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Protocols to Efficiently Support Nested NEMO (NEMO+)

Ben McCarthy, Matthew Jakeman, Dr Chris Edwards
(Lancaster University)

Pascal Thubert
(Cisco Systems)

InfoLab21 | Lancaster University | Lancaster | LA1 4WA | UK
www.infolab21.lancs.ac.uk

InfoLab21
Computing Department

Presentation Overview

Background:

- Network Mobility (NEMO)
  - Overview
- Nested NEMO
  - Overview
  - Scenarios

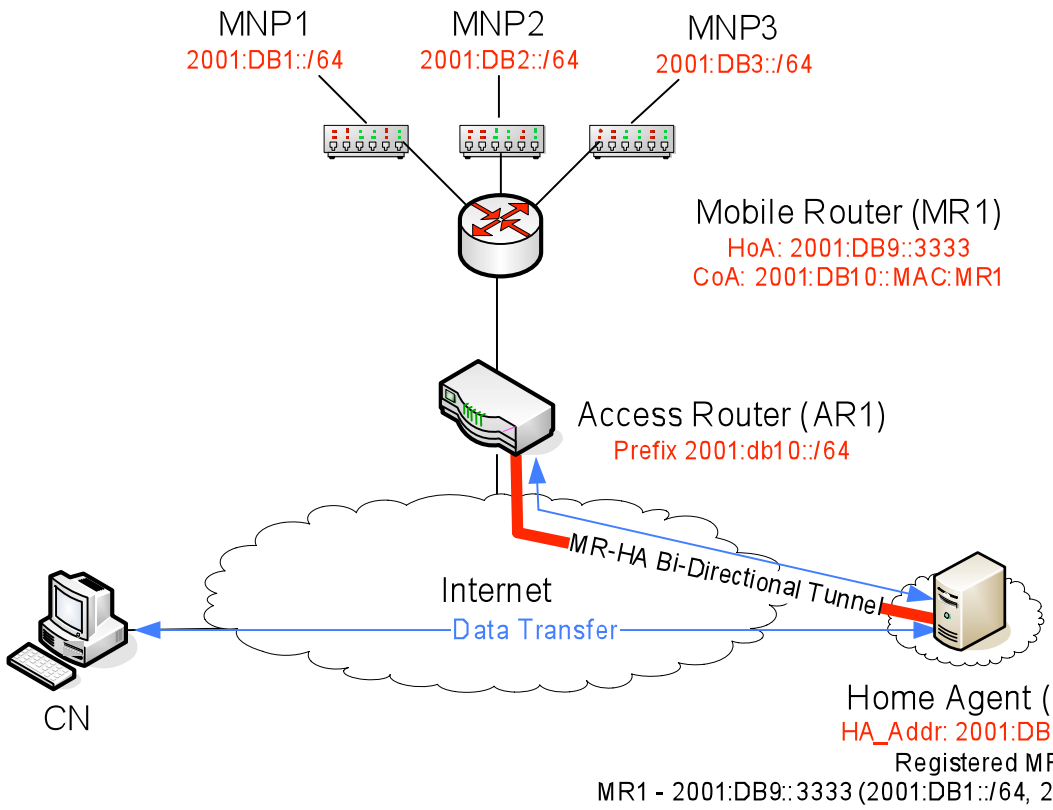
Testing

- Experimental Evaluation
- Simulation

Future Work

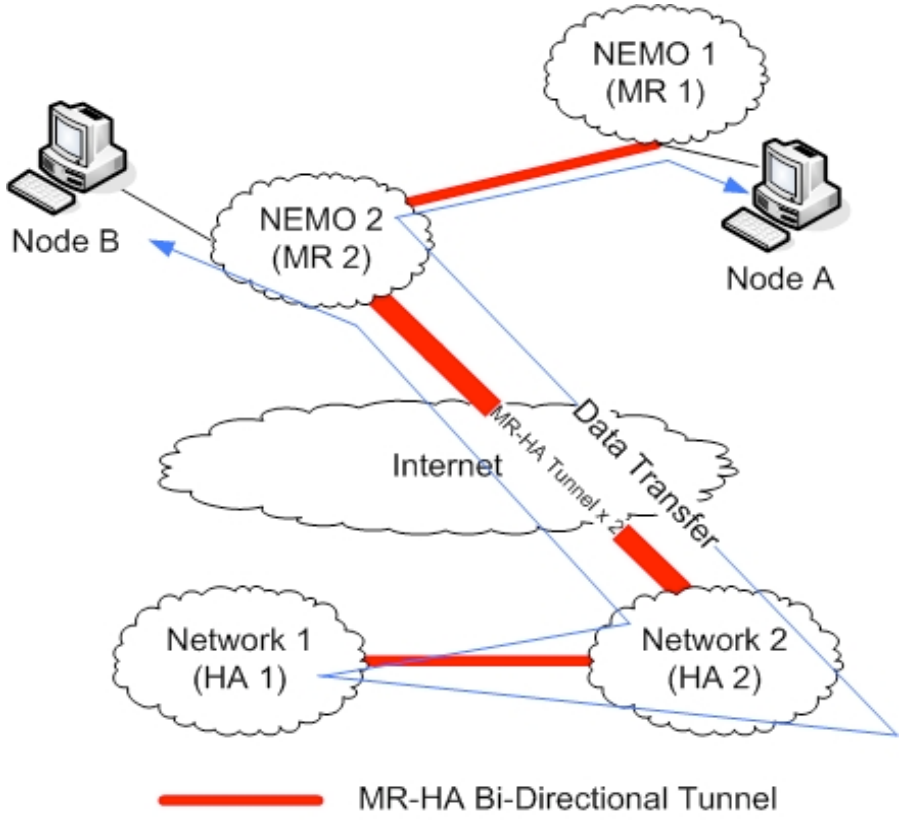
- HA Communication Approach
- MANET-Centric MANEMO

NEMO Basic Support



- Based on MIPv6
  - Support entire networks instead of just hosts
- Hosts connected to the Mobile Router unaware of underlying movement

