10 Gbps (or) 1 Gbps Ethernet Tester – PacketExpert™
Portable Units

PacketExpert™ 10G Standalone
- 2 x 1 Gbps Optical OR Electrical
- 2 x 10 Gbps Optical only

PacketExpert™ 10G Tablet Inspired
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
Optical Connectors and SFP Transceivers

- PacketExpert™ supports LC connectors and 850/1310 nm SFP (Small Factor Pluggable) modules
- Note: In case the customer has different types of connectors, then we need converters like LC-to-SC, LC-to-FC and vice versa.
GL’s Appliances in 10G Network

10Gbps WAN Emulation
(PLinkSim™/IPNetSim™)

Wireshpeed Record Playback
Multi-stream UDP/TCP Traffic Generator

GL

PacketBroker

GL

OC-192/STM-64
Network

IP/ MPLS
Core Network

1Gbps Ethernet

10Gbps Ethernet

BERT, RFC2544, Y.1564, Loopback,
Multi-stream Traffic Generation &
Analysis, RFC 6349

PacketExpert™ 10G
PXG100 - PacketExpert 10G
PXG105 - Wire speed Record /Playback 10G
PXG106 - ExpertSAM™ 10G
PXG107 - PacketBroker 10G
PXG108 - Multi-stream Traffic Generator & Analyzer, RFC6349 10G

GL Communications Inc.
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

Application Protocol
Presentation Protocol
Session Protocol

Framing Representation

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 – 4 bytes each

Ethernet Payload

Host B
MPLS Header – 4 bytes each
IP Header – 20 Bytes
UDP Header – 8 Bytes
Payload – BER Test Pattern
Frame Check Sum – (FCS) – 4 Bytes
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.
BERT Results (with LEDs) and Graph

- 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

#### Options

<table>
<thead>
<tr>
<th></th>
<th>Port 1</th>
<th>Port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

#### Tx

<table>
<thead>
<tr>
<th>Description</th>
<th>Port 1</th>
<th>Port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Frames</td>
<td>941 20E</td>
<td>941 20E</td>
</tr>
<tr>
<td>Valid Frames</td>
<td>941 20E</td>
<td>941 20E</td>
</tr>
<tr>
<td>Bad Frames</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of Bytes</td>
<td>1 425 105 980</td>
<td>1 425 100 946</td>
</tr>
<tr>
<td>Link Utilisation (%)</td>
<td>0.40%</td>
<td>0.40%</td>
</tr>
<tr>
<td>Data Rate (Mbps)</td>
<td>39.470</td>
<td>39.470</td>
</tr>
<tr>
<td>Frame Rate (Frames/ sec)</td>
<td>3 259</td>
<td>3 259</td>
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</tbody>
</table>

#### Rx

<table>
<thead>
<tr>
<th>Description</th>
<th>Port 1</th>
<th>Port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Frames</td>
<td>940 916</td>
<td>941 336</td>
</tr>
<tr>
<td>Bad Frames</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of Bytes</td>
<td>1 424 546 824</td>
<td>1 425 182 719</td>
</tr>
<tr>
<td>Link Utilisation (%)</td>
<td>0.40%</td>
<td>0.40%</td>
</tr>
<tr>
<td>Data Rate (Mbps)</td>
<td>39.485</td>
<td>39.485</td>
</tr>
<tr>
<td>Frame Rate (Frames/ sec)</td>
<td>3 260</td>
<td>3 260</td>
</tr>
</tbody>
</table>

#### BERT Status

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

#### BERT Statistics

<table>
<thead>
<tr>
<th>Description</th>
<th>Port 1</th>
<th>Port 2</th>
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<tbody>
<tr>
<td>BERT Status</td>
<td>Sync</td>
<td>Sync</td>
</tr>
<tr>
<td>Test Time</td>
<td>00:04:49</td>
<td>00:04:49</td>
</tr>
<tr>
<td>Bits Received</td>
<td>11 036 318 520</td>
<td>11 039 083 920</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>
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</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.
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 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.
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

## Global Configuration

### Port Selection
- **Port Selection**: P1 -> P2

### Minimum Frame Length
- **Value**: 64

### Maximum Frame Length
- **Value**: 16000

### Frame Size

<table>
<thead>
<tr>
<th>Quantity</th>
<th>64</th>
<th>136</th>
<th>208</th>
<th>280</th>
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<tbody>
<tr>
<td></td>
<td>352</td>
<td>424</td>
<td>496</td>
<td>568</td>
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<tr>
<td></td>
<td>640</td>
<td>712</td>
<td>784</td>
<td>856</td>
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<td></td>
<td>928</td>
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<td>1072</td>
<td>1144</td>
</tr>
<tr>
<td></td>
<td>1216</td>
<td>1288</td>
<td>1360</td>
<td>1432</td>
</tr>
</tbody>
</table>

### Test Procedure
- **Throughput**
- **Latency**
- **Frame Loss**
- **Back-To-Back**

### Port Selection
- **East Port**: P1
- **Direction**: <->
- **West Port**: P2
Individual Test Configuration Details

**Throughput**
- Port Selection: P1 -> P2
- Tx Configuration:
  - Trial Duration (sec): 60
  - Number Of Trials: 1
- Ports:
  - Port2 To Port3:
    - Min Bandwidth: 1.00
    - Max Bandwidth: 99.00
  - Port3 To Port2:
    - Min Bandwidth: 1.00
    - Max Bandwidth: 99.00

**Latency**
- Port Selection: P1 -> P2
- Tx Configuration:
  - Trial Duration (sec): 10
  - Number Of Trials: 1
- Ports:
  - Port2 To Port3:
    - Bandwidth: 100.00
  - Port3 To Port2:
    - Bandwidth: 100.00

**Frame Loss**
- Port Selection: P1 -> P2
- Tx Configuration:
  - Trial Duration (sec): 10
  - Number Of Trials: 1
- Ports:
  - Port2 To Port3:
    - Min Bandwidth: 1.00
    - Max Bandwidth: 100.00
  - Port3 To Port2:
    - Min Bandwidth: 1.00
    - Max Bandwidth: 100.00

**Back-to-Back**
- Port Selection: P1 -> P2
- Tx Configuration:
  - Trial Duration (sec): 10
  - Number Of Trials: 1
- Ports:
  - Port2 To Port3:
    - Burst Size: 400
    - No Of Bursts: 1
  - Port3 To Port2:
    - Burst Size: 400
    - No Of Bursts: 1
- **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).
Graphs

**Throughput**

![Throughput Graph](image)

**Latency**

![Latency Graph](image)
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

PDF Report

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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 Call

API / CLI Response

PacketExpert™ Client Interface .NET / CLI

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

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.
MAPS™ CLI Server...
## Optional Modules

<table>
<thead>
<tr>
<th>Licenses</th>
<th>Application</th>
<th>Presentation References</th>
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<tbody>
<tr>
<td>PXG105</td>
<td>Wire speed Record /Playback 10G</td>
<td>PacketExpert-Record-Playback-Presentation.ppt</td>
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<tr>
<td>PXG106</td>
<td>ExpertSAM™ 10G</td>
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<td>PXG107</td>
<td>PacketBroker™ 10G</td>
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<td>PXG108</td>
<td>ExpertTCP™ 10G</td>
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<tr>
<td>PXG108</td>
<td>Multi-Stream Traffic Generator and Analyzer 10G</td>
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