

EC6802 Wireless Networks-QUESTION BANK**UNIT I - WIRELESS LAN
PART A****1. Define wireless LAN.**

Local area and Built on exiting wireless communication networks and Allows cellular phone access to Internet services

2. Explain the Problems with Wireless Networks

- Operates in a less controlled environment, so is more susceptible to interference, signal loss, noise, and eavesdropping.
- Generally, wireless facilities have lower data rates than guided facilities.
- Frequencies can be more easily reused with guided media than with wireless media.

3. Differentiate Infra-red and Radio transmission.

Two different basic transmission technologies can be used to set up WLANs. One technology is based on the transmission of infra-red light the other one, which is much more popular, uses radio transmission Both technologies can be used to set up ad-hoc connections for work groups, to connect, e.g., a desktop with a printer without a wire, or to support mobility within a small area.

The main advantages of infra-red technology are its simple and extremely cheap senders and receivers. Disadvantage of infra-red transmission is low bandwidth. Advantages of radio transmission include the long-term experiences made with radio transmission for wide area networks. The main advantage is also a big disadvantage of radio transmission. Shielding is not so simple.

4. What is HIPERLAN?

HIPERLAN is a set of wireless local area network communication standards primarily used in European countries. It has four specifications: HIPERLAN1, HIPERLAN2, HIPERLINK and HIPERACCESS.

5. Give two types of data burst in HIPERLAN?

The transmission format on the physical layer is a burst, which consists of a preamble and a data part. Five different PHY bursts have been defined: broadcast, downlink, uplink with short preamble, uplink with long preamble, and direct link (optional).

The bursts differ in their preambles.

6. Differentiate centralized mode and direct mode.

Centralized mode is based on infrastructure based mode. APs are associated with mobile terminals and all data is transferred between the two terminals via AP.

Direct mode is based on ad-hoc mode. Here data is directly exchanged between mobile terminals.

7. What is scatternet?

Bluetooth enabled devices are organized in groups called piconets. One device in the piconet can act as master; all other devices connected to the master must act as slaves. A master unit is the device that initiates the communication. As more users join the piconets, the throughput per user drops quickly. So they move on to scatternet. It consists of two piconets both having different hopping sequences.

8. Explain the different types of services offered by Bluetooth?

Basic profiles have been specified as: Generic access, service discovery, cordless telephony, intercom, serial port, headset, dialup networking, LAN access, generic object exchange, object push, file transfer, and synchronization. Additional profiles are: Advanced audio distribution, PAN, audio video remote control, basic printing, basic imaging, extended service discovery, generic audio video distribution, hands-free, and hardcopy cable replacement. Each profile selects a set of protocols.

9. Differentiate between WiFi and WiMAX.

WiMAX and Wi-Fi are both wireless broadband technologies, but they differ in the technical execution. Wi-Fi was developed to be used for mobile computing devices, such as laptops, in LANs, but is now increasingly used for more services, including Internet and VoIP phone access, gaming, and basic connectivity of consumer electronics such as televisions and DVD players, or digital cameras. On the other hand WiMAX was developed as a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL.

10. What is WLL?

Wireless local loop (WLL), is a term for the use of a wireless communications link. As subscribers have demanded greater capacity, particularly to support internet use traditional twisted pair tech has become inadequate. Interest being shown in competing wireless technologies for subscriber access. These generally referred to as WLL or fixed wireless access. Mainly used in Urban and rural areas.

11. What is Fresnel zone?

For effective communication at millimeter wavelength, there should be an unobstructed line of sight between transmitter and receiver. In this, if there are any obstacles near the path then it will reduce the power of the received signal (i.e.) increases signal to *noise* ratio. Fresnel Zone provided a mean to calculate where the zones are, where a given obstacle will cause mostly in phase or mostly out of phase reflections b/w the transmitter and receiver.

12. What is NIC?

A PC or workstation uses a wireless NIC to connect to the wireless network. The NIC scans the available frequency spectrum for connectivity and associates it to an access point or another wireless client. The NIC is coupled to the PC/workstation operating system using a software driver.

13. Mention the design goals of WLANs. (Nov/Dec 2014)

- **Global operation:** LAN equipment may be carried from one country to another and this operation should be legal (frequency regulations national and international).
- **Low power:** Take into account that devices communicating via WLAN are typically running on battery power. Special power saving modes and power management functions. Simplified spontaneous co-operation: no complicated setup routines but operate spontaneously after power.
- **Easy to use:** WLANs are made for simple users; they should not require complex management but rather work on a plug-and-play basis.
- **Protection of investment:** A lot of money has been invested for wired LANs, WLANs should be able to interoperate with existing network (same data type and services).
- **Safety and security:** Safe to operate. Encryption mechanism, do not allow roaming profiles for tracking people (privacy)
- **Transparency for applications:** Existing applications should continue to work.

14. What is wireless networking?

Wireless refers to the method of transferring information between a computing device, and a data source, such as an agency database server, without a physical connection

15. What is meant by MAC Protocols?

When an IP packet reaches its destination (sub) network, the destination IP address (a layer 3 or network layer concept) is resolved with the Address Resolution Protocol for IPv4, or by Neighbor Discovery Protocol (IPv6) into the MAC address (a layer 2 concept) of the destination host.

