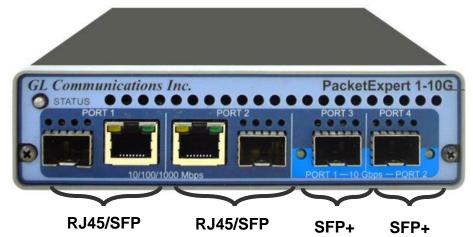
APIs for Test Automation and Remote Access



818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878 Phone: (301) 670-4784 Fax: (301) 670-9187 Email: <u>info@gl.com</u> Website: <u>http://www.gl.com</u>

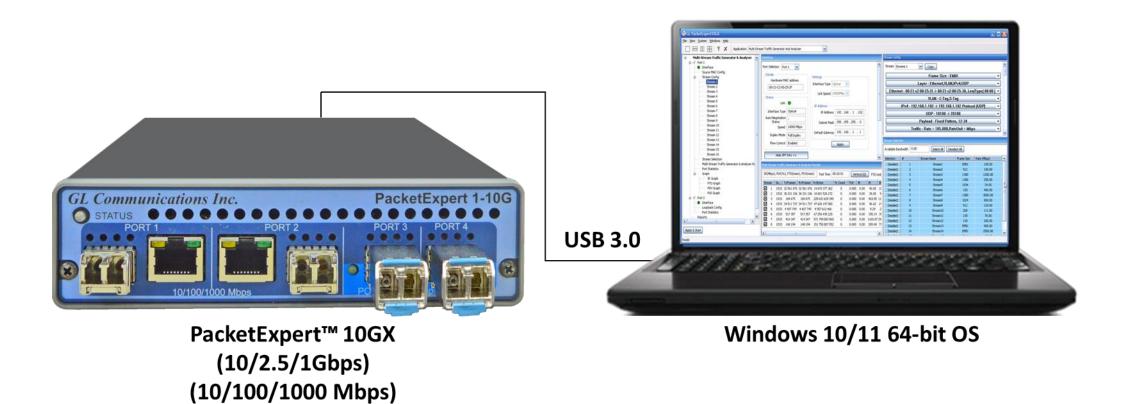
PacketExpert[™] 10GX - Portable Unit (PXN100, PXN101)



Physical Specifications	• Length: 8.45 in (214.63 mm)
	• Width: 5.55 in (140.97 mm)
	• Height: 1.60 in (40.64 mm)
	• Weight: 1.713 lbs
External Power Supply	 +12 Volts (Medical Grade), 3 Amps (For portable units having serial number ≥ 188400)
	 +9 Volts, 2 Amps (For portable units having serial number < 188400)
BUS Interface	• USB 3.0
	Optional 4-Port SMA Jack Trigger Board(TTL Input/Output)
Protocols	IEEE 802.3ae LAN PHY compliance
	RFC 2544 compliance

