18MCA33C Mobile Computing

UNIT I

Introduction

FACULTY

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Year	Subject Title	Semester	Sub. Code
2018 - 2019 Onwards	MOBILE COMPUTING	III	18MCA33C

Objective: The course presents the concepts of Mobile Computing. To enable the students to learn the basics of mobile communication systems and mobile networks and application development.

UNIT I: Introduction: Introduction to networking - Advantages and disadvantages of wireless networking - Evolution of mobile communication generations - Wireless LAN and Wireless WAN - Mobile devices Profiles.

UNIT II: Cellular Concept: Wireless transmission - Frequencies for radio transmission - Regulations - Signals, Signal propagation, Path loss of radio signals, Additional signal propagation effects - Multi-path propagation - Multiplexing - Cellular Systems - Frequency Reuse - Problems with MAC in cellular systems - MACA - CDMA.

UNIT III: Mobile Network Infrastructure: GSM - Mobile services - System architecture - Handover - GPRS - Mobile services - System Architecture - WAP protocol stack - WAE - Blue Tooth - Piconet, scatternet.

UNIT IV: Mobile Applications Architecture: Wireless Internet - Wireless Internet Architecture - Smart Client - Smart Client Architecture - Messaging Architecture - Sample Applications - Characteristics and benefits - Application Model - Infrastructure and Managing Resources - Mobile Software Engineering - Frameworks and Tools.

UNIT V: Application Development: Overview of Android - Devices Running Android - Why for Android - Features of Android - Architecture, Libraries - SDK - Views and View groups - layouts - Menus - Intents and services - Adapters - Using Internet Resources - Dialogs - Capturing Date and Time - Validation - File System in android - File management - Developing Location based applications - Creating map based activities - Packaging and Deployment - Security and Hacking.

TEXT BOOKS:

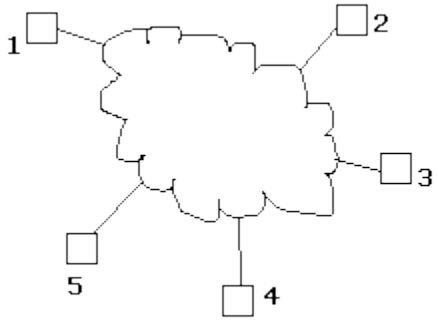
1. Martyn Mallick, "Mobile and Wireless design essentials" Wiley Publishing Inc, 2008.
2. Jochen Schiller, "Mobile Communications", Addison-Wesley, 2003.
3. Reto Meier and Wrox Wiley, "Professional Android 2 Application Development", 2010.

REFERENCE BOOKS:

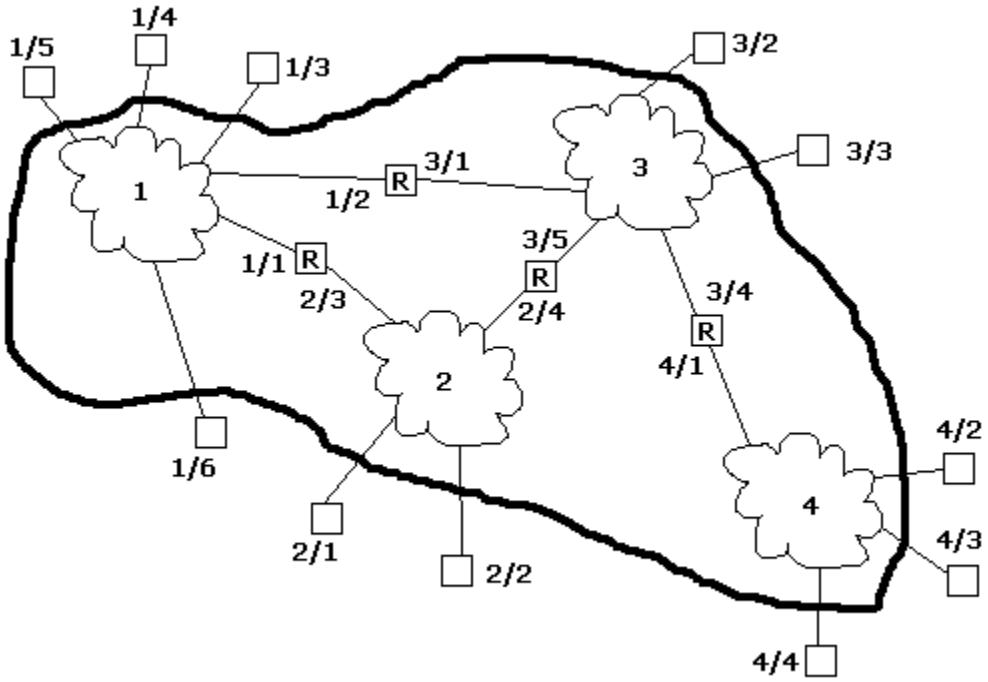
1. Zigurd Mednieks, Laird Dornin G, Blake Meike and Masumi Nakamura, "Programming Android", O"Reilly, 2011.
2. Hansmann, Merk, Nicklous and Stober, "Principles of Mobile Computing", Springer, 2003.

