

Network Mobility Support Terminology
draft-ietf-nemo-terminology-00.txt

Status of This Memo

This document is an Internet-Draft and is in full conformance with all provisions of [Section 10 of RFC2026](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

Abstract

This document defines a terminology for discussing network mobility problems and solution requirements. Network mobility arises when a router connecting an entire network to the Internet dynamically changes its point of attachment to the Internet therefrom causing the reachability of the entire network to be changed in the topology. Such kind of network is referred to as a mobile network. Without appropriate mechanisms, sessions established between nodes in the mobile network and the global Internet cannot be maintained while the mobile router changes its point of attachment.

Table of Contents

Status of This Memo

Abstract

1.	Introduction	04
2.	Architecture Components	05
3.	Functional Terms	07
	Local Fixed Node (LFN)	07
	Local Mobile Node (LMN).	07
	Visiting Mobile Node (VMN)	07
	NEMO-enabled (NEMO-node)	07
	MIPv6-enabled (MIPv6-node)	07
4.	Nested Mobility.	09
	Nested Mobile Network.	09
	root-NEMO.	10
	parent-NEMO.	10
	sub-NEMO	10
	root-MR.	11
	parent-MR.	11
	sub-MR	11
5.	Multihoming	12
	Multihomed Host.	12
	multi-addressed host	12
	multi-interfaced host.	12
	mutli-linked host.	12
	multi-sited host	12
	Multihomed Mobile Router	12
	multi-egress-addressed MR	12
	multi-egress-interfaced MR	12
	mutli-egress-linked MR	12
	multi-egress-sited MR	12
	Multihomed Mobile Network	12
	multi-MR	12
	Multihomed Nested Mobile Network	14

multi-root	14
Multihoming Illustration	14
6. Miscellaneous Terms	16

Host Mobility Support	16
Network Mobility Support (NEMO Support).	16
NEMO Basic Support	16
NEMO Extended Support	16
Node behind the MR	16
Correspondent Node (CN).	16
MNP	16
Idle MNN	16
Idle Mobile Network	16
7. Changes Since Previous Draft	17
A. Acknowledgments.	17
B. References	17
C. Contact Address	18
D. Full Copyright Statement	19

1. Introduction

Network mobility support is concerned with managing the mobility of an entire network which changes its point of attachment to the Internet and thus its reachability in the Internet topology. If network mobility is not explicitly supported by some mechanisms, existing sessions break and connectivity to the global Internet is lost.

This document defines the specific terminology needed to describe the problem space we face with network mobility and to edict the solutions and the requirements they must comply with. This terminology complies with the usual IPv6 terminology [[RFC2460](#)] and the generic mobility-related terms already defined in [[Mobility](#)] and in the Mobile IPv6 [[MIPv6](#)] specifications. Some terms introduced in the present version of the draft may only be useful for the purpose of defining the problem scope and functional requirements of network mobility support and shall be removed or refined once we agree on the requirements.

The first section introduces terms to define the architecture components; the second introduces terms to discuss the requirements, the third, terms to discuss nested mobility; the forth defines multihoming, and the last, miscellaneous terms which do not fit in either sections. The overall terminology is summarized in fig.1 to 5. Fig.1 shows a single mobile subnetwork. Fig.2. shows a larger mobile network comprising several subnetworks, attached on a foreign link. Fig.3 illustrates a node changing its point of attachment within the mobile network. Fig.4 and 5 illustrate nested mobility whereas Fig.6

to Fig.8 illustrate multihoming.

2. Architecture Components

Fig.1 and 2 illustrate the architecture components involved in network mobility. The terms "Fixed Node (FN)", "Mobile Node (MN)", "Mobile Network", "Mobile Router (MR)", "Mobile Network Node (MNN)", "home link", "foreign link", "ingress interface", "egress interface", access router (AR), home link, foreign link are defined in [\[Mobility\]](#).

A mobile network is composed by one or more IP-subnet and is viewed as a single unit. It is connected to the Internet by means of mobile routers (MRs). Nodes behind the MR primarily comprise fixed nodes (nodes unable to change their point of attachment while maintaining ongoing sessions), and additionally mobile nodes (nodes able to change their point of attachment while maintaining ongoing sessions). In most cases, the internal structure of the mobile network will in effect be relatively stable (no dynamic change of the topology), but this is not a general assumption.

