Why is Cloud Computing the Future?

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Abstract

These days, software companies are using a generation of cloud computing technology. The most efficient structure for computation is found in cloud computing, which is entirely Internet-based. Internet-based computing, known as "cloud computing," makes data and shared computing power readily available to computers and other devices. Modern Cloud computing These days, cloud computing is a new area of study. There is no denying that cloud computing offers significant advantages to enterprises. However, cloud computing has several problems, such as costs, service availability, power use, performance, resource management, scheduling, etc. We, therefore, concentrate on "Why Cloud is Future?" and the reasons why cloud computing may be a part of our future in this paper.

Index words-Cloud computing, IaaS, PaaS, SaaS, public Cloud, private Cloud, Hybrid Cloud

Why Cloud Computing?

The Cloud in the digital sphere has everything to do with the Internet. The Cloud powers some of the biggest businesses in the world and is the technology behind some of the most cutting-edge tools and products of recent years. The tech revolution has seen rapid acceptance over the last ten years.

Businesses worldwide are adopting cloud computing and resources to access crucial applications and data on a pay-as-you-go basis. Cloud computing (Fig.1) , highly regarded for its comfort and dependability, is revolutionizing organizations and their operations across industries. The importance of cloud computing, its advantages, and the vital need for cloud computing professionals will all be covered in this article.

Fig.1. Cloud computing applications

I. Introduction

The delivery of computer or IT infrastructure through the Internet is known as cloud computing. With the least amount of work or engagement from the service provider, shared resources, software, applications, and services are available online to satisfy the customer's elastic demand. Despite producing meals, grains, and other goods, agriculture is decentralized, uses simple, old-fashioned techniques, and is subject to several farmer-imposed limitations. Modernization is, therefore, sluggish. As a result, there is an apparent disconnect between the supply and demand channels for agricultural goods. The farmer's financial situation and the country's national income will suffer as a result of this. This barrier can be removed from the agriculture sector with cloud computing technology. All necessary data must be set up to be stored in a centralized location. It may consist of numerous independent databases. Data availability can be achieved by keeping soil-related, weather-related, research, crop, and farmer-related data in one place. Through the usage of connected devices to the cloud system, end users, such as farmers, specialists, consultants, researchers, etc., can readily access this data at any time from any location.

The mobility that Cloud computing offers, both to the leisure user and the commercial and business user, is one of its other primary external uses. Many of us are already familiar with several Cloud Computing services, such as email and Google Docs. AWS Elastic Compute, Google Cloud Engine, and Lambda are the three most well-liked cloud computing platforms.

Microsoft Azure, Google Cloud Platform, and Amazon Web Services are the three most well-known cloud computing platforms. The Cloud is adaptable. Cloud-based services are a good fit for companies with fluctuating or escalating bandwidth needs. Utilizing the service's remote servers allows you to extend your cloud capacity if your needs increase. The necessity to be

proficient in various operating systems and languages is a significant issue with transferring applications to the Cloud. In terms of cloudiness, back-end processes use relational databases; some of the code is written in SQL or another query language. Program logic is likely to be executed on the client side in HTML documents with JavaScript. A server program, which might be created in a scripting language (like PHP, Java, or Python), sits between the database and the client. The information transmitted between the various layers is probably encoded in an XML variant.

II. Background

The existing storage and computing facilities are in intense demand due to the Internet's rapid expansion. The inexpensive commodity PCs become the primary hardware platform Internet service providers use. There are numerous types of software technology.

Three critical cloud computing paradigms based on the underlying resource abstraction technologies have been developed to operate these PCs elastically: the Amazon, Google, and Microsoft styles.

Amazon style

Server virtualization technology serves as the foundation for Amazon's cloud computing. Under the name Amazon Web Service (AWS), Amazon released the Xen-based Elastic Compute CloudTM (EC2), object storage service (S3), and structure data storage service (SimpleDB) during the 2006–2007 period. AWS becomes the first company to offer infrastructure as a service (IaaS) on demand and at a lower cost.

Google style

Google's style is based on a sandbox for each technique. From 2003 to 2006, Google published several research papers outlining a specific type of Platform as a Service (PaaS) cloud computing. In 2008, the Platform—Google App EngineTM (GAE)—was made available to the general public as a service.

