

Bridge Functions Consortium

802.1Q VLAN
Operations Test Suite
Version 1.4



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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 VLAN-aware products. This test suite focuses on testing VLAN Port parameters, Frame Reception, the Ingress Rules, the Forwarding Process, the Egress Rules, and Frame Transmission.

The tests do not determine if a product conforms to the IEEE 802.1Q 2003 standard and they are not designed as interoperability tests. These tests provide one method to isolate problems within the VLAN-aware device that will affect the interoperability performance. Successful completion of all tests contained in this suite does not guarantee that the tested device will operate with other VLAN-aware devices. However, these tests, along with satisfactory performance in the IOL's interoperability test bed, do provide a reasonable level of confidence that the DUT will function well in most VLAN-aware environments.

Organization of Tests

The tests contained in this document are organized to simplify the identification of information related to a test and to facilitate in the actual testing process. Each test contains an identification section that describes the test and provides cross-reference information. The discussion section covers background information and specifies why the test is to be performed. Tests are grouped in order to reduce setup time in the lab environment. Each test contains the following information:

Test Number

The Test Number associated with each test follows a simple grouping structure. Listed first is a letter signifying the standard that the test suite is based on. Next comes a suite number signifying the number of this test suite relative to all other VLAN Test Suites. Next is a test group number to separate the tests into logical groups. Finally is the test's number within the group. This allows for the addition of future tests to the appropriate groups of the test suite without requiring the renumbering of the subsequent tests.

Purpose

This section gives a brief statement outlining what the test is attempting to achieve.

References

This section lists cross-references to the IEEE 802.1Q standard and other documentation that might be helpful in understanding and evaluating the test and results.

Resource Requirements

This section specifies the hardware and test equipment that will be needed to perform the test. The items contained in this section are special test devices or other facilities, which may not be available on all devices.

Last Modification

This section gives the date of the last modification to this test.

Discussion

This section covers the assumptions made in the design or implementation of the test as well as known limitations. Other items specific to the test are covered here.

Test Setup

This section describes the configuration of the test environment. Small changes in the configuration should be included in the test procedure.

Procedure

This section of the test description contains the step-by-step instructions for carrying out the test. It provides a cookbook approach to testing, and may be interspersed with observable results.

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 a certain test is often based on the successful (or unsuccessful) detection of a certain observable result.

Parameters

If this section is present, it lists the possible conformant values for the parameter being tested. Completion of this section indicates the value supported by the DUT.

Possible Problems

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

DEFINITIONS

Access Link: An Access Link is a LAN segment over which only Untagged Frames are transmitted. In the context of this test suite, each port connected with an Access Link has its PVID set to the VID associated with the Access Link.

Hybrid Link: A Hybrid Link is a LAN segment over which both Tagged and Untagged Frames are transmitted. In the context of this test suite, each port connected with a Hybrid Link has its PVID set to the VID associated with the Untagged VLAN on that Hybrid Link.

Priority-Tagged Frame: A Tagged Frame whose Tag Header carries priority information, but carries no VLAN identification information.

PVID: Port VLAN Identifier.

Tag Header: A Tag Header allows user priority information, and optionally, VLAN identification information, to be associated with a frame.

Tagged Frame: A Tagged Frame is a frame that contains a Tag Header immediately following the Source MAC address field of the frame or, if the frame contains a Routing Information field, immediately following the Routing Information field. There are two types of Tagged Frames: VLAN-Tagged Frames and Priority-Tagged Frames.

Trunk Link: A Trunk Link is a LAN segment over which only VLAN-Tagged Frames are transmitted. In the context of this test suite, each port connected with a Trunk Link has its PVID set to the Default PVID.

Untagged Frame: An Untagged Frame is a frame that does not contain a Tag Header.

VLAN-Tagged Frame: A Tagged Frame whose Tag Header carries both VLAN identification and priority information.

Any link that is connected to a Testing Station and not labeled has a PVID equal to the Default PVID and is an untagged member of the Default VLAN. In other words, an unlabeled link is assumed to be a Default Access Link.

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Group 1: Port Parameters

Scope: These tests cover the various Port parameters used by VLAN aware Bridges.

Overview: These tests are designed to verify that the device under test (DUT) properly implements all of the Port parameters that are used for making forwarding/filtering decisions and for classifying incoming frames as belonging to a particular VLAN.

Test VLAN.op.1.1 – Acceptable Frame Types Parameter

Purpose: To determine the value(s) of the Acceptable Frame Types Parameter that the device under test (DUT) supports.

References:

- IEEE 802.1Q 2003: sub-clauses 8.4.3, 8.4.4, 8.6.1, and 8.8

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: Associated with each Port of a VLAN Aware Bridge is an Acceptable Frame Types parameter that controls the reception of VLAN-Tagged and non VLAN-Tagged Frames on that Port. Valid values for this parameter are *Admit All Frames* and *Admit only VLAN-Tagged Frames*. When set to *Admit only VLAN-Tagged Frames*, any frames received on that Port that carry no VID are discarded by the Ingress rule checking function of the Forwarding Process. When set to *Admit All Frames*, all incoming Priority-Tagged and Untagged frames are associated with a VLAN by the Ingress Rules using the PVID of the receiving Port. The Egress Rules are then used to forward these frames out the appropriate Ports. Each Port of a Bridge shall support at least one of these values, and may support both. Where both are supported, the implementation shall support the ability to configure the value of the parameter through management and the default value of the parameter shall be *Admit All Frames*.

Test Setup: Reset factory defaults on the DUT. Connect Testing Stations to the DUT as shown in Figure 1.

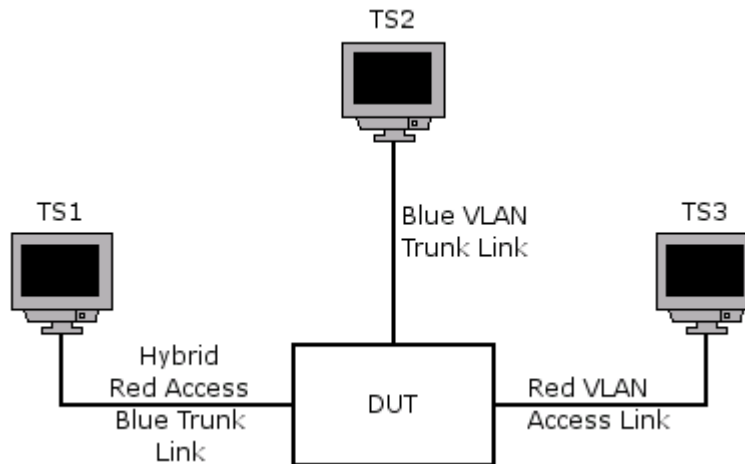


Figure 1

Procedure:

Part a: Admit All Frames

1. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
2. Transmit Untagged Frames from Testing Station 1.
3. Transmit Priority-Tagged Frames from Testing Station 1.
4. Transmit Blue VLAN-Tagged Frames from Testing Station 1.

Part b: Admit only VLAN-Tagged Frames

5. If possible, set the Acceptable Frame Types parameter to *Admit only VLAN-Tagged Frames*.
6. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.

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7. Transmit Untagged Frames from Testing Station 1.
8. Transmit Priority-Tagged Frames from Testing Station 1.
9. Transmit Blue VLAN-Tagged Frames from Testing Station 1.

Observable Results:

- In Part a, Testing Station 2 should receive all of the Blue VLAN-Tagged Frames and Testing Station 3 should receive all of the Untagged and Priority-Tagged Frames.
- In Part b, Testing Station 2 should receive all of the Blue VLAN-Tagged Frames. Testing Station 3 should not receive any traffic.
- If the DUT passes Part a then it supports an Acceptable Frame Types parameter of *Admit All Frames*. If the DUT passes Part b then it supports an Acceptable Frame Types parameter of *Admit only VLAN-Tagged Frames*. If the DUT passes both Parts a and b then it supports both values of the Acceptable Frame Types parameter.
- If the DUT supports both values of the Acceptable Frame Types parameter then the default value should be *Admit All Frames*.

Parameters:

According to the Observable Results above, check the appropriate answer below.
The DUT supports an Acceptable Frame Types parameter of:

Admit All Frames *Admit only VLAN-Tagged Frames* *Both*

Possible Problems:

- None.

Test VLAN.op.1.2 – Enable Ingress Filtering

Purpose: To determine the value(s) of the Enable Ingress Filtering Parameter that are supported by the device under test (DUT).

References:

- IEEE 802.1Q 2003: sub-clauses 8.4.5, 8.6.1, and 8.10.9

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: An Enable Ingress Filtering parameter is associated with each Port of a VLAN Aware Bridge. If this parameter is Set for a given Port, the Ingress Rules checking function of the Forwarding Process shall discard any frame received on that Port whose VLAN classification does not include that Port in its Member set. If this parameter is Reset, the Ingress Rules shall not discard frames received on that Port on the basis of their VLAN classification. The default value for this parameter shall be Reset (i.e., Disable Ingress Filtering). The value of this parameter may be configured through management, if supported. If the implementation supports an Enable Ingress Filtering parameter of Set on any Port, then it shall also support the ability to disable Ingress Filtering on those Ports.

