

Chapter 1 1. The first professional wireless network in 1969 at the University of Hawaii ALOHAnet brand development, in June 1971 began operation. The first commercial wireless network was developed by NCR in 1986, the WaveLAN product line. 2.Wi-Fi; mobile network; IP address; WiMAX; wireless network security; Internet; software defined network

Chapter 2 1. Wired Internet is where the physical line is connected to the Internet, such as an Ethernet cable into the Ethernet port on the back of the computer. The wireless Internet uses airborne digital radio signals to transfer data from a wireless router to a computer with a wireless adapter (built-in or external), but wired media means that the lines (or conductors) of the signal are indispensable. Permission band: 1GHz, 2GHz, 5GHz and 28-60GHz IR; Unauthorized band: ISM, U-NII 3. Indoor and outdoor; Operating frequency (low or high); Mobile terminal speed 4.Reflection: when the obstacle's size is larger than wavelength; Diffraction: when the route from sender to receiver are blocked by sharp fringe; Scattering: when the size of matter is smaller than wavelength.(5)Reflection mainly appears indoor, while diffraction and scattering often happen outdoor. 6.  $P_r = G_t \cdot G_r \cdot P_t / L$ ;  $G = 4\pi A_e / \lambda^2$ ;  $P_r / P_t = G_t \cdot G_r \cdot h_b^2 \cdot h_m^2 / d^4$  7.In free space modeling,  $10 \lg P_r = 10 \lg P_0 - 20 \lg d$ ;  $L_p \text{ [dB]} = 32.45 + 20 \lg f_c \text{ [MHz]} + 20 \lg d \text{ [km]}$ . In two-ray modeling,  $10 \lg P_r = 10 \lg P_0 - 10 \lg d$ ;  $L_p = L_0 + 10 \lg D + X$ . 8.In a wireless communication system, slow fading can be caused by events such as shadows, where larger obstructions mask the main signal path between the transmitter and the receiver, and the received power is reduced. As the distance changes, the power of the slow down, so called slow fading. So it's called slow fading. It will cause the effect like Near-far problem, shadow effect. 9. $L_p = L_0 + 10 \lg D + X$  10. Cannot find. 11.Multipath fading occurs in any environment where there is multipath propagation and there is some movement of elements within the radio communications system. The Doppler shift is the change in frequency of a wave for an observer moving relative to the source of the

wave. 12.Rayleigh distribution  $f(x) = \frac{x}{\sigma^2} e^{-\frac{x^2}{2\sigma^2}}, x > 0$  Ricean distribution:  $p(R) = \frac{R}{\sigma^2} \exp\left(-\frac{R^2 + A^2}{2\sigma^2}\right) \cdot I_0\left(\frac{RA}{\sigma^2}\right)$

13.Dopplershift:  $f_d = \frac{1}{2\pi} \frac{\Delta\phi}{\Delta t} = \frac{v}{\lambda} \cos\theta$ . 14.Rayleigh distribution  $f(x) = \frac{x}{\sigma^2} e^{-\frac{x^2}{2\sigma^2}}, x > 0$  Ricean distribution:

$p(R) = \frac{R}{\sigma^2} \exp\left(-\frac{R^2 + A^2}{2\sigma^2}\right) \cdot I_0\left(\frac{RA}{\sigma^2}\right)$  15. .Cannot find.

Chapter 3 and Chapter 4 1. 3G network to pay the license fee is higher than the 2G network. 3G network construction and maintenance is more expensive than 2G network. From the customer point of view, if the 3G network applications using 3G network, the expenditure will be too high. 2. C = MJN 3. Cannot find.

