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Business Environment in the Context of Cloud Computing: A Review

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Abstract

Many businesses now rely on cloud environments for both personal and corporate use due to the industry's expanding trend of constantly improving technology. The on-demand, pay-as-you-go delivery of IT resources through the internet is known as cloud computing. This indicates that the user just needs to make payments based on how much they use. In layman's terms, it refers to the idea of using the Internet to rent the processing power and storage capacity of a computer from another location. Users can get technology services like computing power, storage, and databases from a cloud provider on a pay-as-you-need basis rather than purchasing and maintaining their own physical data centers and servers. Our object of this article is to peer-review and examines numerous cloud tools, applications, and more to decide which is the best choice for both individual users and businesses. We have investigated the advantages that cloud computing offers.

Keywords: Business Environment; Cloud Computing; IT.

1. Introduction

With the growing trend of ever-evolving technology in the industry, many companies would rely on Cloud environments to utilize for their business applications and personal use. Cloud computing is referred to as the on-demand delivery of IT resources via the internet with pay-as-you-go pricing [1-3]. This means the user only needs to pay depending on how much their usage is. In simple terms, it means it is the concept of borrowing the performance and storage space of a computer from another place through the Internet.
Instead of buying and maintaining users' physical data centers and servers, they can access technology services such as computing power, storage, and databases on a pay-as-you-need basis from a cloud provider. Companies from all different sizes are using the cloud for a wide variety of use cases, such as disaster recovery, big data analytics, email, test and development, virtual desktops, Software as a Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), etc. This way of utilising the cloud does

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not require a huge upfront cost of investments to buy the hardware required for it [4-5]. In return, it allows companies to focus more of their capital on developing their businesses and also have more flexibility in scaling. With the use of the cloud, it ensures that regardless of the location, the size, or the industry, the customers do not need to worry about managing infrastructure and data centers, which means the customers can focus on what matters the most to their businesses or organisations.

With all that said, that is precisely the purpose of our proposal, which is to examine various cloud applications, cloud tools, and more, to determine the best option that can be employed by individual users and organisations alike. We have looked into the benefits that cloud computing brings, and we have also looked at a few different cloud applications and examined the differences between them that set them apart. Furthermore, we have also analysed various elements of different cloud tools that are offered by a number of companies, and what functionality each cloud tool brings to the end-user [6]. Towards the end of our proposal, we have done a deep dive into the services and products offered by AWS, Microsoft Azure, and Google Cloud. By doing so, we cans compare these different companies and how their services and products differ from each other and weigh the pros and cons of each service, which will then give us a clear picture of which cloud service provider may be the overall best choice for the end-user.

2. Overview Benefits of Cloud Computing

Ever since the inception of cloud computing, the constraints of traditional IT infrastructure are getting more apparent. Many businesses today are still struggling to adopt emerging technologies as they did not realise the power of IT development. However, the good news is that the COVID-19 pandemic has accelerated the adoption of digital transformation and technologies in most of the industry [7]. This is indeed a great opportunity for the business industry as cloud-based services offer a much more scalable and reliable IT database that is specifically designed to assist business performance and growth.

When users are adopting the cloud-technology services, some benefits that can be obtained include cost savings compared to traditional on-premises hardware, strong networked data security, scalability, automatic backup and restore data as well as increased collaboration.

2.1 Cost Savings

Cloud computing is probably the most cost-efficient method to utilise, maintain and upgrade the infrastructure. This is because cloud services are deployed on a **pay-as-you-go basis** where users will be paying for what they use only or selecting other scalable options. This feature is also applicable to the data storage space needed to service the client. This indicates that users can rent the storage space they need. Hence, the users get to save costs as the spaces that are not used will not be charged [8]. Cloud computing also eliminates the capital expenditure (CAPEX) of buying hardware and software because businesses no longer need to invest in expensive infrastructure.

Since businesses do not need to build their own IT infrastructure or purchase on-premises hardware and equipment, it could help the organisation to lower costs and guarantee higher returns. In short, this has become one of its selling points and reasons to attract businesses of any size to shift from traditional on-premises hardware to the cloud.

