
All-IP Signaling and Traffic Analysis

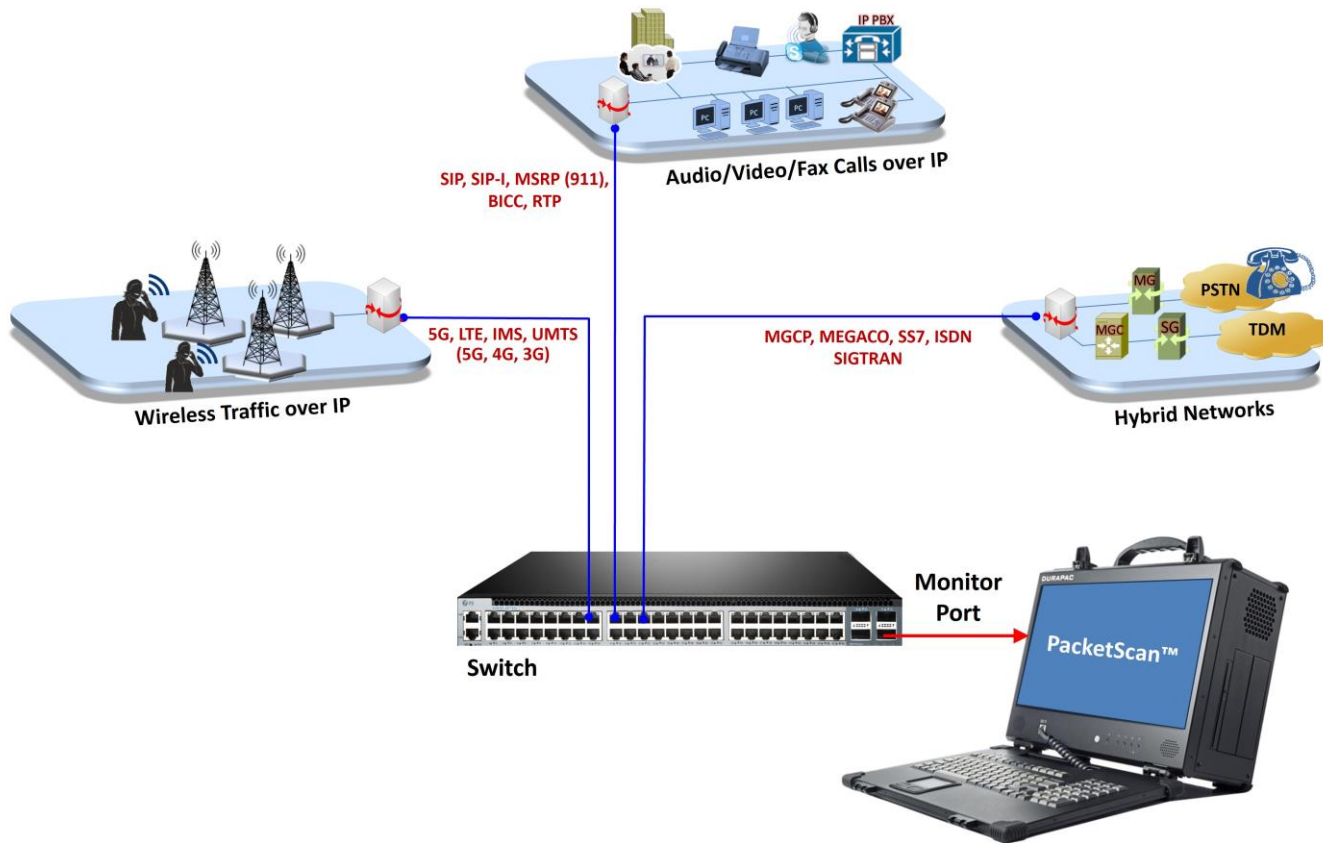
RTP/RTCP/Fax (T.38) Analysis



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PacketScan™ All-IP Signaling and Traffic Analysis

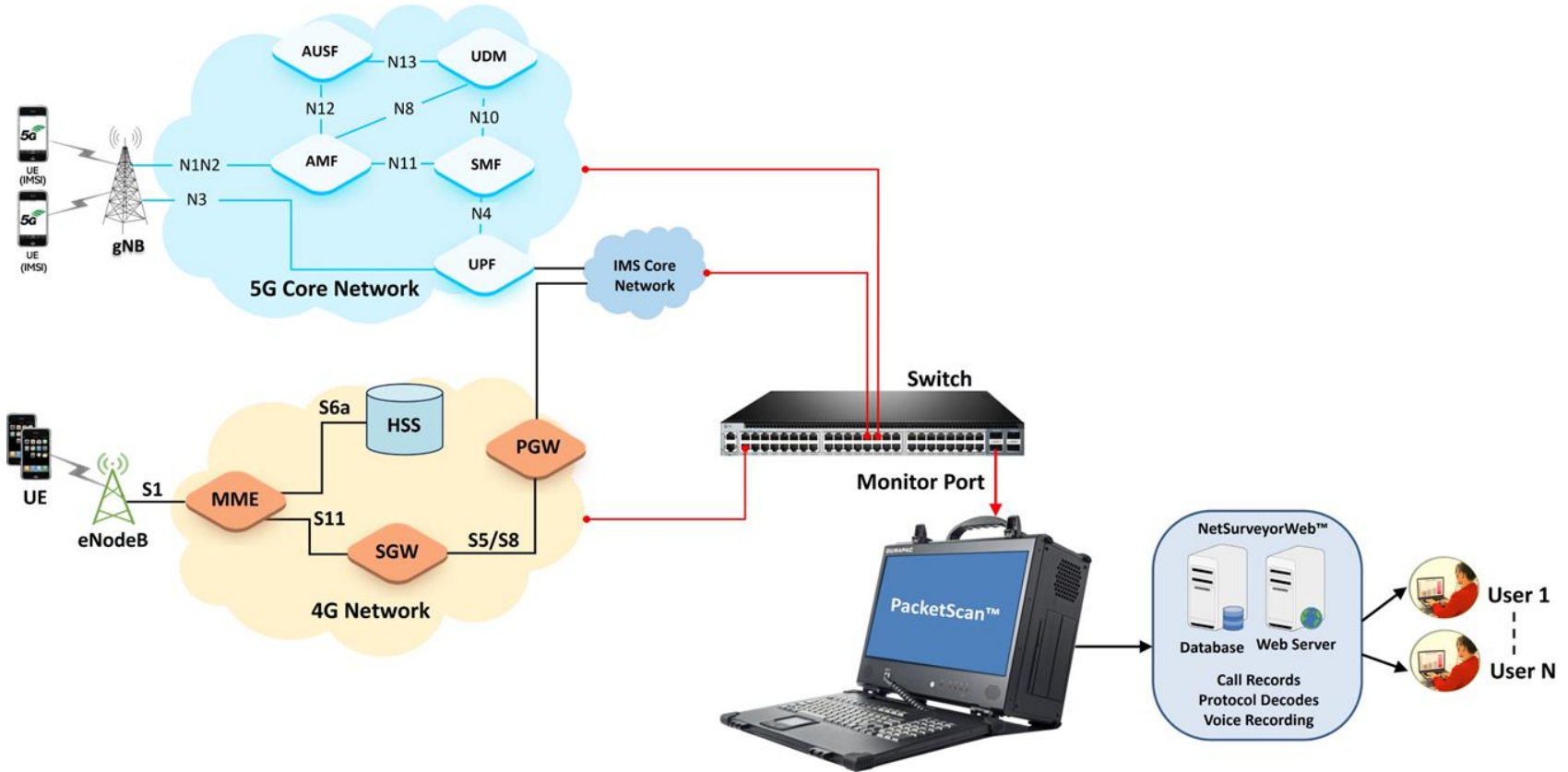
(5G/4G/3G/2G/VoIP/RTP, RTCP/ Video Analysis)



What the Software does?

- Non-Intrusively capture real time IP traffic across high speed
- Captures, segregates, and monitors packets; perform voice quality testing in real-time over VoIP network
- Wirespeed hardware filtering capability to capture packets of interest
- Non-intrusively capture real-time signaling and traffic packets for infinite time and provide call details of per call and aggregated protocol statistics
- Supports monitoring of 5G networks. It captures, segregates, monitors and collects statistics on all calls over N1N2, N4, N8, N10, N11, N12 and N13 interfaces of the 5G network
- Capable of continuous monitoring of communication over IMS network over SIP, S6a, S6d, S13, Cx/Dx, Gx, Rx, Sh, Gy/Ro interfaces
- Monitors and segregates S1AP, NAS, Diameter and eGTP interfaces, deciphers NAS and decrypts Voice over Long-Term Evolution (VoLTE) calls over Internet Secured Protocol Security (IPSEC)
- Can be deployed as a Probe for a centralized monitoring system with Oracle database

5G and LTE Protocol Analysis



Applications

- **Real-time VoIP Traffic Analysis –**

- Analyze 5G Calls
- View RTP, SIP, MSRP, H.323, and MEGACO Calls
- Trigger on Called and / or Calling Party, Packet Impairments
 - Save .HDL (GL's proprietary format) or .PCAP (Ethereal format) or *.PCAPNG file format
 - Save .WAV – time stamped file names
 - Save CDRs
- MOS R-factor – view quality as the call proceeds
- Traffic limited only by hard drive capacity
- T.38 Fax packets decoding

- **Network Monitoring Solutions –**

- Multiple probes can be used for network monitoring
- CDRs can be exported in a text format to a flat file or a remote computer

- **Network Monitoring Solutions (Contd.) –**

- CDRs can also be exported to an Oracle data base
- Results can be accessed remotely using NetSurveyorWeb™, a simple web browser-based application
- Air Traffic Monitoring Solution
- Gateway Delay Measurement along with our TDM Protocol Analyzer

Main Features

<p><u>Comprehensive Analysis Tool</u></p>	<ul style="list-style-type: none">• Capture calls in real-time for infinite time non-intrusively• Detail Signaling, Audio, Video QoS statistics• Call flow graph and Pictorial representation of the statistics• Inband/Outband Detection, Wave graph, Audio play back, Audio/Video recording• Ability to export Call Data Records of completed calls in CSV file format• Complex Filtering and Search capabilities• Option to create multiple aggregate column groups and prioritize the groups as per the requirement to display the summary results efficiently• Allows the user to automatically create search/filter criteria from the current screen selection• Decode support for multi-layer tunneled traffic - GTP, GRE, VXLAN• Support export frame summary for tunneled traffic
<p><u>QOS Parameters and Performance Metrics</u></p>	<ul style="list-style-type: none">• E-model (G.107) based MOS/R-Factor scores• Media Delivery Index for video calls• H.263, H.264 codec support• Jitter, Delay, and Gap for Audio and Video traffic• Minimum, maximum, and average Round Trip Delay (RTD)• Reports Inband (DTMF & MF) events, Outband events as per RFC 2833 or RFC 4733 events, RTP/RTCP packet count per direction
<p><u>Triggers and Actions</u></p>	<ul style="list-style-type: none">• Captures calls based on filter criteria and performs set of actions for the completed calls such as recording, sending email, extraction of voice or fax traffic file

Main Features (Contd.)

<u>SIP Registration Details</u>	<ul style="list-style-type: none">• Registration statistics and trace messages depicted graphically
<u>As a Probe with Central Monitoring System – NetSurveyorWeb™</u>	<ul style="list-style-type: none">• PacketScan™ can send summary fields, frame octets, status, call detail records, along with traffic summary of captured calls to a central database.• NetSurveyorWeb™ displays the data from the database in a simple web-based browser. It features rich graphics, ladder diagrams, CDRs (Call Data Records), custom report and filter configurations
<u>Single Point Analysis System</u>	<ul style="list-style-type: none">• Enhanced to work with GL's Voice Band Analyzer and Call Data Records applications to provide useful call detail records for further analysis using <u>built-in tool in Excel®</u>.
Utilities	<ul style="list-style-type: none">• Provides HDL File Conversion utility to convert ethereal format file (*.PCAP, *.CAP, and *.PCAPNG) to GL's file format (*.HDL) and vice-versa• Includes Excel® Addins to import CDRs into Excel® to analyze using Pivot Table, and Pivot Charts.

Supported Protocols

- Session Initiation Protocol (SIP) - RFC 3261
- Media Gateway Control Protocol (MGCP) - RFC 2705/3435 (3991)
- Media Gateway Control (MEGACO) - RFC 3525 and 3015
- Message Session Relay Protocol (MSRP)
- H.323
- RTP/RTCP
- SCTP - RFC 2960
- Connection Oriented Transport Protocol (COTP, ISO 8073)
- 5G – N1N2, N4, N8, N10, N11, N12 and N13
- SCCP (Skinny)
- SS7 SIGTRAN
- ISDN-SIGTRAN
- GSM A over IP
- GPRS over IP
- UMTS over IP
- LTE
- Diameter

Supported Codecs

- G.711 (mu-Law and A-Law), G.711 Application II (A-law and μ -law with VAD)
- G726 (40, 32, 24, 16kbps)
- GSM (13.2kbps), GSM EFR (12.2 kbit/s), GSM HR
- G729, G729B (8kbps)
- G.722, G.722.1
- ILBC_15_2 (for 20 msec), ILBC_13_33 (for 30 msec)
- SPEEX (Narrow band and Wideband)
- SMV* (Modes - 0, 1, 2 and 3)
- Video codecs include H263++ CIF 190, 350, 512 kbps, QCIF 64, 80, 128 kbps, and H264 codec offers video compression
- Other optional codec include (must be purchased with additional license)
 - AMR (Narrow band and Wideband)
 - EVRC, EVRC0 (Rates - 1/8, 1/2 and 1)
 - EVRCB, EVRCB0 (Rates - 1/8, 1/2 and 1); EVRC-C
 - Opus and EVS (Narrow Band, Wideband, Super Wideband, Full Band)

PacketScan™ Analyzer View

The screenshot displays the PacketScan 64-bit [off-line] application window. The interface is divided into several panes:

- Summary View:** A table showing a list of captured packets. The columns include Device, Frame#, TIME (Relative), Length (Bytes), Error, Length/Protocol Type MAC, Packet Type MAC, Source IP Address IPv4, and Destination IP Address IPv4. The first few rows show packets from Device2, Frame# 178, with various lengths and protocols (RTP).
- Detail View:** A pane showing the details of a selected packet (Device2 Frame=178). It displays Ethernet Frame Data, including MAC Layer, Destination Address, Source Address, Length/Protocol Type, and IP Version.
- Hex Dump View:** A pane showing the hex dump of the frame data, with corresponding ASCII characters on the right.
- CDR View:** A pane showing Call Detail Records (CDR) with columns for Call ID, Call Status, Protocol, Call Originating (Number / Address), Call Destination (Number / Address), Call Start Date & Time, and Call Duration.

Summary View

Detail View

Hex Dump View

CDR View

- Default panes - summary, detail, and hex dump of the frame data views
- Optional panes – statistics and call trace views

Layer Copy/Show/Hide Options

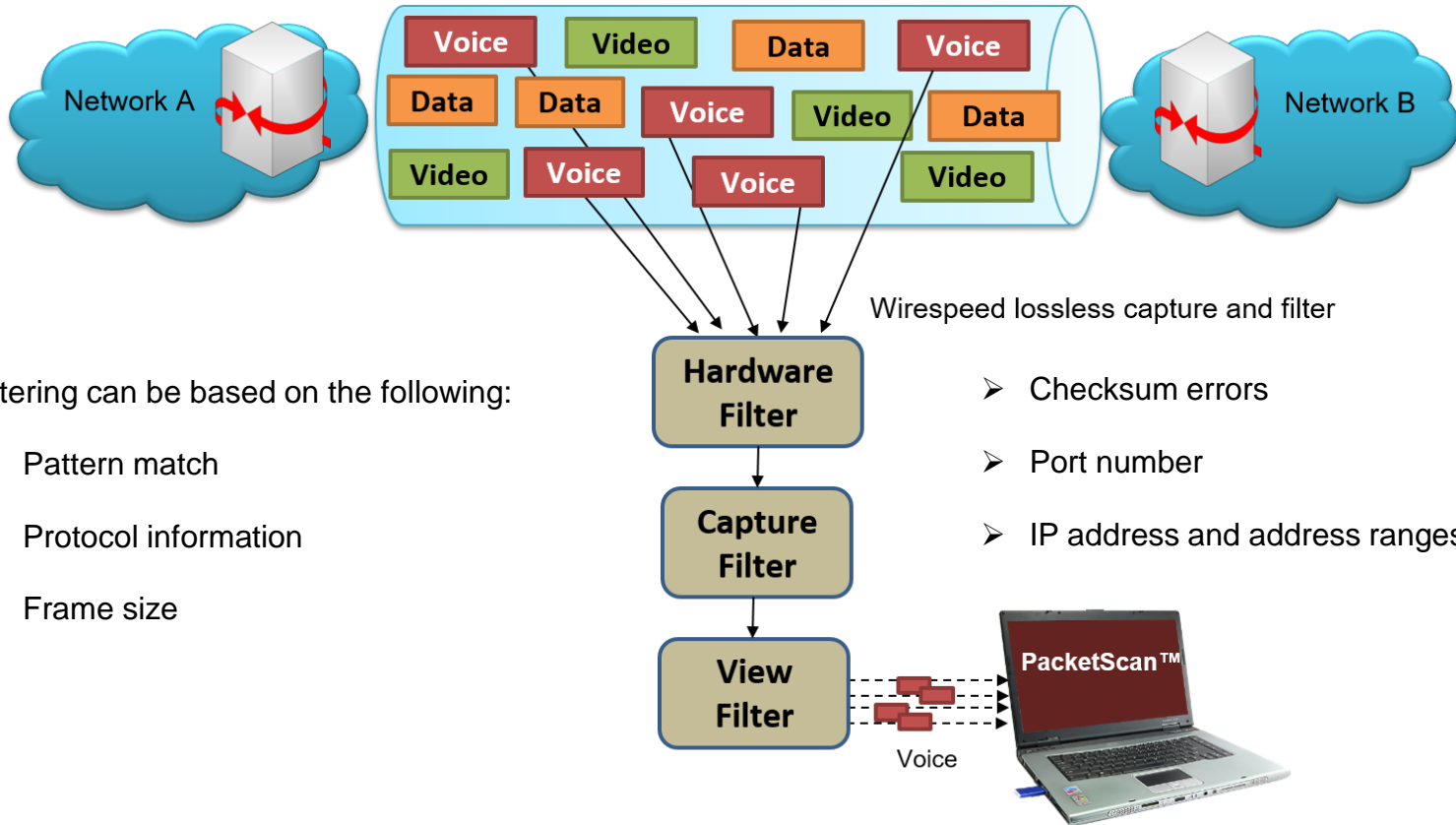
- Provides option to copy the entire layer decode information to the clipboard

The screenshot displays the PacketScan 64-bit interface. The top window shows a table of captured packets. The bottom window shows the detailed decode of an Ethernet frame. A context menu is open over the decode, with 'Copy view to clipboard' and 'Layer show/hide' options highlighted. A red arrow points from the 'Copy view to clipboard' option to the right.

Device	Frame#	TIME (Relative)	Length (Bytes)	Error	Length/Protocol Type MAC	Packet Type MAC	Source IP Address IPv4	Destination IPv4
✓ 2	0	00:00:00.00000000	82		Internet IPI(IPv4)		192.168.1.70	192.168.1.255
✓ 2	1	00:00:01.841976000	82		Internet IPI(IPv4)		192.168.1.142	255.255.255.255
✓ 2	2	00:00:02.347154000	836		Internet IPI(IPv4)	SIP	192.168.1.200	192.168.1.103
✓ 2	3	00:00:02.347730000	354		Internet IPI(IPv4)	SIP	192.168.1.103	192.168.1.200
✓ 2	4	00:00:02.349375000	355		Internet IPI(IPv4)	SIP	192.168.1.103	192.168.1.200
✓ 2	5	00:00:02.349532000	820		Internet IPI(IPv4)	SIP	192.168.1.103	192.168.1.200
✓ 2	6	00:00:04.467457000	92		Internet IPI(IPv4)		192.168.1.1	192.168.1.255
✓ 2	7	00:00:05.748389000	64		Internet IPI(IPv4)			
✓ 2	8	00:00:05.830627000	64		Internet IPI(IPv4)			
✓ 2	9	00:00:05.847465000	82		Internet IPI(IPv4)			
✓ 2	10	00:00:06.038679000	92		Internet IPI(IPv4)			

```
Ethernet Frame Data
===== MAC Layer =====
0000 Destination Address = xFFFFFFFFFFFF
0006 Source Address      = x0016760CFBD4
000C Length/Protocol Type = x0800 Internet IP(IPv4)
===== IPv4 Layer =====
000E Version              = 010
000E Internet Header Length (In 32 bit words) = ...0101 (5)
000F Differentiated Services Field
Differentiated Services Field
000F Differentiated Services Codepoint = 000000... Default
000F Explicit Congestion Notification = .....00 Not-ECT (Not ECN-Capable Transport)
IP Hdr No TCP SegmentationOffload =
0010 Total Length         = 68 (x0044)
0012 Identification      = 24272 (x5ED0)
0014 Reserved Bit        = 0..... Not Set
0014 Don't fragment      = .0..... Not Set
0014 More fragments      = .0..... Not Set
0014 Fragment Offset     = 0 (...00000 00000000)
0016 Time To Live        = 128 (x80)
0017 Protocol             = 00010001 UDP
0018 Header Check Sum    = x5743
001A Source IP Address   = 192.168.1.70 (xC0A80146)
001E Destination IP Address = 192.168.1.255 (xC0A801FF)
===== UDP Layer =====
0022 Source Port         = 1025 (x0401)
0024 Destination Port    = 1947 (x079B)
0026 Length (Header + Data) = 48 (x0030)
0028 Checksum            = x9AC4
```

Wirespeed Filtering



• Filtering can be based on the following:

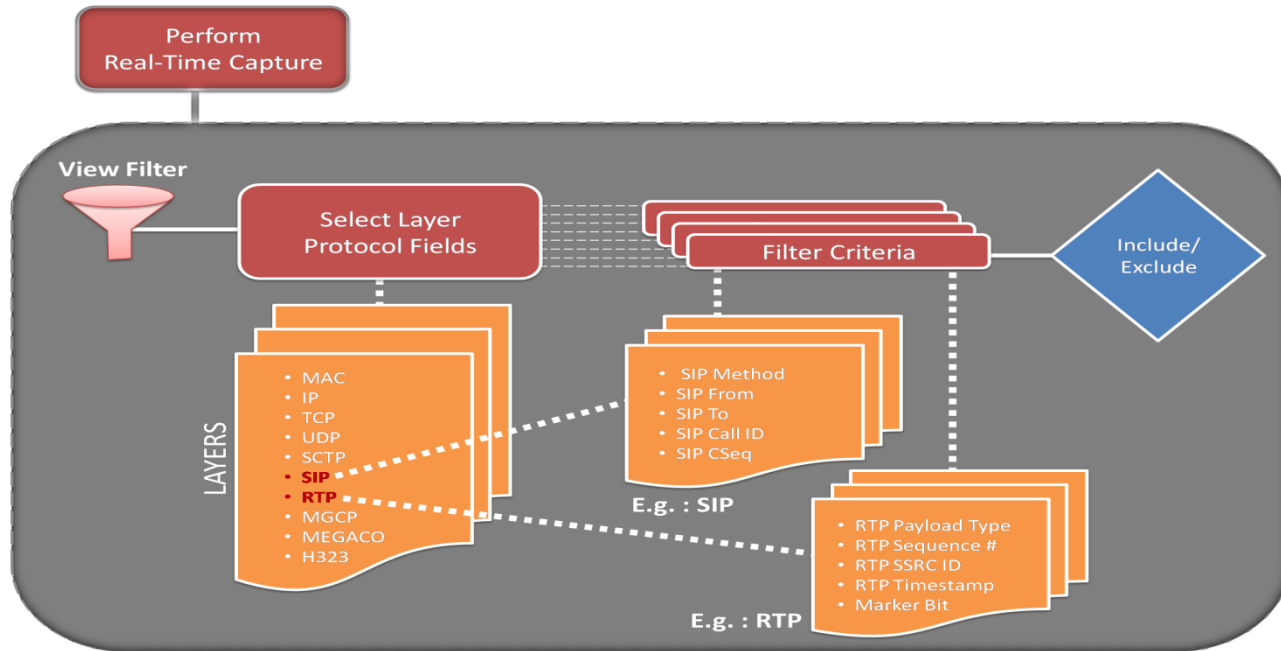
- Pattern match
- Protocol information
- Frame size

- Checksum errors
- Port number
- IP address and address ranges

3 Stages of Filtering

- Hardware Filter (HWF) – “Special NIC” with hardware filtering - very fast
- Capture Filter (CF) – Powerful software filtering but a little slower
- View Filter (VF) – applies on the captured frames to filter only frames of interest
- PacketScan™ HD captured files to/from Wireshark
- PacketScan™ HD PDA – for detailed voice, fax, and video analysis

Real-time and Offline Filters



- Filtering and search capability isolates required frames from original frames in real-time / offline based on parameters set in Data Link layer, MAC layer, IP, TCP/UDP and more

Real-time Capture Filter

The screenshot shows the 'Protocol Capture Configuration' window. On the left, a sidebar contains 'Capture File Options', 'Card & Stream Selection', 'Capture Filter', and 'Gui & Protocol Options'. The main area is titled 'Capture Filters' and includes a 'Filter Selection' list on the left and a 'Filters' configuration panel on the right. A red arrow points from the 'RTP' entry in the 'Filter Selection' list to the 'Filters' panel. The 'Filters' panel has the following settings: 'Filter all RTP data' (checked), 'Auto Detect RTP' (checked), 'Truncate RTP Packets' (unchecked), and 'Truncated Packet Length' set to 54. At the top of the main area, there are options for 'Record Frames As Is' (checked with a help icon), 'Packet Slicing' (unchecked), and a 'Length' field set to 14. At the bottom, there are radio buttons for 'Include' (selected) and 'Exclude', and buttons for 'Deactivate Sel' and 'Deactivate All'.