Introduction to networking

- **A network**: A group of devices that can communicate with each other over **links**. Each device is called a **host**. Each host has a unique **address**.



- **An internet**: A network of networks. On an internet, each host has an address of the form n/h where n is the network number and h is the number of the host on network n. As long as all of the networks in the internet have unique network numbers, combining the network number and host number will give unique global names. Therefore *from the outside an internet looks like a single network!*



- **A router**: A device that appears simultaneously on two or more networks. (Usually this is a computer or device with two or more **network interface cards**, or NICs.)
- **The Internet**: The biggest internet around. "You know it when you see it."

Advantages and disadvantages of wireless networking

Advantages:

1. **Freedom from wires:**
   Can be configured with the use of any physical connection.
2. **Easy to setup :**
   Wireless network is easy to expand and setup
3. **Better or global coverage:**
   It provides global reach by providing networking in places such as rural areas, battlefield, etc… where wiring is not feasible.
4. **Flexibility:**
   Wireless network is more flexible and adaptable compared to wired network.
5. **Cost-effectiveness:**
   Since it is easy to install and doesn't require cables, wireless network is relatively cheaper.
6. **Mobile and portable:**
   Wireless network is easy to carry and re-install in another place.

Disadvantages:

1. As communication is done through open space, it is less secure.
2. Unreliability
3. More open to interference.
4. Increased chance of jamming.
5. Transmission speed is comparably less.

Evolution of mobile communication generations

1G

The very first generation of commercial cellular network was introduced in the late 70's with fully implemented standards being established throughout the 80's. The radio signals used by 1G are analogue, meaning the voice of a call is modulated to a higher frequency rather than being encoded to digital signals.

Analogue signals degrade over time and space meaning that voice data can very often lack quality within a call. In comparison, digital is a representation of analogue stored as signals, meaning larger amounts of data can be carried more effectively.

2G

The second generation saw the introduction of GSM (Global System for Mobile Communication) technologies as a standard in the early 90's. It allowed for digital voice and data to be sent across the network and allowed users to roam for the first time.

2G also used Signalling and Data Confidentially and Mobile Station Authentication to ensure improved security and privacy of telephone calls.

The advance in technology from 1G to 2G introduced many of the fundamental services that we still use today, such as SMS, internal roaming, conference calls, call hold and billing based on services e.g. charges based on long distance calls and real time billing.

2.5G

Between the year 2000 and 2003, an upgrade in technologies introduced the packet network which provided high speed data transfer and internet and became known as 2.5G.

The standards included GPRS (General Packet Radio Service) and EDGE (enhanced Data Rates in GSM).

GPRS supports flexible data transmission rates and provides continuous connection with the network. It also allows for the service provider to charge for the amount of data that is sent rather than their connection time.

3G

Introduced commercially in 2001, the goals set out for third generation mobile communication were to facilitate greater voice and data capacity, support a wider range of applications, and increase data transmission at a lower cost.

For the first time, this generation supported high speed wide band internet access as well as fixed wireless internet access and allowed for video calls, chatting and conferencing, mobile TV, video on demand services, navigational maps, email, mobile gaming, music and digital services such as movies.

Significantly greater security features were introduced within 3G, including Network Access and Domain Security and Application Security.

4G

Initiated in 2010, the fourth generation is an all IP based network system. Its purpose is to provide high speed, high quality and high capacity to users while improving security and lower the cost of voice and data services, multimedia and internet over IP.

The major benefit of an IP based network is that it is able to seamlessly handover, for voice and data to GSM, UMTS and CDMA2000 technologies from the previous different generations infrastructure.

4G introduced the LTE standard which only support packet switching and an all IP Network. There are a significant amount of infrastructure changes needed to be implemented by service providers in order to supply because voice calls in GSM, UMTS and CDMA2000 are circuit switched, so with the adoption of LTE, carriers will have to re-engineer their voice call network.

5G

5G is the next generation of commercial cellular network, set to greatly increase internet connectivity speeds. At this time, there aren't any publicly agreed definitive standards that have been set as with previous generations so not a great deal of information is known about the specific technologies that are going to be used.

