CN-Advanced
L42

Mobility IP

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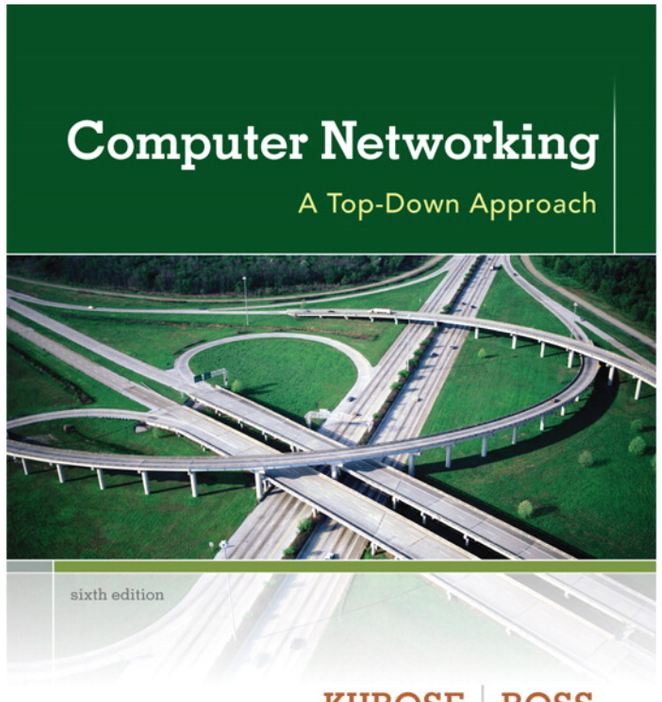
Resources Acknowledgement

Chapter 6
Wireless and Mobile Networks



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Computer Networking: A Top Down Approach
6th edition
Jim Kurose, Keith Ross
Addison-Wesley
March 2012

Mobile IP - RFC 5944

- Mobile IPv4 Requirement
  - Node is able to change its PoA (Point of Attachment)
    - While continuing to communicate
- Possible Mechanisms
  - Node may change its IP Address on PoA change, or
  - Host specific route must be propagated
- Practicality
  - Both of these are often unacceptable
  - First doesn't allow transport layer to work
  - Second one has scaling problem
  - Needs new scalable mechanism

Mobile IP

- Protocol Requirement
  - MN must be able to communicate with others
    - Changes its link layer PoA
    - Doesn't change its IP Address
  - Other (communicating) node need not support mobility features
    - No protocol changes required in other node (CN)