16. What are the different features of MAC Protocols?

- It should implement some rules that help to enforce discipline when multiple nodes contend for a shared channel.
- It should help maximize the utilization of the channel
- Channel allocation needs to be fair.
- It should be capable of supporting several types of traffic having different maximum and average bit rates.

7. What is meant by spread spectrum?

In telecommunication and radio communication, **spread-spectrum** techniques are methods by which a signal (e.g. an electrical, electromagnetic, or acoustic signal) generated with a particular bandwidth is deliberately **spread** in the frequency domain, resulting in a signal with a wider bandwidth.

18. List out the types of spread spectrum?

Frequency Hopping Spread Spectrum (FHSS), Direct-sequence spread spectrum (DSSS), Time Hopping spread spectrum (THSS) and Chirp spread spectrum (CSS)

19. What is Frequency Hopping Spread Spectrum (FHSS)?

Frequency Hopping Spread Spectrum (FHSS) is a method of transmitting radio signals by rapidly switching a carrier among many frequency channels, using a pseudorandom sequence known to both transmitter and receiver. It is used as a multiple access method in the **frequency-hopping code division multiple access (FH-CDMA)** scheme.

20. Give the advantages of spread spectrum over a fixed-frequency transmission?

- Spread-spectrum signals are highly resistant to narrowband interference. The process of re-collecting a spread signal spreads out the interfering signal, causing it to recede into the background.
- Spread-spectrum signals are difficult to intercept. A spread-spectrum signal may simply appear as an increase in the background noise to a narrowband receiver. An eavesdropper may have difficulty intercepting a transmission in real time if the pseudorandom sequence is not known.

- Spread-spectrum transmissions can share a frequency band with many types of conventional transmissions with minimal interference. The spread-spectrum signals add minimal noise to the narrow-frequency communications, and vice versa. As a result, bandwidth can be used more efficiently.

21. What is direct sequence spread spectrum (DSSS)?

DSSS systems transmit the message bearing signals using a bandwidth that is in excess of the bandwidth that is actually needed by the message signal. This spreading of the transmitted signal over a large bandwidth makes the resulting wideband signal to appear as a noise signal which allows greater resistance to intentional and unintentional interference with the transmitted signal.

22. Give the features of DSSS?

DSSS phase-shifts a sine wave pseudo randomly with a continuous string of pseudo-noise (PN) code symbols called "chips", each of which has a much shorter duration than an information bit. That is, each information bit is modulated by a sequence of much faster chips. Therefore, the chip rate is much higher than the information signal bit rate. DSSS uses a signal structure in which the sequence of chips produced by the transmitter is already known by the receiver. The receiver can then use the same PN sequence to counteract the effect of the PN sequence on the received signal in order to reconstruct the information signal.

23. What is Time-Hopping spread spectrum (THSS)?

Time-hopping (TH) is a communications signal technique which can be used to achieve anti-jamming (AJ) or low probability of intercept (LPI). It can also refer to pulse-position modulation, which in its simplest form employs 2^k discrete pulses (referring to the unique positions of the pulse within the transmission window) to transmit k bit(s) per pulse. To achieve LPI, the transmission time is changed randomly by varying the period and duty cycle of the pulse (carrier) using a pseudo-random sequence. The transmitted signal will then have intermittent start and stop times. Although often used to form hybrid spread-spectrum (SS) systems,

24. What is chirp spread spectrum (CSS)?

In digital communications, *chirp spread spectrum (CSS)* is a spread spectrum technique that uses wideband linear frequency modulated chirp pulses to encode information. A chirp is a sinusoidal signal whose frequency increases or decreases over time (often with a polynomial expression for the relationship between time and frequency). In the picture is an example of an up chirp—as you can see, the frequency increases linearly over time.

25. List and explain the inter-frame spacing.

- SIFS (Shortest inter-frame spacing) - It has the highest priority because it has the shortest waiting time for medium access. And it is defined for Short control messages.
- PIFS (PCF inter frame spacing)-It has medium priority because it has a waiting time between DIFS and SIFS. It is used for a time bounded service.
- DIFS (DCF inter frame spacing)-This parameter denotes the longest waiting time and has the lowest priority for medium access.

26. State the significance of Radio transmission over infrared.(April 2017)

Radio transmission	infrared	
(i) Coverage range	Upto 50m for LOS	Upto 10m
(ii) Data rate	100kbps	500bps-1kbps
(iii) Power consumption	5-20 mW during ON state	20-150 mW during ON state

27. OFDM uses a set of orthogonal sub-carriers for transmission of data. OFDM is used in WLANs. Consider an OFDM system that uses 52 sub-carriers out of which 48 are pilot sub-carriers. System bandwidth is 20MHz and OFDM symbol duration including cyclic prefix is 4µs. If code rate is 3/4 and 64 QAM is used, find the data rate. (April 2017)

Data rate = $\frac{\text{No of bits/symbol for the carriers}}{\text{OFDM symbol duration}}$ For 64-QAM with $\frac{3}{4}$ rate, No of bits / subcarrier = $6 \times \frac{3}{4} = 4.5$

Total No. of bits for 48 sub carriers = 4.5 bits per symbol / subcarrier * 48 subcarriers = 216 bits/symbol

Data rate = 216/4µs = 54Mbps.