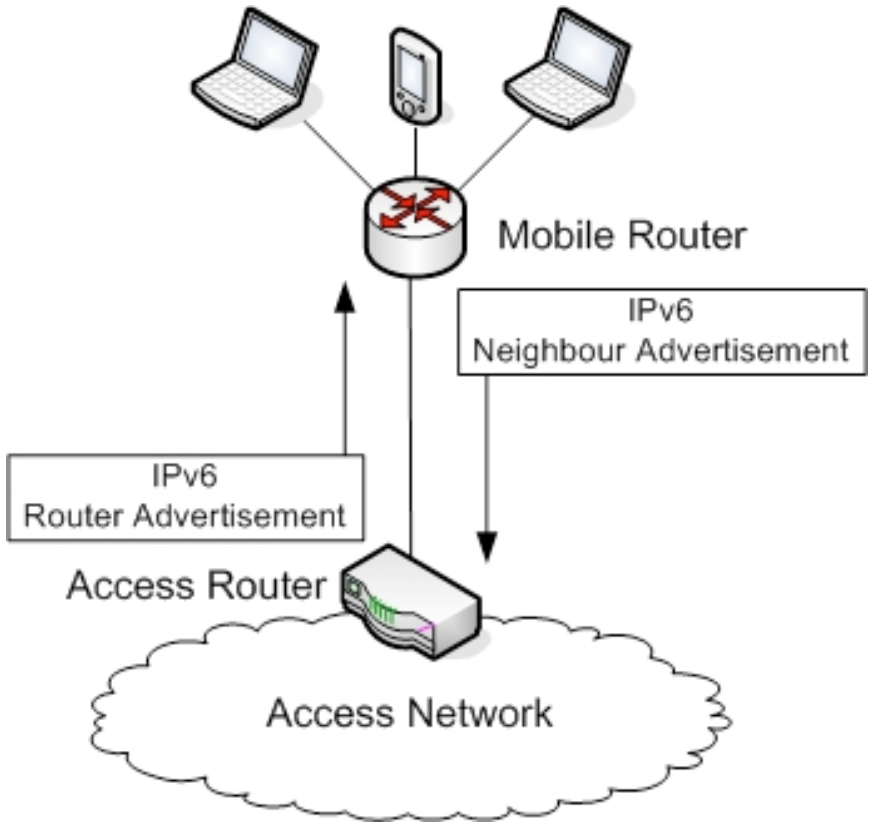
Background



Nested NEMO

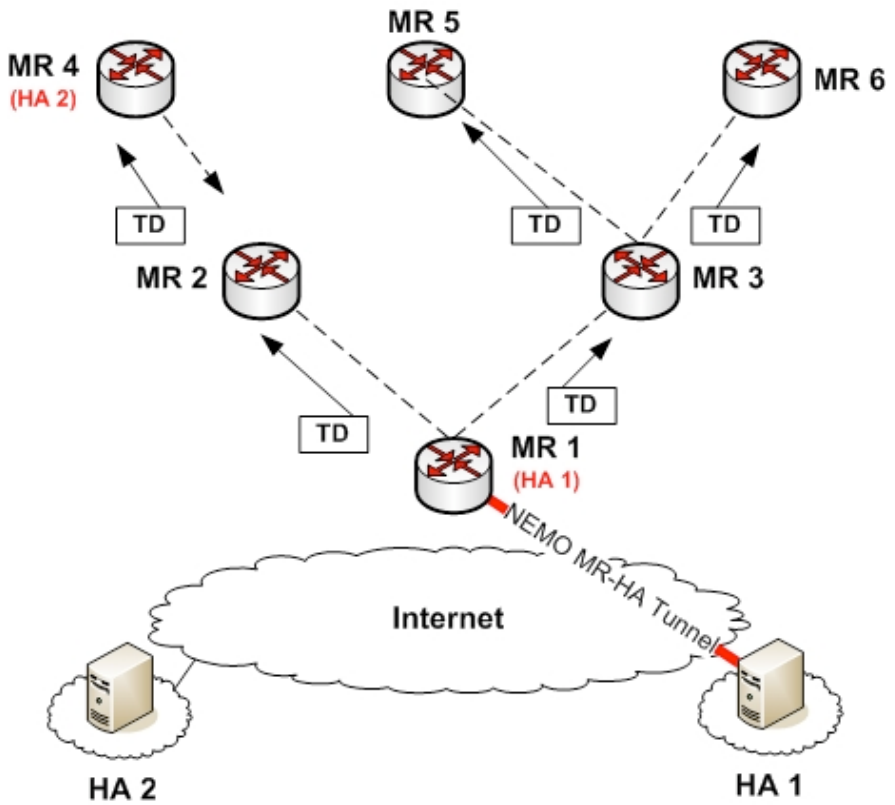
- Extremely inefficient routing when MRs interconnect
  - Packets subjected to “Pinball Routing”
  - Multiple layers of tunnelling
- Internal communication with Nested NEMO must first travel via HAs
- Localised movement unnecessarily registered with HA

