

In-Vehicular Mobile Router: Challenges and Approaches

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February, 2003

<http://www.ist-overdrive.org/>

Outline

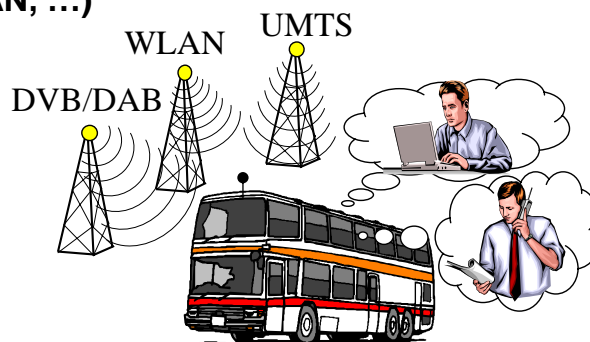
- **Scenario of OverDRiVE Mobile Networks**
- **State of the art**
- **Challenges**
- **Approaches for network mobility**
- **Outlook**

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OverDRiVE Mobile Networks - 1

Focus of OverDRiVE

- Mobility of hosts
- Mobility of networks
- Multiradio (DVB, UMTS, WLAN, ...)
- IPv6 Protocols
- Roaming into/out of IVAN
- Spectrum efficiency
- Multicast

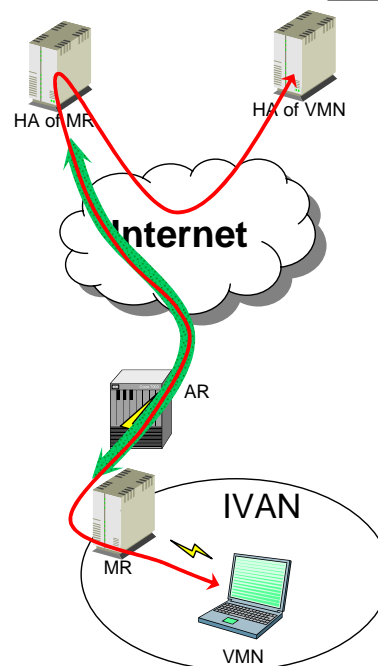


Focus of this Presentation

- Moving Networks: Mobile Router and Mobile Hosts
- Challenges and Approaches

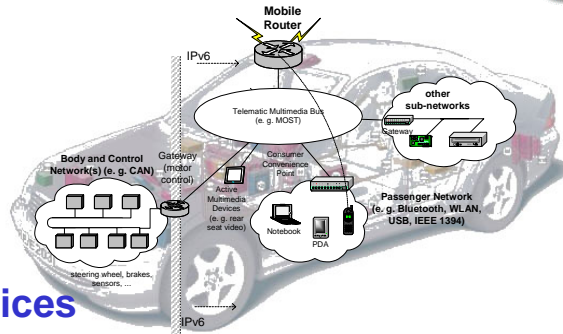
OverDRiVE Mobile Networks - 2

- Intra-Vehicular Networks (IVANs)
 - Controller Area Networks (CANs)
 - Local Area Networks (WLANs & LANs)
- Mobile Router (MR)
 - IPv6 protocols
 - session continuity (MR-HA tunneling approach)
 - reachability
- Dynamic IVAN management
 - multiple access systems inside the IVAN
 - security



