Mobile Computing

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ABSTRACT

A technology that allows transmission of data via a computer, without having to be connected to a fixed physical link. Mobile voice communication is widely spread throughout the world. And also it has a very rapid number of subscribers for different types of cellular networks. It also defines that a device which permits the flow of transmission of data from one computer to another by never been connected to the physical link. This technology has the ability to send and receive data through the cellular network. This is the principle of mobile computing. The rapidly expanding technology of cellular communication, wireless LANs, and satellite services will make information accessible anywhere and at any time. It is human-computer interaction, by which human can communicate with the computer. It allows normal usage like it allows for the transmission of data, voice, and video. In the near future, millions of people will carry a laptop computer. Nowadays, most of the people also use this technology. Some personal digital assistants or personal communicators will run on AA batteries and it may have only a small memory; whereas larger ones and powerful will be laptop computers with large memories and powerful processors. Mobility and portability will create an entirely new class of applications and possibly new massive markets combining personal computer and consumer electronics. Mobile data communication has become very important and rapidly evolving technology. As it allows users to transmit and receive data from remote locations to other remote locations or fixed locations. This proves to be the biggest solution to the biggest problem of business people on the move or mobility.

Keyword: Existing cellular network architecture, Data Communications, CDPD Technology: The Hot Cookie, CDPD Network Reliability, Principles of Mobile Computing, Devices, Mobile Data Communication, Applications of mobile computing, and Limitations of mobile computing, Security issues involved in Mobile, Future, Conclusion, and References.

1. EXISTING CELLULAR NETWORK ARCHITECTURE

Mobile telephony took off and it introduces with the cellular technology. It allowed the efficient utilization of frequencies and enabling the connection of a large number of users. During the 1980's analogue technology was used. Among them, the most well-known systems were the NMT900 and 450 (Nordic Mobile Telephone) and the AMPS (Advanced Mobile Phone Service). In the 1990's digital the digital cellular network technology was introduced with GSM (Global System Mobile) and it will be the most widely accepted system around the world. Other such systems are the DCS1800 (Digital Communication System) and the PCS1900 (Personal Communication System).

A cellular network consists of mobile units linked together to switching equipment, which interconnects the different parts of the network and it allows to access the fixed Public Switched Telephone Network (PSTN). The technology is hidden from view.; it is corporate in a number of transceivers called Base Stations(BS).Every base station is located at a strategically selected place and covers a given area or cell – hence the name cellular communications. A number of adjacent cells grouped together from an area and the corresponding BSs communicate through a so-called Mobile Switching Centre (MSC). The MSC is the heart of cellular radio system. It is responsible for routing or switching calls from the originator to the destination. It can be thought of managing the cell, is responsible for set-up, routing control and termination of the call, for the management of inter-MSC handover and supplementary services, and for collecting charging and accounting information. The MSC may be connected to other MSCs on the same network or to the PSTN.
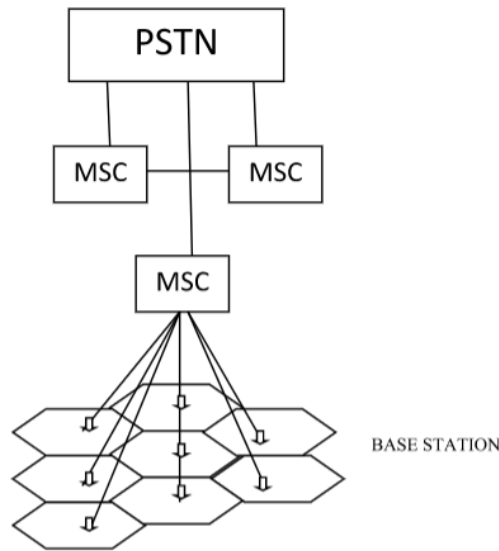
Fig-1Switching Centre

