

5/4/2015

OP1: Communication exists as telecommunication from 1858

Morse creates telegraph in 1837, Bell invents telephone and

in 1876, Tesla patented shortwave wireless communication

in 1894, and Marconi invented radio in 1895, AM radio

in 1906, Sins 1927, the first TV broadcast appeared,

in 1981, the first NAT was established, and in 1998,

BSM, 1997, the first edition of WLAN appeared.

cellular system, mobile management, mobile IP, N-Fi.

Wi-Fi, self-organized networks, WLAN security, wireless

personal area network, sensor networks, IoT, SDN

Op2: Wind media depends on terminals to transmit, it's

more reliable and stable. While the wireless media doesn't

need to set up discrete cable and has low bandwidth

The licensed bands are those individual company pass

a licensing fee for channels and unlicensed bands don't

need permission.

• terrain, operating frequency, speed of mobile terminal

• reflection and transmission when the size of a barrier

is larger than the length of electromagnetic wave.

• Diffraction: when the propagation path is blocked by

the edge of sharp things.

• scattering: when the size of an obstacle is equal or smaller

to the length of electromagnetic wave.

• in indoor environments, through scattering, reflection and

diffraction, radio can be transmitted in certain space. On outdoor

environments, through reflection, diffraction and LOS paths,

radio can arrive at certain terminal.

• $L_p = \frac{P_t}{P_r}$ It is transmitter P_t is the receiver,

$L_p \sim \frac{1}{d^2}$ and $L_p \sim \frac{1}{f^2}$

• free space: $L_p = 32.44 + 20 \lg f + 20 \lg d$

• two-way: $10 \lg P_r = 10 \lg P_t - 10 \lg d^2$

• Slow fading can be caused by causes such as shadowing

where a large obstruction such as a hill or large building

obscures the main signal path between the transmitter

and the receiver

• Multipath is the propagation phenomenon that

results in radio signals reaching the receiving

antenna by two or more paths. The Doppler effect

is the change in frequency or wave length

Rayleigh distribution has a probability density func.

$$p(r) = \begin{cases} \frac{1}{\sigma^2} \exp(-\frac{r^2}{2\sigma^2}) & (0 \leq r < \infty) \\ 0 & (r < 0) \end{cases}$$

Rayleigh distribution is given by

$$p(r) = \left(\frac{r}{\sigma^2}\right) \exp\left(-\frac{r^2}{2\sigma^2}\right) \quad (r \geq 0)$$

• Doppler shift is the change of frequency or wave

length for an observer moving towards to its source.

• Rayleigh distribution $P(R) = P_r(r \leq R) = \int_0^R p(r) dr = 1 - \exp(-\frac{r^2}{2\sigma^2})$

• The average level crossing rate and average fade duration

of the output signal envelope of a selection diversity

combined, depending on independent, but non-identical

fading input branch signals are derived.

• 1976-1997, 2G added the function of receiving data

in 2008, 3G standards are announced: TD-SCDMA,

WCDMA, CDMA2000

• $C = M \cdot T \cdot W$

• $\frac{C}{T} = \frac{W}{M} \cdot K$

• base station: a land station in the land mobile service

applies/dominates: the transmission path from mobile to base

station, from station to mobile.

cells: cellular-telephone sites where the equipment are

placed, location based: service area of a mobile service

mobile switching centers: the center of a network switching

system associated with communication's switching functions.

• The data stored in VLR has either been received from the

HLR or collected from the MR. In practice, for performance

reasons, most vendors intercept the VLR directly to the

V-MSC and, where this is not done, the VLR is very tightly

linked with the MSC via a proprietary interface.

• handoff management: when MS, under different districts, will

it transfers to a new channel and location management:

when MS leaves home network, it enters a foreign network.

MS have to register to home agents through foreign agents

to correct current position.

• wider coverage, more stable connection, faster, low cost.

• purpose: prevent the over-subscription

Difference: measurement of the resource capacity in a network

determined by timeslots, which of CDMA is not fixed.

- SBASN = used for packet switched services, similar to that of MSC/VLR
- AASN = function is close to that of MSC, higher version of gateway GPRS support mode.

- TR-SDMA, CDMA2000, WCDMA
- high speed transmission, broad band multi-media service and global roaming.

- transmission rate: 5.6-15 Mbps. bandwidth 5 MHz, frequency: 200 KHz.
- broad band Internet access, mobile business, video communication, mobile television, wireless searching

- a fine tuned explicit congestion notification (ECN) mechanism for stream control transmission protocol (SCTP), allowing SCTP to differentiate between non-congestion losses from congestion losses and therefore, make it more suitable for lossy wireless links.

- QoS: mobile cloud computing, mobile page, mobile access.

QoS.

- Measuremnt, handover decision, switch selection.

- intra: handoff notice messages sent to all MAs in same SPG.

- inter: for events occurs between MAs in different SPGs.

- MSHO: The mobile decides for itself.

- NCHO: Surrounding BSs measure the signal from BS.

- MCHO: network ask MS to measure signal from BSs.

- advantage: hard handoff: there's no need to be capable for more channels, soft handoff: utilize the info. from different BS.

