Table of Contents

Table of Contents........................................................................................................................... 2
Modification Record........................................................................................................................... 3
Acknowledgments............................................................................................................................... 4
Introduction......................................................................................................................................... 5
References........................................................................................................................................... 7
Test Setup........................................................................................................................................... 8
Group 1: Reception of Valid PFC Frames............................................................................................ 9
  TEST #36.1.1: RECEPTION OF PFC FRAMES..................................................................................... 10
  TEST #36.1.2: RECEPTION OF MULTIPLE PFC FRAMES............................................................... 11
  TEST #36.1.3: RECEPTION OF PFC BETWEEN TRANSMISSION OF FRAMES............................ 12
  TEST #36.1.4: RECEPTION OF PFC DURING TRANSMISSION OF FRAMES................................. 13
  TEST #36.1.5: RECEPTION OF MULTIPLE PRIORITY PFC FRAMES........................................... 14
  TEST #36.1.6: RECEPTION OF PFC FRAME WITH priority_enable_vector SET TO ZERO....... 15
Group 2: Reception of Invalid PFC Frames..................................................................................... 16
  TEST #36.2.1: RECEPTION OF INVALID ADDRESSED PFC FRAMES............................................. 17
  TEST #36.2.2: RECEPTION OF INVALID OPCODE PFC FRAMES.................................................. 18
  TEST #36.2.3: RECEPTION OF INVALID priority_enable_vector PFC FRAMES.......................... 19
  TEST #36.2.4: RECEPTION OF PAUSE FRAMES AFTER PFC NEGOTIATION.............................. 20
  TEST #36.2.5: RECEPTION OF INVALID CRC PFC FRAMES......................................................... 21
  TEST #36.2.6: RECEPTION OF OVERSIZED PFC FRAMES.............................................................. 22
  TEST #36.2.7: RECEPTION OF UNDERSIZED PFC FRAMES........................................................... 23
Group 3: Transmission of PFC Frames............................................................................................ 24
  TEST #36.3.1: TRANSMISSION OF PFC FRAMES............................................................................ 25
  TEST #36.3.2: TRANSMISSION OF PFC FRAMES WHILE INHIBITING TRANSMISSION............... 26
  TEST #36.3.3: RECEIPTION OF EXCESS FRAMES WHILE TRANSMITTING PFC FRAMES........... 27
Group 4: Proper Handling of PFC Frames With Different VLAN IDs........................................... 28
  TEST #36.4.1: SAME PRIORITY IN DIFFERENT VLANs............................................................... 29
  TEST #36.4.2: DIFFERENT PRIORITY IN DIFFERENT VLANs...................................................... 30
Appendix A: Recommended Buffer Size For Different Interfaces................................................. 31

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Modification Record

1. March 11, 2009  Initial Version (mhagen)
2. June 18, 2009  Updated to version 1.0 of the standard (mhagen)
3. September 21, 2009  Some minor corrections (rzarick)
4. March 1, 2010  Updated to version 1.3 of the standard (mhagen)
5. March 1, 2010  Added VLAN ID tests (mhagen)
6. January 10, 2011  Fixed Test #36.2.1 addressing issue (mhagen)
7. March 1, 2011  Updated to version 2.3 of the standard (mhagen)
8. March 3, 2011  Added 36.2.4 back in with new ref (mhagen)
9. April 4, 2012  Updated to the final 802.3bd and 802.1Qbb standards (mhagen)
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David Woolf        University of New Hampshire
Ryan Zarick        University of New Hampshire
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. These tests are designed to determine if a DCB product conforms to specifications defined in IEEE Std 802.1Qbb-2011 Amendment 17: Priority-based Flow Control (hereafter referred to as “PFC”). This suite of tests has been developed to help implementers evaluate the functioning of their Data Center Bridging based products. The tests do not determine if a product conforms to the IEEE standard, nor are they purely interoperability tests. Rather, they provide one method to isolate problems within a Data Center Bridging device. Successful completion of all tests contained in this suite does not guarantee that the tested device will operate with other Data Center Bridging devices. However, combined with satisfactory operation in the IOL’s semi-production environment, these tests provide a reasonable level of confidence that the Device Under Test (DUT) will function well in most multi-vendor Data Center Bridging 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 detailed section discusses the background information and specifies how 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 the Clause followed by the Test Group Number followed by 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
The purpose is a short statement describing what the test attempts to achieve. The test is written at the functional level.

