IPv6 READY

Interoperability Test Scenario
6LoWPAN

Technical Document

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MODIFICATION RECORD

Version 1.0.0a1	January 7, 2014	Y. Li	• Created new test scenarios.

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TBD

INTRODUCTION

Overview

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. This logo program contributes to the feeling that IPv6 is available and ready to be used.

Abbreviations and Acronyms

DAD: Duplicate Address Detection
HUT: Host Under Test
MTU: Maximum Transmission Unit
NCE: Neighbor Cache Entry
NUT: Node Under Test
RUT: Router Under Test
TLLA: Target Link-layer Address
TN: Testing Node
TR: Testing Router
RS: Router Solicitation
RA: Router Advertisement
NS: Neighbor solicitation
NA: Neighbor advertisement
6CO: 6Lowpan Context Option.
ABRO: Authoritative Border Router Option
ARO: Address Registration Option
SLLA: Source Link-Layer Address
TLLA: Target Link-layer Address
PO: Prefix Option

Equipment Type

6LoWPAN Node (LN): A 6LoWPAN Node is any host or router participating in the LoWPAN. This term is used when referring to situations in which either a host or router can play the role described.

6LoWPAN Router (LR): An intermediate router in the LoWPAN who can communicate with other 6LoWPAN Node in the same LoWPAN. 6LoWPAN routers are present only in route-over topologies.

6LoWPAN Border Router (LBR): A border router located at the junction of separate 6LoWPAN networks or between a 6LoWPAN network and another IP network. There may be one or more 6LBRs at

the 6LoWPAN network boundary. A 6LBR is the responsible authority for IPv6 Prefix propagation for the 6LoWPAN network it is serving. An isolated LoWPAN also contains a 6LBR in the network, which provides the prefix(es) for the isolated network.

6LoWPAN Host: A host is participating in the LoWPAN who can communicate with other 6LoWPAN Node in the same LoWPAN.

ADVANCED FUNCTIONALITY TEST

The following test may be omitted if the NUT does not support the advanced functionalities.

TBD

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 and Title comprise the first line of the test block. The Test Label is composed of the short test suite name, the group number, and the test number within the group, separated by periods.

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.

Procedure: This section of the test description 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, which are interpreted in accordance with the observable results given for that test part.

Observable Results: This section lists observable results that can be examined by the tester to verify that the NUT is operating properly. When multiple observable results are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail for each test is usually based on how the NUT's behavior compares to the results described in this section.

Possible Problems: This 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:

[RFC 4944] Montenegro, G., N. Kushalnager, J. Hui, D. Culler, Transmission of IPv6 Packets over IEEE 802.15.4, RFC 4944, September 2007.

[RFC 6282] Hui, J., P. Thubert, Compression Format for IPv6 Datagrams over IEEE 802.15.4-Based Networks, RFC 6282, September 2011.

[RFC 6775] Shelby, Z., S. Chakrabarti, E. Nordmark, C. Bormann, Neighbor Discovery Optimization for IPv6 over Low-Power Wireless Personal Area Networks (6LoWPANs), RFC 6775, November 2012.

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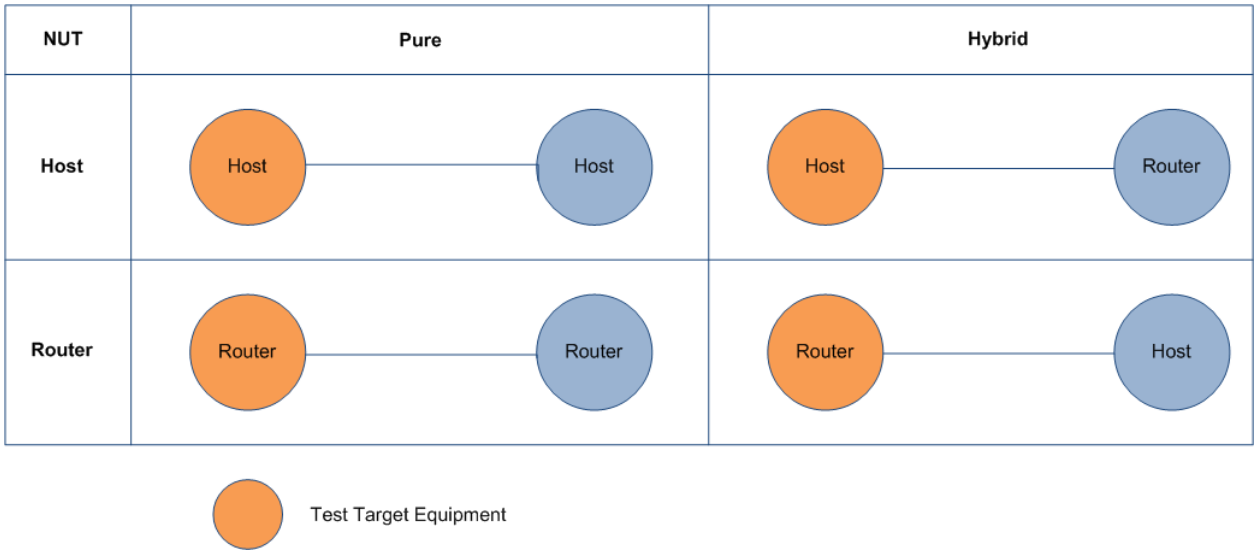
Common Topology

The following is the Common Topology used in all test cases.



