IPv4 CONSORTIUM

OSPF Operations Test Report Revision 2.6

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Mr(s). Vendor,

Enclosed are the results from the Open Shortest Path First (OSPF) 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 2328 and RFC 1583. The tests performed are part of the OSPF Test Suite, which is available on the UNH InterOperability Lab's website:

ftp://ftp.iol.unh.edu/pub/ipv4/testsuites/OSPF_Description.pdf

During the testing process, the following issues were uncovered:

Test #	Result
OSPF_CONF 2.18 b:	The RUT does not transition into state ExStart.
OSPF_CONF5.3 c:	The RUT does not set the V bit in its router-LSAs for Area 1.

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,

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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: Hello Protocol (HELLO)

The following tests verify conformance with the Hello Protocol.

Test #		Result	
OSPF_CONF.1.1	**Basic Hello Packet Verification**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that the Hello packets are sent every HelloInterval seconds to the IP multicast address ALLSPFRouters on broadcast and point-to-point networks.

Comments on Test Procedure

a. The RUT is configured to have a HelloInterval of 10 seconds and to broadcast Hello packets on network 0. Packets are observed on network 0.
b. The RUT's Hello Interval is configured to be 25 seconds. OSPF is restarted on the RUT.

Comments on Test Results	RFC 2328-Section 9.5 RFC 1583-Section 9.5

a. The RUT transmits Hello packets every 10 seconds addressed to AllSPFRouters.
b. The RUT transmits Hello packets every 25 seconds addressed to AllSPFRouters.

Test #		Result	
OSPF_CONF.1.2	**Basic Virtual Link Hello Packet Verification**	**a**	**PASS**

Purpose: To verify that on virtual links Hello packets are sent as unicast every HelloInterval seconds.

Comments on Test Procedure

a. A virtual link should be configured between the RUT and TR1. The RUT is restarted on networks 0 and 1. OSPF is enabled on TR1, and their databases should synchronize. Packets are observed over the virtual link after the RUT and TR1's databases are synchronized.

Comments on Test Results	RFC 2328-Section 9.5 RFC 1583-Section 9.5

a. Hello packets for the virtual link are sent unicast from the RUT to TR1 every HelloInterval seconds. The Area ID field of the Hello packets is set to 0.0.0.0.

Test #		Result	
OSPF_CONF.1.3	**Hello Waiting**	**a**	**PASS**

Purpose: To verify that a router does not elect DR or BDR until it transitions out of Waiting state.

Comments on Test Procedure

a. The RUT is configured to have Priority 1, RouterDeadInterval 40 and HelloInterval 10. The RUT is enabled on network 0. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Sections 9.1, 9.2 and 9.3 RFC 1583-Sections 9.1, 9.2 and 9.3

a. In the RUT's first four Hello packets, the DR and BDR fields are set to 0.0.0.0. In successive Hello packets, the DR field is the address of the interface to network 0.

Test #		Result	
OSPF_CONF.1.4	**Event Backup**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that event BackupSeen occurs properly and brings an interface out of state Waiting.

Comments on Test Procedure

a. The RUT is configured to have priority 1, HelloInterval 10 and RouterDeadInterval 40. All the interfaces are disabled on network 0. OSPF is enabled on TR1, and it should become DR. The RUT is enabled on network 0. Packets are observed on network 0.
b. The RUT's interface to network 0 is disabled. OSPF is enabled on TR2, and it should become the BDR. TR2 is unplugged. The RUT is enabled. After RouterDeadInterval, packets are observed on network 0.
c. The RUT's interface is unplugged, OSPF is reset and the interface is plugged back in. TR1 should list the RUT as BDR. Packets are observed on network 0.
d. The RUT's interface is disabled. OSPF is enabled on TR2, and TR2 should become BDR. The RUT's interface is enabled. After 20 seconds, packets are observed on network 0.

Comments on Test Results	RFC 2328-Sections 9.1, 9.2 and 9.3 RFC 1583-Sections 9.1, 9.2 and 9.3

a. The RUT promotes itself to BDR after TR1 transmits a Hello Packet with the RUT listed as a neighbor, itself as DR and no BDR. However, it is possible that instead of transmitting such a packet, TR1 will run DR election as soon as it sees the RUT, and will therefore transmit a Hello with the RUT as BDR (instead of 0.0.0.0). In such a case, the RUT waits for the RouterDeadInterval to expire before transitioning out of state Waiting.
b. The RUT waits for approximately 40 seconds before it begins to claim itself to be the BDR on network 0.
c. The RUT waits for approximately 40 seconds before it begins to claim itself to be the BDR on network 0.
d. The RUT lists TR2 as the BDR on network 0 in its second or third Hello Packet.

Test #		Result	
OSPF_CONF.1.5	**No Waiting**	**a**	**PASS**
Purpose: To verify that if a router has priority 0 on an interface, the interface state machine does not go through state Waiting but goes directly to DR Other.			
Comments on Test Procedure			
a. TR1 has priority 2 and TR2 has priority 1. The RUT is configured to have priority 0. All routers should have HelloInterval 10 and RouterDeadInterval 40. OSPF is enabled on TR1 and TR2. TR1 should become DR. TR2's interface is unplugged, therefore the RUT will not have a BackupSeen event. The RUT's interface is enabled. Packets are observed on network 0.			
Comments on Test Results	RFC 2328-Section 9.3 RFC 1583-Section 9.3		
a. The RUT immediately becomes DR Other and claims TR1 to be DR as soon as it sees a Hello Packet from TR1 listing itself (RUT) as a neighbor. The Database Process begins between the RUT and TR1 at this point.			

Test #		Result	
OSPF_CONF.1.6	**Existing DR**	**a**	**PASS**
Purpose: To verify that when a router's interface to a network first becomes functional, if there is already an existing DR, it accepts that DR regardless of its own priority.			
Comments on Test Procedure			
a. TR1 has priority 1 and TR2 has priority 1. The RUT is configured to have priority 3. OSPF is enabled on TR1 and TR2. After RouterDeadInterval expires, TR1 should become DR. The RUT is enabled. Packets are observed on network 0.			
Comments on Test Results	RFC 2328-Section 7.3 RFC 1583-Section 7.3		
a. Event BackupSeen occurs and the RUT transmits its next Hello Packet with TR1 as DR and TR2 as BDR.			

Test #		Result	
OSPF_CONF.1.7	**DR Collision**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that if two or more routers have declared themselves DR, the one with the highest priority is chosen to be DR. In the case of a tie, the one having the highest Router ID is chosen.

Comments on Test Procedure

a. TR1 has priority 1. The RUT is configured to have priority 2, and a Router ID higher than TR1's Router ID. The repeater is disconnected from network 0. The routers are restarted, more than RouterDeadInterval seconds the repeater is connected to network 0. Packets are observed on network 0.
b. The repeater is disconnected from network 0. TR1 should have priority 2. The repeater is connected after more than RouterDeadInterval seconds. Packets are observed on network 0.
c. The repeater is disconnected from network 0. TR1's Router ID should be higher than the RUT's Router ID. The repeater is connected after RouterDeadInterval seconds. Packets are observed on network 0.
d. The repeater is disconnected from network 0. TR1 should have priority 3. The repeater is connected after more than RouterDeadInterval seconds. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 9.4 RFC 1583-Section 9.4

a. The RUT remains the DR and TR1 becomes the BDR.
b. The RUT remains the DR and TR1 becomes the BDR.
c. TR1 remains the DR and the RUT becomes the BDR.
d. TR1 remains the DR and the RUT becomes the BDR.

Test #		Result	
OSPF_CONF.1.8	**BDR Becomes DR**	**a**	**PASS**

Purpose: To verify that the BDR becomes DR when the previous DR fails.

Comments on Test Procedure

a. TR1, the RUT and TR2 should be enabled so that they become DR, BDR and DR Other, respectively. OSPF is disabled on TR1. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Sections 7.4, 9.1 and 9.3 RFC 1583-Sections 7.4, 9.1 and 9.3

a. The RUT and TR2 become DR and BDR respectively. They do not resynchronize their databases.

Test #		Result	
OSPF_CONF.1.9	**DR Other Becomes BDR**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that when the DR fails, the DR Other with the highest priority becomes BDR, and synchronizes its database with all the other routers on the network except the new DR.

Comments on Test Procedure

a. All of the TRs should have priority 1. The RUT should be configured to have priority 2. OSPF is enabled on TR1, TR2, TR3 and the RUT so that they become DR, BDR, DR Other and DR Other, respectively. OSPF is disabled on TR1's interface to network 0. Packets are observed on network 0.
b. The RUT is configured to have priority 1. TR3 should have priority 2. OSPF is enabled on TR1. OSPF is restarted on all the routers so that TR1, TR2, TR3 and the RUT become DR, BDR, DR Other and DR Other, respectively. OSPF is disabled on TR1. Packets are observed on network 0.
c. The RUT is configured to have the same priority as TR3, and a Router ID greater than TR3's Router ID. OSPF is enabled on TR1. OSPF is restarted on all the routers so that TR1, TR2, TR3 and the RUT become DR, BDR, DR Other and DR Other, respectively. OSPF is disabled on TR1. Packets are observed on network 0.
d. The RUT is configured to have the same priority as TR3, and the Router ID is less than TR3's Router ID. OSPF is enabled on TR1. OSPF is restarted on all the routers so that TR1, TR2, TR3 and the RUT are DR, BDR, DR Other and DR Other, respectively. OSPF is disabled on TR1. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Sections 9.3 and 9.4 RFC 1583-Sections 9.3 and 9.4

a. TR2 becomes the DR and the RUT becomes the BDR. The RUT synchronizes with TR3, but not with TR2.
b. TR2 becomes the DR and TR3 becomes the BDR. The RUT synchronizes with TR3, but not with TR2.
c. TR2 becomes the DR and the RUT becomes the BDR. The RUT synchronizes with TR3, but not with TR2.
d. TR2 becomes the DR and TR3 becomes the BDR. The RUT synchronizes with TR3, but not with TR2.

Test #		Result	
OSPF_CONF.1.10	**Hello Mismatch**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that any mismatch between the Hello Packet values Area ID, Network Mask, HelloInterval, RouterDeadInterval and the configuration of the receiving interface cause the packet to be dropped as long as the interface is not part of a point-to-point network or a virtual link.

Comments on Test Procedure

a. The Routers are configured so that their Area ID, Network Mask, HelloInterval and RouterDeadInterval match. OSPF is restarted on all the routers. Packets are observed on network 0 after more than RouterDeadInterval seconds.
b. The RUT's Area ID is configured to a value different than TR1's Area ID. OSPF is restarted on all the routers. Packets are observed on network 0 after more than RouterDeadInterval seconds.
c. The RUT's Area ID is reset to the original value. TR1's Network Mask is changed to a value different than the RUT's Network Mask. OSPF is restarted on all the routers. Packets are observed on network 0 after more than RouterDeadInterval seconds.
d. TR1's Network Mask is reset the original value, and the HelloInterval is changed to a value different than the RUT's HelloInterval. OSPF is restarted on all the routers. Packets are observed on network 0 after more than RouterDeadInterval seconds.
e. TR1's HelloInterval is reset to the original value and the RouterDeadInterval is changed to a value different than the RUT's RouterDeadInterval. OSPF is restarted on all the routers. Packets are observed on network 0 after more than RouterDeadInterval seconds.

Comments on Test Results	RFC 2328-Section 10.5 RFC 1583-Sections 9.5 and 10.5

a. The RUT and TR1 become neighbors and then synchronize their databases.
b. The RUT and TR1 do not become neighbors.
c. The RUT and TR1 do not become neighbors.
d. The RUT and TR1 do not become neighbors.
e. The RUT and TR1 do not become neighbors.

Test #		Result	
OSPF_CONF.1.11	**Remote Hello**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that if an incoming OSPF packet is not from a local network then it is discarded.

