Network-based Global Mobility Management (GMM)

Sangjin Jeong
ETRI
2007. 7. 10.
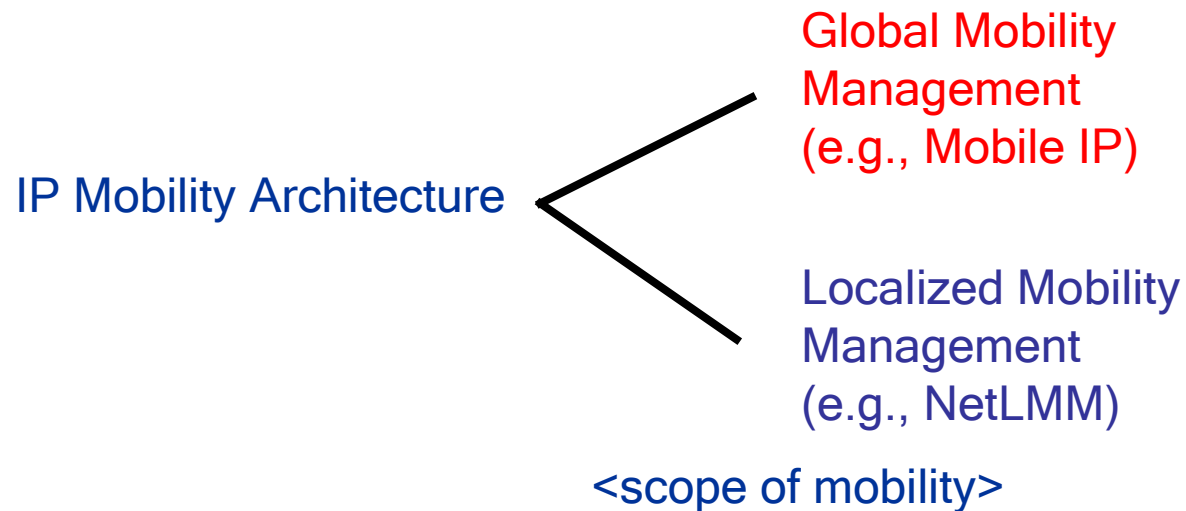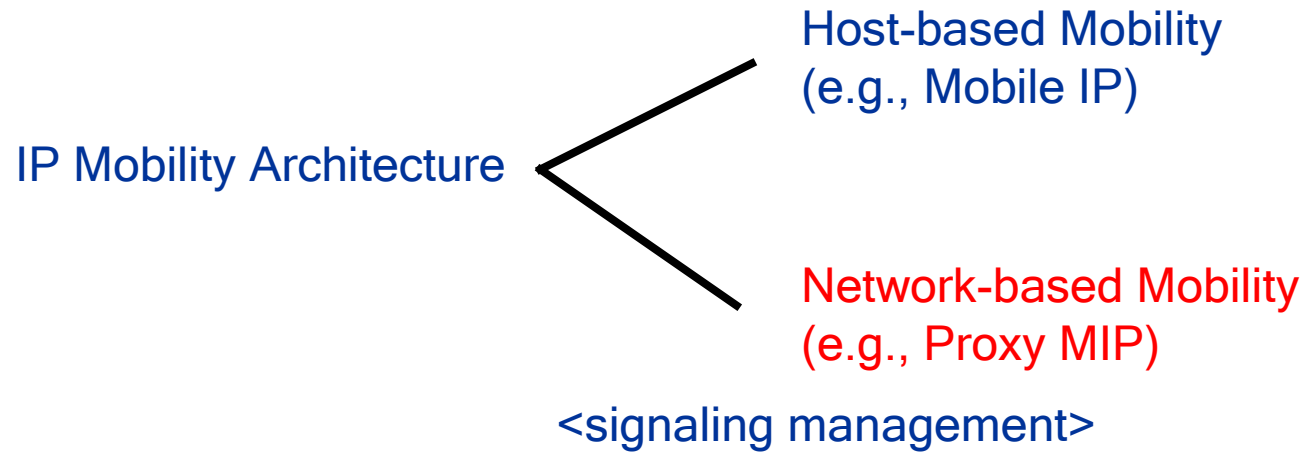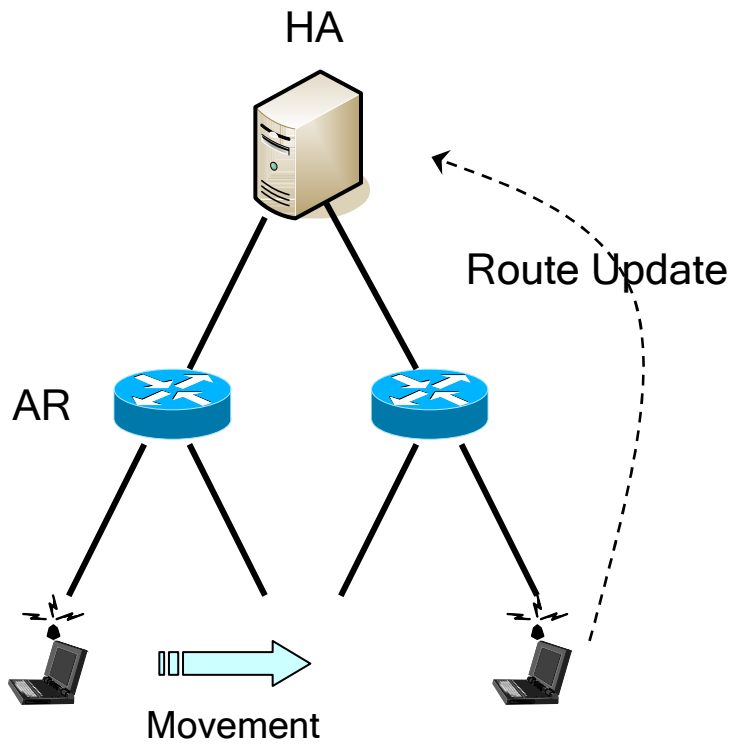**\<sjjeong@etri.re.kr\>**