Microsoft style

Released in October 2008, Microsoft Azure [10] uses .NET as the application container and Windows Azure Hypervisor (WAH) as the foundational cloud infrastructure. Additionally, Azure provides services like SQL service and BLOB object storage. It's difficult to say which one is superior. Still, server virtualization appears more adaptable and compatible with current software and applications, whereas sandboxes impose more significant limitations on programming languages but less abstraction overhead. In cloud computing, server virtualization is now the most well-liked resource abstraction method. Numerous businesses have experimented with and implemented internal cloud computing systems in addition to these public cloud offerings. A fundamental strategy for IT vendors, ISPs, and telecom service providers already involves cloud

computing. Even further, the Cloud has become a national policy in the United States of America and Japan. Some of the early adopters for each style are included in the following table.

III. What is cloud computing?

Cloud computing is the utilization of hardware and software shared across all cloud users and distributed through the Internet by a provider. We can also tell that services that are hosted online are delivered. Infrastructure as a Service (IAAS), Platform as a Service (PAAS), and Software as a Service are just a few of the services available (SAAS). ("The Three Categories of Cloud Services (IaaS, PaaS, SaaS)") There are many public, private, communal, and hybrid clouds (Fig.2).

Fig.2 Cloud computing application

IaaS

In simple terms, the IAAS provides resources to support web applications in terms of storage, operating systems, and networks, which can be accessed using the Internet only on demand.

PaaS

A platform is given to the buyers as a service in PaaS in which a person can install their software program. For a Product, companies provide a predefined.

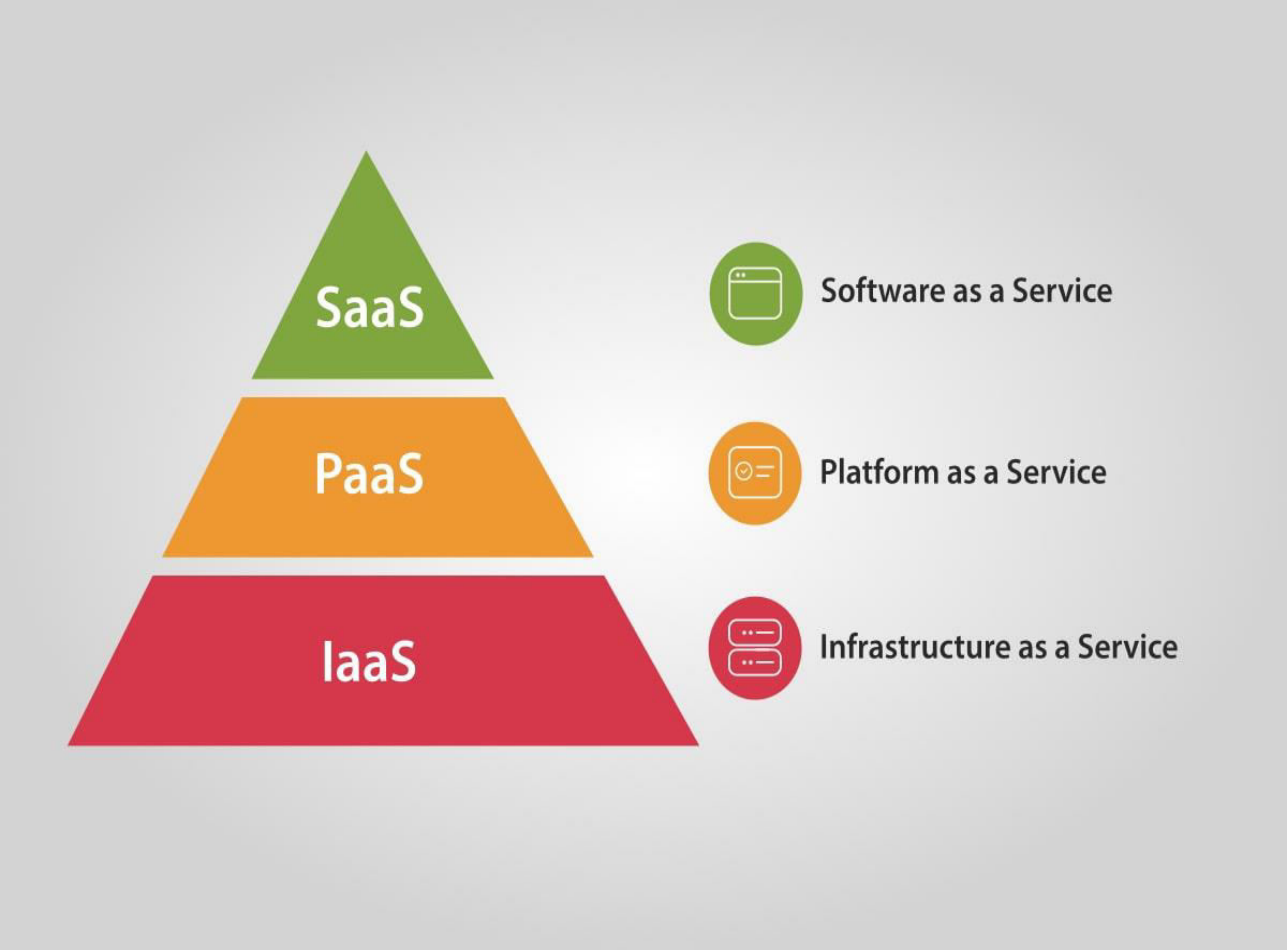
Things of working devices and a server to acquire administration capability of the applications.

