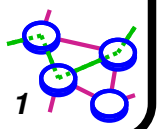
CS551
Wireless and Mobile Networking

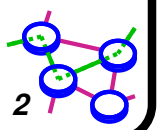
Bill Cheng

http://merlot.usc.edu/cs551-f12



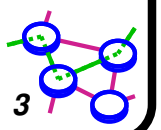
How Is Wireless & Mobile Different From Traditional Networking?

- Wireless
  - cellular vs. ad hoc
  - transmission media is air
    - interference from other radios and obsticals
      $\Rightarrow$ much less reliable
    - higher error rates
    - mitigated by physical level work (coding)
  - not everyone can hear each other
  - slower speed than traditional (limited spectrum)
  - security
    - network may not trust users
    - users may not trust network



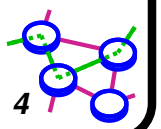
How Is Wireless & Mobile Different From Traditional Networking? (Cont...)

- **Mobile**
  - location change ⇒ routing needs to change
    - what basestation are you talking to
  - limited energy (battery)
  - scaling may not be as important
    - scaling in ad hoc network is open research
  - security, again
    - network may not trust users
    - users may not trust network



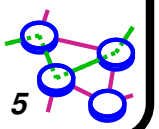
Dimensions of Wireless/Mobile

- mobility
  - one-hop to base-station vs. ad hoc/multi-hop
- wireless
  - fixed vs. mobile
- protocols
  - IP vs. cell phone (3G) vs. protocols for sensor networks
- constraints
  - energy
  - radio range
  - antenna directionality
- trust
  - do you trust others to forward your data
  - to overhear your packets
- app-level issues
  - even if you have connectivity, what can you do?
    - Ex: it may be easier to share files with floppies
    - often e-mail must go through a central server



Approach For This Class

- Lots of work in mobile/wireless
- Look at small sample
  - link-layer: MACAW
  - routing: Mobile IP and DSR
  - transport-layer: SNOOP
  - sensor network: Direct Diffusion
  - applications (CSci555)



CS551

Mobile IP

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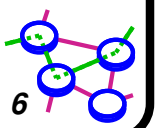
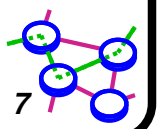


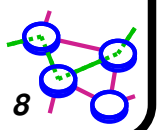
Key Ideas

- **Mobile IP:**
  - **how do people find you if you move around?**
  - **specifically: how do you keep your IP address anywhere you go**



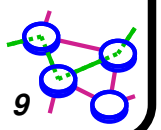
Mobile IP

- How do we deliver IP packets when endpoints move?
- Issues
  - Impact on IP addressing
  - Impact on routing
- Key design considerations
  - Scale
  - Incremental deployment
- Result: Mobile IP [RFC 2290]
  - Internet standard for support for mobility in IP



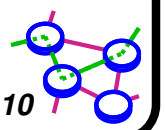
Possible Approaches

- Why not just announce a route to your host?
  - doesn't scale to millions of hosts
  - breaks hierarchical addressing!
- Why not re-address your host?
  - then people can't find out
  - but this is what 95% of people do today, because they only run clients, not servers
- Why not separate naming and addressing?
  - too many protocols use IP addresses instead of hostnames, especially for open connections

