Mobile IP

FEUP

Manuel P. Ricardo

Faculdade de Engenharia da Universidade do Porto

Mobile IP, v4

Motivation

- Forwarding of IP datagrams
  - Based on IP destination address
  - IP network address ←→ physical network
  - Changing network➔ changing IP address

- Possible mobility solution
  - » Register new IP address at the DNS server
  - » Problems
    - DNS update takes long time
    - TCP connections broke

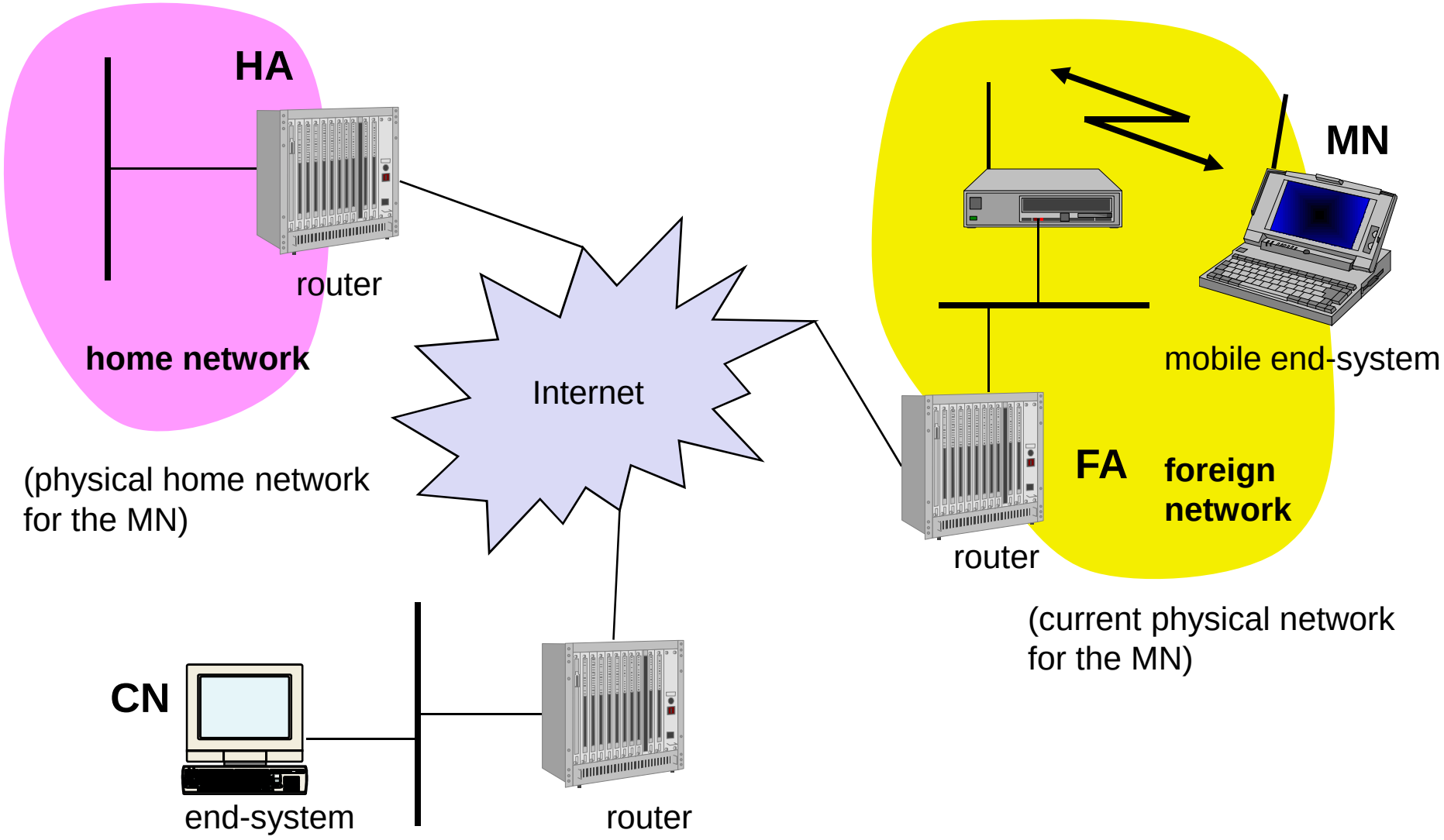
      (source-ip, source-port, destination-ip, destination-port)

