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## *Mobile Computing: A Review*

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### **Abstract**

Nowadays, smartphones have become very famous and are deemed as the foremost communication device in the world. These light and small devices enable their users to transit from one network to another quite easily. Furthermore, mobile-devices decrease the processing data cost besides the time of execution in order to achieve rapid outcomes. Because of these characteristics, novel conceptions in education and industry are emerging, such as BYOD “Bring Your Own Device”. This conception, which is quite new, seeks to utilize personal devices as work elements and will support industry to incorporate a lot of applications on mobiles .This leads to, making the organizations less reliant on desktop execution-power and create more productive employers through smooth deployment operations that can be applied anytime and anywhere at a low cost.

**Keywords:** Smartphones, mobile-devices, BYOD (Bring Your Own Device)

**Note:** The research is based on an M.A thesis or a PhD dissertation (No).

### **1. Introduction**

Mobile computing involves an interaction between human and computer whereby a computer is likely to be brought through regular use. The advent of mobile computing has started a modern period in computing and information technology field. It is basically a technology that enables data transmission by a computer, with no need for any physical connection links between computers. Mobile computing provides an environment for computing with physical mobility. Many instances of the usage of mobile computing are available in our daily life involves on-line delivery

applications that verify persons through credit cards, taxi services that is based on applications of mobile devices, applications that are used to find locations (give information about weather and road statuses in real-time), applications of social media and e-mail on mobile phones and smart devices that can be worn for measuring and recording the statuses of patients in the medical field [1].

## 2. The Structure of Mobile Computing

i. The Communication of Mobile

ii. The Hardware of Mobile

iii. The Software of Mobile

**i. The Communication of Mobile:** can be defend as the infrastructure of mobile computing to guarantee a smooth and authoritative communication. That involves protocols, services, bandwidth, and portals to speed up and support the services of communication. Usually the overlying structure of communication is in the form of radio-waves because the communication medium is unguided, so the signals are transmitted to other devices via air. In conclusion, the communication of mobile can be considered as the area that is in charge of mobile computing technologies works.

**ii. The Hardware of Mobile:** can be defined as types of mobile devices that are used for the purpose of receiving or accessing the mobility service. Examples of such devices are: personal laptops, smartphones, tablets and Personal Digital Assistants (PDAs). These devices normally have a sensory receptor medium that is capable of perception, spotting and receiving incoming signals. Such devices are made to run in full-duplex, in which they have the capability to send and receive signals simultaneously [2].

**iii. The Software of Mobile:** can be defined as fundamental element that runs the mobile device. In other words, the software of mobile is the underlying programs that operates on the hardware of mobile device. Because the transmutation is considered as significant component in mobile computing, this type of computing guarantees that users aren't restricted to any location or bounded by any zone, so they can move anywhere they want. In conclusion, the mobile computing contains all wireless communications [2].

### 3. Mobile Computing Current Trends

One of the first trends in mobile computing was 3G-technologies, this technology considered as one of the most important mobile technology that are available in markets.

**1. 3<sup>rd</sup> Generation Mobile (3G):** Is known as universal mobile telecommunications standard (UMTS) and was introduced to improve GSM by three times. 3G technology was created in early 2000s when web browsers, emails, downloading pictures and videos and many mobile phone technologies were appeared in the area. 3G technology was intended for facilitating larger voice and power of data, backing various types of applications and raise transporting information in small cost. [12]