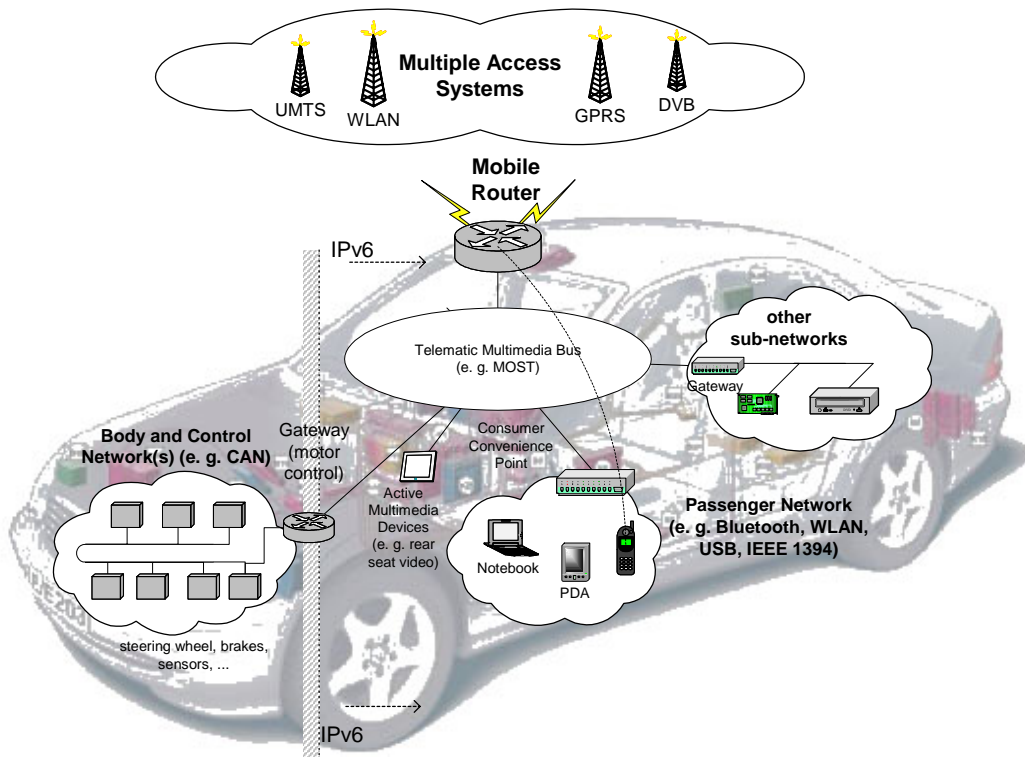
General trends / Scenario

- Moving **vehicles** with **interconnected built-in devices**
- Powerful **smartphones/PDAs** used **outside and inside of vehicles**
- **Multitude of radio access networks** available
- Need for **seamless handover** between access systems while on the move
- Reachability by one **well-known IPv6 address**



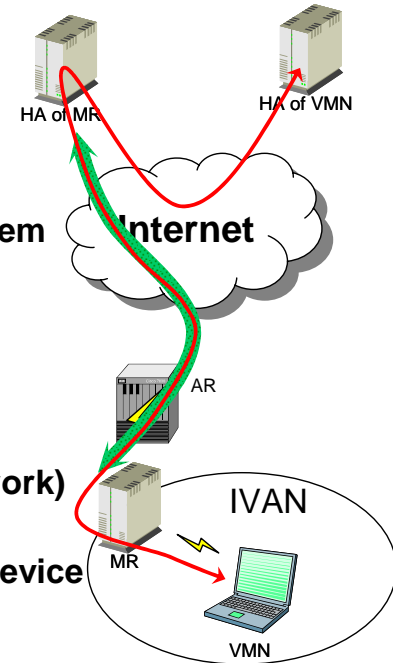
Enabler for sophisticated services (user & vehicle)
YES!

Scenario



Mobility Scenarios

- **Requirement:**
 - **Session continuity** during system handover
 - **Reachability** independent of current access system
 - **Optimized mobility management** based on IPv6
- **OverDRiVE Mobility Scenarios:**
 - **Movement of an IVAN (Intra-Vehicular Area Network)**
 - **Moving into (and out of) an IVAN with a mobile device**
 - **Moving within an IVAN with a mobile device**



State of the art

- **Mobile IPv6 (draft 20 – January 2003)**
 - provides mobility for hosts not networks
 - utilizes few sophisticated IP mechanisms like IP tunneling, Neighbor Discovery and Source Routing
 - no changes to applications necessary
- **Routing protocol** based approaches (Ad-Hoc, OSPF)
- **Mobility using directory services** (SIP, DNS)
- **DHCP style** allocated addresses (“portability”)

Challenges

- **Scalability**
 - no increase in core routers' routing table size due to mobility
 - must support a large number of small mobile networks
- **Security**
 - radio access and small/portable routers open new doors to adversaries
 - service theft and DoS have new aspects
- **Route optimization**
 - Mobile IPv6 for hosts induces performance drawbacks due to bi-directional tunneling
 - Mobile IPv6 for networks is worse: multi-angular routes
- **Interworking with AAA infrastructure**

