

Detailed Review on Cloud Computing and Cloud Security

Prof. Anand G. Sharma¹, Nikita S. Ingle², Arati R. Wadhe³, Ritik S. Hujwant⁴, Kaustubh A. Agrawal⁵

Guide, Department of Information Technology¹

Students, Department of Information Technology^{2,3,4,5}

Shri Sant Gajanan Maharaj College of Engineering, Shegaon, Maharashtra India

sharma.anand2008@gmail.com¹, ningle29102000@gmail.com², aratiwadhe11@gmail.com³

hujwantritik132@gmail.com⁴, kaustubhatulagrawal1999@gmail.com⁵

Abstract: *In the era of Information, we have analyzed that many people are facing the problem of data handling, data storage, and data security. Another problem we have analyzed is that people want an integrated platform with greater accuracy and better security. To solve this problem, we have come up with a solution of integrated cloud storage and browsing application where the user will be allocated some space on the server where one can store their files in a separated and well-mannered form, which will help them to manage their content in an organized manner. We will also provide a marketplace for the user so they can get some required media files from there, which may give integrity to users. For the backend, we will use the concept of data compression using a backpropagation algorithm (using neural networks) which will help to user store more files in a compressed manner on the server. The data will be encrypted using cryptography algorithms, which will increase the security of data by multiple times.*

Keywords: Data Compression, Cryptography, Data Security, Space Allocation, Data Encryption, Neural Networks

I. INTRODUCTION

Cloud computing is one of the emerging technology which enables the user to remotely access the information, resources, and infrastructure of any computing device. The resources are located on a central server to which the clients have to access. Clients are given particular login credentials with which a client can log in to the server and can perform the task, and further log out once the task is done. Cloud computing reduces the individual hardware as well as the software production and even reduces the task of maintenance for any individual client. Depending on the usage, resources and software can be dynamically allocated to the client as any cloud uses a pay-as-you-go model in which the user has to pay only for that resource which he is using and dynamically increase or decrease. The further will cover in-depth knowledge regarding cloud computing. The three main objectives of this cloud storage system are

1. **Durability:** Data should be stored at multiple places in multiple parts so that it will become more secure. Natural disasters, mechanical faults, or human error should not result in data loss.
2. **Availability:** The user's data should be available whenever needed free of cost. Users can access to his/her data through the internet using a secured ID and Password anywhere.
3. **Security:** Ideally all data is encrypted, using the most secure encryption technology to increase the security level of users' data. Also, there is a requirement of a unique ID as well as its matching password to access that data from a server that is only known to the user

II. LITERATURE SURVEY

G. Deepika in the paper "Holographic Versatile Disk" in 2011 stated that the future of optical drives can be holographic versatile disks due to various reasons such as capacity, durability, and operational functionality. The data has to be converted to its equivalent binary format. This 3 D structure is called a hologram. This hologram is further implanted in the disk in the form of an interference fringe pattern (Light and dark patterns of light). In this way, data can be recorded on the disk, and to read this data, the same reference beam is used at a particular angle and the projection of previously stored data can be retrieved for further use. This can be implemented in cloud servers for storage.

B.Deepthi et al., "Hybrid Secure Cloud Storage data based on improved Encryption Scheme", 2021 IEEE. This paper includes the study to secure users' private information which is stored in the cloud, the information may be sensitive. The method proposed by the author can solve the issues related to the brute force attack. This hybrid method protects the data by combining AES and Honey Encryption which is again re-encrypted using a proxy server.

Mehdi Bahrami, "Cloud Computing for Emerging Mobile Cloud Apps", 2015 IEEE states the study behind the concept of a cloud computing system, cloud software architecture, and the necessity of the latest mobile cloud computing applications. The new mobile app designs, network apps, app designing tools, and the need behind the migration of apps to the cloud computing systems. This paper also points out some major challenges and the economical factors, the importance of mobile cloud computing architecture in the field of application designing, as well as the how app-designing industry has a chance to append to the cloud computing system with a small investment. The problems related to privacy and security in cloud computing applications are stated in the paper. The paper demonstrates some case studies which present both sides of mobile cloud vendors and consumers in real-time. It gives a viewpoint to the future developers for the start-up in the field of cloud computing mobile apps and explains the cost-effective model for emerging mobile app developers.

Weigang Li, Yu Yao from Intel Asia-Pacific Research & Development Ltd in "Accelerate Data Compression in File System" in the year 2016, IEEE has proposed a theory about data compression. They said that data compression is a process of representing information like images, text, video, or any other systematically with as less as possible bits. Compressed data is understandable to only that person who has knowledge of decoding.

Gustavo de Los Reyes, Sanjay Macwan, Deepak Chawla, Cristina Serban from AT&T Security Research Center in "Securing the Mobile Enterprise with Network-Based Security and Cloud Computing", 2012 IEEE. They have mentioned the security architecture of mobile enterprise which uses internet-based security to simplify, improve and enhance and reinstate current security perimeters which were disappearing. They have mentioned current cloud computing environments and emerging technologies and the scope in this field. Since security plays a vital role in cloud computing, they have proposed various theories and their opinions on network security.

