Experimental
Mobile IPv6

Self Test Specification
for Mobile Node with IKEv1

Technical Document
Version 1.0.2

IPv6 Forum *http://www.ipv6forum.org*
IPv6 Logo Committee *http://www.ipv6ready.org*

Modification Record

Version 1.0.2 November 1, 2007

Editorial

Title, footer, and copyright were fixed.

Version 1.0.1 July 18, 2006

Correction of cover and Acknowledgements.

Version 1.0.0 June 12, 2006

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Principle Authors:

- IPv6 Promotion Council, Certification Working Group

Commentators:

- IRISA-INRIA

Introduction

The IPv6 forum plays a major role to bring together industrial actors, to develop and deploy the new generation of IP protocols. Contrary to IPv4, which started with a small closed group of implementers, the universality of IPv6 leads to a huge number of implementations. Interoperability has always been considered as a critical feature in the Internet community.
Due to the large number of IPv6 implementations, it is important to provide the market a strong signal proving the level of interoperability across various products.
To avoid confusion in the mind of customers, a globally unique logo programme should be defined. The IPv6 logo will give confidence to users that IPv6 is currently operational. It will also be a clear indication that the technology will still be used in the future. To summarize, this logo programme will contribute to the feeling that IPv6 is available and ready to be used.

The IPv6 Logo Programme consists in three phases

Phase 1 :
In a first stage, the Logo will indicate that the product includes IPv6 mandatory core protocols and can interoperate with other IPv6 implementations.

Phase 2 :
The "IPv6 ready" step implies a proper care, technical consensus and clear technical references. The IPv6 ready logo will indicate that a product has successfully satisfied strong requirements stated by the IPv6 Logo Committee (v6LC).
To avoid confusion, the logo "IPv6 Ready" will be generic. The v6LC will define the test profiles with associated requirements for specific functionalities.

Phase 3 :
Same as Phase 2 with IPsec mandated.

This document is an experimental enhancing part of “Mobile IPv6” test specification.
“Mobile IPv6 with IKEv1” is experimental and IPv6 Ready Logo doesn't include IKEv1 right now. However, we have sorted out the documents about IKEv1 and we want to publish them here.

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3 Common Setup

3.1 Common Setup-1 (Experimental enhancing part)

- Set IKE configuration
  - MN must be the initiator of the Security Association.
  - MN should establish required IPsecSA as an initiator after ISAKMP SA establishment.

6. Test Specification: Mobile Node operation

There are experimental enhancing parts.

6.13 IPsec SA

6.13.1 manual configuration

6.13.1.1 MN-1-1-2-1-001 - Use the manual configuration of security association between MN and HA

[PURPOSE]
MN-1-1-2-1-001 - Use the manual configuration of security association between MN and HA

[CATEGORY]
HOST : ADVANCED FUNCTION (REAL HOME LINK)

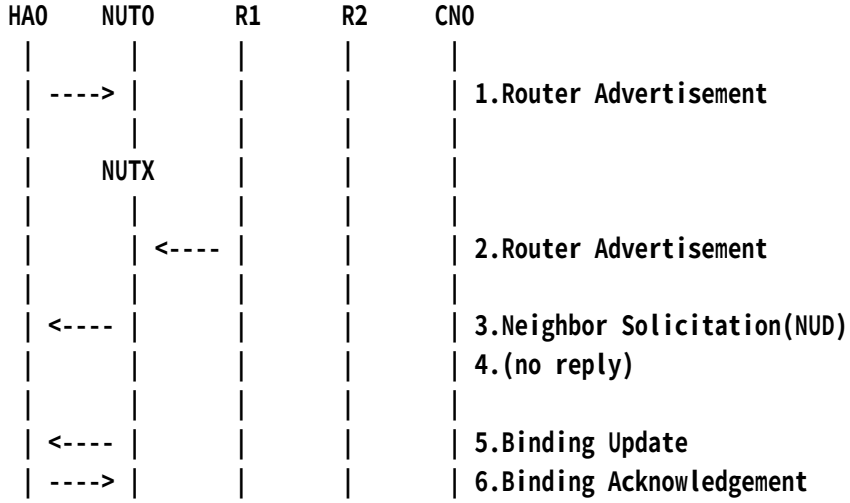
[REQUIREMENT OF TEST]
Function of Real Home Link: YES

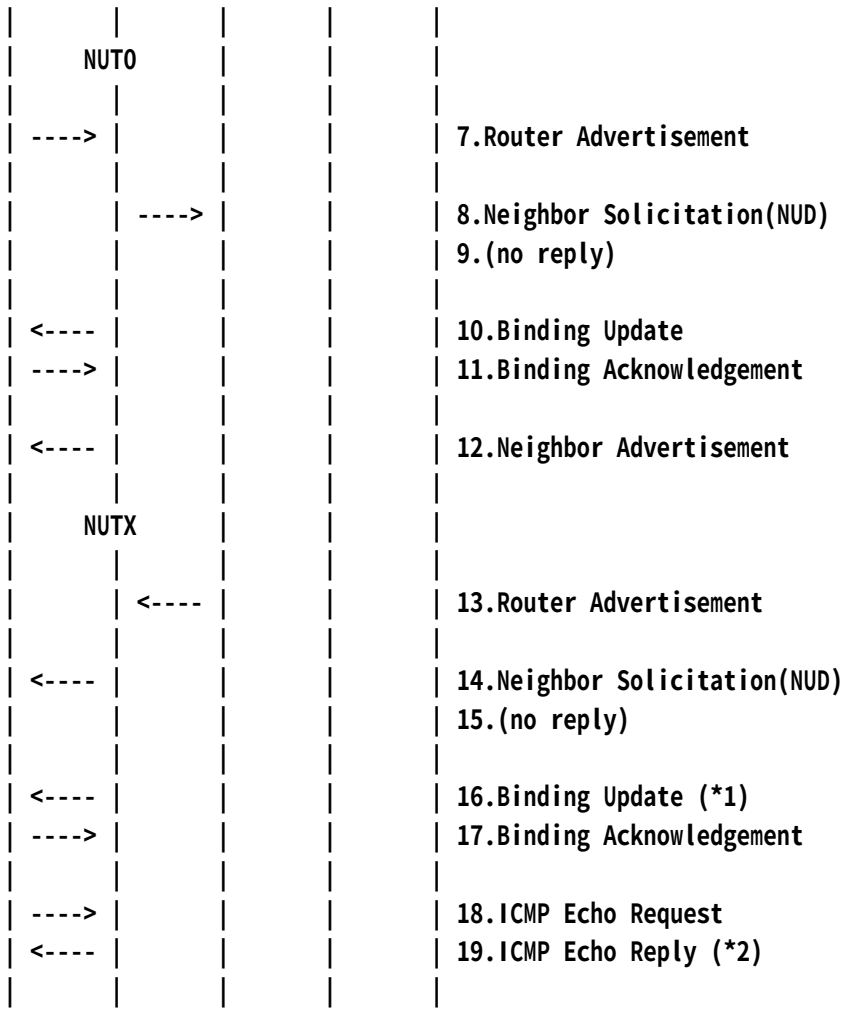
[TOPORGY]
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]
Refer to 3.1 Common Setup-1

[INITIALIZATION]
NONE

[PROCEDURE]





1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation(NUD). (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)
   # Wait during a maximum of 3 seconds(RFC2461).
5. Receive Binding Update to HA0. (NUTX -> HA0) (Refer to 5.14.1)
6. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
7. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
8. Receive Neighbor Solicitation(NUD). (NUTX -> R1) (Refer to 5.3.3)
9. (no reply)
   # Wait during a maximum of 3 seconds(RFC2461).
10. Receive Binding Update to HA0. (NUT0 -> HA0) (Refer to 5.14.1)
11. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)
12. Receive Neighbor Advertisement. (NUT0 -> NUT0_allnode_multi)
    (Refer to 5.4.1)
13. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
14. Receive Neighbor Solicitation(NUD). (NUT0 -> HA0) (Refer to 5.3.3)
15. (no reply)

Wait during a maximum of 3 seconds(RFC2461).

16. Receive Binding Update to HA0. (NUTX -> HA0) (*1) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

17. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

IPv6 Header	Source Address	HA (global)
	Destination Address	MN care-of (global)
Type2 Routing Header	Home Address	MN (global)
Encapsulating Security Payload	Security Parameter Index	Any
	Sequence	Any
	Initialization Vector	Any
Mobility Header	MH Type	6

18. Send ICMP Echo Request. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.7.3)
19. Receive ICMP Echo Reply. (NUTX -> HA0 with Home Address Option) (*2) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: HA0 receives Binding Update.

Then, check whether this packet fills all of the following.

- The ESP header is included.
- The Acknowledge(A) bit is set to ON.
- The Home Registration(H) bit is set to ON.
- The Alternate Care-of Address mobility option is included.
  - The Care-of Address field is set to the Care-of Address.

(*2) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3775 Mobility Support in IPv6

See Section 11.7.1, 6.1.7

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents

See Section 4.2

6.13.2 auto configuration

6.13.2.1 Binding Updates and Acknowledgements

6.13.2.1.1 MN-1-2-1-1-001 - Sending BU (Establishing New SA1/SA2)

[PURPOSE]
MN-1-2-1-1-001 - Sending BU (Establishing New SA1/SA2)

[CATEGORY]
HOST : ADVANCED FUNCTION (IKE)

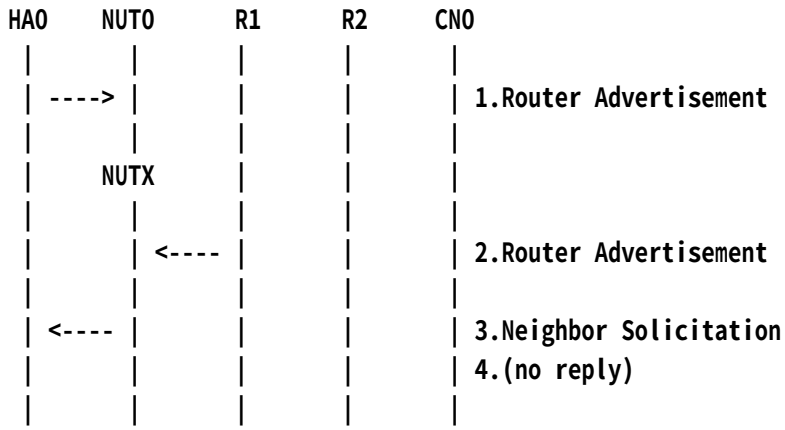
[REQUIREMENT OF TEST]
Function of IKE: YES

[TOPORGY]
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]
Refer to 3.1 Common Setup-1

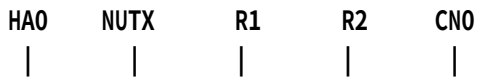
[INITIALIZATION]

- In the case of Real Home Link



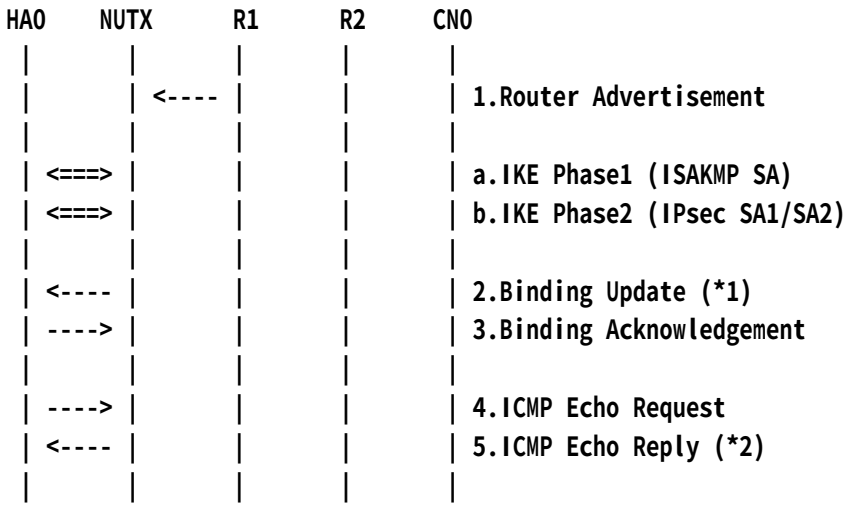
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (*1) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
4. Send ICMP Echo Request. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.7.3)
5. Receive ICMP Echo Reply. (NUTX -> HA0 with Home Address Option) (*2) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: HA0 receives Binding Update.
Then, check whether this packet fills all of the following,
- using new IPsec SA1.

(*2) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3775 Mobility Support in IPv6

See Section 11.3.2

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents

See Section 4.4

6.13.2.1.2 MN-1-2-1-1-002 - Sending BU (Foreign -> Stay, ISAKMP SA expired, IPsec SA1/SA2 expired)

[PURPOSE]

MN-1-2-1-1-002 - Sending BU (Foreign -> Stay, ISAKMP SA expired, IPsec SA1/SA2 expired)

[CATEGORY]

HOST : ADVANCED FUNCTION (IKE)

[REQUIREMENT OF TEST]

Function of IKE: YES

[TOPORGY]

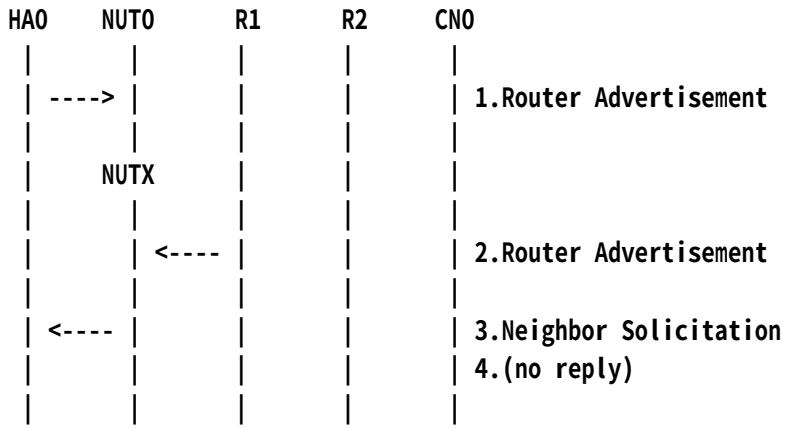
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

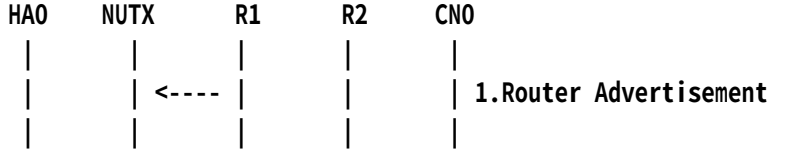
[INITIALIZATION]

- In the case of Real Home Link



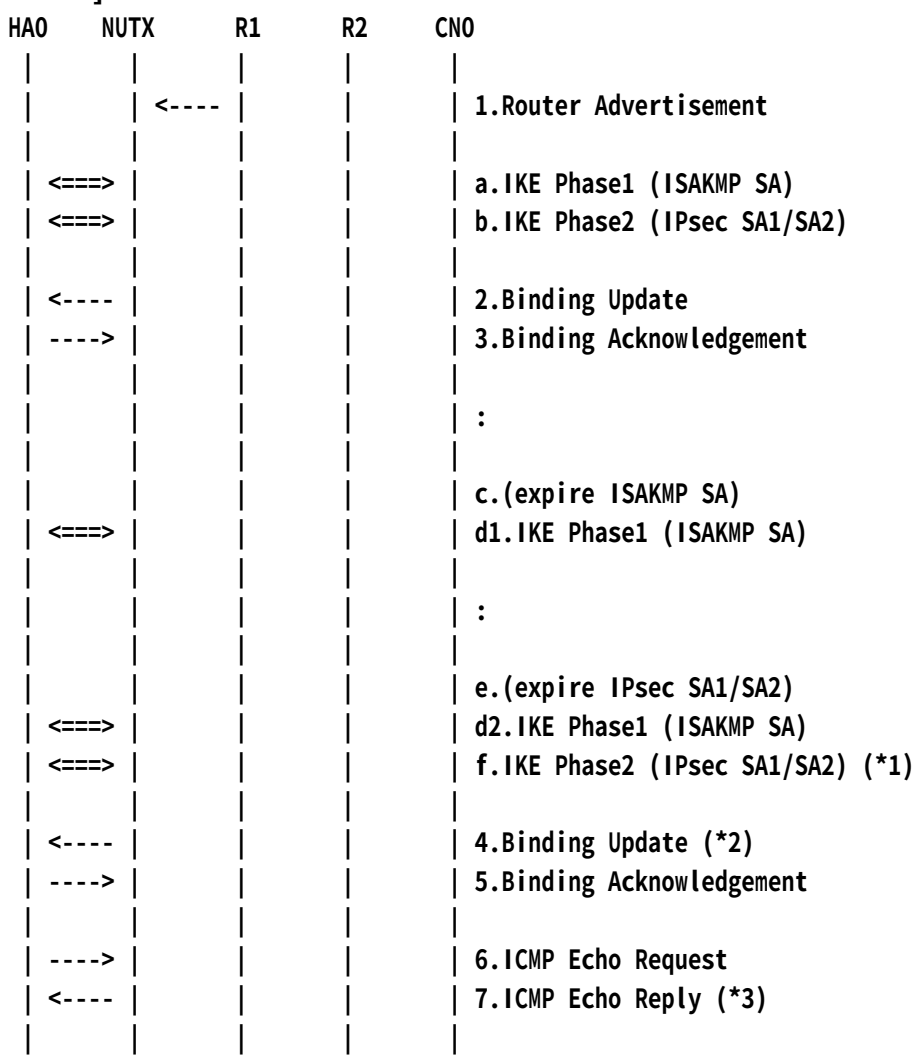
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. (expire ISAKMP SA)
d1. IKE Phase1 (ISAKMP SA) or [d2]
e. (expire IPsec SA1/SA2)
d2. [d1] or IKE Phase1 (ISAKMP SA)
f. IKE Phase2 (IPsec SA1/SA2) (*1)

4. Receive Binding Update. (NUTX -> HA0) (*2) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

5. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
6. Send ICMP Echo Request. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.7.3)
7. Receive ICMP Echo Reply. (NUTX -> HA0 with Home Address Option) (*3) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA1/SA2 is re-established after re-establishing ISAKMP SA.

(*2) PASS: HA0 receives Binding Update.
Then, check whether this packet fills all of the following,
- using new IPsec SA1.

(*3) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.3.2

6.13.2.1.3 MN-1-2-1-1-004 - Sending BU (Foreign -> Stay, ISAKMP SA exist, IPsec SA1/SA2 expired)

[PURPOSE]

MN-1-2-1-1-004 - Sending BU (Foreign -> Stay, ISAKMP SA exist, IPsec SA1/SA2 expired)

[CATEGORY]

HOST : ADVANCED FUNCTION (IKE)

[REQUIREMENT OF TEST]

Function of IKE: YES

[TOPORGY]

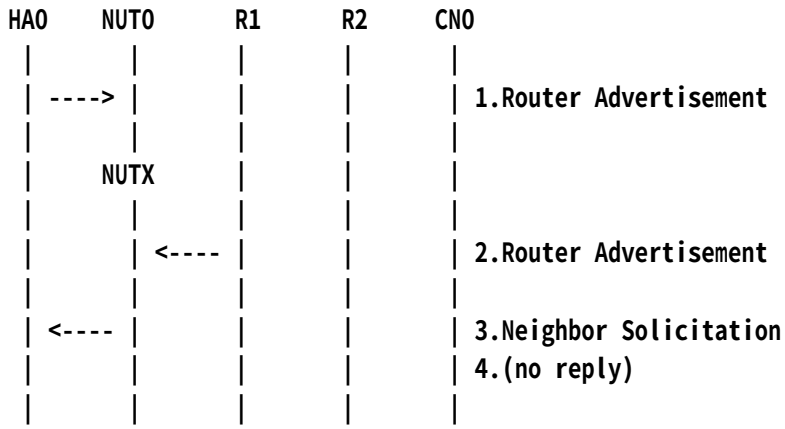
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

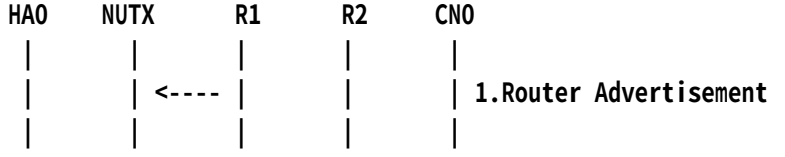
[INITIALIZATION]

- In the case of Real Home Link



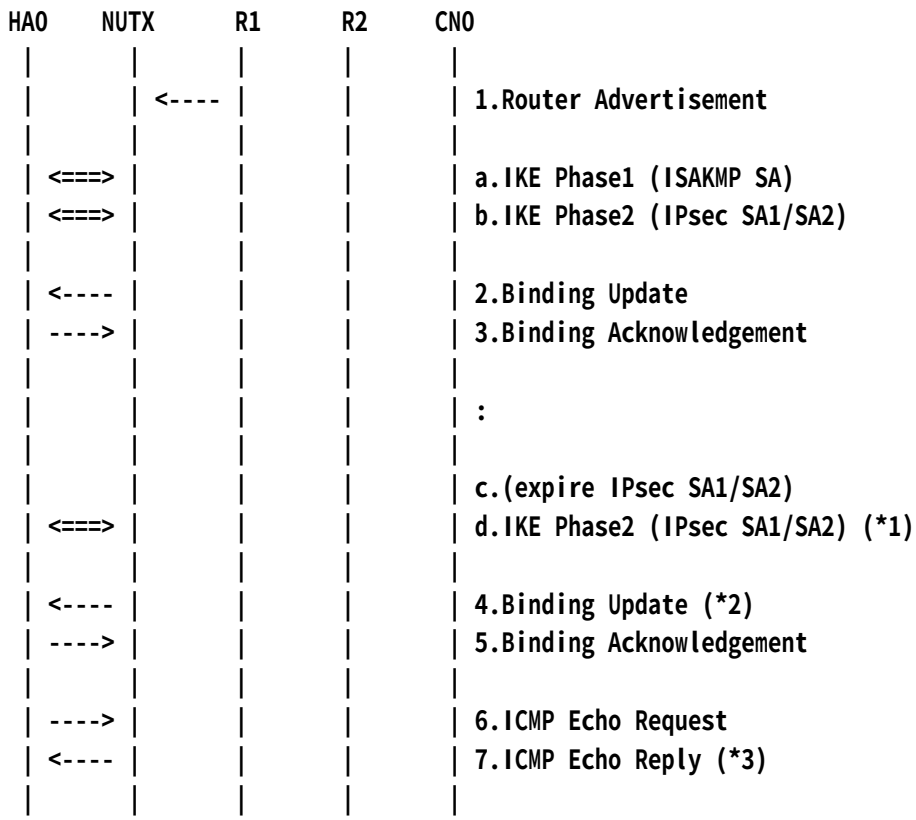
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. (expire IPsec SA1/SA2)
d. IKE Phase2 (IPsec SA1/SA2) (*1)

4. Receive Binding Update. (NUTX -> HA0) (*2) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

5. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

6. Send ICMP Echo Request. (HA0 -> NUTX with Type2 Routing Header)
   (Refer to 5.7.3)
7. Receive ICMP Echo Reply. (NUTX -> HA0 with Home Address Option) (*3)
   (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA1/SA2 is re-established.