PART B

1. Explain and compare the media access control mechanism of DCF methods adopted in IEEE 802.11 WLAN (April 2017)
2. Describe the architecture and protocol stack of Bluetooth technology. (April 2017)
3. Briefly explain about the system and protocol architecture of 802.11.
4. Explain with an example the DSR Routing protocol. And Discuss how power management done in IEEE 802.11 infrastructure architecture.

5. Describe the functions of MAC & Physical layer of IEEE 802.16 in detail?
6. Explain in detail about Wifi and Wimax.
7. Discuss IEEE 802.16 Protocol in detail.
8. (a) Describe spectrum allocation for WiMAX (b) Give the significance of BRAN
9. Explain HiperLAN in detail.
10. Discuss in detail about spread spectrum techniques.

UNIT II MOBILE NETWORK LAYER PART A

1. What is meant by mobile IP?

Mobile IP communication protocol refers to the forwarding of Internet traffic with a fixed IP address even outside the home network. It allows users having wireless or mobile devices to use the Internet remotely.

2. List out the features of Mobile IP?

- Transparency : Mobile end system should continue to keep its IP address
- Compatibility : It should be compatible with existing internet protocol
- Scalability : It should be scalable to support billions of moving host worldwide.
- Security : provide users with secure communication over the internet

3. Mention 3- types of address assignment policies used in DHCP.

Manual configuration – manager can configure a specific address for a specific computer.

Dynamic configuration – server loans an address to a computer for a limited time. **Automatic configuration** – DHCP server assigns permanent address when a computer first attaches to the network.

4. What are the different terminologies of mobile IP?

- Home Network
- Home address
- Foreign agent
- Foreign Network
- Mobile IP

6. What is agent advertisement?

Foreign and the home agents advertise their presence through periodic agent advertisement messages. An agent advertisement message, lists one or more care of address and a flag indicating whether it is a home agent or a foreign agent.

7. What are the key mechanisms in mobile IP?

- Discovering the care of address
- Registering the care of address
- Tunneling to the care of address.

8. Mention the different entities in a mobile IP.

Mobile Node, Correspondent Node, Home Network, Foreign Network, Foreign Agent, Home Agent, Care-Of address, Foreign agent COA and Co-located COA.

9. What is encapsulation and de-capsulation? (April 2017)

Encapsulation is the mechanism of taking a packet consisting of packet header and data putting it into the data part of a new packet. The reverse operation, taking a packet out of the data part of another packet, is called de-capsulation.

10. Define an outer header and outer header.

The HA takes the original packet with the MN as destination, puts it into the data part of a new packet and sets the new IP header in such a way that the packet is routed to the COA. The new header is called the outer header. There is an inner header which can be identical to the original header as this case for IP-in-IP encapsulation, or the inner header can be computed during encapsulation.

11. What is meant by generic routing encapsulation?

Generic routing encapsulation allows the encapsulation of packets of one protocol suite into the payload portion of a packet of another protocol suite

12. What are the general problems of mobile IP regarding security and support of quality of service?

Mobility poses many security problems. A minimum requirement is the authentication of all messages related to the management of mobile IP. It must be sure for the IP layer if it forwards a packet to a mobile host that this host really is the receiver of the packet. The IP layer can only guarantee that the IP addresses of the receiver is correct. There are no ways of preventing faked IP address or other attacks

13. Define Tunnel?

Tunnel establishes a virtual pipe for data packets between a tunnel entry and a tunnel endpoint. Packets entering a tunnel are forwarded inside the tunnel and leave the tunnel unchanged. Sending a packet through a tunnel is achieved by using encapsulation.

14. What is a Care of address in Mobile-IP? (April 2017)

Care-of address (COA): The COA defines the current location of the MN from an IP point of view. All IP packets sent to the MN are delivered to the COA, not directly to the IP address of the MN. Packet delivery toward the MN is done using a tunnel. To be more precise, the COA marks the tunnel endpoint, i.e., the address where packets exit the tunnel.

15. What are the types of care of address?

It is the address that is used to identify the present location of a foreign agent

- Foreign agent care of address
- Co-located care of address

16. What is the different operation of mobile IP?

- The remote client sends a datagram to the MN using its home address it reaches the home agent as usual.
- The home agent encapsulates the datagram in a new packet and sends it to the foreign agent.

17. Define Home agent

It is located in home network and it provides several services for the Mobile Network (MN). Home agent maintains a location registry. The location registry keeps track of the node locations using the current care of address of the mobile network.

18. Define Ad hoc wireless network with example?

An ad-hoc network is a local area network (LAN) that is built spontaneously as devices connect. Instead of relying on a base station to coordinate the flow of messages to each node in the network, the individual network nodes forward packets to and from each other. In Latin, ad hoc literally means "for this," meaning "for this special purpose" and also, by extension, improvised or impromptu. In the Windows operating system, ad-hoc is a communication mode (setting) that allows computers to directly communicate with each other without a router.