Protocol Capture Configuration

Save Load Default

Capture File Options

Card & Stream Selection

Capture Filter

Gui & Protocol Options

Record Frames As Is Packet Slicing Length 14

Capture Filters

Filter Selection

- Layers
- Protocol
- MAC
- VLAN
- IP (All Levels)
- IP (Outer)
- ESP
- TCP
- UDP
- Inner IP
- Inner UDP
- SCTP
- SIP
- RTP
- MSRP
- MGCP
- MEGACO
- H323
- RTSP

Filters

- Filter all RTP data
- Auto Detect RTP
- Truncate RTP Packets
- Truncated Packet Length: 54

Include Exclude

Deactivate Sel Deactivate All

Display Filter (Offline)

The screenshot shows the 'Analyzer GUI and Protocol Configuration' window. On the left is a sidebar with various configuration options, including 'View Filter' which is highlighted. The main area is divided into three sections:

- Filter Selection:** A tree view showing protocol layers. 'RTP' is expanded, and 'RTP Payload Type' is selected with a green checkmark. A red arrow points from this selection to the right panel.
- RTP Payload Type Value:** A list of audio payload types. 'Comfort Noise' is selected and highlighted in blue. Below the list are 'Activate' and 'Deactivate' buttons.
- All Selected:** A table showing the current filter configuration.

Layer	Field	Filter Value
RTP	RTP Payload Type	Comfort Noise

At the bottom, there are radio buttons for 'Conditions for all selections': AND, OR, Include, and Exclude. 'Include' is selected. To the right are 'Deactivate Sel' and 'Deactivate All' buttons.

Encapsulated Security Payload (ESP) Deciphering

The screenshot shows the 'Protocol Capture Configuration' window with the 'Layers' pane on the left and the 'Filters' pane on the right. The 'Filters' pane has the checkbox 'Decode Encrypted ESP Payload' checked, and the 'Deciphered Payload' radio button selected. Below it, the 'ESP SAs' field is visible with an 'Edit' button. A red arrow points to the 'ESP' layer in the 'Layers' pane.

Below the configuration window is the 'ESP SAs' window, which contains a table of ESP Security Associations. The table has columns for IP Protocol, Src IP, Dest IP, SPI, Encryption, Encryption Key, Authentication, and Authentication Key.

IP Protocol	Src IP	Dest IP	SPI	Encryption	Encryption Key	Authentication	Authentication Key
IPv4	192.168.12.86	192.168.12.45	0x05d2ede0	AES-CBC [RFC3602]	0x97D055ABC4E0826C394DC0F2CCBE6...	HMAC-MD5-96 [RFC2403]	0x6CC1C7BE902D253286386E7B7C...
IPv4	192.168.12.45	x.x.x.x	0x467113ba	AES-CBC [RFC3602]	0x97D055ABC4E0826C394DC0F2CCBE6...	HMAC-MD5-96 [RFC2403]	0x6CC1C7BE902D253286386E7B7C...
IPv4	192.168.12.86	192.168.12.251	0xd02382c2	AES-CBC [RFC3602]	0x97D055ABC4E0826C394DC0F2CCBE6...	HMAC-MD5-96 [RFC2403]	0x6CC1C7BE902D253286386E7B7C...
IPv4	192.168.12.251	192.168.12.86	0x129e7b1a	AES-CBC [RFC3602]	0x97D055ABC4E0826C394DC0F2CCBE6...	HMAC-MD5-96 [RFC2403]	0x6CC1C7BE902D253286386E7B7C...
IPv4	192.168.12.90	192.168.12.45	0xa5e7259a	AES-CBC [RFC3602]	0x97D055ABC4E0826C394DC0F2CCBE6...	HMAC-MD5-96 [RFC2403]	0x6CC1C7BE902D253286386E7B7C...
IPv4	192.168.12.45	*	0x9637e4c8	AES-CBC [RFC3602]	0x97D055ABC4E0826C394DC0F2CCBE6...	HMAC-MD5-96 [RFC2403]	0x6CC1C7BE902D253286386E7B7C...
IPv4	192.168.12.90	192.168.12.251	0x57be7f1a	AES-CBC [RFC3602]	0x97D055ABC4E0826C394DC0F2CCBE6...	HMAC-MD5-96 [RFC2403]	0x6CC1C7BE902D253286386E7B7C...
IPv4	*	192.168.12.90	*	AES-CBC [RFC3602]	0x97D055ABC4E0826C394DC0F2CCBE6...	HMAC-MD5-96 [RFC2403]	0x6CC1C7BE902D253286386E7B7C...

- ESP filter is used to provide **ESP SAs value** to decrypt ESP packets

Comparison of Before and After ESP Deciphering

PacketScan 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

Device	Frame#	TIME (Relative)	Length (Bytes)	Error	Length/Protocol Type	Packet Type	Source IP Address	Destination IP Address	Source Address
					MAC	MAC	IPv4	IPv4	IPv6
✓	1	0	00:00:00:00000000		822	Internet [IP]IPv4	192.168.12.86	192.168.12.45	
✓	1	1	00:00:00:515721000		822	Internet [IP]IPv4	192.168.12.86	192.168.12.45	
✓	1	2	00:00:01:537143000		822	Internet [IP]IPv4	192.168.12.86	192.168.12.45	
✓	1	3	00:00:03:558345000		822	Internet [IP]IPv4	192.168.12.86	192.168.12.45	
✓	1	4	00:00:04:626310000		806	Internet [IP]IPv4	192.168.12.90	192.168.12.45	
✓	1	5	00:00:05:143077000		806	Internet [IP]IPv4	192.168.12.90	192.168.12.45	
✓	1	6	00:00:06:165570000		806	Internet [IP]IPv4	192.168.12.90	192.168.12.45	

Device# Frame# 0 at 00:00:00:00000000 OK Len=822

Ethernet Frame Data *** Right click to SHOW/HIDE layer details or copy ***

```

----- MAC Layer -----
0000 Destination Address      = xE0D55EADFDFD
0006 Source Address          = xFC1A1492A8CF
000C Length/Protocol Type    = x0800 Internet IP(IPv4)
----- IPv4 Layer -----
000E Version                  = 0100 (4)
000E Internet Header Length (In 32 bit words) = 0101 (5)
Differentiated Services Field
000F Differentiated Services Codepoint = 00000000 Default
000F Explicit Congestion Notification = 00000000 Not-ECT (Not ECN-Capable Transport)
IP Hdr No TCP SegmentationOffload
0010 Total Length             = 808 (x0328)
0012 Identification          = 31181 (x79CD)
0014 Reserved Bit             = 0 (Not Set)
0014 Don't fragment          = 0 (Not Set)
0014 More fragments          = 0 (Not Set)
0014 Fragment Offset         = 0 (000000 00000000)
0016 Time To Live            = 128 (x80)
0017 Protocol                 = 00110010 Encap Security Payload
0018 Header Check Sum        = x2403
001A Source IP Address        = 192.168.12.86 (xCOA80C56)
001E Destination IP Address  = 192.168.12.45 (xCOA80C2D)
----- Encapsulating Security Payload Protocol Layer -----
0022 Security Parameter Index = 9709956 (x05D2E06)
0026 Sequence Number         = 1 (x00000001)
ESP Payload Data             = x49F74319A723AF44...BFA3074B9C6D5534 (Length 32)
  
```

Off-line Viewing: C:\Users\Sunil\Desktop\FastRecorderAndPacketExtractor

Before Deciphering

PacketScan 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

Device	Frame#	TIME (Relative)	Length (Bytes)	Error	Length/Protocol Type	Packet Type	Source IP Address	Destination IP Address	Source Address
					MAC	MAC	IPv4	IPv4	IPv6
✓	1	0	00:00:00:00000000		769	Internet [IP]IPv4	SIP	192.168.12.86	192.168.12.45
✓	1	1	00:00:00:515721000		769	Internet [IP]IPv4	SIP	192.168.12.86	192.168.12.45
✓	1	2	00:00:01:537143000		769	Internet [IP]IPv4	SIP	192.168.12.86	192.168.12.45
✓	1	3	00:00:03:558345000		769	Internet [IP]IPv4	SIP	192.168.12.86	192.168.12.45
✓	1	4	00:00:04:626310000		764	Internet [IP]IPv4	SIP	192.168.12.90	192.168.12.45

0018 Header Check Sum = x2403

001A Source IP Address = 192.168.12.86 (xCOA80C56)

001E Destination IP Address = 192.168.12.45 (xCOA80C2D)

----- UDP Layer -----

0022 Source Port = 5060 (x13C4)

0024 Destination Port = 5060 (x13C4)

0026 Length (Header + Data) = 735 (x02DF)

0028 Checksum = x16FB

----- SIP Layer -----

```

INVITE sip:0001@192.168.12.45 SIP/2.0
Via: SIP/2.0/UDP 192.168.12.86:5060;branch=z9hG4bK-29-103772070-10509-4472
Max-Forwards: 70
Allow: INVITE, BYE, CANCEL, ACK, INFO, OPTIONS, SUBSCRIBE, NOTIFY, REFER, REGISTER, UPDATE
From: 0001 <sip:0001@192.168.12.86>;tag=FromTag-26-103772070-10506-4472
To: 0001 <sip:0001@192.168.12.45>
Call-ID: GL-NAPS-28-103772070-10508-4472@192.168.12.86
CSeq: 1 INVITE
Contact: 0001 <sip:0001@192.168.12.86>
Content-Type: application/sdp
Content-Length: 238

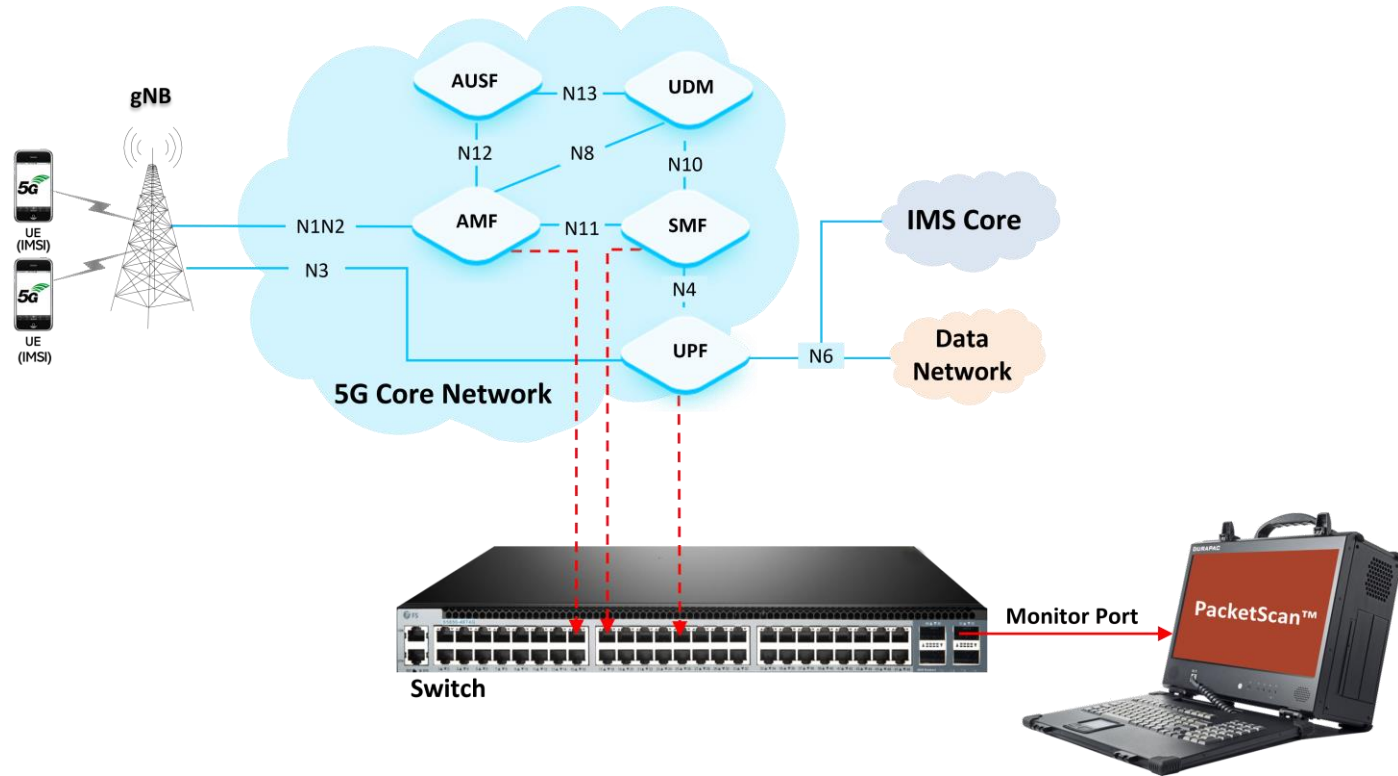
v=0
o=0001 31062954 1 IN IP4 192.168.12.90
s=SIP Call
c=IN IP4 192.168.12.90
t=0 0
m=audio 1034 RTP/AVP 0 8 101
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:101 telephone-event/8000
a=rtsp:101 telephone-event/8000
a=rtsp:101 0-15
a=ptime:20
a=sendrecv
  
```

Off-line Viewing: C:\Users\Sunil\Desktop\FastRecorderAndPacketExtractor, 56 Frames

After Deciphering

5G Protocol Analysis

- Captures, segregates, monitors and collects statistics on all calls over N1N2, N4, N8, N12 and N13 interfaces of the 5G network
- Provides VoNR call statistics such as caller, callee, MOS scores, discarded packets and voice storage



Decode View - 5G NGAP Layer

PacketScan 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Device	Frame#	TIME (Relative)	Length (Bytes)	Error	Length/Protocol Type MAC	Packet Type MAC	Source IP Address IPv4	Destination IP Address IPv4
✓ 0	0	00:00:00.000000000	130		Internet IP(IPv4)		192.168.31.55	192.168.31.77
✓ 0	1	00:00:00.070066000	126		Internet IP(IPv4)		192.168.31.77	192.168.31.55
✓ 0	2	00:00:00.400049000	102		Internet IP(IPv4)		192.168.31.55	192.168.31.77
✓ 0	3	00:00:00.472182000	130		Internet IP(IPv4)		192.168.31.77	192.168.31.55
✓ 0	4	00:00:05.829074000	230		Internet IP(IPv4)		192.168.31.55	192.168.31.77
✓ 0	5	00:00:05.883006000	82		Internet IP(IPv4)		192.168.31.77	192.168.31.55

003A Payload Protocol Identifier = x0000003C NGAP
Parameter Padding = x0000
===== NGAP Layer =====

003E NGAP-PDU = InitiatingMessage (0)

003E InitiatingMessage =

003F ProcedureCode = 4 id-DownlinkNASTransport

0040 procedureCriticality = 1 ignore(1)

0042 Value =

0042 DownlinkNASTransport =

0042 ProtocolIE-Container = 3 Items

0045 Item = 0

0045 ProtocolIE-Field =

0045 ProtocolIE-ID = 10 id-AMF-UE-NGAP-ID

0047 procedureCriticality = 0 reject(0)

0049 Value =

004A AMF-UE-NGAP-ID = 2

004B Item = 1

004B ProtocolIE-Field =

004B ProtocolIE-ID = 85 id-RAN-UE-NGAP-ID

004D procedureCriticality = 0 reject(0)

004F Value =

0050 RAN-UE-NGAP-ID = 2

0051 Item = 2

0051 ProtocolIE-Field =

0051 ProtocolIE-ID = 38 id-NAS-PDU

0053 procedureCriticality = 0 reject(0)

0055 Value =

0055 NAS PDU =

0056 NAS PDU Dump = x7E0056000200002188821DE340CB350DB1EFA850501A484A20103AE3588D45F780000CBE535FE4F4B155
===== 5G NAS Layer =====

0056 Extended Protocol Discriminator = 01111110 5GS Mobility Management Messages

0057 Security Header Type = ...0000 Plain NAS message, not security protected

Filter is active. C:\Program Files\GL Communications Inc\Pa\Idle filtr 23 of 113 395 frames Missed Frames : 0

LTE Protocol Analysis

- Captures and monitors real-time signaling and traffic on LTE networks
- The application segregates, monitors and collects statistics on all calls and can test eNodeB or UE over various interfaces, including S1, S3, S4, S5 (or S8), S6a, S10, S11, S13, and X2

The screenshot shows the PacketScan 64-bit [off-line] interface. The top part is a table of captured packets:

Device	Frame#	TIME (Relative)	Length (Bytes)	Error	Length/Protocol Type MAC	Packet Type MAC	Source IP Address IPv4	Destination IP Address IPv4
✓ 2	13	00:00:04.216954000	62		Internet IP(IPv4)		192.168.12.27	192.168.12.26
✓ 2	14	00:00:04.222937000	154		Internet IP(IPv4)		192.168.12.27	192.168.12.26
✓ 2	15	00:00:04.242992000	382		Internet IP(IPv4)		192.168.12.26	192.168.12.110

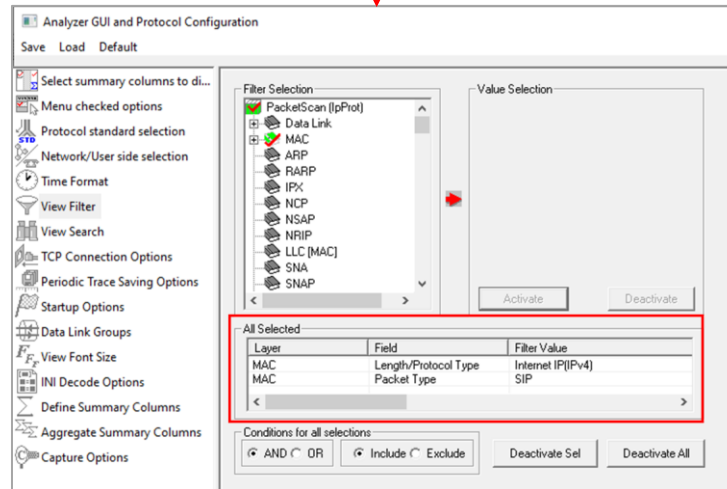
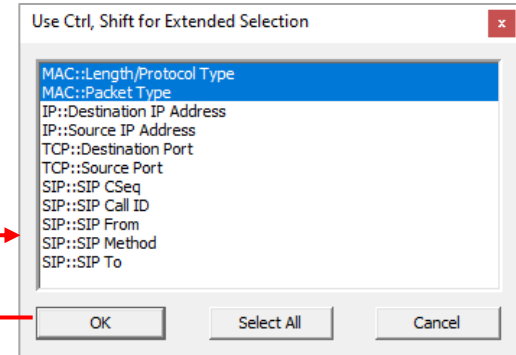
The bottom part shows a detailed view of an S1AP-PDU (InitiatingMessage (0)) with the following structure:

```
----- S1AP Layer -----
003E S1AP-PDU = InitiatingMessage (0)
003E InitiatingMessage =
003F ProcedureCode = 13 id-uplinkNAStransport
0040 Criticality = 1 ignore(1)
0042 Value =
0042 UplinkNAStransport =
0042 ProtocolIE-Container = 5 Items
0045 Item = 0
0045 ProtocolIE-Field =
0045 ProtocolIE-ID = 0 id-MME-UE-S1AP-ID
0047 Criticality = 0 reject(0)
0049 Value =
004A MME-UE-S1AP-ID = 17
004B Item = 1
004B ProtocolIE-Field =
004B ProtocolIE-ID = 8 id-eNB-UE-S1AP-ID
004D Criticality = 0 reject(0)
004F Value =
0050 eNB-UE-S1AP-ID = 10006
0052 Item = 2
0052 ProtocolIE-Field =
0052 ProtocolIE-ID = 26 id-NAS-PDU
0054 Criticality = 0 reject(0)
0056 Value =
0056 NAS PDU =
0057 NAS-PDU = x27F98D586700BA14F34C1D246F2948C4A5F4AB770DA52DD7E52EEEB43A6A1DAF32AF08B49C98F81D4DD3
0081 Item = 3
0081 ProtocolIE-Field =
0081 ProtocolIE-ID = 100 id-EUTRAN-CGI
0083 Criticality = 1 ignore(1)
0085 Value =
0085 EUTRAN-CGI =
0086 PLMNidentity =
0086 MCC = 001
0087 MNC = 01
0089 CellIdentity =
0001 Cell Identity = 00110000 00011110 01100000 0010.... (50456066)
008D Item = 4
008D ProtocolIE-Field =
008D ProtocolIE-ID = 67 id-TAI
008F Criticality = 1 ignore(1)
0091 Value =
```

Filter Criteria From Screen Selection

- Allows the user to automatically create filter criteria from the current screen selection

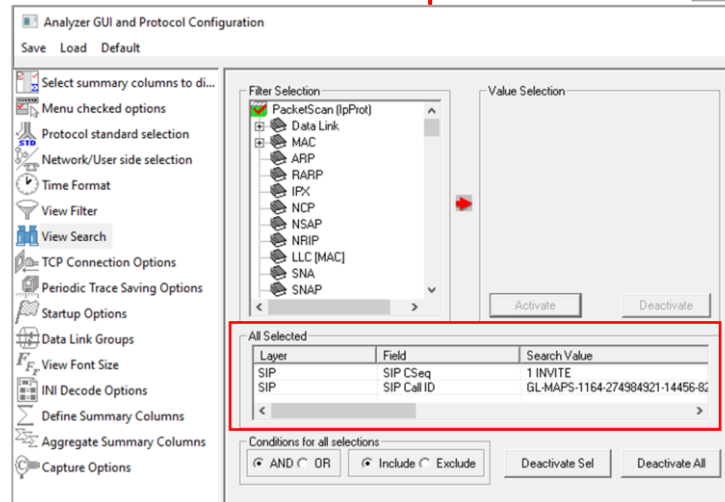
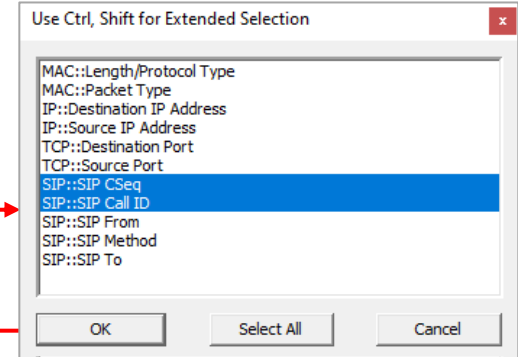
Frame#	TIME (Relative)	Length (Bytes)	Error	Packet Type MAC	Source IP Address IP	Destination IP Address IP	Source Address IPv6	Destination Address IPv6
0	00:00:00.00000000	66		SIP	192.168.12.122	192.168.12.123		
1	00:00:00.000003480	66		SIP	192.168.12.123	192.168.12.122		
2	00:00:00.000003870	54		SIP	192.168.12.122	192.168.12.123		
3	00:00:00.000310480	823		SIP	192.168.12.122	192.168.12.123		
4	00:00:00.000611840	416		SIP	192.168.12.123	192.168.12.122		
5	00:00:00.001110720	54		SIP	192.168.12.122	192.168.12.123		
6	00:00:00.001833300	779		SIP	192.168.12.123	192.168.12.122		
7	00:00:00.002150590	484		SIP	192.168.12.122	192.168.12.123		



Search Criteria From Screen Selection

- Allows the user to automatically create search criteria from the current screen selection

Frame#	TIME (Relative)	Length (Bytes)	Error	Packet Type MAC	Source IP Address IP	Destination IP Address IP	Source Address IPv6	Destination Address IPv6
0	00:00:00.000000000	66		SIP	192.168.12.122	192.168.12.123		
1	00:00:00.000003480	66		SIP	192.168.12.123	192.168.12.122		
2	00:00:00.000003870	54		SIP	192.168.12.122	192.168.12.123		
3	00:00:00.000310480	823		SIP	192.168.12.122	192.168.12.123		
4	00:00:00.000611840	416		SIP	192.168.12.123	192.168.12.122		
5	00:00:00.001110720	54		SIP	192.168.12.122	192.168.12.123		
6	00:00:00.001833300	779		SIP	192.168.12.123	192.168.12.122		
7	00:00:00.002150590	484		SIP	192.168.12.122	192.168.12.123		



Aggregate Summary Columns

Aggregate Summary Columns

Save Load Default

Select summary columns to di...