ETRI

Goals of this presentation

❑ **Objectives**

- Investigate the essential requirements of network-based Global Mobility Management (GMM)
- Propose Route Optimization (RO) solution for network-based Global Mobility Management

2

Backgrounds (1/3)

Host-based Mobility
(e.g., Mobile IP)

IP Mobility Architecture

Network-based Mobility
(e.g., Proxy MIP)

<signaling management>

Global Mobility
Management
(e.g., Mobile IP)

IP Mobility Architecture

Localized Mobility
Management
(e.g., NetLMM)

<scope of mobility>

3

Host-based Mobility

Network-based Mobility

CN

Internet

Access Network (or ISP) 1

Access Network (or ISP) 2

AR

AP

MN

Intra-link (Layer 2) Mobility

Local Mobility

Global Mobility

L2 Mobility

NetLMM

5

MIP
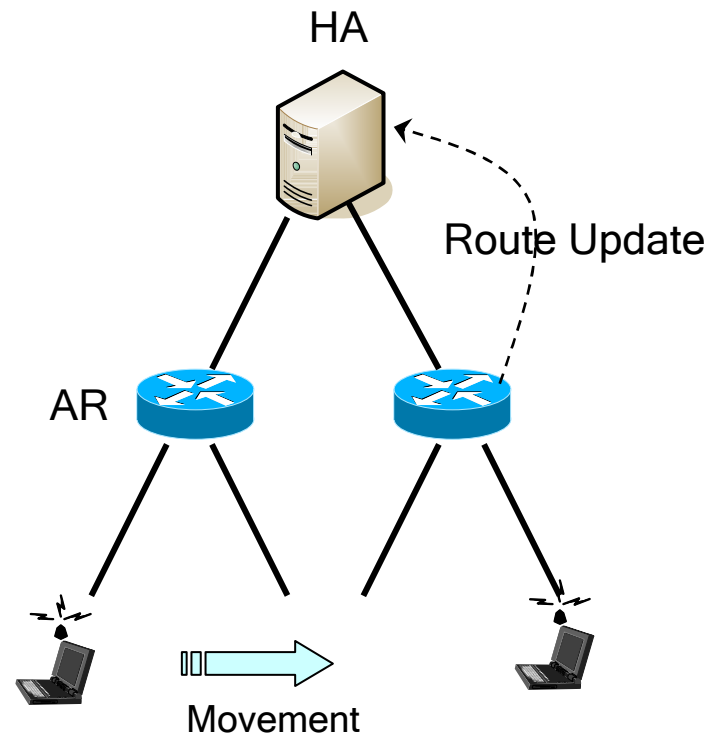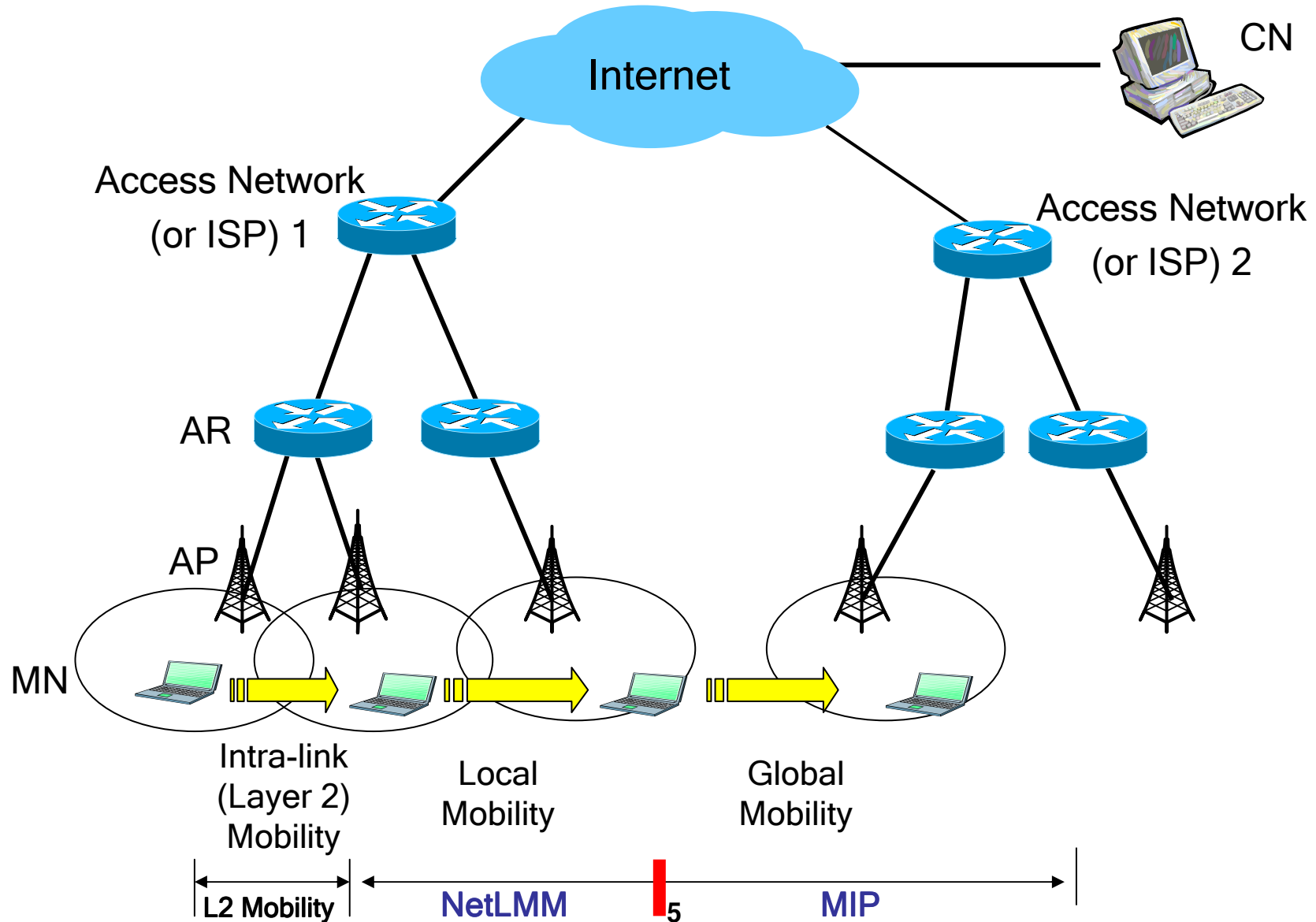
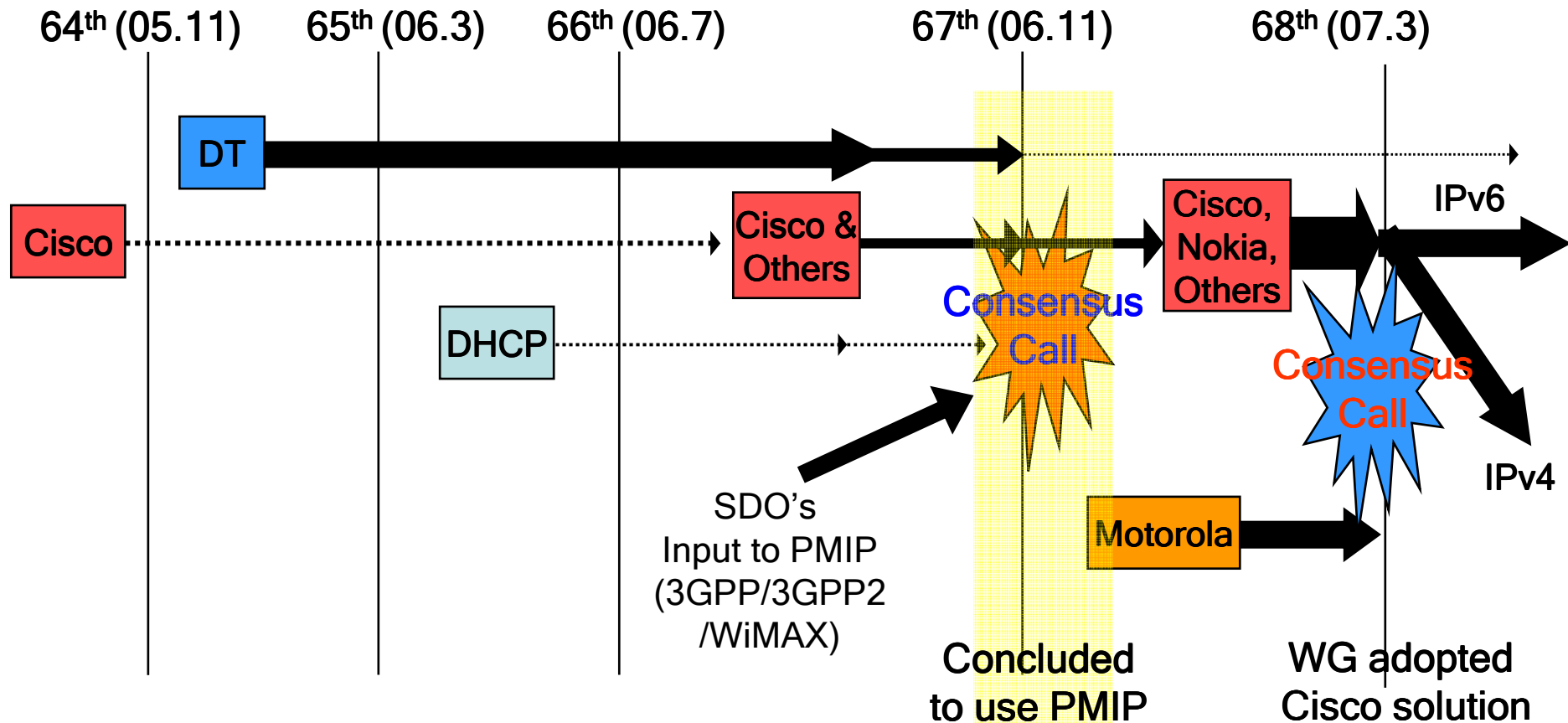# Reasons to network-based mobility support

