

# **IPv6 CONSORTIUM TEST SUITE**

Routing Information Protocol (RIP)  
Over Internet Protocol Version 6  
Multi-System Interoperability Test Suite

**Technical Document**

Version 1.1



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## **MODIFICATION RECORD**

Version 0.1	May 30, 2003 Initial Version
Version 1.0	April 14, 2004 Added Test 1.4
Version 1.1	March 22, 2005 Modified Tests 1.3 and 1.4

## **ACKNOWLEDGEMENTS**

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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 RIPng based products. This test suite has been designed to test interoperability of the device under test with other RIPng 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 RIPng standard but they are designed as interoperability tests. These tests provide one method to isolate problems within the RIPng 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 RIPng capable devices. However, these tests do provide a reasonable level of confidence that the RUT will function well in most RIPng environment.

### **Abbreviations and Acronyms**

Acronyms used in this Test Suite:

N: Network  
NH: Next Hop  
RUT: Router Under Test  
TR: Testing Router  
HL: Hop Limit  
TN: Testing Node

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.

### **Route Notation**

In this test suite, routes are denoted in the following format: N1/48, NH TR1(N2), Metric 1. This denotes a route to network N1, with a 48-bit prefix, a next hop of TR1's IP address on network N2, and a metric of 1. When the next hop routers only have one interface shown on the diagram, the interface's network location is omitted.

## 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 RIPng\_INTEROP.1.2 refers to the second test of the first test group in the RIPng 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:

- [RIPng] G. Malking, R. Minnear, RIPng for IPv6, RFC 2080, January 1997
- [IPv6-SPEC] Hinden, R., S. Deering, Internet Protocol, Version 6 (IPv6) Specification, RFC 2460, December 1998.

## Test RIPng\_INTEROP.1.1: Route Origination

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

### References:

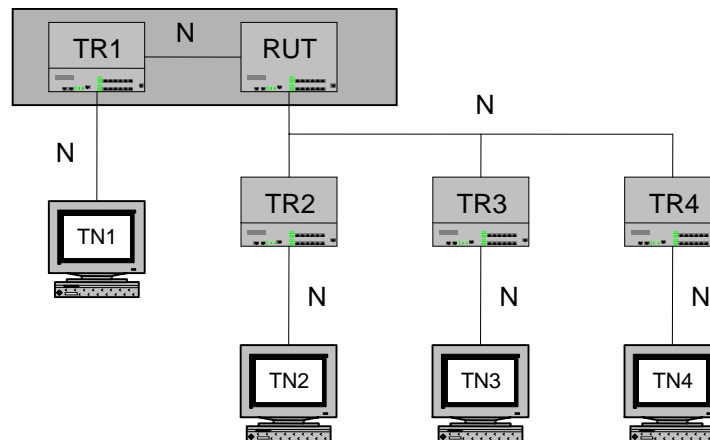
- [RIPng] – Section 2

**Discussion:** This test verifies that the RUT 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, host routes, aggregated (supernet) routes, and default routes. Route tag, next hop, and metric information should be correctly originated in all cases.

**Test Setup:** Connect the RUT to one Interop Partner (TR1) as shown below in the gray shaded area. Enable RIPng on the RUT and TR1. Nodes outside of the gray area do not run the RIPng protocol. Configure the RUT to distribute static routes through RIPng.

Configure the RUT with the following static routes:

- TN2/64, NH TR2(N3), Metric 1
- N5/64, NH TR3(N3), Metric 1
- Default, NH TR4(N3), Metric 2



### Procedure:

*Part A: Check the Routing Table on TR1*

1. Allow the RIPng Protocol to configure.
2. Check TR1's routing table.

*Part B: Default Route Forwarding*

3. TN1 transmits a UDP Packet with a destination equal to the IP address of TN4 to the hardware address of TR1.
4. Observe packets transmitted on all networks.



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*Part C: Network Route Forwarding*

5. TN1 transmits a UDP Packet with a destination equal to the IP address of TN3 to the hardware address of TR1.
6. Observe packets transmitted on all networks.

*Part D: Host Route Forwarding*

7. TN1 transmits a UDP Packet with a destination equal to the IP address of TN2 to the hardware address of TR1.
8. Observe packets transmitted on all networks.

*Part E: Route change*

9. Remove the route TN2/64 from the RUT, and replace it with TN2/64, NH TR3(N3), Metric 1.
10. TN1 transmits a UDP Packet with a destination equal to the IP address of TN2 to the hardware address of TR1.
11. Observe packets transmitted on all networks.

*Part F: Route Removals*

12. Remove all static routes from the RUT.
13. TN1 transmits a UDP packet with a destination equal to the IP address of TN2 to the hardware address of TR1.
14. Observe packets transmitted on all networks.