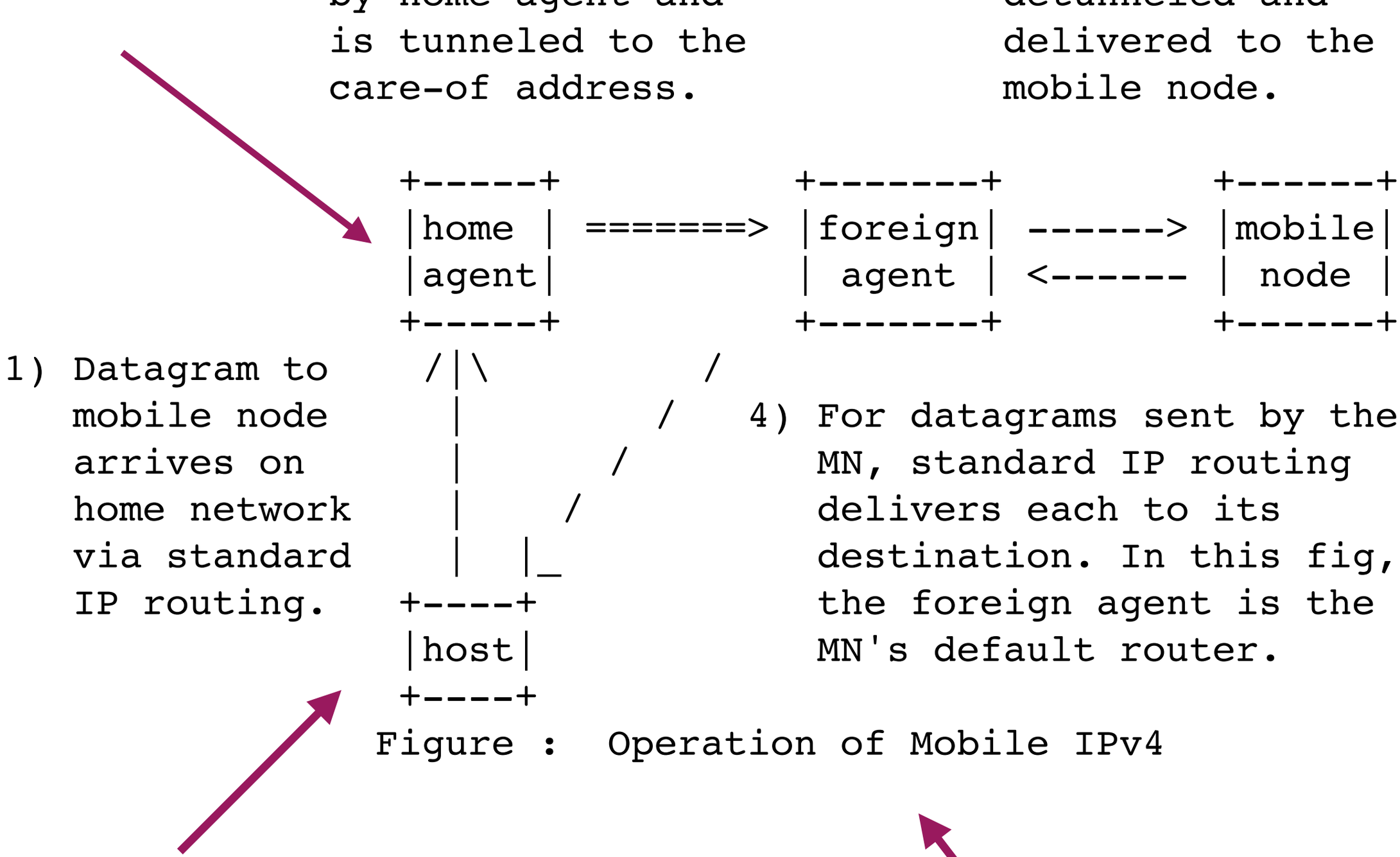
Mobile IP

- RFC 5944: IP Mobility Support (Obsoletes 3944)
- Mobility features requirements:
  - Home agents, Foreign agents,
  - Foreign-agent registration, Care-of-addresses,
  - Encapsulation (packet-within-a-packet)
- Three components of Mobile IP standard:
  - Indirect routing of datagrams
  - Agent discovery
  - Registration with home agent

Mobile IP: Outline of Operation...

2) Datagram is intercepted by home agent and is tunneled to the care-of address.

3) Datagram is detunneled and delivered to the mobile node.



4) For datagrams sent by the MN, standard IP routing delivers each to its destination. In this fig, the foreign agent is the MN's default router.

