IPv4 CONSORTIUM

PIM-SM Operations Test Report Revision 2.1

InterOperability Lab – 121 Technology Drive, Suite 2 – Durham NH, 03824 – +1-603-862-3941

Consortium Managers:	Erica Williamsen Timothy Winters	ericaw@iol.unh.edu twinters@iol.unh.edu
Technician:	Technician A	techniciana@iol.unh.edu

Month Day, Year

Member Contact Name
COMPANY NAME
ADDRESS

Mr(s). Vendor,

Enclosed are the results from PIM Sparse Mode 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 standard requirements, put forth in RFC 2236 and Internet Draft-ietf-pim-sm-v2-new-12.txt. The tests performed are part of the PIM Sparse Mode Test Suite, which is available on the UNH InterOperability Lab's website:

ftp://ftp.iol.unh.edu/pub/ipv4/testsuites/PIM-SM_Description.pdf

During the testing process, the following issues were uncovered:

Test #	Result
PIM_SM.1.2d	The RUT does not support configuration of Triggered_Hello_Delay.
PIM_SM.1.6d	The RUT waits 105 seconds before removing TR1 from its neighbor list. The RUT should wait 56 seconds before removing TR1 from its neighbor list.
PIM_SM.1.6f,g	The RUT did not transmit a Hello message with a zero Holdtime.

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-conformant 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 needed.
WARN	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: Hello Messages and Designated Router Election

The following tests verify conformance with Hello Messaging and DR Election for PIM-SM.

Test #		Result	
PIM_SM.1.1	**Sending Hello Messages**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transmits Hello messages.

Comments on Test Procedure

a. The factory defaults are reset on the RUT. PIM_SM is enabled on the RUT. Packets are observed on network 0.
b. The Hello_Period is configured to a value of 90 seconds on the RUT. PIM-SM is restarted on the RUT. Packets are observed on network 0.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt -Sections 4.3.1 and 4.12

a. The RUT transmits a Hello message to the ALL-PIM-Routers multicast address 224.0.0.13 on network 0 every 30 seconds (Hello_Period).
b. The RUT transmits a Hello message to the ALL-PIM-Routers multicast address 224.0.0.13 on network 0 every 90 seconds (Hello_Period).

Test #		Result	
PIM_SM.1.2	**Triggered Hello Messages**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**N/S**

Purpose: To verify that a router properly transmits a triggered Hello message.

Comments on Test Procedure

a. PIM-SM is enabled on the RUT on network 0. PIM-SM is not enabled on TR1 on network 0. Hello messages are transmitted from TR1 on network 0 every 30 seconds. Packets are observed on network 0.
b. TR1 transmits Hello messages on network 0. TR1 transmits a Hello message with a new GenID on network 0. Packets are observed on network 0.
c. PIM-SM is disabled on the RUT and factory defaults are reset. PIM-SM is enabled on the RUT. Packets are observed on network 0.
d. PIM-SM is disabled on the RUT and the Hello_Period is configured to a value of 10 seconds. PIM-SM is enabled on the RUT. Packets are observed on network 0.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt -Sections 4.3.1 and 4.12

a. The RUT transmits the first Hello message in less than Triggered_Hello_Delay (5) seconds.
b. The RUT transmits the first Hello message in less than Triggered_Hello_Delay (5) seconds.
c. The RUT transmits the first Hello message in less than Triggered_Hello_Delay (5) seconds. The RUT transmits the first Hello message between 0 and the Triggered_Hello_Delay (5) seconds after PIM is enabled.
d. The RUT does not support configuration of Triggered_Hello_Delay.

Test #		Result	
PIM_SM.1.3	**DR Election**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**

Purpose: To verify that a router properly performs DR Election.

Comments on Test Procedure

a. The RUT has DR Priority of 1. TR1 has DR Priority of 2 and an IP address lower than that of TR2 and the RUT. TR2 has a DR Priority of 1 and an IP address higher than that of TR1 and the RUT. The RP, TR1 and TR2 transmit Hello messages on network 0. TR1 and TR2 transmit Hello messages on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on network 1.
b. The RUT has a DR Priority of 2 and an IP address lower than that of TR1. The RP, TR1 and TR2 transmit Hello messages on network 0. TR1 and TR2 transmit Hello messages on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on network 1.
c. The RUT has a DR Priority of 3. The RP, TR1 and TR2 transmit Hello messages on network 0. TR1 and TR2 transmit Hello messages on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on network 1.
d. The RUT has a DR Priority of 2. The RP, TR1 and TR2 transmit Hello messages on network 0. TR1 and TR2 transmit Hello messages on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on network 1.
e. TR2 has an IP address lower than that of the RUT. The RP, TR1 and TR2 transmit Hello messages on network 0. TR1 transmits Hello messages on network 1. TR2 transmits Hello messages without the DR_Election_Priority Option on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on network 1.
f. TR1 has an IP address higher than that of the RUT. TR2 has an IP address lower than that of the RUT. The RP, TR1 and TR2 transmit Hello messages on network 0. TR1 transmits Hello messages on network 1. TR2 transmits Hello messages without the DR_Election_Priority Option on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on network 1.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt -Sections 4.3.1 and 4.3.2

a. TR1 is elected the DR. The RUT does not forward the multicast data received on network 1.
b. TR1 is elected the DR. The RUT does not forward the multicast data received on network 1.
c. The RUT is elected the DR, encapsulates the multicast data packets on network 1 and forwards them to the RP on network 0.
d. The RUT is elected the DR, encapsulates the multicast data packets on network 1 and forwards them to the RP on network 0.
e. The RUT is elected the DR, encapsulates the multicast data packets on network 1 and forwards them to the RP on network 0.
f. TR1 is elected the DR. The RUT does not forward the multicast data received on network 1.

Test #		Result	
PIM_SM.1.4	**Change of DR**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that a router properly changes Designated Routers.

