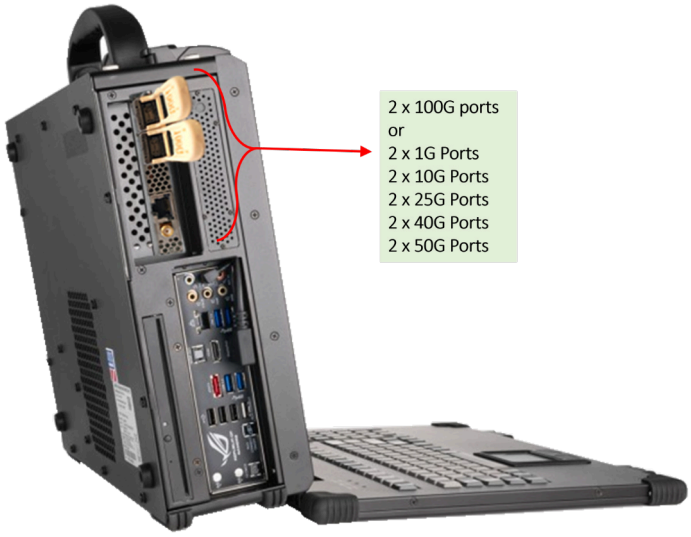
PacketExpert™ 100G

(Ethernet/IP Traffic Generation and Analysis up to 100G)

The PacketExpert™ 100G hardware platform features a dual-port configuration with two high-speed 100G QSFP28 ports (Port 1 and Port 2).

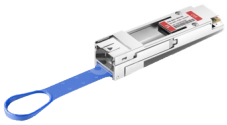
These versatile QSFP28 ports can be easily adapted to support 1G, 10G, 25G, 40G, 50G and 100G Electrical/Optical connections by utilizing QSFP+ adapters with respective SFP modules.

This flexibility empowers the platform to offer two Electrical/Optical ports for comprehensive Ethernet testing. Additionally, if higher test port density is desired, multiple NIC cards can be seamlessly connected to the appliance.



100G QSFP28 Optical Transceiver

SFP+ Optical Transceiver (with Adapter)



SFP+ Optical Transceiver (with Adapter)

Interface Options

Two QSFP28 cages each supporting:

- 100GBASE-SR4/LR4/FR or
- 50GBASE-SR2/LR2 or
- 40GBASE-SR4/LR4 or
- 25GBASE-SR/LR (with QSFP to SFP adapter) or
- 10GBASE-SR/LR (with QSFP to SFP adapter) or
- 1000BASE-X (with QSFP to SFP adapter)

GL Value Set

- Free Online Training
- Three years of Software Support and Warranty including free upgrades (if any)
- Three years of Hardware Support and Warranty

Key Features

- Supports 2 x 100G ports, upgradeable by 2 ports with addition of each device, up to 8 ports per 4U Rack-mount
- Includes RFC 2544, Y.1564, MTGA, OAM, BERT, Smart Loopback, and Scripting capabilities (Python) for test automation
- Complete loopback plugs, and adapters
- Flexibility of testing at different speeds (100G, 50G, 40G, 25G, 10G, 1G)
- High density multi-port configurations for 4x10G, 8x10G and 4x25G ports
- Dual Ports QSFP28 Cages with Adapters
- Supports QSFP28 form factor
- Supports Forward Error Correction (FEC), including Fire Code and RS-FEC (528, 514) and RS-FEC (544, 514)
- Supports Synchronous Ethernet and Precision Time Protocol (PTP)
- BERT with Delay Measurement: Measure latency and jitter during Layer 3/4 BERT tests with threshold-based pass/fail

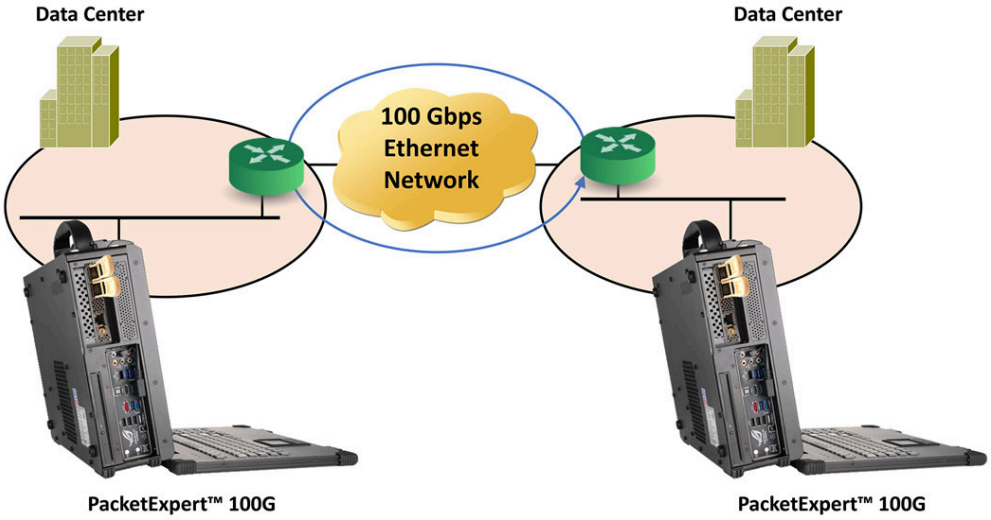
GL Communications Inc.

818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878, U.S.A

(Web) www.gl.com - (V) +1-301-670-4787 (F) +1-301-670-9187 - (E-Mail) info@gl.com

PacketExpert™ 100G

(Next-Generation 100G Carrier-Grade Ethernet Networks)



Overview

GL's **PacketExpert™ 100G** is a cutting-edge hardware platform designed for extensive testing of wirespeed Ethernet and IP networks, supporting speeds of up to 100 Gbps. The PacketExpert™ 100G is a high performance appliance with specialized network interface cards, GL's PacketExpert™ software, large RAM and storage, with optimized processing, and cooling capability. Available in rack-mount and portable platforms.

This versatile device comes with a web-based user interface. All functionalities can be easily accessed through any standard web browser, allowing convenient control from multiple locations and various access devices such as PCs, laptops, and tablets.

PacketExpert™ 100G supports flexible, high-density multi-port configurations using MTP-to-LC breakout cables, enabling 2×10G, 4×10G, 8×10G, as well as 2×25G and 4×25G setups. It offers up to 56×10G or 28×25G ports, ensuring scalable performance and reliability.

PacketExpert™ 100G can perform Bit Error Rate Testing (BERT), Loopback Testing, RFC 2544 Testing (throughput, packet loss and latency measurements), ExpertSAM™ (ITU-T Y.1564) and Multi Stream Traffic Generator and Analyzer. Each 100G port provides independent Ethernet/VLAN/MPLS/IP/UDP layer-wise testing at wirespeed. BERT, RFC 2544, and Loopback applications are implemented on all transport Layers including Layer 2 (Ethernet), Layer 2.5 (VLAN / MPLS), Layer 3 (IPv4 / IPv6), and Layer 4 (UDP).

For more information, visit PacketExpert™ 100G- Comprehensive Ethernet/IP Testing Solution webpage.

