Bridge Functions Consortium

Rapid Spanning Tree
Operations Test Suite
Version 2.4

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MODIFICATION RECORD

Version	Date	Editor(s)	Comments
0.1	2001-04-16		Initial version designed for IEEE Std. 802.1w™-2001
0.3	2001-06-22		First major review and revision
0.4	2001-07-16		First draft completed
1.0	2001-11-07		Test Suite complete
1.1	2001-12-04		Test Suite revised and updated
1.2	2003-07-23		Technical corrections
2.0 Beta 1	2004-02-24	Brandon Barry Fred Mansfield Jr. Garth Russ Anthony Mwingira	Test Suite rewritten in accordance with changed defined in IEEE Std. 802. 1D™-2003 (draft 4). Readability and ease of use are also improved.
2.0	2004-06-08	Brandon Barry Fred Mansfield Jr. Garth Russ	Final edits and completion of 2.0.
2.1	2004-06-23	Brandon Barry Garth Russ	Revised procedures and group descriptions.
2.2	2005-01-27	Tyler Marcotte	Format Modification
2.3	2005-03-11	Corey Hill	IEEE Std. 802.1™ -2004 Update
2.4	2008-05-29	Aaron Stewart	Corrected results for Test 4.3.
	2009-02-27	Timothy Davis	Corrected error in Observable results in test 3.6

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Brandon Barry	UNH InterOperability Laboratory
Fred Mansfield Jr.	UNH InterOperability Laboratory
Garth Russ	UNH InterOperability Laboratory
Anthony Mwingira	UNH InterOperability Laboratory

INTRODUCTION

The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards based products by providing an environment where a product can be tested against other implementations of a standard. This suite of tests has been developed to help implementers evaluate the functionality of their Rapid Spanning Tree capable products.

The operation of Rapid Spanning Tree Protocol (RSTP) provides for the recovery of network connectivity following the failure of a Bridge, Bridge Port, or LAN. The protocol also provides for the recovery of network connectivity following the inclusion of a new Bridge, Bridge Port, or LAN. Unlike the original (protocol version 01) Spanning Tree Protocol, which relies upon fixed timer values in all cases, RSTP (protocol version 02) uses fixed timer values only as worst-case delays (and to ensure backwards-compatibility). Thus, under normal circumstances and in the absence of legacy equipment, the time needed for recovery of network connectivity is determined by a Device's implementation of the protocol. This can result in extremely "rapid" convergence times.

This test suite has been designed based on the set of requirements (expressed in state machine diagrams, tables, and text) defined in IEEE Std. 802.1D™-2004, that pertain to RSTP. The test suite is designed to help determine whether or not the DUT will behave in accordance with the standard during normal operation.

These tests do not determine whether the DUT conforms to IEEE Std. 802.1D™-2004, nor are they designed as interoperability tests. Rather, they provide one method to isolate problems within a Rapid Spanning Tree capable device that will affect interoperability. Successful completion of all tests contained in this suite does not guarantee that the tested device will operate with other Rapid Spanning Tree capable devices. However, combined with satisfactory completion of interoperability testing, these tests provide a reasonable level of confidence that the DUT will function well in most Rapid Spanning Tree capable environments.

REFERENCES

The following documents are referenced in this text:

- IEEE Std. 802.1D™-2004

DEFINITION OF TERMS

Abbreviations and Acronyms

BPDU	Bridge Protocol Data Unit
DUT	Device Under Test
LAN	Local Area Network
LLC	Logical Link Control
MAC	Media Access Control
PIM	Port Information Machine
PPM	Port Protocol Migration State Machine
PRS	Port Role Selection State Machine
PRT	Port Role Transitions Machine
PRX	Port Receive Machine
PTI	Port Timers State Machine
RST	Rapid Spanning Tree
RSTP	Rapid Spanning Tree Protocol
STP	Spanning Tree Protocol
TCM	Topology Change Machine
TCN	Topology Change Notification
TS	Test Station
VLAN	Virtual Local Area Network
DUT<port number>.TS<port number>	Port Label
Port Label	Indicates a Port on the DUT and the TS it is connected to

Port Label examples:

If Port 1 on the DUT is connected to TS1, then Port 1 on the DUT will be described as DUT1.TS1
If Port 1 on the DUT is connected to TS2, then Port 1 on the DUT will be described as DUT1.TS2
If Port 2 on the DUT is connected to TS1, then Port 1 on the DUT will be described as DUT2.TS1
If Port 2 on the DUT is connected to TS2, then Port 2 on the DUT will be described as DUT2.TS2

That is, the Device and Port number preceding the '.' identifies the Port, and the Device and Port number following the '.' identifies what it is connected to.

TEST ORGANIZATION

This document organizes tests by group based on related test methodology or goals. Each group begins with a brief set of comments pertaining to all tests within that group. This is followed by a series of description blocks; each block describes a single test. The format of the description block is as follows:

Test Label: The test label and title comprise the first line of the test block. The test label is the concatenation of the short test suite name, group number, and the test number within the group, separated by periods. The test number is the group number and the test number, also separated by a period. So, test label RSTP.op.1.2 refers to the second test of the first test group in the RSTP Operation suite. The test number is 1.2.

Purpose: The Purpose is a short statement describing what the test attempts to achieve. It is usually phrased as a simple assertion of the feature or capability to be tested.

References: The References section lists cross-references to the specifications and documentation that might be helpful in understanding and evaluating the test and results.

Resource Requirements: The Resource Requirements section specifies the software, hardware, and test equipment that will be needed to perform the test. The Discussion is a general discussion of the test and relevant section of the specification, including any assumptions made in the design or implementation of the test as well as known limitations.

Discussion: The Discussion is a general discussion of the test and relevant section of the specification, including any assumptions made in the design or implementation of the test as well as known limitations.

Test Layout: This diagram shows how the Test Systems, DUT, and any other Devices used should be connected for this test. Elements of the Procedure may change the Layout.

Procedure: This section of the test description contains the step-by-step instructions for carrying out the test. These steps include such things as enabling interfaces, disconnecting links between devices, and sending MAC frames from a Test Station. The test procedure also cues the tester to make observations, which are interpreted in accordance with the observable results given for that test part.

Observable Results: This section lists observable results that can be examined by the tester to verify that the DUT is operating properly. When multiple observable results are possible, this section provides a short discussion on how to interpret them. The determination of a PASS or FAIL for each test is usually based on how the behavior of the DUT compares to the results described in this section.

Possible Problems: This section contains a description of known issues with the test procedure, which may affect test results in certain situations.

TEST SETUP

Bridge Parameters:

- RSTP enabled
- Force Protocol Version = 2 (RSTP)
- Bridge Priority = 0x8000
- Bridge Max Age = 20 seconds
- Bridge Hello Time = 2 seconds
- Bridge Forward Delay = 15 seconds
- FDB ageing time = 300 seconds
- TxHoldCount = 6

Port Parameters:

- RSTP enabled
- PVID = 1
- Member of the Untagged set for Default VLAN (VID 0x001). Not a member of any other VLAN.
- Acceptable Frame Types Parameter = Admit All Frames
- Port Priority = 0x80
- Port Path Cost = 0x00030D40
- AdminEdge = False
- AutoEdge = False
- sendRSTP = True*
- learning = True
- forwarding = True
- tcWhile = 0
- txCount = 0

* Setting this parameter True before performing a given test may require mcheck to be asserted for the Port. If this is not possible, then re-initialize the Port and wait until it:

1. Enters the Forwarding Port State
2. Has tcWhile = 0.

GROUP 1: General Parameters

Scope

To verify the Bridge supports various parameters required for operation of the Rapid Spanning Tree Protocol.

Overview

This Group tests the following parameters:

Default settings required for tests in this suite
Unique Identifier for the Bridge (Bridge Identifier)
Unique Identifier for each Port (Port Identifier)
operPointToPointMAC
adminPointToPointMAC
Force Protocol Version
Default Bridge Parameters
Default Port Parameters
Source MAC address of transmitted BPDUs
BPDU transmission delay
RSTP processing delay

RSTP.op.1.1: Default Settings Required for UNH-IOL RSTP Operations Testing

Purpose: To determine whether the DUT supports configuration of the default parameter values used throughout this test suite.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.2
- IEEE Std. 802.1D™-2004: sub-clause 17.13.1
- IEEE Std. 802.1D™-2004: sub-clause 17.13.3
- IEEE Std. 802.1D™-2004: sub-clause 17.13.4
- IEEE Std. 802.1D™-2004: sub-clause 17.14
- IEEE Std. 802.1D™-2004: Table 7-5
- IEEE Std. 802.1D™-2004: Table 17-1
- IEEE Std. 802.1D™-2004: Table 17-2
- IEEE Std. 802.1D™-2004: Table 17-3
- IEEE Std. 802.1Q™-1998: sub-clause 8.4.3
- IEEE Std. 802.1Q™-1998: Table 9-2

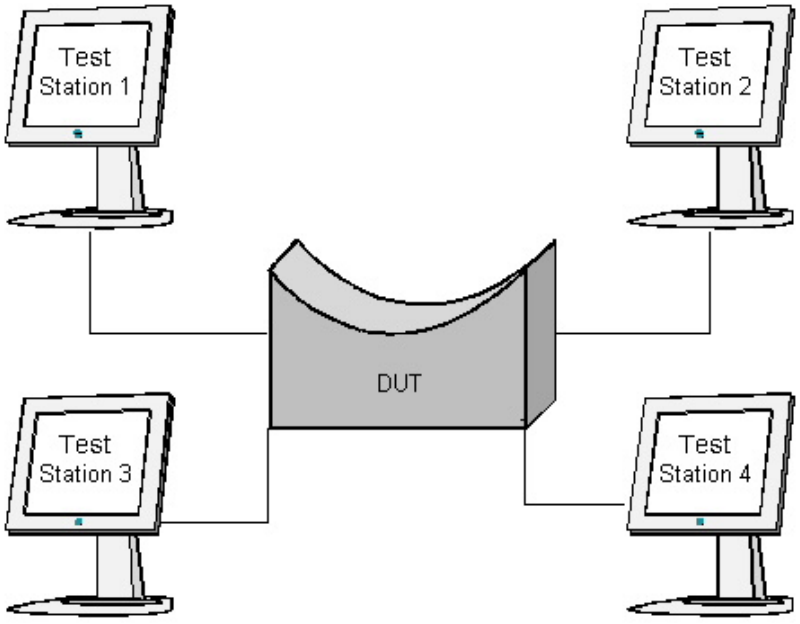
Resource Requirements:

- 4 Test Stations

Discussion:

This test is used to ensure that Bridge and Port parameters relevant to the execution of this test suite can be set to the desired values. These settings will be used throughout the test suite. In the case of RSTP parameters, the (recommended) default values are used, with the exception of Port Path Cost. A Port Path Cost of 200,000 is used as the default for all Ports.

Test Layout:



Procedure:

Part A: Configuration of Default Bridge Settings

1. Ensure that the DUT has RSTP enabled.
2. Ensure that the DUT's Force Protocol Version parameter is set to 2.
3. Ensure that the DUT's Bridge Identifier Priority parameter is set to 0x8000.
4. Ensure that the DUT's Bridge Max Age parameter is set to 20 seconds.
5. Ensure that the DUT's Bridge Hello Time parameter is set to 2 seconds.
6. Ensure that the DUT's Bridge Forward Delay parameter is set to 15 seconds.
7. Ensure that the DUT's TxHoldCount parameter is set to 6.
8. Ensure that the DUT's AgeingTime parameter is set to 300 seconds.

Part B: Configuration of Default Port Settings

1. Ensure that Ports DUT1.TS1, DUT2.TS2, DUT3.TS3, and DUT4.TS4 have enabled RSTP.
2. Set Ports DUT1.TS1, DUT2.TS2, DUT3.TS3, and DUT4.TS4's AdminPointToPointMAC parameter to Auto.
3. If the AutoEdgePort parameter is supported, set it False.
4. If the AdminEdgePort parameter is supported, set it False.
5. Ensure that the DUT's Port Identifier Priority parameter to 0x80.
6. Set the DUT's Port Path Cost to 0x030D40.
7. If the DUT is VLAN-aware, set Ports DUT1.TS1, DUT2.TS2, DUT3.TS3, and DUT4.TS4's Acceptable Frame Types parameter to AdmitAllFrames.
8. If the DUT is VLAN-aware, configure Ports DUT1.TS1, DUT2.TS2, DUT3.TS3, and DUT4.TS4 such that they are members of the Untagged Set for the Default VLAN and are not be members of any other VLAN.
9. If the DUT is VLAN-aware, set the PVID for Ports DUT1.TS1, DUT2.TS2, DUT3.TS3, and DUT4.TS4 to 0x001.

Observable Results:

- In Part A, all of the required parameters should be set to the specified values.
- In Part A, any of the optional parameters that can be set should be set to the specified values.
- In Part B, all of the required parameters should be set to the specified values.
- In Part B, any of the optional parameters that can be set should be set to the specified values.

Possible Problems:

- If the DUT does not support the specified parameter values, it may be necessary to modify or omit tests in this suite.