4. Base station: In wireless communication, it is a transceiver and / or a wider area where multiple other devices are connected to each other. Message: related to GSM and cellular networks, the wireless uplink is the transmission path from the mobile station) to the base station (cell site). Downlink: In connection with a cellular network, a wireless downlink is a transmission path from a cell site to a cellular telephone. The cellular network is located in a region called a cell, each serving a fixed-location transceiver called at least one cell site or base station. MSC: The Mobile Switching Center (MSC) is the primary service delivery node for GSM / CDMA. Routing and voice messages and other services (such as conference call, fax and circuit-switched data) 5. The current wireless network architecture includes: HIR; BSS; UTRAN; VLR; VLR will save the user tour information to the area, HIR contains the user The details of who is in the locating area.6.Mobile switching center and mobile host. 7.Increasing the speed of transferring information and providing more web functions. 8.TDMA&CDMA help all users' phones have a channel to communicate without interfering. 9.SGSN/GGSN accomplish the function of Packet Service, contains User Data

Management, Mobile Session Management, Route, Wireless Source Management. MSC/GMSC/HLR provide Channel Dispose, User Data Management and others. 10. WCDMA; CDMA2000; TD-SCDMA. 11. WCDMA: no GPS; 5MHz; 3.84Mcps; CDMA2000: GPS; 1.25MHz; 1.2288Mcps. 12. Mobile phone games; cell phone business; Internet Surfing and so on. 13. SB based on combination of DiffServ. And IntServ. Models for 3G. DSB is the second based on LANs. Last is AIP, which is combined by ISB and DSB.

Chapter 5 1. Virtual reality 2. Cloud computing 3. Learning and machine learning.

Chapter 6 1. When a mobile station moves from one base station to another, the MSC needs to assign voice and signaling signals to the new base station channel. The handover procedure requires the mobile station to identify the new base station and measure the signal strength. 2. The quality of the channel being used is constantly changing as the mobile unit moves. Therefore, it is necessary to perform channel switching. In contrast to "inter-cell handoff", the channel switching is referred to as "intra-cell handover" where the channel switching cell boundary is performed between adjacent cell sites when the mobile unit spans a mobile unit. 3. MCHO: Network decision for CT-2 and AMPS; NCHO: Move yourself to decide; MAHO: Move the data provided by the network to make a decision. A call to a hard call uses only one channel. The connection of the soft handover to the source unit is only disconnected when a reliable connection to the target cell has been established 5. The base station sends a message and waits for the feed-back. Interval is  $2^n * T$  6. Straight-line model means that using a microscopic traffic flow model to represent traffic. Fluid model means sending out messages and wait for the response. 7. Cannot find 8. switch inside the cells; inter: switch among different cells. 9.

$$H_{kj}(R_0) \triangleq \frac{1}{\pi} F(\beta_{kj}) \beta_{kj} \frac{pdf_{R_j}(R_0 \beta_{jk})}{ccdf_{R_j}(R_0 \beta_{jk})}$$

$$F(\beta) \triangleq \frac{q}{\beta^2} \int_0^\pi \sqrt{(\beta^2 + 1) - 2\beta \cos(\theta)} d\theta.$$

10. To subdivide the congestive cells into subcells, thus they can own their BS. 11. it can make an networks interact with other networks. 12. Location update: enables mobile services to inform cellular systems; Service delivery: defines the business of IT. 13. Time-based: easy to manage, can set different T; Movement-based: error might appear while travelling around boundary; Distance-based: simple. 14. pointer-forward scheme: to minimize network signaling cost from mobility management operation.

Chapter 7 1. So as to acquire a permanent address on the internet. 2. MN = Mobile Node; HA = Home Agent; FA: Foreign Agent; COA = Care of Address; CN = Correspondent Node. 3. FA utilize reverse tunneling by tunneling the MN's packets to HA. 4. Cannot find. 5. FA adds registered MN to the visitor table and relays registration requests between MN and HA. 6. so that if a registration might have error, it will not occupy the service too long.

