
ISDN Analysis and Emulation



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ISDN Analysis and Simulation over T1 E1

T1 E1 Analyzer Hardware Platforms



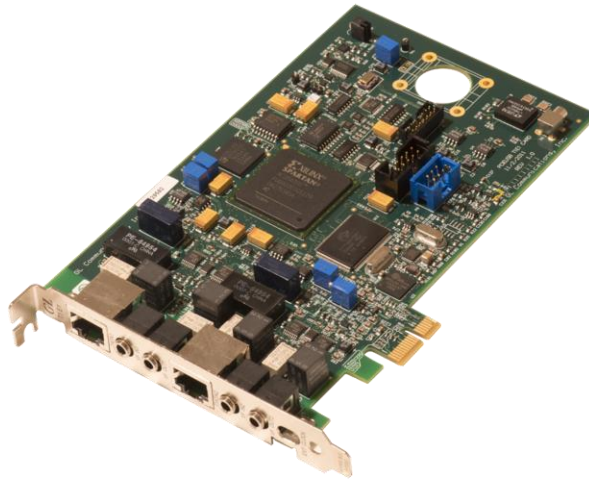
Front Panel

Back Panel

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

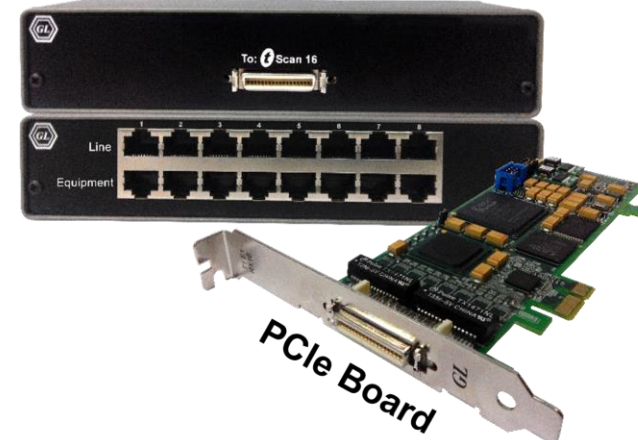


Quad / Octal T1 E1 PCIe Card



Dual T1 E1 Express (PCIe) Board

**tScan16™ with
16-port T1 E1 Breakout Box**

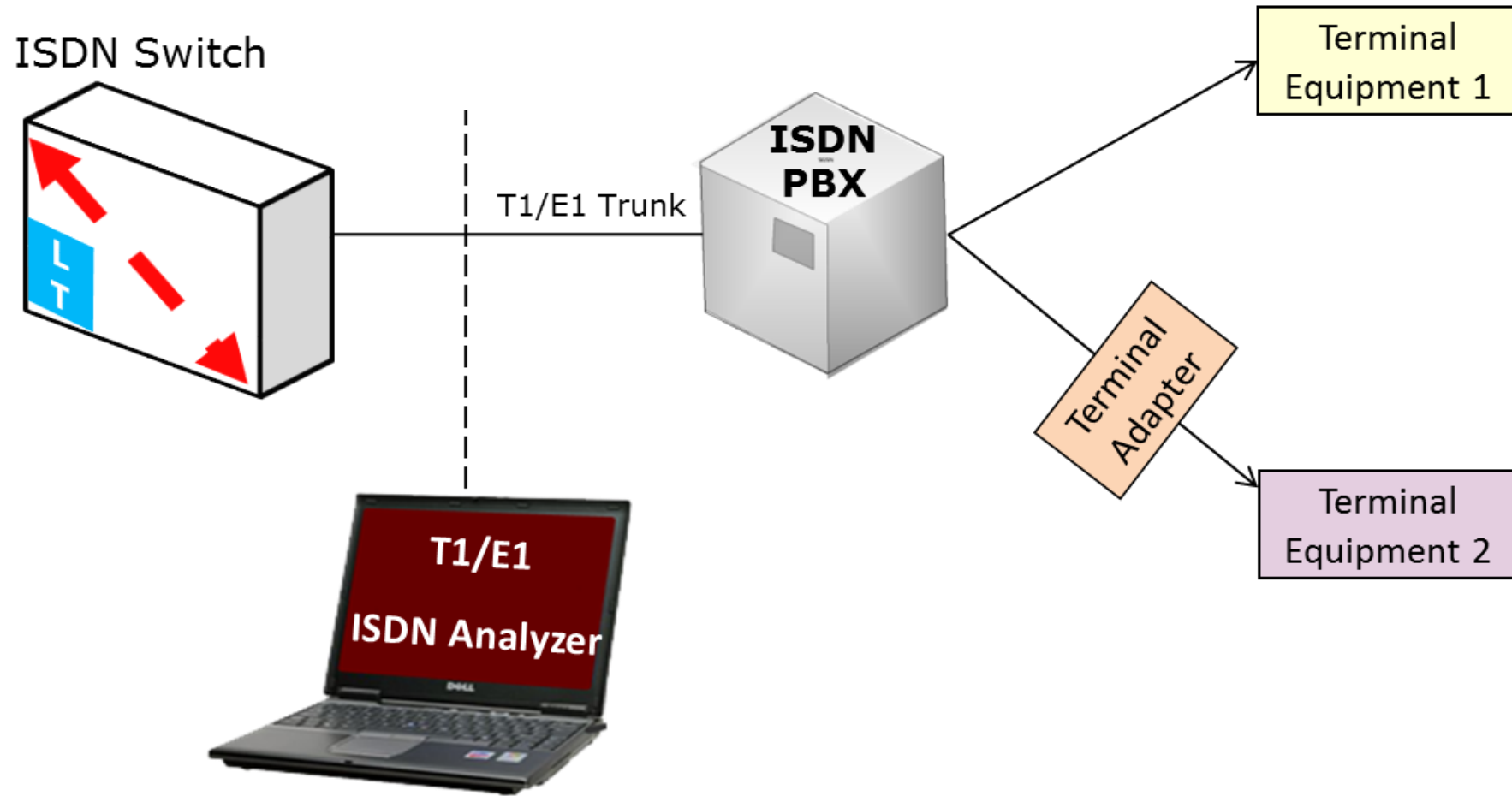


PCIe Board

TDM mTOP™ Solutions



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

Different Views

ISDN Protocol Analysis Q.93x 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Error | Message Type Q.93x | Call Reference Value Q.93x | Channel Number Q.93x | Called Number Q.93x |
|-----|-------|-------|--------|-----------------|-----|-------|-----------------------|-------------------------------|-------------------------|------------------------|
| ✓ 1 | 0 | | 4 | 00:00:00.378362 | 46 | | SETUP | 1538 | 6 | 6704784 |
| ✓ 2 | 0 | | 5 | 00:00:00.379137 | 6 | | | | | |
| ✓ 2 | 0 | | 6 | 00:00:00.379775 | 11 | | CALL PROCEEDING | 1538 | | |
| ✓ 1 | 0 | | 7 | 00:00:00.380175 | 6 | | | | | |

Card1 TimeSlot=0 Frame=4 at 00:00:00.378362 OK Len=46 *** Right click to SHOW/HIDE layers

HDLC Frame Data + FCS

===== LAPD Layer =====

0000 C/R =1. Response(User) Command(Network)

0000 SAPI = 00000000.. (0)

0001 TEI = 00000000.. (0)

0002 Ctl =0 Information

Hex Dump of the Frame Data

| Hex | ASCII |
|---|------------------|
| 02 01 50 62 08 02 06 02 05 04 03 80 90 A3 18 03 | Pb ε |
| A9 83 86 6C 08 80 35 35 35 36 30 30 30 70 08 80 | @111 ε5556000p ε |
| 36 37 30 34 37 38 34 7D 02 91 81 A1 14 4F | 6704784} 'i O |

| Device # | Frame Count(Device #) |
|----------|-----------------------|
| 1 | 13973 |
| total 1 | 13973 |
| 2 | 13973 |
| total 2 | 13973 |

| Call ID | Call Status | Calling Num | Called Num | Call Start Date & Time | Call Duration | Release Complete Cause | DevNo | TS | CRV | Interf |
|---------|-------------|-------------|------------|----------------------------|-----------------|------------------------|-------|----|------|--------|
| 1 | completed | 5551000 | 5179641 | 2019-03-11 15:06:49.165250 | 00:00:00.541387 | Normal call clearing | 1 | 0 | 1794 | |
| 2 | completed | 5552000 | 1626921 | 2019-03-11 15:06:49.173825 | 00:00:00.574650 | Normal call clearing | 1 | 0 | 2050 | |
| 3 | completed | 5553000 | 8604110 | 2019-03-11 15:06:49.182400 | 00:00:00.566350 | Normal call clearing | 1 | 0 | 2306 | |
| 4 | completed | 5554000 | 9402951 | 2019-03-11 15:06:49.190887 | 00:00:00.559737 | Normal call clearing | 1 | 0 | 2562 | |
| 5 | completed | 5555000 | 8752706 | 2019-03-11 15:06:49.199575 | 00:00:00.552900 | Normal call clearing | 1 | 0 | 2818 | |

C:\Program Files\GL Communications Inc\U 27 946 Frames

Summary
view

Detail
view

Hex Dump
view

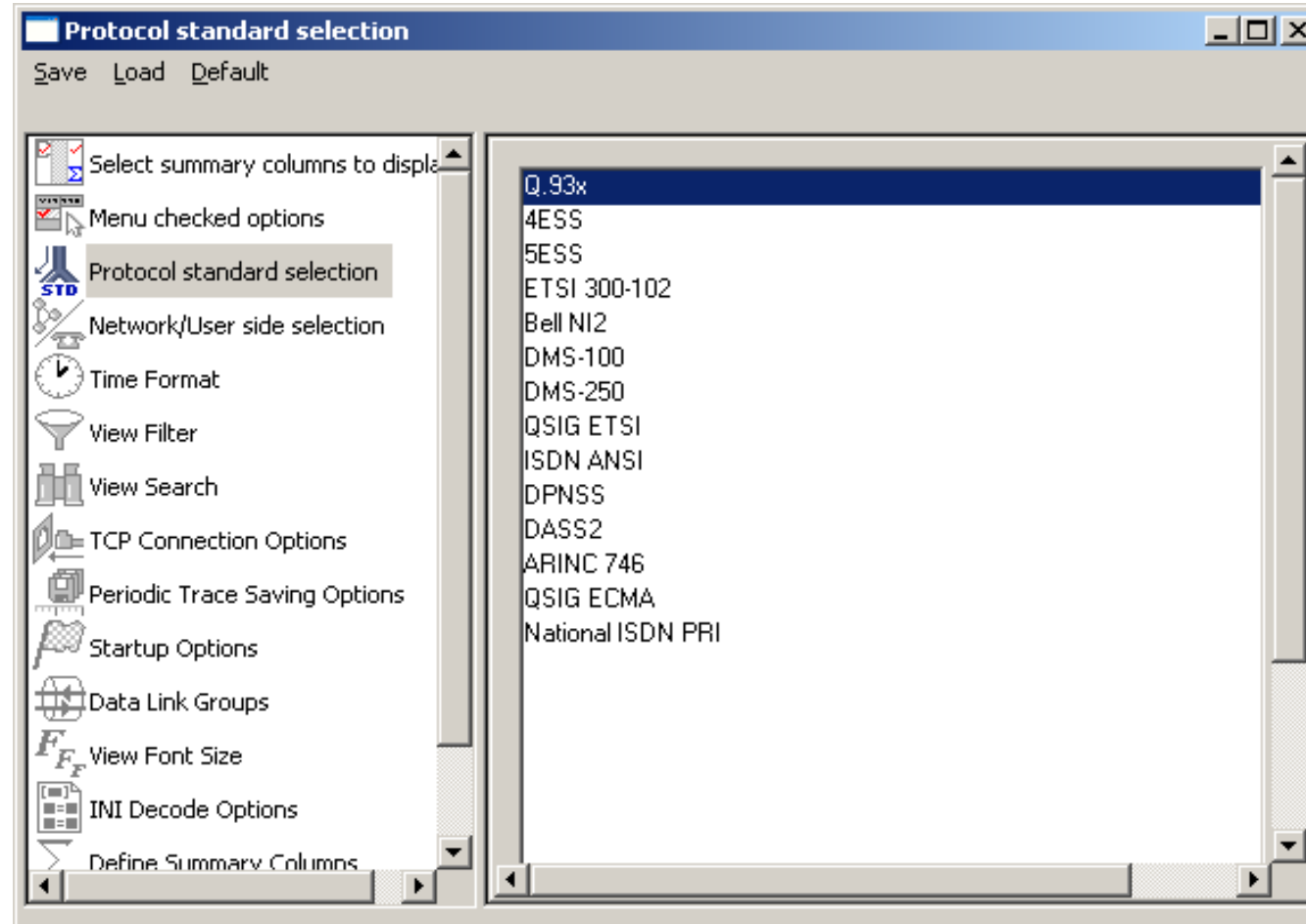
Statistics
view

Call trace
view

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

Card and Stream Selection

- 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

The image shows the 'Protocol Capture Configuration' window, specifically the 'Card & Stream Selection' tab. The window has a sidebar with icons for 'Capture File Options', 'Card & Stream Selection' (active), 'Capture Filter', and 'Gui & Protocol Options'. The main area contains a table for 'PORT ACTIONS' and 'Port\TS' (00-23). Below the table are several configuration sections: 'Data Transmission Rate' (Single Channel with '64 kbps' selected and highlighted by a red box, and '56 kbps' as an option; Hyper-Channel with 'Nx64 kbps', 'Nx56 Kbps (bits 1-7)', and 'Nx56 Kbps (Bits 2-8)' as options; Multiple Hyper-Channels with '128, 192, ... kbps' as an option), 'Subchannels 8-56 kbps' (DS0 bits 1-8 with a slider and 'All'/'None' buttons), 'All Port Settings' (HDLC FCS with '16 bits', '32 bits', and 'None' as options; Interface with 'User' and 'Network' as options; 'Bit Inversion 1<->0' and 'Octet Bit Reversion (MSB <-> LSB)' as checkboxes), and 'Row (Port) Select, Clear, Paste Operations' (with 'Select All', 'Clear All', 'Paste All', and 'Paste List' buttons, and a 'Paste Clipboard to Port List' section with a text input and 'Paste List' button).

| PORT ACTIONS | Port\TS | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|--------------|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| ✓ X @ P | 1 | | | | | | | | | | | | | | | | | | | | | | | | 23 |
| ✓ X @ P | 2 | | | | | | | | | | | | | | | | | | | | | | | | 23 |

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

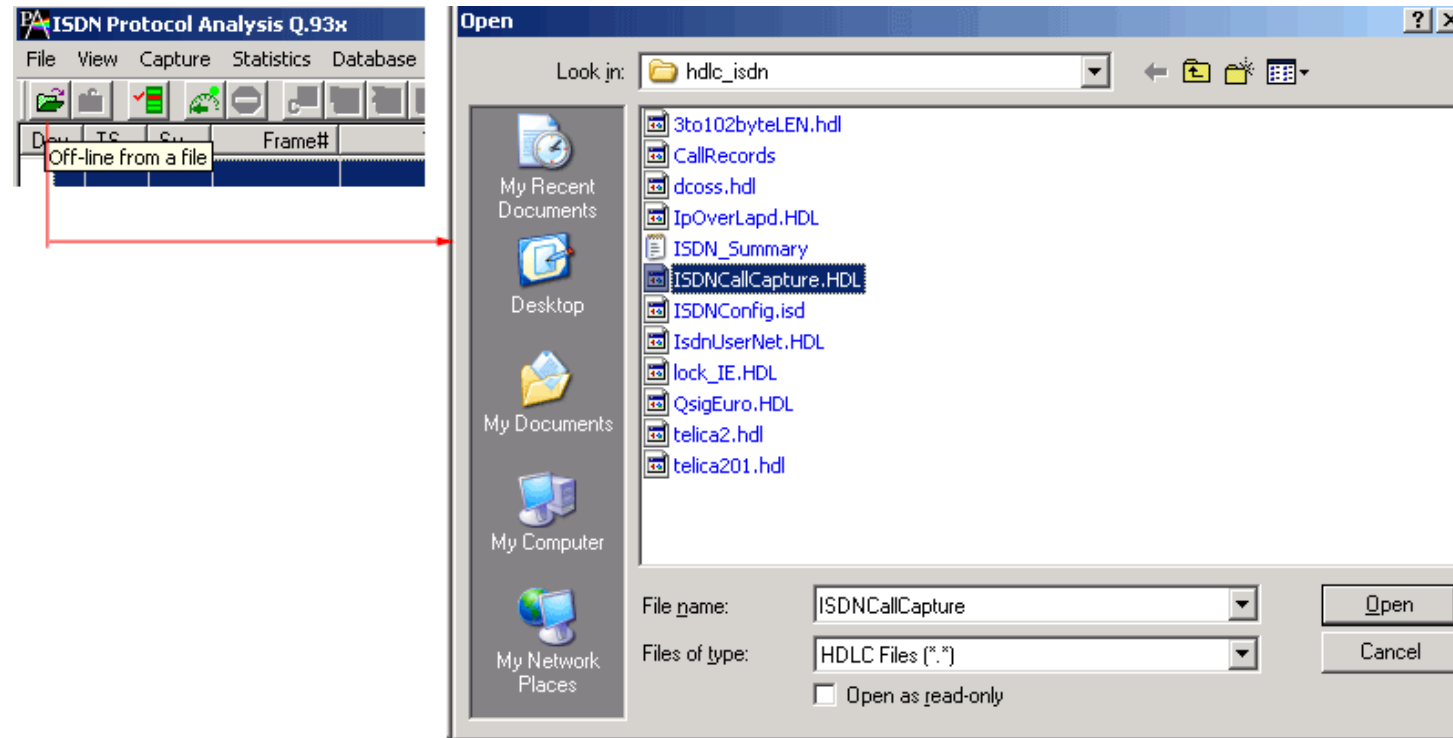
The screenshot displays the ISDN Protocol Analysis Q.93x software interface. The top menu bar includes File, View, Capture, Statistics, Database, Call Detail Records, Configure, and Help. Below the menu is a toolbar with various icons for file operations, capture, and analysis. The main window is divided into several sections:

- Message List:** A table showing a list of captured messages. The columns include Dev, TS, Su, Fram, TIME (Relative), Len, C/R, SAPI, TEI, CTL, P/F, N(S), N(R), FUNC, CRV, and Message Type. The messages shown are SETUP, CALL PROCEEDING, ALERTING, and CONNECT.
- Card2 TimeSlot=23 Frame=43 at 00:00:18.960500 OK Len=40:** A detailed view of a specific message frame.
- HDLC Frame Data + FCS:** A section showing the raw frame data and its cyclic redundancy check (FCS).
- Hex Dump of the Frame Data:** A hex dump of the frame data, showing the raw bytes and their corresponding ASCII values.
- Device # Frame Count(C/R):** A table showing the frame count for each device.
- Call ID Call Status Calling Num Called Num Call Start Date & Time Call Duration Release Complete:** A table showing the details of active calls, including call ID, status, numbers, start time, duration, and completion status.

