Mobile Computing - Brief Overview

Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. The main concept involves −

- Mobile communication
- Mobile hardware
- Mobile software

Mobile communication

The mobile communication in this case, refers to the infrastructure put in place to ensure that seamless and reliable communication goes on. These would include devices such as protocols, services, bandwidth, and portals necessary to facilitate and support the stated services. The data format is also defined at this stage. This ensures that there is no collision with other existing systems which offer the same service.

Since the media is unguided/unbounded, the overlaying infrastructure is basically radio wave-oriented. That is, the signals are carried over the air to intended devices that are capable of receiving and sending similar kinds of signals.

Mobile Hardware

Mobile hardware includes mobile devices or device components that receive or access the service of mobility. They would range from portable laptops, smartphones, tablet Pc's, Personal Digital Assistants.

These devices will have a receptor medium that is capable of sensing and receiving signals. These devices are configured to operate in full- duplex, whereby they are capable of sending and receiving signals at the same time. They don't have to wait until one device has finished communicating for the other device to initiate communications.

Above mentioned devices use an existing and established network to operate on. In most cases, it would be a wireless network.

Mobile software

Mobile software is the actual program that runs on the mobile hardware. It deals with the characteristics and requirements of mobile applications. This is the engine of the mobile device. In other terms, it is the operating system of the appliance. It's the essential component that operates the mobile device.

Since portability is the main factor, this type of computing ensures that users are not tied or pinned to a single physical location, but are able to operate from anywhere. It incorporates all aspects of wireless communications.

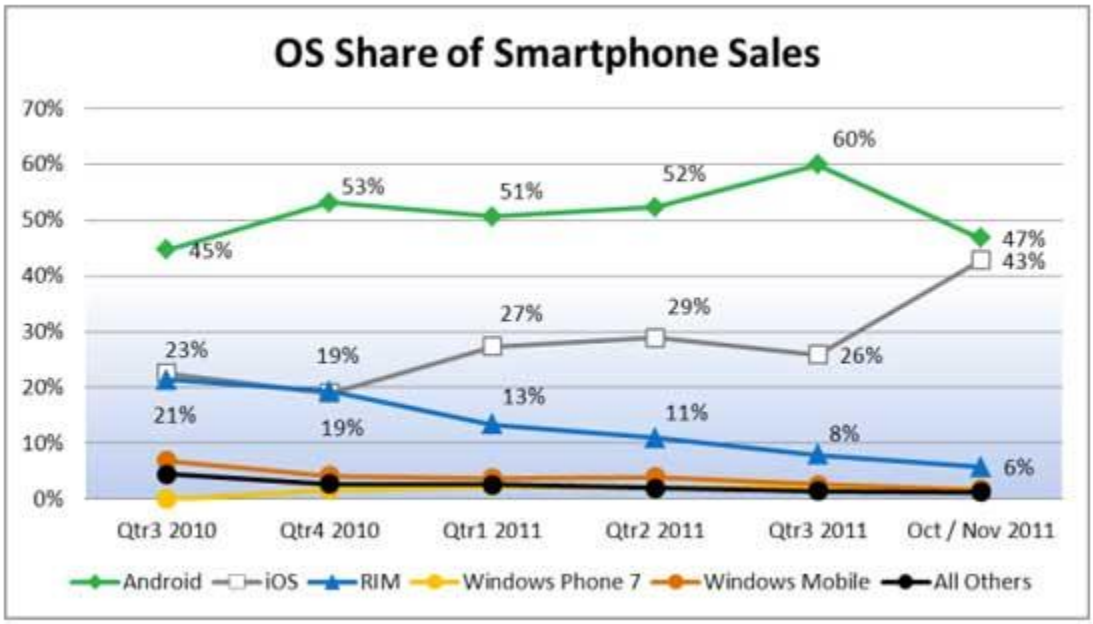
Mobile Computing - Brief Evolution

In today's computing world, different technologies have emerged. These have grown to support the existing computer networks all over the world. With mobile computing, we find that the need to be confined within one physical location has been eradicated. We hear of terms such as telecommuting, which is being able to work from home or the field but at the same time accessing resources as if one is in the office.

The advent of portable computers and laptops, Personal Digital Assistants (PDA), PC tablets and smartphones, has in turn made mobile computing very convenient. The portability of these devices ensure and enable the users to access all services as if they were in the internal network of their company. For example, the use of Tablet PC and iPads. This new technology enables the users to update documents, surf the internet, send and receive e-mail, stream live video files, take photographs and also support video and voice conferencing.

