
Protocol Analysis and Emulation over T3 E3

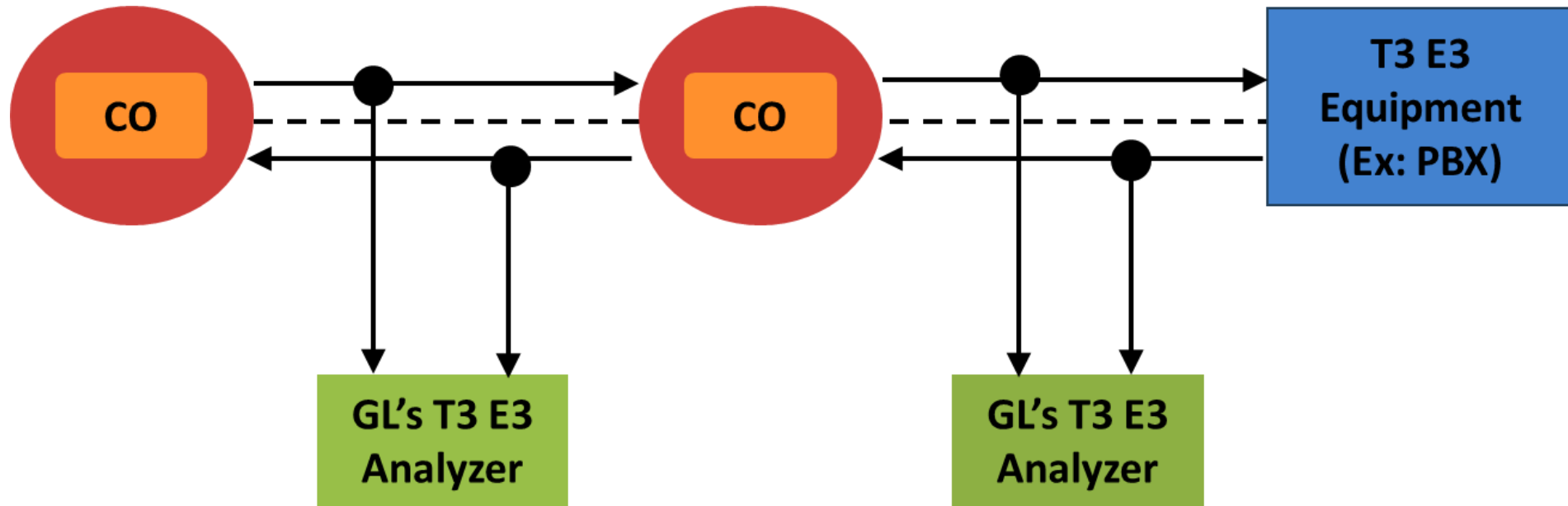


818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: info@gl.com
Website: <https://www.gl.com>

T3 E3 Optional Applications

- BERT
- HDLC Test
- Error and Alarm Generation
- Record and Playback Data to/from File
- Rx Tx Memory Loopback
- Monitor Received Data
- Protocol Analyzers – HDLC, Frame Relay, PPP, ATM and Physical Layer
- HDLC Transmit
- Client/Server
- T1 E1 Send/Receive Server

Protocol Analysis



Real-time Protocol Analysis

- GL's T3 (DS3) /E3 analyzer supports protocol decoding and analysis of ATM, Frame Relay, PPP, and HDLC. All the protocol analyzers are based on similar architecture and support sophisticated filtering, statistics and real-time capture options

The screenshot displays the HDLC Protocol Analysis LAPX+IP software interface. The main window shows a table of captured frames with the following data:

Dev	TS...	Su...	Frame#	TIME (Relative)
✓ 1	0		0	00:00:00.000000
✓ 1	0		1	00:00:00.000180
✓ 1	0		2	00:00:00.000361
✓ 1	0		3	00:00:00.000542
✓ 1	0		4	00:00:00.000723
✓ 1	0		5	00:00:00.000904

Below the table, the software displays the following text:

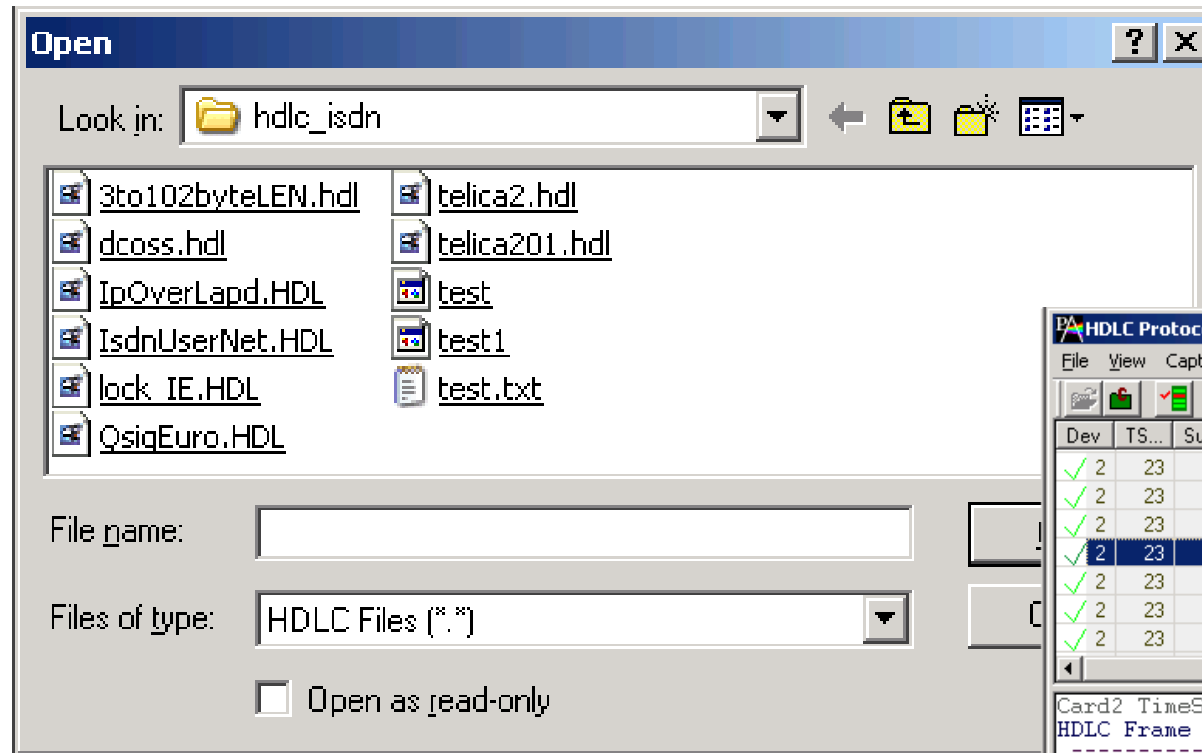
```
Card1 TimeSlot=0 Frame=0 at 00:00:00.000
HDLC Frame Data + FCS
===== LAPX Layer =====
Octets
===== IP Layer =====
Invalid IP Version / IHL
??? Invalid frame/packet structure
```

A hex dump of the frame data is shown below:

```
Hex Dump of the Frame Data
+-----+-----+-----+-----+
00 00 00 00 00 00 00 73 83
```

The right-hand side of the interface features a 'Protocol Capture Configuration' panel with sections for 'Capture File Options', 'Card & Stream Selection', 'Capture Filter', and 'Gui & Protocol Options'. The 'Fctrls' section is visible, showing a list of frames (1 and 2) and a radio button selection for 'FCS' (10 bits or 32 bits).

Offline Protocol Analyzer



HDLC Protocol Analysis LAPD

File View Capture Statistics Database Configure Help

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)
✓ 2	23		0	00:00:00.000000	6		Co...	0	0	Super...	1	
✓ 2	23		1	00:00:09.980000	6		Co...	0	0	Super...	1	
✓ 2	23		2	00:00:19.960000	6		Co...	0	0	Super...	1	
✓ 2	23		3	00:00:27.031875	38		Co...	0	0	Inform...	0	24
✓ 2	23		4	00:00:27.037125	38		Co...	0	0	Inform...	0	25
✓ 2	23		5	00:00:27.043500	38		Co...	0	0	Inform...	0	26
✓ 2	23		6	00:00:27.048875	38		Co...	0	0	Inform...	0	27

Card2 TimeSlot=23 Frame=3 at 00:00:27.031875 OK Len=38

HDLC Frame Data + FCS

----- LAPD Layer -----

C/R =0. Command(User), Response(Netw

SAPI = 000000.. (0)

TEI = 000000.. (0)

Ctl =0 Information

N(S) = 001100.. (24)

P =0 (0)

N(R) = 100011.. (70)

Hex Dump of the Frame Data

```
+-----+-----+-----+-----+-----+-----+-----+-----+
00 01 30 8C 08 02 30 00 05 04 03 90 90 A2 18 03      01 0 00c
A9 83 81 70 0B A1 35 30 38 33 30 32 31 31 31 31      @llp i5083021111
7D 02 91 84 6F 48                                     } 'lOH
```

Off-line Viewing F:\Program Files\Gl Communicat 195 Frames

Key Features

- Consolidated GUI—displays summary of all decodes, detail and hex-dump view of each frame, statistics view, and call detail record views
- Perform real-time/offline/remote analysis
- Supports various protocol standards for proper decode
- Capture options such as port selection, and FCS
- Fine tune results with filtering and search capability
- Export decode results to ASCII or CSV files
- Trace File Saving Options
- Statistics Computation
- Call detail records for Frame Relay, ATM
- Any protocol field can be added to the summary view, filtering, and search features providing users more flexibility to monitor required protocol fields
- Network Monitoring
- Remote access capability

User Interface

The screenshot displays a network analysis application with the following sections:

- Summary View:** A table listing captured frames with columns for Device (Dev), Time Slot (TS...), Subchannel (Su...), Frame#, Time (Relative), Length (Len), Error, Data Link Control Identifier (DLCI), Data Element (DE), BECN, FECN, and Control Field (CTI).
- Detail View:** Shows HDLC Frame Data + FCS for a selected frame, including LAMP Layer details such as EA, C/R, and DLCI.
- Hex Dump View:** Displays the raw hexadecimal data of the frame along with its ASCII representation.
- Statistics View:** A summary table showing frame counts for different devices and C/R types.
- Call Detail View:** A table for recording call information, including Call ID, Call Status, Calling Number, Called Number, Call Start Date & Time, and Call Duration.

The status bar at the bottom indicates the file path: C:\Program Files\GL Communicati and the total number of frames: 200 Frames.

Summary View

Detail View

Hex Dump View

Statistics View

Call Detail View

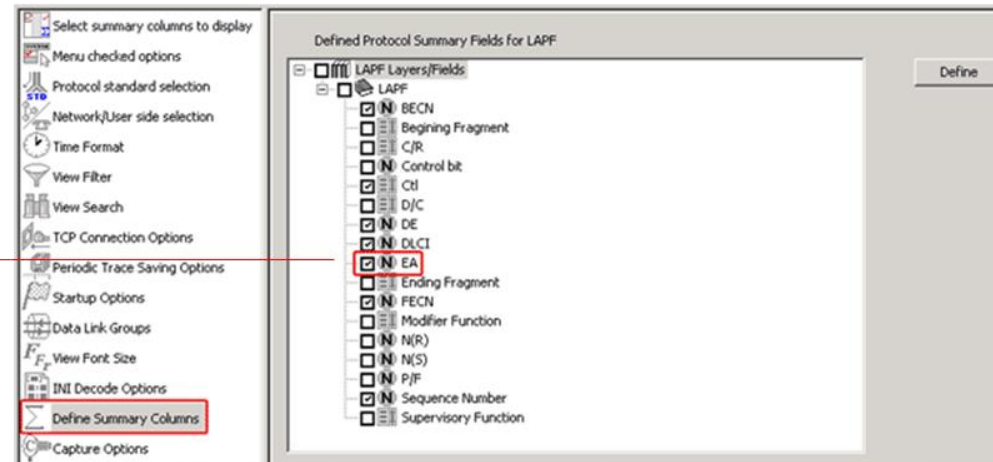
Different Panes

- The user interface comprises of Summary view at the top, followed by the Detail, Hex Dump, Statistics view and an optional Call Trace view at the bottom
 - **Summary View:** displays the columns that contain Frame Number, Time, Frame Error Status, Command/Response, Length, Error, and others 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, the contents of this view can also be copied to clipboard
 - **Hex Dump View:** This pane displays the frame information in HEX and ASCII format, the contents of this view can also be copied to clipboard
 - **Statistics View:** displays the Statistics that are calculated based on the protocol fields
 - **Call Trace View:** displays the call specific information for each individual call from the captured data and display the information in an organized fashion

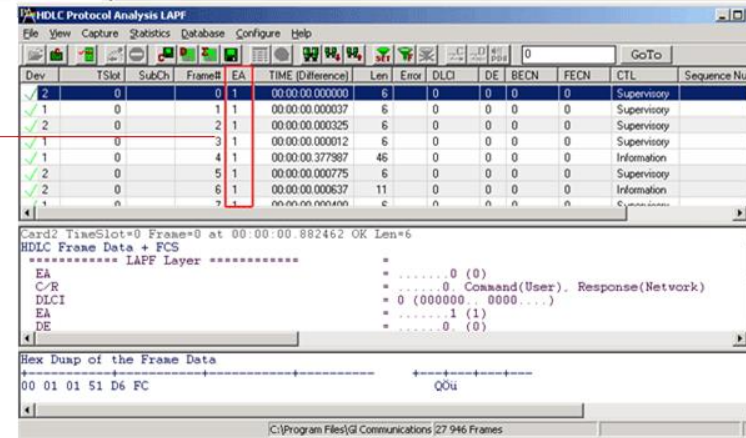
Define Summary Columns

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

Selection of Summary Column



Output display in analyzer



Column Reordering and Resizing

- Click and drag the columns to different positions
- Time (Relative) and Len columns are reordered and TSlot and Frame # columns are resized

The screenshot illustrates the process of reordering and resizing columns in a network analysis tool. The top window shows a table with columns: Dev, TS..., Su..., Frame#, TIME (Relative), Len, Error, BIB, BSN. The bottom window shows a table with columns: Dev, TSlot, Su..., Fra..., Len, TIME (Relative). A context menu is open over the 'Len' column in the top window, and a 'DISPLAYED summary columns' list is shown on the right.

Columns Resized

Columns Reordered

DISPLAYED summary columns

- Ctrl-Up, Ctrl-Down to rearrange columns, DEL to remove, Ctrl-Z to undo delete, Ctrl-A - display all columns
- Drag within list box to rearrange, drag out of the list box to delete

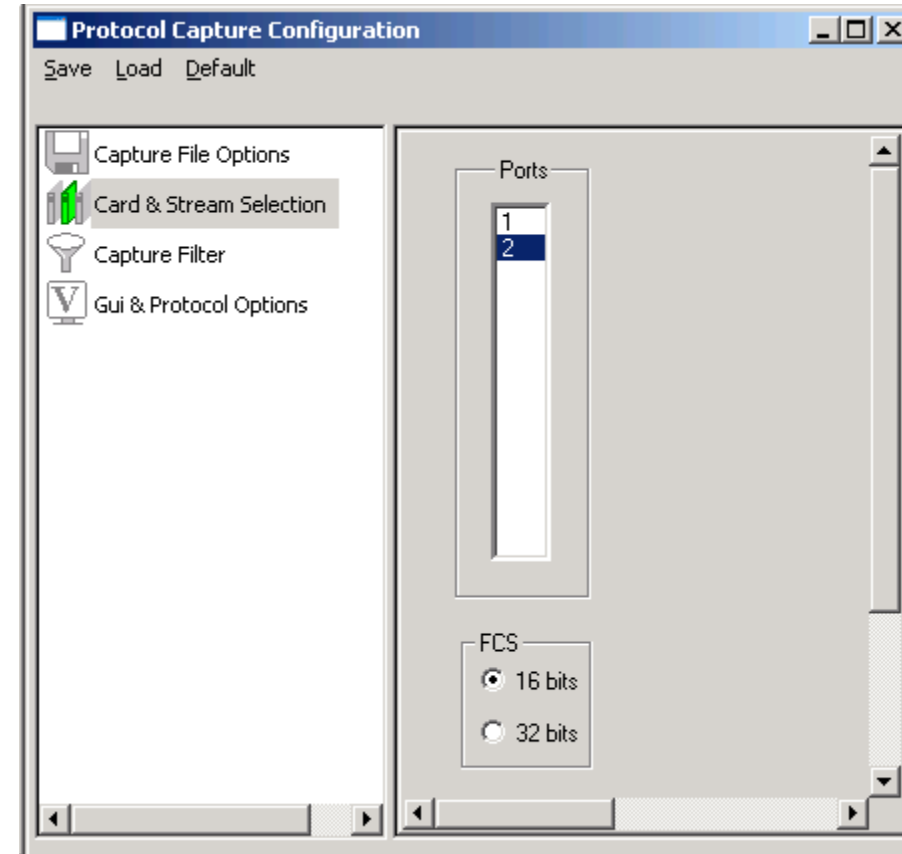
Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	BIB	BSN
✓ 2	0		0	00:00:00.000000	24	Decode...	1	103
✓ 1	0		1	00:00:24.122500	24	Decode...	1	24
✓ 2	0		2	00:00:42.246125	63	Decode...	1	104
✓ 1	0		3	00:00:42.313125	22	Decode...	1	25
✓ 1	0		4	00:00:42.316000	30	D		
✓ 1	0		5	00:00:42.320000	30	D		
✓ 2	0		6	00:00:42.329000	23	D		
✓ 1	0		7	00:00:42.335500	22	D		

Dev	TSlot	Su...	Fra...	Len	TIME (Relative)	De
✓ 2	0		0	24	00:00:00.000000	De
✓ 1	0		1	24	00:00:24.122500	Decode...
✓ 2	0		2	63	00:00:42.246125	Decode...
✓ 1	0		3	22	00:00:42.313125	Decode...
✓ 1	0		4	30	00:00:42.316000	Decode...
✓ 1	0		5	30	00:00:42.320000	Decode...
✓ 2	0		6	23	00:00:42.329000	Decode...
✓ 1	0		7	22	00:00:42.335500	Decode...

Real-time Analysis

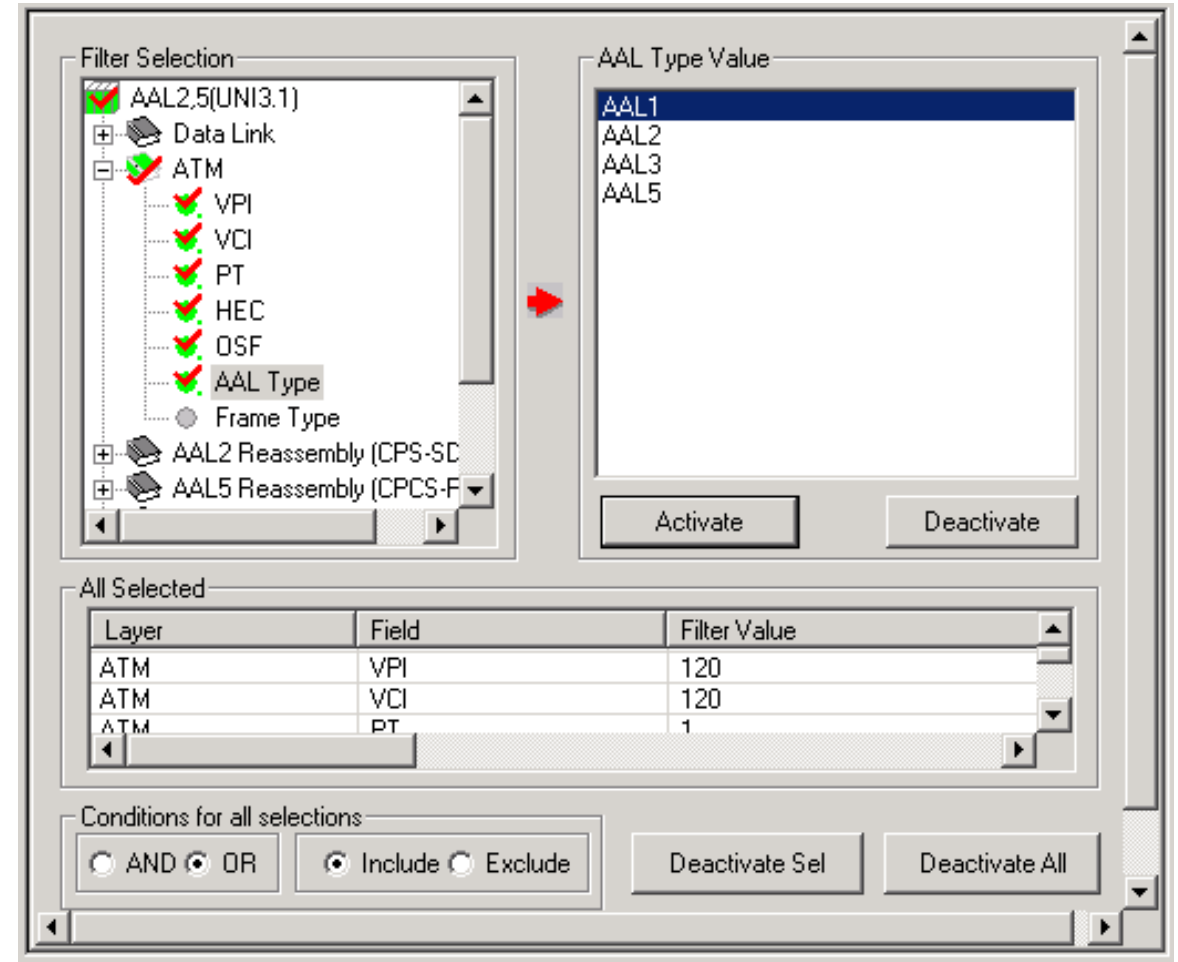
HDLC, Frame Relay, and PPP Analyzers

- Capture and analysis of the frames in real-time or offline
- Frames may also be captured based on their FCS (16 bits, 32 bits, none)
- Recorded trace file can then be analyzed offline and exported to ASCII file, or printed

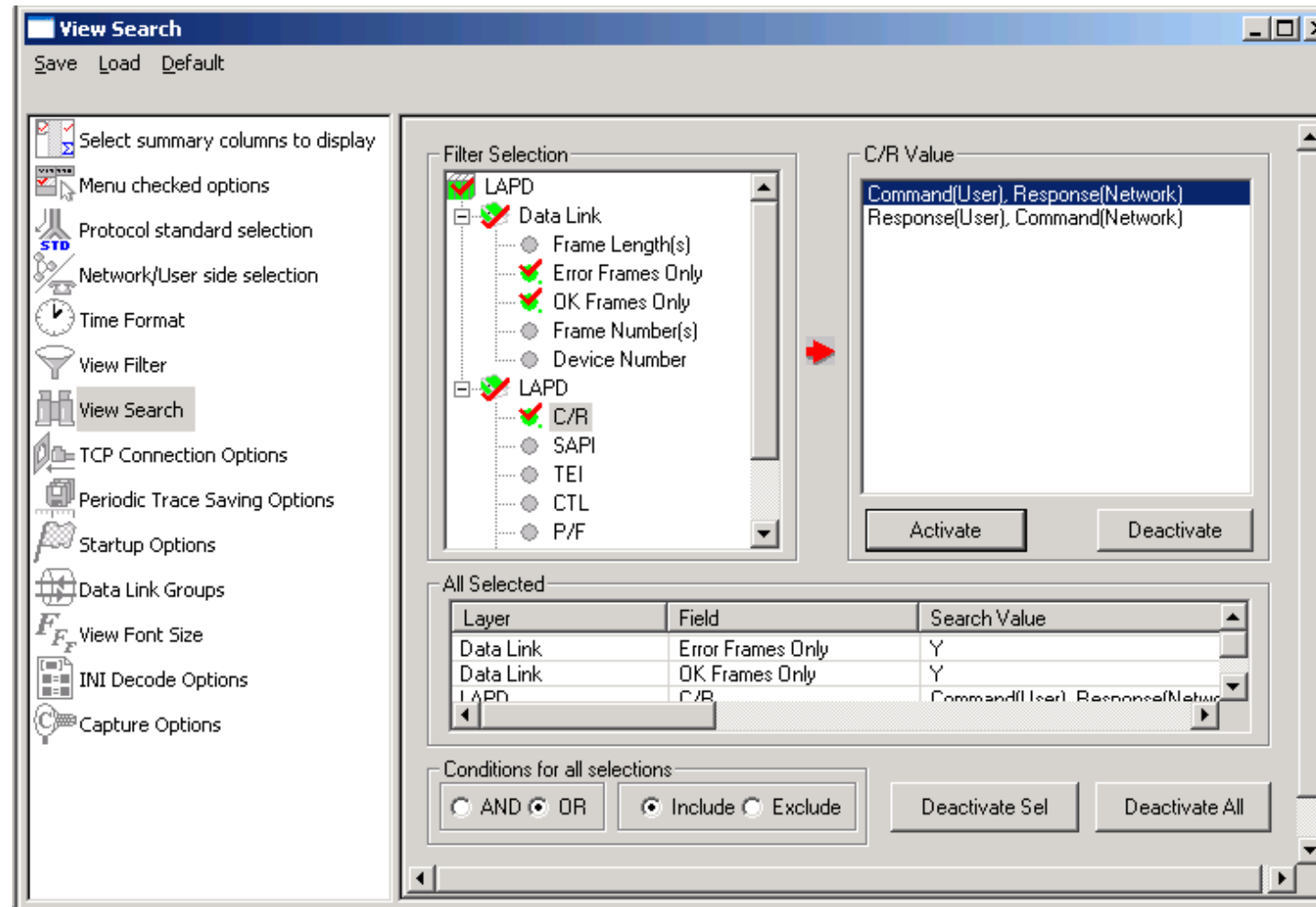


View Filter

- Filtering capability adds a powerful dimension
- Isolate frames of interest from all frames in real-time, as well as offline
- Can specify custom values to filter frames for real-time capture



Search Options



- Search capability helps user to search for a particular frame based on a various protocol fields

Statistics

- Statistics can be obtained for all frames both in real-time as well as offline mode
- Numerous statistics are obtained to study the performance and trend in the analyzer's network
- It is based on protocol fields and different parameters e.g., Use Type (Key/Total/Field), Statistic type (Frame count, Byte count, Frames/Sec) and patterns like Range List, Wild card

Numeric

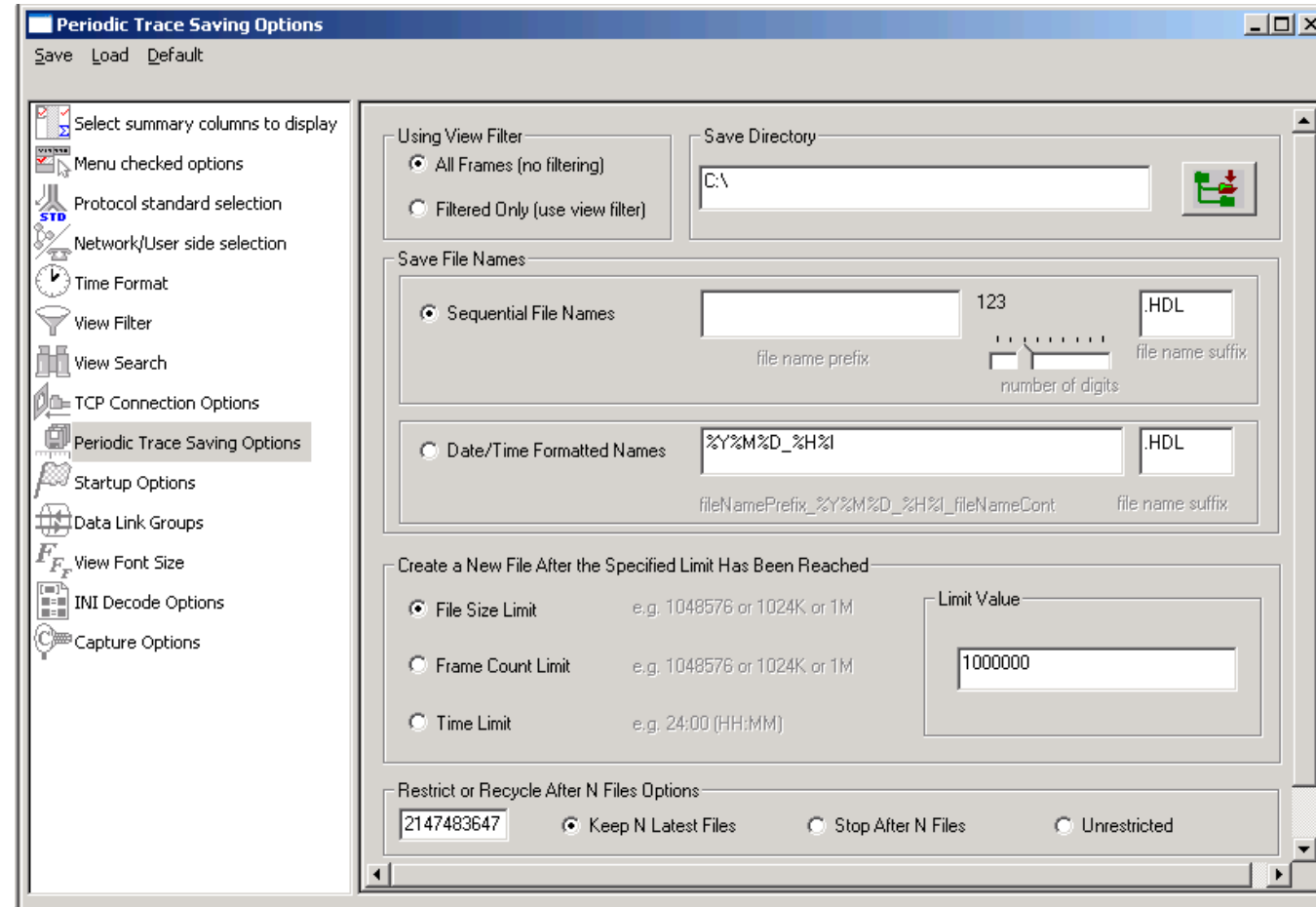
String

Enumerated

Layer	Field Name	Use Type	Statistic Type
Physical ...	Device #	Total	Current Bytes/Sec
Physical ...	Time Stamp	Total	Frame Count
LAPD	C/I	Total	
IP	Delay	Total	Frame Count

