Midterm Exam of Wireless Communications and mobile Internet

chapter 1

1. 1895: wireless radio → 1906 AM → 1920 telecommunication → 1978: SCORE → 1981 NMT → 1988 GSM → 1997 WLAN
2. ① mobile management ② cellular system ③ mobile IP ④ wifi ⑤ WiMAX ⑥ self-organized work ⑦ wireless network security ⑧ wireless personal network ⑨ sensor network ⑩ internet of thing ⑪ SDN

chapter 2

1. wireless → doesn't use wire to transfer data but RF
2. unlicensed: ISM, U-NII licensed: PCS, WLAN (2GHz), UMTS (3GHz)
3. space, atmosphere, media, frequency
4. reflection: size of thing bigger than λ; Diffraction: the route is stopped by sharp obstacle, Scattering: size of thing is considerably small and the number of it is huge. It happens on rough surfaces
5. indoor: send information to each other while outdoor communicate by wave.
6. $\frac{P_r}{P_t} = G_t G_r \frac{h_t^2 h_r^2}{d^4}$
7. freespace modeling: $10\lg P_r = 10\lg P_0 - 20\lg d$
   two-ray modeling: $10\lg P_r = 10\lg P_0 - (40\lg d)$
8. difference in signal power → because location variance caused by obstruction, it varies slowly
9. $L = L_0 + 10\alpha\lg D + X$
10. n: freespace = 2, city 2.6~3.5, city shadow 3~5, buildings: 1.6~1.8, blocked by buildings: 4~6.
11. multipath-scale fading: loss of signals by large objects such as buildings and hills.
    Small-scale fading: constructive interference of paths in route.
    Doppler shift: $v(t) = \frac{vf}{c}\cos\theta(t)$.
12. Rayleigh: $f_{ray}(r) = \frac{r}{\sigma^2}\exp\left(-\frac{r^2}{2\sigma^2}\right)$ $r \geq 0$
    Rice: $f_{rice}(r) = \frac{r}{\sigma^2}\exp\left(\frac{-(r^2+\alpha^2)}{2\sigma^2}\right) I_0\left(\frac{\alpha r}{\sigma^2}\right)$ $r \geq 0$, $\alpha \geq 0$
13. $v(t) = \frac{vf}{c}\cos\theta(t)$.
14. $E(x) = \int_{-\infty}^{+\infty} x f(x)\,dx$
15. I can't solve it.

chapter 3/4

1. acceleration of information transferring (CDMA)
2. C=MJN.
3. $N = i^2 + ij + j^2$
4. Base station: a transceiver connecting a number of other devices
   uplink: transmission path from mobile station to base station
   downlink: transmission path from base station to mobile station
   cells: cellular network that distributed over areas, which served by many transceivers.
   MSC: primary service delivery node for GSM/CDMA.
5. HLR is a central database containing details of subscriber that authorized to use it.
   VLR is the user who have roamed into the jurisdiction of MSC.
6. Hand off management: recognition of new base station, allocate channels.
   Location management: register → pass information to MH
7. ① not crowded ②. large bandwith and good security ③. provide interoperability ④. available of fixed and variable rates ⑤. multi-media.
8. CAC prevents oversubscription of VoIP networks. It is used in the call set-up and applies to real-time media traffic as opposed to data traffic. It ensures there is enough bandwidth for authorized flows.
9. SGSN: deliver data from and to mobile station within geographical service area. Function: packet routing, transfer, mobility management, logical link management, authentication, charging.
   MSC is a primary delivery node for GSM/CDMA. Function: routing voice calls and SMS as well as other services.
10. WCDMA, CDMA2000, TD-SCDMA
11. CDMA
12. fc:1.5Mb/s, Bc:1.25MHz
13. a channel-access scheme is based on a multiplexing method, allowing several data streams or signals to share the same communication channel or physical medium. Like ADSL.