19. What is the advantage of Infra-red technology?

The main advantages of infra-red technology are its simple and extremely cheap senders and receivers.

20. Differentiate wired networks and adhoc wireless networks based on routing.

For wired networks, generally the network is partitioned into two levels: intra-domain and inter-domain. These current routing protocols are mostly designed to deal with simple network failures (e.g., links going up and down, nodes crashing) and can have much vulnerability facing malicious intruders. The compromise of routing function can lead to the denial of network service, the disclosure or modification of sensitive routing information, the disclosure of network traffic, or the inaccurate accounting of network resource usage. For wireless Ad Hoc networks, the situation is even worse. Ad Hoc networks have no pre-deployed infrastructure available for routing packets end-to-end in a network. Nodes communicate with each other without the intervention of centralized access points or base stations, so each node acts both as a router and as a host. Securing Ad Hoc routing presents difficulties not present in traditional network: neither centrally administrated secure routers nor strict policy exist in an Ad Hoc network; the nodes in the networks can be highly mobile, thus rapidly changing the node constellation and the presence or absence of links. So the routing in ad hoc networks is an especially hard task to accomplish securely, robustly and efficiently

21. What is tunneling?

A tunnel establishes a virtual pipe for data packets between a tunnel entry and a tunnel endpoint. Packets entering a tunnel are forwarded inside the tunnel and leave the tunnel unchanged. Tunneling, i.e., sending a packet through a tunnel is achieved by using encapsulation.

22. Give examples for mobile adhoc networks.

Another application example of a mobile ad-hoc network is Bluetooth, which is designed to support a personal area network by eliminating the need of wires between various devices, such as printers and personal digital assistants. A mobile ad-hoc network can also be used to provide crisis management services applications.

23. What is DHCP?

The dynamic host configuration protocol is mainly used to simplify the installation and maintenance of networked computers. If a new computer is connected to a network, DHCP can provide it with all the necessary information for full system integration into the network, e.g., addresses of a DNS server and the default router, the subnet mask, the domain name, and an IP address.

24. Differentiate infrastructure and ad-hoc networks.

Infrastructure network- In this communication typically takes place only between the wireless nodes and the access point. Any two wireless network nodes can communicate with the use of AP.

Ad-hoc networks- This type of network has no infrastructure and it does not have any Ap. Here any wireless nodes from two different wireless networks cannot communicate.

25. What is roaming?

If a user walks around with a wireless station, the station has to move from one access point to another to provide uninterrupted service. Moving between access points is called roaming.

PART B

1. Discuss in brief about the IP packet delivery.
2. Describe in detail the registration procedure.(Nov/Dec 2013)
3. Briefly discuss about agent discovery in mobile-IP.
4. How can the tunneling and encapsulation be performed in mobile-IP? Explain.
5. Explain in detail the Dynamic host configuration protocol. (Nov/Dec 2013,Nov,Dec 2014)
6. Discuss the routing protocols in MANET (Nov/Dec 2014)
7. Describe IPV6 in detail with its extension headers.
8. Explain Mobile IP-SIP in detail.
9. Elaborate on Destination sequence distance vector (DSDV) algorithm with an illustration.
10. Discuss in detail how packets are routed in MANET using Dynamic source routing algorithm.
11. Explain and compare the working mechanism of both Destination sequence distance vector (DSDV) and Dynamic source routing protocol when applied on a mobile adhoc network scenario. **(April 2017)**
12. State the entities and terminologies used in Mobile IP along with tunneling and also explain the three types of encapsulation mechanisms used in mobile IP. **(April 2017)**

UNIT-III MOBILE TRANSPORT LAYER**PART A****1. Define Routers**

Router is responsible for routing the packets that is receives to their destinations based on their IP addresses, possibly via other routers.

2. What are the different layers of TCP/IP?

Application layer, Transport layer, Internet layer, Network access layer

3. What are all the various flavours of TCP available?

- Indirect TCP- I-TCP segments a TCP connection into a fixed part and a wireless part.
- Snooping TCP- Here the foreign agent buffers all packets with destination mobile host and additionally snoops the packet flow in both directions to recognize acknowledgements.
- Mobile TCP- M-TCP wants to improve overall throughput, to lower the delay, to maintain end to end semantics of TCP, and to provide a more efficient handover.
- Fast Transmit/Fast Recovery
- Transmission/Time-out freezing
- Selective retransmission
- Transaction-oriented TCP.

4. What is the goal of M-TCP?

The goal of M-TCP is to prevent the sender window from shrinking if bit errors or disconnection but not congestion cause current problems.

- To provide overall throughput
- To lower the delay
- To maintain end-to-end semantics of TCP
- To provide a more efficient handover.

5. What led to the development of Indirect TCP?

- TCP performs poorly together with wireless links
- TCP within the fixed network cannot be changed.

This led to the development of I-TCP which segments a TCP connection into a fixed part and a wireless part.

6 List the disadvantages of I-TCP (April 2017)

It does not maintain the semantics of TCP as the FH gets the acknowledgement before the packet is delivered at MH. I-TCP does not maintain the end-to-end semantic of TCP and assumes that application layer would ensure reliability

7. What is BOOTP?

BOOTP protocol is used for Booting (starting) a diskless computer over a network. Since a diskless computer does not store the operating system program in its permanent memory, BOOTP protocol helps to download and boot over a network using the operating system files stored on a server located in the network.

