Contribution of AWS on Cloud Computing Technology

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Abstract  
Cloud computing is performing well in today’s World and boosting the ability to use the internet more than ever. Cloud computing has gradually developed into a method for most organizations to utilize its benefits. It is very demanding for all businesses tasked with reducing costs to improve service quality as the organization pays for services based only on incoming and outgoing traffic. The rapid growth of cloud computing has revolutionized the way business is conducted and Amazon Web Services (AWS) has emerged as the leading cloud service provider. This paper explores AWS's contribution to cloud computing, its services, benefits, and security. Through a comprehensive literature review, this paper analyzes the impact of AWS on cloud computing, providing insights into its significance and future directions.


I. Introduction  
Cloud computing is the on-demand delivery of compute power, databases, storage, applications, and other IT resources via a cloud service platform over the Internet. Whether we're running a photo-sharing application with millions of mobile users or we're supporting business's critical operations, a cloud service platform provides flexible and fast access to IT resources at low cost. With cloud computing, we don't have to make a big upfront investment in hardware and spend a lot of time managing that hardware. Instead, we can arrange the exact type and size of computing resources we need to power our new bright idea or manage our IT department. We can access as many resources as we need almost instantly and pay for what we use. Cloud computing provides an easy way to access a broad set of server, storage, database and application services on the Internet. A cloud service platform such as Amazon Web Services owns and maintains the network-connected hardware required for these application services, while we deliver and consume what we need through a web application. In the contemporary digital landscape, where organizations strive to adapt to the dynamic and demanding needs of the digital era, cloud computing has emerged as a transformative technology. At the forefront of this revolutionary shift stands Amazon Web Services (AWS), the leading cloud service provider that has redefined the way computing resources are provisioned and utilized. AWS has grown into a multi-faceted and versatile platform, catering to a myriad of industries, from startups to multinational enterprises, offering a diverse range of services and solutions.

In recent years, the ever-increasing demand for scalable, flexible, and cost-efficient cloud computing solutions has driven the rapid growth of cloud service providers. Among these, Amazon Web Services (AWS) stands tall as a leading pioneer, redefining the landscape of cloud computing and revolutionizing the way businesses and researchers harness the power of technology. This research paper embarks on an insightful journey into the world of AWS, exploring its architecture, key components, and the manifold ways in which it empowers individuals, organizations, and academia to achieve unprecedented heights of innovation and success.

II. Literature Review  
These research paper aims to contribute to the growing body of knowledge in the realm of cloud computing by analyzing and exploring four significant research papers published in reputed IEEE journals. The selected papers, listed below, delve into various aspects of cloud computing, addressing critical issues and proposing innovative solutions:

- The research paper [1] discusses on Amazon Web Services (AWS) and its offerings as a platform for businesses to build private virtual clouds with full control over their infrastructure. AWS provides a wide range of IT solutions that cater to both businesses and IT projects. The cloud's appeal lies in cost savings and efficiency, attracting security professionals. However, it also presents various security and compliance concerns. To address these issues, AWS introduced EC2 instances, which aim to make cloud computing more secure for highly regulated companies. Despite the advantages of cloud computing, there are inherent drawbacks that open up opportunities for studying various cloud-related topics. One significant concern is the security and privacy of data stored and processed on cloud service providers' servers. The paper
reviews several studies related to cloud computing security and privacy, aiming to gain a better understanding of the challenges involved. It also highlights the techniques and solutions employed by the cloud service sector to address these security issues. The main objective of the paper is to shed light on the emerging cloud services market and the upcoming challenges it faces, such as network issues. By understanding these challenges and the solutions applied, businesses and IT professionals can make informed decisions when utilizing cloud services, particularly those provided by Amazon Web Services.

The paper [2] focuses on cloud computing, particularly highlighting Amazon Web Services (AWS) as one of the leading cloud service providers. The paper discusses the rapid growth of cloud computing as a business in the IT industry and emphasizes one of its main advantages: the ability to access and manage services from anywhere through the web. To enable this feature, cloud service providers offer various development tools and services. The paper specifically explores the services provided by AWS, such as cloud build, cloud deployment, cloud9, code pipeline, and code commit. This research paper discusses AWS (Amazon Web Services) and its business perspective over the Cloud services in the IT industry. In the emerging field of IT one of the fastest growing businesses is Cloud Computing. Cloud Computing is a web-based technology, so it can access and manage data anytime and from anywhere using the web. Cloud services help many small and medium businesses to store their data easily, without any heavy infrastructure, which makes Cloud one of the fastest growing businesses. To allow these features to use, Cloud service providers offers different development tools and services. In simple words Cloud Computing can be defined as maintaining data centers and data servers. We can also access technology services by computing power, storage, and database using cloud computing technology such as AWS (Amazon Web Services). In Cloud Computing business AWS is one of the biggest Cloud service providers. AWS Cloud Computing is an emerged model which is already popular among almost all enterprises. It is a cost-effective model and provides a variety of services with a properly managed security as well. The services provided by AWS include Cloud Build, Cloud Deployment, Cloud9, Code Pipeline, Code Commit etc. The main objective of this research paper is to highlight the Cloud services provided by different Cloud service providers and their comparison with AWS. The paper as well presents the pros and cons, pricing of AWS.

