

Deploying reliable IPv6 temporary networks  
thanks to  
**NEMO Basic Support** and  
**Multiple Care-of Addresses registration**

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# Usages and Scenario

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## **Usages and Scenario**

The Mobile Router Implementation

Policy Exchange

Deployment Results

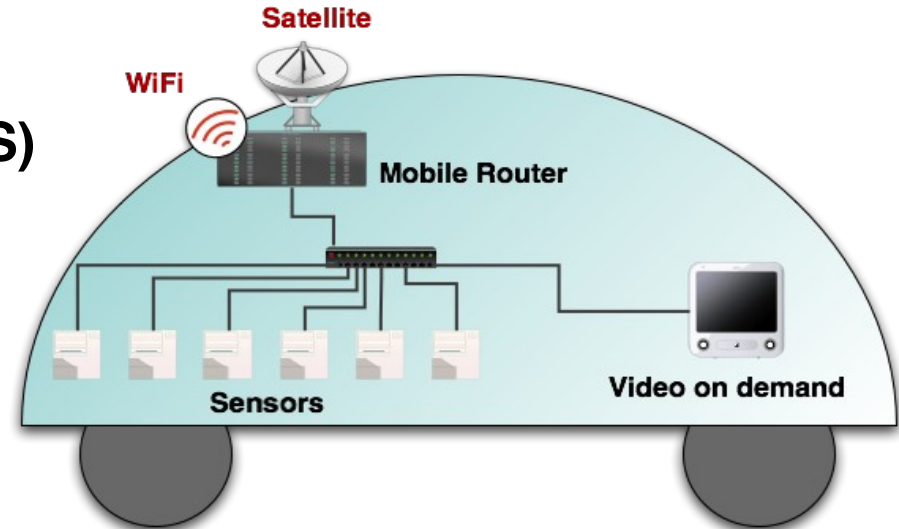
Deployment Issues

Conclusion

# NEMO Basic Support: Some usages

## x Intelligent transportation systems (ITS)

- x Connecting automobile to the Internet,
- x Internet service in buses, trains, etc.



ITS : Intelligent Transportation System



## x Personal Area Networks (PAN)

- x Small sensors and computers network carried by people.

