SIXTH SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY- OCTOBER, 2013

MOBILE COMPUTING

(Common for CT, CM & IF**)**

(Maximum Mark:100) (Time: 3hr)

PART - A

I. Answer the following questions in one or two sentences .Each question carries two mark.

1. State the term cell.

Each transmitter typically called a base station covers a certain area, a cell

2. State the term foot print.

Each satellite can cover a certain area on the earth with its beam (the so-called 'footprint')

3. **Write the use of HLR database.**

Network switching subsystem (**NSS**) (or **GSM core network**) is the component of a GSM system that carries out call switching and mobility management functions for mobile phones roaming on thenetwork of base stations. It is owned and deployed by mobile phone operators and allows mobile devices to communicate with each other and telephones in the wider public switched telephone network(PSTN). The architecture contains specific features and functions which are needed because the phones are not fixed in one location.

4. State the term piconet.

A piconet is a collection of Bluetooth devices which are synchronized to the same hopping sequence.

5. **Write the meaning of Intranet**.

A local or restricted communications network, especially a private network created using World Wide Web software.

PART – B

II. Answer any five of the following. Each question carries 6 marks.

1. **Discuss the term mobility in terms of communication device.**

Mobility is human's nature. In the field of computing and communication technologies, to be able to communicate with other persons and access and process information simultaneously while moving has been as a long expectation that causes great deal of efforts having been made to turn the fancy into fact. The following advances in different technical areas provide the possibility of realizing the imagination, including:

1) The advances in VLSI, antenna, and battery technologies, which make small and light portable devices like laptop, personal digital assistants (PDAs), and cellular phone becoming more and more popular.

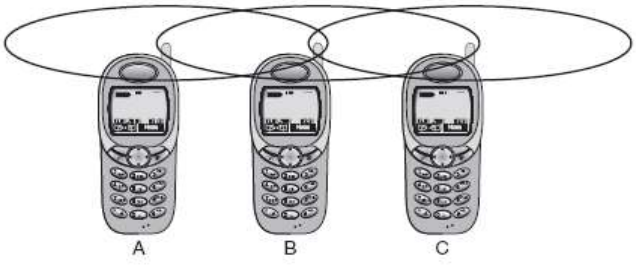
2) The advances in wireless communications theory, which make miscellaneous wireless networks with different air interfaces (e.g. TDMA, CDMA, FDMA, etc.) and wired infrastructures (e.g. Internet, PLMN, ATM, etc.) available.

3) The advances in software technology, e.g. software engineering, language technology, distributed computing, modern database, etc., which make various mobile services with effective supports facilitate human's work and life.

2. Give an idea about hidden and exposed terminal scenario.

A starts sending to B, C does not receive this transmission. C also wants to send something to B and senses the medium. The medium appears to be free, the carrier sense fails. C also starts sending causing a collision at B. But A cannot detect this collision at B and continues with its transmission. A is **hidden** for C

While hidden terminals may cause collisions, the next effect only causes unnecessary delay. Now consider the situation that B sends something to A and C wants to transmit data to some other mobile phone outside the interference ranges of A and B. C senses the carrier and detects that the carrier is busy (B's signal). C postpones its transmission until it detects the medium as being idle again. But as A is outside the interference range of C, waiting is not necessary. Causing a 'collision' at B does not matter because the collision is too weak to propagate to A. In this situation, C is **exposed** to B.

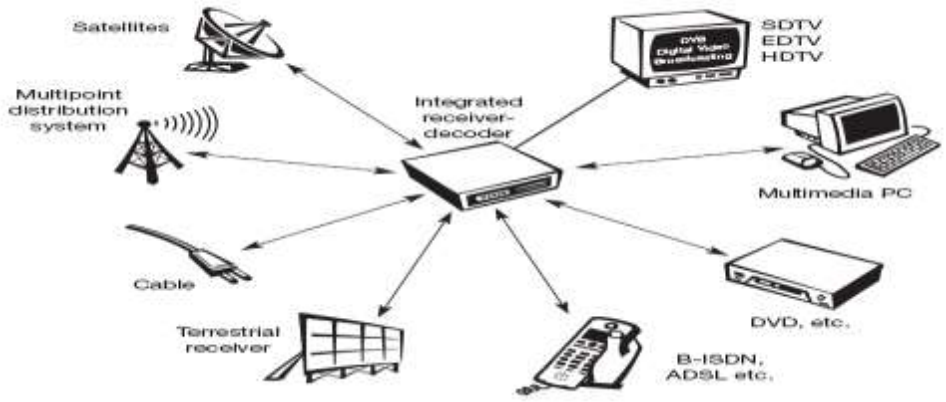


3. **Discuss different applications of satellite systems.**

Weather forecasting: Several satellites deliver pictures of the earth using, e.g., infra red or visible light. Without the help of satellites, the forecasting of hurricanes would be impossible.

