
MLPPP Analysis and Emulation



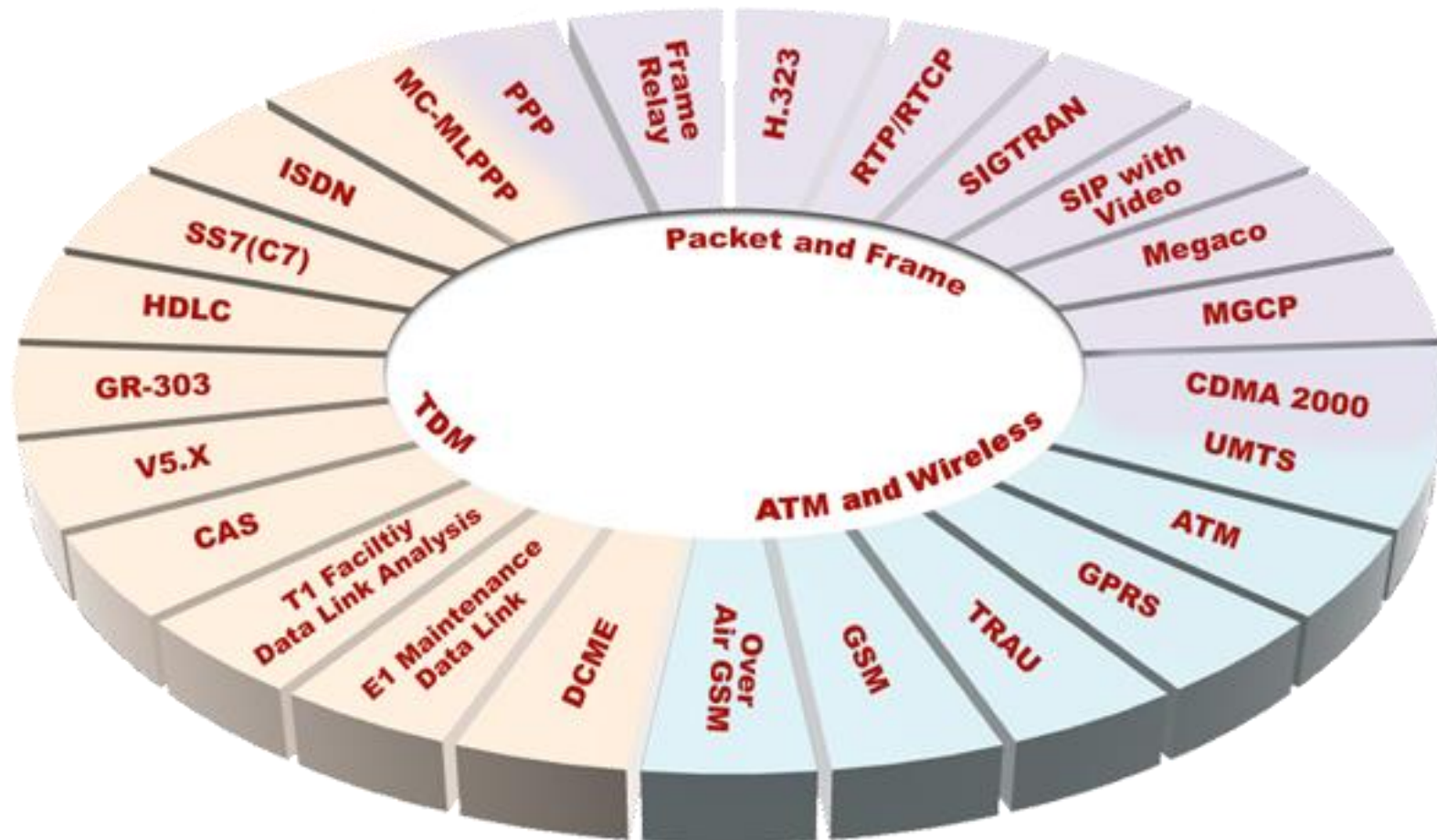
818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: info@gl.com
Website: <https://www.gl.com>

Index

- MC-ML PPP Emulation using Client – Server
 - PPP Simulation
 - MC - MLPPP Simulation
- Simulation using Command Line MLPPPTerr Module
- MLPPP Conformance Testing using MAPS™
- MLPPP Analyzer with Packet Data Analysis
- Call Data Records and Analysis using Excel®

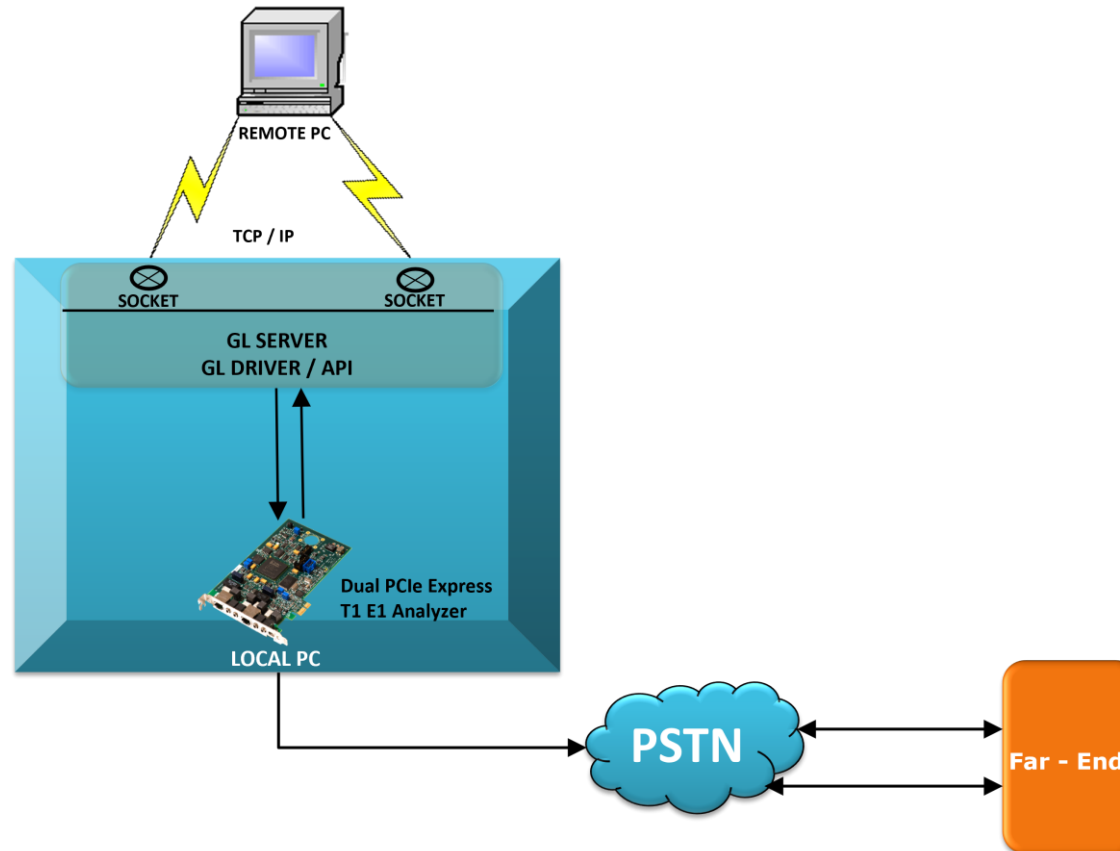
TDM, Wireless, and VoIP Protocol Analysis

- GL Communications provides a host of protocol analyzers for testing a variety of protocols
- Analysis may be done both in real-time and off-line



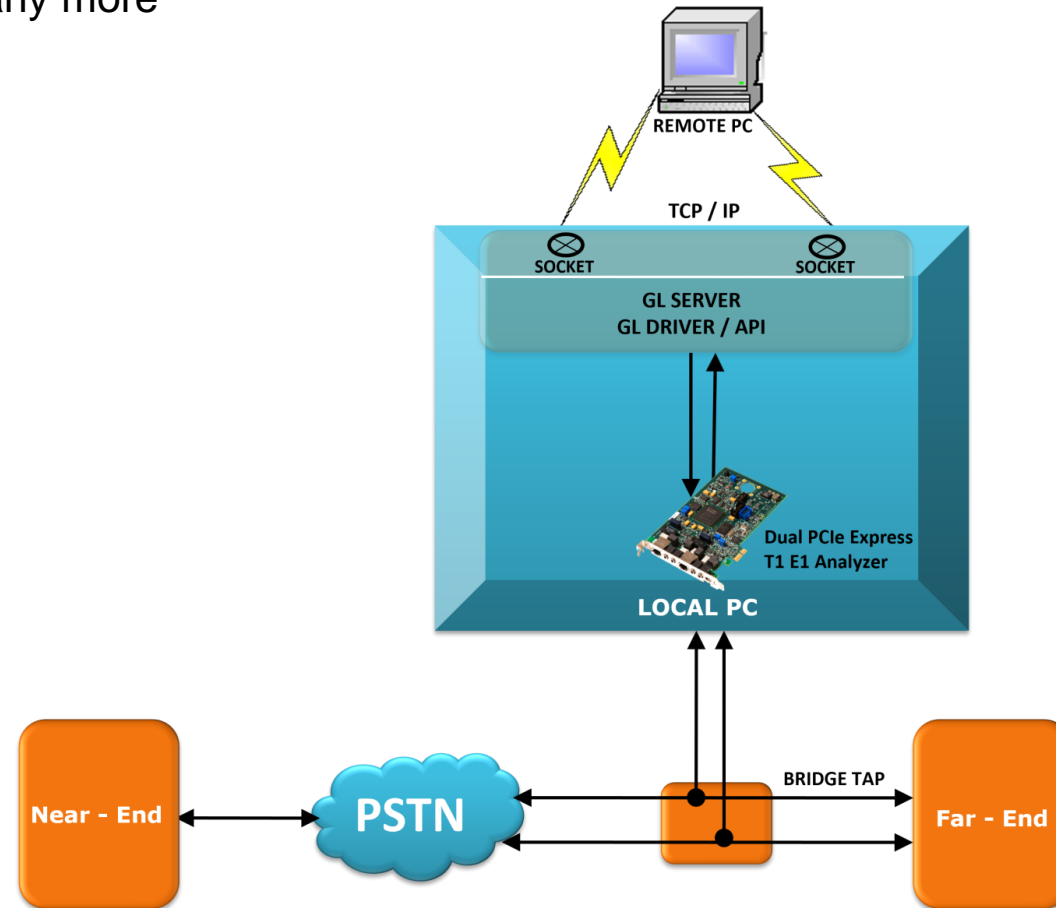
Types of Testing Intrusive and Non-Intrusive

- Intrusive Testing
- Example Applications:
 - BER Testing, Transmit Tone, Gaussian Noise, Transmit Multi frames, Signaling Bits, Error Insertion, Delay Measurement, Protocol Emulation



Types of Testing Intrusive & Non-Intrusive

- Non-Intrusive Monitoring
- Example Applications: Capture and Dialed digits, Call Capture & Analysis, Automated record playback, Playback from file, Protocol Analysis, and many more



Supported Platforms



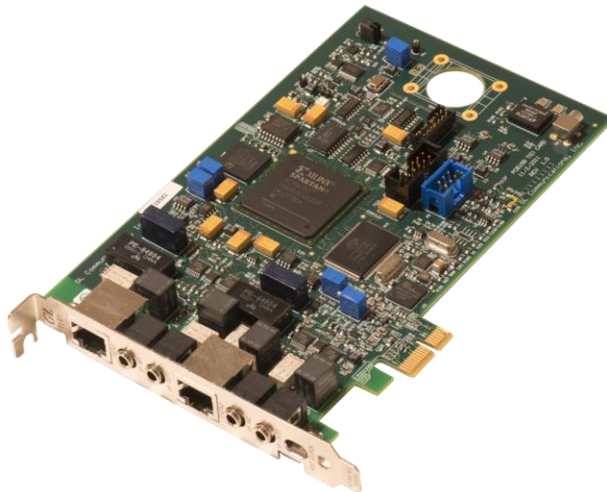
Front Panel

Back Panel

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

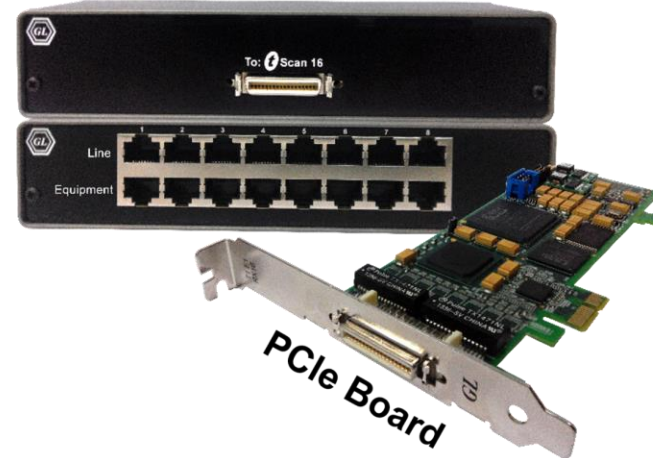


Quad / Octal T1 E1 PCIe Card



Dual T1 E1 Express (PCIe) Board

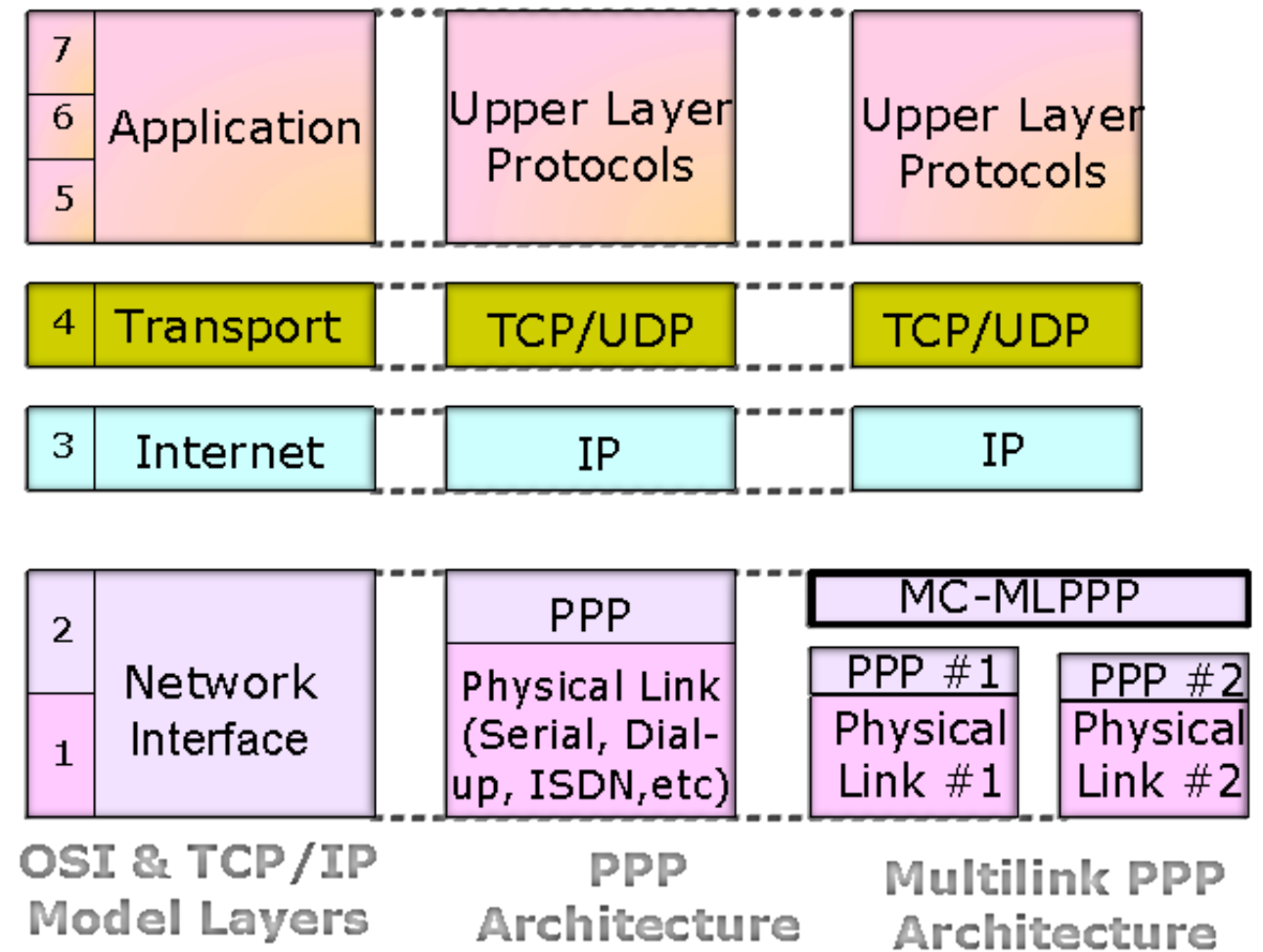
**tScan16™ with
16-port T1 E1 Breakout Box**



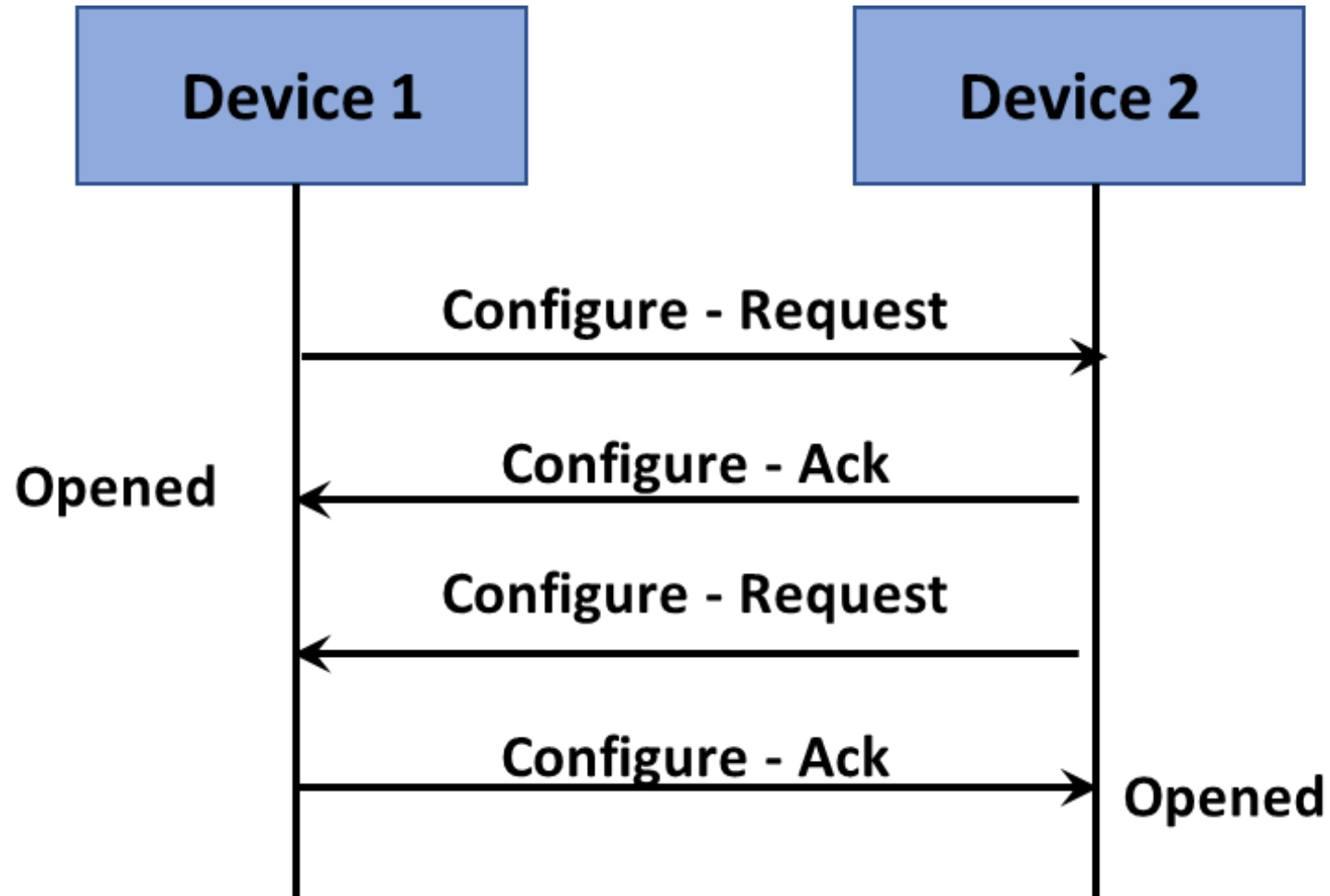
PCIe Board

Multilink PPP Protocol Standards

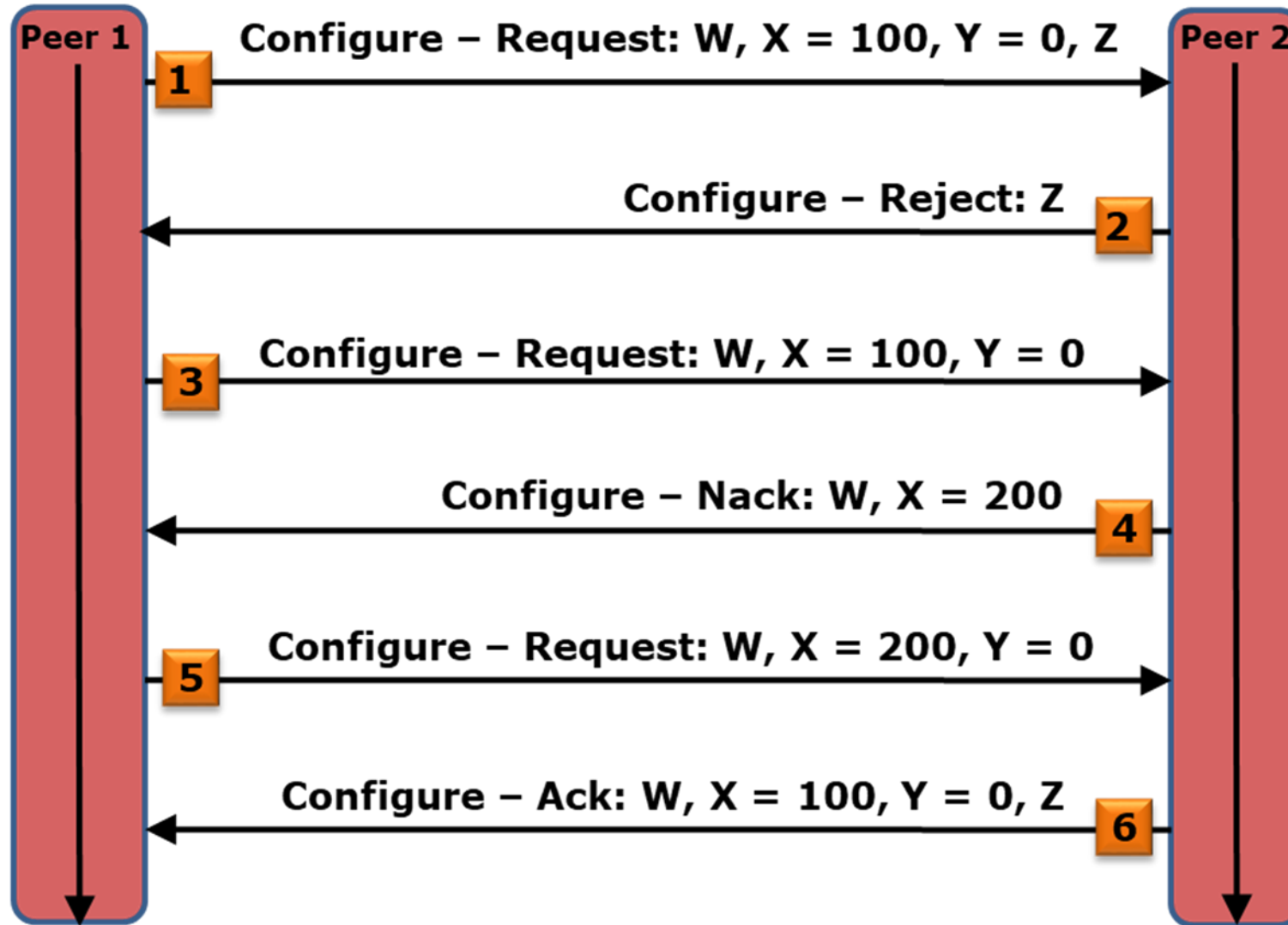
- Multilink PPP (MLP), as defined in RFC 1990, is a variant of PPP
- Aggregates multiple WAN links into single logical channel for the transport of traffic
- MLPPP bundles multiple link-layer channels into a single network-layer channel



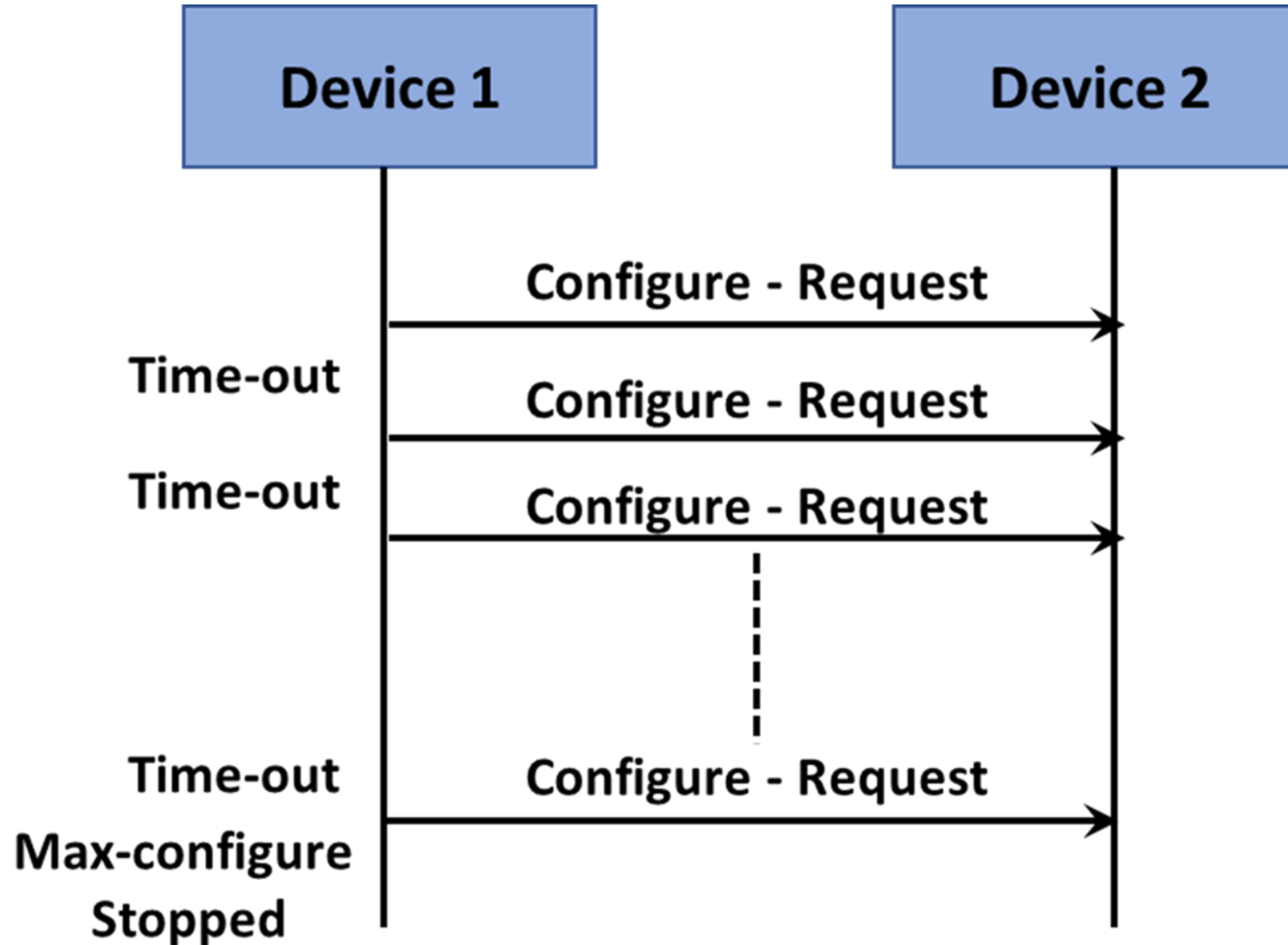
Link Configuration Protocol (LCP)