RSTP.op.1.2: Support for operPointToPointMAC = True, adminPointToPointMAC = Auto or ForceTrue

Purpose: To determine whether the DUT supports the operPointToPointMAC and adminPointToPointMAC parameters when one or the other of those parameters is True.

References:

- IEEE Std. 802.1D™-2004: sub-clause 5.1a
- IEEE Std. 802.1D™-2004: sub-clause 6.4.3
- IEEE Std. 802.1D™-2004: sub-clause 6.5.1
- IEEE Std. 802.1D™-2004: sub-clause 17.12
- IEEE Std. 802.1D™-2004: Figure 17-22

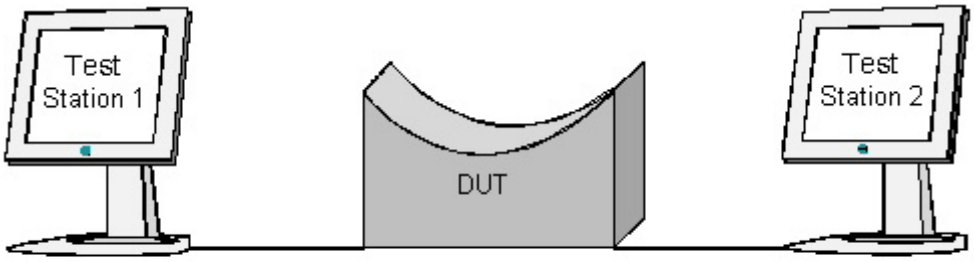
Resource Requirements:

- 2 Test Stations

Discussion:

The Internal Sublayer Service makes available a pair of parameters that permit inspection of, and control over, the administrative and operational state of the point-to-point status of the MAC entity. The administrative parameter, adminPointToPointMAC, can take the values ForceTrue, ForceFalse, and Auto. The operational parameter, operPointToPointMAC, can take a Boolean value of True or False. When the administrative parameter is set to Auto, a set of MAC-specific procedures set the operational parameter True if the Port is determined to be connected to a point-to-point LAN (otherwise the operational parameter is set False). Designated Ports that are not Edge Ports cannot make rapid transitions into the Forwarding Port State unless the operational parameter is True.

Test Layout:



Procedure:

Part A: operPointToPointMAC is True when adminPointToPointMAC is ForceTrue

1. Ensure that the default values are configured on the DUT.
2. Set Port DUT1.TS1's adminPointToPointMAC parameter to ForceTrue.
3. Start capture on Test Stations 1 and 2.
4. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of one every two seconds.
5. Transmit, from Test Station 1, a MakeBackupPortRST frame.
6. Wait 7 seconds.
7. Transmit, from Test Station 1, a RootAgreementRST frame.
8. Wait 2 seconds.
9. Transmit, from Test Station 1, 10 TestTrafficTS1 frames.
10. Transmit, from Test Station 2, 10 TestTrafficTS2 frames.
11. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Part B: operPointToPointMAC is True when adminPointToPointMAC is Auto and the Port is connected to a point-to-point LAN

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Stations 1 and 2.
3. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of one every two seconds.
4. Transmit, from Test Station 1, a MakeBackupPortRST frame.
5. Wait 7 seconds.
6. Transmit, from Test Station 1, a RootAgreementRST frame.
7. Wait 2 seconds.
8. Transmit, from Test Station 1, 10 TestTrafficTS1 frames.
9. Transmit, from Test Station 2, 10 TestTrafficTS2 frames.
10. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Observable Results:

- In Parts A and B, Test Station 1 must capture 10 TestTrafficTS2 frames and Test Station 2 must capture 10 TestTrafficTS1 frames.

Possible Problems:

- Note: Designated Ports that are not Edge Ports cannot make rapid transitions into the Forwarding Port State unless the operational parameter is True.

RSTP.op.1.3: Support for operPointToPointMAC = False, adminPointToPointMAC = Auto or ForceFalse

Purpose: To determine whether the DUT supports the operPointToPointMAC and adminPointToPointMAC parameters when one or the other of those parameters is False.

References:

- IEEE Std. 802.1D™-2004: sub-clause 5.1a
- IEEE Std. 802.1D™-2004: sub-clause 6.4.3
- IEEE Std. 802.1D™-2004: sub-clause 6.5.1
- IEEE Std. 802.1D™-2004: sub-clause 17.12
- IEEE Std. 802.1D™-2004: Figure 17-22

Resource Requirements:

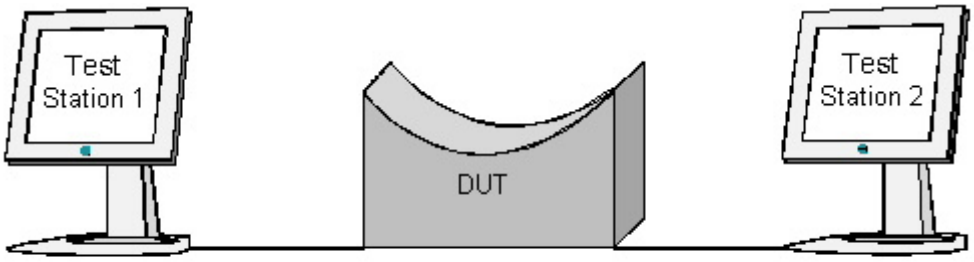
- 2 Test Stations

Discussion:

The Internal Sublayer Service makes available a pair of parameters that permit inspection of, and control over, the administrative and operational state of the point-to-point status of the MAC entity. The administrative parameter, adminPointToPointMAC, can take the values ForceTrue, ForceFalse, and Auto. The operational parameter, operPointToPointMAC, can take a Boolean value of True or False. When the administrative parameter is set to Auto, a set of MAC-specific procedures set the operational parameter True if the Port is determined to be connected to a point-to-point LAN (otherwise the operational parameter is set False).

Designated Ports that are not Edge Ports cannot make rapid transitions into the Forwarding Port State when the operational parameter is False.

Test Layout:



Procedure:

Part A: operPointToPointMAC is False when adminPointToPointMAC is ForceFalse

1. Ensure that the default values are configured on the DUT.
2. Set Port DUT1.TS1's adminPointToPointMAC parameter to ForceFalse.
3. Start capture on Test Stations 1 and 2.
4. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of one every two seconds.
5. Transmit, from Test Station 1, a MakeBackupPortRST frame.
6. Wait 7 seconds.
7. Transmit, from Test Station 1, a RootAgreementRST frame.
8. Wait 2 seconds.
9. Transmit, from Test Station 1, 10 TestTrafficTS1 frames.
10. Transmit, from Test Station 2, 10 TestTrafficTS2 frames.
11. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Part B: operPointToPointMAC is False when adminPointToPointMAC is Auto, and the Port is not connected to a point-to-point LAN

1. Ensure that the default values are configured on the DUT.
2. Set Port DUT1.TS1 to force half-duplex operation.
3. Start capture on Test Stations 1 and 2.
4. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of one every two seconds.
5. Transmit, from Test Station 1, a MakeBackupPortRST frame.
6. Wait 7 seconds.
7. Transmit, from Test Station 1, a RootAgreementRST frame.
8. Wait 2 seconds.
9. Transmit, from Test Station 1, 10 TestTrafficTS1 frames.
10. Transmit, from Test Station 2, 10 TestTrafficTS2 frames.
11. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Observable Results:

- In Parts A and B, Test Station 1 must not capture any TestTrafficTS2 frames and Test Station 2 must not capture any TestTrafficTS1 frames.

Possible Problems:

- None.

RSTP.op.1.4: Unique Bridge and Port Identifiers Exist

Purpose: To determine whether unique identifiers exist for the Bridge and each of its Ports.

References:

- IEEE Std. 802.1D™-2004: sub-clause 9.2.5
- IEEE Std. 802.1D™-2004: sub-clause 9.2.7
- IEEE Std. 802.1D™-2004: sub-clause 17.2
- IEEE Std. 802.1D™-2004: sub-clause 17.18.2
- IEEE Std. 802.1D™-2004: sub-clause 17.19.19

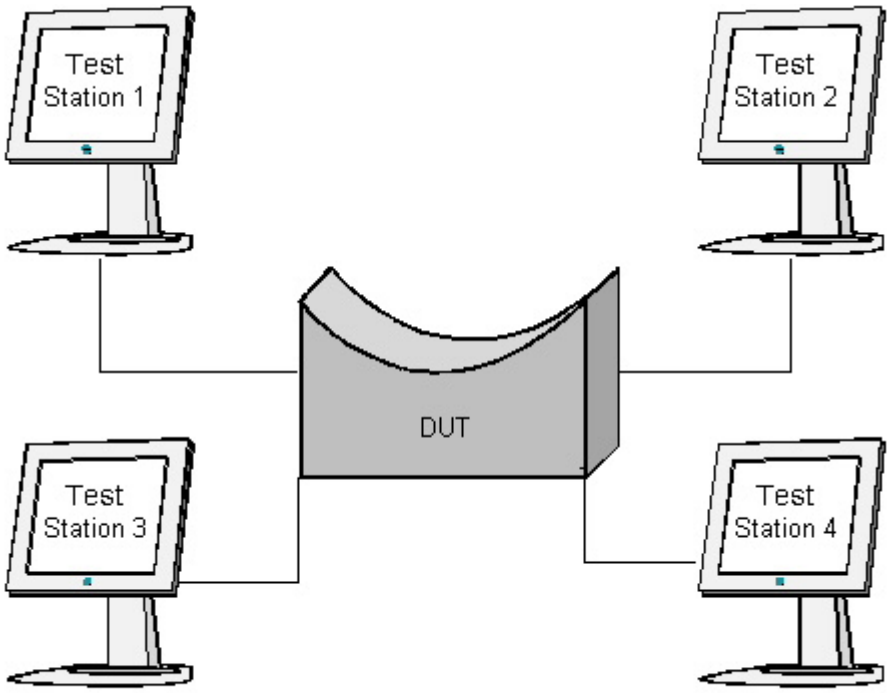
Resource Requirements:

- 4 Test Stations

Discussion:

IEEE Std. 802.1D™-2004 compliant Bridges must meet the following criteria: they must have a unique identifier within the Bridged Local Area Network and each of their Ports must have a unique identifier within the Bridge.

Test Layout:



Procedure:

Part A: Check the Uniqueness of Bridge and Ports Identifiers

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Stations 1 thru 4.
3. Wait 5 seconds.
4. Set the DUT's Force Protocol Version parameter to 0.
5. Wait 5 seconds.
6. Stop capture on Test Stations1 thru 4 and observe the captured frames (if any).

Observable Results:

- Test Stations 1 thru 4 must capture RST BPDUs.
- Test Stations 1 thru 4 must capture Configuration BPDUs.
- RST BPDUs and Configuration BPDUs captured by Test Stations 1 thru 4 must contain the following parameter values:
  Root Bridge Identifier equal to the DUT's Bridge Identifier
  Designated Bridge Identifier equal to the DUT's Bridge Identifier
  Designated Port Identifier equal to the Port Identifier of the Port to which the Test System is connected (e.g. Port DUT1.TS1).

Possible Problems:

- None

RSTP.op.1.5: Force Protocol Version Parameter

Purpose: To determine whether the DUT supports both values of the Force Protocol Version parameter, and that modification of the Force Protocol Version parameter results in re-initialization of the Spanning Tree Protocol Entity.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.4
- IEEE Std. 802.1D™-2004: sub-clause 17.13
- IEEE Std. 802.1D™-2004: sub-clause 17.13.4
- IEEE Std. 802.1D™-2004: sub-clause 17.18.1
- IEEE Std. 802.1D™-2004: sub-clause 17.20.11
- IEEE Std. 802.1D™-2004: sub-clause 17.20.12
- IEEE Std. 802.1D™-2004: sub-clause 17.24
- IEEE Std. 802.1D™-2004: Annex J
- IEEE Std. 802.1D™-2004: Annex K

Resource Requirements:

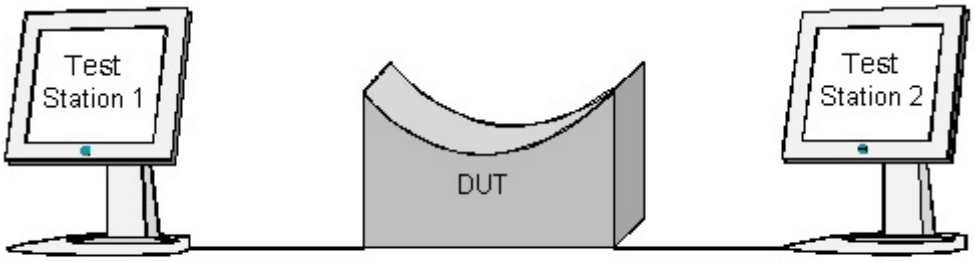
- 2 Test Stations

Discussion:

RSTP is designed to be compatible and interoperable with the Spanning Tree Algorithm and Protocol (STP). An RSTP Bridge Port automatically adjusts to provide interoperability, if it is attached to the same LAN as an STP Bridge. That said it is possible that RSTP's rapid state transitions will increase rates of frame duplication and misordering on the LAN. This is discussed in IEEE Std. 802.1D™-2004: Annex G (informative). An administrative Force Protocol Version parameter causes an RSTP Bridge to use STP compatible BPDUs and timer values on all Bridge Ports. Rapid transitions are disabled, thus supporting applications and protocols that are particularly sensitive to frame duplication and misordering. The values associated with the Force Protocol Version are: 0 for STP Compatibility mode and 2 (the default) for normal operation.

