

# Mobile IPv6

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Comunicacoes Moveis, 5ºano 2002/2003 , LEEC-FEUP

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## Abstract

Configuration and test of a IPv6 network with mobility support based on the Mobile IPv6 protocol and implemented with MIPL – Mobile IPv6 for Linux.

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## I-Introduction

The huge number of mobile terminals working in our days and its continues growth is a reality that must be looked seriously. Today, there are appearing new mobile systems offering a greater availability of bandwidth than GSM, like GPRS and UMTS. These new systems can also offer access to a packet switching network based on IP (like Internet) and all the services supported on this networks. So, Mobility and IP based systems/applications will coexists and used largely in the near future mobile systems.

To support Mobility the IP protocol must allow a mobile terminal to move free in space and keep all its connections up, as well as be reachable to other IP correspondent terminals, i.e. the movement and change of access point by the mobile terminal must be transparent to all layers above IP layer. This implies the use of a fixed IP address per terminal and a temporary address on every new network visited by the terminal, so that the packets can always be routed to the terminal as if it is at its home network. The number of possible addresses with IPv4 is not enough to have an address per terminal which difficult the support of mobility. The next generation of IP, IPv6, will solve this problem with its 128bits addresses and allowed the development of the new mobility protocol named MobileIPv6. This protocol is based on its IPv4 version, MobileIPv4, but uses the new IPv6 mechanisms and facilities like Stateless Address Autoconfiguration and Neighbor Discovery. The protocol has been proposed to the IPv6 standard. If it is accepted, in the near future every computer or mobile device implemented with IPv6 will support mobility by default.

The aim of this work was to study and test the use of MobileIPv6 in a lab environment. In the **section II** of this essay it will be a description of the MobileIPv6 protocol and its working procedures. Next in **section III** is described the work as well as the architecture and configuration of the network and entities used. Thereafter, in **section IV** there are presented the mobility tests done and published the work results. In **section V** are described the tested situations' logs and its respectively analysis. Finally, in **section VI** a conclusion of the work and comments to the Mobile IPv6 and its comparison with the MobileIPv4.

## II-MOBILE IPv6

The Mobile IPv6 protocol allows a node to leave its home network and visit another one keeping all its connections up and being reachable to all the Internet, i.e. moving between different physical networks with continuity of connection. To implement this functionality Mobile IPv6 identifies each node by a unique and static IPv6 address – Home Address.

When the Mobile Node moves away from its home network it sends information to the Home Agent about its current location so that packets sent to it can be intercepted by the Home Agent and tunneled to the actual Mobile Node's location. In order to permit the Mobile Node's packet tunneling it needs a temporary Care-of-Address in each different point of attachment away from its Home network. Mobile Node can get a Care-of-Address in two ways: 1-Stateless Address Autoconfiguration, by receiving Router Advertisement or 2-Stateful Address Autoconfiguration, by being assigned by a DHCP server.

The MobileIPv6 needs the exchange of messages between nodes as well as Data Structures so that the mobility can be performed. The messages exchanged are defined as IPv6 Destination Options and there are four:

**1-Binding Update:** This message is send by the Mobile Node to its Home Agent or to a Correspondent Node to inform them about its current Care-of-Address.

**2-Binding Acknowledgement:** This message is used by the Home Agent or Correspondent Node to inform the Mobile Node of the correct receiving of the Binding Update message. This Binding Acknowledgment is only sent if the Mobile Node ask it to its Home Agent or Correspondent Node.

**3-Binding Request:**This message is sent by any node to the Mobile Node to ask it to send a Binding Update message to inform from its current Care-of-Address.

**4-Home Address:** This option is used by the Mobile Node whenever it sends a packet to a node to inform that destination node about its Home Address.

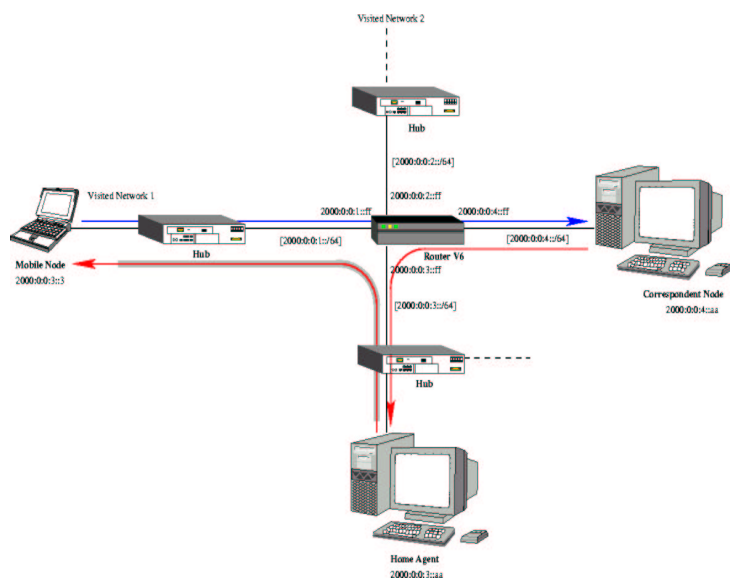
In terms of Data Structures, MobileIPv6 defines three conceptual data structures:

**1-Binding Cache:** This data structures exists in every node and is used to record the binding relations from other nodes. When a node receives a Binding Update message it adds the binding to the Binding Cache. Whenever a node sends a packet, first it searches the Binding Cache and if there is an entry it sends the packet to the destination node's Care-of-Address using a Routing Header otherwise it sends the packet normally to the node's Home Address.

**2-Binding Update List:** Every Mobile Node has one of this lists which is used to keep information about every Binding Update sent by this Mobile Node to any Correspondent Node and to its Home Agent which the lifetime has not yet expired.

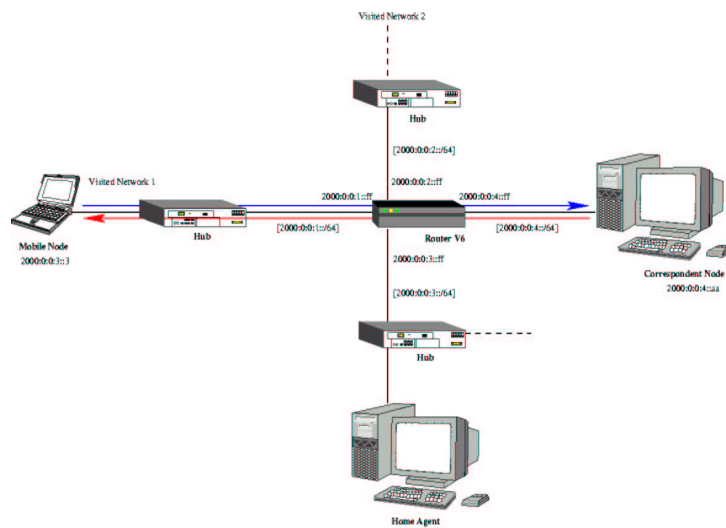
**3-Home Agents List:** Each home link has a node serving as home agent. It generates a list containing information about all other home agents on that link. That list is created based on multicast Router Advertisement, which are sent by all home agents. The Dynamic Home Discovery mechanism uses that information about all other home agents.

The working procedure of the MobileIPv6 protocol will be described in the next paragraphs. The **Registration process** with the Home Agent starts whenever the Mobile Node detects that it has moved from network and after discover a default router and getting a new Care-of-Address by Address Autoconfiguration. The Care-of-Address is composed by the visited home network prefix and the MAC address of the Mobile Node's network card. The Mobile Node gets the visited network prefix by listening to Router Advertisements messages. Composed the Care-of-Address, Mobile Node informs its Home Agent by sending a Binding Update message. After registering the binding in the Binding Cache, Home Agent replies to the Mobile Node with a Binding Acknowledgement message to confirm the register. Now, whenever Home Agent receives packets addressed to the Mobile Node it tunnels them to the Care-of-Address registered to that Mobile Node using IPv6 encapsulation. When the Mobile Node send packets to any destination it sends them directly and adds its actual Care-of-Address to the source field, as well as the Home Address destination option, which allows the transparent use of Care-of-Address by the Correspondent Node. The routing process described above is known as Triangle Routing, because of the logic triangle made by the routing of packets send by the Correspondent Node to a Mobile Node away from its home network.



**Figure-1:** Triangle Routing scheme

Mobile Node also sends a Binding Update message to its Correspondent Node so that it can associate the Mobile Node's Care-of-Address with its Home Address in the Binding Cache and send packets directly instead through Home Agent. This Mobile IPv6 mechanism is known as Router Optimization and is essential for the IPv6 efficient operation because reduces network load and latency, as well as network and home agents congestion. When a Correspondent Node sends a packet it first checks its Binding Cache and if there is an entry it will send the packet to the Mobile Node using a Routing Header with two hops. The first hop is the Care-of-Address and the second is the Home Address of the Mobile node. The packet sent to the Care-of-Address is received by the Mobile Node and is forwarded to the second hop, its Home Address, but this address is the Mobile Node's own address. So, the packet is looped back in the Mobile Node and this means that the Node can work normally like if it is at its home network.

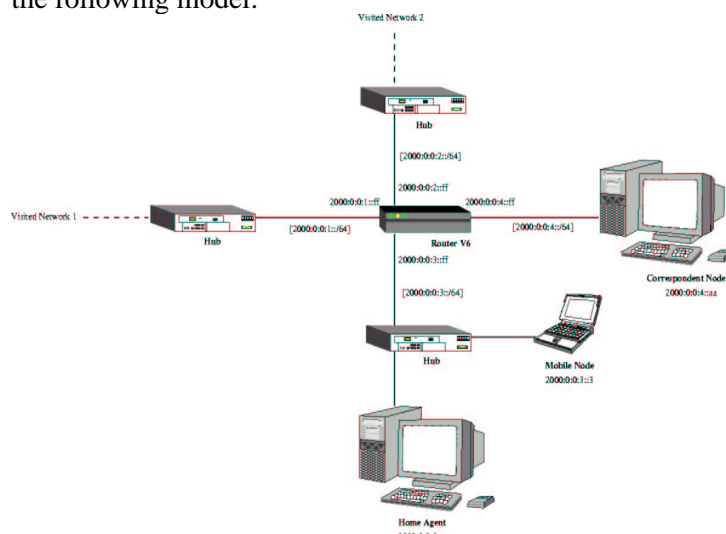


**Figure-2:** Route Optimization scheme

Before Mobile Node can send the Binding Update its has to prove to the Correspondent Node that its Home Address and Care-of-Address are addressable and authentic. This authentication method is known as "return routability procedure" and Mobile Node proves its existence if it receives a "keygen tokens" from its Correspondent Node. The procedure consists in Mobile Node sending at the same time a Home Test Init and a Care-of Test Init message to the Correspondent Node. This last node reply this messages with a Home Test and Care-of Test message, respectively, where is included the "keygen token". Care-of Test Init and Care-of Test messages and routed directly between Mobile Node and Correspondent Node, although, Home Test Init and Home Test messages are reverse tunneled through Home Agent.

