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Analysis of Cloud Storage

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Abstract : *Delivering hosted services over the internet is what cloud computing entails. Cloud computing allows users to create and deploy user applications, including storage and databases, without having to worry about the underlying operating system. Furthermore, the Cloud provides vast storage for both data and databases. One of the most important aspects of Cloud computing is data storage. Storage makes use of infrastructure scattered across multiple sites. To maintain data security, Cloud storage takes use of the internet, virtualization, encryption, and other technologies. This paper begins with introducing cloud computing and related service models. Then we look at cloud storage, including its architecture, benefits, and problems. Finally, we study some of the cloud providers and conclude the paper.*

IndexTerms **- Cloud Storage; Cloud Computing; Data Storage.**

1. INTRODUCTION

The success of cloud technology has accelerated in recent years, and with each passing day, yet more individuals and businesses started to adopt remote apps and migrate their data to the cloud. The concept of cloud computing has been around since the early 2000s, but the concept of computing as a service has been around much longer – as far back as the 1960s, when computer agencies would allow companies to rent time on a mainframe rather than having to buy one themselves. These "time-sharing" services were largely supplanted by the rise of the PC, which made owning a computer much more affordable, and then by the rise of corporate data centres, where companies would store massive amounts of data. However, the notion of having to rent usage of computer power has reemerged time and again – in the 1990s and 2000s with software as a service, utility computing, and grid computing. This was accompanied by cloud computing, which gained traction with the introduction of software as a service and highly scalable cloud-computing providers like Amazon Web Services.

Cloud computing is distribution computing services such as servers, storage, database systems, networking, applications and analytics via the Internet ("the cloud") in order to provide faster innovation, more versatile resources, and cost savings. Businesses can rent anything from software to storage from a cloud provider instead of purchasing their own computing infrastructure or data centres. Cloud computing services now include a wide variety of choices, from storage, networking, and computing power to natural language processing, artificial intelligence, and basic office software solutions. Just about any service which does not involve you to be geographically close to your computer equipment can now be supplied via the cloud.

Cloud technology powers a broad array of services. This includes everything from offerings like Gmail or the cloud backup of your smartphone's photos to services that enable large organizations to control all of their data and run all of their applications in the cloud. Netflix, for example, uses cloud computing services to power its video-streaming service as well as its other business systems. Cloud computing seems to have become the current standard for many apps: as they transition to a subscription model, software vendors are progressively providing their applications as internet services instead of just standalone products. But even so, cloud computing has the potential to introduce new costs and risks for businesses that use it.

The three most common types of cloud service offerings are SaaS, Pass, and IaaS. Software as a service, or SaaS, provides on-demand access to readily available, cloud-hosted application software. Users pay a monthly or annual fee to access a full application from a web browser, desktop client, or mobile app. The vendor manages all software upgrades and patches, which are usually invisible to customers. As part of a service level agreement, the vendor typically guarantees a level of availability, performance, and security (SLA). Salesforce (customer relationship management software), HubSpot (marketing software), Trello (workflow management), Slack (collaboration and messaging), and Canva are examples of popular business or enterprise SaaS solutions (graphics). Many desktop applications (for example, Adobe Creative Suite) are now available as SaaS. (Adobe Creative Cloud).

PaaS, or platform as a service, is a cloud-hosted platform that allows users to access a comprehensive, fully prepared platform to develop, run, maintain, and administer applications on demand. Users access the PaaS via a graphical user interface (GUI), where development or DevOps teams can collaborate on all aspects of the application lifecycle, such as coding, integration, testing, delivery, deployment, and feedback. AWS Elastic Beanstalk, Google App Engine, Microsoft Windows Azure, and Red Hat OpenShift on IBM Cloud are all examples of PaaS solutions.

Infrastructure as a Service is the layer that includes cloud storage (IaaS). IaaS is on-demand access to cloud-hosted computing infrastructure – servers, storage capacity, and networking resources – that customers can provision, configure, and use in the same way they would on-premises hardware. The cloud service provider, on the other hand, hosts, manages, and maintains the hardware and computing resources in its own data centres. IaaS customers access the hardware through an internet connection and pay for it via subscription or pay-as-you-go. IaaS customers typically have the option of hosting virtual machines (VMs) on shared physical hardware (the cloud service provider manages virtualization) or bare metal servers on dedicated (unshared) physical hardware. Customers can provision, configure, and manage servers and infrastructure resources either through a graphical dashboard or programmatically via application programming interfaces (APIs). Every major cloud service provider, including Amazon Web Services, Google Cloud, IBM Cloud, and Microsoft Azure, started with IaaS.

