Xgig 10GE FCoE Load Tester

Introduction Guide

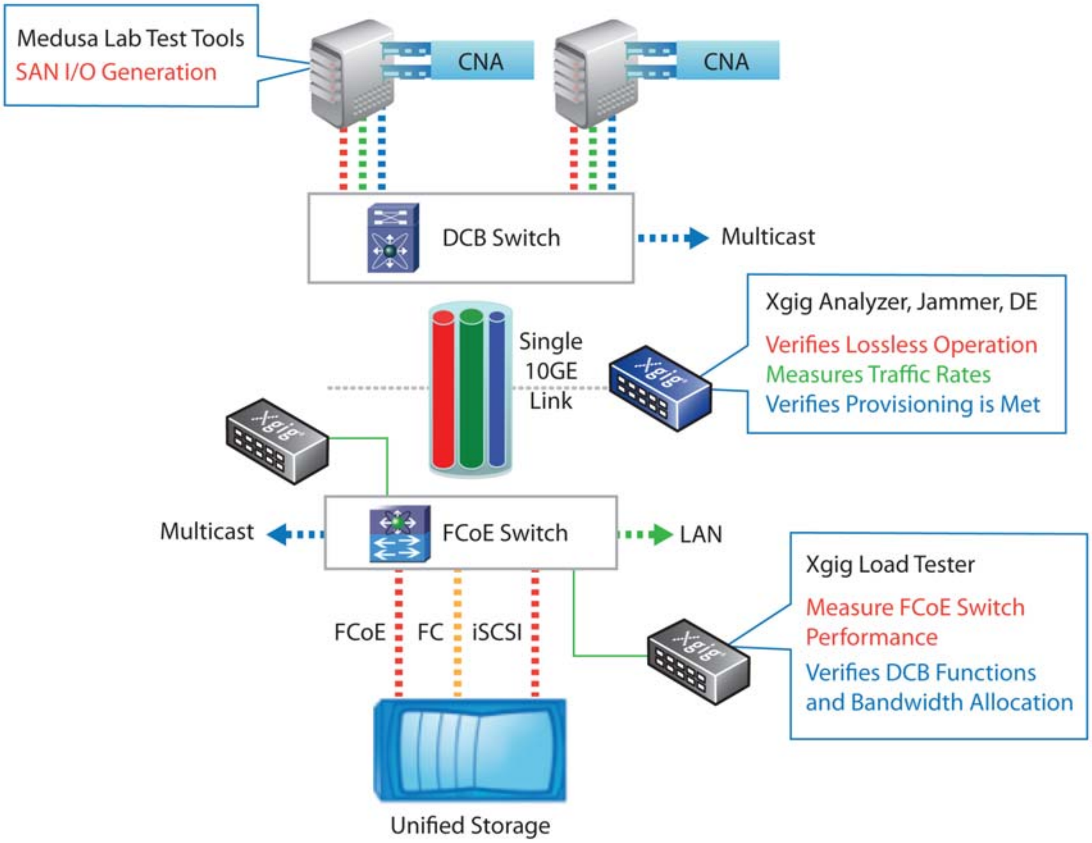
This document provides task-based instructions for using the 10GE FCoE Load Tester features. Topics covered in this document include the following:

Overview

Viavi has made available the industry's highest density FCoE traffic generation tool for comprehensively testing FCoE switches.

FCoE Load Tester generates layer-2 and layer-3 networking traffic with various traffic identities, FCoE traffic, and IP/TCP/UDP traffic. In addition, FCoE Load Tester ports can be combined with FC Load Tester ports to create FC to FCoE topology for mixed protocol performance tests. FCoE Load Tester is capable of FCF-based (supporting both FC-BB-5 and FC-BB-6 standards), as well as direct attached topology tests.

The tool is fully scriptable for automation. Single Frame Tx/Rx - the embedded tool, allows users to manually configure and transmit any custom frames through Load Tester. FCoE Load Tester forms the cornerstone for testing and verifying the design of FCoE equipment and Data Center Bridging (DCB) networks, giving developers complete flexibility and visibility into FCoE traffic.



When combining the newly added control frame capture feature, Xgig FCoE Load Tester will meet the test demands to verify system performance, data integrity, scalability, network robustness, and equipment interoperability.

Switch Testing Summary

Xgig FCoE Load Tester can perform the following tests on the 10Gigabit Ethernet and FCoE switch:

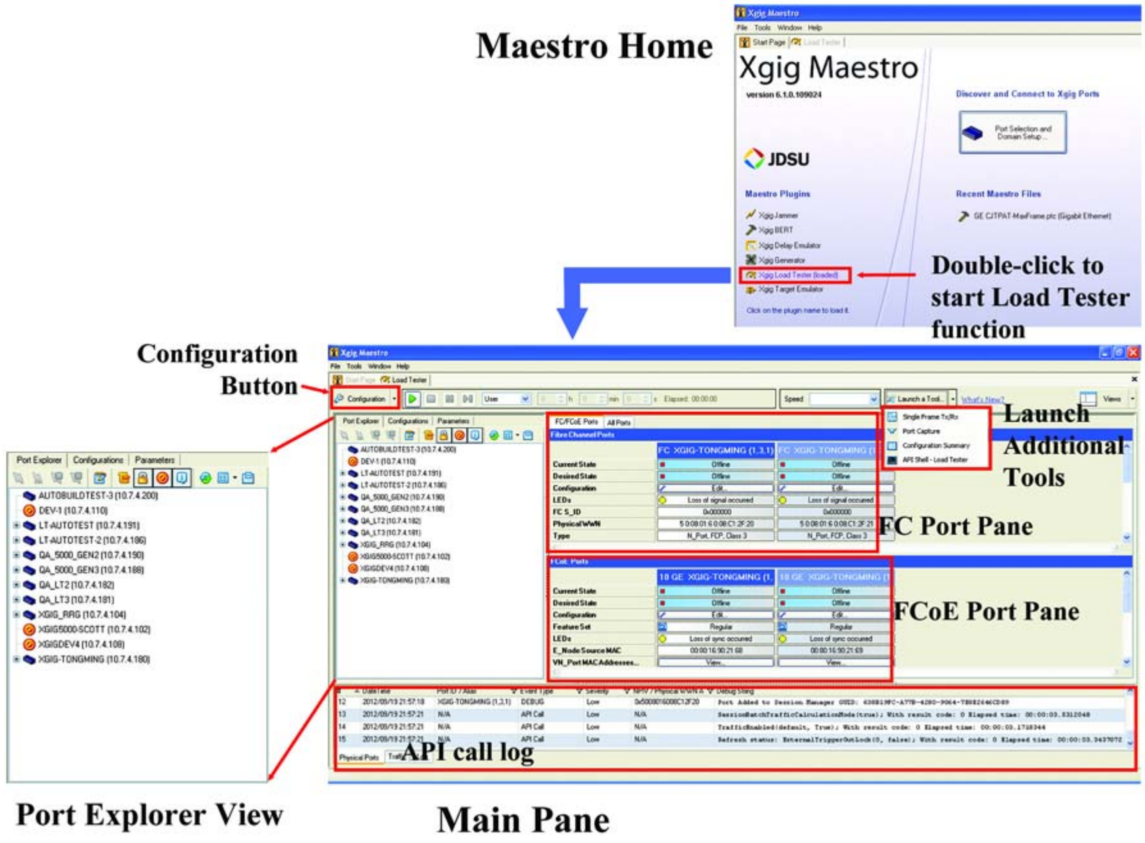
- Functional tests. FCoE Load Tester is used to verify the capability of the switch and directly attached device to successfully establish FCoE links and topologies. The tests include:
  - DCB
    - Priority Flow Control (PFC)
    - Enhanced Transmission Selection (ETS)
    - Data Center Bridging eXchange (DCBX)
  - FIP
    - VLAN discovery
    - FCoE link services
  - FCF/VN
    - Encapsulation and decapsulation functionality

In addition to FCoE traffic, the Load Tester now supports IP, TCP and UDP traffic. To generate this traffic, you are able of configure MACs, VLANs, IP addresses and TCP/UDP source and destination ports.

- Performance tests for FCoE and IP/TCP/UDP applications. Load Tester can create multi-profiles and multi-streams traffic to the switch/fabric and measure the throughput, latency, and errors under extremely stressful conditions:
  - Verify zero frame loss of FCoE traffic under fully meshed traffic topology and random traffic pattern
  - Measure Latency at the advertised maximum switch throughput
  - Measure the maximum forwarding rate, throughput and latency for IP/TCP/UDP traffic with typical and jumbo packets
  - Test upper and lower boundary conditions as well as random variation with minimum payload, maximum payload, random payload size and forced errors
- Debugging. With the release of powerful control frame capture feature, now FCoE Load Tester is capable of creating random traffic profiles as well as decoding the control frames to find and debug the switch’s corner case bugs.

Main Pane

Port selection and license management of Load Tester is now different from other functions under Maestro. The Discovery pane is eliminated and now the port lock/unlock function has been integrated into the Main Pane where it also displays the live status of the locked Load Tester ports.



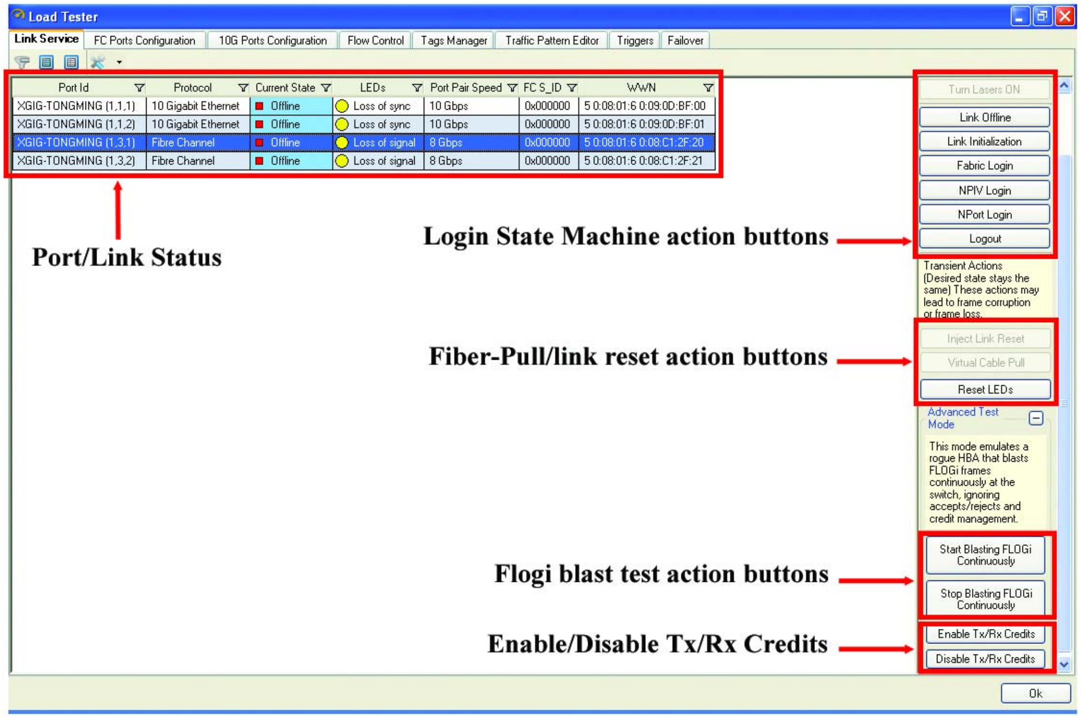
New Chassis/Port Explorer View

The main Load Tester test targets are the switches and fabric. This involves a large number of ports in one test and selecting and managing them could be a challenge for the test setup. With the new Chassis/Port Explorer View, you can access the ports similar to how you would use Windows® Explorer. The time-synced chassis represents the “file folder” and the ports represent the individual “files”. The icon next to each port shows the port status. You can also sort the ports through port status: locked, licensed, unlicensed, incompatible, etc.