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

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

Last Modification
This specifies the date of the last modification to this test.

Discussion
The discussion 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
The setup section describes in detail the configuration of the test environment and includes a block diagram for clarification as well as information such as the interconnection of devices, what monitoring equipment should capture, what the generation equipment should send, and any other configuration information vital to carrying out the test. Small changes in the configuration should be included in the test procedure.

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

 Observable Results
The observable results section lists observables that can be examined by the tester to verify that the DUT is operating properly. When multiple values are possible for an observable, this section provides a short discussion on how to interpret them. Note that complete delineation between the observables in the Procedure and Observable Results is virtually impossible. As such a careful note should be made of the requirements in both sections. In certain cases, it may be necessary to modify certain steps in the Procedure section while doing the actual tests so as to be able to perform the tests. In such cases, the modifications will be noted in the summary report.

Possible Problems
This section provides some clues to look for if the test does not yield the expected results.

Legend
For reasons of brevity, the following abbreviation has been used in the Test Suite:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUT</td>
<td>Device Under Test</td>
</tr>
<tr>
<td>PFC</td>
<td>Priority-based Flow Control</td>
</tr>
<tr>
<td>TS</td>
<td>Testing Station</td>
</tr>
</tbody>
</table>
References

The following documents are referenced in this text:

- IEEE Std 802.1Qbb-2011 IEEE Standard for Local and metropolitan area networks – Media Access Control (MAC) Bridges and Virtual Bridged Local Area Networks – Amendment 17: Priority-based Flow Control
Test Setup

The following test setup is used in this test suite:

Test Setup 1:
Group 1: Reception of Valid PFC Frames

Overview: These tests observe the behavior of the DUT when it receives valid PFC frames. In their entirety, these tests verify that a device properly stops transmitting frames for the correct amount of time and handles a variety of valid PFC frames.
Test #36.1.1: Reception of PFC Frames

Purpose: To verify that the DUT inhibits the transmission of MAC client frames when a PFC frame is received.

References:
[1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 1, 2010.

Discussion: Devices supporting the operation of PFC frames will halt transmission of frames from the specified priority upon reception of a valid PFC frame with a time vector value greater than zero.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames to the TS.
2. Instruct the TS to issue a valid PFC frame.
3. The activity is captured and observed.
4. Vary the length of time that is indicated in the PFC frames.
5. Repeat each length of time 10 times and record the shortest pause time for each.

Observable Results:

On the Monitor, verify that the DUT properly halts transmission for at least the specified value of pause Quantum.

Possible Problems: None
Test #36.1.2: Reception of Multiple PFC Frames

Purpose: To verify that the DUT inhibits or begins transmission of MAC client frames when a PFC frame is received after the DUT has already received a valid PFC frame.

References: [1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 6, 2009.

Discussion: A device that has already received a valid PFC and receives another valid PFC frame shall restart the timer with the new value provided, or in the case of the time_vector set to zero, the device should begin transmission of frames immediately.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames to the TS.
2. Instruct the TS to issue a valid PFC frame with a time_vector set to the maximum value of 65535 pause_quanta.
3. At a set time within the pause period, instruct the TS to issue a valid PFC frame with time_vector zero.
4. The activity is captured and observed.
5. Repeat steps 1-4 with other time_vector values such as another maximum value frame and a frame with a small value that is less than the current time.

Observable Results:

On the Monitor, verify that the DUT properly halts or begins transmission when it receives the second PFC frames.

Possible Problems: None
Test #36.1.3: Reception of PFC Between Transmission of Frames

Purpose: To verify that the time the DUT begins to inhibit transmission of MAC client frames is within the maximum defined time allowed.

References: [1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 1, 2011.

