IPv4 CONSORTIUM

RIPv2 Operations Test Report Revision 4.4

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Mr(s). VENDOR,

Enclosed are the results from the Routing Information Protocol (RIP) testing performed on:

RUT HERE. Identified as "SHORT RUT HERE" MAC Address 01-02-03-04-05-06 s/n 1234567. Console "system" command reports software version 1.2.3.

This testing pertains to a set of RIP requirements, put forth in RFCs 2453 and 2082. The tests performed are part of the RIP Test Suite, which is available on the UNH InterOperability Lab's website:

ftp://public.iol.unh.edu/pub/ipv4/testsuites/RIP_Operations_Description.pdf

During the testing process, the following issues were uncovered:

Test #	Result
RIP 1.2 a, b:	The next hop indicated was not the originator of the RIP Response.

As always, we welcome any comments regarding this Test Suite. If you have any questions about the test procedures or results, please feel free to contact me via e-mail at techniciana@iol.unh.edu or by phone at +1-603-862-3941.

Regards,

Technician A

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The following table contains the test results and their meanings.

Result	Interpretation
PASS	The RUT was observed to exhibit conformant behavior.
FAIL	The RUT was observed to exhibit non-compliant behavior.
PASS with Comments	The RUT was observed to exhibit conformant behavior, however this behavior deviated from previous compliant results. An additional explanation of the situation is included.
Warning	The RUT was observed to exhibit behavior that is not recommended.
NOTE	From the observations, a valid pass or fail could not be determined. An additional explanation of the situation is included.
N/S	Not Supported: The specified behavior is optional and is applicable but not implemented.
N/T	Not Tested: The specified behavior cannot be tested due to a(n) (un)related failure.

Group 1: Processing

The following tests cover portions of the Routing Information Protocol associated with the processing of packets.

Test #		Result	
Test RIP.1.1	**Basic Response Processing**	**a**	**PASS**
Purpose: Verify that a router performs the correct processing on receipt of a properly formatted RIP Response including several route entries.			
Comments on Test Procedure			
a. The TR sent a RIP Response with 3 RTEs to the All RIP-2 Routers Multicast Address.			
Comments on Test Results	RFC 2453 – Sections 3.9.2 and 3.10.1		
a. The RUT transmitted a triggered response to the multicast address 224.0.0.9 on each of its other interfaces advertising the learned routes. The network and subnet mask of each route was the same as was advertised by the test software. The metrics were calculated correctly. The next hops from the original RTEs were learned, and included with each route in the RUT's routing table. They were not changed to indicate the RUT as next hop in the RUT's responses. The RUT included the learned routes in its periodic responses.			

Test #		Result	
Test RIP.1.2	**Next Hop Processing**	**a**	**FAIL**
		b	**FAIL**
		c	**PASS**

Purpose: Verify that a router behaves correctly in several cases where the next hop of a Route Entry should be considered the originator of the packet.

Comments on Test Procedure

a. A RIP Response with a Route Entry was transmitted. The next hop for this RTE was 0.0.0.0. The RUT's routing table was checked to determine what next hop was used for the route advertised.
b. A RIP Response with a Route Entry was transmitted. The next hop for this RTE was not on a directly connected network. The RUT's routing table was checked to determine what next hop was used for the route advertised.
c. A RIP Response was transmitted from R1 for some network N with a next hop of R2. Another RIP Response was transmitted from R1 that included a Route Entry with a next hop on network N, which was not a directly connected network. The RUT's routing table was checked to determine what next hop was used for the route advertised.

Comments on Test Results | RFC 2453 – Sections 4.4 and appendix A

a. The next hop indicated was not the originator of the RIP Response. According to RFC 2453, section 4.4 "*The immediate next hop IP address to which packets to the destination specified by this rout entry should be forwarded. Specifying a value of 0.0.0.0 in this field indicates that routing should be via the originator of the RIP advertisement. An address specified as a next hop must, per force, be directly reachable on the logical subnet over which the advertisement is made.*" Therefore, the RUT should have indicated that the next hop was the originator of the RIP Response.
b. The next hop indicated was not the originator of the RIP Response. Refer to the quote from part a of this test. The RUT should have indicated that the next hop was the originator of the RIP Response.
c. The next hop indicated was treated as 0.0.0.0 (the originator of the RIP Response, e.g., R1) since it was not on a directly connected network.

Test #		Result	
Test RIP.1.3	**Subnet Mask Processing**	**a**	**PASS**

Purpose: Verify that a router correctly interprets and processes the subnet mask field.

Comments on Test Procedure

a. A RIP Response was transmitted with 3 RTEs. Each RTE had a subnet mask value of 0.0.0.0. There was one entry each for a Class A, Class B, and Class C network. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 4.3

a. The triggered response transmitted by the RUT on its other interfaces included the newly learned routes with subnet mask values appropriate to the natural network number.

Test #		Result	
Test RIP.1.4	**Default Route Processing**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: Verify that a router learns default routes.

