IPv6 Consortium

RIPng Operations Test Report Revision 1.1

InterOperability Lab — 121 Technology Drive, Suite 2 — Durham, NH 03824 — (603) 862-2804

Consortium Manager:	Ben Schultz	schultz@iol.unh.edu
Technician:	John Doe	jdoe@iol.unh.edu

January 1, 2003

Mr(s). Vendor
Company Name
Main Street
Anyplace, Anywhere 90210

Mr(s). Vendor,
Enclosed are the results from the IPv6 Core Interoperability testing performed on:

> Router Under Test Name Here. Identified as "SHORT RUT HERE" MAC Address 00-00-CA-02-38-38 s/n 0002493. Console "system" command reports software version 3.99.26.

This testing pertains to a set of standard requirements, put forth in [Standard Name(s) Here]. The tests performed are part of the RIPng Operations Test Suite, which is available on the UNH InterOperability Lab's website:

ftp://ftp.iol.unh.edu/pub/ipv6/testsuites/RIPng_Operations_Plan.pdf

As always, we welcome any comments regarding this Test Suite.

During the testing process, the following issues were uncovered:

Test	Result
RIPng.1.1	Conformance problems were encountered with certain Testing Routers.

If you have any questions about the test procedures or results, please feel free to contact me via e-mail at jdoe@iol.unh.edu or by phone at 603-862-2804.

Regards,

John Doe

The following table contains the test results and their meanings.

Result	Interpretation
PASS	The NUT was observed to exhibit conformant behavior.
FAIL	The NUT was observed to exhibit non-compliant behavior.
PASS with Comments	The NUT was observed to exhibit conformant behavior, however this behavior deviated from previous compliant results. An additional explanation of the situation is included.
Warning	The NUT was observed to exhibit behavior that is not recommended.
Refer to Comments	From the observations, a valid pass or fail could not be determined. An additional explanation of the situation is included.
Not Applicable (N/A)	The NUT does not support the technology required to perform these tests.
Not Available (N/A)	Due to testing station or time limitations, the tests could not be performed, or were performed in a limited capacity.
Not Tested (N/T)	Not tested due to time constraint of the test period.
Borderline	The observed values of the parameter is valid at one extreme, and invalid at the other extreme.
Informative	Results are for informative purposes only and are not judged on a pass or fail basis.

Group 1: Processing

Tests in this group verify the capability of the router to process valid routing messages and correctly propagate routing information.

Test #		Result	
RIPng.1.1	**Basic Response Processing**	**A**	**PASS**
Purpose: Verify that a router correctly processes a valid RIPng response and adds the routes advertised in the response to its routing table.			
Comments on Test Procedure			
A. TR1 transmitted a RIPng response message containing routes to networks N3 through N5. Each route having a different route tag.			
Comments on Test Results			
A. After TR1 transmitted the response message, the RUT sent a triggered response on N2 and N1 (with metric 16). All of the routes learned from TR1 are included with the correct metrics. The RUT propagated the original route tag, as generated by TR1, with each route.			

Test #		Result	
RIPng.1.2	**Next Hop Processing**	**A**	**PASS**
Purpose: Verify that a router properly processes a RIPng response that contains multiple next hop entries.			
Comments on Test Procedure			
A. TR1 transmitted a RIPng response to the RUT. The response contained the following entries: Next Hop Entry for TR2, Route to N3, Next Hop Entry for ::, route to N4.			
Comments on Test Results			
A. The RUT learned the routes advertised by TR1 with the given next hops. The RUT forwarded the Echo Requests from TN1 as follows: the one destined for N3 was sent to the link-layer address of TR2; the Echo Request destined to N4 was sent to the link-layer address of TR1.			

Test #		Result	
RIPng.1.3	**Next Hop Off-Link**	**A**	**PASS**

Purpose: Verify that a router properly interprets an off link next hop router given in a RIPng response message as 0:0:0:0:0:0:0:0, the originator of the response.

Comments on Test Procedure

A. TR1 Transmitted a RIPng response containing the following routes: Next Hop Entry for a system on N4 (a network to which the RUT was not directly attached); a route to N3. TN1 transmitted an Echo Request to the RUT destined to a node on N3.

Comments on Test Results

A. The RUT considered TR1 as the next hop for the route to N3. Upon reception of the RIPng response in Step 1, the RUT transmitted a triggered response on N2, propagating a route to N3. The RUT forwarded the Echo Request sent in Step 2 to TR1

Test #		Result	
RIPng.1.4	**Default Route Processing**	**A**	**PASS**

Purpose: Verify that the NUT properly adds default routes gained from received responses.

