ISDN Analysis and Emulation

GL Communications Inc.
818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: info@gl.com
Website: https://www.gl.com

Index

ISDN Analysis and Simulation over T1 E1

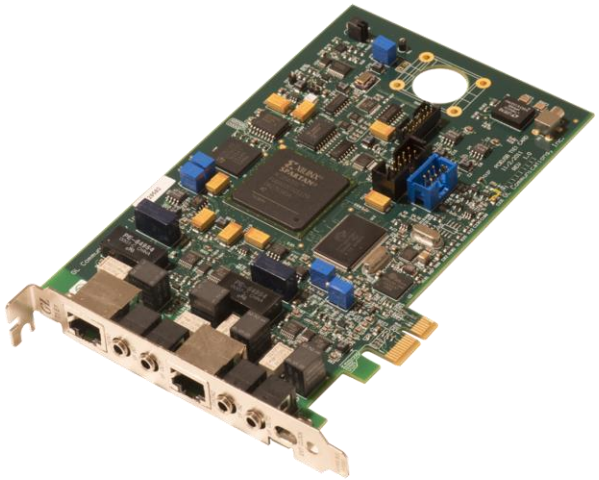
T1 E1 Analyzer Hardware Platforms

Front Panel

Back Panel

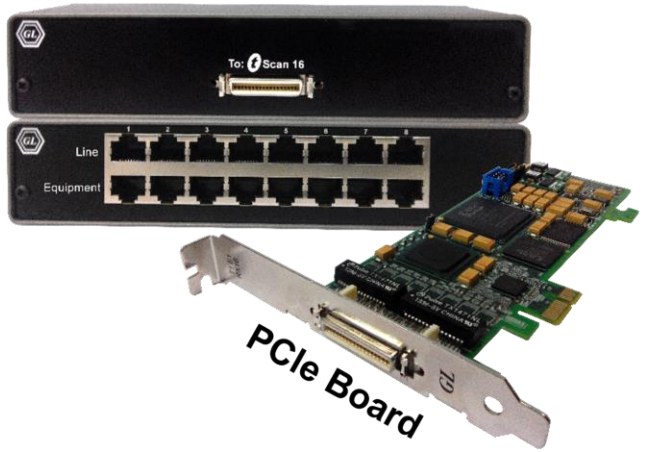
tProbe™ - Portable USB based T1 E1 VF FXO FXS and Serial Datacom Analyzer

Quad / Octal T1 E1 PCIe Card



Dual T1 E1 Express (PCIe) Board

tScan16™ with
16-port T1 E1 Breakout Box



GL Communications

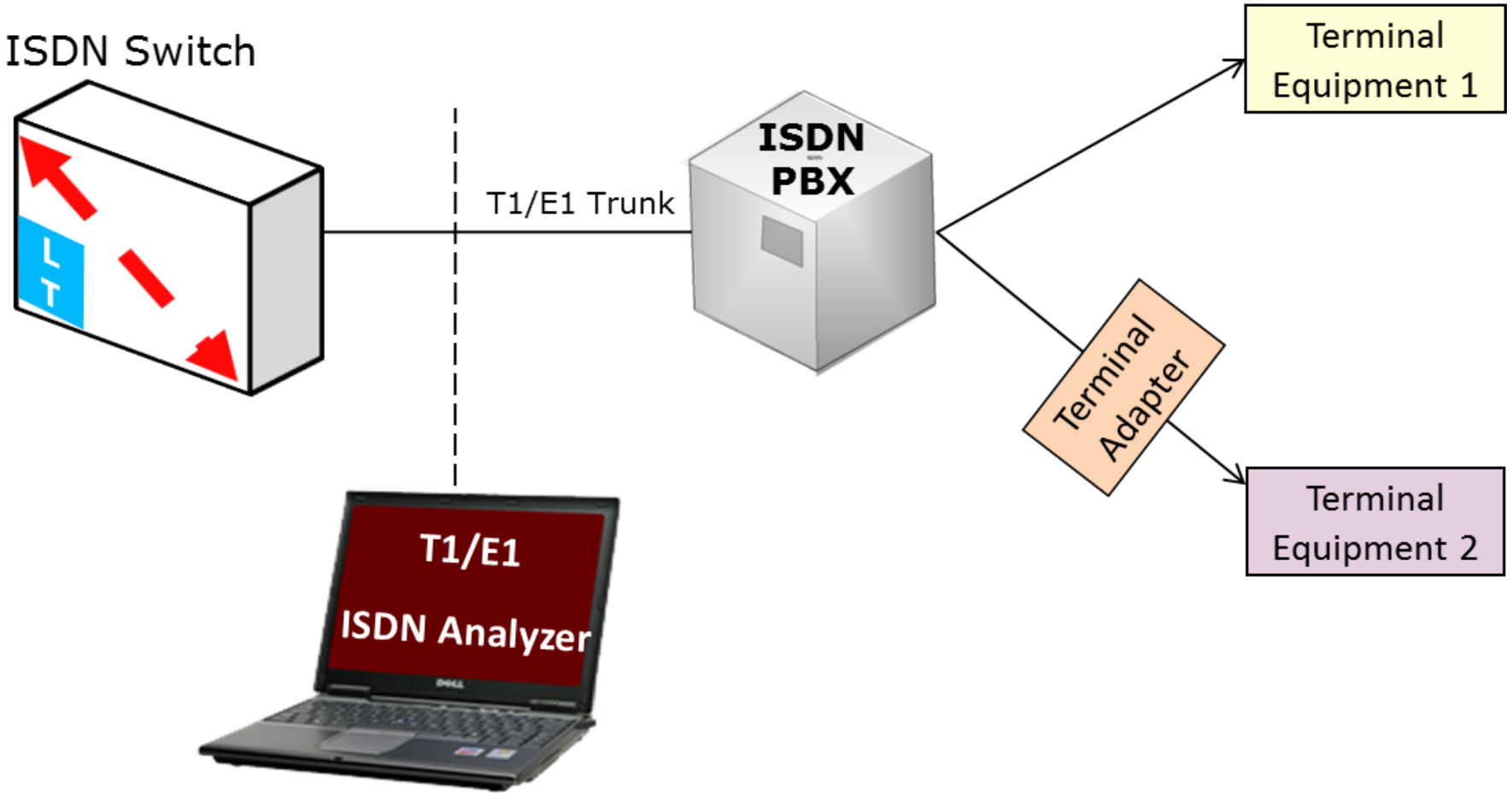
TDM mTOP™ Solutions

mTOP tProbe™ FXO FXS Dual UTA

1U tProbe™ with FXO and FXS

GL Communications

ISDN Analyzer



ISDN Analyzer

- ISDN analyzer can capture and analyze stream of frames on an ISDN PRI link
- It decodes LAPD according to Q.921
- Supports the following types of ISDN analyzers:
  - ➢Real-time ISDN Analyzer
  - ➢Remote/Offline ISDN analyzers

Key Features

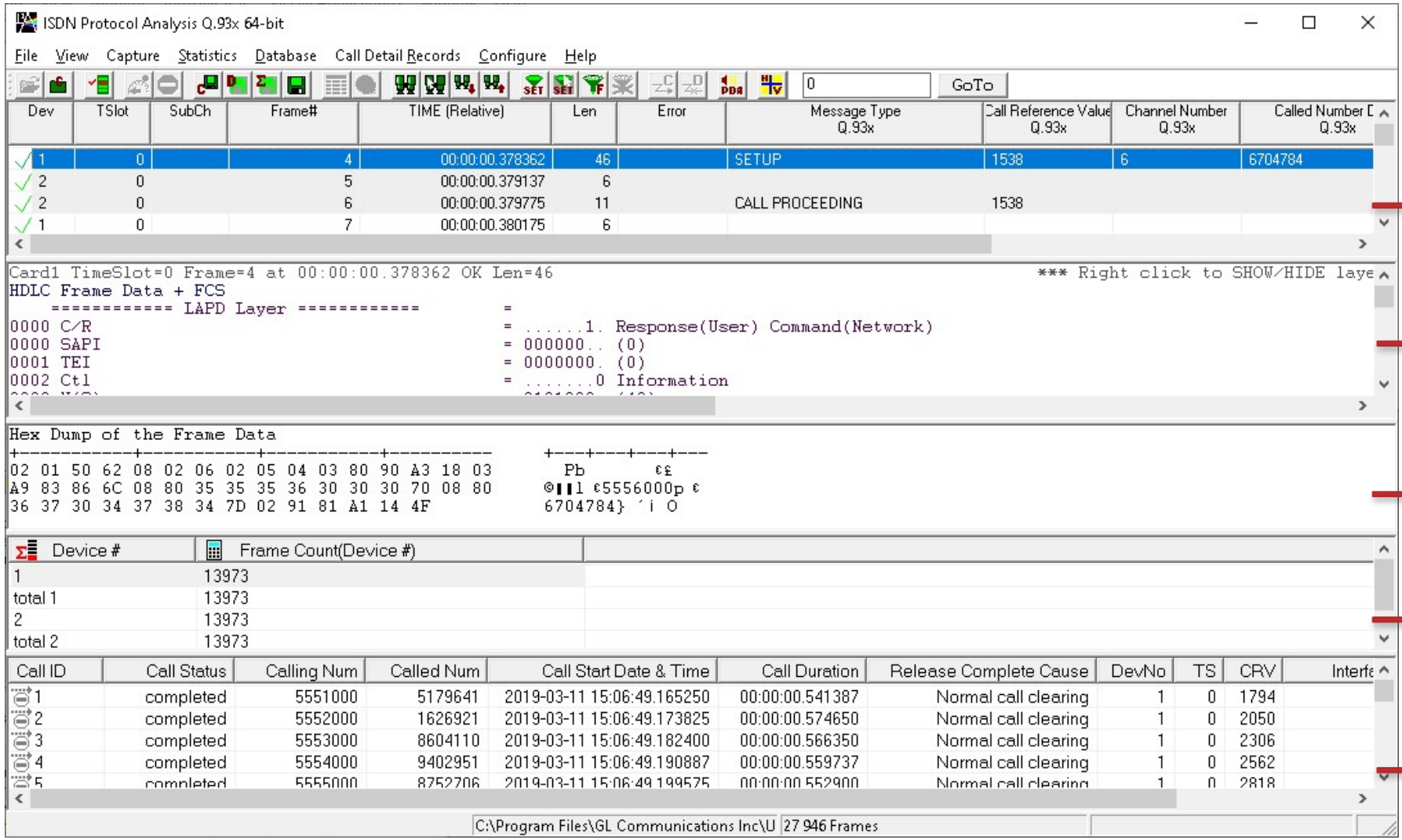
- Perform real-time / offline / remote analysis
- Consolidated GUI – Summary of all decodes, detail, hex-dump views of each frame, statistics view, and call detail record views
- Supports various protocol standards for proper decode
- Capture options - Channel selection, CRC, bit reversion, bit inversion, scrambler and more
- Call Detail Recording feature includes data link groups that help in defining the direction of the calls in a given network and form logical groups comprised of unidirectional (either 'Forward' or 'Backward') data links
- Fine tune results with filtering and search capability based on SAPI, TEI, C/R, N(S), N(R), P/F, Supervisory Functions, and ISDN message types
- Trace File Saving Options
- Remote-access capability
- 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 create search/filter criteria automatically from the current screen selection

Supported Protocols

- LAPD
- Q.931
- 4ESS
- 5ESS
- ETSI (Euro ISDN)
- QSIG ETSI
- BELL NI2 (Bellcore National ISDN-2)
- ANSI
- DASS2
- DPNSS
- ARINC 746
- QSIG ECMA
- DMS 100
- DMS 250

GL Communications

Different Views



Summary view

Detail view

Hex Dump view

Statistics view

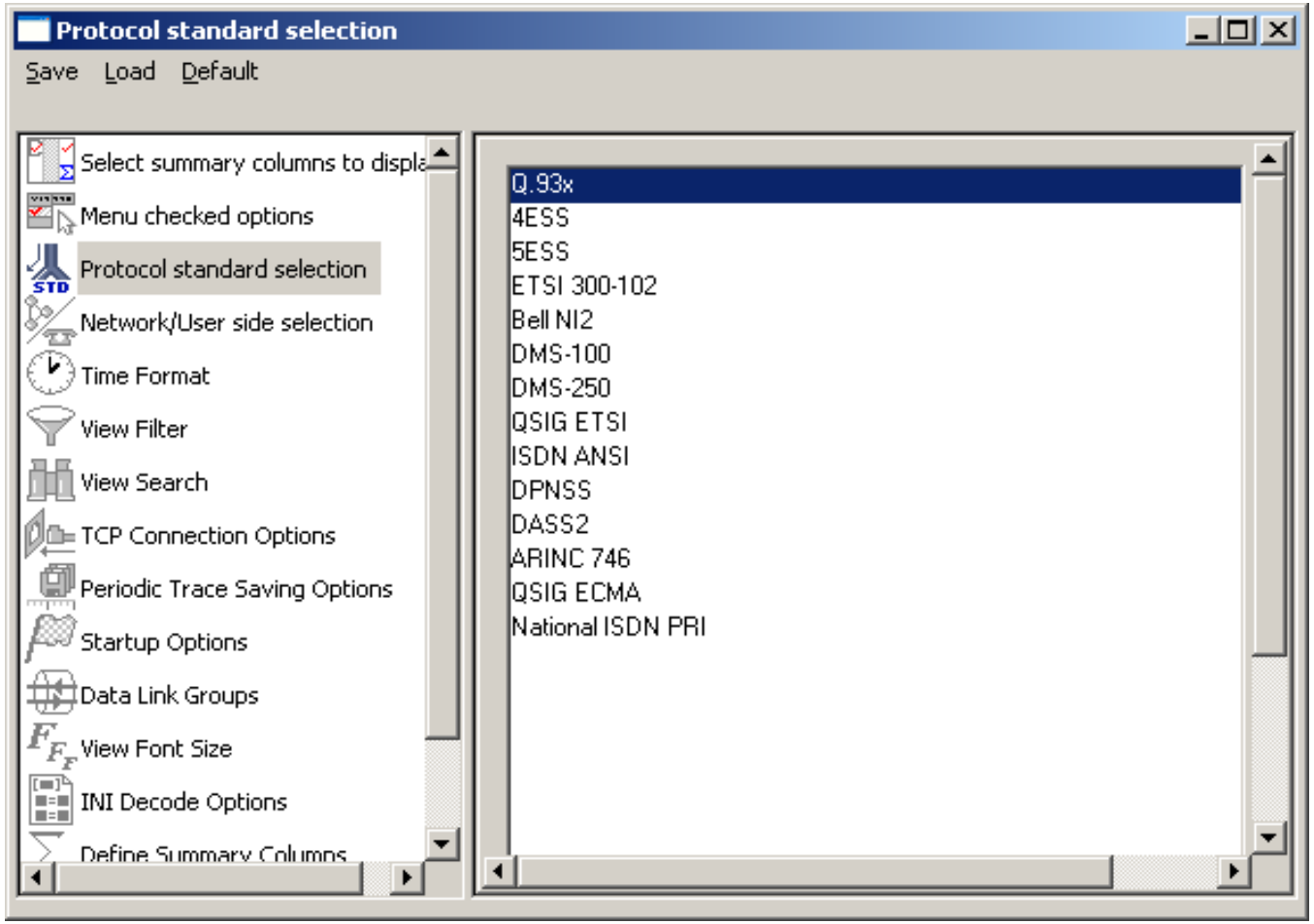
Call trace view

GL Communications

Different Views

- **Summary View**: This pane displays the columns that contain Card Number, Timeslots, Frame Number, Time, Frame Error Status, Command/Response, Length, Error, C/R, SAPI, CTL, P/F, FUNC, and more in a tabular format
- **Detail View**: This pane displays in detail about a frame in order to analyze and decode by selecting it in the summary view
- **Hex Dump View**: This pane displays the frame information in HEX and ASCII format
- **Statistics View**: This pane displays the statistics that are calculated based on the protocol fields
- **Call Trace View (Optional)**: This pane displays the call specific information for each individual call from the captured data and display the information in an organized fashion

Protocol Standards



- Please visit http://www.gl.com/isdn.html for a complete list of supported protocols and specifications for ISDN

Protocol Standards

- Layer 2: Conveys user information between Layer 3 entities across ISDN using the D-channel. LAPD is parsed according to Q.921
- Layer 3: ISDN information parsing depends on the user's selection of the following ISDN Standards
  - Bell NI2 (Bellcore National ISDN-2): It is used in USA (Bellcore). It includes components to communicate information between ISDN user equipment, and the ISDN switch
  - AT&T/Lucent switch 4ESS and 5ESS (TR41449, TR41459 and 235-900-342): It is an ISDN variant adopted in USA by AT&T
  - ETSI 300-102 (Euro ISDN): This variant is adopted in all European countries
  - QSIG (Q-reference point Signalling System) ETSI: QSIG is inter-private PABX signaling system
  - Q.93x: It is an ITU implementation of ISDN
  - Nortel's switch DMS-100/250(NIS-A2111-1 and NIS-A211-4): It is a Northern Telecom’s implementation of National ISDN
  - ISDN ANSI decode - T1.607 (Specification)
- MLPP (Multi-Level Precedence. and Pre-emption) procedures are supported for -
  - ISDN ANSI decode - T1.619 and T1.619a (Specifications)
  - ITU implementation - Q.955.3 (Specification) and
  - Facility Information Element - Q.932 (Specification)

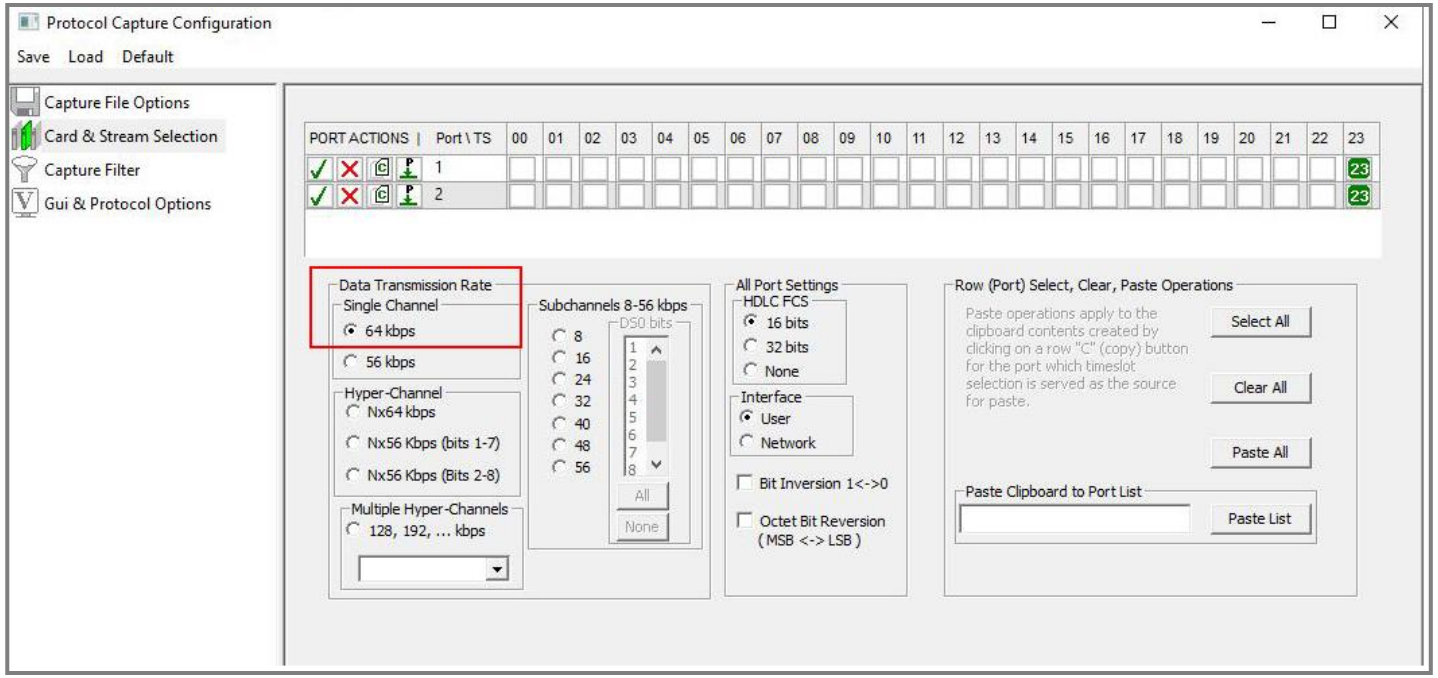
Protocol Standards (Contd.)

- DASS2 - Digital Access Signaling System No 2 - Specification BTNR 190
- DPNSS - Specification ND1301:2001/03
- ARINC 746 - Aeronautical Radio, INC is a signaling protocol based on Q.931
- QSIG ECMA (Q-reference point Signaling System) –Standard ECMA-143 4th Edition - December 2001
- National ISDN PRI CPE (Telcordia – SR-4994)

Real-time Analysis

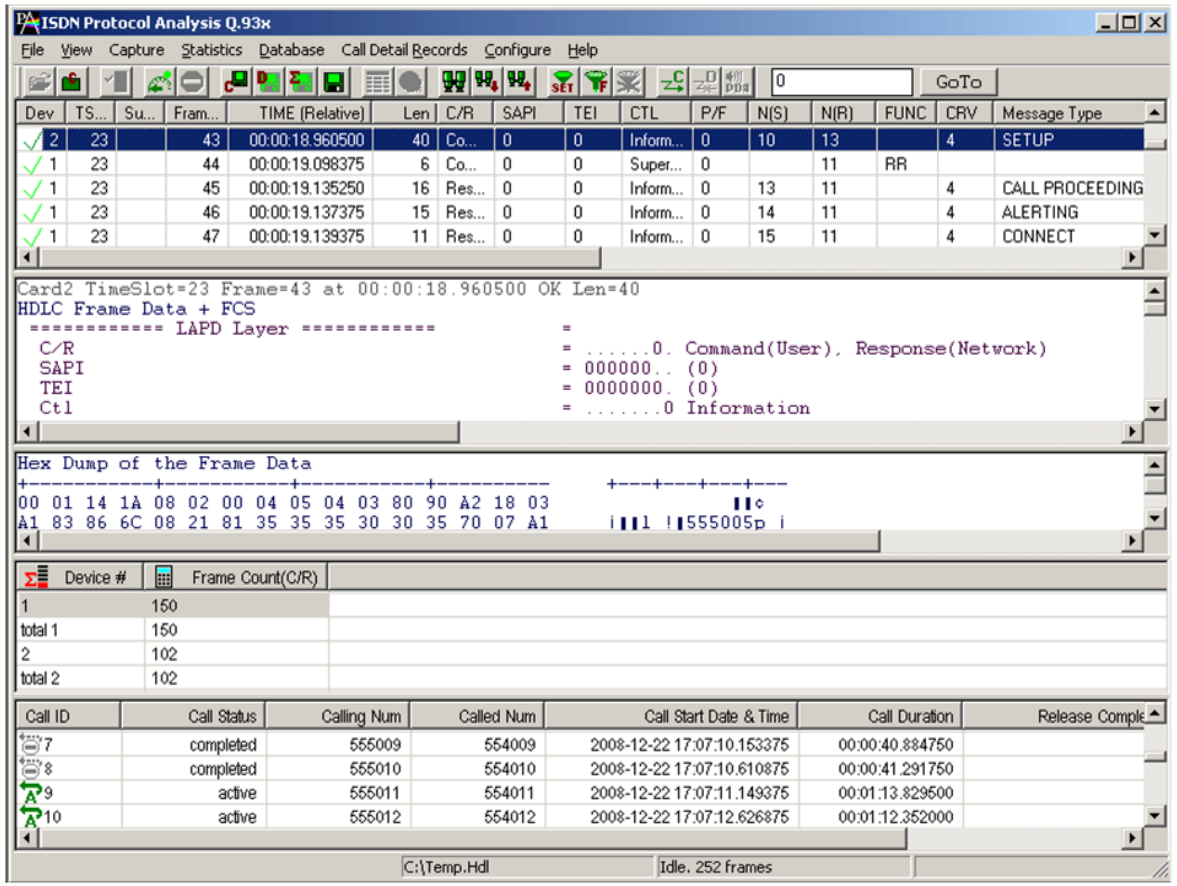
- Streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels (fractional DS0 to DS1) or full bandwidth
- Frames may also be contained in n x 64 kbps, Single Channel – 64 Kbps, 56 Kbps