LCP Negotiation Options

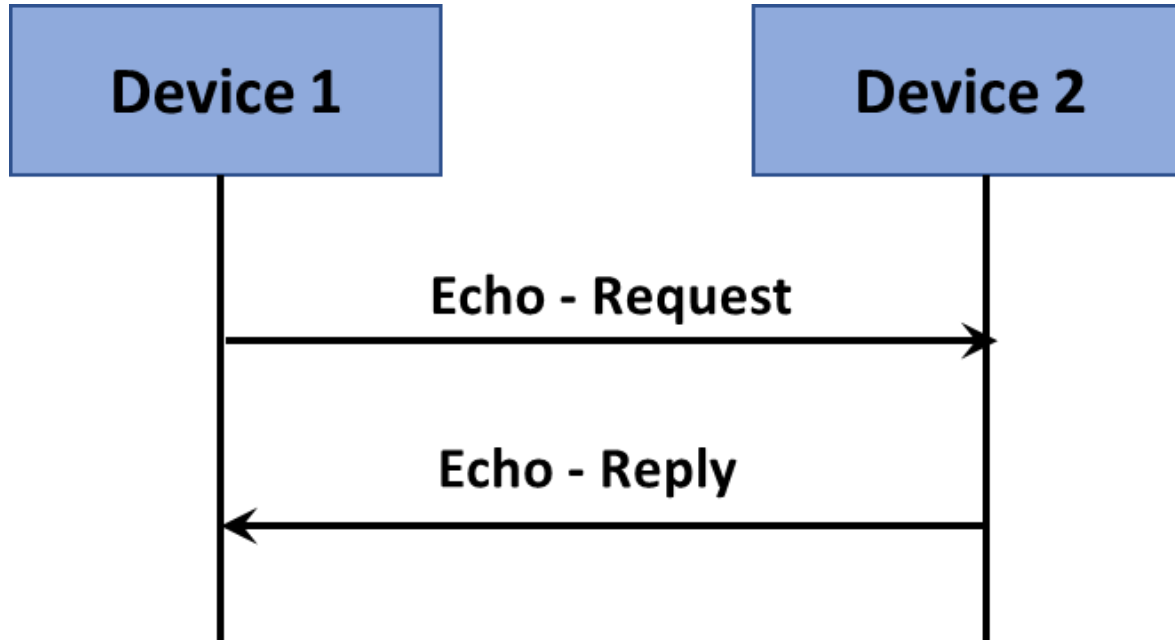


LCP Retransmission

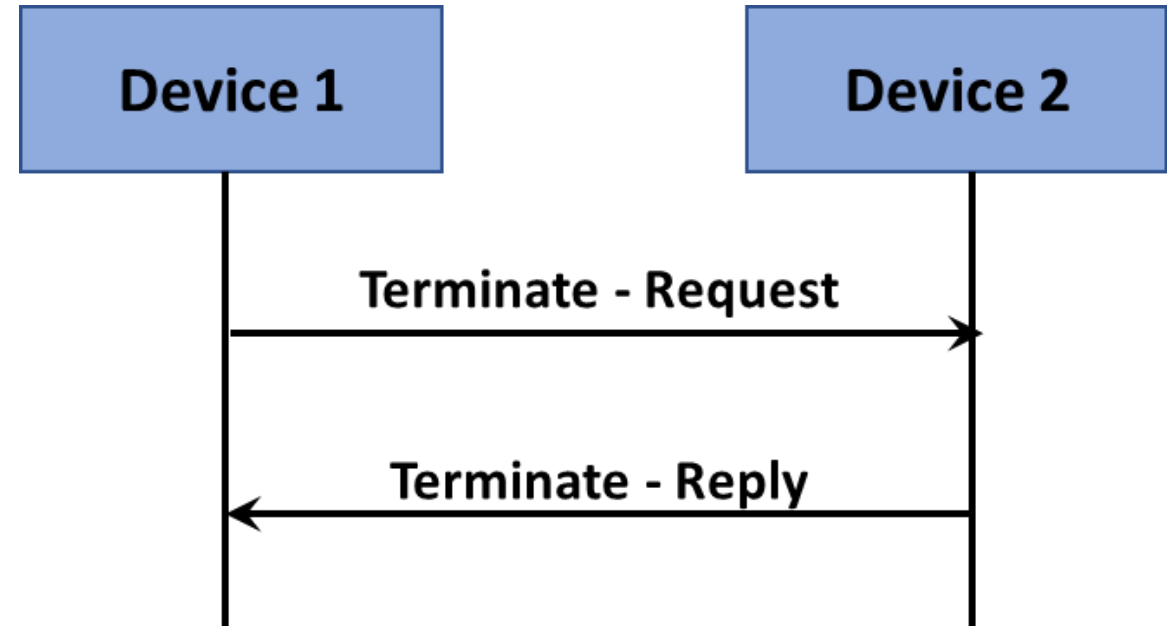


Link Maintenance and Termination

Link Maintenance



Link Termination



Network Control Protocols

IPCP (NCP for IP)

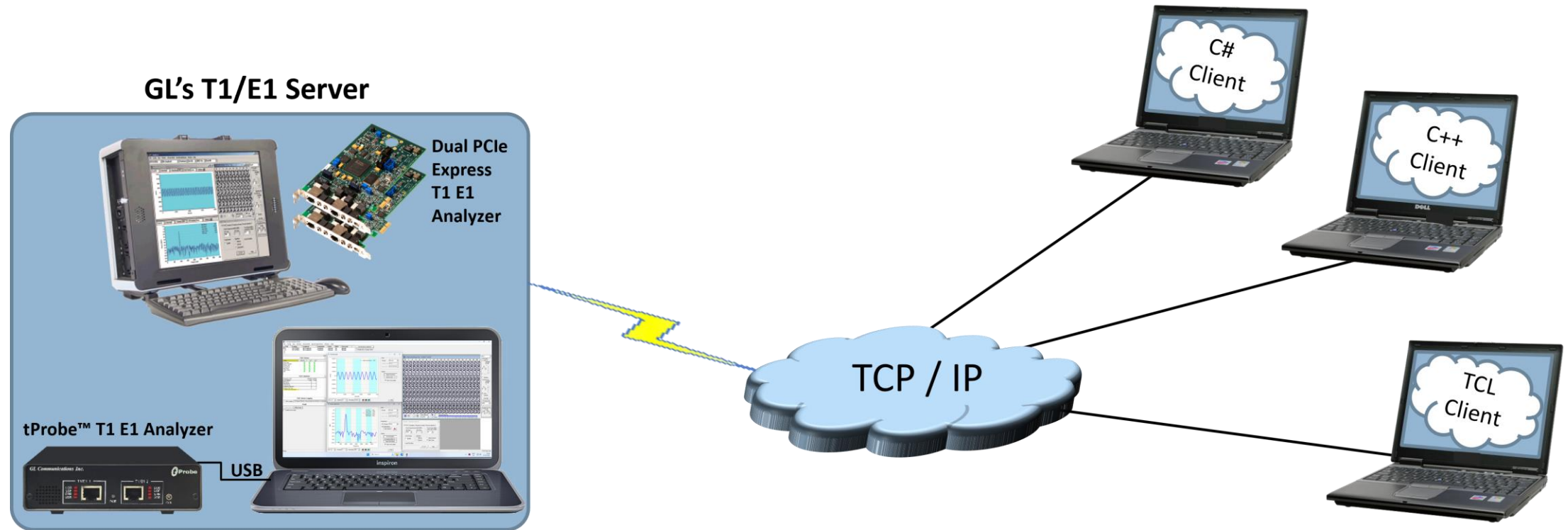
- Responsible for configuring, enabling, and disabling the IP protocol modules on both ends of the point-to-point link
- Supported IPCP standards:
 - RFC 1332 - The PPP Internet Protocol Control Protocol
 - RFC 1877 - PPP Internet Protocol Control Protocol Extensions for Name Server Addresses
- Supported IPCP negotiation options:
 - IP Address
 - IP Address Compression
 - RFC 1144 - Van Jacobson Compression
 - RFC 3544 - IP Header Compression over PPP
 - RFC 2508 - CRTP
 - RFC 2507 - IP Header Compression
 - Primary DNS Server Address
 - Primary NBNS Server Address
 - Secondary DNS Server Address
 - Secondary NBNS Server Address

Network Control Protocols BCP

- BCP is responsible for establishing and configuring Remote Bridging for PPP links
- Supported standard – RFC 3518
- Supported BCP negotiation options:
 - Bridge Identification
 - Line Identification
 - MAC Support
 - Tinygram Compression
 - MAC Address
 - Spanning Tree Protocol
 - IEEE 802 Tagged Frame
 - Management Inline
 - Bridge Control Protocol Indicator

MC-ML PPP Emulation using Client-Server

Windows Client Server MC-MLPPP Emulator



Features

| | |
|---|---|
| Remote operation | ✓ |
| Automation | ✓ |
| Multi-site connectivity | ✓ |
| Simultaneous testing of high capacity T1/E1 systems through a single Client | ✓ |
| Integration of T1/E1 testing into more complex testing systems | ✓ |
| Intrusive / Non-Intrusive T1/E1 Testing | ✓ |

Connect to T1 / E1 Server

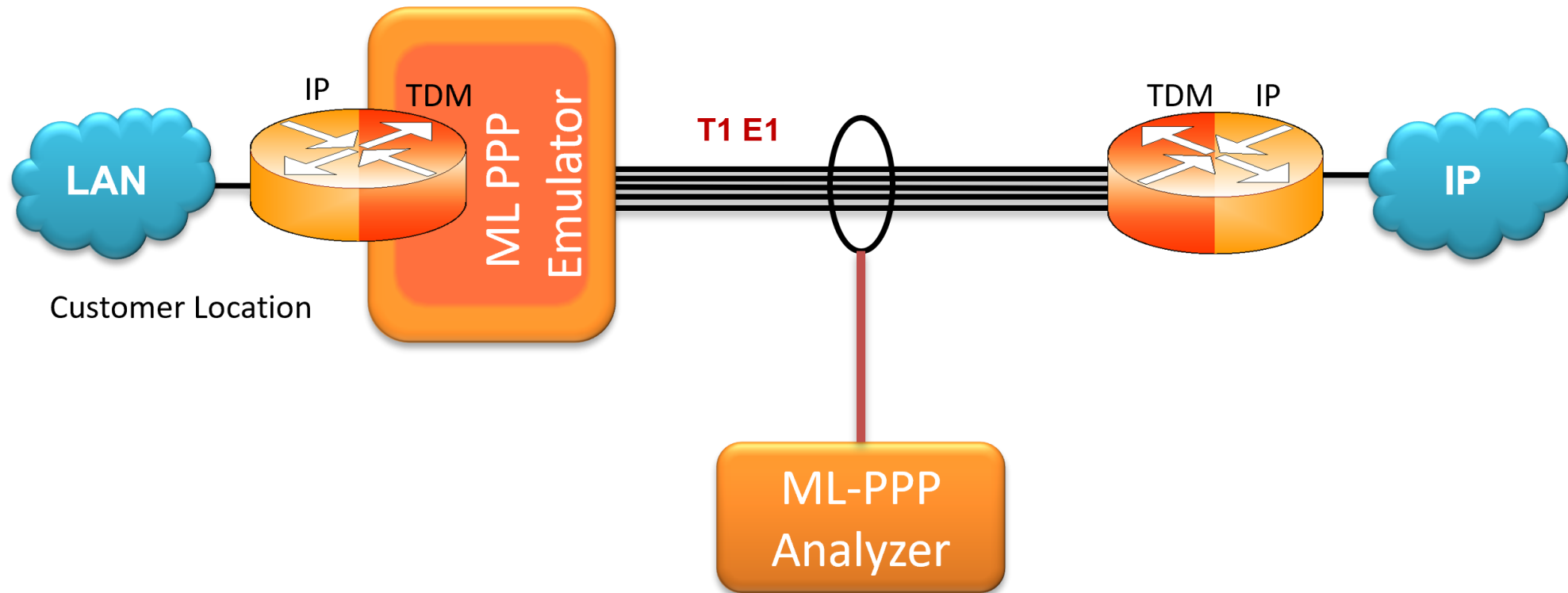
- T1 / E1 is software selectable
- Connects using the same parameters set in server

The screenshot shows a Windows-style dialog box titled "Start GL Server". It contains several configuration options:

- Listen Port:** A text box containing "17090", a dropdown menu showing "<Default>", and a "Restore Default" button.
- Start GL Server:** A large button to initiate the server.
- Exit:** A button to close the dialog.
- Server is Invisible:** A checkbox that is currently unchecked.
- Messaging:** A section with two radio buttons: "Send / Receive Binary Messages" (selected) and "Send / Receive ASCII Messages".
- Version:** A section with two radio buttons: "Send / Receive Version 3 Messages" and "Send / Receive Version 4 Messages" (selected).
- Use These Settings until Further Notice:** An unchecked checkbox.
- Start Server Automatically At Analyzer Start-Up:** An unchecked checkbox.

MC-MLPPP Emulator

- GUI based WCS client, which simulates MC-MLPPP and PPP protocols over T1/E1 links
- Capable of generating and receiving MC-MLPPP/PPP traffic (with or without impairments)
- Traffic source can be sequence number, HDL files (containing packets/frames), flat binary file, user-defined frames (ASCII HEX file), and Ethernet data



Features

- Performs MC-MLPPP as well as PPP simulation
- Supports LCP with the following negotiation options
 - PPP options: MRU, ACFC, PFC, and Magic Number
 - MLPPP Options: MRRU, Short/ Long Sequence Fragment Format, & Endpoint Discrimination
 - Multi-Class Options: Multilink Header Format
- Supports following NCP's:
 - IPCP - RFC 1332 and RFC 1877 standards
 - BCP - RFC 3518 standard
 - PPPMuxCP - RFC 3513 PPP Multiplexing
- Supports PPP Multiplexed data transmission/reception in both PPP and MLPPP frames conforming to RFC 3513
- Supports LCP Echo Test at PPP and MLPPP level
- Payload traffic generation and verification (Sequence number, HDL file (containing packets/frames), Flat Binary file, Ethernet traffic, and User defined frames (ASCII HEX file))
- Transmit and receive Ethernet traffic over T1/E1 links in bridge or router mode

Features

- Differential link delay insertion between PPP links during transmission
- User configurable bandwidth using flags
- Supports fragmentation and reassembly at MLPPP level
- Supports various impairments at PPP link layer and MLPPP Layer
- Provides detailed PPP and MLPPP statistics
- Provides detailed test (Tx/Rx) results per class / per link in GUI as well as through log file in command line
- Ideal solution for automated testing using command line scripts
- Support for HDLC framing with CRC16, CRC32 or without CRC
- Supports IP compression
 - RFC 3544 – IP Header Compression over PPP
 - RFC 1144 - Van Jacobson TCP/IP Compression
 - RFC 2507 - IP Header Compression
 - RFC 2508 - Compressed RTP

Supported Protocols

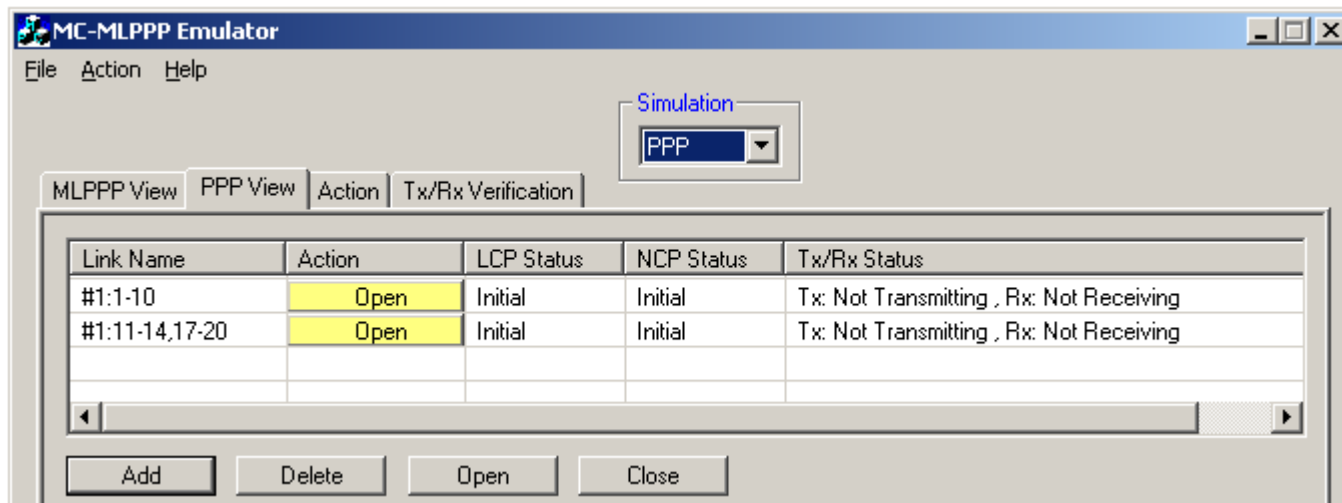
- Point-to-Point Protocol (RFC 1661)
- PPP links in HDLC framing (RFC 1662)
- Multi-link PPP (RFC1990)
- Multi-class extension to MLPPP (RFC 2686)
- Internet Protocol Control Protocol (IPCP) (RFC 1332)
- Internet Protocol Control Protocol Extensions for Name Server Addresses (RFC 1877)
- Bridging Control Protocol (RFC 3518)
- PPP Network Control Protocol for PPP Multiplexing (PPP Mux CP - RFC 3513)

PPP Simulation

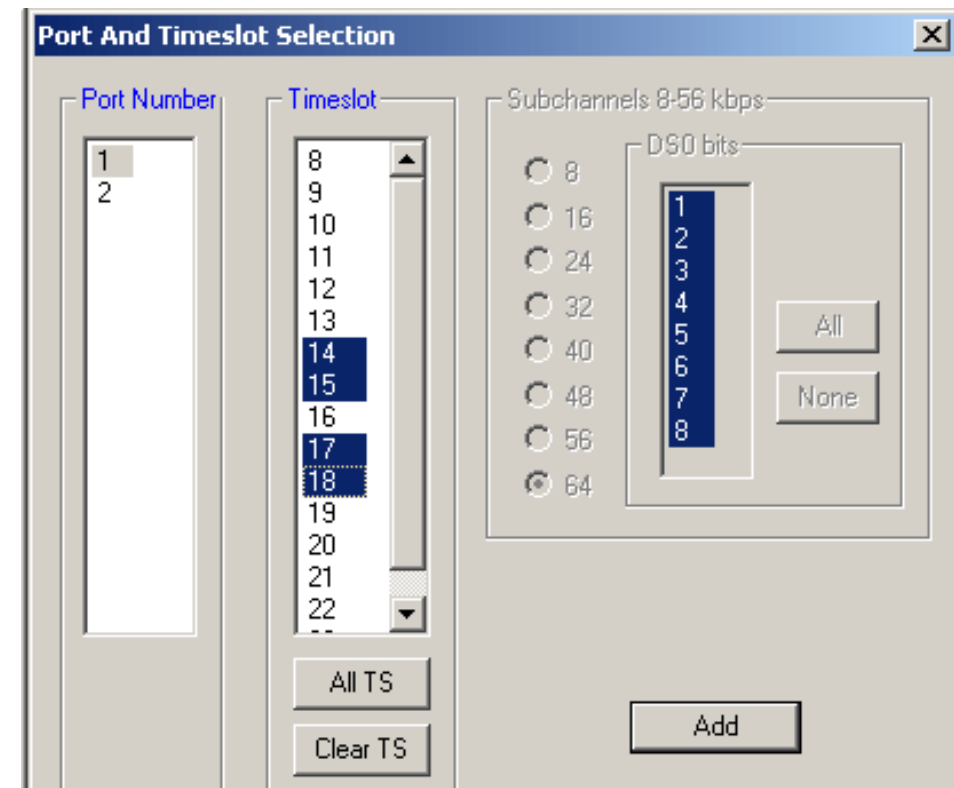
Adding PPP Links

- Supports up to 16 T1/E1 links
- Timeslot of 64 Kbps or a Hyper Channels of $n \times 64$ Kbps or sub channels can also be used
- Supports hyper channels with continuous or discontinuous (sparse) timeslots
- Each link is independent and can be configured with the selected LCP options

Added PPP Links

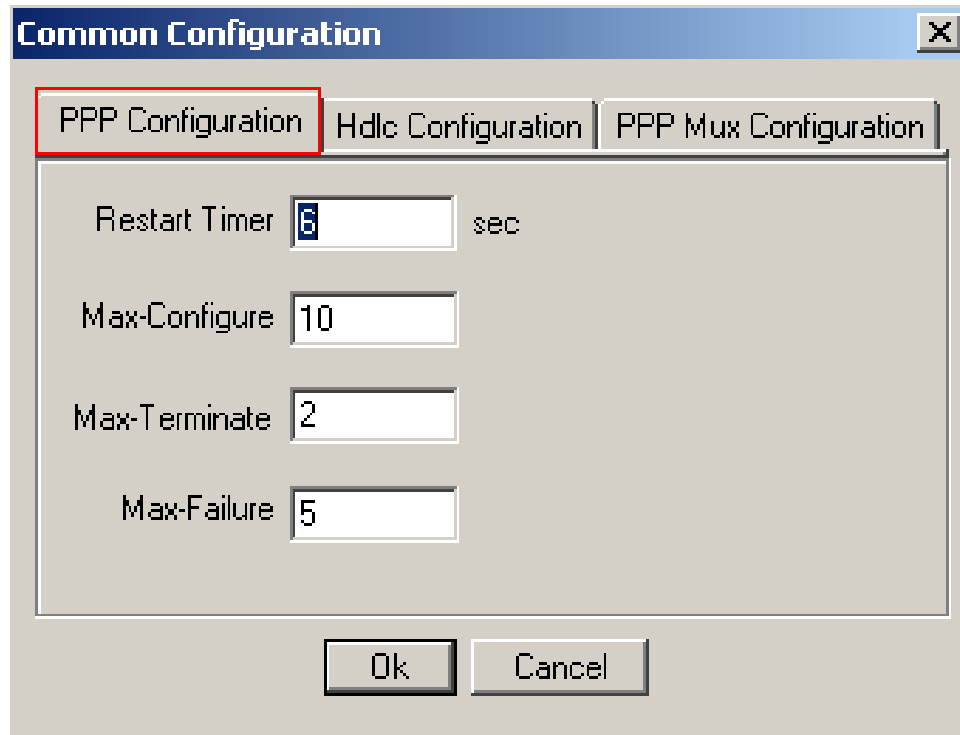


Link Selection



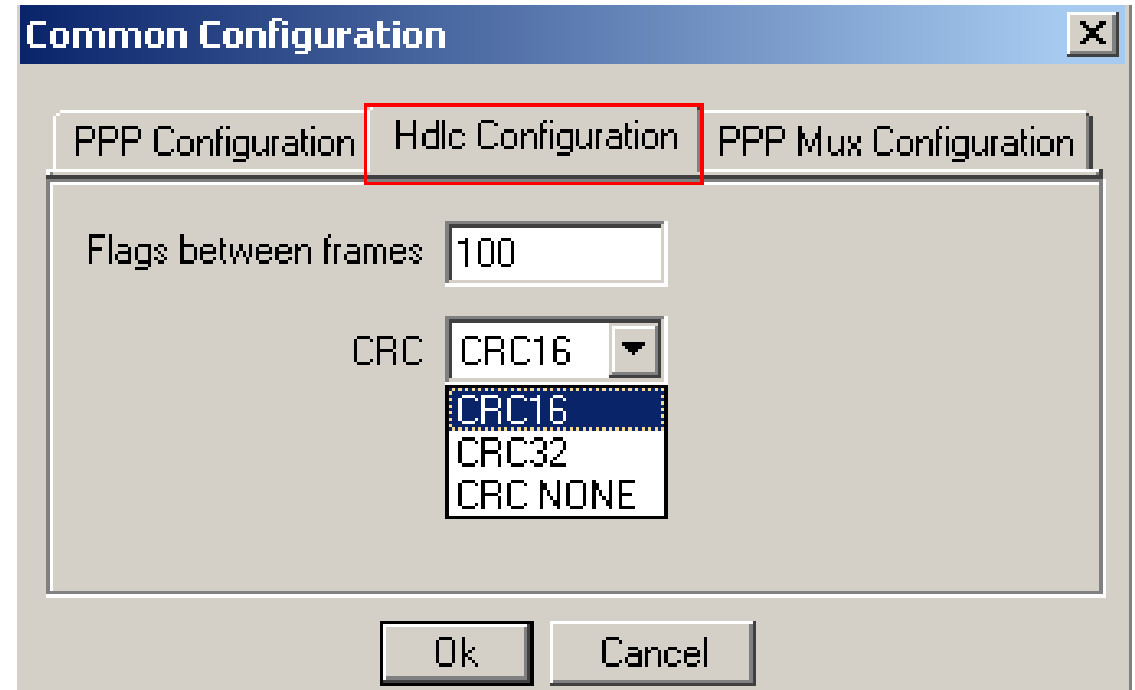
Common Configuration – PPP and HDLC

- PPP Configuration Parameters:
- User configurable LCP parameters, like Restart-timer, Max-Configure, Max-Terminate, and Max-Failure, can be set for all PPP links
- HDLC Configuration Parameters:
- User configurable HDLC configuration parameters for HDLC framing with CRC 16, CRC 32 or without CRC can be set for all PPP links
- User configurable number of flags between HDLC frames



The image shows the 'Common Configuration' dialog box with the 'PPP Configuration' tab selected. The tab is highlighted with a red rectangle. The dialog contains four input fields: 'Restart Timer' set to 6 sec, 'Max-Configure' set to 10, 'Max-Terminate' set to 2, and 'Max-Failure' set to 5. At the bottom are 'Ok' and 'Cancel' buttons.

| Parameter | Value |
|---------------|-------|
| Restart Timer | 6 sec |
| Max-Configure | 10 |
| Max-Terminate | 2 |
| Max-Failure | 5 |

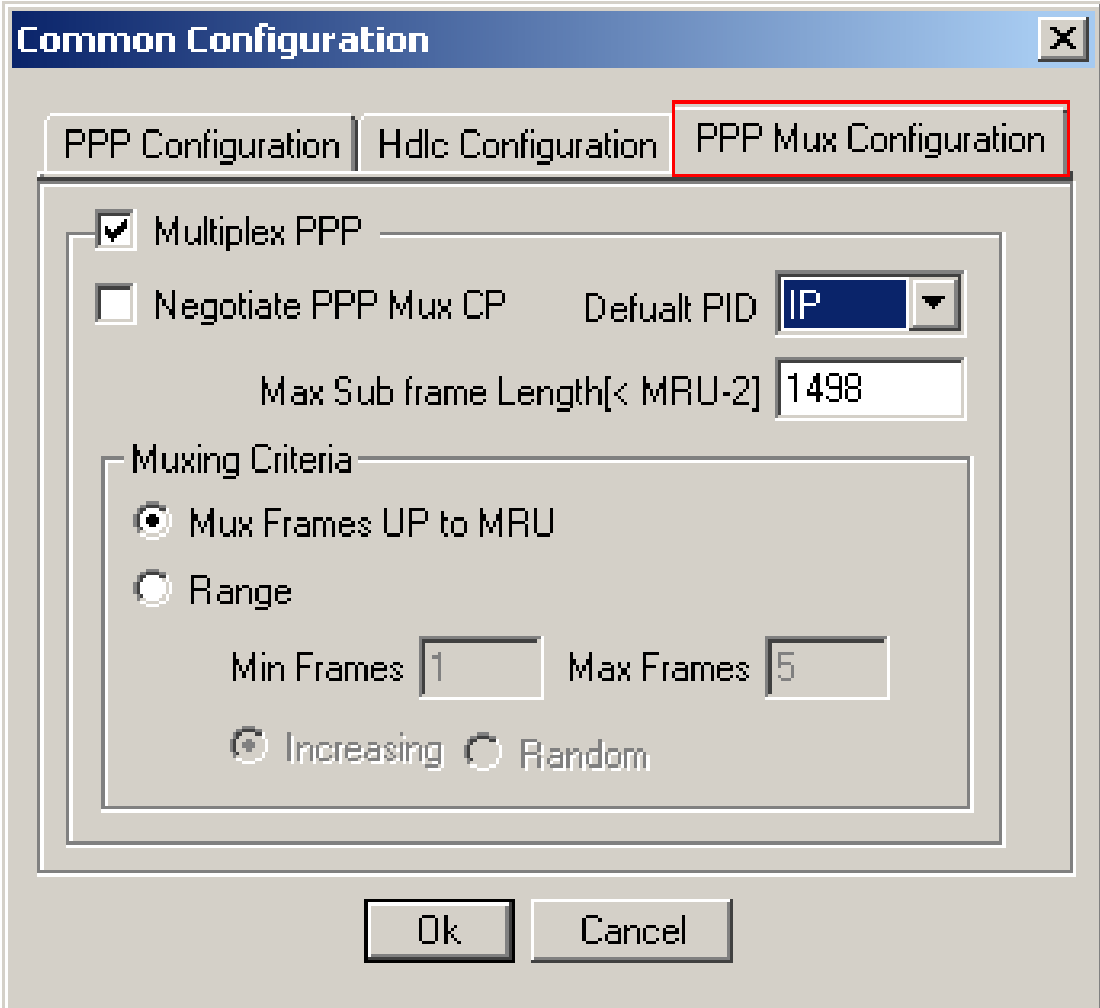


The image shows the 'Common Configuration' dialog box with the 'Hdcl Configuration' tab selected. The tab is highlighted with a red rectangle. The dialog contains two input fields: 'Flags between frames' set to 100 and 'CRC' set to CRC16. A dropdown menu is open for the 'CRC' field, showing options: CRC16 (selected), CRC32, and CRC NONE. At the bottom are 'Ok' and 'Cancel' buttons.

| Parameter | Value |
|----------------------|-------|
| Flags between frames | 100 |
| CRC | CRC16 |

PPP Mux CP Configuration

- PPP Multiplexing feature allows sending multiple PPP encapsulated packets in a single PPP Multiplexed frame
- PPP Mux configuration is an optional feature, will be negotiated for Default PID when enabled.
- User Configurable Maximum Sub-Frame length
- Supports simulation of different muxing scenarios: Mux sub-frames to up the link MRU and Mux within the configured range of sub-frames incrementing from min to max or randomly within the given range



The screenshot shows a 'Common Configuration' dialog box with three tabs: 'PPP Configuration', 'Hdlc Configuration', and 'PPP Mux Configuration'. The 'PPP Mux Configuration' tab is selected and highlighted with a red border. Inside this tab, the 'Multiplex PPP' checkbox is checked. The 'Negotiate PPP Mux CP' checkbox is unchecked. The 'Default PID' is set to 'IP'. The 'Max Sub frame Length[< MRU-2]' is set to '1498'. Under the 'Muxing Criteria' section, the 'Mux Frames UP to MRU' radio button is selected. The 'Range' radio button is unselected. The 'Min Frames' is set to '1' and the 'Max Frames' is set to '5'. The 'Increasing' radio button is selected, and the 'Random' radio button is unselected. At the bottom of the dialog are 'Ok' and 'Cancel' buttons.