III. CLOUD COMPUTING

Cloud computing is the availability of software and hardware resources such as servers, storage, and even operating systems that are installed on the central remote server to any client who is located in a remote location. The clients are provided with their unique login credentials for accessing the resources. This technology is an alternative to discrete hardware and software as one powerful system is set up in a central location to which most of the clients can access it and use the resources and once done with work can log out from the server. This technology reduces the work of maintenance of clients and even employees as only one system has to be maintained. In the further topics, we will go through the depth of several areas of cloud computing.

3.1 Architecture of a Cloud Server and Application

Cloud architecture is the blueprint of various individual technologies combined with cloud infrastructure. Cloud computing architecture comprises two main parts:

1. Front-end Platform or also called User Interface
2. Back-end Platform i.e. Cloud Service Provider

A. Front End

This architecture of cloud computing helps learners to know, how resources of the cloud computing technology were shared via Front End. This interface is visible to the clients, customers, and users as well as with the client's devices which are connected to the internet was used to control the cloud computing environment. Front end architecture of cloud computing is categorized into two parts

- **Web Browser/Application Software:** It acts as an interface that will enable the user to interact with the server or system present at remote locations.
- **User's System and Networks:** It is a connected part of the Front end which includes the user's computer system and other input and output devices along with a stable network to perform computing tasks on the cloud.

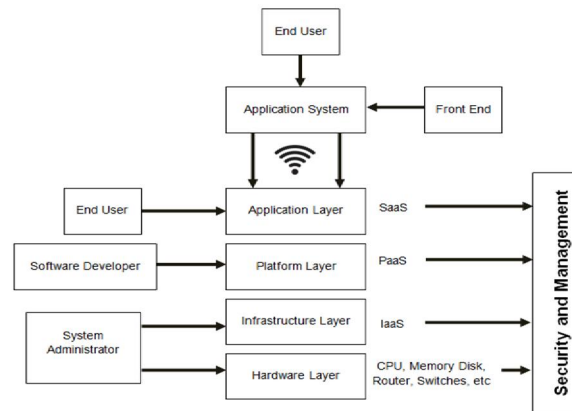


Figure 1: Architecture of a cloud model

B. Backend

Efficient backend architecture always empowers its front end as it embraces the whole infrastructure on the cloud. The backend of cloud computing architecture was handled by cloud service providers which are situated at remote servers. Usually, they are comprised of a physical assembly of four different layers which were the application layer, platform layer, infrastructure layer, and hardware layer along with the security and management software.

- **Application layer:** The application layer is said to be a Software as a Service (SaaS) which is one of the most vital parts of this cloud computing architecture. This is the very first layer which can be any kind of software application or any web service supported by SaaS which handles clients' requests and necessities. It is nothing but the distribution prototype where any third-party hosts any software application and makes it available for users over the network. SaaS makes the hardware, maintenance, licensing, installation, and support cheaper.
- **Platform Layer:** The platform layer consists of Operating systems and applications to provide a Platform as a Service (PaaS) for software development and to perform seamless cloud computing operations.
- **Infrastructure Layer:** The infrastructure layer consists of storage units like CPU, GPU, Motherboard, VMs, virtualization software, and servers on the Infrastructure as a service (IaaS) platform which drives whole cloud software services on host applications and network level. Admin of the system can access this scalable storage and compute power whenever needed.
- **Hardware Layer:** The last layer in cloud computing architecture was the hardware layer, it comprises all the physically manageable aspects like routers, switches, database servers, and memory disks to manage traffic, control power supply along with fault tolerance as well as hardware configurations.
- **Management:** To manage the functioning and performance of the cloud computing environment, we use management software, which also allocates desired resources to specific tasks. It is an intermediate between the backend and frontend of the cloud computing architecture system.
- **Security:** For any cloud computing infrastructure the most important component which will never be neglected is its security. To ensure security in a cloud computing system, a few things are to be done like only authenticate person can access the server, data at the server will be encrypted as well as we need to keep a backup of the user's data.

3.2 Cloud Deployment Model

There are various types of cloud models present, depending upon the requirement of the customer or the need of the organization.

- **PaaS:** It means platform as a service. This service is made up of a programming language execution environment, an operating system, a web server, and a database. Encapsulate the environment where users can build, compile and run their program without worrying about the underlying infrastructure. In this model you manage the data and the application resource- all orders resources are managed by the vendor. This is a domain for developers. Example

product and service of PaaS cloud providing have the following as the PaaS product and service. Amazon web services elastics Beanstalk, Google search Engine, Windows Azure, Heroku, and force.com. PaaS cloud.com putting platform has created the programmer to develop, test, run and manage the applications.