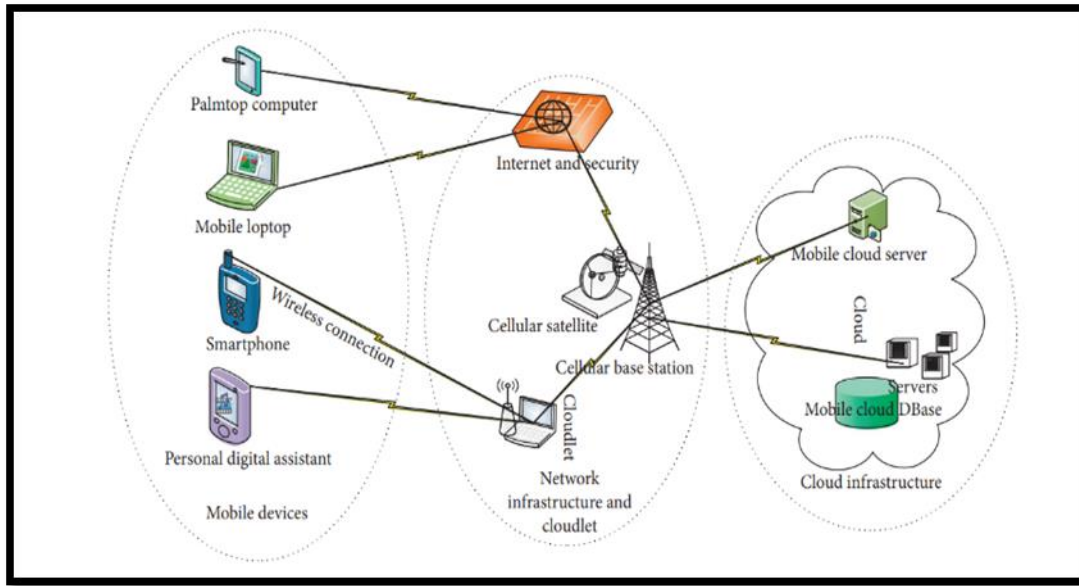
**2. 4<sup>th</sup> Generation (4G):** the 3G technology was later developed into 4G for supporting larger bandwidth and to offer better and faster services than 3G, it is suitable for interactive application such as gaming and streaming that need internet. Also it is sometimes known as Long Term Evaluation (LTE). [13]

**3. 5<sup>th</sup> Generation (5G):** This type of mobile cellular technology has an advantage of an advance level of activity compared to the past generations of mobile cellular technologies. The former technologies contributed in developing the new ones such as 5G, which has been affected by set uses applications. Also it provides pervasive connection for a various actions like downloading large videos, additive communications and actions of very low data rate such as remote sensors [3].

### 4. Mobile Cloud Computing

In the recent years, Mobile Cloud Computing (MCC) has been developed remarkably with regards to investigation as smartphones becomes a necessary device for everyone. It is easy to carry and effective, so it is very useful and appropriate for communications regardless of places or time. MCC signifies a new age of computing, in which the users of the cloud can make use of various services over the internet.

The improvement in mobile applications demands the mobile devices to be more advanced. Thus, the mobile devices may suffer from many difficulties such as the space of memory, strength of battery and the ability of processing. Therefore, the idea of offloading functions for the cloud has been incorporated into the concept of mobile devices. Figure 1, represents MCC system sight [4].



**Figure1: MCC System Sight.**

MCC is one of the most significant and useable technologies that can be utilized in various services such as:

**1) Mobile Commerce:** This is a business model that utilizes mobile devices for transactions. The applications of mobile commerce face issues related to poor network bandwidth and safety. However, these applications use the characteristics of 4G networks and cloud to enhance speed and improve safety in the operations of processing data. Similarly, a Fourth Party Logistics Advanced Video Coding (4PLAVC) trading platform utilizes the cloud to improve the safety of user's data, guarantee the satisfaction of users and preserve competitiveness.

**2) Mobile Learning:** based on e-learning. Conventional mobile learning and related applications are restricted by network capability, device cost, slow network transmission rates, and limited educational operations. Therefore, some cloud e-learning applications have been suggested to address these restrictions. The employment of large storage ability and strong processing ability, the applications of e-learning supply users with superior services. An instance of Mobile cloud computing is "Cornucopia" which is a tool that is used in education area, by undergraduate research students in the field of genetic aiming to make information obtainable and provide space for collaborative work. This tools was created based on cloud computing technology for making video and image processing courses.

**3) Mobile Healthcare:** mobile cloud computing is also used in medical field for minimizing the limitations of medical treatment in regards to privacy,

date security and storage. An example of mobile healthcare information that depends on cloud computing is e-health cloud.

**4) Mobile Gaming:** Cloud servers can remarkably reduce the load on mobile game engines which need huge computer resources like graphic reproduction, so that the players only react with the player interface on their mobile devices. This will help increasing the speed of mobile games as it conserves mobile energy.