❑ During the last decade, host-based mobility management approach was the primary solution for IP mobility management

❑ Mobile IPv6 [RFC3775] and Mobile IPv4 [RFC 3344] are the enabler for IP mobility
- Mobile IP client functionality in the mobile node's IP stack
- Binds mobile node's home address and care-of-address through signaling between the mobile node and home agent
- There exist a number of mobile nodes without Mobile IP functionality
- It is desirable to support IP mobility for all hosts irrespective of the presence or absence of mobile IP functionality in the IP stack

❑ IETF NetLMM (Network-base Localized Mobility Management) WG was formed to develop network-based mobility management protocols

❑ Advantages to using a network-based mobility
- Support hosts without any mobility management protocol
- Avoid tunneling overhead over the air

IETF solution for NetLMM

64th (05.11)   65th (06.3)   66th (06.7)   67th (06.11)   68th (07.3)

DT

Cisco

DHCP

Cisco & Others

Consensus Call

SDO's Input to PMIP (3GPP/3GPP2 /WiMAX)

Cisco, Nokia, Others

IPv6

Consensus Call

Motorola

IPv4

Concluded to use PMIP

WG adopted Cisco solution

- ❑ NetLMM DT solution (draft-giaretta-netlmm-dt-protocol) : designed from the scratch
- ❑ Cisco's solution (draft-ietf-netlmm-proxymip6) : Proxy Mobile IPv6 (leverage MIPv6)
- ❑ Motorola's solution (draft-singh-netlmm-protocol)
- ❑ WG Chair (James Kempf, NTT) resigned after 67th meeting → Vidya Narayanan (Qualcomm)
- ❑ WG Chair (Phil Roberts, Motorola) resigned after 68th meeting → Jonne Soininen (Nokia)

