Bridge Functions Consortium

Rapid Spanning Tree (RSTP)
Interoperability Test Suite
Version 1.2

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1.2	2005-07-07	Tyler Marcotte	Revision to Test RSTP.io.1.4

ACKNOWLEDGEMENTS

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INTRODUCTION

Overview

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 Protocol (RSTP) capable products.

The operation of RSTP provides for rapid recovery of connectivity following the failure of a Bridge, Bridge Port, or a LAN. A new Root Port can transition rapidly to the Forwarding Port State, and the use of explicit acknowledgements between Bridges allows Designated Ports to transition rapidly to the Forwarding Port State. The timers used by RSTP define worst case delays, and are used only as a backup to the normal operation of the protocol.

This test suite has been designed based on the set procedures, state machines, and timers described in IEEE 802.1w-2001. The RSTP frame format is defined in clause 9 of IEEE 802.1w-2001. The test suite focuses on testing whether or not the Device Under Test (DUT) will behave in accordance with the standard during normal operation.

The tests do not determine if a product conforms to the IEEE 802.1w-2001 standard and they are not designed as conformance tests. Rather, they provide one method to isolate problems within RSTP capable devices that will affect their ability to interoperate. Successful completion of all tests contained in this suite does not guarantee that the tested device(s) will operate with other RSTP capable devices. However, combined with satisfactory completion of conformance testing, these tests provide a reasonable level of confidence that the DUT will function well in most RSTP capable environments.

Please note that these tests are interoperability tests. Therefore, failure against a device(s) does not necessarily indicate nonconformance. Rather, it indicates that the two devices are unable to work together properly. Further work should be done to isolate the cause of the failure.

ABBREVIATIONS AND ACRONYMS

BP#	Bridge Partner (the # represents a numerical identifier used to distinguish between Bridge Partners)
DUT	Device Under Test
LBP	Legacy Bridge Partner
RSTP	Rapid Spanning Tree Protocol
STP	Spanning Tree Protocol (sometimes referred to as "common" or "legacy" Spanning Tree Protocol)

DEFINITION OF TERMS

Bridge Partner	Additional Layer-2 devices included in the test network.
LBP	A Legacy Bridge Partner does not support RSTP (but does support STP)
RSTP	The Rapid Spanning Tree Protocol, as defined by IEEE 802.1w-2001
STP	The Spanning Tree Protocol, as defined by IEEE 802.1D-1998
Testing Station	A device capable of transmitting, receiving, and storing MAC frames.
ForceVersion	A per-Bridge variable, used to store the current value of the Force Protocol Version parameter.
mcheck	a Boolean value that may be set to TRUE by the operation of management in order to force the Port Protocol Migration state machine into the SEND_RSTP state.

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 protocol name, test suite type ("io" for interoperability "op" for operations), group number, and the test number within the group, separated by periods. So, test label RSTP.io.1.2 refers to the second test of the first test group in the RSTP Interoperability 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.

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 Setup: The Test Setup section describes the configuration of all devices prior to the start of the test. Different parts of the procedure may involve configuration steps that deviate from what is given in the test setup. Before conducting any Part of a Test, restore this configuration for all devices. If a value is not provided for a protocol parameter, then the protocol's default is used for that parameter. It should be noted that generic setup information is provided in the description of each group.

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, transmitting MAC frames from a Testing Station, and analyzing the contents of a Testing Station's capture buffer.

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 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.

REFERENCES

The following documents are referenced in this text:

- IEEE 802.1D-1998
- IEEE 802.1w-2001

Note: Until it is standardized, the maintenance for IEEE 802.1w-2001 (802.1y) will not be referenced by this text.

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GROUP 1: Rapid Spanning Tree Interoperability

Scope:

The following tests are designed to verify the interoperability of RSTP capable devices. These tests are not designed as performance tests. The relative performance of RSTP capable devices (e.g. the effect of a given Bridge on convergence time or scalability) is beyond the scope of this document.

Because RSTP is compatible with STP, it will be necessary to test the operation of the DUT and it's Bridge Partners in both Rapid Spanning Tree mode and STP Compatibility mode. It is also necessary to test the interoperability of the DUT and Legacy Bridge Partners.

Overview:

These tests verify that the DUT and Bridge Partner successfully interoperate under normal conditions. This provides a means of quickly identifying basic interoperability issues that must be addressed before proceeding with more complicated tests.

These tests check to see whether any of a variety of conditions (e.g. Link Failure, Topology Change, or the presence of non-Default VLANs) will result in the formation of a temporary data loop in what should be a fully and simply connected Spanning Tree. While the majority of tests are conducted using the DUT and a single Bridge Partner, some of the tests are conducted using the DUT and multiple Bridge Partners. Typically, these tests either alter RSTP parameters or alter the physical topology of the network in order to test interoperability.