Common Configuration

PPP Configuration | Hdlc Configuration | **PPP Mux Configuration**

☒ Multiplex PPP

☐ Negotiate PPP Mux CP Default PID: **IP**

Max Sub frame Length[< MRU-2]: **1498**

Muxing Criteria

☒ Mux Frames UP to MRU

☐ Range

Min Frames: **1** Max Frames: **5**

☒ Increasing ☐ Random

Ok Cancel

LCP Configuration

- Link configuration is an optional feature, and the following values are negotiated when enabled
 - MRU (Maximum Receive Unit)
 - ACFC (Address and Control Field Compression)
 - PFC (Protocol Field Compression)
 - Magic Number

The screenshot shows a software window titled "LCP Configuration" with several tabs: "LCP Configuration", "NCP Configuration", "Link Test", "Statistics", "HDLC Statistics", and "Impairments". The "LCP Configuration" tab is active. Inside this tab, there is a red rectangular box highlighting a section containing the following settings:

- ☒ **LCP**
- Maximum Receive Unit:
- ☒ Protocol Field Compression
- ☒ Address and Control Field Compression
- ☒ Magic-Number:

To the right of this highlighted section is a text area titled "LCP Negotiated Values" which contains the text "Link is not configured...". At the bottom of the window, there is a checkbox for "Flags between frames" which is checked, followed by a text input field with the value "100" and a "Set Flags" button.

IPCP Configuration

- IPCP (Internet Protocol Control Protocol) - RFC 1332 and RFC 1877 standards ;
- Following IP compression standards are supported:
 - RFC 3544 IP Header Compression over PPP
 - RFC 1144 Van Jacobson Compression
 - RFC 2507 IP Header Compression
 - RFC 2508 Compressed RTP

The screenshot displays a configuration window for Network Control Protocol (NCP). The 'Network Control Protocol' is set to 'IPCP'. Under the 'Options' section, the 'Option type' is 'IP Compression Protocol'. The 'Enable' checkbox is checked, and the compression method is set to 'IPHC'. The 'TCP Space' is 15, 'Non TCP Space' is 15, 'Max Period' is 256, 'Max Time' is 5, and 'Max Header' is 168. The 'Compress RTP' checkbox is unchecked. Two red arrows point from the 'Option type' dropdown and the 'IPHC' dropdown to two separate lists of options on the right. The first list includes 'IP Address', 'IP Compression Protocol', 'Primary DNS Server Address', 'Primary NBNS Server Address', 'Secondary DNS Server Address', and 'Secondary NBNS Server Address'. The second list includes 'No Compression', 'Van Jacobson Compression', and 'IPHC'.

☒ NCP

Network Control Protocol: IPCP

Options

Option type: IP Compression Protocol

☒ Enable: IPHC

TCP Space: 15 Non TCP Space: 15

Max Period: 256 Max Time: 5

Max Header: 168 ☐ Compress RTP

IP Address

IP Compression Protocol

Primary DNS Server Address

Primary NBNS Server Address

Secondary DNS Server Address

Secondary NBNS Server Address

No Compression

Van Jacobson Compression

IPHC

BCP Configuration

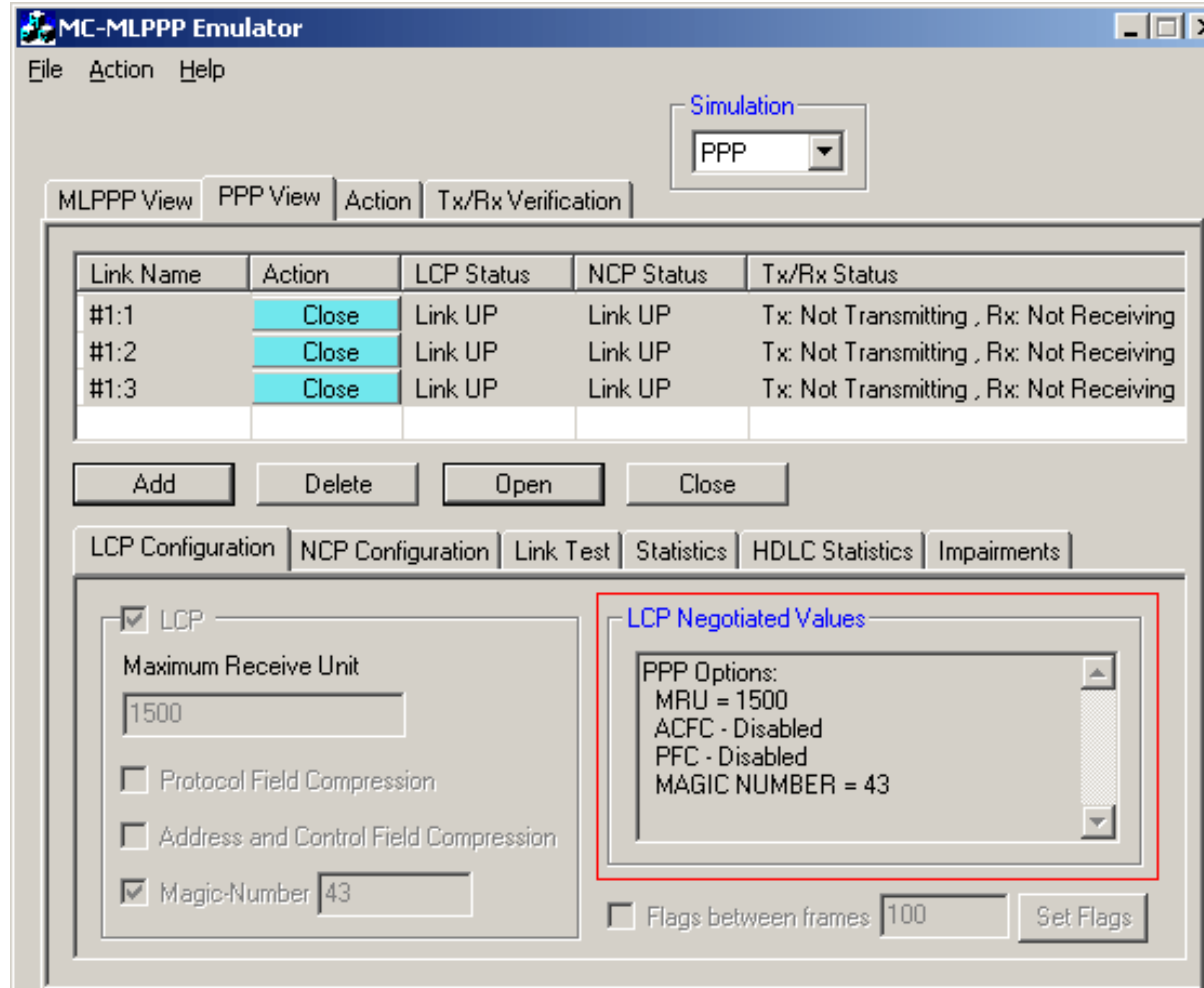
- Supports the following BCP standard
 - BCP in RFC 3518 (Point-to-Point (PPP) Bridging Control Protocol) standard

The screenshot shows the 'NCP' configuration window. The 'Network Control Protocol' dropdown is set to 'IPCP'. Under the 'Options' section, the 'Option type' dropdown is set to 'IP Address', and its list is open, showing options like 'IP Address', 'IP Compression Protocol', 'Primary DNS Server Address', 'Primary NBNS Server Address', 'Secondary DNS Server Address', and 'Secondary NBNS Server Address'. There are also checkboxes for 'IP Address' and 'Peer IP Address' with corresponding input fields.

The screenshot shows the 'NCP' configuration window. The 'Network Control Protocol' dropdown is set to 'BCP'. Under the 'Options' section, the 'Option type' dropdown is set to 'Bridge Identification', and its list is open, showing options like 'Bridge Identification', 'Line Identification', 'MAC-Support', 'Tinygram-Compression', 'MAC-Address', 'Spanning-Tree-Protocol', 'IEEE 802 Tagged Frame', 'Management Inline', and 'Bridge Control Packet Indicator'. There are also checkboxes for 'Select' and 'LAN Segment'.

LCP and NCP Negotiation

- The negotiated LCP values will be displayed, once the link is UP
- Dynamically add/remove (open/close) PPP links without loss in data



Link Test at PPP Level

- Tests link connectivity by sending an echo request and receiving an echo reply
- When the link is up, the test will be started by sending/receiving echo messages

The screenshot shows a network management interface with a tabbed menu at the top. The 'Link Test' tab is selected. Inside this tab, there is a sub-panel with the following elements:

- ☒ Enable
- Max Echo Request:
(Enter -1 for Infinite)
- Data:
- Statistics section (indicated by a blue label):
 - Number of Echo Requests sent:
 - Number of Echo Reply received:
 - Reset button

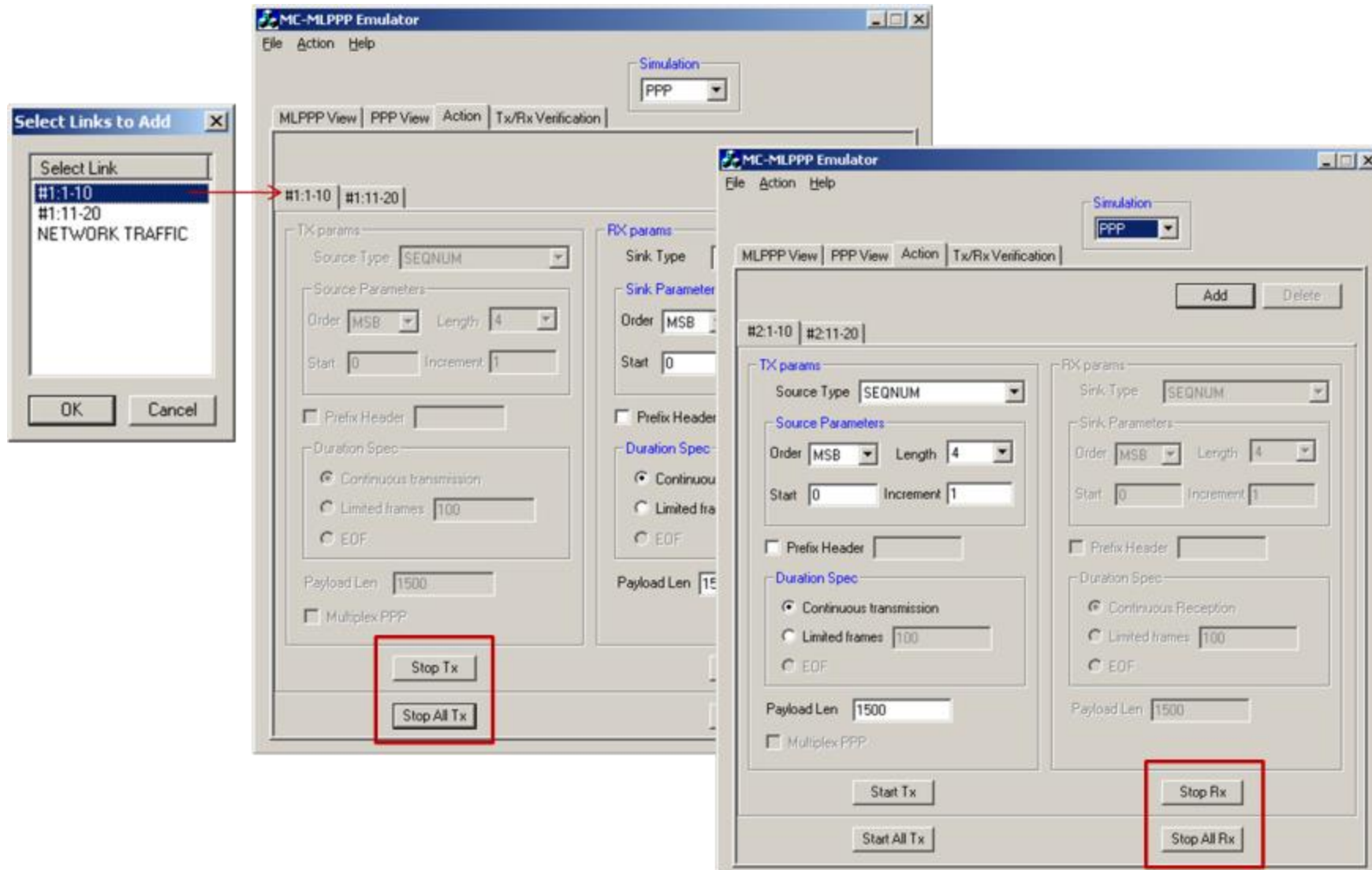
Link Test at PPP Level

- Parameters include: Max Echo Request, Data, and Statistics
- Max-Echo-Request option allows the user to specify the number of times link should be tested
 - If the count is 0 (zero), then link will not be tested
 - If the count is 'n' , then the link will be tested for n times
 - If it is -1, then it will be tested infinite number of times, until the link goes down
- Data field specifies the data to be carried as Payload in Echo Request Message
- Statistics will provide the number of requests sent and number of replies received

Transmit and Receive Functions

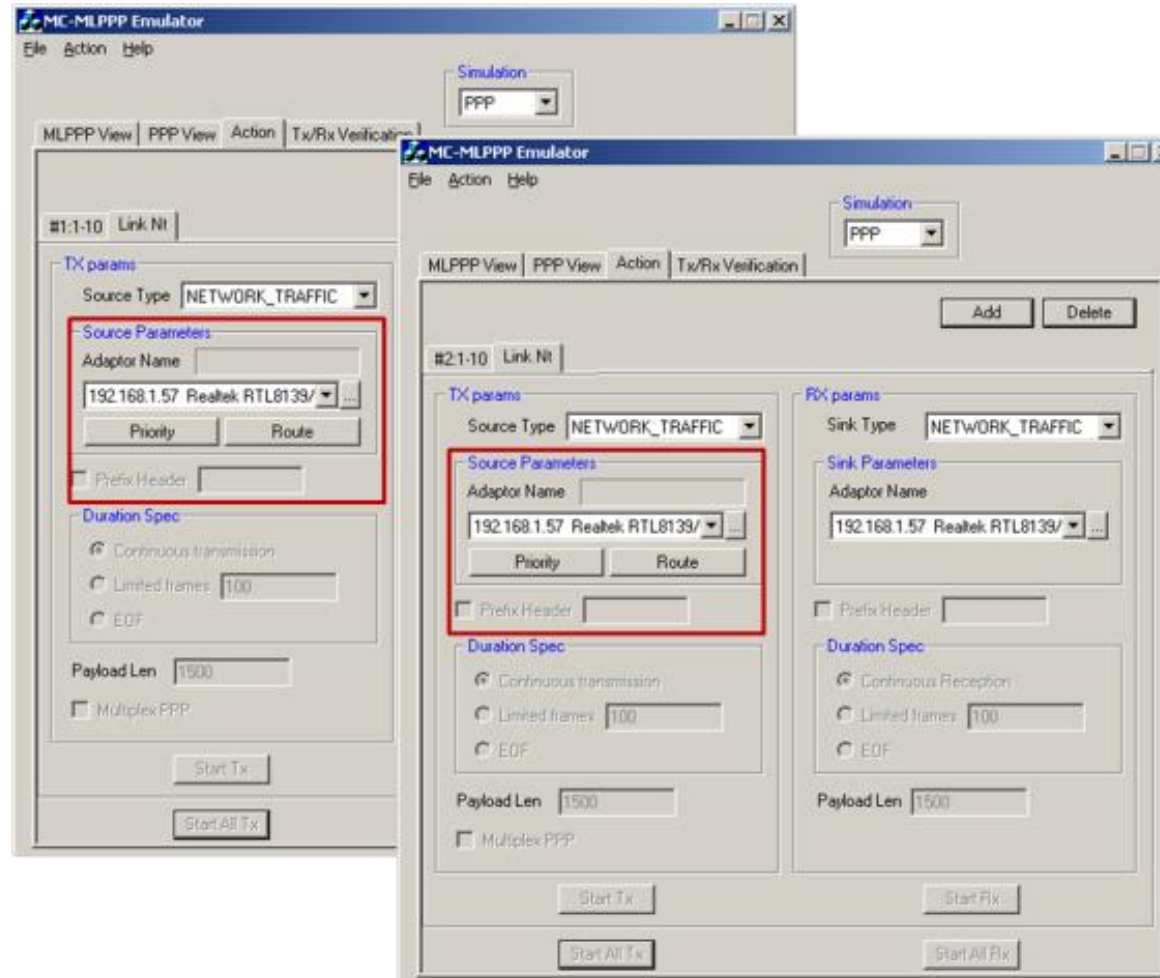
- PPP traffic can be generated, received, and verified on each PPP link individually
- Sequence numbers (1,2,4 or 8 least significant byte first (LSB) or most significant byte first (MSB)) with configurable start sequence numbers and increments
- User defined HEX string frame, which is ASCII based. Can be edited, loaded and saved
- Binary flat files that allows user to provide any random data
- GL *.HDL trace file is GL's packet file format which can be constructed pre-hand or captured using MLPPP Analyzer
- Network traffic (LAN traffic) - In bridge or router mode
- User configurable Tx / Rx duration and payload length for each PPP link
- User selectable PPP multiplexing option for each PPP link

Tx Rx at PPP Level



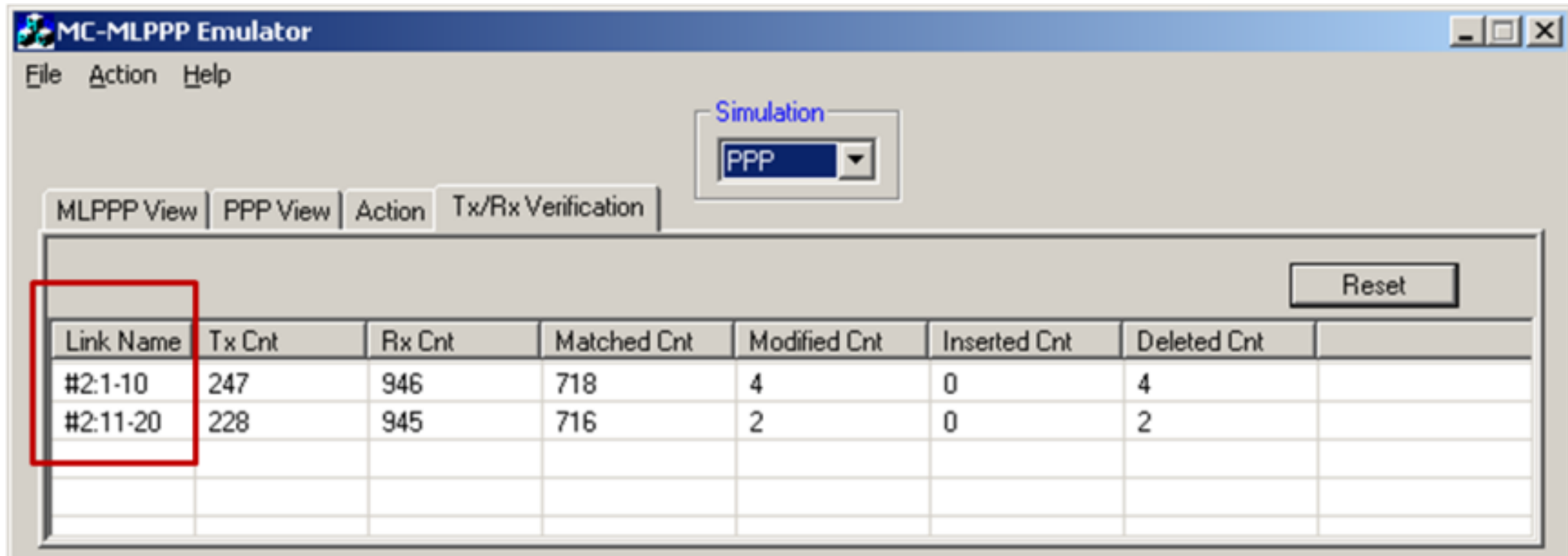
Tx Rx Network Traffic at PPP Level

- Allows user to receive traffic from Ethernet, convert to PPP traffic and send through T1/E1 line and vice versa
- Emulator can be configured in bridge or route mode



Tx Rx Verification

- Tx Rx Verification is common GUI that shows Tx/Rx results for each class (in case of MLPPP) or for each link (in case of PPP)



| Link Name | Tx Cnt | Rx Cnt | Matched Cnt | Modified Cnt | Inserted Cnt | Deleted Cnt | |
|-----------|--------|--------|-------------|--------------|--------------|-------------|--|
| #2:1-10 | 247 | 946 | 718 | 4 | 0 | 4 | |
| #2:11-20 | 228 | 945 | 716 | 2 | 0 | 2 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Impairments at PPP Level

- Impairments that affect an entire frame:
 - Delete Frame
 - Insert Frame
 - CRC error
 - Frame error
 - Duplicate Frame
- Impairments that modify a byte or few bytes in a frame at specified offset :
 - Insert Bytes
 - Delete Bytes
 - Bitwise ANDing octets
 - Bitwise Oring octets
 - Bitwise XORing octets
- Differential link delay insertion during transmission

Impairments at PPP Level

Original Frame

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| FF | 03 | 00 | 3D | 80 | 00 | 00 | 02 |
| 00 | 21 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

Impairment : INS ABCD, OFF 10

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| FF | 03 | 00 | 3D | 80 | 00 | 00 | 02 |
| 00 | 21 | AB | CD | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | | | | | | |

Original Frame

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| FF | 03 | 00 | 3D | 80 | 00 | 00 | 04 |
| 00 | 21 | 01 | 30 | A0 | CD | 40 | 80 |
| 12 | 54 | 67 | 54 | 33 | 65 | 23 | 95 |
| A1 | 2D | 34 | AB | 65 | 76 | F4 | F5 |
| AC | 23 | 43 | A3 | 24 | 5C | 76 | C2 |
| 1C | A3 | D4 | EF | F5 | 65 | F2 | 81 |

Impairment : DEL 10, OFF 10

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| FF | 03 | 00 | 3D | 80 | 00 | 00 | 04 |
| 00 | 21 | 33 | 65 | 23 | 95 | A1 | 2D |
| 34 | AB | 65 | 76 | F4 | F5 | AC | 23 |
| 43 | A3 | 24 | 5C | 76 | C2 | 1C | A3 |
| D4 | EF | F5 | 65 | F2 | 81 | | |
| | | | | | | | |

Impairments at PPP Level

Original Frame

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| FF | 03 | 00 | 3D | 80 | 00 | 00 | 04 |
| 00 | 21 | 01 | 30 | A0 | CD | 40 | 80 |
| 12 | 54 | 67 | 54 | 33 | 65 | 23 | 95 |
| A1 | 2D | 34 | AB | 65 | 76 | F4 | F5 |
| AC | 23 | 43 | A3 | 24 | 5C | 76 | C2 |
| 1C | A3 | D4 | EF | F5 | 65 | F2 | 81 |

Impairment: OR 0xFF, OFF10

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| FF | 03 | 00 | 3D | 80 | 00 | 00 | 04 |
| 00 | 21 | FF | 30 | A0 | 00 | 40 | 80 |
| 12 | 54 | 67 | 54 | 33 | 65 | 23 | 95 |
| A1 | 2D | 34 | AB | 65 | 76 | F4 | F5 |
| AC | 23 | 43 | A3 | 24 | 5C | 76 | C2 |
| 1C | A3 | D4 | EF | F5 | 65 | F2 | 81 |

Impairment: AND 0x00, OFF13

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| FF | 03 | 00 | 3D | 80 | 00 | 00 | 04 |
| 00 | 21 | 01 | 30 | A0 | 00 | 40 | 80 |
| 12 | 54 | 67 | 54 | 33 | 65 | 23 | 95 |
| A1 | 2D | 34 | AB | 65 | 76 | F4 | F5 |
| AC | 23 | 43 | A3 | 24 | 5C | 76 | C2 |
| 1C | A3 | D4 | EF | F5 | 65 | F2 | 81 |

Impairment: XOR 0x0A, OFF12

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| FF | 03 | 00 | 3D | 80 | 00 | 00 | 04 |
| 00 | 21 | FF | 30 | 55 | CD | 40 | 80 |
| 12 | 54 | 67 | 54 | 33 | 65 | 23 | 95 |
| A1 | 2D | 34 | AB | 65 | 76 | F4 | F5 |
| AC | 23 | 43 | A3 | 24 | 5C | 76 | C2 |
| 1C | A3 | D4 | EF | F5 | 65 | F2 | 81 |

Impairments at PPP Level

LCP Configuration | NCP Configuration | Link Test | Statistics | HDLC Statistics | Impairments

☒ Enable

Impairment Type: **DELETE BYTES**

Options:

Byte count:

Byte Offset:

Skip Before Impair:

Impairment Duration:

☐ Repeat

☒ Continuous

Delay:

msec

DELETE FRAME
INSERT FRAME
DELETE BYTES
INSERT BYTES
DUPLICATE FRAME
CRC ERROR
FRAME ERROR
AND
OR
XOR

MC-MLPPP Emulator

File Action Help

Simulation: **PPP**

MLPPP View | PPP View | Action | Tx/Rx Verification

| Link Name | Tx Cnt | Rx Cnt | Matched Cnt | Modified Cnt | Inserted Cnt | Deleted Cnt |
|-----------|--------|--------|-------------|--------------|--------------|-------------|
| #2:1-10 | 247 | 946 | 718 | 4 | 0 | 4 |
| #2:11-20 | 228 | 945 | 716 | 2 | 0 | 2 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Statistics

- PPP Statistics provides important statistics information for the selected PPP link
- Errors that occur during file transmission like the Tx Under/Over Runs, Rx Under/Over Runs, Number of PPP packets with bad FCS and Number of Frame Errors are recorded in the HDLC Statistics

PPP Statistics

| LCP Configuration | NCP Configuration | Link Test | Statistics | DLC Statistics | Impairments |
|--|-------------------|-----------|------------|----------------|-------------|
| Number of octets transmitted | | | | 1624 | Reset |
| Number of total frames transmitted | | | | 104 | |
| Number of total octets received | | | | 1616 | |
| Number of total frames received | | | | 102 | |
| Number of PPP packets with bad addresses | | | | 0 | |
| Number of PPP packets with bad control bytes | | | | 0 | |
| Number of PPP packets too long exceeding the MRU | | | | 0 | |

| LCP Configuration | NCP Configuration | Link Test | Statistic | HDLC Statistics | Impairments |
|---------------------------|-------------------|-----------|-----------|-----------------|-------------|
| Tx Under/Over Runs | | | | 104 | Reset |
| Rx Under/Over Runs | | | | 1616 | |
| No of PPP packets bad FCS | | | | 102 | |
| No of Frame Errors | | | | 0 | |

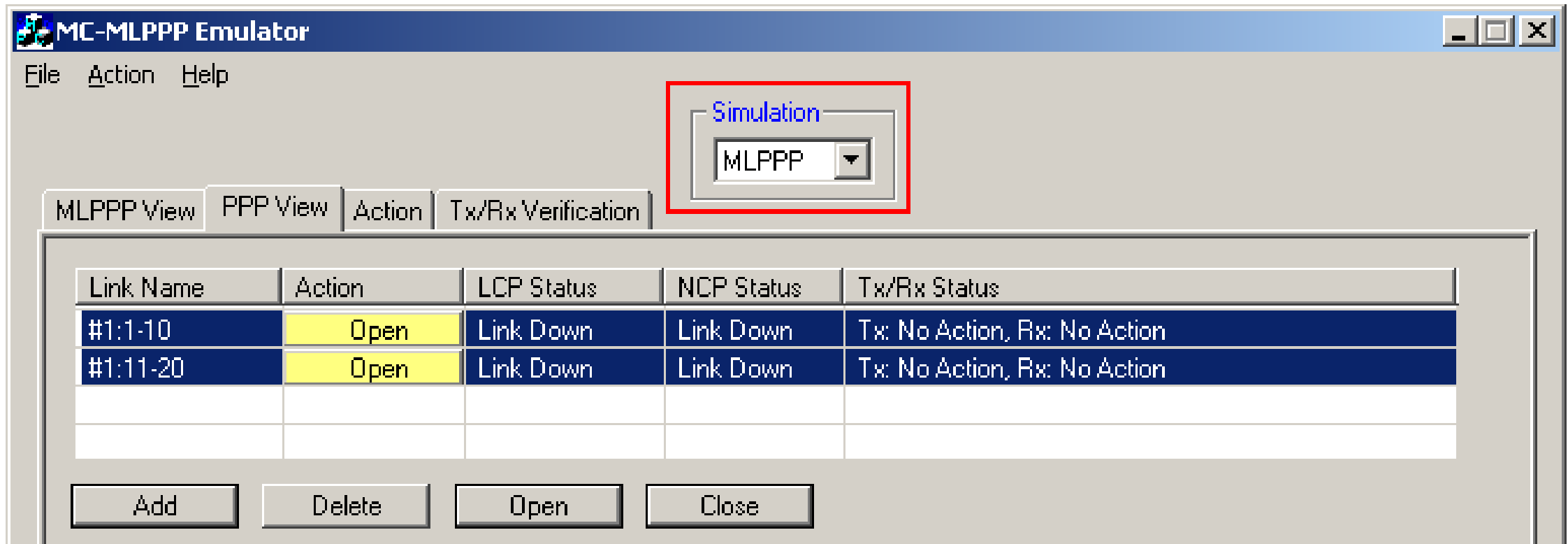
HDLC Statistics

| LCP Configuration | NCP Configuration | Link Test | Statistic | HDLC Statistics | Impairments |
|---------------------------|-------------------|-----------|-----------|-----------------|-------------|
| Tx Under/Over Runs | | | | 104 | Reset |
| Rx Under/Over Runs | | | | 1616 | |
| No of PPP packets bad FCS | | | | 102 | |
| No of Frame Errors | | | | 0 | |

MC - MLPPP Simulation

Adding links to form an MLPPP bundle

- Various PPP links (of any bandwidth varying from 64Kbps to n*64Kbps or sub channels) can be added to form the MLPPP bundle
- MLPPP bundles multiple link-layer channels into a single network-layer channel



