ANALYSIS ON MOBILE CLOUD SECURITY AND COMPARISON OF EXISTING MODELS

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Abstract:

The explosive emergence of Cloud Computing and its services are now everywhere in the World and it is one of the well-known technologies that we are using for both research and development activities nowadays. As small and medium organizations or companies are moving to Cloud Computing because as it supports rapid access to their applications and limits the cost of infrastructure. Cloud Computing for mobiles refers to Mobile Cloud Computing (MCC) as it is the collection of Mobile Computing and Cloud Computing to get one of the industry trend words and the major threads in the IT world since 2009. As business is growing using the computational resources on a pay as you go Model. This paper highlights the benefits and modern MCC uses and issues of MCC are briefly explained and also the security mechanism. MCC is investigating immense in IT due to anyplace whenever information gets to. Cell phones are empowered with rich client experience particularly, smartphones. Apple, Google, Facebook, and Amazon are the main four horsemen in the mobile world. That is the reason versatile distributed computing innovation is developing quickly among the clients and simultaneously, it presents new security dangers moreover. In MCC, a great deal of examinations is being done to annihilate the issues to make IT more solid and secure because all the more valuable information is put away in the Cloud condition. As the Internet-empowered cell phones, tablets keep on developing, online noxious dangers will keep on expanding in number to make more mind-boggling. Making sure information is more basic in the Mobile Cloud environment. In this paper, the working ideas of MCC and its different security issues and arrangements are given by analysts are broke down and also compare with different models.

***Keywords*:** Mobile Cloud Computing, Mobile Cloud Security, Mobile Cloud Networking.

1. Introduction

MCC applications are internet-based and multi-platform that may be installed on differing kinds of mobile devices with varied operational systems. So, for example, if a user enters a photograph on a Cloud app put in on her Smartphone, she will access that image on the same Cloud app put in on her pill and/or portable PC that has totally different operational systems.

Today, there is a good vary of Cloud apps: instant electronic messaging (WhatsApp, Viber), taking notes (Evernote), photo sharing (Snapchat), and file storage and sharing (Google Drive, Dropbox), etc. Even though MCC fulfills several mobile device users' desires and provides tremendous deserves, they arouse privacy considerations regarding revealing personal info to those apps.

On the opposite hand, Cloud Computing literature highlighted many blessings of Cloud apps: (a) period of time application response; (b) increasing the mobile device performance; (c) scalability; (d) reliability; (e) less energy consumption; (f) a lot of knowledge storage capacity; (g) enhancing process power. Thus, these prices and advantages of revealing personal info to MCC apps create a quandary for individuals to use these apps.

This study has many vital contributions to privacy and Cloud Computing literature: 1st, the majority of privacy studies regarding MCC apps read the development from a technical perspective to debate how MCC suppliers will use new privacy practices. However, we tend to believe that as long as MCC suppliers do not recognize what factors influence their customers' privacy considerations regarding victimization MCC apps, a group of individuals still don't use such applications whether or not MCC suppliers acquire the newest privacy and security solutions. Since behavioral aspects of MCC apps privacy have received very little attention, this study opens new views on individuals' privacy considerations regarding victimization MCC apps.

Second, it's prompt that privacy be examined in several contexts so individuals' attitudes towards business apply are utterly understood. MCC apps incorporate plenty of disparate applications and have distinct options, but the previous studies mentioned either privacy on the web that's a really broad thought and will not think about specific options of different technologies, or privacy of specific applications (i.e., location-based service mobile applications) that's a really slender concept. The options of MCC apps are hybrid and mix those of net and mobile applications while adding options that are specific to privacy analysis. This study extends privacy literature by securitizing privacy perceptions regarding all kinds of MCC apps and provides insight into the privacy considerations that ought to be taken into consideration by MCC applications providers to develop their applications.

2. Research Challenges

The key exploration difficulties can be represented as an expansive examination of security issues in MCC as it has a few preferences for both versatile clients and Cloud specialist co-ops, it faces a few difficulties that make it more confused than customary Cloud Computing. We have written this research paper as given as follows. Section 3 highlights the literature survey. Section 4 and 5 highlights the architecture of MCC and Mobile Cloud security concerns. Section 6 limelight the various security concerns in MCC. Comparison of existing models discusses in Section 7. Mobile Cloud networking is given in Section 8. A tabular representation of existing model comparisons has been narrated in Section 9. Finally, Section 10 and 11 discuss about the analysis and the conclusion and future research scope respectively.

