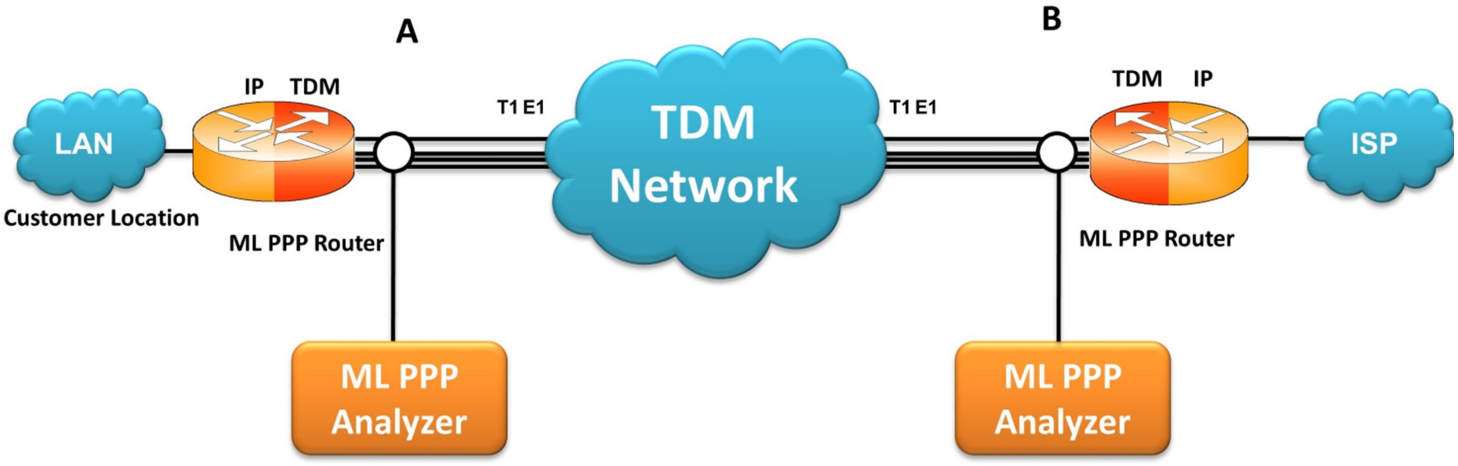
PPP and MLPPP Protocol Analyzer



Overview

The **Point-to-point protocol (PPP)** is a link layer protocol, which encapsulates other network layer protocols like IP for transmission on synchronous (like T1 E1) and asynchronous communications lines. When transmitted over T1 E1 line, PPP frames are based on HDLC frame structure. Today the PPP protocol standard finds wide use in synchronous connections between LANs, bridges, routers and other intermediate devices.

Two major features of PPP protocol are authentication and encapsulation of higher layer protocols. MLPPP bundles multiple link-layer channels into a single network-layer channel. A bundle can consist of multiple physical links of the same type or physical links of different types. Data sent through this channel will be distributed among all the links.

The GL's **MLPPP Analyzer** can be used to capture and decode a host of PPP protocols exchanged between pairs of nodes over T1 E1 links. It provides useful analysis of the PPP, MLPPP, and MC-MLPPP protocols. MLPPP analyzer also supports **Packet Data Analysis** module (requires additional license) to perform detail analysis of MLPPP packets over IP and segregates them into SIP / H323 / MEGACO/ MGCP / T.38 fax calls.

GL Communications supports the following types of MLPPP Analyzers:

- Real-time MLPPP Analyzer with Packet Data Analysis (PDA)
- Offline MLPPP Analyzers

For more details, refer to PPP Protocol Analyzer webpage.

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Main Features

Display Features

- Displays Summary, Detail, Hex-dump, and Statistics Views
- Detail View:
  - Displays decodes of a user-selected frame from the summary view
  - Provides options to display or hide the required protocol layers
  - Contents of this view can also be copied to clipboard
  - Provides option to toggle detail view vertically or horizontally as feasible for the user
- Summary View displays Dev #, Time Slot, Layer 3 Protocol, LCP message type and higher protocol specific information such as Destination and Source IP address, Destination and Source TCP as well as UDP port details, HTTP/FTP message type, and so on in a tabular format
- Statistics View displays statistics based on frame count, byte count, frames/sec, bytes/sec etc for the entire capture data
- Any protocol field can be added to the summary view, filtering, and search features providing users more flexibility to monitor required protocol fields
- Option to combine data from multiple columns under one column
- Option to create multiple aggregate column groups. These groups can be prioritized as per user's requirement to display the summary results efficiently

Supported Protocols

- PPP, MLPPP, Multi-class MLPPP, IPCP, BCP, PPP MUX CP, BPDU, PAP, CHAP, SNMP, STUN, DNS, DHCP, SIP, SCTP, SUA, M3UA, IUA, IEC, and more

Filtering / Search

- Advanced filtering and search based on any user selected protocol fields
- Allows the user to automatically create search/filter criteria from the current screen selection

Capturing Streams

- Streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels or full bandwidth
- Frames can be transmitted/captured in either 64 kbps, 56 kbps, n x 64 kbps, or n x 56 kbps data channels (hyper-channels)
- Supports selection of TS0 in E1 analyzer for the analysis of unframed data

Export Options

- Exports Summary View information to a comma delimited file for subsequent import into a database or spreadsheet
- Capability to export detailed decode information to an ASCII file

Remote Monitoring

- Remote monitoring capability using GL's Network Surveillance System

Additional Features

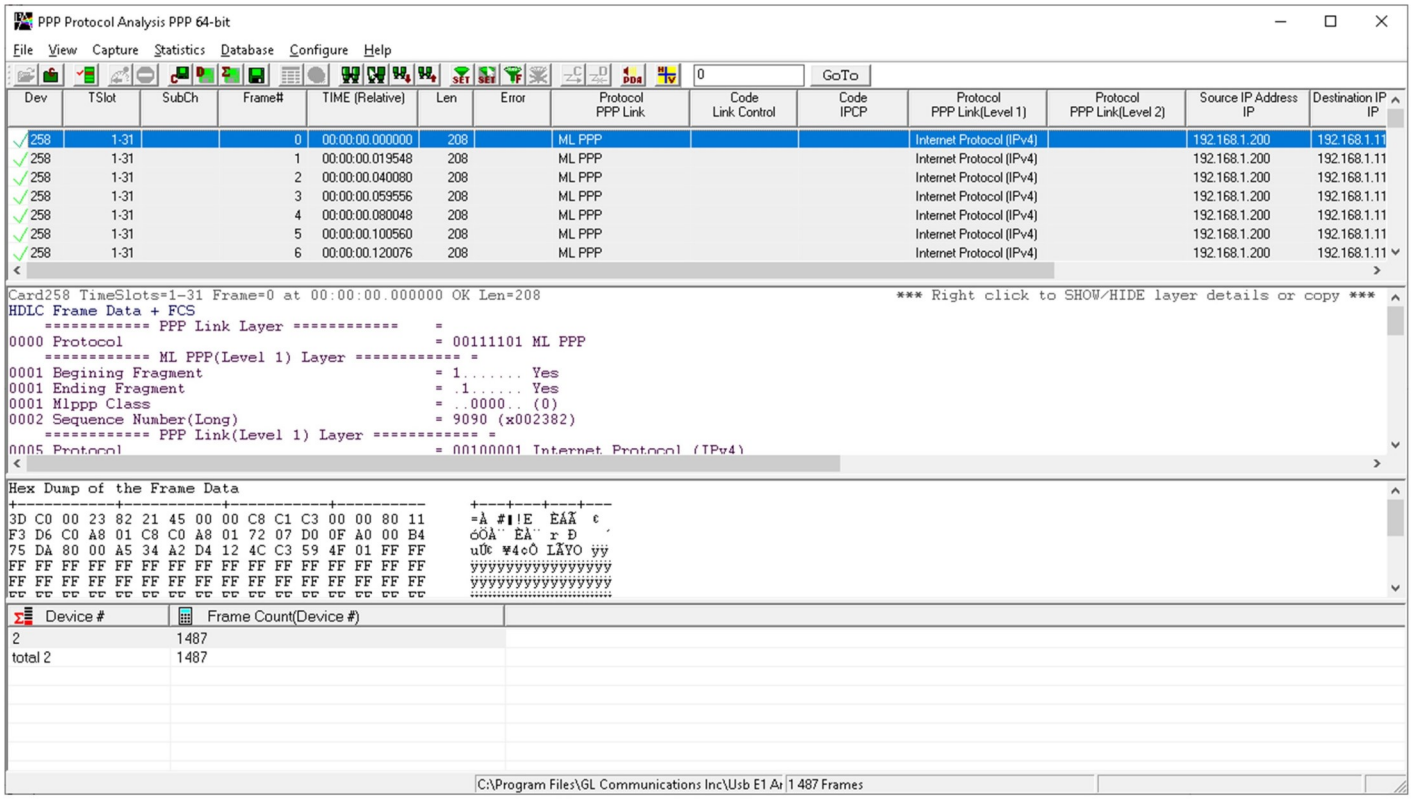
- Ability to test and analyze HDLC based PPP protocol, PPP SIGTRAN and PPP over IP protocols
- Supported Audio and Video codecs: Mulaw, Alaw, G.726 (40/32/24/16 kbps), G.726 with VAD, GSM610, G729, G729B, AMR (Wide and Narrow band codec), ILBC (20 , 30 msec), SPEEX, EVRC, EVRCB, H263+, and H264