- disadvantage: hard: temporary interruptions.

- soft: more complex hardware are needed.

- Feedback handoff based scheme makes use of info feedback from the mobile.

$$L_{FB} = \frac{1}{T_p} = \frac{1}{T_p} + \lambda$$

- straight-line: nodes move in a straight-line until dir changes.

- Fluid flow model: used to describe the fluid level in a receiver

$$H_{k_j}(v) = \begin{cases} \frac{1}{\pi} M_1(T_{k_j}^U) v_k & k \neq j \\ \frac{1}{\pi} M_1(T_{k_j}^U) v_k & k = j \end{cases}$$

- intra-switch handoff: mobile unit moves from one cellular system to a different system which is controlled by different MTSO.

- inter-switch handoff: mobile unit moves from one cellular system to a different system which is controlled by the same MTSO.

$$\text{inter: } T_{k_j, \text{int}} = \{x | \exists x_1 \in \Phi_k, x_2 \in \Phi_k, x_1 \neq x_2, c(x_1) \neq c(x_2), P_k = \frac{P_{k_j}}{k_1 - k_2}\}$$

$$\text{intra: } T_{k_j, \text{in}} = \{x | \exists x_1 \in \Phi_k, x_2 \in \Phi_k, x_1 \neq x_2, c(x_1) = c(x_2), P_k = \frac{P_{k_j}}{k_1 - k_2}\}$$

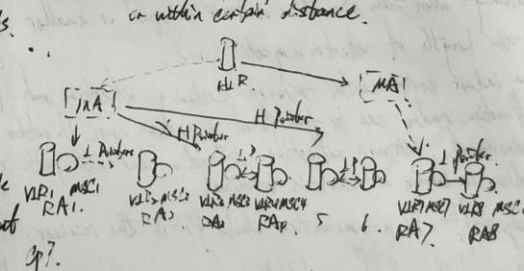
- the handoff rate will increase because the coverage of a particular group of channels are reduced
- The two-tier is based on Client Server architecture. The two-tier architecture is like client server application. The direct communication takes place between client and server and there's no intermediate between client and server.

- When a mobile is open, the cellular network ask it to execute the IMSI catch or other and update its location at certain time interval.

- Time based: difficult to consider paging delay constraints.

- movement based: more back and forth between cells may cause unnecessary updating.

- distance based: low paging costs: better for users movement or within certain distance.



- necessary to creating a computer services, easy to assign PUS addresses.

- MN: mobile node.

- HA: home agent.

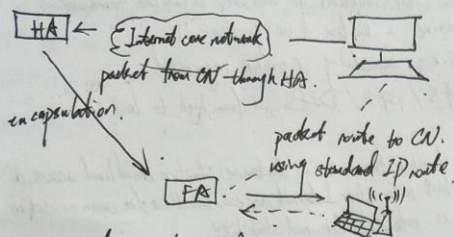
- FA: foreign agent.

- COA: care of address.

- N: communication object of MN.

- The mobile node arrives at a foreign network, listening to the next, afterwards, select a foreign agent supported the reverse tunnel. When it passes, it's registered by the foreign agent.

the data was sent by IP.

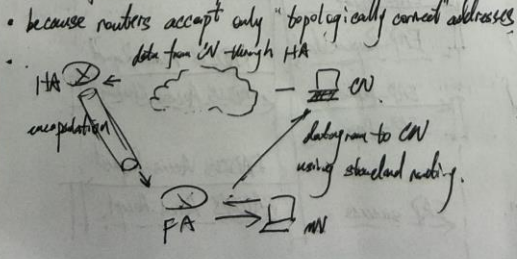


- 1) MN sends request to FA.
 - 2) FA processes it and forwards it to HA.
 - 3) HA sends a reply and forwards to FA.
 - 4) FA reply it and return to state for MN.
- lifetime shows the interval of registration, if there's no limited lifetime for registration, there will be several registration information on different agents, and the MN will be invalid.
 - HA and FA broadcast agent advertisement message regularly, it's the extension of ICMP router, which including route IP address and agent advertisement extensive information.
 - By using registration request, a MN's home agent can create or modify a mobility binding for the MN.
 - FA and HA may reject the register request.

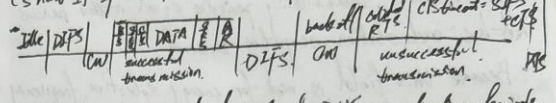
IP in IP encapsulation: in this way, the whole IP data packet is encapsulated and be the payload of the new IP data packet. the inner IP header keeps the same while the outer one is new. minimal encapsulation: the new IP header is inserted between the original IP header and payload.

GRE defines a protocol that any other protocol on network layer can be encapsulated as any protocol on the network layer, send the data to run a protocol is encapsulated in another protocol's node with a low priority gain access before those with higher prioritization.

- 1) MN sends to FA
- 2) FA tunnels packets to HA through encapsulation.
- 3) HA forwards the packets to receiver.