7. cannot find 8. cannot find 9. mobile node might fail authentication. 10. Cannot find. 11. the original IP package would be encapsulated in data payload of another data package. IP address would be grouped and encapsulated respectively at the beginning of tunneling, and would be split at the end of tunneling. 12. Cannot find. 13. Cannot find

Chapter 8 1. DCF = Distributed Coordination Function; PCF = Point Coordination Function; DIFS = DCF Inter Frame Space; SIFS = Short Inter Frame Space; PIFS = PCF Inter Frame Space. 2. DCF gets an selective virtual carrier sense mechanism which enables it to exchange short RTS and CTS frames. 3. 802.11e = a proposed enhancement to the 802.11a and 802.11b wireless LAN (WLAN) specifications; EDCA = Enhanced Distributed Channel Access; HCF = Hybrid Coordination Function. 4. Infrastructure: communicate indirectly, through centralized access points. Ad-hoc: peer to peer. 5. Infrastructure: BS: connects mobiles into wired network, handoff: mobile changes base station. Adhoc does not seem to need any other element to facilitate

communication. 6. Cannot find. 7. Cannot find. 8. Compared to the infrared wireless networks, the radio wireless networks have a longer bandwidth. 9. PLCP PMD are in 802.11 standards so far. 10. The 802.11 defines the signal character and modulation ways. 11. Code-division, frequency-division and time-division transfer data bits to receiver by division. 12. Sorry I can't find it. 13. Unicast of any to be transmitted over WIFI are at much higher rates than multicasts. 14. NAV is a logical abstraction which limits the need for physical carrier-sensing to save power. 15. QoS is supported in 802.11 in both modes by measuring quality of service like bit rate. 16. 802.11 needs synchronization to fulfill timing-synchronization among users. 17. Timing synchronizing. 18. Frames are transmitted periodically to announce the presence of a wireless LAN not PLCP. 19. Clock synchronization is essential for power management protocol in a multi-hop MANET. 20. The power cannot be inefficient to the mobile devices, so we need power Management. 21. The transmitter and receiver will be awake and asleep switch every small time period: in ad-hoc mode, the frequency may be higher to suit the high mobility. 22. ATIM is a management frame with no frame body. When a STA receives ATIM, the formally dozing station must begin the process of retrieving buffered frame from the stations that transmit the ATIM. DTIM beacon is identical to the ordinary beacon. 23. Handover operations between Aps in IEEE802.11 is entirely driven by STA. 24. A message's length may not suit a package, so we fragment it to use standard to transmit. 25. The MAC header contain the message's source and destination. 26. A sector can access multiple users, each user can take multiple user terminals. 27. The IEEE 802.11a standard is a follow-on standard for the IEEE802.11b standard, which adopts OFDM while b adopts DSSS. 28. Wireless LANs are at least as secure as limited local area networks. 29. Making the difficulty of attacking wireless LAN and attack the limited local area network is very difficult. 30. This depends on the specific modification. 31. Standard 64-bit WEP uses a 40 bit key (also known as WEP-40), which is concatenated with a 24-bit initialization vector (IV) to form the RC4 key. 32. WEP provide data confidentiality comparable to that of a traditional wired network. Mac filtering is effective in wired network, but not effective in wireless network. Captive portal is mainly used in wireless open networks. 33. During an active scan, the client radio transmits a probe request and listens for a probe response from an AP. With a passive scan, the client radio listens on each channel for beacons sent periodically by an AP. 34. 802.11 for data and videos, 802.11ac for videos and 802.11ad for uncompressed video. 35. This depends on the specific combination.

Chapter 9 1. WiMAX has QoS guarantee, high transmission speed, variety of business, adopted advanced technologies such as OFDM/OFDMA/AAS/MIMO, and realized mobility of broadband service. 2. WMAN-SC; WMAN-SCa; WMAN-OFDM; WMAN-OFDMA. 3. OFDM divides the channel into a number of orthogonal subchannels, converts the high speed data signal into a parallel low speed sub-data stream, modulates the transmission to each subchannel. Chapter 10 1. One is the traditional ap mode, another one is the ad hoc network mode, 2. The following two conditions are met, then node i and j can be transmitted successfully:  $d_{ij} \leq R_{tli}$  No node node d  $k_j \leq R_1$  does not perform data transmission 3. Neighboring users send messages at the same time will produce inter-user interference, so that the entire network performance deterioration. 4. For optimal throughput, the transmission rate of each node must be strictly controlled and carefully scheduled 5. Exposed terminal

is covered by sending spots, and hidden terminal is hidden since the distance of mobile communication and obstacles.

