ROUTING CONSORTIUM

Routing Information Protocol Version 2 (RIP)
Multi-System Interoperability Test Suite

Technical Document

Revision 2.2

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TABLE OF CONTENTS

MODIFICATION RECORD ii

INTRODUCTION iv

REFERENCES vi

Common Topology 1

Common Test Setup 2

Common Test Setup 2
Common Test Cleanup (for all tests) 2

Group 1: RIPv2 Interoperability 3

Test RIP_INTEROP.1.1: Route Origination 4
Test RIP_INTEROP.1.2: Route Learning and Propagation 6
Test RIP_INTEROP.1.3: Routing Convergence and Calculation 8
Test RIP_INTEROP.1.4: Message Authentication 10

MODIFICATION RECORD

Version 2.2 — July 23, 2008
- Added Host Route Tests to Test Route Origination, and Test Route Learning and Propagation

Version 2.1 — September 18, 2007
- Fixed test 1.1C to send an Echo Request to TN3 instead of TN4
- Fixed test 1.1B and C observable results

Version 2.0 — December 1, 2006
- Reworked all the tests to use a Common Topology and test setup
- Combined tests 1.4 and 1.5 (now 1.3)
- Moved Authentication (1.3) to the end (now 1.4)

Version 1.1 — June 5, 2006
- Updated pictures
- Enhanced readability
- Minor formatting and numerous corrections.

Version 1.0 — July 16, 2004
- Reorganized network setups for all tests
- Updated document layout
- Added Test 1.5 Routing Calculation
- Minor formatting and numerous corrections

Version 0.5 — July 26, 2003
- Reorganized network setups for all tests.
- Numerous corrections.

Version 0.4 — December 2, 2001
- Simplified network setups for tests 1 and 2
- Reworked tests 1 and 2 to use one TR at a time

Version 0.3 — October 23, 2001
- Numerous corrections
- First available draft version

Version 0.2 — October 22, 2001
- Renumbered network elements for consistency between diagrams
- Minor formatting and numerous corrections

Version 0.1 — October 18, 2001
- Initial Version

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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 functionality of their RIP based products. This test suite has been designed to test interoperability of the device under test with other RIP capable devices. This test suite focuses on testing configurations of the network that could cause problems when deployed if the device under test does not operate properly with the devices that it is connected to.

The tests do not determine if a product conforms to the RIP standard but they are designed as interoperability tests. These tests provide one method to isolate problems within the RIP capable device that will affect the interoperability performance. Successful completion of all tests contained in this suite does not guarantee that the tested device will operate with other RIP capable devices. However, these tests do provide a reasonable level of confidence that the RUT will function well in most RIP environments.

Test Software

The UNH IOL Testing Software is not a RIP implementation; it is simply a packet generator that can transmit and receive packets. This allows the Testing Node to generate invalid packets and to simulate parts of the Router Information Protocol. The Testing Software is not currently available to the public.

Abbreviations and Acronyms

TN: **T**esting **N**ode
TR: **T**esting **R**outer

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 RIP_INTEROP.1.2 refers to the second test of the first test group in the RIP InterOperability 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:

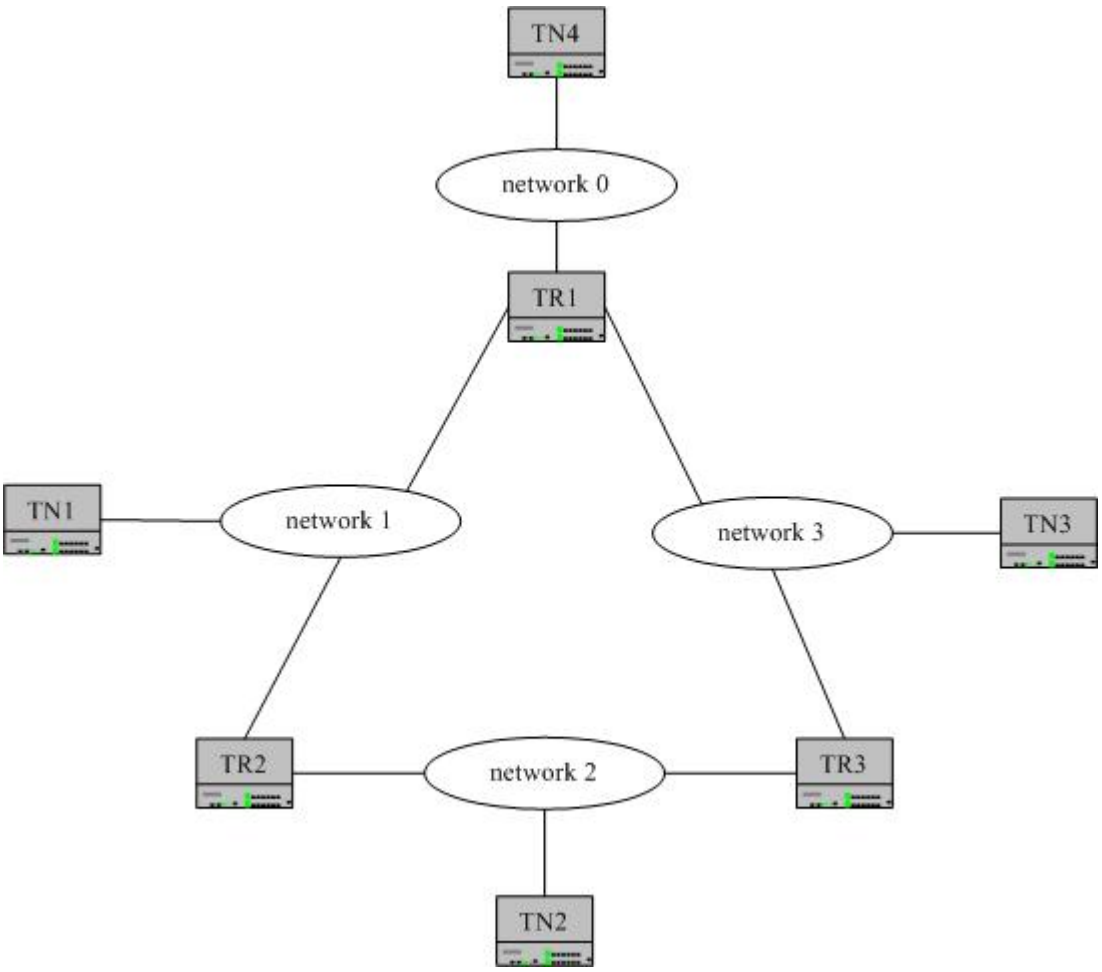
- [1812] Baker, F. "Requirements for IP Version 4 Routers." RFC 1812. Cisco Systems, June 1995.

- [2082] Baker, F. and Atkinson, R. "RIP-2 MD5 Authentication." RFC 2082. Cisco Systems, January 1997.

- [2453] Malkin, G. "RIP Version 2." STD 56. RFC 2453. November 1998

Common Topology

This topology is used for all tests in this test suite.



Common Test Setup

Test in this test suite may refer common test setup procedure defined for this section.

Common Test Setup

Summary: This minimal setup procedure provides the routers with routes to all networks on the Common Topology

1. Configure TR3 interfaces on network 2 and network 3 to have a metric of 2.
2. Enable RIP on TR1, TR2, and TR3.
3. Wait for the devices synchronize.

Common Test Cleanup (for all tests)

Summary: The cleanup procedure causes the devices to remove any RIP information.

1. Disable RIP on all devices.
2. Remove any special configurations not specified in the common test setup.

Group 1: RIPv2 Interoperability

Scope

Tests in this group verify that the devices are able to engage in various aspects of the RIPv2 protocol.

Overview

The following tests verify operations such as Route Origination, Route Learning and Propagation, routing convergence, routing calculation, and message authentication.

Test RIP_INTEROP.1.1: Route Origination

Purpose: To verify that a router correctly communicates RIP routes to other routers on the network running RIP, including routes for directly attached networks and redistributed static routes.

References:

- [2453] – Sections 3 and 4
- [1812] – Section 5.2

Discussion: This test verifies that the TR's can successfully communicate route information to other routers with which it shares a link. A router should be able to communicate several different kinds of routes to its peers, including routes to directly connected networks, aggregated (supernet) routes, and default routes. Route tag, next hop, and metric information should be correctly originated in all cases.

Test Setup: Common Test Setup is performed at the beginning of each part. Disable TR3 for this test. Configure TR1 to not advertise its connection to network 3. Common Test Cleanup is performed after each part.

Procedure:

Part A: Network Route Advertisement

1. TN2 transmits an ICMP Echo Request with destination IP address for TN4 to the link layer address of TR2.
2. Observe the traffic transmitted on all networks.

Part B: Default Route Advertisement

3. Configure TR1 to have a default route to TN3.
4. Configure TR1 to advertise a default route.
5. Wait for the devices to synchronize.
6. TN2 transmits an ICMP Echo Request with destination IP address for TN3 to the link layer address of TR2.
7. Observe the traffic transmitted on all networks.

Part C: Aggregate Route Forwarding

8. Configure TR1 to advertise a network range containing network 3.
9. Wait for the devices to synchronize.
10. TN2 transmits an ICMP Echo Request with destination IP address for TN3 to the link layer address of TR2.
11. Observe the traffic transmitted on all networks.