Mobile IPv4

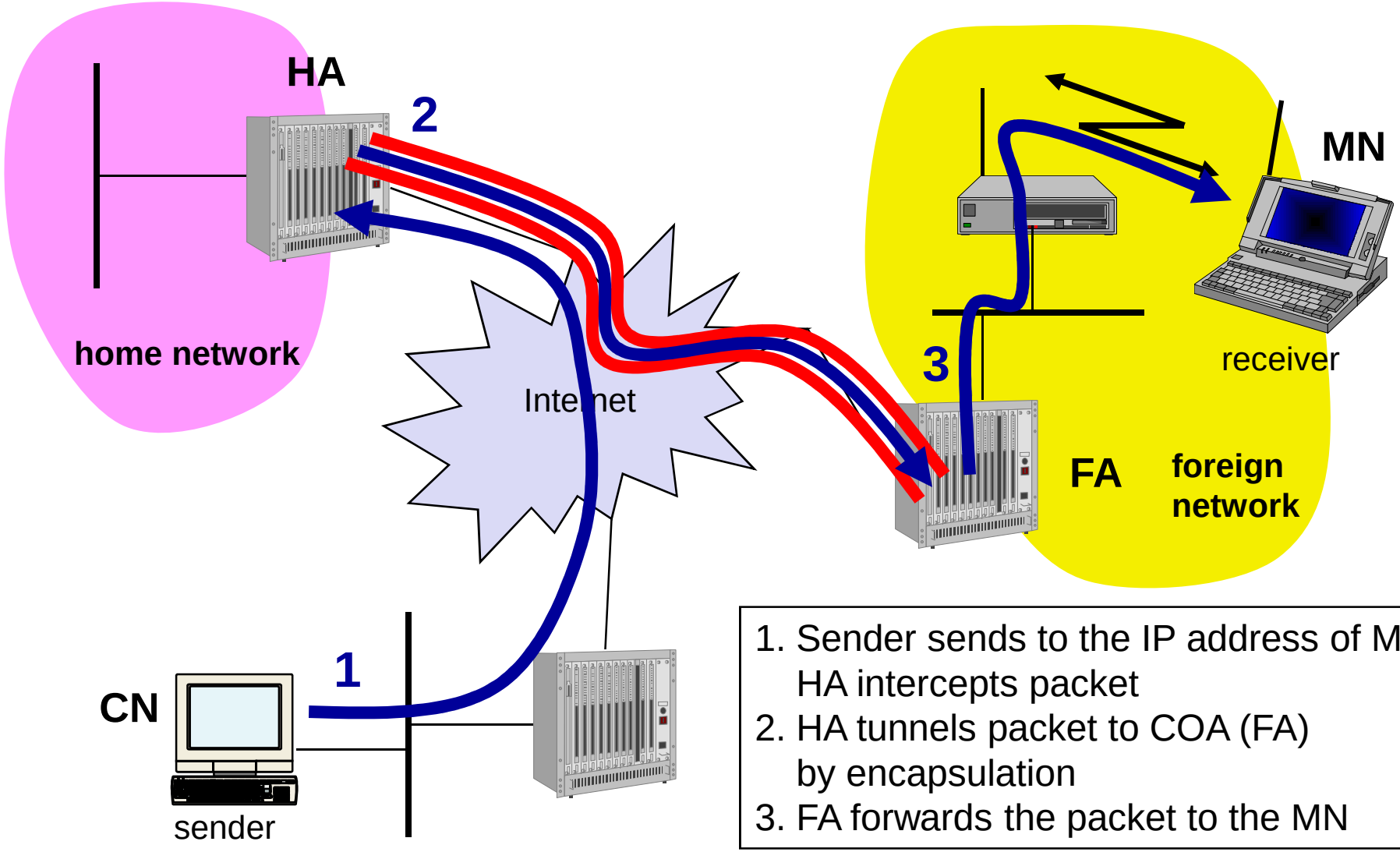
- Characteristics
  - Point of attachement to the network can be changed
  - Host maintains its IP address while it moves
  - Existing routers are not modified

- Terminology
  - » MN, Mobile Node
  - » HA, Home Agent, registers MN location
  - » FA, Foreign Agent, agent at the visited network
  - » COA, Care-of Address, IP address at the visited network
  - » CN, Correspondent Node, host which communicates with the MN