3. Related Research Works

The security of utilizations manages the assurance of mobile applications or mobile application models, which utilize the Cloud assets to offer better types of assistance for mobile clients in the MCC condition. Our early works [19-29] was completely based on Cloud based environments to find out different parameters. Kun Yang et al. have discussed [2] Mobile Cloud Computing and networking. Mobile Cloud Computing implications and challenges [3] are described by M. Rajendra Prasad and Ronnie D. Caytiles et al. [4] have described the security concerns for MCC. Whereas in [5] authors have explained the MCC security considerations.

Authors in [6] [7] have described the framework for secure data processing in MCC. Authors in [30] have devolved an advanced Q-MAC which is basically used for optimal resource allocating for dynamic application in Mobile Cloud Computing using QoS with cache memory. L. Pallavi et al. [31] [32] have developed two algorithms i.e. ERMO Algorithm and BTS algorithm for an energy efficient mobility management in Mobile Cloud Computing system for 5G heterogeneous network. They have also in [35] described about mobility management challenges and solutions in Mobile Cloud Computing system for next generation networks. In [33] authors have narrated PIOCM which extensively defines the properly identifying optimized Cloudlet in Mobile Cloud Computing. In [34] Sairam, V.P.N et al described a User

privacy-preserving encryption strategy out sourcing data in Mobile Cloud Computing. Nalajala, S. et al. [36] have described a light weight secure data sharing scheme for Mobile Cloud Computing. Ravindranath, K. at al in [37] narrated a Dynamic optimization local search offloading algorithm for Mobile Cloud Computing. Hoang T. Dinh et al in [38] have extensively studied the MCC architecture, applications and approaches.

4. Architecture of MCC

From the concept of MCC, the general architecture of MCC is shown in Fig. 1. In this architecture, mobile devices can get to Cloud benefits in two different ways, i.e., through portable base stations e.g., base handset station (BTS) and passageway, or satellite. This sets up and controls the associations and useful interfaces between the systems and cell phones. Portable clients' solicitations and data (e.g., ID and area) are sent to the focal processors that are associated with workers giving versatile system administrations. Here, versatile system administrators can offer types of assistance to portable clients (for verification, approval, and bookkeeping) in view of the home specialist (HA) and supporters' information put away in data sets.

From that point forward, the supporters' solicitations are conveyed to a Cloud through the Internet. In the Cloud, Cloud regulators measure the solicitations to give versatile clients the comparing Cloud administrations. These administrations are created with the ideas of utility registering, virtualization, and administration arranged design (e.g., web, application, and information base workers).

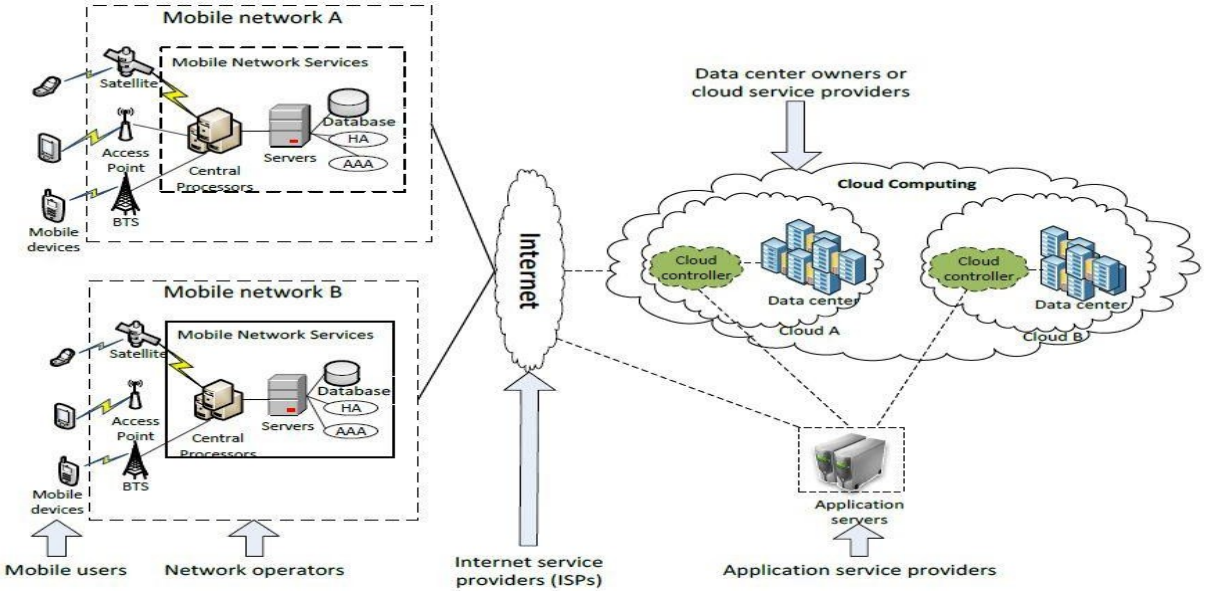


Fig.1 Mobile Cloud Computing Architecture [38]