The FCoE and FC ports are listed under a separate sub-pane. Both the FCoE and FC ports can be configured together if needed. From this main tab, a user can choose to setup the Load Tester configuration, to start or stop a test, to monitor the port status, and to view the API log. The API log displays an entry for each action taken by the GUI. There is also a timer to configure and count the test duration.

Link Service Setup and Testing

As for establishing FCoE link, Xgig Load Tester provides capabilities for explicit control over the Login State machine. The step-by-step manual control allows turning the laser on and off, Link Initialization, Fabric Login, NPIV Login, NPort Login and Logout. The Port/Link Status indicates the result of each link instantiation process.



Port Id	Protocol	Current State	LEDs	Port Pair Speed	FC S_ID	WWN
XGIG-TONGMING (1,1,1)	10 Gigabit Ethernet	🟥 Offline	● Loss of sync	10 Gbps	0x000000	5 0:08:01:6 0:09:0D:BF:00
XGIG-TONGMING (1,1,2)	10 Gigabit Ethernet	🟥 Offline	● Loss of sync	10 Gbps	0x000000	5 0:08:01:6 0:09:0D:BF:01
XGIG-TONGMING (1,3,1)	Fibre Channel	🟥 Offline	● Loss of signal	8 Gbps	0x000000	5 0:08:01:6 0:08:C1:2F:20
XGIG-TONGMING (1,3,2)	Fibre Channel	🟥 Offline	● Loss of signal	8 Gbps	0x000000	5 0:08:01:6 0:08:C1:2F:21

Transient Actions (Desired state stays the same) These actions may lead to frame corruption or frame loss.

This mode emulates a rogue HBA that blasts FLOGi frames continuously at the switch, ignoring accepts/rejects and credit management.

“Link Service” tab can be accessed by clicking “configuration” button.

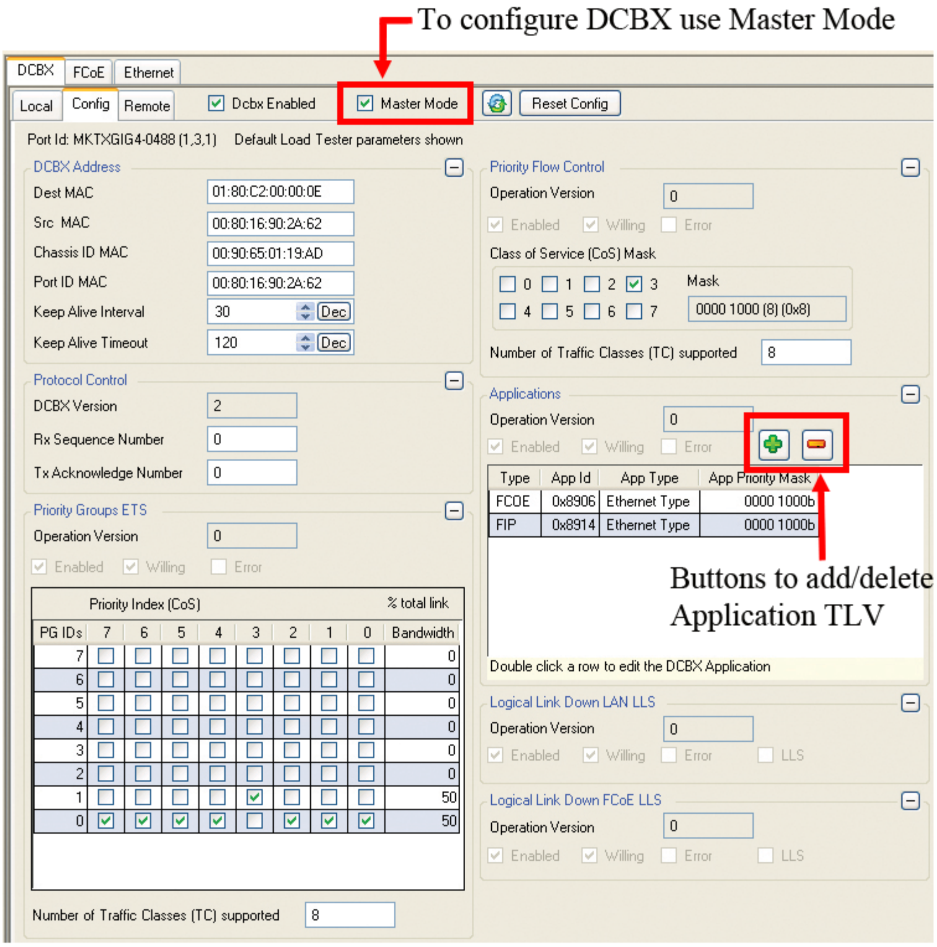
In this pane, the user can also conduct the following tests:

- Manually inject Link Resets
- Emulate a virtual Cable Pull event
- Emulate Flogi blast ignoring login status
- Enable/Disable Tx/Rx credits

DCBX Functional Test

FCoE Load Tester follows the DCBX standard to negotiate the DCB parameters with the connected peers. Flexible in the master or slave mode, Load Tester can conduct interoperability and compliance tests for the DCBX TLV protocol.

DCBX configuration can be accessed from the “10G Ports Configuration” tab. Xgig Load Tester distinguishes itself with the unique capability of simulating converged Ethernet traffic. A user can configure FCoE and Ethernet (LAN) port characteristics concurrently. Together with associated DCBX parameters, it defines how the virtual link, priority group and application are setup in the DCB network.



To configure DCBX use Master Mode

☑ Dcbx Enabled ☑ Master Mode

Port Id: MKTXGIG4-0488 (1,3,1) Default Load Tester parameters shown

DCBX Address

Dest MAC	01:80:C2:00:00:0E
Src MAC	00:80:16:90:2A:62
Chassis ID MAC	00:90:65:01:19:AD
Port ID MAC	00:80:16:90:2A:62
Keep Alive Interval	30 Dec
Keep Alive Timeout	120 Dec

Protocol Control

DCBX Version	2
Rx Sequence Number	0
Tx Acknowledge Number	0

Priority Groups ETS

Operation Version 0

☑ Enabled ☑ Willing □ Error

	Priority Index (CoS)								% total link
PG IDs	7	6	5	4	3	2	1	0	Bandwidth
7	□	□	□	□	□	□	□	□	0
6	□	□	□	□	□	□	□	□	0
5	□	□	□	□	□	□	□	□	0
4	□	□	□	□	□	□	□	□	0
3	□	□	□	□	□	□	□	□	0
2	□	□	□	□	□	□	□	□	0
1	□	□	□	□	☑	□	□	□	50
0	☑	☑	☑	☑	□	☑	☑	☑	50

Number of Traffic Classes (TC) supported 8

Priority Flow Control

Operation Version 0

☑ Enabled ☑ Willing □ Error

Class of Service (CoS) Mask

□ 0 □ 1 □ 2 ☑ 3
□ 4 □ 5 □ 6 □ 7

Mask 0000 1000 (8) (0x8)

Number of Traffic Classes (TC) supported 8

Applications

Operation Version 0

☑ Enabled ☑ Willing □ Error

Type	App Id	App Type	App Priority Mask
FCOE	0x8906	Ethernet Type	0000 1000b
FIP	0x8914	Ethernet Type	0000 1000b

Buttons to add/delete Application TLV

Double click a row to edit the DCBX Application

Logical Link Down LAN LLS

Operation Version 0

☑ Enabled ☑ Willing □ Error □ LLS

Logical Link Down FCoE LLS

Operation Version 0

☑ Enabled ☑ Willing □ Error □ LLS

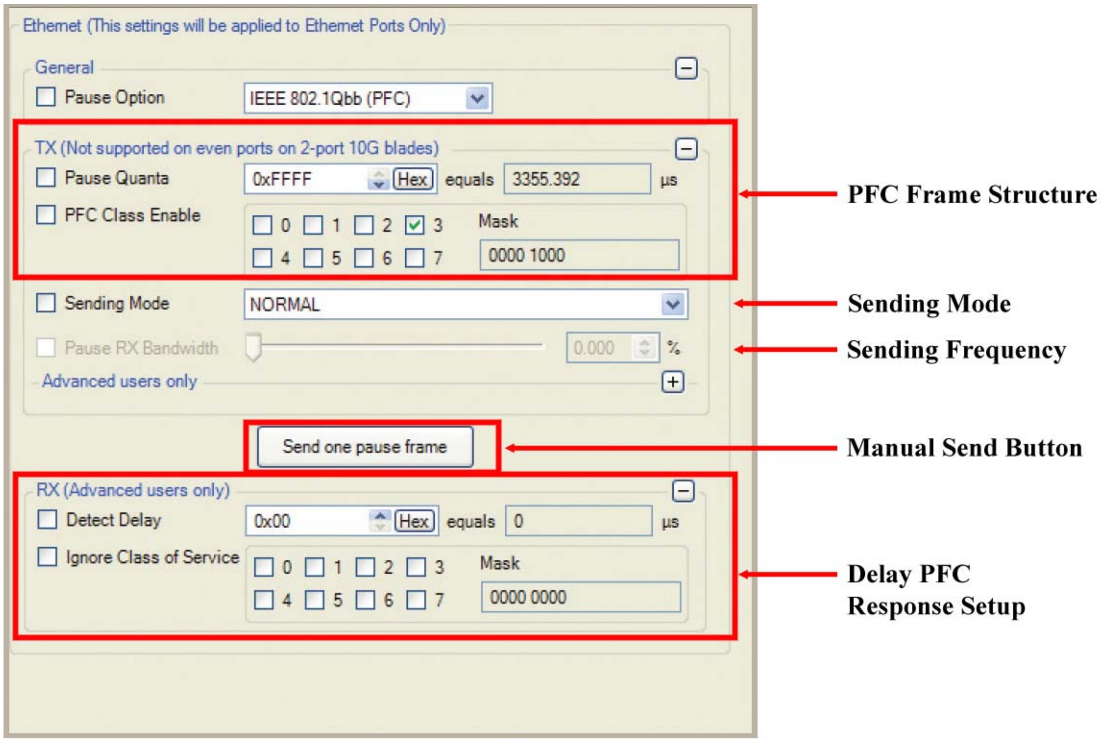
Load Tester is capable of emulating the following DCBX behaviors:

- Master mode – when using master mode, the ETS and PFC TLV are fully configurable. Users can add/edit/delete Application TLV. The default TLVs are FCoE and FIP.
- Slave mode – when using slave mode, Load Tester will display the DCBX TLV parameters from DUT master (remote) and result from slave (local).

DCBX exchanges can also be turned off and other DCBX parameters can be configured.

PFC Tests

Xgig Load Tester offers superior capabilities for PFC testing. In addition to normal traffic flow control mode, which FCoE Load Tester ports pause per PFC request, FCoE Load Tester is also capable of generating user-defined PFC frames.