Menu checked options

Protocol standard selection

Network/User side selection

Time Format

View Filter

View Search

TCP Connection Options

Periodic Trace Saving Options

Startup Options

Data Link Groups

View Font Size

INI Decode Options

Define Summary Columns

Aggregate Summary Columns

Capture Options

Add Delete Aliases Reorder Reverse Use '_' in the name for multiline headers

Name	Display Format	Summary Columns	Separator
Source IP ---> Destination IP	Concat	Destination IP Address_IP Source IP Address_IP	--->

PacketScan 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

Frame#	TIME (Relative)	Length (Bytes)	Packet Type MAC	Source IP ---> Destination IP	Error	Length/Protocol Type MAC	Source IP Address IP	Destination IP Address IP	Destinat TC
3	00:00:00.000310480	823	SIP	192.168.12.123 ---> 192.168.12.123		Internet IP(IPv4)	192.168.12.122	192.168.12.123	5060
4	00:00:00.000611840	416	SIP	192.168.12.122 ---> 192.168.12.123		Internet IP(IPv4)	192.168.12.123	192.168.12.122	57494
5	00:00:00.001110720	54	SIP	192.168.12.123 ---> 192.168.12.122		Internet IP(IPv4)	192.168.12.122	192.168.12.123	5060
6	00:00:00.001833000	779	SIP	192.168.12.122 ---> 192.168.12.123		Internet IP(IPv4)	192.168.12.123	192.168.12.122	57494
7	00:00:00.002150590	484	SIP	192.168.12.123 ---> 192.168.12.122		Internet IP(IPv4)	192.168.12.122	192.168.12.123	5060
8	00:00:00.002188670	214	RTP	192.168.12.123 ---> 192.168.12.122		Internet IP(IPv4)	192.168.12.122	192.168.12.123	
9	00:00:00.002216600	214	RTP	192.168.12.122 ---> 192.168.12.123		Internet IP(IPv4)	192.168.12.123	192.168.12.122	

Device2 Frame=3 at 00:00:00.000310480 OK Len=823 *** Right click to SHOW/HIDE layer details

Ethernet Frame Data

***** MAC Layer *****

0000 Destination Address = xFCAA149CBF99

0006 Source Address = xFCAA149CBF9B

000C Length/Protocol Type = x0800 Internet IP(IPv4)

***** IP Layer *****

000E Version = 0100... (4)

000E Internet Header Length (In 32 bit words) = ...0101 (5)

Differentiated Services Field

000F Differentiated Services Codepoint = 0000000.. Default

000F Explicit Congestion Notification =00 Not-ECT (Not ECN-Capable Transport)

IP Hdr No TCP SegmentationOffload =

0010 Total Length = 809 (x0329)

0012 Identification = 28511 (x6F5F)

0014 Reserved Bit = 0..... Not Set

0014 Don't fragment = .1..... Set

0014 More fragments = .0..... Not Set

0014 Fragment Offset = 0 (...000000 00000000)

0016 Time To Live = 128 (x80)

0017 Protocol = 00000110 TCP

0018 Header Check Sum = x0000

001A Source IP Address = 192.168.12.122 (xC0A80C7A)

001E Destination IP Address = 192.168.12.123 (xC0A80C7B)

Off-line Viewing. C:\Users\Archana\Desktop\Aggregate Summar 11 Frames

Aggregate Summary Column Group

- The user can create multiple aggregate column groups and prioritize the groups as per the requirement to display the summary results efficiently

The screenshot displays the 'Aggregate Summary Columns' configuration window in PacketScan 64-bit. The window is divided into a left sidebar with various analysis options and a main configuration area. The main area has tabs for 'Add', 'Delete', 'Aliases', 'Reorder', and 'Reverse'. Below these tabs is a table for defining aggregate summary columns.

Name	Display Format	Summary Columns	Separator
Group-0	Col_Alias Value	SIP Method_SIP SIP From_SIP SIP To_SIP SIP Call ID_SIP SIP CSeq_SIP	,
Group-1	Col_Alias Value	SSRC identifi Sequence N TimeStamp Marker bit	,
Group-2	Concat	Source Port Destination	,

The main window also shows a network traffic capture. A table of captured packets is visible, with a red box highlighting a specific packet (Frame 3):

Frame#	TIME (Relative)	Length (Bytes)	Packet Type	MAC	Error	Length/Protocol Type	Source IP / MAC
3	00:00:00.000310480	823	SIP				

Below the packet list, the details for the selected packet (Frame 3) are shown, including Ethernet II, Internet Protocol Version 4, and Differentiated Services Codepoint (DSCP) information.

Copy Frames to Memory File

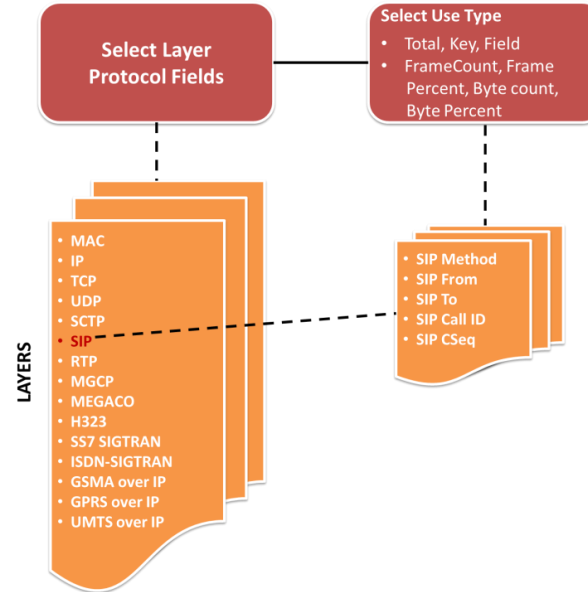
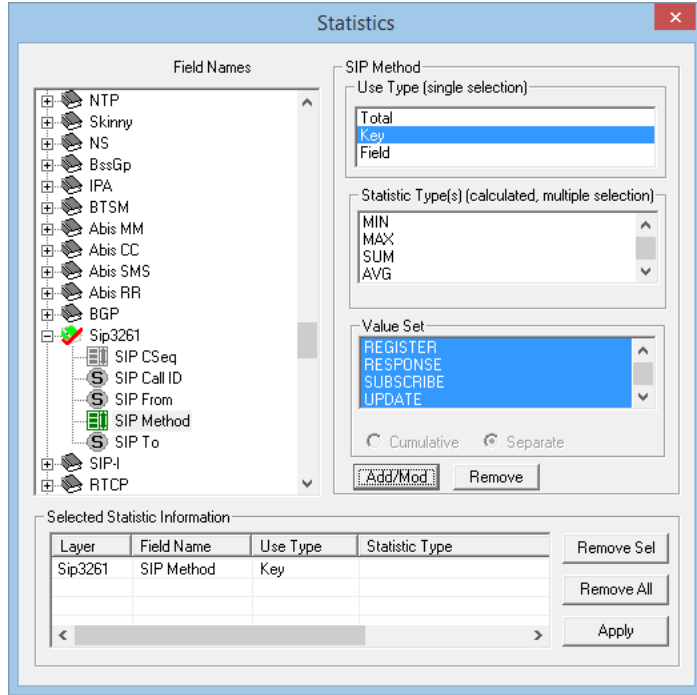
- The user can select and copy the frames (frame range) to the desired location

The screenshot displays the PacketScan 64-bit application window. The main window contains a table of captured frames with the following columns: Device, Frame#, TIME (Relative), Length (Bytes), Error, Length/Protocol Type MAC, and Packet Type MAC. The table lists frames 0 through 10, all from Device 2. Frame 0 is selected. A dialog box titled 'Copy Frames to Memory File' is overlaid on the table. The dialog has a 'Total Frames in Memory' field set to 1, a 'List of frame ranges to copy like 1 10-19 33-77' field with '10-15' entered, and buttons for 'Copy Selected', 'Copy Ranges', 'Copy All', 'Save & Exit', 'Clear Memory', and 'Exit'. Below the table, a portion of the packet details for Frame 0 is visible, showing Ethernet II and Internet Protocol (IPv4) headers.

Device	Frame#	TIME (Relative)	Length (Bytes)	Error	Length/Protocol Type MAC	Packet Type MAC
✓ 2	0	00:00:00.000000000	82		Internet IP(IPv4)	
✓ 2	1	00:00:01.841976000	82		Internet IP(IPv4)	
✓ 2	2	00:00:02.347154000	836		Internet IP(IPv4)	SIP
✓ 2	3	00:00:02.347730000	354		Internet IP(IPv4)	SIP
✓ 2	4	00:00:02.349375000	355		Internet IP(IPv4)	SIP
✓ 2	5	00:00:02.349532000	820		Internet IP(IPv4)	SIP
✓ 2	6	00:00:04.467457000	82		Internet IP(IPv4)	
✓ 2	7					
✓ 2	8					
✓ 2	9					
✓ 2	10					

Device2 Frame=0 at
Ethernet Frame Data
===== MA
0000 Destination Ad
0006 Source Address
000C Length/Protoc
===== IP
000E Version = 0100.... (4)
000E Internet Header Length (In 32 bit words) =0101 (5)
Differentiated Services Field =
000F Differentiated Services Codepoint = 000000.. Default
000F Explicit Congestion Notification =00 Not-ECT (Not ECN-Capable Transport)
IP Hdr No TCP SegmentationOffload =
0010 Total Length = 68 (x0044)
0012 Identification = 24272 (x5ED0)
0014 Reserved Bit = 0..... Not Set

Statistics



E.g. Device # (Its type Numeric)
 Timestamp (String values)
 ARP Hardware type (with predefined value set)

- Various statistics can be obtained to study the performance and trend in the VoIP network, based on protocol fields and different parameters

Packet Data Analysis

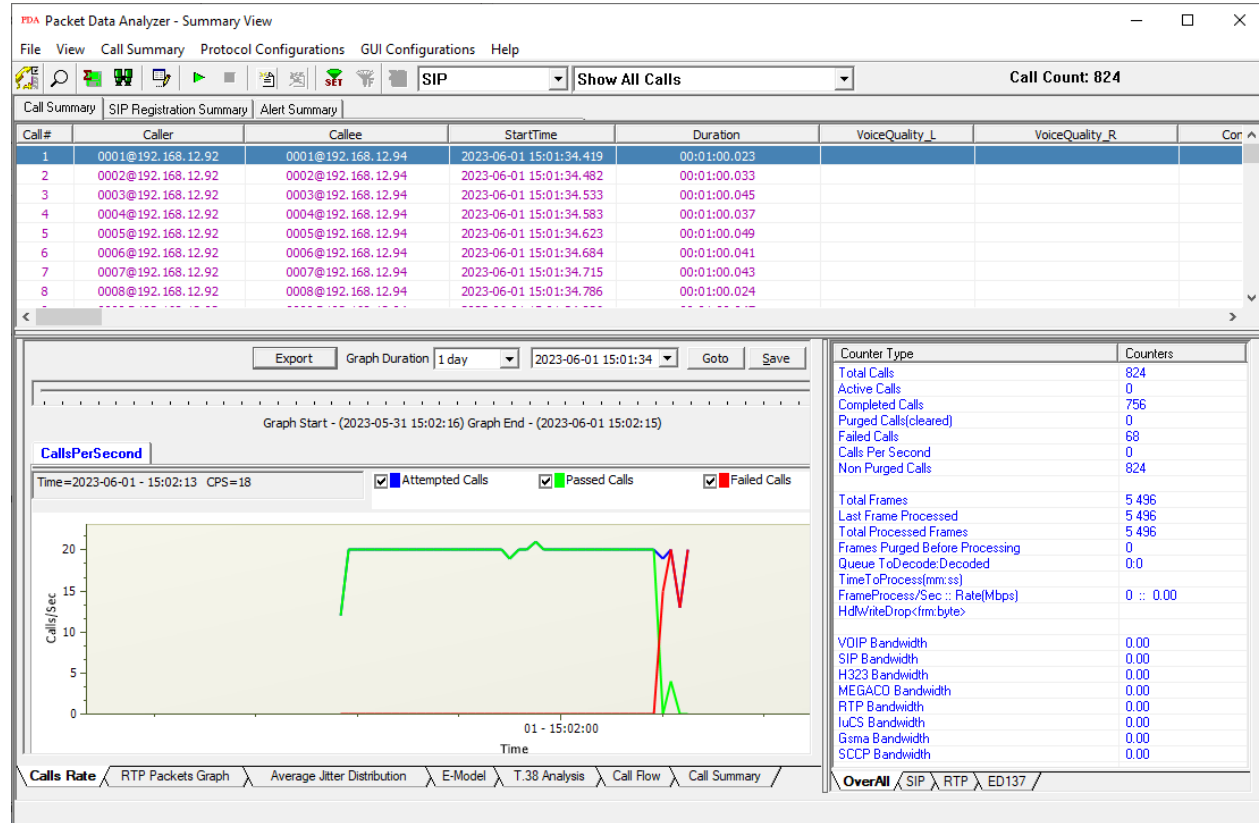
- Packet Data Analysis in PacketScan™ displays the following views
 - Summary view
 - Detail view
 - Registration summary view

The screenshot displays the 'Packet Data Analyzer - Summary View' interface. At the top, there is a menu bar with 'File', 'View', 'Call Summary', 'Protocol Configurations', 'GUI Configurations', and 'Help'. Below the menu is a toolbar with various icons and a dropdown menu set to 'SIP'. The main window is divided into several sections:

- Call Summary Table:** A table with columns for Call #, Caller, Callee, StartTime, Duration, VoiceQuality_L, VoiceQuality_R, and Cor. It lists 7 calls with details such as caller/callee IDs (e.g., 0001@192.168.12.92) and timestamps.
- Graphs and Controls:** A section with 'Export', 'Graph Duration' (set to 1 min), a date/time selector (2023-11-17 10:36:19), and buttons for 'Goto', 'Save', and 'Update Graph'. Below this is a 'Calls Per Second' graph area with checkboxes for 'Attempted Calls', 'Passed Calls', and 'Failed Calls'. The graph shows a flat line at 0 calls per second over a 1-minute period.
- Counter Table:** A table on the right side listing various performance metrics and their values, such as 'Total Calls: 824', 'Completed Calls: 756', and 'Total Frames: 5496'.
- Navigation Bar:** At the bottom, there is a navigation bar with tabs for 'Calls Rate', 'RTP Packets Graph', 'Average Jitter Distribution', 'E-Model', 'T.38 Analysis', 'Call Flow', and 'Call Summary'. The 'Calls Rate' tab is currently selected.

PDA Summary View

- Summary View displays -
 - Summary of data transmission in each direction including calling number, called number, call id, start time, duration, missing packets, etc.
 - Includes separate statistical counts on total packets, calls, failed calls, captured frames, etc., for SIP, H323, MEGACO, and RTP based calls
 - Provides various graphs to view active calls, average jitter distribution, E-model based measurements for R-factor / MOS/ Packet discarded, RTP packets, T.38 fax analysis, and call signaling, Gap, Jitter, Gap/Jitter Distribution, Wave and Spectral Display for media stream analysis, VoIP calls and more



Displaying Filtered Calls using Filter Expressions

- Filter CDRs (Call Detail Records) based on parameters such as caller, time, message count, etc.
- The expression supports the following mathematical operators: ==, <=, >=, !=, <, >, &&, ||
- For example, the filter expression "ErrorCode==400||ErrorCode>600" will display calls with ErrorCode equal to 400 and calls with ErrorCode greater than 600

PDA Packet Data Analyzer - Summary View

File View Call Summary Protocol Configurations GUI Configurations Help

SIP Show Filtered Calls Call Count: 6

ErrorCode==400 || ErrorCode>600

Call Summary SIP Registration Summary Alert Summary

Payload_R	ErrorCode	FailureCause	CallID	EndTime	PostDialDelay	SessionDisconnectDe
	400	5	GL-MAPS-2654-766727097-26124-3688@192.168.12.92	2023-06-01 15:02:12.275	9	0
	603	4	GL-MAPS-2679-766728649-26314-14696@192.168.12.92	2023-06-01 15:02:13.828	9	0
	604	4	GL-MAPS-2677-766728698-26320-13540@192.168.12.92	2023-06-01 15:02:13.879	19	0
	606	4	GL-MAPS-2677-766728748-26326-14572@192.168.12.92	2023-06-01 15:02:13.919	9	0
	400	5	GL-MAPS-2685-766728798-26332-6156@fe80::3f20:7953:f2df:f26a	2023-06-01 15:02:13.973	18	0
	606	4	GL-MAPS-2709-766730449-26530-14696@fe80::3f20:7953:f2df:f26a	2023-06-01 15:02:15.632	9	0

Save Call in *.hdl, *.pcap, and *.pcapng Formats

The screenshot displays the PDA Packet Data Analyzer interface. The main window shows a 'Call Summary' table with columns for Call #, Caller, Callee, StartTime, Duration, VoiceQuality_L, VoiceQuality_R, and Cor. A 'Save Call' dialog box is open, allowing the user to select file formats (HDL File, PCAP File, PCAPNG) and a save path. The dialog also includes an 'Overwrite Files' checkbox and 'Save Call(s)' and 'Exit' buttons. Below the dialog, a 'Calls Per Second' graph is visible, showing a peak in call activity around 15:02:00. The bottom of the interface features a navigation bar with tabs for 'Calls Rate', 'RTP Packets Graph', 'Average Jitter Distribution', 'E-Model', 'T.38 Analysis', 'Call Flow', and 'Call Summary'. The status bar at the bottom indicates 'OverAll' and 'SIP'.

Call #	Caller	Callee	StartTime	Duration	VoiceQuality_L	VoiceQuality_R	Cor
1	0001@192.168.12.92	0001@192.168.12.94	2023-06-01 15:01:34.419	00:01:00.023			
2	0002@192.168.12.92	0002@192.168.12.94	2023-06-01 15:01:34.482	00:01:00.033			
3	0003@192.168.12.92	0003@192.168.12.94	2023-06-01 15:01:34.533				
4	0004@192.168.12.92	0004@192.168.12.94	2023-06-01 15:01:34.583				
5	0005@192.168.12.92	0005@192.168.12.94	2023-06-01 15:01:34.623				
6	0006@192.168.12.92	0006@192.168.12.94	2023-06-01 15:01:34.684	00:01:00.041			
7	0007@192.168.12.92	0007@192.168.12.94	2023-06-01 15:01:34.715	00:01:00.043			
8	0008@192.168.12.92	0008@192.168.12.94					

PDA Save Call - CallNum_3

File Type: HDL File PCAP File PCAPNG Link Type: 0

Path: C:\Program Files\GL Communications Inc\PacketScan\

Overwrite Files

Counters	Value
824	824
0	0
756	756
0	0
68	68
0	0
824	824
5496	5496
5496	5496
5496	5496
0	0
0.0	0.0
0 :: 0.00	0 :: 0.00
HdlWriteDrop<fm.byte>	
VOIP Bandwidth	0.00
SIP Bandwidth	0.00
H323 Bandwidth	0.00
MEGACO Bandwidth	0.00
RTP Bandwidth	0.00
IuCS Bandwidth	0.00
Gsm Bandwidth	0.00
SCCP Bandwidth	0.00

Copy Cell Value to Clipboard

The screenshot shows the 'Packet Data Analyzer - Summary View' interface. At the top, there's a menu bar with 'File', 'View', 'Call Summary', 'Protocol Configurations', 'GUI Configurations', and 'Help'. Below the menu is a toolbar with various icons and a dropdown menu set to 'SIP'. The main area displays a table of call data with columns: Call #, Caller, Callee, StartTime, Duration, VoiceQuality_L, VoiceQuality_R, and Cor. Call #3 is selected, and a context menu is open over it, with 'Copy Cell Value' highlighted. A red arrow points from this menu item to a Notepad window titled '*Untitled - Notepad'. The Notepad window shows the copied text: '2023-06-01 15:01:34.533' and '00:01:00.045' on separate lines, followed by '0003@192.168.12.92' on the next line. Below the table, there's a 'Graph Duration' section with a 'Graph Start' and 'Graph End' range, and a 'Calls Per Second' graph showing call activity over time. On the right side, there's a statistics panel with various metrics like 'Active Calls', 'Completed Calls', and 'Total Frames'.