Comments on Test Procedure

a. The RUT has DR priority of 2. The RP and TR1 transmit Hello messages on network 0. TR1 transmits a Hello message with DR priority of 3 on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on Network 1. The RUT has a DR priority of 5. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on all networks.
b. The RUT has priority of 4. The RP and TR1 transmit Hello messages on network 0. TR1 transmits a Hello message with DR priority of 2 on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. The RUT has DR priority of 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on all networks.
c. The RUT has DR priority of 4. The RP and TR1 transmit Hello messages on network 0. TR1 transmits a Hello message with DR priority of 2 on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. TR2 transmits a Hello message with a DR priority of 5 on Network 1. The SRC transmits multicast data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on all networks.
d. The RUT has DR priority of 3. The RP and TR1 transmit Hello messages on network 0. TR1 transmits a Hello message with DR priority of 5 on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. TR2 transmits a Hello message with DR priority of 2 on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. Packets are observed on all networks.
e. The RUT has DR priority of 4. The RP and TR1 transmit Hello messages on network 0. TR1 transmits a Hello message with DR priority of 3 on network 1. TR2 transmits a Hello message with DR priority of 9 on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 1. TR2 ceases transmission of Hello messages on network 1. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt-Section 4.3.2

a. The RUT elects TR2 as the DR. The RUT does not forward any of the multicast data received on network 1. After the priority is reconfigured, the RUT wins the DR election and thus encapsulates and transmits the data received on network 1 onto network 0.
b. The RUT is elected as the DR and thus encapsulates and transmits the data received on network 1 onto network 0. After the priority is reconfigured, TR2 wins the DR election. TR2 does not forward any of the multicast data received on network 1 after the priority is reconfigured.
c. The RUT is elected as the DR and thus encapsulates and transmits the data received on network 1 onto network 0. After the priority is reconfigured, TR2 wins the DR election. TR2 does not forward any of the multicast data received on network 1 after the priority is reconfigured.
d. The RUT elects TR2 as the DR. The RUT does not forward any of the multicast data received on network 1. After the priority is reconfigured, the RUT wins the DR election and thus encapsulates and transmits the data received on network 1 onto network 0.
e. After TR2 ceases transmission of Hello messages on network 1, the RUT is elected the DR on network 1. The RUT starts to encapsulate the data and forward it onto network 0.

Test #		Result	
PIM_SM.1.5	**Generation ID in DR Election**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly handles the Generation ID Option when present.

Comments on Test Procedure

a. The value of Generation_Identifier transmitted by the RUT is observed on network 0. PIM-SM is restarted on the RUT. Packets are observed on network 0. The previous steps are repeated with a large enough sample size to ensure that the Generation_Identifier is a random number.
b. The RP and TR1 transmit Hello messages on networks 1 and 0. TR1 transmits a (*,G) Join message for the group 224.0.6.130 on network 0. The RP transmitted a Hello message with a new GenID.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt -Section 4.3.1

a. The RUT advertises a new Generation_Identifier each time it is restarted. The Generation_Identifiers should be random.
b. The RUT sent another join message after receiving the new GenID.

Test #		Result	
PIM_SM.1.6	**HoldTime in Hello Messages**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**FAIL**
		e	**PASS**
		f	WARN
		g	WARN

Purpose: To verify that a router properly handles the Hello HoldTime Option.

Comments on Test Procedure

a. The factory defaults are reset on the RUT. PIM-SM is enabled on the RUT. Packets are observed on network 0.
b. TR1 transmits 2 Hello messages with Holdtime of 0x8C on network 0. TR1 stops transmitting Hello messages on network 0. Packets are observed on network 0.
c. TR1 transmits 2 Hello messages not containing the Hello Holdtime Option on network 0. TR1 stops transmitting Hello messages on network 0. Packets are observed on network 0.
d. The RUT is configured to have Hold_period to 16. PIM-SM is enabled on the RUT. Packets are observed on network 0.
e. TR1 transmits several properly formatted Hello messages on network 0. TR1 transmits a Hello message with Holdtime containing a zero value on network 0. TR1 ceases Hello message transmission on network 0. Packets are observed on network 0.
f. TR1 transmits several properly formatted Hello messages on network 0. The RUT's interface to network 0 is disabled. Packets are observed on network 0.
g. TR1 transmits several properly formatted Hello messages on network 0. The IP address of the RUT's interface to network 0 is changed. Packets are observed on network 0.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Sections 4.3.1, 4.3.2, 4.10.2 and 4.12

a. The RUT transmits Hello messages with a value of 105 in the Holdtime field.
b. When TR1 stops transmitting Hello messages, the RUT waits 140 seconds before removing TR1 from its

neighbor list.

c. When TR1 stops transmitting Hello messages, the RUT waits 105 seconds before removing TR1 from its neighbor list.
d. The RUT waits 105 seconds before removing TR1 from its neighbor list. According to Draft-ietf-pim-sm-v2-new-12.txt section 4.10.2 "*holdtime is the amount of time a receiver must keep the neighbor reachable*". Therefore, the RUT should wait 56 seconds before removing TR1 from its neighbor list.
e. The RUT immediately removes TR1 from its neighbor list.
f. The RUT did not transmit a Hello message with a zero Holdtime. According to Draft-ietf-pim-sm-v2-new-12.txt section 4.3.1 "*before an interface goes down or changes IP address, a Hello message with a zero Hold-Time should be sent immediately*". Therefore, the RUT should have transmitted a Hello message with a zero Holdtime after the interface was disabled.
g. The RUT did not transmit a Hello message with a zero Holdtime. According to Draft-ietf-pim-sm-v2-new-12.txt section 4.3.1 "*before an interface goes down or changes IP address, a Hello message with a zero Hold-Time should be sent immediately*". Therefore, the RUT should have transmitted a Hello message with a zero Holdtime after the IP address of the interface was changed.

GROUP 2: Multicast Forwarding

The following tests verify conformance of multicast forwarding in PIM-SM.

Test #		Result	
PIM_SM.2.1	**Forwarding Packets**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly forwards multicast data packets.

Comments on Test Procedure

a. The RP and TR1 transmit Hello messages on networks 0 and 1. TR1 transmits a (*,G) Join message for the group 224.0.6.130 on network 0. The RP forwards data packets from the multicast group 224.0.6.130. Packets are observed on all networks.
b. The RP transmits Hello messages on network 1. IGMP reports for 224.0.6.130 are transmitted on network 0. This causes the RUT to send a (*,G) Join message upstream to the RP. The RP forwards data packets from the multicast group 224.0.6.130. Packets are observed on all networks.
c. The RP transmits Hello messages on network 1. IGMP reports are transmitted for 224.0.6.130 on network 0. IGMP reports are transmitted for 224.0.6.130 on network 1. The RP forwards data packets from the multicast group 224.0.6.130. IGMP Leave messages are transmitted on network 0. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Sections 3 and 4.2

a. The RUT forwards the data packets onto network 0.
b. The RUT forwards the data packets onto network 0.
c. The RUT forwards the data onto network 0 until the Leave message is received.