(*2) PASS: HA0 receives Binding Update.
Then, check whether this packet fills all of the following,
- using new IPsec SA1.

(*3) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.3.2

6.13.2.1.4 MN-1-2-1-1-012 - Sending BU (Foreign -> Foreign -> Stay, ISAKMP SA discard, IPsec SA1/SA2 expired)

[PURPOSE]

MN-1-2-1-1-012 - Sending BU (Foreign -> Foreign -> Stay, ISAKMP SA discard, IPsec SA1/SA2 expired)

[CATEGORY]

HOST : ADVANCED FUNCTION (IKE)

[REQUIREMENT OF TEST]

Function of IKE: YES

[TOPORGY]

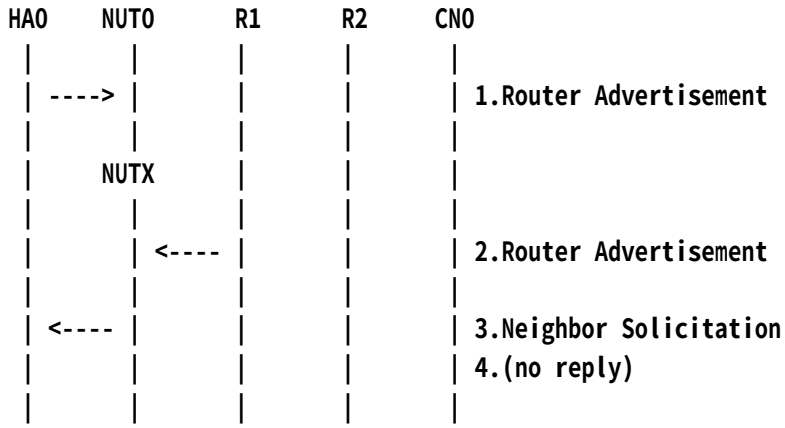
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

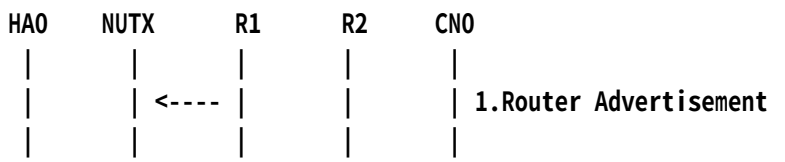
[INITIALIZATION]

- In the case of Real Home Link



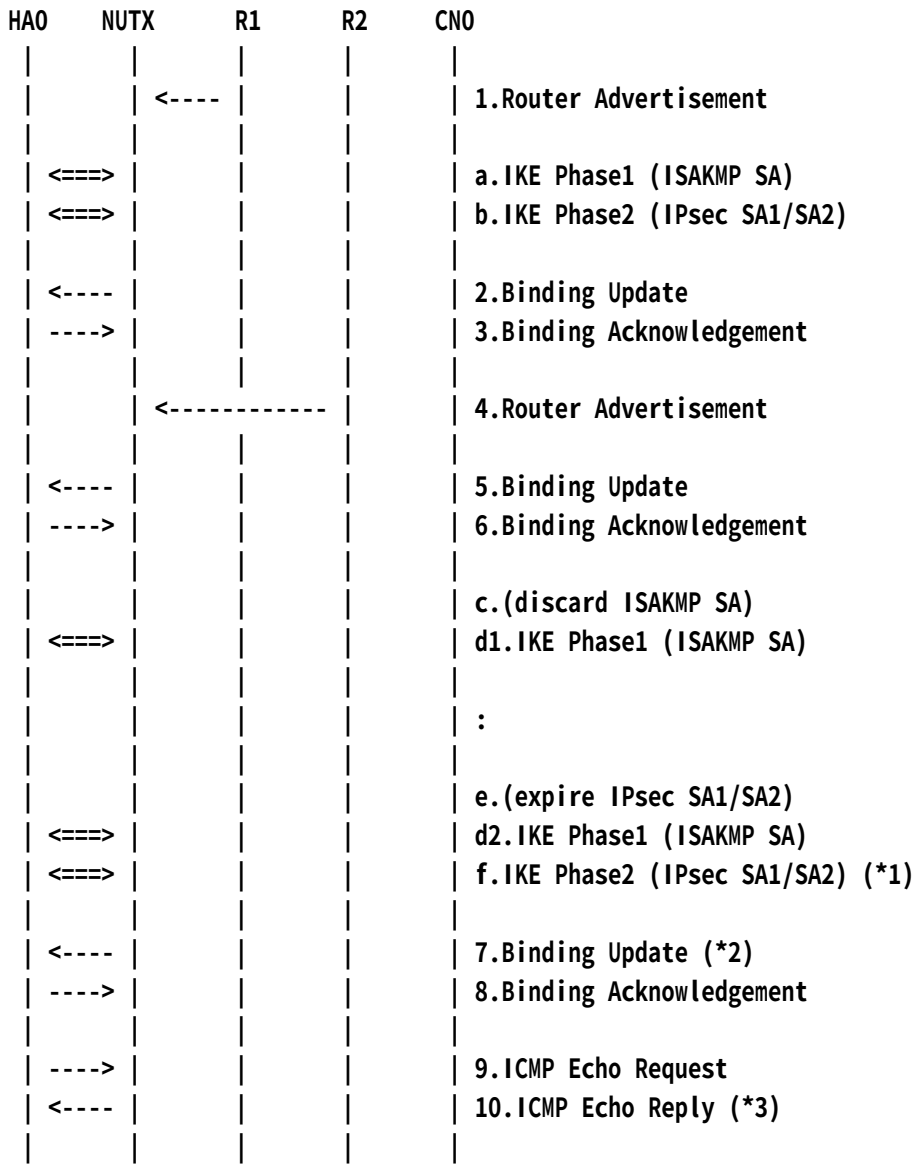
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
4. Send Router Advertisement. (R2 -> R2_allnode_multi) (Refer to 5.2.1)
5. Receive Binding Update. (NUTY -> HA0) (Refer to 5.14.1)
   # (K)bit on/off

6. Send Binding Acknowledgement. (HA0 -> NUTY) (Refer to 5.15.1)
   # (K)bit off

c. (discard ISAKMP SA)
d1. IKE Phase1 (ISAKMP SA) or [d2]
e. (expire IPsec SA1/SA2)
d2. [d1] or IKE Phase1 (ISAKMP SA)
f. IKE Phase2 (IPsec SA1/SA2) (*1)

7. Receive Binding Update. (NUTY -> HA0) (*2) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

8. Send Binding Acknowledgement. (HA0 -> NUTY) (Refer to 5.15.1)
9. Send ICMP Echo Request. (HA0 -> NUTY with Type2 Routing Header)
   (Refer to 5.7.3)
10. Receive ICMP Echo Reply. (NUTY -> HA0 with Home Address Option)
    (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA1/SA2 is re-established after re-establishing ISAKMP SA.
(*2) PASS: HA0 receives Binding Update.
        Then, check whether this packet fills all of the following,
        - using new IPsec SA1.
(*3) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3775 Mobility Support in IPv6
    See Section 11.7.3

6.13.2.1.5 MN-1-2-1-1-014 - Sending BU (Foreign -> Foreign -> Stay, ISAKMP SA update, IPsec SA1/SA2 expired)

[PURPOSE]

MN-1-2-1-1-014 - Sending BU (Foreign -> Foreign -> Stay, ISAKMP SA update, IPsec SA1/SA2 expired)

[CATEGORY]

HOST : ADVANCED FUNCTION (IKE)

[REQUIREMENT OF TEST]

Function of IKE: YES

NUT sets (K) bit in BU which is transmitted to HA: YES

[TOPORGY]

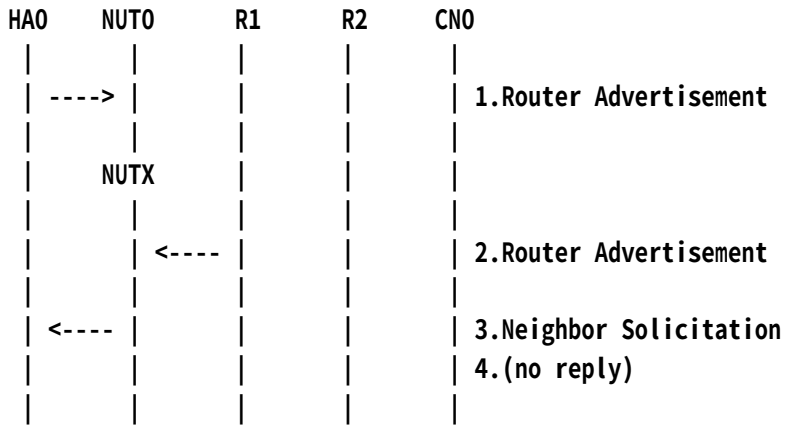
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

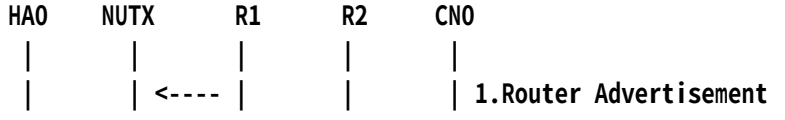
[INITIALIZATION]

- In the case of Real Home Link



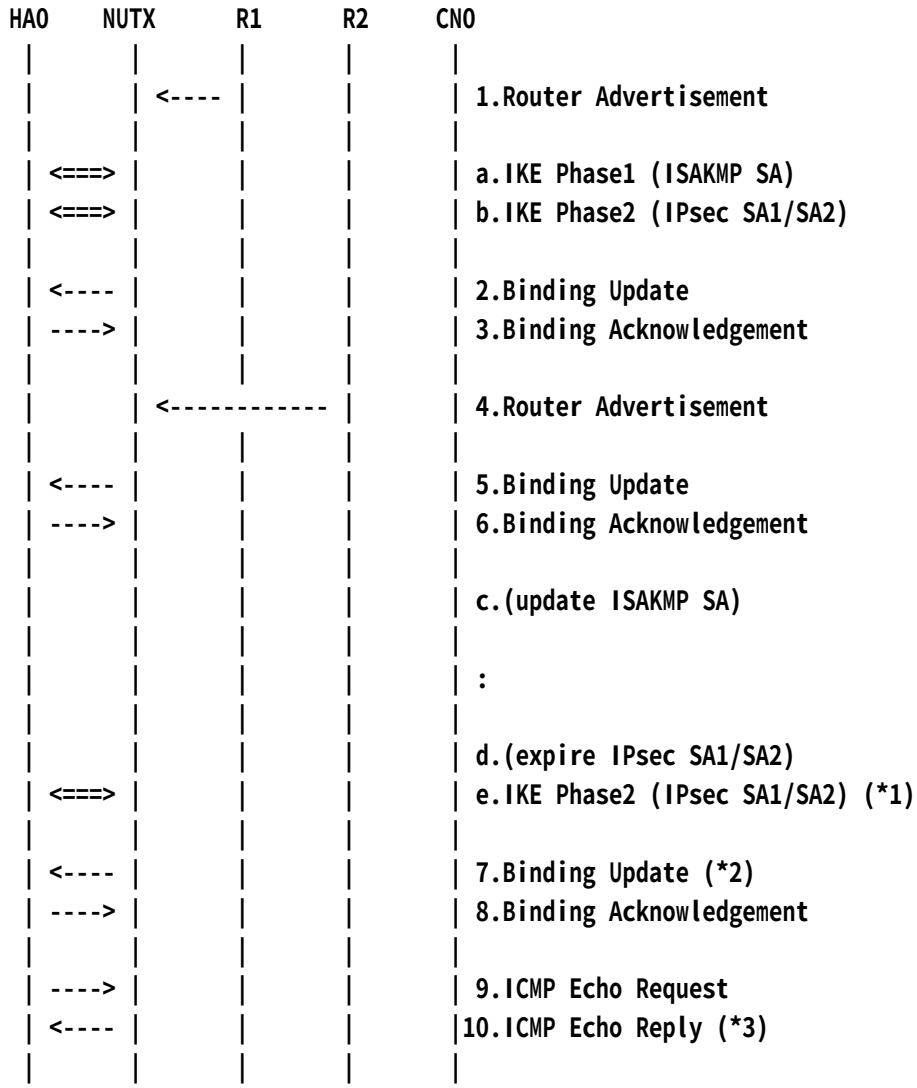
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
4. Send Router Advertisement. (R2 -> R2_allnode_multi) (Refer to 5.2.1)
5. Receive Binding Update. (NUTY -> HA0) (Refer to 5.14.1)
   # (K)bit on
6. Send Binding Acknowledgement. (HA0 -> NUTY) (Refer to 5.15.1)

(K)bit on

c. (update ISAKMP SA)
d. (expire IPsec SA1/SA2)
e. IKE Phase2 (IPsec SA1/SA2) (*1)

7. Receive Binding Update. (NUTY -> HA0) (*2) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

8. Send Binding Acknowledgement. (HA0 -> NUTY) (Refer to 5.15.1)
9. Send ICMP Echo Request. (HA0 -> NUTY with Type2 Routing Header)
   (Refer to 5.7.3)
10. Receive ICMP Echo Reply. (NUTY -> HA0 with Home Address Option) (*3)
    (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA1/SA2 is re-established without re-establishment of ISAKMP SA.
(*2) PASS: HA0 receives Binding Update.
Then, check whether this packet fills all of the following,
- using new IPsec SA1.
(*3) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.7.1, 11.7.3

6.13.2.1.6 MN-1-2-1-1-022 - Sending BU (Foreign -> Home -> Foreign, ISAKMP SA expired, IPsec SA1/SA2 expired)

[PURPOSE]

MN-1-2-1-1-022 - Sending BU (Foreign -> Home -> Foreign, ISAKMP SA expired, IPsec SA1/SA2 expired)

[CATEGORY]

HOST : ADVANCED FUNCTION (IKE)

[REQUIREMENT OF TEST]

Function of IKE: YES

Function of Real Home Link: YES

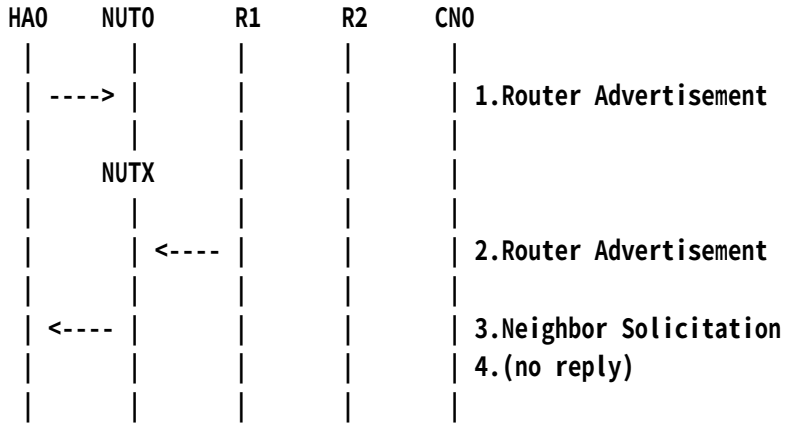
[TOPORGY]

Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

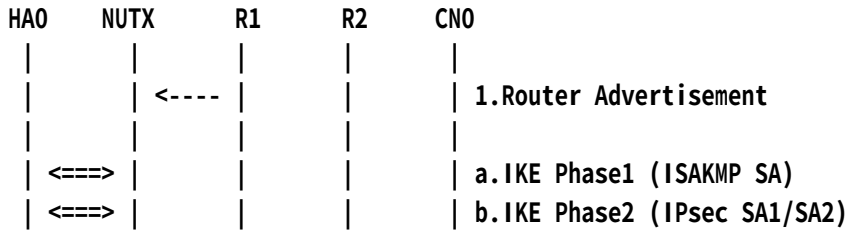
Refer to 3.1 Common Setup-1

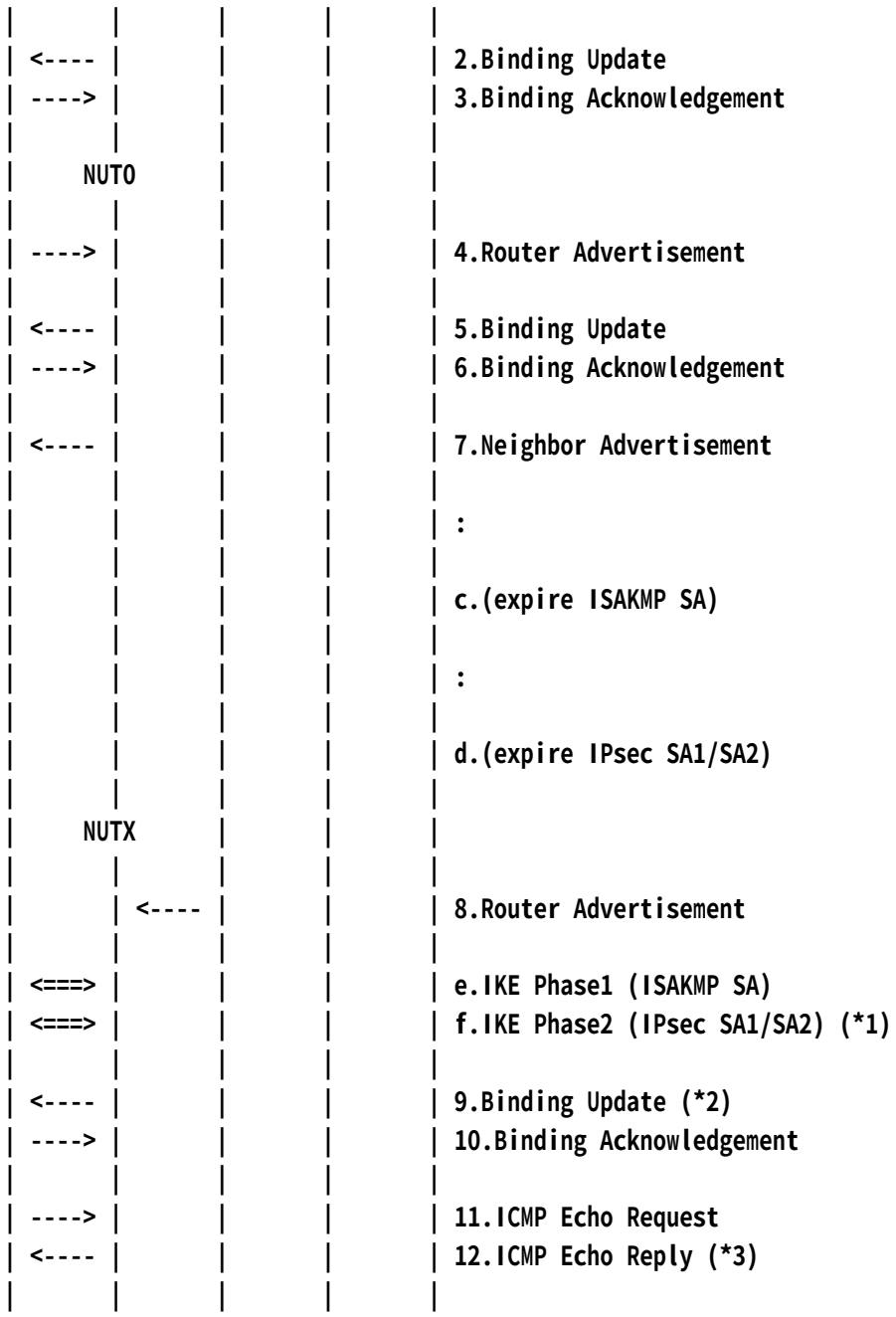
[INITIALIZATION]



