

Advancing Cloud Computing: Case Studies and Practical Solutions for Modern Challenges

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Abstract

Cloud Computing (CC) is a revolutionary and futuristic technological trend that enables the delivery of computing resources. And it is growing strongly as the backbone of industrial future technological infrastructure. As it has a lot to offer but it also has some major downside which cannot be ignored. Cloud Computing offers a transformative solution to unique challenges (related to resources, competition and market dynamics), empowering SMEs to enhance their operations, compete effectively and scale with ease. Startups and SMEs phased so many problems to store large amount of data and sometime the data cannot be fully recovered or lost in case of a system failure or disaster. With the help of cloud computing they can store data in virtualize manner, with reliable backup, increased data security and reduce risk of data lose.

In summary, the results of the analysis show that all the enhancement factors were found to have a significant cloud security influence on adoption of cloud computing for SMEs.

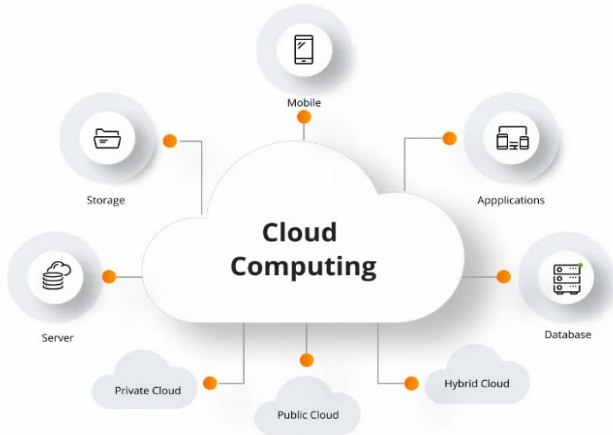
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Introduction

Cloud Computing is defined as a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle application. According to the NIST (National Institute of Standards and Technology), Cloud Computing is still an evolving paradigm. Its definitions, use cases, underlying technologies, issues, risks, and benefits will be refined in a spirited debate by the public and private sector. These definitions, attributes, and characteristics will evolve and change over time. The cloud computing industry represents a large ecosystem of many models, vendors, and market niches. These definitions attempt to encompass all of the various cloud approaches. Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., network, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or

service provider interaction. For example, if a business needs extra storage base for a particular project, it can quickly allocate additional storage resources to a cloud provider's interface, and once the project is over, those resources can be scaled back down to avoid unnecessary costs. So overall, on-demand self-service empowers users to take control of their cloud resources, enabling them to be more agile and responsive to change in demands. Another fundamental characteristic of cloud computing is resource pooling, cloud service providers pool computing resources such as storage, processing power, memory, and networking capabilities to serve multiple customers. Rapid elasticity of cloud computing is the ability of cloud services to quickly scale resources up or down based on demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time. Cloud

computing revolutionizes the way businesses and individuals manage and consume IT resources, offering scalability, cost savings, and flexibility without the need for large upfront investments in hardware or infrastructure.



Benefits of cloud computing

On demand services: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.

Flexibility and scalability: According to the need user can customize their cloud environment cloud have ability to increase and decrease IT resources based on demand.

Disaster recovery and backups: Cloud computing replicates the data and store the data at multiple addresses to ensure availability.

Security: It provides firewall, encryption, and compliance certifications for better security.

Drawbacks of cloud computing

Dependency on internet connectivity: For accessing any cloud services user needs to have stable internet connection and slow connections can disrupt operations.

Limited control: There are some limitations to access the cloud platforms and users have no control on cloud infrastructure.

Cost management: Higher usage of cloud services can increase the cost of cloud services more than owning the infrastructure. And sometimes unexpected charges can arise.

Technical challenges: High skills are required for managing hybrid cloud environment. For adaption of cloud services user need to be well trained.

Real life uses of cloud computing

1. Netflix

Netflix is one of the largest users of cloud computing. By using cloud strategies, it leads global streaming platform and it becomes partner with amazon web services (AWS) for using cloud computing.

Netflix provide best video quality to millions of users worldwide by using cloud computing architecture.

Cloud computing allows Netflix to scalable cloud resources according to the user demand.

Netflix use AWS storage system because AWS helps for storing files, user data, and user preference and recommendations.

Netflix uses AI tools to analyse user behaviour and provide recommendations according to their interest and it also improves user experiences through cloud data processing and analysis.

By using cloud computing resources and services it avoids the expense of maintaining physical data centres and optimize its operational cost.

Cloud computing allows the Netflix to serve user globally and remain the leader in streaming industry.

2. Banking

By using cloud computing banking industry develops their security, scalability, cost-effective, and way to manage data.

Cloud computing reduce the on-premises infrastructure, and result in low capital and operational expenses. Cloud computing allows banks to scale up and down quickly to meet changing demands.

Cloud computing provide secure collaboration and data sharing among employees, partners, customers. It enables banks to quickly deploy new applications and services to improve market time to time.

Cloud based core system enables banks to manage customer's transactions, loan, and accounts more efficiently and it also enables to process payments

quickly and securely. Cloud helps to solve regular compliance of banks and provide relevant solution. Cloud computing require reliable internet connection, which can be a challenge in poor areas. Cloud computing enabling banks for open banking and greater collaboration in the financial sector. Cloud banking is expected to become more widespread worldwide, and more banks are adopting cloud-based solutions.