LCP and NCP Configuration

MLPPP and MC-MLPPP Level

The screenshot shows the 'MC-MLPPP Emulator' window with the following configuration:

- Simulation:** ☒ MLPPP, ☐ PPP
- Views:** MLPPP View, PPP View, Action, Tx/Rx Verification
- Link configuration:** Impairments, Statistics, Link Test
- MC-MLPPP Options:**
 - Fragment Format: Long Sequence
 - Maximum Receive Reconstructed Unit: 1500
 - ☐ Endpoint Discriminator
 - Class: Locally Assigned
 - Address:
 - ☐ Multi-Class options
 - Suspendable classes: 8
 - PPP in MLPPP:**
 - ☐ Protocol Field Compression
 - ☒ Address and Control Field Compression
 - Maximum Differential Delay: 250 ms
- ☒ **NCP**
 - Network Control Protocol: IPCP
 - Ncp Over: MLPPP
 - Options:**
 - Option type: IP Address
 - ☐ IP Address: 0 . 0 . 0 . 0
 - ☐ Peer IP Address: 0 . 0 . 0 . 0

LCP Configuration Options

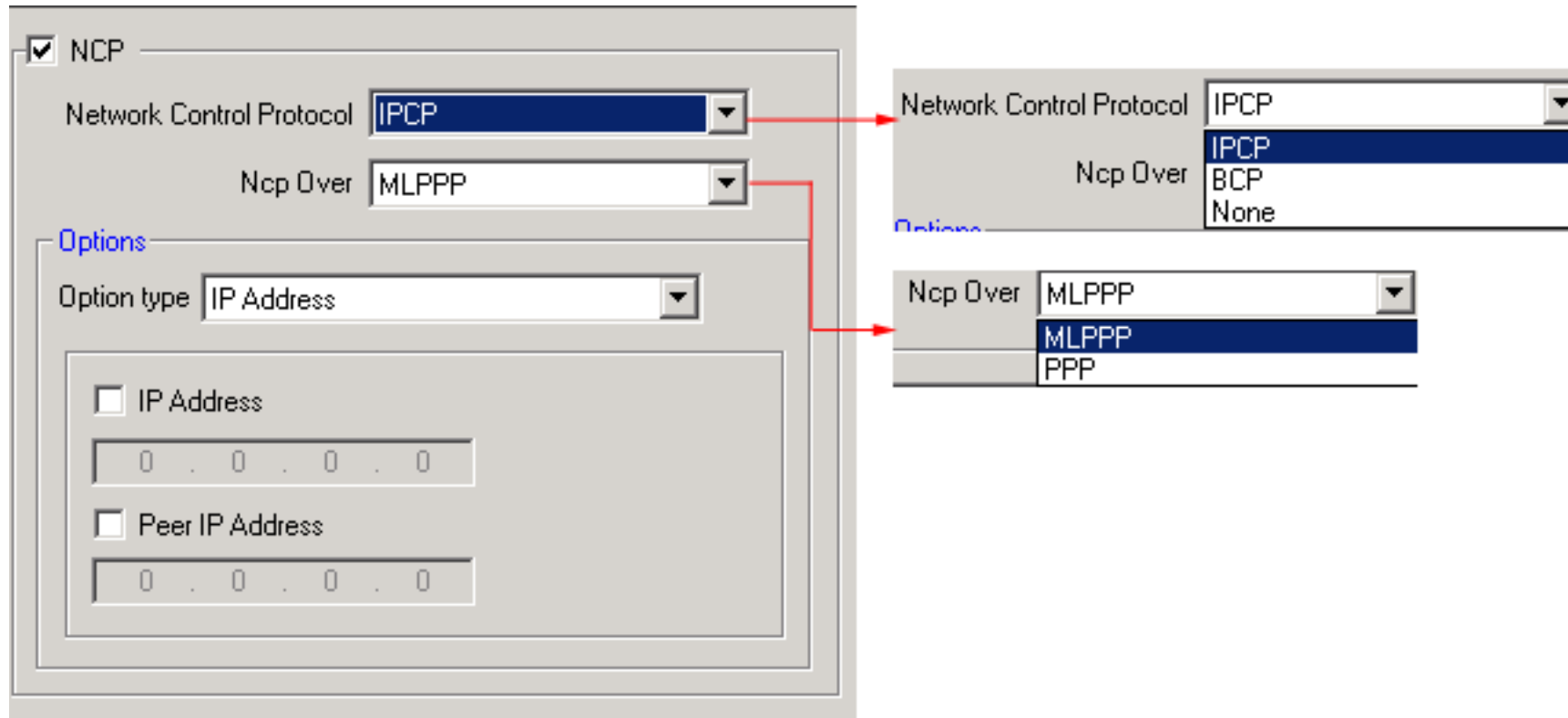
- LCP with the following negotiation options
 - PPP options: MRU, ACFC, PFC, and Magic Number
 - MLPPP Options: MRRU, Short/ Long Sequence Fragment Format, & Endpoint Discrimination
 - Multi-Class Options: Multilink Header Format

PPP in MLPPP

- ☐ Protocol Field Compression
- ☒ Address and Control Field Compression

NCP Configuration Options

- Allows user to send NCP packets over MLPPP or PPP
 - NCP Over PPP - It is possible to send NCP packets directly over PPP layer even though the emulator has been configured for MLPPP simulation
 - NCP over MLPPP - The NCP negotiation will occur over MLPPP Layer
- The NCP status column in PPP view shows NCP layer status per link in PPP simulation. In MLPPP simulation, it shows the status of the entire MLPPP bundle



LCP and NCP Negotiation

MC-MLPPP Emulator

File Action Help

Simulation
MLPPP

MLPPP View PPP View Action Tx/Rx Verification

| Link Name | Action | LCP Status | NCP Status | Tx/Rx Status |
|-----------|--------|------------|------------|------------------------------|
| #2:1-10 | Close | Link UP | Link UP | Tx: No Action, Rx: No Action |
| #2:11-20 | Close | Link UP | Link UP | Tx: No Action, Rx: No Action |

Add Delete Open Close

LCP Configuration NCP Configuration Link Test Statistics HDLC Statistics Impairments

☒ LCP

Maximum Receive Unit
1500

☐ Protocol Field Compression

☐ Address and Control Field Compression

☐ Magic-Number 189

LCP Negotiated Values

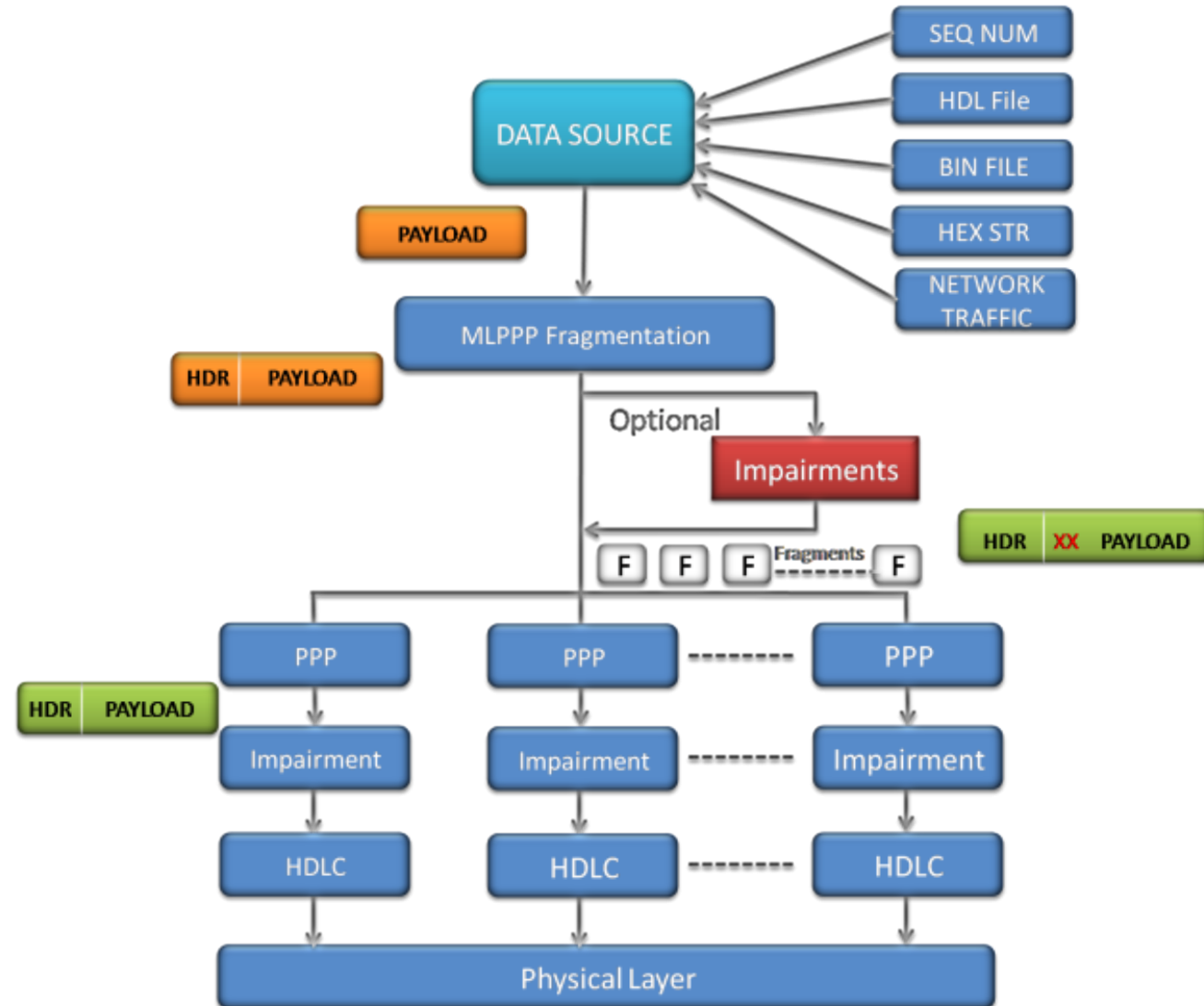
MRU = 1500
ACFC - Disabled
PFC - Disabled
MLPPP Options:
MRRU = 1500
Long Sequence

☐ Flags between frames 100 Set Flags

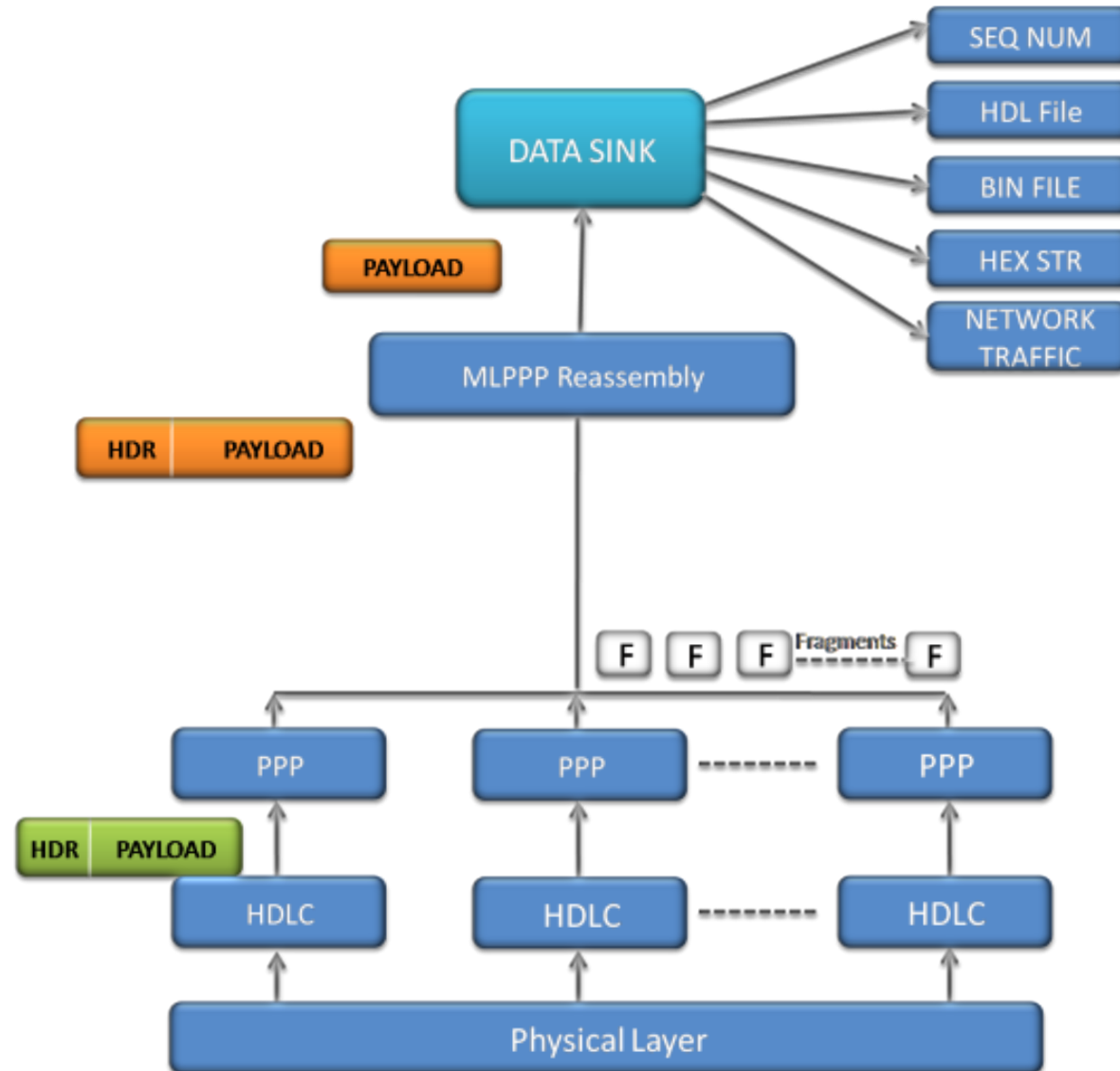
Tx Rx at MC-ML PPP Level

- MLPPP traffic can be generated, received, and verified over multiple classes and MLPPP bundles
- Different source/sink types for each class independently -
 - Sequence numbers (1,2,4 or 8 least significant byte first (LSB) or most significant byte first (MSB)) with configurable start sequence numbers and increments
 - User defined HEX string frame, which is ASCII based. Can be edited, loaded and saved
 - Binary flat files that allows user to provide any random data
 - GL *.HDL trace file is GL's packet file format which can be constructed pre-hand or captured using MLPPP Analyzer
 - Network traffic (LAN traffic) - In bridge or router mode
- User Configurable ML PPP Packet Size and Fragment Size per class
- Tx/Rx Duration Parameters: Continuous, Limited Frames, EOF (End of File)
- User selectable PPP multiplexing option for each class

Transmit Functions

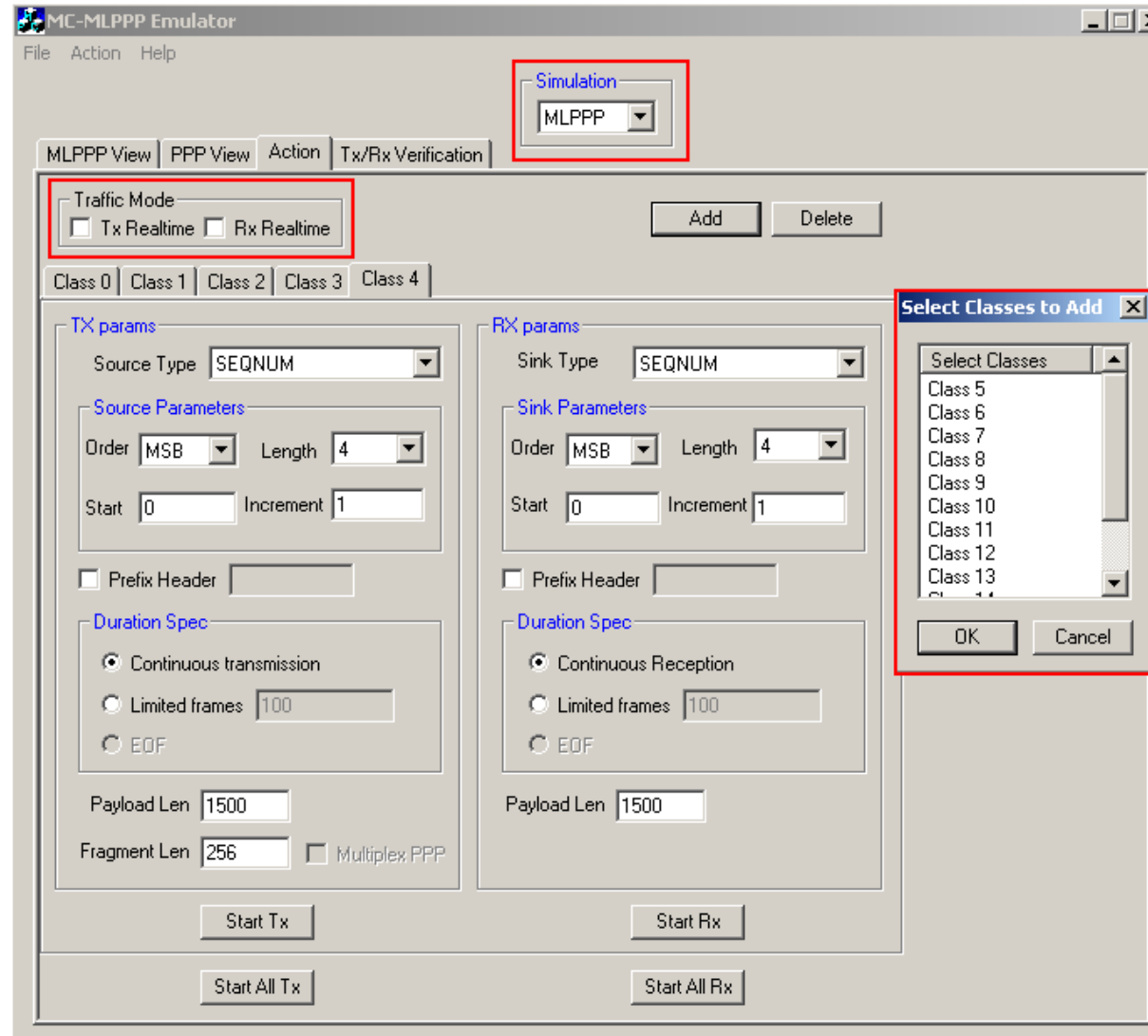


Receive Functions



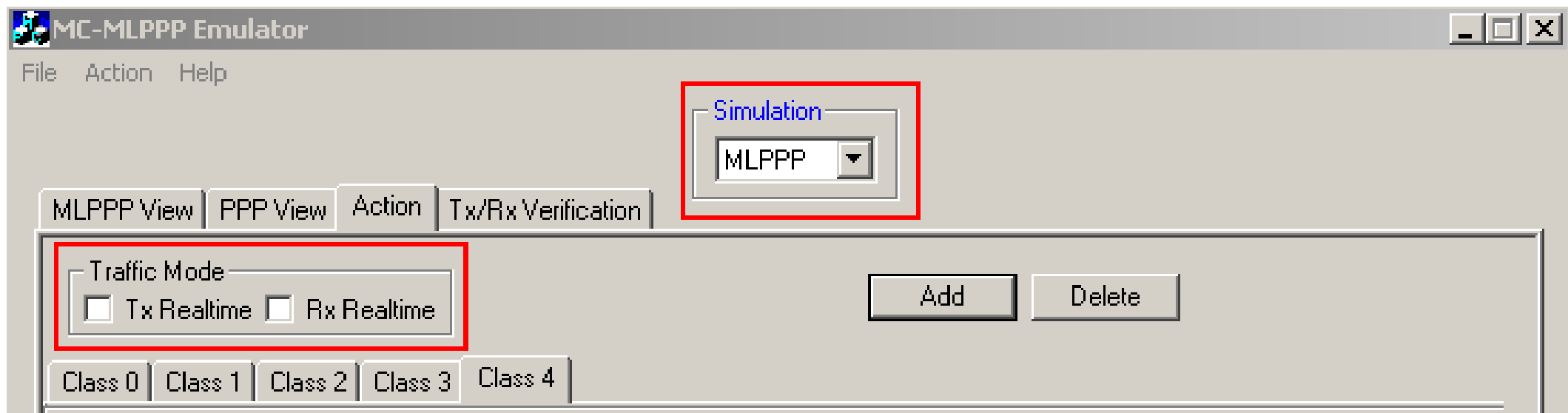
Tx Rx at MC-ML PPP Level

- Traffic is generated and received on the entire MLPPP bundle for various classes



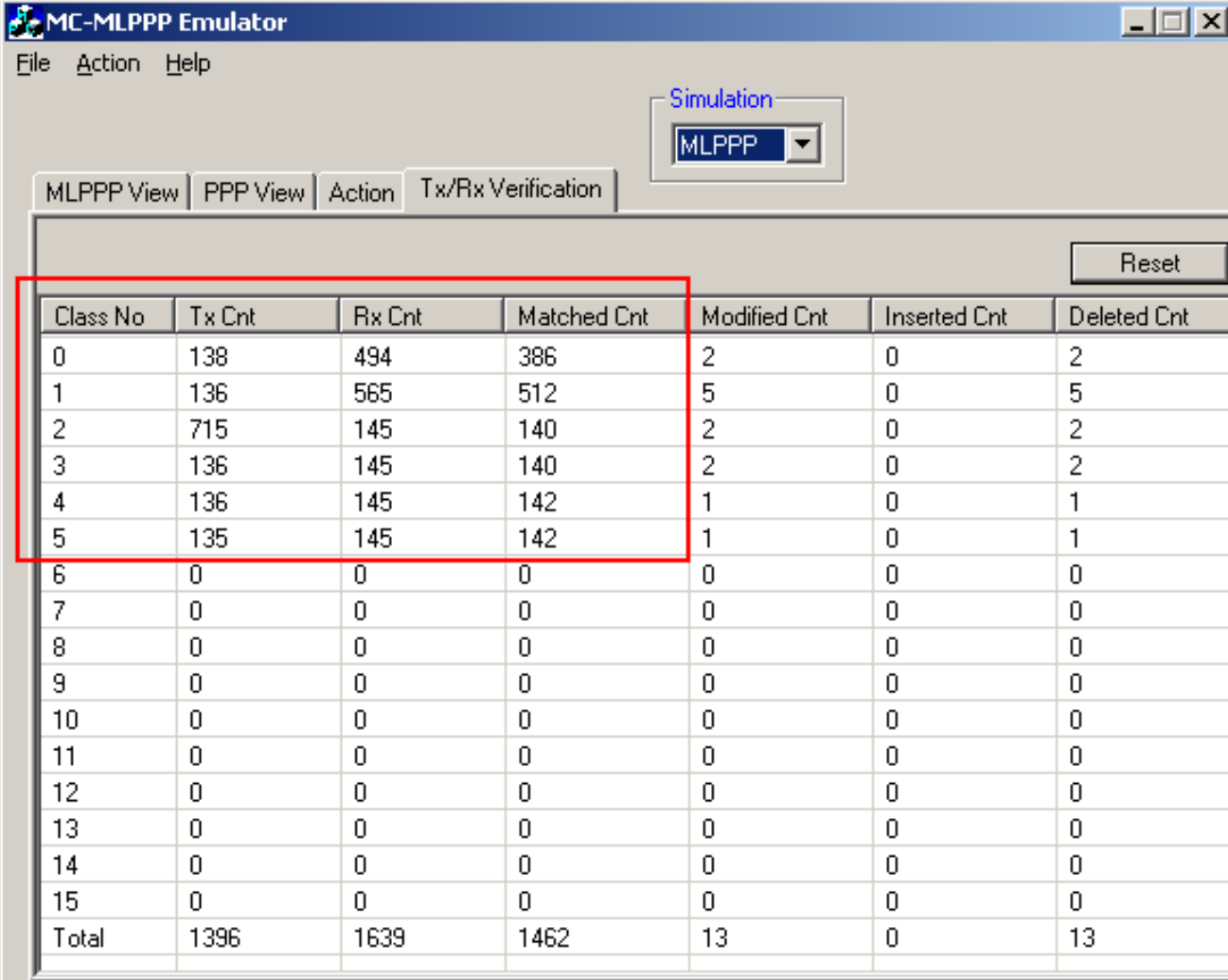
Tx Rx at MC-ML PPP Level

- Traffic mode provides an option to maintain timing between frames
- Emulator configured as router (using NETWORK TRAFFIC source and sink type) requires to maintain the timing while forwarding packets from Ethernet to T1/E1 and vice versa
 - Tx Real-time: Maintains timing while forwarding packet from NIC to T1/E1
 - Rx Real-time: Maintains timing while forwarding packet from T1/E1 to NIC



Tx Rx Verification

- Tx Rx Verification is common GUI that shows Tx/Rx results for each class (in case of MLPPP) or for each link (in case of PPP)

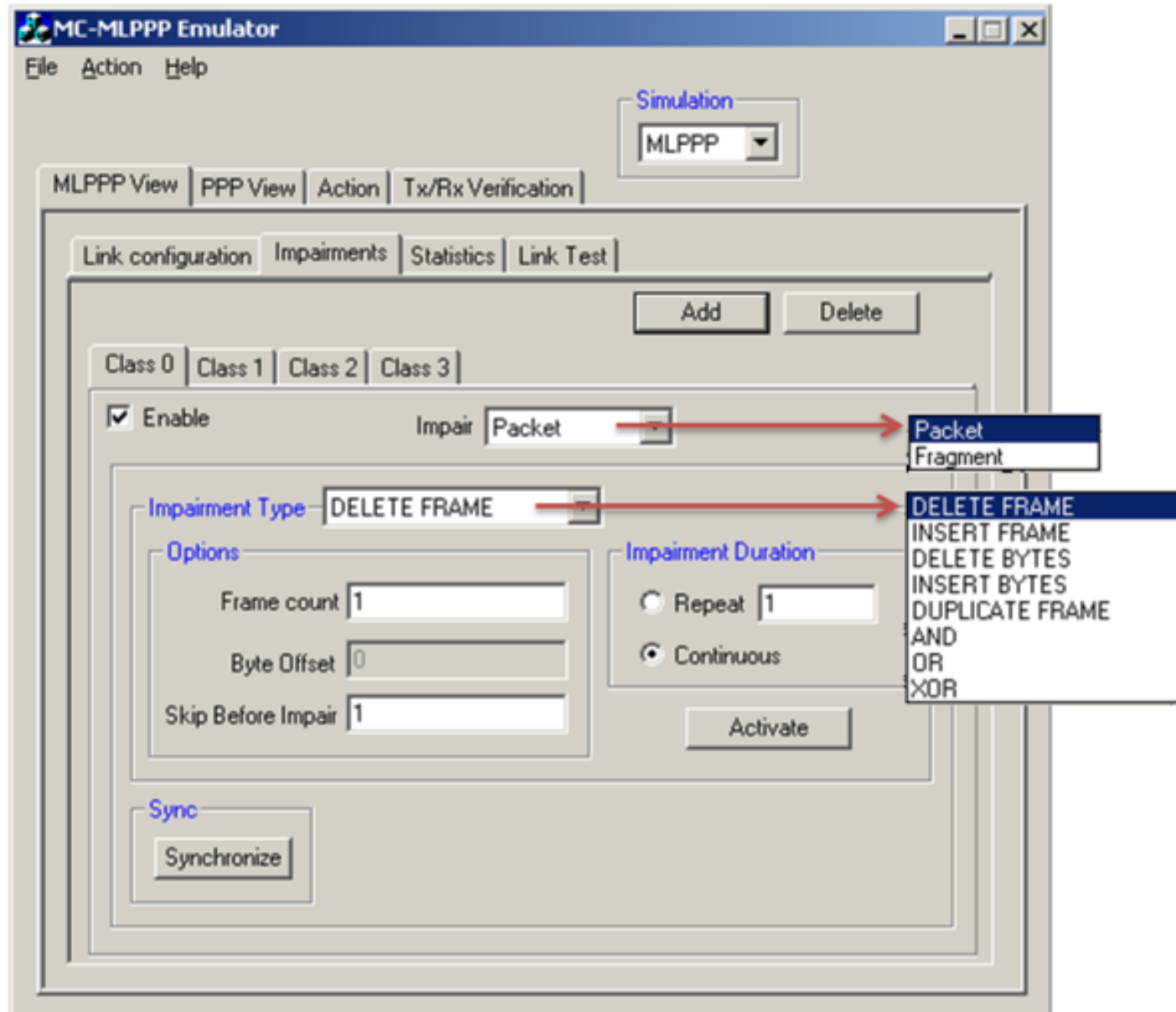


| Class No | Tx Cnt | Rx Cnt | Matched Cnt | Modified Cnt | Inserted Cnt | Deleted Cnt |
|----------|--------|--------|-------------|--------------|--------------|-------------|
| 0 | 138 | 494 | 386 | 2 | 0 | 2 |
| 1 | 136 | 565 | 512 | 5 | 0 | 5 |
| 2 | 715 | 145 | 140 | 2 | 0 | 2 |
| 3 | 136 | 145 | 140 | 2 | 0 | 2 |
| 4 | 136 | 145 | 142 | 1 | 0 | 1 |
| 5 | 135 | 145 | 142 | 1 | 0 | 1 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1396 | 1639 | 1462 | 13 | 0 | 13 |

Impairments at MLPPP Level

- Supports various Fragment/Packet level impairments at MLPPP level for each class and/or for any of the PPP links in the bundle
- Impairment Types Include
 - Delete Frame
 - Insert Frame
 - Delete Bytes
 - Insert Bytes
 - Duplicate Frame
 - Bitwise ANDing octets
 - Bitwise Oring octets
 - Bitwise XORing octets