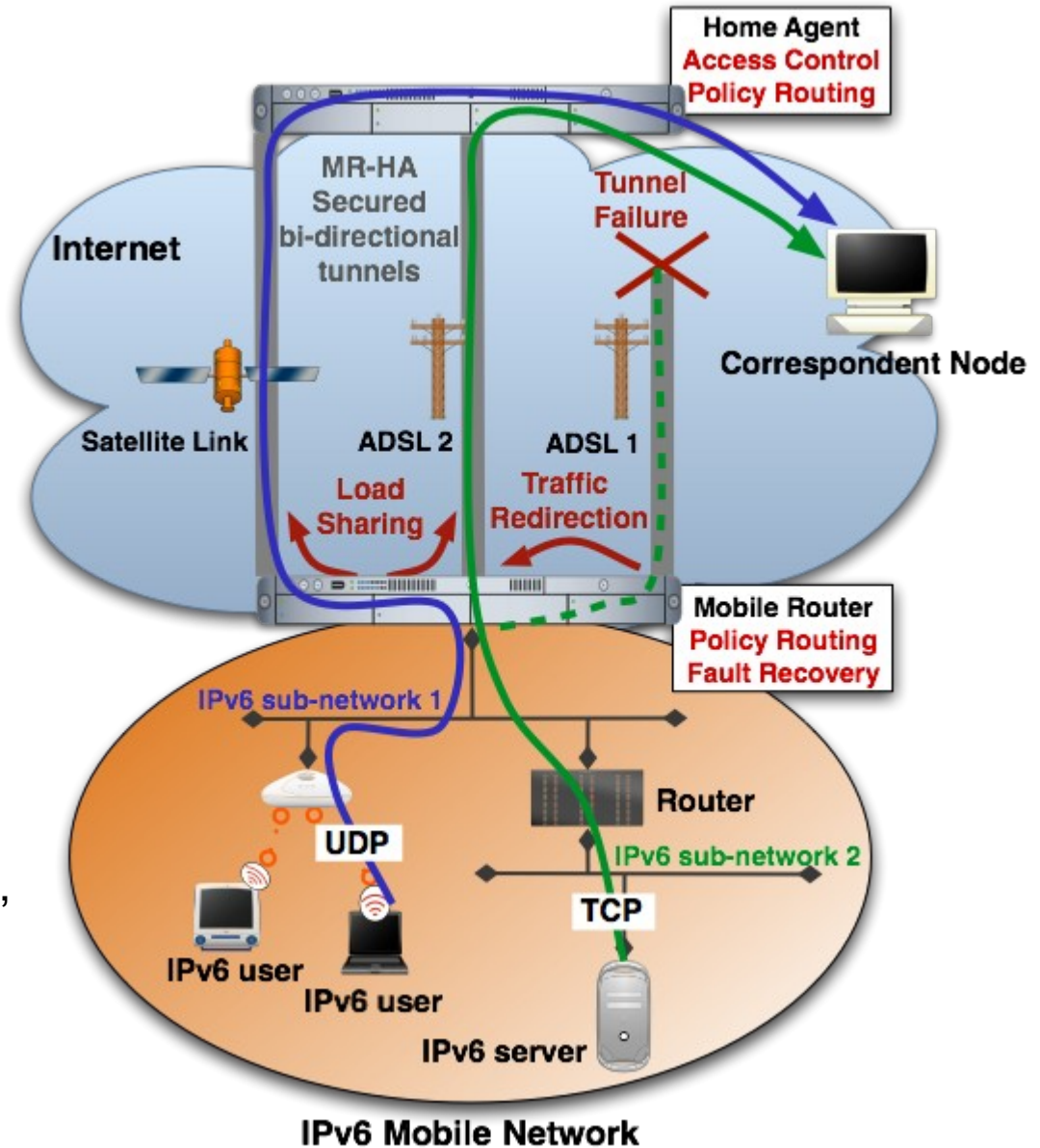
## x Conference networks



- x **Providing IPv6 for conference networks requires to:**
  - x Build the network from scratch,
  - x Route network prefixes to the conference site, or to build tunnels,
  - x Use multihoming for redundancy and fault-tolerance,
  - x Use some tunnel failure detection and recovery mechanism.
  
- x **Why not using NEMO BS and MCoA registration?**
  - x IPv6 Gateway = **Multihomed MR** with multiple access lines:
    - x ADSL, Satellite, etc.
  - x NEMO BS offers:
    - x **Automatic tunnel management** with the HA,
    - x **IPv6 prefixes** automatically routed to the Mobile Network,
  - x MCoA support offers:
    - x **Multiple concurrent MR-HA tunnels** management.

# Benefits

- ✗ **Load Balancing / Load Sharing** between the access networks,
- ✗ **Fault recovery** with traffic redirection,
- ✗ **Access control and filtering** at the HA and the MR, to avoid to overload the MR-HA path,
- ✗ MR-HA path can be protected using **IPSec tunnel mode**,
- ✗ **Easy to deploy** (can be pre-configured),
- ✗ **Transparent** to the end-user.





# The Mobile Router Implementation

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- x **NEMO Basic Support:**

- x **NEPL (NEMO Platform for Linux)** (HUT & Nautilus6 project)

- x <http://www.mobile-ipv6.org>
    - x Feature complete (MR/MN, HA, CN), implicit/explicit modes, DHAAD,
    - x Basic multihoming features (vertical handovers),
    - x But **no multiple concurrent MR-HA tunnels** management.