NOTE:

- Procedures may use TN1 which is used to represent the following nodes in the topology: Host, Router.
- If the NUT is a Host, apply the topologies from the “Host” row according to the test setup in each test case.
- If the NUT is Router, apply the topologies from the “Router” row according to the test setup in each test case.

Common Test Setup

Tests in this test suite may refer to a common test setup procedure defined for this section. Unless otherwise stated in the test case. NUT basic requirements for this test suit are listed below:

1. Supports uncompressed IPv6 datagram.
2. IEEE802.15.4 settings:
    i Channel, modulation, data-rate (Channels 11-26 at 2.4 GHz).
    ii MAC mode is beaconless.
3. Security is off.

Common Test Cleanup (for all tests)

Summary: The Cleanup procedure should cause the NUT to transition Neighbor Cache entries created in this test to state INCOMPLETE and remove any entries from its Default Router and Prefix Lists.

General Node Requirements

- None.

Section 1: Frame Format

Scope

The following tests cover 6LoWPAN frame format.

Overview

The tests in this group verify that a node properly handle uncompressed 6LoWPAN packets.

Test 6LoWPANInterop.1.1: Uncompressed 6LoWPAN Packets (For EUI-64 address)

Purpose: Verify a NUT properly handles uncompressed 6LoWPAN packets.

References:

- [RFC 4944] – 5.1
- [RFC 4944] – 8

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Disable header compression on both TN1 and NUT.
2. Configure TN1 and NUT to use EUI-64 link-local address.
3. TN1 initiates an Echo Request message to NUT's link-local address.
4. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes.
5. Observe the packet received by NUT.
6. Observe the packet received by TN1.

Observable Results:

Step 5: The received packet at NUT is an uncompressed 6LoWPAN packet containing the Echo Request message to NUT's link-local address. The dispatch value in this 6LoWPAN packet is "01000001". Both source and destination addresses are EUI-64 link-local in this 6LoWPAN packet.

Step 6: The received packet at TN1 is an uncompressed 6LoWPAN packet containing the Echo Reply message to TN1's link-local address. The dispatch value in this 6LoWPAN packet is "01000001". Both source and destination addresses are EUI-64 link-local. The data in the Echo Reply message is identical to that in the Echo Request message.

Possible Problems:

- None.

Test 6LoWPANInterop.1.2: Uncompressed 6LoWPAN Packets (For 16-bit short address)

Purpose: Verify a NUT properly handles uncompressed 6LoWPAN packets.

References:

- [RFC 4944] – 5.1
- [RFC 4944] – 8

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Disable header compression on both TN1 and NUT.
2. Configure TN1 and NUT to use 16-bit link-local address.
3. TN1 initiates an Echo Request message to NUT's link-local address.
4. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes.
5. Observe the packet received by NUT.
6. Observe the packet received by TN1.

Observable Results:

Step 5: The received packet at NUT is an uncompressed 6LoWPAN packet containing the Echo Request message to NUT's link-local address. The dispatch value in this 6LoWPAN packet is "01000001". Both source and destination addresses are 16-bit short link-local in this 6LoWPAN packet.

Step 6: The received packet at TN1 is an uncompressed 6LoWPAN packet containing the Echo Reply message to TN1's link-local address. The dispatch value in this 6LoWPAN packet is "01000001". Both source and destination addresses are 16-bit short link-local. The data in the Echo Reply message is identical to that in the Echo Request message.

Possible Problems:

- None.

Test 6LoWPANInterop.1.3: Uncompressed 6LoWPAN packets (For EUI-64 address to 16-bit short address)

Purpose: Verify a NUT properly handles uncompressed 6LoWPAN packets.

References:

- [RFC 4944] – 5.1
- [RFC 4944] – 8

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Disable header compression on both TN1 and NUT.
2. Configure TN1 to use EUI-64 link-local address.
3. Configure NUT to use 16-bit link-local address.
4. TN1 initiates an Echo Request message to NUT's link-local address.
5. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes.
6. Observe the packet received by NUT.
7. Observe the packet received by TN1.

Observable Results:

Step 6: The received packet at NUT is an uncompressed 6LoWPAN packet containing the Echo Request message to NUT's link-local address. The dispatch value in this 6LoWPAN packet is "01000001". The source address is a EUI-64 link-local address, and the destination address is a 16 bit link-local address in this 6LoWPAN packet.

Step 7: The received packet at TN1 is an uncompressed 6LoWPAN packet containing the Echo Reply message to TN1's link-local address. The dispatch value in this 6LoWPAN packet is "01000001". The source address is a 16 bit link-local address, and the destination addresses a EUI-64 link-local address. The data in the Echo Reply message is identical to that in the Echo Request message.

Possible Problems:

- Some implementations cannot combine 16- and 64-bit addresses in one interchange.

Test 6LoWPANInterop.1.4: Uncompressed 6LoWPAN packets (For 16-bit short address to EUI-64 address)

Purpose: Verify a NUT properly handles uncompressed 6LoWPAN packets.

References:

- [RFC 4944] – 5.1
- [RFC 4944] – 8

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Disable header compression on both TN1 and NUT.
2. Configure TN1 to use 16-bit link-local address.
3. Configure NUT to use EUI-64 link-local address.
4. TN1 initiates an Echo Request message to NUT's link-local address.
5. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes.
6. Observe the packet received by NUT.
7. Observe the packet received by TN1.

