PacketExpert™ 1G - Optical and Ethernet Tester

Overview
PacketExpert™ is a portable (USB based) Quad Port Ethernet / VLAN / MPLS / IP / UDP Tester with 4 Electrical Ethernet ports. 2 of the 4 ports can be Electrical or Optical ports, enabling testing on optical fiber links as well. The electrical ports support 10/100/1000 Mbps, and optical ports support 1000 Mbps using SFP. Each GigE port provides independent Ethernet/VLAN/MPLS/IP/UDP testing at wire speed for applications such as BERT, RFC 2544, Loopback, Capture and Playback, ExpertSAM™, PacketBroker, Multi-Stream UDP/TCP Traffic Generator and Analyzer, and ExpertTCP™.

It truly takes confusion out of Ethernet / IP testing at all protocol layers - from Layer1 frames to IP/UDP packets. It can be used as a general purpose Ethernet to IP performance analysis tool for 10 Mbps, 100 Mbps and 1 Gbps Ethernet Local Area Networks and Wide Area Networks (WAN).

It can perform Wire speed BERT (Bit Error Rate Testing) on all ports simultaneously over Layer1, Framed Ethernet (Layer2), Stacked VLAN (Q-in-Q), Stacked MPLS (Layer 2.5), IP and UDP. It can generate and receive various BER patterns, including various PRBS patterns, to properly test the Ethernet to IP link. With the capability to generate/receive traffic with stacked VLAN (Q-in-Q) and stacked MPLS, PacketExpert™ finds use in testing a wide range of networks – from testing individual links/switches, testing local Ethernet/IP networks (LAN), end-to-end testing of Wide Area Networks (WAN), testing Core/MPLS networks, and much more.

Similar to BERT, RFC 2544 can be done over Framed Ethernet (Layer2), Stacked VLAN (Q-in-Q), Stacked MPLS, IP or UDP. Supported tests are - Throughput, Latency, Frame Loss and Back to Back tests as specified in RFC 2544. RFC 2544 test can be done on single/dual electrical or optical ports. In single port, the test can be run on either Port #2 or Port #3 at a time. In dual port, the test can be run on Port #2 and Port #3 simultaneously.

PacketExpert licensing (PXE100) also supports Loopback testing. Loopback testing includes Layer-wise Loopback as well as Smart Loopback testing types on All ports/2 ports on the hardware unit.

GL also offers other Ethernet/IP tester variants such as –
- PacketExpert™ 1G - mTOP™ rack enclosure - a higher density 12/24 GigE ports form factor solution
- mTOP™ Probe with PacketExpert™ 1G Multi-Port Ethernet - a hardware unit designed for easier portability and convenient for field testing.

For detailed information on PacketExpert™, visit PacketExpert™ 1G - Optical and Ethernet Tester webpage.
### Main Features

**Operations**
- Control multiple hardware units from a single GUI, multiplying the number of ports available per system.
- Capability of remote operation, and automation using TCL/C# and Python scripts and MAPS CLI (client-server) architecture.

**Wire speed BERT**
- Traffic options lets technicians generate Ethernet to IP frames with user-configurable frame length, and frame size with varying traffic rates.
- Supports industry standards PRBS patterns $2^{25}-1$, $2^{29}-1$, $2^{31}-1$, and $2^{31}-1$, constant patterns like all ones, all zeroes, alt ones-zeroes and user-defined test patterns ranging between 1 to 32 bits.
- Single as well as constant rate Bit Error and FCS Error Insertion.
- Optional sequence number insertion allows detecting out-of-sequence packets and packet loss.
- Support for frame lengths from 64 bytes to Jumbo frames (up to 2048 bytes).
- User-defined header parameters for MAC, VLAN, MPLS, IP and UDP layers.
- Testing with stacked VLAN (Q-in-Q) and MPLS – up to 3 levels.

**Loopback**
- Both smart loopback (auto layer detection) and layers-wise loopback capabilities for incoming traffic.

**RFC 2544**
- Throughput, back-to-back, latency and frame loss testing supporting uni-directional and bi-directional traffic between ports.
- Supports RFC 2544 on single or dual electrical / optical ports.
- User-defined configuration parameters such as frame size, trial duration, number of trials, etc.

**Statistics and Graphs**
- Detailed test result reports in PDF and CSV file formats.
- Detailed frame statistics in tabular format for all the ports.
- Provides various vital measurements such as Bit Error Rate, Bit Error Count, Sync Loss Count, Sync Loss Seconds, and Error Free Seconds.
- Real time graphical representation of the combined Throughput and Bit Error rate, plotted over time for BERT testing.
- Graphs and Statistics for all the RFC 2544 tests.
- Link (P2-P3/P3-P2) statistics and Port (P2, P3) statistics.

**Optional Applications**
- **ExpertSAM** - ITU-T Y.1564 Complete validation of Ethernet service-level agreements (SLAs) in a single test
- **Capture/Playback** - Wirespeed Packet Capture, Filter, Drop (for real-time analysis) & Storage (for offline analysis)
- **PacketBroker** - Capture packets non-intrusively with advanced features like Filters, Aggregation, Packet Modification, and Output traffic
- **Multi-Stream UDP/TCP Traffic Generator and Analyzer** - Generates and Analyses of up to 12 user defined streams of varying packet length traffic.
Wire-speed BER Testing with Traffic Generation

Wire-speed BERT measures Bit Error Rate on Layer1, Framed Ethernet (Layer2), Stacked VLAN (Q-in-Q), Stacked MPLS (Layer 2.5), IP and UDP layers.