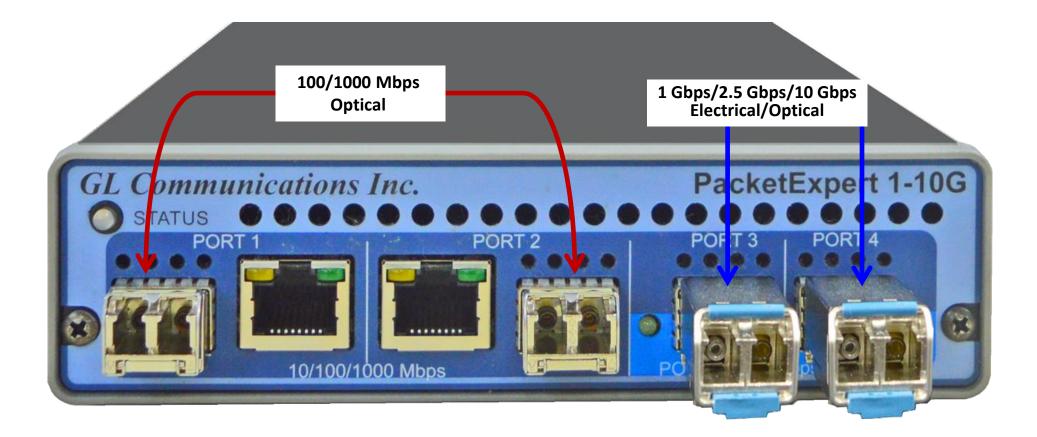


PacketExpert™ Software



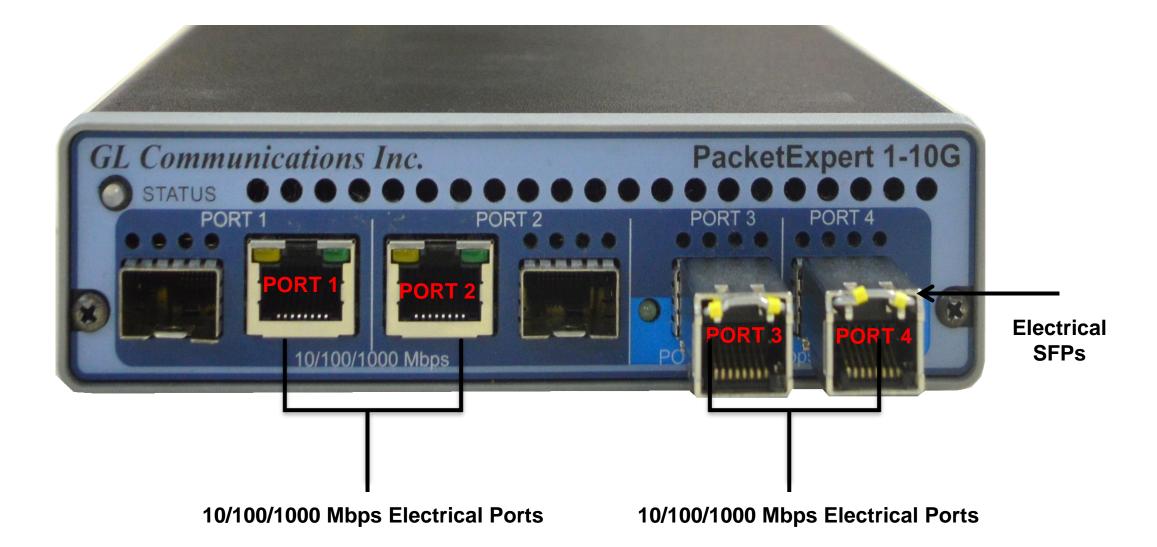


PacketExpert[™] 10GX - Optical Ports





PacketExpert[™] 10GX - Electrical Ports





mTOP[™] 1U Rack Option with 12 TTL

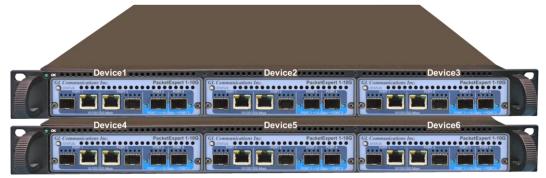




MTOP™ Rack Units



High Density 1U Rack option

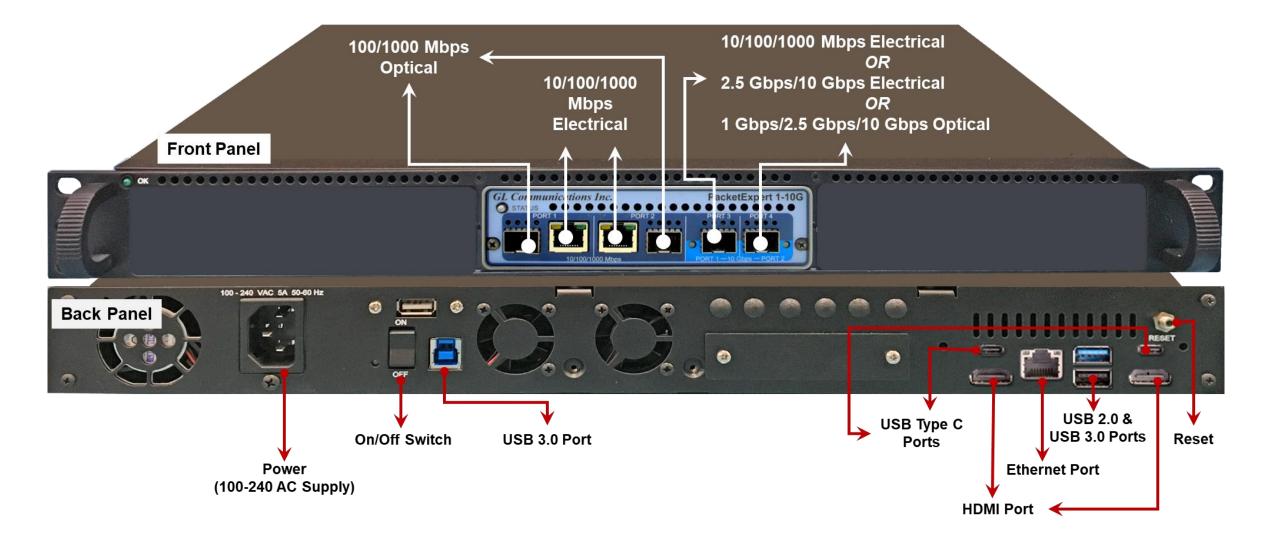


Stacked High Density 1U Rack option

Physical Specifications	 Length: 16 in (406.4) Width: 19 in (482.6) Height: 1U / 2U
External Power Supply	ATX Power Supply
BUS Interface	 1U mTOP[™] (MT001 + 3x PXN100) Rackmount Enclosure can support up to 3 PXN100s 2U Rack Mount (with 6x PXN100) Rackmount Enclosure can support up to 6 PXN100s Optional 4 to 12 Port SMA Jack Trigger Board (TTL Input/Output)
SBC Specifications	 Intel Core i3 or optional i7 NUC Equivalent, Windows® 11 64-bit Pro Operating System USB 3.0 and USB 2.0 Ports, ATX Power Supply USB Type C Ports, Ethernet 2.5GigE port 256 GB Hard drive, 8G Memory (Min) Two HDMI ports



