Review Article

Cloud Computing Technology Challenges and Benefits: A Review

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Abstract

Cloud computing is the delivery of computing services, including as servers, storage, databases, networking, software, analytics, and intelligence, via the Internet to enable faster innovation, flexible resources, and scale economies. Cloud technologies have been used more and more in recent years as technology has evolved. Because data can be stored, sent to multiple locations simultaneously, and accessed at any time, cloud technologies are attractive. It is a system that makes it possible to store data online, freeing users from the limitations of physical environments and storage devices and allowing access at any time and from any location.

Keywords: *Challenges, Internet of Things (IoT), Cloud Technologies, Cyber-attacks, Benefits. Types of Cloud Computing.*

I. INTRODUCTION

The name "cloud computing" first appeared in the early 2000s, but the idea of "computing as a service" has been present since the 1960s, when computer bureaus allowed businesses to rent time on mainframes rather than having to purchase one themselves. These "time-sharing" services were primarily replaced by the development of the personal computer (PC), which made owning a computer much more accessible, and subsequently by the emergence of corporate data centers, which allowed businesses to store enormous amounts of data. But in the application service providers, utility computing, and grid computing of the late 1990s and early 2000s, the idea of renting access to computing resources has repeatedly come up. Then came cloud computing, which truly took off with the appearance of software as a service (SaaS) provider and hyperscale cloud computing companies like Amazon Web Services. In recent years, the pace of advancement in electronic and communication tools has reached previously unheard-of levels. New technological advancements or innovations occur daily in our lives. Thanks to cloud technology, it is also possible for individuals and gadgets to exchange information, move data, and store data centrally. Cloud technologies are appealing because data may be stored, transmitted to numerous locations at once, and accessed at any time. It is a technology that was created in the 1960s and offers functions including data transfer and storage. It is a system that enables data storage on the Internet, releasing users from the constraints of physical settings and storage devices and enabling access from any location at any time. The cloud ecosystem's devices are not physically linked. This service is offered by distant network servers. It is also known as data virtualization. It is intended to operate applications, transfer content and services, and securely store and manage data. It is accessible from any internet-connected device. A collection of virtual services known as "cloud computing" ensures that data is stored in an internet-accessible, external environment and operates on a pay-as-you-go basis, allowing customers to only pay for the services they really use. Cloud technologies allow users to store their data and programs in a remote location and make them accessible whenever they want. They are practical and simple to use. It is a well-known service provider due to the advantages of ease of administration, configuration, access, and service. It offers services for either individual or business use. In the modern era, it may be argued that communication and access to the internet are available everywhere. Even compared to earlier decades recent years have seen a lot more growth. The use of cloud computing has surpassed traditional data storage and transit methods as well. In the commercial environment, these systems are more frequently employed since they offer quick and secure data transport, storage, manageability, and accessibility. The rapid development of this industry and diverse security requirements are due to the increasing demand for cloud computing [10–14]. Open-source software is used in the distributed system architecture of

cloud computing. Users' personal data and the locations where it is physically stored are kept private. One benefit of cloud computing is that it can do a variety of functions and be accessed from anywhere in the world. It offers excellent business mobility and can be moved to the cloud using browsers. This increases the appeal of cloud computing products, which also saves on traditional storage costs. The benefits and drawbacks of cloud computing were also examined in this study. The security flaws in cloud technology were thoroughly investigated for this study [3]. The advent of cost-effective, secure, and collaborative cloud-based accounting tools has changed financial administration for companies of all kinds. Organizations can gain a competitive edge, increase efficiency, and improve decision-making skills by adopting these technologies [4]. The study illuminates the transformational effect of fusing blockchain with cloud computing, opening the door to new opportunities and advancements in the digital age [5] through this thorough analysis. Cloud-based computing solutions have had a huge impact on the accounting business, altering how accountants manage financial data. Businesses may now store and access their accounting data on a platform in the cloud, providing users more flexibility and convenience. By doing away with manual data entry, the technology speeds up the creation of financial accounts and reports and reduces errors [6]. Here, we outline the effective application of a widely used comparative genomics method. Although there is a lot of misunderstanding about what the cloud is, the study indicated that IT managers are actively implementing cloud computing projects to achieve bioscience goals. The survey also discovered that addressing access, security, and performance issues is necessary for mainstream enterprise adoption [7]. This study tries to pinpoint the strategic course for bringing cloud computing technology into Ukraine's educational system in order to modernize it. Methods: To investigate the present trends in the modernization of the educational system and the function of information and communication technologies, the study uses analysis and forecasting.
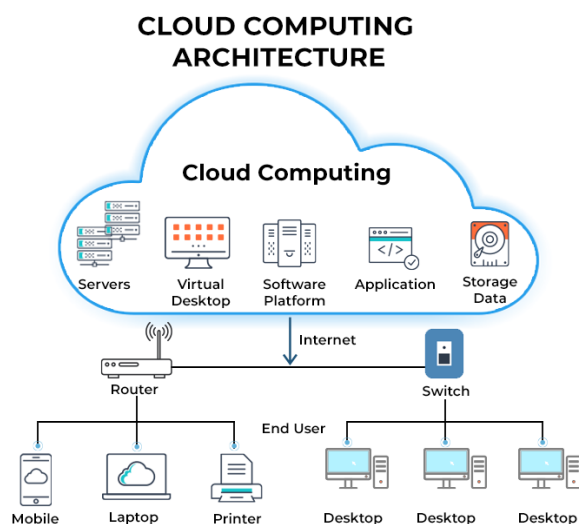

