

Overview of wireless Networks (Chapter 1)

- 1831 electromagnetic induction, 1876 Bell, Marconi
- 1896 wireless, 1906 AM, 1927 broadcast, 1941 NMT
- 1948 GSM

Cellular system, mobile management, mobile IP, Wi-Fi, WiMax, self-organizing network, wireless network security, wireless personal area network, sensor network, Internet of Things, software defined network

Radio Propagation (Chapter 2)

- wired: visible and wireless: invisible.
- licensed: 3 GHz WLAN, 30 to 6 GHz LMD, unlicensed: ISM, U-NII.
- signal source: frequency, distance
- reflection and transmission: λ is small
- scattering: signal has wave boundary
- indoor: mainly affected by reflection and diffraction in transmission range, and scattering appears out of range
- outdoor: affected by reflection from buildings and ground, by diffraction from roof, and by LOS path
- the relationships can be explain by:

Two-ray modeling:
 Loss: $\propto \frac{1}{d^2}$, receiving power: $P_{rx} \propto \frac{1}{d^4}$
 free space modeling:
 Loss: $32.45 + 20 \log d [MHz] + 20 \log [km]$
 receiving power: $P_{rx} \propto \frac{1}{d^2}$, transmission delay: $\propto d$

shadowing fading: slow fading, change relatively slow, caused by shadow, distant signal will be weak.

- macro-cell systems:
 $PL[dB] = (14.9 - 6.55 \log f) + 40.5 + 26.16 \log d$
 $\log f = -13.2 \log (f/30) + 0.7$
- micro-cell systems:
 $PL[dB] = -59.4 + 38 \log d + (14.5 + 1.1 \log f) \log f$

Multipath fading: different path, distance and phase
 small-scale fading: consists of multipath fading and Doppler shift
 Doppler shift: because of relative motion, wavelength changes
 spectrum: a band of colors, produced by different light

Rayleigh distributions, amplitude and phase are statistical independence
 Ricean distributions: amplitude subjects to Gaussian distribution, describe multipath propagation
 Doppler shift: relative motion and wavelength changes. $v(f) = \frac{df}{dt}$ or $\frac{df}{dt}$

level of crossing rate: $\propto \frac{v}{\lambda}$ depends on average fade duration: $\propto \frac{\lambda}{v}$

Cellular System (Chapter 3 and 4)

- 3G services can transmit voice and data
- CDMA 2000 / WCDMA / TD-SCDMA

base station: with fixed location and relay information.
 think ground station up to a satellite, downlink: satellite down to ground stations.
 cells: area covered by cellular telephone transmitter

location registers: provides a local database for the subscribers wherever they are physically located within a PLMN.
 home location register: stores the details such as ID or billing details.

handoff management: It lets mobile nodes keep connection active when it moves from one access point to another.

location management: It enables networks to track the locations of mobile nodes.
 It can transmit voice and data information.
 data rate is very high and is stable.

TDMA: digital modulation, limited system capacity.
 CDMA: greater capacity, greater of communication.

5G, Internet of Everything, satellite communications
 Mobility Management (Chapter 6)

MSC/GMSC/HLR: makes it possible to cross-connect circuit switched calls initiated by using IP, ATM, AAL2 as well as TDM.
 CDMA 2000, WCDMA, TD-SCDMA
 CDMA and global communication.

transmission rate: 150 kbps
 operation bandwidth: 1.6 MHz.
 operation frequencies: 450 MHz.

WCDMA: easy for transition.
 TD-SCDMA: efficient spectrum utilization.
 combines ISB and DS-SS architectures to facilitate the integration of wireless LAN and 3G cellular networks toward a uniform architecture for all-IP wireless networks.

Future Technologies (Chapter 5)
 5G, Internet of Everything, satellite communications

intra-switch: connect to the same switch
 inter-switch: connect to different switch
 the first phase uses the virtual path to re-route user connections, the second one which is a distributed optimization process is initiated to optimally re-route hand-off connections.

MCHO: MHO: the network generates or renews connections and resources.

soft handoff: increase fading through macro diversity, reduce Node B power (advantage)

using several radio links requires more channelization codes and more resources (disadvantage)

The decision as to which access network the handoff is formulated from the movement tracking mechanism which is based on a synchronization feedback.

straight-line model: calculate depreciation by taking an equal amount of the assets cost.
 fluid flow model: represents examples of how fluids of "various viscosity" interact with networks of pipes.

Both states have been specified in RNS. The conventional recovery protocol for inter-switch handoff will not be standardized.

increases the handoff rate.
 a software architecture in which a presentation layer or interface runs on a client, and a data layer or structure gets stored on a server.