2.2 Data Security

Information security is a major concern for many companies recently. Data theft or loss of devices containing valuable information could cause the organisation financial loss, reputational damage, deterioration of customer trust and brand erosion. This is where cloud computing comes into place as many providers offer a broad set of policies, technologies and controls to strengthen the overall security posture

from potential threats. With that, cloud offers better safety features and services like authentication, access management and data encryption.
According to RapidScale, the statistic represents that 94% of businesses reported they saw an improvement in security after switching to the cloud services [9]. The purpose of having such advanced security features is to ensure the data stored in the cloud is handled securely and confidentially. To illustrate, Google Cloud has come up with an Advanced Protection Program where the account can only be enrolled by using the user's phone's built-in security key or using physical keys which is also known as Titan Security Key. Besides, with most cloud-based services, users can add different security settings on their side. Hence, this has proven that cloud has a strong network data security provided to the individuals and companies.

2.3 Scalability

Cloud infrastructure is fundamentally flexible to allocate the demand by scaling up or down the IT resources. For example, the web application can be scaled up if the traffic of the visitor's increases to handle the heavy workload so that the system will not go down and thus lose money, and vice versa. Scaling helps in delivering the right amount of IT resources such as the magnitude of computing power, storage, and bandwidth from the right geographical location. Apart from that, scaling can be done in a short period. This is such an amazing feature as the on-premises physical infrastructure took a long time to process and it required a huge amount of expenditure [10-12]. A scalable solution can be beneficial as it allows for consistent and long-term expansion in a structured manner.

2.4 Back-up and Restore Data

Initially, people tend to save all the valuable data inside the hard drive in PCs and laptops. However, the biggest nightmare might happen if the local hardware fails out of sudden which results in the users or the organisations losing the valuable data forever. Data loss may be caused by many different factors like system failure due to virus infections, human error and software failure [13]. Data loss could also occur due to the malicious action that sends malware to corrupt the data storing system.
This has shown the significance of investing in a cloud-computing solution where it can backup and restore all the data constantly [14]. The outstanding feature is that it is safe and accessible from any device as long as there is an internet connection. Even if the local PCs are down, users are still allowed to access all the data by login into their account on other devices.

2.5 Increased Collaboration

The cloud system also provides a collaboration function between groups and communities who have access to the same files to ensure the documents are securely shared. This helps many people, especially the organisations and individuals who live apart to collaborate on the same piece of document. Team members can view and exchange information easily and securely over a cloud-based platform. Furthermore, it removes the communication limitations of traditional IT models where previously people used to travel from one destination to another destination just to get the softcopy [15-16]. Subsequently, this helps the work performance to become more effective and efficient as work gets done in a short period. Aside from increasing performance, it also helps in reducing carbon emissions as people can now access easily via the cloud and minimise the air pollution while travelling to other places.

3. Types of Cloud Applications

There is a wide range of cloud applications available in the market, which are usually offered under 3 different categories: Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS). Cloud applications, under whichever category, are hosted by third-party service providers. All the infrastructure, as well as development, are taken care of by the service providers, and the user does not need to worry about maintaining the infrastructure [17]. SaaS offerings are applications accessible via mobile and desktop web clients used by consumers and businesses alike, it includes services such as Gmail, Dropbox, Salesforce, Slack, etc. PaaS products are often used by software developers to deploy their applications; it includes services such as those offered through AWS Elastic Beanstalk, Google App Engine, Heroku, etc. IaaS products refer to the infrastructure used to enable SaaS and PaaS products, such as servers, storage, virtualization, etc. Some providers of such products include AWS, Microsoft Azure, DigitalOcean, and more.

3.1 Cloud Applications, Differences, and Aspects

Even if two cloud applications are in the same category, that does not mean they are homogeneous. Take email clients for example, such as Gmail and Outlook, while they both are the same kind of SaaS application designed to do the same tasks, they offer quite different experiences [18-19]. Though they both have similar features such as calendars and notes, as well as chats and conference calls, there are things they do differently.