### III-Experience Description and network configuration

The purpose of the experience was to configure an IPv6 Network with mobility support and then test it. In order to test the mobility in this IPv6 network it was used the following model:



**Figure-3:** Network organization scheme

The Mobile IPv6 implementation used in this experience was the MIPL-Mobile IPv6 for Linux, version: mipv6-0.9.5.1-v2.4.20. To support the MIPv6 the following procedures must be done:

- Make the Kernel patch to support IPv6 protocol;
- Compile and install the tools in userspace necessary to

configure and install the MIPv6;

- Configure the MIPv6 entities;

(The first two points are not in the scope of this work.)

To configure the HA, CN and the MN it was used a common configuration file installed in each entity: “/etc/sysconfig/network-mip6.conf”. The correspondent function of each entity HA, CN and MN are set in the file's field: “FUNCTIONALITY=” as “ha|cn|mn” respectively.

To the HA and router another configuration file was used: “/etc/radvd.conf”. In this file, those entities can be configured to make “Router Advertisement”. Properties like the minimum/maximum time interval between two “Router Advertisements” messages can also be set, among others properties. To activate the Mobile IPv6, the Home Agent and the Router must be running their radvd (“Router Advertisement”) daemons and the Mobile IPv6 must be started in all the entities involved.

Note: all of the procedures described above had already been taken at the time of the experience.

The experience really began with the configuration of the MN. To set its IPv6 address and gateway the following commands were used:

- `ifconfig eth0 inet6 add 2000:0:0:3::3/64`
- `route -A inet6 add 2000::/3 gw 2000:0:0:3::ff`

To check if the new network configuration is correctly set, as well as, to get MN's MAC address, the command “ifconfig” can be used.

- MAC address of the Mobile Node:  
00:C0:DF:08:D5:B6

The Mobile IPv6 configuration file in the MN was edited with:

- “FUNCTIONALITY=mn”;
- “TUNNEL\_SITELOCAL=yes”;
- “HOMEADDRESS=2000:0:0:3::3/64”;
- “HOMEAGENT=2000:0:0:3::aa/64”.

After these configuring steps, the module was started. The following script start/stops the module: “mobile-ip6 start|stop”.

## IV-Tests and Results

In order to test the connectivity between the Mobile Node and the Home Agent; between the Mobile Node and the Correspondent Node it was used the command “ping6”. The Table-1 resumes these connectivity tests:

From	To	Result
MN (2000:0:0:3::3)	HA (2000:0:0:3::aa)	Ok
MN (2000:0:0:3::3)	CN (2000:0:0:4::aa)	Ok

**Table-1**

Now that the connectivity between the entities is achieved a procedure to test the mobility of the Mobile Node was made. So, with Mobile Node at its home network a connection to the Correspondent Node was established with ping6. Then the Mobile Node was moved to the visited network 1 and it was verified that the pings stopped but restarted normally after 2 or 3 seconds. Thereafter, the Mobile Node was moved to the visited network 2 and back to its home network

and the same situation was verified.

Other test done was to connect the mobile node at each of the possible networks and execute ping6 to the CN and HA. The Table-2 summarize these results. To correctly understand the table the symbols should be interpreted as follow: “MN@” means “Mobile Node at” and bellow this symbol are the correspondent networks where this node was connected when communicating with other nodes. The symbol “⇒” means “communicating with” and in front of this symbol are the nodes that the MN communicated with.

MN@	NODE	MIN (ms)	AVG (ms)	MAX (ms)	MDEV (ms)
Home Network ⇒	CN	0,932	0,985	1,076	0,50
	HA	0,348	0,371	0,410	0,031
Visited Network 1 ⇒	CN	0,672	0,706	0,816	0,036
	HA	0,863	0,897	1,051	0,045
Visited Network 2 ⇒	CN	0,650	0,675	0,715	0,025
	HA	0,873	0,920	1,060	0,052

**Table-2**

The next experience done was to test the connectivity between the Mobile Node and another Mobile Node in different situations. Table-4 was obtained using the command “ping6” from the Mobile Node 1 “2000:0:0:3::3” to the Mobile Node 2 “2000:0:0:3::6”:

MN1@	NODE	MIN (ms)	AVG (ms)	MAX (ms)	MDEV (ms)
Home Network ⇒	MN2@Home Network	0,355	0,405	0,906	0,116
	MN2@Visited Network 1	1,343	1,424	1,964	0,142
Visited Network 1 ⇒	MN2@Home Network	1,323	1,353	1,428	0,050
	MN2@Visited Network 1	1,891	1,955	2,636	0,162

**Table-4**

To check the Binding Update List and its registered bindings it was used the diagnostics tool from the MIPv6, “mipdiag”. Here is an example of one of that diagnostics:

```
tux33:~# mipdiag -l
Mobile IPv6 Binding update list
Recipient CN: 2000:0:0:3::aa
BINDING home address: 2000:0:0:3::3 care-of address: 2000::1:2c0:dfff:fe08:d5b6
expires: 80 sequence: 0 state: 1
delay: 3 max delay 256 callback time: 33
```

It can be seen that the Mobile Node's home address is associated with its Care-of-Address from the visited network 1. It can also be identified that the address is composed by the network prefix 2000:0:0:1 and by the MN's MAC address 00:C0:DF:08:D5:B6

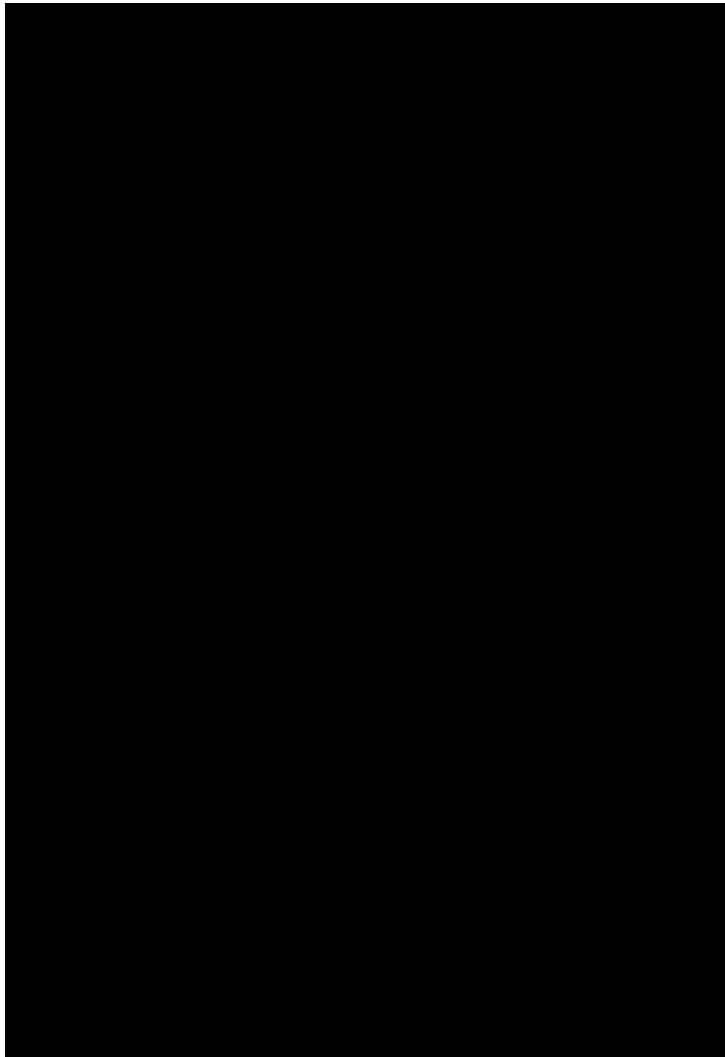
## V-Logs Description and Analysis

In order to check the Mobile IPv6 message's exchange there was used the network protocol analyzer Ethereal. Different test sceneries were executed and two of them were selected to be analyzed. The complete log files are attached in the end of this essay with some comments. Next there is presented the sceneries' description followed by the MIPv6 messages exchange diagram and a short comment.

- LOG1:

This test was made using the Mobile Node (2000:0:0:3::3) and the Correspondent Node. The Mobile Node started at the Home Network, moved to the Network 1 then to Network 2

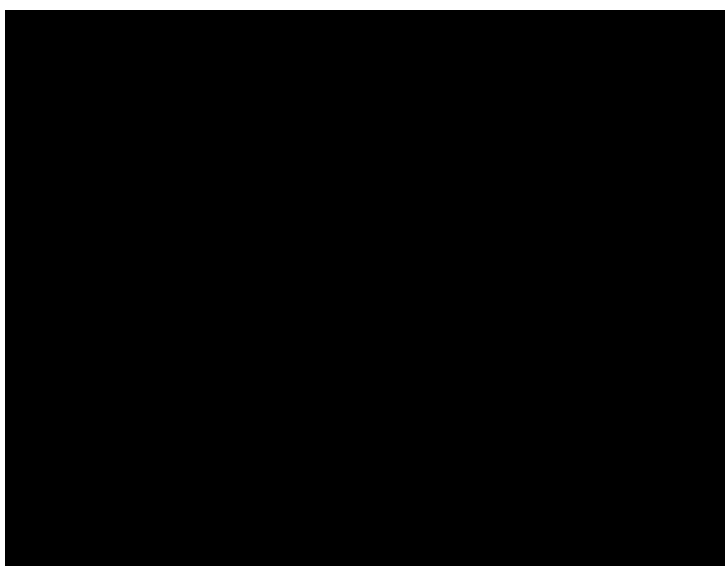
and finally returns back to its Home Network.