Periodic File Saving Option

- 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



Data Link Groups

- Currently applicable to only Frame Relay analyzer, used to define 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: East

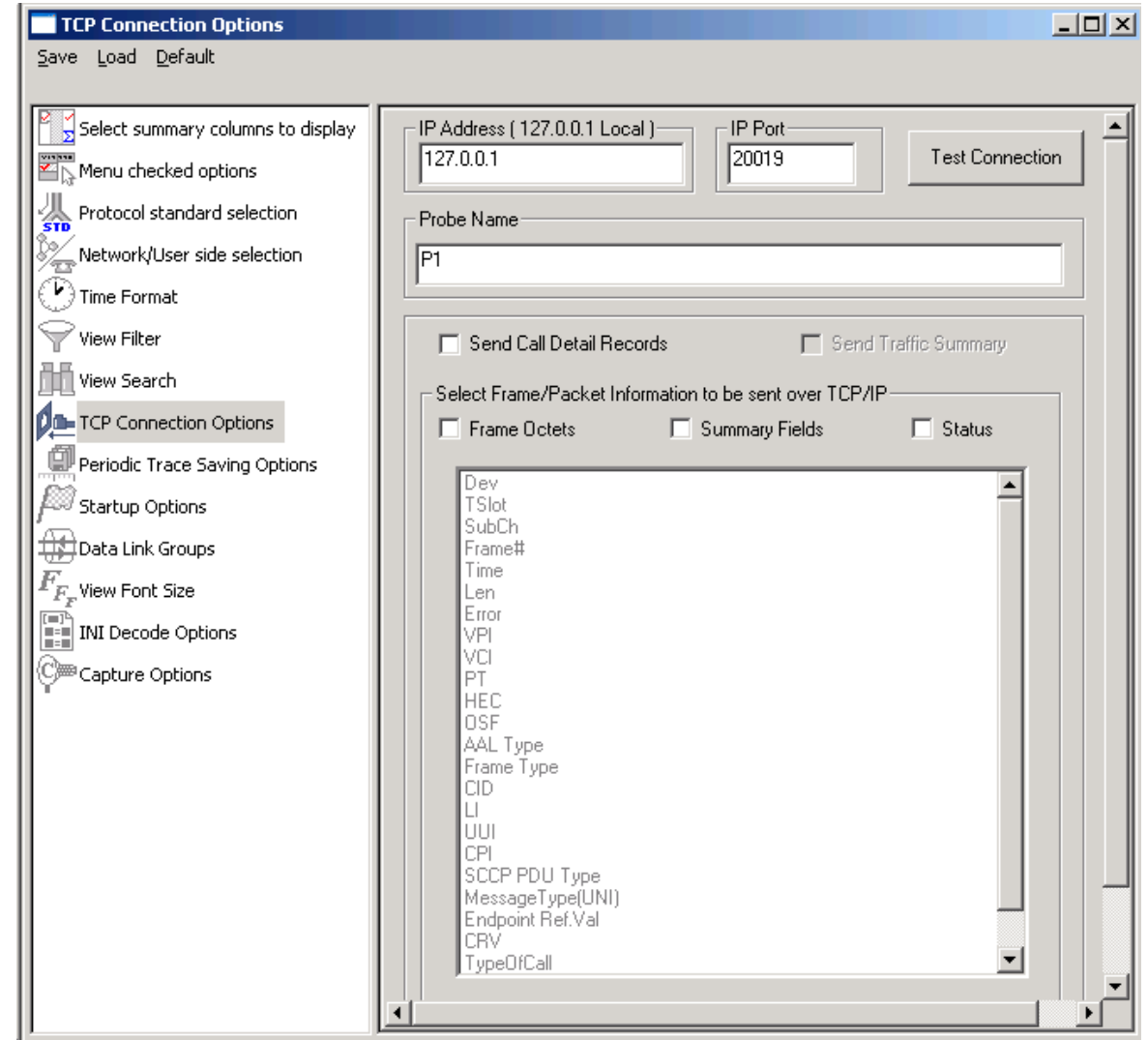
Forward Link Direction

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

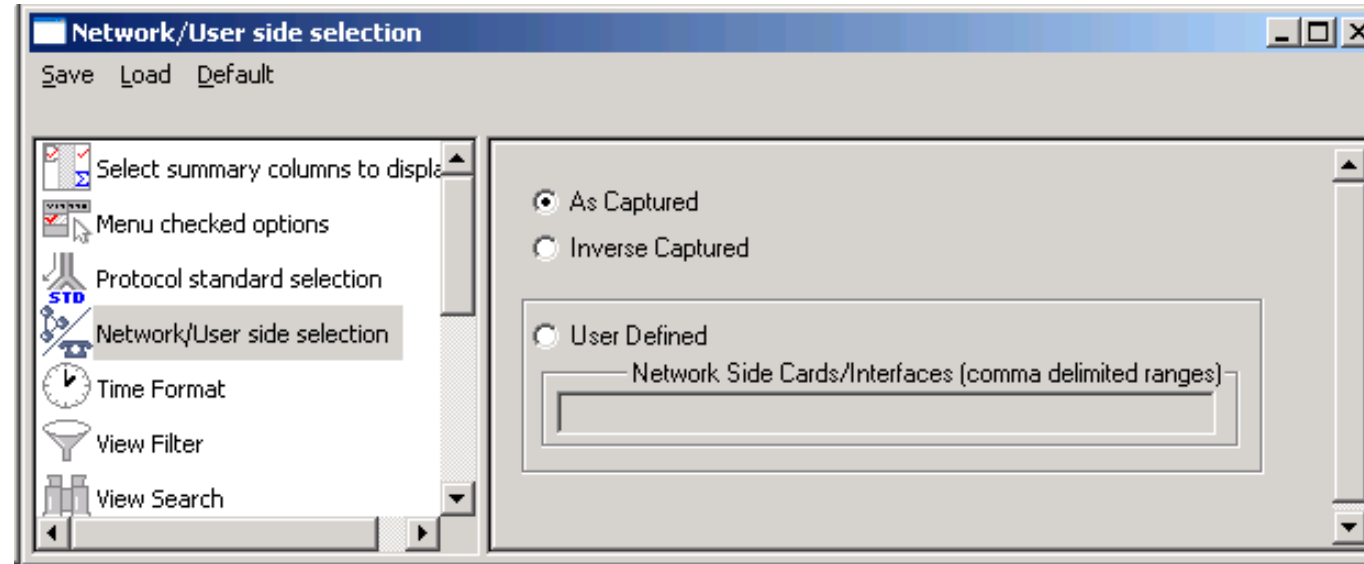
Buttons: Add, Odd Cards, Even Cards, All Cards, None, Delete Sel, Delete All, Default

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

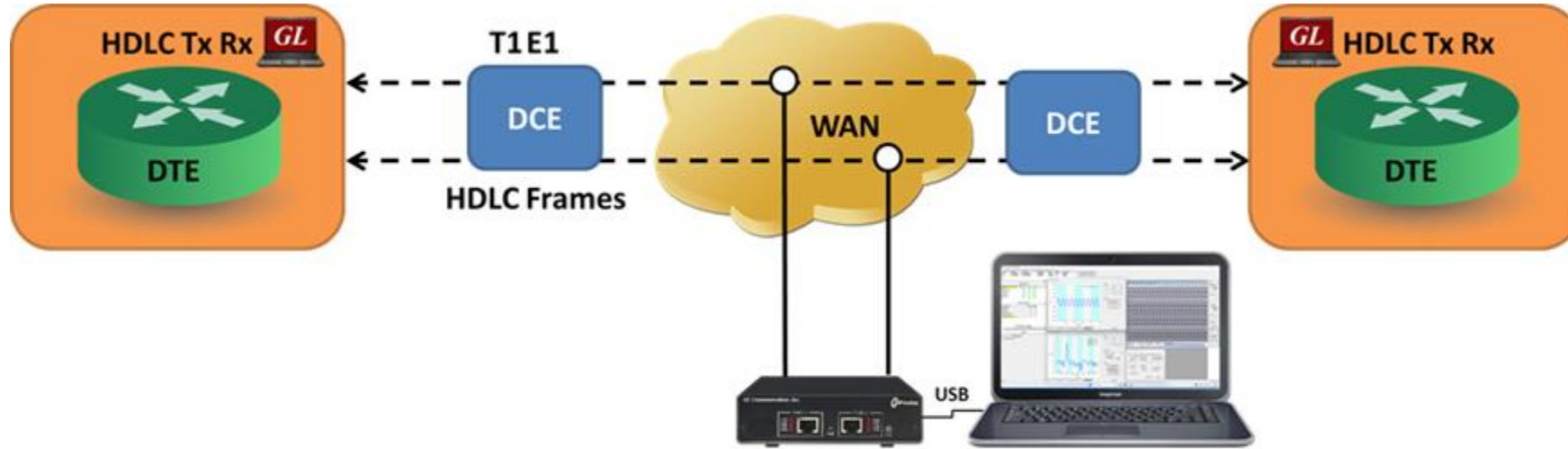


Save/Load All Configuration Settings



- Provides a consolidated interface for all the settings required in the analyzer such as protocol selection, stream/interface selection, etc.
- Configuration settings can be saved to a file, loaded from a configuration file, or just prefer to revert to the default values using the default option

GL's HDLC Analysis and Emulation Products



GL's HDLC Analysis and Emulation

HDLC Emulation (Tx/Rx)

- Designed to transmit and receive HDLC frames over unstructured T3 E3
- The FCS (also known as cyclic redundancy check CRC) is calculated using a polynomial
 - 16 bit FCS is generated using polynomial $1+x^5+x^{12}+x^{16}$
 - 32 bit FCS is defined in RFC 1662 and is using polynomial $x^0+x^1+x^2+x^4+x^5+x^7+x^8+x^{10}+x^{11}+x^{12}+x^{16}+x^{22}+x^{23}+x^{26}+x^{32}$

The screenshot shows the 'HDLC Test' application window. It features several configuration panels:

- Tx Port:** A list box containing 'NoTx', 'Tx Port 1', and 'Tx Port 2'. 'Tx Port 1' is selected.
- Rx Port:** A list box containing 'NoRx', 'Rx Port 1', and 'Rx Port 2'. 'Rx Port 2' is selected.
- Flags Between Frames:** A text box containing the value '1000'.
- FCS:** Radio buttons for '16 bits' (selected) and '32 bits'.
- Frame Length without CRC:** Text boxes for 'Min:' (value 1), 'Max:' (value 8000), and 'Fixed:' (value 8).
- Fixed/Variable Length:** A list box with options 'Fixed', 'Var Increm.', and 'Var Random'. 'Var Random' is selected.
- Tx Counters:** 'Tx Total:' (value 160925) and 'Tx Frames Queued:' (value 4345).
- Rx Counters:** 'Rx Total:' (value 0), 'Rx Frame Errors:' (value 0), 'Rx CRC Errors:' (value 0), 'Rx Frames Queued:' (value 0), 'Rx Length Errors:' (value 0), and 'Rx SEQ Errors:' (value 0).
- Prepend Fixed Frame Header (Hex):** A large empty text area.

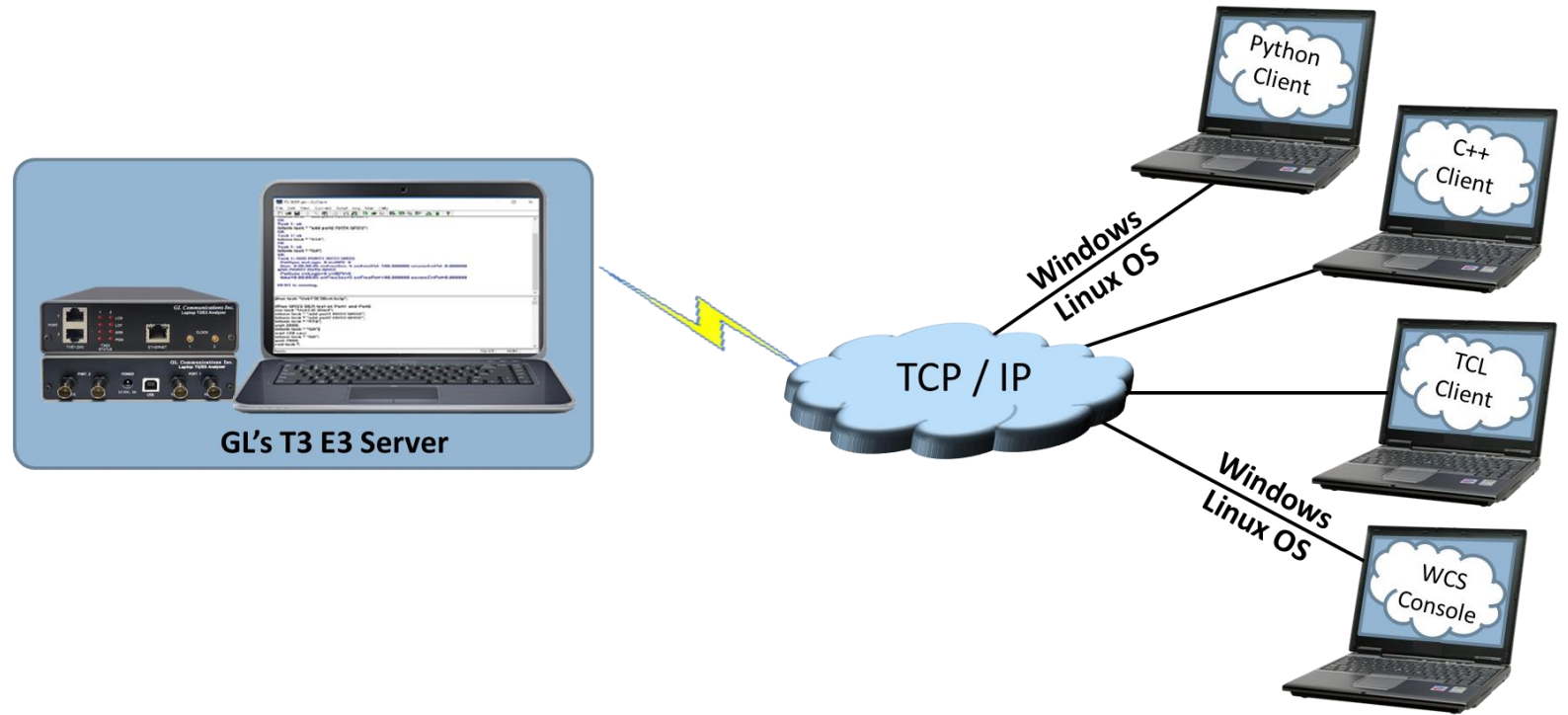
Control buttons 'Start', 'Stop', and 'Cancel' are located on the right side of the window.

Features

- Verifies the proper working of HDLC protocols by simulating various scenarios taking place in a real-time network
- The HLIU application has the following features:
 - Logic Error insertion
 - CRC Error insertion
 - Drop a Frame
 - Change Frame Order
 - Duplicate a Frame
 - Insert a Frame
 - Delay a Frame

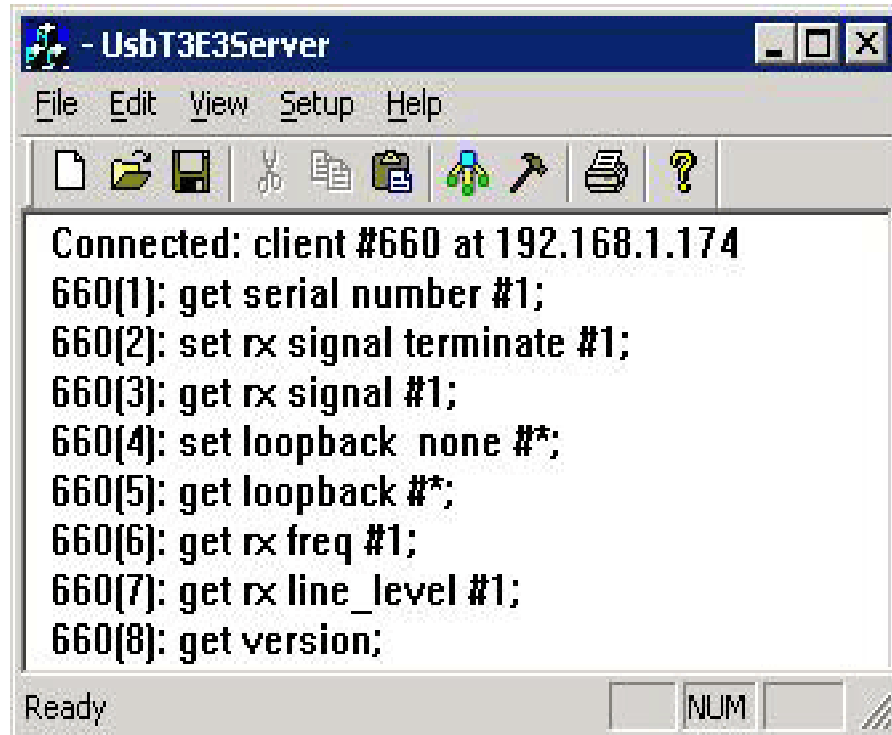
Windows Client Server for T3 E3 Analysis

- GL's Windows Client/Server software is a non-GUI based program for remote, scripted, and automated control of T3 E3 configuration, capture, transmission and more
- Supported clients are C++, C#, Windows TCL, and Windows/Linux Python on Windows® and Linux® operating systems

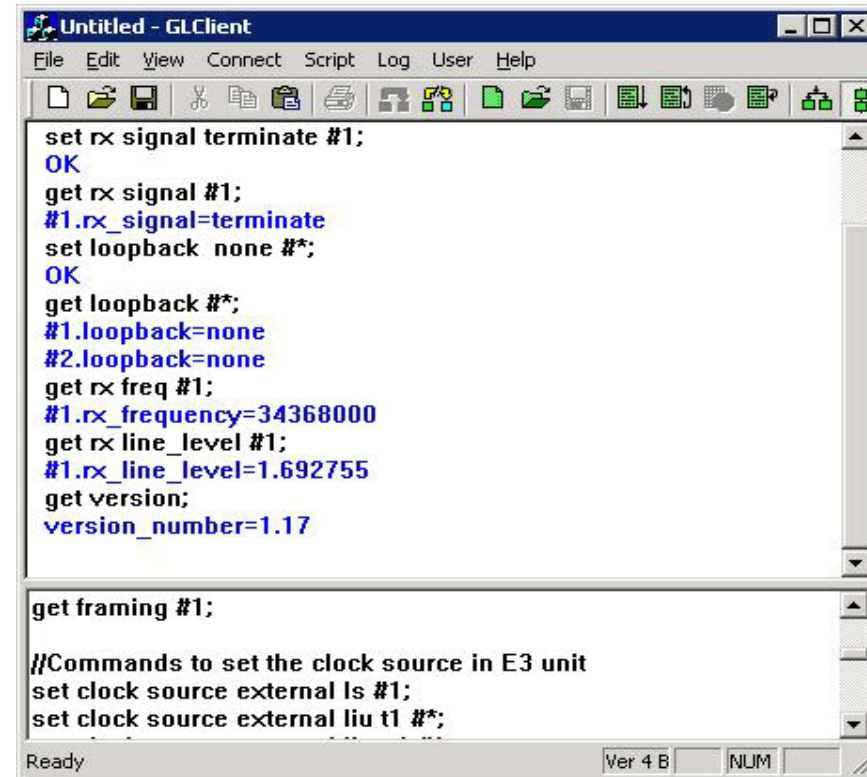


Server and Client Interface

Server Interface



Client Interface



Windows/Linux Client Console

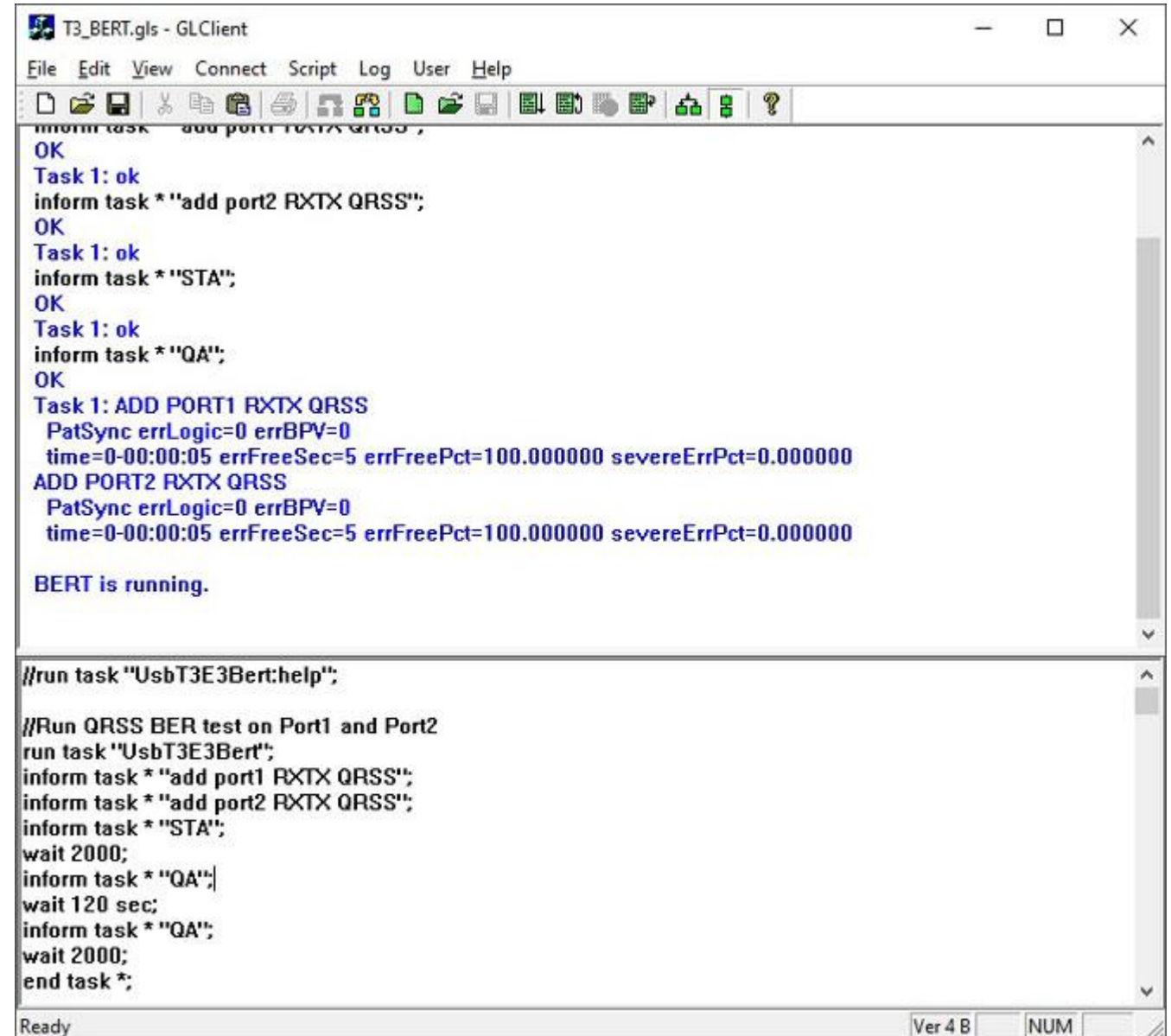
- Windows/Linux Client (WLC) is a Command Line Interface (CLI) application that issues commands to T1 E1 WCS server and display replies into Console/PowerShell/Terminal Windows. WLC works in Windows® and Linux® versions. However, through SSH or another remote access terminal it can be used on any operating system. WLC is a portable Windows/Linux WCS client communication library compatible with WCS server

```
upArrow - prev cmd; downArrow - next cmd; F7 - recent command list; exit - to disconnect and quit;
F:\src\GLClient\WcsCons\x64\Release>wscscons
Type '?' for help.
conn 192.168.10.78 17090
OK
$monitor all alarms #1;
Task1>>start=0x2481991b
$monitor all alarms #2;
Task2>>start=0x2481ba82
query task 2
>OK
Task2>>#2.los=false, #2.los_count=0, #2.ais=false, #2.ais_count=0, #2.sync=false, #2.sync_count=0, #2.nloop=false, #2.nloop_count=0, #2.rbl=false, #2.rbl_count=0, #2.ferr=false, #2.ferr_count=0, #2.ryel=false, #2.ryel_count=0, #2.bpv=false, #2.bpv_count=0, #2.esovr=false, #2.esovr_count=0, #2.esunf=false, #2.esunf_count=0
query task 1
>OK
Task1>>#1.los=false, #1.los_count=0, #1.ais=false, #1.ais_count=0, #1.sync=false, #1.sync_count=0, #1.nloop=false, #1.nloop_count=0, #1.rbl=false, #1.rbl_count=0, #1.ferr=false, #1.ferr_count=0, #1.ryel=false, #1.ryel_count=0, #1.bpv=false, #1.bpv_count=0, #1.esovr=false, #1.esovr_count=0, #1.esunf=false, #1.esunf_count=0
get multiframe format *
>Unexpected input '*' at offset 23
get multiframe format #*
>#1.mf_fmt=193e; #2.mf_fmt=193e; #3.mf_fmt=193e; #4.mf_fmt=193e
disconn
OK
```

WCS Module TT3600/EE3600 – Bit Error Rate Test (BERT)

BERT on framed or unframed unchannelized T3 E3 is an optional WCS Server side module that:

- Performs BERT on pseudo random patterns such as QRSS, 2^6-1 , 2^9-1 , $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{23}-1$, etc.
- Single or continuous Bit Error insertion for Logic and BPV errors
- Capability of remote operation, automation, and multi-site connectivity



```
T3_BERT.gls - GLClient
File Edit View Connect Script Log User Help
inform task * "add port1 RXTX QRSS";
OK
Task 1: ok
inform task * "add port2 RXTX QRSS";
OK
Task 1: ok
inform task * "STA";
OK
Task 1: ok
inform task * "QA";
OK
Task 1: ADD PORT1 RXTX QRSS
PatSync errLogic=0 errBPV=0
time=0-00:00:05 errFreeSec=5 errFreePct=100.000000 severeErrPct=0.000000
ADD PORT2 RXTX QRSS
PatSync errLogic=0 errBPV=0
time=0-00:00:05 errFreeSec=5 errFreePct=100.000000 severeErrPct=0.000000

BERT is running.

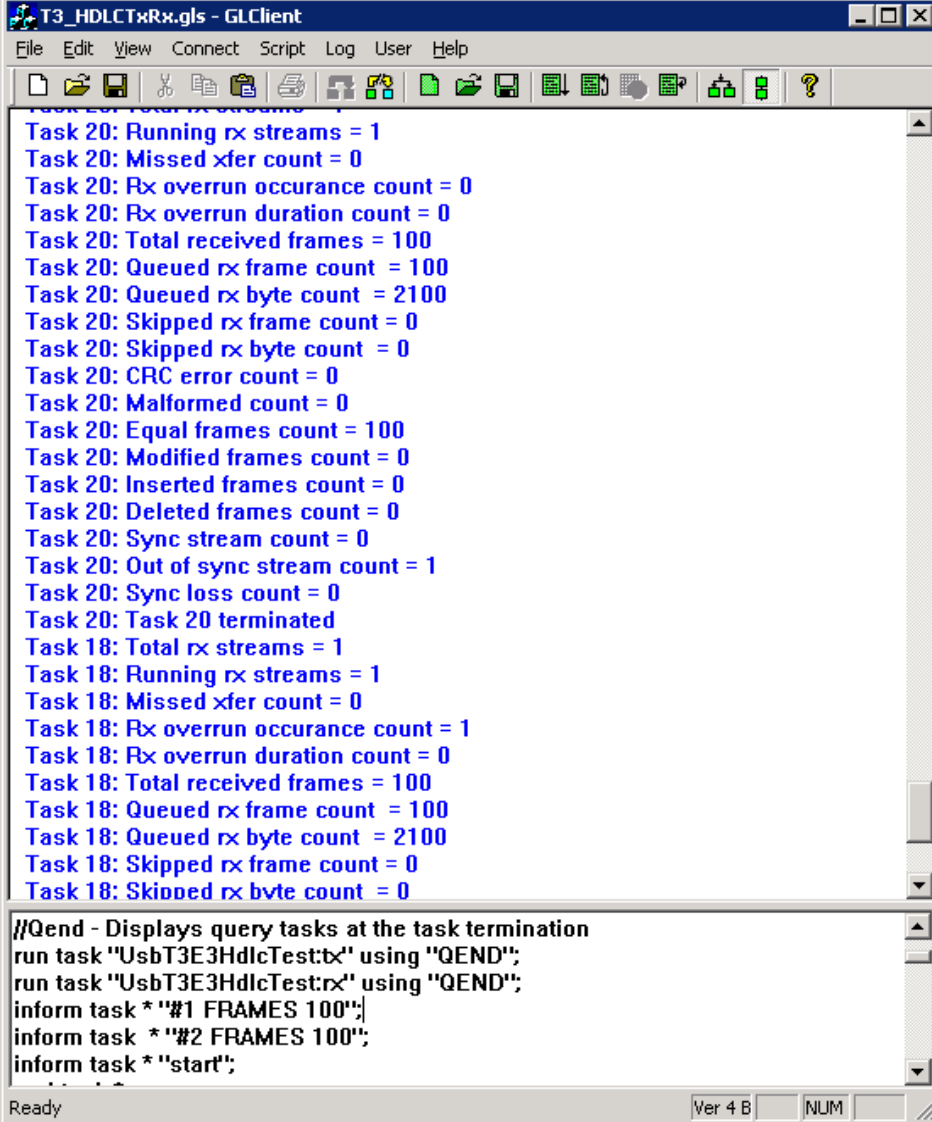
//run task "UsbT3E3Bert:help";

//Run QRSS BER test on Port1 and Port2
run task "UsbT3E3Bert";
inform task * "add port1 RXTX QRSS";
inform task * "add port2 RXTX QRSS";
inform task * "STA";
wait 2000;
inform task * "QA";
wait 120 sec;
inform task * "QA";
wait 2000;
end task *;
```