Impairments at MLPPP Level



Impairments at MLPPP Level

MC-MLPPP Emulator

File Action Help

Simulation

MLPPP

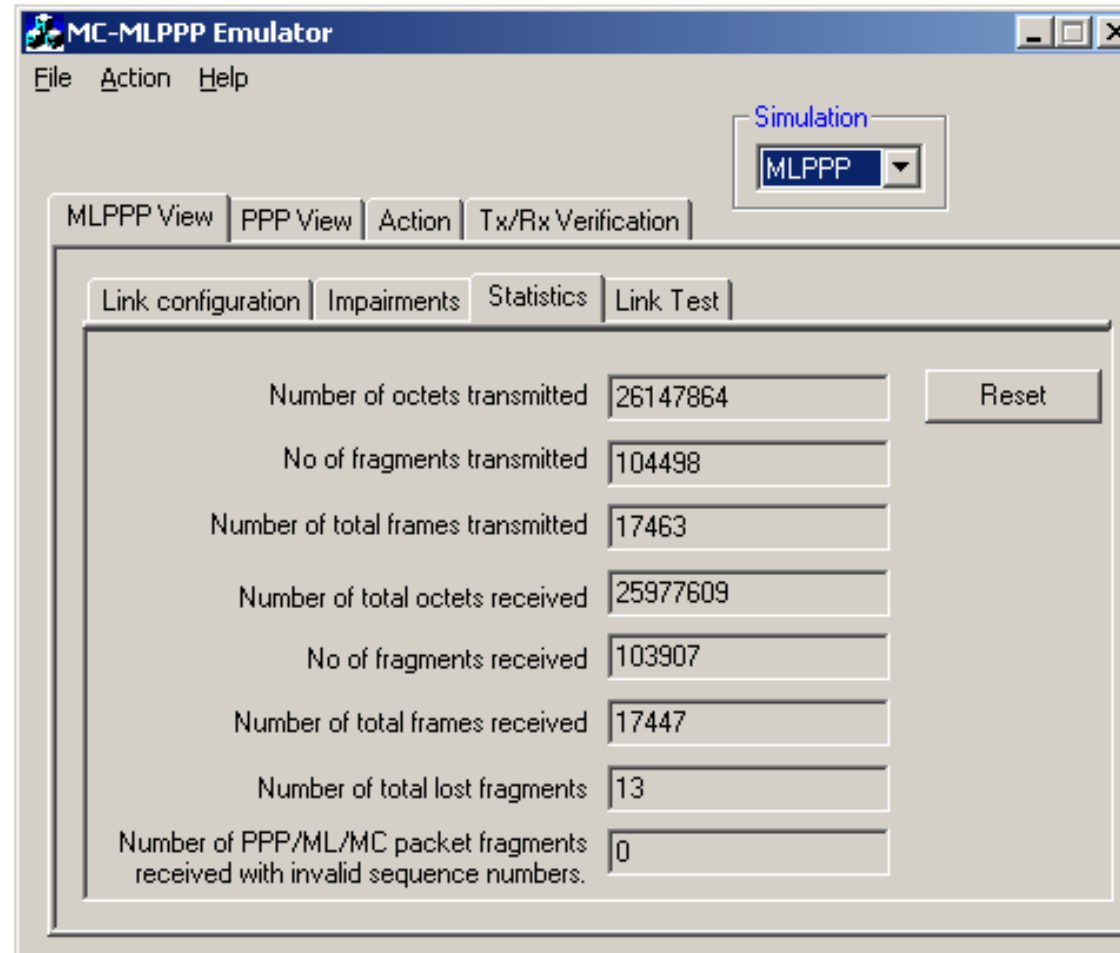
MLPPP View PPP View Action Tx/Rx Verification

Reset

| Class No | Tx Cnt | Rx Cnt | Matched Cnt | Modified Cnt | Inserted Cnt | Deleted Cnt | |
|----------|--------|--------|-------------|--------------|--------------|-------------|--|
| 0 | 524 | 338 | 327 | 5 | 0 | 166 | |
| 1 | 523 | 505 | 496 | 4 | 0 | 4 | |
| 2 | 523 | 324 | 313 | 3 | 0 | 178 | |
| 3 | 522 | 694 | 497 | 3 | 187 | 3 | |
| 4 | 522 | 505 | 494 | 2 | 0 | 2 | |
| 5 | 1044 | 1012 | 1000 | 4 | 0 | 4 | |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Total | 3658 | 3378 | 3127 | 21 | 187 | 357 | |

Statistics

- Provides important information about the MLPPP bundle –
 - Number of transmitted/received octets, frames, fragments
 - Number of lost fragments, and
 - Number of PPP/ML/MC packet fragments received with invalid sequence numbers



The screenshot shows the 'MC-MLPPP Emulator' window with the 'Statistics' tab selected. The window has a menu bar with 'File', 'Action', and 'Help'. Below the menu bar is a 'Simulation' dropdown menu set to 'MLPPP'. The main area contains several tabs: 'Link configuration', 'Impairments', 'Statistics', and 'Link Test'. The 'Statistics' tab is active, displaying a list of statistics with their corresponding values in text boxes. A 'Reset' button is located to the right of the first two statistics.

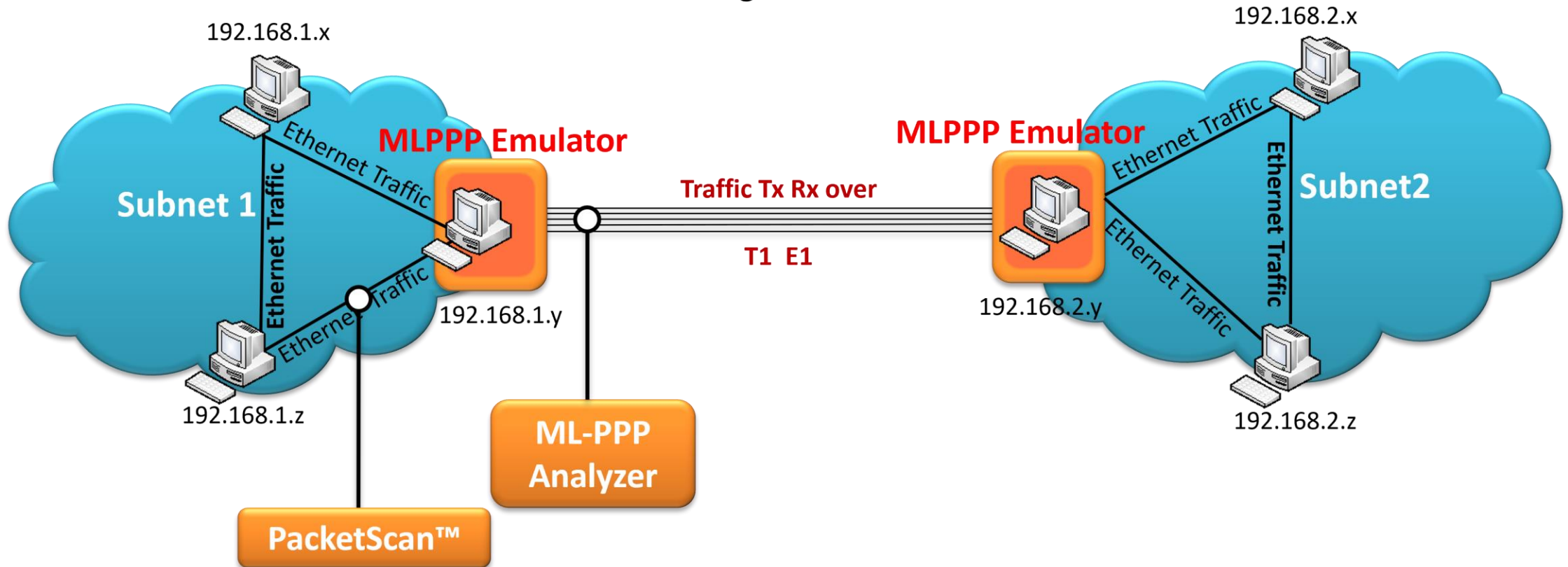
| Statistic | Value |
|--|----------|
| Number of octets transmitted | 26147864 |
| No of fragments transmitted | 104498 |
| Number of total frames transmitted | 17463 |
| Number of total octets received | 25977609 |
| No of fragments received | 103907 |
| Number of total frames received | 17447 |
| Number of total lost fragments | 13 |
| Number of PPP/ML/MC packet fragments received with invalid sequence numbers. | 0 |

MLPPP Emulator as Bridge and Router

- To establish connection between two machines residing in two LANs, MLPPP emulator can be configured to work as –
 - MLPPP router (if IPCP type of negotiation is used)
 - or
 - MLPPP Bridge (if BCP type of negotiation is used)

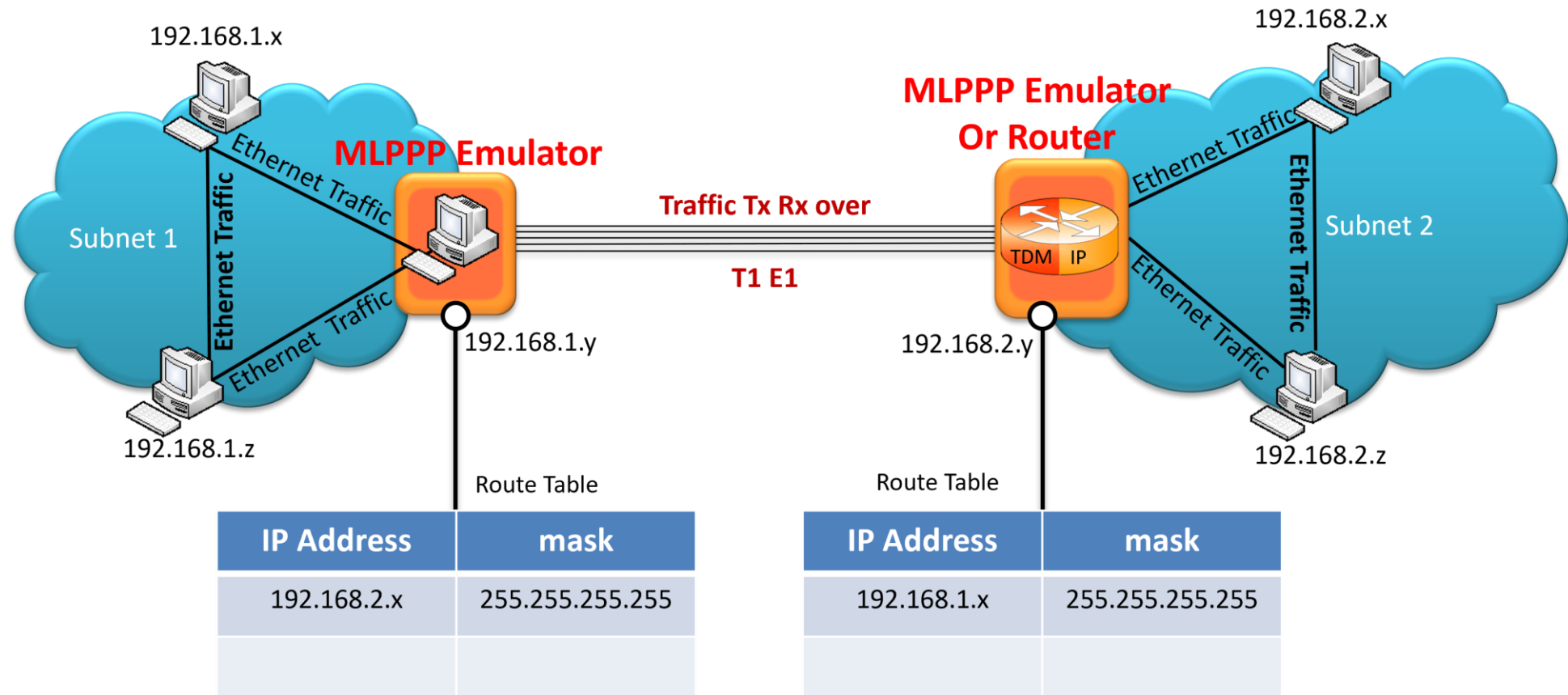
MC-MLPPP Emulator in Bridge Mode

In Bridge Mode



MC-MLPPP Emulator in Router Mode

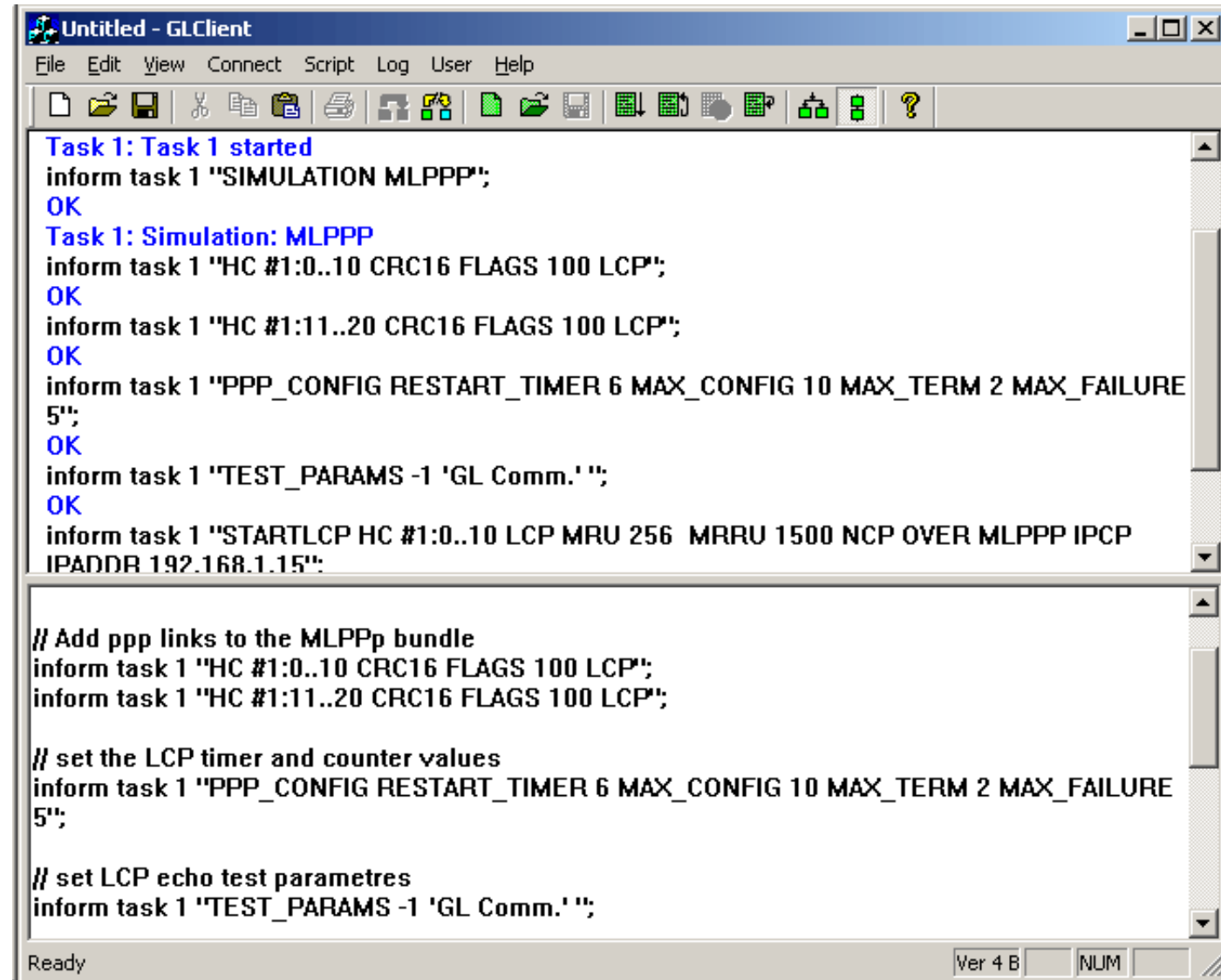
In Routing Mode



Simulation using Command Line MLPPPTerr Module

MC- ML PPP Emulator Command Line

- Sends and receives ML PPP frames with or without impairments
- Displays the command syntax, Logs the events
- Lower pane in the screen displays the script; upper pane displays the script and the server responses



The screenshot shows a window titled "Untitled - GLClient" with a menu bar (File, Edit, View, Connect, Script, Log, User, Help) and a toolbar. The main area is divided into two panes. The upper pane shows a sequence of commands and responses for a task named "Task 1". The lower pane shows a script for adding PPP links and setting LCP parameters.

```
Task 1: Task 1 started
inform task 1 "SIMULATION MLPPP";
OK
Task 1: Simulation: MLPPP
inform task 1 "HC #1:0..10 CRC16 FLAGS 100 LCP";
OK
inform task 1 "HC #1:11..20 CRC16 FLAGS 100 LCP";
OK
inform task 1 "PPP_CONFIG RESTART_TIMER 6 MAX_CONFIG 10 MAX_TERM 2 MAX_FAILURE 5";
OK
inform task 1 "TEST_PARAMS -1 'GL Comm.' ";
OK
inform task 1 "STARTLCP HC #1:0..10 LCP MRU 256 MRRU 1500 NCP OVER MLPPP IPCP IPADDR 192.168.1.15";

// Add ppp links to the MLPPp bundle
inform task 1 "HC #1:0..10 CRC16 FLAGS 100 LCP";
inform task 1 "HC #1:11..20 CRC16 FLAGS 100 LCP";

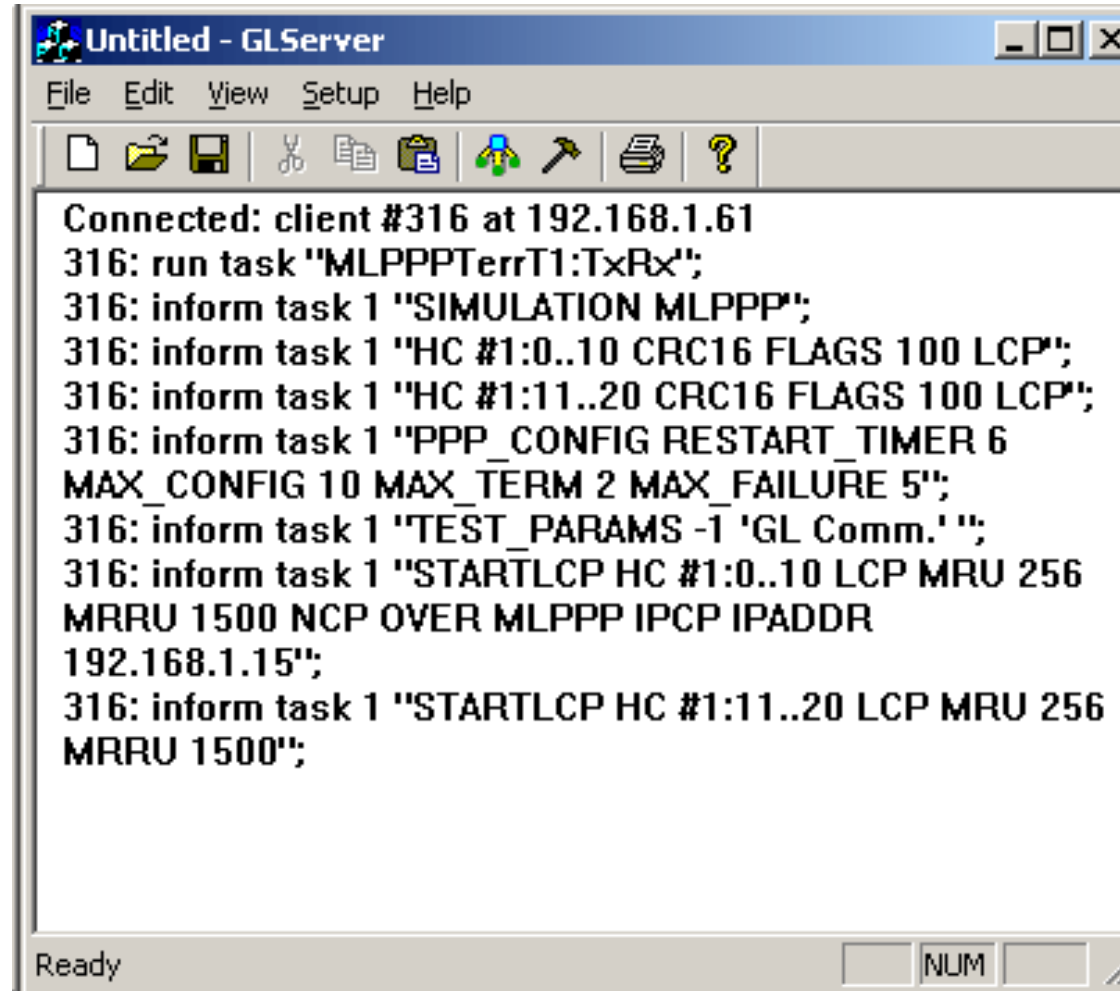
// set the LCP timer and counter values
inform task 1 "PPP_CONFIG RESTART_TIMER 6 MAX_CONFIG 10 MAX_TERM 2 MAX_FAILURE 5";

// set LCP echo test parameters
inform task 1 "TEST_PARAMS -1 'GL Comm.' ";
```

Ready Ver 4 B NUM

MC- ML PPP Emulator Command Line T1 / E1 Server

- Logs the commands and tasks from the client



The screenshot shows a window titled "Untitled - GLServer" with a menu bar (File, Edit, View, Setup, Help) and a toolbar. The main text area contains the following log entries:

```
Connected: client #316 at 192.168.1.61
316: run task "MLPPPTerrT1:TxRx";
316: inform task 1 "SIMULATION MLPPP";
316: inform task 1 "HC #1:0..10 CRC16 FLAGS 100 LCP";
316: inform task 1 "HC #1:11..20 CRC16 FLAGS 100 LCP";
316: inform task 1 "PPP_CONFIG RESTART_TIMER 6
MAX_CONFIG 10 MAX_TERM 2 MAX_FAILURE 5";
316: inform task 1 "TEST_PARAMS -1 'GL Comm.'";
316: inform task 1 "STARTLCP HC #1:0..10 LCP MRU 256
MRRU 1500 NCP OVER MLPPP IPCP IPADDR
192.168.1.15";
316: inform task 1 "STARTLCP HC #1:11..20 LCP MRU 256
MRRU 1500";
```

The status bar at the bottom shows "Ready" and a "NUM" button.

Sample Script

// Start a task and set the simulation type

```
run task "MLPPPTerrT1:TxRx";  
inform task 1 "SIMULATION MLPPP";
```

// Add PPP links to the MLPPP bundle

```
inform task 1 "HC #1:0..10 CRC16 FLAGS 100 LCP";  
inform task 1 "HC #1:11..20 CRC16 FLAGS 100 LCP";
```

// set the LCP timer and counter values

```
inform task 1 "PPP_CONFIG RESTART_TIMER 6 MAX_CONFIG 10 MAX_TERM 2  
MAX_FAILURE 5";
```

// set LCP echo test parameters

```
inform task 1 "testlcp HC #1:1..31 'GL Comm' -1" ";
```

// start LCP with selected LCP and NCP negotiation options

inform task 1 "STARTLCP HC #1:0..10 LCP MRU 256 MRRU 1500 NCP OVER MLPPP
IPCP IPADDR 192.168.1.15";

inform task 1 "STARTLCP HC #1:11..20 LCP MRU 256 MRRU 1500";

// Inform the Tx/rx parameters for the desired class

inform task 1 "Rx: CLASS 0 CONT SEQNUM MSB4 FIXLEN 1500";

inform task 1 "Tx: CLASS 0 CONT SEQNUM MSB4 FIXLEN 1500 FRAGSIZE 256";

// Start Tx/Rx

inform task 1 "STARTRX CLASS 0";

inform task 1 "STARTTX CLASS 0";

// Stop Tx/Rx

inform task 1 "STOPTX CLASS 0";

inform task 1 "STOPRX CLASS 0";

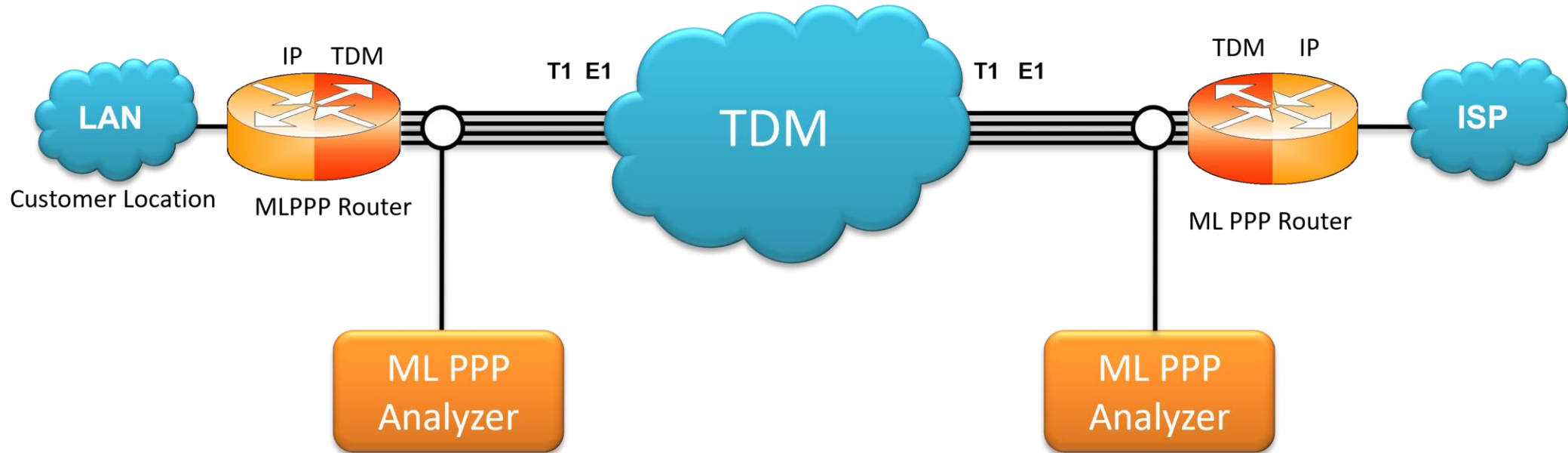
// end the task

end task 1;

MLPPP Analyzer

MLPPP 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



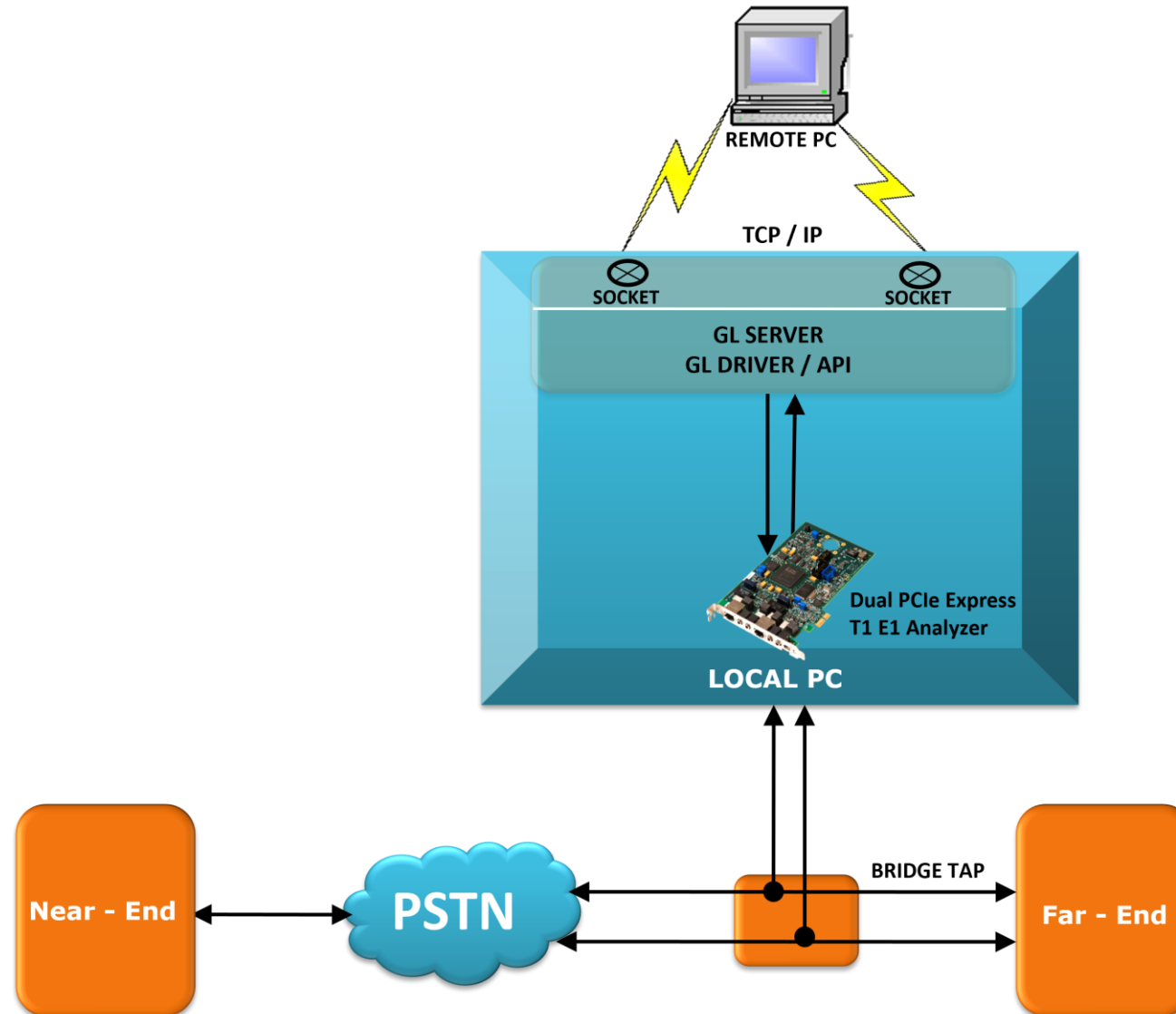
Features

- Ability to capture and decode both PPP routed protocols, PPP bridged protocols, MLPPP and MC-MLPPP streams of data
- Ability to test and perform numerous measurements across WAN- LAN or LAN-LAN connection
- Ability to test and analyze HDLC based PPP protocol, PPP SIGTRAN, and PPP over IP protocols in synchronous environment
- Supports decoding of frames with two MLPPP layers
- Supports reassembly of captured MLPPP fragments
- Multiple bundle of MLPPP traffic on various T1/E1 channels can be decoded simultaneously in the same or different GUI instances
- 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
- Remote monitoring capability using GL's Network Surveillance System