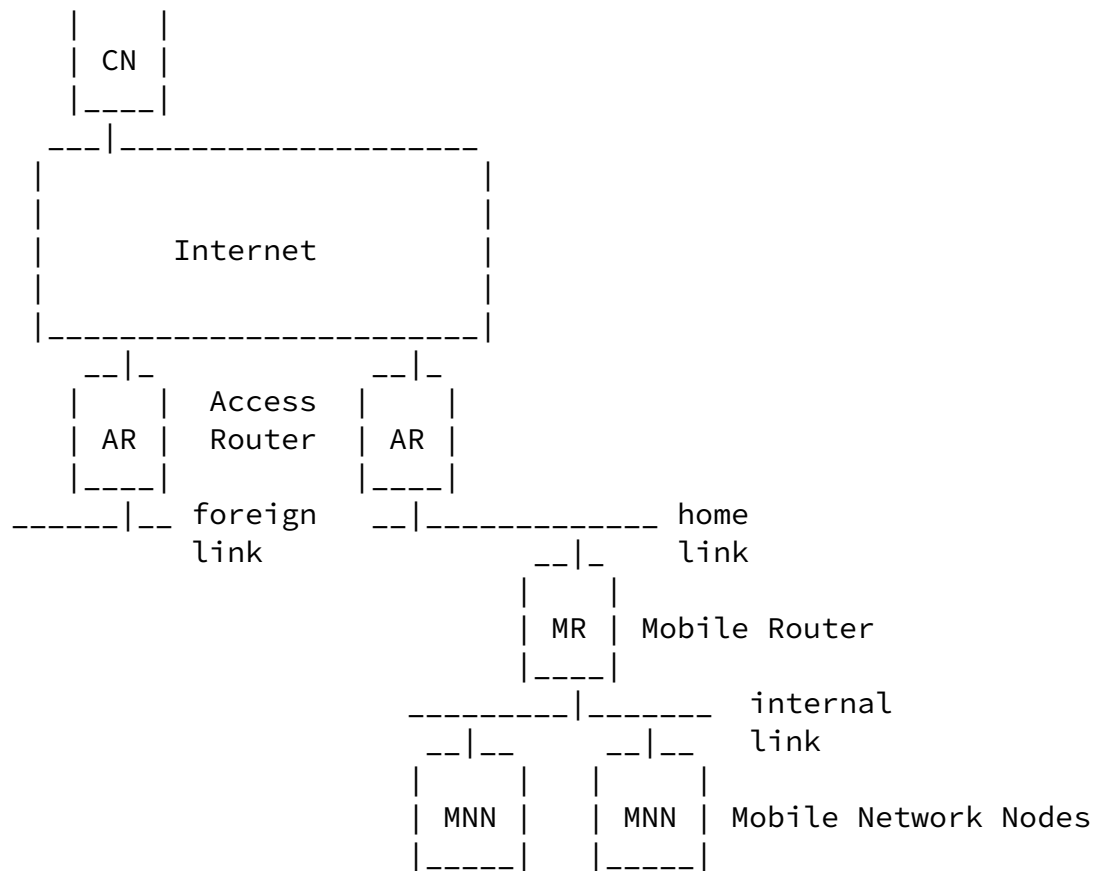
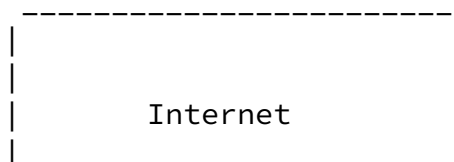


Fig.1: Architecture Components

At the network layer, MRs get access to the global Internet from the Access Routers (ARs) on the visited link. The MR maintains the Internet connectivity for the entire mobile network. It has one or more egress interface(s) and one or more ingress interface(s). When forwarding a packet to the Internet the packet is transmitted upstream through one of the MR's egress interfaces to the AR; when forwarding a packet from the AR down to the mobile network, the packet is transmitted downstream through one of the MR's ingress interfaces.