The research paper [3] suggests on cloud computing and modernization strategies for migrating on-premise applications to the Amazon Web Services (AWS) cloud. The paper acknowledges the increasing interest in cloud computing within the IT business and highlights its appeal to businesses due to its simplicity, cost-effectiveness, and ability to host and scale applications dynamically. The primary objective of the research is to study and discuss the strategies for digitally transforming on-premise applications and transferring them to the AWS cloud. This transformation involves not only moving the applications but also migrating the associated databases and using AWS cloud automation deployment with DevOps tools to streamline the process.

Application modernisation is a crucial procedure that entails upgrading and improving current programs in order to take use of the capabilities of contemporary cloud platforms like Amazon Web Services (AWS). In order to enhance performance, scalability, and cost-effectiveness, enterprises may upgrade their applications with the aid of a broad variety of services provided by AWS. Using rehosting method, our current apps are moved to AWS without undergoing any substantial modifications to their design or coding. The objective is to swiftly migrate apps to the cloud in order to take advantage of its scalability and dependability while postponing more major modernization initiatives until a later time. To provide a seamless lift and shift procedure, AWS offers services like AWS Server Migration Service (SMS) and AWS Database Migration Service (DMS). Refactoring entails fundamentally altering the application's codebase and design in order to benefit from cloud-native services. Using AWS managed services like Amazon RDS (Relational Database Service) or Amazon DynamoDB for databases and AWS Lambda for serverless computing are a few examples of how to achieve this. The goal is to maximize scalability and flexibility while also optimizing the application for the cloud environment. Re-platforming is a compromise method that entails moving apps to a cloud-native platform with the least amount of codebase modification. To reduce operating costs while still leveraging AWS infrastructure services, we may transfer our application from an on-premises server to AWS Elastic Beanstalk, which offers a Platform-as-a-Service (PaaS) environment. We may bundle apps and their dependencies into separate units using containerization, which ensures consistency across many environments. To easily deploy and maintain containerized applications, AWS provides Amazon Elastic Container Service (ECS) and Amazon Elastic Kubernetes Service (EKS). Scalability, resource efficiency, and quicker deployment times are made possible by containers. Keep in mind that our organization's best modernization plan will rely on a variety of variables, including the complexity of the applications involved, the demands of the company, and the current technology stack. We may pick the most effective strategy for successful application modernization on AWS with the aid of a careful evaluation and careful preparation.

In the paper [4] discussion has been given on cloud computing and its applications, particularly in the context of web server load balancing. The paper highlights the benefits of cloud computing, the challenges of traditional on-premise web server management, and the use of AWS (Amazon Web Services) cloud computing technologies to design an efficient and effective web server. Before going to the cloud computing let us know some notes on cloud computing. Cloud computing is the large interest accessibility of the architecture which leads to the information storage compute power for the dynamic client administration. Cloud computing is a specialised way for the IT sectors by which the organisation is working. Cloud Computing means on demand services over the internet. Let us take an example to understand it clearly; we are using Netflix, Google Drive, Google photos by which we are connected to the cloud. In cloud computing we can store data storing, managing and accessibility of the data and programs on the remote server that are hosted on internet instead of computer hard drives. Now as per AWS, AWS act as a cloud providers as like AWS some other companies like IBM cloud. I cloud many other companies
has over taken the cloud computing so that the cost of tech team, electricity can be undertake in one place i.e. cloud computing. Load balancing act as an important role in cloud computing. To load balance a web server on AWS (Amazon Web Services), we can use the Elastic Load Balancing service. Elastic Load Balancing automatically distributes incoming application traffic across multiple targets, such as Amazon EC2 instances, containers, and IP addresses, to ensure high availability and scalability. Once our load balancer is set up, it will distribute incoming traffic across our web servers, improving availability and scalability. We can also configure additional features like SSL/TLS termination, session persistence, and advanced request routing based on different criteria. Remember to monitor our load balancer and web servers to ensure they are operating optimally and make any necessary adjustments as our application needs evolve. Load balancing directs and controls internet traffic between the application servers and their visitors or clients. As a result, it improves an application’s availability, scalability, security, and performance. Server failure or maintenance can increase application downtime, making our application unavailable to visitors. Load balancers increase the fault tolerance of our systems by automatically detecting server problems and redirecting client traffic to available servers. We can use load balancing to make these tasks easier to run application server maintenance or upgrades without application downtime. Provide automatic disaster recovery to backup sites so that the performance for the health checks and prevent issues that can cause downtime. AWS follows the basic complimentary design server so that they can stand by web server.