Setup:

For all tests in this group, unless otherwise stated, the following setup must be used:

All Ports on the DUT and (Legacy) Bridge Partner should be Untagged members of the Default VLAN. These Ports should not be members of any other VLAN. They should all have the Default PVID. The Acceptable Frame Types parameter should be set to Admit All Frames. The Enable Ingress Filtering parameter should be Reset. The Admin Edge Port parameter should be set False. Bridge Max Age, Bridge Hello Time, and Bridge Forward Delay should be set to their recommended default values. Bridge priority, Port priority, and Port Path Cost should be set to their recommended default values. AdminPointToPointMAC should be set to Auto, and the Force Protocol Version parameter should be set to 2. Any additional test setup needed for a test will be described in the Test Setup portion of the test itself. Before conducting any Part of a test in this group, set up the DUT and Bridge Partner(s) as described above, and perform any additional test setup described in the Test Setup portion of the test itself. Failure to do so could invalidate test results!

Test RSTP.io.1.1 – Basic RSTP Interoperability

Purpose: To verify that the DUT and a Rapid Spanning Tree capable Bridge Partner using the recommended default settings will successfully interoperate when connected with one, two, and more than two links.

References:

- IEEE 802.1w-2001: sub-clauses 17.1-17.5

Resource Requirements:

- 2 Testing Stations
- 1 Bridge Partner

Discussion: Before examining likely points of interoperability failure, the test suite seeks first to determine whether the DUT and its Bridge Partner(s) successfully interoperate under normal conditions.   Once a single link between the DUT and Bridge Partner has been established, and the Testing Stations are able to exchange traffic, Ports on the DUT and Bridge Partner are connected with one and then two redundant links. Meanwhile, the DUT and Bridge Partner take turns as the Root Bridge, and check is made to verify that both devices properly select the Root Port using first the Root Path Cost and then the Designated Port Identifier.

Test Setup: Configure the DUT and Bridge Partner as specified for Tests in this Group. Connect the DUT and Bridge Partner with a single link. Connect Testing Station 1 and Testing Station 2 to the DUT and Bridge Partner as shown. Configure the DUT as the Root Bridge. Allow time for the Spanning Tree to converge.
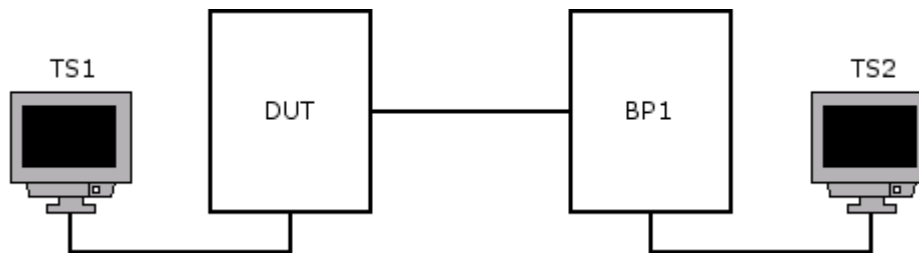
Procedure:

Part A: Single Link
1. Set Testing Stations 1 and 2 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from both Testing Stations.
3. Observe the frames received by each Testing Station.

Part B: Redundant Link - Root Port Selection Based on Root Path Cost
1. Set Testing Stations 1 and 2 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from both Testing Stations.
3. Connect the DUT and Bridge Partner with an additional link. If possible, choose a link of a different speed. Otherwise, set the Path Cost for Ports used to connect the DUT and Bridge Partner with an additional link to a value other than the recommended default.
4. Allow time for the Spanning Tree to converge.
5. Observe the frames received by each Testing Station.
6. Configure the Bridge Partner such that it is the Root Bridge, and repeat Steps 1-5.

Part C: Multiple Redundant Links - Root Port Selection Based on Designated Port Identifier
1. Set Testing Stations 1 and 2 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from both Testing Stations.
3. Connect the DUT and Bridge Partner with two additional link of the same speed as the existing link.

4. Allow time for the Spanning Tree to converge.
5. Observe the frames received by each Testing Station.
6. Configure the Bridge Partner such that it is the Root Bridge, and repeat Steps 1-5.

Observable Results:

- In Parts A, B, and C, once the Spanning Tree has converged, all traffic should be successfully exchanged between Testing Stations. None of the Testing Stations should receive duplicated or misordered frames.
- While conducting Parts B and C, once the Spanning Tree has converged, ensure that the appropriate Bridge is the Root Bridge.
- While conducting Part B, in each case, once the Spanning Tree has converged, the two Ports on the Root Bridge that are connected to the non-Root Bridge should be in the Forwarding State; of the two Ports on the non-Root Bridge that are connected to the Root Bridge, the one with the lower Path Cost value should be in the Forwarding State, while the other should be in the Discarding Port State.
- While conducting Part C, in each case, once the Spanning Tree has converged, the three Ports on the Root Bridge that are connected to the non-Root Bridge should be in the Forwarding State; of the three Ports connecting the non-Root Bridge to the Root Bridge, the one that received the best Designated Port Identifier in RST BPDUs transmitted by the Root Bridge should be in the Forwarding State, while the other two Ports should be in the Discarding State.

