TELEDYNE LECROY
Everywhere**you**look™

Measuring Network Convergence

APPLICATION NOTE

How testing your network's re-convergence time with industry leading measurement precision simplifies measuring the operations of resiliency mechanisms.

A variety of network resiliency mechanisms are available to ensure that today's networks are highly reliable. These technologies have been developed to enable protection of links and nodes through fast and automatic switching in the event of failures on primary paths. Resiliency technologies minimize traffic loss and expedite recovery time during network failure.
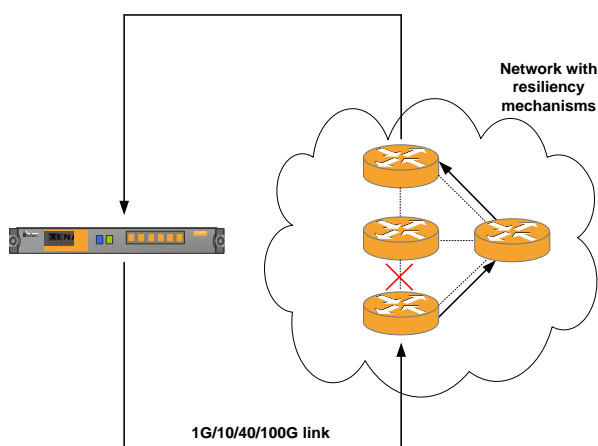
The Teledyne LeCroy Xena testers enable very accurate testing of your network's re-convergence time, which simplifies the testing of resiliencies technologies such as Automatic Protection Switching, Spanning and Rapid Spanning Tree Protocols (STP/RSTP), Virtual Router Redundancy Protocol (VRRP) and Fast Re-Route (FRR).

The measurement precision is industry leading in terms of precision, since disruption periods down to 1 microsecond can be identified by the Teledyne LeCroy Xena tester, and are measured with a precision of 1 microsecond. Furthermore, every Teledyne LeCroy Xena test port (1/10/40/100G) provides the ability to measure network re-convergence.

This application note details how to use Teledyne LeCroy Xena to measure the operation of such resiliency mechanisms.

Service activation test application

The network setup for re-convergence time measurement is shown in the figure below. A source test port sends traffic into a system of network components. The traffic can use Layer 2 or Layer 3 packet headers depending on the nature of the SUT (such as switches and/or routers). After we have verified that the traffic is passing error-free across the SUT from the Teledyne LeCroy Xena source port to the Teledyne LeCroy Xena destination port, a failure is deliberately introduced into the network (such as disconnecting an optical fiber or shutting down a optical laser), which will trigger the network resiliency mechanisms to forward traffic over a redundant link or path. The destination test port will then measure the network re-convergence time and frame/packet loss using the Teledyne LeCroy Xena tester's gap monitor and logging mechanism.


- Figure 1 Setup for measurement of network resiliency mechanism.

Test details example

The following steps illustrate how the Teledyne LeCroy Xena tester can be used to measure the performance of the networks resiliency mechanism, using the Teledyne LeCroy Xena testers Gap monitor and logging mechanism which are available in the XenaManager GUI application.

For simplicity, this example is using Layer 2 traffic but could also use Layer 3 traffic by simply adding IP headers to the traffic and defining the ports IP address. The example illustrates the measurement of the re-convergence time on a single port, but all of the available Teledyne LeCroy Xena test ports available can be added to the test scenario.

Step 1: Select source and destination test ports. Reserve a source and a destination port on the Teledyne LeCroy Xena tester. In this example, the source port is Chassis 0 / Module 2 / Port 4, and the destination port is Chassis 0 / Module 2 / Port 5. Note that the source and destination ports can also be the same port.
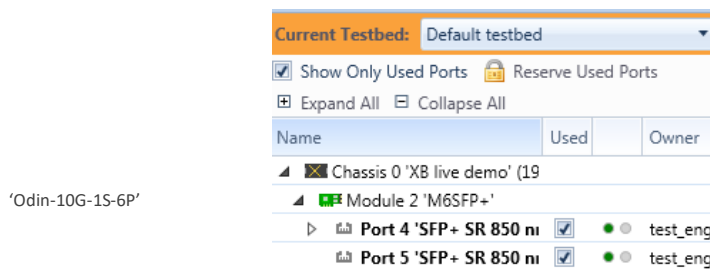

Step 2: Teach DUT the MAC address of the destination port. On the destination test port (Chassis XB-2 / Module 2 / Port 5), enable MAC Auto-Training to teach the DUT the destination ports MAC address.
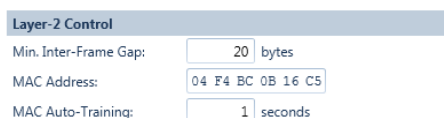

Step 3: Define traffic on the source test port. On the source test port, define a default Ethernet stream with a fixed 64-byte packet length and 10% uniform traffic load, and set the streams destination MAC address equal to the destination ports MAC address.