The constant and ever increasing demand for superior and robust smart devices has been a catalyst for market share. Each manufacturer is trying to carve a niche for himself in the market. These devices are invented and innovated to provide state-of-the-art applications and services. For instance, different manufacturers of cellular phones have come up with unique smartphones that are capable of performing the same task as computers and at the same processing speed. The market share for different competitors is constantly being fought for. For example, the manufacturers of Apple's

iPhone OS, Google's Android' Microsoft Windows Mobile, Research In Motion's Blackberry OS, are constantly competing to offer better products with each release.



Source: The NPD Group, Consumer Tracking Service, Mobile Phone Track

The need for better, portable, affordable, and robust technology has made these vendors to constantly be innovative. Market figure and statistics show an ever growing need to purchase and use such devices for either professional or personal use. It is in this light that services to suit long-term implementation are developed or innovated. It has also pushed other industry vendors to adopt services that will provide better services. For example, cellular service providers are forced to improve and be innovative to capture more subscribers. This can be in terms of superior services such as high speed internet and data access, voice and video service etc. Hence the adoption of different generations of networks like of 2G, 2.5G, 3G, 4G network services.

The essence of mobile computing is to be able to work from any location. The use of iPads, tablets, smartphones, and notebooks, have pushed the demand for these devices. Modern day workers have such devices that enable them to carry out their work from the confines of their own location. These devices are configured to access and store large amounts of vital data. Executive and top management can take decisions based on ready information without going to the office. For example, sales reports and market forecasts can be accessed through these devices or a meeting can take place via video or audio conferencing through these devices. With such features being high in demand, manufacturers are constantly coming up with applications geared to support different services in terms of mobile computing.

Mobile Computing - Classification

Mobile computing is not only limited to mobile phones, but there are various gadgets available in the market that are built on a platform to support mobile computing. They are usually classified in the following categories −

Personal Digital Assistant (PDA)

The main purpose of this device is to act as an electronic organizer or day planner that is portable, easy to use and capable of sharing information with your computer systems.

PDA is an extension of the PC, not a replacement. These systems are capable of sharing information with a computer system through a process or service known as synchronization. Both devices will access each other to check for changes or updates in the individual devices. The use of infrared and Bluetooth connections enables these devices to always be synchronized.

With PDA devices, a user can browse the internet, listen to audio clips, watch video clips, edit and modify office documents, and many more services. The device has a stylus and a touch sensitive screen for input and output purposes.

Smartphones

This kind of phone combines the features of a PDA with that of a mobile phone or camera phone. It has a superior edge over other kinds of mobile phones.

Smartphones have the capability to run multiple programs concurrently. These phones include high-resolution touch screens, web browsers that can access and properly display standard web pages rather than just mobile-optimized sites, and high-speed data access via Wi-Fi and high speed cellular broadband.

The most common mobile Operating Systems (OS) used by modern smartphones include Google's Android, Apple's iOS, Nokia's Symbian, RIM's BlackBerry OS,

Samsung's Bada, Microsoft's Windows Phone, and embedded Linux distributions such as Maemo and MeeGo. Such operating systems can be installed on different phone models, and typically each device can receive multiple OS software updates over its lifetime.

Tablet PC and iPads

This mobile device is larger than a mobile phone or a PDA and integrates into a touch screen and is operated using touch sensitive motions on the screen. They are often controlled by a pen or by the touch of a finger. They are usually in slate form and are light in weight. Examples would include ipads, Galaxy Tabs, Blackberry Playbooks etc.

They offer the same functionality as portable computers. They support mobile computing in a far superior way and have enormous processing horsepower. Users can edit and modify document files, access high speed internet, stream video and audio

data, receive and send e-mails, attend/give lectures and presentations among its very many other functions. They have excellent screen resolution and clarity.

Mobile Computing - Major Advantages

Mobile computing has changed the complete landscape of our day-to-day life. Following are the major advantages of Mobile Computing −

Location Flexibility

This has enabled users to work from anywhere as long as there is a connection established. A user can work without being in a fixed position. Their mobility ensures that they are able to carry out numerous tasks at the same time and perform their stated jobs.

