MOBILE COMPUTING

Lecture Notes

Chapter- 1

INTRODUCTION TO WIRELESS NETWORKS & MOBILE COMPUTING

SYLLABUS

1.1 Networks
1.2 Wireless Networks
1.3 Mobile Computing
1.4 Mobile Computing Characteristics
1.5 Application of Mobile Computing

1.1 Networks

A network is two or more computers (or other electronic devices) that are connected together, usually by cables or Wi-Fi. Some computer networks will have a server. A server is a powerful computer that often acts as a central hub for services in a network e.g. e-mails, internet access and file storage.

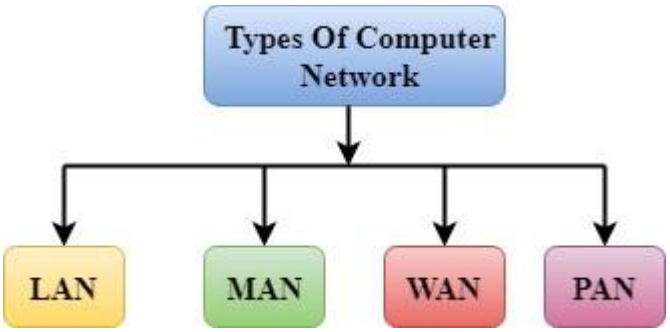
An example of networking is sharing and acquiring information between different divisions of the same company to share information and solve business problems. An example of networking is linking the entire network of computers to a print server to allow each workstation to have the ability to print documents.

A Controller Area Network (CAN bus) is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other's applications without a host computer.

Types of Networks

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.

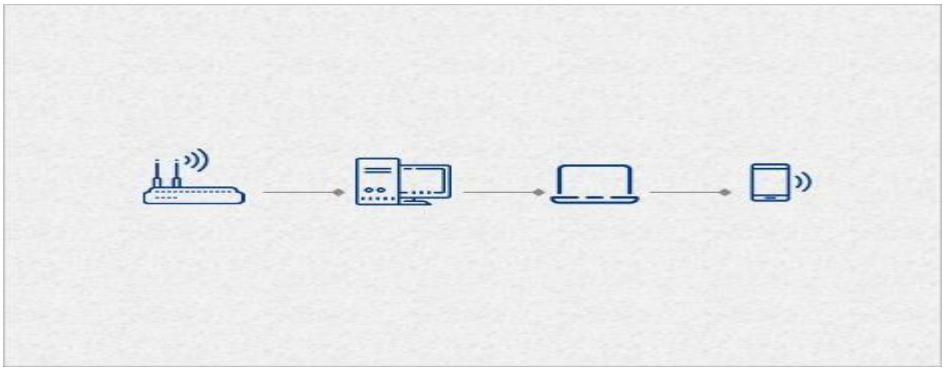
A computer network can be categorized by their size. A computer network is mainly of four types:



- LAN (Local Area Network)
- PAN (Personal Area Network)
- MAN (Metropolitan Area Network)
- WAN (Wide Area Network)

1.2 Wireless Networks

In recent years, however, wireless technologies have grown and become much more popular. Wi-Fi and other wireless technologies have become the favourite option for building computer networks. One of the reasons for this is that wireless networks can easily support different types of wireless gadgets that have become popular over the years, such as smartphones and tablets. Mobile networking is now an important thing to consider because it's not going to go away anytime soon.



A wireless network is a computer network that uses wireless data connections between network nodes.

Wireless networking is a method by which homes, telecommunications networks and business installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. Telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level (layer) of the OSI model network structure.

Examples of wireless networks include cell phone networks, wireless local area networks (WLANs), wireless sensor networks, satellite communication networks, and terrestrial microwave networks.

Table 7.5. 802.11 Wireless Standards

IEEE Standard	Frequency/ Medium	Speed	Topology	Transmission Range	Access Method	Spread Spectrum
802.11	2.4GHz RF	1 to 2Mbps	Ad hoc infrastructure	20 feet indoors.	CSMA/CA	DSSS/FHSS
802.11a	5GHz	Up to 54Mbps	Ad hoc infrastructure	25 to 75 feet indoors; range can be affected by building materials.	CSMA/CA	OFDM

802.11b	2.4GHz	Up to 11Mbps	Ad hoc infrastructure	Up to 150 feet indoors; range can be affected by building materials.	CSMA/CA	DSSS
802.11g	2.4GHz	Up to 54Mbps	Ad hoc infrastructure	Up to 150 feet indoors; range can be affected by building materials.	CSMA/CA	DSSS
802.11n	2.4GHz/5GHz	Up to 600Mbps	Ad hoc infrastructure	175+ feet indoors; range can be affected by building materials.	CSMA/CA	OFDM