Example

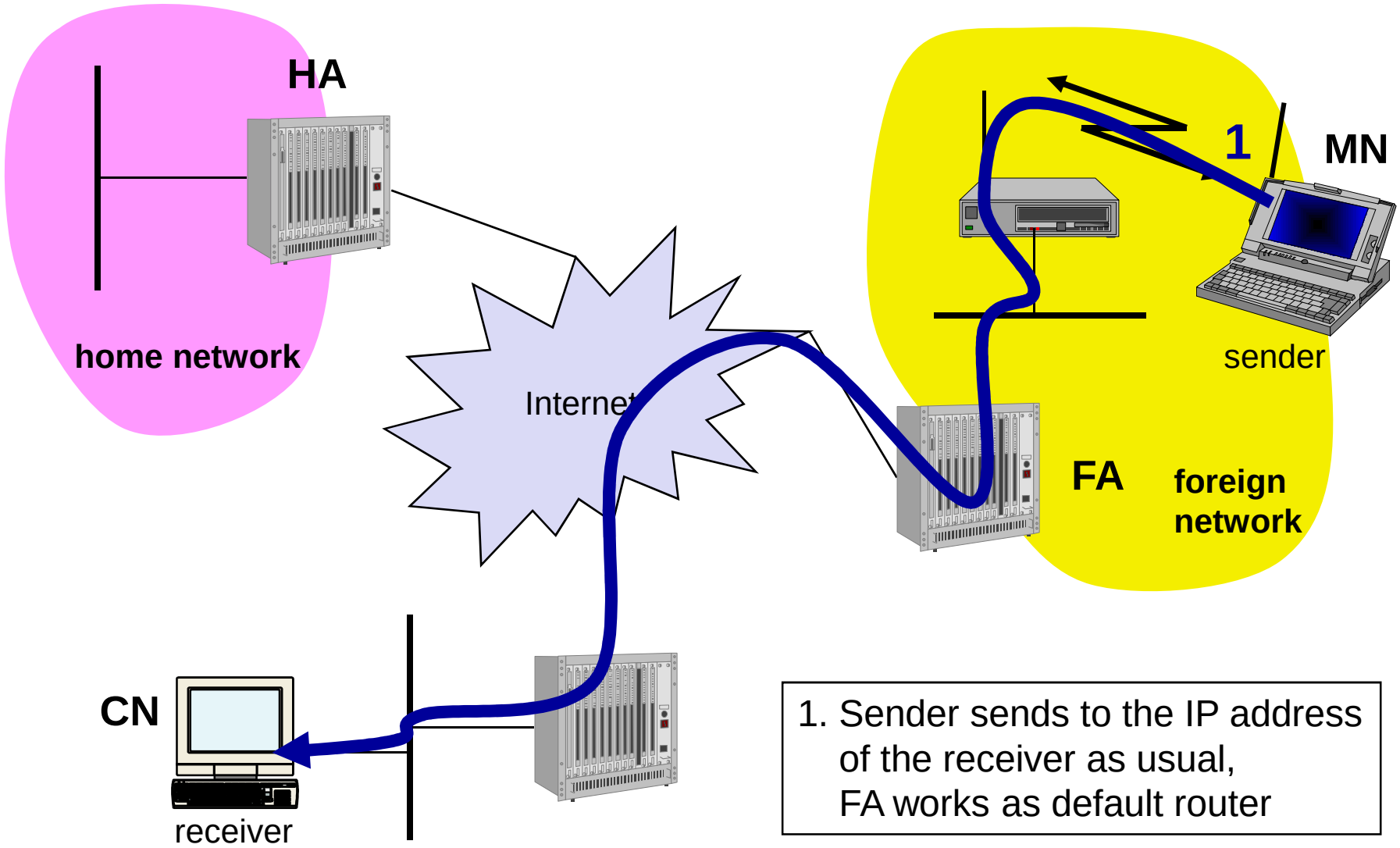

HA
router
home network
(physical home network
for the MN)
Internet
MN
mobile end-system
FA
foreign
network
router
(current physical network
for the MN)
CN
end-system
router

Data Transferred to the MN



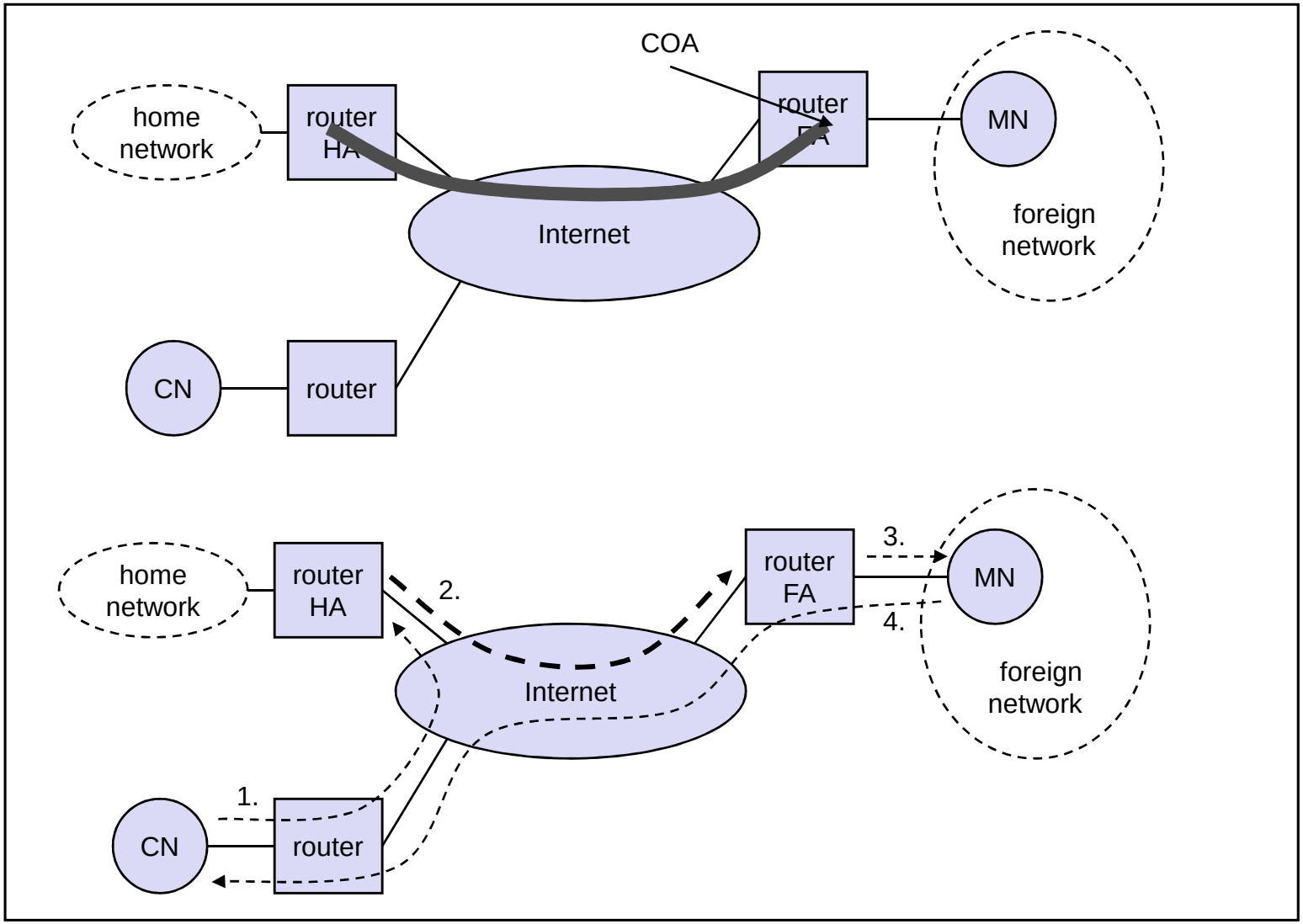
1. Sender sends to the IP address of MN, HA intercepts packet
2. HA tunnels packet to COA (FA) by encapsulation
3. FA forwards the packet to the MN