Gmail and Outlook each have a distinctly different user interface (UI), which is perhaps what sets them apart the most. Gmail seems to have a more minimalist layout by default, whereas Outlook has a layout that looks more complicated. They also sort emails somewhat differently: Gmail sorts emails using labels, whereas Outlook sorts emails not just using labels but also by allowing users to create their own folders. Additionally, while both Gmail and Outlook are technically free, they do offer paid tiers catered for businesses and organisations that are for extra features such as custom email address domain names, enhanced phishing prevention, enhanced encryption, etc [20]. When it comes to PaaS applications, some of the more popular options are AWS Elastic Beanstalk and Heroku. Both platforms support the most popular programming languages such as Java, Python, Node.js, Go, Ruby, and PHP. However, Heroku actually supports two additional languages: Scala and Clojure. While both provide the same fundamental functionality, they both also differ in another way. AWS Elastic Beanstalk is a more complex platform and can be harder to use, whereas Heroku is known to be more user-friendly.

In terms of IaaS providers, AWS and Microsoft Azure are perhaps the top players in the industry. A key infrastructure provided by these providers is the virtual machine (VM), which is a software that allows the user to run an instance/emulation of an operating system (OS) via virtual computing resources provided by the third-party service provider, all on the user's hardware without them needing to install a separate OS in a separate partition [21-24]. Both AWS EC2 and Microsoft Azure VM offer instances for many different types of computing tasks that vary from general purpose to high performance. While these two VMs are largely the same in terms of overall features such as auto-scaling of resources and performance of the different VM types, the difference comes down to things like some smaller features. For example, AWS EC2 supports a hibernation feature which allows the user to temporarily pause the VM, but Microsoft Azure VM does not have such a feature. Another difference lies in the price of the service. Looking at the pay-as-you-go pricing of a couple of their Linux VMs — with an equivalent number of CPU cores and amount of RAM — we can see a noticeable distinction in the pricing [25]. In terms of general computing, the "t4g.xlarge" instance from AWS costs $0.1344 per hour, and the "B4ms" instance from Microsoft Azure costs $0.166 per hour. In terms of memory-optimised compute, AWS's "r6g.4xlarge" offers its services at

a cost of $0.8064 per hour, and Microsoft Azure's "E16as v5" offers its services at a cost of $0.904 per hour. It can be deduced that Microsoft Azure might cost more than AWS overall.

3.2 Evaluation Cloud Applications

In the age of cloud computing, technology has been more robust than ever. However, that is not to say that they are flawless. Perhaps the most common issue with servers is outages. All servers can break down, regardless of whether it is operated by AWS or Microsoft Azure. Just over 4 months ago, a couple of AWS servers in the United State (U.S) states suffered from outages on three separate occasions [26], all within the same month, affecting many services that depend on its infrastructures, such as the Epic Games Store and Netflix. Microsoft Azure servers suffered from a similar fate last October, except it had a much more drastic outage that affected its users globally. Storing any kind of data in the servers of third-party service providers will also lead to privacy concerns, as it is entirely possible that the service providers might have access to the user's confidential and personal data.

Likewise, the software has its issues too. Bugs and glitches can occur as a result of a limitation in the code. A notorious example of a software limitation is the Y2K bug. Across the globe, there was widespread fear that the moment the year transitions from 1999 to 2000 a ginormous bug would hit computer systems worldwide, potentially causing severe problems for databases worldwide, wreaking havoc on everything from airline bookings to financial records [27-28]. This serves as an example that all it takes to cause a potentially disruptive software issue is a small shortcoming in the code of software, which always arises as a result of human error.

Using cloud applications will also always carry an inherent privacy concern. The top service providers might be using cutting-edge security protocols to protect their servers, but that doesn't mean they are 100% immune to cyberattacks [29]. Therefore, by using cloud drives to store data and files, or email clients to send and receive emails, the user will always take the risk of having their confidential data and emails leaked if there are any malicious parties involved.

4. Analysis of Various Cloud Tools

Cloud monitoring is a way of investigating, examining, and dealing with the operation work process in a cloud-based IT infrastructure. Manual or automated management tactics affirm the accessibility and website performance, servers, applications, and other cloud infrastructure [30]. The system will continuously evaluate the resource levels, server response time and speed to predict the problems that possibly will occur in the future therefore this can avoid things to go worst.

Furthermore, cloud monitoring tools support us with getting to the cloud-based infrastructure. These tools are to check the performance and security of services and applications. With these devices, you can determine more production with cost-efficient cloud applications [31]. When the ideal choice is identified, a more useful and cost-building structure is made with these tools. It will be more effective to manage things when more industries understand the usefulness of tools and cloud monitoring systems.

