Bridge Functions Consortium

Multiple Spanning Tree Protocol
Interoperability Test Suite
Version 1.1

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MODIFICATION RECORD

Version	Date	Editor(s)	Comments
0.8	2004-12-05	Brandon Barry Anthony Mwingira Curtis Simonson	Initial draft released for review
0.85	2004-12-06	Brandon Barry Curtis Simonson	Minor updates to draft.
0.90	2005-03-20	Curtis Simonson	Minor updates
0.95	2005-08-01	Charles Lavery	Minor update to complete test 3.2 and make the test setup/procedure for test 2.2 more clear.
1.1	2009-06-24	Timothy Davis	Updated Test Suite

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Timothy Davis	UNH InterOperability Lab
Anthony Mwingira	UNH InterOperability Lab
Curtis Simonson	UNH InterOperability Lab
Charles Lavery	UNH InterOperability Lab

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 Multiple Spanning Tree Protocol capable products.

IEEE Std. 802.1Q™-2003 states:

> *"The MSTP algorithm and protocol provides simple and full connectivity for frames assigned to any given VLAN throughout a Bridged Local Area Network comprising arbitrarily interconnected Bridges, each operating MSTP, STP […], or RSTP […]. MSTP allows frames assigned to different VLANs to follow separate paths, each based on an independent Multiple Spanning Tree Instance (MSTI), within Multiple Spanning Tree (MST) Regions composed of LANs and or MST Bridges. These Regions and the other Bridges and LANs are connected into a single Common Spanning Tree (CST)"*[1]

This test suite has been designed based on the set of IEEE Standards that pertain to Multiple Spanning Tree Protocol. 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. 802.1Q™-2003, nor are they designed as conformance tests. Rather, they provide one method to isolate problems within a Multiple Spanning Tree Protocol 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 Multiple Spanning Tree Protocol 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 Multiple Spanning Tree Protocol capable environments.

[1] IEEE Std. 802.1Q-2003: clause 13

REFERENCES

The following documents are referenced in this text:

[IEEE Std. 802.1Q™-2003] IEEE Computer Society LAN/MAN Standards Committee, "Standard for Local and Metropolitan Area Networks: Media Access Control (MAC) Bridges"

[IEEE Std. 802.1D™-2004] IEEE Computer Society LAN/MAN Standards Committee, "IEEE Standards for Local and metropolitan area networks Virtual Bridged Local Area Networks"

DEFINITION OF TERMS

Abbreviations and Acronyms:

IEEE 802.1[2]	
BPDU	Bridge Protocol Data Unit
CIST	Common and Internal Spanning Tree
CST	Common Spanning Tree
IST	Internal Spanning Tree
LAN	Local Area Network
MAC	Medium Access Control
MCID	MST Configuration Identifier
MST	Multiple Spanning Tree
MST BPDU	Multiple Spanning Tree Bridge Protocol Data Unit
MSTI	Multiple Spanning Tree Instance
MSTP	Multiple Spanning Tree Protocol
PDU	Protocol Data Unit
PVID	Port VID
RST BPDU	Rapid Spanning Tree Bridge Protocol Data Unit
SST	Single Spanning Tree
ST BPDU	Spanning Tree Bridge Protocol Data Unit
STP	Spanning Tree Protocol
VID	VLAN Identifier
VLAN	Virtual LAN

MSTP.io Test Suite	
BP	Bridge Partner
DUT	Device Under Test
MST_BP	Multiple Spanning Tree Bridge Partner
RST_BP	Rapid Spanning Tree Bridge Partner
ST_BP	Spanning Tree Bridge Partner
TS	Test Station

[2] IEEE Std. 802.1Q-2003: clause 4

Definitions:

IEEE 802.1[3]	
Boundary Port	A Bridge Port attaching an MST Bridge to a LAN that is not in the same region.
Common and Internal Spanning Tree (CIST)	The single Spanning Tree calculated by STP and RSTP together with the logical continuation of that connectivity through MST Bridges and regions, calculated by MSTP to ensure that all LANs in the Bridged Local Area Network are simply and fully connected.
Common Spanning Tree (CST)	The single Spanning Tree calculated by STP and RSTP, and by MSTP to connect MST Regions.
Detagged frame	The detagged frame of an untagged frame is the frame itself. The detagged frame of a tagged frame (i.e. a VLAN-tagged or priority-tagged frame) is the frame that results from untagging the frame by the appropriate procedure.
Frame	A unit of data transmission on an IEEE 802 LAN MAC that conveys a PDU between MAC Service users. There are three types of frame; untagged, VLAN-tagged, and priority-tagged.
Internal Spanning Tree (IST)	The connectivity provided by the CIST within a given MST Region.
Legacy region	A set of LAN segments interconnected such that there is physical connectivity between any pair of segments using only IEEE Std 802.1D, 1998 Edition-conformant, VLAN-unaware MAC Bridges.
MST Bridge	A Bridge capable of supporting the CST, and one or more MSTIs, and of selectively mapping frames classified in any given VLAN to the CST or a given MSTI.
MST Configuration Table	A configurable table that allocates each and every possible VLAN to the Common Spanning Tree or a specific Multiple Spanning Tree Instance
MST Region	A set of LANs and MST Bridges physically connected via Ports on those MST Bridges, where each LAN's CIST Designated Bridge is an MST Bridge, and each Port is either the Designated Port on one of the LANs, or else a non-Designated Port of an MST Bridge that is connected to one of the LANs, whose MCID matches exactly the MCID of the Designated Bridge of that LAN.

[3] IEEE Std. 802.1Q-2003: clause 3

Multiple Spanning Tree (MST) Configuration Identifier	A name for, revision level, and a summary of a given allocation of VLANs to Spanning Trees.
Multiple Spanning Tree Instance (MSTI)	One of a number of Spanning Trees calculated by MSTP within an MST Region, to provide a simply and fully connected active topology for frames classified as belonging to a VLAN that is mapped to the MSTI by the MST Configuration Table used by MST Bridges of that MST Region.
Priority-tagged frame	A tagged frame whose tag header carries priority information, but carries no VLAN identification information.
Single Spanning Tree (SST) Bridge	A Bridge capable of supporting only a single spanning tree, the CST. The single spanning tree may be supported by the Spanning Tree Algorithm and Protocol (STP) defined in IEEE Std. 802.1D, 1998 Edition, or by the Rapid Spanning Tree Algorithm and Protocol (RSTP), defined in IEEE Std 802.1D, 2004 Edition.
Spanning Tree	A simply and fully connected active topology formed from the arbitrary physical topology of connected Bridged Local Area Network components by relaying frames through selected bridge ports and not others. The protocol parameters and states used and exchanged to facilitate the calculation of that active topology and to control the bridge relay function.
Tagged frame	A tagged frame is a frame that contains a tag header immediately following the Source MAC address field of the frame […]. There are two types of tagged frames; VLAN-tagged frames and priority-tagged frames.
Tag header	A tag header allows user priority information, and optionally, VLAN identification information, to be associated with a frame.
Untagged frame	An untagged frame is a frame that does not contain a tag header immediately following the Source MAC Address field of the frame […].
Virtual Bridged Local Area Network (LAN)	A Bridged LAN in which the existence of one or more VLAN-aware Bridges allows the definition, creation, and maintenance of VLANs.
Virtual Local Area Network (VLAN)	A subset of the active topology of a Bridged Local Area Network. Associated with each VLAN is a VLAN Identifier (VID).

VLAN-aware	A property of Bridges or end stations that recognize and support VLAN-tagged frames.
VLAN-tagged frame	A tagged frame whose tag header carries both VLAN identification and priority information.
VLAN-unaware	A property of Bridges or end stations that do not recognize VLAN-tagged frames.