Test Setup: Reset factory defaults on the DUT. Connect Testing Stations to the DUT as shown in Figure 1.

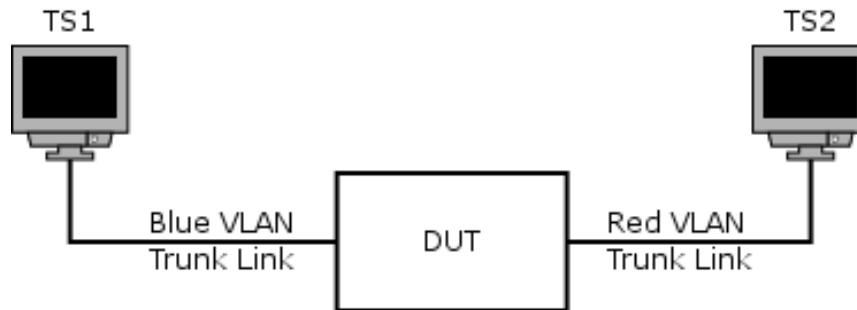


Figure 1

Procedure:

Part a: Enable Ingress Filtering parameter Reset

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit Red VLAN-Tagged Frames from Testing Station 1.

Part b: Enable Ingress Filtering parameter Set

3. If possible, enable Ingress Filtering on the DUT for the Port connected to Testing Station 1.
4. Set Testing Station 2 to capture arbitrary MAC frames.
5. Transmit Red VLAN-Tagged Frames from Testing Station 1.

Observable Results:

- In Part a, Testing Station 2 should receive all of the frames transmitted from Testing Station 1.
- In Part b, Testing Station 2 should see no traffic.
- If the DUT passes Part a, then it supports an Enable Ingress Filtering parameter of Reset. If the DUT passes Part b, then it supports an Enable Ingress Filtering parameter of Set. If the DUT passes both Parts a and b, then it supports both values of the Enable Ingress Filtering parameter.

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- If the DUT supports both values of the Enable Ingress Filtering parameter, then the default value should be Reset.

Parameters:

According to the Observable Results above, check the appropriate answer below.
The DUT supports an Enable Ingress Filtering parameter of:

Reset *Both*

Possible Problems:

- None.

Test VLAN.op.1.3 – Default PVID

Purpose: To verify that the device under test (DUT) properly supports the default PVID when not explicitly configured.

References:

- IEEE 802.1Q 2003: sub-clauses 5.1, 8.4.4 and 8.6.1, 8.9
- IEEE 802.1Q 2003: Table 9-2

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: In Port-based VLAN classification within a bridge, the VID associated with an incoming Untagged or Priority-Tagged Frame (i.e. a frame with no tag header, or a frame with a tag header that carries the null VLAN ID) is determined by the Ingress Rules. The classification mechanism used by the Ingress Rules requires that a specific VID, the PVID, be associated with each Port on a Bridge. This PVID provides the VID for all Untagged and Priority-Tagged Frames received on that Port and thus must contain a valid VID. This PVID shall be configurable through management operations if supported. If no PVID has been explicitly configured for a given Port, the PVID shall assume the value of the default PVID defined in Table 9-2.

Test Setup: Reset factory defaults on the DUT. Connect Testing Stations to the DUT as shown in Figure 1.

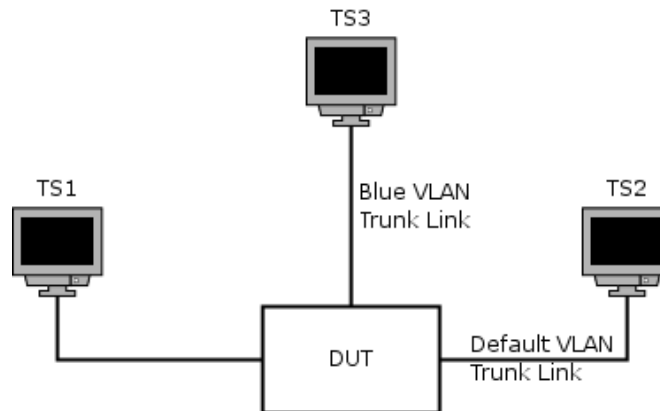


Figure 1

Procedure:

1. If possible, set the Enable Ingress Filtering parameter to Reset.
2. Add the Port on the DUT that is connected to Testing Station 1 as a Tagged member of the Member set for the Blue VLAN. Do not explicitly configure a PVID for this Port.
3. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
4. Transmit Untagged Frames from Testing Station 1.
5. If the Port on the DUT connected to Testing Station 1 is in the Member set for the default VLAN, then remove that Port from the Member set for the default VLAN.
6. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
7. Transmit Untagged Frames from Testing Station 1.
8. If possible, set the Enable Ingress Filtering parameter to Set.
9. Repeat steps 2 through 7.

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Observable Results:

- In steps 4 and 7, Testing Station 2 should receive all of the frames transmitted from Testing Station 1. These frames should be tagged for the default VLAN. Testing Station 3 should receive no traffic.
- In step 9 (Enable Ingress Filtering parameter of Set), while repeating step 4, Testing Station 2 should receive all of the frames transmitted from Testing Station 1 and Testing Station 3 should receive no traffic. While repeating step 7, Testing Stations 2 and 3 should not receive any of the frames transmitted from Testing Station 1.

Possible Problems:

- It may not be possible for the Port on the DUT that is connected to Testing Station 1 to be removed from the default VLAN.

Test VLAN.op.1.4 – PVID Configured through Management

Purpose: To verify that the device under test (DUT) properly supports the configuration of the PVID through management.

References:

- IEEE 802.1Q 2003: sub-clauses 5.1, 8.4.4 and 8.6.1
- IEEE 802.1Q 2003: Table 9-2

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: In Port-based VLAN classification within a bridge, the VID associated with an incoming Untagged or Priority-Tagged Frame (i.e. a frame with no tag header, or a frame with a tag header that carries the null VLAN ID) is determined by the Ingress Rules. The classification mechanism used by the Ingress Rules requires that a specific VID, the PVID, be associated with each Port on a Bridge. This PVID provides the VID for all Untagged and Priority-Tagged Frames received on that Port and thus must contain a valid VID. This PVID shall be configurable through management operations if supported. If no PVID has been explicitly configured for a given Port, the PVID shall assume the value of the default PVID defined in Table 9-2.

Test Setup: Reset factory defaults on the DUT.

Procedure:

Part a: Setting the PVID to Invalid VIDs

1. Attempt to add an unused Port on the DUT as an Untagged member of the Member set for VID 0x0000.
2. Attempt to set the PVID of that unused Port to 0x0000.
3. Repeat steps 1 and 2 using a VID of 0x0FFF and 0xFFFE.
4. Repeat steps 1 through 3 adding the unused Port as a Tagged member of the Member set for the specified VIDs.

Part b: Setting the PVID to Valid VIDs (Informational Only)

5. Attempt to add an unused Port on the DUT as an Untagged member of the Member set for VID 0x0002.
6. Attempt to set the PVID of that unused Port to 0x0002.
7. Repeat steps 5 and 6 using a VID of 0x0FFE.
8. Repeat steps 5 through 7 adding the unused Port as a Tagged member of the Member set for the specified VIDs.

Observable Results:

- In Part a, no PVID configurations should be accepted.
- In Part b, all PVID configurations should be accepted.

Possible Problems:

- If management is not supported, this test cannot be completed.
- In Part b, if the DUT does not support the full range of VIDs then some of the PVID configurations may not be possible.
- In Part b, the DUT may not allow the PVID of a given Port to be set to a VID whose Member set contains that Port as a Tagged member

Test VLAN.op.1.5 – PVID Assigned to a Port in no VLAN Member Set

Purpose: To verify that the device under test (DUT) properly supports the default PVID when a Port is not in any VLANs.

References:

- IEEE 802.1Q 2003: sub-clauses 5.1, 8.4.4 and 8.6.1
- IEEE 802.1Q 2003: Table 9-2

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: In Port-based VLAN classification within a bridge, the VID associated with an incoming Untagged or Priority-Tagged Frame (i.e. a frame with no tag header, or a frame with a tag header that carries the null VLAN ID) is determined by the Ingress Rules. The classification mechanism used by the Ingress Rules requires that a specific VID, the PVID, be associated with each Port on a Bridge. This PVID provides the VID for all Untagged and Priority-Tagged Frames received on that Port and thus must contain a valid VID. This PVID shall be configurable through management operations if supported. If no PVID has been explicitly configured for a given Port, the PVID shall assume the value of the default PVID defined in Table 9-2.

Test Setup: Reset factory defaults on the DUT. Connect Testing Stations to the DUT as shown in Figure 1.