PDA Main Features

- Supported protocols – SIP (Session Initiation Protocol RFC 2543 and RFC 3261), MEGACO, MGCP, H323/H225, T.38 Fax, and RTP
- Full RTP Analysis with audio capture/playback supported for all common codecs
- Provides the registration summary of each SIP registration including the user agent, registrar, status, registration request delay (RRD), etc. and graphical view of the active registrations and registration trace of each registration
- Provides Video QoS Statistics such as Missing Packets, Delay, Gap, Video Frame Count, Media Delivery Index (MDI - (Delay Factor : Media Loss Rate)), and Frame Rate, and more
- Supported Audio and Video codecs: Mulaw, Alaw, G.726 (40/32/24/16 kbps), G.726 with VAD, GSM610, G729, G729B, AMR (Wide and Narrow band codec), ILBC (20 , 30 msec), SPEEX, EVRC, EVRCB, H263+, and H264

Summary, Detail, and Hex dump Views

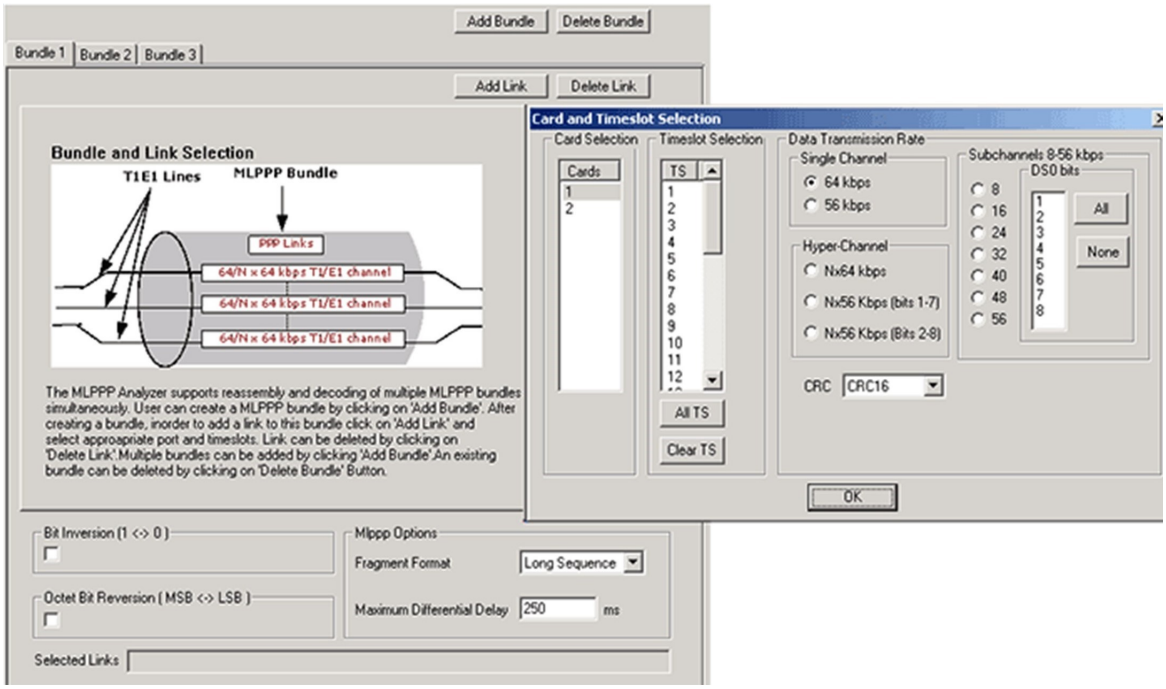
The analyzer displays Summary, Detail, and Hex dump Views in different panes. The Summary View displays Frame Number, Time, Length, Error, PPP Layer3 Protocol, LCP Code, IPCP code, BCP code, Class, Seq No, PPP Message type and more. The user can select a frame in Summary View to analyze and decode each frame in the Detail View. The Hex dump View displays the frame information in HEX and ASCII formats. The contents of Detail and Hex dump view can also be copied to clipboard.



Summary, Detail, and Hex dump Views

Real-time and Offline Analysis

The MLPPP analyzer supports reassembly and decoding of multiple MLPPP bundles simultaneously. Each MLPPP bundle will reassemble packets from PPP links. The real-time capturing requires user to specify timeslots, bit inversion, octet bit reversion, user/network side, hyper channel selection, CRC, and MLPPP options (fragment format, max differential delay). The captured raw data can then be transmitted using the HDLC File Playback application. The recorded trace file can be used for offline analysis or exported to a comma-delimited file, or ASCII file.

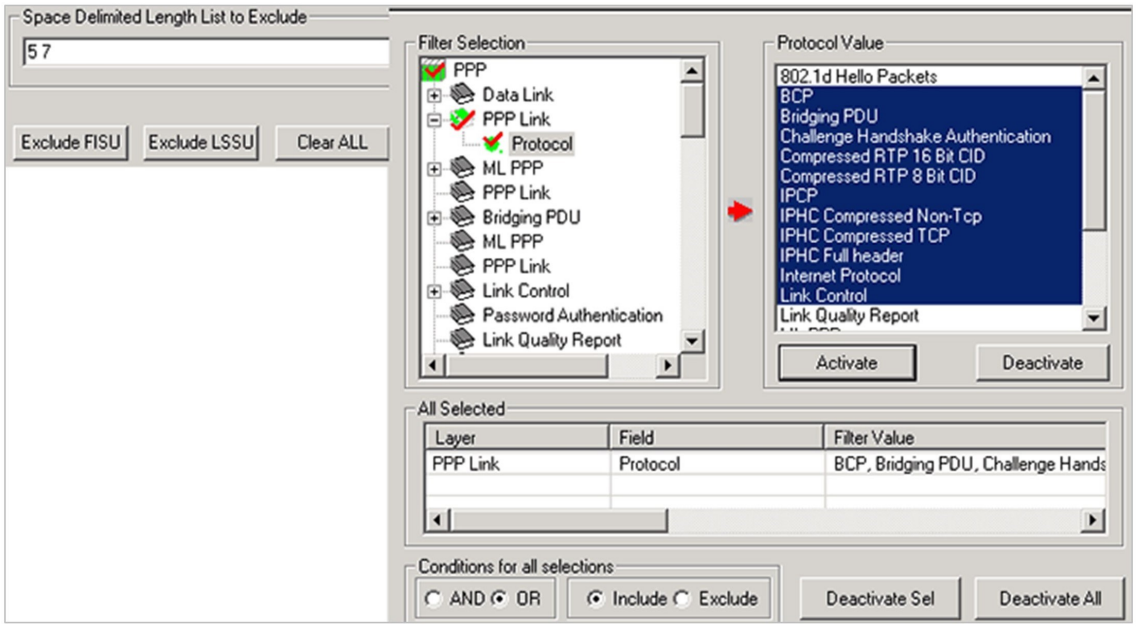


Stream / Interface Selection

Filtering and Search

Users can record all or filtered traffic into a trace file and also can create search/filter criteria automatically from the current screen selection. Filter and search capabilities adds a powerful dimension to the MLPPP analyzer. These features isolate required frames from the captured frames in real-time, as well as offline. In real-time capturing, filter based on length of frames can be set. The frames can be also be filtered after completion of capture based on Frame Number, Time, Length, Error, Layer3 Protocol, LCP Code, IPCP code, Seq no, MLPPP class, and so on.

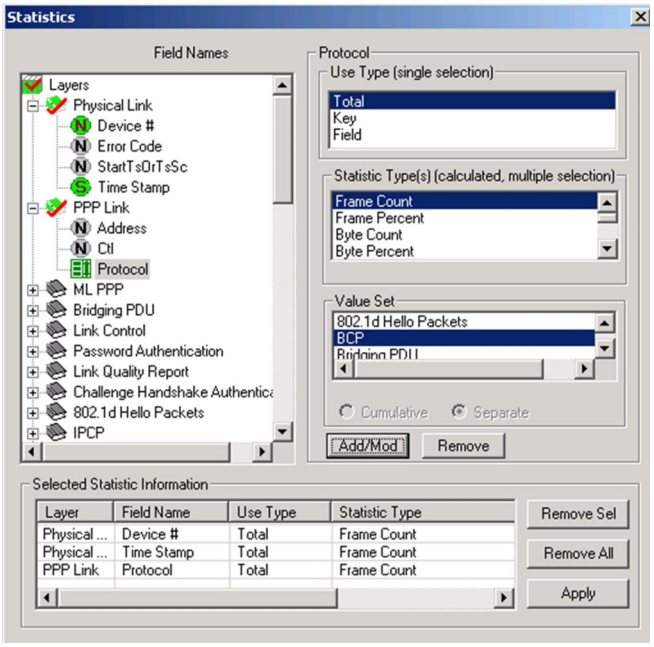
Similarly, search capability helps user to search for a particular frame based on specific search criteria.



