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A SURVEY ON MOBILE CLOUD COMPUTING

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ABSTRACT

Through this abstract I will show that MCC is a new field. To put it simply, mobile cloud computing is a part and parcel of today's mobile devices because these devices are so pervasive and have so many uses. Mobile Cloud Computing (MCC) has now become a common technology of the mobile users because of the development of mobile services and the at the same time discovery of the cloud computing services. Thus, the MCC merges mobile services with the cloud computing and thus, it creates the possibilities for everyday mobile use. The computes', memory size, storage capacity and energy capacity of mobile devices are all limited. Consequently, the cloud computing can be the solution of the problems that are in the mobile environments. Cloud computing is responsible for the simplification of computing and the increase of its capabilities by allowing the services to be accessed from any place via the Internet without the necessity of the resources investment. The combination of cloud computing, mobile computing, and sensing is the foundation of new applications that deal with big data collection and the identification of patterns. The traffic levels on the city highways are estimated by the multiple areas that people go through frequently. It is a tool for extending the lives of mobile device batteries and processing power.

Keywords- Mobile Cloud Computing; Mobile Computing; Cloud Computing, MCC virtualization, challenges in Mobile Cloud Computing, issues; Applications, wireless network computing offloading.

I. INTRODUCTION

The infrastructure which facilitates data processing and data storage process through a single platform is known as mobile cloud computing. MCC, cloud computing, and wireless style compliance for conference proceedings is the mobile cloud computing. The built-in features comprise margins, column widths, line spacing, and style of type. Examples of the type styles are there in this text and these are the ones that are enclosed in the parenthesis that is italic after the example. Some features, such as the network computing, are also considered to be characteristic of the new generation of car. Because of the fast progress in wireless technology, networking, and mobile computing, there has been a surge in the mobile subscriptions. Analysts at TechNavio forecast that between 2011 and 2015, the Enterprise Mobile Cloud Computing market in North America will grow at a CAGR of 18. The need for enterprise mobility which is on the rise is one of the main reasons for the surge. The fact that cloud computing allows the software to operate online makes it a big research subject. Applications from all over the world can be accessed anytime as the technology has made it possible by the cloud technology. The issues that are associated with the mobile phones are the battery power management, the memory requirements, and the restriction on the calculation power as the mobile phone usage increases and the computational capability increases. Mobile cloud computing is a means of allowing users to use cloud services and to perform calculations while moving on the street. A cloud is a collection of datacenters that are run by providers who also supply and manage the services for them. The firms such as Amazon, Microsoft, and Google have distributed their data centres and cloud services to various places around the world.

II. MOBILE CLOUD COMPUTING ARCHITECTURE

Mobile devices can gain cloud services in two ways:

1. The first of the important elements is the virtualized computing core (VC), a hosted cloud service that consists of the several cloud computing services which are required to function on the mobile device.

2. The second vital element of the MCC system is the client-side application (CSA) that runs the MCC apps on the host device. Thus, to run the programmes for the clients the CSA has a cloud execution service. The MCC programme can apply to a variety of cloud services in order to improve its performance when it is operating in

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the CES. They are associated with base stations by means of a satellite connection or a mobile network. Telecom networks give the customers the possibility to connect to the internet and get online through their mobile devices thus enabling them to access cloud services. Mobile customers, mobile operators, Internet service providers (ISPs), cloud providers, etc. are the principal components of the architecture. Smartphones with Wi-Fi capabilities are linked to network providers through satellite channels or base stations. The demands that are given from mobile devices are handled by the network providers and the central servers. Processing takes place at the top level of the architectural system, usually in the cloud. Offering a cloud service, the network provider acts as a middleman to the mobile consumers.