Discussion: A device that receives a valid PFC frame must start the timer and halt transmission of frames on the paused priority in a reasonable amount of time. Any frames that are already submitted to be transmitted must not be halted, but new frames submitted should be held. The standard recognizes this may not be an immediate function and thus define the maximum amount of time in which a frame can be sent as 614.4ns if MACsec is not used and 19360 bit times (for 10G Ethernet) if MACsec is used after the reception of the PFC frame.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. The DUT is instructed to transmit two valid frames with a minimum IPG to the TS.
2. Instruct the TS to issue a valid PFC frame between the two valid frames from the DUT.
3. Repeat steps 1-2 while increasing the gap between frames the DUT transmits until the second frame is observed to be paused.
4. The activity is captured and observed.

Observable Results:

On the Monitor, verify that when the second frame is observed to be paused, the time between the frames sent from the DUT is less than or equal to 614.4ns bit times if MACsec is not used or 19360 bit times (for 10G Ethernet) if MACsec is used.

Possible Problems: This test is only run by special request due to the complexity and time required to implement and run the test.
Test #36.1.4: Reception of PFC During Transmission of Frames

Purpose: To verify that when the DUT begins to pause traffic during the transmission of a frame, the transmission of the frame is not interrupted.

References:
[1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 11, 2009.

Discussion: A device that receives a valid PFC frame must set a timer and halt transmission of frames on the specified priority for the given amount of time. If the time begins during the transmission of a frame, the transmission of the frame should not be interrupted.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. Instruct the TS to issue a valid PFC frame that causes the DUT to commence pausing traffic.
2. The DUT is instructed to transmit two valid frames.
3. Instruct the TS to issue a valid PFC frame with time_vector of zero, that causes the DUT to begin transmitting traffic.
4. Instruct the TS to issue a valid PFC frame that cause the DUT to commence pausing traffic during the transmission of the first frame.
5. The activity is captured and observed.

Observable Results:

On the Monitor, verify that the DUT continues to transmit the first frame unimpeded and does not transmit the second frame until after the time specified in the pause frame.

Possible Problems: Special care must be taken to ensure that the second frame is outside the window of time that frames can be transmitted after receiving a pause notification.
Test #36.1.5: Reception of Multiple Priority PFC Frames

**Purpose:** To verify that the DUT properly pauses traffic on multiple priorities.

**References:**
[1] PFC – Clause 36

**Resource Requirements:**
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

**Last Modification:** March 9, 2009.

**Discussion:** A device that receives a PFC frame should pause only those priorities specified with a time_vector greater than 0. A device might share priorities in a single queue in which case, a priority other than the one paused will be blocked.

**Test Setup:** *Test Setup 1.* Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority for each queue supported by the device.

**Procedure:**

1. The DUT is instructed to transmit a large number of valid frames on each priority configured.
2. Instruct the TS to issue a valid PFC frame that cause the DUT to commence pausing traffic on each configured priority.
3. The activity is captured and observed.
4. Repeat steps 1-3 for various combinations of pausing and resuming traffic on each of the priorities configured on the DUT.

**Observable Results:**

On the Monitor, verify that when traffic is paused or resumed on one priority it does not affect the traffic on another priority.

**Possible Problems:** Knowledge of the internal workings of the DUT may be needed in order to establish how many queues are available and what priorities share queues.
Test #36.1.6: Reception of PFC Frame with priority_enable_vector set to zero

Purpose: To verify that the DUT properly observes the priority_enable_vector field.

References:
[1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: June 18, 2009.

Discussion: A device that receives a PFC frame should pause only those priorities specified with a priority_enable_vector of 1 and time_vector greater than 0. A device might share priorities in a single queue in which case, a priority other than the one paused will be blocked.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority for each queue supported by the device.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames on each priority configured.
2. Instruct the TS to issue a valid PFC frame with the priority_enable_vector field set to 0 and timer_vector field set to the maximum value.
3. The activity is captured and observed.
4. Repeat steps 1-3 for various combinations of pausing and resuming traffic on each of the priorities configured on the DUT.

Observable Results:

On the Monitor, verify that the DUT does not pause traffic on any priority.