NEMO+ Protocols



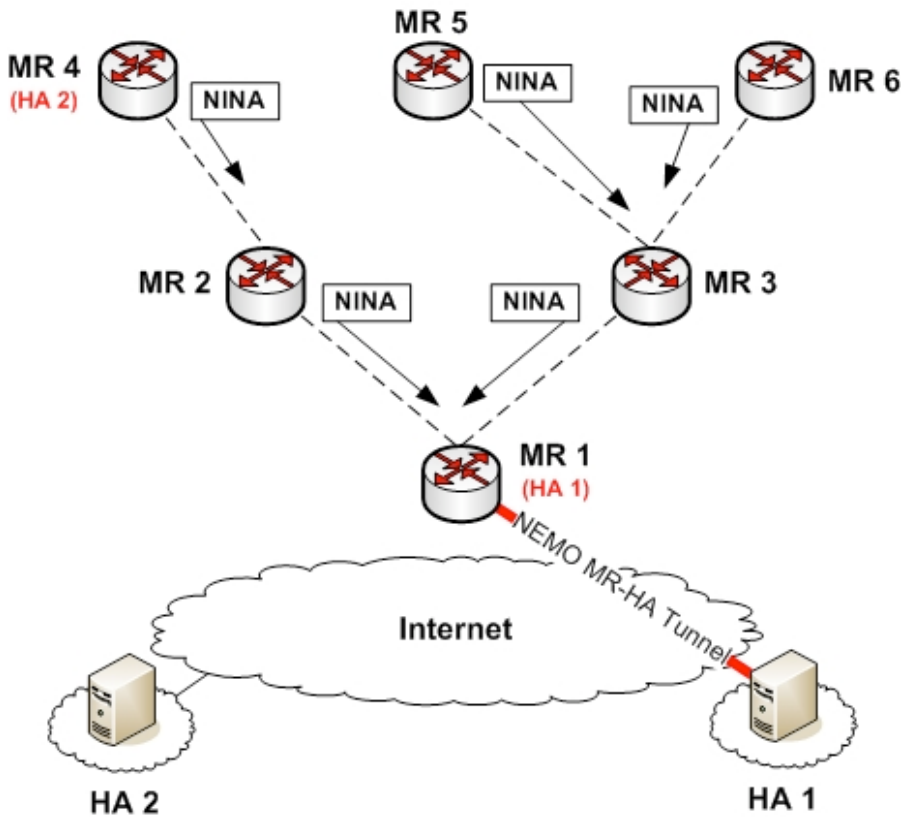
- Protocols to efficiently support Nested NEMO networks:
  - Tree Discovery (TD)
  - Network In Node Advertisement (NINA)
  - Reverse Routing Header (RRH)
- Leverage existing transfer that NEMO MR carries out
  - MR presents itself to the AR as individual host

