COMP312-09A
Communications and Systems Software

Mobile IP

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Mobile IP

- Motivation
- Other Solutions
- Mobile IPv4
- Mobile IPv6

Mobile Internet

- Cellular Telephony has been enormously successful
- Many (most??) computers now laptops.
- Many small portable devices now Internet enabled
- Internet applications part of many peoples lives

Internet Mobility

- The Internet was not designed to allow mobility

Actually, if you were designing a network to *prevent* mobility it could have an architecture very much like the Internet

Mobility problem

- IP address defines where you are
  - It includes the address of the subnet you are attached to.
  - Routing uses it to find you on the network

Therefore when you move, your IP address *must change.*

Mobility Problem

- IP address defined who you are
  - TCP binds all your connections to your IP address
  - Other nodes identify who they have a connection to by the IP address.
- Therefore as you move you *require* that your IP address *stays the same*.

Mobility Solutions

- Go down the stack.
- Layer 2 mobility solutions can provide very good mobility
  - Wide availability
  - Seamless hand-overs

Layer 2 Solution

- By definition restricted to a single interface type.
- Normally radio for best mobility
  - Lower speeds
  - Wide area solutions require expensive infrastructure
  - Local area solutions only local
- Cannot use the best connection option available at the time.

Mobility solutions

- Ignore the problem
- Rely on higher layers to maintain sessions as connections and IP addresses change.
- Works well for some applications
  - e.g. web browsing
- Doesn't work for other applications.
  - e.g. streaming media

Mobile IP Solution

- Problem
  - IP address must change
  - Require IP address to stay the same
- Solution
  - Two IP addresses
  - Can tunnel between them

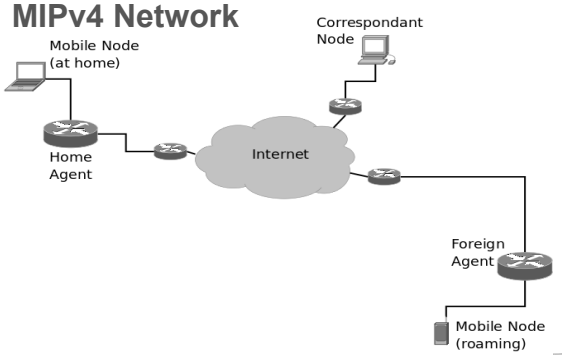
Mobile IPv4 Components

- Mobile Node
  - Device that moves but maintains IP connections
- Home address.
  - Stays the same
  - Cannot move on the network
- Home agent
  - Looks after home address
  - Forwards packets to Care-of address

Mobile IPv4 Components

- Care-of address
  - Address temporarily used by mobile node when it is attached elsewhere
- Foreign agent
  - Device that provides access to care-of address on other networks
- Correspondent node
  - Anybody the mobile node has a connection to

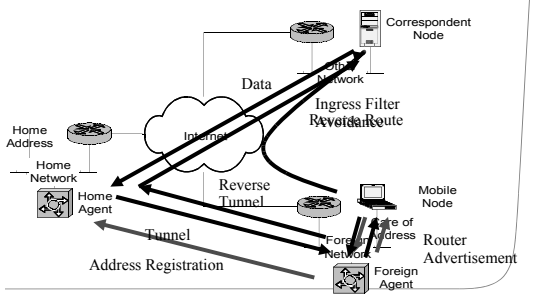
MIPv4 Network



Proceedure

- Home and Foreign Agents send out router advertisements
- Mobile node can detect if it is at home or visiting.
- At home it can use its' home address
- Roaming it must register with the foreign agent to get a care-of address
- Then it must register the care-of address with the Home agent
- Proceedure repeats whenever Mobile node moves

Mobile IPv4



Traffic

- Packets from Correspondent node go to Home agent
- Home Agent tunnels packets to Care of Address via Foreign Agent
- Packets from Mobile node can be
  - Reversed tunneled to the Home agent OR
  - Sent directly to Correspondent node (triangular routing)

Tunneling

MIPv4 Issues

- Mobile Nodes detect movement (i.e. network change) through change of router advertisements.
  - Can be slow – limited by advertisement interval
  - Router advertisements not standard – need Foreign agents on every link
- There may not be many Care-of addresses available
  - Addresses can be NATed from Foreign agent

MIPv4 Issues

- Handover Registrations are a security vulnerability
  - Need strong security associations
- Tunneling has extra overhead – MTU issues
- Home agent is point of failure
- Routing may be inefficient
  - Worst case is communicating with another node on the same remote network