There are plenty of cloud computing monitoring tools which are available in the market. First of all, **Retrace**. It is one of the cloud-based tools created for software developers and coders with help in coding and design development. This is viewed as the top among all the tools that are currently available in the market as it guarantees the developers to make progressive coding consistently [32]. The idea is to make the developer complete their jobs more efficiently. This tool cost is in an affordable price range which is suitable for small and medium businesses to use. Secondly, **TrueSight Pulse**. This is one of the cloud-based monitoring tools that help to perform well and oversee operations alongside cost management structure. It provides end-user performance experience to identify issues. It also allows users to control

costs and deal with the right resources at economical costs. This tool serves to reduce unnecessary expenses, which a company can use to invest in business future needs. Additionally, **Aternity,** this cloud tool is specially intended for the end-user experience. It can track what users see when they interact with applications in a business workflow [33]. It also shows the response time between the client application and the device's back end. Hence, this allows companies to resolve issues immediately as well as improves client communication. Moreover, **SolarWinds**. This cloud computing monitoring tool is a powerful economy network monitoring software that allows users to diagnose, resolve and detect problems. It also enables them to visually track and monitor network performance from time to time.

Last but not least, **Express**. It is a SaaS cloud computing monitoring tool that offers security and improvement of services, empowering the cloud application ready. These tool applications, for example, dropbox, salesforce, and so forth, deal with every one of the tools with investigating and fixing issues that can straightforwardly or indirectly affect the business the focal business and company stages like Starbucks, PayPal, and P&G. 5.0 Comparison of Amazon Web Services, Microsoft Azure and Google Cloud Platform table 1.

Table 1 Introduction of the Service Providers

			
Service Provider	**Amazon Web Services (AWS)**	**Microsoft Azure**	**Google Cloud Platform (GCP)**
Establishment	Launched in 2006	Publicly launched in 2010	Launched in 2008
Availability Zones	Offers 26 regions with 84 availability zones	Offers 60+ regions in 140 countries	Offers 29 regions with 88 total zones
Brands Trust	• Nasa • Samsung • Netflix • Mcdonald's • Disney • Airbnb	• NBA • PepsiCo • NHS • Bosch • General Electric • Make-a-Wish	• HSBC • Paypal • 20th Century Fox • Dominos • Twitter • Toyota

Amazon Web Services (AWS) was officially launched on March 14, 2006 and is currently available in 26 regions and 84 zones. It provides servers, storage, networking, remote computing, email, and security services and this is why the top companies like Nasa, Samsung, Netflix and Disney are currently using it.

Microsoft Azure first launched in October 2008 and is currently serving over 60 regions. Its services include databases, analytics, compute, etc. It is a popular option among enterprises of all sizes such as PepsiCo, General Electric, and more.

Google Cloud Platform (GCP) is a suite of Google's public cloud that has been running for cloud development, deployment, scaling, monitoring and management services since 2008. It is built on the same infrastructure that Google uses internally for its end-user products like Google Search, YouTube and Gmail. There are currently 29 regions with 88 total zones of physical data centres available worldwide [34]. Since GCP shares the same infrastructure as Google Search and YouTube, this has attracted many notable companies to deploy the services. Some major clients of GCP are HSBC Bank, PayPal, Twitter, and so on table 2.

Table 2 Products & Services

Products & Services			
Compute	Amazon Elastic Cloud Compute (EC2)	Azure Virtual Machine (VM)	Google Compute Engine
Database	Amazon Relational Database Service	Azure SQL	Cloud SQL
Storage	Amazon S3	Azure Blob Storage	Google Cloud Storage
Networking	Amazon Virtual Private Cloud (VPC)	Azure Virtual Network	Virtual Private Cloud
Troubleshooting	EC2 Rescue	Azure Site Recovery	Stackdriver Logging
Monitoring	Amazon CloudWatch	Azure Monitor	Google Stackdriver

Each company offers different products and services. It can be differentiated into a few domains such as compute, database, storage, networking, troubleshooting and monitoring services.

