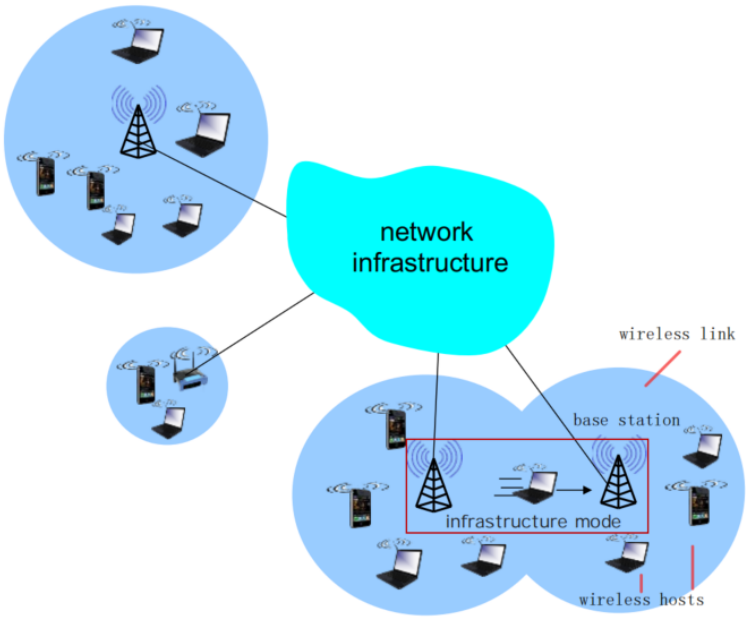
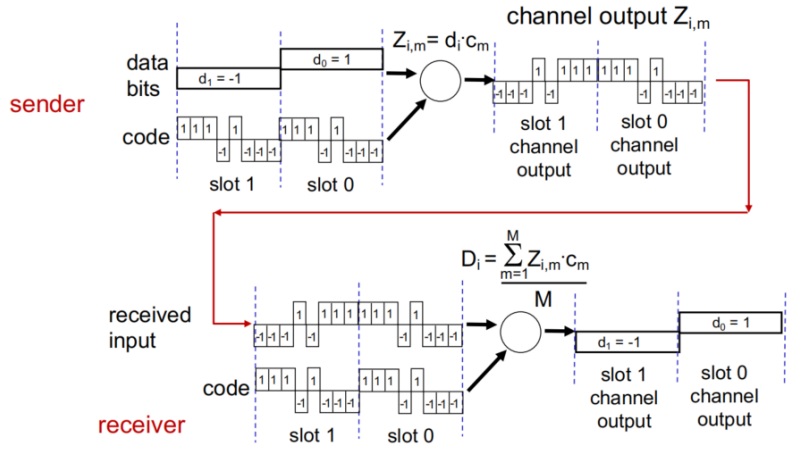
Ch7 Mobile

