

Cloud Computing - An insight to latest trends and Developments

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ABSTRACT

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Computing technology is rapidly improving and becoming more advanced over time. In order to stay up with the rapid transformation, industry executives pay close attention to the disruptive technologies positioned to deliver value in the cloud. In today's hyperconnected world, staying on top of trends is essential for survival and staying ahead of competitors. Because Cloud Computing has evolved into a large-scale computing system with seamless access to virtually unlimited resources, and various people from various sectors are using Cloud Computing for various reasons, it is now necessary to discuss technology trends and developments in general for Cloud Computing. This paper focuses on the basics of the aspects of understanding of Cloud Computing, as well as the present status, and trends of Cloud Computing. The study also explores the evolving cloud innovation of emerging paradigms like Blockchain, IoT, AI/AR, Edge, and Green cloud computing, containers, etc. in near future cloud computing systems. **Keywords** : Cloud computing trends, cloud computing challenges, Cloud Paradigms and Technologies, IoT, Blockchain, Artificial Intelligence, Hybrid cloud, Serverless, Green cloud computing

I. INTRODUCTION

Cloud computing is a self-service, on-demand Internet infrastructure that allows users to use computer resources from anywhere at any time [1]. It is not a new technology, but rather a new way of providing computer resources. Microsoft Hotmail and Google Docs are two well-known non-healthcare applications, while Microsoft HealthVault and Google Health Platform are two well-known health-care applications [2]. However, as compared to traditional computing, this approach offers three additional

benefits: large computer resources available on demand, no upfront commitment from customers, and payment for use on a need-to-know basis [3]. Its uses in industries, businesses, transport, educational, and national security have been documented in several papers, forums, and blogs [4, 5, 6].

In the post-pandemic era, cloud computing will continue to play a key role. According to Cisco, cloud data centres will process 94 percent of workloads and compute instances by 2021, while traditional data centres will process 6 percent. Statista, on the other hand, estimates that the cloud services industry will

be worth around 172.1 billion USD by 2021 [7]. According to the Gartner analysis [8], the pandemic's economic, organisational, and social consequences will continue to serve as a catalyst for digitalisation and cloud service adoption. This is especially true for hybrid workforce use cases including as collaboration, remote work, and innovative digital services. During 2020 and 2021, cloud computing surged as work turned virtual and businesses reacted to the worldwide pandemic by

focusing on the supply of digital services. Rapid adoption and growth are expected to continue in 2022. This Paper mainly focuses on Cloud Computing basics and current trends of cloud computing in section 2 and 3. In addition, section 3 also discusses the latest innovative clouds using Blockchain, IoT, Artificial Intelligence. Section 4 discusses different future innovations like green cloud computing and finishes with conclusion in section 5.

II. Cloud Computing - Insights

In comparison to contemporary versions, early cloud computing offered limited capability. Virtual machines (VMs), also known as virtual private servers, were first introduced, together with supporting capabilities including access key management, block storage devices, and VM snapshots, in the early stages of development. Infrastructure as a service (IaaS) is the most fundamental and general component of the cloud computing architecture. More abstract layers, such as platform as a service (PaaS), software as a service (SaaS), and others, were further developed[1]. Databases, business applications, business analytics, e-commerce, quantum computing, and blockchain systems are just a few of the services and products available in today's cloud systems. Both structured query languages and non-structured query languages are included in databases. Cloud computing data centres contain huge reserves of processing capacity, which means that their benefits lay not only in the

variety of services offered, but also in the potential for scaling. Scaling thus is essential not just for mission-critical applications, but also for enabling computationally intensive scientific computations [2, 3]. Cloud service providers can offer these scalability options throughout the whole cloud architecture. The ratio between implementation needs and resulting advantages, on the other hand, is determined by the layer of computational abstraction selected [4]:

- Scaling IaaS necessitates the setup of an external load balancer as well as the ability to deploy the scaled application on a generic operating system; nodes can be deployed semi- automatically, but the usage of an external orchestrating tool is desirable.
- Scaling PaaS (e.g., Kubernetes, OpenShift) necessitates the ability to bundle an application into a container(s) as well as the usage of declarative language to specify the cluster and cluster services configuration (i.e. applications).
- Scaling SaaS often necessitates the use of minimal skills or expertise in order to provide flawless outputs, but unable to deploy and perform any customized calculation.