$mTOP^{\rm TM}$ 1U Rack Option with Built in SBC





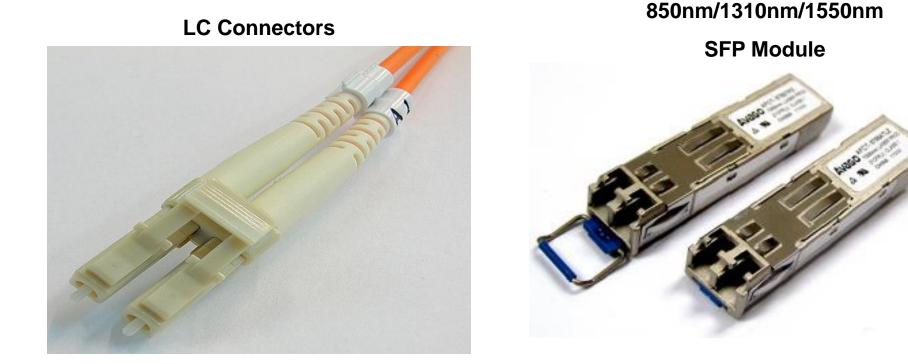
mTOP[™] Probe with 10GX Hardware Unit + SBC



Physical Specifications	 Length: 10.4 in. (264.16 mm) Width: 8.4 in. (213.36 mm) Height: 3.0 in. (76.2 mm) Optional 4-Port SMA Jack Trigger Board (TTL Input/Output) External USB based Wi-Fi adaptor
External Power Supply	 +12 Volts (Medical Grade), 3 Amps
SBC Specifications	 Intel Core i3 or optional i7 NUC Equivalent, Windows® 11 64-bit Pro Operating System USB 2.0 and 3.0 Ports, 12V/ 3Amps Power Supply USB Type C Ports, Ethernet 2.5GigE port 256 GB Hard drive, 8G Memory (Min) Two HDMI ports



Optical Connectors and SFP Transceivers



PacketExpert[™] 10GX supports LC connectors and 850nm/1310nm/1550nm 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



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



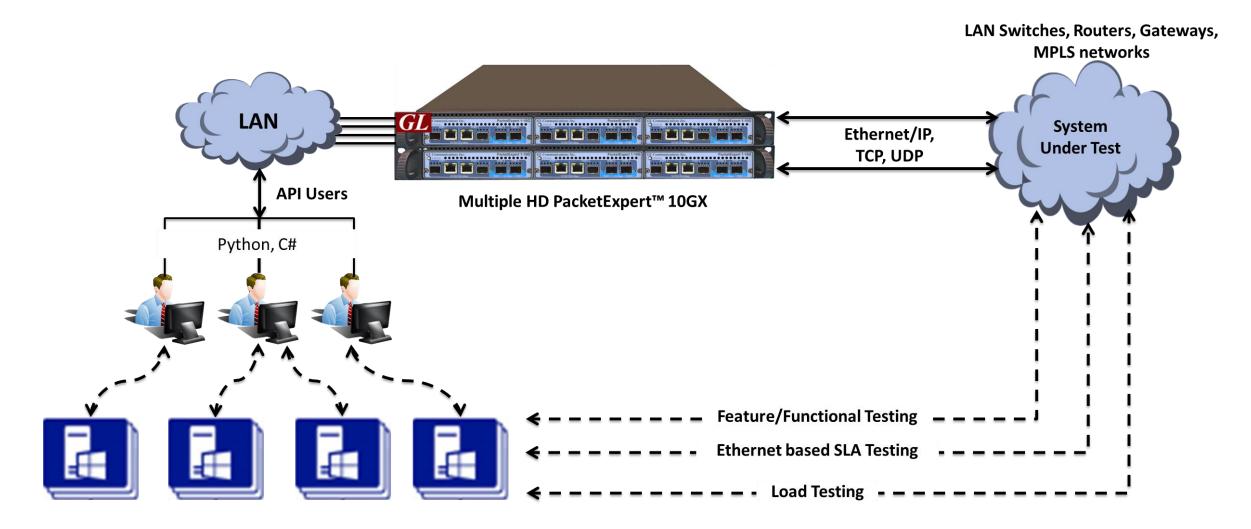
PacketExpert[™] APIs for Test Automation and Remote Access