It should be noted that any modification of the Force Protocol Version parameter would result in re-initialization of the Spanning Tree Protocol Entity by means of asserting BEGIN.

Test Layout:



Procedure:

Part A: Force Protocol Version Parameter Changed to 0

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Stations 1 and 2.
3. Wait 5 seconds.
4. Set the DUT's Force Protocol Version parameter to 0.
5. Wait 2 seconds.
6. Transmit, from Test Station 1, 10 TestTrafficTS1 frames.
7. Transmit, from Test Station 1, a MakeRootPortRST frame.
8. Wait 2 seconds
9. Transmit, from Test Station 2, a RootAgreementRST frame.
10. Wait 5 seconds.
11. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Part B: Force Protocol Version Parameter Changed to 2

1. Ensure that the default values are configured on the DUT.
2. Set the DUT's Force Protocol Version parameter to 0.
3. Wait 45 seconds.
4. Start capture on Test Stations 1 and 2.
5. Wait 5 seconds.
6. Set the DUT's Force Protocol Version parameter to 2.
7. Wait 2 seconds.
8. Transmit, from Test Station 1, 10 TestTrafficTS1 frames.
9. Transmit, from Test Station 1, a MakeRootPortRST frame.
10. Wait 2 seconds.
11. Transmit, from Test Station 2, a RootAgreementRST frame.
12. Wait 5 seconds.
13. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Observable Results:

- In Part A, Test Stations 1 and 2 must capture the following frames in the order given: RST BPDUs, Configuration BPDUs.
- In Part B, Test Stations 1 and 2 must capture the following frames in the order given: Configuration BPDUs, RST BPDUs.
- In Parts A and B, Test Station 2 must not capture any TestTrafficTS1 frames.

Possible Problems:

- None.

RSTP.op.1.6: Source MAC address of BPDUs

Purpose: To determine whether the source MAC address contained in BPDUs transmitted by the DUT is the unique MAC address of the transmitting Port.

References:

- IEEE Std. 802.1D™-2004: sub-clause 6.4.1
- IEEE Std. 802.1D™-2004: sub-clause 7.6

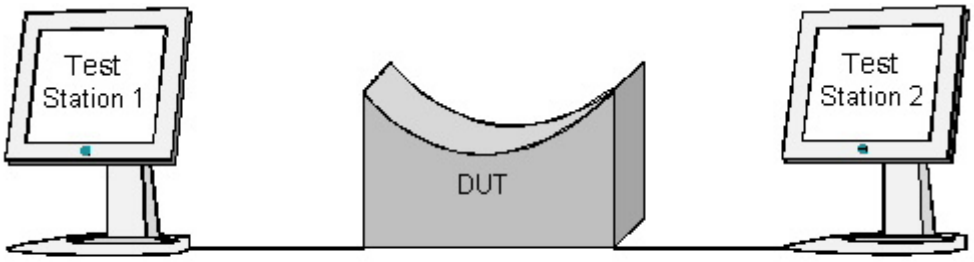
Resource Requirements:

- 2 Test Stations

Discussion:

The Spanning Tree Protocol entities of Bridges attached to a given individual LAN in a Bridged Local Area Network communicate by exchanging Bridge Protocol Data Units (BPDUs). Properly formatted BPDUs carry the source MAC address of the transmitting Port.

Test Layout:



Procedure:

Part A: Source MAC Address of BPDUs

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Wait 5 seconds.
4. Transmit, from Test Station 1, a MakeRootPortConfig frame.
5. Wait 2 seconds.
6. Transmit, from Test Station 2, a TCN_BPDU frame.
7. Wait 7 seconds.
8. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- Test Station 1 should capture the following frames in the order given: RST BPDUs, TCN BPDUs, Configuration BPDUs. These frames must contain a source MAC address parameter equal to the source MAC address that identifies Port DUT1.TS1.

Possible Problems:

- None.

RSTP.op.1.7: Maximum BPDU Transmission Delay and Maximum RSTP Processing Delay

Purpose: To ensure the delay between internal timer related events and BPDU transmission does not exceed the maximum allowed value.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.32
- IEEE Std. 802.1D™-2004: Table 17-5

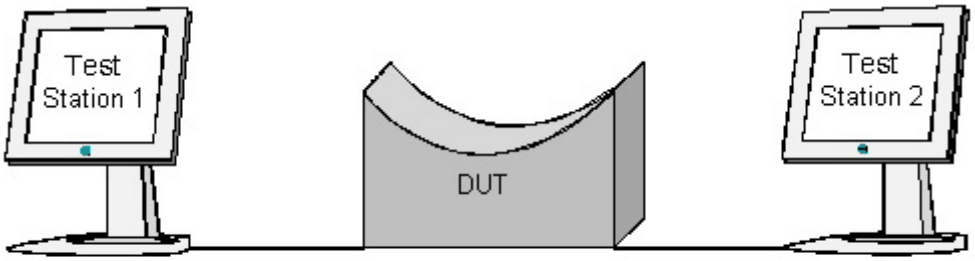
Resource Requirements:

- 2 Test Stations
- 1 Repeater

Discussion:

The delay between the occurrence of an external event and the action or actions mandated by the RSTP specification as a consequence of the event shall not exceed the Maximum RSTP processing delay. The delay between internal timer related events and the transmission of all BPDUs on Ports mandated by the RSTP specification as a consequence shall not exceed the Maximum BPDU transmission delay.

Test Layout:



Procedure:

Part A: Maximum RSTP Processing Delay and Maximum BPDU Transmission Delay are not Exceeded

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 2.
3. Wait 5 seconds.
4. Transmit, from Test Station 1, a MakeRootPortRST frame.
5. Wait 5 seconds.
6. Stop capture on Test Station 2 and observe the captured frames (if any).

Observable Results:

- Test Station 2 must capture RST BPDUs with a Root Bridge Identifier equal to the BridgeIdentifier of the DUT.
- Test Station 2 must capture RST BPDUs with a Root Bridge Identifier of 0x7000 00BFCBFCBFC0.
- The time interval between the last frame with a Root Bridge Identifier equal to the BridgeIdentifier of the DUT and the first frame with a Root Bridge Identifier of 0x7000 00BFCBFCBFC0 must be less than 1.4 seconds.

Possible Problems:

- This test does not attempt to test all possible combinations of external and/or internal timer-related events under any conditions (doing so would go far beyond the scope of this test suite). Thus this test can only help to ensure the RSTP Performance Requirements are met.

GROUP 2: BPDU Encoding, Frame Format, and Validation

Scope

This group of tests verifies that the DUT uses the proper Frame Format and Parameter Encoding for the BPDUs it transmits, and that the DUT properly validates the BPDUs it receives.

Overview

This Group tests the Frame Format of the following:

BPDU Types:

Configuration BPDUs
RST BPDUs
TCN BPDUs

BPDU Parameters:

Protocol Identifier
Protocol Version Identifier
BPDU Type
Flags
Root Bridge Identifier
Root Path Cost
Bridge Identifier
Port Identifier
Message Age
Max Age
Forward Delay
Version One Length

Validation of BPDUs based on the following criteria:

Protocol Identifier
Message Age
Total Number of Octets in the BPDU

RSTP.op.2.1: RST BPDU frame format – DUT is the Root Bridge

Purpose: This test verifies that RST BPDUs transmitted by the DUT are properly formatted when the DUT is the Root Bridge.

References:

- IEEE Std. 802.1D™-2004: 9.3.3
- IEEE Std. 802.1D™-2004: Figure 9-3

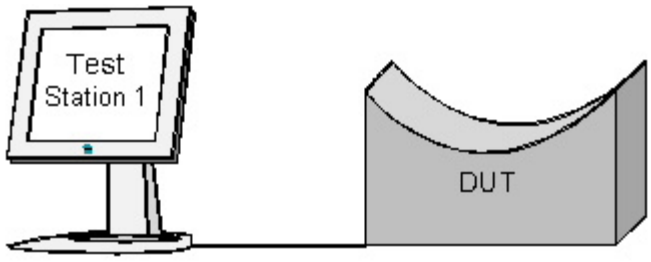
Resource Requirements:

- 1 Test Station

Discussion:

This test examines an RST BPDU transmitted by the DUT when it is the Root Bridge.

Test Layout:



Procedure:

Part A: RST BPDU Transmission Using Default Settings

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Wait 6 seconds.
4. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- Test Station 1 must capture RST BPDUs. These RST BPDUs must contain the following parameter values:

  Protocol Identifier of 0x00 00
  Protocol Version Identifier of 0x02
  BPDU Type of 0x02
  Flags of 0x3C or 0x7C
  Root Bridge Identifier equal to the DUT's Bridge Identifier
  Root Path Cost of 0x00 00 00 00
  Designated Bridge Identifier equal to the DUT's Bridge Identifier
  Designated Port Identifier equal to that of Port DUT1.TS1
  Message Age of 0x00 00
  Max Age of 0x1400
  Hello Time of 0x02 00
  Forward Delay of 0x0F 00
  Version 1 Length of 0x00

Possible Problems:

- None.

RSTP.op.2.2: Configuration BPDU Frame Format – DUT is the Root Bridge

Purpose: This test verifies that Configuration BPDUs transmitted by the DUT are properly formatted when the DUT is the Root Bridge.

References:

- IEEE Std. 802.1D™-2004: sub-clause 9.3.1
- IEEE Std. 802.1D™-2004: Figure 9-1

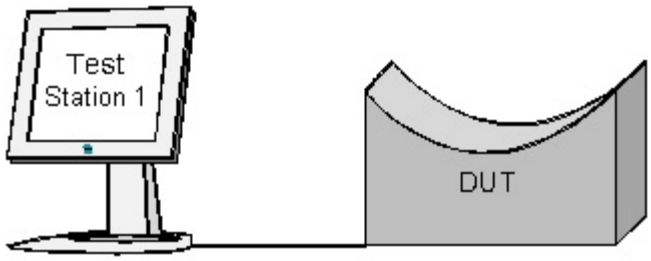
Resource Requirements:

- 1 Test Station

Discussion:

This test examines a Configuration BPDU transmitted by the DUT when it is the Root Bridge.

Test Layout:



Procedure:

Part A: Configuration BPDU Transmission Using Default Settings

1. Ensure that the default values are configured on the DUT.
2. Set the DUT's Force Version parameter to zero
3. Start capture on Test Station 1.
4. Wait 6 seconds.
5. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- Test Station 1 must capture Configuration BPDUs. These Configuration BPDUs must contain the following parameter values:

  Protocol Identifier of 0x00 00
  Protocol Version Identifier of 0x00
  BPDU Type of 0x00
  Flags of 0x00
  Root Bridge Identifier equal to the DUT's Bridge Identifier
  Root Path Cost of 0x00 00 00 00
  Designated Bridge Identifier equal to the DUT's Bridge Identifier
  Designated Port Identifier equal to that of Port DUT1.TS1
  Message Age of 0x00 00
  Max Age of 0x14 00
  Hello Time of 0x02 00
  Forward Delay of 0x0F 00

Possible Problems:

- None.

RSTP.op.2.3: RST BPDU Frame Format – DUT is not the Root Bridge

Purpose: This test verifies that RST BPDUs transmitted by the DUT are properly formatted when the DUT is not the Root Bridge.

References:

- IEEE Std. 802.1D™-2004: sub-clause 9.3.3
- IEEE Std. 802.1D™-2004: sub-clause 17.6
- IEEE Std. 802.1D™-2004: sub-clause 17.21.20
- IEEE Std. 802.1D™-2004: Figure 9-3

Resource Requirements:

- 2 Test Stations

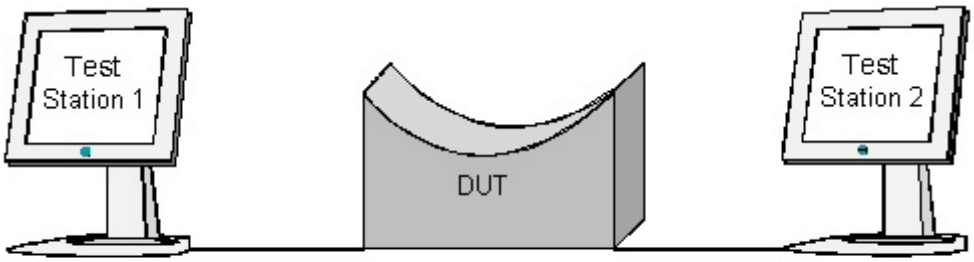
Discussion:

When a Bridge is not the Root Bridge, the components of the message priority vector and message times conveyed in RST BPDUs transmitted by its Ports are derived as follows:

Root Bridge Identifier	Root Bridge Identifier held by the Root Port
Root Path Cost	Sum of the Root Path Cost held by and Path Cost of the Root Port.
Designated Bridge Identifier	Bridge Identifier.
Designated Port Identifier	Port Identifier of the transmitting Port.
Message Age	Message Age held by the Root Port, incremented by 1 second and rounded to the nearest whole second.
Max Age	Max Age held by the Root Port.
Hello Time	Bridge Hello Time.
Forward Delay	Forward Delay held by the Root Port.

