IPv6 Ready

DHCPv6 Interoperability Test Specification

Technical Document

Revision 2.0.0a

IPv6 Forum   *http://www.ipv6forum.org*
UNH InterOperability Lab (USA)   *http://www.ipv6ready.org*
TAHI Project (Japan)

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Acknowledgements

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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 give to the market a strong signal proving the interoperability degree of various products.

To avoid confusion in the mind of customers, a unique logo program has been defined. The IPv6 logo gives confidence to users that IPv6 is currently operational. It is also a clear indication that the technology will still be used in the future. This logo program contributes to the feeling that IPv6 is available and ready to be used.

Definitions

DAD	Duplicate Address Detection (DAD)
DHCP	Dynamic Host Configuration Protocol
DUID	DHCP Unique Identifier
NUT	Node Under Test
IA	Identify Association
ID	Identifier
TN	Testing Node
TR	Test Router
TAR-XX	Target Device
REF-XX	Reference Device
Client	DHCPv6 Client Device
Server	DHCPv6 Server Device
RelayAgent	DHCPv6 Relay Agent Device
RR	Requesting Router
DR	Delegating Router

Test Organization

This document organizes tests by group based on related test methodology or goals. Each group begins with a brief set of comments pertaining to all tests within that group. This is followed by a series of description blocks; each block describes a single test. The format of the description block is as follows:

Test Label	The **Test Label** is the first line of the test page. It will have the following form:
	    IP.IOP.A.B
	
	Where each component indicates the following:
	    IP – Test Suite Identifier
	    IOP – Interoperability Test Suite
	    A – Group Number
	    B – Test Number
	
	Scripts implementing this test suite should follow this convention, and may also append a character in the set [a-z] indicating a particular test part.

Purpose	The **Purpose** is a short statement describing what the test attempts to achieve. It is usually phrased as a simple assertion of the feature or capability to be tested.
References	The **References** section lists cross-references to the specifications and documentation that might be helpful in understanding and evaluating the test and results
Test Setup	The **Test Setup** section describes the configuration of all devices prior to the start of the test. Different parts of the procedure may involve configuration steps that deviate from what is given in the test setup. If a value is not provided for a protocol parameter, then the protocol's default is used for that parameter.
Procedure and Expected Behavior	The **Procedure and Expected Behavior** table contains the step-by-step instructions for carrying out the test. These steps include such things as enabling interfaces, unplugging devices from the network, or sending packets from a test station. The test procedure also cues the tester to make observations of expected behavior, as needed, as not all steps require observation of results. If any behavior is expected for a procedure, it is to be observed prior to continuing to the next step. Failure to observe any behavior prior to continuing constitutes a failed test. Note, that while test numbers continue between test parts, each test part is to be executed independently (Following Common Test Setup and Cleanup as indicated), and are not cascaded from the previous part.
Possible Problems	The **Possible Problems** section contains a description of known issues with the test procedure, which may affect test results in certain situations.

References

The following documents are referenced in these texts:

[DHCPv6]   T. Mrugalski, M. Siodelski, B. Volz, A.Yourtchecnko, M. Richardson, S.Jiang, T.Lemon, T.Winters, Dymanic Host Configuration Protocol for IPv6 (DHCPv6) , RFC 8415, November 2018.

[ICMPv6]   Conta, A., S. Deering M. Gupta, Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification, RFC 4443, March 2006.

[3646]   R. Droms, Editor. , DNS Configuration options for Dynamic Host Configuration Protocol for IPv6, RFC 3646, February 2003.

General Node Requirements

To obtain the IPv6 Ready Logo Phase-2 for DHCPv6, the client, server and relay agent must satisfy all of the following requirements.

Equipment Type

There are five possibilities for equipment types:

DHCP client (or client):
> A node that initiates requests on a link to obtain configuration parameters from one or more DHCP servers.

DHCP relay agent (or relay agent):
> A node that acts as an intermediary to deliver DHCP messages between clients and servers, and is on the same link as the client.

DHCP server (or server):
> A node that responds to requests from clients, and may or may not be on the same link as the client(s).

Interoperable Device Reqirements

Each applicant must be tested against other devices according to the following (All Vendors MUST be different):

1. Client Application
   a. Must be tested against 2 Servers and 2 Relay-Agents
2. Server Application
   a. Must be tested against 2 Clients and 2 Relay-Agents
3. Relay-Agent Application
   a. Must be tested against:
      i. 2 Clients, 2 Servers, and 2 Relay-Agents
   b. 4 Different vendors are required, the vendor in each device type must be different.

Advanced Functionality Tests

TBD

Group 1: DHCPv6 Messages

Scope

Tests in this group cover basic interoperability of the Dynamic Host Configuration Protocol for IPv6 (DHCPv6).

Overview

These tests are designed to verify the readiness of DHCPv6 client, server and relay agent interoperability vis-à-vis the base specifications of the Dynamic Host Configuration Protocol for IPv6.

Test DHCPInterop.1.1: DHCPv6 Initialization

Purpose: To verify that a device can properly interoperate while initializing DHCPv6.

Reference:
- [8415] – Section 5
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.
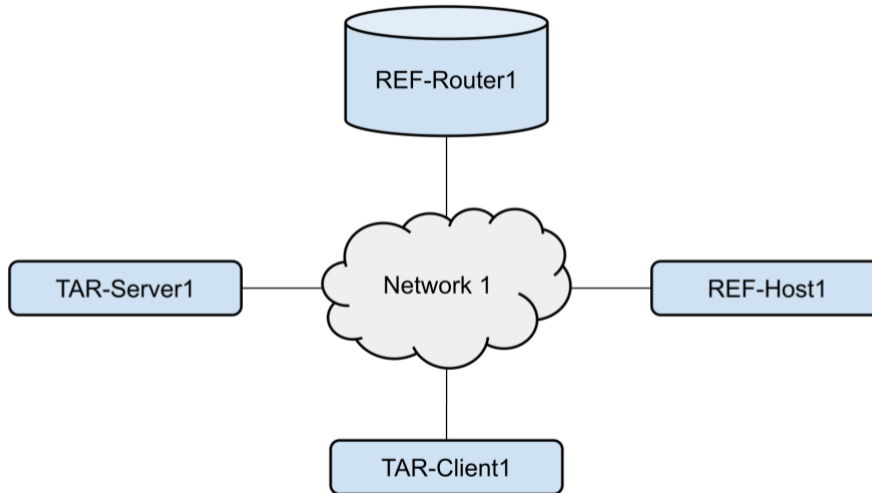
Procedure:
Part A: IA_NA

Step	Action	Expected Behavior
1.	Configure TAR-Client1 to disable auto-configuration and enable DHCPv6.	TAR-Client1 sends a solicit message.
2.		TAR-Server1 sends an advertise message with the IP address information included.
3.		TAR-Client1 then sends a request message to confirm the IP address and ask for additional information.
4.		The TAR-Server1 responds with a Reply message that contains the confirmed address.

Step	Action	Expected Behavior
5.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part B: IA_PD

Step	Action	Expected Behavior
6.	Configure TAR-Client1 to disable auto-configuration and enable DHCPv6 Prefix Delegation.	TAR-Client1 sends a solicit message.
7.		TAR-Server1 sends an advertise message with the IA_PD included.
8.		The TAR-Client1 then sends a request message to confirm the prefix and ask for additional information.
9.		The TAR-Server1 responds with a Reply message that contains the confirmed prefix.
10.		TAR-Client1 transmits a valid Renew Message with the same prefix as given in the Reply Message from the previous step.

Part C : Both IA_NA and IAPD

Step	Action	Expected Behavior
11.	Configure TAR-Client1 to disable auto-configuration and enable DHCPv6 for both IA_NA an IA_PD.	TAR-Client1 sends a single solicit message that contains both the IA_NA and IA_PD.
12.		TAR-Server1 sends a single advertise message with the IA_NA and IA_PD included.
13.		The TAR-Client1 then sends a request message to confirm the prefix and address.
14.		The TAR-Server1 responds with a Reply message that contains the confirmed prefix and address.
15.		TAR-Client1 transmits a valid Renew Message with the same prefix and address as given in the Reply Message from the previous step.

Possible Problems: None.

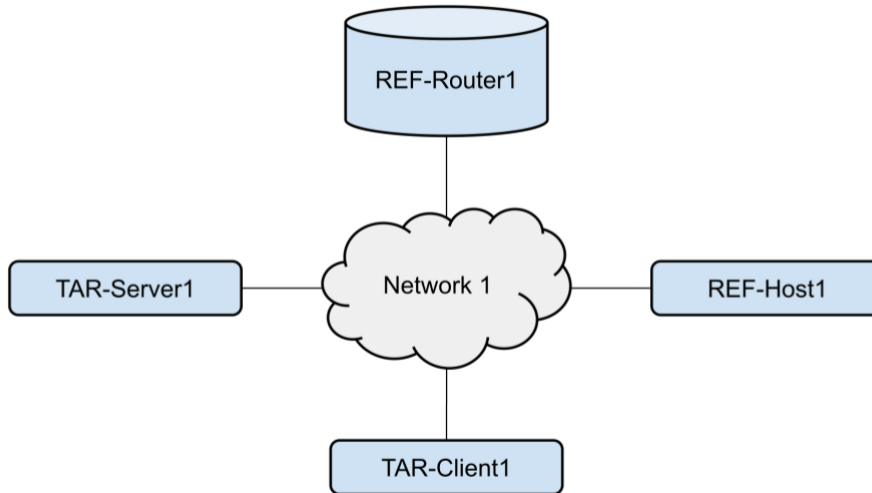## Test DHCPInterop.1.2: Transmission of Confirm message

Purpose: To verify a client and server device properly handles Confirm messages.

Reference:
- [8415] – Section 18.2.3
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.