Possible problems:

- None.

Test RSTP.io.1.2 – Non-default timers

Purpose: To verify the interoperability of the DUT and a Rapid Spanning Tree capable Bridge Partner when using non-default timer values.

References:

- IEEE 802.1D-1998: sub-clause 8.10.2

Resource Requirements:

- 2 Testing Stations
- 1 Bridge Partner

Discussion: While the timers defined by Rapid Spanning Tree Protocol define worst-case delays, and are used only as a backup to the normal operation of the protocol, failure to properly implement the various RSTP timers can result a failure to interoperate. This test seeks to verify the operation of the DUT and its Bridge Partner(s) when one, the other, or both are using timer values other than the recommended default values. While this test could be conducted using the full range of timer values that can be set on the DUT or Bridge Partner, it should at least be conducted using the minimum and maximum allowed values. Observe the parameter restrictions set forth in clause 8.10.2 of IEEE 802.1D-1998:

Parameter	Allowed Range of Values	Recommended Default Value
Bridge Hello Time	1.0-10.0	2.0
Bridge Max Age	6.0-40.0	20.0
Bridge Forward Delay	4.0-30.0	15.0

$$2 (\text{Forward Delay} – 1.0) >= \text{Max Age} >= 2 (\text{Hello Time} + 1.0)$$

Test Setup: Configure the DUT and Bridge Partner as specified for Tests in this Group. Connect the DUT and Bridge Partner with three links. Connect Testing Station 1 and Testing Station 2 to the DUT and Bridge Partner as shown. Configure the DUT as the Root Bridge. Allow time for the Spanning Tree to converge.
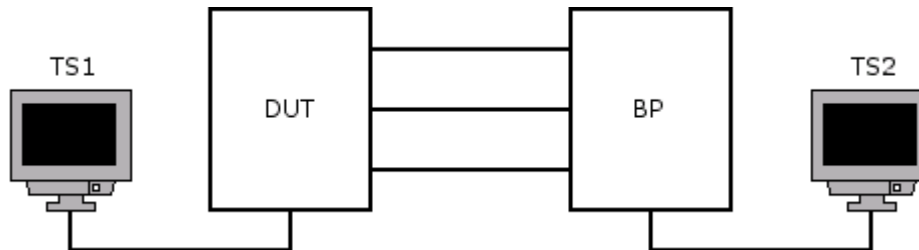
Procedure:

Part A: Non-default timer values
1. Set Testing Stations 1 and 2 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from both Testing Stations.
3. Configure the bridge timer values of the Root Bridge such that they are not the recommended default values. Observe the parameter restrictions set forth in clause 8.10.2 of IEEE 802.1D-1998.
4. Once the non-Root Bridge has propagated at least two RST BPDUs containing the timer values used in Step 3, observe the frames captured by each Testing Station.
5. Configure the non-Root Bridge such that it is the Root Bridge.
6. Repeat Steps 1-5 as often as time permits, each time using a different combination of timer values.

Observable Results:

- In every case, once the Spanning Tree has converged, ensure that the appropriate Bridge is the Root Bridge.
- In every case, once the Spanning Tree has converged, all traffic should be successfully exchanged between Testing Stations. None of the Testing Stations should receive duplicated or misordered frames.

Possible Problems:

- Devices that do not support configuration of Bridge Timers should not be configured as the Root Bridge for this test. If neither the DUT nor any of it's potential Bridge Partners support configuration of Bridge Timers, this test cannot be performed.

Test RSTP.io.1.3 – Link Failure and Re-initialization

Purpose: To verify the interoperability of the DUT and a Rapid Spanning Tree capable Bridge Partner when one or more then links between them fails and is later re-initialized.

References:

- IEEE 802.1w-2001: sub-clause 17.23

Resource Requirements:

- 2 Testing Stations
- 1 Bridge Partner

Discussion: A fundamental benefit of Rapid Spanning Tree Protocol is that it provides for rapid recovery of connectivity following the failure of a Bridge, Bridge Port, or a LAN. A Bridged LAN running the Rapid Spanning Tree Protocol will likely have been designed with this in mind. By disabling and later re-enabling links which are part of the Active Topology, the DUT and Bridge Partner are forced to recover from exactly the sort of problem the protocol was designed to solve.

