Simultaneous Use of Multiple Interfaces in Mobile Nodes

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Motivation

▶ Simultaneous Use of Multiple Interfaces in Mobile Nodes – Feasibility ?

- Rapid development in the area of new wireless standards (802.11*, 802.16, 802.20, UMTS, evolved 3G, etc)
- Mobile terminals are capable of supporting multiple wireless connectivities (two, three or even more standards are appearing)

▶ This Opens the Possibility of Using Multiple Interfaces (Multiple Access Types) Simultaneously

- High-bandwidth access type might be used for file transfers (e.g. music download) while a low-bandwidth, high reliability access might simultaneously be used for a VoIP call

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Outline

▶ Problem Description

▶ History of MONAMI6 WG at IETF

▶ Goals & Benefits of using Simultaneous use of Multiple Interfaces

▶ Flow based routing for the use of Simultaneous Access

▶ Conclusion

Problem Description

▶ IP-level mobility support protocols such as Mobile IP (RFC 3344, RFC 3775) and NEMO Basic Support (RFC 3963) have been conceived by the IETF to support Mobility in heterogeneous environments

▶ No standardized support for the use of multiple access technologies simultaneously

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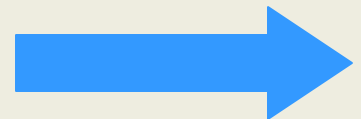
Problem Description, Cont

▸ There are several proposals (extensions to MIP & NEMO) available

- Keeping simultaneous Bindings (Multiple CoA registration)
- How to use multiple attachments simultaneously / Flow based routing

▸ Standard solution is needed (to ease deployment of mobility support)

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Discussions @ IETF MIP WG

▸ Several discussions at MIP WGs since 2003
  - Rejected due to several reasons (Lack of time, problem was not yet well understood nor documented)

▸ Authors of existing drafts
  - Document the problem
  - 3 Problem statement drafts
    - Generic draft
    - mipv6 specific draft
    - nemo specific draft

▸ MONAMI6 (<u>MO</u>bile <u>N</u>odes <u>A</u>nd <u>M</u>ultiple <u>I</u>nterfaces in MIP<u>6)</u>

IETF Monami6 WG

▶ MONAMI6

- Aug.05: Monami6 BOF, 63th IETF
- 1st Monami6 WG Meeting, 64th IETF, Vancouver, Nov.05
  - http://www.ietf.org/html.charters/monami6-charter.html

▶ Charter

- Informational
  - Motivations for a node using multiple interfaces and the scenarios
  - Analysis document explaining what are the limitations for mobile hosts using multiple simultaneous Care-of Addresses and Home Agent addresses using Mobile IPv6
- Std track
  - Protocol extension to Mobile IPv6 (RFC 3775) and NEMO Basic Support (RFC 3963) to support the registration of multiple Care-of Addresses at a given Home Agent address
  - A "Flow/binding policies exchange" solution for an exchange of policies from the mobile host/router to the Home Agent and from the Home Agent to the mobile host/router influencing the choice of the Care-of Address and Home Agent address

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PB Generic Draft – Real life Scenarios

▶ 6 distinct benefits are devised:
  - Ubiquitous Access
  - Reliability
  - Load Sharing
  - Load Balancing
  - Preference Settings
  - Aggregate Bandwidth

▶ Case 1: One interface, multiple prefixes are announced. Few benefits are achievable (load sharing, preference set up)

▶ Case 2: Several interfaces. All benefits are achievable, ubiquitous access is more likely