Examples are Linux, Apache, MySQL, PHP, Ruby, etc.

SaaS

It is used to host cloud-based applications over the Internet so people can use them and it works on the 'pay as you go' model so that we can use only what we need and what we use.

Examples are googling docs, calendars, and email (Fig.3).



Fig,3. Software, Platform, and Infrastructure as Service

IV. Types of Cloud

Public Cloud is a public model service; anyone can use it and share it, but some general models will be paid. For example, google drive offers free storage, but Amazon's EC2 service is delivered, so this can be considered.

Private Cloud- It is a private network that only one organization can use and is not available to people outside the organization. For example, college wi-fi will be only accessible to those who are in that organization, but outsiders cannot access wi-fi.

Hybrid Cloud is a combination or mix of two or more environments, like a private cloud in a public cloud.

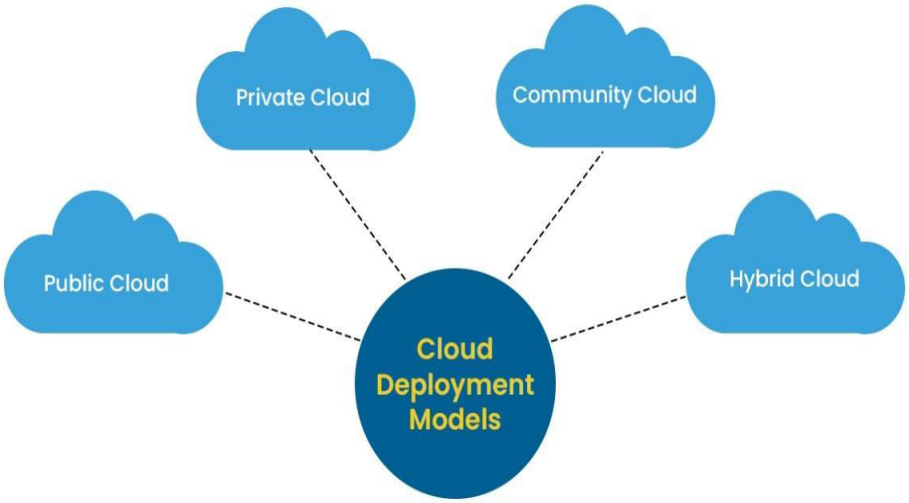


Fig.4. Cloud computing deployment models

Advantages

- *Strict security*: When it comes to safety, it uses the best data encryption method(AES-256) and simultaneously uses amazon simple storage service(S3), which strengthens security (Fig.4).
- *Cost saving:* When it comes to maintenance, it will be less due to 'no physical infrastructure will be present' and 'Pay as you go' is a famous saying of the Cloud because we will pay for what we use, and it will save a considerable amount of money.

- *Flexibility:* As it is scalable, we can upgrade to any storage we want and degrade it, so it is flexible without the need for the IT team to update the storages of the computers physically.
- *Loss prevention:* As we know, employees must store data in their laptops, but if something happens to the computer, like stolen, the Cloud can prevent data loss by backing up the data in the Cloud so that no data will be lost.

V. Why is cloud future?

Space exploration

Space exploration has so much hype these days that many companies are investing billions in it (Fig.5). Still, when cloud computing comes into play, companies save money for equipment costs for storing footage data, whereas cloud computing does its work by saving massive amounts of money. Cloud computing is used to retrieve data over a shared server.