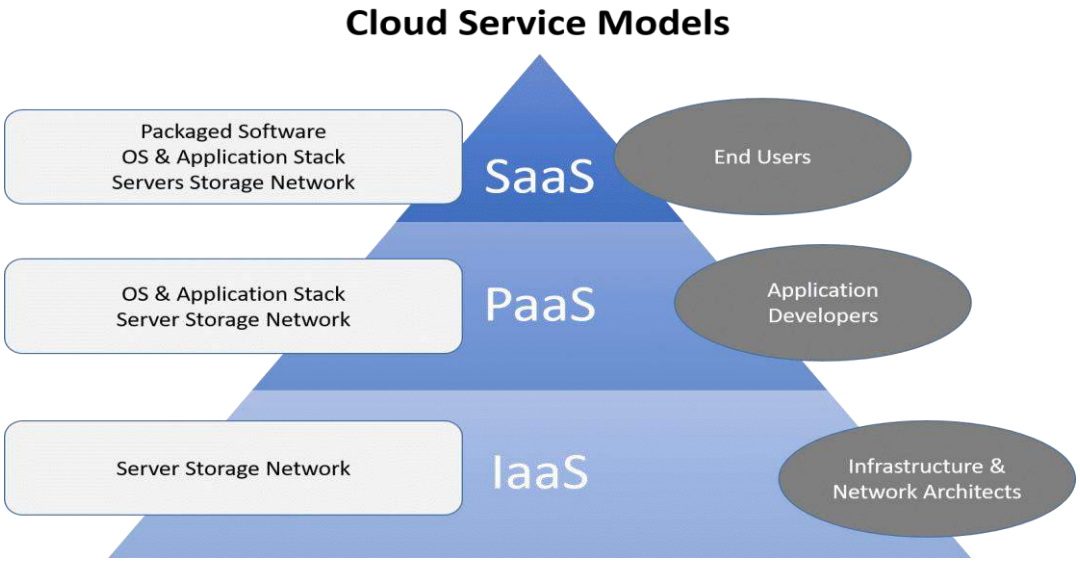

Figure 1. Cloud sevice models source

Storage is a critical component of Cloud computing. Storage could be for an enterprise database or for simple data storage, similar to storing data on a local hard drive. Data is stored in multiple third-party services in the cloud rather than on dedicated servers as in traditional networked data storage. When storing data, the customer "sees" a virtual server, giving the impression that data is stored in a specific location with a specific name, but such a location does not exist in reality. It's just a fictitious name for a virtual space created in the Cloud. The data of the users could be stored on any computer in any data centre across multiple geographical locations. The actual storage location of the data may change over time as the Cloud dynamically manages available storage locations around the data centres. Despite the fact that the data location is virtual, the user sees a static location for his data and can manage the storage space as if he were on a personal computer. A typical Cloud storage architecture consists of a master control server and several storage servers. At its most basic, a Cloud storage system requires only one data server that is connected to the Internet. A user sends copies of files to the data server via the Internet, which records the information. Users store their data in the Cloud and no longer have complete control over their data as they would if the data was stored on a local computer. As a result, the accuracy, security, and availability of data stored on the Cloud server must always be guaranteed.

The paper further discusses the architecture, advantages, challeges, types and providers of cloud storage services after the literature review.

2. LITERATURE REVIEW

K. Bowers, A. Juels, A. Oprea proposed a Cloud Storage model called High-Availability and Integrity Layer (HAIL). The primary goal is to ensure the integrity and accessibility of user data stored in the Cloud. The HAIL model enables safe and efficient Cloud data storage. The authors proposed a Cloud data storage system in 'A Cloud Data Storage System for Supporting Both OLTP and OLAP', with an emphasis on support for both Online Analytical Processing (OLAP) and Online Transaction Processing (OLTP) data processing forms. The emphasis was on data freshness and storage redundancy. The authors of 'Cloud Storage as the Infrastructure of Cloud Computing', 2010 International Conference on Intelligent Computing and Cognitive Informatics presented a paper that discussed the Cloud storage reference model and reviewed various Cloud storage challenges. Research on Cloud Storage Architecture and Key Technologies presented a review of research works on Cloud storage architecture and related underpinning technologies. A Study on Data Storage Security Issues in Cloud Computing, 2nd International Conference on Intelligent Computing, Communication & Convergence (ICCC-2016) presented a survey of data storage security concerns in Cloud computing. The paper relied on identifying various challenges related to data stored by CSP(Cloud Service Provider). The authors then presented and debated various solutions. Security opportunities and challenges in