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PB Generic Draft – Real life Scenarios
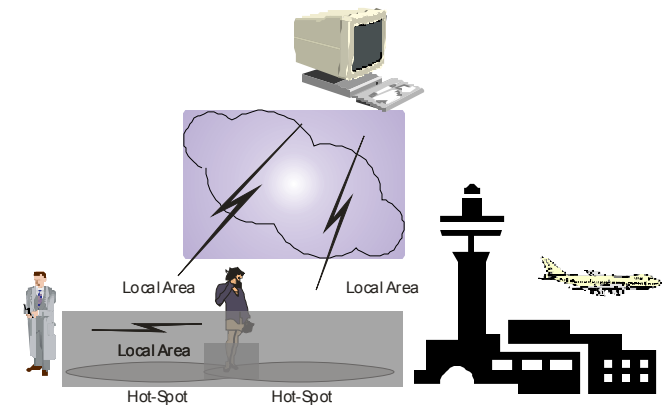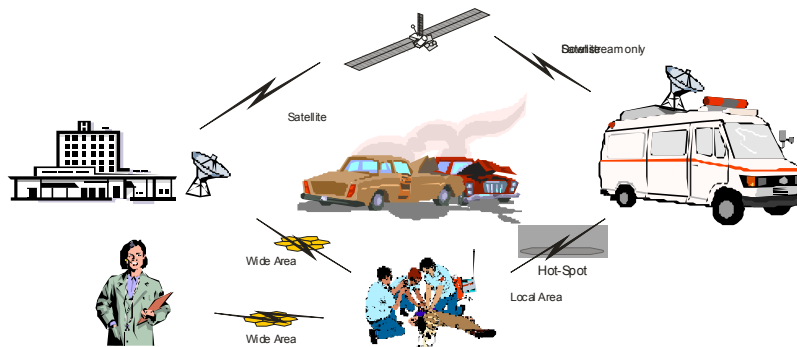
- Different interfaces for different use
  - Downloads medical records over satellite link (Faster bit rate, Longer traversal delay)
  - VC with the specialist over wide area cellular link (best for real time at the moment)

Flow based Routing
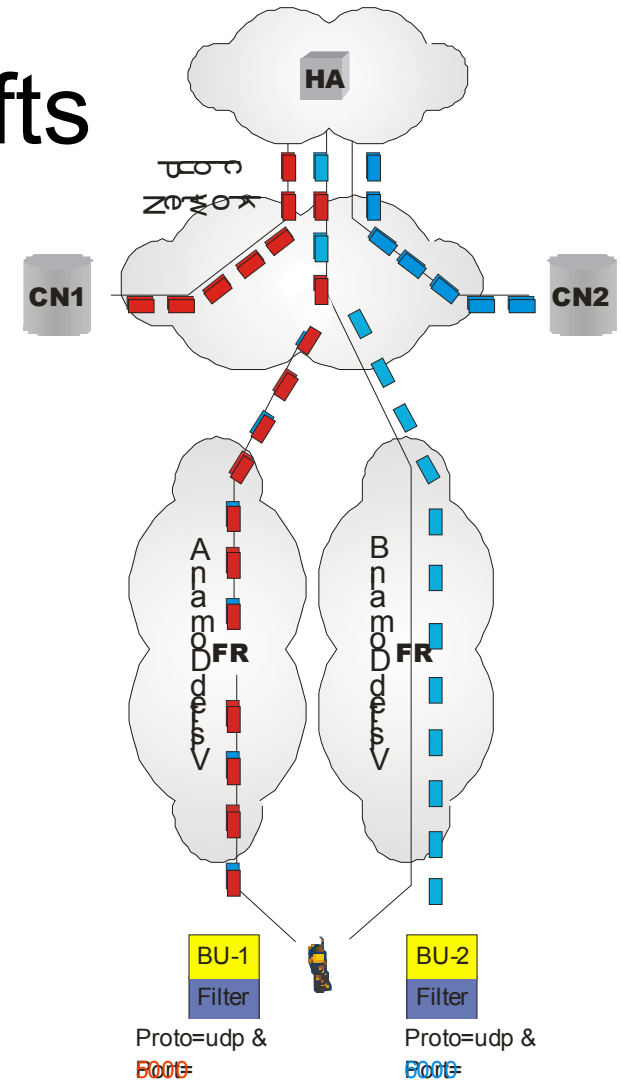
▶ Flow is a sequence of packets sent from a particular source to a particular (uni-cast or multicast) destination

▶ Flow based routing – Route different flows over different routing paths

▶ Is Flow based routing usable/required in heterogeneous environments?

