Chapter6 - Wireless and Mobile Networks

Topics:

- Introduction
- Wireless links, characteristics
- IEEE 802.II wireless LANs("Wi-Fi")
- Cellular Internet Access
- Principles: addressing and routing to mobile users
- Mobile IP
- Handling mobility in cellular networks
- Mobility and higher-level protocols

Introduction

Elements of wireless network:

- wireless hosts
- base station: typically connected to wired network, responsible for sending packets between wired network and wireless hosts
- wireless links: typically connect mobiles to base station, related to two dimensions: data rate and range.

Two modes:

- infrastructure mode

  base station connects mobile into wired network.

  handoff: mobile changes base station providing connection into wired network
- ad hoc mode

  no base stations here

  nodes can only transmit to other nodes with link coverage

	infrastructure mode	**ad hoc mode**
single hop	Wi-Fi, WiMAX, cellular	Bluetooth, ad hoc nets
multiple hops	mesh net	MAXNET, VANET

Wireless links, characteristics

1- difference between wireless and wired networks

- decreased signal strength
- interference from other sources
- multipath propagation

2- SNR and BER

- increased power -> increased SNR -> decreased BER
- given SNR, higher rate -> higher BER

3- two problems

- hidden terminal problem
- signal attenuation

4- CDMA6

IEEE802.II wireless LANs("Wi-Fi")

802.II b, 802.II a, 802.II g, 802.II n ---> all use CSMA/CA for multiple access, and have base-station and ad-hoc network versions

1- Basic Service Set (Cell)

- wireless hosts
- access point(AP): base station
- ad hoc mode: hosts only

host:

- scans channels, listening for **beacon frames** containing AP's name.
- select AP to associate with
- typically run DHCP to get IP address in AP's subnet

scanning:

- passive scanning
- active scanning

CSMA/CA

no collision detection for:

- weak received signals for sense collisions
- can't sense all collisions in any case

Avoiding collisions - **RTS-CTS** to avoid collisions of long data frames.

Sender first transmit small request-to-send(RTS) packets to BS using CSMA. Then BS broadcasts clear-to-send （CTS) in response to RTS. CTS is received by all nodes while sender could send data frame and other stations defer transmissions.

2- The mobility with same subnet

H1 remains in same IP subnet, and IP address can remain the same.

As the signal from BSS1 decreases, H1 will accept BSS2's beacon frame and get into BSS2.

The switch will use **self-learning** to know which switch port could be used to reach H1.

3- advanced capabilities

- rate adaptation

  base station, mobile dynamically change transmission rate as mobile moves, SNR varies.

- power management

  when an node is sleeping, the AP knows not to transmit frames to this node until next beacon frame. The beacon frame contains list of mobiles with AP-to-mobile frames waiting to be sent, the node will stay awake if AP-to-mobile frames to be sent, otherwise keep sleep again until next beacon frame.

4- personal area network 802.15

- less than 10m diameter
- replacement for cables
- ad hoc: there is no infrastructure
- master/slave: master grants requests and slaves request permission to send

Cellular Internet access

A cellular contains **cells**/BSS:

- BTS - base transceiver station
- mobile users
- air-interface

Radio spectrum division:

- combined FDMA/TDMA
- CDMA

principles: addressing and routing to mobile users

1- vocabulary

home network: permanent "home" network of mobile

foreign network/visited network: network in which mobile currently resides

home agent: entity that will perform mobility functions on behalf of mobile, when mobile is remote.

foreign agent: entity in visited network that performs mobility functions on behalf of mobile

permanent address: address in home network.

2- approaches

- routing handle

  routers advertise permanent address of mobile-nodes-in-resident.

- end-system handle
  - indirect routing: communication from correspondent to mobile goes through home agent, then forward to remote.
  - direct routing: correspondent gets foreign address of mobile, sends directly to mobile.

registration:

When a mobile visits a foreign network, it'll contact with foreign agent, then the foreign agent will contact home agent to advertise the existence of mobile.

- indirect routing - triangle routiing

  1 - correspondent addresses packets using home address of mobile

  2 - home agent intercepts packets, forward to foreign agent

  3 - foreign agent receives packets, forward to mobile

  4 - mobile replies directly to correspondent

- direct routing

  1 - correspondent requests, receives foreign address of mobile

  2 - correspondent forwards to foreign agent then forward to mobile

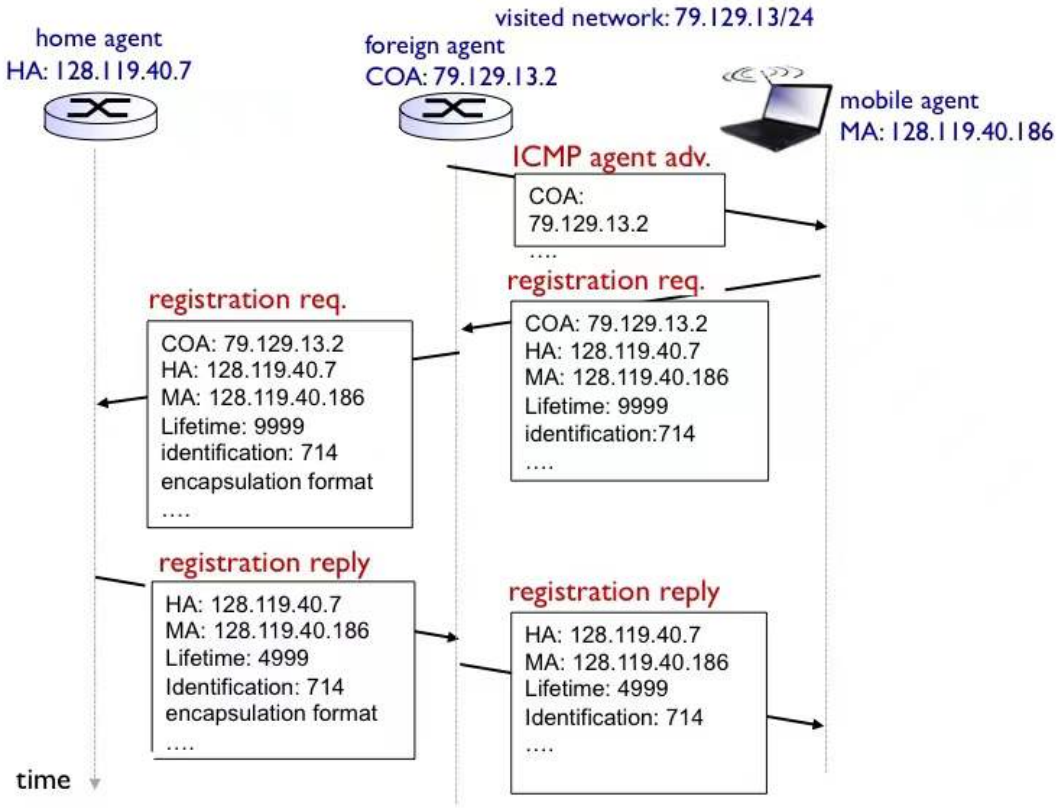
accommodating mobility to solve the movement of mobile

There is a anchor foreign agent(**FA**)

another kind of triangle routing(?)

Mobile IP

- agent discovery
  - agent advertisement: foreign/home agents advertise service by broadcasting ICMP messages
  - agent solicitation
- registration with home agent
- indirect routing of datagrams: encapsulation packet



Handling mobility in cellular networks

- home network: contains HLR
- visited network: contains VLR