**Observable Results:**

- *In Part A*
  - Step 2:** TR1 must have the following routes:
    - Default, NH RUT(N2), Metric 3
    - N5/64, NH RUT(N2), Metric 2
    - N3/64, NH RUT(N2), Metric 2
    - TN3/64, NH RUT(N2), Metric 2
- *In Part B*
  - Step 4:** The RUT must forward the UDP packet to TR4 (N3).
- *In Part C*
  - Step 6:** The RUT must forward the UDP packet to TR3 (N3).
- *In Part D*
  - Step 8:** The RUT must forward the UDP packet to TR2 (N3).
- *In Part E*
  - Step 11:** The RUT must forward the UDP packet to TR3 (N3).
- *In Part F*
  - Step 14:** The RUT must forward the UDP packet to TR4 (N3).

**Possible Problems:**

- It may not be possible to configure the RUT to explicitly set the metrics for static routes.

## Test RIPng\_INTEROP.1.2: Route Learning and Propagation

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

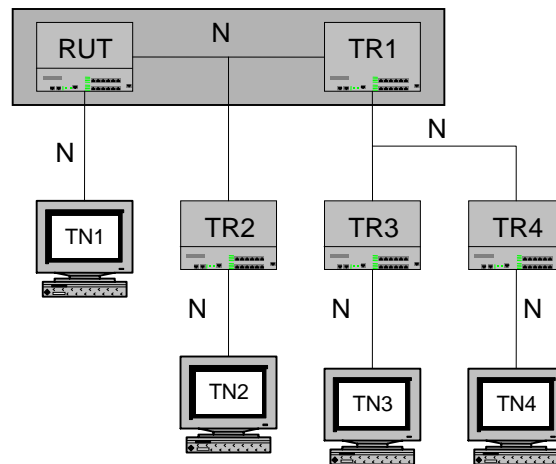
### References:

- [RIPng] – Section 2

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

**Test Setup:** Connect the RUT to one Interop Partner (TR1) as shown below in the gray shaded area. Enable RIPng on the RUT and TR1. Nodes outside the gray area do not run the RIPng protocol. Configure TR1 to distribute static routes through RIPng, and to tag static routes with a tag of 10. Configure TR1 with the following static routes:

- N4/64, NH TR2 (N2), Metric 1
- N5/64, NH TR3 (N3), Metric 1
- Default, NH TR4(N3), Metric 2



### Procedure:

#### Part A: Check the RUT's Routing Table

1. Allow the RIPng Protocol to configure.
2. Observe the RIPng packets sent by the RUT on N1.

#### Part B: Default Route Forwarding

3. TN1 transmits a UDP Packet with destination equal to the IP address of TN4 to the hardware address of the RUT.
4. Observe packets transmitted on all networks.

#### Part C: Network Route Forwarding

5. TN1 transmits a UDP Packet with destination equal to the IP address of TN3 to the hardware

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address of the RUT.

6. Observe packets transmitted on all networks.

*Part D: Next Hop not Running RIPng*

7. TN1 transmits a UDP Packet with destination equal to the IP address of TN2 to the hardware address of the RUT.
8. Observe packets transmitted on all networks.

*Part E: Remove Routes*

9. Remove all static routes from the RUT.
10. TN1 transmits a UDP packet with a destination equal to the IP address of TN2 to the hardware address of the RUT.
11. Observe packets transmitted on all networks.

**Observable Results:**

- *In Part A*
  - Step 2:** The RUT must have the following routes:
    - Default, NH TR1(N2), Metric 3
    - N3/64, NH TR1(N2), Metric 2
    - N4/64, NH TR2(N2), Metric 2
    - N5/64, NH TR1(N2), Metric 2
  - The RIPng packets sent by the RUT on N1 must reflect this route table.
- *In Part B*
  - Step 4:** The RUT must forward the UDP Packet to TR1 (N2).
- *In Part C*
  - Step 6:** The RUT must forward the UDP packet to TR1.
- *In Part D*
  - Step 8:** The RUT should forward the UDP packet to TR2.
- *In Part E*
  - Step 11:** The RUT must forward the UDP packet to TR1.

**Possible Problems:**

- A Router may choose to ignore the information in the next hop field, this is sub-optimal but is valid.

### Test RIPng\_INTEROP.1.3: Routing Convergence

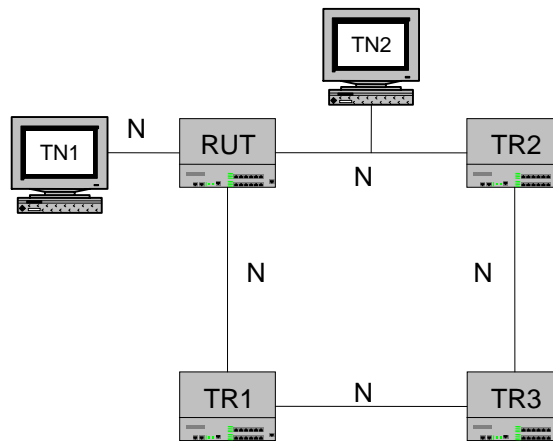
**Purpose:** To verify that a router can interoperate with other RIPng implementations.