Ready Ver 4 B NUM

WCS Module - HDLC Emulation and Analysis

- The FCS (also known as cyclic redundancy check CRC) is calculated using a polynomial
 - Sends HDLC frames with or without impairments
 - Receives and verifies HDLC frames and optionally logs the errors
 - Capability of remote operation, automation, and multi-site connectivity



```
T3_HDLCTxRx.gls - GLClient
File Edit View Connect Script Log User Help
Task 20: Total rx streams = 1
Task 20: Running rx streams = 1
Task 20: Missed xfer count = 0
Task 20: Rx overrun occurrence count = 0
Task 20: Rx overrun duration count = 0
Task 20: Total received frames = 100
Task 20: Queued rx frame count = 100
Task 20: Queued rx byte count = 2100
Task 20: Skipped rx frame count = 0
Task 20: Skipped rx byte count = 0
Task 20: CRC error count = 0
Task 20: Malformed count = 0
Task 20: Equal frames count = 100
Task 20: Modified frames count = 0
Task 20: Inserted frames count = 0
Task 20: Deleted frames count = 0
Task 20: Sync stream count = 0
Task 20: Out of sync stream count = 1
Task 20: Sync loss count = 0
Task 20: Task 20 terminated
Task 18: Total rx streams = 1
Task 18: Running rx streams = 1
Task 18: Missed xfer count = 0
Task 18: Rx overrun occurrence count = 1
Task 18: Rx overrun duration count = 0
Task 18: Total received frames = 100
Task 18: Queued rx frame count = 100
Task 18: Queued rx byte count = 2100
Task 18: Skipped rx frame count = 0
Task 18: Skipped rx byte count = 0

//Qend - Displays query tasks at the task termination
run task "UsbT3E3HdlcTest:tx" using "QEND";
run task "UsbT3E3HdlcTest:rx" using "QEND";
inform task * "#1 FRAMES 100";
inform task * "#2 FRAMES 100";
inform task * "start";

Ready Ver 4 B NUM
```

WCS Module - HDLC Emulation and Analysis

Sample script for transmit and receive function:

```
//creates 2 streams on port 1 and 2, sequential numbers of fixed length 8 byte long + 4 byte (crc  
32 by default) each consisting of 12000 frames with 200 flags between frames
```

```
// insert some impairment ( corrupt 10 consecutive frames, skipping 9 frames, offs 3 XOR 5 ) on  
both the cards.
```

```
run task "UsbT3E3HdlcTest:tx";
```

```
inform task * "#1,2 SEQNUM FIXLEN 8 FRAMES 12000 FLAGS 200";
```

```
inform task * "error rep 10 skip 9 offs 3 xor f5";
```

```
inform task * "start";
```

```
end task *;
```

HDLC Analyzer

HDLC Protocol Analyzer

- GL's T3 (DS3) /E3 analyzer supports protocol decoding and analysis of ATM, Frame Relay, PPP, and HDLC. All the protocol analyzers are based on similar architecture and supports sophisticated filtering, statistics and real-time capture options

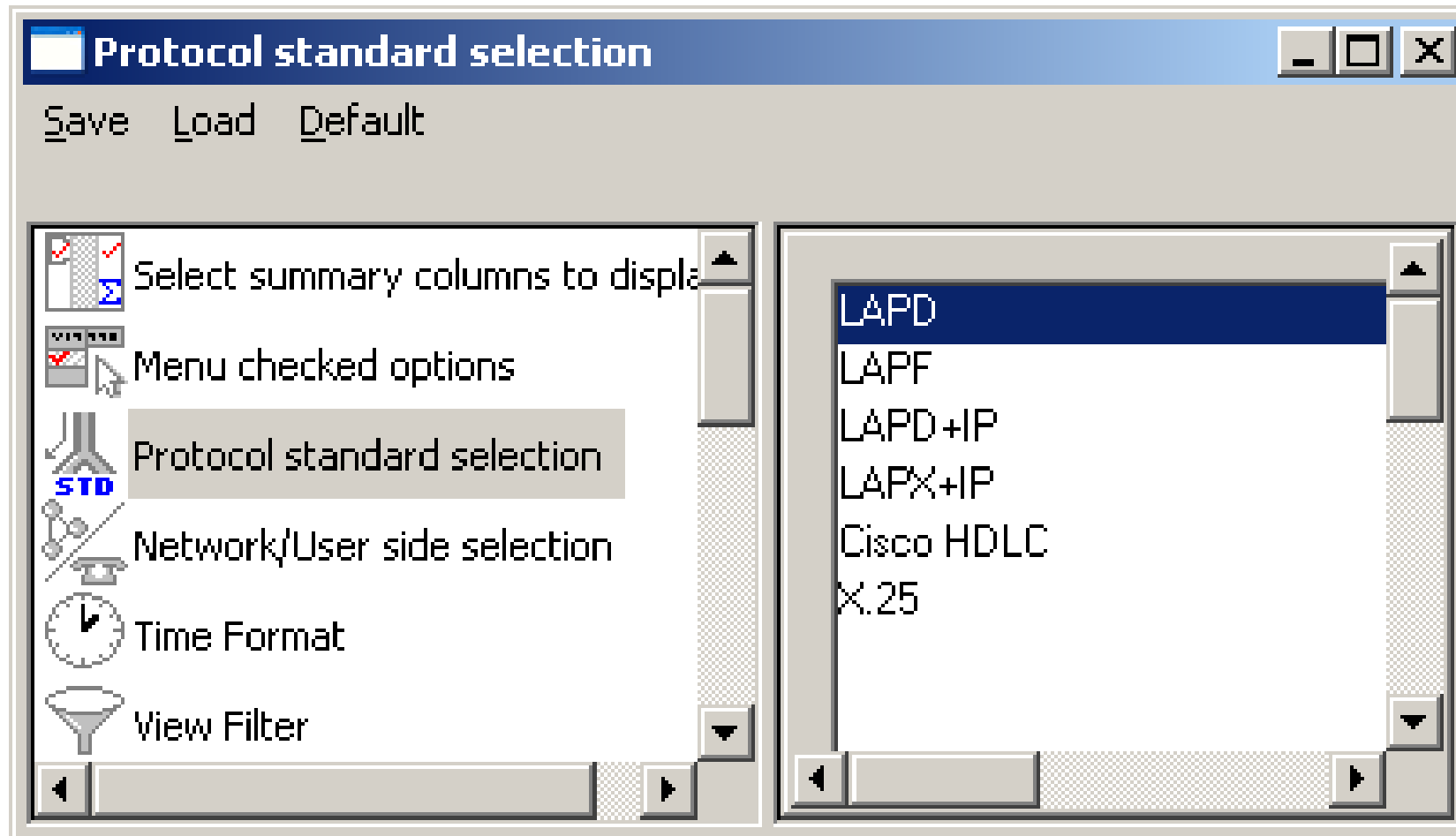
The screenshot displays the HDLC Protocol Analysis LAPD software interface. At the top, there is a menu bar (File, View, Capture, Statistics, Database, Configure, Help) and a toolbar with various icons. Below the toolbar is a table of captured frames. The table has columns for Dev, TS..., Su..., Frame#, TIME (Relative), Len, Error, C/R, SAPI, TEI, CTL, P/F, and N(S). Frame 3 is highlighted in blue. Below the table, the software shows the details for Card2 TimeSlot=23 Frame=3 at 00:00:27.031875 OK Len=38. The HDLC Frame Data + FCS section shows the LAPD Layer parameters: C/R (0), SAPI (0), TEI (0), Ctl (0 Information), N(S) (24), P (0), and N(R) (70). The Hex Dump of the Frame Data section shows the hexadecimal representation of the frame data: 00 01 30 8C 08 02 30 00 05 04 03 90 90 A2 18 03 A9 83 81 70 0B A1 35 30 38 33 30 32 31 31 31 7D 02 91 84 6F 48. The status bar at the bottom indicates 'Off-line Viewing' and 'F:\Program Files\Gl Communicat\195 Frames'.

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)
✓ 2	23		0	00:00:00.000000	6		Co...	0	0	Super...	1	
✓ 2	23		1	00:00:09.980000	6		Co...	0	0	Super...	1	
✓ 2	23		2	00:00:19.960000	6		Co...	0	0	Super...	1	
✓ 2	23		3	00:00:27.031875	38		Co...	0	0	Inform...	0	24
✓ 2	23		4	00:00:27.037125	38		Co...	0	0	Inform...	0	25
✓ 2	23		5	00:00:27.043500	38		Co...	0	0	Inform...	0	26
✓ 2	23		6	00:00:27.048875	38		Co...	0	0	Inform...	0	27

```
Card2 TimeSlot=23 Frame=3 at 00:00:27.031875 OK Len=38
HDLC Frame Data + FCS
===== LAPD Layer =====
C/R          = .....0. Command(User), Response(Netw
SAPI         = 000000.. (0)
TEI          = 000000.. (0)
Ctl          = .....0 Information
N(S)         = 001100.. (24)
P            = .....0 (0)
N(R)         = 100011.. (70)

Hex Dump of the Frame Data
+-----+-----+-----+-----+-----+
00 01 30 8C 08 02 30 00 05 04 03 90 90 A2 18 03      01 0 00c
A9 83 81 70 0B A1 35 30 38 33 30 32 31 31 31 31      @pp i5083021111
7D 02 91 84 6F 48                                   } 'IoH
```

Supported Protocol Standards



User Interface

The screenshot displays a network analysis tool with the following sections:

- Summary View:** A table listing captured frames with columns for Device (Dev), TS, Su..., Frame#, TIME (Relative), Len, Error, DLCI, DE, BECN, FECN, and CTI.
- Detail View:** Shows HDLC frame data for Frame 0, including LAMP Layer information and fields like EA, C/R, and DLCI.
- Hex Dump View:** Displays the hex dump of the frame data alongside its ASCII representation.
- Statistics View:** A summary table showing frame counts for different devices and C/R types.
- Call Detail View:** A table for recording call information, including Call ID, Call Status, Calling Num, Called Num, Call Start Date & Time, and Call Duration.

Summary View

Detail View

Hex Dump View

Statistics View

Call Detail 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

Offline Analyzer

Open

Look in:

3to102byteLEN.hdl	telica2.hdl
dcoss.hdl	telica201.hdl
IpOverLapd.HDL	test
IsdnUserNet.HDL	test1
lock_IE.HDL	test.txt
QsigEuro.HDL	

File name:

Files of type: HDLC Files (*.*)

Open as read-only

HDL Protocol Analysis LAPD

File View Capture Statistics Database Configure Help

0 GoTo

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)
✓ 2	23		0	00:00:00.000000	6		Co...	0	0	Super...	1	
✓ 2	23		1	00:00:09.980000	6		Co...	0	0	Super...	1	
✓ 2	23		2	00:00:19.960000	6		Co...	0	0	Super...	1	
✓ 2	23		3	00:00:27.031875	38		Co...	0	0	Inform...	0	24
✓ 2	23		4	00:00:27.037125	38		Co...	0	0	Inform...	0	25
✓ 2	23		5	00:00:27.043500	38		Co...	0	0	Inform...	0	26
✓ 2	23		6	00:00:27.048875	38		Co...	0	0	Inform...	0	27

Card2 TimeSlot=23 Frame=3 at 00:00:27.031875 OK Len=38

HDLC Frame Data + FCS

```

===== LAPD Layer =====
C/R          = .....0. Command(User), Response(Network)
SAPI         = 000000.. (0)
TEI          = 0000000. (0)
Ctl          = .....0 Information
N(S)         = 0011000. (24)
P            = .....0 (0)
N(R)         = 1000110. (70)
    
```

Hex Dump of the Frame Data

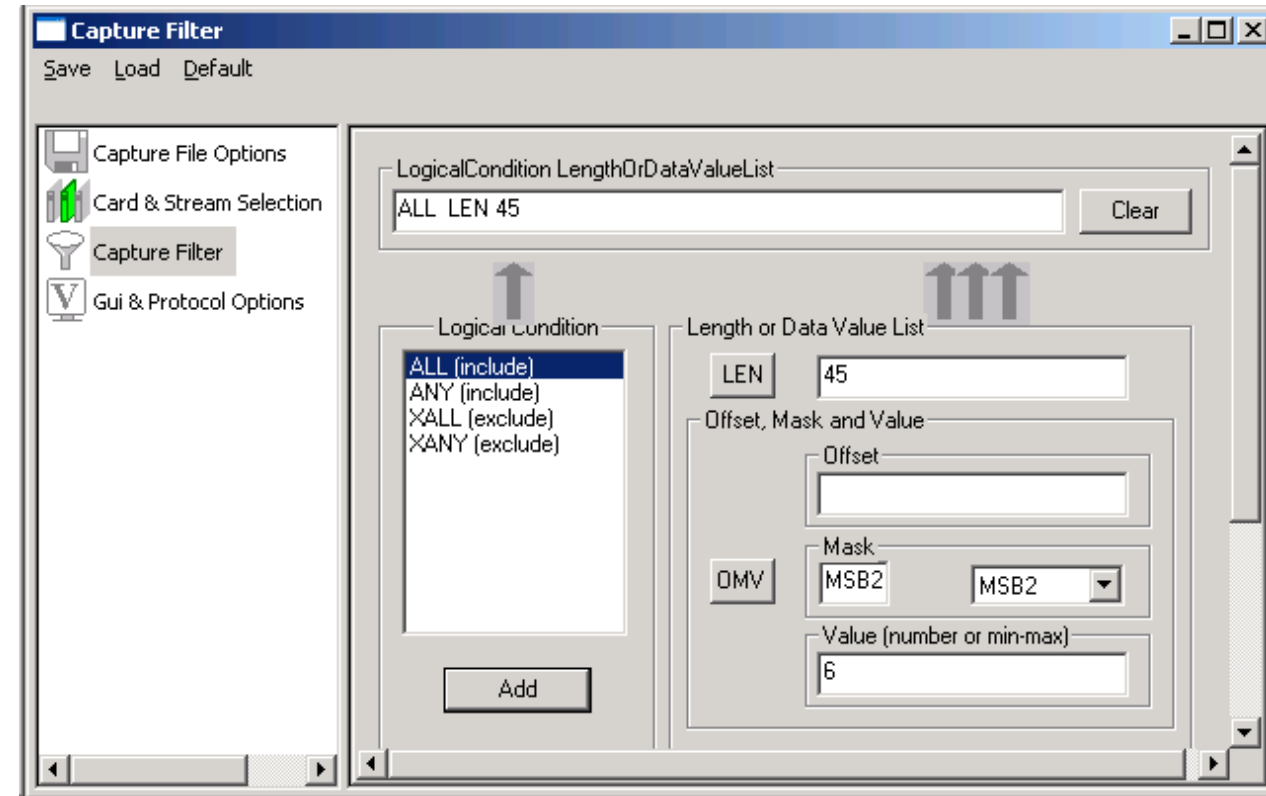
```

+-----+-----+-----+-----+-----+-----+-----+-----+
00 01 30 8C 08 02 30 00 05 04 03 90 90 A2 18 03      01 0 00
A9 83 81 70 0B A1 35 30 38 33 30 32 31 31 31 31    @pp i5083021111
7D 02 91 84 6F 48                                  } 'oH
    
```

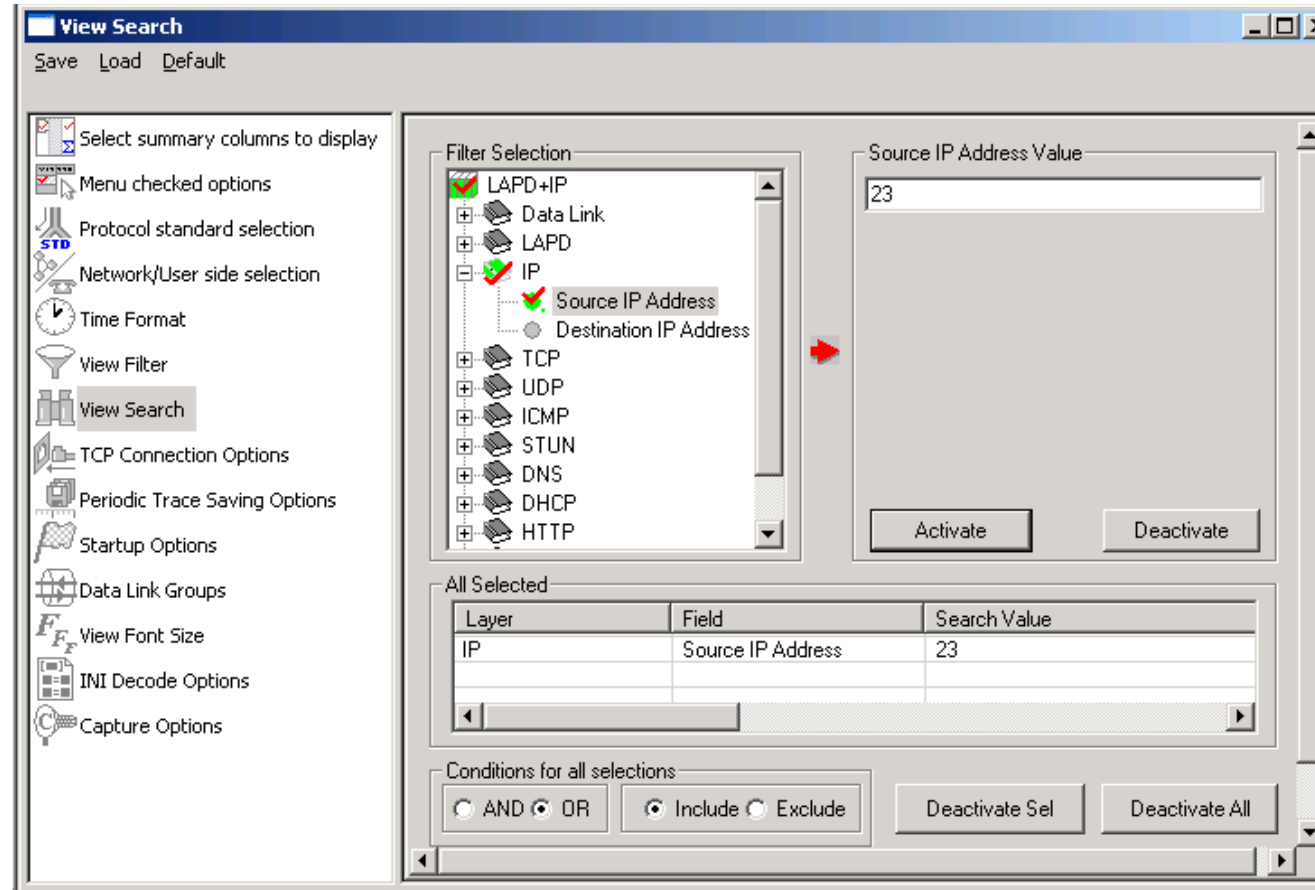
Off-line Viewing F:\Program Files\GL Communicat 195 Frames

HDLC Based Capture Filter

- Real-time filter for HDLC based protocols like Frame Relay, and PPP allows the capture of frames with defined length, offset, mask, and values
- Logical conditions to include (ALL and ANY) and to exclude (XALL and XANY)



Offline View Filter



- Isolates required frames from all frames in real-time/offline
- Filter applies to the captured frames and is based on the data link and other decoded protocol field values: CTL, C/R, Modifier Function, N(R), N(S), P, P/F, SAPI, supervisory function and TEI

Statistics

- Statistics is an important feature available in HDLC analyzer and can be obtained for all frames both in real-time as well as offline mode
- Numerous statistics can be obtained to study the performance and trend in the HDLC networks based on various protocol fields and parameters

The screenshot shows the 'Statistics' dialog box with the following configuration:

- 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, IP, TCP.
- Modifier Function:** Use Type (single selection): Total, Key, Field.
- Statistic Type(s) (calculated, multiple selection):** Frame Count, Frame Percent, Byte Count, Byte Percent.
- Value Set:** DISC, DM, FRMR, SABME.
- Options:** Cumulative, Separate.
- Buttons:** Add/Mod, Remove.

Selected Statistic Information:

Layer	Field Name	Use Type	Statistic Type
Physical ...	Device #	Field	Frame Count, Frame Perc
Physical ...	Time Stamp	Field	Frame Count, Frame Perc
LAPD	C/R	Key	Frame Count, Frame Perc
LAPD	Modifier Function	Total	

Buttons: Remove Sel, Remove All, Apply.

Statistics View in HDLC Analyzer

HDLC Protocol Analysis LAPD+IP

File View Capture Statistics Database Configure Help

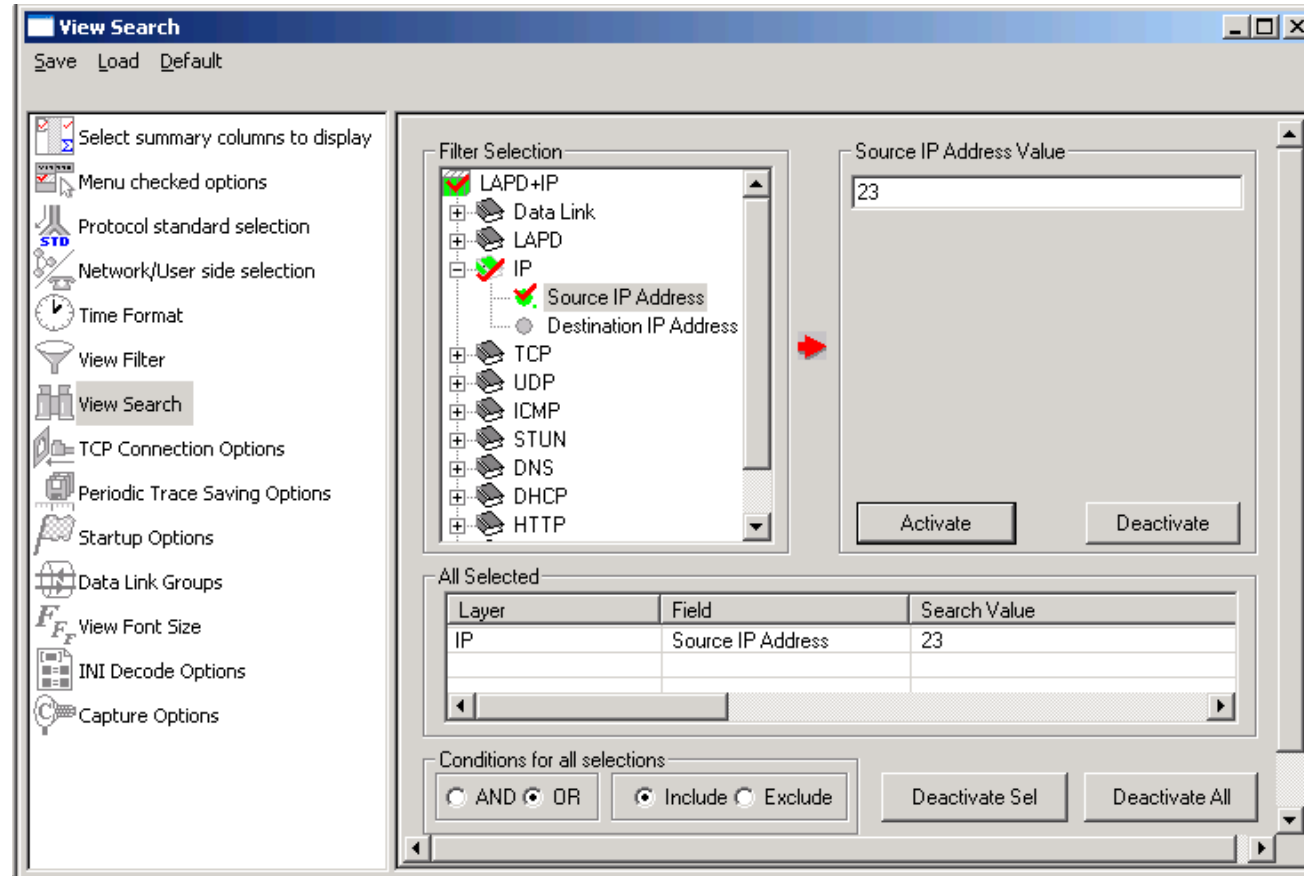
0 GoTo

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)
✓ 2	23		0	00:00:00.000000	6		Co...	0	0	Super...	1		70
✓ 2	23		1	00:00:09.980000	6		Co...	0	0	Super...	1		70
✓ 2	23		2	00:00:19.960000	6		Co...	0	0	Super...	1		70
✓ 2	23		3	00:00:27.031875	38	Decode Error	Co...	0	0	Inform...	0	24	70
✓ 2	23		4	00:00:27.037125	38	Decode Error	Co...	0	0	Inform...	0	25	70
✓ 2	23		5	00:00:27.043500	38	Decode Error	Co...	0	0	Inform...	0	26	70
✓ 2	23		6	00:00:27.048875	38	Decode Error	Co...	0	0	Inform...	0	27	70
✓ 2	23		7	00:00:27.054625	38	Decode Error	Co...	0	0	Inform...	0	28	70
✓ 2	23		8	00:00:27.060000	38	Decode Error	Co...	0	0	Inform...	0	29	70
✓ 2	23		9	00:00:27.065500	38	Decode Error	Co...	0	0	Inform...	0	30	70
✓ 2	23		10	00:00:27.070750	38	Decode Error	Co...	0	0	Inform...	0	31	70
✓ 2	23		11	00:00:27.076125	38	Decode Error	Co...	0	0	Inform...	0	32	70
✓ 2	23		12	00:00:27.081500	38	Decode Error	Co...	0	0	Inform...	0	33	70
✓ 2	23		13	00:00:27.086875	38	Decode Error	Co...	0	0	Inform...	0	34	70

Device #	C/R	Frame Count(C/R)	Frame Count(Device #)
2	Command(User), Response(Network) (0)	11	11
Total	total Command(User), Response(Network) (0)	11	11
2	Response(User), Command(Network) (1)	92	92
Total	total Response(User), Command(Network) (1)	92	92

Off-line Viewing C:\Program Files\GL Communicatio 195 Frames

Search Options



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

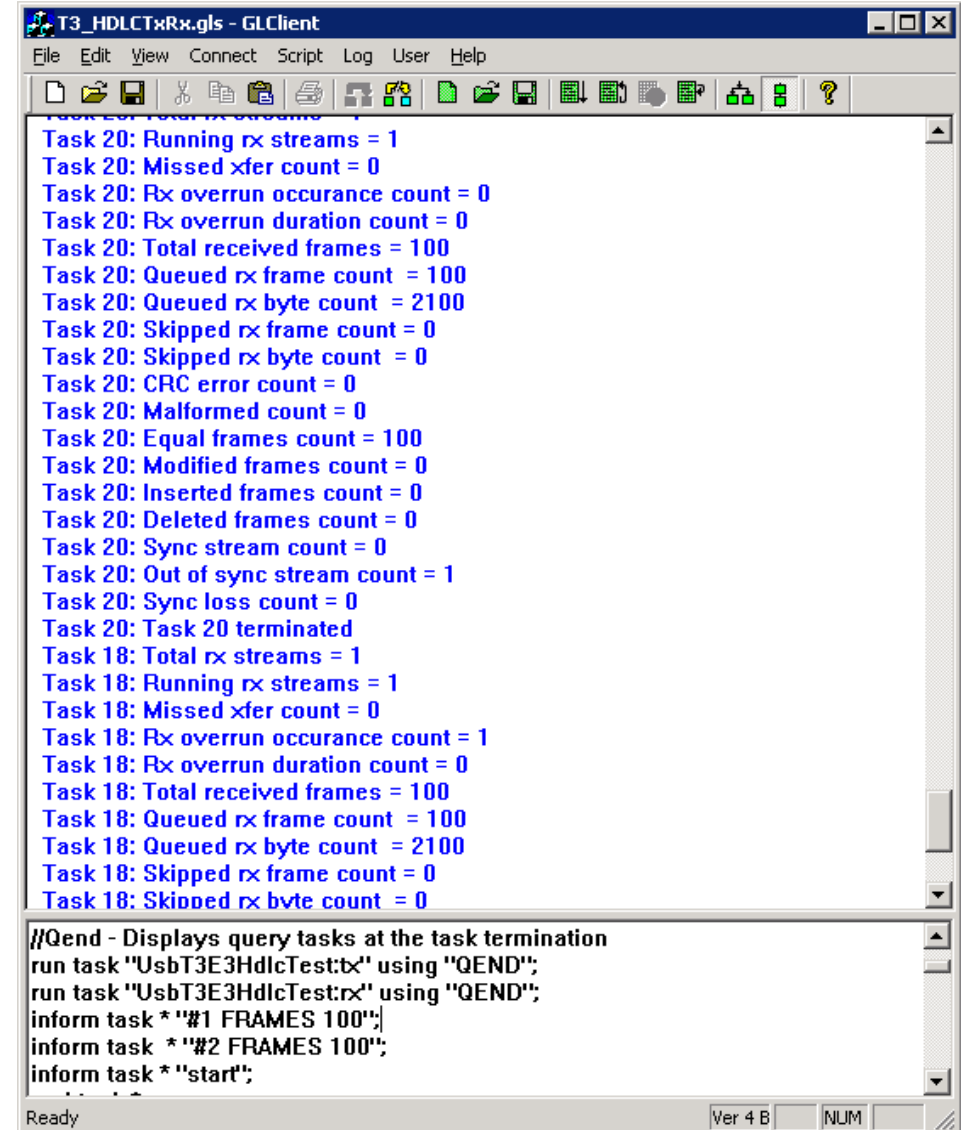
HDLC Emulation (Tx/Rx)

- Designed to transmit and receive HDLC frames over unstructured T3 E3
- The FCS (also known as cyclic redundancy check CRC) is calculated using a polynomial
 - 16 bit FCS is generated using polynomial $1+x^5+x^{12}+x^{16}$
 - 32 bit FCS is defined in RFC 1662 and is using polynomial $x^0+x^1+x^2+x^4+x^5+x^7+x^8+x^{10}+x^{11}+x^{12}+x^{16}+x^{22}+x^{23}+x^{26}+x^{32}$

The screenshot shows the HDLC Test software interface. It features two port selection lists (Tx Port and Rx Port) with options for NoTx, Tx Port 1, and Tx Port 2. Configuration fields include Flags Between Frames (100), Frame Length without CRC (Min: 1, Max: 8000, Fixed: 9), and FCS (16 bits selected, 32 bits unselected). The Fixed/Variable Length section has Fixed selected. Status fields show Tx Total: 1299804, Tx Frames Queued: 207184, Rx Total: 1299804, Rx Frames Queued: 207184, Rx Frame Errors: 0, Rx Length Errors: 0, Rx CRC Errors: 0, and Rx SEQ Errors: 0. A Prepend Fixed Frame Header (Hex) field is also present.