Figure 1: model of cloud computing technology

II. THE CHALLENGES FACED IN CLOUD COMPUTING

Cloud is an important resource with its various benefits, but it has various risks and challenges as well. This article will dive deep into a few of the most common cloud computing challenges faced by the industry, cloud security challenges and risks, and cliched cloud computing problems and solutions.

1. Data security and privacy

When working with Cloud environments, data security is a major concern as users have to take responsibility for their data, and not all Cloud providers can assure 100% data privacy.

No identity access management, lack of visibility and control tools, data misuse, and cloud misconfiguration are the common reasons behind cloud privacy leaks. There are also concerns about malicious insiders, insecure APIs, and neglect or oversights in cloud data management.

Solution:

Install and implement the latest software updates, as well as configure network hardware to prevent security vulnerabilities. Using antivirus and firewalls, increasing bandwidth for Cloud data availability, and implementing cybersecurity solutions are some ways to prevent data security risks.

2. Multi-cloud environments

Multi-cloud environments present issues and challenges such as – configuration errors, data governance, lack of security patches, and no granularity. It is difficult to apply data management policies across various boards while tracking the security requirements of multi-clouds.

Solution:

Implementing a multi-cloud data management solution can help you manage multi-cloud environments. We should be careful while choosing the solution, as not all tools offer specific security functionalities, and multi-cloud environments continue to become highly sophisticated and complex.

3. Performance challenges

The performance and security of cloud computing solutions depend on the vendors, and keep in mind that if a Cloud vendor goes down, you may lose your data too.

Solution:

Cloud Service Providers should have real-time SaaS monitoring policies.

4. Interoperability and flexibility

when you try to shift applications between two or multiple Cloud ecosystems, interoperability is a challenge. Some of the most common issues are:

Match the target cloud environment's specifications by rebuilding application stacks

Managing services and apps in the target cloud ecosystem

Working with data encryption during migration

Configuring networks in the target cloud for operations

Solution:

Before starting work on projects, setting Cloud interoperability as well as portability standards can help organizations solve this problem. The use of multi-layer authorization and authentication tools is a good choice for account verifications in hybrid, public, and private cloud ecosystems.

5. High dependence on network

When transferring large volumes of information between Cloud data servers, a lack of sufficient internet bandwidth is a common problem. There is a risk of sudden outages, and data is highly vulnerable. To help prevent business losses from sudden outages, enterprises should ensure there is high bandwidth without sacrificing performance.

Solution:

Focus on improving operational efficiency and pay more for higher bandwidth to address network dependencies.

6. Lack of knowledge and expertise

Hiring the right Cloud talent is another common challenge in cloud computing. There is a shortage of working security professionals with the necessary qualifications in the industry. As the workloads are increasing, so are the number of tools launched in the market. Enterprises need good expertise in order to efficiently utilize these tools and look out for the best fit.

Solution:

Hire Cloud professionals having specializations in DevOps as well as automation.

7. Reliability and availability

High unavailability of Cloud services, as well as lack of reliability, are the major concerns in these ecosystems. In order to keep up with ever-changing business requirements, businesses are forced to seek additional computing resources.

If a Cloud vendor gets hacked, the sensitive data of organizations using their services gets compromised.

Solution:

Improve both aspects by implementing the NIST Framework standards in Cloud environments.

8. Password security

Account managers manage all their cloud accounts using the same passwords. Password management poses a critical problem, and it is often found that users resort to using weak and reused passwords.

Solution:

Secure all your accounts by using a strong password management solution. To further improve security, in addition to a password manager, use Multifactor Authentication (MFA). Cloud-based password managers should alert users of security risks and leaks.

9. Cost management

Although Cloud Service Providers (CSPs) offer a pay-as-you-go subscription model for services, hidden costs are charged as underutilized resources in enterprises, making the costs can add up.