Real-time and Offline Filter

Statistics View

Statistics is an important feature available in MLPPP analyzer and can be obtained for all frames both in real-time as well as offline mode. Various statistics can be obtained to study the performance and trend in the PPP network based on protocol fields and parameters.

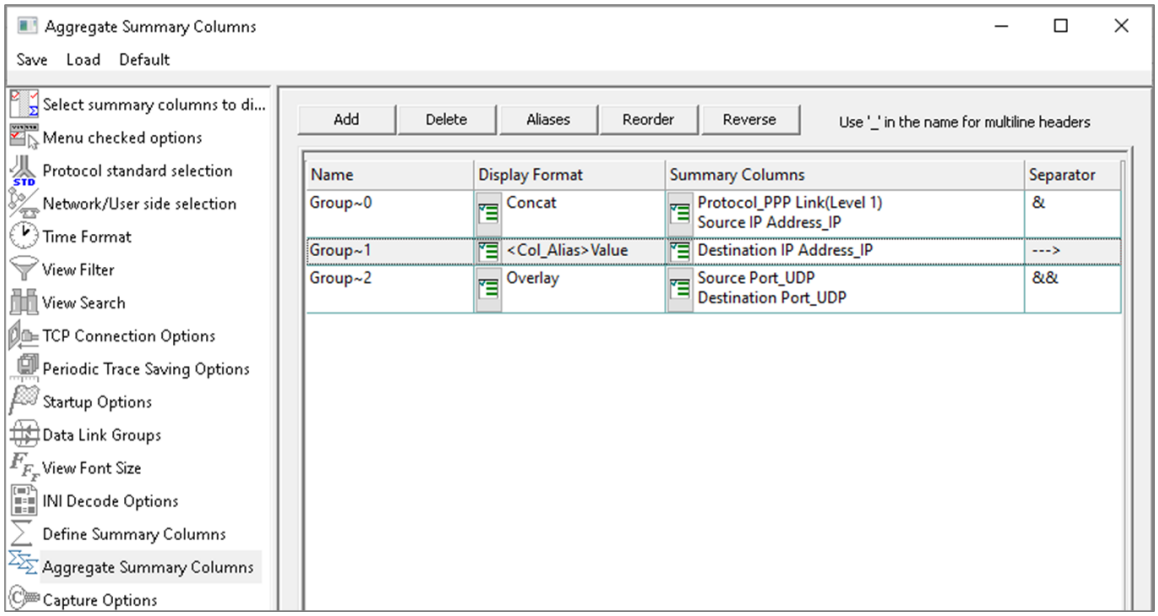


Statistics Definition Dialog

Aggregate Column Group

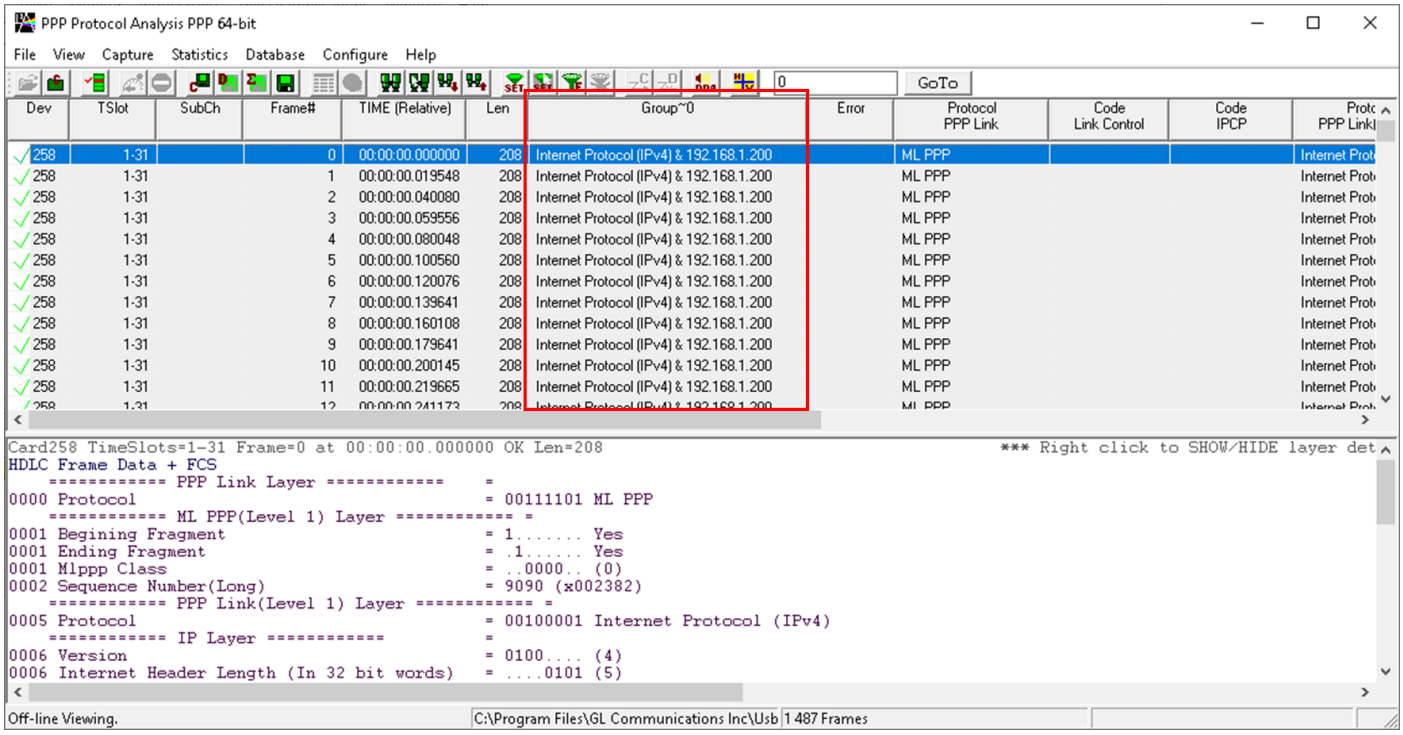
The enhanced feature of the protocol analyzer is aggregate column groups. The user can also create multiple aggregate column groups and prioritize the groups as per the requirement to display the summary results in an efficient way.

If the user has five different aggregate columns and wants to prioritize some columns, the user can create a group of aggregate columns with the highest priority and will display only the columns of chosen priority. If the values are null, then the next group values are displayed. The aggregate columns comprising a group will have the same prefix and suffix index as ~0, ~1 … ~N. The **group~0** is the root aggregate group that has the highest priority.



Aggregate Column Group

The updated results are as shown in the below screenshot. Here the root aggregate group~0 summary columns are displayed first and then Group~1 and Group~2 as per the assigned priority if the higher group values are null.



