Ethernet Switching Protocols

Jumbo Frames
Conformance Test Suite

Version 1.0

Last Updated: January 29, 2018

Ethernet Switching Protocols
UNH InterOperability Laboratory

Improving networks worldwide.

21 Madbury Rd Suite 100
Durham, NH 03824
Phone: +1-603-862-0090
Fax: +1-603-862-4181
www.iol.unh.edu

Contents

Modification Record

Version	Date	Editor(s)	Comments
0.1	2005-09-05	Curtis Knittle Curtis Simonson	Initial Draft
0.2	2006-09-26	Chester Balut Curtis Simonson	Industry Reviewed Test Suite
1.0	2018-01-29	Patrick Lee Alaeric Schuster Maxwell Renke Tim Sheehan Jimmy Trinh Johnson Trinh Ben Jarman Alex Saveliev	Re-Structured Test Suite Created New Tests Appended Old Tests Created New Sections

Introduction

The University of New Hampshire's InterOperability Laboratory (UNH-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 Jumbo Frame capable products.

This test suite has been designed based on the set of common accepted practices that pertain to Jumbo Frames. The test suite is designed to help determine whether or not the DUT will behave in accordance with the industry standard practice during normal operation.

These tests are not designed as performance tests. The relative performance of Jumbo Frame capable devices (e.g. forwarding rate, throughput latency, etc.) is beyond the scope of this document. These tests examine the DUT's Jumbo Frame functionality at ideal physical layer conditions.

Abbreviations and Acronyms

IEEE 802.1

FCS	Frame Check Sequence(a.k.a Cyclic Redundancy Check)
ID	Identifier
LAN	Local Area Network
MAC	Media Access Control
MTU	Maximum Transmission Unit
PVID	Port VID
STP	Spanning Tree Protocol
VID	VLAN Identifier
VLAN	Virtual LAN

Jumbo Frames Conformance Test Suite

DUT	Device Under Test
DUT.TS	Port on the DUT connected to Test Station (ex.DUT.TS1 refers to the Port on the DUT connected to Test Station 1)
TS	Test Station (ex. TS1 refers to Test Station 1)

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 label FDB.op.1.2 refers to the second test of the first group in the Filtering Database Conformance Test Suite.

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

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

Resource Requirements: The Resource Requirements section specifies the software, hardware, and test equipment that will be needed to perform the test.

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

Test Setup: The Default Test Setup section describes the configuration of the DUT prior to the start of the test. The procedure may involve configuration steps that deviate from what is given in the test setup. If a value is not provided for a protocol parameter, then the protocol's default is used for that parameter.

Test 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 may also cues instruct 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.

Group 1: Basic Jumbo Frames

Scope: To verify that the DUT properly processes untagged Jumbo Frames and determine the maximum frame size supported by the DUT.

Test Jumbo.op.1.1 — Jumbo Maximum Untagged Frame Size

Purpose: To determine the maximum untagged frame size supported by the DUT.

References: [1] IEEE Std. 802.3-2012 [2] IEEE Std. 802.1Q-2011

Resource Requirements: 2 Test Stations capable of transmitting and receiving arbitrary MAC frames.

Discussion: Ethernet devices claiming ”Jumbo Frames” capabilities indicate support for data payloads greater than 1500 bytes (i.e. MTUs greater than 1518 bytes untagged and 1522 bytes tagged). This Test verifies the maximum data payload and MTU supported by the DUT. This Test also examines the DUT’s learning behavior for Jumbo Frames.

Test Setup: Refer to the Default Test Setup in Appendix A.

Test Procedure:

Part A: Informational: Determine Maximum Untagged Frame Size

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS1, continuously transmit untagged Jumbo Frames with a frame size starting at 1518 and incrementing by 1 until reaching a frame size of 12000.
3. Wait 2 seconds.

Part B: Verify Maximum Untagged Frame Size

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS1, continuously transmit untagged Jumbo Frames with a frame size starting at 1518 and incrementing by 1 until reaching the maximum frame size received in Part A.
3. Wait 2 seconds.