Ethernet (This settings will be applied to Ethernet Ports Only)

General
□ Pause Option: IEEE 802.1Qbb (PFC)

TX (Not supported on even ports on 2-port 10G blades)
□ Pause Quanta: 0xFFFF (Hex) equals 3355.392 µs
□ PFC Class Enable: □ 0 □ 1 □ 2 ☑ 3 □ 4 □ 5 □ 6 □ 7 Mask 0000 1000

□ Sending Mode: NORMAL
□ Pause RX Bandwidth: 0.000 %
Advanced users only

Send one pause frame

RX (Advanced users only)
□ Detect Delay: 0x00 (Hex) equals 0 µs
□ Ignore Class of Service: □ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 Mask 0000 0000

The special PFC testing can be configured in the "Flow Control" tab. There are three user-forced generation modes:

- Send same PFC frame with specific pause time
- Iterate between Pause(x)=FFFF (TX_Off) to pause TX and Pause(x)=0 (TX_on) to resume TX
- Send multiple TX_Off to pause TX then multiple TX_On to resume TX

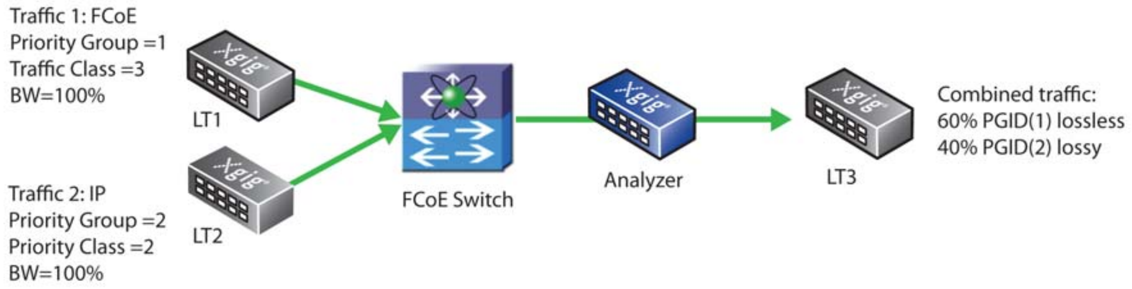
The PFC frame transmission frequency is defined by the paused RX Bandwidth of Load Tester. A user can also configure this by setting up individual time durations.

These special PFC generation modes are useful to verify the interoperability of DUT to different pause request behaviors. Together with Analyzer which will measure the DUT's PFC response time, they test the robustness of PFC implementation.

In additional to force pausing TX of DUT, a user can also force to delay the response to PFC frames from DUT or ignore the PFC request on selected traffic class. This feature can be used to measure switch ingress buffer margin.

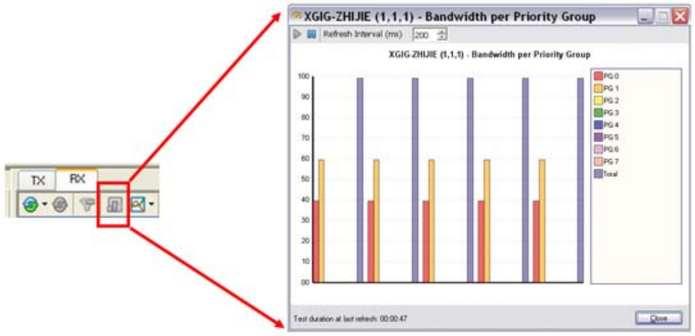
Enhanced Transmission Selection (ETS)

ETS is the arbitration mechanism on the EGRESS side of the switch. FCoE Load Tester verifies the ETS function and performance of the switch. The ETS negotiation result is shown in DCBX parameter window and there is a graphic display for RX throughput per each priority group. The statistics will help to verify that the switch is complying with the negotiated bandwidth for each traffic priority at congestion.



NOTE

The throughput chart can be initiated from the Traffic/RX pane.



XGIG-ZHIJIE (1,1,1) - Bandwidth per Priority Group

Refresh Interval (ms) 200

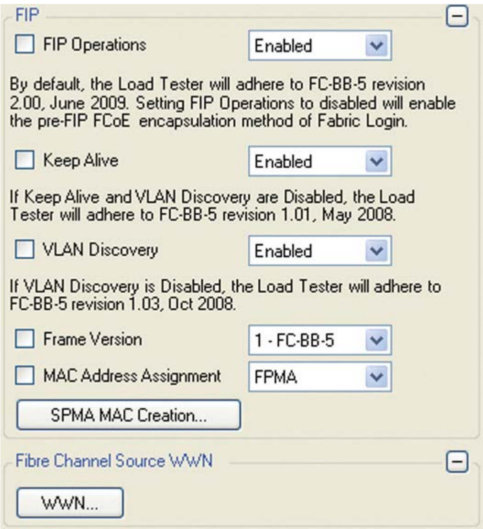
Test duration at last refresh: 00:00:47

FIP Functional Tests

FIP is the link service protocol for FCoE. Xgig Load Tester supports the ratified FIP standard and various interim drafts to facilitate interoperability tests. Below is the reference table of configurations for FIP versions.

FIP Version	FIP Operation	Keep_Alive	VLAN Discovery	Frame Version	MAC Address Assignment
V2.0	enable	enable	enable	1	FPMA
V1.0.3	enable	enable	disable	1	FPMA
V1.0.1	enable	disable	disable	0	FPMA
Pre-FIP *	disable	disable	disable	0	FPMA or SPMA

*** Support legacy FCOE FLOGI - wrap FLOGI in FCoE frame**



□ FIP Operations: Enabled

By default, the Load Tester will adhere to FC-BB-5 revision 2.00, June 2009. Setting FIP Operations to disabled will enable the pre-FIP FCoE encapsulation method of Fabric Login.

□ Keep Alive: Enabled

If Keep Alive and VLAN Discovery are Disabled, the Load Tester will adhere to FC-BB-5 revision 1.01, May 2008.

□ VLAN Discovery: Enabled

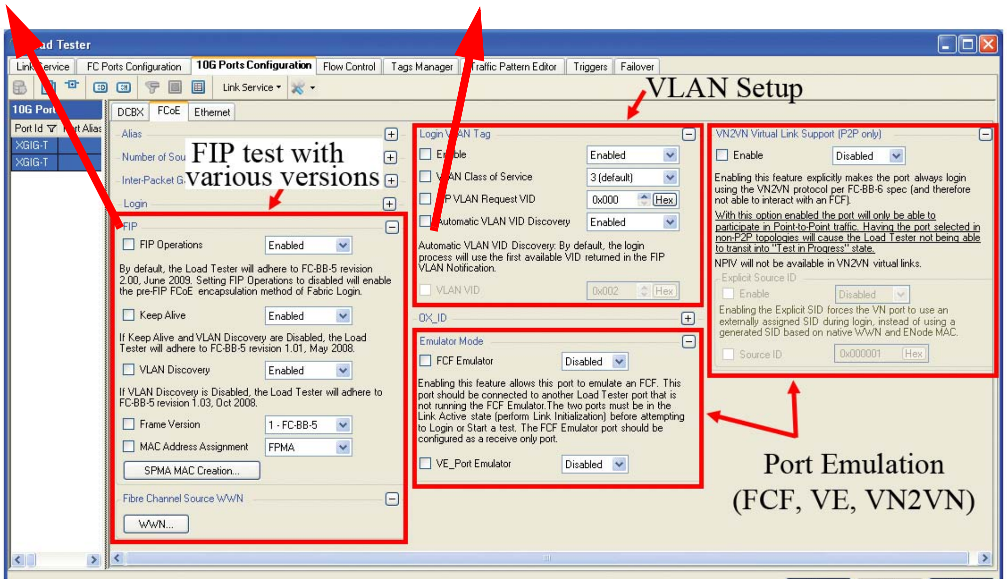
If VLAN Discovery is Disabled, the Load Tester will adhere to FC-BB-5 revision 1.03, Oct 2008.

□ Frame Version: 1 - FC-BB-5

□ MAC Address Assignment: FPMA

FIP configuration can be accessed from "Configuration" > "10G Ports Configuration" tab > "FCoE" sub-tab. In the same pane, you can further customize the VLAN tag of FIP frames.

By default, the Load Tester port emulates VN port of FC-BB-5 model. In the same pane, a user can also configure the Load Tester port to emulate FCF port, VE_Port and VN_Port to VN_Port direct attached topology following FC-BB-6 specification. When connected to a FCF DUT, FCF emulator is disabled and the Load Tester verifies the FCF and VE port functionality with VN_Port and VE port emulation. When connected to an end node, FCF emulator or VN2VN virtual link service is enabled and the Load Tester can verify the DUT's FIP link services.



FIP test with various versions

FIP

□ FIP Operations: Enabled

By default, the Load Tester will adhere to FC-BB-5 revision 2.00, June 2009. Setting FIP Operations to disabled will enable the pre-FIP FCoE encapsulation method of Fabric Login.

□ Keep Alive: Enabled

If Keep Alive and VLAN Discovery are Disabled, the Load Tester will adhere to FC-BB-5 revision 1.01, May 2008.

□ VLAN Discovery: Enabled

If VLAN Discovery is Disabled, the Load Tester will adhere to FC-BB-5 revision 1.03, Oct 2008.

□ Frame Version: 1 - FC-BB-5

□ MAC Address Assignment: FPMA

SPMA MAC Creation...

Fibre Channel Source WWN

WWN...

VLAN Setup

Login VLAN Tag

□ Enable: Enabled

□ VLAN Class of Service: 3 (default)

□ FIP VLAN Request VID: 0x000 Hex

□ Automatic VLAN VID Discovery: Enabled

Automatic VLAN VID Discovery: By default, the login process will use the first available VID returned in the FIP VLAN Notification.

□ VLAN VID: 0x002 Hex

Emulator Mode

□ FCF Emulator: Disabled

Enabling this feature allows this port to emulate an FCF. This port should be connected to another Load Tester port that is not running the FCF Emulator.The two ports must be in the Link Active state (perform Link Initialization) before attempting to Login or Start a test. The FCF Emulator port should be configured as a receive only port.

□ VE_Port Emulator: Disabled

VN2VN Virtual Link Support (P2P only)

□ Enable: Disabled

Enabling this feature explicitly makes the port always login using the VN2VN protocol per FC-BB-6 spec (and therefore not able to interact with an FCF).

With this option enabled the port will only be able to participate in Point-to-Point traffic. Having the port selected in non-P2P topologies will cause the Load Tester not being able to transit into "Test in Progress" state.

NPIV will not be available in VN2VN virtual links.

Explicit Source ID

□ Enable: Disabled

Enabling the Explicit SID forces the VN port to use an externally assigned SID during login, instead of using a generated SID based on native WWN and ENode MAC.