Transferência de Dados do MN



1. Sender sends to the IP address of the receiver as usual, FA works as default router

Mobility Phases



Comunication MN - Agents

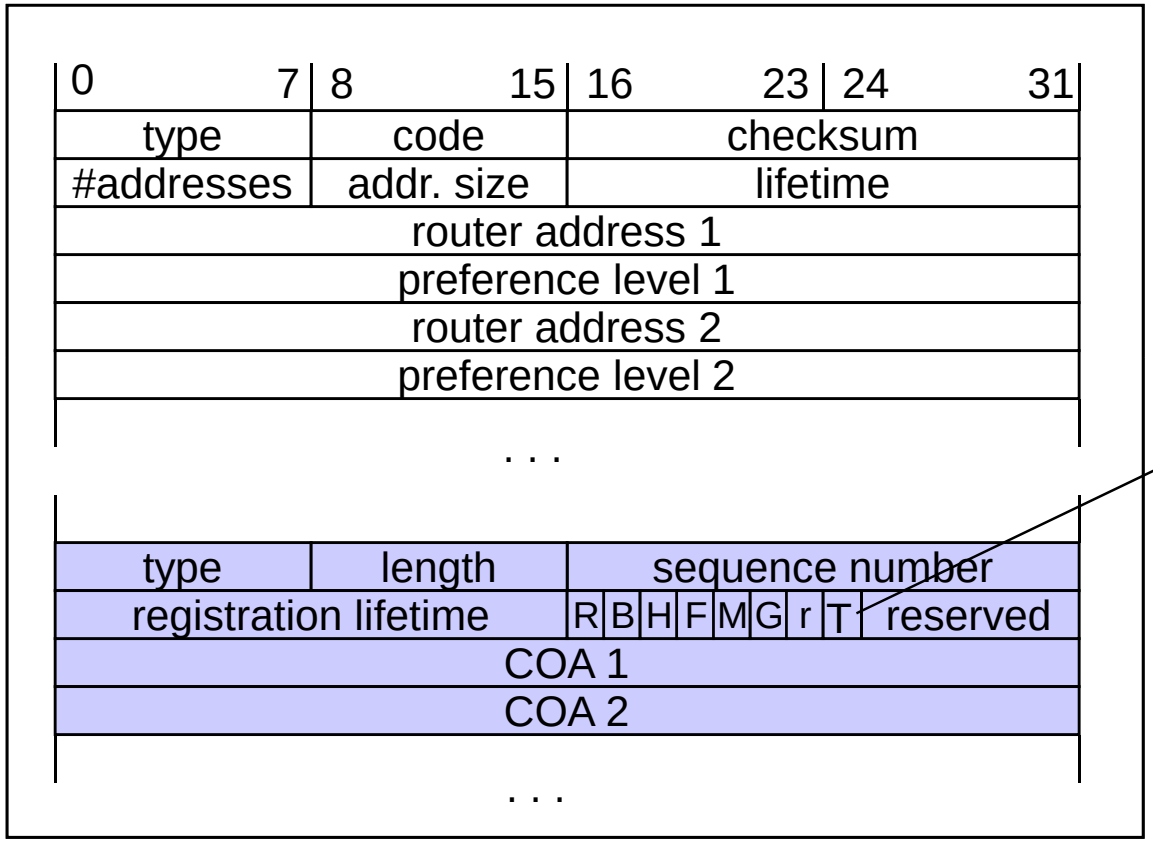
- MN discovers the network
  - » Mobility agents send regularly messages to their networks

    ICMP Router Advertisment Protocol (RFC 1256) messages
  - » MN listens to the messages; decides about the networks
    - – Its home network, or
    - – A visited networks → also gets a CoA

- When the MN visits a network
  - » In the visited network
    - – MN sends COA to HA (via FA) → new location registered at the HA
  - » In the home network
    - – HA assums the MN IP address
    - – Packets destined to MN

      are intercepted by HA and tunnelled to the MN (CoA address)

ICMP Router Advertisment Messages – Mobility Extension



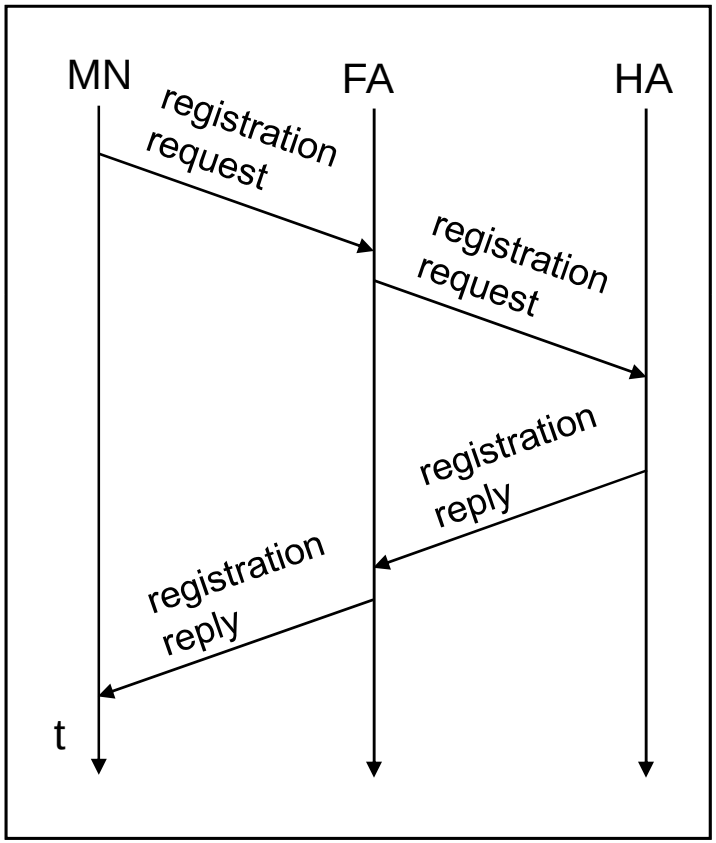
R – registration required
B – FA busy
H – agent is HA
F – agent is FA
M – minimal encaspulation accepted
G – GRE encapsulation accepted
r – not used
T – FA supports reverse tunneling

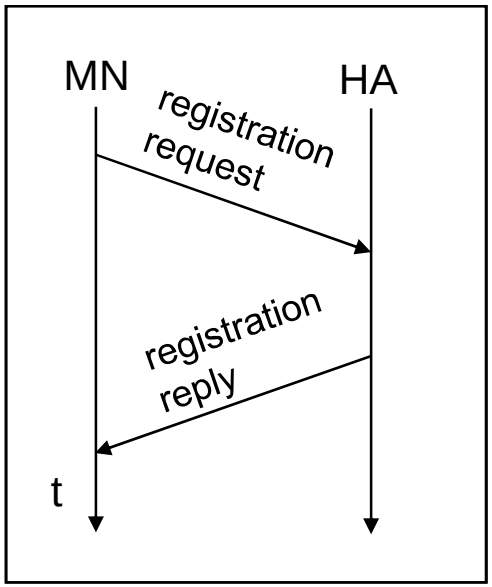
Message sent by mobility agents (HA and FA)

To think about

- Can we remove the Foreign Agent from MIPv4? What are the consequences of it?

