

A Comparative Analysis Of Cloud Service Providers

Chetan N. Rathod ¹, Bhumika K. Charnanand ²

¹Vivekanand College for BCA, Surat

²Smt. Z.S. Patel College, Surat

Abstract:

In the upcoming years, cloud computing, a new and developing technology, is anticipated to drastically alter the IT industry. Leading enterprise companies like Amazon, Microsoft, and Google now offer a wide range of cloud services in the form of specialised, dependable, and reasonably priced web applications. Numerous people and organisations from a variety of fields, including business, education, and health, are drawn to these services. Our goal in this paper is to familiarise cloud users with the most well-known Cloud Service Providers (CSPs). We additionally present a comparative analysis of these CSPs based on various service-related criteria. Before moving their business, people and organisations can use the study presented in this paper to make important decisions about the costs and advantages of cloud technology.

Keywords:

Cloud computing, Cloud Service Providers, SaaS, PaaS, IaaS

Introduction:

When businesses and educational institutions improved the performance of their massive mainframe computers in the 1950s, enabling multiple users to access computers simultaneously from multiple terminals via a shared central processing unit, the fundamental idea of cloud computing first emerged. Businesses like the massive online retailer Amazon.com Inc. were instrumental in the growth of cloud computing following the dot-com bubble burst in the early 2000s. The current state of cloud computing is the result of the widespread use of virtualisation and service-oriented architecture, as well as the availability of high-capacity networks and inexpensive computers. Large data centres are replacing desktop and portable PCs as the primary location for computing and data in a recent IT trend [1]. It simply refers to the computation's delivery.

As stated by the National Institute of Standards and Technology (NIST), "Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [2,5]. Increasing the usability of distributed resources that cooperate to achieve high availability and reliability at the lowest possible cost is the ultimate goal of cloud technology. Numerous beneficial features, including virtualisation, scalability, and quality of service, are also linked to this technology [3, 4]. Cloud computing is defined by the National Institute of Standards and Technology (NIST) as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources."

Vendors known as Cloud Service Providers (CSPs), such as Google, Microsoft, and Amazon, lease cloud services to their clients that are used dynamically in response to client demand. Service Level Agreements (SLAs) are a type of contract that governs the relationship between cloud customers and CSPs. Table 1 lists the four primary cloud types that CSPs offer to their clients: public, private, community, and hybrid versions. According to table 2, they also provide three primary categories of cloud services, which are as follows: Platform as a Service (PaaS) and Software as a Service (SaaS) are two examples of Infrastructure as a Service (IaaS) [13].

Table 1: Types of cloud computing offered by CSPs

Deployment model	Scope of Services	Owned by	Managed by	Security Level	Location
Public	General public and large industry groups	CSP	CSP	Low	off premise
Private	Single organization	Single organization	Single organization or CSP	High	off or on premise
Community	Organizations that share the same mission, policy and security requirements	Several organizations	Several organizations or CSP	High	off or on premise
Hybrid	Organizations and public	Organizations and CSP	Organizations and CSP	medium	off and on premise

Table 2: A comparison between cloud service models

	Application Software	Operating System	Virtual resources/ HW
SaaS	CSP	CSP	CSP
PaaS	Customer	CSP	CSP
IaaS	Customer	customer	CSP

The purpose of this article is to familiarise cloud users with the most well-known CSPs and their offerings. In order to assist people and organisations in making important decisions regarding the costs and advantages of cloud computing services and applications prior to relocating their operations to this new, emerging environment, it also compares CSPs. This is how the remainder of the paper is structured: The key features of cloud computing are outlined in section 2, followed by an introduction to the most popular CSPs and an example of the services they offer to clients in section 3, a comparison of CSPs using various criteria in section 4, and a conclusion and future work in section 5.

Characteristics of Cloud Computing

Cloud computing technology presents numerous intriguing aspects that make it a promising solution for various challenge that face individuals and companies [14]. These qualities include:

1. **Scalability:** The cloud is scalable; for instance, Google, Yahoo, and Amazon have hundreds of thousands of servers worldwide. CSPs only need to make small changes to the cloud's software and infrastructure in order to add new servers and nodes.
2. **Virtualisation:** Users can access any resources they require without worrying about the specifics of physical connections because the cloud isolates users from physical resources at the virtual level.
3. **Reliability:** Cloud computing is more dependable than local computers due to the use of several redundant processing nodes, or replication.
4. **Versatility:** Cloud computing doesn't focus on any one particular use case. The cloud supports many apps that can operate concurrently.
5. **Elastic Resource Pooling:** Users believe that the cloud is a limitless supply of resources that can be quickly and flexibly allocated and released in response to demand.
6. **On-demand Measured Services:** You can rent services based on your usage; cloud services are similar to gas, electricity, and water in that you can pay for what you use.
7. **Economic:** Clouds can be constructed with very cheap nodes, and their centralised management helps businesses avoid the rapidly rising management costs of data centres.