Test #		Result	
PIM_SM.2.2	**Encapsulate Packets**	**a**	**PASS**

Purpose: To verify that a router properly encapsulates data packets.

Comments on Test Procedure

a. The RP transmits Hello messages on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 0. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 4.4.1

a. The RUT encapsulates the data packets and forwards the packets upstream to network 0 for the RP.

Test #		Result	
PIM_SM.2.3	**Forwarding Encapsulated Data Packets**	**a**	**PASS**
Purpose: To verify that a router appropriately uses the Link TLV field.			
Comments on Test Procedure			
a. The RP and TR1 transmit Hello messages on networks 0 and 1. TR1 transmits encapsulated data packets for multicast group 224.0.6.130 from the source network on network 0. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 4.2		
a. The RUT forwards the encapsulated data packets from network 0 onto network 1 for the RP.			

Test #		Result	
PIM_SM.2.4	**Encapsulation for Multiple RP's**	**a**	**PASS**
Purpose: To verify that a router properly encapsulates and transmits data packets to the proper RP.			
Comments on Test Procedure			
a. RP1 is statically configured for the multicast group 224.0.6.130 and RP2 is statically configured for the multicast group 224.0.6.131. RP1 and RP2 transmit Hello messages on networks 0 and 1. The SRC1 transmits data with a multicast destination address of 224.0.6.130 on network 2. The SRC2 transmits data with a multicast destination address of 224.0.6.131 on network 3. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 3		
a. The RUT encapsulates the data packets from network 2 and transmits them onto network 0. The RUT also encapsulates the data packets from network 3 and transmits them onto network 1.			

Test #		Result	
PIM_SM.2.5	**Source Packets**	**a**	**PASS**
Purpose: To verify that a router properly forwards source packets.			
Comments on Test Procedure			
a. The RP and TR1 transmit Hello messages on networks 1 and 0. TR1 transmits an (S,G) Join message with a group address of 224.0.6.130 and a source address of 10.10.15.81 on network 0. IGMP reports are transmitted for the group 224.0.6.130 on network 1. The RP transmits data packets from the multicast group 224.0.6.130 with a source address of 10.10.15.80 on network 1. The RP transmits data packets from the multicast group 224.0.6.130 with a source address of 10.10.15.81 on network 1. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 3		
a. The RUT forwards the data with a source address of 10.10.15.81 onto network 0. The data with a source address of 10.10.15.80 is not forwarded.			

Test #		Result	
PIM_SM.2.6	**Forward Encapsulated and Decapsulated Data Packets**	**a**	**PASS**
Purpose: To verify that a router properly forwards both encapsulated and decapsulated data packets.			
Comments on Test Procedure			
a. The RP transmits Hello messages on network 1. The SRC with an IP address of 10.10.10.80 transmits data packets with a multicast group address of 224.0.6.130 on network 0. The RUT encapsulates the data packets and forwards them to the RP. The RP transmits a Join (S,G) message with a source of 10.10.10.80 and the group address of 224.0.6.130 on network 1. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 3		
a. The RUT forwards both encapsulated and decapsulated data packets onto network 1.			

Test #		Result	
PIM_SM.2.7	**RegisterStop (S,G)**	**a**	**PASS**
Purpose: To verify that a router properly accepts a RegisterStop message.			
Comments on Test Procedure			
a. The RP transmits Hello messages on network 1. The SRC with an IP address of 10.10.10.80 transmits data packets with a multicast group address of 224.0.6.130 on network 0. The RUT should encapsulate these packets and forward them to the RP. The RP transmits a Join (S,G) with the source of 10.10.10.80 and the group address of 224.0.6.130 on network 1. After the RP receives both the encapsulated and decapsulated data packets, the RP transmits a RegisterStop to the RUT on network 1. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 3		
a. Upon receiving the RegisterStop, the RUT stops forwarding the encapsulated data packets. The decapsulated data packets continue to be forwarded onto network 1.			

Test #		Result	
PIM_SM.2.8	**RegisterStop (*,G)**	**a**	**PASS**
Purpose: To verify that a router properly accepts RegisterStop (*,G) from the DR.			
Comments on Test Procedure			
a. The RP transmits Hello messages on network 1. The SRC transmits data packets with a multicast destination of 224.0.6.130 on network 0. The RUT encapsulates these data packets and forwards them onto network 1. The RP transmits a Join (S,G) for group 224.0.6.130. The RP transmits a RegisterStop (*,G) for the multicast group 224.0.6.130 containing a source address set to a value of all zeros on network 1. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 4.4.1		
a. Upon receiving the RegisterStop, the RUT accepts the RegisterStop and stops encapsulating data.			

Test #		Result	
PIM_SM.2.9	**Data Forwarding to Several Networks**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly forwards data packets onto the correct network.

Comments on Test Procedure

a. The RP and TR1 transmit Hello messages on networks 1 and 2. TR1 transmits a (*,G) Join message for the group 224.0.6.130 on network 2. IGMP reports for 224.0.6.131 are transmitted on network 0. The RP forwards data packets from the multicast group 224.0.6.130 on network 1. Packets are observed on all networks.
b. The RP and TR1 transmit Hello messages on networks 1 and 2. TR1 transmits a (*,G) Join message for the group 224.0.6.130 on network 2. IGMP reports for 224.0.6.130 are transmitted on network 0. The RP forwards data packets from the multicast group 224.0.6.130 on network 1. Packets are observed on all networks.
c. The RP and TR1 transmit Hello messages on networks 1 and 2. TR1 transmits a (*,G) Join message for the group 224.0.6.130 on network 2. IGMP reports for 224.0.6.130 are transmitted on network 0. The RP forwards data packets from the multicast group 224.0.6.130 on network 1. IGMP leave messages for 224.0.6.130 is transmitted on network 0. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 4.3

a. The RUT forwards the data packets from network 1 to network 2.
b. The RUT forwards the data packets from network 1 to networks 0 and 2.
c. The RUT forwards the data packets from network 1 to networks 0 and 2. After the Leave message is received, data packets are only forwarded onto network 2.