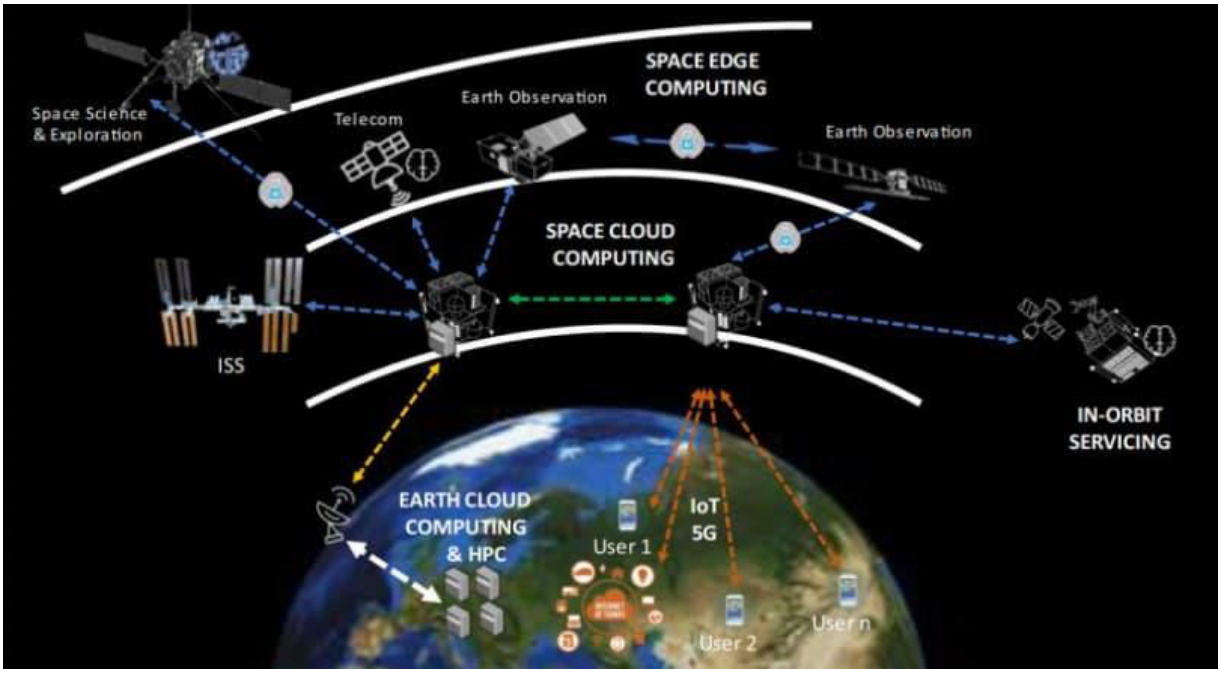


Fig.5. Space cloud computing

Education system

Cloud computing is used in many ways. It is used by various institutions to host classes online and to share resources through online services. It is also used to scale their institutions so that students from other continents can attend courses online and get their degrees through various platforms like Coursera colleges offer their degrees online (Fig.6). It can save money by providing them the e-books and other online textbooks rather than physical books so that they can save the cost of textbooks.