Call #	Caller	Callee	StartTime	Duration	VoiceQuality_L	VoiceQuality_R	Cor
1	0001@192.168.12.92	0001@192.168.12.94	2023-06-01 15:01:34.419	00:01:00.023			
2	0002@192.168.12.92	0002@192.168.12.94	2023-06-01 15:01:34.482	00:01:00.033			
3	0003@192.168.12.92	0003@192.168.12.94	2023-06-01 15:01:34.533	00:01:00.045			
4	0004@192.168.12.92	0004@192.168.12.94	2023-06-01 15:01:34.584				
5	0005@192.168.12.92	0005@192.168.12.94	2023-06-01 15:01:34.614				
6	0006@192.168.12.92	0006@192.168.12.94	2023-06-01 15:01:34.684	00:01:00.041			
7	0007@192.168.12.92	0007@192.168.12.94	2023-06-01 15:01:34.715	00:01:00.043			
8	0008@192.168.12.92	0008@192.168.12.94	2023-06-01 15:01:34.786	00:01:00.024			

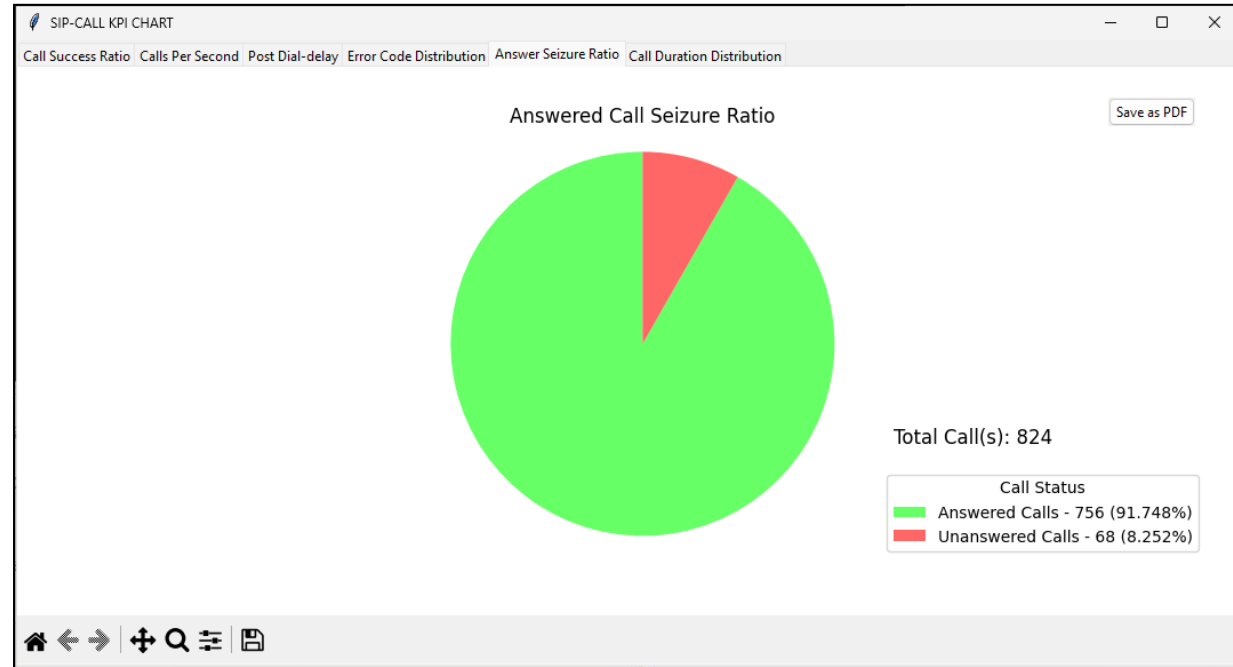
Statistics Panel:

- Active Calls: 0
- Completed Calls: 756
- Purged Calls(cleared): 0
- Failed Calls: 68
- Calls Per Second: 0
- Non Purged Calls: 824
- Total Frames: 5 496
- Last Frame Processed: 5 496
- Total Processed Frames: 5 496
- Frames Purged Before Processing: 0
- Queue ToDecode:Decoded: 0:0
- TimeToProcess(mm:ss):
- FrameProcess/Sec :: Rate(Mbps): 0 :: 0.00
- HdWriteDrop(rm.byte):
- VDIP Bandwidth: 0.00
- SIP Bandwidth: 0.00
- H323 Bandwidth: 0.00
- MEGACO Bandwidth: 0.00
- RTP Bandwidth: 0.00
- LuCS Bandwidth: 0.00
- GsmA Bandwidth: 0.00
- SCCP Bandwidth: 0.00

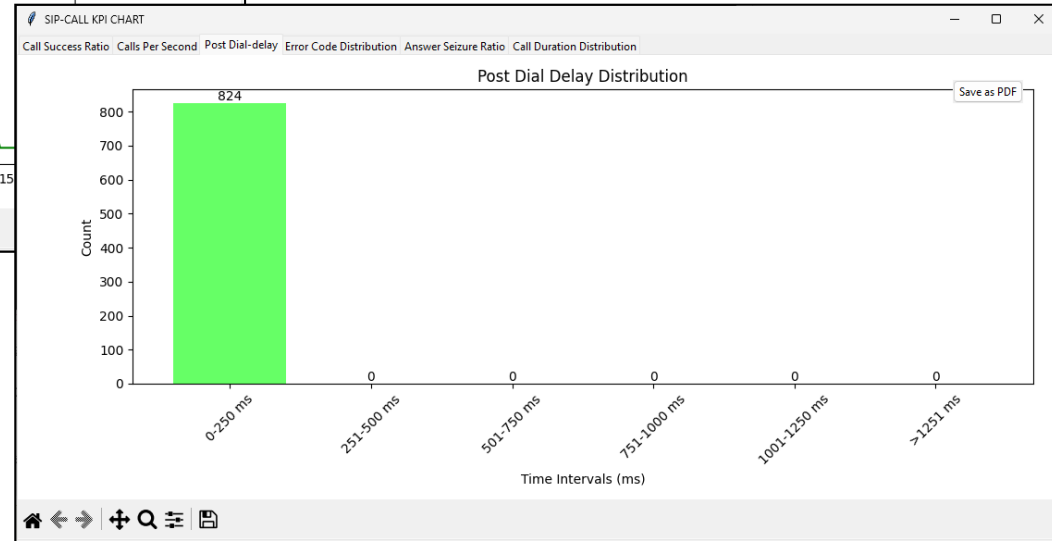
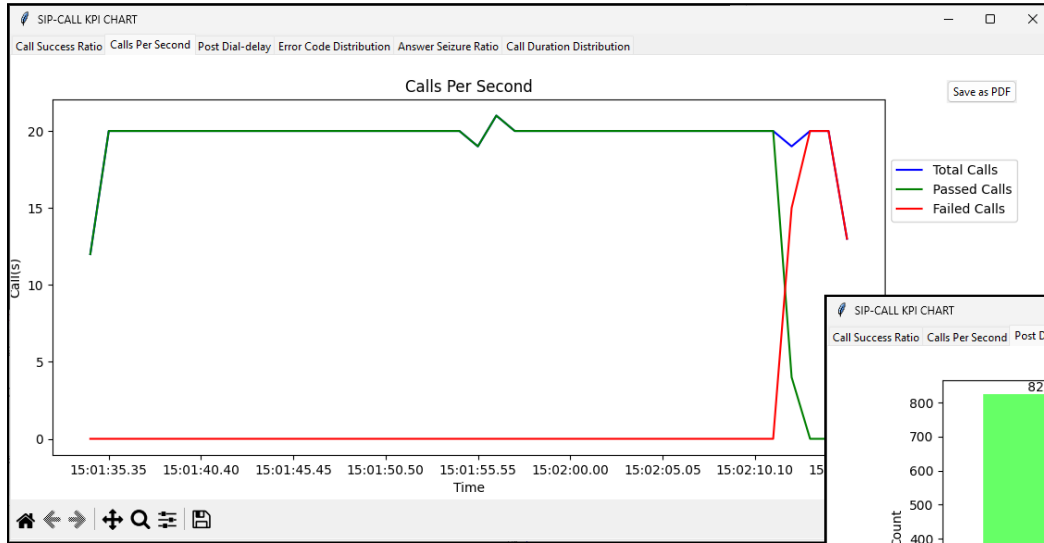
Key Performance Indicators (KPIs) Report for SIP Calls

The SIP Call Summary KPI Report includes KPIs for the following fields:

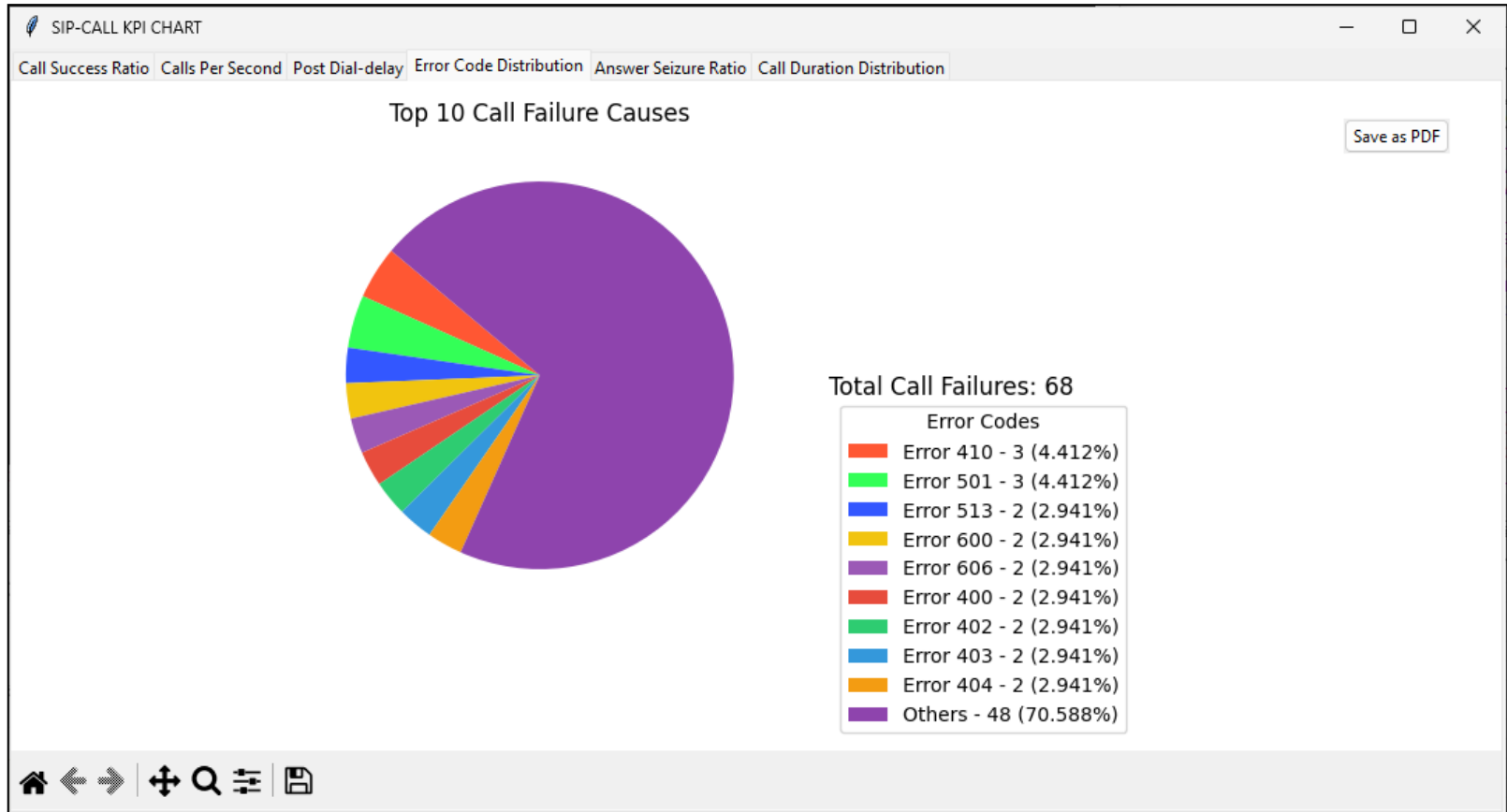
- **Call Success Ratio:** Displays graph for "Successful" and "Unsuccessful Calls," including counts and percentages (%)
- **Calls Per Second:** Shows graph "Total," "Passed," and "Failed Calls per second."
- **Post Dial Delay:** Shows delay counts in milliseconds (0-250ms, 251-500ms, etc.)
- **Error Code Distribution:** Lists Top 10 Call Failure Causes with counts and percentages (%)
- **Answer Seizure Ratio:** Shows "Answered" and "Unanswered Calls," with counts and percentages (%)
- **Call Duration Distribution:** Provides call counts for different durations (0-1 sec, 1-10 sec, etc.)



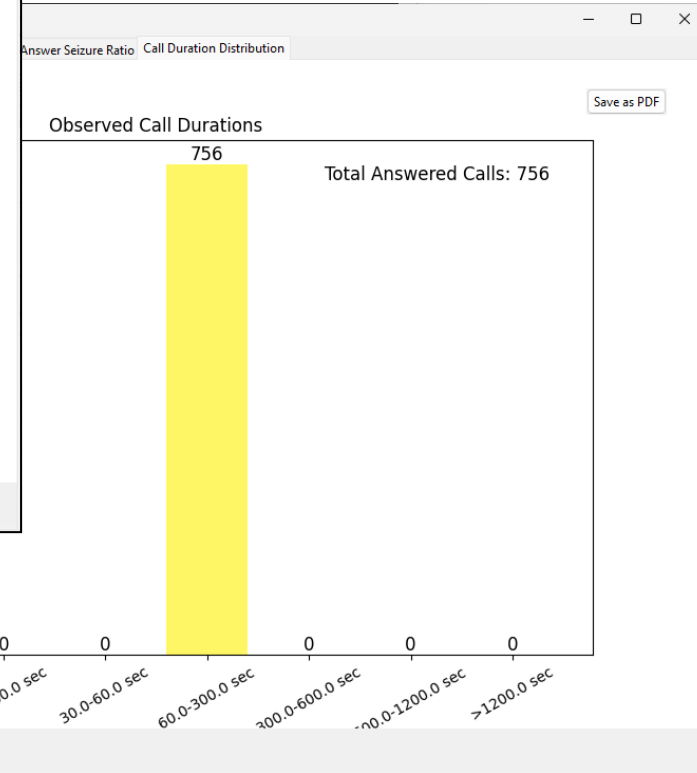
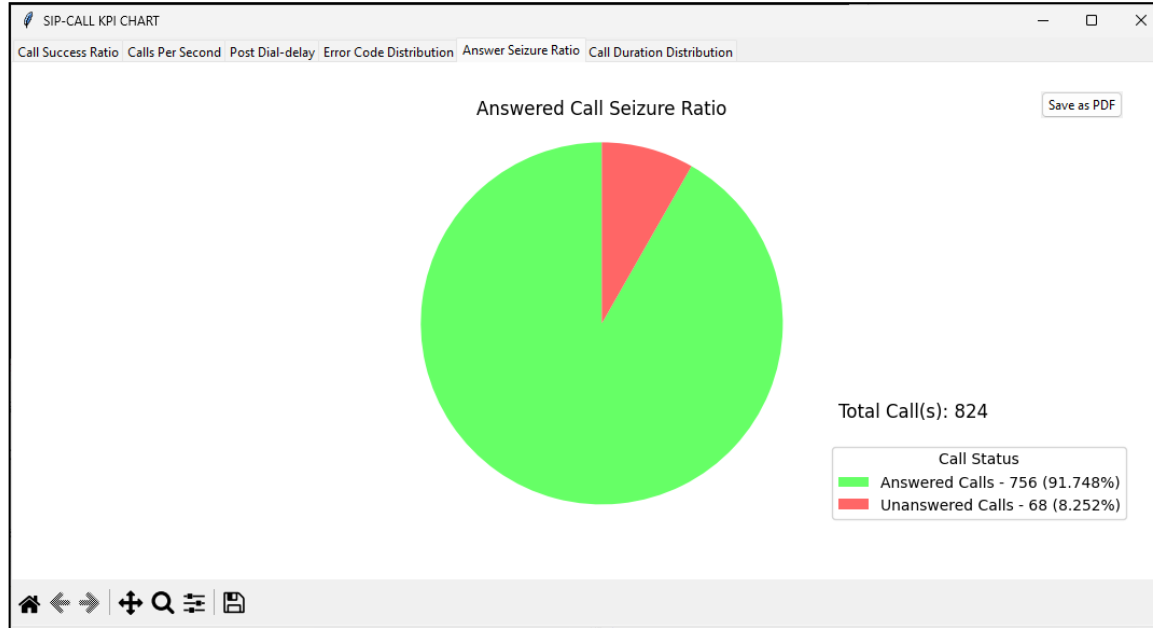
Calls Per Second and Post Delay KPIs



Error Code Distribution KPI



Answer Seizure Ratio and Call Duration Distribution KPIs



Call Graph – SIP Call

- Displays the message sequences of captured VoIP calls
- Decodes of the selected SIP message is displayed on the right pane
- The Complete Stack option enables the user to view the full call details for the selected message on the ladder diagram

The screenshot shows the PDA Packet Data Analyzer interface. The top menu includes File, View, Call Summary, Protocol Configurations, GUI Configurations, and Help. The main window displays a 'Call Summary' table with columns for Call #, Caller, Callee, StartTime, Duration, VoiceQuality_L, VoiceQuality_R, and Cor. A red box highlights the first row of the table, which corresponds to the selected call.

Call #	Caller	Callee	StartTime	Duration	VoiceQuality_L	VoiceQuality_R	Cor
1	0001@192.168.12.92	0001@192.168.12.94	2023-06-01 15:01:34.419	00:01:00.023			
2	0002@192.168.12.92	0002@192.168.12.94	2023-06-01 15:01:34.482	00:01:00.033			
3	0003@192.168.12.92	0003@192.168.12.94	2023-06-01 15:01:34.533	00:01:00.045			
4	0004@192.168.12.92	0004@192.168.12.94	2023-06-01 15:01:34.583	00:01:00.037			
5	0005@192.168.12.92	0005@192.168.12.94	2023-06-01 15:01:34.623	00:01:00.049			

Below the table is a ladder diagram showing the sequence of SIP messages between the caller (192.168.12.92) and the callee (192.168.12.94). The messages are: INVITE (00:00.000), SIP/2.0 100 Trying (00:00.020), SIP/2.0 180 Ringing (00:00.029), SIP/2.0 200 OK (00:00.153), ACK (00:00.163), BYE (01:00.177), and SIP/2.0 200 OK (01:00.187). A red box highlights the INVITE message, and a red arrow points from it to the decoded message details on the right.

The decoded message details on the right show the following information:

```
Find Complete Stack
===== MAC Layer =====
Destination Address = x6C626D3EB30
Source Address      = x54BEF737BC79
Length/Protocol Type = x0800 Internet IP (IPv4)
===== IPv4 Layer =====
Version              = 0100.... (4)
Internet Header Length (In 32 bit words) = ...0101 (5)
Differentiated Services Field
Differentiated Services Codepoint        = 000000.. Default
Explicit Congestion Notification         = .....00 Not-ECT (Not ECN-C
IP Hdr No TCP SegmentationOffload       =
Total Length          = 761 (x02F9)
Identification        = 15592 (x3CE8)
Reserved Bit          = 0..... Not Set
Don't fragment        = 0..... Not Set
More fragments        = 0..... Not Set
Fragment Offset       = 0 (...00000 00000000)
Time To Live          = 128 (x80)
Protocol              = 00010001 UDP
Header Check Sum      = x0000
Source IP Address     = 192.168.12.92 (xC0A80C5C)
Destination IP Address = 192.168.12.94 (xC0A80C5E)
===== UDP Layer =====
Source Port           = 5060 (x13C4)
Destination Port      = 5060 (x13C4)
Length (Header + Data) = 741 (x02E5)
```

A red box highlights the 'Complete Stack' option in the 'Find' menu, and a red arrow points from it to the decoded message details. A blue text box with a red arrow points to the decoded message details, stating: 'Displays decoded information of the selected SIP message'.

Call Graph – SIP ED-137

- Displays the message sequences of SIP ED-137 call
- Decodes of the selected SIP message is displayed on the right pane

The screenshot shows the Packet Data Analyzer (PDA) interface. The top pane displays a 'Call Summary' table with the following data:

Call #	Caller	Callee	CallID	StartTime	Duration	Src_L	Payload_L	TotalPackets_L	ConversationalMos_L	ConversationalR_L	Listen
1	0001@192.168.1.52	0001@192.168.12.105	GL-MAPS_3_1879751-8...	2017-01-13 12:31:10	00:00:29.844	29014389	PCMA/8000	444	4.20	93	4
2	0001@192.168.1.52	0001@192.168.12.105	GL-MAPS_10_2093727-...	2017-01-13 12:34:44	00:00:00.000						
3	0001@192.168.1.52	0001@192.168.12.105	GL-MAPS_10_2145086-...	2017-01-13 12:35:35	00:00:37.021	21949045	G729/8000	550	4.06	87	4
4	0005@192.168.1.52	0005@192.168.12.117	GL-MAPS_44_2802778-...	2017-01-13 12:46:33	00:00:00.000						
5	0005@192.168.1.52	0001@192.168.12.105	GL-MAPS_3_2920954-1...	2017-01-13 12:48:31	00:00:28.116	2092952065	PCMA/8000	1399	4.20	93	4

The bottom pane shows a detailed view of a SIP message sequence between 192.168.1.52 and 192.168.12.105. The sequence includes:

- 00.00.000: INVITE (5060)
- 00.00.023: SIP/2.0 100 Trying (5060)
- 00.00.148: SIP/2.0 200 OK (5060)
- 00.00.154: ACK (5060)
- 00.00.155: Keep Alive (6000)
- 00.00.161: Keep Alive (6000)
- 00.01.170: SUBSCRIBE (5060)
- 00.01.176: SIP/2.0 200 OK (5060)
- 00.01.178: NOTIFY (5060)
- 00.01.182: SIP/2.0 200 OK (5060)

The right pane shows the decoded details of the selected SIP message (SIP/2.0 200 OK):

```
===== MAC Layer =====
Destination Address = xCOEAE484BA90
Source Address = x54BEF737BC42
Length/Protocol Type = x0800 Internet IP(IPv4)
===== IP Layer =====
Version = 0100.... (4)
Internet Header Length (In 32 bit words) = ....0101 (5)
Differentiated Services Field =
Differentiated Services Codepoint = 100010.. Assured Forwarding 41
Explicit Congestion Notification = .....00 Not-ECT (Not ECN-Capable Tran
Total Length = 961 (x03C1)
Identification = 22542 (x580E)
Reserved Bit = 0..... Not Set
Don't fragment = .0..... Not Set
More fragments = .0..... Not Set
Fragment Offset = 0 (...00000 00000000)
Time To Live = 128 (x80)
Protocol = 00010001 User Datagram
Header Check Sum = x0000
Source IP Address = 192.168.1.52 (xCOA80134)
Destination IP Address = 192.168.12.105 (xCOA80C69)
===== UDP Layer =====
Source Port = 5060 (x13C4)
Destination Port = 5060 (x13C4)
```

Call Graph – MSRP Call

- Decodes of the selected MSRP message is displayed on the right pane

The screenshot displays the PDA Packet Data Analyzer interface. At the top, there is a menu bar with 'File', 'View', 'Call Summary', 'Protocol Configurations', 'GUI Configurations', and 'Help'. Below the menu is a toolbar with various icons and a dropdown menu set to 'SIP'. The main window is divided into two panes. The upper pane shows a 'Call Summary' table with columns for Call #, Caller, Callee, CallID, StartTime, Duration, EndTime, and CallSuccess. The lower pane shows a 'Column Width' section and a 'Find' search box. The main display area is a sequence diagram showing the flow of messages between two IP addresses: 192.168.10.13 and 192.168.10.14. The messages include INVITE, SIP/2.0 100 Trying, SIP/2.0 180 Ringing, SIP/2.0 200 OK, ACK, MSRP/SEND, MSRP/200 OK, MSRP/REPORT, and another MSRP/SEND. The selected MSRP/SEND message is highlighted in red, and its detailed decode is shown in the right-hand pane. The decode includes fields like To-Path, From-Path, Message-ID, Success-Report, Failure-Report, Byte-Range, and Content-Type.

