment, security, performance, scalability, pricing model, scaling,services

1 Introduction

Cloud computing is the distribution of computing services over the Internet includes servers, storage, databases, networking, applications, analytics, and intelligence. They are being discussed and compared to identify the differences between them and serve as a reference point for business management purposes. The third-party company or vendors provide computing resources that are more flexible, reliable, and cost efficiency to help their customers boosting business performance, encourage development, and enable innovation.

2 Comparative Evaluation Between Amazon EC2, Google Cloud Platform, and Microsoft Azure

2.1 Service model (IaaS, PaaS, SaaS)

There are three service models provided that meet the business requirement.

Infrastructure as a Service (IaaS) – Provide access to servers, storage, networks, processing power, and other computing resources in the cloud. IaaS is completely self-service where the organization can control the entire infrastructure through a dashboard or an API.

Platform as a Service (Paas) – Provide access to a cloud environment in which personalized applications can be created, controlled, and distributed using a suite of prebuilt tools. The organization or a third-party vendor can handle all servers, storage, and networking, while developers may retain program maintenance.

Software as a Service (Saas) – Provide applications that can be accessed via the Web. These applications are managed by the software vendor, thus frees the organization

from the relentless burden of operational issues including applications maintenance, infrastructure management, and network protection.

2.2 Virtual Machine (VM) (micro, small, medium, large)
An emulation of a computer system with its own CPU, memory, network interface, and storage, created on a physical hardware system.

2.3 Storage
Modern data storage scenarios that offer massively scalable object store for data objects, disk storage for virtual machines (VMs), a file system service for the cloud, a messaging store for reliable messaging, and NoSQL stores.

2.4 OS environments offered
Provides services to both the users and to the programs such as provides programs an environment to execute and provides users the services to execute programs in a convenient manner.

2.5 Security
Security tools and capabilities available for the users such as providing visibility and controls over the security of the user's program.

2.6 Performance and scalability
Performance in cloud computing includes the optimum cost of cloud services, reliability, and scalability.

2.7 Pricing model
Pay only when the user uses it and depends on the rate of each service.

2.8 Auto-Scaling/Elasticity
Autoscaling is a cloud computing technique for dynamically allocating computational resources. An application typically scale based on load balancing serving capacity.

2.9 Monitoring tools/service provided
Tools or services are provided for each cloud computing provider.

Table 1. Comparison between AWS EC2, GCP, and Microsoft Azure

Public Cloud	AZW EC2	Google Cloud Platform	Microsoft Azure
Service Model (IaaS,PaaS,SaaS)	• **PaaS:**AWS functionality requires the user to link multiple providers together and create a full application creation and implementation pipeline.	• **PaaS:** supports the development and delivery of software written in several languages and frameworks. • **IaaS:**delivers predefined and customizable types of machines	• **Platform as a service (PaaS):** provides hosting and tools to streamline the creation and implementation of software using a range of languages and frameworks

Virtul Machine (micro, small, medium, large)	• Use Elastic Compute Cloud (EC2) • Use Elastic Beanstalk for running and scaling Web applications	• Use Compute Engine • Expert using Kubernetes • Use Google App Engine	• Use Virtual Machine • Use Service Fabric that specifically designed for applications with microservices architechture.
Storage	• Simple Storage Service (S3) as storage services • Aurora as database services • Glacier as backup services	• Cloud Storage as storage services • Cloud SQL as database services • There is no backup services	• Blob Storage as storage services • SQL Database as database services • Archive Storage as backup services
OS environments offered	• Offer Lambda serverless computing • Use Amazon API Gateway	• Use Cloud functions • Use Cloud endpoints	• Use Azure functions • Use Azure API gateway
Security	Use Fortinet that offers security measures for VPC(Virtual Private Cloud) in several availability zones on an on-demand basis	Use FortiGate Next-Generation Firewall for advanced security as well as critical firewalling.	Use Fortinet that provides optimized security for data and apps while removing extra overhead required during migration
Performane and scalability	• Expand or reduce capacity within minutes, not hours or days • Glacier as the backups services	• Redundant Backups. • Storage options are more targeted and unified.	• Provide several backups solutions: Achival storage,Recovey backups and Site recovery
Model	• On-Demand • Savings Plans • Reserved Instances • Spot Instances • Dedicated Hosts	• On-Demand-Sustained Use	• On Demand-Short Term Commitments (Prepaid/Monthly)
Pricing	• Per hour	• Per minute (>=10 minutes)	• Per minute Commitments (Prepaid/ Monthly)
Auto-Scaling/Elasticity	• Can build scaling plans that automate how groups of different resources respond to changes in demand	• Only works with zonal and regional managed instance groups (MIGs). Unmanaged instance groups are not supported	• Host resources in par with the demand and configured parameters.
Monitoring tools/service provided	• Elastic Block Storage (EBS) • Elastic File System (EFS)	• Cloud storage • Persistent disk • Transfer appliance • Transfer service	• Blob Storage • Queue Storage • File Storage • Disk Storage

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4.0 Opinion

4.1 Jaudan Afzal
AWS's advantages are that it provides a lot more services than other platforms, and is dominant in features such as configuration, monitoring, and security it is also a pioneer in cloud computing so they are more experienced in the field. Amazon AWS's disadvantages being there is a technical support fee which varies as per different packages and other generic cloud computing drawbacks such as internet dependency, security concerns, and so on. I think the platform that I would use for software development is that I would rather use Amazon AWS the reason being that it has more experience in the field and that it has more features than any other platform compared to the Google cloud platform which is new and has fewer features and also Microsoft Azure's speed problems which could prove problematic if you do not live near an Azure server.
4.2 Wong Pei San
The advantage of AWS EC2 is its flexibility and availability. No restriction for the location. But, it is the most expensive among the three. GCP is not global reach and absence of backup options but it is cost-efficient. Microsoft Azure is well in offering a hybrid cloud model, which provides advantages for users in scalability and security aspects, especially companies. I will choose Microsoft Azure. As I prefer a hybrid solution that improve security and risk management. So, I no need to worry about the data leakage problem. Second, there are several choices for backup services which help me to back up my data when anything happens such as power failure. Last, there are resource locks for me to protect my data from being accidentally deleted or modified.
4.3 Nurmazli Azlin
The organization needs to consider some pros and cons before choosing and implement any cloud computing. AWS had become the most dominant cloud computing and can meet the current and future needs of customers. But because of their higher rate, some organizations are concerned about the cost structure. While Microsoft Azure had the extensive groundwork it had achieved through joining the pioneers with full-stack to deliver cloud services. But some of Azure's enterprise-grade applications seem to be imperfect and less ready for the enterprise than expected. GCP can handle giant workloads much faster. Because of the late-born of GCP, they do not have many amounts of data centers available with AWS or Azure and different from other competitors. In my opinion, I would choose Microsoft Azure as they could deliver an advanced cloud solution and current needs even though it is a fresh cloud computing compared to AWS and others.
4.4 Siti Hajar
AWS has the massive scope of its global operation but it has a hard time managing company's core structure effectively. Meanwhile, Azure can grow rapidly because many enterprises already familiar with Microsoft apps but there is also a complaint from the customer about their services feel less enterprise-ready. GCP easy to integrate with other Google Cloud Services and it has many regions available to store data but the support fee is expensive and has a complex pricing schema. In my opinion, I will choose AWS because of the maturity and stability. AWS has been around since 2002 and stride in 2006 by focusing on EC2, cloud storage, and SQS. Besides, Amazon has a longer perfect cloud platform than others and the largest sites websites also trust their cloud to AWS such as Netflix, ESPN, Hulu, and Zillow.

5.0 References

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