14. 3G cellular networks towards a uniform architecture for all-IP wireless networks. Proposing a flexible hierarchical resource management mechanism for the proposed all-IP architecture which aims at providing connection level quality of service for mobile users.

chapter 5

1. ① mobile computer cloud ② mobile web pages ③. mobile access ④ persuasive computing

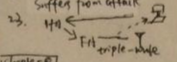
chapter 6

1. when mobile station is moving from one base station to another. MSC needs to allocate the voice and signals to remain. hand off process requires it to identify new station and caculate the signal power.
2. intra-hand off: the quality of channel varies with the movement unit thus to switch chanels.
   intercell hand off: switch occurs between adjacent cell when cross the boarder.
3. MCHO: station monitor the signal power and choose the best one.
   NCHO: network monitor the power and lanch the switch
   MAHO: station monitor the power and network make switch.
4. Advantages: soft: the chances of terminating calls are lower.
   hard: one call for one channel only.
   Disadvantages: soft: more hardware
   hard: Pingpong effects.
5. moniter the change of power (dB) between base unit and mobile unit, once exceed the threshold, execute the switch of handoff.
6. straight-line mode: linear behavior
   Fluid-flow model: macroscopic mobility model, used in determining boundary crossing rate and dwell time within a given radio range in the context of movements of nodes in mobile ad-hoc networks. In cellular network, the FF mobility model is used for intra-cell and inter-cell movements of mobile nodes. It can also be used for the MANET to evaluate the link status and in turn the link provides important information for further analysis of network throughput.
7. not mentioned in books, due to the unknown size and shape
8. intra-switch: use another cell within system.
   inter-switch: transfer the call and use inter handoff
9. not mentioned in books, due to the unknown size and shape
10. Smaller cells lead to high handoff rate.
11. two-tier refers to proposed changes in architecture the would give priority to the traffic of those who have paid for premium service. Inherent in the model is the possibility for discrimination between different types of content and services.
12. location update: when mobile unit closed, the network will report its location in a certain interval.
    Service delivery: use available access interface for called used and send feedbacks to end this service delivery.
13. advantages: time saving, flexible, easy for location.
    disadvantages: not clear for location, don't know where to start and end, without time label.
14. state-based dynamic location management scheme: the user is partitioned into different mobility state set and its location area size is changed dynamically corresponding to the state set that it belongs to. It can be used in current 2G, 3G with slightly modifying of the equipment software.

chapter 7

1. once changing location, we need a new address (IP) when data is transfering though TCP, the information will lose for the sake of interrupt.
2. MH: the location varies frequently
   HA: a route used for mobile-nodes in home agent
   FA: a route used for mobile-nodes in foreign agent.
   COA: when mobile node switches to other places. It is the IP that relevant to it
   CN: a thing to communicate with mobile-nodes.
3. MH → FA —(tunnel packet / encapsulation)→ HA → receiver
14. Mobile node → Foreign agent ⇄ Home agent
15. mobile node send a registration request to foreign agent → foreign agent process it and pass it to home agent → home agent replies to foreign one → foreign agent passes the reply back to mobile node
16. convenient for creating and modifying the bind for mobile node
17. to judge whether you are home or foreign. It is broadcasted frequently but home and foreign agents to declare its existance.
18. the only change is addition T bit. if it is set, the mobile note ask home agent to accept a reverse tunnel from the care-of address.

19. when it doesn't support reverse tunnel to receive the request, it fails
20. IP In IP: the whole data is encapsulated to become new IP set. (RFC2003)
minimize capsulation: new IP head is inserted into original one, reduce the data in tunnels (RFC 2004). (I prefer this one)
general rove encapsulation: to capsulate any protocol in different network layers.
21. ① capture the data from communicating nodes by home agents
② capsulate it and pass it to mobile node through tunnels
③ at the end of the tunnel, the data is opened and moves on.
④ use standard IP route.
22. it is safe and efficient. otherwise will cause the loss of data and suffer from attack
23.