Comments on Test Procedure

a. The RUT is configured to have an address of X.Y.11.1 on network 1 with a netmask of 255.255.255.0. TR1 should have an address of X.Y.12.2 on network 1 with a netmask of 255.255.255.0. The RUT is configured to have an address of X.Y.10.1 on network 0 with a netmask of 255.255.255.0. Network 0 is X.Y.10.0/24 and network 1 is X.Y.11.0/24. OSPF is restarted on all the routers. Packets are observed on network 0 and network 1.
b. OSPF is disabled on the routers. TR1's address on network 1 is changed to X.Y.10.2. OSPF is restarted on the routers. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 10.5 RFC 1583-Sections 9.5 and 10.5

a. The RUT does not list TR1 as a neighbor in its Hello packets.
b. The RUT does not list TR1 as a neighbor in its Hello packets.

Test #		Result	
OSPF_CONF.1.12	**E Bit in Hello Packets**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that the E bit of the Opinions field in a Hello Packet is set if and only if the attached area is not a stub area. If two routers on a network do not agree on the E bit, they will not become neighbors.

Comments on Test Procedure

a. All of the routers should agree that the area is not a stub area. OSPF is restarted on the routers. Packets are observed on network 0.
b. TR1 is changed so that the attached area is a stub area. OSPF is restarted on the routers. Packets are observed on network 0.
c. The RUT is configured so that the attached area is a stub area. OSPF is restarted on the routers. Packets are observed on network 0.
d. TR1 is changed so that the attached are is not a stub area. OSPF is restarted on the routers. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Sections 9.5 and 10.5 RFC 1583-Sections 9.5 and 10.5

a. The E bit is set in the RUT's Hello packets and TR1 is listed as a neighbor.
b. The E bit is set in the RUT's Hello packets and not set in TR1's Hello packets. The RUT does not list TR1 as a neighbor.
c. The E bit is not be set in either router's Hello packets. The RUT lists TR1 as a neighbor.
d. The E bit is set in TR1's Hello packets and not set in the RUT's Hello packets. The RUT does not list TR1 as a neighbor.

Group 2: Flooding and Adjacency

The following tests verify the flooding and adjacency procedures of the OSPF protocol.

Test #		Result	
OSPF_CONF.2.1	**Multi-access Adjacencies**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that on a multi-access network, the DR and BDR become adjacent with all other routers, while a DR Other only becomes adjacent with the DR and BDR.

Comments on Test Procedure

a. The routers should have priority 1. The RUT is configured to have the highest Router ID. OSPF is enabled on TR1, TR2 and TR3 so that they become DR, BDR and DR Other, respectively. The RUT is enabled. Packets are observed on network 0.
b. OSPF is disabled on TR3. OSPF is restarted on TR1, the RUT and TR2 so that they become DR, BDR and DR Other, respectively. OSPF is enabled on TR3. Packets are observed on network 0.
c. OSPF is disabled on TR3. OSPF is restarted on the RUT, TR1 and TR2 so that they become DR, BDR and DR Other, respectively. OSPF is enabled on TR3. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 10.4 RFC 1583-Section 10.4

a. The RUT forms adjacencies with TR1 and TR2. It does not transmit DD packets to TR3.
b. The RUT forms adjacencies with all routers.
c. The RUT forms adjacencies with all routers.

Test #		Result	
OSPF_CONF.2.2	**OSPF DD MTU Field**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly sets the MTU for its interface to a network in DD packets.

Comments on Test Procedure

a. The RUT is configured so that it will become adjacent with TR1. OSPF is restarted on the routers. Packets are observed on network 0 and network 1.
b. The RUT is configured to form a virtual link with TR1 in Area 1. OSPF is restarted on the routers. Packets are observed on network 0, network 1 and the virtual link.

Comments on Test Results	RFC 2328-Section 10.8

a. The RUT sets the Interface MTU Field of its DD packets to 1500.
b. The RUT sets the Interface MTU Field of its DD packets sent across the virtual link to zero.

Test #		Result	
OSPF_CONF.2.3	**MTU Mismatch**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly identifies the MTU for its interface to a network in its DD packets, and any incoming DD packet with an MTU set higher than this value will be dropped.

Comments on Test Procedure

a. The RUT is configured to have a lower MTU and Router ID than TR1. OSPF is enabled on the routers. Packets are observed on network 0.
b. The RUT is configured to have a lower MTU, but a higher Router ID than TR1. OSPF is restarted on the routers. Packets are observed on network 0.
c. The RUT is configured have a lower Router ID but higher MTU than TR1. OSPF is restarted on the routers. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 10.6

a. When the RUT has a lower Router ID than TR1, both the RUT and TR1 transmit their initial DD packets, but the RUT drops TR1's since it has a higher MTU setting. The RUT does not transmit a DD packet with the I bit clear.
b. When the RUT has the higher Router ID, after the initial packets are sent, TR1 transmits a packet with the MS and I bits not set. The RUT drops this packet since the MTU setting is set higher than its own.
c. After receiving an initial DD packet from TR1, the RUT transmits a DD packet with the MS and I bits clear.

Test #		Result	
OSPF_CONF.2.4	**Master Negotiation**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that the Master/Slave is properly negotiated.

Comments on Test Procedure

a. The RUT is configured with a lower Router ID than TR1's Router ID. OSPF is enabled on the routers. Packets are observed on network 0 after their databases are synchronized.
b. The RUT is configured with a higher Router ID than TR1's Router ID. OSPF is restarted on the routers. Packets are observed on network 0 after their databases are synchronized.

Comments on Test Results	RFC 2328-Section 10.6 RFC 1583-Section 10.6

a. After the RUT receives the initial DD packet from TR1, it transmits DD packets with the I and MS bits clear. The sequence number is set to that specified in TR1's initial DD packet.
b. The RUT receives a DD packet from TR1 with the I and MS bits clear and the sequence number equal to its own sequence number. The RUT transmits a DD packet with the I bit clear, the MS bit set and the sequence number incremented by one.

Test #		Result	
OSPF_CONF.2.5	**Self-Originated LSA Processing**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router advances its LS sequence numbers when it finds that there are old LSAs originated by itself in another router's database.

Comments on Test Procedure

a. OSPF is enabled on the routers. After their databases synchronize, OSPF is restarted on the RUT. When TR1 and the RUT resynchronize their databases, TR1 lists the RUT's old router-LSA in one its DD packets.Packets are observed on network 0.
b. TR1 also lists the RUT's old network-LSA in one of its DD packets. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 13.4 RFC 1583-Section 13.4

a. The RUT requests its old router-LSA. After TR1 transmits this old router-LSA, the RUT transmits a new router-LSA with a higher sequence number.
b. The RUT requests its old network-LSA. After TR1 transmits this old network-LSA, the RUT transmits an LS Update containing this LSA with MaxAge.

Test #		Result	
OSPF_CONF.2.6	**Receiving Old LSAs**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router discards an LSA that is older than the database copy if it supports only RFC 1583. If the router supports RFC 2328, a router should transmit its current database copy of the LSA unicast back to a neighbor from whom it receives an LSA that is older than the database copy.

Comments on Test Procedure

a. OSPF is enabled on the routers. Their databases should synchronize. TR1 transmits a router-LSA for itself with sequence number 0x70000001. TR1 transmits a router-LSA for itself with sequence number 0x8FFFFFFE after more than minLSInterval. Packets are observed on network 0.
b. OSPF is enabled on the routers. Their databases should synchronize. TR1 transmits a router-LSA for itself with sequence number 0x70000001. TR1 transmits a router-LSA for itself with sequence number 0x8FFFFFFE after more than minLSInterval. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 13 RFC 1583-Section 13

a. The RUT drops the router-LSA with sequence number 0x8FFFFFFE.
b. Upon receipt of the router-LSA with sequence number 0x8FFFFFFE, the RUT transmits the sequence number 0x70000001 instance of router-LSA unicast to TR1. It does not acknowledge the older (0x8FFFFFFE) LSA, and does not place TR1 on its retransmission list when it transmits the newer LSA (0x70000001).

Test #		Result	
OSPF_CONF.2.7	**Neighbor in Lower State than Exchange**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router discards an LSA that is older than the database copy if it supports only RFC 1583. If the router supports RFC 2328, a router should transmit its current database copy of the LSA unicast back to a neighbor from whom it receives an LSA that is older than the database copy.

Comments on Test Procedure

a. OSPF is enabled on the routers. TR1 transmits Hello packets listing the RUT as a neighbor, but no DD packets (so the RUT cannot go beyond state ExStart). After receiving an initial DD packet from the RUT, TR1 transmits a Link State Update unicast to the RUT. Packets are observed on network 0.
b. TR1 transmits a Link State Request packet. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Sections 10.7 and 13 RFC 1583-Sections 10.7 and 13

a. The RUT does not acknowledge the Link State Update from TR1, and it does not add the LSA to its link state database.
b. The RUT does not respond the Link State Request from TR1.

Test #		Result	
OSPF_CONF.2.8	**DD Retransmission**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly retransmits DD packets.

Comments on Test Procedure

a. TR1 should have a higher Router ID than the RUT. OSPF is enabled on the routers. TR1 transmits only an initial DD packet. Packets are observed on network 0.
b. OSPF is restarted on the routers. TR1 transmits enough LSAs to fill at least four DD packets. TR1 is shut down for RouterDeadInterval. OSPF is restarted on TR1. During the DD Exchange process, after the RUT transmits its third DD packet, TR1 should retransmit its previous packet. Packets are observed on network 0.
c. TR1 should have a lower Router ID than the RUT. OSPF is restarted on the routers. After the DD Exchange process started, TR1 transmits only its first non-initial DD packet to the RUT. Packets are observed on network 0.
d. OSPF is restarted on the routers. TR1 transmits enough LSAs to fill at least four DD packets. TR1 is shut down and restarted after RouterDeadInterval. TR1 only transmits empty DD packets so that the RUT's last DD packet contains LSA Headers. Within RouterDeadInterval of receiving the RUT's last DD packet, TR1 transmits its last DD packet. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 10.8 RFC 1583-Section 10.8

a. The RUT transmits a non-initial DD packet after receiving TR1's initial packet. The RUT does not retransmit this packet as a result of not receiving another DD packet from TR1.
b. The RUT retransmits its third DD packet RxmtInterval after receiving the duplicate DD packet.
c. The RUT retransmits its last DD packet to TR1 every RxmtInterval seconds.

Test #		Result	
OSPF_CONF.2.9	**Event Sequence Number Mismatch**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**
		g	**PASS**
		h	**PASS**

Purpose: To verify that a router transitions to state ExStart when Event SeqNumberMismatch occurs.

Comments on Test Procedure

a. Both the RUT and TR1 should consider the area a non-stub area. After receiving the first non-initial DD packet from the RUT, TR1 transmits a DD packet with the E bit clear in the Options field. Packets are observed on network 0.
b. OSPF is restarted on the routers. TR1 sets the M bit in its first two non-initial DD packets. After receiving the next DD packet from the RUT, TR1 sets the I bit in its next DD packet. Packets are observed on network 0.
c. OSPF is restarted on the routers. TR1 sets the M bit in its first two non-initial DD packets. After receiving the next DD packet from the RUT, TR1 transmits a DD packet with a sequence number higher than expected. Packets are observed on network 0.
d. OSPF is restarted on the routers. TR1 sets the M bit in its first two non-initial DD packets. After receiving the next DD packet from the RUT, TR1 transmits a DD packet with a sequence number lower than expected. Packets are observed on network 0.
e. TR1 has a higher Router ID than the RUT. OSPF is restarted on the routers. After the RUT transmits its first non-initial packet, TR1 transmits its next packet with the MS bit clear. Packets are observed on network 0.
f. OSPF is restarted on the routers. After more than RouterDeadInterval after the DD Exchange process is complete, TR1 transmits a DD packet to the RUT, with everything set appropriately as for what would have been its next DD packet, if necessary. Packets are observed on network 0.
g. OSPF is restarted on the routers. After the RUT transmits its first non-initial DD packet, TR1 transmits its next packet containing an LSA Header of an unknown LS type. Packets are observed on network 0.
h. Both the RUT and TR1 should consider the area to be in a stub area. OSPF is restarted on the routers. TR1's first non-initial DD packet includes an LSA Header for an AS-external-LSA. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Sections 10.6 and 10.8 RFC 1583-Sections 10.6 and 10.8

a. The RUT transitions to state ExStart and transmits a DD packet with the I, MS and M bits set when it receives TR1's DD packet with different Options.
b. The RUT transitions to state ExStart after TR1 transmits its DD packet with the I bit unexpectedly set.
c. The RUT transitions to state ExStart after receiving the DD packet with an unexpected sequence number.
d. The RUT transitions to state ExStart after receiving the DD packet with an unexpected sequence number.
e. The RUT transitions to state ExStart after receiving the DD packet with the MS bit clear.
f. The RUT transitions to state ExStart when it receives TR1's DD packet more than RouterDeadInterval after reaching state Loading.
g. The RUT transitions to state ExStart after receiving the DD packet containing an LSA Header of unknown type.
h. The RUT transitions to state ExStart after receiving TR1's DD packet containing an AS-external-LSA Header.