1.3 Introduction to Mobile Computing

The rapidly expanding technology of cellular communication, wireless LANs, and satellite services will make information accessible anywhere and at any time. Regardless of size, most mobile

computers will be equipped with a wireless connection to the fixed part of the network, and, perhaps, to other mobile computers. The resulting computing environment, which is often referred to as ***mobile or nomadic computing***, no longer requires users to maintain a fixed and universally known position in the network and enables almost unrestricted mobility. Mobility and portability will create an entire new class of applications and, possibly, new massive markets combining personal computing and consumer electronics.

Mobile Computing *is an umbrella term used to describe technologies that enable people to access network services anyplace, anytime, and anywhere.* **Mobile Computing**

- **A technology that is capable of providing an environment which enables users to transmit data from one device to other device without the use of any physical link/cables is known as Mobile Computing.**
- **It means, data transmission is done wireless-ly with the help of wireless devices such as mobiles, laptops etc.**
- **Whenever any device is connected to a network without being connected physically over a link or cable, data transmission such as messages, voice recording, videos etc. can be done be done by using the concept of mobile computing.**
- **Mobile Computing technology helps users to access and transmit data from any remote locations without being present there physically.**
- **Thus, having such a big coverage diameter, it is one of the fastest and most reliable sectors of computing technology field.**

Mobile computing is used in different contexts with different names. The most common names are:

- **Mobile Computing**
- **Nomadic Computing**
- **Ubiquitous Computing**
- **Pervasive Computing**

- **Invisible Computing**

–Mobile Computing:

- The computing environment is mobile and moves along with the user.
- This is similar to the telephone number of a GSM (Global System for Mobile communication) phone, which moves with the phone.
- The offline (local) and real-time (remote) computing environment will move with the user.
- In real-time mode user will be able to use all his remote data and services online.

– Ubiquitous Computing:

This is the generic definition of ubiquity, where the information is available anywhere, all the time.

– Virtual Home Environment:

(VHE) is defined as an environment in a foreign network such that the mobile users can experience the same computing experience as they have in their home or corporate computing environment.

- For example, one would like to put one's room heater on when one is about 15 minutes away from home.

– Nomadic Computing:

The computing environment is nomadic and moves along with the mobile user.

- This is true for both local and remote services.

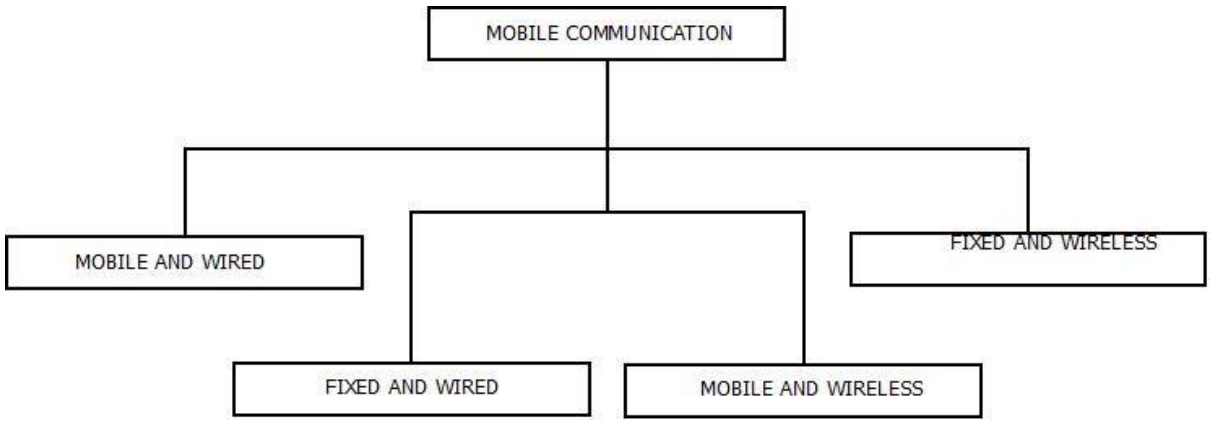
– Pervasive Computing:

A computing environment, which is pervasive in nature and can be made available in any environment.