26. a sensor can cross multiple layers, and users can take
27. a is followed with b. Adapting OFDM while b adapts DSSS
28. WLANs are at least as secure as limited local area networks
29. make the attack of local area difficult
30. It is up to the specific modification
31. WEP – 40 bit key → 24-bit initialization vector. Mac filtering
is effective in wired network (capture portal) basically used in
32. wireless open networks
33. active scanning: the client radio transmits a probe request and listens for a probe response from AP.
passive scanning: 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 ad for uncompressed video
35. It is up to different combination

Chapter 8

1. DCF: fundamental MAC technique of IEEE 802.11 based WLAN stand. It employs a CSMA/CA with binary exponential backoff algorithm.
PCF: a MAC technique used in IEEE 802.11 based WLAN. It resides in a point coordinator also known as AP, to coordinate the communication within network.
DIFS: is acronym for DCF Interframe spacing. It is the time delay for which sender wait under completing its back off.
SIFS: the time for which receiver wait before sending to CTS to sender and sender waits after receiving CTS, thus can avoid collision.
PIFS = SIFS + Slot time.
2. It is mainly used to minimize the amount of time spent when a collision occurs.
3. IEEE 802.11e: an approved amendment to IEEE 802.11 and defines a set of quality of service enhancements for wireless LAN applications through modifications to MAC layer.
EDCA: high-priority traffic with a higher chance of being sent.
HCF: a new coordination function to enhance DCF & PCF
4. Ad-hoc mode: allows each device to communicate directly. no central AP.
Infrastructure mode: require use of Access point.
5. ① no base station ② nodes can only transmit to other nodes within link coverage.
③ nodes organize themselves into a network to route themselves.
6. in Data link layer (MAC) and Physical layer (PHY)
7. LLC: Data link layer
MAC: divide into MAC / management to access mechanism fragmentation and encryption / roam in ESS, power management.
PLCP: carrier sensing assessment, forming packets for PHYs.
PMD: modulation and code.
8. radio wireless networks have a longer bandwidth.
9. PLCP, PMD
10. use single character and modulation ways for priorities
11. time-division, code-division, frequency-division
12. I can't solve it
13. unicast has higher rates than multicast.
14. Because NAV is to limit the need for physical sensing and can save a lot of power.
15. QoS is supported in 802.11 in both modes. Because it measure the quality of service like bit rates.
16. It is needed to fullfill time-synchronization among users.
17. ad-hoc mode
18. frames are transmitted periodically to announce the presence of a wireless LAN but not PLCP
19. it is essential for multi-hop environment.
20. it can be efficient to mobile devices using power management.
21. TX and RX will be awake and sleep switch in small time period. In ad-hoc mode the frequency will be higher.
22. ATIM: a management frame with no frame body. When STA receive ATIM, the formally dozing station must begin the process of retrieving buffered frame from stations.
DTIM: is identical to ordinary beacon.
23. It is driven by STA
24. When the length is not suitable for packet, it need to segment.
25. The MAC head contains messages' destination and source.

Chapter 9

1. QoS guarantee, high transmission speed, variety of business. OFDM/OFDMA/AS/MIMO
2. It is responsible for transmitting the convergence sublayer data unit to receive MAC layer data.
3. It 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. infrastructure Network is tradition AP mode and ad-hoc network is ad-hoc mode.
2. node i, j can be transferred successfully: $\begin{cases} d(i,j) \le R_i \cdot I_i \\ d_{ij} \le R_i \end{cases}$
3. neighboring deterioration
4. the transmission rate of each node must be strictly controlled and carefully scheduled.
5. They will cause the waste of network timeslot resources, increase the probability of data collision and seriously affect the throughput, capacity and transmission relay.