III. Current Trends in Cloud Computing

Cloud computing is expected to expand substantially by 2022. In terms of implementing comprehensive strategies around enterprise-wide cloud migration, the trend will undoubtedly improve. The steady transition from zoom meetings to cloud tool deployment to boost certain functions is inevitable. From altering the global cloud service provider (CSP) industry to organisations shifting from a lift-and-shift strategy to cloud, 2022 will undoubtedly witness a significant increase in enterprises using cloud native technology. To keep up with their competition, businesses are increasingly relying on cloud apps to move and scale. Few of the latest trends are listed here.

3.1 Hybrid cloud

Businesses have generally had two alternatives when shifting to the cloud. They can employ public cloud solutions that are easily available and pay-as-you-go, or more personalised and adaptable private cloud options. Private cloud (in which an enterprise basically has its own cloud and data never has to leave its premises) is also occasionally required for regulatory and security concerns. Today,

major cloud providers like as Microsoft, Amazon, and IBM are boosting the use of "hybrid" models that combine the best of both worlds. Data that must be accessible often and promptly, such as by customers, can be stored on public AWS or Azure servers and accessed via tools, apps, and dashboards. Data that is more sensitive or critical can be maintained on private servers with access controlled and processed using private programmes. A hybrid cloud solution can help by reducing complexity and making the backend stack transparent when it is not needed [5]. Hybrid cloud is clearly the new normal.

3.2 Serverless cloud

The paradigm of serverless computing (FaaS) has recently gained popularity. Serverless computing conceals the execution environment, letting the user to concentrate on the important computations rather than implementation, setup, and scalability [4]. Amazon (AWS Lambda), Microsoft (Azure Functions), and IBM Cloud Functions are among the serverless cloud providers. Also referred as "functions-as-a-service," this concept means that businesses are not constrained to leasing servers or paying for preset amount of storage or bandwidth. It promises a true pay-as-you-go service, with infrastructure that expands discreetly as an application demands. Serverless computing will play a significant role in generating new user experiences that make innovation more accessible throughout the cloud and the overall technology environment [5].

3.3 Artificial Intelligence (AI) in cloud computing

As part of Software-as-a-Service (SaaS) platforms that provide benefits, AI, particularly Machine Learning (ML), may augment existing cloud platforms, data management, and AI tools. Several AI-based platforms, including AWS, Azure, Google Cloud Platform, and IBM Cloud, provide Machine Learning as a Service (MLaaS). Deep learning models for image identification might be incorporated to commercial apps to expedite the development process and customise cloud models[6,7]. Furthermore, AI strives to make IoT and Fog nodes aware of the workload environment and adapt in real time to deliver improved QoS, reduce power consumption, and reduce infrastructure costs. AI includes a wide range of search algorithms, machine learning, reinforcement learning, and planning [8]. As a result, the cloud and AI will inevitably revolutionise data storage, automate repetitive processes, and process data across several domains, fostering an atmosphere of efficiency, security, and agility.

3.4 IoT(Internet of Things),Edge Computing and Augmented Reality (AR)

An Internet of Things (IoT) platform is a cloud-enabling platform that interacts with common devices to allow cloud-based applications and services. IoT acts as a mediator, gathering data from various devices through remote device configuration and smart device management. IoT platforms are a cloud computing trend due to their intelligent connectivity. Edge Computing has been considered as a viable approach to address huge computing demands and resource scarcity among mobile users [9, 10]. Edge computing moves application hosting from centralised data centres to the network edge, bringing customers and data generated by applications closer together. Edge computing is seen as one of the primary facilitators of meeting 5G's stringent Key Performance Indicators (KPIs), such as increased mobile broadband, reduced latency, and huge connectivity [11]. Furthermore, advancements in technologies such as 5G and edge computing will

assist the sector in using the AR (Augmented Reality) cloud. 5G, GPS III, and DApps have the potential to take augmented reality to the next level. As the future of augmented reality, the AR Cloud is one of the most promising technologies utilised across sectors such as healthcare, travel, retail, education, real estate, and more. Because of their significant investments in Edge, 5G, and AI/AR, most public cloud providers, including HP, Nvidia, Microsoft, and IBM, have begun shifting workloads [12,13].