8. **Maintenance:** CSPs are in charge of maintaining the infrastructure, whether it be software or hardware, which relieves the IT team in an organisation of some of its
9. **Easy Management:** Compared to within the company, cloud-based applications with a lot of storage are simpler to use and administer. Additionally, at the user level, all you really need is a basic web browser that can connect to the internet.
10. **Cost Savings:** Cloud computing significantly lowers SMEs' IT expenditures. Expensive systems are not necessary for infrequent use of powerful processing power. Additionally, a lot less manpower is needed for such systems. With apps like Google Apps, even basic apps like email can be set up and are largely free.
11. **Calamity Management:** An offsite backup is always beneficial in the event of a calamity. For the majority of businesses, it is imperative to regularly backup important data using cloud storage services. CSPs also make sure they have disaster recovery procedures in place.
12. **Green Computing:** The primary drawbacks of modern computing systems are energy consumption, electronic waste produced over time, and harmful emissions brought on by the widespread use of systems in organisations. Utilising cloud computing services, which protect the environment and produce the least amount of e-waste, can help reduce this.

CLOUD SERVICE PROVIDERS

The most well-known cloud service providers in the IT industry are the main topic of this study. Seven businesses that offer a wide range of cloud services have been selected so that we can compare them from various angles. Below is a description of these businesses:

Amazon:

One of the most well-known CSPs is Amazon.com [6], which provides a wide range of cloud services, such as:

- Cloud computing power is offered by Amazon EC2 (Amazon Elastic Compute Cloud).
- High-reliability cloud storage is the focus of Amazon S3 (Amazon Simple Storage Service). Amazon RDS (Amazon Rational Database Services) offers robust cloud database management tools.
- The essential database features are offered by Amazon Simple DB.
- Amazon Rout 53, also known as Amazon Scalable DNS, offers safe Internet-based routing servers.
- Amazon CloudFront is devoted to efficiently managing and distributing material via the Internet.
- A web service called Amazon Elastic MapReduce lets user's process enormous amounts of data on the cloud.

Google:

Google [7] joint the cloud market in 2007 by simple services such as email, calendars, online documentation. Now, google has various cloud services such as:

- Compute Engine is an IaaS that allows users to run heavy workloads on virtual servers housed within Google's network.
- App Engine is a Platform as a Service (PaaS) that allows users to create apps with integrated high-performance platforms.
- Cloud Storage: where users may use Google's dependable, safe storage services to save any kind of information, regardless of size.
- Working with relational databases using various DBMSs is what cloud SQL is all about. One solution for unstructured databases is Cloud Datastore.
- BigQuery: Google offers specialised services to handle massive volumes of data in light of the recent big data revolution.

Microsoft:

Microsoft began offering cloud services in late 2009 with the release of Windows Azure [8]. Microsoft Windows Azure is a cloud platform that provides a range of services, including:

- Infrastructure: high-performance, fully supported, scalable, on-demand infrastructure.
- Web development: gives developers access to a highly strong platform for creating and implementing web applications.
- A mobile development platform offers cloud-based services for creating and testing mobile applications.
- One of Microsoft Windows Azure's competitive advantages is media, which is devoted to producing, modifying, and disseminating all forms of media.
- Storage: a cloud storage solution for processing and managing data, regardless of how big or regular the data.
- Big data cloud: an Apache Hadoop-supported big data solution.
- Identity and access management: a user can use a single sign to restrict access and store active directories in the cloud.

HP:

One of the most well-known hardware companies in the world, HP [10] has a significant market share in servers and data centres. HP began providing cloud services in the previous years, including:

- HP Cloud Compute: scalable processing power that customers can control and pay as you use.
- HP Cloud Storage: offers range of storage options for individuals and business sectors.
- HP Cloud CDN: refers to Content Delivery Networks and it is a web service that delivers data from HP Cloud Storage to customers around the world at high speed using global network of servers from HP and Akamai
- Database developers can configure and process relational databases in an environment provided by HP Cloud Relational Database.
- The HP Cloud Application Platform gives businesses the ability to create, implement, and expand cloud-based applications.
- With HP Cloud DNS, a user can effectively and safely manage their DNS zones.
- HP Cloud Identity Service: offers a unified approach to authentication and identity management for HP cloud users.

AT&T:

The leading American provider of worldwide communication and information technologies is AT&T [12]. It begins by offering four main cloud computing services:

- Cloud computing: offers computer resources to both individual and corporate sectors.
- Storage as a service is offered by cloud storage.
- Network Enablement: offers cloud networking services by giving users access to a virtual private network (VPN).
- Platform as Service: gives programmers a platform on which to create cloud-based applications.

Salesforces:

Salesforces [11] mainly focuses on specific cloud applications related to sales and customer relationship management. It provides some cloud products such as:

- Sales Cloud: a cloud-based platform specifically designed for sales applications.
- Service Cloud: a cloud-based platform specifically designed for customer service management systems.
- Platform: Platform as a service is another service offered by most cloud providers.

Conclusions:

We compared some of the most well-known cloud computing service providers in this article. This comparison will assist people and organisations in making important judgements regarding the costs and advantages of cloud computing before relocating their operations to this new setting. The market for cloud computing is extremely promising. As a result, researchers and technological experts need to put in greater effort to investigate. It is still necessary to conduct comparative research between cloud models, cloud

methodologies, and particular cloud techniques. Further research is also required on creative solutions to cloud computing security issues.

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