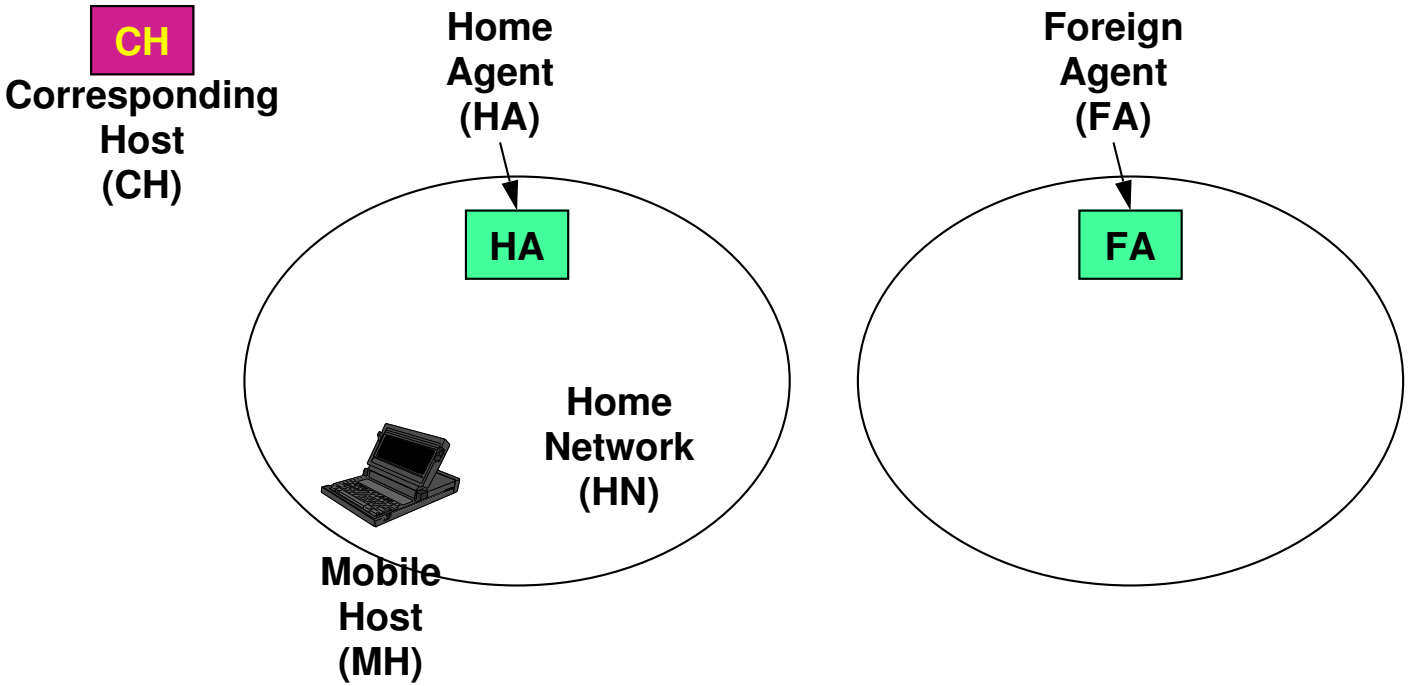


The IETF Mobile IP Approach

- A location registry
  - keeps track of where you are
  - tunnels packets to you
- Pros:
  - good scalability (many users)
  - incremental deployment easy
- Cons:
  - triangle routing through home
  - must be careful about security
  - is it really necessary? (consider end-to-end argument)