Display of Aggregate Column Group in Summary View

Packet Data Analysis (PDA) – Summary View

Main Features

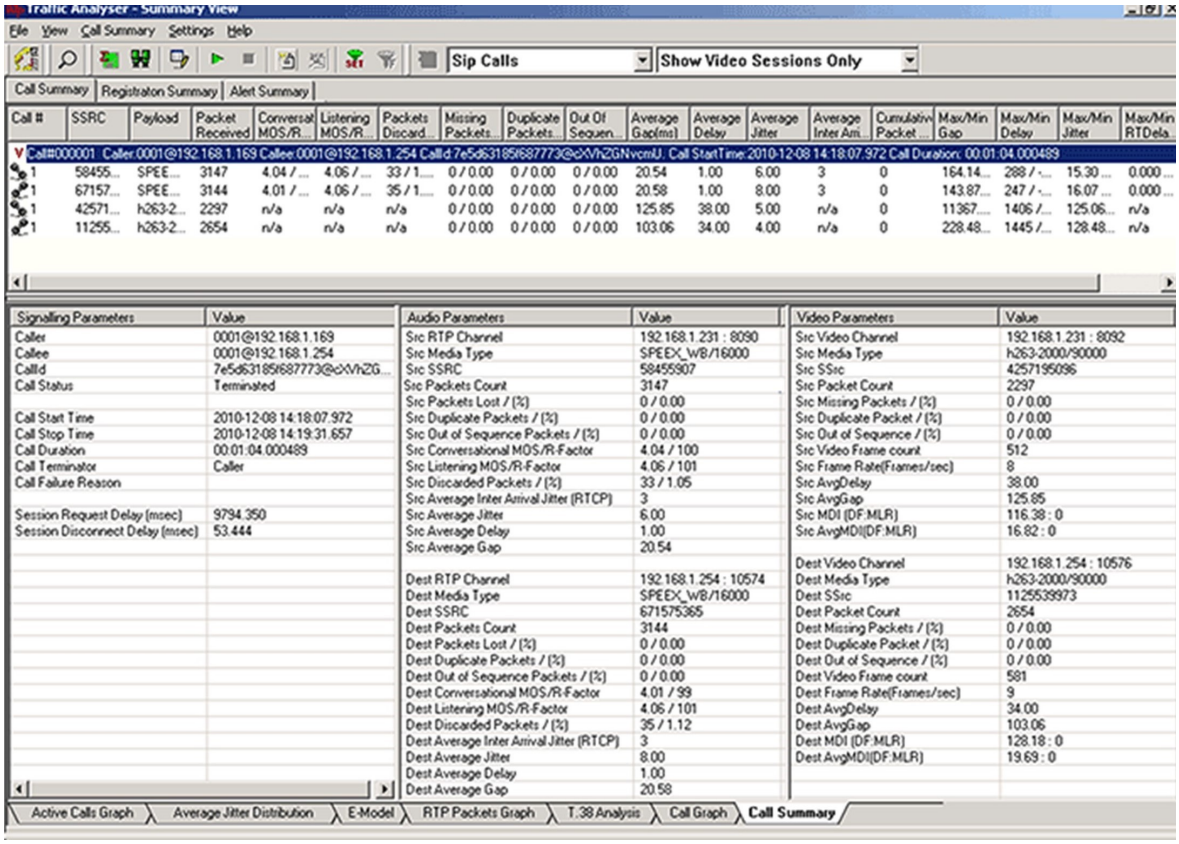
- Call Quality Of Service (QOS) for all calls with E-Model based (G.107) Mean Opinion Score (MOS) and R-factor with individual and summary statistics presented in graphical and tabular formats
- Calculates minimum, maximum, and average Round Trip Delay (RTD) values for SIP calls
- Graphs are provided for key values to give a pictorial representation of the statistics; some of the graphs available are – active calls, average jitter, E-Model MOS/R-Factor/Packets Discarded, RTP packets summary, ladder diagram for T.38 traffic, and call signaling
- Displays summary of signaling, audio, and video (for all video calls) parameters of each call in call summary
- Generates alert summary when particular vital parameters go beyond a specified value
- Ability to save a particular call in **HDL, PCAP,** or **PCAPNG** file format for further detail analysis
- Calls and sessions are classified as active, completed, or failed giving the user an idea about the calls and its status in the network.
- Individual and summary statistics presented in graphical and tabular formats

PDA - Summary View

- TA Summary view displays summary of data transmission in each direction including calling number, called number, duration, max/min RTD, average RTD and so on
- It includes separate statistical counts on total packets, calls, failed calls for SIP, H323, MEGACO, and RTP based calls. The user can get the statistics of active calls, purged calls, and so on

Call Summary – Signaling, Audio, and Video Parameters

- The Call Summary displays the signaling, audio, and video parameters of each call for SIP, RTP, MEGACO, and H323 in a tabular format
- Video QoS parameters such as Codec Info, Frame Rate, Missing Packets, Delay, Gap, Video Frame Count, Out Of Sequence count, Duplicate Packets count, Media Delivery Index (MDI), etc. are displayed for all video calls with H.263 and H.264 codecs

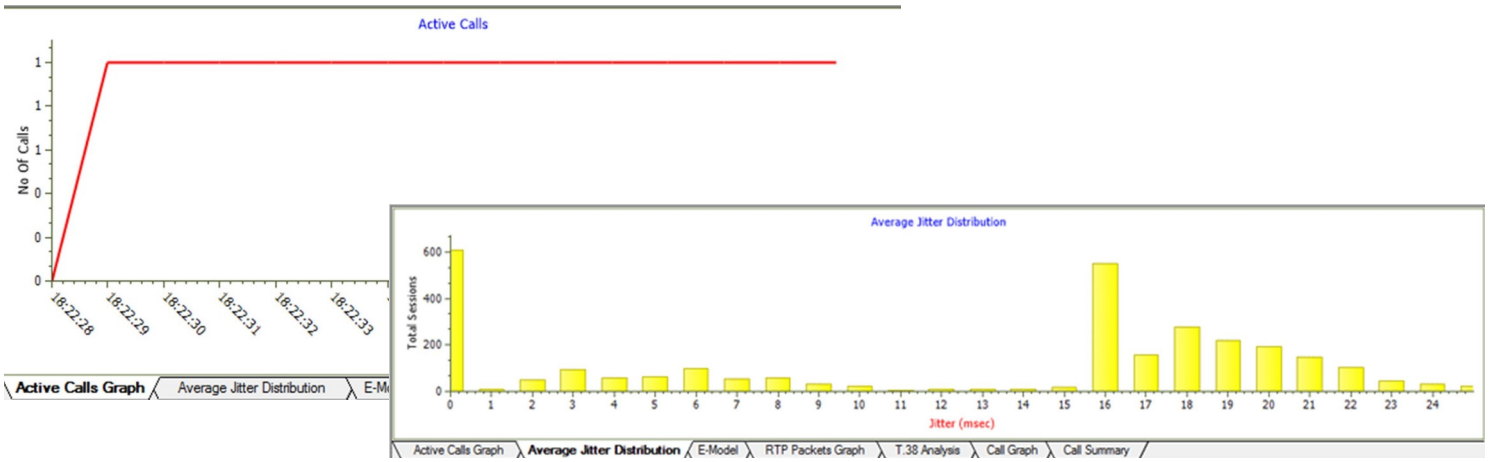


Signaling, Audio, and Video Parameters

Graphs in PDA – Summary View

Active Calls – A line graph, depicting the Number Of Calls Vs Time.

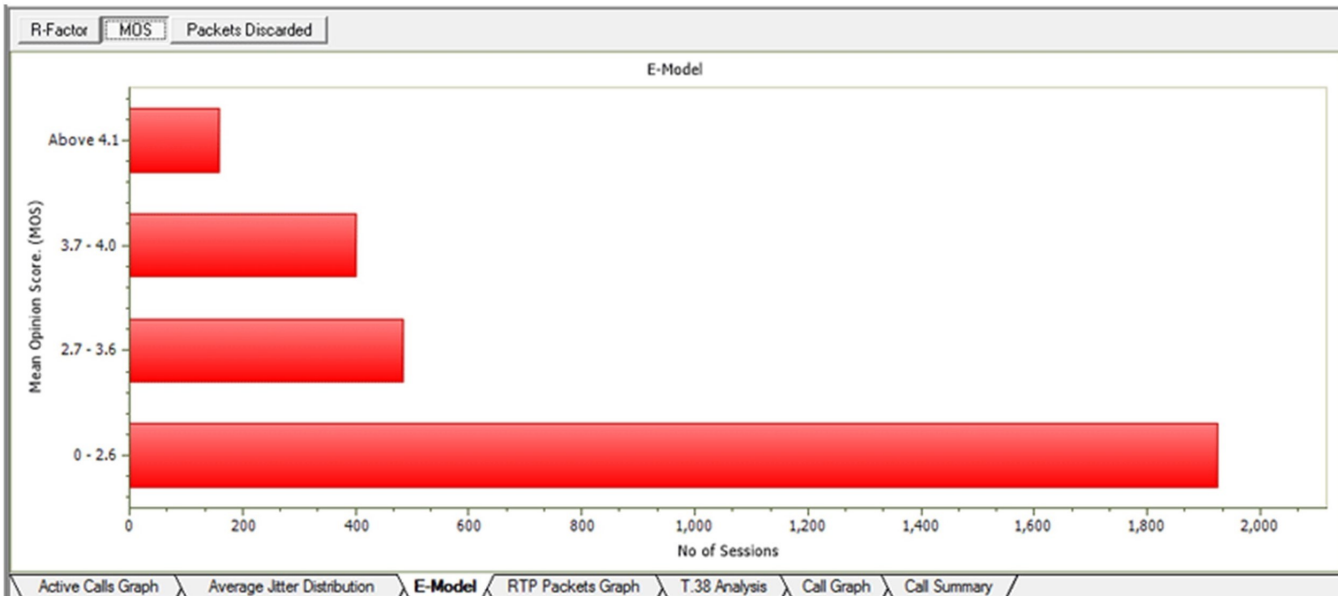
Average Jitter Distribution – Distribution of the Average Jitter values across the Total Sessions.



Active Calls and Average Distribution Graphs

E-model - This graph provides R-factor, MOS and packets discarded against number of sessions- all these three graphs show statistics of terminated calls.