In the compute domain, the primary service used by AWS is **Amazon Elastic Cloud Compute (EC2)** which functions as a web service interface that provides resizable compute capacity in the AWS cloud. As for Microsoft Azure, it offers a wide range of **Azure Virtual Machines (VMs)** suited for different tasks [35]. As for GCP, it is operating on the **Compute Engine** system. Each of the compute systems works on the same functionality and idea which is to let users create and launch virtual machines without an on-premises infrastructure, just that the names are different. The only difference is the speed of launching the infrastructure. AWS took 60 to 90 seconds to run the application whereas Azure took more than 1 minute to do so. GCP is considered as the fastest one where it takes seconds to launch the application.

When it comes to database services used for the upkeep of applications, AWS is using **Amazon Relational Database Service (RDS)** as their database system where the databases like MySQL, Oracle, MariaDB,

SQL server and Aurora can be managed automatically by RDS. Meanwhile, Microsoft offers them through **Azure SQL** and GCP is deploying on the **Cloud SQL.**

In terms of storage, AWS is using **Amazon S3** whereas Microsoft Azure is using **Azure Blob Storage** to serve all kinds of data (images, documents, video, audio, etc.) to browsers as well as for backup and restore purposes [36]. Meanwhile, GCP deploys **Google Cloud Storage** which provides a similar kind of object-storage system as AWS and Azure to store users' data with advanced security and sharing capabilities.
Moving on to the networking domain, the primary service that AWS is using is **Amazon Virtual Private Cloud (VPC).** From this networking service, customers can run code, store data or do anything else they could do in the ordinary private cloud [37]. **Azure Virtual Network** is used to set up a private network within an organisation, and it is used to facilitate the communication between Azure services within that network. On the other hand, **Virtual Private Cloud (VPC)** is provided by GCP with the characteristics of being global, shareable, expandable and transparent. Users can easily scale the IP space of any subnets by using their own IP addresses across all the regions.

When users face any errors or outages that need to be resolved, AWS users may use the troubleshooting feature which is **EC2 Rescue** as it allows users to run and resolve their issues whereas **Azure Site Recovery** is used to ensure that the organisation's crucial applications still run in such a situation. Similarly, in GCP, users can easily troubleshoot the specific part with the **Stackdriver Logging** service.
The last domain is monitoring. The only monitoring service provided in AWS is **AWS CloudWatch.** Users may use it if they are thinking of monitoring data in the forms of metrics, logs or events [38]. Some basic information is provided such as the amount of traffic coming in, the performance of the instance, etc. Microsoft also provides its users with the ability to monitor the performance of their applications via **Azure Monitor**, which collects and analyses logs to resolve any issues. Also, GCP runs on the Google **Stackdriver** which provides the same functionality as AWS CloudWatch table 3.

Table 3 shows the tools

	aws	Microsoft Azure	Google Cloud
Tools	• Amazon Corretto • AWS Cloud9 • AWS CloudShell • AWS x-ray	• Visual Studio • Azure PowerShell • Azure Data Studio • AzCopy	• Cloud Build • Cloud Tasks • Container Registry • Source Repositories • Deployment Manager • Endpoints

AWS offers tools like **Amazon Corretto**, **AWS Cloud9**, **AWS CloudShell**, and **AWS x-ray**. All of the services are designed to enable developers and IT professionals practising DevOps to rapidly and safely deliver software. First of all, **Amazon Corretto** is a multiplatform, production-ready distribution of the Open Java Development Kit and comes with support that includes security fixes and performance

enhancement. Secondly, **AWS Cloud9** is a cloud-based integrated development that helps to run and debug code which includes the terminal, debugger and code editor [39]. Furthermore, **AWS CloudShell** is a browser-based shell that makes it simple to safely manage, explore, and collaborate with AWS resources. Moreover, **AWS x-ray** is a service that assists developers to debug and analyse distributed applications. Normally, customers will use it to monitor application traces like knowing how the application or its underlying services are performing.

With $200 Azure credit available to the user upon registering, Microsoft Azure provides many tools. A **visual Studio** is software used for the development of desktop apps, web apps, websites, and mobile apps. It comes built-in with IntelliSense, which is a code-completion tool, and it also supports third-party plugins to provide a seamless coding experience. **Azure PowerShell** is a cloud-based command-line interface (CLI) that allows the user to execute commands by using scripts called cmdlets to automate processes such as the provisioning of VMs or management of storage accounts [40]. **Azure Data Studio** is a cross-platform database tool, and it is used to manage on-premise of off-premise SQL databases. **AzCopy** is a CLI that lets its users copy data to and from an Azure storage account or Azure Blob Storage.