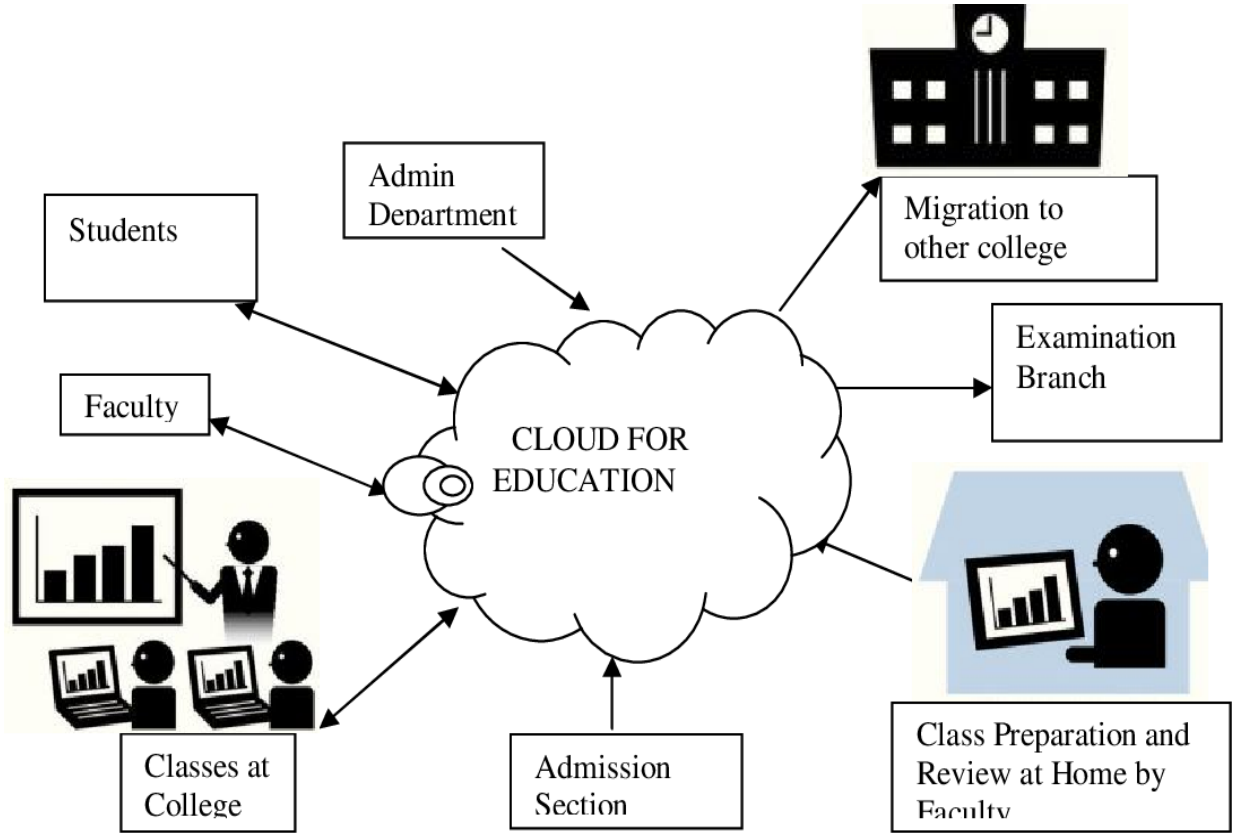


Fig.6. Cloud computing for education

Healthcare industry

Maintaining a patient's medical history in their records and it is difficult to retrieve data if they need because of the extensive data will be there (Fig.7), so Cloud helps to save costs by storing data in cloud databases, and it makes it easy for doctors to share data among them to make tasks easier. Cloud is used to increase the efficiency of the industry. This technology is easy to access to them and has a low initial cost to start.

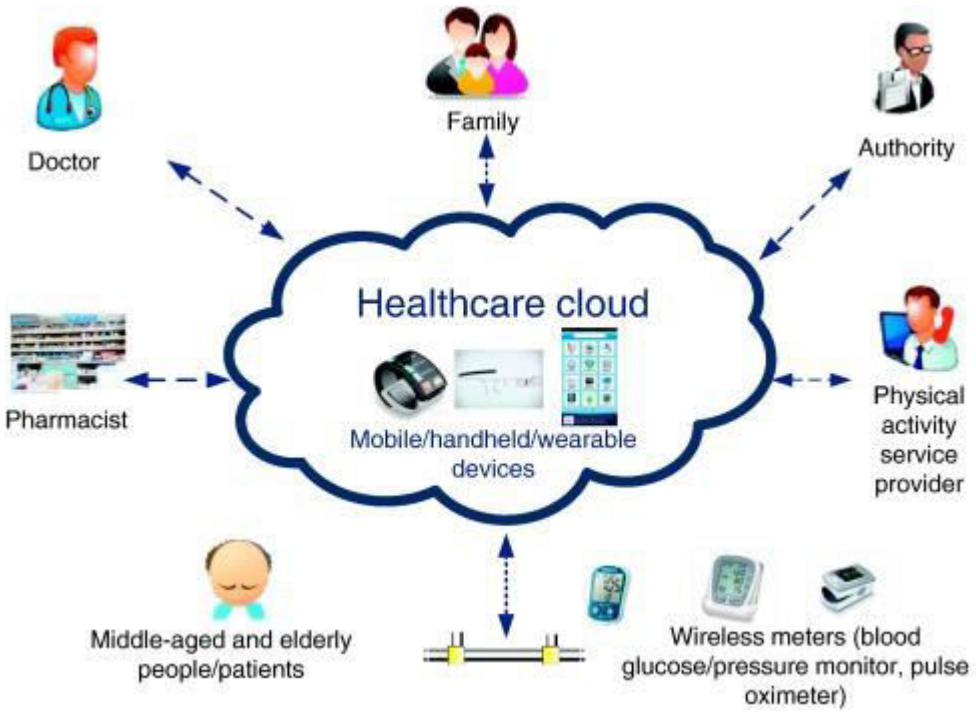


Fig.6. Cloud computing in healthcare

Business expansion

It helps to increase the company's productivity, reduces the cost of buying physical servers, saves space, and makes data sharing easy over the Cloud. Many companies are shifting towards Cloud to facilitate the installation cost of physical servers (Fig.7). Companies can scale their company as much as they want because if there is any sudden increase in customers or server crashes, it takes months to calculate and install the physical server here. Cloud plays a crucial role. Small businesses use the Cloud.