Main Features

PacketExpert™ 100G Hardware - Portable / Rack-mount

- Portable PCIe based hardware supports 2*100G ports
- Upgradeable to 8 ports in 2 ports increments
- Supports QSFP28 form factor
- Supports 1G, 2x10G, 4x10G, 8x10G, 2x25G, 4x25G, 2x40G, 2x50G and 2x100G speeds on the same ports, with suitable adapters and breakout cables

Web based User Interface

- Includes web-based interface, accessible by standard web browsers across different operating systems
- The web interface allows multiple users to connect to a single or multiple web servers and independently run tests on different hardware units
- Control multiple devices from a single GUI, multiplying the number of ports available per system

Wirespeed Ethernet / IP Testing

- Simultaneously generate and receive Ethernet traffic at 100% wirespeed (bidirectional 100 Gbps rate)
- User-configurable frame size, rate, MAC, IP, MPLS, and VLAN
- Supports Forward Error Correction (FEC) with IEEE 802.3-compliant, including Fire Code and RS-FEC (528, 514) and RS-FEC (544, 514)
- Wirespeed BERT, Smart Loopback and RFC 2544 applications
- Support for frame lengths from 64 bytes to Jumbo frames (up to 16000 bytes)
- Test at Ethernet (Layer 2), VLAN / Stacked MPLS (Layer 2.5), IP (Layer 3 including IPv4 and IPv6) and UDP (Layer 4)
- Customize Ethernet, IP and UDP protocol headers
- Supports DAC (Direct Attach Cable) and AOC (Active Optical Cable), offering cost-effective, low-latency, and energy-efficient solutions for short-distance connectivity in data centers.
- Up to 4 multi-device support for all high density testing applications
- BERT Patterns, supports industry ANSI and ITU standard PRBS patterns – 2^9-1, 2^11-1, 2^15-1, 2^20-1, 2^23-1 and 2^31-1, as well as user defined static patterns
- Python Application Programming Interfaces to allow scripting and automation
- Real-time results are displayed in both tabular and graphical representations
- Test result reports available in PDF and CSV file formats
- Detailed frame statistics presented in tabular format for all the ports
- Synchronous Ethernet (SyncE) monitoring with real-time QL tracking and instant event alerts for superior clock synchronization
- Supports flexible multi-port configurations with MTP to LC breakout cables, enabling 10G (2x10G, 4x10G, 8x10G) and 25G (2x25G, 4x25G) Ethernet operation via QSFP28 ports

Wirespeed BERT Across all Layers

- BERT is applicable for Ethernet (Layer2), up to 3 stacked VLAN (Q-in-Q), up to 3 stacked MPLS (Layer 2.5), IPv4/IPv6 (Layer3) and UDP (Layer4)
- Ability to introduce single bit errors or selectable error insertion rates
- User-defined header parameters for MAC, VLAN, MPLS, IPv4/IPv6 and UDP layers
- Multi-device support for wirespeed BERT and simultaneous BERT/Loopback applications to increase the number of parallel BERT tests
- Real-time graphical representation of the combined throughput and Bit Error rate can be plotted over time for BERT testing
- **BERT with Delay Measurement:** Validate packet integrity and timing by measuring **latency and jitter** during Layer 3/4 BERT tests, with **min/max/current/average** statistics and threshold-based pass/fail

Smart Loopback Testing

- Supports smart loopback (auto layer detection), swap source and destination addresses at MAC, IP, and UDP layers
- Muti-device support for all port loopback applications will increase the number of simultaneous loopback ports

Main Features (*Contd.*)

RFC 2544 Network Testing

- RFC 2544 is applicable for Layers Ethernet, VLAN, MPLS, IPv4/IPv6
- Supports Throughput, Latency, Frame Loss, and Back-to-Back performance tests
- Uni-directional and bi-directional RFC 2544 testing supported
- User-defined configuration parameters such as frame size, trial duration, number of trials, etc.
- User selectable single or dual ports RFC 2544 testing
- Multi-device support for multiple parallel RFC 2544 tests
- Graphs and Statistics for all the RFC 2544 tests

ExpertSAM™ (ITU-T Y.1564) Testing

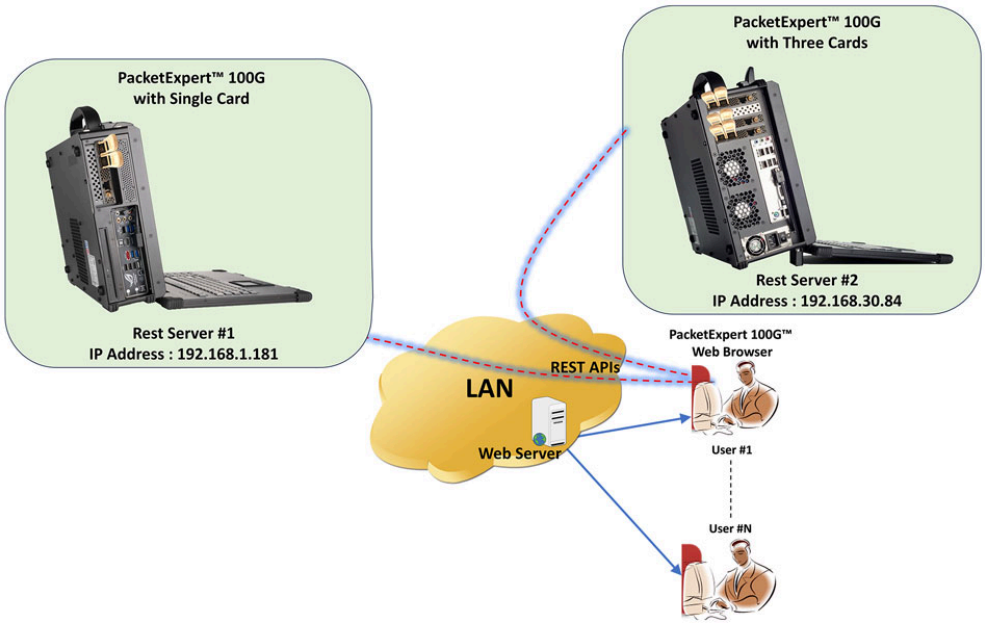
- Comprehensive validation of Ethernet Service-Level Agreements (SLAs) in a single test
- Supports Service Configuration and Service Performance tests, compliant with the ITU-T Y.1564 standard
- Generates traffic at CIR (guaranteed traffic), EIR (best effort bandwidth), and Traffic Policing rates (dropped bandwidth) to ensure Key Performance Indicators (KPI) are met
- Offers Color Aware mode, generating traffic marked as Green or Yellow, with separate measurements for each; supports VLAN PCP, IP TOS, and IP DSCP color marking
- Supports Stacked VLAN with C-Tag (Customer Tag) and S-Tag (Service Tag) to emulate Carrier Ethernet traffic
- Each port can handle up to 16 streams, enabling the device to manage 32 services under full load conditions
- Compatible with EMIX (Ether MIX) frame sizes, supporting up to 5 different frame sizes per service
- Allows for frame lengths ranging from 64 bytes to Jumbo frames (up to 16,000 bytes)
- Simultaneously measures Information Rate (IR) or Throughput, Frame Loss Ratio (FLR), Frame Transfer Delay (FTD) or Latency, and Frame Delay Variation (FDV) or Jitter, with a Pass/Fail verdict
- Validates all services simultaneously to ensure consistent quality over time