III. Cloud Service Models

There are three main cloud service models. Each model represents a different part of the cloud computing stack and gives us a different level of control over our IT resources:

- **Infrastructure as a service (IaaS):** Services in this category are the basic building blocks for cloud IT and typically provide us with access to networking features, computers (virtual or on dedicated hardware), and data storage space. IaaS provides us with the highest level of flexibility and management control over our IT resources. It is the most similar to existing IT resources that many IT departments and developers are familiar with today.

- **Platform as a service (PaaS):** Services in this category reduce the need for us to manage the underlying infrastructure (usually hardware and operating systems) and enable us to focus on the deployment and management of our applications.

- **Software as a service (SaaS):** Services in this category provide us with a completed product that the service provider runs and manages. In most cases, software as a service refers to end-user applications. With a SaaS offering, we do not have to think about how the service is maintained or how the underlying infrastructure is managed. We need to think only about how we plan to use that particular piece of software. A common example of a SaaS application is web-based email, where we can send and receive email without managing feature additions to the email product or maintaining the servers and operating systems that the email program runs on.

IV. Cloud Deployment Models

There are three main cloud computing deployment models, which represent the cloud environments that our applications can be deployed in:

- **Cloud:** A cloud-based application is fully deployed in the cloud, and all parts of the application run in the cloud. Applications in the cloud have either been created in the cloud or have been migrated from an existing infrastructure to take advantage of the benefits of cloud computing. Cloud-based applications can be built on low-level infrastructure pieces or they can use higher level services that provide abstraction from the management, architecting, and scaling requirements of core infrastructure.

- **Hybrid:** A hybrid deployment is a way to connect infrastructure and applications between cloud-based resources and existing resources that are not located in the cloud. The most common method of hybrid deployment is between the cloud and existing on-premises infrastructure. This model enables an organization to extend and grow their infrastructure into the cloud while connecting cloud resources to internal systems.

- **On-premises:** Deploying resources on-premises, using virtualization and resource management tools, is sometimes called private cloud. While on-premises deployment does not provide many of the benefits of cloud computing, it is sometimes sought for its ability to provide dedicated resources. In most cases, this deployment model is the same as legacy IT infrastructure, but it might also use application management and virtualization technologies to increase resource utilization.

This research paper endeavors to delve deep into the extensive ecosystem of AWS, understanding its underlying architecture, exploring the plethora of services it provides, and comprehending its significance in shaping the future of modern computing paradigms. With its scalability, flexibility, cost-effectiveness, and a vast array of offerings, AWS has effectively democratized access to sophisticated computing resources, allowing businesses of all scales to embark on ambitious digital transformations. Throughout this paper, we will analyze the key components of AWS, dissecting its core infrastructure and how it orchestrates a global network of data centers to provide seamless and highly available cloud services. We will elucidate the fundamental concepts of AWS, such as virtual servers (EC2 instances), scalable storage options (S3), and robust database services (RDS and DynamoDB), among others, which form the building blocks of the AWS ecosystem. Moreover, we will explore how AWS has catalyzed advancements in artificial intelligence, machine learning, and big data analytics through services like Amazon SageMaker, Amazon Recognition, and Amazon Redshift, enabling businesses to harness the potential of data-driven insights for innovation and growth. Security and compliance are paramount considerations in the cloud computing domain, and as such, we will investigate the
sophisticated security measures implemented by AWS to safeguard data and applications. Additionally, we will discuss the compliance standards adhered to by AWS, assuring regulatory requirements are met across various industries, including finance, healthcare, and government. Furthermore, this research paper will discuss real-world case studies of organizations that have successfully leveraged AWS to optimize their operations, enhance customer experiences, and achieve unprecedented scalability. The impact of AWS on business agility, cost savings, and time-to-market will be critically examined, illustrating the advantages it offers in comparison to traditional on-premises infrastructures.