All other values (with the exception of BPDU flags, which are tested more thoroughly elsewhere) conveyed in RST BPDUs are immutable.

Test Layout:



Procedure:

Part A: RST BPDU Frame Format when the DUT is not the Root Bridge

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortBigMsgTimesRST frames at a rate of one every two seconds.
3. Transmit, from Test Station 2, a RootAgreementRST frame.
4. Wait 2 seconds.
5. Start capture on Test Station 2.
6. Wait 11 seconds.
7. Stop capture on Test Station 2 and observe the captured frames (if any).

Observable Results:

- Test Station 2 must capture RST BPDUs. These RST BPDUs must contain the following BPDU parameter values:

  Protocol Identifier of 0x00 00
  Protocol Version Identifier of 0x02
  BPDU Type of 0x02
  Flags of 0x3C or 0x7C
  Root Bridge Identifier of 0x70 00 00 BF CB FC BF C0
  Root Path Cost of 0x00 06 1A 80
  Designated Bridge Identifier equal to the DUT's Bridge Identifier
  Designated Port Identifier equal to that of Port DUT1.TS1
  Message Age of 0x0B 00
  Max Age of 0x28 00
  Hello Time of 0x02 00
  Forward Delay of 0x1E 00
  Version 1 Length of 0x00

Possible Problems:

- None.

RSTP.op.2.4: Configuration BPDU Frame Format – DUT is not the Root Bridge

Purpose: This test verifies that Configuration BPDUs transmitted by the DUT are properly formatted when the DUT is not the Root Bridge.

References:

- IEEE Std. 802.1D™-2004: sub-clause 9.3.1
- IEEE Std. 802.1D™-2004: sub-clause 17.6
- IEEE Std. 802.1D™-2004: sub-clause 17.21.19
- IEEE Std. 802.1D™-2004: Figure 9-1

Resource Requirements:

- 2 Test Stations

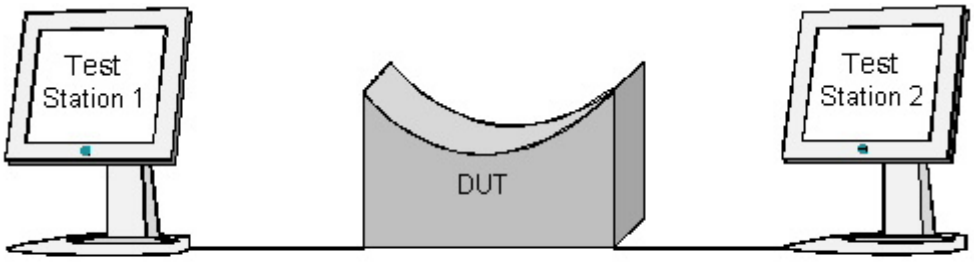
Discussion:

When a Bridge is not the Root Bridge, the components of the message priority vector and message times conveyed in Configuration BPDUs transmitted by its Ports are derived as follows:

Root Bridge Identifier	Root Bridge Identifier held by the Root Port.
Root Path Cost	Sum of the Root Path Cost held by and Path Cost of the Root Port.
Designated Bridge Identifier	Bridge Identifier of the DUT.
Designated Port Identifier	Port Identifier of the transmitting Port.
Message Age	Message Age held by the Root Port, incremented by 1 second and rounded to the nearest whole second.
Max Age	Max Age held by the Root Port.
Hello Time	Bridge Hello Time.
Forward Delay	Forward Delay held by the Root Port.

All other values (with the exception of BPDU flags, which are tested more thoroughly elsewhere) conveyed in Configuration BPDUs are immutable.

Test Layout:



Procedure:

Part A: Configuration BPDU Frame Format when the DUT is not the Root Bridge

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortBigMsgTimesRST frames at a rate of one every two seconds.
3. Transmit, from Test Station 2, a MigratePort2STP frame.
4. Wait 2 seconds.
5. Start capture on Test Station 2.
6. Wait 11 seconds.
7. Stop capture on Test Station 2 and observe the captured frames (if any).

Observable Results:

- Test Station 2 must capture Configuration BPDUs. These Configuration BPDUs must contain the following BPDU parameter values:

  Protocol Identifier of 0x00 00
  Protocol Version Identifier of 0x00
  BPDU Type of 0x00
  Flags of 0x00
  Root Bridge Identifier equal to 0x70 00 00 BF CB FC BF C0
  Root Path Cost of 0x00 06 1A 80
  Designated Port Identifier equal to that of Port DUT1.TS1
  Message Age of 0x0B 00
  Max Age of 0x28 00
  Hello Time of 0x02 00
  Forward Delay of 0x1E 00

Possible Problems:

- None.

RSTP.op.2.5: TCN BPDU Frame Format – DUT is not the Root Bridge

Purpose: This test verifies that TCN BPDUs transmitted by the DUT are properly formatted when the DUT is not the Root Bridge.

References:

- IEEE Std. 802.1D™-2004: sub-clause 9.3.2
- IEEE Std. 802.1D™-2004: sub-clause 17.21.21
- IEEE Std. 802.1D™-2004: Figure 9-2

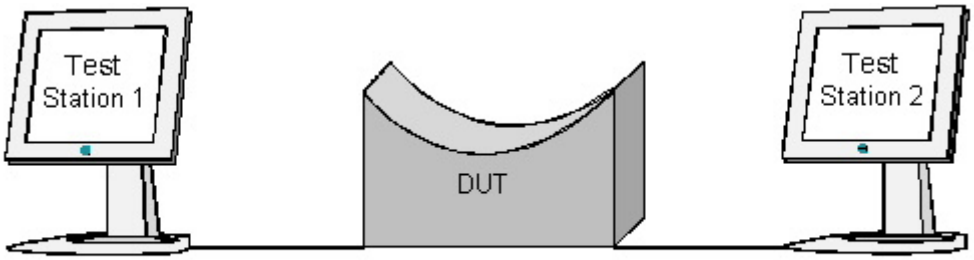
Resource Requirements:

- 2 Test Stations

Discussion:

The BPDU parameters conveyed in TCN BPDUs are immutable. TCN BPDUs are transmitted when a Bridge that is not the Root Bridge detects or is notified of a Topology Change, and its Root Port is determined to be connected to the same LAN as an STP Bridge. This is required for STP compatibility.

Test Layout:



Procedure:

Part A: TCN BPDU Frame Format when the DUT is not the Root Bridge

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortConfig frames at a rate of one every two seconds.
3. Transmit, from Test Station 2, a NotifyTC_RST frame.
4. Start capture on Test Station 1.
5. Wait 5 seconds.
6. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- Test Station 1 must capture TCN BPDUs. These TCN BPDUs must contain the following BPDU parameter values:

  Protocol Identifier of 0x00 00
  Protocol Version Identifier of 0x00
  BPDU Type of 0x80

Possible Problems:

- None.

RSTP.op.2.6: BPDU Validation based on Protocol Identifier

Purpose: To verify that the DUT does not accept frames which contain any Protocol Identifier other than 0x0000 as valid Spanning Tree BPDUs.

References:

- IEEE Std. 802.1D™-2004: sub-clause 9.3.4

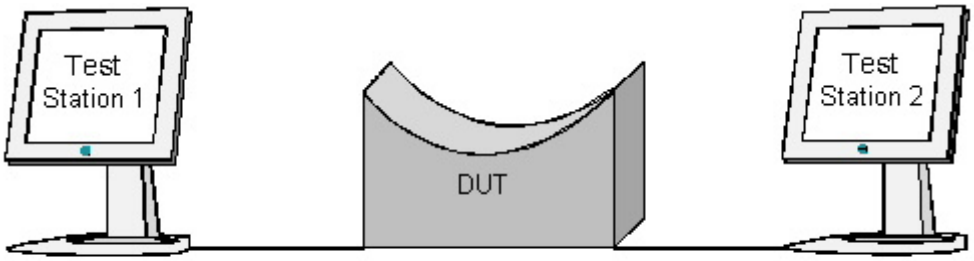
Resource Requirements:

- 2 Test Stations

Discussion:

The Bridge Group Address, 0x01 80 C2 00 00 00, and the LLC address that specifies the Bridge Protocol Entity, 0x42, may be used for any number of protocols. For this reason a Protocol Identifier specifying the Spanning Tree Protocol is contained in all BPDUs used by any version of the Spanning Tree Protocol.

Test Layout:



Procedure:

Part A: BPDU Validation Based on Protocol Identifier: RST BPDUs

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 2, a MakeRootPortBadProtocolIdRST frame.
4. Wait 5 seconds.
5. Stop capture on Test Station 1 and observe the captured frames (if any).

Part B: BPDU Validation Based on Protocol Identifier: Configuration BPDUs

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 2, a MakeRootPortBadProtocolIdConfig frame.
4. Wait 5 seconds.
5. Stop capture on Test Station 1 and observe the captured frames (if any).

Part C: BPDU Validation Based on Protocol Identifier: TCN BPDUs

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 2, a BadProtocolId_TCN_BPDU frame.
4. Wait 5 seconds.
5. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- In Parts A, B, and C, Test Station 1 must capture RST BPDUs. These frames must contain a Root Bridge Identifier equal to the BridgeIdentifier of the DUT. These frames must not contain any Topology Change information.

Possible Problems:

- None.

RSTP.op.2.7: BPDU Validation based on Message Age

Purpose: To verify that the DUT does not process a Spanning Tree BPDU if it's Message Age component is greater than or equal to its Max Age component.

References:

- IEEE Std. 802.1D™-2004: sub-clause 9.3.4
- IEEE Std. 802.1D™-2004: sub-clause 17.27

Resource Requirements:

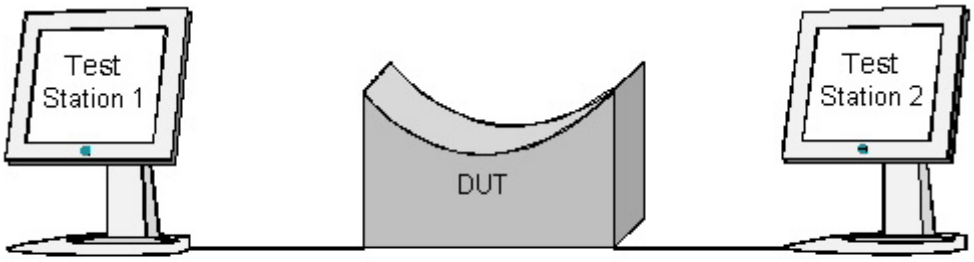
- 2 Test Stations

Discussion:

Configuration Messages containing a Message Age that (when incremented by one second and rounded to the nearest whole second) is greater than their Max Age are aged out "immediately". The Port Information Machine (PIM) describes this behavior.

Because the order of execution of state blocks in different state machines is undefined except as constrained by their transition conditions, it is possible that a Bridge may transmit a Configuration Message containing values from a received Configuration Message that is due to be aged out. In this case, provided txCount is less than TxHoldCount, another updated Configuration Message will soon follow.

Test Layout:



Procedure:

Part A: BPDU Validation Based on Message Age: RST BPDUs

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 2, a MakeRootPortStaleRST frame.
4. Wait 4 seconds.
5. Stop capture on Test Station 1 and observe the captured frames (if any).
6. Repeat this Part using a MakeRootPortVeryStaleRST frame instead of a MakeRootPortStaleRST frame.

Part B: BPDU Validation Based on Message Age: Configuration BPDUs

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 2, a MakeRootPortStaleConfig frame.
4. Wait 4 seconds.
5. Stop capture on Test Station 1 and observe the captured frames (if any).
6. Repeat this Part using a MakeRootPortVeryStaleConfig frame instead of a MakeRootPortStaleConfig frame.

Observable Results:

- In Parts A and B, in each case, Test Station 1 must capture RST BPDUs.
- In Parts A and B, in each case, Test Station 1 must not capture more than one RST BPDU containing the Root Bridge Identifier conveyed in the Configuration Message transmitted by Test Station 2.
- In Parts A and B, in each case, if Test Station 1 captures an RST BPDU containing the Root Bridge Identifier conveyed in the Configuration Message transmitted by Test Station 2, it must capture an RST BPDU containing a Root Bridge Identifier equal to the Bridge Identifier of the DUT within the next 1.2 seconds.

Possible Problems:

- None.

RSTP.op.2.8: BPDU Validation Based on Number of Octets in BPDU

Purpose: To verify that the DUT does not process a Spanning Tree BPDU if it contains less than the minimum number of octets required for validation of BPDUs of the type denoted by its BPDU Type field.