Multi Stream Traffic Generator and Analyzer

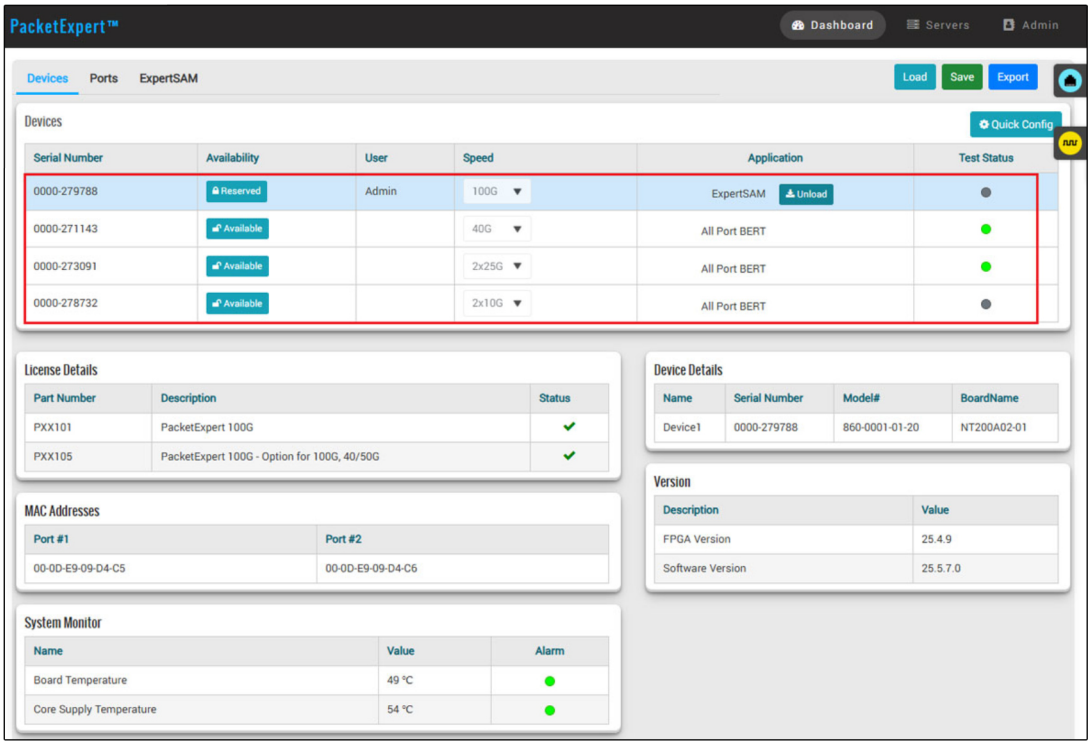
- **Traffic Generation:**
  - ♦ Generates multiple streams with customizable protocol headers, packet sizes and payloads
  - ♦ Streams can be defined with various header fields like Source and Destination MAC Address, VLAN and MPLS tags, Source and Destination IP Address, Source and Destination UDP ports
  - ♦ Each stream can include a mixture of different frames sizes (up to 5)
  - ♦ Emulate Carrier Ethernet traffic with stacked VLANs (C-Tag and S-Tag)
- **Traffic Analysis**:
  - ♦ Real-time statistics of throughput, packet loss, round-trip delay, and jitter across multiple streams
  - ♦ Real-time graphs of all statistics mentioned above, for each stream
  - ♦ Comprehensive statistics for individual streams
  - ♦ Delivers per-port frame statistics such as Total Frames and Bytes Received, Rx Frame Rate, and Rx Data Rate

Multiple Servers and Multiple Devices

The PacketExpert™ 100G web interface offers users the convenience of accessing multiple servers that are located in different areas within the same LAN. This allows for seamless connectivity and management of multiple PacketExpert™ 100G devices from a single server, enhancing efficiency and control.



PacketExpert™ 100G - Multiple Servers and Multiple Devices

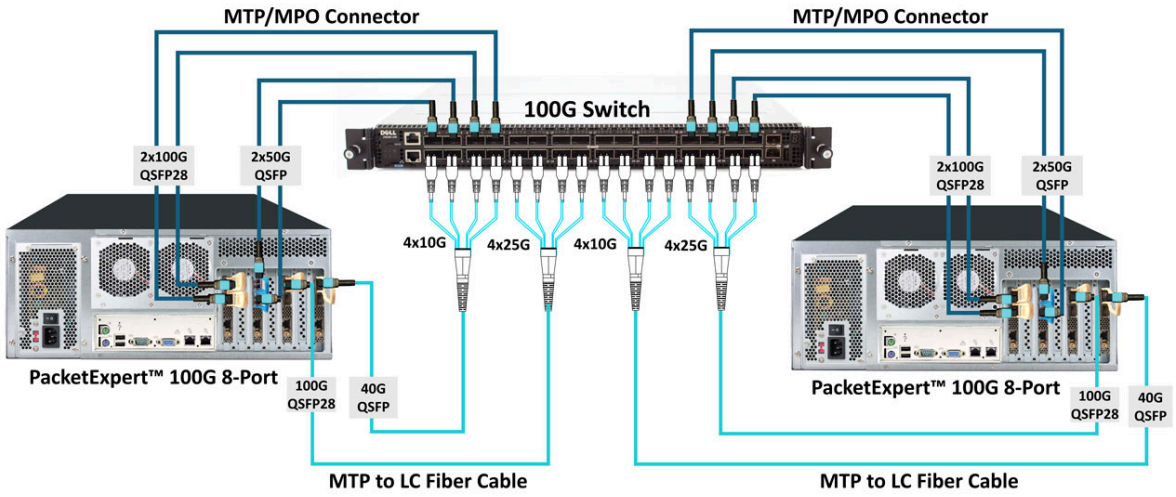


PacketExpert™ 100G Web Interface with Multiple Devices

High Density Multi-Port Support

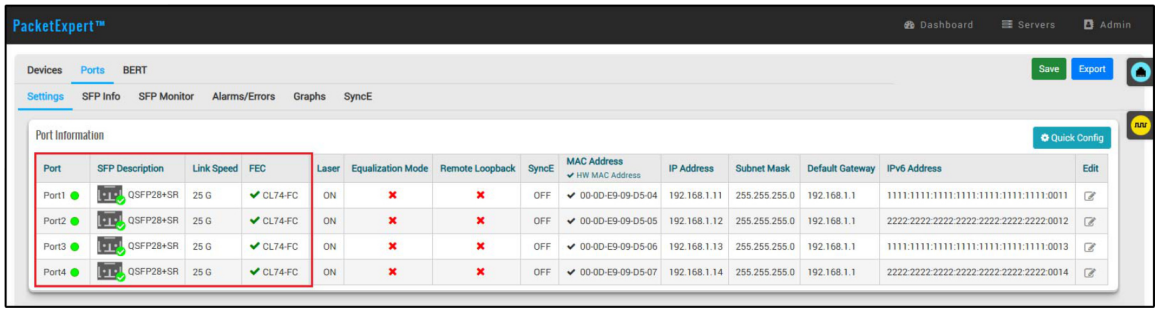
PacketExpert™ 100G delivers robust multi-port capabilities for testing high-performance Ethernet switches at speeds including 2×10G, 4×10G, 8×10G, 2×25G, 4×25G, 2×40G, 2×50G, and 2×100G. Multiple units can be rack-mounted and run in parallel to test several switch ports simultaneously. Each test card supports full line-rate traffic generation and analysis, enabling simultaneous transmission and reception on every port. This scalable setup ensures wirespeed validation of multi-port switches under real-world conditions with high accuracy and throughput.