Chapter 11

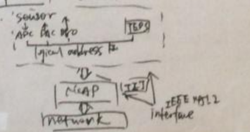
1. ① request the workstation → sending authentication frame
② return frames that are validated
③ get and encrypt the question text, send management frame
④ share key to decrypt text
2. ① applicant sends EAPOL start frame to authenticators.
② certifier requests to provide identity information.
③ the applicant will be sent to certifier
④ identity information will be sent to AS
⑤ RADIUS server informs the result
⑥ The certifier sends the certification result to applicant.
3. ① WEP: AS is undirectional → lead to impoverished AP
② WAPI: add a certification WAI
③ IEEE 802.11i: enhance the WLAN identity authentication.

Chapter 12

1. ① low power consumption ② low cost ③ Enhance compatibility ④ reduce relay ⑤ effective coverage to expand.
2. Standy a connection
3. RFID Tag / Tag readers, application software system.
4. ① energy supply (label) ② data transmission in tags ③ security in transmission ④ multi-target recognition technology
5. ①. Toll ②. RFID only electronic liscence plate ③. campus card

Chapter 13 STIM

1.



Chapter 13

2. power module: offer power
sensor: kind of WSN node which can obtain environmental and equipment status.
Microcontroller: receive data from sensor and process it.

3. ① In smart homes –
② improve energy-efficient performances

4. ①. broadcast the status to surrounding and receive status from other nodes. ②. organized into a connected network ③ Suitable pathed are computed on the sensing data

5. range is short. Node can communicate with it neighbours.

6 transmission rate, delivery probability and network lifetime.
rate decreases, trade off, other increases.

7. Ambient energy harvesting.

Chapter 14

1. ①Software defined Radio (SDR)
② Bluetooth Low Energy (BLE)
③ Body Area network (BAN)
④. RFID
⑤. cognitive radio

2. ① good security ② good resolution of multi-roof ③. high transmission speed ④. big capacity ⑤. low interference ⑥. low consumption
⑦ precise location ⑧. low expense

3. ① It is based on traditional blue tooth, and simplifies to stack of protocol, defines the speed of data transferring and power dissipation
②. Chip-design like both single and dual-mode.

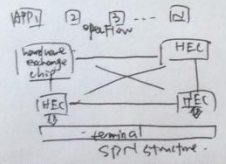
4. use radio to capture, sense infomation from environment, thus it can label the hole of the spectrum and choose the most suitable band and parameter (sensor, analysis. judgement).

5. Feature. use RFID and transform it to fast transferring data technology
Application: medical care. navigation. personal entertainment. company

Chapter 15

1. a programmable network with core of centralized management through normalization. The structure is decomposed into application layer. control layer and hardware exchange layer.

2.



SDN structure.

3. ①. openFlow light 2. POF 3. OCF

4. highly-responsive and huge amount of data transferring service.
③. high-security.

Chapter 16.17 and 18

1. ①Sensor ②. Electrical machinery ③ video camera 4. GPS navigator ⑤. microphone ⑥ sonar ⑦. infrared receiver ⑧ wifi

2. ①. self-driving ② environmental detection ③
④. arm × field ⑤ housing
For self-driving cars. it uses auto-control. ① CV knowledge to tell cars where to stop and how to solve to overspeed problem as well as how to avoid obstacles.

Chapter 19

1. MIMI → multi input/output
SISO → single input/output

2. input → interleave → modulate → code → upsample → ↑
output ← de-mapper ← demodule ← decode ← downsample ← ↓

3. ①. space diversity is to transfer the same information on parallel mutes. The receiver is used to eliminate the influence caused by channel to increase credibility.
②. space multiplexing is to transfer different information. The receiver is to recover the signal.

4. ① WIFI ②. DAS ③. multi-user MIMO.
For DAS has the advantage of image rejection and obtaining huge-loss of diversity.

Chapter 21-22

1. ①security of value
②. security of account
③. security of transaction
④. security of privacy

2. ①. information of version
② format
③ judgement bit
④ signal symbol } location vertice. timing

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