Midterm Exam

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CHAPTER:1 1. Faraday electromagnetic induction -1831 ⇒ Morse telegraphe 1837 ⇒ Maxwell telegraph 1873 ⇒ Bell phone -1876 ⇒ 1894 Tesla short wireless communication expr ⇒ 1895 Marconi Radio ⇒ 1927 Television ⇒ 1946 Mobile phone ⇒ 1958: communication satellite (SCORE) ⇒ 1981: NMT ⇒ 1988: GSM ⇒ 1991: first version of wireless network

2. Cellular System, mobile management, mobile IP. WiFi. WiMAX self-contain network. Sensor network. Internet of things Software-defined Networking(SDN)

CHAPTER:2 1. Propagation media: cable vs air, stability, bandwidth. broadcast feature.

2. Authorityed: 1GHz- Cellur Network, 2GHz- PCS/WLAN. IR.. unauthorized: U-NII. PCS ...

3. distance, media. frequence

4. Reflection: reflection occurs when the size of the obstacle is greater than the wavelength of the electromagnetic wave.

5. Diffraction: edge diffraction // Scattering: rough surface.

5. Indoor: 1. reflection 2. diffraction 3. scattering
Outdoor: 1. reflection (ground) 2. reflection (architecture) 3. Roof diffraction

6. Distance is high when the loss is Large // the gain of antenna is small // the height of base station is low.

⇒ when emitting energy is a constant. the energy received is a small amount.

7. Formula: $\frac{P_r}{P_t} = G_t G_r (\lambda/4\pi d)^2$

8. Slow fading (shadow fading LP) [changes of signal strength is caused by location in middle level]

9. $L_P = L_0 + 10\alpha \lg D + X$

10.

11. Multipath fading: the superposition of signals with different paths. //
Doppler: Frequency caused by the motion //

12. Rayleigh distribution is used to describe multipath phenomenon

13. Doppler shift: $v(t) = \frac{vf}{c}\cos\theta(t)$

14. $f_{rayc}(r) = r/\delta^2 \cdot \exp(-r^2/2\delta^2)$ $(r \geq 0)$
$f_{ric}(r) = r/\delta^2 \cdot \exp(\frac{-(r^2+a^2)}{2\delta^2}) \cdot I_0(\frac{ar}{\delta^2}), (r \geq 0, a > 0)$

15. $P_Z(z) = \frac{2m^{mz^{2m-1}}}{\Gamma(m)\cdot P_r^m} \exp\left[-\frac{2\delta^2}{mz^2}\right]$.

CHAPTER 3 4: 1. 05/2008 3G / TD-SCDMA / WCDMA / CDMA2000

2. When the transmitting power increase. cell radius decrease and the system capacity increase.

3. $q = \frac{D}{R}$, $q = \sqrt{3N}$, $N = \frac{q^2}{3}$

4. BS: Sharing mobile communication station:
UpLink: link connecting satellite to ground station
DownLink: From satellite to one or more ground station
Cellular Network: multiple low power radio block covering the entire service area.
Service Area: working area covered by radio
MSC: mobile switching center

5. HLR is responsible for the management of mobile users
VLR is a database of all the users' calling info.
VLR also provides some service for users.

6 handoff management: recognize new base station. channel allocation.
Location management: home agent. outside agent

7. The main difference is in the transmission of sound and data to enhance speed and also process images, music, video.

8. TDMA

9. GPRS core network provides mobile management. session -management / transmission of GSM & WCDMA
GPRS pipeline protocol defines IP. primarily for GSM and WCDMA. User can connect to the Internet while moving from one place to another.

10. WCDMA. / CDMA2000 / TD-SCDMA

11. ① Global roaming ② high-speed data transmission ③ multimedia service

12. GPRS 2.5G Technology EDGE → EGPRS
200k bits/s — transmission rate / 400k bit/s - bandwidth

13. mobile business / video calling / wireless searching / mobile television

14.

CHAPTER5

1. mobile - cloud- computing / mobile- web / mobile- access plan

CHAPTER 6

1. It can monitor the changes of signal intensity and launch the transformation process // Also, it can recognize new base station. build new connections between base station and mobile station.

2. Inter handoff: A mobile device can avoid interrupti if it moves from one cellular system to another cellular system.

Intra handoff: the switching method within the same MTSO

3. MCHO: monitoring the signal strength from mobile BS and it select the best way // also turn on the switch.
MAHO: the mobile station control network switching when monitoring the signal strength.

4. Hard handoff: ① user can only use one channel
② Ping-Ponging effect cannot be avoided.

Soft handoff: ① reduce the signal connection probability to the target cells.
② Require complex hardware equipme

5. When we monitor the signal intensity and if its variance beyond the threshold. the mobile station will launch the transform program.