**Diagram 1-** MIPv6 message exchange diagram of log1

• LOG2

The Mobile Node 2000:0:0:3::3 was kept at its Visited Network 2, while the MN 2000:0:0:3::6 starts at its Home Network, then went to the its Visited Network 1 and finally returns back to its Home Network.



**Diagram 2-** MIPv6 message exchange diagram of log2

The message exchange between the three entities are in accordance with the description made in section II of this essay. At the attached logs, it can be seen that the Home Address is added in the Destination Option Header on packets send by the Mobile Node (when away from its home address) to the Correspondent Node.

Note:In the Diagrams there are only represented MIPv6 and ECHO messages. However, to contextualize the other MIPv6 message, the Router Advertisement, Neighbor Solicitation and Neighbor advertisement messages are also present in the log files.

## VI-Conclusions

The realization of this experience allowed to conclude the existence of many differences and significant improvement of the IPv6 mobility when compared with its version of IPv4.

The first positive impression was the simplicity of the entities' configuration with only one common configuration file per each entity. Secondly, the fast registration and connection recovery, when the Mobile Node changes from network, allows a very comfortable use of MIPv6.

Other positive difference of Mobile IPv6 protocol is that it does not need DHCP nor Foreign Agents on foreign links to configure the care-of address of Mobile Nodes, due to the use of stateless addressing configuration and neighbor discovery mechanisms.

A fundamental positive feature of Mobile IPv6 is its Route Optimization mechanism which reduces network load and latency, as well as network and homes agents congestion. In Mobile IPv4 this feature is possible but only as an additional option and not as an internal part of the standard protocol.

The great improvements of Mobile IPv6 are only possible because is based on the IPv6 protocol and take advantage of its 128bits addressing that solves the problem of insufficient possible addresses of IPv4 protocol and allows that each computer/terminal has its own static IP address. Also the new IPv6 Routing Header feature avoids the inefficient use IPv4 encapsulation. In terms of security, IPSec is already integrated in the IPv6 standard, so all Mobile IPv6 security requirements are based on that protocol and can be achieved. Summing up, IPv6 and its correspondent mobility protocol showed a very good performance and a comfortable use. For sure, these protocols will have an important place in the near future IP based communications, like the 3G mobile communications.

## VII-References

- [1]-W.Fristche&F.Heissenhuber, "MobileIPv6-Mobility Support for the Next Generation Internet", IABG, 2000
- [2]-M.Ricardo, "Mobilidade IP", FEUP, 2002
- [3]-S.Deering & R.Hinden, "Internet Protocol, version 6 (IPv6) – Specification", RFC 2460, 1998
- [4]-D.Johnson, C.Perkins & J.Arkko, "Mobility Support in IPv6", Internet Draft, 26/Feb/2003
- [5]-Charles E. Perkins, "Mobile Networking Though Mobile IP"
- [6]-"MIPL Mobile IPv6 main configuration file"
- [7]-"MIPL Mobile IPv6 diagnostics and configuration tool"

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## Log 1 – Attachment

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(...)

=====  
Mobile Node(2000:0:0:3::3) at its home network  
pinging Correspondent Node(2000:0:0:4::aa)=====

Frame 119 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 00:40:f4:6f:bd:79  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: ICMPv6 (0x3a)  
Hop limit: 63  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Internet Control Message Protocol v6

Type: 128 (Echo request)  
Code: 0  
Checksum: 0xe698 (correct)  
ID: 0x5101  
Sequence: 0x1000  
Data (56 bytes)

```
0000 88 68 c2 3e b8 8c 09 00 08 09 0a 0b 0c 0d 0e 0f  .h.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 120 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:40:f4:6f:bd:79, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: ICMPv6 (0x3a)  
Hop limit: 63  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6

Type: 129 (Echo reply)  
Code: 0  
Checksum: 0xe598 (correct)  
ID: 0x5101  
Sequence: 0x1000  
Data (56 bytes)

```
0000 88 68 c2 3e b8 8c 09 00 08 09 0a 0b 0c 0d 0e 0f  .h.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 121 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:80:c8:43:30:0f  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: ICMPv6 (0x3a)  
Hop limit: 64  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Internet Control Message Protocol v6

Type: 128 (Echo request)  
Code: 0  
Checksum: 0xd171 (correct)  
ID: 0x5101  
Sequence: 0x1100  
Data (56 bytes)

```
0000 89 68 c2 3e cb b3 09 00 08 09 0a 0b 0c 0d 0e 0f .h.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 122 (118 bytes on wire, 118 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:80:c8:43:30:0f

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: ICMPv6 (0x3a)  
Hop limit: 64  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Internet Control Message Protocol v6

Type: 128 (Echo request)  
Code: 0  
Checksum: 0x9f71 (correct)  
ID: 0x5101  
Sequence: 0x1200  
Data (56 bytes)

```
0000 8a 68 c2 3e fb b3 09 00 08 09 0a 0b 0c 0d 0e 0f .h.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

====MOBILE Node moved from network and start sending Neighbor and Route Solicitations to find a new default router and get its new Care-of-Address====

Frame 123 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:80:c8:43:30:0f

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
Destination address: fe80::280:c8ff:fe43:300f (fe80::280:c8ff:fe43:300f)

Internet Control Message Protocol v6

Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0x1c7c (correct)  
Target: fe80::280:c8ff:fe43:300f (fe80::280:c8ff:fe43:300f)  
ICMPv6 options

Frame 124 (70 bytes on wire, 70 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 33:33:00:00:00:02

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 16  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
Destination address: ff02::2 (ff02::2)

Internet Control Message Protocol v6

Type: 133 (Router solicitation)  
Code: 0  
Checksum: 0x102f (correct)  
ICMPv6 options

Frame 125 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 33:33:ff:08:d5:b6

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::240:f4ff:fe6f:cc05 (fe80::240:f4ff:fe6f:cc05)  
Destination address: ff02::1:ff08:d5b6 (ff02::1:ff08:d5b6)

Internet Control Message Protocol v6

Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0x6df3 (correct)  
Target: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
ICMPv6 options

Frame 126 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
Destination address: fe80::240:f4ff:fe6f:cc05 (fe80::240:f4ff:fe6f:cc05)

Internet Control Message Protocol v6

Type: 136 (Neighbor advertisement)  
Code: 0  
Checksum: 0x35ec (correct)  
Flags: 0x60000000  
Target: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
ICMPv6 options

Frame 127 (110 bytes on wire, 110 bytes captured)

Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 56  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::240:f4ff:fe6f:cc05 (fe80::240:f4ff:fe6f:cc05)  
Destination address: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)

Internet Control Message Protocol v6

Type: 134 (Router advertisement)  
Code: 0  
Checksum: 0xd6ff (correct)  
Cur hop limit: 64  
Flags: 0x00  
Router lifetime: 9  
Reachable time: 0  
Retrans time: 0  
ICMPv6 options  
ICMPv6 options

====MN has already its new Care-of-Address in the Visited Network 1  
and send a Binding Update message to the Home Agent====

Frame 128 (94 bytes on wire, 94 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 40  
Next header: IPv6 destination option (0x3c)  
Hop limit: 255  
Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 1 (16 bytes)  
Mobility Header Type: Binding Update (5)  
Reserved: 0x00  
Checksum: 0x8436  
Binding Update  
Sequence number: 0  
1... .... = Acknowledge (A) flag: Binding Acknowledgement requested  
.1.. .... = Home Registration (H) flag: Home Registration  
..1. .... = Link-Local Compatibility (L) flag: Link-Local Address Compatibility  
...1 .... = Key Management Compatibility (K) flag: Key Management Mobility Compatibility  
Lifetime: 2500 (10000 seconds)  
Mobility Options  
PadN: 4 bytes

Frame 129 (158 bytes on wire, 158 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 104  
Next header: IPv6 (0x29)  
Hop limit: 255  
Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: ICMPv6 (0x3a)  
Hop limit: 64  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Internet Control Message Protocol v6

Type: 128 (Echo request)  
Code: 0  
Checksum: 0xd171 (correct)  
ID: 0x5101  
Sequence: 0x1300  
Data (56 bytes)

```
0000 8b 68 c2 3e c7 b3 09 00 08 09 0a 0b 0c 0d 0e 0f  .h.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 130 (86 bytes on wire, 86 bytes captured)  
Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 33:33:ff:08:d5:b6

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000



Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::240:f4ff:fe6f:cc05 (fe80::240:f4ff:fe6f:cc05)  
Destination address: ff02::1:ff08:d5b6 (ff02::1:ff08:d5b6)

Internet Control Message Protocol v6

Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0x4c73 (correct)  
Target: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
ICMPv6 options

Frame 131 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
Destination address: fe80::240:f4ff:fe6f:cc05 (fe80::240:f4ff:fe6f:cc05)

Internet Control Message Protocol v6

Type: 136 (Neighbor advertisement)  
Code: 0  
Checksum: 0xf2eb (correct)  
Flags: 0x60000000  
Target: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
ICMPv6 options

Frame 132 (206 bytes on wire, 206 bytes captured)

Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 152  
Next header: ICMPv6 (0x3a)  
Hop limit: 63  
Source address: 2000:0:0:3::aa (2000:0:0:3::aa)  
Destination address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

Internet Control Message Protocol v6

Type: 1 (Unreachable)  
Code: 3 (Address unreachable)  
Checksum: 0xeb61 (correct)

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 104  
Next header: IPv6 (0x29)  
Hop limit: 254  
Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: ICMPv6 (0x3a)  
Hop limit: 64  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Internet Control Message Protocol v6

Type: 128 (Echo request)  
Code: 0  
Checksum: 0xd171 (correct)  
ID: 0x5101  
Sequence: 0x1300  
Data (56 bytes)

0000 8b 68 c2 3e c7 b3 09 00 08 09 0a 0b 0c 0d 0e 0f .h.>.....  
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....  
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#\$\$%&'()\*+,-./  
0030 30 31 32 33 34 35 36 37 01234567

Frame 133 (110 bytes on wire, 110 bytes captured)

Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 33:33:00:00:00:01

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 56

Next header: ICMPv6 (0x3a)

Hop limit: 255

Source address: fe80::240:f4ff:fe6f:cc05 (fe80::240:f4ff:fe6f:cc05)

Destination address: ff02::1 (ff02::1)

Internet Control Message Protocol v6

Type: 134 (Router advertisement)

Code: 0

Checksum: 0x8cfc (correct)

Cur hop limit: 64

Flags: 0x00

Router lifetime: 9

Reachable time: 0

Retrans time: 0

ICMPv6 options

ICMPv6 options

===Home Agent sends a Binding Acknowledgement message to the MN===

Frame 134 (94 bytes on wire, 94 bytes captured)

Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 40

Next header: IPv6 routing (0x2b)

Hop limit: 254

Source address: 2000:0:0:3::aa (2000:0:0:3::aa)

Destination address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

Routing Header, Type 2

Next header: Mobile IPv6 (0x3e)

Length: 2 (24 bytes)

Type: 2

Segments left: 1

Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)

Header length: 1 (16 bytes)

Mobility Header Type: Binding Acknowledgement (6)

Reserved: 0x00

Checksum: 0x7cc1

Binding Acknowledgement

Status: Binding Update accepted (0)

0... .. = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility

Sequence number: 0

Lifetime: 58 (232 seconds)

Mobility Options

PadN: 4 bytes

Frame 135 (158 bytes on wire, 158 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 104

Next header: IPv6 (0x29)

Hop limit: 255

Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 64

Next header: ICMPv6 (0x3a)

Hop limit: 64

Source address: 2000:0:0:3::3 (2000:0:0:3::3)

Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Internet Control Message Protocol v6

Type: 128 (Echo request)

Code: 0

Checksum: 0xbe4a (correct)

ID: 0x5101

Sequence: 0x1400

Data (56 bytes)