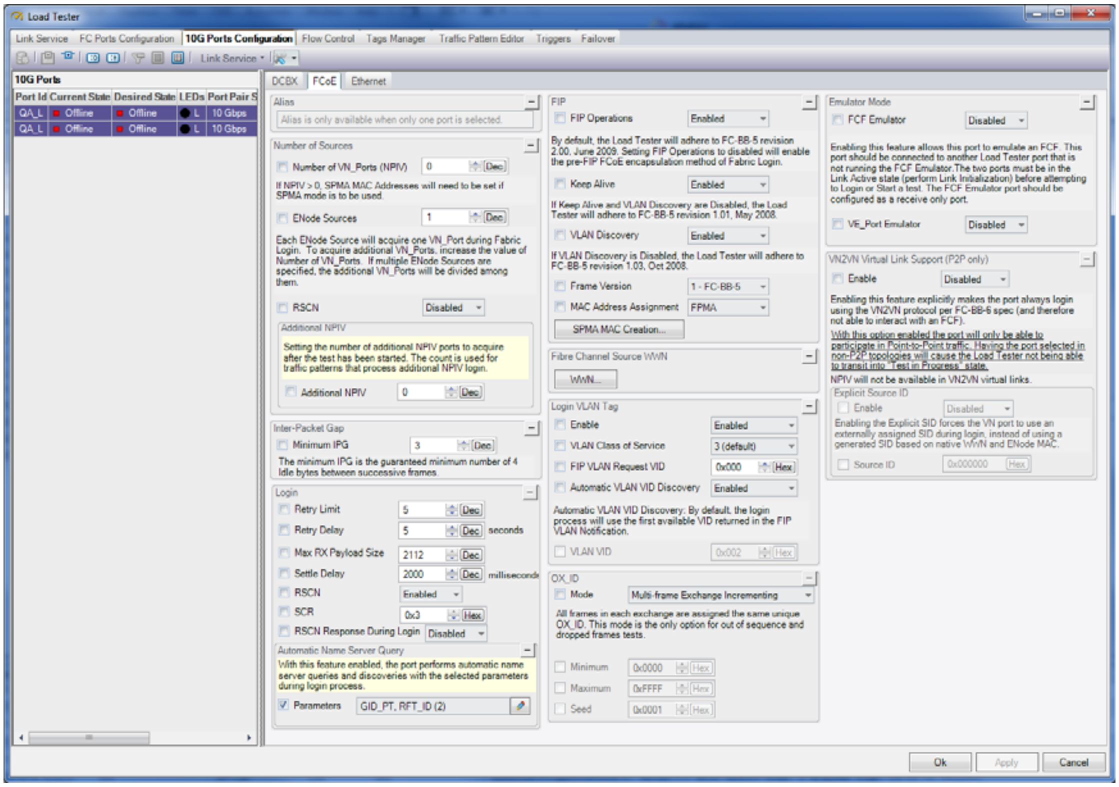
□ Source ID: 0x000001 Hex

Port Emulation
(FCF, VE, VN2VN)

FCoE Port Configuration

Similar to FC Load Tester, FCoE port configuration also allows the user to configure the following parameters:

- Virtual port (NPIV) setup (up to 255 NPIV ports per Load Tester port)
- Login retry and link reset options
- Custom name server query configuration (full command library for Flogi, NPort Login and zoning)
- WWN custom configuration (automatic assignment by default)
- OX_ID mode configuration:
  - Multi-frame Exchange Incrementing – multiple frames in each exchange. Each exchange and all frames within the exchange are assigned a unique OX_ID. The OX_ID value increments per exchange depending on the starting value (OX_ID Base), sequential step value (OX_ID Step), and number of frames per exchange (Exchange Length). These options can be set in the Profile Parameters window in the Traffic Pattern Editor tab.
  - Single-frame Exchange Incrementing – single frame in each exchange. OX_ID value increments sequentially in each transmitted frame within the pre-configured range set with (OX_ID Min, OX_ID Max).
  - Single-frame Exchange Random – single frame in each exchange. OX_ID value in each transmitted frame varies randomly within the pre-configured range set with (OX_ID Min, OX_ID Max, OX_ID Seed).



10G Ports

Port Id	Current State	Desired State	LEDs	Port Pair S
QA_L	Offline	Offline	● L	10 Gbps
QA_L	Offline	Offline	● L	10 Gbps

Alias

Alias is only available when only one port is selected.

Number of Sources

□ Number of VN_Ports (NPIV) 0 Dec

If NPIV > 0, SPMA MAC Addresses will need to be set if SPMA mode is to be used.

□ ENode Sources 1 Dec

Each ENode Source will acquire one VN_Port during Fabric Login. To acquire additional VN_Ports, increase the value of Number of VN_Ports. If multiple ENode Sources are specified, the additional VN_Ports will be divided among them.

□ RSCN Disabled

Additional NPIV

Setting the number of additional NPIV ports to acquire after the test has been started. The count is used for traffic patterns that process additional NPIV login.

□ Additional NPIV 0 Dec

Inter-Packet Gap

□ Minimum IPG 3 Dec

The minimum IPG is the guaranteed minimum number of 4 Idle bytes between successive frames.

Login

□ Retry Limit 5 Dec

□ Retry Delay 5 Dec seconds

□ Max RX Payload Size 2112 Dec

□ Settle Delay 2000 Dec milliseconds

□ RSCN Enabled

□ SCR 0x3 Hex

□ RSCN Response During Login Disabled

Automatic Name Server Query

With this feature enabled, the port performs automatic name server queries and discoveries with the selected parameters during login process.

☑ Parameters GID_PT, RFT_ID (2)

FIP

□ FIP Operations Enabled

By default, the Load Tester will adhere to FC-BB-5 revision 2.00, June 2009. Setting FIP Operations to disabled will enable the pre-FIP FCoE encapsulation method of Fabric Login.

□ Keep Alive Enabled

If Keep Alive and VLAN Discovery are Disabled, the Load Tester will adhere to FC-BB-5 revision 1.01, May 2008.

□ VLAN Discovery Enabled

If VLAN Discovery is Disabled, the Load Tester will adhere to FC-BB-5 revision 1.03, Oct 2008.

□ Frame Version 1 - FC-BB-5

□ MAC Address Assignment FPMA

SPMA MAC Creation...

Fibre Channel Source WWN

WWN...

Login VLAN Tag

□ Enable Enabled

□ VLAN Class of Service 3 (default)

□ FIP VLAN Request VID 0x000 Hex

□ Automatic VLAN VID Discovery Enabled

Automatic VLAN VID Discovery: By default, the login process will use the first available VID returned in the FIP VLAN Notification.

□ VLAN VID 0x002 Hex

OX_ID

□ Mode Multi-frame Exchange Incrementing

All frames in each exchange are assigned the same unique OX_ID. This mode is the only option for out of sequence and dropped frames tests.

□ Minimum 0x0000 Hex

□ Maximum 0xFFFF Hex

□ Seed 0x0001 Hex

Emulator Mode

□ FCF Emulator Disabled

Enabling this feature allows this port to emulate an FCF. This port should be connected to another Load Tester port that is not running the FCF Emulator.The two ports must be in the Link Active state (perform Link Initialization) before attempting to Login or Start a test. The FCF Emulator port should be configured as a receive only port.

□ VE_Port Emulator Disabled

VN2VN Virtual Link Support (P2P only)

□ Enable Disabled

Enabling this feature explicitly makes the port always login using the VN2VN protocol per FC-BB-6 spec (and therefore not able to interact with an FCF).

With this option enabled the port will only be able to participate in Point-to-Point traffic. Having the port selected in non-P2P topologies will cause the Load Tester not being able to transit into "Test in Progress" state.

NPIV will not be available in VN2VN virtual links.

Explicit Source ID

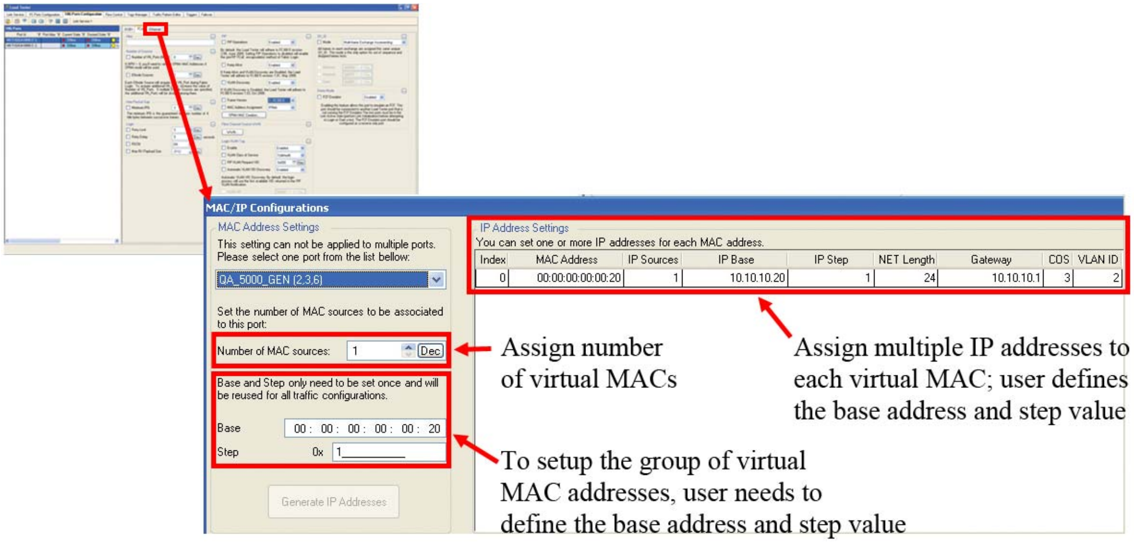
□ Enable Disabled

Enabling the Explicit SID forces the VN port to use an externally assigned SID during login, instead of using a generated SID based on native WWN and ENode MAC.

□ Source ID 0x000000 Hex

Ethernet MAC and IP Address Configuration

For setting up the port characteristics for IP/TCP or UDP virtual inks, use the “Ethernet” sub-tab under “10G Ports Configuration”. The user can configure custom virtual MAC and multiple IP addresses for each virtual MAC. They can also configure gateway and subnet length so that Load Tester can setup IP traffic properly when using ARP. The TCP or UDP source and destination port setup is however part of traffic pattern definition and configured in the “traffic profile configuration” tab instead.



This setting can not be applied to multiple ports. Please select one port from the list bellow:

QA_5000_GEN (2,3,6)

Set the number of MAC sources to be associated to this port:

Number of MAC sources: 1 Dec

Base and Step only need to be set once and will be reused for all traffic configurations.

Base 00 : 00 : 00 : 00 : 00 : 20

Step 0x 1

You can set one or more IP addresses for each MAC address.

Index	MAC Address	IP Sources	IP Base	IP Step	NET Length	Gateway	COS	VLAN ID
0	00:00:00:00:00:20	1	10.10.10.20	1	24	10.10.10.1	3	2

Assign number of virtual MACs

Assign multiple IP addresses to each virtual MAC; user defines the base address and step value

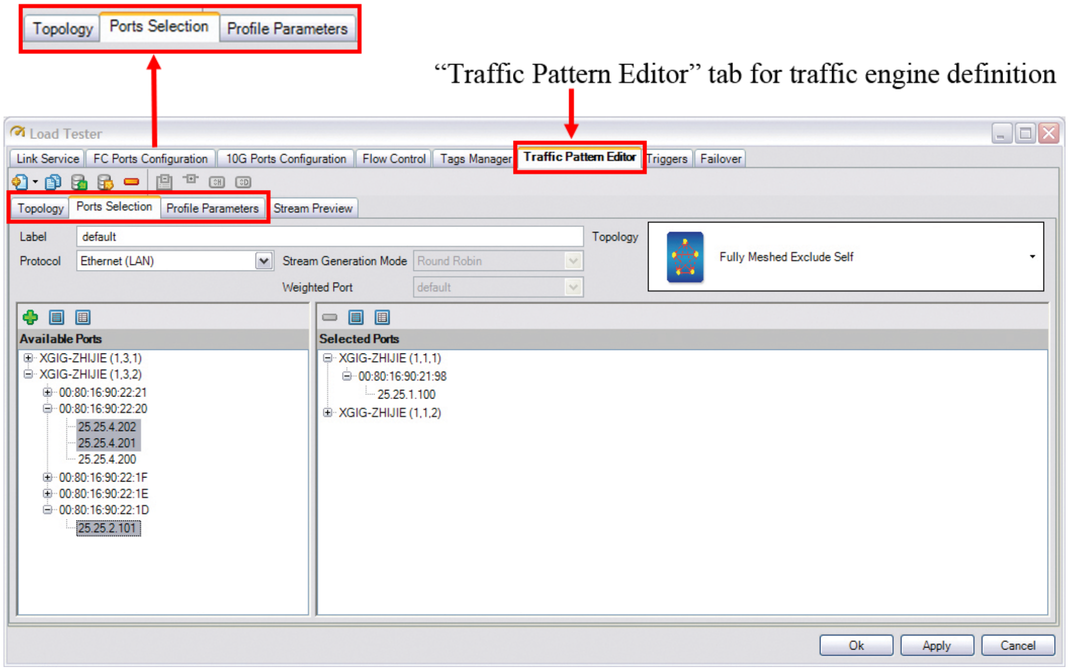
To setup the group of virtual MAC addresses, user needs to define the base address and step value

NOTE

FCoE virtual link is always present by default. For Ethernet/IP traffic only test, the user needs to disable FCoE login from this tab.