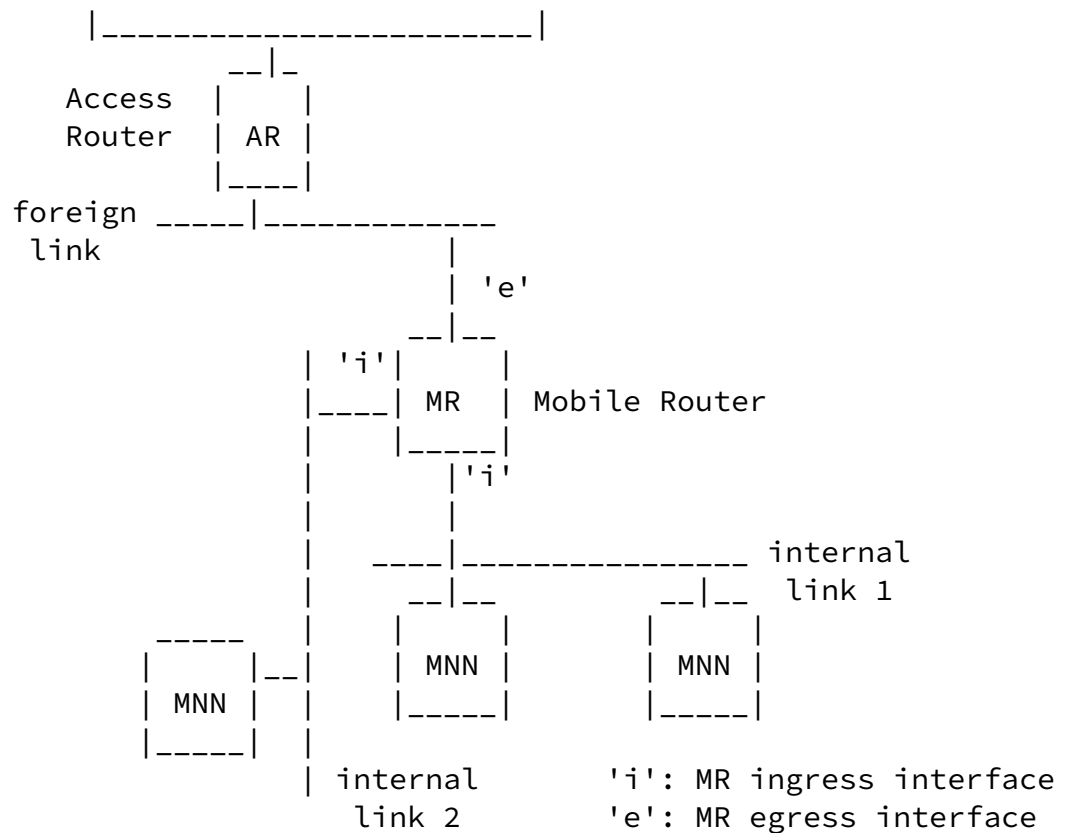


Fig.2: Larger Mobile Network with 2 subnets

3. Functional Terms

Within the term Mobile Network Node (MNN), we can distinguish between LFN, VMN and LMN. The distinction is a property of how different types of nodes can move in the topology and is necessary to discuss issues related to mobility management and access control, but does not preclude that mobility should be handled differently. Nodes are classified according to their function and capabilities with the

rationale that nodes with different properties (may) have different requirements.

Local Fixed Node (LFN)

A fixed node (FN), either a host or a router, that belongs to the mobile network and which doesn't move topologically with respect to the MR.

Local Mobile Node (LMN)

A mobile node (MN), either a host or a router who can move topologically with respect to the MR and whose home link belongs to the mobile network.

Visiting Mobile Node (VMN)

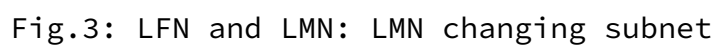
A mobile node (MN), either a host or a router who can move topologically with respect to the MR and whose home link doesn't belong to the mobile network. A VMN that gets attached to a foreign link within the mobile network obtains an address on that link.

NEMO-enabled (NEMO-node)

A node that has been extended with network mobility support capabilities and that may take special actions based on that (details of the capabilities are not known yet, but it may be implementing some sort of Route Optimization).