- **Radio and TV broadcast satellites:** Hundreds of radio and TV programs are available via satellite. This technology competes with cable in many places, as it is cheaper to install and, in most cases, no extra fees have to be paid for this service. Today's satellite dishes have diameters of 30–40 cm in central Europe, (the diameters in northern countries are slightly larger).
- **Military satellites:** One of the earliest applications of satellites was their use for carrying out espionage. Many communication links are managed via satellite because they are much safer from attack by enemies.

4. **Discuss digital video broadcasting.**



The center point is an integrated receiver-decoder (set-top box) connected to a high-resolution monitor. This set-top box can receive DVB signals via satellites, terrestrial local/regional senders (multi-point distribution systems, terrestrial receiver), cable, B-ISDN, ADSL, or other possible future technologies.

Cable, ADSL, and B-ISDN connections also offer a return channel, i.e., a user can send data such as channel selection, authentication information, or a shopping list. Audio/video streams can be recorded, processed, and replayed using **digital versatile disk (DVD)** or multimedia PCs. Different levels of quality are envisaged: **standard definition TV (SDTV)**, **enhanced definition TV (EDTV)**, and **high definition TV (HDTV)** with a resolution of up to 1,920 □□1,080 pixels.

5. **Compare infrared and radio transmission.**

- The main **advantages** of infra red technology are its simple and extremely cheap senders and receivers which are integrated into nearly all mobile devices available today. PDAs, laptops, notebooks, mobile phones etc. have an infra red data association (IrDA) interface. Version 1.0 of this industry standard implements data rates of up to 115 Kbit/s, while IrDA 1.1 defines higher data rates of 1.152 and 4 Mbit/s. No licenses are needed for infra red technology and shielding is very simple. Electrical devices do not interfere with infra red transmission.

  ● **Disadvantages** of infra red transmission are its low bandwidth compared to other LAN technologies. Typically, IrDA devices are internally connected to a serial port limiting transfer rates to 115 kbit/s. Even 4 Mbit/s is not a particularly high data rate. However, their main disadvantage is that infra red is quite easily shielded. Infra red transmission cannot penetrate walls or other obstacles. Typically, for good transmission quality and high data rates a LOS, i.e., direct connection, is needed.
- **Advantages** of radio transmission include the long-term experiences made with radio transmission for wide area networks (e.g., microwave links) and mobile cellular phones. Radio transmission can cover larger areas and can penetrate (thinner) walls, furniture, plants etc. Additional coverage is gained by reflection. Radio typically does not need a LOS if the frequencies are not too high. Furthermore, current radio-based products offer much higher transmission rates (e.g., 54 Mbit/s) than infra red (directed laser links, which offer data rates well above 100 Mbit/s. These are not considered here as it is very difficult to use them with mobile devices).

  ● Again, the main advantage is also a big **disadvantage** of radio transmission. Shielding is not so simple. Radio transmission can interfere with other senders, or electrical devices can destroy data transmitted via radio. Additionally, radio transmission is only permitted in certain frequency bands. Very limited ranges of license-free bands are available worldwide and those that are available are not the same in all countries. However, a lot of harmonization is going on due to market pressure.

a. List different applications of Bluetooth.

- By installing a Bluetooth network in your office you can do away with the complex and tedious taskof networking between the computing devices, yet have the power of connected devices. No longer would you be bound to fixed locations where you can connect to the network. Each Bluetooth device could be connected to 200 other devices making the connection of every

device with every other possible. Since it supports both point to point and point to multipoint it will virtually make the maximum number of simultaneously linked devices unlimited.

- The Bluetooth technology connects all your office peripherals wirelessly. Connect your PC or notebook to printers, scanners and faxes without the ugly and trouble some cable attachments. You can increase your freedom by connecting your mouse or the keyboard wirelessly to your computer.