WCS Module - HDLC Emulation and Analysis

- USB T3 E3 HDLC Tx/Rx Test (UsbT3E3HdlcTest) is an optional WCS Server side module that:
 - Sends HDLC frames with or without impairments
 - Receives and verifies HDLC frames and optionally logs the errors
 - Capability of remote operation, automation, and multi-site connectivity



```
T3_HDLCTxRx.gls - GLClient
File Edit View Connect Script Log User Help
Task 20: Total rx streams = 1
Task 20: Running rx streams = 1
Task 20: Missed xfer count = 0
Task 20: Rx overrun occurrence count = 0
Task 20: Rx overrun duration count = 0
Task 20: Total received frames = 100
Task 20: Queued rx frame count = 100
Task 20: Queued rx byte count = 2100
Task 20: Skipped rx frame count = 0
Task 20: Skipped rx byte count = 0
Task 20: CRC error count = 0
Task 20: Malformed count = 0
Task 20: Equal frames count = 100
Task 20: Modified frames count = 0
Task 20: Inserted frames count = 0
Task 20: Deleted frames count = 0
Task 20: Sync stream count = 0
Task 20: Out of sync stream count = 1
Task 20: Sync loss count = 0
Task 20: Task 20 terminated
Task 18: Total rx streams = 1
Task 18: Running rx streams = 1
Task 18: Missed xfer count = 0
Task 18: Rx overrun occurrence count = 1
Task 18: Rx overrun duration count = 0
Task 18: Total received frames = 100
Task 18: Queued rx frame count = 100
Task 18: Queued rx byte count = 2100
Task 18: Skipped rx frame count = 0
Task 18: Skipped rx byte count = 0

//Qend - Displays query tasks at the task termination
run task "UsbT3E3HdlcTest:tx" using "QEND";
run task "UsbT3E3HdlcTest:rx" using "QEND";
inform task *"#1 FRAMES 100";
inform task *"#2 FRAMES 100";
inform task *"start";

Ready Ver 4 B NUM
```

WCS Module - HDLC Emulation and Analysis

Sample script for transmit and receive function:

```
//creates 2 streams on port 1 and 2, sequential numbers of fixed length 8 byte long + 4 byte (crc  
32 by default) each consisting of 12000 frames with 200 flags between frames
```

```
// insert some impairment ( corrupt 10 consecutive frames, skipping 9 frames, offs 3 XOR 5 ) on  
both the cards.
```

```
run task "UsbT3E3HdlcTest:tx";
```

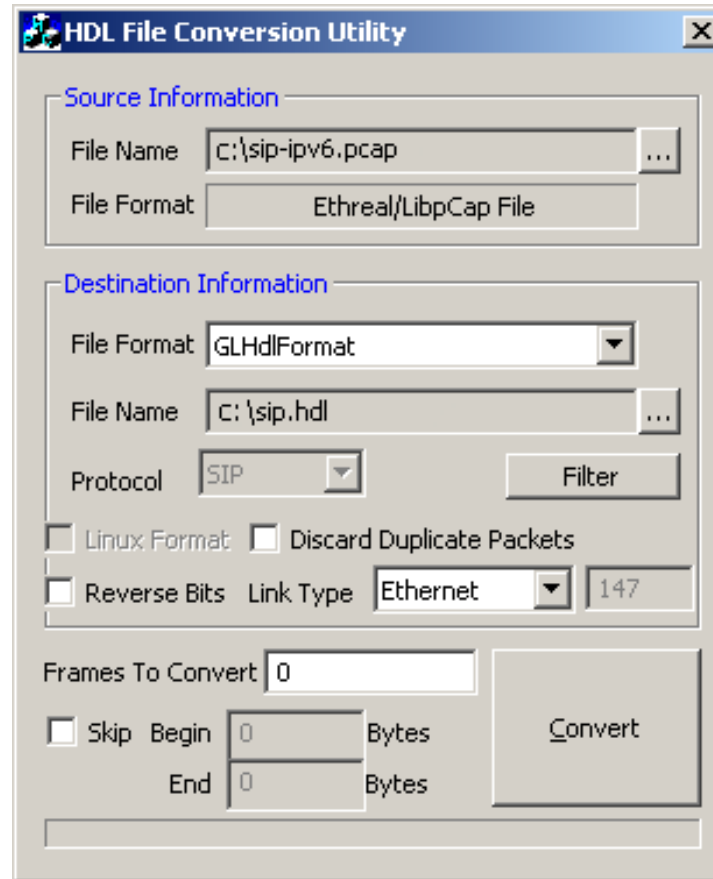
```
inform task * "#1,2 SEQNUM FIXLEN 8 FRAMES 12000 FLAGS 200";
```

```
inform task * "error rep 10 skip 9 offs 3 xor f5";
```

```
inform task * "start";
```

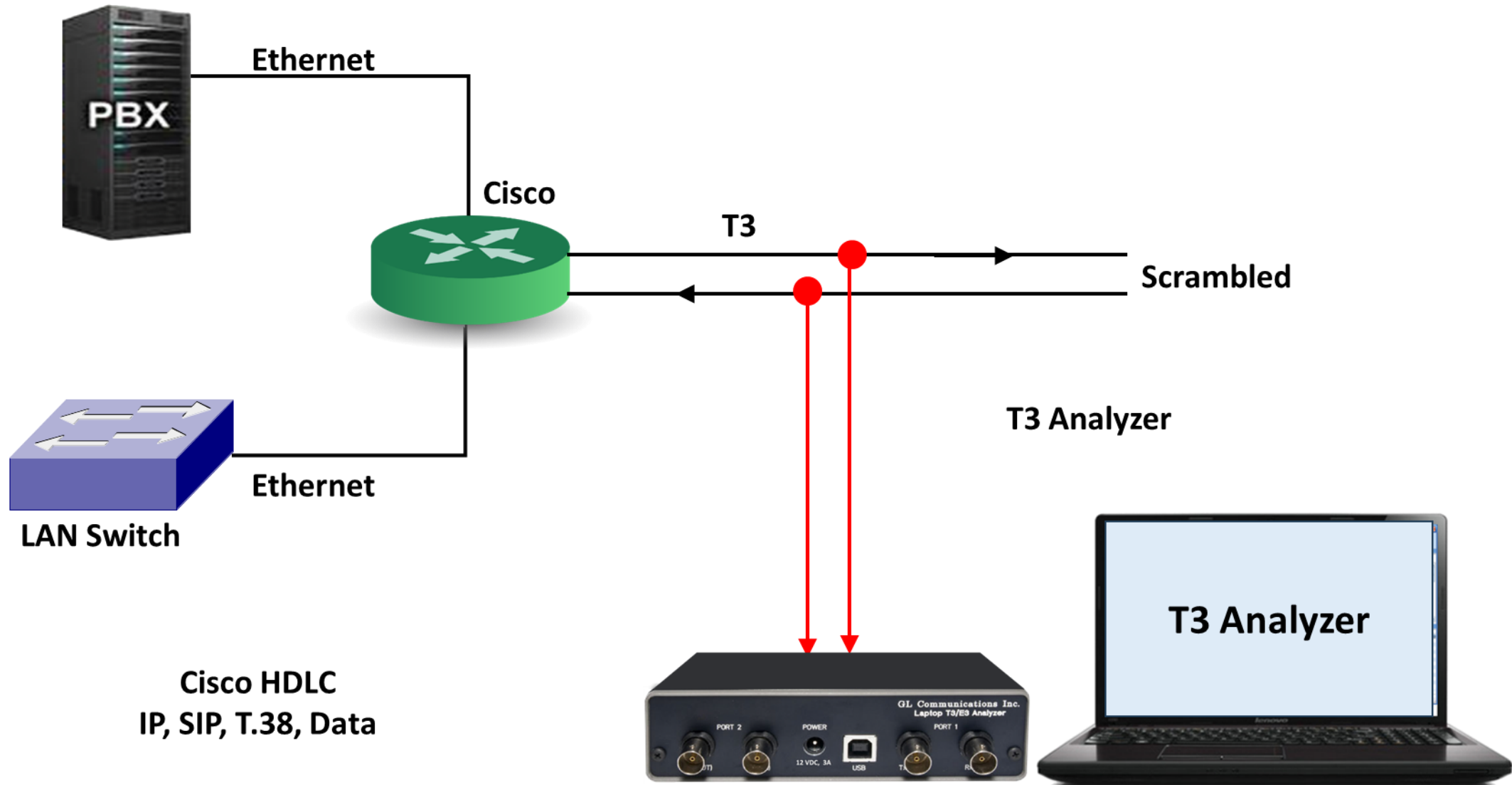
```
end task *;
```

HDL File Conversion Utility



- HDL File Conversion Utility converts a file from Ethereal format (.PCAP and .CAP) to GL proprietary file format (.HDL) and vice-versa

Cisco HDLC



Cisco HDLC
IP, SIP, T.38, Data

Cisco HDLC Protocol Standard

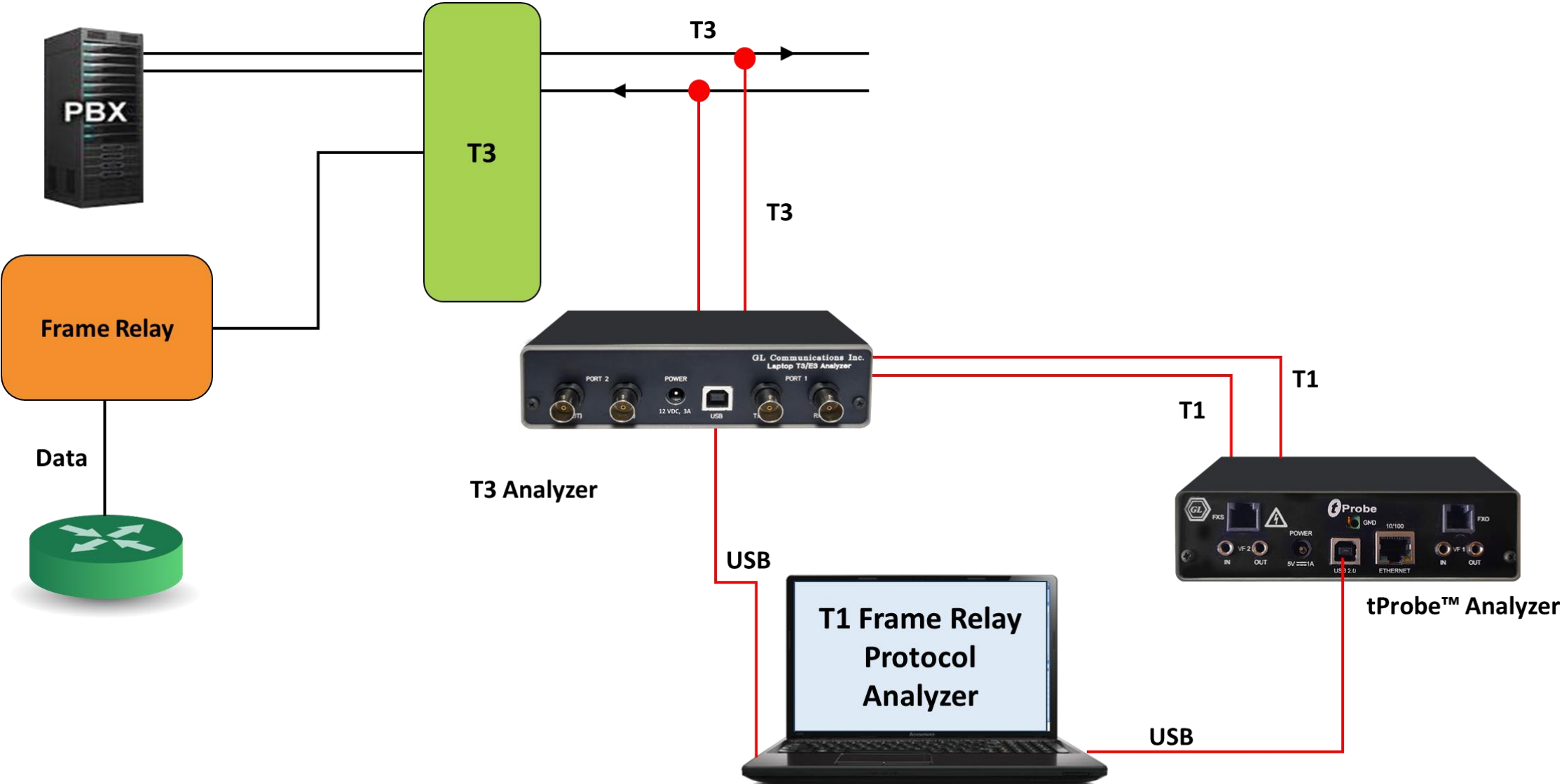
The screenshot displays the 'HDLC Protocol Analysis Cisco HDLC' application window. The main pane shows the details of a captured frame:

```
Card1 TimeSlots=0-23 Frame=2 at 2010-04-08 11:12:51.706552 OK Len=66
HDLC Frame Data + FCS
===== Cisco HdLC Layer =====
0000 Address          = 00001111 Unicast Packets
0001 Control          = 0 (x00)
0002 Protocol         = x0800 IP
===== IP Layer =====
0004 Version          = 0100.... (4)
0004 Internet Header Length (In 32 bit words) = ....0101 (5)
Type of Service
0005 Precedence      = 000..... Routine
0005 Delay           = ...0.... Normal Delay
0005 Throughput      = ....0... Normal Throughput
0005 Reliability     = .....0.. Normal Reliability
0005 Reserved for Future Use = .....00 (0)
0006 Total Length    = 60 (x003C)
0008 Identification = 8569 (x2179)
000A Reserved        = 0..... (0)
000A DF              = .0..... May Fragment
000A MF              = ..0..... Last Fragment
000A Fragment Offset = 0 (...00000 00000000)
000C Time To Live    = 127 (x7F)
000D Protocol        = 00000001 Internet Control Message
000E Header Check Sum = x668E
0010 Source IP Address = 192.168.30.102 (xC0A81E66)
0014 Destination IP Address = 192.168.20.3 (xC0A81403)
===== ICMP Layer =====
0018 ICMP Type       = 00001000 Echo Message
Code                 = 00000000 Code Value
Checksum             = 12124 (x2F5C)
Identifier           = 512 (x0200)
Sequence Number      = 7168 (x1C00)
Data                 = x61626364656666768696A6B6C6D6E6F7071727374757677616263646566676869
Hex Dump of the Frame Data
+-----+-----+-----+-----+-----+-----+
0F 00 08 00 45 00 00 3C 21 79 00 00 7F 01 66 8E      E <!y | f|
CU A8 1E 66 C0 A8 14 03 08 00 2F 5C 02 00 1C 00      A` fA` ^
61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F 70      abcdefghijklmnop
```

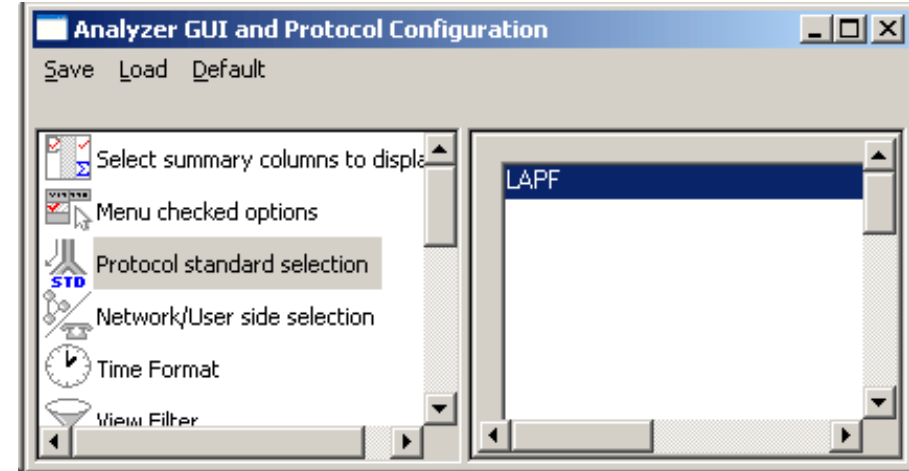
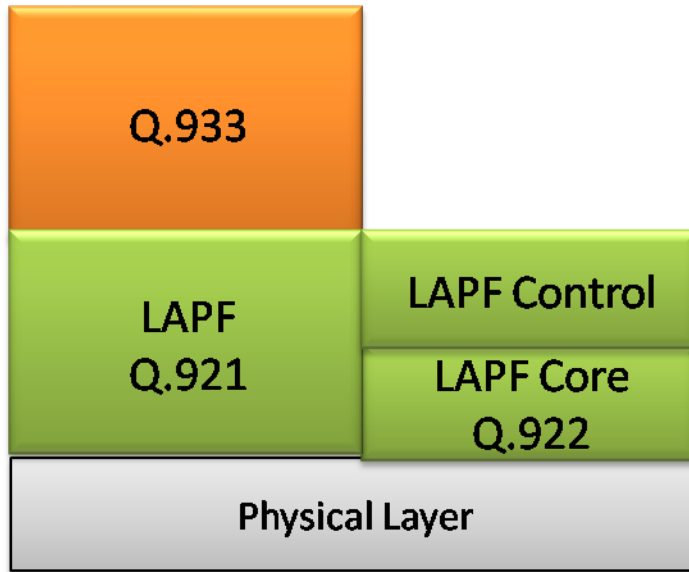
The hex dump shows the frame structure: 0F 00 08 00 (flag, address, control, protocol), followed by IP header fields (0004-0005), ICMP header (0018), and data (0014-0018). The data field contains the ASCII string 'abcdefghijklmnop'.

Frame Relay Analyzer

Frame Relay

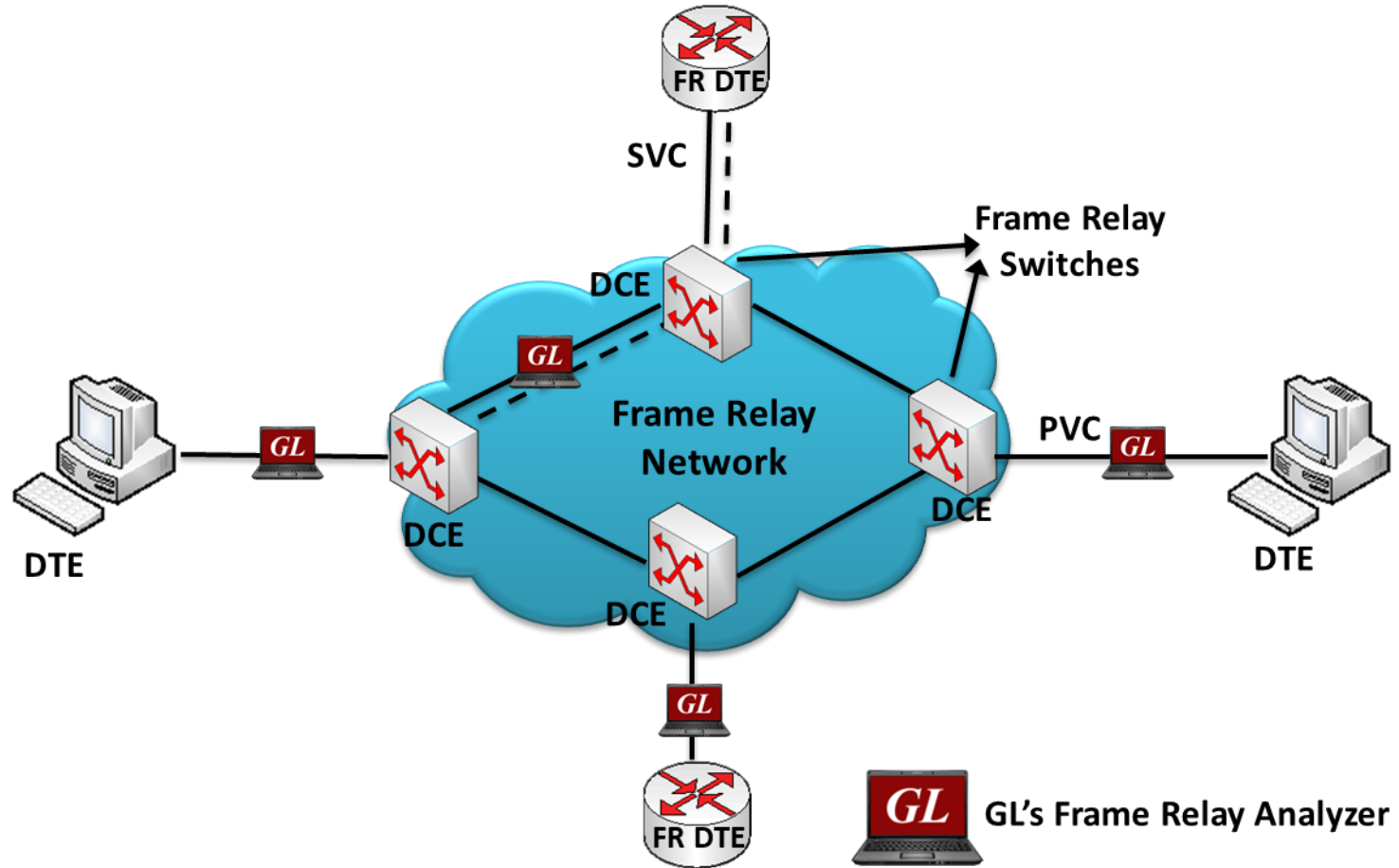


Supported Protocols (Frame Relay)



- LAPF – Enhanced version of LAPD (Q.921) and decodes Layer 2 as Link Access Procedure/Protocol (LAPF) as defined in the ITU Q.922
- ITU Q.921, Q.922
- Multi-protocol encapsulation, FRF.9, FRF.12, SNAP, PPP, link control protocol RFC 1661
- Q.933, SVC, and LMI signaling
- IP, TCP, UDP, SMTP, POP3, STUN, DNS, DHCP, HTTP, FTP, SNMP, RIP

GL's Frame Relay Analyzer



T3 (DS3) Frame Relay Analyzer

The screenshot displays the Frame Relay Protocol Analysis LAPP (FRAP) software interface. The main window shows a table of captured frames with the following columns: Dev, TS..., Su..., Frame#, TIME (Relative), Len, Error, DLCI, DE, BECN, FECN, CTL, NLPID, and Source IP Address. The table contains 10 rows of data, all with a checkmark in the 'Dev' column, indicating successful captures. The 'NLPID' column shows various values, including 'PPP in frame relay' and 'Q.933'.

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	DLCI	DE	BECN	FECN	CTL	NLPID	Source IP Address
✓ 2	0		0	00:00:00.000000	45		416	0	0	0	Unnu...	PPP in frame relay	
✓ 2	0		1	00:00:00.296748	45		416	0	0	0	Unnu...	PPP in frame relay	
✓ 1	0		2	00:00:00.443543	20		56	0	0	0	Unnu...	PPP in frame relay	
✓ 1	0		3	00:00:00.561277	16		0	0	0	0	Unnu...	Q.933	
✓ 1	0		4	00:00:00.573712	20		40	0	0	0	Unnu...	PPP in frame relay	
✓ 2	0		5	00:00:00.596578	45		416	0	0	0	Unnu...	PPP in frame relay	
✓ 2	0		6	00:00:00.896409	45		416	0	0	0	Unnu...	PPP in frame relay	
✓ 2	0		7	00:00:01.299238	45		416	0	0	0	Unnu...	PPP in frame relay	
✓ 1	0		8	00:00:01.444655	20		56	0	0	0	Unnu...	PPP in frame relay	
✓ 1	0		9	00:00:01.553199	16		0	0	0	0	Unnu...	Q.933	
✓ 1	0		10	00:00:01.575749	20		40	0	0	0	Unnu...	PPP in frame relay	

Card2 TimeSlot=0 Frame=0 at 00:00:00.000000 OK Len=45
HDLC Frame Data + FCS
***** LAPP Layer *****
EA =0 (0)
C/R =0. Command(User), Response(Network)
DLCI = 416 (011010... 0000....)
EA =1 (1)
DE =0. (0)
BECN =0.. (0)
FECN =0... (0)
Ctl =11 Unnumbered
Modifier Function = 000.00.. UI
P/F = ...0.... (0)
***** Multiprotocol Encapsulation Layer *****
NLPID = 11001111 PPP in frame relay

Hex Dump of the Frame Data

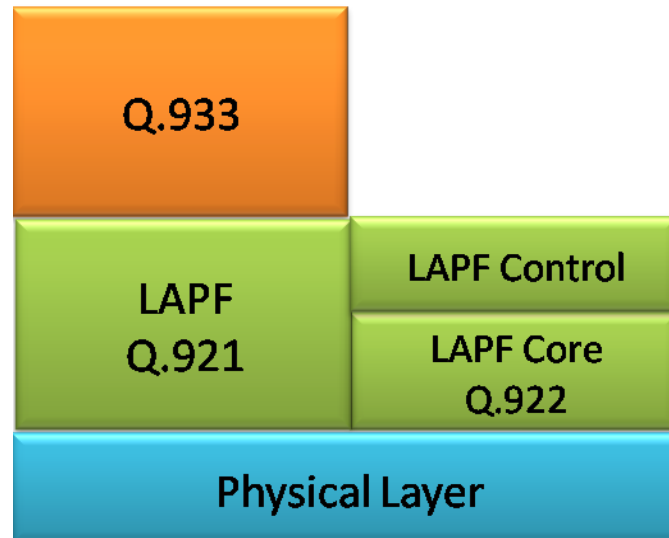
68 01 03 CF C0 21 01 69 00 25 05 06 D0 BF B8 72 h YÄ! i % Dö,r
11 04 06 40 13 17 01 58 59 50 4C 45 58 08 00 87 @ XYPLEX |
0C 54 18 00 02 00 00 00 00 00 00 19 C5 T Ä

Off-line Viewing C:\Program Files\GL Communications Inc\Usb T 200 Frames

Features

- Supports decoding of encapsulated protocols, and long frames up to 16 Kbytes
- Analyze Permanent Virtual Connection (PVC) and Switched Virtual Connection (SVC) frames
- Supports filtering and search features based on LAPF parameters and Q.933 layer parameters such as DLCIs, Message Type, FECN, BECN, DE, NLPID's TCP, IP, SMTP, POP3, and so on
- Provides Summary View, Detail View, Hex dump, statistics, and call trace views
- Capability to export summary as well as detail information to an ASCII file for subsequent import into a database or spreadsheet
- Streams can be captured on the selected ports
- Multiple streams of traffic on various T3 E3 ports can be simultaneously decoded (single instance can decode multiple streams)

Supported Protocols Structure



- Q.921, Q.922, LAPF
- Multi-protocol encapsulation, FRF.9, FRF.12, SNAP, PPP, link control protocol RFC 1661
- Q.933, SVC, and LMI signaling
- IP, TCP, UDP, SMTP, POP3, STUN, DNS, DHCP, HTTP, FTP, SNMP, RIP

Frame Relay Header Information

Frame Relay Protocol Analysis LAPF

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	DLCI	DE	BECN	FECN	CTL	Sequence Number	Sequence Num
✓ 2	0		0	00:00:00.000000	45		416	0	0	0	Unn...		
✓ 2	0		1	00:00:00.296748	45		416	0	0	0	Unn...		
✓ 1	0		2	00:00:00.443543	20		56	0	0	0	Unn...		