Possible Problems: None
Group 2: Reception of Invalid PFC Frames

Overview: These tests observe the behavior of the DUT when it receives invalid PFC frames. In their entirety, these tests verify that a device behaves properly when it receives PFC frames with bad fields and of various sizes.
Test #36.2.1: Reception of invalid addressed PFC Frames

Purpose: To verify that the DUT rejects invalid addressed PFC frames.

References:
[1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: January 10, 2011.

Discussion: The Destination Address field of a PFC frame may contain only the well-known multicast address 01-80-C2-00-00-01. If any other address is received by a device the PFC frame should be ignored.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames to the TS.
2. Instruct the TS to transmit invalid broadcast, multicast and unicast addressed PFC frames to the DUT.
3. The activity is captured and observed.

Observable Results:

On the Monitor, verify that the DUT does not inhibit the transmission of valid frames upon reception of a PFC frame with an invalid address.

Possible Problems: None
Test #36.2.2: Reception of invalid opcode PFC Frames

Purpose: To verify that the DUT rejects invalid opcode PFC frames.

References:
[1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.


Discussion: The opcode field of a PFC frame may only contain 01-01. If any other opcode is received by a device the PFC frame should be ignored.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames to the TS.
2. Instruct the TS to transmit invalid opcode PFC frames to the DUT including: 01-02 through 01-07 and reserved opcodes.
3. The activity is captured and observed.

Observable Results:

On the Monitor, verify that the DUT does not inhibit the transmission of valid frames upon reception of a PFC frame with an invalid opcode.

Possible Problems: None
Test #36.2.3: Reception of invalid priority_enable_vector PFC Frames

Purpose: To verify that the DUT rejects invalid priority_enable_vector PFC frames.

References: [1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: September 21, 2009.

Discussion: The priority_enable_vector field of a transmitted PFC frame shall contain only 0 in the most significant octet (MSO). If a non zero value in the MSO of the priority_enable_vector field is received, the MSO can be ignored and the frame acted upon normally.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames to the TS.
2. Instruct the TS to transmit invalid and valid priority_enable_vector PFC frames to the DUT including a series of non-zero values in the most significant octet.
3. The activity is captured and observed.

Observable Results:

On the Monitor, verify that the DUT inhibits the transmission of valid frames upon reception of a PFC frame with any value set to the most significant octet of the priority_enable_vector.

Possible Problems: None
Test #36.2.4: Reception of PAUSE frames after PFC negotiation

Purpose: To verify that the DUT rejects PAUSE frames after PFC has been negotiated.

References:
[1] IEEE 802.3bd – Annex 31B.1

Resource Requirements:
- Testing Station capable of transmitting user defined PAUSE and PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: December 19, 2011.

Discussion: Once the use of PFC frames have been negotiated with a device, PAUSE frames should not be used again. Any PAUSE frames received after the negotiation of the use of PFC frames should be ignored.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:
1. The DUT is instructed to transmit a large number of valid frames.
2. Instruct the TS to transmit properly formatted PAUSE frames to the DUT.
3. The activity is captured and observed.

Observable Results:
On the Monitor, verify that the DUT does not inhibit the transmission of valid frames upon reception of a properly formatted PAUSE frame.

Possible Problems: None
Test #36.2.5: Reception of invalid CRC PFC Frames

Purpose: To verify that the DUT rejects invalid CRC PFC frames.

References: [1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.


Discussion: Reception of a PFC frame with an invalid CRC should be caught and dropped before being acted upon.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames.
2. Instruct the TS to transmit properly formatted PFC frames with an invalid CRC to the DUT.
3. The activity is captured and observed.

Observable Results:

On the Monitor, verify that the DUT does not inhibit the transmission of valid frames upon reception of a PFC frame with an invalid CRC.

Possible Problems: None
Test #36.2.6: Reception of Oversized PFC Frames

Purpose: To verify that the DUT properly handles a PFC frame that is greater than the standard size allowed.

References:
[1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 6, 2009.

Discussion: Reception of a PFC frame that is larger than the defined minFrameSize in length shall either be dropped or truncated to the appropriate size.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames.
2. Instruct the TS to transmit properly formatted PFC frames that is larger than minFrameSize to the DUT.
3. The activity is captured and observed.
4. Repeat steps 1-3 with a variety of larger than allowed frame sizes.