5. Mobile Cloud Security

MCC conveys with it 2 significant parts: one is Cloud and another is portable devices. The last part and a couple of parts of the past have been referenced inside the previous areas. In our survey it has been referenced that to understand a protected mobile Cloud structure, in elective words, a safe mobile Cloud cannot be accomplished while not introductory creation certain a safe Cloud condition. For this reason, have we tend to referenced widely gauges required to ensure the security of the Cloud. This area examines the security issues/difficulties of the mobile Cloud that we will, in general, accept joined with the data assembled from the audits allotted on Cloud security can ensure achievement in arranging a safe portable Cloud engineering. Fundamentally the wellbeing issues in portable distributed computing are identified with (1) security issues in the Cloud, (2) security of the phone and (3) the security of the line between the Cloud assets.

6. Security Concern

In this space of Mobile Cloud Computing security problems arises in 2 totally different components one belongs to mobile phones and mobile network security and another is security on Cloud i.e. Cloud security.

6.1. Cloud-based Security Concern

Cloud gives stockpiling and calculation and furthermore besides the data keeps on the Cloud needs security [13] which depicts the Cloud security front in 3 little print. First is to remain the data taken care of inside the Cloud secure which proposes the information kept by the customer couldn't be gotten to by the untouchable so for that the information is taken care of in mixed kind on the Cloud in any case that data is also known to the Cloud supplier in Associate in Nursing decoded kind as encryption is performed by the Cloud suppliers only with the objective that they should be solid.

6.2. Securing Mobile Cloud Requirements

1. Integrity: In integrity the information keeps on the Cloud by the client through the cell phone should be incorporated. Clients should capture any place the information is solid and who will get to it and each entry should be approved consequently therefore no run of the secret data is finished.

2. Authentication: In authentication the major issue when compact contraptions purchaser gets to the data keep on Cloud each passage ought to be ensured so the customer will get to data related with them solely no unapproved get to ought to be appropriate and this should be conceivable by various check instruments like giving login ids passwords, pins to particular customer to affirm their character which grants them to incite admittance to their information ardently.

3. Digital rights management: Computerized media are getting pilfered just because of their essence on Cloud obviously. Media like recordings, pictures, sound, and eBooks are wildly gotten to with the goal that they should be whole in encoded kind so no theft of the individual media fundamental to the client will get an irresistible specialist on the net unlawfully.

7. Comparison of Existing Models

7.1. Smartlab Architecture

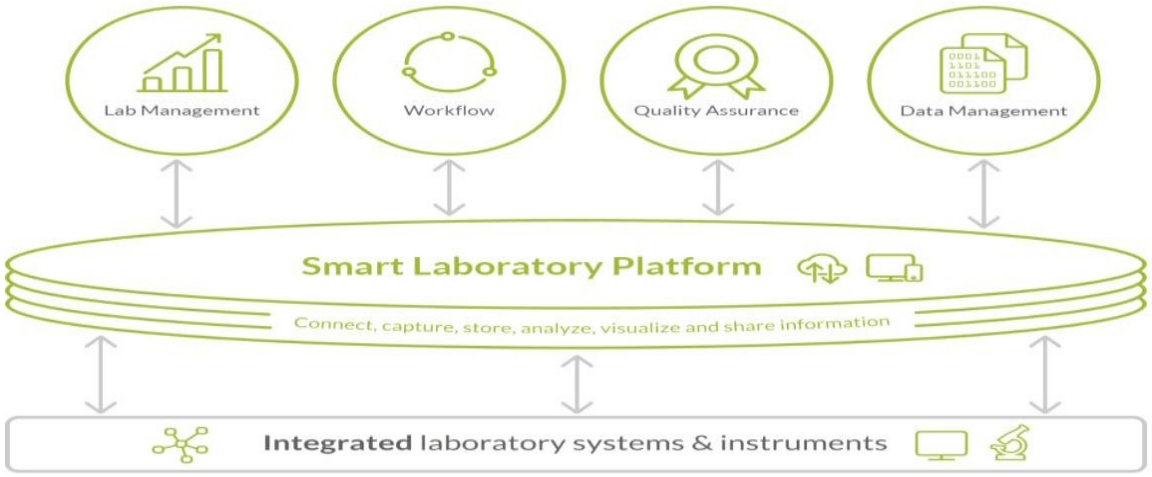
SmartLab is an experimental test bed of about forty plus real android smartphones and emulated devices running android operating system. This system is deployed at the Computer Science department infrastructure building at the University of Cyprus. This enables the registered users to achieve the following tasks, once they have to download and install the apk or the executable file on their device.