Under Google Cloud Free Program, it provides a 90 days trial with $300 free credits in the account. The free tier version has offered the end-users with few useful tools such as in App Modernization (cloud build, cloud task), Containers (container registry, source repositories) and Management (Deployment Manager, Endpoints) sectors. Cloud build and cloud tasks are examples of App Modernization tools. **Cloud build** is the product that is used to develop, debug, and deploy using Google Cloud's serverless CI/CD infrastructure. Next, **Cloud Tasks** provides Asynchronous task execution services. This means that the end-user can perform work concurrently outside of a user or service-to-service request. Besides, GCP also allows users to manage and store Docker container images securely with the **Container Registry** tool. To continue, Cloud **Source Repositories** are private Git repositories which can be accessed and used by multiple users. Next, **Cloud Deployment Manager** is the service that creates and manages the cloud's resources. Lastly, **Cloud Endpoints** is a tool that specialises in API development and provides insights with Cloud Logging, Cloud Monitoring and Cloud Trace table 4.

Table 4 Overview of Estimated Cost

Machine Type			
Smallest Instance	0.5 GB of memory and 1 virtual CPU ~$0.0065/ hour	0.5 GB of memory and 1 virtual CPU ~$0.005/hour	0.6 GB of memory and 1 shared-core virtual CPU ~$0.0053/hour
Largest Instance	12 TB RAM and 448 virtual CPUs ~$109.2/ hour	24.576 TB RAM and 896 virtual CPUs ~$174.805/hour	11.776 TB RAM and 416 vCPUs ~$59.060/hour

The cheapest package offered by AWS has 512 MB of memory with only 1 virtual CPU and it costs $0.0065 per hour which is equivalent to $4.75 per month. On the other hand, the most expensive package offered

by AWS comes with 12 TB together with 448 virtual CPUs and it costs $109.2 per hour which is estimated to cost $78k monthly.
Comparing the smallest instances from AWS and Microsoft Azure, it appears that the instance offered by Microsoft Azure is a better bang for the user's buck, with the same specs but at a cheaper price [41-44]. Moving on, when comparing the largest instances from all three services, the one from Microsoft Azure dominates the rest in terms of performance. With 24.576 TB RAM and 896 vCPUs, it is significantly stronger than the ones from AWS and GCP, and is consequently significantly more expensive, with a cost of $174.805/hour.
The estimated cost of GCP's most basic instance charges $0.0053/hour with 1 shared-core virtual CPU and 0.6 GB RAM. This is about 23% cheaper compared to one from AWS. Meanwhile, GCP offers a favourable option with its largest instance that costs $59.06 per hour and it includes 11.776 TB of RAM and 416 vCPUs, which is almost as powerful as the one from AWS but is much cheaper table 5.

Table 5 shows the strengths

		
High performance	Robust support for hybrid cloud technologies	Committed to open source and portability
Easy to use especially for new user	Integration with Microsoft Windows and other Microsoft Services	Offer highly specialised compute service such as big data, analytics, and machine learning
One of the safest cloud computing platforms	Extensive auto-scaling of resources	Deep discount and flexible contracts

There are strengths of using AWS such as high performance, user-friendly and secure to use. First of all, AWS offers high performance computing service therefore companies do not need to worry about the speed as some companies think that productivity is very important to compete against their rival companies. Secondly, AWS is user-friendly as the first-time user can find it easy to use. They can edit data and do whatever they want easily. In addition, AWS is one of the safest platforms in the market therefore plenty of top companies are using it as a security uppermost priority for any company that is data-driven [45]. A strength of Microsoft Azure is that it has robust support for hybrid cloud technologies, allowing the user to fully optimise their experience by using resources provided by two or more cloud deployment models. Another strength is that, by using Microsoft Azure, users will have integration with Microsoft Windows and Microsoft 365 which will allow for a seamless experience. Finally, Azure is very highly scalable in terms of resources, and it is very reliable in automatically ensuring that the servers will perform smoothly for all users at all times.
One of the strengths of deploying GCP is that it is committed to open source and portability. This means that it is publicly accessible to solve real-world problems for the users. It promotes open-source innovation, cooperation and sustainability that helps organisations to stand out at a lower cost. Besides, it also offers