Card and Stream Selection



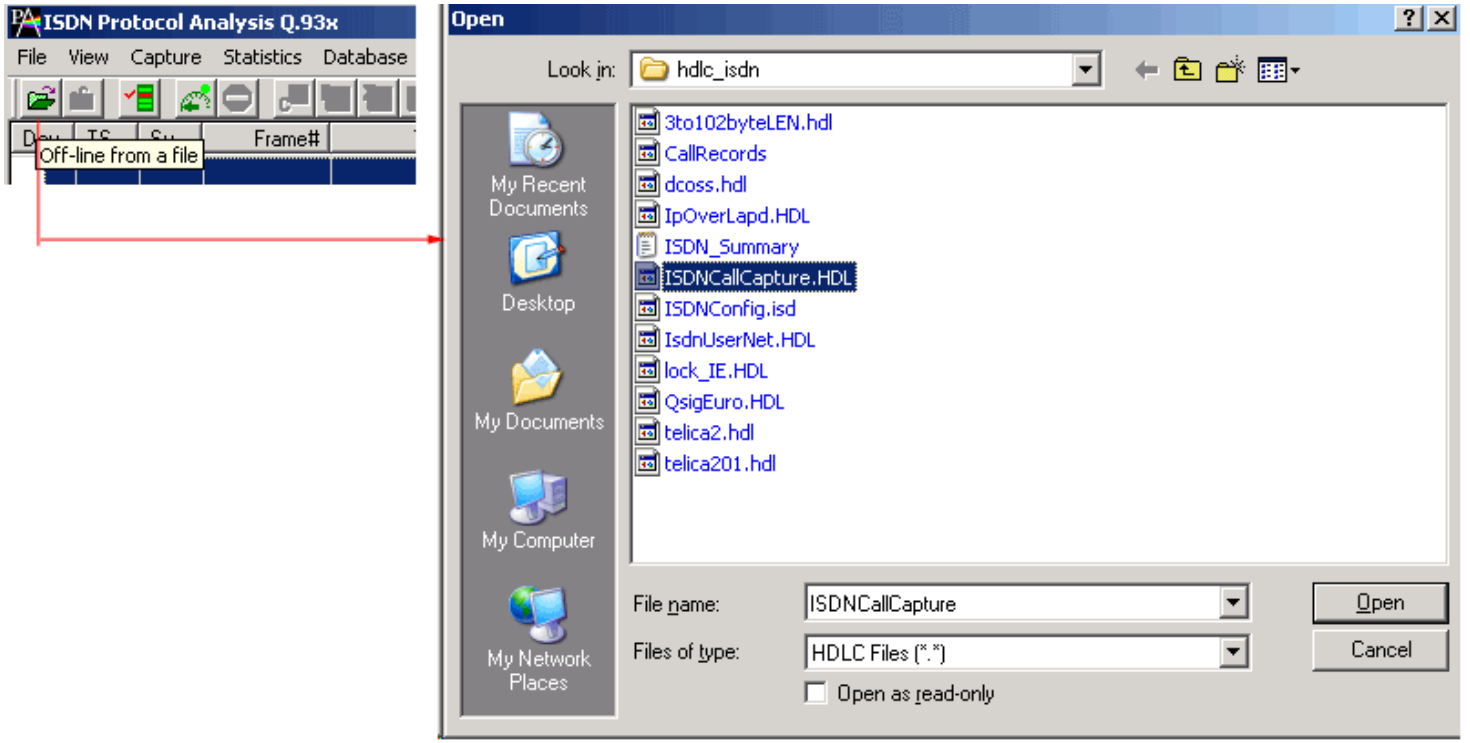
Real-time Analysis

- Streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels (fractional DS0 to DS1), Hyper-channels (n x 64 kbps, n x 56 kbps), or full bandwidth
- Frames may also be captured based on their FCS (16 bits, 32 bits, none), bit inversion, octet bit reversion, user/network side options
- Recorded trace file can then be analyzed offline
- Capability to export summary view details to comma separated values (CSV) format for subsequent import into a database or spreadsheet
- Capability to export detail decode information to an ASCII file

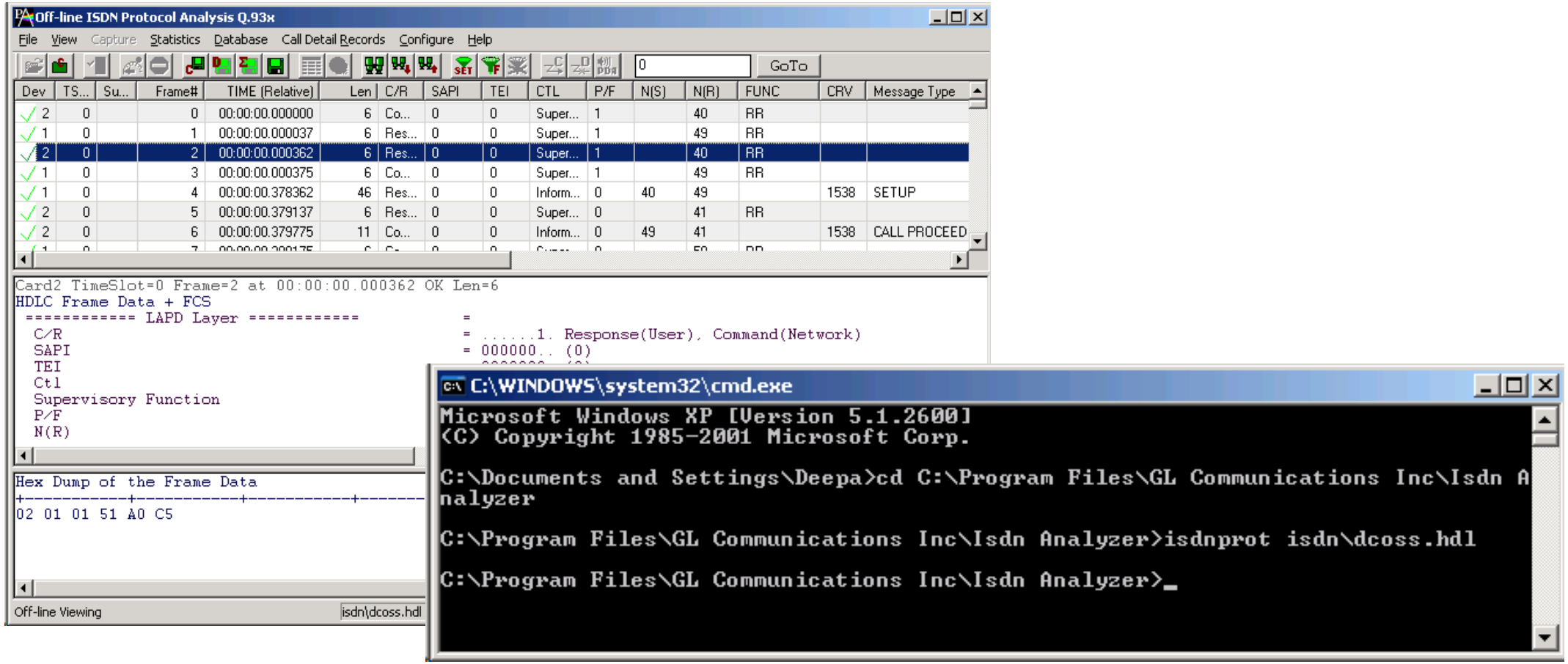


Offline Analysis

- Off-line analysis is equivalent to capturing a file in pre-defined timeslots
- Captured frames or only the filtered frames can be exported to *.HDL file for the further off-line analysis
- Trace file for offline analysis can be loaded either through analyzer GUI or through simple command-line arguments

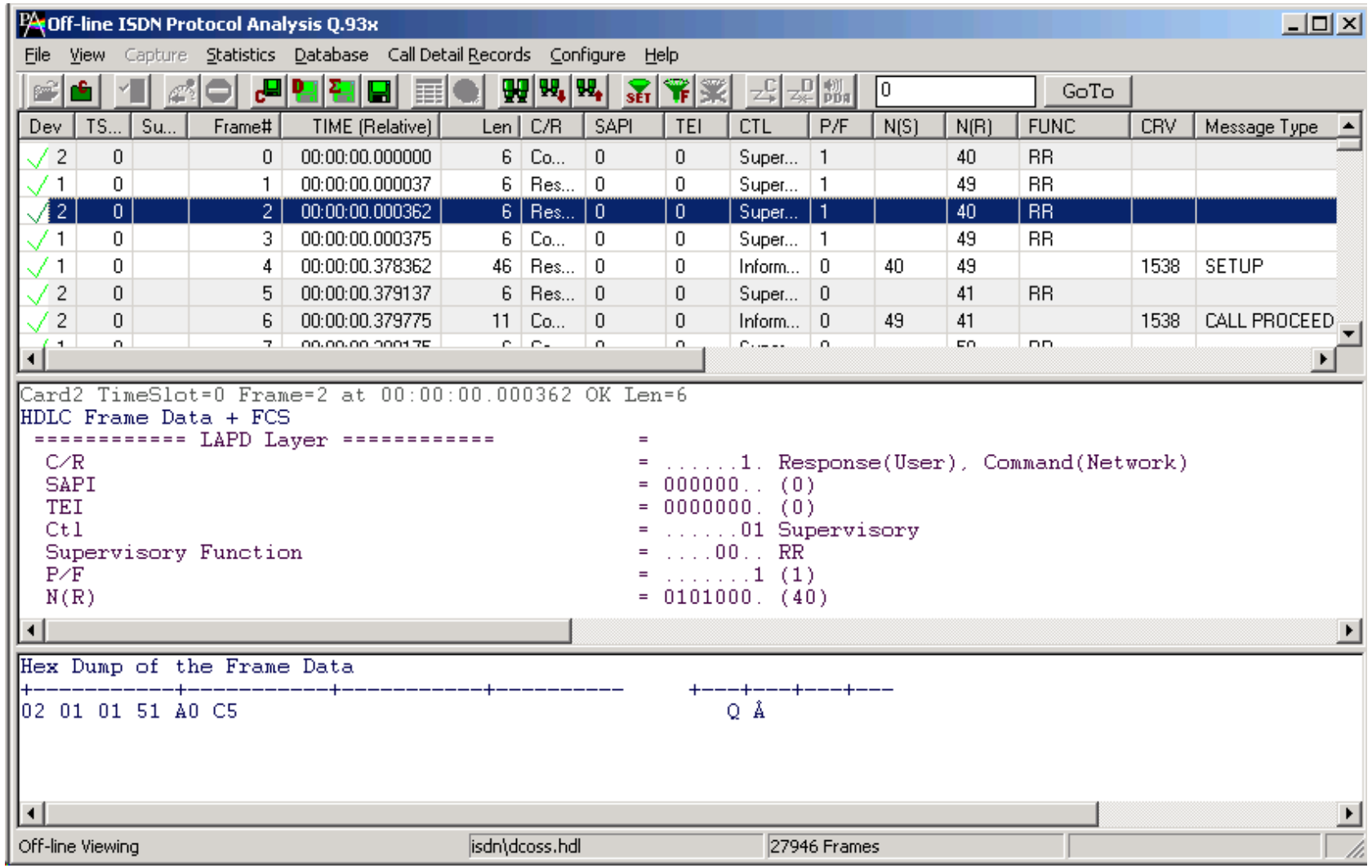


Invoke ISDN Offline Analysis

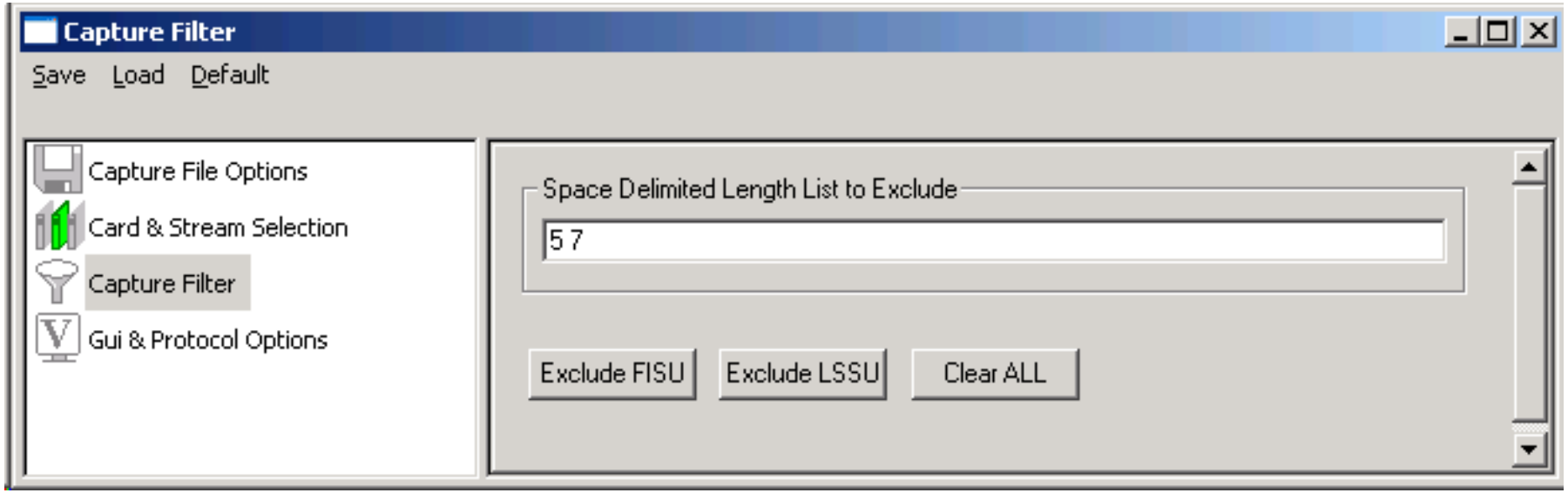


- Trace files for offline analysis can be loaded through simple command-line arguments as below:
  - Command Syntax: isdnprot isdn\Filename.hdl

Offline Analysis

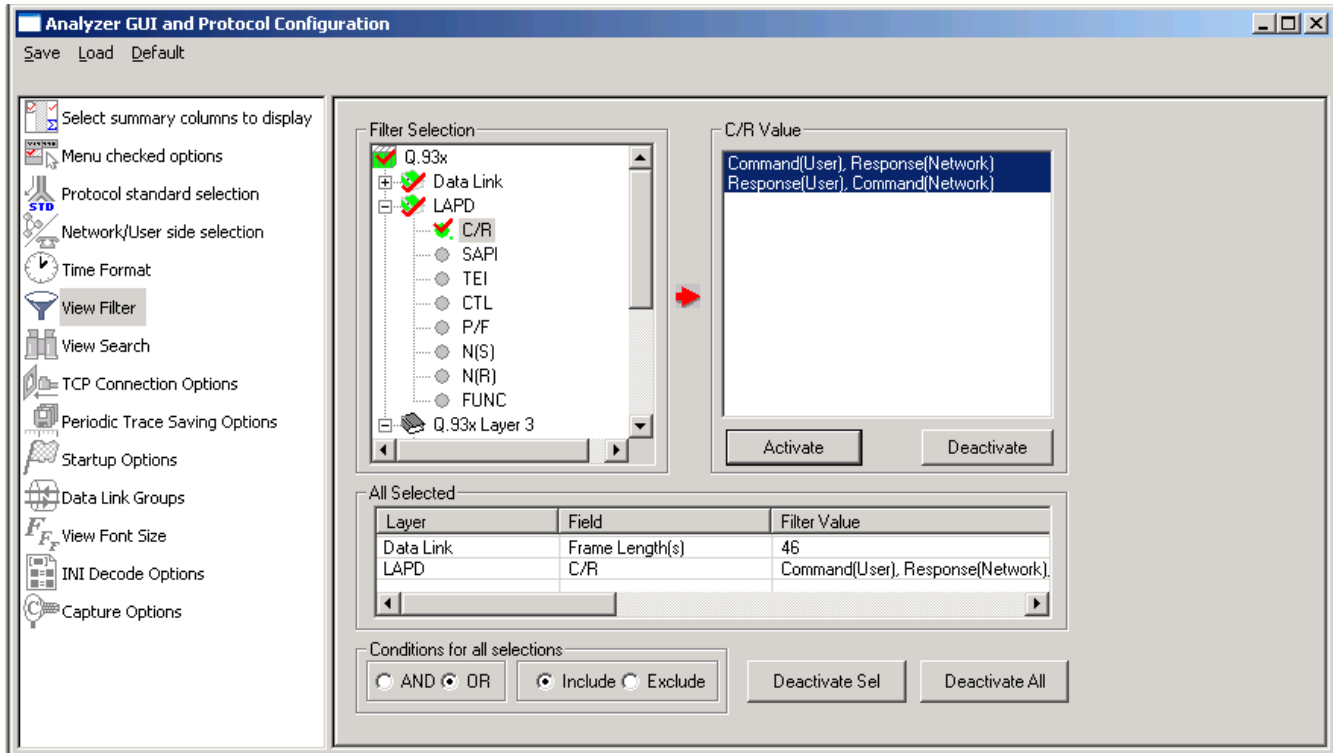


Filters - Real-time Capture Filter



- Real-time capture filter can be set prior to capturing frames
- Real-time filter parameters - Frame Length, (LSSU (Link Status Signal Unit), FISU (Fill-in Signal Unit), or any other user-defined frame)

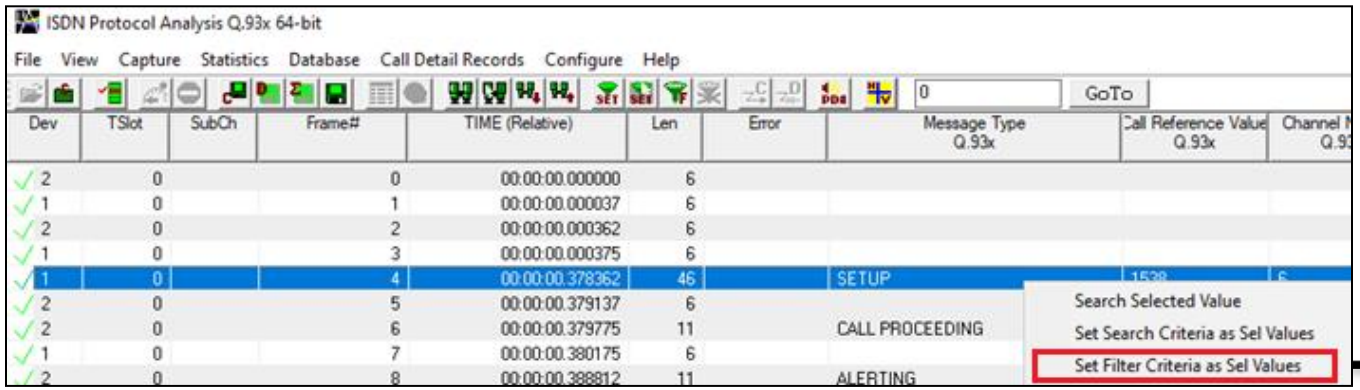
Filters – Offline View Filter

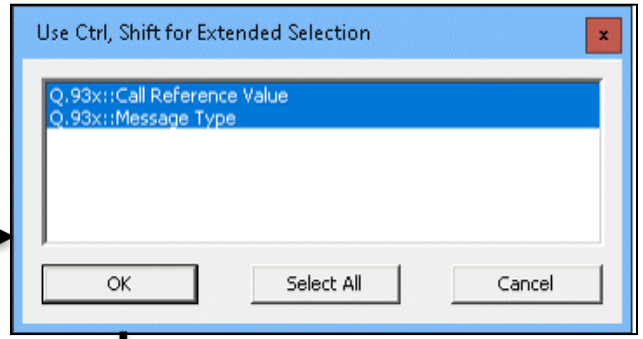


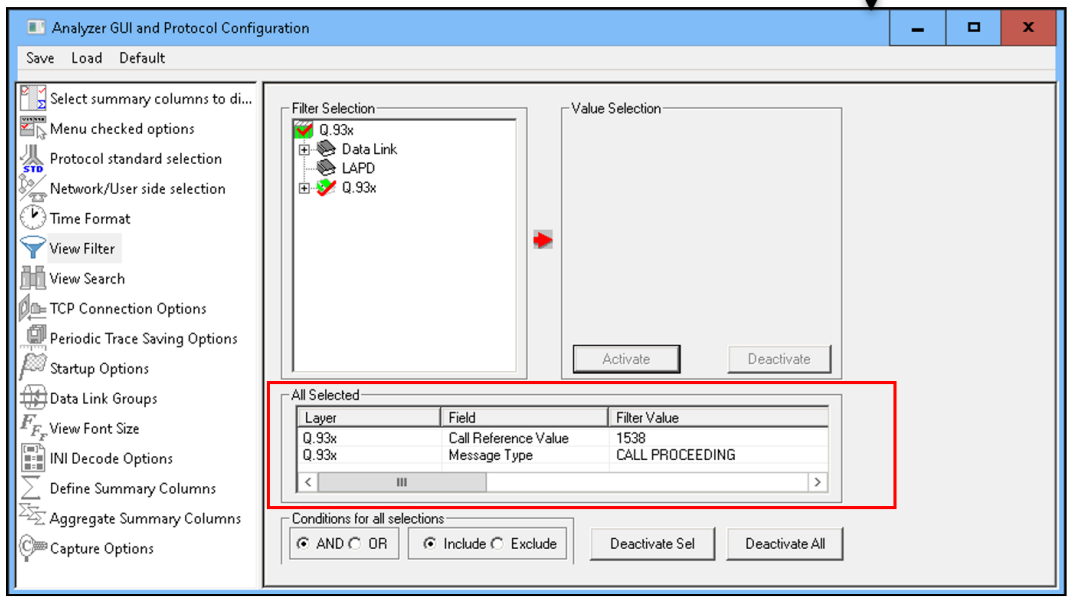
- Isolates required frames from all frames in real-time, as well as offline
- Allows filtering according to various layers and protocol fields such as C/R, TEI, SAPI, Called/Calling number, CRV, ISDN message type, cause value, call reference flag, and more