Procedure:

Step	Action	Expected Behavior
1.	Configure the TAR-Client1 to enable DHCPv6.	The TAR-Client1 performed duplicate address detection on each of the addresses in the IAs it receives in the Reply message from TAR-Server1.
2.	Ref-Host1 transmits an Echo Request to the TAR-Client1's global address.	
3.	Disconnect the TAR-Client1 from Network 1.	
4.	Allow enough time to elapse such that the TAR-Client1 recognizes a	The TAR-Client1 transmits a Confirm message to the server. TAR-Server1 responded with a REPLY without a status

	link down, reconnect the TAR-Client1.	code option or with a status code option including a status code of 0 (Success) stating that the addresses are appropriate for the link. The REPLY Message does not contain an IA Option.
5.	Ref-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 sends an Echo Reply in response to the Echo Request from Ref-Host1.

Possible Problems: None.

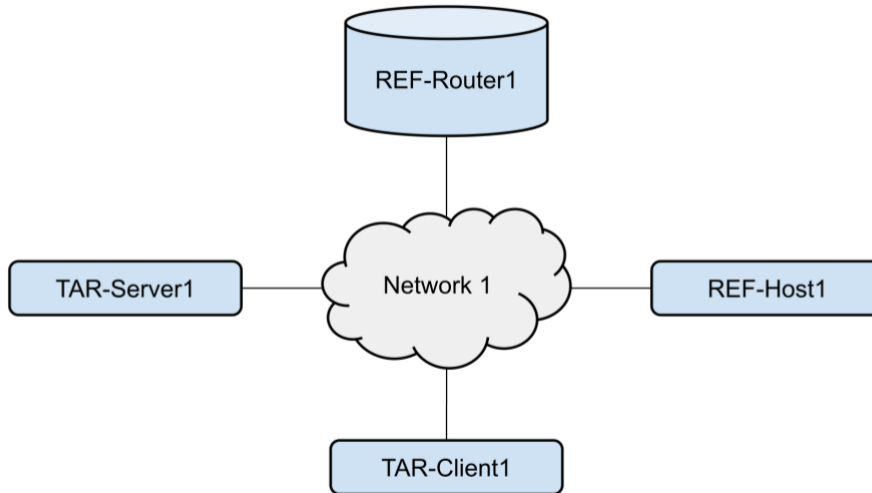## Test DHCPInterop.1.3: Transmission of Renew messages

Purpose: To verify a client and server device properly handles Renew messages.

Reference:
- [8415] – Section 18.2.4
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.

Procedure:

Part A: IA_NA

Step	Action	Expected Behavior
1.	Configure the TAR-Client1 to enable DHCPv6 for addresses.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA_NA (the TAR-Server1 sets T1 to 50s and T2 to 80s).
2.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends its first Renew message T1 (50) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message. TAR-Server1 transmits a

		properly formatted Reply message in response to the Renew message.
3.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part B: IA_PD

Step	Action	Expected Behavior
4.	Configure the TAR-Client1 to enable DHCPv6 for prefixes.	The TAR-Client1 should have received IPv6 prefix information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA_PD (the TAR-Server1 sets T1 to 50s and T2 to 80s).
5.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends its first Renew message T1 (50) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.
6.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends its first Renew message T1 (50) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.

Part C: Both IA_NA and IA_PD

Step	Action	Expected Behavior
7.	Configure the TAR-Client1 to enable DHCPv6 for both addresses and prefixes.	The TAR-Client1 should have received IPv6 prefix information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA_PD (the TAR-Server1 sets T1 to 50s and T2 to 80s).
8.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends its first Renew message T1 (50) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message containing both the IA_NA and IA_PD. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.
9.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Possible Problems: None.

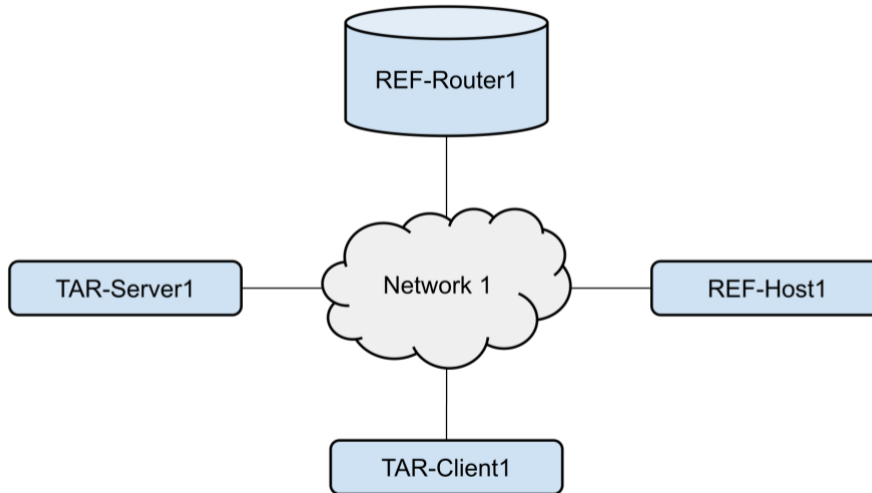# Test DHCPInterop.1.4: Transmission of Rebind messages

Purpose: To verify a client and server device properly handles Rebind messages.

Reference:
- [8415] – Section 18.2.5
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.

Procedure:

Part A: IA_NA

Step	Action	Expected Behavior
1.	Configure the TAR-Client1 to enable DHCPv6 for addresses.	
2.	Allow enough time for the TAR-Client1 to receive IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA (the TAR-Server1 sets T1 to 50s and T2 to 80s).	
3.	Disconnect the TAR-Server1 from Network 1.	After time 80s (T2) the TAR-Client1 transmits a Rebind message.

Step	Action	Expected Behavior
4.	Reconnect the TAR-Server1 to the link and confirm that the TAR-Client1's address is renewed on the next rebind.	
5.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part B: IA_PD

Step	Action	Expected Behavior
6.	Configure the TAR-Client1 to enable DHCPv6 for prefixes.	
7.	Allow enough time for the TAR-Client1 to receive IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA (the TAR-Server1 sets T1 to 50s and T2 to 80s).	
8.	Disconnect the TAR-Server1 from Network 1.	After time 80s (T2) the TAR-Client1 transmits a Rebind message.
9.	Reconnect the TAR-Server1 to the link and confirm that the TAR-Client1's address is renewed on the next rebind.	
10.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part C: Both IA_NA and IA_PD

Step	Action	Expected Behavior
11.	Configure the TAR-Client1 to enable DHCPv6 for addresses and prefixes.	
12.	Allow enough time for the TAR-Client1 to receive IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA_NA and IA_PD(the TAR-Server1 sets T1 to 50s and T2 to 80s).	
13.	Disconnect the TAR-Server1 from Network 1.	After time 80s (T2) the TAR-Client1 transmits a Rebind message with both the IA_PD and IA_NA.
14.	Reconnect the TAR-Server1 to the link and confirm that the TAR-Client1's address is renewed on the next rebind.	

15.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Possible Problems: None.

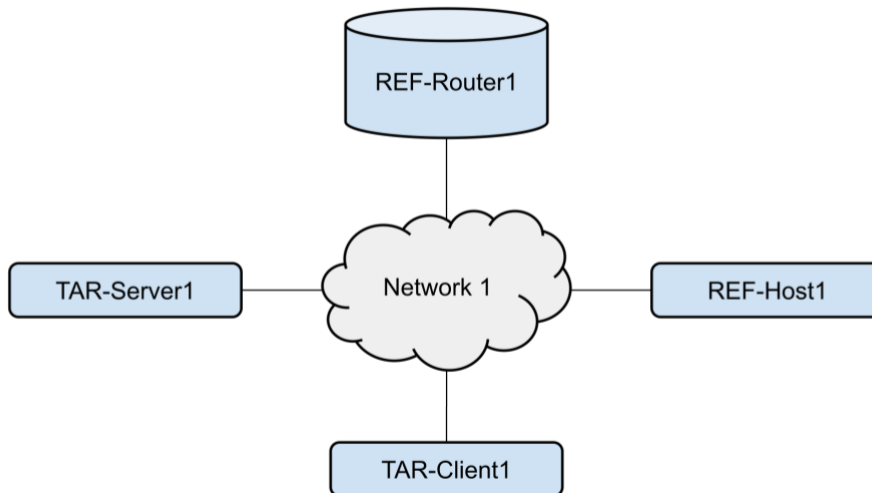## Test DHCPInterop.1.5: Transmission of Release messages

Purpose: To verify that a client and server device transmits properly formatted Release messages and to verify that a client device properly releases IPv6 addresses configured by a server.

Reference:
- [8415] – Sections 18.2.7
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.

Procedure:

Part A: IA_NA

Step	Action	Expected Behavior
1.	Configure the TAR-Client1 to enable DHCPv6 for addresses	
2.	Allow enough time for the TAR-Client1 to receive IPv6 address information from the TAR-Server1.	
3.	Configure the TAR-Client1 to release the IPv6 global address.	The TAR-Client1 transmits a Release message. The TAR-Server1 transmits a Reply message in response with a success code.

Step	Action	Expected Behavior
4.	REF-Host1 transmits an ICMPv6 Echo Request to the TAR-Client1's released address.	The TAR-Client1 must not reply to the Echo Request or Neighbor Solicitations from REF-Host1.

Part B: IA_PD

Step	Action	Expected Behavior
5.	Configure the TAR-Client1 to enable DHCPv6 for prefixes.	
6.	Allow enough time for the TAR-Client1 to receive IPv6 prefix information from the TAR-Server1.	
7.	Configure the TAR-Client1 to release the IPv6 prefix.	The TAR-Client1 transmits a Release message. The TAR-Server1 transmits a Reply message in response with a success code.
8.	Wait for timer T1 (50s) to expire.	The TAR-Client1 must not transmit a Renew message for the prefix advertised in 6.

Part C: Both IA_NA and IA_PD

Step	Action	Expected Behavior
9.	Configure the TAR-Client1 to enable DHCPv6 for prefixes.	
10.	Allow enough time for the TAR-Client1 to receive IPv6 address and prefix information from the TAR-Server1.	
11.	Configure the TAR-Client1 to release the IPv6 address and prefix.	The TAR-Client1 transmits a Release message containing both IA_NA and IA_PD. The TAR-Server1 transmits a Reply message in response with a success code.
12.	REF-Host1 transmits an ICMPv6 Echo Request to the TAR-Client1's released address.	The TAR-Client1 must not reply to the Echo Request or Neighbor Solicitations from REF-Host1.
13.	Wait for timer T1 (50s) to expire.	The TAR-Client1 must not transmit a Renew message for the prefix advertised in 6.