Observable Results:

Step 6: The received packet at NUT is an uncompressed 6LoWPAN packet containing the Echo Request message to NUT's link-local address. The dispatch value in this 6LoWPAN packet is "01000001". The source address is a 16 bit link-local address, and the destination address is a EUI-64 link-local address in this 6LoWPAN packet.

Step 7: The received packet at TN1 is an uncompressed 6LoWPAN packet containing the Echo Reply message to TN1's link-local address. The dispatch value in this 6LoWPAN packet is "01000001". The source address is a EUI-64 link-local address, and the destination addresses a 16-bit link-local address. The data in the Echo Reply message is identical to that in the Echo Request message.

Possible Problems:

- Some implementations cannot combine 16- and 64-bit addresses in one interchange.

Test 6LoWPANInterop.1.5: Uncompressed 6LoWPAN Fragmented Packets

Purpose: Verify a NUT properly handles uncompressed 6LoWPAN fragmented packets.

References:

- [RFC 4944] – 5.1
- [RFC 4944] – 5.2

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Disable header compression on both TN1 and NUT.
2. TN1 initiates an Echo Request message to NUT's link-local address.
3. Set the payload of the ICMP message to 253 bytes, and the total size of the IPv6 message to 301 bytes.
4. Observe the packets received by TN1.
5. Observe the packets received by NUT.

Observable Results:

Step 4: The received packets at TN1 are a sequence of uncompressed 6LoWPAN packets containing the Echo Reply message from NUT to TN1 itself. The dispatch value in the first fragment starts with "11000", and the dispatch value in the following fragments starts with "11100". The offsets form a contiguous sequence. All fragments except the last one must be multiples of 8 bytes. The data in the Echo Reply message packets is identical to that in the Echo Request message packets.

Step 5: The received packets at NUT are a sequence of uncompressed 6LoWPAN packets containing the Echo Request fragments from TN1 to NUT itself. The dispatch value in the first fragment starts with "11000", and the dispatch value in the following fragments starts with "11100". The offsets form a contiguous sequence. All fragments except the last one must be multiples of 8 bytes. NUT correctly reassembles the Echo Request fragments received from TN1.

Possible Problems:

- None.

Test 6LoWPANInterop.1.6: Maximum Size Uncompressed 6LoWPAN Fragmented Packets

Purpose: Verify an NUT properly handles maximum size uncompressed 6LoWPAN fragmented packets.

References:

- [RFC 4944] – 5.1
- [RFC 4944] – 5.3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Disable header compression on both TN1 and NUT.
2. TN1 initiates an Echo Request message to NUT's link-local address.
3. Set the payload of the ICMP message to 1232 bytes, and the total size of the IPv6 message to 1280 bytes.
4. Observe the packets received by TN1.
5. Observe the packets received by NUT.

Observable Results:

Step 4: The received packets at TN1 are a sequence of uncompressed 6LoWPAN packets containing the Echo Reply message from NUT to TN1 itself. The dispatch value in the first fragment starts with "11000", and the dispatch value in the following fragments starts with "11100". The offsets form a contiguous sequence. All fragments except the last one must be multiples of 8 bytes. The data in the Echo Reply message packets is identical to that in the Echo Request message packets.

Step 5: The received packets at NUT are a sequence of uncompressed 6LoWPAN packets containing the Echo Request fragments from TN1 to NUT itself. The dispatch value in the first fragment starts with "11000", and the dispatch value in the following fragments starts with "11100". The offsets form a contiguous sequence. All fragments except the last one must be multiples of 8 bytes. NUT correctly reassembles the Echo Request fragments received from TN1.

Possible Problems:

- None.

Test 6LoWPANInterop.1.7: Uncompressed 6LoWPAN Multicast to All-nodes (For EUI-64 address)

Purpose: Verify a NUT properly handles uncompressed 6LoWPAN multicast to all-nodes.

References:

- [RFC 4944] – 5.1
- [RFC 4944] – 8

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Disable header compression on both TN1 and NUT.
2. Configure TN1 and NUT to use EUI-64 link-local address.
3. TN1 initiates an Echo Request message to the link-local all-node multicast address (FF02::1).
4. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes.
5. Observe the packet received by NUT.
6. Observe the packet received by TN1.

Observable Results:

Step 5: The received packet at NUT is an uncompressed 6LoWPAN packet containing the Echo Request message to NUT. The dispatch value in this 6LoWPAN packet is “01000001”.

Step 6: The received packet at TN1 is an uncompressed 6LoWPAN packet containing the Echo Reply message to TN1. The dispatch value in this 6LoWPAN packet is “01000001”. The data in the Echo Reply message is identical to that in the Echo Request message.

Possible Problems:

- None.

Test 6LoWPANInterop.1.8: Uncompressed 6LoWPAN Multicast to All-nodes (For 16-bit short address)

Purpose: Verify a NUT properly handles uncompressed 6LoWPAN multicast to all-nodes.