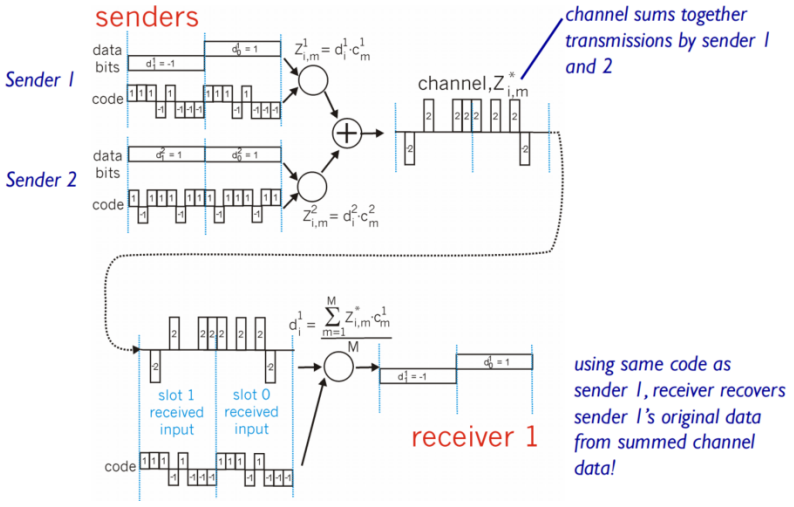
- Intro



  - wireless host: stationary or mobile (无线不一定可移动)
  - base station: sending pkt between wired network and wireless host(s)
    - cell towers, 802.11 access points
  - wireless link:
    - 连接host和基站
    - backbone link: 连接不同基站和网络节点
    - Multiple Access Protocol 多路访问协议：当多个用户共享同一无线频谱资源时，避免数据传输冲突和干扰——CMDA
  - 网络主要工作模式
    - infrastructure mode
      - 基站将移动设备连接到有线网络
      - handoff: 移动设备切换基站连接
    - ad hoc mode
      - 没有基站，所有的设备（节点）通过无线通信直接互相连接
      - 节点仅能与在链路覆盖范围内的其他节点通信
      - 节点自组织成网络并相互路由
- Wireless
  - 特点
    - 与有线比较
      - decreased signal strength 传播时radio signal attenuates衰减

    - interference from other sources 干扰
    - multipath propagation
  - SNR: signal-to-noise ratio 信噪比：$\mathrm{SNR}\uparrow$更容易从noise中提取signal
  - SNR versus BER tradeoffs
- **CDMA: Code Division Multiple Access**
  - 给每个user分配一个独特的code
  - 所有用户共用相同的freq但是用唯一的code来encode data
  - 每个bit发送时要乘以chipping seq，使得以更快的rate发送——chipping rate





- IEEE 802.11 wireless LANs (“Wi-Fi”)
  - 标准小结

Standard	Frequency Range (United States)	Data Rate
802.11b	2.4–2.485 GHz	up to 11 Mbps
802.11a	5.1–5.8 GHz	up to 54 Mbps
802.11g	2.4–2.485 GHz	up to 54 Mbps

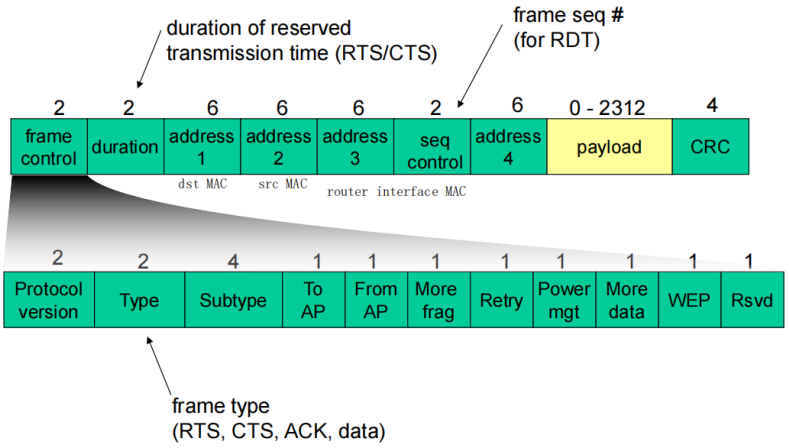
    - 802.11b
      - DSSS，Direct Sequence Spread Spectrum 所有设备用相同的chipping code
    - 802.11n: multiple antennae
      - 2.4-5 GHz

        - 200Mbps
- 架构
    - 基本模块：BBS (Basic Service Set)=1 base station + n wireless hosts
    - base station: Access Point (AP) 链路层，不谈IP
- channel & association
    - 每个host在发送消息时都要和一个AP关联
        - AP 周期性发送beacon frame
        - host扫描所有信道（11个），监听beacon frame（AP's SSID & MAC）Service Set Identifier
        - host选择一个AP to associate with, 发送request frame. AP: response frame (active scanning)
        - host 发送DHCP发现报文并获得在这个子网中的IP
    - scan channel & listen beacon frame
        - passive scanning
            - AP send beacon frame
            - host send association request frame to selected AP
            - selected AP send host association response frame
        - active scanning
            - host广播 probe request frame
            - APs send probe response frame
            - 同被动扫描后面两步
- multiple access-----CSMA/CA（**carrier sense multiple access** with collision avoidance)
    - no collision detection--- fading receive signal, hidden terminal
    - sender
        - if sense channel idle for DIFS (Distributed Inter-Frame Space)
            - transmit entire frame
        - if sense channel busy
            - 选取随机backoff time
            - 当channel idle，timer下降
            - timer = 0，transmit
            - if no ACK，增加backoff
    - receiver
        - 收到frame以后在SIFS后return ACK (Short Inter-Frame Space)
    - RTS-CTS:只有frame长度大于基站设置的RTS阈值时才会发送
        - hidden terminal：两个host都能连接到相同的AP，但是彼此之间超过了传输距离