Cloud computing are discussed in Security in Cloud Computing: Opportunities and Challenges, Information Sciences 305 (2015). The paper primarily addressed Cloud security concerns while also discussing various aspects of data storage. The authors of Towards Secure and Dependable Storage Services in Cloud Computing, IEEE Transactions on Cloud Computing noted that while using Cloud storage frees users from the resources required for local storage, the security of such data becomes a concern. The paper then proposed a storage security mechanism that was shown to be effective against specific types of attacks but not completely complete, as it was still vulnerable to other types of attacks. The proposed approach has its own set of flaws. The authors of 'RACS: A Case for Cloud Storage Diversity' presented a model for distributing data storage across multiple providers that is similar to the RAID architecture. The Redundant Array of Cloud Storage model (RACS). The authors simulated the model and concluded that when switching CSPs, users save about seven times their money using RACS. A. Singh, S. Pasupuleti in their paper presented in 6th International Conference on Advances in Computing & Communications concentrated on ensuring the integrity of the user's data on the Cloud. The paper described a technique for performing optimised auditing of data storage security protocols used in Cloud storage systems. When stored on Cloud servers, the proposed model protects user data from attacks. The authors of Efficient Sharing of Secure Cloud Storage Services presented a method for providing an efficient and secure way for users in a Cloud storage system to share data. The scheme provides secure access to shared data based on user hierarchies. In Data Classification for Achieving Security in Cloud Computing, the authors presented a method for classifying data for security purposes. Based on classification patterns, the approach ensured data privacy and security in storage.

3. ARCHITECTURE

Cloud storage is made up of thousands of storage devices clustered together by network, distributed file system, and other storage middleware to provide users with Cloud storage. Storage can take the form of stand-alone arrays, converged infrastructure, hyper converged infrastructure, software-defined storage, or public Cloud storage in general. Storage could also be in the form of a block, file, or object.

Many of these storage systems make use of network infrastructure such as fibre, iSCSI, NFS, and SMB. These network infrastructure interconnect storage systems such as NVMe-based arrays, hybrid arrays, HCI, public Cloud for primary and backup, and container storage. Storage resource pools, distributed file systems, service level agreements, and service interfaces are typical Cloud storage structures. Figure 3 depicts a five-layer Cloud storage model consisting of the network and storage infrastructure layer, storage management layer, metadata management layer, storage overlay layer, and service interface layer, while Figure 2 depicts the Cloud storage architecture.

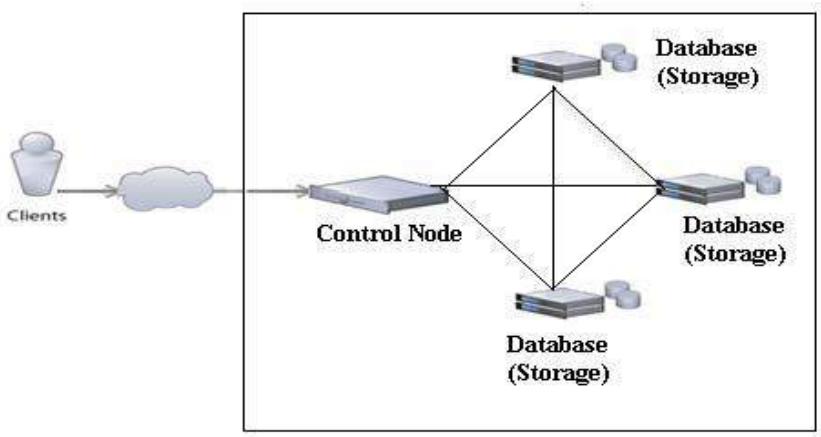

Figure 2 Cloud storage system architecture

Service Interface
Storage Overlay
Metadata Management
Storage Management
Network and Storage Infrastructure

Figure 3 Cloud Storage Layered Model

The following are descriptions of the various layers in the Cloud Storage Model depicted in Fig. 3:

• Network and storage infrastructure is made up of distributed wired and wireless networks that connect storage devices.