The bottom status bar indicates the current file is C:\Temp.Hdl and shows 252 frames.

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

The application window displays a table of protocol frames. The table has columns: Dev, TS..., Su..., Frame#, TIME (Relative), Len, C/R, SAPI, TEI, CTL, P/F, N(S), N(R), FUNC, CRV, and Message Type. The selected frame (Frame 2) is shown in the details pane below the table.

| Dev | TS... | Su... | Frame# | TIME (Relative) | Len | C/R | SAPI | TEI | CTL | P/F | N(S) | N(R) | FUNC | CRV | Message Type |
|-----|-------|-------|--------|-----------------|-----|--------|------|-----|-----------|-----|------|------|------|------|--------------|
| ✓ 2 | 0 | | 0 | 00:00:00.000000 | 6 | Co... | 0 | 0 | Super... | 1 | | 40 | RR | | |
| ✓ 1 | 0 | | 1 | 00:00:00.000037 | 6 | Res... | 0 | 0 | Super... | 1 | | 49 | RR | | |
| ✓ 2 | 0 | | 2 | 00:00:00.000362 | 6 | Res... | 0 | 0 | Super... | 1 | | 40 | RR | | |
| ✓ 1 | 0 | | 3 | 00:00:00.000375 | 6 | Co... | 0 | 0 | Super... | 1 | | 49 | RR | | |
| ✓ 1 | 0 | | 4 | 00:00:00.378362 | 46 | Res... | 0 | 0 | Inform... | 0 | 40 | 49 | | 1538 | SETUP |
| ✓ 2 | 0 | | 5 | 00:00:00.379137 | 6 | Res... | 0 | 0 | Super... | 0 | | 41 | RR | | |
| ✓ 2 | 0 | | 6 | 00:00:00.379775 | 11 | Co... | 0 | 0 | Inform... | 0 | 49 | 41 | | 1538 | CALL PROCEED |

Card2 TimeSlot=0 Frame=2 at 00:00:00.000362 OK Len=6
HDLC Frame Data + FCS
===== LAPD Layer =====
C/R =1. Response(User), Command(Network)
SAPI = 000000.. (0)
TEI = 000000.. (0)
Ctl
Supervisory Function
P/F
N(R)

Hex Dump of the Frame Data
+-----+
02 01 01 51 A0 C5

Off-line Viewing isdn\dcoss.hdl

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Deepa>cd C:\Program Files\GL Communications Inc\Isdn Analyzer

C:\Program Files\GL Communications Inc\Isdn Analyzer>isdnprot isdn\dcoss.hdl

C:\Program Files\GL Communications Inc\Isdn Analyzer>_
```

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

Offline Analysis

Off-line ISDN Protocol Analysis Q.93x

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

| Dev | TS... | Su... | Frame# | TIME (Relative) | Len | C/R | SAPI | TEI | CTL | P/F | N(S) | N(R) | FUNC | CRV | Message Type |
|-----|-------|-------|--------|-----------------|-----|--------|------|-----|-----------|-----|------|------|------|------|--------------|
| ✓ 2 | 0 | | 0 | 00:00:00.000000 | 6 | Co... | 0 | 0 | Super... | 1 | | 40 | RR | | |
| ✓ 1 | 0 | | 1 | 00:00:00.000037 | 6 | Res... | 0 | 0 | Super... | 1 | | 49 | RR | | |
| ✓ 2 | 0 | | 2 | 00:00:00.000362 | 6 | Res... | 0 | 0 | Super... | 1 | | 40 | RR | | |
| ✓ 1 | 0 | | 3 | 00:00:00.000375 | 6 | Co... | 0 | 0 | Super... | 1 | | 49 | RR | | |
| ✓ 1 | 0 | | 4 | 00:00:00.378362 | 46 | Res... | 0 | 0 | Inform... | 0 | 40 | 49 | | 1538 | SETUP |
| ✓ 2 | 0 | | 5 | 00:00:00.379137 | 6 | Res... | 0 | 0 | Super... | 0 | | 41 | RR | | |
| ✓ 2 | 0 | | 6 | 00:00:00.379775 | 11 | Co... | 0 | 0 | Inform... | 0 | 49 | 41 | | 1538 | CALL PROCEED |
| ✓ 1 | 0 | | 7 | 00:00:00.380135 | 6 | Co... | 0 | 0 | Super... | 0 | | 50 | RR | | |

Card2 TimeSlot=0 Frame=2 at 00:00:00.000362 OK Len=6

HDLC Frame Data + FCS

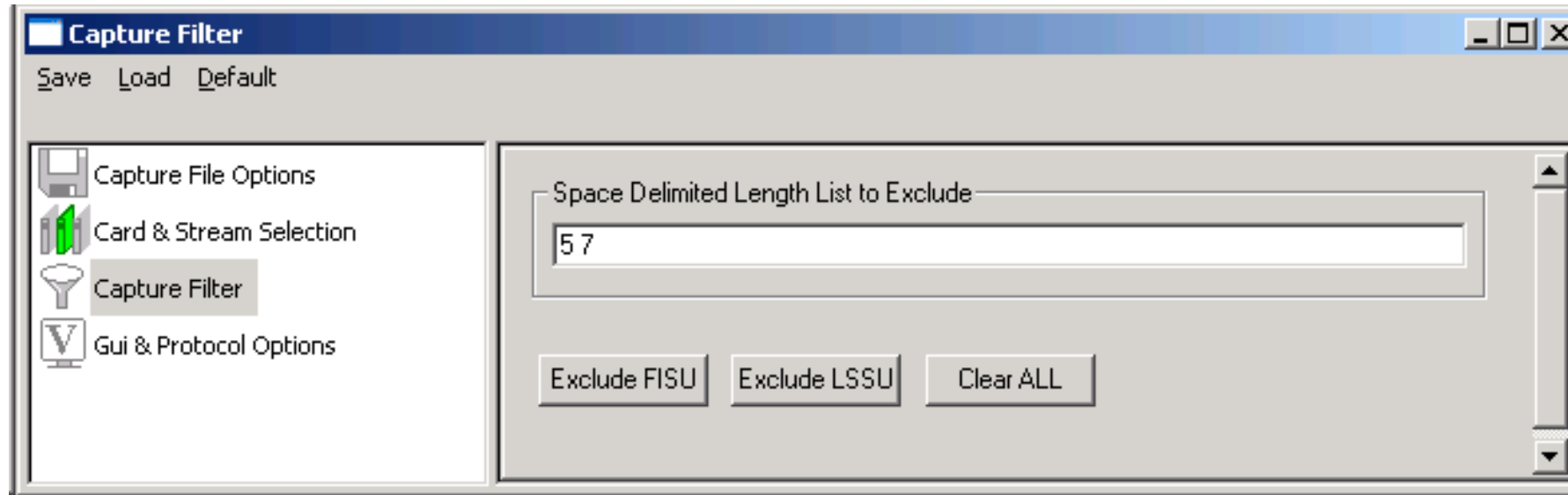
```
===== LAPD Layer =====
C/R          = .....1. Response(User), Command(Network)
SAPI         = 000000.. (0)
TEI          = 0000000.. (0)
Ctl          = .....01 Supervisory
Supervisory Function = ....00.. RR
P/F          = .....1 (1)
N(R)         = 0101000.. (40)
```

Hex Dump of the Frame Data

