Ethernet Tester – PacketExpert™

1 Gbps
Portable Unit

- Interfaces
  - 2 x 10/100/1000 Base-T Electrical only
  - 2 x 1000 Base-X Optical OR 10/100/1000 Base-T Electrical
  - Single Mode or Multi Mode Fiber SFP support with LC connector
  - Optional 4-Port SMA Jack Trigger Board (TTL Input/Output)

- Protocols:
  - RFC 2544 compliance
  - ITU-T Y.1564 (ExpertSAM)

- Power:
  - +9 volts, 2.2 Amps

- Bus Interface:
  - USB 2.0
1U Rack Option

• 19” rack option, w/ Embedded Single Board Computer (SBC)
• SBC Specs: Intel Atom CPU, 4GB RAM, Windows® 7, MSATA SSD, 4 USB Ports
PacketExpert SA (PXE124) is a 24-Port PacketExpert™ w/ Embedded Single Board Computer (SBC). SBC Specs: Intel Atom CPU, 4GB RAM, Windows® 7 (32 bit), MSATA SSD, 2 USB Ports. 19" 2U Rackmount Enclosure. (If options, then x 6).

PacketExpert SA (PXE112) is a 12-Port PacketExpert™ w/ Embedded Single Board Computer (SBC). SBC Specs: Intel Atom CPU, 4GB RAM, Windows® 7 (32 bit), MSATA SSD, 2 USB Ports. 19" 1U Rackmount Enclosure. (If options, then x 3).
PacketExpert 24 Ports – Hardware Specifications

- Power (120-130 AC Supply)
- 2 x Ethernet (2GB) ports
- USB 2.0
- VGA Display
- Serial COM Port

12-Port PacketExpert with 1000 Mbps Fiber Interface and 10/100/1000 Mbps CAT-5 Interface.
PacketExpert - 24 Ports Unit
Different Applications loaded on same Platform

Bert/Loopback
(24 ports, 2 ports Bert & 2 ports Loopback per device)

All Port Loopback
(24 ports, 4 ports per device)

All Port BERT
(24 ports, 4 ports per device)

RFC 2544
(12 Ports, 2 ports per device - Ports 2 & 3)

PacketExpert SA (PXE124)

Note: Only one application can run at a time
Optical Connectors and SFP Transceivers

- PacketExpert™ supports LC connectors and 850/1310 nm SFP (Small Factor Pluggable) modules
- Note: In case customer have different type of connectors, then we need converters like LC-to-SC, LC-to-FC and vice-versa.
GL’s Appliances in Network

1Gbps WAN Emulation (IPLinkSim™/IPNetSim™)

Wirespeed Record Playback
Multi-Stream UDP/TCP Traffic Generator

OC-192/STM-64
Network

PacketBroker

GL

1Gbps Ethernet

BERT, RFC2544,
Y.1564, Loopback

1Gbps Ethernet

IP/ MPLS
Core Network

1Gbps Ethernet

1Gbps Ethernet

1Gbps Ethernet

PacketExpert™ 1G

PXE100 - PacketExpert™
PXE104 - PacketExpert™ - SA (4 ports)
PXE112 - PacketExpert™ - SA (12 Ports)
PXE124 - PacketExpert™ - SA (24 Ports)
PXE105 - Wire speed Record /Playback - 1G
PXE107 - PacketBroker™ - 1G
PXE108 - Multi-Stream UDP/TCP Traffic Generator and Analyzer
PXE106 - ExpertSAM™ - 1G

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Applications

• Test and verify QoS Parameters of network devices like Switches/Routers etc.

• End to end testing of network paths for QoS parameters

• In-depth troubleshooting of the Carrier network in the event of network failures or impairments

• QoS testing of Triple-play services to ensure that they fully qualify SLA parameters

• Terrestrial wireless, satellite, and other WAN technologies network validations.

• Test VoIP network in real-time conditions to verify if it meets the quality requirements before you deploy.

• Testing video on IP networks by emulating the loss and congestion characteristics

• SPF support can be used for Broadband aggregation applications, Metro edge switching, Metro and access multi-service platforms, and are suitable for Fast Ethernet applications.
PacketExpert™
Ethernet / IP Tester

- BERT
- RFC 2544
- Smart Loopback
- IPNetSim
- IPLinkSim
- ITU-T Y.1564 (ExpertSAM™)
- Wire-Speed Record / Playback
- PacketBroker
- Multi-Stream Traffic Generator Analyzer
- RFC-6349 based TCP Throughput Testing (ExpertTCP™)
Wire-Speed BERT
OSI Model

Host A
- Preamble – 7 Bytes
- Start Frame Delimiter – (SFD) – 1 Byte
- MAC Header –
  - Dest/Src MAC Address – 6 Bytes
  - Ether Length/Type – 2 Bytes (0x0800)
  - IP
  - VLAN Header – 4 bytes each

Framing Representation
- Pre
- SFD
- MAC Header
- VLAN Header
- MPLS Header
- BERT Pattern
- FCS

Host B
- Ethernet Payload
- MPLS Header – 4 bytes each
- IP Header – 20 Bytes
- UDP Header – 8 Bytes
- Payload – BERT Test Pattern
- Frame Check Sum – (FCS) – 4 Bytes
BER Testing at Layer 2

Source PC

MAC Address: aa-aa-aa-aa-aa-aa

Destination PC

MAC Address: bb-bb-bb-bb-bb-bb

Layer 2

Switch

Transmit

Receive
BER Test Setup at Layer 3 / 4...