Saves Time

The time consumed or wasted while travelling from different locations or to the office and back, has been slashed. One can now access all the important documents and files over a secure channel or portal and work as if they were on their computer. It has enhanced telecommuting in many companies. It has also reduced unnecessary incurred expenses.

Enhanced Productivity

Users can work efficiently and effectively from whichever location they find comfortable. This in turn enhances their productivity level.

Ease of Research

Research has been made easier, since users earlier were required to go to the field and search for facts and feed them back into the system. It has also made it easier for field officers and researchers to collect and feed data from wherever they are without making unnecessary trips to and from the office to the field.

Entertainment

Video and audio recordings can now be streamed on-the-go using mobile computing. It's easy to access a wide variety of movies, educational and informative material. With the improvement and availability of high speed data connections at considerable cost, one is able to get all the entertainment they want as they browse the internet for streamed data. One is able to watch news, movies, and documentaries among other entertainment offers over the internet. This was not possible before mobile computing dawned on the computing world.

Streamlining of Business Processes

Business processes are now easily available through secured connections. Looking into security issues, adequate measures have been put in place to ensure authentication and authorization of the user accessing the services.

Some business functions can be run over secure links and sharing of information between business partners can also take place.

Meetings, seminars and other informative services can be conducted using video and voice conferencing. Travel time and expenditure is also considerably reduced.

CHARACTERISTICS OF MOBILE COMPUTING

1. **Portability** - The Ability to move a device within a learning environment or to different environments with ease.

2. **Social Interactivity** - The ability to share data and collaboration between users.

3. **Context Sensitivity** - The ability to gather and respond to real or simulated data unique to a current location, environment, or time.

4. **Connectivity** - The ability to be digitally connected for the purpose of communication of data in any environment.

5. **Individual** - The ability to use the technology to provide scaffolding on difficult activities and lesson customization for individual learners.

6. **Small Size** - Mobile devices are also known as handhelds, palmtops and smart phones due to their roughly phone-like dimensions. A typical mobile device will fit in the average adult's hand or pocket. Some mobile devices may fold or slide from a compact, portable mode to a slightly larger size, revealing built-in keyboards or larger screens. Mobile devices make use of touch screens and small keypads to receive input, maintaining their small size and independence from external interface devices. The standard form of a mobile device allows

the user to operate it with one hand, holding the device in the palm or fingers while executing its functions with the thumb.

Netbooks and small tablet computers are sometimes mistaken for true mobile devices, based on their similarity in form and function, but if the device's size prohibits one-handed operation or hinders portability, then it cannot be considered a true mobile device.

7. **Wireless Communication** - Mobile devices are typically capable of communication with other similar devices, with stationary computers and systems, with networks and portable phones. Base mobile devices are capable of accessing the Internet through Bluetooth or Wi-Fi networks, and many models are equipped to access cell phone and wireless data networks as well. Email and texting are standard ways of communicating with mobile devices, although many are also capable of telephony, and some specialized mobile devices, such as RFID and barcode

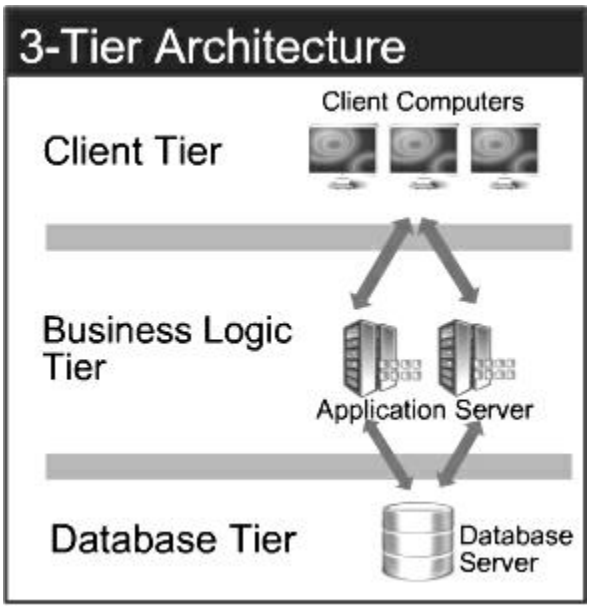
Mobile Computing Architecture

Mobile computing architecture refers to the definition of multiple layers between user application interfaces, devices, and network hardware. A well-defined architecture is necessary for systematic calculations and access to data and software objects.