Card2 TimeSlot=0 Frame=0 at 00:00:00.000000 OK Len=45

HDLC Frame Data + FCS

```

===== LAPF Layer =====
0000 EA = .....0 (0)
0000 C/R = .....0. Command(User), Response(Network)
0000 DLCI = 416 (011010.. 0000....)
0001 EA = .....1 (1)
0001 DE = .....0. (0)
0001 BECN = .....0.. (0)
0001 FECN = .....0... (0)
0002 Ctl = .....11 Unnumbered
0002 Modifier Function = 000.00.. UI
0002 P/F = ...0.... (0)
===== Multiprotocol Encapsulation Layer =====
0003 NLPID = 11001111 PPP in frame relay
===== PPP over frame relay Layer =====
0004 PPP Protocol = xC021 Link Control Protocol
===== Link Control Protocol RFC1661 Layer =====
0006 Code = 00000001 Configure-Request
0007 Identifier = 105 (x69)
0008 Length = 37 (x0025)
000A Type = 00000101 Magic-Number
000B Length = 6 (x06)
000C Data = xD0BFB872
0010 Type = 00010001 Reserved
0011 Length = 4 (x04)
0012 Data = x0640
0014 Type = 00010011 Reserved
0015 Length = 23 (x17)
0016 Data = x015859504C45580800870C54180002000000000000
    
```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+-----+-----+
68 01 03 CF C0 21 01 69 00 25 05 06 D0 BF B8 72   h  YÃ! i % Ðð,r
11 04 06 40 13 17 01 58 59 50 4C 45 58 08 00 87   @  XYPLEX  |
0C 54 18 00 02 00 00 00 00 00 00 19 C5           T      Å
    
```

C:\Program Files\GL Communications Inc\Laptr 200 Frames

Real-time Protocol Analyzer

- Frame Relay is commonly used data link protocol based on packet switching technology
- It is mainly incorporated by the corporate data networks due to its cost-effective data transmission, and flexible bandwidth
- Displays Summary, Detail, Hex-dump, Statistics, and Call Trace Views

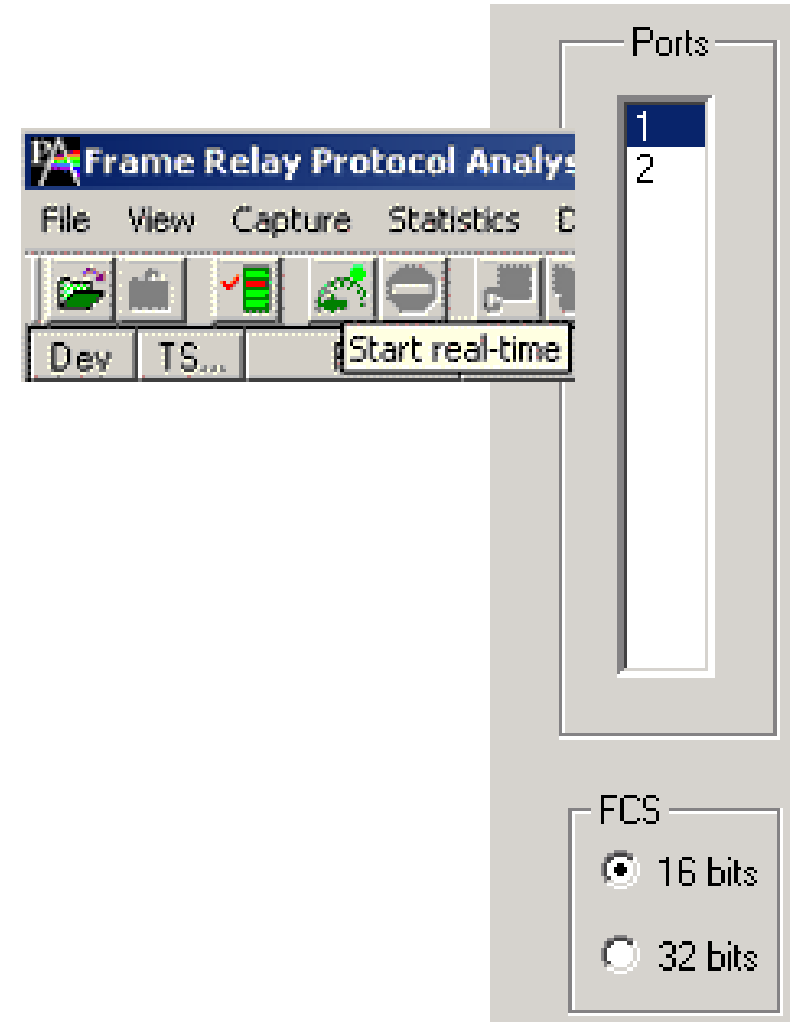
The screenshot displays the 'Frame Relay Protocol Analysis LAPP' software interface. It features a menu bar (File, View, Capture, Statistics, Database, Call Detail Records, Configure, Help) and a toolbar. The main window is divided into several sections:

- Summary View:** A table listing captured frames with columns for Dev, SubCh, Frame#, TIME, Len, Error, DLCI, DE, BECN, FECN, CTL, Sequence Number, and Sequence.
- Detail View:** A section titled 'HDLC Frame Data + FCS' showing the LAPP Layer details, including EA, C/R, DLCI, and DE fields.
- Hex Dump View:** A section titled 'Hex Dump of the Frame Data' showing a hex dump of the frame data with corresponding ASCII characters.
- Statistics View:** A table showing statistics for Device #, C/R, Frame Count(Device #), and Frame Count(C/R).
- Call Detail Record View:** A table with columns for Call ID, Call Status, Calling Num, Called Num, Call Start Date & Time, Call Duration, Release Complete Cause, and De.

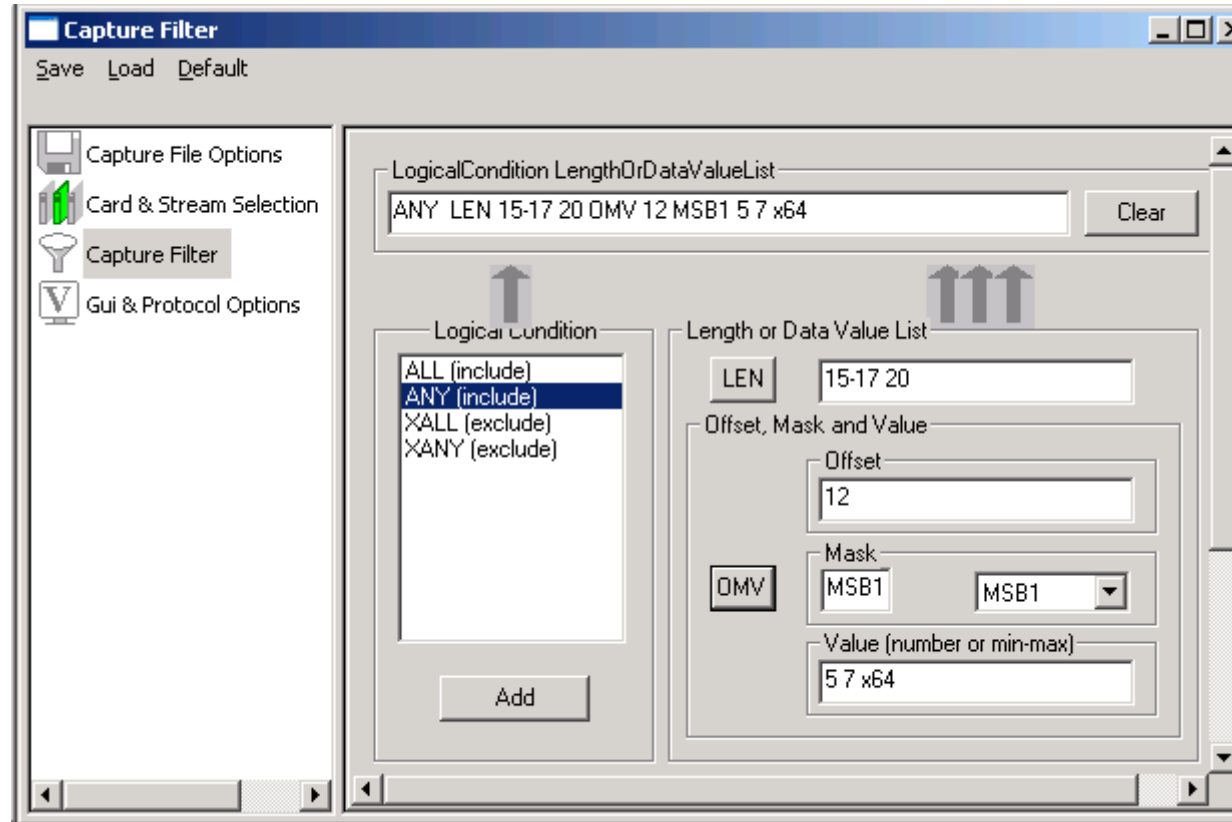
Arrows on the right side of the screenshot point to these five views: Summary View, Detail View, Hex Dump View, Statistics View, and Call Detail Record View.

Real-time Capture

- Capture and analyze Frame Relay frames using T3 E3 real-time analyzers
- All or filtered traffic can be recorded into a trace file
- Real-time capturing requires user to specify ports

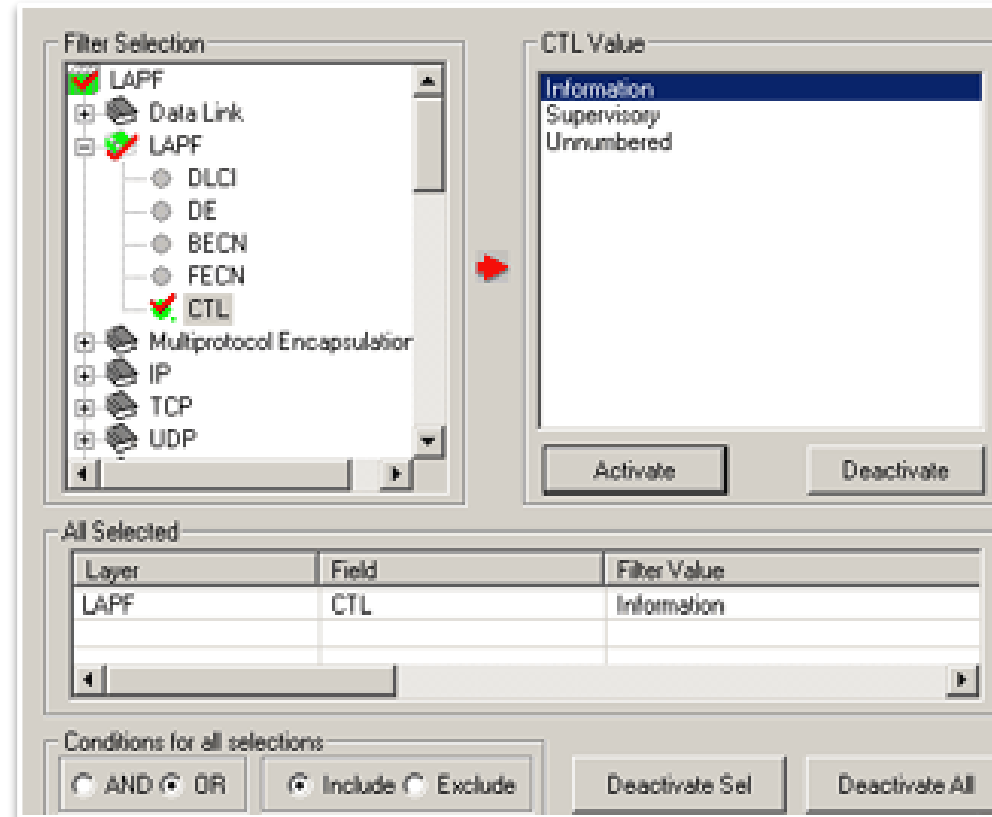


Real-time Filter and Search Criteria



- Capture frames with specified length and/or, a value at an offset
- Capture Filter based on ALL and ANY or to exclude XALL and XANY logical conditions

Offline Filter and Search Criteria



- Offline filter based on Frame Number, Time, Length, Error, DLCI, DE, BECN, FECN, CTL, NLPID and other parameters
- Search for a specific frame based on the criteria

Statistics Option

Field Names

- Layers
 - Physical Link
 - Device #
 - Error Code
 - StartTsOrTsSc
 - Time Stamp
 - LAPF
 - BECN
 - C/R
 - CI
 - D/C
 - DE
 - DLCI
 - EA
 - FECN
 - Modifier Function
 - N(R)
 - N(S)
 - P/F

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	Frame Percent
Physical ...	Time Stamp	Total	Byte Count
LAPF	C/R	Total	Byte Percent

Remove Sel
Remove All
Apply

Statistics View

Frame Relay Protocol Analysis LAPF

File View Capture Statistics Database Call Detail Records Configure Help

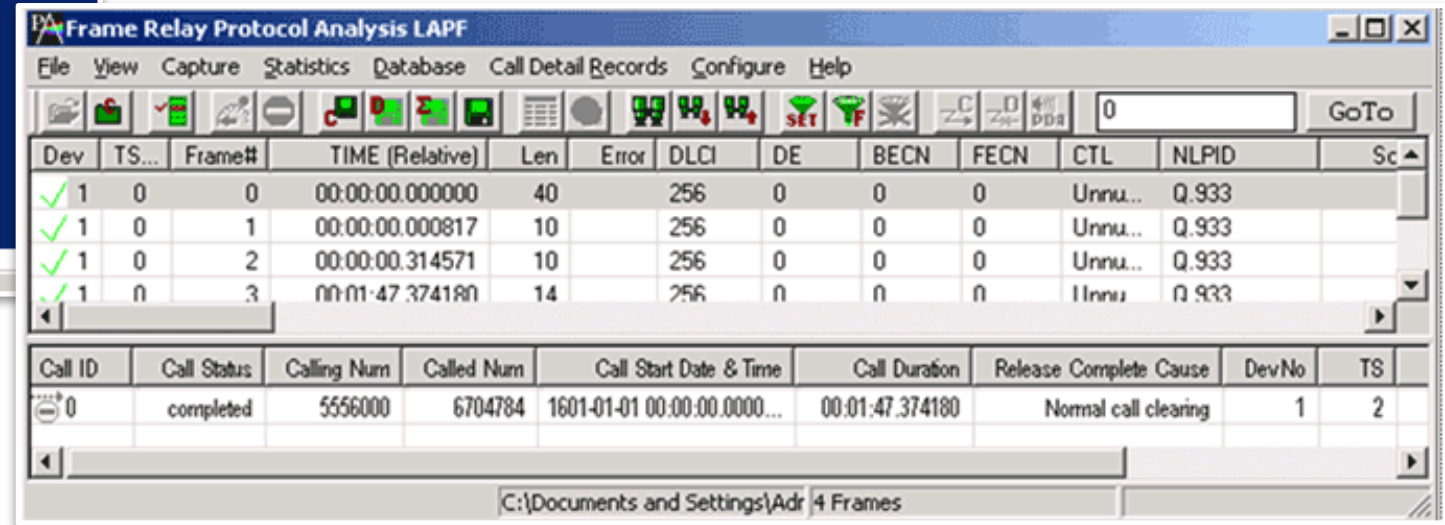
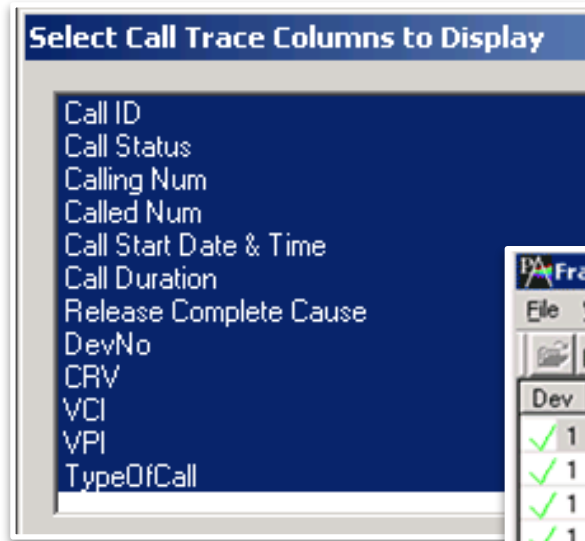
goto

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	DLCI	DE	BECN	FECN	CTI
✓ 2	0		0	00:00:00.000000	45		416	0	0	0	Uni
✓ 2	0		1	00:00:00.296748	45		416	0	0	0	Uni
✓ 1	0		2	00:00:00.443543	20		56	0	0	0	Uni
✓ 1	0		3	00:00:00.561277	16		0	0	0	0	Uni
✓ 1	0		4	00:00:00.573712	20		40	0	0	0	Uni
✓ 2	0		5	00:00:00.596578	45		416	0	0	0	Uni
✓ 2	0		6	00:00:00.896409	45		416	0	0	0	Uni
✓ 2	0		7	00:00:01.299238	45		416	0	0	0	Uni
✓ 1	0		8	00:00:01.444655	20		56	0	0	0	Uni
✓ 1	0		9	00:00:01.553199	16		0	0	0	0	Uni
✓ 1	0		10	00:00:01.575749	20		40	0	0	0	Uni
✓ 2	0		11	00:00:01.596014	45		416	0	0	0	Uni
✓ 2	0		12	00:00:01.895845	45		416	0	0	0	Uni
✓ 2	0		13	00:00:02.195675	45		416	0	0	0	Uni

Device #	C/R	Frame Count(C/R)	Frame Count(Device #)
1	Command(User), Response(Network) (0)	162	162
2	Command(User), Response(Network) (0)	38	38
Total	total Command(User), Response(Network) (0)	200	200

C:\Program Files\GL Communicati 200 Frames

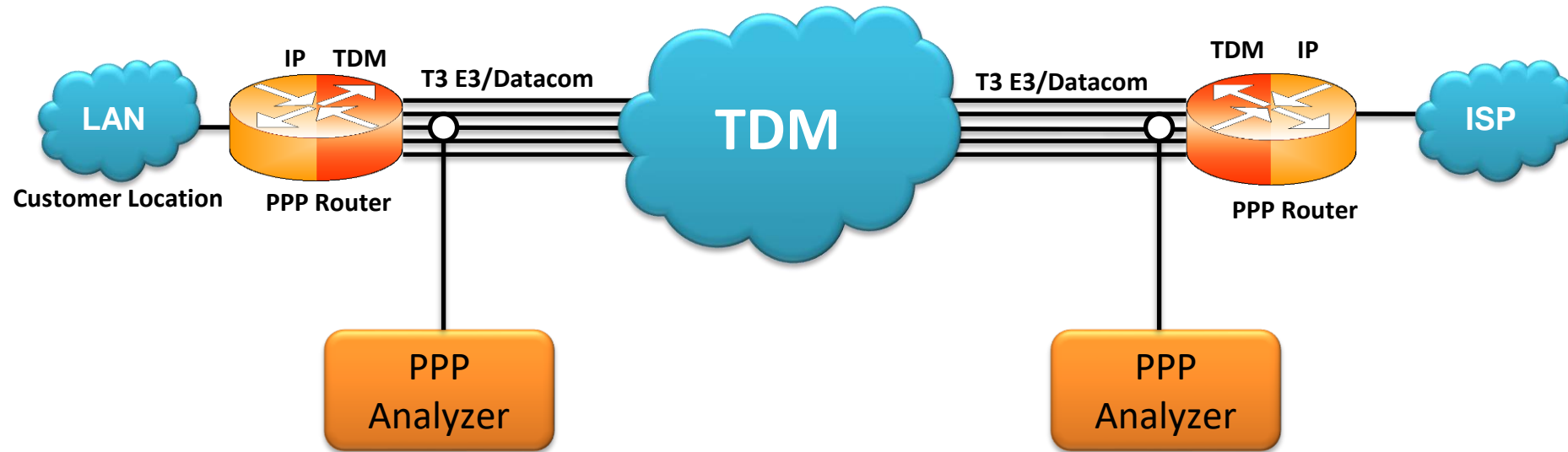
Call Detail Records



- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, CRV, release complete cause etc. are displayed

PPP Analyzer

GL's T3 PPP Analyzer

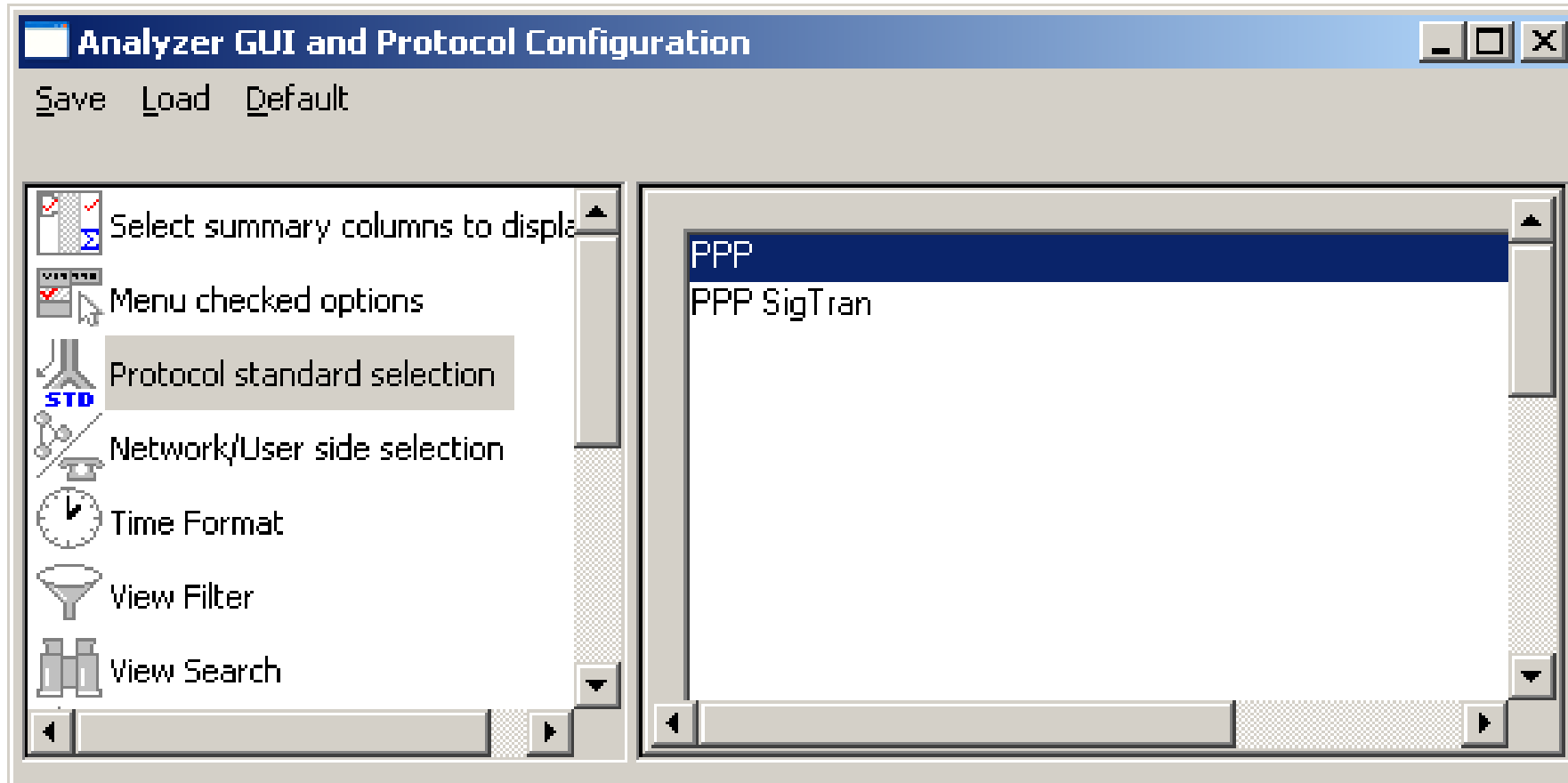


- Ability to decode and analyze PPP, MLPPP, and MC-MLPPP packets exchanged between the two nodes over T1 E1 link
- MLPPP analyzer also supports Packet Data Analysis module (requires additional license) to perform detail analysis of MLPPP packets over IP and segregates them into SIP/H323/MEGACO/MGCP/T.38 Fax calls

Features

- Supports a host of protocols PPP, IPCP, BCP, BPDU, PAP, CHAP, HTTP, SNMP, STUN, FTP, DNS, and DHCP
- Ability to test and perform numerous measurements across WAN- LAN or LAN-LAN connection
- Ability to test and analyze HDLC based PPP protocol in synchronous environment
- Search and filtering capabilities for both real-time as well as offline analysis
- Provides Summary, Detail, Statistics, and Hex dump views
- Supports Packet Data Analysis module for real-time IP call analysis including SIP, RTP, MEGACO, H.323, and MGCP, and T.38 Fax calls
- Detailed information of all the captured Frames or only the filtered frames can be exported to ASCII file for the further off-line analysis and printed
- Capability to export summary as well as detail information to an ASCII file for subsequent import into a database or spreadsheet
- Ability to capture and decode both PPP routed protocols, PPP bridged protocols
 - User can decode frames from the recorded trace files and can be played back using HDLC playback application

Supported Protocol Standards



PPP Protocol Analysis

- It provides useful analysis of the PPP, MLPPP, and MC-MLPPP protocols which includes distribution of protocols, protocol fields, frame lengths and frame status

The screenshot displays the PPP Protocol Analysis software interface. At the top, there is a menu bar (File, View, Capture, Statistics, Database, Configure, Help) and a toolbar with various icons. Below the toolbar is a table listing captured frames:

Dev	SubCh	Frame#	TIME (...)	Len	Error	PPP Layer3Protocol	Mlppp Seq No
✓ 2		0	00:00:...	402		Internet Protocol	
✓ 2		1	00:00:...	174		Internet Protocol	
✓ 2		2	00:00:...	236		Internet Protocol	
✓ 2		3	00:00:...	70		Internet Protocol	
✓ 2		4	00:00:...	70		Internet Protocol	

Below the table, the details of the selected frame (Frame 0) are shown:

```
Ctl = 00000011 (3)
Protocol = 00000000 00100001 Internet Protocol
----- IP Layer -----
Version = 0100.... (4)
Internet Header Length (In 32 bit words) = ....0101 (5)
Type of Service =
  Precedence = 000..... Routine
  Delay = ...0.... Normal Delay
  Throughput = ....0... Normal Throughput
  Reliability = .....0.. Normal Reliability
```

Below the details is a hex dump of the frame data:

```
Hex Dump of the Frame Data
+-----+-----+-----+-----+-----+-----+
FF 03 00 21 45 00 01 8E DE 88 40 00 36 06 EC 59  y !E |p|@ 6 iY
48 25 C9 91 CA AE 9C 22 E8 9F 06 B8 4C 96 B7 F8  H%E'É@! "è| ,L|ø
00 44 EE 79 80 18 16 D0 74 F4 00 00 01 01 08 0A  Diy| Ètô
02 53 69 BA 02 73 17 46 03 00 01 5A 08 02 76 D1  Si° s F Z vN
05 04 03 80 90 A3 6C 0E 01 83 39 36 35 39 34  ||èl |966594
32 39 37 36 37 39 70 0C 81 39 32 35 33 33 31  297679n |9253331
```

At the bottom, there is a summary table:

Σ Address	Σ Ctl	Σ Protocol
255	3	Internet Protoc...
total 255	total 3	total Internet P...

The status bar at the bottom indicates "Off-line Viewing" and the file path "C:\Program Files\GL Communications In | 11 938 Frames".

Real-time Analysis

The screenshot displays the PPP Protocol Analysis application interface. It is divided into several sections:

- Summary View:** A table listing protocol frames with columns for Device (Dev), Time Slot (TS), Sequence (S), Frame Number (Frame#), Relative Time (TIME (Relative)), Length (Len), PPP Layer (PPP Layer3Pro...), MPPP Sequence (Mppp Se...), MPPP Code (Mppp CL...), LCP Code, IPCP Code, and PPP Mux/CP Code. Frame 14 is highlighted.
- Detail View:** A text-based representation of the selected frame (Frame 14) showing HDLC Frame Data + FCS and the internal structure of the ML PPP Layer, including fields like Address, Ctl, Protocol, and Beginning Fragment.
- Hex Dump View:** A hex dump of the frame data with corresponding ASCII characters shown to the right.
- Statistics View:** A summary table showing the count of frames for various codes across different devices.

Summary View

Detail View

Hex Dump View

Statistics View

Configure *.ini File

The screenshot displays the PPP Protocol Analysis software interface. The main window shows a capture table with columns: Dev, TSlot, SubCh, Frame#, TIME (Relative), Len, Error, Source IP Address, and Destination. Below the table, the protocol details for the selected frame (Frame 0) are shown, including HDLC Frame Data + FCS, PPP Link Layer, and IP Layer. A hex dump of the frame data is also visible.

Overlaid on the main window are two configuration windows:

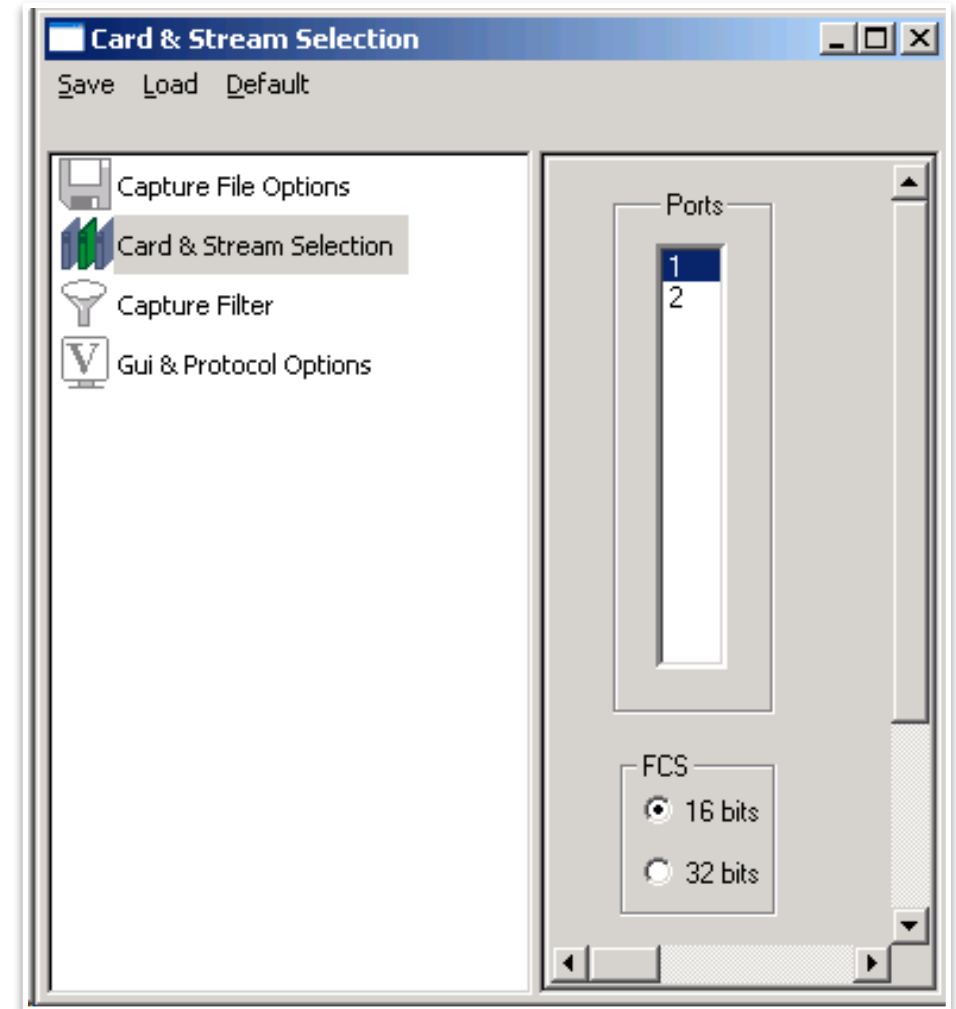
- INI Decode Options:** A dialog box with a list of options on the left and an INI file path on the right. The path is `C:\Program Files\GL Communications Inc\Laptop T3 Analyzer\PPPProt.ini`. The INI file content is visible in the right pane.
- PppProt - Notepad:** A text editor window showing the INI file content. The file contains configuration options for MLPPP sequence number format, L2 length, L2 protocol, and sequence number format choice.

The INI file content shown in the Notepad window is:

```
----- MLPPP sequence number format values -----  
;SEQ_NUM_FORMAT  
;0 -> SHORT SEQ FORMAT  
;1 -> LONG SEQ FORMAT  
-----  
;Default values 4:PPP, 10:MLPPP  
[#UNKNOWN_L2_LENGTH]  
L2_LENGTH_VAL=4; 10  
;0:MLPPP Absent, 1:MLPPP Present  
[#MLPPP_PRESENCE]  
MLPPP = 0 ;1  
;2:PPP, 3:CiscoHdlc, Else: Unknown L2  
[#LAYER_2_PROTOCOL]  
L2_PROTOCOL=2  
;0:short seq, 1:long seq  
[#MLPPP_SEQ_NUM_FORMAT_CHOICE]  
SEQ_NUM_FORMAT = 1
```

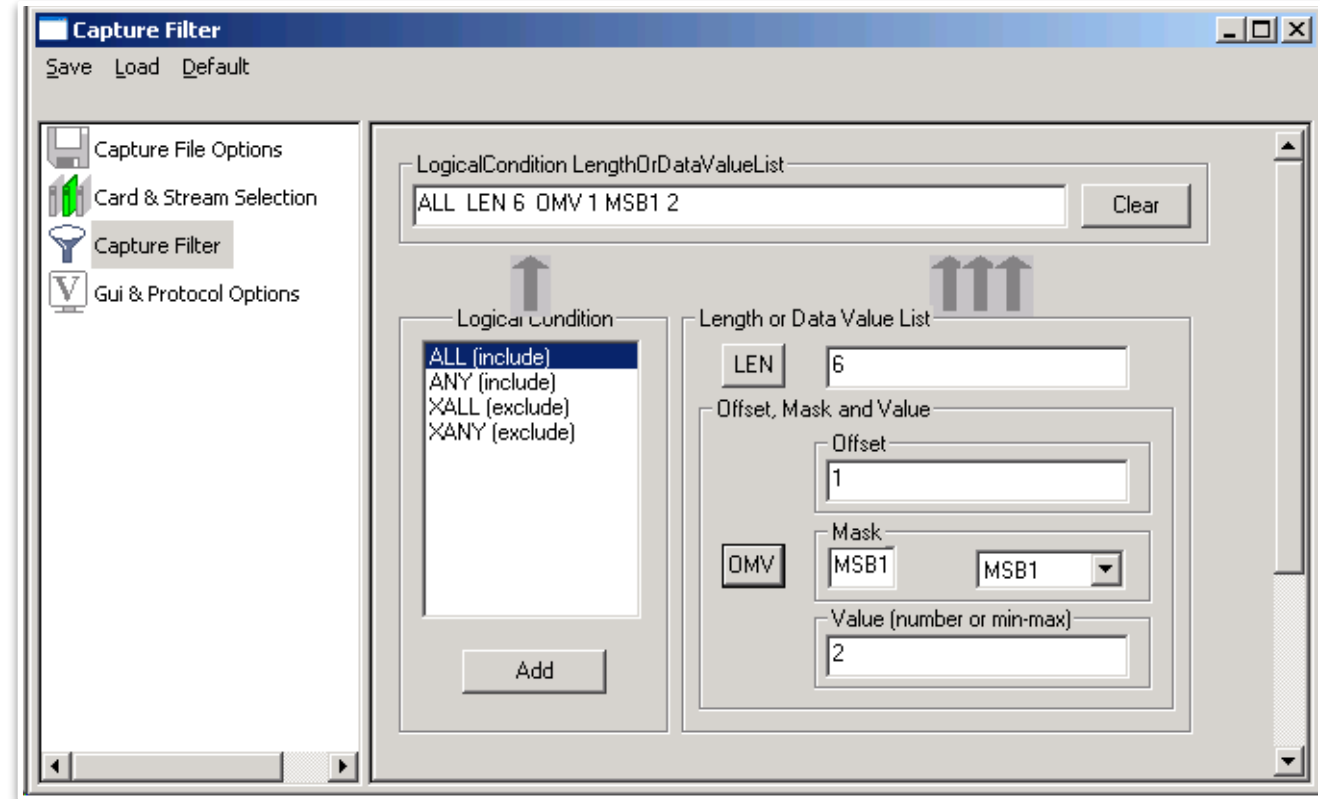
Real-time Analysis

- Multiple ports can be selected for a single instance of analyzer to capture the frames simultaneously
- Specify ports, and Frame Check Sequence (FCS) for real-time capture

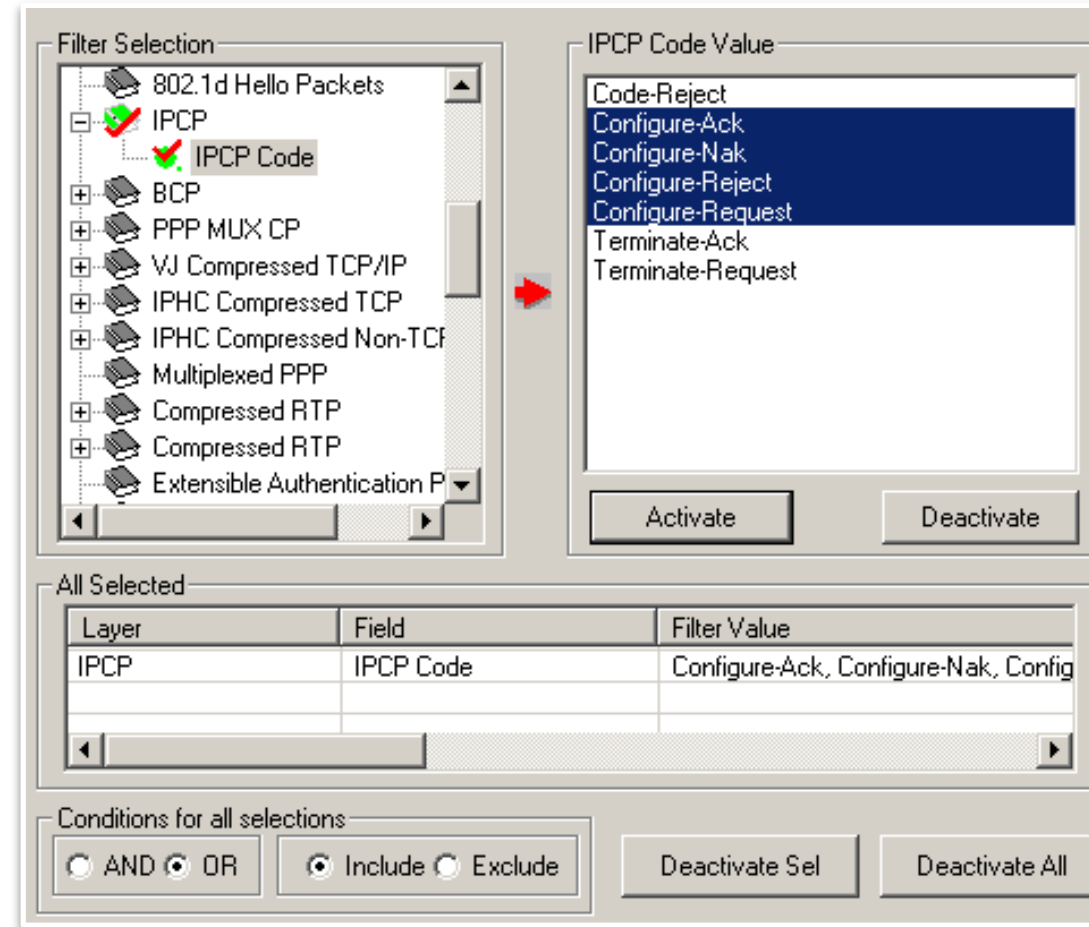


Real-time Filtering and Search Criteria

- Filter can be set based on length of frames, Frame Number, Time, Length, Error, Layer3 Protocol, LCP Code, IPCP code, TCP and UDP source and destination port, PPP Message type, and so on
- Based on specific search criteria users can search for a particular frame



Offline Filtering and Search Criteria



- Users can use recorded trace files for offline analysis. Filtering and search criteria can be set for offline analysis as well

Statistics Options

Field Names

- IPCP
- BCP
 - Bridge#
 - Code
 - Identifier
 - LAN Segment Number
 - Length
 - MAC Address
 - MAC Type
 - Option
 - Protocol
 - Type
- PPP MUX CP
- VJ Compressed TCP/IP
- IPHC Compressed TCP
- IPHC Compressed Non-TCP
- Multiplexed PPP
- Compressed RTP

Type

Use Type (single selection)

- Total
- Key
- Field

Statistic Type(s) (calculated, multiple selection)

- MIN
- MAX
- SUM
- AVG

Value Set

- Bridge Control Packet Indicator
- Bridge-Identification
- IEEE 802 Tagged Frame
- LAN-Identification

Cumulative Separate

Add/Mod Remove

Selected Statistic Information

Layer	Field Name	Use Type	Statistic Type
BCP	Bridge#	Total	MAX
BCP	Length	Total	MIN
BCP	Type	Total	

Remove Sel

Remove All

Apply

Configure *.ini File (PPP)

The screenshot displays the PPP Protocol Analysis software interface. The main window shows a table of frames with columns: Dev, TSlot, SubCh, Frame#, TIME (Relative), Len, Error, Source IP Address, and Destination. Below the table, it shows HDLC Frame Data + FCS and a Hex Dump of the Frame Data. The Hex Dump shows the following data:

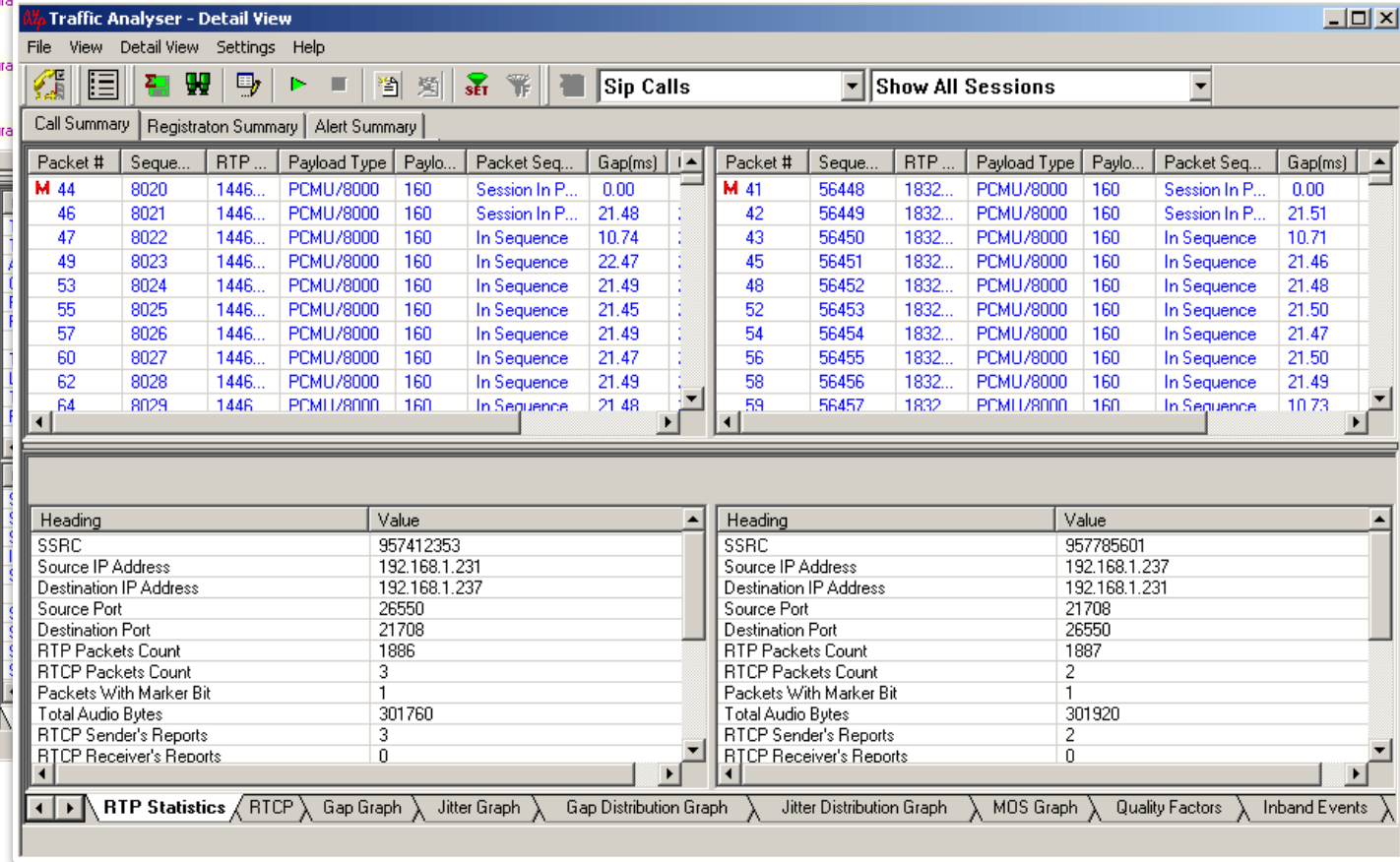
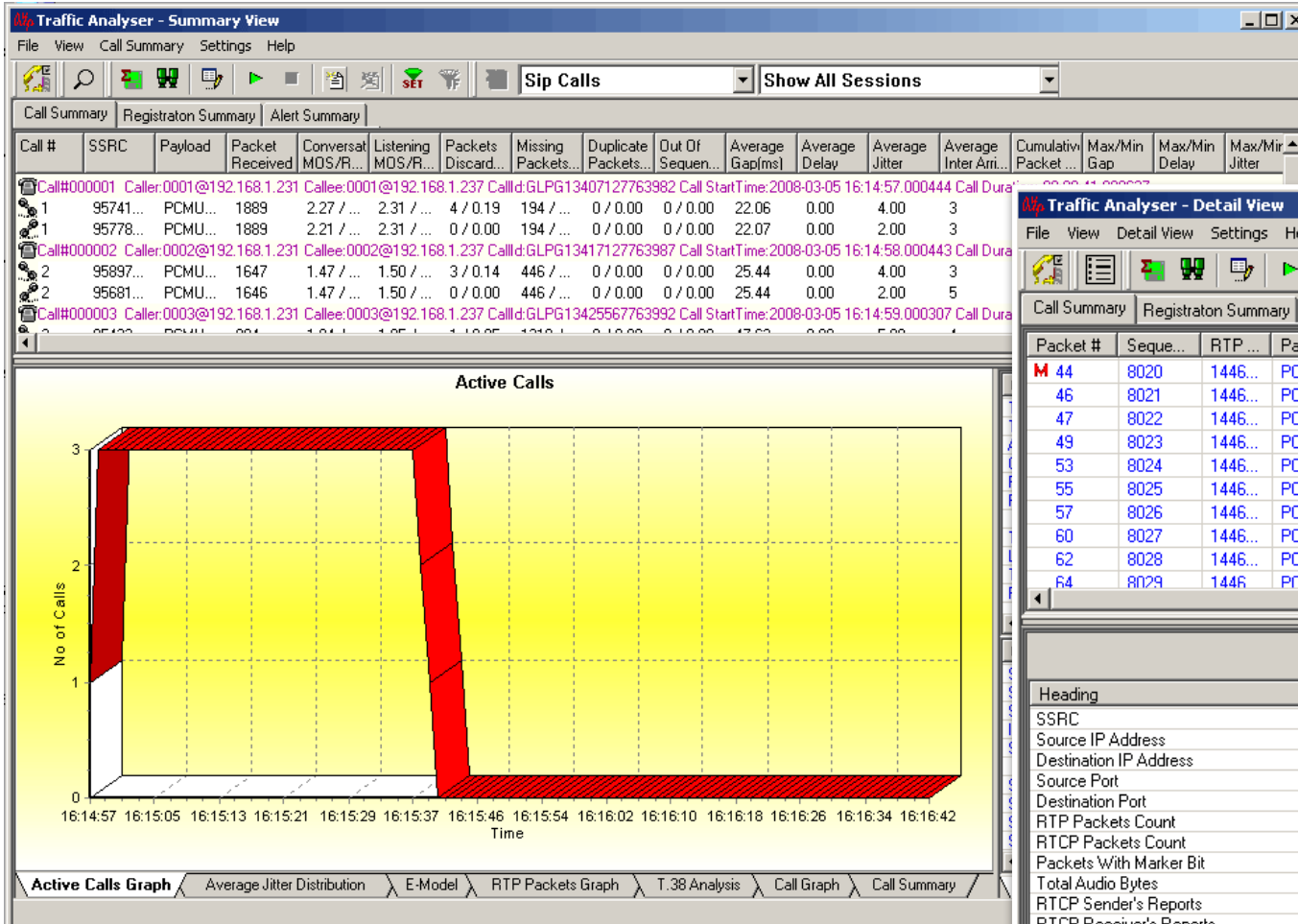
Hex	ASCII
FF 03 00 21 45 00 03 36 02 3E 00 00 80 11 B0 F9	ÿ !E 6 > € *ù
C8 A8 01 C8 C0 A8 01 67 D3 52 13 C4 03 22 FA 5F	À" ÈÀ" gOR À "ù
49 4E 56 49 54 45 20 73 69 70 3A 30 30 30 31 40	INVITE sip:0001@
31 39 32 2E 31 36 38 2E 31 2E 31 30 33 20 53 49	192.168.1.103 SI
50 2F 32 2E 30 0D 0A 56 69 61 3A 20 53 49 50 2F	P/2.0 Via: SIP/
32 2E 30 2F 55 44 50 20 31 39 32 2E 31 36 38 2E	2.0/UDP 192.168.
31 2E 32 30 30 3A 35 30 36 30 3B 62 72 61 6E 63	1.200:5060;branc
68 3D 7A 39 68 47 34 62 4B 33 38 31 31 33 33 33	h=z9hG4bK3811333
35 33 36 2D 33 33 32 0D 0A 4D 61 78 2D 46 6F 72	536-332 Max-For
72 61 72 6A 73 3A 20 32 30 0D 0A 41 6C 6C 6F 72	warder: 20 Allow

The software also shows two configuration windows:

- INI Decode Options**: A window with a list of options to select summary columns to display. The file path is C:\Program Files\GL Communications Inc\Laptop T3 Analyzer\PppProt.ini.
- PppProt - Notepad**: A Notepad window showing the configuration file content. The file path is C:\Program Files\GL Communications Inc\2550 Frames. The content includes:

```
----- MLPPP sequence number format values -----
; SEQ_NUM_FORMAT
; 0 -> SHORT SEQ FORMAT
; 1 -> LONG SEQ FORMAT
-----
; Default values 4:PPP, 10:MLPPP
[#LINKNOWN_L2_LENGTH]
L2_LENGTH_VAL=4; 10
; 0:MLPP Absent, 1:MLPP Present
[#MLPPP_PRESENCE]
MLPPP = 0 ;1
; 2:PPP, 3:CiscoHdlc, Else: Unknown L2
[#LAYER_2_PROTOCOL]
L2_PROTOCOL=2
; 0:short seq, 1:long seq
[#MLPPP_SEQ_NUM_FORMAT_CHOICE]
SEQ_NUM_FORMAT = 1
```

Packet Data Analysis (Traffic Analysis Tool for IP)



PDA Call Graph

The screenshot displays the 'Traffic Analyser - Summary View' interface. At the top, there is a menu bar (File, View, Call Summary, Settings, Help) and a toolbar with various icons. Below the toolbar, there are tabs for 'Call Summary', 'Registration Summary', and 'Alert Summary'. The main area is divided into two sections: a table of call statistics and a detailed view of a selected call.

Call Summary Table:

Call #	SSRC	Payload	Packet Received	Conversational MOS/R-Factor	Listening MOS/R-Factor	Packets Discarded/(%)	Missing Packets/(%)	Duplicate Packets/(%)	Out Of Sequence Packets/(%)	Average Gap(ms)	Average Delay	Average Jitter	Average Inter Arrival Jitter
1	95...	PCM...	1889	2.12 / 43	2.17 / 44	38 / 1.83	194 / 9.33	0 / 0.00	0 / 0.00	22.06	0.00	4.00	3
1	95...	PCM...	1889	2.21 / 45	2.27 / 46	5 / 0.24	194 / 9.32	0 / 0.00	0 / 0.00	22.07	0.00	2.00	3
2	95...	PCM...	1647	1.43 / 27	1.47 / 28	29 / 1.39	446 / 21.34	0 / 0.00	0 / 0.00	25.44	0.00	4.00	3

SIP Call Flow Diagram:

The diagram shows a sequence of SIP messages between two endpoints: 192.168.1.231 (left) and 192.168.1.237 (right). The messages are:

- 54098 → 5060: INVITE
- 5060 → 54098: SIP/2.0 100 Trying
- 5060 → 54098: SIP/2.0 180 Ringing
- 5060 → 54098: SIP/2.0 200 OK
- 54098 → 5060: ACK
- 54098 → 5060: BYE
- 5060 → 54098: SIP/2.0 200 OK

SIP Message Details:

```
INVITE sip:0001@192.168.1.237 SIP/2.0
Via: SIP/2.0/UDP 192.168.1.231:5060;branch=z9hG4bK1340712776
Max-Forwards: 70
Allow: INVITE,BYE,CANCEL,ACK,INFO,PRACK,COMET,OPTIONS,SUBSCRIBE
From: 0001 <sip:0001@192.168.1.231>;tag=GLPG_1340712776-398
To: 0001 <sip:0001@192.168.1.237>
Call-ID: GLPG13407127763982
CSeq: 1 INVITE
Contact: 0001 <sip:0001@192.168.1.231>
Content-Type: application/sdp
Content-Length: 352
v=0
o=0001 44494868 44494875 IN IP4 192.168.1.231
s=-
c=IN IP4 192.168.1.231
t=0 0
```

Annotations in the image include a blue box around the first two rows of the call summary table, a blue arrow pointing from the table to the SIP flow diagram, and another blue arrow pointing from the SIP message details to the diagram.

FAX over IP (T.38) Calls Analysis

- Packet Data Analyzer (PDA) provides Fax (T.38 data) over VoIP monitoring and decoding capability
- The captured fax calls are indicated with “F”

Traffic Analyser - Summary View

File View Call Summary Settings Help

Sip Calls **Show Fax Calls**

Call #	SSRC	Payload	Packet Received	Conversat MOS/R...	Listening MOS/R...	Packets Discard...	Missing Packets...	Duplicate Packets...	Out Of Sequen...	Average Gap(ms)	Average Delay	Average Jitter	Average Inter-Arri...	Cumulativ Packet...	Max/Min Gap
F 1	24899...	PCMA...	321	4.18 / ...	4.20 / ...	0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	20.00	0.00	0.00	0	0	21.10 ...
F 1	56526...	PCMA...	322	4.18 / ...	4.20 / ...	0 / 0.00	0 / 0.00	0 / 0.00	1 / 0.31	19.87	0.00	0.00	0	0	20.03 ...

Ladder diagram showing the FAX Call

5004 → 6302 NSF

5004 → 6302 DIS:DSR:ITU-T V.27 ter and V.29

5004 → 6302 no-signal

5004 ← 6302 v21-preamble

5004 ← 6302 TSI NUM:

5004 ← 6302 DCS:DSR:9600bps, ITU-T V.29

5004 ← 6302 no-signal

5004 ← 6302 v29-9600-training

5004 ← 6302 t4-non-ecm-data:v29-9600: 0 pkts lost

==== T.38 Layer =====

UDPTLPacket = SEQUENCE

seq-number = INTEGER

Contents = 4

primary-ifp-packet = Open Type

Length = 12

IFPPacket = SEQUENCE

Preamble = 1

type-of-msg = CHOICE

Choice Index = 1

data = ENUMERAT

Extensibility Marker = 0

Contents = 0 v21(0

data-field = SEQUENCE

Iteration Count = 2

data-field = Instance

data-field = SEQUENCE

Preamble = 1

Displays the decoded information of the selected FAX message

Average Jitter Distribution | E-Model | RTP Packets Graph | **T.38 Analysis** | Call Graph | Call Summary

PPP SIP Header Info – PPP/SIP/RTP

The screenshot displays the 'PPP Protocol Analysis PPP' window. The top pane shows a table of captured frames:

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	Source IP Address	Destination IP Address	UDP Source Port
2	0-23		0	00:00:00.000000	828		192.168.1.200	192.168.1.103	54098
2	0-23		1	00:00:00.004838	346		192.168.1.103	192.168.1.200	54098

The main pane shows the protocol stack for the selected frame (Frame 0):

```
Card2 TimeSlots=0-23 Frame=0 at 00:00:00.000000 OK Len=828
HDLC Frame Data + FCS
----- PPP Link Layer -----
0000 Address = 11111111 (255)
0001 Ctl = 00000011 (3)
0002 Protocol = 00000000 00100001 Internet Protocol (IPv4)
----- IP Layer -----
0004 Version = 0100 (4)
0004 Internet Header Length (In 32 bit words) = 0000101 (5)
Type of Service
0005 Precedence = 000 (Routine)
0005 Delay = 000 (Normal Delay)
0005 Throughput = 000 (Normal Throughput)
0005 Reliability = 000 (Normal Reliability)
0005 Reserved for Future Use = 000 (0)
0006 Total Length = 822 (x0336)
0008 Identification = 574 (x023E)
000A Reserved = 0 (0)
000A DF = 0 (May Fragment)
000A MF = 0 (Last Fragment)
000A Fragment Offset = 0 (00000000 00000000)
000C Time To Live = 128 (x80)
000D Protocol = 00010001 User Datagram
000E Header Check Sum = xB0F9
0010 Source IP Address = 192.168.1.200 (xC0A801C8)
0014 Destination IP Address = 192.168.1.103 (xC0A80167)
----- UDP Layer -----
0018 Source Port = 54098 (xD352)
001A Destination Port = 5060 (x13C4)
001C Length (Header + Data) = 802 (x0322)
001E Checksum = 64095 (xFA5F)
----- Sip3261 Layer -----
HDR = INVITE sip:0001@192.168.1.103 SIP/2.0
HDR = Via: SIP/2.0/UDP 192.168.1.200:5060:branch=z9hG4bK3811333536-332
```

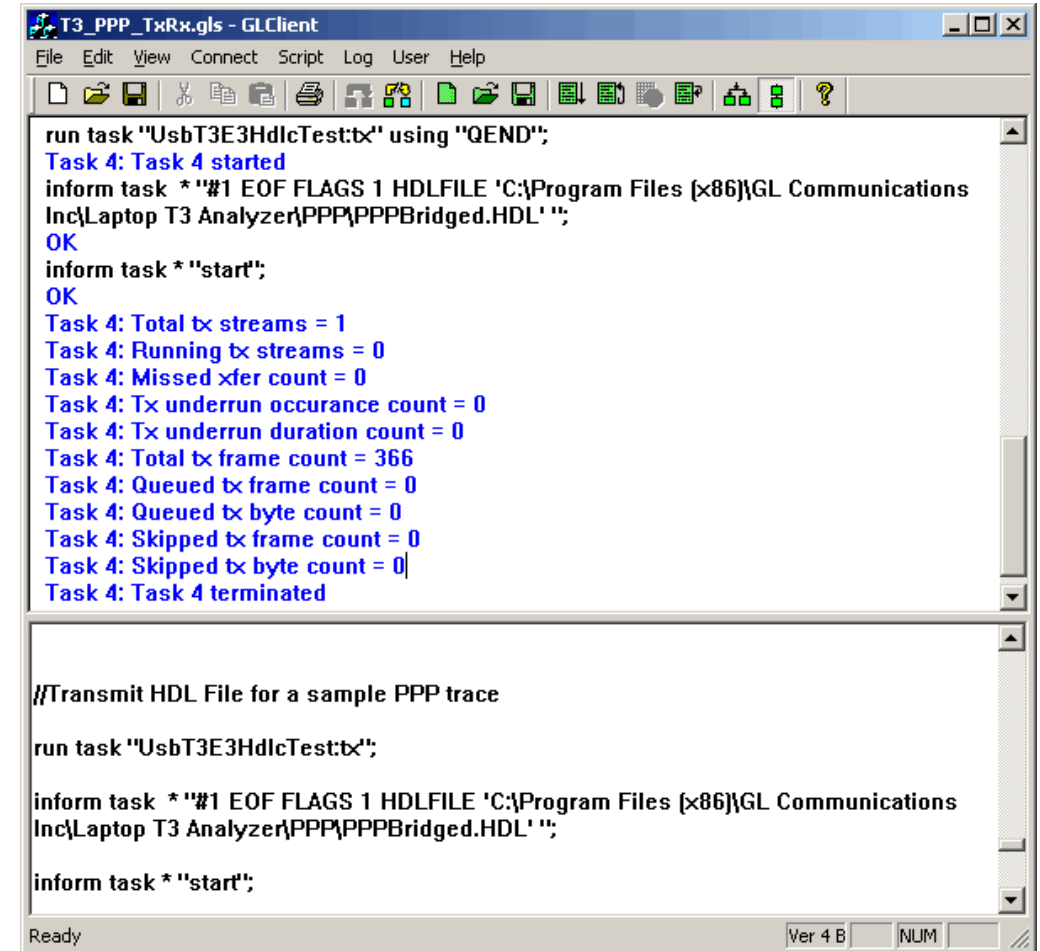
The bottom pane shows the hex dump of the frame data:

```
Hex Dump of the Frame Data
FF 03 00 21 45 00 03 36 02 3E 00 00 80 11 B0 F9  y !E 6 > e *u
CU A8 01 C8 C0 A8 01 67 D3 52 13 C4 03 22 FA 5F  A "EÀ" qÓR Å "ú
```

WCS Module (TT3635/EE3635)

T3 E3 PPP Tx/Rx Test (UsbT3E3HdlcTest) is an optional WCS module that:

- Sends PPP frames with or without impairments
- Receives and verifies PPP frames and optionally logs the errors
- Provides remote operation, automation, and multi-site connectivity



```
run task "UsbT3E3HdlcTest:tx" using "QEND";
Task 4: Task 4 started
inform task *"#1 EOF FLAGS 1 HDLFILE 'C:\Program Files [x86]\GL Communications
Inc\Laptop T3 Analyzer\PPP\PPPBridged.HDL' ";
OK
inform task * "start";
OK
Task 4: Total tx streams = 1
Task 4: Running tx streams = 0
Task 4: Missed xfer count = 0
Task 4: Tx underrun occurrence count = 0
Task 4: Tx underrun duration count = 0
Task 4: Total tx frame count = 366
Task 4: Queued tx frame count = 0
Task 4: Queued tx byte count = 0
Task 4: Skipped tx frame count = 0
Task 4: Skipped tx byte count = 0
Task 4: Task 4 terminated

//Transmit HDL File for a sample PPP trace

run task "UsbT3E3HdlcTest:tx";

inform task *"#1 EOF FLAGS 1 HDLFILE 'C:\Program Files [x86]\GL Communications
Inc\Laptop T3 Analyzer\PPP\PPPBridged.HDL' ";

inform task * "start";
```

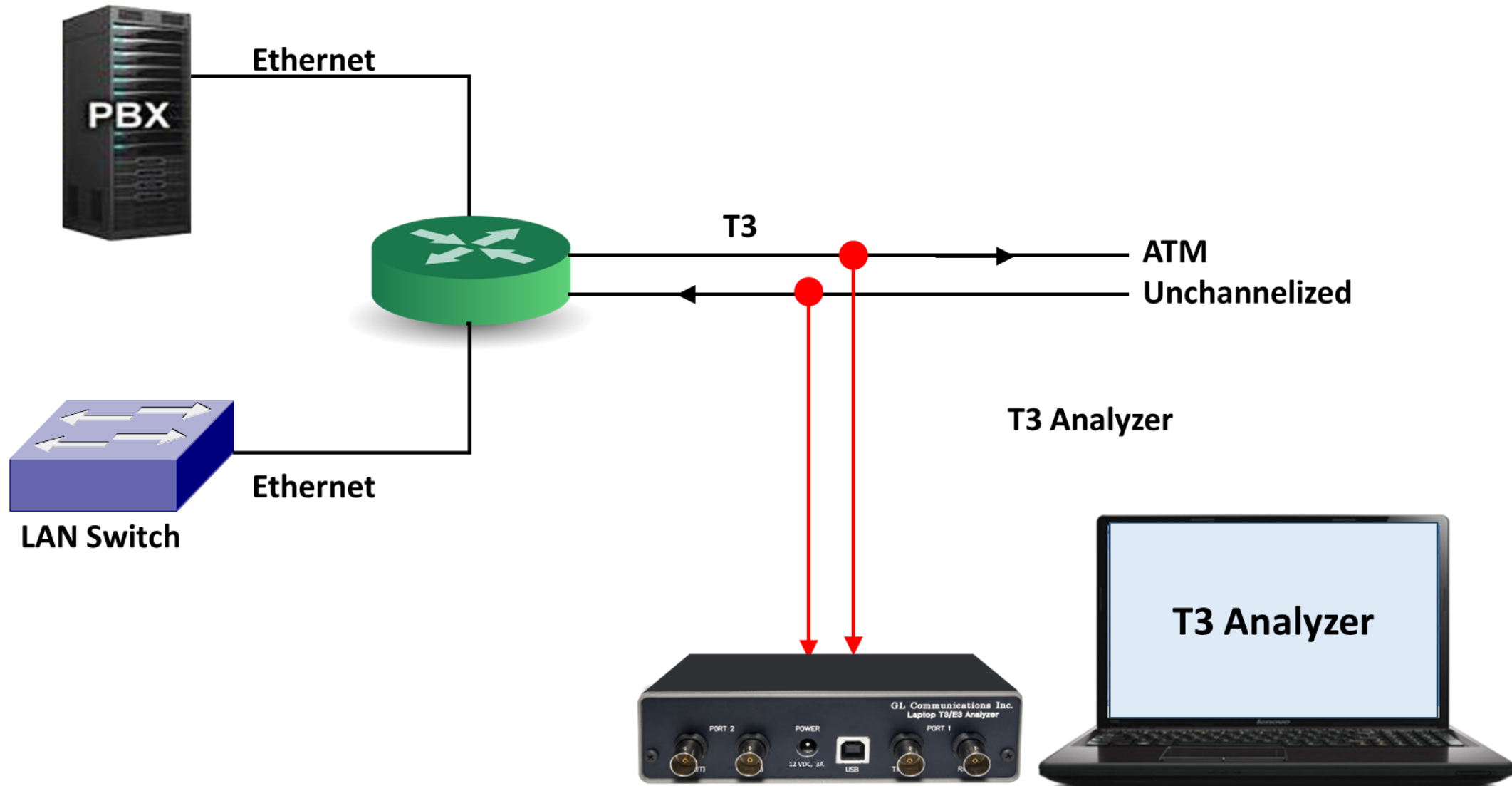
Ready Ver 4 B NUM

Sample Script

- Sample Script for PPP Emulation and Analysis:
- //Transmit HDL File for a sample PPP trace
- run task "UsbT3E3HdlcTest:tx" using "QEND";
 run task "UsbT3E3HdlcTest:rx" using "QEND";
 inform task * "#2 EOF FLAGS 1 HDLFILE 'C:\Temp.HDL' ";
 inform task * "#1 EOF FLAGS 1 HDLFILE 'C:\Program Files\GL Communications
Inc\Laptop T3 Analyzer\PPP\PPPBridged.HDL' ";
 inform task * "start";
 end task *;

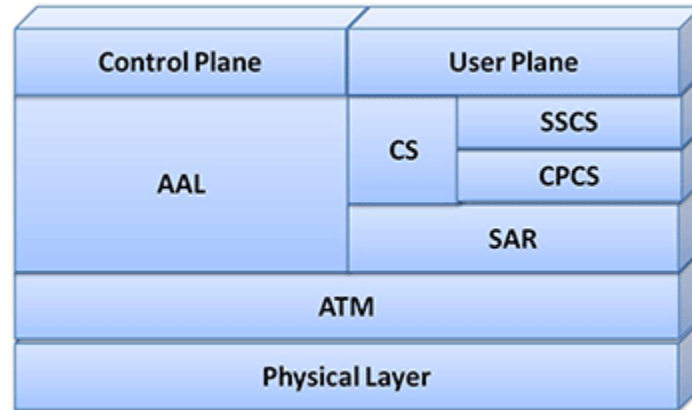
ATM Analyzer

ATM Unchannelized

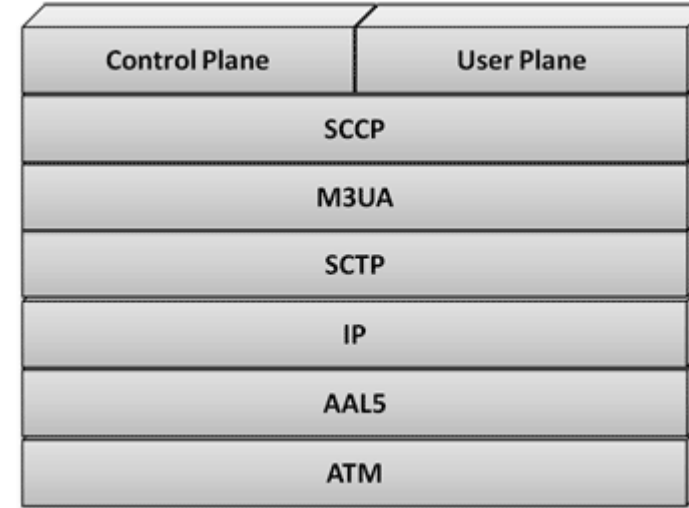


Supported Protocols (ATM)

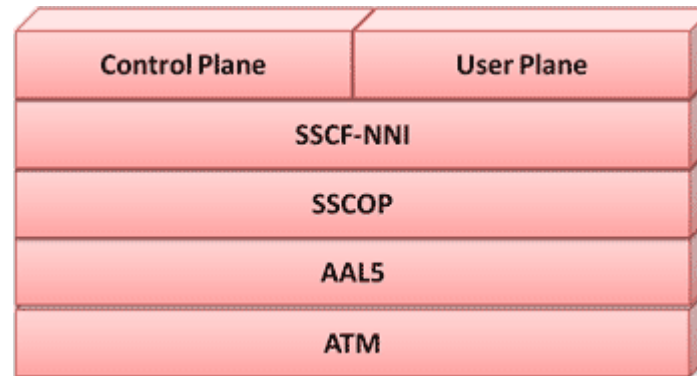
ATM Protocol Stack



Classical IP over ATM Protocol Stack

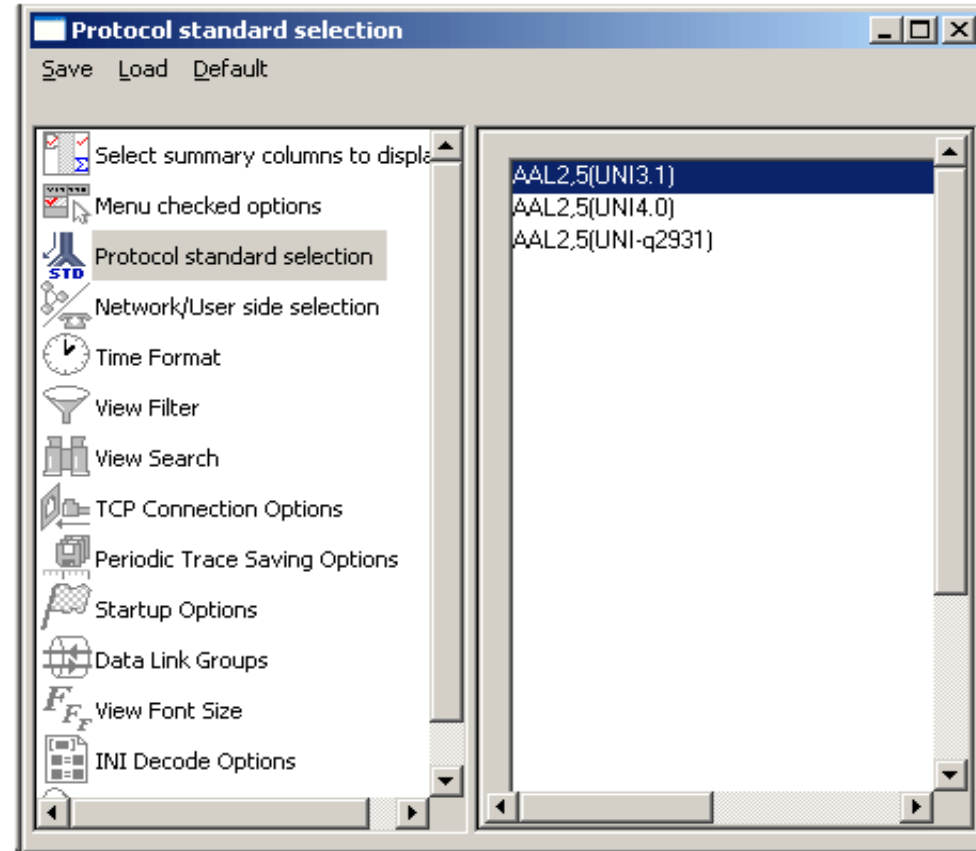


SS7 over ATM Protocol Stack

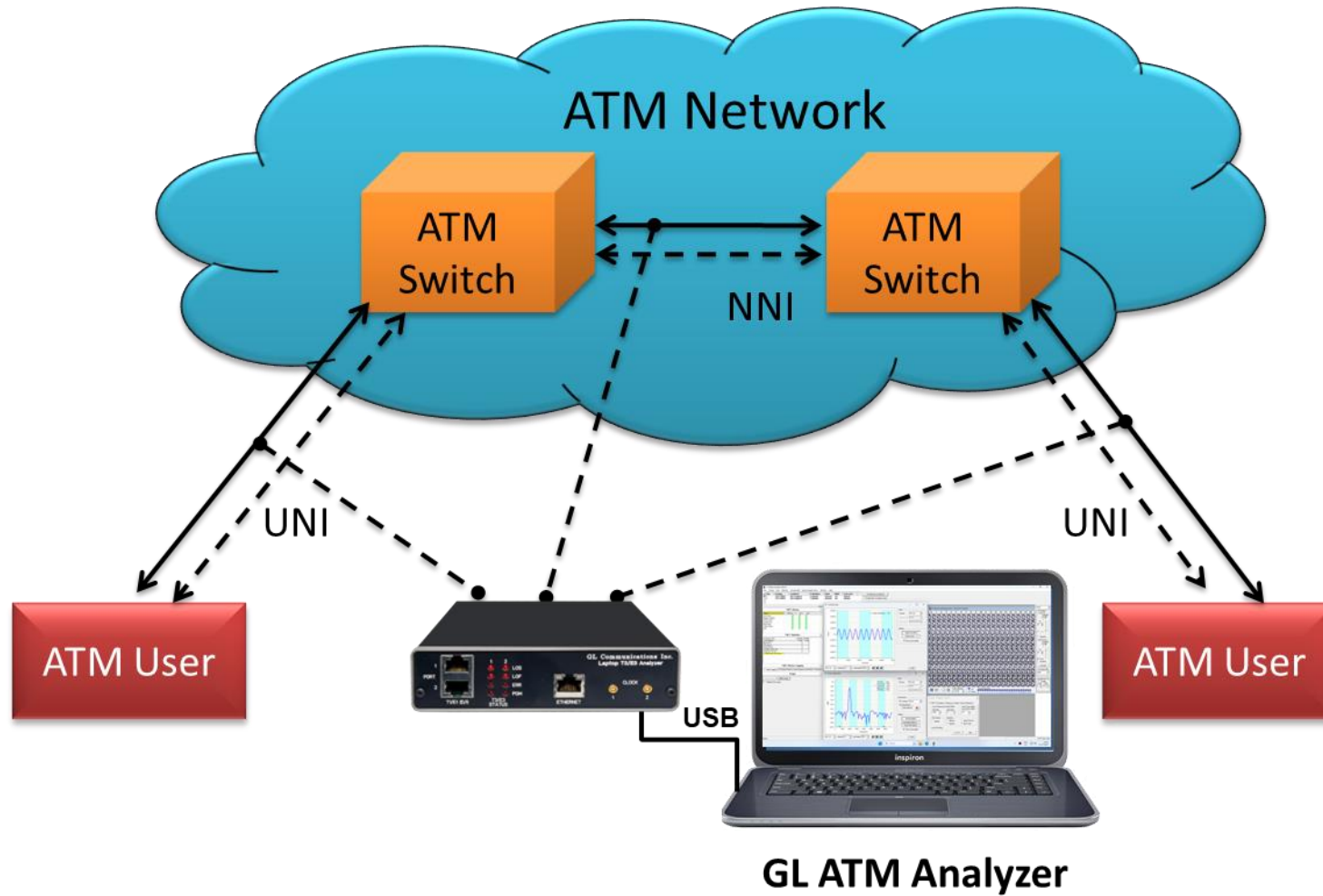


Supported Protocols Standards

- ITU-T Recommendation I.361, I.366.1, I.366.2
- ITU-T Standard Interfaces(UNIQ.2931), ATM Forum Standard Interfaces (UNI 3.0, 3.1, 4.0)



GL's ATM Protocol Analyzer



ATM Protocol Analysis

- Asynchronous Transfer Mode (ATM) is a flexible network, which carries voice, video, and data in the same way, i.e. fixed length cells
- Displays Summary, Detail, Hex-dump, Statistics, and Call Trace Views

The screenshot displays the ATM Protocol Analysis AAL2,5(UNI4.0) interface. It features a menu bar (File, View, Capture, Statistics, Database, Call Detail Records, Configure, Help) and a toolbar with various icons. The main window is divided into several sections:

- Summary View:** A table showing captured frames with columns for Dev, Frame#, TIME, Len, Error, VPI, VCI, PT, HEC, OSF, AAL Type, Frame Type, IMA, and IMA IC. The first four rows show frames 0, 1, 2, and 3, all with a length of 53 and type 'ATM-Cell'.
- Detail View:** A text-based representation of the ATM layer data for a selected frame, showing fields like GFC, VPI, VCI, and PT with their corresponding values and bit patterns.
- Hex Dump View:** A hex dump of the frame data, showing the hexadecimal values of the frame's payload and their corresponding ASCII characters.
- Statistics View:** A table summarizing the captured frames, showing the device number, frame type, and frame count.
- Call Detail Record View:** A table showing call details, including Call ID, Call Status, Calling Num, Called Num, Call Start Date & Time, Call Duration, and Release Complete Cause.

Summary View

Detail View

Hex Dump View

Statistics View

Call Detail Record View

Features

- Ability to configure .ini file for PVC carrying UNI signaling messages to get the proper decoding options
- Any protocol field can be added to the summary view, filtering, and search features providing users more flexibility to monitor required protocol fields
- CRC verification for AAL5 carrying packet data
- Call trace capability based on UNI signaling parameters, VPI/VCI etc.
- Displays Summary, Detail, Hex-Dump, Statistics, and Call Detail View
- Captures, decodes, filters, and reassembles AAL2 and AAL5 frames in real-time, from within the ATM cells according to user defined VPI/VCI
- Capturing and re-assembling frames that were transmitted with Inverse Multiplexing. IMA combines up to 8 T1 E1 links to form a single high-speed connection with flexible bandwidth options
- Unscrambling of ATM cells based on SDH $X^{43} + 1$ algorithm
- Advanced search and filtering capabilities
- Recorded raw data can be played back using raw data playback application

Real-time Analysis

ATM Protocol Analysis AAL2,5(UNI3.1)

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TScout	Frame#	TIME (Relative)	Len	VPI	VCI	PT	HEC	Frame Type	IMA	IMA ID	IMA Fra...	IMA Group State
✓ 1	4	0	00:00:00.000000	53	0	0	5	100	ATM-Cell	IMA Control ...	1	106	Operational
✓ 2	4	1	-00:00:00.086343	53	0	0	5	100	ATM-Cell	IMA Control ...	2	89	Operational
✓ 1	4	2	00:00:00.001656	53	100	101	0	110	ATM-Cell				
✓ 2	4	3	-00:00:00.084687	53	100	101	0	110	ATM-Cell				
✓ 1	4	4	00:00:00.003312	53	100	101	0	110	ATM-Cell				

Device1 TScout=4 Frame=0 at 00:00:00.000000 OK Len=53

ATM Frame Data

```

===== ATM Layer =====
0000 GFC                = 0000.... (0)
0000 VPI                = 0 (...0000 0000....)
0001 VCI                = 0 (...0000 00000000 0000....)
0003 PT                 = ....101. (5)
0003 CLP                = .....1 (1)
0004 HEC                = 01100100 (100)
===== OAM Layer =====

```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+-----+-----+
00 00 00 0B 64 03 80 6A 00 07 04 01 A2 00 00 00      d | j   e
00 FC 00 00 00 00 00 00 00 00 00 00 00 00 00 00      ü
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 02 D1                                         Ñ

```

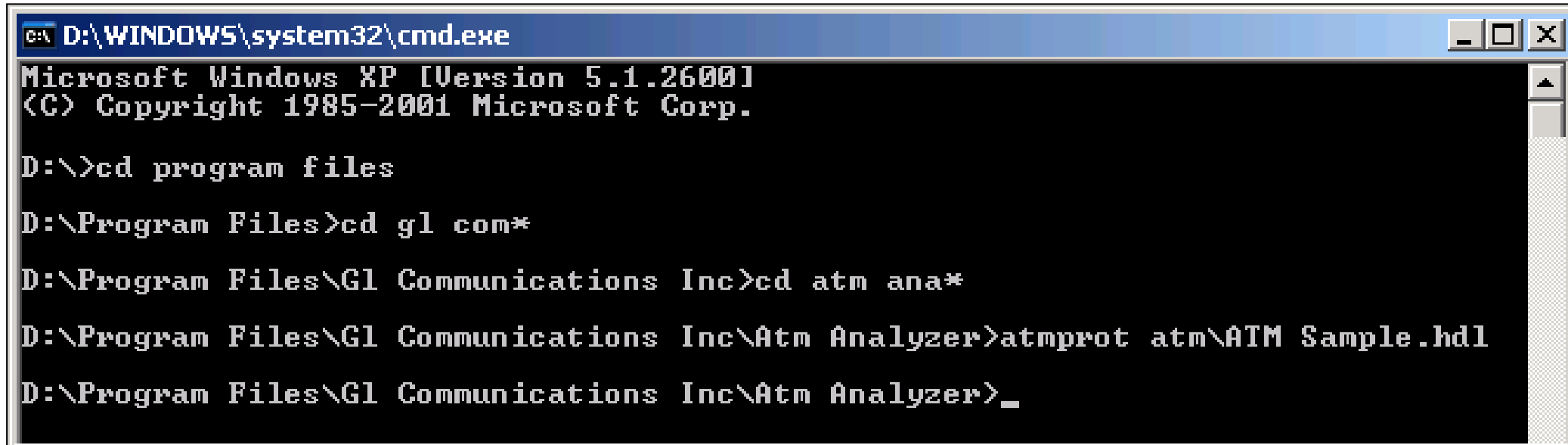
Running. Utilization 0.00% C:\Temp.Hdl Captured 154 669 frames

Stream Selection for Real-time Capture

The screenshot shows the 'Protocol Capture Configuration' window. The left sidebar contains the following options: Capture File Options, Card & Stream Selection (highlighted), Capture Filter, Reassembly Options, and Gui & Protocol Options. The main area is titled 'Card and Time Slot Selection' and contains a table with columns for 'PORT ACTIONS' and 'Port \ TS' (00-26). Two rows are visible, both with '1' and '2' in the 'Port \ TS' column. The 'PORT ACTIONS' column contains icons for checkmark, X, copy, and paste. Below the table are several checkboxes: 'User (unchecked) / Network (checked)', 'Bit Inversion (1 <-> 0)', and 'Octet Bit Reversion (MSB <-> LSB)'. There are also radio buttons for 'ATM Mapping' (Direct Mapping selected, PLCP unselected) and a checkbox for 'SDH X^43+1' under 'Scrambler'. At the bottom, there is an 'Inverse Multiplexing' section with a checkbox and a dropdown menu for 'IMA Frame Size' set to 128. On the right side, there is a text box titled 'Row (Port) Select, Clear, Paste Oper' and a 'Paste Clipboard to Port List' section with an empty text input field.