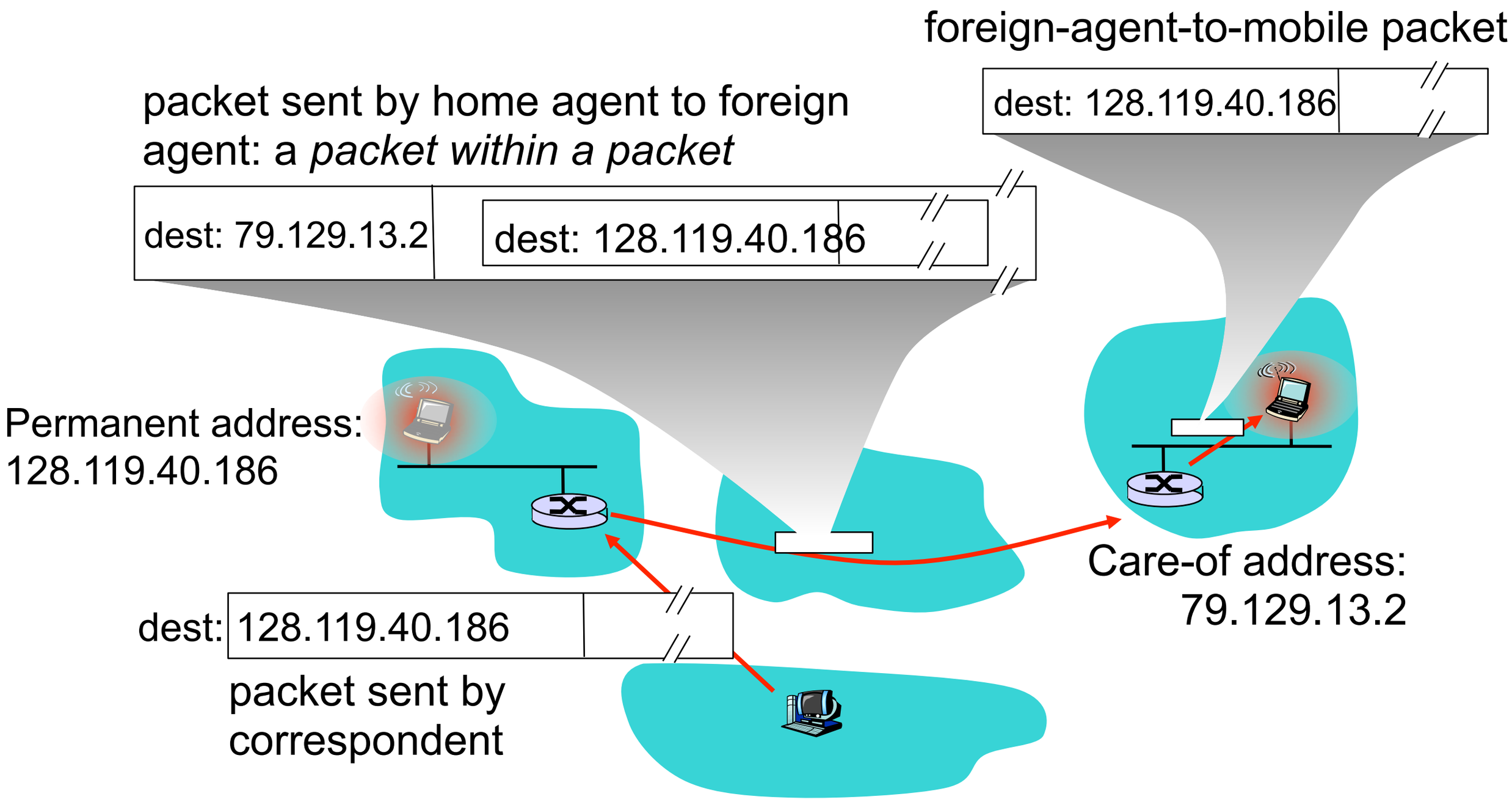
Figure : Operation of Mobile IPv4

src: RFC5944

Mobile IP: Key components

- Agent Discovery
  - Defines protocols used by home or foreign agent
    - Agents advertise its services to mobile users
    - Mobile users can solicit these services
- Registration
  - Protocols to register/de-register mobile node with home/foreign agents
- Indirect Routing
  - How to forward datagrams to mobile nodes
    - Correspondent node to mobile node in Home N/W

Mobile IP: indirect routing



Mobile IP: Outline of Operation

- Mobility Agents advertise their presence
  - Both foreign agents and home agents
  - A mobile node may solicit these advertisement msgs
- Mobile nodes decides if it is home or foreign n/w
- When Mobile node is in Home network
  - Operates without mobility services
  - When returning to Home Network
    - Deregisters with Home Agent
- When Mobile node moves to foreign networks
  - Obtains a CoA (Care of Address)
    - Possibly by FA's Advertisement
    - By external means e.g DHCP

Mobile IP: Outline of Operation...