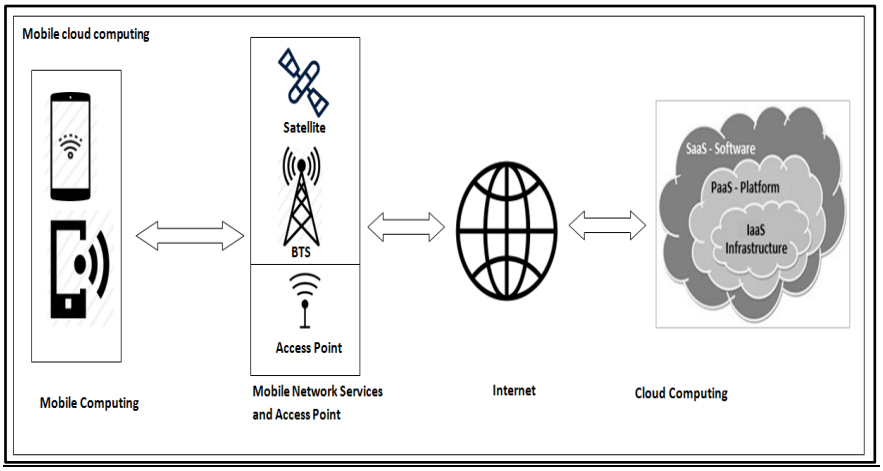

Fig.1 Mobile Cloud Computing Architecture

The primary goal of cloud computing is to offer consumers affordable services. Small firms can access resources and discover new growth prospects by utilising cloud services. They make mobile users' lives easier, boost their processing capacity, prolong the life of their batteries, offer a communication channel, and increase task completion efficiency.Software as a service (SAAS), platform as a service (PAAS), and infrastructure as a service (IAAS) are among the services offered by the cloud model.

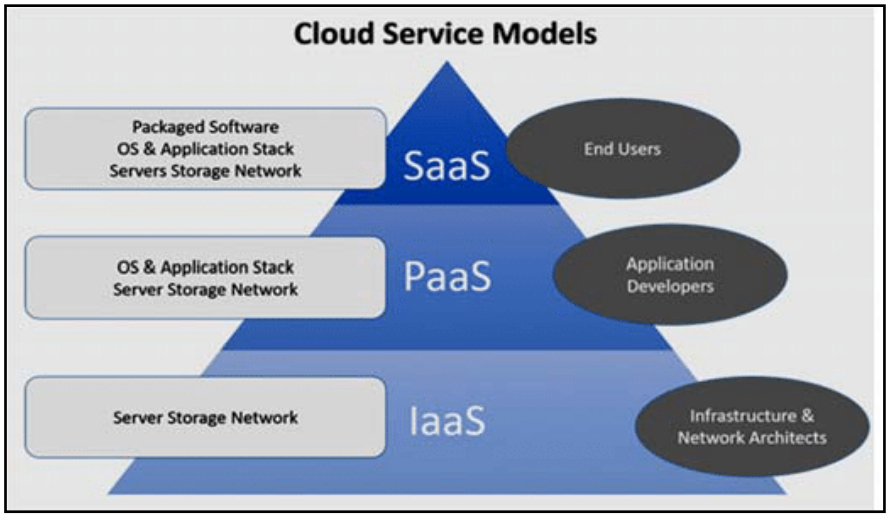

Fig.2 Cloud computing layers

A. Infrastructure-as-a-Service (IaaS)

Infrastructure as a Service (IaaS) also covers the provision of virtualized computing infrastructure resources like server space, storage resources and networking and which users can install and configure just as they would do in hardware on-premises instead of in cloud. The data of clients is accommodated and managed in the provider's own data centres instead of being stored locally and the distinction is crucial. Their customers pay either at the rate of subscription or pay-as-you-go, and they access their services through an internet connection [5].

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B. Software-as-a-Service (SaaS)

SaaS (Software as a Service) is the application software based in the cloud which is ready-to-use. A while ago, it was called cloud application services. By means of a desktop client or mobile app, or in a web browser, to enjoy the expanded version of a program, subscribers must pay a monthly or annual fee. The SaaS vendor takes care of everything for the customer from hosting and managing an application to all of the infrastructure needed to deliver it, which includes servers, storage, networking, middleware, application software, and data storage. The latest software upgrades and fixes are managed by the vendor without the customers even realizing it. A service level agreement (SLA) from a vendor in most cases will include promises about availability rate, performance and security. Customers have the opportunity to add additional users and data storage at a higher device cost if necessary [5].

C. Platform-as-a-Service (PaaS)

The cloud-based environment for developing, launching, and provisioning applications is provided by a Platform-as-a-Service (PaaS). That is, total number of gadgets and software's for instance servers of testing, development, and deployment; OS software; storage, networking, databases, middleware, runtimes, frameworksand development tools are handled and maintained by cloud services provider. Moreover, the provided services includesecurity,insurance, and backups, operating system and software upgrades. The roles of developers and DevOps teams can be merged across the application lifecycle process incorporating into the loop as coding, integration as well as testing, delivering and feedback, with a graphical user interface (GUI) as the point of access for the PaaS [5].