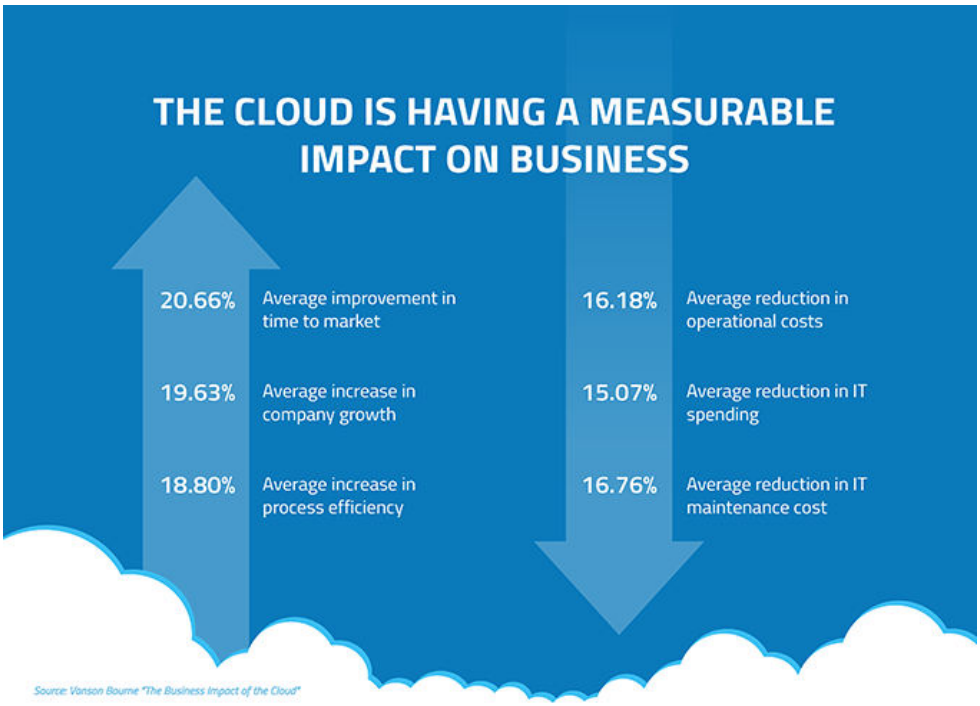


Fig.7. Cloud computing impact on business

Agriculture

In this sector, the Cloud is playing a vital role; by installing IoT devices integrated with IOT in their farms, they can know the condition of the land, whether it contains moisture or is dry, and if it is dry, it can sprinkle water all over the land. Cloud will let the farmer know the condition of the plant. We can operate them from anywhere; Cloud reduces the technical issues in IOT devices (Fig.8). There will be no delay in the exchange of information over the Cloud. It will modernize farming and increases yields, hence increasing the national income.