2. DATA COMMUNICATION

Data communication is the exchange of data using existing communication network. Data covers a wide range of applications including file transfer, the interconnection between wide area networks (WAN), electronic mail, access to the Internet and the World Wide Web (WWW).
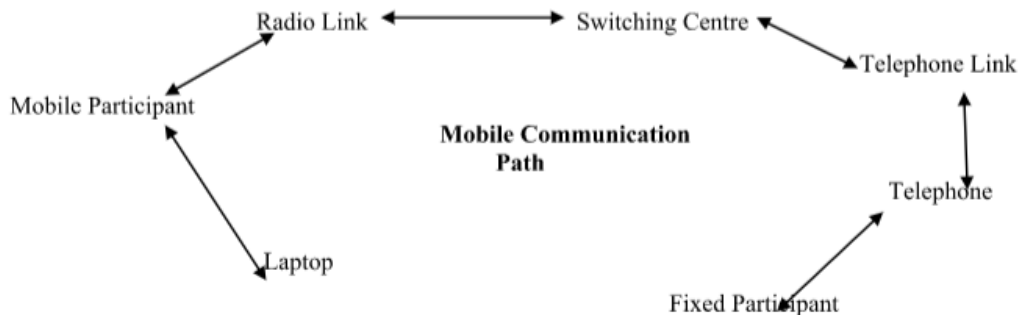

Fig-2Mobile Communication Overview

Data communication have been achieved using a variety of networks such as PSTN, leased-lines and more recently network ISDN(Integrated Service Data Network) and ATM(Asynchronous Transfer Mode) / Frame Relay. These networks are partly or fully analogue or digital using technologies such as circuit switching, packet switching, etc.

2.1Circuit Switching

Circuit Switching implies that data from one user (sender) to another (receiver) has to follow a pre- specified path. If a link is to be used that is busy, the message cannot be redirected. It is a property which causes many delays.

2.2Packet Switching

Packet Switching is an attempt to make better utilization of an existing network and by splitting the message to be sent into packets. Each packet contains information about the sender, the receiver, the position of the packet in the message as well as part of the actual message. There are many protocols defining the way of packets can be sent from sender to the receiver. The most widely used are the virtual circuit switching system, which implies that packet has to be sent through the same path and the Datagram System which allows the packet to be sent at various paths depending on the network availability.

3. CDPD TECHNOLOGY: THE HOT COOKIE

Today, the mobile data communications market is becoming dominated by a technology called CDPD. There are more other alternatives to this technology namely called Circuit Switched Cellular, Specialized Mobile Radio and Wireless Data Networks. From the table below the CDPD Technology is more advantageous than the others.

	Cellular Digital Packet Data	Circuit Switched Cellular	Specialized Mobile Radio(Extended)	Proprietary Wireless Data Networks
Speed	Best	Best	Good	Good
Security	Best	Better	Good	Better
Ubiquity	Best	Best	Good	Better
Cost of Service	Best	Better	Better	Good
Cost of Deployment	Best	Best	Better	Good
Mobility	Best	Good	Better	Good
Interoperability	Best	Good	Good	Better

CDPD's principle lies in the usage of the idle time in between existing voice signals. That are being sent across the cellular networks. The major advantage of this system is the fact that the idle time is not chargeable. So the cost of data transmission is very low. This is the most important consideration by business individuals.

CDPD network allows fixed link and a packet switched system respectively. Fixed users have a fixed physical link to the CDPD network. In the case of mobile end users, if CDPD network facilitates are non-existent then the user can connect to existing circuit switched network and transmit data via these networks. This is known as Circuit Switched CDPD (CS-CDPD).

4. CDPD NETWORK RELIABILITY
There are some actions that are necessary in order to obtain reliability over a network.

- **User Authentication**
  The procedure will checks that if the identity of the subscriber transferred over the radio path corresponds with the details held in the network.
- **User Anonymity**
  Instead of using actual directory telephone number, the International Mobile Subscriber Identity (IMSI) number is used within the network to uniquely identify a mobile subscriber.
- **Fraud Prevention**
  Protection against impersonation of authorized users and fraudulent use of the network is required.
- **Protection of user data**
  All the signals within the network are encrypted and the identification key is never transmitted through the air. This ensures maximum network and data security.

5. PRINCIPLES OF MOBILE COMPUTING
Portability
Devices or nodes connected within the mobile computing system and they should facilitate mobility. These devices may have limited device capabilities and limited power supply. But it should have sufficient processing capabilities and physical portability to operate in a movable environment.
- **Connectivity**
  Connectivity defines the quality of service (QoS) of the network connectivity. In a mobile computing system, the network availability is expected to be maintained at a high level.
- **Interactivity**
  The nodes belonging to a mobile computing system are connected with one another. These are connected to communicate and collaborate through the active transaction of data.
- **Individuality**
  A portable device or a mobile node connected to a mobile network often donate an individual. A mobile computing system should be able to adopt the technology to obtain the individual needs. And also to obtain contextual information of each node.