References:

- IEEE Std. 802.1D™-2004: sub-clause 9.3.4

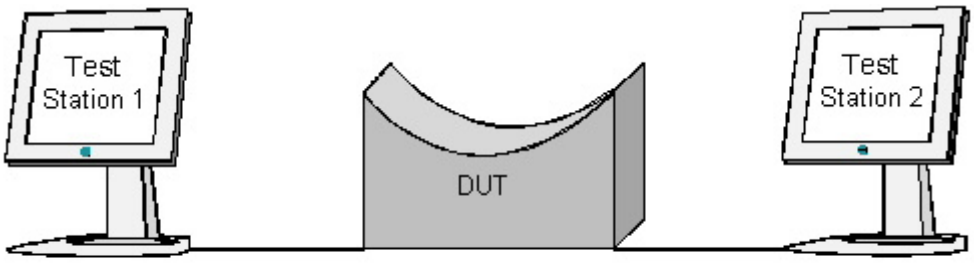
Resource Requirements:

- 2 Test Stations

Discussion:

The requirements for validation of each BPDU Type (Configuration, Rapid Spanning Tree, and Topology Change Notification) vary from type to type. That said, a BPDU shall be considered invalid (and shall not be processed) if it does not contain the minimum number of octets specified for BPDUs of that type. Because all BPDUs containing the BPDU Type used to denote TCN BPDUs also contain the minimum number of octets specified for TCN BPDUs, the validation of TCN BPDUs based on the number of octets they contain need not be tested.

Test Layout:



Procedure:

Part A: BPDU Validation Based on Number of Octets – Configuration BPDUs

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 2.
3. Continuously transmit, from Test Station 1, MakeRootPortTooFewOctetsConfig frames at a rate of one every two seconds.
4. Wait 6 seconds.
5. Stop capture on Test Station 2 and observe the captured frames (if any).

Part B: BPDU Validation Based on Number of Octets – RST BPDUs

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 2.
3. Continuously transmit, from Test Station 1, MakeRootPortTooFewOctetsRST frames at a rate of one every two seconds.
4. Wait 6 seconds.
5. Stop capture on Test Station 2 and observe the captured frames (if any).

Observable Results:

- In Part A, Test Station 2 must capture RST BPDUs. These frames must not contain a Root Bridge Identifier equal to the Root Bridge Identifier conveyed in Configuration BPDUs transmitted by Test Station 1.
- In Part B, Test Station 2 must capture RST BPDUs. These frames must not contain a Root Bridge Identifier equal to the Root Bridge Identifier conveyed in RST BPDUs transmitted by Test Station 1.

Possible Problems:

- None.

GROUP 3: Bridge and Port parameter configuration

Scope

If the Bridge allows management to modify various parameters, these tests verify that the Bridge has the capability to use the full range of permissible values for those parameters.

Overview

Devices that claim to support configuration of the following parameters must pass this group of tests. For devices that do not support configuration of the following parameters, proceed to the next group of tests.

Bridge Priority
Bridge Forward Delay
Bridge Max Age
Bridge Hello Time
Port Priority
Port Path Cost

RSTP.op.3.1: Per-Bridge Parameters – Bridge Identifier Priority

Purpose: These tests determine whether the DUT permits modification of the Bridge Identifier Priority parameter, and if so, verifies that all 16 permissible values are configurable.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.2
- IEEE Std. 802.1D™-2004: sub-clause 17.14
- IEEE Std. 802.1D™-2004: Table 17-2

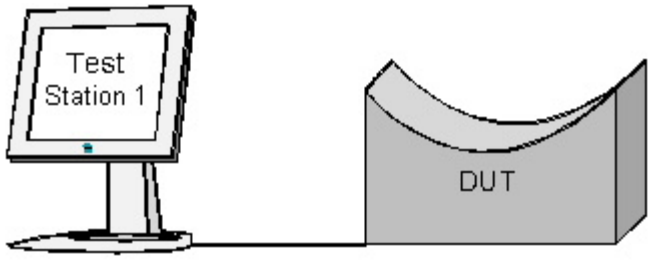
Resource Requirements:

- 1 Test Station

Discussion:

Table 17-2 of IEEE Std. 802.1D™-2004 specifies the default value and range for the Bridge Identifier Priority. If management supports configuration of the Bridge Identifier Priority, then the Bridge shall have the capability to use the full range of values (0 – 61,440 in increments of 4,096).

Test Layout:



Procedure:

Part A: Incrementing Bridge Identifier Priority

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Set the DUT's Bridge Identifier Priority parameter to 0x0000.
4. Wait 3 seconds.
5. If the DUT's Bridge Identifier Priority parameter is equal to 0xF000 then continue to the next step; otherwise increment the DUT's Bridge Identifier Priority parameter by 0x1000 and repeat the previous step.
6. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- For each of the following Bridge Identifier Priority values, Test Station 1 must capture at least one RST BPDU containing the specified Bridge Identifier Priority value:

  0x0000, 0x1000, 0x2000, 0x3000, 0x4000, 0x5000, 0x6000, 0x7000, 0x8000, 0x9000, 0xA000, 0xB000, 0xC000, 0xD000, 0xE000, and 0xF000.

Possible Problems:

- If the DUT does not support modification of the Bridge Identifier Priority parameter, this test is Not Applicable (N/A). It is not mandatory to allow modification of the Bridge Identifier Priority parameter.

RSTP.op.3.2: Per-Bridge Parameters – Bridge Forward Delay

Purpose: These tests determine whether the DUT permits modification of the Bridge Forward Delay parameter, and if so, verifies that a number of different Forward Delay values are configurable.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.14
- IEEE Std. 802.1D™-2004: Table 17-1

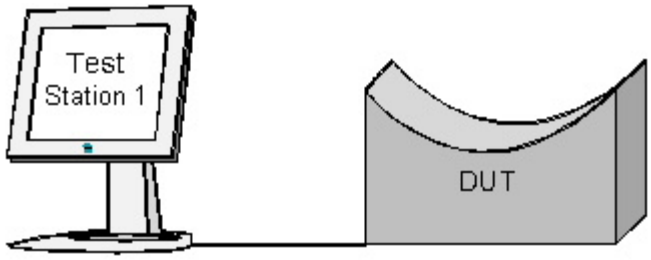
Resource Requirements:

- 1 Test Station

Discussion:

Table 17-1 of IEEE Std. 802.1D™-2004 specifies the default value and range for RSTP Timer and Transmit Hold Count parameter values. If management supports configuration of Bridge Forward Delay then the Bridge shall have the capability to use the full range of values (4.0-30.0 seconds). This test tests the default, minimum, and maximum values as well as two other, randomly selected, valid times.

Test Layout:



Procedure:

Part A: Modifying Bridge Forward Delay

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Set the DUT's Bridge Max Age to 6, and Bridge Forward Delay to 4.
4. Wait 3 seconds.
5. Set the DUT's Bridge Forward Delay to 15.
6. Wait 3 seconds.
7. Set the DUT's Bridge Forward Delay to 30.
8. Wait 3 seconds.
9. Set the DUT's Bridge Forward Delay to an integer between 4 and 30, but not 4, 15, or 30.
10. Wait 3 seconds.
11. Set the DUT's Bridge Forward Delay to an integer between 4 and 30, but not 4, 15, 30, or the integer used in the prior step.
12. Wait 3 seconds.
13. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- For each of the following Forward Delay values, Test Station 1 must capture at least one RST BPDU containing the specified Forward Delay value:

  0x0400, 0x0F00, 0x1E00, and the two randomly generated Bridge Forward Delay values.

Possible Problems:

- If the DUT does not support modification of the Bridge Forward Delay parameter, this test is Not Applicable (N/A). It is not mandatory to allow modification of the Bridge Forward Delay parameter.

RSTP.op.3.3: Per-Bridge Parameters – Bridge Max Age

Purpose: These tests determine whether the DUT permits modification of the Bridge Max Age parameter, and if so, verifies that a number of different Max Age values are configurable.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.14
- IEEE Std. 802.1D™-2004: Table 17-1

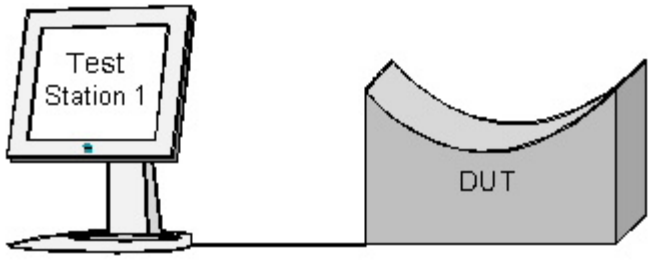
Resource Requirements:

- 1 Test Station

Discussion:

Table 17-1 of IEEE 802.1D™-2004 specifies the default value and range for RSTP Timer and Transmit Hold Count parameter values. If management supports configuration of the Bridge Max Age parameter, then the Bridge shall have the capability to use the full range of values (6.0-40.0 seconds). This test tests the default, minimum, and maximum values as well as two other, randomly selected, valid times.

Test Layout:



Procedure:

Part A: Modifying Bridge Max Age

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Set the DUT's Bridge Max Age to 6.
4. Wait 3 seconds.
5. Set the DUT's Bridge Max Age to 20.
6. Wait 3 seconds.
7. Set the DUT's Bridge Max Age to 28.
8. Wait 3 seconds.
9. Set the DUT's Bridge Forward Delay to 21.
10. Set the DUT's Bridge Max Age to 40.
11. Wait 3 seconds.
12. Set the DUT's Max Age to an integer between 6 and 40, but not 6, 20, 28, or 40. Set Forward Delay equal to at least the value of Max Age divided by 2, plus one. $\geq \left(\frac{MaxAge}{2} + 1 \right)$
13. Wait 3 seconds.
14. Set the DUT's Max Age to an integer between 6 and 40, but not 6, 20, 28, 40, or the integer used in the prior step. Set Forward Delay equal to at least the value of Max Age divided by 2, plus 1. $\geq \left(\frac{MaxAge}{2} + 1 \right)$
15. Wait 3 seconds.
16. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- For each of the following Max Age values, Test Station 1 must capture at least one RST BPDU containing the specified Max Age value:

  0x0600, 0x1400, 0x1C00, 0x2800, and the two randomly generated Max Age values.

Possible Problems:

- If the DUT does not support modification of the Bridge Max Age parameter, this test is Not Applicable (N/A). It is not mandatory to allow modification of the Bridge Max Age parameter.

RSTP.op.3.4: Per-Bridge Parameters – Bridge Hello Time

Purpose: These tests determine whether the DUT permits modification of the Bridge Hello Time.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.14
- IEEE Std. 802.1D™-2004: Table 17-1

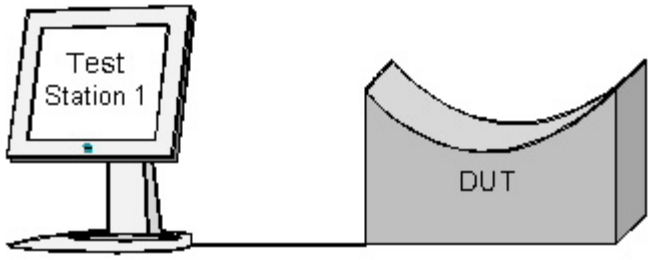
Resource Requirements:

- 1 Test Station

Discussion:

Table 17-1 of IEEE Std. 802.1D™-2004 specifies a fixed value of 2.0 seconds for Bridge Hello Time.

Test Layout:



Procedure:

Part A: Bridge Hello Time modification

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Wait 3 seconds.
4. Stop capture on Test Station 1 and observe the captured frames (if any).
5. Attempt to set the DUT's Bridge Hello Time to 1 second.
6. Attempt to set the DUT's Bridge Hello Time to 9 seconds.

Observable Results:

- Test Station 1 must capture at least one RST BPDU containing a Bridge Hello Time of 0x0200.
- Management must not permit modification of the DUT's Bridge Hello Time parameter.

Possible Problems:

- None.

RSTP.op.3.5: Per-Port Parameters – Port Identifier Priority

Purpose: These tests determine whether the DUT permits modification of the Port Identifier Priority, and if so, verifies that all 16 permissible values are configurable.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.2
- IEEE Std. 802.1D™-2004: sub-clause 17.14
- IEEE Std. 802.1D™-2004: Table 17-2

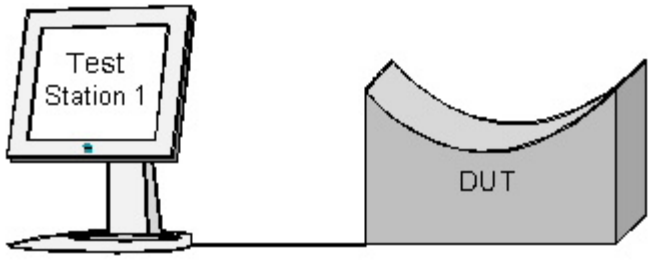
Resource Requirements:

- 1 Test Station

Discussion:

Table 17-2 of IEEE 802.1D™-2004 specifies the default value and range for the Port Identifier Priority. If Bridge management supports configuration of Port Identifier Priority, then the Bridge shall have the capability to use the full range of values (0 – 240 in increments of 16).