Test #		Result	
PIM_SM.2.10	**Multiple Sources**	**a**	**PASS**

Purpose: To verify that a router properly transmits data packets from several sources.

Comments on Test Procedure

a. The RP, TR1, TR2 and TR3 transmit Hello messages on networks 1, 2, 0 and 3. TR1 transmits an (S,G) Join message for the multicast group 224.0.6.130 containing a source of 10.10.15.80 on network 2. TR2 transmits an (S,G) Join message for the multicast group 224.0.6.130 containing a source of 10.10.15.84 on network 0. TR3 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 3. The RP transmits data packets from the multicast group 224.0.6.130 from the source 10.10.15.80. The RP transmits data packets from the multicast group 224.0.6.130 from the source 10.10.15.84 on network 1. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 4.3

a. The RUT forwards the multicast data with a source address of 10.10.15.80 from network 1 to network 2. The RUT forwards the multicast data with a source address of 10.10.15.84 from network 1 to network 0. The RUT forwards both streams of multicast data from network 1 to network 3.

Test #		Result	
PIM_SM.2.11	**Forwarding From Multiple RPs**	**a**	**PASS**

Purpose: To verify that a router properly forwards encapsulated data packets to the correct RP.

Comments on Test Procedure

a. RP1 is statically configured for the multicast group 224.0.6.130. RP2 is statically configured for the multicast group 224.0.6.131. RP1, RP2, TR1 and TR2 transmit Hello messages on networks 0,1,2 and 3. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 2. TR2 transmits a (*,G) Join message for the multicast group 224.0.6.131 on network 3. RP1 transmits data packets from the multicast group 224.0.6.130 on network 0. RP2 transmits data packets from the multicast group 224.0.6.131 on network 1. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 2.1

a. The RUT forwards the data packets with a multicast destination of 224.0.6.130 from network 0 to network 2. The RUT forwards the data packets with a multicast destination of 224.0.6.131 from network 1 to network 3.

Test #		Result	
PIM_SM.2.12	**PIM Tree Receiver**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly creates a PIM tree.

Comments on Test Procedure

a. TR1 and TR2 transmit Hello messages on network 2. IGMP reports for 224.0.6.130 are transmitted on network 0. This causes the RUT to send a (*,G) Join message upstream to the RP. The RP transmits data packets on network 1 to the multicast destination address of 224.0.6.130. TR2 forwards the data packets on to network 2. Packets are observed on all networks.
b. The RUT transmits a Join (S,G) with the source address of 10.10.15.80 and a group address of 224.0.6.130 on network 1. TR1 transmits multicast data packets to TR1 on network 2. Both TR1 and TR2 transmit multicast data packets with the source address of 10.10.15.80 with a group address of 224.0.6.130. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 3

a. The RUT forwards multicast data packets from network 2 to network 0.
b. On network 2 the RUT continues to forward data packets from network 2.

Test #		Result	
PIM_SM.2.13	**PIM Tree - Source**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly creates a PIM tree when connected to the source network.

Comments on Test Procedure

a. The RP transmits Hello messages on network 1. TR1 and TR2 transmit Hello messages on network 0. The SRC transmits multicast data packets for the multicast group 224.0.6.130 on network 2. TR1 transmits a (*,G) Join with a group address of 224.0.6.130 on network 0.
b. RP transmits a Join (S,G) with the source address of 10.10.12.80 and a group address of 224.0.6.130 on network 2. The RP transmits a RegisterStop message on network 1 to the RUT. Packets are observed on all networks.
c. The TR1 transmits an (S,G) Join with the source address of 10.10.10.80 and a group address of 224.0.6.130 on network 0. TR1 receives two copies of the data packets, one from the SPT and one from the RPT. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt-Section 3

a. The RUT encapsulates the data packets from the SRC and forwards them onto network 2.
b. The RUT stops encapsulating the data. The RUT forwards no data.
c. The RUT should forward data packets from network 2 to network 0.

GROUP 3: Reception of Join and Prune Messages

The following tests verify conformance with the receiving of Join and Prune messages in PIM-SM.

Test #		Result	
PIM_SM.3.1	**Unknown Join Messages**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that the router properly ignores PIM Join messages from unknown neighbors.

Comments on Test Procedure

a. The RP and TR1 transmit Hello messages on networks 0 and 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. TR2 transmits a (*,*,RP) Join message with a source address of the RP on network 2. On network 1, data for the multicast group 224.0.6.130 is forwarded by the RP. Packets are observed on all networks.
b. The RP and TR1 transmit Hello messages on networks 0 and 1. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 0. TR2 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 2. On network 1, data for the multicast group 224.0.6.130 is forwarded by the RP. Packets are observed on all networks.
c. The RP and TR1 transmit Hello messages on networks 0 and 1. TR1 transmits an (S,G) Join message with a source address of 10.10.15.80 for the multicast group 224.0.6.130 on network 0. TR2 transmits an (S,G) Join message with a source address of 10.10.15.80 for the multicast group 224.0.6.130 on network 2. On network 1, data for the multicast group 224.0.6.130 is forwarded by the RP. Packets are observed on all networks.
d. The RP, TR1 and TR2 transmit Hello messages on networks 1, 0 and 2. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 0. TR2 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 2. On network 1, data for the multicast group 224.0.6.130 is forwarded by the RP. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-09.txt – Sections 4.5 and 4.3.1

a. The RUT does not forward the multicast data onto network 2.
b. The RUT does not forward the multicast data onto network 2.
c. The RUT does not forward the multicast data onto network 2.
d. The RUT forwards the multicast data onto networks 0 and 2.

Test #		Result	
PIM_SM.3.2	**Join Messages Destination Address**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly processes destination addresses.