1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

[PROCEDURE]





1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
4. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
5. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)
6. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)

7. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi) (Refer to 5.4.1)

c. (expire ISAKMP SA)
d. (expire IPsec SA1/SA2)

8. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

e. IKE Phase1 (ISAKMP SA)
f. IKE Phase2 (IPsec SA1/SA2) (*1)

9. Receive Binding Update. (NUTX -> HA0) (*2) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

10. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
11. Send ICMP Echo Request. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.7.3)
12. Receive ICMP Echo Reply. (NUTX -> HA0 with Home Address Option) (*3) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA1/SA2 is re-established after re-establishing ISAKMP SA.
(*2) PASS: HA0 receives Binding Update.
Then, check whether this packet fills all of the following,
- using new IPsec SA1.
(*3) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents
See Section 4.2

6.13.2.1.7 MN-1-2-1-1-024 - Sending BU (Foreign -> Home -> Foreign, ISAKMP SA exist, IPsec SA1/SA2 expired)

[PURPOSE]

MN-1-2-1-1-024 - Sending BU (Foreign -> Home -> Foreign, ISAKMP SA exist, IPsec SA1/SA2 expired)

[CATEGORY]

HOST : ADVANCED FUNCTION (IKE)

[REQUIREMENT OF TEST]

Function of IKE: YES

Function of Real Home Link: YES

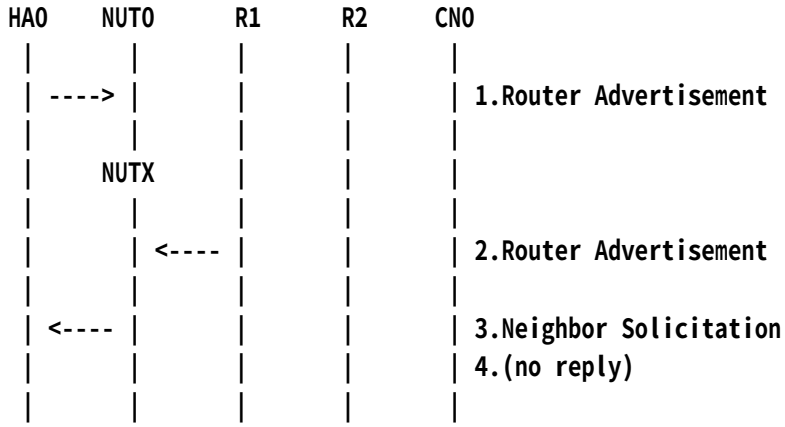
[TOPORGY]

Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

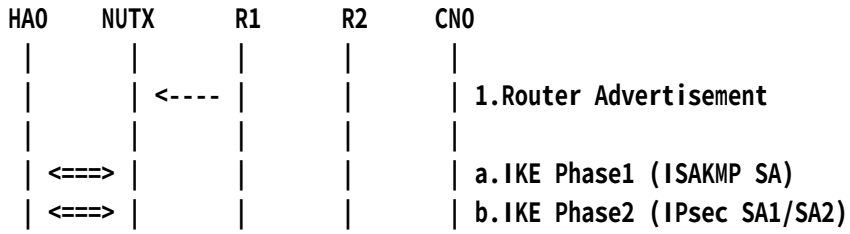
Refer to 3.1 Common Setup-1

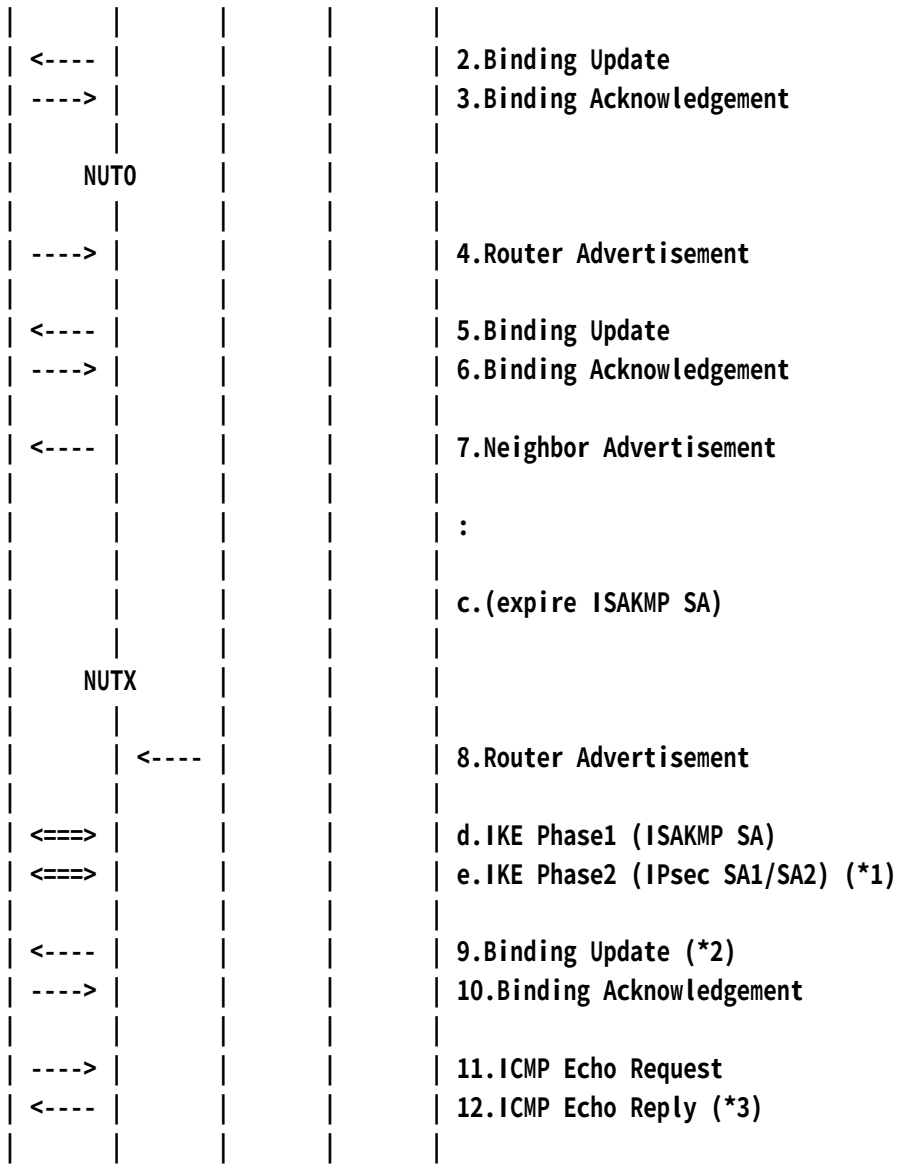
[INITIALIZATION]



1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

[PROCEDURE]





1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
4. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
5. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)
6. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)
7. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi) (Refer to 5.4.1)

c. (expire ISAKMP SA)

8. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

d. IKE Phase1 (ISAKMP SA)
e IKE Phase2 (IPsec SA1/SA2) (*1)

9. Receive Binding Update. (NUTX -> HA0) (*2) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

10. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
11. Send ICMP Echo Request. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.7.3)
12. Receive ICMP Echo Reply. (NUTX -> HA0 with Home Address Option) (*3) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA1/SA2 is re-established.
(*2) PASS: HA0 receives Binding Update.
Then, check whether this packet fills all of the following,
- using new IPsec SA1.
(*3) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents
See Section 4.2

6.13.2.1.8 MN-1-2-1-1-025 - Sending BU (Foreign -> Home -> Foreign, IPsec SA1/SA2 exist)

[PURPOSE]

MN-1-2-1-1-025 - Sending BU (Foreign -> Home -> Foreign, IPsec SA1/SA2 exist)

[CATEGORY]

HOST : ADVANCED FUNCTION (IKE)

[REQUIREMENT OF TEST]

Function of IKE: YES

Function of Real Home Link: YES

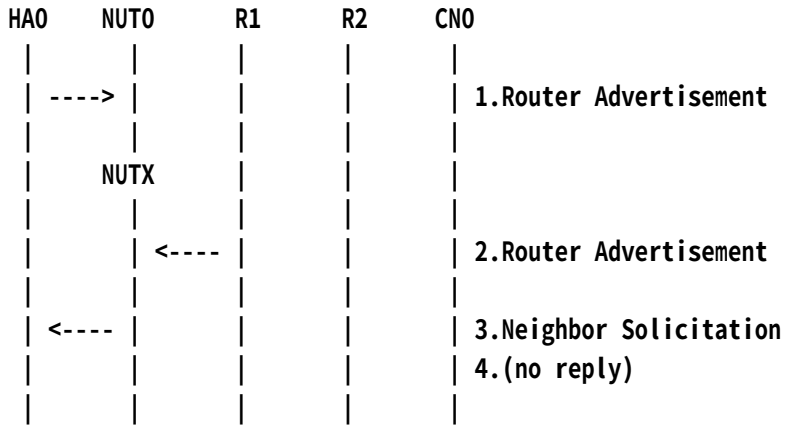
[TOPORGY]

Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

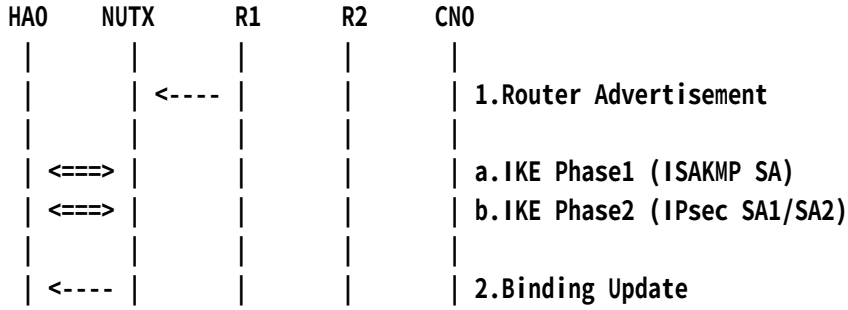
Refer to 3.1 Common Setup-1

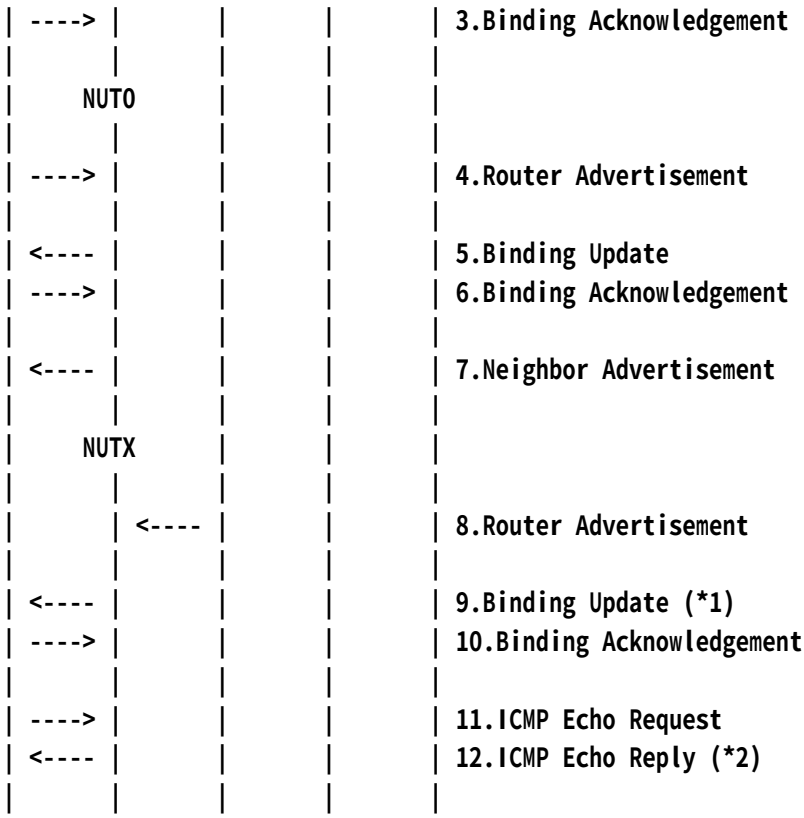
[INITIALIZATION]



1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

[PROCEDURE]





1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
4. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
5. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)
6. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)
7. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi) (Refer to 5.4.1)
8. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
9. Receive Binding Update. (NUTX -> HA0) (*1) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

10. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
11. Send ICMP Echo Request. (HA0 -> NUTX with Type2 Routing Header)

(Refer to 5.7.3)

12. Receive ICMP Echo Reply. (NUTX -> HA0 with Home Address Option) (*2)
(Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: HA0 receives Binding Update.
Then, check whether this packet fills all of the following,
- using old IPsec SA1.

(*2) PASS: HA0 receives ICMP Echo Reply with Home Address Option.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents
See Section 4.2

6.13.2.2 Return Routability Signaling

6.13.2.2.1 MN-1-2-2-1-001 - Sending HoTI (Establishing New SA3/SA4)

[PURPOSE]

MN-1-2-2-1-001 - Sending HoTI (Establishing New SA3/SA4)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND RETURN ROUTABILITY))

[REQUIREMENT OF TEST]

Function of IKE: YES

Function of Return Routability: YES

[TOPORGY]

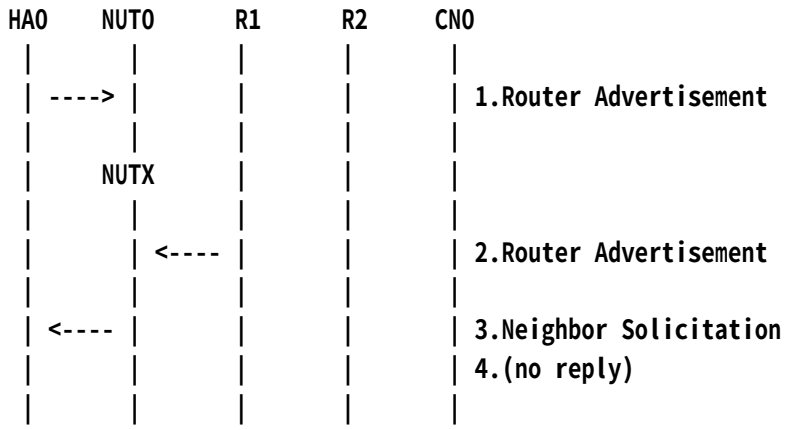
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

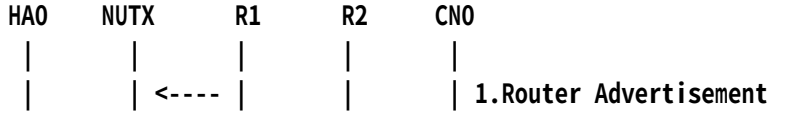
[INITIALIZATION]

- In the case of Real Home Link



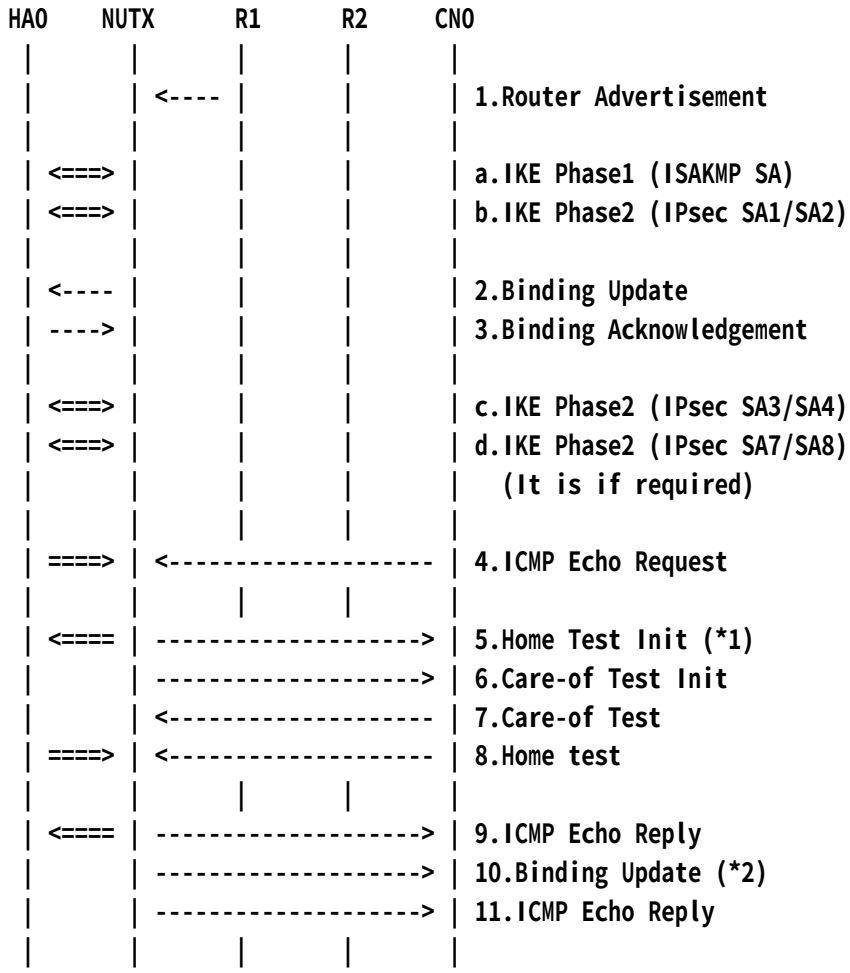
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. IKE Phase2 (IPsec SA3/SA4)
d. IKE Phase2 (IPsec SA7/SA8)

4. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
5. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0) (*1)
   (Refer to 5.10.2)

6. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
7. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
8. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
9. Receive ICMP Echo Reply or [11]. (out: NUTX -> HA0, in: NUT0 -> CN0) (Refer to 5.8.2)
10. Receive Binding Update. (NUTX -> CN0) (*2) (Refer to 5.14.3)

IPv6 Header	Source Address		MN care-of
	Destination Address		CN (global)
Destination Option Header	Home Address		MN home (global)
Mobility Header	MH Type		5
Mobility options	Nonce Indices	Option Type	4
		Option Length	4
		Home Nonce Index	Any
		Care-of Nonce Index	Any
	Binding Authorization Data	Option Type	5
		Option Length	12
		Authenticator	Any

11. [9] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: CN0 receives Home Test Init.
Then, check whether this packet fills all of the following,
- using new IPsec SA3.