• Storage management: domains and logical entities are used to organise geographically distributed storage resources. Furthermore, data can be stored in storage media as files or blocks.

• Metadata Management: groups global domain data storage metadata information and collaborates with different domains for load balancing.

• Storage Overlay: This layer handles virtualization, service retrieval, and redirection. A middleware can be used to connect distributed data storage devices and then present them to users as a single, simplified virtual storage network.

• Service Interface: provides a consistent interface for clients to access Cloud storage.

4. ADVANTAGE OF CLOUD STORAGE

4.1. Scalability:

Cloud computing is scalable and versatile. If the data plan is insufficient, the service package will be increased. You won't have to transfer data from one location to another, and you'll have more space in your computing environment to work with.

4.2. Availability and ease of access:

Most cloud platforms include drag-and-drop functionality and are simple to use. Google Drive is an example of a Google or Apple iDrive. Both have simple instructions, and you can easily upload your file to your online drive without any professional knowledge. For example, if the drive that uses a mobile device has been saved, you can recover the file that uses a machine or another internet access system. It makes no difference where you are right now. If you have a reliable Internet connection, you can access your files from any location in the information centres online.

4.3. Convenient data exchanging

Each cloud storage provider's file sharing options allow you to share your files with other users. You have the option of sending a file to a different user or requesting that numerous users view your files. Although most vendors offer a cloud environment in which two users can share information using the same cloud provider, only a handful offer inter-file sharing features.

4.4. Automation

Cloud storage works on your device like a hard drive, and any ongoing activity will not be tempered if you want to save a cloud entry. Even one customer may utilise an online storage service, and because it is all managed and automated by the supplier, one user's present obligation cannot affect the position of another.

4.5. Preservation

Security is our primary concern when it comes to the web, and cloud storage services are primarily used by large and small businesses, so they make sure the provider provides additional security when choosing their business's cloud service. Online storage uses replicated servers to store information, and even if one of these database centres fails, the data is handled, secured, and tracked by the other data centre. Only the data will be lost if all of the database provider's information centres fail or are destroyed, which is extremely unlikely given the thousands of information centres in a cloud storage facility.

4.6. Economical

The company simply outsources the storage issue to online services. The use of cloud data management by the organisation reduces the investment of internal resources. The cloud storage service manages this platform, which requires little internal power and resources from the company. Several cloud storage providers offer cloud storage for life at a reasonable price, which can be a win-win situation for small businesses and customers.

4.7. Multiple consumers:

The same cloud environment can be used for a variety of purposes. A standard file can work with most users using cloud storage. You might, for example, allow many users to see and edit your files. The information can be accessed in real time by an allowed user from anywhere in the world.

4.8. Usability

You don't need a hard disc or a flash drive to view or show your files because everything is done online. If you wish to download a file or data, you will need a memory card; otherwise, you can access the information from your device. However, if you only want to browse your files, it may not take up much space on your PC. Any changes to the information are reflected in every system synced with the storage service, even if they are minor. You don't need to be a cloud storage service expert or have any prior experience. All jobs are completed by the seller himself.

4.9. Synchronization

Every storage provider provides the synchronisation function. Synchronisation allows you to use any system to synchronise your cloud storage data. However, as previously said, we would employ synchronisation to access our data from any device or location on the planet. You will be able to access your subscription storage service from any computer with a valid username and password, and you will be able to view all of your data stored in cloud storage. You do not need to transfer data from one computer to another, but you will need a reliable internet connection to access any of your files.

5. ISSUES OF CLOUD STORAGE SERVICES

5.1. Data Management

Data in storage can be organised in database mode, file mode, or block mode. The database can be proprietary or open source. The database can only handle a limited number of data types. The block level is the simplest data storage type; it is used by both databases and files. Other storage organisation modes must be used with block level.

5.2. Cloud Storage Virtualization and Availability

Operating systems, servers, networks, and storage are all areas where virtualization is used. In the data access technique, storage virtualization is used to map logical storage to physical storage. Users will be able to hide storage locations and storage modes thanks to cloud virtualization. Cloud availability entails continuous operation and recovery.