Filtering Criteria From Screen Selection

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

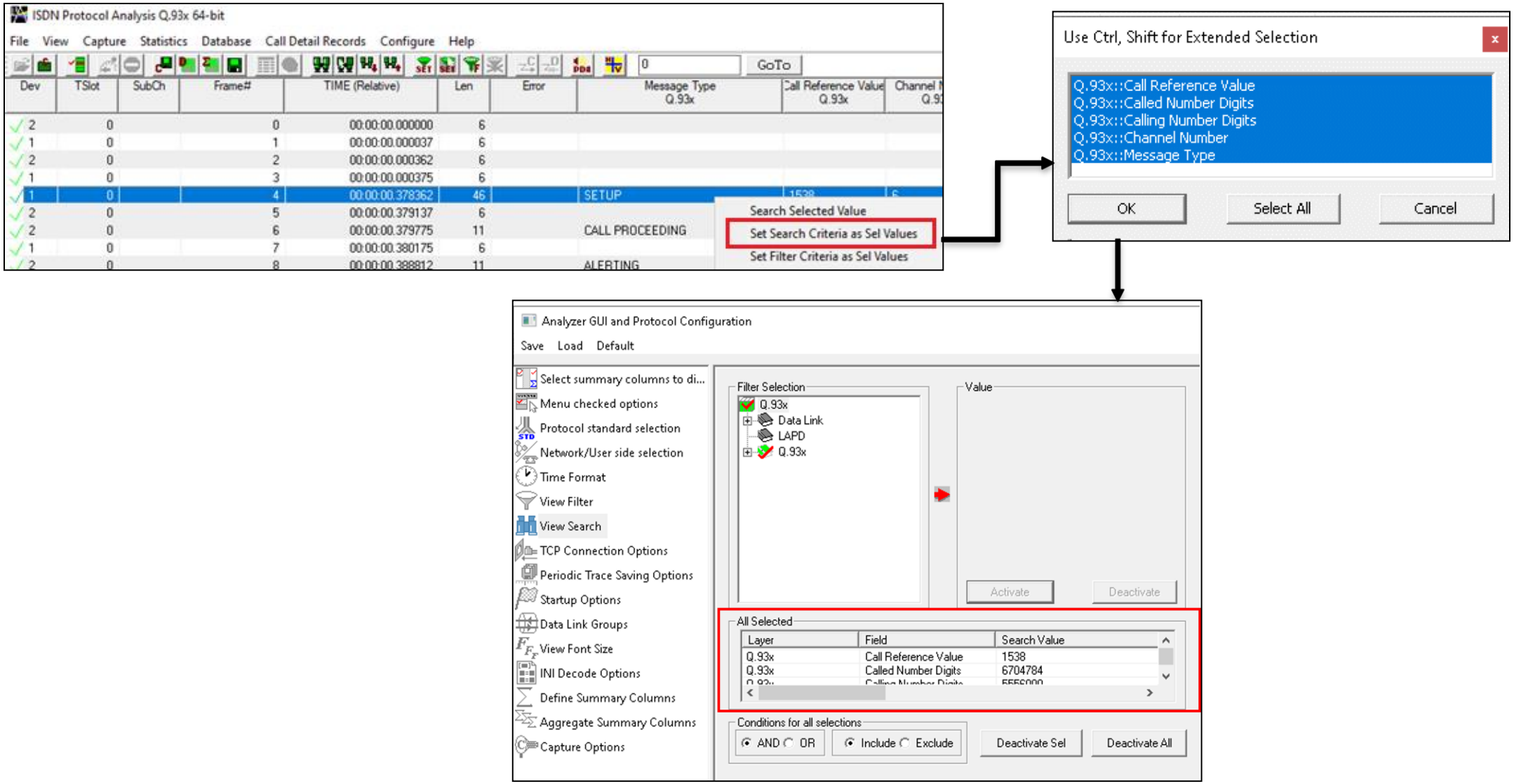




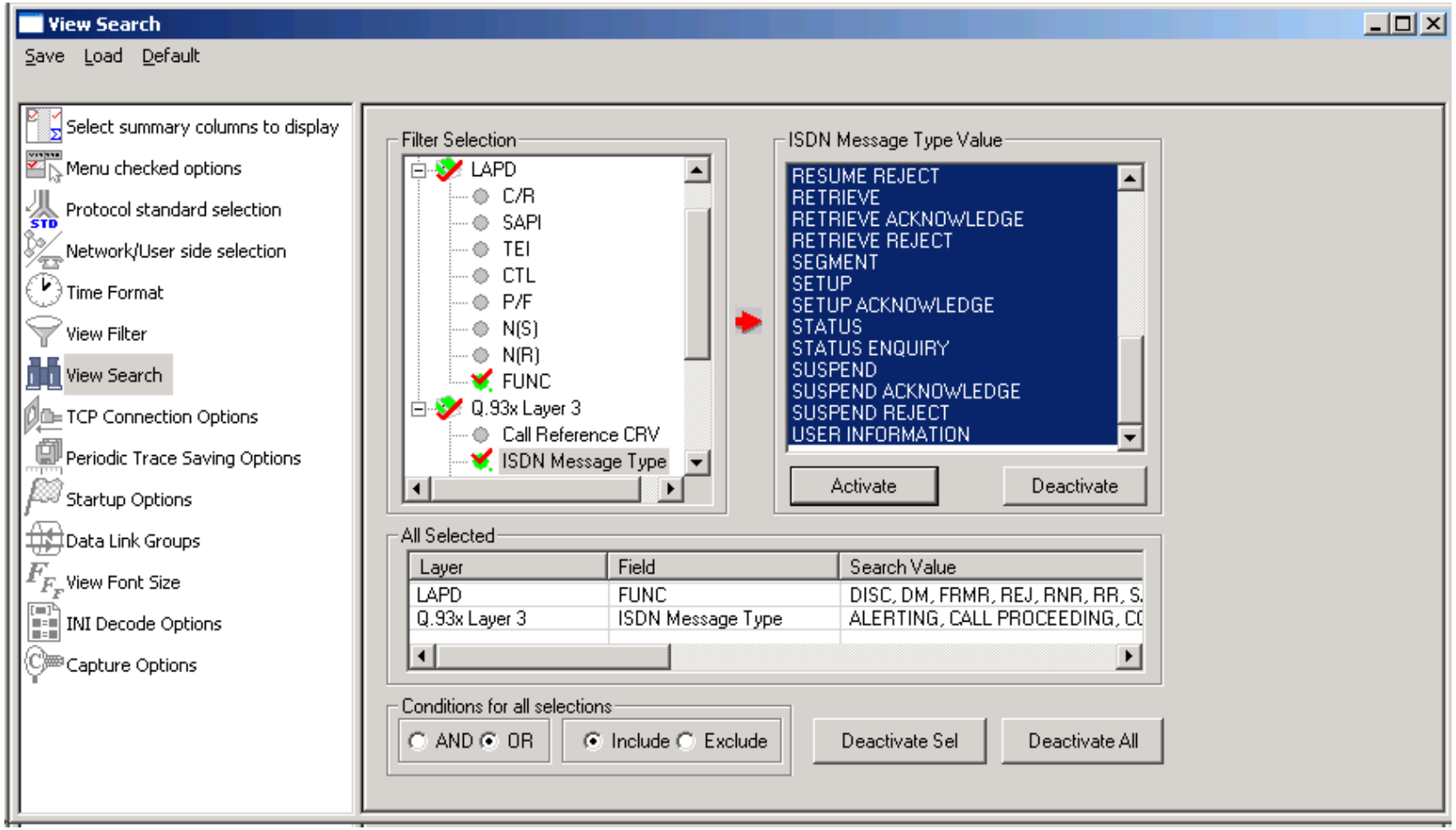


Search Criteria From Screen Selection

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



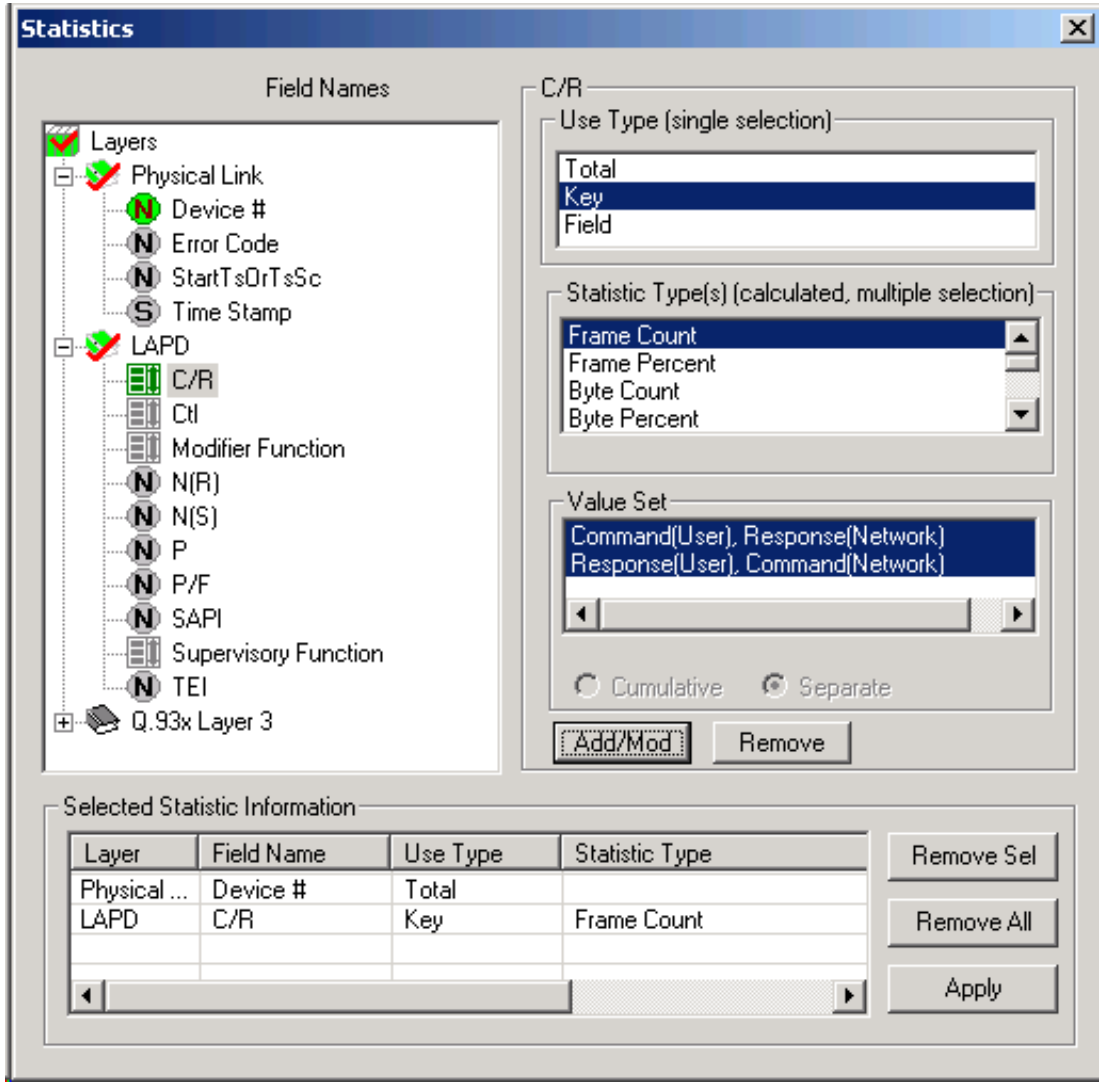
Search Options



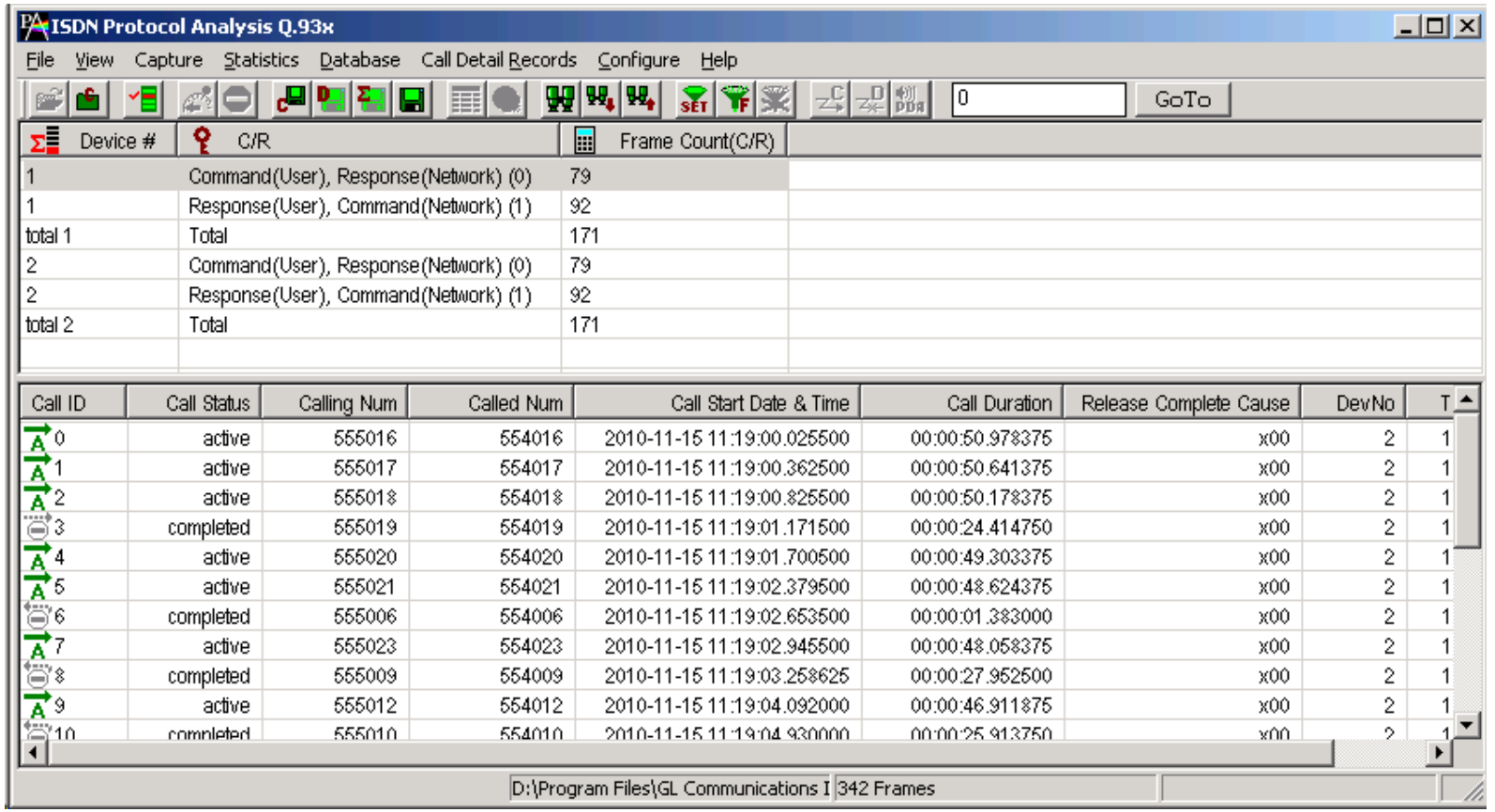
- Search features helps users to search for a particular frame based on specific search criteria

Statistics

- Numerous statistics can be obtained to study the performance of the network based on protocol fields and different parameters
- Statistics can be obtained based on various layers and protocol field values both in real-time as well as offline mode



Call Detail Records



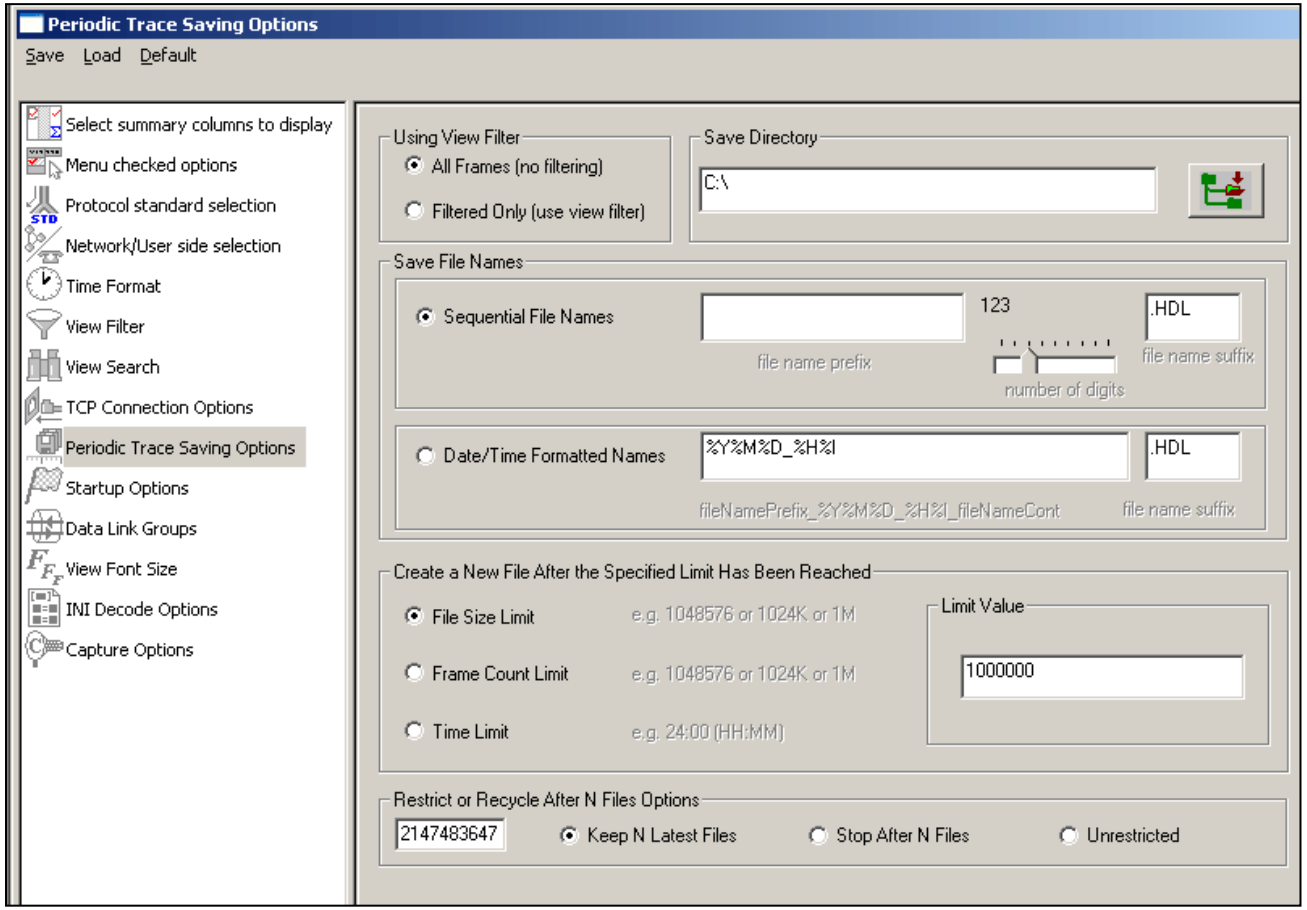
- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, CRV, release complete cause etc are displayed
- CDR Find option allows to search a particular call detail record from the captured traces

GL Communications

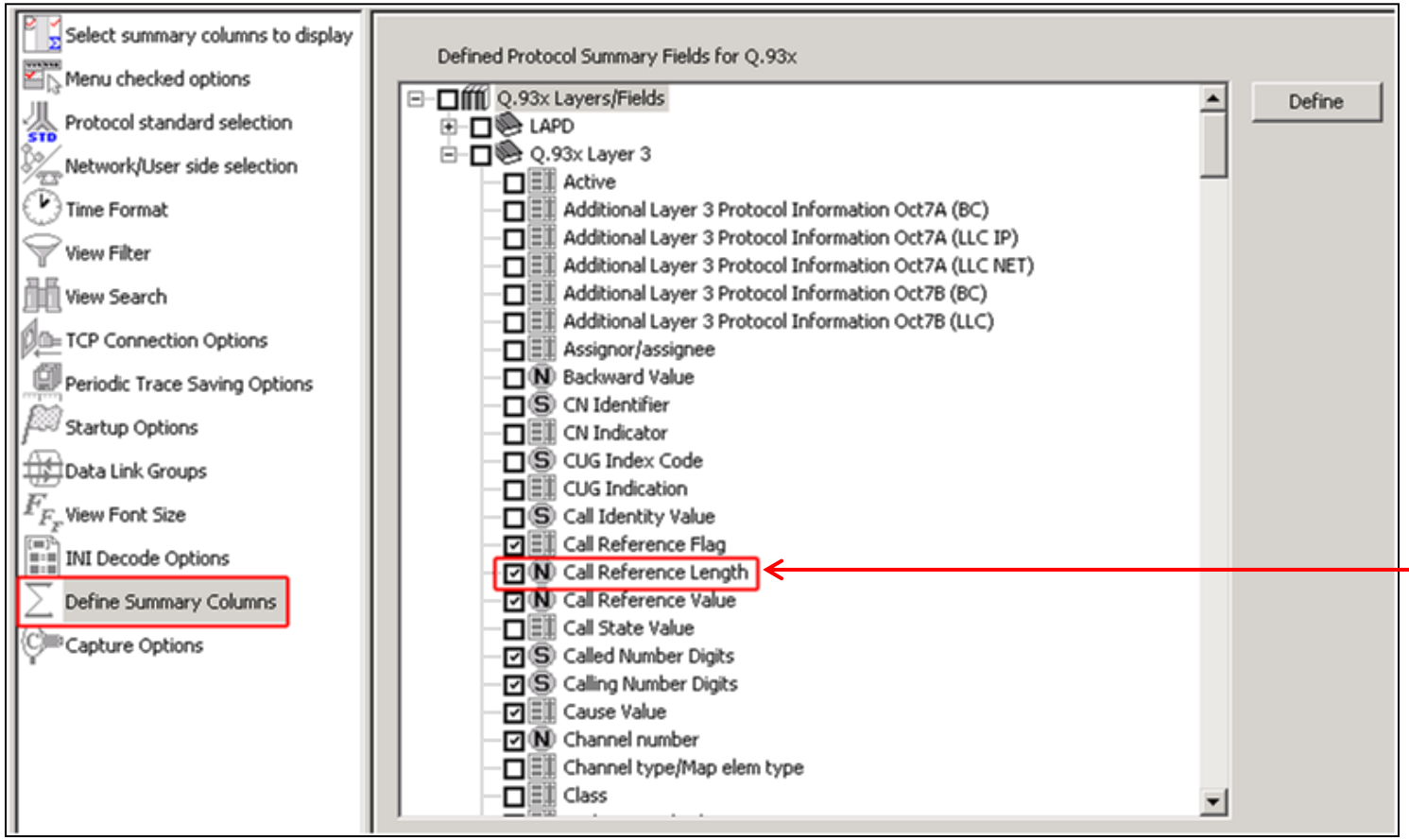
Saving options for the trace files

Captured trace files can be controlled by saving the trace using different conventions such as –

- Trace files with user-defined prefixes
- Trace file with date-time prefixes
- Slider control to indicate the total number of files, file size, frame count, or time limit



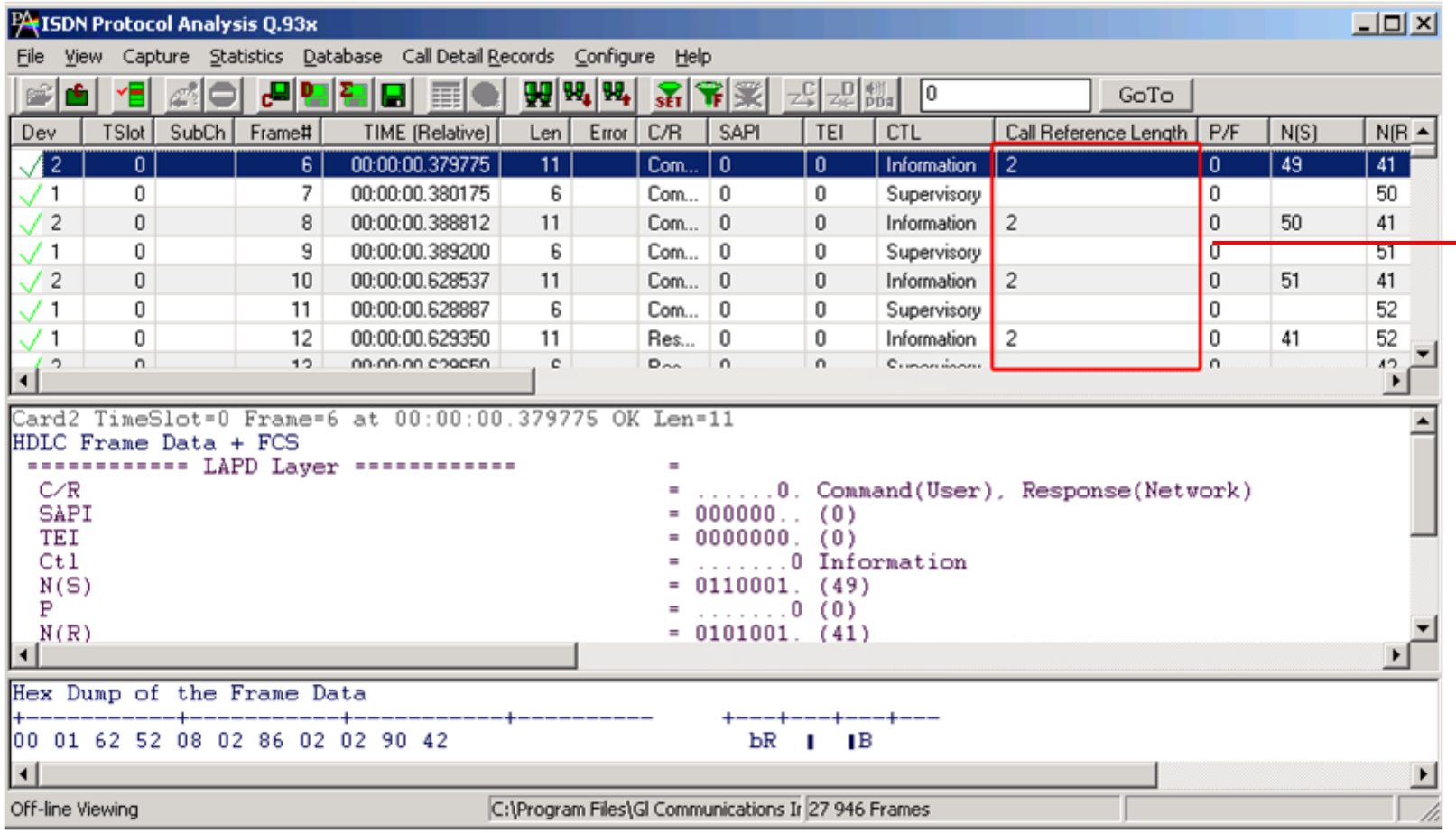
Define Summary Columns



Selection of Summary Column

- Required protocol fields can be added through Define summary column option
- User can remove the protocol field which is not required