- MN registers its CoA with its HA
  - Uses registration/reply message
    - Possibly via foreign agent
- Datagrams sent to MN in its home network
  - Intercepted by HA
  - Tunneled by HA to CoA
  - Delivered to Mobile Node
- Datagrams sent by MN
  - Generally sent directly to its destination
  - Uses standard IP routing and not via its HA

Mobile IP: Outline of Operation...

- Tunnel setup between HA and CoA
- CoA
  - Must be a normal IP address
  - Datagrams delivered using conventional IP routing
  - Extracts the original Datagram and delivers to MN
- CoA Acquisition
  - Provided by FA via agent advertisement
    - It is the IP address of FA
    - FA acts as the tunnel endpoint
    - Preferred mechanism
      - No additional IP address requirement

Mobile IP: Outline of Operation...

- CoA Acquisition...
  - Co-Located CoA
    - Acquired by MN itself through external means
      - May be acquired thru DHCP
    - MN associates it with its network interface
    - MN serves as the tunnel end point
  - Advantages of Co-located CoA
    - Does not need Foreign Agent
  - Disadvantages
    - Foreign network needs additional network addresses
      - For assigning to visiting mobile nodes

Mobile IP: Outline of Operation...

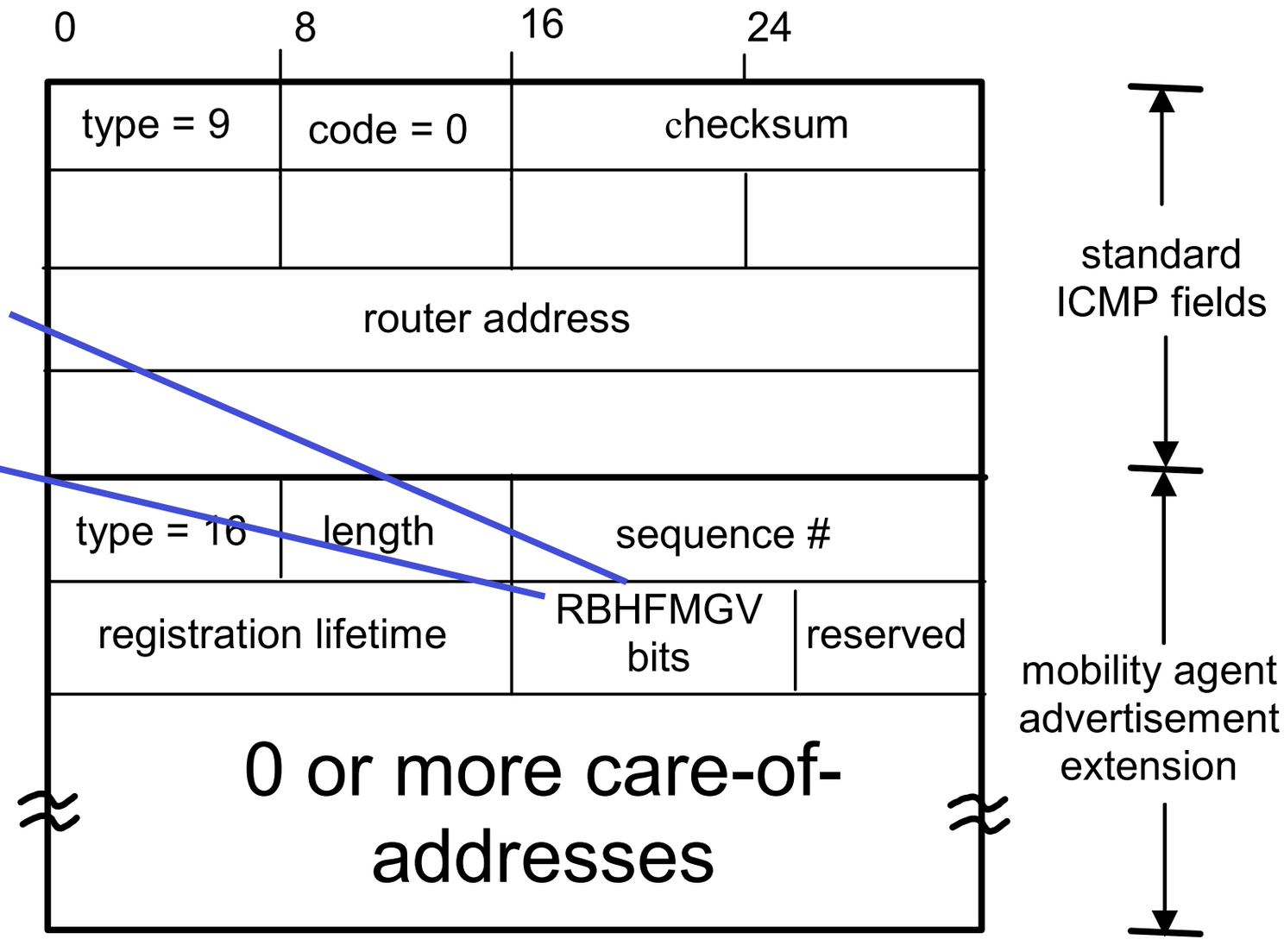
- Distinction between FA and CoA
  - CoA is end of Tunnel
  - FA is mobility agent that provides services to MN
- Functionality of HA
  - Ability to intercept datagrams meant for HA
    - Using proxy and gratuitous ARP
    - Should have n/w interface on the home addr of MN

