

Analysis of Cloud Service Providers

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Abstract

Currently, cloud computing is being used as a technology that greatly changes the IT field. For many businesses, many cloud services are available in the form of custom, reliable, and cost-effective web applications. Most cloud service providers provide functions such as IoT, machine learning, AI services, blockchain, AR & VR, mobile services, and containers in addition to basic cloud services that support the scalability of processors, memory, and storage. In this paper, we will look at the most used cloud service providers and compare the services provided by the cloud service providers.

Keywords: *Cloud Service, Cloud Computing, Cloud Service Provider, AWS, Azure, Google Cloud Platform*

1. INTRODUCTION

Amid the global pandemic, all enterprises and organizations are rapidly transitioning to the cloud. The proliferation of 5G is expected to significantly stimulate demand for cloud-edge applications. More tasks will be edge-based, replaced by smart sensor data and artificial intelligence processes for small-scale machine learning tasks. Telecommuting, the subscription economy, and the cloud will allow people to cut back on the hardware they need to work and always have access to the most up-to-date software through an affordable desktop.[1][2]

For consumers who need cloud services at a time when these trends and demand for cloud services are rapidly increasing, the comparison of the services and characteristics of each cloud service provider will be of great help in adopting cloud services.

Chapter 2 introduces cloud computing, and Chapter 3 introduces AWS, Microsoft Azure, and Google Cloud Platform, which are representative cloud service providers, and the services and features they provide. Chapter 4 compares and analyzes services and features of AWS, Microsoft Azure, and Google Cloud Platform.

2. CLOUD COMPUTING

Cloud computing refers to on-demand availability of computer system resources such as data storage (cloud storage) and computing power without direct active management of users. Cloud computing is a type of Internet-based computing that processes information not on one's own computer but on another computer connected to the cloud, and provides shared computer processing resources and data to computers and other devices upon request. [3][4]

Table 1 shows detailed information of cloud service providers that are currently most used. In the next section, we will learn about cloud service providers.

Table 1. Cloud Service Providers

Cloud Service Providers	Owner	Launched	Website
AWS	Amazon.com	2006	https://aws.amazon.com/
Microsoft Azure	Microsoft	2008	https://azure.microsoft.com
Google Cloud Platform	Google	2008	https://cloud.google.com/

3. CLOUD SERVICE PROVIDERS

3.1 AWS

Amazon Web Services(AWS) provides online services for other web sites and client-side applications. Many of these services are not exposed directly to end users, but instead provide functionality that other developers can use in their applications.[5]

Figure 1 shows AWS products, and it can be seen that IoT, mobile service, machine learning, and container functions are provided in addition to basic functions as cloud services.

**Figure 1. AWS Products**

3.2 Microsoft Azure

Azure is a cloud computing service that builds, tests, deploys, and manages applications and services through Microsoft data centers, offering SaaS(Software as a Service), PaaS(Platform as a Service), and IaaS(Infrastructure as a Service).[6]

Table 2 shows various services provided by Azure and their descriptions.

3.3 Google Cloud Platform

Google Cloud Platform is a cloud computing service that provides infrastructure as a service, platform as a service, and serverless computing environment.[7]

Table 3 shows various services provided by Google Cloud Platform and their descriptions.

Table 2. Services of Azure [6]

Category	Description
AI + ML	Develop next-generation applications with artificial intelligence capabilities for all developers and scenarios.
DevOps	Deliver innovation faster with simple, reliable tools for continuous updates.
Hybrid + Multicloud	Get Azure innovation everywhere—bring the agility and innovation of cloud computing to your on-premises workloads.

ID	Manage user identity and access to protect against advanced threats across devices, data, apps and infrastructure.
IoT	Use IoT for any device and platform without changing your infrastructure.
Storage	Secure, massively scalable cloud storage for data, apps, and workloads.
Web	Build, deploy, and scale powerful web applications quickly and efficiently.
Windows Virtual Desktop	The best virtual desktop experience available on Azure.
Developer Tool	Build, manage, and continuously deliver cloud applications using your platform or language.
Management & Governance	Simplify, automate and optimize the management and compliance of your cloud resources.
Networking	Connect cloud and on-premises infrastructure and services to deliver the best possible experience for customers and users.
DB	Fully managed, secure, enterprise-grade database service.
Migration	Simplify and accelerate your migration to the cloud with guidance, tools, and resources.
Mobile	Build and deploy cross-platform and native apps for any mobile device.
Media	Deliver high-quality video content anytime, anywhere, on any device.
Security	Enterprise protection from advanced threats in hybrid cloud workloads.
Analytics	Collect, store, process, analyze and visualize data of various types, quantities, and development rates.
Blockchain	Build and manage blockchain-based applications with an integrated suite of tools.
Containers	Develop and manage containerized applications faster with integrated tools.
Computing	Access cloud computing capacity and on-demand scaling and pay only for the resources you use.
Integration	Seamlessly integrate on-premises and cloud-based applications, data and processes across the enterprise.
Mixed Reality	Blend the real and digital worlds to create immersive collaboration experiences.

Table 3. Services of Google Cloud Platform [7]

Category	Description
Computing	Support PaaS, IaaS.
Storage & DB	Support Cloud Storage, Cloud SQL, Cloud Datastore.
Networking	Support VPC, Cloud Load Balancing. Cloud CDN.
Big Data	Big data platform for running Apache Hadoop and Apache Spark jobs.
Cloud AI	Support Cloud AutoML, Cloud TPU, Cloud Machine Learning Engine, Cloud Natural Language, Cloud Speech-to-Text, Cloud Text-to-Speech, Cloud Translation API, Cloud Vision API, Cloud Video Intelligence.