```
+-----+-----+-----+-----+-----+
02 01 01 51 A0 C5                               Q A
```

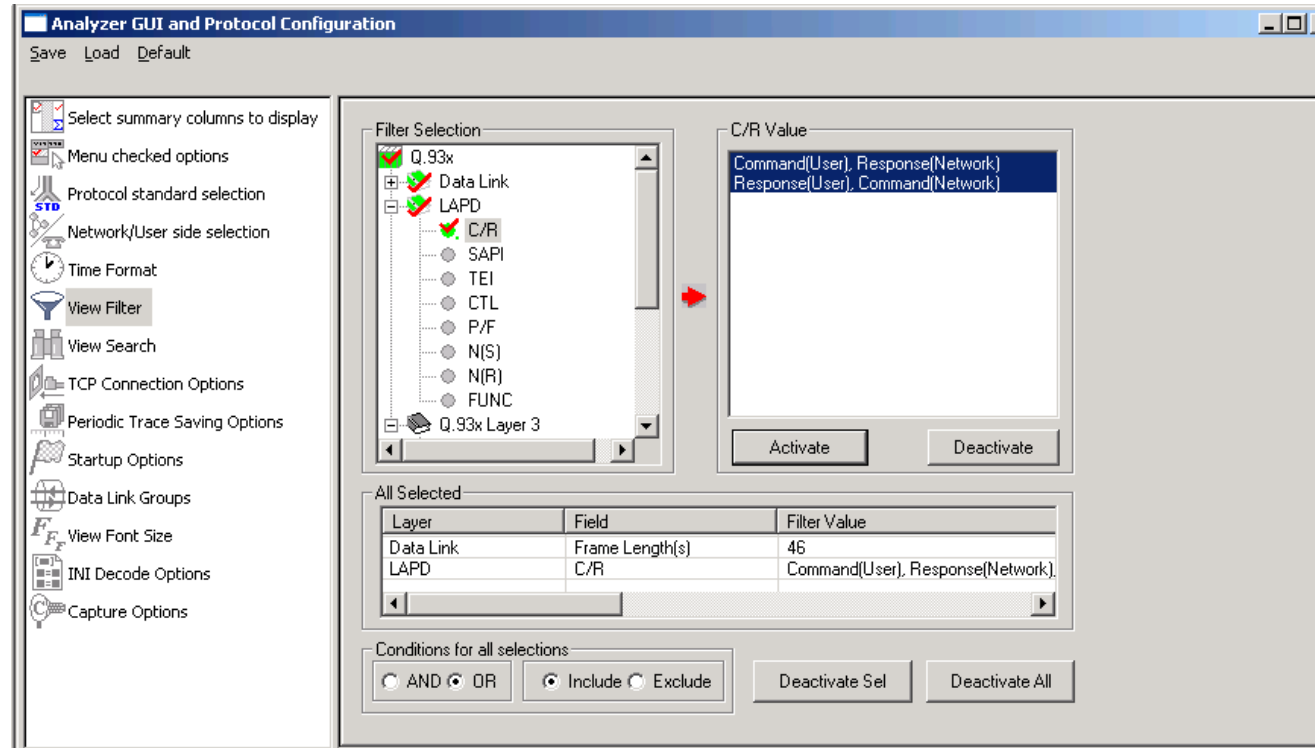
Off-line Viewing | isdn\dcoss.hdl | 27946 Frames

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

The screenshot illustrates the process of creating filter criteria from a screen selection. It shows the 'ISDN Protocol Analysis Q.93x 64-bit' application with a table of network events. A context menu is open over the 'SETUP' event, with 'Set Filter Criteria as Sel Values' highlighted. An arrow points to a dialog box titled 'Use Ctrl, Shift for Extended Selection' which lists 'Q.93x::Call Reference Value' and 'Q.93x::Message Type'. Another arrow points to the 'Analyzer GUI and Protocol Configuration' window, where the 'Filter Selection' pane shows 'Q.93x' selected, and the 'All Selected' table lists the chosen criteria.

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Error | Message Type Q.93x | Call Reference Value Q.93x | Channel N Q.93x |
|-----|-------|-------|--------|-----------------|-----|-------|-----------------------|-------------------------------|--------------------|
| ✓ 2 | 0 | | 0 | 00:00:00.000000 | 6 | | | | |
| ✓ 1 | 0 | | 1 | 00:00:00.000037 | 6 | | | | |
| ✓ 2 | 0 | | 2 | 00:00:00.000362 | 6 | | | | |
| ✓ 1 | 0 | | 3 | 00:00:00.000375 | 6 | | | | |
| ✓ 1 | 0 | | 4 | 00:00:00.378362 | 46 | | SETUP | 1538 | 16 |
| ✓ 2 | 0 | | 5 | 00:00:00.379137 | 6 | | | | |
| ✓ 2 | 0 | | 6 | 00:00:00.379775 | 11 | | CALL PROCEEDING | | |
| ✓ 1 | 0 | | 7 | 00:00:00.380175 | 6 | | | | |
| ✓ 2 | 0 | | 8 | 00:00:00.388812 | 11 | | ALERTING | | |

Search Selected Value
Set Search Criteria as Sel Values
Set Filter Criteria as Sel Values

Use Ctrl, Shift for Extended Selection

Q.93x::Call Reference Value
Q.93x::Message Type

OK Select All Cancel

Analyzer GUI and Protocol Configuration

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

Filter Selection

Q.93x
Data Link
LAPD
Q.93x

Value Selection

Activate Deactivate

All Selected

| Layer | Field | Filter Value |
|-------|----------------------|-----------------|
| Q.93x | Call Reference Value | 1538 |
| Q.93x | Message Type | CALL PROCEEDING |

Conditions for all selections

AND OR Include Exclude

Deactivate Sel Deactivate All

Search Criteria From Screen Selection

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

The screenshot illustrates the process of creating search criteria from a screen selection. It shows the 'ISDN Protocol Analysis Q.93x 64-bit' window with a table of protocol data. A context menu is open over the table, with the option 'Set Search Criteria as Sel Values' highlighted. An arrow points from this option to a dialog box titled 'Use Ctrl, Shift for Extended Selection' which lists the search criteria. Another arrow points from this dialog to the 'Filter Selection' section of the 'Analyzer GUI and Protocol Configuration' window, where the criteria are listed in the 'All Selected' table.

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Error | Message Type | Call Reference Value | Channel |
|-----|-------|-------|--------|-----------------|-----|-------|-----------------|----------------------|---------|
| ✓ 2 | 0 | | 0 | 00:00:00.000000 | 6 | | | | |
| ✓ 1 | 0 | | 1 | 00:00:00.000037 | 6 | | | | |
| ✓ 2 | 0 | | 2 | 00:00:00.000362 | 6 | | | | |
| ✓ 1 | 0 | | 3 | 00:00:00.000375 | 6 | | | | |
| ✓ 1 | 0 | | 4 | 00:00:00.378362 | 46 | | SETUP | 1538 | 6 |
| ✓ 2 | 0 | | 5 | 00:00:00.379137 | 6 | | | | |
| ✓ 2 | 0 | | 6 | 00:00:00.379775 | 11 | | CALL PROCEEDING | | |
| ✓ 1 | 0 | | 7 | 00:00:00.380175 | 6 | | | | |
| ✓ 2 | 0 | | 8 | 00:00:00.388812 | 11 | | ALERTING | | |

Search Selected Value
Set Search Criteria as Sel Values
Set Filter Criteria as Sel Values

Use Ctrl, Shift for Extended Selection

- Q.93x::Call Reference Value
- Q.93x::Called Number Digits
- Q.93x::Calling Number Digits
- Q.93x::Channel Number
- Q.93x::Message Type

OK Select All Cancel

Analyzer GUI and Protocol Configuration

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

Filter Selection

- Q.93x
- Data Link
- LAPD
- Q.93x

Value

Activate Deactivate

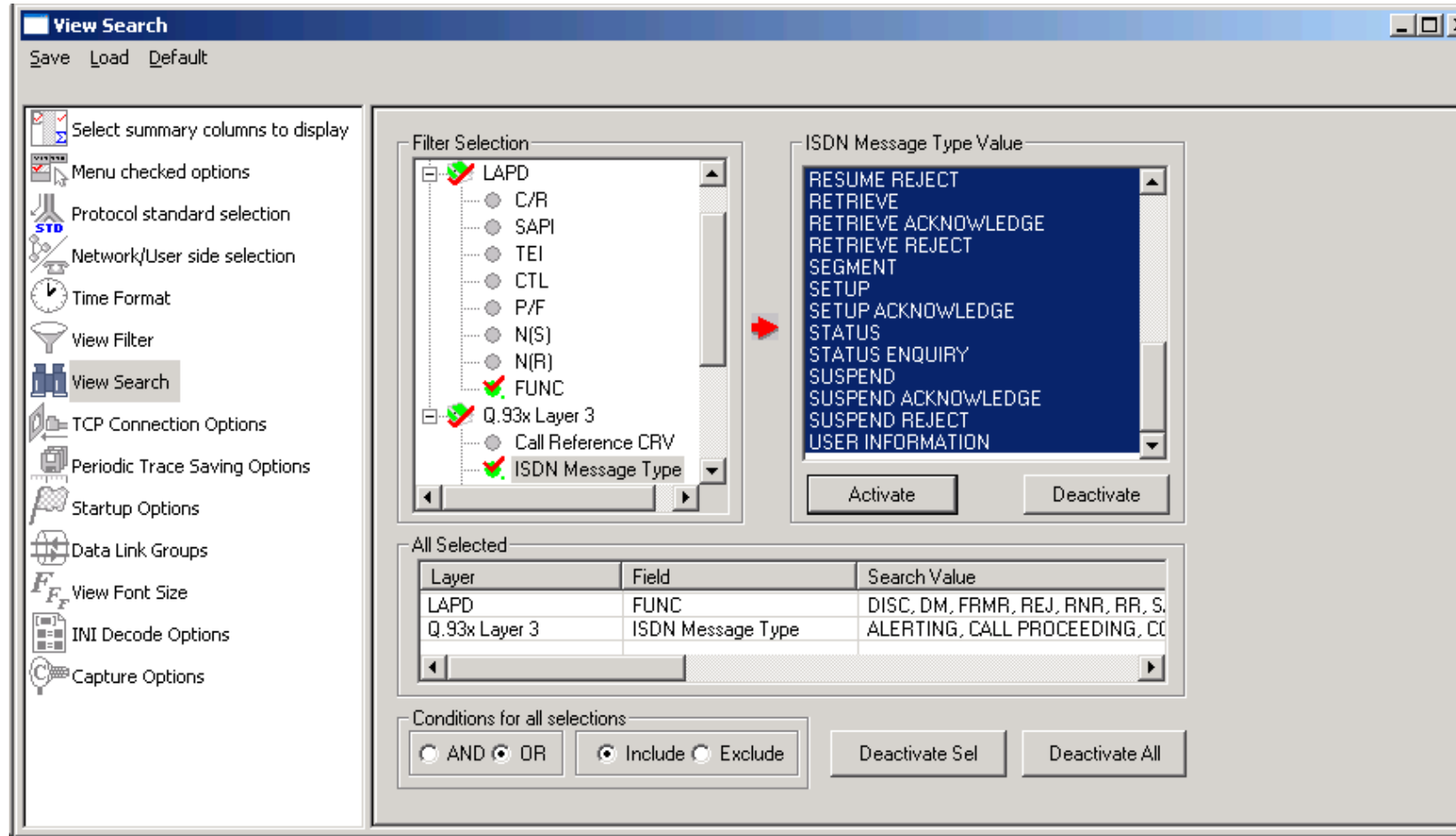
All Selected

| Layer | Field | Search Value |
|-------|-----------------------|--------------|
| Q.93x | Call Reference Value | 1538 |
| Q.93x | Called Number Digits | 6704784 |
| Q.93x | Calling Number Digits | 5556nnn |

Conditions for all selections

AND OR Include Exclude Deactivate Sel Deactivate All

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

Statistics

Field Names

Layers

- Physical Link
 - Device #
 - Error Code
 - StartTsOrTsSc
 - Time Stamp
- LAPD
 - C/R
 - Ctl
 - Modifier Function
 - N(R)
 - N(S)
 - P
 - P/F
 - SAPI
 - Supervisory Function
 - TEI
- Q.93x Layer 3

C/R

Use Type (single selection)

- Total
- Key
- Field

Statistic Type(s) (calculated, multiple selection)

- Frame Count
- Frame Percent
- Byte Count
- Byte Percent

Value Set

- Command(User), Response(Network)
- Response(User), Command(Network)

☐ Cumulative ☒ Separate

Add/Mod Remove

Selected Statistic Information

| Layer | Field Name | Use Type | Statistic Type |
|--------------|------------|----------|----------------|
| Physical ... | Device # | Total | |
| LAPD | C/R | Key | Frame Count |

Remove Sel Remove All Apply

Call Detail Records

ISDN Protocol Analysis Q.93x

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

| Device # | C/R | Frame Count(C/R) |
|----------|--------------------------------------|------------------|
| 1 | Command(User), Response(Network) (0) | 79 |
| 1 | Response(User), Command(Network) (1) | 92 |
| total 1 | Total | 171 |
| 2 | Command(User), Response(Network) (0) | 79 |
| 2 | Response(User), Command(Network) (1) | 92 |
| total 2 | Total | 171 |

| Call ID | Call Status | Calling Num | Called Num | Call Start Date & Time | Call Duration | Release Complete Cause | DevNo | T |
|---------|-------------|-------------|------------|----------------------------|-----------------|------------------------|-------|---|
| 0 | active | 555016 | 554016 | 2010-11-15 11:19:00.025500 | 00:00:50.978375 | x00 | 2 | 1 |
| 1 | active | 555017 | 554017 | 2010-11-15 11:19:00.362500 | 00:00:50.641375 | x00 | 2 | 1 |
| 2 | active | 555018 | 554018 | 2010-11-15 11:19:00.825500 | 00:00:50.178375 | x00 | 2 | 1 |
| 3 | completed | 555019 | 554019 | 2010-11-15 11:19:01.171500 | 00:00:24.414750 | x00 | 2 | 1 |
| 4 | active | 555020 | 554020 | 2010-11-15 11:19:01.700500 | 00:00:49.303375 | x00 | 2 | 1 |
| 5 | active | 555021 | 554021 | 2010-11-15 11:19:02.379500 | 00:00:48.624375 | x00 | 2 | 1 |
| 6 | completed | 555006 | 554006 | 2010-11-15 11:19:02.653500 | 00:00:01.383000 | x00 | 2 | 1 |
| 7 | active | 555023 | 554023 | 2010-11-15 11:19:02.945500 | 00:00:48.058375 | x00 | 2 | 1 |
| 8 | completed | 555009 | 554009 | 2010-11-15 11:19:03.258625 | 00:00:27.952500 | x00 | 2 | 1 |
| 9 | active | 555012 | 554012 | 2010-11-15 11:19:04.092000 | 00:00:46.911875 | x00 | 2 | 1 |
| 10 | completed | 555010 | 554010 | 2010-11-15 11:19:04.930000 | 00:00:25.913750 | x00 | 2 | 1 |

D:\Program Files\GL Communications I 342 Frames

- 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

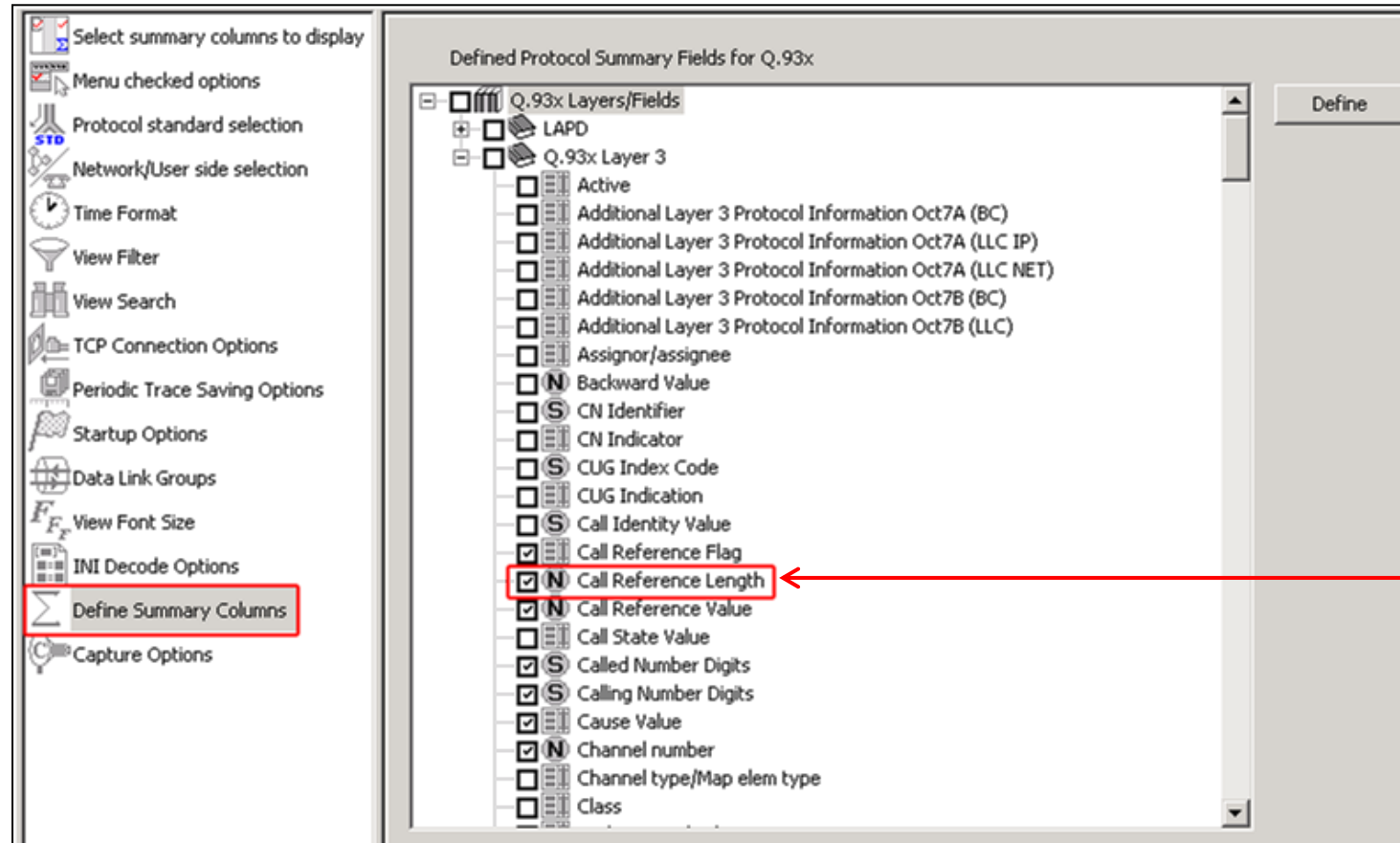
Saving options for the trace files

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

The screenshot shows the 'Periodic Trace Saving Options' dialog box. On the left is a sidebar with icons and labels for various settings: 'Select summary columns to display', 'Menu checked options', 'Protocol standard selection', 'Network/User side selection', 'Time Format', 'View Filter', 'View Search', 'TCP Connection Options', 'Periodic Trace Saving Options' (highlighted), 'Startup Options', 'Data Link Groups', 'View Font Size', 'INI Decode Options', and 'Capture Options'. The main area has tabs 'Save', 'Load', and 'Default'. It contains several sections: 'Using View Filter' with radio buttons for 'All Frames (no filtering)' and 'Filtered Only (use view filter)'; 'Save Directory' with a text field 'C:\' and a folder icon; 'Save File Names' with two options: 'Sequential File Names' (with a text field for 'file name prefix', a spinner for 'number of digits' set to 123, and a text field for 'file name suffix' set to '.HDL') and 'Date/Time Formatted Names' (with a text field for 'fileNamePrefix_%%Y%%M%%D_%%H%%I' and a text field for 'file name suffix' set to '.HDL'); 'Create a New File After the Specified Limit Has Been Reached' with radio buttons for 'File Size Limit', 'Frame Count Limit', and 'Time Limit', each with a 'Limit Value' field (the 'Frame Count Limit' field shows '1000000'); and 'Restrict or Recycle After N Files Options' with a text field '2147483647' and radio buttons for 'Keep N Latest Files', 'Stop After N Files', and 'Unrestricted'.

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

The screenshot displays the ISDN Protocol Analysis Q.93x software interface. The top menu bar includes File, View, Capture, Statistics, Database, Call Detail Records, Configure, and Help. Below the menu is a toolbar with various icons for file operations, capture control, and protocol analysis. The main window is divided into two panes. The upper pane shows a table of captured frames with columns: Dev, TSlot, SubCh, Frame#, TIME (Relative), Len, Error, C/R, SAPI, TEI, CTL, Call Reference Length, P/F, N(S), and N(R). The lower pane displays the details of the selected frame (Frame 6), including the HDLC Frame Data + FCS and the Hex Dump of the Frame Data.

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Error | C/R | SAPI | TEI | CTL | Call Reference Length | P/F | N(S) | N(R) |
|-----|-------|-------|--------|-----------------|-----|-------|--------|------|-----|-------------|-----------------------|-----|------|------|
| ✓ 2 | 0 | | 6 | 00:00:00.379775 | 11 | | Com... | 0 | 0 | Information | 2 | 0 | 49 | 41 |
| ✓ 1 | 0 | | 7 | 00:00:00.380175 | 6 | | Com... | 0 | 0 | Supervisory | | 0 | | 50 |
| ✓ 2 | 0 | | 8 | 00:00:00.388812 | 11 | | Com... | 0 | 0 | Information | 2 | 0 | 50 | 41 |
| ✓ 1 | 0 | | 9 | 00:00:00.389200 | 6 | | Com... | 0 | 0 | Supervisory | | 0 | | 51 |
| ✓ 2 | 0 | | 10 | 00:00:00.628537 | 11 | | Com... | 0 | 0 | Information | 2 | 0 | 51 | 41 |
| ✓ 1 | 0 | | 11 | 00:00:00.628887 | 6 | | Com... | 0 | 0 | Supervisory | | 0 | | 52 |
| ✓ 1 | 0 | | 12 | 00:00:00.629350 | 11 | | Res... | 0 | 0 | Information | 2 | 0 | 41 | 52 |
| ✓ 2 | 0 | | 13 | 00:00:00.629650 | 6 | | Com... | 0 | 0 | Supervisory | | 0 | | 42 |

Card2 TimeSlot=0 Frame=6 at 00:00:00.379775 OK Len=11

HDLC Frame Data + FCS

```

===== LAPD Layer =====
C/R          = .....0. Command(User), Response(Network)
SAPI         = 000000.. (0)
TEI          = 0000000. (0)
Ctl          = .....0 Information
N(S)         = 0110001. (49)
P            = .....0 (0)
N(R)         = 0101001. (41)

```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+
00 01 62 52 08 02 86 02 02 90 42
                                bR  I  IB

```

Off-line Viewing

C:\Program Files\Gl Communications Ir\27 946 Frames

→ **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

The image shows two windows from a network analysis tool. The top window is 'Aggregate Summary Columns', which allows users to define custom summary columns. It has a menu on the left with options like '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', and 'Capture Options'. The main area has buttons for 'Add', 'Delete', 'Aliases', 'Reorder', and 'Reverse', along with a note 'Use '_' in the name for multiline headers'. A table lists defined groups:

| Name | Display Format | Summary Columns | Separator |
|---------|-------------------|---|-----------|
| Group~0 | Concat | Calling Number Digits_Q.93x Called Number Digits_Q.93x | ---> |
| Group~1 | <Col_Alias> Value | Cause Value_Q.93x | |
| Group~2 | Concat | Call Reference Value_Q.93x Message Type_Q.93x | & |