```
0000 8c 68 c2 3e d8 da 09 00 08 09 0a 0b 0c 0d 0e 0f .h.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 136 (158 bytes on wire, 158 bytes captured)

Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 104

Next header: IPv6 (0x29)

Hop limit: 254

Source address: 2000:0:0:3::aa (2000:0:0:3::aa)

Destination address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 64

Next header: ICMPv6 (0x3a)

Hop limit: 62

Source address: 2000:0:0:4::aa (2000:0:0:4::aa)

Destination address: 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6

Type: 129 (Echo reply)

Code: 0

Checksum: 0xbd4a (correct)

ID: 0x5101

Sequence: 0x1400

Data (56 bytes)

```
0000 8c 68 c2 3e d8 da 09 00 08 09 0a 0b 0c 0d 0e 0f .h.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

====MN starts sending the Home Test and Care-of Test Init messages  
to its Correspondent Node to prove that its Home Address and  
Care-of-Address are true and addressable====

Frame 137 (110 bytes on wire, 110 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 56

Next header: IPv6 (0x29)

Hop limit: 255

Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 16

Next header: Mobile IPv6 (0x3e)

Hop limit: 255

Source address: 2000:0:0:3::3 (2000:0:0:3::3)

Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)

Header length: 1 (16 bytes)

Mobility Header Type: Home Test Init (1)

Reserved: 0x00

Checksum: 0x3e2a

Home Test Init

Home Init Cookie: 0x417d7954460b43f5

Frame 138 (70 bytes on wire, 70 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 16

Next header: Mobile IPv6 (0x3e)

Hop limit: 255

Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)

Header length: 1 (16 bytes)

Mobility Header Type: Care-of Test Init (2)

Reserved: 0x00

Checksum: 0xae54

Care-of Test Init

Care-of Init Cookie: 0x2224694804a08d20

Frame 139 (78 bytes on wire, 78 bytes captured)

Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 24

Next header: Mobile IPv6 (0x3e)

Hop limit: 254

Source address: 2000:0:0:4::aa (2000:0:0:4::aa)

Destination address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)

Header length: 2 (24 bytes)

Mobility Header Type: Care-of Test (4)

Reserved: 0x00

Checksum: 0xe73b

Care-of Test

Care-of Nonce Index: 0

Care-of Init Cookie: 0x2224694804a08d20

Home Keygen Token: 0x06e822548957127c

Frame 140 (118 bytes on wire, 118 bytes captured)

Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 64

Next header: IPv6 (0x29)

Hop limit: 254

Source address: 2000:0:0:3::aa (2000:0:0:3::aa)  
Destination address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

#### Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 24  
Next header: Mobile IPv6 (0x3e)  
Hop limit: 253  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000:0:0:3::3 (2000:0:0:3::3)

#### Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 2 (24 bytes)  
Mobility Header Type: Home Test (3)  
Reserved: 0x00  
Checksum: 0x9a18  
Home Test  
Home Nonce Index: 0  
Home Init Cookie: 0x417d7954460b43f5  
Home Keygen Token: 0x8800fd376cccb003

====MN sends a Binding Update message to the Correspondent Node====

Frame 141 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

#### Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: IPv6 destination option (0x3c)  
Hop limit: 255  
Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

#### Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

#### Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 4 (40 bytes)  
Mobility Header Type: Binding Update (5)  
Reserved: 0x00  
Checksum: 0xdec6  
Binding Update  
Sequence number: 0  
0... .... = Acknowledge (A) flag: Binding Acknowledgement not requested  
.0.. .... = Home Registration (H) flag: No Home Registration  
..0. .... = Link-Local Compatibility (L) flag: No Link-Local Address Compatibility  
...0 .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Lifetime: 105 (420 seconds)

#### Mobility Options

Nonce Indices  
Home nonce index: 0  
Care-of nonce index: 0  
PadN: 8 bytes  
Binding Authorization Data  
Authenticator: C43CEF222AD2B35E86597DB1

Frame 142 (62 bytes on wire, 62 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05

#### Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 8

Next header: ICMPv6 (0x3a)  
Hop limit: 64  
Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

Internet Control Message Protocol v6  
Type: 152 (Mobile Prefix Solicitation)  
Code: 0 (Should always be zero)  
Checksum: 0xe9ad (correct)  
Identifier: 4 (0x04)  
Reserved: 34525

===Pinging to the Correspondent Node is recovered  
already with Route Optimization===

Frame 143 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 destination option (0x3c)  
Hop limit: 64  
Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Destination Option Header  
Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6  
Type: 128 (Echo request)  
Code: 0  
Checksum: 0xac23 (incorrect, should be 0xf5a8)  
ID: 0x5101  
Sequence: 0x1500  
Data (56 bytes)

```
0000 8d 68 c2 3e e8 01 0a 00 08 09 0a 0b 0c 0d 0e 0f  .h.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 144 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 routing (0x2b)  
Hop limit: 63  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)

Routing Header, Type 2  
Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6  
Type: 129 (Echo reply)  
Code: 0  
Checksum: 0xab23 (incorrect, should be 0xf4a8)  
ID: 0x5101  
Sequence: 0x1500  
Data (56 bytes)

```
0000 8d 68 c2 3e e8 01 0a 00 08 09 0a 0b 0c 0d 0e 0f  .h.>.....
```

```
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37          01234567
```

...

```
Frame 217 (142 bytes on wire, 142 bytes captured)
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05
Internet Protocol Version 6
  Version: 6
  Traffic class: 0x00
  Flowlabel: 0x00000
  Payload length: 88
  Next header: IPv6 destination option (0x3c)
  Hop limit: 64
  Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)
  Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)
Destination Option Header
  Next header: ICMPv6 (0x3a)
  Length: 2 (24 bytes)
  PadN: 4 bytes
  Option Type: 201 (0xc9) - Home Address Option
  Option Length : 16
  Home Address : 2000:0:0:3::3 (2000:0:0:3::3)
Internet Control Message Protocol v6
  Type: 128 (Echo request)
  Code: 0
  Checksum: 0x2ad5 (incorrect, should be 0x745a)
  ID: 0x5101
  Sequence: 0x3300
  Data (56 bytes)
```

```
0000 ab 68 c2 3e 2d 50 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>-P.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37          01234567
```

```
Frame 218 (142 bytes on wire, 142 bytes captured)
Ethernet II, Src: 00:40:f4:6f:cc:05, Dst: 00:c0:df:08:d5:b6
Internet Protocol Version 6
  Version: 6
  Traffic class: 0x00
  Flowlabel: 0x00000
  Payload length: 88
  Next header: IPv6 routing (0x2b)
  Hop limit: 63
  Source address: 2000:0:0:4::aa (2000:0:0:4::aa)
  Destination address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)
Routing Header, Type 2
  Next header: ICMPv6 (0x3a)
  Length: 2 (24 bytes)
  Type: 2
  Segments left: 1
  Home Address : 2000:0:0:3::3 (2000:0:0:3::3)
Internet Control Message Protocol v6
  Type: 129 (Echo reply)
  Code: 0
  Checksum: 0x29d5 (incorrect, should be 0x735a)
  ID: 0x5101
  Sequence: 0x3300
  Data (56 bytes)
```

```
0000 ab 68 c2 3e 2d 50 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>-P.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37          01234567
```

...