Test Layout:



Procedure:

Part A: Incrementing Port Identifier Priority

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Set Port DUT1.TS1's Port Identifier Priority parameter to 0x00.
4. Wait 3 seconds.
5. If Port DUT1.TS1's Port Identifier Priority parameter is equal to 0xF0 then continue to the next step; otherwise increment the DUT's Port Identifier Priority parameter by 0x10 and repeat the previous step.
6. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- For each of the following Port Identifier Priority values, Test Station 1 must capture at least one RST BPDU containing the specified Port Identifier Priority value:

  0x00, 0x10, 0x20, 0x30, 0x40, 0x50, 0x60, 0x70, 0x80, 0x90, 0xA0, 0xB0, 0xC0, 0xD0, 0xE0, and 0xF0.

Possible Problems:

- If the DUT does not support modification of the Port Identifier Priority, this test is Not Applicable (N/A). It is not mandatory to allow modification of the Port Identifier Priority parameter.

RSTP.op.3.6: Per-Port Parameters, Port Path Cost

Purpose: These tests verify that if the Port Path Cost can be modified, that a number of different values are configurable.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.2
- IEEE Std. 802.1D™-2004: sub-clause 17.14
- IEEE Std. 802.1D™-2004: Table 17-3

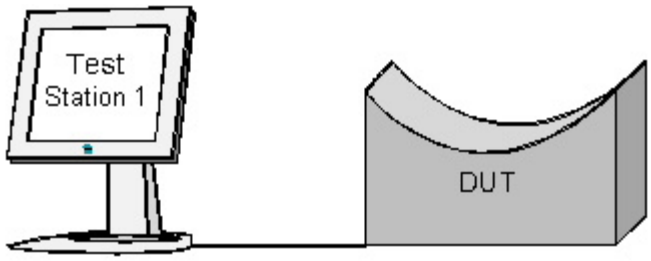
Resource Requirements:

- 1 Test Station

Discussion:

Table 17-3 of IEEE 802.1D™-2004 specifies the Port Path Cost values. If the Port Path Cost can be updated by management, then the Bridge shall have the capability to use the full range of Port Path Cost values.

Test Layout:



Procedure:

Part A: Modifying Port Path Cost Values

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortRST frames at a rate of one every two seconds.
3. Start capture on Test Station 2.
4. Wait 3 seconds.
5. Set Port DUT1.TS1's Port Path Cost to 0x00000001.
6. Wait 3 seconds.
7. Set Port DUT1.TS1's Port Path Cost to 0x000007D0.
8. Wait 3 seconds.
9. Set Port DUT1.TS1's Port Path Cost to 0x00004E20.
10. Wait 3 seconds.
11. Set Port DUT1.TS1's Port Path Cost to 0x00030D40.
12. Wait 3 seconds.
13. Set Port DUT1.TS1's Port Path Cost to 0x001E8480.
14. Wait 3 seconds.
15. Set Port DUT1.TS1's Port Path Cost to 0x01312D00.
16. Wait 3 seconds.
17. Set Port DUT1.TS1's Port Path Cost to 0x0BEBC200.
18. Wait 3 seconds.
19. Set Port DUT1.TS1's Port Path Cost to a randomly generated value between 1 and 200,000,000, not equal to 0x00000001, 0x000007D0, 0x00004E20, 0x00030D40, 0x001E8480, 0x01312D00, or 0x0BEBC200.
20. Wait 3 seconds.
21. Stop capture on Test Station 2 and observe the captured frames (if any).

Observable Results:

- For each of the following Port Path Cost values, Test Station must capture at least one RST BPDU containing the specified Port Path Cost value:

  0x00030D41, 0x00031510, 0x00035B60, 0x00061A80, 0x002191C0, 0x01343A40, 0xBEECF40, and the randomly generated Port Path Cost.

  These values are the sum of the Path Cost assigned to Port DUT1.TS1 and the Root Path Cost parameter conveyed in MakeRootPortRST frames transmitted by TS1.

Possible Problems:

- If the DUT does not support modification of the Port Path Cost, this test is Not Applicable (N/A). It is not mandatory to allow modification of the Port Path Cost parameter.

GROUP 4: Timers

Scope

To verify the operation of timers controlled in part by the operation of the Port Timers state machine (PTI).

Overview

This Group tests the following timer values:

edgeDelayWhile
fdWhile
helloWhen
rcvdInfoWhile
tcWhile
txCount
mdelayWhile

RSTP.op.4.1: edgeDelayWhile Timer

Purpose: This test verifies that the DUT properly implements the edgeDelayWhile timer in the event that its Ports support the AutoEdgePort parameter.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.13.9
- IEEE Std. 802.1D™-2004: sub-clause 17.17.1
- IEEE Std. 802.1D™-2004: sub-clause 17.22
- IEEE Std. 802.1D™-2004: sub-clause 17.23
- IEEE Std. 802.1D™-2004: sub-clause 17.25

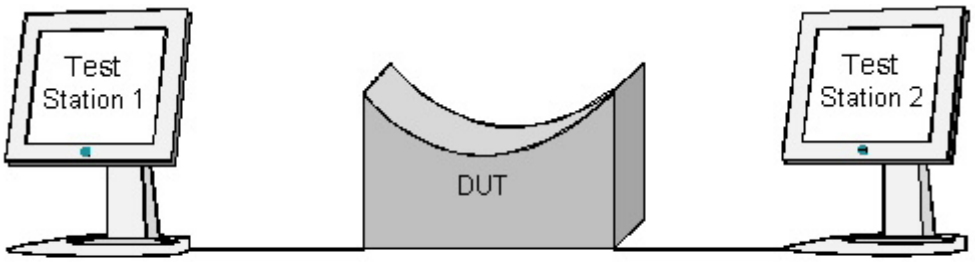
Resource Requirements:

- 2 Test Stations

Discussion:

The AutoEdgePort parameter is used by the Bridge Detection state machine to determine whether it is appropriate to set the Operational Edge Port parameter True automatically in the event the Bridge does not receive a BPDU after a fixed interval (Migrate Time). In the event a Port does become an Edge Port, it will be able to transition immediately from the discarding to the forwarding port state. The value of edgeDelayWhile is set and maintained by the operation of the Port Receive Machine (PRX) and the Port Role Transitions Machine (PRT). The value of edgeDelayWhile is decremented by operation of the Port Timers state machine (PTI).

Test Layout:



Procedure:

Part A: edgeDelayWhile Timer

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortRST frames at a rate of one every two seconds.
3. Set the AutoEdgePort parameter for Port DUT2.TS2 True.
4. Start capture on Test Station 2.
5. Transmit, from Test Station 2, a MakeAlternatePortRST frame.
6. Wait 7 seconds.
7. Transmit, from Test Station 1, 10 TestTrafficSA1 frames.
8. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- Test Station 2 must capture 10 TestTrafficSA1 frames.

Possible Problems:

- If the DUT does not support the AutoEdgePort parameter, this test is Not Applicable (N/A). It is not mandatory to support the AutoEdgePort parameter.

RSTP.op.4.2: The fdWhile Timer

Purpose: This test verifies that the DUT properly implements the fdWhile timer.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.17.2
- IEEE Std. 802.1D™-2004: sub-clause 17.20.5
- IEEE Std. 802.1D™-2004: sub-clause 17.20.6
- IEEE Std. 802.1D™-2004: sub-clause 17.22
- IEEE Std. 802.1D™-2004: sub-clause 17.29

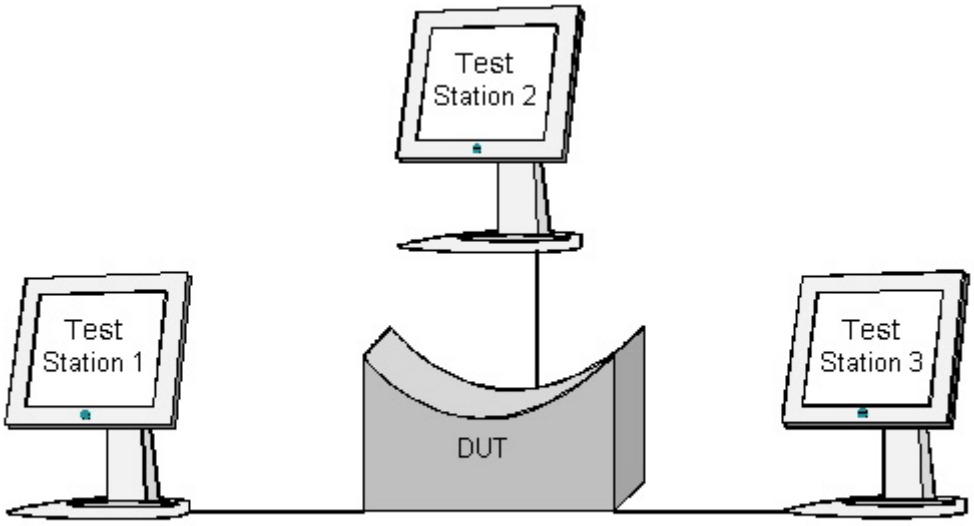
Resource Requirements:

- 3 Test Stations

Discussion:

The fdWhile timer is used to delay port state transitions until other Bridges (especially Bridges using an older version of the Spanning Tree Protocol) receive information necessary to correctly reduce the current topology into a single fully and simply connected Spanning Tree. The value of fdWhile is set and maintained by the operation of the Port Role Transitions state machine (PRT). The value of fdWhile is decremented by the operation of the Port Timers state machine (PTI).

Test Layout:



Procedure:

Part A: fdWhile Timer – PRT:INIT_PORT to PRT:DESIGNATED_FORWARD

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Stations 2 and 3.
3. Disable Ports DUT2.TS2 and DUT3.TS3.
4. Enable Ports DUT2.TS2 and DUT3.TS3.
5. Transmit, from Test Station 3, a MigratePort2STP frame.
6. Wait 20 seconds.
7. Transmit, from Test Station 1, 10 TestTrafficSA1 frames.
8. Wait 4 seconds.
9. Transmit, from Test Station 1, 10 TestTrafficSA2 frames.
10. Wait 9 seconds.
11. Transmit, from Test Station 1, 10 TestTrafficSA3 frames.
12. Wait 4 seconds.
13. Transmit, from Test Station 1, 10 TestTrafficSA4 frames.
14. Stop capture on Test Stations 2 and 3 and observe the captured frames (if any).

Part B: fdWhile Timer – PRT:ALTERNATE_PORT to PRT:DESIGNATED_FORWARD

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortRST frames at a rate of one every two seconds.
3. Transmit, from Test Station 2, a MakeAlternatePortRST frame.
4. Transmit, from Test Station 3, a MakeAlternatePortConfig frame.
5. Wait 21 seconds.
6. Transmit, from Test Station 1, 10 TestTrafficSA1 frames.
7. Wait 4 seconds.
8. Transmit, from Test Station 1, 10 TestTrafficSA2 frames.
9. Wait 9 seconds.
10. Transmit, from Test Station 1, 10 TestTrafficSA3 frames.
11. Wait 4 seconds.
12. Transmit, from Test Station 1, 10 TestTrafficSA4 frames.
13. Stop capture on Test Stations 2 and 3 and observe the captured frames (if any).

Observable Results:

- In Parts A and B, Test Stations 2 and 3 must not capture any TestTrafficSA1 frames.
- In Parts A and B, Test Station 3 must not capture any TestTrafficSA2 frames.
- In Parts A and B, Test Station 3 must not capture any TestTrafficSA3 frames.
- In Parts A and B, Test Station 2 must capture 10 TestTrafficSA2 frames.
- In Parts A and B, Test Station 2 must capture 10 TestTrafficSA3 frames.
- In Parts A and B, Test Stations 2 and 3 must capture 10 TestTrafficSA4 frames.

Possible Problems:

- None.

RSTP.op.4.3: helloWhen timer

Purpose: This test tests the helloWhen timer. This timer is used to ensure that a Designated Port transmits at least one BPDU each Hello Time period.

References:

- IEEE Std. 802.1D™-2004: 17.17.3
- IEEE Std. 802.1D™-2004: sub-clause 17.22

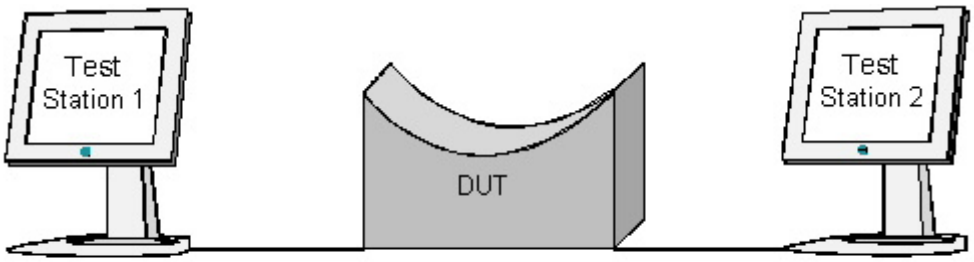
Resource Requirements:

- 2 Test Stations

Discussion:

The helloWhen timer is used to ensure that at least one BPDU is transmitted by a Designated Port in each Hello Time period. The value of helloWhen is set and maintained by the operation of Port Transmit state machine (PTX). The value of helloWhen is decremented by the operation of the Port Timers state machine (PTI).