Solution:

Implementing resource utilization monitoring tools as well as auditing systems regularly are some ways organizations can fix this. It's one of the most efficient methods to deal with major challenges and manage budgets in cloud computing.

10. Lack of expertise

Cloud computing is a highly competitive field, and there are many professionals who lack the required knowledge and skills to be employed in the industry. There is also a huge gap in supply and demand for certified individuals and many job vacancies.

Solution:

Companies should help existing IT staff in upskilling their careers and skills by investing in Cloud training programs.

11. Control or governance

Good IT governance makes sure that the right tools are used and assets get implemented as per procedures and agreed-on policies. Lack of governance is a common problem in cloud computing, and companies utilize tools that do not align

with their vision. IT teams don't get total control of compliance, data quality checks, and risk management, thus creating many uncertainties when migrating to the cloud from traditional infrastructures.
Solution:
Traditional IT operations should be adopted to accommodate Cloud migrations.
12. Compliance
When it comes to having the best data compliance policies, cloud Service Providers (CSP) are not up-to-date. Organizations run into compliance issues with state laws and regulations whenever a user transfers data from internal servers to the cloud.
Solution
The General Data Protection Regulation Act is expected to address compliance issues in the future for CSPs [16].

III. BENEFITS OF USING THE CLOUD

The specific advantages will depend on the sort of cloud service utilized, but, in general, employing cloud services frees businesses from having to purchase or manage their own computing infrastructure. There is no need to purchase servers, maintain operating systems or applications, decommission outdated hardware or software, or dispose of it because the supplier will handle all of these tasks for you. It may make sense to use a cloud provider rather than internal resources for common apps like email. Cloud services may be able to provide end users with a more secure and effective service since a company that specializes in managing and securing these services is likely to have better skills and more experienced people than a small business could afford to hire. Because they just pay for the resources they use, businesses using cloud services are able to move projects forward more quickly and try out ideas without incurring lengthy procurement delays or significant up-front expenditures. Advocates of the cloud frequently point to this idea of corporate agility as a major benefit. It should be simpler and quicker to launch new apps with the flexibility to quickly spin up new services without the time and effort required for conventional IT procurement. Additionally, the elastic nature of the cloud makes it simpler to scale up a new application fast if it proves to be really successful. It might be more cost-effective for a business to host an application in the cloud rather than have dedicated hardware and software that sit idle for a large portion of the time if the program has large usage peaks, such as those that only occur at specific times of the week or year. For services like email or CRM, switching to cloud-hosted applications could free up internal IT workers, and if such programs don't produce any competitive advantage, there won't be much of an impact elsewhere. Moving to a services model also moves spending from capital expenditure (capex) to operational expenditure (opex), which may be useful for some companies.

IV. TYPES OF CLOUD COMPUTING

1. Software-as-a-service (SaaS): Customers must license a software program in this case. Usually, licenses are offered on demand or under a pay-asyou-go arrangement. Microsoft Office 365 contains a mechanism like this.
2. Infrastructure-as-a-service (IaaS): It involves a technique for offering anything over IP-based connectivity as part of an on-demand service, from operating systems to servers and storage. Clients can obtain these resources through an outsourced, on-demand service rather than having to buy software or servers. IaaS systems like IBM Cloud and Microsoft Azure are well-known examples.
3. Platform-as-a-service (PaaS) of the three layers of cloud computing, this is regarded as the most complicated. PaaS and SaaS are quite similar, with the main distinction being that PaaS is a platform for developing software that is distributed over the Internet rather than delivering software as a service online [1].

V. PROBLEMS WITH THE CLOUD

There are hazards, of course, with all the speed, efficiencies, and innovations that come with cloud computing. Security has always been a major worry when using the cloud, especially when dealing with private financial and medical documents. Although regulations require cloud computing firms to strengthen their compliance and security measures, it is still a problem today. Important data is encrypted for protection, but if the encryption key is lost, the data is gone as well. Cloud computing firms' servers are susceptible to internal errors, power outages, and natural calamities. The geographical reach of cloud computing cuts both ways: A California blackout may render customers in New York helpless, and a Texas company could lose its data if something causes its Maine-based provider to fall. This illustrates the geographical reach of cloud computing. There is a learning curve for both employees and management, as with any technology. However, errors can spread throughout an entire system when numerous people access and alter data through a single gateway [2].

VI. CONCLUSION

Due to its widespread use, cloud computing is vulnerable to attacks. The main difference between assaults that cloud technology is vulnerable to and those that it is not is that it is available to all devices within the same ecosystem. This situation changes the character and intensity of attacks. Cyberattacks [8, 9] and their methods are no exception to the ever-changing cyber world. This report includes a comparison of cloud computing technology [15].

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