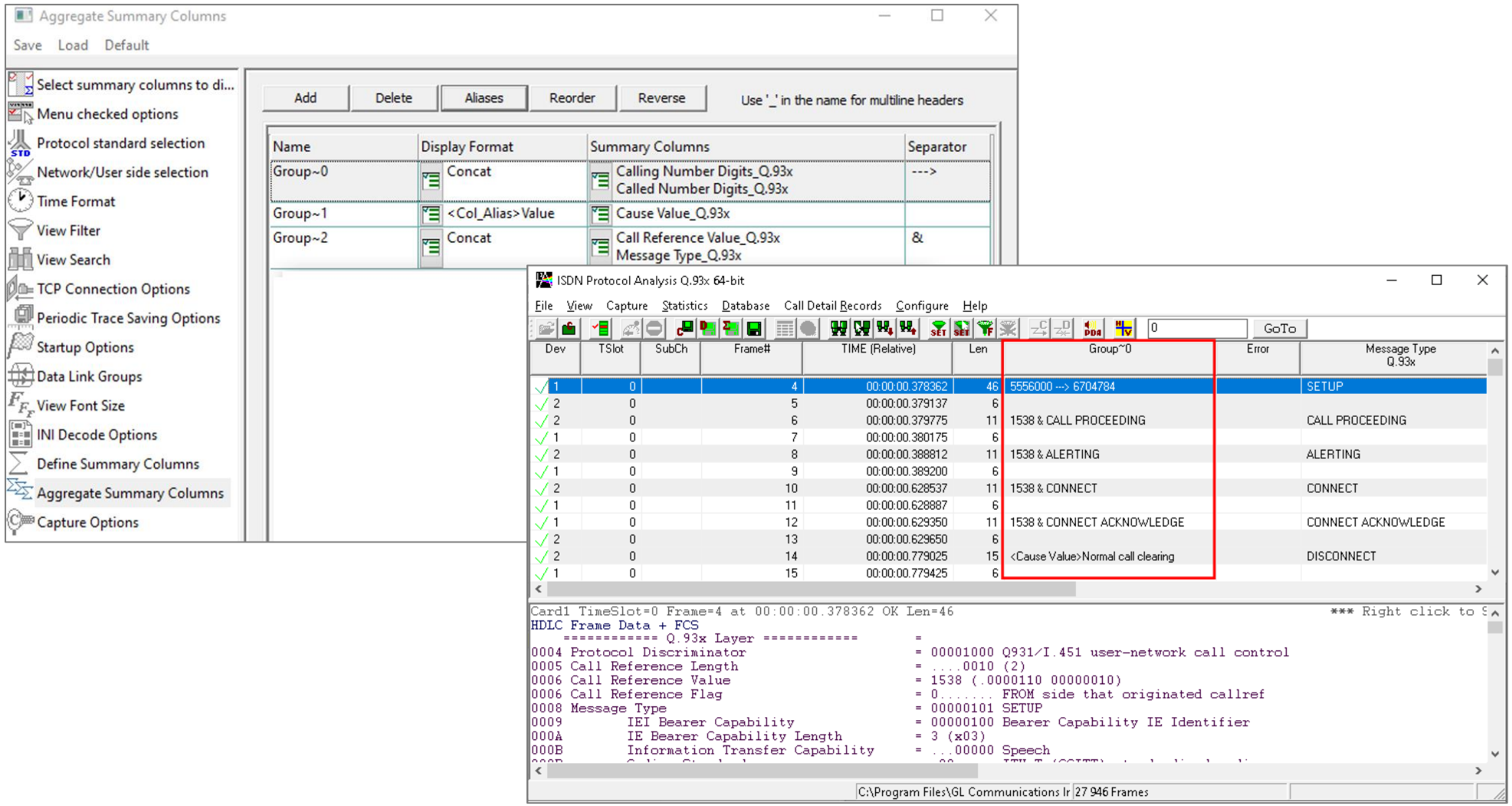
Define Summary Columns Output



Output display in analyzer

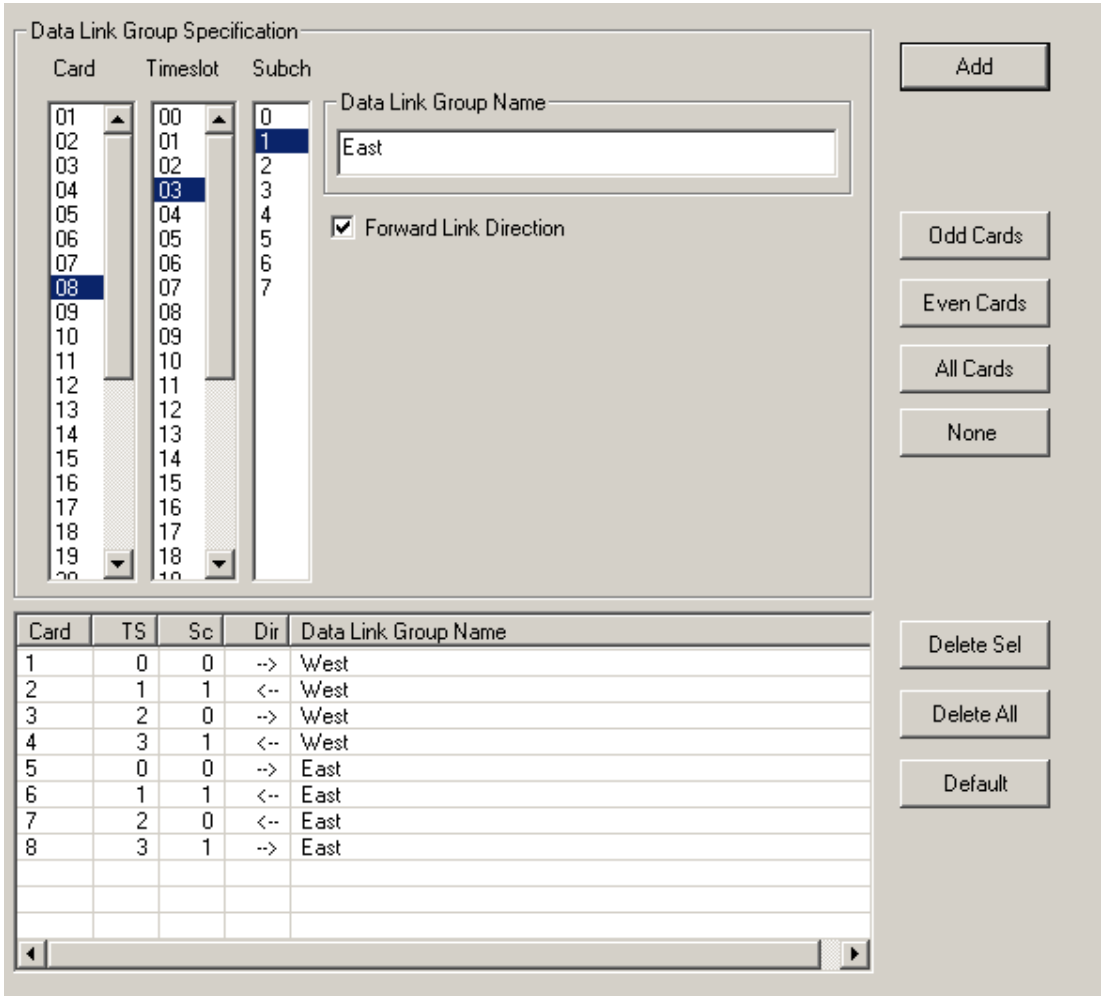
Aggregate Group Column

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



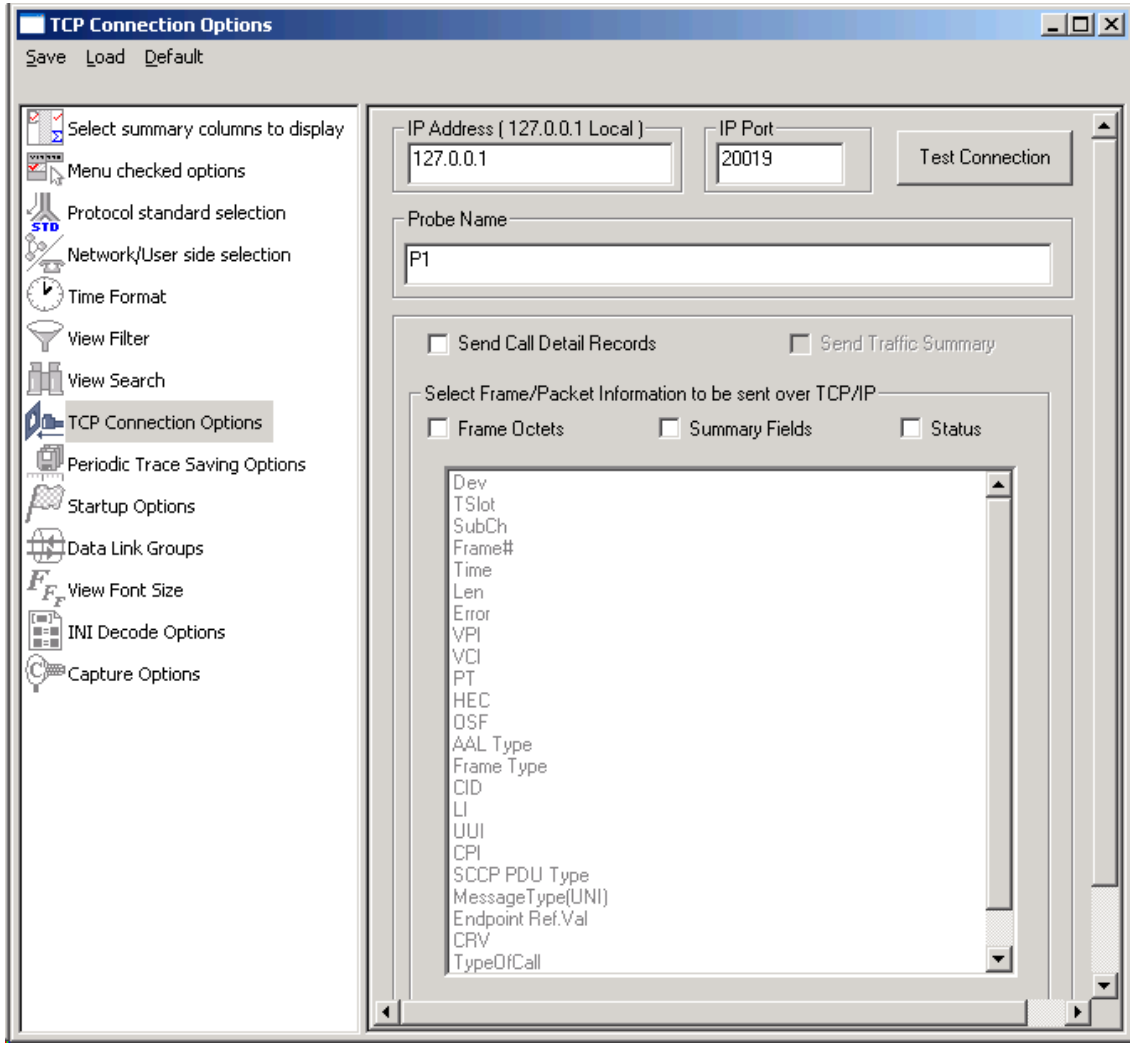
Data Link Group

- Data link groups that help in defining the direction of the calls in a given network and form logical groups comprised of unidirectional (either 'Forward' or 'Backward') data links



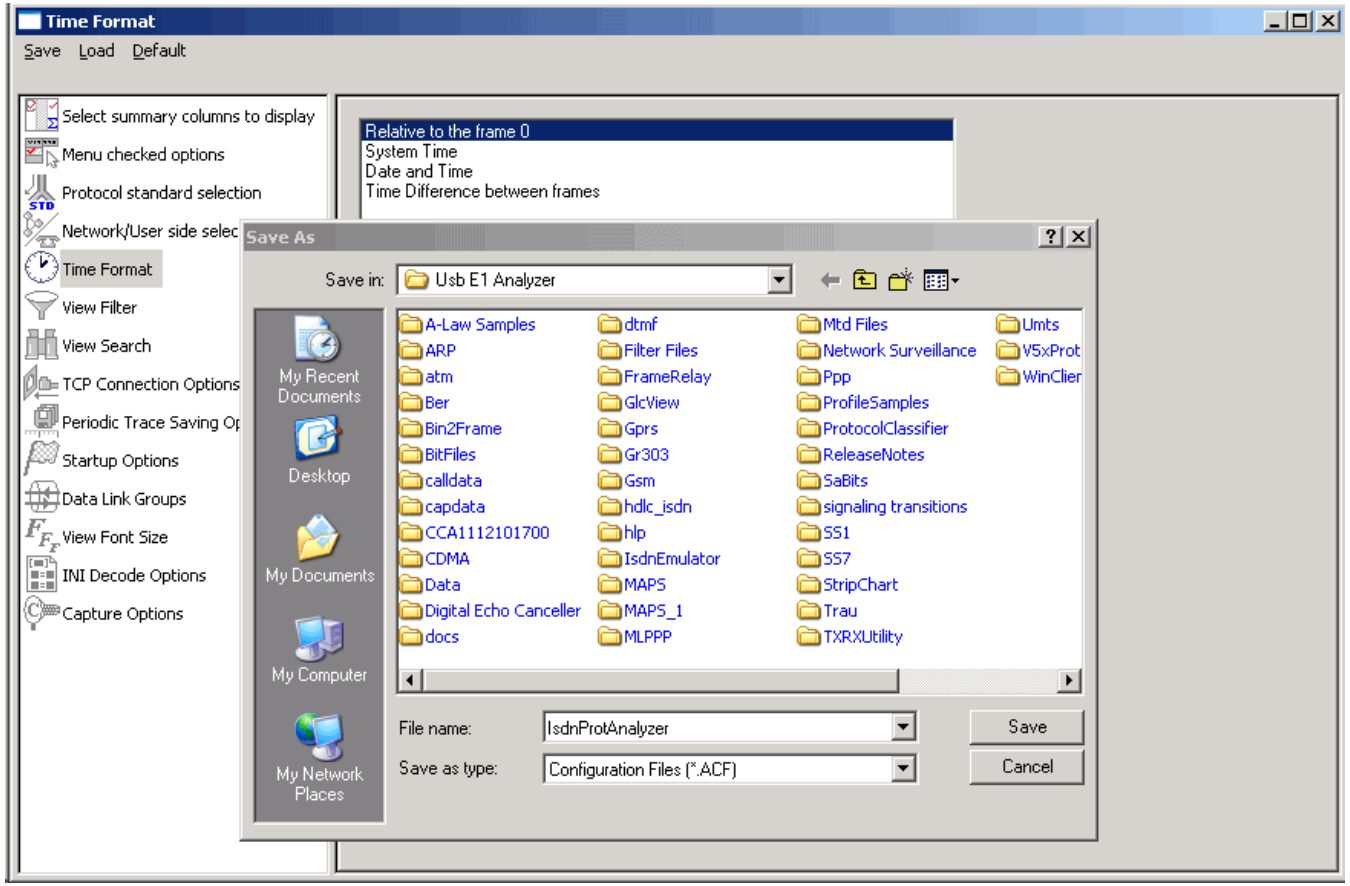
TCP Connection Options

- Used for Network Surveillance and Monitoring
- Designed to send protocol summary information and binary frame data via TCP- IP connection to a **Database Loader** to load data into a database



Save/Load All Configuration Settings

- Provides a consolidated interface for GUI and protocol settings
- Configuration settings can be saved to a file, loaded from a configuration file, or just revert to the default values using the default option



Remote ISDN Analyzer

What are Remote Protocol Analyzers?

“HDLC based protocols can be monitored remotely via a set of hardware and software features available with our T1 or E1 based protocol analyzers

- The RPA functionality permits:
  - Unattended and 24/7 operation
  - Remote accessibility for difficult connection situations
  - Remote non-intrusive operation
  - Remote detailed diagnostic capability
- Supported protocols for remote analysis includes -
  - HDLC
  - ISDN
  - SS7
  - GR303
  - Frame Relay
  - V5.x

GL Communications

Key Features

- Client side consists of a PC with Ethernet connectivity and GUI Remote Protocol Analysis software – no special T1 or E1 hardware is required
- Multiple T1 E1 servers may be simultaneously connected to a single remote client using a single GUI
- Multiple remote clients may access a single T1 E1 server. Also, the T1 E1 server is fully functional while being accessed as a server. Thus, a user may perform T1 E1 operations locally on the server while a remote client is accessing the same server, in real time
- Supports real-time and offline analysis at the remote client location
- Remote analyzers support capturing of encapsulated protocols and long frames
- Common filtering criteria can be set for T1 E1 cards located on multiple servers

Pre-requisites

- At the site of monitoring

  ➢Dual T1 E1 PCI based cards or USB based T1 E1 units

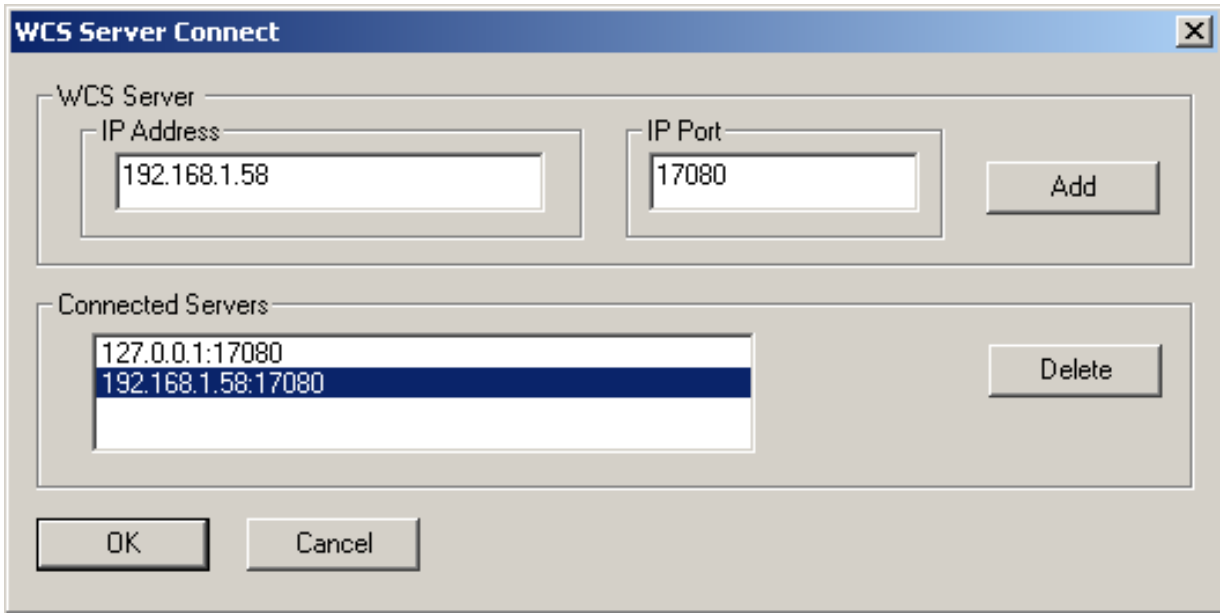
  ➢T1 E1 Server software with HDLC capture software

- At the client location

  ➢Appropriate GUI based “Remote Protocol Analyzer” such as ISDN, SS7, and others – licensed via “Dongle”

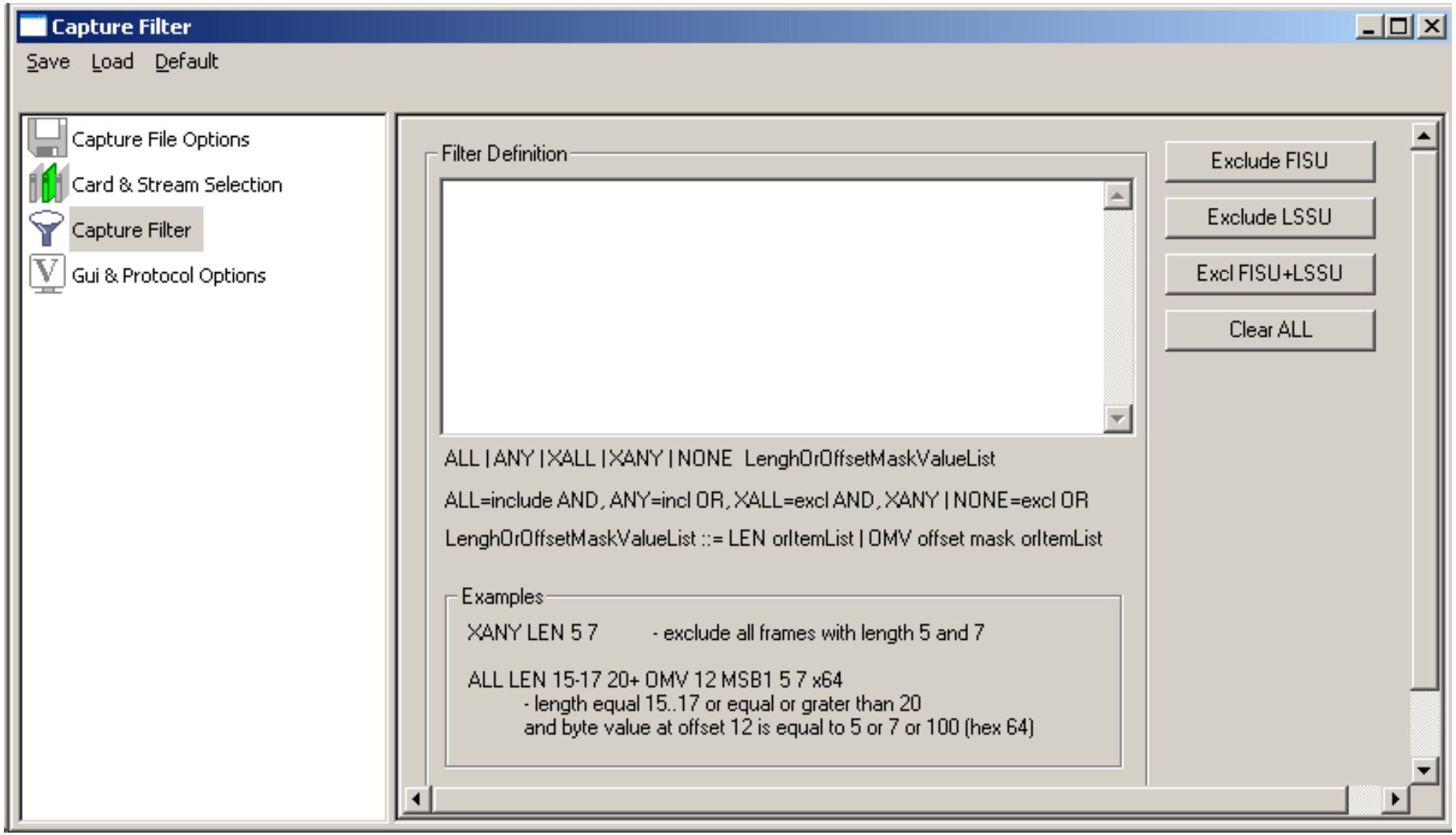
  ➢LAN/WAN TCP/IP Network with sufficient bandwidth to transport HDLC frames.

Remote Analysis



- Users are required to enter IP address of the WCS server and an IP Port
- Multiple Server IP Addresses can be added to connect simultaneously to all T1 E1 cards
- Lists an IP addresses and the IP port numbers
- Option is provided for an user to select the desired IP address of the server

Capture Filter



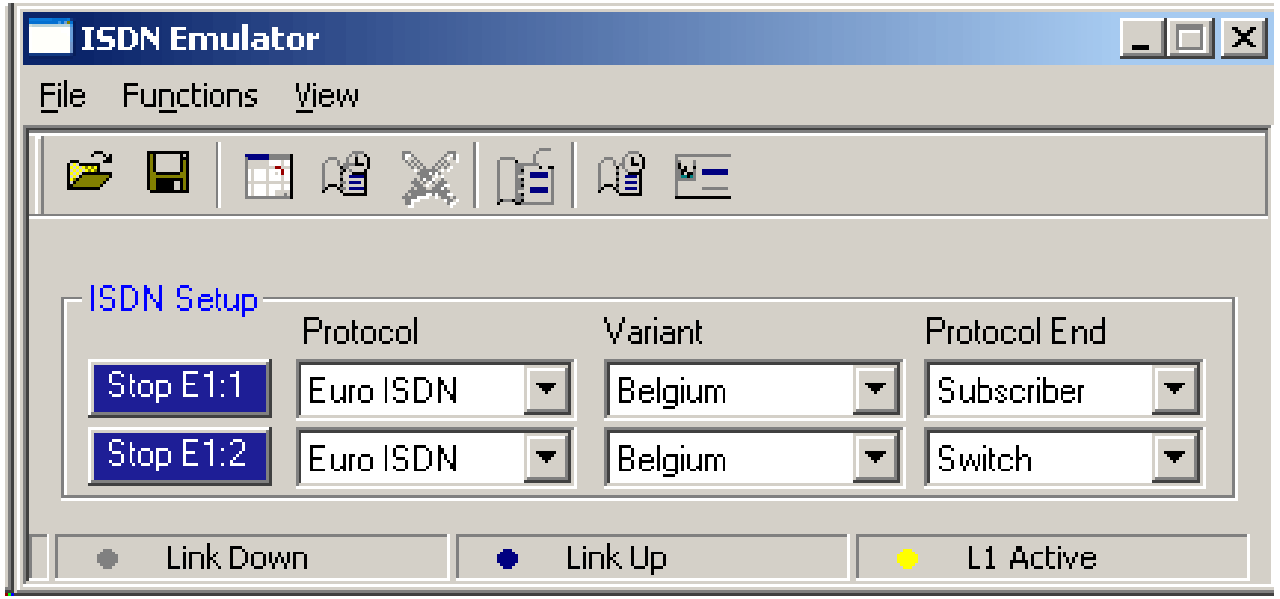
Capture Filter

- Real-time capture filter can be set prior to capturing frames
- Real-time filter parameter – Frame Length

  LSSU (Link Status Signal Unit), FISU (Fill-in Signal Unit), or any other user-defined frame

ISDN Emulator (XX029)

ISDN Emulator

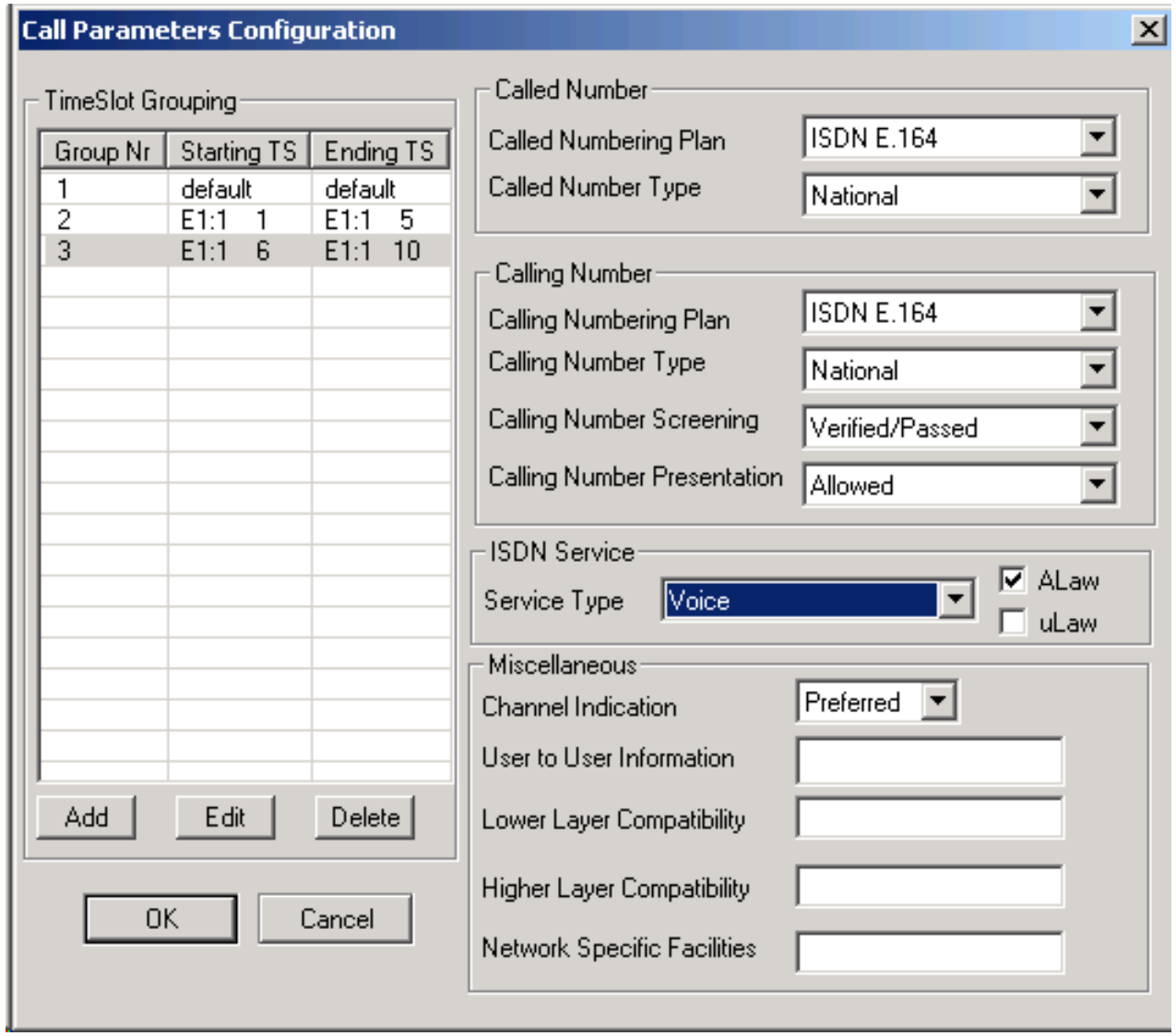


- Complete solution for testing, troubleshooting, installation and maintenance of devices and networks implementing PRI ISDN
- ISDN configuration includes selection of various ISDN standards, variants and NFAS, and more
- Send / capture PCM voice files, send / detect DTMF/MF digits, and send / detect frequency tones over an established calls

Key Features

- Nearly all ISDN standards and variants are supported. Variants are AT & T #4ESS, AT & T #5ESS, Bellcore #5ESS, National ISDN 2, Nortel, DMS – 250, and Siemens EWSD
- 1 to 4 Configurable Signaling Links
- Switch and Subscriber Emulation
- User Friendly GUI for Configuring the ISDN Layer parameters
- Provides various release causes such as rejected, no user response, user busy, congested, and so on for disconnection of the particular call on the channel
- Simple NFAS setup for T1
- Single/Dual T1, Single/Dual E1 Interfaces for the ISDN Signaling Links
- Call Records for Complete or Incomplete Calls
- Companion product "ISDN Protocol Analyzer" displays all ISDN Messages in Real Time
- Place call or accept call for each timeslot or for the whole trunk
- Supports Overlap Digit Sending
- Exports call records to a TEXT file
- Displays Lap D (Layer 2) statistics