Comments on Test Procedure

A. TR1 transmitted a RIPng response indicating that it should be used as the default route. TN1 transmitted an Echo Request to the RUT destined for a node on N3.

Comments on Test Results

A. Upon receipt of the RIPng response from TR1 in Step 1, the RUT transmitted a triggered response on N2, propagating the default route. The RUT forwarded the Echo Request sent in Step 2 to TR1.

Test #		Result	
RIPng.1.5	**Empty Messages**	**A**	**PASS**
		B	**PASS**

Purpose: Verify that the router does not produce any response on receipt of an empty message.

Comments on Test Procedure

A. TR1 transmitted a RIPng response containing no entries.
B. TR1 transmitted a RIPng request containing no entries.

Comments on Test Results

A. The RUT did not transmit any triggered responses. The RUT ignored the empty message.
B. The RUT did not transmit any triggered responses. The RUT ignored the empty message.

Test #		Result	
RIPng.1.6	**Full Table Request Processing**	**A**	**PASS with Comments**

Purpose: Verify that the router properly responds to a full table request.

Comments on Test Procedure

A. TR1 transmitted a RIPng response containing routes to N3 and N4. TR4 transmitted a RIPng full table request to the RUT. TR1 transmitted a RIPng full table request to the RUT.

Comments on Test Results

A. The RUT transmitted a response to TR4 and TR1 that contained all of the route table entries advertised by TR1. Because poison reverse is enabled, the RUT set the metrics of routes to N3 and N4 to 16 when responding to TR1, since these routes were learned on the network.

Test #		Result	
RIPng.1.7	**Equal Metric Routes**	**A**	**PASS**

Purpose: Verify that the router does not switch back and forth between multiple next hops for a route advertised at the same metric by more than one neighbor.

Comments on Test Procedure

A. TR1 transmitted a RIPng response containing routes to N3 and N4 with a metric of 2. TR4 transmitted a RIPng response containing a route to N3 with a metric of 2. TR1 transmitted a RIPng response containing routes to N3 and N4 with a metric of 2. TR4 transmitted a RIPng response containing a route to N3 with a metric of 2. TR1 transmitted a RIPng response containing routes to N3 and N4 with a metric of 2. TR4 transmitted a RIPng response containing a route to N3 with a metric of 2. TR1 transmitted a RIPng response containing routes to N3 and N4 with a metric of 2. TR4 transmitted a RIPng response containing a route to N3 with a metric of 2.

Comments on Test Results

A. Since TR4 never advertised a metric lower than TR1, the RUT maintained TR1 as the next hop for N3 and did not generate any triggered responses after the initial response.

Test #		Result	
RIPng.1.8	**Triggered Response Generation**	**A**	**PASS**

Purpose: Verify that the router includes only those routes that have changed when sending a triggered response.

Comments on Test Procedure

A. After waiting for a periodic RIPng response from the RUT, TR1 transmitted a RIPng response with routes to N3, N4, N5, N6 and N7 at a metric of 3. After 5 seconds TR1 then transmitted a RIPng response with routes to N5, N6 and N7 at a metric of 2.

Comments on Test Results

A. The RUT sent a triggered response on N2 upon receiving the second response message from TR1. That response only contained routes to N5, N6 and N7 at the newly learned metric.

Test #		Result	
RIPng.1.9	**Large Routing Table Response Generation**	**A**	**PASS**

Purpose: Verify that the router sends more than one response when it would be impossible to include all of its routes in a single update due to the MTU of the link.

Comments on Test Procedure

A. TN1 transmitted two responses that, when processed, result in a routing table larger than could be included in a single RIPng packet given the links MTU.

Comments on Test Results

A. Each time the RUT generated RIPng responses onto N2, it correctly divided the contents of its routing table into multiple packets for transmission onto the link. The RUT's entire routing table was included in each set of updates, with no duplicates or exclusions.

Test #		Result	
RIPng.1.10	**Version Number Forward Compatibility**	**A**	**PASS**

Purpose: Verify that the router processes a RIPng packet with a numerically higher RIPng version number.

Comments on Test Procedure

A. TR1 sends a RIPng response with version number set to 2 and a route to N3.

Comments on Test Results

A. The RUT did not crash or generate invalid packets.

Test #		Result	
RIPng.1.11	**Neighbor List Funcionality**	**A**	**PASS**

Purpose: Verify that a router restricts the routers from which updates will be accepted when configured to do so.