MIPv6-enabled (MIPv6-node)

A node which has been extended with host mobility support capabilities as defined in [[MIPv6](#)] and that may take special actions based on that



4. Nested Mobility

Nested mobility occurs when there are more than one level of mobility. A MNN acts as an Access Router (AR) and allows visiting nodes to get attached to it. There are two cases of nested mobility:

- when the attaching node is a single node: VMN (see figure 4). For instance, when a passenger carrying a mobile phone gets Internet access from the public access network deployed into a bus.
- when the attaching node is a router with nodes behind it, i.e. a mobile network (see figure 5). For instance, when a passenger carrying a PAN gets Internet access from the public access network deployed in the bus.

For the second case, we introduce the following terms:

Nested Mobile Network

A mobile network is said to be nested when a mobile network is getting attached to a larger mobile network. The aggregated hierarchy of mobile networks becomes a single nested mobile network.

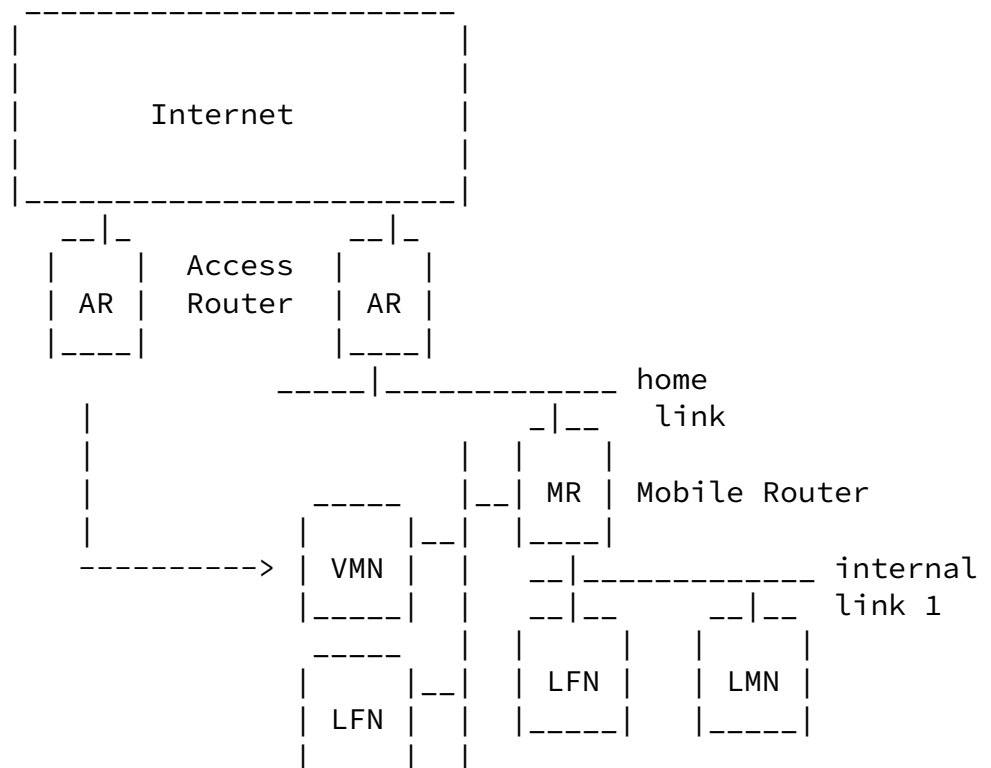


Fig.4: Nested Mobility: single VMN attached to a mobile network

root-NEMO

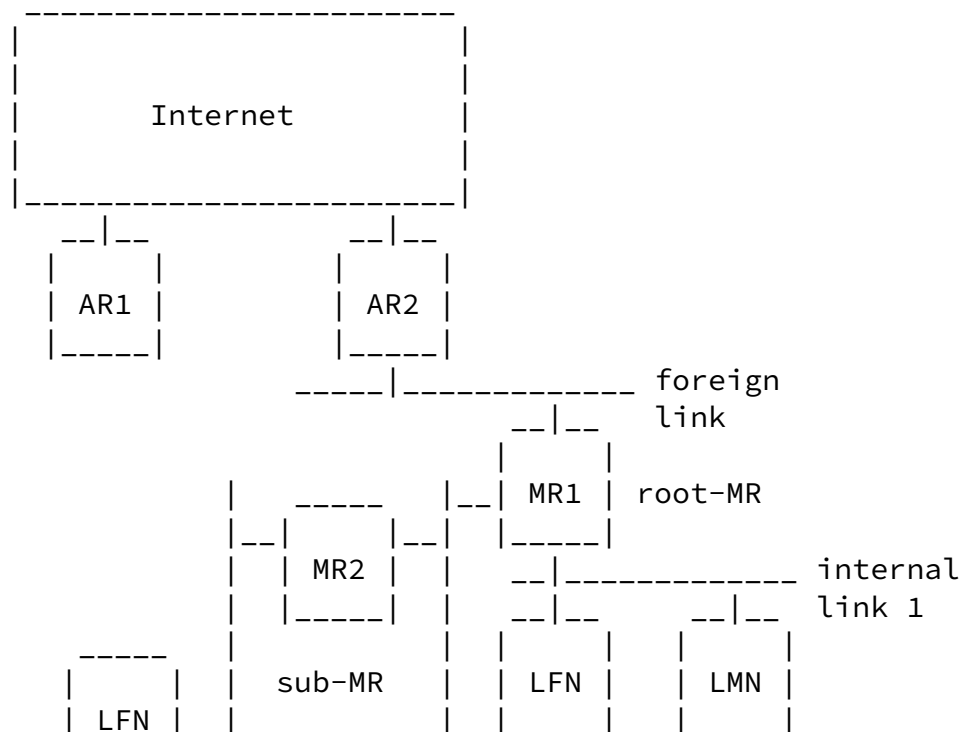
The mobile network at the top of the hierarchy connecting the aggregated nested mobile network to the Internet.

parent-NEMO

The upstream mobile network providing Internet access to a mobile network down the hierarchy.