Call Parameters Configuration

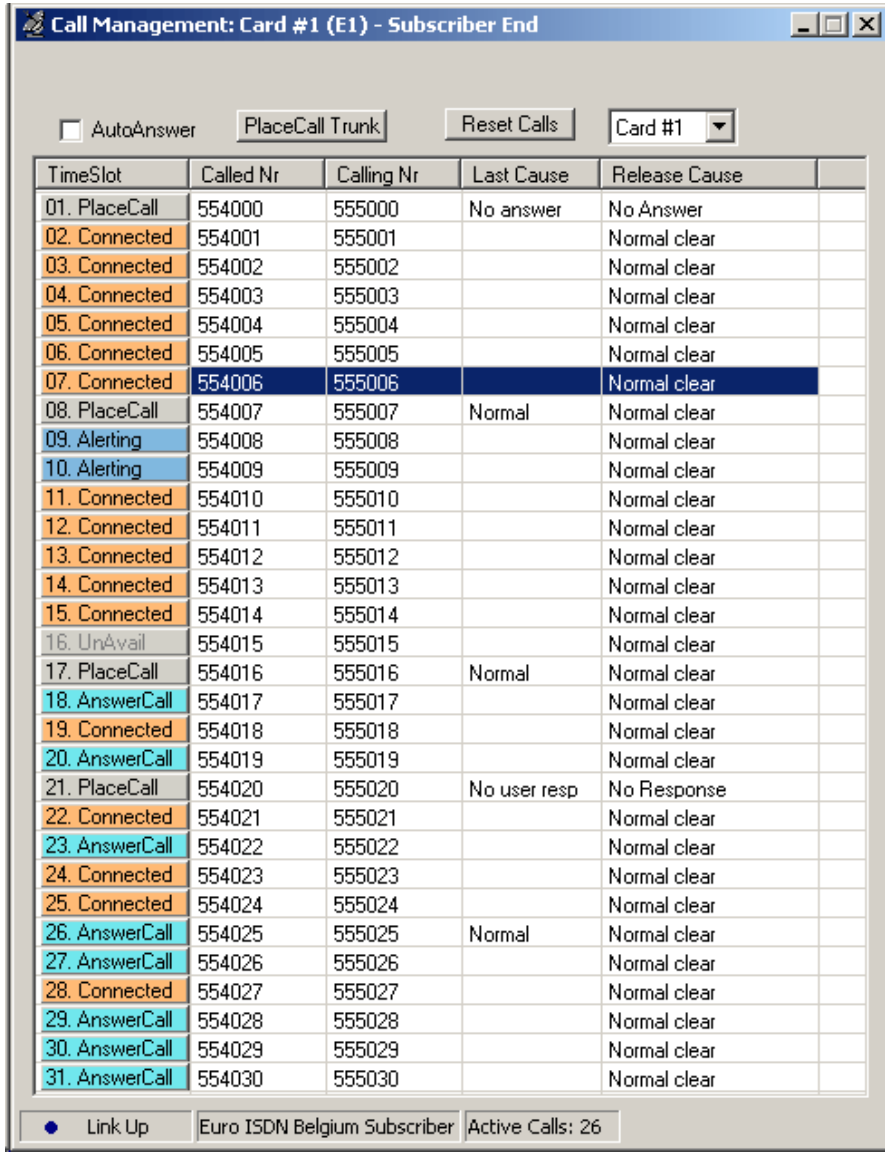


Call Parameters Configuration

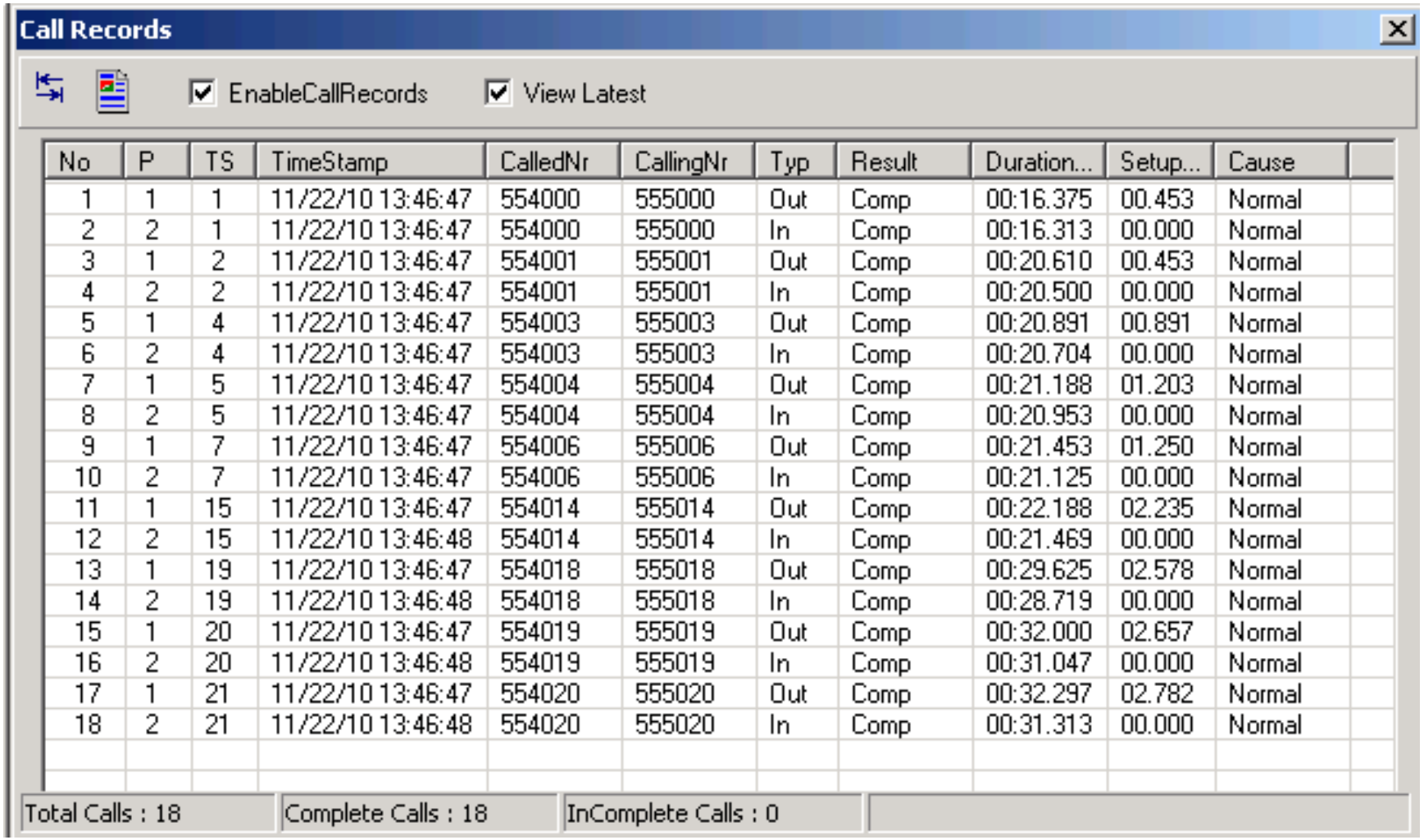
- The user-defined parameters are associated with the ISDN Setup message
- Allows to configure and modify ISDN parameters based on the user requirements
- ISDN call parameters includes –
  - Called/Calling Numbering plan
  - Called/Calling Number Type
  - Calling Number Screening
  - Calling Number Presentation
  - ISDN service type
  - A-Law/u-Law selection
  - Channel Indication
  - User-to-User Information
  - Low Layer compatibility
  - High Layer compatibility
  - Network-specific facilities
- ISDN parameters may be saved within a Timeslot group so as to allow multiple ISDN parameter configurations, simultaneously
- Quick configuration for Called and Calling Number

Call Management

- Allows the user to place calls on a single or on all timeslots manually
- Status field, indicates the link status or ISDN protocol status on that card
- The following types of manual calls may be made:
  - Software originated call to a standard phone
  - Software originated call to a number not corresponding to a standard phone or fax machine (software generated/received calls over timeslots without physical connections)
  - Call originated from a standard phone to ISDN emulator
- Various Release Cause codes such as Unassign Num, Call Forward, User Busy, and many more can be set for disconnecting a particular call



Call Records



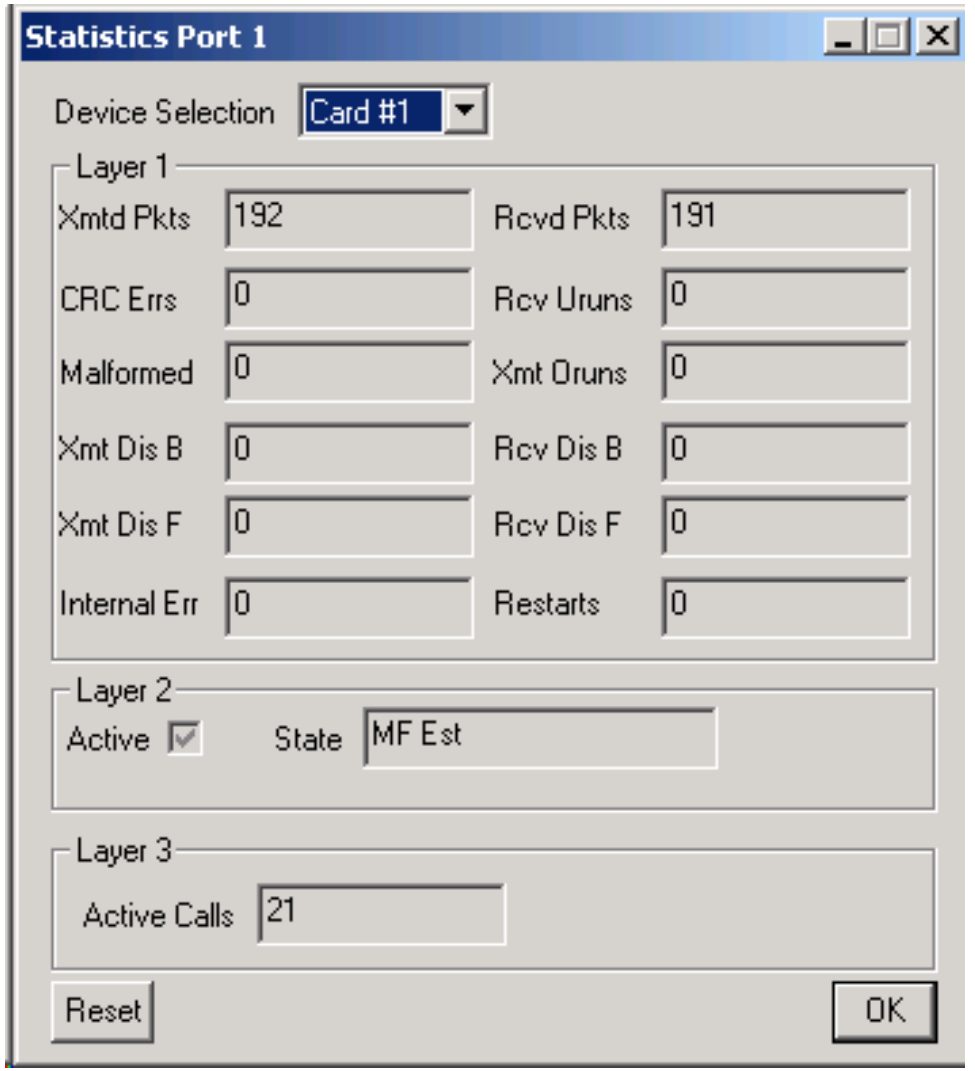
No	P	TS	TimeStamp	CalledNr	CallingNr	Typ	Result	Duration...	Setup...	Cause
1	1	1	11/22/10 13:46:47	554000	555000	Out	Comp	00:16.375	00.453	Normal
2	2	1	11/22/10 13:46:47	554000	555000	In	Comp	00:16.313	00.000	Normal
3	1	2	11/22/10 13:46:47	554001	555001	Out	Comp	00:20.610	00.453	Normal
4	2	2	11/22/10 13:46:47	554001	555001	In	Comp	00:20.500	00.000	Normal
5	1	4	11/22/10 13:46:47	554003	555003	Out	Comp	00:20.891	00.891	Normal
6	2	4	11/22/10 13:46:47	554003	555003	In	Comp	00:20.704	00.000	Normal
7	1	5	11/22/10 13:46:47	554004	555004	Out	Comp	00:21.188	01.203	Normal
8	2	5	11/22/10 13:46:47	554004	555004	In	Comp	00:20.953	00.000	Normal
9	1	7	11/22/10 13:46:47	554006	555006	Out	Comp	00:21.453	01.250	Normal
10	2	7	11/22/10 13:46:47	554006	555006	In	Comp	00:21.125	00.000	Normal
11	1	15	11/22/10 13:46:47	554014	555014	Out	Comp	00:22.188	02.235	Normal
12	2	15	11/22/10 13:46:48	554014	555014	In	Comp	00:21.469	00.000	Normal
13	1	19	11/22/10 13:46:47	554018	555018	Out	Comp	00:29.625	02.578	Normal
14	2	19	11/22/10 13:46:48	554018	555018	In	Comp	00:28.719	00.000	Normal
15	1	20	11/22/10 13:46:47	554019	555019	Out	Comp	00:32.000	02.657	Normal
16	2	20	11/22/10 13:46:48	554019	555019	In	Comp	00:31.047	00.000	Normal
17	1	21	11/22/10 13:46:47	554020	555020	Out	Comp	00:32.297	02.782	Normal
18	2	21	11/22/10 13:46:48	554020	555020	In	Comp	00:31.313	00.000	Normal

- Displays completed as well as incomplete call chronologically

GL Communications

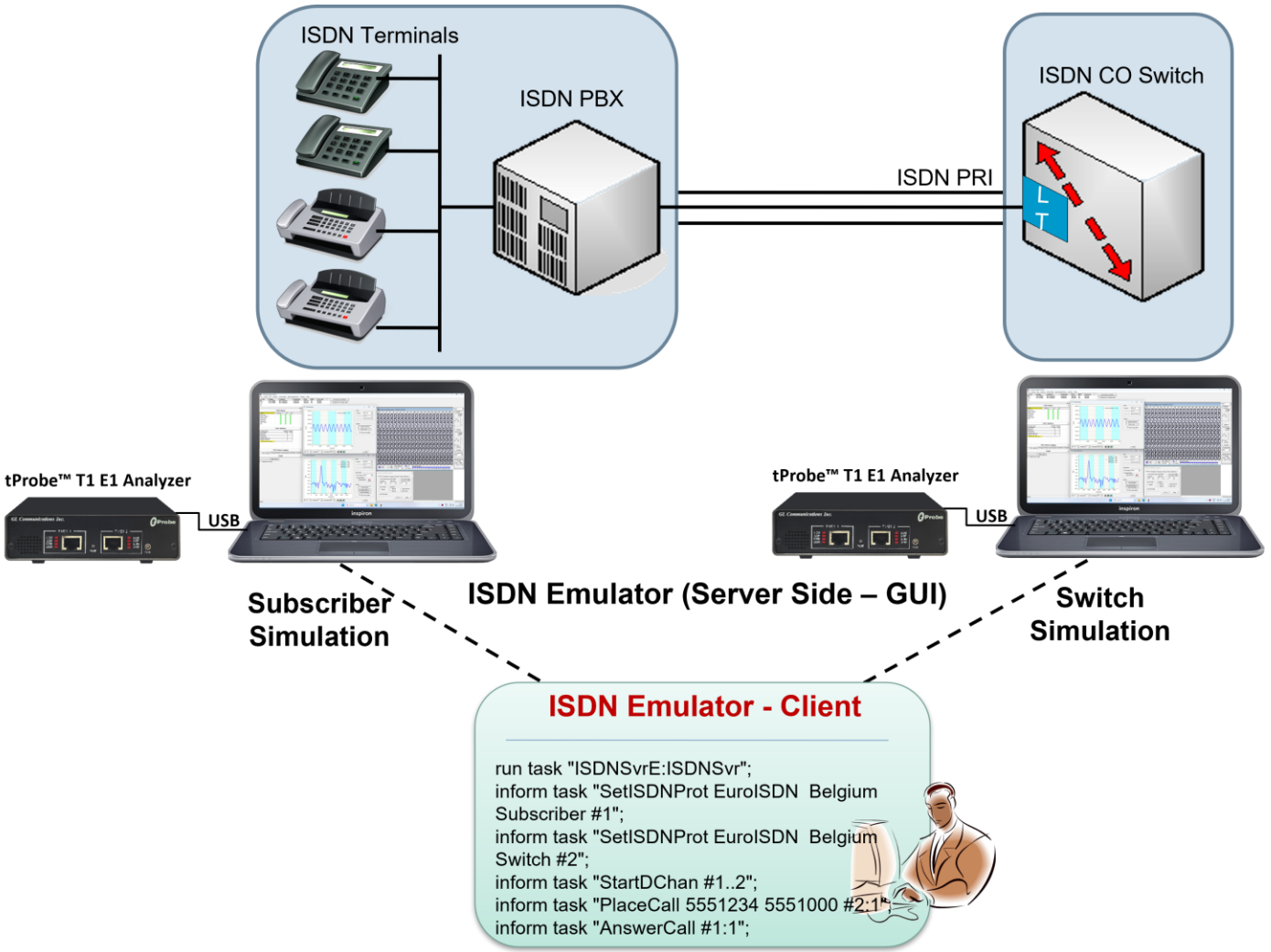
Card Statistics

- Displays the complete statistics for Layer 1, LAPD and Layer 3
- Layer1 statistics includes number of packet. sent/received, CRC errors, Internal errors, number of Restarts, Receive Under runs and Transmission Overruns etc.
- LAPD details includes if LAPD is active and its state
- Layer 3 details include number of active calls

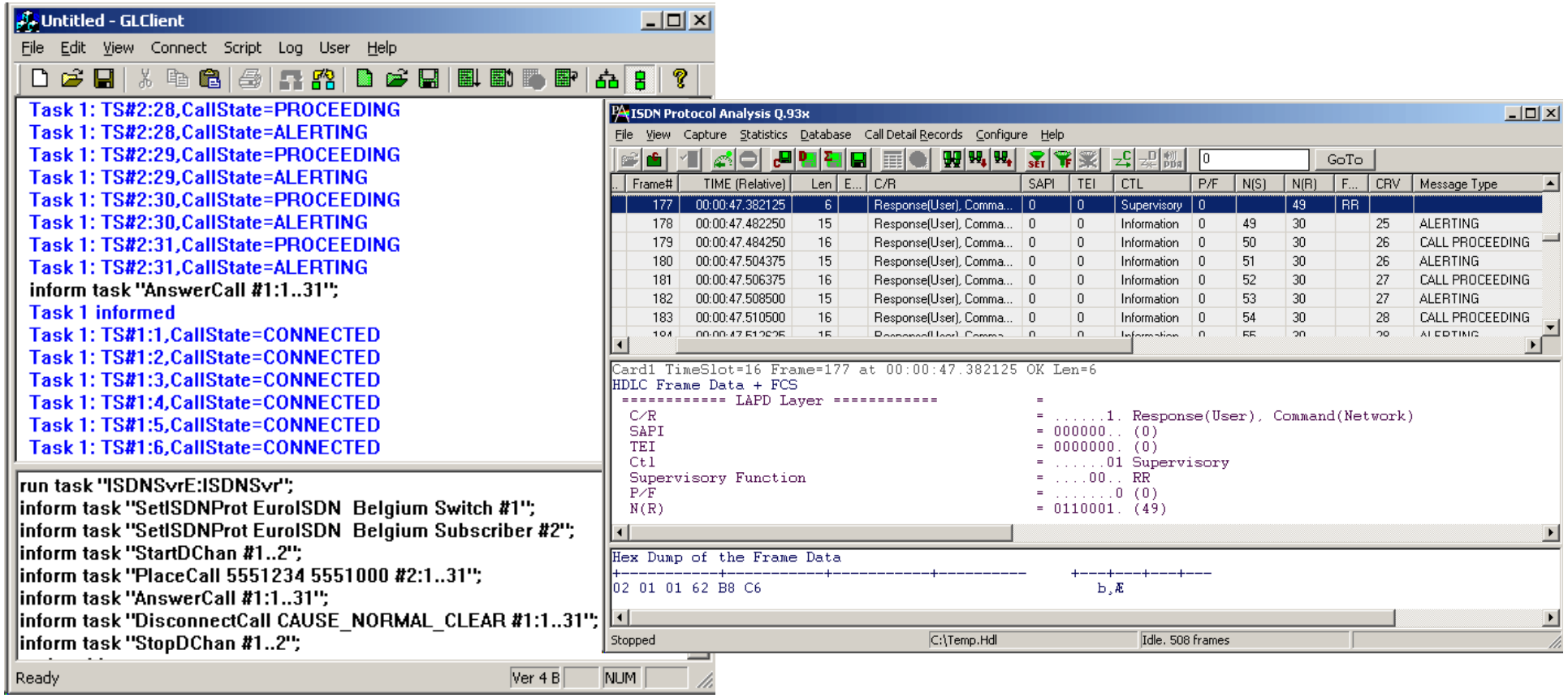


ISDN Emulation using Client Server

ISDN Emulation
(Module license # - XX629)



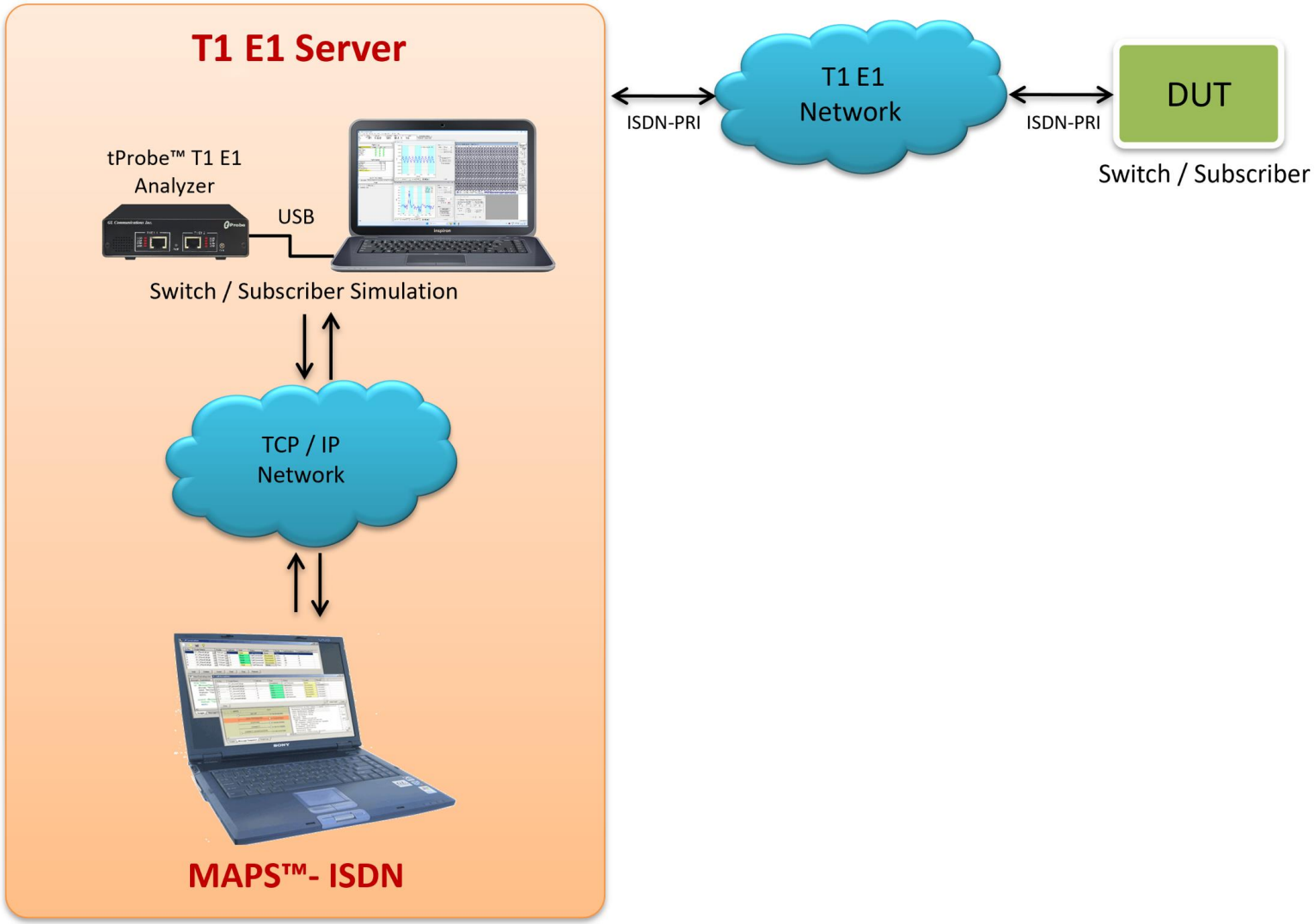
MAPS™ - ISDN (XX648)



- Place and Answer ISDN Calls
- Monitor all link state and call state

High-Capacity ISDN Emulation using MAPS™

MAPS™ - ISDN (XX648)



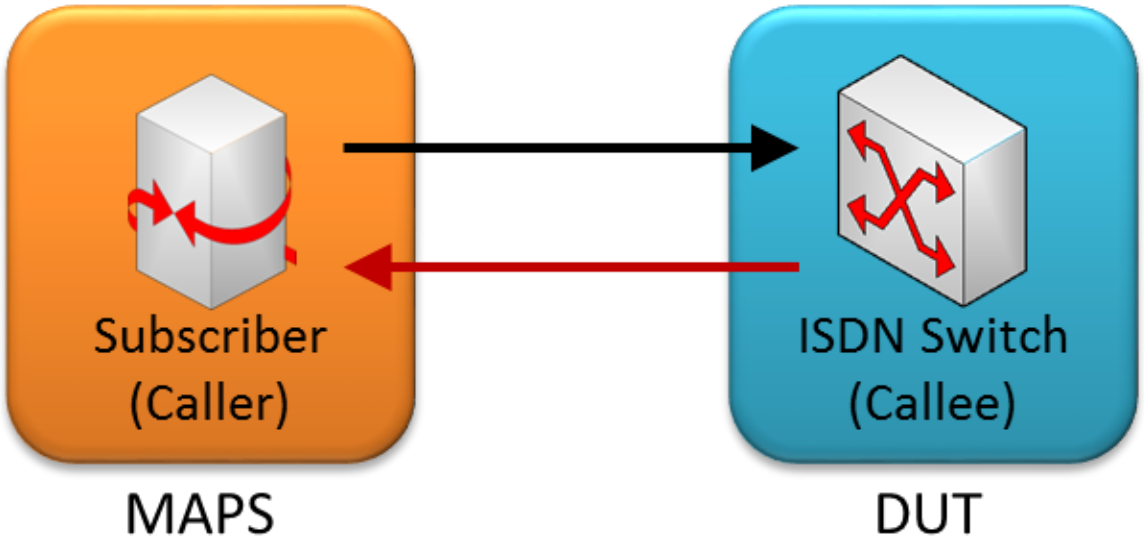
MAPS™ - ISDN Key Features

- ISDN simulation over TDM (T1 E1)
- Multiple T1 E1 line interfaces supported
- Access to all ISDN Message Parameters such as Call Reference Value, Called Number, Calling Number, Port Number, and more
- Switch and Subscriber Emulation
- Provides various release cause codes such as rejected, no user response, user busy, congested, and so on to troubleshoot the problems in ISDN
- Overlap sending of ISDN messages
- Supports NFAS testing for T1 only
- Supported on Windows® 8 (or higher) operating systems