===MN requests an echo to the Correspondent Node but get no reply because it moves to the Visited Network 2===

Frame 233 (142 bytes on wire, 142 bytes captured)  
 Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:40:f4:6f:cc:05  
 Internet Protocol Version 6  
 Version: 6  
 Traffic class: 0x00  
 Flowlabel: 0x00000  
 Payload length: 88  
 Next header: IPv6 destination option (0x3c)  
 Hop limit: 64  
 Source address: 2000::1:2c0:dfff:fe08:d5b6 (2000::1:2c0:dfff:fe08:d5b6)  
 Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)  
 Destination Option Header  
 Next header: ICMPv6 (0x3a)  
 Length: 2 (24 bytes)  
 PadN: 4 bytes  
 Option Type: 201 (0xc9) - Home Address Option  
 Option Length : 16  
 Home Address : 2000:0:0:3::3 (2000:0:0:3::3)  
 Internet Control Message Protocol v6  
 Type: 128 (Echo request)  
 Code: 0  
 Checksum: 0x4ad5 (incorrect, should be 0x945a)  
 ID: 0x5101  
 Sequence: 0x3700  
 Data (56 bytes)

```

0000  af 68 c2 3e 05 50 0a 00 08 09 0a 0b 0c 0d 0e 0f  .h.>.P.....
0010  10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020  20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$%&'()*+,-./
0030  30 31 32 33 34 35 36 37                          01234567
  
```

Frame 234 (110 bytes on wire, 110 bytes captured)  
 Ethernet II, Src: 00:c0:df:10:90:56, Dst: 33:33:00:00:00:01  
 Internet Protocol Version 6  
 Version: 6  
 Traffic class: 0x00  
 Flowlabel: 0x00000  
 Payload length: 56  
 Next header: ICMPv6 (0x3a)  
 Hop limit: 255  
 Source address: fe80::2c0:dfff:fe10:9056 (fe80::2c0:dfff:fe10:9056)  
 Destination address: ff02::1 (ff02::1)  
 Internet Control Message Protocol v6  
 Type: 134 (Router advertisement)  
 Code: 0  
 Checksum: 0x2e0f (correct)  
 Cur hop limit: 64  
 Flags: 0x00  
 Router lifetime: 18  
 Reachable time: 0  
 Retrans time: 0  
 ICMPv6 options  
 ICMPv6 options

===MN already has its new Care-of-Address in Visited Network 2 after listening the Routing Advertisement messages. It send a Binding Update message to the Home Agent to inform the new Care-of-Address===

Frame 235 (94 bytes on wire, 94 bytes captured)  
 Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
 Internet Protocol Version 6  
 Version: 6  
 Traffic class: 0x00  
 Flowlabel: 0x00000  
 Payload length: 40  
 Next header: IPv6 destination option (0x3c)  
 Hop limit: 255  
 Source address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
 Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)



#### Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

#### Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 1 (16 bytes)  
Mobility Header Type: Binding Update (5)  
Reserved: 0x00  
Checksum: 0x9435  
Binding Update  
Sequence number: 1  
1... .. = Acknowledge (A) flag: Binding Acknowledgement requested  
.1.. .. = Home Registration (H) flag: Home Registration  
..1. .... = Link-Local Compatibility (L) flag: Link-Local Address Compatibility  
...0 .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Lifetime: 2500 (10000 seconds)  
Mobility Options  
PadN: 4 bytes

====MN starts sending the Home Test and Care-of Test Init messages  
to its Correspondent Node to prove that its Home Address and  
Care-of-Address are true and addressable====

Frame 236 (110 bytes on wire, 110 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56

#### Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 56  
Next header: IPv6 (0x29)  
Hop limit: 255  
Source address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

#### Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 16  
Next header: Mobile IPv6 (0x3e)  
Hop limit: 255  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

#### Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 1 (16 bytes)  
Mobility Header Type: Home Test Init (1)  
Reserved: 0x00  
Checksum: 0x3e2a  
Home Test Init  
Home Init Cookie: 0x417d7954460b43f5

Frame 237 (70 bytes on wire, 70 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56

#### Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 16  
Next header: Mobile IPv6 (0x3e)  
Hop limit: 255  
Source address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

#### Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 1 (16 bytes)

Mobility Header Type: Care-of Test Init (2)  
Reserved: 0x00  
Checksum: 0x5efc  
Care-of Test Init  
Care-of Init Cookie: 0x939f75ac8bffd738

Frame 238 (86 bytes on wire, 86 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 33:33:ff:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe10:9056 (fe80::2c0:dfff:fe10:9056)  
Destination address: ff02::1:ff08:d5b6 (ff02::1:ff08:d5b6)  
Internet Control Message Protocol v6  
Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0xed8e (correct)  
Target: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
ICMPv6 options

Frame 239 (86 bytes on wire, 86 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
Destination address: fe80::2c0:dfff:fe10:9056 (fe80::2c0:dfff:fe10:9056)  
Internet Control Message Protocol v6  
Type: 136 (Neighbor advertisement)  
Code: 0  
Checksum: 0x4378 (correct)  
Flags: 0x60000000  
Target: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
ICMPv6 options

Frame 240 (78 bytes on wire, 78 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 24  
Next header: Mobile IPv6 (0x3e)  
Hop limit: 254  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
Mobile IPv6  
Payload protocol: IPv6 no next header (0x3b)  
Header length: 2 (24 bytes)  
Mobility Header Type: Care-of Test (4)  
Reserved: 0x00  
Checksum: 0xc9d3  
Care-of Test  
Care-of Nonce Index: 0  
Care-of Init Cookie: 0x939f75ac8bffd738  
Home Keygen Token: 0xaaaf21e3e638e053

===Home Agent send the Binding Acknowledgement to the MN===

Frame 242 (94 bytes on wire, 94 bytes captured)

Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 40  
Next header: IPv6 routing (0x2b)  
Hop limit: 254  
Source address: 2000:0:0:3::aa (2000:0:0:3::aa)  
Destination address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)

Routing Header, Type 2  
Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6  
Payload protocol: IPv6 no next header (0x3b)  
Header length: 1 (16 bytes)  
Mobility Header Type: Binding Acknowledgement (6)  
Reserved: 0x00  
Checksum: 0x7cc0  
Binding Acknowledgement  
Status: Binding Update accepted (0)  
0... .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Sequence number: 1  
Lifetime: 58 (232 seconds)  
Mobility Options  
PadN: 4 bytes

Frame 243 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: IPv6 (0x29)  
Hop limit: 254  
Source address: 2000:0:0:3::aa (2000:0:0:3::aa)  
Destination address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)

Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 24  
Next header: Mobile IPv6 (0x3e)  
Hop limit: 253  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6  
Payload protocol: IPv6 no next header (0x3b)  
Header length: 2 (24 bytes)  
Mobility Header Type: Home Test (3)  
Reserved: 0x00  
Checksum: 0x9a18  
Home Test  
Home Nonce Index: 0  
Home Init Cookie: 0x417d7954460b43f5  
Home Keygen Token: 0x8800fd376cccb003

===MN send Binding Update Message to the Correspondent Node  
to inform the new Care-of-Address in Visited Network 2===

Frame 246 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000

Payload length: 64  
Next header: IPv6 destination option (0x3c)  
Hop limit: 255  
Source address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination Option Header  
Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)  
Mobile IPv6  
Payload protocol: IPv6 no next header (0x3b)  
Header length: 4 (40 bytes)  
Mobility Header Type: Binding Update (5)  
Reserved: 0x00  
Checksum: 0x58a7  
Binding Update  
Sequence number: 2  
0... .... = Acknowledge (A) flag: Binding Acknowledgement not requested  
.0.. .... = Home Registration (H) flag: No Home Registration  
..0. .... = Link-Local Compatibility (L) flag: No Link-Local Address Compatibility  
...0 .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Lifetime: 105 (420 seconds)  
Mobility Options  
Nonce Indices  
Home nonce index: 0  
Care-of nonce index: 0  
PadN: 8 bytes  
Binding Authorization Data  
Authenticator: 8753645D1D98C6776F70DC87

.....

Frame 251 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 destination option (0x3c)  
Hop limit: 64  
Source address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination Option Header  
Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)  
Internet Control Message Protocol v6  
Type: 128 (Echo request)  
Code: 0  
Checksum: 0x45d5 (incorrect, should be 0x8f59)  
ID: 0x5101  
Sequence: 0x3800  
Data (56 bytes)

```
0000 b0 68 c2 3e 08 50 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>.P.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 252 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00

Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 routing (0x2b)  
Hop limit: 63  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)

Routing Header, Type 2

Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6

Type: 129 (Echo reply)  
Code: 0  
Checksum: 0x44d5 (incorrect, should be 0x8e59)  
ID: 0x5101  
Sequence: 0x3800  
Data (56 bytes)

```
0000 b0 68 c2 3e 08 50 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>.P.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

...

Frame 360 (142 bytes on wire, 142 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 destination option (0x3c)  
Hop limit: 64  
Source address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Destination Option Header

Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6

Type: 128 (Echo request)  
Code: 0  
Checksum: 0x19ae (incorrect, should be 0x6332)  
ID: 0x5101  
Sequence: 0x4700  
Data (56 bytes)

```
0000 bf 68 c2 3e 16 77 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>.w.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 361 (142 bytes on wire, 142 bytes captured)

Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 routing (0x2b)  
Hop limit: 63  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)

Routing Header, Type 2

Next header: ICMPv6 (0x3a)

Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6

Type: 129 (Echo reply)  
Code: 0  
Checksum: 0x18ae (incorrect, should be 0x6232)  
ID: 0x5101  
Sequence: 0x4700  
Data (56 bytes)

```
0000 bf 68 c2 3e 16 77 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>.w.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

====Last echo request send by MN before it moves from the  
Visited Network2 back to its home network. It solicitates  
for Router and Neighbord Advertisements====

Frame 367 (142 bytes on wire, 142 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 destination option (0x3c)  
Hop limit: 64  
Source address: 2000::2:2c0:dfff:fe08:d5b6 (2000::2:2c0:dfff:fe08:d5b6)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Destination Option Header

Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6

Type: 128 (Echo request)  
Code: 0  
Checksum: 0x85ad (incorrect, should be 0xcf31)  
ID: 0x5101  
Sequence: 0x4900  
Data (56 bytes)

```
0000 c1 68 c2 3e a6 77 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>.w.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 368 (70 bytes on wire, 70 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 33:33:00:00:00:02

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 16  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
Destination address: ff02::2 (ff02::2)

Internet Control Message Protocol v6

Type: 133 (Router solicitation)  
Code: 0  
Checksum: 0x102f (correct)  
ICMPv6 options

Frame 369 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 33:33:ff:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::280:c8ff:fe43:300f (fe80::280:c8ff:fe43:300f)  
Destination address: ff02::1:ff08:d5b6 (ff02::1:ff08:d5b6)

Internet Control Message Protocol v6  
Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0xfdb8 (correct)  
Target: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
ICMPv6 options

Frame 370 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:80:c8:43:30:0f  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
Destination address: fe80::280:c8ff:fe43:300f (fe80::280:c8ff:fe43:300f)

Internet Control Message Protocol v6  
Type: 136 (Neighbor advertisement)  
Code: 0  
Checksum: 0xfdce (correct)  
Flags: 0x60000000  
Target: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)  
ICMPv6 options

Frame 371 (110 bytes on wire, 110 bytes captured)

Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 56  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::280:c8ff:fe43:300f (fe80::280:c8ff:fe43:300f)  
Destination address: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)

Internet Control Message Protocol v6  
Type: 134 (Router advertisement)  
Code: 0  
Checksum: 0x66c3 (correct)  
Cur hop limit: 64  
Flags: 0x20  
Router lifetime: 9  
Reachable time: 0  
Retrans time: 0  
ICMPv6 options  
ICMPv6 options

Frame 372 (78 bytes on wire, 78 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 33:33:ff:00:00:aa  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 24  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: :: (::)  
Destination address: ff02::1:ff00:aa (ff02::1:ff00:aa)

Internet Control Message Protocol v6

Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0x5951 (correct)  
Target: 2000:0:0:3::aa (2000:0:0:3::aa)

...

Frame 374 (86 bytes on wire, 86 bytes captured)  
Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 33:33:00:00:00:01

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: 2000:0:0:3::aa (2000:0:0:3::aa)  
Destination address: ff02::1 (ff02::1)

Internet Control Message Protocol v6

Type: 136 (Neighbor advertisement)  
Code: 0  
Checksum: 0x9c72 (correct)  
Flags: 0xa0000000  
Target: 2000:0:0:3::aa (2000:0:0:3::aa)  
ICMPv6 options

===MN send a Binding Update message to its Home Agent  
to inform it that is at home again===

Frame 375 (94 bytes on wire, 94 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:80:c8:43:30:0f

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 40  
Next header: IPv6 destination option (0x3c)  
Hop limit: 255  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 1 (16 bytes)  
Mobility Header Type: Binding Update (5)  
Reserved: 0x00  
Checksum: 0x9df8  
Binding Update  
Sequence number: 2  
1... .... = Acknowledge (A) flag: Binding Acknowledgement requested  
.1.. .... = Home Registration (H) flag: Home Registration  
..1. .... = Link-Local Compatibility (L) flag: Link-Local Address Compatibility  
...0 .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Lifetime: 0 (0 seconds)

Mobility Options

PadN: 4 bytes

Frame 376 (70 bytes on wire, 70 bytes captured)  
Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 00:40:f4:6f:bd:79

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 16



Next header: Mobile IPv6 (0x3e)  
Hop limit: 254  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 1 (16 bytes)  
Mobility Header Type: Home Test Init (1)  
Reserved: 0x00  
Checksum: 0xccb4  
Home Test Init  
Home Init Cookie: 0xad5857eec66dea92

Frame 377 (78 bytes on wire, 78 bytes captured)  
Ethernet II, Src: 00:40:f4:6f:bd:79, Dst: 00:80:c8:43:30:0f  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 24  
Next header: Mobile IPv6 (0x3e)  
Hop limit: 254  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 2 (24 bytes)  
Mobility Header Type: Home Test (3)  
Reserved: 0x00  
Checksum: 0x28a3  
Home Test  
Home Nonce Index: 0  
Home Init Cookie: 0xad5857eec66dea92  
Home Keygen Token: 0x8800fd376cccb003

Frame 378 (86 bytes on wire, 86 bytes captured)  
Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 33:33:ff:00:00:03  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: 2000:0:0:3::aa (2000:0:0:3::aa)  
Destination address: ff02::1:ff00:3 (ff02::1:ff00:3)

Internet Control Message Protocol v6

Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0x4016 (correct)  
Target: 2000:0:0:3::3 (2000:0:0:3::3)  
ICMPv6 options

Frame 379 (86 bytes on wire, 86 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:80:c8:43:30:0f  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:3::aa (2000:0:0:3::aa)

Internet Control Message Protocol v6

Type: 136 (Neighbor advertisement)  
Code: 0  
Checksum: 0xff6a (correct)  
Flags: 0x60000000  
Target: 2000:0:0:3::3 (2000:0:0:3::3)  
ICMPv6 options

===Home Agent sends a Binding Acknowledgement message to the MN===

Frame 380 (94 bytes on wire, 94 bytes captured)

Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 40

Next header: IPv6 routing (0x2b)

Hop limit: 255

Source address: 2000:0:0:3::aa (2000:0:0:3::aa)

Destination address: 2000:0:0:3::3 (2000:0:0:3::3)

Routing Header, Type 2

Next header: Mobile IPv6 (0x3e)

Length: 2 (24 bytes)

Type: 2

Segments left: 1

Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)

Header length: 1 (16 bytes)

Mobility Header Type: Binding Acknowledgement (6)

Reserved: 0x00

Checksum: 0x7cf9

Binding Acknowledgement

Status: Binding Update accepted (0)

0... .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility

Sequence number: 2

Lifetime: 0 (0 seconds)

Mobility Options

PadN: 4 bytes

Frame 381 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 33:33:00:00:00:01

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 32

Next header: ICMPv6 (0x3a)

Hop limit: 255

Source address: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)

Destination address: ff02::1 (ff02::1)

Internet Control Message Protocol v6

Type: 136 (Neighbor advertisement)

Code: 0

Checksum: 0x371f (correct)

Flags: 0x20000000

Target: fe80::2c0:dfff:fe08:d5b6 (fe80::2c0:dfff:fe08:d5b6)

ICMPv6 options

Frame 382 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 33:33:00:00:00:01

Internet Protocol Version 6

Version: 6

Traffic class: 0x00

Flowlabel: 0x00000

Payload length: 32

Next header: ICMPv6 (0x3a)

Hop limit: 255

Source address: 2000:0:0:3::3 (2000:0:0:3::3)

Destination address: ff02::1 (ff02::1)

Internet Control Message Protocol v6

Type: 136 (Neighbor advertisement)

Code: 0

Checksum: 0x6114 (correct)

Flags: 0x20000000

Target: 2000:0:0:3::3 (2000:0:0:3::3)

## ICMPv6 options

Frame 383 (78 bytes on wire, 78 bytes captured)  
Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 24  
Next header: Mobile IPv6 (0x3e)  
Hop limit: 253  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000:0:0:3::3 (2000:0:0:3::3)

### Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 2 (24 bytes)  
Mobility Header Type: Home Test (3)  
Reserved: 0x00  
Checksum: 0x28a3  
Home Test  
Home Nonce Index: 0  
Home Init Cookie: 0xad5857eec66dea92  
Home Keygen Token: 0x8800fd376cccb003

===MN sends a Binding Update message to the Correspondent node===

Frame 384 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:80:c8:43:30:0f  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: IPv6 destination option (0x3c)  
Hop limit: 255  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

### Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

### Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 4 (40 bytes)  
Mobility Header Type: Binding Update (5)  
Reserved: 0x00  
Checksum: 0xcb86  
Binding Update  
Sequence number: 3  
0... .... = Acknowledge (A) flag: Binding Acknowledgement not requested  
.0.. .... = Home Registration (H) flag: No Home Registration  
..0. .... = Link-Local Compatibility (L) flag: No Link-Local Address Compatibility  
...0 .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Lifetime: 0 (0 seconds)

### Mobility Options

Nonce Indices  
Home nonce index: 0  
Care-of nonce index: 0  
PadN: 8 bytes  
Binding Authorization Data  
Authenticator: BDB6D8DAF3F95CE7BA470787

Frame 385 (214 bytes on wire, 214 bytes captured)  
Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00

Flowlabel: 0x00000  
Payload length: 160  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::280:c8ff:fe43:300f (fe80::280:c8ff:fe43:300f)  
Destination address: 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6

Type: 137 (Redirect)  
Code: 0  
Checksum: 0x9eed (correct)  
Target: 2000:0:0:3::ff (2000:0:0:3::ff)  
Destination: 2000:0:0:4::aa (2000:0:0:4::aa)  
ICMPv6 options  
ICMPv6 options

Frame 386 (118 bytes on wire, 118 bytes captured)

Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 00:40:f4:6f:bd:79

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: IPv6 destination option (0x3c)  
Hop limit: 254  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)

Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 4 (40 bytes)  
Mobility Header Type: Binding Update (5)  
Reserved: 0x00  
Checksum: 0xcb86  
Binding Update  
Sequence number: 3  
0... .... = Acknowledge (A) flag: Binding Acknowledgement not requested  
.0.. .... = Home Registration (H) flag: No Home Registration  
..0. .... = Link-Local Compatibility (L) flag: No Link-Local Address Compatibility  
...0 .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Lifetime: 0 (0 seconds)

Mobility Options

Nonce Indices  
Home nonce index: 0  
Care-of nonce index: 0  
PadN: 8 bytes  
Binding Authorization Data  
Authenticator: BDB6D8DAF3F95CE7BA470787

Frame 387 (110 bytes on wire, 110 bytes captured)

Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 33:33:00:00:00:01

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 56  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::280:c8ff:fe43:300f (fe80::280:c8ff:fe43:300f)  
Destination address: ff02::1 (ff02::1)

Internet Control Message Protocol v6

Type: 134 (Router advertisement)  
Code: 0  
Checksum: 0x1cc0 (correct)  
Cur hop limit: 64  
Flags: 0x20

Router lifetime: 9  
Reachable time: 0  
Retrans time: 0  
ICMPv6 options  
ICMPv6 options

===The pinging to the Correspondent Node is restored===

Frame 390 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:80:c8:43:30:0f, Dst: 00:40:f4:6f:bd:79  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: ICMPv6 (0x3a)  
Hop limit: 63  
Source address: 2000:0:0:3::3 (2000:0:0:3::3)  
Destination address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Internet Control Message Protocol v6  
Type: 128 (Echo request)  
Code: 0  
Checksum: 0x13ae (correct)  
ID: 0x5101  
Sequence: 0x4a00  
Data (56 bytes)

```
0000 c2 68 c2 3e 16 77 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>.w.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

