Academic Guru Publication House

Advances in Cloud Computing Security
Techniques and Applications
Volume 1
Year: 2021

AG PH Books

Mobile Cloud Computing Applications survey: Security and Privacy

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Abstract

Mobile cloud computing, a novel approach for mobile computing that has been in development for decades, results from the combination of powerful mobile devices and cloud computing services. The MCC enables cloud computing to be integrated into the mobile environment and solves performance issues. As a result, The Cloud Technology is able to transcend the limits of mobile computing. For mobile apps, cloud technology offers adequate computational capacity to operate on a cloud platform. By offloading applications to a resource-rich Remote server, the novel technology known as mobile cloud computing (MCC) is introduced to overcome the limitations of mobile devices (such as battery life, storage capacity, processing capacity). MCC integrates two technologies (Mobile Computing, Cloud Computing). MCC is described in this study, as well as security and privacy issues, threats, and obstacles that are associated with MCC.

Keywords: Computing of Mobile, Cloud Computing, Mobile Cloud Computing, security.

1. INTRODUCTION

Mobile gadgets have played a significant influence in our contemporary and virtual lifestyles during the last couple decades. For example, according to an International Data Corporation (IDC) report in 2016, the use of tablets and mobile devices grew by 1.6 billion units [1]. For a variety of reasons, mobile apps have become more popular over the last several years across a wide range of industries. Apps may

* ISBN No. 978-81-955340-6-7

be downloaded from Android play store and Apple iTunes, regardless of location, thanks to mobile computing. Despite the high-end capabilities of mobile cloud computing for executing a variety of real-time apps, consumers continue to ask for greater processing power. The battery life, storage capacity, processing power, and connectivity capabilities of mobile computing devices are all constrained.

In its most basic form, mobile cloud computing (MCC) refers to a system in which data storage and processing take place outside to mobile device. As an alternative, MCC may be described as a mix of the mobile web and cloud computing, which is the most common method to access apps for mobile users and the Internet services.

2. MOBILE CLOUD COMPUTING

Computers and other devices are given with shared resources and information (such the electrical grid) across a network as a service rather than a product, and this is known as Cloud Computing (typically the Internet). An end-awareness users of the physical location and system setup is not required in order to utilise this service. Computing, communication, and storage resources which are shared in a virtualized and isolated environment by many users that are the primary focus of most of the cloud research.

- There are several common obstacles for mobile devices (battery life, storage, bandwidth etc.)
- Using cloud computing infrastructure, platforms, and applications is a low-cost and scalable way for consumers to benefit from cloud computing's benefits.
- Since all resource-intensive calculation may be performed in the cloud, a strongest device configuration (e.g., CPU performance, RAM capacity, etc.) is not required for mobile cloud computing.

For example, base transceiver stations (BTS, access points or satellites) create and regulate the connections (air links and functional interfaces) between the mobile networks and mobile devices shown in Figure 1. Central processors linked to servers delivering mobile network services receive mobile user requests and information (e.g., ID and location).

Using the home agent (HA) and subscriber data stored in the database, mobile network operators may deliver mobile users services like AAA (authentication, authorization, and accounting). Subscriber requests are then sent to a cloud computing facility via the internet. Requests for cloud services are processed by cloud controllers in the cloud, which then supply the services to mobile users. The utility computing, virtualization, and service-oriented architecture principles are used to create these services (e.g., web, application, and database servers)