Management Tool	Monitoring, logging, and diagnostics for applications on Google Cloud Platform and AWS.
Identity & Security	A security and data risk platform for data and services running on Google Cloud Platform.
IoT	Support Cloud IoT Core, Edge TPU, and Cloud IoT Edge. Edge TPU is a purpose-built ASIC designed to run inference at the edge.
API Platform	Support Maps Platform, Apigee API Platform, Developer Portal, API Analytics, Apigee Sense, Cloud Endpoints, Service Infrastructure.

4. ANALYSIS OF CLOUD SERVICE PROVIDERS

This section compares different services from cloud service providers such as AWS[8], Azure[9], and Google Cloud Platform[10].

As many companies use cloud services rather than build their own services, the cloud service market is also rapidly growing. Most cloud service providers support scalability of processors, memory, and storage as basic cloud services. With the support of these services, companies can efficiently cope with the rapid increase in users or data increases. If a company can know which products are used for the service it wants to support, the company can select and use an appropriate cloud service.

Table 4 shows VM, memory caching, DB, big data services of cloud service providers. Most cloud service providers offer Virtual Machines for Microsoft Windows and Linux, and use Redis and Memcached to support millions of requests per second for real-time applications. Also MySQL, PostgreSQL, Microsoft SQL Server, NoSQL, and most databases are supported, and it can be seen that MapReduce, Hadoop, and Apache Spark are used for big data processing.

Table 4. VM, Memory Caching, DB, Big Data Comparison of Cloud Service Providers

Service	AWS	Azure	Google Cloud Platform
VM	Microsoft Windows Linux	Microsoft Windows Linux	Microsoft Windows Linux
Memory Caching	Redis Memcached	Redis	Redis Memcached
DB	MySQL PostgreSQL Microsoft SQL Server NoSQL MongoDB Apache Cassandra	MySQL PostgreSQL Microsoft SQL Server NoSQL	MySQL PostgreSQL Microsoft SQL Server NoSQL
Big Data	MapReduce	Hadoop	Apache Hadoop Apache Spark

Table 5 shows AI service, ML, blockchain, mobile service, CDN, IoT, AR & VR, quantum tech, robotics, and container services of cloud service providers. All cloud service providers provide AI services, machine learning, CDN, IoT, and container services.

CDN (Content Delivery Network or Content Distribution Network) refers to a system that stores and provides data in a network with multiple nodes to efficiently deliver content. The purpose of CDN is to deliver

content to users with high usability and efficiency. CDNs serve much of the content that exists on the Internet today, including web elements (text, graphics, scripts), downloadable elements (media files, software, documents), applications (e-commerce, portals), real-time media, and on-demand media. streaming, and social networks.[11]

Table 5. Service Comparison of Cloud Service Providers

Service	AWS	Azure	Google Cloud Platform
AI Services	O	O	O
ML	O	O	O
CDN	O	O	O
IoT	O	O	O
Container	O	O	O
Blockchain	O	O	
Mobile Service	O	O	
AR & VR	O	O	
Quantum Tech	O		
Robotics	O		

AWS provides AI services such as advanced text analytics, automated code reviews, chatbots, demand forecasting, document analysis, fraud prevention, image and video analysis, personal recommendations, real-time translation, text to speech, and transcription. Azure lets you build computer vision and speech models with a developer kit that includes an AI-powered cloud search service, Chatbot, and AI sensors for mobile app and web development. Google Cloud Platform provides AI services such as speech to text, text to speech, language detection and translation, and sentiment analysis and classification of unstructured text.

AWS can build, train, and deploy machine learning models at scale, provide deep learning inference acceleration, and Azure can build and train all machine learning models and deploy them from the cloud to the edge. Google Cloud Platform can train and develop custom machine learning models through AutoML.

Containers are a technology that allows applications to be developed and deployed more efficiently, and has been gaining popularity in the new cloud market in recent years. One of the biggest advantages of container is that they provide the code and environment required to run an application in a package, so it is easy to deploy and move to any operating environment.[12]

AWS and Azure provide Blockchain, Mobile Service, and AR & VR services. As a blockchain service, AWS creates and manages scalable blockchains and provides blockchain services of a fully managed ledger database, Azure allows you to build, manage, and scale consortium blockchain networks, and build blockchain apps in the cloud. It can be easily prototyped.

As a mobile service, AWS provides tools and services to support development workflows for native iOS/Android, React Native, and JavaScript developers. Azure continuously builds, tests, releases, and monitors mobile and desktop apps, and Xamarin lets you quickly create cloud-based mobile apps.

AWS provides Quantum Tech and Robotics services. With AR & VR, AWS makes it easy to create and run browser-based 3D, AR, and VR applications, while Azure provides mixed reality technology that blends the real and digital worlds.

AWS provides a development environment for exploring and building quantum algorithms, testing them in quantum circuit simulators, and running them on a variety of quantum computing hardware technologies. It also provides the most complete cloud solution for robotics developers to simulate, test, and securely deploy

robotics applications at scale, and is the perfect solution for simulation-to-simulation and regression testing that customers use for multi-robot simulation and CI/CD integration. It provides a managed and scalable infrastructure.

5. CONCLUSION

In this paper, we investigated various services of cloud service providers such as AWS, Azure, and Google Cloud Platform.

It can be seen that most cloud service providers provide functions such as IoT, Machine Learning, AI services, Blockchain, AR & VR, Mobile services, and Containers in addition to basic cloud services that support the scalability of processor, memory, and storage. More services will be added to the cloud service, and more companies will use the cloud service.

Reviews of cloud service providers can help people who plan to use cloud services in the future to decide which services are available and in which environments they are optimal.

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