

A top-level analysis on well-known cloud service providers across multiple aspects

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1 Introduction

Cloud computing has become an integral part in the upcoming industrial revolution, also known as IR 4.0. Cloud computing brings capabilities that almost sound magical by any technological standards from the past 10 years. With cloud computing, an individual has the capability to establish a massive network of computers that span across the globe with comprehensive capabilities to accomplish the need of any organization within a single day.

1.1 Comparative Evaluation

In this report, we are taking a look at multiple cloud service providers which are Amazon's EC2, the Google cloud platform and Microsoft Azure. It's worth noting that Amazon's scope in terms of cloud infrastructure is extremely wide and therefore we are focusing on EC2 in this paper.

in terms of evaluation, the aspects that we are assessing would be pricing, performance and the overall capabilities for the respective platforms including their available tiers and plans.

Background:

Amazon EC2:

The amazon EC2 cloud computing from AWS (Amazon Web Services) started about 15 years ago and has been since one of the leading platforms in the cloud computing space.

Their services include Computing and storage as well as routing and managed databases among many other services.

Google Cloud platform:

In terms of being renown as the go to search engine, Google's reach has been expanding over the years by utilizing its success in other business aspects such as search engines in order to enter the cloud computing race.

Microsoft Azure:

Microsoft is a corporation that was founded in 1975 by none other than Bill Gates and their operating system for example is being run by approx. 87.89% of systems worldwide.

Therefore it was only a logical step for Microsoft to bring their operating system into the cloud market domain. Their move in this market happened in 2010 making it the youngest among all the other platforms in this report.

1.3 Service Model (IaaS, PaaS, SaaS)

When it comes to IaaS, PaaS and SaaS; Infrastructure as a service, Platform as a service and Software as a service respectively, Amazon undoubtedly has the largest range of available zones with 66 zones across 190 countries. It provides all three models with a large variety of variations.

Google cloud platform and Microsoft Azure follow closely in terms of availability regions except in zones where Google has 67 zones which is one zone more compared to Amazon, and they both provide all three service models. AZURE and Google have an advantage in terms of SaaS given they both have been providing large scale applications via the cloud such as Office 365 for Microsoft and G-Suite for Google, therefore they ported their expertise in optimizing these applications towards general availability for users who utilize their SaaS services.

2 Virtual machine instances and hardware

Across all three providers. The hardware being used generally depends on the type of instance being selected by the users. Depending on whether the user requires a balanced server, memory optimized or storage optimized to determine the capability of the server being used in terms of computing, memory, storage and network bandwidth.

For Amazon EC2. Their general hardware tends to range from AMD EPYC 7000 processors as well as dual Intel Xeon E5-2686 all the way to a single E5-2686 chip that are being segmented into multiple virtual machines that each host a virtual private server or a VPS. Their Hypervisor being used for VM environments is called the AWS Nitro System.

And available instances for EC2 are Mac which are powered by Apple Mac mini computers and T4g, T3, T3a, T2, M6g, M5, M5a, M5n, M5zn, M4, A1 with the latter being their most cost-effective option. This list is only for general purpose computing and the complete list can be found here [4]

As for Google cloud platform, we were unable to get any exact configuration but we found that they tend to get into agreements with hardware providers such as Dell and HP to maintain their constantly expanding cloud platforms.

Their available virtual machines are available in families with general purpose instances being divided into types which are called E2, N2, N2D, N1 and Compute optimized instances being called C2 while Memory optimized instances being named

M2 and M1. From their naming scheme we can determine the type of optimization by looking at the first letter in the instance family.

The complete list of their provided instances is found here [5]

For Azure, they provide a truly impressive range of VM instances that can be found here [2].

Their general-purpose instances range from A0 to A4. Recently new instances which are dubbed as the v2 instances are available with the previous instances. For example, there is A0v2 which would have an increase in allocated ram to allow for better performance for tasks that require a little more performance compared to lower tiers.

Storage

All three major providers have the capability to support the growth of any business. Starting from micro businesses and all the way up to enterprises with worldwide location coverage.

All providers have recently moved almost all of their storage units from regular HDD units to enterprise grade NVME Solid state units which provide higher read /write capabilities.

Virtually and given the nature of cloud computing capabilities, these providers can provide unlimited storage theoretically this report we will be looking at storage capability per instance.

Amazon's storage can scale with up to 4x 900GB NVME SSD storage units for r5 instances. That measures at approx. 3.6TB of raw next gen storage compared to normal SSD and HDD units.