- **R-Factor** – A bar Graph that plots R-Factor across No of Sessions
- **MOS** – A bar Graph that plots Mean Opinion Score values across No. of Sessions
- **Packets Discarded** – A bar Graph that plots Packets Discarded across No. of Sessions
- **RTP Packets Graph** - Plots and compares out of ordered packets, missing packets and duplicate packets against Total Audio Packets

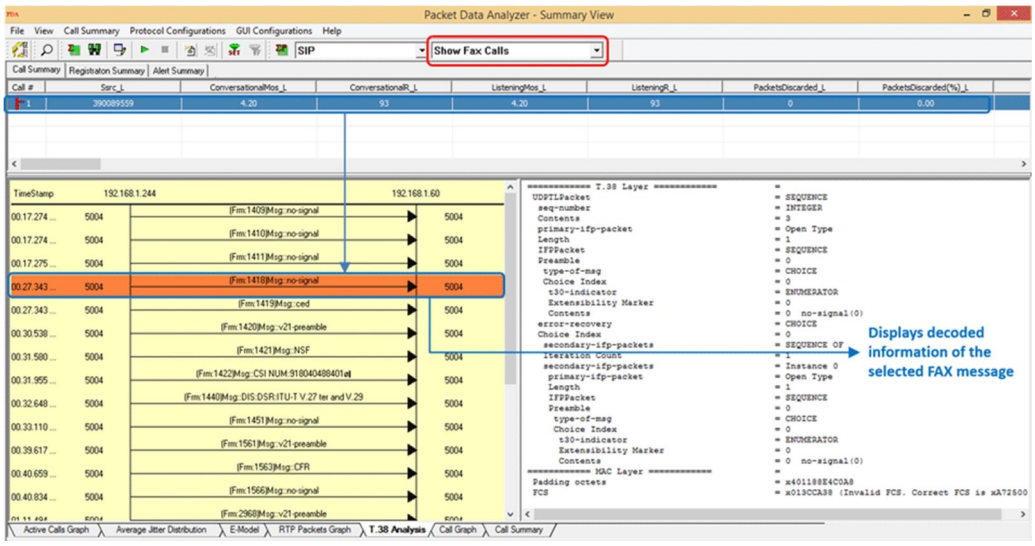


E-Model Graph

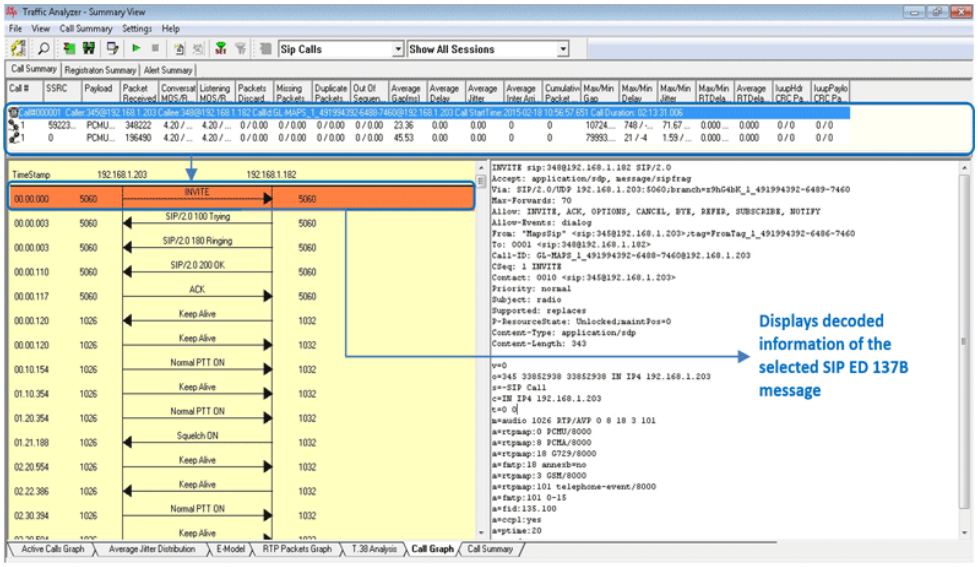
Graphs in PDA – Summary View (*Contd.*)

T.38 Analysis - Supports decoding, and monitoring of Fax (T.38 data) over VoIP. Identified T.30 messages is displayed in T.38 ladder diagram.

Call Graph - Displays the message sequence of captured VoIP (SIP or MEGACO) calls.



T.38 analysis Diagram



Call Flow Ladder Diagram

Packet Data Analysis (PDA) – Detail View

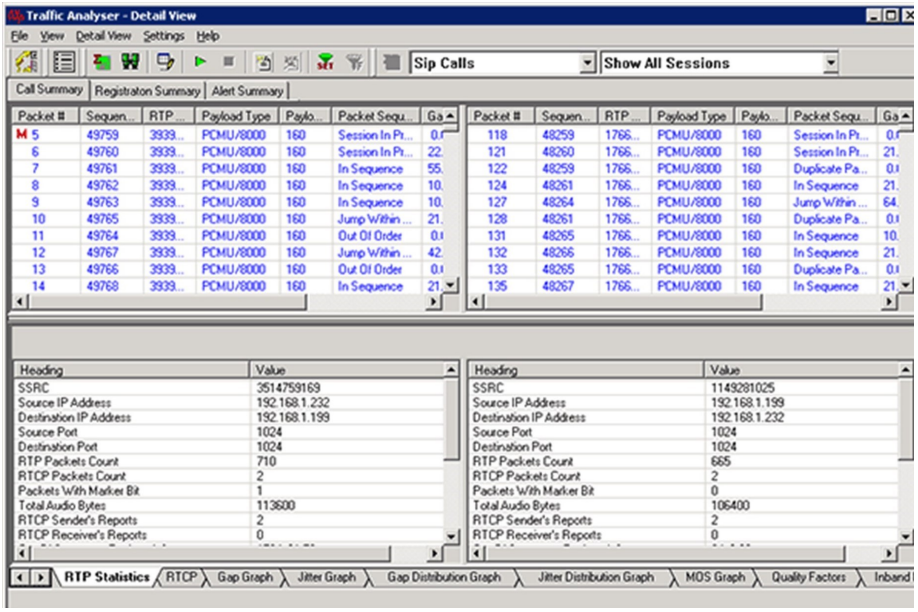
Main Features

- Provides further detail statistics on the two (or one) RTP sessions that are part of a single call
- RTP sessions include the graphical representation of R-Factor statistics which includes Quality Metrics with R-Factor and MOS Factors graphs, Jitter Buffer Statistics, Degradation Factor, Burst Metrics, and Delay Metrics
- Codecs: Mulaw, Alaw, G.726 (40/32/24/16 kbps), G.726 with VAD, GSM610, G729, G729B, AMR (Wide and Narrow band), ILBC (20 , 30 msec), SPEEX, EVRC, EVRCB, H263+, and H264

Packet Data Analysis (PDA) – Detail View (*Contd.*)

PDA – Detail View

This display assists in any comparisons that are to be made between the two RTP sessions of a call. Each frame of the selected session is dissected and its contents are displayed in a tabular form for easier viewing and comparisons. Vital aspects from the RTP frame needed for close analysis are included in the table.