QoS.
 • DCF (distributed coordination function), a mac technique, employs a CSMA/CA with binary exponential backoff.
 PCF (point coord. func) DCF (DCF: inter frame space), SIFS (short if space) PIFS (PCF if space).



IEEE 802.11 is a set of MAC and PHY specifications for implementing wireless local area network computer communication in the 900 MHz and 2.4 GHz frequency bands. They are created and maintained by IEEE 802. ETSI support differentiated distribution access to wireless media and HCF: hybrid coord. func. access.

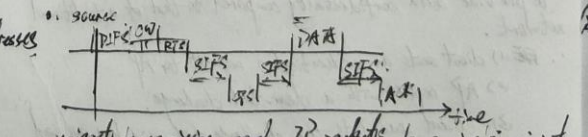
- ad-hoc: p2p, can directly, infrastructure mode: includes STA and AP, ESS.
- infrastructure network: STA connects with AP.
- 802.11 is a set of data link and physical layer protocols. MAC for link-to-link data transfer, PHY responsible for putting bits.

• LLC is upper sublayer of the data link layer.
 MAC = access mechanism, encryption
 PLCP: carrier-sensing assessment, forming packets for physical layer
 PHY: channel tuning.

- Difference: the frequency of the transmitted signal.
- advantage: high security, limited range, more private.
- 802.11 = FHSS and DSSS, modulation, PLCP, PMP.
- 802.11a: OFDM of DA with 5.8 GHz / 54 mbps.
- 802.11b: DSSS, 5.5 mb/s or 11 mb/s.
- 802.11g: OFDM.

five different priorities for data packets to be sent: other one node finishes serving many other nodes compete for the right to send. the first objective of prioritization is to make sure no data to run a protocol is encapsulated in another protocol's node with a low priority gain access before those with higher prioritization.

• pif = station listens for channel status for a PIFS interval, pif resides in AP to coordinate the communication within network.



- unicast transmission sends IP packets to a single recipient on a network, just one sender one receiver.
- Multicast: from one or more nodes to many hosts on a network.
- to limit the need for physical carrier sensing so as to save power.

WAP: uses the stream cipher RC4 for confidentiality, and MD5 for integrity.

API: Digital certificate, pre-shared key, wireless key negotiation.

IEEE 802.1x: multiple identity, 4-way handshake, group key handshake.

p 12.

improved transmission distance, low energy consumption.

active, sniff, hold, park.

Roads: responsible for two-way communication with Electric Tg. and receives control commands from host.

Chip technology: Antenna Design, Packaging technology, application technique, Standard research problem, Anti-collision technology.

Logistics warehousing, sales statistics, personal identification.

Cp 13.

The WSN consists of a data-aware network and a data distribution network. The base stations are one or more components of the WSN with much more computational, energy and communication resources. They act as a gateway between sensor nodes and the end users as they typically forward data from the WSN to a server.

Base station-gateway, monitoring station server.

Health-care monitoring, environmental sensing, smart dust.

Directed perception model, virtual potential field, coverage enhancement.

Power consumption constraints for roads using batteries, ability to cope with node failures, some mobility of nodes, scalability to large node scale of deployments.

The amount of data to be sent to the sink node can be reduced, which also saves the energy consumption.

Battery, Compressed air energy storage.

Cp 14.

UWB, SDR, RFID.

High security, high processing speed, high capacity.

BLE is intended to provide considerably reduced power consumption and cost while maintaining a similar communication range.

Interacting with their operating environment.

Medical care, wireless access systems, navigation and positioning.

Cp 15.

The control plane is separated from data plane.

OpenFlow, VLAN.

SDMN, SD-WAN, SD-LAN, security using the SDN.

Flow visualization, software-based traffic analysis, programmability of network.

Cp 16, 17 and 18.

Laptop, power-generating machine, camera, navigator, microphone, sensor, IRM.

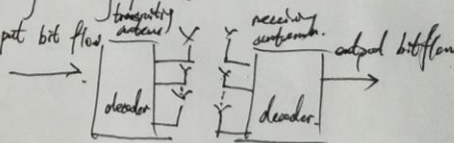
Leap-Frog Path Design, Real-time Indoor Mapping.

Cooperative Multi-Robot Estimation and Control, taking advantage of distance sensor of the car to locate some objects in a known environment.

Cp 19.

SISO system is the simplest form of the communication system in which there's single transmitting antenna at the source and a single receiving antenna at destination. MIMO, between a transmitter and a receiver, signal can go through many paths.

input bit flow, transmitter antenna, receiver antenna, output bit flow.



MIMO. Space-diversity is any one of several wireless diversity schemes that uses two or more antennas to improve the quality and reliability of a wireless link while space-multiplexing is the use of separate point-to-point electrical channels for each transmitted channel, which can greatly improve transmission rate.

Distributed Antenna System, MIMO-OFDM.

Cp 21 & 22.

The bitcoin protocol includes several features that protect it against some of these attacks, such as unauthorized spending, double spending, forging bitcoins and tampering with block data.

- High Capacity Encoding of Data, Small Printout Size,
Kerji and Kern Capacity, Dirt and Damage Resistance,
Readable from any direction in 360°,
Structured Append Feature.