Call #	Caller	Callee	CallID	StartTime	Duration	EndTime	CallSuccess
2	0002@192.168.10.13	0002@192.168.10.14	GL-MAPS-24652-493054435-1755...	2021-05-11 01:43:17.742	00:02:00.037	2021-05-11 01:45:17.909	1
3	0003@192.168.10.13	0003@192.168.10.14	GL-MAPS-24656-493054534-1755...	2021-05-11 01:43:17.828	00:02:00.057	2021-05-11 01:45:18.028	1
4	0004@192.168.10.13	0004@192.168.10.14	GL-MAPS-24587-493054633-1755...	2021-05-11 01:43:17.915	00:02:00.024	2021-05-11 01:45:18.081	1
5	0005@192.168.10.13	0005@192.168.10.14	GL-MAPS-24670-493054734-1755...	2021-05-11 01:43:18.013	00:02:00.055	2021-05-11 01:45:18.210	1
6	0006@192.168.10.13	0006@192.168.10.14	GL-MAPS-24591-493054834-1755...	2021-05-11 01:43:18.123	00:02:00.022	2021-05-11 01:45:18.297	1
7	0007@192.168.10.13	0007@192.168.10.14	GL-MAPS-24699-493054933-1755...	2021-05-11 01:43:18.231	00:02:00.023	2021-05-11 01:45:18.394	1
8	0008@192.168.10.13	0008@192.168.10.14	GL-MAPS-24659-493055033-1755...	2021-05-11 01:43:18.318	00:00:00.000	2021-05-11 01:43:18.328	0
9	0009@192.168.10.13	0009@192.168.10.14	GL-MAPS-24663-493055133-1755...	2021-05-11 01:43:18.415	00:00:00.000	2021-05-11 01:43:18.425	0

```
MSRP glMapsMrsp226789 SEND
To-Path: msrp://192.168.10.14:21366/GL_MAPS_0CA5E3B3;tcp
From-Path: msrp://192.168.10.13:24339/GL_MAPS_3B40F48D;tcp
Message-ID: glMapsMrsp226788
Success-Report: no
Failure-Report: yes
Byte-Range: 1-270/270
Content-Type: text/plain

GL's Message Automation & Protocol Simulation (MAPS™) is a protocol simulation and
-----glMapsMrsp226789
```

LTE Call Flow

Packet Data Analyzer - Summary View

File View Call Summary Protocol Configurations GUI Configurations Help

LTE Show All Calls Call Count: 1

Call Summary SIP Registration Summary Alert Summary

Call#	IMSI	M_TMSI	Result	EmmCause	EsmCause	APN	SIAuthenticationResult	S6a Authentic
1	001013012041631	1549201847	Attach Accepted	CS domain not available	Regular deactivation	internet-ims	SI Authenticated	Authent

Column Width Absolute Timing Show Latest

192.168.12.27 192.168.12.26 192.168.12.110

36412 InitialUEMessage - Attach Request-PDN C 36412

3668 Authentication-Information Request 3668

3668 Authentication-Information Answer 3668

36412 DownlinkNASTransport - Authentication R 36412

36412 UplinkNASTransport - Authentication Res 36412

36412 DownlinkNASTransport - Security Mode C... 36412

36412 UplinkNASTransport - Security Mode Con 36412

36412 DownlinkNASTransport - ESM Information... 36412

36412 UplinkNASTransport - ESM Information R 36412

3668 Update-Location Request 3668

3668 Insert-Subscriber-Data Request 3668

3668 Insert-Subscriber-Data Answer 3668

3668 Update-Location Answer 3668

36412 InitialContextSetupRequest - Attach Acce... 36412

36412 InitialContextSetupResponse 36412

36412 UplinkNASTransport - Attach Complete Ac 36412

36412 UplinkNASTransport - PDN Connectivity R 36412

Find Complete Stack

```
----- SIAP Layer -----
SIAP-PDU
InitiatingMessage
  ProcedureCode = 12 id-initialUEMessage
  Criticality = 1 ignore(1)
  Value
    InitialUEMessage
      ProtocolIE-Container = 5 Items
      Item = 0
      ProtocolIE-Field
        ProtocolIE-ID = 8 id-eNB-UE-SIAP-ID
        Criticality = 0 reject(0)
        value
          eNB-UE-SIAP-ID = 10006
      Item = 1
      ProtocolIE-Field
        ProtocolIE-ID = 26 id-NAS-PDU
        Criticality = 0 reject(0)
        value
          NAS-PDU = 2
          NAS-PDU = x0741720BF600F110000201DAD46F3504E06
      Item = 2
      ProtocolIE-Field
        ProtocolIE-ID = 67 id-TAI
        Criticality = 0 reject(0)
        value
          TAI = 3
          pLMNIdentity
            MCC = 001
            MNC = 01
            TAC = x0002
      Item = 3
      ProtocolIE-Field
        ProtocolIE-ID = 100 id-EUTRAN-CCI
        Criticality = 1 ignore(1)
        value
          EUTRAN-CCI = 3
          pLMNIdentity
```

Calls Rate Call Flow Call Summary

Call Graph – 5G N1N2 Call

Packet Data Analyzer - Summary View

File View Call Summary Protocol Configurations GUI Configurations Help

5G N1N2 Interface Show All Calls Call Count: 1

Call#	StartTime	EndTime	Duration	SUPI	SUCI	STMSI	IMEISV	gNB	AMF	RanUeNgapId
1	2024-05-29 01:20:10.496	2024-05-29 01:20:36.313	00:00:16.009	001013012041631	3012041631	230464386	1234567890123001	192.168.31.77	192.168.31.55	2

Column Width Absolute Timing Show Latest

gNB	AMF	AUSF	UDM
InitialUEMessage - Registration Request	38412		
51002 POST /nausf-auth/v1/ue-authentications	6666	51001 POST /nudm-ueau/v1/suci-0-001-01-000	6666
		51001 200	6666
51002 201		6666	
DownlinkNASTransport - Authentication R...	38412		
UplinkNASTransport - Authentication Res...	38412		
51002 PUT /nausf-auth/v1/ue-authentications/A	6666		
51002 200		6666	
DownlinkNASTransport - Security Mode C...	38412		
UplinkNASTransport - Security Mode Com...	38412	51001 POST /nudm-ueau/v1/imsi-001013012041631	6666
		51001 201	6666
51006 PUT /nudm-uecm/v1/imsi-001013012041631/registrations/amf-3gpp-access	6666		
51006 201		6666	
51006 GET /nudm-sdm/v2/imsi-001013012041631/nssai	6666		
51006 200		6666	
51006 GET /nudm-sdm/v2/imsi-001013012041631/am-data	6666		
51006 200		6666	

```

===== NGAP Layer =====
NGAP-PDU
InitiatingMessage
  ProcedureCode = 15 id-InitialUEMessage
  procedureCriticality = 0 reject(0)
  Value
    InitialUEMessage
      ProtocolIE-Container = 6 Items
      Item = 0
      ProtocolIE-Field
        ProtocolIE-ID = 85 id-RAN-UE-NGAP-ID
        procedureCriticality = 0 reject(0)
        Value
          RAN-UE-NGAP-ID = 2
          Item = 1
          ProtocolIE-Field
            ProtocolIE-ID = 38 id-NAS-PDU
            procedureCriticality = 0 reject(0)
            Value
              NAS-PDU
                NAS PDU Dump = x7E004171000D0100F11000000000
                Item = 2
                ProtocolIE-Field
                  ProtocolIE-ID = 121 id-UserLocationInformation
                  procedureCriticality = 0 reject(0)
                  Value
                    UserLocationInformation
                      userLocationInformationNR (1)
                      nR-CGI =
                      pLMNIdentity = 001
                      MCC = 01
                      MNC = 00000000000000000000000000000000
                      nRCellIdentity =
                      tAI =
                      pLMNIdentity = 001
                      MCC = 01
                      MNC = 0000001
                      tAC =
                      Item = 3
                  ProtocolIE-Field
                    ProtocolIE-ID = 90 id-RRCEstablishmentCause
                    procedureCriticality = 0 reject(0)
  
```

Calls Rate Call Flow Call Summary



Signaling / Audio/ Video QoS Parameters

IDA Packet Data Analyzer - Summary View

File View Call Summary Protocol Configurations GUI Configurations Help

SIP Show All Calls Call Count: 824

Call Summary SIP Registration Summary Alert Summary

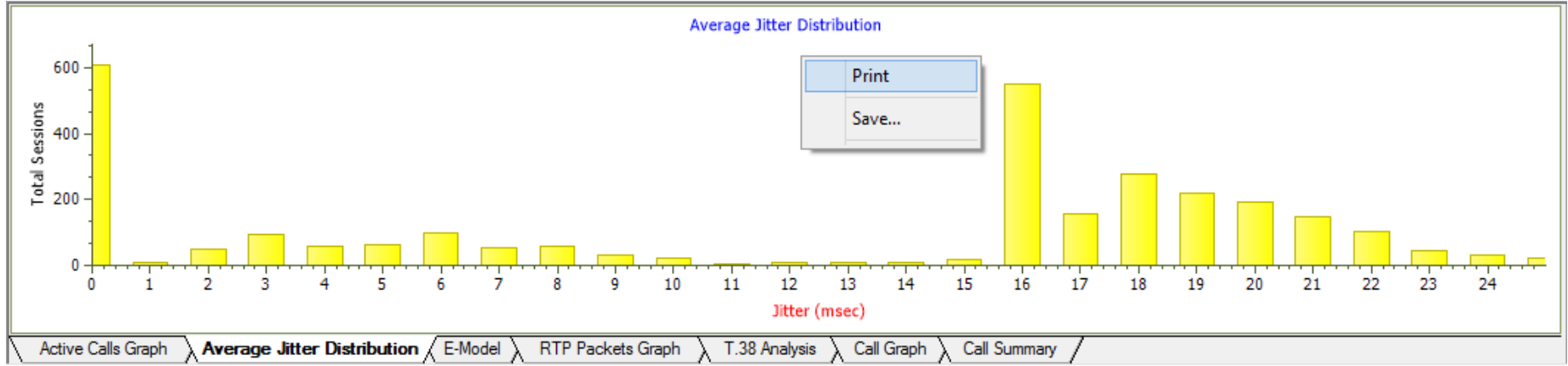
Call #	SSRC	Payload	Packet Received	Conversational MOS/R...	Listening MOS/R...	Latest MOS_Dist	OverAll VoiceQ...	Packets Discard...	Missing Packets...	Duplicate Packets...	Out Of Sequence	Average Gap(ms)	Average Delay	Average Jitter	Average Inter	Cumulative Packet	Max/Min Gap	Max/Min Delay	Max/Min Jitter	Max/Min RTDela...	Average RTDela...	IuupHdr CRC	Iu CI
Call#000001 Caller:0001 Callee:0001 CallId:GL-MAPS-1898-766689277-20836-3688@192.168.12.92 Call StartTime:2023-06-01 15:01:34.419 Call Duration: 00:01:00.023																							
1	42949...	PCMU...	0	0.00 / 0	0.00 / 0	0 / 0 / 0		0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0.00	0.00	0.00	0	0	0.00 / ...	0 / 0	0.00 / ...	0.000 ...	0.000	0 / 0	0
1	42949...	PCMU...	0	0.00 / 0	0.00 / 0	0 / 0 / 0		0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0.00	0.00	0.00	0	0	0.00 / ...	0 / 0	0.00 / ...	0.000 ...	0.000	0 / 0	0
Call#000002 Caller:0002 Callee:0002 CallId:GL-MAPS-1898-766689328-20842-14696@192.168.12.92 Call StartTime:2023-06-01 15:01:34.482 Call Duration: 00:01:00.033																							
2	42949...	MuLA...	0	0.00 / 0	0.00 / 0	0 / 0 / 0		0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0.00	0.00	0.00	0	0	0.00 / ...	0 / 0	0.00 / ...	0.000 ...	0.000	0 / 0	0
2	42949...	MuLA...	0	0.00 / 0	0.00 / 0	0 / 0 / 0		0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0.00	0.00	0.00	0	0	0.00 / ...	0 / 0	0.00 / ...	0.000 ...	0.000	0 / 0	0
Call#000003 Caller:0003 Callee:0003 CallId:GL-MAPS-1898-766689378-20848-13540@192.168.12.92 Call StartTime:2023-06-01 15:01:34.533 Call Duration: 00:01:00.045																							
3	42949...	PCMA...	0	0.00 / 0	0.00 / 0	0 / 0 / 0		0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0.00	0.00	0.00	0	0	0.00 / ...	0 / 0	0.00 / ...	0.000 ...	0.000	0 / 0	0

Signaling Parameters	Value	Audio Parameters	Value	Video Parameters	Value
Caller	0001	Src RTP Channel	192.168.12.92: 1026	Src Video Channel	
Callee	0001	Src Media Type	PCMU/8000	Src Media Type	
CallId	GL-MAPS-1898-766...	Src SSRC	4294967295	Src SSrc	
Call Status	Terminated	Src Packets Count	0	Src Packets Count	
Call Initiated Time	2023-06-01 15:01:3...	Src Missing Packets / (%)	0 / 0.00	Src Missing Packets / (%)	
Call Established Time	2023-06-01 15:01:3...	Src Duplicate Packets / (%)	0 / 0.00	Src Duplicate Packets / (%)	
Call Stop Time	2023-06-01 15:02:3...	Src Out of Sequence Packets / (%)	0 / 0.00	Src Out of Sequence Packets / (%)	
Call Duration	00:01:00.023	Src Conversational MOS/R-Factor	0.00 / 0	Src Video Frame count	
Call Terminator	Callee	Src Listening MOS/R-Factor	0.00 / 0	Src Frame Rate(Frames/sec)	
Call Failure Reason		Src GoodCMos/FairCMos/PoorCMos (Seconds)	0 / 0 / 0	Src AvgDelay	
Session Request Delay (msec)	29.972	Src Voice Quality		Src AvgGap	
Session Disconnect Delay (msec)	9.886	Src Discarded Packets / (%)	0 / 0.00	Src MDI (DF:MLR)	
Post Pickup Delay (msec)	00.00	Src Average Inter Arrival Jitter (RTCP)	0	Src AvgMDI(DF:MLR)	
Total Signaling Frames	7	Src Average Jitter	0.00	Dest Video Channel	
Call Type		Src Average Delay	0.00	Dest Media Type	
SubCallType		Src Average Gap	0.00	Dest SSrc	
PTTCount	0	Dest RTP Channel	192.168.12.94: 1026	Dest Packets Count	
SquelchCount	0	Dest Media Type	PCMU/8000	Dest Missing Packets / (%)	
PTTMCount	0	Dest SSRC	4294967295	Dest Duplicate Packets / (%)	
PTTSCount	0	Dest Packets Count	0	Dest Out of Sequence Packets / (%)	
PPSCTCount	0	Dest Missing Packets / (%)	0 / 0.00	Dest Video Frame count	
		Dest Duplicate Packets / (%)	0 / 0.00	Dest Frame Rate(Frames/sec)	
		Dest Out of Sequence Packets / (%)	0 / 0.00	Dest AvgDelay	
		Dest Conversational MOS/R-Factor	0.00 / 0	Dest AvgGap	

Average Jitter Distribution E-Model T.38 Analysis Call Flow Call Summary

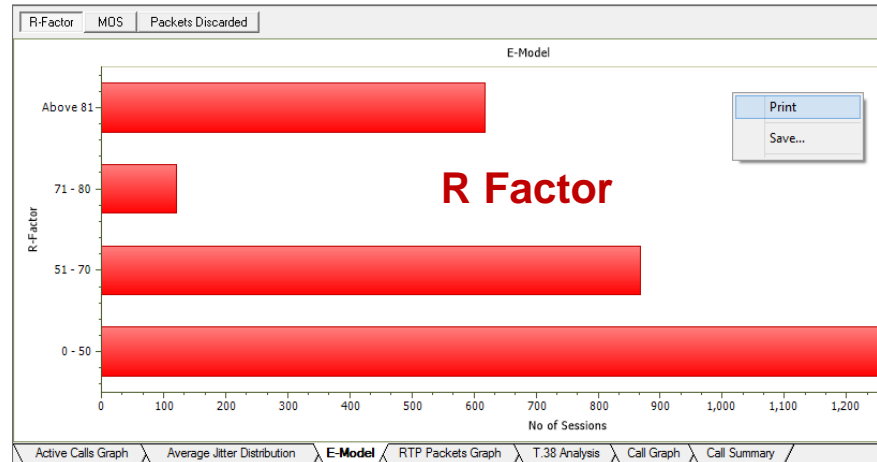
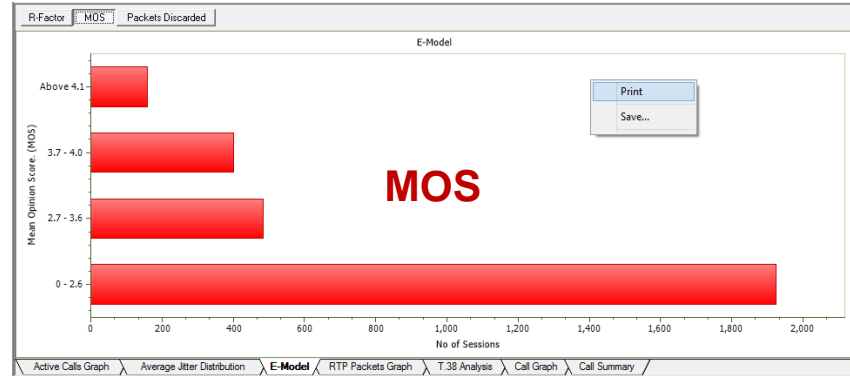
Average Jitter Distribution Graph

- Distribution of the Average Jitter values across Total Sessions

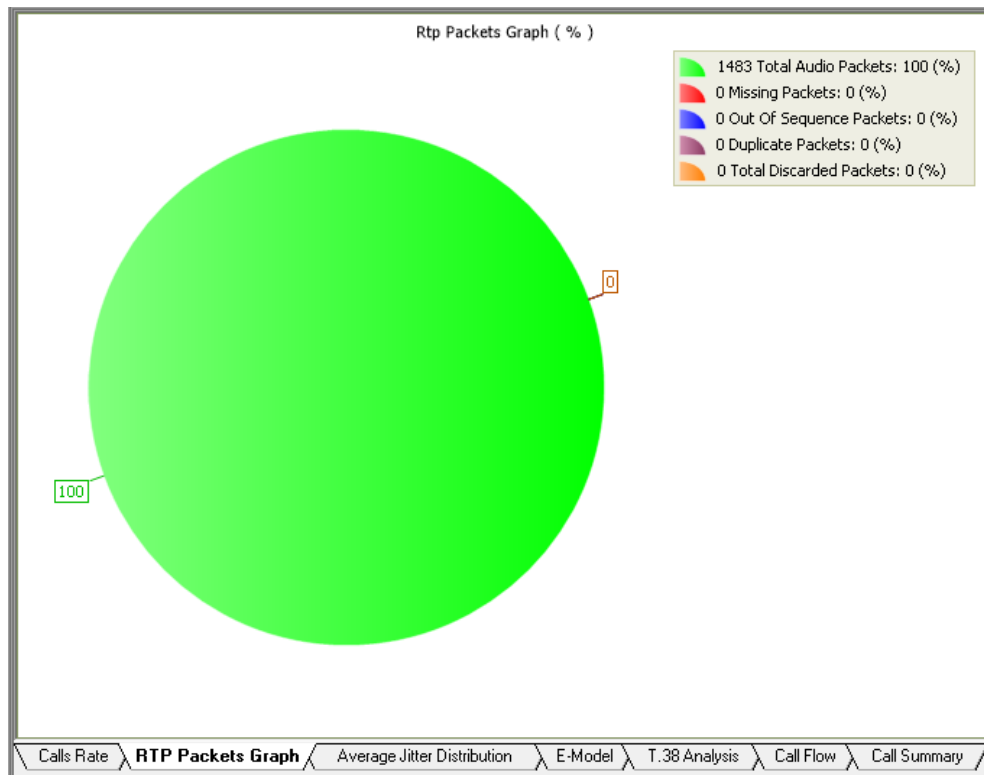


MOS Graph and R-Factor Graph

- E-Model 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 across No. of Sessions
 - Packets Discarded – A bar graph that plots Packets Discarded across No. of Sessions



RTP Packets Graph



- RTP Packets graph plots and compares out of ordered packets, missing packets and duplicate packets against Total Audio Packets

T.38 Analysis - Fax over IP

- Supports capturing and decoding of Fax (T.38 data) calls over VoIP
- Decodes of selected FAX message is displayed on the right pane
- Captured fax calls by PacketScan™ can also be analyzed using GLInsight™ by saving the fax calls directly in (*.PCAP) Ethereal file format

The screenshot displays the Packet Data Analyzer - Summary View interface. The 'Show Fax Calls' button is highlighted in the toolbar. The call summary table shows a single call with source IP 390089559 and destination IP 93. The packet list shows several frames, with the frame at timestamp 00.27.343... (Ffm:1419)Msg:no-signal selected. The protocol tree on the right shows the T.38 Layer details, including fields like seq-number, Contents, primary-ifp-packet, Length, and IPFPacket. A blue arrow points from the selected frame in the packet list to the T.38 Layer details in the protocol tree, with the text 'Displays decoded information of the selected FAX message'.