MSTP.io Test Suite	
Bridge Partner	A MAC Bridge used for interoperability testing. Because these are interoperability tests, the extent to which a given Bridge Partner conforms to a particular protocol need not be determined prior to or during testing.
Device Under Test	The Bridge on which the MSTP.io test suite is being conducted.
Multiple Spanning Tree Bridge Partner	A Bridge Partner configured to operate Multiple Spanning Tree Protocol
MSTP-aware Bridge	A Bridge Partner that supports Spanning Tree Protocol version 3 or higher.
MSTP-unaware Bridge	A Bridge Partner that does not support Spanning Tree Protocol versions greater than 2.
Rapid Spanning Tree Bridge Partner	A Bridge Partner configured to operate Rapid Spanning Tree Protocol
Spanning Tree Bridge Partner	A Bridge Partner configured to operate Spanning Tree Protocol
Test Station	A tool that supports the analysis and generation of test traffic, i.e. MAC frames.

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 MSTP.io.1.2 refers to the second test of the first test group in the MSTP 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. 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 Settings:

At the start of each test, all Bridges in the test setup must be configured as follows.

GMRP support:
- Disable

GVRP support:
- Disable

VLANs:
- These and no other VLANs must be configured on the DUT and its BPs:

Bridge VLAN Settings			
VLAN Name	**Preferred VID[α]**	**Member Set[β]**	**Untagged Set[γ]**
Default	0x001	None	All
Blue	0x002	All	None
Green	0x003	All	None
Red	0x010	All	None

STP support:
- Enable (force) version 3 (MSTP) on DUT and MST_BPs
- Enable (force) version 2 (RSTP) on RST_BP
- Enable version 0 ("Common" STP) on ST_BP

MSTP-unaware Bridge STP Settings		
Bridge	**BridgePriority**	**BridgeTimes**
RST_BP	0xB	Default
ST_BP	0xC	Default

- Default Bridge Times
  - Bridge Hello Time = 2 seconds
  - Bridge Max Age = 20 seconds
  - Bridge Forward Delay = 15 seconds

[α] The VID values listed are the preferred values for the test suite. Any valid VID may be used, provided all Bridges use the same VID for each VLAN Name. Thus if the DUT uses VID 0x321 for the Blue VLAN, all of the Bridge Partners must use VID 0x321 for the Blue VLAN.

[β] Each Bridge need only include Ports used to connect BPs and TSs in the Member Set for the Default, Blue, Green and Red VLAN.

[γ] Ports not used for testing may be in the Untagged Set for any VLAN(s).

MSTP-aware Bridge CIST Settings		
Bridge	**CistBridgePriority**	**CistBridgeTimes**
DUT	0x7000	Default
MST_BP1	0x8000	Default
MST_BP2	0x9000	Default
MST_BP3	0xA000	Default

- Default CistBridgeTimes:
  - Bridge Max Age: 20 seconds
  - Bridge Forward Delay: 15 seconds
  - Bridge Max Hops: 20

MSTP-aware Bridge MSTI 0x001 Settings		
Bridge	**MstiBridgePriority**	**MstiBridgeTimes**
DUT	0xA000	Default
MST_BP1	0x7000	Default
MST_BP2	0x8000	Default
MST_BP3	0x9000	Default

MSTP-aware Bridge MSTI 0x002 Settings		
Bridge	**MstiBridgePriority**	**MstiBridgeTimes**
DUT	0x9000	Default
MST_BP1	0xA000	Default
MST_BP2	0x7000	Default
MST_BP3	0x8000	Default

- Default MstiBridgeTimes (for all MSTIs):
  - Bridge Max Hops: 20

Note – In every case, the BridgePriority value refers to the settable component (i.e. the four most significant bits)

Default MCID:

0x00554E482D494F4C3A4246430000000000000000000000000000000000000000000000000000
DF54822EB6208025E35A8EB54A92872A

Configuration Identifier Format Selector:

0x00

Configuration Name:

0x554E482D494F4C3A4246430000000000000000000000000000000000000000000000000000
"UNH-IOL:BFC"

Revision Level:

0x0000

Configuration Digest (generated from MST Configuration Table):

0xDF54822EB6208025E35A8EB54A92872A

MST Configuration Table*	
VID	**MST ID**
0x002	0x001
0x003	0x001
0x010	0x002

*All other VIDs are mapped to the CIST

Port Settings:

VLANs:

At the start of each test, all Ports in the test setup must be configured as follows.

- Acceptable Frame Types parameter: Admit All Frames
- Enable Ingress Filtering parameter: Reset (i.e. Disable Ingress Filtering)
- PVID: 0x001

MSTP-unaware Bridge Port Settings:

At the start of each test, all MSTP-unaware Ports in the test setup must be configured as follows.

- Port Path Cost: 0x00030D40
- Port Priority: 0x8

MSTP-aware Bridge Port Settings:

At the start of each test, all MSTP-aware Ports in the test setup must be configured as follows.

- MSTP-aware Bridge Port Hello Time: 2 seconds

MSTP-aware Bridge Port Settings (CIST, MSTI 0x001, MSTI 0x002)		
Bridge Port	**Port Priority**	**(External and Internal) Path Cost**
DUT.1	0x1	0x00030D40
DUT.2	0x2	0x00030D40
DUT.3	0x3	0x00030D40
DUT.4	0x4	0x00030D40
DUT.5	0x5	0x00030D40
DUT.6	0x6	0x00030D40
DUT.7	0x7	0x00030D40
DUT.8	0x8	0x00030D40
DUT.9	0x9	0x00030D40
MST_BP1.1	0x1	0x00030D40
MST_BP1.2	0x2	0x00030D40
MST_BP1.3	0x3	0x00030D40
MST_BP1.4	0x4	0x00030D40
MST_BP1.5	0x5	0x00030D40
MST_BP1.6	0x6	0x00030D40
MST_BP1.7	0x7	0x00030D40
MST_BP1.8	0x8	0x00030D40
MST_BP1.9	0x9	0x00030D40
MST_BP2.1	0x1	0x00030D40
MST_BP2.2	0x2	0x00030D40
MST_BP2.3	0x3	0x00030D40
MST_BP2.4	0x4	0x00030D40
MST_BP2.5	0x5	0x00030D40
MST_BP2.6	0x6	0x00030D40
MST_BP2.7	0x7	0x00030D40
MST_BP2.8	0x8	0x00030D40
MST_BP2.9	0x9	0x00030D40
MST_BP3.1	0x1	0x00030D40
MST_BP3.2	0x2	0x00030D40
MST_BP3.3	0x3	0x00030D40
MST_BP3.4	0x4	0x00030D40
MST_BP3.5	0x5	0x00030D40
MST_BP3.6	0x6	0x00030D40
MST_BP3.7	0x7	0x00030D40
MST_BP3.8	0x8	0x00030D40
MST_BP3.9	0x9	0x00030D40

Note – In every case, the Port Priority value refers to the settable component (i.e. the four most significant bits)

Note –Port naming convention: DUT.3 refers to Port 3 on the DUT and MST_BP2.2 refers to Port 2 on MST_BP2.

GROUP 1: Convergence

Scope

These tests help determine whether MST BPs in a Bridged LAN composed of Bridges that support different versions of STP (i.e. version 0, version 2, and version 3) implement MSTP in a way that meets the following requirements:

"It will configure the active topology into a single spanning tree for any given VLAN, such that there is at most one data route between any two end stations for frames consistently allocated to a given VID by Bridges conforming to this standard, eliminating data loops."[4]

"The active topology will, with a high probability, stabilize within a short, known, bounded interval in order to minimize the time for which the service in unavailable for communication between any pair of end stations."[5]

Overview

This group of tests first verifies the convergence of a Bridged LAN composed of the DUT, its Bridge Partners, and 6 Test Stations when each Bridge is configured using the default values defined for this test suite. The convergence of the same Bridged LAN is then tested using alternate configuration settings for the DUT and each Bridge Partner.