Observable Results:

Part A:

- In step 3, record the highest received untagged frame size.

Part B:

- In step 3, TS2 must capture all of the frames transmitted by TS1.

Possible Problems: None.

Test Jumbo.op.1.2 — Learning Based on Source MAC Address

Purpose: To verify, through Jumbo Frames, that the DUT learns source MAC addresses when they denote a specific end station.

References: [1] IEEE Std. 802.3-2012 [2] IEEE Std. 802.1Q-2011

Resource Requirements: 3 Test Stations capable of transmitting and receiving arbitrary MAC frames.

Discussion: When a frame is received on a port and is not discarded by the ingress rules, that frame is passed to the Learning Process. The Learning Process creates a Dynamic Filtering Entry associated with the frame's VID in the Filtering Database if, and only if, each of the following is true:

- The port on which the frame was received is in a state that allows learning.
- The source MAC address in the frame denotes a specific end station.
- The resulting number of entries would not exceed the capacity of the Filtering Database.
- The Member set for the frame's VID includes at least one port.

This Dynamic Filtering Entry associates the reception port with the source MAC address for use in future forwarding/filtering decisions.

In order for a Bridge to properly function in a Jumbo Frame-enabled network, it must at least support Jumbo Frame forwarding, Jumbo Frame learning, tagged Jumbo Frame forwarding and tagged Jumbo Frame learning.

This group of tests verify the extent of the DUT's Jumbo Frame functionality, including and beyond that of basic Jumbo Frame forwarding.

Test Setup: Refer to the Default Test Setup in Appendix A.

Test Procedure:

Part A: Basic Learning of a Source MAC Address

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS2, transmit 10 Jumbo_Src22 frames.
3. From TS1, transmit 10 Jumbo_Dest22 frames.
4. Wait 2 seconds.

Part B: Learning of Multiple Addresses on Separate Ports

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS2, transmit 10 Jumbo_Src22 frames.
3. From TS3, transmit 10 Jumbo_Src33 frames.
4. From TS1, transmit 10 Jumbo_Dest33 frames.
5. Wait 2 seconds.

Part C: Overwriting an Address on One Port - DUT Does Not Keep Old Address

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS2, transmit 10 Jumbo_Src22 frames.
3. From TS2, transmit 10 Jumbo_Src33 frames.
4. From TS1, transmit 10 Jumbo_Dest22 frames.

Part D: Overwriting an Address on One Port - DUT Learns New Address

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS2, transmit 10 Jumbo_Src22 frames.
3. From TS2, transmit 10 Jumbo_Src33 frames.
4. From TS1, transmit 10 Jumbo_Dest33 frames.

Observable Results:

Part A:

- In step 4, TS2 must receive all of the frames transmitted by TS1.
- In step 4, TS3 must not receive any of the frames transmitted by TS1.

Part B:

- In step 5, TS3 must receive all of the frames transmitted by TS1.
- In step 5, TS2 must not receive any of the frames tranmitted by TS1.

Part C:

- In step 4, TS2 must receive all of the frames transmitted by TS1.
- In step 4, TS3 must receive all of the frames transmitted by TS1.

Part D:

- In step 4, TS2 must capture all of the frames transmitted by TS1.
- In step 4, TS3 must not capture any of the frames transmitted by TS1.

Possible Problems: None.

Group 2: Basic Tagged Jumbo Frames

Scope: To verify the extent of the DUT's Jumbo Frame functionality.

Test Jumbo.op.2.1 — Jumbo Maximum Tagged Frame Size

Purpose: To verify that the DUT processes all tagged Jumbo Frames up to the maximum frame size supported by the DUT.

References: [1] IEEE Std. 802.3-2012 [2] IEEE Std. 802.1Q-2011

Resource Requirements: 2 Test Stations capable of transmitting and receiving arbitrary MAC frames.

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 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: Refer to the default test setup in Appendix A.
Set DUT.TS1's PVID to 10.
Set DUT.TS1 to be part of the untagged member set of VLAN 10.
Set DUT.TS2 to be part of the tagged member set of VLAN 10.