Test #		Result	
OSPF_CONF.2.10	**Basic Flooding**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly floods non-AS-external-LSAs throughout the area but not outside of it.

Comments on Test Procedure

a. TR1 and TR2's interfaces to network 0 are down. TR1 and TR2 are started so that they become DR and BDR on network 1. OSPF is enabled on the RUT. OSPF is enabled on TR3. OSPF is enabled on TR1's interface on network 0. Packets are observed on network 0.
b. OSPF is restarted on the routers so that TR1, the RUT and TR2 become DR, BDR and DR Other on network 1, respectively. TR1's interface to network 0 is disabled. Packets are observed on network 0.
c. OSPF is enabled on the routers so that the RUT, TR1 and TR2 become DR, BDR and DR Other on network 1, respectively. TR1's interface on network 0 is enabled. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 13 RFC 1583-Section 13

a. After TR1 transmits its new router-LSA to network 1, the RUT floods it to network 2, but not network 3.
b. After TR1 transmits its new router-LSA to network 1, the RUT floods it to network 2, but not network 3.
c. After TR1 transmits its new router-LSA to network 1, the RUT floods it to network 2, but not network 3.

Test #		Result	
OSPF_CONF.2.11	**Flooding AS-External-LSAs**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router properly floods AS-external-LSAs throughout the OSPF AS.

Comments on Test Procedure

a. TR1 is an ASBR, with an external link configured. A virtual link is configured between the RUT and TR3 in area 1. OSPF is enabled on TR1 and TR2 so that they become DR and BDR on network 0. OSPF is enabled on all of the other routers. TR1's cost on the external link should change. Packets are observed on network 0.
b. OSPF is restarted on the routers so that TR1, the RUT and TR2 become DR, BDR and DR Other on network 0, respectively. TR1's cost on the external link should change. Packets are observed on network 0.
c. OSPF is restarted on the routers so that the RUT, TR1 and TR2 become DR, BDR and DR Other on network 0, respectively. TR1's cost on the external link should change. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 13 RFC 1583-Section 13

a. After TR1 transmits its new AS-external-LSA to network 0, the RUT floods it to network 2 and network 3, but not network 1 or the virtual link.
b. After TR1 transmits its new AS-external-LSA to network 0, the RUT floods it to network 2 and network 3, but not network 1 or the virtual link.
c. After TR1 transmits its new AS-external-LSA to network 0, the RUT floods it to network 2 and network 3, but not network 1 or the virtual link.

Test #		Result	
OSPF_CONF.2.12	**Flooding LSA Acknowledgments**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**

Purpose: To verify that a router properly floods or acknowledges an incoming LSA.

Comments on Test Procedure

a. TR1 and TR2's interfaces to network 1 are disabled. OSPF is enabled on the router so that the RUT, TR1 and TR2 become DR, BDR and DR Other on network 0, respectively. TR2's interface to network 1 is enabled. Packets are observed on all networks.
b. TR2's interface to network 1 is disabled. TR1's interface to network 1 is enabled at least ten seconds after TR2's interface to network 1 is disabled (so the packets are separated). Packets are observed on network all networks.
c. OSPF is restarted on the routers so that TR2, the RUT and TR1 become DR, BDR and DR Other on network 0, respectively. TR2's interface to network 0 is unplugged. TR1's interface to network 1 is disabled. Packets are observed on all networks.
d. TR2's interface to network 0 is plugged in. OSPF is restarted on the router so that TR2, the RUT and TR1 become DR, BDR and DR Other on network 0, respectively. TR2's interface to network 1 is enabled. Packets are observed on all networks.
e. OSPF is restarted on the routers so that TR1, TR2 and the RUT become DR, BDR and DR Other on network 0, respectively. TR2's interface to network 1 is disabled. Packets are observed on all networks.
f. The RUT's interface to network 2 is disabled. Packets are observed on all networks.

Comments on Test Results

RFC 2328-Section 13.5
RFC 1583-Section 13.5

a. After TR2 transmits its new router-LSA to the AllDRouters address on network 0, the RUT floods it back to the AllSPFRouters address on network 0. It does not transmit an explicit acknowledgement.
b. After TR1 transmits its new router-LSA to the AllSPFRouters address on network 0, the RUT does not flood the LSA. It transmits an acknowledgement to the AllSPFRouters address.
c. After TR1 transmits its new router-LSA for the AllDRouters address on network 0, the RUT waits RxmtInterval and then retransmits the LSA to TR2.
d. After TR2 transmits its new router-LSA to the AllSPFRouters address, the RUT transmits a delayed Acknowledgement to the AllSPFRouters address.
e. After TR2 transmits its new router-LSA to the AllSPFRouters address, the RUT transmits a delayed Acknowledgement to the AllDRouters address.
f. After TR1 floods the RUT's new router-LSA to network 0, the RUT does not transmit an Acknowledgement.

Test #		Result	
OSPF_CONF.2.13	**LSA Retransmission**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that a router properly places all routers that it is adjacent with on its retransmission list when appropriate.

Comments on Test Procedure

a. The RUT's interface to network 1 is disabled. OSPF is enabled on the routers so that the RUT, TR1, TR2 and TR3 become DR, BDR, DR Other and DR Other on network 0, respectively. TR1 (BDR) and TR2's (DR Other) interfaces from network 0 are unplugged. The RUT's interface to network 1 is enabled. Packets are observed on network 0 and network 1.
b. TR1 and TR2's interfaces to network 0 are plugged in. OSPF is restarted on the routers so that TR1, the RUT, TR2 and TR3 become DR, BDR, DR Other and DR Other on network 0, respectively. TR1 (DR) and TR2's (DR Other) interfaces from network 0 are unplugged. The RUT's interface to network 1 is disabled. Packets are observed on network 0 and network 1.
c. TR1 and TR2's interfaces to network 0 are plugged in. OSPF is restarted on the routers so that TR1, TR3, the RUT and TR2 become DR, BDR, DR Other and DR Other on network 0, respectively. TR1 (DR) and TR2's (DR Other) interfaces to network 0 are unplugged. The RUT's interface to network 1 is enabled. Packets are observed on network 0 and network 1.
d. TR1 and TR2's interfaces to network 0 are plugged in. OSPF is restarted on the routers so that TR1, TR3, the RUT and TR2 become DR, BDR, DR Other and DR Other on network 0, respectively. TR3 (BDR) and TR2's (DR Other) interfaces to network 0 are unplugged. The RUT's interface to network 1 is disabled. Packets are observed on network 0 and network 1.
e. The RUT's retransmission frequency on network 0 is observed.

Comments on Test Results

RFC 2328-Section 13.6
RFC 1583-Section 13.6

a. The RUT updates its router-LSA with a link to network 1. It only receives an acknowledgement from TR3. Five seconds after it sent the router-LSA, it retransmits it to TR1 and TR2.
b. The RUT updates its router-LSA with a link to network 1. It only receives an acknowledgement from TR3. Five seconds after it sent the router-LSA, it retransmits it to TR1 and TR2.
c. After the RUT enables its interface to network 1, it updates its router-LSA with a link to network 1. It only receives an acknowledgement from TR3. Five seconds after it sent the router-LSA, it retransmits it to TR1 but not TR2.
d. After the RUT disables its interface to network 1, it updates its router-LSA with a link to network 1. It only receives an acknowledgement from TR1. Five seconds after it sent the router-LSA, it retransmits it to TR3 but not TR2.
e. The RUT retransmits only a single packet to a neighbor every RxmtInterval.

Test #		Result	
OSPF_CONF.2.14	**LSA Flooding Guarantee**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**

Purpose: To verify that a router properly places all that it is adjacent with on its retransmission list when appropriate.

Comments on Test Procedure

a. TR3's interface to network 1 is disabled. OSPF is enabled on the routers so that the RUT, TR3, TR2 and TR1 become DR, BDR, DR Other and DR Other on network 0, respectively. TR1 (DR Other) and TR2's (DR Other) interfaces from network 0 are unplugged. TR3's (BDR) interface to network 1 is enabled. Packets are observed on network 0 and network 1.
b. TR1 and TR2's interfaces to network 0 are plugged in. OSPF is restarted on the routers so that the RUT, TR1, TR2 and TR3 become DR, BDR, DR Other and DR Other on network 0, respectively. TR1's (BDR) interface to network 0 is unplugged. TR3's (DR Other) interface to network 1 is disabled. Packets are observed on network 0 and network 1.
c. TR1's interface to network 0 is plugged in. OSPF is restarted on the routers so that TR3, the RUT, TR1 and TR2 become DR, BDR, DR Other and DR Other on network 0, respectively. TR1 (DR Other) and TR2's (DR Other) interfaces to network 0 are unplugged. TR3's (DR) interface to network 1 is enabled. Packets are observed on network 0 and network 1.
d. TR1 and TR2's interfaces to network 0 are plugged in. OSPF is restarted on the routers so that TR1, the RUT, TR2 and TR3 become DR, BDR, DR Other and DR Other on network 0, respectively. TR1's (DR) interface to network 0 is unplugged. TR3's (DR Other) interface to network 1 is disabled. Packets are observed on network 0 and network 1.
e. TR1's interface to network 0 is plugged in. OSPF is restarted on the routers so that TR3, TR2, TR1 and the RUT become DR, BDR, DR Other and DR Other on network 0, respectively. TR1 (DR Other) and TR2's (BDR) interfaces to network 0 are unplugged. TR3's (DR) interface to network 1 is enabled. Packets are observed on network 0 and network 1.
f. TR1 and TR2's interfaces to network 0 are plugged in. OSPF is restarted on the routers so that TR2, TR3, TR1 and the RUT become DR, BDR, DR Other and DR Other on network 0, respectively. TR1 (DR Other) and TR2's (DR) interfaces to network 0 are unplugged. TR3's (BDR) interface to network 1 is disabled. Packets are observed on network 0 and network 1.

Comments on Test Results | RFC 2328-Section 13.6
RFC 1583-Section 13.6

a. After TR3 transmits its new router-LSA to network 0, TR1 and TR2 do not acknowledge the LSA. RxmtInterval after the first transmission, the RUT begins retransmitting this LSA unicast to both TR1 and TR2.
b. After TR3 transmits its new router-LSA to network 0, the RUT floods the LSA to the network. When TR1 does not transmit an acknowledgement, the RUT retransmits the LSA unicast to TR1 every RxmtInterval seconds.
c. After TR3 transmits its new router-LSA to network 0, the RUT retransmits TR3's router-LSA unicast to both TR1 and TR2 every RxmtInterval seconds.
d. After TR3 transmits its new router-LSA to network 0, TR1 is not able to flood the LSA since it was unplugged. Therefore, the RUT retransmits the LSA to TR1 every RxmtInterval.
e. The RUT retransmits TR3's new router-LSA to TR2 (not TR1) every RxmtInterval.
f. The RUT retransmits TR3's new router-LSA to TR2 (not TR1) every RxmtInterval.

Test #		Result	
OSPF_CONF.2.15	**LSA Multicast**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that a router transmits its LS Update packets to the correct multicast address depending on the state of its interface.