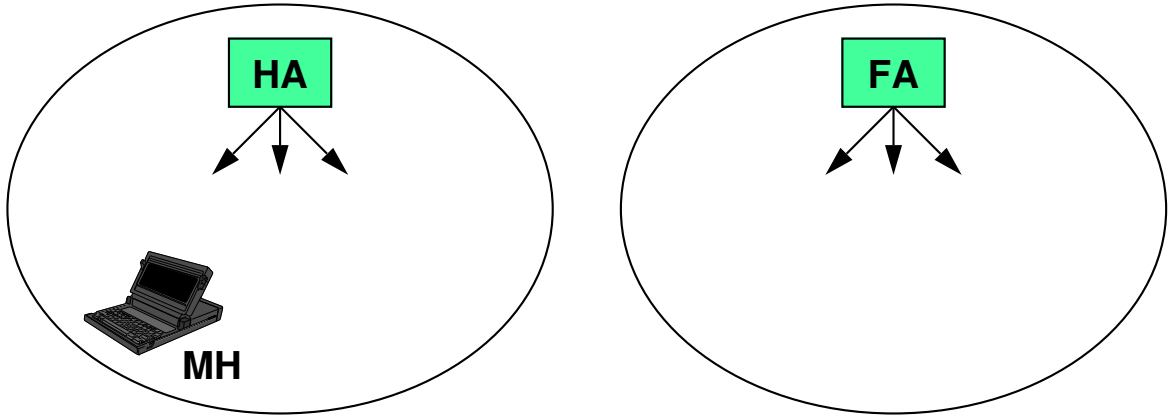
Mobile IP Terminology



Discovering Agents

CH

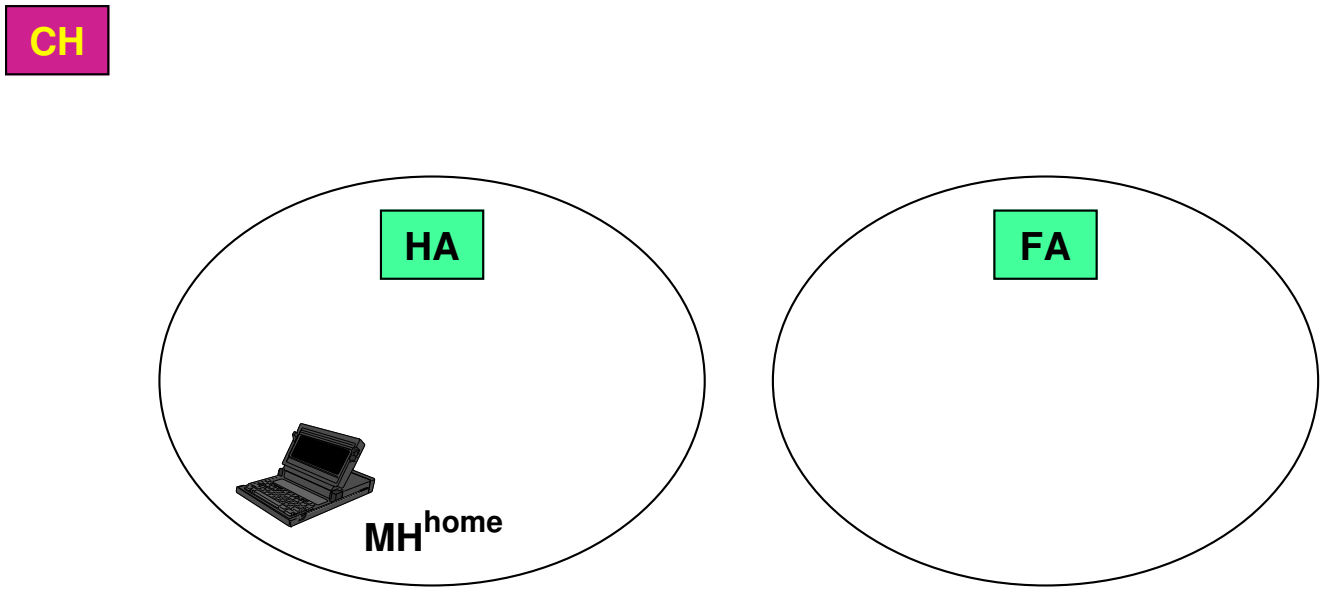
Routers periodically beacon ICMP router advertisements



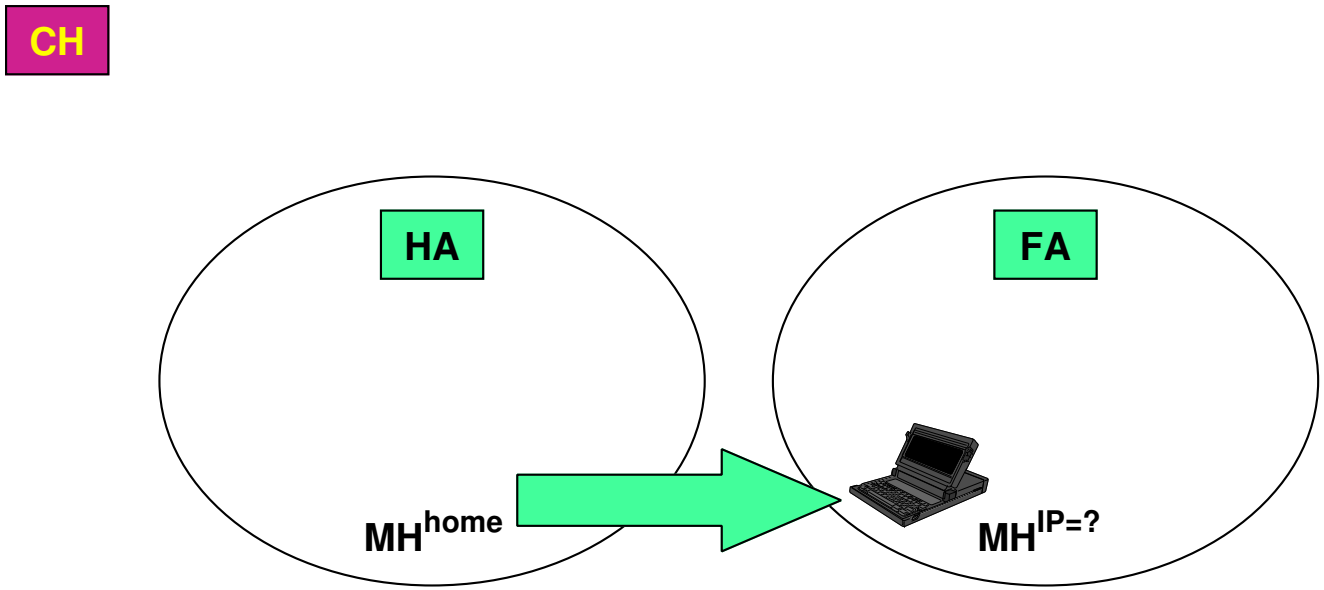
Q: How do laptops usually figure things out? Why not use that?

