Moonv6 Test Suite

Routing Convergence
Interoperablility Test Suite

Technical Document

Revision 0.2

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TABLE OF CONTENTS

MODIFICATION RECORD

Draft Version Complete	March 1, 2004
Version 0.2 Complete	March 3, 2004, Updated the OSPF tests, rewrote the BGP test (1.5).

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Eric Barrett	University of New Hampshire
Kari Revier	University of New Hampshire
Benjamin Schultz	University of New Hampshire

INTRODUCTION

Overview

The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards-based products by providing an environment where a product can be tested against other implementations of a standard. This suite of tests has been developed to help implementers evaluate the functioning of their Internet Protocol, version 6 capable products. The tests do not determine if a product conforms to the IPv6 routing specifications, nor are they purely interoperability tests. Rather, they provide one method to isolate problems within a device. Successful completion of all tests contained in this suite does not guarantee that the tested device will interoperate with other IPv6 devices. However, combined with satisfactory operation in the IOL's semi-production environment, these tests provide a reasonable level of confidence that the Router Under Test will function well in many multi-vendor IPv6 environments.

The definition of "convergence" for this test suite means that the traffic flow from ingress to egress is restored after the primary link that the traffic flow was upon is altered due to a change in topology.

The tests in this suite are written in a generic manner that does not define the specific speed of different link types. When traffic is passed through the network to measure convergence times, it is assumed that the network will converge from the time the first egress data packet is dropped until the next egress data packet is received. It should be remembered that the faster traffic is passed through the network, the higher resolution of convergence time will be produced. These tests will be optimal if performed on the same link type, but it is not a requirement.

Acronyms

ABR: **A**rea **B**order **R**outer	**AS:** **A**utonomous **S**ystem	**MED:** **M**ulti-**E**xit **D**iscriminator
RD: **R**oute **D**istinguisher	**RT:** **R**oute **T**arget	
RUT: **R**outer **U**nder **T**est	**TR:** **T**esting **R**outer	**G:** Traffic **G**enerator

When several entities of the same type are present in a test configuration, a number is appended to the acronym to yield a label for each entity. For example, if there were three testing routers in the test configuration, they would be labeled TR1, TR2 and TR3.

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 by concatenating the short test suite name, the group number, and the test number within the group, separated by periods. The Test Number is the group and test number, also separated by a period. So, test label CONV.1.2 refers to the second test of the first test group in the routing convergence test suite. The test number is 1.2.
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.
Resource Requirements:	The Resource Requirements section specifies the software, hardware, and test equipment that will be needed to perform the test.
Discussion:	The Discussion is a general discussion of the test and relevant section of the specification, including any assumptions made in the design or implementation of the test as well as known limitations.
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:	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 packet 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 RUT 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 RUT'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 this text:

Test CONV.1.1: Basic OSPFv3 Convergence

Purpose: To verify that OSPF convergence can occur when the network topology changes.

References:

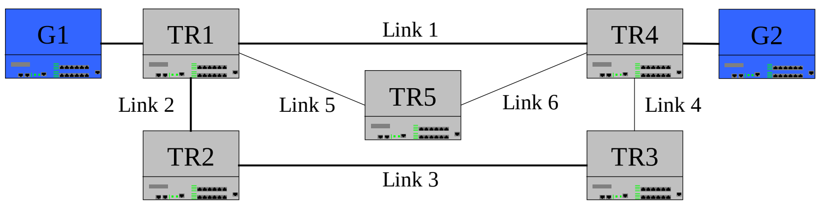
Resource Requirements:

- Monitor to capture packets

Last Modification: March 3, 2004

Discussion: Routing protocols share link information to determine the best path through the network. When the topology changes, routing protocols update their tables to reflect the change and optimize traffic flow.

Test Setup: Connect the network as described in the figure below. Enable OSPF, set all link costs to 4 and all routers to be in area 0.



Procedure:
Part A: Link Cost Change

1. Pass continuous IPv6 traffic from G1 to G2 and from G2 to G1.
2. On TR1 and TR4, change the cost from 4 to 40 for Link 1.
3. Allow the network to converge and observe the egress data traffic.
4. On TR1 and TR4, change the cost from 40 to 4 for Link 1.
5. Allow the network to converge and observe the egress data traffic.