Comments on Test Procedure

a. The RUT's interface to network 0 is disabled. The routers are started so that the RUT becomes the DR on network 1. The RUT's interface to network 0 is enabled. Packets are observed on network 0 and network 1.
b. The routers are restarted so that the RUT becomes BDR on network 1. The RUT's interface to network 0 is disabled. Packets are observed on network 0 and network 1.
c. The packets are observed for the hardware address of the AllSPFRouters address in the RUT's LS Update.
d. The RUT is configured to have priority 0 on network 1. The routers are restarted (TR1 should become DR). The RUT's interface to network 0 is enabled. Packets are observed on network 0 and network 1.
e. The packets are observed for the hardware address of the AllDRouters address in the RUT's LS Update.

Comments on Test Results	RFC 2328-Section 13.3 RFC 1583-Section 13.3

a. The RUT transmits its new router-LSAs in Link State Update packets to the AllSPFRouters address (254.0.0.5).
b. The RUT transmits its new router-LSAs in Link State Update packets to the AllSPFRouters address (254.0.0.5).
c. The AllSPFRouters address is algorithmically mapped to the 01:00:5e:00:00:05 hardware address.
d. The RUT transmits its new router-LSA in a Link State Update packet to the AllDRouters address (224.0.0.6).
e. The AllDRouters address is algorithmically mapped to the 01:00:5e:00:00:06 hardware address.

Test #		Result	
OSPF_CONF.2.16	**Unicast LSA Retransmissions**	**a**	**PASS**

Purpose: To verify that a router transmits all retransmitted LSAs in unicast Link State Update packets.

Comments on Test Procedure

a. The RUT's interface to network 0 is disabled. OSPF is enabled on the routers. TR1's interface to network 1 is unplugged. The RUT's interface to network 0 is enabled. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 13.6 RFC 1583-Section 13.6

a. RxmtInterval after the initial transmission, the RUT retransmits its router-LSA unicast to TR1.

Test #		Result	
OSPF_CONF.2.17	**LSA Request Retransmission**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router retransmits an unsatisfied LS Request every RxmtInterval seconds, and that an LSA is removed from its LS Request List upon reception of a valid Link State Update containing that LSA.

Comments on Test Procedure

a. OSPF is enabled on the routers. During the DD process, TR1 transmits 5 DD packets full of LSA headers, without any LS Updates (independently or in response to Requests). Packets are observed on network 0.
b. The total number of LSRequests the RUT transmits on network 0 are observed.
c. OSPF is restarted on the routers. During the DD process, TR1 transmits 5 DD packets full of LSA headers. TR1 transmits LSAs in an LS Update in response to the RUT's LS Request. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 10.9 RFC 1583-Section 10.9

a. The RUT retransmits its unsatisfied LS Request every RxmtInterval seconds.
b. The RUT transmits only one LS Request packet every RxmtInterval seconds.
c. The RUT stops requesting the LSAs included in TR1's LS Update packet.

Test #		Result	
OSPF_CONF.2.18	**Bad LSA Requests**	**a**	**PASS**
		b	**FAIL**

Purpose: To verify that a router transitions to state ExStart when event BadLSReq occurs.

Comments on Test Procedure

a. OSPF is enabled on the routers. After the DD process, TR1 requests an LSA that is not in the RUT's link state database. Packets are observed on network 0.
b. OSPF is restarted on the routers. TR1 floods its own router-LSA with sequence number 0x3. TR1 is shut down for more than RouterDeadInterval. TR1 is restarted. During the Database Exchange process, TR1 includes its own router-LSA in one of its DD packets with a higher sequence number. After the RUT requests this LSA, TR1 transmits its router-LSA with sequence number 0x2. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Sections 10.1, 10.2 and 13 RFC 1583-Sections 10.1, 10.2 and 13

a. The RUT transitions to state ExStart after receiving TR1's LS Request.
b. The RUT does not transition into state ExStart. RFC 2328 states in section 10.1 that *"Event SeqNumberMismatch forces ExStart state."* Therefore, the RUT should transition to state ExStart after receiving TR1's LS Update containing the older version of the LSA.

Test #		Result	
OSPF_CONF.2.19	**MaxAge Flooding**	**a**	**PASS**
Purpose: To verify that a router properly floods an LSA when its age reaches MaxAge.			
Comments on Test Procedure			
a. OSPF is enabled on the routers. After the routers synchronize, TR1 should send a router-LSA with its age set to 3575 seconds. Approximately 25 seconds later, observe the packets transmitted on the network.			
Comments on Test Results	RFC 2328-Section 14 RFC 1583-Section 14		
a. When TR2's router-LSA reaches MaxAge (1 hour) in the RUT's link state database, the RUT floods the LSA with age set to 3600 seconds.			

Test #		Result	
OSPF_CONF.2.20	**LSA Refresh**	**a**	**PASS**
Purpose: To verify that a router transmits all retransmitted LSAs in unicast Link State Update packets.			
Comments on Test Procedure			
a. OSPF is enabled on the routers. Approximately 30 minutes after the RUT and TR1 are enabled, packets are observed on network 0.			
Comments on Test Results	RFC 2328-Section 12.4 RFC 1583-Section 12.4		
a. The RUT floods all of its self-originated LSAs when they reach LSRefreshTime. This occurs approximately 30 minutes after the RUT was started.			

Test #		Result	
OSPF_CONF.2.21	**LSA Removed from Retransmission**	**a**	**PASS**
Purpose: To verify that a router removes an LSA from its state retransmission list when that LSA has been removed from its link state database.			
Comments on Test Procedure			
a. TR3's interface to network 1 should be down. OSPF is enabled on the routers so that the RUT is DR on network 0. TR1 is unplugged from network 0. TR3 is enabled on network 1. TR3 should originate a new router-LSA on network 0, including its link to network 1. After the RUT begins retransmitting TR3's router-LSA to TR1, TR3's interface to network 1 is disabled. TR3 should originate a new router-LSA on network 0, without the link to network 1. Packets are observed on network 0 and network 1.			
Comments on Test Results	RFC 2328-Section 12.2 RFC 1583-Section 12.2		
a. The RUT stops retransmitting TR3's previous router-LSA, and only retransmits the newer instance.			

Test #		Result	
OSPF_CONF.2.22	**Neighbor State Down**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify the handling of packets from routers in state down.

Comments on Test Procedure

a. OSPF is enabled on the RUT. TR1 transmits a DD Packet on network 0. Traffic is observed on network 0.
b. OSPF is restarted on the RUT. TR1 transmits an LSRequest to the RUT on network 0. Traffic is observed on network 0.
c. OSPF is restarted on the RUT. TR1 transmits a Router-LSA to the RUT on network 0. Traffic is observed on network 0.

Comments on Test Results	RFC 2328-Sections 10.6, 10.7, and 13 RFC 1583-Sections 10.6, 10.7, and 13

a. The RUT ignores the DD Packet transmitted by TR1.
b. The RUT ignores the LSRequest Packet transmitted by TR1.
c. The RUT ignores the Router-LSA transmitted by TR1.

Group 3: Link State Advertisements

The following tests verify the origination and receipt of Link State Advertisements.

Test #		Result	
OSPF_CONF.3.1	**Transit Link Router LSAs**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router transmits a new router-LSA when an attached network changes from a stub network to a transit network.

Comments on Test Procedure

a. The RUT is configured to have priority 0. TR1 should have priority 1. OSPF is enabled on the RUT and wait for RouterDeadInterval. TR1 is enabled. Packets are observed on network 0.
b. The RUT is configured to have priority 1. TR1 is enabled and it should become the DR. OSPF is enabled on the RUT. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 12.4.1.2 RFC 1583-Section 12.4.1

a. After the routers synchronize, the RUT transmits a router-LSA with its interface to network 0 described by a type 2 (transit) link. The Link ID of this is set to the IP Address of TR1.
b. After the routers synchronize, the RUT transmits a router-LSA with its interface to network 0 described by a type 2 (transit) link. The Link ID of this is set to the IP Address of TR1.

Test #		Result	
OSPF_CONF.3.2	**Router LSAs with DR Changes**	**a**	**PASS**
		b	**PASS**
		c	**PASS**

Purpose: To verify that a router transmits a new router-LSA when an attached network changes from a stub network to a transit network.

Comments on Test Procedure

a. OSPF is enabled on the routers so that TR1, TR2 and the RUT become DR, BDR and DR Other, respectively. TR1 is disabled. Packets are observed on network 0.
b. TR1 is enabled and it should become DR Other. TR2 is disabled. Packets are observed on network 0.
c. The RUT is configured to have priority 0. OSPF is restarted on the routers so that TR1, TR2 and the RUT become DR, BDR and DR Other, respectively. TR1 is disabled. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Section 12.4.1.2 RFC 1583-Section 12.4.1

a. After TR1 is disabled for the first time, the RUT transmits a new router-LSA with the Link ID of the type 2 Link for network 0 set to TR2's IP Address.
b. After TR2 is disabled, the RUT transmits a new router-LSA with the Link ID for network 0 set to its interface to network 0.
c. After TR1 is disabled, the RUT transmits a new router-LSA with the Link ID for network 0 set to TR2's IP Address.

Test #		Result	
OSPF_CONF.3.3	**Stub Network Router LSAs**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that a router properly identifies a directly connected stub network with a type 3 link in its router-LSA.

Comments on Test Procedure

a. The RUT is configured to have priority 0 on network 1. TR1 should have priority 1. OSPF is enabled on the routers. TR1's interface on network 1 is disabled. Packets are observed on network 0 and network 1.
b. The RUT is configured to have priority 2 on network 1. TR1's interface to network 1 is enabled. Packets are observed on network 0 and network 1.
c. TR1's interface to network 1 is disabled. Packets are observed on network 0 and network 1.
d. The RUT's interface to network 1 is disabled. TR1's interface to network 1 is enabled. The RUT's interface to network 1 is enabled. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 12.4.1.2 RFC 1583-Section 12.4.1

a. The RUT transmits its new router-LSAs to network 0 with a type 3 (stub) link containing network 1's IP Address as the Link ID.
b. After the RUT and TR1 become adjacent on network 1, the RUT transmits a new router-LSA with a type 2 (transit) link containing its own IP Address as both the Link ID and Link Data.
c. The RUT transmits its new router-LSA to network 0 with a type 3 (stub) link containing network 1's IP Address as the Link ID.
d. When the RUT's interface comes up on network 1 it goes through state Waiting before it becomes adjacent with TR1. During this time, the RUT transmits a new router-LSA to network 0 with a type 3 (stub) link containing network 1's IP Address in the LinkID field.

Test #		Result	
OSPF_CONF.3.4	**Network LSAs with DR Changes**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router originates a network-LSA for a network on which it is DR and has at least one adjacent neighbor.

Comments on Test Procedure

a. TR1's interface to network 1 is disabled. The RUT is configured to have priority 1 on both of its interfaces. OSPF is enabled on the routers. Packets are observed on network 0 and network 1.
b. TR1's interface to network 1 is enabled. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 12.4.1.2 RFC 1583-Section 12.4.1

a. The RUT does not originate a network-LSA for network 1.
b. After the RUT and TR1 become adjacent on network 1, the RUT originates a network-LSA for network 1.

Test #		Result	
OSPF_CONF.3.5	**Attached Routers in Network LSAs**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router originates a network-LSA, it lists all of those routers with which it is fully adjacent in the LSA.

Comments on Test Procedure

a. TR2's interface to network 1 is disabled. The RUT is configured to have priority 1 on both of its interfaces. OSPF is enabled on the routers so that the RUT and TR1 become DR and BDR on network 1, respectively. After the routers have synchronized, TR2's interface to network 1 is enabled. Packets are observed on network 0 and network 1.
b. TR2's interface to network 1 is disabled. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 12.4.2 RFC 1583-Section 12.4.2

a. After becoming adjacent with TR2 on network 1, the RUT originates a new network-LSA for network 1 listing itself, TR1 and TR2 as attached routers.
b. Approximately RouterDeadInterval after TR2's last Hello Packet, the RUT transmits a new network-LSA for network 1 that does not include TR2 as an attached router.

Test #		Result	
OSPF_CONF.3.6	**Intra-Area Summary ASBR-LSAs**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that an ABR properly originates a summary-ASBR-LSA when it has an intra-area route to an ASBR.

