

Midterm Exam

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[Chapter 1]: ① Communication appears from 1930s as Telecommunication. Faraday discovered electromagnetic induction at 1831. It's the base of telephone, telegram and wireless communication. At 1958, SCORE satellite launched and open a new era of wireless. Then the cellular network came out and called GSM. Now we use 3G, 4G and 5G in the future.

② Base technics: Cellular System; Mobile Management; Mobile IP; Wi-Fi; WiMAX; self-organizing network; wireless security; Sensor network; IOT; SDN.

[Chapter 2]: ① Wired media need cable or other lines, while wireless need media include micro-wave, satellite, laser and so on. Wired media are stable and have wider bandwidth, and to the wireless media vice versa. ② Licensed Band include 1GHz, 2GHz, 5GHz and 28-66GHz and IR, unlicensed band include ISM, U-NII. ③ 3 factors: reflection, diffraction, scattering.

④ Reflection: when the obstacles' size larger than wavelength, it appears. Diffraction: when the route of TX and RX are blocked by sharp fringe, diffraction appears. Scattering: when the size of matter smaller than wavelength, it appears. ⑤ Reflection mostly appears indoor, and diffraction and scattering mainly happened outdoor. ⑥ P_r pass distance, the $P_r = P_t d^{-2}$

and $P_o = P_e (4\pi R^2 / \lambda^2)$ ① free space: $L_p [dB] = 22.44 + 20 \lg f_c [MHz] + 20 \lg d [km]$ two way: $10 \lg P_r = 10 \lg P_t - 10 \lg (4\pi d)$ ② Shadowing: the same distances from transmitter may receive different degree of signal, and the signal strength changes for the location change. Many are caused by buildings or walls. ③ fade Margin: $L_f = L_o + 10 \lg D + X$. ④ $L_p(d) = \begin{cases} A + B \lg d & \text{city} \\ A + B \lg d - C & \text{suburban} \\ A + B \lg d - D & \text{free space} \end{cases}$
 $A = 69.55 + 26.16 \lg f_c - 13.82 \lg h_b - a$; $B = 44.9 - 6.75 \lg h_b$; $C = 4 + 12 \lg (f_c / 128)$; $D = 40.94 + 4.78 (\lg f_c)^2 - 18.33 \lg f_c$

⑤ multi-path: signal arrive from different paths and collapse. Doppler shift: The wavelength will change for the motion of source and spectator ⑥ Rayleigh.

⑦ We can compute Doppler shift with $v(t) = \frac{v_f}{c} \cos \theta(t)$
 ⑧ Rayleigh: $f_{D, rms} = f_c \exp(-\frac{v^2}{2c^2})$, $f_{D, rms} = \frac{v}{\lambda} \sigma$. Ricean: $f_r = \frac{v}{\lambda} \exp(-\frac{v^2 + a^2}{2\sigma^2}) I_0(\frac{av}{\sigma^2})$ $v > 0$, $a > 0$, $R = a$.

[Chapter 3/4] ① 1996-1997, the GSM, CDMA appeared and they can receive email or website. then at 2008, IEEE publish the rule of 3G, which determine the born of 3G. ② $C = MJN$ (C is capacity, J is areas and K is channels)

③ $\frac{S}{I} = \frac{2D-R}{2D-R} + 2D^{-k} + 2(D+R)^{-k}$ ④ base station is the station to handle the mobile devices' requirements. uplink is mobile phones send messages, and downlink is base station send msg to mobile devices. A base station can cover an area, it's local area. Mobile switch center connect different base station. ⑤ MSC contains following items: HLR; BSS; UTRAN; VLR and so on. VLR save the information of a user tour to the area, and HLR contain the detailed info for all users. ⑥ Mobile switching center and Mobile Host. ⑦ Increase speed of transfer voice and data, and can be used globally.

⑧ TDMA and CDMA help all phones have a channel to not interfere and communicate. ⑨ SGSN/GSN accomplish the function of Packet Service, contains User Data Management, Mobile Session Management, Route, Counting, Fees, Wireless Source Management, MSC | G/MSC | VLR, pro-

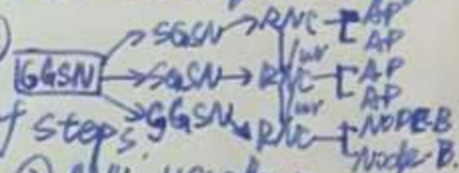
vide Channel dispense, User data Management and so on. ⑩ WCDMA; CDMA2000; TD-SCDMA. ⑪ WCDMA: 5.0 Gbps, 5MHz, 3.84 Mcps, CDMA2000: 3.1MHz, 1.2288 Mcps. ⑫ Surf Internet; cell phone business; video phone; cell-phone TV; wireless search, cellphone office, hand phone games.

⑬ ISB, based on combination of DiffServ and IntServ models for 3G. DSB is the second. based on LANs. last is AIP, combines ISB and DSB for all-ip network.

[Chapter 5] ① 1. Mobile Cloud Computing. 2. Web app 3. Mobile Web Initiative.