[4] IEEE Std. 802.1Q-2003: sub-clause 13.1.a
[5] IEEE Std. 802.1Q-2003: sub-clause 13.1.c

MSTP.io.1.1: Basic Convergence Using Defaults

Purpose: Verify that the DUT and its BPs produce a stable active topology when the default test setup is used.

References:

- IEEE Std. 802.1Q-2003: sub-clause 13.1.a
- IEEE Std. 802.1Q-2003: sub-clause 13.1.c

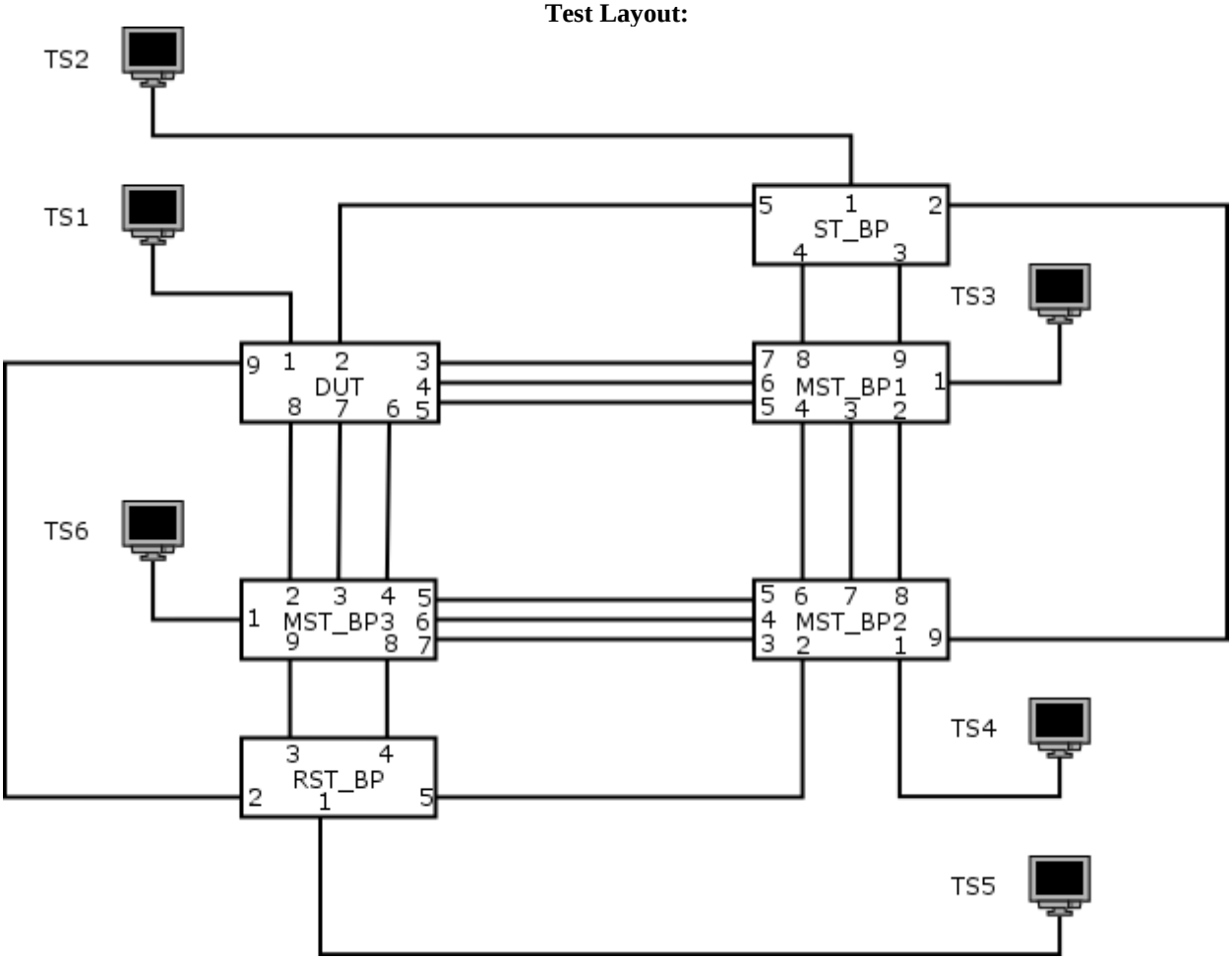
Resource Requirements:

- 6 TSs
- 3 MST_BPs
- 1 RST_BP
- 1 ST_BP

Discussion:

A Bridged LAN composed of Bridges that support version 0, 2, or 3 of Spanning Tree Protocol is configured such that it should produce a single spanning tree for any given VLAN, that is, there will be exactly one data route between any pair of end stations in a given VLAN for frames allocated to that VLANs VID. The default test setup is used. *This test must pass before any other tests in this suite are conducted.*

Test Layout:



Procedure:

Part A: Basic Convergence

1. Ensure that the default values are configured on the DUT, MST_BP1, MST_BP2, MST_BP3, RST_BP, and ST_BP.
2. Start capture on TS1, TS2, TS3, TS4, TS5, and TS6.
3. Transmit 10 D1, 10 R1, 10 G1, and 10 B1 Test Frames from TS1 at a rate of 10 every second.
4. Transmit 10 D2, 10 R2, 10 G2, and 10 B2 Test Frames from TS2 at a rate of 10 every second.
5. Transmit 10 D3, 10 R3, 10 G3, and 10 B3 Test Frames from TS3 at a rate of 10 every second.
6. Transmit 10 D4, 10 R4, 10 G4, and 10 B4 Test Frames from TS4 at a rate of 10 every second.
7. Transmit 10 D5, 10 R5, 10 G5, and 10 B5 Test Frames from TS5 at a rate of 10 every second.
8. Transmit 10 D6, 10 R6, 10 G6, and 10 B6 Test Frames from TS6 at a rate of 10 every second.
9. Stop capture on TS1, TS2, TS3, TS4, TS5, TS6, and observe the captured frames (if any).

Observable Results:

- TS1 must capture all Test Frames transmitted by TS2, TS3, TS4, TS5, and TS6.
- TS2 must capture all Test Frames transmitted by TS1, TS3, TS4, TS5, and TS6.
- TS3 must capture all Test Frames transmitted by TS1, TS2, TS4, TS5, and TS6.
- TS4 must capture all Test Frames transmitted by TS1, TS2, TS3, TS5, and TS6.
- TS5 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS6.
- TS6 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS5.
- TS1 must not capture any D1, R1, G1, or B1 Test Frames.
- TS2 must not capture any D2, R2, G2, or B2 Test Frames.
- TS3 must not capture any D3, R3, G3, or B3 Test Frames.
- TS4 must not capture any D4, R4, G4, or B4 Test Frames.
- TS5 must not capture any D5, R5, G5, or B5 Test Frames.
- TS6 must not capture any D6, R6, G6, or B6 Test Frames.
- The DUT must be the Root Bridge of the CIST.
- The MST_BP1 must be the Root Bridge of the MSTI 0x001.
- The MST_BP2 must be the Root Bridge of the MSTI 0x002.

Possible Problems:

- None

MSTP.io.1.2: Basic Convergence Using Alternate Settings

Purpose: Verify that the DUT and its BPs produce a stable active topology when an alternate test setup is used.