Possible Problems: None.

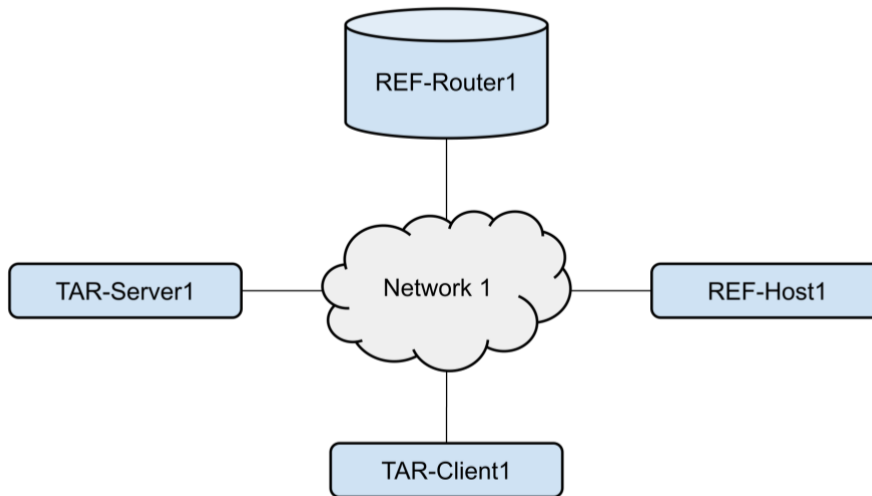## Test DHCPInterop.1.6: Transmission of Decline messages

Purpose: Verify that a client and server properly handles the transmission and reception of Decline messages.

Reference:
- [8415] – Section 18.2.8
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.

Procedure:

Step	Action	Expected Behavior
1.	Configure the TAR-Server1 to have only the address of the REF-Host1 in its address pool.	
2.	Configure the TAR-Client1 to enable DHCPv6.	
3.	Allow enough time for the TAR-Client1 to receive IPv6 address information from the TAR-Server1.	TAR-Client1 transmits a DAD NS for its global address. The REF-Host1 transmits a solicited NA in response to the DAD NS with non-unique tentative address. The TAR-Client1 transmits a Decline message. TAR-Server1 transmits a Reply Message.

4.	TAR-Server1 transmits an ICMPv6 Echo Request to the REF-Host1's global address.	The TAR-Client1 must not reply to the Echo Request or Neighbor Solicitations from TAR-Server1.

Possible Problems: None.

## Test DHCPInterop.1.7: Transmission of Information Request Message

Purpose: Verify that a client and server properly handles the transmission and reception of Information Request messages.

Reference:
- [8415] – Section 18.2.6
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1 for stateless DHCPv6. Configure REF-Router1 to transmit Router Advertisements for Network 1's prefix with a preferred and valid lifetime of 600 seconds and the O bit set to 1, L and A bits are set to 1. Configure REF-DNS-Server1 to have a DNS host name of "dhcpv6" in the "test.example.com" domain with a record for REF-Host1. Disable DHCPv6 on all devices after test.
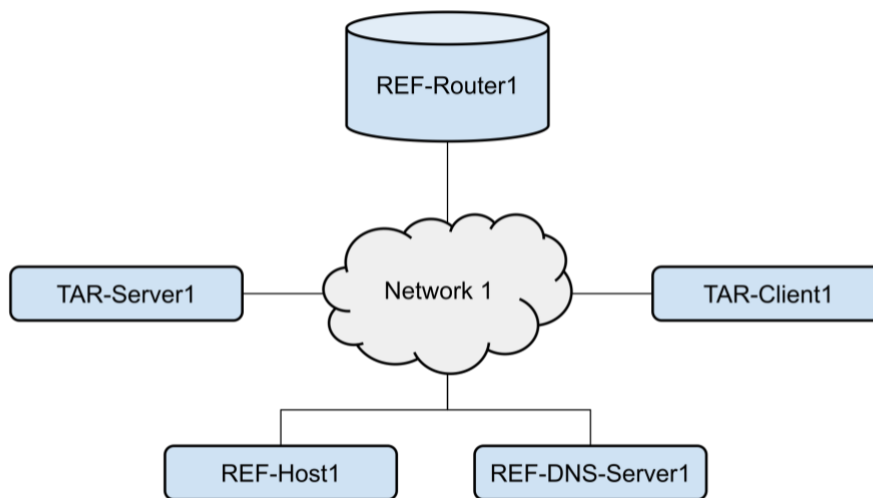
Procedure:
Part A: DNS Recursive Name Server Option

Step	Action	Expected Behavior
1.	Configure TAR-Server1 to include a DNS Recursive Name Server option that includes REF-DNS-Server1's global IPv6 address.	
2.	Configure TAR-Client1 to enable stateless DHCPv6.	TAR-Client1 sends a Information Request message. TAR-Server1 transmits a Reply Message.

Step	Action	Expected Behavior
3.	TAR-Client1 to transmit an Echo Request to "dhcpv6.test.example.com".	The TAR-Client1 received an Echo Reply from REF-DNS-Server1.

Step	Action	Expected Behavior
4.	Configure TAR-Server1 to include a DNS Recursive Name Server option that includes REF-DNS-Server1's Global IPv6 address as the name server and a Domain Search List option that includes "test.example.com".	
5.	Configure TAR-Client1 to enable stateless DHCPv6.	TAR-Client1 sends a Information Request message. TAR-Server1 transmits a Reply Message.
6.	Configure TAR-Client1 to transmit an Echo Request to "dhcpv6".	The TAR-Client1 received an Echo Reply from REF-DNS-Server1.

Possible Problems: In each part, if the NUT does not have the command that transmits an Echo Request, the NUT can use an alternate command that transmits a DNS Standard Query.

## Test DHCPInterop.1.8: Advertise message Status

Purpose: To verify a client and server device properly handle Advertise messages with a status code of 2 (NoAddrsAvail) or status code of 6 (NoPrefixAvail).

Reference:
- [RFC-8415] – Section 18.2.9

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.
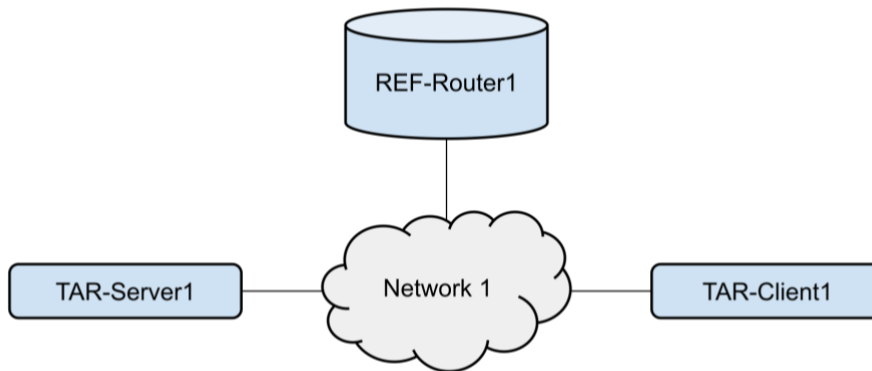
Procedure:

Part A: NoAddrsAvail

Step	Action	Expected Behavior
1.	Configure the TAR-Server1 to have no available addresses.	
2.	Configure the TAR-Client1 to enable DHCPv6.	The TAR-Server1 transmits an Advertise message containing the status code 2. The TAR-Client1 must ignore the Advertise message from the TAR-Server1 and not transmit a Request message.

Part B: NoPrefixAvail

Step	Action	Expected Behavior

3.	Configure the TAR-Server1 to have no available addresses.	
4.	Configure the TAR-Client1 to enable DHCPv6.	The TAR-Server1 transmits an Advertise message containing the status code 2. The TAR-Client1 must ignore the Advertise message from the TAR-Server1 and not transmit a Request message.

Possible Problems: None.

Test DHCPInterop.1.9: Transmission of Reply Message with NotOnLink

Purpose: To verify a client and server device properly handle Reply messages with NotOnLink.

Reference:
- [RFC 8415] – Section 18.2.10
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1 and Network2. Disable DHCPv6 on all devices after test.

Procedure:

Step	Action	Expected Behavior
1.	Configure the TAR-Client1 to enable DHCPv6.	

2.	Allow enough time for the TAR-Client1 to receive IPv6 address information from REF-Server1.	
3.	Disconnect the TAR-Client1 from Network 1.	
4.	Allow enough time to elapse such that the TAR-Client1 recognizes a link down; reconnect the TAR-Client1 to Network 2.	The TAR-Client1 transmits a properly formatted Confirm message. The TAR-Server1 transmits a Reply message with the status code 4 (NotOnLink). The Reply Message does not contain an IA Option. The TAR-Client1 then performs DHCP server solicitation and client-initiated configuration.
5.	Allow enough time for the TAR-Client1 to receive IPv6 address information from TAR-Server1.	
6.	REF-Host1 transmits an ICMPv6 Echo Request to TAR-Client1's new global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Possible Problems: None.

Test DHCPInterop.1.10: Relay-Agent Basic Message Exchange

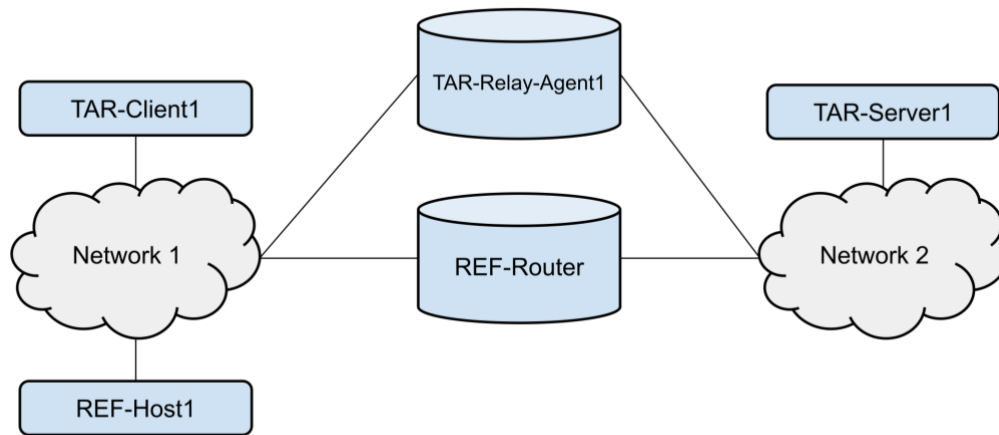**Purpose:** To verify that a device can properly interoperate with a DHCPv6 Relay Agent.