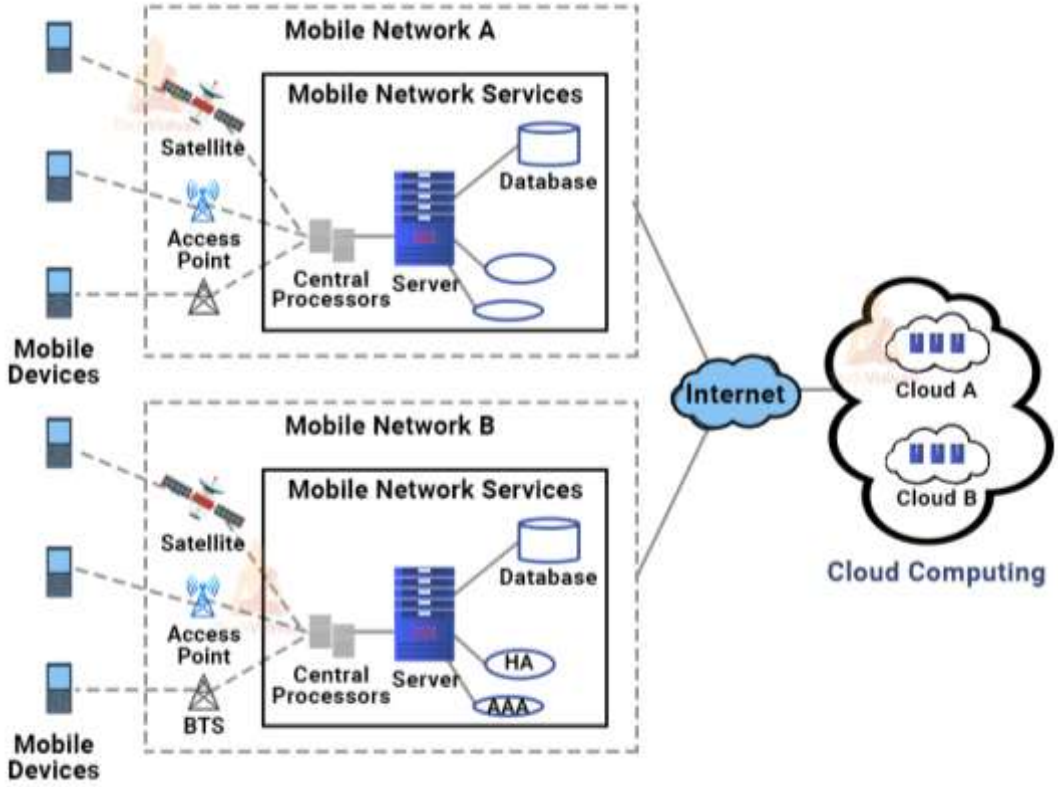

Figure 1: Mobile Cloud Architecture

3. MOBILE CLOUD COMPUTING SERVICE MODELS

Similar to CC architecture, these services are utilised to develop the MCC's infrastructure. [2]:used to build CC architecture [2]:

- *Mobile Cloud Infrastructure-as-a-Service (MIaaS)*—In a pay-as-you-use model, computation, storage, network components, and devices are supplied, managed, and returned in response to a customer's request in a pay-as-you-use model. There are two ways to set up the mobile cloud's infrastructure:
- In the pay-as-you-go model, clients are offered mobile cloud infrastructure and resources in accordance with value of their payment, where compute, storage resource and network components are provisioned, maintained & returned to clients according to their request.
- *Mobile Network-as-a-Service (MNaaS)*—As a result, the vendor may react to on-demand requests from customers and dynamically create, implement, and design a wireless network infrastructure for mobile connection, to cloud infrastructure. Because of its scalability and flexibility, the startup costs are inexpensive. Consider OpenStack, Google App Engine, and

Microsoft Azure, just to name a few examples.

- *Mobile Platform-as-a-Service (MPaaS)*—App hosting, development, validation, and deploymenttools are all supported by this service. App Mobi, for example, is a tool that aids in the creation, distribution, and validation of mobile applications (as easy as possible).
- *Mobile Software-as-a-Service (MSaaS)*—This kind of software is delivered to customers in form of Mobile Software-as-a-Service (MSasS). Thin mobile client-based Internet connection is used in this paradigm to enable to access mobile application services (deployed and operated in the cloud) to the mobile users.

The following are the main categories into which Mobile Cloud Computing applications may be broken down:

- Sensing capability: It is possible to use a smartphone as a sensor. Some of the properties that sensors are capable of monitoring are humidity,temperature andblood pressure. Sensor data may be uploaded to cloud at a further time. Information stored in the cloud is available to a global audience.
- With mobile cloud, users may pick what information they want to keep private and what information they want to make available to the public.
- Reliability and Data storage: Cloud storage preserves and backs up users' data if there is a problem with their device.
- Personal information security: When a storage device fails, users' data is safely stored in the mobile cloud, where it is automatically restored.
- In the cloud, virtual computers and a secure search engine work together to increase the security of user data.
- Health monitoring: Sensors may be used to store and send personal health information to the cloud through mobile devices. To help people maintain their health, health care providers may access such information in the cloud and provide them advice. For health monitoring, mobile devices may be utilised as sensors, too.
- Sensing as a service: The mobile cloud offers platform,infrastructure, and software as a service for sensing purposes. When it comes to using several programmes, compatibility isn't a problem.

4. MOBILE CLOUD COMPUTING APPLICATION

The worldwide market for mobile apps is growing at an accelerating rate. MCC has been included into a variety of mobile apps. Mobile commerce, mobile learning,mobile healthcare,mobile social networking, mobile sensing, multimedia sharing, mobile gaming, location-based mobile service, and augmented reality are some of the current examples of MCC applications. As a result of simultaneous user access and transaction processing, mobile commerce such as e-banking, e-advertising, and e-

shopping makes advantage of scalable processing capacity and security mechanisms. Security and administrative controls are provided to guarantee that smartphone users have the privileges and access permissions essential for secure viewing and sharing of multimedia material. Learning resources on the cloud may be accessed at any time and from any location thanks to mobile learning. Many MCC applications, including healthcare, social networking, and environmental/health monitoring, will be revolutionised by mobile sensing using sensor-equipped cellphones. Massive amounts of patient data may now be saved in cloud in real time thanks to mobile healthcare. Scalability in mobile gaming is achieved by the use of scalable compute in the cloud and real-time data updates on the mobile device. It is possible to upload audio/video/multimedia material for real-time sharing through mobile social networking, with cloud computing offering not only storage but also security to safeguard the confidentiality and data integrity.