7

Goals of Proxy Mobile IPv6

❑ Provide network-based mobility management support to a mobile node within a restricted and topologically localized portion of the network (PMIPv6 domain)

❑ No participation of mobile node in mobility related signaling

❑ Scope of PMIPv6 (LMA & MAG are dual stack)

<PMIPv6 deployment in IPv6 infrastructure>

<PMIPv6 deployment in IPv4 infrastructure>
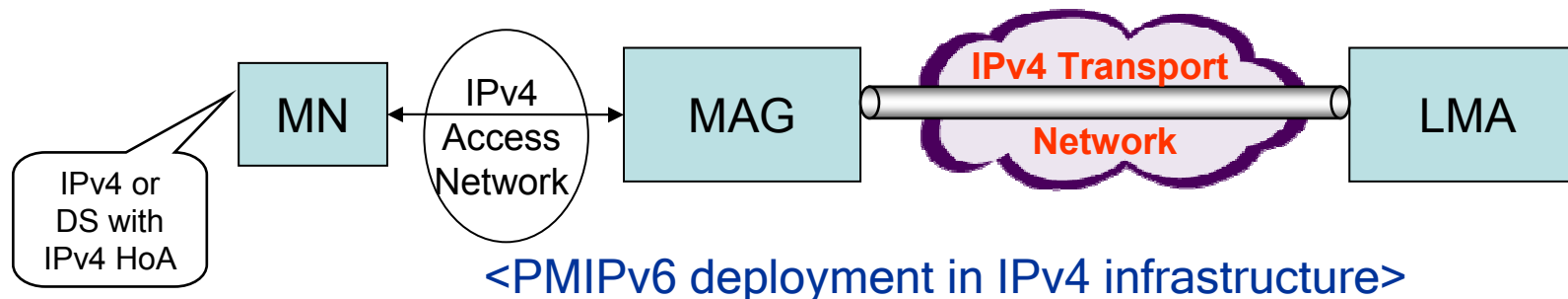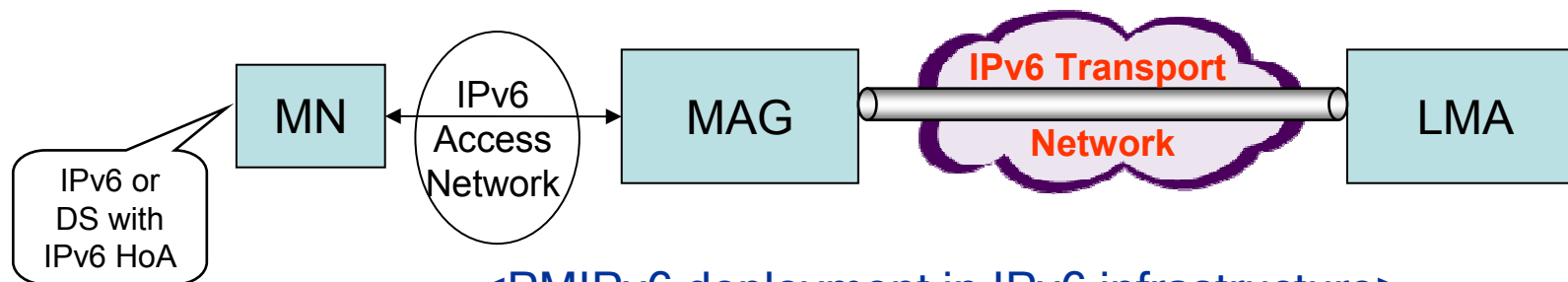
Proxy Mobile IPv6 terms

❑ LMA (Local Mobility Anchor)

- Entity that maintains the current IP location of the mobile node (home agent in MIP6)

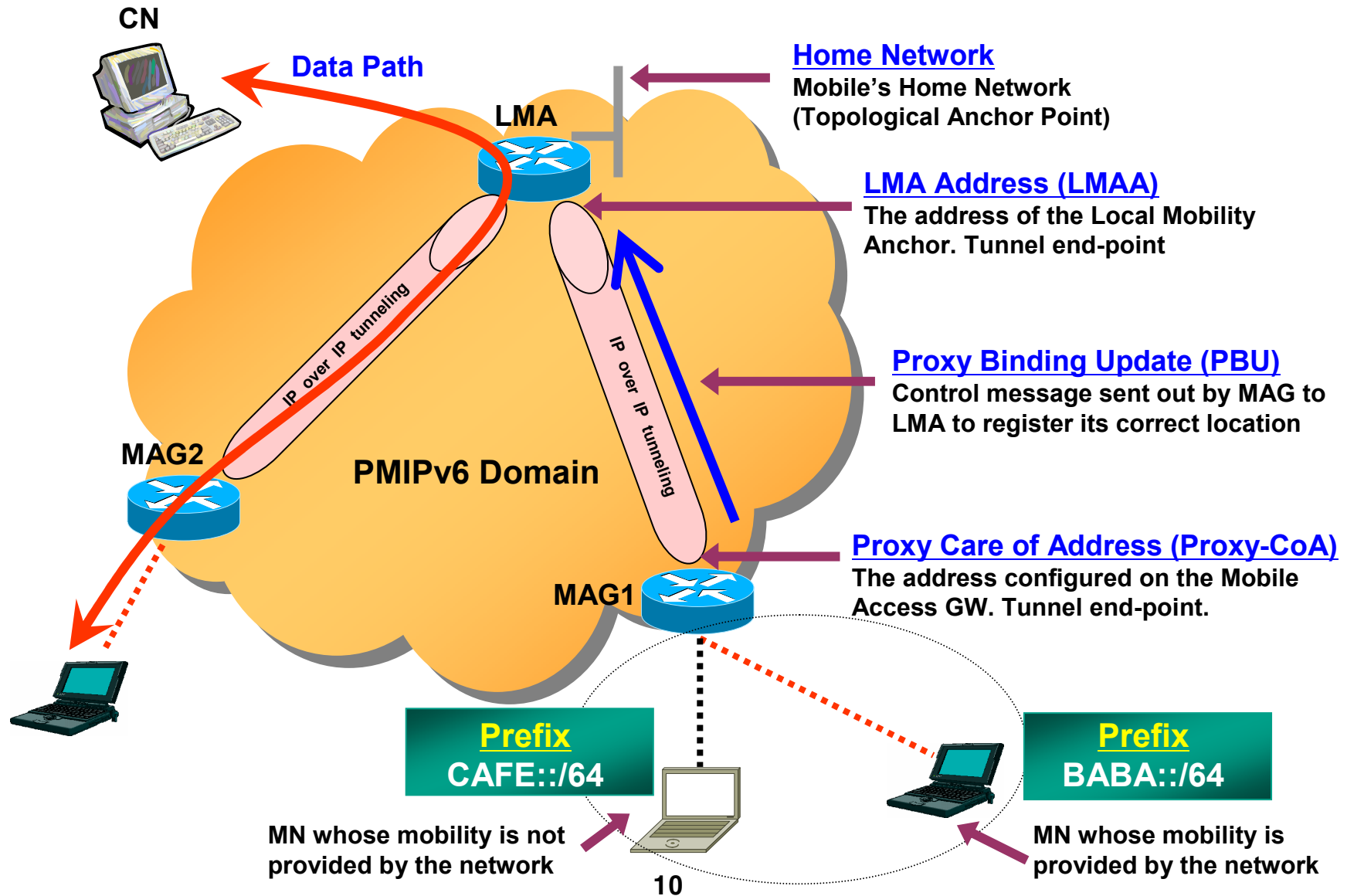❑ MAG (Mobile Access Gateway)