Reference:
- [8415] – Section 19
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1 and Network2. Disable DHCPv6 on all devices after test.

Procedure:
Part A: Basic Message Exchange with Relay Agent

Step	Action	Expected Behavior
1.	Configure the TAR-Router1 to advertise a Router Advertisement with a RDNSS Option including REF-DNS1 as the Server.	The TAR-Client1 sends a solicit message to the ALL_DHCP_Relay_Agents_and_Servers address. TAR-Relay-Agent1 transmits a Relay-forward Solicit message in relaying of the Solicit message from TAR-Client1. The TAR-Server1 sends a Relay-reply advertise message with the IP address information included.

Step	Action	Expected Behavior
		TAR-Relay-Agent1 transmits an Advertisement message to TAR-Client1. TAR-Relay-Agent1 transmits a Relay-forward Request message in relaying of the Request message from TAR-Client1 to TAR-Server1 and the TAR-Relay-Agent1 transmitted a Reply message in relaying of the Relay-reply Reply message from TAR-Server1 to TAR-Client1 that contains the confirmed address.
2.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part B: Confirm Message with Relay Agent

Step	Action	Expected Behavior
3.	Configure TAR-Client1 to disable auto-configuration and enable DHCPv6.	The TAR-Client1 sends a solicit message to the ALL_DHCP_Relay_Agents_and_Servers address. TAR-Relay-Agent1 transmits a Relay-forward Solicit message in relaying of the Solicit message from TAR-Client1. The TAR-Server1 sends a Relay-reply advertise message with the IP address information included. TAR-Relay-Agent1 transmits an Advertisement message to TAR-Client1. TAR-Relay-Agent1 transmits a Relay-forward Request message in relaying of the Request message from TAR-Client1 to TAR-Server1 and the TAR-Relay-Agent1 transmitted a Reply message in relaying of the Relay-reply Reply message from TAR-Server1 to TAR-Client1 that contains the confirmed address.
4.	Disconnect the TAR-Client1 from Network 1.	
5.	Allow enough time to elapse such that the TAR-Client1 recognizes a link down, reconnect the TAR-Client1.	TAR-Relay-Agent1 transmitted a Relay-forward Confirm message in relaying of the Confirm message. TAR-Relay-Agent1 then transmitted a Reply message in relaying of the Relay-reply message from TAR-Server1 to TAR-Client1. The Reply Message does not contain an IA Option.
6.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part C: Renew Message with Relay Agent

Step	Action	Expected Behavior
7.	Configure TAR-Client1 to disable auto-configuration and enable DHCPv6.	
8.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA (the TAR-Server1 sets T1 to 50s and T2 80s).	TAR-Relay-Agent1 transmitted a Relay-forward Renew message in relaying of the Renew message. TAR-Relay-Agent1 then transmitted a Reply message in relaying of the Relay-reply message from TAR-Server1 to TAR-Client1.
9.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part D: Rebind Message with Relay Agent

Step	Action	Expected Behavior
10.	Configure TAR-Client1 to disable auto-configuration and enable DHCPv6.	
11.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA (the TAR-Server1 sets T1 to 50s and T2 80s).	
12.	Disconnect TAR-Server1 from Network 2.	TAR-Relay-Agent1 transmitted a Relay-forward Rebind message in relaying of the Rebind message.
13.	Reconnect the TAR-Server1 to Network 2 and confirm that the TAR-Client1's address is renewed on the next rebind.	

Part E: Release Message with Relay Agent

Step	Action	Expected Behavior
14.	Configure TAR-Client1 to disable auto-configuration and enable DHCPv6.	The TAR-Client1 sends a solicit message to the ALL_DHCP_Relay_Agents_and_Servers address. TAR-Relay-Agent1 transmits a Relay-forward Solicit message in relaying of the Solicit message from TAR-Client1. The TAR-Server1 sends a Relay-reply advertise message with the IP address information included.

Step	Action	Expected Behavior
		TAR-Relay-Agent1 transmits an Advertisement message to TAR-Client1. TAR-Relay-Agent1 transmits a Relay-forward Request message in relaying of the Request message from TAR-Client1 to TAR-Server1 and the TAR-Relay-Agent1 transmitted a Reply message in relaying of the Relay-reply Reply message from TAR-Server1 to TAR-Client1 that contains the confirmed address.
15.	Configure the TAR-Client1 to release the IPv6 global address.	TAR-Relay-Agent1 transmitted a Relay-forward Release message in relaying of the Release message. TAR-Relay-Agent1 then transmitted a Reply message in relaying of the Relay-reply message from TAR-Server1 to TAR-Client1.
16.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 does not transmit an Echo Reply in response to the Echo Request from REF-Host1.

Part F: Decline Message with Relay Agent

Step	Action	Expected Behavior
17.	Configure the TAR-Server1 to have only the address of the REF-Host1 in its address pool.	
18.	Configure the TAR-Client1 to enable DHCPv6.	
19.	Allow enough time for the TAR-Client1 to receive IPv6 address information from the TAR-Server1.	TAR-Relay-Agent1 transmitted a Relay-forward Decline message in relaying of the Decline message. TAR-Relay-Agent1 then transmitted a Reply message in relaying of the Relay-reply message from TAR-Server1 to TAR-Client1.
20.	TAR-Server1 transmits an ICMPv6 Echo Request to the REF-Host1's global address.	The TAR-Client1 does not transmit an Echo Reply in response to the Echo Request from REF-Host1.

Part G: Information Request Message with Relay Agent

Step	Action	Expected Behavior
21.	Configure TAR-Server1 to include a DNS Recursive Name Server option that includes REF-DNS-Server1's Global IPv6 address as the name server.	
22.	Configure TAR-Client1 to enable stateless DHCPv6..	The TAR-Client1 sends an information request message. TAR-Relay-Agent1 transmitted a Reply message in relaying of the Relay-reply Reply message containing the DNS Recursive Name Server option

		from TAR-Server1 to TAR-Client1 that contains the confirmed address.
23.		TAR-Relay-Agent1 transmits a Relay-forward Information Request message in relaying of the Information Request message from TAR-Client1.
24.		The TAR-Server1 sends a Relay-reply Reply message with the DNS Recursive Name Server option.
25.		TAR-Relay-Agent1 transmitted a Reply message in relaying of the Relay-reply Reply message containing the DNS Recursive Name Server option from TAR-Server1 to TAR-Client1 that contains the confirmed address.
26.	TAR-Client1 transmits an Echo Request to "dhcpv6.test.example.com",	The TAR-Client1 received an Echo Reply from REF-DNS-Server1.

Possible Problems: In part G, if the NUT does not have the command that transmits an Echo Request, the NUT can use an alternate command that transmits a DNS Standard Query.

Test DHCPInterop.1.11: Layered Relay-Agent Basic Message Exchange

Purpose: To verify that a device can properly interoperate with multiple DHCPv6 Relay Agent.
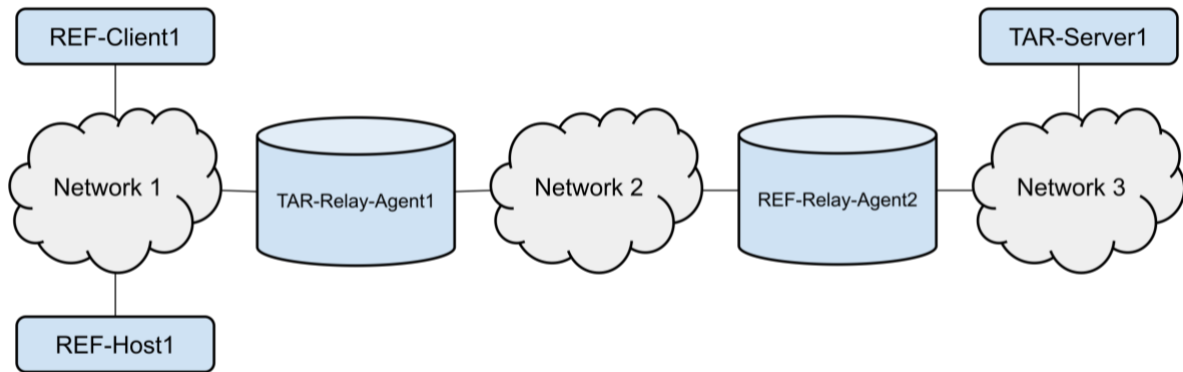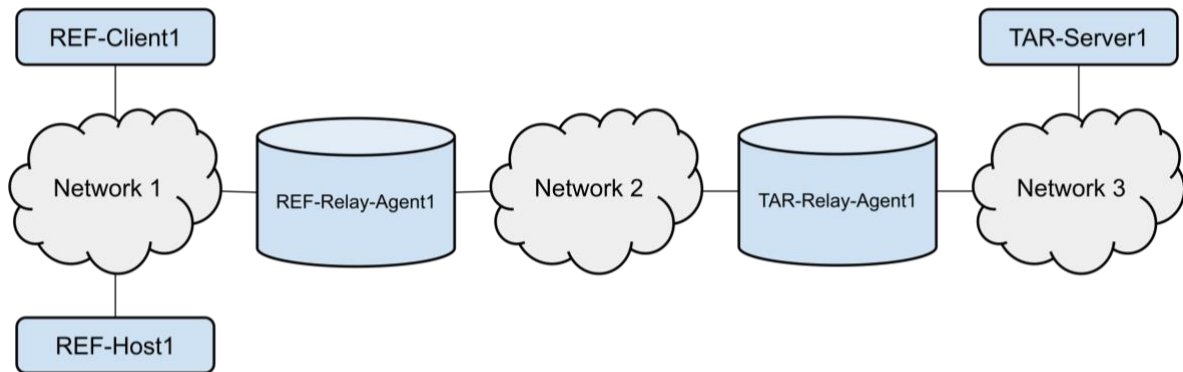
Reference:
- [8415] – Section 19.1.2