Chapter 11 1. 1. Workstation sends the authentication frame, and AP return a verification frame. Then AP will receive third frame, if it is same to the one it sent, then successful. 2. Applicants EAPOL Start frames to certifier, then certifier ask for applicants' identity information. And applicants sent the identity information, and certifier receives it and encapsulates into RADIUS Access Request frame and sends to AS. Result depends on the authentication.

3. WEP's core uses RC4 sequence coding algorithm and it has drawbacks such as one-sided authentication; WAPI is improved based on WEP, it contains ASU which is trusted third party, STA and AP which are two-way authentication; 802.11i is also improved based on WEP. It includes 802.1x into WLAN, enforces identity authentication in WLAN and applies two more encryption mechanisms: TKIP and CCMP.

Chapter 12 1. improvement of transmission distance (up to 60m) and reduction of power consumption. 2. Stand-by State, Intermediate State and Connecting State. 3. Reader: handle two-way communication with electronic tag, and it is RFID's system information control and processing center; Electronic tag: is used for communication with the reader. 4. Chip technology, RFID anti-collision technology, security privacy issues. 5. Logistics transportation management, retail merchandise and Manufacturing process.

Chapter 13 1. Cannot find. 2. Perceptual acquisition unit, Computing unit, Communication unit and Power unit. 3. Mobile: military use such as smart dust and C4ISR system; Stationary: medical and health use such as hospitalized patient management and remote health monitoring. 4. Aircraft sowing, artificial embedding or rocket ejection. 5. It is subject to IEEE 802.15.4, and data rate reaches to 40kb/s, and the communication range is up to 1000 feet. 6. Cannot find. 7. Battery or solar power supply

Chapter 14 1. Radio Frequency Identification (RFID), Ultra Wideband (UWB), Software Defined Radio (SDR), Bluetooth Low Energy (BLE) Body Area Networks (BAN), cognitive radio. 2. Good security, High processing gain, Multi-path resolution, High transfer rate, System capacity, Strong anti-interference, low power consumption, positioning accuracy, a low cost of their own translation. 3. Based on traditional Bluetooth, it simplifies the stack of protocol, sets the speed of data transfer and power dissipation, so that the radio can capture or sense information from the environment, so it can label the hole of the spectrum and choose the most suitable band and parameter. (Including sensor, analysis and judgement) 4. Application: health care wireless access / identification system navigation and positioning services personal multimedia entertainment military and space applications their own translation Software-Defined Networking

Chapter 15 1. SDN achieves the separation of the control layer and the forwarding layer, and achieves centralized management and programmable network through standardization instead of IP. 2. Separation of data forwarding and control, network equipment control plane and data separation, network virtualization and open interface. 3. Traffic visualization, prevention of DDOS and cloud security. 4. Separation of network control and physical topology network makes SDN get rid of hardware restrictions on the network architecture. Moreover, because all network nodes in SDN are managed centrally by the central controller, management of the network data is more efficient and stable.

Chapter 16, 17 & 18 1. Motor, various kinds of sensors, camera, micro-phones and network communication module. 2. Wireless sensor networks, automatic parking and self-driving car. Self-driving car.

Chapter 19 1. SISO uses a single antenna to send and a single antenna to receive. MIMO uses multiple antennas to send and multiple antennas to receive and thus there are multiple transmission paths between the transmitter and receiver. 2. Cannot find. 3. Space diversity: receive multiple copies of the same information through multiple channels. Space multiplexing: using multiple antennas at the receiving and transmitting ends, making the most of the multipath components in spatial propagation. 4. Multiuser MIMO, Networked MIMO and Distributed MIMO. Distributed MIMO

Chapter 21 & 22 1. Security of monetary value: value usually fluctuates, and it's not safe. Account security: Users can generate a wallet. 2. Blank area, Position detection pattern, Positioning graphics and Data and error correction codewords.