The bottom window is 'ISDN Protocol Analysis Q.93x 64-bit'. It displays a table of protocol frames. A red box highlights the 'Group~0' column, which shows concatenated values for 'Calling Number Digits' and 'Called Number Digits'. Below the table, a detailed view of a frame is shown:

```
Card1 TimeSlot=0 Frame=4 at 00:00:00.378362 OK Len=46
HDLC Frame Data + FCS
===== Q.93x Layer =====
0004 Protocol Discriminator = 00001000 Q931/I.451 user-network call control
0005 Call Reference Length = ....0010 (2)
0006 Call Reference Value = 1538 (.0000110 00000010)
0006 Call Reference Flag = 0..... FROM side that originated callref
0008 Message Type = 00000101 SETUP
0009 IEI Bearer Capability = 00000100 Bearer Capability IE Identifier
000A IE Bearer Capability Length = 3 (x03)
000B Information Transfer Capability = ...00000 Speech
000C ...
```

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

Data Link Group Specification

| Card | Timeslot | Subch |
|------|----------|-------|
| 01 | 00 | 0 |
| 02 | 01 | 1 |
| 03 | 02 | 2 |
| 04 | 03 | 3 |
| 05 | 04 | 4 |
| 06 | 05 | 5 |
| 07 | 06 | 6 |
| 08 | 07 | 7 |
| 09 | 08 | |
| 10 | 09 | |
| 11 | 10 | |
| 12 | 11 | |
| 13 | 12 | |
| 14 | 13 | |
| 15 | 14 | |
| 16 | 15 | |
| 17 | 16 | |
| 18 | 17 | |
| 19 | 18 | |
| 20 | 19 | |

Data Link Group Name:

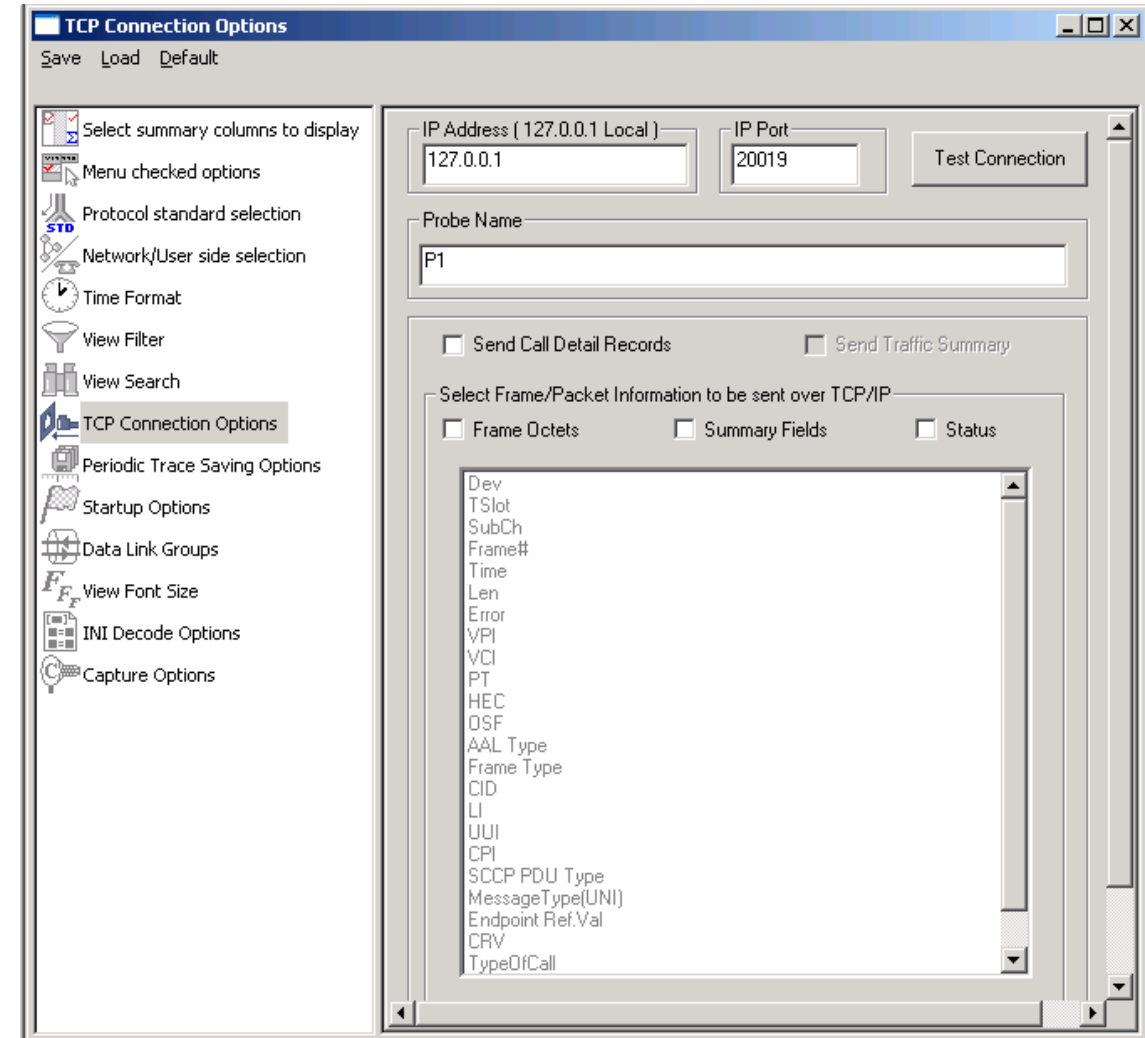
☒ Forward Link Direction

| Card | TS | Sc | Dir | Data Link Group Name |
|------|----|----|-----|----------------------|
| 1 | 0 | 0 | --> | West |
| 2 | 1 | 1 | <-- | West |
| 3 | 2 | 0 | --> | West |
| 4 | 3 | 1 | <-- | West |
| 5 | 0 | 0 | --> | East |
| 6 | 1 | 1 | <-- | East |
| 7 | 2 | 0 | <-- | East |
| 8 | 3 | 1 | --> | East |
| | | | | |
| | | | | |
| | | | | |

Buttons: Add, Odd Cards, Even Cards, All Cards, None, Delete Sel, Delete All, Default

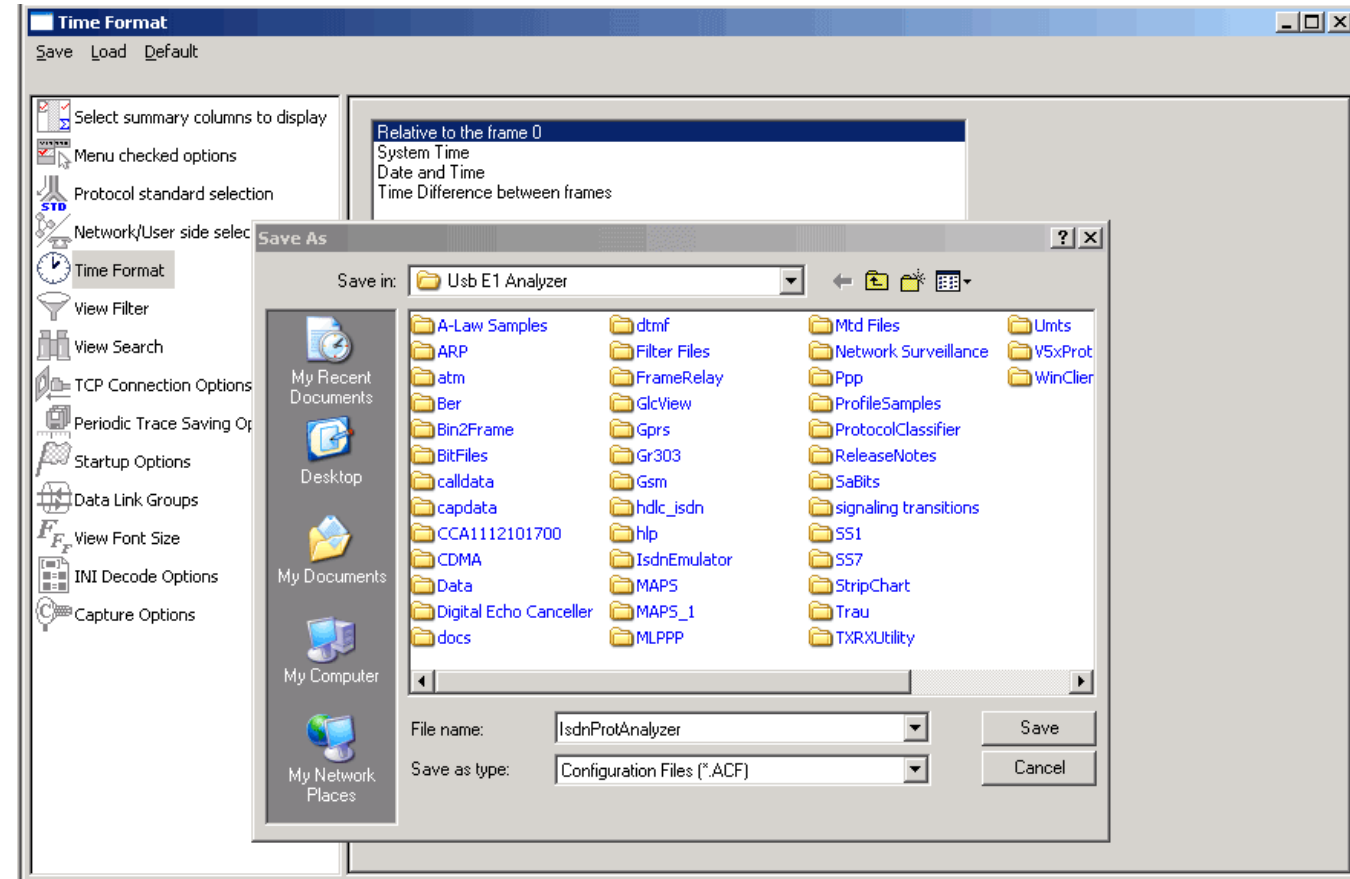
TCP Connection Options

- 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

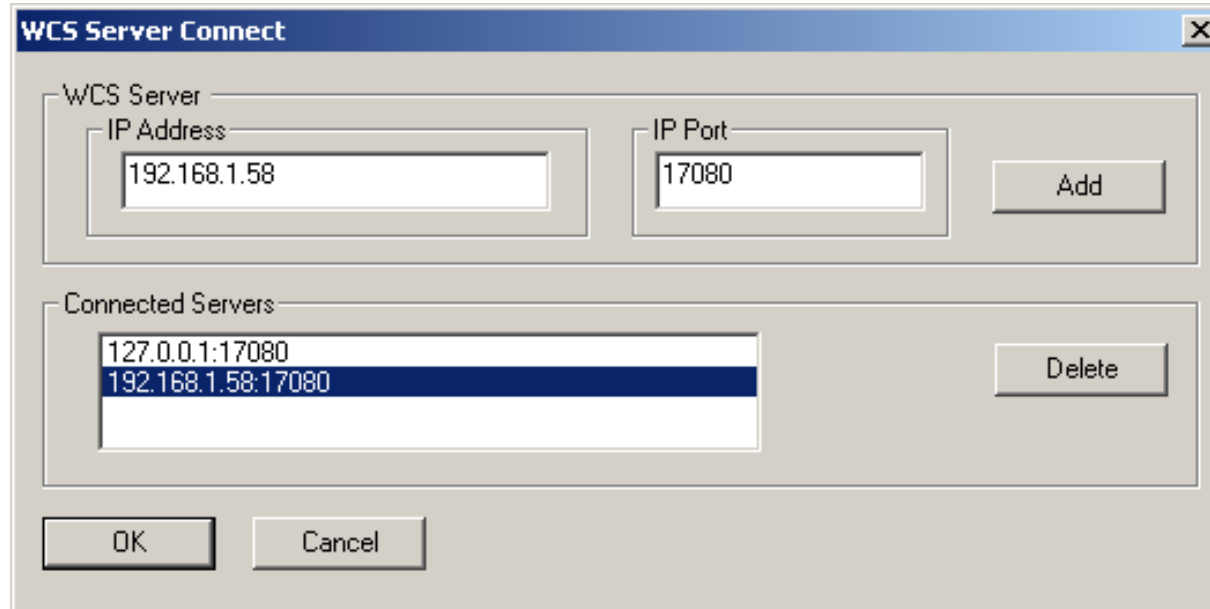
Key Features

- 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

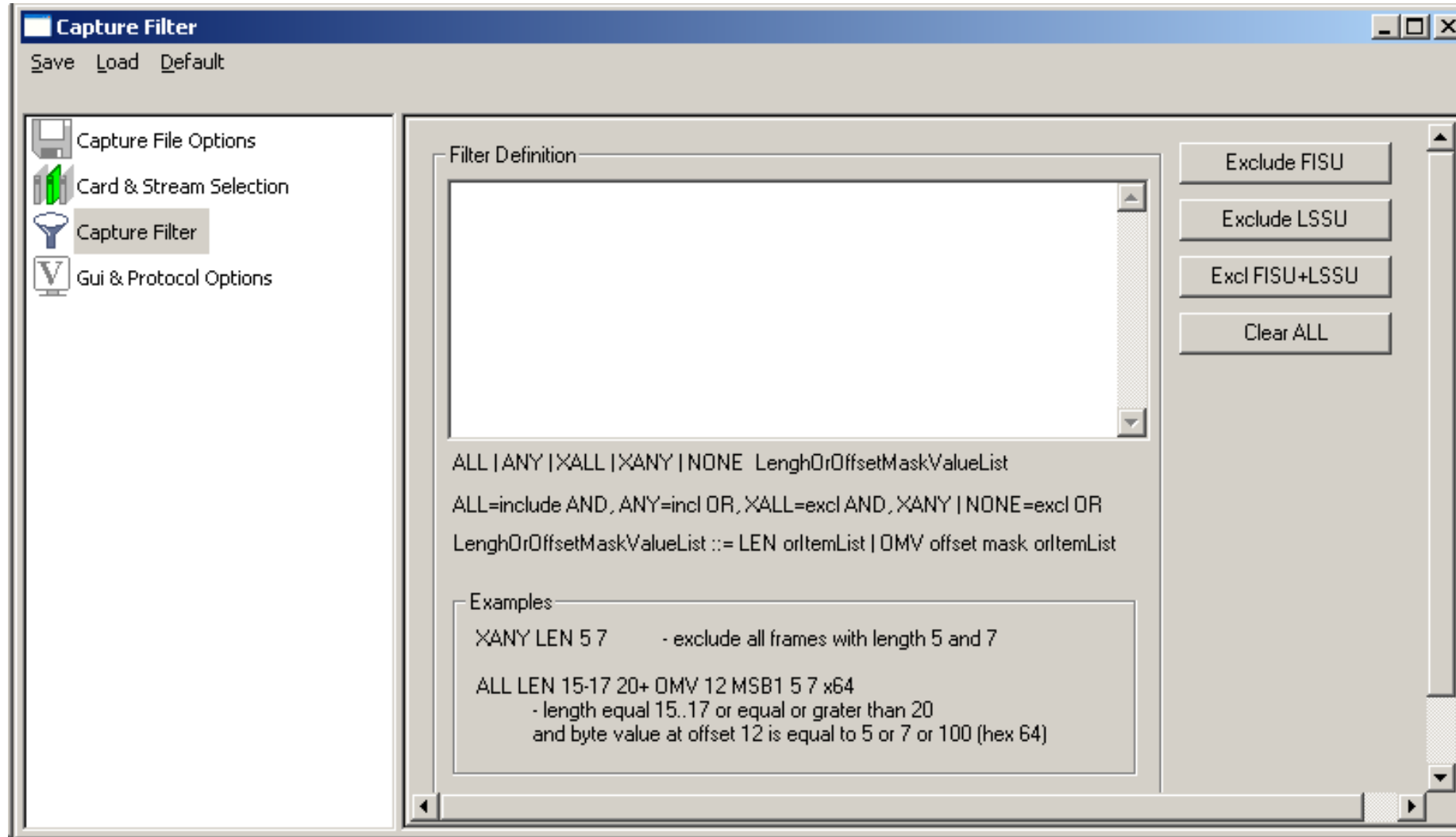


The 'WCS Server Connect' dialog box is used for configuring server connections. It features two input fields for 'IP Address' (containing '192.168.1.58') and 'IP Port' (containing '17080'), with an 'Add' button to the right. Below these is a 'Connected Servers' list box containing '127.0.0.1:17080' and '192.168.1.58:17080' (the latter is selected), with a 'Delete' button to its right. At the bottom are 'OK' and 'Cancel' buttons.