References:

- [RFC 4944] – 5.1
- [RFC 4944] – 8

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Disable header compression on both TN1 and NUT.
2. Configure TN1 and NUT to use 16-bit link-local address.
3. TN1 initiates an Echo Request message to the link-local all-node multicast address (FF02::1).
4. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes.
5. Observe the packet received by NUT.
6. Observe the packet received by TN1.

Observable Results:

Step 5: The received packet at NUT is an uncompressed 6LoWPAN packet containing the Echo Request message to NUT. The dispatch value in this 6LoWPAN packet is “01000001”.

Step 6: The received packet at TN1 is an uncompressed 6LoWPAN packet containing the Echo Reply message to TN1. The dispatch value in this 6LoWPAN packet is “01000001”. The data in the Echo Reply message is identical to that in the Echo Request message.

Possible Problems:

- None.

Section 2: Header Compression

Scope

The following tests cover 6LoWPAN header compression.

Overview

The tests in this group verify that a node properly handle compressed 6LoWPAN packets.

Test 6LoWPANInterop.2.1: Compressed 6LoWPAN Packets (For EUI-64 address and hop limit set to 64)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets.

References:

- [RFC 6282] – 3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Enable header compression on both TN1 and NUT.
2. Configure TN1 and NUT to use EUI-64 link-local address.
3. Configure TN1 and NUT with default hop limit to 64.
4. TN1 initiates an Echo Request message to NUT's link-local address.
5. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
6. Observe the packet received by NUT.
7. Observe the packet received by TN1.

Observable Results:

Step 6: The received packet at NUT is a compressed 6LoWPAN packet containing the Echo Request message to NUT. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Step 7: The received packet at TN1 is a compressed 6LoWPAN packet containing the Echo Reply message to TN1. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Possible Problems:

- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.2.2: Compressed 6LoWPAN Packets (For 16-bit short address and hop limit set to 64)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets.

References:

- [RFC 6282] – 3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Enable header compression on both TN1 and NUT.
2. Configure TN1 and NUT to use 16-bit short link-local address.
3. Configure TN1 and NUT with default hop limit to 64.
4. TN1 initiates an Echo Request message to NUT's link-local address.
5. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
6. Observe the packet received by NUT.
7. Observe the packet received by TN1.

Observable Results:

Step 6: The received packet at NUT is a compressed 6LoWPAN packet containing the Echo Request message to NUT. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Step 7: The received packet at TN1 is a compressed 6LoWPAN packet containing the Echo Reply message to TN1. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Possible Problems:

- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.2.3: Compressed 6LoWPAN Packets (For EUI-64 address and hop limit set to 63)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets.

References:

- [RFC 6282] – 3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Enable header compression on both TN1 and NUT.
2. Configure TN1 and NUT to use EUI-64 link-local address.
3. Configure TN1 and NUT with default hop limit to 63.
4. TN1 initiates an Echo Request message to NUT's link-local address.
5. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 63, no traffic class or flow label is being used.
6. Observe the packet received by NUT.
7. Observe the packet received by TN1.

Observable Results:

Step 6: The received packet at NUT is a compressed 6LoWPAN packet containing the Echo Request message to NUT. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 00 and the hop limit field is carried in-line, SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Step 7: The received packet at TN1 is a compressed 6LoWPAN packet containing the Echo Reply message to TN1. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 00 and the hop limit field is carried in-line, SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Possible Problems:

- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.2.4: Compressed 6LoWPAN Packets (For 16-bit short address and hop limit set to 63)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets.

References:

- [RFC 6282] – 3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Enable header compression on both TN1 and NUT.
2. Configure TN1 and NUT to use 16-bit link-local address.
3. Configure TN1 and NUT with default hop limit to 63.
4. TN1 initiates an Echo Request message to NUT's link-local address.
5. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 63, no traffic class or flow label is being used.
6. Observe the packet received by NUT.
7. Observe the packet received by TN1.

Observable Results:

Step 6: The received packet at NUT is a compressed 6LoWPAN packet containing the Echo Request message to NUT. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 00 and the hop limit field is carried in-line, SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Step 7: The received packet at TN1 is a compressed 6LoWPAN packet containing the Echo Reply message to TN1. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 00 and the hop limit field is carried in-line, SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Possible Problems:

- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.2.5: Compressed 6LoWPAN Packets (For EUI-64 address to 16-bit short address)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets.

References:

- [RFC 6282] – 3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Enable header compression on both TN1 and NUT.
2. Configure TN1 to use EUI-64 link-local address and NUT to use 16-bit link-local address.
3. Configure TN1 and NUT with default hop limit to 64.
4. TN1 initiates an Echo Request message to NUT's link-local address.
5. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
6. Observe the packet received by NUT.
7. Observe the packet received by TN1.

Observable Results:

Step 6: The received packet at NUT is a compressed 6LoWPAN packet containing the Echo Request message to NUT. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Step 7: The received packet at TN1 is a compressed 6LoWPAN packet containing the Echo Reply message to TN1. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Possible Problems:

- Some implementations cannot combine 16- and 64-bit addresses in one interchange.
- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.2.6: Compressed 6LoWPAN Packets (For 16-bit short address to EUI-64 address)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets.

References:

- [RFC 6282] – 3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under both Pure and Hybrid topologies in this test case.