- x **MCoA extension for NEPL** (Nautilus6 project)

- x draft-ietf-monami6-multiplecoa-01
  - x <http://software.nautilus6.org/MCoA/>
  - x For 2.6.15 kernel (next release: 2.6.16 kernel)
  - x Policy routing is achieved using the **ip6tables** tool (netfilter)



# Policy Exchange

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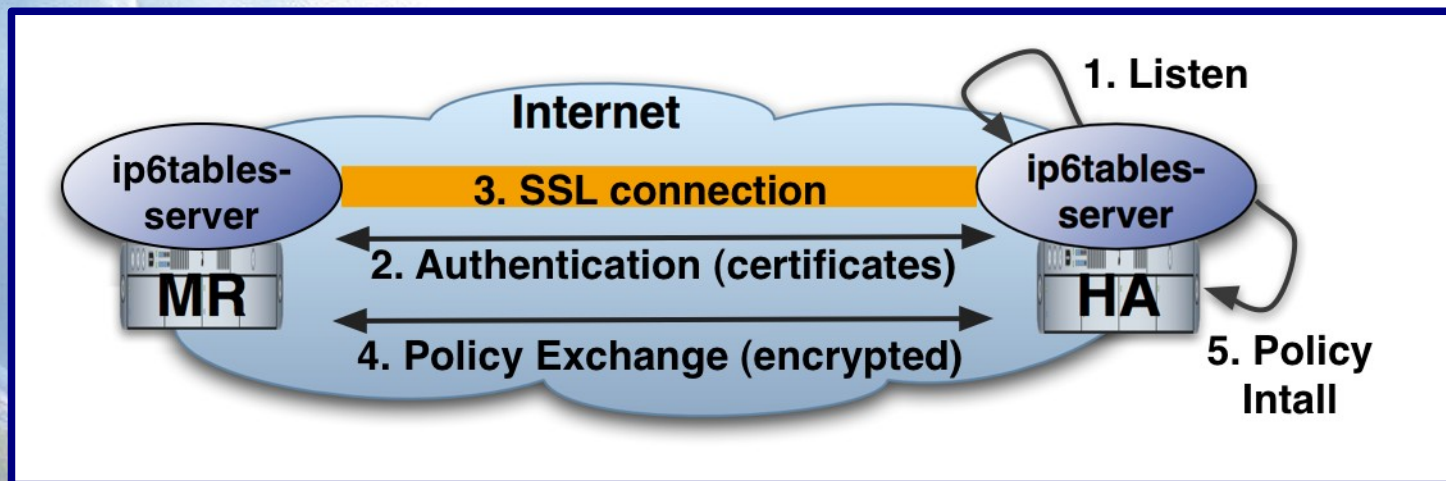
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## ✘ **Multihomed Router:**

- ✘ Policies are defined for **policy routing**, on the HA and the MR,
  - ✘ **Netfilter** on GNU/Linux, **ipfilter** on NetBSD, etc.
- ✘ It is important to **synchronize** policies between the MR and the HA:
  - ✘ When policies are added, modified, deleted,
  - ✘ To ensure **consistency** between the MR and the HA.

- ✗ **Implementation on GNU/Linux**
  - ✗ draft-mitsuya-monami6-flow-distribution-policy-02
  - ✗ Based on the **netfilter packet filtering framework**,



- ✗ **ip6tables-server** extends **ip6tables** and:
  1. Listens to the network waiting for connection,
  2. Authenticate a peer using **X509 certificates**,
  3. Establish a secure connection between the peers using **SSL**,
  4. Send or receive routing policies,
  5. Install them on the system.