– Invisible Computing:

A disappearing (nobody will notice its presence) everyplace computing environment. User will be able to use both local and remote services. **Mobile Communication**

- **Mobile Communication is the framework that is responsible behind the working of mobile computing technology.**
- **It ensures the consistency and reliability of communication process through this framework.**
- **Mobile communication framework includes communication devices such as mobiles, laptops, as rules of conduct, fitness etc. They are responsible for delivering of smooth communication process.**
- **Mobile communication can be of one of the following forms as mentioned below.**



1.4 Characteristics of Mobile Computing

A communication device can exhibit any one of the following characteristics:

- **Fixed and wired**: This configuration describes the typical desktop computer in an office. Neither weight nor power consumption of the devices allow for mobile usage. The devices use fixed networks for performance reasons.

- **Mobile and wired**: Many of today's laptops fall into this category; users carry the laptop from one hotel to the next, reconnecting to the company's network via the telephone network and a modem.

- **Fixed and wireless**: This mode is used for installing networks, e.g., in historical buildings to avoid damage by installing wires, or at trade shows to ensure fast network setup.

- **Mobile and wireless**: This is the most interesting case. No cable restricts the user, who can roam between different wireless networks. Most technologies discussed in this book deal with this type of device and the networks supporting them. Today's most successful example for this category is GSM with more than 800 million users.

Or

Ubiquity - Ability of a user to perform computations from anywhere and at any time.

Location Awareness- Can provide information about the current location of a user to a tracking station.

Adaptation- GPS Implies the ability of a system to adjust bandwidth fluctuation without inconveniencing the user.

Broadcast- Efficient delivery of data can be made simultaneously to hand reads of mobile users.

Personalization- Services in a mobile environment can be easily personalized according to a user's profile.

Functions of Mobile Computing

We can define a computing environment as mobile if it supports one or more of the following characteristics: **User Mobility:**

– User should be able to move from one physical location to another location and use the same service.

– The service could be in the home network or a remote network.

– Example could be a user moves from London to New York and uses Internet to access the corporate application the same way the user uses in the home office.

Network Mobility:

– User should be able to move from one network to another network and use the same service. – Example could be a user moves from Hong Kong to New Delhi and uses the same GSM phone to access the corporate application through WAP (Wireless Application Protocol). In home network he uses this service over GPRS (General Packet Radio Service) whereas in Delhi he accesses it over the GSM network.

Bearer Mobility:

– User should be able to move from one bearer to another and use the same service.

– Example could be a user was using a service through WAP bearer in his home network in Bangalore. He moves to Coimbatore, where WAP is not supported, he switches over to voice or SMS (Short Message Service) bearer to access the same application.

Device Mobility:

– User should be able to move from one device to another and use the same service.

–Example could be sales representatives using their desktop computer in home office. During the day while they are on the streets, they would like to use their Palmtop to access the application.

Session Mobility:

– A user session should be able to move from one user-agent environment to another.

– Example could be a user was using his service through a CDMA (Code Division Multiple Access) IX network. The user entered into the basement to park the car and got disconnected from his CDMA network. User goes to home office and starts using the desktop. The unfinished session in the CDMA device moves from the mobile device to the desktop computer.

Service Mobility:

– User should be able to move from one service to another.

– Example could be a user is writing a mail. To complete the mail user needs to refer to some other information. In a desktop PC, user simply opens another service (browser) and moves between them using the task bar. User should be able to switch amongst services in small footprint wireless devices like in the desktop.

Host Mobility:

–The user device can be either a client or server.

–When it is a server or host, some of the complexities change.

– In case of host mobility, the mobility of IP needs to be taken care of.

1.5 Applications of Mobile Computing

- **Some of the major field in which mobile computing can be applied are:**
  - **Web or Internet access.**
  - **Global Positioning System (GPS).**
  - **Emergency services.** ○ **Entertainment services** ○ **Educational services.**

Limitations of Mobile Computing

- **Resource constraints:** Battery
- **Interference:** Radio transmission cannot be protected against interference using shielding and result in higher loss rates for transmitted data or higher bit error rates respectively.
- **Bandwidth:** Although they are continuously increasing, transmission rates are still very low for wireless devices compared to desktop systems. Researchers look for more efficient communication protocols with low overhead.
- **Dynamic changes in communication environment:** variations in signal power within a region, thus link delays and connection losses

- **Network Issues:** discovery of the connection-service to destination and connection stability

- **Interoperability issues:** the varying protocol standards

- **Security constraints:** Not only can portable devices be stolen more easily, but the radio interface is also prone to the dangers of eavesdropping. Wireless access must always include encryption, authentication, and other security mechanisms that must be efficient and simple to use.

Assignment Questions:

1. What is WLAN? Explain briefly.
2. Elaborate the applications of mobile computing.