III. DIFFERENT FEATURES OF MOBILE CLOUD COMPUTING

Numerous features are offered by mobile cloud computing, including multi-tenancy, virtualization, mobility, flexibility, scalability, and mobile utility billing.

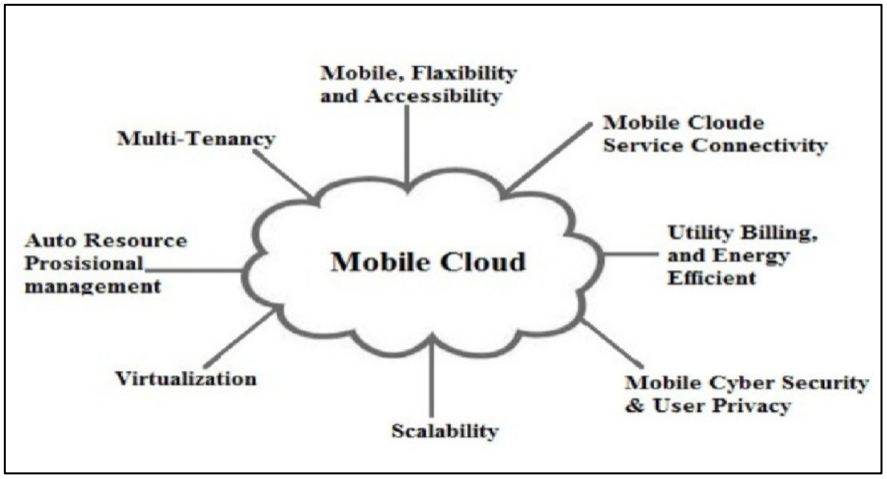

Fig.3 Features of Mobile Cloud Computing

IV. APPLICATIONS OF MOBILE CLOUD COMPUTING

At the moment, mobile users are using a range of new cloud computing applications; these applications are cloud storage [16], mobile mobile media [17], learning and education [18], mobile social networks [19], mobile gaming [20], and cloud-assisted IoT [21, 22]. These applications are designed to satisfy the requirements of the mobile users and the features of the mobile gadgets for which they are developed [23]. These apps are usually designed for the users of mobile devices who have low resources so that they can access the cloud services. Mobile applications must be separated into three primary categories based on their requirements in order to be offloaded to the cloud: The three types of the models in the three models are the clients' or the client-cloud, the cloud-based or the cloud-based model. In a client-cloud based systems, the application is divided into the main components and the execution of the application in a client-based systems is done by a mobile device. The tasks are carried out locally by the mobile device and then remotely by the cloud. Besides, a cloud's feature of a device is the component which is the part which enables the device to function, process, and store data.

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V. ISSUES AND CHALLENGES OF MCC

There are a lot of problems and issues in the field of MCC, and these problems are related to several elements such as end users, operations, data and application service management, and security. We talk about many of the MCC-related problems and challenges that are in this sector. Mobile cloud infrastructure is the first one. The second is MCC's privacy. Mobility comes in third. Eco-friendly computing is at number four. The last one is SaaS engineering for mobile devices. To sum up, we can see that mobile cloud computing providers are collecting personal user data which is almost a gold mine. Hence, we call clouds silver lines. At first, the data was stored on the hard drive of the computer or on a USB drive or any other device, but if the machine is damaged or the USB drive is lost, the data is also gone. Hard drives are used for permanent data storage, but if the hard drive is damaged, the data is also lost. Cloud storage has done away with these problems and the data is never lost. We are going to talk about a few of the cloud computing problems here. The problems are discussed in the following section.

1) Users are not aware of the real location of their data, which is supplied on demand by the cloud providers.
2) If there is a problem with the data, the cloud provider has to be responsible; the user is not even aware of both the data harm and the data recovery.
3) The most significant problem with the cloud when a consumer attempts to change cloud providers is data migration. Moreover, there is no certainty that the data on the previous cloud will be perfectly clear if we change providers.
4) When the cloud provider is hacked, it becomes a huge problem as to where our data can be retrieved.