Comments on Test Procedure

a. A RIP Response was transmitted with one RTE indicating a default route. The subnet mask value was 0.0.0.0. The packets transmitted by the RUT were observed.
b. A RIP Response was transmitted with one RTE indicating a default route. The subnet mask value was 255.255.255.0. The packets transmitted by the RUT were observed.
c. A RIP Response was transmitted from TR1 with one RTE indicating a default route. A RIP Response was then transmitted from TR2 with one RTE indicating a default route. The packets transmitted by the RUT and the RUT's routing table were observed.
d. A default route was configured on the RUT. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.7 and RFC 1812 – Section 5.2.4.3

a. The RUT transmitted a triggered response advertising the default route.
b. The RUT did not crash or generate invalid packets.
c. The default route was not present twice in any RIP Responses sent by the RUT.
d. The RUT propagated the default route as 0.0.0.0 with a subnet mask of 0 bits.

Test #		Result	
Test RIP.1.5	**Infinite Metric Processing**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router behaves properly when the metric calculated for a route is 16.

Comments on Test Procedure

a. A RIP Response was transmitted with a Route Entry with metric 1. Another RIP Response was transmitted with two RTEs. One RTE gave the route advertised in Step 1 with metric 15. The other gave a route that was not in the RUT's table, with metric 15. The packets transmitted by the RUT were observed.
b. The metric for one of the interfaces on the RUT was set to 2. A RIP Response was transmitted with a Route Entry with metric 1 to the interface in Step 5. A RIP Response was transmitted with two RTEs. One RTE gave the route advertised in Step 6 with metric 15; the other gave a route that was not in the RUT's table, with metric 15. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.9.2

a. The RUT transmitted a triggered response giving the route that it learned in Step 1 with the newly calculated metric of 16. The other route present in the response transmitted in Step 2 was not present in any response transmitted by the RUT.
b. The RUT transmitted a triggered response giving the route that it learned in Step 6 with the newly calculated metric of 16. The other route present in the response transmitted in Step 7 was not present in any response transmitted by the RUT.

Test #		Result	
Test RIP.1.6	**Host Route Processing**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router identifies and processes host routes correctly.

Comments on Test Procedure

a. A RIP Response was transmitted with a host route. The packets transmitted by the RUT were observed.
b. The RUT was configured not to accept host routes. A RIP Response was transmitted with a host route followed by a valid route entry. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.7

a. The RUT learned the host route from the RIP Response, and transmitted a triggered response advertising it.
b. The RUT did not learn the host route from the RIP Response. The valid route that followed was processed normally. Host routes were not present in any RIP Responses transmitted by the RUT.

Test #		Result	
Test RIP.1.7	**Version Number Processing**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: Verify that a router obeys the rules for processing RIP messages of versions other than 2.

Comments on Test Procedure

a. A RIP version 1 Response was transmitted including a Route Entry for some network. The packets transmitted by the RUT were observed.
b. A RIP version 0 Response was transmitted including a Route Entry for some network. The packets transmitted by the RUT were observed.
c. A RIP version 1 Request was transmitted including a Route Entry the RUT did not have. The packets transmitted by the RUT were observed.
d. A RIP version 2 Request was transmitted including a Route Entry the RUT did not have. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.10.2, 4.6, and 5.1

a. The RUT learned the version 1 route advertised.
b. The RUT did not learn the version 0 route advertised.
c. The RUT responded with a RIP version 1 Response including the Route Entry with metric 16.
d. The RUT responded with a RIP version 2 Response including the Route Entry with metric 16.

Test #		Result	
Test RIP.1.8	**Family Identifier Processing**	**a**	**PASS**

Purpose: Verify that a router properly handles RIP Responses that contain RTEs with Address Family Identifiers other than 2.

Comments on Test Procedure

a. A RIP Response was transmitted with one RTE that had the Address Family Identifier set to something other than 2. Another RIP Response was transmitted that had a mix of RTEs, one with Address Family Identifier 2, the others with Address Family Identifier set to something other than 2. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.6 and 3.9.2

a. The only new route the RUT had was the route with Address Family Identifier 2. The RUT learned no other new routes during this test.

Test #		Result	
Test RIP.1.9	**Route Tags Processing**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router properly learns and re-advertises route tags.

Comments on Test Procedure

a. A RIP Response was transmitted including several RTEs, each with a different route tag. The packets transmitted by the RUT were observed.
b. A RIP Response was transmitted including 2 RTEs, each with a route tag. Another RIP Response was transmitted for route 1, but with a lower metric and a different route tag. This response was from a source different from the one used in the previous step. Route 2 was allowed to expire. A response was then transmitted from the same router used in Step 4, but with a different route tag. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 4.2

a. The RUT sent out the routes advertised in a triggered response, and the route tag for each route was included unchanged.
b. Both routes used the route tag from the most recent response.

Test #		Result	
Test RIP.1.10	**Triggered Response Processing**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router observes the rules regarding triggered responses.