6. Straight-line model: user behavior is defined as linear behaviour. //

Fluid-flow model: regard the user as reservoir and connection as pipe and model the reaction in system in this way.

7. $f(t) = \beta^\gamma \cdot t^{\gamma-1} / \Gamma(\gamma) \cdot e^{-\beta t}$
$f^*(s) = (\frac{\beta}{s+\beta})^\gamma$ $(\beta = \gamma\mu)$

8. intra-switch: when the given mobile signals in giv cells becomes very weak. the MTSO discovers that other cells in the system can transmit the signal. MTSO will use intra-switch// Inter-switch: MTSO can not find other replacable cells in the system. it will use inter-switch.

9. $f(cdo, dav) = a(cdo)[dav]^{d(cdo)}$
$g(cdo, dav) = b(cdo)[dav]^{c(cdo)}$

10. The smaller the cell area, the highest the switching frequency.

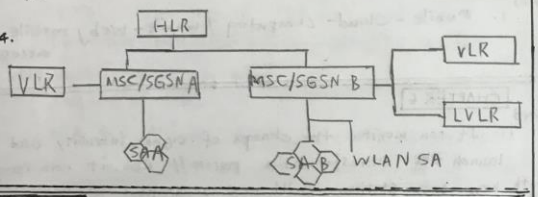
11. The two-tier structure is a client that runs on the presentation layer. it is also an interface. It function is storing data layer and data structure on server.

12 Location Update: the mobile network asks for reporting location and send location time when the mobile device is restarted.

Service Delivery: The caller will send a feedback to terminate the delivery if a person has already found a viable channel.

13. time-based: more reliable but will miss some UE.
movement-based: less pressure / miss UE moves slowly.
Distance-based: most reliable but two pressure on BS.

14.



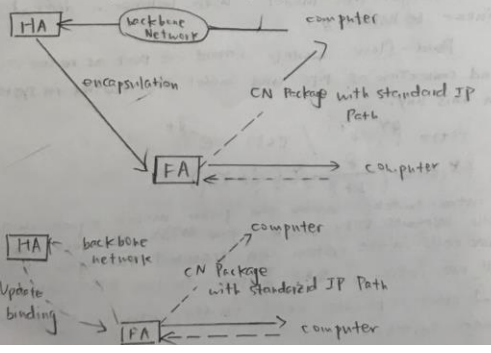
Chapter 7

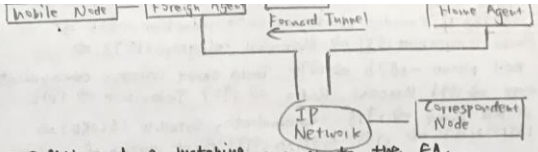
1. A permanent IP address that can help people ensure they can connect to the correct steadily.

2. (MN): a host that change its location frequently. from one link to another link.
(FA): ~~an~~ a router of outside link where MN locates The CoA is given by FA.
(HA): a router on link, used to keep the location information of mobile nodes.
(CoA): when the mobile node switches to the field link. one IP address associated with that node.
(CN): A communication object for a mobile node.

3. According to the established paths. Mobile IP helps to send IP datagrams. The identity of the MN is decided by host address, regardless of current/connected network. Mobile IP matches the node address generated by the host address through the mapping of the address through the matching algorithm.

4.

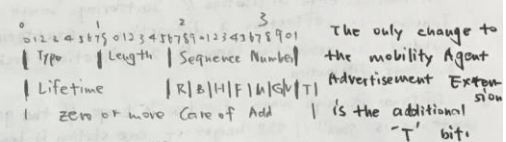




5. ① MN send a matching request to the FA.
② FA send the matching request to the HA
③ HA response and decide whether this request should be postponed
④ FA process the registration reply and then relay it to the mobile node to inform it of the disposition of its request.

6. A limited lifetime allows a mobile node registers with its home agent using a registration request message so that its home agent can create or modify a mobility binding for the MN.

7.

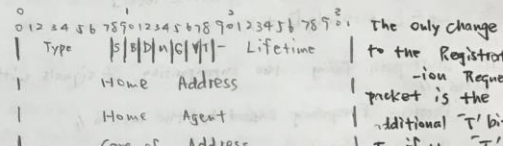


The only change to the mobility Agent Advertisement Extension is the additional 'T' bit.

T Agent offers reverse tunneling service

A foreign agent that sets the 'T' bit MUST support the two delivery. styles currently supported: Direct and Encapsulating Delivery Style.

8.



The only change to the Registration Request packet is the additional 'T' bit. if the 'T' bit is set. the mobile node asks its home agent to accept a reverse tunnel from the care-of address. Mobile nodes using a foreign agent care-of address ask the foreign agent to reverse-tunnel its packets.