Call #	Src_L	ConversationalMos_L	ConversationalR_L	ListeningMos_L	ListeningR_L	PacketsDiscarded_L	PacketsDiscarded(%)_L
1	390089559	4.20	93	4.20	93	0	0.00

TimeStamp	192.168.1.244	192.168.1.60	
00.17.274...	5004	(Ffm:1409)Msg:no-signal	5004
00.17.274...	5004	(Ffm:1410)Msg:no-signal	5004
00.17.275...	5004	(Ffm:1411)Msg:no-signal	5004
00.27.343...	5004	(Ffm:1419)Msg:no-signal	5004
00.27.343...	5004	(Ffm:1419)Msg:ced	5004
00.30.538...	5004	(Ffm:1420)Msg:v21-preamble	5004
00.31.580...	5004	(Ffm:1421)Msg:NSF	5004
00.31.955...	5004	(Ffm:1422)Msg:CSI NUM 918040468401et	5004
00.32.648...	5004	(Ffm:1440)Msg:DIS.DSR.ITU-T V.27 ter and V.29	5004
00.33.110...	5004	(Ffm:1451)Msg:no-signal	5004
00.39.617...	5004	(Ffm:1561)Msg:v21-preamble	5004
00.40.659...	5004	(Ffm:1563)Msg:CFR	5004
00.40.834...	5004	(Ffm:1566)Msg:no-signal	5004
01.11.404...	5004	(Ffm:2368)Msg:v21-preamble	5004

```
===== T.38 Layer =====
UDFPLPacket = SEQUENCE
seq-number = INTEGER
Contents = 3
primary-ifp-packet = Open Type
Length = 1
IPFPacket = SEQUENCE
Preamble = 0
type-of-msg = CHOICE
Choice Index = 0
t30-indicator = ENUMERATOR
Extensibility Marker = 0
Contents = 0 no-signal(0)
error-recovery = CHOICE
Choice Index = 0
secondary-ifp-packets = SEQUENCE OF
Iteration Count = 1
secondary-ifp-packets = Instance 0
primary-ifp-packet = Open Type
Length = 1
IPFPacket = SEQUENCE
Preamble = 0
type-of-msg = CHOICE
Choice Index = 0
t30-indicator = ENUMERATOR
Extensibility Marker = 0
Contents = 0 no-signal(0)
===== MAC Layer =====
Padding octets = x401188E4C0A8
FCS = x013CCA38 (Invalid FCS. Correct FCS is xA72500)
```

Displays decoded information of the selected FAX message

Call Detail View

- Provides a detail look at the two (or one) RTP sessions that are part of a single call
- Left and right panes accommodate the two sessions

Packet Data Analyzer - Detail View

File View Detail View Protocol Configurations GUI Configurations Help

SIP Show All Sessions

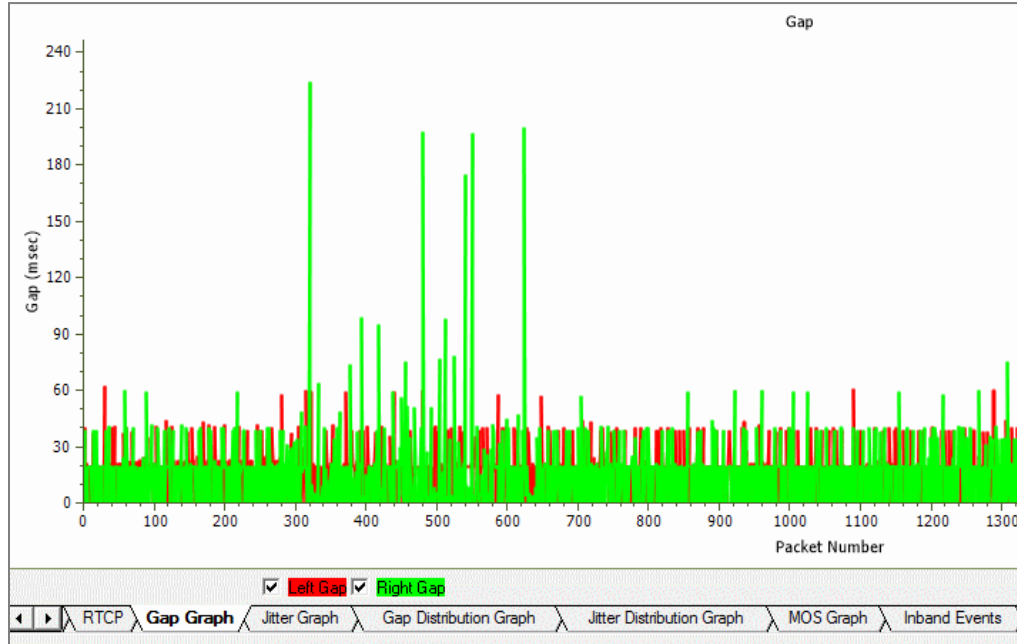
Call Summary Registrator Summary Alert Summary

Packet #	Sequen...	RTP ...	Payload Type	Payload...	Packet Sequ...	Gap(ms)	Gap...	Delay	Jitter	Packet #	Sequen...	RTP ...	Payload Type	Payload...	Packet Sequ...	Gap(ms)	Gap...	Delay	Jitter
M 5	41763	4325...	PCMU/8000	160	Session In Pr...	0.00	0.00	0	0.00	M 9	47038	3301...	PCMU/8000	160	Session In Pr...	0.00	0.00	0	0.00
6	41764	4325...	PCMU/8000	160	Session In Pr...	20.06	20.00	0	0.00	11	47039	3301...	PCMU/8000	160	Session In Pr...	18.81	20.00	-1	0.08
7	41765	4325...	PCMU/8000	160	In Sequence	19.53	20.00	0	0.03	13	47040	3301...	PCMU/8000	160	In Sequence	20.50	20.00	0	0.10
8	41766	4325...	PCMU/8000	160	In Sequence	19.52	20.00	0	0.06	15	47041	3301...	PCMU/8000	160	In Sequence	19.53	20.00	0	0.13
10	41767	4325...	PCMU/8000	160	In Sequence	21.50	20.00	1	0.14	17	47042	3301...	PCMU/8000	160	In Sequence	21.49	20.00	1	0.21
12	41768	4325...	PCMU/8000	160	In Sequence	19.53	20.00	0	0.17	19	47043	3301...	PCMU/8000	160	In Sequence	19.52	20.00	0	0.23
14	41769	4325...	PCMU/8000	160	In Sequence	19.53	20.00	0	0.19	21	47044	3301...	PCMU/8000	160	In Sequence	19.59	20.00	0	0.24
16	41770	4325...	PCMU/8000	160	In Sequence	20.49	20.00	0	0.20	23	47045	3301...	PCMU/8000	160	In Sequence	19.47	20.00	0	0.27
18	41771	4325...	PCMU/8000	160	In Sequence	19.57	20.00	0	0.22	25	47046	3301...	PCMU/8000	160	In Sequence	20.51	20.00	0	0.28
20	41772	4325...	PCMU/8000	160	In Sequence	20.51	20.00	0	0.23	27	47047	3301...	PCMU/8000	160	In Sequence	19.53	20.00	0	0.29
22	41773	4325...	PCMU/8000	160	In Sequence	19.52	20.00	0	0.25	29	47048	3301...	PCMU/8000	160	In Sequence	20.55	20.00	0	0.31
24	41774	4325...	PCMU/8000	160	In Sequence	20.75	20.00	0	0.28	31	47049	3301...	PCMU/8000	160	In Sequence	19.48	20.00	0	0.33
26	41775	4325...	PCMU/8000	160	In Sequence	19.31	20.00	0	0.31	33	47050	3301...	PCMU/8000	160	In Sequence	20.51	20.00	0	0.34
28	41776	4325...	PCMU/8000	160	In Sequence	19.50	20.00	0	0.32	35	47051	3301...	PCMU/8000	160	In Sequence	19.53	20.00	0	0.35

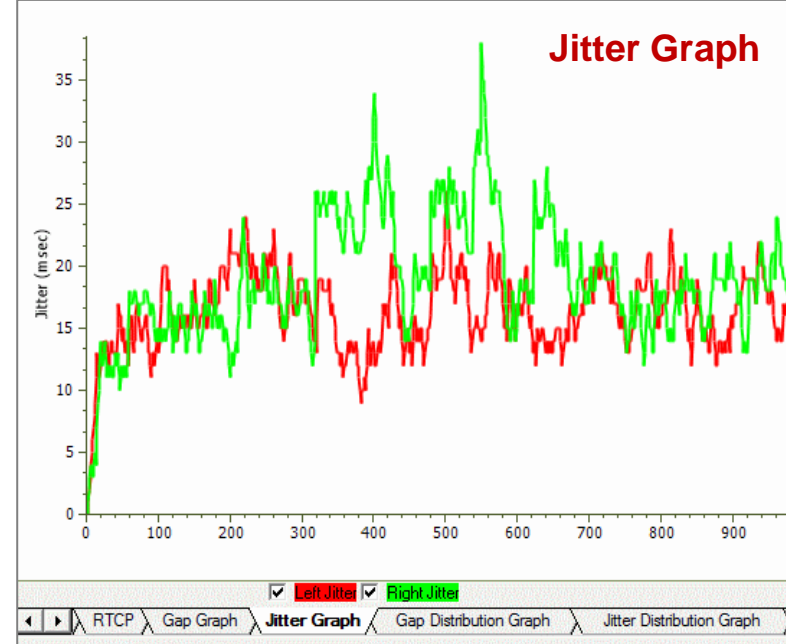
Heading	Value	Heading	Value
SSRC	3365468417	SSRC	3380545537
Source IP Address	192.168.1.200	Source IP Address	192.168.1.103
Destination IP Address	192.168.1.103	Destination IP Address	192.168.1.200
Source Port	1024	Source Port	1024
Destination Port	1024	Destination Port	1024
RTP Packets Count	1271	RTP Packets Count	1268
RTP Packets Count	2	RTP Packets Count	1
Packets With Marker Bit	1	Packets With Marker Bit	1
Total Audio Bytes	203201	Total Audio Bytes	202721
RTCP Sender's Reports	2	RTCP Sender's Reports	1
RTCP Receiver's Reports	0	RTCP Receiver's Reports	0
Out Of Sequence Packets %	0 \ 0.00	Out Of Sequence Packets %	0 \ 0.00
Missing Packets %	0 \ 0.00	Missing Packets %	0 \ 0.00
Duplicate Packets %	0 \ 0.00	Duplicate Packets %	0 \ 0.00
MOS-CQ \ Conversational R	4.20 \ 93	MOS-CQ \ Conversational R	4.20 \ 93
MOS-LQ \ Listening R	4.20 \ 93	MOS-LQ \ Listening R	4.20 \ 93
G.107 R	92	G.107 R	92
Nominal MOS \ Nominal R	4.20 \ 93	Nominal MOS \ Nominal R	4.20 \ 93

RTP Statistics RTCP Gap Graph Jitter Graph Gap Distribution Graph Jitter Distribution Graph MOS Graph Inband Events RTP Events Wave Graph Spectral Display R-Factor Statistics

Gap and Jitter Graph

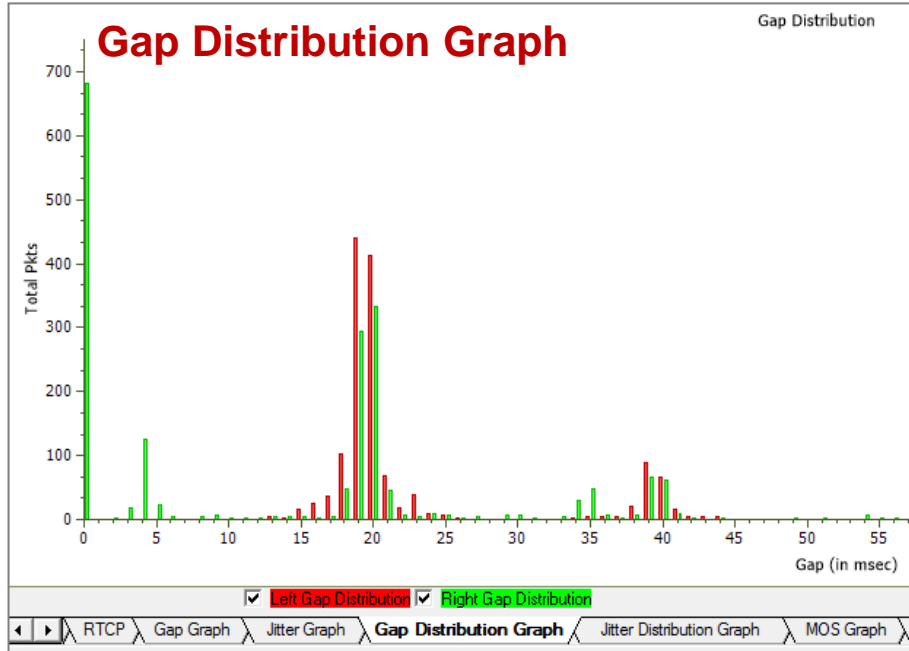


- Gap graph plots the Gap (in milliseconds) versus the packet number

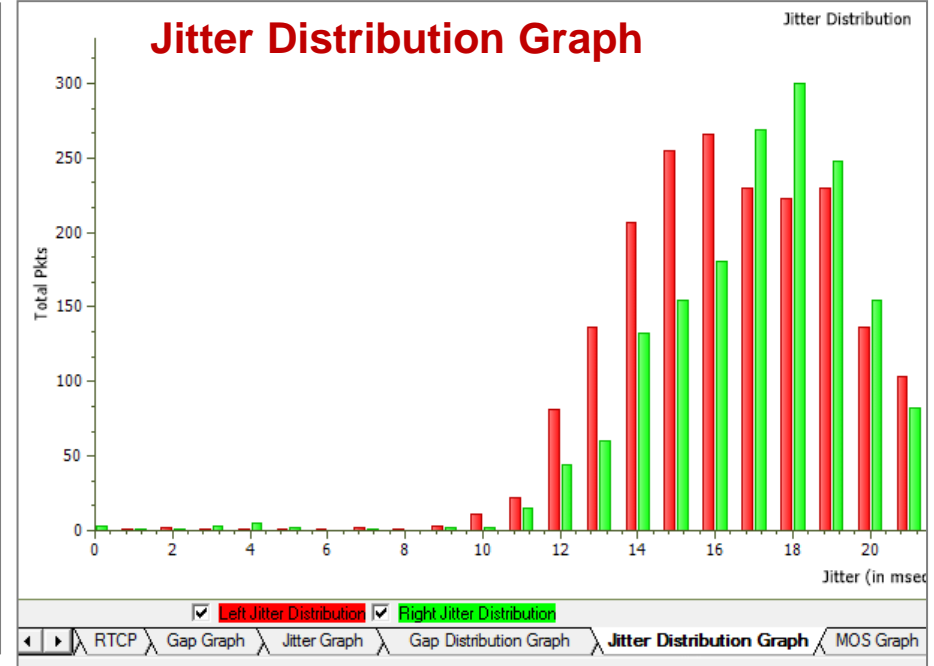


- Jitter graph plots the Jitter versus the packet number

Gap and Jitter Distribution Graph



- Number of packets with a particular value of gap is plotted against the (gap) value



- Number of packets with a particular value of jitter is plotted against the jitter value

MOS Graph



- MOS Graph plots Mean Opinion Score values throughout the duration of the call

Inband and Outband (RTP) Events

TimeStamp	Type	Event	On(ms)	Power(dBm)	Freq1(Hz)/Pow...	Freq2(Hz)/Pow...
00:00:00.000	IDLE		45470	0.00		
00:00:45.470	DTMF	1	80	-1.89	698/-6.01	1210/-4.01
00:00:45.550	IDLE		80	0.00		
00:00:45.630	DTMF	2	80	-1.87	698/-6.00	1337/-3.99
00:00:45.710	IDLE		80	0.00		
00:00:45.790	DTMF	3	80	-1.85	698/-5.98	1470/-3.99
00:00:45.870	IDLE		80	0.00		
00:00:45.950	DTMF	4	80	-1.86	771/-5.98	1210/-4.01
00:00:46.030	IDLE		80	0.00		
00:00:46.110	DTMF	5	80	-1.86	771/-5.98	1337/-3.99
00:00:46.190	IDLE		80	0.00		
00:00:46.270	DTMF	6	80	-1.87	771/-5.99	1470/-3.99
00:00:46.350	IDLE		80	0.00		
00:00:46.430	DTMF	7	80	-1.86	853/-5.98	1210/-4.01
00:00:46.509	IDLE		80	0.00		
00:00:46.590	DTMF	8	80	-1.89	853/-6.01	1337/-3.99
00:00:46.670	IDLE		80	0.00		

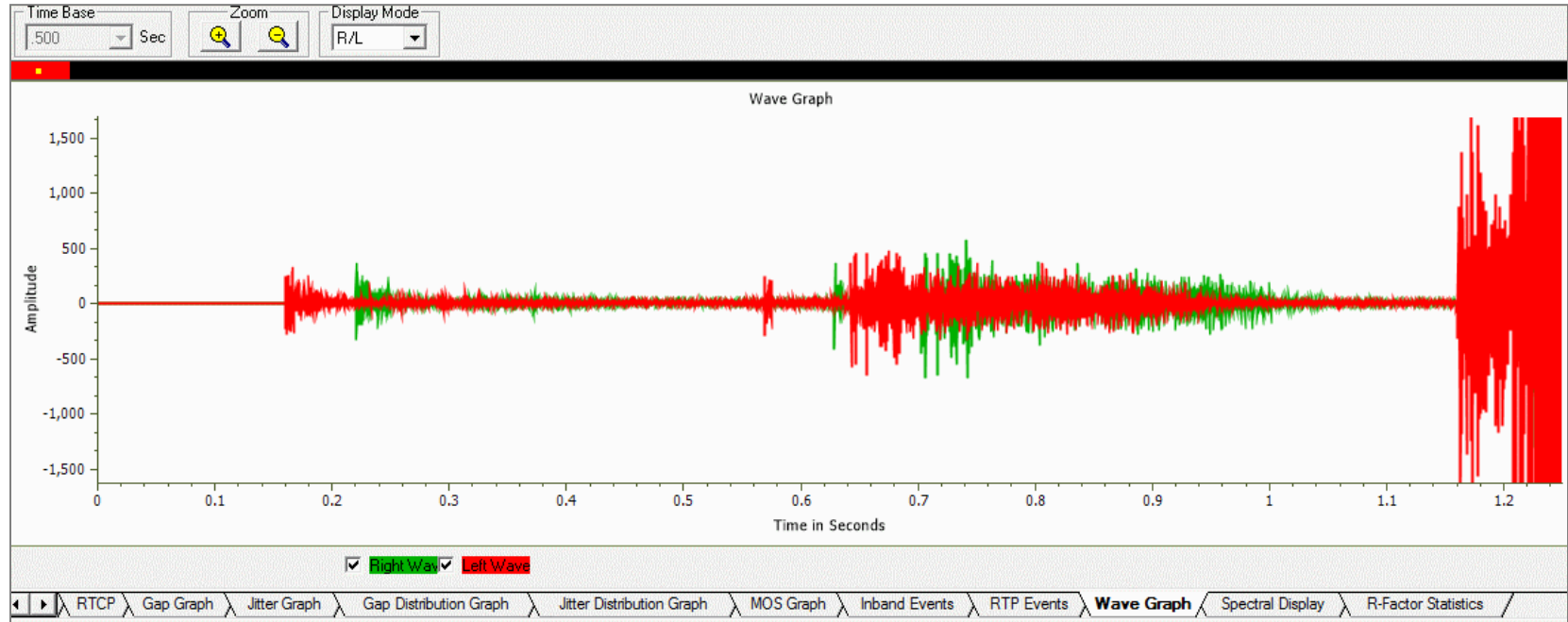
TimeStamp	Event	Volume (-dBm)	Duration (ms)
12:09:02.652	DTMF 1	6	80
12:09:02.812	DTMF 2	6	80
12:09:02.971	DTMF 3	6	80
12:09:03.132	DTMF 4	6	80
12:09:03.292	DTMF 5	6	80
12:09:03.452	DTMF 6	6	80
12:09:03.612	DTMF 7	6	80
12:09:03.772	DTMF 8	6	80
12:09:03.931	DTMF 9	6	80
12:09:04.092	DTMF 0	6	80
12:09:04.252	DTMF A	6	80
12:09:04.412	DTMF B	6	80
12:09:04.572	DTMF C	6	80
12:09:04.732	DTMF D	6	80
12:09:04.891	DTMF #	6	80
12:09:36.324	MF 1	6	80

Inband Events | RTP Events | Wave Graph | Spectral Display | R-Factor

RTP Events | Wave Graph | Spectral Display | R-Factor Statistics

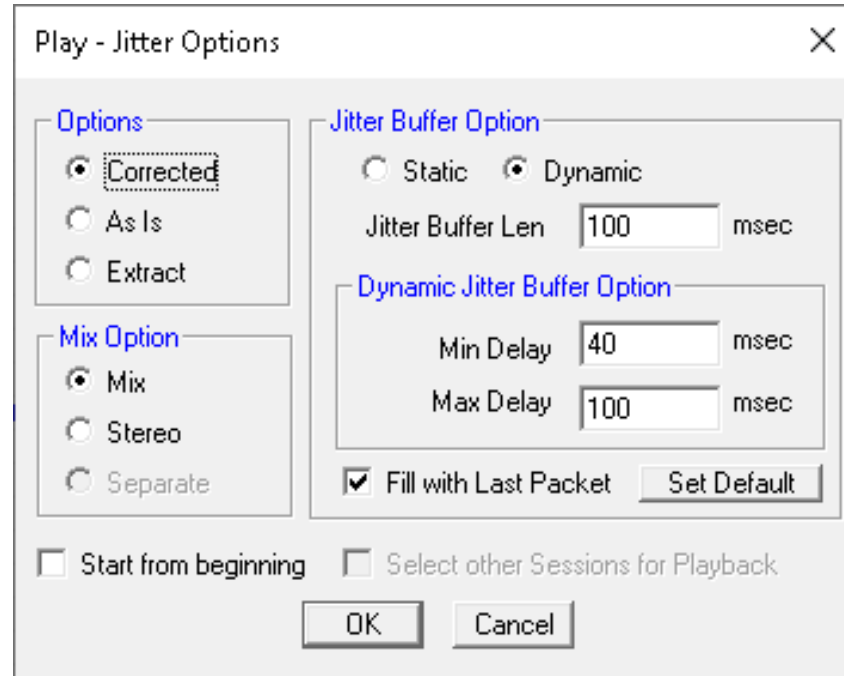
- Inband Event tab displays Inband DTMF and MF digits as they are received on selected RTP stream
- Outband (RTP) Events tab displays all Outband RTP events defined in RFC 2833 or RFC 4733

Wave and Spectral Graphs



- 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

Play Audio



- Plays the RTP streams of a call to the PC speaker using a soundcard
- Provides a host of options such as jitter buffer settings, audio mixing, and so on to play a live call in real-time or play captured voice files

Write to File

- Various options are provided to save captured calls
- Use the files with voice quality analysis software to calculate the mean opinion score of the call
- Records the RTP stream to a file in *.wav format

Write To File - Jitter Options

Options

Corrected
 As Is
 Extract

Mix Option

Mix
 Stereo
 Separate

Jitter Buffer Option

Static Dynamic
Jitter Buffer Len msec

Dynamic Jitter Buffer Option

Min Delay msec
Max Delay msec

Fill with Last Packet

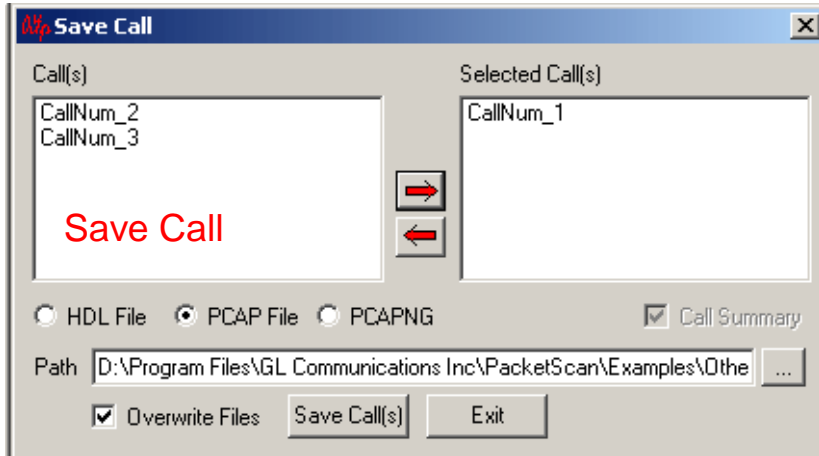
Start from beginning

File Record

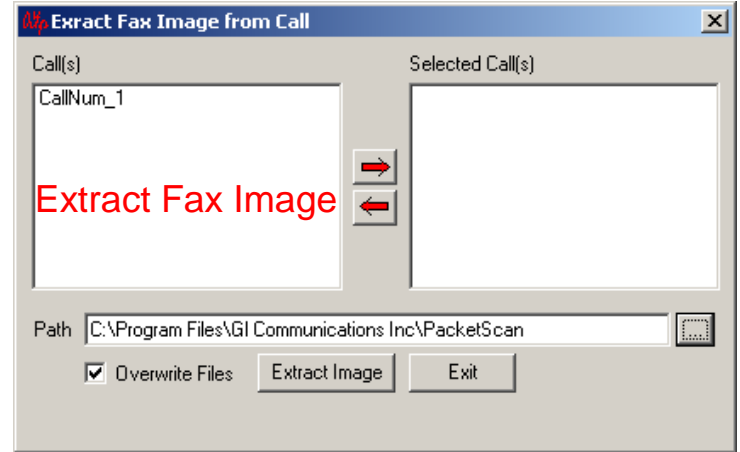
Use SSRC for File Name

C:\Program Files\GL Communications Inc\PacketScan\Sample...