Procedure:

1. Enable header compression on both TN1 and NUT.
2. Configure TN1 to use 16-bit link-local address and NUT to use EUI-64 link-local address.
3. Configure TN1 and NUT with default hop limit to 64.
4. TN1 initiates an Echo Request message to NUT's link-local address.
5. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
6. Observe the packet received by NUT.
7. Observe the packet received by TN1.

Observable Results:

Step 6: The received packet at NUT is a compressed 6LoWPAN packet containing the Echo Request message to NUT. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Step 7: The received packet at TN1 is a compressed 6LoWPAN packet containing the Echo Reply message to TN1. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 0, SAM is 11, DAC is 0 and DAM is 11.

Possible Problems:

- Some implementations cannot combine 16- and 64-bit addresses in one interchange.
- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.2.7: Compressed UDP Packets (For EUI-64 and server port 5683)

Purpose: Verify a NUT properly handles compressed UDP packets.

References:

- [RFC 6282] – 4.3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

1. Enable header compression on both Host and Router.
2. Configure the Host to use EUI-64 link-local address.
3. Install a CoAP Ping server on port 5683 on the Host.
4. The 6LR initiates a CoAP Ping Request to the Host's CoAP Ping server.
5. Observe the packet received by the Host.
6. Observe the packet received by the 6LR.

Observable Results:

Step 5: The Host receives a 6LoWPAN packet containing the CoAP Ping message from the 6LR. LOWPAN_IPHC is set. The LOWPAN_NHC is 111100**x**0, the source port is compressed to 8 bits (**x** = 1) or uncompressed (**x** = 0), the destination port is uncompressed 5683.

Step 6: The 6LR receives a 6LoWPAN packet containing the CoAP Reset message from the Host. LOWPAN_IPHC is set. The LOWPAN_NHC is 1111000**x**, the source port is uncompressed 5683, the destination port is compressed to 8 bits (**x** = 1) or uncompressed (**x** = 0).

Possible Problems:

- The LOWPAN_NHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.

Test 6LoWPANInterop.2.8: Compressed UDP Packets (For 16-bit short address and server port 5683)

Purpose: Verify a NUT properly handles compressed UDP packets.

References:

- [RFC 6282] – 4.3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

1. Enable header compression on both Host and Router.
2. Configure the Host to use 16-bit link-local address.
3. Install a CoAP Ping server on port 5683 on the Host.
4. The 6LR initiates a CoAP Ping Request to the Host's CoAP Ping server.
5. Observe the packet received by the Host.
6. Observe the packet received by the 6LR.

Observable Results:

Step 5: The Host receives a 6LoWPAN packet containing the CoAP Ping message from the 6LR. LOWPAN_IPHC is set. The LOWPAN_NHC is 111100**x**0, the source port is compressed to 8 bits (**x** = 1) or uncompressed (**x** = 0), the destination port is uncompressed 5683.

Step 6: The 6LR receives a 6LoWPAN packet containing the CoAP Reset message from the Host. LOWPAN_IPHC is set. The LOWPAN_NHC is 1111000**x**, the source port is uncompressed 5683, the destination port is compressed to 8 bits (**x** = 1) or uncompressed (**x** = 0).

Possible Problems:

- The LOWPAN_NHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.

Test 6LoWPANInterop.2.9: Compressed UDP Packets (For EUI-64 address and server port 61616)

Purpose: Verify a NUT properly handles compressed UDP packets.

References:

- [RFC 6282] – 4.3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

1. Enable header compression on both Host and Router.
2. Configure the Host to use EUI-64 link-local address.
3. Install a CoAP Ping server on port 61616 on the Host.
4. The 6LR initiates a CoAP Ping Request to the Host's CoAP Ping server.
5. Observe the packet received by the Host.
6. Observe the packet received by the 6LR.

Observable Results:

Step 5: The Host receives a 6LoWPAN packet containing the CoAP Ping message from the 6LR. LOWPAN_IPHC is set. The LOWPAN_NHC is 111100**x**1, the destination port is compressed to 4 bits of 0000 (**x** = 1) or 8 bits of 0xb0 (**x** = 0).

Step 6: The 6LR receives a 6LoWPAN packet containing the CoAP Reset message from the Host. LOWPAN_IPHC is set. The LOWPAN_NHC is 1111001**x**, the source port is compressed to 4 bits of 0000 (**x** = 1) or 8 bits of 0xb0 (**x** = 0).

Possible Problems:

- The LOWPAN_NHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.

Test 6LoWPANInterop.2.10: Compressed UDP Packets (For 16-bit short address and server port 61616)

Purpose: Verify a NUT properly handles compressed UDP packets.

References:

- [RFC 6282] – 4.3

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

1. Enable header compression on both Host and Router.
2. Configure the Host to use 16-bit link-local address.
3. Install a CoAP Ping server on port 61616 on the Host.
4. The 6LR initiates a CoAP Ping Request to the Host's CoAP Ping server.
5. Observe the packet received by the Host.
6. Observe the packet received by the 6LR.

Observable Results:

Step 5: The Host receives a 6LoWPAN packet containing the CoAP Ping message from the 6LR. LOWPAN_IPHC is set. The LOWPAN_NHC is 111100**x**1, the destination port is compressed to 4 bits of 0000 (**x** = 1) or 8 bits of 0xb0 (**x** = 0).

