Chapter 1: (1) In 1831, Faraday demonstrated electromagnetic induction. In 1867, Maxwell predicts existence of electromagnetic (EM) waves. Building on Maxwell's work, Hertz in 1887 invented the oscillator and created radio waves. Then Marconi in 1895 sent a radio telegraph transmission across the English Channel, and in 1901 a transmission across the Atlantic. There have been so many great contributions since then, from Edwin Armstrong (who created FM radio), to Lee De Forest (who invented the electron tube), and Andrew Viterbi (who came up with digital decoding and CDMA) - and so many more that we can't list them all here./(2)Cellular systems; mobility management; mobile IP; Wi-Fi; WiMAX; Self-Organizing Map; Wireless Network Security; Wireless Personal-Area Network; sensor network; Internet of Things; Software Defined Network.

Chapter 2: (1) The wireless media includes the microwave, satellite, laser, infrared ray, etc. The wired media contains the twisted-pair, coaxial-line, optical cable, etc. The wireless media doesn't need the cable or the optical fiber because it's transmitted in the air. However, the wired media means the according wire (or conductor) to the signal is indispensable./(2)Licensed band include 1GHz, 2 GHz, 5GHz and 28-60GHz and IR, and unlicensed band include ISM, U-NII./(3)Terrain (indoor and outdoor); operating frequency (low or high); the velocity of the mobile terminals; interference source. /(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) $P_r = \frac{G_t G_r P_t}{L}$; $G = \frac{4\pi A_e}{\lambda^2}$; $\frac{P_r}{P_t} = G_t G_r \frac{h_b^2 h_m^2}{d^4}$ /(7)In free space modeling, $10\lg P_r = 10\lg P_0 - 20\lg d$; $L_p[dB] = 32.45 + 20\lg f_c[MHz] + 20\lg d[km]$. In two-ray modeling, $10\lg P_r = 10\lg P_0 - 10\alpha\lg d$; $L_p = L_0 + 10\alpha\lg D + X$ ./(8)In the wireless communication system, slow fading can be caused by events such as shadowing, where a large obstruction obscures the main signal path between the transmitter and the receiver, and the received power decreases. Since the power decreases slowly with the change of distance, so it's called slow fading.   Effect: Near-far problem; Doppler Effect; shadow effect./(9)Fade margin: $L_p = L_0 + 10\alpha\lg D + X$

/(10)   In Macro-cell Model   In Micro-cell Model

/(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 describes multipath phenomenon./(13)Doppler shift: $v(t) = \frac{Vf}{c}\cos\theta(t)$ /(14)Rayleigh: $f(x) = \frac{r}{\sigma^2}\exp(-\frac{r^2}{2\sigma^2})$, Ricean: $f(x) = \frac{r}{\sigma^2}\exp(-\frac{r^2+a^2}{2\sigma^2})I(\frac{\alpha r}{\sigma^2})$.

/(15)Average fade duration not found.

Chapter 3&4: (1)1996-1997, the GSM and CDMA appeared and people can receive email and make

calls. In 2008, IEEE published the ruler of 3G, TD-SCDMA, WCDMA and CDMA2000 are the main techs in 3G./(2)$C = MJN$ (where C is capacity)

/(3)$\dfrac{S}{I} = \dfrac{R^{-k}}{2(D-R)^{-k}+2D^{-k}+2(D+R）^{-k}}$ /(4)Base station is the station to handle the requirements of mobile devices. Uplink means mobile phones send messages, and downlink means base stations send messages to mobile devices. A base station can cover an area, which is called the locating area. Mobile switch center connects different base stations./(5)Current wireless network architecture contains: HIR; BSS; UTRAN; VLR and others. VLR saves the information of a user tour to the area, and HIR contains the detailed information of users who are 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)ISB 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) Cloud computing; Web APP; Ubiquitous computing.

Chapter 6: (1) Mobile initial->raise call->paging request->receive call->continue paging->cross-area switch/(2)Intra hand-off means the users don't change the base stations, otherwise inter hand-off. /(3)MCHO: network makes decision, used in CT-2 and AMPS; NCHO: mobile decides for itself; MAHO: the mobile provides the data for the network to make decisions./(4)The hard hand-off's one call uses only one channel. The soft hand-off's connection to the source cell is broken only 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 means the base station directly connects to the mobile phones; fluid flow means the center send messages to wait for the flow to the device./(7)We can find it on journals of IEEE./(8)Initial procedure->find new links->data vote control./(9)Not found./(10)If the cell is splitting, there will be a kind of interfere, so the rate will be down./(11)Two-tier network contains control tier and micro area./(12)A device will detect whether it comes to a new wave area, it will send a notice and the control part will provide the service again./(13)Time-based detect change at every single time and it may suit for the small movements; movement –based suit for the unmoved device for energy efficiency; distance –based depends on the distance./(14)We can find the diagram on Professor Wang's book (1st edition)—page69.figure 6-7.

Chapter 7: (1) Every time an IP address changes, it takes lots of steps which are not suitable for mobile devices./(2)MN: frequently moving node; HA: a router on the link route containing the location message; FA: a router transferring the new location to HA when the device moves; COA: an IP address related to the node when it transfers to outer links; CN: communicating-opponent node./(3)When getting a data bag, it will be dense to a tunnel bag with the information of router to transfer it to the destination. /(4)Hometown Node->HA->Internet->FA->MN. /(5)The MN initiates the register for the change of link. It will broadcast to the outer Host and Hometown Host. /(6)If in a life-time the node doesn't receive the same host message, we can think 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 register to the right HA, which means failure./(10)IP in IP, minimal encapsulation and general router encapsulation./(11)Reverse tunneling appears in the IPv6s Home Agent, it transport the bag to the end directly.