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1 and enable DHCPv6. Disable DHCPv6 on all devices after test.
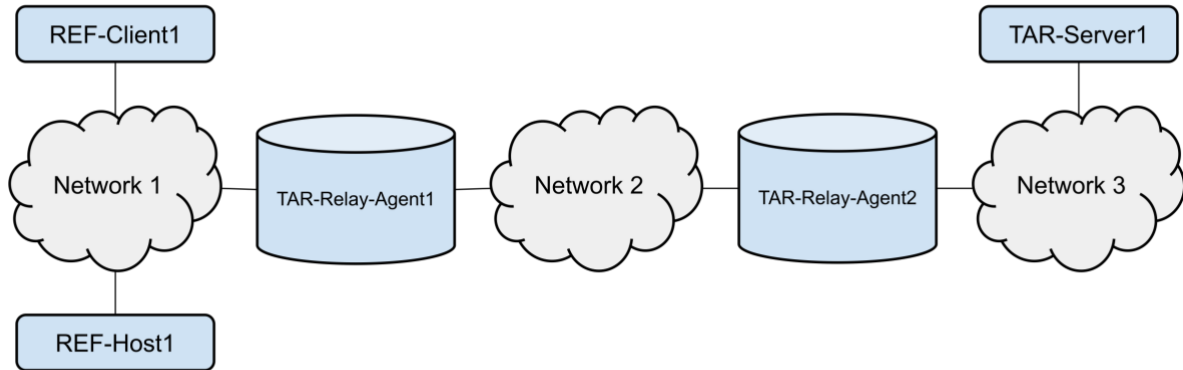
Part A-B:

Part B:

Part C:

Part D:
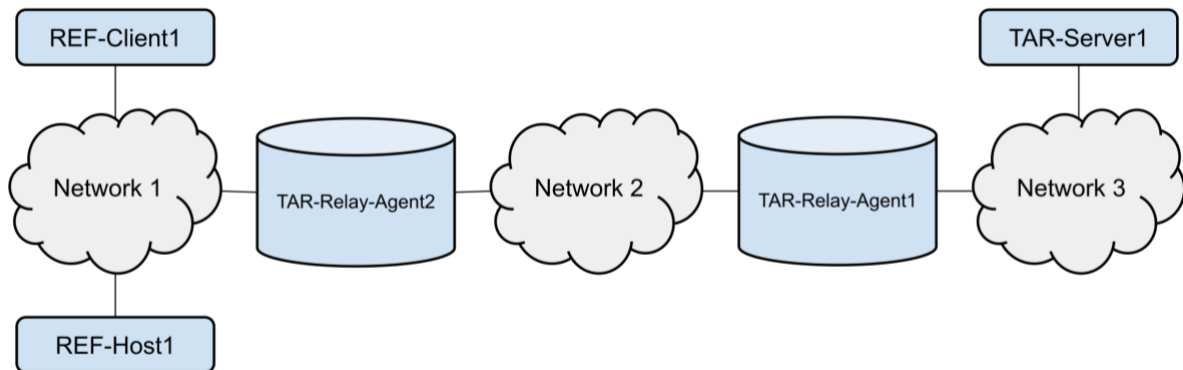
Procedure:

Part A: Solicit Relay-Agent to Server Off-link

Step	Action	Expected Behavior
1.	Configure REF-Client1 to disable auto-configuration and enable DHCPv6.	
2.	The REF-Client1 transmitted a solicit message on to the ALL_DHCP_Relay_Agents_and_Servers address.	TAR-Relay-Agent1 transmitted a Relay-Forward message containing the Solicit message from REF-Client1.
3.	REF-Relay-Agent2 transmitted a Relay-Forward message to the TAR-Server1 containing the Relay-Forward message from TAR-Relay-Agent1.	TAR-Server1 transmitted a Relay-Reply message to REF-Relay-Agent2 containing an Advertise message with the IP address information.
4.	REF-Relay-Agent2 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing the Advertise message	TAR-Relay-Agent1 transmitted an Advertise message to REF-Client.

Step	Action	Expected Behavior
5.	REF-Client1 transmitted a Request message.	TAR-Relay-Agent1 transmitted a Relay-forward message containing the Request message from REF-Client1 to REF-Relay-Agent2.
6.	REF-Relay-Agent2 transmitted a Relay-Forward message containing the Relay-Forward message from TAR-Relay-Agent1 to TAR-Server1.	TAR-Server1 transmitted a Relay-Reply message to REF-Relay-Agent2 containing a Reply message with the confirmed IP address
7.	REF-Relay-Agent2 transmitted a Relay-Reply message containing a Reply message to TAR-Relay-Agent1.	TAR-Relay-Agent1 transmitted a Reply message to REF-Client1 that contains the confirmed address.
8.	REF-Host1 transmits an Echo Request to the REF-Client1's global address.	The REF-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part B: Information-request Relay-Agent to Server Off-link

Step	Action	Expected Behavior
9.	Configure REF-Client1 to enable stateless DHCPv6.	
10.	The REF-Client1 transmitted a information-request message.	TAR-Relay-Agent1 transmitted a Relay-Forward message containing the information-request message from REF-Client1.
11.	REF-Relay-Agent2 transmitted a Relay-Forward message to the TAR-Server1 containing the Relay-Forward message from TAR-Relay-Agent1.	TAR-Server1 transmitted a Relay-Reply message to REF-Relay-Agent2 containing an Reply message with DNS information.
12.	REF-Relay-Agent2 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing the Advertise message	TAR-Relay-Agent1 transmitted an Reply message to REF-Client.
13.	REF-Client1 transmits an Echo Request to "dhcpv6.test.example.com",	The REF-Client1 received an Echo Reply from REF-DNS-Server1.

Part C: Solicit Relay-Agent to Server On-link

Step	Action	Expected Behavior
14.	Configure REF-Client1 to disable auto-configuration and enable DHCPv6.	
15.	The REF-Client1 transmitted a Solicit message.	
16.	REF-Relay-Agent2 transmitted a Relay-Forward message containing the Solicit message from REF-Client1.	TAR-Relay-Agent1 transmitted a Relay-Forward message to the TAR-Server1 containing the Relay-Forward message from REF-Relay-Agent2.
17.		TAR-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing

Step	Action	Expected Behavior
		an Advertise message with the IP address information.
18.		TAR-Relay-Agent1 transmitted a Relay-Reply message to REF-Relay-Agent2 containing the Advertise message.
19.	REF-Relay-Agent2 transmitted an Advertise message to REF-Client1.	
20.	REF-Client1 transmitted a Request message..	
21.	REF-Relay-Agent2 transmitted a Relay-forward message containing the Request message from REF-Client1 to TAR-Relay-Agent1.	TAR-Relay-Agent1 transmitted a Relay-Forward message containing the Relay-Forward message from REF-Relay-Agent2 to TAR-Server.
22.		TAR-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing a Reply message with the confirmed IP address.
23.		TAR-Relay-Agent1 transmitted a Relay-Reply message containing a Reply message to REF-Relay-Agent2.
24.	REF-Relay-Agent2 transmitted a Reply message to REF-Client1 that contains the confirmed address.	
25.	REF-Host1 transmits an Echo Request to the REF-Client1's global address.	The REF-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part D: Information-request Relay-Agent to Server On-link

Step	Action	Expected Behavior
26.	Configure REF-Client1 to enable stateless DHCPv6.	
27.	The REF-Client1 transmitted a Information Request message.	
28.	REF-Relay-Agent2 transmitted a Relay-Forward message containing the Information message from REF-Client1.	TAR-Relay-Agent1 transmitted a Relay-Forward message to the TAR-Server1 containing the Relay-Forward message from REF-Relay-Agent2.
29.		TAR-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing an Reply message with the DNS information.
30.		TAR-Relay-Agent1 transmitted a Relay-Reply message to REF-Relay-Agent2 containing the Reply message.
31.	REF-Relay-Agent2 transmitted an Reply message to REF-Client1.	
32.	REF-Client1 transmits an Echo Request to "dhcpv6.test.example.com",	The REF-Client1 received an Echo Reply from REF-DNS-Server1.

Part E: Solicit Relay-Agent to Relay-Agent to Server Off-link

Step	Action	Expected Behavior
33.	Configure REF-Client1 to disable auto-configuration and enable DHCPv6.	
34.	The REF-Client1 transmitted a solicit message.	TAR-Relay-Agent1 transmitted a Relay-Forward message containing the Solicit message from REF-Client1.
35.		TAR-Relay-Agent2 transmitted a Relay-Forward message to the REF-Server1 containing the Relay-Forward message from TAR-Relay-Agent1.
36.	REF-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent2 containing an Advertise message with the IP address information.	TAR-Relay-Agent2 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing the Advertise message.
37.		TAR-Relay-Agent1 transmitted an Advertise message to REF-Client1.
38.	REF-Client1 transmitted a Request message.	TAR-Relay-Agent1 transmitted a Relay-forward message containing the Request message from REF-Client1 to TAR-Relay-Agent2.
39.		TAR-Relay-Agent2 transmitted a Relay-Forward message containing the Relay-Forward message from TAR-Relay-Agent1 to REF-Server1.
40.	REF-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent2 containing a Reply message with the confirmed IP address	TAR-Relay-Agent2 transmitted a Relay-Reply message containing a Reply message to TAR-Relay-Agent1.
41.		TAR-Relay-Agent1 transmitted a Reply message to REF-Client1 that contains the confirmed address.
42.	REF-Host1 transmits an Echo Request to the REF-Client1's global address.	The REF-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part F: Information-request Relay-Agent to Relay-Agent to Server Off-link

Step	Action	Expected Behavior
43.	Configure REF-Client1 to enable stateless DHCPv6.	
44.	The REF-Client1 transmitted a information-request message.	TAR-Relay-Agent1 transmitted a Relay-Forward message containing the Information-request message from REF-Client1.
45.		TAR-Relay-Agent2 transmitted a Relay-Forward message to the REF-Server1

Step	Action	Expected Behavior
		containing the Relay-Forward message from TAR-Relay-Agent1.
46.	REF-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent2 containing an Reply message with the DNS information.	TAR-Relay-Agent2 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing the Reply message.
47.		TAR-Relay-Agent1 transmitted an Reply message to REF-Client1.
48.	REF-Client1 transmits an Echo Request to "dhcpv6.test.example.com",	The REF-Client1 received an Echo Reply from REF-DNS-Server1.

