Unit 4: Mobile Computing 4

Unit Structure

4.1 LEARNING OBJECTIVES

After studying this chapter, students should be able to understand:

- Architecture of wireless communication technology
- Concept of computing on move
- Basic of wireless communication standards
- Characteristics of mobile computing
- Responsibilities of mobile operating system
- Constraints of mobile operating system
- Structure of mobile computing application

4.2 INTRODUCTION

In previous units, we have learnt about the basic work of generalize operating system. In this unit we will learn about the working methodology of mobile operating system. Mobile operating system needs to perform all the activities which are performed by the generalize operating system. In addition, mobile operating system needs to handle incoming and outgoing calls, receiving notification, send and receive SMS etc. Mobile operating system also needs to identify its device's geographical location and provide computing to the mobile applications that works on geographical location. A mobile operating system controls everything from handling the input, to controlling the memory and the overall functioning of the device. It also manages the communication and the interplay between the mobile device and other compatible hardware such as computers, televisions or printers. In short mobile operating system does computing based on mobility. Here in this unit we will learn about location based computing handled by the mobile operating system.

4.3 MOBILE COMPUTING

Mobile computing is an ability to compute remotely while on the move. We can also say that computing on mobility is called mobile computing. It is also called ubiquitous computing or nomadic computing. It is a kind of technology which allows transmission of any kind of data (voice, graphics, binary or else) using wireless device. Mobile computing consists of three components:

4.3.1 Wireless Communication Technology

The wireless communication technology refers to the infrastructure that provides a faultless and reliable communication facility. The technology consists of wireless protocols, services, bandwidth and other necessary components which are required by the wireless communication.

4.3.1.1 Architecture of wireless communication technology

To set up the communication infrastructure four main components are required. The Base Station, the core network, Radio Access Network and Mobile hardware. First of all the entire coverage area is divided into small part. The small part is called Cell so it is also called cellular mobile communication. The base station (BS) is established in the center of each cell. The BS receives data from the mobile device in the cell and forwards the data to the appropriate mobile device. If the destination mobile hardware is located in other cell then BS will use "hands-off" mechanism to the destination BS. The BS keeps track of the data of all mobile hardware in its cell. The BS and mobile hardware communicates with each other over the radio access network. It is the primarily component of the BS. Figure-17 shows the architecture of wireless communication technology.
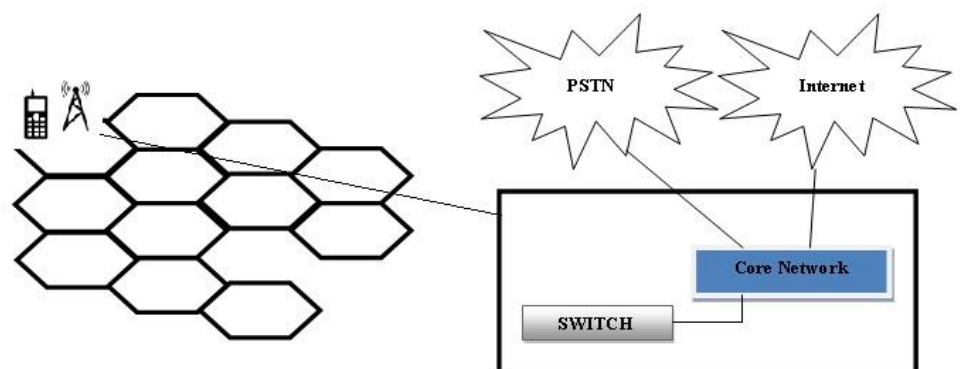

Figure-17 Architecture of Wireless Communication Technology

On the other hand, the core network interconnects with the base stations (BSs) and Mobile Switching Center (MSC). The core network also provides an interface to other networks such as traditional telephone line (PSTN) and the Internet.

4.3.1.2 Wireless Communication Standard

The wireless communication standard has developed to great extent in last five decades. The growth of standard is categorized in terms of generation. Each generation provide higher data transmission rate and additional capabilities. The Table-5 shows the summary of the wireless communication standard for each generation.

Generation	Feature	Standards	Speed
1st (1G)	Supports analog transmission Only voice communication	Nordic Mobile Telephone (NMT), Advanced Mobile Phone System (AMPS), Total Access Communication System (TACS)	600 to 1200 Bps
2nd (2G)	Digital transmission Single channel can be use by multiple user	Global System for Mobile (GSM)	9.6 Kbps
2nd (2.5G)	Supports web browsing Supports video stream	General Packet Radio Service (GPRS)	28Kbps
3rd (3G)	Supports enhanced Video stream	Universal Mobile Telephone System (UMTS),	384 Kbps
4th (4G)	IP telephony Gaming services High definition mobile TV	Long Term Evolution (LTE)	5.8 Mbps
5th (5G)	Low Battery Consumption Multiple data transfer rate	5G NR (5G New Radio)	1GBps (minimum)

Table-5 wireless communication standard for each generation

4.3.2 Mobile Hardware

Any device that can be easily carried and moved from one place to another is called a mobile device / mobile hardware. It may be laptop, PDA, Tablet, smart phone etc. These kinds of devices have a capability of sending and receiving signals. These devices can also transmit and receive signals at the same time.