/(12)A bag came and the data from mobile node will be delivered by a kind of special route.

/(13)It may send to the outer agent first, then to the Internet, then HA, and finally the Home Node. Chapter 8:(1) DCF: Distributed Coordination Function; PCF: Point Coordination Function; DIFS: Distributed Inter-frame Spacing; SIFS: shortest inter-frame spacing; PIFS: = SIFS+ slot time. /(2)DCF cannot solve the hidden or exposed terminal problem completely without RTS/CTS. /(3)EDCA: Enhanced Distributed Channel Access; HCF: Hybrid Coordination Function./(4)In the infrastructure networks, the AP is like a net bridge; but Ad-hoc suits for temporary ones./(5)As mentioned below /(6)IEEE 802.11(1999 version) defines the physical layer, media and MAC, including TCP/IP. /(7)LLC and MAC are data link sublayers; PLCP and PMD are physical sublayer. /(8)Radio wireless networks have wider bandwidth, powerful data transfer function. /(9)Physical layers are PLCP, PMD. /(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.
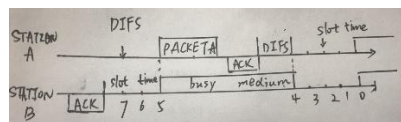

/(12)

/(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 SEA 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 IEEE820.11 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)The different data headers are provided by different protocols./(27)802.11b uses DSSS to modulate the message, but 802.11a use OFDM./(28)WEP's goal is to secure the wireless network./(29)The WEP provide a tunnel that is encoded in SSH and it can provide safe links.
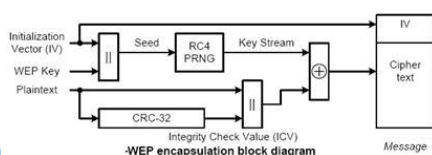
/(30)
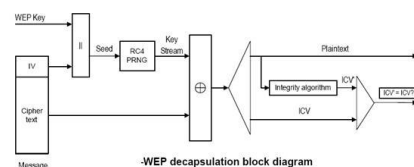
/(31)Open System& Shared Key./(32)The WEP cannot provide enough security, so we change it to IEEE820.11 and China uses WAPI./(33)The active scanning will discover the devices in the area, but the passive scanning will response only when the device send message to the AP./(34)It's designed

to be a special layer of 802.11./(35)Valid station, semi-mobile station and mobile station combine into a Basic Service Set.

Chapter 9: (1) WiMAX has high speed, max overlaps, and provide good support to mobility./(2)It uses WMAN-SC; WMAN-SCa; WMAN-OFDM; WMAN-OFDMA./(3)OFDM divides the channels to many quadrature subsets and give different users different subset to accomplish the multi-address.

Chapter 10: (1) Infrastructure network need to prepare the base facilities to a certain area, while ad-hoc network can provide mobile and self-organized system./(2)It uses DSR to achieve route discovery, rout reply, route maintenance and route caching./(3)One device may receive data and succeed while others fail in the area./(4)RTP/RCTP can provide the condition./(5)Exposed terminal is covered by sending spots, and hidden terminal is hidden since the distance of mobile communication and obstacles.

Chapter 11: (1) IV + Secret Key->WEP Seed->PRNG->Key Stream->Plaintext->Ciphertext. (2)We can find the diagram on Professor Wang's book (1st edition)—page156.figure 11-5./(3)WEP is replaced by IEEE 802.11i which defined Temporal Key Integrity and CBC-MAC protocol. WAPI is produced by China and it uses ASU to secure message.

Chapter 12: (1)4.0 has really low energy need./(2)Connect State and middle state./(3)Reader provides energy to activate the label and transfer data. Electric label stores information./(4)The key techs of RFID are chip tech, antenna design tech, packaging tech, label application techs, standard research and anti-collapse tech./(5)Transportation, retail and manufacture region.

Chapter 13: (1) The sensor networks provide data to base station and monitoring station, then stations process data and send results to other devices. /(2)In the node each element provide different functions./(3)Smart Dust; military application; medical application; long-distance supervision./(4)We can put the wireless sensor into our fracture then detect the data./(5)The data rate is the amount of data that is sent to the station every second./(6)The trade-off of WSNs we focus is the electric power limit and the power's self-organization./(7)The WSN will use wireless power to work continuously.

Chapter 14: (1) Super wide band wireless tech; radio frequency identification; Bluetooth 4.0./(2)Ultra-Wideband can be used in ad-hoc wireless network and home entertainment center./(3)The low energy Bluetooth's features are ultra-low energy, high speed and high security./(4)The cognitive radio can change its parameters of transmitter automatically and study to suit./(5)Body Area Network can access the data from clothes and body and used into health application.

Chapter 15: (1) SDN is a structure that can be programmed and it apply the OpenFlow tech to detect the 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 in many devices./(4)The SDN can reduce the energy need for information transferring with good efficiency.

Chapter 16, 17&18: (1) Motor, camera, different types of sensors, micro-computer, antenna and so on./(2)Wireless robots; safeguard robots; detect robots.

Chapter 19: (1) MIMO have many routes and SISO only have one route./(2)MIMO channel have multi0path property and can be represented to $y = \bar{H}\bar{x} + \bar{k}$ ./(3)The space-multiplexing uses different reflections in space layers./(4)MIMO is used in multi-antenna and switcher.

Chapter 21&22: (1) Bitcoin can generate a wallet.dat and if someone get this wallet, and the coin will cost./(2)Version information; format information; check bit; identifier.