A: DHCP... because it didn't exist when Mobile IP started.

Registration

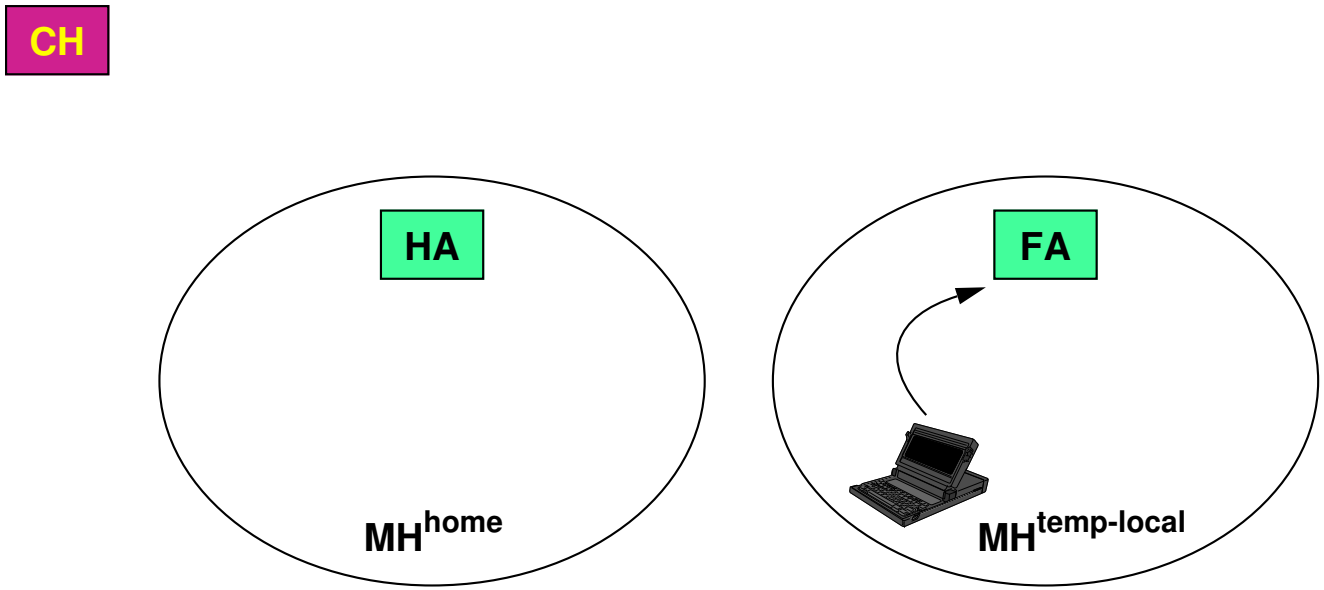


Registration (Cont...)



