Mid-terms Exam

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1.Chapter 1 (1) The demonstration of (electrical) telegraphy in 1832 followed shortly after the discovery of electromagnetism early in the 1820's. In the 1840's, telegraph networks were built on the U.S. East Coast and in California. Rapid extension of their use followed; the first transatlantic cable was laid in 1858. In 1864, James Clerk Maxwell postulated wireless propagation. Marconi and Popov started experiments with the radio-telegraph shortly thereafter, and Marconi patented a complete wireless system in 1897. (2)cellular system, mobile management, mobile IP, WiFi, WiMAX, web security, IoT

2.Chapter2 (1) Wired media provides a guided link between one fixed terminal to another. The link conducts electric signal related to the transmission of information. Wireless media transmits signals without wires and over the wire. (2)Licensed bands meaning that individual companies pay a licensing fee for the to transmit on assigned channels within that band. Unlicensed bands don't require any permission and people can use them for free. (3)obstacle, atmosphere, ground. (4)The reflection happens when the size of the obstacle is larger than the wavelength of th electromagnetic. The diffraction happens when the route between the transmiter and receiver are obstructed by a sharp object. The scattering happens when the size of the object is smaller than the wavelength of the electromagnetic and the amount of the objects are huge as well. (5)indoor: reflection outdoor: scattering and diffraction

(6)$L_p = \frac{d^4}{P_t P_r} = \frac{d^4}{G_t G_r h_b^2 h_m^2}$ (7)free space modeling:$L_p[dB] = 32.45 + 20lgf_c[Mhz] + 20lgd[km]$/ $P_r = \frac{G_t G_r P_t}{L}$/ $\tau = \frac{D}{C}$ two-ray modeling:$L_p[dB] = 32.45 + 20lgf_c[Mhz] + 20lgd[km]$/ $P_r = P_t G_t G_r \frac{h_b^2 h_m^2}{d^4}$/ $\tau = \frac{D}{C}$

(8)Shadowing fading refers to the change of the power of the signal caused by the change of the location. The pass loss adds a random component whose distribution depends on the loss component. (9)fade margin=receive power-receive sensitivity. (10) Small-scale fading is that the rapid changes in the received wireless signal over a short period of time or within a short distance range. Multipath fading: The signal is superimposed by different paths. Doppler shift:Light from moving objects will appear to have different wavelengths depending on the relative motion of the source and the observer.

(11)A Rayleigh distribution is often observed when the overall magnitude of a vector is related to its directional components. When there is a dominant stationary (nonfading) signal component present, such as a line-ofsight propagation path, the small-scale fading envelope distribution is Ricean. (12)Doppler shift:The wavelength of the object radiation changes due to the relative movement of the wave source and the observer. Doppler formula 1+z = sqrt((1+v/c)/(1-v/c)). The spectrum shows the dark absorption lines first seen by Fraunhofer. (14)The level of crossing rate:$LCR = \sqrt{2pi}f_d pe^{-p^2}$ Average fade duration:$AFD = \frac{e^{p^2}-1}{pf_d\sqrt{2pi}}$

Chapter 3 and Chapter 4 (1)The first major step in the evolution of GSM networks to 3G occurred with the introduction of General Packet Radio Service (GPRS). (2)without the interference ,the higher transmitting power, the larger cell radius are, and the larger system capacity is. (3)base station: fixed in one place for high power multichannel bi-directional radios. uplink: the physical channel from the mobile station to the base station. downlink: the physical channel from the base station to the mobile station. location area: a collection of a group of cells in a mobile communication system and is an important part of mobility management of mobile stations/ MSC: the core of the network. (6)The current wireless network architecture divided into three layers: Physical network layer, Intermediate environment layer, Application network layer. VLR is a dynamic database that stores the information of the MS (collectively referred to as the customer), the information needed for the outgoing call, and the information about the user's contracted service and the additional service. HLR is a database responsible for mobile user management, permanent storage and record the area of the user's contract data, and dynamically update the user's location information in order to call the service to provide the user's network routing. (7) 2G is the GSM specification intended for providing mobile communication for voice and 3G is the specification for mobile communication with enhanced capabilities for mobile users other than voice. GSM air interface data rate is 270Kbps and 3G allows a minimum of 2Mbpsdownlink in stationary mobile and 384Kbps while moving. GSM uses TDMA and FDMA for multiple access technology and 3G utilizes variations of CDMA technology like WCDMA, CDMA2000, CDA2000 1X EV-DO.