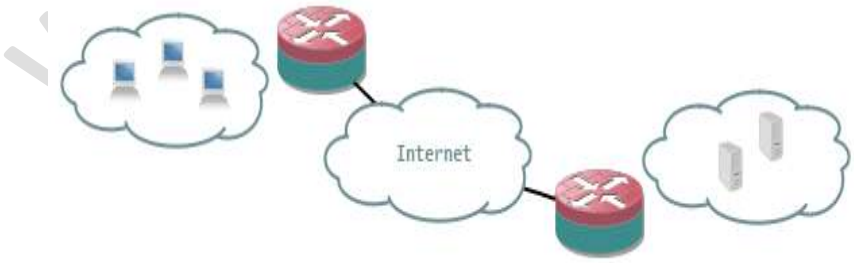
- If your digital cameras in Bluetooth enabled, you can send still or video images from any location to any location without the hassle of connecting your camera to the mobile phone on the wireline phone.

- Bluetooth allows us to have three way phones. At home, your phone functions as a portable phone (fixed line charge). When you're on the move, it functions as a mobile phone (cellular charge). And when your phone comes within range of another mobile phone with built-in Bluetooth wireless technology it functions as a walkie-talkie (no telephony charge).

- In meetings and conferences you can transfer selected documents instantly with selected participants, and exchange electronic business cards automatically, without any wired connections.

- Connect your wireless headset to your mobile phone, mobile computer or any wired connection to keep your hands free for more important tasks when you're at the office or in your car.

6. Describe different types of Virtual Private Network.

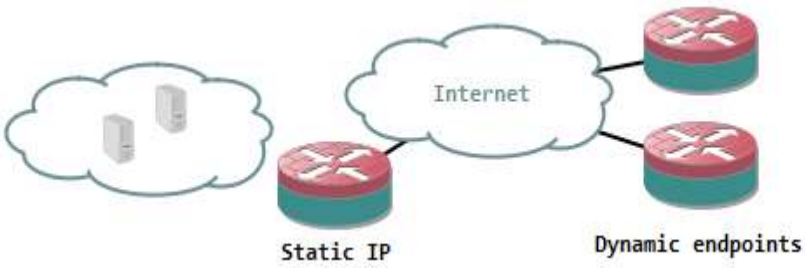


Site-to-site VPN

often abbreviated to S2SVPN. It's a connection between two sites and encrypts all traffic between two (or multiple) subnets. There are two types of S2SVPN:

- Policy-based: interesting traffic triggers an ACL and is encrypted and sent to the remote VPN peer.
- Routed: traffic is routed into an encrypted tunnel to the remote VPN peer.

For a detailed explanation and configuration, Jeremy made some excellent posts about this on Packetlife: Part 1 for policy-based and Part 2 for routed



DMVPN

A dynamic multipoint VPN is not a protocol but more a technique using different protocols. One or more central hub routers are required, but the remote (spoke) routers can have dynamic IPs and more can be added without having to modify the configuration on the hub router(s), or any other spoke routers. The routers use a next-hop resolution protocol, combined with a dynamic routing protocol to discover remote peers and subnets. The VPN itself is a mGRE tunnel (GRE with multiple endpoints) which is encrypted.

PART – C

(Answer one full question from each unit, each question carries 15 mark)

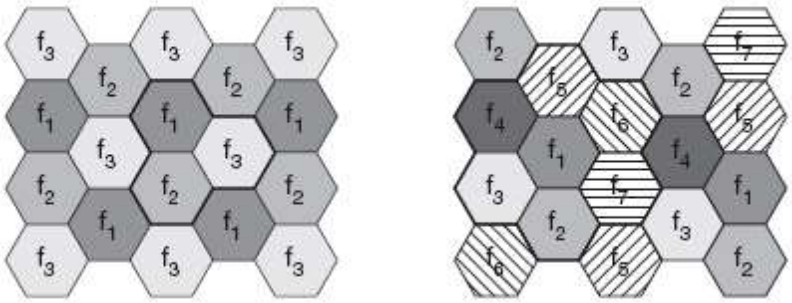
Unit -1

III. (a) Explain CDMA Technology in detail. (8)

Codes with certain characteristics can be applied to the transmission to enable the use of **code division multiplexing (CDM)**. **Code division multiple access (CDMA)** systems use exactly these codes to separate different users in code space and to enable access to a shared medium without interference. The main problem is how to find "good" codes and how to separate the signal from noise generated by other signals and the environment. A code for a certain user should have a good autocorrects- Inhibit sense