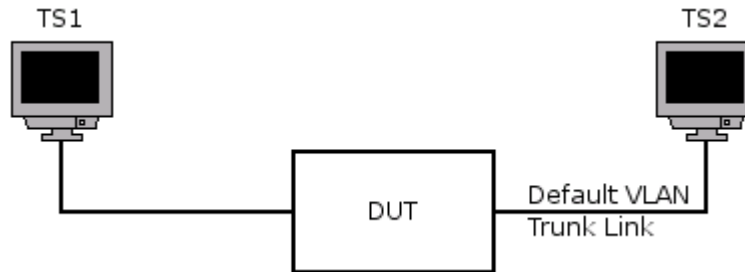


Figure 1

Procedure:

1. Ensure that the Port on the DUT that is attached to Testing Station 1 is not in the member set of any VLAN.
2. If possible, set the Enable Ingress Filtering parameter to Reset.
3. Set Testing Station 2 to capture arbitrary MAC frames.
4. Transmit Untagged Frames from Testing Station 1.
5. If possible, set the Enable Ingress Filtering parameter to Set.
6. Repeat steps 3 and 4.

Observable Results:

- In step 3, Testing Station 2 should receive all of the frames transmitted from Testing Station 1. All frames should be received tagged for the default VLAN.
- In step 6, neither Testing Station should receive traffic.

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Possible Problems:

- It may not be possible for the Port on the DUT that is connected to Testing Station 1 to be removed from all VLANs.
- If the Enable Ingress Filtering parameter can not be set, this test can not be completed.

Group 2: Frame Reception

Scope: These tests cover the various aspects of frame reception.

Overview: These tests are designed to verify that the device under test (DUT) takes the appropriate action upon reception of frames with varying formats. This involves discarding received frames that have errors and regeneration of user priority.

Test VLAN.op.2.1 – Minimum Tagged Size

Purpose: To verify that the device under test (DUT) forwards VLAN-Tagged Frames of minimum size and discards those with a size less than this minimum.

References:

- IEEE 802.1Q 2003: Annex C.5.1
- IEEE 802.1Q 2003: sub-clauses 6.5 and 8.5

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: There are two compliant methods to use when transmitting a VLAN-Tagged Frame. One method may result in VLAN-Tagged Frames with a size less than 68 bytes but at least 64 bytes. The second method is to include additional octets before the FCS field in order for the transmitted frame length to be 68 bytes. This method results in a minimum VLAN-Tagged Frame size of 68 bytes. VLAN-Tagged Frames smaller than 64 bytes shall be discarded upon reception.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

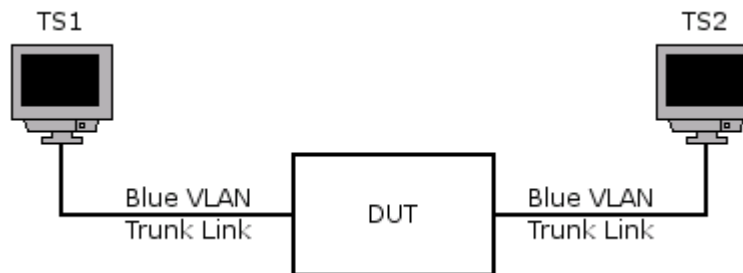


Figure 1

Procedure:

Part a: Minimum Tagged Size

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit 64 byte Blue VLAN-Tagged Frames from Testing Station 1.

Part b: Minimum Tagged Size Exceeded

3. Set Testing Station 2 to capture arbitrary MAC frames.
4. Transmit 63 byte Blue VLAN-Tagged Frames from Testing Station 1.

Observable Results:

- In Part a, Testing Station 2 should receive all frames transmitted from Testing Station 1.
- In Part b, Testing Station 2 should receive no traffic.

Possible Problems:

- None.

Test VLAN.op.2.2 – Maximum Tagged Size

Purpose: To verify that the device under test (DUT) forwards VLAN-Tagged Frames of maximum size and discards those with a size greater than this maximum.

References:

- IEEE 802.1Q 2003: Annex C.5.1
- IEEE 802.1Q 2003: sub-clauses 6.5 and 8.5

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: The maximum size for a VLAN-Tagged or Priority-Tagged Frame is 1522 bytes. Frames larger than this maximum shall be discarded upon reception.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

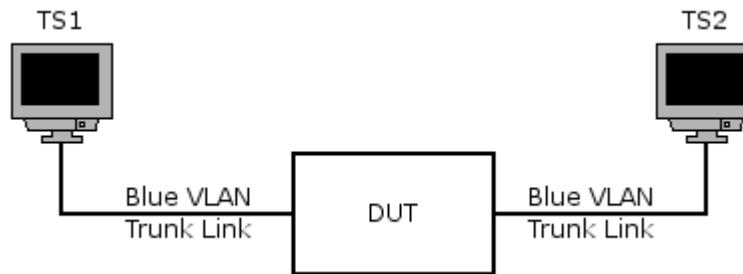


Figure 1

Procedure:

Part a: Maximum Tagged Size

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit 1522 byte Blue VLAN-Tagged Frames from Testing Station 1.

Part b: Maximum Tagged Size Exceeded

3. Set Testing Station 2 to capture arbitrary MAC frames.
4. Transmit 1523 byte Blue VLAN-Tagged Frames from Testing Station 1.

Observable Results:

- In Part a, Testing Station 2 should receive all frames transmitted from Testing Station 1.
- In Part b, Testing Station 2 should receive no traffic.

Possible Problems:

- None.

Test VLAN.op.2.3 – Untagging Minimum Tagged Sized Frames

Purpose: To verify that the device under test (DUT) properly untags and forwards VLAN-Tagged Frames of minimum size.

References:

- IEEE 802.1Q 2003: Annex C.5.1
- IEEE 802.1Q 2003: sub-clauses 6.5 and 8.5

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: There are two compliant methods to use when transmitting a VLAN-Tagged Frame. One method may result in VLAN-Tagged Frames with a size less than 68 bytes but at least 64 bytes. The second method is to include additional octets before the FCS field in order for the transmitted frame length to be 68 bytes. This method results in a minimum VLAN-Tagged Frame size of 68 bytes. VLAN-Tagged Frames smaller than 64 bytes shall be discarded upon reception. When VLAN-Tagged Frames of size 64 bytes are forwarded over an Access Link, those frames are untagged before being transmitted. This untagging must not result in an Untagged Frame of size less than 64 bytes.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

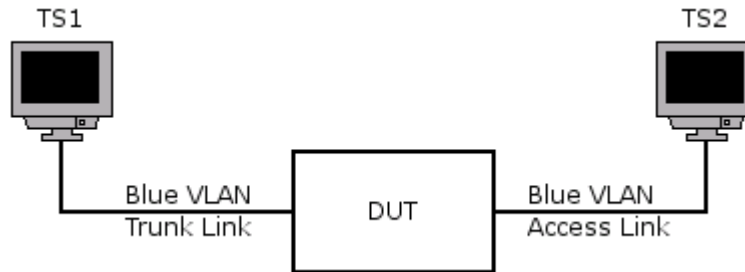


Figure 1

Procedure:

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit 64 byte Blue VLAN-Tagged Frames from Testing Station 1.
3. Repeat Steps 1 and 2 using 65-68 byte Blue VLAN-Tagged Frames.

Observable Results:

- Testing Station 2 should receive all frames transmitted from Testing Station 1. These frames should be 64 bytes in length.

Possible Problems:

- None.

Test VLAN.op.2.4 – Regenerating User Priority

Purpose: To verify that the device under test (DUT) correctly regenerates the User Priority of received frames.

References:

- IEEE 802.1Q 2003: sub-clause 8.5.1
- IEEE 802.1Q 2003: Table 8-1

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: The user priority of received frames must be regenerated using the User Priority Regeneration Table – Table 8.1. This regenerated user priority will be used to map the frames to an outgoing traffic class and access priority.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

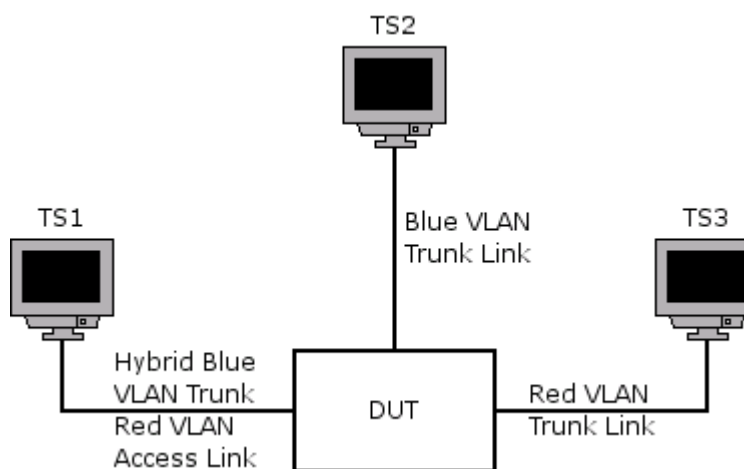


Figure 1

Procedure:

1. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
2. Transmit Blue VLAN-Tagged Frames from Testing Station 1 that contain a non-zero priority value.
3. Transmit Priority-Tagged Frames from Testing Station 1 that contain a non-zero priority value.