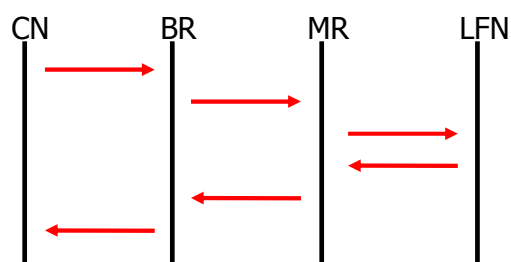
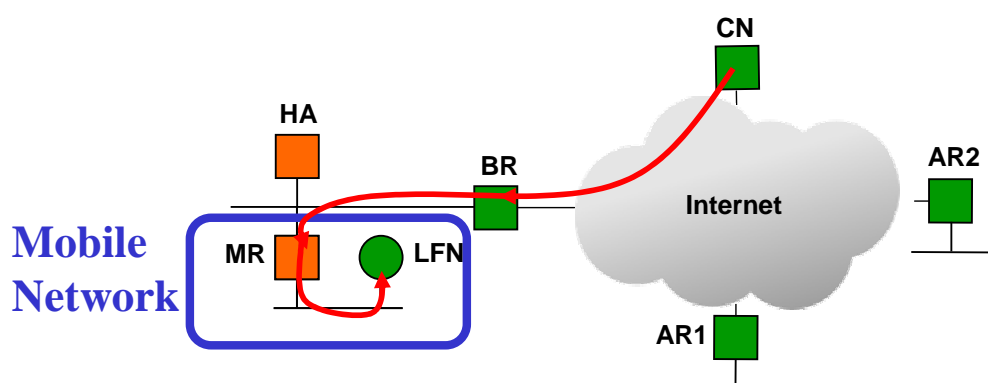
OverDRiVE Approach

- **Mobile IPv6** uses a bi-directional tunnel between MN and HA in order to simulate the presence of MN at home
- **Mobile networks based on Mobile IPv6:**
 - use a Mobile Router (MR) instead of a MN
 - maintain the bi-directional tunnel between MR and HA
 - **modify HA behavior**
 - **modify router behavior**
 - no modifications to BU format
- **Several mobility scenarios fully supported:**
 - all **OverDRiVE mobility** scenarios:
 - simple mobile network
 - mobile host and mobile network
 - in addition: nested mobile networks

Entities in the Network

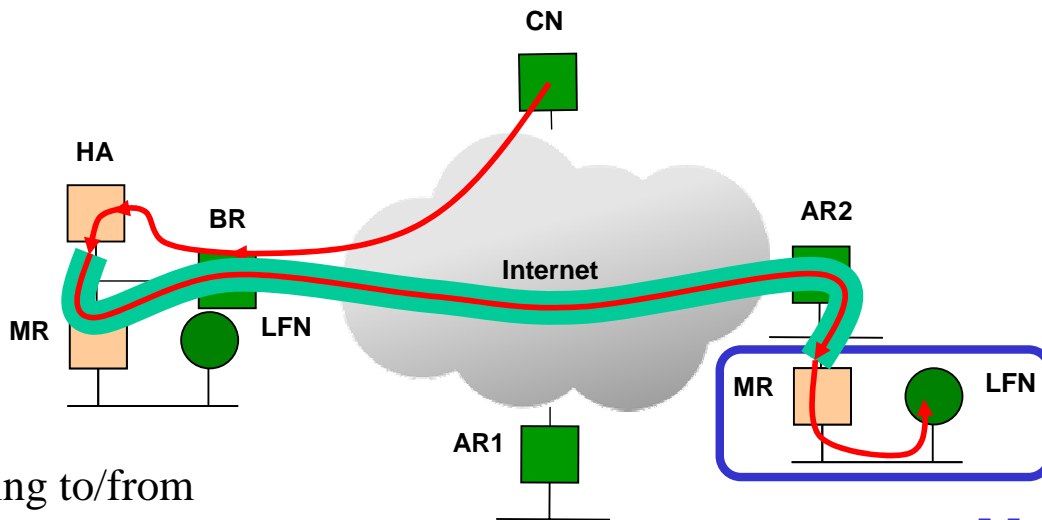
- **MR: Mobile Router**
- **BR: Border Router -**
Connects the MR's home domain to the Internet.
- **AR: Access Router -**
MR's point of attachment when not at home.
- **HA: Home Agent - (MR-HA)**
Forwards packets to MR when not at home.
- **LFN: Local Fixed Node -**
Mobility unaware node.
- **CN: Correspondant Node -**
Communication peer in the Internet.