The flexible multi-port configurations using MTP-to-LC breakout cables support 4×10G, 8×10G, and 4×25G. With 40G QSFP transceivers, each port splits into four 10G channels, delivering 8×10G per card (Ports 1 and 2) and up to 56×10G in a 4U chassis with 7 cards. With 100G QSFP transceivers, Port 1 splits into four 25G channels, providing 4×25G per card and up to 28×25G in a 4U chassis.



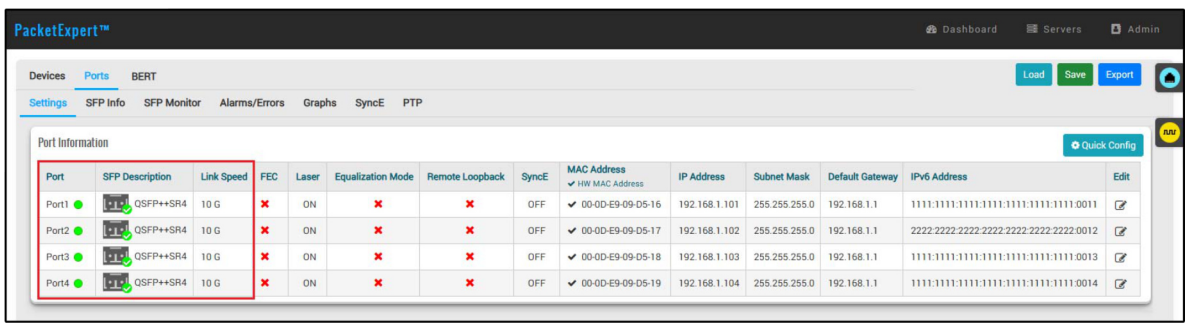
Multi Port 4x10G and 4x25G Setup Diagram

When configured in 4x25G mode, PacketExpert™ activates four independent ports (Port 1 to Port 4), each operating at a data rate of 25 Gbps.



Port Settings - 4x25G

When configured in 8x10G mode, PacketExpertT activates eight independent ports (port 1 to port 8), each operating at a data rate of 10 Gbps.

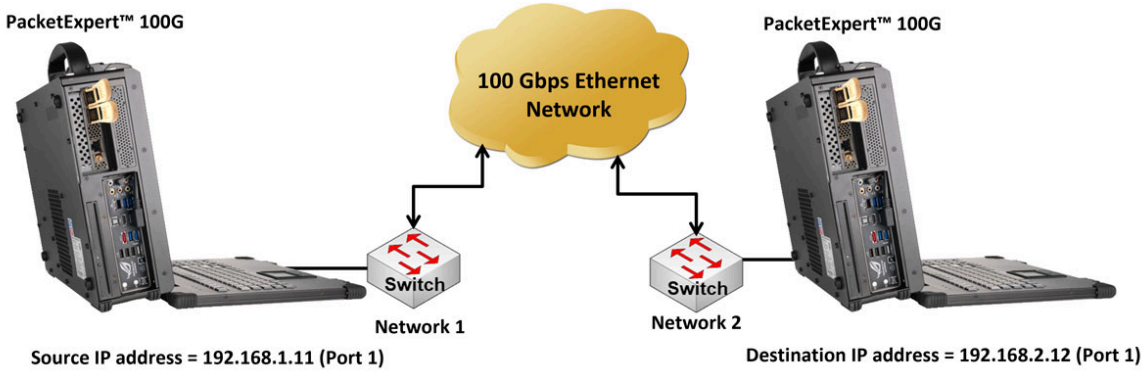


Port Settings - 8x10G

Wirespeed BER Testing

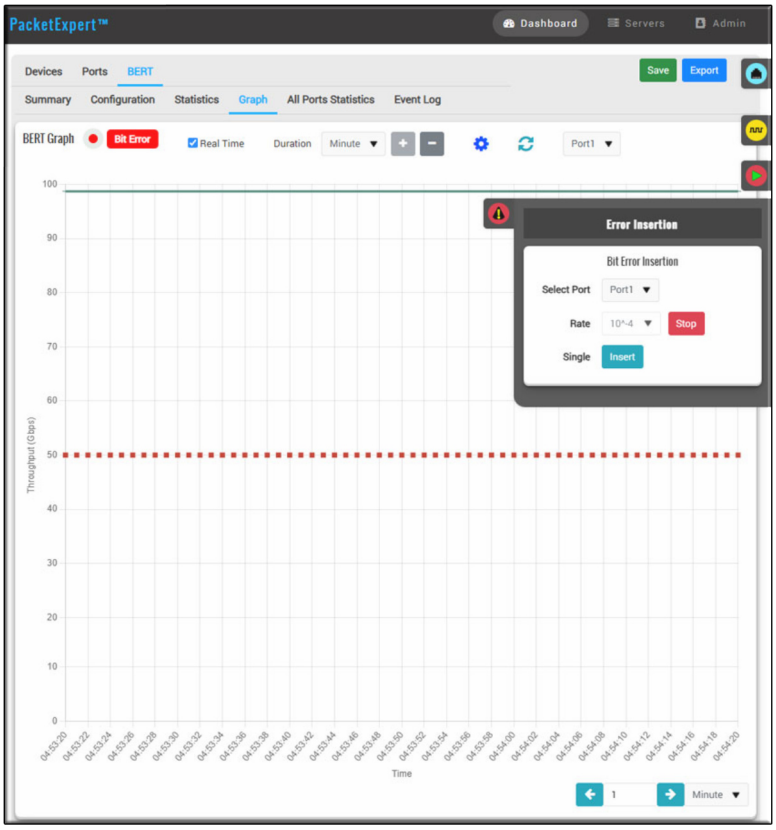
PacketExpert™ 100G supports wirespeed Bit Error Rate Testing (BERT) up to 100Gbps over Framed Ethernet (Layer2), Stacked VLAN (Q-in-Q), Stacked MPLS (Layer 2.5), IPv4/IPv6, and UDP layers at specific frame length and traffic rate. It can generate and receive various BER Traffic Patterns, including various industry standard PRBS patterns, User-defined test patterns, Bit Error Insertion, and FCS Error Insertion. Wirespeed BERT is supported on two 100 Gbps optical ports. The screen below displays the PacketExpert™ 100G web interface, running All Port BER test on both the Port#1 and Port#2 optical ports. Optional sequence number insertion allows detecting out-of-sequence packets and packet loss.

In addition to BER, PacketExpert™ 100G measures **packet delay (latency)** and **jitter** during BERT runs. Users can view **min/max/current/average** values and apply t**hreshold-based pass/fail** to quickly confirm timing performance across routed paths.