FCoE and DCB Switch Performance Test

One important use of Load Tester is to verify the performance of the FCoE/DCB switch and fabric by creating a test case that stresses the DUT at its full line rate. Xgig Load Tester is capable of generating up to 1024 data streams per physical port with various complex topologies. The stream generation is controlled by eight traffic profile engines for each port (6 for 2-port Xgig 10GE blade).


“Traffic Pattern Editor” tab for traffic engine definition

Label: default
Protocol: Ethernet (LAN)
Stream Generation Mode: Round Robin
Weighted Port: default
Topology: Fully Meshed Exclude Self

Available Ports
- XGIG-ZHIJIE (1,3,1)
- XGIG-ZHIJIE (1,3,2)
  - 00:80:16:90:22:21
  - 00:80:16:90:22:20
    - 25.25.4.202
    - 25.25.4.201
    - 25.25.4.200
  - 00:80:16:90:22:1F
  - 00:80:16:90:22:1E
  - 00:80:16:90:22:1D
    - 25.25.2.101

Selected Ports
- XGIG-ZHIJIE (1,1,1)
  - 00:80:16:90:21:98
    - 25.25.1.100
- XGIG-ZHIJIE (1,1,2)

Defining Traffic Profile Engine

Each engine is responsible for generating one or more data streams depending on the topology setup. In a converged test environment, each engine can be used to define a specific traffic priority group or traffic class, i.e. the FCoE traffic or IP traffic.

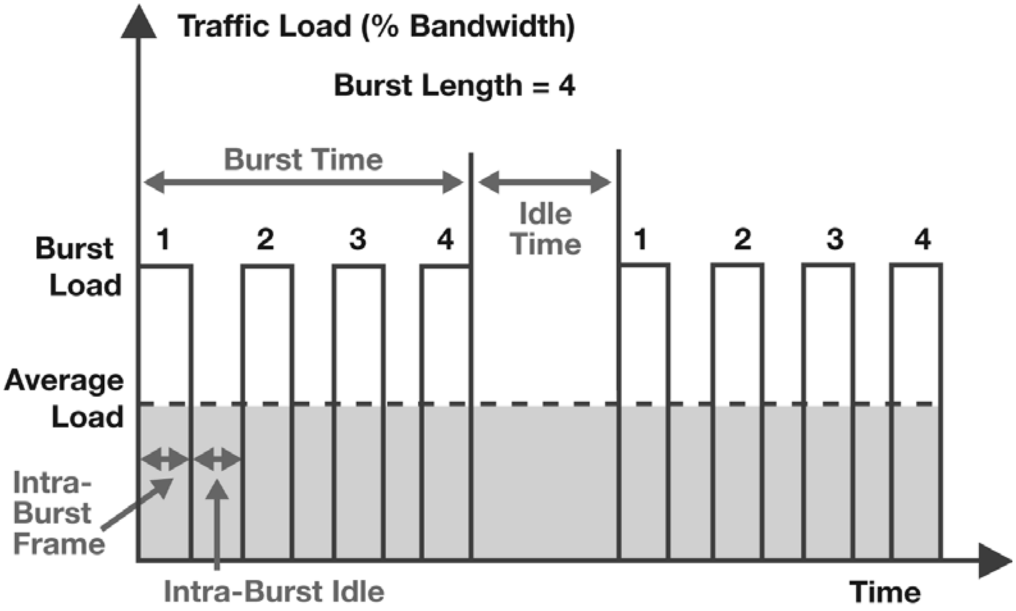
A traffic profile engine is defined using the “Traffic Pattern Editor” tab. There are three sub-tabs defining three steps of configuration and the following parameters are required to define an engine:

- Application type: FCoE or LAN Ethernet
- Load characteristics
- Topology setup
- Exchange/transaction setup
- Payload configuration and TCP/UDP plug-in
- Frame error generation

Use the "Stream Preview" tab to preview the data streams created by the traffic profile engine.

Burst Profile Definition

Load Tester can generate data traffic in a step load pattern. This diagram shows the burst traffic profile. The Burst Load profile is defined by Average Load, Burst Load and frame length.



The definition of each parameter is as follows:

Burst Load: Average of burst load time + zero load time/total time

Average Load: The overall average load over the time

Burst Length: The number of frames during the burst load transmission

The Burst Time, Idle Time, Intra-Burst Frame Time and Intra-Burst Idle Time are calculated values from the above parameters.

Defining Load Characteristics

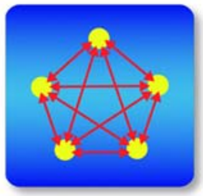
The load defined here indicates the desired throughput at transmission. There are two load modes available – continuous load and burst load, both of which are defined as % relative to the theoretical throughput maximum of the physical link (e.g. for 10GE the maximum load is 1000MB/s).

Note that the bandwidth sharing among multiple virtual links in one physical pipeline is determined by the “stream generation mode”. Xgig Load Tester supports two options which can be selected from “Port Selection” sub-tab:

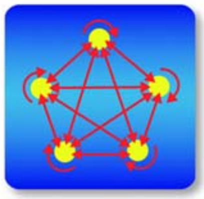
- Round Robin – Bandwidth are equitably shared with all streams
- Weighted – streams are interleaved per exchange base (1-32 frames per exchange) and weighted based on priority

Topology Options

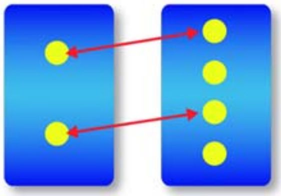
Load Tester has the following topology options:



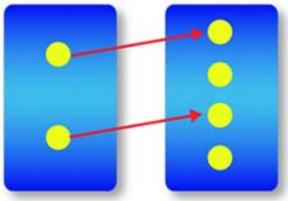
Fully-Meshed
Excluding Self



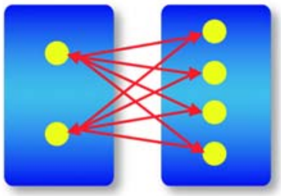
Fully-Meshed
Including Self



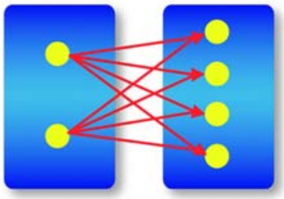
Point-to-Point
Bidirectional



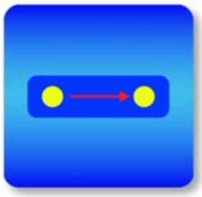
Point-to-Point
Unidirectional



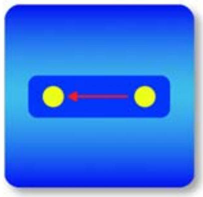
Partially-Meshed
Bidirectional



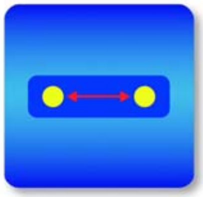
Partially-Meshed
Unidirectional



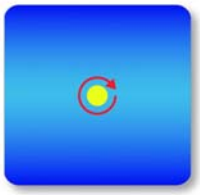
Pair Odd



Pair Even



Pair Ports



Self

The topology can be configured at either the MAC port or the IP levels port.

Exchange/Stream Setup

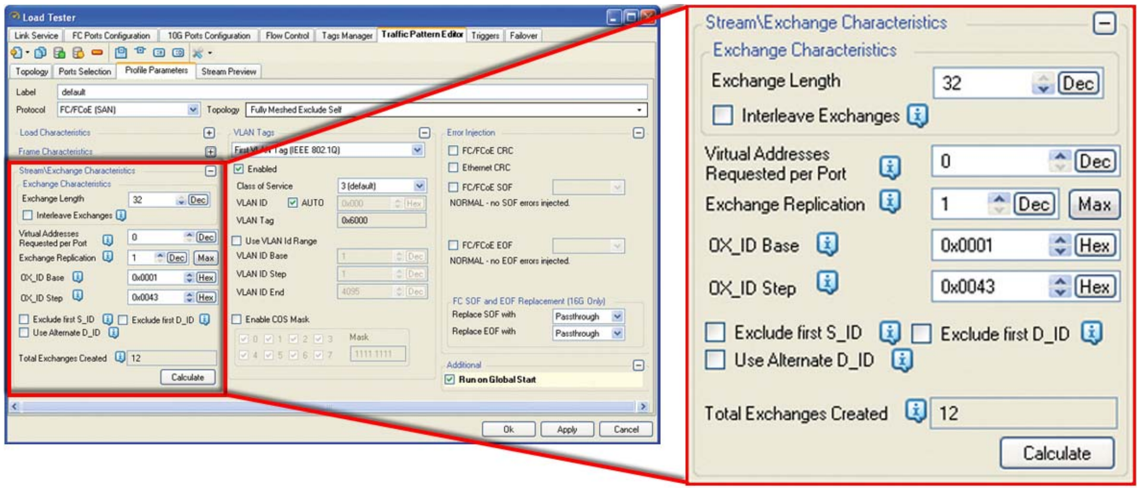
Each traffic profile engine might generate more than one stream/exchange. The number of exchanges (for FCoE traffic) or streams (for LAN Ethernet traffic) generated from each traffic profile engine is determined by different parameters.

FCoE exchange is defined by the combination of three parameters:

- S_ID
- D_ID
- OX_ID

Ethernet stream is defined by the combination of five parameters:

- source MAC
- destination MAC
- source IP
- destination IP
- VLAN



Label: default
Protocol: FC/FCoE (SAN)
Topology: Fully Meshed Exclude Self

First VLAN Tag (IEEE 802.1Q)
☑ Enabled
Class of Service: 3 (default)
VLAN ID ☑ AUTO 0x000 Hex
VLAN Tag: 0x6000
☐ Use VLAN Id Range
VLAN ID Base: 1 Dec
VLAN ID Step: 1 Dec
VLAN ID End: 4095 Dec
☐ Enable COS Mask
☑ 0 ☑ 1 ☑ 2 ☑ 3 ☑ 4 ☑ 5 ☑ 6 ☑ 7 Mask: 1111 1111

☐ FC/FCoE CRC
☐ Ethernet CRC
☐ FC/FCoE SOF
NORMAL - no SOF errors injected.
☐ FC/FCoE EOF
NORMAL - no EOF errors injected.
Replace SOF with: Passthrough
Replace EOF with: Passthrough
☑ Run on Global Start

Stream\Exchange Characteristics
Exchange Characteristics
Exchange Length: 32 Dec
☐ Interleave Exchanges
Virtual Addresses Requested per Port: 0 Dec
Exchange Replication: 1 Dec Max
OX_ID Base: 0x0001 Hex
OX_ID Step: 0x0043 Hex
☐ Exclude first S_ID ☐ Exclude first D_ID
☐ Use Alternate D_ID
Total Exchanges Created: 12
Calculate

FCoE Exchange Configuration

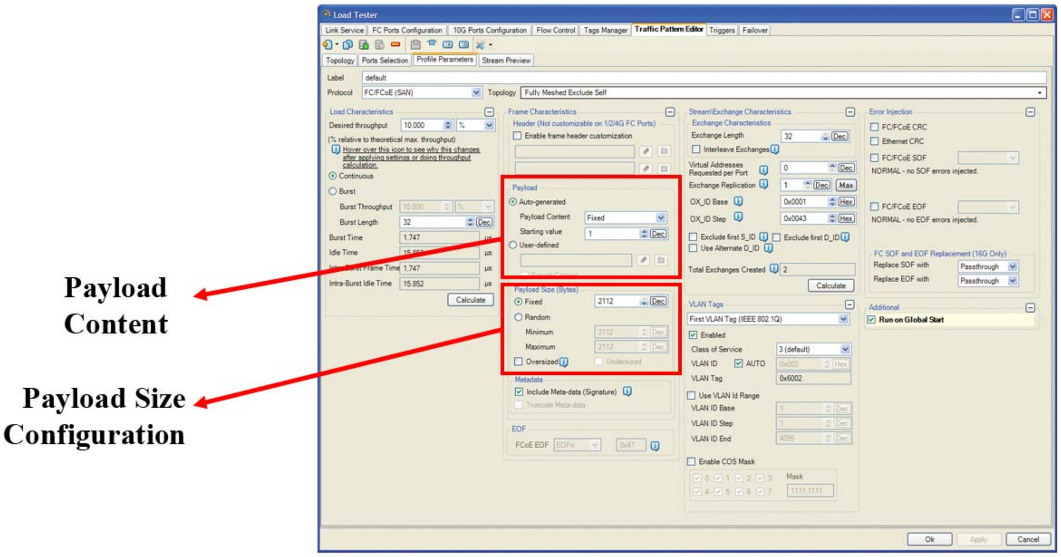
The number of exchanges/streams in one engine is calculated by the following formula and listed in the pane for your reference:

Number of exchanges/Streams = Number of links FCoE Exchange configuration by topology exchange stream replication

Frame Construction - Frame Header and Payload Setup

Xgig Load Tester allows user to construct any standard and custom frames/packets through header and payload configuration.