Supported Protocols

- Link Control Protocol (LCP)
- Bridging PDU (BPDU)
- PPP, Multiplexed PPP
- Multi-class extension to MLPPP
- Multi-link PPP
- Network Control Protocol (NCP)
 - Internet Protocol Control Protocol (IPCP)
 - Bridging Control Protocol (BCP)
 - PPP Mux CP
- Cisco HDLC decodes
- STUN, SNMP, RIP
- Link Quality Report (LQR)
- DHCP, DNS, ICMP
- Van Jacobson TCP/IP compression decodes
- IPHC
- IP, TCP, UDP
- PAP, CHAP
- SIP, MGCP, MEGACO
- RTP, CRTP, RTCP
- H.263, H.264, H.450
- ISDN H.225, MPEG2
- T.38
- RAS, SCTP
- M2UA, M2PA, M3UA
- ISUP, SCCP
- SUA, IUA, TUP
- Test and Network Management Messages

Non-Intrusive Testing



Different Views

- Virtual Packet Analysis (VPA) view
- Packet Data Analysis (PDA)/ Traffic Analyzer (TA) views

MLPPP Analysis View

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

Packet Data Analysis

- Summary view (Call Quality Matrix) displays complete summary of call information in graphical format, along with a summary of alerts
- Detail View (RTP diagnostic) displays packet by packet statistics for particular call information in tabular format
- Registration summary view displays statistics and status of the SIP registration process

Real-time Analysis

PPP Protocol Analysis PPP 64-bit

File View Capture Statistics Database Configure Help

0 GoTo

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Error | Protocol PPP Link | Code Link Control | Code IPCP | Protocol PPP Link(Level 1) | Protocol PPP Link(Level 2) | Source IP Address IP | Destination IP IP |
|-------|-------|-------|--------|-----------------|-----|-------|----------------------|----------------------|--------------|-------------------------------|-------------------------------|-------------------------|----------------------|
| ✓ 258 | 1-31 | | 0 | 00:00:00.000000 | 208 | | ML PPP | | | Internet Protocol (IPv4) | | 192.168.1.200 | 192.168.1.11 |
| ✓ 258 | 1-31 | | 1 | 00:00:00.019548 | 208 | | ML PPP | | | Internet Protocol (IPv4) | | 192.168.1.200 | 192.168.1.11 |
| ✓ 258 | 1-31 | | 2 | 00:00:00.040080 | 208 | | ML PPP | | | Internet Protocol (IPv4) | | 192.168.1.200 | 192.168.1.11 |
| ✓ 258 | 1-31 | | 3 | 00:00:00.059556 | 208 | | ML PPP | | | Internet Protocol (IPv4) | | 192.168.1.200 | 192.168.1.11 |
| ✓ 258 | 1-31 | | 4 | 00:00:00.080048 | 208 | | ML PPP | | | Internet Protocol (IPv4) | | 192.168.1.200 | 192.168.1.11 |
| ✓ 258 | 1-31 | | 5 | 00:00:00.100560 | 208 | | ML PPP | | | Internet Protocol (IPv4) | | 192.168.1.200 | 192.168.1.11 |
| ✓ 258 | 1-31 | | 6 | 00:00:00.120076 | 208 | | ML PPP | | | Internet Protocol (IPv4) | | 192.168.1.200 | 192.168.1.11 |

Card258 TimeSlots=1-31 Frame=0 at 00:00:00.000000 OK Len=208 *** Right click to SHOW/HIDE layer details or copy ***

HDLC Frame Data + FCS

```

===== PPP Link Layer =====
0000 Protocol = 00111101 ML PPP
===== ML PPP(Level 1) Layer =====
0001 Beginning Fragment = 1..... Yes
0001 Ending Fragment = .1..... Yes
0001 Mlppp Class = ..0000.. (0)
0002 Sequence Number(Long) = 9090 (x002382)
===== PPP Link(Level 1) Layer =====
0005 Protocol = 00100001 Internet Protocol (IPv4)

```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+-----+-----+
3D C0 00 23 82 21 45 00 00 C8 C1 C3 00 00 80 11 =À #!E EAX e
F3 D6 C0 A8 01 C8 C0 A8 01 72 07 D0 0F A0 00 B4 60A EA r D
75 DA 80 00 A5 34 A2 D4 12 4C C3 59 4F 01 FF FF uUc #4c0 LAYO yy
FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF yyyyyyyyyyyyyyyy
FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF yyyyyyyyyyyyyyyy

```

| Device # | Frame Count(Device #) |
|----------|-----------------------|
| 2 | 1487 |
| total 2 | 1487 |

C:\Program Files\GL Communications Inc\Usb E1 A 1 487 Frames

Different Views

- Summary View: This pane displays the columns that contain Card Number, Timeslots, Frame Number, Time, Frame Error Status, PPP Layer 3 Protocol, LCP Code, BCP Code, IPCP code, MLPPP Class, 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 various statistics that are calculated based on the protocol fields

Real-time Analysis

Real-time Analysis Configuration Interface

Bundle Selection: Bundle 1 | Bundle 2

Card Selection: Card 1 | Card 1

Buttons: Add Bundle, Delete Bundle, Add Link, Delete Link

Timeslot Selection:

| TS |
|----|
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |
| 7 |
| 8 |
| 9 |
| 10 |

Data Transmission Rate:

Single Channel:

- ☐ 64 kbps
- ☐ 56 kbps

Hyper-Channel:

- ☒ Nx64 kbps
- ☐ Nx56 Kbps (bits 1-7)
- ☐ Nx56 Kbps (Bits 2-8)

CRC: CRC16

Subchannels 8-56 kbps:

DS0 bits:

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |
| 7 |
| 8 |

Buttons: All, None

Bit Inversion (1 <-> 0): ☐

Octet Bit Reversion (MSB <-> LSB): ☐

Mlppp Options:

Fragment Format: Long Se

Maximum Differential Delay: 250

Selected Links: TS 1:1,HC 1:2..10

Card and Timeslot Selection Dialog:

Card Selection: Cards

| |
|---|
| 1 |
| 2 |

Timeslot Selection:

| TS |
|----|
| 0 |
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |
| 7 |
| 8 |
| 9 |
| 10 |
| 11 |

Data Transmission Rate:

Single Channel:

- ☒ 64 kbps
- ☐ 56 kbps

Hyper-Channel:

- ☐ Nx64 kbps
- ☐ Nx56 Kbps (bits 1-7)
- ☐ Nx56 Kbps (Bits 2-8)

CRC: CRC16

Subchannels 8-56 kbps:

DS0 bits:

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |
| 7 |
| 8 |

Buttons: All, None

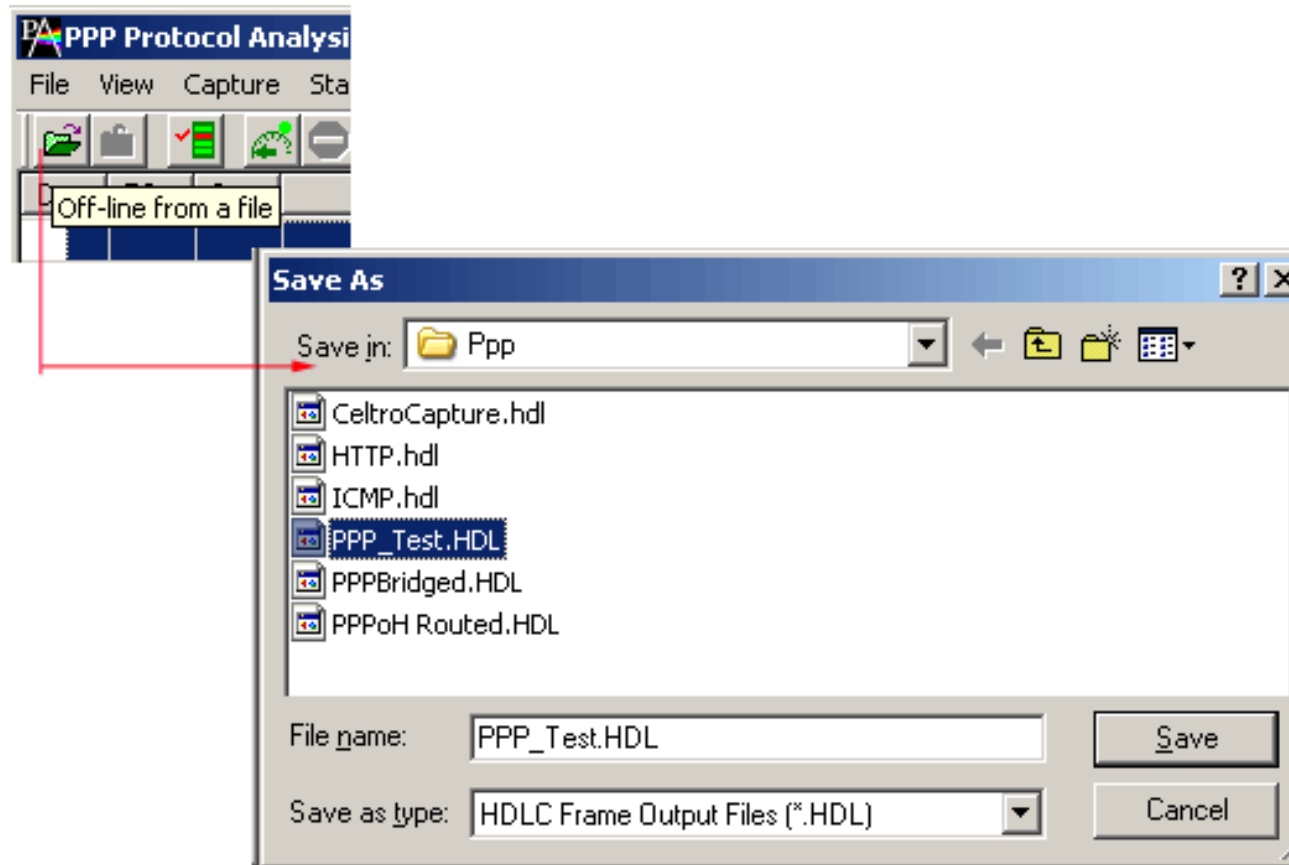
Buttons: All TS, Clear TS, OK

Real-time Analysis

- Streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels (fractional DS0 to DS1) or full bandwidth
- Frames can be captured in either, n x 64 kbps, or n x 56 kbps data channels
- Capture frames based on MLPPP options such as fragment format (long or short), & maximum differential delay
- Supports reassembly and decoding of multiple ML PPP bundles simultaneously. Each MLPPP bundle is created by selecting groups of timeslots on various cards
- 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, exported to ASCII file, or printed

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



Offline Analysis

- Trace files for offline analysis can be loaded through simple command-line arguments as below:

Command Syntax: ppprot ppp\Filename.hdl

The screenshot displays the PPP Protocol Analysis PPP application interface. The main window shows a list of frames with columns: Dev, TS..., Su..., Frame#, TIME (Relative), Len, Error, PPP Layer3Prot..., Mlppp Seq No, Mlppp Class, and PPP(Hihger) La... The frames are as follows:

| Dev | TS... | Su... | Frame# | TIME (Relative) | Len | Error | PPP Layer3Prot... | Mlppp Seq No | Mlppp Class | PPP(Hihger) La... |
|-----|-------|-------|--------|-----------------|-----|-------|-------------------|--------------|-------------|-------------------|
| ✓ 1 | 1-30 | | 0 | 00:00:00.000000 | 19 | | Link Control | | | |
| ✓ 1 | 1-30 | | 1 | 00:00:00.391391 | 19 | | Link Control | | | |
| ✓ 1 | 1-30 | | 2 | 00:00:04.986112 | 19 | | Link Control | | | |
| ✓ 1 | 1-30 | | 3 | 00:00:05.002229 | 28 | | ML PPP | 0 | 0 | ML PPP |
| ✓ 1 | 1-30 | | 4 | 00:00:07.975691 | 28 | | ML PPP | 1 | 0 | ML PPP |
| ✓ 1 | 1-30 | | 5 | 00:00:39.987229 | 12 | | Link Control | | | |

A command prompt window is open, showing the following commands and output:

```
C:\D:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
D:\>cd D:\Program Files\GL Communications Inc\PPP Analyzer
D:\Program Files\GL Communications Inc\PPP Analyzer>pppprot ppp\PPP_Test.hdl
D:\Program Files\GL Communications Inc\PPP Analyzer>
Protocol = 00000000 00111101 ML PPP
===== ML PPP Layer =====
Beginning Fragment = 1..... Yes
Ending Fragment = .1..... Yes
Mlppp Class = ..0000.. (0)
Sequence Number(Long) = 0. (*0000000)
```

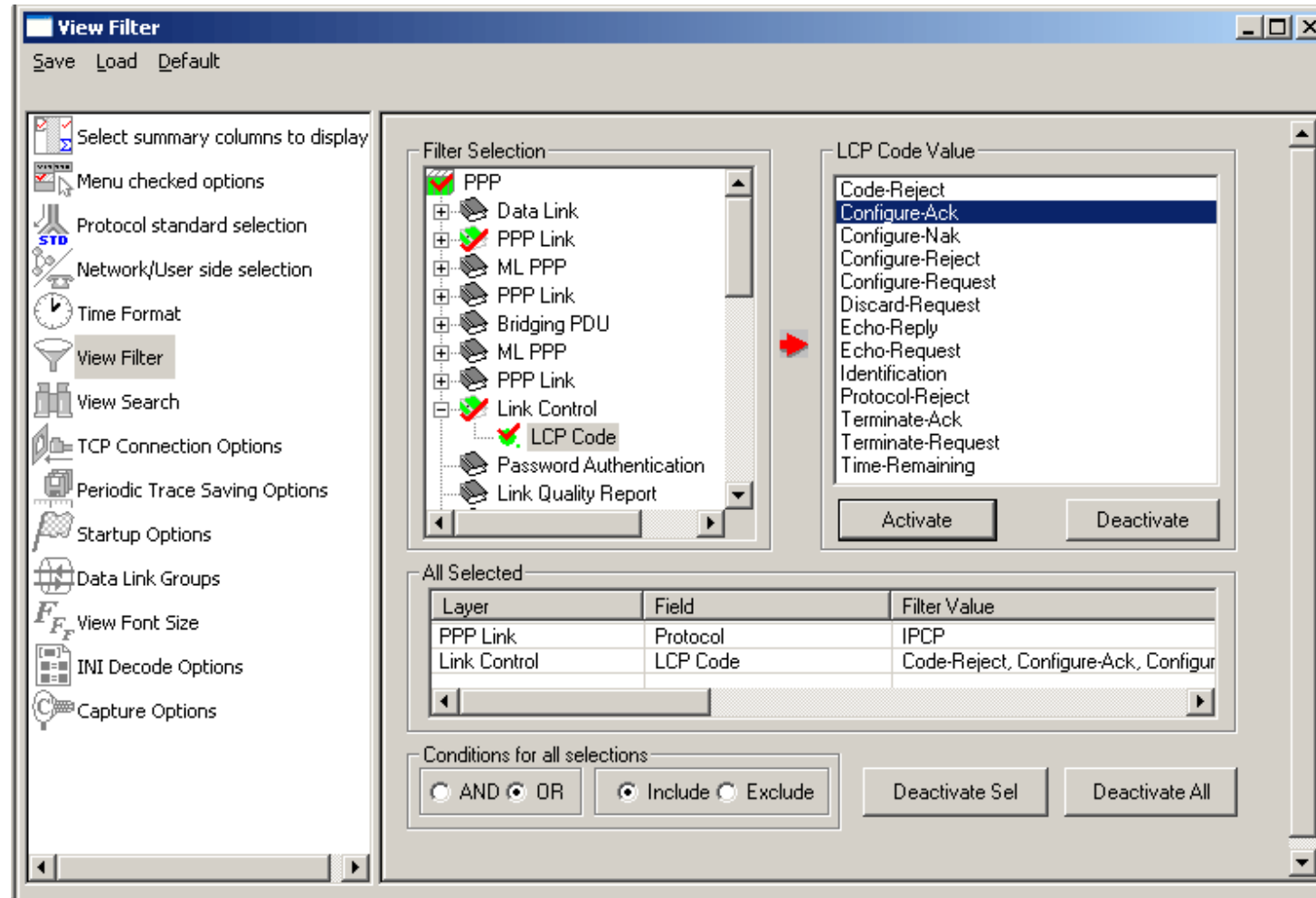
Below the command prompt, the Hex Dump of the Frame Data is shown:

```
Hex Dump of the Frame Data
+-----+-----+-----+-----+-----+-----+-----+-----+
FF 03 00 3D C0 00 00 00 00 3D C0 00 00 00 80 21  y  =A  =A  !!
01 01 00 0A 03 06 0A 00 00 33 85 96                      3!!
```

The status bar at the bottom indicates "Off-line Viewing" and "C:\Program Files\GL Communicati 489 Frames".

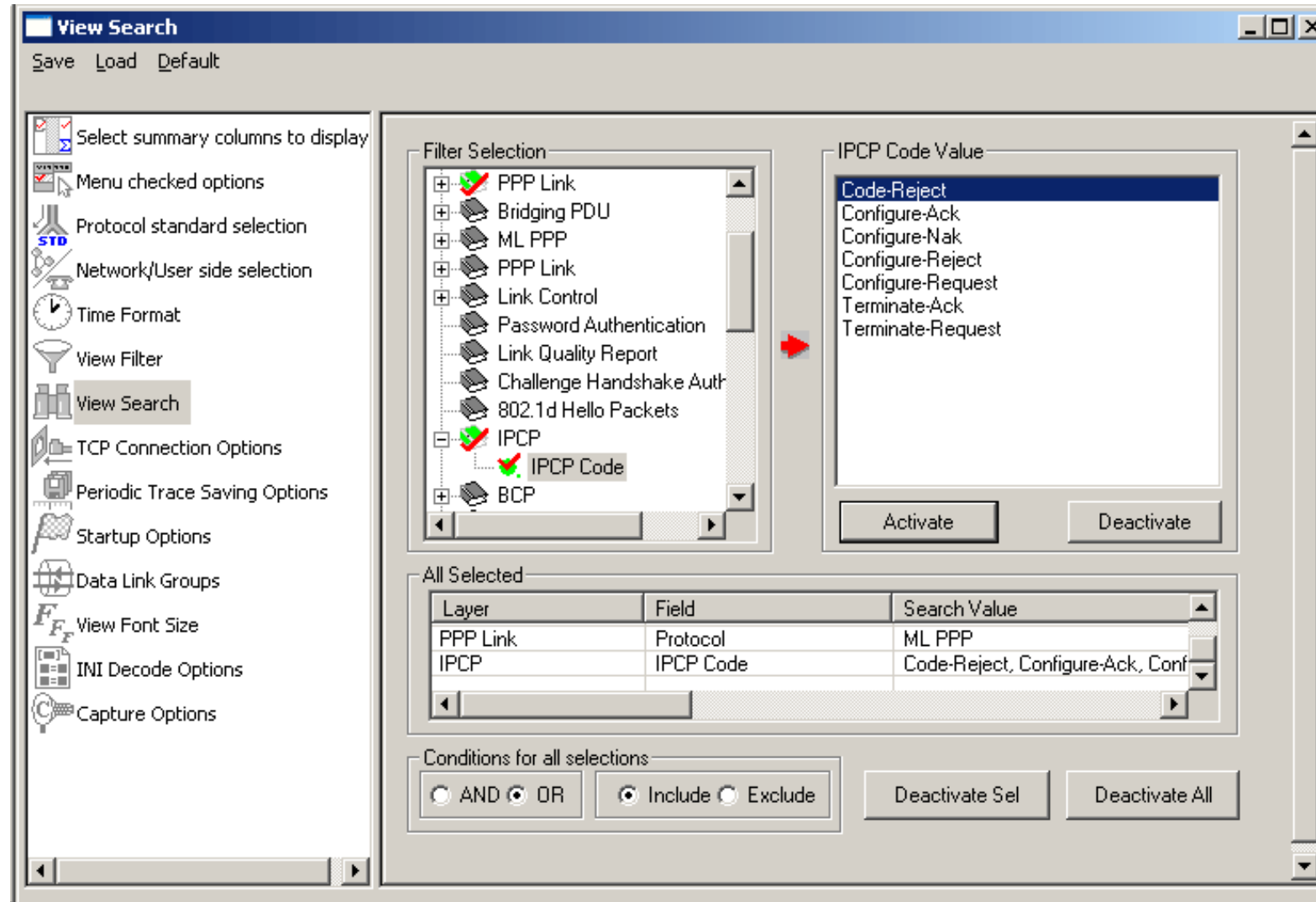
Filters - Offline View Filter

- Isolates required frames from all frames in real-time, as well as offline
- Allows filtering according to various layers and protocol fields such as LCP Code, IPCP, ML PPP sequence number, message type, mlppp class, TCP / UDP source and destination port and more



Search Options

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



Filtering Criteria From Screen Selection

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

The screenshot shows the 'PPP Protocol Analysis PPP 64-bit' window with a table of network data. The table has columns: Dev, TSlot, SubCh, Frame#, TIME (Relative), Len, Error, Protocol, PPP Link, Code Link Control, and Code IPCP. The data rows are as follows:

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Error | Protocol | PPP Link | Code Link Control | Code IPCP |
|-------|-------|-------|--------|-----------------|-----|-------|----------|----------|-------------------|-----------|
| ✓ 258 | 1-31 | | 0 | 00:00:00.000000 | 208 | | ML PPP | | | |
| ✓ 258 | 1-31 | | 1 | 00:00:00.019548 | 208 | | ML PPP | | | |
| ✓ 258 | 1-31 | | 2 | 00:00:00.040080 | 208 | | ML PPP | | | |
| ✓ 258 | 1-31 | | 3 | 00:00:00.059556 | 208 | | ML PPP | | | |
| ✓ 258 | 1-31 | | 4 | 00:00:00.080048 | 208 | | ML PPP | | | |

Below the table, there are three buttons: 'Search Selected Value', 'Set Search Criteria as Sel Values', and 'Set Filter Criteria as Sel Values'. A red arrow points from the 'Set Filter Criteria as Sel Values' button to a dialog box titled 'Use Ctrl, Shift for Extended Selection'. The dialog box contains a list of filter criteria: 'PPP Link::Protocol', 'PPP Link(Level 1)::Protocol', 'IP::Destination IP Address', 'IP::Source IP Address', 'UDP::Destination Port', and 'UDP::Source Port'. Below the list are 'OK', 'Select All', and 'Cancel' buttons.

The screenshot shows the 'Analyzer GUI and Protocol Configuration' window. On the left is a sidebar with various options: '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 is divided into 'Filter Selection' and 'Value Selection' sections. The 'Filter Selection' section has a tree view with the following items: 'PPP', 'Data Link', 'MLPPP Error', 'PPP Link', 'ML PPP(Level 1)', 'PPP Link(Level 1)', 'Bridging PDU', 'ML PPP(Level 2)', 'PPP Link(Level 2)', 'Link Control', 'Password Authentication', and 'Link Quality Report'. A red arrow points from the 'PPP Link' item to the 'Value Selection' section. The 'Value Selection' section has 'Activate' and 'Deactivate' buttons. Below these sections is a table titled 'All Selected' with columns 'Layer', 'Field', and 'Filter Value'. The table contains the following data:

| Layer | Field | Filter Value |
|-------------------|----------|--------------------------|
| PPP Link | Protocol | ML PPP |
| PPP Link(Level 1) | Protocol | Internet Protocol (IPv4) |

At the bottom, there are 'Conditions for all selections' with radio buttons for 'AND' and 'OR', and 'Include' and 'Exclude' checkboxes. There are also 'Deactivate Sel' and 'Deactivate All' buttons.

Search Criteria From Screen Selection

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

The image shows a sequence of three screenshots illustrating the process of creating search criteria from a screen selection in the PPP Protocol Analysis GUI.

Top Left Screenshot: The main window of the PPP Protocol Analysis GUI. The table below shows the captured data. The row for Frame# 1 is selected.

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Error | Protocol | Code | Code |
|-------|-------|-------|--------|-----------------|-----|-------|----------|--------------|------|
| | | | | | | | PPP Link | Link Control | IPCP |
| ✓ 258 | 1-31 | | 0 | 00:00:00.000000 | 208 | | ML PPP | | |
| ✓ 258 | 1-31 | | 1 | 00:00:00.019548 | 208 | | ML PPP | | |
| ✓ 258 | 1-31 | | 2 | 00:00:00.040080 | 208 | | ML PPP | | |
| ✓ 258 | 1-31 | | 3 | 00:00:00.059556 | 208 | | ML PPP | | |
| ✓ 258 | 1-31 | | 4 | 00:00:00.080048 | 208 | | ML PPP | | |
| ✓ 258 | 1-31 | | 5 | 00:00:00.100560 | 208 | | ML PPP | | |

Top Right Screenshot: A dialog box titled "Use Ctrl, Shift for Extended Selection". It contains a list of search criteria options:

- PPP Link::Protocol
- PPP Link(Level 1)::Protocol
- IP::Destination IP Address
- IP::Source IP Address
- UDP::Destination Port
- UDP::Source Port

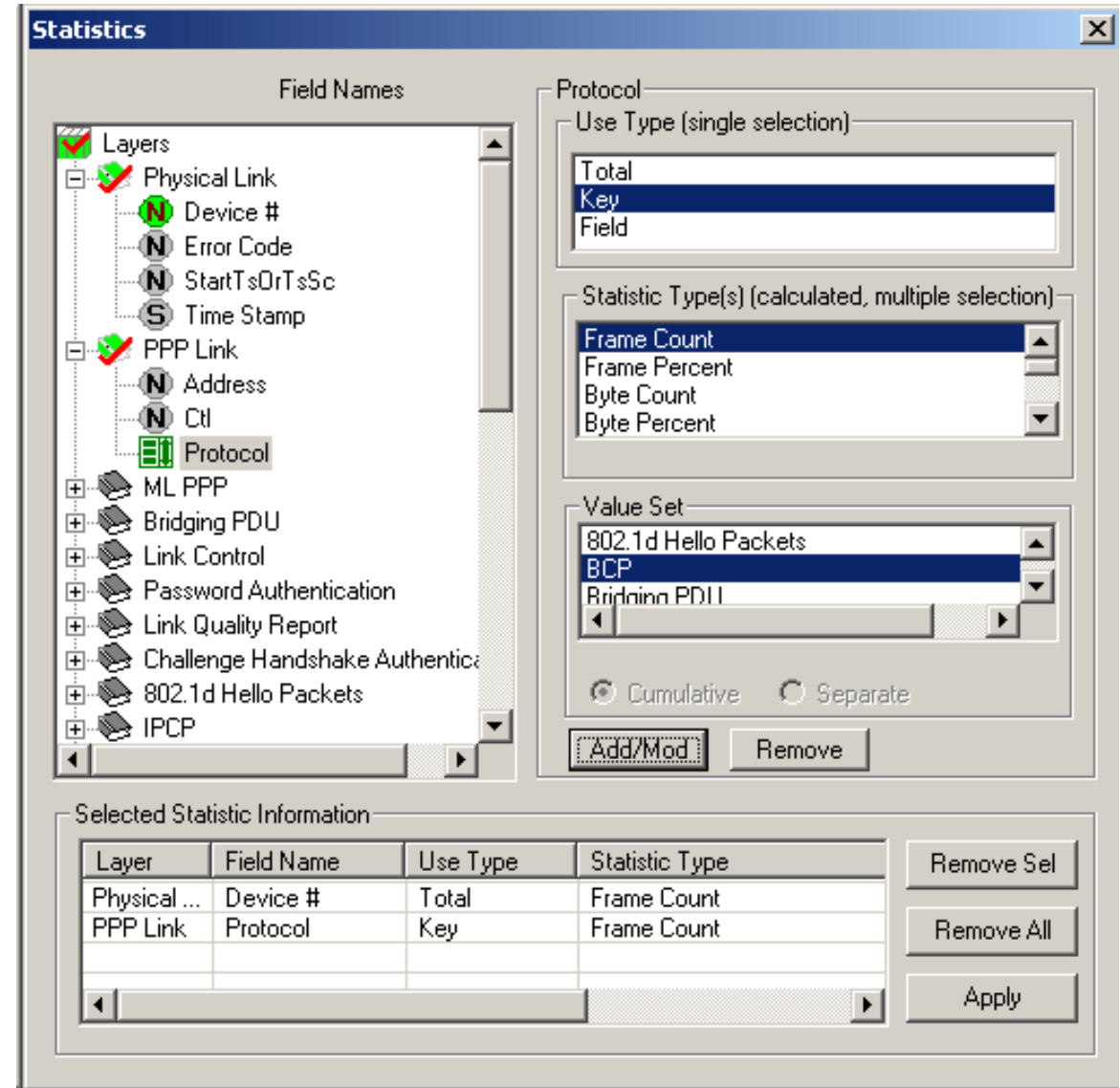
Bottom Screenshot: The "Analyzer GUI and Protocol Configuration" window. The "Filter Selection" pane shows a tree view of protocol layers. The "Value Selection" pane shows the selected criteria for the "All Selected" filter.

| Layer | Field | Search Value |
|-------------------|------------------------|--------------------------|
| PPP Link(Level 1) | Protocol | Internet Protocol (IPv4) |
| IP | Destination IP Address | 192.168.1.114 |

Red arrows indicate the flow of the process: from the selected row in the main table to the dialog box, and then to the "Value Selection" pane in the configuration window.

Statistics

- Statistics is an important feature available in PPP 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 PPP networks based on various protocol fields and parameters

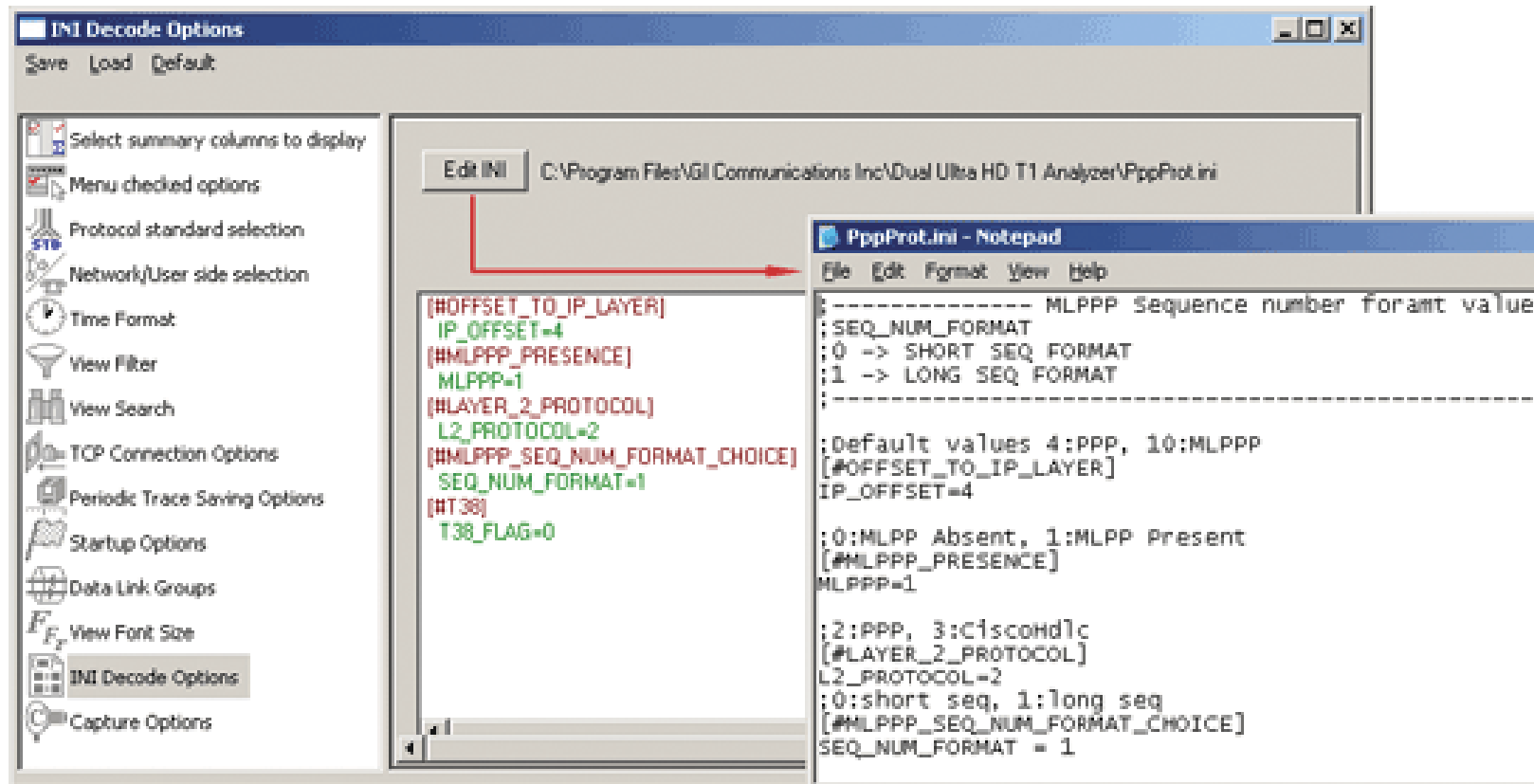


Saving a File

- 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

Configuring INI Decode Options

- PPPProt.INI configuration file enables –
 - Customization of the value for the sequence number format
 - Select either decoding of MLPPP frames or Cisco HDLC frames



Define Summary Columns

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

The screenshot displays the 'PPP Protocol Analysis' software interface. On the left, a sidebar lists various configuration options, with 'Define Summary Columns' highlighted by a red box and an arrow pointing to it. The main window is titled 'Defined Protocol Summary Fields for PPP' and contains a table of fields. The 'Version' field is checked, and a red box highlights it. Below the table, the 'Hex Dump of the Frame Data' is visible. A red arrow points from the 'Output display in analyzer' text to the main analysis window.

Defined Protocol Summary Fields for PPP

| Field | Selected |
|-------------------|-------------------------------------|
| IP | <input type="checkbox"/> |
| Compartment | <input type="checkbox"/> |
| Copied Flag | <input type="checkbox"/> |
| DF | <input type="checkbox"/> |
| Delay | <input type="checkbox"/> |
| Destination IP | <input type="checkbox"/> |
| Flag | <input type="checkbox"/> |
| Fragment Offset | <input type="checkbox"/> |
| Handling Res | <input type="checkbox"/> |
| Header Check | <input type="checkbox"/> |
| Identification | <input type="checkbox"/> |
| Internet Address | <input type="checkbox"/> |
| Internet Header | <input type="checkbox"/> |
| Length | <input type="checkbox"/> |
| MF | <input type="checkbox"/> |
| Option Class | <input type="checkbox"/> |
| Option Number | <input type="checkbox"/> |
| Overflow | <input type="checkbox"/> |
| Pointer | <input type="checkbox"/> |
| Precedence | <input type="checkbox"/> |
| Protocol | <input type="checkbox"/> |
| Reliability | <input type="checkbox"/> |
| Reserved | <input type="checkbox"/> |
| Reserved for | <input type="checkbox"/> |
| Route Data | <input type="checkbox"/> |
| Router Alert | <input type="checkbox"/> |
| Security | <input type="checkbox"/> |
| Source IP Address | <input type="checkbox"/> |
| Version | <input checked="" type="checkbox"/> |
| IPHC Full Header | <input type="checkbox"/> |
| CID Space | <input type="checkbox"/> |
| CID (if 8 B) | <input type="checkbox"/> |

PPP Protocol Analysis PPP

| Dev | TSlot | SubCh | Frame# | TIME | Len | Error | Version |
|-----|-------|-------|--------|----------|-----|-------|---------|
| 2 | 1-31 | | 0 | 00:00:00 | 180 | | 4 |
| 2 | 1-31 | | 1 | 00:00:00 | 408 | | 4 |
| 2 | 1-31 | | 2 | 00:00:00 | 242 | | 4 |
| 2 | 1-31 | | 3 | 00:00:00 | 76 | | 4 |
| 2 | 1-31 | | 4 | 00:00:00 | 76 | | 4 |
| 2 | 1-31 | | 5 | 00:00:00 | 76 | | 4 |
| 2 | 1-31 | | 6 | 00:00:00 | 76 | | 4 |
| 2 | 1-31 | | 7 | 00:00:00 | 76 | | 4 |

Hex Dump of the Frame Data