- Overview
- Features
- Working principle
- MAPS[™] CLI Server API Clients
- Typical Test Systems
- IPLinkSim

- ITU-T Y.1564 (ExpertSAM™)
- Wire-Speed Record / Playback
- PacketBroker
- Multi-Stream Traffic Generator Analyzer
- RFC-6349 based TCP Throughput Testing (ExpertTCP™)



Overview





Overview

- With additional licensing, PacketExpert[™] supports Command line Interface (CLI) to access all the functionalities remotely such as Bert, Loopback, RFC 2544, Record Playback, IPNetSim[™], ExpertSAM[™], PacketBroker[™], and Multi Stream Traffic Generator and Analyzer using Python, C# client APIs and MAPS[™] CLI Client/Server architecture
- PacketExpert[™] can be configured as server-side application using the GL's MAPS[™] Client-Server architecture, to provide the capability of remote operation, automation, and multi-site connectivity, using any client-side scripting tools such as the Python, C#
- On the client side, the packaged library file is provided which allows the client interface to communicate with the MAPS[™] CLI Server to perform PacketExpert[™] specific functionalities

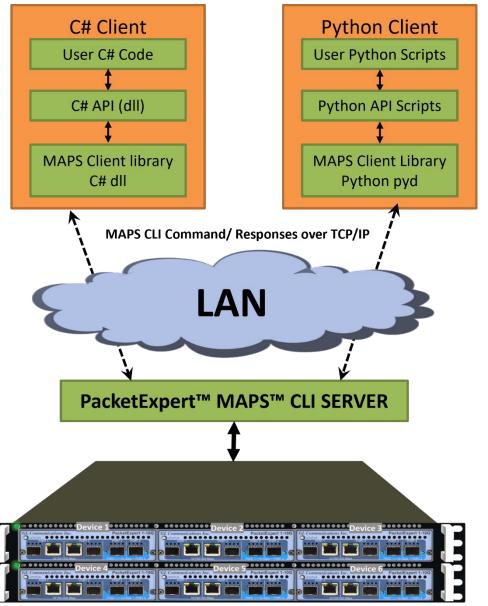


Features

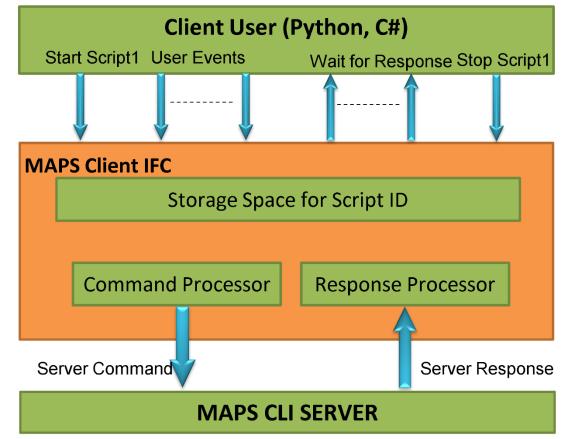
- Capability of remote operation, automation and multi-site connectivity using Python/C# client and MAPS[™] CLI server
- Scripts for MAC, VLAN, MPLS, IP and UDP layers testing
- Multiple PacketExpert[™] can be controlled remotely from single client application via MAPS[™] CLI server
- Scripts for Bert, Loopback, RFC 2544, Record Playback, IPLinkSim[™], PacketBroker[™], WAN Link Emulation, Multistream Traffic Generation and Analysis, and ExpertSAM[™] testing