- Different access technologies have different characteristics (capabilities, capacities, cost, use cases, QoS and security)

- Applications may run more efficiently on one access technology than others (e.g. VoIP needs QoS capabilities in the radio access, FTP doesn't)

- MNs should be able to maximise the utilization of the available access technologies

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Current Proposals – Flow Based Routing
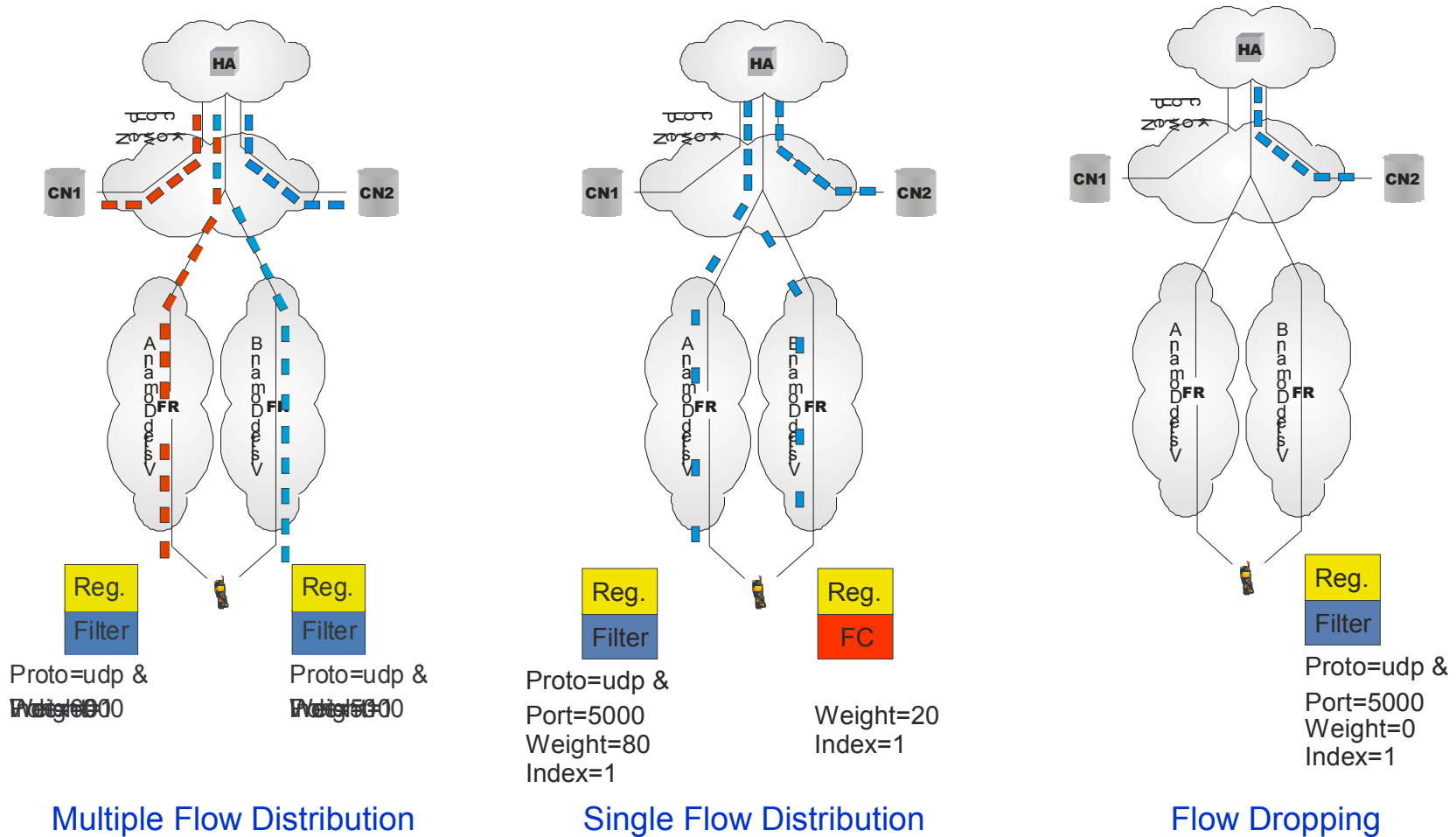
▶ draft-soliman-mobileip-flow-move-03