The MCC has many major reservations, so called mobility problems, often cloud computing linked, which are due to these cloud computing issues and problems.As a result, mobile cloud computing captures the personal data of the users of the mobile device, that is either safe or not safe. So, we finally get to know that the primary problem of mobile cloud computing is the security and privacy issues. The physical risks that are involved in the theft or loss of mobiles are the MCC community's imminent big challenge. Besides, it is physically endangered. If the user has a password or pin-based security feature on, there is a high probability that no one else will be able to use the mobile device. The SIM cards being taken out of the mobile device and given to anyone else is also the main cause of the problems in the mobile cloud computing.Many research papers on mobile cloud architectures and infrastructures have been published in these days. A segment of the published works is on the development of the mobile thin-client architecture. The following research articles discuss thin clients: Air [18], [20], and Hyrax [21] are the topics that we are made to think on. The second major area in the MCC infrastructures that is mentioned in the study paper [22] and is the link with computation offloading is one.

VI. GENERATIONS OF MOBILECLOUD COMPUTING

A. First Generation - The first generation is the one that concentrates on the mobile personal clouds. One of the advantages is that each service is launched and Maintenance in the MCC datacenter. The other hand, the system is also extremely adaptable. This factor is related to the synchronization since the mobile and application data content is in a state of coordination. The system in which the functions of mobility are the ones which are important is the one in which the functions are the ones that are significant[16]..

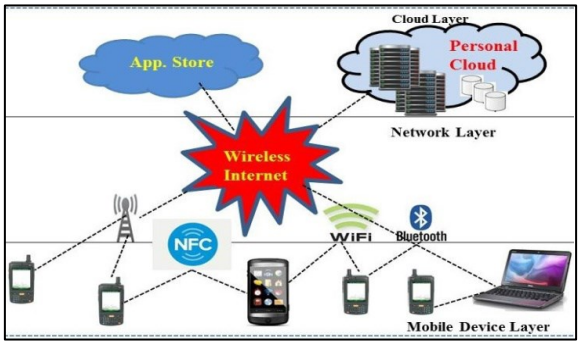

Fig.6 First Generation: Personal Cloud infrastructures

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B. Second Generation- Cloud-Based Mobile Cloud Infrastructures serve as the foundation for the second generation, which is built upon them. All of the services for this system are installed and run by the MCC datacenter. One of the newest and better features of the second generation is the On-demand service. This functionality thus informs us that contents, services, and data are being transmitted to the mobile cloud based on user request. The scalability of the second generation systems is another feature