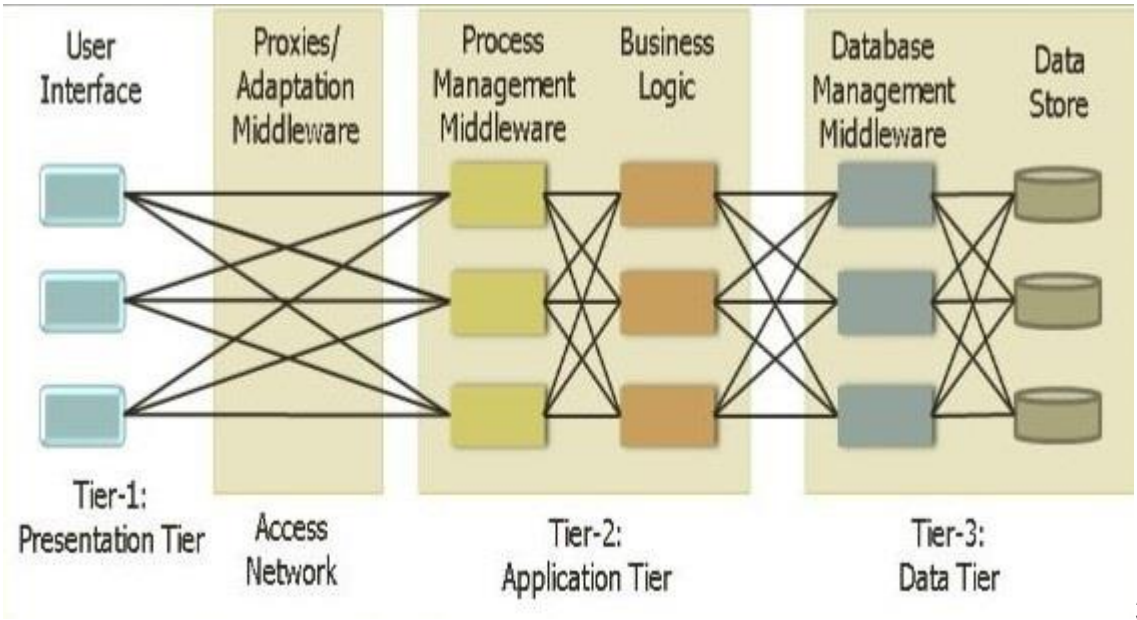
Mobile computing usually implies wireless transmission but, wireless transmission does not imply mobile computing. Mobile computing follows some of the **attributes.** List of attributes are mentioned in this earlier post. **Attributes of Mobile Computing.**

3-Tier Architecture of Mobile computing

A 3-tier architecture is an application program that is organized into three major parts, comprising of:



1. **Layer-1 : Presentation Layer (UI)**
2. **Layer-2: Application Layer(AL)**
3. **Layer-3: Data Access Layer(DA)**



3 Tier Architecture Mobile Computing

Each tier is distributed to a different place or places in a network. These tiers do not necessarily correspond to physical locations on various computers on a network, but rather to logical layers of the application.

1. **Presentation Layer (UI):**
    - This layer presents data to the user and optionally permits data manipulation and data entry, also this layer requests the data form Business layer.
    - This layer accomplished through use of Dynamic HTML and client-side data sources and data cursors.
2. **Application Layer (AL)**:
    - The business logic acts as the server for client requests from workstations. It acts according Business rules fetch or insert data through the Data Layer.
    - In turn, it determines what data is needed (and where it is located) and acts as a client in relation to a third tier of programming that might be located on a local or mainframe computer.
    - Because these middle-tier components are not tied to a specific client, they can be used by all applications and can be moved to different locations, as response time and other rules require.
3. **Data Access Layer (DA):**
    - The third tier of the 3-tier system is made up of the DBMS that provides all the data for the above two layers.
    - This is the actual DBMS access layer.
    - Avoiding dependencies on the storage mechanisms allows for updates or changes without the application tier clients being affected by or even aware of the change.

Cellular Concept Mobile Computing Technology

Cellular Concepts refers to the use of a group of cells to provide communication from one place to another place when the user is mobile. A cellular system in mobile computing implements space division multiplexing or SDM. Each transmitter in the cellular system is called a base station.

Base station

The base station covers a specific area that is called a cell.