References:

- IEEE Std. 802.1Q-2003: sub-clause 13.1.a
- IEEE Std. 802.1Q-2003: sub-clause 13.1.c

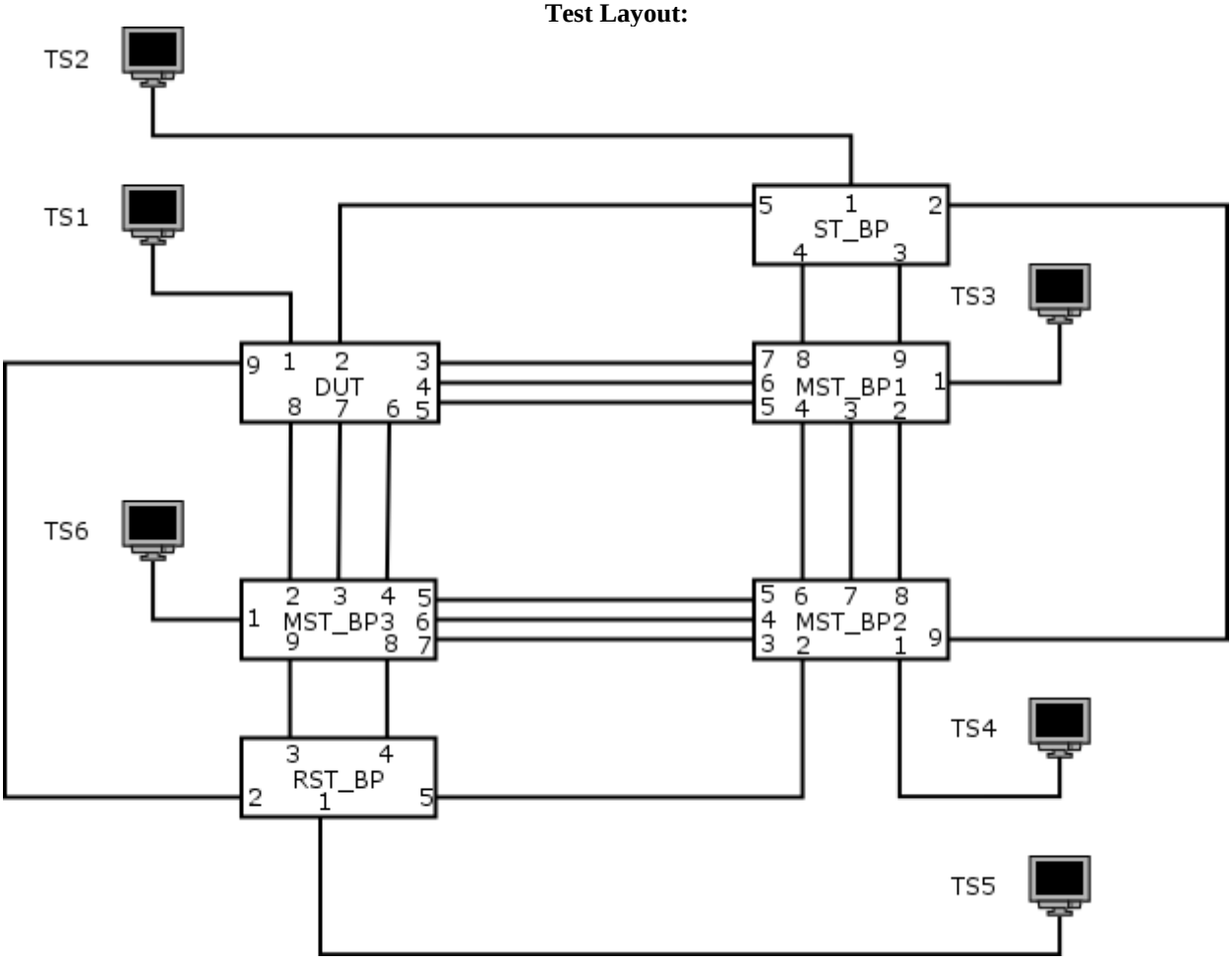
Resource Requirements:

- 6 TSs
- 3 MST_BPs
- 1 RST_BP
- 1 ST_BP

Discussion:

A Bridged LAN composed of Bridges that support version 0, 2, or 3 of Spanning Tree Protocol is configured such that it should produce a single spanning tree for any given VLAN, that is, there will be exactly one data route between any pair of end stations in a given VLAN for frames allocated to that VLANs VID. The default test setup is modified such that the Root Bridge for the CIST and each MSTI differs. Timer values are also modified.

Test Layout:



Procedure:

Part A: Basic Convergence Using Alternate Settings

1. Ensure that the default values are configured on the DUT, MST_BP1, MST_BP2, MST_BP3, RST_BP, and ST_BP.
2. Set DUT's CIST Bridge Priority to 0xC000. Set DUT's MSTI Bridge Priority for MSTI 0x001 to 0x7000. Set DUT's MSTI Bridge Priority for MSTI 0x002 to 0x8000.
3. Set MST_BP1's CIST Bridge Priority to 0xB000. Set MST_BP1's MSTI Bridge Priority for MSTI 0x001 to 0xA000. Set MST_BP1's MSTI Bridge Priority for MSTI 0x002 to 0x7000.
4. Set MST_BP2's CIST Bridge Priority to 0xA000. Set MST_BP2's MSTI Bridge Priority for MSTI 0x001 to 0x9000. Set MST_BP2's MSTI Bridge Priority for MSTI 0x002 to 0xA000.
5. Set MST_BP3's CIST Bridge Priority to 0x9000. Set MST_BP3's MSTI Bridge Priority for MSTI 0x001 to 0x8000. Set MST_BP3's MSTI Bridge Priority for MSTI 0x002 to 0x9000.
6. Set RST_BP's CIST Bridge Priority to 0x8000.
7. Set ST_BP's CIST Bridge Priority to 0x7000.
8. Set DUT's, MST_BP1's, MST_BP2's and MST_BP3's CIST Bridge Max Age to 6 and CIST Bridge Forward Delay to 4.
9. Set STP_BP's and RST_BP's Bridge Hello Time to 1, Bridge Max Age to 6 and Bridge Forward Delay to 4.
10. Wait 60 seconds.
11. Start capture on TS1, TS2, TS3, TS4, TS5, and TS6.
12. Transmit 10 D1, 10 R1, 10 G1, and 10 B1 Test Frames from TS1 at a rate of 10 every second.
13. Transmit 10 D2, 10 R2, 10 G2, and 10 B2 Test Frames from TS2 at a rate of 10 every second.
14. Transmit 10 D3, 10 R3, 10 G3, and 10 B3 Test Frames from TS3 at a rate of 10 every second.
15. Transmit 10 D4, 10 R4, 10 G4, and 10 B4 Test Frames from TS4 at a rate of 10 every second.
16. Transmit 10 D5, 10 R5, 10 G5, and 10 B5 Test Frames from TS5 at a rate of 10 every second.
17. Transmit 10 D6, 10 R6, 10 G6, and 10 B6 Test Frames from TS6 at a rate of 10 every second.
18. Stop capture on TS1, TS2, TS3, TS4, TS5, TS6, and observe the captured frames (if any).

Observable Results:

- TS1 must capture all Test Frames transmitted by TS2, TS3, TS4, TS5, and TS6.
- TS2 must capture all Test Frames transmitted by TS1, TS3, TS4, TS5, and TS6.
- TS3 must capture all Test Frames transmitted by TS1, TS2, TS4, TS5, and TS6.
- TS4 must capture all Test Frames transmitted by TS1, TS2, TS3, TS5, and TS6.
- TS5 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS6.
- TS6 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS5.
- TS1 must not capture any D1, R1, G1, or B1 Test Frames.
- TS2 must not capture any D2, R2, G2, or B2 Test Frames.
- TS3 must not capture any D3, R3, G3, or B3 Test Frames.
- TS4 must not capture any D4, R4, G4, or B4 Test Frames.
- TS5 must not capture any D5, R5, G5, or B5 Test Frames.
- TS6 must not capture any D6, R6, G6, or B6 Test Frames.
- The ST_BP must be the Root Bridge of the CIST.
- The DUT must be the Root Bridge of the MSTI 0x001.
- The MST_BP1 must be the Root Bridge of the MSTI 0x002.