▶ draft-nomadv6-mobileip-filters-02.txt

▶ draft-montavont-mobileip-ha-filtering-v6-00.txt
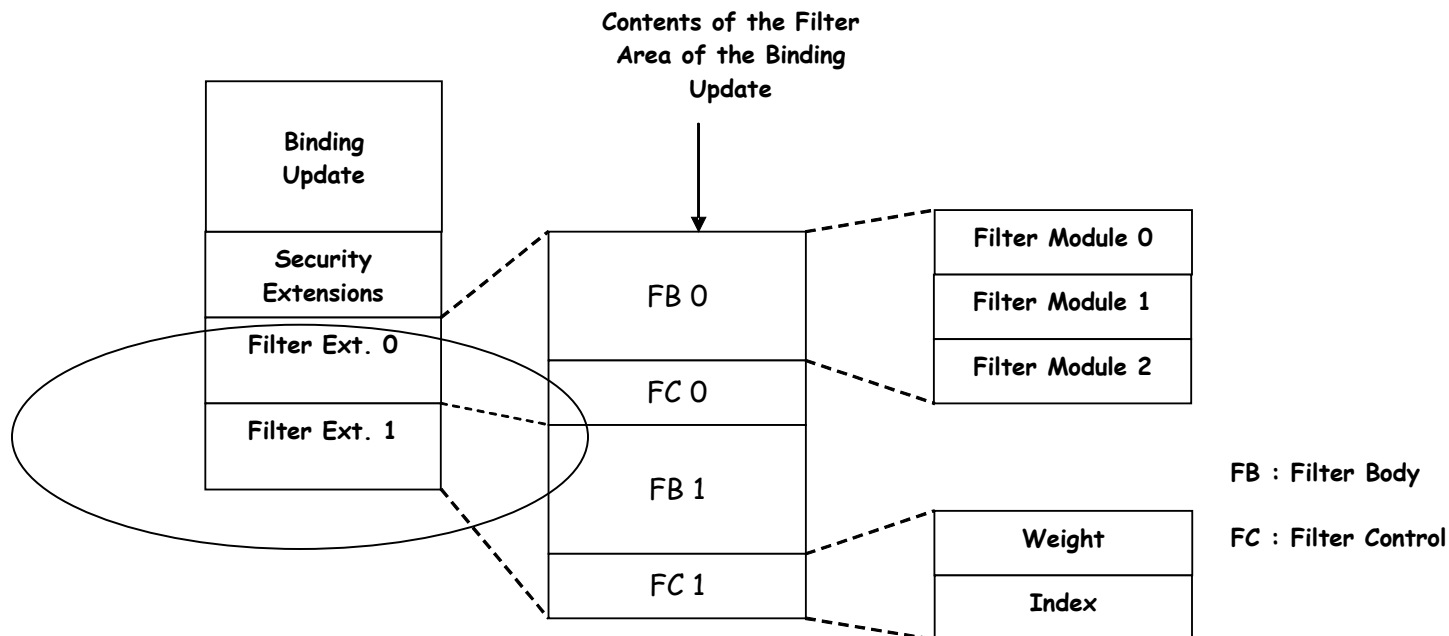
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Overview to NOMAD Drafts

▶ Simultaneous use of multiple BUs

▶ Flow based routing

- Load balancing
- Preference Settings

3 Operation Modes of NOMAD

Multiple Flow Distribution — Proto=udp & Port=5000 Weight=80 Index=1 / Proto=udp & Port=5000 Weight=20 Index=1

Single Flow Distribution — Proto=udp & Port=5000 Weight=80 Index=1 / Weight=20 Index=1

Flow Dropping — Proto=udp & Port=5000 Weight=0 Index=1

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Format – NOMAD Filtering Extension

Contents of the Filter Area of the Binding Update

Binding Update

Security Extensions

Filter Ext. 0

Filter Ext. 1

FB 0

FC 0

FB 1

FC 1

Filter Module 0

Filter Module 1

Filter Module 2

Weight

Index

FB : Filter Body

FC : Filter Control

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Types of Filter Modules

➤ Nine Types of Filter Modules

- Flow Label, Traffic Class
- Protocol Number
- Source Address
- Source Network
- Source Port Number
- Source Port Number Range
- Destination Port Number
- Destination Port Number Range
- Free form, specifies the value of an area anywhere within the packet

Implementation Issues

▸ When a data packet comes to the HA, How does it identify the data packet to route based on the filtering rule?

- Uses **iptables** to mark packets

▸ How does the HA route the marked packet to the identified location?

- Uses **iproute2** to forward marked packets

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Open Issues

▸ Multi-homed MNs

▸ Co-exist with other MIP extensions (HMIP & Route

▸ Support for MRs

▸ Optimal design for efficient transmission over the wireless interface?