(*2) PASS: CN0 receives Binding Update.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.3.2

6.13.2.2.2 MN-1-2-2-1-002 - Sending HoTI (Foreign -> Stay, ISAKMP SA expired, IPsec SA3/SA4 expired)

[PURPOSE]

MN-1-2-2-1-002 - Sending HoTI (Foreign -> Stay, ISAKMP SA expired, IPsec SA3/SA4 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND RETURN ROUTABILITY))

[REQUIREMENT OF TEST]

Function of IKE: YES

Function of Return Routability: YES

[TOPORGY]

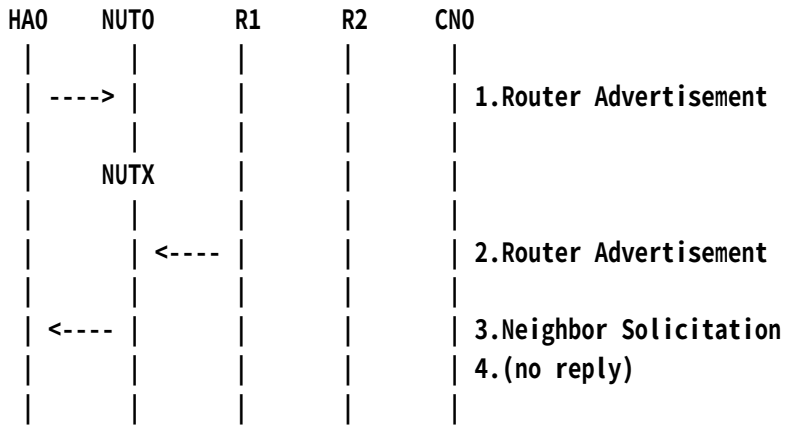
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

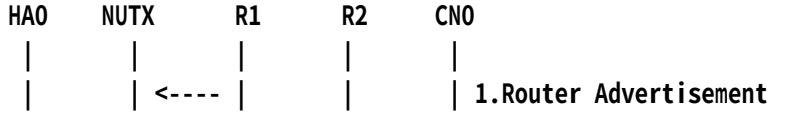
[INITIALIZATION]

- In the case of Real Home Link



1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link

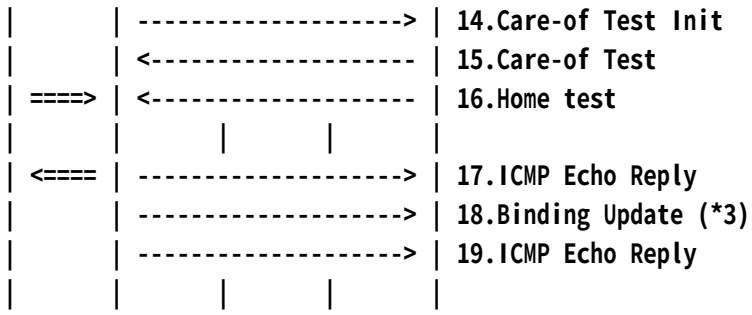


```
        |       |       |       |       |
```

1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]

```
       HA0     NUTX      R1      R2      CN0
        |       |       |       |       |
        |       | <---- |       |       | 1.Router Advertisement
        |       |       |       |       |
        | <===> |       |       |       | a.IKE Phase1 (ISAKMP SA)
        | <===> |       |       |       | b.IKE Phase2 (IPsec SA1/SA2)
        |       |       |       |       |
        | <---- |       |       |       | 2.Binding Update
        | ----> |       |       |       | 3.Binding Acknowledgement
        |       |       |       |       |
        | <===> |       |       |       | c.IKE Phase2 (IPsec SA3/SA4)
        | <===> |       |       |       | d.IKE Phase2 (IPsec SA7/SA8)
        |       |       |       |       |   (It is if required)
        |       |       |       |       |
        | ====> | <-------------------- | 4.ICMP Echo Request
        |       |       |       |       |
        | <==== | --------------------> | 5.Home Test Init
        |       | --------------------> | 6.Care-of Test Init
        |       | <-------------------- | 7.Care-of Test
        | ====> | <-------------------- | 8.Home test
        |       |       |       |       |
        | <==== | --------------------> | 9.ICMP Echo Reply
        |       | --------------------> | 10.Binding Update
        |       | --------------------> | 11.ICMP Echo Reply
        |       |       |       |       |
        |       |       |       |       |
        |       |       |       |       | :
        |       |       |       |       |
        |       |       |       |       | e.(expire ISAKMP SA)
        | <===> |       |       |       | f1.IKE Phase1 (ISAKMP SA)
        |       |       |       |       |
        |       |       |       |       | :
        |       |       |       |       |
        |       |       |       |       | g.(expire IPsec SA3/SA4)
        | <===> |       |       |       | f2.IKE Phase1 (ISAKMP SA)
        | <===> |       |       |       | h.IKE Phase2 (IPsec SA3/SA4) (*1)
        |       |       |       |       |
        | ====> | <-------------------- | 12.ICMP Echo Request
        |       |       |       |       |
        | <==== | --------------------> | 13.Home Test Init (*2)
```



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. IKE Phase2 (IPsec SA3/SA4)
d. IKE Phase2 (IPsec SA7/SA8)

4. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
5. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.10.2)
6. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
7. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
8. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
9. Receive ICMP Echo Reply or [11]. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.8.2)
10. Receive Binding Update. (NUTX -> CN0) (Refer to 5.14.3)
11. [9] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option)
    (Refer to 5.8.3)

e. (expire ISAKMP SA)
f1. IKE Phase1 (ISAKMP SA) or [f2]
g. (expire IPsec SA3/SA4)
f2.[f1] or IKE Phase1 (ISAKMP SA)
h. IKE Phase2 (IPsec SA3/SA4) (*1)

12. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0)
    (Refer to 5.7.2)
13. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0) (*2)
   (Refer to 5.10.2)

IPv6 Header	Source Address	MN Care-of (global)
	Destination Address	HA (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
IPv6 Header	Source Address	MN home

			(global)
	Destination Address		CN (global)
Mobility Header	MH Type		1

14. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
15. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
16. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
17. Receive ICMP Echo Reply or [19]. (out: NUTX -> HA0, in: NUT0 -> CN0) (Refer to 5.8.2)
18. Receive Binding Update. (NUTX -> CN0) (*3) (Refer to 5.14.3)

IPv6 Header	Source Address		MN care-of
	Destination Address		CN (global)
Destination Option Header	Home Address		MN home (global)
Mobility Header	MH Type		5
Mobility options	Nonce Indices	Option Type	4
		Option Length	4
		Home Nonce Index	Any
		Care-of Nonce Index	Any
	Binding Authorization Data	Option Type	5
		Option Length	12
		Authenticator	Any

19. [17] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: CN0 receives Home Test Init.
Then, check whether this packet fills all of the following,
- using new IPsec SA3.

(*2) PASS: CN0 receives Binding Update.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.3.2

6.13.2.2.3 MN-1-2-2-1-004 - Sending HoTI (Foreign -> Foreign -> Stay, ISAKMP SA discard, IPsec SA3/SA4 expired)

[PURPOSE]

MN-1-2-2-1-004 - Sending HoTI (Foreign -> Foreign -> Stay, ISAKMP SA discard, IPsec SA3/SA4 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND RETURN ROUTABILITY))

[REQUIREMENT OF TEST]

Function of IKE: YES

Function of Return Routability: YES

[TOPORGY]

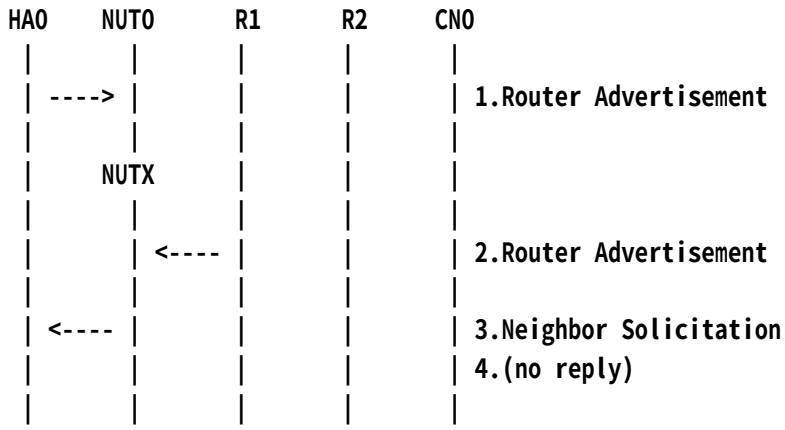
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

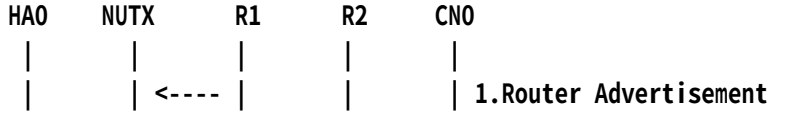
[INITIALIZATION]

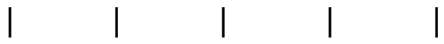
- In the case of Real Home Link



1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

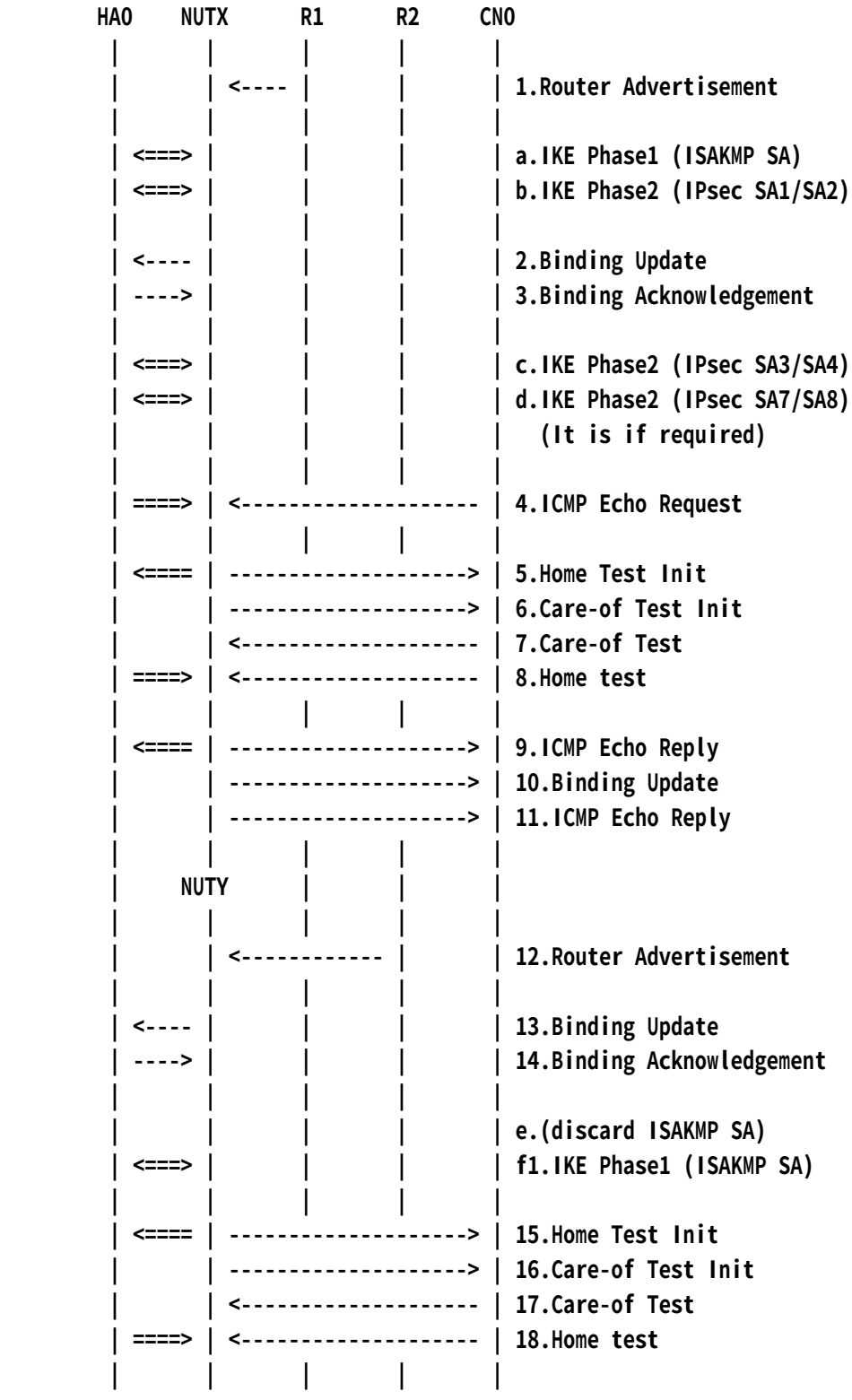
- In the case of Virtual Home Link

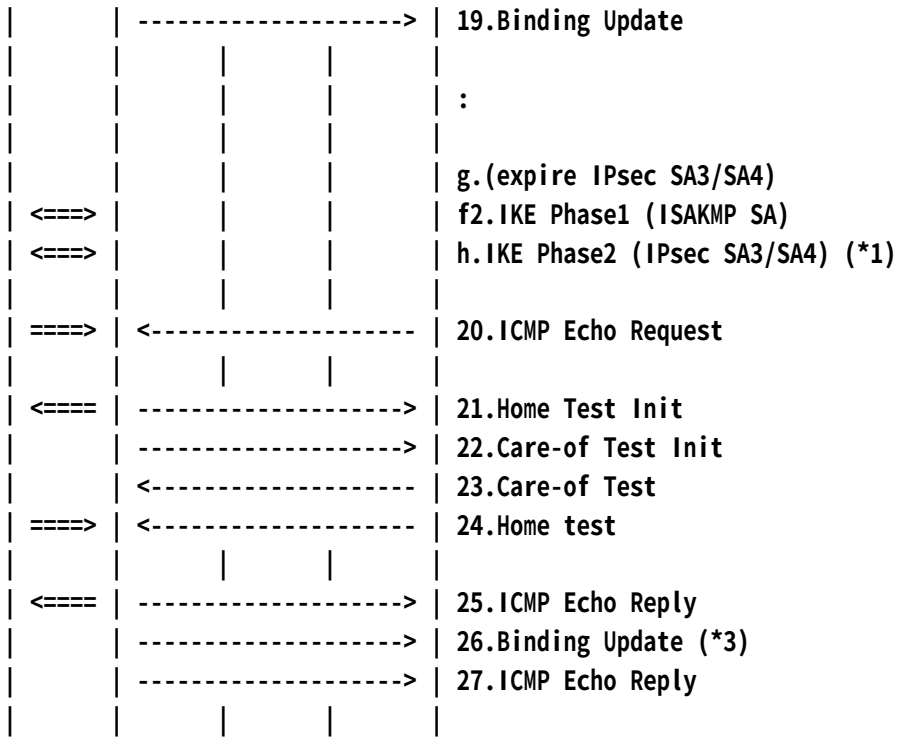




1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]





1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. IKE Phase2 (IPsec SA3/SA4)
d. IKE Phase2 (IPsec SA7/SA8)

4. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
5. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.10.2)
6. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
7. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
8. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
9. Receive ICMP Echo Reply or [11]. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.8.2)
10. Receive Binding Update. (NUTX -> CN0) (Refer to 5.14.3)
11. [9] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option)
    (Refer to 5.8.3)
12. Send Router Advertisement. (R2 -> R2_allnode_multi) (Refer to 5.2.1)
13. Receive Binding Update. (NUTY -> HA0) (Refer to 5.14.1)
    # (K)bit on/off

14. Send Binding Acknowledgement. (HA0 -> NUTY) (Refer to 5.15.1)
    # (K)bit off

e. (discard ISAKMP SA)
f1. IKE Phase1 (ISAKMP SA) or [f2]

15. Receive Home Test Init. (out: NUTY -> HA0, in: NUT0 -> CN0) (Refer to 5.10.2)
16. Receive Care-of Test Init. (NUTY -> CN0) (Refer to 5.11.1)
17. Send Care-of Test. (CN0 -> NUTY) (Refer to 5.13.1)
18. Send Home Test. (out: HA0 -> NUTY, in: CN0 -> NUT0) (Refer to 5.12.2)
19. Receive Binding Update. (NUTY -> CN0) (Refer to 5.14.3)

g. (expire IPsec SA3/SA4)
f2. [f1] or IKE Phase1 (ISAKMP SA)
h. IKE Phase2 (IPsec SA3/SA4) (*1)

20. Send ICMP Echo Request. (out: HA0 -> NUTY, in: CN0 -> NUT0) (Refer to 5.7.2)
21. Receive Home Test Init. (out: NUTY -> HA0, in: NUT0 -> CN0) (*2)
    (Refer to 5.10.2)

IPv6 Header	Source Address	MN Care-of (global)
	Destination Address	HA (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
IPv6 Header	Source Address	MN home (global)
	Destination Address	CN (global)
Mobility Header	MH Type	1

22. Receive Care-of Test Init. (NUTY -> CN0) (Refer to 5.11.1)
23. Send Care-of Test. (CN0 -> NUTY) (Refer to 5.13.1)
24. Send Home Test. (out: HA0 -> NUTY, in: CN0 -> NUT0) (Refer to 5.12.2)
25. Receive ICMP Echo Reply or [27]. (out: NUTY -> HA0, in: NUT0 -> CN0)
    (Refer to 5.8.2)
26. Receive Binding Update. (NUTY -> CN0) (*3) (Refer to 5.14.3)

IPv6 Header	Source Address		MN care-of
	Destination Address		CN (global)
Destination Option Header	Home Address		MN home (global)
Mobility Header	MH Type		5
Mobility options	Nonce Indices	Option Type	4
		Option Length	4
		Home Nonce Index	Any
		Care-of Nonce Index	Any
	Binding Authorization Data	Option Type	5
		Option Length	12
		Authenticator	Any

27. [25] or Receive ICMP Echo Reply. (NUTY -> CN0 with Home Address Option)
    (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA3/SA4 is re-established after re-establishing ISAKMP SA.
(*2) PASS: CN0 receives Home Test Init.
Then, check whether this packet fills all of the following,

- using new IPsec SA3.

(*3) PASS: CN0 receives Binding Update.

[REFERENCES]

RFC3775 Mobility Support in IPv6

See Section 11.7.3

6.13.2.2.4 MN-1-2-2-1-006 - Sending HoTI (Foreign -> Foreign -> Stay, ISAKMP SA update, IPsec SA3/SA4 expired)

[PURPOSE]

MN-1-2-2-1-006 - Sending HoTI (Foreign -> Foreign -> Stay, ISAKMP SA update, IPsec SA3/SA4 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND RETURN ROUTABILITY))

[REQUIREMENT OF TEST]

Function of IKE: YES
Function of Return Routability: YES
NUT sets (K) bit in BU which is transmitted to HA: YES

[TOPORGY]

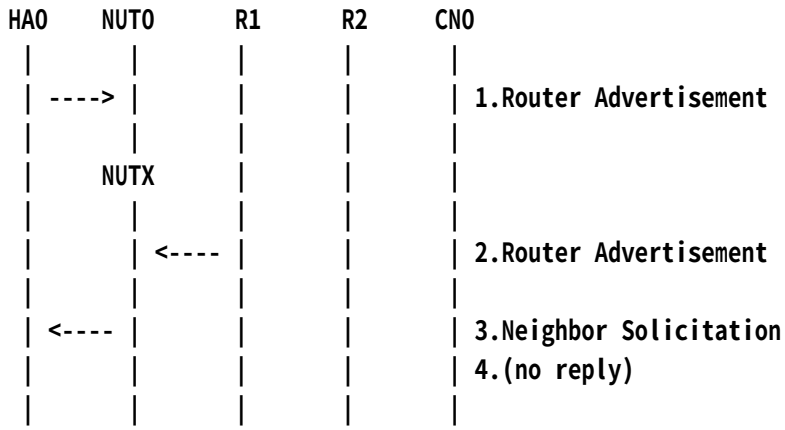
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

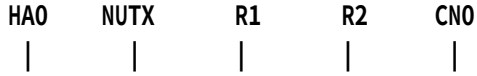
[INITIALIZATION]

- In the case of Real Home Link



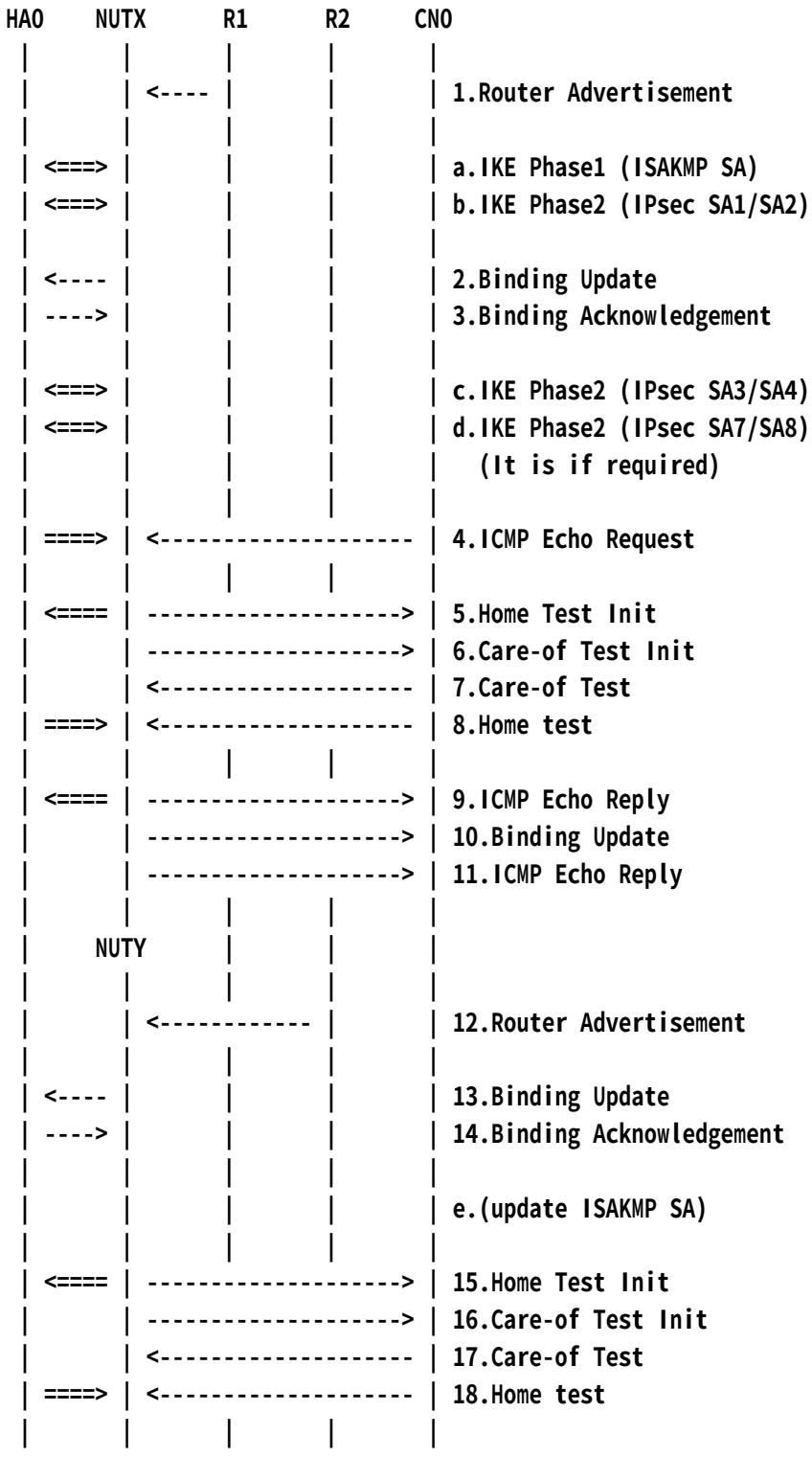
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

