CAC-1B

Cloud computing

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Task: Perform a study on "CLOUD SERVICE PROVIDERS & THEIR CLOUD SERVICES". Select any 5 major players in the cloud and their major cloud platforms and services.

1. AWS

AWS is a cloud service company that was created in 2006 as a subsidiary of Amazon. It was one of the earliest widely available cloud computing systems. According to Canalys, Amazon is the global leader in IaaS, accounting for 31% of the cloud industry. AWS charges are calculated on a pay-as-you-go basis, based on the hardware, software, and networking options selected. Subscribers can purchase a single virtual AWS computer or a cluster of virtual computers. Currently, AWS serves 245 countries and spans 25 geographic regions: 7 in North America, 9 in Asia-Pacific, 6 in Europe, 1 in South America, 1 in the Middle East, and 1 in Africa.

**Strength:** AWS has the largest market share in IaaS and PaaS, and is a leader in the majority of cloud products provided worldwide. Large enterprises deploy business-critical workloads to Amazon more often than to any other cloud provider. The company has a strong managed service provider network, with 67 premier consulting partners worldwide. Enterprises perceive AWS as a strategic provider of cloud infrastructure. AWS delivers end-to-end solutions, starting from servers to embedded operating systems in Edge devices, and the comprehensive technological stat in between.

**Weaknesses:** Despite proclaimed price reductions, the price for some services, like the AWS computer service, has not become cheaper since 2014. AWS optimizes their best cloud services, and if the customer is tied to Amazon products, it may not be easy to switch to another service provider. Another challenge is using less than 20% of purchased services, which can be laborious and lengthy to re-engineer and optimize. Although appropriately priced, the expenditures for AWS cloud services can go considerably high, if they aren’t taken care of.

**Services:** AWS has over 175 cloud services for a broad range of use cases and industries. The top Amazon most used services are Amazon EC2 (compute capacity), Amazon RDS (relational database), Amazon S3 (cloud storage), Amazon CloudFront (content delivery service), and Amazon Glacier (web storage service). EC2 allows Amazon customers to use virtual computer clusters that are available all the time. Most services are not exposed directly to end-users, however, they do provide functionality via APIs for developers to use within apps.

1. Microsoft Azure

Microsoft Azure holds a strong second place after AWS. The company provides a broad range of enterprise-focused services. Every quarter Microsoft Azure releases tens of products, services, and enhancements resulting from research and development initiatives, made over multiple years. Azure offers the ability to instantly provision computing resources on-demand and is the best-in-class in the hybrid cloud among other cloud vendors. Canalys reports that Microsoft Azure’s market share among IaaS cloud providers is 20%. Microsoft Azure costs similarly to AWS. There are some use cases when Azure is more affordable and when AWS is more economical. Still, Google Cloud is more affordable than both AWS and Microsoft Azure. At present, there is a lack of standardization between cloud providers — no two cloud providers offer the same price in the same way. Azure has 54 regions and is more available than any other cloud provider.

**Strength:** The use cases of Microsoft Azure are diverse and manifold, thanks to the number of service offerings the company provides. Azure has partnerships with Oracle, VMware and SAP, further extending its capabilities. Microsoft Azure has a strong managed service provider network with 32 partners on its list. On top of that, Microsoft leads the PaaS segment of cloud service providers with a suite of tools, including Azure DevOps and Visual Studio Codespaces (the tool that enables the use of a public cloud and developer tools, such as Visual Studio Code).

**Weaknesses:** Microsoft support is quite expensive. In addition, Microsoft Azure has a lower ratio of availability zones than other cloud service providers. There’s still room for resilience-centered reengineering efforts and service availability improvements though. On top of that, Azure doesn’t provide any form of guaranteed capacity to its customers, and even pre-paid contracts and reserved instances are not capacity guarantees. During the COVID-19 spike, some Microsoft Azure customers were not able to provision the cloud capacity they had already paid for.

**Services:** Microsoft Azure has over 600 services. Azure offers VMs as a part of its IaaS offering, Active Directory to synchronize on-premises directories, and enables single sign-on. The company also provides mobile engagement with real-time analytics and tracking of user behaviors and storage services, as well as data management tools such as Azure Data Explorer, Azure SQL Database, Serverless, CDN, Azure AI, Azure Blockahung Workbench, Azure IoT, and other services.

1. Google Cloud

Google Cloud has a third-place on Gartner’s Magic Quadrant of cloud providers, after AWS and Microsoft Azure. In the last year, Google Cloud has substantially increased its hybrid and multi-cloud workload using Antos which allows users to manage workloads on Google, AWS, and Azure. Besides, Firebase, a Google-purchased cloud mobile Backend-as-a-Service (BaaS), has grown quite rapidly and become widely adopted by developers. Firebase remains a highly-demanded BaaS platform despite it being run on the top of Google Cloud. The market share of Google Cloud infrastructure, as a service market, is 7% per Canalys. Google Cloud offers a pay-as-you-go model. A pricing calculator and custom quotes can help to understand the costs based on the workloads, locations, and other variables. Google Cloud provides $300 in free credits for 90 days to new customers that start running cloud workflows with them. Also, Google Cloud has a special program for startups and they can get a minimum of $2,000 in initial startup credits to use. Google Cloud is available in 200 countries. It spans 25 regions (9 in North and South America, 9 in Asia-Pacific, and 7 in Europe).