▸ Security issues

Conclusion

▶ Overview to IETF MONAMI6 WG

  • Standisation that is being discussed in the area of simultaneous use of interfaces in MNs

▶ Overview to Flow based Routing based on NOMAD Draft

▶ We are discussing how to merge all drafts – Common solution for Flow based Routing, addressing all open issues

  • Message Format, Use of BU/BA to send Filters, Types of Filters
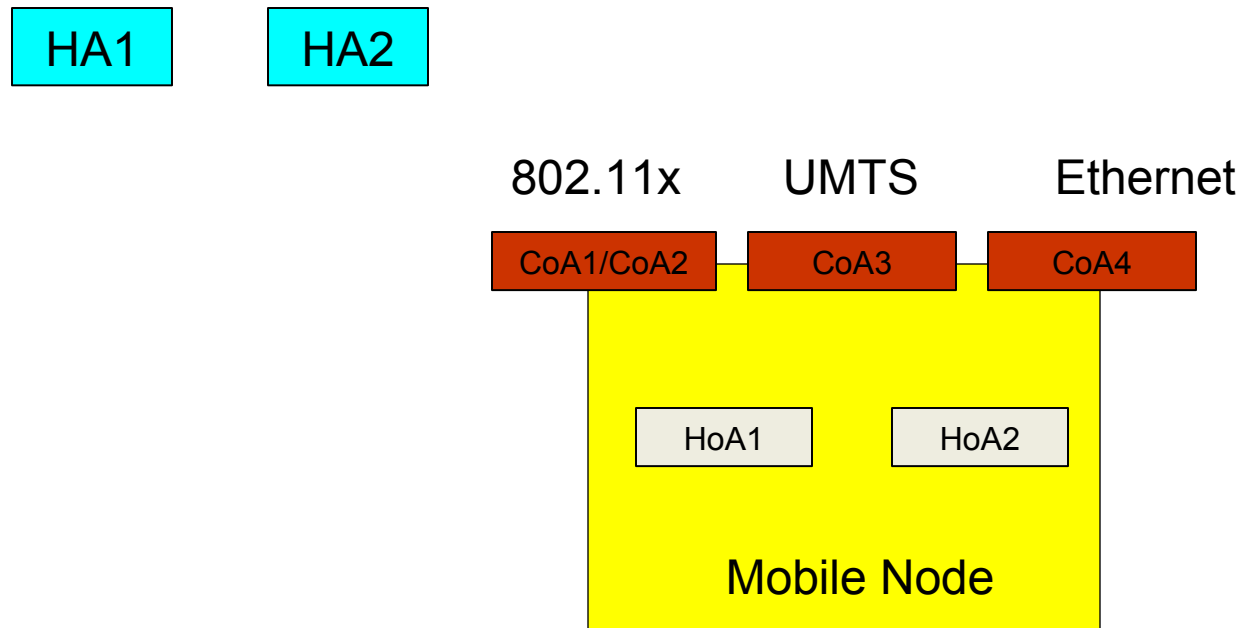 • Out of Scope: Local Policies in the MN that decides which flow should be associated with which CoA/Interfaces