Tree Discovery (TD)



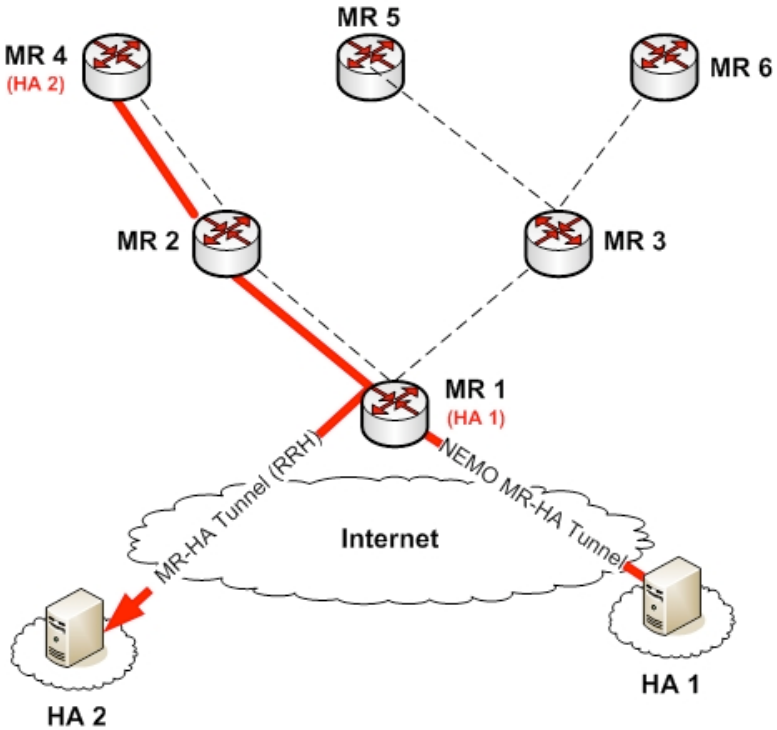
- IPv6 Router Advs augmented with Tree Info Option (RA+TIO)
- Helps MR decide which tree to connect to.
- Helps avoid loop formation
- RA+TIO carries info such as:
  - If top level router has Internet connection
  - Tree depth
  - Tree ID

Network In Node Advertisement (NINA)



- Performed once MR has connected to tree
- NINA = IPv6 NA + Network In Node Option
- Advertises availability or loss of routes to MNPs up the tree

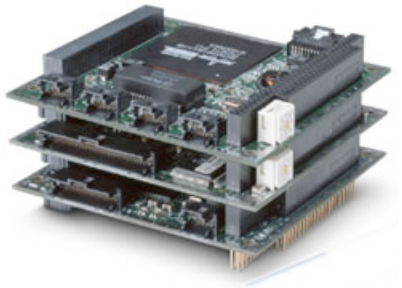
Reverse Routing Header (RRH)



- Added to packets leaving / going to a Nested NEMO
- Records the CoA of the Top Level MR
  - Also designed to record the path through the Nested NEMO if NINA is not present
- Ensures packets leave Nested NEMO and travel directly to the appropriate HA.
  - Removes tunnel nesting

NEMO+ Implementations

- 2 separate implementations
  - Linux (Kernel version 2.6.22)
    - 2Ghz CPU, 512MB RAM
  - Cisco IOS
    - Cisco 3200 Mobile Access Routers (MARs)
- Evaluation testbed comprised of both implementations
  - 2 HAs
  - 4 MRs
  - Predefined set of movements