highly specialised computer services such as big data, analytics and machine learning [46]. Therefore, it is regarded as a load balancer that assists enterprises to achieve a high-performance level at lower costs compared to the traditional on-premises load balancing technology. Additionally, Google also offers various deep discounts and flexible contracts to attract customers. This can be proved where GCP has a feature per-second billing model which lets users save more. It also offers various discounts such as Committed Use Discounts (CUDs) where the discount is up to 57% for most resources including machine types or GPUs table 6.

Table 6 shows the weaknesses

		
Lack of experts	Lack of sufficient management tools	Limited range of services for big companies
Price Variations	Over-spending on services	High cost of downloading data from the storage
General issues like server down due to millions of users	Inconsistency in speed across different regions	High cost of support fee

Although lots of top companies are using AWS, there are still some weaknesses of using AWS such as lack of experts, price variations and general issues like server down. First of all, companies face difficulty in looking for the right professionals to work on AWS which can lead these organisations to better performance as only a few professionals are skilled in AWS [46]. Secondly, the price of AWS services varies based on factors like the electricity, cost of land and taxes from region to region. Last but not least, Amazon is a huge family with millions of customers therefore users may sometimes experience problems like server down due to heavy traffic on the server.

Despite all its strong points, Microsoft Azure has its weaknesses. First, it has insufficient management tools in comparison to AWS and GCP, and thus Azure users will have to put more effort into managing their system. Second, it is quite easy to overspend on Microsoft Azure services, as it is very easy to start using the wide variety of Azure services provided, and the user may purchase unnecessary capacity that goes underutilised. Lastly, even though Microsoft Azure has many servers across the globe, nothing is guaranteeing that the servers will all run at the same performance [47]. Besides, in certain areas coverage may be weak, and thus performance will be unfairly slow for those people.

While GCP offers certain benefits, it also has a few weaknesses. To illustrate, Google has a limited range of services for big companies compared to its rivals. Moreover, the cost of downloading data from Google Cloud Storage is costly where it is charged 0,12 USD per GB. The support fee is also extravagant where the most basic service (Silver class) demands 150 USD monthly.

5. Recommendation of One Service Provider

Nowadays, cloud computing solutions and their services are no longer exclusive to huge corporations. On the other hand, cloud technology is equally useful for small and medium-sized businesses. The service provider that would be recommended based on our end-users of small to medium-sized businesses is **Microsoft Azure** [48]. This is because once the user signed up for the Microsoft Azure cloud service platform, they will get to run virtual desktops and applications with its storage and backup system based in the cloud.

Moreover, Azure is a cloud computing platform vastly designed to offer organisations built-in migration tools. This means businesses are able to migrate Windows Server and Remote Desktop Services (RDS) to various other devices.

As a hybrid cloud service, it has a huge capacity for integrating and managing the user's environments. It supports almost all the popular platforms like IOS devices, Windows, and Android phone apps along with its web service. The solution is suitable for all types of business setups starting from small and medium-sized businesses [49-[50]. It also provides customer support through online tutorials and knowledge-based documentation.

Even when the business grows, security, scalability, and analytics may be easily achieved. Not to mention its multi-layer security and data backup features, which are available to users from the beginning. It keeps all files safely even after giving employees access to data. Lastly, when comparing the cloud services from different price points, Microsoft Azure offers the most economical rates at 0.005 per hour for 0.5 GB of memory and 1 virtual CPU. This is also scalable depending on the requirements of the business where it can scale up to the largest instance at a total of 24.576 TB of RAM and 896 virtual CPUs.

6. Conclusion

Due to the industry's growing trend of constantly advancing technology, many firms today rely on cloud environments for both personal and corporate use. Cloud computing is the term for the on-demand, pay-as-you-go distribution of IT services over the internet. This suggests that the user only needs to pay for what they actually utilise. In simple words, it refers to the concept of renting a computer's processing power and storage space from another place over the Internet. Instead of buying and maintaining their own physical data centres and servers, users can purchase technology services like computing power, storage, and databases from a cloud provider on a pay-as-you-need basis.

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