Observable Results:

- Testing Station 2 should receive all of the Blue VLAN-Tagged Frames being transmitted from Testing Station 1. The User Priority in these frames should be the same as the priority value that was transmitted.
- Testing Station 3 should receive all of the Priority-Tagged Frames being transmitted from Testing Station 1. The User Priority in these frames should be the same as the priority value that was transmitted.

Possible Problems:

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- If the DUT only supports an Acceptable Frame Types parameter of *Admit Only VLAN-Tagged Frames*, the Priority-Tagged Frames will be discarded by the DUT.

Test VLAN.op.2.5 – Bad FCS Received

Purpose: To verify that the device under test (DUT) correctly discards received frames that contain an invalid FCS.

References:

- IEEE 802.1Q 2003: sub-clause 8.5

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: A received frame that is in error shall be discarded upon reception.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

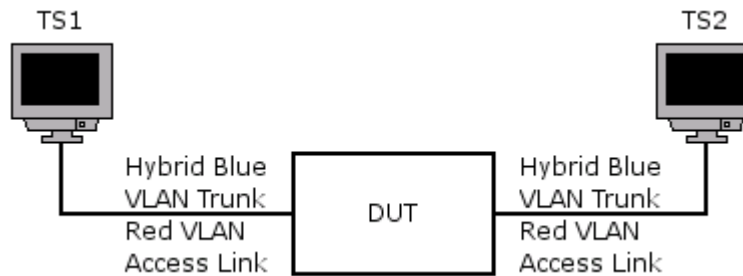


Figure 1

Procedure:

Part a: Tagged Frames

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit Blue VLAN-Tagged Frames from Testing Station 1. The FCS for the transmitted frames should be equal to the FCS for the equivalent Untagged Frame.
3. Repeat steps 1 and 2 using Priority-Tagged Frames.

Part b: Untagged Frames

4. Set Testing Station 2 to capture arbitrary MAC frames.
5. Transmit Untagged Frames from Testing Station 1. The FCS for the transmitted frames should be equal to the FCS for an equivalent Red VLAN-Tagged Frame.

Observable Results:

- For both parts a and b, Testing Station 2 should not receive any traffic.

Possible Problems:

- None.

Group 3: The Ingress Rules

Scope: These tests cover the various aspects associated with the Ingress Rules.

Overview: These tests are designed to verify that the device under test (DUT) correctly discards frames based on the Acceptable Frame Types parameter and the Enable Ingress Filtering parameter for a given Port. These tests also verify that the DUT properly classifies all incoming frames as belonging to a single VLAN for forwarding purposes.

Test VLAN.op.3.1 – Acceptable Frames Type Parameter Verification

Purpose: To verify that the device under test (DUT) properly implements the Acceptable Frames Types parameter.

References:

- IEEE 802.1Q 2003: sub-clauses 8.4.3 and 8.6.1
- IEEE 802.1Q 2003: Table 9-2

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: If the Acceptable Frame Types parameter has the value *Admit only VLAN-Tagged Frames* and the VID is the null VLAN ID for a given Port, then all Priority-Tagged and Untagged Frames that are passed to the Ingress Rules shall be discarded and not forwarded to any other Port or submitted to the Learning Process. If the Acceptable Frame Types parameter has the value *Admit All Frames* for a given Port, then no frames shall be discarded by the Ingress Rules based upon the Acceptable Frame Types parameter.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

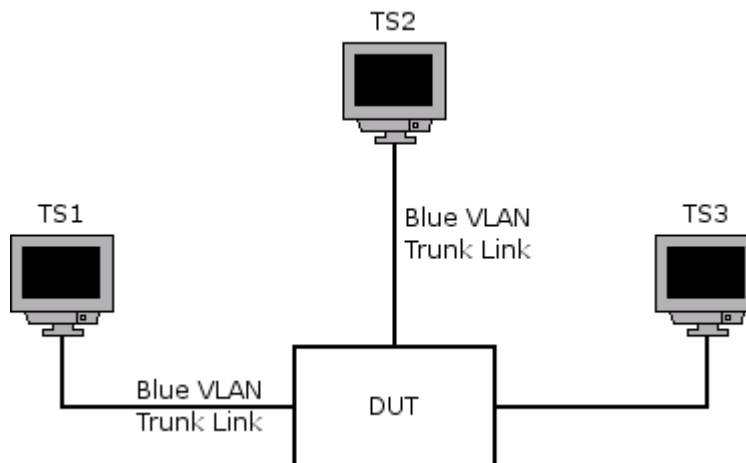


Figure 1

Procedure:

1. If possible, set the Acceptable Frame Types parameter for the Port on the DUT that is connected to Testing Station 1 to *Admit only VLAN-Tagged Frames*.
2. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
3. Transmit Untagged Frames from Testing Station 1.
4. Transmit Priority-Tagged Frames from Testing Station 1.
5. Transmit Blue VLAN-Tagged Frames from Testing Station 1.
6. If possible, set the Acceptable Frame Types parameter for the Port on the DUT that is connected to Testing Station 1 to *Admit All Frames*.
7. Repeat Steps 2 through 5.

Observable Results:

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- In Step 5, Testing Station 2 should only see the Blue VLAN-Tagged Frames that were transmitted from Testing Station 1. Testing Station 3 should see no traffic.
- In Step 7, Testing Station 2 should only see the Blue VLAN-Tagged Frames that were transmitted from Testing Station 1. Testing Station 3 should see all of the Priority-Tagged and Untagged Frames that were transmitted from Testing Station 1.

Possible Problems:

- If the DUT does not support an Acceptable Frames Type parameter of *Admit only VLAN-Tagged Frames* then this test cannot be completed.

Test VLAN.op.3.2 – VLAN Classification

Purpose: To verify that the device under test (DUT) associates all incoming frames that are passed to the Ingress Rules with exactly one VLAN.

References:

- IEEE 802.1Q 2003: sub-clauses 8.4.4, 8.6.1 and 8.9
- IEEE 802.1Q 2003: Table 9-2

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: Each frame received by a VLAN-aware Bridge shall be classified as belonging to exactly one VLAN by associating a VID value with the received frame. If the received frame is either a Priority-Tagged or Untagged Frame (i.e. a frame with no tag header, or a frame with a tag header that carries the null VLAN ID) and Port based classification is used, this classification is achieved by using the PVID value associated with the receiving Port. If the received frame is VLAN-Tagged, this classification is achieved by using the VID carried in the frame itself.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

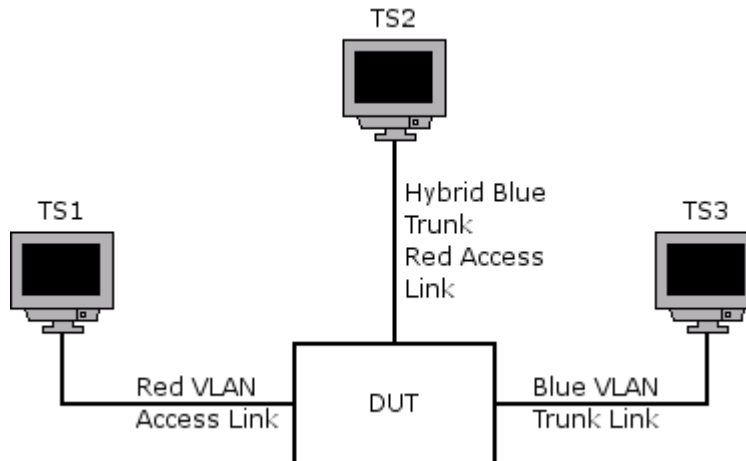


Figure 1

Procedure:

Part a: Classification Using the PVID

1. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
2. Transmit Untagged frames from Testing Station 1.

Part b: Classification Using the VID in the Received Frame

3. Set Testing Stations 1 and 3 to capture arbitrary MAC frames.
4. Transmit Blue VLAN-Tagged Frames from Testing Station 2.

Observable Results:

- In Part a, Testing Station 2 should receive all of the frames transmitted from Testing Station 1. These frames should be Untagged. Testing Station 3 should receive no traffic.

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- In Part b, Testing Station 3 should receive all of the frames transmitted from Testing Station 2. These frames should be Tagged for the Blue VLAN. Testing Station 1 should receive no traffic.

Possible Problems:

- None.

Test VLAN.op.3.3 – Ingress Filtering

Purpose: To verify that the device under test (DUT) properly filters frames based on the value of the Enable Ingress Filtering parameter.