Comments on Test Procedure

a. A RIP Response was transmitted including several routes. Another RIP Response was transmitted, giving a subset of the routes advertised in the first step with a higher metric. The packets transmitted by the RUT were observed.
b. A RIP Response was transmitted giving a route with metric 1. Every second thereafter, the metric was incremented and the response packet was transmitted again. The response was sent a total of ten times. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.10.1, 3.10.2

a. In Step 2, the RUT sent a triggered response to all networks except the network to which TR1 was connected. The triggered response included only the routes that changed as a result of the response sent in the previous step. The RUT did not transmit a triggered response on the network to which TR1 was connected, as no routes had changed due to split horizon/poisoned reverse processing.
b. The RUT waited a random interval from 1 to 5 seconds between transmitting triggered responses.

Test #		Result	
Test RIP.1.11	**Route Timeout Processing**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: Verify that a router performs route timeout correctly.

Comments on Test Procedure

a. A RIP Response was transmitted including RTEs for two routes. Another RIP Response was transmitted for one of the routes given in Step 1 with a metric of 16. More than 300 seconds elapsed and the packets transmitted by the RUT were observed.
b. A RIP Response was transmitted including a RTE for 1 route. 60 seconds elapsed. Another RIP Response was transmitted including the RTE sent in Step 4. More than 300 seconds elapsed and the packets transmitted by the RUT were observed.
c. A RIP Response was transmitted including a RTE for 1 route. 240 seconds elapsed. Another RIP Response was transmitted including the RTE sent in Step 8. More than 300 seconds elapsed and the packets transmitted by the RUT were observed.
d. A RIP Response was transmitted including a RTE for 1 route. A RIP Response was transmitted including the RTE sent in Step 12 with a metric of 16. 60 seconds elapsed. Another RIP Response was transmitted including the RTE sent in Step 12 with a metric of 16. More than 120 seconds elapsed and the packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.8, 3.9.2

a. The RUT transmitted a triggered response for the route that was expired after the RIP Response in Step 2 was received. It was also included in periodic responses with metric 16 for 120 seconds after its expiration. The route that was not updated by Step 2 expired after 180 seconds from Step 1 and was included in periodic RIP Responses with metric 16 for 120 seconds.
b. In Step 5, the RUT advertised the learned route for 60 seconds. In Step 6, the timeout timer for the entry created in Step 4 was restarted. In Step 7, the RUT advertised the learned route with the appropriate metric for 180 seconds from when the RIP Response was transmitted in Step 6. The RUT then advertised the learned route with a metric of 16 for 120 seconds.
c. In Step 9, the RUT advertised the learned route for 180 seconds. The RUT then advertised the learned route with a metric of 16 for 60 seconds. In Step 10, the timeout timer was restarted and the garbage-collection timer stopped. In Step 11, the RUT advertised the learned route for 180 seconds from when the RIP Response was transmitted in Step 10. The RUT then advertised the learned route with a metric of 16 for 120 seconds.
d. In Step 13, the RUT sent a triggered response for the deleted route. In Step 14, the RUT included the deleted route with a metric of 16 in its periodic updates. In Step 15, the RUT did not restart the garbage-collection timer. In Step 16, the RUT only included the deleted route with a metric of 16 in its periodic updates for 60 additional seconds.

Test #		Result	
Test RIP.1.12	**Number of Entries Processing**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: Verify that a router handles responses that contain an unusual number of RTEs.

Comments on Test Procedure

a. A RIP Response was transmitted with no RTEs. The packets transmitted by the RUT were observed.
b. A RIP Request was transmitted with no RTEs. The packets transmitted by the RUT were observed.
c. A RIP Response was transmitted with 25 valid RTEs. A RIP Request was transmitted with the 25 valid RTEs given in the previous step. The packets transmitted by the RUT were observed.
d. Two RIP Responses were transmitted, each with 20 valid RTEs. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.9.1 and 3.10.2

a. The empty response did not cause the RUT to generate any packets.
b. The empty request did not cause the RUT to generate any packets.
c. The RUT processed the response with 25 routes as normal. All of the routes from the test packet were added and were present in the RUT's triggered response. In Step 6, the RUT responded to the RIP Request with all 25 RTEs in one RIP Response.
d. The RUT transmitted multiple RIP Responses each containing a subset of its routing information for that network.

Test #		Result	
Test RIP.1.13	**Compatibility with v1 Switches Processing**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: Verify that a router behaves properly in each of the modes described for the v1 compatibility switch.

