A Review Paper on Cloud Computing Architecture, Types, Advantages and Disadvantages

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Abstract: *In the IT industry, we are now in the era of Cloud Computing Technology. Cloud computing, which is based on the Internet, has the most powerful computation architecture. It is made up of a collection of connected and integrated hardware, software, and internet infrastructure. It has a number of features atop grid computing and other types of computing. In this work, I provide a summary of cloud computing evaluations based on a review of more than 30 cloud computing articles. The outcome of this study represents the state of the IT industry before and after cloud computing. Cloud computing is defined as the provision of resources such as network, storage, and servers on demand or on a pay-per-use basis over the internet. Although cloud computing is assisting the Information Technology business, there is still a need for more study and development in this area. In this work, we have contributed an advanced overview focused on the cloud computing idea and the most advanced research issues.*

Keywords: Client, Architecture, Cloud, Cloud Computing, IAAS, FAAS, PAAS.

I. INTRODUCTION

The influence of cloud computing on business and end users is impossible to overstate: the ubiquitous presence of software that operates on cloud networks has altered many elements of daily life. Startups and organisations can save costs and expand their offerings by utilising cloud computing instead of purchasing and managing all of the necessary hardware and software. Independent developers now have the ability to create apps and internet services that are available worldwide. Researchers can now share and analyse data at scales previously only available to large-scale operations. Furthermore, internet users may instantly access software and storage to produce, exchange, and store digital media in quantities much exceeding their personal computing power. Despite the fact that cloud computing is becoming more prevalent, many people are unaware of its specifics. What is the cloud, how does one use it, and what are the advantages for corporations, developers, researchers, government officials, healthcare providers, and students? We'll give a comprehensive review of cloud computing, its history, delivery models, offerings, and risks in this conceptual post.
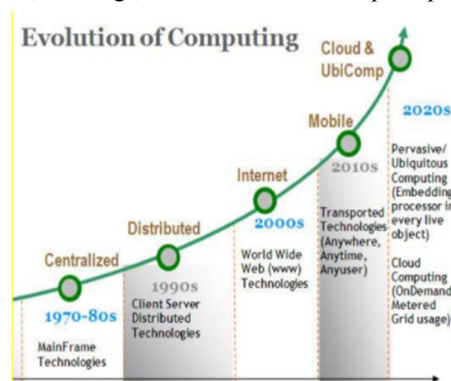
By the end of this review paper, you should know how the cloud can support business, research, education, and community infrastructure, as well as how to get started using it for your own projects. In today's world, everyone makes use of cloud computing services in their daily lives. Google Photos, Google Drive, and iCloud, for example. Cloud computing will become a necessity for the IT industry in the future.

II. CLOUD COMPUTING DEFINITION

The term "cloud" refers to software tools and services that run over the Internet or through a web browser. This is in contrast to traditional systems, which are limited to running on a single machine. As a result, cloud computing refers to the delivery of services such as data storage, networking, and servers over the Internet. Users can save files on a distant database rather than a hard drive or storage tool with cloud computing. A device that is linked to the internet is all that is required to access the database.

2.1 Cloud Computing Architecture

Cloud computing technology, as we all know, is used by both small and large businesses to store data on the cloud and access it from anywhere at any time utilising an internet connection.

III. ARCHITECTURE OF CLOUD COMPUTING

The architecture of cloud computing is a mix of service-oriented and event-driven architecture.
The architecture of cloud computing is separated into two parts:

- The Front End
- The Back End

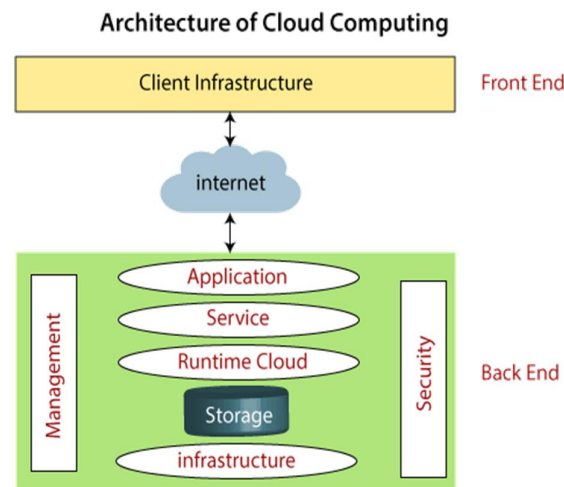The below diagram shows the architecture of cloud computing