- Entity that signals the mobile node's location the the LMA

❑ Concept of PMIP6 domain

- Typically denotes scope of an LMA

- IP address of mobile nodes remain the same within the domain

Proxy Mobile IPv6 architecture

CN

Data Path

LMA

Home Network
Mobile's Home Network
(Topological Anchor Point)

LMA Address (LMAA)
The address of the Local Mobility Anchor. Tunnel end-point

IP over IP tunneling

IP over IP tunneling

Proxy Binding Update (PBU)
Control message sent out by MAG to LMA to register its correct location

MAG2

PMIPv6 Domain

Proxy Care of Address (Proxy-CoA)
The address configured on the Mobile Access GW. Tunnel end-point.

MAG1

Prefix
CAFE::/64

Prefix
BABA::/64

MN whose mobility is not provided by the network

MN whose mobility is provided by the network

10

Motivation for network-based GMM

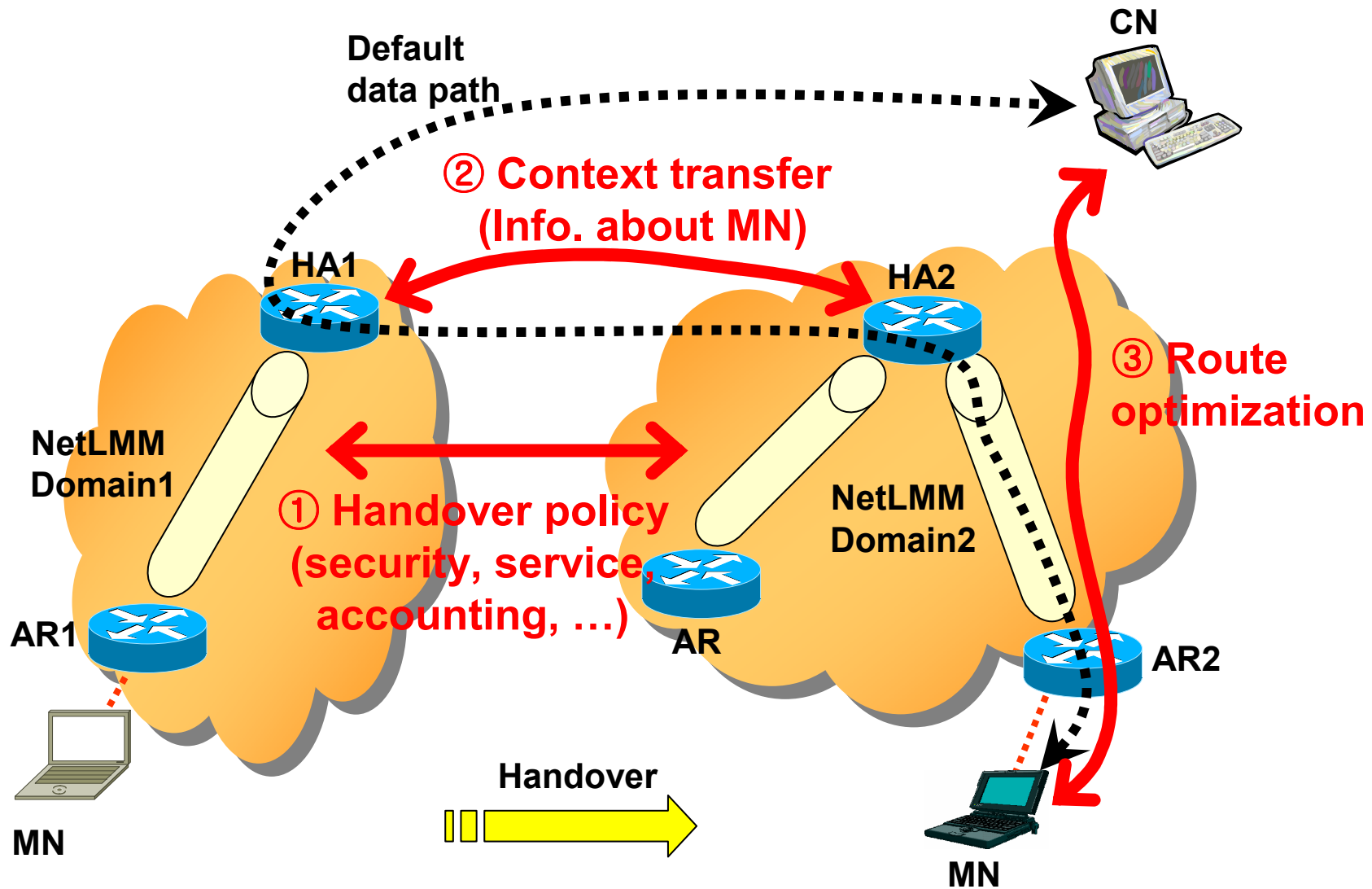❑ Mobile nodes w/o mobility management protocols can roam over global Internet
  - Heavy burden for lightweight mobile nodes to do MM signaling