PacketExpert™ 100G - BERT Testing

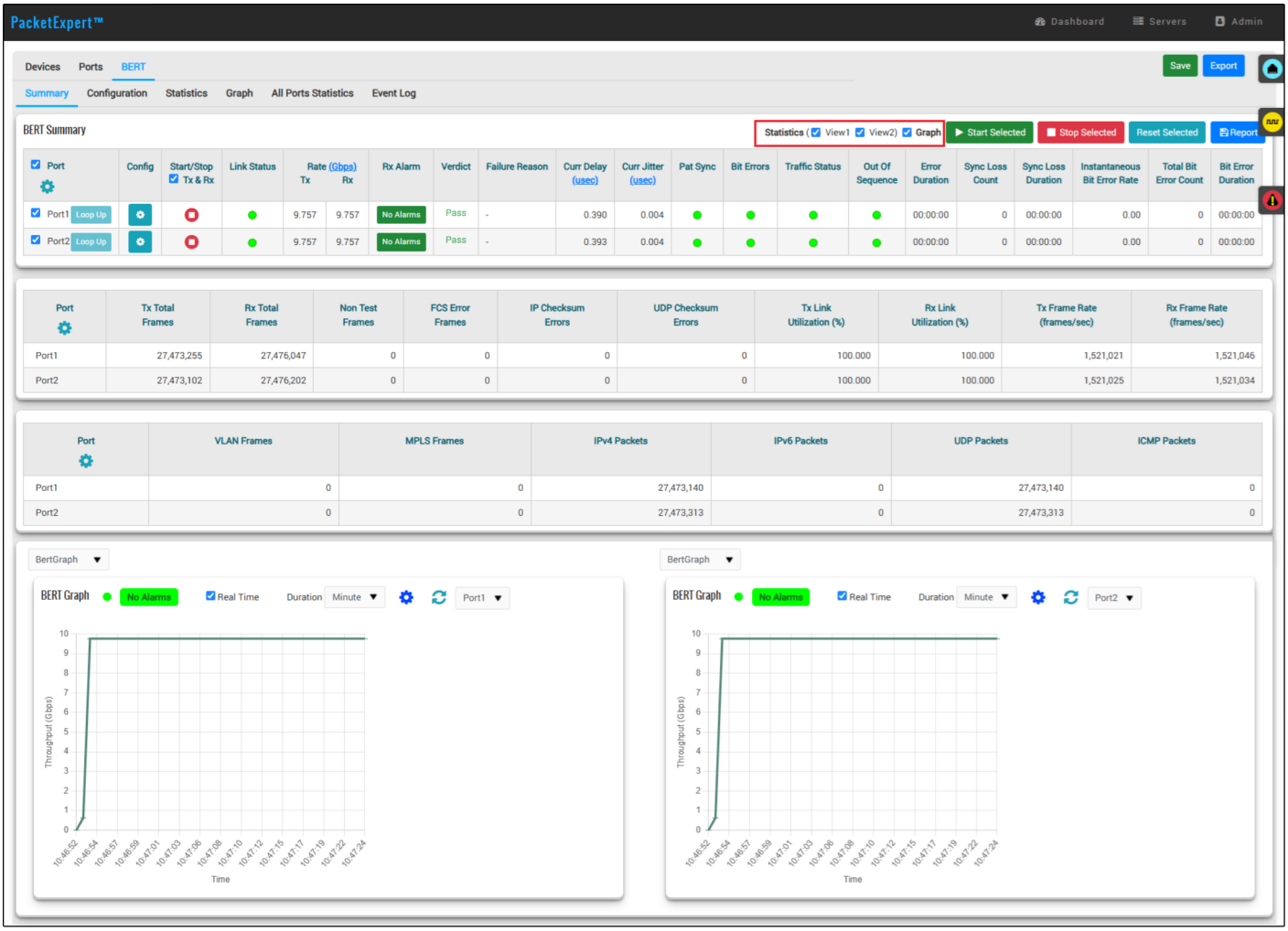
PacketExpert™ 100G offers a real-time presentation of the combined Throughput and Error Events detected during Bit Error Rate Testing. These occurrences are depicted on a graphical chart as data points over the course of the test. The graph initiates at the beginning of the BER test and stops when the BER test is terminated.



All Port BERT Graph with Bit Error

BERT Summary

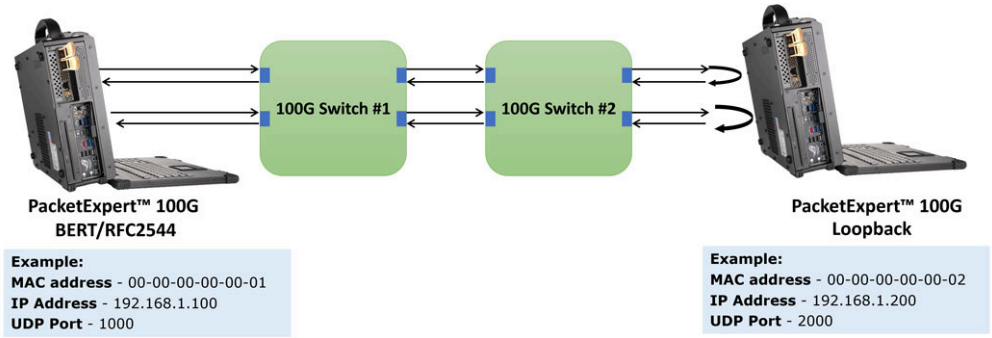
PacketExpert™ 100G provides options to view the summary of the test along with BERT graphs showing throughput, bit errors, and sync status.



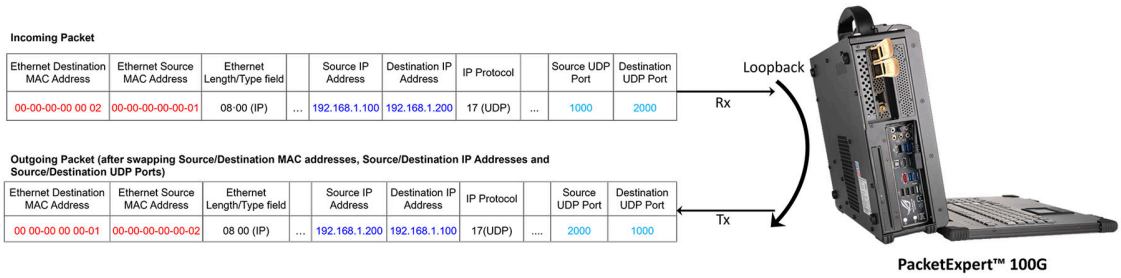
PacketExpert™ 100G - BERT Summary

All Port Loopback Testing

PacketExpert™ 100G offers Smart Loopback capability on two 100 Gbps Optical ports (Port 1 and Port 2). When in Smart Loopback mode, PacketExpert™ 100G analyzes incoming traffic, identifies Source and Destination Addresses, and then redirects the traffic on the same port after swapping them. It effortlessly manages stacked VLAN and stacked MPLS configurations.