6. DEVICES

Some of the most common forms of mobile computing devices are given below:

- Portable computers, compact, lightweight units including a full character set to keyboard. Also primarily intended as hosts for software that may be parameterized, as laptops, notebooks, notepads, etc.
- Mobile phones, including a restricted key set primarily intended but not restricted to for vocal communications, as smartphones, cell phones, feature phones, etc.
- Smart cards that can run multiple applications but typically payment, travel and secure area access.
- Wearable computers mostly limited to functional keys and primarily intended for incorporation of software agents, as watches, wristbands, necklaces, keyless implants, etc.

The existence of these classes is expected to be long lasting, and complementary in personal usage, none replacing one the in all features of convenience.

Other types of mobile computers have been introduced since the 1990s including the:

- **Portable Computers**

  The portable computer is a computer that is designed to be moved from one place to another and includes a display and keyboard.

  PDA, laptop, smart watch, smartphone, tablet PC are the examples.

- **Personal Digital Assistant**

  A personal digital assistant (PDA), also known as a handheld PC, or Personal Digital Assistant, is a mobile device that done functions as a personal information manager. PDAs were largely discontinued in the early 2010s, after the widespread adoption of highly capable of smartphones, in particular, those based on IOS and Android.

- **Ultra-mobile PC**

  An ultra-mobile PC was a miniature version of a pen computer, a class of laptop whose specifications were launched by Microsoft and Intel in spring 2006. Sony had already made a first attempt in this direction in 2004 with its Vaio U Series, which was however only sold in Asia.

- **Laptop**

  A laptop often called a notebook or notebook computer. Laptops are folded shut for transportation, and thus are suitable for mobile use. Although originally there was a distinction between laptops and notebooks. The former being bigger and heavier than the latter, as of 2014, there is often no longer any difference.

- **Smartphones**

  A smartphone is a mobile personal computer with a mobile operating system. With features that are useful for mobile or handheld use. Smartphones which are typically pocket-sized have the ability to place and receive voice or video calls and create and receive text messages. Also some personal digital assistant.

- **Tablet Computer**

  A tablet computer, commonly shortened to tablet. It is a mobile computer with a touch screen display, which is usually a color processing circuitry, a rechargeable battery in a single thin, flat package. Most tablets also have sensors, including digital cameras, a microphone, and an accelerometer so images on screens are always displayed upright.

7. MOBILE DATA COMMUNICATION

Wireless data connections used in mobile computing take three general forms. So, cellular data service uses technologies such as GSM, CDMA or GPRS, 3G networks such as W.CDMA, EDGE or CDMA2000 and more recently 4G networks such as LTE, LTE-Advanced. These networks are usually available within the commercial cell towers. Wi-Fi connection offer higher performance may be private business network or public network. They have a typical range of 100 feet indoors and up to 1000 feet outdoors. Satellite internet connection access covers areas where cellular and Wi-Fi are not available. And they may be set up anywhere the user has a line of sight to the satellite's location. Some enterprise deployments combine networks from multiple cellular networks or a mix of cellular, Wi-Fi and satellite. When a mixed network is a use then VPN not only handles the security concerns but also performs the multiple network logins automatically. It keeps the application connection alive to prevent crashes or data loss during network transitions or coverage loss.

8. APPLICATIONS OF MOBILE COMPUTING

- **For Estate Agents**

  Estate agents can work either at home or out in the field. With mobile computers, they can be more productive. They can obtain current real estate information by accessing multiple listing services, which they can do from home, office or car when out with clients. They can provide immediate feedback to

clients regarding specific homes, with faster loan approvals, since applications can be submitted on the spot. Therefore, mobile computers allow them to devote more time to clients.

- **Emergency Services**
Where the emergency services are involved then it has ability to receive information is vital. Information regarding the address, type and other details of an incident can be dispatched quickly, via a CDPD system using mobile computers, to one or several appropriate mobile units each are in the vicinity of the incident.

- **In courts**
Defense counsels can take mobile computers in court. When the opposing counsel references a case which they are not familiar, they can use the computer to get direct, real-time access to on-line legal database services, where they can gather information on the case and related precedents. Therefore mobile computers allow immediate access to a wealth of information, making people better informed and prepared.