# Deployment Results

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## x **4-days conference**

- x Needed to provide 24/24h IPv6 access

## x **Multihomed Mobile Router**

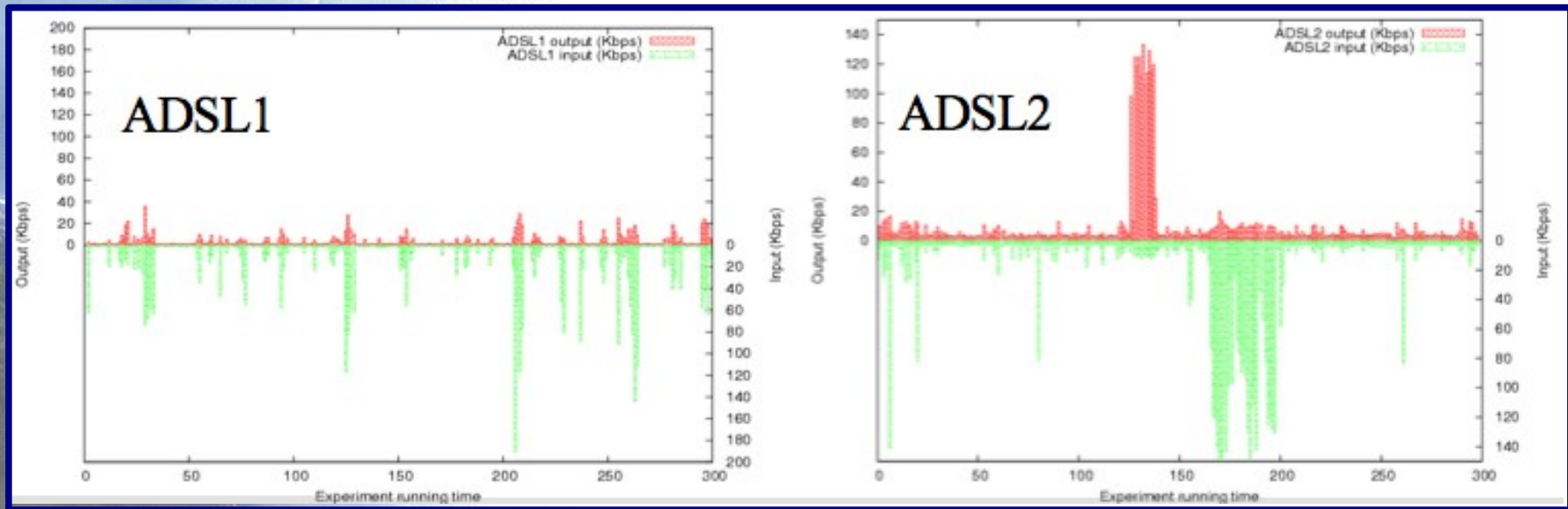
- x Used as the IPv6 gateway,
- x NEPL + MCoA,
- x Connected to two 8Mbps ADSL lines.
- x ip6tables-server for policy exchange,

## x **IPv6 Statistics**

- x 80 IPv6 users in the conference network,
- x Input traffic: 4.7GB
- x Output traffic: 1.8GB
- x From the NEMO, unreachability to the Internet: 2%
  - x Although each line had long unreachability time,
  - x But as long as one line is available, the NEMO is reachable.