sub-NEMO

The downstream mobile network attached to a mobile network up the hierarchy. It becomes a subservient of the parent-NEMO. The sub-NEMO is getting Internet access through the parent-NEMO and does not provide Internet access to the parent-NEMO.



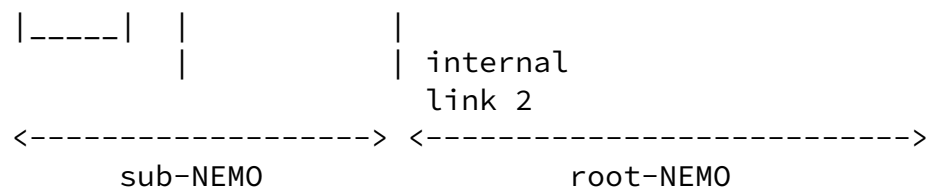


Fig.5: Nested Mobility: sub-NEMO attached to a larger mobile network

root-MR

The MR(s) of the root-NEMO used to connect the nested mobile network to the fixed Internet.

parent-MR

The MR(s) of the parent-NEMO.

sub-MR

The MR(s) of the sub-NEMO connected to a parent-NEMO

5. Multihoming

Multihoming, as currently defined by the IETF, covers site-multihoming [[MULTI6](#)] and host multihoming.

Multihomed Host

Within host-multihoming, a host may either be:

- multi-addressed: multiple source addresses to choose between on a given interface; all IPv6 nodes are multi-addressed due to the presence of link-local addresses on all interfaces.
- multi-interfaced: multiple interfaces to choose between, on the same link or not.
- multi-linked: multiple links to choose between (just like multi-interfaced but all interfaces are NOT connected to the same link)
- multi-sited: when using IPv6 site-local address and attached to different sites

Multihomed Mobile Router

A MR is multihomed when it has simultaneously more than one active connection to the Internet, that is when it is either:

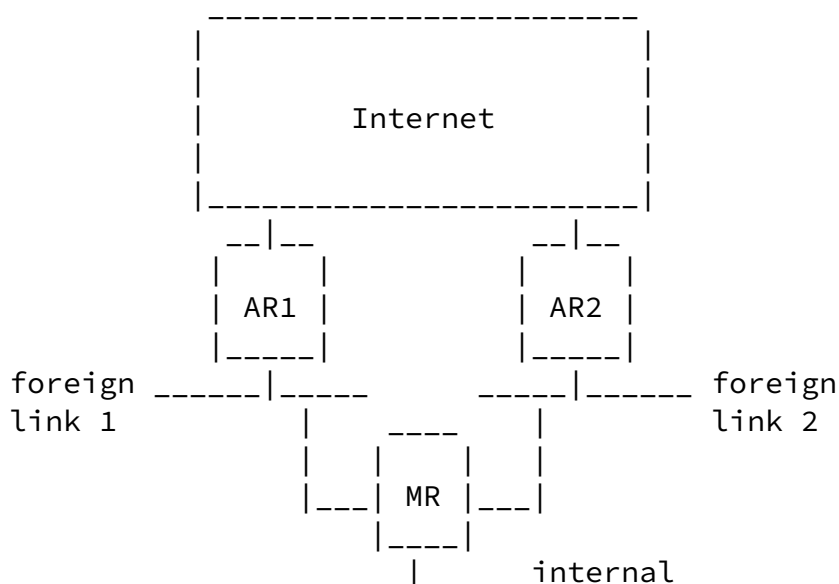
- multi-egress-addressed MR: the MR has simultaneously multiple active addresses to choose between on a given egress interface
- multi-egress-interfaced MR: the MR has simultaneously multiple active egress interfaces on the same link or not
- multi-egress-linked MR: the MR has simultaneously multiple active egress interfaces on distinct links
- multi-egress-sited MR: the MR is simultaneously attached to different sites (possible distinct ISPs).

Multihomed Mobile Network

A mobile network is multihomed when there more than one active interface connected to the global Internet, that is when either:

- a MR is multihomed, or
- mutlti-MR: the mobile network has more than one MR to choose

between



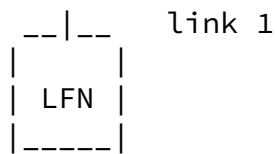


Fig.6: Multihomed Mobile Network: multi-interfaced MR

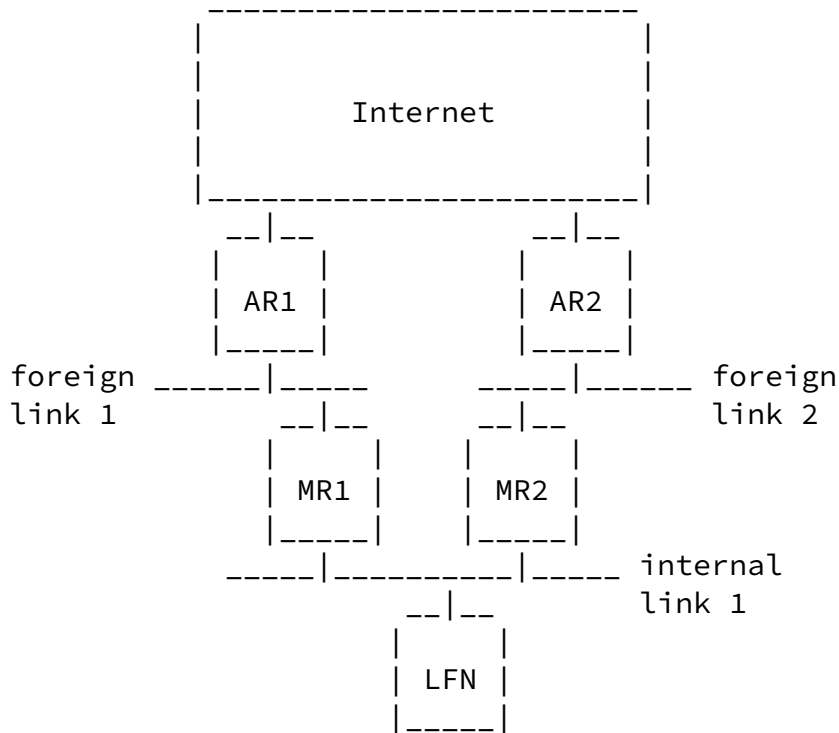


Fig.7: Multihomed Mobile Network: multi-MR

Multihomed Nested Mobile Network

A nested mobile network is multihomed when there more than one active interface connected to the global Internet, that is when either:

- a root-MR is multihomed, or
- multi-root: there are more than one root-MR to choose between

Illustration

Fig.6 and 7 show two examples of multihomed mobile networks. Fig.8. shows two independent mobile networks. mobile_network_1 is single-homed to the Internet through MR1. mobile_network_2 is multihomed to the Internet through MR2a and MR2b.

Let's consider the two following nested scenarios:

Scenario 1: what happens when MR2a attaches to AR1 ?