Part B: Link Down

6. Pass continuous IPv6 traffic from G1 to G2 and from G2 to G1.
7. Disconnect Link 1.
8. Allow the network to converge and observe the egress data traffic.
9. Reconnect Link 1.
10. Allow the network to converge and observe the egress data traffic.

Observable Results:

- In Part A, when the metric is set to 40, IPv6 traffic flow changes from (TR1-TR4) to (TR1-TR5-TR4). When the cost is restored, traffic flow is restored to its original path (TR1-TR4).
- In Part B, when Link 1 is disconnected, IPv6 traffic flow changes from (TR1-TR4) to (TR1-TR5-TR4). When link 1 is reconnected, traffic flow is restored to its original path (TR1-TR4).

Possible Problems: None.

Test CONV.1.2: OSPFv2 and OSPFv3 Convergence

Purpose: To verify that OSPF convergence can occur when the network topology changes.

References:

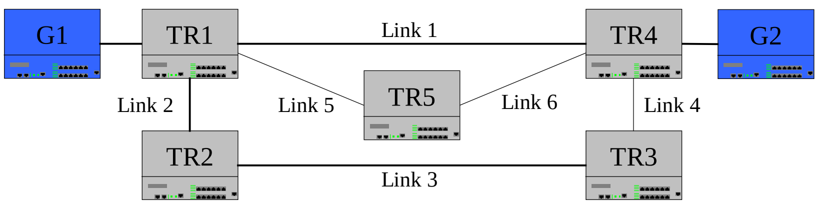
Resource Requirements:

- Monitor to capture packets

Last Modification: March 3, 2004

Discussion: Routing protocols share link information to determine the best path through the network. When the topology changes, routing protocols update their tables to reflect the change and optimize traffic flow. OSPFv2 and OSPFv3 are two separate protocols that route IPv4 and IPv6 traffic respectively. These protocols use separate software processes and should operate like "ships in the night", in that they do not interfere with each other.

Test Setup: Connect the network as described in the figure below. Enable OSPF, set all link costs to 4 for OSPFv2 and OSPFv3 and all routers to be in area 0.



Procedure:

Part A: Link Cost Change, same topologies

1. Pass continuous IPv4 and IPv6 traffic from G1 to G2 and from G2 to G1.
2. On TR1 and TR4, change the cost from 4 to 40 for Link 1.
3. Allow the network to converge and observe the egress data traffic.
4. On TR1 and TR4, change the cost from 40 to 4 for Link 1.
5. Allow the network to converge and observe the egress data traffic.

Part B: Link Down, same topologies

6. Pass continuous IPv4 and IPv6 traffic from G1 to G2 and from G2 to G1.
7. Disconnect Link 1.
8. Allow the network to converge and observe the egress data traffic.
9. Reconnect Link 1.
10. Allow the network to converge and observe the egress data traffic.
11. Observe the packets received on G1 and G2.

Part C: Link Cost Change, different topologies

12. Ensure IPv6 is disabled on TR5.
13. Pass continuous IPv4 and IPv6 traffic from G1 to G2 and from G2 to G1.
14. On TR1 and TR4, change the cost from 4 to 40 for Link 1.
15. Allow the network to converge and observe the egress data traffic.
16. On TR1 and TR4, change the cost from 40 to 4 for Link 1.
17. Allow the network to converge and observe the egress data traffic.
18. Observe the packets received on G1 and G2.

Part D: Link Down, different topologies

19. Ensure IPv6 is disabled on TR5.
20. Pass continuous IPv4 and IPv6 traffic from G1 to G2 and from G2 to G1.
21. Disconnect Link 1.
22. Allow the network to converge and observe the egress data traffic.
23. Reconnect Link 1.
24. Allow the network to converge and observe the egress data traffic.
25. Observe the packets received on G1 and G2.