Frame 391 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:40:f4:6f:bd:79, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: ICMPv6 (0x3a)  
Hop limit: 63  
Source address: 2000:0:0:4::aa (2000:0:0:4::aa)  
Destination address: 2000:0:0:3::3 (2000:0:0:3::3)  
Internet Control Message Protocol v6  
Type: 129 (Echo reply)  
Code: 0  
Checksum: 0x12ae (correct)  
ID: 0x5101  
Sequence: 0x4a00  
Data (56 bytes)

```
0000 c2 68 c2 3e 16 77 0a 00 08 09 0a 0b 0c 0d 0e 0f .h.>.w.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

---

---

## Log 2 – Attachment

---

===The Router sends Router Advertisements messages to the network, in order to Mobile Nodes listen to those messages and compose their Care-of-Address if necessary===

Frame 1 (110 bytes on wire, 110 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 33:33:00:00:00:01  
Internet Protocol Version 6  
  Version: 6  
  Traffic class: 0x00  
  Flowlabel: 0x00000  
  Payload length: 56  
  Next header: ICMPv6 (0x3a)  
  Hop limit: 255  
  Source address: fe80::2c0:dfff:fe10:9056  
  Destination address: ff02::1  
Internet Control Message Protocol v6  
  Type: 134 (Router advertisement)  
  Code: 0  
  Checksum: 0x2e0f (correct)  
  Cur hop limit: 64  
  Flags: 0x00  
  Router lifetime: 18  
  Reachable time: 0  
  Retrans time: 0  
  ICMPv6 options  
  ICMPv6 options

===Starts the communication between the Mobile Nodes:  
2000:0:0:3@ Visited Network 2 and 2000:0:0:6@Home Network.  
The Mobile Node 2000:0:0:3 being at Visited Network 2 uses its Care-of-Address.  
This first packet will not be dropped if there isn't a correspondent Binding Cache  
entry since this packet contains a Home Address Option.===

Frame 2 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
  Version: 6  
  Traffic class: 0x00  
  Flowlabel: 0x00000  
  Payload length: 88  
  Next header: IPv6 destination option (0x3c)  
  Hop limit: 64  
  Source address: 2000::2:2c0:dfff:fe08:d5b6  
  Destination address: 2000:0:0:3::6  
Destination Option Header  
  Next header: ICMPv6 (0x3a)  
  Length: 2 (24 bytes)  
  PadN: 4 bytes  
  Option Type: 201 (0xc9) - Home Address Option  
  Option Length : 16  
  Home Address : 2000:0:0:3::3 (2000:0:0:3::3)  
Internet Control Message Protocol v6  
  Type: 128 (Echo request)  
  Code: 0  
  Checksum: 0x4c8d (incorrect, should be 0x9611)  
  ID: 0x4c02  
  Sequence: 0x0100  
  Data (56 bytes)

```
0000 4c 78 c2 3e a5 2c 07 00 08 09 0a 0b 0c 0d 0e 0f  Lx.>.,.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$%&'()*+,-./
0030 30 31 32 33 34 35 36 37                          01234567
```

===The Mobile Node 2000:0:0:6@Home Network replies to the MN 2000:0:0:3@Visited Network 2 request.The reply is sent directly to the MN's 22000:0:0:3 Care-of-Address.===

Frame 3 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 routing (0x2b)  
Hop limit: 62  
Source address: 2000:0:0:3::6  
Destination address: 2000::2:2c0:dfff:fe08:d5b6

Routing Header, Type 2  
Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6  
Type: 129 (Echo reply)  
Code: 0  
Checksum: 0x4b8d (incorrect, should be 0x9511)  
ID: 0x4c02  
Sequence: 0x0100  
Data (56 bytes)

```
0000 4c 78 c2 3e a5 2c 07 00 08 09 0a 0b 0c 0d 0e 0f  Lx.>.,.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37                          01234567
```

(...)

===The Router sends Router Advertisements messages to the network periodically===

Frame 17 (110 bytes on wire, 110 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 33:33:00:00:00:01  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 56  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe10:9056  
Destination address: ff02::1

Internet Control Message Protocol v6  
Type: 134 (Router advertisement)  
Code: 0  
Checksum: 0x2e0f (correct)  
Cur hop limit: 64  
Flags: 0x00  
Router lifetime: 18  
Reachable time: 0  
Retrans time: 0  
ICMPv6 options  
ICMPv6 options

(...)

===These kind of messages are sent by the Mobile Node to check if the router is still reachable===

Frame 28 (86 bytes on wire, 86 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe08:d5b6  
Destination address: fe80::2c0:dfff:fe10:9056  
Internet Control Message Protocol v6  
Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0x2dd3 (correct)  
Target: fe80::2c0:dfff:fe10:9056  
ICMPv6 options

===In response to a Neighbor solicitation, a Neighbor advertisement message is sent to the Target.===

Frame 29 (86 bytes on wire, 86 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe10:9056  
Destination address: fe80::2c0:dfff:fe08:d5b6  
Internet Control Message Protocol v6  
Type: 136 (Neighbor advertisement)  
Code: 0  
Checksum: 0x912a (correct)  
Flags: 0xe000000  
Target: fe80::2c0:dfff:fe10:9056  
ICMPv6 options

Frame 30 (110 bytes on wire, 110 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 33:33:00:00:00:01  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 56  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe10:9056  
Destination address: ff02::1  
Internet Control Message Protocol v6  
Type: 134 (Router advertisement)  
Code: 0  
Checksum: 0x2e0f (correct)  
Cur hop limit: 64  
Flags: 0x00  
Router lifetime: 18  
Reachable time: 0  
Retrans time: 0  
ICMPv6 options  
ICMPv6 options

(...)



===The Mobile Node 2000:0:0:6 sends a Home Test Init message to the other MN 2000:0:0:3. This kind of messages is sent when the MN initiates the return routability procedure and request a home keygen token from a Correspondent Node===

Frame 42 (94 bytes on wire, 94 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 40  
Next header: IPv6 routing (0x2b)  
Hop limit: 253  
Source address: 2000:0:0:3::6  
Destination address: 2000::2:2c0:dfff:fe08:d5b6

Routing Header, Type 2  
Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6  
Payload protocol: IPv6 no next header (0x3b)  
Header length: 1 (16 bytes)  
Mobility Header Type: Home Test Init (1)  
Reserved: 0x00  
Checksum: 0xfaf6  
Home Test Init  
Home Init Cookie: 0x06e6dc9957094e21

===The MN 2000:0:0:3 sends the correspondent Home Test message responding to the Home Test Init message received. This message includes a 64-bit home keygen token.===

Frame 43 (102 bytes on wire, 102 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 48  
Next header: IPv6 destination option (0x3c)  
Hop limit: 255  
Source address: 2000::2:2c0:dfff:fe08:d5b6  
Destination address: 2000:0:0:3::6

Destination Option Header  
Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6  
Payload protocol: IPv6 no next header (0x3b)  
Header length: 2 (24 bytes)  
Mobility Header Type: Home Test (3)  
Reserved: 0x00  
Checksum: 0xe726  
Home Test  
Home Nonce Index: 768  
Home Init Cookie: 0x06e6dc9957094e21  
Home Keygen Token: 0x27f30f7ac3a413b5

Frame 44 (142 bytes on wire, 142 bytes captured)  
 Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
 Internet Protocol Version 6  
   Version: 6  
   Traffic class: 0x00  
   Flowlabel: 0x00000  
   Payload length: 88  
   Next header: IPv6 routing (0x2b)  
   Hop limit: 62  
   Source address: 2000:0:0:3::6  
   Destination address: 2000::2:2c0:dfff:fe08:d5b6  
 Routing Header, Type 2  
   Next header: ICMPv6 (0x3a)  
   Length: 2 (24 bytes)  
   Type: 2  
   Segments left: 1  
   Home Address : 2000:0:0:3::3 (2000:0:0:3::3)  
 Internet Control Message Protocol v6  
   Type: 129 (Echo reply)  
   Code: 0  
   Checksum: 0x0c7b (incorrect, should be 0x55ff)  
   ID: 0x4c02  
   Sequence: 0x1300  
   Data (56 bytes)

```
0000  5e 78 c2 3e be 3e 09 00 08 09 0a 0b 0c 0d 0e 0f  ^x.>.>.....
0010  10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020  20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$%&'()*+,-./
0030  30 31 32 33 34 35 36 37                          01234567
```

===The MN 2000:0:0:3::6 sends a Care-of Test Init message requesting a 64-bit care-of keygen token from the Correspondent Node(2000:0:0:3::3 in the present situation).===

Frame 45 (110 bytes on wire, 110 bytes captured)  
 Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
 Internet Protocol Version 6  
   Version: 6  
   Traffic class: 0x00  
   Flowlabel: 0x00000  
   Payload length: 56  
   Next header: IPv6 (0x29)  
   Hop limit: 254  
   Source address: 2000:0:0:3::aa  
   Destination address: 2000::2:2c0:dfff:fe08:d5b6  
 Internet Protocol Version 6  
   Version: 6  
   Traffic class: 0x00  
   Flowlabel: 0x00000  
   Payload length: 16  
   Next header: Mobile IPv6 (0x3e)  
   Hop limit: 253  
   Source address: 2000::1:2c0:dfff:fe08:d5af  
   Destination address: 2000:0:0:3::3  
 Mobile IPv6  
   Payload protocol: IPv6 no next header (0x3b)  
   Header length: 1 (16 bytes)  
   Mobility Header Type: Care-of Test Init (2)  
   Reserved: 0x00  
   Checksum: 0x0ba7  
   Care-of Test Init  
     Care-of Init Cookie: 0x59c8eff6d692a037

===Responding to a Care-of Test Init, a Care-of Test message is sent to the MN's later's Care-of address. This message contains and includes the created care-of nonce and the home keygen token===

Frame 46 (118 bytes on wire, 118 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 64  
Next header: IPv6 (0x29)  
Hop limit: 255  
Source address: 2000::2:2c0:dfff:fe08:d5b6  
Destination address: 2000:0:0:3::aa

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 24  
Next header: Mobile IPv6 (0x3e)  
Hop limit: 255  
Source address: 2000:0:0:3::3  
Destination address: 2000::1:2c0:dfff:fe08:d5af

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 2 (24 bytes)  
Mobility Header Type: Care-of Test (4)  
Reserved: 0x00  
Checksum: 0xb2f9  
Care-of Test  
Care-of Nonce Index: 768  
Care-of Init Cookie: 0x59c8eff6d692a037  
Home Keygen Token: 0x63eb7757e85f9001

===After the Home Test Init and the Care-of Test Init, the MN 2000:0:0:6 can now send a Binding Update message to the Mobile Node 2000:0:0:3. This message is sent directly.===

Frame 47 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 routing (0x2b)  
Hop limit: 254  
Source address: 2000::1:2c0:dfff:fe08:d5af  
Destination address: 2000::2:2c0:dfff:fe08:d5b6

Routing Header, Type 2

Next header: IPv6 destination option (0x3c)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::6 (2000:0:0:3::6)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 4 (40 bytes)  
Mobility Header Type: Binding Update (5)

Reserved: 0x00  
Checksum: 0x8ebe  
Binding Update  
Sequence number: 0  
0... .... = Acknowledge (A) flag: Binding Acknowledgement not requested  
.0.. .... = Home Registration (H) flag: No Home Registration  
..0. .... = Link-Local Compatibility (L) flag: No Link-Local Address Compatibility  
...0 .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Lifetime: 105 (420 seconds)  
Mobility Options  
Nonce Indices  
Home nonce index: 768  
Care-of nonce index: 768  
PadN: 8 bytes  
Binding Authorization Data  
Authenticator: 8A8FAE2F4CFC5183A66362A6

===Its clear the Route Optimization, both Mobile Nodes: 2000:0:0:3@Visited Network 2 and 2000:0:0:6@Visited Network 1; now communicate directly to each other===

Frame 48 (166 bytes on wire, 166 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 112  
Next header: IPv6 routing (0x2b)  
Hop limit: 64  
Source address: 2000::2:2c0:dfff:fe08:d5b6  
Destination address: 2000::1:2c0:dfff:fe08:d5af  
Routing Header, Type 2  
Next header: IPv6 destination option (0x3c)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::6 (2000:0:0:3::6)  
Destination Option Header  
Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)  
Internet Control Message Protocol v6  
Type: 128 (Echo request)  
Code: 0  
Checksum: 0x2054 (incorrect, should be 0xb367)  
ID: 0x4c02  
Sequence: 0x1400  
Data (56 bytes)