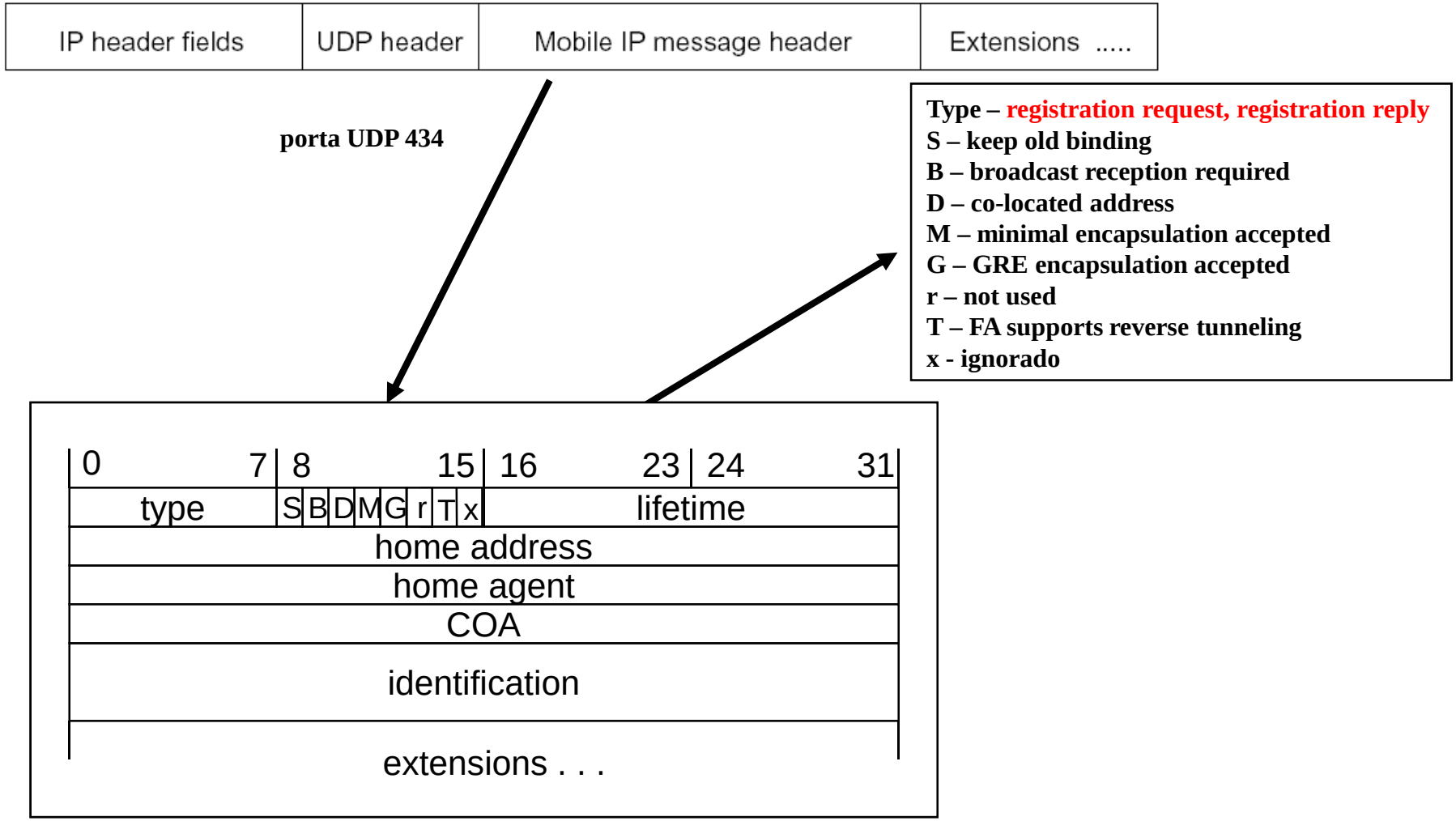
MN registers in the Home Agent



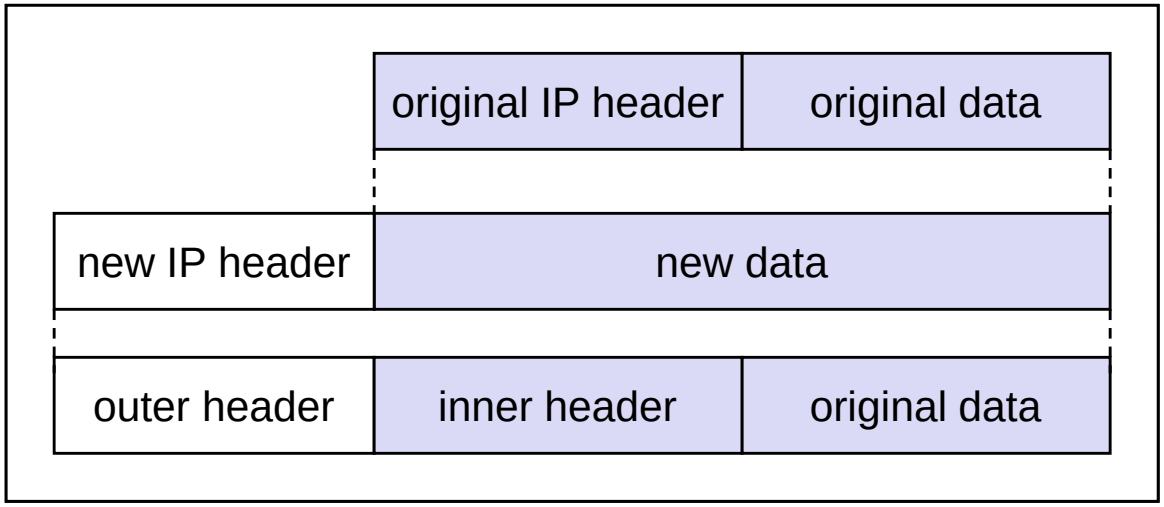


- **Co-located address**
- **Tunnel will end at the MN**
- **Address obtained by DHCP, for instance**