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	24	25	26
✓ ✗ Ⓞ Ⓟ	1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23			
✓ ✗ Ⓞ Ⓟ	2	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23			

Opening Trace File from Command Prompt



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

D:\>cd program files
D:\Program Files>cd gl com*
D:\Program Files\Gl Communications Inc>cd atm ana*
D:\Program Files\Gl Communications Inc\Atm Analyzer>atmprot atm\ATM Sample.hdl
D:\Program Files\Gl Communications Inc\Atm Analyzer>_
```

- The trace files can be loaded using the command prompt

Import Captured Files

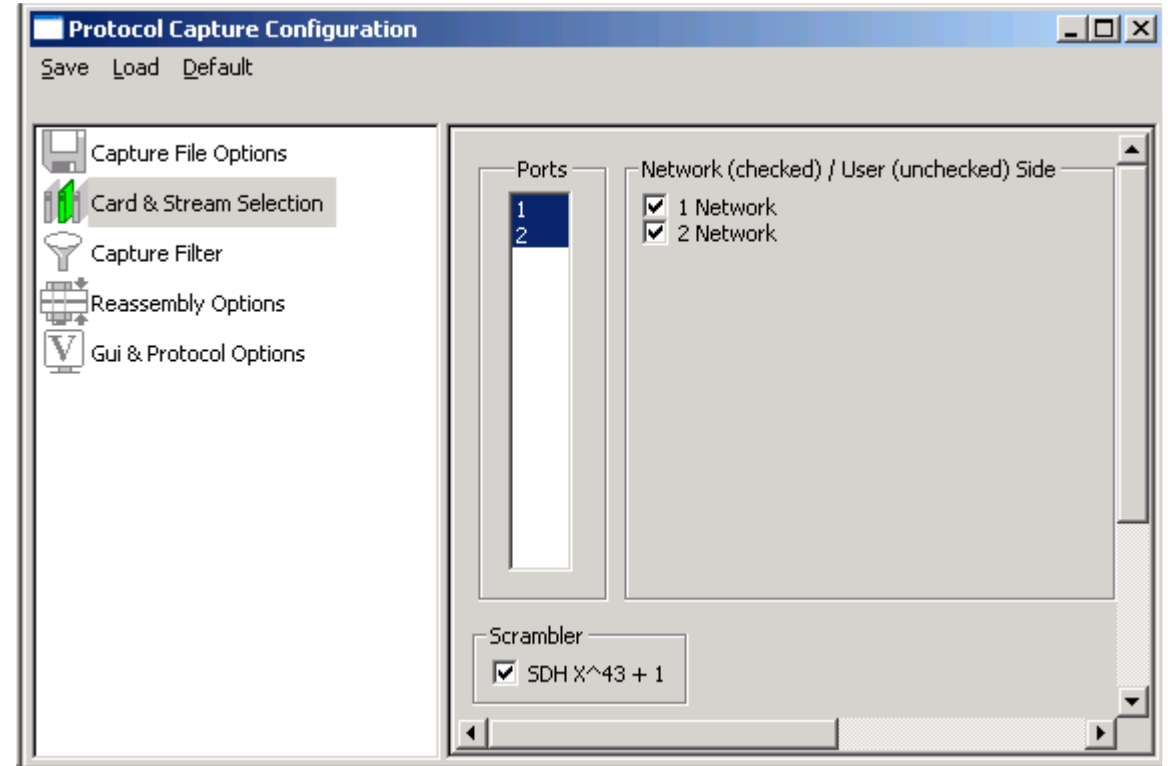
- ATM Import Plug-in (AIP) is an option can open off-line files, apply filter and re-assembly according to the user specified criteria

Applications

- Can be used as independent standalone units as "probes" integrated in a network surveillance systems
- Triggering, collecting, and filtering for unique subscriber information and relaying such information to a back-end processor
- Collecting Call Detail Records (CDR) information for billing

Real-time Analysis

- Capture and analysis of the frames in real-time or offline
- ATM raw data capturing requires users to specify ports, user/network side, and scrambling options
- Recorded trace file can then be analyzed offline and exported to ASCII file, or printed



Real-time Filtering and Search Criteria

- Specify custom VPI, VCI, and PT type values to filter frames during real-time capture
- Similarly, search capability helps user to search for a particular frame based on specific search criteria

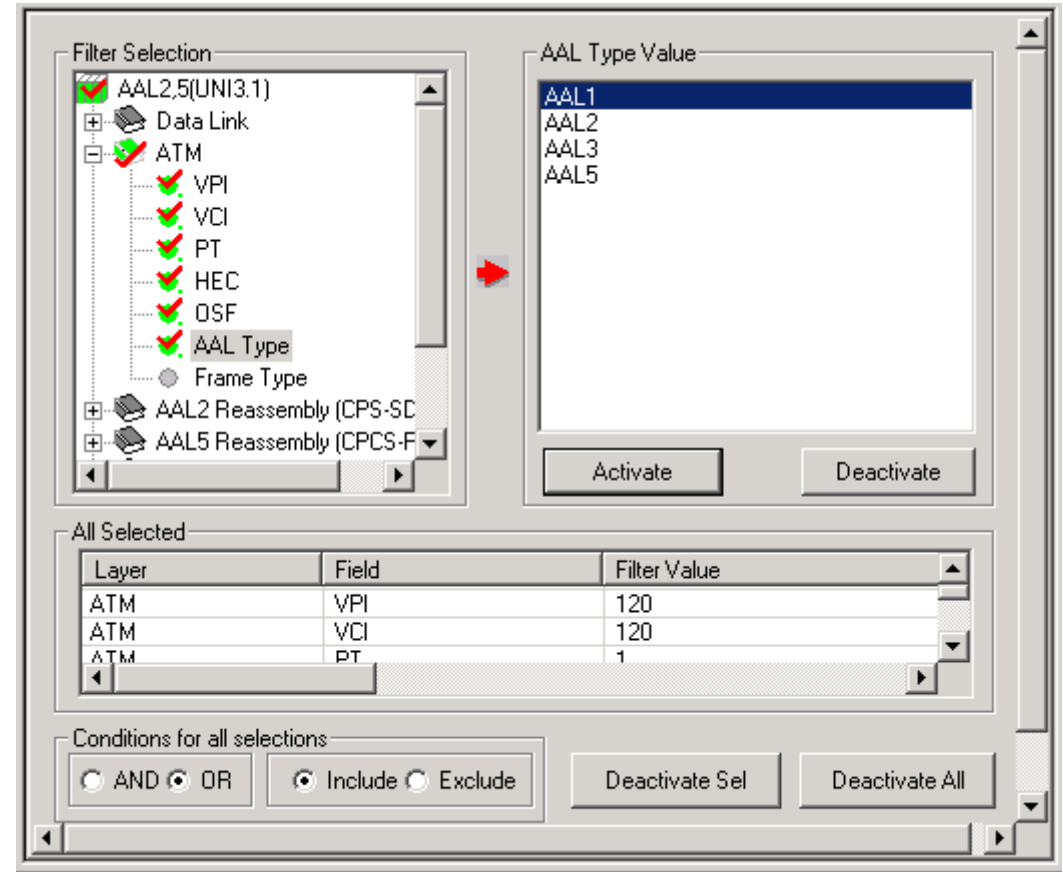
The image shows a software dialog box titled "ATM Layer" with several sections for configuring filters and search criteria:

- Idle Cells:** A section containing a checked checkbox labeled "Capture when checker".
- AND / OR:** A section with two radio buttons, "AND" and "OR", where "OR" is selected.
- VPI list:** An empty text input field.
- VCI list:** An empty text input field.
- PT:** A section containing a list box with the values "011", "100", "101", and "110". The "011" value is highlighted in blue. To the right of the list box are two buttons: "Select ALL" and "Clear ALL".

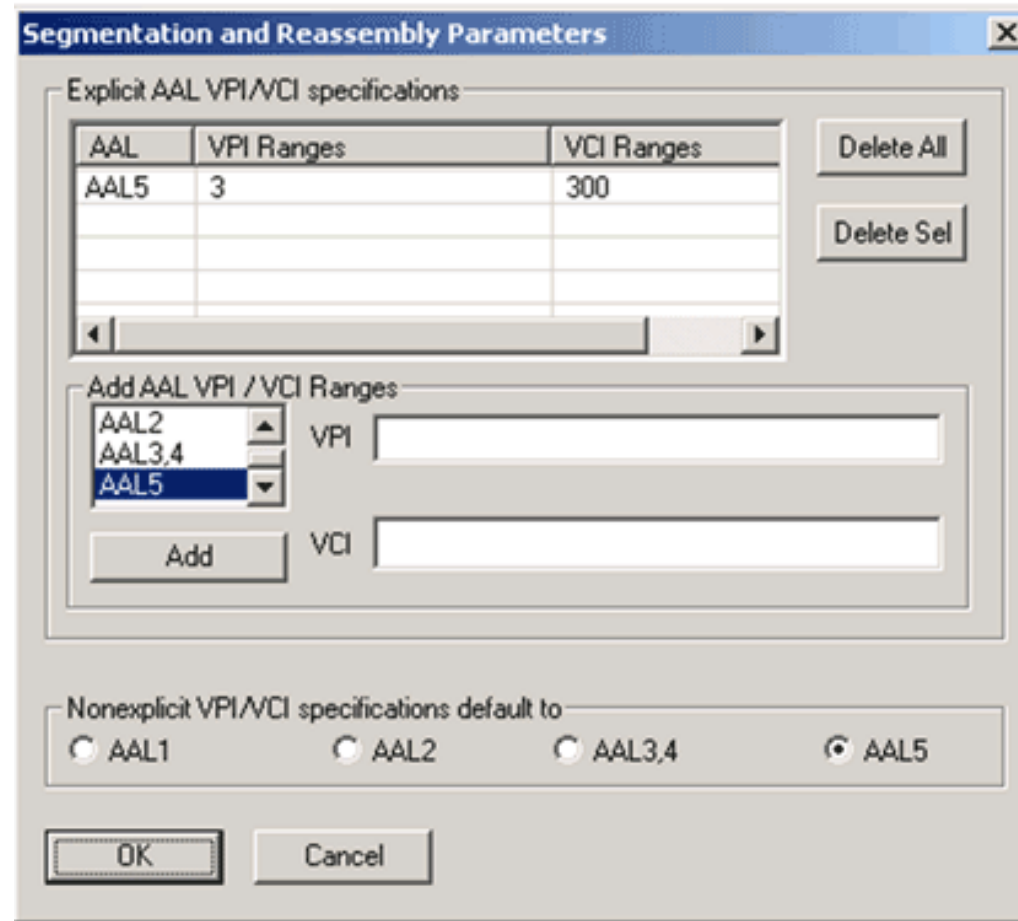
At the bottom of the dialog box, there is a "Clear ALL" button.

Offline Filtering and Search Criteria

- Filtering capability adds a powerful dimension
- Isolate frames of interest from all frames in real-time, as well as offline
- Can specify custom values to filter frames for real-time capture



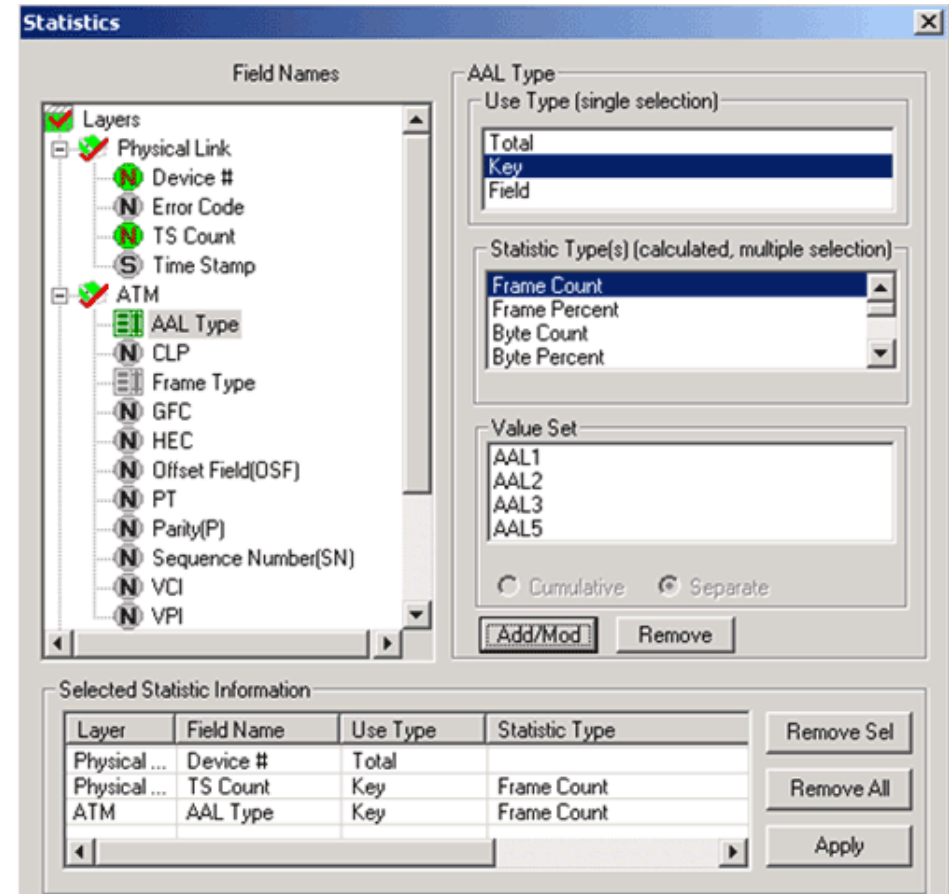
Reassembly Option in ATM Analyzers



- Reassembly option is used to specify VPI /VCI value to reassemble as per the Segmentation and Reassembly rules

Statistics

- Statistics can be obtained for all frames both in real-time as well as offline mode
- Numerous statistics are obtained to study the performance and trend in the analyzer's network
- It is based on protocol fields and different parameters e.g., Use Type (Key/Total/Field), Statistic type (Frame count, Byte count, Frames/Sec) and patterns like Range List, Wild card



Statistics View in ATM Analyzer

ATM Protocol Analysis AAL2,5(UNI4.0)

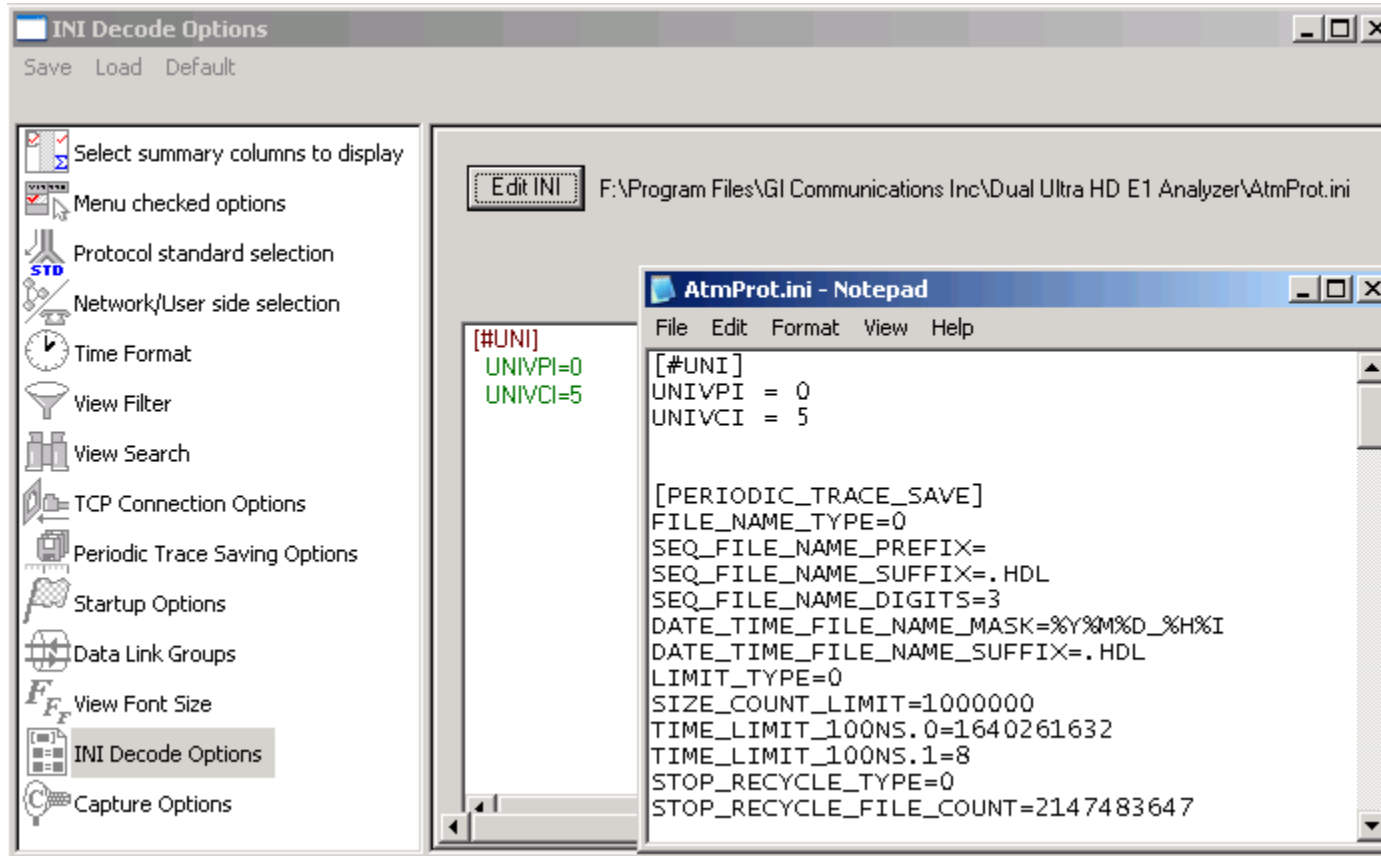
File View Capture Statistics Database Call Detail Records Configure Help

Dev	Frame#	TIME (Relative)	Len	Error	VPI	VCI	PT	HEC	OSF	AAL Type	Frame Type
✓ 3	0	00:00:00.000000	52		4	101	1	20		AAL2	CPS-Frame
✓ 3	1	00:00:00.000000	50		4	101	1	20		AAL2	SSSAR-Frame
✓ 4	2	00:00:00.000119	53		4	101	0	26	0	AAL2	ATM-Cell
✓ 4	3	00:00:00.000119	52		4	101	0	26		AAL2	CPS-Frame
✓ 4	4	00:00:00.000119	50		4	101	0	26		AAL2	SSSAR-Frame
✓ 3	5	00:00:00.000276	53		4	101	1	20	0	AAL2	ATM-Cell
✓ 3	6	00:00:00.000276	52		4	101	1	20		AAL2	CPS-Frame
✓ 3	7	00:00:00.000276	50		4	101	1	20		AAL2	SSSAR-Frame
✓ 4	8	00:00:00.000395	53		4	101	0	26	0	AAL2	ATM-Cell
✓ 4	9	00:00:00.000395	52		4	101	0	26		AAL2	CPS-Frame
✓ 4	10	00:00:00.000395	50		4	101	0	26		AAL2	SSSAR-Frame
✓ 3	11	00:00:00.000552	53		4	101	1	20	0	AAL2	ATM-Cell
✓ 3	12	00:00:00.000552	52		4	101	1	20		AAL2	CPS-Frame

Device #	Frame Type	Frame Count(Frame Ty...
3	ATM-Cell (0)	357
4	ATM-Cell (0)	379
Total	total ATM-Cell (0)	736
3	CPS-Frame (1)	358
4	CPS-Frame (1)	379
Total	total CPS-Frame (1)	737
3	SSSAR-Frame (2)	358
4	SSSAR-Frame (2)	379
Total	total SSSAR-Frame (2)	737

Filter is active. C:\Program Files\GL Communication Ftr 2210 of 2864 frames

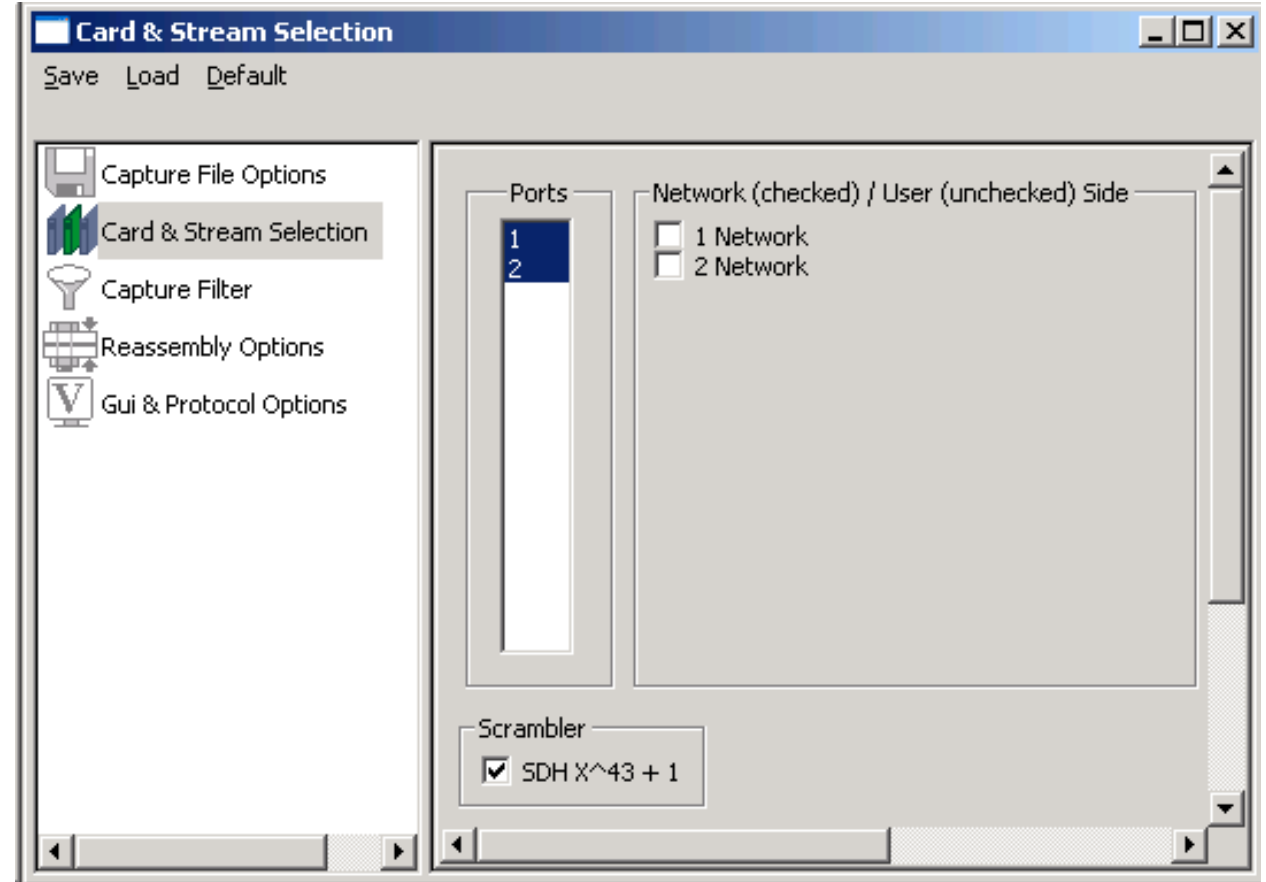
Configuring INI Decode Options



- Currently applicable to only ATM analyzer, INI configuration file enables the user to enter custom values for PVC carrying UNI signaling messages to get the proper decoding

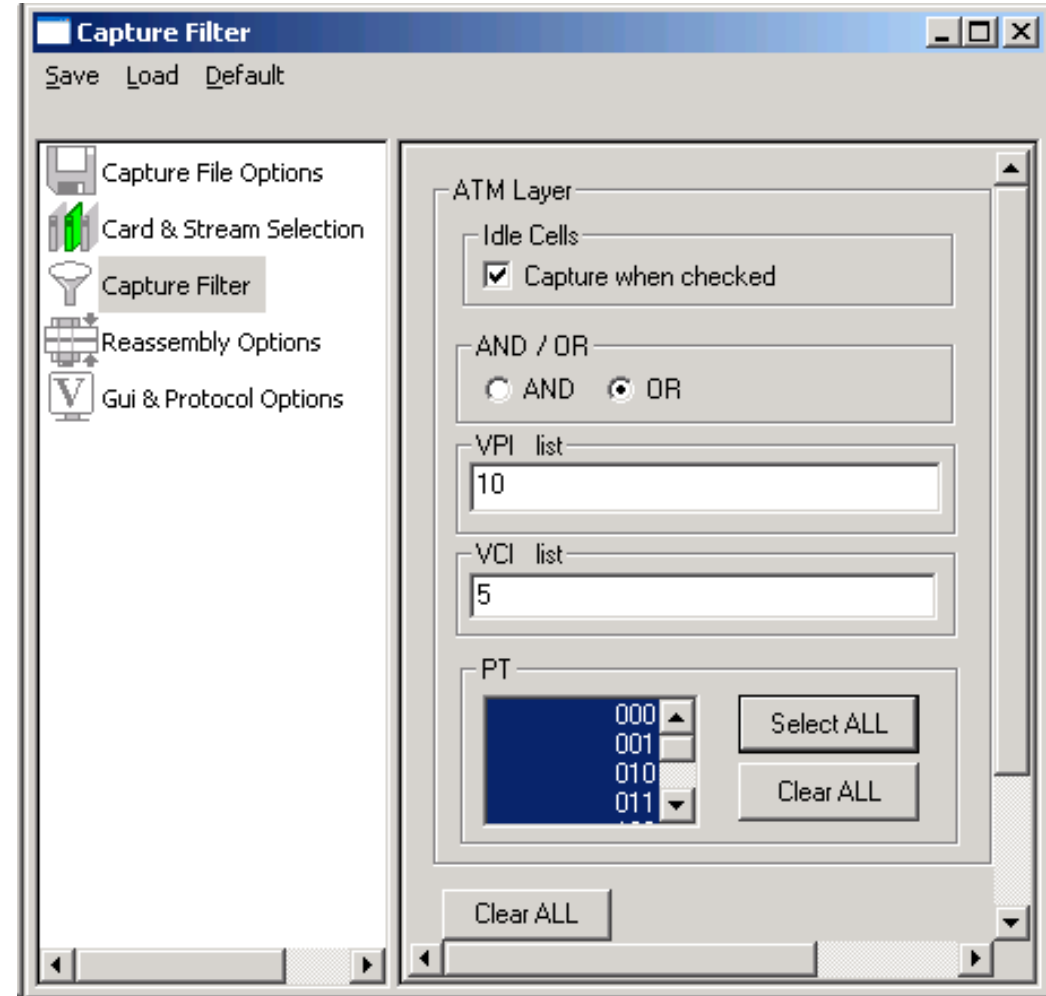
Real-time Analysis

- Captures, decodes, filters, and reassembles AAL2 and AAL5 frames in real-time, from within the ATM cells according to user defined VPI/VCI
- ATM raw data capturing requires users to specify ports, user/network side, and scrambling options
- Recorded trace file can then be analyzed offline and exported to ASCII file, or printed



ATM Based Capture Filter

- Real-time filter for ATM based protocols allows the capture of frames with defined VPI and VCI values
- Can specify multiple values for the options



ATM Header Info - ATM SSCS Layer

ATM Protocol Analysis AAL2,5(UNI3.1)

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TScout	Frame#	TIME [...]	Len	Error	VPI	VCI	PT	HEC	OSF	AAL Type	Frame Type	IMA	IMA ID	IMA Fr
✓ 1	24	0	00:00:...	11		14	1223	4	0		AAL2	CPS-Frame			
✓ 1	24	1	00:00:...	13		14	1223	4	0		AAL2	CPS-Frame			
✓ 1	24	2	00:00:...	13		14	1223	4	0		AAL2	CPS-Frame			
✓ 1	24	3	00:00:...	14		14	1223	4	0		AAL2	CPS-Frame			
✓ 1	24	4	00:00:...	14		14	1223	4	0		AAL2	CPS-Frame			
✓ 1	24	5	00:00:...	14		14	1223	4	0		AAL2	CPS-Frame			

Device1 TScout=24 Frame=0 at 00:00:00.000000 OK Len=11

ATM Frame Data

```

===== ATM Layer =====
0000 VPI = 14 (00000000 1110....)
0001 VCI = 1223 (....0000 01001100 0111....)
0003 PT = ....100. (4)
0003 CLP = .....1 (1)
0004 HEC = 00000000 (0)
===== AAL2 Reassembly (CPS-SDU) Layer =====
CPS-Paket Header
0005 Channel Identifier (CID) = 162 (xA2)
0006 Length Indicator (LI) = 000010.. (2)
0006 User-to-User Indication (UUI) = 31 (.....11 111.....)
0007 HEC = ...10101 (21)
===== SSCS Layer =====
Alarm Packet
0008 OAM Type = 1100.... External Alarms
0008 Function Type(For External Alarms) = ....0001 External RAI
0009 Message Type = 000000.. Alarm/Loopback Packet
0009 CRC = 547 (.....10 00100011)
    
```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+-----+-----+
00 E0 4C 79 00 A2 0B F5 C1 02 23          àIy c ŠÁ #
    
```

Off-line Viewing C:\Program Files\GL Communications Inc\Laptr 17 Frames

Physical Layer Analyzer

- Captures LOS, LOF, AIS, IDLE, RAI/X-BIT, Excessive 0's alarms at T3 E3 level
- Captures Sync Loss, Carrier Loss, AIS, Blue, Yellow, Distance MF, Frame Error alarms at T1 E1 level
- Alarms can be captured for a specified time interval
- Advanced filtering and search based on any user selected alarms
- Displays Summary, Detail, Hex-Dump, and Statistics views
- Exports Summary and Detail View information to an ASCII file
- Provides options to save captured alarms into an HDL file and these files can be imported offline for further analysis
- Channelized T3 E3 application can monitor Physical Layer Alarms up to 336 ports
- USB T3 E3 application can monitor Physical Layer Alarms up to 12 ports

Dev	Frame#	TIME (Relative)	Len	Error	LOF Alarm Status Physical	LOS Alarm Status Physical	AIS Alarm Status Physical	IDLE Alarm Status Physical	RAI/X-BIT Alarm Status Physical	Excessive 0's Alarm Status Physical
3	3254	00:01:32.791000	12		ON	ON	off	off	clf	
4	3255	00:01:32.794000	12		off	off	off	off	clf	
1	3256	00:01:32.898000	12		ON	ON	off	off	clf	
2	3257	00:01:32.900000	12		ON	ON	off	off	clf	
3	3258	00:01:32.905000	12		ON	ON	off	off	clf	
4	3259	00:01:32.909000	12		off	off	off	off	clf	
1	3260	00:01:33.014000	12		ON	ON	off	off	clf	
2	3261	00:01:33.017000	12		ON	ON	off	off	clf	
3	3262	00:01:33.020000	12		ON	ON	off	off	clf	
4	3263	00:01:33.023000	12		off	off	off	off	clf	
1	3264	00:01:33.126000	12		ON	ON	off	off	clf	
2	3265	00:01:33.130000	12		ON	ON	off	off	clf	
3	3266	00:01:33.133000	12		ON	ON	off	off	clf	
4	3267	00:01:33.136000	12		off	off	off	off	clf	

```
Device3 TScout=0 Frame=3254 at 00:01:32.791000 OK Len=12 *** Right click to SHOW/HIDE layer details
ATM Frame Data
***** Physical Layer *****
0000 Type = 00000011 T3/E3 Alarms
0001 Counter = 00000101 (5)
      LOS Alarm = 00000000 (0)
      LOS Alarm Status = 00000001 ON
      LOF Alarm = 00000001 (1)
      LOF Alarm Status = 00000001 ON
      AIS Alarm = 00000010 (2)
      AIS Alarm Status = 00000000 off
      IDLE Alarm = 00000011 (3)
      IDLE Alarm Status = 00000000 off
      RAI/X-BIT Alarm = 00000100 (4)
      RAI/X-BIT Alarm Status = 00000000 off
```


Observing T3 Alarms

Monitoring T3 Alarms in USB T3 Analyzer

- The Monitor T3 Alarms windows are used to show T3 line status - 4 ports are shown below. Alarms will track the T3 signals states. The **Green** LED indicates No Alarm, **Red** LED indicates Alarm is present, and **Yellow** LED indicates Alarm is detected (Active) and switches to Non-active state

The screenshot displays the USB T3 Analyzer software interface, showing four monitoring windows for ports #1, #2, #3, and #4. The main window has a menu bar (File, View, Config, Monitor, Applications, Help) and a toolbar with various icons. Below the toolbar, there are several dropdown menus for configuration: Rx Signal (Terminate), Loopback (None), Framing (C-Bit), Clock Source (Internal), Mode Selection (Structured [T3 to T1]), and Port Selection (Port 1). The four monitoring windows are arranged in a row, each showing a list of alarms with corresponding LED indicators (Green for No Alarm, Red for Alarm present, Yellow for Alarm detected/Active). The errors section shows counts for Frame Errors, P-Bit Parity, C-Bit Parity, FEBE Errors, BPV, and Excessive 0's. The signal input section shows Freq (Hz) and Level Vp (dBdsx).

Port	LOS	LOF	AIS	IDLE	RAI / X-BIT	Excessive 0's	Frame Errors	P-Bit Parity	C-Bit Parity	FEBE Errors	BPV	Excessive 0's	Freq (Hz)	Level Vp (dBdsx)
#1	Red	Red	Green	Green	Green	Red	3	1	0	0	65535	65535	---	---
#2	Red	Red	Green	Green	Green	Red	0	0	0	0	0	0	---	---
#3	Red	Red	Green	Green	Green	Red	0	0	0	0	0	0	---	---
#4	Green	Green	Green	Green	Green	Green	0	0	0	0	0	0	44 735 943	1.19 (4.6)

Thank you