Chapter 1: 1. Smoke, fire, flags → multihop → telegraph → telephone → radio → satellite → analog cellular → DCS-GSM → WLAN

2. Cellular system, mobility management, mobile IP, Wi-Fi, WiMAX, ad hoc network, wireless network security, WPAN, sensor network, IoT, SDN

Chapter 2. 1. (1) Wired media is more reliable and faster; wireless media is relatively unstable and lower. (2) Wired media transmit end-to-end, wireless media transmit in terms of broadcast.

2. (1) You have to pay the license holder for service if using the licensed band, but unlicensed is free. (2) Licensed band ensures wireless operators don't interfere each other, unlicensed band can't. (3) Licensed band is impractical for certain uses, unlicensed band is more practical.

3. (1) propagation loss (2) fade out (3) transmission distortion (4) effect of interference and noise.

4. (1) reflection and transmission: when the obstacle is only larger than the wavelength of the electromagnetic wave, reflection occurs (2) diffraction: when the propagation path between the transmitter and receiver and the receiver is blocked by a sharp edge, diffraction occurs (3) scattering: when the size of the object is the order of the wavelength of the electromagnetic wave or less, and the number of such obstacle objects per unit volume is very large, scattering occurs.

5. (1) reflection and transmission: effect by earth, walls (2) diffraction: effect by edges and walls and big objects. (3) scattering: effect by surface, small objects

6. distance ↑, transmission power ↑, receiving power ↓, antenna gains ↑, height ↑, pass low ↑

7. free space modeling: $L_p = \frac{P_t}{P_r}$, $P_r = \frac{C_0}{d^2}$

$L_p = 32.45 + 20\lg f_c[MHz] + 20\lg d[km]$

two-ray modeling: $L_p = \frac{P_t}{P_r} = G_t G_r \frac{h_t^2 h_r^2}{d^4}$

$P_r = P_0 d^{-\alpha} = P_0 d^{-4}$

8. Shadow fading: the signal strength in a mobile communication environment.

9. $L_p = L_0 + 10\lg D^x$

10. macro-cell: a few thousand meters to tens of kilometers.
micro-cell: a few hundred meters to a thousand meters.

11. (1) Multipath fading: superposition of signals through different paths. (2) Doppler: superposition of signals through different paths.

12. the wavelength of the object radiation changes due to the relative movement of the wave source and the observer. In front of the wave of the motion, the wave is compressed, the wavelength becomes shorter and the frequency becomes higher.

ts Chapter 3 & 4

1. $C = M \cdot N$. $D = \sqrt{3}N \cdot R$

2. $N = i^2 + ij + j^2$, $S/I = (\frac{D}{R})^n / N_1 = \frac{k}{N_1}$

$= (\sqrt{3N})^k / N_1$

3. Basestation: a radio transmission station that transmits information between a mobile telephone terminal and a mobile telephone terminal through a mobile communication switching center in a certain radio coverage area.
Uplink: to facilitate the cascade the ports between the two switches.

4. HLR: HLR is the basic information of the user. VLR is the user's dynamic information and state information.

5. Location Management: Location registration, authentication, Database update

Call delivery: database check, terminal paging

6. Achieve the global roaming in any time, any place. Achieve high-speed data transmission and broad band multimedia service.

7. TDMA is time division multiple access, CDMA is code division multiple access

8. WCDMA: CDMA2000, TD-SCDMA

9. Global roaming, high-speed transmission, broadband multimedia service

10. ARIB STD: DMA2, 2.1Mbps, 1940-1955MHz, 2130-2145MHz.

Chapter 5: Mobile cloud computing, Mobile web, pervasive computing

Chapter 6. 1. Initial phase, finding a new connection, controlling the data flow.

2. (1) inter-switch handoff: original base station and target base station are connected to the same switch. (2) inter-switch handoff: original base station and target base station are connected to different switches.

3. MCHO: mobile stations keep monitoring the signal intensity and quality in the communication part when satisfying the handoff conditions, choose a best handoff option and then initiate a handoff request.
NCHO: when signal is less than some threshold value, network will handoff to a new port.
MAHO: mobile station and measures, network controls.