Comments on Test Procedure

a. TR1, the RP and TR2 transmit Hello messages on networks 0, 1 and 2. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. The upstream neighbor address field should contain the address of TR2. TR2 transmits a Join message with a source address of the RP on network 2. The upstream neighbor address field should contain the address of the RUT. Data for the multicast group 224.0.6.130 is forwarded by the RP on network 1. Packets are observed on all networks.

b. TR1, the RP and TR2 transmit Hello messages on networks 0, 1 and 2. TR1 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 1. The upstream neighbor address field should contain the address of TR2. TR2 transmits a (*,G) Join message with a source address of the RP on network 2. The upstream neighbor address field should contain the address of the RUT. Data for the multicast group 224.0.6.130 is forwarded by the RP on network 1. Packets are observed on all networks.

c. TR1, the RP and TR2 transmit Hello messages on networks 0, 1 and 2. TR1 transmits an (S,G) Join message with a source address of 10.10.15.80 and a group address of 224.0.6.130 on network 1. The upstream neighbor address field should contain the address of TR2. TR1 transmits an (S,G) Join message with a source address of 10.10.10.80 and a group address of 224.0.6.130 on network 2. The upstream neighbor address field should contain the address of the RUT. Data with a source address of 10.10.10.80 for multicast group 224.0.6.130 is forwarded by the RP on network 1. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.1

a. The RUT forwards all the multicast data packets from network 1 to network 2.
b. The RUT forwards 224.0.6.130 multicast data packets from network 1 to network 2.
c. The RUT forwards the multicast data packets with a source of 10.10.15.80 and a destination of 224.0.6.130 from network 1 to network 2.

Test #		Result	
PIM_SM.3.3	**Transitions from (*,*,RP) NoInfo State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions from the NoInfo State when receiving a (*,*,RP) message.

Comments on Test Procedure

a. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. On network 1, data for multicast group 224.0.6.130 is forwarded by the RP. Packets are observed on all networks.
b. TR1 and the RP transmit Hello messages on networks 0 and 1 respectively. TR1 transmits a (*,*,RP) Prune message with a source address of the RP on network 0. On network 1, data for multicast group 224.0.6.130 is forwarded by the RP. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.1

a. The RUT forwards the multicast data packets onto network 0.
b. The RUT does not forward the multicast data packets onto network 0 until after having received a (*,*,RP) Join message.

Test #		Result	
PIM_SM.3.4	**Transitions from (*,*,RP) State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions from the Join State when receiving a (*,*,RP) message.

Comments on Test Procedure

a. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. On network 1, data for multicast group 224.0.6.130 is forwarded by the RP. After 30 seconds, a second (*,*,RP) Join message is transmitted on network 0 with a source address of the RP. Packets are observed on all networks.
b. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. On network 1, data for multicast group 224.0.6.130 is forwarded by the RP. TR1 transmits a (*,*,RP) Prune message with a source address of 224.0.6.130. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.1

a. The RUT forwards the multicast data packets 105 seconds after the second Join message was sent. After 105 seconds, the RUT stops sending data onto network 0.
b. The RUT stops forwarding multicast data onto network 0 after the Prune message is received.

Test #		Result	
PIM_SM.3.5	**Transitions from (*,*,RP) Prune Pending State**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly transitions from the Prune Pending State when receiving a (*,*,RP) message.

Comments on Test Procedure

a. TR1, the RP and TR2 transmit Hello messages on networks 0 and 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. TR2 transmits a (*,*,RP) Join message with a source address of the RP on network 0. Data for the multicast group 224.0.6.130 is forwarded by the RP on network 1. TR1 transmits a (*,*,RP) Prune message with a source address of the RP on network 0. After 2.5 seconds, TR2 transmits a (*,*,RP) Join message with a source address of the RP on network 0. Packets are observed on all networks.

b. TR1 and TR2 transmit Hello messages on networks 0. The RP transmits Hello messages on network 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. TR2 transmits a (*,*,RP) Join message with a source address of the RP on network 0. Data for the multicast group 224.0.6.130 is forwarded by the RP on network 1. TR1 transmits a (*,*,RP) Prune message with a source address of the RP on network 0. Packets are observed on all networks.

c. TR1 and TR2 transmit Hello messages on networks 0. The RP transmits Hello messages on network 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. TR2 transmits a (*,*,RP) Join message with a source address of the RP on network 0. Data for the multicast group 224.0.6.130 is forwarded by the RP on network 1. TR1 transmits a (*,*,RP) Prune message with a source address of the RP on network 0. TR2 transmits a (*,*,RP) Prune message with a source address of the RP on network 0. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.1

a. The RUT forwards the multicast data onto network 0 during the entire test.

b. The RUT forwards the multicast data onto network 0 until TR1 transmits its prune. Afterwards, a Prune Echo message is transmitted onto network 0 and multicast data is not forwarded.

c. The RUT forwards the multicast data onto network 0 until TR1 transmits its Prune. Afterwards, a Prune Echo message is transmitted onto network 0 and multicast data is not forwarded.

Test #		Result	
PIM_SM.3.6	**Transitions from (*,G) NoInfo State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions from the NoInfo State when receiving a (*,G) message.

Comments on Test Procedure

a. TR1 and the RP transmit Hello messages on network 0 and network 1, respectively. On network 0, TR1 transmits a Join (*,G) message with a group address of 224.0.6.130. Multicast data for multicast group 224.0.6.130 is forwarded by the RP on network 1. Packets are observed on network 0.
b. TR1 and the RP transmit Hello messages on network 0 and network 1, respectively. On network 0, TR1 transmits a Prune (*,G) message with a group address of 224.0.6.130. Multicast data for multicast group 224.0.6.130 is forwarded by the RP on network 1. On network 0, TR1 transmits a Join(*,G) message with a group address of 224.0.6.130. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.2

a. The RUT forwards the multicast data packets onto network 0.
b. The RUT forwards multicast data packets onto network 0 until after having received a Join (*,G) message.

Test #		Result	
PIM_SM.3.7	**Transitions from (*,G) Join State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions from the Join State when receiving a (*,G) message.

Comments on Test Procedure

a. TR1 and the RP transmit Hello messages on networks 0 and 1, respectively. TR1 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. On network 1, data for the multicast group 224.0.6.130 is forwarded by the RP. After 30 seconds, a second (*,G) Join message is transmitted on network 0 with a source address of the RP. Packets are observed on all networks.
b. TR1 and the RP transmit Hello messages on networks 0 and 1, respectively. TR1 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. On network 1, data for the multicast group 224.0.6.130 is forwarded by the RP. TR1 transmits a (*,G) Prune message with a group address of 224.0.6.130 on network 0. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.2

a. The RUT continues to forward the multicast data 105 seconds after the second Join message was sent. After 105 seconds, the RUT stops sending data onto network 1.
b. The RUT stops forwarding data onto network 1 after the Prune message is received.