Save Call and Extract Fax Image

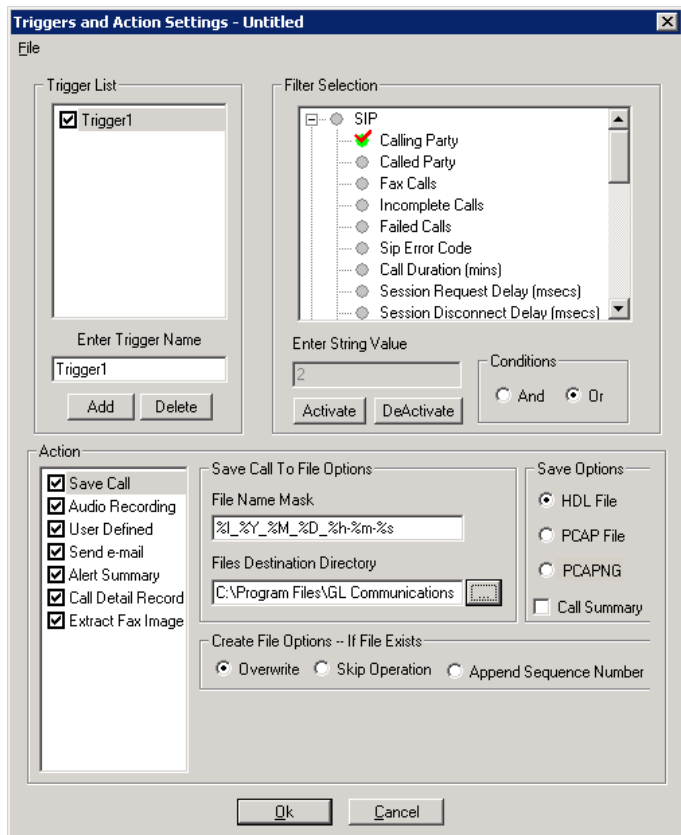


- Saves a particular call in either GL's proprietary HDL file format or Ethernet PCAP file format or PCAPNG file format
- Saves the Call Summary details including signaling and audio / fax/ video parameters for a particular call in *.rtf file
- Helps in getting data from real-time traffic locations to the lab for detailed analysis



- Extracts Fax image in the TIFF format from the selected fax call

Trigger and Action Settings



- Set the triggers and actions criteria to filter calls and perform additional actions on the completed calls
- Trigger actions on certain SIP, RTP, MEGACO, and H.323 parameters
- Triggering factors includes calling number, called number, incomplete calls, fax calls, call duration, MOS factor, sip error code, average jitter, and more
- Actions include
 - Saving call to a file `-.hdl`, `*.pcap`, or `*.pcapng`
 - Recording audio to a file
 - Sending an email alert
 - Generates alerts when particular vital parameters go beyond a specified value
 - Outputs call detail records as CSV
 - Extract Fax in Tiff format

Call Detail Records (CSV)

- Creates three types of Comma Separated Value (CSV) files such as Call Side Record, Call Master Record, and Call Events Record
 - **Call Side Record:** It is a record concerning each party participating in the call. For example: Probe ID, Call ID, Side, Address, File Name, SSRC, Codec, Total Packets, and so on
 - **Call Master Record:** It contains fields concerning the call, For example: Probe ID, CALL ID, Side 1, Side 2, Protocol name, Start & Released dated and time, and so on
 - **Call Event Record:** It gives an event-by-event account of the call. For example: Probe ID, Call ID, Side, Class ID, Start, Duration, Source IP address, Destination IP Address, and so on
- Use Sub Folders option to automatically create the subfolders after some time duration

Action

- Save Call
- Audio Recording
- User Defined
- Send e-mail
- Alert Summary
- Call Detail Record
- Extract Fax Image

Call Side Record Probe Name

Call Master Record

Call Events Record

CSV Files Destination Directory

...

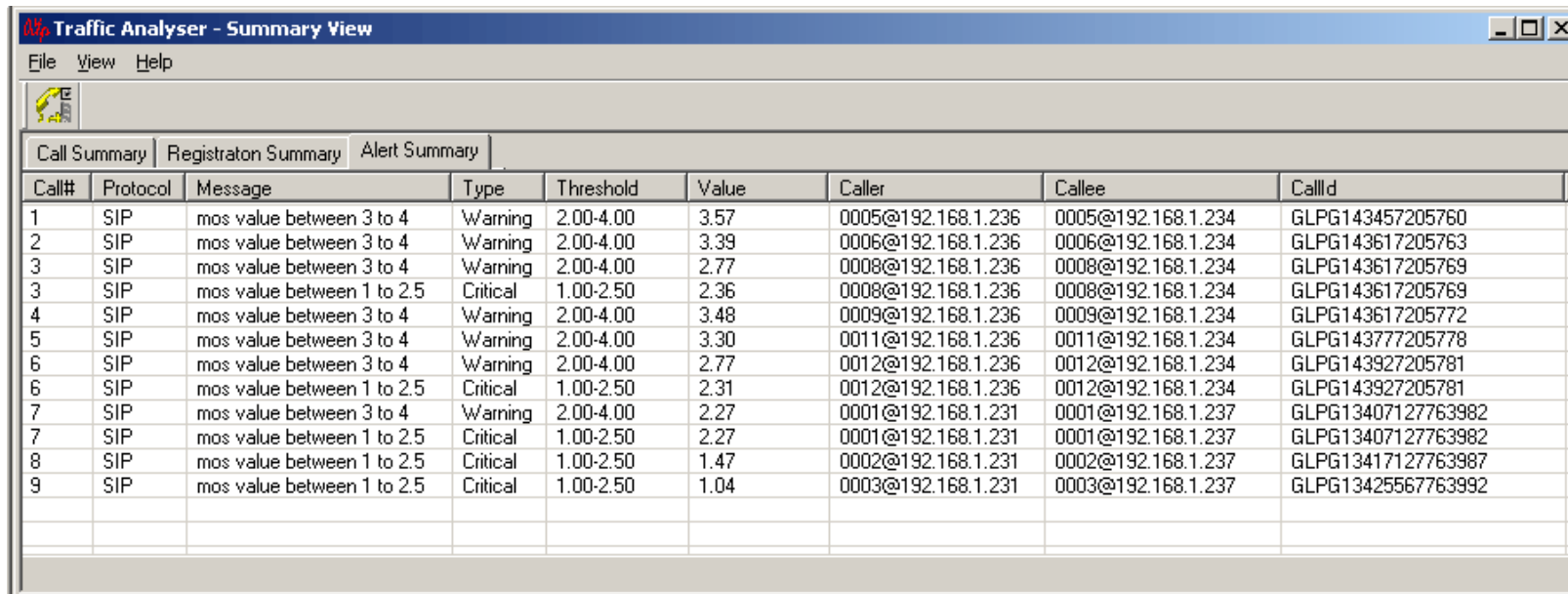
Use Sub Folders

Folder Prefix Create Subfolder Every hr

Create File Options -- If File Exists

Overwrite Skip Operation Append Sequence Number

Alert Summary

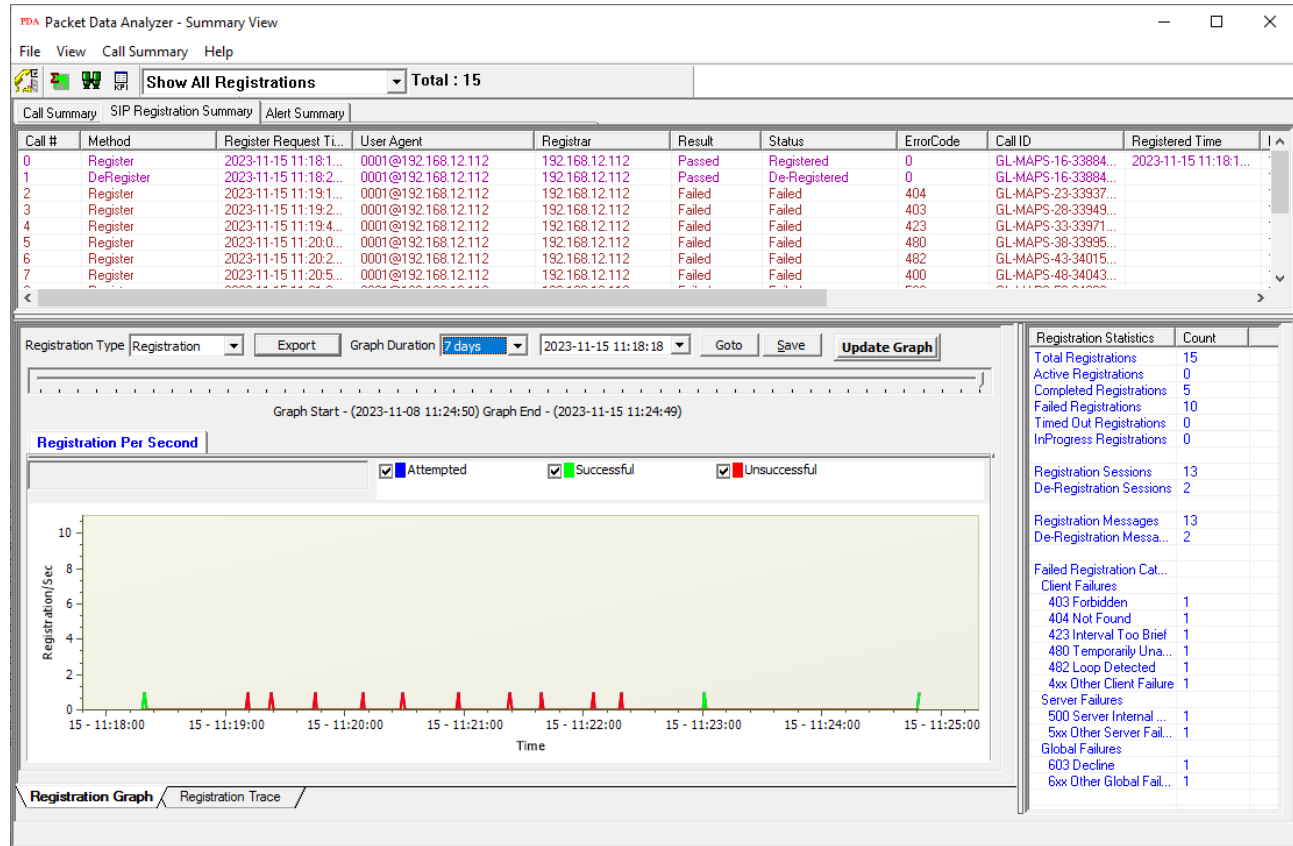


The screenshot shows a software window titled "Traffic Analyser - Summary View" with a menu bar (File, View, Help) and a toolbar. Below the toolbar are three tabs: "Call Summary", "Registraton Summary", and "Alert Summary". The "Alert Summary" tab is active, displaying a table with the following columns: Call#, Protocol, Message, Type, Threshold, Value, Caller, Callee, and Callid. The table contains 9 rows of alert data.

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	GLPG14377205778
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

- Generates alerts when vital parameters go beyond a specified value
- Provides an active list of the alerts for the events in a tabular column
- Displays the summary of call#, user-defined message, threshold value, actual value for which the alert occurred, callee, caller, and callid

Registration Summary



- Displays the SIP registration information in a tabular format which includes user agent, registrar, registered time, status, and so on for each user agent
- Displays the active registration graph of the entire registration summary
- Provides the trace display of each registration

Registration Trace

- Displays the message sequence of registered calls. Message sequence pictorially displays the messages exchanged for a particular scenario between a user agent and the registrar

Packet Data Analyzer - Summary View

File View Call Summary Help

Show All Registrations Call Count: 179100

Call Summary SIP Registration Summary Alert Summary

Call#	Method	RegisterRequestTime	UserAgent	Registrar	Result	Status	ErrorCode	CallID	RegisteredTime	Requests	Responses	Exp
0	Register	2023-11-15 18:49:0...	001013012041632	ims.mnc001.mcc00...	Passed	Registered	0	GL-MAPS-27303-29...	2023-11-15 18:49:0...	2	2	360
1	Register	2023-11-15 18:49:0...	001013012041638	ims.mnc001.mcc00...	Passed	Registered	0	GL-MAPS-27309-29...	2023-11-15 18:49:0...	2	2	360
2	Register	2023-11-15 18:49:0...	001013012041631	ims.mnc001.mcc00...	Passed	Registered	0	GL-MAPS-27293-29...	2023-11-15 18:49:0...	2	2	360
3	Register	2023-11-15 18:49:0...	001013012041633	ims.mnc001.mcc00...	Passed	Registered	0	GL-MAPS-27273-29...	2023-11-15 18:49:0...	2	2	360
4	Register	2023-11-15 18:49:0...	001013012041636	ims.mnc001.mcc00...	Passed	Registered	0	GL-MAPS-27352-29...	2023-11-15 18:49:0...	2	2	360
5	Register	2023-11-15 18:49:0...	001013012041634	ims.mnc001.mcc00...	Passed	Registered	0	GL-MAPS-27296-29...	2023-11-15 18:49:0...	2	2	360
6	Register	2023-11-15 18:49:0...	001013012041639	ims.mnc001.mcc00...	Passed	Registered	0	GL-MAPS-27278-29...	2023-11-15 18:49:0...	2	2	360
7	Register	2023-11-15 18:49:0...	001013012041637	ims.mnc001.mcc00...	Passed	Registered	0	GL-MAPS-27298-29...	2023-11-15 18:49:0...	2	2	360

Column Width Absolute Timing Show Latest

Time	Frame#	192.168.191.1	192.168.12.18
00:00:00.000	5781	5060	5060
		REGISTER	
00:00:00.134	5864	5060	5060
		SIP/2.0 401 Unauthorized	
00:00:00.145	5872	5060	5060
		REGISTER	
00:00:00.167	5942	5060	5060
		SIP/2.0 200 OK	

Find Complete Stack

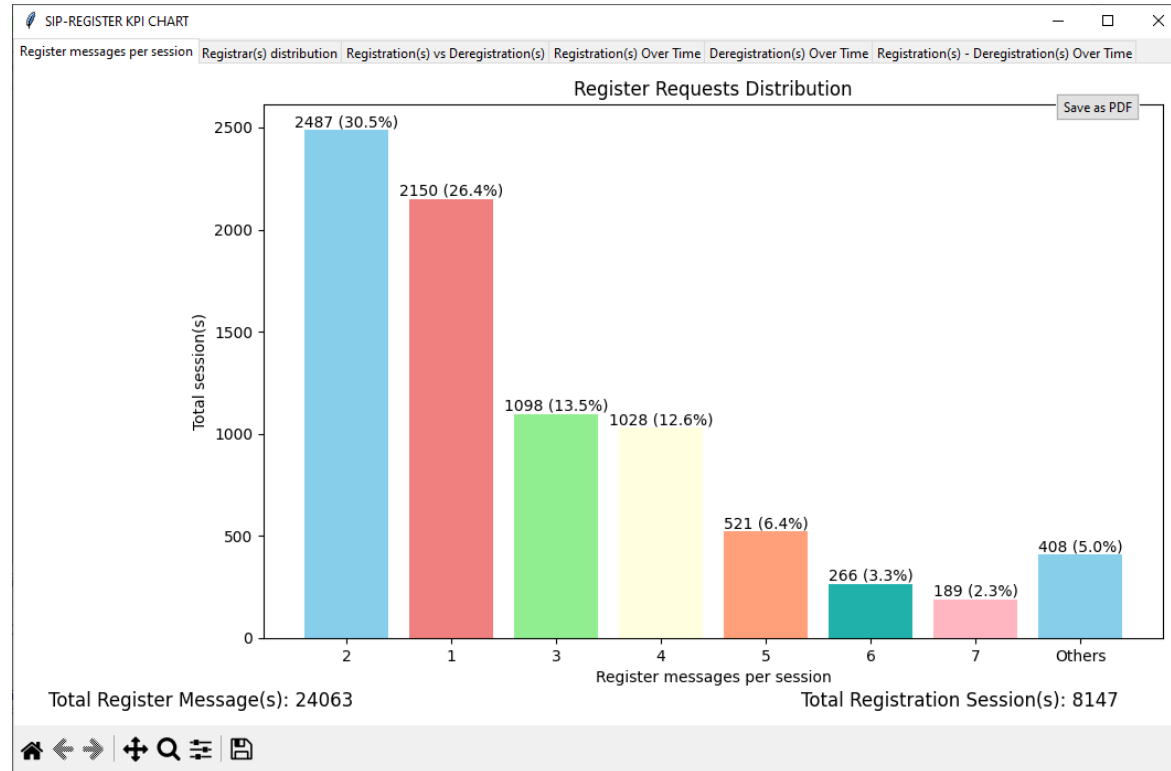
```

===== SIP Layer =====
REGISTER sip:ims.mnc001.mcc001.3gppnetwork.org SIP/2.0
Via: SIP/2.0/UDP 192.168.191.1:5060;branch=z9hG4bK-27306-29450043-189206-8912
Max-Forwards: 70
Allow: INVITE, BYE, CANCEL, ACK, INFO, PRACK, COMET, OPTIONS, SUBSCRIBE, NOTIFY, REGISTER, UPDATE
From: <sip:001013012041632@ims.mnc001.mcc001.3gppnetwork.org>;tag=FromTag-27304-2945000
To: <sip:001013012041632@ims.mnc001.mcc001.3gppnetwork.org>
Call-ID: GL-MAPS-27303-29450009-189203-8912@192.168.191.1
CSeq: 1 REGISTER
Supported: path, sec-agree
Authorization: Digest username="001013012041632@ims.mnc001.mcc001.3gppnetwork.org", realm=
Expires: 30
Contact: <sip:001013012041632@192.168.191.1>;+g.3gpp.smsip
P-Preferred-Identity: 001013012041632 <sip:001013012041632@ims.mnc001.mcc001.3gppnetwork.org>
P-Access-Network-Info: 3GPP-NR-TDD; utran-cell-id-3gpp=00101000001000000001
Privacy: None
Content-Length: 0
    
```

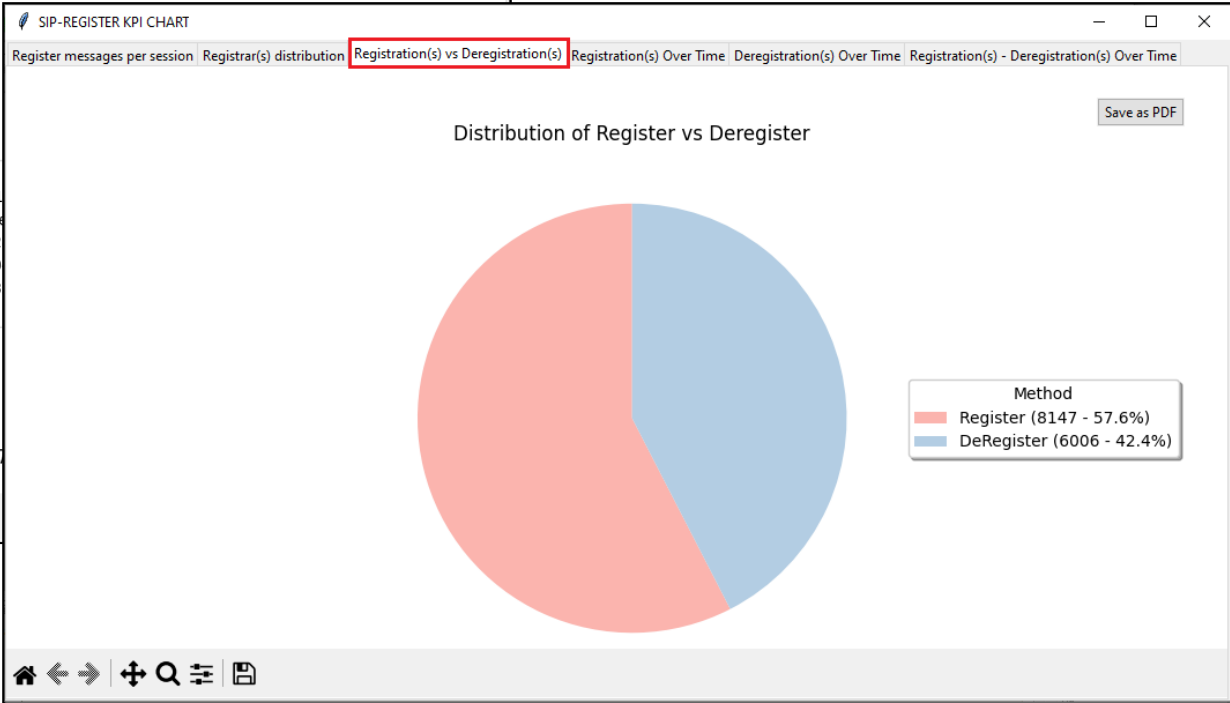
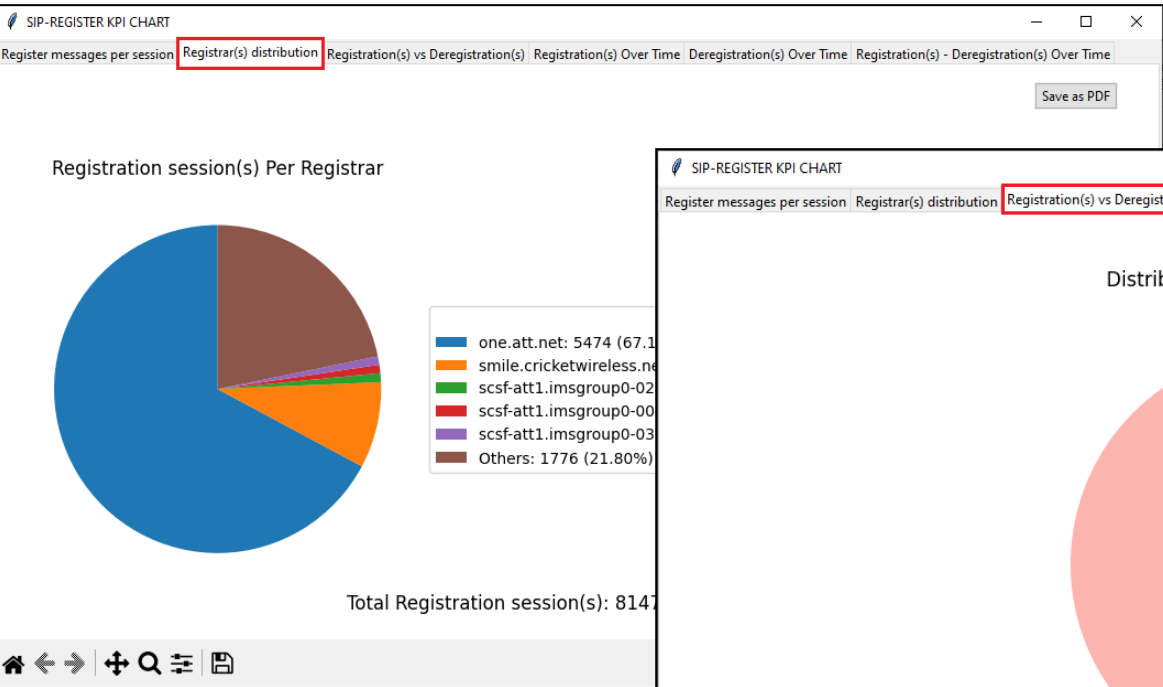
Registration Graph Registration Trace