For header configuration, the GUI provides the header template similarly to Analyzer to facilitate building the frame header structure. A user also has an option to load the header content directly from a .txt file.


Payload Content
Payload Size Configuration
Load Tester
Link Service | FC Ports Configuration | 10G Ports Configuration | Flow Control | Tags Manager | Traffic Pattern Editor | Triggers | Failover
Topology | Ports Selection | Profile Parameters | Stream Preview
Calculate
Ok
Apply
Cancel

Label: default
Protocol: FC/FCoE (SAN) Topology: Fully Meshed Exclude Self

Load Characteristics
Desired throughput: 10.000 %
(% relative to theoretical max. throughput)
Hover over this icon to see why this changes after applying settings or doing throughput calculation.
● Continuous
○ Burst
Burst Throughput: 10.000 %
Burst Length: 32 Dec
Burst Time: 1.747 µs
Idle Time: 15.852 µs
Intra-Burst Frame Time: 1.747 µs
Intra-Burst Idle Time: 15.852 µs

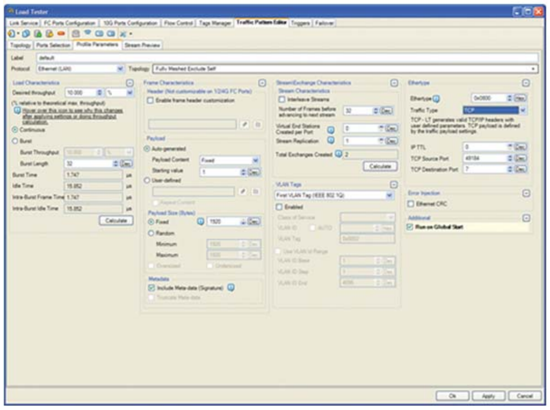
Frame Characteristics
Header (Not customizable on 1/2/4G FC Ports)
□ Enable frame header customization
Payload
● Auto-generated
Payload Content: Fixed
Starting value: 1 Dec
○ User-defined
Payload Size (Bytes)
● Fixed 2112 Dec
○ Random
Minimum 2112 Dec
Maximum 2112 Dec
□ Oversized □ Undersized
Metadata
☑ Include Meta-data (Signature)
□ Truncate Meta-data
EOF
FCoE EOF: EOFn 0x41

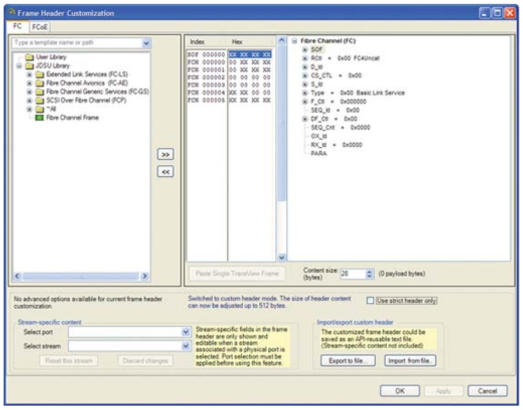
Stream\Exchange Characteristics
Exchange Characteristics
Exchange Length: 32 Dec
□ Interleave Exchanges
Virtual Addresses Requested per Port: 0 Dec
Exchange Replication: 1 Dec Max
OX_ID Base: 0x0001 Hex
OX_ID Step: 0x0043 Hex
□ Exclude first S_ID □ Exclude first D_ID
□ Use Alternate D_ID
Total Exchanges Created: 2

VLAN Tags
First VLAN Tag (IEEE 802.1Q)
☑ Enabled
Class of Service: 3 (default)
VLAN ID ☑ AUTO 0x002 Hex
VLAN Tag: 0x6002
□ Use VLAN Id Range
VLAN ID Base: 1 Dec
VLAN ID Step: 1 Dec
VLAN ID End: 4095 Dec
□ Enable COS Mask
☑ 0 ☑ 1 ☑ 2 ☑ 3 ☑ 4 ☑ 5 ☑ 6 ☑ 7 Mask: 1111 1111

Error Injection
□ FC/FCoE CRC
□ Ethernet CRC
□ FC/FCoE SOF
NORMAL - no SOF errors injected.
□ FC/FCoE EOF
NORMAL - no EOF errors injected.
FC SOF and EOF Replacement (16G Only)
Replace SOF with: Passthrough
Replace EOF with: Passthrough

Additional
☑ Run on Global Start





Options for payload content

- Fixed/Incrementing/Long Mixed/Random/Rotate Left/Rotate Right patterns
- Stressful noise patterns such as CRPAT, CJTPAT
- Random payload content
- Custom payload directly loaded from data file

Options for payload size

- Fixed 24-2112 byte for FCoE traffic
- Fixed 46-16384 byte for LAN Ethernet traffic
- Random

NOTE

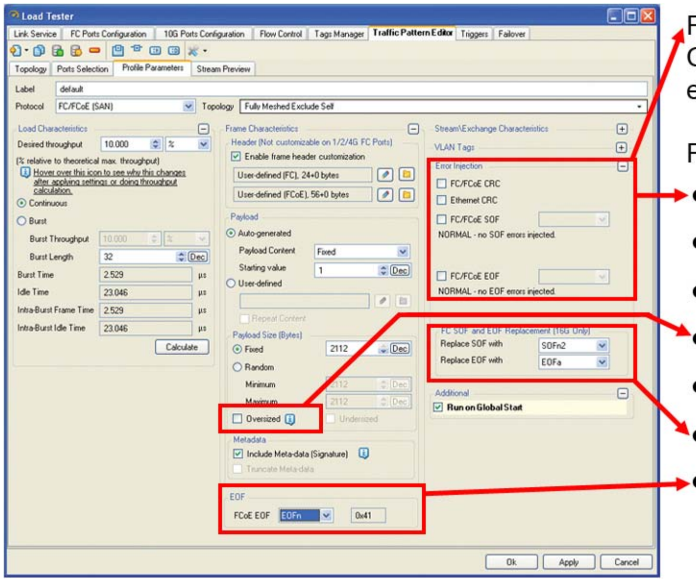
By eliminating metadata, frames with zero payloads can be generated.

TCP/UDP plug-in

- IP TTL
- Source port value
- Destination port value

Frame Error Generation

Xgig Load Tester offers options to plug-in errors when generating frames.



Label: default
Protocol: FC/FCoE (SAN)
Topology: Fully Meshed Exclude Self

Load Characteristics
Desired throughput: 10.000 %
(% relative to theoretical max. throughput)
Hover over this icon to see why this changes after applying settings or doing throughput calculation.
● Continuous
○ Burst
Burst Throughput: 10.000 %
Burst Length: 32 Dec
Burst Time: 2.529 µs
Idle Time: 23.046 µs
Intra-Burst Frame Time: 2.529 µs
Intra-Burst Idle Time: 23.046 µs

Frame Characteristics
Header (Not customizable on 1/2/4G FC Ports)
☑ Enable frame header customization
User-defined (FC), 24+0 bytes
User-defined (FCoE), 56+0 bytes
Payload
● Auto-generated
Payload Content: Fixed
Starting value: 1 Dec
○ User-defined
□ Repeat Content
Payload Size (Bytes)
● Fixed: 2112 Dec
○ Random
Minimum: 2112 Dec
Maximum: 2112 Dec
□ Oversized
□ Undersized
Metadata
☑ Include Meta-data (Signature)
□ Truncate Meta-data
EOF
FCoE EOF: EOFn 0x41

Stream\Exchange Characteristics
VLAN Tags
Error Injection
□ FC/FCoE CRC
□ Ethernet CRC
□ FC/FCoE SOF
NORMAL - no SOF errors injected.
□ FC/FCoE EOF
NORMAL - no EOF errors injected.
FC SOF and EOF Replacement (16G Only)
Replace SOF with: SOFn2
Replace EOF with: EOFa
Additional
☑ Run on Global Start

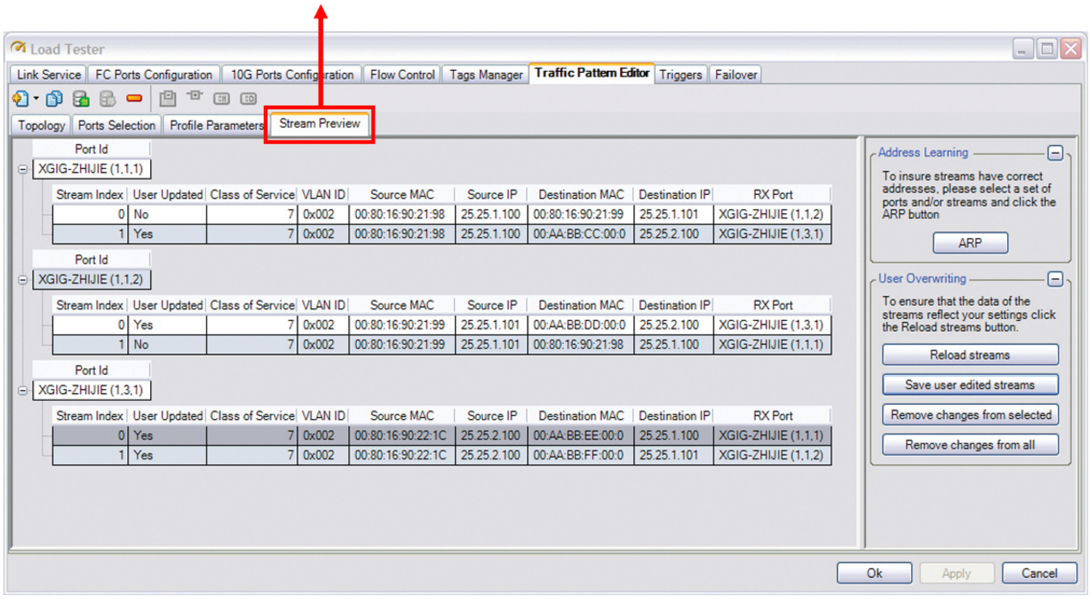
For Ethernet traffic, Ethernet CRC errors can be created to each packet.