- **SaaS:** SaaS is one of the three conveyance models in distributed computing. While orchestrating requests of SaaS, PaaS, and SaaS. It implies the product as assistance. This assistance is stage free. For SaaS not have to introduce the product on your PC since it runs a solitary distance of programming and is accessible for a long time client. All PC assets are answerable for conveying. SaaS is overseen by the seller. This assistance is available through an internet browser or lightweight client application. Who utilize a SaaS End clients are incessant clients of a SaaS. Model item and administrations of SaaS. Well-known SaaS suppliers offer the item and administrations.
- **IaaS:** It implies foundation as assistance. This help offers the registering engineering and framework that it offers all figuring assets however in a virtual climate so various clients can get to them. The assets are incorporated in information stockpiling, virtualization, servers, and systems administration. Most merchants are liable for dealing with the four assets. In this model, the client will be liable for dealing with different assets like application, Data, Runtime, and middleware. IaaS is utilized by the system admin. Model items and administrations of IaaS incorporate Amazon EC2, GoGrid, and RACKSPACE.com. IaaS gives admittance to central assets like actual machines, virtual machines, virtual capacity, and so forth.

3.3 Types of Services provided by Cloud

There are four different types of cloud systems which are,

1. Public cloud
2. Private cloud
3. Hybrid cloud
4. Community cloud

Public Cloud: We all are aware of the public cloud with the same name. The cloud which is generally preferred whether it is Google Drive or Mega or Dropbox all came under a public cloud. It simply means the cloud services which were provided by a third party like any IT firm over the internet.

- **Private cloud:** Private cloud means there was a person who has a complete set-up of hard disks network connection along with different servers and all-time active internet facility. It is for those who can individually afford a cloud system. It was costlier as compared to the public cloud but it provides a lot of security since we are the only one who has the right to access it.
- **Hybrid Cloud:** It is simply a combination of both cloud private clouds. The biggest disadvantage of the private cloud was its inability to scale on-demand along with addressing peak loads effectively. So to overcome this. Challenge public clouds are needed. But then security might get comprised. Hence, a hybrid cloud came into the picture. It overcomes the disadvantages of both cloud types.
- **Community cloud:** Many IT or any other companies are there won't trust these cloud service providers since their data are most crucial to them and they don't want that anyone can hack it. For example, the Defense system of any country never trusts these cloud service providers since if how their data leaks then there might be a possibility that the security of the whole country may affect it. So they use their cloud system. They make their server storage system which was accessible to only trusted persons. This cloud system is called a community cloud.

3.4 Cloud Security Analysis

As we've already discussed security in cloud computing architecture we know its importance very well. Since nowadays most people prefer cloud base services to save their data it will become a serious issue to provide security architecture for users' data. To deal with security in cloud base services we need to focus on two major points which were

1. Security Mechanism and
2. Security Services

A. Security Mechanism

There must be an effective mechanism that will provide security for the users' data on the server. An overall mechanism preserves the Confidentiality and Integrity of data and provides Authentication so to avoid unauthorized access to the system. There are various algorithms available that were used to save a user's data in encrypted form at the server so that if a random hacker hacks the server then he/she will get a random meaningless text. If a hacker tries to decrypt it then he will require a key by which it was encrypted. But that key is securely saved and to hack that key is merely impossible. There are two types of encryption techniques that were used to securely save a user's data at a remote location

- Symmetric Encryption
- Asymmetric Encryption

In the symmetric encryption technique, there is only one key that was used to encrypt as well as decrypt data. While in the Asymmetric type of encryption technique, we use two different keys one is a public key which will be known to everyone and another is the private key which is only known to the receiver by using a combination of two keys we will enhance the security level.

Nowadays new technology is used for, encrypting data not as such new it is just a combination of both types of encrypting data with multiple algorithms that will give a hike to security as well as cryptanalyst will not able to figure out how data was encrypted.

So this double encryption technique is also nowadays in trend. To encrypt data two methods are used first is substitution and the other is a transposition. The substitution will simply substitute any character with another one. Like a is replaced with g or some other character. While in transposition we transfer positions of characters in a word like abcd will change to cold.

For example, let we need to encrypt "Hi, How are you, Alexa" By performing various operations on it we will get "e#v,qrdbej,quiz,ytvza" if you can observe we can see that every <space> is replaced with ",". This way if a hacker gets this code then also without the knowledge of encryption algorithms and encrypting key he can't do anything.

So in this way, we can provide an encryption mechanism for the server. We can easily provide confidentiality to the data of users along with that we need to provide integrity. Integrity means the user's data shouldn't be modified, for that, we generally prefer to declare that message as immutable so that if hackers try to edit it, then the system will create a new message which was not the previous one and then the system administrator will easily identify that someone has tried to edit data, moreover, the system will by default delete that modified data.

B. Security Services

When we talk about security by just proven ding encryption mechanism will not work ideally we also need to give various kinds of security services. Generally, there are six major security services

Containerization

Containerization has become the biggest trend in IT companion to virtualization. It involves encapsulating or packaging up software package code and every one of its dependencies so that it will run uniformly and systematically on any infrastructure. The technology is quickly maturing, leading to measurable edges for developers and operations groups further as overall software package infrastructure.