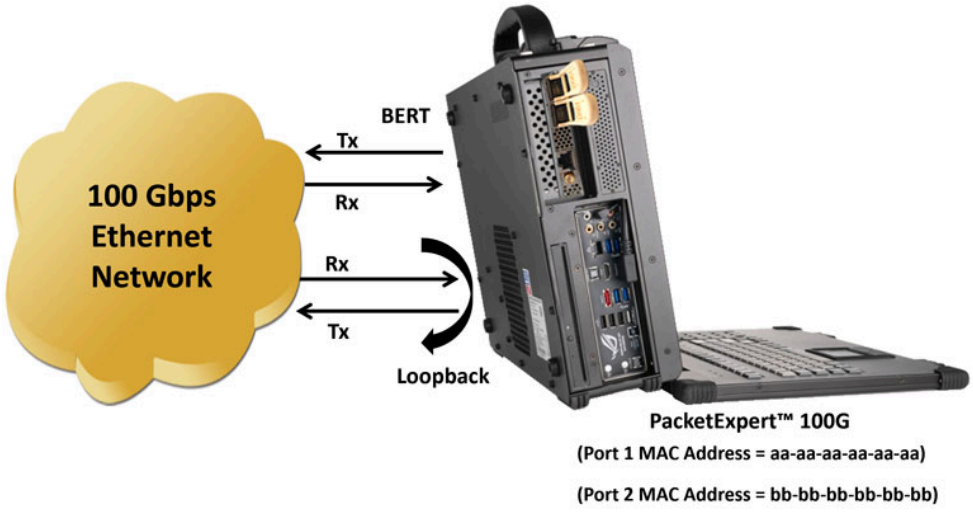
PacketExpert™ 100G - All Port Loopback Testing



PacketExpert™ 100G - Smart Loopback Testing

BERT and Loopback Testing

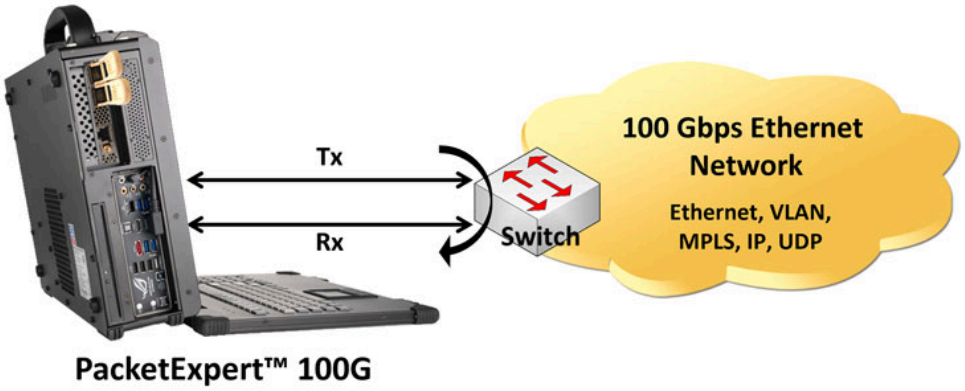
For testing across a network, the remote PacketExpert™ 100G can be left in Loopback mode. BERT is controlled by the local end PacketExpert™ 100G.



PacketExpert™ 100G - BERT and Loopback Testing

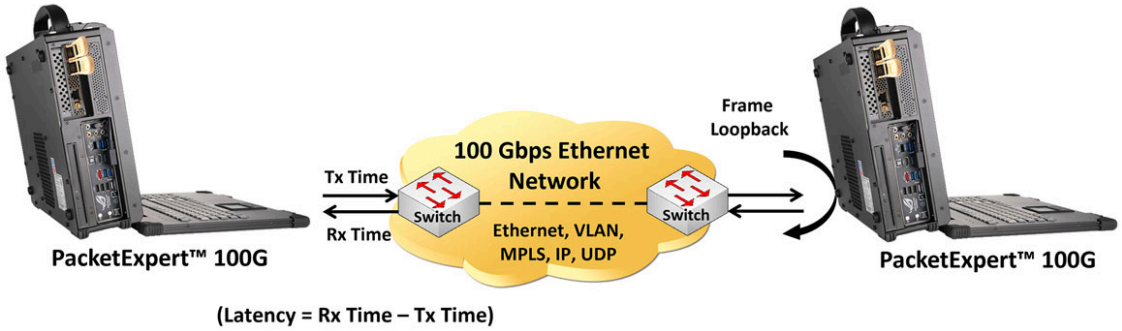
RFC 2544 Testing

PacketExpert™ 100G supports RFC 2544 tests on two 100 Gbps Optical ports (Port 1 and Port 2) on Layers 2, 2.5, and 3. RFC 2544 tests includes Ethernet Throughput, Latency, Frame Loss, and Back-to-Back performance tests in accordance with RFC 2544 specifications. The test is setup such that the traffic can be generated and transmitted on either of the ports and the looped back traffic from the DUT is received on the opposite port validating the test parameters.



PacketExpert™ 100G - Dual Port RFC 2544 Testing

When conducting a single-port RFC 2544 test using PacketExpertT 100G, you can choose to perform the test on either Port 1 or Port 2 individually, but it is not feasible to run RFC 2544 tests concurrently on both Port 1 and Port 2.

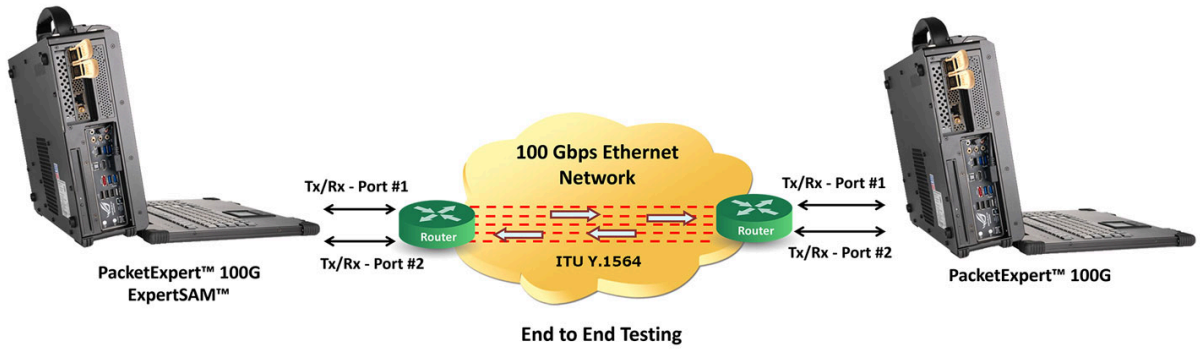


PacketExpert™ 100G - Single Port RFC 2544 Testing

ExpertSAM™ (ITU-T Y.1564) Testing

ExpertSAM™ is a basic application available within the PacketExpert™ 100G (PXX100), is designed for multiservice testing to validate the maximum performance of devices or networks under test. It evaluates Ethernet service capacity across diverse traffic types—voice, video, email, online trading, and more—addressing the limitations of traditional RFC 2544 testing. Built on the ITU-T Y.1564 standard, ExpertSAM™ performs a single test consisting Service Configuration Test and Service Performance Test.