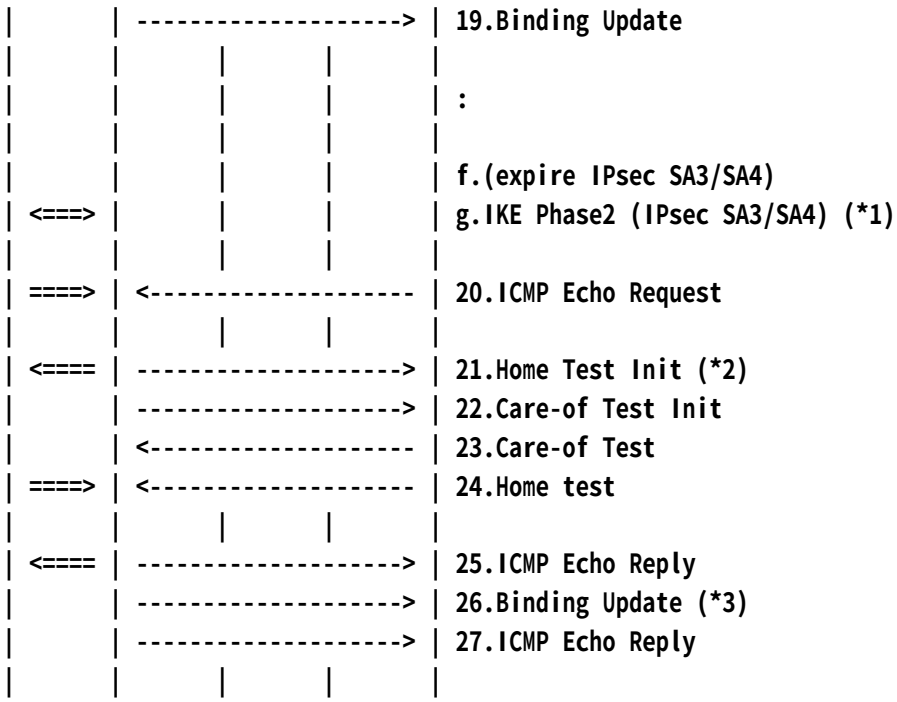
- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]





1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. IKE Phase2 (IPsec SA3/SA4)
d. IKE Phase2 (IPsec SA7/SA8)

4. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
5. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.10.2)
6. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
7. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
8. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
9. Receive ICMP Echo Reply or [11]. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.8.2)
10. Receive Binding Update. (NUTX -> CN0) (Refer to 5.14.3)
11. [9] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option)
    (Refer to 5.8.3)
12. Send Router Advertisement. (R2 -> R2_allnode_multi) (Refer to 5.2.1)
13. Receive Binding Update. (NUTY -> HA0) (Refer to 5.14.1)
    # (K)bit on
14. Send Binding Acknowledgement. (HA0 -> NUTY) (Refer to 5.15.1)

(K)bit on

e. (update ISAKMP SA)

15. Receive Home Test Init. (out: NUTY -> HA0, in: NUT0 -> CN0) (Refer to 5.10.2)
16. Receive Care-of Test Init. (NUTY -> CN0) (Refer to 5.11.1)
17. Send Care-of Test. (CN0 -> NUTY) (Refer to 5.13.1)
18. Send Home Test. (out: HA0 -> NUTY, in: CN0 -> NUT0) (Refer to 5.12.2)
19. Receive Binding Update. (NUTY -> CN0) (Refer to 5.14.3)

f. (expire IPsec SA3/SA4)
g. IKE Phase2 (IPsec SA3/SA4) (*1)

20. Send ICMP Echo Request. (out: HA0 -> NUTY, in: CN0 -> NUT0) (Refer to 5.7.2)
21. Receive Home Test Init. (out: NUTY -> HA0, in: NUT0 -> CN0) (*2)
(Refer to 5.10.2)

IPv6 Header	Source Address	MN Care-of (global)
	Destination Address	HA (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
IPv6 Header	Source Address	MN home (global)
	Destination Address	CN (global)
Mobility Header	MH Type	1

22. Receive Care-of Test Init. (NUTY -> CN0) (Refer to 5.11.1)
23. Send Care-of Test. (CN0 -> NUTY) (Refer to 5.13.1)
24. Send Home Test. (out: HA0 -> NUTY, in: CN0 -> NUT0) (Refer to 5.12.2)
25. Receive ICMP Echo Reply or [27]. (out: NUTY -> HA0, in: NUT0 -> CN0)
(Refer to 5.8.2)
26. Receive Binding Update. (NUTY -> CN0) (*3) (Refer to 5.14.3)

IPv6 Header	Source Address		MN care-of
	Destination Address		CN (global)
Destination Option Header	Home Address		MN home (global)
Mobility Header	MH Type		5
Mobility options	Nonce Indices	Option Type	4
		Option Length	4
		Home Nonce Index	Any
		Care-of Nonce Index	Any
	Binding Authorization Data	Option Type	5
		Option Length	12
		Authenticator	Any

27. [25] or Receive ICMP Echo Reply. (NUTY -> CN0 with Home Address Option)
(Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA3/SA4 is re-established without re-establishment of ISAKMP SA.
(*2) PASS: CN0 receives Home Test Init.
Then, check whether this packet fills all of the following,
- using new IPsec SA3.
(*3) PASS: CN0 receives Binding Update.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.7.1, 11.7.3

6.13.2.2.5 MN-1-2-2-1-018 - Sending HoTI (Security policy entries is inactive)

[PURPOSE]

MN-1-2-2-1-018 - Sending HoTI (Security policy entries is inactive)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND RETURN ROUTABILITY))

[REQUIREMENT OF TEST]

Function of IKE: YES
Function of Real Home Link: YES
Function of Return Routability: YES

[TOPORGY]

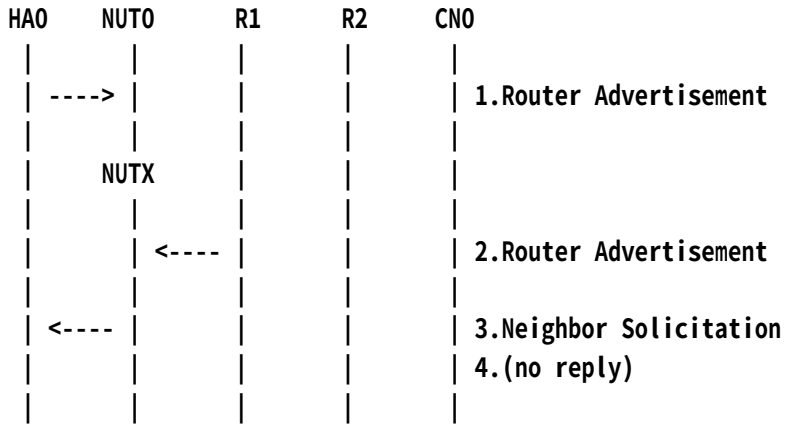
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

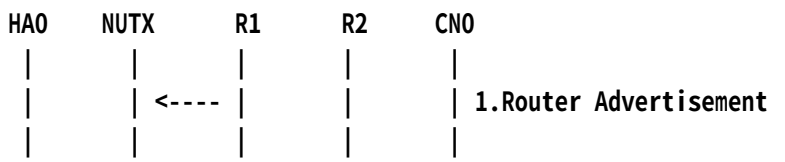
[INITIALIZATION]

- In the case of Real Home Link



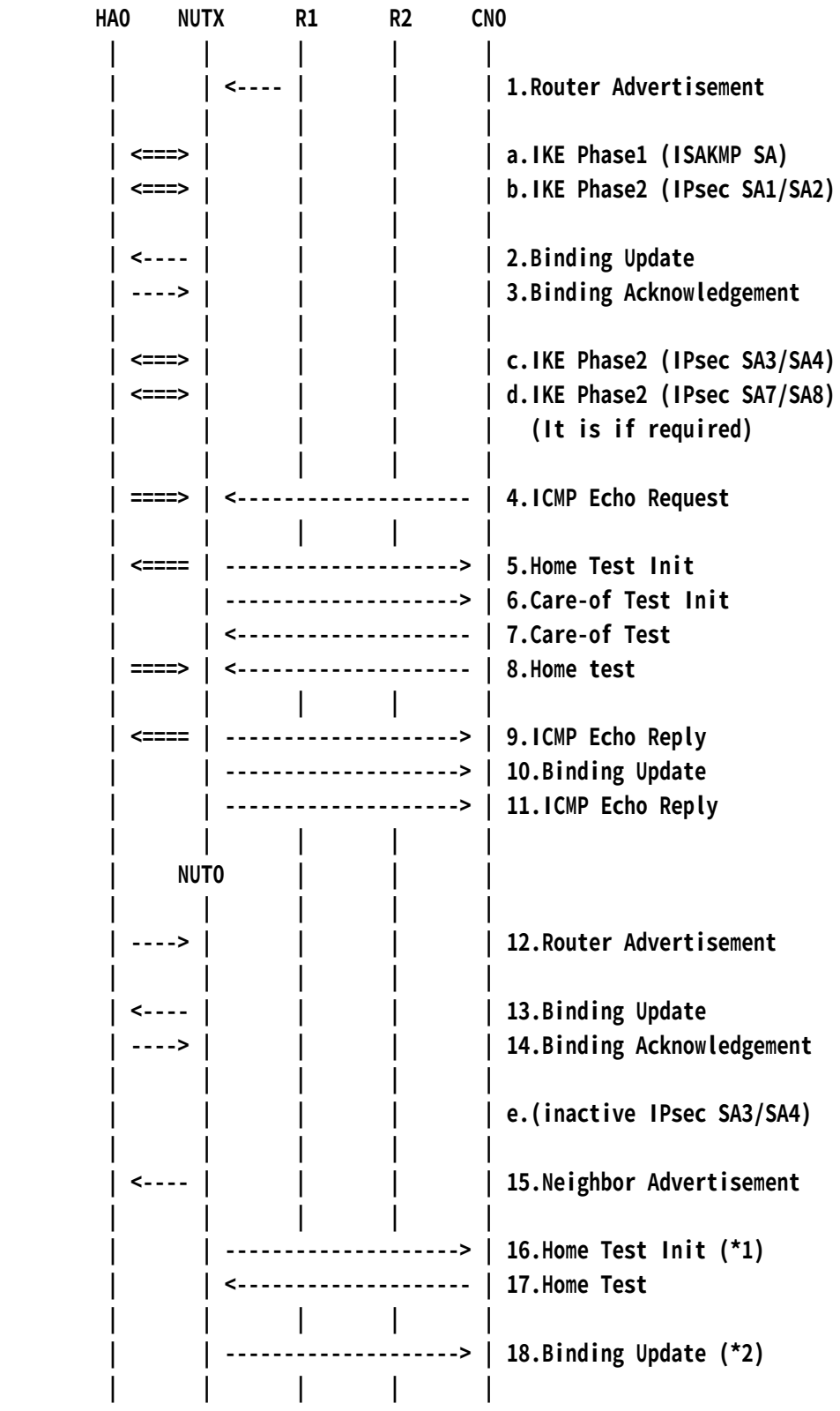
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. IKE Phase2 (IPsec SA3/SA4)
d. IKE Phase2 (IPsec SA7/SA8)

4. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
5. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.10.2)
6. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
7. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
8. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
9. Receive ICMP Echo Reply or [11]. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.8.2)
10. Receive Binding Update. (NUTX -> CN0) (Refer to 5.14.3)
11. [9] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option)
    (Refer to 5.8.3)
12. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
13. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)
14. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)

e. (inactive IPsec SA3/SA4)

15. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi)
    (Refer to 5.4.1)
16. Receive Home Test Init. (NUT0 -> CN0) (*1) (Refer to 5.10.1)

IPv6 Header	Source Address	MN home (global)
	Destination Address	CN (global)
Mobility Header	MH Type	1

17. Send Home Test. (CN0 -> NUT0) (Refer to 5.12.1)
18. Receive Binding Update to CN0. (NUT0 -> CN0) (*2) (Refer to 5.14.3)

[JUDGMENT]

(*1) PASS: CN0 receives Home Test Init.
Then, check whether this packet fills all of the following,
- The security policy entries is inactive.

(*2) PASS: CN0 receives Binding Update.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents

See Section 4.2

6.13.2.2.6 MN-1-2-2-1-010 - Sending HoTI (Foreign -> home -> Foreign, ISAKMP SA expired, IPsec SA3/SA4 expired)

[PURPOSE]

MN-1-2-2-1-010 - Sending HoTI (Foreign -> home -> Foreign, ISAKMP SA expired, IPsec SA3/SA4 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND RETURN ROUTABILITY))

[REQUIREMENT OF TEST]

Function of IKE: YES
Function of Return Routability: YES
Function of Real Home Link: YES

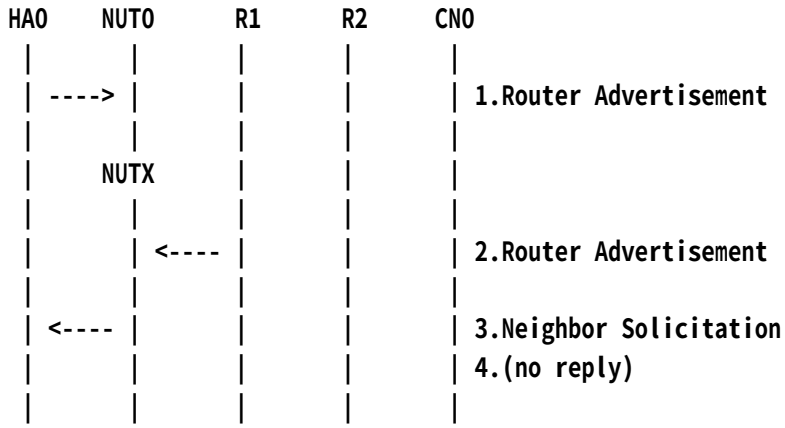
[TOPORGY]

Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

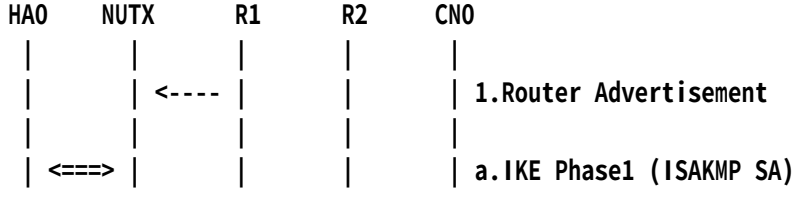
Refer to 3.1 Common Setup-1

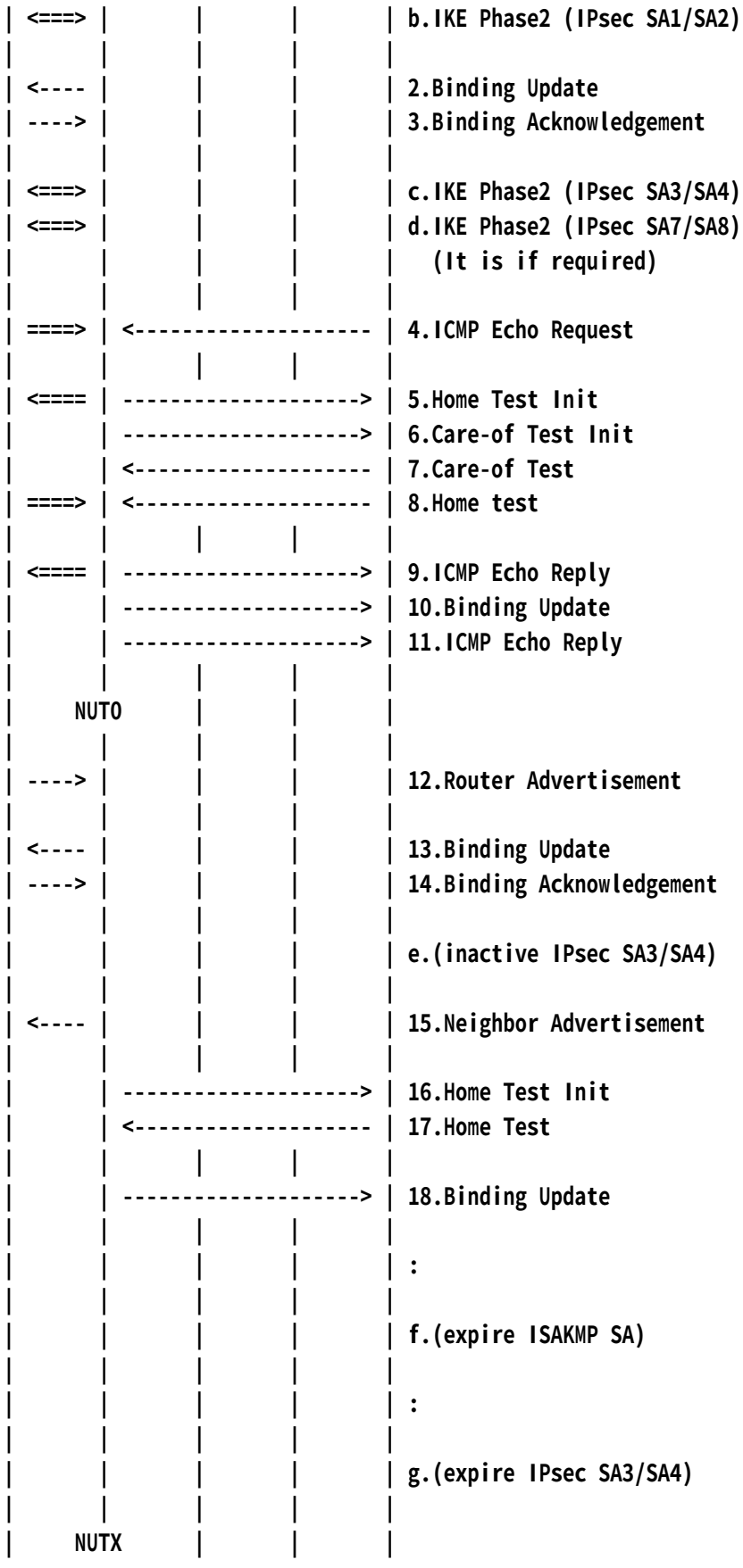
[INITIALIZATION]

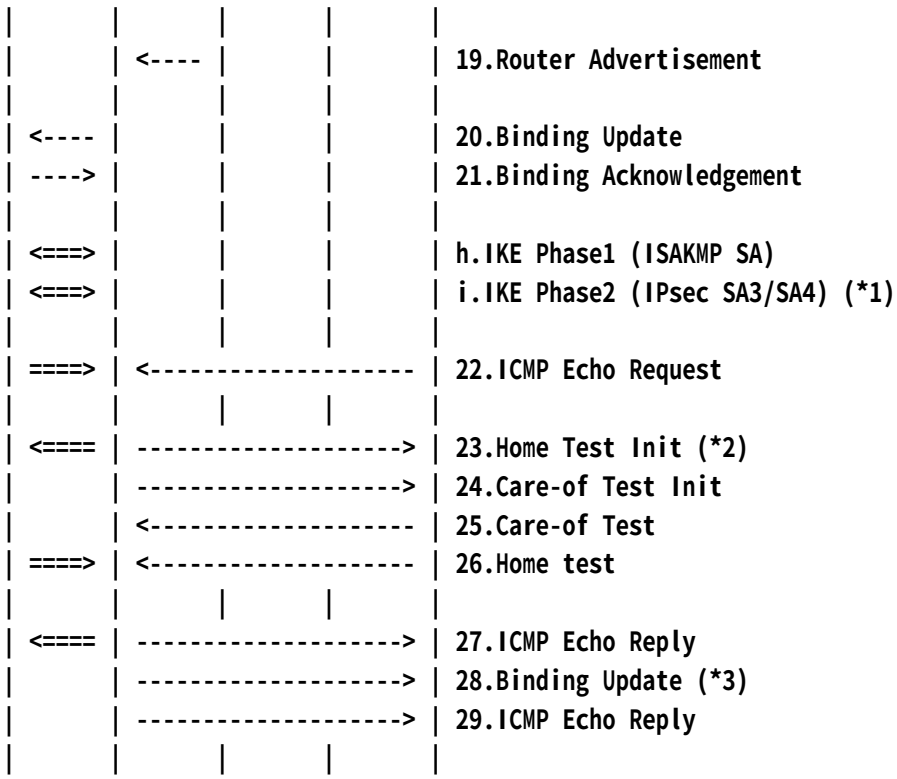


1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

[PROCEDURE]




b.IKE Phase2 (IPsec SA1/SA2)
2.Binding Update
3.Binding Acknowledgement
c.IKE Phase2 (IPsec SA3/SA4)
d.IKE Phase2 (IPsec SA7/SA8)
(It is if required)
4.ICMP Echo Request
5.Home Test Init
6.Care-of Test Init
7.Care-of Test
8.Home test
9.ICMP Echo Reply
10.Binding Update
11.ICMP Echo Reply
NUTO
12.Router Advertisement
13.Binding Update
14.Binding Acknowledgement
e.(inactive IPsec SA3/SA4)
15.Neighbor Advertisement
16.Home Test Init
17.Home Test
18.Binding Update
:
f.(expire ISAKMP SA)
:
g.(expire IPsec SA3/SA4)
NUTX



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. IKE Phase2 (IPsec SA3/SA4)
d. IKE Phase2 (IPsec SA7/SA8)

4. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
5. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.10.2)
6. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
7. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
8. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
9. Receive ICMP Echo Reply or [11]. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.8.2)
10. Receive Binding Update. (NUTX -> CN0) (Refer to 5.14.3)
11. [9] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option)
    (Refer to 5.8.3)
12. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
13. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)

14. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)

e. (inactive IPsec SA3/SA4)

15. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi) (Refer to 5.4.1)
16. Receive Home Test Init. (NUT0 -> CN0) (Refer to 5.10.1)
17. Send Home Test. (CN0 -> NUT0) (Refer to 5.12.1)
18. Receive Binding Update to CN0. (NUT0 -> CN0) (Refer to 5.14.3)

f. (expire ISAKMP SA)
g. (expire IPsec SA3/SA4)

19. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
20. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
21. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

h. IKE Phase1 (ISAKMP SA)
i. IKE Phase2 (IPsec SA3/SA4) (*1)

22. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
23. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0) (*2) (Refer to 5.10.2)

IPv6 Header	Source Address	MN Care-of (global)
	Destination Address	HA (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
IPv6 Header	Source Address	MN home (global)
	Destination Address	CN (global)
Mobility Header	MH Type	1

24. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
25. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
26. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
27. Receive ICMP Echo Reply or [29]. (out: NUTX -> HA0, in: NUT0 -> CN0) (Refer to 5.8.2)
28. Receive Binding Update. (NUTX -> CN0) (*3) (Refer to 5.14.3)

IPv6 Header	Source Address		MN care-of
	Destination Address		CN (global)
Destination Option Header	Home Address		MN home (global)
Mobility Header	MH Type		5
Mobility options	Nonce Indices	Option Type	4
		Option Length	4
		Home Nonce Index	Any
		Care-of Nonce Index	Any
	Binding Authorization Data	Option Type	5
		Option Length	12
		Authenticator	Any

29. [27] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA3/SA4 is re-established after re-establishing ISAKMP SA.