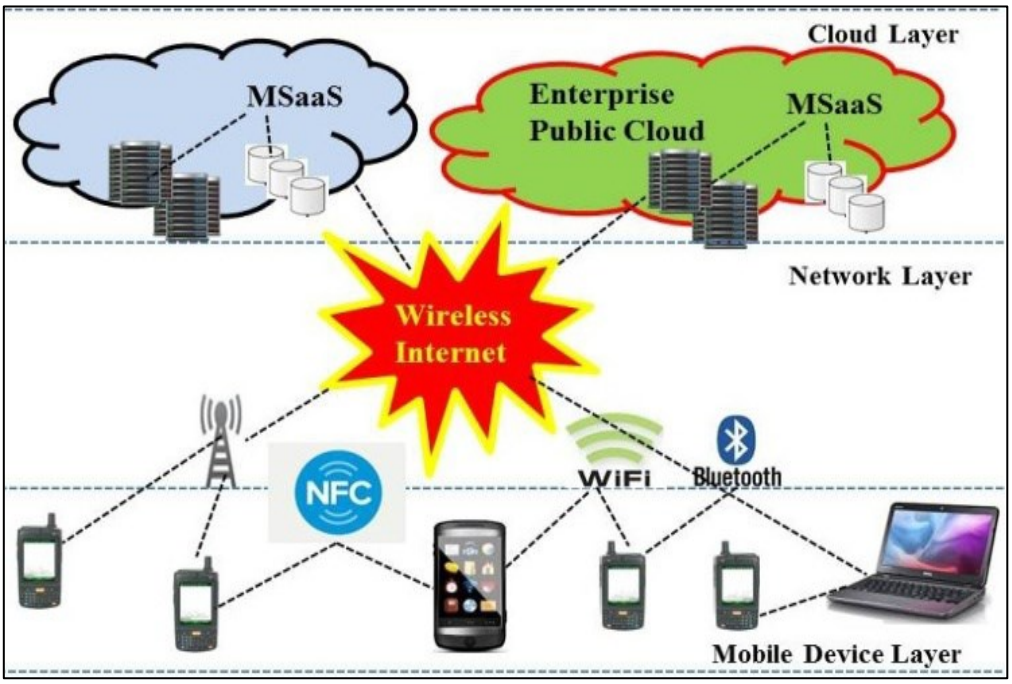

Fig.7 Second Generation: Mobile Cloud infrastructures

C. Third Generation- MobileCloud offers services. According to a poll done by Virgin Media Business CEO Mark Heraghty, the use of mobile devices in businesses has altered (dramatically) as a result of the increase in mobile data consumption [17]. We will discuss each of the four levels that comprise the third generation below. The first layer is cloud computing. Comprising the second layer is the Network layer. Mobile Layer is Layer 4, and Mobile Cloud Layer is Layer 3.

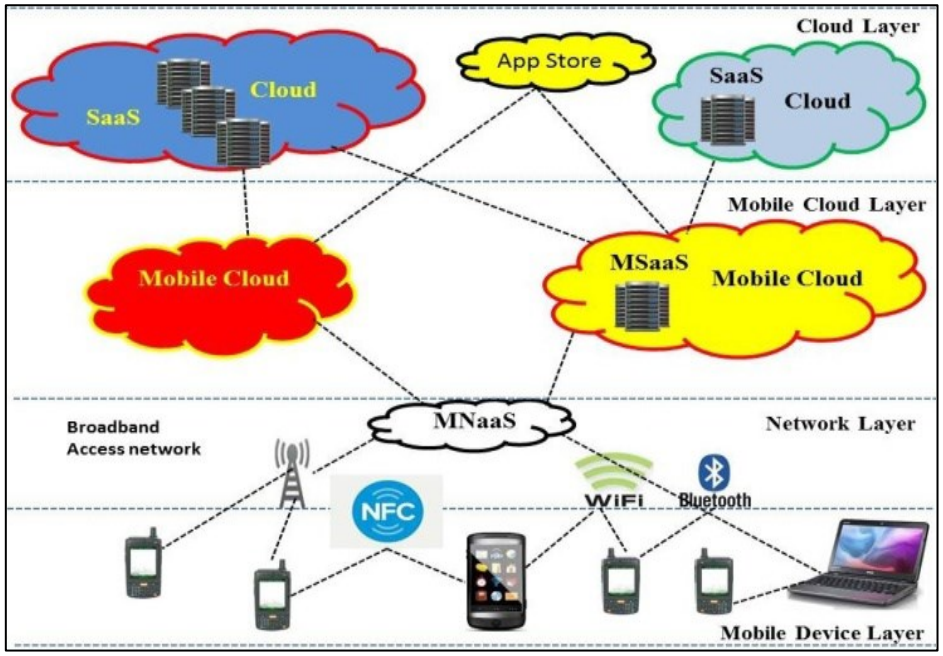

Fig.7 Third Generation: Mobile Cloud Service infrastructures

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VII. MOBILE COMPUTING

The term "mobility" has gained widespread usage and is becoming an increasingly important component in today's computing world. Mobile computing, networking, and security technologies have experienced an incredible boom in the development of mobile devices, including cellphones, PDAs, GPS navigation, and laptops. Furthermore, with the development of wireless technologies like WiFi, WiMax, and Ad Hoc Networks and their freedom from wire restrictions, users may find surfing the Internet considerably easier. Consequently, more and more individuals today view such portable devices as their main source of leisure and work in their daily lives.

The core components of mobile computing are hardware, software, and connectivity. Mobile devices, such laptops and smartphones, or the mobile components of these devices, can be considered as hardware concepts. Mobile computing software refers to the various mobile programmes on the devices, such as mobile browsers, games, and antivirus programmes. The communication issue encompasses the mobile network design, protocols, and data delivery in their application. They need to be open and honest with end users.

1) **Features**: the features of mobile computing are as follows:

A. **Mobility**:Mobile nodes in a mobile computer network can utilise the Mobile Support Station (MSS) to establish connections with other users while they are out and about, including stationary nodes in a wired network.

B. **Diversity of network conditions**: Mobile nodes can connect to wired or wireless networks with high capacity or low bandwidth, or they can even be disconnected from the networks they usually utilise.