Supports generating various PRBS patterns such as $2^2-1$, $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{25}-1$, $2^{30}-1$, $2^{35}-1$, including constant patterns such as All Ones, All Zeros, Alternate Ones-Zeros and user-defined test patterns ranging from 1 bit to 32 bits. Selection of optional sequence number insertion allows detection of out-of-sequence packets and packet loss. Rx Config includes an option to process received packets for FCS errors. BERT can be run simultaneously on all ports or can be combined with Loopback to run BERT. In addition, the PacketExpert™ also allows sending traffic of specific frame length and rate.

Figure: BERT payload with various PRBS patterns

Wire speed BERT Results (with LEDs and Graph)

PacketExpert™ analyzes the received BER pattern and provides various vital measurements such as Bit Error Rate, Bit Error Count, Bit Error Seconds, Sync Loss Count, Sync Loss Seconds, Error Free Seconds, No Rx Data Count/Seconds, and Bert Status. It also gives a real time graphical representation of the Throughput and Bit Error rate, plotted over time as shown in figure below. Supports Test Report Generation in PDF and CSV file formats.

Figure: BERT Results (with LEDs) and Graph

Link Status and Configuration

Hardware Interface details are displayed independently per port. It includes:

- Hardware MAC address
- Link status
- Current Operating Mode (Electrical/Optical)
- Auto Negotiated Status and Link Speed
- Duplex Mode
- Flow Control

Users can put the port to either Electrical or Optical operating mode. Also, users can opt for Auto negotiated speed or force the speed to one of 10/100/1000 Mbps. Default IP address settings for the port can be configured. Send Pause Frame feature to send user-defined Quanta of pause frames at a time manually on each port independently.

Packet Configuration Stacked VLAN (Q-in-Q), MPLS

BERT and RFC2544 testing over Ethernet [Layer 2] and MPLS [Layer 2.5] allows configuration of various layer parameters.

PacketExpert™ supports up to 3 level stacked VLANs (Q-in-Q) headers and stacked MPLS headers [Layer 2.5]. For each VLAN tag, user can specify the VLAN Type Field, VLAN Id and Priority. User can specify MPLS Label ID, CoS (class of service) bits and TTL field for each MPLS level (MPLS #1, MPLS #2 and MPLS #3).

Figure: Interface Dialog & Link Status

Figure: Packet Configuration Stacked VLAN and MPLS Configurations

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Packet Configuration over IP and UDP

PacketExpert™ allows users to configure Ethernet/MPLS/IP/UDP header parameters, including stacked VLAN IDs, stacked MPLS labels, Frame Size, and Rate.

Users can edit various packet header parameters at Layer2 (framed Ethernet), Layer 2.5 (stacked MPLS), Layer3 (IP) & Layer4 (UDP) for both BERT and RFC 2544 testing.

**[Layer 3]** - **IP** - allows Source and Destination IP Addresses. Users can configure various IP header fields like TOS, TTL, Protocol, Header Checksum, and Identification field.

**[Layer 4]** - **UDP** - allows Source and Destination UDP ports to be defined. User can choose to allow hardware to calculate/verify checksum or provide a fixed value.

![Figure: IP & UDP Layers Configuration](image)

### Tx and Rx Frame Statistics

Detailed statistics per port are provided. In addition to statistics like Frame Count, Frame Rate, Link Utilization, others are provided based on various categories like Frame Type (Unicast/Broadcast/Multicast, VLAN), frame lengths (64, 65-127, 1024-1518, Oversized, Undersized), Protocol Type (IPv4, IPv6, UDP, TCP, ICMP, IGRP, etc). VLAN Statistics (per Stack position), MPLS Statistics (per stack position) are also displayed for the configured stacks.

![Figure: General Port Statistics](image)

### Loopback Testing

PacketExpert™ has All ports/2 ports Loopback capability. PacketExpert™ supports Layer-wise Loopback as well as Smart Loopback. Supported Loopback types are -

- **Smart Loopback** - Analyzes incoming traffic, automatically detects and swaps Source and Destination MAC, IP, and UDP addresses before sending back the packet.
- **Layer-wise Loopback** - Swaps Source and destination MAC/IP/UDP addresses before sending back the packet and loops back the incoming packets as is.

![Command Line Interface (CLI)](image)

### Command Line Interface (CLI)

PacketExpert™ is enhanced to support Command Line Interface (CLI) with additional CXE100 license to access all the functionalities remotely using TCL client, Python client, C# client and MAPS™ CLI Server. The CLI supports all the PacketExpert™ test modules including - All Port Bert, Bert Loopback, All Port Loopback, RFC 2544, Record/Playback, PacketBroker, ExpertSAM™, and Multi-Stream Traffic Generation and Analysis.

### Buyer’s Guide

- **PXE100** – PacketExpert™ 1G
- **CXE100** - CLI support for PXE100

### Related Hardware

- **PXE104** - PacketExpert™ - SA (4 ports) 1G
- **PXE112** - PacketExpert™ - SA (12 Ports) 1G
- **PXE124** - PacketExpert™ - SA (24 Ports) 1G

### Related Software

- **PXE105** - Wire speed Record/Playback 1G
- **PXE106** - ExpertSAM™ 1G
- **PXE107** - PacketBroker™ 1G
- **PXE108** - Multi-Stream UDP/TCP Traffic Generator and Analyzer

For complete list, refer PacketExpert™ 1G - Optical and Ethernet Tester

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