Comments on Test Procedure

a. The RUT was configured to operate in RIP-1 Mode. Time elapsed to allow the RUT to transmit a periodic response. The RUT was configured to operate in RIP-1 Compatible Mode. Time elapsed to allow the RUT to transmit a periodic response. The RUT was configured to operate in RIP-2 mode. Time elapsed to allow the RUT to transmit a periodic response. In each case, the packets transmitted by the RUT were observed.
b. The RUT was configured to accept only RIP-1 messages. The RUT was also configured to transmit RIP-1 messages. A RIP version 2 Request was transmitted for a Route Entry the RUT does not have. A RIP version 2 Response was transmitted with a Route Entry. A RIP version 1 Request was then transmitted for a Route Entry the RUT does not have. Finally, a RIP version 1 Response was transmitted with a Route Entry. The packets transmitted by the RUT were observed.
c. The RUT was configured to accept only RIP-2 messages. The RUT was also configured to transmit RIP-2 messages. A RIP version 2 Request was transmitted for a Route Entry the RUT does not have. A RIP version 2 Response was transmitted with a Route Entry. A RIP version 1 Request was then transmitted for a Route Entry the RUT does not have. Finally, a RIP version 1 Response was transmitted with a Route Entry. The packets transmitted by the RUT were observed.
d. The RUT was configured to accept both RIP-1 and RIP-2 messages. The RUT was also configured to transmit RIP-2 messages. A RIP version 2 Request was transmitted for a Route Entry the RUT does not have. A RIP version 2 Response was transmitted with a Route Entry. A RIP version 1 Request was then transmitted for a Route Entry the RUT does not have. Finally, a RIP version 1 Response was transmitted with a Route Entry. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 4.6, 5.1

a. In Step 1, the RUT transmitted RIP-1 Response Packets to the Subnet Broadcast Address. In Step 3, the RUT transmitted RIP-2 Response Packets to the Subnet Broadcast Address. In Step 5, the RUT transmitted RIP-2 Response Packets to the All RIP-2 Router Multicast Address.
b. The RUT ignored the version 2 messages. The RUT processed the version 1 messages normally.
c. The RUT processed the version 2 messages normally. The RUT ignored the version 1 messages.
d. The RUT processed the version 2 messages normally. The RUT did not respond to the RIP version 1 Request. The RUT processed the version 1 message normally.

Test #		Result	
Test RIP.1.14	**Full Table Request Processing**	**a**	**PASS**

Purpose: Verify that a router responds properly to full table RIP Requests.

Comments on Test Procedure

a. A RIP Response was transmitted including a valid RTE. Another RIP Response was transmitted with a different RTE to the RUT's other interface. A full table request was sent to each interface. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2453 – Section 3.9.1

a. In Step 3, the RUT transmitted response packets, including all of its learned and configured routes. Split-horizon/poisoned reverse processing was performed on the responses.

Test #		Result	
Test RIP.1.15	**Specific Route Request Processing**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router responds properly to specific RIP Requests.

Comments on Test Procedure

a. A RIP Response was transmitted including one RTE. Another RIP Response was transmitted with a single RTE to the RUT's other interface. A specific multicast RIP Request was then transmitted for the RTEs given in the first two steps, as well as another route that the RUT did not have. The packets transmitted by the RUT were observed.
b. A RIP Response was transmitted including one RTE. Another RIP Response was transmitted with a single RTE to the RUT's other interface. A specific unicast RIP Request was then transmitted for the RTEs given in the first two steps, as well as another route that the RUT did not have. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2453 – Section 3.9.1

a. The RUT transmitted a response for the routes requested, filling in their metrics from its routing table. For the route that was not in its table, a metric of 16 was given. No Split-horizon/poisoned reverse processing was done on this response; metrics were given exactly as they were in the RUT's table.
b. The RUT transmitted a response for the routes requested, filling in their metrics from its routing table. For the route that was not in its table, a metric of 16 was given. No Split-horizon/poisoned reverse processing was done on this response; metrics were given exactly as they were in the RUT's table.

Test #		Result	
Test RIP.1.16	**Simple Authentication Processing**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: Verify that a router properly processes a RIP authentication entry.

Comments on Test Procedure

a. The RUT was configured not to perform RIP-2 authentication. A RIP Response was transmitted with an authentication entry and a Route Entry. The packets transmitted by the RUT were observed.
b. The RUT was configured to perform RIP-2 authentication, with password ABCDEFGHIJKL. A RIP Response was transmitted with an authentication header (correct password) and a Route Entry. The packets transmitted by the RUT were observed.
c. The RUT was configured to perform RIP-2 authentication, with password ABCDEFGHIJKL. A RIP Response was transmitted with an authentication header (incorrect password) and a Route Entry. The packets transmitted by the RUT were observed.
d. The RUT was configured to perform RIP-2 authentication, with password ABCDEFGHIJKL. A RIP Response with no authentication header and one Route Entry. The packets transmitted by the RUT were observed.
e. The RUT was configured to perform RIP-2 authentication, with password ABCDEFGHIJKL. A RIP Response was transmitted with two authentication headers and one Route Entry. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 4.1, 5.2

a. The RUT ignored the response packet with an authentication entry. The RUT did not learn the route from this packet.
b. The RUT learned the Route Entry in the RIP Response.
c. The RUT did not learn the Route Entry in the RIP Response.
d. The RUT did not learn the Route Entry in the RIP Response.
e. The RUT did not crash or generate invalid packets. The RUT processed the Route Entry in the RIP Response.

Test #		Result	
Test RIP.1.17	**UDP Port Processing**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router correctly handles the proper UDP ports for RIP.