The test measures CIR/EIR/Overshoot traffic, Frame Loss, Frame Delay, and Jitter, ensuring all metrics meet defined thresholds. Round-trip testing is supported using loopback mode, with results reflecting average performance across both Tx and Rx paths.

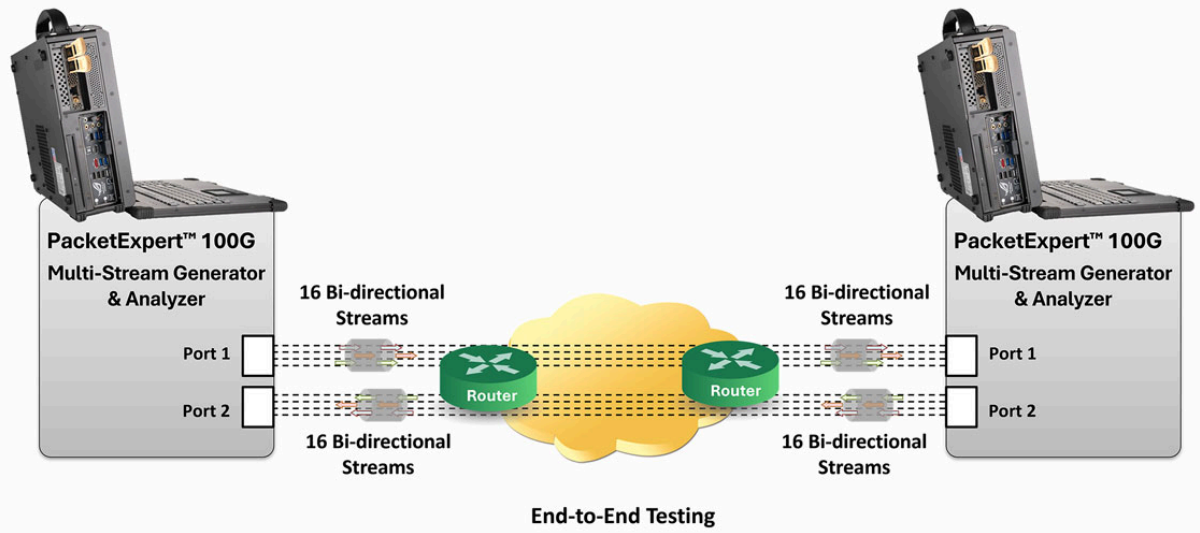


PacketExpert™ 100G - ExpertSAM™ End to End Testing

Multi Stream Traffic Generator and Analyzer (MTGA)

The Multi Stream Traffic Generator and Analyzer is a basic application available within the PacketExpert 100G platform. This Ethernet tester can generate multi-stream Ethernet traffic with varying protocol headers, packet lengths, payloads and analyze traffic, making it an excellent tool for comprehensive end-to-end testing of Wide Area Networks at speeds up to 100 Gbps.

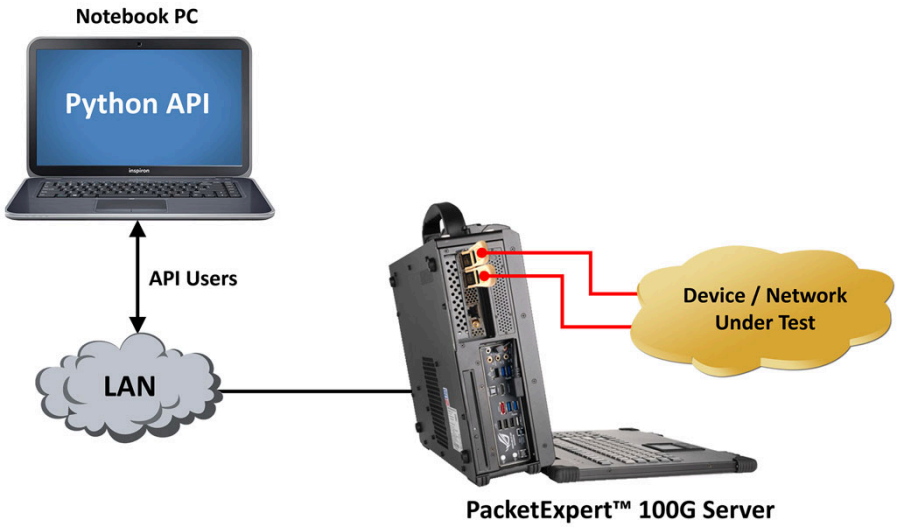
As depicted in the network diagram, up to 16 traffic streams per port can be generated according to user-defined configurations, including MAC/VLAN/IP/UDP headers, rate, and frame size. Different traffic classes (such as voice, video, and data) can be prioritized based on the configured frame size and rate. The system offers a graphical view of live Packet Loss, Round Trip, Delay and Jitter for all streams to monitor performance.



PacketExpert™ 100G - MTGA End to End Testing

Python Client

The Python interface developed for PacketExpert™ 100G allows users to control all features of PacketExpert™ through Python APIs. The Python interface is implemented based on a client-server (Rest API's) model.



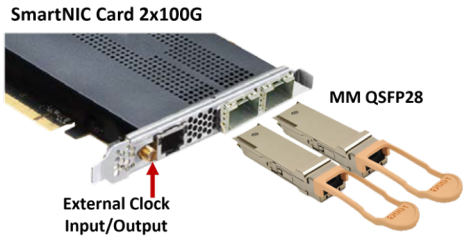
PacketExpert™ 100G - Python client

AllPortBert_Sample_app.py

```python
from Core.Utils import *
from PacketExpertTests import *
import time


def main():
    # Specify server details and test configuration
    server_ip = "192.168.1.152"
    server_port = 3333
    device_list = [1]
    port_list = [1, 2]

    err, device_test_configuration = set_device_traffic_config(device_list)

    # Configure TC1 Bert Test Parameters

    device_test_configuration[1].port_mode = PortMode.Gbps100
    device_test_configuration[1].start_frame_size = 64
    device_test_configuration[1].start_rate = 1
    device_test_configuration[1].start_error_rate = 4  # Bit error insertion rate 10^-4

    test_duration = 10

    default_json_path = 'C:\\Users\\Desktop\\PXXPythonClient-Release\\JSON\\'
    result_file_path = 'C:\\Users\\Desktop\\PXXPythonClient-Release\\Log\\'
    result_file_name = "Bert_Results"

    generate_report_info = GenerateReport()
    generate_report_info.test_conducted_by = "GLIndia"
    generate_report_info.filename = "Bert_Report"
    generate_report_info.title = "All Port Bert"

    generate_report_info.init_selected_ports(device_list, port_list, AppName.AllPortBERT)

    enable_generate_report = True
```