Part G: Solicit Relay-Agent to Relay-Agent to Server On-link

Step	Action	Expected Behavior
49.	The REF-Client1 transmitted a solicit message.	
50.		TAR-Relay-Agent2 transmitted a Relay-Forward message containing the Solicit message from REF-Client1.
51.		TAR-Relay-Agent1 transmitted a Relay-Forward message to the REF-Server1 containing the Relay-Forward message from TAR-Relay-Agent2.
52.	REF-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing an Advertise message with the IP address information.	TAR-Relay-Agent1 transmitted a Relay-Reply message to TAR-Relay-Agent2 containing the Advertise message.
53.		TAR-Relay-Agent2 transmitted an Advertise message to REF-Client1.
54.	REF-Client1 transmitted a Request message.	TAR-Relay-Agent2 transmitted a Relay-forward message containing the Request message from REF-Client1 to TAR-Relay-Agent1.
55.		TAR-Relay-Agent2 transmitted a Relay-Forward message containing the Relay-Forward message from TAR-Relay-Agent1 to REF-Server1.
56.	REF-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing a Reply message with the confirmed IP address.	TAR-Relay-Agent1 transmitted a Relay-Reply message containing a Reply message to TAR-Relay-Agent2.
57.		TAR-Relay-Agent2 transmitted a Reply message to REF-Client1 that contains the confirmed address.
58.	REF-Host1 transmits an Echo Request to the REF-Client1's global address.	The REF-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Step	Action	Expected Behavior
59.	Configure REF-Client1 to enable stateless DHCPv6.	
60.	The REF-Client1 transmitted a information-request message.	TAR-Relay-Agent2 transmitted a Relay-Forward message containing the Solicit message from REF-Client1.
61.		TAR-Relay-Agent1 transmitted a Relay-Forward message to the REF-Server1 containing the Relay-Forward message from TAR-Relay-Agent2.
62.	REF-Server1 transmitted a Relay-Reply message to TAR-Relay-Agent1 containing an Reply message with the DNS information.	TAR-Relay-Agent1 transmitted a Relay-Reply message to TAR-Relay-Agent2 containing the Reply message.
63.		TAR-Relay-Agent2 transmitted an Reply message to REF-Client1.
64.	REF-Client1 transmits an Echo Request to "dhcpv6.test.example.com".	The REF-Client1 received an Echo Reply from REF-DNS-Server1.

Possible Problems: None.

Group 2: DHCPv6 Configruation Parameters

Scope

Tests in this group cover interoperability of the Dynamic Host Configuration Protocol for parameters set by the server for the client.

Overview

These tests are designed to verify that the server can send DHCPv6 parameters to the client and they are honored.

Test DHCPInterop.2.1: T1/T2 Time of Zero

Purpose: To verify that a client properly processes the T1/T2 timers set to zero.

Reference:
- [8415] – Section 14.2, 18.2.10

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.
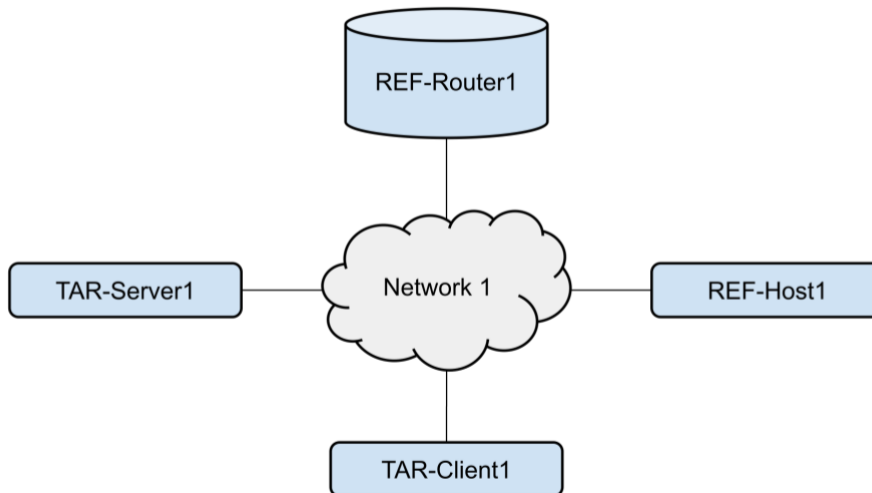
Procedure:
Part A: T1 of Zero in IA_NA

Step	Action	Expected Behavior
1.	Configrue TAR-Server1 to advertise a T1 and T2 value of 0 in IA_NA.	
2.	Configure the TAR-Client1 to enable DHCPv6 for addresses.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 value of 0 to the TAR-Client1's IA_NA.
3.		TAR-Client1 must not transmit a DHCPv6 Renew message immediately.

Part B: T2 of Zero in IA_NA

Step	Action	Expected Behavior
4.	Configrue TAR-Server1 to advertise a T1 and T2 value of 0 in IA_NA.	
5.	Configure the TAR-Client1 to enable DHCPv6 for addresses.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T2 value of 0 to the TAR-Client1's IA_NA.
6.	Disconnect the TAR-Server1 from Network 1.	TAR-Client1 must not transmit a DHCPv6 Rebind message immediately after the Renew or Reply message.

Part C: T1 of Zero in IA_PD

Step	Action	Expected Behavior
7.	Configrue TAR-Server1 to advertise a T1 and T2 value of 0 in IA_PD.	
8.	Configure the TAR-Client1 to enable DHCPv6 for prefixes.	The TAR-Client1 should have received IPv6 prefix information from the TAR-Server1. The TAR-Server1 assigns the T1 value of 0 to the TAR-Client1's IA_PD.
9.		TAR-Client1 must not transmit a DHCPv6 Renew message immediately.

Part D: T2 of Zero in IA_PD

Step	Action	Expected Behavior
10.	Configrue TAR-Server1 to advertise a T1 and T2 value of 0 in IA_PD.	
11.	Configure the TAR-Client1 to enable DHCPv6 for prefixes.	The TAR-Client1 should have received IPv6 prefix information from the TAR-Server1. The TAR-Server1 assigns the T2 value of 0 to the TAR-Client1's IA_NA.
12.	Disconnect the TAR-Server1 from Network 1.	TAR-Client1 must not transmit a DHCPv6 Rebind message immediately after the Renew or Reply message.

Possible Problems: None.

## Test DHCPInterop.2.2: Single Exchange for Multiple IAs

Purpose: To verify that a client properly performs a single exchange with a server.

Reference:
- [8415] – Section 18.1, 18.2.4

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.
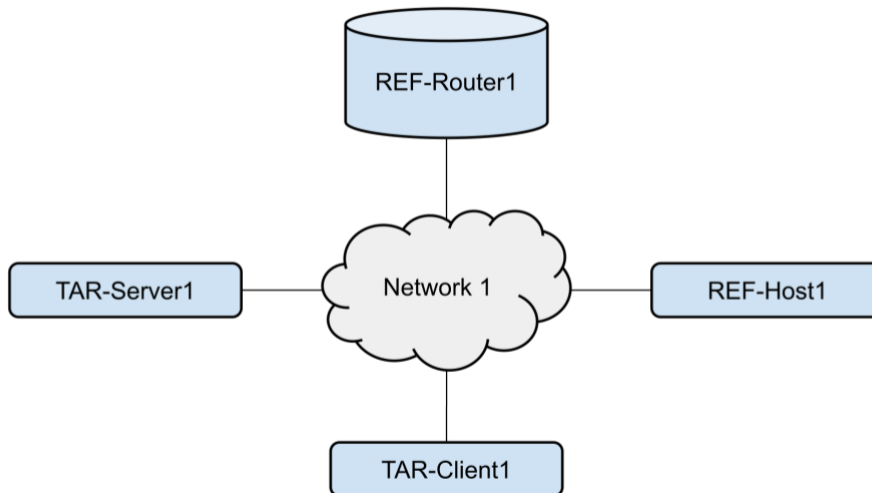
Procedure:

Part A: Higher IA_NA T1

Step	Action	Expected Behavior
1.	Configrue TAR-Server1 to have a T1 value X in the IA_NA higher then T1 value Y in the IA_PD.	
2.	Configure the TAR-Client1 to enable DHCPv6 for addresses and prefixes.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 value of value Y from the IA_PD to the TAR-Client1's IA_NA.
3.	Wait for timer T1 (Ys) to expire.	The TAR-Client1 sends its first Renew message T1 (Y) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a

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		Renew message with both the IA_NA and IA_PD options present. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.

Part B: Higher IA_NA T2

Step	Action	Expected Behavior
4.	Configure TAR-Server1 to have a T2 value X in the IA_NA higher then T2 value Y in the IA_PD.	
5.	Configure the TAR-Client1 to enable DHCPv6 for addresses and prefixes.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T2 value of value Y from the IA_PD to the TAR-Client1's IA_NA.
6.	Disconnect the TAR-Server1 from Network 1.	
7.	Wait for timer T2 (Ys) to expire.	The TAR-Client1 sends its first Rebind message T2 (Y) seconds after the reception of the Reply message from the TAR-Server1. TAR-Client1 transmits a Rebind with both the IA_NA and IA_PD options present. TAR-Server1 transmits a properly formatted Reply message in response to the Rebind message.