8. Define Agent solicitation

Mobile node does not receive any COA, then the MN should send an agent solicitation message. But it is important to monitor that these agent solicitation message do not flood the network.

10. What is Snooping TCP?

In this approach, the foreign agent buffers all packets with destination mobile host and additionally 'snoops' the packet flow in both directions to recognize acknowledgements. The reason for buffering packets toward the mobile node is to enable the foreign agent to perform a local retransmission in case of packet loss on the wireless link.

11. What is M-TCP? Give the advantages of M-TCP. (April 2017)

M-TCP (mobile TCP) M-TCP splits the TCP connection into two parts as I-TCP does. An unmodified TCP is used on the standard host-supervisory host (SH) connection, while an optimized TCP is used on the SH-MH connection. The supervisory host is responsible for exchanging data between both parts similar to the proxy in ITCP. The advantages of M-TCP are the following: It maintains the TCP end-to-end semantics. If the MH is disconnected, it avoids useless retransmissions, slow starts or breaking connections by simply shrinking the sender's window to 0. Since it does not buffer data in the SH as I-TCP does, it is not necessary to forward buffers to a new SH.

12. What is I-TCP?

I-TCP segments a TCP connection into a fixed part and a wireless part. The example is mobile host connected via a wireless link and an access point to the 'wired' internet where the correspondent host resides. The correspondent node could also use wireless access.

Standard TCP is used between the fixed computer and the access point. No computer in the internet recognizes any changes to TCP. Instead of the mobile host, the access point now terminates the standard TCP connection, acting as a proxy.

13. Differentiate types of Care of address.

The COA could be located at the FA, i.e., the COA is an IP address of the FA. The FA is the tunnel end-point and forwards packets to the MN. Many MN using the FA can share this COA as common COA. The COA is co-located if the MN temporarily acquired an additional IP address which acts as COA. This address is now topologically correct, and the tunnel endpoint is at the MN. Co-located addresses can be acquired using services such as DHCP. One problem associated with this approach is the need for additional addresses if MNs request a COA.

14. What is selective re-transmission?

A very useful extension of TCP is the use of selective retransmission. If a single packet is lost, the sender can now determine precisely which packet is needed and can retransmit it. Using selective retransmission is also beneficial in all other networks.

15. What is meant by a binding cache?

One way to optimize the route is to inform the CN of the current location by caching it in a binding cache which is a part of the local routing table for the CN.

16. What is the basic purpose of DHCP?

Dynamic Host configuration Protocol is set of rules used by communication devices, to request and obtain an IP address from a server which has a list of address available for assignment.

17. How does I-TCP isolate problems on the wireless link?

- I-TCP does not need any changes in the TCP protocol.
- Transmission errors on the wireless link cannot propagate into the fixed network.
- Mechanisms are needed to improve TCP performance as in the case of I-TCP only the mobile host and foreign agents need changes. Hence we can test new schemes without destabilizing the system.
- As there is strict partition, two different protocols can be used between the FA/MH and other end.

18. What is time out freezing?

It is used in situations where the mobile node (MN) faces long durations of disconnection. During the timeout period the MN may get some data sequences. After timeout, the TCP transmission freezes.

19. What are the possible locations for care of address?

The care-of address is a slightly tricky concept. There are two different types, which correspond to two distinctly different methods of forwarding datagrams from the home agent router. Foreign agent COA: The COA could be located at the FA, i.e., the COA is an IP address of the FA. The FA is the tunnel endpoint and forwards packets to the MN. Co-located COA: The COA is co-located if the MN temporarily acquired an additional IP address which acts as COA. This address is now topologically correct, and the tunnel endpoint is at the MN. Co-located addresses can be acquired using services such as DHCP.

20. What is triangular routing?

The inefficient behavior of a non-optimized mobile IP is called triangular routing. The triangle is made up of three segments, CN to HA, HA to COA\MN, and MN back to CN.

PART B

1. Explain the traditional TCP .What are the improvements that are made into the classical TCP?
2. Explain in detail about Mobile-IP.
3. (a)Discuss how Snooping TCP acts as a Transparent TCP and explain the role of foreign agent in it in detail.
(b)What happens in the case of I-TCP if the mobile is disconnected? Discuss
4. Write notes on Mobile TCP and transaction oriented TCP in detail.
5. Explain in detail the advantages and dis-advantages of I-TCP.
6. Discuss in brief the pros and cons of Snooping TCP.
7. Elaborate on classical enhancements to TCP for mobility.
8. Describe the benefits and shortcomings of Mobile TCP.
9. Explain in detail how TCP is optimized for 3G wireless networks?
10. Write short notes on time-out freezing and selective re-transmission.
11. Write your understanding on indirect TCP, Snooping TCP, Mobile TCP and transaction oriented TCP. (April 2017)
12. Describe the working mechanism of Traditional TCP. (April 2017)

UNIT IV WIRELESS WIDE AREA NETWORK

PART A

1. List the sub-systems of UMTS Terrestrial Radio Access Network (UTRAN).

The UTRAN consists of a set of radio network subsystems (RNSs). The RNS has two main logical elements: Node B and an RNC.