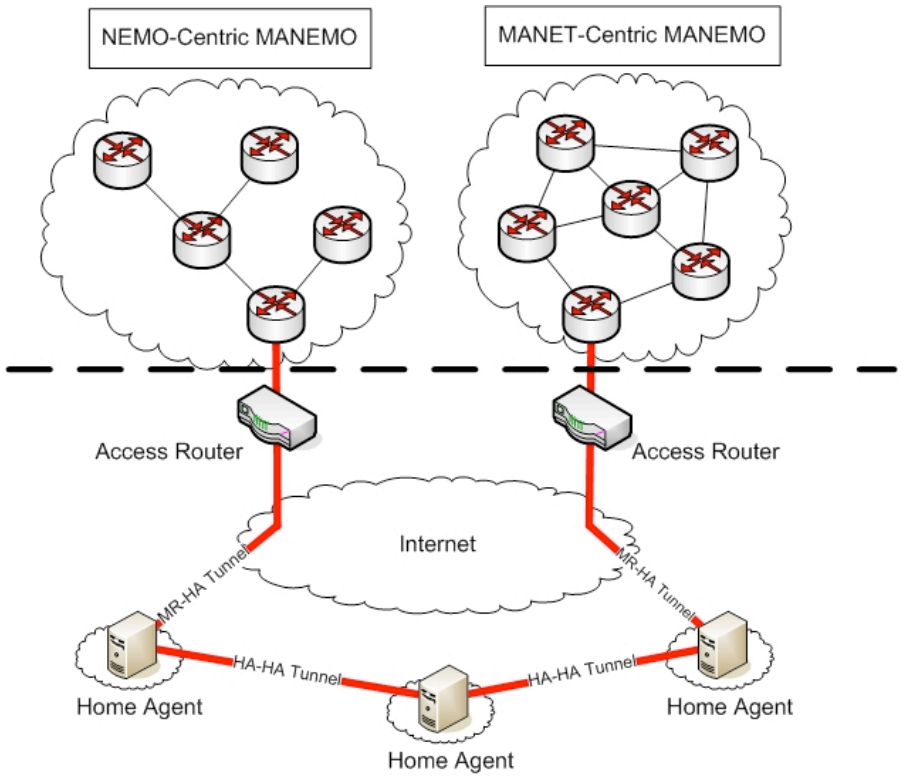


Preliminary Results

- Experimental evaluation testing consisted of roaming an MR across a testbed of four MRs and two HAs
- Comparative measurements were recorded for both NEMO BS and NEMO + in each testbed configuration.
  - Highlights performance benefits attained by removing Nested Tunneling and Pinball Route
- Simulation
  - OMNETT++ simulation runs

Future Work

- Integrate TD & NINA into a HA communication approach (UMA)
  - Supersedes RRH
- Support MANET routing protocol.
  - Different requirements:
    - NEMO-Centric: packets principally transmitted to nodes in the Internet
    - MANET-Centric: inter -communication between nodes as important



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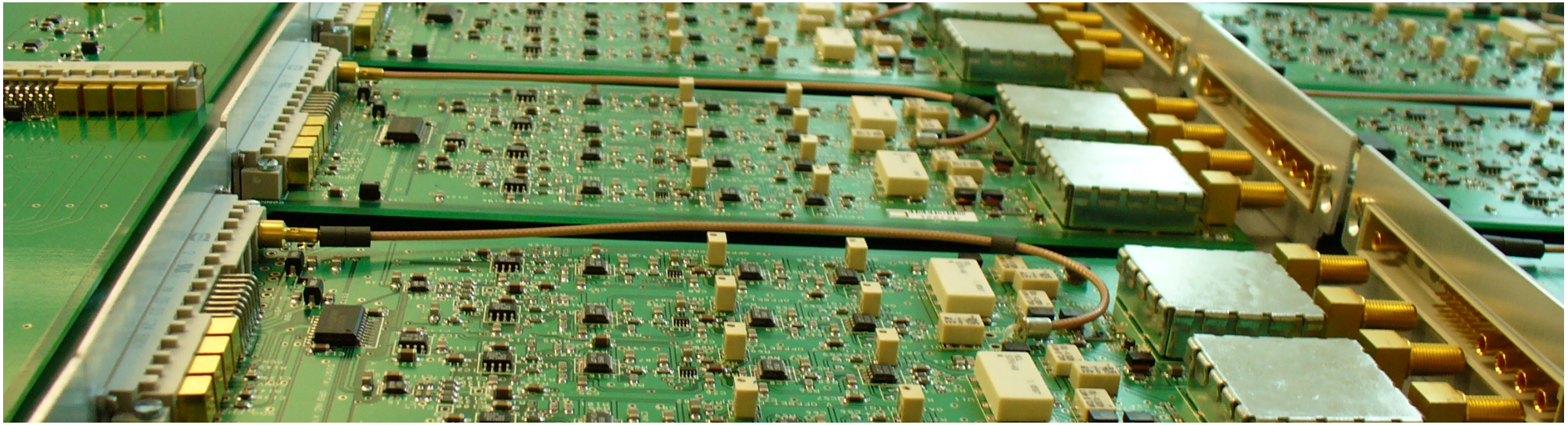
Questions?



Further Information: www.network-mobility.org