Test Setup: Configure the DUT and Bridge Partner as specified for Tests in this Group. Connect the DUT and Bridge Partner with three links. Connect Testing Station 1 and Testing Station 2 to the DUT and Bridge Partner as shown. Configure the DUT as the Root Bridge. Allow time for the Spanning Tree to converge.
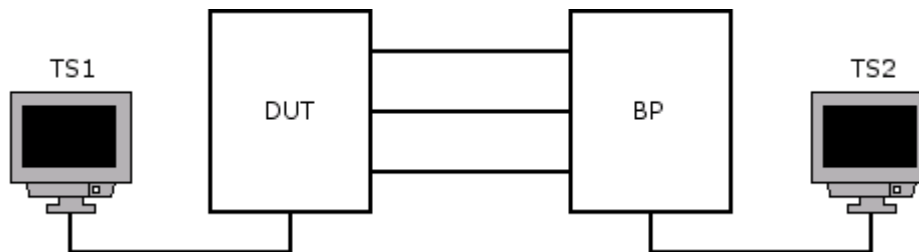
Procedure:

Part A: Link Failure and Re-initialization
1. Set Testing Stations 1 and 2 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from both Testing Stations.
3. Disconnect the link between the Root Bridge and the Root Port on the non-Root Bridge.
4. Allow time for the Spanning Tree to converge.
5. Disconnect the link between the Root Bridge and the Root Port on the non-Root Bridge.
6. Allow time for the Spanning Tree to converge.
7. Re-connect the link that was disconnected in Step 5.
8. Allow time for the Spanning Tree to converge.
9. Re-connect the link that was disconnected in Step 3.
10. Allow time for the Spanning Tree to converge.
11. Observe the frames captured by each Testing Station.
12. Configure the Bridge Partner such that it is the Root Bridge, and repeat Steps 1-11.

Observable Results:

- None of the Testing Stations should receive duplicated or misordered frames.
- While a temporary interruption in traffic may occur after a link has been disconnected or re-connected, once the Spanning Tree has converged, traffic should be successfully exchanged between Testing Stations.

Possible Problems:

- None.

Test RSTP.io.1.4 – Non-Default VLAN

Purpose: This test is conducted when both the DUT and Bridge Partner support the configuration of non-Default VLANs. It verifies that the DUT and Bridge Partner successfully interoperate when connected with multiple links in the same, non-Default VLAN.

References:

- IEEE 802.1w-2001: sub-clauses 17.5, 17.24

Resource Requirements:

- 2 Testing Stations
- 1 Bridge Partner

Discussion: When a Port is in the Discarding Port State or the Learning Port State, the Forwarding Process shall discard received frames and shall not submit forwarded frames for transmission. This test seeks to verify that the DUT and its Bridge Partner(s) successfully interoperate when the Bridged LAN of which they are a part is composed of one or more non-Default VLANs.

Test Setup: Configure the DUT and Bridge Partner as specified for Tests in this Group. Connect the DUT and Bridge Partner with three links. Connect Testing Station 1 and Testing Station 2 to the DUT and Bridge Partner as shown. Configure the DUT as the Root Bridge. Allow time for the Spanning Tree to converge.
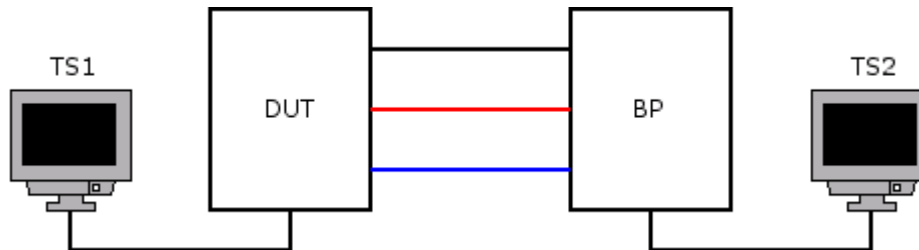
Procedure:

Part A: Non-Default VLAN
1. Set Testing Stations 1 and 2 to capture MAC frames.
2. Configure the links between the DUT and Bridge Partner as Default, Red, and Blue Access Links, respectively.
3. Configure the Ports on the DUT and Bridge Partner that connect them to Testing Stations as Tagged members of the Red and Blue VLANs and Untagged members of the Default VLAN. Ensure that the Acceptable Frame Types parameter for said Ports is Admit All Frames.
4. Continuously transmit Untagged, Red VLAN-tagged, and Blue VLAN-tagged unicast, multicast, and broadcast frames from both Testing Stations.
5. Configure the non-Root Bridge such that the Default Access Port connecting it to the Root Bridge is in the Forwarding State.
6. Allow time for the Spanning Tree to converge.
7. Observe the frames captured by each Testing Station, then set Testing Stations 1 and 2 to capture MAC frames.
8. Configure the non-Root Bridge such that the Red Access Port connecting it to the Root Bridge is in the Forwarding State.
9. Allow time for the Spanning Tree to converge.