C. **Frequent disconnection and consistency**: Depending on a number of variables, including battery life, wireless communication range, network conditions, and so forth, mobile nodes may periodically detach and reconnect to the wireless network.

D. **Dis-symmetrical network communication:** On the other hand, mobile nodes have relatively weak send/receiveability; strong send/receiveability is enabled by servers, access points, and other MSS. Consequently, the transmission overhead and bandwidth of the downlink and uplink varies.

2) **Challenges**: A mobile computer network may face more problems and obstacles due to its multiple mobility nodes and wireless environment than a normal cable network in a variety of areas, such as signal interruption, security, hand-off latency, battery limitations, insufficient processing capacity, and so on. Moreover, the effects of landforms on mobile computer networks' Quality of Service (QoS) are even more pronounced.

CLOUD COMPUTING

Since 2007, "cloud computing" has grown in popularity.Because so many individuals and organisations have addressed these concepts from diverse angles, there is sadly no universally accepted definition of cloud computing or cloud computing systems.Data storage on cloud servers and retrieval via client cache memory technology are the main functions of cloud computing systems, according to C. Hewitt [3]. Products like laptops, PCs, smartphones, and other devices could be among these clients. Definitionally, cloud computing is a parallel distributed computing system made up of several virtual machines connected internally, as stated by R. Buyya [4]. These technologies enable service providers to supply customers with dynamic computing resources in accordance with their Service Level Agreement (SLA). However, several authors did point out that cloud computing was not an entirely unique concept. L. Youseff [5] at UCSB claims that cloud computing is merely the culmination of several previously developed ideas from diverse study fields, along with a few original ones. These ideas include invirtualization, distributed and grid computing, and service-oriented architectures (SOA).

Features: the features of Cloud Computing are as follows:

A. **Virtualization**: The "Cloud," which can be compared to a virtual resource pool, virtualizes every hardware device at the bottom layer [11]. Without having to maintain their own data centres, end users receive data from cloud computing providers and utilise browsers to access the services they need. Furthermore, in order to maximise resource efficiency, some virtual machines (VMs) are commonly installed on servers; in the event of a server overflow, these VMs aid in load migration.

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B. Reliability, usability and extensibility: Customers don't need to worry about issues like malware attacks, software updates, patching software flaws, or data loss when storing their data on the cloud. Cloud computing solutions migrate and backup data to other machines and automatically remove afflicted nodes from the system in the case of a server or virtual machine (VM) failure [12]. This guarantees that the system operates normally in general. To manage a variety of requests from thousands of hosts and nodes in the interim, a large-scale network's cloud can be extended both horizontally and vertically [13]..

C. Large-scale: In order to attain super processing and huge storage capabilities, a cloud computing system may comprise thousands of servers and PCs. For example, Google Cloud Computing now manages 2% of all servers, or around 1 million servers dispersed over 200 locations globally, and it intends to expand to handle 10 million servers over the next ten years [14].

D. Autonomy: An autonomous system, a cloud system configures and distributes hardware, software, and storage resources to clients on demand, all while maintaining transparent management for end users.

Challenges: Firstly, in order to provide a safe and highly effective service, cloud computing needs an improved mechanism because of the numerous third-party software and infrastructures that are being used in computing. Due to the large quantity of electricity that data centres use, effective resource scheduling techniques and methods are required to preserve energy. Furthermore, in cloud computing, consumers and service providers establish a Service Level Agreement (SLA), which necessitates tracking service performance and analysis. And lastly, cloud computing service providers cannot function without easy-to-use application interfaces.

VIII. CONCLUSION

The rising use of mobile phones is causing a daily evolution of mobile applications. Due to the rise in mobile usage, consumers desire to utilise every feature available on their mobile device. This is an essential area of research since cloud computing is opening up new options in this industry.The amount of computations in domains like science, technology, and commerce is growing daily. MCC has been concentrating on improving its mobile constraints and leveraging virtualization approaches to increase its power in recent years. As was previously said, a variety of MCC models have been proposed; nonetheless, they are all devoid of application privacy. To guarantee both protection from harmful attacks and unauthorised access, a security system is necessary. You can utilise the MCC privacy framework to address this problem. This technique offers a method for setting up a virtual private network to keep an eye on user activity and the authentication system. To make mobile cloud computing and data management policies viable and dependable in the future, a standard should be developed to address these problems. This work lays out a roadmap for further studies and suggests some possible avenues for this topic.

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