multiple access using a busy tone lation2 and should be **orthogonal** to other codes. Orthogonal in code space has the same meaning as in standard space (i.e., the three dimensional space). Think of a system of coordinates and vectors starting at the origin, i.e., in (0, 0, 0).3 Two vectors are called orthogonal if their inner product is 0, as is the case for the two vectors (2, 5, 0) and (0, 0, 17): (2, 5, 0)*(0, 0, 17) = 0 + 0 + 0 = 0. But also vectors like (3, –2, 4) and (–2, 3, 3) are orthogonal: (3, –2, 4)*(–2, 3, 3) = –6 – 6 + 12 = 0. By contrast, the vectors (1,2,3) and (4,2, –6) are not orthogonal (the inner product is –10), and (1, 2, 3) and (4, 2, –3) are "almost" orthogonal, with their inner product being –1 (which is "close" to zero). This description is not precise in a mathematical sense. However, it is useful to remember these simplified definitions when looking at the following examples where the original code sequences may be distorted due to noise. Orthogonality cannot be guaranteed for initially orthogonal codes.

(**b) Discuss the structure of CELL. Write any two advantages and disadvantages.** **(7)**



Cellular systems for mobile communications implement SDM. Each transmitter, typically called a **base station**, covers a certain area, a **cell**. Cell radii can vary from tens of meters in buildings, and hundreds of meters in cities, up to tens of kilometers in the countryside.

Advantages of cellular systems with small cells are the following:

● **Higher capacity**: Implementing SDM allows frequency reuse. If one transmitter is far away from another, i.e., outside the interference range, it can reuse the same frequencies. As most mobile phone systems assign frequencies to certain users (or certain hopping patterns), this frequency is blocked for other users. But frequencies are a scarce resource and, the number of concurrent users per cell is very limited. Huge cells do not allow for more users. On the contrary, they are limited to less possible users per km2. This is also the reason for using very small cells in cities where many more people use mobile phones.

● **Less transmission power**: While power aspects are not a big problem for base stations, they are indeed problematic for mobile stations. A receiver far away from a base station would need much more transmit power than the current few Watts. But energy is a serious problem for mobile handheld devices.

● **Local interference only**: Having long distances between sender and receiver results in even more interference problems. With small cells, mobile stations and base stations only have to deal with 'local' interference.

● **Robustness**: Cellular systems are decentralized and so, more robust against the failure of single components. If one antenna fails, this only influences communication within a small area.

disadvantages:

● **Infrastructure needed**: Cellular systems need a complex infrastructure to connect all base stations. This includes many antennas, switches for call forwarding, location registers to find a mobile station

Handover needed: The mobile station has to perform a handover when changing from one cell to another. Depending on the cell size and the speed of movement, this can happen quite often.

● **Frequency planning**: To avoid interference between transmitters using the same frequencies, frequencies have to be distributed carefully. On the one hand, interference should be avoided, on the other, only a limited number of frequencies is available.

OR

IV. (a) State the following internetworking terms : (8)

(i) **End system:** In networking jargon, the computers that are connected to a computer network are sometimes referred to as **end systems**.

(ii) **Intermediate system**: **intermediate System to Intermediate System** (**IS-IS**) is a routing protocol designed to move information efficiently within a computer network, a group of physically connected computers or similar devices.

(iii) **Bridge:** A bridge can be used to connect networks, typically of different types. A wireless Ethernet bridge allows the connection of devices on a wired Ethernet network to a wireless network. The bridge acts as the connection point to the Wireless LAN

(iv) **Router:** A wireless router is actually two devices, an access point and a router.

- Access point – allows wireless devices to connect to the network.
- Router – does the following:
    - Directs data going to and from devices connected to the network

- Allows network-connected devices to share a single connection to the Internet (through a cable, DSL, or FiOS modem)
- Allows network-connected devices to communicate with each other

(b) Discuss the concept of TDMA and FDMA.