10. Observe the frames captured by each Testing Station, then set Testing Stations 1 and 2 to capture MAC frames.
11. Configure the non-Root Bridge such that the Blue Access Port connecting it to the Root Bridge is in the Forwarding State.
12. Allow time for the Spanning Tree to converge.
13. Observe the frames captured by each Testing Station, then set Testing Stations 1 and 2 to capture MAC frames.
14. Configure the Bridge Partner such that it is the Root Bridge, and repeat Steps 1-15

Observable Results:

- None of the Testing Stations should receive duplicated or misordered frames.
- When the Default Access Port on the non-Root Bridge is in the Forwarding State, the Red and Blue Access Ports on the non-Root Bridge should be in the Discarding State. When the Red Access Port on the non-Root Bridge is in the Forwarding State, the Default and Blue Access Ports on the non-Root Bridge should be in the Discarding State. When the Blue Access Port on the non-Root Bridge is in the Forwarding State, the Default and Red Access Ports on the non-Root Bridge should be in the Discarding State.
- In Steps 7, 10, and 13, once the Spanning Tree has converged, the Testing Stations should successfully exchange traffic associated with the Default, Red, and Blue VLAN, respectively. No other traffic should be exchanged between Testing Stations.

Possible Problems:

- If the DUT does not support the configuration of non-Default VLANs, this test cannot be performed. If a Bridge Partner does not support the configuration of non-Default VLANs, this test cannot be performed using that Bridge Partner.
- If either the DUT or the Bridge Partner does not support hybrid links, configure the Ports on the DUT and Bridge Partner that connect to the Test Stations as Tagged members of the Default, Red, and Blue VLANs.
- If either the DUT or the Bridge Partner does not support hybrid links or the configuration of the Default VLAN, the Test can not be completed.

Test RSTP.io.1.5 – STP Compatibility Mode

Purpose: To verify that the DUT and Bridge Partner successfully interoperate when connected via Ports running in STP Compatibility Mode.

References:

- IEEE 802.1w-2001: sub-clauses 17.12, 17.16.1, 17.18.10, 17.26

Resource Requirements:

- 2 Testing Stations
- 1 Bridge Partner

Discussion: Because support for operating RSTP in "STP compatibility mode" was deemed necessary, the DUT and its Bridge Partners must support the Force Protocol Version parameter. The Force Protocol Version parameter is set to 2 during normal RSTP operation. However, when the parameter is set to 0, rapid transitions of Alternate Ports to Root Ports, and the rapid transitions of Designated Ports to Forwarding are disabled. The device transmits only legacy Configuration BPDUs and TCN BPDUs. Any RSTP BPDUs it receives are discarded. mcheck is a Boolean value that may be set to TRUE by the operation of management in order to force the Port Protocol Migration state machine into the SEND_RSTP state. Its value is set to FALSE on entry to the SEND_RSTP state. Forcing the state machine to send RST BPDUs in this manner can be used to test whether all legacy Bridges on a given LAN have been removed. The value of mcheck cannot be set TRUE if the value of ForceVersion is less than 2; i.e., the mcheck facility is ineffective if the Bridge is set to operate in STP Compatibility mode.

Test Setup: Configure the DUT and Bridge Partner as specified for Tests in this Group. Connect the DUT and Bridge Partner with three links. Connect Testing Station 1 and Testing Station 2 to the DUT and Bridge Partner as shown. Configure the DUT as the Root Bridge. Allow time for the Spanning Tree to converge.
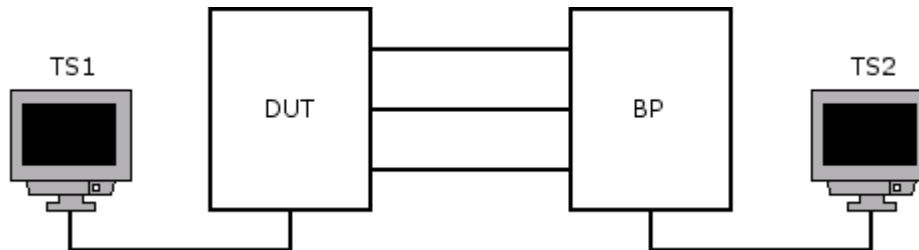
Procedure:

Part A: STP compatibility
1. Set Testing Stations 1 and 2 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from both Testing Stations.
3. Set ForceVersion for the Root Bridge to zero.
4. Allow time for the Spanning Tree to converge.
5. Set ForceVersion for the Root Bridge to two.
6. Set mcheck TRUE for each Port on the Root Bridge.
7. Observe the frames captured by each Testing Station, and set Testing Stations 1 and 2 to capture MAC frames.
8. Set ForceVersion for the non-Root Bridge to zero.
9. Allow time for the Spanning Tree to converge.
10. Set ForceVersion for the non-Root Bridge to two.