```
FF 03 00 3D C0 00 0C 3C 00 21 45 00 00 AA F9 89  +--+--+--+
40 00 3F 06 C9 3C CA AE 9C 22 48 25 C9 91 06 B8  @ ? E<E@HxE'
E8 9F 00 44 EE F3 4C 96 B9 52 80 18 00 D7 08 84  e! DióL'R! x |
00 00 01 01 08 0A 02 73 1B B2 02 53 6A 22 03 00  s' Si"
```

Selection of Summary Column

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 screenshot displays two windows from the GL Communications software. The 'Aggregate Summary Columns' dialog box is in the foreground, showing a list of summary columns and their display formats. The 'PPP Protocol Analysis' window is in the background, showing a table of protocol analysis results.

Aggregate Summary Columns Dialog:

| Name | Display Format | Summary Columns | Separator |
|---------|-------------------|--|-----------|
| Group~0 | Concat | Protocol_PPP Link(Level 1) Source IP Address_IP | & |
| Group~1 | <Col_Alias> Value | Destination IP Address_IP | --- |
| Group~2 | Overlay | Source Port_UDP Destination Port_UDP | |

PPP Protocol Analysis Window:

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Group~0 | Error | Protocol PPP Link |
|------|-------|-------|--------|-----------------|-----|--|-------|-------------------|
| ✓258 | 1-31 | | 0 | 00:00:00.000000 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 1 | 00:00:00.019548 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 2 | 00:00:00.040080 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 3 | 00:00:00.059556 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 4 | 00:00:00.080048 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 5 | 00:00:00.100560 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 6 | 00:00:00.120076 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 7 | 00:00:00.139641 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 8 | 00:00:00.160108 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 9 | 00:00:00.179641 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 10 | 00:00:00.200145 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 11 | 00:00:00.219665 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |
| ✓258 | 1-31 | | 12 | 00:00:00.241173 | 208 | Internet Protocol (IPv4) & 192.168.1.200 | | ML PPP |

Card258 TimeSlots=1-31 Frame=0 at 00:00:00.000000 OK Len=208 ***

HDLC Frame Data + FCS

----- PPP Link Layer ----- =

0000 Protocol = 00111101 ML PPP

----- ML PPP(Level 1) Layer ----- =

0001 Beginning Fragment = 1..... Yes

0001 Ending Fragment = .1..... Yes

0001 Mlppp Class = ..0000.. (0)

0002 Sequence Number(Long) = 9090 (x002382)

----- PPP Link(Level 1) Layer ----- =

0005 Protocol = 00100001 Internet Protocol (IPv4)

----- IP Layer ----- =

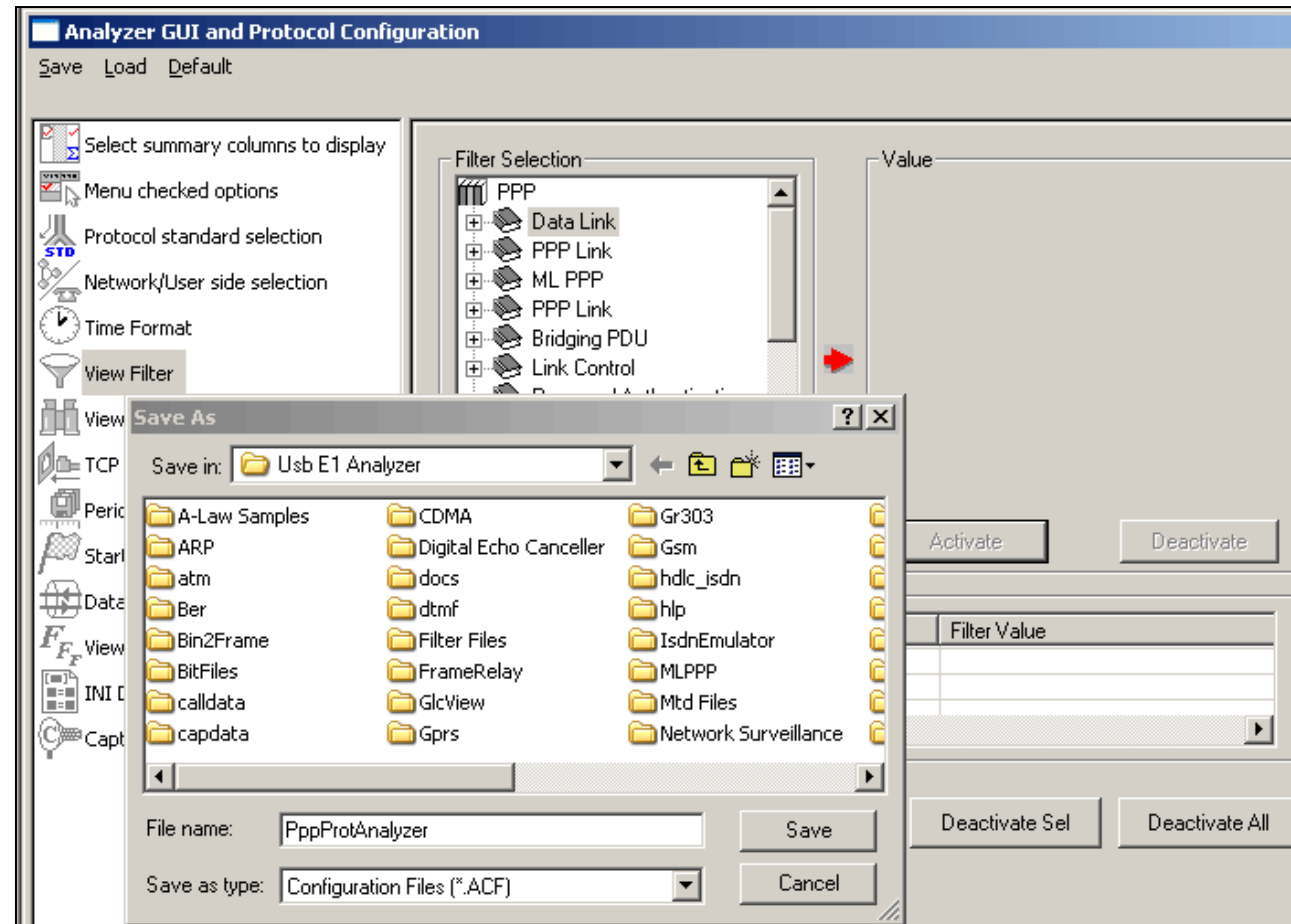
0006 Version = 0100.... (4)

0006 Internet Header Length (In 32 bit words) =0101 (5)

Off-line Viewing. C:\Program Files\GL Communications Inc\Urb 1487 Frames

Save/Load All Configuration Settings

- Protocol Configuration window provides a consolidated interface for all the settings required in the analyzer such as protocol selection, filter criteria, search criteria, and so on
- Configuration settings can be saved to a file, loaded from a configuration file, or user may just revert to the default values using the default option



HDL File Format

| Record Count (4 Bytes) | Version (2 Bytes) | Circular (1 Byte) | Trace Type (1 Byte) |
|--|-------------------|-------------------|---------------------|
| Reserved (12 Bytes) | | | |
| Comments (124 Bytes) | | | |
| Length of frame 1 (2 Bytes) : Begin of Frame 1 | | | |
| Frame Header (13 Bytes) [Ref: HdlcTraceRecord2] | | | |
| Frame Data (n Bytes) | | | |
| Length of frame 1 (2 Bytes) : End of Frame 1 | | | |
| Length of frame 2 (2 Bytes) : Begin of Frame 2 | | | |
| Frame Header (13 Bytes) [Ref: HdlcTraceRecord2] | | | |
| Frame Data (n Bytes) | | | |
| Length of frame 2 (2 Bytes) : End of Frame 2 | | | |
| ... | | | |
| ... | | | |
| ... | | | |
| Length of frame 'n' (2 Bytes) : Begin of Frame 'n' | | | |
| Frame Header (13 Bytes) [Ref: HdlcTraceRecord2] | | | |
| Frame Data (n Bytes) | | | |
| Length of frame 'n' (2 Bytes) : End of Frame 'n' | | | |

- Record Count: Number of Frames (Records) in the file
- Version: Version of HDL file
- Circular: If circular buffer is used, set it to 1, else set to 0
- Trace Type: Set to 0
- Reserved: Not used, set to 0
- Comments: Not used, set to 0

Frame Header Information

- Timestamp: Time of capture in 100ns
- Dev No: GL card number
- Sub channels used: Indicates whether sub channels are used or not. If whole of channel is used for one stream, it is set to 0
- Time slot for sub channels: Timeslot number used for sub channels
- Start and End Ts: Starting / ending timeslot or sub channel
- Error flag

Packet Data Analysis

Packet Data Analysis

- Packet Data Analysis consists of -
 - Summary view
 - Detail view
 - Registration summary view

Main Features of PDA

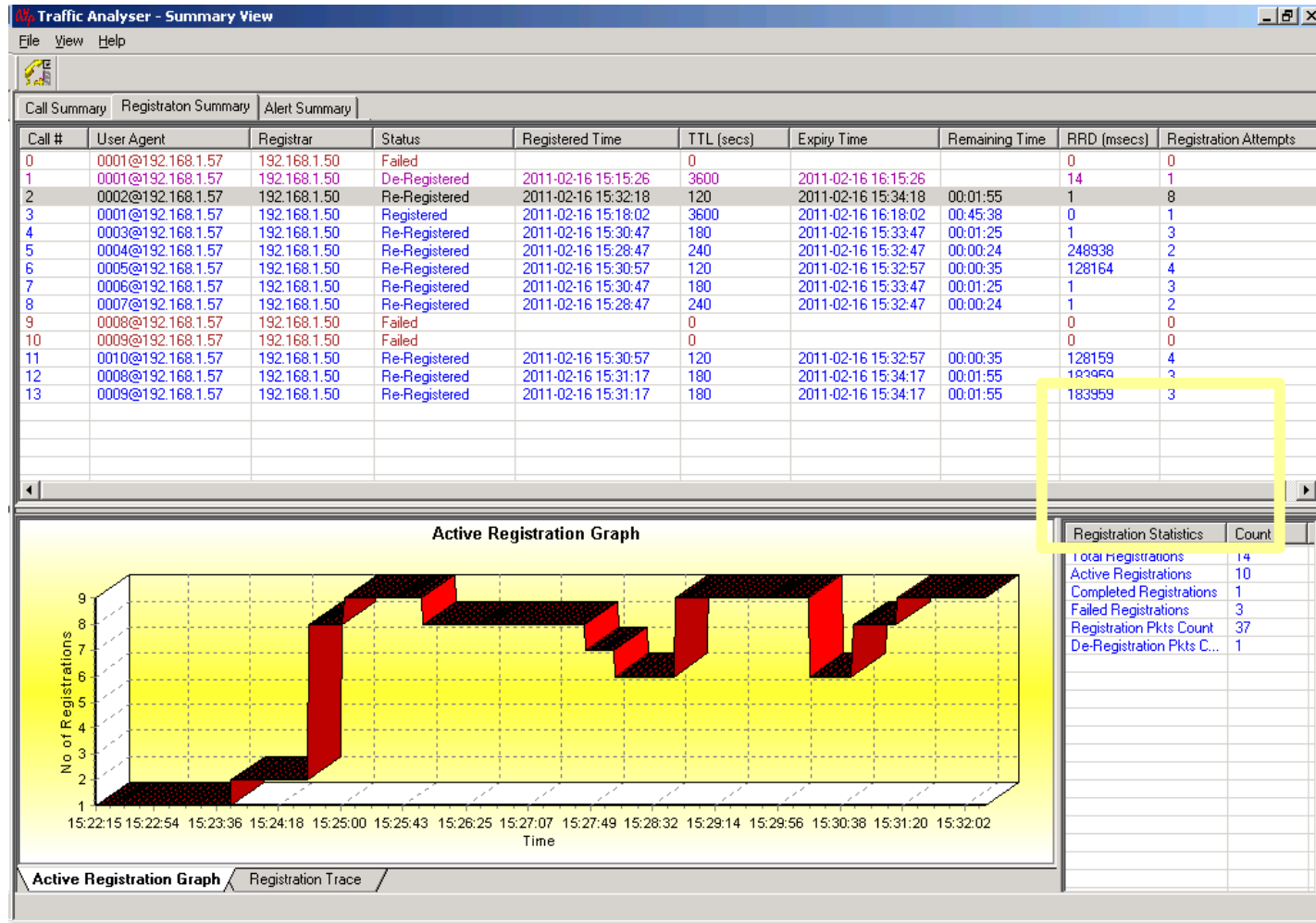
- Supported protocols - SIP (Session Initiation Protocol RFC 2543 and RFC 3261), MEGACO RFC 3525, MEGACO RFC 3015, MGCP, T.38, H323/H225, and RTP
- Full RTP Analysis with audio capture/playback supported for all common codecs
- Supports saving the selected calls from traffic analyzer into *.HDL or *.PCAP formats
- T.38 Analysis - User can decode T.38 frames received over VoIP calls and can have ladder diagram for T.38 traffic flow, reassemble the fragmented data & to identify the T.30 message from it
- Displays summary of signaling, audio, and video parameters of each call.
- Video parameters such as Source/Destination Video Channels, Media Type, SSRC, Average Delay/Gap, Packet Counts, Media Delivery Index (MDI- (Delay Factor : Media Loss Rate)), and Frame Rate are calculated are displayed for all video calls

Main Features of PDA

- Real-time audio/video monitoring of RTP streams; Record audio and video data of a session to a file in QuickTime format
- Supported audio and video codecs: Mul-law, A-law, G.711 App II, G726 (40 , 32, 24 and 16 kbps), G726 with VAD, GSM610, G.722, G.722.1, G729, G729B, AMR, ILBC, SPEEX, EVRC, EVRCB, EVRC-C, H.263, and H.264
- Call Quality Of Service (QOS) for all calls with E-Model based (G.107) Mean Opinion Score (MOS) and R-factor with individual and summary statistics presented in graphical and tabular formats
- Alert Summary tab provides summary of each alerts that have occurred during the analysis
 - Support Video QoS for H.263+ and H.264 video codec; provides video capture & video conference monitoring and video compression capability
 - Capable of displaying Video QoS Statistics such as Missing Packets, Delay, Gap, Video Frame Count, Media Delivery Index (MDI- (Delay Factor : Media Loss Rate)), and Frame Rate, and more

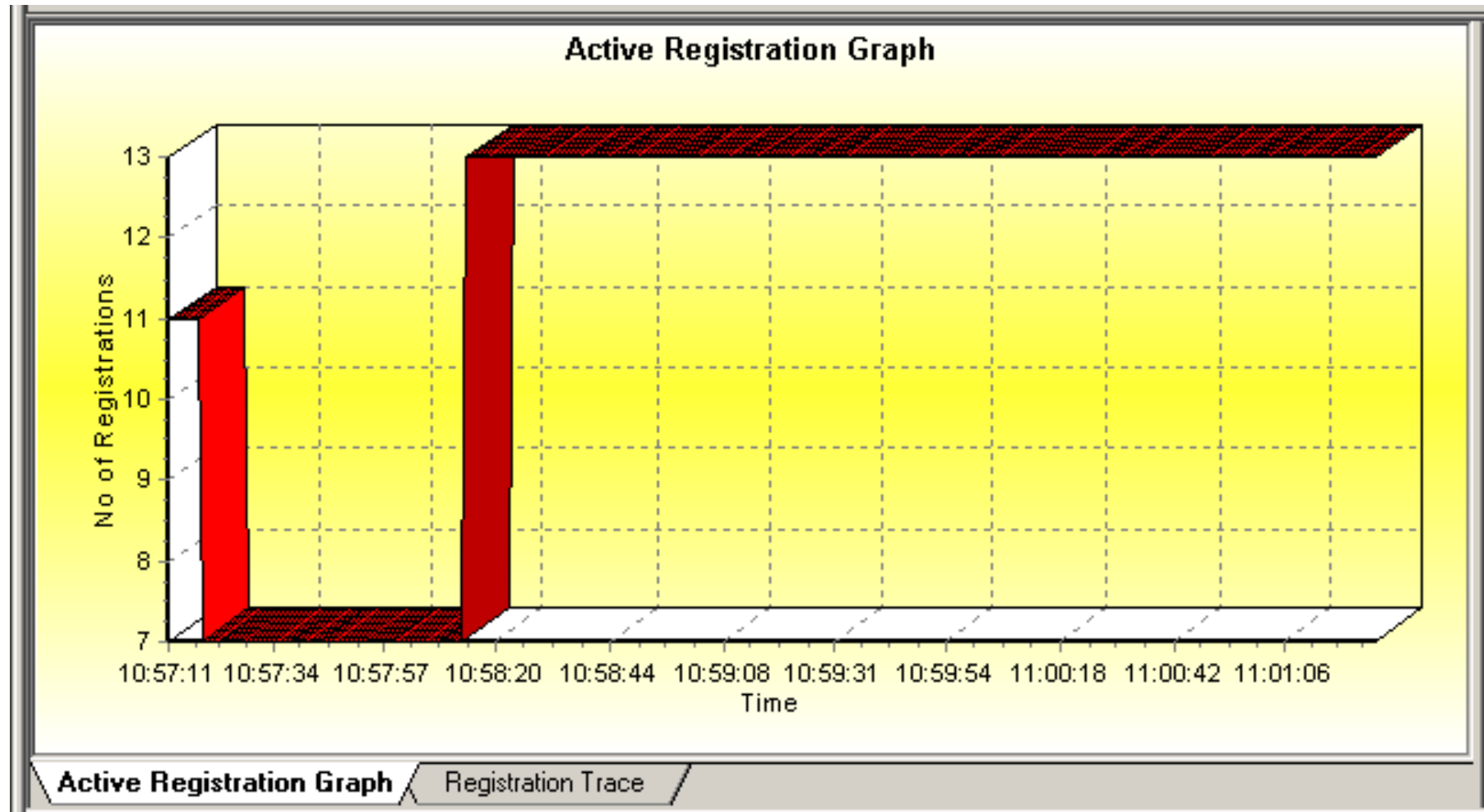
Registration Summary

- Provides the registration summary of each SIP registration including the user agent, registrar, status, registered time, expiry time, time to live, remaining time, Registration Request Delay (RRD), and number of registration attempts



Active Registration Graph

- Displays the active registration graph of the entire registration summary
- Simple line graph, depicting the Number Of Active Registration Vs Time



Registration Trace

Traffic Analyser - Summary View

File View Help

Call Summary Registraton Summary Alert Summary

| Call # | User Agent | Registrar | Status | Registered Time | TTL (secs) | Expiry Time | Remaining Time | RRD (msecs) | Registration Attempts |
|--------|-------------------|--------------|---------------|---------------------|------------|---------------------|----------------|-------------|-----------------------|
| 0 | 0001@192.168.1.57 | 192.168.1.50 | Failed | | 0 | | | 0 | 0 |
| 1 | 0001@192.168.1.57 | 192.168.1.50 | De-Registered | 2011-02-16 15:15:26 | 3600 | 2011-02-16 16:15:26 | | 14 | 1 |
| 2 | 0002@192.168.1.57 | 192.168.1.50 | Re-Registered | 2011-02-16 15:25:56 | 120 | 2011-02-16 15:27:56 | 00:00:03 | 1 | 5 |
| 3 | 0001@192.168.1.57 | 192.168.1.50 | Registered | 2011-02-16 15:18:02 | 3600 | 2011-02-16 16:18:02 | 00:50:08 | 0 | 1 |
| 4 | 0003@192.168.1.57 | 192.168.1.50 | Re-Registered | 2011-02-16 15:27:46 | 180 | 2011-02-16 15:30:46 | 00:02:54 | 1 | 2 |
| 5 | 0004@192.168.1.57 | 192.168.1.50 | Registered | 2011-02-16 15:24:38 | 240 | 2011-02-16 15:28:38 | 00:00:45 | 0 | 1 |
| 6 | 0005@192.168.1.57 | 192.168.1.50 | Re-Registered | 2011-02-16 15:26:46 | 120 | 2011-02-16 15:28:46 | 00:00:53 | 128164 | 2 |
| 7 | 0006@192.168.1.57 | 192.168.1.50 | Re-Registered | 2011-02-16 15:27:46 | 180 | 2011-02-16 15:30:46 | 00:02:54 | 1 | 2 |
| 8 | 0007@192.168.1.57 | 192.168.1.50 | Registered | 2011-02-16 15:24:38 | 240 | 2011-02-16 15:28:38 | 00:00:45 | 1 | 1 |
| 9 | 0008@192.168.1.57 | 192.168.1.50 | Failed | | 0 | | | 0 | 0 |
| 10 | 0009@192.168.1.57 | 192.168.1.50 | Failed | | 0 | | | 0 | 0 |
| 11 | 0010@192.168.1.57 | 192.168.1.50 | Re-Registered | 2011-02-16 15:26:46 | 120 | 2011-02-16 15:28:46 | 00:00:53 | 128159 | 2 |
| 12 | 0008@192.168.1.57 | 192.168.1.50 | Registered | 2011-02-16 15:25:03 | 180 | 2011-02-16 15:28:03 | 00:00:09 | 0 | 1 |
| 13 | 0009@192.168.1.57 | 192.168.1.50 | Registered | 2011-02-16 15:25:03 | 180 | 2011-02-16 15:28:03 | 00:00:09 | 0 | 1 |

192.168.1.57

192.168.1.50

54098

5060

5060

54098

5060

54098

5060

54098

REGISTER

SIP/2.0 200 OK

REGISTER

SIP/2.0 200 OK

REGISTER

SIP/2.0 200 OK

REGISTER

```

REGISTER sip:192.168.1.50 SIP/2.0
Via: SIP/2.0/UDP 192.168.1.57:5060;branch=z9hG4bK729508016-3623
Max-Forwards: 70
Allow: INVITE,BYE,CANCEL,ACK,INFO,PRACK,COMET,OPTIONS,SUBSCRIBE,NOTIFY,
From: 0002 <sip:0002@192.168.1.57>;tag=GLPG_729508016-3624
To: sip:0002@192.168.1.57
Call-ID: GLPG7295080163622
CSeq: 1 REGISTER
Expires: 120
Contact: 0002 <sip:0002@192.168.1.57>
Content-Length: 0
    