9. If a foreign or home agent that does not support reverse tunnels receives a request with the 'T' bit set the Registration Request fails.

10. IP-in-IP encapsulation: defined by RFC 2003. the entire IP packet is encapsulated directly and becomes the net load of the new IP packet. // minimal encapsulation: defined by RFC 2004. In the smallest encapsulation technology, the new IP header is inserted between the original IP header and the original IP Payload, and the smallest package remo the redundant portion of the IP header and the outer IP header in the IP encapsulation of the IP envelope. Reduce the number of additional bytes required to implement the tunnel. // Generic Routing encapsulation: defined by RFC 1701, defines a protocol that encapsulates any other network layer protocol on any other network layer. and data packets running one protocol are encapsulated in the payload of the data grouping of another protocol.

when original datagram is splited. we can only choose IP in IP.

reverse tunnel is also called reverse connection, is often used as the restriction of firewall of open hosts.

RAT equipped with reverse connection will send ~~FF~~ SYN packets to ~~se~~ client IP. to ensure the client allow the outer links.

2. ~~cause~~ some agent only can accept reverse tunneling due to firewall.

3. Mobile phones and laptops are IPs with firewalls. Some Servers are not equipped with firewalls.

CHAPTER 8

1. DFC: a mac technology of IEEE 802.11 based on WLAN Standard.
   PCF: a mac tech to coordinate.
   DIFS: acronym for DCF interframe spacing.
   SIFS: time before sending.
   PIFS: the sum of SIFS and slot time.

2. If some collision occurs, RTS/CTS access mechanism is mainingly used to minimize the amount of time.

3. IEEE 802. defines a set of quality of service. it can be view as the strengthening of WLAN and steaming multimedia.

4. Ad-hoc allow each device to communicate with each other
   Infrasture mode use AP (access point) to control the communication.

5. Ad-hoc mode are composed of nodes only. route among themselves, and, infrastructure has nodes and base stations.

6. ① Data Link Layer
   ② Physical Layer
   > IEEE 802.11

7. LLC (logical link control): control the logic link
   MAC: access, fragmentation, encryption
   PLCP: carrier sensing assessments
   PMD: modulation and coding

8. IR is electromagnetic radiation with a wavelength longer than that of visible light.
   [In short range communication] (300GHz-400GHz)
   Radio is used in Large-range communication with higher bandwidth.

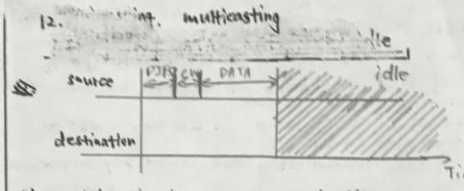
9. 802.11 ⇒ 1 MAC 和 3 PHY
   802.11 a ⇒ 5GHz band at 54 Mbps.
   802.11 b ⇒ 2.4GHz and 5GHz
   802.11 g ⇒ 2.4GHz and 54 Mbps

10. After one node has finished sending, many other nodes can compete for the right to send. The first objective of prioritization phase is to make sure that no nodes with a lower priority gains access to the medium while packets with higher priority are waiting at other nodes. The mechanism always grants nodes with higher priority access to the medium (no matter how high the load on lower priority

11. Distributed Coordination Function (DCF)
    Point coordination Function (PCF)
    Hybrid Coordination Function (HCF)

① DCF listen to the channel status for a DIFS interval.
② PCF enables access point waiting
③ HCF control HCCA and worked like a PCF

12. ...ing. multicasting



13. multicasting is group communication where information is addressed to a group of destination.
    unicasting is the sending of messages to a single network destination identified by a unique address.

14. network allocation vector (NAV) is a virtual carrier-sensing mechanism used with IEEE 802.11 which limits the need of physical carrier-sensing at the air interface in order to save power.

15. Point Coordination Function (PCF) takes role of Qos Management. PCF is also only avaible in infrastructure mode. Not supported in ad-hoc mode.

16. In 802.11, modes need to communicate with each other by broadcasting, where collisions are not allowed. So, it needs all the modes to synchronize.

17. All stations have their own local TSF timer. TSF keeps the time for synchronization.

18. Beacon can let time to be divided into serval slots. if the time of beacon is not equal to STA. move clock forward.

19. multi-hop network environment to synchronize the multi-hop MANET. letting faster nodes send out early and correct the time.

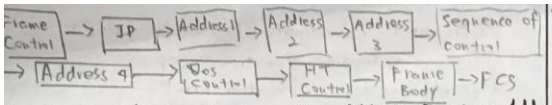
20. some equippments can only be supported by battery. So, it is very important thing to consider battery consumption.

21. power management in Ad-hoc mode use CSMA to access the channel and use RTS.CTS.ACK. to overcome hidden terminal.
    // The same thing in Ad-hoc network.