Observable Results:

On the Monitor, verify that if the DUT drops the improper frames it does not inhibit transmission of frames, but if the DUT truncates the frames transmission of frames should be inhibited.

Possible Problems: None
Test #36.2.7: Reception of Undersized PFC Frames

Purpose: To verify that the DUT properly handles a PFC frame that is less than the standard size allowed.

References:
[1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 6, 2009.

Discussion: Reception of a PFC frame that is smaller than the defined minFrameSize in length shall be dropped.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:
1. The DUT is instructed to transmit a large number of valid frames.
2. Instruct the TS to transmit properly formatted PFC frames that are less than minFrameSize to the DUT.
3. The activity is captured and observed.
4. Repeat steps 1-3 with a variety of smaller than allowed frame sizes.

Observable Results:
On the Monitor, verify that the DUT does not inhibit the transmission of valid frames upon reception of a PFC frame that is smaller than allowed.

Possible Problems: None
Group 3: Transmission of PFC Frames

Overview: These tests observe the behavior of the DUT when it transmits PFC frames. In their entirety, these tests verify that a device behaves properly when its buffers become overloaded and it must send PFC frames.
Test #36.3.1: Transmission of PFC Frames

Purpose: To verify that the DUT transmits a properly formatted PFC frame when its buffers become overloaded.

References: 
[1] PFC – Clause 36

Resource Requirements: 
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 6, 2009.

Discussion: In order to prevent frame loss due to congestion, a device is expected to issue a PFC frame when it's buffers begin to become overloaded.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. Instruct the TS to cause the DUT to issue a PFC frame. It may be possible to do this by transmitting large data packets with the minimum inter-packet-gap for an extended time.
2. The activity is captured and observed.

Observable Results:

On the Monitor, verify that the DUT issues a properly formatted PFC frame.

Possible Problems: Methods for causing the DUT to source a PFC frame may vary from device to device.
Test #36.3.2: Transmission of PFC Frames While Inhibiting Transmission

Purpose: To verify that the DUT transmits a properly formatted PFC frame when its buffers become overloaded and it is currently inhibiting transmission of frames.

References:
[1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 6, 2009.

Discussion: In order to prevent frame loss due to congestion, a device is expected to issue a PFC frame when it's buffers begin to become overloaded. Additionally, PFC cannot be used to inhibit the transmission of MAC Control frames.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. Instruct the TS to issue a valid PFC frame to the DUT causing it to inhibit transmission of data frames.
2. Instruct the TS to cause the DUT to issue a PFC frame. It may be possible to do this by transmitting large data packets with the minimum inter-packet-gap for an extended time.
3. The activity is captured and observed.

Observable Results:
On the Monitor, verify that the DUT issues a properly formatted PFC frame.

Possible Problems: Methods for causing the DUT to source a PFC frame may vary from device to device.
Test #36.3.3: Reception of Excess Frames While Transmitting PFC Frames

Purpose: To verify that the DUT maintains the proper buffer requirements to prevent frame loss when a reasonable amount of frames are received after the DUT transmits PFC frames.

References:
[1] PFC – Annex O

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.


Discussion: In order to prevent frame loss due to congestion, a device is expected to issue a PFC frame when it's buffers begin to become overloaded. Additionally, a device should transmit a PFC frame with enough buffer space to handle frames that are in flight before the PFC frame is acted upon by the other side.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group.

Procedure:

1. Instruct the TS to cause the DUT to issue a PFC frame. It may be possible to do this by transmitting large data packets with the minimum inter-packet-gap for an extended time.
2. Instruct the TS to then transmit an additional amount of data that could be seen by a DUT in a worst case scenario based on the calculations in Appendix A.
3. The activity is captured and observed.

Observable Results:

On the Monitor, verify that the DUT does not drop any frames.