4.3.3 Mobile Software

Mobile software is the program that runs on the mobile hardware. It is responsible to manage the hardware. It also deals with the requirement of mobile applications. It is an interface between mobile applications and mobile hardware. Generally, mobile software is called mobile operating system (MOS). Mobile operating system is the kernel of the mobile hardware. Android, iOS, Window Phone, BlackBerry are the example of mobile operating systems. The detailed working of mobile operating system will be learnt in the upcoming block.

4.4 CHARACTERISTICS OF MOBILE COMPUTING

Most important characteristics of mobile computing are computing on the move that is transmitting or receiving data by any or both sender and receiver even when they are in motion. The following are the some of the important characteristics of mobile computing.

➢ **Location alertness:**

A mobile device with the Global Positioning System (GPS) can provide the current location of the mobile user. Many mobile applications provide a location based services. For example cab service provides the current location of car. It also provides the traveler moving direction on real-time. The Map application provides the location based information such as fuel pump, restaurants, ATM point and many more.

➢ **Omni Presence:**

Omni presence is also called "present everywhere". Mobile computing needs to perform computing from anywhere and at anytime. A mobile user can receive the notification at anywhere at any time but within wireless coverage area.

- ➢ **Broadcasting:**

    Mobile computing supports broadcasting characteristics. The mobile computing has capability of broadcasting messages simultaneously to thousands of mobile user. For example, all users at a specific location, such as a cab service operator may send advertising information to those who are near to the airport.

- ➢ **Ability to enhancement:**

    Mobile computing has a capability to work in the changing environment. It adjusts to bandwidth fluctuation without inconvenience to the mobile user. In mobile computing, adjustment is crucial due to disconnections or fluctuations of bandwidth that can rise due to any reason.

- ➢ **Customization:**

    Mobile environment can be easily personalized as per the user's profile. For example mobile user can block notification from the specific source, he/she can block message etc. This can be easily done through customization.

- ➢ **Library Support:**

    Mobile operating systems should contain middleware libraries and frameworks with APIs which implement and abstract the functionality of the features of the mobile devices. The purpose is to provide functional consistency and to ease the software development. Middleware library and framework is a software layer that acts as a mediator between the application and the mobile operating system.

- ➢ **Robustness:**

    A user expects a mobile operating system to be robust. This means it should be strong and unlikely to fail or crash. The device must not only be designed to avoid crash, but must also provide support functions and policies. These support functions and policies allows the device to handle application errors and out-of-memory situations, without hampering the functionalities of the Smartphone.

4.5 RESPONSIBILITIES OF MOBILE OPERATING SYSTEM

In comparison to the generalize operating system mobile operating systems have some additional responsibilities which are mandatory to be performed. The most important responsibility of mobile operating system is efficient utilization of device resources for the multiple tasks. The resources managed by the mobile operating system are processor, SD cards, files, cameras, speaker etc. Mobile OS is expected to run multiple mobile applications at the same time and each application may require one or more resources. For example mobile user can play music and at the same time he/she can take photo. Here playing music requires access to the speakers, music files with internet communication and music bits computing. At the same time user uses mobile camera to capture the photo.

The mobile operating system needs to provide highly interactive interface with the limited size of screen. Along with this, the interface needs to control the communication with the base station using the different type of communication protocols. The communication may be based on data, voice or video form. The mobile operating system offers a high resolution screen and a big / small screen size that helps user to carry out different functions easily. Some mobile device provides touch screen facility for better view and easy functioning of the device.

The mobile devices communicate with base station, computers and various types of peripheral devices. In such devices, mobile operating system requires enhanced communication support. The mobile operating system uses communication protocols depending on the generation of the communication technology like 1G, 2G, 3G etc. To communicate with the computer laptops and other devices, mobile OS needs to support TCP/IP and other wireless protocols. To communicate within small range it supports Bluetooth and multiple interfacing protocols and hardware interfaces.

The mobile operating system provides support to a various types of input mechanisms. The user can give input by the use of small touch on screen or using query keyboard. The input comes from the attached device such as thumb scanner, cameras or any kind of attached sensors.

Various mobile applications run on the mobile operating system. Basic applications like address book, messaging, map, phone book etc need hardware access. All the installed mobile applications are managed by the mobile operating system.

The mobile operating system also manage incoming and outgoing calls The user can manage multiple calls (conference calls) and concurrent calls on the mobile device with the help of User Interface (UI). The mobile operating system allows you to record the calls in digital format and save them to your computer.

Latest mobile device identify its location using GPS. The GPS (Global Positioning System) feature present in the mobile device helps users to get driving directions, point of interest in the locality, or search businesses by using the gadget. By managing this facility actual implement of mobile computing is achieved by the mobile operating system.