- 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

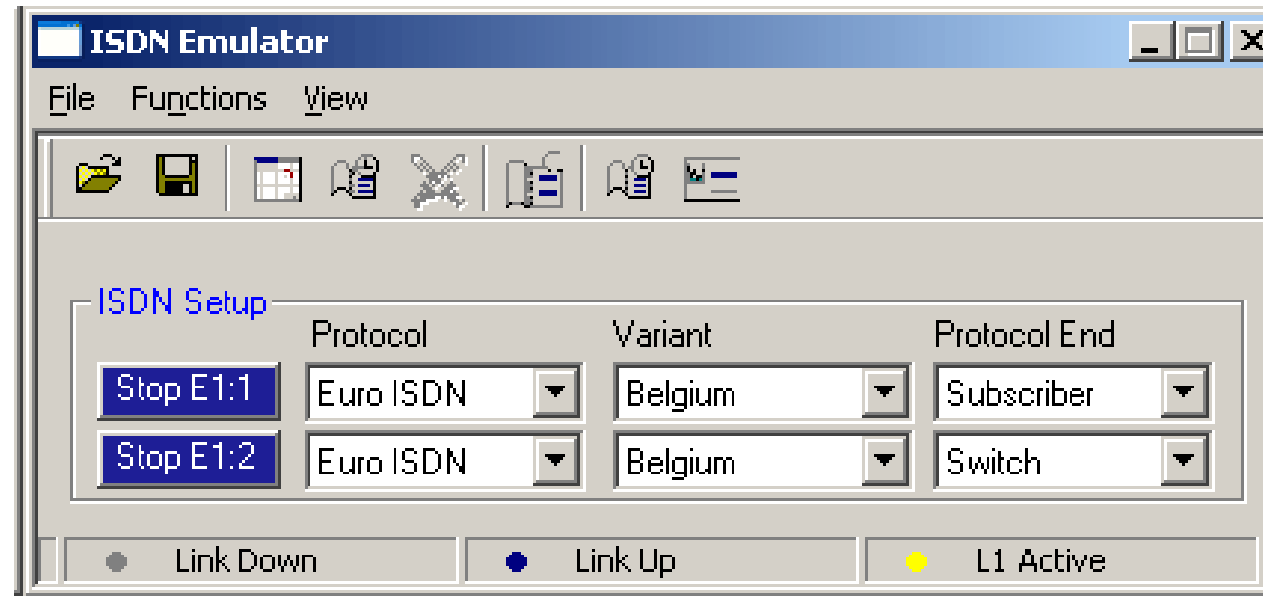


Capture Filter

- 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

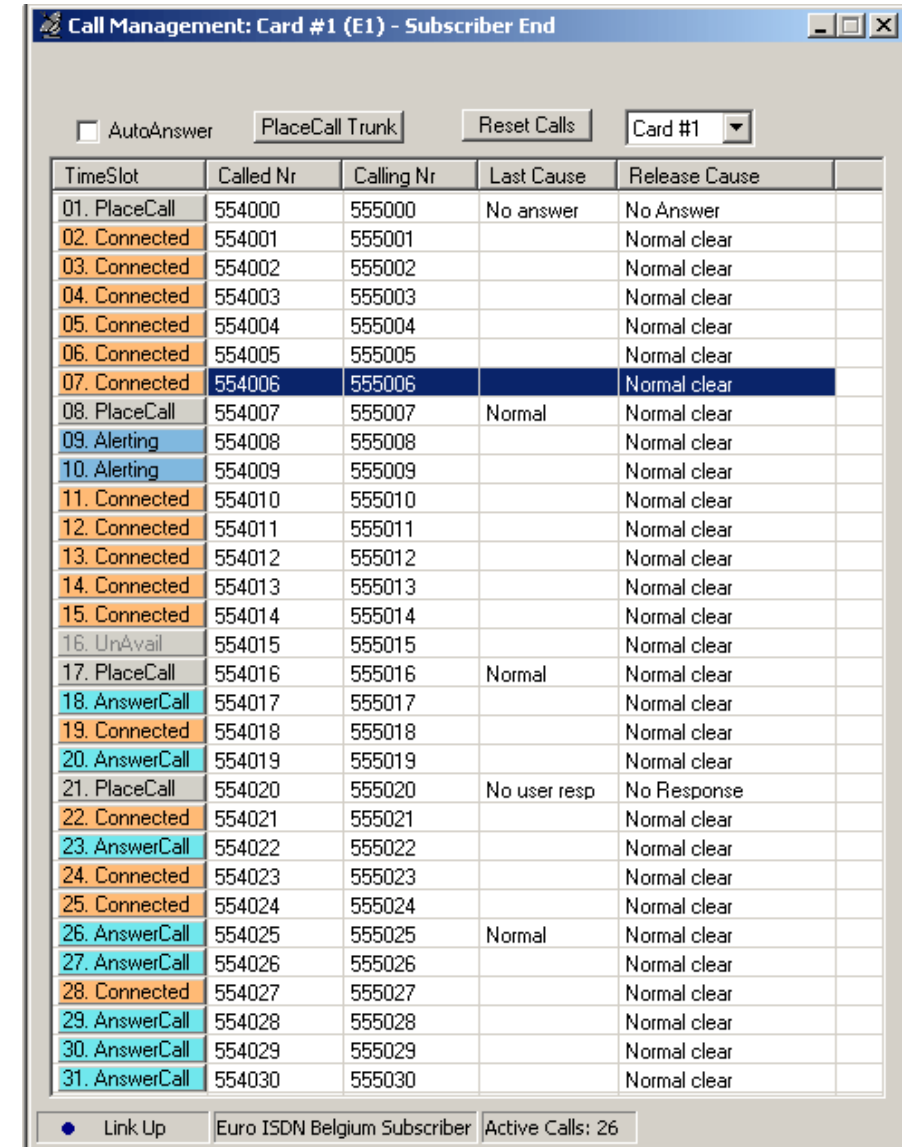
[illegible]

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 Management: Card #1 (E1) - Subscriber End

☐ AutoAnswer Card #1 ▾

| TimeSlot | Called Nr | Calling Nr | Last Cause | Release Cause |
|----------------|-----------|------------|--------------|---------------|
| 01. PlaceCall | 554000 | 555000 | No answer | No Answer |
| 02. Connected | 554001 | 555001 | | Normal clear |
| 03. Connected | 554002 | 555002 | | Normal clear |
| 04. Connected | 554003 | 555003 | | Normal clear |
| 05. Connected | 554004 | 555004 | | Normal clear |
| 06. Connected | 554005 | 555005 | | Normal clear |
| 07. Connected | 554006 | 555006 | | Normal clear |
| 08. PlaceCall | 554007 | 555007 | Normal | Normal clear |
| 09. Alerting | 554008 | 555008 | | Normal clear |
| 10. Alerting | 554009 | 555009 | | Normal clear |
| 11. Connected | 554010 | 555010 | | Normal clear |
| 12. Connected | 554011 | 555011 | | Normal clear |
| 13. Connected | 554012 | 555012 | | Normal clear |
| 14. Connected | 554013 | 555013 | | Normal clear |
| 15. Connected | 554014 | 555014 | | Normal clear |
| 16. UnAvail | 554015 | 555015 | | Normal clear |
| 17. PlaceCall | 554016 | 555016 | Normal | Normal clear |
| 18. AnswerCall | 554017 | 555017 | | Normal clear |
| 19. Connected | 554018 | 555018 | | Normal clear |
| 20. AnswerCall | 554019 | 555019 | | Normal clear |
| 21. PlaceCall | 554020 | 555020 | No user resp | No Response |
| 22. Connected | 554021 | 555021 | | Normal clear |
| 23. AnswerCall | 554022 | 555022 | | Normal clear |
| 24. Connected | 554023 | 555023 | | Normal clear |
| 25. Connected | 554024 | 555024 | | Normal clear |
| 26. AnswerCall | 554025 | 555025 | Normal | Normal clear |
| 27. AnswerCall | 554026 | 555026 | | Normal clear |
| 28. Connected | 554027 | 555027 | | Normal clear |
| 29. AnswerCall | 554028 | 555028 | | Normal clear |
| 30. AnswerCall | 554029 | 555029 | | Normal clear |
| 31. AnswerCall | 554030 | 555030 | | Normal clear |

● Link Up Euro ISDN Belgium Subscriber Active Calls: 26

Call Records

| Call Records | | | | | | | | | | | |
|---|---|---|---------------------|---|-----------|---|--------|-------------|----------|--------|--|
|  | |  | | <input checked="" type="checkbox"/> EnableCallRecords | | <input checked="" type="checkbox"/> View Latest | | | | | |
| No | P | TS | TimeStamp | CalledNr | CallingNr | Type | 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 | |
| | | | | | | | | | | | |
| Total Calls : 18 | | | Complete Calls : 18 | | | Incomplete Calls : 0 | | | | | |

- Displays completed as well as incomplete call chronologically

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

The screenshot shows a window titled "Statistics Port 1" with a "Device Selection" dropdown set to "Card #1". The window is divided into three sections: Layer 1, Layer 2, and Layer 3.

Layer 1 Statistics:

| Statistic | Value | Statistic | Value |
|--------------|-------|-----------|-------|
| Xmtd Pkts | 192 | Rcvd Pkts | 191 |
| CRC Errs | 0 | Rcv Uruns | 0 |
| Malformed | 0 | Xmt Druns | 0 |
| Xmt Dis B | 0 | Rcv Dis B | 0 |
| Xmt Dis F | 0 | Rcv Dis F | 0 |
| Internal Err | 0 | Restarts | 0 |

Layer 2 Statistics:

Active ☒ State MF Est

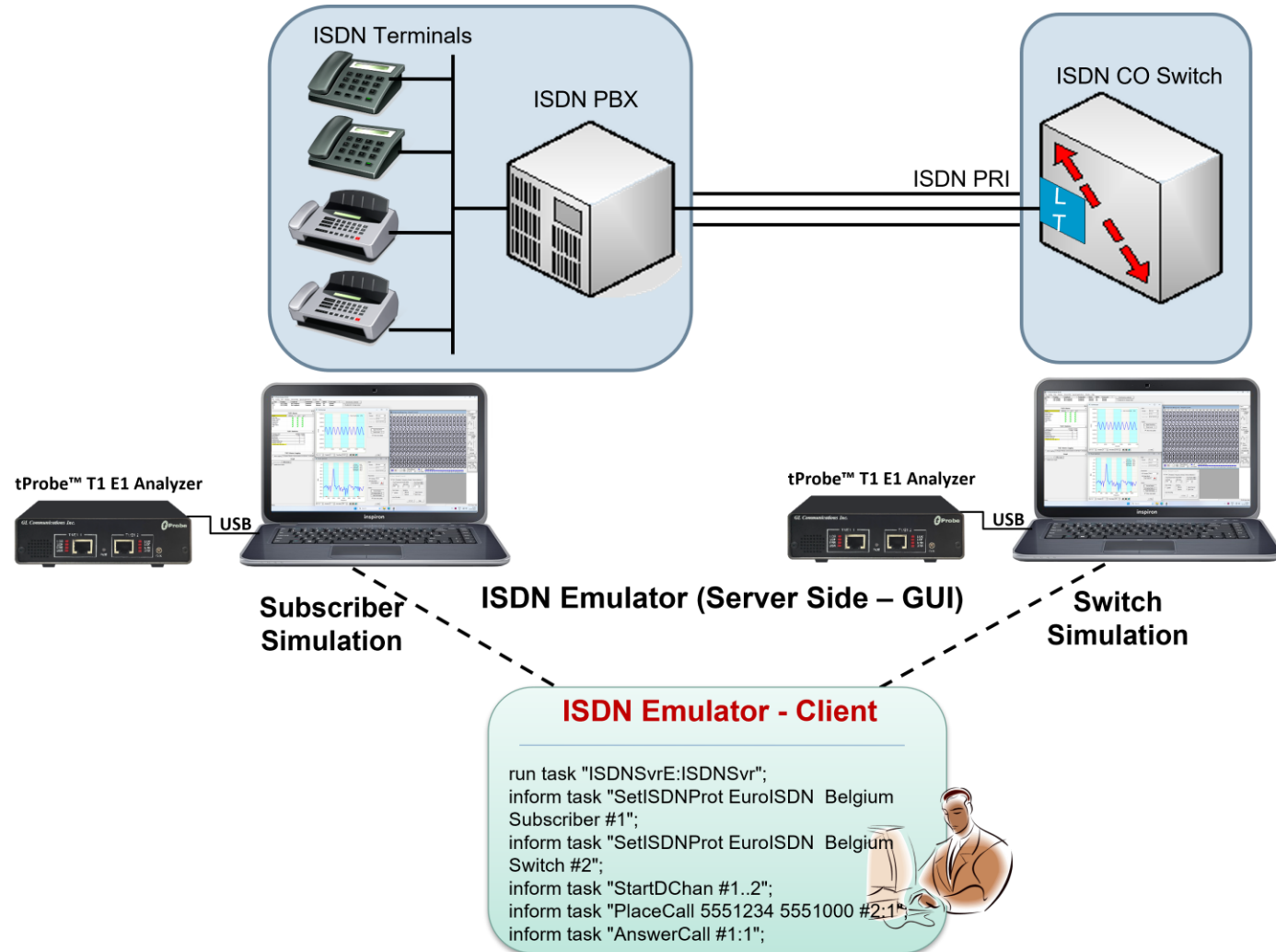
Layer 3 Statistics:

Active Calls 21

Buttons: Reset, OK

ISDN Emulation using Client Server

ISDN Emulation (Module license # - XX629)



MAPS™ - ISDN (XX648)

The screenshot displays two windows from the GLClient application. The left window, titled 'Untitled - GLClient', shows a list of tasks and their states, along with a command prompt for running tasks. The right window, titled 'ISDN Protocol Analysis Q.93x', shows a table of captured frames and a detailed view of a specific frame (Frame 177).

Task List:

- Task 1: TS#2:28, CallState=PROCEEDING
- Task 1: TS#2:28, CallState=ALERTING
- Task 1: TS#2:29, CallState=PROCEEDING
- Task 1: TS#2:29, CallState=ALERTING
- Task 1: TS#2:30, CallState=PROCEEDING
- Task 1: TS#2:30, CallState=ALERTING
- Task 1: TS#2:31, CallState=PROCEEDING
- Task 1: TS#2:31, CallState=ALERTING
- inform task "AnswerCall #1:1..31";
- Task 1 informed
- Task 1: TS#1:1, CallState=CONNECTED
- Task 1: TS#1:2, CallState=CONNECTED
- Task 1: TS#1:3, CallState=CONNECTED
- Task 1: TS#1:4, CallState=CONNECTED
- Task 1: TS#1:5, CallState=CONNECTED
- Task 1: TS#1:6, CallState=CONNECTED

Command Prompt:

```
run task "ISDNSvrE:ISDNSvr";
inform task "SetISDNProt EuroISDN Belgium Switch #1";
inform task "SetISDNProt EuroISDN Belgium Subscriber #2";
inform task "StartDChan #1..2";
inform task "PlaceCall 5551234 5551000 #2:1..31";
inform task "AnswerCall #1:1..31";
inform task "DisconnectCall CAUSE_NORMAL_CLEAR #1:1..31";
inform task "StopDChan #1..2";
```

ISDN Protocol Analysis Q.93x Frame Table:

| Frame# | TIME (Relative) | Len | E... | C/R | SAPI | TEI | CTL | P/F | N(S) | N(R) | F... | CRV | Message Type |
|--------|-----------------|-----|------|--------------------------|------|-----|-------------|-----|------|------|------|-----|-----------------|
| 177 | 00:00:47.382125 | 6 | | Response(User), Comma... | 0 | 0 | Supervisory | 0 | | 49 | 30 | 25 | ALERTING |
| 178 | 00:00:47.482250 | 15 | | Response(User), Comma... | 0 | 0 | Information | 0 | 49 | 30 | | 26 | CALL PROCEEDING |
| 179 | 00:00:47.484250 | 16 | | Response(User), Comma... | 0 | 0 | Information | 0 | 50 | 30 | | 26 | ALERTING |
| 180 | 00:00:47.504375 | 15 | | Response(User), Comma... | 0 | 0 | Information | 0 | 51 | 30 | | 27 | CALL PROCEEDING |
| 181 | 00:00:47.506375 | 16 | | Response(User), Comma... | 0 | 0 | Information | 0 | 52 | 30 | | 27 | ALERTING |
| 182 | 00:00:47.508500 | 15 | | Response(User), Comma... | 0 | 0 | Information | 0 | 53 | 30 | | 28 | CALL PROCEEDING |
| 183 | 00:00:47.510500 | 16 | | Response(User), Comma... | 0 | 0 | Information | 0 | 54 | 30 | | 28 | ALERTING |
| 184 | 00:00:47.512500 | 15 | | Response(User), Comma... | 0 | 0 | Information | 0 | 55 | 30 | | 29 | ALERTING |