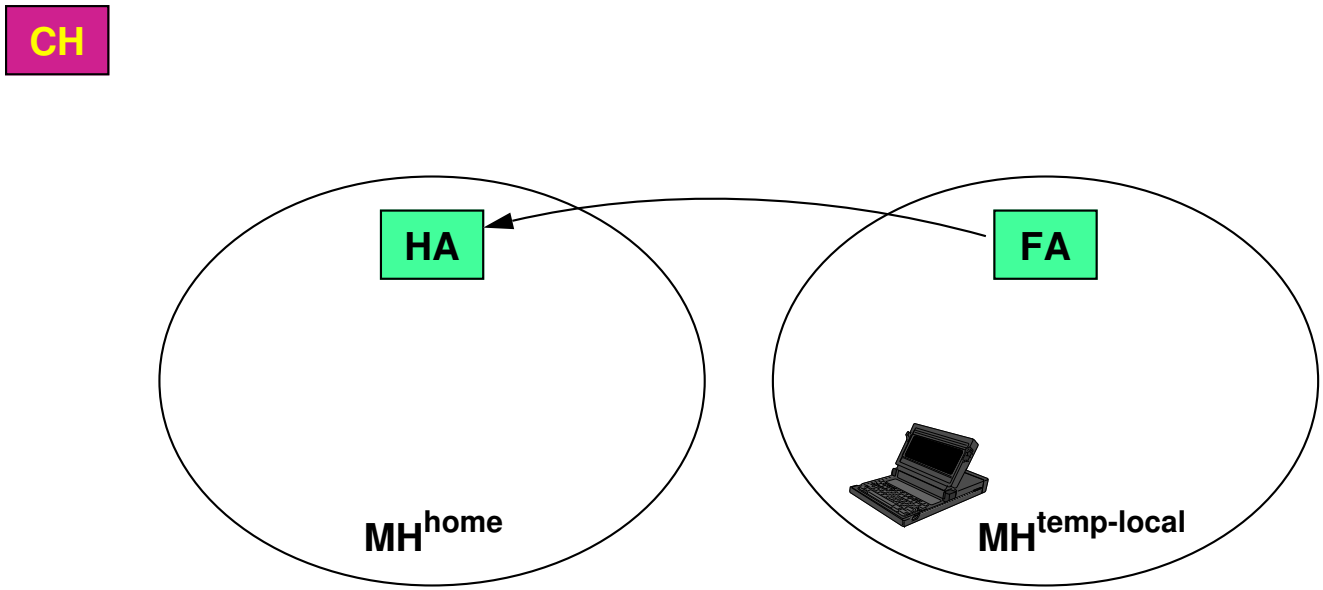
- MH moves to foreign network

Registration (Cont...)



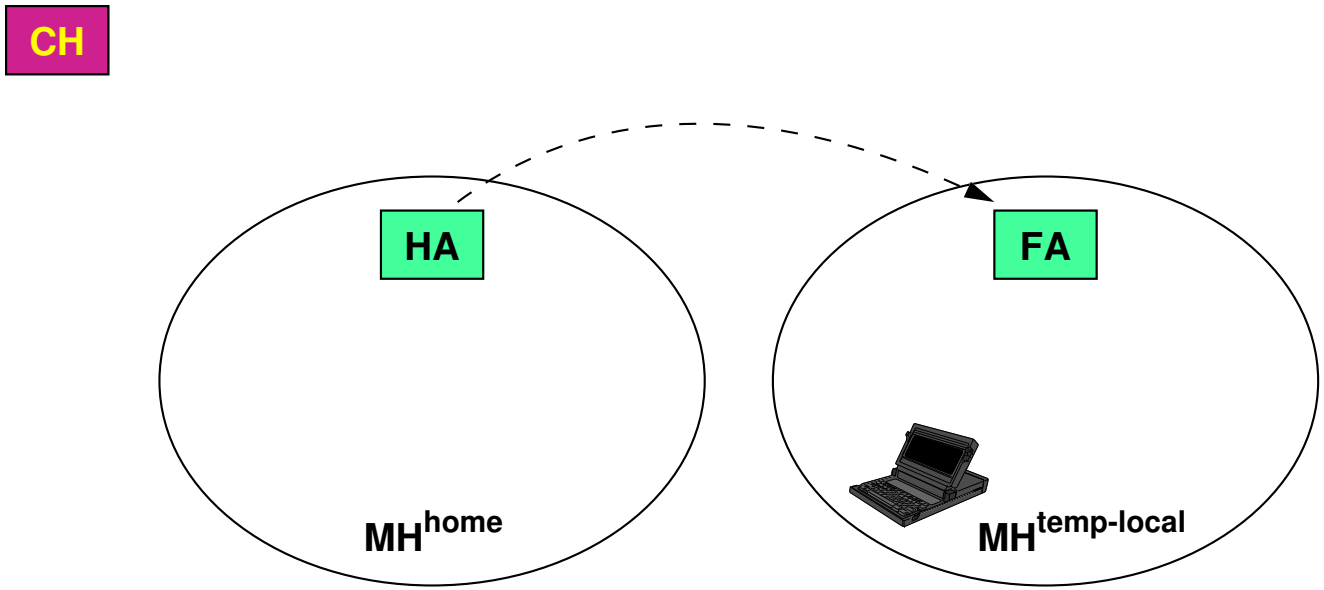
- MH registers with FA and gets temp local IP address

Registration (Cont...)