Part C: Higher IA_PD T1

Step	Action	Expected Behavior
8.	Configure TAR-Server1 to have a T1 value X in the IA_PD higher then T1 value Y in the IA_NA.	
9.	Configure the TAR-Client1 to enable DHCPv6 for addresses and prefixes.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 value of value Y from the IA_NA to the TAR-Client1's IA_PD.
10.	Wait for timer T1 (Ys) to expire.	The TAR-Client1 sends its first Renew message T1 (Y) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message with both the IA_NA and IA_PD options present. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.

Part D: Higher IA_PD T2

Step	Action	Expected Behavior
11.	Configure TAR-Server1 to have a T2 value X in the IA_PD higher then T2 value Y in the IA_NA.	
12.	Configure the TAR-Client1 to enable DHCPv6 for addresses and prefixes.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T2 value of value Y from the IA_NA to the TAR-Client1's IA_PD.
13.	Disconnect the TAR-Server1 from Network 1.	
14.	Wait for timer T2 (Ys) to expire.	The TAR-Client1 sends its first Rebind message T2 (Y) seconds after the reception of the Reply message from the TAR-Server1. TAR-Client1 transmits a Rebind with both the IA_NA and IA_PD options present. TAR-Server1 transmits a properly formatted Reply message in response to the Rebind message..

Possible Problems: None.

Test DHCPInterop.2.3: Address Lifetime

Purpose: To verify that a client properly processes the lifetime values from the server.

Reference:
- [8415] – Section 18.2.10.1
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.
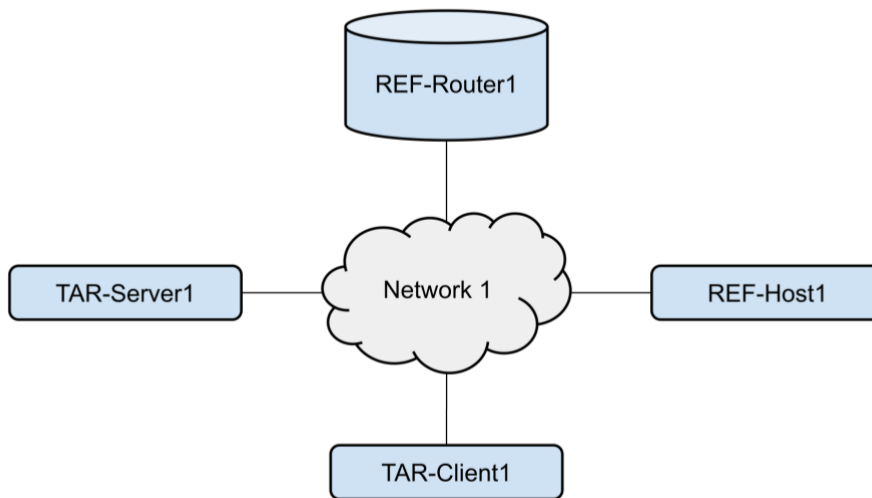
Procedure:
Part A: IA_NA Lifetime

Step	Action	Expected Behavior
1.	Configure the TAR-Server to assign addresses with a valid lifetime of 60 seconds.	
2.	Configure the TAR-Client1 to enable DHCPv6 for addresses.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the a valid lifetime of 60 seconds in the Reply message.
3.	Disconnect the TAR-Server1 from Network 1.	

Step	Action	Expected Behavior
4.	Wait 65 seconds.	
5.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part B: IA_PD Lifetime

Step	Action	Expected Behavior
6.	Configure the TAR-Server to assign addresses with a valid lifetime of 60 seconds.	
7.	Configure the TAR-Client1 to enable DHCPv6 for addresses.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the a valid lifetime of 60 seconds in the Reply message.
8.	Disconnect the TAR-Server1 from Network 1.	
9.	Wait 65 seconds.	TAR-Client1 must not transmit any Renew or Rebind messages containing the IA_PD advertised in Step 6.

Possible Problems: None.

## Test DHCPInterop.2.4: Change Address and Prefixes

Purpose: To verify that a client properly updates address and prefixes lifetime values from the server.

Reference:
- [8415] – Section 18.2.10
- [4443] – Section 5.5.3

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.
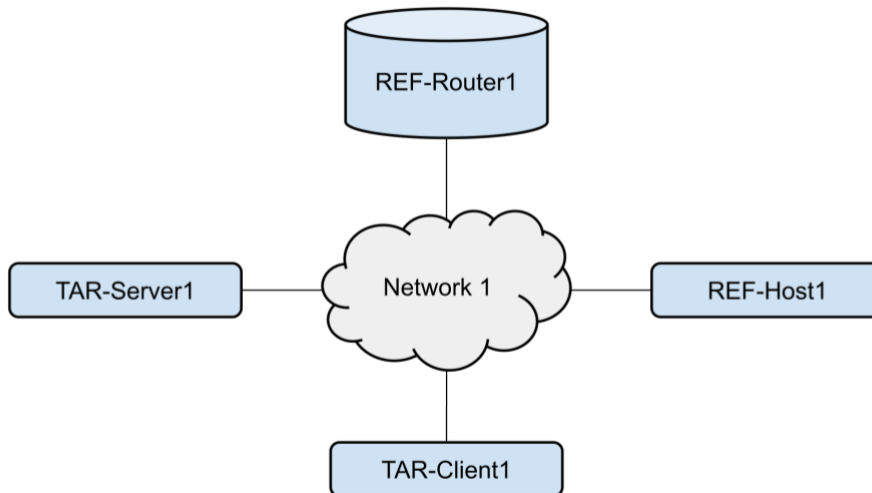
Procedure:

Part A: Change Address

Step	Action	Expected Behavior
1.	Configure the TAR-Client1 to enable DHCPv6 for addresses.	The TAR-Client1 should have received IPv6 address information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA_NA (the TAR-Server1 sets T1 to 50s and T2 to 80s).
2.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends its first Renew message T1 (50) seconds after the reception of the Reply message from the

Step	Action	Expected Behavior
		TAR-Server1. The TAR-Client1 transmits a Renew message. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.
3.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address in Step 1.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.
4.	Configure TAR-Server1 to remove the current address of TAR-Client1 from the address pool.	
5.	Wait for a Renew message from TAR-Client1.	TAR-Client1 transmits a Renew message. TAR-Server1 transmits a Reply message with an IA_NA with a new address.
6.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address in Step 1.	The TAR-Client1 must NOT transmits an Echo Reply in response to the Echo Request from REF-Host1.
7.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address in Step 5.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.

Part B: Change Prefix

Step	Action	Expected Behavior
8.	Configure the TAR-Client1 to enable DHCPv6 for prefixes.	The TAR-Client1 should have received IPv6 prefix information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA_PD (the TAR-Server1 sets T1 to 50s and T2 to 80s).
9.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends its first Renew message T1 (50) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message with IA_PD from Step 8. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.
10.	Configure TAR-Server1 to remove the current prefix of TAR-Client1 from the prefix pool.	
11.	Wait for a Renew message from TAR-Client1.	TAR-Client1 transmits a Renew message. TAR-Server1 transmits a Reply message with an IA_PD with a new prefix.
12.	Wait for timer T1 (50s) to expire.	TAR-Client1 transmits a Renew message with the new prefix. TAR-Server1 transmits a Reply message.

Possible Problems: None.

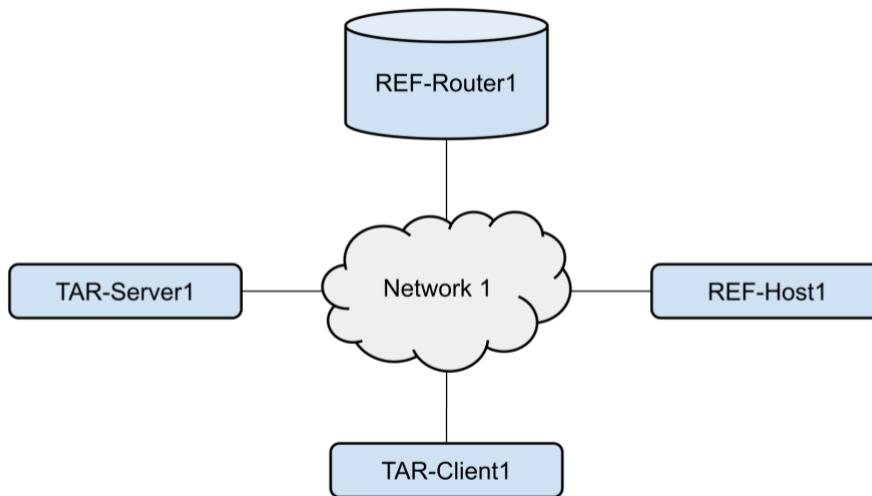## Test DHCPInterop.2.5: SOL_MAX_RT and INF_MAX_RT

Purpose: To verify that a client properly processes the SOL_MAX_RT and INF_MAX_RT from the server..

Reference:
- [8415] – Section 18.2.1, 21.24, 21.25

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.

Procedure:

Part A: SOL_MAX_RT

Step	Action	Expected Behavior
1.	Configure TAR-Server1 to set the SOL_MAX_RT option to 180 second and to not assign IPv6 addresses or prefixes.	
2.	Configure the TAR-Client1 to enable DHCPv6 for addresses and prefixes.	TAR-Client1 transmits a valid DHCPv6 Solicit message. TAR-Server1 transmits a valid DHCPv6 Advertise Message containing SOL_MAX_RT option set to 180 for every Solicit Message from TAR-

Step	Action	Expected Behavior
		Client1. TAR-Client must not send Request messages to TAR-Server1.
3.	Wait 600 seconds.	The last two DHCPv6 Solicit Messages transmitted by the CE Router must be between 162 and 198 seconds apart.

Part B: INF_MAX_RT

Step	Action	Expected Behavior
4.	Configure TAR-Server1 to set the INF_MAX_RT option to 180 second and to not assign IPv6 addresses or prefixes.	
5.	Configure TAR-Client1 to enable stateless DHCPv6.	TAR-Client1 transmits a valid Information-request. TAR-Server1 transmits a valid DHCPv6 Reply Message containing SOL_MAX_RT option set to 180 for every Information-request Message from TAR-Client1.
6.	Wait 600 seconds.	The last two DHCPv6 Information-request Messages transmitted by the CE Router must be between 162 and 198 seconds apart.