Test #		Result	
PIM_SM.3.8	**Transitions from (*,G) Prune Pending State**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly transitions from the Prune Pending State when receiving a (*,G) message.

Comments on Test Procedure

a. TR1 and TR2 transmit Hello messages on network 0. The RP transmits Hello messages on network 1. TR1 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. TR2 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. On network 1, data for the multicast group 224.0.6.130 is forwarded by the RP. TR1 transmits a (*,G) Prune message with a group address of 224.0.6.130 on network 0. After 2.5 seconds, TR2 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. Packets are observed on all networks.

b. TR1 and TR2 transmit Hello messages on networks 0. The RP transmits Hello messages on network 1. TR1 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. TR2 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. Data for the multicast group 224.0.6.130 is forwarded by the RP on network 1. TR1 transmits a (*,G) Prune message with a group address of 224.0.6.130 on network 0. Packets are observed on all networks.

c. TR1 and TR2 transmit Hello messages on networks 0. The RP transmits Hello messages on network 1. TR1 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. TR2 transmits a (*,G) Join message with a group address of 224.0.6.130 on network 0. Data for the multicast group 224.0.6.130 is forwarded by the RP on network 1. TR1 transmits a (*,G) Prune message with a group address of 224.0.6.130 on network 0. TR2 transmits a (*,G) Prune message with a group address of 224.0.6.130 on network 0. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.2

a. The RUT forwards the multicast data onto network 0.

b. The RUT forwards the multicast data onto network 0 until step TR1 transmits its Prune. Afterwards, a Prune Echo message is transmitted onto network 0 and multicast data is not forwarded.

c. The RUT forwards the multicast data onto network 0 until step TR2 transmits its Prune. Afterwards, a Prune Echo message is transmitted onto network 0 and multicast data is not forwarded.

Test #		Result	
PIM_SM.3.9	**Transitions from (S,G) NoInfo State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions from the NoInfo State when receiving an (S,G) message.

Comments on Test Procedure

a. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. On network 1, data with a source address of 10.10.11.80 for the multicast group 224.0.6.130 is forwarded by the RP. Packets are observed on all networks.
b. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. Data for a multicast group 224.0.6.130 is forwarded by the RP on network 1. TR1 transmits an (S,G) Prune message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.3

a. The RUT forwards the multicast data packets onto network 0.
b. The RUT does not forward the multicast data packets onto network 0 until after having received an (S,G) Join message. After the (S,G) Prune the data was no longer forwarded.

Test #		Result	
PIM_SM.3.10	**Transitions from (S,G) Join State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions from the Join State when receiving an (S,G) message.

Comments on Test Procedure

a. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits an (S,G) Join message with a source address of 10.10.15.80 and a group address of 224.0.6.130 on network 0. On network 1, data with a source address of 10.10.15.80 for the multicast group 224.0.6.130 is forwarded by the RP. After 30 seconds, TR1 transmits an (S,G) Join message with a source address of 10.10.15.80 and a group address of 224.0.6.130 on network 0. Packets are observed on all networks.
b. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits an (S,G) Join message with a source address of 10.10.15.80 and a group address of 224.0.6.130 on network 0. On network 1, data with a source address of 10.10.15.80 for a multicast group 224.0.6.130 is forwarded by the RP on network 1. TR1 transmits an (S,G) Prune message with a source address of 10.10.15.80 and a group address of 224.0.6.130 on network 1. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.3

a. The RUT continues to forward the multicast data 105 seconds after the second Join message was transmitted.
b. The RUT stops forwarding the multicast data packets onto network 0 after the Prune message is received.

Test #		Result	
PIM_SM.3.11	**Transitions from (S,G) Prune Pending State**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly transitions from the Prune Pending State when receiving an (S,G) message.

Comments on Test Procedure

a. TR1 and TR2 transmit Hello messages on network 0. The RP transmits Hello messages on network 1. TR1 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. TR2 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. On network 1, data with a source address of 10.10.11.80 for the multicast group 224.0.6.130 is forwarded by the RP. TR1 transmits an (S,G) Prune message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. After 2.5 seconds, TR2 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. Packets are observed on all networks.

b. TR1 and TR2 transmit Hello messages on network 0. The RP transmits Hello messages on network 1. TR1 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. TR2 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. On network 1, data with a source address of 10.10.11.80 for the multicast group 224.0.6.130 is forwarded by the RP. TR1 transmits an (S,G) Prune message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. Packets are observed on all networks.

c. TR1 and TR2 transmit Hello messages on network 0. The RP transmits Hello messages on network 1. TR1 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. TR2 transmits an (S,G) Join message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. On network 1, data with a source address of 10.10.11.80 for the multicast group 224.0.6.130 is forwarded by the RP. TR1 transmits an (S,G) Prune message with a source address of 10.10.15.80 and a group address of 224.0.6.130 on network 0. TR2 transmits an (S,G) Prune message with a source address of 10.10.11.80 and a group address of 224.0.6.130 on network 0. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.3

a. The RUT forwards the multicast data onto network 0.

b. The RUT forwards the multicast data onto network 0 until TR1 transmits its Prune. Afterwards, a Prune Echo message is transmitted onto network 0 and multicast data is not forwarded.

c. The RUT forwards the multicast data onto network 0 until step TR2 transmits its Prune. Afterwards, a Prune Echo message is transmitted onto network 0 and multicast data is not forwarded.

GROUP 4: Transmission of Join and Prune Messages

The following tests verify conformance with transmission of Join and Prune messages in PIM-SM.

Test #		Result	
PIM_SM.4.1	**Transmission from (*,*,RP) NotJoined State**	**a**	**PASS**
Purpose: To verify that a router properly transitions to (*,*,RP) Joined state.			
Comments on Test Procedure			
a. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. Packets are observed on network 1.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 4.5.5		
a. 60 seconds after step 2, the RUT transmits a (*,*,RP) Join message to the RP. The RUT sets the Join Timer for TR1. After 60 seconds, the RUT transmits another (*,*,RP) Join message to the RP.			

Test #		Result	
PIM_SM.4.2	**Transitions from (*,*,RP) Joined State, Setup 1**	**a**	**PASS**
Purpose: To verify that a router properly transitions its state while in (*,*,RP) Joined state.			
Comments on Test Procedure			
a. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. After 10 seconds, TR1 transmits a (*,*,RP) Join message with a source address of the RP. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.5		
a. After 60 seconds, the RUT transmits another Join (*,*,RP) to the RP.			