For FCoE traffic, errors include:

- FCoE dual CRC error
- Corrupted SOF
- Corrupted EOF
- Oversized frame
- Zero payload and undersized frame
- Invalid SOF/EOF error (FC)
- Invalid EOF error (FCoE)

Stream Preview

After the traffic profile engines are configured, a user can preview the results in the “Stream Preview” tab before starting the traffic. The streams are listed under each Load Tester port. A user can also make changes to each stream directly from this tab.



Stream Preview

Port Id: XGIG-ZHIJIE (1,1,1)

Stream Index	User Updated	Class of Service	VLAN ID	Source MAC	Source IP	Destination MAC	Destination IP	RX Port
0	No	7	0x002	00:80:16:90:21:98	25.25.1.100	00:80:16:90:21:99	25.25.1.101	XGIG-ZHIJIE (1,1,2)
1	Yes	7	0x002	00:80:16:90:21:98	25.25.1.100	00:AA:BB:CC:00:0	25.25.2.100	XGIG-ZHIJIE (1,3,1)

Port Id: XGIG-ZHIJIE (1,1,2)

Stream Index	User Updated	Class of Service	VLAN ID	Source MAC	Source IP	Destination MAC	Destination IP	RX Port
0	Yes	7	0x002	00:80:16:90:21:99	25.25.1.101	00:AA:BB:DD:00:0	25.25.2.100	XGIG-ZHIJIE (1,3,1)
1	No	7	0x002	00:80:16:90:21:99	25.25.1.101	00:80:16:90:21:98	25.25.1.100	XGIG-ZHIJIE (1,1,1)

Port Id: XGIG-ZHIJIE (1,3,1)

Stream Index	User Updated	Class of Service	VLAN ID	Source MAC	Source IP	Destination MAC	Destination IP	RX Port
0	Yes	7	0x002	00:80:16:90:22:1C	25.25.2.100	00:AA:BB:EE:00:0	25.25.1.100	XGIG-ZHIJIE (1,1,1)
1	Yes	7	0x002	00:80:16:90:22:1C	25.25.2.100	00:AA:BB:FF:00:0	25.25.1.101	XGIG-ZHIJIE (1,1,2)

Address Learning
To insure streams have correct addresses, please select a set of ports and/or streams and click the ARP button

User Overwriting
To ensure that the data of the streams reflect your settings click the Reload streams button.

NOTE

Click “ARP” button to notify any address changes to the address server.

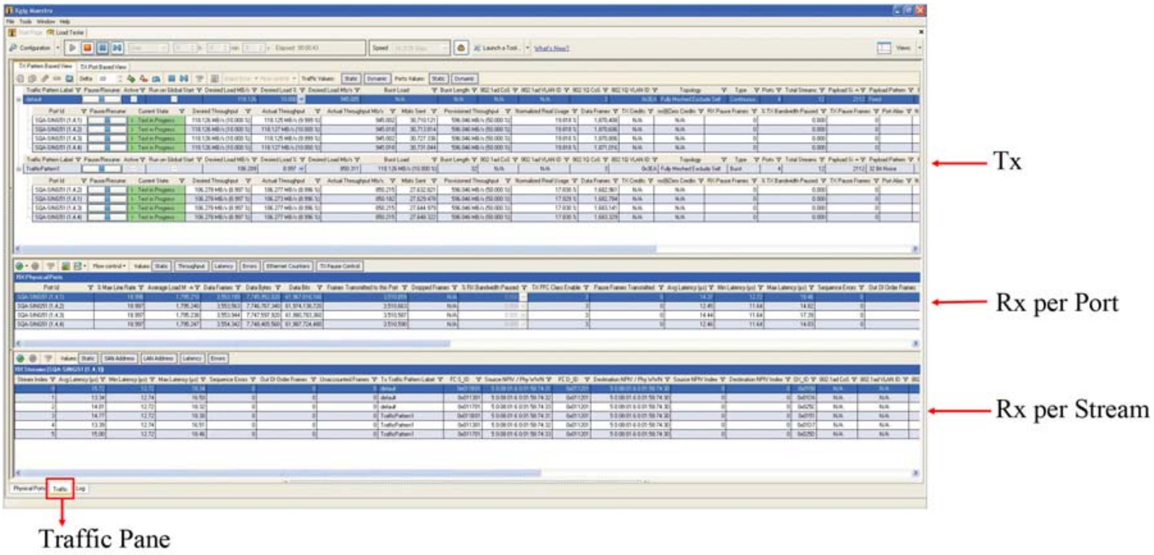
TX and RX Statistics

Xgig FCoE Load Tester provides comprehensive counters to verify every aspect of switch performance including throughput, latency, frame counts, frame type counts, frame errors and exchange errors. The user can monitor data streams from different views.

For TX, there are data views per physical port, per traffic profile or TX stream.

For RX, there are data views per physical port and per stream.

TX and RX views can be displayed in different tabs or can be tiled horizontally or vertically and are seen on the same screen.



Tx

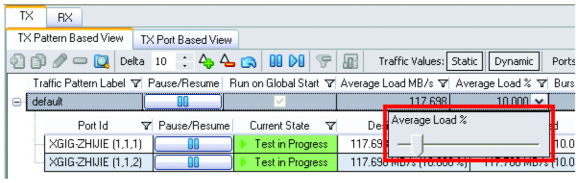
Rx per Port

Rx per Stream

Traffic Pane

Adjusting Live Traffic

While displaying statistical measurements on the Traffic pane, the user can also adjust the data streams on-the-fly. This gives the user incredible flexibility in managing live data streams.

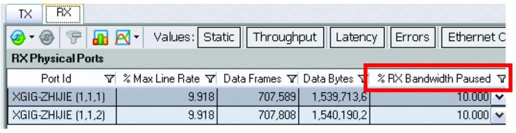


Traffic Pattern Label	Pause/Resume	Run on Global Start	Average Load MB/s	Average Load %	Burs
default	▯▯	☑	117.698	10.000	

Port Id	Pause/Resume	Current State	Des
XGIG-ZHIJIE (1,1,1)	▯▯	Test in Progress	117.69
XGIG-ZHIJIE (1,1,2)	▯▯	Test in Progress	117.690 MB/s (10.000 %)

Average Load %

Adjust the TX Load % with the Sliding Bar



RX Physical Ports

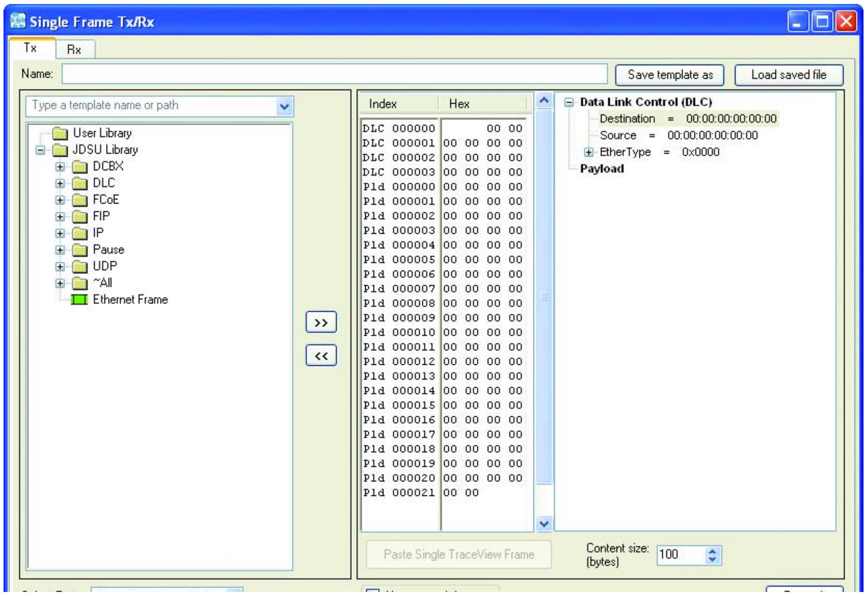
Port Id	% Max Line Rate	Data Frames	Data Bytes	% RX Bandwidth Paused
XGIG-ZHIJIE (1,1,1)	9.918	707,589	1,539,713,6	10.000
XGIG-ZHIJIE (1,1,2)	9.918	707,808	1,540,190,2	10.000

Adjust the RX Bandwidth Pause %

Tools Embedded in Xgig Load Tester

Clicking “Launch a Tool” button on the top of main pane provides the user with direct access to the following embedded tools:

- **Single Frame Tx/Rx** — This tool allows users to directly control the transmission engine and access the receiving buffer for incoming frames. With the help of frame template, a user can construct any frame from the GUI and manually transmit it on the link. Meanwhile, frames received from DUT can be retrieved and displayed one frame at a time. The Rx buffer saves up to 64 frames and is purged after retrieving. This tool can be used for protocol compliance test, functional verification and manual exchange management.

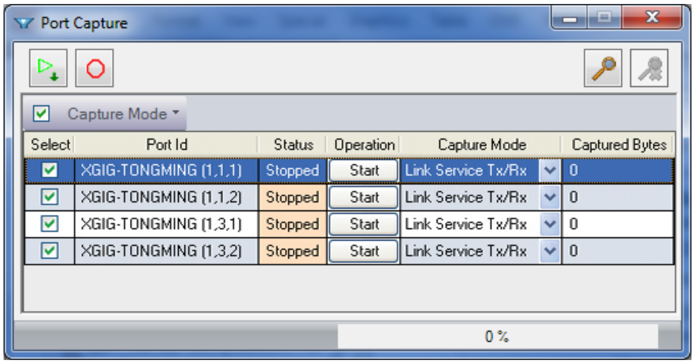


```
Index         Hex
DLC 000000          00 00
DLC 000001 00 00 00 00
DLC 000002 00 00 00 00
DLC 000003 00 00 00 00
Pld 000000 00 00 00 00
Pld 000001 00 00 00 00
Pld 000002 00 00 00 00
Pld 000003 00 00 00 00
Pld 000004 00 00 00 00
Pld 000005 00 00 00 00
Pld 000006 00 00 00 00
Pld 000007 00 00 00 00
Pld 000008 00 00 00 00
Pld 000009 00 00 00 00
Pld 000010 00 00 00 00
Pld 000011 00 00 00 00
Pld 000012 00 00 00 00
Pld 000013 00 00 00 00
Pld 000014 00 00 00 00
Pld 000015 00 00 00 00
Pld 000016 00 00 00 00
Pld 000017 00 00 00 00
Pld 000018 00 00 00 00
Pld 000019 00 00 00 00
Pld 000020 00 00 00 00
Pld 000021 00 00
```

```
Data Link Control (DLC)
  Destination  =  00:00:00:00:00:00
  Source  =  00:00:00:00:00:00
  EtherType  =  0x0000
Payload
```

Content size: (bytes) 100

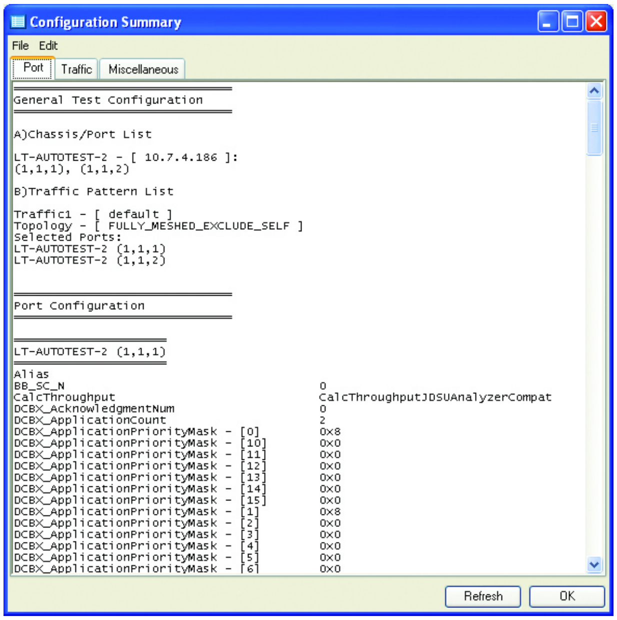
- **Port Capture** — This tool is used to enable, manage, and view the trace capture at each Load Tester port. Up to 128MB of control frames only or all frames can be captured per port. This tool gives complete visibility of DUT behaviors in addition to performance statistics by capturing protocol traces. The traces follow Xgig TraceView format. There is a hot key available to directly launch TraceView on the GUI.