11. Set mcheck TRUE for each Port on the non-Root Bridge.
12. Observe the frames captured by each Testing Station.
13. Configure the Bridge Partner such that it is the Root Bridge, and repeat Steps 1-12.

Observable Results:

- Traffic should be successfully exchanged between Testing Stations.
- None of the Testing Stations should receive duplicated or misordered frames.

Possible problems:

- If the DUT or (any of its Bridge Partners) do not properly support the Force Protocol Version parameter or mcheck, this test cannot be performed with that device configured as the Root Bridge

Test RSTP.io.1.6 – Legacy Root Bridge

Purpose: To verify that the DUT and Bridge Partner successfully interoperate when they are connected to a Bridge that only supports STP and said Bridge is the Root of the Bridged LAN.

References:

- IEEE 802.1w-2001: sub-clauses 17.12, 17.26

Resource Requirements:

- 2 Testing Stations
- 1 Bridge Partner
- 1 Legacy Bridge Partner

Discussion: The protocol does not require that RSTP-capable bridges have ForceVersion equal to 0 in order to interoperate with Legacy Bridge Partners. When one of it's Ports receives a legacy Configuration BPDU or TCN BPDU, an RSTP-capable Bridge will place the receiving Port into Spanning Tree Compatibility Mode until either it receives an RSTP BPDU after the mDelayWhile timer has expired or mcheck is set TRUE for that Port. The presence of Legacy Bridge Partners will affect the ability of the Spanning Tree to converge and recover rapidly, but it should not affect the interoperability of devices in said Spanning Tree.

Test Setup: Configure the DUT and Bridge Partner as specified for Tests in this Group. Connect the DUT and Bridge Partner with two links. Connect Testing Station 1 and Testing Station 2 to the DUT and Bridge Partner as shown. Allow time for the Spanning Tree to converge. Configure the LBP as the Root Bridge.
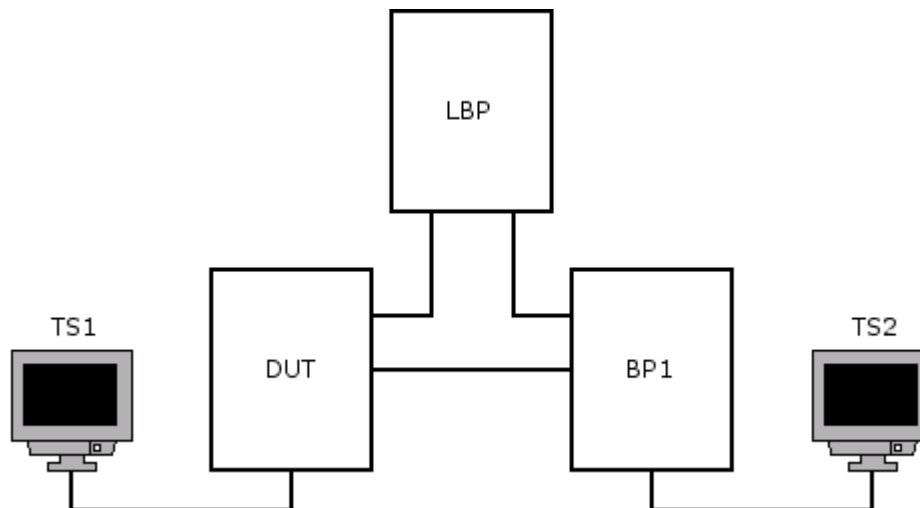
Procedure:

Part A: STP Root Bridge
1. Set Testing Stations 1 and 2 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from both Testing Stations.
3. Connect the DUT to the LBP with one link.
4. Connect the Bridge Partner to the LBP with one link.
5. Allow time for the Spanning Tree to converge.
6. Observe the frames captured by each Testing Station.

Observable Results:

- Traffic should be successfully exchanged between Testing Stations.
- None of the Testing Stations should receive duplicated or misordered frames.

Possible problems:

- None.

Test RSTP.io.1.7 – Topology Change

Purpose: To verify that the DUT and Bridge Partners successfully interoperate in the event of a topology change.

References:

- IEEE 802.1w-2001: sub-clauses 17.10, 17.25

Resource Requirements:

- 4 Testing Stations
- 3 Bridge Partners

Discussion: While previous tests will have resulted in Topology Changes, this test focuses specifically on the effect of Topology Changes on RSTP interoperability. To this end, multiple Bridge Partners are used for this test. The devices in the test network are assigned the role of Root Bridge, one after another. The resulting Topology Changes should not result in the formation of a temporary data loop.