Movement of a simple mobile network - 1



Routing to/from
Local Fixed Node
of **Mobile Network**
at Home

Movement of a simple mobile network - 2

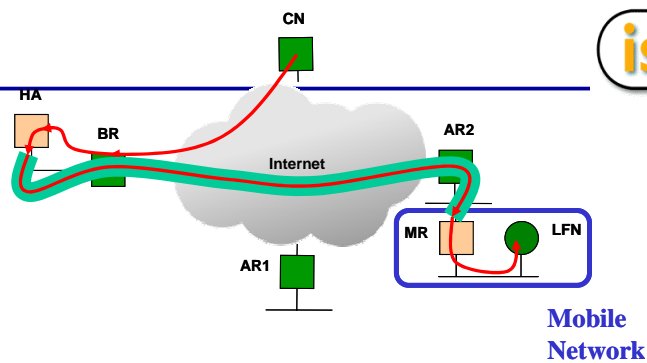


Routing to/from
Local Fixed Node
of **Mobile Network**
at **Access Router 2 (AR2)**

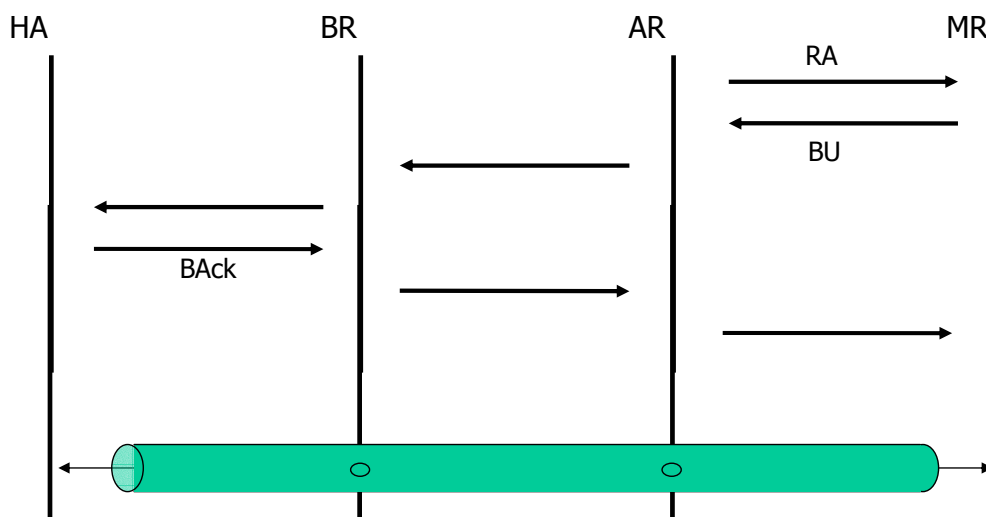
Mobile Network

MR-HA tunnel setup

(Home Agent
of Mobile Router)