References:

- IEEE 802.1Q 2003: sub-clauses 8.4.5, 8.6.1, and 8.10.9

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: If the Enable Ingress Filtering parameter is Set for a given Port then all frames received on that Port whose VLAN classification does not include that Port in its Member set shall be discarded. Otherwise, frames shall not be discarded on the basis of their VLAN classification.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

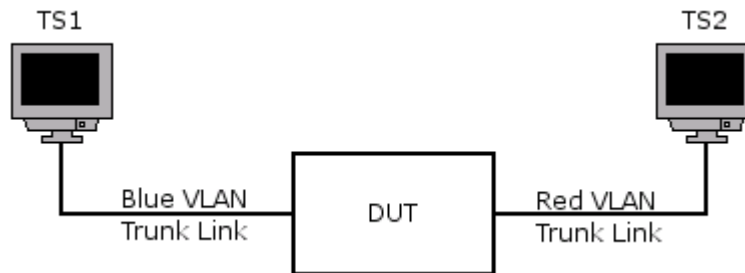


Figure 1

Procedure:

1. Verify that the Enable Ingress Filtering parameter is Reset on the Port of the DUT that is connected to Testing Station 1.
2. If possible, set the PVID of the Port on the DUT that is connected to Testing Station 1 to the VID associated with the Red VLAN.
3. Set Testing Station 2 to capture arbitrary MAC frames.
4. Transmit Untagged Frames from Testing Station 1.
5. Transmit Red VLAN-Tagged Frames from Testing Station 1.
6. If possible, set the Enable Ingress Filtering parameter for the Port on the DUT that is connected to Testing Station 1 to Set.
7. Repeat steps 3 through 5.

Observable Results:

- In Steps 3 through 5, Testing Station 2 should receive all of the Untagged and Red VLAN-Tagged Frames transmitted from Testing Station 1.
- In Step 7, Testing Station 2 should not receive any traffic.

Possible Problems:

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- If the DUT does not allow the PVID of a given Port to be set to the VID of a VLAN that does not include that Port in its Member Set, this test will not be completed.
- If the DUT does not support an Enable Ingress Filtering Parameter of Set, this test can't be completed.

Group 4: The Forwarding Process

Scope: These tests cover the various aspects of the Forwarding Process.

Overview: These tests are designed to verify that the device under test (DUT) forwards all received frames out all appropriate Ports and filters frames on all other Ports. If multiple traffic classes are supported by the DUT, then these tests verify that the mapping of user priority to traffic classes is implemented properly. This also tests that frames are queued and subsequently transmitted appropriately based on these traffic classes. Finally, these tests verify that the FCS is properly recalculated for all forwarded frames.

Test VLAN.op.4.1 – Enforcing Topology Restrictions

Purpose: To verify that the device under test (DUT) properly selects all potential transmission Ports and discards frames for all other Ports.

References:

- IEEE 802.1Q 2003: sub-clauses 8.6.2 and 8.6
- IEEE 802.1Q 2003: Figure 8-8
- IEEE 802.1D 2003: sub-clauses 8.4

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: When a frame is received on a Port of a Bridge it is passed to the Forwarding Process for transmission out other Ports of the Bridge. The Forwarding Process selects its potential transmission Ports using the following four restrictions:

1. The Port on which the frame was received was in a Forwarding State, and
2. The Port considered for transmission is in a Forwarding State, and
3. The Port considered for transmission is not the same as the Port on which the frame was received, and
4. The size of the mac_service_data_unit conveyed by the frame does not exceed the maximum size of mac_service_data_unit supported by the LAN to which the Port considered for transmission is attached.

For all other Ports on the Bridge the frame shall be discarded.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1. Ensure that all Ports on the DUT that are connected to Testing Stations are only in the Default VLAN and have the Default PVID. Enable Spanning Tree on the DUT and allow time for it to configure.

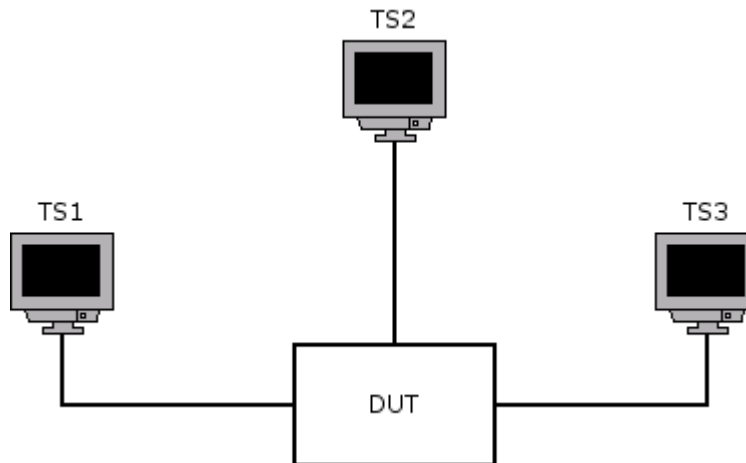


Figure 1

Procedure:

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Part a: Frames Received on a Non-Forwarding Port

1. Transmit Configuration BPDUs from Testing Station 1 containing a Root Identifier of higher priority than that of the DUT and a Root Path Cost of 0x0000000A.
2. Transmit Configuration BPDUs from Testing Station 2 containing the Root Identifier used by Testing Station 1 and a Root Path Cost of 0x00000005.
3. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
4. Transmit unicast, broadcast, and multicast frames from Testing Station 1.

Part b: Frames not Forwarded on a Non-Forwarding Port

5. Transmit Configuration BPDUs from Testing Station 2 containing a Root Identifier of higher priority than that of the DUT and a Root Path Cost of 0x0000000A.
6. Transmit Configuration BPDUs from Testing Station 1 containing a Root Identifier equal to that used by Testing Station 2 and a Root Path Cost of 0x00000005.
7. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
8. Transmit unicast, broadcast, and multicast frames from Testing Station 1.

Part c: Frames not Forwarded on Receiving Port

9. Set Testing Station 1 to capture arbitrary MAC frames.
10. Transmit unicast, broadcast, and multicast frames from Testing Station 1.

Observable Results:

- In Part a, Testing Stations 2 and 3 should not receive any traffic.
- In Part b, Testing Station 2 should not receive any traffic. Testing Station 3 should receive all of the unicast, broadcast, and multicast frames transmitted from Testing Station 1.
- In Part c, Testing Station 1 should not receive any traffic.

Possible Problems:

- If the DUT does not support Spanning Tree this test cannot be completed.

Test VLAN.op.4.2 – Filtering Frames

Purpose: To verify that the device under test (DUT) properly discards frames based on entries in the Filtering Database.

References:

- IEEE 802.1Q 2003: sub-clauses 8.6.2, 8.6.3, 8.10.6, and 8.10.8
- IEEE 802.1Q 2003: Tables 8-5, 8-6, and 8-7

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: When a frame is received on a Port of a Bridge it is passed to the Forwarding Process for transmission out other Ports of the Bridge. The Forwarding Process then selects all potential transmission Ports and makes filtering decisions based on:

1. The destination MAC address carried in the received frame;
2. The VID associated with the received frame;
3. The information contained in the Filtering Database for that MAC address and VID;
4. The default Group filtering behavior for the potential transmission Port.

For each potential transmission Port the frame shall be forwarded or discarded (i.e., filtered) on the basis of this information in accordance with the definition of the Filtering Database entry types.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1. Ensure that all Ports on the DUT that are connected to Testing Stations are only in the Default VLAN and have the Default PVID.

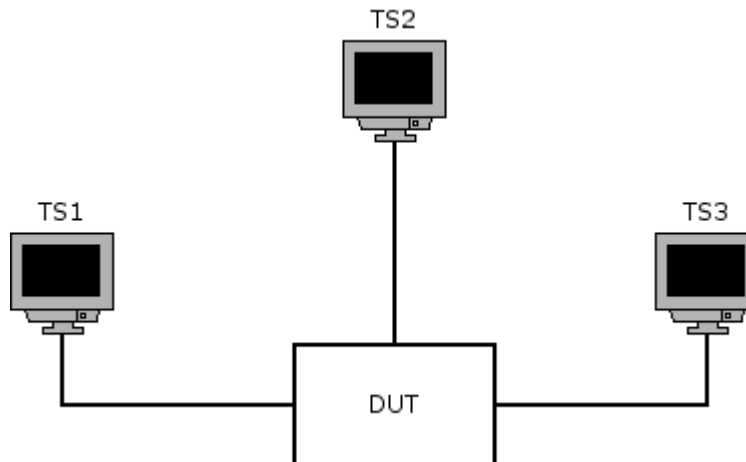


Figure 1

Procedure:

Part a: Frames Filtered by MAC Address

1. Transmit unicast frames from Testing Station 2 containing a source address of 22-22-22-22-22-22.
2. Transmit unicast frames from Testing Station 3 containing a source address of 44-44-44-44-44-44.
3. Set Testing Station 2 and 3 to capture arbitrary MAC frames.

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4. Transmit unicast frames from Testing Station 1 with the destination address alternating between 22-22-22-22-22-22 and 44-44-44-44-44-44.