Cell

Cell radius can vary from tens of meters in building, hundreds of meters in a city, and tens of kilometers in the country.

The shape of a cell depends on the environmental conditions such as type of building, mountains, weather conditions, load, and other conditions. Generally, it is hexagon shape but not an exact hexagon.

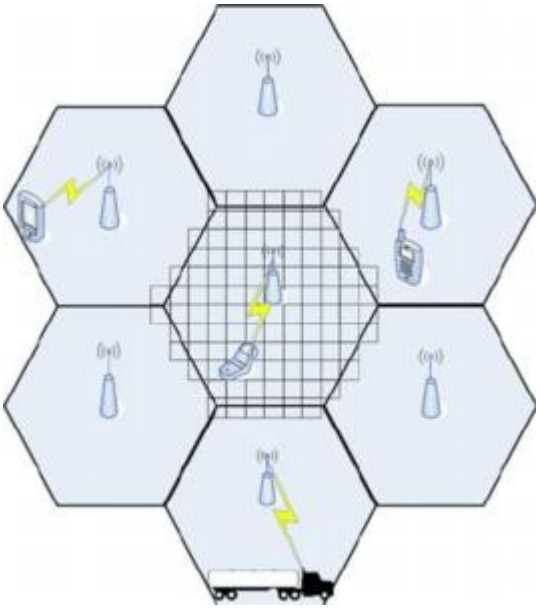


Figure: Cell Structure

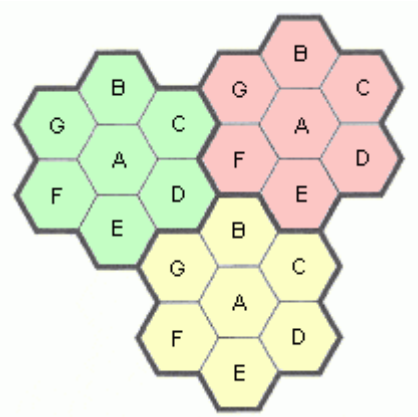
Mobile computing used cellular system and it has the following advantages:

- Higher Capacity

Cellular system uses SDM. SDM allows frequency reuse. If one transmitter is far away from another transmitter particularly out of the range of the interference area then another transmitter can use the same frequency as shown in the following figure-

Mobile systems assign one specific frequency to a certain user and that frequency is blocked for the use by other users. But frequency is a scarce

resource therefore for their optimum utilization of the same frequency, the same frequency is used for other users using the technique frequency reuse.



- Less Transmission Power

  Transmission power is not a big issue for the base station but it is important for the mobile receivers. Keeping cell size small facilitate mobile receivers because as they move far from the base station their receiving capacity reduces and due to small cells after a few distances they can again access receiving power from the cell nearby them and the problem of the mobile receiver is solved.

- Local Interference

  When the distance is large between the sender and receiver then interference is also more and difficult to manage. There is only local interference when cells are small and that is easy to handle by the base station and the mobile station.

- Robustness

  The cellular system is decentralized therefore more robust as compared to when centralized. If any component fails only that specific area affected and the rest of the part remains unaffected and works efficiently.

Cellular System or having small cells have the following disadvantages

- Infrastructure Requirement

  Cellular system establishment needs complex infrastructure, storage registers to locate mobile users in local areas and roaming, antennas, transmitters, receivers, and amplifiers, etc. that are expensive.

- Handover Needed

  The mobile system needs handovers when they change cells. This is quite often which further incur a cost.

- Frequency Planning

  To avoid the interference between transmitters frequencies are planned carefully. Frequency is a limited resource therefore they are distributed intelligently so that they can be reused without any kind of interference.

Wireless Telephony : Objective, Features and Application

Wireless telephony is the technology that operates by the transmission of information through space; there is no physical or fixed connection between sender and receiver devices. By using wireless telephony people can be transceivers information from airplanes, driving cars, swimming pools, and jog in the park. Wireless telephony come in two basic varieties:

1. Cordless phones (sometimes called portable telephones) and
2. Mobile phones (sometimes called cell phones).

Cordless phones are devices consisting of a base station and a handset sold as a set for use within the home. These are never used for networking, because of their limited range; usually, it's expected range up to the same building or some short distance from the base station. The base station attaches to the telephone network the same way a corded telephone does.