❑ Easy to support both IPv6 and IPv4 nodes
  - Current GMM protocols (MIPv4, MIPv6) are not easy to simultaneously support both IPv4 and IPv6 nodes

❑ ISPs may not want hierarchical two-level mobility
  - MIP for GMM, PMIP for LMM

❑ Scope of global mobility management
  - Global MM : MM handling movements on a global basis (i.e. handover between administrative domains)
  - Local MM : MM handling movements in a local basis (or limited area) (i.e. within single administrative domain)

Requirements for network-based GMM

❑ Inter-NetLMM domains handover policy agreement

– Security association, service provision, accounting, …

❑ Context transfer mechanism

– Need to get MN's state from home NetLMM domain

❑ Route optimization

– MN communicates with other nodes via LMA in the home domain

CN

Default
data path

② **Context transfer**
(Info. about MN)

HA1

HA2

③ **Route**
optimization

NetLMM
Domain1

NetLMM
Domain2

① **Handover policy**
(security, service,
accounting, …)

AR

AR1

AR2

MN

Handover

MN

14

Proposed route optimization solution
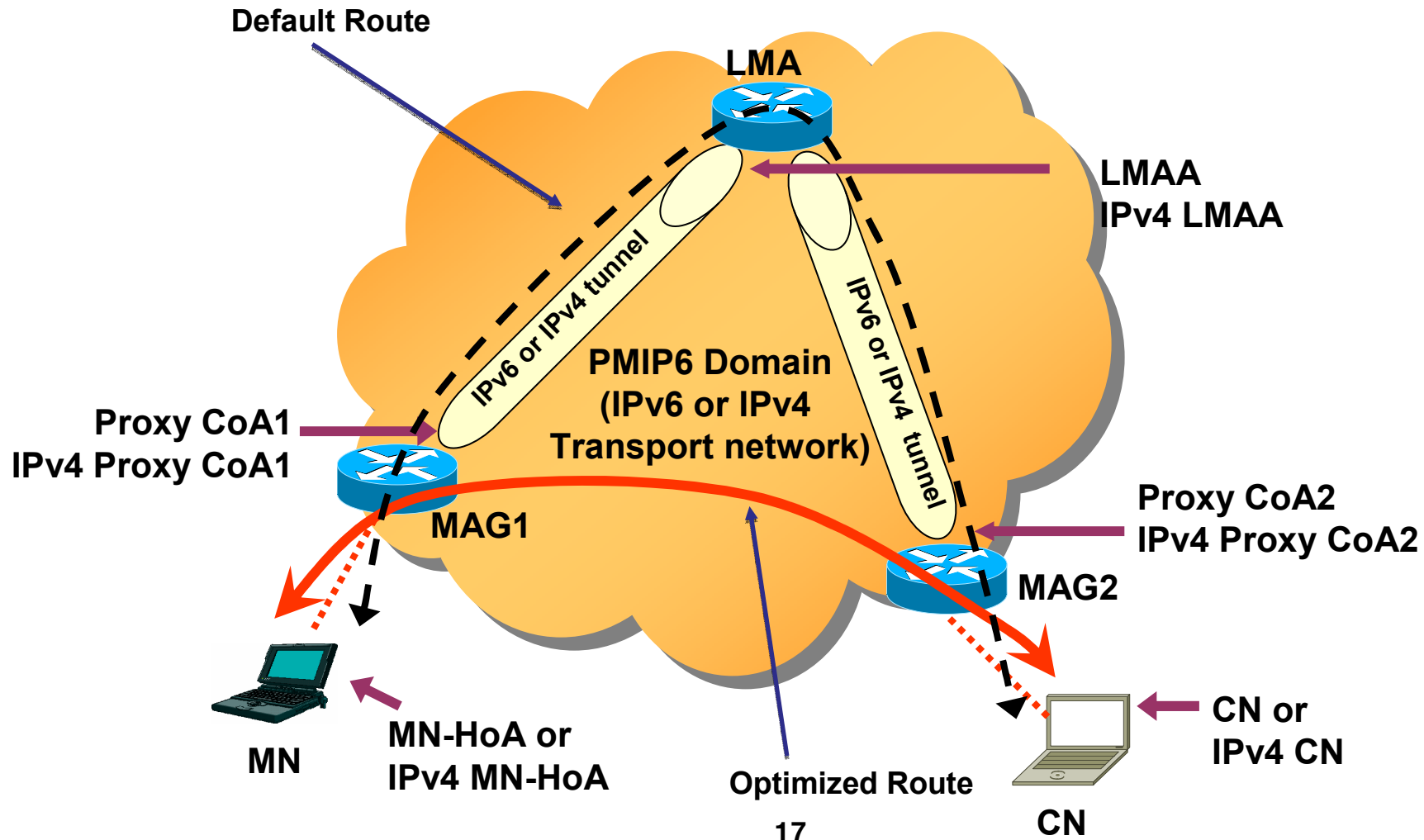
❑ Essential requirement for network-based global mobility management

❑ Route optimization (RO) is especially useful, when NetLMM domain spans geographically large area