Comments on Test Procedure

a. A specific RIP Request was transmitted for a route that the RUT did not have, from UDP port 300 and to port 520. Another specific RIP Request was transmitted for a route that the RUT did not have, from UDP port 521 and to port 520. A specific RIP Request was then transmitted for a route that the RUT did not have, from UDP port 520 and to port 300. The packets transmitted by the RUT were observed.
b. Time elapsed to allow for a periodic RIP Response from the RUT. A RIP Response was transmitted with a route that the RUT did not have, from UDP port 300 and to port 520. Another RIP Response was transmitted with a route that the RUT did not have, from UDP port 521 and to port 520. A RIP Response was then transmitted with a route that the RUT did not have, from UDP port 520 and to port 300. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2453 – Section 3.6, 3.9.2

a. In Step 1, the RUT transmitted a RIP Response for the route specified with a metric of 16, to UDP port 300 from UDP port 520. In Step 2, the RUT transmitted a RIP Response for the route specified with a metric of 16, to UDP port 521 from UDP port 520. In Step 3, the RUT did not respond to the RIP Request sent to a UDP port that was not 520.
b. In Step 5, the RUT transmitted a RIP Response to and from UDP port 520. In Steps 6 through 8, the RUT did not learn the Route Entry in the RIP packet.

Test #		Result	
Test RIP.1.18	**Heuristic for RIP Response Processing**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router uses the heuristic for selecting between two routers advertising the same route with the same metric.

Comments on Test Procedure

a. A RIP Response was transmitted from TR1 containing a Route Entry with a metric of 5. 30 seconds elapsed. A RIP Response was transmitted from TR2 containing the same Route Entry in Step 1 with a metric of 5. The packets transmitted by the RUT were observed.
b. A RIP Response was transmitted from TR1 containing a Route Entry with a metric of 5. 90 seconds elapsed. A RIP Response was transmitted from TR2 containing the same Route Entry in Step 1 with a metric of 5. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2453 – Section 3.9.2

a. The RUT did not update the Route Entry specifying TR2 as the next hop.
b. The RUT updated the Route Entry specifying TR2 as the next hop.

Test #		Result	
Test RIP.1.19	**Metric Processing**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router properly handles RTEs that are not better than the current route for that network.

Comments on Test Procedure

a. A RIP Response was transmitted from TR1 containing a Route Entry with a metric of 6. Another RIP Response was transmitted from TR2 containing the same Route Entry in Step 1 with a metric of 7. The packets transmitted by the RUT were observed.
b. A RIP Response was transmitted from TR1 containing a Route Entry with a metric of 6. Another RIP Response was transmitted from TR1 containing the same Route Entry in Step 5 with a metric of 7. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.9.2

a. The RUT did not update the Route Entry specifying TR2 as the next hop.
b. The RUT transmitted a triggered RIP Response for the Route Entry with metric 8.

Test #		Result	
Test RIP.1.20	**Static Route Processing**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: Verify that a router properly handles static routes with the RIP protocol.

Comments on Test Procedure

a. A static route was configured on one of the interfaces on the RUT. The packets transmitted by the RUT were observed.
b. The static route from Part A was allowed to remain configured. More than 300 seconds elapsed. The packets transmitted by the RUT were observed.
c. A static route for network 133.178.119.0 was configured on one of the interfaces on the RUT. A RIP Response was transmitted containing a Route Entry for the configured static route with a metric of 16. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2453 – Section 3.5

a. The RUT propagated the static route in its periodic RIP Responses.
b. The RUT did not expire or delete the static route.
c. The RUT did not expire the static route.

Group 2: Validation

The following tests cover portions of the Routing Information Protocol associated with the validation of packets.

Test #		Result	
Test RIP.2.1	**Network Validation**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router ignores RTEs for invalid networks.

Comments on Test Procedure

a. A RIP Response was transmitted with an entry for a Class D network address followed by a valid entry. A RIP Response was then transmitted with an entry for a Class E network address followed by a valid entry. A RIP Response was then transmitted with an entry for the network 0.0.0.1 followed by a valid entry. A RIP Response was then transmitted with an entry for the all 1s network followed by a valid entry. A RIP Response was then transmitted for the loopback network address followed by a valid entry. A RIP Response was then transmitted for the loopback host address followed by a valid entry. A RIP Response was then transmitted for the subnet broadcast address followed by a valid entry. A RIP Response was then transmitted for a multicast address followed by a valid entry. The packets transmitted by the RUT were observed.

b. A RIP Response was transmitted with an entry for the network of the RUT's interface followed by a valid entry. A RIP Response was then transmitted for the host address of the RUT's interface followed by a valid entry. A RIP Response was then transmitted for the network of the RUT's other interface followed by a valid entry. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2453 – Section 3.9.2

a. The RUT did not add any of the invalid routes advertised in the test. The valid routes that followed were processed normally.

b. The RUT did not add any of the invalid routes advertised in the test. The valid routes that followed were processed normally.

Test #		Result	
Test RIP.2.2	**Metric Validation**	**a**	**PASS**

Purpose: Verify that a router correctly handles invalid values of the metric field in the RTE.