Mobile IP: agent discovery

- *Agent advertisement:* foreign/home agents advertise service by broadcasting ICMP messages (typefield = 9)

H,F bits: home and/or foreign agent

R bit: registration required



Mobile IP: agent discovery

- Flag Bits
  - B - Agent is busy, can't take any more registrations
  - H - identifies agent as home agent
  - F - identifies agent as foreign agent
  - R - registration of mobile node required with FA
  - M - Minimal encapsulation supported
  - G - GRE Tunnel
  - r - reserved
  - T - foreign agent supports reverse tunneling
  - X - mobile node support registration revocation

Mobile IP: agent discovery

- Agent Solicitation
  - Mobile node does not want to wait for router advt.
  - TTL is set to 1
  - Similar to ICMP Router solicitation
    - ICMP Type = 10
  - Must be implemented by a mobile node
  - Used when CoA can't be determined thru link layer
  - Initial rate: max rate of 1 per sec up to 3 solicitations
    - Rate reduced subsequently using exponential binary backoff

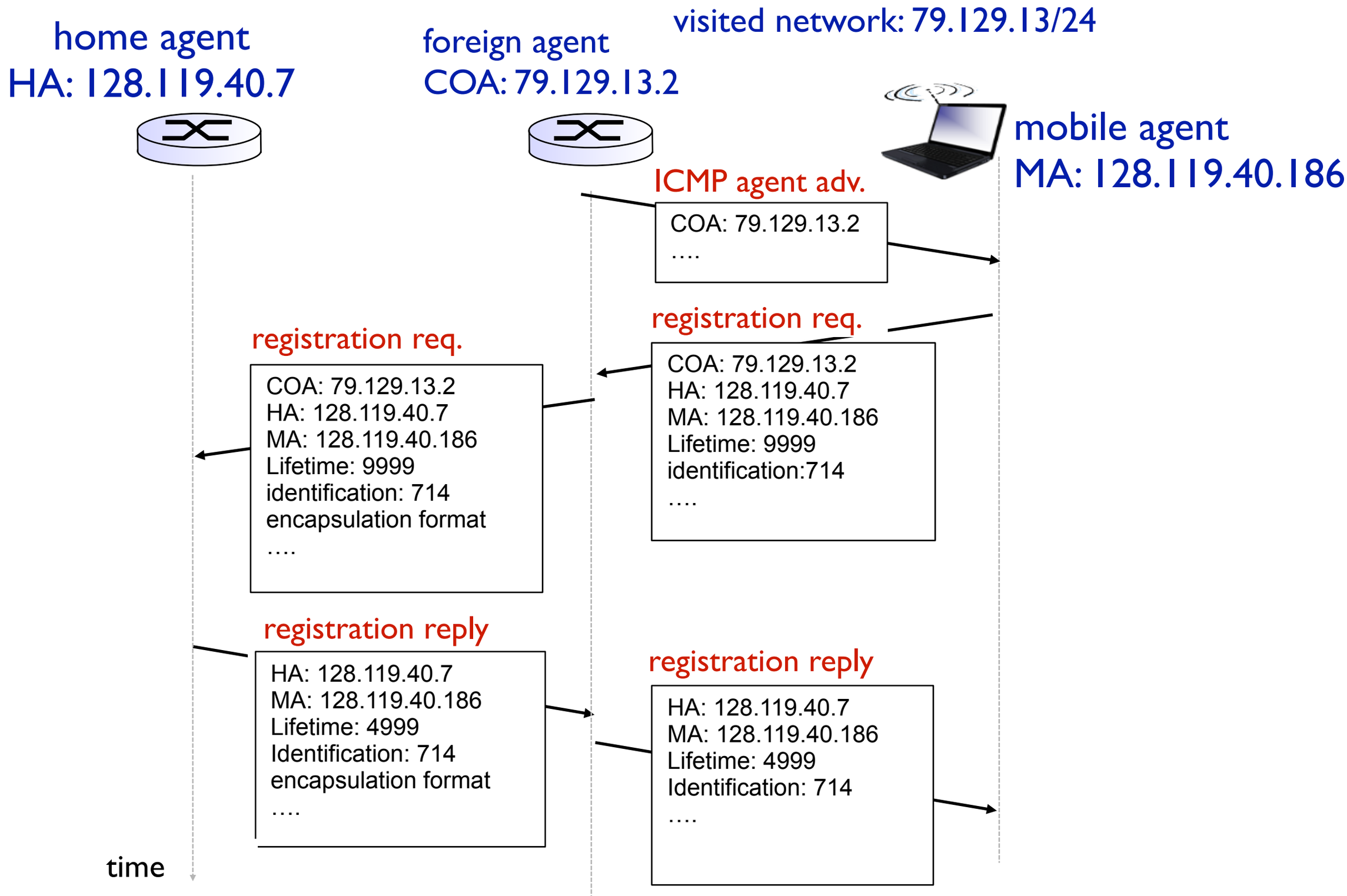
Mobile IP: Move Detection

- Move Detection by Mobile Agent
- Algo 1
  - Use of lifetime value in registration msg.
  - Time expires and no registration renewal
- Algo 2
  - Use of network prefixes
  - When new agent advt. has different n/w prefixes
  - Implies node movement
- Mobile node should do registration with new agent
- Returning home
  - When receive agent advertisement from home agent
  - De-registers with home agent

Mobile IP: Registration

- Registration overview
  - When using FA's CoA
    - Register via that CoA (i.e. FA)
  - When using Co-located CoA, but receives agent advt. with R bit set
    - Register via that FA
  - When using co-located CoA otherwise
    - Register directly with HA
  - When returned to home network
    - Deregister with HA
- Registration messages
  - Registration request and registration reply
- Example: next slide

Mobile IP: registration example



Mobile IP: Routing

- Encapsulation
  - Must support
    - IP in IP (RFC 2003)
  - Alternative encapsulations
    - Minimal encapsulation within IP: RFC 2004
    - GRE tunnel: RFC 2784

Mobile IP: Routing at Mobile Node

- Receiving broadcasts
  - HA will send Broadcast when MN specifies so during registration
- Receiving Multicasts
  - MN joins the multicast group in foreign network
  - MN sets up bi-directional tunnel

Summary

- Mobility
- Vocabulary:
  - Home network, Visited network, permanent address,
  - Home agent, Foreign agent, Care of Address, Correspondent
- Routing: Indirect and Direct
- Mobile IP
- Tunneling
- Colocated Care of Address.