Part b: Frames Filtered by VID

5. Add the Port on the DUT that is connected to Testing Station 2 as a Tagged member of the Blue VLAN.
6. Add the Port on the DUT that is connected to Testing Station 3 as a Tagged member of the Red VLAN.
7. Add the Port on the DUT that is connected to Testing Station 1 as a Tagged member of both the Blue and Red VLANs.
8. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
9. Transmit VLAN-Tagged frames from Testing Station 1 alternating between the VIDs for the Blue and Red VLANs.

Observable Results:

- In Part a, Testing Station 2 should receive all of the frames with the 22-22-22-22-22-22 destination address but no others. Testing Station 3 should receive all of the frames with the 44-44-44-44-44-44 destination address but no others.
- In Part b, Testing Station 2 should receive all of the Blue VLAN-Tagged frames but no others. Testing Station 3 should receive all of the Red VLAN-Tagged frames but no others.

Possible Problems:

- None.

Test VLAN.op.4.3 – Transmitting Frames

Purpose: To verify that the device under test (DUT) properly queues frames and subsequently selects them for transmission based on the received user priority.

References:

- IEEE 802.1Q 2003: sub-clauses 8.6.5, 8.6.6, and 8.6.7
- IEEE 802.1Q 2003: Tables 8-2 and 8-3
- IEEE 802.1D 2003: Annex H.2

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: The Forwarding Process provides storage for queued frames while waiting for an opportunity to transmit them. The order of frames received on a given Bridge Port shall be preserved for:

1. Unicast frames with a given user-priority for a given combination of destination_address and source_address;
2. Group-addressed frames with a given user_priority for a given destination_address.

The Forwarding Process may provide more than one transmission queue for a given Bridge Port. Frames are assigned to a transmission queue based on their priority using a traffic class table that is part of the state information for each Port. Frames are selected for transmission from these queues using the following algorithm:

1. For each Port, frames are selected for transmission on the basis of the traffic classes that the Port supports. For a given supported value of traffic class, frames are selected from the corresponding queue for transmission only if all queues corresponding to numerically higher values of traffic class supported by the Port are empty at the time of selection;
2. For a given queue, the order in which frames are selected for transmission shall maintain the ordering requirement specified in 8.6.5.

User Priority must then be mapped to outbound access priority as well but 802.3 doesn't have any priority support so all user priority values map to access priority 0.

Test Setup: Connect nine Testing Stations to the DUT. The Ports on the DUT that are connected to the first eight Testing Stations should be configured as Hybrid Red Access Blue Trunk Links. The Port on the DUT that is connected to the ninth Testing Station should be configured as a Red and Blue VLAN Trunk Link.

Procedure:

1. Transmit Blue VLAN-Tagged Frames from Testing Station 1 containing a user-priority of 0 continuously at line rate.
2. Transmit Blue VLAN-Tagged Frames from Testing Station 2 containing a user-priority of 1 continuously at line rate.
3. Transmit Blue VLAN-Tagged Frames from Testing Station 3 containing a user-priority of 2 continuously at line rate.
4. Transmit Blue VLAN-Tagged Frames from Testing Station 4 containing a user-priority of 3 continuously at line rate.

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5. Transmit Blue VLAN-Tagged Frames from Testing Station 5 containing a user-priority of 4 continuously at line rate.
6. Transmit Blue VLAN-Tagged Frames from Testing Station 6 containing a user-priority of 5 continuously at line rate.
7. Transmit Blue VLAN-Tagged Frames from Testing Station 7 containing a user-priority of 6 continuously at line rate.
8. Transmit Blue VLAN-Tagged Frames from Testing Station 8 containing a user-priority of 7 continuously at line rate.
9. Set Testing Station 9 to capture arbitrary MAC frames.
10. Record all frames captured by Testing Station 9.
11. Repeat steps 1-10 using Priority-Tagged Frames in place of the Blue VLAN-Tagged Frames.

Observable Results:

- If the captured frames all contain a user priority of 7, the device supports 7 or 8 traffic classes.
- If the captured frames all contain a user priority evenly distributed between 6 and 7, the device supports 3, 4, 5 or 6 traffic classes.
- If the captured frames all contain a user priority evenly distributed between 4, 5, 6, and 7, the device supports 2 traffic classes.
- If the captured frames all contain a user priority evenly distributed between all valid priorities, the device supports 1 traffic class.

Possible Problems:

- None.

Test VLAN.op.4.4 – Recalculating FCS

Purpose: To verify that the device under test (DUT) correctly recalculates the FCS for Frames that it tags and untags.

References:

- IEEE P802.1Q/D11, July 30, 2003: sub-clause 9.1

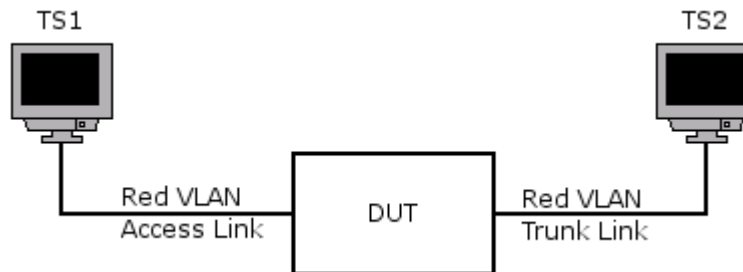
Resource Requirements:

- A Testing Station capable of transmitting VLAN-Tagged Frames.
- A Monitor capable of capturing Untagged Frames.

Last Modification: March 9, 1999

Discussion: If a Tagged Frame is received by a VLAN-aware device and the transmitting Port is in the Untagged Member set of the target VLAN, the Frame is required to be untagged before being forwarded. After untagging, the FCS must be recalculated as specified in sub-clause 9.1.

Test Setup: Connect the Testing Station to a Trunk Port for VLAN Red on the DUT. Connect the Monitor to an Access Port for VLAN Red on the DUT.



Procedure:

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit Untagged Frames from Testing Station 1.
3. Set Testing Station 1 to capture arbitrary MAC frames.
4. Transmit Red VLAN-Tagged Frames from Testing Station 2.

Observable results:

- On the Testing Stations, verify that the DUT has correctly recalculated the FCS for the Frames that it has tagged and untagged.

Possible Problems:

- None.

Group 5: The Egress Rules

Scope: These tests cover the various aspects of the Egress Rules.

Overview: These tests are designed to verify that the device under test (DUT) discards frames on egress if, for the frame's VID, as determined by the ingress rules, the transmission Port is not present in the Member set. These tests also verify that frames are transmitted appropriately based on the include_tag parameter.

Test VLAN.op.5.1 – Frames Discarded Based on Member Set

Purpose: To verify that the device under test (DUT) properly discards, on all potential transmission Ports, frames whose VLAN classification does not include that Port in its Member set.

References:

- IEEE 802.1Q 2003: sub-clauses 8.6.1, 8.6.4, 8.10.9

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: When a frame is received by the Forwarding Process a potential set of transmission Ports is selected from amongst those Ports currently in the active topology. The egress rules are used to determine whether or not the frame is eligible to be forwarded on a given Port on the basis of that frame's VLAN Classification. If the potential transmission Port is not in the Member set associated with the frame's VLAN classification, the frame shall be discarded on the Port.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

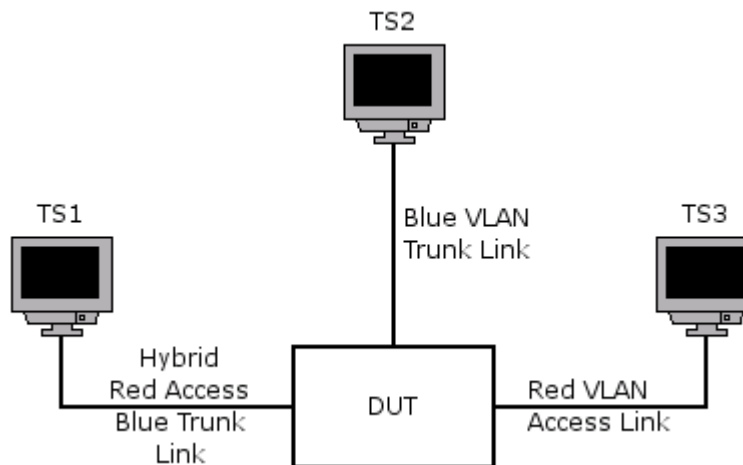


Figure 1

Procedure:

Part a: Frames Filtered Using Untagged Set

1. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
2. Transmit Blue VLAN-Tagged Frames from Testing Station 1.

Part b: Frames Filtered Using Member Set

3. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
4. Transmit Untagged Frames from Testing Station 1.

Observable Results:

- In Part a, Testing Station 2 should receive all frames being transmitted by Testing Station 1. Testing Station 3 should not receive any traffic.

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- In Part b, Testing Station 2 should not receive any traffic. Testing Station 3 should receive all of the frames being transmitted by Testing Station 1.

Possible Problems:

- None.

Test VLAN.op.5.2 – No Leakage Between VLANs

Purpose: To verify that the device under test (DUT) does not allow frames to leak into the incorrect VLAN while the network load is high.