Working Principle of MAPS[™] CLI

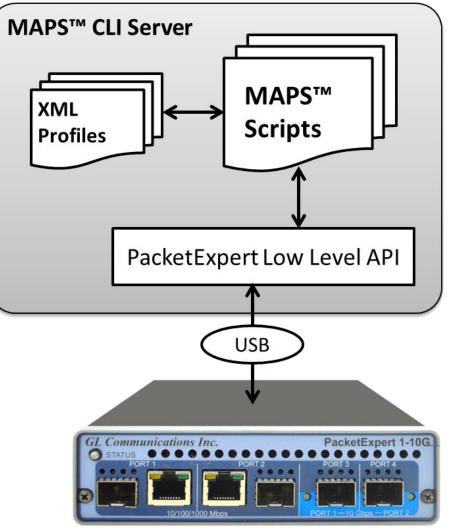


Communications



MAPS[™] CLI Server

- GL's proprietary MAPS[™] CLI Server scripts (*.gls files) developed specifically for PacketExpert[™] implements various PacketExpert[™] functionalities like BERT, RFC 2544, and others
- MAPS[™] CLI Server interfaces internally with low level PacketExpert[™] APIs to access PacketExpert[™] hardware and to perform tasks



PacketExpert[™] 1G/10G



MAPS[™] CLI Server (Contd.)

Eile Edit View	- 8
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View Latest Command	
<pre>N14-4:24 15:01:37.799000 : UserEvent 2 "SetEnableMPLS"# "Direction"="TX","EnableMPLS"="True","PortIndex"=3; N14-4:24 15:01:37.903000 : UserEvent 2 "SetMPLSParameters"# "Direction"="TX","MumMPLSStacks"=3,"PortIndex"=3; N14-4:24 15:01:38.013000 : UserEvent 2 "SetMPLSParameters"# "Direction"="TX","MPLSCos"=2,"MPLSLabel"=12000,"MPLSStackId"=0,"MPLSTTL"=128,"PortInd N14-4:24 15:01:38.231000 : UserEvent 2 "SetMPLSParameters"# "Direction"="TX","MPLSCos"=2,"MPLSLabel"=14000,"MPLSStackId"=2,"MPLSTTL"=128,"PortInd N14-4:24 15:01:38.344000 : UserEvent 2 "SetEnableInterfaceIPv4Address"# "Direction"="TX","PortIndex"=3,"SourceIPv4Address"="True","PortIndex"=3; N14-4:24 15:01:38.345000 : UserEvent 2 "SetEosurceIPv4Address"# "Direction"="TX","PortIndex"=3,"SourceIPv4Address"="True","PortIndex"=3; N14-4:24 15:01:38.455000 : UserEvent 2 "SetEostinationIPv4Address"# "Direction"="TX","PortIndex"=3,"SourceIPv4Address"="True","PortIndex"=3; N14-4:24 15:01:38.670000 : UserEvent 2 "SetEostinationIPv4Address"# "Direction"="TX","PortIndex"=3,"TOSDS"=0; N14-4:24 15:01:38.670000 : UserEvent 2 "SetIOSDS"# "Direction"="TX","PortIndex"=3,"TOSDS"=0; N14-4:24 15:01:38.890000 : UserEvent 2 "SetIPProtocol"# "Direction"="TX","PortIndex"=3,"ToSDS"=0; N14-4:24 15:01:38.99000 : UserEvent 2 "SetIPProtocol"# "Direction"="TX","PortIndex"=3,"ToSDS"=0; N14-4:24 15:01:39.9105000 : UserEvent 2 "SetIPProtocol"# "Direction"="TX","PortIndex"=3,"ToSDS"=0; N14-4:24 15:01:39.219000 : UserEvent 2 "EnableIPIdentificationInc"# "Direction"="TX","EnableIPIdentification"="True","PortIndex"=3; N14-4:24 15:01:39.219000 : UserEvent 2 "SetIPIChecksum"# "Direction"="TX","PortIndex"=3,"SourceUDPPort"#"OreIndex"=3; N14-4:24 15:01:39.219000 : UserEvent 2 "SetIPIChecksum"# "Direction"="TX","PortIndex"=3,"SourceUDPPort"="SourceUPPOrt"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"SourceUPPORT"#"S</pre>	lex"=3;
)14-4-24 15:01:40.418000 : UserEvent 2 "SetRate"# "Direction"="TX","PortIndex"=3,"Rate"=100;)14-4-24 15:01:40.524000 : UserEvent 2 "SetRateUnit"# "Direction"="TX","PortIndex"=3,"RateUnit"="Percentage";)14-4-24 15:01:40.633000 : UserEvent 2 "GetLayer"# "Direction"="TX","PortIndex"=3;)14-4-24 15:01:40.748000 : UserEvent 2 "GetSourceMACAddress"# "Direction"="TX","PortIndex"=3;	
114-4-24 15:01:40.740000 : UserEvent 2 "GetDourceMACAddress" # "Direction" = "TX", "PortIndex"=3; 114-4-24 15:01:40.966000 : UserEvent 2 "IsInterfaceMACAddressEnabled" # "Direction"="TX", "PortIndex"=3; 114-4-24 15:01:41.074000 : UserEvent 2 "GetEthernetLenType" # "Direction"="TX", "PortIndex"=3; 114-4-24 15:01:41.074000 : UserEvent 2 "GetEthernetLenType" # "Direction"="TX", "PortIndex"=3;	