Containerization helps developers to form and deploy applications securely and quickly. With old techniques, code is developed in exceedingly specific computing settings that, once transferred to a replacement location, usually end up in bugs and errors. As an example, once a developer transfers code from a PC to a virtual machine (VM) like from a UNIX or MAC to a Windows software system or any other operating system it may generate due to changes in systems and syntax. Containerization eliminates this drawback by bundling the applying code in conjunction with the connected configuration files, libraries, and dependencies needed for it to run. This single package of a software system or "container" is abstracted far from the host software system, and hence, it stands alone and becomes portable—able to come across any platform or cloud, free from problems.

There are many advantages of containerization; a few of them are given below:

- **Portability:** This was the biggest advantage of containerization over traditional techniques. We can easily share our data across platforms without actually doing changes to code that didn't get any errors.
- **Agility:** The open-supply longshoreman Engine for running containers started the trade commonplace for containers with easy developer tools and a universal packaging approach that works on each UNIX system and Windows operating systems. The instrumentation scheme has shifted to engines managed by the Open Instrument Initiative (OCI). Code developers will continue mistreatment of agile or DevOps tools and processes for fast application development and sweetening.
- **Speed:** Containers area units are typically named as "lightweight," which means they share the machine's software (OS) kernel and don't seem to be over-involved with this additional overhead. Not solely will this drive higher server efficiencies, it additionally reduces server and licensing prices whereas dashing up start-times as there's no software in addition.
- **Fault isolation:** Every container operates independently of others. If anyone's container fails it doesn't affect the continued next operation of the other containers. Software Development teams will easily identify the issue and fix it without any change in other containers.
- **Security:** The isolation of applications as containers inherently prevents the invasion of malicious code from poignant different containers or the host system. In addition, security permissions may be outlined to mechanically block unwanted elements from coming into containers or limit communications with uncalled-for resources.

Cloud Cryptography

Cloud computing provides data storage services, it is a virtual platform where users upload, store and access their data anytime and anywhere they need it. Cloud service providers also give access to the software, platform, and infrastructure service in a single package. Many Business organizations make use of cloud computing for the storage and maintenance of their enterprise tools and contents. Cloud computing provides an impressive set of advantages to all types of clients, individuals, or businesses, like flexible storage, easier access, automatic updates, pay-per-use service, etc.

As data stored in the cloud is sensitive, security and privacy act as a crucial role in hiding sensitive data from unauthorized parties. Security, Availability, Integrity, and Confidentiality are the primary elements that users consider before signing up for cloud computing services.

Usually, the field of information technology mainly takes care of data availability and integrity. It does not give adequate notions of data confidentiality. This is why cloud cryptography should be used by any organization. Cloud Cryptography is the way to take care of the security worries of both users and service providers.

Cloud Cryptography is the technique of encoding or transforming a user's data to make it unintelligible and inaccessible before it's transferred to cloud storage. Furthermore, encryption is not only used to secure data and its confidentiality. At the root, digital data is meant to be transmitted and encryption is necessary to perform the transmission in a protected direction. Cloud cryptography ensures that the information sent by the user must be secure when it is transferred to another user and the other user is who they intended to send the data to and not any malicious attacker. Cryptography is also beneficial to achieving flexibility, data privacy, and compliance which is a vital necessity for any organization.

In cryptography, mathematical algorithms are used to convert data (plain text), either text, file, code, or image, to an unreadable form (ciphertext) to hide from unauthorized and malicious users. It is the simplest and most important way to ensure that cloud data cannot be broken, stolen, and read by someone with unusual motives.

Cloud storage providers encrypted data and passed encryption keys to users. These keys are used to safely encrypt data if necessary. Decryption converts encrypted data back to readable data. The main components of any cryptography method are plain text, secret key, encryption algorithm, cipher data, and decryption algorithm. Cryptography is categorized into main two types: Symmetric key cryptography and asymmetric key cryptography.

Symmetric Key Cryptography

Symmetric key cryptography is also called private or single key cryptography. In this type of cryptography, only one key is used for encryption as well as decryption. The sender encrypts the data and passes the encrypted data to the other end to transmit the encryption key to the receiver, utilizing the key receiver to decrypt the ciphertext. The most popular symmetric

encryption methods are DES (Data Encryption Standards) and AES (Advanced Encryption Standards). In respect of cloud computing private key encryption is mainly used to secure the user data.

Asymmetric Key Cryptography

Asymmetric key cryptography is also known as public-key cryptography. In asymmetric cryptography, two distinct keys are used private key and a public key. A public key encrypts the plain text from the sender side and this key is available to everyone present in the communication process. A private key is used to decrypt the ciphertext at the receiver's end and this key is only known to the receiver. Commonly there is a mathematical relation between two secret keys, but the public encryption key is not sufficient to define the private decryption key. Asymmetric key cryptography is recommended over the symmetric key cryptography in the field of security, as there is no need to distribute the key, but it is slow in processing. RES (Rivest Shamir Adelman) encryption and Diffie Hellman algorithm are examples of asymmetric key cryptography.

Crypto as a Service (CaaS) has developed the concept of cloud computing from the information security aspect, discovered a new technique to use cryptography technology in the cloud environment, and helped create a new method.