- mobile_network_2 becomes a subservient of mobile_network_1
- mobile_network_1 is the parent-NEMO (and also the root-NEMO)
- mobile_network_2 is the sub-NEMO
- MR1 is the root-MR for the aggregated nested mobile network
- MR2a is a sub-MR in the aggregated nested mobile network
- mobile_network_2 is still multihomed to the Internet, but to AR1 and ARz
- the aggregated nested mobile network is not multihomed

Scenario 2: what happens when MR1 attaches to AR2 ?

- mobile_network_1 becomes a subservient of mobile_network_2
- mobile_network_1 is the sub-NEMO
- mobile_network_2 is the parent_NEMO (and also the root-NEMO)

- MR2a and MR2b are both root_MRs for the aggregated nested mobile network
- MR1 is a sub-MR in the aggregated nested mobile network

- mobile_network_1 is not multihomed
- the aggregated nested mobile network is multihomed

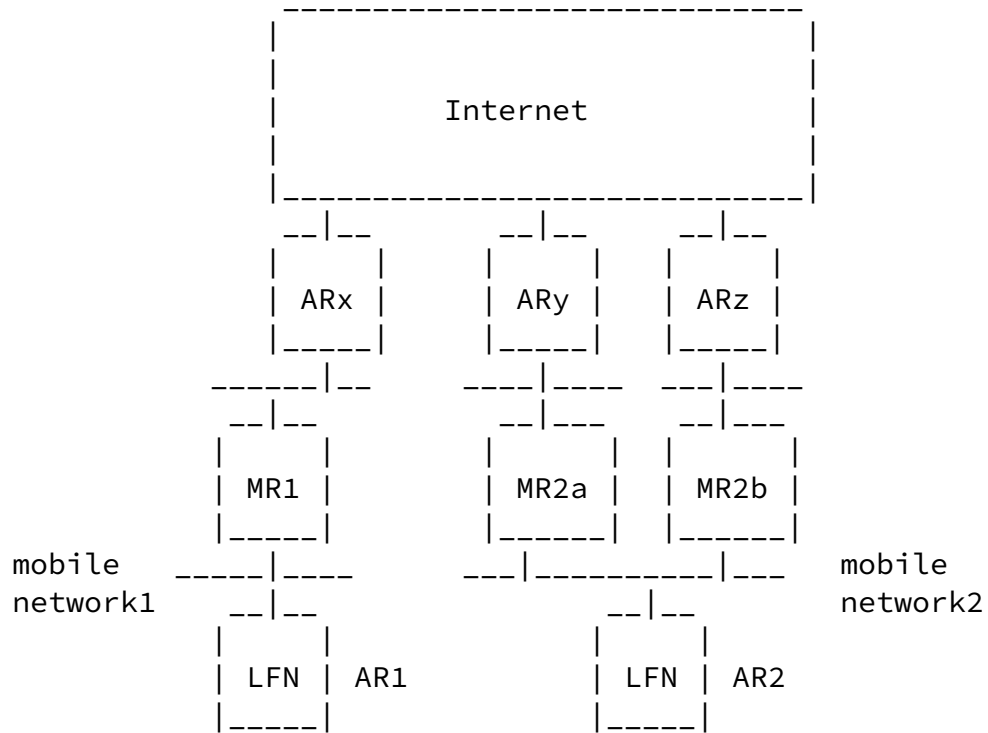


Fig.8: Multihomed Nested Mobile Network

6. Miscellaneous Terms

Host mobility support

Host Mobility Support is a mechanism which maintains session continuity between mobile nodes and their correspondents upon the mobile host's change of point of attachment. It could be achieved by Mobile IPv6.

Network Mobility support (NEMO Support)

Network Mobility Support is a mechanism which maintains session continuity between mobile network nodes and their correspondent upon a mobile router's change of point of attachment. Solutions for this problem are classified into NEMO Basic Support, and NEMO Extended Support.

NEMO Basic Support

NEMO Basic support is to preserve session continuity by means of bidirectional tunneling much like what is done using [[MIPv6](#)] for mobile nodes.

NEMO Extended Support

NEMO Extended support is to provide the necessary optimization, including routing optimization between arbitrary MNNs and CNs.

Node behind the MR

Any MNN in a mobile network, beside the MRs connecting the mobile network to the Internet.

Correspondent Node (CN)

Any node that is communicating with one or more MNNs. A CN could either be located in the fixed network or within the mobile network, and could be either fixed or mobile.