22. Ad hoc TIM (ATIM): transmitted in ATIM-Window by stations who want to send buffered packets structured as the same as TIM.

23. In 802.11 networks, a handover means re-association with the new AP. if moving out of cells, the cell will perform a handover operation to deliver the user to the adjacent cell.

24. Packets may be formed that can pass through link a link with a smaller MTU. than the original datagram size. The fragments are reassembled by the receiving host



6. 4 address is needed: Transmitter Address. Receiver Address. Source Addre, Dest Addr.

an 802.11 device is transmitting to a receiving device, either one or both) of these devices may not be the actual source or destination of L2 traffic.

7. IEEE 802.11a-1999 or 802.11a was an amendation to the IEEE 802.11 wireless local network specifications.

8. WEP is a security protocol for WiFi networks. The goal of WEP is to make wire networks as secure as wired network.

9. Standard 64-bit WEP uses a 40 bit key (WEP-40) concatenated with 24-bit IV.

10. Open System authentication and Shared key authentication

12. Active scan occurs when client change to IEEE 802.11 radio to the channel scanned. Passive scan is performed by simple changing clients IEEE 802.11 radio

13. highest priority. / lowest priority - waiting time

14. More links increase throughput / along with the transmitting nodes.

CHAPTER 9

1. High-speed transmission. / Qos (certain) service / Adopting OFDM/OFDMA. AAS to realize the mobility
2. TCL Take control of control logic // PMD deals with channel.
3. OFDM will divide channel into orthogonal sub channels / low speed data to transmit each sub channel

CHAPTER 10

1. traditional AP mode, only one ~~center~~ core. // ad hoc mode a peer network, no core
2. N_i - node i / D_{ij} - Node i ⇔ Node j / R_t 可正常距離 / R_L 干扰距離 / $R_L > R_t$, $R_L = 2R_t$.
   Cond: ① $D_{ij} \le R_t$ ② $D_{kj} \le R_L$. K node has no transmission.
3. All the users share one channel in IEEE 802.11 MAC
4. Upper bound:
$$TH = \frac{E[P]}{\min(4H_{ab}) \times T}$$
Lower bound:
$$TH = \frac{E[P]}{\min(H_a, b) \times T + \max(H_{ab}, 0) \times T}$$
5. The probability of collision will increase. influence network throughput, capacity. delay.

CHAPTER 11

1. C8 Q29 the same answer
2. use physical layer to authenticate the LAN equipment
3. Q32 - C8 the same

CHAPTER 12

1. low consumption / low delay / range from 10m to 60m
2. Page / Page Scan / Inquiry / Inquiry Scan
3. RFID Tag / RFID Reader / Application System
4. Power supply in Tag // Data Transmission from Tag to Reader
5. Student ID Card // Electronic Car License Card

1. The nodes organized in different topo The sensor get the data from detection area. Management nodes are used for management
2. power module / sensor / micro controller / wireless transceiver
3. smart electricity consumption services online monitoring system.
4. ① sensor broadcast status ② seuson network organize as ③ suitable path is computed.
5. communication distance nodes is short.
6. reliability, data rate and life time
7. nuclear factory is suitable for MSN

CHAPTER 14

1. SDR / RFID / cognitive radio
2. Anti-jamming performance / low cost / High transfer rate
3. Bluetooth low energy is simplification of bluetooth
4. A CR monitor its own performance and determine RF environment and adjust radio settings
5. Short distance / high speed / Time change / Personali

CHAPTER 15

1. SDN is a new architecture, seeking to be suitable for high-bandwidth. dynamic nature
2. Data transmitting based on flow. Routing based on central controller, coding facing to APP
3. Video and corellation application, combined storage
4. SDN lets us manage network easier, make it programmable.

CHAPTER 16, 17, 18

1. Camera, microphone, GPS. Wi-Fi, velocity sensor. barometer
2. Real time indoor-mapping. Fully Distributed Scalable-Smoothing and Mapping
   Auto parking can compute the best way when parking according environmental parameters.

CHAPTER 19

1. MIMO require the system have more than 1 antenna. so it can have multiple paths
   SISO has only one path.
2. $X = [X_1, X_2, \cdots X_{N_T}]^T$; $Y = [Y_1, Y_2, \cdots Y_{N_R}]^T$
   CHANNEL Matrix: $H = \begin{bmatrix} h_{11} & \cdots \\ h_{21} & \cdots \end{bmatrix}$
3. Space-diversity use multiple path to transmit the data to have Qos Quality.
4. Distribute MIMO. Networking MIMO.

CHAPTER 20 21 22

1. We cannot measure the value bitcoin in a stable state. while bitcoin cannot be stolen. (hard).
2. QR codes is composed of squres. Its coding area includes graphs, characters and it also has high capacity.
   Besides, it can be printed easily.