Part D: Host Route Advertisement

12. Configure TR1 not to advertise its connection to network 3.
13. Configure TR1 to have a host route to TN3.
14. Configure TR1 to advertise the host route.
15. Wait for the devices to synchronize.
16. TN2 transmits an ICMP Echo Request with destination IP address for TN3 to the link layer address of TR2.
17. Observe the traffic transmitted on all networks.

Observable Results:

Part A:

Step 2: TR2 forwards the ICMP Echo Request to TR1 on Network 1. TR1 then forwards the ICMP Echo Request to TN4 on network 0.

Parts B, C, and D

Step 7, 11, and 17 TR2 forwards the ICMP Echo Request to TR1 on Network 1. TR1 then forwards the ICMP Echo Request to TN3 on network 3.

Possible Problems:

- None.

Test RIP_INTEROP.1.2: Route Learning and Propagation

Purpose: To verify that a router can interoperate with other RIP implementations.

References:

- [2453] – Sections 3 and 4
- [1812] – Section 5.2

Discussion: This test verifies that the TR's can successfully learn and propagate route information from other routers with which it shares a link.

Test Setup: Common Test Setup is performed at the beginning of each part. Disable TR2's interface on network 2. Configure TR3 to not advertise its connection to network 2. Common Test Cleanup is performed after each part.

Procedure:

Part A: Default Route Processing

1. Configure TR3 to have a default route to TN2.
2. Configure TR3 to advertise a default route.
3. Wait for the devices to synchronize.
4. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
5. Observe the traffic transmitted on all networks.

Part B: Default Route Forwarding

6. Configure TR3 to have a default route to TN2.
7. Configure TR3 to advertise a default route.
8. Wait for the devices to synchronize.
9. TN1 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR2.
10. Observe the traffic transmitted on all networks.

Part C: Aggregate Route Processing

11. Configure TR3 to advertise a network range containing network 2.
12. Wait for the devices to synchronize.
13. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
14. Observe the traffic transmitted on all networks.

Part D: Aggregate Route Forwarding

15. Configure TR3 to advertise a network range containing network 2.
16. Wait for the devices to synchronize.
17. TN1 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR2.
18. Observe the traffic transmitted on all networks.

Part E: Host Route Processing

19. Configure TR3 not to advertise its connection to network 2.
20. Configure TR3 to have a host route to TN2.
21. Configure TR3 to advertise the host route.

22. Wait for the devices to synchronize.
23. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
24. Observe the traffic transmitted on all networks.

Part F: Host Route Forwarding

25. Configure TR3 not to advertise its connection to network 2.
26. Configure TR3 to have a host route to TN2.
27. Configure TR3 to advertise a host route.
28. Wait for the devices to synchronize.
29. TN1 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR2.
30. Observe the traffic transmitted on all networks.

Part G: Network Route Processing

31. Configure TR3 to advertise its connection to network 2.
32. Wait for the devices to synchronize.
33. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
34. Observe the traffic transmitted on all networks.

Part H: Network Route Forwarding

35. Configure TR3 to advertise its connection to network 2.
36. Wait for the devices to synchronize.
37. TN1 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR2.
38. Host the traffic transmitted on all networks.

Observable Results:

- *Part A, C, E, and G:*
  Step 5, 14, 24, and 34 TR1 forwards the ICMP Echo Request to TR3 on network 3. TR3 then forwards the ICMP Echo Request to TN2 on network 2.
- *Part B, D, F, and H:*
  Step 10, 18, 30, and 38 TR2 forwards the ICMP Echo Request to TR1 on network 1. TR1 then forwards the ICMP Echo Request to TR3 on network 3. TR3 then forwards the ICMP Echo Request to TN2 on network 2. Alternatively, TR2 may send an ICMP redirect to TN1. After which TR1 forwards the ICMP Echo Request to TR3 on network 3.

Possible Problems:

- None.

Test RIP_INTEROP.1.3: Routing Convergence and Calculation

Purpose: To verify that a router can interoperate with other RIP implementations.

References:

- [2453] – Sections 3 and 4
- [1812] – Section 5.2

Discussion: This test verifies that TR's can successfully detect and adjust to changes in network topology.

Test Setup: Common Test Setup is performed at the beginning of each part. Common Test Cleanup is performed after each part.

Procedure:

Part A: Setup

1. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
2. Observe the traffic transmitted on all networks.