❑ Leverage procedures in MIP6 for PMIP6

  – Return Routability (RR) procedures

❑ Develop MIP6 route optimization based solution for PMIPv6 (IPv6 and IPv4 nodes support)
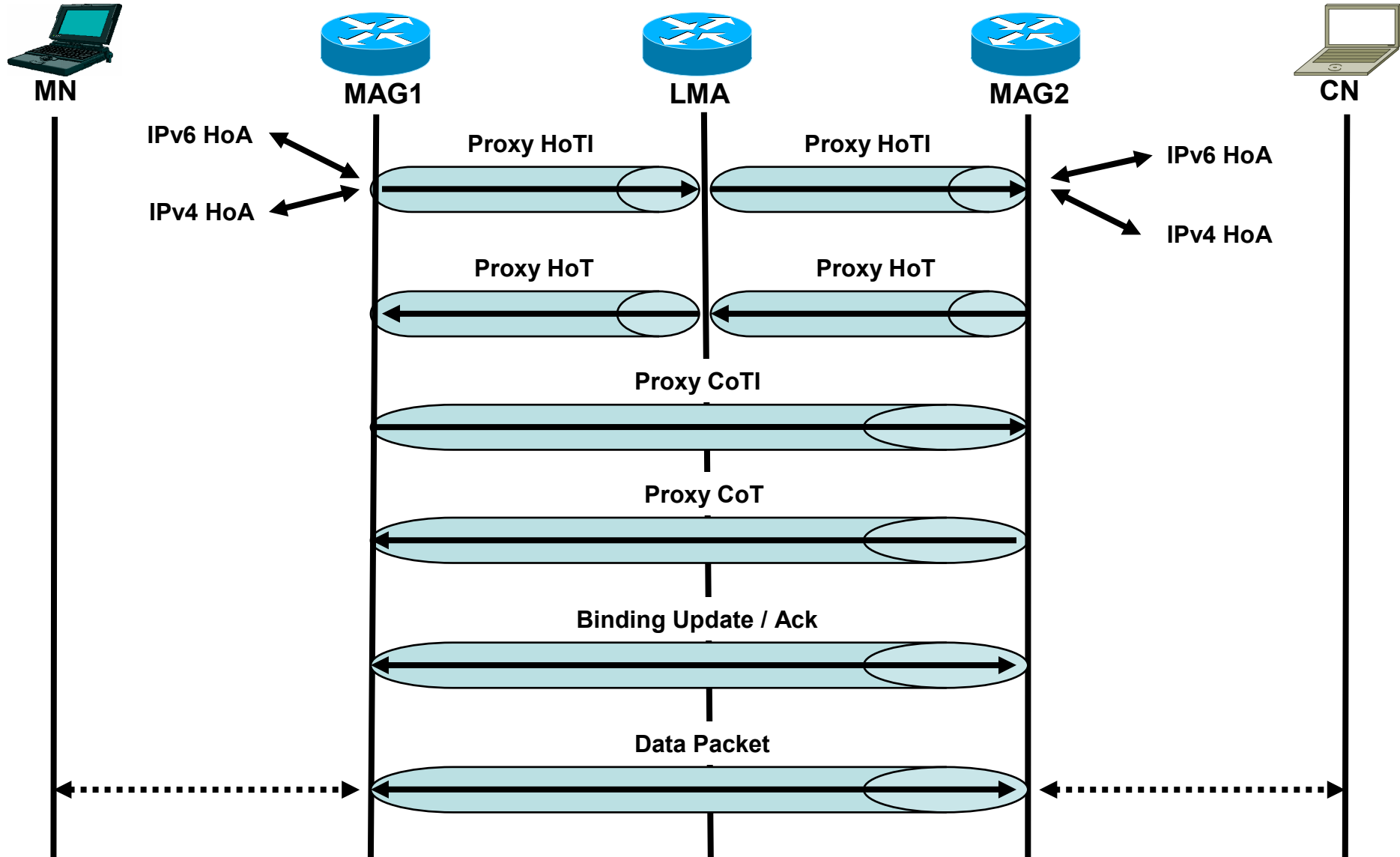
Basic considerations

❑ **MAG supports MIP6 RR** requirements and functions defined in RFC 3775

- MAG processes RO instead of MN and CN (w/o MIP6)
  - MAG intercepts and processes RO messages for MN and CN
- MAG initiates/responds to RO: RR requirements for MN (Process HAO, Type 2 RT header, RR procedures, etc)

❑ Use **MAG's address as CoA** for MN-HoA

- Multiple MNs under single MAG
  - Mapping between single Proxy CoA and multiple MN-HoAs
  - MAG needs to initiate per MN RR procedure and to maintain per MN RO state

❑ MN is connected **to MAG via directly connected route**

- RO between MAG and CN or between MAGs would be acceptable

Simple route optimization scenario within PMIP6 domain

Default Route

LMA

LMAA
IPv4 LMAA

IPv6 or IPv4 tunnel

IPv6 or IPv4 tunnel

PMIP6 Domain
(IPv6 or IPv4
Transport network)

Proxy CoA1
IPv4 Proxy CoA1

MAG1

Proxy CoA2
IPv4 Proxy CoA2

MAG2

MN

MN-HoA or
IPv4 MN-HoA

Optimized Route

CN or
IPv4 CN

CN

17

Procedures for route optimization

MN   MAG1   LMA   MAG2   CN

IPv6 HoA

IPv4 HoA

Proxy HoTI   Proxy HoTI

IPv6 HoA

IPv4 HoA

Proxy HoT   Proxy HoT

Proxy CoTI

Proxy CoT

Binding Update / Ack

Data Packet

Route optimization (IPv4/IPv6 network, IPv4/IPv6 HoA support)

MN   MAG1   LMA   MAG2   CN

HoTI

HoTI

P.CoA1	LMAA

LMAA	P.CoA2

HoT

MAG2 replies with HoT

	MN IPv4	CN IPv4
MN IPv6	CN IPv6	P.CoA1	P.CoA2

To be routed in IPv4 transport net.