ISDN Supported Protocol Standards

Supported Protocols	Standard / Specification Used
Q.931	ITU-T Q.931 / Q.932(Facility IE) / Q.955.3 (MLPPP Procedures)
4ESS	ISDN PRI (TR-41449)
5ESS	ISDN PRI (Lucent Tech - 5ESS 2000)
BELL	ISDN PRI (Bell Core SR-NWT-002343)

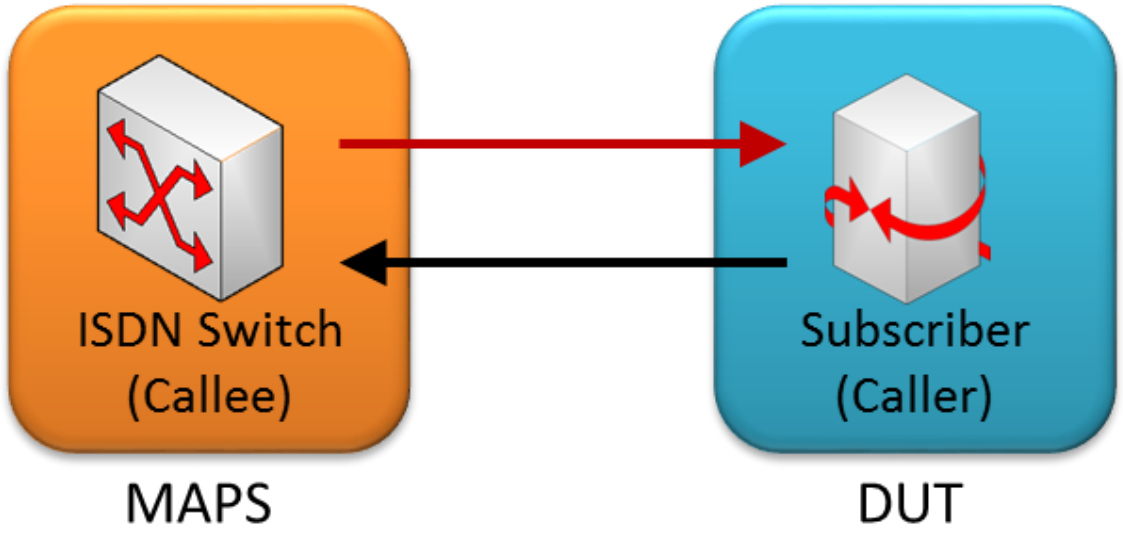
MAPS™ - ISDN as Subscriber



Scenario: MAPS™ testing ISDN Switch

- MAPS™ - ISDN can be configured to act as Subscriber to generate ISDN messages
- Capable to test ISDN Switch by sending ISDN messages

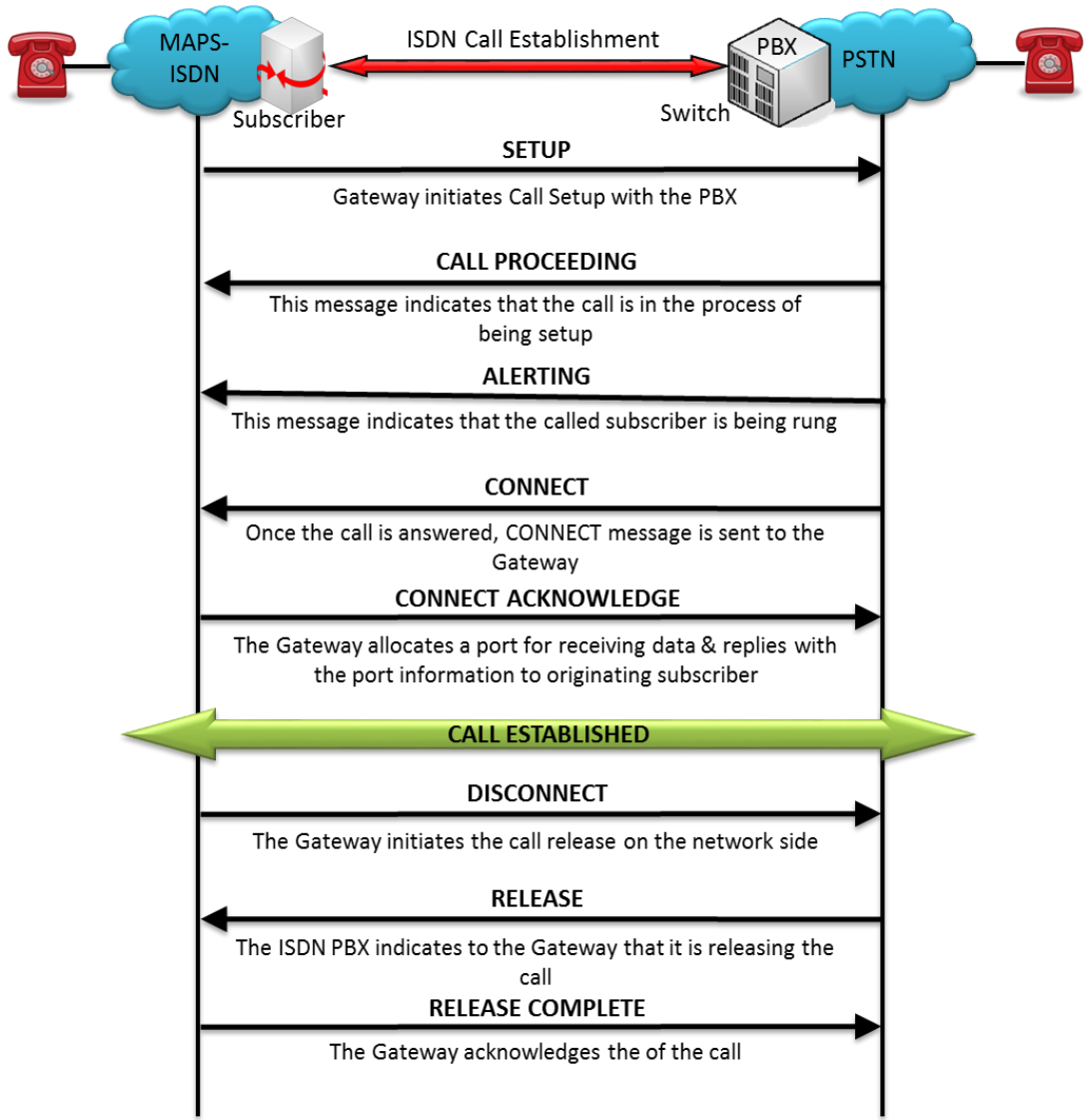
MAPS™ - ISDN as ISDN Switch



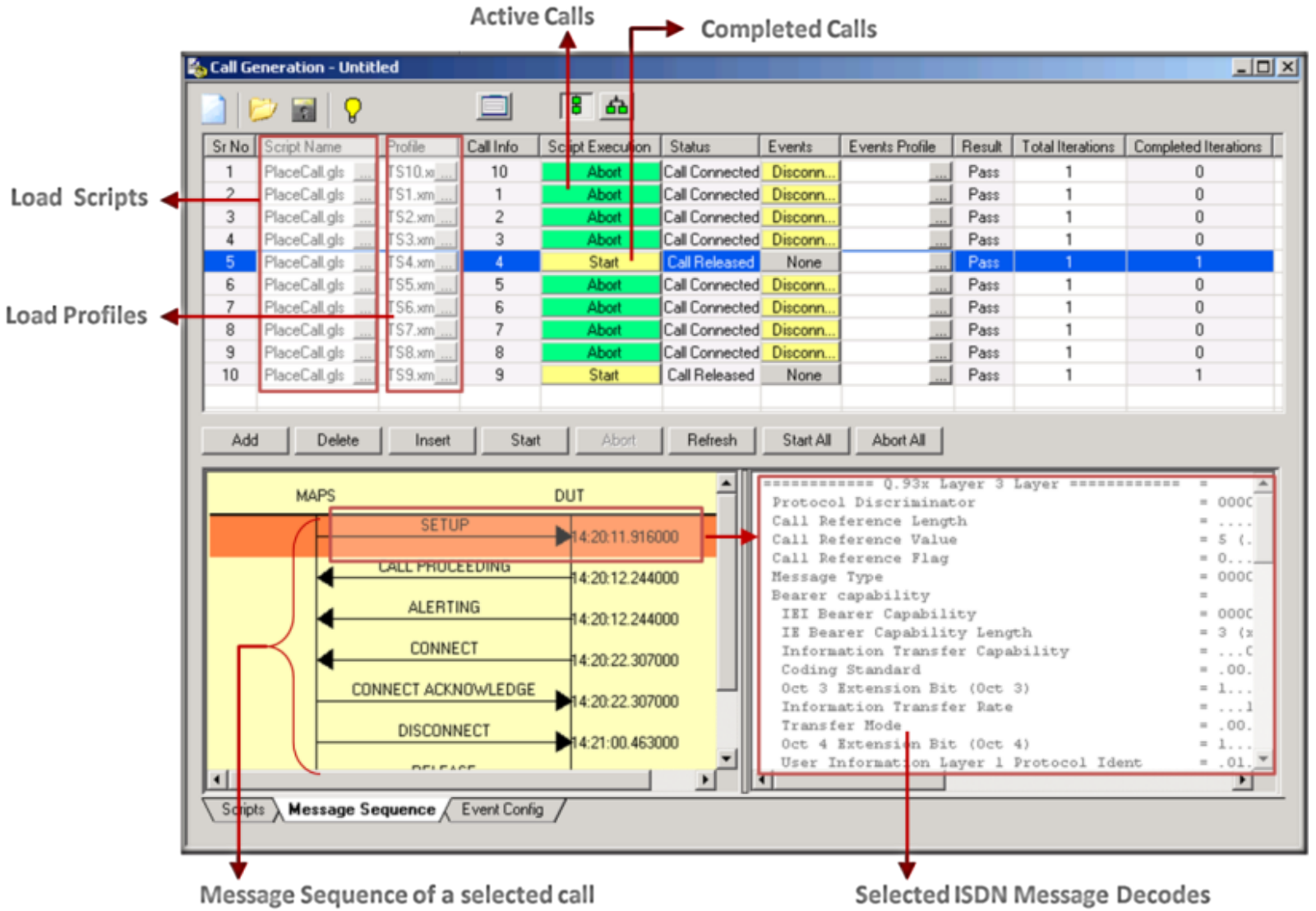
Scenario: MAPS™- ISDN acting as Switch

- MAPS™ - ISDN can be configured to act as Subscriber to generate ISDN messages
- Capable to test ISDN Switch by sending ISDN messages

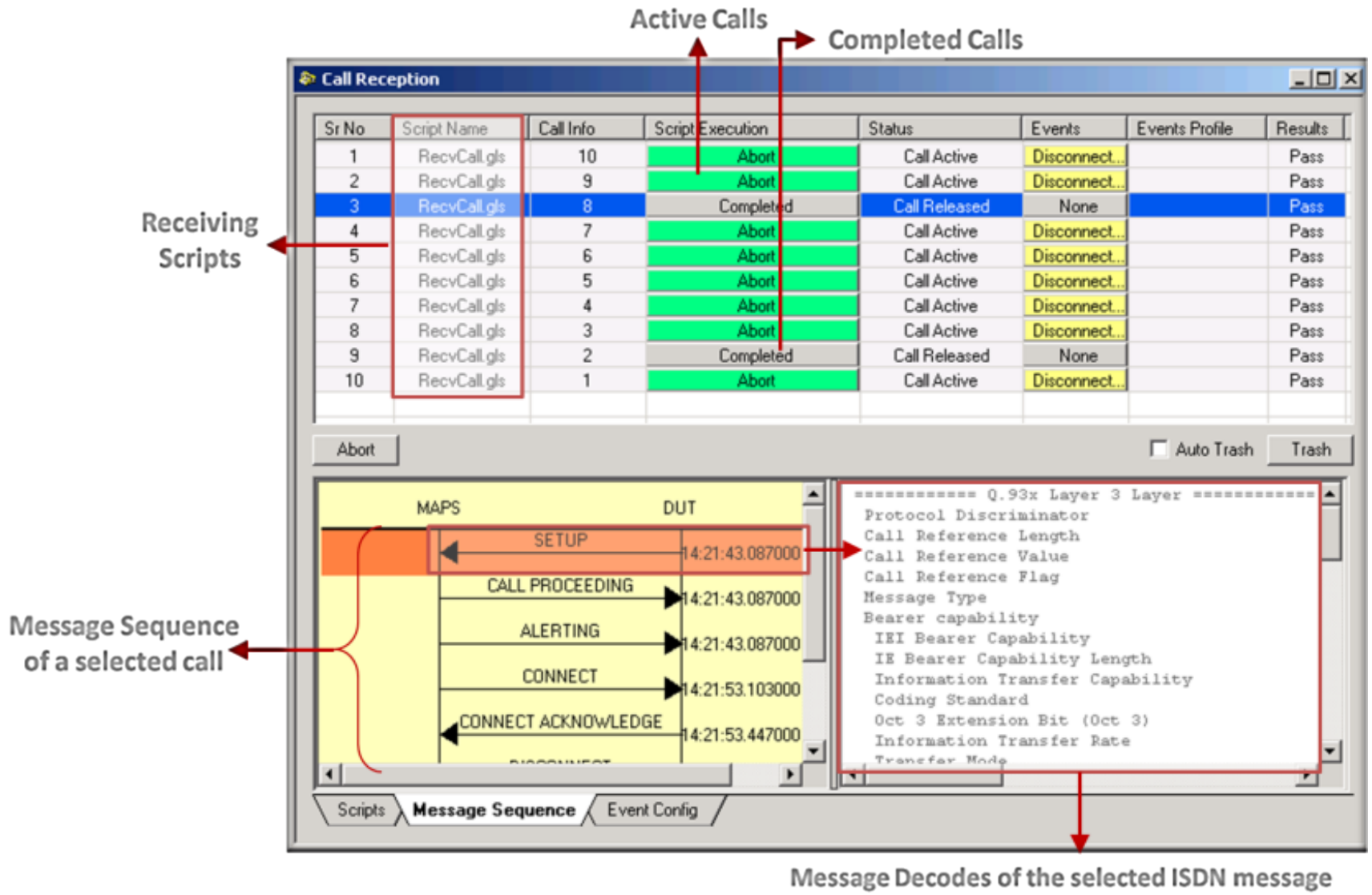
Typical ISDN Call Flow



MAPS™ - ISDN Call Generation

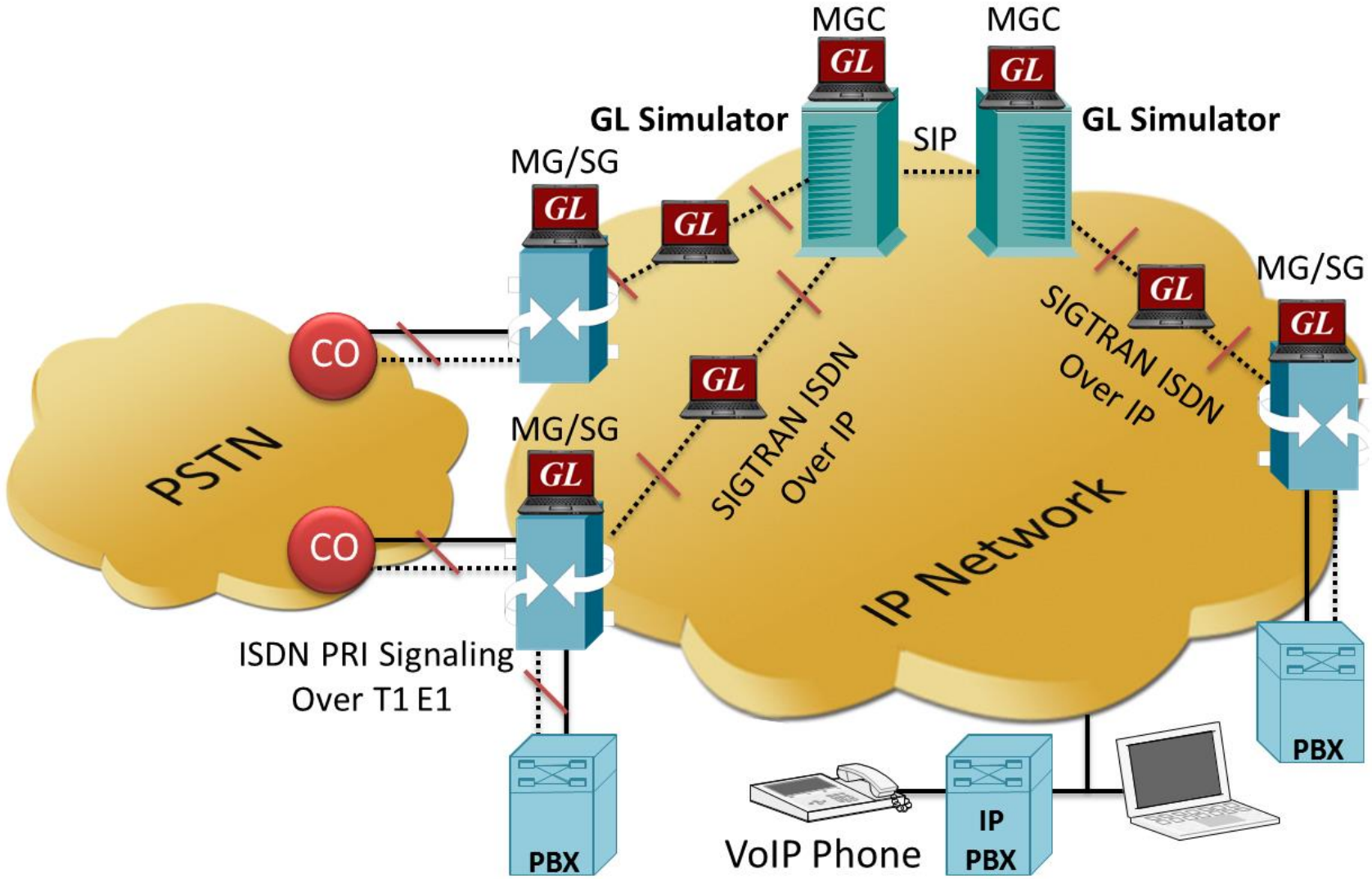


MAPS™ - ISDN Call Reception



High-Capacity ISDN SIGTRAN Emulation using MAPS™

MAPS™ ISDN - SIGTRAN (PKS135)



MAPS™ ISDN-SIGTRAN
Simulate Elements in ISDN Network over IP

GL Communications

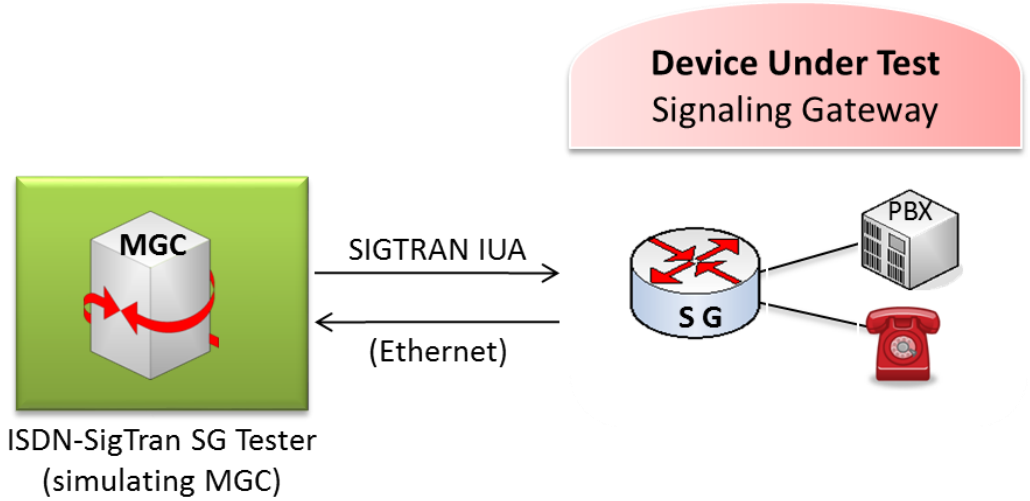
Key Features

- Simulates ISDN signalling over IP (ISDN-SIGTRAN)
- Generates and process all ISDN messages such as Setup, Connect, Release messages, and more
- Switch and Subscriber Emulation
- User controlled access to optional ISDN parameters such as timers
- Provides various release cause codes such as rejected, no user response, user busy, congested, and so on to troubleshoot the problems in ISDN
- Impairments can be applied to messages to simulate error conditions
- Supports scripted call generation and automated call reception

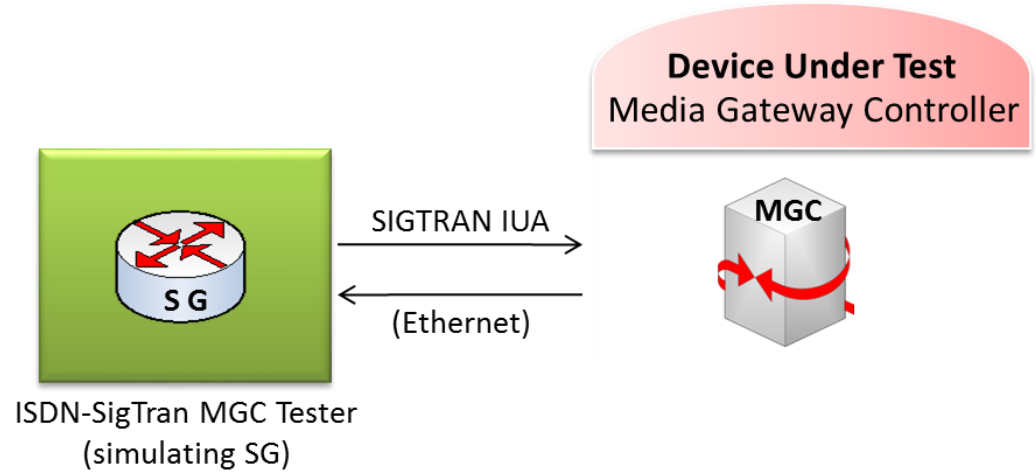
Supported Protocol Standards

Supported Protocols	Standard / Specification Used
ISDN SIGTRAN	
Q.931	ITU-T Q.931 / Q.932(Facility IE) / Q.955.3 (MLPP Procedures)
4ESS	ISDN PRI (TR-41449)
5ESS	ISDN PRI (Lucent Tech - 5ESS 2000)
BELL	ISDN PRI (Bell Core SR-NWT-002343)
IUA	RFC 4233 Integrated Services Digital Network (ISDN) Q.921-User Adaptation Layer