(*2) PASS: CN0 receives Home Test Init.

Then, check whether this packet fills all of the following,

- using new IPsec SA3.

(*3) PASS: CN0 receives Binding Update.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents

See Section 4.2

6.13.2.2.7 MN-1-2-2-1-014 - Sending HoTI (Foreign -> home -> Foreign, ISAKMP SA exist, IPsec SA3/SA4 expired)

[PURPOSE]

MN-1-2-2-1-014 - Sending HoTI (Foreign -> home -> Foreign, ISAKMP SA exist, IPsec SA3/SA4 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND RETURN ROUTABILITY))

[REQUIREMENT OF TEST]

Function of IKE: YES
Function of Real Home Link: YES
Function of Return Routability: YES
NUT sets (K) bit in BU which is transmitted to HA: YES

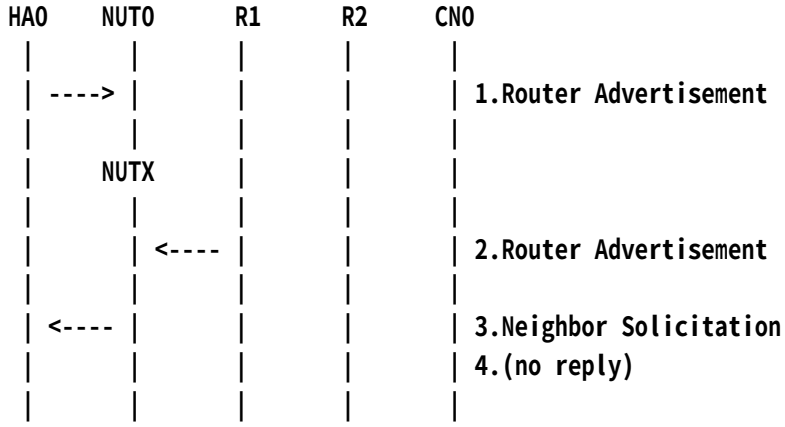
[TOPORGY]

Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

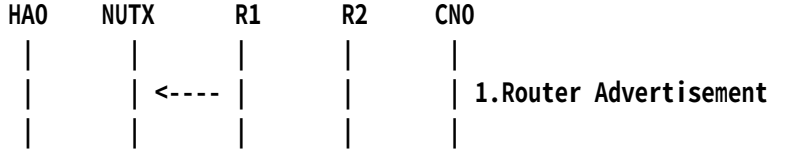
Refer to 3.1 Common Setup-1

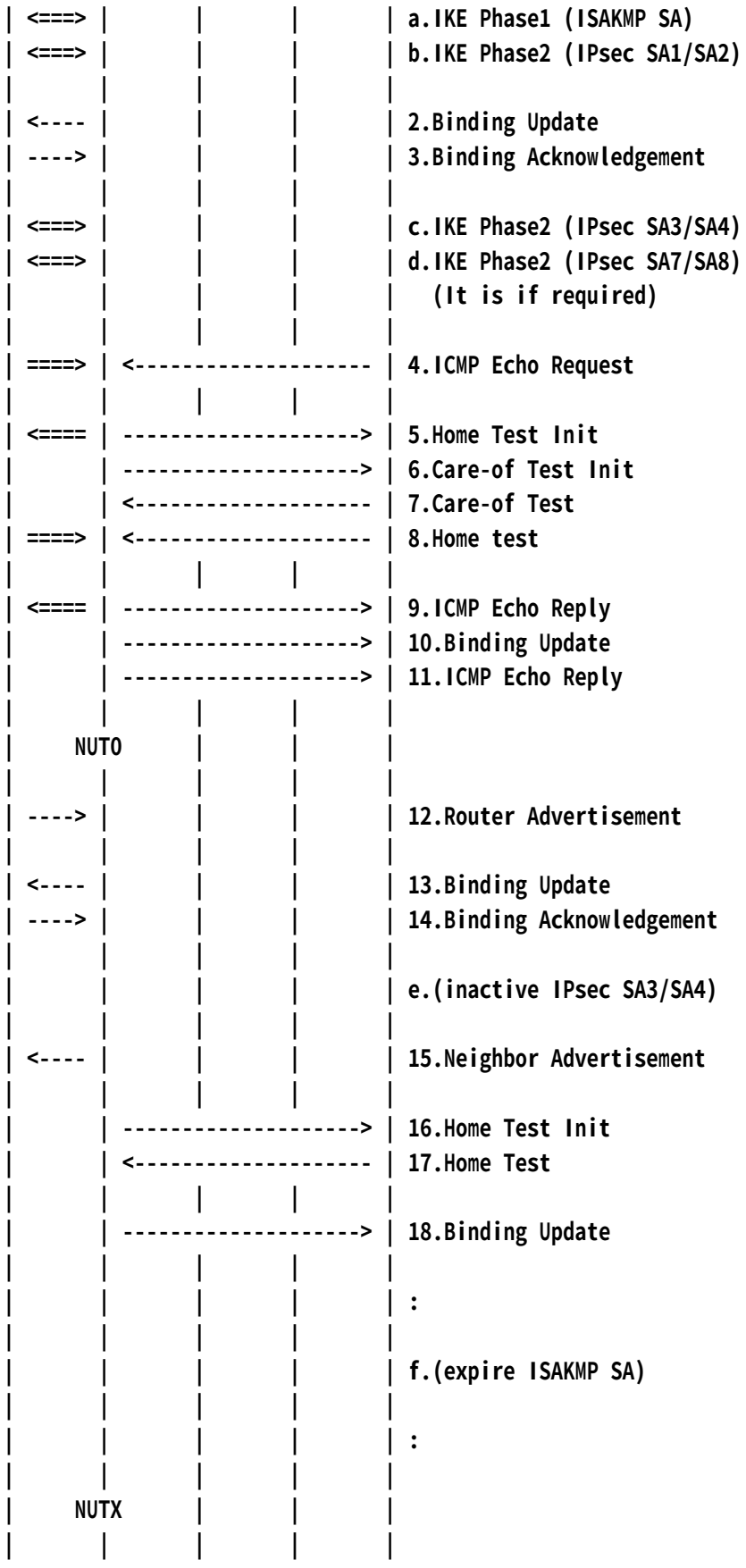
[INITIALIZATION]

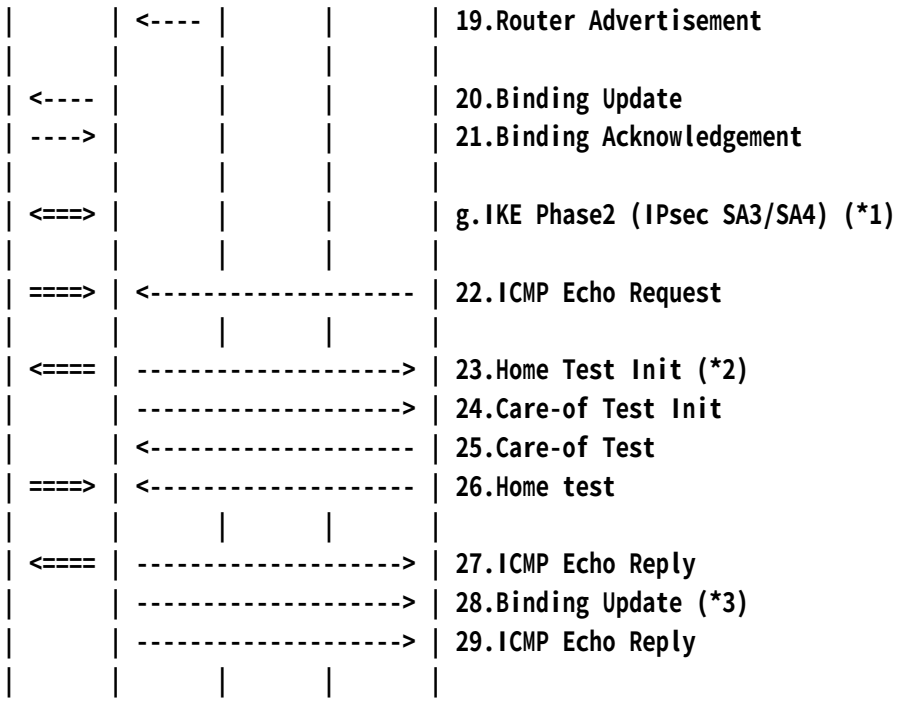


1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

[PROCEDURE]




a.IKE Phase1 (ISAKMP SA)
b.IKE Phase2 (IPsec SA1/SA2)
2.Binding Update
3.Binding Acknowledgement
c.IKE Phase2 (IPsec SA3/SA4)
d.IKE Phase2 (IPsec SA7/SA8)
(It is if required)
4.ICMP Echo Request
5.Home Test Init
6.Care-of Test Init
7.Care-of Test
8.Home test
9.ICMP Echo Reply
10.Binding Update
11.ICMP Echo Reply
NUTO
12.Router Advertisement
13.Binding Update
14.Binding Acknowledgement
e.(inactive IPsec SA3/SA4)
15.Neighbor Advertisement
16.Home Test Init
17.Home Test
18.Binding Update
:
f.(expire ISAKMP SA)
:
NUTX



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

c. IKE Phase2 (IPsec SA3/SA4)
d. IKE Phase2 (IPsec SA7/SA8)

4. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
5. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.10.2)
6. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
7. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
8. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
9. Receive ICMP Echo Reply or [11]. (out: NUTX -> HA0, in: NUT0 -> CN0)
   (Refer to 5.8.2)
10. Receive Binding Update. (NUTX -> CN0) (Refer to 5.14.3)
11. [9] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option)
    (Refer to 5.8.3)
12. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
13. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)
    # (K)bit on
14. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)

(K)bit on

e. (inactive IPsec SA3/SA4)

15. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi) (Refer to 5.4.1)
16. Receive Home Test Init. (NUT0 -> CN0) (Refer to 5.10.1)

17. Send Home Test. (CN0 -> NUT0) (Refer to 5.12.1)
18. Receive Binding Update to CN0. (NUT0 -> CN0) (Refer to 5.14.3)

f. (expire IPsec SA3/SA4)

19. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
20. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
21. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

g. IKE Phase2 (IPsec SA3/SA4) (*1)

22. Send ICMP Echo Request. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.7.2)
23. Receive Home Test Init. (out: NUTX -> HA0, in: NUT0 -> CN0) (*2) (Refer to 5.10.2)

IPv6 Header	Source Address	MN Care-of (global)
	Destination Address	HA (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
IPv6 Header	Source Address	MN home (global)
	Destination Address	CN (global)
Mobility Header	MH Type	1

24. Receive Care-of Test Init. (NUTX -> CN0) (Refer to 5.11.1)
25. Send Care-of Test. (CN0 -> NUTX) (Refer to 5.13.1)
26. Send Home Test. (out: HA0 -> NUTX, in: CN0 -> NUT0) (Refer to 5.12.2)
27. Receive ICMP Echo Reply or [29]. (out: NUTX -> HA0, in: NUT0 -> CN0) (Refer to 5.8.2)
28. Receive Binding Update. (NUTX -> CN0) (*3) (Refer to 5.14.3)

IPv6 Header	Source Address		MN care-of
	Destination Address		CN (global)
Destination Option Header	Home Address		MN home (global)
Mobility Header	MH Type		5
Mobility options	Nonce Indices	Option Type	4
		Option Length	4
		Home Nonce Index	Any
		Care-of Nonce Index	Any
	Binding Authorization Data	Option Type	5
		Option Length	12
		Authenticator	Any

29. [27] or Receive ICMP Echo Reply. (NUTX -> CN0 with Home Address Option) (Refer to 5.8.3)

[JUDGMENT]

(*1) PASS: IPsec SA3/SA4 is re-established.

(*2) PASS: CN0 receives Home Test Init.
Then, check whether this packet fills all of the following,
- using new IPsec SA3.
(*3) PASS: CN0 receives Binding Update.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents

See Section 4.2

6.13.2.3 Prefix Discovery

6.13.2.3.1 MN-1-2-3-1-001 - Sending MPS (Establishing New SA5/SA6)

[PURPOSE]
MN-1-2-3-1-001 - Sending MPS (Establishing New SA5/SA6)

[CATEGORY]
HOST: ADVANCED FUNCTION (IKE (AND MPD))

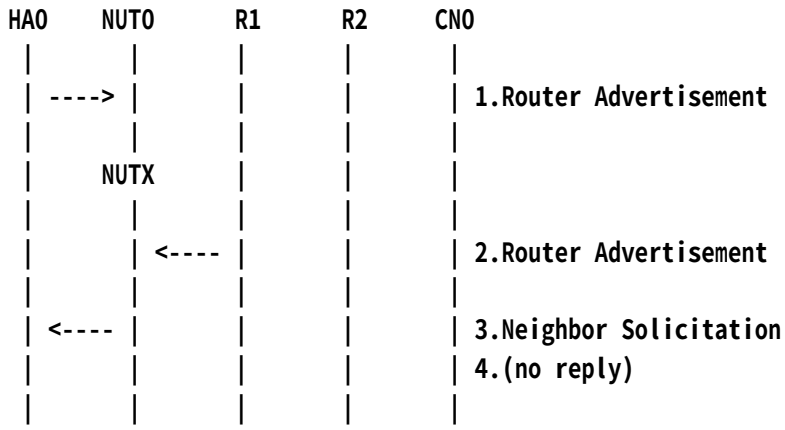
[REQUIREMENT OF TEST]
Function of IKE: YES
Function of Mobile Prefix Discovery: YES

[TOPORGY]
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]
Refer to 3.1 Common Setup-1

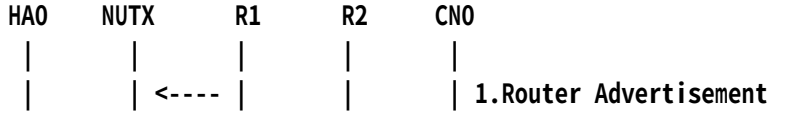
[INITIALIZATION]

- In the case of Real Home Link



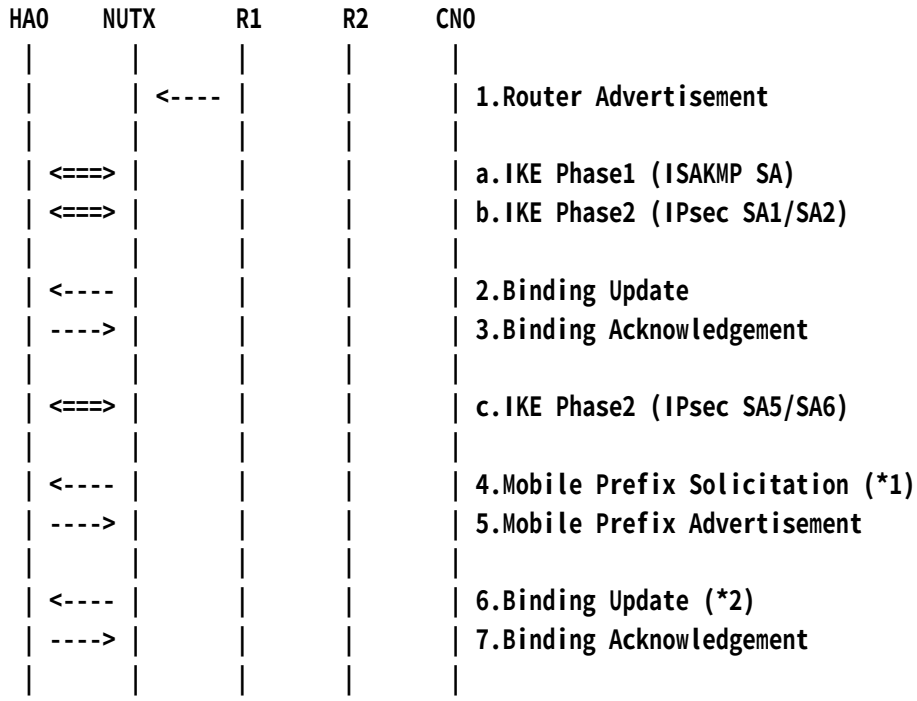
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
   # The Status field is set to 1(accepted but prefix discovery necessary).

c. IKE Phase2 (IPsec SA5/SA6)

4. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (*1) (Refer to 5.19.1)

IPv6 Header	Source Address	MN care-of (global)
	Destination Address	HA (global)
Destination Option Header	Home Address of Mobile Node	MN home (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
Mobility Header	Type	146

5. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)
   # The Prefix Information option is included, and,

- The Valid Lifetime is set less than the remaining lifetime of the home registration.

- The Preferred Lifetime is set less than the remaining lifetime of the home registration.

6. Receive Binding Update. (NUTX -> HA0) (*2) (Refer to 5.14.1)
7. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

[JUDGMENT]

(*1) PASS: HA0 receives Mobile Prefix Solicitation.
Then, check whether this packet fills all of the following,
- using new IPsec SA5.