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Acknowledgement

▶ PB Drafts

- Nicolas Montavont (ENST-Bretagne), R. Wakikawa (Keio University), T. Ernst (Keio University / WIDE), C. Ng (Panasonic Singapore Labs), K. Kuladinithi (University of Bremen)
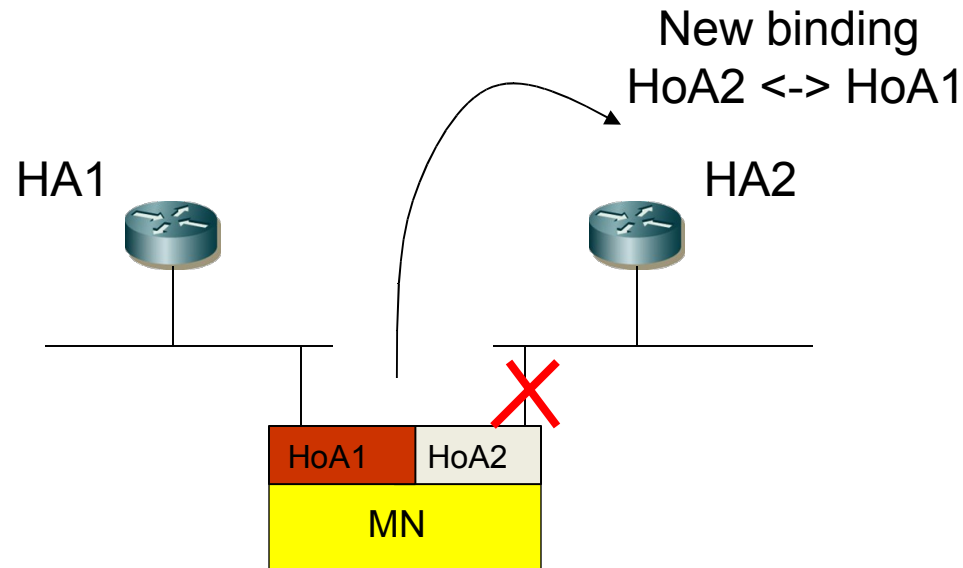
▶ Flow Based Routing

- NOMADv6
  - Niko Fikouras, Carmelita Görg (University of Bremen)
- Other 2 Drafts
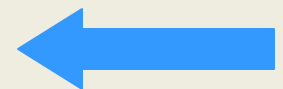 - Hesham Soliman (Flarian), Nicolas Montavont (ENST-Bretagne)

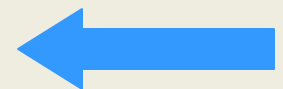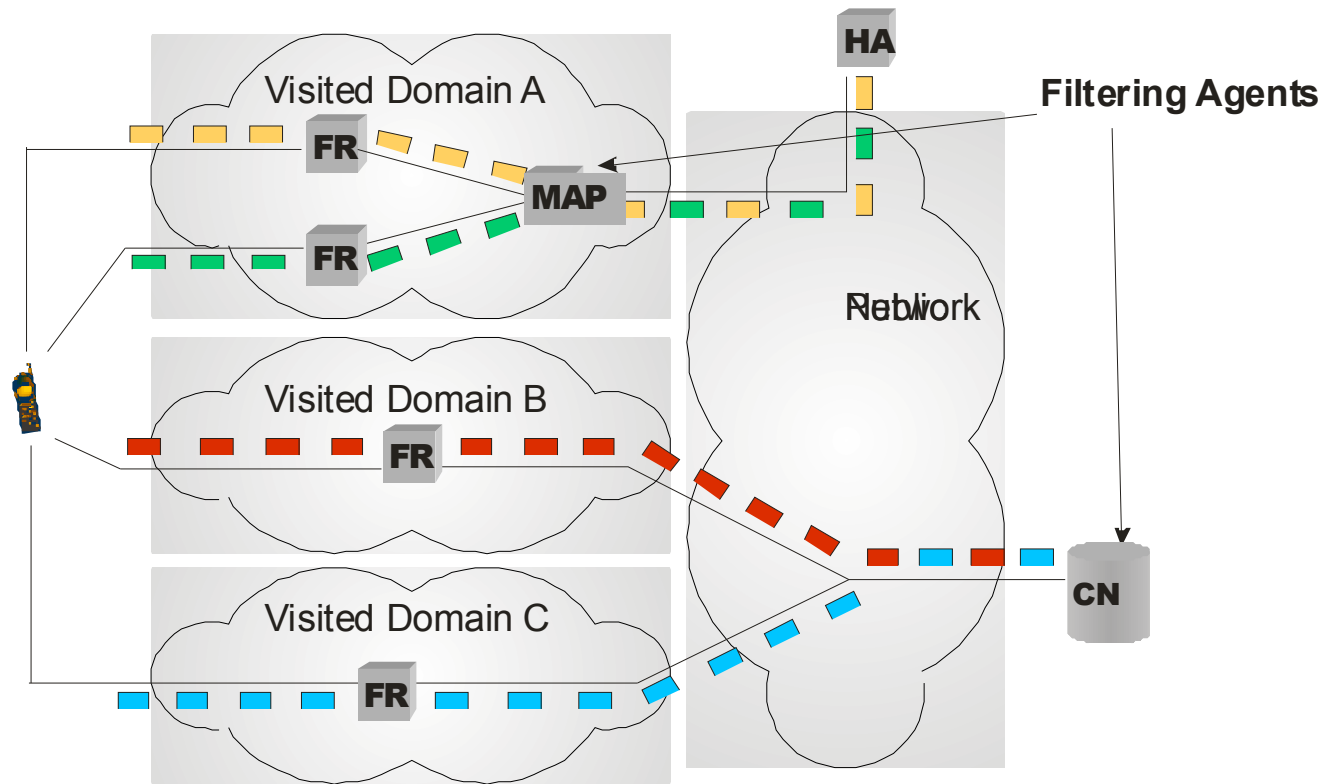Universität Bremen