5.3. Deduplication of data

Data deduplication is concerned with data storage, backup, recovery, and archiving with the goal of reducing storage space by compressing internal duplicated data. Data deduplication is the most effective technique to reduce data volumes, reduce storage requirements, and reduce data security costs and dangers. Because of the predicted exponential growth of data for enterprise and science, huge storage will be required, and data deduplication will help save space and money.

5.4. Cloud Storage Deployment

Cloud storage should be sold depending on application and technical requirements. Middleware and an overlay layer connect the various storage networks. The data need application should choose the geographical location. Storage costs should be optimised according to the deployment mode. To update the distribution policies and access control, feedback from various servers and clients should be collected.

5.5. Cloud Storage Safety

Storage media physical security and data security are two aspects of cloud storage security. Certification, authority, audit, and encryption are all aspects of cloud storage and security. Security of cloud storage also affects storage service procedures, which include software, hardware, data information, network security, and user privacy.

5.6. Load Balancing and Data Migration

Moving data from one storage site to another, most likely in different locations, is what cloud data migration entails. In the Cloud storage system, the goal is to ensure local balancing. When the storage capacity is exceeded, the data should be transferred to other Cloud storage units while retaining the pointers in the old storage location, or the metadata should be modified and updated simultaneously. Local balancing is used to retain storage spaces open for later use in different Cloud storage systems. It has the potential to improve storage accountability and availability. Data migration is an excellent load balancing method, although it might cause bandwidth and I/O issues. Data replication is a sort of data migration that keeps the original data. Data replication is a distributed Cloud storage solution that maintains multiple copies of the same content across numerous storage devices and locations. Based on the user's access frequency and server workloads, the ideal Cloud storage solution should automatically produce needed copies.

6. SECURITY CONCERNS

Users have little control over the data kept in cloud data centres using cloud computing. Cloud providers have complete control and can conduct tasks such as copying, deleting, and modifying data. Cloud computing has higher security concerns than information housed in traditional data centres due to the absence of user control, multitenancy, and virtualization ideas. Cloud storage has been linked to four security vulnerabilities.

6.1 Vulnerability and Data Recoverability

Data on the Cloud can be breached due to the Cloud's elastic nature and other properties such as resource pooling and multi-tenancy. A resource assigned to one Cloud user may be assigned to another user at a later time. A malevolent user can use memory and storage recovery techniques to obtain data from a prior user.

6.2 Inadequate Media Sanitization

The problem is that tangible media is being destroyed for numerous causes. It may be necessary to replace a disc or remove data from a disc. Additionally, service cancellation may be required. The CSP may be exposed to hazards if it does not adequately sanitise the devices. Additionally, multi–tenancy raises the risk of device sanitization.

6.3 Outage of Data

Many clients desire online storage that is elastic and highly available. Cloud companies compete on price, as well as SLAs that guarantee uptime and availability. There is no compelling need to install another fail safe on top of Cloud storage systems because cloud providers provide adequate protection against component failures. Despite this, outages in Cloud data centres occur, resulting in data loss for many Cloud customers.

6.4 Backup of data

Data backup is another concern that must be addressed with caution. The CSP requires regular backups to assure data availability and recovery in the event of both intentional and unintentional disasters. In addition, backups must be safeguarded from illegal access and tampering. Several security models exist to ensure the use of data in storage. SecCloud employs a storage security protocol that protects both user data uploaded to the Cloud and computations conducted on that data. A scheme that allows users to rank the importance of secrecy, availability, and integrity on a scale of one to ten had also been proposed before. The numbers are used to calculate a user's data's sensitivity level and eventual protection. An approach based on on–demand data correctness verification was also presented. The model verifies the validity of Cloud data without having explicit knowledge of the entire dataset. It is also possible to encrypt data prior to outsourcing, but if such data is to be shared, there will be a significant amount of data overload.

6.5 Reliability and Privacy

Data integrity, confidentiality, privacy, and availability are all issues that cloud computing faces. Cloud users are growing at an exponential rate, and more applications are being hosted in the Cloud as a result of its simplicity. A successful attack on any aspect of data in storage could result in a breach, giving unauthorised access to all Cloud users' data. Because of virtualization, data can be processed by multiple people thanks to multi–tenancy. A malevolent insider could also compromise data security during processing. There's also the unsolved question of what CSPs do with the data that their customers store in their data centres.