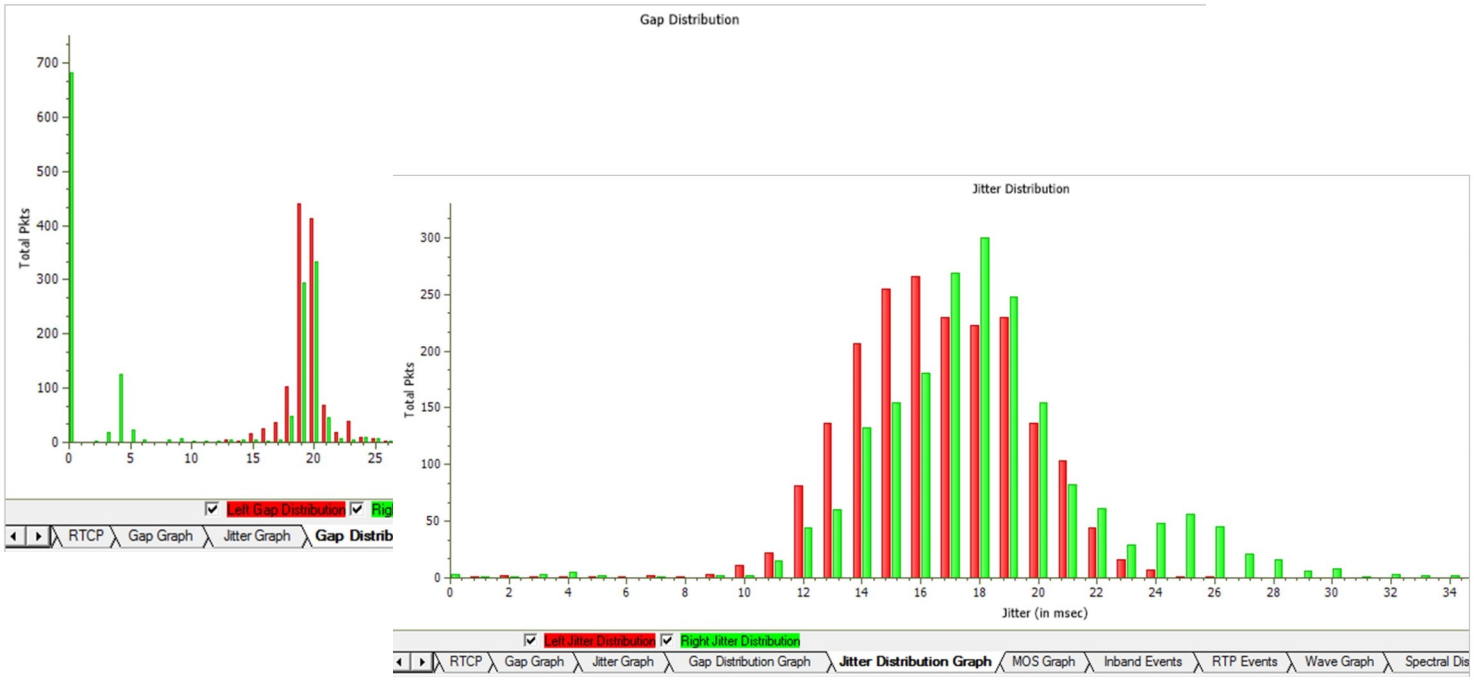
Traffic Analyzer Detail View

Graphs in PDA – Detail View

Gap/Jitter graphs – Plots the Gap (in milliseconds)/Jitter versus the packet number.

Gap Distribution Graph – Number of packets with a particular value of gap is plotted against the (gap) value.

Jitter Distribution Graph – Number of packets with a particular value of jitter is plotted against the jitter value.



Gap/Jitter Distribution Graph

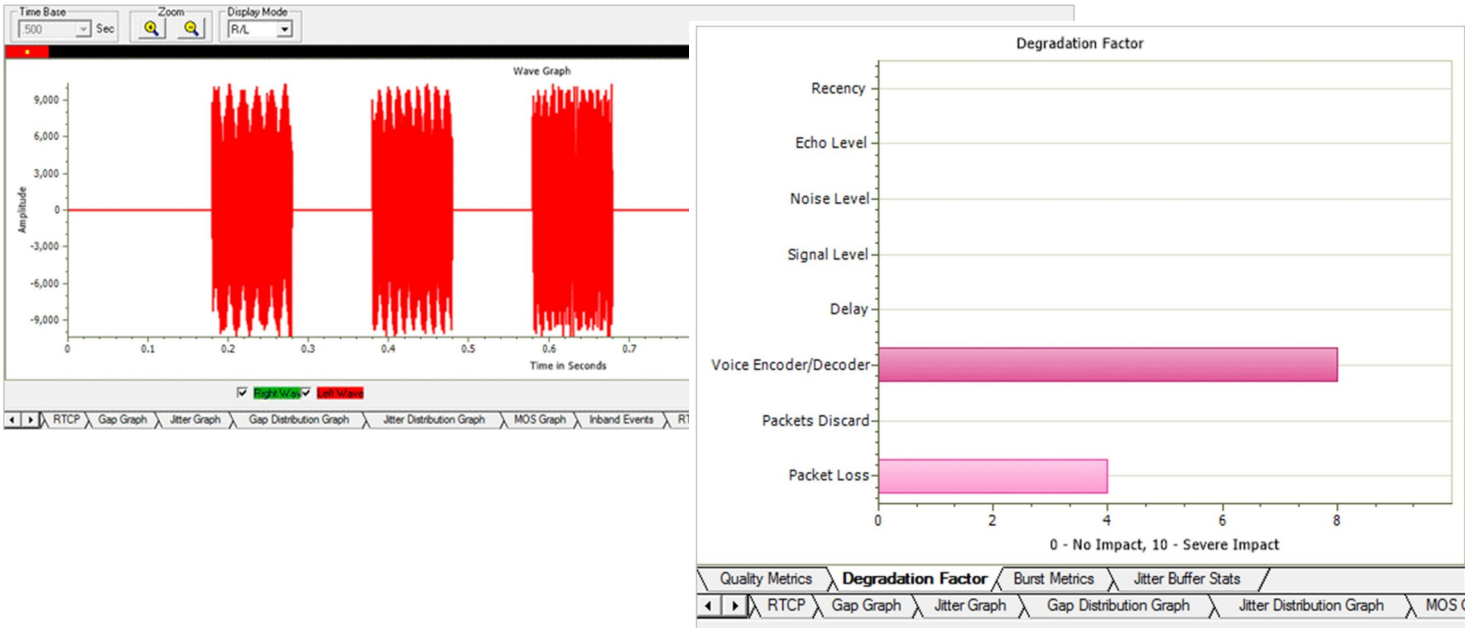
Graphs in PDA – Detail View

MOS Graph – Plots Mean Opinion Score values throughout the duration of the call.

Quality Factor – Plots and compares Good Quality packets, Packets Discarded, and Echo level against total Packets for each individual session.

Wave graph – Displays the amplitude of the incoming signal in a selected call as a function of time.

Spectral Display – Displays the power of incoming signal while the capturing is going on as a function of frequency.



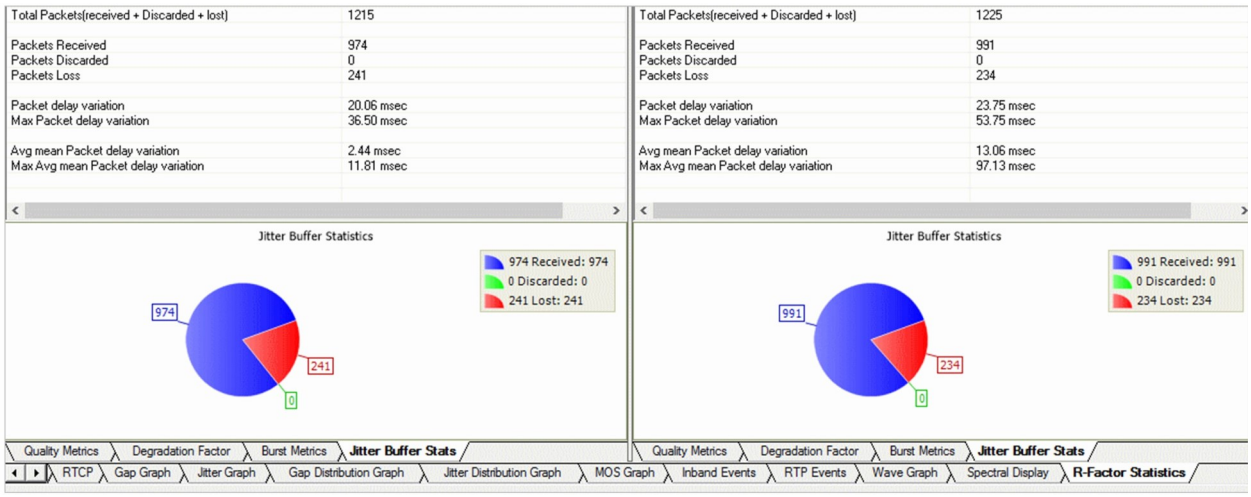
Wave Graph and Quality Factors

Quality Metrics based on E-model includes R-Factor and MOS Factor. R-Factor bar graph will display statistics such as R Listening, R Conversational, R-G107, and R-Nominal values.

MOS Factor bar graph will display statistics such as MOS CQ, MOS PQ, and MOS Nominal values during a call.

Degradation Factor – A pie chart plots and compares different statistics such as Good Quality, Packets discarded, Echo level, Packet loss, and Regency against total Packets for each individual sessions.

Jitter Buffer Statistics – A pie chart plots and compares packets received, packets discarded and packets lost against total Packets for each individual sessions. Also provides a tabular data on average.