Test Procedure:

Part A: Informational: Determine Maximum Tagged Frame Size

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS1, continuously transmit VID 10 Tagged Jumbo Frames with a frame size starting at 1523 and incrementing by 1 until reaching a frame size of 12000.
3. Wait 2 seconds.

Part B: Verify Maximum Tagged Frame Size

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS1, continuously transmit VID 10 Tagged Jumbo Frames with a frame size starting at 1523 and incrementing by 1 until reaching the maximum tagged frame size received in Part A.
3. Wait 2 seconds.

Observable Results:

Part A:

- In step 3, record the highest received tagged frame size.

Part B:

- In step 3, TS2 must capture all of the frames transmitted by TS1.

Possible Problems: None.

Test Jumbo.op.2.2 — Learning Based on Source MAC Address Through VLANs

Purpose: To verify, through Jumbo Frames, that the DUT properly forwards traffic over VLANs.

References: [1] IEEE Std. 802.3-2012 [2] IEEE Std. 802.1Q-2011

Resource Requirements: 4 Test Stations capable of transmitting and receiving arbitrary MAC frames.

Discussion: When a frame is received on a port and is not discarded by the ingress rules, that frame is passed to the Learning Process. The Learning Process creates a Dynamic Filtering Entry associated with the frame's VID in the Filtering Database if, and only if, each of the following is true:

- The port on which the frame was received is in a state that allows learning.
- The source MAC address in the frame denotes a specific end station.
- The resulting number of entries would not exceed the capacity of the Filtering Database.
- The Member set for the frame's VID includes at least one port.

This Dynamic Filtering Entry associates the reception port with the source MAC address for use in future forwarding/filtering decisions. In order for a Bridge to properly function in a Jumbo Frame-enabled network, it must at least support Jumbo Frame forwarding, Jumbo Frame learning, tagged Jumbo Frame forwarding and tagged Jumbo Frame learning.

This group of tests verify the extent of the DUT's Jumbo Frame functionality, including and beyond that of basic Jumbo Frame forwarding.

This group of tests will also verify tagged and untagged configurations and frames being used in testing.

Test Setup: Refer to the default test setup in Appendix A.
Set DUT.TS1's PVID to 10.
Set DUT.TS1 to be part of the untagged member set of VLAN 10.
Set DUT.TS2 to be part of the tagged member set of VLAN 10.
Set DUT.TS3 to be part of the tagged member set of VLAN 10.
Set DUT.TS3 to be part of the tagged member set of VLAN 1.

Test Procedure:

Part A: Verify Tagged and Untagged Traffic

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS1, transmit 10 Jumbo_Src11 frames.
3. From TS4, transmit 10 Jumbo_Dest11_Tag10 frames.
4. Wait 2 seconds.

Part B: Verify Tagged Traffic on a VLAN

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS2, transmit 10 Jumbo_Src22_Tag10 frames.
3. From TS4, transmit 10 Jumbo_Dest22_Tag10 frames.
4. Wait 2 seconds.

Part C: Verify Tagged Traffic on the Default VLAN

1. Ensure that the DUT is configured to the test setup as defined above.
2. From TS3, transmit 10 Jumbo_Src33_Tag1 frames.
3. From TS4, transmit 10 Jumbo_Dest33_Tag1 frames.
4. Wait 2 seconds.

Observable Results:

Part A:

- In step 4, TS1 must receive all of the frames transmitted by TS4.
- In step 4, TS2 must not receive any of the frames transmitted by TS4.
- In step 4, TS3 must not receive any of the frames transmitted by TS4.