Step 6: The 6LR receives a 6LoWPAN packet containing the CoAP Reset message from the Host. LOWPAN_IPHC is set. The LOWPAN_NHC is 1111001**x**, the source port is compressed to 4 bits of 0000 (**x** = 1) or 8 bits of 0xb0 (**x** = 0).

Possible Problems:

- The LOWPAN_NHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.

Section 3: Neighbor Discovery

Scope

The following tests cover 6LoWPAN neighbor discovery.

Overview

The tests in this group verify that a node properly handle 6LoWPAN neighbor discovery.

Test 6LoWPANInterop.3.1: Register Global IPv6 Address (For EUI-64)

Purpose: Verify that a NUT is able to register its global IPv6 address.

References:

- [RFC 6775] – 10.2

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after the last part.

Test the NUT under Hybrid topology in this test case.

Procedure:

Part A: Register global IPv6 address

1. Enable header compression on both Host and Router.
2. Configure the Host to use EUI-64 link-local address.
3. Initialize the network interface of the Host.
4. Observe the $packet_1$ received by the Router.
5. Observe the $packet_1$ received by the Host.
6. Observe the $packet_2$ received by the Router.
7. Observe the $packet_2$ received by the Host.

Part B: Communicate through global IPv6 address

8. The Router initiates an Echo Request to the Host's new global address, using its own global address as the source.
9. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
10. Observe the packet received by the Host.
11. Observe the packet received by the Router.

Observable Results:

- *Part A*

  Step 4: The $packet_1$ received by the Router is a Router Solicitation message sent by the Host to all-routers multicast address with SLLAO set to EUI-64 and source address set to its EUI-64 link local address.

  Step 5: The $packet_1$ received by the Host is a unicast Router Advertisement message sent by the Router containing PIO and optionally 6CO, Host's link-local address is used and the L bit is not set. The Host configures its tentative global IPv6 address based on the PIO information in this Router Advertisement packet (EUI-64).

  Step 6: The $packet_2$ received by the Router is a Neighbor Solicitation message sent by the Host containing ARO and SLLAO with the source address set to GP64.

  Step 7: The $packet_2$ received by the Host is a Neighbor Advertisement message sent by the Router with Status set to 0 and destination address set to GP64. The Host updates the status of the tentative address.

- *Part B*

Step 10: The received packet at the Host is a compressed 6LoWPAN packet containing the Echo Request message to the Host. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away).
Step 11: The received packet at the Router is a compressed 6LoWPAN packet containing the Echo Reply message to the Router. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away).

Possible Problems:

- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.3.2: Register Global IPv6 Address (For 16-bit short address)

Purpose: Verify that a NUT is able to register its global IPv6 address.

References:

- [RFC 6775] – 10.2

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after the last part.

Test the NUT under Hybrid topology in this test case.

Procedure:

Part A: Register global IPv6 address

1. Enable header compression on both Host and Router.
2. Configure the Host to use 16-bit link-local address.
3. Initialize the network interface of the Host.
4. Observe the $packet_1$ received by the Router.
5. Observe the $packet_1$ received by the Host.
6. Observe the $packet_2$ received by the Router.
7. Observe the $packet_2$ received by the Host.

Part B: Communicate through global IPv6 address

8. The Router initiates an Echo Request to the Host's new global address, using its own global address as the source.
9. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
10. Observe the packet received by the Host.
11. Observe the packet received by the Router.

Observable Results:

- *Part A*

  Step 4: The $packet_1$ received by the Router is a Router Solicitation packet sent by the Host to all-routers multicast address with SLLAO set to EUI-64 and source address set to its EUI-64 link local address.

  Step 5: The $packet_1$ received by the Host is a unicast Router Advertisement packet sent by the Router containing PIO and optionally 6CO, Host's link-local address is used and the L bit is not set. The Host configures its tentative global IPv6 address based on the PIO information in this Router Advertisement packet (16-bit).

  Step 6: The $packet_2$ received by the Router is a Neighbor Solicitation packet sent by the Host containing ARO and SLLAO with the source address set to GP16.

  Step 7: The $packet_2$ received by the Host is a Neighbor Advertisement packet sent by the Router with Status set to 0 and destination address set to GP16. The Host updates the status of the tentative address.

- *Part B*

Step 10: The received packet at the Host is a compressed 6LoWPAN packet containing the Echo Request message to the Host. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away).
Step 11: The received packet at the Router is a compressed 6LoWPAN packet containing the Echo Reply message to the Router. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away).

Possible Problems:

- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.3.3: Behavior under Multiple Prefixes (For EUI-64)

Purpose: Verify a NUT properly behaves under multiple prefixes.

References:

- [RFC 4861] – 3.1

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after the last part.

Test the NUT under Hybrid topology in this test case.

Procedure:

Part A: Register global IPv6 address

1. Enable header compression on both Host and Router.
2. Configure the Host to use EUI-64 address.
3. Configure the Router with multiple prefixes.
4. Initialize the network interface of the Host.
5. Observe the $packet_1$ received by the Router.
6. Observe the $packet_1$ received by the Host.
7. Observe the $packet_2$ received by the Router.
8. Observe the $packet_2$ received by the Host.

Part B: Communicate through global IPv6 address

9. The Router initiates an Echo Request to one of the Host's new global addresses, using the appropriate own global address as the source.
10. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
11. Observe the packet received by the Host.
12. Observe the packet received by the Router.