(8)3G is less in cost, faster in data transmission, safer in security, more functional including mobile TV GPS etc. (9)SGSN: deliver the data packet from and to the mobile station within the geographical service area. GGSN: internetwork between the GPRS network and external packet switched network. MSC: responsible for routing voice calls,SMS and other services. GMSC: a special kind MSC that is used to route calls outside the mobile network. (10)WCDMA,CDMA2000,TD-SCDMA (11)a.The spectrum resources of the high frequency band are applied b. It can handle images, music, video streaming and other media forms, including web browsing, teleconferencing, e-commerce and other information services (12)GSM's maximum data communication speed from 9600bit / sec to 171.2Kbit / s. EDGE communication speed up to 384Kbit / s   500Kbit / s between Bandwidth 1.25MHz. (14)DSB: based on the DIIFSER model target for high-bandwidth wireless LANs with little management capabilities. ISB: based on combination of Diffserv and InterServe models for low-bandwidth 3G cellular network with large capabilities. AIP: combine ISB and DSB architecture.

Chapter5 (1)5G, IoT and IoE,, cybersecurity, molecular communication, network congestion

Chapter6 (1)First, the initiation of handoff is triggered by either the mobile device, or a network agent, or the changing network conditions. The second stage is for a new connection generation, where the network must find new resources for the handoff connection and perform any additional routing operations. Finally, data-flow control needs to maintain the delivery of the data from the old connection path to the new connection path according to the agreedupon QoS guarantees. (2)Handoffs

in homogeneous networks are referred to as intra-system handoffs. Handoffs between homogeneous networks are referred to as inter-system handoffs. (3)MCHO(mobile-controlled handoff): The MS continuously monitors the signal of the surrounding BSs When some handoff criteria are met, the MS checks the best candidate BS for an available traffic channel and launches a handoff request NCHO(network-controlled) :The network (MSC) asks all surrounding BSs to measure the signal (RSSI) from the MS and report the measurement results back the network. MAHO(mobile-assist handoff):Both the MS and BS supervise the quality of the link.

(4)hard handoff: break before make. minimize the distruption to the call. soft handoff:make before break.The interval during which the two connections are used in parallel,involve using connections to more than two cells. (5)The handover is executed once the chage in signal strength between the base unit and the mobile unit exceeds the threshold. (6)straight -line: the node moves in a straight line until the direction changes. Fluid flow: (7)if the Gauss-Markov Model has strong memory, the velocity of mobile node at time slot is same as its previous velocity. (8)If during ongoing call mobile unit moves from one cellular system to a different cellular system which is controlled by different MTSO, a handoff procedure which is used to avoid dropping of call is referred as Inter System Handoff; And a handoff procedure which is used to avoid dropping of call is referred as Intra System Handoff.

(9) $H_{kj}(v) = \frac{1}{\pi}\mu_1(T_{kj}^{(1)})v \ if \ k \neq j \ H_{kj}(v) = \frac{2}{\pi}\mu_1(T_{kj}^{(1)})v \ if \ k = j$

(10)the smaller the cells, the higher rate of the handoff. (11)A two-tier architecture is a software architecture in which a presentation layer or interface runs on a client, and a data layer or data structure gets stored on a server. (12)When the mobile unit is powered on or off, the cellular network will ask it to report its location within a certain interval. Service Provided: The cellular network searches the available access interface of the called user. The caller will send feedback to end the service delivery if successful. (13)time-based: update at constant time intervals. This saves user computation, but increases overhead significantly if the user does not move movement-based:update each time they traverse a certain number of cells. better than the time-based scheme, unless the users were constantly moving. distance-based:update if the user moved a certain radial length of distance. it requires the cellular device to keep track of such distances, which added much computational complexity. (14) In the pointer-forward scheme, a pointer chain between access routers is established to reduce the binding update traffic to the mobility anchor point. In addition, a mobile node (MN) performs a binding update to the correspondent node depending on its mobility. Specifically, an on-link care-of address is chosen for the MN with low mobility, whereas a regional care-of address is selected for the MN with high mobility.