7. TYPES OF CLOUD STORAGE

7.1 Personal Cloud Storage: This is a type of public cloud storage that stores personal information on the cloud and allows customers to access it from anywhere. It also allows for data synchronisation and knowledge transfer between devices. Apple icloud is an example of private cloud storage. PCS devices provide home users with the benefits of high-capacity, cloud-based storage while maintaining control over their personal information. Users can access material from several computers using their PCS system's browser, while mobile apps are available for iOS and Android smartphones. Files are also shared when not using a public cloud provider.

7.2 Public Cloud Storage: Public cloud storage is a cloud storage architecture that enables for the storage, editing, and preservation of human and organisational data. This type of information is stored on a multinational cloud service that is available via the internet via a subscription-based payment system in which customers only pay for storage space. Public cloud storage is provided by a data company that openly supports, manages, and stores data for multiple customers. Storage as a service, storage of useful features, and internet storage are also terms used to describe the public cloud computing architecture.

7.3 Private Cloud Storage: Private secondary storage is a type of deport mechanism that saves an enterprise's data on in-house storage servers using cloud computing and storage technology.Private cloud storage is comparable to public cloud storage in that it provides usability, scalability, and adaptability to the storage architecture. However, unlike public cloud storage, it is only accessible by one company and its allowed external partners. Internal cloud storage is often referred to as private cloud storage.

7.5 Hybrid Cloud Storage: This mixes proprietary and public cloud computing, storing sensitive data in the private cloud and other data in the public cloud.

8. CLOUD STORAGE PROVIDERS

There are hundreds of cloud storage providers in the industry, each offering unique solutions, but the ideal cloud storage platform for your data is determined by your company needs. To determine the best cloud storage solution for my company, examine the following factors:

1. Evaluate the features you require in your cloud storage, such as scalability, control, bandwidth, multi-tenancy, latency, and data availability.

2. Decide what sort of storage architecture is required by your applications/instances, such as block, file, or object storage.

3. Estimate how much space you'll need and how often you'll save data (daily, weekly, monthly, etc.).

In the global cloud storage service market, there are several major participants, but Amazon Web Services (AWS), Microsoft, Google, and IBM are the top four. They all have different storage choices. Depending on the goal of use and the individual use scenario, each service has its own set of advantages and disadvantages. Let's look at some of the public cloud providers' detailed block, object, and file storage systems.

8.1. Storage of objects

As the name implies, object-based storage is a hierarchy-free technique of storing data as discrete objects, with each object including a configurable amount of metadata, the data itself, and an application's distinctive identifying name for retrieving data. For unstructured data, object storage is ideal. It has metadata properties and is quite scalable. Hot for immediately accessible data, cool for infrequently accessed data, and cold for archive and rarely accessed data are the three categories of object storage available from cloud storage providers. The less expensive storage is the colder it is.

8.1.1 Object Storage on AWS

Depending on the use case, AWS offers a variety of storage classes. S3 is Amazon Web Services' primary object storage platform. S3 Standard-Infrequent Access for cool storage and Glacier for cold storage are both available.

Amazon S3 Standard — This storage option is designed for frequently accessed data and is great for cloud applications, dynamic websites, content distribution, gaming, and data analytics. It has a short latency and a fast throughput rate.

Amazon S3 Standard – Infrequent Access (Amazon S3 Standard – IA)—Storage option for data that is accessed less frequently, such as long-term backups and disaster recovery.

Amazon Glacier– This storage system is extremely durable and designed for data that is accessed infrequently. Data is encrypted and unchangeable and saved in archives for long-term storage.

8.1.2 Object Storage in Azure

Azure Blobs is Microsoft's cloud object storage offering. Blob storage is ideal for storing unstructured (text or binary) data such as photos, videos, audio, and documents. Azure storage provides improved data integrity, mutability, and flexibility. Blob storage is great for storing files for distributed access, providing images or documents directly to a browser, streaming video and music, writing to log files, backing up and restoring data, disaster recovery, and preserving data for analysis by an on-premises or Azure-hosted application. It's one of the most dependable cloud storage options for businesses.