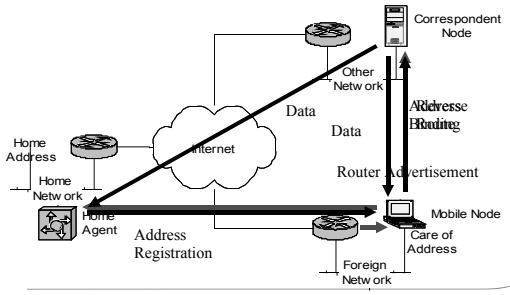
IPv6

- Advantages
  - Lots of address space
  - Standards still being formed when Mobile IP developed
  - Lots of address space
- Problems
  - Same architecture

MIPv6

- No Foreign Agents
  - Lots of addresses.
  - SAA or DHCP
- End host support (Correspondent nodes)
  - Route optimisation
  - Mandatory IPSec
- Better Integration with protocol
  - Less overhead

Mobile IPv6 System



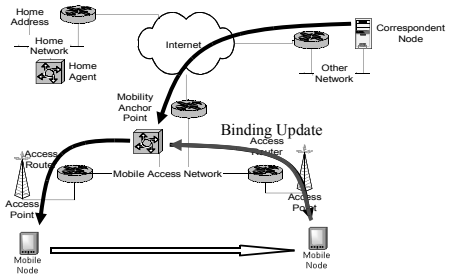
Improving MIPv6

- Hierarchical MIP
  - Manage mobility locally
- Fast Handovers
  - Use routers to help
- NEMO
  - Move whole networks

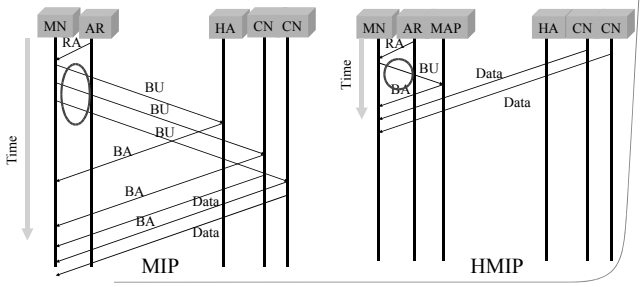
Hierarchical MIPv6

- Mobility Anchor Point acts as local Home Agent
- All handovers in local domain only need to update MAP
- Original Home agent and correspondent nodes receive binding updates with MAP address
- All data goes through MAP to Mobile node
- Reduces handover latency
- Reduces frequency of binding updates to Home Agent and Correspondent nodes

Hierarchical MIPv6



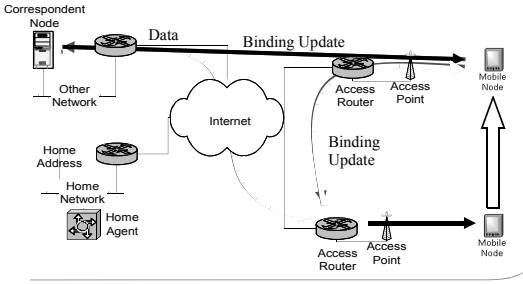
Hierarchical MIPv6 Improvement



Fast Handovers

- MIPv6 has a lot of delays
  - Forming addresses
  - Sending binding update
- Support of routers can reduce packet loss during delays
- Two types depending on whether Layer 2 triggers available

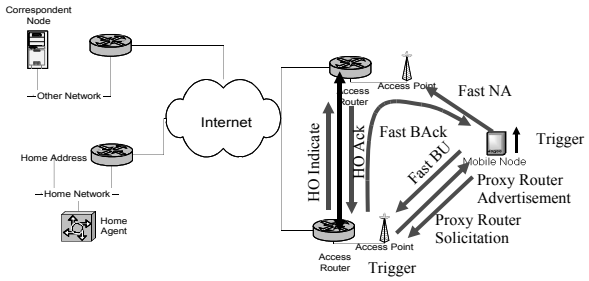
Fast (Reactive) Handovers



Anticipated Handovers

- L3 Handover initiated (prepared for) before L2 network change
- Requires Trigger anticipating handover
  - Most likely from radio L2
  - May be policy as well
  - Needs consistent interface to maintain L2 independence
  - Similar to cellular system
- Either MN or Access Router may initiate handover,

Fast (Anticipated) Handover



NEMO

- NEtwork MObility
- Since IPv6 has lots of addresses can hand out entire network prefixes as Care of addresses.
- Supports mobile planes trains and automobiles.