As we embark on this journey to explore the multifaceted world of AWS, we aim to provide an in-depth understanding of its capabilities, challenges, and future prospects. Through this comprehensive analysis, we seek to empower decision-makers, researchers, and technologists alike with valuable insights into the limitless potential of Amazon Web Services in driving innovation and propelling organizations towards a more connected and digitally empowered future.

V. AWS Storage Services

It’s been a sufficient time since cloud-computing was introduced and now, many service-providers are providing cloud services. However, problems still persist while using cloud-computing services in IT sector. Many people were not sure about its trust-ability since all the data of companies remain online on the cloud and anyone from anywhere can easily access that data, even leading to much damage. Before AWS was introduced, some issues with cloud computing were:

1. Privacy Concern
2. Compliance
3. Security Concern
4. Sustainability
5. Higher Cost
6. Lacking reliability in providing services

In order to solve these problems, AWS was introduced as a cloud-service provider in March, 2006. It provides highly secured infrastructure. Moreover, we don’t need to worry about maintaining data-centers as AWS manages that accordingly. It also provides a bunch of different services like compute, storage, database etc. We can also easily trade capital expenses for variable expenses. Auto-scaling also equips with guessing the capacity of data. Our speed and agility are also increased. Additionally, we can easily go global in minutes without spending money or running & maintain data-centers. The current infrastructure of AWS provides services like compute, storage, databases, networking, security, analytics, android, automatic scaling & monitoring, etc. These services help the organizations to choose what is right for them, lowers infrastructure costs and easily scales. Efficiency is also increased by using these services. AWS Cloud Adoption Framework (CAF) provides guidance and best practices to help organizations identify gaps and processes. It also helps organizations build a comprehensive approach to cloud computing—both across the organization and throughout the IT lifecycle—to accelerate successful cloud adoption. Due to all it’s benefits, AWS is trusted by the largest enterprisers and also the most blistering start-ups for storage, data analytics & processing, archiving data, etc.

There are three main cloud storage types: object storage, file storage, and block storage. Each offers its own advantages and has its own use cases.

- **Object storage**: Organizations have to store a massive and growing amount of unstructured data, such as photos, videos, machine learning (ML), sensor data, audio files, and other types of web content, and finding scalable, efficient, and affordable ways to store them can be a challenge. Object storage is a data storage architecture for large stores of unstructured data. Objects store data in the format it arrives in and makes it possible to customize metadata in ways that make the data easier to access and analyze. Instead of being organized in files or folder hierarchies, objects are kept in secure buckets that deliver virtually unlimited scalability. It is also less costly to store large data volumes.

Applications developed in the cloud often take advantage of the vast scalability and metadata characteristics of object storage. Object storage solutions are ideal for building modern applications from scratch that require scale and flexibility, and can also be used to import existing data stores for analytics, backup, or archive.

- **File storage**: File-based storage or file storage is widely used among applications and stores data in a hierarchical folder and file format. This type of storage is often known as a network-attached storage (NAS) server with common file level protocols of Server Message Block (SMB) used in Windows instances and Network File System (NFS) found in Linux.

- **Block storage**: Enterprise applications like databases or enterprise resource planning (ERP) systems often require dedicated, low-latency storage for each host. This is analogous to direct-attached storage (DAS) or a storage area network (SAN). In this case, we can use a cloud storage service that stores data in the form of blocks. Each block has its own unique identifier for quick storage and retrieval.

VI. Amazon Simple Storage Service (S3)

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers industry-leading scalability, data availability, security, and performance. We can use Amazon S3 to store and retrieve any amount of data at any time, from anywhere.

Amazon Simple Storage Service (Amazon S3) is an object storage service offering industry-leading scalability, data availability, security, and performance. Customers of all sizes and industries can store and protect any amount of data for virtually any use case, such as data lakes, cloud-native applications, and mobile apps. With cost-effective storage classes and easy-to-use management features, we can optimize costs, organize data, and configure fine-tuned access controls to meet specific business, organizational, and compliance requirements. Figure 1. shows how the Amazon Simple Storage Service works.
The diagram shows how to move data to Amazon S3, manage stored data in Amazon S3, and analyze data with other services. Three sections display from left to right.

The first section has an illustration of a database, a server, and a document. The first section is titled "Move data". The first section says, moving of data to Amazon S3 from wherever it lives – in the cloud, in applications, or on-premises. Nearby icons show different types of data: analytics data, log files, application data, video and pictures, and backup and archival.

The second section has an illustration of an empty bucket. The second section is titled "Amazon S3". The second section says, object storage built to store and retrieve any amount of data from anywhere. The second section has more text under the heading "Store data". The text says, create bucket, and specify the region, access controls, and management options. Upload any amount of data. A nearby illustration shows a bucket that contains a square, a circle, and a triangle. The second section also has icons that show Amazon S3 features. The features are Control access to data, optimize cost with storage classes, replicate data to any Region, access from on-premises or VPC, protect and secure our data, and gain visibility into our storage.