Comments on Test Procedure

a. A RIP Response was transmitted containing a Route Entry for network1 with metric 5. A RIP Response was transmitted containing a Route Entry for network1 with metric 17, followed by a valid Route Entry. Another RIP Response was transmitted containing a Route Entry with metric -1, followed by a valid Route Entry. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2453 – Section 3.9.2

a. The RUT did not expire the RTE for network1 or set the metric to 16. The RUT added none of the routes with invalid metrics advertised in the test. The valid routes that followed were processed normally.

Test #		Result	
Test RIP.2.3:	**Must Be Zero Fields Validation**	**a**	**PASS**
Purpose: Verify that a router discards RIP-1 packets that have data in the "must be zero" fields defined for that version of RIP.			
Comments on Test Procedure			
a. A version 1 RIP Response was transmitted with data in the unused header field, with a valid RTE. Another version 1 RIP Response was transmitted containing data in the route tag field of the RTE. A version 1 RIP Response was then transmitted with data in the next hop field of the RTE. A version 1 RIP Response was then transmitted with data in the subnet mask field of the RTE. The packets transmitted by the RUT were observed.			
Comments on Test Results	RFC 2453 – Section 3.6, 5		
a. The RUT added none of the routes advertised in the test.			

Test #		Result	
Test RIP.2.4	**Command Number Validation**	**a**	**PASS**
Purpose: Verify that a router ignores RIP packets with invalid commands.			
Comments on Test Procedure			
a. A RIP Traceon was transmitted, including a Route Entry as would be expected in a RIP Response. A RIP Traceoff was then transmitted, including a Route Entry as would be expected in a RIP Response. A RIP packet with an unknown command number was transmitted, including a Route Entry as would be expected in a RIP Response. The packets transmitted by the RUT were observed.			
Comments on Test Results	RFC 1058 – Section 3.1		
a. The RUT ignored the commands in this test and added none of the new routes advertised.			

Test #		Result	
Test RIP.2.5	**Invalid Number of Entries Validation**	**a**	**PASS**
Purpose: Verify that a router does not encounter an error on receipt of a RIP Response with more than 25 entries.			
Comments on Test Procedure			
a. A version 2 RIP Response was transmitted, including more than 25 Route Entries. A Version 1 RIP Response was transmitted, including more than 25 Route Entries. A version 2 RIP Request was transmitted, including more than 25 Route Entries. A version 1 RIP Request was then transmitted, including more than 25 Route Entries. The packets transmitted by the RUT were observed.			
Comments on Test Results	RFC 2453 – Section 3.6		
a. The RUT did not crash or generate any invalid packets.			

Test #		Result	
Test RIP.2.6	**Source Address Validation**	**a**	**PASS**

Purpose: Verify that a router checks RIP Responses for validity with regards to the source IP address.

Comments on Test Procedure

a. A RIP Response was transmitted, with a source address equal to the loopback address, and a Route Entry. A RIP Response was then transmitted, with a multicast source address, and a Route Entry. A RIP Response was then transmitted with a source address that is not on the directly connected network, and a Route Entry. A RIP Response was then transmitted with a source address the same as the RUT's receiving interface, and a Route Entry. A RIP Response was then transmitted with a source address the same as the RUT's interface on another network, and a Route Entry. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2453 – Section 3.9.2

a. The RUT did not learn any of the routes advertised in this test.

Test #		Result	
Test RIP.2.7	**Next Hop Validation**	**a**	**PASS**

Purpose: Verify that a router checks RIP Responses for validity with regards to the next hop field in Route Entries.

Comments on Test Procedure

a. A RIP Response was transmitted, with a next hop equal to the loopback address. A RIP Response was then transmitted, with a multicast address as next hop. A RIP Response was then transmitted with a next hop the same as the RUT's interface. A RIP Response was then transmitted with a next hop the same as the RUT's interface on another network. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2453 – Section 4.4

a. The RUT ignored the RTEs with invalid Next Hops.

Group 3: Forwarding

The following tests cover portions of the Routing Information Protocol associated with the forwarding of packets.

Test #		Result	
Test RIP.3.1	**Basic Forwarding**	**a**	**PASS**
Purpose: Verify that a router can perform basic forwarding functions.			
Comments on Test Procedure			
a. A RIP Response was transmitted with three RTEs: one network route, one host route, and one default route. An ICMP Echo Request was then transmitted, destined for the host given in the host route. An ICMP Echo Request was then transmitted, destined for the network given in the network route. An ICMP Echo Request was then transmitted destined for a network the RUT had no specific route for. The packets transmitted by the RUT were observed.			
Comments on Test Results	RFC 1812 – Section 5.2.1.2		
a. In Step 2, the ICMP Echo Request was forwarded to the next hop given for the host route. In Step 3, the ICMP Echo Request was forwarded to the next hop given for the network route. In Step 4, the ICMP Echo Request was forwarded to the next hop given for the default route.			