Two-tier: base station will update the location after a particular time.
 Easy to manage and can know whether the terminal is powered off.
 Movement-based: one context is managed. it will be set to 0 initially and incremental with each and every time the user crosses the boundary.

Distance-based: The mobile base station will keep track of mobile terminal location.
 Better for who generally move less, and more within specific distance.

Mobile IP (Chapter 7)
 to forward certain packets from the Internet to computers or devices.

MN: mobile nodes; HA: Home Agent; FA: Foreign Agent; CA: care of Address; CN: correspondent Node.
 a mobile node sends its packets through a router on the foreign net it is currently to establish a correct reverse tunnel.

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- WEP: demand of keys
MAC filtering: whitelink/blacklist
- Captive portals: bonding between network operation and content providers.
- active: client transmits probe request and listens for a probe response.
passive: client listens on each channel for beacons.
- With EPC, high-priority traffic has a higher chance of being sent than low-priority traffic.

WiMAX (Chapter 9)

- QoS guarantee, high transmission rates, rich and diverse function
- In OFDM the signal itself is directly split into independent channels, modulated by data and then multiplexed to create the OFDM carrier.

Ad Hoc Networks (Chapter 10)

- in intranet network: devices on the network all communicate through a single access point.
- ad-hoc network: don't require a central access point, instead, devices connect directly to each other.
- a region established by a sensing body to prohibit specific activities in a specific geographic area.
- hidden terminal: nodes in a wireless network that are out of range of other nodes.
- exposed terminal: nodes that can be seen by other nodes.

Security (Chapter 11)

- working station sends the authentication frame and AP returns a verification frame. Then AP will receive third frame if it is come to the one it sent, then successful.
- If the decrypted text matches the original challenge text, access point and station share WEP key.

- WEP: direct demand of authentication, easy to crack
- WPA2: wireless LAN Authentication and Privacy Infrastructure, (Cisco) mentioned.
- IEEE 802.11i: WPA2, next update provides significant improvement in the level of security.

Bluetooth and RFID (Chapter 12)

- enhance the transmission distance and reduce energy consumption.
- connection state and standby state
- Roaming: receive radio signals, electronic tag; attach to the objects to the identifier.

- Chip technology, antenna design, technology, packaging technology, testing, application technology, standard, research issues, anti-collision technology.
- logistics field, retail field, identity field

- perceptual acquisition unit, computing unit, communication unit and power unit.
- smart dust, A Line in the Sand,

- CHIRP system, remote health monitoring and automatic sprinkler
- air craft saving and rocket ejection.

- data rates: 40kb/s
range: up to 1000 feet.
- the trade-off is prominently exhibited during the deployment phase of sensor networks, if some nodes are deployed easier than others.

- solar energy, battery-powered

Internet of Things (Chapter 14)

- sensor technology, RFID tags and embedded system to data logs
- High security, high processing speed, high resolution, high transmission rate, high system capacity, strong anti-jamming performance, low power consumption, accurate positioning and low cost.
- Bluetooth Low energy has Ultra-low power, lower power consumption, higher reliability, lower cost, higher transmission rate and higher security.

- particular frequency is transmitted when you choose your preferred station on radio, Range of antenna is tuned to get the station by default the frequency signals.

- devices: small, low transmit power and high data transfer rate
application: health care, wireless access, remote identification system, navigation and location services, personal networks, entertainment, military and space applications.

- Software-defined Networking (Chapter 15)
the physical separation of the network control plane from the data plane and where a control plane controls several devices.

- directly programmable, agile, centrally managed, programmatically controlled and open standards-based and vendor-neutral.

- cloud idea
It save lots of time and the network architecture iterative cycle will be greatly reduced.

Intelligent Robots, Cars and Drones (Chapter 16, 17 and 18)

- robot, camera, microphone, inertial navigator, sensor, range finders, infrared receivers, touch sensor, pressure sensor and WIFI.
- Unmanned vehicle, target tracking and environmental monitoring, monitor the environment by the WSN.

MIMO (Chapter 19)

- SISO means single input single output and MIMO means multiple input and multiple output.



- space diversity: use two or more antennas to improve the quality and reliability of a wireless link.
- space-multiplexing: transmit independent and separately encoded data signals from each of the multiple transmit antennas.
- station share WEP key.

- distributed MIMO; Anti-shadow effect, access to large-scale fading diversity
virtual MIMO.

Bitcoin and Graphic Code (Chapter 21 and 22)

- Its value ~~range~~ fluctuates greatly, accounts' security is low, but the transaction process ~~is~~ is safe and ~~can~~ protect privacy is able to
- encoding area, picture pattern, delimiter, positioning pattern, calibration pattern.

2. 掩模(匿

可以使符号
的可能性降为最

3. 扩充解

这种方式
(如字母等),以
行编码。