4. hard handoff: advantage: share channel resources
disadvantage: disconnected during handoff
soft hand off: keep connection during handoff, but takes too much channel resources

5. Switch receives the datagram, and transmits to the target MAC. If there is no corresponding MAC address in the MAC address table, switch broadcasts the datagram to all of the ports. When the target responses, switch learns and saves the MAC-port correspondence

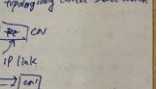
6. (1) location update: when mobile device passes through different roaming areas, it should report to cellular network.
(2) Service delivery: mobile device initiates, mobile device starts the services, service delivery, using the service, keep service, handoff through the areas

7. Time-based scheme: The signaling load within the network may be reduced, but generating unnecessary network traffic.
Movement-based scheme: Conserving network resources, but limiting the paging operation.
Distance-based scheme: Easily interfere with existing network, but limiting the paging operation

Chapter 7: 1. Permanent IP address: one more stable and has higher speed than dynamic IP address, and it's easy for others to access your server.

2. MN: Moving node. HA: home agent.
FA: foreign agent. CoA: Care-off address.
CN: the object that a MN communicates with

3. Without reverse tunneling, the routing within the Internet is independent of the source address of the datagram. With reverse tunneling, intermediate routers might check for an topologically correct source address.

4. 

5. (1) MN sends a registration request to the prospective FA to begin the registration process
(2) FA processes the registration request and then relays the request to the HA.
(3) HA sends a registration reply to FA to grant or deny the request.
(4) FA processes the registration reply and then relays the reply to MN to inform the MN of the disposition of the request.
(5) If MN registers directly with HA, MN sends a registration request to HA, the HA sends a registration reply to the MN that grants or denies the request.
6. Lifetime indicates the interval of registration. If there is no new registration request arrives before the lifetime is out, we think the MN is invalid.
7. BA and FA broadcast agent advertisement regularly to declare their existences.
8. MN registration request to register with HA, then the HA can create or modify binding for the MN.

The FA can relay the registration request to HA
9. HA may deny the registration request.
10. (1) IP-in-IP encapsulation: The whole IP datagram is encapsulated and the payload of the new IP datagram. The inner IP head is kept except TTL minus 1, outer IP head is the complete IP head
(2) minimal encapsulation: The new IP head is inserted between the original IP head and original IP payload.

(2). GRE: GRE defines a protocol that any network layer protocol can encapsulate any other network layer protocol. The data of naming a protocol is encapsulated in another protocol's payload of data.

HA and FA have to be able to use IP-in-IP encapsulation; minimal encapsulation can save bytes, but when original datagram is have been sliced, it cannot work.

11. If an intermediate router checks for a topologically correct source address, the mobile node needs to set up a reverse tunnel. By setting of a reverse tunnel from the CoA to HA, you ensure a topologically correct source address for the IP data packet. A MN can request a reverse tunnel between FA and HA when MN registers.

Chapter 8 1.(1) DCF: DCF is the fundamental MAC technologies of the IEEE 802.11 based WLAN standard. (2) PCF: PCF is a MAC technique used in IEEE 802.11 based WLAN
(3) DIFS, PIFS. The AP waits for PIFS duration rather than DIFS duration to grasp the channel. PIFS is less than DIFS duration and hence the point coordinator always has the priority to access the channel. (4) SIFS: SIFS stands for shortest interframe spacing. It is considered as shortest among above mention networking terminology. There is a relation: PIFS = SIFS + 1 slot time, DIFS = SIFS + 2 × slot time.

2. The RTS/CTS access mechanism mainly used to minimize the amount of time spent when a collision occurs since collision occurs in the share messages. After the successful RTS/CTS exchange the source station transmits the data packet then the receiver responds with an ACK frame.