PacketExpert™ 100G - Python Script

Hardware Specifications



PacketExpert™ 100G SmartNIC

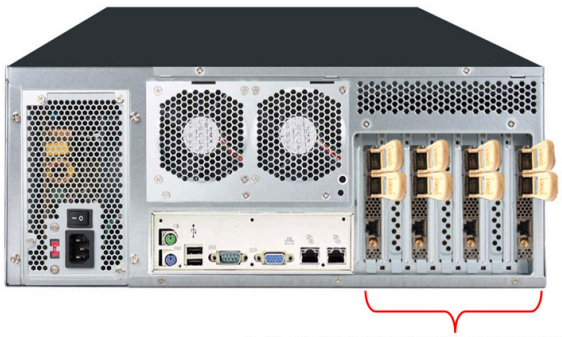
SmartNIC Specifications (Per Card)	
Optical Components	• 2 x QSFP28 cages for 2 x 100 GbE, 2 x 50GbE, and 2 x 40 GbE • Supports 2 x 25 GbE, 2 x 10 GbE, and 2 x 1 GbE with QSFP-to-SFP adapter
PCIe	PCIe Gen 3, 16 lanes
RAM	8 GBytes DDR4 SDRAM
1000Base-T Port	RJ45 for IEEE1588v2
Single-ended Coaxial I/O	SMA connector, 50 Ohms for External Clock Input/Output
Temperature Range	0C to 45C
Operating Humidity	20% to 80%
Storage	-10 to 60C
Oscillator Accuracy	+/- 4.6ppm

Hardware Specifications (*Contd.*)

PacketExpert™ 100G Rack-mount Platforms

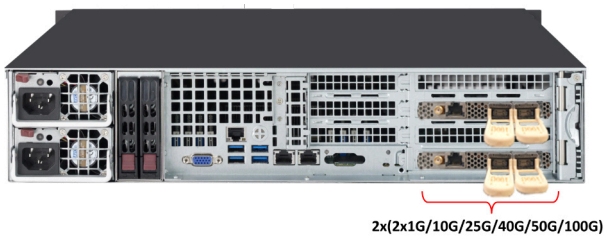
- Ideal for Lab environments that require centralized management of multiple servers and network devices
- Rack-mount units offer flexibility for scaling up or down as needed by adding or removing individual units

PacketExpert™ 100G 4U Rack-mount



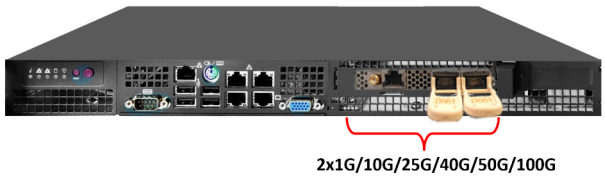
Specifications	
Dimensions	6.9” H x 16.9” W x 17.5” D
Weight	72 lbs.
Number of Supported Cards/Ports	Up to 7 Cards x (2x100G Ports), Maximum of 14 Ports.
Multi-Port	Up to **56×10G** ports (using 40G QSFP transceivers on Port 1 and Port 2). Up to **28×25G** ports (using 100G QSFP transceiver on Port 1 only).
Power supply	800W

PacketExpert™ 100G 2U Rack-mount



Specifications	
Dimensions	3.5” H x 17.2” W x 17.7” D
Weight	30 lbs.
Number of Supported Cards/Ports	Up to 2 Cards x (2x100G Ports), Maximum of 4 Ports
Multi-Port	Up to **16×10G** ports (using 40G QSFP transceivers on Port 1 and Port 2) Up to **8×25G** ports (using 100G QSFP transceiver on Port 1 only)
Power supply	800W

PacketExpert™ 100G 1U Rack-mount



Specifications	
Dimensions	1.7” H x 17.2” W x 9.8” D
Weight	10 lbs.
Number of Supported Cards/Ports	1 x Full-height 1 Card x (2x100G Ports), Maximum of 2 Ports
Multi-Port	Up to **8×10G** ports (using 40G QSFP transceivers on Port 1 and Port 2) Up to **4×25G** ports (using 100G QSFP transceiver on Port 1 only)
Power supply	200W

Hardware Specifications (*Contd.*)

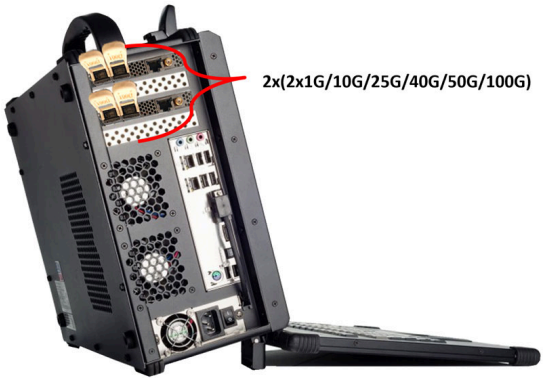
PacketExpert™ 100G Portable Platforms

- Ideal for field engineers, military personnel, or researchers who need a powerful and portable computing solution in remote or rugged locations
- Suitable for environments where traditional desktops or laptops may be too fragile or lack necessary durability

Ultra-Portable PacketExpert™ 100G

Specifications	
Dimensions	12.4” H x 16.41” W x 4.39” D
Display	17.3” 1920x1080
Weight	16.5 lbs.
Number of Supported Cards/Ports	Up to 2 Cards x (2x100G Ports), Maximum of 4 Ports
Multi-Port	Up to **16×10G** ports (using 40G QSFP transceiver on Port 1 and Port 2) Up to **8×25G** ports (using 100G QSFP transceiver on Port 1 only)
Power supply	400W (optional 500W)

Portable PacketExpert™ 100G



Specifications	
Dimensions	13.62” H x 16.50” W x 7.25” D
Display	17.3” 1920x1080
Weight	~23 lbs. (10.4kg)
Number of Supported Cards/Ports	Up to 3 Cards x (2x100G Ports), Maximum of 6 Ports
Multi-Port	Up to **24×10G** ports (using 40G QSFP transceiver on Port 1 and Port 2) Up to **12×25G** ports (using 100G QSFP transceiver on Port 1 only)
Power supply	680W 100/240VAC

Portable PacketExpert™ 100G

Specifications	
Dimensions	17.06” x 13.67” x 9.02” (H x W x D)
Display	17.3” 1920x1080
Weight	~ 30 lbs.
Number of Supported Cards/Ports	Up to 6 Cards x (2x100G Ports), Maximum of 12 Ports
Multi-Port	Up to **48×10G** ports (using 40G QSFP transceiver on Port 1 and Port 2) Up to **24×25G** ports (using 100G QSFP transceiver on Port 1 only)
Power supply	1000W 100-240VAC

Buyer's Guide

Item No	Product Description
PXX106	PacketExpert™ 100G – One card / 2 Port Platform with 2 MM SFPs and 2 FO cables
PXX107	PacketExpert™ 100G - Two Card / 4 Port Platform with 4 MM SFPs and 4 FO cables
PXX108	PacketExpert™ 100G – One card / 2 Port Platform with 2 SM SFPs and 2 FO cables
PXX110	PacketExpert™ 100G - Two Card / 4 Port Platform with 4 SM SFPs and 4 FO cables
PXX10X	PacketExpert™ 100G – 4 Card Platform / 8 Port Platform
** Standard MM/SM kit includes, SFPs for all rates, with Pelican case for Lunchbox; including PXX100, PXX101, PXX105, and PXX109; Electrical /SM SFPs and Loopback Plugs extra; Includes 3-year hardware/software support warranty.	

Note: PCs which include GL hardware/software require Intel or AMD processors for compliance.

For more information, on related Software and Accessories, visit PacketExpert™ 100G– Resources and PacketExpert™ 100G– Accessories webpage.