Figure 2

A. Front End

The client interacts with the front end. It includes client-side interfaces and applications for interacting with cloud computing services. Web servers (such as Chrome, Firefox, and Internet Explorer), thin and fat clients, tablets, and mobile devices all make up the front end.

B. Back End

The service provider uses the back end. It oversees all of the resources needed to deliver cloud computing services. It includes a massive quantity of data storage, as well as security measures, virtual machines, deployment models, servers, and traffic management mechanisms, among other things.

3.1 Components of Cloud Computing Architecture

The components of cloud computing architecture are as follows:

A. Client Infrastructure

Client Infrastructure is a component of the front end. It has a graphical user interface (GUI) that allows you to interact with the cloud.

B. Application

Any software or platform that a client desires to use might be considered an application.

C. Service

A Cloud Services handles which sort of service you use based on the needs of the client. The three types of services provided by cloud computing are as follows:

1. Software as a Service (SaaS), often known as cloud application services, is a type of cloud computing service. SaaS programmes, for the most part, run immediately through the web browser, eliminating the need to download and install them. The following are some noteworthy SaaS examples: Google Apps, Salesforce Dropbox, Slack, Hubspot, and Cisco WebEx are some examples of cloud-based applications.
2. PaaS (Platform as a Service) is sometimes referred to as cloud platform services. It's similar to SaaS, but the distinction is that PaaS provides a platform for software development, whereas SaaS allows us to access software through the internet without requiring a platform. Windows Azure, Force.com, Magento Commerce Cloud, and OpenShift are some examples.
3. IaaS (Infrastructure as a Service) – It's also known as cloud infrastructure for services. It is in charge of handling data, middleware, and runtime environments for programmes. Amazon Web Services (AWS) EC2, Google Compute Engine (GCE), and Cisco Meta pod are some examples.

D. Runtime Cloud

The virtual machines' execution and runtime environments are provided by Runtime Cloud.

E. Storage

One of the most crucial aspects of cloud computing is storage. It offers a massive quantity of cloud storage capacity for storing and managing data.

F. Infrastructure

It offers services at three levels: host, application, and network. Cloud infrastructure refers to the hardware and software components that are required to enable the cloud computing model, such as servers, storage, network devices, virtualization software, and other storage resources.

G. Management

Management is used to coordinate and manage backend components such as applications, services, runtime cloud, storage, and infrastructure, as well as other security issues.

H. Security

Security is an in-built back-end component of cloud computing. It implements a security mechanism in the back end.

I. Internet

The Internet serves as a conduit for front end and backend developers to engage and communicate with one another.

IV. DIFFERENT TYPES OF CLOUDS

An organisation can use one of four different types of clouds.

1. Public cloud
2. Private cloud
3. Hybrid cloud
4. Community cloud

A. Public Cloud

Amazon and Google, for example, are well-known for their public clouds. This cloud is noted for having a lot of storage space. A public cloud is generally used by business teams for collaborative projects or software development. Many platforms will also allow customers to pay for more capacity as needed, allowing for scalability.

B. Private Cloud

Private clouds, like public cloud storage, allow users to access, use, and cache data on the cloud from anywhere. Private cloud infrastructure, on the other hand, is frequently protected by a firewall, which is a network security device that monitors and restricts network traffic. This means that only those who have been given permission to use these computing resources can do so. Private clouds will be preferred by companies with stringent regulatory criteria to protect their information and data.

C. Hybrid Cloud

Hybrid clouds combine the benefits of both public and private clouds. They're designed to let consumers use and save data on both platforms at the same time.