Compared to FDMA, **time division multiple access (TDMA)** offers a much more flexible scheme, which comprises all technologies that allocate certain time slots for communication, i.e., controlling **TDM**. Now tuning in to a certain frequency is not necessary, ie., the receiver can stay at the same frequency the whole time. Using only one frequency, and thus very simple receivers and transmitters, many different algorithms exist to control medium access. As already mentioned, listening to different frequencies at the same time is quite difficult,

Frequency division multiple access (FDMA) comprises all algorithms allocating frequencies to transmission channels according to the **frequency division multiplexing (FDM)** Channels can be assigned to the same frequency at all times, i.e., pure FDMA, or change frequencies according to a certain pattern, i.e., FDMA combined with TDMA. The latter example is the common practice for many wireless systems to circumvent narrowband interference at certain frequencies, known as frequency hopping. Sender and receiver have to agree on a hopping pattern, otherwise the receiver could not tune to the right frequency. (7)

Unit – II

V. (a) Explain different handover scenario in GSM.

Cellular systems require **handover** procedures, as single cells do not cover the whole service area, but, e.g., only up to 35 km around each antenna on the countryside and some hundred meters in cities
There are two basic reasons for a handover (about 40 have been identified in the standard):

● The mobile station **moves out of the range** of a BTS or a certain antenna of a BTS respectively. The received **signal level** decreases continuously until it falls below the minimal requirements for communication. The **error rate** may grow due to interference, the distance to the BTS may be too high (max. 35 km) etc. – all these effects may diminish the **quality of the radio link** and make radio transmission impossible in the near future.

● The wired infrastructure (MSC, BSC) may decide that the **traffic in one cell is too high** and shift some MS to other cells with a lower load (if possible). Handover may be due to **load balancing**.

- four possible handover scenarios in GSM:

● **Intra-cell handover:** Within a cell, narrow-band interference could make transmission at a certain frequency impossible. The BSC could then decide to change the carrier frequency (scenario 1).

● **Inter-cell, intra-BSC handover:** This is a typical handover scenario. The mobile station moves from one cell to another, but stays within the control of the same BSC. The BSC then performs a handover, assigns a new radio channel in the new cell and releases the old one (scenario 2).

● I**nter-BSC, intra-MSC handover:** As a BSC only controls a limited number of cells; GSM also has to perform handovers between cells controlled by different BSCs. This handover then has to be controlled by the MSC (scenario 3).

● **Inter MSC handover:** A handover could be required between two cells belonging to different MSCs. Now both MSCs perform the handover together (8)

(**b) Discuss different types of satellite orbits with their merits.**

GEO

If a satellite should appear fixed in the sky, it requires a period of 24 hours. Using the equation for the distance between earth and satellite $r = (g \cdot R2/(2 \cdot \square \cdot f)2)1/3$ and the period of 24 hours $f = 1/24$h, the resulting distance is 35,786 km. The orbit must have an inclination of 0 degrees.

Advantages: Three GEO satellites are enough for a complete coverage of almost any spot on earth. Senders and receivers can use fixed antenna positions, no adjusting is needed. GEOs are ideal for TV and radio broadcasting. Lifetime expectations for GEOs are rather high, at about 15 years.

LEO

As LEOs circulate on a lower orbit, it is obvious that they exhibit a much shorter period (the typical duration of LEO periods are 95 to 120 minutes). Additionally, LEO systems try to ensure a high elevation for every spot on earth to provide a high quality communication link. Each LEO satellite will only be visible from the earth for around ten minutes.

Advantages: Using advanced compression schemes, transmission rates of about 2,400 bit/s can be enough for voice communication. LEOs even provide this bandwidth for mobile terminals with omni-directional antennas using low transmit power in the range of 1W. The delay for packets delivered via a LEO is relatively low (approx 10 ms).

MEO

MEOs can be positioned somewhere between LEOs and GEOs,

Advantages: Using orbits around 10,000 km, the system only requires a dozen satellites which is more than a GEO system, but much less than a LEO system. These satellites move more slowly relative to the earth's rotation allowing a simpler system design (satellite periods are about six hours).
Depending on the inclination, a MEO can cover larger populations, so requiring fewer handovers.

(7)

OR

VI. (a) Describe the main components of GSM architecture.

Base station subsystem (BSS): A GSM network comprises many BSSs, each controlled by a base station controller (BSC). The BSS performs all functions necessary to maintain radio connections to an MS, coding/decoding of voice, and rate adaptation to/from the wireless network part. Besides a BSC, the BSS contains several BTSs.

● **Base transceiver station (BTS)**: A BTS comprises all radio equipment, i.e., antennas, signal processing, amplifiers necessary for radio transmission. A BTS can form a radio cell or, using sectorized antennas, several cells , and is connected to MS via the **Um interface** (ISDN U interface for mobile use), and to the BSC via the **Abis interface**. The Um interface contains all the mechanisms necessary for wireless transmission (TDMA, FDMA etc.) and will be discussed in more detail below. The Abis interface consists of 16 or 64 kbit/s connections. A GSM cell can measure between some 100 m and 35 km depending on the environment (buildings, open space, mountains etc.) but also expected traffic.