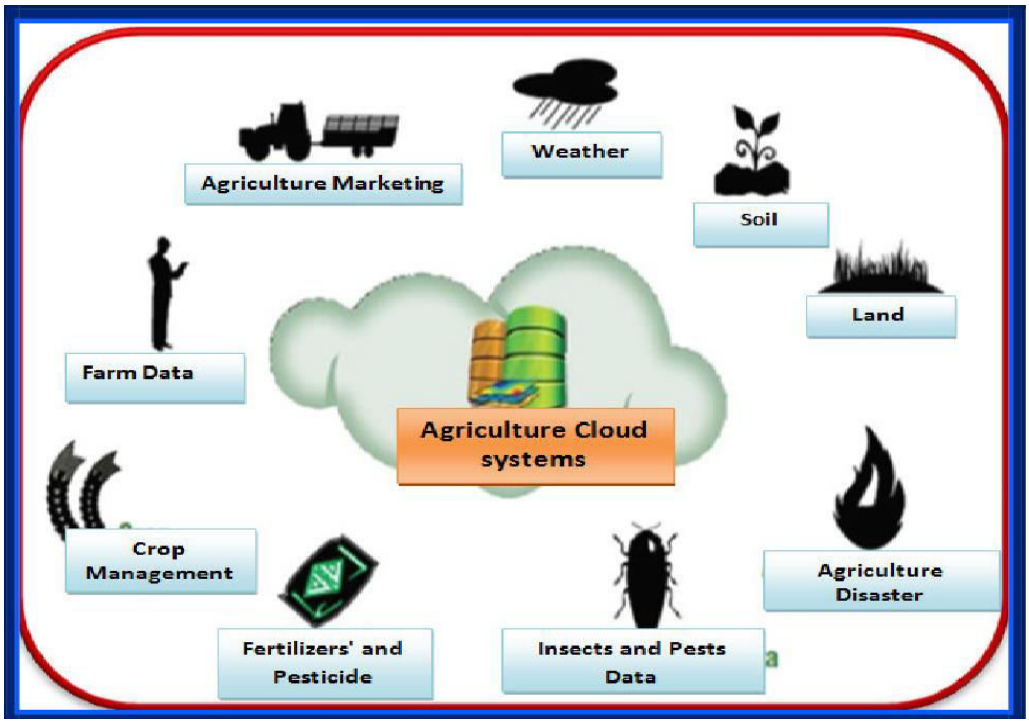


Fig. 8. Cloud computing in agriculture

VI. Key issues and challenges faced by cloud computing.

Computer paradigms have many problems, and some new issues brought on by cloud computing also need to be adequately resolved if the Cloud is to be fully realized. Numerous issues with current cloud adoption show the specific business risk of using cloud services and the major obstacles. These challenges must be overcome to satisfy both the service provider's needs and supply users with high-quality services. Power and energy management, data isolation, resource availability, security, protection, identity management, and resource management and resource heterogeneity are only a few categories into which the problems can be divided. Although many concerns need addressing, the following can be considered to be of the utmost importance.

Privacy and security

According to a poll by International Data Corporation (IDC), cloud adoption's three most prominent problems are security, performance, and availability. The key issues are how it addresses safety and privacy issues brought forth by data application and transit on networks, data management loss, diverse resources' nature, and various security standards. Any time data is processed, moved, or stored outside of an organization's boundaries, and there is an inherent danger that the organization may be attacked. Both internal and external security dangers are possible. Different people and groups, such as adversaries or external risk, come from hackers or intruders who do not have direct access to the Cloud. Affiliates, contractors, current or former employees,

and other parties with expertise in a company's computers, networks, and data to support operations represent a threat to internal security is a well-known problem. Cloud computing raises privacy issues since service providers may access data stored there, which could result in major corporate trust issues and legal repercussions if changed unintentionally or on purpose.

Performance

According to the IDC report, performance is the second-biggest problem with cloud adoption. When a user switches to Cloud computing infrastructure, the Cloud must offer enhanced performance. Applications running on the cloud system's capabilities are typically used to gauge performance. Lack of enough resources, such as storage space, bandwidth restrictions, slower CPU speeds, RAM, network connections, etc., can lead to deficient performance. Users frequently choose to use services from many clouds, some public, and community clouds, while others have private clouds housing some data or apps. The provision of adequate resources for data-intensive applications is increasingly difficult. Poor performance may lead to the cessation of service delivery, client loss, a decrease in bottom-line revenues, etc.

Scalability and Elasticity

The most impressive and distinctive aspects of cloud computing are its elasticity and scalability. These functions enable users to utilize cloud resources that are deployed following their needs in limitless quantities as needed. Scalability is the system's capacity to continue operating adequately when resources are increased. On the other hand, flexibility refers to adjusting resource levels as required. However, elasticity further permits the infrastructure's dynamic integration and extraction of physical resources. The elastic nature of cloud computing allows resource allocation to change in size in response to demand. Scalability is made possible through elasticity, which enables the system to scale up or down the level of services the user has subscribed to. There are two main approaches to offer scalability: horizontally and vertically.

Vertical scalability refers to adding resources to a single node in the system, customarily by adding memory or processors to a single computer. Horizontal scalability refers to adding more nodes to the system, like adding a new computer to a conventional service provider system.

Interoperability and portability

The ability to use the same tools or applications on different cloud service provider platforms is known as interoperability. Application, service, management, and data interoperability are some of the various levels at which interoperability can be defined. Users of cloud services must be free to move between clouds whenever they want without vendor lock-in restrictions. One of the critical challenges to interoperability in cloud computing is the potential for vendor lock-in. There are no

open standards for VM formats and service deployment interfaces; open APIs or standardized interfaces are the key obstacles to realizing it. One cloud solution will work with multiple platforms and apps in addition to other clouds, thanks to cloud portability.

Energy Consumption

According to a survey conducted by Amazon, servers account for 53% of the entire cost over a 3-year amortization period for Amazon data centers, while energy and cooling requirements account for the remaining expenses account for 42% of the total budget over a 15-year amortization period, including both direct power consumption (19%) and cooling requirements (23%). Data centers consumed more than 1.5% of the energy produced in the United States in 2006, projected to rise by 18% yearly. Numerous servers are housed in cloud data centers, equipped with cooling systems to eliminate the heat produced by the servers. These servers' energy usage and cooling system emissions contribute to global warming (GHGs). Additionally, cloud data centers, a fundamental component of the cloud infrastructure, are expensive to run and use a lot of energy. For instance, the power usage of the Google data center is comparable to that of a large metropolis like San Francisco. We need to build such networks, scheduling criteria, hardware, software, hardware, and other protocols that use energy in an eco-friendly and optimal manner because ICT helps to generate applications and facilities for human prosperity. The objective isn't just to diminish the utilization of power and, subsequently, the expense consumed by server farms but to keep up with ecological principles important not exclusively to make do but to flourish.