Test #		Result	
Test RIP.3.2	**Priority Forwarding**	**a**	**PASS**
Purpose: Verify that a router prefers the best available route when forwarding.			
Comments on Test Procedure			
a. A RIP Response was transmitted with a default route. An ICMP Echo Request was then transmitted for some destination on network1. A RIP Response was transmitted advertising a natural network route network1. Network1 was subnetted. An ICMP Echo Request was then transmitted for some destination on network1. A RIP Response was transmitted advertising a natural network route network 1, with a lower metric than the previous RIP Response. An ICMP Echo Request was then transmitted for some destination on network1. A RIP Response was transmitted for a subnetted network route on network 1. An ICMP Echo Request was then transmitted for some destination on network1. A RIP Response was then transmitted for a subnetted network route on network 1, with a lower metric than the previous RIP Response. An ICMP Echo Request was then transmitted for some destination on network1. The packets transmitted by the RUT were observed.			
Comments on Test Results	RFC 1812 – Section 5.2.1.2		
a. Each ICMP Echo Request was forwarded to the next hop specified in the most recently transmitted response packet.			

Test #		Result	
Test RIP.3.3	**Expired Route**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router does not use an expired route for forwarding.

Comments on Test Procedure

a. A RIP Response was transmitted containing a default route and a next hop of TR1. 180 seconds elapsed. An ICMP Echo Request was transmitted destined for some destination on network1. The packets transmitted by the RUT were observed.
b. A RIP Response was transmitted containing a default route and a next hop of TR1. A RIP Response was then transmitted for the default route with metric 16. An ICMP Echo Request was transmitted destined for some destination on network1. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 1812 – Section 5.2.1.2 and RFC 2453 – Section 3.8

a. The ICMP Echo Request sent in Step 3 was not forwarded to the next hop of TR1, as the route was no longer valid.
b. The ICMP Echo Request sent in Step 8 was not forwarded to the next hop of TR1, as the route was no longer valid.

Group 4: MD5 Authentication

The following tests cover portions of the Routing Information Protocol that involve authentication of RIP messages by the MD5 algorithm.

Test #		Result	
Test RIP.4.1	**Basic MD5 Authentication**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: Verify that a router can perform basic MD5 authentication processing functionality.

Comments on Test Procedure

a. The RUT was configured not to perform MD5 authentication. A RIP Response with a correct MD5 authentication header and a Route Entry was transmitted. The packets transmitted by the RUT were observed.
b. The RUT was configured to perform MD5 authentication, with a secret of ABCDEFGHIJKL. A RIP Response with a correct authentication header and a Route Entry was transmitted. The packets transmitted by the RUT were observed.
c. The RUT was configured to perform MD5 authentication, with a secret of ABCDEFGHIJKL. A RIP Response with no authentication header and a Route Entry was transmitted. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2082 – Section 3

a. The RUT ignored the response packet with MD5 authentication and did not learn the route.
b. The RUT learned the route given in the MD5 authenticated RIP Response.
c. The RUT did not learn the route given in the un-authenticated RIP Response.

Test #		Result	
Test RIP.4.2	**Incorrect Digest**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: Verify that a router does not accept RIP messages with MD5 authentication using an incorrect digest.

Comments on Test Procedure

a. The RUT was configured to perform MD5 authentication, with two different keys (Key IDs 1 and 2) on a single interface. A RIP Response was transmitted with a correct authentication header for Key ID 1, but the digest for Key ID 2, and a Route Entry. The packets transmitted by the RUT were observed.
b. The RUT was configured to perform MD5 authentication, with a secret of ABCDEFGHIJKL. A RIP Response was transmitted with an authentication header, an incorrect digest formed by incrementing the correct digest by one, and a Route Entry. The packets transmitted by the RUT were observed.
c. The RUT was configured to perform MD5 authentication, with a secret of ABCDEFGHIJKL. A RIP Response was transmitted with an authentication header, an incorrect digest of all zeros, and a Route Entry. The packets transmitted by the RUT were observed.
d. The RUT was configured to perform MD5 authentication, with a secret of ABCDEFGHIJKL. A RIP Response was transmitted with an authentication header, an incorrect digest of all ones, and a Route Entry. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2082 – Section 3

a. The RUT ignored the response message and did not learn the advertised route.
b. The RUT ignored the response message and did not learn the advertised route.
c. The RUT ignored the response message and did not learn the advertised route.
d. The RUT ignored the response message and did not learn the advertised route.

Test #		Result	
Test RIP.4.3	**Sequence Numbers**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: Verify that a router handles sequence numbers properly.

Comments on Test Procedure

a. The RUT was configured to perform MD5 authentication, with password ABCDEFGHIJKL. The packets transmitted by the RUT were observed.
b. The RUT was configured to perform MD5 authentication, with password ABCDEFGHIJKL. A RIP Response was transmitted with an authentication header, a sequence number N, and a Route Entry. A RIP Response was then transmitted with an authentication header, a sequence number N, and the same Route Entry with a better metric. A RIP Response was transmitted with an authentication header, a sequence number N+1, and the same Route Entry with a better metric. The packets transmitted by the RUT were observed.
c. The RUT was configured to perform MD5 authentication, with password ABCDEFGHIJKL. A RIP Response was transmitted with an authentication header, a sequence number N+1, and a Route Entry. A RIP Response was transmitted with an authentication header, a sequence number N-1, and the same Route Entry with a better metric. The packets transmitted by the RUT were observed.
d. The RUT was configured to perform MD5 authentication, with two different keys (Key IDs 1 and 2) on a single interface. A RIP Response was transmitted with a properly formatted authentication header for Key ID 1, a sequence number N+1, and a Route Entry. A RIP Response was then transmitted with a properly formatted authentication header for Key ID 2, a sequence number N-1, and a Route Entry. The packets transmitted by the RUT were observed.