Test #		Result	
PIM_SM.4.3	**Suppression and Override in (*,*,RP) Joined State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions its state while in Joined state.

Comments on Test Procedure

a. TR1 transmits Hello messages on network 0. The RP and TR2 transmit Hello messages on network 1. TR2 transmits a (*,*,RP) Join message with a source address of the RP on network 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. Packets are observed on all networks.
b. TR1 transmits Hello messages on network 0. The RP and TR2 transmit Hello messages on network 1. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. TR2 transmits a (*,*,RP) Join message with a source address of the RP on network 1. TR1 transmits a (*,*,RP) Prune message with a source address of the RP on network 0. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.5

a. The RUT waits t_joinsuppress seconds before transmitting a (*,*,RP) Join message on network 0.
b. The RUT transmits a (*,*,RP) Join message within 60 seconds of seeing the (*,*,RP) Prune message sent on network 0.

Test #		Result	
PIM_SM.4.4	**Transitions from (*,*,RP) Joined State, Setup 2**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions its state while in Joined state.

Comments on Test Procedure

a. TR1 transmits Hello messages on network 0. TR2 transmits Hello messages on networks 1 and 3. TR3 transmits Hello messages on networks 2 and 3. The RP transmits Hello messages on Network 3. TR2 is the upstream next hop for the RUT. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. Packets are observed on all networks.
b. TR1 transmits Hello messages on network 0. TR2 transmits Hello messages on networks 1 and 3. TR3 transmits Hello messages on networks 2 and 3. The RP transmits Hello messages on Network 3. TR2 is the upstream next hop for the RUT. TR1 transmits a (*,*,RP) Join message with a source address of the RP on network 0. TR2 transmits a Hello message with a new GenID on network 1. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.5

a. 60 seconds after step 3, the RUT transmits a (*,*,RP) Prune message to TR2. The RUT sends a (*,*,RP) Join message to TR3 and sets the Join Timer to expire after 60 seconds. After 60 seconds, the RUT transmits another (*,*,RP) Join message to TR2.
b. 60 seconds after step 7, the RUT sets the Join Timer to t-Override seconds. After 60 seconds, the RUT transmits a (*,*,RP) Join message to TR2.

Test #		Result	
PIM_SM.4.5	**Transmission from (*,G) NotJoined State**	**a**	**PASS**
Purpose: To verify that a router properly transitions state when in (*,G) NotJoined state.			
Comments on Test Procedure			
a. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits a (*,G) Join message with a source address of the RP for the multicast group 224.0.6.130 on network 0. Packets are observed on network 1.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 4.5.6		
a. Immediately after TR1 transmits a (*,G) Join message on network 0, the RUT transmits a (*,G) Join message to the RP for the multicast group 224.0.6.130. The RUT sets the Join Timer for TR1. After 60 seconds, the RUT transmits another (*,G) Join message to the RP for the multicast group 224.0.6.130.			

Test #		Result	
PIM_SM.4.6	**Transitions from (*,G) Joined State, Setup 1**	**a**	**PASS**
Purpose: To verify that a router properly transitions state when in (*,G) Joined state.			
Comments on Test Procedure			
a. TR1 and the RP transmit Hello messages on networks 0 and 1. The RP is the upstream next hop for the RUT. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 0. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.6		
a. Immediately after TR1 transmits a (*,G) Join message on network 0, the RUT transmits a (*,G) Join message for the multicast group 224.0.6.130 to the RP and resets the Join Timer to 60 seconds. After 60 seconds, the RUT transmits another (*,G) Join message for the multicast group 224.0.6.130 to the RP.			

Test #		Result	
PIM_SM.4.7	**Suppression and Override in (*,G) Joined State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions state when in (*,G) Joined state.

Comments on Test Procedure

a. TR1 transmits Hello messages on network 0. The RP and TR2 transmit Hello messages on network 1. TR2 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 1. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 0. Packets are observed on all networks.
b. TR1 transmits Hello messages on network 0. The RP and TR2 transmit Hello messages on network 1. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 0. TR2 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 1. TR2 transmits a (*,G) Prune message for the multicast group 224.0.6.130 on network 1. Packets are observed on all networks

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.6

a. The RUT waits t_joinsuppress seconds before transmitting a (*,G) Join message for the multicast group 224.0.6.130 on network 1.
b. The RUT transmits a (*,G) Join message for the multicast group 224.0.6.130 within t_override seconds of seeing the (*,G) Prune message.

Test #		Result	
PIM_SM.4.8	**Transitions from (*,G) Joined State, Setup 2**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions state when in (*,G) Joined state.

Comments on Test Procedure

a. TR1 transmits Hello messages on network 0. TR2 transmits Hello messages on networks 1 and 2. TR3 transmits Hello messages on networks 1 and 3. TR1, TR2 and TR3 should be elected DR on networks 0, 2 and 3. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 0. The RUT's next hop for the RP changes from TR2 to TR3. Packets are observed on networks 2 and 3.
b. TR1 transmits Hello messages on network 0. TR2 transmits Hello messages on networks 1 and 2. TR3 transmits Hello messages on networks 1 and 3. TR1, TR2 and TR3 should be elected DR on networks 0, 2 and 3. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 0. TR2 transmits a Hello messages with a new GenID on network 1. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.6

a. The RUT transmits a (*,G) Prune message for the multicast group 224.0.6.130 on network 2 and then a (*,G) Join message for the multicast group 224.0.6.130 on network 3.
b. The RUT transmits a (*,G) Join message for the multicast group 224.0.6.130 on network 2.

Test #		Result	
PIM_SM.4.9	**Transmission (S,G) NotJoined State**	**a**	**PASS**
Purpose: To verify that a router properly transitions state when in (S,G) NotJoined state.			
Comments on Test Procedure			
a. TR1 and the RP transmit Hello messages on networks 0 and 1. TR1 transmits an (S,G) Join message with a source address of the RP for the multicast group 224.0.6.130 on network 0. Packets are observed on network 1.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt-Section 4.5.7		
a. Immediately after TR1 transmits a Join (S,G) message on network 0, the RUT transmits an (S,G) Join message to the RP. The RUT sets the Join Timer for TR1. After 60 seconds, the RUT transmits another (S,G) Join message to the RP.			