5. ADVANTAGES AND DISADVANTAGES OF MCC

Some benefits of Mobile Cloud Computing are [3]:

1) Extending Battery Lifetime—One of the most significant considerations to every mobile device maker is the battery's lifespan. Many approaches to reducing power usage have been put out so far, such as optimising CPU performance or adjusting screen brightness. Improvements to the mobile infrastructure (hardware) are required to make these modifications viable, however these changes may have an impact on manufacturing costs and may not be achievable on all devices. Computing offloading, a method for moving resource-constrained devices (such as mobile devices) to the cloud, has been presented as a way to address all of these issues. This reduces the amount of energy needed to run apps that take a long time to complete.
2) Improving Storage Capacity—In today's mobile devices, the most common issue is a lack of available storage space. MCC have solved an issue that has plagued the mobile industry for years. Users of mobile devices may now store and access almost unlimited amounts of data in the cloud. Amazon Simple Storage Service [Amazon.com/s3], Flicker, Facebook, and many more apps employ this cloud approach.
3) Reliability—When data backup was put into mobile phones, it improved even more since data that had been lost (even accidentally) could no longer be recovered. It was MCC that revolutionised the storing of data (by users). Cloud storage means that data may now be accessible from any (different) device.
4) Dynamic Provisioning—It has long been an issue in operating systems to have to wait for a resource while a process completes its job. There are numerous scheduling algorithms that may be used to distribute resources to process based on its wait time. Introducing dynamic on-demand resource provisioning as a flexible option to execute programmes without reservations or wait times for resources was MCC's solution to this challenge.

5) Scalability—In order for a service provider to satisfy the needs of its customers on a daily basis, they must be able to adapt quickly and easily. With MCC's flexible resource provisioning, the applications may be extended (add/modify) with little or no limitation on the resources used.

6) Multitenancy—There are several ways to save production costs in software, and multitenancy is one of the most effective (e.g.: network operator, data centre owners, etc.).

Some drawbacks of Mobile Cloud Computing are [4]:

1) Security—For years, the security of user data has been a top priority. Users of mobile devices save critical data on the cloud, which must be safeguarded to prevent severe losses. As a result, one of MCC's drawbacks is the inability to adequately safeguard user data.

2) Performance—Two things that have always been a concern for mobile devices are performance and user experience. When comparing the mobile app to the original, there would be significant reductions and modifications (that we use in desktop). For instance, Chase offers its customers a mobile banking app (to make transactions easy and fast). Things like "Things you can do" are missing from the mobile version of the programme compared to the PC/desktop version, which has more features (that cuts down performance).

3) Connectivity and Latency—In data transport, latency and connectivity play a significant impact. Data transmission may be slowed down or even halted entirely by a single weak signal or weak link. Because weather, signal traffic, and other factors such as these may easily impact bandwidth and signal strength, the service provider should do frequent checks on these parameters.

4) Compatibility—In order for a mobile phone to switch operating systems, it must be able to work with a wide range of devices and apps. It is difficult for a service provider to function in a consistent environment due to the usage of multiple applications for different technologies, which reduces compatibility.

5) Limited Resources— Memory storage, battery, and other variables have weakened mobile devices' ability to receive and analyse information. This is due to the fact that mobile devices have less processing power than a desktop/PC. Because of their resource limitations, mobile devices have become a roadblock in MCC.

6. MOBILE CLOUD COMPUTING ISSUES

Mobile communication issues:

- ✓ Low bandwidth: Low bandwidth is a major problem in mobile communication since radio resources for wireless networks are substantially more limited than those for wired networks.
- ✓ Service availability: Because of traffic jams, network outages, and poor signal strength, customers' mobile devices may have trouble accessing the cloud to utilise a service.
- ✓ Heterogeneity: In order to meet MCC criteria (always-on connection, on-demand scalability, and efficiency of energy), it’s challenging to handle wireless communication with extremely diverse networks.

- Problems with computing: Offloading of computing:
- MCC has one of the most important characteristics.
- Energy savings may not always be achieved by offloading.
- There are a number of considerations to keep in mind when deciding whether and how much of a service code should be offloaded.

7. CONCLUSIONS

Because of the rapid rise in data computing, data processing capacity is increasingly seen as a critical resource in many nations. Mobile cloud computing, which combines the benefits of both cloud computing and mobile, has opened up a number of new research avenues in recent years. The combination of cloud computing with mobile devices in mobile cloud computing is an important method to improving capabilities of real-time applications. Mobile devices are utilised to gather data from any location, while the cloud is used for data processing and delivery. There are several uses for mobile cloud computing. Different MCC applications, such as mobile health monitoring, MMS, MCC in the military sector were explored in this article. Mobile cloud computing, on the other hand, has certain drawbacks, such as the risk of data loss when mobile devices save and retrieve data from the cloud. As a result, we must enhance the level of protection for users who need to authenticate in order to access data.

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