Card1 TimeSlot=16 Frame=177 at 00:00:47.382125 OK Len=6

HDLC Frame Data + FCS

```

===== LAPD Layer =====
C/R          = .....1. Response(User), Command(Network)
SAPI         = 000000.. (0)
TEI          = 0000000.. (0)
Ctl          = .....01 Supervisory
Supervisory Function = ....00.. RR
P/F          = .....0 (0)
N(R)         = 0110001. (49)
    
```

Hex Dump of the Frame Data

```

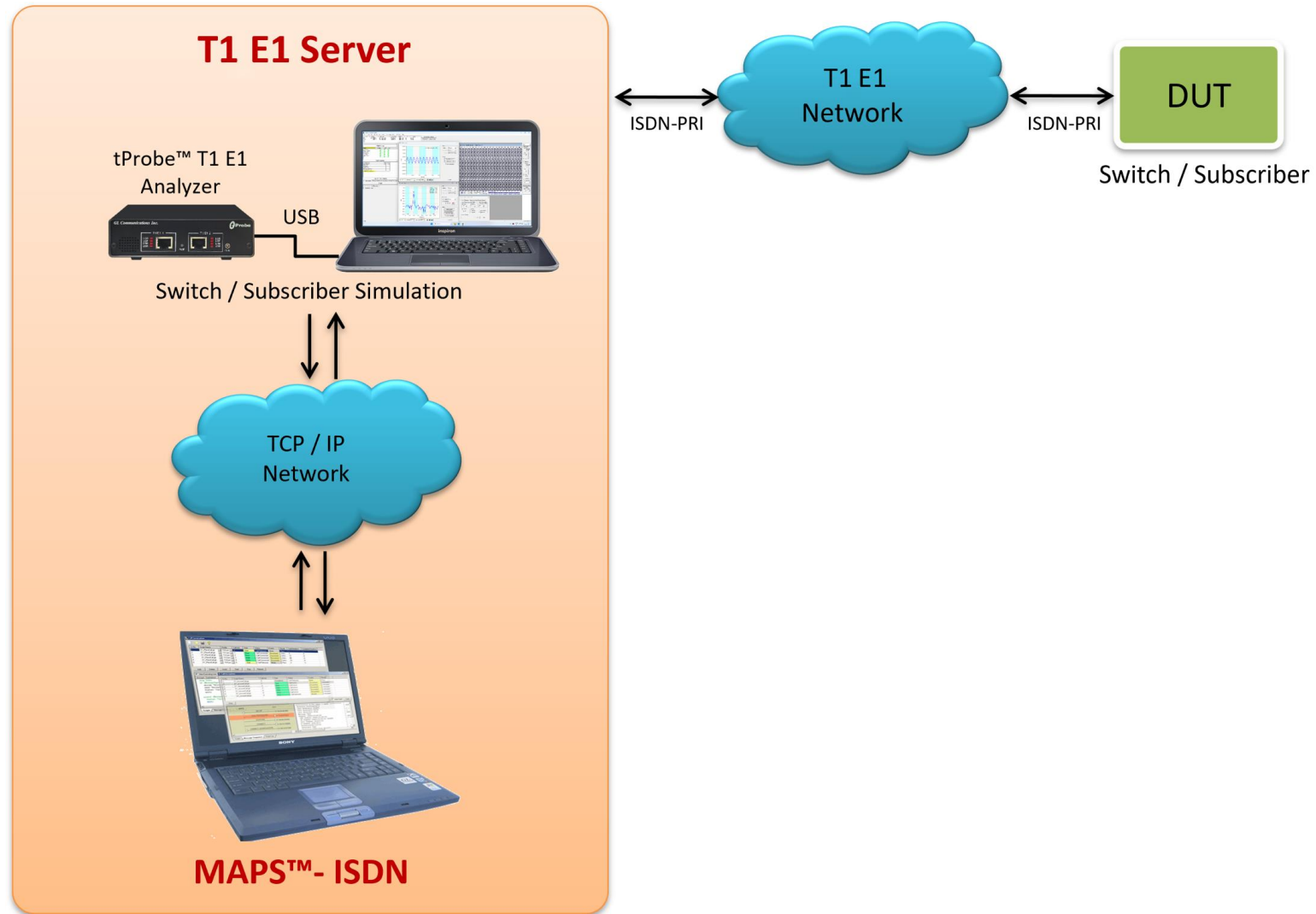
+-----+-----+-----+-----+-----+-----+
02 01 01 62 B8 C6                                     b,Æ
    
```

Stopped C:\Temp\Hdl Idle, 508 frames

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

High-Capacity ISDN Emulation using MAPS™

MAPS™ - ISDN (XX648)



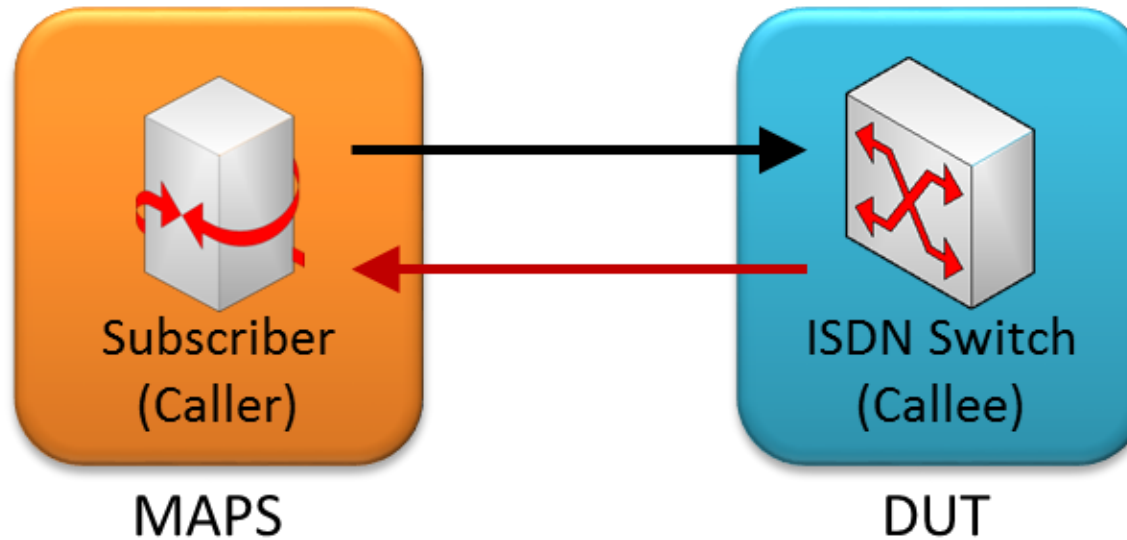
MAPS™ - ISDN Key Features

- 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) |

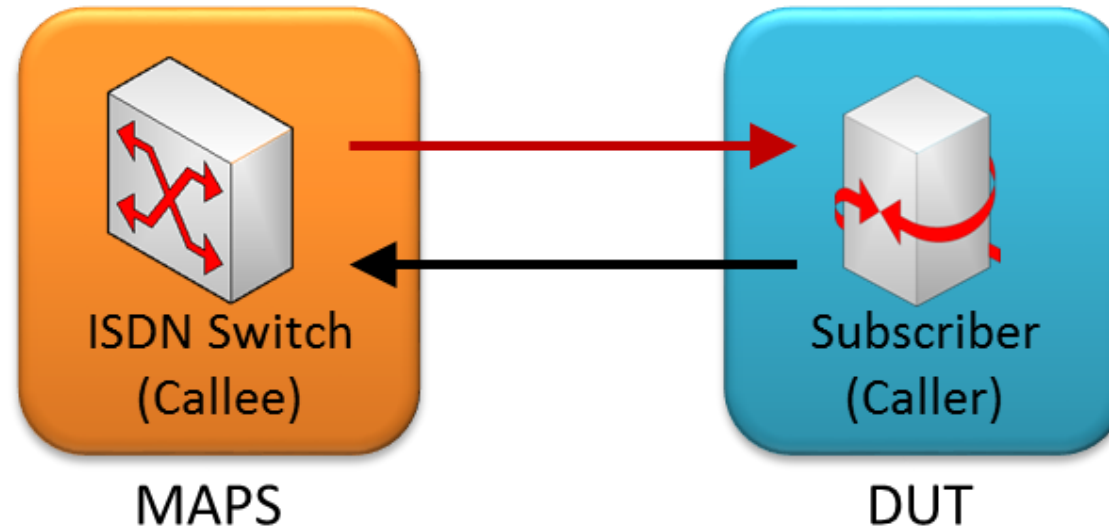
MAPS™ - ISDN as Subscriber



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

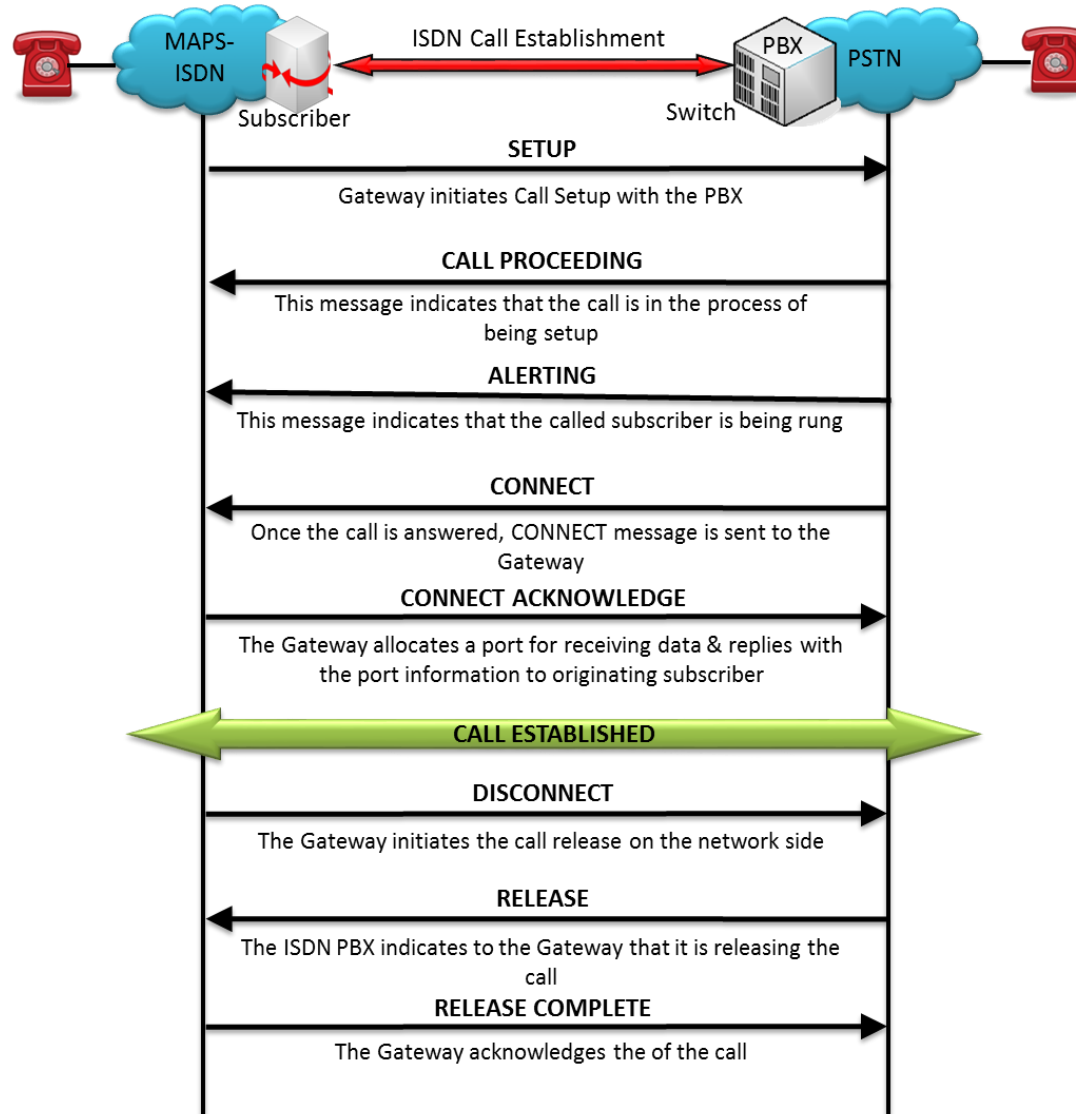
MAPS™ - ISDN as ISDN Switch



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

Active Calls Completed Calls

Load Scripts Load Profiles

Call Generation - Untitled

| Sr No | Script Name | Profile | Call Info | Script Execution | Status | Events | Events Profile | Result | Total Iterations | Completed Iterations |
|-------|---------------|----------|-----------|------------------|----------------|------------|----------------|--------|------------------|----------------------|
| 1 | PlaceCall.gls | TS10.xml | 10 | Abort | Call Connected | Disconn... | | Pass | 1 | 0 |
| 2 | PlaceCall.gls | TS1.xml | 1 | Abort | Call Connected | Disconn... | | Pass | 1 | 0 |
| 3 | PlaceCall.gls | TS2.xml | 2 | Abort | Call Connected | Disconn... | | Pass | 1 | 0 |
| 4 | PlaceCall.gls | TS3.xml | 3 | Abort | Call Connected | Disconn... | | Pass | 1 | 0 |
| 5 | PlaceCall.gls | TS4.xml | 4 | Start | Call Released | None | | Pass | 1 | 1 |
| 6 | PlaceCall.gls | TS5.xml | 5 | Abort | Call Connected | Disconn... | | Pass | 1 | 0 |
| 7 | PlaceCall.gls | TS6.xml | 6 | Abort | Call Connected | Disconn... | | Pass | 1 | 0 |
| 8 | PlaceCall.gls | TS7.xml | 7 | Abort | Call Connected | Disconn... | | Pass | 1 | 0 |
| 9 | PlaceCall.gls | TS8.xml | 8 | Abort | Call Connected | Disconn... | | Pass | 1 | 0 |
| 10 | PlaceCall.gls | TS9.xml | 9 | Start | Call Released | None | | Pass | 1 | 1 |

Add Delete Insert Start Abort Refresh Start All Abort All

MAPS DUT

SETUP 14:20:11.916000

CALL PROCEEDING 14:20:12.244000

ALERTING 14:20:12.244000

CONNECT 14:20:22.307000

CONNECT ACKNOWLEDGE 14:20:22.307000

DISCONNECT 14:21:00.463000

RELEASE

===== Q.93x Layer 3 Layer =====

Protocol Discriminator = 000C

Call Reference Length =

Call Reference Value = 5 (.

Call Reference Flag = 0...

Message Type = 000C

Bearer capability =

IEI Bearer Capability = 000C

IE Bearer Capability Length = 3 (x

Information Transfer Capability = ...C

Coding Standard = .00.

Oct 3 Extension Bit (Oct 3) = 1...

Information Transfer Rate = ...1

Transfer Mode = .00.

Oct 4 Extension Bit (Oct 4) = 1...

User Information Layer 1 Protocol Ident = .01.