The research on cloud computing architecture was published by the National Institute of Standards and Technology (NIST) in September 2011. Another cloud computing architecture was developed by IBM. Some organizations which give cloud cryptography services are Amazon Web Services (AWS), JN TASS, Alibaba Cloud, and Sansec have offered high available security solutions of the cloud, such as AWS CloudHSM service which is the earliest one to be attained commercialization.

Cloud Load Balancing

Cloud computing is an expeditiously developing technology as it offers an immense amount of IT resources as a utility service at a low cost and flexible strategy. Hence, users of cloud computing are now evolving for every department of the organization, government, and education for expansion in the use of cloud services. Since many cloud users access the cloud services at the same time. It is very difficult to cloud servers to manage all these user requests simultaneously. Sometimes it may result in system server breakdowns. Currently managing cloud load balancing is the most challenging issue in the cloud computing field.

Load balancing is the technique of distributing the work that a computer has to perform between two or more computers in such a way that the work is performed rapidly and provides efficient usage of assets. It distributes the workload such that no computer is highly loaded while other computers in the network are doing the least work or being idle. Load balancing ensures that all the nodes in the network will carry out the approximately equivalent amount of tasks. The main purpose of cloud load balancing is to increase response time, low cost, and give better performance. Therefore, Cloud is also known as a pool of services.

A perfect load-balancing algorithm helps in making use of the available resources most efficiently, by making sure that there is no node is overloaded or underloaded. The purpose of load balancing includes optimum use of resources, enhance throughput, avoiding overloading, and decreasing response.

Clouds are mainly related to workload balancing to distribute workload across various computing resources in the network. The accessibility of cloud computing resources, load balancing, and inexpensive document management will be of adequate interest to benefit the system itself. Transfer of the load using load balancing in the cloud can be utilized across the globe. Load balancing support cloud server to enhance response time to provide strategic resources and network throughput. The traffic on the server is divided between different servers to avoid delays in sending and receiving the data.

Traffic on the internet is growing speedily, therefore workload on the server is increasing rapidly this leads to server overloading, mostly for popular web servers. There are two key solutions to overcome the issue of overloading the server are as follows:

- First the server is restored to the high-performance server, even a new server may also undergo overloading soon and demand to enhance the productivity.
- The second is the multiple-server solution, in this scalable service system the cluster of services is built It is more cost-effective and scalable to build a server cluster system for network service.

Load balancing is classified into two types: Static load balancing algorithm and Dynamic load balancing algorithm.

a. Static Load Balancing Algorithm

This algorithm in cloud computing does not consider the state of the system or measures like the load level of the processor, as it distributes the tasks. Mainly distributes the traffic equally among the servers. It depends on the capability to perform machine processing.

To perform this algorithm, it needs the depth of knowledge of server resources during the implementation for better processor operation. Round robin algorithm, Min-Min algorithm, Max-Min algorithm, and Opportunistic Load balancing algorithm are some techniques of static load balancing.

b. Dynamic Load Balancing Algorithms

The dynamic algorithm first finds out the lightest server in the whole network and preference is given to it for load balancing. This is required in real-time communication with the network which leads to an increase in the system's traffic. To control the load, the current state of the system is used.

The characteristic of dynamic algorithms helps to make decisions to transfer the load in the current system state. In this system, processes can transfer from a highly utilized machine to an underutilized machine in a real-life scenario. In this algorithm different strategies are used for sharing the load in a dynamic heterogeneous environment. Honey bee algorithm, group active, dynamic bias sampling load balancing algorithm, and Ant Colony optimization technique. During execution time, it re-distributes processes among processors. It is constructed to dynamically gather information and engine attributes.

3.5 Characteristics and Advantages of Clouds

There are various advantages of cloud computing in various fields. These are as follows:

- **Easy Maintenance:** In cloud computing, it is easy to maintain servers as these servers use sophisticated technology which requires low maintenance at higher efficiency rates. Here the clients need not worry about the maintenance because there is only one central server which has to be maintained by the technicians and support engineers. One data center can serve data to millions of customers.
- **Backup and Recovery:** Since all our data is stored in the cloud so the process of backing it up and restoring the same is much easier than storing the same on a physical device the various cloud services providers offer a reliable and flexible backup solution in the cloud making the processes of backup and recovery much simpler than other traditional methods of data storage.
- **Cost Saving:** The most vital role played by Cloud Computing is in cost-saving. The cloud is accessible at less expensive rates and lowers the company's IT expenses. It eliminates investment, Software, Hardware, information storage, package update, management, etc. pays the maximum amount as you utilize. It permits users to obtain solely what they use and in keeping with the demand, the cost gets a rise.
- **Scalability:** The system or server can handle the traffic when the systems grow in a non-linear fashion. At the stage of growth of the online business, the system which was designed as per the earlier requirement can be upgraded to new requirements with the concept of scaling, where the number of systems is increased in the vertical or horizontal direction as per the requirement of business model. Scalable architecture can handle the burst of traffic and heavy working loads that will help in the smooth performance of the cloud. Scaling up and down can be easily performed in a very simpler manner. With scalability, one does not need to worry about additional capacity needs. It ensures that with the continuous growth of the cloud with the enormous amount of storage.
- **Versatility/Flexibility:** Flexibility is the capacity of the cloud administrations to give on-request contributions, agilely exchanging assets when a request goes down. It is many times a quick response to clients dropping or adding administrations continuously. Cloud flexibility is otherwise called fast versatility. In the flexible climate, the accessible assets match the present interest as intently as could be expected. Flexibility embraces both "Responsibility increment" and "Responsibility decline" by giving and pulling out assets in a programmed way.