8.1.3 Cloud Storage by Google

GCS (Google Cloud Storage) is a single object storage solution for any workload. High-performance object storage and backup, as well as archival storage solutions, are divided into four categories. All four classes have a low latency and a long lifespan.

I. High-performance storage (Hot): GCS provides multi-regional and regional storage for data that is accessed often.

II. Multi-Regional storage allows you to store material that is regularly accessible all over the world, such as website content, streaming videos, games, and mobile apps.

III. For data analytics, regional storage allows frequent access to data in the same region of Google Cloud DataProc or Google Compute Engine instances.

IV. Archival Cloud Storage (Cool & Cold): It provides Nearline and Coldline storage for data that is accessed infrequently.

8.1.4 IBM Object Storage in the Cloud

For unstructured data, IBM Cloud provides flexible and scalable cloud storage with policy-based archive capabilities. This dependable cloud storage solution is intended for data archiving, or the long-term storage of infrequently accessed data, as well as analytics and backup, as well as web and mobile applications. IBM has four storage class tiers, all of which are integrated with Aspera high-speed data transmission, which enables easy data movement to and from Cloud Object Storage as well as query-in-place features, allowing you to put data analytics to work for you.

8.2. Storing Files

File-based storage saves data in files and folders and stores it in a hierarchical manner. Many workloads or programmes rely on shared file systems, which means they require a file system as well as access to shared files. Cloud file storage is a service that allows users to store data in the cloud using popular file-level protocols such as NFS (Network File System) and SMB (Server Message Block). Through shared file systems, it gives servers and applications access to shared data. Unstructured and semi-structured data like spreadsheets, presentations, and other file-based data, as well as workloads like huge content repositories, media stores, development environments, and user home directories, are excellent for cloud file storage.

8.2.1 AWS File Storage – EFS

EFS Elastic File System (EFS) is the scalable file storage option for Amazon Web Services (AWS). Amazon EFS is completely managed, simple to set up, and provides elastic storage capacity, which means your applications may use storage on-demand whenever they need it. It's designed to deliver low latency, high throughput, and high IOPS for a wide range of workloads. It supports the Network File System version 4 (NFSv4.1 and NFSv4.0) protocol and provides file locking and robust data consistency. It also integrates nicely with today's applications and tools. You receive scalable file storage for Amazon EC2 as well as redundant data storage capacity across different availability zones with Amazon EFS. EFS also supports encryption in both transit and at rest for file systems.

Use cases for elastic file storage

Its general-purpose performance mode is suited for latency-sensitive use cases including web serving environments, content management systems, home directories, and file serving in general.

Developer tools, enterprise applications, container storage, media and entertainment processing workflows, database backups, and big data analytics workloads are also supported by Amazon EFS.

8.2.2 File Storage in Azure

Azure Files is a Microsoft cloud file storage solution that provides fully managed file shares. The industry-standard Server Message Block 3.0 (SMB) protocol makes these shares accessible from anywhere. Azure File Storage is application and cross-platform compatible. It enables applications to mount file shares from anywhere in the world, whether on-premises (Windows, Linux, and macOS) or in the cloud. Azure File Storage supports the construction of modern applications using the REST API standard. Azure File Sync provides hybrid flexibility by caching and synchronising Azure File shares on Windows Servers for regional access.

Use cases for Azure File Storage

Azure Files is intended to replace or complement on-premises file servers, "lift and shift" programmes to the cloud, and facilitate new cloud development projects such as log writing by cloud apps, shared application settings access, and so on.

8.2.3 Google File Storage

Cloud Filestore by Google is a managed file storage service for applications that require a shared file system and a file system interface. In the cloud, Google offers a fully managed network-attached storage (NAS) service. For file-based workloads, it provides low latency, high throughput, and high IOPS without sacrificing speed. Users can customise their filesystem for a specific workload and mount Filestore file shares on Compute Engine VMs with GCP Filestore. Google Kubernetes Engine and the rest of the Google Cloud portfolio are both connected with Google Cloud Filestore. The Google Cloud Platform (GCP) console has a storage option called Cloud Filestore.

Use cases for Google's file storage:

Media processing, home directories, rendering workflows, application migrations, web content management. Currently, the service is in beta.