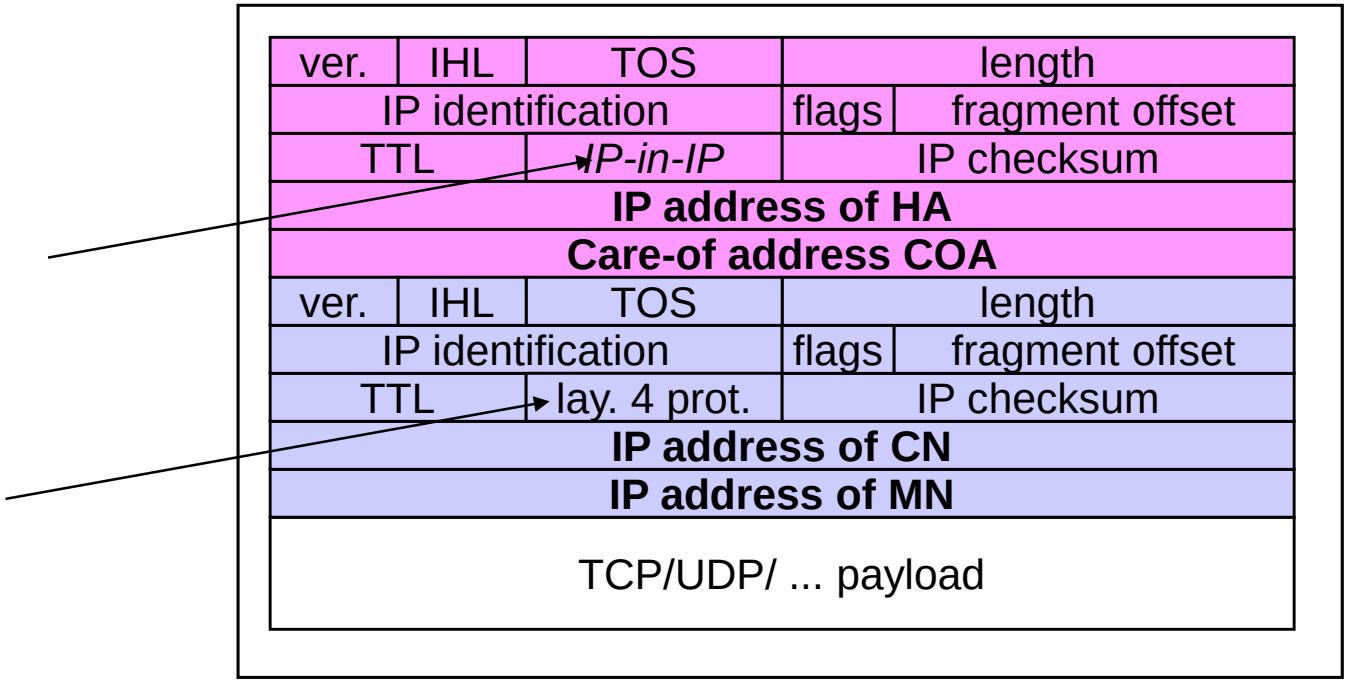
Register Messages



Encapsulation, Tunnels



IP em IP (mandatory)

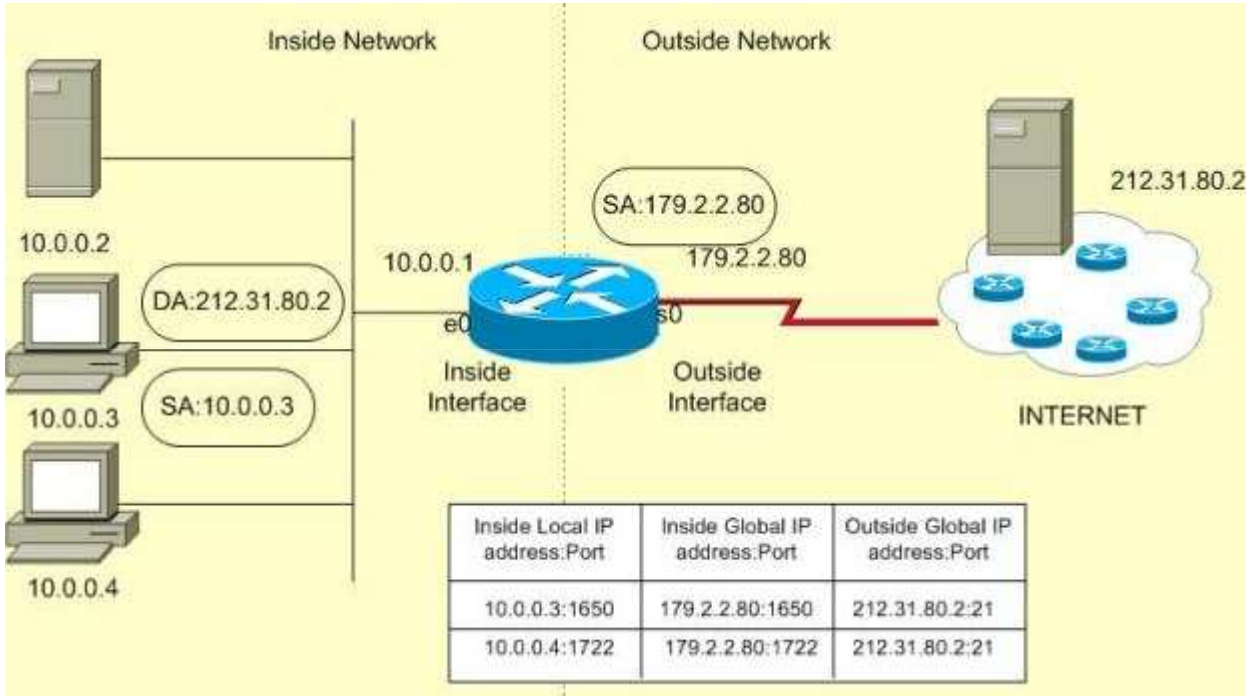


Tunnel HA → COA

To think about

- What is NAT (Network Address Translation)?