Possible Problems: The amount of data transmitted is highly dependent upon a variety of different variable such as link speed, max frame length and cable length. For the case of 100m 10GBASE-T link without MACsec, the maximum buffer required would be 126,024 bits (about 15.5KB). If MACsec is used, the maximum buffer required becomes 145,384 bits (about 18KB). A general formula for buffer requirements is:

\[
DV = 2*(Max\ Frame) + (PFC\ Frame) + 2*(Cable\ Delay) + 2*Interface\ Delay + Higher\ Layer\ Delay
\]
Group 4: Proper Handling of PFC Frames With Different VLAN IDs

Overview: These tests observe the behavior of the DUT when it transmits and receives PFC frames based on traffic with different VLAN IDs. In their entirety, these tests verify that a device behaves properly when it receives a PFC frame or sends PFC frames independent of the VLAN ID of the traffic class.
Test #36.4.1: Same Priority in Different VLANs

Purpose: To verify that the DUT properly handles the case when the same priority is configured for two different VLANs.

References: [1] PFC – Clause 36

Resource Requirements:
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

Last Modification: March 1, 2010.

Discussion: A PFC frame is a MAC control frame that operates on the priority field of the VLAN tag. PFC is intended to work on different priorities regardless of VLAN ID.

Test Setup: Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least one priority group with two different VLAN IDs.

Procedure:

1. The DUT is instructed to transmit a large number of valid frames from two different VLAN IDs with the same priority to the TS.
2. Instruct the TS to issue a valid PFC frame.
3. The activity is captured and observed.

Observable Results:

On the Monitor, verify that the DUT properly pauses the traffic in both VLAN IDs with the same priority.

Possible Problems: None.
Test #36.4.2: Different Priority in Different VLANs

**Purpose:** To verify that the DUT properly handles the case when different priorities are configured for two different VLANs.

**References:**
[1] PFC – Clause 36

**Resource Requirements:**
- Testing Station capable of transmitting user defined PFC frames to the DUT.
- Monitor capable of capturing Ethernet traffic.

**Last Modification:** March 1, 2010.

**Discussion:** A PFC frame is a MAC control frame that operates on the priority field of the VLAN tag. PFC is intended to work on different priorities regardless of VLAN ID.

**Test Setup:** Test Setup 1. Connect the Testing Station, the DUT and the Monitor as shown. The DUT has been configured to support at least two priority groups with two different VLAN IDs.

**Procedure:**

1. The DUT is instructed to transmit a large number of valid frames from one VLAN ID and priority to the TS.
2. Instruct the TS to issue a valid PFC frame to the priority of the VLAN ID NOT being transmitted.
3. The activity is captured and observed.

**Observable Results:**

On the Monitor, verify that the DUT does not pause the traffic of the first VLAN ID and priority.

**Possible Problems:** None.
Appendix A: Recommended Buffer Size For Different Interfaces

The following formula should be used to determine the amount of buffer capacity needed in order to ensure frames are not lost (cited from PFC-Annex O):

$$DV = 2*(\text{Max Frame}) + (\text{PFC Frame}) + 2*(\text{Cable Delay}) + 2*\text{Interface Delay} + \text{Higher Layer Delay}$$

<table>
<thead>
<tr>
<th>Interface</th>
<th>Max Frame Size</th>
<th>PFC Frame Size</th>
<th>Cable Delay</th>
<th>Interface Delay</th>
<th>High Layer Delay</th>
<th>Total Delay Value (bit times)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10GBASE-T (100m)</td>
<td>2*16,160</td>
<td>672</td>
<td>2*5,556</td>
<td>2<em>25,600 + 2</em>12,288</td>
<td>6,144</td>
<td>126,024</td>
</tr>
<tr>
<td>10GBASE-SR (300m)</td>
<td>2*16,160</td>
<td>672</td>
<td>2*16,668</td>
<td>2<em>25,600 + 2</em>4,096</td>
<td>6,144</td>
<td>131,864</td>
</tr>
<tr>
<td>10GBASE-CX4 (15m)</td>
<td>2*16,160</td>
<td>672</td>
<td>2*834</td>
<td>2<em>25,600 + 2</em>2,560</td>
<td>6,144</td>
<td>97,124</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interfaces with MACsec Enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>10GBASE-T (100m)</td>
</tr>
<tr>
<td>10GBASE-SR (300m)</td>
</tr>
<tr>
<td>10GBASE-CX4 (15m)</td>
</tr>
</tbody>
</table>

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