References:

- IEEE 802.1Q 2003: sub-clauses 8.6.1, 8.6, 8.6.4

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: Frames that are received on a Port of a Bridge receive a VLAN classification on Ingress and, if they are not discarded by the Ingress Rules, are passed to the Forwarding Process and the Learning Process. The Forwarding Process is then responsible for making forwarding or filtering decisions based in part on the VLAN classification of the frame using the Egress Rules. All frames that are not filtered are then stored in queues until such a time that the frames can be submitted to the individual MAC entities for transmission. If frames are received at a faster rate than they can be forwarded these queues will eventually overflow. When this occurs there should not be any leakage of frames destined for one VLAN into another VLAN.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

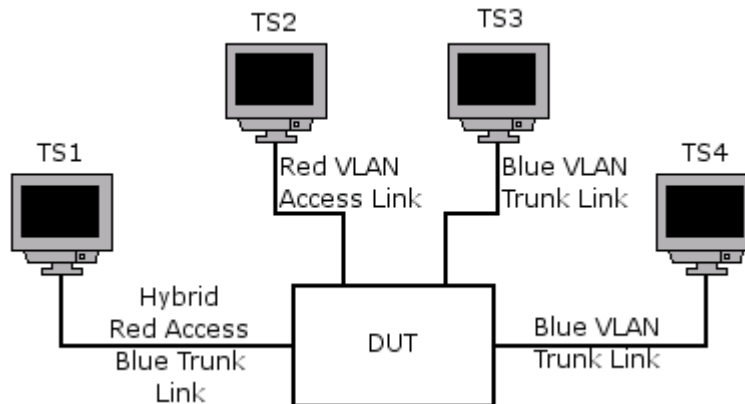


Figure 1

Procedure:

1. Set Testing Stations 1 and 2 to capture arbitrary MAC frames.
2. Transmit Blue VLAN-Tagged Frames from Testing Stations 3 and 4 at line rate.

Observable Results:

- Testing Station 1 should receive Blue VLAN-Tagged Frames from Testing Stations 3 and 4. Testing Station 2 should not see any traffic from Testing Stations 3 and 4.

Possible Problems:

- None.

Test VLAN.op.5.3 – include_tag Parameter Correct

Purpose: To verify that the device under test (DUT) properly determines the include_tag parameter for all frames that it forwards.

References:

- IEEE 802.1Q 2003: sub-clauses 8.6.1, 8.6, 8.10.9

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: When a frame is forwarded out a Port of a Bridge, it must be forwarded in either a VLAN-Tagged or an Untagged format. The Egress Rules are responsible for determining the appropriate format based on the Untagged Set associated with the VID of the frame. If the transmission Port is a member of the Untagged Set for that VID then the frame is forwarded Untagged, otherwise the frame is forwarded VLAN-Tagged. Note that this method does not allow a device to forward any Priority-Tagged Frames.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

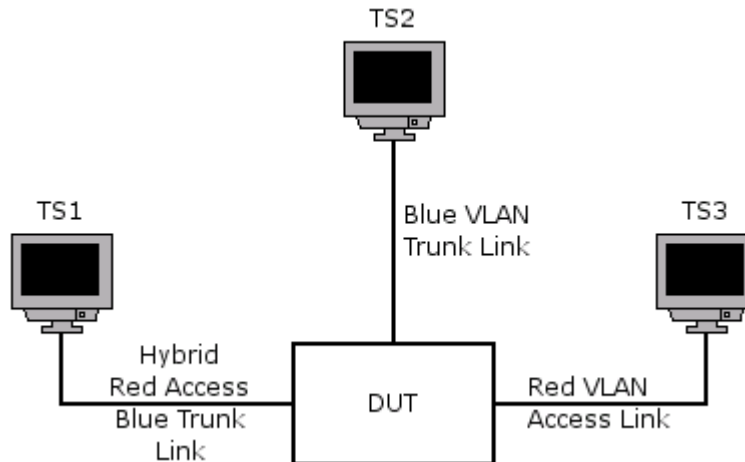


Figure 1

Procedure:

1. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
2. Transmit Blue VLAN-Tagged Frames from Testing Station 1.
3. Transmit Untagged Frames from Testing Station 1.
4. Transmit Priority-Tagged Frames from Testing Station 1.

Observable Results:

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- Testing Station 2 should receive all of the Blue VLAN-Tagged Frames being transmitted by Testing Station 1. Testing Station 3 should receive all of the Untagged and Priority-Tagged Frames being transmitted by Testing Station 1.
- The frames captured by Testing Station 2 should be Blue VLAN-Tagged Frames.
- The frames captured by Testing Station 3 should be Untagged Frames.

Possible Problems:

- None.

Group 6: Learning Constraints

Scope: These tests cover the various aspects of Learning Constraints.

Overview: These tests are designed to determine whether the device under test (DUT) is an SVL Bridge or an IVL Bridge. If management operations are supported these tests verify that the DUT detects Learning Constraint Inconsistencies properly as Learning Constraints are configured through management.

Test VLAN.op.6.1 – SVL vs. IVL Learning

Purpose: To determine if the device under test (DUT) is a Shared VLAN Learning (SVL), an Independent VLAN Learning (IVL), or an SVL/IVL bridge.

References:

- IEEE 802.1Q 2003: sub-clause 3.9, 3.27, 3.28, 8.10.7

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: In an SVL Bridge a single Filtering Identifier (FID) is supported and all VIDs are mapped to that FID. In an IVL Bridge multiple FIDs are supported and only one VID can be mapped to each FID. In an SVL/IVL Bridge multiple FIDs are supported with the ability to map multiple VIDs to each FID. In an SVL/IVL Bridge it is necessary to provide a set of VLAN Learning Constraints that are used to determine whether a given pair of VLANs is using SVL or IVL. Shared Learning Constraints (S Constraints) assert that Shared VLAN Learning shall occur between a pair of identified VLANs and are of the form {A S B}, where A and B are the VIDs. An S Constraint is interpreted as meaning that Shared VLAN Learning shall occur between the VLANs identified by the pair of VIDs. Independent Learning Constraints (I Constraints) assert that a given VLAN is a member of a set of VLANs amongst which Independent VLAN Learning shall occur and take the form {A I N}, where A is a VID and N is an Independent Set Identifier. An I Constraint is interpreted as meaning that Independent VLAN Learning shall occur among the set of VLANs comprising VLAN A and all other VLANs identified in I Constraints that carry the same Independent Set Identifier, N. A given VID may appear in any number (including zero) of S Constraints and/or I Constraints.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

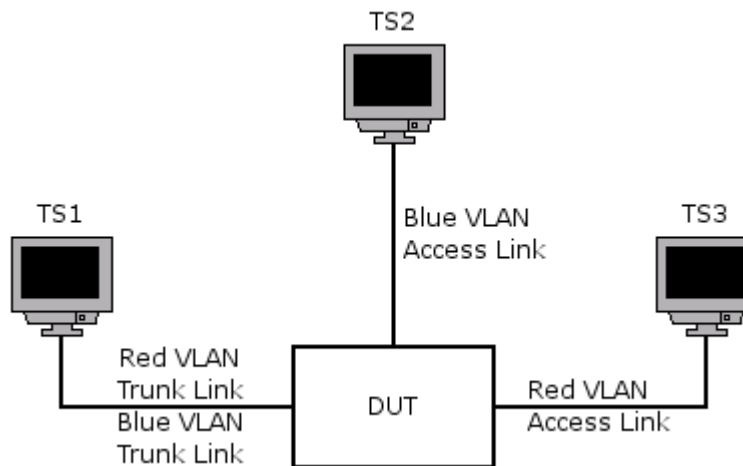


Figure 1

Procedure:

Part a: Shared VLAN Learning

1. If the DUT allows VLAN Learning Constraints to be configured through management, create an S Constraint for the Red and Blue VLANs.
2. Transmit unicast Untagged Frames containing a source address of 0x222222222222 from Testing Station 2.
3. Transmit unicast Untagged Frames containing a source address of 0x222222222222 from Testing Station 3.

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4. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
5. Transmit unicast, Blue VLAN-Tagged Frames containing a destination address of 0x222222222222 from Testing Station 1.
6. Transmit unicast, Red VLAN-Tagged Frames containing a destination address of 0x222222222222 from Testing Station 1.

Part b: Independent VLAN Learning

7. If the DUT allows VLAN Learning Constraints to be configured through management, create an I Constraint for the Red and Blue VLANs.
8. Transmit unicast Untagged Frames containing a source address of 0x444444444444 from Testing Station 2.
9. Transmit unicast Untagged Frames containing a source address of 0x444444444444 from Testing Station 3.
10. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
11. Transmit unicast, Blue VLAN-Tagged Frames containing a destination address of 0x444444444444 from Testing Station 1.
12. Transmit unicast, Red VLAN-Tagged Frames containing a destination address of 0x444444444444 from Testing Station 1.