- Upload and install apk file on a variety of android running devices,
- Capture output
- Rebooting of devices
- Create jobs which are interactive using Monkey Runner Scripts
- Full remote device interaction, and many more

The basic aim of SmartLab architecture is to facilitate and promote research in a network of mobile Cloud programming environments and to improve communication protocols and system designs and other applications. This comprises of an air conditioned laboratory with a connected network of forty plus smartphones featuring Wi-Fi coverage. These smartphones are mounted to a VMware Vcenter remotely located in a cluster of rooms using local proxies. Android ADB server is used to instruct and execute all the commands throughout the connected network of smartphones. And all these states of connections are maintained in a MySQL database.

7.2. Smartlab Work Flow

The workflow of SmartLab architecture is divided into 3 phases with each consisting of several steps in between the individual deployment i.e. resource allocation, document transfer and cooperate with devices.



.Fig. 2 Smartlab Workflow

Operations

Coming up next are the utilization of the design:

- **SmartTrace** : This is a structure that is publicly supported which is utilized for executing conveyed likeness looking through questions dependent on the directions that are put away on the associated system of the cell phones
- **SmartP2P**: This is a novel system intended for looking through articles, for example, pictures, recordings, and different documents. These are caught by the current client in a network that is worried about client security.

Future Work

- SmartLab is open to the public for registration
- New Features such as Web 2.0 GUI, Eclipse Plugin, Crowd sourced Platform
- Scientific publication summarization of SmartLab Experiments

8. Mobile Cloud Networking

In recent times, MCC is becoming very dominant in the driving of the IT industry. The Mobile Cloud can be defined as the combination of mobile device, network, storage and non-localized computing, with several features like on-demand and pay as you go service.

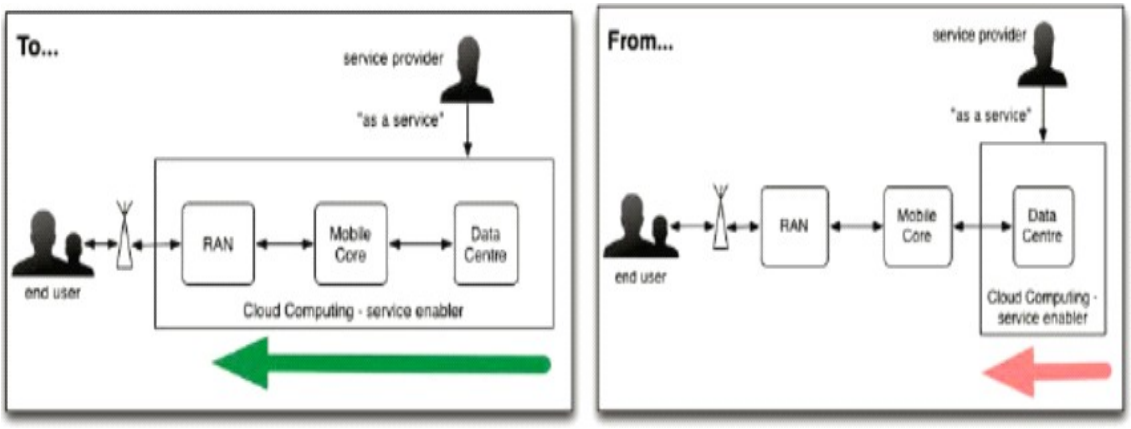


Fig.3 Mobile Cloud Networking

One of the significant issues of Cloud Computing is the development of programming businesses that isn't comprehended by telecom specialists.

8.1. Objective of Mobile Cloud Project

- Prototype creation using novel mobile network architecture and technologies using the proof-of concepts.
- Expend the support and elasticity of novel mobile services that are currently existing over the globe.