(*2) PASS: HA0 receives Binding Update.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.3.2

6.13.2.3.2 MN-1-2-3-1-002 - Sending MPS (Foreign -> Stay, ISAKMP SA expired, IPsec SA5/SA6 expired)

[PURPOSE]

MN-1-2-3-1-002 - Sending MPS (Foreign -> Stay, ISAKMP SA expired, IPsec SA5/SA6 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND MPD))

[REQUIREMENT OF TEST]

Function of IKE: YES

Function of Mobile Prefix Discovery: YES

[TOPORGY]

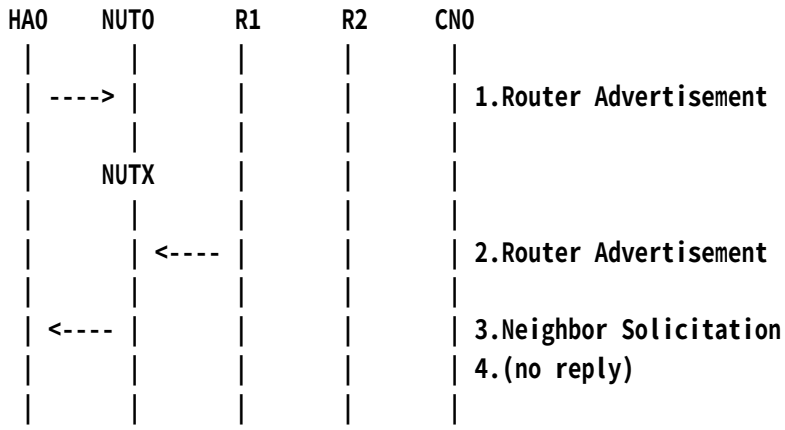
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

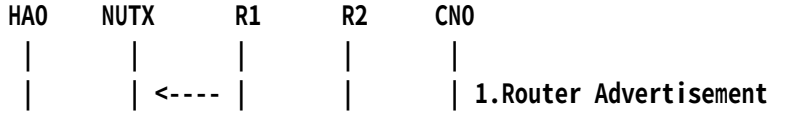
[INITIALIZATION]

- In the case of Real Home Link



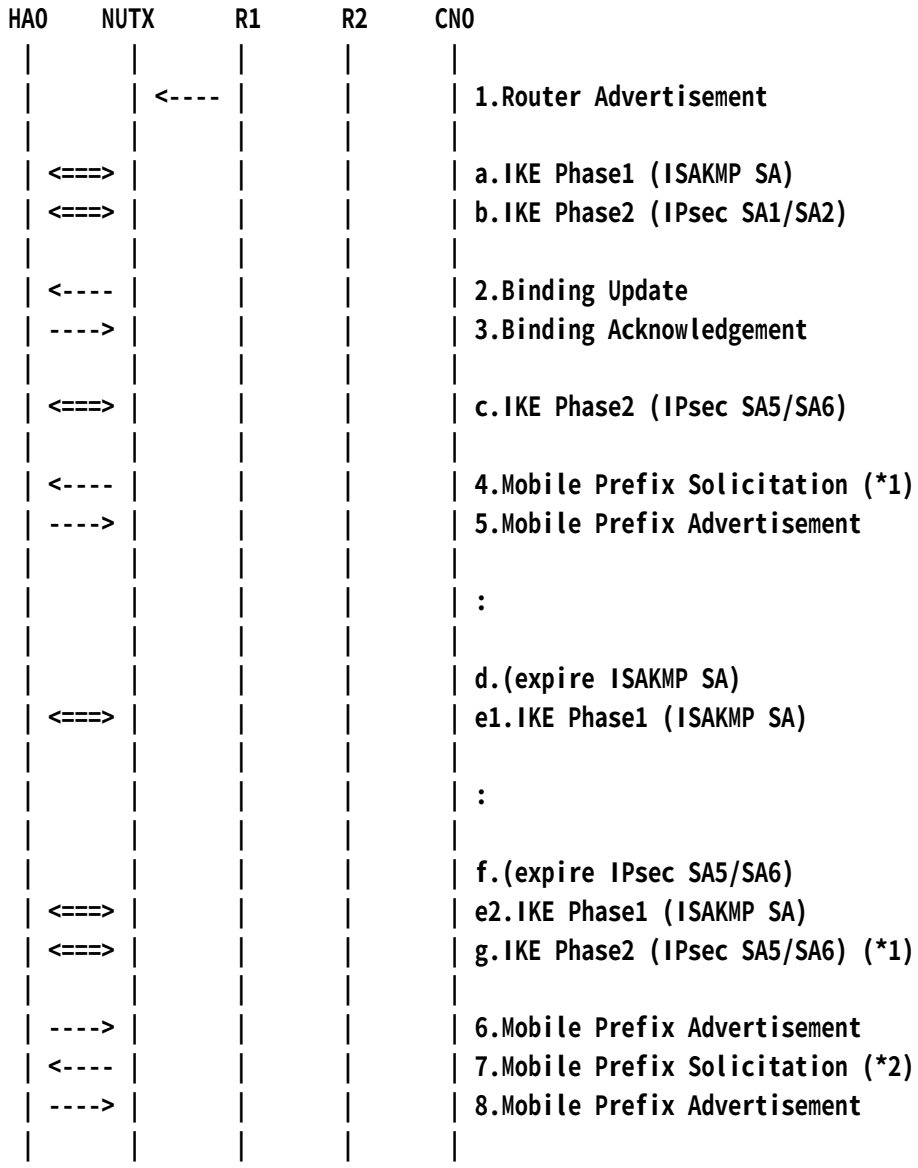
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
   # The Status field is set to 1(accepted but prefix discovery necessary).

c. IKE Phase2 (IPsec SA5/SA6)

4. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (Refer to 5.19.1)
5. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)

d. (expire ISAKMP SA)
e1. IKE Phase1 (ISAKMP SA) or [e2]

f. (expire IPsec SA5/SA6)
e2. [e1] or IKE Phase1 (ISAKMP SA)
g. IKE Phase2 (IPsec SA5/SA6) (*1)

6. Send unsolicited Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)
7. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (*2) (Refer to 5.19.1)

IPv6 Header	Source Address	MN care-of (global)
	Destination Address	HA (global)
Destination Option Header	Home Address of Mobile Node	MN home (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
Mobility Header	Type	146

8. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)

[JUDGMENT]

(*1) PASS: IPsec SA5/SA6 is re-established after re-establishing ISAKMP SA.
(*2) PASS: HA0 receives Mobile Prefix Solicitation.
Then, check whether this packet fills all of the following,
- using new IPsec SA5.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.3.2

6.13.2.3.3 MN-1-2-3-1-004 - Sending MPS (Foreign -> Foreign -> Stay, ISAKMP SA discard, IPsec SA5/SA6 expired)

[PURPOSE]

MN-1-2-3-1-004 - Sending MPS (Foreign -> Foreign -> Stay, ISAKMP SA discard, IPsec SA5/SA6 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND MPD))

[REQUIREMENT OF TEST]

Function of IKE: YES

Function of Mobile Prefix Discovery: YES

[TOPORGY]

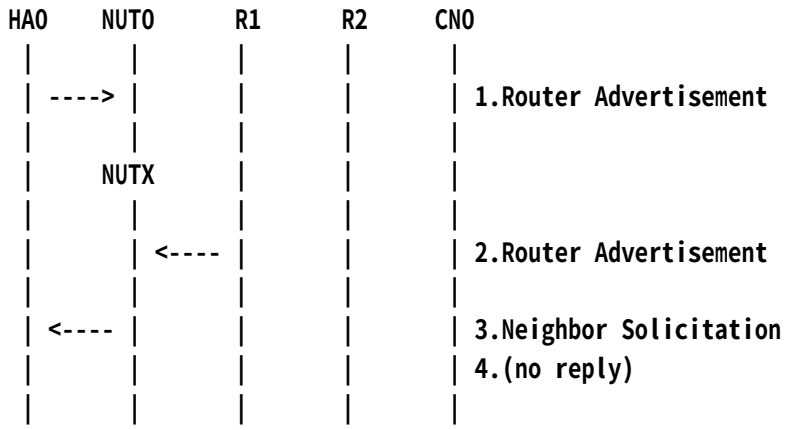
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

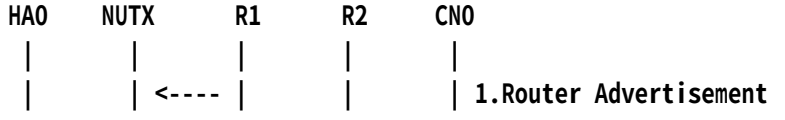
[INITIALIZATION]

- In the case of Real Home Link



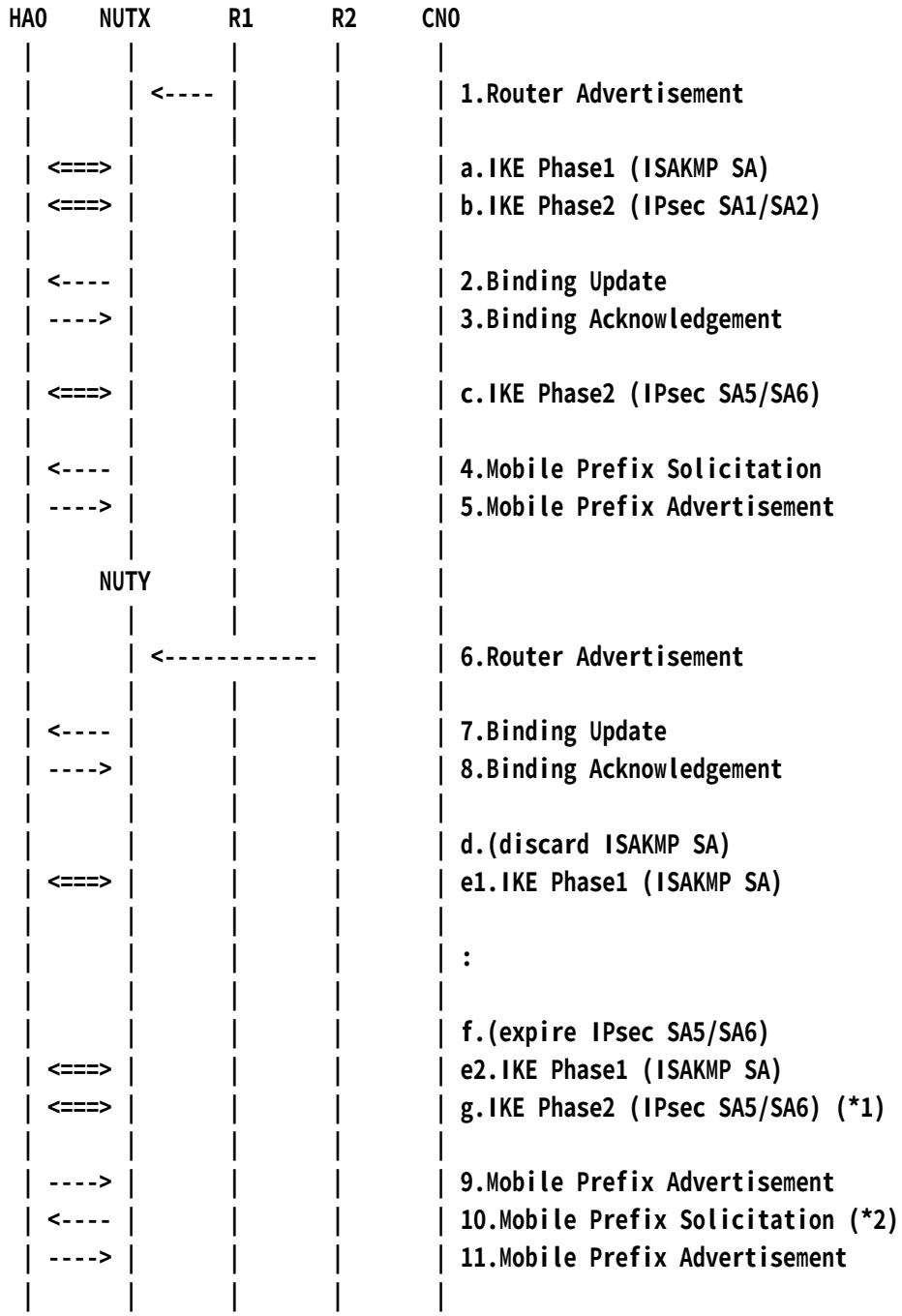
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
   # The Status field is set to 1(accepted but prefix discovery necessary).

c. IKE Phase2 (IPsec SA5/SA6)

4. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (Refer to 5.19.1)
5. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)
6. Send Router Advertisement. (R2 -> R2_allnode_multi) (Refer to 5.2.1)
7. Receive Binding Update. (NUTY -> HA0) (Refer to 5.14.1)
   # (K)bit on/off
8. Send Binding Acknowledgement. (HA0 -> NUTY) (Refer to 5.15.1)
   # (K)bit off

d. (discard ISAKMP SA)
e1. IKE Phase1 (ISAKMP SA) or [e2]
f. (expire IPsec SA5/SA6)
e2. [e1] or IKE Phase1 (ISAKMP SA)
g. IKE Phase2 (IPsec SA5/SA6) (*1)

9. Send unsolicited Mobile Prefix Advertisement. (HA0 -> NUTY with Type2 Routing Header) (Refer to 5.20.1)
10. Receive Mobile Prefix Solicitation. (NUTY -> HA0 with Home Address Option) (*2) (Refer to 5.19.1)

IPv6 Header	Source Address	MN care-of (global)
	Destination Address	HA (global)
Destination Option Header	Home Address of Mobile Node	MN home (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
Mobility Header	Type	146

11. Send Mobile Prefix Advertisement. (HA0 -> NUTY with Type2 Routing Header) (Refer to 5.20.1)

[JUDGMENT]

(*1) PASS: IPsec SA5/SA6 is re-established after re-establishing ISAKMP SA.
(*2) PASS: HA0 receives Mobile Prefix Solicitation.
Then, check whether this packet fills all of the following,
- using new IPsec SA5.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.7.3

6.13.2.3.4 MN-1-2-3-1-006 - Sending MPS (Foreign -> Foreign -> Stay, ISAKMP SA update, IPsec SA5/SA6 expired)

[PURPOSE]

MN-1-2-3-1-006 - Sending MPS (Foreign -> Foreign -> Stay, ISAKMP SA update, IPsec SA5/SA6 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND MPD))

[REQUIREMENT OF TEST]

Function of IKE: YES
Function of Mobile Prefix Discovery: YES
NUT sets (K) bit in BU which is transmitted to HA: YES

[TOPORGY]

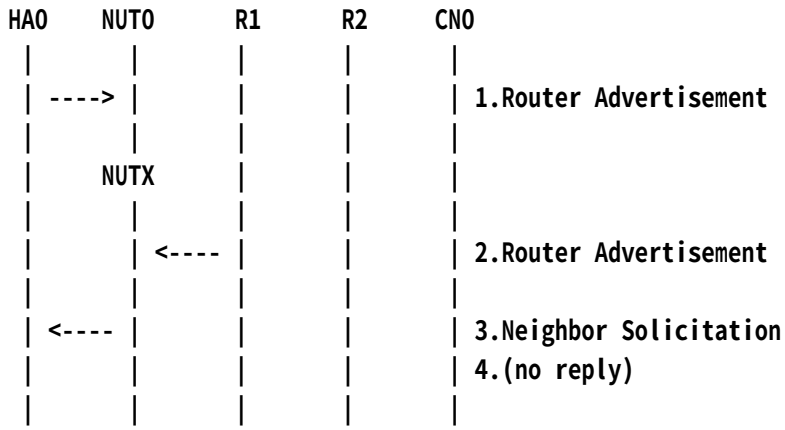
Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

Refer to 3.1 Common Setup-1

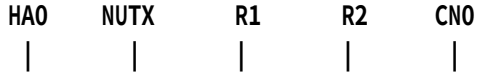
[INITIALIZATION]

- In the case of Real Home Link



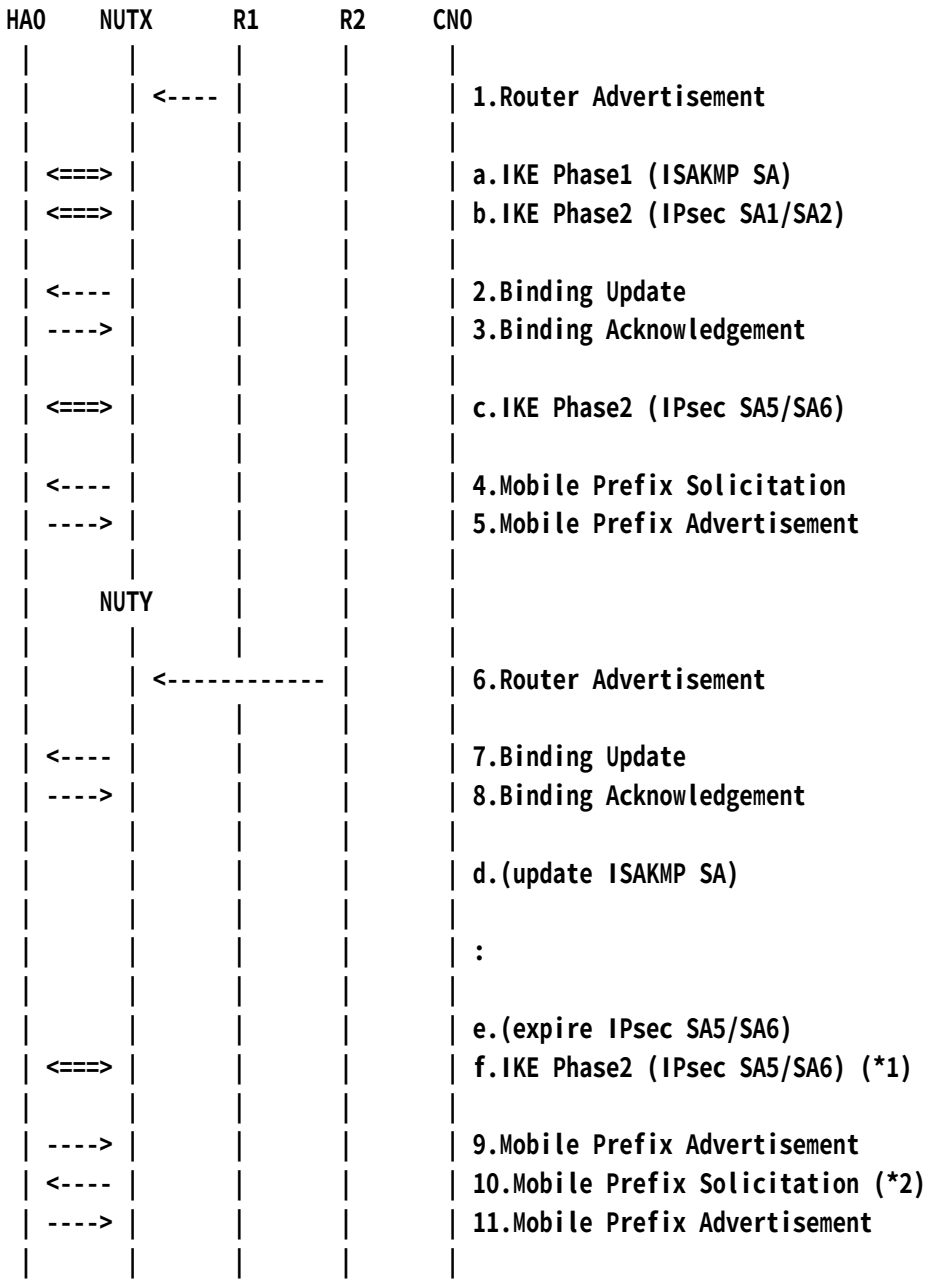
1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

- In the case of Virtual Home Link



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

[PROCEDURE]



1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
   # The Status field is set to 1(accepted but prefix discovery necessary).

c. IKE Phase2 (IPsec SA5/SA6)

4. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (Refer to 5.19.1)
5. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)
6. Send Router Advertisement. (R2 -> R2_allnode_multi) (Refer to 5.2.1)
7. Receive Binding Update. (NUTY -> HA0) (Refer to 5.14.1)
   # (K)bit on
8. Send Binding Acknowledgement. (HA0 -> NUTY) (Refer to 5.15.1)
   # (K)bit on

d. (update ISAKMP SA)
e. (expire IPsec SA5/SA6)
f. IKE Phase2 (IPsec SA5/SA6) (*1)

9. Send unsolicited Mobile Prefix Advertisement. (HA0 -> NUTY with Type2 Routing Header) (Refer to 5.20.1)
10. Receive Mobile Prefix Solicitation. (NUTY -> HA0 with Home Address Option) (*2) (Refer to 5.19.1)

IPv6 Header	Source Address	MN care-of (global)
	Destination Address	HA (global)
Destination Option Header	Home Address of Mobile Node	MN home (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
Mobility Header	Type	146

11. Send Mobile Prefix Advertisement. (HA0 -> NUTY with Type2 Routing Header) (Refer to 5.20.1)

[JUDGMENT]

(*1) PASS: IPsec SA5/SA6 is re-established without re-establishment of ISAKMP SA.
(*2) PASS: CN0 receives Mobile Prefix Solicitation.
Then, check whether this packet fills all of the following,
- using new IPsec SA5.