Possible Problems:

- None

GROUP 2: Predictable, Reproducible, Configurable Topology

Scope

These tests help determine whether MST BPs in a Bridged LAN composed of Bridges that support different versions of STP (i.e. version 0, version 2, and version 3) implement MSTP in a way that meets the following requirements:

"The active topology will be predictable and reproducible, and may be selected by management of the parameters of the algorithm, thus allowing the application of Configuration Management, following traffic analysis, to meet the goals of Performance Management."[6]

"[The protocol] will, with a high probability, continue to provide simple and full connectivity for frames even in the presence of administrative errors in the allocation of VLANs to spanning trees."[7]

Overview

This group of tests first verifies that a Bridged LAN composed of the DUT, its Bridge Partners, and 6 Test Stations produces a predictable and reproducible active topology when Path Cost parameters are used to perform Configuration Management. The DUT and its MST BPs are then modified such that they do not use identical MCIDs. Despite this error in the allocation of VLANs to spanning trees, the active topology must remain predictable and reproducible.

[6] IEEE Std. 802.1Q-2003: sub-clause 13.1.d
[7] IEEE Std. 8021.Q-2003: sub-clause 13.1.h

MSTP.io.2.1: Configuration Management via Path Cost

Purpose: Verify that the DUT and its BPs produce a stable, predictable active topology when Path Cost parameters are used to perform Configuration Management.

References:

- IEEE Std. 802.1Q-2003: sub-clause 13.1.d
- IEEE Std. 802.1Q-2003: sub-clause 13.1.h

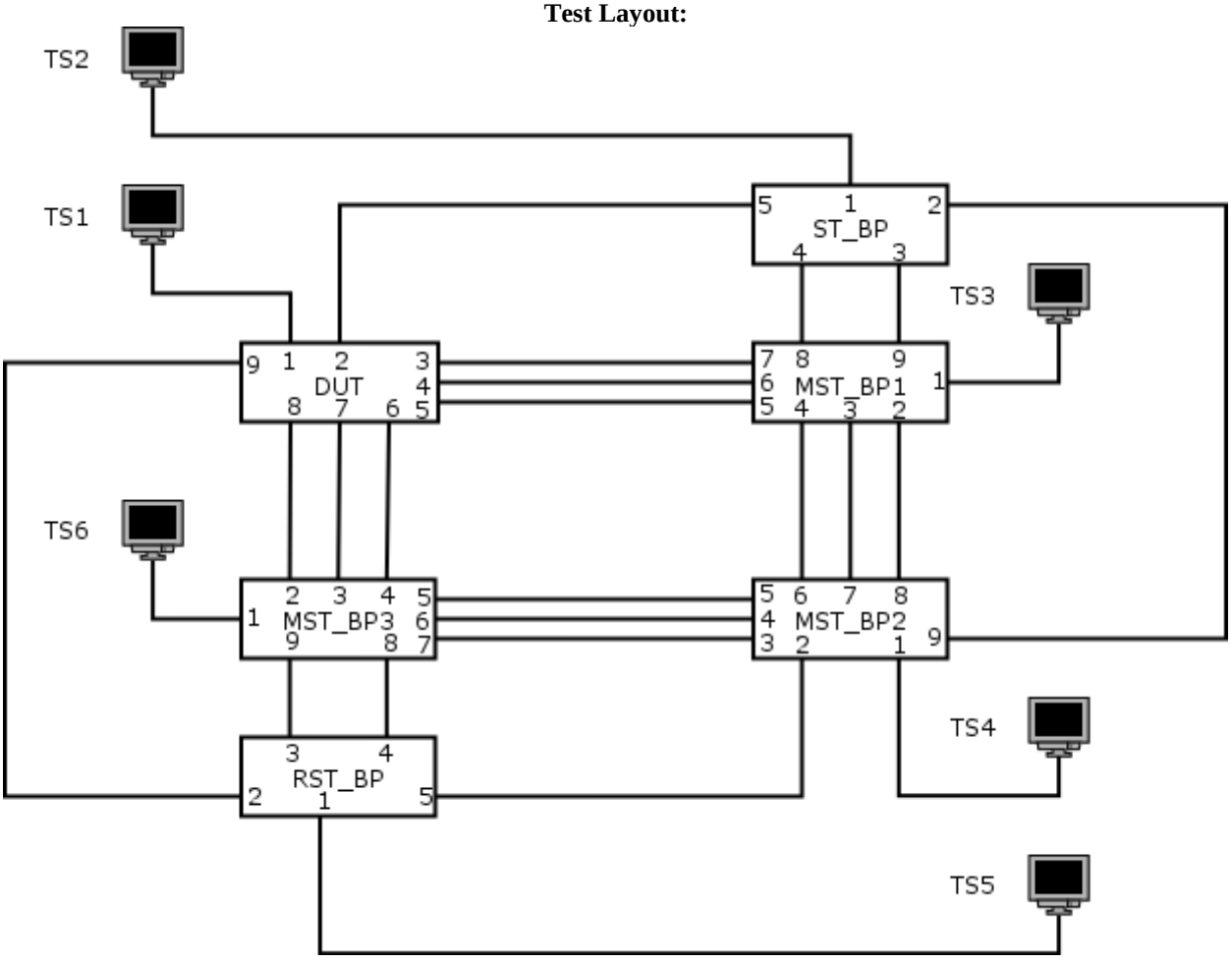
Resource Requirements:

- 6 TSs
- 3 MST_BPs
- 1 RST_BP
- 1 ST_BP

Discussion:

A Bridged LAN composed of Bridges that support version 0, 2, or 3 of Spanning Tree Protocol is configured such that it should produce a single spanning tree for any given VLAN, that is, there will be exactly one data route between any pair of end stations in a given VLAN for frames allocated to that VLANs VID. Path Cost parameters are modified to ensure the active topology is composed of a particular set of data routes.

Test Layout:



Procedure:

Part A: Path Cost Based Configuration Management

1. Ensure that the default values are configured on the DUT, MST_BP1, MST_BP2, MST_BP3, RST_BP, and ST_BP.
2. Set Port Path Cost values on all devices to those values specified in Tables MSTP.io.2.1a, MSTP.io.2.1b, MSTP.io.2.1c and MSTP.io.2.1d (Pages 9-12).
3. Wait 60 seconds.
4. Start capture on TS1, TS2, TS3, TS4, TS5, and TS6.
5. Transmit 10 D1, 10 R1, 10 G1, and 10 B1 Test Frames from TS1 at a rate of 10 every second.
6. Transmit 10 D2, 10 R2, 10 G2, and 10 B2 Test Frames from TS2 at a rate of 10 every second.
7. Transmit 10 D3, 10 R3, 10 G3, and 10 B3 Test Frames from TS3 at a rate of 10 every second.
8. Transmit 10 D4, 10 R4, 10 G4, and 10 B4 Test Frames from TS4 at a rate of 10 every second.
9. Transmit 10 D5, 10 R5, 10 G5, and 10 B5 Test Frames from TS5 at a rate of 10 every second.
10. Transmit 10 D6, 10 R6, 10 G6, and 10 B6 Test Frames from TS6 at a rate of 10 every second.
11. Stop capture on TS1, TS2, TS3, TS4, TS5, TS6, and observe the captured frames (if any).