Google has a different approach to storage where you can pay for persistence storage in terms of Gigabyte per month [7]. Currently their pricing starts at MYR 0.16 per Gigabyte/month. This allows for flexible storage capabilities.

Azure has multiple storage approaches. Whether its storage that is database and big data related such as Azure data lake and blobs or normal fully managed storage such as the managed disks and files. The pricing for the managed disks starts at MYR 6.16 per month which is extremely affordable to any business wishing to take the step towards cloud storage.

OS environment Offered

In terms of OS Amazon comes at top given that they provide apple's mac instances as well as windows and Linux operating system options for their virtual machines.

Google cloud and azure both provide Different Linux flavors such as ubuntu and centos as well as windows server and desktop instances.

Security

All providers have amazing capabilities in terms of security. Google provides Titan keys which are a state-of-the-art security keys to provide the highest level of security. Amazon and Azure, both provide 2FA (Two Factor Authentication) and firewalls for instances that are not charged against the user making it excellent when configured properly by the user.

performance and scalability

When a business utilizing cloud computing grows, it's natural for it to scale up its infrastructure and instances to match the demand. However, doing this could result in a linear increase in costs if not managed and planned well. AZURE provides Azure advisor which provides critical information about what needs to be done in order to optimize workloads. To make it even better it's free to use. Amazon's AWS platforms provide their own version called AWS trusted advisor while Google completely lacks this critical feature which is vital for scalability. Performance wise, all three providers trade blows across instances.

Pricing

Amazon's pricing for the EC2:

Their pricing model is divided into two main aspects which are On-Demand and spot instances. Where for the on demand the user pays for the compute capability per a unit of time which can be per hour or per second. For spot instances, they are considered as a buffer in the sense they can be brought online when needed. This allows for applications that have varying demands to per say request extra computing power when a certain threshold set by the developer is reached to ensure optimum operations.

Amazon also provides savings plans where the users can pay a very low price for their EC2 deployments given that they agree to sign a so-called commitment where the users agree to use a minimum in terms of price. The savings can be as much as 72% for a 3-year commitment.

Their lowest tier starts at 3.02 USD for a nano instance of T4g and can go as high as 2304USD per month for a m4.16xlarge instance. These pricings are based on the instance being deployed in US east region and running on a Linux distribution. Other regions might vary pricing wise. In Malaysia and Asia in general the cost would be lower.

Google cloud platform Pricing:

Google comes in on top in terms of pricing overall. This seems as a push to gain more foothold in the cloud computing business. Their pricing is generally favorable and they even provide 300USD worth of credit to use on their services. Their price per performance is tempting especially on shared instances where the pricing starts at 6.11 USD (about MYR 24) and can go as high as USD 782.69 per month which is roughly MYR 3165.

Azure pricing

Microsoft Azure's pricing has been getting extremely competitive recently. Their Linux VM machines cost starts from USD 0.004 per hour (About MYR11.52 per month).

While this sounding really good, it gets more competitive given that that Azure is owned by Microsoft making windows instances relatively cheap compared to all the other competitors.

This translates to about 71% more saving [6] compared to AWS's EC2 instances running windows VM machines.

On the higher tiers when looking at high performance computing instances, prices can go as high as USD 2,628 per month (MYR 10,512) for a VM machine with 128 cores. This cost goes down by 50% to USD 1,314 (MYR 5256), when the user reserves the unit for 3 years.

The cost is much lower for compute optimized while trading blows with google and AWS across the instances.

Monitoring tools/service provided

Azure comes at top in terms of monitoring tools with their security center combined with Azure monitor. This tool provides complete vision not just over deployed instances alone, but rather the whole network and including applications, this however comes at a steep price starting at about MYR 820 per day when ingesting log traffic of up to 100GB.

Amazon's tools include their management console and cloud watch which despite being a powerful tool, lacks the user-friendly aspect making it difficult to use for the average user. This could result in a security laps in our opinion.

Google cloud monitoring allows for customizability and is capable of providing excellent monitoring capabilities but ends up joining amazon's AWS in terms of being difficult to use.

opinion

In our opinion, All the providers looked at in this report have sufficient capabilities in terms of supporting businesses. Despite amazon's AWS being the most known and used currently. Google cloud and Azure have been claiming more users and exponentially increasing their offerings and capabilities in the cloud computing sector. This recent push can be justified by the huge increase in online transactions across all fields given the recent COVID pandemic. We believe that selecting the best provider depends on the individual needs for the user. This is due to the fact each of the providers have strengths and weakness when it comes to different services. For instance, if a windows server is needed; AZURE would be the best choice, however if GPU related activities are needed then Google cloud would be the optimum approach.

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