Part B: Better Path Available

3. Change TR3's metric on network 2 and network 3 to 1.
4. Change TR2's metric on network 1 and network 2 to 2.
5. Wait for the devices to synchronize.
6. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
7. Observe the traffic transmitted on all networks.
8. Change TR3's metric on network 2 and network 3 to 2.
9. Change TR2's metric on network 1 and network 2 to 1.
10. Wait for the devices to synchronize.
11. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
12. Observe the traffic transmitted on all networks.

Part C: Setup

13. TN4 transmits an ICMP Echo Request with destination IP address for TN3 to the link layer address of TR1.
14. Observe the traffic transmitted on all networks.

Part D: Link Down and Link Reestablished

15. Disable TR1's interface on network 3.
16. Wait for the devices to synchronize.
17. TN4 transmits an ICMP Echo Request with destination IP address for TN3 to the link layer address of TR1.
18. Observe the traffic transmitted on all networks.
19. Enable TR1's interface on network 3.
20. Wait for the devices to synchronize.
21. TN4 transmits an ICMP Echo Request with destination IP address for TN3 to the link layer

address of TR1.

22. Observe the traffic transmitted on all networks.

Observable Results:

- *Part A:*
  Step 2: TR1 forwards the ICMP Echo Request to TR2 on network 1. TR2 forwards the ICMP Echo Request to TN2 on network 2.
- *Part B:*
  Step 7: TR1 forwards the ICMP Echo Request to TR3 on network 3. TR3 forwards the ICMP Echo Request to TN2 on network 2.
  Step 12: TR1 forwards the ICMP Echo Request to TR2 on network 1. TR2 forwards the ICMP Echo Request to TN2 on network 2.
- *Part C:*
  Step 14: TR1 forwards the ICMP Echo Request to TN3 on network 3.
- *Part D:*
  Step 18: TR1 forwards the ICMP Echo Request to TR2 on network 1. TR2 forwards the ICMP Echo Request to TN3 on network 2. TR3 forwards the ICMP Echo Request to TN3 on network 3.
  Step 22: TR1 forwards the ICMP Echo Request to TN3 on network 3.

Possible Problems:

- None.

Test RIP_INTEROP.1.4: Message Authentication

Purpose: To verify that a router correctly performs RIP simple text and MD5 message authentication.

References:

- [2453] – Sections 3 and 4
- [2082] – Sections 3.2 and 5
- [1812] – Section 5.2

Discussion: This test verifies that the TR's can successfully perform simple password and MD5 based authentication.

Test Setup: Common Test Setup is performed at the beginning of each part. Common Test Cleanup is performed after each part.

Procedure:

Part A: Authentication Settings Mismatched (Simple vs. None)

1. Configure TR1 to use simple authentication on network 1.
2. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
3. Observe the traffic transmitted on all networks.

Part B: Simple Text Authentication Passwords Mismatched

4. Configure TR1 to use simple authentication on network 1.
5. Configure TR2 to use simple authentication on network 1 with a different password than the one used in step 4.
6. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
7. Observe the traffic transmitted on all networks.

Part C: Simple Text Authentication

8. Configure TR1 to use simple authentication on network 1.
9. Configure TR2 to use simple authentication on network 1 with the same password used in step 8.
10. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
11. Observe the traffic transmitted on all networks.

Part D: MD5 Settings Mismatched (MD5 vs. None)

12. Configure TR1 to use MD5 authentication on network 1.
13. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
14. Observe the traffic transmitted on all networks.

Part E: MD5 Passwords Mismatched

15. Configure TR1 to use MD5 authentication on network 1.
16. Configure TR2 to use MD5 authentication on network 1 with a different password than the one used in step 15.
17. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
18. Observe the traffic transmitted on all networks.

Part F: MD5 Authentication

19. Configure TR1 to use MD5 authentication on network 1.
20. Configure TR2 to use MD5 authentication on network 1 with the same password used in step 19.
21. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
22. Observe the traffic transmitted on all networks.

Part G: MD5 Settings Mismatched (Simple vs. MD5)

23. Configure TR2 to use simple authentication on network 1.
24. Configure TR1 to use MD5 authentication on network 1.
25. TN4 transmits an ICMP Echo Request with destination IP address for TN2 to the link layer address of TR1.
26. Observe the traffic transmitted on all networks.

Observable Results:

- *Part A, B, D, E, and G:*
  Step 3, 7, 14, 18, and 26: TR1 forwards the ICMP Echo Request to TR3 on network 3. TR3 forwards the ICMP Echo Request traffic to TN2 on network 2.
- *Part C, and F:*
  Step 11, and 22: TR1 forwards the ICMP Echo Request to TR2 on network 1. TR2 forwards the ICMP Echo Request to TN2 on network 2.

Possible Problems:

- The TR's may not support simple text authentication or MD5 authentication.