3. (1) IEEE 802.11e is an approved amendment to the IEEE 802.11 standard that defines a set of quality of service enhancements for wireless LAN applications through modifications to the MAC layer. (2) EDCA is enhanced distributed channel access with EDCA, high-priority traffic has a higher chance of being sent than low priority traffic. (3) HCF is a new coordination function within HCF, there are two methods of channel access: HCCA and EDCA.

4. Ad hoc network allows each device to communicate directly with each other; there is no central AP. Infrastructure mode network requires the use of an AP.

5. In infrastructure mode: base station: connects mobiles into wired network; handoff: mobile changes base station providing connection into wired network.
In ad hoc mode: no base station, nodes can only transmit to other nodes within link coverage. nodes organize themselves into a network: route among them selves

6. 802.11 is in Data link layer of TCP/IP stack

7. LLC: LLC is logical link control, it is the upper sublayer of the data link layer of the 7-layers OSI model. (2) MAC layer is specified in 802.11, it is divided into MAC and MAC management.
(3) PLCP: carrier sensing assessment, forming packets for PHY's. (4) PMD: modulation and coding.

8. Infrared is used in devices such as the mouse, keyboard and pointers. It's signal have higher frequencies and cannot pass through walls. Its advantage: short-range communication. Advantage: has high cannot be used for long distance communication.

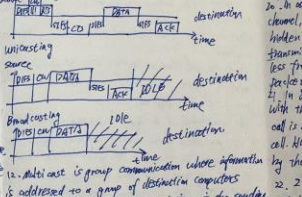
Radio is the transmission of signals through free space by modulation of electromagnetic waves with frequencies below those of visible light.

Advantage: simple-easy to use, high-speed, covers large area. Dis advantage: limited number of free frequency bands, shielding is different, greater power consumption, less clear.

9. 802.11-1 MAC and 3 PHY layers, 802.11a - operates in the IEEE 802.11 standard that defines a set of 5 GHz band at 54 Mbps. 802.11b - operates in both 2.4 GHz and 5 GHz at 5.5 Mbps and 11 Mbps
802.11g - operates in 2.4 GHz at 54 Mbps

10. After one node has finished sending, many other nodes can compete for the right to send. The first objective of the prioritization phase is to assign some of these nodes with a longer priority access to the medium which packets with higher priority are waiting at other nodes.

11. Collision with RTS/CTS exchange



12. Multicast is group communication where information is addressed to a group of destination computers simultaneously. Unicast: transmission is the sending of messages to a single network destination identified by a unique address.

13. NAV may be thought of as a counter, which counts down to zero at a uniform rate. When the counter is 0, the virtual CS indication is that the medium is idle; when non-zero, the indication is busy.

14. Tos is one in 802.11. Infrastructure mode can ad hoc mode are in 802.11

15. A timing synchronization function keeps the stations for all stations in the same basic service set synchronized. All stations shall maintain a local TSF timer.

16. All station maintain a local timer, timing synchronization function keeps timers from all stations in synch, AP controls timing in infrastructure networks, distributed function for independent BSS.

17. IEEE 802.11 TSF: time divided into beacon intervals, each containing a beacon generation window. Each station waits for a random number of slots, and transmits a beacon if no one else transmits a beacon. Beacon contains a time stamp. On receiving a beacon, STA adapts beacon's timing. clocks drive any forward.

18. Yes. ASP was proposed to synchronize a multihop ad hoc network. An adaptive protocol called ~~synchronous~~ ASP is proposed for time synchronization in 802.11-based multihop ad hoc networks. The basic idea of the protocol is to let the fastest nodes send out beacon more often and self correction of the clocks. This protocol is fast to adapt to the environment. self correction in multi-hop scenario.

19. Since mobile hosts are supported by battery power saving battery as much as possible is very important.

20. In ad hoc mode, CSMA/CA is used to access the channel. RTS, ACK, PS-Poll are used to overcome hidden terminal. In infrastructure mode, TIM transmitted with every beacon, delivery TIM transmitted less frequently, for sending buffered broadcast packet.

21. In 802.11 networks, a handover means roaming with the new AP. In a cellular wireless network, the call is not dropped when a user moves to another cell. Handovers are based on measurement performed by the mobile terminal and base station.