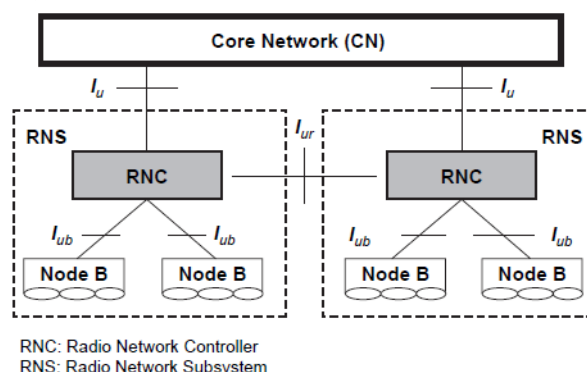
2. State the responsibilities of an RNC.

An RNC is responsible for the use and allocation of all the radio resources of the RNS to which it belongs. The RNC also handles the user voice and packet data traffic, performing the actions on the user data streams that are necessary to access the radio bearers.

3. State the responsibilities of Node B.

A Node B is responsible for radio transmission and reception in one or more cells to/from the user equipment (UE).

4. Draw the UTRAN logical architecture.



5. What is the need for I_u interface?

The UMTS I_u interface is the open logical interface that interconnects one UTRAN to the UMTS core network (UCN). On the UTRAN side the I_u interface is terminated at the RNC, and at the UCN side it is terminated at U-MSC.

6. State the three different protocol planes of I_u interface.

The I_u interface consists of three different protocol planes — the radio network control plane (RNCP), the transport network control plane (TNCP), and the user plane (UP).

7. List the functions of RNCP.

It carries information for the general control of UTRAN radio network operations. It carries information for control of UTRAN in the context of each specific call. It carries user call control (CC) and mobility management (MM) signaling messages.

8. What is the need for I_{ur} interface?

The connection between two RNCs (serving RNC (SRNC) and drift RNC (DRNC)) is the I_{ur} interface. It is used in soft handoff scenarios when different macro diversity streams of one communication are supported by Node Bs that belong to different RNCs. Communication between one RNC and one Node B of two different RNCs are realized through the I_{ur} interface.

9. What are the functions carried out by I_{ur} interface?

Basic inter-RNC mobility support, Dedicated channel traffic support, Common channel traffic support and Global resource management support.

10. What is the need for I_{ub} interface?

The connection between the RNC and Node B is the I_{ub} interface. There is one I_{ub} interface for each Node B. The I_{ub} interface is used for all of the communications between Node B and the RNC of the same RNS.

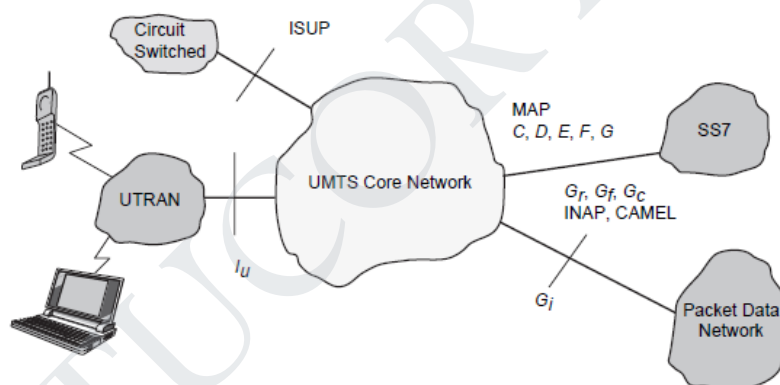
11. State the functionality of U_u interface.

The UMTS U_u interface is the radio interface between a Node B and one of its UE. The U_u is the interface through which UE accesses the fixed part of the system.

12. State the functions of 3G-MSC.

The 3G-MSC is the main CN element to provide CS services. The 3G-MSC also provides the necessary control and corresponding signaling interfaces including SS7, MAP, ISUP (ISDN user part), etc. The 3G MSC provides the interconnection to external networks like PSTN and ISDN.

13. Draw UMTS core network architecture.



14. Write about 3G-SGSN.

The 3G-SGSN is the main CN element for PS services. The 3G-SGSN provides the necessary control functionality both toward the UE and the 3G-GGSN. It also provides the appropriate signaling and data interfaces including connection to an IP-based network toward the 3G-GGSN, SS7 toward the HLR/EIR/AUC and TCP/IP or SS7 toward the UTRAN.

15. List the functions of 3G-GGSN

The GGSN provides interworking with the external PS network. It is connected with SGSN via an IP-based network. The GGSN may optionally support an SS7 interface with the HLR to handle mobile terminated packet sessions.

16. What are the tasks carried out by SMS-GMSC?

Reception of short message packet data unit (PDU), Interrogation of HLR for routing information and Forwarding of the short message PDU to the MSC or SGSN using the routing information.