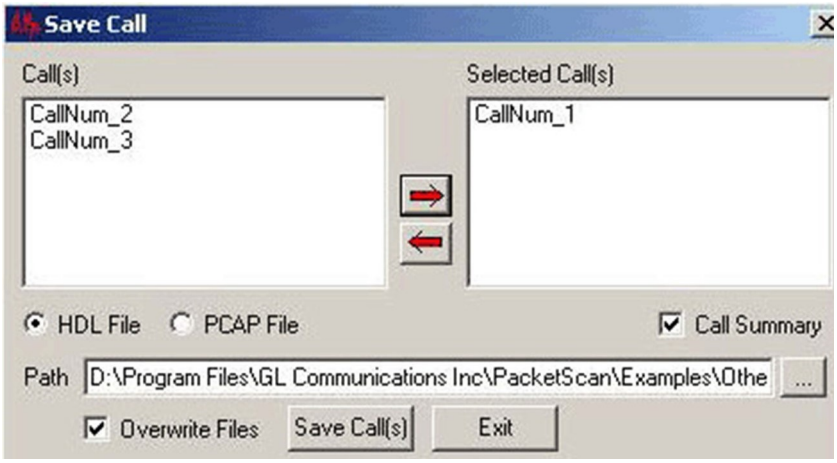


Jitter Buffer Statistics

Other Features in PDA

Save call

The Save Call feature enables the user to save a particular call either in GL's proprietary *.HDL file format or in Ethereal *.PCAP file format. Call Summary details could also be saved for a particular call and this will be saved as a *.rtf file. This is especially useful to get data from real-time traffic locations to the lab for detail analysis of a flawed call.



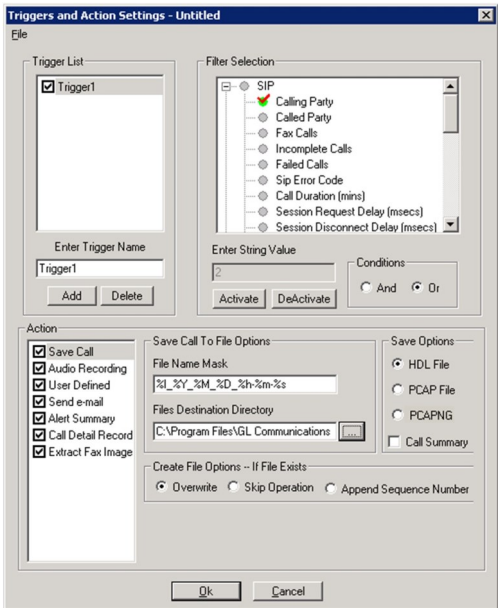
Save Call

RTP/RTCP Statistics and Inband Events

The user can get the complete details of a single selected call such as Total Packets count, SSRC, RTP packet count, RTCP packet count, Total Audio bytes. Inband Events display inband DTMF and MF digits as they are received with details such as Timestamp, Type, Event, On-Time, Power, Freq1 / Power1, Freq2 / Power2.

Triggers and Action Settings

Triggers and Action Settings allow the user to filter calls based on certain SIP, RTP, MEGACO, and H323 parameters followed by a set of actions for the completed calls. The filtered file can be saved in either GL's proprietary HDL file format or Ethereal PCAP file format. Additionally, a summary of call signaling and audio parameters can be saved as *.rtf file. The actions include saving call to a file, recording audio to a file, sending an email, posting alert summary, viewing custom calls in summary view, creating Call Detail Records in CSV file format, and extracting Fax from calls in TIFF format.

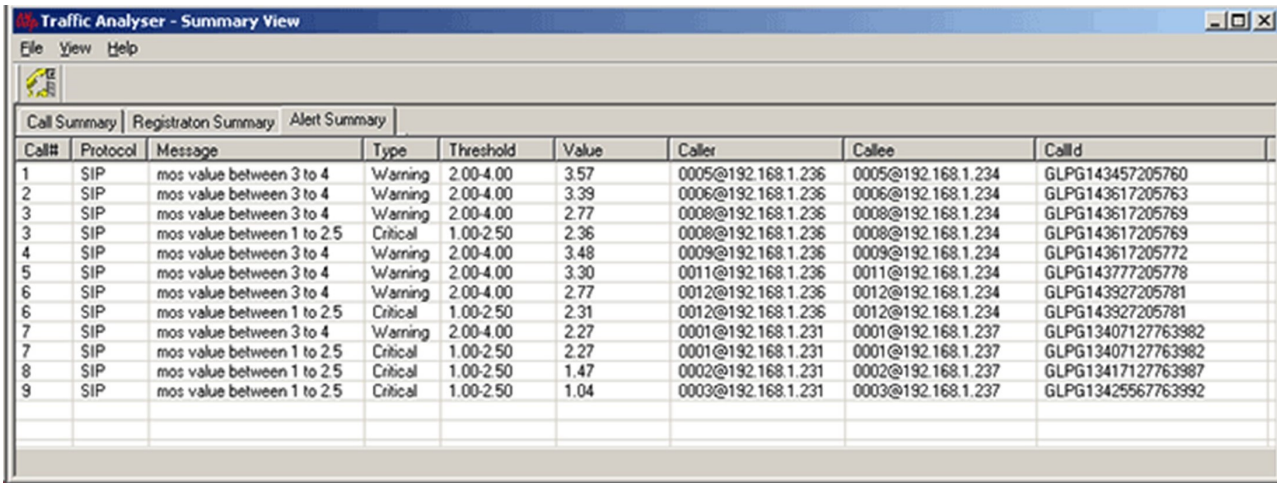


Trigger and Action Settings

Other Features in PDA (*Contd.*)

Alert Summary

PDA generates alerts when particular vital parameters go beyond a specified value and display in Alert Summary table. The user can specify the criteria based on which the alerts are to be generated. The tab provides an active list of the alerts that have occurred during the test session in tabular columns.

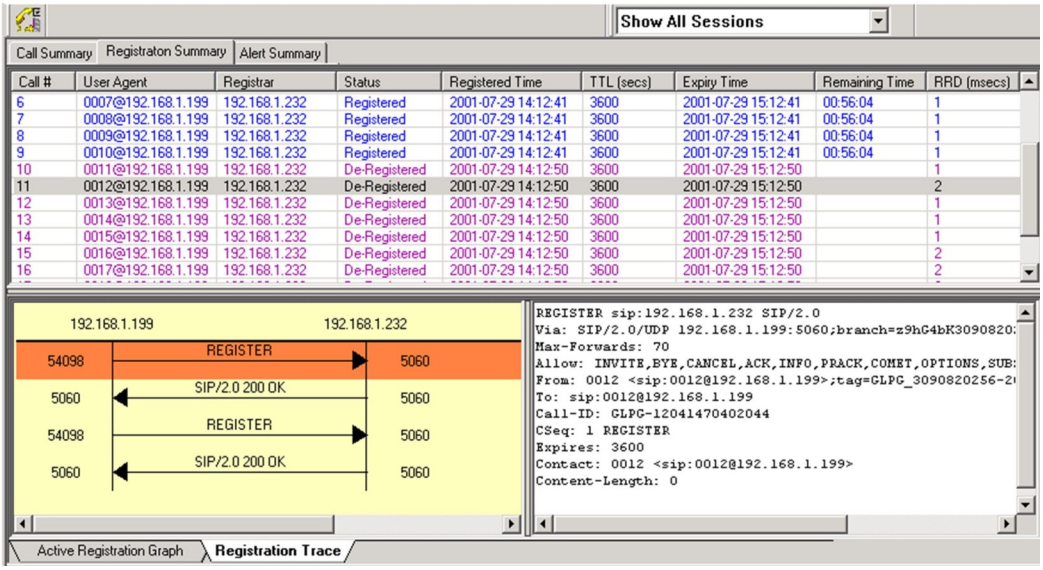


Call#	Protocol	Message	Type	Threshold	Value	Caller	Callee	CallId
1	SIP	mos value between 3 to 4	Warning	2.00-4.00	3.57	0005@192.168.1.236	0005@192.168.1.234	GLPG143457205760
2	SIP	mos value between 3 to 4	Warning	2.00-4.00	3.39	0006@192.168.1.236	0006@192.168.1.234	GLPG143617205763
3	SIP	mos value between 3 to 4	Warning	2.00-4.00	2.77	0008@192.168.1.236	0008@192.168.1.234	GLPG143617205769
3	SIP	mos value between 1 to 2.5	Critical	1.00-2.50	2.36	0008@192.168.1.236	0008@192.168.1.234	GLPG143617205769
4	SIP	mos value between 3 to 4	Warning	2.00-4.00	3.48	0009@192.168.1.236	0009@192.168.1.234	GLPG143617205772
5	SIP	mos value between 3 to 4	Warning	2.00-4.00	3.30	0011@192.168.1.236	0011@192.168.1.234	GLPG143777205778
6	SIP	mos value between 3 to 4	Warning	2.00-4.00	2.77	0012@192.168.1.236	0012@192.168.1.234	GLPG143927205781
6	SIP	mos value between 1 to 2.5	Critical	1.00-2.50	2.31	0012@192.168.1.236	0012@192.168.1.234	GLPG143927205781
7	SIP	mos value between 3 to 4	Warning	2.00-4.00	2.27	0001@192.168.1.231	0001@192.168.1.237	GLPG13407127763982
7	SIP	mos value between 1 to 2.5	Critical	1.00-2.50	2.27	0001@192.168.1.231	0001@192.168.1.237	GLPG13407127763982
8	SIP	mos value between 1 to 2.5	Critical	1.00-2.50	1.47	0002@192.168.1.231	0002@192.168.1.237	GLPG13417127763987
9	SIP	mos value between 1 to 2.5	Critical	1.00-2.50	1.04	0003@192.168.1.231	0003@192.168.1.237	GLPG13425567763992