Observable Results:

- In Parts A and B, when the topology changes, IPv4 and IPv6 traffic flow changes from (TR1-TR4) to (TR1-TR5-TR4). When the link or cost is restored, traffic flow is restored to its original path (TR1-TR4).
- In Parts C and D, when the topology changes, IPv4 traffic flow changes from (TR1-TR4) to (TR1-TR5-TR4). IPv6 traffic flow changes from (TR1-TR4) to (TR1-TR2-TR3-TR4). When the link or cost is restored, traffic flow is restored to its original path (TR1-TR4).

Possible Problems: None.

Test CONV.1.3: Multi-Area OSPFv3 Convergence

Purpose: To verify that OSPF convergence can occur when the network topology changes.

References:

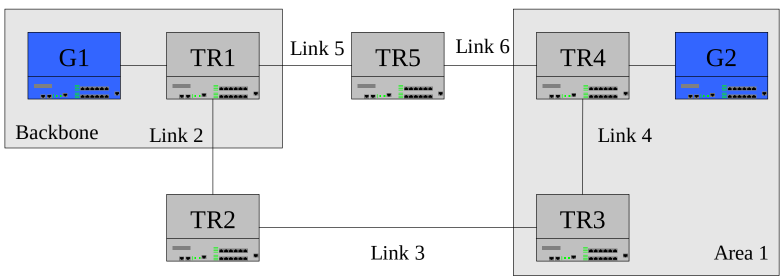
Resource Requirements:

- Monitor to capture packets

Last Modification: March 3, 2004

Discussion: Routing protocols share link information to determine the best path through the network. When the topology changes, routing protocols update their tables to reflect the change and optimize traffic flow. OSPFv2 and OSPFv3 are two separate protocols that route IPv4 and IPv6 traffic respectively. These protocols use separate software processes and should operate like "ships in the night", in that they do not interfere with each other.

Test Setup: Connect the network as described in the figure below. Enable OSPF, set all link costs to 4 for OSPFv2 and OSPFv3. Configure TR1 to be in area 0. Configure TR3 and TR4 to be in area 1. Configure TR2 and TR5 to be ABRs between area 0 and area 1.



Procedure:

Part A: Link Cost Change, same topologies

1. Pass continuous IPv4 and IPv6 traffic from G1 to G2 and from G2 to G1.
2. On TR1 and TR5, change the cost from 4 to 40 for Link 5.
3. Allow the network to converge and observe the egress data traffic.
4. On TR1 and TR5, change the cost from 40 to 4 for Link 5.
5. Allow the network to converge and observe the egress data traffic.

Part B: Link Down, same topologies

6. Pass continuous IPv4 and IPv6 traffic from G1 to G2 and from G2 to G1.
7. Disconnect Link 5.
8. Allow the network to converge and observe the egress data traffic.
9. Reconnect Link 5.
10. Allow the network to converge and observe the egress data traffic.

Observable Results:

- In Parts A and B, when the topology changes, IPv4 and IPv6 traffic flow changes from (TR1-TR5-TR4) to (TR1-TR2-TR3-TR4). When the link or cost is restored, traffic flow is restored to its original path (TR1-TR5-TR4).

Possible Problems: None.

Test CONV.1.4: Virtual Link OSPFv3 Convergence

Purpose: To verify that OSPF convergence can occur over a virtual link.

References:

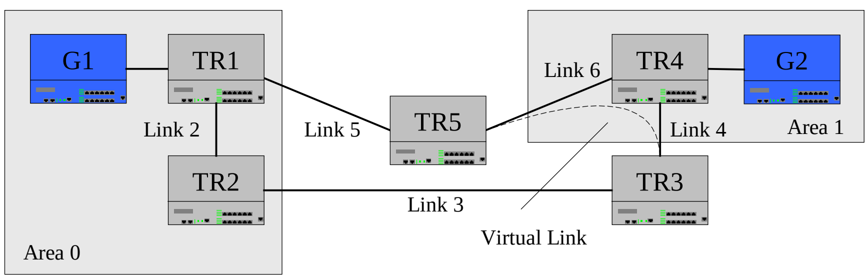
Resource Requirements:

- Monitor to capture packets

Last Modification: March 3, 2004

Discussion: Routing protocols share link information to determine the best path through the network. When the topology changes, routing protocols update their tables to reflect the change and optimize traffic flow. OSPFv2 and OSPFv3 are two separate protocols that route IPv4 and IPv6 traffic respectively. These protocols use separate software processes and should operate like "ships in the night", in that they do not interfere with each other.