Chapter7 (1)The user does not have to do the network configuration. (2)Ahome agent(HA) stores information about mobile nodes whose permanent home address is in the home agent's network. Aforeign agent(FA) stores information about mobile nodes visiting its network. Care of Address(CoA)is a termination point of a tunnel toward a MH, for datagrams forwarded to the MH while it is away from home. A mobile node(MN) is a node who switch from one chain to another. A communicating node(CN) is a node which a mobile node sends package to. (3)intermediate routers might check for a topologically correct source address. If an intermediate router does check, you should set up a reverse tunnel. By setting up a reverse tunnel from the mobile node's care-of address to the home agent, you ensure a topologically correct source address for the IP data packet. (4)a.Request forwarding services when visiting a foreign network b.Inform their home agent of their current care-of address c.Renew a registration that is due to expire d.Deregister when they return home (5)To remove the unnecessary MN after a period of time.

(6)The limited lifetime allows the mobile node to register with its home agent using the registration request message so that its home agent can create or modify the mobility binding of the mobile node (7)An agency is a full-service business that can manage all aspects of a campaign. They vary in size and range, and are suitable for different types of customers. Some institutions have only one or two major customer account management. There are hundreds of other customers around the country or many field offices around the world. In general, advertising agencies will be able to manage an account, provide creative services, and purchase media access for customers

(8)IP-in-IP Encapsulation: an outer header is added with SourceIP, the entry point of the tunnel and the Destination point, the exit point of the tunnel. While doing this, the inner packet is unmodified (except the TTL field, which is decremented). The Don't Fragment and the Type Of Service fields should be copied to the outer packet. Minimal Encapsulation:A minimal forwarding header is defined for datagrams which are not fragmented prior to encapsulation. Use of this encapsulating method is optional. Minimal encapsulation MUST NOT be used when an original datagram is already fragmented, Generic Routing Encapsulation: can encapsulate a wide variety of network layer protocols inside virtual point-to-point links over an Internet Protocol network.

(9) When you access the port of server component. The server component will control the client component to create a reverse tunnel connection to the server component. The Firewall/Gateway/Router will not restrict this. Then client component can receive data from server component and port forwarding to the application on the computer that behind Firewall/Gateway/Router. This is the basic idea of reverse tunnel that can let you access some application that you can not directly access. (10)Because we cant make a direct connection to a client computer from an outside connection. A tunnel is the best way to poke a hole. (11)example: X11 applications tunneled via SSH, and VNC sessions.

Chapter8 (1)DCF(Distributed coordination function): fundamental MAC technique of the IEEE 802.11 based WLAN standard. PCF(Point coordination function): fundamental MAC technique of the IEEE 802.11 based WLAN standard. SIFS(Short Interframe Space) DIFS(DCF Interframe Space) PIFS(PCF Interframe Space)

(2)DCF also has an optional virtual carrier sense mechanism that exchanges short Request-to-send (RTS) and Clear-to-send

(CTS) frames between source and destination stations during the intervals between the data frame transmissions.

(3) 802.11e defines a set of quality of service (QoS) enhancements for wireless LAN applications through modifications to the Media Access Control (MAC) layer. HCF: hybrid coordination function , EDCA: Enhanced Distributed Channel Access

(4)Wi-Fi networks in infrastructure mode are generally created by Wi-Fi routers, while ad-hoc networks are usually short-lived networks created by a laptop or other device.infrastructure mode require a centralized access point while devices on the wireless network connect directly to each other.

(5)infrastructure mode: Wi-Fi routers act as a centralized access point. ad hoc mode: Two laptops with NIC in which one of them has access to the Internet. (6)802.11 is the wifi protocal in the data link layer. TCP/IP protocals are respectively in the transport layer and network layer. TCP/IP protocals obey the 802.11 standard to run on the WLAN.

(7)LLC(Logical Link Control): identify the protocals of network layer and package them. MAC(Media Access Control): distribute the use of the channel when the competition exists in the public channel. PLCP(Physical Layer Convergence Procedure):constuct the frame before the transmit. PMD(Phsical Medium Dependent):transmit the frame. (8)infrared wireless networks:use infrared as transmission media. However, you must point them directly at the piece of equipment you are trying to control. radio wireless networks:use radio as transmission media.It can allow you to place your equipment behind the obstruct.

(9)frequency hopping (802.11 FHSS) and direct sequence (802.11 DSSS). (10)HIPERLAN 1 provides five different priorities for the packets to be sent. After a node is sent, many other nodes can compete to send permissions. The first goal of the priority phase is to ensure that nodes with no lower priority can access the media and packets with higher priority wait at other nodes. The mechanism always allows nodes with higher priority access to the media, regardless of the lower priority of the load.