Comments on Test Procedure

A. After configuring the RUT to accept response messages from TR1 only, TR1 sent a RIPng response with a route to N3. TR4 sent a response with a route to N4

Comments on Test Results

A. The RUT did not learn a route to N4 through TR4. It did learn the route to N3 through TR1. The route to N3 was present in the RUT's responses transmitted on N2; a route to N4 was not propagated.

Test #		Result	
RIPng.1.12	**Prefix List Functionality**	**A**	**PASS**
Purpose: Verify that a router restricts the networks that it learns from response messages when configured to do so.			
Comments on Test Procedure			
A. After configuring the RUT to disallow learning the prefix of N3 and to disallow learning routes to an aggregated (48 bit) prefix including N4, TR1 sent a RIPng response that contained routes to N3, N4 and N5.			
Comments on Test Results			
A. The RUT did not learn the routes to N4 or N4, but did learn the route to N5. Only the route to N5 was propagated in the RUT's responses on N2.			

Group 2: Input Validation

Tests in this group verify the capability of a RIPng enabled router to validate incoming RIPng packets.

Test #		Result	
RIPng.2.1	**Must Be Zero Fields**	**A**	**PASS**
Purpose: Verify that a router ignores data present in the "must be zero" portions of next hop fields of a RIPng response.			
Comments on Test Procedure			
A. TR1 transmitted a response with the following routes: Next Hop Entry for TR2; route to N3, Next Hop Entry ::; route to N4. The second next hop entry had a non-zero in the MBZ fields. TR1 transmitted an Echo Request to a node on N4.			
Comments on Test Results			
A. The RUT forwarded the Echo Request destined to the node on N4 to the link-layer address of TR1.			

Test #		Result	
RIPng.2.2	**Incorrect UDP Ports**	**A**	**PASS**
		B	**PASS**
Purpose: Verify that the router ignores responses received on or sent from any UDP port other than the designated RIPng port.			
Comments on Test Procedure			
A. TR1 transmitted a RIPng response from source UDP port other than 521, with a route to N3. B. TR1 transmitted a RIPng response from destination UDP port other than 521, with a route to N4.			
Comments on Test Results			
A. The RUT ignored the RIPng response; the route to N3 was not present in the RUT's responses on N2. B. The RUT ignored the RIPng response; the route to N4 was not present in the RUT's responses on N2.			

Test #		Result	
RIPng.2.3	**Incorrect Hop Count**	**A**	**PASS**
Purpose: Verify that a router ignores a RIPng response that has a hop count not equal to 255.			
Comments on Test Procedure			
A. TR1 transmitted a RIPng response with a hop limit less than 255, with a route to N3.			
Comments on Test Results			
A. The RUT did not learn the route to N3 from TR1; the RUT did not include a route to N3 in its responses sent on N2.			

Test #		Result	
RIPng.2.4	**Invalid Route Entries**	**A**	**PASS**
Purpose: Verify that the router uses the proper criteria in order to validate the route entries in a route update message, and does not add or propagate invalid routes.			
Comments on Test Procedure			
A. TR1 transmitted a RIPng response with 5 route table entries. The first route table entry was a multicast prefix, the second was a link-local prefix, the third had a prefix length of 129, the fourth had a metric of 17 and the fifth is a valid route entry to N3.			
Comments on Test Results			
A. Only the route to N3 was included in the triggered and periodic responses from the RUT. None of the invalid routes were present in the RUT's response messages on N2 or in the RUT's routing table.			

Test #		Result	
RIPng.2.5	**Response From Off-Link Router**	**A**	**PASS**
Purpose: Verify that the router ignores a route update sent from an off link, global address.			
Comments on Test Procedure			
A. TR1 transmitted a RIPng response onto N1, with a route to N3; the source IP address of this packet is TR1's global Ipv6 address on N4.			
Comments on Test Results			
A. The RUT did not learn the route to N3. The RUT did not include a route to N3 in its responses sent on N2.			

Test #		Result	
RIPng.2.6	**Response Received From Router's Own Address**	**A**	**PASS**
Purpose: Verify that the router ignores a route update sent from its own address.			
Comments on Test Procedure			
A. TR1 transmitted a RIPng response onto N1 with a source address equal to the Ipv6 address of the RUT on N1. This response contains a route to N3.			
Comments on Test Results			
A. The RUT did not learn the route to N3. The RUT did not include a route to N3 in its responses sent on N2.			