Layer 3 Testing between PacketExpert™ located in different IP Networks

In this case, Source and the Destination PacketExpert™ applications are located in different IP networks. These 2 networks are connected through a router. A simple example above shows 2 LANs connected through a router.

GL Communications Inc.
PacketExpert™ 24 Ports - BERT

PacketExpert SA (PXE124)

- 24 Bidirectional BERT streams, each full line rate, upto 1 Gbps

Multi-port Switch

Network
(Layer2 – Stack VLAN, MPLS, IP/UDP)
• Optional Sequence number insertion allows detecting Out-of-sequence packets and packet loss.

• Detailed BERT statistics like the Bit Error Count, Bit Error Rate, Bit Error Seconds etc., are provided.

• Bit Error Count is displayed in both Tabular and Graphical formats.
### All Ports Result

#### Transmission (Tx)
- **Total Frames**: 941,226 (Port 1), 941,226 (Port 2)
- **Valid Frames**: 941,226 (Port 1), 941,226 (Port 2)
- **Bad Frames**: 0 (Port 1), 0 (Port 2)
- **Number Of Bytes**: 1,425,106,490 (Port 1), 1,425,100,946 (Port 2)
- **Link Utilisation(%)**: 0.400 (Port 1), 0.400 (Port 2)
- **Data Rate(Mbps)**: 39.470 (Port 1), 39.470 (Port 2)
- **Frame Rate(Frames/sec)**: 3,259 (Port 1), 3,259 (Port 2)

#### Reception (Rx)
- **Valid Frames**: 940,916 (Port 1), 941,338 (Port 2)
- **Bad Frames**: 0 (Port 1), 0 (Port 2)
- **Number Of Bytes**: 1,424,546,824 (Port 1), 1,425,182,734 (Port 2)
- **Link Utilisation(%)**: 0.400 (Port 1), 0.400 (Port 2)
- **Data Rate(Mbps)**: 39.485 (Port 1), 39.485 (Port 2)
- **Frame Rate(Frames/sec)**: 3,260 (Port 1), 3,260 (Port 2)

#### BERT Status

<table>
<thead>
<tr>
<th>BERT Status</th>
<th>Port 1</th>
<th>Port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx Traffic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sync Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bit Errors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Out Of Sequence Packets</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### BERT Statistics

<table>
<thead>
<tr>
<th>BERT Status</th>
<th>Port 1</th>
<th>Port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Time</td>
<td>00:04:49</td>
<td>00:04:49</td>
</tr>
<tr>
<td>Bits Received</td>
<td>11,038,318,820</td>
<td>11,039,933,920</td>
</tr>
<tr>
<td>Bit Error Count</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bit Error Rate</td>
<td>-0.000E+00</td>
<td>-0.000E+00</td>
</tr>
<tr>
<td>Bit Error Seconds</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sync Loss Count</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sync Loss Seconds</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Loopback helps in easy test setup, especially in end-to-end testing, when the other end is in a remote place.

In such cases, one PacketExpert™ can be put in constant Loopback at the remote end, and BERT tests can be started / stopped anytime at the local end.
**Layer 2 - Ethernet Loopback Types**

- PacketExpert™ has all ports/2 ports Loopback capability. PacketExpert™ supports Layer-wise Loopback as well as Smart Loopback.
- The above picture depicts the Ethernet Loopback type, swaps Source and Destination MAC addresses before sending back the packet.

<table>
<thead>
<tr>
<th>Ethernet Dst MAC Address</th>
<th>Ethernet Src MAC Address</th>
<th>Ethernet Len/Type Field</th>
<th>Payload</th>
<th>FCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex: bb-bb-bb-bb-bb-bb</td>
<td>Ex: aa-aa-aa-aa-aa-aa</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Loopback Testing (all ports/2 ports)

- Supports Loopback on 10G / 1G ports
- Loopback Types – Smart Loopback, Layer 1, Ethernet, IP, UDP
- General statistics per port (similar to BERT port level statistics)
RFC 2544 Testing
RFC 2544 Testing

RFC 2544 test application includes the following tests:

- **Throughput** - Maximum number of frames per second that can be transmitted without any error
- **Latency** - Measures the time required for a frame to travel from the originating device through the network to the destination device.
- **Frame Loss** - Measures the network’s response in overload conditions
- **Back-to-Back** - It measures the maximum number of frames received at full line rate before a frame is lost.
PacketExpert™ 24 Ports – RFC 2544

PacketExpert SA (PXE124)

6 simultaneous bidirectional RFC 2544 test at full line rate, upto 1 Gbps

Network
(Layer2 – Stack VLAN, MPLS, IP/UDP)

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Highlights

- Throughput, back-to-back, latency and frame loss testing supporting uni-directional and bi-directional traffic between ports
- Supports RFC 2544 on electrical / optical (1000Mbps) ports and optical only (10G) ports
- Includes various parameter configurations such as Test Selection, Frame Sizes selection, Unidirectional/Bidirectional, Number of trials, Trial Duration, and many more.
- User-defined options to configure various packet header parameters, like MAC addresses, IP addresses, UDP ports, VLAN ID, MPLS Labels, and more.
- Results are displayed in both tabular as well as graphical format.
Global Configurations
Individual Test Configuration Details

Throughput

Latency

Frame Loss

Back-to-Back
Results

- **Throughput** – Both relative (% of link speed) and absolute (in Mbps) throughput values are displayed.
- **Latency** – displayed in Microseconds.
- **Back-to-Back** – Displayed in Frames/Burst.
- **Frame Loss** – Displays the Frame Loss Rate (in %) against attempted Frame Rate (in % of link speed).
Throughput

Latency
Graphs...

Back-to-Back

Frame Loss
Port Statistics

- Per port detailed statistics are provided –
  - Tx / Rx Frame count
  - Number of Bytes transmitted & received
  - Tx & Rx Frame Rate
  - Broadcast, Multicast, Control, VLAN, Pause Frame count
  - Frame count for byte lengths 64/65-127
  - MPLS and VLAN Frame count for various stack level
  - IPv4/ UDP packet count
  - Oversized / Undersized Error frame count
  - FCS error count
  - IP/UDP checksum error count and others
Generate Reports

**Configuration**

- **Choose Format**: PDF
- **Title**: PacketExpert
- **User Comments**: Generate RFC 2544 result
- **Header**: RFC2544-Throughput
- **Footer**: GL Communications
- **User Logo**: Expert\GL_Logo.JPG
- **File name**: PacketExpert\report1

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**PDF Report**

**CSV Report**
Command Line Interface (CLI)
PacketExpert™ also supports Command line Interface (CLI) to access all the functionalities remotely such as using TCL (Tool Command Language) and MAPS™ CLI Client/Server architecture.
Working Principle of MAPS™ CLI

.NET / CLI User

Set / Get / Start / Stop ...
API / CLI Response

PacketExpert™ Client Interface .NET / CLI

API Call
API Return Value

USB 2.0 Interface

PacketExpert™ Hardware
The TCL Client consists of 2 components:

- **TCL shell** – the DOS like command window into which user can enter TCL commands
- **GL’s proprietary TCL Extension DLL** – GL’s proprietary TCL extension dll name is “MapsClientIfc.dll”. The TCL Extension DLL provides functionality to execute MAPS™ commands like Start Script, Stop Script, etc.
TCL Client...
MAPS™ CLI Server consists of these components:

- **Scripts** – GL’s proprietary scripts (.gls files) implements various PacketExpert™ functionalities like BERT, RFC 2544 etc. The TCL client invokes these scripts to run the tests and get back the results.

- **XML config files** – These are xml files containing the configuration information for the test. Eg: MAC Addresses, IP Addresses, BERT parameters, RFC 2544 parameters, and other parameters.

- **PacketExpert™ API** – These are internal low level APIs used by the MAPS™ Scripts to control the PacketExpert™ hardware.
### Optional Modules

<table>
<thead>
<tr>
<th>Licenses</th>
<th>Application</th>
<th>Presentation References</th>
</tr>
</thead>
<tbody>
<tr>
<td>PXE105</td>
<td>Wire speed Record /Playback - 1G</td>
<td>PacketExpert-Record-Playback-Presentation.ppt</td>
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<tr>
<td>PXE106</td>
<td>ExpertSAM™ - 1G</td>
<td>PacketExpert-ExpertSAM-Presentation.ppt</td>
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<tr>
<td>PXE107</td>
<td>PacketBroker™ - 1G</td>
<td>PacketExpert-PacketBroker-Presentation.ppt</td>
</tr>
<tr>
<td>PXE108</td>
<td>ExpertTCP™ - 1G</td>
<td>PacketExpert-ExpertTCP-Presentation.ppt</td>
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<td>PXE108</td>
<td>Multi-Stream Traffic Generator and Analyzer – 1G</td>
<td>PacketExpert-MTGA-Presentation.ppt</td>
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