Mobile device has a feature like inbuilt digital high resolution camera and voice / sound recorder. User of the mobile device can take video using such inbuilt device. The Mobile operating system need to provide a support to share the captured video as Multi Media Message (MMS) using email, Bluetooth or other communication technology / software. The mobile OS also manage the facility of sending and receiving the text messages.

Mobile operating system uses memory for the various tasks. This is an important responsibility of mobile operating system. The RAM (Random Access Memory) is the physical location in the chip where the mobile operating system and other applications run. The RAM size for a mobile device can be small, so mobile operating system manages it in efficient manner. Besides the Ram, users can add flash memory for storing their data like contact details, songs, video recording etc. Flash Memory in a mobile device is either inbuilt or can be installed as an add-on.

An important responsibility of mobile operating system is synchronizing data with a computer. Most of the mobile device comes with the facility to synchronize to a PC. This feature allows maintaining the latest contact information, mails stored on software.

4.6 SPECIAL CONSTRAINS FOR THE MOBILE OPERATING SYSTEM

The operating system for a mobile device needs to work in presence of many types of constraints which are not faced by the generalize operating systems. Some of the important constraints of the mobile operating system are as under:

➢ **Limited Battery Power**

Mobile device receives the power supply from the battery. The battery power is limited and drains fast if we make extensive use of mobile device, so mobile operating system needs to minimize power consumption.

➢ **Limited Processing Power**

Majority of the mobile device have ARM based processors. These processors are certainly energy efficient, powerful and cheaper compared to the desktop processors yet these are significantly slower.

➢ **Limited Memory**

Mobile device usually have small size of memory as compared to general computer system. To cope up with this condition mobile operating system itself is of small size and yet provides a rich set of functionalities to meet users demand.

➢ **Limited Screen Size**

The mobile screen size is small compared to laptop or desktop computer. Mobile operating system needs to support innovative user interface to overcome this to minimize user's inconveniences. The mobile operating system should take minimum input from the user interface.

➢ **Bandwidth fluctuation**

Mobile device communicate with other devices with the use of wireless medium. A wireless medium is directly susceptible to atmospheric noise and there by causes high bit error rate. In addition, bandwidth of wireless medium may have fluctuation randomly due to atmospheric noise, movement of objects.

➢ **Small size of keyboard**

The mobile device provides very small sized keypad or display touch screen based keypad. In both the interface, typing in the documents is difficult. To overcome this limitation mobile operating system provides a facility of the word completion prompts.

4.7 STRUCTURE OF MOBILE COMPUTING APPLICATIONS

One of the most important responsibilities of mobile operating system is to run the mobile applications. The mobile operating system need to run mobile application onto hardware; manage the middleware components and user interface. Generally mobile application is structure is three tire, namely presentation tier, application tier and data tier.

Presentation tier focuses on user interface. A good user interface facilitates the users to issue requests and to present the results to them meaningfully. The application tier is responsible to make logical decisions and perform calculations. It also moves and processes data between the presentation and data layers. The application tier is the heart of the application. The data tier is responsible to provide the basic facilities of data storage and manipulation.

4.8 LET US SUM UP

In this unit, we have learnt about mobile computing. Let's quickly review the main points of the unit.

➢ Mobile computing is an ability to compute while on the move.

➢ The wireless communication technology is refers to the infrastructure based on reliable communication technology consisting of wireless protocols, services, bandwidth and other necessary components.

➢ To setup the communication infrastructure four main components are required: Base Station, the core network, Radio Access Network and Mobile hardware.

➢ Mobile communication standards start from 1G and latest implement is 5G.

- Mobile computing has some characteristics like location awareness, omni presence, broadcasting, ability to enhancement, customization, library support and robustness.
- Mobile operating system has some constrains like limited battery power, limited processing power, limited memory, limited screen size, bandwidth fluctuation and Small size of keyboard.

4.9 CHECK YOUR PROGRESS

Fill in the blanks.

1. Mobile computing is computing on _____.
2. Mobile computing is also called _____ or _____ computing.
3. The primary work of wireless communication technology is to transmit _____.
4. BS stands for _____.
5. The _____ receives data from the mobile device in the cell.
6. MSC stands for _____.
7. First generation wireless communication standard support speed between _____ to ___ BPS.
8. GPRS stands for _____.
9. LTE stands for _____.
10. GPS stands for _____.

4.10 CHECK YOUR PROGRESS: POSSIBLE ANSWERS

1. Move
2. Ubiquitous, nomadic
3. data
4. Base Station
5. Base Station
6. Mobile Switching Center
7. 600, 1200
8. General Packet Radio Service
9. Long Term Evolution
10. Global Positioning System

4.11 FURTHER READING

- Prasant Kumar pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI.

4.12 ASSIGNMENTS

Write the answer of the following Questions

1. Explain architecture of wireless communication technology.
2. List the wireless communication standards.
3. Write a short note on characteristics of mobile computing.
4. Explain responsibilities of mobile operating system.
5. What are the constrains for mobile operating system?