Test #		Result	
PIM_SM.4.10	**Transitions from (S,G) Joined State, Setup 1**	**a**	**PASS**
Purpose: To verify that a router properly transitions state when in (S,G) Joined state.			
Comments on Test Procedure			
a. TR1 and the RP transmit Hello messages on networks 0 and 1. The RP is the upstream next hop for the RUT. TR1 transmits an (S,G) Join message with a source address of 10.10.15.80 for the multicast group 224.0.6.130 on network 0. Packets are observed on all networks.			
Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.7		
a. Immediately after TR1 transmits a Join (S,G) message on network 0, the RUT transmits an (S,G) Join message to the RP and resets the Join Timer to 60 seconds. After 60 seconds, the RUT transmits another (S,G) Join message to the RP.			

Test #		Result	
PIM_SM.4.11	**Suppression and Override in (S,G) Joined State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions state when in (S,G) Joined state.

Comments on Test Procedure

a. TR1 transmits Hello messages on network 0. The RP and TR2 transmit Hello messages on network 1. TR2 transmits an (S,G) Join message with a source address of 10.10.15.80 for the multicast group 224.0.6.130 on network 1. TR1 transmits an (S,G) Join message with a source address of 10.10.15.80 for the multicast group 224.0.6.130 on network 0. Packets are observed on all networks.
b. TR1 transmits Hello messages on network 0. The RP and TR2 transmit Hello messages on network 1. TR1 transmits an (S,G) Join message with a source address of 10.10.15.80 for the multicast group 224.0.6.130 on network 0. TR2 transmits an (S,G) Join message with a source address of 10.10.15.80 for the multicast group 224.0.6.130 on network 1. TR2 transmits an (S,G) Prune message with a source address of 10.10.15.80 for the multicast group 224.0.6.130 on network 1. Packets are observed on all networks.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.7

a. The RUT waits t_joinsuppress seconds before transmitting an (S,G) Join message for the multicast group 224.0.6.130 on network 1.
b. The RUT transmits an (S,G) Join message for the multicast group 224.0.6.130 within t_override seconds of seeing the (S,G) Prune message.

Test #		Result	
PIM_SM.4.12	**Transitions from (S,G) Joined State, Setup 2**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions state when in (S,G) Joined state.

Comments on Test Procedure

a. The RUT is configured to transmit Hello messages on networks 0, 2 and 3. TR1 transmits Hello messages on network 0. TR2 transmits Hello messages on networks 1 and 2. TR3 transmits Hello messages on network 1 and 3. The RP transmits Hello messages on network 3. TR1, TR2 and TR3 should be elected DR on networks 0, 2 and 3. TR1 transmits an (S,G) Join message with a source address of the RP for the multicast group 224.0.6.130 on network 0. This causes the RUT to transition to (S,G) Joined state. The RUT's next hop changes to TR3. Packets are observed on networks 2 and 3.
b. The RUT is configured to transmit Hello messages on networks 0, 2 and 3. TR1 transmits Hello messages on network 0. TR2 transmits Hello messages on networks 1 and 2. TR3 transmits Hello messages on network 1 and 3. The RP transmits Hello messages on network 3. TR1, TR2 and TR3 should be elected DR on networks 0, 2 and 3. TR1 transmits an (S,G) Join message with a source address of the RP for the multicast group 224.0.6.130 on network 0. This causes the RUT to transition to (S,G) Joined state. TR2 transmits a Hello message with a new GenID on network 2. Packets are observed on network 2.

Comments on Test Results	Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.7

a. After 60 seconds, the RUT transmits an (S,G) Prune message for the multicast group 224.0.6.130 on network 2 and also transmits an (S,G) Join message for the multicast group 224.0.6.130 on network 3.
b. After t_override seconds, the RUT transmits an (S,G) Join message for the multicast group 224.0.6.130 on network 2.

Test #		Result	
PIM_SM.4.13	**Transitions from (S,G) NotPruned State**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly transitions state when in (S,G) NotPruned state.

Comments on Test Procedure

a. TR1, TR2, and TR3 transmit Hello messages on network 0. TR2 and TR4 transmit Hello messages on network 1. The RP and TR2 transmit Hello messages on network 2. TR1 transmits an (S,G) Join message for the multicast group 224.0.6.130 with the upstream neighbor address set to the address of TR2 on network 0. TR4 forwards multicast data from source 10.10.15.80 for the multicast group 224.0.6.130 on network 1. An IGMP report for multicast group 224.0.6.130 is transmitted by the receiver. The RUT should transmit a (*,G) Join message upstream. TR1 transmits an (S,G) Join message for source 10.10.15.80 and multicast group 224.0.6.130 with the upstream neighbor address set to the address of TR3 on network 0. TR1 transmits an (S,G,rpt) Prune message for the multicast group 224.0.6.130 with upstream neighbor address set to the address of TR2 on network 0. Packets are observed on all networks.

b. TR1, TR2, and TR3 transmit Hello messages on network 0. TR2 and TR4 transmit Hello messages on network 1. The RP and TR2 transmit Hello messages on network 2. TR1 transmits a (*,G) Join message for the multicast group 224.0.6.130 with the upstream neighbor address set to the address of TR2 on network 0. TR4 forwards multicast data from source 10.10.15.80 for the multicast group 224.0.6.130 on network 1. An IGMP report for multicast group 224.0.6.130 is transmitted by the RUT. The RUT should transmit a (*,G) Join message upstream. TR1 transmits an (S,G) Join message for source 10.10.15.80 and multicast group 224.0.6.130 with the upstream neighbor address set to the address of TR3 on network 0. TR1 transmits an (S,G, rpt) Prune message for the multicast group 224.0.6.130 with the upstream neighbor address set to the address of TR2 on network 0. TR1 transmits an (S,G,rpt) Join message for the multicast group 224.0.6.130 with upstream neighbor address set to the address of TR2 on network 0. Packets are observed on all networks.

Comments on Test Results | Draft-ietf-pim-sm-v2-new-12.txt – Section 4.5.9

a. The RUT sets the Override Timer to t_override seconds. After t_override seconds, the RUT transmits an (S,G,rpt) Join message for source 10.10.15.80 and multicast group 224.0.6.130 with the upstream neighbor address set to the address of TR2.

b. The RUT cancels the Override Timer and does not transmit an (S,G,rpt) Join message.