

What is Cloud Computing? Benefits and challenges of Cloud

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Abstract

Cloud computing provides on-demand delivery of computer resources ranging from, compute, data storage, networking, software, and other IT services over the internet in exchange for pay as you go billing model. The study discusses various types of cloud computing available, cloud computing advantages, cloud computing implementation models, cost-effective IT solution, IT service agility, challenges, and features of cloud computing in this growing digital world.

Keywords: cloud, data storage, compute, digital, on-demand billing model.

Introduction

Cloud computing is an internet-based infrastructure that allows users to access computing resources on demand from any location (Brown & Weihl, 2011). It is a new way of delivering computing resources rather than modern technology. Some examples of non-healthcare applications of cloud computing include Google, Gmail, Docs, and Microsoft Hotmail, while some healthcare examples include the Google Health platform and Microsoft HealthVault (Armbrust et al., 2010). This model has several advantages over traditional computing, including the ability to pay for use on a short-term basis as needed, the lack of a required upfront commitment from users, and the availability of enormous amounts of computing resources on demand (Mell & Grance, 2010).

Cloud computing has become popular in recent years due to its advancements. It is a way of providing computing and storage resources on demand, with the goal of reducing costs for businesses. Cloud storage, a key component of cloud computing, allows users to store and access data over the internet and offers benefits such as offsite backup, security, and large storage capacity at a low cost.

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There are five types of cloud storage: private, personal, public, community, and hybrid (Xiao & Xiao, 2013).

2. Advantages of Cloud Computing

Cloud computing has numerous benefits due to the availability of various technical resources, such as the ability to store and process large amounts of data and offer various IT services. It also helps reduce costs and address resource limitations by sharing resources among users. However, it is important to ensure the security of the platform to maintain performance and resource reliability, as it has become a focus of security research in recent years. This research includes data storage software, network, and security (Khan et al., 2021).

NIST defines cloud computing as a model for accessing and integrating resources through various service providers, with the convenience of on-demand access (Grance, 2011). It follows a Pay as You Go (PAYG) model, where users only pay for the services they use. This allows users to customize software, storage, and platforms to meet the needs of end-users or clients. The research community has invested a lot of effort into this concept due to its benefits (Karthika & Muthukumar, 2021).

3. Types of Cloud Computing

From a service perspective, there are three main types of cloud computing models: Infrastructure-as-a-service (IaaS), Platform-as-a-service (PaaS), and Software-as-a-service (SaaS). Software as a service (SaaS) refers to applications, such as electronic health records (EHRs), that is hosted by a cloud service provider and accessed through a network, usually the internet. Platform as a service (PaaS) refers to development tools, such as operating systems, which are hosted in the cloud and accessed through a web browser. This allows developers to build web applications without installing any tools on their own computers and to deploy those applications without requiring specialized administrative skills. Infrastructure as a service (IaaS) refers to the outsourcing of equipment used to support operations, such as servers, storage, hardware, and networking components, to a cloud provider. The provider owns and is responsible for maintaining the equipment, while the user pays on the basis of per-use (Iyer & Henderson, 2010).

4. Models for the implementation of Cloud Computing

The NIST has identified four models for implementing cloud computing: private, community, public, and hybrid. Public cloud refers to a cloud service provider offering resources, such as storage and applications, through the internet on a PAYG basis to the general public. Private cloud refers to a cloud infrastructure operating solely for a single organization, meaning that the data center supplies or proprietary network-hosted services to a particular group of people. Community cloud refers to a cloud infrastructure shared by multiple organizations with common concerns, including compliance considerations, policy, mission, and security requirements. Hybrid cloud refers to a cloud infrastructure that combines two or more clouds including private, public, or community, allowing an organization to provide and manage some resources within its own data center while having others provided externally (IBM and Juniper Networks Solutions Brief, 2009).

5. Opportunities and Challenges

According to recent research, 75% of chief information officers (CIO) stated that they are planning to utilize cloud computing in future (Danek, 2009). According to a forecast given by Mark Beccue, the number of people using mobile cloud applications is expected to increase significantly, reaching almost one billion by 2014, up from 71 million (Cherry, 2009). There is a belief among many managers, experts, and organizations in the health sector that cloud computing can enhance services and research. Furthermore, a report by ENISA indicated that there will be a significant global investment in various sectors, including healthcare, in this new computing model. The report also predicted that approximately \$44 billion will be invested globally in cloud computing by 2013, which could potentially bring significant benefits to the healthcare industry (Bannerman, 2010). One of the main benefits of cloud computing is its affordability. By using cloud computing, an organization can easily obtain a cost-effective IT solution without the need to purchase or evaluate hardware or software or hire internal IT staff to manage and maintain in-house infrastructure. This allows the organization to focus on important tasks without incurring additional costs for IT staffing and training. In addition, the cloud computing approach allows for rapid deployment and flexibility in terms of access to healthcare resources. This means that hospitals and other healthcare providers can adapt to changes in demand without having to adjust their infrastructures (Kudtarkar et al., 2010).