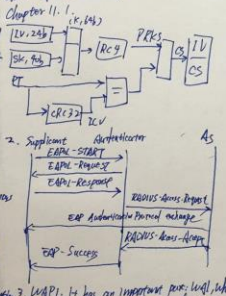
22. 2 byte - frame control, 2 byte - duration ID, 6 bytes - address 1-4, 2 byte - sequence control, 2 byte - QoS control, 4 byte - HT control

23. while an 802.11 device is transmitting to a receiving device, either one of these devices may not be the actual source or destination of the L2 traffic. There are cases where you need 4 addresses can create situations where you need 4 different distinct addresses: TA, RA, SA, DA.

24. 802.11a is an amendment to the 802.11 wireless local network specification that defines requirements for an orthogonal frequency division multiplexing communication system. 802.11b operates in the 2.4GHz radio spectrum, prone to interference (not expensive wireless LAN specification).

25. It is a security protocol for Wi-Fi networks. Since wireless networks transmit data over radio waves, it is easy to intercept data over wireless transmission. The goal of WEP is make wireless network as secure as wired N

such as those connected by ethernet cables.
26. Standard 64-bit WEP uses a 40-bit key, which is concatenated with a 24-bit initialization vector to form the RC4 key. At the time that the 27. (1) The client sends an authentication request to the AP. (2) The AP replies with a clear-text challenge. (3). The client encrypts the challenge text using the configured WEP key and sends it back in another authentication request. (4) The AP decrypts the response. If this matches the challenge text, the AP sends back a positive reply.
28. -(1) WEP: It only provides confidentiality at the network level, it doesn't tell us who is connected. (2) MAC filtering: it doesn't identify a person, but easily spoofed, and not a secret information. (3) Captive portals: it's very popular and flexible, easy to implement, but not transparent, not standardized and requires regular re-authentication, may require an external authentication server.
29. (1) 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. Passive scanning is performed by simply changing the client IEEE 802.11 radio to the channel being scanned and waiting for a periodic beacon frame from any AP on that channel.
30. 802.11- Inter frame spacing: defined different inter frame spacing, CDSIFS: lows in 802.11b, with highest priority for Ack, CTS, polling response. (2) PIFS: 30 us in 802.11b with medium priority, for time-bounded service using PCF. (3). DIFS: 50 us in 802.11 b with lowest priority, for asynchronous data service.
Chapter 9. 1. (1) Its transmission distance is much more far. (2) provides excellent last-mile service network access service. (3) has better extendibility and stability, (4) Provides higher speed bandwidth, provides multimedia communication service. (5) It defines the duplex mode, length of frame, modulation coding technique, etc. It also defines 4 implementations in physical layer: WMAN-SCa, WMAN-OFDM, WMAN-OFDMA.
3. OFDM divided channel into some orthogonal carrier sets, and allocates different carrier set to different users to use, thus it can achieve multi-access function. (1) transmitter
Chapter 10. 1. (1) Infrastructure network: messages by central nodes, each end system communicates with central nodes. (2) Ad hoc network is a non-central-node network composed of mobile end nodes with wireless transceiver.
2. Nodes inside the exclusion region are not allow to transmit, to limit the interference caused to the receiver.
3. (2) hidden terminal are the nodes that which are in the coverage area of the receiving node but out of the coverage area of the sending node. (2) Exposed terminals are the nodes which are in the coverage area of the sending node but out of the coverage area of the receiving node.
Chapter 11. 1.