Comments on Test Results | RFC 2082 – Section 3.1, 3.2.2

a. The RUT transmitted periodic RIP Responses with proper MD5 authentication. The sequence numbers in each response were non-decreasing.
b. With each RIP Response, the RUT learned the route advertised with the new metric.
c. The RUT learned the Route Entry in the RIP Response transmitted in Step 10. The RUT did not learn the Route Entry with the new metric transmitted in Step 11.
d. With each RIP Response, the RUT learned the route advertised.

Test #		Result	
Test RIP.4.4	Sequence Number Zero	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: Verify that a router handles a sequence number of zero properly.

Comments on Test Procedure

a. The RUT was configured to perform MD5 authentication, with a secret of ABCDEFGHIJKL. A RIP Response with an authentication header, a sequence number of N, and a Route Entry was transmitted. The link between the RUT and the Testing Station was disconnected and then reconnected. A RIP Response with an authentication header, a sequence number of zero, and the same Route Entry with a better metric was transmitted. The packets transmitted by the RUT were observed.
b. The RUT was configured to perform MD5 authentication, with a secret of ABCDEFGHIJKL. A RIP Response with an authentication header, a sequence number of N, and a Route Entry was transmitted. 300 seconds elapsed. A RIP Response with an authentication header, a sequence number of zero, and the same Route Entry with a better metric was transmitted. The packets transmitted by the RUT were observed.
c. The RUT was configured to perform MD5 authentication, with a secret of ABCDEFGHIJKL. A RIP Response with an authentication header, a sequence number of N, and a Route Entry was transmitted. A RIP Response with an authentication header, a sequence number of zero, and the same Route Entry with a better metric was transmitted. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2082 – Section 3.1, 3.2.2

a. In Step 4, the RUT accepted the Route Entry and updated the metric.
b. In Step 10, the RUT accepted the Route Entry and updated the metric.
c. In Step 15, the RUT did not accept the Route Entry and update the metric.

Test #		Result	
Test RIP.4.5	**UDP Checksums**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router accepts MD5 authenticated RIP messages with varying UDP checksums.

Comments on Test Procedure

a. The RUT was configured to perform MD5 authentication, with password ABCDEFGHIJKL. A RIP Response was transmitted with a correct authentication header, a Route Entry, and a random, incorrect, UDP checksum. The packets transmitted by the RUT were observed.
b. The RUT was configured to perform MD5 authentication, with password ABCDEFGHIJKL. A RIP Response was transmitted with a correct authentication header, a Route Entry, and an incorrect UDP checksum of zero. The packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2082 – Section 3.2.1 and RFC 1812 – Section 6.1

a. The RUT did not learn the route advertised in the RIP packet.
b. The RUT learned the route advertised in the RIP packet.

Test #		Result	
Test RIP.4.6	**Key Lifetime Expiry**	**a**	**PASS**
		b	**PASS**

Purpose: Verify that a router handles key lifetime expiry properly.

Comments on Test Procedure

a. The RUT was configured to perform RIP-2 authentication, with password ABCDEFGHIJKL, Key ID 1, and a lifetime of five minutes. Every sixty seconds until Key ID 1 expired, a RIP Response was transmitted with a correct MD5 authentication header and a Route Entry. More than five minutes elapsed. A RIP Response was then transmitted with a correct MD5 authentication header and same Route Entry. The packets transmitted by the RUT were observed.

b. The RUT was configured to perform RIP-2 authentication, with password ABCDEFGHIJKL, Key ID 1, and a lifetime of five minutes. One minute elapsed. Another key was configured with a Key ID of 2 and a lifetime of five minutes. The new key's lifetime was set to begin in one minute. One minute elapsed. Every thirty seconds until Key ID 1 expired, a RIP Response was transmitted from TR1 with a correct MD5 authentication header, a Route Entry, and a Key ID of 1. Every thirty seconds until Key ID 2 expired, a RIP Response was transmitted from TR2 with a correct MD5 authentication header, a Route Entry, and a Key ID of 2. Five minutes elapsed and the packets transmitted by the RUT were observed.

Comments on Test Results	RFC 2082 – Section 4

a. In Step 2, the RUT learned the route advertised in the RIP packet. The RUT continued to use the existing key after the lifetime had expired. The timeout for the route learned in Step 2 was updated by the RIP Response sent in Step 3.

b. In Step 7, the RUT learned the routes advertised in the RIP packets. The RUT advertised its routes using both keys, while both keys were still alive. Following the expiry of Key ID 1, the RUT only transmitted its routes using Key ID 2.