Test Layout:



Procedure:

Part A: helloWhen based on Bridge Hello Time

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Stations 1 and 2.
3. Wait 6 seconds.
4. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Part B: helloWhen based on Received Information, 1 second.

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortSmallMsgTimesRST frames at a rate of one every second.
3. Start capture on Test Stations 1 and 2.
4. Wait 45 seconds.
5. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Part C: helloWhen based on Received Information, 0 seconds.

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortHelloTimeZeroRST frames at a rate of one every second.
3. Start capture on Test Stations 1 and 2.
4. Wait 45 seconds.
5. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Part D: helloWhen based on Received Information, $0 < x < 1$ seconds.

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortHelloTimeLessThanOneRST frames at a rate of one every half second.
3. Start capture on Test Stations 1 and 2.
4. Wait 45 seconds.
5. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Part E: helloWhen based on Received Information, 10 seconds.

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortBigMsgTimesRST frames at a rate of one every 10 seconds.
3. Start capture on Test Stations 1 and 2.
4. Wait 45 seconds.
5. Stop capture on Test Stations 1 and 2 and observe the captured frames (if any).

Observable Results:

- In each Part, Test Station 2 should capture at least one BPDU every two seconds, with a Hello Time value equal to 2 seconds.

Possible Problems:

- None.

RSTP.op.4.4: The rcvdInfoWhile Timer

Purpose: This test verifies that the DUT properly implements the rcvdInfoWhile timer.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.17.6
- IEEE Std. 802.1D™-2004: sub-clause 17.21.23
- IEEE Std. 802.1D™-2004: sub-clause 17.22
- IEEE Std. 802.1D™-2004: sub-clause 17.27

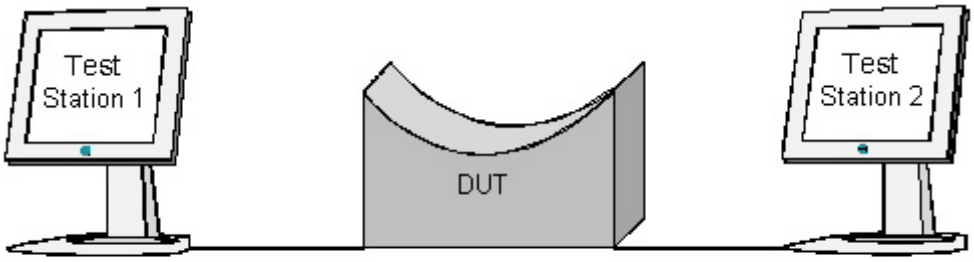
Resource Requirements:

- 2 Test Stations

Discussion:

Not all failure conditions can be detected and signaled by changes in MAC_Operational status. The rcvdInfoWhile timer is used to ensure that information conveyed in received Configuration Messages is discarded unless refreshed by regular reception of Configuration Messages from the Designated Port. The value of rcvdInfoWhile is set and maintained by the operation of the Port Information Machine (PIM). The value of rcvdInfoWhile is decremented by operation of the Port Timers state machine (PTI).

Test Layout:



Procedure:

Part A: rcvdInfoWhile Timer – DUT is not the Root Bridge

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 2, a MakeRootPortAlmostStaleRST frame.
4. Wait 5 seconds.
5. Transmit, from Test Station 2, a MakeRootPortAlmostStaleRST frame.
6. Wait 5 seconds.
7. Stop capture on Test Station 1 and observe the captured frames (if any).

Part B: rcvdInfoWhile Timer – Root is Legacy Bridge Using Non-Default Hello Time

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 2, a MakeRootPortBigMsgTimesRST frame.
4. Wait 29 seconds.
5. Transmit, from Test Station 2, a MakeRootPortBigMsgTimesRST frame.
6. Wait 29 seconds.
7. Stop capture on Test Station 1 and observe the captured frames (if any).

Observable Results:

- In Parts A and B, Test Station 1 must capture RST BPDUs containing a Root Bridge Identifier of 0x70 00 00 BF CB FC BF C0.
- In Parts A and B, Test Station 1 must not capture any RST BPDUs containing a Root Bridge Identifier equal to the BridgeIdentifier of the DUT after it has captured an RST BPDU containing a Root Bridge Identifier of 0x70 00 00 BF CB FC BF C0.

Possible Problems:

- None.

RSTP.op.4.5: tcWhile

Purpose: This test verifies that the DUT properly implements the tcWhile timer.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.21.7
- IEEE Std. 802.1D™-2004: sub-clause 17.21.19
- IEEE Std. 802.1D™-2004: sub-clause 17.21.20
- IEEE Std. 802.1D™-2004: sub-clause 17.22
- IEEE Std. 802.1D™-2004: sub-clause 17.26
- IEEE Std. 802.1D™-2004: sub-clause 17.31

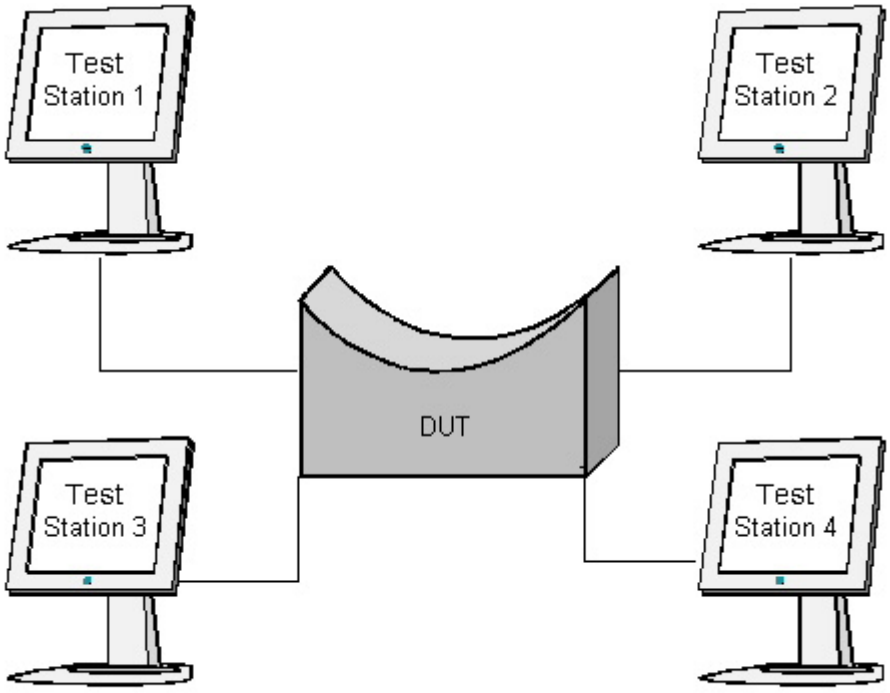
Resource Requirements:

- 4 Test Stations

Discussion:

The tcWhile timer governs the duration during which Topology Change Notification (TCN) messages are transmitted. This ensures that station location information will be relearned when new paths become part of the active topology. The value of tcWhile is set by the operation of the Topology Change Machine (TCM). The value of the tcWhile timer is decremented by the operation of the Port Timers state machine (PTI).

Test Layout:



Procedure:

Part A: tcWhile – Root Port has sendRSTP = True, Default Bridge Timer Values

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortRST frames at a rate of one every two seconds.
3. Transmit, from Test Station 2, a MigratePort2STP frame.
4. Start capture on Test Stations 1 thru 3.
5. Transmit, from Test Station 4, a NotifyTC_RST frame.
6. Wait 50 seconds.
7. Stop capture on Test Stations 1 thru 3 and observe the captured frames (if any).

Part B: tcWhile – Root Port has sendRSTP = False, Default Bridge Timer Values

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortConfig frames at a rate of one every two seconds.
3. Transmit, from Test Station 2, a MigratePort2STP frame.
4. Start capture on Test Stations 1 thru 3.
5. Transmit, from Test Station 4, a NotifyTC_RST frame.
6. Wait 50 seconds.
7. Stop capture on Test Stations 1 thru 3 and observe the captured frames (if any).

Part C: tcWhile – Root Port has sendRSTP = True, Large Bridge Timer Values

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortBigMsgTimesRST frames at a rate of one every two seconds.
3. Transmit, from Test Station 2, a MigratePort2STP frame.
4. Start capture on Test Stations 1 thru 3.
5. Transmit, from Test Station 4, a NotifyTC_RST frame.
6. Wait 80 seconds.
7. Stop capture on Test Stations 1 thru 3 and observe the captured frames (if any).

Part D: tcWhile – Root Port has sendRSTP = False, Large Bridge Timer Values

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortBigMsgTimesConfig frames at a rate of one every two seconds.
3. Transmit, from Test Station 2, a MigratePort2STP frame.
4. Start capture on Test Stations 1 thru 3.
5. Transmit, from Test Station 4, a NotifyTC_RST frame.
6. Wait 80 seconds.
7. Stop capture on Test Stations 1 thru 3 and observe the captured frames (if any).

Observable Results:

- In Parts A and C, Test Station 1 must capture exactly 2 RST BPDUs with the Topology Change flag set.
- In Part B, Test Station 1 must capture TCN BPDUs for at least 30 seconds and no more than 35 seconds.
- In Part D, Test Station 1 must capture TCN BPDUs for at least 60 seconds and no more than 70 seconds.
- In Parts A and B, Test Station 2 must capture Configuration BPDUs with the Topology Change flag set for at least 30 seconds and no more than 35 seconds.
- In Parts C and D, Test Station 2 must capture Configuration BPDUs with the Topology Change flag set for at least 60 seconds and no more than 70 seconds.
- In Parts A, B, C, and D, Test Station 3 must capture exactly 2 RST BPDUs with the Topology Change flag set.

Possible Problems:

- None.

RSTP.op.4.6: txCount

Purpose: This test verifies that the DUT enforces the BPDU transmission rate limit specified by Transmit Hold Count.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.13
- IEEE Std. 802.1D™-2004: sub-clause 17.19.44
- IEEE Std. 802.1D™-2004: sub-clause 17.20.13
- IEEE Std. 802.1D™-2004: sub-clause 17.22
- IEEE Std. 802.1D™-2004: sub-clause 17.26
- IEEE Std. 802.1D™-2004: Table 17-1

Resource Requirements:

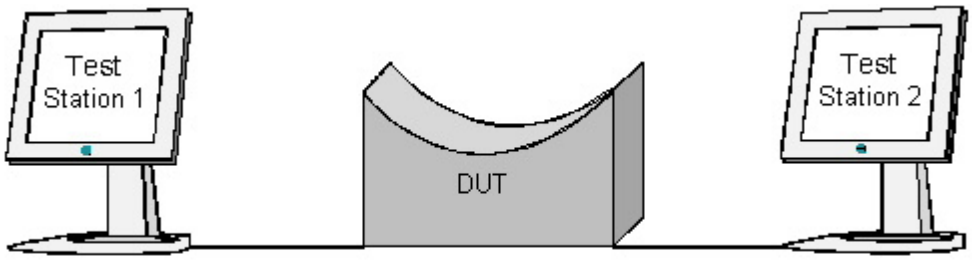
- 2 Test Stations

Discussion:

A primary design requirement of RSTP is that BPDUs do not consume more than a very small percentage of the total available communications bandwidth. The txCount parameter is used to impose a BPDU transmission rate limit on each Port. When a Port transmits a BPDU, its txCount parameter is incremented; BPDUs may not be transmitted until txCount is less than Transmit Hold Count.

The value of txCount is set by the operation of the Port Transmit state machine (PTX). The value of txCount is decremented by the operation of the Port Timers state machine (PTI).

Test Layout:



Procedure:

Part A: txCount = 6

1. Ensure that the default values are configured on the DUT.
2. Wait 10 seconds.
3. Start capture on Test Station 1.
4. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of 10 every second. Decrement the Root Path Cost in each successive MakeRootPortRST frame by 1.
5. Wait 5 seconds.
6. Stop capture on Test Station 1 and observe the captured frames (if any).

Part B: txCount = 1

1. Ensure that the default values are configured on the DUT.
2. Set the DUT's Transmit Hold Count parameter to 1.
3. Wait 10 seconds.
4. Start capture on Test Station 1.
5. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of 10 every second. Decrement the Root Path Cost in each successive MakeRootPortRST frame by 1.
6. Wait 5 seconds.
7. Stop capture on Test Station 1 and observe the captured frames (if any).

Part C: txCount = 10

1. Ensure that the default values are configured on the DUT.
2. Set the DUT's Transmit Hold Count parameter to 10.
3. Wait 10 seconds.
4. Start capture on Test Station 1.
5. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of 10 every second. Decrement the Root Path Cost in each successive MakeRootPortRST frame by 1.
6. Wait 5 seconds.
7. Stop capture on Test Station 1 and observe the captured frames (if any).