D. Community Cloud

A private cloud that functions similarly to a public cloud is referred to as a community cloud. They are collaborative in nature, allowing different authorised companies to exchange and collaborate on the same applications. Community clouds are typically used by firms who are in the same industry but have similar security or regulatory concerns. Community clouds are commonly used by healthcare providers and government institutions, for example.
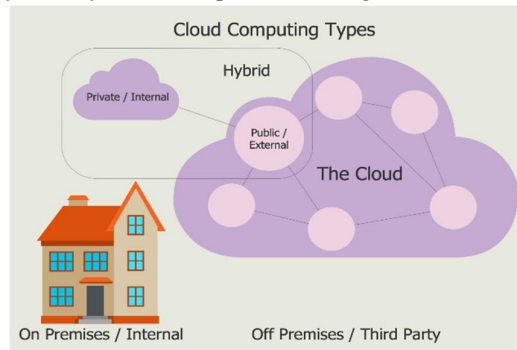

Figure 3

V. TYPES OF CLOUD COMPUTING SERVICES

Cloud providers will typically offer various computing services.

5.1 Infrastructure as a Service (IaaS)

This is a service model that lays the groundwork for a company's cloud strategy. Because it delivers a wide range of resources, Infrastructure as a Service is considered the most adaptable and all-encompassing cloud application. On-demand networking, data storage, and processing power are all included. Iaas also does not necessitate hardware investments because the platform provides these resources. IaaS is frequently used by people who desire a cost-effective and scalable cloud solution.

5.2 Platform as a Service (PaaS)

Platform as a Service (PaaS) Infrastructure as a Service (IaaS) is the more advanced version. PaaS is an IT framework, computing platform, and solution stack that is delivered as a service. It also enables non-technical users to create unique web apps without having to worry about data storage and management. PaaS also provides hosting services, network connectivity, and server software.

5.3 Software as a Service (SaaS)

The computing service, SaaS, combines the many services provided by IaaS and PaaS. Business analytics, automation, and client administration are just a few of the functions that Software as a Service can handle. SaaS also provides user-friendly browser-based software tools, minimising the requirement for IT expertise, time-consuming set-up, and maintenance. This is the most widely used cloud computing service, where SaaS apps such as Gmail and Slack are frequently used.
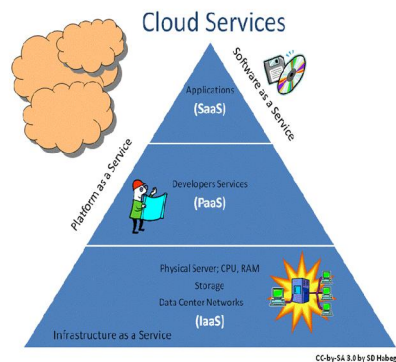

Figure 4

5.4 Function as a Service (FaaS)

Function as a Service (FaaS) is a newer cloud computing model. Without the use of a server, software developers can construct apps on the platform. This improves efficiency and allows specialists to concentrate on developing applications. Google Cloud Functions and Microsoft Azure Functions are two examples of FaaS systems.