Wireless LAN and Wireless WAN

LANs come under the category of small scale networks within a single building or campus.

WANs are Wide Area Networks which cover a wider area such a city, or a limited area greater than LAN. **Wireless Personal Area Networks (PANs)** are the next step down from WLANs, covering smaller areas with low power transmission, for networking of portable and mobile computing devices such as PCs, Personal Digital Assistants (PDAs).

Fundamentals of WLANs

The technical issues in WLANs must be understood in order to appreciate the difference between wired networks and wireless networks. The use of WLANs and their design goals are then studied. The types of WLANS, their components and their basic functionalities are also detailed.

IEEE 802.11 Standard

This section introduces a prominent standard ion WLANs, the IEEE 802.11 standard. The medium access control (MAC) layer and the physical layer mechanisms are explained. This section also covers some of the optional functionalities such as security and quality of service (QoS).

HIPERLAN Standard

This section describes another WLAN standard, HIPERLAN standard, which is a European standard based on radio access.

Bluetooth

This section deals with the Bluetooth standard, which enables personal devices to communicate with each other in the absence of infrastructure.

WLAN Fundamentals

While both portable terminals and mobile terminals can move from one place to another, portable terminals are accessed only when they are stationary.

Mobile Terminals (MTs), on the other hand, are more powerful, and can be accessed when they are in motion. WLANs aim to support truly mobile work stations.

WLAN Uses

Wireless computer networks are capable of offering versatile functionalities. WLANs are very flexible and can be configured in a variety of topologies based on the application. Some possible uses of WLANs are described below.

- Users would be able to surf the Internet, check e-mail, and receive Instant Messages on the move.
- In areas affected by earthquakes or other disasters, no suitable infrastructure may be available on the site. WLANs are handy in such locations to set up networks on the fly.
- There are many historic buildings where there has been a need to set up computer networks. In such places, wiring may not be permitted or the building design may not be conductive to efficient wiring. WLANs are very good solutions in such places.

Design Goals

The following are some of the goals which have to be achieved while designing WLANs −

- **Operational simplicity** − Design of wireless LANS must incorporate features to enable a mobile user to quickly set up and access network services in a simple and efficient manner.
- **Power efficient operation** − The power-constrained nature of mobile computing devices such as laptops and PDAs necessitates the important requirement of WLANs operating with **minimal power consumption**. Therefore, the design of WLAN must incorporate power-saving features and use appropriate technologies and protocols to achieve this.
- **License-free operation** − One of the major factors that affects the cost of wireless access is the license fee for the spectrum in which a particular wireless access technology operates. **Low cost of access** is an important aspect for popularizing a WLAN technology. Hence the design of WLAN should consider the parts of the

frequency spectrum. For its operation which **does not require** an explicit<blicensing.< p=""></blicensing.<>

- **Tolerance to interference** − The proliferation of different wireless networking technologies both for civilian and military applications have led to a significant **increase in the interference level** across the radio spectrum.

  The WLAN design should account for this and take appropriate measures by way of selecting technologies and protocols to operate in the presence of interference.

- **Global Usability** − The design of the WLAN, the choice of technology, and the selection of the operating frequency spectrum should take into account the prevailing **spectrum restriction** in countries across the world. This ensures the acceptability of the technology across the world.

- **Security** − The inherent broadcast nature of wireless medium adds to the requirement of security features to be included in the design of WLAN technology.

- **Safety requirements** − The design of WLAN technology should follow the safety requirements that can be classified into the following.

  - Interference to medical and other instrumentation devices.
  - Increased power level of transmitters that can lead to health hazards.

  A well-designed WLAN should follow the power emission restrictions that are applicable in the given frequency spectrum.

- **Quality of service requirements** − Quality of Service (**QoS**) refers to the provisioning of designated levels of performance for multimedia traffic. The design of WLAN should take into consideration the possibility of **supporting a wide variety** of traffic, including multimedia traffic.

- **Compatibility with other technologies and applications** − The interoperability among different LANS is important for efficient communication between hosts operating with different LAN technologies.

Mobile devices Profiles.

Mobile Information Device Profile (MIDP) is a specification for the use of Java technology for mobile devices. In the context of software development, MIDP sits on top of the Connected Limited Device Configuration (CLDC).

Because MIDP is primarily used with CLDC, which is designed for highly constrained devices with limited CPUs, screen size, RAM, battery power and user interface, midlets are ideal for low-end cell phones.

Applications written with MIDP are normally designed for cell phones and PDAs. They are known as midlets.

THANK YOU

This content is taken from the text books and reference books prescribed in the syllabus.