Test Setup: Configure the DUT, BP1, BP2, and BP3 as specified for Tests in this Group. Connect the DUT to BP1 with one link. Connect BP1 to BP3 with one link. Connect BP3 to BP2 with one link. Connect BP2 to the DUT with one link. Connect Testing Stations 1-4 as shown. Configure the DUT as the Root Bridge. Allow time for the Spanning Tree to converge.
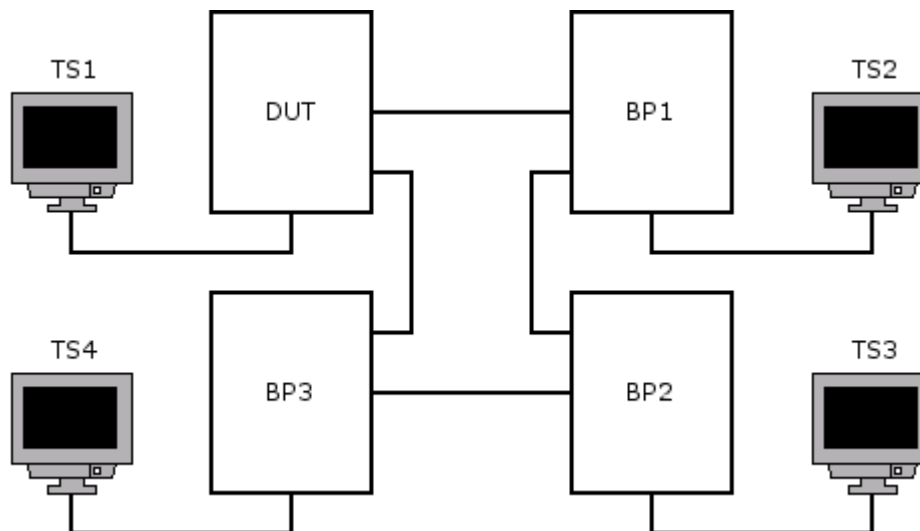
Procedure:

Part A: Rotating Root Bridge
1. Set Testing Stations 1, 2, 3, and 4 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from each Testing Station.
3. Configure BP1 such that it is the Root Bridge.
4. Allow time for the Spanning Tree to converge.
5. Configure BP2 such that it is the Root Bridge.
6. Allow time for the Spanning Tree to converge.
7. Configure BP3 such that it is the Root Bridge.
8. Allow time for the Spanning Tree to converge.
9. Configure the DUT such that it is the Root Bridge.
10. Allow time for the Spanning Tree to converge.
11. Observe the frames captured by each Testing Station.

Observable Results:

- Traffic should be successfully exchanged between Testing Stations.
- None of the Testing Stations should receive duplicated or misordered frames.

Possible problems:

- None.

Test RSTP.io.1.8 – Root Failure

Purpose: To verify that the DUT and Bridge Partners successfully interoperate despite the failure or removal of the Root Bridge.

References:

- IEEE 802.1w-2001: sub-clause 17.23

Resource Requirements:

- 4 Testing Stations
- 3 Bridge Partners

Discussion: This test seeks to verify that the DUT and Bridge Partners can successfully recover from the failure or removal of the Root Bridge. The ability to recover from such a failure (in particular, the ability to do so without the use of timer values) is one of the primary benefits of RSTP.

Test Setup: Configure the DUT, BP1, BP2, and BP3 as specified for Tests in this Group. Connect the DUT to BP1 with one link. Connect the DUT to BP2 with one link. Connect the DUT to BP3 with one link. Connect BP1 to BP2 with one link. Connect BP1 to BP3 with one link. Connect BP2 to BP3 with one link. Connect Testing Stations 1-4 as shown. Configure the DUT as the Root Bridge. Allow time for the Spanning Tree to converge.
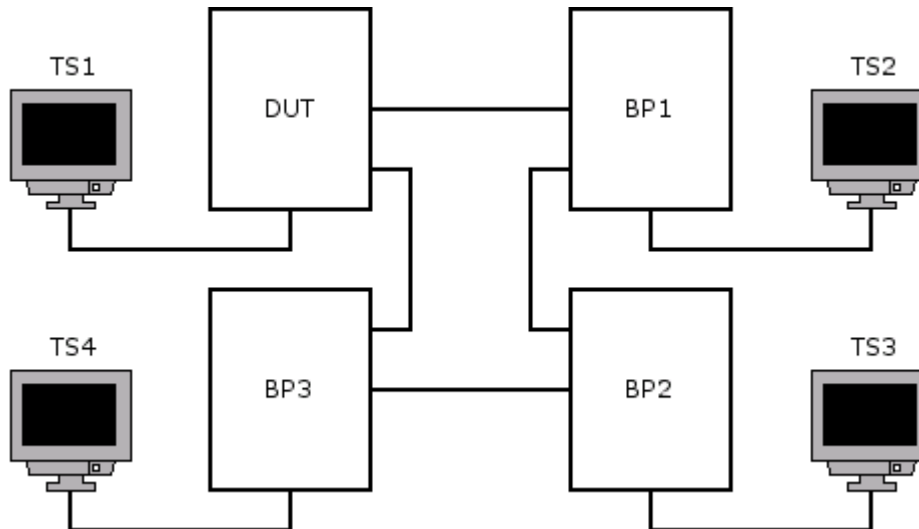
Procedure:

Part A: Root Disabled
1. Set Testing Stations 1, 2, 3 and 4 to capture MAC frames.
2. Continuously transmit unicast, multicast, and broadcast frames from each Testing Station.
3. Disconnect all power from the Root Bridge.
4. Allow time for the Spanning Tree to converge.
5. Observe the frames captured by each Testing Station.
6. Reconnect all power to the Bridge that was powered down in Step 3.
7. Repeat Steps 1-6 three times, once with each of BP1, BP2, and BP3 configured such that it is the Root Bridge.

Observable Results:

- None of the Testing Stations should receive duplicated or misordered frames.

Possible problems:

- None.

Test RSTP.io.1.9 – Network Initialization

Purpose: To verify that the DUT and Bridge Partners successfully interoperate upon network initialization.

References:

- IEEE 802.1w-2001: sub-clause 17.1, 17.21

Resource Requirements:

- 4 Testing Stations
- 3 Bridge Partners

Discussion: This test verifies that the DUT does not behave in a manner inconsistent with the requirements of the Spanning Tree Algorithm, even when the network is (re)initialized. While such an event will result in a temporary inability to receive or forward MAC frames, it should not result in either the formation of transient data loops or the duplication and misordering of frames. A full mesh test setup is used for added thoroughness.

Test Setup: Configure the DUT, BP1, BP2, and BP3 as specified for Tests in this Group. Connect the DUT to BP1 with one link. Connect the DUT to BP2 with one link. Connect the DUT to BP3 with one link. Connect BP1 to BP2 with one link. Connect BP1 to BP3 with one link. Connect BP2 to BP3 with one link. Connect Testing Stations 1-4 as shown. Allow time for the Spanning Tree to converge.
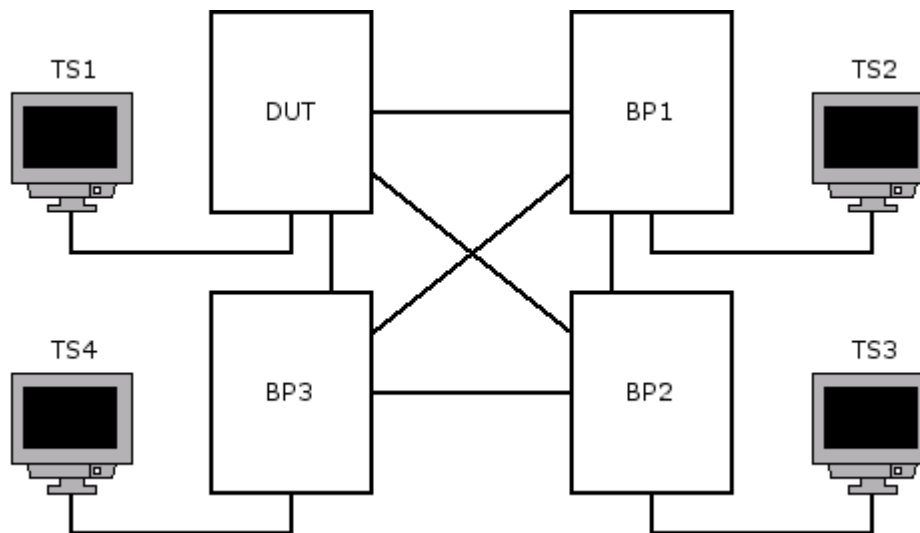
Procedure:

Part A: Network Initialization
1. Configure the DUT such that it will be selected as the Root Bridge upon network initialization.
2. Set Testing Stations 1, 2, 3 and 4 to capture MAC frames.
3. Continuously transmit unicast, multicast, and broadcast frames from each Testing Station.
4. Disconnect all power to the DUT and Bridge Partners.
5. Restore power to the DUT and Bridge Partners.
6. Allow time for initialization of all devices.
7. Allow time for the Spanning Tree to converge.
8. Observe the frames captured by each Testing Station.
9. Configure BP1 such that it will be selected as the Root Bridge upon network initialization.
10. Repeat Steps 2-8 three times, once with each of BP1, BP2, and BP3 configured such that it is the Root Bridge.

Observable Results:

- In each case, once power has been restored to the DUT and Bridge Partners and the Spanning Tree has converged, all traffic should be successfully exchanged between Testing Stations.
- None of the Testing Stations should receive duplicated or misordered frames.

Possible problems:

- Some of the captured frames may contain errors, because frames are being transmitted when power to the test setup is disconnected.