Multihomed Mobile Node

A MN with several HoAs/CoAs

HA1 **HA2**

802.11x UMTS Ethernet

CoA1/CoA2 CoA3 CoA4

HoA1 HoA2

Mobile Node

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Redundancy Purpose: Using a HoA as a CoA

New binding
HoA2 <-> HoA1

HA1

HA2

HoA1 | HoA2

MN

HoA1 becomes the CoA of HoA2

HMIP & Route Optimization

Mobile IP (To Keep Continuity of Services)
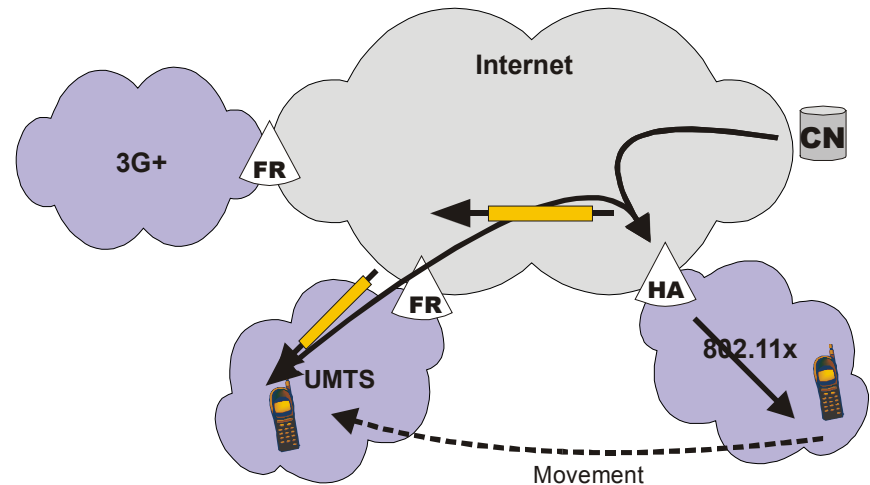
<u>Mobile Node</u>
- Acquire roaming address (care-of address, COA)
- Register roaming address

<u>Home Agent</u>
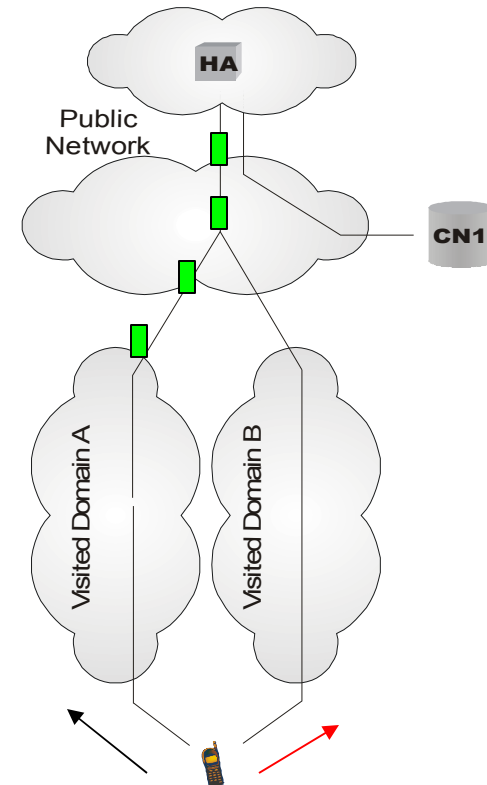- Intercept incoming traffic
- Tunnel to new location

<u>NEMO</u>
- Moving network

Multiple Bindings with MIP

- Mobile IPv6
  - only keeps single binding

2 types of connectivities, 1 Binding Update

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