Group 3: Timers

Tests in this group verify that a RIPng enabled router properly implements protocol timers specified in [RIPng].

Test #		Result	
RIPng.3.1	**Route Timeout and Garbage Collection**	**A**	**PASS**
		B	**PASS**
		C	**PASS**
		D	**PASS**

Purpose: Verify that the router properly triggers and handles route expiration and garbage collection.

Comments on Test Procedure

A. TR1 transmitted a RIPng response with routes to N3, N4 and N5, all with metrics of 1, after waiting 15 seconds, TR1 transmitted the same RIPng response, with the metric for the route to N3 set to 16.
B. 150 seconds was allowed to pass.
C. TR1 transmitted a response containing only a route to N5, with a metric of 1. after 30 seconds TR2 transmitted a RIPng full table route request to the RUT.
D. 155 seconds was allowed to pass.

Comments on Test Results

A. The RUT immediately transmitted a triggered RIPng update onto N2 upon receipt of the response from TR1 expiring the route to N3. This response should include a single route to N3 with metric 16.
B. The RUT included the route to N3 in its periodic updates until 120 seconds elapsed from when the route expired.
C. 180 seconds after the RUT learned the route to N4 the route to N4 should expire. The RUT should generate a triggered response onto N2 including only a route to N4 with metric 16.
D. 180 seconds after the RUT updated the route to N5 the route to N5 expired. The RUT generated a triggered response onto N2 including only a route to N5 with a metric 16.

Test #		Result	
RIPng.3.2	**Route Time Half Expired Heuristic**	**A**	**PASS**

Purpose: Verify that the router switches from one next hop to another with the same metric if the current timer is at least half expired.

Comments on Test Procedure

A. TR1 transmitted a RIPng response with a route to N3, metric 1. after 110 seconds TR2 transmitted a RIPng response with a route to N3, metric 1.

Comments on Test Results

A. Because the timer for its route to N3 is more than half expired when the response from TR2 is received, the RUT adopted the route to N3 through TR2. This can be seen through the transmission of a triggered update on N1.

Test #		Result	
RIPng.3.3	**Triggered Response Delay Interval**	**A**	**PASS**

Purpose: Verify that the router waits the proper amount of time between sending triggered responses.

Comments on Test Procedure

A. TR1 transmitted a RIPng response with a route to N3, metric 8, then 500 milliseconds were allowed to pass. This was repeated six additional times, each time reducing the metric of the route to N3 by 1.

Comments on Test Results

A. While each packet from TR1 would normally cause the RUT to generate a triggered response on N2, they are sent so fast that the RUT did not generate triggered responses for each one. The RUT delayed a random interval of 1-5 seconds between triggered responses.

Group 4: Forwarding

Tests in this group verify the capability of a router to forward packets based on a routing table populated by the RIPng protocol.

Test #		Result	
RIPng.4.1	**Route Priority**	**A**	**PASS**
		B	**PASS**
		C	**PASS**
		D	**PASS**
		E	**PASS**

Purpose: Verify that the proper routes are used when more than one route is available for a given network.

Comments on Test Procedure

A. TR1 transmitted a RIPng response with a single default route entry, metric 3. TN1 sent an Echo Request message to the RUT destined for a node on N3.
B. TR2 transmitted a RIPng response with a route to the 48-bit prefix that includes N3, metric 4. TN1 sent an Echo Request message to the RUT destined for a (different) node on N3.
C. TR1 transmitted a RIPng response with a route to the 48-bit prefix that includes N3, metric 2. TN1 sent an Echo Request message to the RUT destined for a (different) node on N3.
D. TR2 transmitted a RIPng response with a route to N3, metric 5, and a prefix length of 62. TN1 sent an Echo Request message to the RUT destined for a (different) node on N3.
E. TR1 transmitted a RIPng response with a route to N3, metric 1. TN1 sent an Echo Request message to the RUT destined for a (different) node on N3.

Comments on Test Results

A. The RUT forwarded the Echo Request destined for N3 to the link-layer address of TR1.
B. The RUT forwarded the Echo Request destined for N3 to the link-layer address of TR2.
C. The RUT forwarded the Echo Request destined for N3 to the link-layer address of TR1.
D. The RUT forwarded the Echo Request destined for N3 to the link-layer address of TR2.
E. The RUT forwarded the Echo Request destined for N3 to the link-layer address of TR1.