KPI Report (Registration)

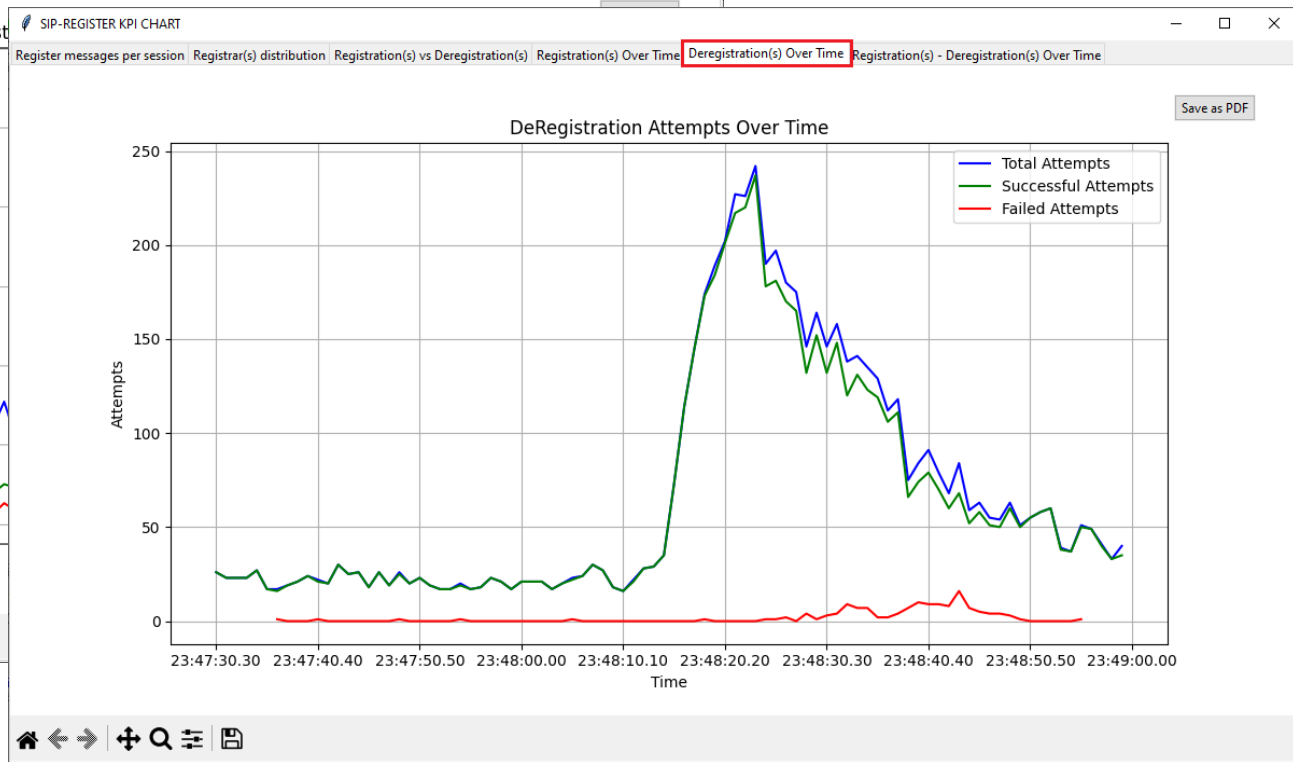
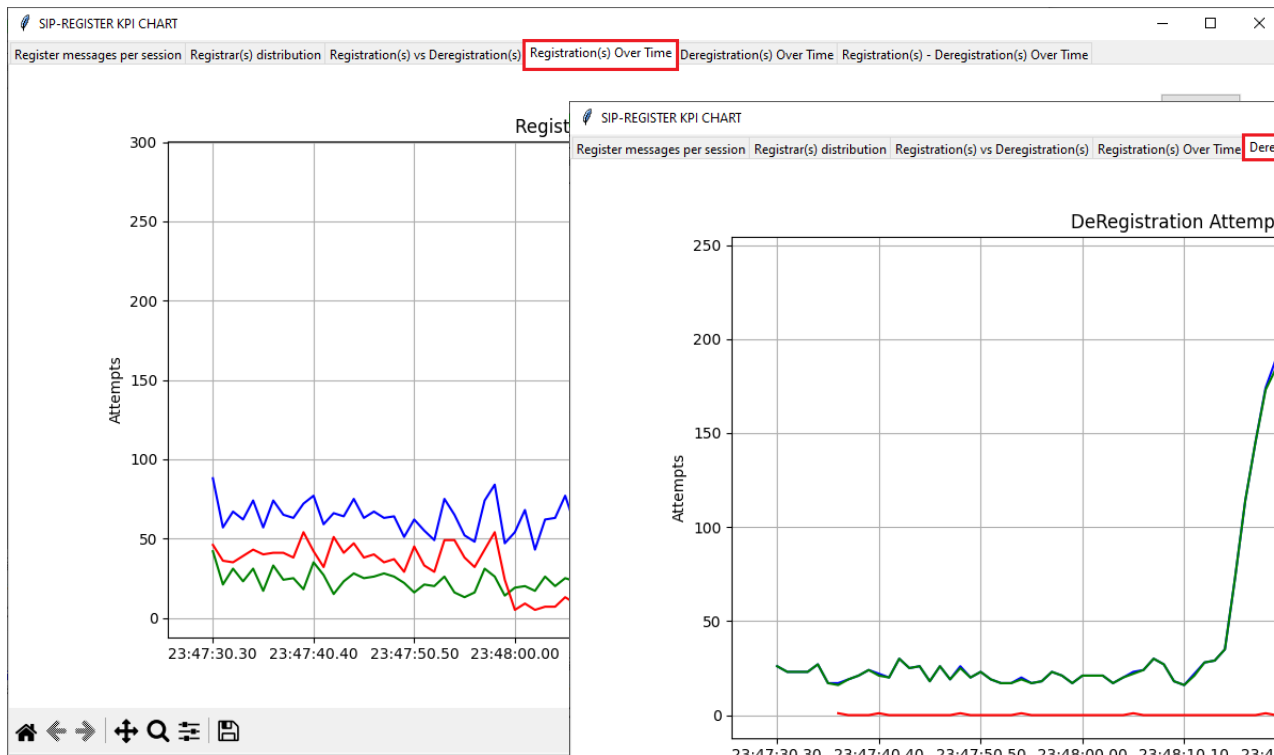
- The SIP Registration Summary KPI Report includes KPIs for the following:
- **Register Messages per Session:** Shows a graph for the distribution of Register Requests
- **Registrar(s) Distribution:** Displays a graph for the number of Registration sessions per Registrar
- **Registration(s) vs Deregistration(s):** Illustrates a graph comparing the distribution of Register and Deregister counts with percentages (%)
- **Registration(s) Over Time:** Show the graphs for "Successful," "Failed," and "Total Attempts" per second
- **Deregistration(s) Over Time:** Displays a graph for "Successful" and "Total Attempts" per second
- **Registration(s) - Deregistration(s) Over Time:** Shows a graph for overall "Register & Deregister attempts," "Register & Deregister passed," and "Register & Deregister failed" attempts per second



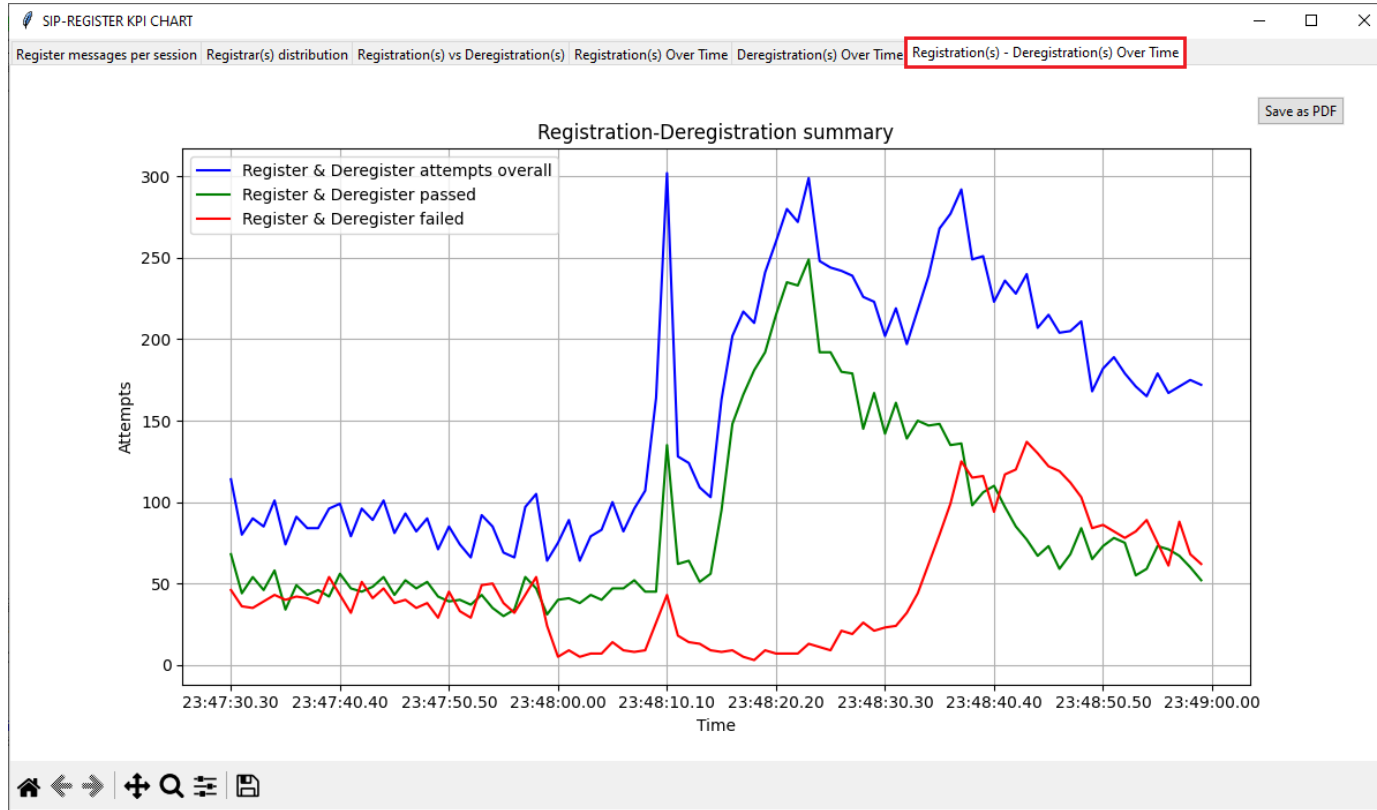
Registrar(s) Distribution, Registration vs Deregistration KPIs



Registration(s) over Time, Deregistration over Time KPIs

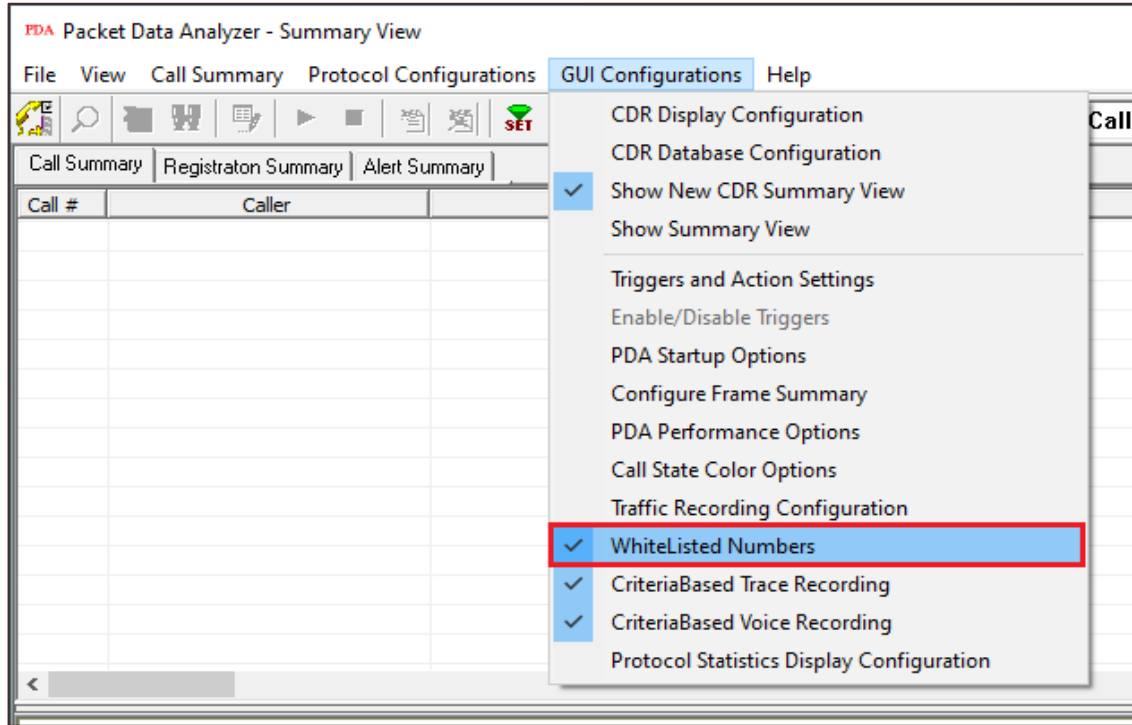


Registration(s)-Deregistration(s) over Time KPI



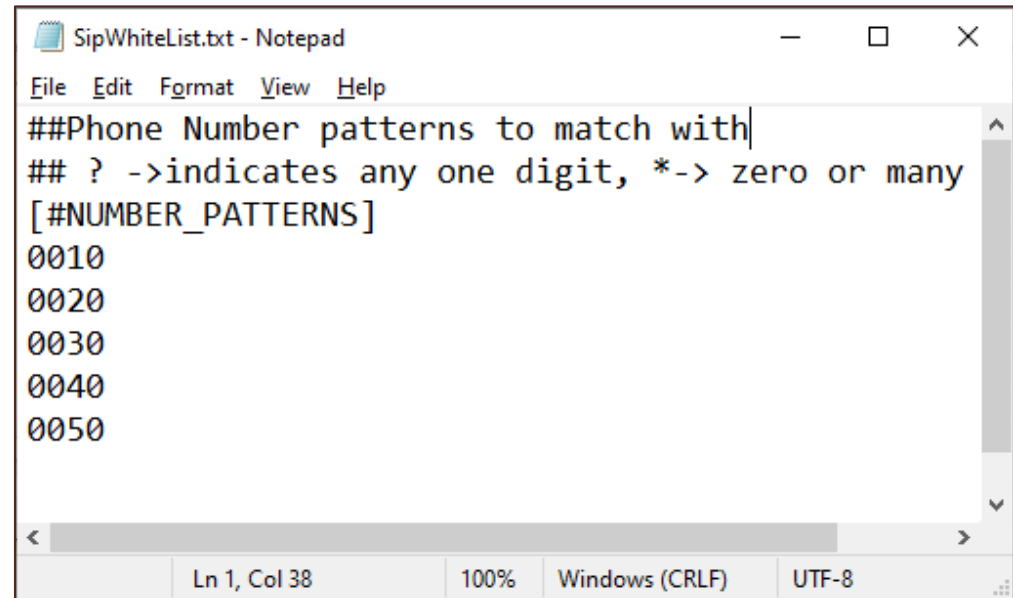
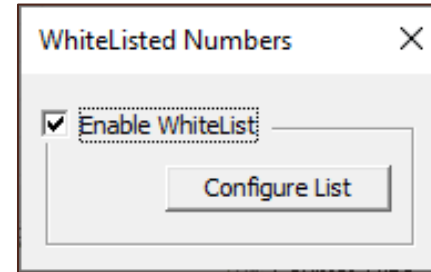
Whitelist Configuration

- On the **PDA** main window, click on **GUI Configurations** → **WhiteListed Numbers** to configure Whitelist number



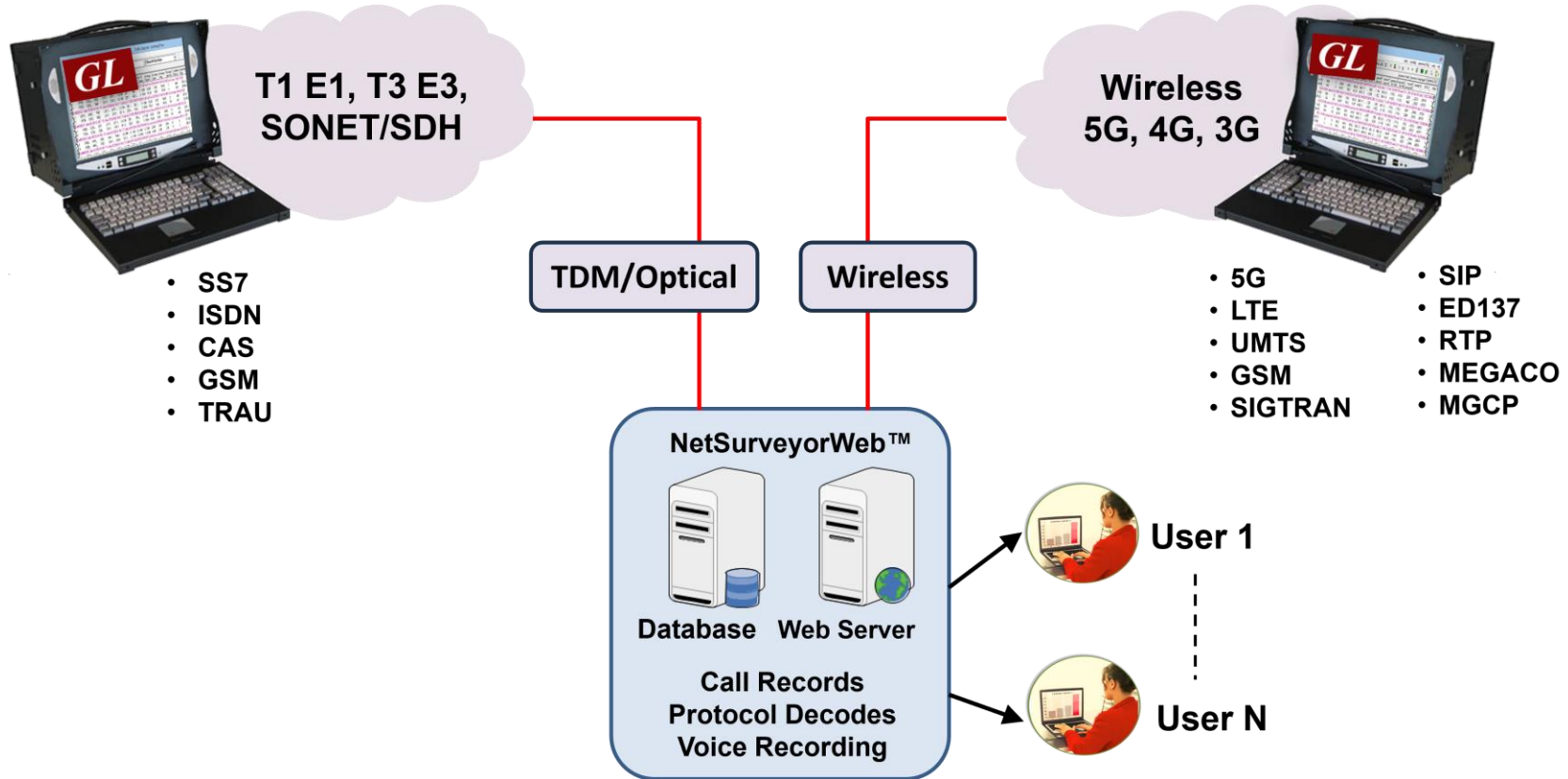
Whitelist Configuration (Contd.)

- Check the **Enable WhiteList** option and click on **Configure List**. This will invoke **SIPWhiteList.txt** in the Notepad application
- Enter the **SIP Caller** or **Callee** Number
- The following numbers should be added in the **SipWhiteList.txt** file
 - 0010
 - 0020
 - 0030
 - 0040
 - 0050
- **Save** and **Close** the file



```
##Phone Number patterns to match with
## ? ->indicates any one digit, *-> zero or many
[#NUMBER_PATTERNS]
0010
0020
0030
0040
0050
```

NetSurveyorWeb™ - Network Surveillance System



NetSurveyorWeb™ Main GUI

The screenshot displays the NetSurveyorWeb main GUI. At the top, it shows 'GL NetSurveyorWeb' and 'Protocol Type' set to 'VOIP (SIP & H323)'. The user 'GI' is logged in. The main content area shows a 'Quick CDR \ All Calls' section with a date range of '2018-07-05' and a time range of '00:00:00' to '23:59:59'. Below this is a table of call records. The table has the following columns: SIno, Calling Number, Called Number, Starttime, Duration, Call Success, Failure Cause, Listening Mos1, Listening Mos2, Payload1, and Page. The table contains 12 rows of call data, each with a 'Call Flow' icon and a 'Call' icon. The 'Payload1' column shows various payloads such as 'SPEEX/8000', 'iLBC_15_2/8000', and 'EVRCB/8000'.

SIno	Calling Number	Called Number	Starttime	Duration	Call Success	Failure Cause	Listening Mos1	Listening Mos2	Payload1	Page
1	0159@192.168.12.163	0159@192.168.12.164	2018-07-05 12:12:47.134	00:01:00.024	1	0	3.02	3.02	SPEEX/8000	15
2	0160@192.168.12.163	0160@192.168.12.164	2018-07-05 12:12:47.134	00:01:00.024	1	0	3.02	3.02	SPEEX/8000	15
3	0161@192.168.12.163	0161@192.168.12.164	2018-07-05 12:12:47.134	00:01:00.024	1	0	4.16	4.16	SPEEX/8000	15
4	0158@192.168.12.163	0158@192.168.12.164	2018-07-05 12:12:47.104	00:01:00.024	1	0	4.16	4.16	SPEEX/8000	15
5	0157@192.168.12.163	0157@192.168.12.164	2018-07-05 12:12:47.094	00:01:00.024	1	0	4.16	4.16	SPEEX/8000	15
6	0156@192.168.12.163	0156@192.168.12.164	2018-07-05 12:12:47.094	00:01:00.024	1	0	3.02	3.02	SPEEX/8000	15
7	0155@192.168.12.163	0155@192.168.12.164	2018-07-05 12:12:47.064	00:01:00.024	1	0	4.16	4.16	SPEEX/8000	15
8	0153@192.168.12.163	0153@192.168.12.164	2018-07-05 12:12:47.044	00:01:00.024	1	0	4.01	4.01	iLBC_15_2/8000	15
9	0154@192.168.12.163	0154@192.168.12.164	2018-07-05 12:12:47.044	00:01:00.024	1	0	3.95	3.95	iLBC_13_33/8000	15
10	0152@192.168.12.163	0152@192.168.12.164	2018-07-05 12:12:47.034	00:01:00.024	1	0	3.98	3.98	EVRCB/8000	15
11	0151@192.168.12.163	0151@192.168.12.164	2018-07-05 12:12:47.024	00:01:00.024	1	0	3.98	3.98	EVRCB/8000	15
12	0150@192.168.12.163	0150@192.168.12.164	2018-07-05 12:12:47.014	00:01:00.024	1	0	3.77	3.77	EVRCB/8000	20

- Multiple PacketScan™ probes can be used for network monitoring, with call detail reports exported to a central data base
- Results can be accessed remotely using NetSurveyorWeb™, a simple web browser-based application

Thank you