Observable Results:

- In Part a, Testing Station 2 should not receive any traffic. Testing Station 3 should receive all of the Red VLAN-Tagged frames being transmitted by Testing Station 1.
- In Part b, Testing Station 2 should receive all of the Blue VLAN-Tagged frames being transmitted by Testing Station 1. Testing Station 3 should receive all of the Red VLAN-Tagged frames being transmitted by Testing Station 1.
- If the DUT passed Part a, it is an SVL Bridge.
- If the DUT passed Part b, it is an IVL Bridge.
- If the DUT passed both Parts a and b, it is an SVL/IVL Bridge.

Parameters:

According to the Observable Results above, check the appropriate answer below.
The DUT is an:

SVL Bridge

IVL Bridge

SVL/IVL Bridge

Possible Problems:

- None.

Test VLAN.op.6.2 – Shared Learning Constraints

Purpose: To determine if the device under test (DUT) properly implements Shared Learning Constraints.

References:

- IEEE 802.1Q 2003: sub-clause 8.10.7.2

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: In an SVL/IVL Bridge, the learning of MAC addresses is controlled by using Learning Constraints. There are two types of Learning Constraints, Shared Learning Constraints (or S Constraint) and Independent Learning Constraints (or I Constraints). An S Constraint takes the form {A S B}, where A and B are VLANs. An S Constraint is interpreted as meaning that Shared VLAN Learning shall occur between the VLANs identified by the pair of VLANs. An I Constraint takes the form {A I N}, where A is a VLAN and N is an Independent Set Identifier. An I Constraint is interpreted as meaning that Independent VLAN Learning shall occur among the set of VLANs comprising VLAN A and all other VLANs identified in I Constraints that carry the same Independent Set Identifier, N. A given VLAN may appear in any number (including zero) of S Constraints and/or I Constraints.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

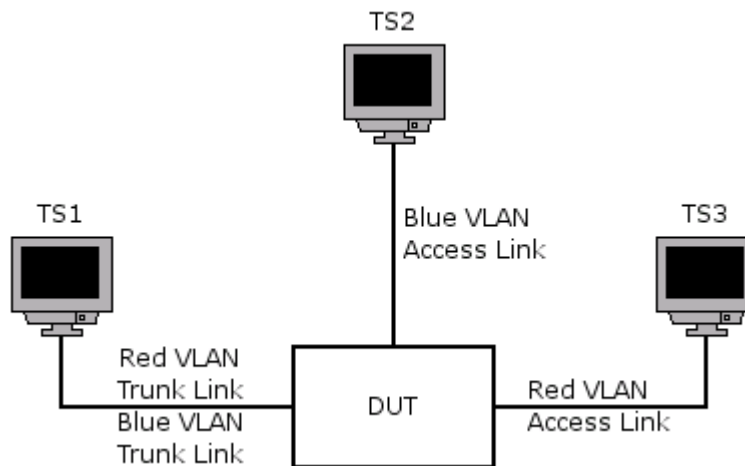


Figure 1

Procedure:

1. If the DUT allows VLAN Learning Constraints to be configured through management, create an S Constraint for the Blue and Green VLANs and for the Red and Green VLANs.
2. Transmit unicast Untagged Frames containing a source address of 0x222222222222 from Testing Station 2.
3. Transmit unicast Untagged Frames containing a source address of 0x222222222222 from Testing Station 3.
4. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
5. Transmit unicast, Blue VLAN-Tagged Frames containing a destination address of 0x222222222222 from Testing Station 1.
6. Transmit unicast, Red VLAN-Tagged Frames containing a destination address of 0x222222222222 from Testing Station 1.

Observable Results:

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- Testing Station 2 should not receive any traffic. Testing Station 3 should receive all of the Red VLAN-Tagged frames being transmitted by Testing Station 1.

Possible Problems:

- None.

Test VLAN.op.6.3 – Independent Learning Constraints

Purpose: To determine if the device under test (DUT) properly implements Independent Learning Constraints.

References:

- IEEE 802.1Q 2003: sub-clause 8.10.7.2

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: In an SVL/IVL Bridge, the learning of MAC addresses is controlled by using Learning Constraints. There are two types of Learning Constraints, Shared Learning Constraints (or S Constraint) and Independent Learning Constraints (or I Constraints). An S Constraint takes the form {A S B}, where A and B are VLANs. An S Constraint is interpreted as meaning that Shared VLAN Learning shall occur between the VLANs identified by the pair of VLANs. An I Constraint takes the form {A I N}, where A is a VLAN and N is an Independent Set Identifier. An I Constraint is interpreted as meaning that Independent VLAN Learning shall occur among the set of VLANs comprising VLAN A and all other VLANs identified in I Constraints that carry the same Independent Set Identifier, N. A given VLAN may appear in any number (including zero) of S Constraints and/or I Constraints.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1.

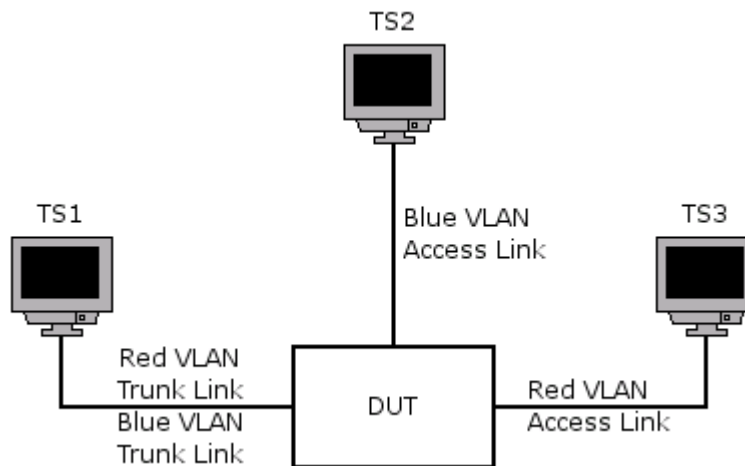


Figure 1

Procedure:

1. If the DUT allows VLAN Learning Constraints to be configured through management, create an I Constraint for the Red and Blue VLANs.
2. Transmit unicast Untagged Frames containing a source address of 0x222222222222 from Testing Station 2.
3. Transmit unicast Untagged Frames containing a source address of 0x222222222222 from Testing Station 3.
4. Set Testing Stations 2 and 3 to capture arbitrary MAC frames.
5. Transmit unicast, Blue VLAN-Tagged Frames containing a destination address of 0x222222222222 from Testing Station 1.
6. Transmit unicast, Red VLAN-Tagged Frames containing a destination address of 0x222222222222 from Testing Station 1.

Observable Results:

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- Testing Station 2 should receive all of the Blue VLAN-Tagged Frames being transmitted by Testing Station 1.
Testing Station 3 should receive all of the Red VLAN-Tagged frames being transmitted by Testing Station 1.

Possible Problems:

- None.

Test VLAN.op.6.4 – Learning Constraint Inconsistencies and Violations

Purpose: To determine if the device under test (DUT) properly reports Learning Constraint inconsistencies and violations.

References:

- IEEE 802.1Q 2003: sub-clause 8.10.7.2, 8.10.7.3, 12.10.3.10

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: February 15, 2008

Discussion: In an SVL/IVL Bridge, the learning of MAC addresses is controlled by using Learning Constraints. There are two types of Learning Constraints, Shared Learning Constraints (or S Constraint) and Independent Learning Constraints (or I Constraints). An S Constraint takes the form {A S B}, where A and B are VIDs. An S Constraint is interpreted as meaning that Shared VLAN Learning shall occur between the VLANs identified by the pair of VIDs. An I Constraint takes the form {A I N}, where A is a VID and N is an Independent Set Identifier. An I Constraint is interpreted as meaning that Independent VLAN Learning shall occur among the set of VLANs comprising VLAN A and all other VLANs identified in I Constraints that carry the same Independent Set Identifier, N. A given VID may appear in any number (including zero) of S Constraints and/or I Constraints. Learning Constraint inconsistencies and/or violations may occur when management attempts to create new Learning Constraints or modify the fixed VID to FID allocations. On detection of a violation, the Bridge shall issue a Notify Learning Constraint Violation management notification, for each inconsistency or violation detected, in order to alert any management stations to the existence of the violation.

Procedure:

1. Create an S Constraint for the Red and Blue VLANs.
2. Create an I Constraint of the form {Red I 1}.
3. Attempt to create an I Constraint of the form {Blue I 1}.
4. Remove all of the constraints created above.
5. Create I Constraints of the form {Red I 1}, {Blue I 1}, {Blue I 2}, and {Green I 2}.
6. Attempt to create an S Constraint of the form {Red S Green}.
7. Remove all of the constraints created above.
8. Attempt to create an S Constraint of the form {A S A}.

Observable Results:

- In Step 3, the Constraint configuration should not be permitted.
- In Steps 6 and 8, the Constraint configuration should be permitted.

Possible Problems:

- None.