FUSE is a Google open-source utility that allows you to mount Cloud Storage buckets as file systems on Linux or macOS. You can use it to upload and retrieve Cloud Storage objects using file system semantics.

8.2.4 File Storage by IBM

IBM provides quick and dependable flashbacked NFS file storage. For general-purpose workloads, IBM Cloud File Storage provides durability tiers. It allows users to customise IOPs, allowing them to increase storage capacity according to workload demands and regulate total IOPs per storage volume. There is also performance provisioning and the ability to build file shares in granular increments (from 1000 GB to 12000 GB). For file storage, IBM offers per-gigabyte pricing tiers up to 48k IOPS, with capabilities like flash-backed storage, snapshots and replication, data at rest encryption, volume duplication, expandable volumes, and customizable IOPS.

8.3. Storage in Blocks

Data is kept in volumes called blocks in block storage, which is utilised in storage-area network (SAN) systems. The server administrator configures each volume or block as an individual hard drive. Block storage is commonly used in database storage, file systems, and RAID arrays. Traditional magnetic spinning hard-drive discs or newer solid-state drives (SSD), which are generally more expensive but have superior performance, are divided into two groups by each supplier.

8.3.1 AWS EBS Block Storage

Web services from Amazon EBS (Elastic block storage service) is a block-level storage service that may be utilised with EC2 instances for long-term persistent and fast accessible data. Any instance that is operating and in the same Availability Zone can use these Elastic Block Store volumes.

AWS EBS provides two types of volumes: transactional SSD-backed storage (next-generation high-performance drives) and throughput-intensive HDD-backed storage (conventional magnetic).

8.3.2 Block Storage in Azure

Microsoft Azure's Block storage service is Azure Managed Disks. For Azure IaaS VMs, Azure builds and manages discs of your choice. It is in charge of VM disc storage accounts.

Ultra SSD Managed Disks are designed for the most demanding workloads and provide extremely scalable performance, Premium SSD Managed Disks are designed for production and performance-sensitive workloads, Standard SSD Managed Disks are designed for cost-effective and consistent performance, and Standard HDD Managed Disks are designed for VMs running latency-insensitive workloads, backup and archiving applications, and when production-level performance is not required.

8.3.3 Block Storage by Google

Google Persistent Disk is Google Cloud's block storage. For high throughput and latency-sensitive workloads, it also has SSD and HDD storage options. This storage can be used in Google Compute Engine or Google Kubernetes Engine instances.

i. Zonal persistent disc and Zonal SSD persistent disc are two of its products.

ii. Regional persistent disc and regional SSD persistent disc are two types of regional block storage.

iii. Local SSD: Transient local block storage with high performance.

iv. Cloud storage buckets provide inexpensive object storage.

8.3.4 Block Storage by IBM

IBM Cloud provides persistent Block Storage based on iSCSI. This flash-backed storage is deployable and customisable, with capacities ranging from 25 GB to 12,000 GB and 48,000 IOPS. It can be set up and handled separately from compute instances.

IOPS provisioning is available in two ways on IBM Block storage:

Endurance:

It is built to meet a variety of application requirements. It includes capabilities such as replication and snapshots, as well as pre-defined performance levels. For various application requirements, there are four IOPS performance tiers:

For workloads with low I/O intensity, 25 IOPS per GB is recommended.

For most general-purpose applications, 2 IOPS per GB is sufficient.

For higher-intensity workloads, 4 IOPS per GB is recommended.

For the most demanding applications, 10 IOPS per GB is recommended.

Performance:

This sort of block storage is built to handle a lot of data. It has a range of IOPS rates (100–48,000) and storage sizes ranging from 20 GB to 12 TB.

9. CONCLUSION

Users can access cloud computing services such as compute, storage, and applications via the Internet. CSPs have decreased the requirement for infrastructure spending by making resources available to users. The Cloud is utilised for a variety of tasks, although compute and storage are two of the most common. The focus of this paper was on cloud storage. Cloud storage solutions, architecture, models, and difficulties were studied in depth. We also looked into the storage services provided by key worldwide cloud service providers including Amazon Web Services, Google, Microsoft, and IBM. To sum up, despite some Cloud issues, notably in terms of security and privacy, Cloud storage is still being widely adopted and research continues in order to broaden the scope of Cloud storage adaption even farther.

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