[REFERENCES]

RFC3775 Mobility Support in IPv6
See Section 11.7.1, 11.7.3

6.13.2.3.5 MN-1-2-3-1-010 - Sending MPS (Foreign -> Home -> Foreign, ISAKMP SA expired, IPsec SA5/SA6 expired)

[PURPOSE]

MN-1-2-3-1-010 - Sending MPS (Foreign -> Home -> Foreign, ISAKMP SA expired, IPsec SA5/SA6 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND MPD))

[REQUIREMENT OF TEST]

Function of IKE: YES
Function of Mobile Prefix Discovery: YES
Function of Real Home Link: YES

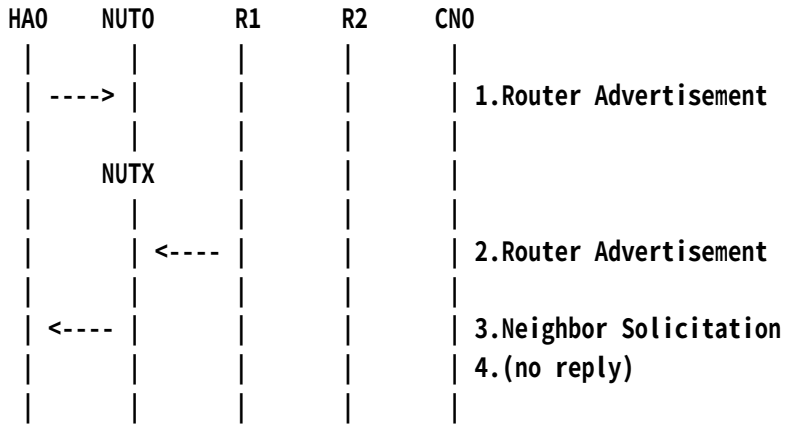
[TOPORGY]

Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

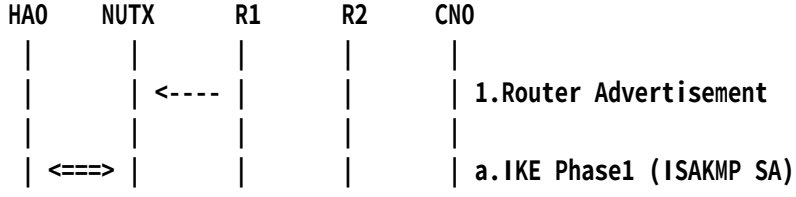
Refer to 3.1 Common Setup-1

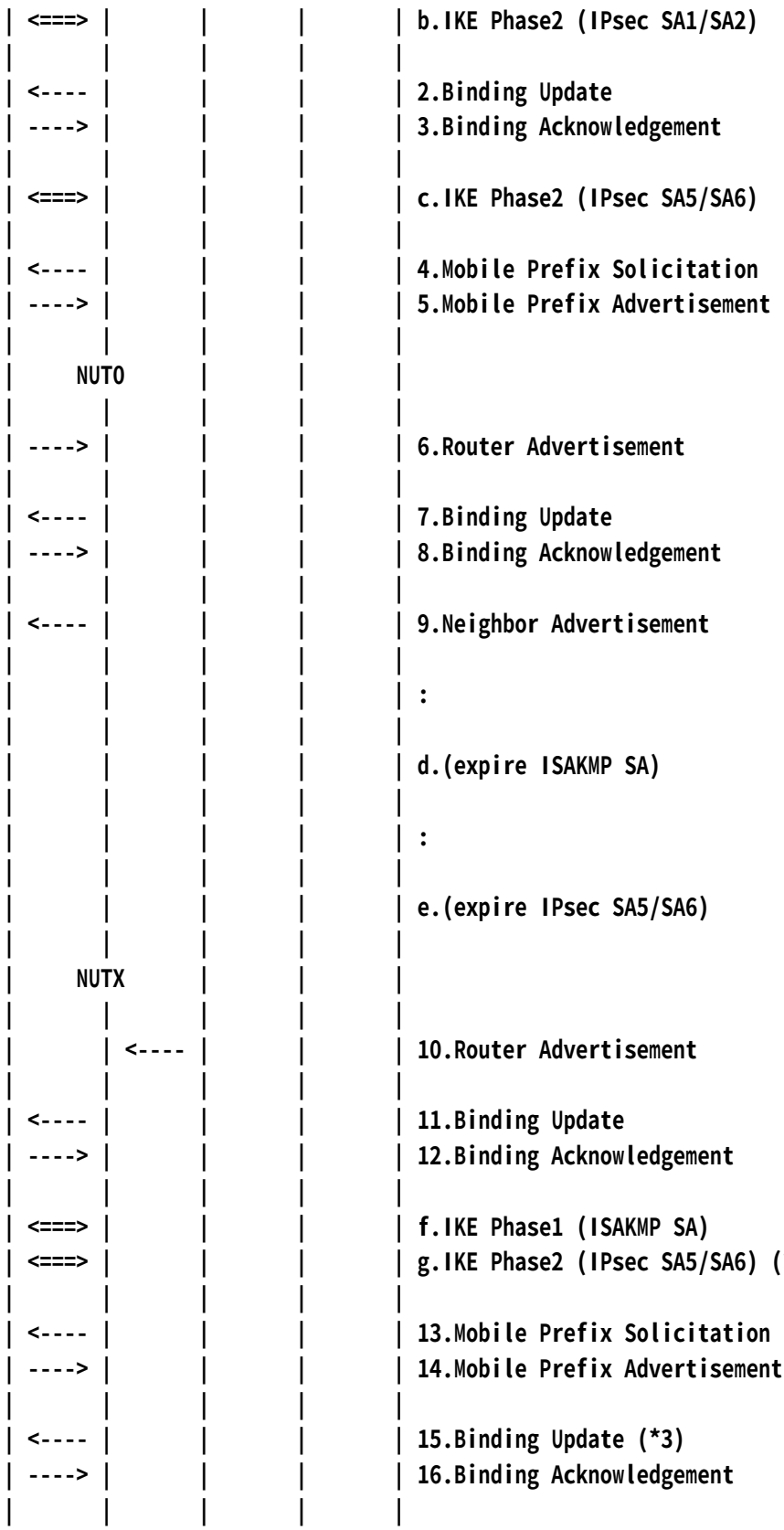
[INITIALIZATION]



1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

[PROCEDURE]





1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
   # The Status field is set to 1(accepted but prefix discovery necessary).

c. IKE Phase2 (IPsec SA5/SA6)

4. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (Refer to 5.19.1)
5. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)
6. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
7. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)
8. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)
9. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi) (Refer to 5.4.1)

d. (expire ISAKMP SA)
e. (expire IPsec SA5/SA6)

10. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
11. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
12. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
    # The Status field is set to 1(accepted but prefix discovery necessary).

f. IKE Phase1 (ISAKMP SA)
g. IKE Phase2 (IPsec SA5/SA6) (*1)

13. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (*2) (Refer to 5.19.1)

IPv6 Header	Source Address	MN care-of (global)
	Destination Address	HA (global)
Destination Option Header	Home Address of Mobile Node	MN home (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
Mobility Header	Type	146

14. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)
    # The Prefix Information option is included, and,
    # - The Valid Lifetime is set less than the remaining lifetime of the home registration.
    # - The Preferred Lifetime is set less than the remaining lifetime of the home registration.

15. Receive Binding Update. (NUTX -> HA0) (*3) (Refer to 5.14.1)

IPv6 Header	Source Address		MN care-of (global)
	Destination Address		HA (global)
Destination Option Header	Home Address		MN home (global)
Encapsulating Security Payload	Security Parameter Index		Any
	Sequence		Any
	Initialization Vector		Any
Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

16. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)

[JUDGMENT]

(*1) PASS: IPsec SA5/SA6 is re-established after re-establishing ISAKMP SA.

(*2) PASS: HA0 receives Mobile Prefix Solicitation.

Then, check whether this packet fills all of the following,

- using new IPsec SA5.

(*3) PASS: HA0 receives Binding Update.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents

See Section 4.2

6.13.2.3.6 MN-1-2-3-1-014 - Sending MPS (Foreign -> Home -> Foreign, ISAKMP SA exist, IPsec SA5/SA6 expired)

[PURPOSE]

MN-1-2-3-1-014 - Sending MPS (Foreign -> Home -> Foreign, ISAKMP SA exist, IPsec SA5/SA6 expired)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND MPD))

[REQUIREMENT OF TEST]

Function of IKE: YES
Function of Mobile Prefix Discovery: YES
Function of Real Home Link: YES
NUT sets (K) bit in BU which is transmitted to HA: YES

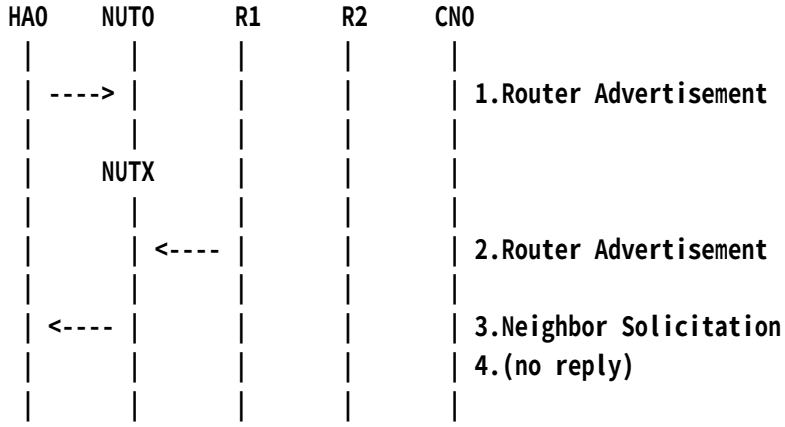
[TOPORGY]

Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

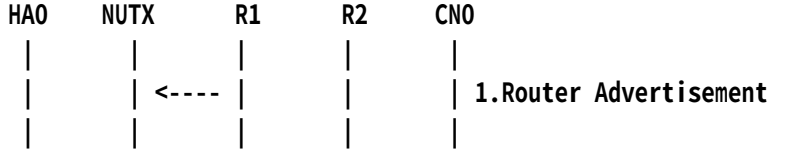
Refer to 3.1 Common Setup-1

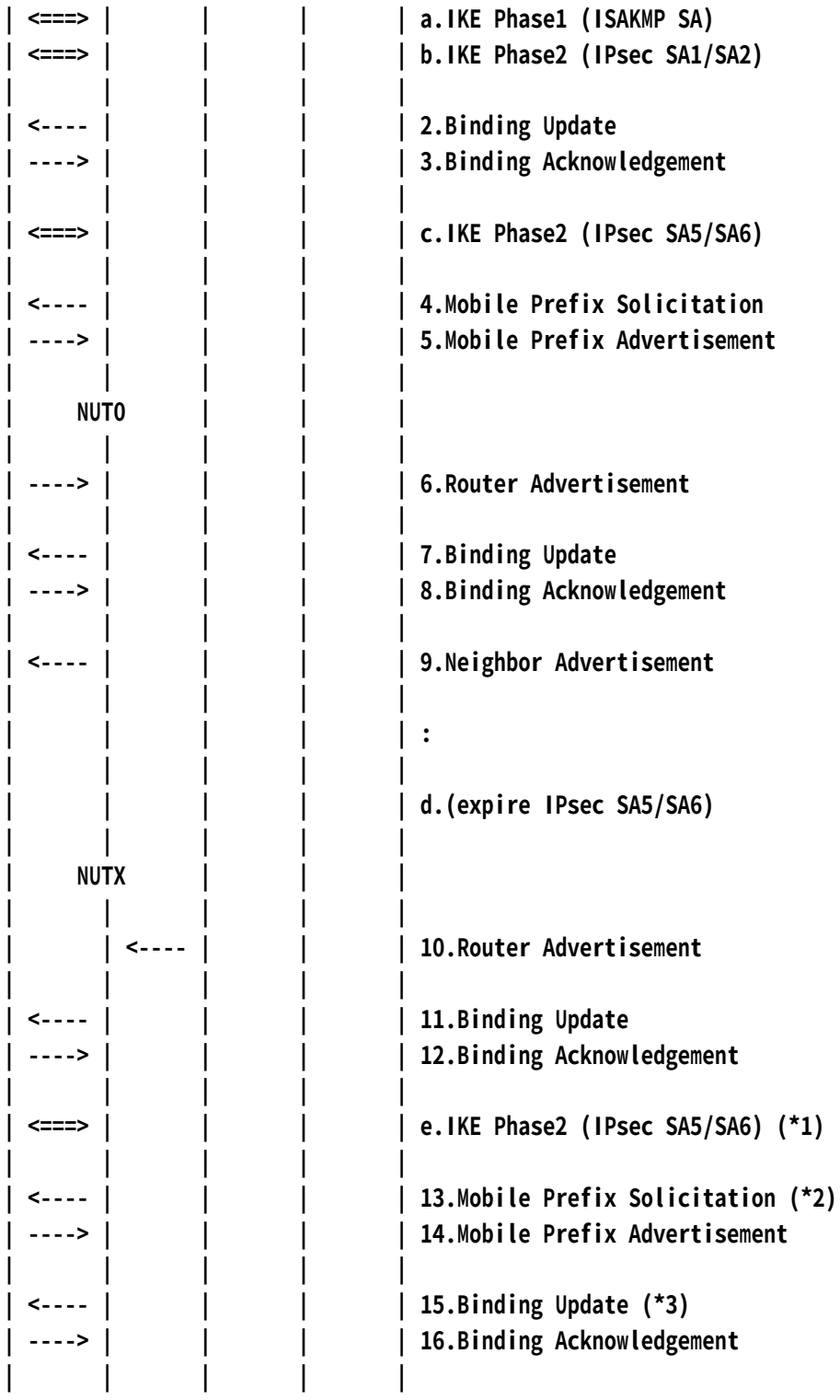
[INITIALIZATION]



1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

[PROCEDURE]





1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
   # The Status field is set to 1(accepted but prefix discovery necessary).

c. IKE Phase2 (IPsec SA5/SA6)

4. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (Refer to 5.19.1)
5. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)
6. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
7. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)
8. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)
9. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi) (Refer to 5.4.1)

d. (expire IPsec SA5/SA6)

10. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
11. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
    # (K)bit on
12. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
    # (K)bit on
    # The Status field is set to 1(accepted but prefix discovery necessary).

e. IKE Phase2 (IPsec SA5/SA6) (*1)

13. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (*2) (Refer to 5.19.1)

IPv6 Header	Source Address	MN care-of (global)
	Destination Address	HA (global)
Destination Option Header	Home Address of Mobile Node	MN home (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
Mobility Header	Type	146

14. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header)
    # The Prefix Information option is included, and,
    # - The Valid Lifetime is set less than the remaining lifetime of the home registration.
    # - The Preferred Lifetime is set less than the remaining lifetime of the home registration.
15. Receive Binding Update. (NUTX -> HA0) (*3) (Refer to 5.14.1)

IPv6 Header	Source Address	MN care-of (global)
	Destination Address	HA (global)
Destination Option Header	Home Address	MN home (global)
Encapsulating Security Payload	Security Parameter Index	Any
	Sequence	Any
	Initialization Vector	Any

Mobility Header	MH Type		5
Mobility options	Alternate Care-of Address	Type	3
		Option Length	16
		Address	MN care-of

16. Send Binding Acknowledgement. (HA0 -> NUTX)

[JUDGMENT]

(*1) PASS: IPsec SA5/SA6 is re-established.

(*2) PASS: HA0 receives Mobile Prefix Solicitation.

Then, check whether this packet fills all of the following,

- using new IPsec SA5.

(*3) PASS: HA0 receives Binding Update.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents

See Section 4.2

6.13.2.3.7 MN-1-2-3-1-017 - Sending MPS (Foreign -> Home -> Foreign, IPsec SA5/SA6 exist)

[PURPOSE]

MN-1-2-3-1-017 - Sending MPS (Foreign -> Home -> Foreign, IPsec SA5/SA6 exist)

[CATEGORY]

HOST: ADVANCED FUNCTION (IKE (AND MPD))

[REQUIREMENT OF TEST]

Function of IKE: YES
Function of Mobile Prefix Discovery: YES
Function of Real Home Link: YES

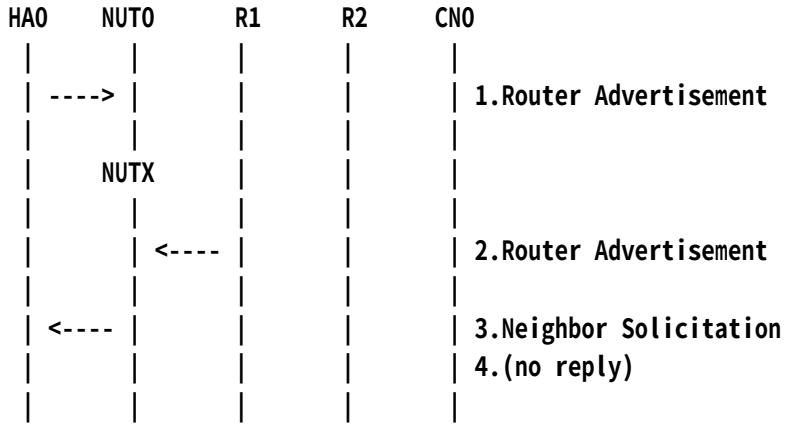
[TOPORGY]

Refer to 2.1.1.1 Common Topology-1

[TEST SETUP]

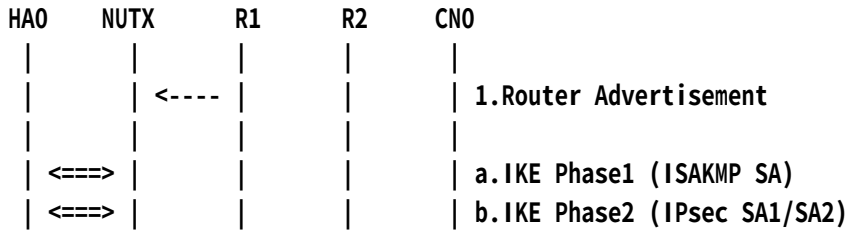
Refer to 3.1 Common Setup-1

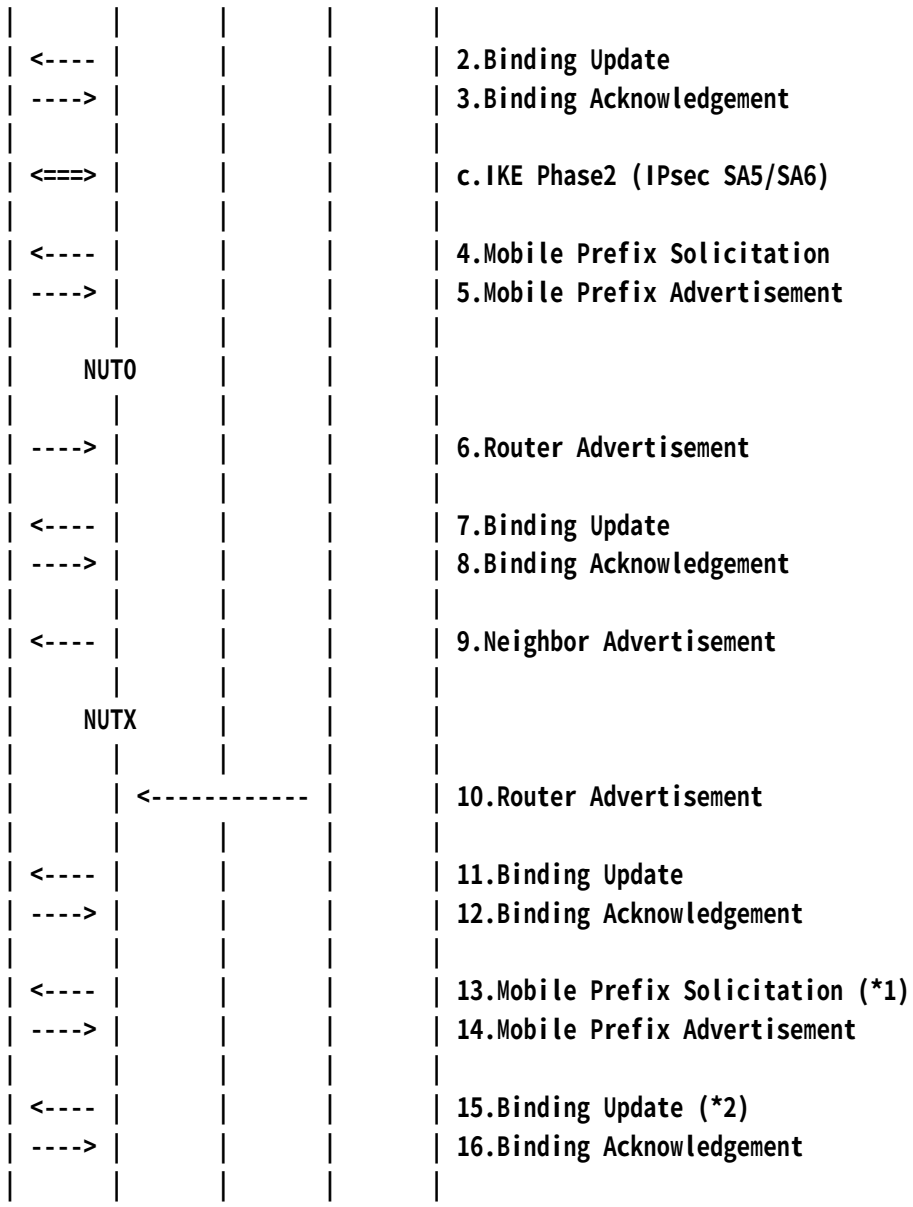
[INITIALIZATION]



1. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
2. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
3. Receive Neighbor Solicitation. (NUT0 -> HA0) (Refer to 5.3.3)
4. (no reply)

[PROCEDURE]





1. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)

a. IKE Phase1 (ISAKMP SA)
b. IKE Phase2 (IPsec SA1/SA2)

2. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
3. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
   # The Status field is set to 1(accepted but prefix discovery necessary).

c. IKE Phase2 (IPsec SA5/SA6)

4. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (Refer to 5.19.1)

5. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header) (Refer to 5.20.1)
6. Send Router Advertisement. (HA0 -> HA0_allnode_multi) (Refer to 5.2.2)
7. Receive Binding Update. (NUT0 -> HA0) (Refer to 5.14.1)
8. Send Binding Acknowledgement. (HA0 -> NUT0) (Refer to 5.15.1)
9. Receive Neighbor Advertisement. (NUT0(Unspecified) -> HA0_allnode_multi) (Refer to 5.4.1)
10. Send Router Advertisement. (R1 -> R1_allnode_multi) (Refer to 5.2.1)
11. Receive Binding Update. (NUTX -> HA0) (Refer to 5.14.1)
12. Send Binding Acknowledgement. (HA0 -> NUTX) (Refer to 5.15.1)
    # The Status field is set to 1(accepted but prefix discovery necessary).
13. Receive Mobile Prefix Solicitation. (NUTX -> HA0 with Home Address Option) (*1) (Refer to 5.19.1)

IPv6 Header	Source Address	MN care-of (global)
	Destination Address	HA (global)
Destination Option Header	Home Address of Mobile Node	MN home (global)
Encapsulating Security Payload	Security Parameters Index	Any
	Sequence Number	Any
	Initialization Vector	Any
Mobility Header	Type	146

14. Send Mobile Prefix Advertisement. (HA0 -> NUTX with Type2 Routing Header)
    # The Prefix Information option is included, and,
    # - The Valid Lifetime is set less than the remaining lifetime of the home registration.
    # - The Preferred Lifetime is set less than the remaining lifetime of the home registration.
15. Receive Binding Update. (NUTX -> HA0) (*2) (Refer to 5.14.1)
16. Send Binding Acknowledgement. (HA0 -> NUTX)

[JUDGMENT]

(*1) PASS: CN0 receives Mobile Prefix Solicitation.
Then, check whether this packet fills all of the following,
- using old IPsec SA5.

(*2) PASS: HA0 receives Binding Update.

[REFERENCES]

RFC3776 Using IPsec to Protect Mobile IPv6 Signaling Between Mobile Nodes and Home Agents
See Section 4.2

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