Scripts Message Sequence Event Config

Message Sequence of a selected call Selected ISDN Message Decodes

MAPS™ - ISDN Call Reception

Active Calls → Completed Calls

Receiving Scripts

Message Sequence of a selected call

Message Decodes of the selected ISDN message

The screenshot displays the MAPS™ ISDN Call Reception interface. At the top, there are two tabs: 'Active Calls' and 'Completed Calls'. Below these is a table with the following columns: Sr No, Script Name, Call Info, Script Execution, Status, Events, Events Profile, and Results. The table contains 10 rows of call data. A red box highlights the 'Script Name' column for all rows, and a red arrow points to it from the 'Receiving Scripts' label. Another red box highlights the 'Script Execution' column for rows 1-9, and a red arrow points to it from the 'Active Calls' label. A third red box highlights the 'Script Execution' column for rows 3 and 9, and a red arrow points to it from the 'Completed Calls' label. Below the table, there are buttons for 'Abort', 'Auto Trash', and 'Trash'. The bottom section of the interface shows a 'Message Sequence' diagram with two columns: 'MAPS' and 'DUT'. The diagram shows a sequence of messages: SETUP, CALL PROCEEDING, ALERTING, CONNECT, and CONNECT ACKNOWLEDGE. A red box highlights the 'SETUP' message, and a red arrow points to it from the 'Message Sequence of a selected call' label. To the right of the diagram is a 'Message Decodes' window showing the details of the selected ISDN message. A red box highlights this window, and a red arrow points to it from the 'Message Decodes of the selected ISDN message' label. The 'Message Decodes' window shows the following fields: Protocol Discriminator, Call Reference Length, Call Reference Value, Call Reference Flag, Message Type, Bearer capability, IEI Bearer Capability, IE Bearer Capability Length, Information Transfer Capability, Coding Standard, Oct 3 Extension Bit (Oct 3), Information Transfer Rate, and Transfer Mode.

| Sr No | Script Name | Call Info | Script Execution | Status | Events | Events Profile | Results |
|-------|--------------|-----------|------------------|---------------|---------------|----------------|---------|
| 1 | RecvCall.gls | 10 | Abort | Call Active | Disconnect... | | Pass |
| 2 | RecvCall.gls | 9 | Abort | Call Active | Disconnect... | | Pass |
| 3 | RecvCall.gls | 8 | Completed | Call Released | None | | Pass |
| 4 | RecvCall.gls | 7 | Abort | Call Active | Disconnect... | | Pass |
| 5 | RecvCall.gls | 6 | Abort | Call Active | Disconnect... | | Pass |
| 6 | RecvCall.gls | 5 | Abort | Call Active | Disconnect... | | Pass |
| 7 | RecvCall.gls | 4 | Abort | Call Active | Disconnect... | | Pass |
| 8 | RecvCall.gls | 3 | Abort | Call Active | Disconnect... | | Pass |
| 9 | RecvCall.gls | 2 | Completed | Call Released | None | | Pass |
| 10 | RecvCall.gls | 1 | Abort | Call Active | Disconnect... | | Pass |

Abort Auto Trash Trash

MAPS DUT

SETUP 14:21:43.087000

CALL PROCEEDING 14:21:43.087000

ALERTING 14:21:43.087000

CONNECT 14:21:53.103000

CONNECT ACKNOWLEDGE 14:21:53.447000

DISCONNECT

===== Q.93x Layer 3 Layer =====

Protocol Discriminator

Call Reference Length

Call Reference Value

Call Reference Flag

Message Type

Bearer capability

IEI Bearer Capability

IE Bearer Capability Length

Information Transfer Capability

Coding Standard

Oct 3 Extension Bit (Oct 3)

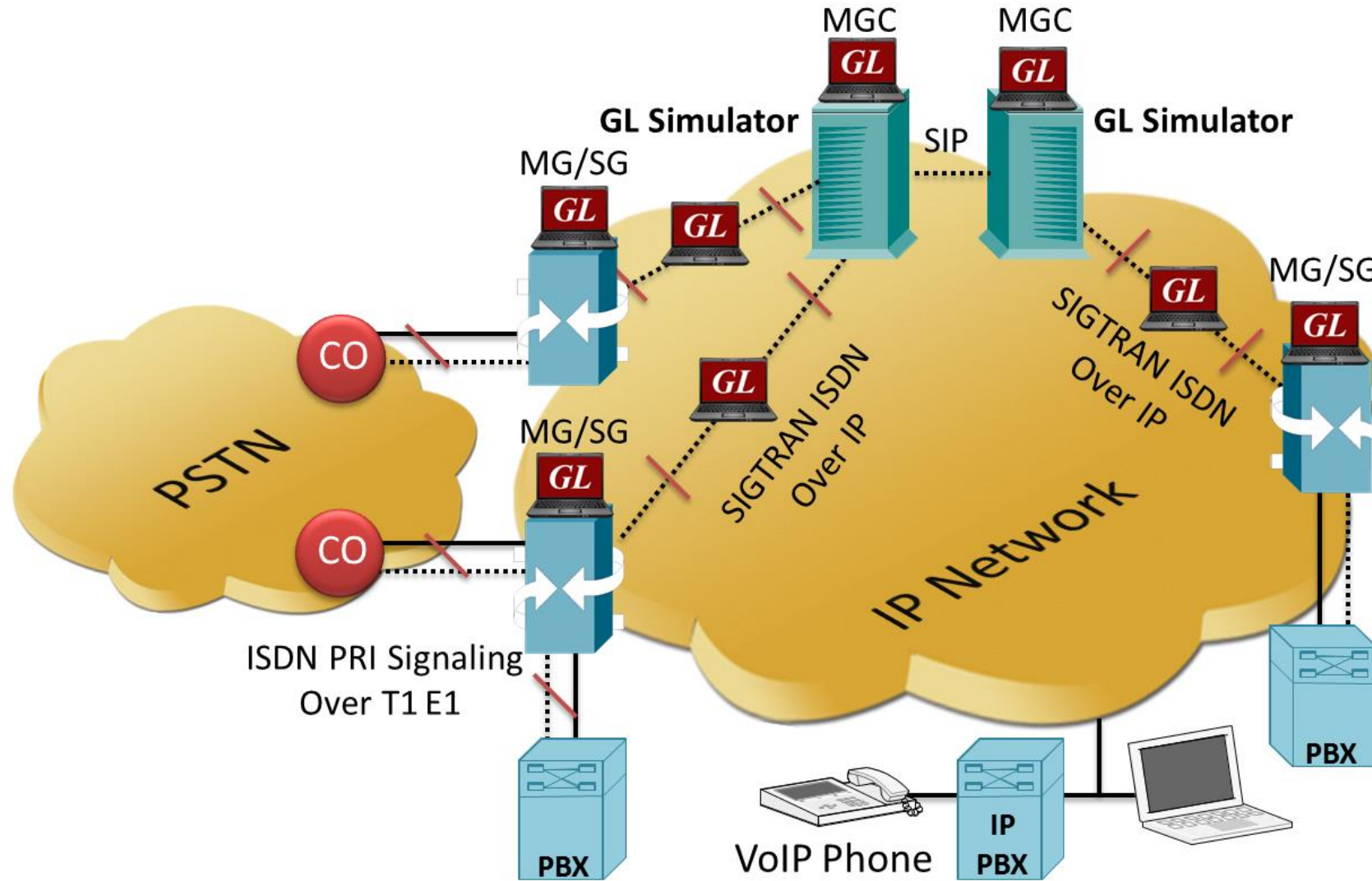
Information Transfer Rate

Transfer Mode

Scripts Message Sequence Event Config

High-Capacity ISDN SIGTRAN Emulation using MAPS™

MAPS™ ISDN - SIGTRAN (PKS135)



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

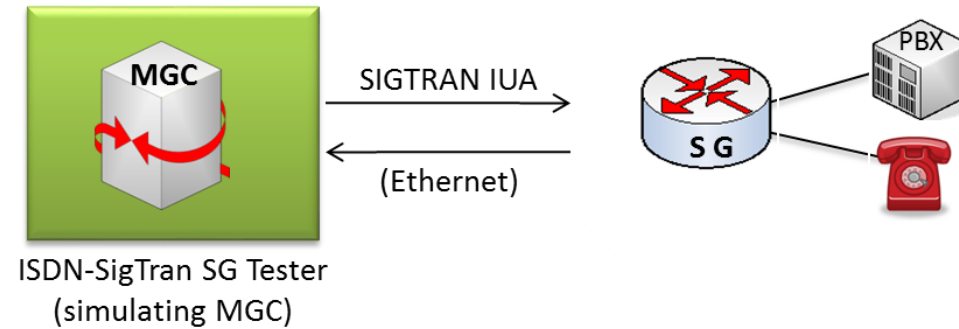
Key Features

- 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

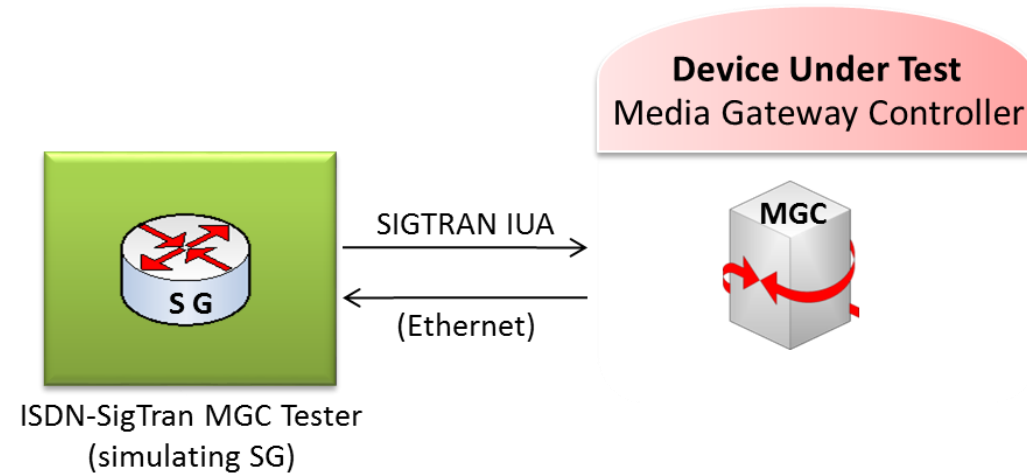
Supported Protocol Standards

| 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

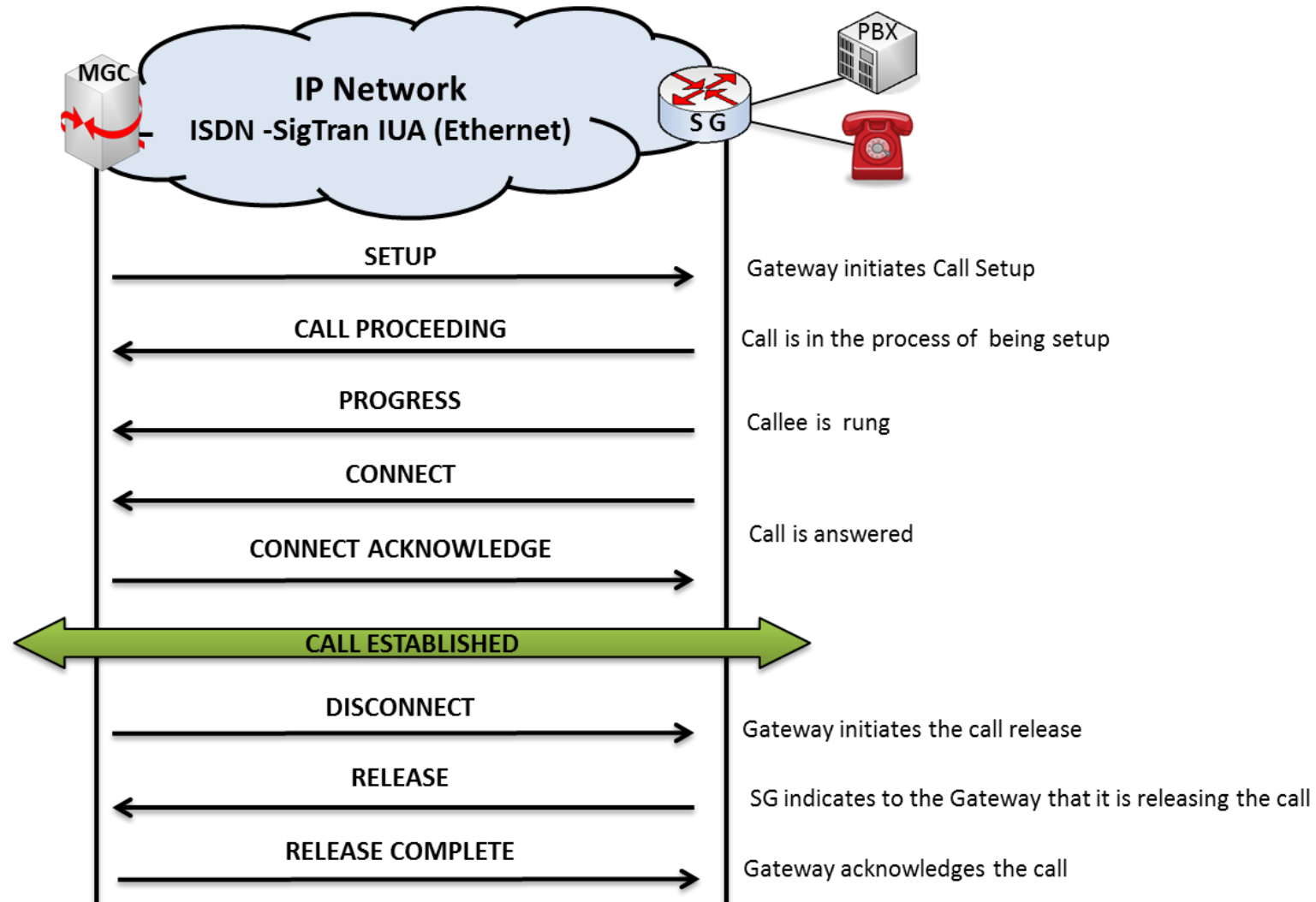


Scenario: MAPS™ acting as MGC



Scenario: MAPS™ acting as Signaling GW

Typical Call Scenario



Call Generation and Reception

Active Calls ← → Completed Calls

Load Scripts and Profiles

Script Contents

Commands already executed

Receiving Scripts

Message Sequence of a selected call

Message Decodes of the selected ISDN message

| Sr No | Script Name | Profile | Call Info | Script Execution | Status | Events | Events Profile | Result | Total Iterations | Completed Iterations |
|-------|---------------|---------|-----------|------------------|----------------|----------|----------------|--------|------------------|----------------------|
| 1 | PlaceCall.gls | SigPro1 | 1 | Abort | Call Connected | Disconn. | | Pass | Infinite | 93 |

Script Contents

```
KeyIdentifier:CN;  
  
send "SETUP" "SETUPImport" retxmit T303 (2,T303 msec);  
State="Call Initiated";  
EventLog ("Call Initiated");  
Recvwaittime=8000 ;  
  
"mainloop":  
recv msg wait Recvwa  
recv msg wait Recvwa
```

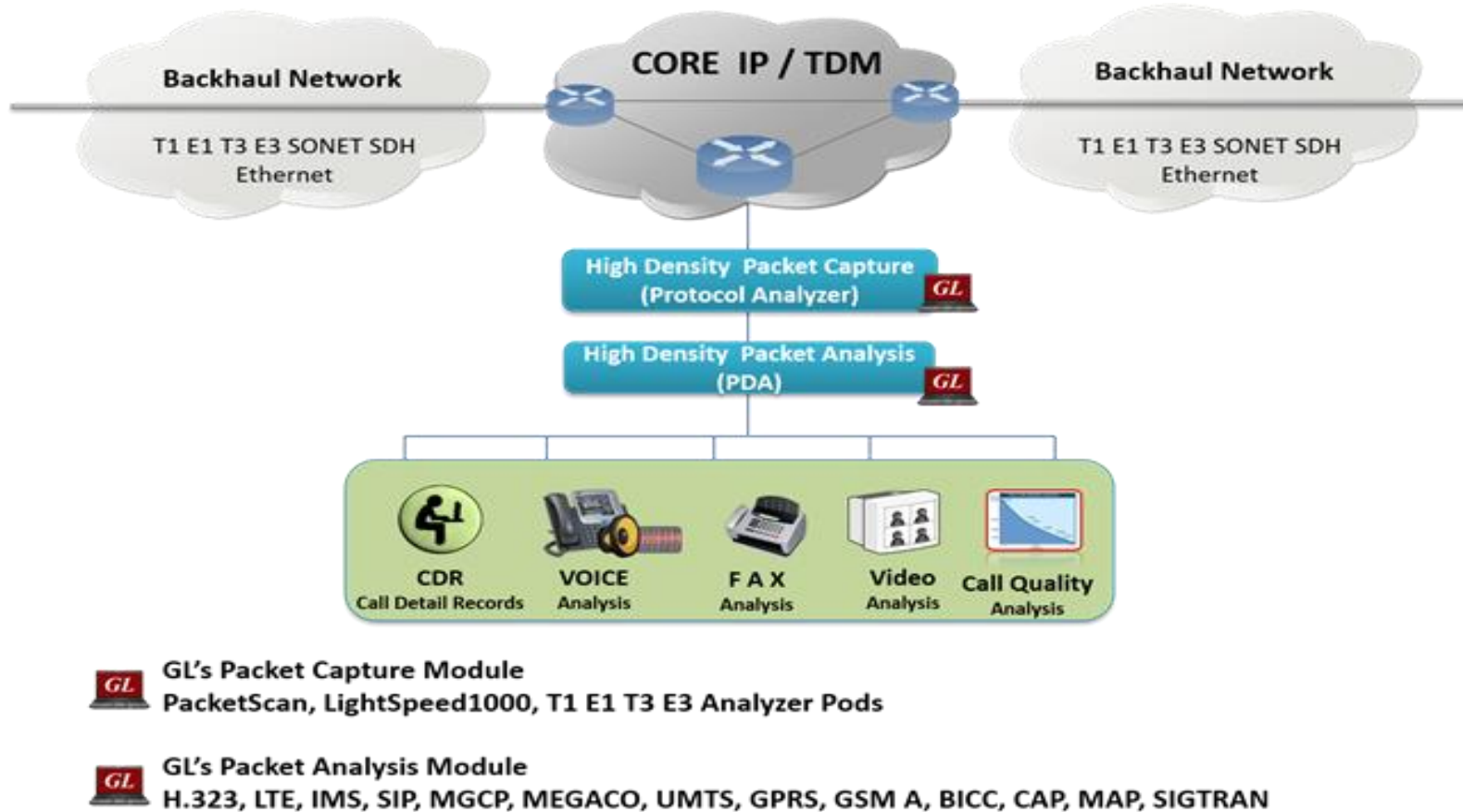
| Sr No | Script Name | Call Info | Script Execution | Status | Events | Events Profile | Results |
|-------|--------------|-----------|------------------|---------------|------------|----------------|---------|
| 1 | RecvCall.gls | 1 | Completed | Call Released | None | | Pass |
| 2 | RecvCall.gls | 1 | Abort | Call Active | Disconnec. | | Pass |

Message Sequence of a selected call

Message Decodes of the selected ISDN message

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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Supports capturing of voice, digits, tones and FAX etc to *.PCM file format |
| Triggers and Actions | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Supports saving the selected calls from traffic analyzer into *.HDL, *.PCAP, or *.PCAPNG formats |

ISDN Data Link Group

[illegible]

Traffic Recording Configurations

Traffic Recording Configuration

File

Traffic Recording

☒ Recording (Non Segmented)

Directory C:\Program Files\GL Communications Inc\E . . .