The investigation, implementation, and assessment of the mechanical establishment for such a framework is the primary objective of Mobile Cloud Networking. This will bolster continuous help and on-time execution which is more productive. These can be founded on a baseband unit parade and QoS Control. This is going to run on an upgraded portable Cloud stage utilizing the product accessible equipment.

This can only be achieved by a greater unit of a decentralized procession of the data which is purely based on the load balancing factor. This also provides Wireless, mobile core, and End to end SLAs and through the follow me Cloud concept. This project is leading the technical Part of the project is controlled by SAP and ZHAW.

8.2. Mobile and Distributed Computing (MDC Lab)

As we are discussing on MDC, we first know what Mobile Computing and Distributed Computing is. MDC which targets on three things that are architectures, protocols and platforms in mobiles and distributing computing. The gathering plans to create calculations, apparatuses, and advancements which offer vitality productive, blame tolerant, adaptable, secure, and elite registering administrations. The exploration interests of the gathering incorporate portable processing, distributed computing, matrix figuring, and substantial scale disseminated frameworks, universal registering, mist figuring, superior frameworks for enormous information examination, green processing, versatile/specially appointed systems, and security. MDC is as of now taking a shot at numerous examination extends and teaming up with research gatherings/labs around the globe. Mobile Computing is becoming very dominant in the driving of the IT industry. In 1990, mobile phones are meant for voice calls and messages. Mobile Computing can be defined as the combination of mobile device, network, storage and non-localized Computing.

The basic aim of Mobile Computing is to promote research in the network of mobile Cloud programming environments.

8.3. Distributed Computing

It is a term used to solve big problems from many computers. One method to solve big problems by using a supercomputer. As supercomputers are very expensive so many researchers do not use it. Another way to solve the problem to split the big problem into smaller problems. An example where Distributed Computing is used is the Great Internet Mersenne Prime Search. Another way to define Distributed Computing that it is a field of software engineering that reviews circulated frameworks. A distributed system is a network that consists of self-ruling PCs that are associated with utilizing a conveyance “middleware “. It allows resource sharing and allows the users with a single and integrated coherent network.

The advantages of Distributed Computing are:

1. Telecommunication network
2. System applications that are the internet and distributed system.

Future Work for Distributed Computing are:

1. Move to micro services.
2. Other teams and companies run and manage our services and infrastructure.
   This makes the future of Mobile and Distributed Computing looks increasingly exciting.

8.4. Mobile Cloud Computing (MobCC Lab)

In recent times the Mobile Cloud Computing is becoming very dominant in the driving of the IT industry. Mobile Cloud, as the name, suggests that it is the combination of Mobile device + Network + Storage + Non-Localized Computing. Have various features like On-demand and pay as you go service. Mobile Cloud

Computing Lab is deployed at the Faculty of Computer Science and Information Technology at the University of Malaya.

The various advancements in MobCC lab are given as follows:

1. Advancement of novel technologies and structures utilizing the model with the verification of-idea to change the current, versatile structure and change to entirely Cloud-based portable frameworks.
2. The extension of Cloud Computing to support the elasticity and provisioning of novel mobile services.
3. Creation of the concept of business support systems that are fully embraced with mobile Cloud notions.

InIT Cloud Computing Lab (ICCLab)

ICCLAB is an examination lab expanding and driving the Cloud figuring exploration and instruction. This lab research is driven by Prof-Dr. Thomas Michael Bohnert and it is useful under the Service Engineering gathering of Zhaw's InIT (Institute of Applied Information Technology) fuse with the Splab. It comprises of various foundations, levels of understanding, and nationalities. An exploration group is a functioning gathering whose space exists in Swiss and EU research fields and furthermore critical two-sided exercises with neighborhood Swiss organizations.

ICC LAB FEATURES

- It has an all-around thought and creative examination approach.
- It is fundamentally concentrating on Education.
- It is dynamic in MCC ventures.
- It produces open-source free software.

Mobility, ubiquity, and anyplace, whenever, anything joined with on-request benefits is the forces of the Cloud. Mobile and Cloud Computing are the two transformations driving and pushing its industry in recent and upcoming years.

Objectives

- To build up a worldview and advancements, utilizing calculated models, to manage clients from current mobile structures to completely Cloud-based mobile frameworks.
- To stretch out Cloud Computing to help client's on-request administration and adaptability of offering types of assistance.
- To grow new ideas for operational and business emotionally supportive networks that completely rise the progression of mobile Cloud.