● **Base station controller (BSC)**: The BSC basically manages the BTSs. It reserves radio frequencies, handles the handover from one BTS to another within the BSS, and performs paging of the MS. The BSC also multiplexes the radio channels onto the fixed network connections at the A interface.

(8)

(**b) Discuss about broadcast systems.**

Unidirectional distribution systems or broadcast systems are an extreme version of asymmetric communication systems. Quite often, bandwidth limitations, differences in transmission power, or cost factors prevent a communication system from being symmetrical. **Symmetrical communication systems** offer the same transmission capabilities in both communication directions, i.e., the channel characteristics from A to B are the same as from B to A (e.g., bandwidth, delay, costs). Examples of symmetrical communication services are the plain old telephone service (POTS) or GSM, if end-to-end communication is considered. In this case, it does not matter if one mobile station calls the other or the other way round, bandwidth and delay are the same in both scenarios.

This symmetry is necessary for a telephone service, but many other applications do not require the same characteristics for both directions of information transfer. Consider a typical client/server environment. Typically, the client needs much more data from the server than the server needs from the client. Today's most prominent example of this is the World Wide Web. Millions of users download data using their browsers (clients) from web servers. A user only returns information to the server from time to time.

(7)

Unit - III

VII. (a) List different advantages and disadvantages of WLAN.

Some **advantages** of WLANs are:

● **Flexibility:** Within radio coverage, nodes can communicate without further restriction. Radio waves can penetrate walls, senders and receivers can be placed anywhere (also non-visible, e.g., within devices, in walls etc.). Sometimes wiring is difficult if firewalls separate buildings (real firewalls made out of, e.g., bricks, not routers set up as a firewall). Penetration of a firewall is only permitted at certain points to prevent fire from spreading too fast.

● **Planning:** Only wireless ad-hoc networks allow for communication without previous planning, any wired network needs wiring plans. As long as devices follow the same standard, they can communicate. For wired networks, additional cabling with the right plugs and probably interworking units (such as switches) have to be provided.

● **Design:** Wireless networks allow for the design of small, independent devices which can for example be put into a pocket. Cables not only restrict users but also designers of small PDAs, notepads etc. Wireless senders and receivers can be hidden in historic buildings, i.e., current networking technology can be introduced without being visible.

● **Robustness:** Wireless networks can survive disasters, e.g., earthquakes or users pulling a plug. If the wireless devices survive, people can still communicate. Networks requiring a wired infrastructure will usually break down completely.

Disadvantages:

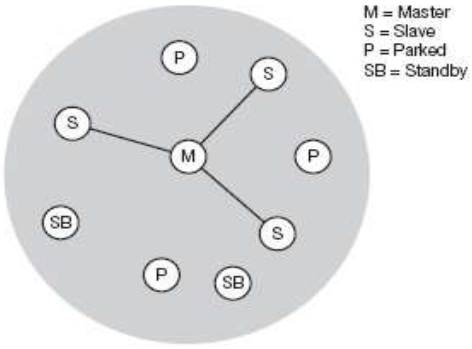
● **Quality of service:** WLANs typically offer lower quality than their wired counterparts. The main reasons for this are the lower bandwidth due to limitations in radio transmission (e.g., only 1–10 Mbit/s user data rate instead of 100–1,000 Mbit/s), higher error rates due to interference (e.g., 10–4 Instead of 10–12 for fiber optics), and higher delay/delay variation due to extensive error correction and detection mechanisms.

● **Proprietary solutions:** Due to slow standardization procedures, many companies have come up with proprietary solutions offering standardized functionality plus many enhanced features (typically a higher bit rate using a patented coding technology or special inter-access point protocols).
However, these additional features only work in a homogeneous environment, i.e., when adapters from the same vendors are used for all wireless nodes. At least most components today adhere to the basic standards IEEE 802.11b or (newer) 802.11a.
● **Restrictions:** All wireless products have to comply with national regulations.
Several government and non-government institutions worldwide regulate the operation and restrict frequencies to minimize interference.Consequently,

(8)

(b) Discuss about Bluetooth technology.