17. Why do we need Firewall in a network?

This entity is used to protect the service providers' backbone data networks from attack from external packet data networks. The security of the backbone data network can be ensured by applying packet filtering mechanisms based on access control lists or any other methods deemed suitable.

18. Write about DNS.

The DNS server is used, as in any IP network, to translate host names into IP addresses, i.e., logical names are handled instead of raw IP addresses. Also, the DNS server is used to translate the access

point name (APN) into the GGSN IP address. It may optionally be used to allow the UE to use logical names instead of physical IP addresses.

19. List out the need for DHCP.

A dynamic host configuration protocol server is used to manage the allocation of IP configuration information by automatically assigning IP addresses to systems configured to use DHCP.

20. State the salient features of HSDPA.

HSDPA is based on the same set of technologies as high data rate (HDR) to improve spectral efficiency for data services — such as shared downlink packet data channel and high peak data rates (8–10 Mbps) — using high-order modulation and adaptive modulation and coding, hybrid ARQ (HARQ) retransmission schemes, fast scheduling and shorter frame sizes. HSDPA also shortens the round-trip time between the network and terminals and reduces variance in downlink transmission delay.

21. What is the role of firewall used in UMTS network? (April 2017)

All traffic coming in and going out of the private network is handled by the firewall. The firewall ensures that only authenticated traffic is allowed to pass through it.

PART B

1. Explain in detail about UTRAN Logical Architecture with a neat sketch.
2. Discuss in brief about the logical interfaces of UTRAN.
3. Describe the distribution of UTRAN functions in RNC and Node B.
4. Elaborate on UMTS core network architecture with a neat sketch. (April 2017)
5. Explain the UMTS network architecture with GSM,3G and also explain the reference architecture (April 2017)
6. Discuss the salient features of HSDPA with respect to physical layer.
7. Explain LTE network architecture and associated protocols in detail.
8. Distinguish between I_{ur} and I_{ub} interfaces of UTRAN.
9. Discuss in detail the PS protocol architecture of I_u interface.
10. Describe the CS protocol architecture of I_u interface.
11. Explain the functions performed by 3G-SGSN and 3G-GGSN.

UNIT V 4G NETWORKS

PART A

1. Differentiate between 3G and 4G networks?

3G	4G
Bandwidth used is 5-20 MHz	Bandwidth used is more than 100MHz
Access technologies used are WCDMA and CDMA 2000	OFDM and MC-CDMA technologies are used

2. What is the data rate offered by 4G systems?

4G networks operate with higher data rates of 20-100 Mbps in mobile mode.

3. List the key features of 4G networks from the user point of view. (April 2017)

- High usability: anytime, anywhere, and with any technology
- Support for multimedia services at low transmission cost
- Personalization
- Integrated services

4. Mention the challenges faced by 4G networks (April 2017)

- Limitations in device size
- Cost and power consumption,
- Backward compatibilities to systems

5. What are the applications of 4G technology?

- Virtual navigation
- Tele-medicine
- Tele-geo-processing applications

6. What is multi carrier modulation? Mention its advantages. (April 2017)

MCM is a baseband process that uses parallel equal bandwidth subchannels to transmit information and is normally implemented with fast Fourier transform (FFT) techniques. MCM's advantages are better performance in the inter-symbol-interference environment, and avoidance of single-frequency interferers.

7. What are the types of multi carrier modulation?

The types of multi carrier modulation are multicarrier code division multiple access (MC-CDMA) and orthogonal frequency division multiplexing (OFDM) using time division multiple access (TDMA).

8. Explain the concept of Multiple Input Multiple Output (MIMO)?

Smart antenna techniques, such as multiple-input multiple-output (MIMO) systems, can extend the capabilities of the 3G and 4G systems to provide customers with increased data throughput for mobile high-speed data applications. MIMO systems use multiple antennas at both the transmitter and receiver to increase the capacity of the wireless channel

9. Give the capacity equation for Single Input Single output (SISO) system.

The channel bandwidth is B , the transmitter power is P_t , the signal at the receiver has an average signal-to-noise ratio of SNR_0 , then the Shannon limit on channel capacity C is

$$C = B \log_2(1+SNR_0)$$

10. Explain briefly the concept of MIMO-OFDM systems in detail.

OFDM and MIMO techniques can be combined to achieve high spectral efficiency and increased throughput. The OFDM-MIMO system transmits independent OFDM modulated data from multiple antennas simultaneously. At the receiver, after OFDM demodulation, MIMO decodes each sub channel to extract data from all transmit antennas on all the sub channels.