Comments on Test Procedure

a. TR1 is an ASBR. The cost of the RUT's interface to network 0 is configured to 1 and to network 1 to 2. All other costs are 1. OSPF is enabled on all the routers. The RUT's interface to network 0 should be disabled. OSPF is restarted on all the routers. After the routers have synchronized, the RUT's interface to network 0 is enabled. Packets are observed on all networks.
b. The RUT's interface to network 0 is disabled. Packets are observed on all networks.
c. TR1's interface to network 1 is disabled. Packets are observed on all networks.
d. TR2's interface to network 0 is disabled. Packets are observed on all networks.
e. The RUT's interface to network 0 is enabled (the RUT should originate a new summary-ASBR-LSA for TR1 with metric 1). TR1 is not an ASBR. (TR1 should be a router that allows the user to change the ASBR status without resetting). Packets are observed on all networks.

Comments on Test Results	RFC 2328-Sections 12.4 and 12.4.3 RFC 1583-Sections 12.4 and 12.3.3

a. The RUT originates a new summary-ASBR-LSA for TR1 with metric 1. This LSA is only sent to network 2.
b. The RUT originates a new summary-ASBR-LSA for TR1 with metric 2. This LSA is only sent to network 2.
c. The RUT originates a new summary-ASBR-LSA for TR1 with metric 3. This LSA is only sent to network 2.
d. The RUT sets its summary-ASBR-LSA for TR1 to MaxAge. This is only sent to network 2.
e. The RUT sets its summary-ASBR-LSA for TR1 to MaxAge. This is only sent to network 2.

Test #		Result	
OSPF_CONF.3.7	**Intra-Area Summary Network LSAs**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that an ABR properly originates a summary-network-LSA for a network for which it has an intra-area route.

Comments on Test Procedure

a. The cost of the RUT's interface to network 0 is 1 and network 1 is 2. TR1's cost to network 0 is 2. All other costs are 1. The RUT's interface to network 0 is disabled. OSPF is restarted on all the routers. After the routers have synchronized, the RUT's interface to network 0 is enabled. Packets are observed on all networks.
b. The RUT's interface to network 0 is disabled. Packets are observed on all networks.
c. TR1's cost to network 0 is 1. Packets are observed on all networks.
d. TR1's interface to network 0 is disabled. Packets are observed on all networks.

Comments on Test Results	RFC 2328-Sections 12.4 and 12.4.3 RFC 1583-Sections 12.4 and 12.4.3

a. The RUT originates a new summary-network-LSA for network 0 with metric 1. This LSA is only sent to network 2 and network 3.
b. The RUT originates a new summary-network-LSA for network 0 with metric 4. This LSA is only sent to network 2 and network 3.
c. The RUT originates a new summary-network-LSA for network 0 with metric 3. This LSA is only sent to network 2 and network 3.
d. The RUT sets its summary-network-LSA for network 0 to MaxAge. This LSA is only sent to network 2 and network 3.

Test #		Result	
OSPF_CONF.3.8	**Inter-Area Summary ASBR LSAs**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**
		g	**PASS**

Purpose: To verify that an ABR properly originates a summary-ASBR-LSA when it has an inter-area router to an ASBR.

Comments on Test Procedure

a. The costs of TR2's interface to network 2 and TR3's interface to network 3 each should be 3. The cost of the RUT's interface to network 2 should be 3. All other costs should be set to 1. TR4 is an ASBR. OSPF is enabled on the routers. Packets are observed on all networks.
b. The cost of TR2's interface to network 2 is 1. Packets are observed on all networks.
c. TR2's interface to network 2 is disabled. Packets are observed on all networks.
d. The cost of TR3's interface to network 3 is 1. Packets are observed on all networks.
e. The cost of TR3's interface to network 3 is 6. Packets are observed on all networks.
f. TR3's interface to network 2 is disabled. Packets are observed on all networks.
g. TR3's interface to network 2 is enabled. After the RUT originates a summary-ASBR-LSA for TR4 to network 0, TR4 is disabled. Packets are observed on all networks.

Comments on Test Results

RFC 2328-Sections 12.4 and 12.4.3
RFC 1583-Sections 12.4 and 12.4.3

a. The RUT transmits a summary-ASBR-LSA to network 0 for TR4 with the AdvertisingRouter field set to its Router ID. The metric is set to 6.
b. The RUT transmits a new summary-ASBR-LSA with metric 5.
c. The RUT transmits a new summary-ASBR-LSA with metric 6.
d. The RUT transmits a new summary-ASBR-LSA with metric 4.
e. The RUT transmits a new summary-ASBR-LSA with metric 9.
f. The RUT transmits a new instance of the summary-ASBR-LSA with MaxAge.
g. The RUT transmits a new instance of the summary-ASBR-LSA with MaxAge.

Test #		Result	
OSPF_CONF.3.9	**Inter-Area Summary LSAs**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**
		g	**PASS**
		h	**PASS**
		i	**PASS**

Purpose: To verify that a router properly transmits summary-network-LSAs for those networks reachable by inter-area routers.

Comments on Test Procedure

a. The cost of TR3's interface to network 3 is 4. The cost of the RUT's interface to network 2 should be set to 3 and the cost of TR2's interface to network 2 is 6. All other costs should be set to 1. The RUT and TR1 must not have direct links to network 3. The RUT should not have an IP Address defined on network 3. OSPF is enabled on all the routers. Packets are observed on all networks.
b. The cost of TR3's interface to network 3 is 5. Packets are observed on all networks.
c. The cost of TR3's interface to network 3 is 4. Packets are observed on all networks.
d. The cost of the RUT's interface to network 2 is configured to 8. Packets are observed on all networks.
e. The cost of TR2's interface to network 2 is 5. Packets are observed on all networks.
f. TR2 is enabled on network 3 in Area 2 with a cost of 2. Packets are observed on all networks.
g. TR2 is disabled. Packets are observed on all networks.
h. TR3's interface to network 3 is disabled. Packets are observed on all networks.
i. TR3's interface to network 3 is enabled. Packets are observed for a summary-network-LSA sent to network 0 for network 3. TR3's interface to network 2 is unplugged. Packets are observed on all networks.

Comments on Test Results

RFC 2328-Sections 12.4 and 12.4.3
RFC 1583-Sections 12.4 and 12.4.3

a. The RUT transmits a summary-network-LSA to network 0 advertising network 3 with a metric of 7.
b. The RUT transmits a summary-network-LSA to network 0 advertising network 3 with a metric of 8.
c. The RUT transmits a summary-network-LSA to network 0 advertising network 3 with a metric of 7.
d. The RUT transmits a summary-network-LSA to network 0 advertising network 3 with a metric of 11.
e. The RUT transmits a summary-network-LSA to network 0 advertising network 3 with a metric of 10.
f. The RUT transmits a summary-network-LSA to network 0 advertising network 3 with a metric of 3.
g. The RUT transmits a new summary-network-LSA to network 0 advertising network 3 with a metric of 12.
h. The RUT flushes its summary-network-LSA for network 3.
i. The RUT flushes its summary-network-LSA for network 3 after RouterDeadInterval seconds.

Test #		Result	
OSPF_CONF.3.10	**Inter-Area Becomes Intra-Area**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that an ABR properly transmits a summary-network-LSA for a network for which it previously had an intra-area route but now only has an inter-area route (due to an interface going down).

Comments on Test Procedure

a. All costs should be set to 1. OSPF is enabled on all the routers. Packets are observed on all networks.
b. The RUT's interface to network 3 is disabled. Packets are observed on all networks.

Comments on Test Results	RFC 2328-Sections 12.4.2 and 12.4.3 RFC 1583-Sections 12.4.2 and 12.4.3

a. The RUT transmits a summary-network-LSA advertising a route to network 3 on both network 2 and network 1. The costs should be 1.
b. The RUT transmits a new summary-network-LSA for network 3 to network 2 with metric 3. It also sets its summary-network-LSA for network 3 to MaxAge on network 1.

Test #		Result	
OSPF_CONF.3.11	**Area Ranges with RFC 1583**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that an ABR properly uses a configured address range, as per RFC 1583.

Comments on Test Procedure

a. An address range should be configured on the RUT for network 0 and network 1 in Area 1. The cost of the RUT's interfaces to network 0 is configured to 2 and network 1 is configured to 3. All other costs should be set to 1. OSPF is enabled on the routers. Packets are observed on all networks.
b. The RUT's interface to network 0 is disabled. Packets are observed on all networks.
c. The cost of the RUT's interface to network 1 is configured to 2. Packets are observed on all networks.
d. The RUT should not transit a new summary-network-LSA for the address range. Packets are observed on all networks.

Comments on Test Results	RFC 1583-Sections 12.4 and 12.4.3

a. The RUT transmits a summary-network-LSA to both network 2 and network 3 for the address range with cost 2.
b. The RUT transmits a new summary-network-LSA to network 2 and network 3 for the address range with cost 3.
c. The RUT transmits a summary-network-LSA to both network 2 and network 3 for the address range with cost 2.
d. The RUT does not transmit a new summary-network-LSA for the address range.

Test #		Result	
OSPF_CONF.3.12	**Area Ranges with RFC 2328**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that an ABR properly uses a configured address range, as per RFC 2328.

Comments on Test Procedure

a. An address range should be configured on the RUT for network 0 and network 1 in Area 1. The cost of the RUT's interfaces to network 0 is configured to 1, network 1 is configured to 7, network 2 is configured to 3 and network 3 is configured to 1. All other costs should be set to 1. The RUT's interfaces to network 0 and network 1 are disabled. TR1's interface to network 0 is enabled. OSPF is enabled on the routers. Packets are observed on all networks.
b. The RUT's interface to network 1 is enabled. TR1's interface to network 0 is disabled. Packets are observed on all networks.
c. The RUT's interface to network 0 is enabled. Packets are observed on all networks.
d. The cost of TR2's interface to network 1 is 3. Packets are observed on all networks.

Comments on Test Results	RFC 2328-Sections 12.4 and 12.4.3

a. The RUT transmits a summary-network-LSA for network 0 and network 1 to network 3, but not network 2. The RUT does not use its configured address range yet.
b. The RUT transmits a new summary-network-LSA for the address range to network 2 and network 3 with cost 8.
c. The RUT transmits a new summary-network-LSA for the address range to network 2 and network 3 with cost 2.
d. The RUT transmits a new summary-network-LSA for the address range to network 2 and network 3 with cost 4.

Test #		Result	
OSPF_CONF.3.13	**Flushing Summary Area Range LSAs**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that an ABR properly flushes any advertisements it originated for a configured address range when all of the component networks become unreachable.

Comments on Test Procedure

a. An address range is configured on the RUT and TR1 for network 0 and network 1, set to DoNotAdvertise. OSPF is enabled on the routers. Packets are observed on all networks.
b. The status of the address range is changed on the RUT to Advertise. The RUT should transmit a summary-network-LSA with the address range to network 2 and network 3. The RUT's interface to network 0 and network 1 are disabled. Packets are observed on all networks.

Comments on Test Results	RFC 2328-Sections 12.4 and 12.4.3 RFC 1583-Sections 12.4 and 12.4.3

a. The RUT does not transmit a summary-network-LSA for the address range.
b. The RUT sets its last summary-network-LSA for the address range to MaxAge.

Test #		Result	
OSPF_CONF.3.14	**Transit Area Summary Area Ranges**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that an ABR does not summarize backbone networks to transit areas.

Comments on Test Procedure

a. An address range is configured on the RUT and TR1 for network 0 and network 1, in the backbone. The status of the address range is configured on the RUT to Advertise. A virtual link is configured between TR1 and TR3. OSPF is enabled on the routers. Packets are observed on all networks.
b. The status of the address range is changed on the RUT to DoNotAdvertise. Packets are observed on all networks.

Comments on Test Results	RFC 2328-Section 12.4.3 RFC 1583-Section 12.4.3

a. The RUT does not transmit a summary-network-LSA for the address range to Area 1. It transmits summary-network-LSAs for the individual backbone networks to Area 1.
b. The RUT does not transmit a summary-network-LSA for the address range to Area 1. It transmits summary-network-LSAs for the individual backbone networks to Area 1.