 CLI Server script execution is Event Driven, i.e., Server detects the Events such as InsertStatus, InterfaceStatus, IsRunning, LoadProfileStatus, RFC2544Init, RFC2544TestConfig, TestDirection and others



Python Client and Scripting

- The Python Client consists of following components:
- Python API scripts, that provide High Level APIs, using which all the PacketExpert[™] functionalities are accessible to the users
- These APIs in turn use a low level library to communicate with the PacketExpert[™] MAPS[™] server

	APIs
Us	er Defined Python Scripts
	Python API
	Low Level Library



Python Client

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Run:		AllPortBert_SampleApplication × 🛃 AllPortBert_SampleApplication ×
đ		AllPortBert application Initialised Press any key to continue , 'q' to quit
=	ll: ti	Running BERT Test Loading Configuration *********************************Device 1 ************************
*	÷	<pre>Load Configuration Done ************************************</pre>
		Port : 3 Tx Started Port : 4 Tx Started

Bert Results of Port 1 [{'Traffic Status': 'Rx Traffic'}, {'Sync Status': 'InSync'}, {'Bit Error Status': 'No Error'}, {'Out Of Sequence Status': 'No Error'}, {'BERT Status': 'Sync'}, {'BERT Test Time': '00:00:07'}, {'Bits Received': '5 226 410 336'}, {'Bit Error Count': '0'}, {'Bit Error Rate': '0.000E+00'}, {'Bit Error Seconds': '0'}, {'Sync Loss Count': '0'}, {'Sync Loss Seconds': '0'}, {'Out of Sequence Count': '0'}, {'Out of Sequence Seconds': '0'}, {'Error Free Seconds': '7'}]

Bert Results of Port 2
[{'Traffic Status': 'Rx Traffic'},
 {'Sync Status': 'InSync'},
 {'Bit Error Status': 'No Error'},
 {'Out Of Sequence Status': 'No Error'},
 {'BERT Status': 'Sync'},
 {'BERT Test Time': '00:00:07'},



...

C# Client and Scripting

- The C# interface developed for PacketExpert[™] allows users to control all features of PacketExpert[™] through C# APIs
- The C# client connects to the MAPS[™] CLI server using TCP/IP sockets

MAPSChentCSAPLd	MAPSClientCSAP1.dll
(C# API dll)	



C# Client

C:\Program Files\GL Communications Inc\PacketExpertPxeClient\C#\AllPortBert_ConsoleApplication.exe

Port3

Traffic Status: Rx Traffic Sync Status: InSync Bit Error Status: No Error Out Of Sequence Status: No Error BERT Status: Sync BERT Test Time: 00:00:18 Bits Received: 17 012 794 104 Bit Error Count: 0 Bit Error Rate: 0.000E+00 Bit Error Seconds: 0 Sync Loss Count: 0 Sync Loss Seconds: 0 Out of Sequence Count: 0 Out of Sequence Seconds: 0 Error Free Seconds: 19

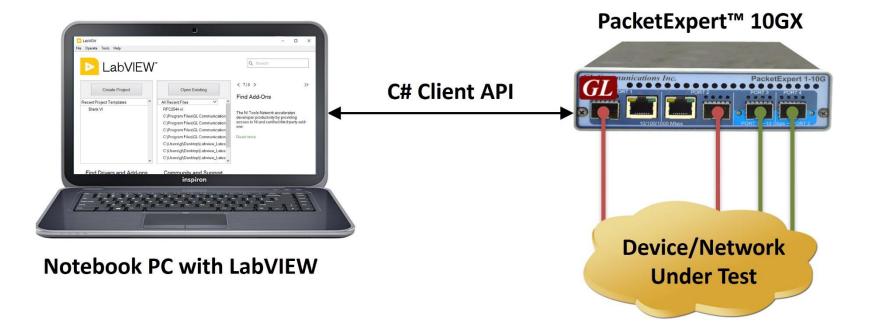
Port4

Traffic Status: Rx Traffic Sync Status: InSync Bit Error Status: No Error Out Of Sequence Status: No Error BERT Status: Sync BERT Test Time: 00:00:18 Bits Received: 17 071 621 200 Bit Error Count: 0 Bit Error Rate: 0.000E+00 Bit Error Seconds: 0 Sync Loss Count: 0