(11)Four wireless LAN access methods: the IEEE 802.11 Distributed Coordination Function (DCF) Point coordination function (PCF) the hybrid coordination function (HCF). (12)

(13)A Unicast transmission/stream sends IP packets to a single recipient on a network. A Multicast transmission sends IP packets to a group of hosts on a network. (14)To ensure whether the medium is busy or idle. (15)Qos is supported in 802.11. (16)A Timing Synchronization Function (TSF) keeps the timers for all stations in the same Basic Service Set (BSS) synchronized.

(17)Timing synchronization is achieved by stations periodically exchanging timing information through beacon frames. In (infra) BSS, the AP sends the TSF information in the beacons. In Independent Basic Service Set (IBSS, ad-hoc), each station competes to send the beacon. (18)Beacon contains a timestamp. On receiving a beacon, STA adopts beacons coming if T(beacon)¿T(STA)

(19)PC power management for computer systems is desired for many reasons, particularly: Reduce overall energy consumption, Prolong battery life for portable and embedded systems, Reduce cooling requirements, Reduce noise, Reduce operating costs for energy and cooling.

(20)The DTIM beacon frame synchronizes the timers and notifies the Wi-Fi client on whether it has any buffered unicast traffic or not. At the end of a beacon interval, the Wi-Fi client powers up opening what's called the Announcement Traffic Indication Message (ATIM) window. The access point then takes advantage of the ATIM window to send a beacon frame. (21)Cellular networks and 802.11 networks employ handover mechanisms for handover within the same network type (aka horizontal handover).

(23)DTIM transmitted less frequently(every DTIM interval), for sending buffered broadcast packets ATIM transmitted in ATIM-Window by station who want to send buffered packets, structured the same as TIM (24)in 802.11 networks, a handover means reassociating with the new AP.

(25)IP fragmentation is an Internet Protocol (IP) process that breaks down a datagram into smaller fragments so that a link can be formed through a link with a maximum transmission unit (MTU) that is smaller than the size of the original datagram Grouping.

(26)To provide data confidentiality comparable to that of a traditional wired network. (27)Because these devices may not be the actual source or destination of L2 traffic when the 802.11 device is sending to the receiving device. So four different addresses are required: Transmitter Address (TA) Receiver Address (RA) Source Address (SA) Destination Address (DA)

(28)IEEE 802.11a-1999 or 802.11a is a revision of the IEEE 802.11 wireless LAN specification for the definition of Orthogonal Frequency Division Multiplexing (OFDM) communication (29) WEP is a Wi-Fi network security protocol. The goal of WEP is to make the wireless network as secure as a wired network, such as a network connected via an Ethernet cable systems. (30)The standard 64-bit WEP uses a 40-bit key (also known as WEP-40), which is connected to the 24-bit initialization vector (IV) to form an RC4 key.

(31)In Open System authentication, the WLAN client need not provide its credentials to the Access Point during authentication. Any client can authenticate with the Access Point and then attempt to associate. In effect, no authentication occurs. Subsequently, WEP keys can be used for encrypting data frames. At this point, the client must have the correct keys. (32) Open System authentication offers no real authentication. However,it is possible to derive the keystream used for the handshake by capturing the challenge frames in Shared Key authentication. Therefore, data can be more easily intercepted and decrypted with Shared Key authentication than with Open System authentication.

(33) WEP/WPA -only provide confidentiality at the network level but they do not tell us who is connected. MAC filtering - Problem: doesn't identify a person - Easily spoofed, and not a secret information IP address - Doesn't restrict physical access to the medium - Easily spoofed (34) Active scanning occurs when the client changes its IEEE 802.11 radio to the channel being
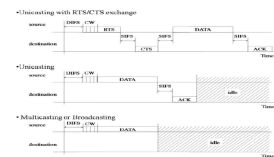
scanned, broadcasts a probe request, and then waits to hear any probe responses from APs. Passive scanning is performed by simply changing the clients IEEE 802.11 radio to the channel being scanned and waiting for a periodic beacon from any APs.

(35)SIFS¿PIFS¿DIFS (36) A combination of both may be useful. 802.1x everywhere is possible, on LAN/WLAN (dedicated SSID). Guest-style captive portal for the rest (different SSID). Captive portal remains more intuitive for first time users.