**References:**

- [RIPng] – Section 2

**Discussion:** This test verifies that the RUT can successfully detect and adjust to changes in network topology.

**Test Setup:** Connect the RUT and three Interop Partners (TR1, TR2 and TR3) as shown below. TN1 and TN2 do not run the RIPng protocol, and are simulated using a packet generator. Enable RIPng on all of the routers. All routers have a metric of 1 on all interfaces unless otherwise specified in a test.



**Procedure:**

*Part A: Setup*

1. Allow RIPng protocol to configure.
2. Check the RUT routing table.

*Part B: Link Up*

3. TN1 transmits an Echo Request destined for TN2 to the hardware address of the RUT.
4. Observe all packets transmitted on all networks.

*Part C: Link Down*

5. Disconnect the RUT's interface to N1.
6. Wait 200 seconds.
7. TN1 transmits an Echo Request destined for TN2 to the hardware address of the RUT.
8. Observe all packets transmitted on all networks.

*Part D: Link Reestablished*

9. Reconnect RUT's interface to N1.
10. Wait 40 seconds.

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11. TN1 transmits an Echo Requests destined for TN2 to the hardware address of the RUT.
12. Observe all packets transmitted on all networks.

**Observable Results:**

- *In Part A*
  - Step 2:** The RUT must have the following routes:
    - N3/64, NH TR2(N1), Metric 2
    - N4/64, NH TR1(N2), Metric 2
- *In Part B*
  - Step 6:** The RUT must forward the Echo Request from TN1 to TN2. TN1 should receive an Echo Reply from TN2 in response to each Echo Request.
- *In Part C*
  - Step 12:** The RUT must forward the Echo Request from TN1 to TR1. TN1 should receive an Echo Reply from TN2 in response to each Echo Request.
- *In Part D*
  - Step 18:** The RUT must forward the Echo Request from TN1 to TN2. TN1 should receive an Echo Reply from TN2 in response to each Echo Request.

**Possible Problems:**

- None.

## Test RIPng\_INTEROP.1.4: Routing Calculation

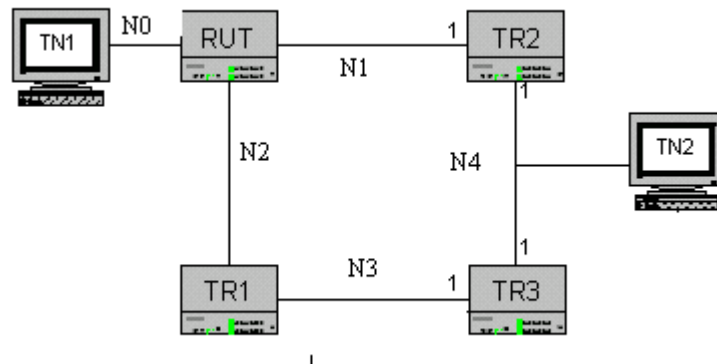
**Purpose:** To verify that a router can interoperate with other RIPng implementations.

### References:

- [RIPng] – Section 2

**Discussion:** This test verifies that the RUT can successfully detect and adjust to changes in network topology.

**Test Setup:** Connect the RUT and three Interop Partners (TR1, TR2 and TR3) as shown below. TN1 and TN2 do not run the RIPng protocol, and are simulated using a packet generator. Enable RIPng on all of the routers. All routers have a metric of 1 on all interfaces unless otherwise specified in a test.



### Procedure:

#### Part A: Setup

1. Allow RIPng protocol to configure.
2. Check the RUT routing table.

#### Part B: Metric of 1

3. TN1 transmits an Echo Request destined for TN2 to the hardware address of the RUT.
4. Observe all packets transmitted on all networks.

#### Part C: Worse Metric

5. Configure the RUT to have a metric of 10 on network 1.
6. TN1 transmits an Echo Request destined for TN2 to the hardware address of the RUT.
7. Observe all packets transmitted on all networks.

#### Part D: Better Metric

8. Configure the RUT to have a metric of 3 on network 1.
9. Configure TR1 to have a metric of 1 on network 3.
10. TN1 transmits an Echo Requests destined for TN2 to the hardware address of the RUT.
11. Configure TR1 to have a metric of 4 on network 3.
12. TN1 transmits an Echo Request destined for TN2 to the hardware address of the RUT.

13. Observe all packets transmitted on all networks.

**Observable Results:**

- *In Part A*
  - Step 2:** The RUT should have the following routes:
    - N3/64, NH TR2(N1), Metric 2
    - N4/64, NH TR1(N2), Metric 2
- *In Part B*
  - Step 6:** The RUT must forward the Echo Request from TN1 to TR2. TN1 must receive an Echo Reply from TN2 in response to each Echo Request.
- *In Part C*
  - Step 11:** the RUT must forward the Echo Request from TN1 to TR1. TN1 should receive an Echo Reply from TN2 in response to each Echo Request.
- *In Part D*
  - Step 16:** The RUT must forward the Echo Request from TN1 to TR1. TN1 must receive an Echo Reply from TN2 in response to each Echo Request.
  - Step 18:** The RUT must forward the Echo Request from TN1 to TR2. TN1 must receive an Echo Reply from TN2 in response to each Echo Request.

**Possible Problems:**

- None.