Bandwidth Cost

A key component of cloud computing is high-speed connectivity. With the help of cloud computing, businesses can still save money on hardware and software. Necessitates using more bandwidth. Without fast communication links, utilizing Cloud computing services to their full potential is nearly impossible. Moving to the Cloud almost eliminates the upfront costs but also raises the price of transporting data to and from private clouds and other clouds or the cost of data transmission via networks. Whenever a consumer application uses a lot of data and the user's information is spread across several clouds, the problem is magnified. Cloud computing offers less expensive data-intensive jobs that are still more CPU-intensive than CPU-intensive, with Gray's adage "Put the computation near the data" still applicable. In other words, using a private cloud rather than a public or hybrid Cloud can improve the performance of data-intensive applications.

VII. What to migrate

Applications for IT management (26.2%), collaboration applications (25.4%), applications for individuals (25%) and businesses (23.4%), applications for the development and deployment of

applications (16.8%), servers (15.6%), and storage (15.5%) are the seven IT systems/applications that are being moved to the Cloud, according to an IDC survey from 2008. Due to security and privacy concerns, this survey's sample size of 244 shows that enterprises are still hesitant to migrate their data to the Cloud. The report also reveals that the most straightforward IT systems are those used for ancillary purposes like personal applications and IT administration. In contrast to SaaS, IaaS is more conservatively used by enterprises willing to keep vital operations local while outsourcing less critical tasks to the Cloud. Even though this part has addressed several cloud computing-related concerns and difficulties, there are still several additional important ones that should be taken into account. . A few of these, such as resource automation management, resource management of leftover and extra resources, costing model management, service level agreement (SLA) management, etc., are also present and deserve immediate attention. These problems should not be viewed as obstacles to cloud computing; instead, they should be carefully addressed and viable solutions investigated before embracing this technology.

VIII. Conclusion

Cloud computing is expected to revolutionize the IT industry and become a critical part of all businesses shortly. It is created on the pay-as-you-go model for internet service delivery, which has benefits like no upfront costs, a minor IT team, and cheaper operating costs, to mention a few. Although cloud computing has promising futures for businesses and researchers, specific complex concerns must be handled properly, such as security, performance, dependability, scalability, interoperability, virtualization, etc. Improvements in bandwidth technologies, associated service models, and security models have the potential to transform both this field and the IT sector completely. The concept of cloud computing has been discussed, along with its uses, services, advantages, and why it is the future. The paper also sheds some light on several problems and obstacles that must be overcome if the Cloud is to be successfully implemented and become a significant aspect of our lives to flourish.

References

[1] Choudhary, Sushil Kumar, R. S. Jadoun, and H. L. Mandoriya. "Role of cloud computing technology in agriculture fields." Computing 7.3 (2016): 1-7.
[2] Mente, R. and Kale, A., 2017, November. Cloud computing and its effects in various fields. In 12th International Conference on Recent Trends in Engineering, Science, and Management (pp. 386-392).
[3] Sheth, A., Bhosale, S. and Kadam, H., 2021. Research paper on cloud computing. Emerging Advancement and Challenges in Science, Technology, and Management, pp.87-92.
[4] de Gouveia Dal Pino, E.M. and Kowal, G., 2015. Particle acceleration by magnetic reconnection. Magnetic Fields in Diffuse Media, pp.373-398.
[5] Rajaraman, V., 2014. Cloud computing. Resonance, 19, pp.242-258.
[6] Srivastava, P. and Khan, R., 2018. A review paper on cloud computing. International Journal of Advanced Research in Computer Science and Software Engineering, 8(6), pp.17-20.

[7] Wang, L., Von Laszewski, G., Younge, A., He, X., Kunze, M., Tao, J. and Fu, C., 2010. Cloud computing: a perspective study New Generation Computing2010282137, 146.
[8] Cocian, R. (2020) Cloud Computing for Space Exploration - IEEE Transmitter, IEEE Transmitter. Available at: https://transmitter.ieee.org/why-were-using-cloud-computing-for-space-exploration/#:~:text=Cloud%20computing%20uses%20the%20internet,take%20days%20to%20retrieve%20data. (Accessed: 28 January 2023).
[9] Sajid, M. and Raza, Z., 2013, December. Cloud computing: Issues & challenges. In International Conference on Cloud, Big Data and Trust (Vol. 20, No. 13, pp. 13-15). sn.