Chapter 9 (1) WiMAX: provide high-speed connection for the Internet, the data transmission distance up to 50km, with QoS protection, high transmission rate, business diversity. Using OFDM / OFDMA, AAS, MIMO, and other advanced technology to achieve the broadband business mobile.

(2) The transport convergence sublayer is responsible for receiving the MAC layer data unit encapsulation transfer convergence sublayer data unit. The physical media dependent sub-layer performs channel coding, modulation and other functions. It supports the coordination between MAC layer and physical layer channel management information.

(3) OFDM divides the channel into a number of orthogonal subchannels, converts the high speed data signal into parallel low speed sub-data streams, and modulates the transmission to each subchannel.

Chapter 10 (1)infrastructure: nodes access to the center point through the center point data exchange. ad-hoc: no center point.

(2)Define the number of nodes N, ni (1 i N) that node i, dij said the distance between nodes i and j. Rt denotes the node transmission distance, Rl denotes the interference distance, Rl¿ Rt, Rl = QRt. In the case of using the same channel. The following two conditions are met, then node i and j can be transmitted successfully: I) dijRt Ii) No node node d kj R1 does not perform data transmission

(3) When the neighboring users to send messages at the same time will produce inter-user interference, so that the entire network performance deterioration.as a result, the exclusion range is set.

(4)Upper bound: all data is transmitted at a balanced pace. Lower bound: path reuse in unexpected cases.

(5)The hidden terminal and exposed terminal will cause the disorderly contention and waste of ad hoc network time slot resources, increase the probability of data collision, and seriously affect the network throughput, capacity and data transmission delay.

Chapter11 (1)a.request the workstation to send the authentication frame. b.AP received, return a verification frame,c.obtain the challenge text from the frame and encrypt it with the shared key WEP algorithm, and send an authentication management frame

(2) WEP: Authentication status is unidirectional, resulting in potentially impoverished AP. WAPI: add a certification infrastructure WAI used to achieve the user's identity authentication. IEEE 802.11i: enhanced WLAN identity authentication and access control capabilities; increased key management mechanism.

Chapter12 (1)low power consuption (2)Page, Page Scan, Inquiry, Inquiry Scan. (3)tag enenrgy supply, tag reader. (4)company door card, school card.

Chapter13 (1)The sensor network acquires data from the detection area and preprocesses the data (2)power and power management modules, sensors, microcontrollers, and wireless transceivers. (3)smart dust, a line in the sand. (4)the smaller the transmission rate ,the higher transmission reliability. (5)Environmental energy collection from external sources.

Chapter 14 (1)intelligent home,intelligent education , green communication. (2)high security, high resulution in muli path, high transmission rate,high capacity, low power. (3)Bluetooth can handle a lot of data, but consumes battery life quickly and costs a lot more. BLE do not need to exchange large amounts of data, and can therefore run on battery power for years at a cheaper cost. (4)body as transmission medium. application:navigation and location, individual media entertainment, millitary and space application.

Chapter 15 (1)Software-defined networking (SDN) is an programmable web architecture purporting to be dynamic, manageable, cost-effective, and adaptable. (2)central control routing mechanism, stream -based data fowarding mechanism,application-oriented programming mechanism. (3)SD-WAN

Chapter 16,17,18 (1)Sensors,moters,camera, navigation device,ir receiver, Wifi and Ethernet support. (2)bluetooth, near field communication,wifi,zigbee. Zigbee is a new wireless network technique in short distance and low rate. The sensors only recquire a little power to transmit the date between sensors.

Chapter 19 (1)SISO means Single Input Single Output while MIMO means Multiple Input Multiple Output.In SISO system only one antenna is used at transmitter and one antenna is used at Receiver while in MIMO case multiple antennas are used.MIMO system delivers higher data rate due to transmission of multiple data symbols simultaneously using multiple antennas, this technique is called as Spatial Multiplexing (SM). With SM data rate can be enhanced. (2) (3) diversity techniques: provides diversity gain,Aimed at improving the reliability spatial multiplexing techniques:provides degrees of freedom or multiplexing gain Aimed at improving the data rate of the system (4)distributed antenna system,virtual MIMO,cellular MIMO system

Chapter 21 and 22 (1)value securuty, account securuty, transaction security, privacy security, (2)