8.5. Mobile and Cloud Lab

Mobile and Cloud Computing Laboratory is arranged at the Institute of Computer Science, Faculty of Science and Technology, University of Tartu. It oversees exploration and instructing in the field of portable registering and distributed computing territory. It for the most part centers on the business inclining points like Cloud Computing, versatile application advancement, mobile Cloud, mobile web benefits, the Internet of Things, and are moving towards logical registering and undertaking and modern applications to the Cloud.

Research works

- Cloud Computing-The research objective here is to mull over the development of enormous business applications to the Cloud and to think about their execution on the Cloud.
- Scientific Computing On Cloud-The research objective here is to consider the development of intelligent figuring applications to the Cloud and to diminish the mass weight on these applications and counts to Cloud Computing structures like MapReduce.
- Mobile computing-This research manages to create mobile applications for different stages and gadgets (for example, Android, iOS, Windows Phone 7, and so forth). It additionally manages to secure and using sensor information in building and dealing with applications for various areas.\Mobile Cloud-The objective of this research is to research how to proficiently and achieve extreme use of Cloud assets inside a Cloud application (otherwise known as mobile Cloud applications).

- Mobile Web Services- This research topic manages the conjuring, provisioning, revelation and combination of web administrations from PDAs, in creating mobile applications.
- Internet of Things-The objective of this research is to beaten the difficulties of digital physical frameworks in the Internet of Things. The difficulties incorporate interoperability, independent machine-to-machine correspondence, programmed design, vitality effectiveness, dependability, and so on.

9. Existing Models Comparison

Models	Security	Cost	Future Scope	Scalability
Smart lab Architecture	Smart trace and Smartp2p Are Used for Protecting the Privacy Of User	Low	Working on Web2.0 GUI And Eclipse Plugin	High
Mobile Cloud Networking	Implements of Various Security Algorithms for Seamless Experience	Medium	Working to Minimize Data Loss	Low
Mobile And Distributed Computing	Distributed System are Used as They are More Secure	High	Working to Provide Low Infrastructure Cost	High
Mobile Cloud Computing	High	High	Working to Minimize Data Fluctuation	Medium
Init Cloud Lab	Peer Too Peer Encryption	Medium	Stabilizing and Initiating VM Migration	Medium
Mobile And Cloud Lab	Various Encryption Algorithms Used At Both Ends.	Low	Image Sensor and Tools To Direct Migrate On Cloud	Medium

10. Analysis

Cloud Computing is that the model offers a couple of sorts of help and now used for security works conjointly. There exist genuine issues that choice for worry about this new variety of innovation anyway some of these contemplations are unimportant bits of gossip with none premise of defense. One of the significant concerns alluding to this imperative subject of intrigue (Mobile Cloud Computing) is that of security (KPMG, 2010), that this examination has focused on. In leading this investigation, we will in general have made an undertaking to explain the wellbeing challenges that plague this developing innovation and have gone a stage extra to proffer achievable moderation plans or answers for rib these security contemplations. Through an escalated audit of significant writing, we have been prepared to get statistical data points identifying with the expected dangers of interest in Mobile Cloud Computing. we will, in general, didn't complete our existence discovering drive on just information accumulated from instructional exercise examination or materials. Outfitted with information from trusty gatherings we tend to have the option to set up what some of the significant contemplations are tied in with receiving versatile Cloud Computing. With an unmistakable order knowledge, we will in general proceed with investigating and causing out polls to detect some of the courses through that the setup contemplations are regularly settled subsequently on blessing a feasible response to reestablishing trust in portable distributed computing, considering the tremendous edges of Mobile Cloud Computing and Cloud Computing; a premier examination group has tipped distributed

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11. Conclusion & Future Research Scope

It can be inferred from the detailed study of the models and the comparison table that the SmartLab architecture is the best of all the existing models. The Smartlab architecture offers good security, is low in cost, has a great future scope and offers max scalability among all 6 compared models. This paper researches the ideas of Mobile Cloud Computing (MCC), testing security issues and penetrates, different existing security systems, lastly, a few arrangements that expansion the security in the Mobile Cloud Environment. The majority of the systems neglected the security of client information protection, information stockpiling, and vitality safeguarding information sharing. Client information protection and mobile application that utilizations Cloud are the most testing factor. To accomplish greater security in the portable Cloud condition, dangers should be tended to and concentrated as needs be. To address all these security issues, the information security plan should be created which decreases the security dangers and furthermore reduces expenses and multifaceted nature to receive Cloud Computing in a portable domain. It is basic to remember that the structuring of things to come system arrangements ought to be more practical and ought to give better security and execution today.

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