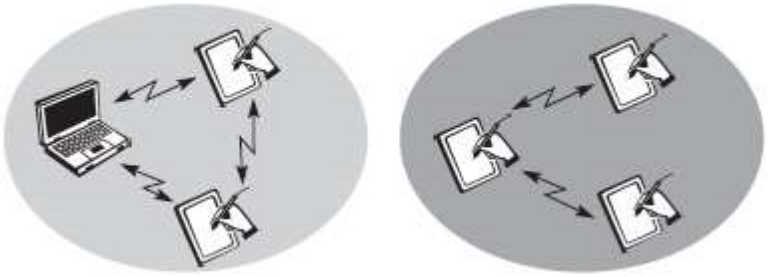
Comparing Bluetooth with other WLAN technology we have to keep in mind that one of its goals was to provide local wireless access at very low cost. From a technical point of view, WLAN technologies like those above could also be used, however, WLAN adapters, e.g., for IEEE 802.11, have been designed for higher bandwidth and larger range and are more expensive and consume a lot more power.
A very important term in the context of Bluetooth is a **piconet**. A piconet is a collection of Bluetooth devices which are synchronized to the same hopping
Sequence One device in the piconet can act as **master** (M), all other devices connected to the master must act as **slaves** (S). The master determines the hopping pattern in the piconet and the slaves have to synchronize to this pattern. Each piconet has a unique hopping pattern.



(7)

OR

VIII. (a) Explain system architecture of IEEE 802.11 ad hoc wireless LAN.



Ad-hoc wireless networks, however, do not need any infrastructure to work.
Each node can communicate directly with other nodes, so no access point controlling medium access is necessary. Figure shows two ad-hoc networks with three nodes each. Nodes within an ad-hoc network can only communicate if they can reach each other physically, i.e., if they are within each other's radio range or if other nodes can forward the message. In ad-hoc networks, the complexity of each node is higher because every node has to implement medium access mechanisms, mechanisms to handle hidden or exposed terminal problems, and perhaps priority mechanisms, to provide a certain quality of service. (8)

(b) Describe the Bluetooth Standard documents.

Protocol Architecture

Bluetooth is defined as a layered protocol architecture consisting of core protocols, cable replacement and telephony control protocols, and adopted protocols.

The *core protocols* form a five-layer stack consisting of the following elements:

- **Radio.** Specifies details of the air interface, including frequency, the use of frequency hopping, modulation scheme, and transmit power.
- **Baseband.** Concerned with connection establishment within a piconet, addressing, packet format, timing, and power control.
- **Link manager protocol (LMP).** Responsible for link setup between Bluetooth devices and ongoing link management. This includes security aspects such as authentication and encryption, plus the control and negotiation of baseband packet sizes.
- **Logical link control and adaptation protocol (L2CAP).** Adapts upper-layer protocols to the baseband layer. L2CAP provides both connectionless and connection-oriented services.

- **Service discovery protocol (SDP).** Device information, services, and the characteristics of the services can be queried to enable the establishment of a connection between two or more Bluetooth devices.

Usage Models

A number of usage models are defined in Bluetooth profile documents. In essence, a usage model is a set of protocols that implement a particular Bluetooth-based application. Each profile defines the protocols and protocol features supporting a particular usage model. Following are the highest-priority usage models:

- **File transfer.** The file transfer usage model supports the transfer of directories, files, documents, images, and streaming media formats. This usage model also includes the capability to browse folders on a remote device.

- **Internet bridge.** With this usage model, a PC is wirelessly connected to a mobile phone or cordless modem to provide dial-up networking and fax capabilities. For dial-up networking, AT commands are used to control the mobile phone or modem, and another protocol stack (such as PPP over RFCOMM) is used for data transfer. For fax transfer, the fax software operates directly over RFCOMM.

- **LAN access.** This usage model enables devices on a piconet to access a LAN. Once connected, a device functions as if it were directly connected (wired) to the LAN.

- **Synchronization.** This model provides a device-to-device synchronization of PIM (personal information management) information, such as phone book, calendar, message, and note information. IrMC (Ir mobile communications) is an IrDA protocol that provides client/server capability for transferring updated PIM information from one device to another.

- **Three-in-one phone.** Telephone handsets that implement this usage model may act as a cordless phone connecting to a voice base station, as an intercom device for connecting to other telephones, and as a cellular phone.