Part B:

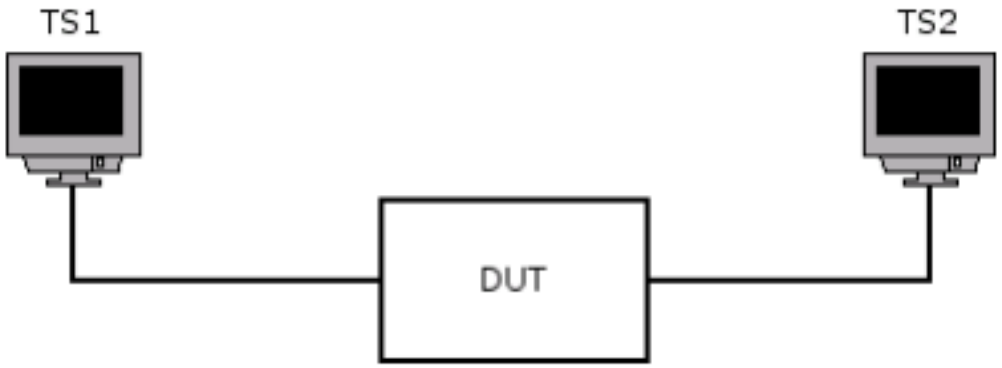
- In step 4, TS2 must receive all of the frames transmitted by TS4.
- In step 4, TS1 must not receive any of the frames transmitted by TS4.
- In step 4, TS3 must not receive any of the frames transmitted by TS4.

Part C:

- In step 4, TS3 must receive all of the frames transmitted by TS4.
- In step 4, TS1 must not receive any of the frames transmitted by TS4.
- In step 4, TS2 must not receive any of the frames transmitted by TS4.

Possible Problems: None.

Appendix A: Default Test Setup



Default Settings: DUT

- Port Admin Status: Enabled (all ports)
- Ageing Time = 300 seconds
- Bridge Spanning Tree Admin Status: Disabled
- All ports PVID = 1
- All ports must be a member of the Untagged set for the Default VLAN (VID0x001). Not a member of any other VLAN.
- MTU = Maximum allowed size

Appendix B: Frame Document

Jumbo_Src11		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 22 22 AA 11
07..12	Source MAC Address	00 00 11 11 11 11
-	VLAN Tag Header	None
13..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Src22		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 11 22 AA 22
07..12	Source MAC Address	00 00 22 22 22 22
-	VLAN Tag Header	None
13..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Dest22		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 22 22 22 22
07..12	Source MAC Address	00 00 11 22 AA 11
-	VLAN Tag Header	None
13..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Src33		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 11 22 BB 33
07..12	Source MAC Address	00 00 33 33 33 33
-	VLAN Tag Header	None
13..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Dest33		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 33 33 33 33
07..12	Source MAC Address	00 00 11 22 BB 11
-	VLAN Tag Header	None
13..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Dest11_Tag10		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 11 11 11 11
07..12	Source MAC Address	00 00 22 22 AA 44
13..16	VLAN Tag Header	VID=10, Priority=0
17..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Src22_Tag10		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 22 22 BB 22
07..12	Source MAC Address	00 00 22 22 22 22
13..16	VLAN Tag Header	VID=10, Priority=0
17..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Dest22_Tag10		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 22 22 22 22
07..12	Source MAC Address	00 00 22 22 BB 44
13..16	VLAN Tag Header	VID=10, Priority=0
17..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Src33_Tag1		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 22 22 CC 33
07..12	Source MAC Address	00 00 33 33 33 33
13..16	VLAN Tag Header	VID=1, Priority=0
17..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Jumbo_Dest33_Tag1		
Field (Octet(s))		**Value (Hexadecimal)**
01..06	Destination MAC Address	00 00 33 33 33 33
07..12	Source MAC Address	00 00 22 22 CC 44
13..16	VLAN Tag Header	VID=1, Priority=0
17..1996	Data	Pseudo-random Data Pattern
1997..2000	Frame Check Sequence	Calculated at Runtime

Appendix C: Vendor Support Questionnaire

In order to provide top-tier services to our customers, the technician executing the test suite against a device under test needs to know which options and parameter values the device is claiming support for.

This appendix contains a list of support options which are to be specified by the vendor prior to testing.

Frame Size Constraints:	Maximum Untagged Size: _____ Maximum Tagged Size: _____