Part D: txCount set to 0 when Transmit Hold Count is modified

1. Ensure that the default values are configured on the DUT.
2. Wait 10 seconds.
3. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of 10 every second. Decrement the Root Path Cost in each successive MakeRootPortRST frame by 1.
4. Wait 2 seconds.
5. Start capture on Test Station 1.
6. Set the DUT's Transmit Hold Count parameter to 10.
7. Wait 5 seconds.

Observable Results:

- In Parts A, B, C, and D Test Station 1 must capture RST BPDUs.
- In Part A, Test Station 1 must not capture more than 7 RST BPDUs in any one-second interval.
- In Part B, Test Station 1 must not capture more than 2 RST BPDUs in any one-second interval.
- In Part C, Test Station 1 must not capture more than 11 RST BPDUs in any one-second interval.
- In Part D, there must be 1 and only 1 one-second interval during which Test Station 1 captures more than 9 RST BPDUs.

Possible Problems:

- If the DUT does not support configuration of Transmit Hold Count, Parts B, C and D are considered Not Applicable (N/A). It is not mandatory to support configuration of Transmit Hold Count.

RSTP.op.4.7: mdelayWhile

Purpose: This test verifies that the DUT properly implements the Migration Delay timer.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.13.9
- IEEE Std. 802.1D™-2004: sub-clause 17.17.4
- IEEE Std. 802.1D™-2004: sub-clause 17.19.13
- IEEE Std. 802.1D™-2004: sub-clause 17.22
- IEEE Std. 802.1D™-2004: sub-clause 17.24
- IEEE Std. 802.1D™-2004: Table 17-1

Resource Requirements:

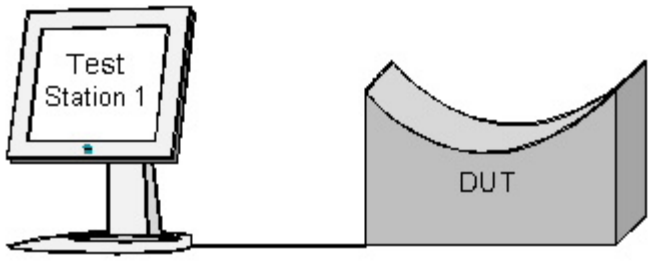
- 1 Test Station

Discussion:

The Migration Delay timer allows RSTP Bridges to synchronize their migration state before changing the type of BPDUs they transmit.

The value of mdelayWhile is set to a fixed value, Migrate Time, by the operation of the Port Protocol Migration state machine (PPM). The value of mdelayWhile is decremented by the operation of the Port Timers state machine (PTI).

Test Layout:



Procedure:

Part A: mdelayWhile Governs Transition from PPM:SELECTING_STP to PPM:SENSING

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 1, a MigratePort2STP frame.
4. Wait 0.5 seconds.
5. Transmit, from Test Station 1, 20 MigratePort2RSTP frames at a rate of 10 every second.
6. Transmit, from Test Station 1, a MigratePort2STP frame.
7. Stop capture on Test Station 1 and observe the captured frames (if any).

Part B: mdelayWhile Governs Transition from PPM:CHECKING_RSTP to PPM:SENSING

1. Ensure that the default values are configured on the DUT.
2. Transmit, from Test Station 1, a MigratePort2STP frame.
3. Wait 4 seconds.
4. Start Capture on Test Station 1.
5. Transmit, from Test Station 1, a MigratePort2RSTP frame.
6. Wait 0.5 seconds.
7. Transmit, from Test Station 1, 20 MigratePort2STP frames at a rate of 10 every second.
8. Transmit, from Test Station 1, a MigratePort2RSTP frame.
9. Stop capture on Test Station 1 and observe the captured frames (if any).

Part C: mdelayWhile Ignored When mcheck is True in PPM:SELECTING_STP

1. Ensure that the default values are configured on the DUT.
2. Start capture on Test Station 1.
3. Transmit, from Test Station 1, a MigratePort2STP frame.
4. Wait until Test Station 1 has captured a Configuration BPDU.
5. Set Port DUT1.TS1's mcheck parameter True.
6. Wait 5 seconds.

Observable Results:

- In Part A, Test Station 1 must capture Configuration BPDUs. While it is possible that Test Station 1 will have captured RST BPDUs prior to capturing Configuration BPDUs, once Test Station 1 has begun capturing Configuration BPDUs it must not capture any additional RST BPDUs.
- In Part B, Test Station 1 must capture RST BPDUs. While it is possible that Test Station 1 will have captured Configuration BPDUs prior to capturing RST BPDUs, once Test Station 1 has begun capturing RST BPDUs it must not capture any additional Configuration BPDUs.
- In Part C, Test Station 1 must capture RST BPDUs.
- In Part C, Test Station 1 must capture exactly one Configuration BPDU.

Possible Problems:

- If the DUT does not allow mcheck to be set True for a given Port, this Part C of this test is Not Applicable (N/A). It is not mandatory to allow mcheck to be set True for a given Port.

GROUP 5: Port Role Transitions

Scope

To determine whether the DUT properly computes Port Role assignments based on the current set of priority vectors, and that Ports assigned a given Port Role properly assume that Port Role.

Overview

This Group tests the following Port Role Transitions:

Designated Port	→	Root Port
Designated Port	→	Alternate Port
Root Port	→	Designated Port
Root Port	→	Alternate Port
Alternate Port	→	Designated Port
Alternate Port	→	Root Port

RSTP.op.5.1: Port Role Transitions: Designated Port

Purpose: This test helps verify that Ports on the DUT which have been assigned the Designated Port Role properly transition into the Root and Alternate Port Roles when re-computation of Port Roles determines it is appropriate for them to do so.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.21.8
- IEEE Std. 802.1D™-2004: sub-clause 17.21.25
- IEEE Std. 802.1D™-2004: sub-clause 17.29

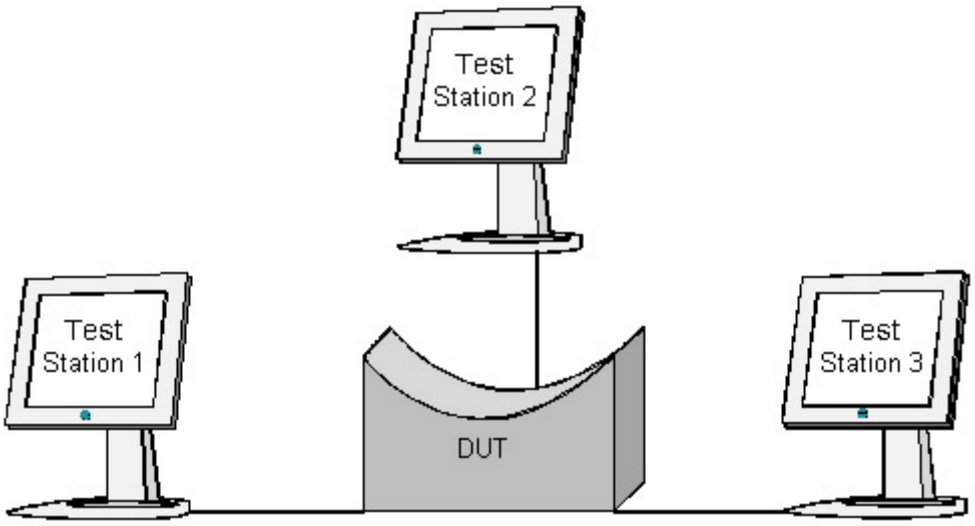
Resource Requirements:

- 3 Test Stations

Discussion:

If a Port's Role is not equal to the selectedRole assigned by the Port Role Selection state machine (PRS), the Port will transition into its selectedRole in the manner described by the Port Role Transitions state machine (PRT).

Test Layout:



Procedure:

Part A: Designated Port Transitions to Root Port Role and Back Again, Designated Port Transitions to Alternate Port Role and Back Again

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeRootPortConfig frames at a rate of one every two seconds.
3. Continuously transmit, from Test Station 2, MakeAlternatePortRST frames at a rate of one every two seconds.
4. Start capture on Test Stations 1 thru 3.
5. Transmit, from Test Station 3, a NotifyTC_RST frame.
6. Transmit, from Test Station 1, 10 TestTrafficTS1 frames.
7. Transmit, from Test Station 2, 10 TestTrafficTS2 frames.
8. Transmit, from Test Station 3, 10 TestTrafficTS3 frames.
9. Stop transmitting, from Test Station 2, MakeAlternatePortRST frames.
10. Wait 3 seconds.
11. Stop transmitting, from Test Station 1, MakeRootPortConfig frames.
12. Wait 11 seconds.
13. Transmit, from Test Station 1, 10 TestTrafficSA1 frames.
14. Transmit, from Test Station 2, 10 TestTrafficSA2 frames.
15. Transmit, from Test Station 3, 10 TestTrafficSA3 frames.
16. Stop capture on Test Stations 1 thru 3 and observe the captured frames.

Observable Results:

- Test Stations 1 and 2 must not capture any TestTrafficTS1 frames.
- Test Stations 1 thru 3 must not capture any TestTrafficTS2 frames.
- Test Stations 2 and 3 must not capture any TestTrafficTS3 frames.
- Test Station 1 must capture 10 TestTrafficTS3 frames.
- Test Station 3 must capture 10 TestTrafficTS1 frames.
- Test Stations 1 and 2 must each capture 10 TestTrafficSA3 frames.
- Test Stations 1 and 3 must each capture 10 TestTrafficSA2 frames.
- Test Stations 2 thru 3 must each capture 10 TestTrafficSA1 frames.
- Test Station 1 must capture TCN BPDUs.

Possible Problems:

- None.

RSTP.op.5.2: Port Role Transitions: Root Port to Alternate Port

Purpose: This test helps verify that a Port on the DUT which has been assigned the Root Port Role properly transitions into the Alternate Port Role and back again when re-computation of Port Roles determines it is appropriate for the Port to do so.

References:

- IEEE Std. 802.1D™-2004: sub-clause 17.21.8
- IEEE Std. 802.1D™-2004: sub-clause 17.21.25
- IEEE Std. 802.1D™-2004: sub-clause 17.29

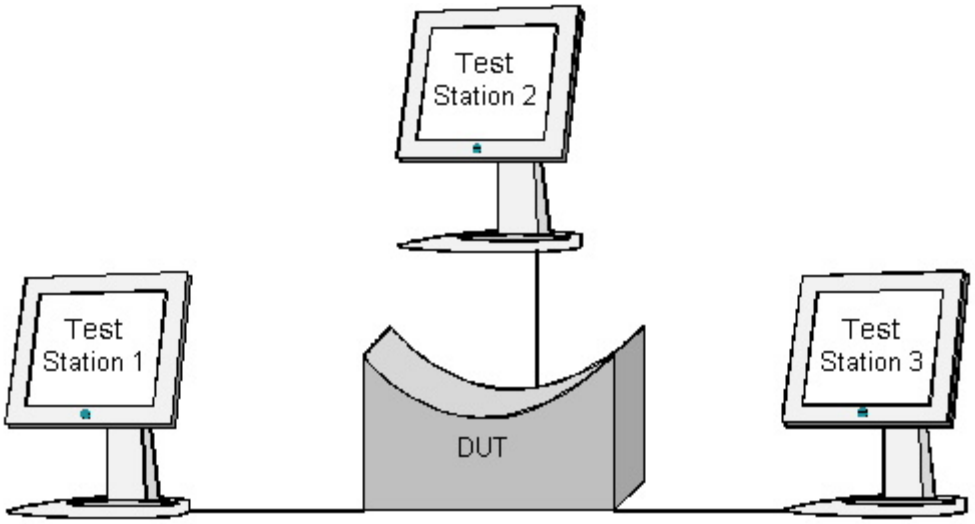
Resource Requirements:

- 3 Test Stations

Discussion:

If a Port's Role is not equal to the selectedRole assigned by the Port Role Selection state machine (PRS), the Port will transition into its selectedRole in the manner described by the Port Role Transitions state machine (PRT).

Test Layout:



Procedure:

Part A: Root Port Transitions to Alternate Port Role and Back Again

1. Ensure that the default values are configured on the DUT.
2. Continuously transmit, from Test Station 1, MakeAlternatePortRST frames at a rate of one every two seconds.
3. Continuously transmit, from Test Station 2, MakeRootPortRST frames at a rate of one every two seconds.
4. Start capture on Test Stations 1 and 3.
5. Transmit, from Test Station 1, 10 TestTrafficTS1 frames.
6. Transmit, from Test Station 3, 10 TestTrafficTS3 frames.
7. Stop transmitting, from Test Station 2, MakeRootPortRST frames.
8. Wait 7 seconds.
9. Transmit, from Test Station 1, 10 TestTrafficSA1 frames.
10. Transmit, from Test Station 3, 10 TestTrafficSA3 frames.

Observable Results:

- Test Stations 1 and 3 must not capture any TestTrafficTS1 frames.
- Test Stations 1 and 3 must not capture any TestTrafficTS3 frames.
- Test Station 1 must capture 10 TestTrafficSA3 frames.
- Test Station 3 must capture 10 TestTrafficSA1 frames.

Possible Problems:

- None.