MAPS™ - ISDN SIGTRAN Configuration

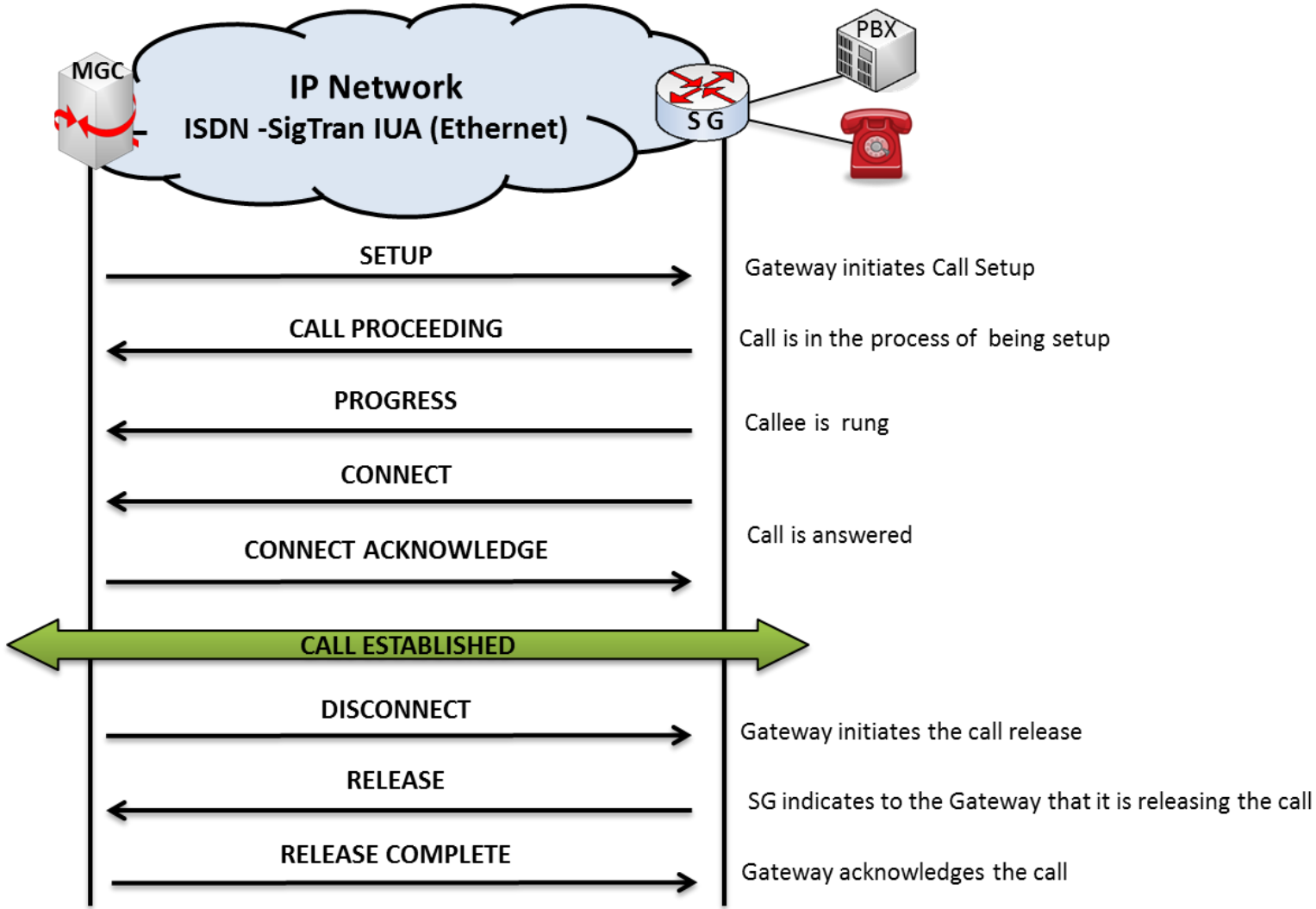


Scenario: MAPS™ acting as MGC

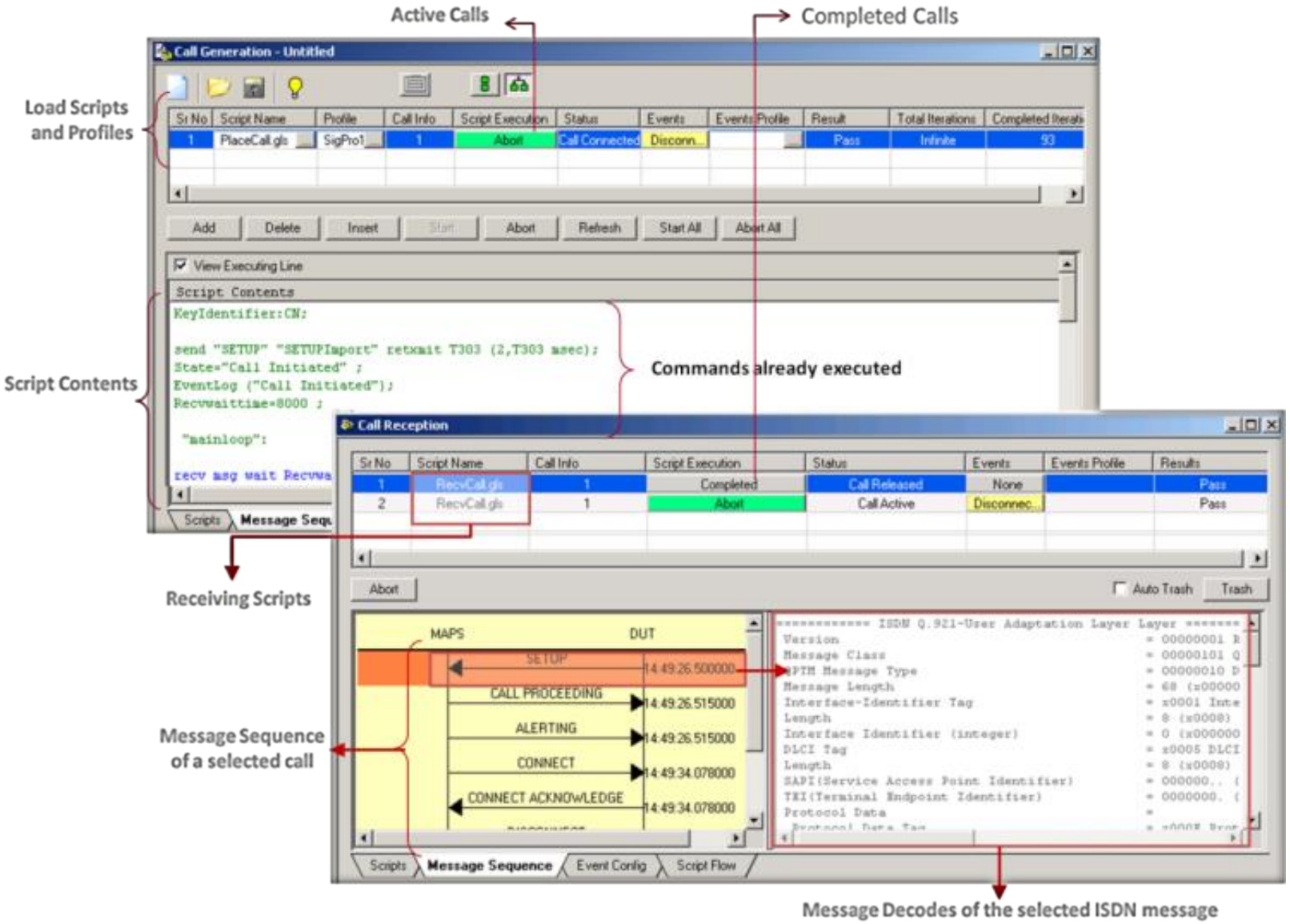


Scenario: MAPS™ acting as Signaling GW

Typical Call Scenario

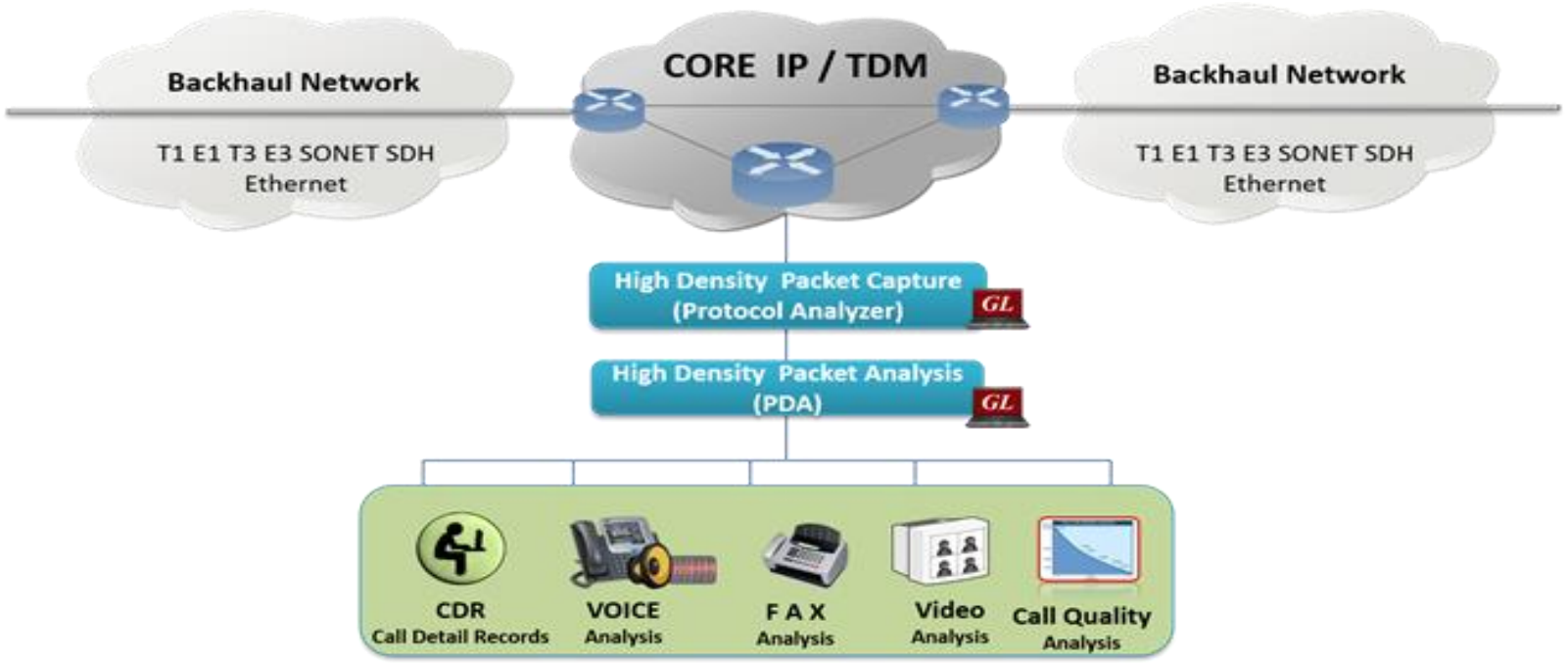


Call Generation and Reception



ISDN Packet Data Analysis (PDA)

Packet Data Analyzer over TDM

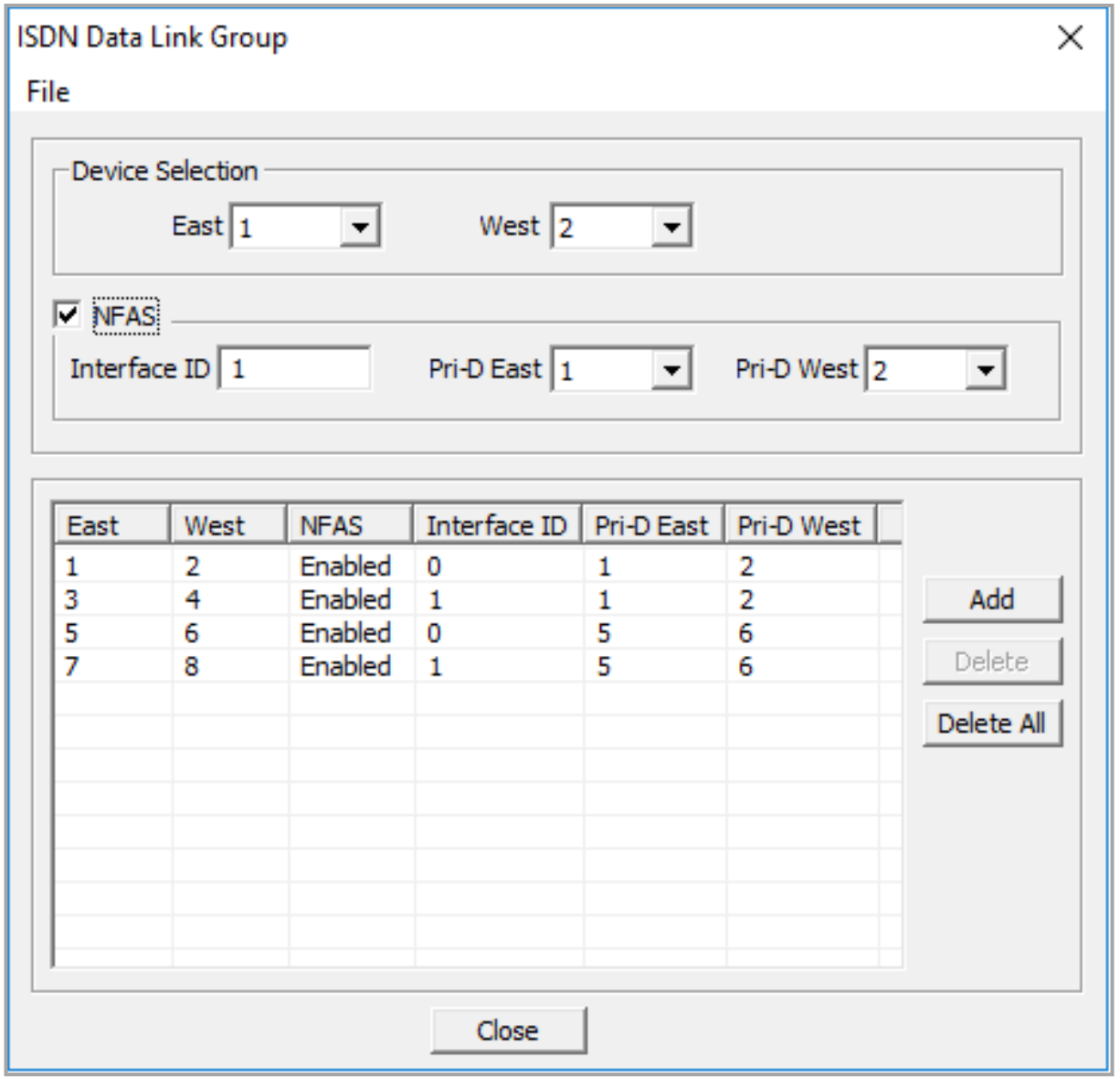


- Monitors live TDM networks including capture, analysis, and reporting of every call-in detail. Supported protocols include CAS, ISDN, ISUP, CAMEL, MAP, INAP, and GSM

Main Features

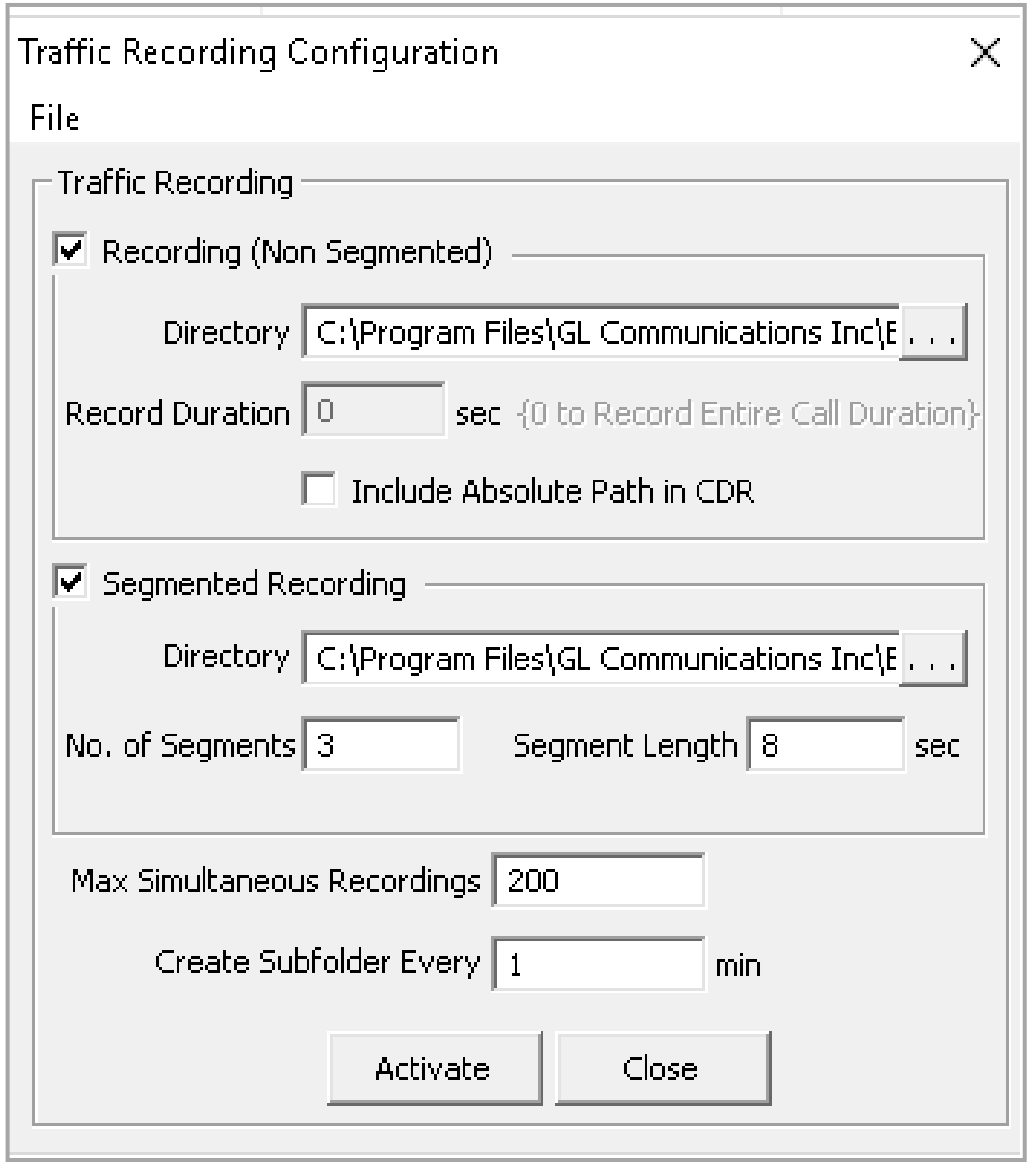
CDR, Call Flow, Statistics, and Report Generation	• Isolates call specific information for each individual call from the captured data and displays the information in an organized fashion • A host of call and message counters gives the user an instantaneous snapshot of the traffic on the network • Pictorial representation of the statistics including ladder diagrams for the calls of various protocols • Ability to export and analyze call detail records of completed calls in CSV file format. • These reports can be further fed to DB and accessed using GL's NetSurveyorWeb™ Lite for analysis • Isolates calls, a graphical call flow diagram can be created from a call trace. • Filters on CDR information feature is used to search required calls by using "key" as CDR parameters • Event counters on CDR information provides over all count of completed events such as total calls, active calls, completed calls, purged calls, failed calls, calls per second, remaining calls and more • Flexible options are provided to interchange/hide the columns as required
Traffic Recording	• Supports capturing of voice, digits, tones and FAX etc to *.PCM file format
Triggers and Actions	• Filter captures based on protocol parameters such as OPC, DPC or CIC in case of ISUP followed by a set of actions such as save call, send mail, trigger alarm notification etc. for the completed calls
Exporting Calls	• Supports saving the selected calls from traffic analyzer into *.HDL, *.PCAP, or *.PCAPNG formats