Observable Results:

- TS1 must capture all Test Frames transmitted by TS2, TS3, TS4, TS5, and TS6.
- TS2 must capture all Test Frames transmitted by TS1, TS3, TS4, TS5, and TS6.
- TS3 must capture all Test Frames transmitted by TS1, TS2, TS4, TS5, and TS6.
- TS4 must capture all Test Frames transmitted by TS1, TS2, TS3, TS5, and TS6.
- TS5 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS6.
- TS6 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS5.
- TS1 must not capture any D1, R1, G1, or B1 Test Frames.
- TS2 must not capture any D2, R2, G2, or B2 Test Frames.
- TS3 must not capture any D3, R3, G3, or B3 Test Frames.
- TS4 must not capture any D4, R4, G4, or B4 Test Frames.
- TS5 must not capture any D5, R5, G5, or B5 Test Frames.
- TS6 must not capture any D6, R6, G6, or B6 Test Frames.
- The DUT must be the Root Bridge of the CIST.
- The MST_BP1 must be the Root Bridge of the MSTI 0x001.
- The MST_BP2 must be the Root Bridge of the MSTI 0x002.

Possible Problems:

- None

Table MSTP.io.2.1:

MSTP MSTI 0x111 Bridge Port Settings		
Bridge Port	**Port Priority**	**(External and Internal) Path Cost**
DUT.1	0x1	0x00030D40
DUT.2	0x2	0x00030D40
DUT.3	0x3	0x00030D40
DUT.4	0x4	0x00000009
DUT.5	0x5	0x00030D40
DUT.6	0x6	0x00030D40
DUT.7	0x7	0x00030D40
DUT.8	0x8	0x00030D40
DUT.9	0x9	0x00030D40
MST_BP1.1	0x1	0x00030D40
MST_BP1.2	0x2	0x00030D40
MST_BP1.3	0x3	0x00030D40
MST_BP1.4	0x4	0x00030D40
MST_BP1.5	0x5	0x00030D40
MST_BP1.6	0x6	0x00030D40
MST_BP1.7	0x7	0x00030D40
MST_BP1.8	0x8	0x00030D40
MST_BP1.9	0x9	0x00030D40
MST_BP2.1	0x1	0x00030D40
MST_BP2.2	0x2	0x00030D40
MST_BP2.3	0x3	0x00030D40
MST_BP2.4	0x4	0x00030D40
MST_BP2.5	0x5	0x00030D40
MST_BP2.6	0x6	0x00030D40
MST_BP2.7	0x7	0x00000009
MST_BP2.8	0x8	0x00030D40
MST_BP2.9	0x9	0x00030D40
MST_BP3.1	0x1	0x00030D40
MST_BP3.2	0x2	0x00030D40
MST_BP3.3	0x3	0x00000009
MST_BP3.4	0x4	0x00030D40
MST_BP3.5	0x5	0x00030D40
MST_BP3.6	0x6	0x00030D40
MST_BP3.7	0x7	0x00030D40
MST_BP3.8	0x8	0x00030D40
MST_BP3.9	0x9	0x00030D40

Note – In every case, the Port Priority value refers to the settable component (i.e. the four most significant bits)

Note –Port naming convention: DUT.3 refers to Port 3 on the DUT and MST_BP2.2 refers to Port 2 on MST_BP2. Port numbers in table correspond to Port numbers in MSTP.io.2.1 Test Layout figure.

Table MSTP.io.2.1:

MSTP MSTI 0x222 Bridge Port Settings		
Bridge Port	**Port Priority**	**(External and Internal) Path Cost**
DUT.1	0x1	0x00030D40
DUT.2	0x2	0x00030D40
DUT.3	0x3	0x00030D40
DUT.4	0x4	0x00030D40
DUT.5	0x5	0x00000008
DUT.6	0x6	0x00030D40
DUT.7	0x7	0x00030D40
DUT.8	0x8	0x00030D40
DUT.9	0x9	0x00030D40
MST_BP1.1	0x1	0x00030D40
MST_BP1.2	0x2	0x00030D40
MST_BP1.3	0x3	0x00030D40
MST_BP1.4	0x4	0x00000008
MST_BP1.5	0x5	0x00030D40
MST_BP1.6	0x6	0x00030D40
MST_BP1.7	0x7	0x00030D40
MST_BP1.8	0x8	0x00030D40
MST_BP1.9	0x9	0x00030D40
MST_BP2.1	0x1	0x00030D40
MST_BP2.2	0x2	0x00030D40
MST_BP2.3	0x3	0x00030D40
MST_BP2.4	0x4	0x00030D40
MST_BP2.5	0x5	0x00030D40
MST_BP2.6	0x6	0x00030D40
MST_BP2.7	0x7	0x00030D40
MST_BP2.8	0x8	0x00030D40
MST_BP2.9	0x9	0x00030D40
MST_BP3.1	0x1	0x00030D40
MST_BP3.2	0x2	0x00030D40
MST_BP3.3	0x3	0x00030D40
MST_BP3.4	0x4	0x00030D40
MST_BP3.5	0x5	0x00000008
MST_BP3.6	0x6	0x00030D40
MST_BP3.7	0x7	0x00030D40
MST_BP3.8	0x8	0x00030D40
MST_BP3.9	0x9	0x00030D40

Note – In every case, the Port Priority value refers to the settable component (i.e. the four most significant bits)

Note –Port naming convention: DUT.3 refers to Port 3 on the DUT and MST_BP2.2 refers to Port 2 on MST_BP2. Port numbers in table correspond to Port numbers in MSTP.io.2.1 Test Layout figure.

Table MSTP.io.2.1:

MSTP CIST Bridge Port Settings		
Bridge Port	**Port Priority**	**(External and Internal) Path Cost**
DUT.1	0x1	0x00030D40
DUT.2	0x2	0x00030D40
DUT.3	0x3	0x00030D40
DUT.4	0x4	0x00030D40
DUT.5	0x5	0x00030D40
DUT.6	0x6	0x00030D40
DUT.7	0x7	0x00030D40
DUT.8	0x8	0x00030D40
DUT.9	0x9	0x00030D40
MST_BP1.1	0x1	0x00030D40
MST_BP1.2	0x2	0x00030D40
MST_BP1.3	0x3	0x00030D40
MST_BP1.4	0x4	0x00030D40
MST_BP1.5	0x5	0x00030D40
MST_BP1.6	0x6	0x00030D40
MST_BP1.7	0x7	0x0000000A
MST_BP1.8	0x8	0x00030D40
MST_BP1.9	0x9	0x00030D40
MST_BP2.1	0x1	0x00030D40
MST_BP2.2	0x2	0x00030D40
MST_BP2.3	0x3	0x00030D40
MST_BP2.4	0x4	0x00030D40
MST_BP2.5	0x5	0x00030D40
MST_BP2.6	0x6	0x00030D40
MST_BP2.7	0x7	0x00030D40
MST_BP2.8	0x8	0x0000000A
MST_BP2.9	0x9	0x00030D40
MST_BP3.1	0x1	0x00030D40
MST_BP3.2	0x2	0x00030D40
MST_BP3.3	0x3	0x00030D40
MST_BP3.4	0x4	0x0000000A
MST_BP3.5	0x5	0x00030D40
MST_BP3.6	0x6	0x00030D40
MST_BP3.7	0x7	0x00030D40
MST_BP3.8	0x8	0x00030D40
MST_BP3.9	0x9	0x00030D40

Note – In every case, the Port Priority value refers to the settable component (i.e. the four most significant bits)

Note –Port naming convention: DUT.3 refers to Port 3 on the DUT and MST_BP2.2 refers to Port 2 on MST_BP2. Port numbers in table correspond to Port numbers in MSTP.io.2.1 Test Layout figure.

Table MSTP.io.2.1:

STP, RSTP Bridge Port Settings		
Bridge Port	**Port Priority**	**(External and Internal) Path Cost**
ST_BP.1	0x8	0x00030D40
ST_BP.2	0x8	0x00030D40
ST_BP.3	0x8	0x00030D40
ST_BP.4	0x8	0x00030D40
ST_BP.5	0x8	0x00000007
RST_BP.1	0x8	0x00030D40
RST_BP.2	0x8	0x00000007
RST_BP.3	0x8	0x00030D40
RST_BP.4	0x8	0x00030D40
RST_BP.5	0x8	0x00030D40

Note – In every case, the Port Priority value refers to the settable component (i.e. the four most significant bits)

Note –Port naming convention: DUT.3 refers to Port 3 on the DUT and MST_BP2.2 refers to Port 2 on MST_BP2. Port numbers in table correspond to Port numbers in MSTP.io.2.1 Test Layout figure.