3.7 Disadvantages

1. Require a Consistent Internet Association

Distributed computing is inconceivable without a web association. To get to any application and archive you want a steady web association that necessary a high-velocity web.

2. Put away information probably won't be secure

With distributed computing, every one of your information is put away in the cloud. that is fine and dandy however how secure is the cloud can't unapproved use again with Cloud Computing every one of your information is put away in the cloud that is just fine yet how secure is the cloud mightn't unapproved clients at any point get close enough to your private information.

3. Secure

It is truly challenging for the client to change starting with one Cloud Service Provider and then onto the next. Nonetheless, it is beyond the realm of possibilities because every one of the cloud suppliers involves different standard dialects for their foundation.

3.8 Use cases and Applications of Cloud

Due to enhancements in technology in the field of clouds, most of the fields in day-to-day computing applications use the cloud as the business platform which can improvise the living of the people and provides a variety of features to the user at no cost. Some of the use cases of cloud computing are mentioned as follows:

- **Data Storage Applications:** The major problem of storage that was faced by the people is been solved by the development of cloud storage platforms where users can securely save their data to maintain the confidentiality of user data. This service provides the availability of data to users anytime and from anywhere in the world by just a simple login process. Cloud storage applications ensure that only authorized persons can modify or update their data. Nowadays these applications focused on security enhancement, where a biometric digital signature is being used to authenticate the user who is being logged in.
- **Online Web Applications:** Due to the Software-as-a-Service model of the cloud, now the user can use any software without installing it into the system. The software is installed on the central server where the clients need to log in with their username and password, use the software - complete the task successfully and log out of it. This service also provides additional services with the software such as file sharing and file storage. The software is embedded in the web application and the users are allowed to log in and perform the task without installing the software in the system.
- **Accounting Application:** Bookkeeping programming is one of the continuous utilization of distributed computing that helps the executives connect with the bookkeeping section of the business. Out and out is one such application utilized by bigger endeavors helping progressively everyday bookkeeping administration. It assists you with following continuous costs, benefits, and misfortunes. Kash Flow and Zoho Books are different instances of cloud bookkeeping applications.
- **Big Data Analysis:** In the era of information, it is not easy to handle and manage such a large amount of data on a computer system. For analysis of a large amount of data, high configured systems, and high storage capacity. For this purpose, data must be stored on the central cloud server where different users can sign in and perform their tasks over data.
- **IoT applications:** In the field of IoT, cloud computing plays a vital role as to connect various macro and micro-devices with cloud databases and actuation. Some sensors are connected with clouds for recording real-time data which is further used for real-time actuation. It is one of the efficient ways to get data from all the sensors at one central location.

There are several other applications where the cloud plays an important as in the field of machine learning and artificial intelligence where large data sets are required to train the model of ML. These data sets are present in clouds, so they can be publicly usable. Other applications are hosting, resource sharing, data sharing, and service providing.

IV. PROJECT MYCLOUD SERVICES

MyCloud Services is an android application product based on the concept of cloud computing, cryptography, efficient data storage technique, and data compression to a larger extent. This application provides an enormous amount of features to its users are high capacity data storage, cloud browsing, and cloud hosting, and provides safety to a larger extent so that the data of users must be secured and preserved for a larger amount of time. This is an all-in-one cloud application for users

so that users need not download different applications for different purposes. Let's study the application in brief.

Hardware Model of MyCloud Services

There are a variety of components required to build the cloud infrastructure. These are as follows:

Hardware:

When we hear about cloud computing the figure came into our mind as it was a virtual data storing system but In actuality, there was also hardware system like hard disk, NAS servers, router, firewall, multiple backup devices, storage array, load balancer, etc. as a part of physical infrastructure. These hardware components were present at various geographical locations so that if the user's data was corrupt then we can easily retrieve it from another server.

Virtualization is a technology that connects different servers, abstracting as well as dividing resources so that users can easily access them from any location.

Virtualization

Virtualization is a technology that differentiates IT functions along with its services from hardware systems. It is an alternative to containers. Both will do well some companies prefer virtualization technology while some prefer containers. Then these virtual resources were allocated to the centralized pools then they were considered clouds. With the help of clouds, we can enjoy various benefits like dynamic resource pools and automated infrastructure scaling along with self-access control to data over the internet

Storage

In a single data center, there were many storage devices i.e. Hard disks and all, which may store tons of data under a single roof. Managing these millions of data sometimes becomes a hectic task. Data must have a backup, it must be encrypted, integrat3d so these things if not managed efficiently also if data is not saved separately then it might happen that someone intruders will access data of other person or if the system is not effective then if A person wants to access his data then the system will fetch data of some other person so these things are to be avoided at the storage location.