——容易碰撞

- 发送前host先发送RTS(request to send)，包含发送data和确认ACK所需要的总时间
- AP：收到RTS时广播CTS(clear to send)
- $T = 2SIFS + T_{data} + T_{ACK}$

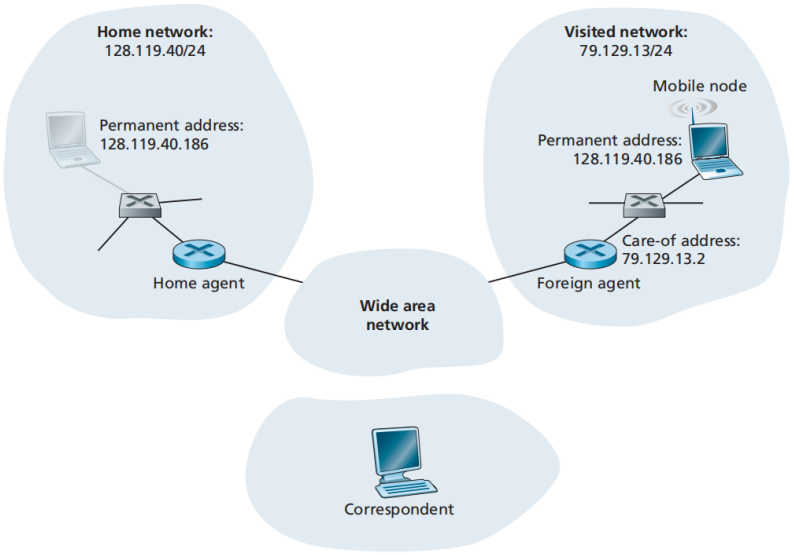
- addressing



- 从一个子网移动到另一个子网
- advanced capabilities
  - Rate adaptation：当BER过高自动切换为较低的transmission rate
  - power management

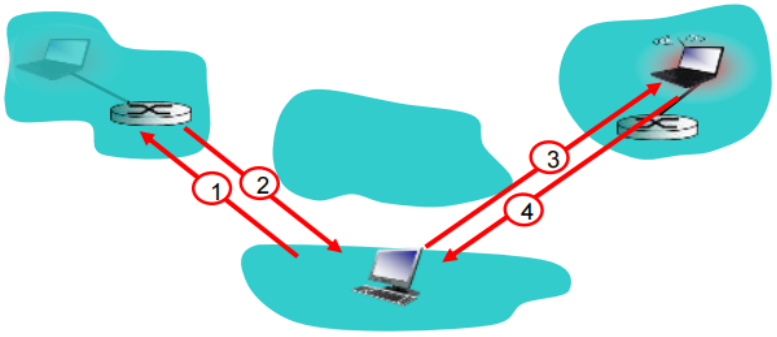
- Cellular Internet Access 蜂窝网络
  - 架构
    - cell
      - base station BS
      - mobile users
      - air-interface: protocol between mobile and BS
  - 标准

- Mobility
  - Principles: addressing and routing to mobile users
  - term



- care-of-address: address in visited network. COA转交地址
- home network: 永久居所
- visited network: 移动节点当前所在的网络
- foreign agent: 帮助移动节点做移动管理的功能

- approaches
  - router: 移动节点的地址（如IP地址）被foreign agent通过常规的路由表交换进行广播
  - end-system
    - indirect routing：先找home agent，通过COA发给foreign agent，再传给dst
      - 节点到foreign agent register，离开需要注销
      - foreign agent 到home agent 注册 COA，不用注销
      - home agent 数据包封装协议
      - foreign agent 拆封协议
      - 三角路由选择问题——低效
    - direct routing：直接向home agent询问COA



      - 当节点用一个外部网络移动到另一个外部网络时——anchor foreign agent：
      - 节点向新的外部代理注册
      - 新的外部代理给anchor注册新COA