This draft introduces some scenarios for mobile networks, i.e. IP networks that change their points of attachment to the Internet, and proposes requirements for network mobility support in the context of the NEMO working group.
Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC-2119.

1. Introduction

Node mobility has been previously addressed in various IETF WGs. However, with the rise of interests in vehicular networks and personal area networks (PAN), which imply aggregated mobility of nodes and devices therein, the overall IP connectivity framework needs to be extended to provide support of mobile networks, in addition of mobile nodes. This is the aim of the NEMO WG.

This draft starts with a description of mobile network scenarios, followed by a recommendation of technical requirements for the solution. Requirements are divided into two categories: general requirements defining the scope of a network mobility solution, and additional requirements specific to the base network mobility support developed by the NEMO WG.

2. Definitions

Definitions that pertain to mobile networks protocols are mainly derived from Mobile IP [4] and Mobile IPv6 [3]. Mobile-network terminology is defined in [2].

3. Scenarios

The formation of a mobile network can exist in various levels of complexity. In the simplest case, a mobile network contains just a mobile router and a host. In the most complicated case, a mobile network is itself a multi-level aggregation of mobile networks with collectively thousands of mobile routers and hosts.

The idea of the mobile router is taken for granted to refer to the router in a mobile network that attaches the mobile network dynamically to various parts of an IP infrastructure. Each mobile node and router can have one or more IP interfaces.

Here are the scenarios of various instances of mobile networks:

- A cellphone with one cellular interface and one Bluetooth interface together with a Bluetooth-enabled PDA constitute a very simple instance of a mobile network. The cellphone is the mobile router while the PDA is used for web browsing or runs a personal web server.

- A train’s passengers use their laptops with Wireless LAN cards to connect to Wireless LAN Access Points deployed in the train. The mobile router is used to link together the Access Points and to provide connectivity to the Internet. Similar scenario can occur as well on a plane, on a ship, and any moving vehicles.
- A car network links its electronic devices (such as brake or injection electronics but also the onboard computer offering maps on LCD’s or the audio player) to the mobile router that is connected to the Internet via a cellular network.

- Multi-level aggregation of mobile networks can be desirable. For example, a person carrying a personal area network of a cellphone and a PDA getting into a car, might wish to offer Internet access to the car’s electronic devices, or it might want to use the car’s own mobile router to connect his/her PDA to the Internet (instead of the cellphone).

- More complex cases, but still real, arise when a larger number of larger sets of equipments interact. One specific case is a typical Fire Department deployment in action. A MESA [5] firefighter would carry a personal area network (with a mobile router and numerous IP-enabled devices). The firefighter’s mobile router has a wireless connection to a vehicle whose mobile router is attached to a private public-safety backbone via a wireless link (maybe satellite link). Being part of the public-safety network, the firefighter can receive data such as building plans, and send data such as photographs, thermal images, lifesign information, etc.

4. General Requirements for Network Mobility Support

The following requirements define the scope of a network mobility solution in NEMO:

- Permanent connectivity and unicast session continuity: The solution MUST allow all nodes in the mobile network to be reachable via their permanent IP addresses, as well as maintain ongoing sessions as the mobile router changes its point of attachement within the topology.

- Implementation in the IP layer: The solution MUST be implemented at the IP layer level. It MUST be transparent to any upper layer so that any upper layer protocol can run unchanged on top of an IP layer extended with network mobility support.

- Mobile networks of any size: The solution MUST support mobile networks of any size. The solution MUST be applicable to small networks (e.g. a PAN comprising a few devices attached to a single mobile router) and large networks (e.g. several subnetworks with a very large numbers of MNNs). It is worth mention that NEMO WG will consider only leaf networks, i.e. mobile networks (irrespective of their size) that will not carry transit traffic.

- No change to the Internet addressing and routing architecture: The solution MUST NOT require changes to the Internet addressing nor routing architecture. It MUST be independent of any routing protocols and MUST preserve route aggregation in the Internet.
- Home equivalent operations: The solution MUST ensure transparent continuation of routing and management operations for a mobile router away from home. Especially, a mobile router running a routing protocol MUST be able to pursue advertising of its routes on its home network. Similarly, management operations such as Router Renumbering MUST be possible for a roaming mobile router.

- Nested mobility: The solution MUST support nested mobility. It MUST support mobile nodes visiting and leaving mobile networks, as well as mobile networks attaching to other mobile networks (nested mobile networks). The solution MUST no restrict in any way the number of levels in the hierarchy of nested mobile networks.

- Multihoming: The solution MUST function for multihomed mobile networks. Cases of multihomed mobile networks include ones with a single mobile router that has multiple attachments to the Internet, as well as ones with multiples mobile routers to attach to the Internet.

- Security: The solution MUST have its specific security issues fully addressed.

- Co-existence with others protocols:
  - The solution MUST allow for co-existence with the AAA and access control frameworks (e.g. PANA). If extra mobile network-specific concerns need to be addressed in these frameworks, the NEMO WG will interact with related WGs.
  - The solution MUST allow for co-existence with QoS protocols, as well as Mobile IPv4 and Mobile IPv6 protocols.

- Multicast session continuity: The solution SHOULD maintain ongoing multicast sessions of MNNs as the mobile router changes its point of attachment within the topology.

5. Additional Requirements for the Base Network Mobility Support

The following requirements are placed on the base network mobility solution to be specified by the NEMO WG:

- Base network mobility support for both IPv4 and IPv6: A solution MUST be provided for both IPv4 and IPv6 environments. Each one MUST base on Mobile IPv4 and Mobile IPv6 respectively. As such two different solutions MAY be defined.

- Based on bi-directional Tunneling between MR and MR’s Home Agent (MRHA tunnel):
  - The base network mobility solution for IPv6 MUST rely on the Mobile IPv6 bi-directional tunnel between the mobile router and its Home Agent.
  - The base network mobility solution for IPv4 MUST rely on the Mobile IPv4 bi-directional tunnel between the mobile router and its Home Agent.
- No changes to Correspondent Nodes: The base solution for network mobility MUST NOT require any modification to MNN’s Correspondent Nodes.

- Network Mobility transparency to MNNs: The base solution for network mobility MUST NOT require any modification to any node in the mobile network (MNNs) but the mobile router. Especially, the base solution MUST provide network mobility management without the need for nodes behind the mobile router to be aware of the network’s mobility and take part in NEMO Mobility Management. Upon a move, the mobile router MUST ensure continuity of the sessions of MNNs transparently to them.

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References


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