3. Medical field

Cloud computing has managed the medical field by providing scalability, efficiency, and secure solution for healthcare organization. Doctors can easily access patient data remotely and enabling telemedicine and efficient collaboration.

Cloud platforms host video conferencing and store large medical images (e.g., MRIs, CT scans) and analyse images globally in real- time.

It enables seamless communication between patient and doctors for their improvement in care coordination. hospitals and clinics in different locations can share and update patient records in real- time. cloud based apps empower patients to manage their health data, book appointments, receive reminders and it also accessible to allow to view test results, treatment plans, and medical history.

Cloud providers ensure high levels of data security and it services offers backups and recovery option for critical medical data. It depended on internet connectivity and ensure compliance with healthcare regulation like HIPAA (health insurance portability and accountability act).

4. Streaming

Streaming using cloud computing involves cloud based infrastructure to deliver digital content like videos, games, or audio to use over the internet. It ensures the scalability, reliability, and power of cloud platforms.

Cloud platforms automatically scale resources ups and downs according to the fluctuations in demands and it ideals for live events and provide real time video encoding.

Cloud based solutions ensure that content is optimized and deliver to various devices (like smartphone, TVs, tablets) and it is cost effective for

startups and pay only for that resources which is used for Streaming.

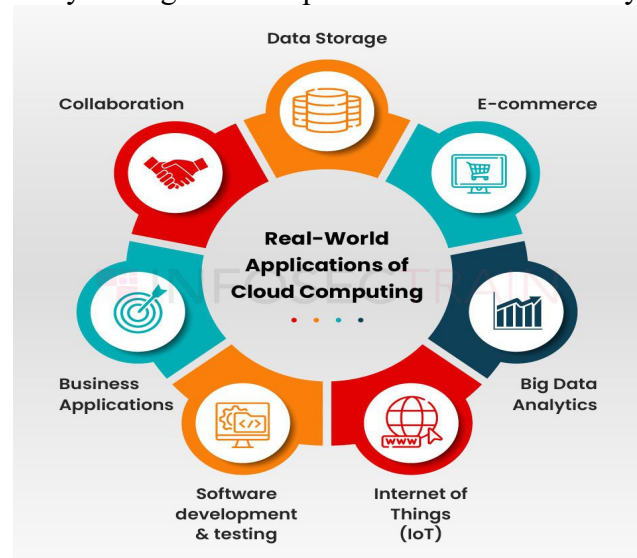
Platforms like Disney +, Hulu and Spotify, Coursera, zoom, live events use cloud computing infrastructure. It provides the low latency for user and data centres worldwide and not need of physical servers as it works on cloud hardware.

Streaming platforms must ensure user data is secure and private.

5. Communication

Communication using cloud computing to enable real time communication, data sharing and collaboration across the devices. Cloud platforms integrate voice, video, message, email, and file sharing into single platforms, cloud enables instant communication through voice and video calls and messaging (like zoom, Google meet, Microsoft teams).

Cloud platforms store chat history and emails so user can access it from any device. Media streaming platforms use cloud communication to deliver content globally in real time and more platforms like WhatsApp, Instagram rely on cloud communication to handles millions of messages and media sharing, enables communication from any location with an internet connection, resources scale automatically based on user demands and communication reliable on stable and fast internet connection. Real-time communication may suffer delays in regions with poor network connectivity.



Real life case study

10th and 12th Boards Result

When 10th and 12th boards results get announce many students try on same site to see their results and because of thousands of students use same site at a single time huge traffic is occurred and it increases the chances of site crashing.

Most of the traffic occurs within in the first 1,2 hours of the result announcement.

The site of CBSE board www.cbse.nic.in hits approx. 25 to 30 million students.

It has the chances of student may see wrong grades and missing information and sometimes users also unable to retrieve their results.

There is no alternative site for checking the result when the primary website crashes.

Solutions

Cloud computing provide the solution for site crashing with the help of multiple cloud platform like AWS, Azure, or Google cloud etc.

It dynamically adds or reduce the server resources based on traffic.

Load balancer helps in dividing or distributing incoming request across multiple servers.

Cloud computing database helps in storing and fetching data during peak traffic to handle read heavy operations.

Online Payment Platforms

In today's world we use online transaction apps for paying bills, shopping, insurance, etc. but sometimes there can be glitches occur while during transaction.

These transactions may get failed or take too long to process the transaction or can be delay in process and sometimes users face delays in refund for temporary period.

Sometimes users have a risk to lose their sensitive information like card details and passwords.

When user enter multiple logins but get failed then their account can be shut down for temporary period.

Solutions

Cloud computing is the solution for down server and data lose.

Cloud platforms detect the problem and allocate the server according to their demand. If server goes down, then other servers take the excess load.

Cloud load balancer helps to distribute the congestion into multiple servers to work properly. If one server fails it redirect to another strong server.

Example: if a server of one city fails then the system automatically shifted to the other city's server.

Conclusion

Cloud computing has transformed how organisations and individual use cloud technology in an efficient manner. As cloud technology continues to evolve, it promises to drive innovation, improve data security, and enable new business model, making it a critical component of the modern technological landscape. Cloud computing uses virtualization concept for increasing efficiency. Virtualization is a technique of creating virtual version of physical hardware called hypervisor. With the help of hypervisor technique organisations use different servers on a single physical device to reduce cost, traffic and it also allows shares all the resources without interrupting each other.

However, organisations are considering cloud services which is better security, privacy, and compliance factors as they integrate cloud solutions into their operations for growth and betterment.

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