**5) Mobile Banking:** Which includes applications that allow the user to make transactions, payments and balance checking with their mobile devices. Presently, mobile banking can be made with SMS and also by a certain apps that usually downloaded on the device based on the MCC concept [5].

## **5. Advantages and Disadvantages of Mobile Computing**

### **5.1 Advantages**

#### **1. Raise in productivity**

Reducing the cost and time for a company's personnel and clients, as the mobile devices can be utilized out in the field.

#### **2. Entertainment**

Mobile devices is also utilized for individual amusement purposes, and also in producing presentations and send them to personnel and clients.

#### **3. Portability**

Which is the ability to be moved freely and easily. It considered the prime advantage of mobile computing, as the individual is not limited to one physical place. Therefore they may achieve any computing task anywhere.

#### **4. Cloud Computing**

In which documents and files are stored on a remote server and the client will be able to access them anytime and anywhere as long as there's an internet connection.

### **5.2 Disadvantages**

#### **1. Connection Quality**

The first disadvantage of mobile computing is need to be connected to WiFi, 3G, GPRS or 4G connections. This is considered as a disadvantage due to that, if the users aren't nearby any of those, they have no access to the internet, and the apps won't work.

#### **2. The Concerns of Security**

The mobile connection to VPNs may not always be safe, also syncing with other devices might cause security problems. Additionally, a WiFi network considered as a risk because WEP or WPA security can be easily bypassed.

### 3. Power Consuming

Since mobile devices utilize batteries, the power charge is often not long. This is a limitation, especially when there is no source of power for recharging the device [6].

### 7. Mobile Computing Security

The problems and risks of security that are associated with mobile computing are composed of two types: first concerned with data transport, and the second is concerned with data being stored on mobile devices. In addition to that adding cloud to mobile computing may raise the challenges [11] as shown in figure2

- **Security problems of wireless network:** interception of radio signals by hacker, and of network not managed entirely by user, due to that many wireless networks rely on another private networks ran by others, therefor the users will have minimum security control on the data.
- **Device Security problems:** Various security attacks can affect the mobile devices for the purpose of stealing important data of users that are stored on these devices. [7].

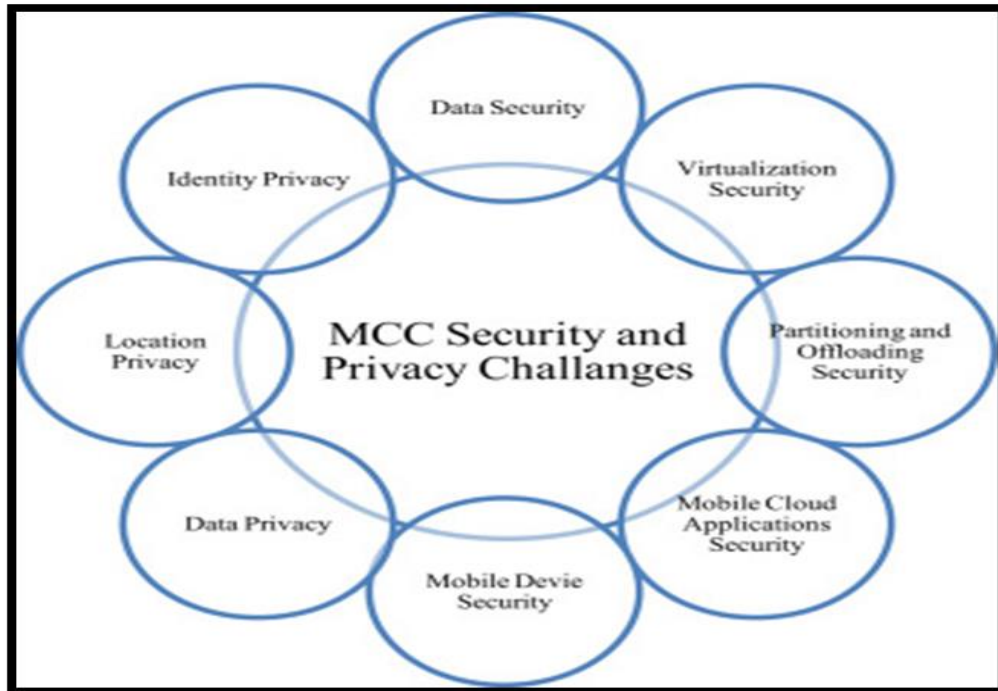


Figure2: Security Problems in Mobile Cloud Computing.