Cordless Phone

mobile phone

Mobile phone is one another generation of wireless telephony that can highly feasible to make and receive calls over a radio frequency carrier while the mobile user is moving within a telephone service area. The radio frequency is responsible to establish a connection to the switching systems of a mobile phone operator, which provides access to the public switched telephone network (PSTN). Most modern mobile telephone services use a cellular network architecture, and therefore mobile telephones are often also called cellular telephones or cell phones. The Mobile phone wireless telephony has gone through three distinct generations, with different technologies:

1. Analog voice.

2. Digital voice.
3. Digital voice and data (Internet, e-mail, etc.).

Wireless telephony can be used like a local area network (LAN) with voice capability and can be part of a larger network or can be connected to the telephone system. Its real-time example is Personal Access Communications System (PACS). It is a type of wireless telephony compatible with telephone sets, answering machines, fax machines, and computers.

Features of wireless telephony:

As the high acceptability of wireless telephony across the world wireless telephony requires a different set of features as follows;

1) High Capacity Load Balancing: The origin of wireless telephony to cover smartphones, tablets, e-readers devices, etc. With the increased demand for wireless telephony infrastructure, it must require to incorporate high-capacity load balancing. The actual mean of load balancing is that when one access point is overloaded or a number of users reach up to the limit, the wireless telephony allows the system to actively shift wireless device users from one access point to another depending on the capacity that is available.

2) Scalability: The growth rate in the popularity of new wireless gadgets will only continue to grow. Wireless telephony needs to have the ability to start small if necessary, but expand in terms of coverage and capacity as needed without having to overhaul or build an entirely new network.

3) Mobility: Wireless telephony is more popular for its mobility features that assign and control the wireless links for network connections. It provides the alerting function for wireless telephony devices for data completion to a wireless terminal.

4) Centralized Management: In the current high-technology world wireless telephony is much more complex and it may consist of hundreds or even thousands of access points. Therefore, wireless telephony will require a smarter way of managing all the access points within the specified network that network is named as centralized management. Updates and configuration changes should be made once the system updates all access points across over wireless telephony network.

5) Real Time Wireless Visibility: For all wireless telephony devices, the administrator needs to have the ability to see the wireless telephony network users in real-time, what type of device users are using, what type of coverage

shows in that area, and the status of the different networking components that may affect the use of that device et. The wireless telephony administrator needs to be able to see what's going on in order to address any issues.

6) Quality of Service/Application Prioritization:

Quality of service simply means that wireless telephony systems should be able to determine what uses are most important to their network.

Applications of wireless telephony:

As the hugged amount of valuable features wireless telephony is highly acceptable by industry and common people in their daily life. Various real-time application of wireless telephony are as follow;

To provide wireless data communications:

Wireless data communications are an essential component of mobile computing. To achieve fast and secure data transmission with high-speed wireless telephony is highly advanced technology. The various available technologies differ in local availability, coverage range, and performance, and in some circumstances, users must be able to employ multiple connection types and switch between them.

To transfer wireless energy:

Wireless telephony is applicable to wirelessly energy transfer processes, in this technology electrical energy is transmitted from a power source to an electrical load that does not have a built-in power source, without the use of interconnecting wires. There are two different fundamental methods for wireless energy transfer are as follow;

1. Far-field methods that involve beaming power/lasers,
2. Near-field using induction that involves radio or microwave transmissions.

Both methods utilize electromagnetism and magnetic fields.

To support wireless medical technologies:

The latest wireless technologies of wireless telephony, such as mobile body area networks (MBAN), have the capability to monitor blood pressure, heart rate, oxygen level, and body temperature. The MBAN works by sending low-powered wireless signals to receivers that feed into nursing stations or monitoring sites. This technology helps with the intentional and unintentional risk of infection or disconnection that arises from wired connections.

Important Questions on Mobile Computing

1) What is Mobile Computing? Or What do you understand by Mobile Computing?

2) What are the basic building blocks for Mobile Computing?

3) What do you understand by Mobility in Mobile Computing?

4) What are the two different types of mobility in Mobile Computing?

5) What are the main obstacles that occurred in mobile communications?

6) What is the full form of a SIM card?

7) What information is stored on a SIM card?

8) What does a SIM do? Or What is the working of a SIM card in Mobile communication?

9) What are the different advantages of Mobile Computing?

10) What are the main disadvantages of Mobile Computing?