[Chapter 6] ①. Mobile initial → raise call → paging request → receive call → continue paging.
→ cross area switch. ② if the users don't change their base station, it's intra handoff.
if not, it's inter hand-off ③ MCHO: Network makes decision. used in GPRS and GPRS.

MCHO: mobile decides for itself. MCHO: The mobile provide data for the network to make the decision. ④ soft handoffs doesn't need to change its channels, but only the base station it belong to, it use the data from base station efficiently. ⑤ the base station send a msg and wait for the feedback. the intervals are $2^N T$. ⑥ straight line is base station directly connect to the mobile phones. flood flow is the carrier send many msgs to wait for the flow to the device. ⑦ initial procedure → find new links → data rate control. ⑧ intra-cluster and inter-cluster handoff rate has been found. ⑨ if the cell is splitting, there will be a kind of interference, so the rate will be down. ⑩ two-tier network will contain control tier and micro area. ⑪ A device will detect nearby it came to a new wave area, it will send a notice and the control point will provide the service again. ⑫ time-based detect change at every single time and it may suit for the small movement. movement based suit for the unmoved device for energy efficiency. distance-based as depends on its distances. ⑬

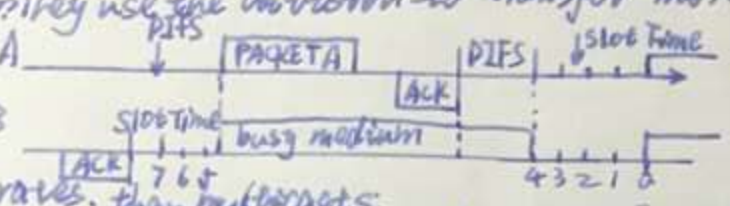


[Chapter 7] ①. Every time a IP address changes, it needs a lot of steps, so the usually changes is not suitable for mobile devices ② MN: usually moved / Node (Moso); HA: a router on the link route containing the location msg; FA: when the device moved, transfer the new location to the HA. COA: when to transfer outer link a IP address related to the node. CN: a mobile node communicate opponents. ③ When got a data bag, it will be done to a tunnel bag with the info of router. to transfer this bag to the destination. ④ Home-own Node → HA → Internet → FA → MN ⑤ The MN initiates

the registration for the change of link. It will broadcast to the outer Host and Home-town Host. ⑥ If in a life time the node doesn't receive the same home msg, it can be thought that the link is end. ⑦ every valid HA will response and the MN will know how to link. ⑧ the request will deliver to the HA. ⑨ the router service may not route your registration to the right HA, and it will be fail. ⑩ IP-in-IP, minimal encryption and general router encryption. If the data is excess split, the minimal way can't be used. ⑪ reverse tunneling appears in the IPv6's Home Agent, it transport the bag to the end directly. ⑫ for example, a bag come and the data from mobile node will be deliver by a kind of special route, so it may be the only way. ⑬ It may want to the outer agent first, then to the Internet, then to HA, and to the Home Node.

[Chapter 8] ① Distributed Coordination Function. DIFS is acronym of PCF Interframe spacing. SIFS stands for short est Interframe spacing. PCF is Point coordination function. PIFS = SIFS + Slot time. ② PCF doesn't solve the hidden terminal and/or exposed terminal problem completely, it only alleviates the problem through RTS and CTS. ③ EDCA: Enhanced Distributed Channel Access (EDCA) HCF: Hybrid Coordination Function (HCF) ④ In the Infrastructure Networks, the AP is like a network bridge, and the Ad-hoc WLAN, suit for the temporary network. ⑤ It's answered with last question. ⑥ IEEE 802.11 (1999 version) define no physical layer, and media so point-to MAC. and include TCP/IP. ⑦ LLC and MAC is data link layer and PLCP and PMD are Physical Layer. ⑧ The radio wireless network have wider bandwidth, powerful data transfer function and use MIMO-OFDM.

④ Physical Layers are PLCP, PMP ⑤ It define the signal character and modulation ways. So the different packages have the same way to. ⑥ the three types are code-division, frequency-division and time-division. They work like the communication theory. They use the division to transfer more data bits to the receiver. ⑦ Unicast of any kind will likely station B to be transmitted over



WIFI at much higher rates. than multicasts.

⑧ NAV is a logical abstraction which limits the need for physical carrier-sensing at the air interface in order to save power. ⑨ QoS supported in 802.11 in both modes by quantitatively measure quality of service. such as BER or bit rate.

⑩ Because it needs synchronization to fulfill timing synchronization among users. ⑪ In 802.11, we use Timing Synchronization Function in both modes.

⑫ Beacon frames are transmitted periodically to announce the presence of a wireless LAN. it's different from PLCP, so we need both.

⑬ Clock synchronization is very important for power management protocol in a multi-hop MANET. such as MTP. it's for the MANETs based on IEEE 802.11 ad hoc mode. ⑭ Because to the mobile devices, the power can be too inefficient, so we need power management.