## 8. Recent Advances in Mobile Computing

### 1) Mobile Geospatial Computing Systems (MGCSs)

Geospatial Computing (GC) includes the use of computing devices along with specialized sensors to obtain, process, analyze, manage, and visualize geospatial data. Because of new advancements in mobile computing and sensor technology, modern mobile devices can achieve higher needs of geospatial computing. Thus, Mobile Geospatial Computing Systems (MGCSs) has progressed quickly [8].

### 2) Intelligent Healthcare Systems Assisted by Data Analytics and Mobile Computing

In Medical aspect, very helpful applications of mobile computing has been provided as supporting technologies for mobile healthcare. Smartphones applications are used by medical professionals in daily clinical practice. There's various medical software programs that enable individuals to execute office nursing tasks, such as time and information management or even reaching a clinical decision making. These systems architecture include **the data acquisition layer** as it collects the medical data of the user as its main function, **data management layer** (distributed file storage - DFS) and Distributed Parallel Computing (DPC), **and application service layer**. The latter involves three fractions: user interface, API, and data access. It provides the user with basic visual data analysis results [9].

### 3) Image Retrieval on Multiple Mobile Devices

Deep leaning has been used on mobile devices due to their high performance. Fine tuning the mobile devices can improve the deep learning quality of these devices. A light weight fine tuning technique is used to minimize cost to a level that it can be operated on mobile devices. That cost may be minimized even more through utilizing distributing computing on mobile devices. This method is applied to a group photoware apps called Lets Pic-DL. It only needs twenty four sec. to fine-tune a pre-trained Mobile Net with a hundred images on 5 Galaxy S8 units, this will result in an excellent photo retrieval accuracy reflected a 27–35% improvement [10].

## Conclusions

Mobile computing involves an interaction between human and computer whereby a computer is likely to be brought through regular use, that enables transmission of data, audio or video. Mobile computing is mobile hardware and software as well as the communications between them.

Nowadays computing is not tied to one location. By using mobile computing, persons can work from any place they wish as long as they have an internet connection and the necessary security. Since it is considered as a dynamic technology, mobile computing will be the future of most if not all computing and information transactions. This overview involves the growth of mobile computing and its future with the cloud and security issues. The mobile computing enables the producing and transmitting of video and audio recordings. Its benefits appear in movie making, personal chat material and academic research. The individual is capable of getting all the entertainment he wants as he explores the internet on his mobile device as long as there's an available and advance high speed data (internet) at a precise cost.

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### الحوسبة المتنقلة: مراجعة

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### مستخلص البحث:

في الوقت الحاضر ، أصبحت الهواتف الذكية مشهورة جداً وتعتبر جهاز الاتصال الأول في العالم. تتيح هذه الأجهزة الخفيفة والصغيرة لمستخدميها الانتقال من شبكة إلى أخرى بسهولة تامة. علاوة على ذلك ، تعمل الأجهزة المحمولة على تقليل تكلفة بيانات المعالجة إلى جانب وقت التنفيذ من أجل تحقيق نتائج سريعة. بسبب هذه الخصائص ، تظهر مفاهيم جديدة في التعليم والصناعة ، مثل BYOD "أحضر جهازك الخاص". يسعى هذا المفهوم الجديد تمامًا إلى استخدام الأجهزة الشخصية كعناصر عمل وسيدعم الصناعة لدمج الكثير من التطبيقات على الهواتف المحمولة ، وهذا يؤدي إلى جعل المؤسسات أقل اعتمادًا على حواسيب ال desktop وخلق أصحاب عمل أكثر إنتاجية من خلال سلاسة عمليات النشر التي يمكن تطبيقها في أي وقت وفي أي مكان بتكلفة منخفضة.

الكلمات المفتاحية : الهواتف الذكية، الاجهزة المحمولة، BYOD (احضر جهازك الخاص)  
ملاحظة : هل البحث مستل من رسالة ماجستير او اطروحة دكتوراه ؟ كلا.