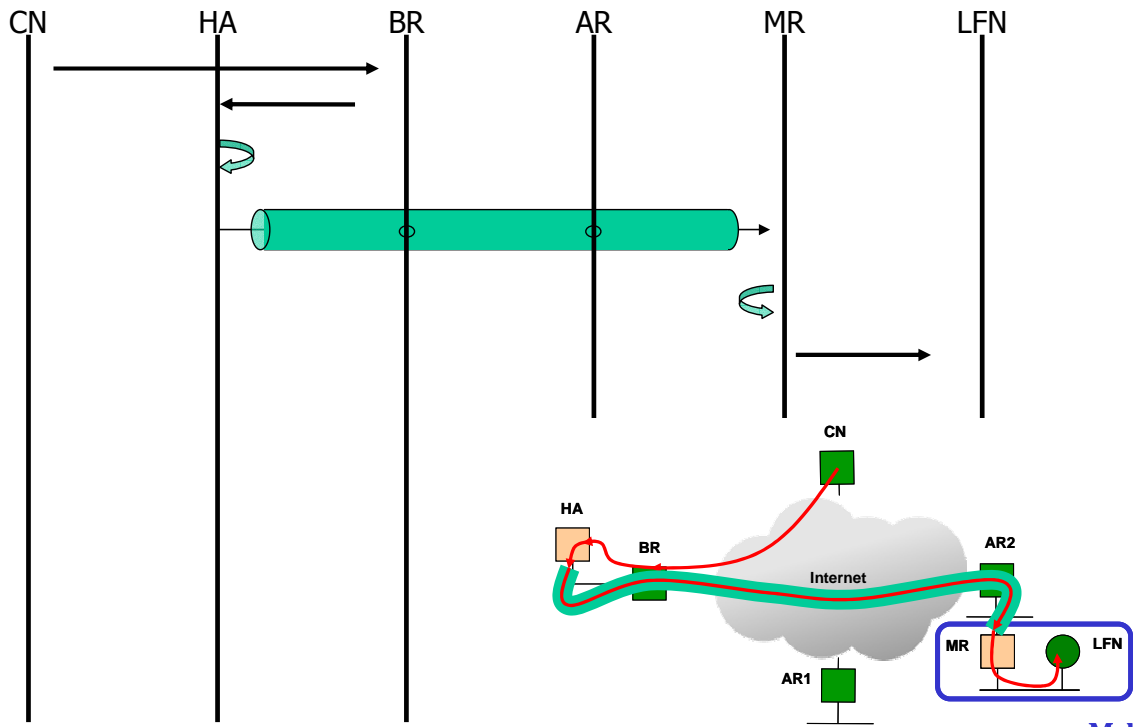


Mobile Network



1. Router Advertisement
2. Binding Update
3. Binding Acknowledge
4. Tunnel „Ready“

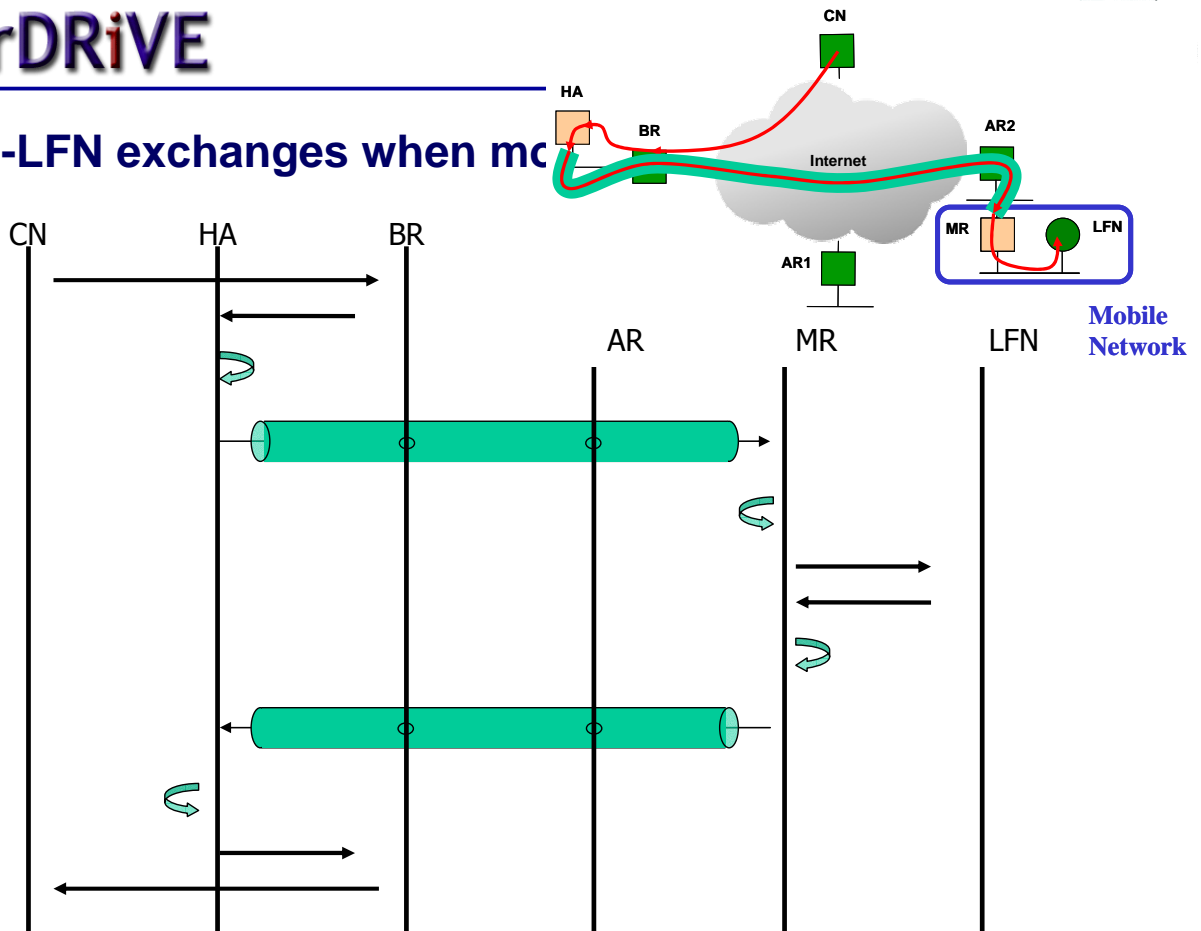
CN-LFN exchanges when mobile network is away