The traffic load must be sufficiently high to ensure that the Tx packet spacing is less than the re-convergence period of the network. In this example the 10% load is equivalent to a packet spacing

of 0.6 micro seconds on the 10 Gbps test port, so even a re-convergence period of one micro-second could be measured (although any network system is unlikely to provide such fast re-convergence).
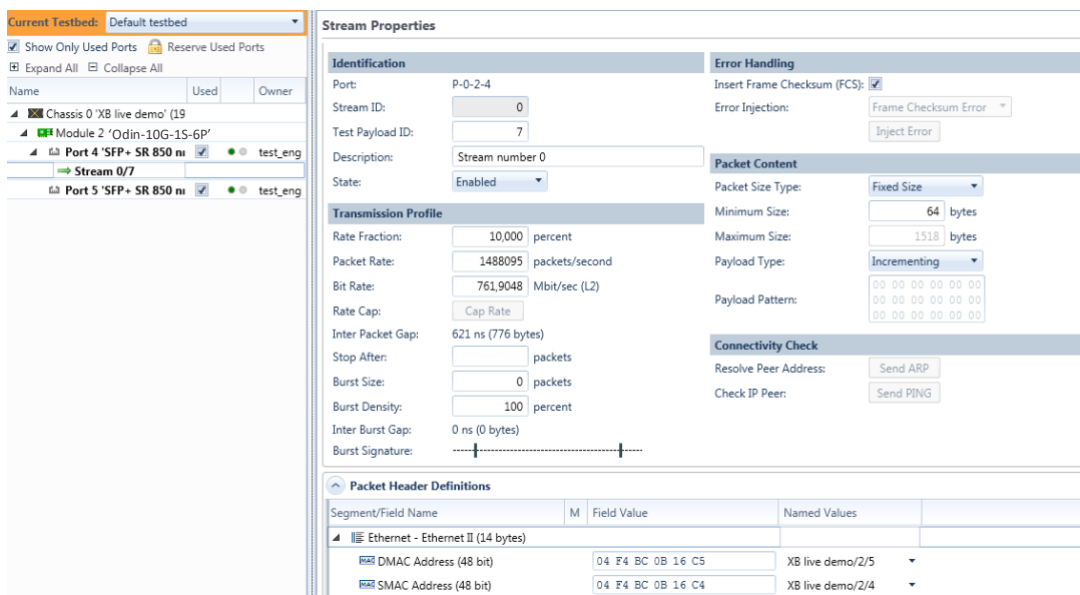

Step 4: Enable the logging of Disruptions. First, enable the view of the Event Log Panel.
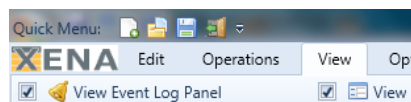
Then, <u>enable "Poll Always" of the destination ports Rx statistics so that traffic disruptions statistics are always polled and properly logged regardless of whether the user have the destination ports Statistics window visible in the GUI or not.</u>

Press the clear log, in the "Event Log" window, and enable logging of Disruptions.
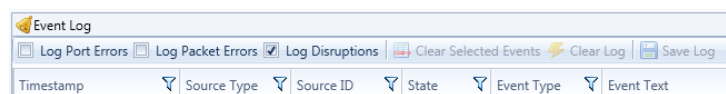
Step 5: Configure the Gap Monitor. The final step is the configuration of the Gap monitoring function, which is the test function we will use to identify and log periods with no traffic (Idle) on the destination Teledyne LeCroy Xena port, as they occur when the SUT is re-converging itself.

If the target re-convergence requirement is 50 ms, we can expect to see re-convergence periods which are above and below this threshold. To configure the Gap Monitor so that both events above and below this threshold are logged, we will set the Gap Monitor period to 1 ms. With this, we will log any disruptions, meaning an idle period on the destination port, which is 1 ms or higher.

We will also configure the criteria for when the re-convergence is considered to be completed, by specifying how many consecutive packets must arrive on the destination, where the spacing between each of these packets in less than the Gap Monitor Start period (= 1 ms).

We will define this threshold as 10 packets (the measured disruption period is considered upon arrival of the first packet).

Step 6: Measure using the Gap Monitor. We can now begin to measure the re-convergence performance of the SUT, by introducing failures in the SUT by disconnecting optical fibers or shutting down optical lasers. For each re-convergence process, the Teledyne LeCroy Xena destination port will identify the disruption period, and add an entry to the Event Log. In this example, three disruption events have been logged.

The measurement precision is industry leading in terms of precision, since disruption periods down to 1 microsecond can be identified by the Teledyne LeCroy Xena tester, and are measured with a precision of 1 microsecond.