- **Headset.** The headset can act as a remote device's audio input and output interface. (7)

Unit – IV

IX. (a) Describe the wireless logical loop.

Wireless local loop (WLL), is a term for the use of a wireless communications link as the "last mile / first mile" connection for delivering plain old telephone service (POTS) or Internet access (marketed under the term "broadband") to telecommunications customers. Various types of WLL systems and technologies exist.

Other terms for this type of access include **Broadband Wireless Access** (BWA), **Radio In The Loop** (RITL), **Fixed-Radio Access** (FRA), **Fixed Wireless Access** (FWA) and **Metro Wireless** (MW).

ixed Wireless Terminal (FWT) units differ from conventional mobile terminal units operating within cellular networks – such as GSM – in that a fixed wireless terminal or desk phone will be limited to an almost permanent location with almost no roaming abilities.

WLL and FWT are generic terms for radio based telecommunications technologies and the respective devices which can be implemented using a number of different wireless and radio technologies.

Wireless local loop service is segmented into a number of broad market and deployment groups. Services are split between Licensed – commonly used by carriers and Telcos – and Unlicensed services more commonly deployed by home users and Wireless ISPs (WISPs). (8)

(b) Discuss different application of Wimax.

Wimax network provides the ability for service provider to deploy new era broadband service. **Wimax applications** are most effective than today. It provides a broad customer base, while adding up a mobility feature to those services. **Wimax technology applications** are a mean of service providers to present data, video, voice, mobile and internet access. There are various benefits of **Wimax technology** such as it provides simple based prospective cost saving and service efficiency but to be capable to allow VoIP calling, mobile devices, video making and high speed data transfer (7)

OR

X. (a) Explain about Wi-Fi Technology.

Wi-Fi is the name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections. A common misconception is that the term Wi-Fi is short for "*wireless fidelity*," however this is not the case. Wi-Fi is simply a trademarked term meaning IEEE 802.11x.

The Wi-Fi Alliance, the organization that owns the Wi-Fi (registered trademark) term specifically defines Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards."

Initially, Wi-Fi was used in place of only the 2.4GHz 802.11b standard, however the Wi-Fi Alliance has expanded the generic use of the Wi-Fi term to include any type of network or WLAN product based on any of the 802.11 standards, including 802.11b, 802.11a, dual-band, and so on, in an attempt to stop confusion about wireless LAN interoperability.

Wi-Fi works with no physical wired connection between sender and receiver by using radio frequency (RF) technology, a frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space. The cornerstone of any wireless network is an access point (AP). The primary job of an access point is to broadcast a wireless signal that computers can detect and "tune" into. In order to connect to an access point and join a wireless network, computers and devices must be equipped with wireless network adapters (8)

(b) Discuss about wireless application protocol technology.

Wireless Application Protocol (**WAP**) is a technical standard for accessing information over a mobile wireless network. A WAP browser is a web browser for mobile devices such as mobile phones that uses the protocol.

Before the introduction of WAP, mobile service providers had limited opportunities to offer interactive data services, but needed interactivity to support Internet and Web applications such as:

- Email by mobile phone
- Tracking of stock-market prices
- Sports results
- News headlines
- Music downloads

The Japanese i-mode system offers another major competing wireless data protocol. As of 2013, WAP use has largely disappeared in Europe and the United States. Most modern handset internet browsers now support full HTML, so do not need to use WAP markup for webpage compatibility.

The WAP standard described a protocol suite allowing the interoperability of WAP equipment, and software with different network technologies, such as GSMand IS-95 (also known as CDMA).

he bottom-most protocol in the suite, the WAP Datagram Protocol (WDP), functions as an adaptation layer that makes every data network look a bit likeUDP to the upper layers by providing unreliable transport of data with two 16-bit port numbers (origin and destination). All the upper layers view WDP as one and the same protocol, which has several "technical realizations" on top of other "data bearers" such as SMS, USSD, etc. On native IP bearers such as GPRS, UMTS packet-radio service, or PPP on top of a circuit-switched data connection, WDP is in fact exactly UDP.

WTLS, an optional layer, provides a public-key cryptography-based security mechanism similar to TLS.

WTP provides transaction support (reliable request/response) adapted to the wireless world. WTP supports more effectively than TCP the problem of packet loss, which occurs commonly in 2G wireless technologies in most radio conditions, but is misinterpreted by TCP as network congestion.

Finally, one can think of WSP initially as a compressed version of HTTP. (7)