OverDRiVE: Ericsson - ComNets - DaimlerChrysler - France Telecom - Motorola - RAI

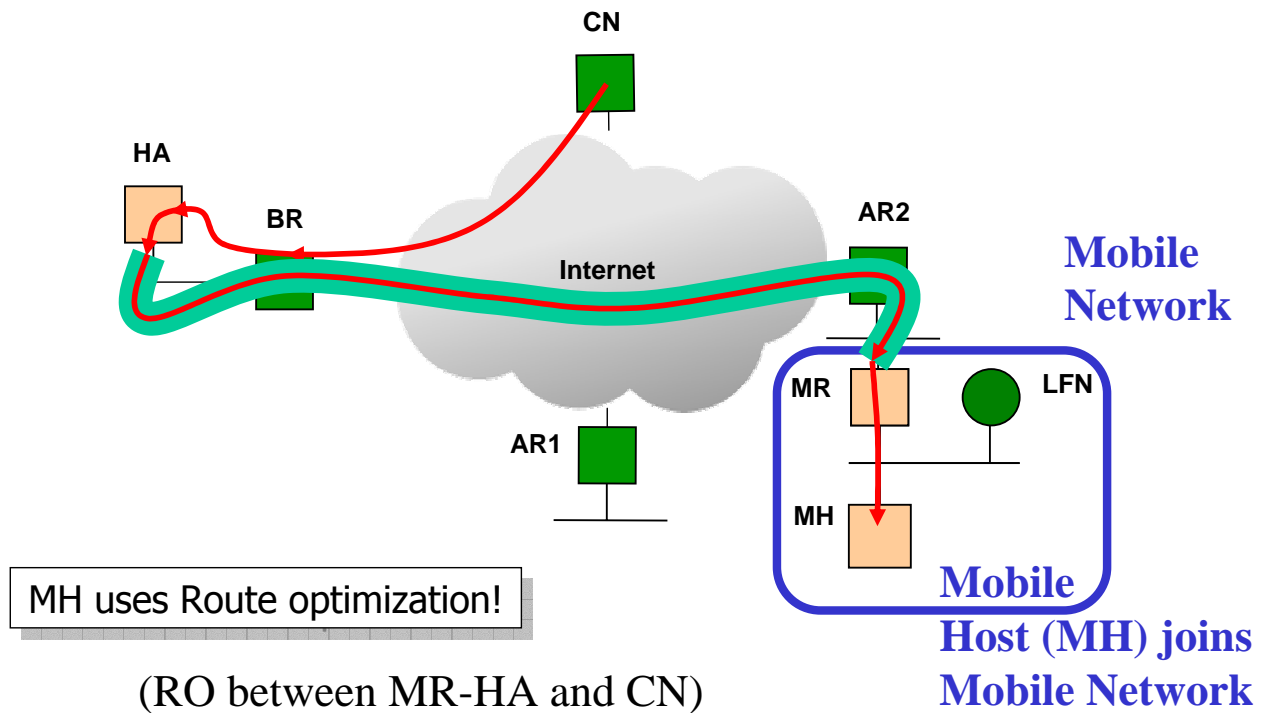
Mobile Network

CN-LFN exchanges when mobile network is away

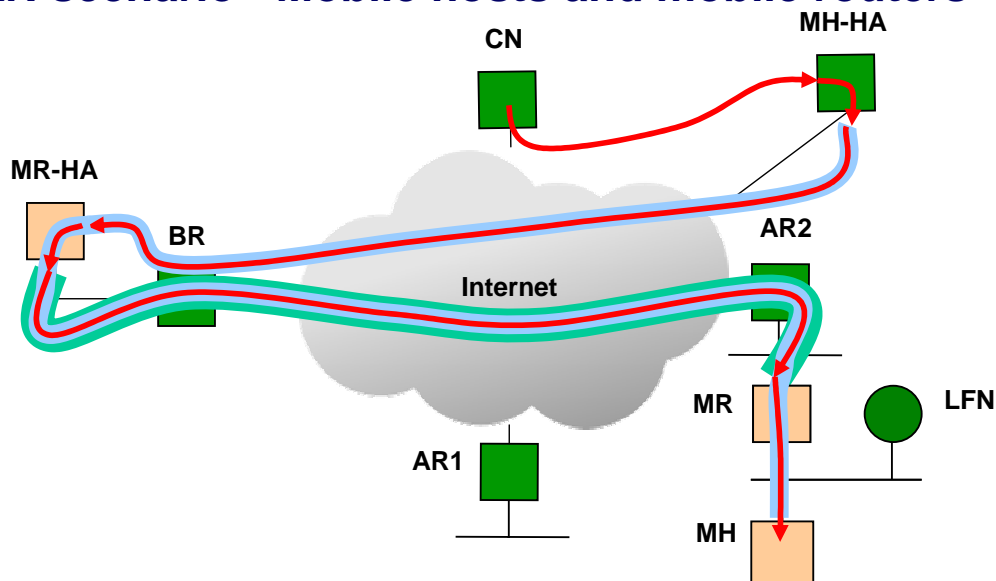


OverDRiVE: Ericsson - ComNets - DaimlerChrysler - France Telecom - Motorola - RAI - UNI Bonn - UNI Surrey

IVAN scenario - Mobile hosts and mobile routers



IVAN scenario - Mobile hosts and mobile routers

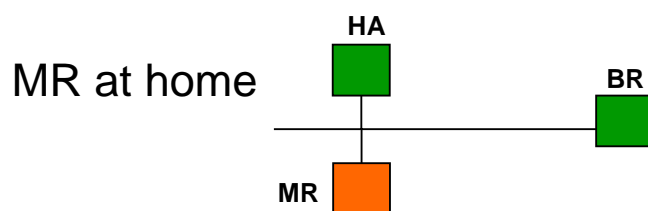


Protocol issues 1

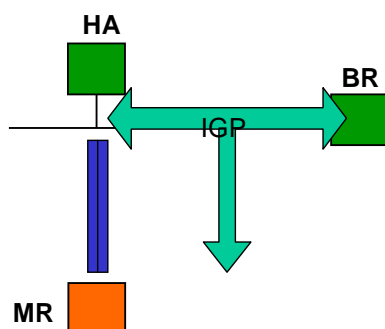
HA needs a way to **acquire routes towards the mobile network** link:

- Manually configured on the HA
- Dynamically configured on the HA:
 - ICMP Redirects
 - IGP
 - triggered by Prefix Delegation
 - triggered by DHCPv6-prefix

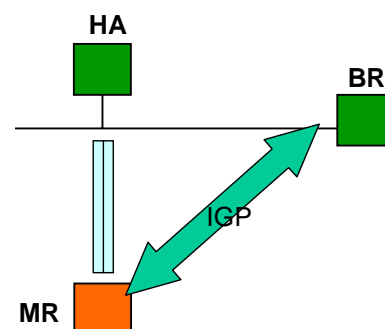
Protocol Issues 2: dynamic routing protocol



MR away – option 1:
HA “active” IGP node



MR away – option 2:
HA “transparently” forwards to MR



Implementation & Demonstrator

- based on Motorola open source LIVSIX IPv6 stack for mobility environments
- <http://www.nal.motlabs.com/livsix>
- for mobile hosts and mobile routers
- supports nested mobility
- no modifications to the BU message format

Conclusion & Outlook

- **Network Mobility** in OverDRiVE
 - MR-HA tunnel approach
 - based on MIPv6
 - transparency of mobility within the IVAN
- **Further optimizations:**
 - avoid **excessive tunneling**
 - avoid **crossover tunnels**
 - define and **support route optimization**

The End.

Comments

Suggestions

Remarks

Thank You!

Objectives

Questions

<http://www.ist-overdrive.org/>