Mobility Header (Proxy HoTI)

MN IPv4 HAO

CN IPv4 Alt Addr

Extend to deliver IPv4 HoA in HoTI msg

Route optimization (IPv4/IPv6 network, IPv4/IPv6 HoA support)

MN   MAG1   LMA   MAG2   CN

CoTI

CoT

MAG2 replies with CoT

Src : IPv6 P. CoA1, Dst : IPv6 P.CoA2
or
Src : IPv4 P. CoA1, Dst : IPv4 P.CoA2

P.CoA1	CN IPv6	P.CoA1	P.CoA2

Mobility Header
(Proxy CoTI)

MN IPv4 Alt CoA

CN IPv4 Alt Addr

Extend to deliver IPv4 CoA/HoA in HoTI msg

■ **MAG maintains binding cache entry: MN HoA, MN CoA(P.CoA1), CN HoA, CN CoA(P.CoA2)**

20

MN

MAG1

LMA

MAG2

CN

Src: MN-HoA, dst: CN-HoA

Lookup binding cache

Outer - src: P.CoA1, dst: P.CoA2
Inner - src: MN-HoA, dst: CN-HoA

Src: MN-HoA, dst: CN-HoA

Src: CN-HoA, dst: MN-HoA

Lookup binding cache

Outer - src: P.CoA2, dst: P.CoA1
Inner - src: CN-HoA, dst: MN-HoA

Src: CN-HoA, dst: MN-HoA
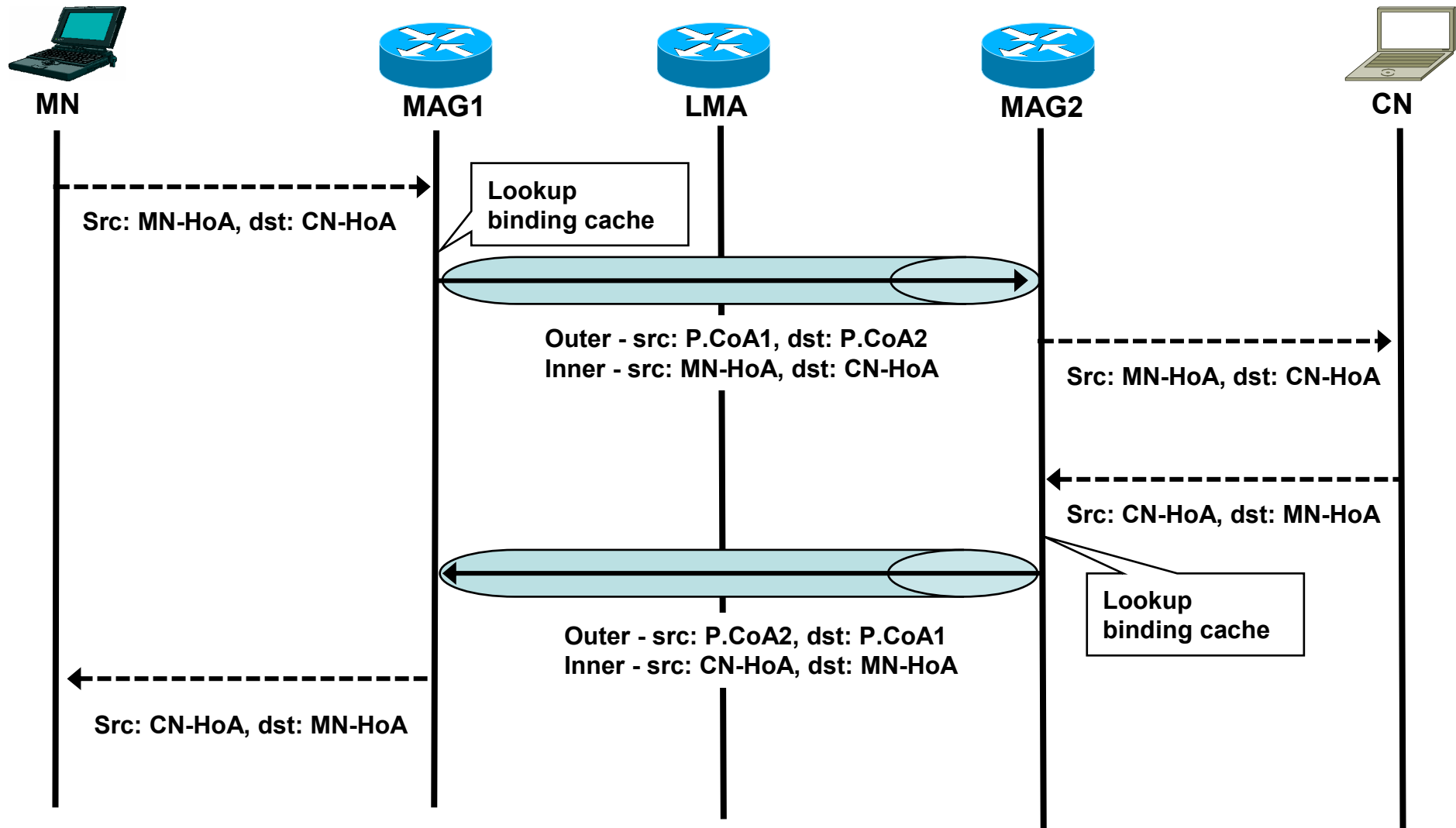
Discussion

❑ **PMIP6 can be a way to facilitate the deployment of IP mobility**

- Reuse deployed infrastructure & Mobile IPv6 functionality
- Favorable to ISPs

❑ **MIP6-based route optimization can be applied to PMIP6 with minor changes**

- MAG operation
- Delivery MAG's address (possible new mobility option or other mechanism)

❑ **Research activities in network-based GMM**

- Route optimization (ETRI)
  - Plan to propose RO as an IETF NetLMM WG item when rechartering happens
- Cross-NetLMM domain security association
- Context transfer mechanism

Open issues