## x Load Balancing

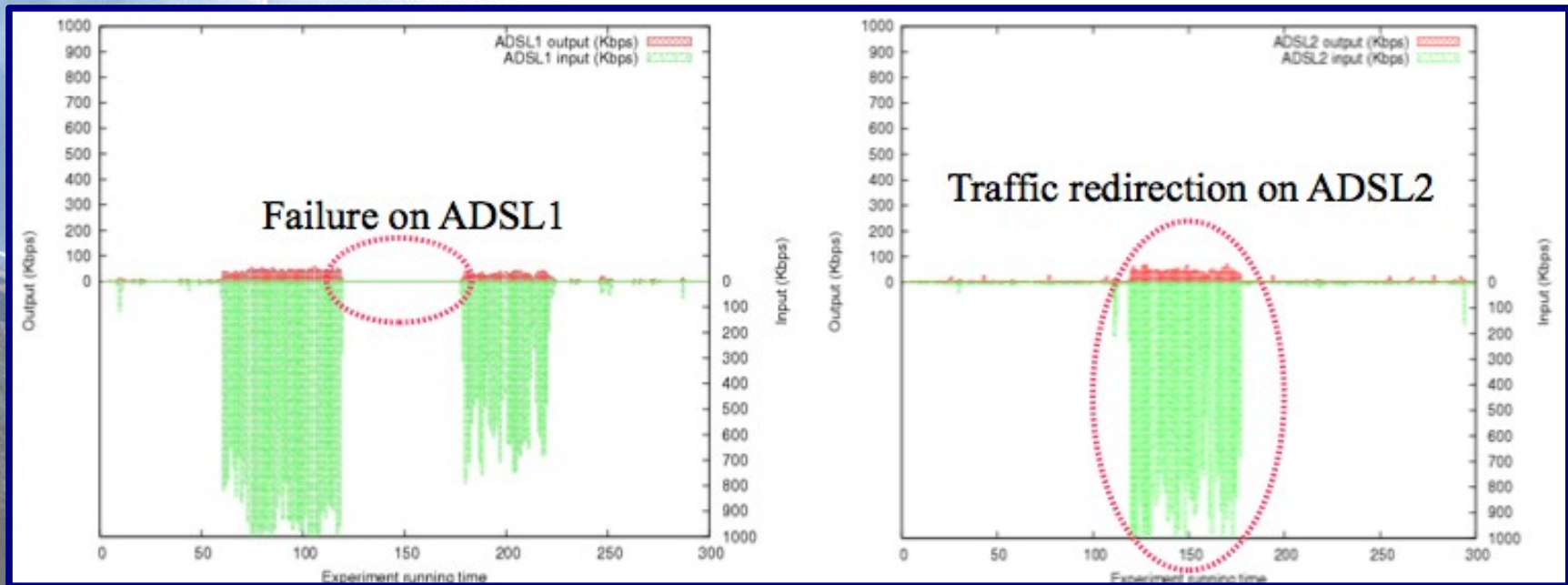
- x Simple policy routing rules
  - x ADSL1: HTTP and HTTPS traffic (TCP traffic on port 80 and 443)
  - x ADSL2: all other traffic



- x Could be interesting to adapt the policies according to the traffic load on each link
  - x Traffic shaping, scheduling

## x Fault Tolerance

- x When Interface failure occurs:
  - x traffic redirected to another interface (the most preferred)
  - x No need to re-order routing policies



- x Failures at the access network can be quickly detected (L2 triggers)
- x Failures at the MR-HA path can be detected by using BU as a heartbeat



- x **Transparency for the users**
  - x Users (MNNs) only need IPv6, that is supported by all main OS,
  - x Users always reachable at the same address,
  - x IPv6 Reachability is always ensured
    - x As long as at least one access network is available at the MR
    - x traffic redirected to another interface (the most preferred)
    - x No need to re-order routing policies



# Deployment Issues

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## x **MTU issues:**

- x MR connected via IPv6-IPv6-IPv4 tunnel
  - x IPv6-IPv4 tunnel to get IPv6 connectivity at the access network
  - x IPv6-IPv6 MR-HA tunnel
  - x Path MTU reduced
- x MTU size has to be reduced on hosts:
  - x MNNs: by sending “icmpv6 too big” messages, or through the RAs
  - x Peers on the Internet: some hosts/servers filters all icmpv6 message
- x One solution: **fragment the tunneled packets between MR and HA**
  - x Tunneled packets are originated by the MR or the HA, and the destination is the HA or the MR,
  - x This increases the load on tunnel endpoints (MR and HA), but allows any hosts to send packets whose size is up to the host MTU.





# Conclusion

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- ✧ **NEMO BS** with **MCoA** is a very likely architecture to deploy temporary networks:
  - ✧ Easy to deploy: can be pre-configured
  - ✧ Match high requirements: load sharing, fault tolerance, transparency

## ✧ Future work

- ✧ Improve the fault detection system
  - ✧ But not really specific to mobility
- ✧ Improve policy routing environment on Linux
  - ✧ To take the maximum benefits from multihomed mobile nodes,
  - ✧ **Traffic Shapping, scheduling, etc.**

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- ✘ **Thank you for listening!**
  - ✘ **Any questions?**

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