- **In Companies**
Managers can use mobile computers in critical presentations to major customers. They can access the latest market share information. At a small recess, they can revise the presentation to take advantage of this information. They can communicate with the office about possible new offers and call meetings for discussing response to the new proposals. Therefore, mobile computers can leverage competitive advantages.

- **Stock Information Collection/Control**
In environments where access to stock is very limited ie: factory warehouses. The use of small portable electronic databases accessed via a mobile computer would be ideal. Data collated could be directly written to a central database, via a CDPD network, which holds all stock information. Hence the need for transfer of data to the central computer at a later date is not necessary.

- **Credit Card Verification**
When customers use credit cards for transactions, the intercommunication required between the bank central computer. In order to effect verification of the card usage, can take place quickly and securely over cellular channels using a mobile computer unit.

- **Taxi/Truck Dispatch**
Using the idea of a centrally controlled dispatcher with several mobile units (taxis). Mobile computing allows the taxis to be given full details of the dispatched job as well as allowing the taxis to communicate information.

9. LIMITATIONS OF MOBILE COMPUTING

- **Security Standards**
When working with mobile, one is dependent on public networks, requiring careful use of VPN. Security is a major concern while concerning the mobile computing standard on the fleet. One can easily attack the VPN through a huge number of networks interconnected through a line.

- **Transmission Interferences**
Weather, terrain, and the range from the nearest signal point can all interfere with signal reception, reception in tunnels, some buildings, and rural areas is often poor.

- **Human Interface with device**
Screens and keyboards tend to be small, which may make them hard to use. Alternate input methods such as speech or handwriting recognition require training.

- **Range and bandwidth**
Mobile Internet access is generally slower than direct cable connections, using technologies such as GPRS and EDGE, and more recently HSDPA, HUSPA, 3G and 4G networks and also the upcoming 5g network. These networks are usually available within the range of commercial cell phone towers. High-speed network wireless LANs are inexpensive but have very limited range.

- **Power Consumption**
When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power. Combined with the compact size of many mobile devices. This often means, unusually expensive batteries must be used to obtain the necessary battery life.

10. SECURITY ISSUES INVOLVED IN MOBILE

Mobile security or mobile phone security has increasingly important in mobile computing. It relates to the security of personal information now stored on the smartphone.

More and more users and businesses use smartphones as communication tools but also as means of planning and organizing their work and private life. Within companies, these technologies are causing profound changes in the organization of information systems and therefore they have become the source of new risks.

Indeed, smartphones collect and compile an increasing amount of sensitive information to which access must be controlled to protect the privacy of the user and the intellectual property of the company.

All smartphones, as computers, are preferred targets of attack. These attacks exploit weaknesses related to smartphones that can come from means of communication like SMS, Wi-Fi, MMS, and GSM. There are also attacks that exploit software vulnerabilities from the web browser and operating system. Finally, there are forms of malicious software that rely on the weak knowledge of average users.

Different security counter-measure are being developed and applied to smartphones, from security in different layers of software to the dissemination of information to end users. There are good practices to be observed at all levels, from design to use, through the development of operating systems, software layers, and downloadable apps.

11. FUTURE

With the rapid technology advancements in Artificial Intelligence, Integrated Circuitry and increases in Computer Processor speeds, the future of mobile computing looks increasingly exciting. With the emphasis increasingly on compact, small mobile computers, it may also be possible to have all the practicality of a mobile computer in the size of a handheld organizer or even smaller. Use of Artificial Intelligence may allow mobile units to be the ultimate in personal secretaries, which can receive emails and paging messages, understand what they are about. And it changes the individual's personal schedule according to the message. This can then be checked by the individuals to plan his/her day. The working lifestyle will change, with the majority of people working from home, rather than commuting. This may be beneficial to be environment as less transportation will be utilized. This mobility aspect may be carried further in that, even in social spheres, people will interact via mobile stations, eliminating the need to venture outside of the house. The future of Mobile Computing is very promising indeed, although technology may go too far, causing detriment to society.

12. CONCLUSION

Today's computing has rapidly grown from being confined to a single location. With mobile computing, people can work from the comfort of any location they wish to as long as the connection and the security concerns are properly factored. In the same light, the presence of high-speed connections has also promoted the use of mobile computing.

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