Test #		Result	
OSPF_CONF.3.15	**LSAs with Virtual Links**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**
		g	**PASS**
		h	**PASS**
		i	**PASS**

Purpose: To verify that an ABR does not summarize backbone networks to transit areas.

Comments on Test Procedure

a. The RUT's interface to network 2 is disabled. A virtual link between the RUT and TR1 is configured in Area 1. OSPF is enabled on the routers. Packets are observed on all networks.
b. The RUT's transit area router-LSA is observed.
c. The cost of TR2's interface to network 3 is 2. Packets are observed on all networks.
d. The cost of TR3's interface to network 3 is 1. Packets are observed on all networks.
e. The RUT's interface to network 2 is enabled. Packets are observed on all networks.
f. TR1's interface to network 3 is disabled. TR1's interfaces to network 1 and network 2 are enabled. The RUT's interfaces to networks 1 and 2 are disabled, and network 3 is enabled with cost 1. OSPF is restarted on all the routers. Packets are observed on all networks.
g. The cost of TR2's interface to network 2 is 3. Packets are observed on all networks.
h. TR1's interfaces to networks 1 and 2 are disabled. Packets are observed on all networks.
i. The RUT's transit area router-LSA is observed.

Comments on Test Results

RFC 2328-Sections 12.4.1.3 and 16.1 Step 4
RFC 1583-Section 12.4.1.1

a. After the virtual adjacency forms, the RUT originates a new backbone router-LSA listing the virtual neighbor TR1 as type 4 virtual link. The Link ID of the type 4 virtual Link is set to TR1's Router ID, and the Link Data should be set to the IP Address of the RUT's interface to network 1. The metric of this virtual link is set to 3.
b. After the virtual link between the RUT and TR1 becomes fully adjacent, the RUT updates its transit area router-LSA by adding the V-bit to the router options field.
c. The RUT originates a new backbone router-LSA with the metric of the virtual link set to 4.
d. The RUT originates a new backbone router-LSA with the metric of the virtual link set to 3.
e. The RUT originates a new backbone router-LSA with the metric of the virtual link set to 2. The Link Data field is set to the IP Address of the RUT's interface to network 2.
f. The RUT transmits its unicast Hello packets to the IP Address of TR1's interface to network 1.
g. After changing TR2's cost to network 2, the RUT transmits its unicast Hello packets to the IP Address of TR1's interface to network 2.
h. The RUT originates a new router-LSA for the backbone not listing the virtual neighbor.
i. The RUT updates its transit area router-LSA by removing the V-bit from the options field.

Test #		Result	
OSPF_CONF.3.16	**Advertising Static Routes**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that an ASBR properly originates AS-external-LSAs for static routes with the configured type, cost and forwarding address.

Comments on Test Procedure

a. The RUT is configured to have a static route to an external network. The RUT is configured to be a non-ASBR. OSPF is enabled on the routers. Packets are transmitted on network 0 and network 1.
b. The RUT is configured to be an ASBR advertising an external route to network 2 with a type 1 metric of 1. Packets are observed on network 0 and network 1.
c. The RUT is configured to advertise the external route with a type 2 metric of 1. Packets are observed on network 0 and network 1.
d. The RUT is configured to advertise the route with the forwarding address set to a non-OSPF router on network 0. Packets are observed on network 0.
e. The RUT is configured to advertise the route with the forwarding address set to a non-OSPF router on network 1. Packets are observed on network 1.

Comments on Test Results	RFC 2328-Section 2.3 RFC 1583-Section 2.3

a. The RUT does not transmit any AS-external-LSAs into OSPF.
b. The RUT transmits an ASE for network 2 with the metric type set to 1 and the metric set to 1.
c. The RUT transmits an ASE for network 2 with the metric type set t o 2 and the metric set to 1.
d. The RUT sets the forwarding address to the IP Address of the non-OSPF router on network 0.
e. The RUT sets the forwarding address to the IP Address of the non-OSPF router on network 1.

Test #		Result	
OSPF_CONF.3.17	**Advertising RIP Routers**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that an ASBR properly advertises externally learned destinations.

Comments on Test Procedure

a. OSPF should be enabled on TR1 and the RUT on network 0. RIP should be enabled on TR2 and the RUT on network 1. All costs should be configured to 1. The RUT is configured to be an ASBR and to export RIP learned routes. TR2 should not have a static route to network 2. The RUT is enabled. TR1 should be enabled. A static route is configured on TR2 to network 2 with metric of 4, it should export the route to RIP. Packets are observed on network 0 and network 1.
b. The cost of TR2's static route to network 2 is 1. Packets are observed on network 0 and network 1.
c. The cost of TR2's static route to network 2 is 7. Packets are observed on network 0 and network 1.
d. The static route on TR2 is removed. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 12.4.4 RFC 1583-Section 12.4.5

a. The RUT transmits an AS-external-LSAs advertising routes to network 1 and network 2.
b. When the cost of TR2's static route to network 2 is changed to 1, the RUT originates a new AS-external-LSA for the route to network 2, with the cost decreased by 3.
c. When the cost of TR2's static route to network 3 is changed to 7, the RUT originates a new AS-external-LSA for the route to network 2, with the cost increased by 6.
d. The RUT originates a new AS-external-LSA for the route to network 2, with age set to MaxAge.

Test #		Result	
OSPF_CONF.3.18	**Remove Redundant ASEs**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that an ASBR flushes its own AS-external-LSA when another ASBR with higher Router ID originates a functionally equivalent AS-external-LSA.

Comments on Test Procedure

a. The RUT, TR1 and TR2 should be running OSPF on network 0. The RUT's Router ID should be higher than TR1's. The RUT and TR1 are ASBRs with static routes to network 1 with TR3 as the next hop. TR1's interface to network 0 is disabled. OSPF is enabled on the routers. After the RUT originates its AS-external-LSA for network 1, TR1's interface to network 0 is enabled. Packets are observed on network 0 and network 1.
b. The RUT is configured to have a lower Router ID than TR1. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 12.4.4 RFC 1583-Section 12.4.5

a. After the RUT and TR1 originate ASE LSAs to network 1, the RUT does not flush its own AS-external-LSA for network 1.
b. The RUT flushes its AS-external-LSA for network 1.

Test #		Result	
OSPF_CONF.3.19	**Default Summary-LSA Origination**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that an ABR connected to a stub area properly originates a default summary-LSA into the stub area with StubDefaultCost when configured to do so.

Comments on Test Procedure

a. The RUT is configured to transmit a default summary-LSA with metric 4. OSPF is enabled on the routers. Packets are observed on network 0 and network 1.
b. The StubDefaultCost is configured on the RUT to 9. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 12.4.3.1 RFC 1583-Section 12.4.4

a. When the StubDefaultCost is set to 4, the RUT originates a summary-network-LSA on network 1 with the Link State ID 0.0.0.0, netmask 0.0.0.0 and metric 4.
b. When the StubDefaultCost is set to 9, the RUT originates a summary-network-LSA on network 1 with Link State ID 0.0.0.0, netmask 0.0.0.0 and metric 9.

Test #		Result	
OSPF_CONF.3.20	**Default Summary-LSA Use**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router internal to a stub area should correctly use a default summary-LSA.

Comments on Test Procedure

a. The RUT should not have an IP Address configured for network 0. TR1 and TR2 should originate default summary-LSAs with metrics 1 and 8, respectively. The cost of the RUT's interface to network 1and network 2 are configured to be 10 and 1, respectively. The RUT should not have a static default route configured. OSPF is enabled on the routers. Packets are observed on network 0 and network 1.
b. The StubDefaultCost on TR2 is 14. Packets are observed on network 0 and network 1.

Comments on Test Results	RFC 2328-Section 12.4.3.1 RFC 1583-Section 12.4.4

a. The RUT originally has a default route in its routing table with the next hop set to TR2's interface on network 2.
b. After the StubDefaultCost on TR2 is changed to 14, the default route in the RUT's routing table has TR1 as a next hop.

Test #		Result	
OSPF_CONF.3.21	**Host Bits in AS-External LSAs**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that a router properly handles and sets Host Bits in AS-external-LSAs.

Comments on Test Procedure

a. TR1 should be an ASBR with static routes to 10.0.0.0/8 and 10.0.0.0/16 with routers TR2 and TR3 as next hops. TR2 and TR3 should not be running OSPF. OSPF is enabled on the routers. Packets are observed on network 0.
b. The RUT is configured to be an ASBR with a static route for 10.0.0.0/16. Start the routers. Packets are observed on network 0.
c. A static route is configured on the RUT for 10.0.0.0/8. Packets are observed on network 0.
d. A static route is configured on the RUT for 10.255.0.0/24. Packets are observed on network 0.
e. A static route is configured on the RUT for 10.255.0.0/16. Packets are observed on network 0.

Comments on Test Results	RFC 2328-Appendix E RFC 1583-Appendix E

a. The RUT has separate routes in its routing table for 10.0.0.0/8 and 10.0.0.0/16 with the next hop set to TR2 and TR3, respectively.
b. After the static route to 10.0.0.0/16 is configured on the RUT, the RUT originates an AS-external-LSA for 10.0.0.0 (Link State ID can actually be anything from 10.0.0.0 to 10.255.255.255, but preferably 10.0.0.0) with netmask 255.255.0.0.
c. After the static route to 10.0.0.0/8 is configured on the RUT, the RUT originates an AS-external-LSA for 10.0.0.0/16 with a different Link State ID than that used for 10.0.0.0/8.
d. After the static route to 10.255.0.0/24 is configured on the RUT, the RUT originates an AS-external-LSA for 10.255.0.0/24, preferably using the Link state ID 10.255.0.0.
e. After the static route to 10.255.0.0/16 is configured on the RUT, the RUT advertises 10.255.0.0/16 using a different Link State ID (or else change the one being used for 10.255.0.0/24). The preferable action, if it had used the Link State ID 10.255.0.0 for the previous AS-external-LSA, would be to advertise the 10.255.0.0/24 route with a new Link State ID, preferably 10.255.0.255. It then can advertise the route to 10.255.0.0/16 with the Link State ID 10.255.0.0.

Test #		Result	
OSPF_CONF.3.22	**LSA Sequence Numbers**	**a**	**PASS**
Purpose: To verify that when a router must increment the LS sequence number of a self-originated LSA past 0x7FFFFFF, it flushes the current instance of the LSA from the routing domain before originating a new instance with sequence number 0x80000001.			
Comments on Test Procedure			
a. OSPF is enabled on the routers. After the routers go through the DD process, TR1 transmits an LS Update to the RUT containing a router-LSA with the RUT's Router ID as the Link state ID, and the sequence number set to 0x7FFFFFFF. Packets are observed on network 0.			
Comments on Test Results	RFC 2328-Sections 12.1.6 and 14.1 RFC 1583-Sections 12.1.6 and 14.1		
a. The RUT sets the 0x7FFFFFFF instance of its router-LSA to MaxAge before originating a new one with sequence number of 0x80000001.			

Group 4: Route Calculation

The following tests verify the routing table build process of the OSPF Protocol.

Test #		Result	
OSPF_CONF.4.1	**Intra-Area Paths Preferred**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router prefers intra-area OSPF routes to inter-area OSPF routes.

Comments on Test Procedure

a. The cost of TR2's interface to network 2 is 10. The cost of the RUT's interface to network 0 is 1 and to network 1 is 1. The RUT does not have an IP Address configured on network 2. OSPF is enabled on all routers. The RUT's routing table is observed.
b. TR3 advertises an external route to some network N. The RUT's routing table is observed.

Comments on Test Results	RFC 2328-Section 16.2 (6) RFC 1583-Section 16.2 (6)

a. The RUT's routing table has a route to network 2 in its routing table with the next hop set to TR2's interface on network 0.
b. RUT's routing table has a route to network N in its routing table with the next hop set to TR2's interface on network 0.

Test #		Result	
OSPF_CONF.4.2	**Inter-Area Routes through Transit Areas**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**
		g	**PASS**

Purpose: To verify that a router properly calculates inter-area routes when it is an ABR attached to a transit area.