PacketExpert[™] Integration with LabVIEW using C# Client

PacketExpert[™] Integration with LabVIEW





PacketExpert[™] Integration with LabVIEW using C# Client

BERT Statistics

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		(
		BERT Results	Port 1	Port 2	Port 3	Port 4		
		Traffic Status	Idle	No Rx Traffic	No Rx Traffic	No Rx Traffic	1	
		Sync Status	Idle	InSync	InSync	InSync		
		Bit Error Status	Idle	No Error	No Error	No Error	1	
		Out Of Sequence Status	Idle	No Error	No Error	No Error		
		BERT Status	Idle	Sync	Sync	Sync		
		BERT Test Time	00:01:59	00:01:59	00:01:59	00:01:59		
		Bits Received	111 866 884 800	111 852 627 584	111 861 928 832	111 863 056 256		
		Bit Error Count	0	0	0	0		
		Bit Error Rate	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
		Bit Error Seconds	0	0	0	0		
		Sync Loss Count	0	0	0	0		
		Sync Loss Seconds	0	0	0	0		
		Out Of Sequence Count	0	0	0	0		
		Out Of Sequence Seconds	0	0	0	0		
		Error Free Seconds	119	119	119	119		

		All Port			
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Valid Frames	9534600	9544040	Valid Frames	9544040	9534600
Bad Fremes	9334600	0	Valid trames Bad Frames	0	0
Number of Bytes	14473522800	14487852720	Number of Bytes	14487852720	14473522800
Link Utilisation	0.000	0.000	Link Utilisation	0.000	0.000
	0.000	0.000		0.000	0.000
Data Rate	0.000	0.000	Data Rate	0.000	10.000
Frame Rate			Frame Rate	×	
	0	0		0	0
Broadcast Frames Multicast Frames	0	0	Broadcast Frames Multicast Frames	0	0
	-	0		0	0
Control Frames		0	Control Frames	0	0
VLAN Frames				0	10 10
Pause Frames			Pause Frames	-	
Wrong Opcode Frames	0	0	Wrong Opcode Frames	0	0
Out of Bound Frames	0	0	Out of Bound Frames	0	0
Length Type Out of Range Fi	imes 0	0	Length Type Out of Range Frames	0	0
64 Byte Length Frames	- 6	0	64 Byte Length Frames		
65-127 Byte Length Frames		0	65-127 Byte Length Frames	0	0
128-255 Byte Length Frames	0	0	128-255 Byte Length Frames	0	0
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512-1023 Byte Length Frame	0	0		9544040	9534600
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512-1023 Byte Length Frame 1004-1518 Byte Length Fram Oversized Frames Undersized Frames 1 Level Stacked VLAN Frame 2 Level Stacked VLAN Frame 3 Level Stacked VLAN Frame	0 	0 0 0 0 0 0	Diversized Frames Undersized Frames FCS Enror Frames El Level Stacked VLAN Frames B Level Stacked VLAN Frames	954040 0 - - - -	0 0 0 0 0
512-1023 Byte Length Frame 1004-1538 Byte Length Frame Developed Frames Undersized Frames 1 Level Stacket VIAN Frame 2 Level Stacket VIAN Frame 3 Level Stacket VIAN Frame 1 Level Stacket MIPLS Frame	0 	0 0 0 0 0 0 0	Oversized Frames Undersized Frames FCS Error Frames I Level Stacked VLAN Frames 3 Level Stacked VLAN Frames 1 Level Stacked VMLAN Frames 1 Level Stacked VMLS Frames	954040 0 - - - - - - - - - -	0 0 0 0 0 0 0 0 0
512-1020 Byte Length Frame 1024-1518 Byte Length Fram Dowisized Frames Undersized Frames FCS Inter Frames I Lenet Backed VLAN Frame 3 Lenet Backed VLAN Frame 3 Lenet Backed MIAN Frame 2 Lenet Backed MIAS Frame 2 Lenet Backed MIAS Frame	0 + -	0 0 0 0 0 0	Densister Frames [Andraider Frames] FCSI store Frames 7 Level Stacket VIAM Frames	954040 0 - - - - - - - - - - - - - - - - -	0 0 0 0 0
512-1020 Byte Length Frame 2021-1518 Byte Length Fram Overside Frames Underside Frames I Level Stacked VLAN Frame 2 Level Stacked VLAN Frame 2 Level Stacked VLAN Frame 2 Level Stacked MICS Frame 2 Level Stacked MICS Frame 2 Level Stacked MICS Frame 2 Level Stacked MICS Frame	0 + -		Devision Frames Distributed Frames FCS.tem Frames FLeed Statistical VLAM Frames	954400 0 - - - - - - - - - - - - - - - - -	