Record Duration 0 sec {0 to Record Entire Call Duration}

☐ Include Absolute Path in CDR

☒ Segmented Recording

Directory C:\Program Files\GL Communications Inc\E . . .

No. of Segments 3 Segment Length 8 sec

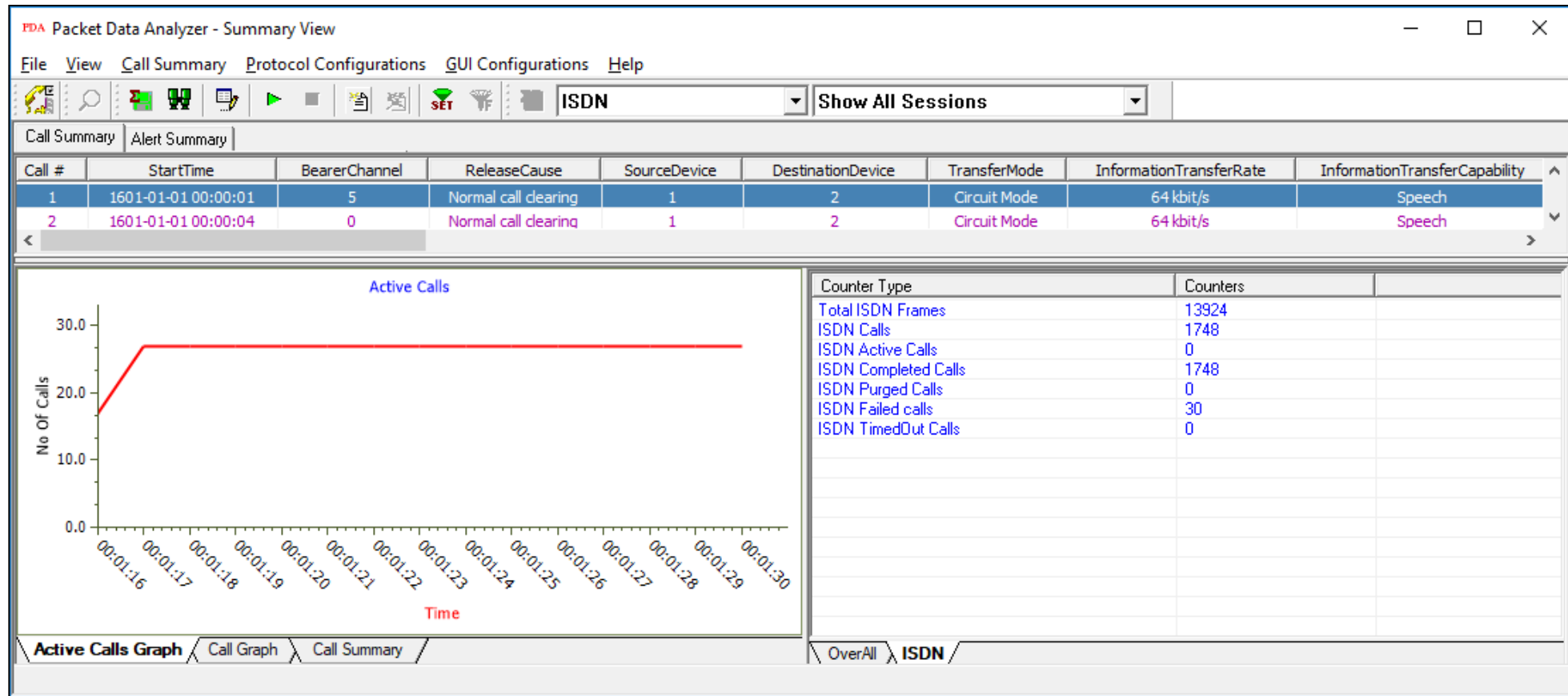
Max Simultaneous Recordings 200

Create Subfolder Every 1 min

Activate Close

ISDN Call Summary

Active Call Graph



Summary View

Packet Data Analyzer - Summary View

File View Call Summary GUI Configurations Help

ISDN Show All Calls

Call Summary Alert Summary

| Call # | StartTime | Caller | Callee | CallReference | SourcePort | DestinationPort | TimeSlot | BearerChannel | InterfaceType | InterfaceId | Result | ReleaseCause | Duration | BillingTime(mSec) | S |
|--------|-------------------------|------------|------------|---------------|------------|-----------------|----------|---------------|------------------------|-------------|--------|----------------------|--------------|-------------------|---|
| 1 | 2019-03-04 16:36:24.426 | 8556782101 | 7685612901 | 2 | 1 | 2 | 16 | 1 | Primary Rate Interface | 0 | Pass | Normal call clearing | 00:01:01.489 | 60178 | |
| 2 | 2019-03-04 16:36:24.436 | 8556782102 | 7685612902 | 3 | 1 | 2 | 16 | 2 | Primary Rate Interface | 0 | Pass | Normal call clearing | 00:01:01.481 | 60175 | |
| 3 | 2019-03-04 16:36:24.443 | 8556782103 | 7685612903 | 4 | 1 | 2 | 16 | 3 | Primary Rate Interface | 0 | Pass | Normal call clearing | 00:01:01.476 | 60172 | |
| 4 | 2019-03-04 16:36:24.450 | 8556782104 | 7685612904 | 5 | 1 | 2 | 16 | 4 | Primary Rate Interface | 0 | Pass | Normal call clearing | 00:01:01.487 | 60185 | |
| 5 | 2019-03-04 16:36:24.458 | 8556782105 | 7685612905 | 6 | 1 | 2 | 16 | 5 | Primary Rate Interface | 0 | Pass | Normal call clearing | 00:01:01.489 | 60179 | |
| 6 | 2019-03-04 16:36:24.465 | 8556782106 | 7685612906 | 7 | 1 | 2 | 16 | 6 | Primary Rate Interface | 0 | Pass | Normal call clearing | 00:01:01.484 | 60176 | |

Column Width

| TimeStamp | Frame Number | 1 | 2 |
|-----------|--------------|------|------|
| 00.00.000 | 8 | 1:16 | 2:16 |
| 00.00.986 | 19 | 1:16 | 2:16 |
| 00.00.989 | 20 | 1:16 | 2:16 |
| 00.00.990 | 21 | 1:16 | 2:16 |
| 00.01.153 | 40 | 1:16 | 2:16 |
| 01.01.168 | 66 | 1:16 | 2:16 |
| 01.01.325 | 73 | 1:16 | 2:16 |
| 01.01.489 | 81 | 1:16 | 2:16 |

Find

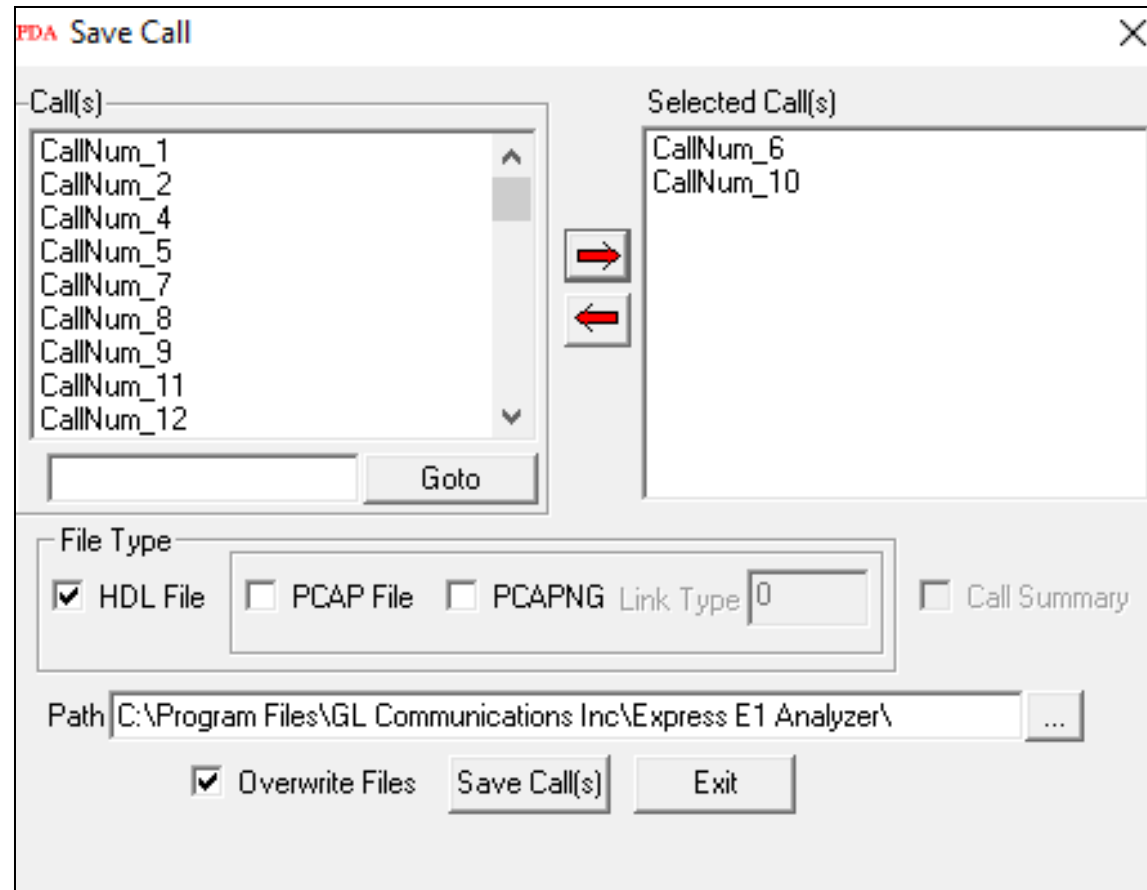
```

===== LAPD Layer =====
C/R = .....0.. Command(User) Response(Network)
SAPI = 000000.. (0)
TEI = 0000000.. (0)
Ctl = .....0 Information
N(S) = 0000000.. (0)
P = .....0 (0)
N(R) = 0000000.. (0)
===== Q.931 Layer =====
Protocol Discriminator = 00001000 Q931/I.461 user-network call control
Call Reference Length = ....0010 (2)
Call Reference Value = 2 (.00000000 00000010)
Call Reference Flag = 0..... FROM side that originated callref
Message Type = 00000101 SETUP
IEI Bearer Capability = 00000100 Bearer Capability IE Identifier
IE Bearer Capability Length = 3 (x03)
Information Transfer Capability = ...00000 Speech
Coding Standard = .00..... ITU_T (CCITT) standardized coding
Information Transfer Rate = ...10000 64 kbit/s
Transfer Mode = .00..... Circuit Mode
User Information Layer 1 Protocol (LLC) = ...00011 A-law Rec G.711
User Information Layer 1 Protocol Identifier = .01..... (1)
IEI Channel Identification = 00011000 Channel Identification IE Identifier
IE Channel Identification Length = 3 (x03)
    
```

Active Calls Graph Call Graph Call Summary

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

The screenshot shows a software window titled "Audio Recording". On the left, under the "Action" header, is a list of seven checked options: "Save Call", "Audio Recording", "User Defined", "Send e-mail", "Alert Summary", "Call Detail Record", and "Extract Fax Image". The "Audio Recording" option is highlighted. The main area on the right is titled "Audio Recording Options" and contains three sections. The first section, "Audio File Name Mask", has a text box containing the pattern "%l_%Y_%M_%D_%h-%m-%s.wav". The second section, "Audio Files Destination Directory", has a text box containing "\\GL Communications Inc\\" and a browse button "...". The third section, "Audio Mixing Options", contains three radio buttons: "Mix" (which is selected), "Stereo", and "To Separate Wave File". Below these sections is a "Create File Options -- If File Exists" section with three radio buttons: "Overwrite" (selected), "Skip Operation", and "Append Sequence Number".

Action

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

Audio Recording Options

Audio File Name Mask

%l_%Y_%M_%D_%h-%m-%s.wav

Audio Files Destination Directory

\\GL Communications Inc\

...

Audio Mixing Options

☒ Mix ☐ Stereo ☐ To Separate Wave File

Create File Options -- If File Exists

☒ Overwrite ☐ Skip Operation ☐ Append Sequence Number

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

Send e-mail

The screenshot shows a configuration window titled "Send e-mail". On the left, under the "Action" section, there is a list of checkboxes: "Save Call", "Audio Recording", "User Defined", "Send e-mail", "Alert Summary", "Call Detail Record", and "Extract Fax Image". The "Send e-mail" checkbox is selected. On the right, there are three sections: "Audio Recording Options" with a text field for "Audio File Name Mask" containing the pattern "%I_%Y_%M_%D_%h-%m-%s.wav"; "Audio Files Destination Directory" with a text field containing "\\GL Communications Inc\\" and a browse button "..."; and "Audio Mixing Options" with three radio buttons: "Mix" (selected), "Stereo", and "To Separate Wave File". At the bottom, there is a section "Create File Options -- If File Exists" with three radio buttons: "Overwrite" (selected), "Skip Operation", and "Append Sequence Number".

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

Alert Summary

Action

| | | |
|---|---------------|---------------------------------|
| <input checked="" type="checkbox"/> Save Call | Alarm Type | Warning |
| <input type="checkbox"/> Audio Recording | | |
| <input type="checkbox"/> User Defined | Alarm Message | Triggers at the specified value |
| <input type="checkbox"/> Send e-mail | | |
| <input checked="" type="checkbox"/> Alert Summary | | |
| <input type="checkbox"/> Call Detail Record | | |
| <input type="checkbox"/> Extract Fax Image | | |

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

Call Detail Record (CDR)

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

- 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

Triggers and Action Settings - Untitled

File

- New Configuration
- Load Configuration**
- Save as Configuration
- Delete Configuration
- Exit

Filter Selection

- ISDN
 - Calling Party
 - Called Party
 - Call Reference
 - Failed Calls
 - All Calls

Enter Trigger Name

Enter Value

Conditions

☐ And ☐ Or

Activate DeActivate

Action

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

Save Call To File Options

File Name Mask

Files Destination Directory

Save Options

- ☐ HDL File
- ☐ PCAP File
- ☐ PCAPNG
- Link Type
- ☐ Call Summary

Create File Options -- If File Exists

☐ Overwrite ☐ Skip Operation ☐ Append Sequence Number

Ok Cancel

PDA Open

← → ↑ ↓ This PC > Documents Search Documents

Organize New folder

| Name | Date modified | Type |
|-------------------------|------------------|-------------|
| Custom Office Templates | 17-05-2019 12:47 | File folder |
| IPMsg | 03-06-2019 10:23 | File folder |
| SnagIt Catalog | 17-05-2019 12:17 | File folder |

File name: File1.tgr Trigger Files (*.tgr)

Open Cancel

PDA Start-up Options

PDA Startup Options

☒ Execute Tasks On PDA Startup

Startup Tasks

☒ Enable Triggers And Actions

Triggers And Actions Profile

C:\Program Files\GL Communications Inc\tProt ...

Select Protocol ISDN

ISDN

☒ Enable CSV

CSV Export Profile

...

- 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