Possible Problems: None.

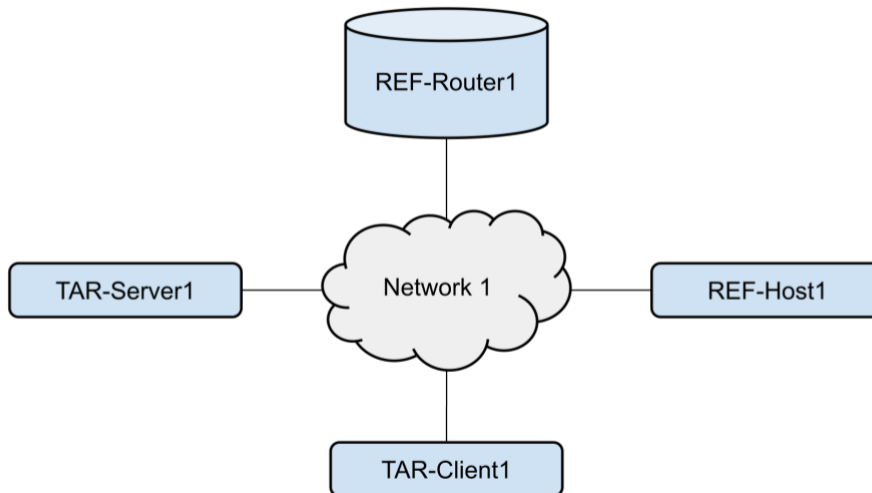## Test DHCPInterop.2.6: Refreshing Configuration Information

Purpose: To verify that a client properly processes multiple IAs from the server.

Reference:
- [8415] – Section 18.2.12

Node Requirements: See General Node Requirements.

Test Setup: For each part, connect the devices as per the figure below. Initialize TAR-Server1, REF-Host1 and enable DHCPv6. If the NUT does not work without the appropriate Router Advertisement, a REF-Router1 can be used to transmit a Router Advertisement with the appropriate parameters on Network1. Disable DHCPv6 on all devices after test.

Procedure:

Part A: Reboot

Step	Action	Expected Behavior
1.	Configure the TAR-Client1 to enable DHCPv6 for both addresses and prefixes.	The TAR-Client1 should have received IPv6 prefix information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA_PD (the TAR-Server1 sets T1 to 50s and T2 to 80s).
2.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends its first Renew message T1 (50) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message containing both the IA_NA and IA_PD. TAR-Server1 transmits a

		properly formatted Reply message in response to the Renew message.
3.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.
4.	Reboot TAR-Client1.	After TAR-Client1 completes the reboot it should transmit a DHCPv6 Rebind message containing both the IA_NA and IA_PD. TAR-Server1 transmits a valid Reply message.
5.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends a Renew message T1 (50) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message containing both the IA_NA and IA_PD. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.

Part B: Reconnect

Step	Action	Expected Behavior
6.	Configure the TAR-Client1 to enable DHCPv6 for both addresses and prefixes.	The TAR-Client1 should have received IPv6 prefix information from the TAR-Server1. The TAR-Server1 assigns the T1 and T2 parameters to the TAR-Client1's IA _PD (the TAR-Server1 sets T1 to 50s and T2 to 80s).
7.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends its first Renew message T1 (50) seconds after the reception of the Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message containing both the IA_NA and IA_PD. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.
8.	REF-Host1 transmits an Echo Request to the TAR-Client1's global address.	The TAR-Client1 transmits an Echo Reply in response to the Echo Request from REF-Host1.
9.	Disconnect TAR-Client1 from the Network 1.	After TAR-Client1 completes the reboot it should transmit a DHCPv6 Rebind message containing both the IA_NA and IA_PD. TAR-Server1 transmits a valid Reply message.
10.	Connect TAR-Client to the Network 1.	After TAR-Client1 reconnects to the network it should transmit a DHCPv6 Rebind message containing both the IA_NA and IA_PD. TAR-Server1 transmits a valid Reply message
11.	Wait for timer T1 (50s) to expire.	The TAR-Client1 sends a Renew message T1 (50) seconds after the reception of the

		Reply message from the TAR-Server1. The TAR-Client1 transmits a Renew message containing both the IA_NA and IA_PD. TAR-Server1 transmits a properly formatted Reply message in response to the Renew message.

Possible Problems: None.

Modification Record

Version 2.0.0a   March 10, 2020
- Reformatted to updated IPv6 Ready Logo Template.
- Added a Server must transmit a Reply to a Release message in 1.5.
- Moved Appendix to another document.
- Added Group 2 for the updates from merging 3315/3633/3736.
- Merged Group 4 into Group 1.
- Removed Group 2 and Group 5 (RFC 3646)
- Moved 3.1 to 1.7.
- Added 3.2 to 1.10.
- Added 3.3 to 1.11.

Version 1.1.1   January 14, 2020
- Removed Phase-2.
- Correct Appendix

Version 1.1.0   September 15, 2009
- Added Group 4 RFC 3633 and Group 5 RFC 3633 + RFC 3646
- Removed Relay-Agent Basic Message Exchanges that includes an Interface ID Option (*Advanced*) tests.

Version 1.0.5   August 1, 2009
- Updated Observable Results from Version 1.0.4 update.

Version 1.0.4   November 14, 2008
- Changed Observable Results to indicate the Confirm-Reply Message does not contain an IA Option. Applies to following Test Cases:
  - Client Initiated: Transmission of Confirm messages
  - Server Initiated: Transmission of Reply messages with NotOnLink
  - Relay-Agent Basic Message Exchanges (B)
  - ADVANCED - Relay-Agent Basic Message Exchanges that includes an Interface ID

<div align="center">Option (B)</div>

| Version 1.0.3 | August 7, 2008 |

- Cleaned up test setup on:
  - Relay Agent Basic Message Exchange with DNS Configuration Options
  - Relay Agent Basic Message Exchange with DNS Configuration Options and Interface ID Option
  - Layered Relay Agent Basic Message Exchange with DNS Configuration Options
- Fixed topology diagram for Layered Relay Agent Stateless DHCPv6 Basic Message Exchange with DNS Configuration Options part A and B.
- Fixed Appendix (added missing elements and reworded broken ones)
- Fixed Relay-Agent Basic Message Exchanges part F and Relay-Agent Basic Message Exchanges that includes an Interface ID Option part F by adding REF-Router1 so there is a route between networks.
- Fixed Relay-Agent Basic Message Exchanges that includes an Interface ID Option part F observable results.

| Version 1.0.2 | June 12, 2008 |

- Added Parts to "Layered Relay-Agent Basic Message Exchange," "Layered Relay-Agent Basic Message Exchange with DNS Configuration Options," and "Layered Relay-Agent Stateless DHCPv6 Basic Message Exchange with DNS Configuration Options" to test server vs. Relay, then two test to test relay vs relay
- Added a statement to all section 2 and 3 test setups binding "dhcpv6.test.example.com" to REF-DNS-Server1"
- Added a check for responses to Neighbor Solicitations to:
  - "Client Initiated: Transmission of Release Messages"
  - "Client Initiated: Transmission of Decline Messages"
  - "Relay-Agent Basic Message Exchange" part e and f
  - "Relay-Agent Basic Message Exchange that

includes and Interface ID Option" part e and
f

- Updated test "Layered Relay-Agent Basic Message
Exchange," "Layered Relay-Agent Basic Message
Exchange with DNS Configuration Options," and
"Layered Relay-Agent Stateless DHCPv6 Basic
Message Exchange with DNS Configuration
Options" to use REF-Client1 instead of TAR-
Client1
- Modified Test "Client Initiated: Transmission of
Decline Messages," "Relay-Agent Basic Message
Exchange" part f, and "Relay-Agent Basic Message
Exchange that includes and Interface ID Option" to
clarify addressing issues
- Modified Appendix to require test "Relay-Agent
Basic Message Exchange" to be run once per pair of
test partners instead of twice per pair.
- Updated "Client Initiated: Transmission of Confirm
messages" and "Client Initiated: Transmission of
Decline Messages" to allow for assumed status of
SUCCESS when no status code is present.
- Modified Required tests
  - Client no longer needs to run:
    - "Layered Relay-Agent Basic Message
Exchange"
    - "Layered Relay-Agent Basic Message
Exchange with DNS Configuration Options"
    - "Layered Relay-Agent Stateless DHCPv6
Basic Message Exchange with DNS
Configuration Options"
    - "Relay-Agent Basic Message Exchange that
includes an Interface ID Option"
    - "Relay-Agent Basic Message Exchange with
DNS Configuration Options that includes an
Interface ID Option"
    - "Stateless DHCPv6 Relay-Agent Basic
Message Exchange with DNS Configuration
Options that includes an Interface ID
Option"
  - Servers and Relay Agents are allowed to run
either:
    - "Relay-Agent Basic Message Exchange" or
"Relay-Agent Basic Message Exchange that

includes an Interface ID Option"
- "Relay-Agent Basic Message Exchange with DNS Configuration Options" or "Relay-Agent Basic Message Exchange with DNS Configuration Options that includes an Interface ID Option"
- "Stateless DHCPv6 Relay-Agent Basic Message Exchange with DNS Configuration Options" or "Stateless DHCPv6 Relay-Agent Basic Message Exchange with DNS Configuration Options that includes an Interface ID Option"

- Modified Appendix to reflect changed requirements
- Removed Interface ID check from "Stateless DHCPv6 Relay-Agent Basic Message Exchange with DNS Configuration Options"
- Fixed minor typos
- Fixed typos in Test "Layered Relay-Agent Basic Message Exchange with DNS Configuration Options" part Band D, "Transmission of Renew Messages for DNS Configuration Options" part B, and "Transmission of Rebind Messages for DNS Configuration Options" part B, "dhcpv6" was mistyped as "dhcpv6.test.example.com"
- Fixed typos in "Layered Relay-Agent Basic Message Exchange with DNS Configuration Options" part A and C, "dhcpv6.test.example.com" was mistyped as "dhcpv6"
- Added Copyright

Version 1.0.1   April 26, 2007
Version 1.0.0   April 25, 2007