MSTP.io.2.2: MCID Mismatch

Purpose: Verify that the DUT and its BPs produce a stable, predictable active topology when MCIDs used by MST BPs differ.

References:

- IEEE Std. 802.1Q-2003: sub-clause 13.1.d
- IEEE Std. 802.1Q-2003: sub-clause 13.1.h

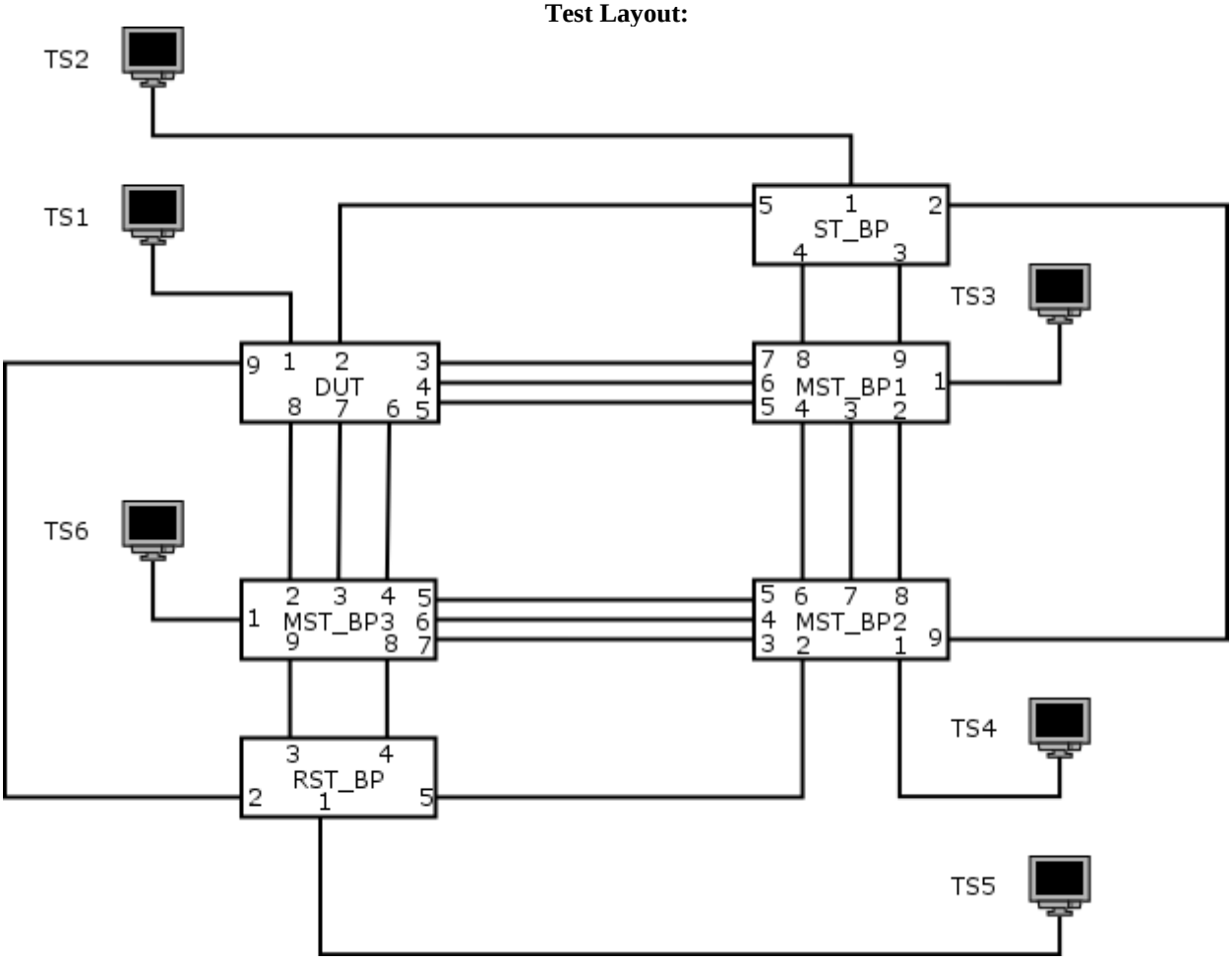
Resource Requirements:

- 6 TSs
- 3 MST_BPs
- 1 RST_BP
- 1 ST_BP

Discussion:

A Bridged LAN composed of Bridges that support version 0, 2, or 3 of Spanning Tree Protocol is configured such that it should produce a single spanning tree for any given VLAN, that is, there will be exactly one data route between any pair of end stations in a given VLAN for frames allocated to that VLANs VID. The DUT and its MST_BPs are configured such that their MCIDs differ. This should result in the creation of multiple MST Regions.

Test Layout:



Procedure:

Part A: MCID Mismatch

1. Ensure that the default values are configured on the DUT, MST_BP1, MST_BP2, MST_BP3, RST_BP, and ST_BP.
2. Configure an MCID mismatch by creating two unique MST Regions: Set the configuration name for {MST_BP2, MST_BP3} to "UNH-IOL:BFC2".
3. Wait 60 seconds.
4. Start capture on TS1, TS2, TS3, TS4, TS5, and TS6.
5. Transmit 10 D1, 10 R1, 10 G1, and 10 B1 Test Frames from TS1 at a rate of 10 every second.
6. Transmit 10 D2, 10 R2, 10 G2, and 10 B2 Test Frames from TS2 at a rate of 10 every second.
7. Transmit 10 D3, 10 R3, 10 G3, and 10 B3 Test Frames from TS3 at a rate of 10 every second.
8. Transmit 10 D4, 10 R4, 10 G4, and 10 B4 Test Frames from TS4 at a rate of 10 every second.
9. Transmit 10 D5, 10 R5, 10 G5, and 10 B5 Test Frames from TS5 at a rate of 10 every second.
10. Transmit 10 D6, 10 R6, 10 G6, and 10 B6 Test Frames from TS6 at a rate of 10 every second.
11. Stop capture on TS1, TS2, TS3, TS4, TS5, TS6, and observe the captured frames (if any).

Observable Results:

- TS1 must capture all Test Frames transmitted by TS2, TS3, TS4, TS5, and TS6.
- TS2 must capture all Test Frames transmitted by TS1, TS3, TS4, TS5, and TS6.
- TS3 must capture all Test Frames transmitted by TS1, TS2, TS4, TS5, and TS6.
- TS4 must capture all Test Frames transmitted by TS1, TS2, TS3, TS5, and TS6.
- TS5 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS6.
- TS6 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS5.
- TS1 must not capture any D1, R1, G1, or B1 Test Frames.
- TS2 must not capture any D2, R2, G2, or B2 Test Frames.
- TS3 must not capture any D3, R3, G3, or B3 Test Frames.
- TS4 must not capture any D4, R4, G4, or B4 Test Frames.
- TS5 must not capture any D5, R5, G5, or B5 Test Frames.
- TS6 must not capture any D6, R6, G6, or B6 Test Frames.

Possible Problems:

- None

GROUP 3: Fault Tolerance and Automatic Reconfiguration

Scope

These tests help determine whether MST BPs in a Bridged LAN composed of Bridges that support different versions of STP (i.e. version 0, version 2, and version 3) implement MSTP in a way that meets the following requirement:

"It will provide fault tolerance by automatic reconfiguration of the spanning tree topology as a result of Bridge failure or a breakdown in the data path, within the confines of the available Bridged Local Area Network components, and for the automatic accommodation of any Bridge or Bridge Port added to the network without the formation of transient data loops."[8]

Overview

This group of tests first verifies that a Bridged LAN composed of the DUT, its Bridge Partners, and 6 Test Stations reconfigures properly in the event a data path(s) fails. Replacing an entire MST Region with an RST BP further tests the fault tolerance and automatic reconfiguration of the Bridged LAN.