Observable Results:

- *Part A*

  Step 5: The $packet_1$ received by the Router is a Router Solicitation message sent by the Host to all-routers multicast address with SLLAO set to EUI-64 and source address set to its EUI-64 link local address.

  Step 6: The $packet_1$ received by the Host is a unicast Router Advertisement message sent by the Router containing PIO with multiple prefixes and optionally 6COs, Host's link-local addresses are used and the L bit is not set. The Host configures a number of tentative global IPv6 address based on the PIO information in this Router Advertisement packet (EUI-64).

  Step 7: The $packet_2$ received by the Router is a Neighbor Solicitation message sent by the Host containing ARO and SLLAO with the source address set to GP64.

  Step 8: The $packet_2$ received by the Host is a Neighbor Advertisement message sent by the Router with Status set to 0 and destination address set to GP64. The Host updates the status of the tentative addresses.

- *Part B*

Step 11: The received packet at the Host is a compressed 6LoWPAN packet containing the Echo Request message to the Host. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away).
Step 12: The received packet at the Router is a compressed 6LoWPAN packet containing the Echo Reply message to the Router. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away).

Possible Problems:

- This test case is optional, as not all 6LRs and hosts allow multiple prefixes.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.3.4: Behavior under Multiple Prefixes (For 16-bit short address)

Purpose: Verify a NUT properly behaves under multiple prefixes.

References:

- [RFC 4861] – 3.1

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after the last part.

Test the NUT under Hybrid topology in this test case.

Procedure:

Part A: Register global IPv6 address

1. Enable header compression on both Host and Router.
2. Configure the Host to use 16-bit short address.
3. Configure the Router with multiple prefixes.
4. Initialize the network interface of the Host.
5. Observe the packet1 received by the Router.
6. Observe the packet1 received by the Host.
7. Observe the packet2 received by the Router.
8. Observe the packet2 received by the Host.

Part B: Communicate through global IPv6 address

9. The Router initiates an Echo Request to one of the Host's new global addresses, using the appropriate own global address as the source.
10. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
11. Observe the packet received by the Host.
12. Observe the packet received by the Router.

Observable Results:

- *Part A*

  Step 5: The $packet_1$ received by the Router is a Router Solicitation message sent by the Host to all-routers multicast address with SLLAO set to EUI-64 and source address set to its EUI-64 link local address.

  Step 6: The $packet_1$ received by the Host is a unicast Router Advertisement message sent by the Router containing PIO with multiple prefixes and optionally 6COs, Host's link-local addresses are used and the L bit is not set. The Host configures a number of tentative global IPv6 address based on the PIO information in this Router Advertisement packet (16-bit).

  Step 7: The $packet_2$ received by the Router is a Neighbor Solicitation message sent by the Host containing ARO and SLLAO with the source address set to GP16.

  Step 8: The $packet_2$ received by the Host is a Neighbor Advertisement message sent by the Router with Status set to 0 and destination address set to GP16. The Host updates the status of the tentative addresses.

- *Part B*

Step 11: The received packet at the Host is a compressed 6LoWPAN packet containing the Echo Request message to the Host. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away).
Step 12: The received packet at the Router is a compressed 6LoWPAN packet containing the Echo Reply message to the Router. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away).

Possible Problems:

- This test case is optional, as not all 6LRs and hosts allow multiple prefixes.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.3.5: NUD Behavior

Purpose: Verify a NUT can properly perform NUD behavior.

References:

- [RFC 6775] – 5.5

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

Part A: NUT is a Host

1. Enable header compression on both Host and Router.
2. Configure the Host to use EUI-64 address.
3. Turn on the Host and let it register its global address with the Router.
4. The Host sends a sequence of Echo Request to 2001:db8::1.
5. Observe the packet sent by the Host.

Part B: NUT is a 6LR (ICMP version)

6. Enable header compression on both Host and Router.
7. Configure the Host to use EUI-64 address.
8. Turn on the Host and let it register its global address with the Router.
9. Let the Router send a sequence of Echo Requests to the Host.
10. After 10 seconds, disable the Echo Reply function on the Host.
11. Observe the packet sent by the Router.

Part C: NUT is a 6LR (UDP version)

12. Enable header compression on both Host and Router.
13. Configure the Host to use EUI-64 address.
14. Install a CoAP Ping server on port 5683 of the Host.
15. Turn on the Host and let it register its global address with the Router.
16. Let the Router send a sequence of CoAP pings to the Host.
17. After 10 seconds, disable the CoAP server function on the Host.
18. Observe the packet sent by the Router.

Observable Results:

- *Part A*
  Step 5: The Host sends a unicast Neighbor Solicitation message to the Router to perform NUD.
- *Part B*
  Step 11: The Router sends a unicast Neighbor Solicitation message to the Host to perform NUD.
- *Part C*
  Step 15: The Router sends a unicast Neighbor Solicitation message to the Host to perform NUD.

Possible Problems:

- Part B is optional, since not all hosts allow disabling Echo Reply function.
- Part C is optional, since not all hosts allow disabling CoAP server function.

Section 4: Combined Neighbor Discovery and Header Compression

Scope

The following tests cover 6LoWPAN support of combination of neighbor discovery and header compression.

Overview

The tests in this group verify that a 6LoWPAN device that supports header compression properly supports the combination use of the header compression and neighbor discovery.