Network

If someone says that he will provide the most effective security, users' data were integrated but there is no network facility then it will make no sense. It is as much important as other components. Network not only means internet it also means interconnecting server and storage devices. Cloud allows for the creation of virtual local area networks (VLANs) and allocates dynamic as well static addresses as required for all network resources. A cloud network system configuration is comprised of several subnetworks, each of them having different levels of visibility.

Software Model of MyCloud Services

MyCloud Services is an efficient cloud service application that provides all features in only a single application so that users do not have to download multiple applications for several tasks. MyCloud Services application consists of several modules and sub-modules. These modules are described as follows:

Login/Sign-up module:

This is the preliminary module that initiates when the application starts. It consists of two fragments a login fragment and a sign-up fragment where the user has to log in with their credentials for accessing the application. Here users are also provided with the feature of "Sign in with Google" so that users can log in with no extra process. Here this application also provides the feature of forgot password and remember me option so that users can have multiple features in their hands to manage their accounts on their own. Another fragment is the sign-up fragment which is an optional option for registration where users need to fill up the fields and register themselves with MyCloud Services.

Dashboard Module:

This is the central module of the MyCloud Services application which provides connectivity to all the other modules of the application. It consists of various features and options such as a search box - which is commonly connected with all the

buckets present over the server for file storage. MyCloud Services uses a differential storage strategy for efficient data storage as it provides separate options for different types of files for storage and access. Coming next is the recently viewed files section from where the user can see and access the recently viewed files. MyCloud Services also provide the service to connect with other drives present in the market such as Google Drive and DropBox. It also has a navigation menu that consists of different options for smooth navigation to other options and sub-modules.

MyCloud Storage module:

MyCloud Services provides a facility for storing data to users on the cloud in a discrete manner so that users can get their data in a well-organized manner. Here user data and files are categorized based on the extensions to apply to filter over data that is being inserted in the file bucket on the server. Here we have applied validation to the client-side backend. The file which is being selected by the user is being validated that the file which is being uploaded with the extensions restricted for the bucket if it is found true then the file is being uploaded else the error message is being flashed.

MyCloud Store:

MyCloud Store is one of the most featured modules where users can connect to the server and do surfing from the cloud application. The user does not have to download different applications for different purposes. In this store, the user will get all the features such as newsfeed, calendar, hosting, access to different media file platforms, and various other features. This feature of MyCloud makes the application unique and attractive to other users.

Other Drive Connectivity:

MyCloud Services provides a feature of getting connected to other drives such as Google Drive and DropBox. The user can access their data which is present on other drives from the MyCloud application. So that users can get integrity and can prove the model of all in one drive application.

Other Utility Features:

MyCloud Services has various other utility features such as storage analysis, automatic data sync feature, dark theme, general settings, and various other things. MyCloud uses two-step data encryption methodology to make sure that the data must be secure whenever any data transaction takes place between client and server. The application even makes sure that the data must be end-to-end encrypted. The servers of MyCloud use various firewalls and security authentication protocols to prevent the condition of server breaches. These servers use the most recent technology for storing high capacity data as the HDS method – Holographic Data Storage method which provides high capacity for storing data and provides longevity to the data for more than 100 years.

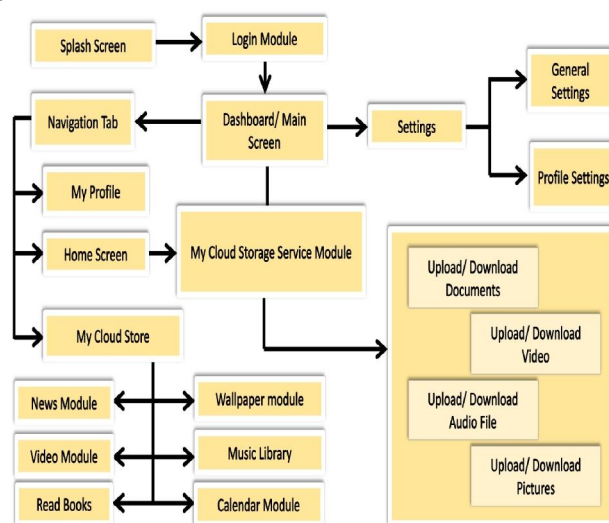


Fig. 2. Flow diagram of MyCloud Services app

Comparison with other cloud services

My cloud vs Google Drive When we talk about cloud services providers there are very known IT companies that provide cloud storage platforms just like Google's drive, Microsoft's Dropbox, and so on. And these are well-known trusted companies then why will someone prefer our MyCloud service? Initially, when one thinks about this the answer will be a waste of time and source but if we deeply think of this then there are a few drawbacks of these cloud services providers, which were overcome by our cloud application.