Select	Port Id	Status	Operation	Capture Mode	Captured Bytes
☑	XGIG-TONGMING (1,1,1)	Stopped	Start	Link Service Tx/Rx	0
☑	XGIG-TONGMING (1,1,2)	Stopped	Start	Link Service Tx/Rx	0
☑	XGIG-TONGMING (1,3,1)	Stopped	Start	Link Service Tx/Rx	0
☑	XGIG-TONGMING (1,3,2)	Stopped	Start	Link Service Tx/Rx	0

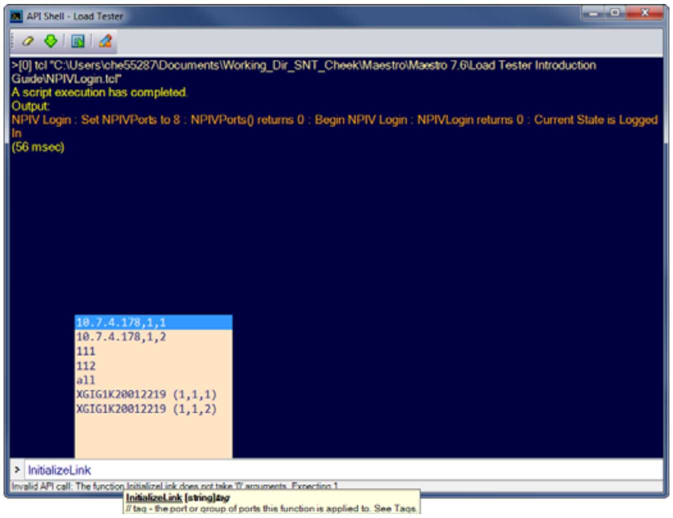
0 %

- **Configuration Summary** — This tool helps to review and summarize the detailed configuration results of each Load Tester port on a single list view.



```
General Test Configuration

A)Chassis/Port List

LT-AUTOTEST-2 - [ 10.7.4.186 ]:
(1,1,1), (1,1,2)

B)Traffic Pattern List

Traffic1 - [ default ]
Topology - [ FULLY_MESHED_EXCLUDE_SELF ]
Selected Ports:
LT-AUTOTEST-2 (1,1,1)
LT-AUTOTEST-2 (1,1,2)


Port Configuration


LT-AUTOTEST-2 (1,1,1)

Alias
BB_SC_N                                   0
CalcThroughput                            CalcThroughputJDSUAnalyzerCompat
DCBX_AcknowledgmentNum                    0
DCBX_ApplicationCount                     2
DCBX_ApplicationPriorityMask - [0]        0x8
DCBX_ApplicationPriorityMask - [10]       0x0
DCBX_ApplicationPriorityMask - [11]       0x0
DCBX_ApplicationPriorityMask - [12]       0x0
DCBX_ApplicationPriorityMask - [13]       0x0
DCBX_ApplicationPriorityMask - [14]       0x0
DCBX_ApplicationPriorityMask - [15]       0x0
DCBX_ApplicationPriorityMask - [1]        0x8
DCBX_ApplicationPriorityMask - [2]        0x0
DCBX_ApplicationPriorityMask - [3]        0x0
DCBX_ApplicationPriorityMask - [4]        0x0
DCBX_ApplicationPriorityMask - [5]        0x0
DCBX_ApplicationPriorityMask - [6]        0x0
```

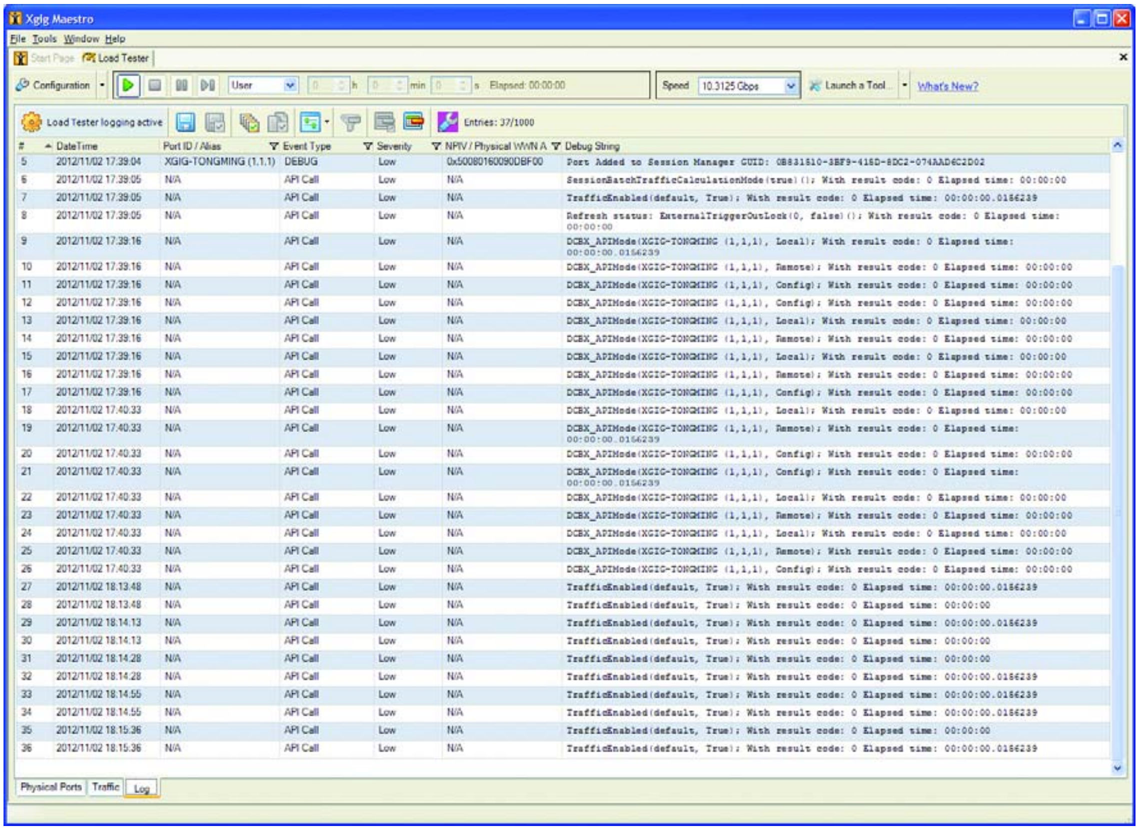
- **API Shell: Load Tester** — This tool is designed to facilitate automation programming. The user is able to expedite coding with API function pop-up hints, load and execute scripts and review results from this tool.



```
>[0] tcl "C:\Users\che55287\Documents\Working_Dir_SNT_Cheek\Maestro\Maestro 7.6\Load Tester Introduction
Guide\NPIVLogin.tcl"
A script execution has completed.
Output:
NPIV Login : Set NPIVPorts to 8 : NPIVPorts() returns 0 : Begin NPIV Login : NPIVLogin returns 0 : Current State is Logged
In
(56 msec)

10.7.4.178,1,1
10.7.4.178,1,2
111
112
all
XGIG1K20012219 (1,1,1)
XGIG1K20012219 (1,1,2)

> InitializeLink
Invalid API call: The function InitializeLink does not take '0' arguments. Expecting 1
InitializeLink [string]tag
// tag - the port or group of ports this function is applied to. See Tags.
```

API Log and Test Automation

All the Xgig Load Tester functions are supported with appropriate APIs to facilitate test and manufacturing automation through scripts. The log view lists the operation history. Scripting languages supported are C/C++ and Tcl.



#	DateTime	Port ID / Alias	Event Type	Severity	NPIV / Physical WWN A	Debug String
5	2012/11/02 17:39:04	XGIG-TONGMING (1.1.1)	DEBUG	Low	0x50080160090DBF00	Port Added to Session Manager GUID: 0B831610-3BF9-416D-8DC2-074AAD6C2D02
6	2012/11/02 17:39:05	N/A	API Call	Low	N/A	SessionBatchTrafficCalculationMode(true)(); With result code: 0 Elapsed time: 00:00:00
7	2012/11/02 17:39:05	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00.0156239
8	2012/11/02 17:39:05	N/A	API Call	Low	N/A	Refresh status: ExternalTriggerOutLock(0, false)(); With result code: 0 Elapsed time: 00:00:00
9	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Local); With result code: 0 Elapsed time: 00:00:00.0156239
10	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Remote); With result code: 0 Elapsed time: 00:00:00
11	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Config); With result code: 0 Elapsed time: 00:00:00
12	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Config); With result code: 0 Elapsed time: 00:00:00
13	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Local); With result code: 0 Elapsed time: 00:00:00
14	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Remote); With result code: 0 Elapsed time: 00:00:00
15	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Local); With result code: 0 Elapsed time: 00:00:00
16	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Remote); With result code: 0 Elapsed time: 00:00:00
17	2012/11/02 17:39:16	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Config); With result code: 0 Elapsed time: 00:00:00
18	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Local); With result code: 0 Elapsed time: 00:00:00
19	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Remote); With result code: 0 Elapsed time: 00:00:00.0156239
20	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Config); With result code: 0 Elapsed time: 00:00:00
21	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Config); With result code: 0 Elapsed time: 00:00:00.0156239
22	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Local); With result code: 0 Elapsed time: 00:00:00
23	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Remote); With result code: 0 Elapsed time: 00:00:00
24	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Local); With result code: 0 Elapsed time: 00:00:00
25	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Remote); With result code: 0 Elapsed time: 00:00:00
26	2012/11/02 17:40:33	N/A	API Call	Low	N/A	DCBX_APIMode(XGIG-TONGMING (1,1,1), Config); With result code: 0 Elapsed time: 00:00:00
27	2012/11/02 18:13:48	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00.0156239
28	2012/11/02 18:13:48	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00
29	2012/11/02 18:14:13	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00.0156239
30	2012/11/02 18:14:13	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00
31	2012/11/02 18:14:28	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00
32	2012/11/02 18:14:28	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00.0156239
33	2012/11/02 18:14:55	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00.0156239
34	2012/11/02 18:14:55	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00.0156239
35	2012/11/02 18:15:36	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00
36	2012/11/02 18:15:36	N/A	API Call	Low	N/A	TrafficEnabled(default, True); With result code: 0 Elapsed time: 00:00:00.0156239

Terminology Abbreviations

API	Application Programming Interface	LAN	Local Area Network
DCB	Data Center Bridge	MAC	Media Access Control
DCBX	DCB Exchange protocol	NPIV	N_Port ID Virtualization
DUT	Device Under Test	PFC	Priority Flow Control
ETS	Enhanced Transmission Selection	TCP	Transmission Control Protocol
FCoE	Fibre Channel over Ethernet	TTL	Time To Live
FIP	FCoE Initialization Protocol	TLV	Transistor-Transistor Logic
GUI	Graphical User Interface		Type-Length-Value
IP	Internet Protocol	UDP	User Datagram Protocol

Technical Assistance

If you require technical assistance, call 1-844-GO-VIAVI (1-844-468-4284) or e-mail Techsupport-snt@viavisolutions.com.

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