Test Setup: Connect the network as described in the figure below. Enable OSPF, set all link costs to 4 for OSPFv2 and OSPFv3. Configure TR1 and TR2 to be in area 0. Configure TR4 to be in area 1. Configure TR5 and TR3 to be ABRs between areas 0 and 1, with a virtual link connecting them together.



Procedure:
Part A: Link Cost Change
1. Pass continuous IPv4 and IPv6 traffic from G1 to G2 and from G2 to G1.
2. On TR1 and TR5, change the cost from 4 to 40 for Link 5.
3. Allow the network to converge and observe the egress data traffic.
4. On TR1 and TR5, change the cost from 40 to 4 for Link 5.
5. Allow the network to converge and observe the egress data traffic.

Part B: Link Down
6. Pass continuous IPv4 and IPv6 traffic from G1 to G2 and from G2 to G1.
7. Disconnect Link 5.
8. Allow the network to converge and observe the egress data traffic.
9. Reconnect Link 5.
10. Allow the network to converge and observe the egress data traffic.

Observable Results:
- In Parts A and B, when the topology changes, IPv4 and IPv6 traffic flow changes from (TR1-TR5-TR4) to (TR1-TR2-TR3-TR4) over the virtual link. When the link or cost is restored, traffic flow is also restored to its original path (TR1-TR5-TR4).

Possible Problems: None.

Test CONV.1.5: Basic BGP4+ Convergence

Purpose: To verify that BGP4+ Convergence can occur when the network topology changes.

References:

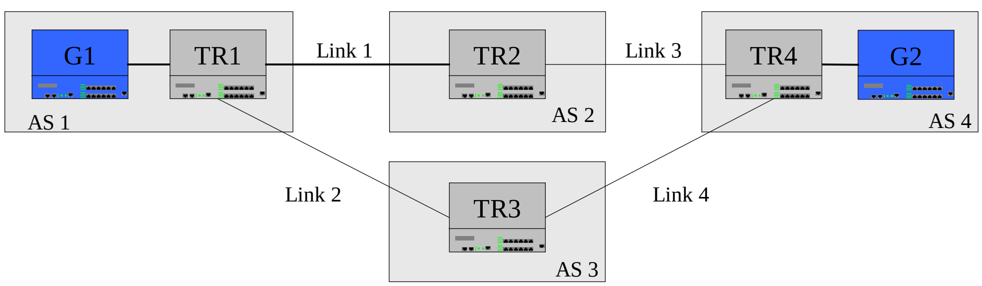
Resource Requirements:

- Monitor to capture packets

Last Modification: March 3, 2004

Discussion: Routing protocols share link information to determine the best path through the network. When the topology changes, routing protocols update their tables to reflect the change and optimize traffic flow.

Test Setup: Connect the network as described in the figure below. Enable BGP and configure each router to be in the proper AS. TR4 advertises an MED of 1 to TR3 and an MED of 5 to TR2.



Procedure:

Part A: Link Cost Change

1. Pass continuous IPv6 traffic from G1 to G2 and from G2 to G1.
2. TR4 advertises MED of 10 to TR3 for its path to G2.
3. Allow the network to converge and observe the egress data traffic.
4. TR4 advertises an MED of 1 to TR3 for its path to G2.
5. Allow the network to converge and observe the egress data traffic.

Part B: Link Down

6. Pass continuous IPv6 traffic from G1 to G2 and from G2 to G1.
7. Disconnect Link 1.
8. Allow the network to converge and observe the egress data traffic.
9. Reconnect Link 1.
10. Allow the network to converge and observe the egress data traffic.

Observable Results:

- In Parts A and B, when the topology changes, IPv6 traffic flow changes from (TR1-TR3-TR4) to (TR1-TR2-TR4). When the link or cost is restored, traffic flow is also restored to its original path.

Possible Problems: None.