Challenges in the application of Cloud Computing

There are several challenges to the adoption of cloud computing, including concerns about data security and privacy, organizational resistance to change, loss of governance, and uncertain provider compliance. Trust is a major factor in the reluctance of many customers to use the cloud, as they are concerned about the effectiveness of the security and privacy controls of providers when their sensitive data and mission-critical applications are moved to the cloud. Changing traditional workflows and organizational resistance to sharing data is another common management challenge in the adoption of cloud computing. In some cases, a service level agreement may not provide a commitment to allow the client to audit its data, which impacts the ability of the cloud user to meet its mission and goals and could result in a loss of data governance. Additionally, if a provider is unable to meet compliance norms, such as applicable standards, laws, and regulations, it could put the customer's investment at risk. In some cases, certain customer services, such as credit card transactions, may not be able to be used (Jansen & Grance, 2011).

6. Features of Cloud Computing:

Cloud computing has unique features that set it apart from other computing methods. These features can be divided into two categories: basic and essential. The essential features of cloud computing include:

Accessibility through a wide network

Cloud services can be accessed using common protocols that allow users to access them from a variety of applications and platforms. Cloud services and resources can be accessed at any time from personal computers, mobile phones, and laptops, regardless of the user's location, as long as there is sufficient internet access.

Self-service on demand

This is a fundamental feature of cloud computing that allows users to access computing services such as server time and network storage as needed. Cloud computing services can be provided at any time based on a user's request, even without human interaction.

Rapid elasticity

Cloud computing provides elastic and fast computing capacity that enables quick scaling in and instant scaling out. It is not enough to simply deliver services on demand; cloud computing's elasticity allows it to provide varying amounts of services at any given time. Cloud subscribers can effectively meet their expectations for quality of service and save on costs by increasing service capacity during peak periods and decreasing it during off-peak periods.

Resource pooling

Cloud resource providers bring together computing resources to meet the diverse computing needs of different users with a variety of virtual and physical resources. These pooled resources, such as storage devices and servers, are shared among a large number of users. Cloud resource providers select the most appropriate services from pooled resources for each cloud user's task for the optimization of the quality of service. Cloud resource sharing is the preferred option as it allows for cost savings by enabling multiple apps to be developed in the cloud rather than using dedicated computing resources.

Service measurement

This is an automated service that optimizes and monitors the use of a service and corresponds to a certain level of abstraction to the type of cloud computing resources. It also controls, reports, and monitors service utilization, leading to the actual purchase of resources (Mahdavisarif et al., 2021).

7. Barriers in the implementation of Cloud Computing

There are several barriers that may delay or prevent organizations from implementing cloud computing strategies. Many organizations are worried about the privacy and security ramifications of cloud computing. However, some organizations do not feel that these concerns are invincible or that there are no possible solutions. Cloud computing minimizes the administrative tasks performed by back-end IT systems, leading to an increased workload for front-end workers. It may also result in significant reductions in the size of the IT department's workforce, which could be perceived as a threat by the department's expertise. As a result, employees may fear losing their jobs and the management of critical systems. Control over IT and service lifecycles in the cloud is lacking. Outages in the cloud system have occurred at companies which can prevent large enterprises from using cloud computing methods due to concerns about documentation and publicized outages. Currently, there are not well-developed standards for APIs and cloud computing interfaces, technical standards, and standards for interoperability between public clouds and private clouds or vice versa (Jangjou & Sohrabi, 2022).

8. Conclusion

Cloud computing has significantly impacted how businesses function and has become a fundamental component of many organization's IT systems. By using the cloud, companies can easily access computing resources as needed, expand their operations as required, and lower their IT expenses. Cloud computing also offers improved security, reliability, and flexibility compared to on-premises systems. It is unsurprising, therefore, that the adoption of cloud computing has significantly increased in recent years and is expected to continue growing in the future.

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