Test 6LoWPANInterop.4.1: Make Use of Context 0 (For EUI-64)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets with context 0.

References:

- [RFC 6775] – 5.4
- [RFC 6282] – 3.1.1

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

1. Enable header compression on both Host and Router.
2. Configure Host and Router to use EUI-64 address.
3. Configure Host and Router with default hop limit to 64.
4. Set up Host with Router and Host receives context 0 for the global prefix.
5. Host initiates an Echo Request message to Router's GP64 address.
6. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
7. Observe the packet received by Router.
8. Observe the packet received by Host.

Observable Results:

Step 7: The received packet at Router is a compressed 6LoWPAN packet containing the Echo Request message to Router. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 1, SAM is 01, DAC is 1, DAM is 11, and the context identifier extension is not present (CID = 0).

Step 8: The received packet at Host is a compressed 6LoWPAN packet containing the Echo Reply message to Host. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, HLIM is 10 (the hop limit field is compressed away), SAC is 1, SAM is 01, DAC is 1, DAM is 11, and the context identifier extension is not present (CID = 0).

Possible Problems:

- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.4.2: Make Use of Context 0 (For 16-bit short address)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets with context 0.

References:

- [RFC 6775] – 5.4
- [RFC 6282] – 3.1.1

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

1. Enable header compression on both Host and Router.
2. Configure Host and Router to use 16-bit short address.
3. Configure Host and Router with default hop limit to 64.
4. Set up Host with Router and Host receives context 0 for the global prefix.
5. Host initiates an Echo Request message to Router's GP16 address.
6. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
7. Observe the packet received by Router.
8. Observe the packet received by Host.

Observable Results:

Step 7: The received packet at Router is a compressed 6LoWPAN packet containing the Echo Request message to Router. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 1, SAM is 10, DAC is 1, DAM is 11, and the context identifier extension is not present (CID = 0).

Step 8: The received packet at Host is a compressed 6LoWPAN packet containing the Echo Reply message to Host. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, HLIM is 10 (the hop limit field is compressed away), SAC is 1, SAM is 10, DAC is 1, DAM is 11, and the context identifier extension is not present (CID = 0).

Possible Problems:

- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.4.3: Make Use of Context Not Equal to 0 (For EUI-64)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets with context not equal to 0.

References:

- [RFC 6775] – 5.4
- [RFC 6282] – 3.1.2

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

1. Enable header compression on both Host and Router.
2. Configure Host and Router to use EUI-64 address.
3. Configure Host and Router with default hop limit to 64.
4. Set up Host with Router and Host receives context not equal to 0 for the global prefix.
5. Host initiates an Echo Request message to Router's GP64 address.
6. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
7. Observe the packet received by Router.
8. Observe the packet received by Host.

Observable Results:

Step 7: The received packet at Router is a compressed 6LoWPAN packet containing the Echo Request message to Router. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 1, SAM is 01, DAC is 1, DAM is 11, and a Context Identifier Extension (CID) is used for this.

Step 8: The received packet at Host is a compressed 6LoWPAN packet containing the Echo Reply message to Host. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, HLIM is 10 (the hop limit field is compressed away), SAC is 1, SAM is 01, DAC is 1, DAM is 11, and a Context Identifier Extension (CID) is used for this.

Possible Problems:

- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.

Test 6LoWPANInterop.4.4: Make Use of Context Not Equal to 0 (For 16-bit short address)

Purpose: Verify a NUT properly handles compressed 6LoWPAN packets with context not equal to 0.

References:

- [RFC 6775] – 5.4
- [RFC 6282] – 3.1.2

Test Setup: The network is setup according to Common Topology. Common Test Setup is performed at the beginning of this test part. The Common Test Cleanup procedure is performed after each part.

Test the NUT under Hybrid topology in this test case.

Procedure:

1. Enable header compression on both Host and Router.
2. Configure Host and Router to use 16-bit short address.
3. Configure Host and Router with default hop limit to 64.
4. Set up Host with Router and Host receives context not equal to 0 for the global prefix.
5. Host initiates an Echo Request message to Router's GP16 address.
6. Set the payload of the ICMP message to 4 bytes, and the total size of the IPv6 message to 52 bytes. The Hop Limit is 64, no traffic class or flow label is being used.
7. Observe the packet received by Router.
8. Observe the packet received by Host.

Observable Results:

Step 7: The received packet at Router is a compressed 6LoWPAN packet containing the Echo Request message to Router. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, TF is 11 (the ECN, DSCP and FLOW LABEL fields are compressed away), HLIM is 10 (the hop limit field is compressed away), SAC is 1, SAM is 10, DAC is 1, DAM is 11, and a Context Identifier Extension (CID) is used for this.

Step 8: The received packet at Host is a compressed 6LoWPAN packet containing the Echo Reply message to Host. The dispatch value in this 6LoWPAN packet is "011TFxHL". In the LOWPAN_IPHC, HLIM is 10 (the hop limit field is compressed away), SAC is 1, SAM is 10, DAC is 1, DAM is 11, and a Context Identifier Extension (CID) is used for this.

Possible Problems:

- The LOWPAN_IPHC fields checking tests whether the best compression is used, but it is not a requirement for interoperability.
- The Echo Reply message might use a different hop limit in some implementations, and then the HLIM value might be different.