NAT – Network Address Translation



Inside Local IP address:Port	Inside Global IP address:Port	Outside Global IP address:Port
10.0.0.3:1650	179.2.2.80:1650	212.31.80.2:21
10.0.0.4:1722	179.2.2.80:1722	212.31.80.2:21

To think about

- Does MIPv4 work when MN has a private CoA address?

Mobile IP, v6

Mobile IPv6 Móvel – Working Principles

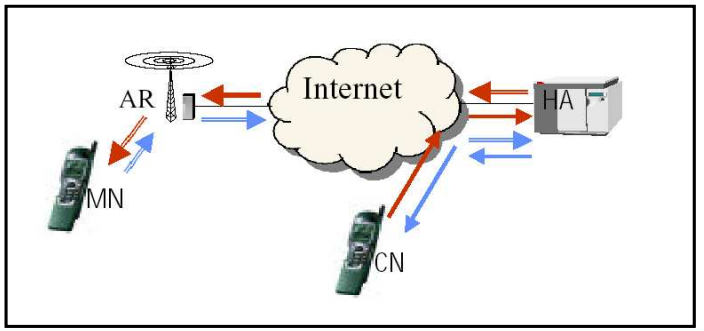
- Differences to MIPv4
  - » No *ForeignAgent*
  - » Regsistration signalling **(HomeAddress ←→ CareOfAddress)**
    - – Sent as an IPv6 extension header → *Mobility Header*
    - – B*inding* relations (**HomeAddress ←→ CareOfAddress**) also stored in CNs

- *Binding* messages
  - » *BindingUpdate*
    - – MN informs HA/CN about *CareOfAddress*
  - » *BindingAcknowledgement*
    - – Received by MN. Confirms *BindingUpdate*
  - » *BindingRefreshRequest*
    - – Sent by HA/CN. Asks MN to refresh the *binding*

Register Operation

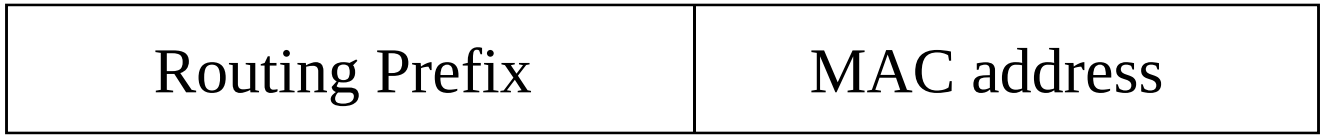
- Register ← Node moves to the visited network
  - Autoconfigures new address, in the visited network (next slide) → *CareOfAddress*
  - *CareOfAddress* prefix == prefix in the visited network
  - MN registers COA in HA → IPv6 packet with *BindingUpdate* (mobility extension)
  - HA registers MN. Sends *BindingAcknowledgment*

- Tunnel between MN e HA
  - HA, in home network
    - intercepts packet to MN
    - sends packet to registered *CareOfAddress*; by tunnel
  - MN
    - Sends packet in tunnel to HA



Autoconfiguration of CoA, in the visited network

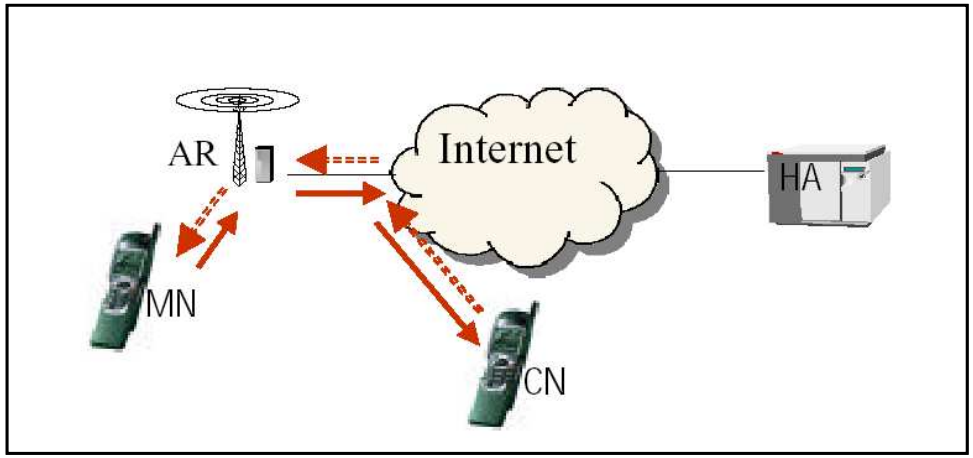
- MN
  - » Listens to *RouterAdvertisment* messages
    (up to 50 msg/s)
    - – Determines network address
  - » Builds address, in the visited network: the *CareOfAddress*



- DHCPv6 can be used in alternative for the MN to get CoA

Route Optimization

- When MN receives a tunnelled packe
  - » it sends *BindingUpdate* to CN
- HomeAddress ←→ CareOfAddress binding
  - – also at the CN
- Packets exchanged directly between MN and CN