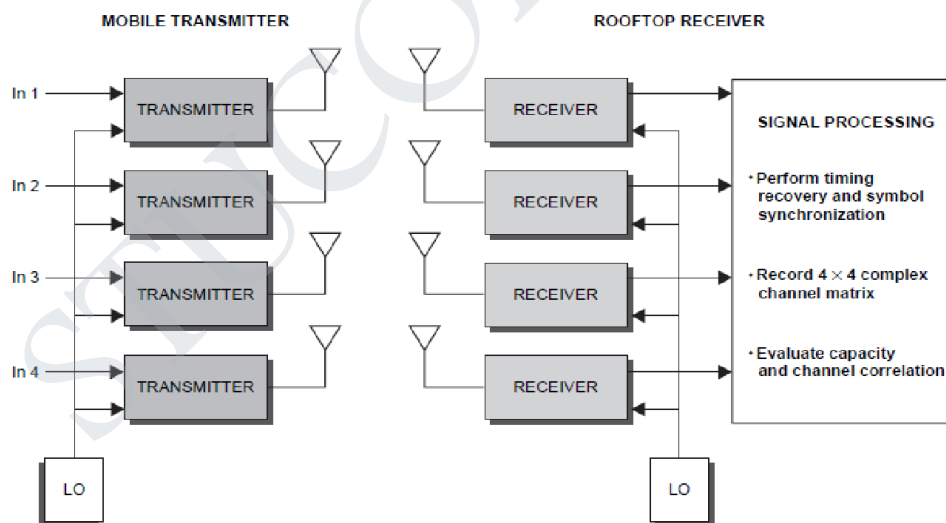
11. How efficient packet data transmission can be achieved in 4G networks?

Efficient packet data transmission can be achieved by using a suitable automatic repeat request (ARQ) scheme combined with an adaptive modulation and coding system, and a time-slot scheduler that uses channel predictions.

12. Explain briefly the concept of Bell Lab Layered Space Time (BLAST) architecture.

BLAST is a space division multiplexing (SDM)-based MIMO system. It provides the best trade-off between system performance (spectral efficiency and capacity) and system implementation complexity. The spectral efficiency of BLAST ranges from 20 to 40 bps/Hz. It uses a zero-forcing (ZF) nonlinear detection algorithm based on a spatial nulling process combined with symbol cancellation to improve system performance. The BLAST exploits multipath by using scattering characteristics of the propagation environment to enhance transmission accuracy.

13. Sketch the block diagram of MIMO system.



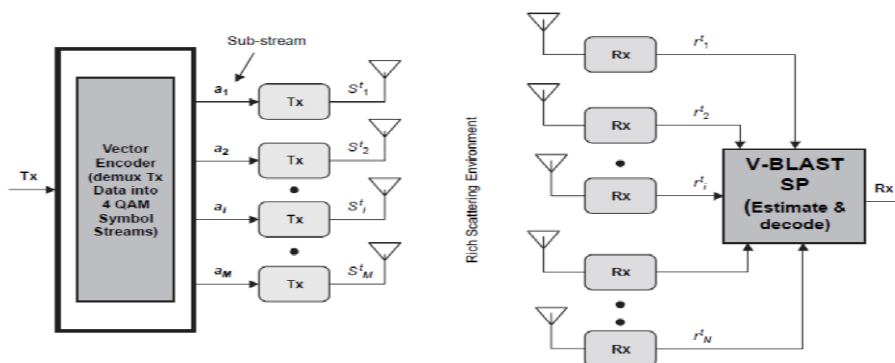
14. What is Software Defined Radio (SDR)?

A software-defined radio (SDR) system is a radio communication system which uses significant amounts of signal processing in a general purpose computer, or a reconfigurable piece of digital electronics.

15. List out the features of 4G networks?

- Fully converged services
- Software independency
- Diverse user devices
- Autonomous networks

16. Sketch the architecture of BLAST system.



17. Mention the hardware components of Software Defined Radio?

The hardware of a software-defined radio typically consists of a super heterodyne RF front end which converts RF signals from and to analog RF signals, and analog to digital converters and digital to analog converters which are used to convert digitized intermediate frequency (IF) signals from and to analog form respectively.

18. List out the various advantages of SDR technology.

- Software-defined radios can be quickly and easily upgraded with enhanced features. In fact, the upgrade could be delivered over-the-air.
- Software-defined radios can talk and listen to multiple channels at the same time.

19. What is Cognitive Radio? Mention any one application.

The CR can be viewed as an enabling technology that will benefit several types of users by introducing new communications and networking models for the whole wireless world, creating better business opportunities for the incumbent operators and new technical dimensions for smaller operators, and helping shape an overall more efficient approach regarding spectrum requirements and usage in the next generation wireless networks.

Application: Spectrum Sensing

20. Explain services provided by 4G?

4G systems will provide not only telecommunications services, but also data and multimedia services. To support multimedia services, high-data-rate services with system reliability will be provided. Personalized service will be provided by 4G networks. It is expected that when 4G services are launched, users in widely different locations, occupations, and economic classes will use the services.

PART B

1. Compare and contrast the key parameters of 3G and 4G networks.
2. Explain motivation behind the evolution of 4G technology in detail.
3. Explain the key challenges faced by 4G networks and also propose solutions of how to mitigate those challenges.
4. Explain the concept of Multi carrier modulation (MCM) in detail.
5. Write your understanding on behaviour of smart antenna techniques (April 2017)
6. Explain in detail about Adaptive modulation and Coding with time slot scheduler in detail(April 2017)
7. With a neat block diagram explain the concept of BLAST architecture in detail.
8. Explain in detail about Software Defined Radio (SDR).
9. Explain the concept of Cognitive Radio and enumerate in detail its role in field of spectrum sensing by highlighting its bottlenecks.
10. Explain the various spectrum sensing methods in detail by highlighting their pros and cons.