2. Supplicant Authenticator AS

3. WAPI: It has an important pair: WAI, which is used to achieve the authentication of users. IEEE 802.11i: It pulls 802.1x in the WLAN security and key management mechanism, and proposes,
TKIP and CCMP
Chapter 12. 1. (2) Bluetooth 4.0 increases the transmission distance and reduces the energy consumption.
2. Connection state and stand-by state.
3. (1) Reader: it intercommunicates with electronic tag and receives the control commands from the host system. (2) Electronic tag: when system works, reader send the energy query signal, after the tag receives the signal, it rectifies part of the signal to DC power to provide the circuit in the electronic tag, and the other part of energy signal is modulated by the data in the electronic tag and then reflected back to the reader.
4. Chip technology, Antenna design technology, encapsulation technology, tag application technology, standard research technology, RFID anti-collision technology, security and privacy.
5. Charging system, logistic management system, security and anti-counterfeiting.
Chapter 13. 1. The sensor network consists of a data-aware network and a data distribution network, controlled by a management center.
2. Sensor nodes are very close to each other, have local processing capability, can be randomly and rapidly deployed even in places inaccessible for human, can collaboratively work.
3, Humidity, vehicular movement, lighting condition
4. Direction sensor network, directed perception model, virtual potential field, coverage enhancement.
5. Data-centric, self-organizing network, the number of nodes.
6 Battery.
Chapter 14. 1. UWB, SDR, RFID
2. High security, high processing speed, high resolution, high transmission rate, high system capacity, strong anti-jamming performance, low power consumption, accurate positioning, low cost
3. Compared with the classic Bluetooth protocol, BLE inherited the classic Bluetooth RF technology on the basic of the classic Bluetooth protocol stack to further simplify.
4. Cognitive radios can change their transmitter parameters by interacting with their operating environment.
5. The human body network consists of a set of compact, mobile sensor and a body hostile, the body as the center, by the human body and the network elements of the communication network. Medical care, wireless access system, navigation and positioning.
Chapter 15. 1. SDN is to achieve the control layer and forwarding layer separation, through the standardization of centralized management and programmable network.
2. In the SDN network, the control plane is separated from the forwarding plane. The control layer and the application layer are called the north bound API interface. The union-application layer provides the centralized management and programming interface. The software can be used to define the network control and network communication with the central node.
3. openflow, VXLAN
4. TCP/IP architecture cannot meet the rapid response and a large number of data transmission services, network security issues.
Chapter 16, 17, 18. 1. Moon, camera, inertial navigator, microphone, sonar rangefinder, infrared receiver, touch sensor, pressure sensor, WIFI.
2. Leap-Ing path design, real-time indoor mapping, fully distributed, scalable sensing and mapping, Leap-Ing path design: the use of three to trolled and a special combination of the pace, making the straight forward the error narrowed.

Chapter 19. 1. The SISO is a communication system using a single transmit antenna and a single receiving antenna. MIMO is an acronym for multiple input multiple output. In order to avoid data inconsistency and cannot be reassembled, the receiver will receive multiple antennas and then recalculate with DSP. According to the time difference factor, the separate data re-combination and then send the correct and fast data stream.
2. $Y = Hx + n$. X is a transmission signal, y is a reception signal, H is a channel matrix in the frequency domain, n is a superimposed noise in the channel.
3. Spatial classification can be understood as a repeat transmission on the data stream for a certain coding operation, so that each code word to meet a certain constraint between the receiving end of the corresponding process can be restored after the data flow. And the effect of reducing the bit error rate is achieved. The spatial multiplexing is simple. The transmitter divides the data stream into multiple words and is transmitted from different antennas. By using the multiplexing technology technique, it can be multiplied without increasing the bandwidth. Increase the data transfer rate.
4. Distributed MIMO, virtual MIMO, centralized MIMO.
virtual MIMO: By combining multiple users with only single antennas as a unitary unit, the unit can be equivalent to having multiple antennas.
Chapter 21. 22. 1. Bit currency transactions are by verifying the user's private key to ensure the legitimacy of the transaction each transaction is in real time by a data base called level DB to record.
2. Version information, format information, information and check digit, identifier, silent area.
feedback handoff scheme: makes the use of information feed back from the mobile. It attains fast handoff, with relatively small buffer requirements at both the base station and mobile terminal.
Flow Fluid flow mobility model: it can derive the average rate of boundary crossing per unit time out of a given area, but it is difficult to apply the model to the modern per-user based location area strategies or to study overlapped area strategy performance.

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