Comments on Test Procedure

a. The RUT's costs to network 0 and network 1 are 7 and 1, respectively. TR2's cost to network 2 is 3. All other costs are 1. No virtual links are configured. The RUT's interface on network 0 is disabled. OSPF is enabled on all routers.
b. The RUT's interface on network 0 is enabled.
c. A virtual link is configured between TR1 and TR2 in Area 1.
d. TR3 advertises an external route.
e. Area 2 is reconfigured as a part of the backbone. OSPF is restarted on the routers.
f. The RUT's routing table is observed
g. TR1 and TR2's interfaces to network 0 are disabled. TR1's interface to network 2 is enabled in the backbone.

Comments on Test Results	RFC 2328-Sections 16.2 and 16.3 RFC 1583-Sections 16.2 and 16.3

a. After the routers synchronize, the RUT's routing table has an entry for network 2 with next hop set to TR2's IP Address on network 1.
b. The RUT's routing table has an entry for network 2 with next hop set to TR2's IP Address on network 0.
c. The RUT has in its routing table a route to network 2 with TR2's interface on network 1 as the next hop.
d. The RUT has in its routing table a route to network 3 with TR2's interface on network 1 as the next hop.
e. The RUT has in its routing table a route to network 2 with TR2's interface on network 1 as the next hop.
f. The RUT has in its routing table a route to network 3 with TR2's interface on network 1 as the next hop.
g. The RUT does not have a route to network 2.

Test #		Result	
OSPF_CONF.4.3	**ASE Forwarding Addresses**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that a properly uses the ForwardingAddress field in AS-external-LSAs.

Comments on Test Procedure

a. TR1 is an ASBR with an external route to network 3 through a router on network 2. The AS-external-LSA is configured with a type 1 cost of 1 and has the forwarding address set to next hop's IP Address on network 2. TR2 does not transmit any AS-external-LSAs at this time. The RUT does not have an IP Address configured on network 3. OSPF is enabled on TR1 and TR2, and their databases are exchanged. TR1 transmits the AS-external-LSA with the forwarding address set. OSPF is turned off on TR1. The RUT is enabled.
b. OSPF is enabled on TR1.
c. TR1's next hop for network 3 is configured to be a router on network 0. TR1 originates a new AS-external-LSA for network 3 with the forwarding address set to a router on network 0.
d. TR2 is configured to transmit an AS-external for network 3 with type 1 metric 1 without the forwarding address set. The RUT's routing table is observed.
e. The RUT's cost to network 1 is configured to be 3.

Comments on Test Results	RFC 2328-Sections 16.2 and 16.3 RFC 1583-Sections 16.2 and 16.3

a. The RUT receives TR1's AS-external-LSA from TR2 but does not install a route to network 3.
b. The RUT has a route to network 3 with the next hop set to TR2's IP Address on network 1. The RUT uses its least cost path to network 2 as the path to network 3.
c. The RUT has a route to network 3 with the next hop set to the forwarding address of the ASE.
d. The RUT has a route to network 3 with the next hop set to TR2's IP Address on network 1.
e. After the change, the RUT has a route to network 3 with the next hop set to the forwarding address advertised in TR1's AS-external-LSA.

Test #		Result	
OSPF_CONF.4.4	**Intra-area Routes to an ASBR**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that a properly uses the ForwardingAddress field in AS-external-LSAs.

Comments on Test Procedure

a. TR1 is an ASBR advertising an AS external LSA. The RUT's costs to networks 0, 1 and 2 are configured to be 1, 2 and 3, respectively. 1583 compatibility is enabled. OSPF is enabled on the routers.
b. The RUT's cost to network 0 is configured to be 2.
c. The RUT's costs to networks 0, 1 and 2 are configured to be 1, 2 and 3, respectively. 1583 compatibility is disabled. OSPF is restarted on the routers.
d. The RUT's cost to network 1 is configured to be 3.

Comments on Test Results | RFC 2328-Sections 16.4 (3) and 16.4.1

a. The RUT chooses the path with the least cost. It has a route to the external network with TR1's interface on network 0 as the next hop.
b. Since there are two paths with the least cost, the RUT chooses the path through the area with the largest Area ID. It has a route to the external network with TR1's interface on network 1 as the next hop.
c. The RUT prefers intra-area paths through non-backbone areas. It has a route to the external network with TR1's interface on network 1 as the next hop.
d. Since there are two intra-area non-backbone paths with equal cost, the RUT chooses the path through the area with the largest Area ID. It has a route to the external network with TR1's interface on network 2 as the next hop.

Test #		Result	
OSPF_CONF.4.5	**Preference for Internal Routes**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router chooses the correct type of route when OSPF internal and external routes exist to a network.

Comments on Test Procedure

a. TR1 has a static route to network 3 with path type 1 and metric 1. All other costs are set to 2. The RUT and TR1 do not have an IP Address configured for network 3. OSPF is enabled on the routers and the RUT's routing table s observed.
b. Area 2 is reconfigured as part of the backbone. OSPF is restarted on the routers.

Comments on Test Results | RFC 2328-Sections 16.4 (6a)

a. The RUT lists a route to network 3 with TR2's IP Address on network 0 as the next hop.
b. The RUT lists a route to network 3 with TR2's IP Address on network 0 as the next hop.

Test #		Result	
OSPF_CONF.4.6	**Type 1 and Type 2 AS-External Routes**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that when choosing between multiple ASBRs advertising routes to the same destination, the router prefers type 1 routes to type 2. If only type 2 costs are present, a router always chooses the path to the ASBR advertising the lowest type 2 metric.

Comments on Test Procedure

a. TR1 and TR2 are ASBRs with external routes to network 2 with path types 1 and 2, respectively. TR1's type 1 metric is 10. TR2's type 2 metric is 1. The RUT's interfaces to network 0 and network 1 have metrics 1 and 10, respectively. OSPF is enabled on the routers. Packets transmitted on all networks are observed.
b. TR1 has an external route to network 2 is type 2 with metric 2. The RUT's cost to network 0 is configured to be 11.

Comments on Test Results	RFC 2328-Sections 16.4 (6b) RFC 1583-Section 16.4(6)

a. The RUT's routing table has a route to network 2 with TR1's interface on network 1 as the next hop.
b. The RUT's routing table has a route to network 2 with TR2's interface on network 0 as the next hop.

Test #		Result	
OSPF_CONF.4.7	**Multiple ASBRs through Intra-area Paths with 1583 Compatibility Enabled**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that a router properly chooses between multiple ASBRs when RFC 1583 compatibility is enabled.

Comments on Test Procedure

a. RFC 1583 compatibility is enabled on the RUT. TR1, TR2 and TR3 are ASBRs advertising an AS-external-LSA to the same destination without the forwarding address set. The RUT's costs to networks 0, 1 and 2 are 1, 10 and 20, respectively. The type and cost of the AS-external-LSAs for the TRs are: type 1 and cost 1 on TR1, type 1 and cost 20 on TR2, and type 1 and cost 5 on TR3. OSPF is enabled on the routers. The RUT's routing table is observed.
b. The cost of TR1's AS-external-LSA is 25. The RUT's routing table is observed again.
c. The type and cost of the AS-external-LSAs is configured to be type 2, cost 1 for all the TRs. OSPF is restarted on the routers. The RUT's routing table is observed.
d. The cost of the RUT's interface to network 0 is configured to be 11. The RUT's routing table is observed again.

Comments on Test Results | RFC 2328-Sections 16.4 (6d)

a. Before the cost of TR1's AS-external-LSA is changed to 25, the RUT has a route to the external network with TR1's interface on network 0 as the next hop.
b. After the cost is changed, the RUT has a route to the external network with TR3's interface on network 2 as the next hop.
c. Before the cost of the RUT's interface to network 0 is changed to 11, the RUT has a route to the external network with TR1's interface on network 0 as the next hop.
d. After the cost is changed, the RUT has a route to the external network with TR2's interface on network 1 as the next hop.

Test #		Result	
OSPF_CONF.4.8	**Multiple ASBRs through Intra-area Paths with 1583 Compatibility Disabled**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that a router properly chooses between multiple ASBRs when RFC 1583 compatibility is enabled.

Comments on Test Procedure

a. TR1, TR2 and TR3 are ASBRs advertising an AS-external-LSA to the same destination without the forwarding address set. The RUT's costs to networks 0, 1 and 2 are 1, 10 and 20, respectively. The type and cost of the AS-external-LSAs for the TRs are: type 1 and cost 1 on TR1, type 1 and cost 20 on TR2, and type 1 and cost 5 on TR3. RFC 1583 compatibility is disabled on the RUT. TR1, TR2 and the RUT are enabled. The RUT's routing table is observed.
b. TR3 is enabled. The RUT's routing table is observed.
c. The type and cost of the AS-external-LSAs is configured to be type 2, cost 1 for all the TRs. OSPF is restarted on the routers. The RUT's routing table is observed.
d. The cost of the RUT's interface to network 2 is configured to be 5. The RUT's routing table is observed again.

Comments on Test Results | RFC 2328-Sections 16.4 (6c), (6d) and 16.4.1 (first bullet)

a. The RUT has a route to the external network with TR2's interface on network 1 as the next hop.
b. The RUT has a route to the external network with TR3's interface on network 2 as the next hop.
c. Before the cost of the RUT's interface to network 2 is changed to 5, the RUT has a route to the external network with TR2's interface on network 1 as the next hop.
d. After the cost is changed, the RUT has a route to the external network with TR3's interface on network 2 as the next hop.

Test #		Result	
OSPF_CONF.4.9	**Multiple ASBRs Reachable via Backbone Areas with 1583 Compatibility**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that a router properly chooses between multiple ASBRs reachable through inter-area or intra-area backbone routes when RFC 1583 compatibility is enabled or disabled.

Comments on Test Procedure

a. 1583 compatibility is enabled on the RUT. TR3 and TR4 are ASBRs advertising AS-external-LSAs with type 1 metric to the same destination. The cost of TR3's type 1 ASE is 20 and the cost of TR4's type 1 ASE is 5. OSPF is enabled on the routers.
b. The cost of TR4's type 1 ASE is 12.
c. TR3 and TR4 are set to advertise the external destination with the same type 2 metric. The cost of TR1's interface to network 1 is 11.
d. The cost of TR1's interface to network 1 is 1.

Comments on Test Results | RFC 2328-Sections 16.4 (6c) and (6d)

a. The RUT has a route to the external network with TR2's network 0 IP Address as the next hop.
b. The RUT has a route to the external network with TR1's network 0 IP Address as the next hop.
c. The RUT has a route to the external network with TR2's network 0 IP Address as the next hop.
d. The RUT has a route to the external network with TR1's network 0 IP Address as the next hop.

Test #		Result	
OSPF_CONF.4.10	**Multiple ASBRs Reachable via Backbone Areas without 1583 Compatibility**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that a router properly chooses between multiple ASBRs reachable through inter-area or intra-area backbone routes when RFC 1583 compatibility is enabled or disabled.

Comments on Test Procedure

a. 1583 compatibility is disabled on the RUT. TR3 and TR4 are ASBRs advertising AS-external-LSAs with type 1 metric to the same destination. The cost of TR3's type 1 ASE is 20 and the cost of TR4's type 1 ASE is 5. OSPF is enabled on the routers.
b. The cost of TR4's type 1 ASE is 12.
c. TR3 and TR4 are set to advertise the external destination with the same type 2 metric. The cost of TR1's interface to network 1 is 11.
d. The cost of TR1's interface to network 1 is 1.

Comments on Test Results | RFC 2328-Sections 16.4 (6c) and (6d)

a. The RUT has a route to the external network with TR2's network 0 IP Address as the next hop.
b. The RUT has a route to the external network with TR1's network 0 IP Address as the next hop.
c. The RUT has a route to the external network with TR2's network 0 IP Address as the next hop.
d. The RUT has a route to the external network with TR1's network 0 IP Address as the next hop.

Group 5: Configuration and Formatting

The following tests verify that necessary OSPF parameters are configurable and that OSPF packets are properly formatted.