The third section is titled "Analyze data". The third section says, use AWS and third-party services to analyze our data to gain insights. Nearby icons show ways of analyzing data: artificial intelligence (AI), advanced analytics, and machine learning (ML).

VII. Amazon Elastic File System (EFS)

Amazon Elastic File System (Amazon EFS) is a simple, serverless, set-and-forget, elastic file system. There is no minimum fee or setup charge. We pay only for the storage we use, for read and write access to data stored in Infrequent Access storage classes, and for any provisioned throughput. Amazon Elastic File System (EFS) automatically grows and shrinks as we add and remove files with no need for management or provisioning. Figure 2 shows workflow diagram of the Amazon Elastic File System working.
VIII. **Amazon Elastic Block Store (EBS)**

AWS Elastic Block Store (EBS) is Amazon’s block-level storage solution used with the EC2 cloud service to store persistent data. This means that the data is kept on the AWS EBS servers even when the EC2 instances are shut down. Amazon Elastic Block Store (EBS) is a block storage system used to store persistent data. Amazon EBS is suitable for EC2 instances by providing highly available block level storage volumes. It has three types of volume, i.e. General Purpose (SSD), Provisioned IOPS (SSD), and Magnetic.

AMazon Elastic Block Store (Amazon EBS) is an easy-to-use, scalable, high-performance block-storage service designed for Amazon Elastic Compute Cloud (Amazon EC2). Figure 3 shows the work flow diagram of the Amazon Elastic Block Store working.

![Figure 3. Work flow diagram of the Amazon Elastic Block Store](image)

IX. **Conclusion**

This research paper has a primary focus on Amazon Web Services (AWS), one of the leading cloud service providers in the contemporary digital landscape. Cloud computing has revolutionized the way businesses, academia, and individuals access and utilize computing resources, enabling unprecedented scalability, cost-efficiency, and flexibility. Throughout this paper, we have explored the fundamental concepts of cloud computing, elucidating how AWS empowers organizations to access a broad array of server, storage, database, and application services via a cloud service platform over the Internet. The on-demand nature of cloud computing allows businesses to access the exact type and size of computing resources required, eliminating the need for substantial upfront investments in hardware and enabling rapid scalability to meet dynamic demands.

AWS not only provides system development services but also helps to deploy the system globally at a low cost. Traditionally it was difficult for a company to provide performance to distributed users so that they could focus on only one area at a time. But with the help of, AWS this problem was solved and now one can send its usage worldwide and show better information to customers. AWS provides a wide range of cloud computing services that assist in the development of complex applications.

AWS, as a transformative platform, has played a pivotal role in shaping the landscape of modern computing paradigms. With its robust architecture and global network of data centers, AWS ensures seamless and highly available cloud services. AWS has an infrastructure which is designed based on security processes that are critically important to protect customer data. AWS infrastructure contains hardware, operating software, security standards, network, and other essential resources. Security and compliance have been paramount considerations in cloud computing, and AWS has demonstrated a robust approach to safeguarding data and applications. With sophisticated security measures and adherence to stringent compliance standards, AWS ensures data integrity and confidentiality, making it a trusted platform for businesses in various industries.

With all these services present in the AWS is already the number 1 cloud platform used by Public Cloud and it is also a fast-growing platform in case of Community Cloud. But, there are still many future scopes to improve of strengthen the services. In the market there are plenty other competitors, so improvement is the key to hold the position in the market. Amazon web services should effectively manage customer queries and provide the most relevant answers. AWS as we do not have a lot of portable storage, virtual storage devices are not expensive. As there are many future scopes, AWS cannot go without certain limitations that can make customers decide on competitive cloud platforms. Difficult Service Implementation as most of the AWS services require expertise for their implementation and support. AWS are used to off-radar updates and modernization which keep the general audience in the dark about significant modifications. AWS has been
developing an increasing number of open-source solutions, but perform less cooperation and support to open-source communities. It also has database compatibility issues as Amazon’s Aurora, Redshift and Dynamo DB are compatible only with AWS.

As we conclude this research paper, it is evident that AWS has not only democratized access to sophisticated computing resources but has also emerged as a catalyst for innovation, enabling businesses and researchers to achieve new heights of success. The limitless potential of Amazon Web Services in driving efficiency, scalability, and agility in modern computing paradigms promises a future where cloud computing will continue to shape and redefine industries worldwide.

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