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52.1023 Byte Length France 1026-1518 Spit Length France Duraised France Trans. TCS Torr France TLE-on' Stacket YLAN France TLE-on' Stacket YLAN France TLE-on' Stacket YLAN France TLE-on' Stacket MVLA France TLE-on' Stacket MVLA France PLO-accium France	0 + -	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Devision Frames Devision Frames FCS.tem Frames Toel Storen Frames Toel Storen VI.MA Frames Toel Storen VI.MA Frames Toel Storen VI.MA Frames Toel Storen VI.S.Trames Toel Storen VI.S.Trames Toel Storen VI.S.Trames Toel Storen VI.S.Trames Toel Storen VI.S.Trames To Conclusion Frames IP Conclusion Frames	954400 0 - - - - - - - - - - - -	
52 1023 Byte Length Franc 102-1518 Byte Length Franc Diversion France Test Start France Test Start France Test Start France Test Start Add Franc Test Start Add Franc De Architect	0 + -	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Devision Frames Devision Frames FCS from Frames FLeed Stacket VLAM Frames ELeed Stacket VLAM Frames ELeed Stacket VLAM Frames ELeed Stacket VLAM Frames ELeed Stacket VLAM Frames FLeed Stacket VLAM Frames FLAM Stacket FLAM Franket FLAM Franket	954400 0 - - - - - - - - - - - - - - - - -	0 0 0 0 0 0 0 0 0 0 0 0 0 0
52 1023 Byte Length France 1006 1158 Byte Length France Oversized France Undersond France TeCS Inter France TeCS Inter France TeCH State France Port Packets Port Packets	0 + -	0 0 0 0 0 0 0 0 0 0 0 0 0 0	Densister Frames Goldsmither Frames FCSS tree Frames 1 Level Stacket VLAN Frames 2 Level Stacket VLAN Frames 1 Level Stacket VLAN Frames 1 Level Stacket VHSS Frames 1 Level Stacket VHSS Frames 1 Level Stacket VHSS Frames 1 Level Stacket VHSS Frames 1 Concluss Frames 1	954040 0 - - - - - - - - - - - - - - - - -	0 0 0 0 0 0 0 0 0 0 0 0 0 0
52 1023 Byte Length Franc (104-518) Byte Length Franc Understand France Inderstand France In Cast Start France In Cast Start France In Cast Start France In Cast Start (104) Franc Incest Start (104	0 + -	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Devision Frames Understand Frames FES Error Frames T Level Stocket VLAN Frames P de Antone Frames P de Packets VLAN Frames P de Packets VLAN Frames VLAN Frames P de Packets VLAN Frames VLAN Frames	954000 0 	0 0 0 0 0 0 0 0 0 0 0 0 0 0
50 1021 Byte Length Franc 1966 1518 Byte Length Franc Oversion France 1965 Length France 1965 Length France 1966 Length France 1966 Length HJAI Franc 1966 HJAI Franc 1966 HJAI Franc 2066 HJAI France 2066 HJAI France	0 + -	9 0 0 0 0 0 0 0 0 0 0 0 0 0	Devision Frames Jonatized Frames FCS from Frames T Level Stacket VAM Frames 2 Level Stacket VAM Frames 1 Leve	954000 0 0 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -	р р р р р р р р р р р р р р
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52 1023 Byte Length Franc 1906-1518 Spie Length Franc Devices France In Concession France In Practice In Practice In Practice	0 + -	0 0	Devision Frame Devision Frame FrCS from Frame FrCS from Frame Free Standy 1044 Frame Free Stacket VMA Frame Free Stacket Free Stacket Free Free Stacket Free Stacket Free Free Stacket Free Stacket Free Free Stacket Free Stacket F	954000 0 0 - - -	0 0
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Thank You