1. Access rights: If we ask someone to whom there are rights to the data of the user at google? Then mostly played says that that was our data and we own its complete right whatever we want to do with that we'll do. When we want to delete we'll delete when we want to view it we'll do so. But the truth was that Google only owns its rights. They have the right to delete our data anytime but we don't know that because we haven't read all its terms and conditions we simply agree on them all. So now if we talk about MyCloud we will provide 100% rights to the user in any condition.
2. Storage Limit: Secondly these cloud service providers give e-access to a few GBs of data and for more storage, we need to pay them but we were giving a minimum of 50GB of storage and if someone wants more data then they need to pay a charge which was competitively less than these big firms. Apart from this, we are also providing various services in a single application.
3. Stable internet connection: We know that to access any file in drive or Dropbox, we must require a stable internet connection, but many times due to weather or climatic change or any other reason we can't get proper internet access. So to overcome this problem we were providing an application that will do a lot of work offline apart from downloading and uploading data users can do various activities.
4. Daily data limit: As we all know google drive gives only have a 5GB limit for daily data uploading and downloading to free users. Also, there are few cloud services providers like Mega cloud which only give a 3GB limit to download, and if someone has stored a movie or any important document there of around 2.1GB he/she needs to wait for a day to download the remaining part. So this is not an effective use of cloud storage devices. Hence we are providing data storage to users with no daily limit. If the user wants to download 50GB of the file then also he can do it in a single day provided he/she has good internet connectivity.
5. Google Brose's data: It seems funny if someone says that google watch users' data was stored at various locations, they read your emails, messages, and history. But, indeed, they do so. And we are the ones who give them this permission. We blindly accept all terms and conditions which will lead them to do so. But they say that they are only analysing data for recommending correct advertisements. By this, we have come to two different features of our application which was we don't watch or analyse users' data, and secondly, our cloud application has no ads so that user seamlessly do their work without any barrier.

V. FUTURE SCOPE OF OUR PROJECT

Over the past few years, the longer-term of cloud computing has modified drastically. Today, everyone was powerfully connected, with the assistance of digital technologies. It can be the reason why the scope of cloud computing and cloud storage devices had changed. The number of jobs, technologies, and analysis investments needed to establish the cloud computing future scope, has additionally hyperbolic. This can be why we tend to bump into several spectacular trends in cloud computing. In upcoming years cloud computing will play a vital role in every field of living such as data storage, web hosting and web commerce, and other applications. Cloud storage can become the future replacement of physical storage drives as everyone will switch to the cloud for different services because it works on the pay-as-you-go model which means the user has privileges to choose the services that they want to use at a minimum cost. In the future, our application can be proven as an all one solution of features and services that can be space-efficient, feature efficient, and compact. In this application, many new features can be added such as upgradation in encryption level, better UI design, and even web surfing feature. In the future, this application can be scaled over to a greater extent as it can be an all-in-one solution for different applications so users will need just only one application that is capable of performing a variety of tasks related to clouds. This application is capable of replacing many other applications in the market and even it is very light-weight, even this application can be switched to Progressive Web Apps which can take space only a few kilobytes and can become more light-weight and space-efficient.

Our application has a lot of scopes but basic few points are mentioned below.

1. Better cloud service: The future of cloud applications and services in the field of education, as well as industries of these domains, will witness the power of voice controllable applications because everyone wants to access anything with the least hurdles and hence it will have more demand in future. Even it was also user-friendly, simplistic in design, and well organized.
2. Security: One of the most important areas of discussion about cloud computing technology would be security. Not only for the end-user but also a cloud service provider, it is most important to take care of user data, protect it from hackers, and provide it with at least 3 levels of security by using an encryption algorithm. We had taken care of this issue and also to gain trust it is also useful, as well as it will attract more customers if we give a guarantee to the user about the privacy of their data at our server.
3. Market Growth: As per reports by the end of 2018, the market growth of cloud computing had crossed 128 billion, USD. But after covid, it has crossed 400 billion USD. This won't be a drop in the upcoming days since its future will only go on the increase. Even big brands and IT companies were migrating their services as well as products to the cloud, just to earn profit.
4. Virtualization: Finally, we'd like to concentrate on the longer term of virtualization and cloud computing. This is often a noteworthy bond that has a lot of scope for analysis and development. To start with, once cloud computing and virtualization area units are brought along, a novel design is needed. This might be a development that maps to the qualities of the Computing Cell. And, the computing cells are understood for their consistent want for finer and more complicated code infrastructure that is paired with Byzantine options like cryptography, third party authentication, economical and reliable network segmentation, and information management.

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VII. CONCLUSION

In this paper, cloud computing for mobile cloud applications is presented. This application is an integrated cloud storage and browsing application. It is specifically designed to solve the problems related to data handling, data security, and data storage. Another problem analyzed is that there is a requisite for the integrated application. In this application, users will be allocated storage space on the server where user can store their files in a separate manner which will help them to organize the data efficiently. This application also provides a browsing facility, so that users can download media files if required. The backpropagation algorithm used in the backend to implement the concept of data compression will help users to store more files in a compressed manner on the server. The data encryption algorithm is used to secure data from unauthenticated users. The main focus of this application is to make data storing, accessing, and retrieving more efficient make cloud services more flexible, reduce cost and provide an integrated platform to users.

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