**Strength:** Google Cloud stands out in big data, machine learning and data science capabilities with its products like TensorFlow, ML Kit and Google Datasets. It offers an end-to-end AI platform built on the latest technologies and is enabled by tools like TensorFlow and TPUs (Tensor Processing Unit – an AI accelerator application-specific integrated circuit).

**Weaknesses:** Google has challenges with positioning itself as an enterprise-class IaaS solution. Its offerings have not yet reached the level of enterprise maturity that AWS and Microsoft Azure provide, and some of them are not yet as fully packaged as the ones offered by Google Cloud’s rivals. Likewise, Google Cloud has a smaller pool of well-versed managed service providers than other cloud vendors.

**Services:** The Google Cloud platform offers 100 products that can be grouped into six categories: storage, databases, computing and hosting (servers, containers VMs), networking (VPC, load balancing, cloud DNS), big data (Big Query for data analysis, Dataflow for batch and streaming data processing), and machine learning (AI platform).

1. Alibaba Cloud

As per Gartner’s report, Alibaba Cloud holds a solid fourth place amongst cloud service providers, after AWS, Microsoft Azure, and Google Cloud. Founded in 2009 to deliver platform support to the Alibaba Group, it is now selling different cloud offerings to businesses worldwide. Alibaba Cloud has the biggest market share among cloud providers in China and Asia-Pacific for IaaS (Infrastructure as a Service) and IUS (Infrastructure Utility Services). Alibaba Cloud has a lower cost, by around 25%, than overseas cloud service providers. Compared with other cloud providers, Alibaba Cloud has a slower response time in locations like the USA. However, Alibaba Cloud has better CPU and memory utilization than the overseas cloud providers, making it more suitable for hosting large application workloads in the region. Alibaba spans over 23 regions and has 69 availability zones worldwide. Additionally, it is the number one CDN in China with over 2,300 nodes in China and 500 overseas nodes.

**Strength:** Alibaba Cloud offers a broad set of PaaS and IaaS that are comparable in availability, performance and security to the service portfolios of other service cloud providers. Companies located in Asia-Pacific and China that wish to leverage cloud services at scale in this part of the world may opt for Alibaba Cloud solutions. Alibaba is still further extending its infrastructure and presence to other locations in competition with other cloud providers, like in the Middle East. Alibaba Cloud is effective for hosting large apps and is scalable to sustain a peak number of users.

**Weaknesses:** Alibaba has a limited adoption in other parts of the world, except for South Asia. In other regions, particular services may be available only when using specific computing instances. In terms of third-party software integrations and operational tools, Alibaba’s international offering is limited more than Alibaba China’s. Investment in international markets is needed for it to become a genuinely global cloud service provider.

**Services:** Alibaba Cloud provides PaaS and IaaS. It uses both Xen and KVM (Kernel-based virtual machine) hypervisors that are a part of Alibaba’s cloud architecture for creating VM’s (virtual machines) that use the Elastic Compute Service. Alibaba also offers an Object Storage service, a CDN (content delivery network), a Docker-based Cloud Container Service, a pre-configured private cloud Apsara Stack, several database services based on Apsara DB, and a Cloud Intelligence Brain (an AI platform).

1. Oracle Cloud

Oracle cloud holds fifth place among cloud providers, after AWS, Microsoft Azure, Google Cloud, and Alibaba. Oracle’s Cloud market share is around 2% and the company ranks fifth globally. When it comes to payment models, cloud pricing models are complex. The price depends upon different factors, such as CPU and memory usage. Oracle has customers that historically pay for licenses for traditional software-related services and can get a discount if they decide to run workloads in the cloud. Altogether, Oracle Cloud is not as affordable as AWS. However, Oracle offers a pay-as-you-go model where the IaaS and PaaS services are charged only for the resources used. Oracle Cloud is available worldwide in 29 cloud regions.

**Strength:** Oracle Cloud has a strong partnership with Microsoft Azure so that their customers can run their workloads across the two clouds. This ensures an additional layer of interoperability. Their customers can deploy the full stack of apps in a multi-cloud environment, preserving high performance and resiliency without a need to re-engineer the cloud architecture. Plus, Oracle customers can also migrate their existing workloads and apps, or develop cloud-native applications that use a blend of Oracle Cloud and Microsoft Azure services.

**Weaknesses:** Snowflake (data warehousing solution) is not yet available on Oracle, though two of the three of Snowflake’s founders worked there for over a decade. Some of Oracle’s customers, that use both Oracle and Microsoft Azure, want to limit the usage of Oracle Cloud due to the unfavorable perception of Oracle’s viability. Oracle has a comparatively small market share in the database PaaS, which is especially important for businesses that are historically committed to Oracle database services. The company has made several steps in offering new products, such as Oracle Cloud Functions, that enable developers to create, run and scale applications in a serverless environment, however, not all of the new products have been adopted by Oracle’s customers.

**Services:** Oracle offers 65 cloud services, including the industry-standards like Kubernetes, Terraform, and CloudEvents. Oracle offers an Autonomous Database, which is a service that leverages machine learning to self-repair and self-optimize, and that delivers higher performance. The company also provides dedicated regions in data centers, edge computing, clustered databases, bare metal GPUs (graphic processing units), and database machines.