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### Comparison of Major Cloud Providers

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## **Comparison of Major Cloud Providers**

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## Comparison of Major Cloud Providers

This paper will compare the following major cloud providers: Microsoft Azure, Amazon AWS, Google Cloud, and IBM Cloud. An introduction to the companies and their history, fundamentals and services, strengths and weaknesses, costs, and their security will be discussed throughout this writing.

### Microsoft Azure

Microsoft Azure (MS Azure) is a cloud service provided by Microsoft, providing over 200 products and cloud services for IT cloud solutions (*What is Azure-Microsoft Cloud Services: Microsoft Azure*).

MS Azure offers PaaS and IaaS solutions (Klint, 2021). Some IaaS services include Azure Virtual Networks, Azure VMs, Azure VDI, and Azure Disc Storage that allow you to build your own network architecture from the ground up (Klint, 2021). PaaS solutions range from options from Azure SQL and Azure app services to help you develop and deploy your applications (Klint, 2021).

Depending on what exact services you want to use from Azure, the price for using them could range from free to using only what you need to use.

One positive Azure shows is their ever-expanding amount of data centers. More data centers not only mean services and apps that are physically closer to their users, but also having a much better chance of legal requirements being met in your country since more data center are being pushed out (Klint, 2021). Another positive is their ability to integrate quite well with tools like Visual Studio and File Storage (Klint, 2021). One negative for Azure is the absurdly large amount of services, plus services that are renamed, that must be kept track of (Klint, 2021). This makes it hard to track the services that are necessary for you.

## **Amazon AWS**

Physical products, music, and software aren't the only things Amazon uses to make untold amounts of profit. They also sell cloud services to clients. Amazon Web Services (AWS) offers cloud computing solutions to customers.

AWS charges its clients for what resources they are using at the time and not what resources the client/customer thinks they need, nor the maximum amount of resources to ensure that they can handle the work load.

Security-wise, AWS keeps on its toes in terms of data security. With their data centers spread out all over the globe, any sort of disaster, whether it be man-made or a force of nature, ensures that not all of AWS data centers are compromised (Page, 2021). To add on, the way Amazon locates their data centers makes them more hidden to prying eyes and allows access into them only when absolutely necessary (Page, 2021).

One obvious strength for AWS is the fact that it is Amazon's "cash cow", being the main profit provider for the company (Page, 2021). One big criticism of Amazon, not just AWS, is their "anticompetitive behavior", pushing hard to get any competition out of the way and being accused of apparently using software for themselves that were already published by other tech companies (Fulton, 2021).

## **Google Cloud**

Sometimes referred to as Google Cloud Platform or GCP, Google Cloud provides cloud computing services that allow for development and deployment of applications, also known as PaaS services (Fulton, 2021).

The basic service GCP offers is what's called Compute Engine (GCE). GCE is an IaaS solution that hosts virtual machines, similar to what AWS offers (Fulton, 2021).

In terms of the pricing for Google Cloud's services, like the pricing of AWS cloud services, you pay for what you use and not for what you think will need. Resources used are tracked by Google Cloud, which include "processing power, data storage, database queries, and network connectivity" (Fulton, 2021). They also charge customers by the second instead of by the minute in an effort to be more competitive (Fulton, 2021). A pricing calculator is offered by Google to allow for estimates. However, those estimates of what resources you think you will be consuming will have to be pretty close (Fulton, 2021).

One strength that Google Cloud can flex is their automation of deploying modern apps. With Google being the founder of Kubernetes, they took a more proactive approach on automating the deployment of apps with many components (Fulton, 2021). Another strength is their cost control, pushing out competitive costs in certain scenarios (Fulton, 2021). Finally, they are much more friendly with first-time users on the platform. They give examples that go step-by-step on how to perform tasks on Google Cloud, like deploying a Linux VM (Fulton, 2021).

### **IBM Cloud**

Previously known as IBM Bluemix and IBM SoftLayer, IBM Cloud provides PaaS and IaaS cloud solutions (Casey, 2017). IBM bought SoftLayer in 2013 to get a foundation for their IaaS services (Casey, 2017). They then put SoftLayer under the Bluemix brand of PaaS services they offered, allowing both IaaS and PaaS services for customers on one console until they rebranded both into IBM Cloud in 2017 (Casey, 2017).

IaaS services provided by IBM Cloud include "compute power, storage and networking", with having the option between bare-metal or virtual servers for computer power (Casey, 2017). Their PaaS solutions allow developers to create and push out applications with IBM Cloud PaaS and is based on Cloud Foundry, an open-source cloud platform (Casey, 2017). Their cloud

supports a wide array of programming languages, including “Java, Node.js, PHP and Python”, along with others (Casey, 2017).

Similar to Google Cloud and AWS’ pricing, IBM Cloud’s prices work on a pay as you go basis, with clients only paying only for the resources they use (Casey, 2017). Plus, they also offer subscription services that includes a monthly bill and discounted pricing as a result (Casey, 2017). Like Google Cloud, IBM allows companies access to their IBM Cloud pricing calculator to get a better idea of how much they will have to pay for services (Casey, 2017).

One weak point compared to the other providers in this writing is that IBM Cloud doesn’t seem to be as popular as AWS, Azure, or GCP, with the previously mentioned providers falling in as the top three most popular choices, unlike IBM Cloud (Klint, 2021).

### **Summary**

One thing in common between all of these cloud providers is the fact that they are competitors in the cloud computing market. Amazon seems to be most aggressive between the four mentioned cloud providers however, as shown by their apparent “anticompetitive behavior” (Fulton, 2021). They also all have the pay-as-you-go option for the cloud resources used by clients. Apart from IBM Cloud, all of these cloud providers also seem to be quite popular choices for cloud computing services (Klint, 2021).

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