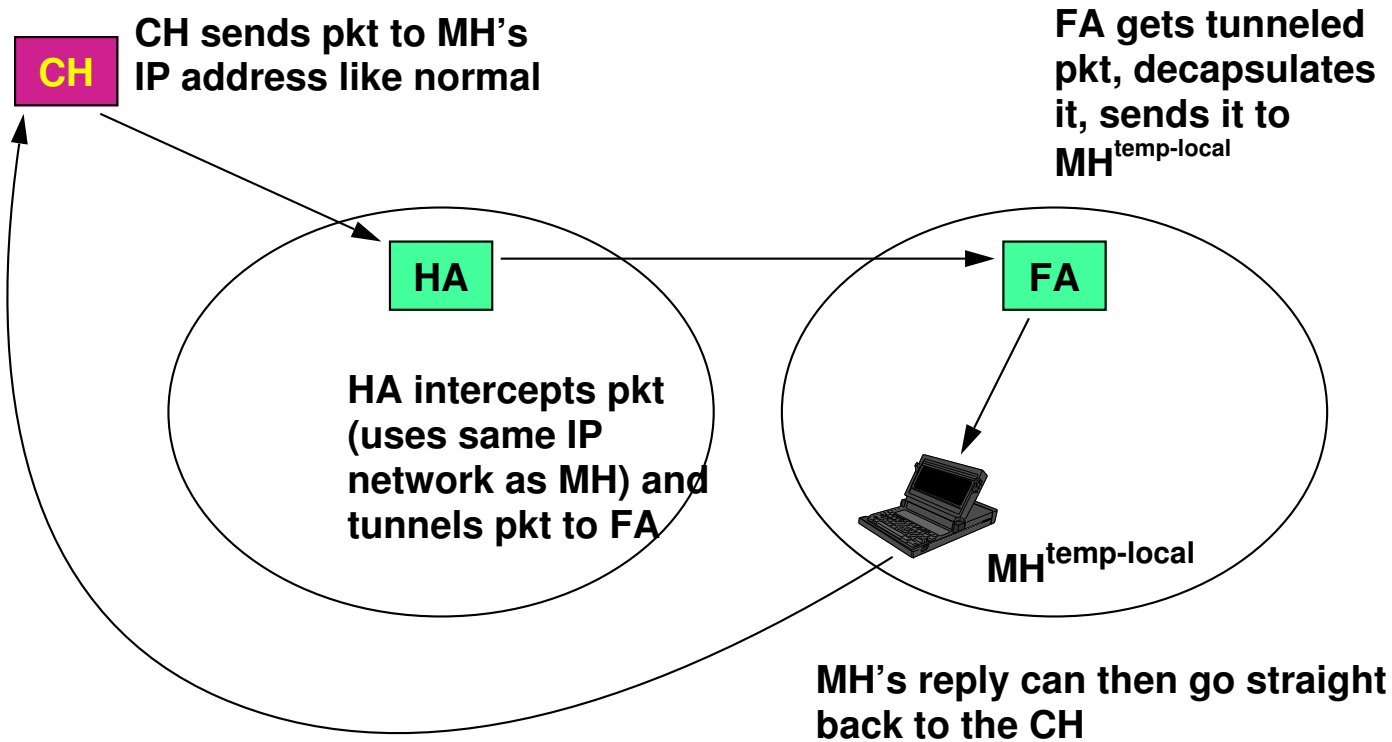
- FA informs HA so HA always knows

Registration (Cont...)



- HA setups tunnel to FA

Tunneling



- CH does not have to be Mobile IP-aware
- Triangular routing

Other Mobile IP Issues

- Route optimality
  - resulting paths are not optimal, they all go through the HA
  - can be improved with *route optimization*
    - smart senders keep cache of FA & MH[local-temp]
    - one more thing to keep updated
- Smooth handoffs
  - don't want to drop pkts when changing FAs
- Security issues
  - authentication
    - FA may make false claim that MH is in its network
    - don't want others to claim to be MH
  - confidentiality
    - FA may be listening and recording
  - FA may modify messages