Route Optimization

- Packets in the direction CN → MN
  - » CN
    - – Before sending packet to MN → reads binding cache
    - – If there is no entry for the MN → sends packet as usual
    - – If there is an entry
      - > Sends packet to *CareOfAddress* (IP destination address = *CareOfAddress*)
      - > Add to packet a *RoutingHeade*r with 2 hops (list of addresses to visit)
        - • 1º hop → CareOfAddress; 2º hop → HomeAddress of MN
  - » MN
    - – receives packet in CareOfAddress (co-located address)
    - – Forwards the packet to itself
- Packets in the direction MN → CN
  - – Source address = *CareOfAddress*
  - – Inclusion of *DestinationHeader* with information about *HomeAddress*
  - – CN receives packet and fills packet source address with *HomeAddress* received
    - > In order to put this information in the socket structure → *HomeAddress*

Routing Header – Packet Forwarding
Packet Sent from S to D, through I1, I2, I3

As the packet travels from S to I1:

Source Address = S	**Hdr Ext Len = 6**
Destination Address = I1	**Segments Left = 3**
	Address[1] = I2
	Address[2] = I3
	Address[3] = D

To remember ….

As the packet travels from I1 to I2:

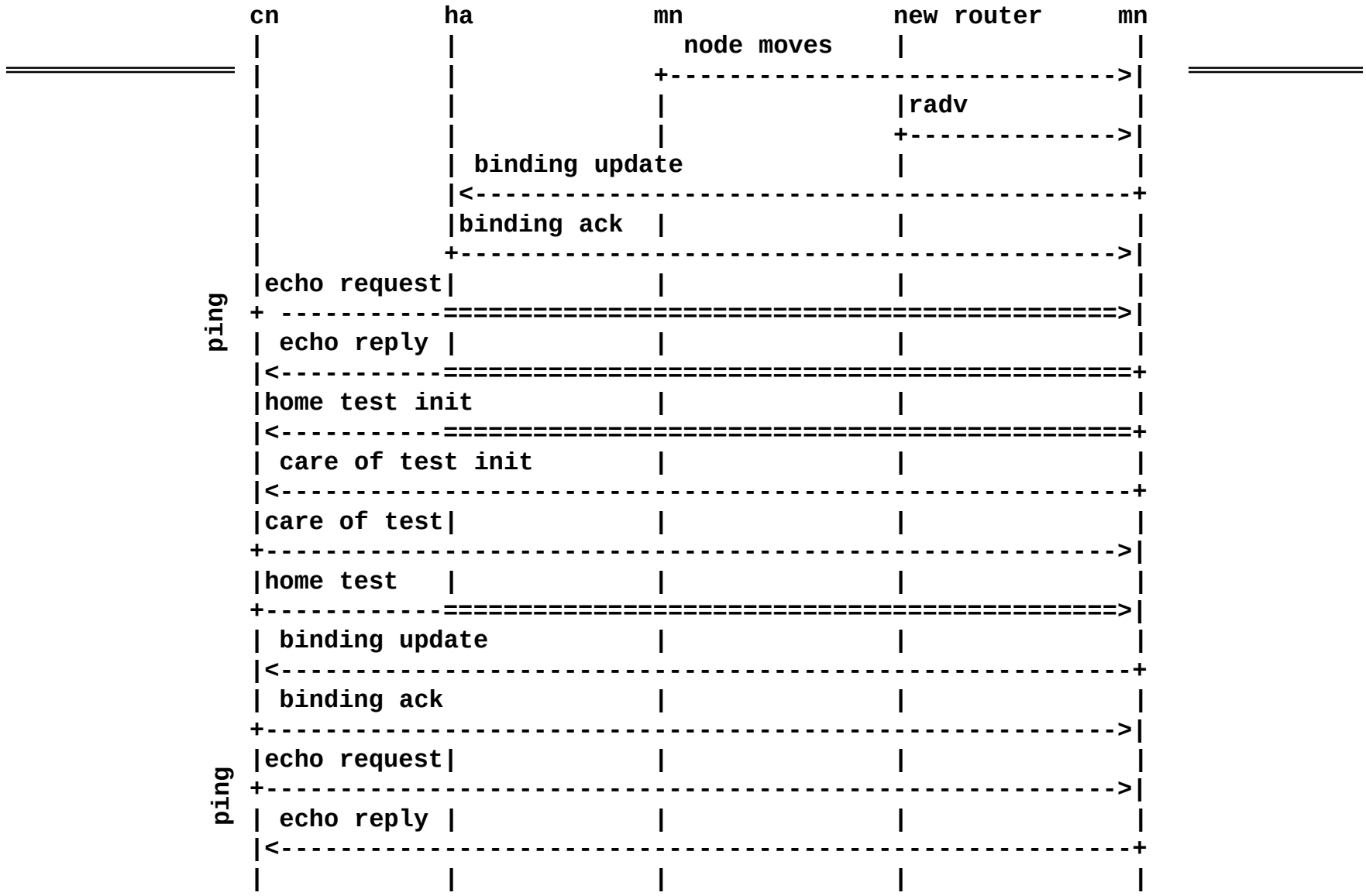
Source Address = S	**Hdr Ext Len = 6**
Destination Address = I2	**Segments Left = 2**
	Address[1] = I1
	Address[2] = I3
	Address[3] = D

As the packet travels from I2 to I3:

Source Address = S	**Hdr Ext Len = 6**
Destination Address = I3	**Segments Left = 1**
	Address[1] = I1
	Address[2] = I2
	Address[3] = D

As the packet travels from I3 to D:

Source Address = S	**Hdr Ext Len = 6**
Destination Address = D	**Segments Left = 0**
	Address[1] = I1
	Address[2] = I2
	Address[3] = I3


cn
ha
mn
new router
mn
node moves
radv
binding update
binding ack
ping
echo request
echo reply
home test init
care of test init
care of test
home test
binding update
binding ack
ping
echo request
echo reply