```
0000 5f 78 c2 3e a9 65 09 00 08 09 0a 0b 0c 0d 0e 0f  _x.>.e.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$%&'()*+,-./
0030 30 31 32 33 34 35 36 37                          01234567
```

===The communication between the Mobile Nodes proceeds normally, with messages sent directly to each other with: 2000:0:0:3@Visited Network 2 and 2000:0:0:6@Visited Network 1.===

Frame 49 (166 bytes on wire, 166 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 112

Next header: IPv6 routing (0x2b)  
Hop limit: 63  
Source address: 2000::1:2c0:dfff:fe08:d5af  
Destination address: 2000::2:2c0:dfff:fe08:d5b6

Routing Header, Type 2

Next header: IPv6 destination option (0x3c)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1

Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Destination Option Header

Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::6 (2000:0:0:3::6)

Internet Control Message Protocol v6

Type: 129 (Echo reply)  
Code: 0  
Checksum: 0x1f54 (incorrect, should be 0xb267)  
ID: 0x4c02  
Sequence: 0x1400  
Data (56 bytes)

```
0000 5f 78 c2 3e a9 65 09 00 08 09 0a 0b 0c 0d 0e 0f  _x.>.e.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

(...)

Frame 52 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe08:d5b6  
Destination address: fe80::2c0:dfff:fe10:9056

Internet Control Message Protocol v6

Type: 135 (Neighbor solicitation)  
Code: 0  
Checksum: 0x2dd3 (correct)  
Target: fe80::2c0:dfff:fe10:9056  
ICMPv6 options

Frame 53 (86 bytes on wire, 86 bytes captured)

Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6

Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 32  
Next header: ICMPv6 (0x3a)  
Hop limit: 255  
Source address: fe80::2c0:dfff:fe10:9056  
Destination address: fe80::2c0:dfff:fe08:d5b6

Internet Control Message Protocol v6

Type: 136 (Neighbor advertisement)  
Code: 0  
Checksum: 0x912a (correct)  
Flags: 0xe0000000  
Target: fe80::2c0:dfff:fe10:9056  
ICMPv6 options

(...)

Frame 93 (166 bytes on wire, 166 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
  Version: 6  
  Traffic class: 0x00  
  Flowlabel: 0x00000  
  Payload length: 112  
  Next header: IPv6 routing (0x2b)  
  Hop limit: 64  
  Source address: 2000::2:2c0:dfff:fe08:d5b6  
  Destination address: 2000::1:2c0:dfff:fe08:d5af  
Routing Header, Type 2  
  Next header: IPv6 destination option (0x3c)  
  Length: 2 (24 bytes)  
  Type: 2  
  Segments left: 1  
  Home Address : 2000:0:0:3::6 (2000:0:0:3::6)  
Destination Option Header  
  Next header: ICMPv6 (0x3a)  
  Length: 2 (24 bytes)  
  PadN: 4 bytes  
  Option Type: 201 (0xc9) - Home Address Option  
  Option Length : 16  
  Home Address : 2000:0:0:3::3 (2000:0:0:3::3)  
Internet Control Message Protocol v6  
  Type: 128 (Echo request)  
  Code: 0  
  Checksum: 0x0b0a (incorrect, should be 0x9e1d)  
  ID: 0x4c02  
  Sequence: 0x2700  
  Data (56 bytes)

```
0000 72 78 c2 3e 96 af 0b 00 08 09 0a 0b 0c 0d 0e 0f  rx.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

===The Mobile Node 2000:0:0:6@Visited Network 1 will move home again. All the procedures described above will repeat for the present situation.===

Frame 94 (94 bytes on wire, 94 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
  Version: 6  
  Traffic class: 0x00  
  Flowlabel: 0x00000  
  Payload length: 40  
  Next header: IPv6 routing (0x2b)  
  Hop limit: 253  
  Source address: 2000:0:0:3::6  
  Destination address: 2000::2:2c0:dfff:fe08:d5b6  
Routing Header, Type 2  
  Next header: Mobile IPv6 (0x3e)  
  Length: 2 (24 bytes)  
  Type: 2  
  Segments left: 1  
  Home Address : 2000:0:0:3::3 (2000:0:0:3::3)  
Mobile IPv6  
  Payload protocol: IPv6 no next header (0x3b)  
  Header length: 1 (16 bytes)  
  Mobility Header Type: Home Test Init (1)  
  Reserved: 0x00  
  Checksum: 0x900a  
  Home Test Init  
    Home Init Cookie: 0x6f26e0bde2c4c0ed

Frame 95 (102 bytes on wire, 102 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 48  
Next header: IPv6 destination option (0x3c)  
Hop limit: 255  
Source address: 2000::2:2c0:dfff:fe08:d5b6  
Destination address: 2000:0:0:3::6

Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 2 (24 bytes)  
Mobility Header Type: Home Test (3)  
Reserved: 0x00  
Checksum: 0x7c3a  
Home Test  
Home Nonce Index: 768  
Home Init Cookie: 0x6f26e0bde2c4c0ed  
Home Keygen Token: 0x27f30f7ac3a413b5

Frame 96 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6

Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 routing (0x2b)  
Hop limit: 253  
Source address: 2000:0:0:3::6  
Destination address: 2000::2:2c0:dfff:fe08:d5b6

Routing Header, Type 2

Next header: IPv6 destination option (0x3c)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Destination Option Header

Next header: Mobile IPv6 (0x3e)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::6 (2000:0:0:3::6)

Mobile IPv6

Payload protocol: IPv6 no next header (0x3b)  
Header length: 4 (40 bytes)  
Mobility Header Type: Binding Update (5)  
Reserved: 0x00  
Checksum: 0xa58b  
Binding Update  
Sequence number: 1  
0... .... = Acknowledge (A) flag: Binding Acknowledgement not requested  
.0. .... = Home Registration (H) flag: No Home Registration  
..0. .... = Link-Local Compatibility (L) flag: No Link-Local Address Compatibility  
...0 .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility  
Lifetime: 0 (0 seconds)

Mobility Options

Nonce Indices  
Home nonce index: 768  
Care-of nonce index: 0

PadN: 8 bytes  
Binding Authorization Data  
Authenticator: 31CD5CC01F7C458BC28316CB

===The Mobile Node 2000:0:0:3 makes the echo request to 2000:0:0:6@Home Network===

Frame 97 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:08:d5:b6, Dst: 00:c0:df:10:90:56  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 destination option (0x3c)  
Hop limit: 64  
Source address: 2000::2:2c0:dfff:fe08:d5b6  
Destination address: 2000:0:0:3::6

Destination Option Header  
Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
PadN: 4 bytes  
Option Type: 201 (0xc9) - Home Address Option  
Option Length : 16  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6  
Type: 128 (Echo request)  
Code: 0  
Checksum: 0x090a (incorrect, should be 0x528e)  
ID: 0x4c02  
Sequence: 0x2800  
Data (56 bytes)

```
0000 73 78 c2 3e 96 af 0b 00 08 09 0a 0b 0c 0d 0e 0f  sx.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```

===The MN 2000:0:0:6 now at home again replies to the 2000:0:0:3@Visited Network 2 request. The communication continues.===

Frame 98 (142 bytes on wire, 142 bytes captured)  
Ethernet II, Src: 00:c0:df:10:90:56, Dst: 00:c0:df:08:d5:b6  
Internet Protocol Version 6  
Version: 6  
Traffic class: 0x00  
Flowlabel: 0x00000  
Payload length: 88  
Next header: IPv6 routing (0x2b)  
Hop limit: 62  
Source address: 2000:0:0:3::6  
Destination address: 2000::2:2c0:dfff:fe08:d5b6

Routing Header, Type 2  
Next header: ICMPv6 (0x3a)  
Length: 2 (24 bytes)  
Type: 2  
Segments left: 1  
Home Address : 2000:0:0:3::3 (2000:0:0:3::3)

Internet Control Message Protocol v6  
Type: 129 (Echo reply)  
Code: 0  
Checksum: 0x080a (incorrect, should be 0x518e)  
ID: 0x4c02  
Sequence: 0x2800  
Data (56 bytes)

```
0000 73 78 c2 3e 96 af 0b 00 08 09 0a 0b 0c 0d 0e 0f  sx.>.....
0010 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  .....
0020 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f  !"#$$%&'()*+,-./
0030 30 31 32 33 34 35 36 37 01234567
```