⑮ the transmitter and receiver will be awake and asleep switch every small time period. in ad-hoc mode, the frequency may be much higher to suit the high mobility. ⑯ ATIM is a management frame with no frame body. When a STA receives ATIM, that formally dozing station must begin the process of retrieving buffered frame from the stations that transmitted the ATIM. DTIM beacon is identical in structure to the ordinary beacon. ⑰ Handover operations between APs in IEEE 802.11 is entirely driven by STA ⑱ Because a message's length may not suit a package, so we should fragment it so that we can use standard to transmit it. ⑲ the MAC header contain the msg's source and destination. ⑳ Because the different data header was provided by different protocol. ㉑ 802.11a use DSSS to modulate the msg, but 802.11g use OFDM. it can speed up the transmission. ㉒ WEP's goal is to secure the wireless network.

㉓ the WEP provide a tunnel that was encode in csh and it can provide safe link. ㉔ The WEP can not provide enough security, so we change it to IEEE 802.11i and China provide WAPI as new standard. ㉕ The active scanning will discover the devices in the area, but the passive scanning will response only the device send msg to the AP.

㉖ It's design as a special layer to add into 802.11 so that can be used. ㉗ There are called station, semi-mobile station and mobile station. They combine into a Basic Service Set, BSS. And the Basic Service Area overlaps to form the whole system.

[Chapter 9] ① WiMAX has high speed, max overlaps, easily organized and provide good support to mobility. ② It use WMAN-SC; WMAN-SCA; WMAN-OFDM; WMAN-OFDMA. ③ OFDM divide the channels to many quadrature subsets and give different users the different subset to accomplish the multi-address.

[Chapter 10] ① Infrastructure network need to prepare the base facilities to a certain area and ad-hoc network can provide mobile and self-organized system to the network. ② It use DSR to do the route discovery, route reply and route maintenance and route caching. ③ For the decision between different devices, one device may receive many data and one of them will success but other may fail. so it's the exclusion region. ④ we should use RTP/RTCP to provide the suitable environment. ⑤ Exposed terminal is covered by send

spot but excluded by receive spot. hidden terminal is hidden for the distance of mobile communication and other obstacles.

[Chapter 11] ① the initial vector and secure key will combine into the complete key. then use the RC4 algorithm to produce PRKs. the data will use CBC algorithm to use the data. then the key and data. it will produce the serial ② Applicant send authority the EAPOL Start frames start authority. The authority send request to ask applicant to provide identity. Applicant response and send back info. Authority secure the identity to RADIUS Access Request frames and send to AS. RADIUS test and confirm. then open.

③ IEEE 802.11i provide Temporal Key Integrity and CBC MAC protocol. and. China produce the WAPI protocol. it use ASi to secure the msg.

[Chapter 12] ① 4.0 has very low energy need. and a small battery can provide year-long work. ②. Connect State, middle State. ③ Reader provide energy to active the label and transfer data. Electric table label to save some information. ④. The key techniques is chip tech, antenna design tech, Packaging tech, label app techniques, standard tech, and anti-collapse tech. ⑤ Transportation Region; Retail Region; Manufacture Region.

[Chapter 13] ① The sensor networks provide data to the base station and monitoring station. then the station process the data. then send the result to other devices. ② In the node every element provide the different function. ③ In the military application, Smart dust. A line in the sand. In medical, long distance surgery. ④. We can put the wireless sensor into our fracture then we can detect the data. ⑤ The data rates is the sensor data every second send to the stations. ⑥ The trade-off of WSNs we focus is the electric power limit and we should have the power to self-organized. ⑦ In the future the W/U will use wireless power to work continuously.

[Chapter 14] ① Super Wide Band wireless technology. Radio Frequency Identification. and Bluetooth 4.0. ② Ultra Wideband can be used in ad-hoc wireless network and Home entertainment center. ③ The low energy bluetooth's biggest feature is ultra low energy and high. ability, high secure and high speed. ④ The cognitive radio can changes its parameters of transmitter automatically. it can study and detect. deduction. ⑤ Body Area Network can access the data from clothes and body. the application is medical health, wireless terminal.

[Chapter 15] ① SDN is a structure that can be programmed. It apply the detach of control layer and transfer layer. ② The working principle is Openflow which contains controller, switcher and protocol. ③ the SDN can easily accomplish the protocol and network functions fewer the number of facilities. ④ The SDN can reduce the energy needs from information transfer and can provide the best path to improve the efficiency. other sensor.

[Chapter 16, 17, 18] ① Motor, camera, inertia sensor, microphone. ② Wireless robot; Safe guard robot, detect robot. The safe guard robot can have indoor location and automatic charge. ③ MIMO have many routes and SISO only have one route. ④ MIMO channel have multi-path property and can be represented to $y = Hx + n$. ⑤ The space-division multiple access use different reflection in space layers. ⑥ MIMO used on multi antenna and switcher. [Chapter 21, 22] ① Bitcoin can generate a wallet.dat. and if someone get this wallet and the coin can be lost and it's not very safe. ②. version information, format information, and check bit. Finally, the identifier.