3.5 Virtual Cloud Desktops, Development/Database/Desktop as a Service(DaaS) and BlockChain

The software need of a device which is managed by cloud service providers is a virtual cloud desktop. As the computing power is maintained by cloud-based services, the user can begin with a screen and minimal hardware. The virtual cloud desktop reduces the unnecessary expenditures associated with purchasing new hardware. Users must only pay for the real cloud usage. Amazon's Workspaces platform, Microsoft's Windows Virtual Desktop, and Google's Chromebook devices all provide a Desktop-as-a-Service (DaaS) computing architecture. DaaS solutions assist enterprises in reducing desktop support and improving multi-device capabilities. Blockchain is a breakthrough technology with several advantages such as increased data security, decentralisation, improved private key security, microtransactions, and speedier disaster recovery. Blockchain-based cloud storage is gaining popularity because it provides improved protection against fraudsters and hackers. With its interconnected blocks and decentralised design, it combines security and scalability. This technology is useful in cloud storage since it encrypts data stored in the cloud [14,15,16].

IV. What Nextdevelopments in Cloud Computing

4.1 Yotascale

Yotascale is a next-generation computing and autonomous performance monitoring technology designed to eliminate reliance on humans. Yotascale use Artificial Intelligence to make ahead forecasts or choices regarding cloud prices, allowing it to save even more cost. Yotascale can also do real-time analysis to spot anomalous patterns using deep learning approaches (supervised/unsupervised methods or prediction), identify the main cause, and make future forecasts regarding cloud consumption and cost [17].

4.2 Cloud Gaming

Gaming-as-a-service is currently being offered by all of the huge companies. Since 2020, Google, Amazon, and Microsoft have been present in the gaming market, with Sony being the most recent arrival. However, this trend is expected to grow dramatically in the coming year, as cloud technology improves faster than in previous years with the 5G online model. Cloud gaming is definitely showing advantages similar to those of on-demand movie streaming services such as Netflix, Amazon Prime, Hotstar, and so on. Users do not require additional storage space or specialised technology, which has a significant influence on total expenses [18].

4.3 Green Cloud Computing

Green Cloud computing refers to Cloud Computing services' capacity to limit the usage of underutilized resources. Green IT concerns affect both the software stack and the hardware level. A software stack is a collection of applications that work together to generate a result or accomplish a shared purpose. The effective use of computer resources benefits the environment and promotes energy conservation. The use of ready-made computer resources customised to an organization's demands undoubtedly aids in the reduction of power costs. Computers are managed centrally, allowing for greater management of

ancillary expenditures like as energy use and carbon emissions [19,20,21].

4.4 Containers and Kubernetes

Businesses may use containers to create, test, and deploy new apps in a dedicated, cloud-based environment. This allows developers to concentrate on the intricacies of their applications, while IT teams concentrate on deploying and managing solutions as they are produced, making the entire process faster and more efficient. Kubernetes is an open-source container orchestration technology that streamlines the process of delivering and maintaining container-based applications. Aside from automatically scaling apps based on client demand, the software also analyses the performance of new services, allowing firms to solve issues before they arise [22].

V. Conclusion

A commitment to agility and change is required to perfect cloud services. These many trends are intrinsic to the cloud, and they will continue to evolve at a faster rate as cloud usage grows and the cloud is calibrated to give sharper insights. The most anticipated trend will be hybrid cloud computing, with FaaS, AI, and AR gaining traction. Aside from the aforementioned trends, additional notable trends include cloud security, open source, serverless architecture, and the IoT platform. Using a combination of multiple technologies and the cloud to modernise corporate operations can result in significant benefits. Cloud service providers would create more sophisticated tactics to improve data defences, and organisations would incorporate security into their development pipelines and assure cloud-agnostic safeguards across all clouds.

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