MNP

An acronym for Mobile Network Prefix (defined in [[Mobility](#)])

Idle MNN

A MNN that does not engage in any communication.

Idle Mobile Network

A mobile network that does not engage in any communication outside the network may be considered idle from the global Internet. This doesn't preclude that MNNs are themselves idle. Internal traffic between any two MNNs located in the same mobile network is not concerned by this statement.

7. Changes since [draft-ernst-nemo-terminology-01.txt](#)

- removed terms "inter-domain mobility" and "intra-domain mobility". Those are replaced with terms "Global mobility" and "Local mobility" from [[Mobility](#)]
- removed terms "access router", "mobile network prefix", "home subnet prefix", "foreign subnet prefix", "fixed node", "mobile node", "mobile network", "mobile network node". "ingress interface", "egress interface" to avoid redundancy with [[Mobility](#)] where those terms are defined.
- MIPv6-enabled not anymore restricted to the MN Operation
- removed section "applications" to avoid redundancy with [[Requirements](#)]
- more text for multi-homing

[A.](#) Acknowledgments

The material presented in this document takes most of the text from our former internet-drafts submitted to MobileIP WG and to the former MONET BOF. Authors would therefore like to thank both Motorola Labs Paris and INRIA (PLANETE team, Grenoble, France), for the opportunity to bring this terminology to the IETF, and particularly Claude Castelluccia (INRIA) for his advices, suggestions, and direction, Alexandru Petrescu (Motorola) and Christophe Janneteau (Motorola). We also acknowledge the input from Hesham Soliman (Ericsson), Mattias Pettersson (Ericsson), and numerous other people on the NEMO mailing list.

[B.](#) References

[Requirements] Thierry Ernst
"Network Mobility Support Requirements"
[draft-ietf-nemo-requirements.txt](#)
Work in progress.

[MIPv6] David B. Johnson and C. Perkins.
"Mobility Support in IPv6".
Internet Draft [draft-ietf-mobileip-ipv6.txt](#),
Work in progress.

[Mobility] J. Manner and M. Kojo
"Mobility Related Terminology"
[draft-ietf-seamoby-mobility-terminology.txt](#)

Ernst and Lach

Expires November 2003

[Page 17]

INTERNET-DRAFT Network Mobility Support Terminology May 2003

Work in progress

[MULTI6] B. Black, V. Gill and J. Abley
"Requirements for IPv6 Site-Multihoming Architectures"
[draft-ietf-multi6-multihoming-requirements.txt](#)
Work in progress

[IPv6-NODE] John Loughney
"IPv6 Node Requirements"
[draft-ietf-ipv6-node-requirements.txt](#)
Work in progress.

[Perkins] C. E. Perkins.
"Mobile IP, Design Principles and Practices."
Wireless Communications Series.
Addison-Wesley, 1998. ISBN 0-201-63469-4.

[RFC1726] C. Partridge
"Technical Criteria for Choosing IP the Next
Generation",
IETF [RFC 1726 section 5.15](#), December 1994.

[RFC2460] S. Deering and R. Hinden.
"Internet Protocol Version 6 (IPv6) Specification".
IETF [RFC 2460](#), December 1998.

[RFC2002] C. Perkins (Editor).
"IP Mobility Support".
IETF [RFC 2002](#), October 1996.

[C](#). Contact Address

Questions about this document can be directed to the authors:

Thierry Ernst,
Keio University.
5322 Endo, Fujisawa-shi,
Kanagawa 252-8520, Japan.
Phone : +81-466-49-1100
Fax : +81-466-49-1395
Email : ernst@sfc.wide.ad.jp

Hong-Yon Lach
Motorola Labs Paris, Lab Manager,
Networking and Applications Lab (NAL)
Espace Technologique - Saint Aubin
91193 Gif-sur-Yvette Cedex, France
Phone: +33-169-35-25-36

Ernst and Lach

Expires November 2003

[Page 18]

INTERNET-DRAFT Network Mobility Support Terminology

May 2003

Email: Hong-Yon.Lach@crm.mot.com

D. Full Copyright Statement

Copyright (C) The Internet Society (2002). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT

NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN
WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF
MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Funding for the RFC editor function is currently provided by the
Internet Society.