V. ADVANTAGES OF CLOUD COMPUTING

Figure 5

- **Cost Savings:** One of the most significant advantages of Cloud Computing is cost savings. It allows you to save a lot of money because it doesn't require any actual hardware. In addition, maintaining the hardware does not necessitate the use of trained employees. The cloud service provider is in charge of purchasing and managing equipment.
- **Strategic Edge:** Cloud computing gives you a leg up on your competitors. One of the biggest features of Cloud services is that you may access the most up-to-date programmers at any time without having to spend time or money on installation.
- **High Speed:** With cloud computing, you can instantly deploy your service with fewer clicks. With this speedier deployment, you may receive the resources you need for your system in less time.
- **Back-up and Restore Data:** With cloud computing, you can instantly deploy your service with fewer clicks. With this speedier deployment, you may receive the resources you need for your system in less time.
- **Automatic Software Integration:** Software integration is something that happens automatically in the cloud. As a result, you won't have to put in any extra effort to customize and integrate your apps according to your preferences.
- **Reliability:** One of the most important advantages of Cloud hosting is its reliability. You will always be kept up to date on any changes.
- **Mobility:** Employees working on-site or in remote locations can quickly access all of the company's services. All they require is access to the Internet.
- **Unlimited Storage Capacity:** The cloud provides nearly infinite storage space. With relatively low monthly rates, you may simply enlarge your storage capacity at any moment.
- **Collaboration:** Employees in different countries can collaborate in a more easy and safe manner thanks to the cloud computing platform.
- **Quick Deployment:** Last but not least, cloud computing allows you to deploy applications quickly. As a result, if you want to use the cloud, your entire system can be up and running in a matter of minutes. However, the amount of time required is dependent on the technology employed in your company.
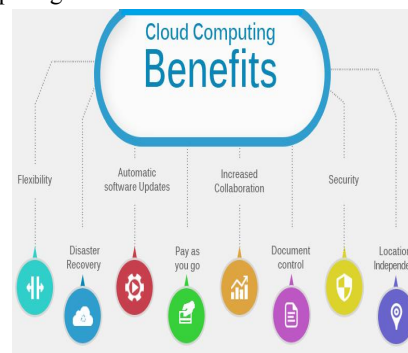
Other Important Benefits of Cloud Computing

Figure 6

Apart from the above, some other Cloud Computing advantages are:

- On-Demand Self-service
- Multi-tenancy
- Offers Resilient Computing
- Fast and effective virtualization
- Provide you low-cost software
- Offers advanced online security
- Location and Device Independence
- Always available, and scales automatically to adjust to the increase in demand
- Allows pay-per-use

- Web-based control & interfaces
- API Access available.

5.1. Disadvantages

Here, are significant challenges of using Cloud Computing:

Figure 7

- **Performance Can Vary:** When you work in a cloud environment, your application runs on a server that also serves as a resource provider for other enterprises. Any selfish activity on your tenant's part, or a DDOS assault, could degrade the performance of your shared resource.
- **Technical Issues:** Cloud computing is prone to outages and other technical problems. Even the best cloud service provider firms, despite maintaining excellent maintenance standards, may run into problems.

5.2 Security Threat in the Cloud

Another disadvantage of using cloud computing services is the security risk. You should be aware that if you use cloud computing, you will be sharing all of your company's sensitive data with a third-party cloud computing service provider. This information could be accessed by hackers.

Figure 8

- **Downtime:** When working with cloud computing, it's also important to factor in downtime. This is due to the fact that your cloud provider may have power outages, poor internet access, and service maintenance, among other things.
- **Internet Connectivity:** In cloud computing, reliable Internet access is essential. You can't use the cloud if you don't have access to the internet. Furthermore, there is no other means to collect data from the cloud.
- **Lower Bandwidth:** Many cloud storage companies restrict their users' bandwidth use. As a result, if your company exceeds the allotted budget, the extra costs could be enormous.
- **Lacks of Support:** Customers are not properly supported by cloud computing firms. They also encourage their users to rely on FAQs or online help, which can be a time-consuming task for non-technical people.

VI. CONCLUSION

- The cloud is a term that refers to software systems and services that may be accessed over the Internet using a web browser like Google Chrome or Safari.
- Cloud computing refers to the on-demand provision of computer system services such as data storage, networking, intelligence, and analytics.
- Many businesses are incorporating cloud applications into their operations, with the worldwide cloud computing market expected to hit $623.3 billion by 2023.
- Public, private, hybrid, and community clouds are the four types of cloud.
- Infrastructure as a Service, Platform as a Service, Software as a Service, and Function as a Service are the four main types of cloud computing.
- Regardless of the benefits and drawbacks of Cloud Computing, we cannot dispute that it is the fastest expanding segment of network-based computing. It benefits consumers of all sizes, including basic users, developers, companies, and all types of businesses. As a result, this technology will be around for a long time.

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