[8] IEEE Std. 802.1Q-2003: sub-clause 13.1.b

MSTP.io.3.1: Fault Tolerance

Purpose: Verify that the DUT and its BPs properly reconfigure the active topology when a data path(s) fail.

References:

- IEEE Std. 802.1Q-2003: sub-clause 13.1.b

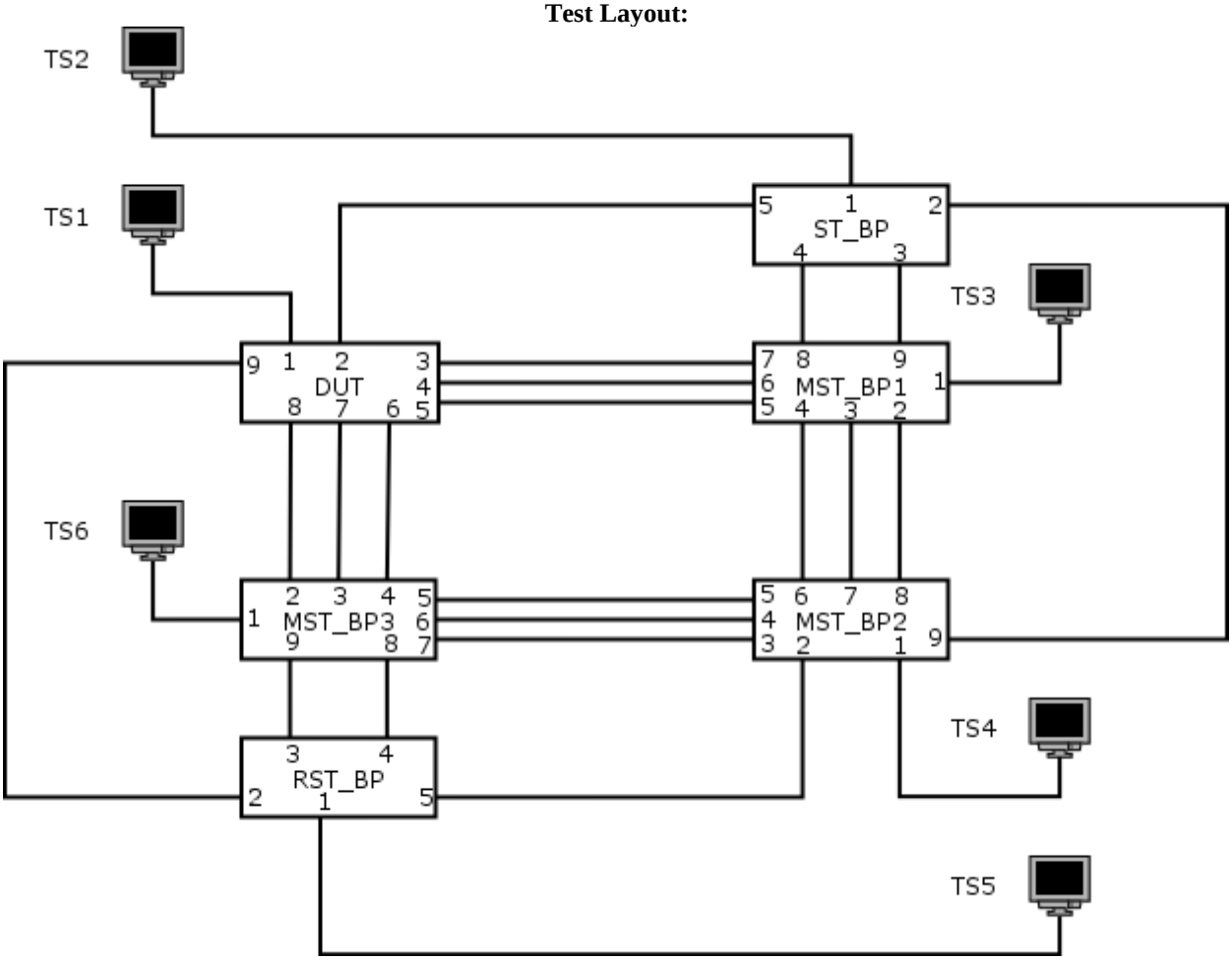
Resource Requirements:

- 6 TSs
- 3 MST_BPs
- 1 RST_BP
- 1 ST_BP

Discussion:

A Bridged LAN composed of Bridges that support version 0, 2, or 3 of Spanning Tree Protocol is configured such that it should produce a single spanning tree for any given VLAN, that is, there will be exactly one data route between any pair of end stations in a given VLAN for frames allocated to that VLANs VID. During the test, Bridges are disabled and links are disconnected, causing data paths to fail. Fault detection and resulting automatic reconfiguration should be predictable and reproducible.

Test Layout:



Procedure:

Part A: Fault Tolerance

1. Ensure that the default values are configured on the DUT, MST_BP1, MST_BP2, MST_BP3, RST_BP, and ST_BP.
2. Start capture on TS1, TS2, TS3, TS4, TS5, and TS6.
3. Disconnect five randomly chosen links in the Test Network, excluding links connected to Test Stations.
   Note – Every Bridge must have a connection to at least one other Bridge in the Test Network.
4. Wait 60 seconds.
5. Start capture on TS1, TS2, TS3, TS4, TS5, and TS6.
6. Transmit 10 D1, 10 R1, 10 G1, and 10 B1 Test Frames from TS1 at a rate of 10 every second.
7. Transmit 10 D2, 10 R2, 10 G2, and 10 B2 Test Frames from TS2 at a rate of 10 every second.
8. Transmit 10 D3, 10 R3, 10 G3, and 10 B3 Test Frames from TS3 at a rate of 10 every second.
9. Transmit 10 D4, 10 R4, 10 G4, and 10 B4 Test Frames from TS4 at a rate of 10 every second.
10. Transmit 10 D5, 10 R5, 10 G5, and 10 B5 Test Frames from TS5 at a rate of 10 every second.
11. Transmit 10 D6, 10 R6, 10 G6, and 10 B6 Test Frames from TS6 at a rate of 10 every second.
12. Stop capture on TS1, TS2, TS3, TS4, TS5, TS6, and observe the captured frames (if any).

Observable Results:

- TS1 must capture all Test Frames transmitted by TS2, TS3, TS4, TS5, and TS6.
- TS2 must capture all Test Frames transmitted by TS1, TS3, TS4, TS5, and TS6.
- TS3 must capture all Test Frames transmitted by TS1, TS2, TS4, TS5, and TS6.
- TS4 must capture all Test Frames transmitted by TS1, TS2, TS3, TS5, and TS6.
- TS5 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS6.
- TS6 must capture all Test Frames transmitted by TS1, TS2, TS3, TS4, and TS5.
- TS1 must not capture any D1, R1, G1, or B1 Test Frames.
- TS2 must not capture any D2, R2, G2, or B2 Test Frames.
- TS3 must not capture any D3, R3, G3, or B3 Test Frames.
- TS4 must not capture any D4, R4, G4, or B4 Test Frames.
- TS5 must not capture any D5, R5, G5, or B5 Test Frames.
- TS6 must not capture any D6, R6, G6, or B6 Test Frames.
- The DUT must be the Root Bridge of the CIST.
- The MST_BP1 must be the Root Bridge of the MSTI 0x001.
- The MST_BP2 must be the Root Bridge of the MSTI 0x002.

Possible Problems:

- None

TEST FRAMES

Test Frames are only provided to active UNH-IOL Bridge Functions Consortium members.