Alert Summary View

Packet Data Analysis (PDA) – Registration Summary

- Provides the registration summary of each SIP registration including User Agent, Registrar, Status, Registered Time, Expiry Time, Time to Live, Remaining Time, and Registration Request Delay (RRD), and Re-registration Attempts
- Provides graphical view of the active registrations and registration trace of each registration



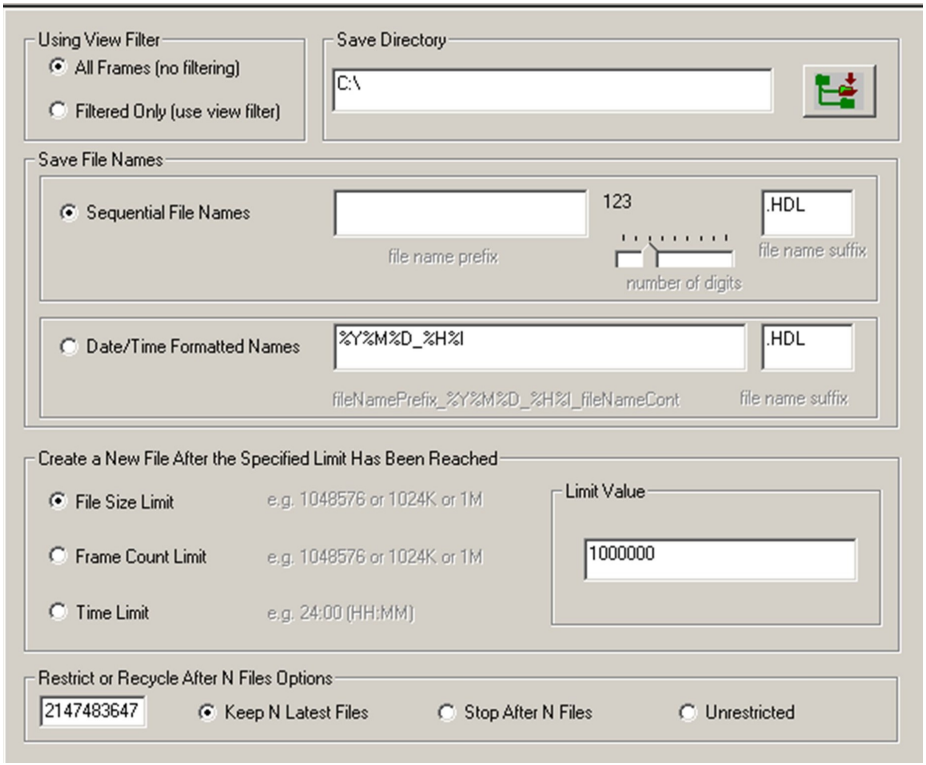
Call #	User Agent	Registrar	Status	Registered Time	TTL (secs)	Expiry Time	Remaining Time	RRD (msecs)
6	0007@192.168.1.199	192.168.1.232	Registered	2001-07-29 14:12:41	3600	2001-07-29 15:12:41	00:56:04	1
7	0008@192.168.1.199	192.168.1.232	Registered	2001-07-29 14:12:41	3600	2001-07-29 15:12:41	00:56:04	1
8	0009@192.168.1.199	192.168.1.232	Registered	2001-07-29 14:12:41	3600	2001-07-29 15:12:41	00:56:04	1
9	0010@192.168.1.199	192.168.1.232	Registered	2001-07-29 14:12:41	3600	2001-07-29 15:12:41	00:56:04	1
10	0011@192.168.1.199	192.168.1.232	De-Registered	2001-07-29 14:12:50	3600	2001-07-29 15:12:50		1
11	0012@192.168.1.199	192.168.1.232	De-Registered	2001-07-29 14:12:50	3600	2001-07-29 15:12:50		2
12	0013@192.168.1.199	192.168.1.232	De-Registered	2001-07-29 14:12:50	3600	2001-07-29 15:12:50		1
13	0014@192.168.1.199	192.168.1.232	De-Registered	2001-07-29 14:12:50	3600	2001-07-29 15:12:50		1
14	0015@192.168.1.199	192.168.1.232	De-Registered	2001-07-29 14:12:50	3600	2001-07-29 15:12:50		1
15	0016@192.168.1.199	192.168.1.232	De-Registered	2001-07-29 14:12:50	3600	2001-07-29 15:12:50		2
16	0017@192.168.1.199	192.168.1.232	De-Registered	2001-07-29 14:12:50	3600	2001-07-29 15:12:50		2

```
REGISTER sip:192.168.1.232 SIP/2.0
Via: SIP/2.0/UDP 192.168.1.199:5060;branch=z9hG4bK3090820
Max-Forwards: 70
Allow: INVITE,BYE,CANCEL,ACK,INFO,PRACK,COMET,OPTIONS,SUB
From: 0012 <sip:0012@192.168.1.199>;tag=GLPG_3090820256-2
To: sip:0012@192.168.1.199
Call-ID: GLPG-12041470402044
CSeq: 1 REGISTER
Expires: 3600
Contact: 0012 <sip:0012@192.168.1.199>
Content-Length: 0
```

Registration Summary

Enhanced Trace Saving Options

Users can control the captured trace files by saving the trace using different conventions such as trace files with user-defined prefixes, trace file with date-time prefixes, and slider control to indicate the total number of files, file size, frame count, or time limit. This feature also allows the captured frames to be saved into a trace file based on the filtering criteria set using display filter feature



Protocol Trace Saving Options for PoS Protocol Analysis

MLPPP Emulation Capabilities

Automated testing can be accomplished using client-server based PPP, MLPPP, and Multi-Channel (MC) MLPPP Emulation and Analysis (MLPPPTerr) module. The application permits traffic generation and verification over PPP links and may be accessed through a GUI or through command line scripts.

For more details, refer to MC-MLPPP Emulation using Client-Server webpage.

Supported Protocol Standards

Available Standards	Supported Protocols	Specification Used
PPP	PPP	RFC 1331,1220,1333,1548,1661, 1570
PPP SIGTRAN	MultiPPP (PPP Multilink Protocol)	RFC1717, RFC1990
	Multiplexed PPP	RFC 3153
	CRTP	RFC 2508
	Cisco HDLC	http://www.protocols.com/pbook/bridge.htm#CISCOROUTER
	CHAP (Challenge Handshake Authentication Protocol)	RFC1334 http
	IPHC (IP Header Compression)	RFC 2507, RFC 3544
	LCP (Link Control Protocol)	RFC1570, RFC1661
	NCP	RFC 801
	LQR (Link Quality Report)	RFC1333
	Multi-class extensions to PPP (MC MLPPP)	RFC2686
	PPP (Point-to-Point Protocol) over HDLC	RFC1662
	PPP-BPDU (PPP Bridge Protocol Data Unit)	RFC1638
	BCP (Bridging Control Protocol)	RFC 3518
	IPCP (IP Control Protocol)	RFC1332
	IPCP Extensions for Name Server Addresses	RFC 1877
	PPPMuxCP	RFC 3153
	ISDN H.225	H.225 Q.931 Layer
	SCTP	RFC 2960
	SUA (SCCP UA)	RFC 3868
	SNMP (V1, V2)	RFC 1157,1155,1902,3416,2863, 2578,3418,2011,2012 etc.
	SIP3261, MGCP, MEGACO, RTP, and RTCP	RFC 3261, RFC 3435, RFC 3015, RFC 2833, and RFC 3550
	H.263, H.245, and H.450	ITU-T H.263, ITU-T H.245, and ITU-T H.450.1 to H.450.12

Buyer's Guide

Item No	Product Description
XX135	Real-time MLPPP Protocol Analyzer (T1 E1)
OLV135	Offline MLPPP Protocol Analyzer
XX136	PPP and MLPPP Packet Analysis – Real-time Packet Voice, Video, and Fax Analysis

Item No	Related Hardware
PTE001	tProbe™ Dual T1 E1 Laptop Analyzer (Require Basic Software)
FTE001	QuadXpress T1 E1 Main Board (Quad Port)
ETE001	OctalXpress T1 E1 Daughter boards (Octal Port)
TTE001	tScan16™ T1 E1 Boards
XTE001	Dual Express (PCIe) T1 E1 Boards

Item No	Related Software
XX600	Basic Client/Server Scripted Control Software (Included with Basic Software)
XX634	w/ Client-server Multi-Channel HDLC Emulation and Analysis, File based High Throughput HDLC Record/Playback
XX635	w/PPP Emulation and Analysis
XX636	w/Multi-Class (MC) MLPPP Emulation and Analysis

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

For more details, refer to PPP Protocol Analyzer webpage.

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