ISDN Data Link Group



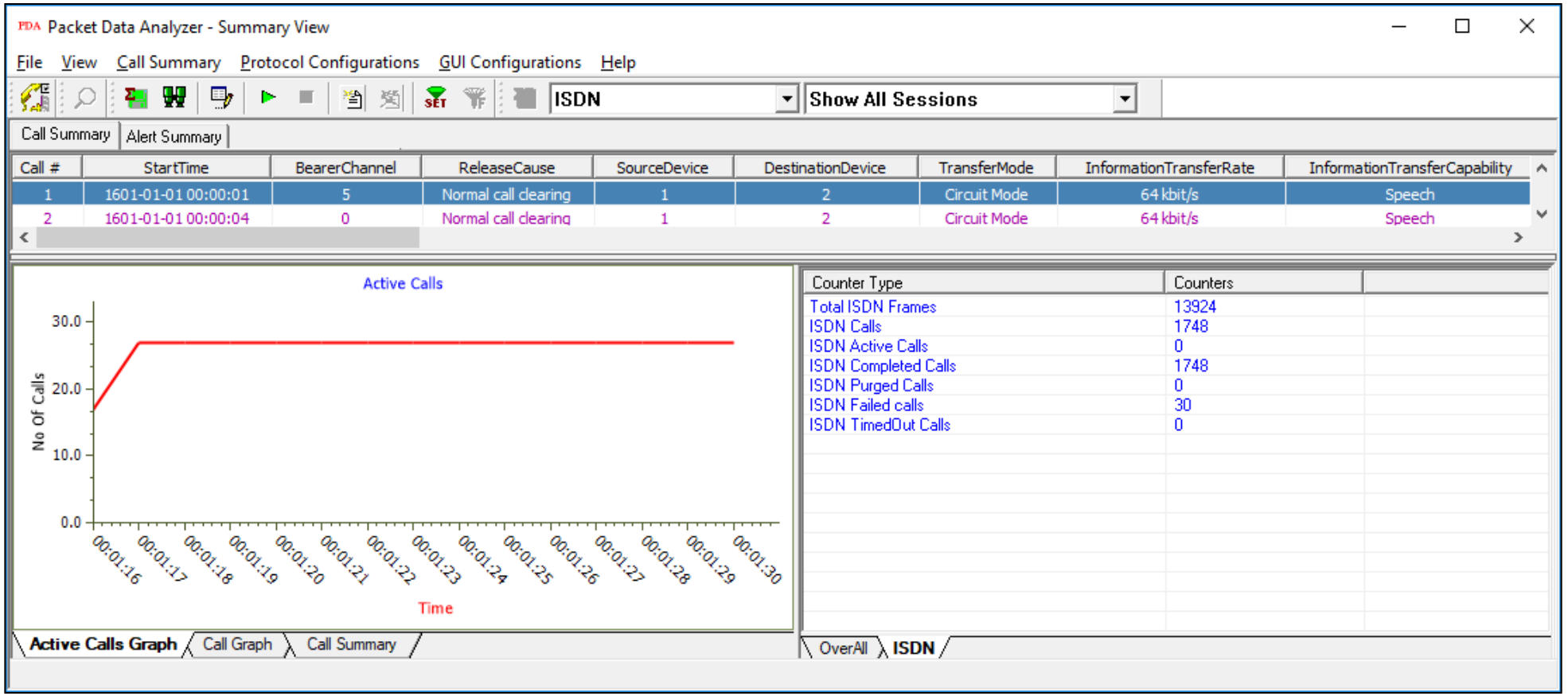
GL Communications

Traffic Recording Configurations

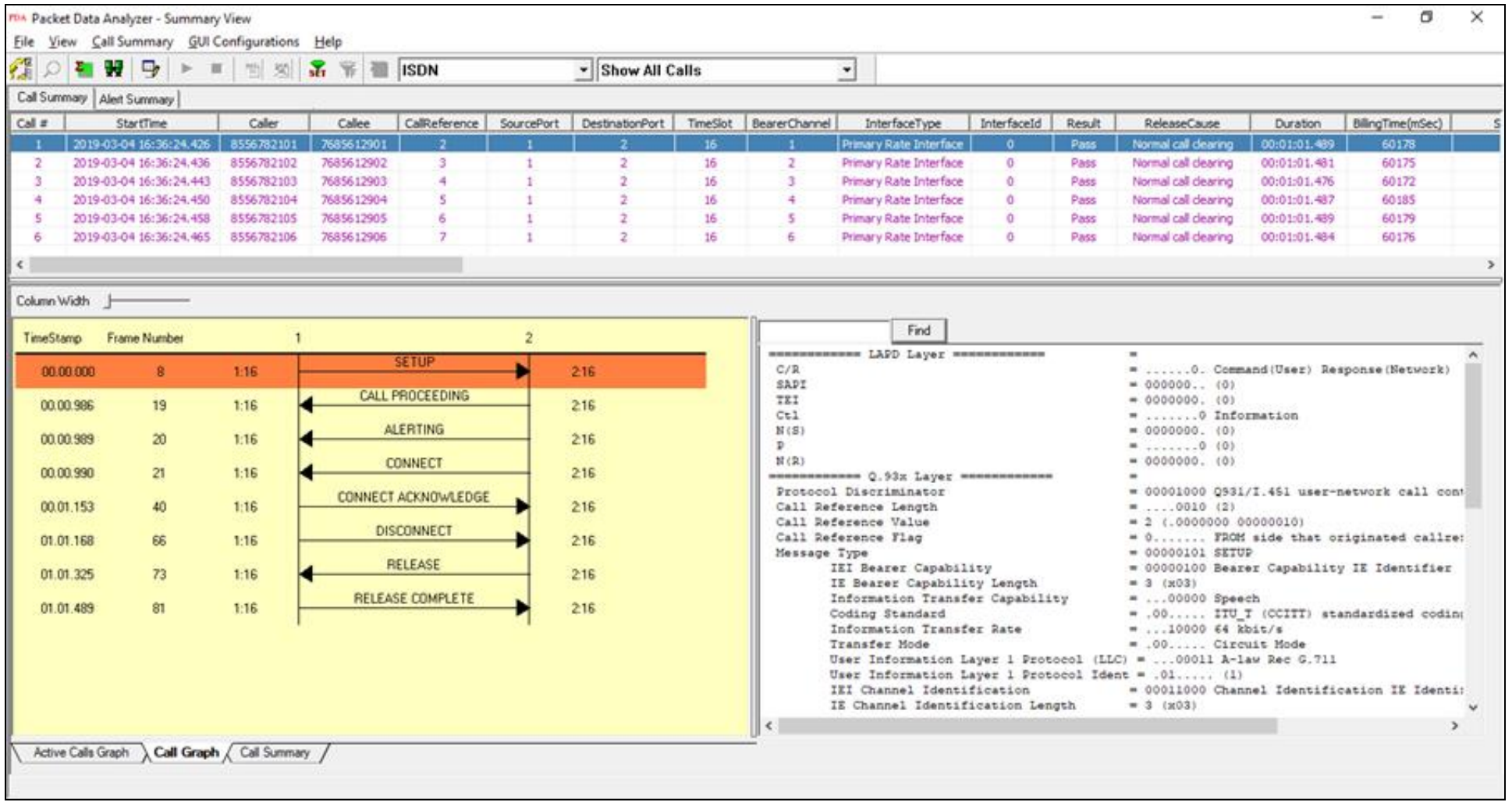


ISDN Call Summary

Active Call Graph

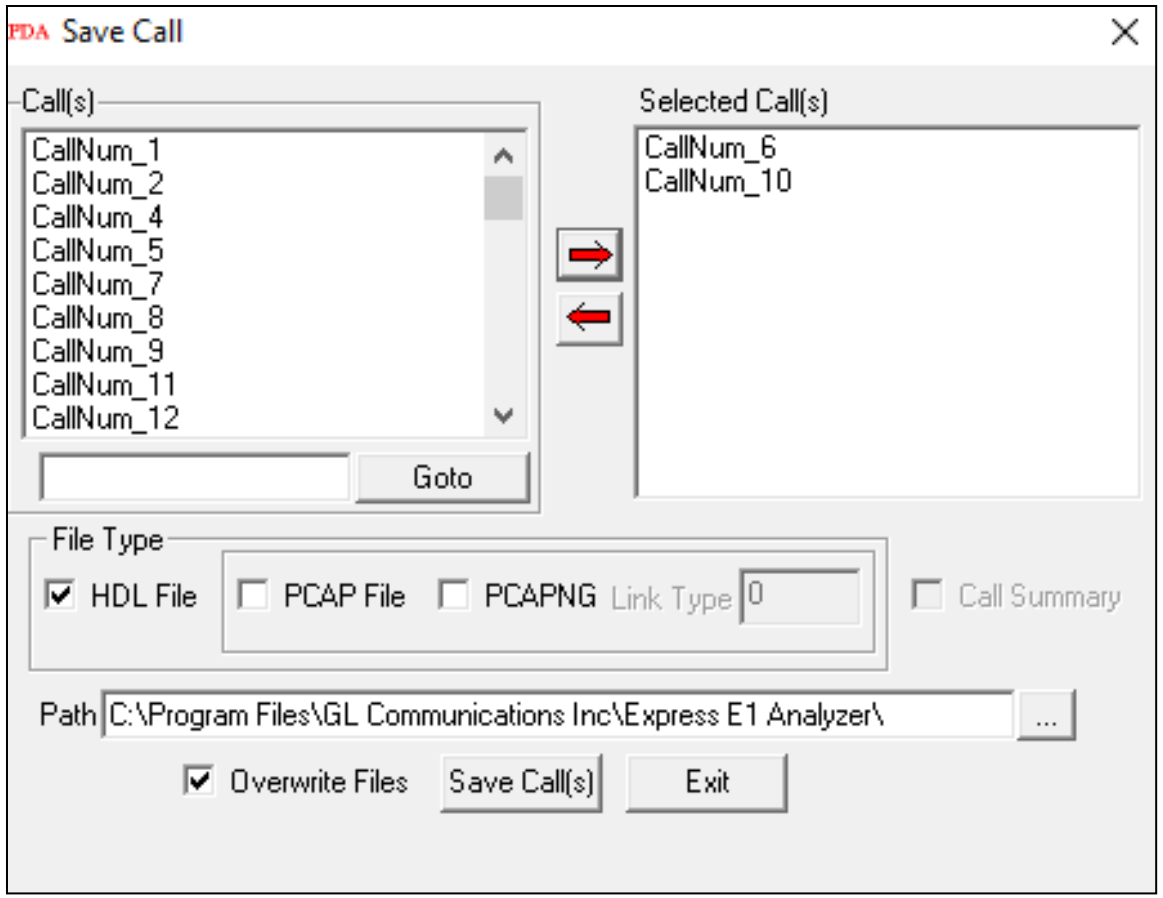


Summary View



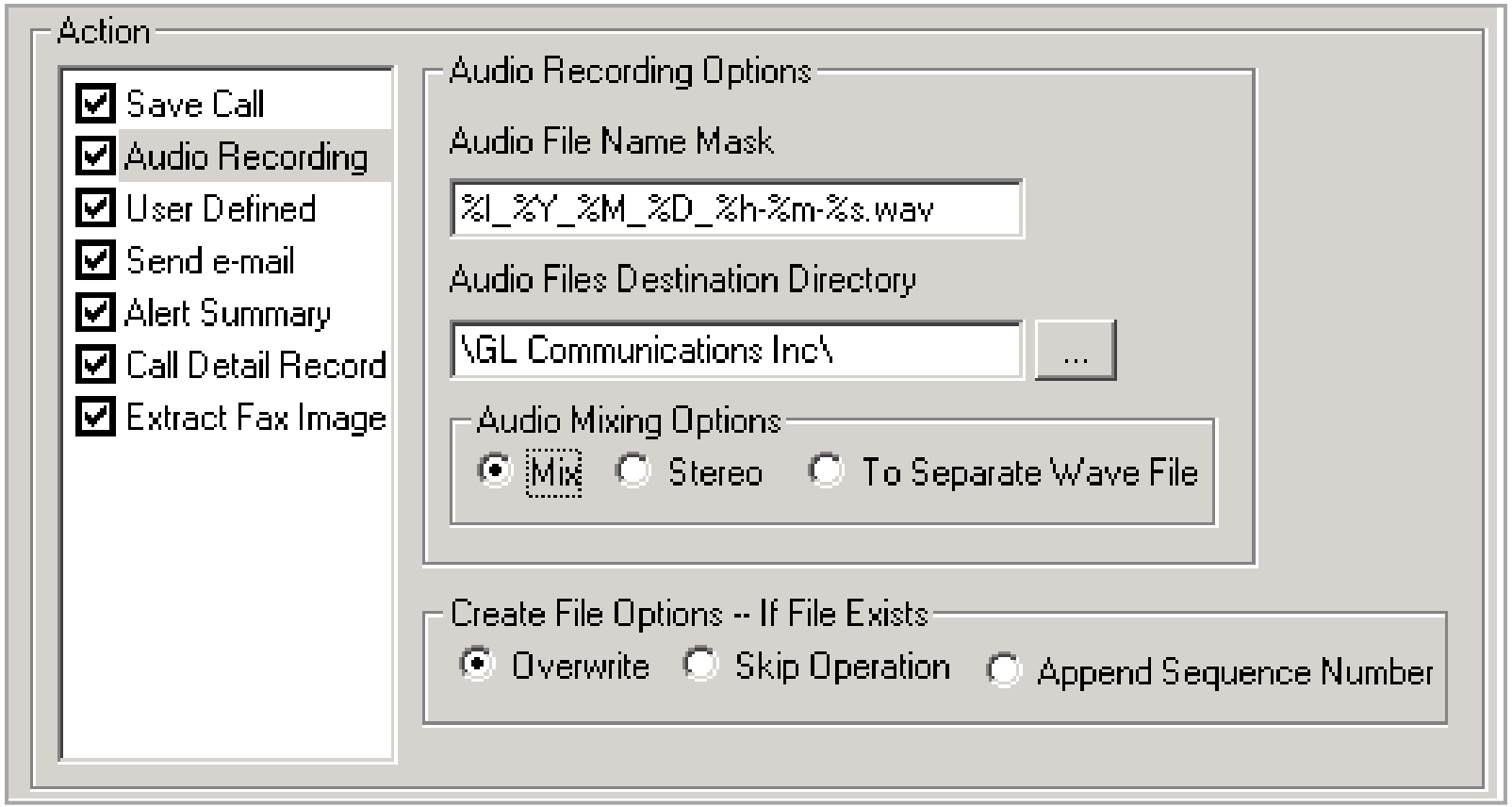
Triggers and Action Settings

Save Call to File



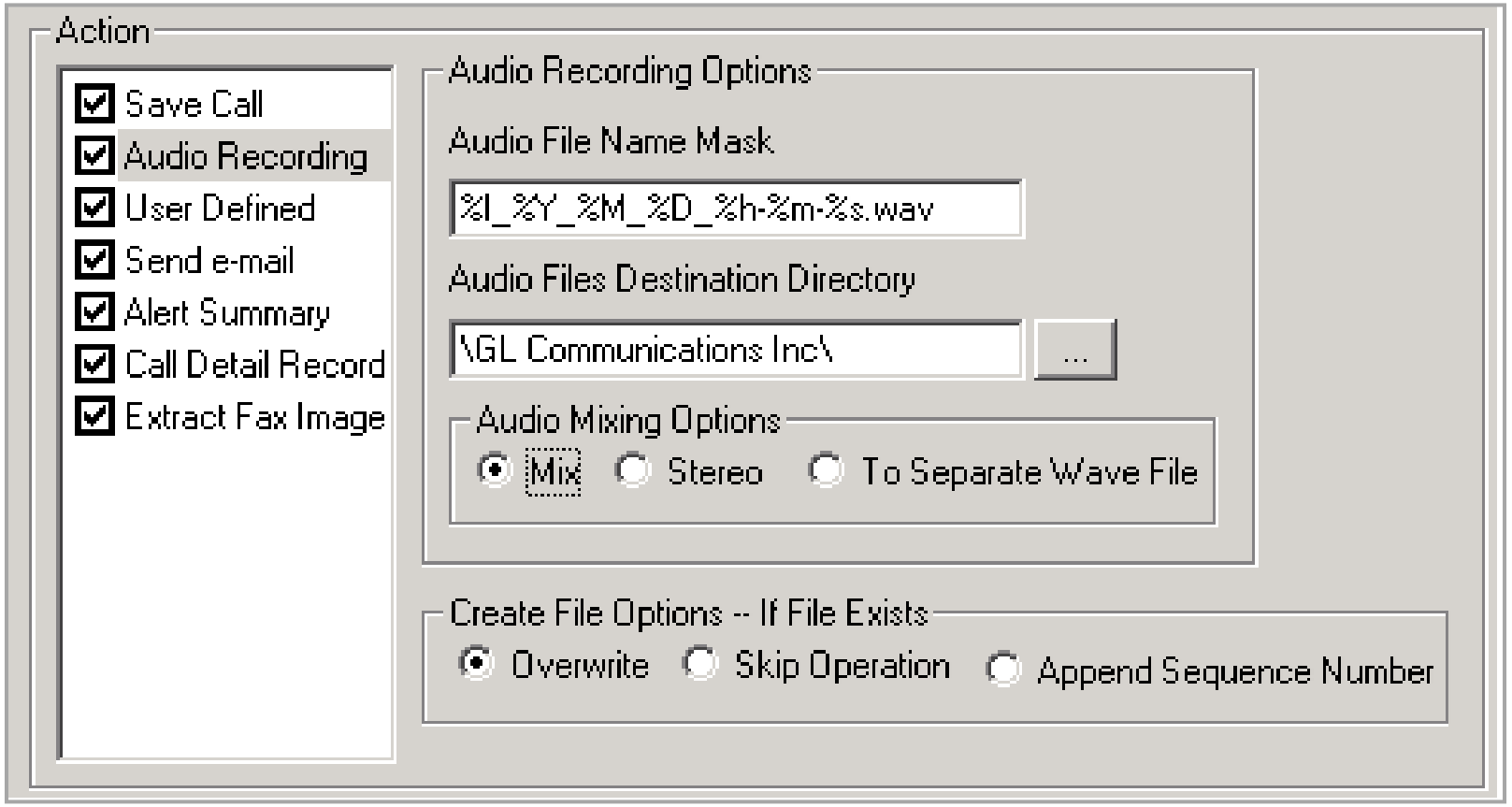
- Allows the users to save the filtered files either in *.HDL, *.PCAP, or *.PCAPNG format

Audio Recording



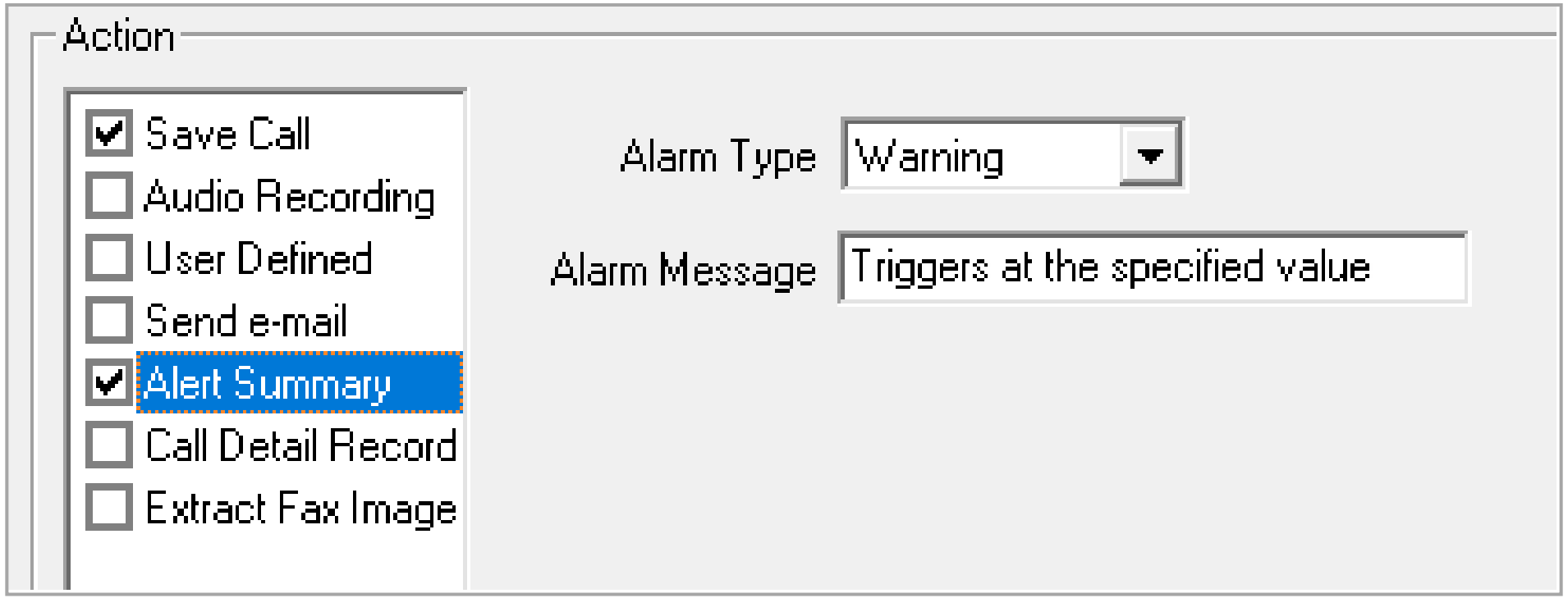
- Allows to save the filtered files as the voice files in *.wav format

Send e-mail



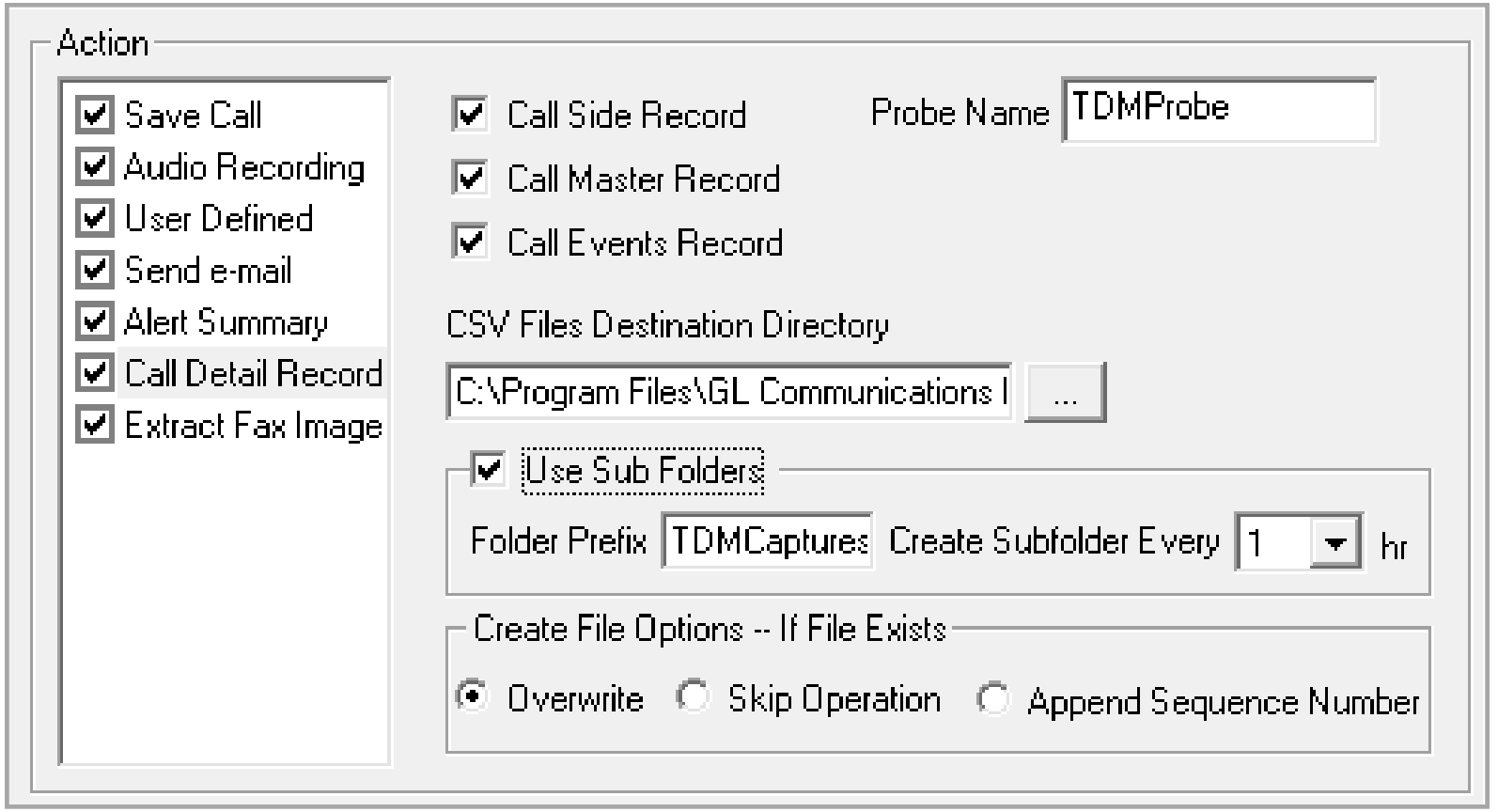
- With this option, the Packet Data Analyzer sends an e-mail containing useful information about each filtered call

Alert Summary



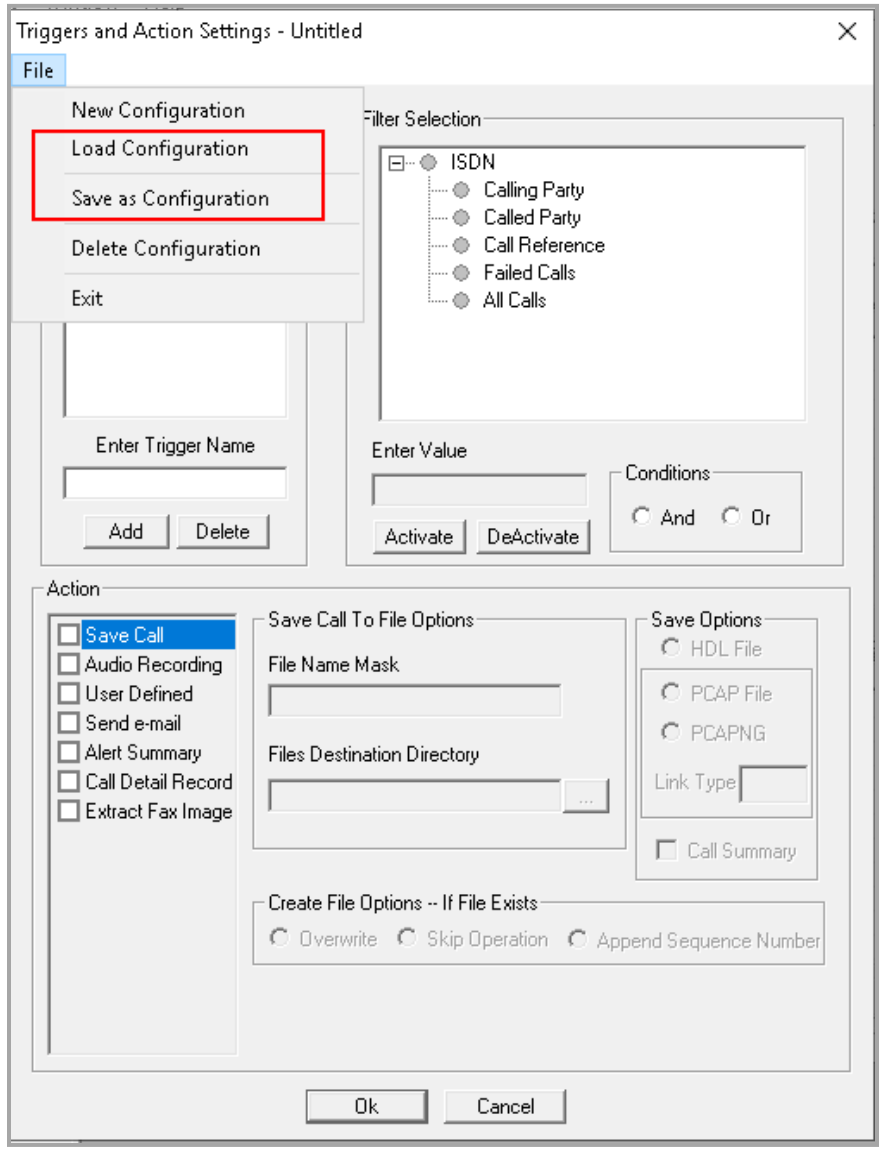
- With this option, the user can set the alarm type and alarm message for the selected triggering type

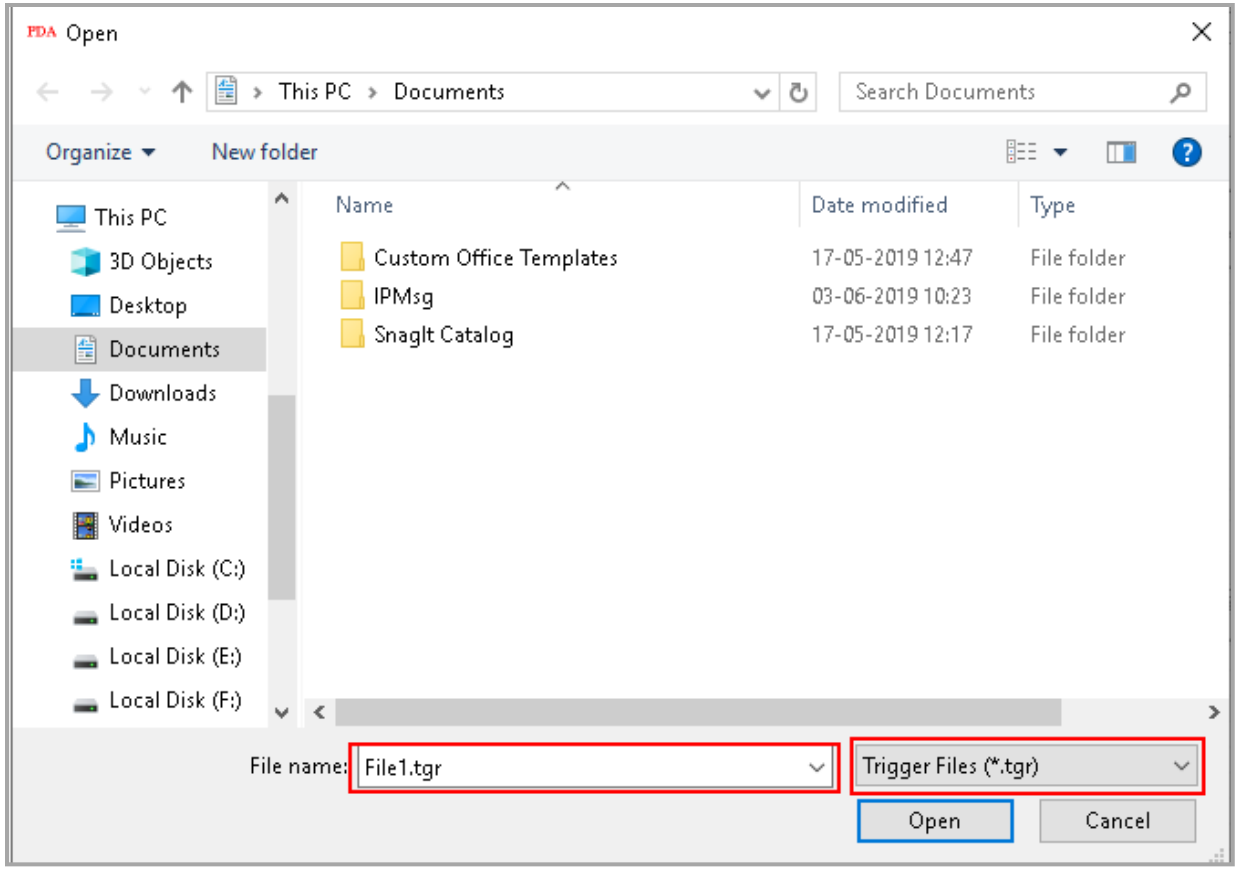
Call Detail Record (CDR)



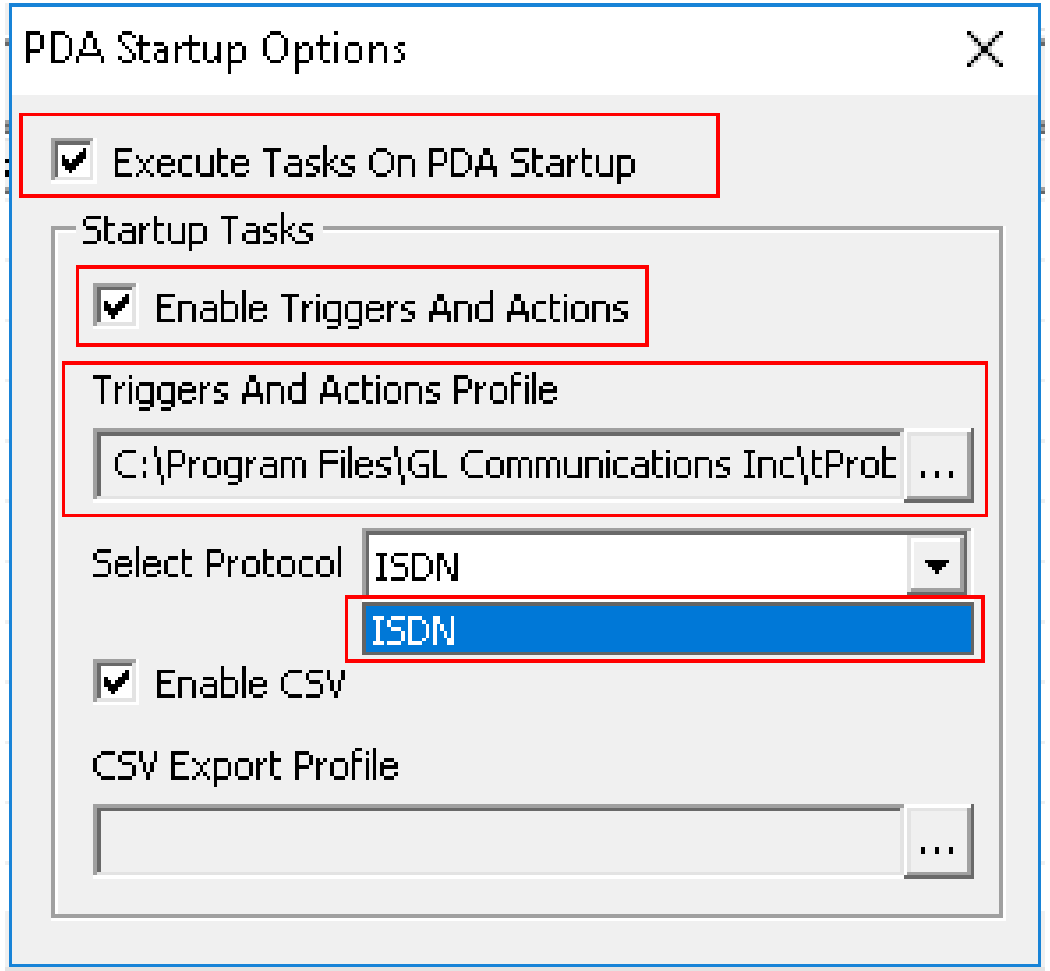
- With this option, the Packet Data Analyzer can output call detail records (CDR) in the form of three Comma Separated Value (CSV) files such as Call Side Record, Call Master Record, and Call Events

Load or Save Configurations





PDA Start-up Options



- Allows user to configure start-up tasks which will be started automatically whenever PDA is launched
- Loads the selected Triggers and Actions profile while invoking PDA

Thank you