Test #		Result	
OSPF_CONF.5.1	**Area Parameters**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
Purpose: To verify that the area parameters listed below are configurable.			
Comments on Test Procedure			
a-d. All tests in this section are implicitly tested by other tests. They are here only as a checklist.			
Comments on Test Results	RFC 2328-Appendix C.2 RFC 1583-Appendix C.2		
a. The Area ID is configurable on the RUT. b. Component address ranges are configurable including address/mask pair and Advertise/DoNotAdvertise status indication on the RUT. c. External routing capability is configurable on the RUT. d. StubDefaultCost is configurable on the RUT.			

Test #		Result	
OSPF_CONF.5.2	**Interface Parameters**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**
		f	**PASS**
		g	**PASS**
		h	**PASS**
		i	**PASS**
		j	**PASS**
		k	**PASS**

Purpose: To verify that the area parameters listed below are configurable.

Comments on Test Procedure

a-k. All tests in this section are implicitly tested by other tests. They are here only as a checklist.

Comments on Test Results	RFC 2328-Appendix C.3 RFC 1583-Appendix C.3

a. The IP Address of an interface is configurable on the RUT.
b. The IP network mask of an interface is configurable on the RUT.
c. The OSPF Area ID of an interface is configurable on the RUT.
d. The RouterPriority of an interface is configurable on the RUT.
e. HelloInterval is configurable on the RUT.
f. RouterDeadInterval is configurable on the RUT.
g. InfTransDelay is configurable on the RUT.
h. Interface output cost is configurable on the RUT.
i. RxmtInterval is configurable on the RUT.
j. AuthenticationType is configurable to None or Simple or Cryptographic on the RUT.
k. Interface AuthenticationKey is configurable on the RUT.

Test #		Result	
OSPF_CONF.5.3	**Router LSA Bits**	**a**	**PASS**
		b	**PASS**
		c	**FAIL**
		d	**PASS**
		e	**PASS**

Purpose: To verify that a router properly sets the E, B and V bits in its router-LSAs.

Comments on Test Procedure

a. The RUT is configured to be an ASBR advertising an AS external LSA. Area 2 is a stub area. OSPF is enabled on all routers. Packets are observed on all networks.
b. The RUT's router-LSAs are observed.
c. A virtual link is configured between TR1 and the RUT. OSPF is restarted on all routers.
d. The RUT is configured to be a non-ASBR. OSPF is restarted on all routers.
e. The RUT's interfaces in Areas 0 and 2 along with the virtual link are disabled. TR2 is enabled on Network 0. A virtual link is configured between TR1 and TR2. OSPF is restarted on all routers.

Comments on Test Results	RFC 2328-Section 12.4.1 RFC 1583-Section 12.4.1

a. The RUT sets the E bit in its router-LSAs for Areas 0 and 1 but not for Area 2.
b. The RUT also sets the B bit in all its router-LSAs.
c. The RUT does not set the V bit in its router-LSAs for Area 1. According to Section 12.4.1 of RFC 2328, *"In addition, the router sets bit V in its router-LSA for Area A if and only if the router is the endpoint of one or more fully adjacent virtual links having Area A as their Transit area."* Therefore, the RUT should set the V bit in its router-LSAs for Area 1.
d. The RUT does not set the E bit in any of its LSAs.
e. The RUT does not set any bits in its router-LSA for Area 1.

Test #		Result	
OSPF_CONF.5.4	**IP Header Fields**	**a**	**PASS**
		b	**PASS**

Purpose: To verify that a router properly sets the TOS and Precedence fields in the IP header.

Comments on Test Procedure

a. OSPF is enabled on the RUT. The IP Precedence field is observed in the RUT's Hello packets.
b. The IP TOS field is observed in the RUT's Hello packets.

Comments on Test Results	RFC 2328-Section 4.3 RFC 1583-Section 4.3

a. The IP Precedence field of the packet is set to 0xc0.
b. The IP TOS field is set to 0.

Test #		Result	
OSPF_CONF.5.5	**No Virtual Links in Stub Areas**	**a**	**PASS**

Purpose: To verify that a router does not allow a virtual link to be configured in a stub area.

Comments on Test Procedure

a. Area 1 is a stub area. A virtual link is configured between the RUT and TR1.

Comments on Test Results	RFC 2328-Section 4.3 RFC 1583-Section 4.3

a. The RUT does not allow the user to configure the virtual link through Area 1. If the user is allowed to configure the virtual link, the RUT does not transmit unicast Hello packets to TR1 in Area 1. The virtual adjacency does not form.

Test #		Result	
OSPF_CONF.5.6	**Simple Authentication with RFC 1583**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that authentication type is configurable on a per-area basis, and additional authentication data is configurable on a per-interface basis.

Comments on Test Procedure

a. The RUT and TR1 are configured with AuType 0 in Area 0, and AuType 1 in Area 1. TR2 is configured with AuType 1 in Area 0, and AuType 0 in Area 1. The same password is configured on the following interfaces: RUT in Network 1, TR1 on Network 1, and TR2 on Network 0.
b. OSPF is enabled on all routers. Transmitted packets are observed on both networks.
c. TR2 is disabled on Network 1. The RUT is configured with AuType1 in Area 0. TR1 is configured with AuType 1 in Area 0. TR2 is configured with AuType 0 in Area 0. The RUT and TR1 are configured with the same password on Network 0. A virtual link is configured between the RUT and TR1 with AuType1 using a different password. OPSF is restarted on all routers.
d. The traffic transmitted on Networks 0 and 1 is observed.

Comments on Test Results	RFC 1583-Appendix D

a. The RUT allows the user to configure the AuType.
b. The RUT becomes neighbors with TR1 on both network 0 and network 1. The RUT does not become neighbors with TR2 on network 0 and network 1.
c. The RUT becomes neighbors with TR1 on both network 0 and network 1. The virtual link becomes active.
d. The RUT does not become neighbors with TR2.

Test #		Result	
OSPF_CONF.5.7	**Simple Authentication with RFC 2328**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**

Purpose: To verify that authentication type is configurable on a per-area basis, and additional authentication data is configurable on a per-interface basis.

Comments on Test Procedure

a. The RUT is configured with AuType 0 on its interface to network 0. TR1 is configured with AuType 0 on its interface to network 0. TR2 is configured with AuType 1 on its interface to network 0. The RUT and TR1 are configured with AuType 1 their interfaces to network 1. The same password is configured on the RUT and TR1.
b. A virtual link is configured between RUT and TR1 through Area 1, with AuType 1.
c. OSPF is enabled on the routers. After adjacencies are formed, packets transmitted on both networks are observed.
d. The RUT and TR2 are configured with AuType 2 and the same password on their interfaces to network 0. The virtual link is reconfigured with AuType2. OSPF is restarted on all routers and the packets transmitted on both networks are observed.

Comments on Test Results | RFC 2328-Appendix D

a. The RUT allows the user to configure the AuType on its interface to network 0.
b. The RUT allows the user to configure the AuType for the virtual link.
c. TR2 and over the virtual link, the RUT becomes neighbor with TR1 on both network 0 and network 1. The RUT does not become neighbors with TR2. The virtual link becomes active.
d. The RUT becomes neighbor with TR2, but not with TR1. The virtual link becomes active.

Test #		Result	
OSPF_CONF.5.8	**MD5 Authentication**	**a**	**PASS**
		b	**PASS**
		c	**PASS**
		d	**PASS**
		e	**PASS**

Purpose: To verify that Authentication Type can be set to MD5 or cryptographic.

Comments on Test Procedure

a. The RUT is configured with AuType 2 on its interface to network 0. TR2 is configured to have AuType 2 on its interface to network 0. They are configured to have the same Key ID and password.
b. A virtual link is configured between the RUT and TR2 over Area 1. Both ends of the virtual link are configured with AuType 2 with the same password and Key ID.
c. OSPF is enabled on the routers and traffic transmitted on both networks is observed.
d. TR1 is configured to have a different password, but same Key ID as the RUT on its interface to network 0. OSPF is restarted on the routers and traffic transmitted on network 0 is observed.
e. TR1 is configured to have the same password as the RUT, but with a different Key ID. OSPF is restarted on the routers and traffic transmitted on network 0 is observed.

Comments on Test Results	RFC 2328-Appendix D

a. The RUT allows AuthenticationType cryptographic to be configured on its interface to network 0.
b. The RUT allows AuthenticationType cryptographic to be configured over the virtual link.
c. The RUT and TR1 become adjacent on network 0 and over the virtual link.
d. The RUT and TR1 do not become neighbors on network 0.
e. The RUT and TR1 do not become neighbors on network 0.

Test #		Result	
OSPF_CONF.5.9	**Incorrect Checksums**	**a**	**PASS**

Purpose: To verify the handling of the Checksum field.

Comments on Test Procedure

a. OSPF is enabled on the routers. TR1 transmits an LSA with an invalid checksum

Comments on Test Results	RFC 2328-Section 12.1.7 RFC 1583-Section 12.1.7

a. The RUT does not acknowledge the LSA. The RUT does not install the LSA in its link state database.

Test #		Result	
OSPF_CONF.5.10	**#Advertisements Field**	**a**	**PASS**
Purpose: To verify the handling of the #Advertisements field in LS Update packets			
Comments on Test Procedure			
a. OSPF is enabled on the routers. TR1 transmits an LS Update packet with less LSAs than #Advertisements.			
Comments on Test Results	RFC 2328-Appendix A.4.1 RFC 1583-Appendix A.4.1		
a. The RUT does not crash. The RUT may have installed the LSAs contained in the packet in its link state database.			

Test #		Result	
OSPF_CONF.5.11	**Packet Length Field**	**a**	**PASS**
Purpose: To verify the handling of the PacketLength field in OSPF packets.			
Comments on Test Procedure			
a. OSPF is enabled on the routers. TR1 transmits an OSPF packet with fewer bytes than described in the Packet length field			
Comments on Test Results	RFC 2328-Appendix A.4.1 RFC 1583-Appendix A.4.1		
a. The RUT does not crash.			

Test #		Result	
OSPF_CONF.5.12	**LSA Header Length Field**	**a**	**PASS**
Purpose: To verify the handling of the Length field in the LSA header.			
Comments on Test Procedure			
a. OSPF is enabled on the routers. TR1 transmits an LSA shorter than the length described in the LSA header.			
Comments on Test Results	RFC 2328-Appendix A.4.1 RFC 1583-Appendix A.4.1		
a. The RUT does not crash.			

Test #		Result	
OSPF_CONF.5.13	**Router LSA #Links Field**	**a**	**PASS**
Purpose: To verify the handling of the #Links field in router-LSAs..			
Comments on Test Procedure			
a. OSPF is enabled on the routers. TR1 transmits a router-LSA with the #links field indicating more links than the actual number of links in the LSA.			
Comments on Test Results	RFC 2328-Appendix A.4.2 RFC 1583-Appendix A.4.2		
a. The RUT does not crash. The corresponding LSA in the RUT's link state database has only the links listed in the received LSA			

Test #		Result	
OSPF_CONF.5.14	**Router LSA #TOS Field**	**a**	**PASS**
Purpose: To verify the handling of the #TOS field in router-LSAs.			
Comments on Test Procedure			
a. OSPF is enabled on the routers. TR1 transmits a router-LSA with a #TOS field indicating more TOS metrics than the actual number of TOS metrics in the LSA.			
Comments on Test Results	RFC 2328-Appendix A.4.2 RFC 1583-Appendix A.4.2		
a. The RUT does not crash. The corresponding LSA in the RUT's link state database has only the TOS metrics listed in the received LSA.			

Test #		Result	
OSPF_CONF.5.15	**Bad LSA Age**	**a**	**PASS**
Purpose: To verify the handling of the LSAge field in LSA packets.			
Comments on Test Procedure			
a. OSPF is enabled on the routers. TR1 transmits an LSA with Age greater than MaxAge.			
Comments on Test Results	RFC 2328-Section 12.1.1 RFC 1583-Section 12.1.1		
a. RUT does not crash. The RUT discards the LSA, does not acknowledge it and does not install it in its link state database or flood the LSA with Age set to MaxAge.			