```

Registration Trace

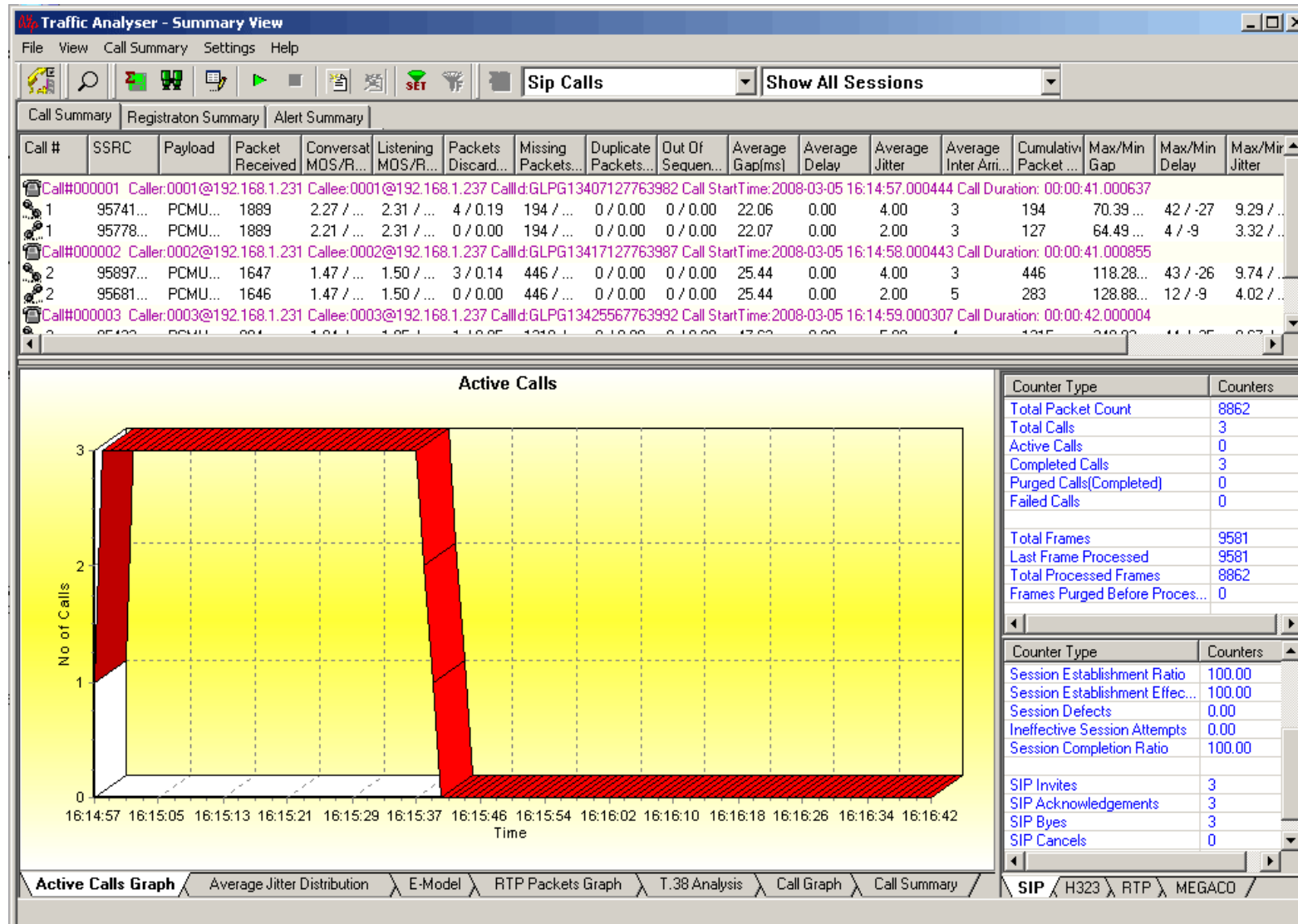
- Displays the message sequence of registered calls
- Message sequence pictorially displays the messages exchanged for a particular scenario between a user agent and the registrar

Summary View

Summary View displays -

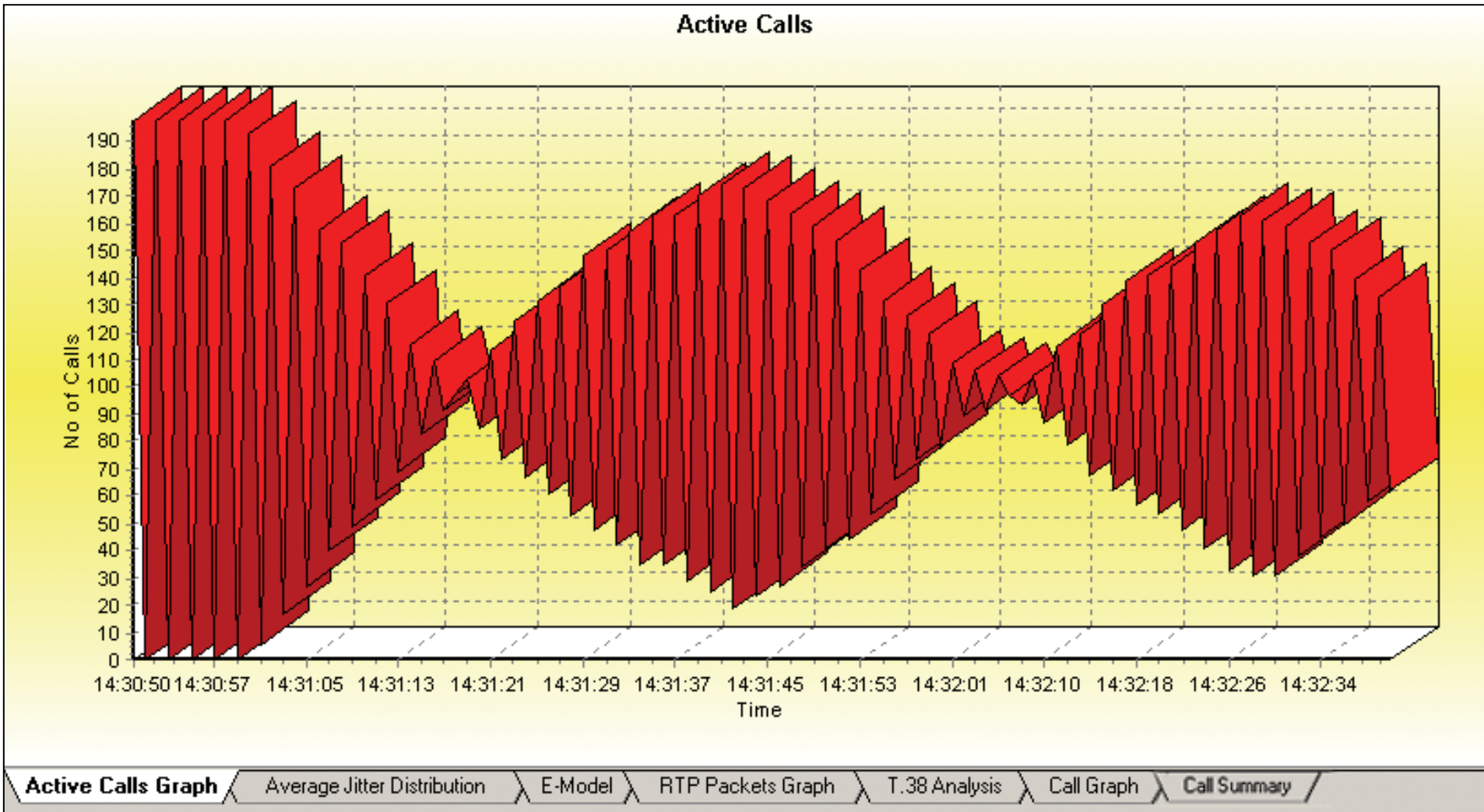
- Summary of data transmission in each direction including calling number, called number, call id, start time, duration, missing packets, and so on
- Includes separate statistical counts on total packets, calls, failed calls, captured frames, etc., for SIP, H323, MEGACO, T.38, and RTP based calls
- Provides various graphs to view active calls, active jitter distribution, E-model based measurements for R-factor / MOS/ Packet discarded, RTP packets, T.38 fax analysis, and call flow graph over the duration of the call

Summary View



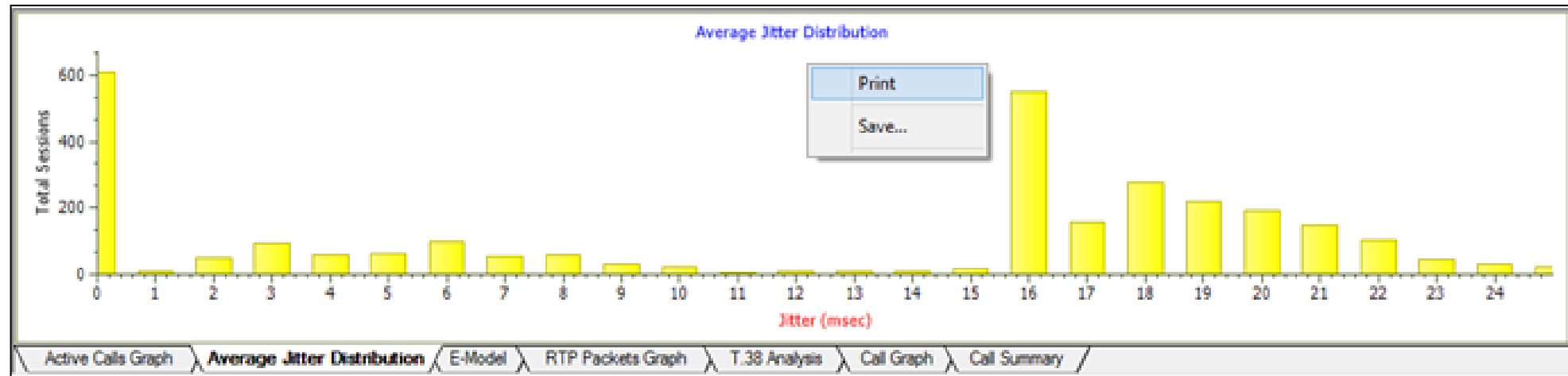
Active Calls Graph

- Active calls graph depicts the Number Of Calls plotted Vs Time across Total Sessions



Average Jitter Distribution Graph

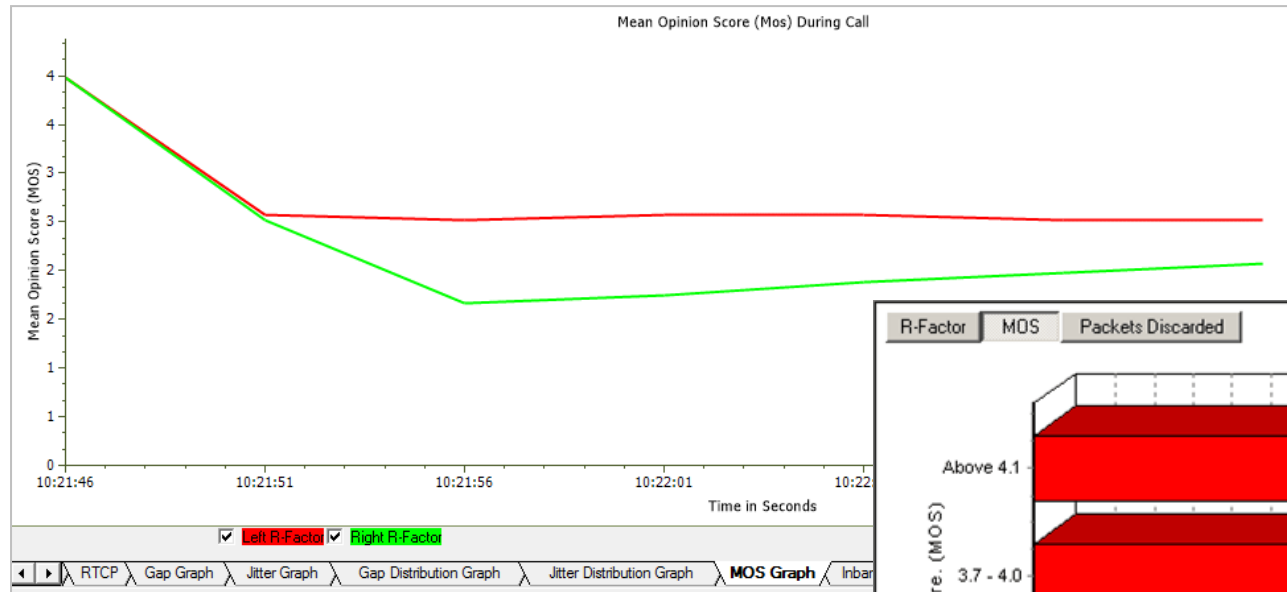
- Distribution of the Average Jitter values across Total Sessions



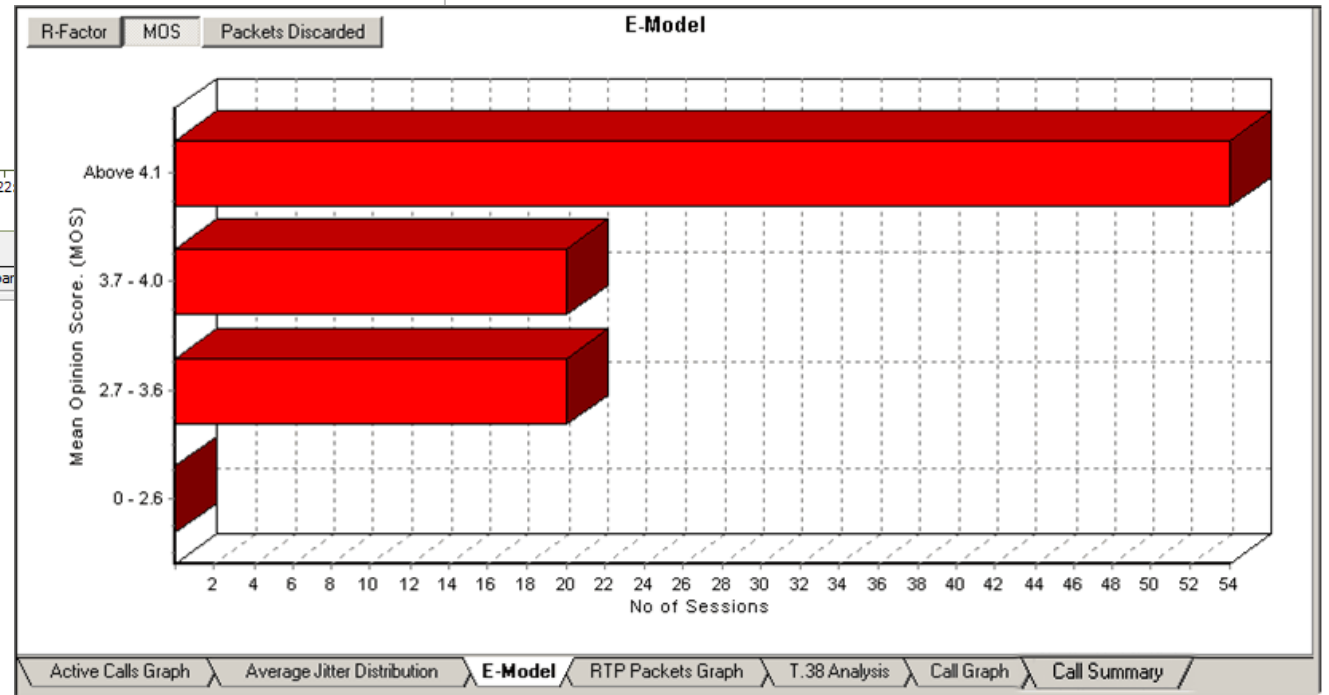
E-Model Graphs

- E-Model graph provides R-factor, MOS, and packets discarded against number of sessions
- All these three graphs show statistics of terminated calls
 - R-Factor – A bar graph that plots R-Factor across No of Sessions
 - MOS – A bar graph that plots Mean Opinion Score across No. of Sessions
 - Packets Discarded – A bar graph that plots Packets Discarded across No. of Sessions

MOS Graph and R-Factor Graph

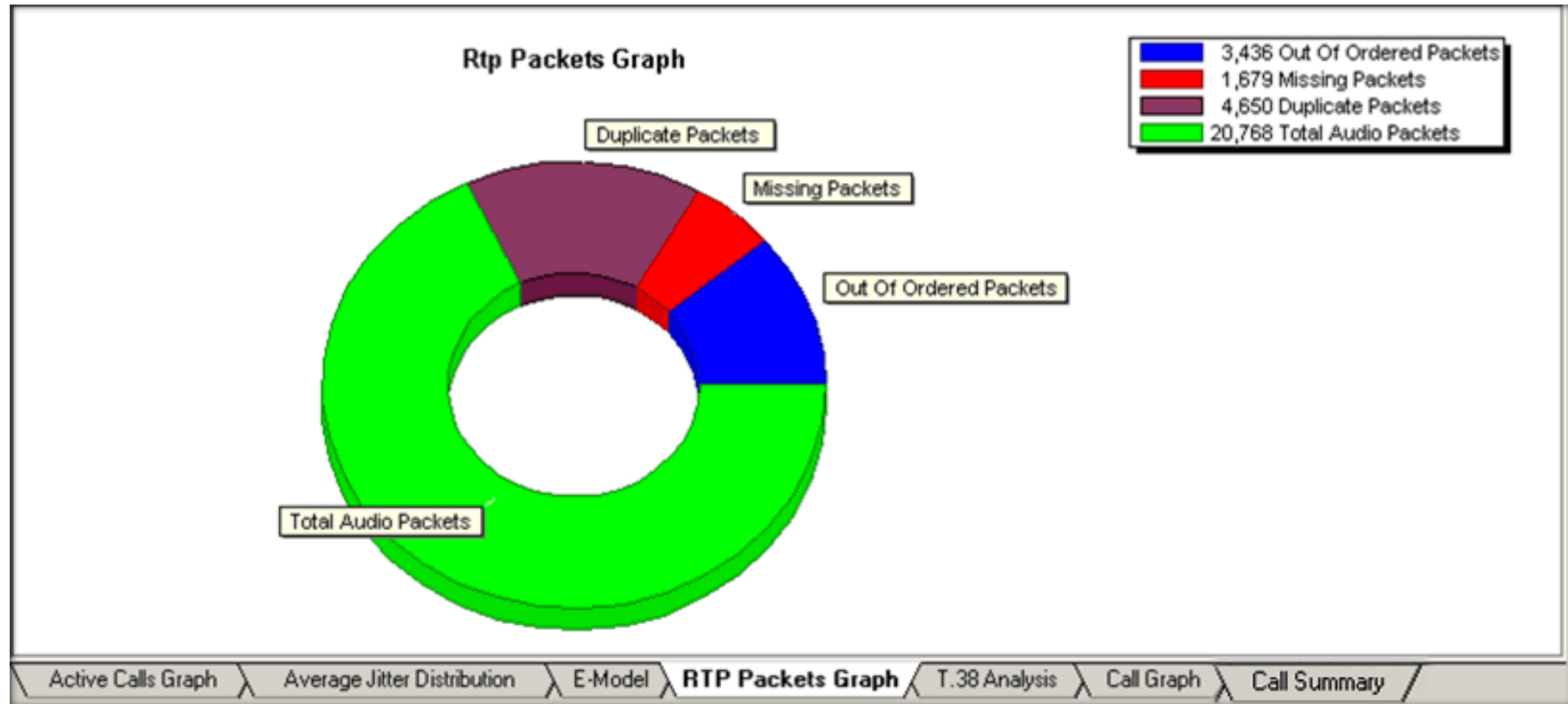


R Factor



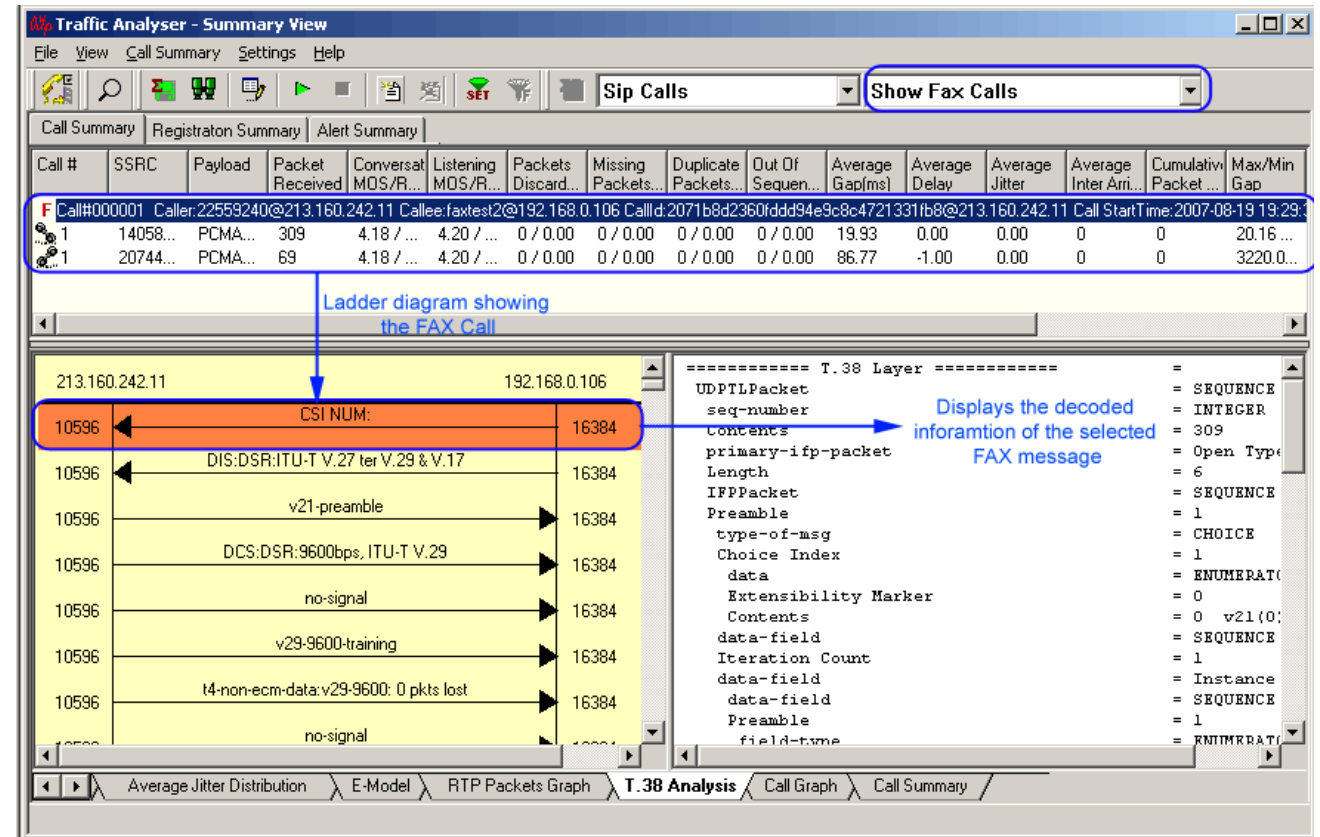
RTP Packets Graph

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



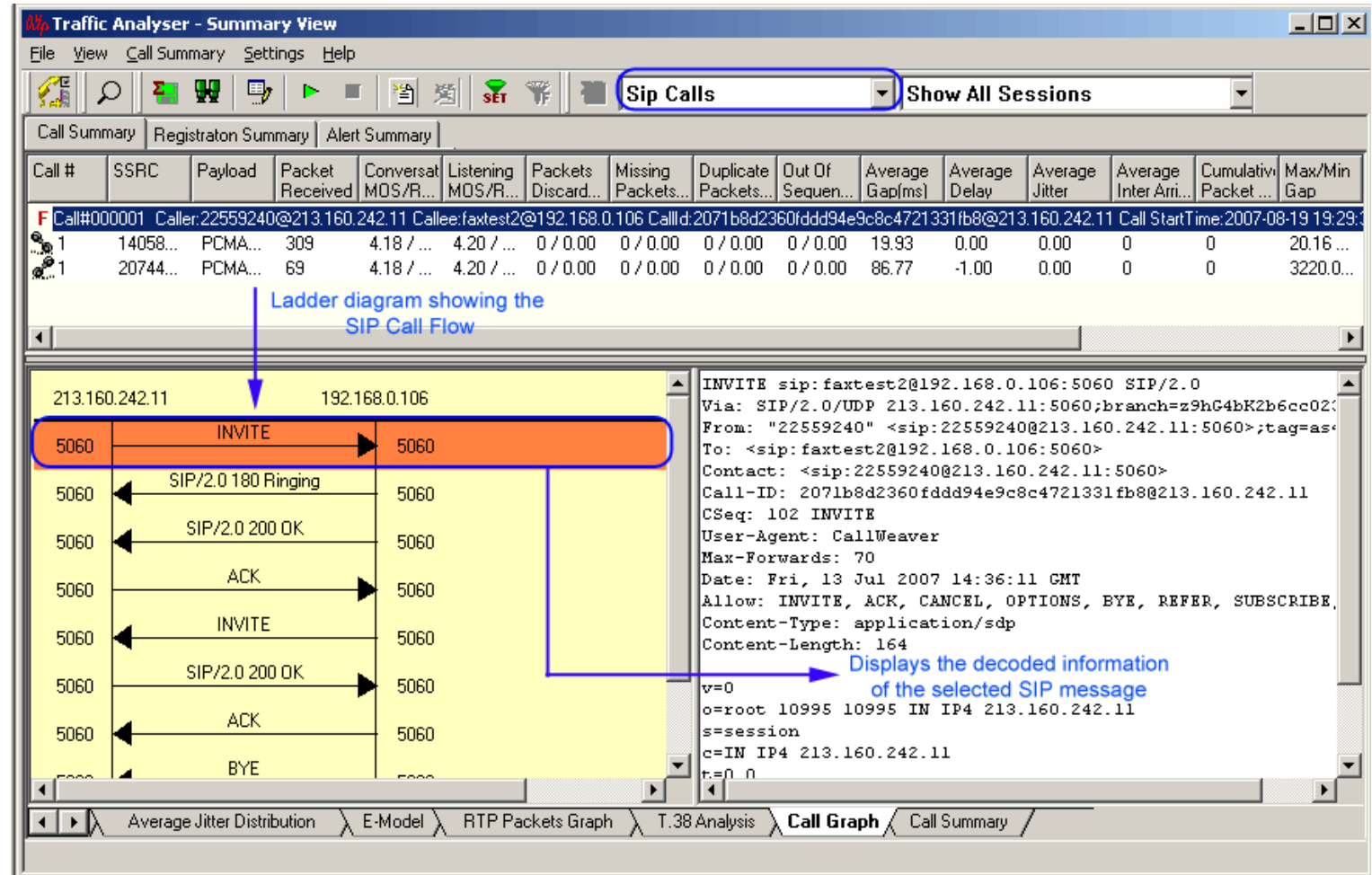
T.38 Analysis - Fax over IP

- Supports capturing and decoding of Fax (T.38 data) calls over VoIP; also reassembles the fragmented data and identifies the T.30 message from it
- Decodes of selected FAX message is displayed on the right pane
- Captured fax calls can also be analyzed using GLInsight™ by saving the fax calls directly in (*.PCAP) Ethereal file format



Call Graph – SIP Call

- Displays the message sequences of captured VoIP calls
- Decodes of the selected SIP message is displayed on the right pane



Signaling, Audio, and Video Parameters

Traffic Analyser - Summary View

FileViewCall SummarySettingsHelp

</

Signaling, Audio, and Video Parameters

- Displays the signaling, audio, and video parameters of each call for SIP, RTP, H323, and MEGACO in a tabular format
- Signaling parameters include caller, callee, call id, call status, call start time & stop time, duration of the call, call terminator, call failure reason, session request delay, and session disconnect delay
- Audio parameters include the source and destination information such as TP Channel, Media Type, SSRC value, Packets Count, Missing Packets, Duplicate Packets, Out of Sequence Packets, and so on
- Video QoS parameters include Video Channels, Codec Info, SSRC, Frame Count, Packet Count, Packets Lost, Duplicate Packets, Out of order Packets, Frame Rate, Media Delivery Index (Delay Factor : Media Loss Rate), Average Media Delivery Index

Detail View

- Provides a detail look at the two (or one) RTP sessions that are part of a single call
- Left and right panes accommodate the two sessions
- Provides detailed statistical information for Inband (DTMF & MF)events, RFC 2833 events, RTP/RTCP packet count and reports per direction, duplicate and missing packets
- Includes host of graphs such as Gap, Jitter, Gap Distribution, Jitter MOS, Quality, Wave Graph, Spectral Display, R-Factor scores, MOS scores, Delay metrics, Burst metrics, and Jitter Buffer statistics for media stream analysis

Detail View

Traffic Analyser - Detail View

File View Detail View Settings Help

Sip Calls **Show All Sessions**

Call Summary | Registraton Summary | Alert Summary

| Packet # | Seque... | RTP ... | Payload Type | Paylo... | Packet Seq... | Gap(ms) | |
|-------------|----------|---------|--------------|----------|-----------------|---------|--|
| M 44 | 8020 | 1446... | PCMU/8000 | 160 | Session In P... | 0.00 | |
| 46 | 8021 | 1446... | PCMU/8000 | 160 | Session In P... | 21.48 | |
| 47 | 8022 | 1446... | PCMU/8000 | 160 | In Sequence | 10.74 | |
| 49 | 8023 | 1446... | PCMU/8000 | 160 | In Sequence | 22.47 | |
| 53 | 8024 | 1446... | PCMU/8000 | 160 | In Sequence | 21.49 | |
| 55 | 8025 | 1446... | PCMU/8000 | 160 | In Sequence | 21.45 | |
| 57 | 8026 | 1446... | PCMU/8000 | 160 | In Sequence | 21.49 | |
| 60 | 8027 | 1446... | PCMU/8000 | 160 | In Sequence | 21.47 | |
| 62 | 8028 | 1446... | PCMU/8000 | 160 | In Sequence | 21.49 | |
| 64 | 8029 | 1446... | PCMU/8000 | 160 | In Sequence | 21.48 | |

| Packet # | Seque... | RTP ... | Payload Type | Paylo... | Packet Seq... | Gap(ms) | |
|-------------|----------|---------|--------------|----------|-----------------|---------|--|
| M 41 | 56448 | 1832... | PCMU/8000 | 160 | Session In P... | 0.00 | |
| 42 | 56449 | 1832... | PCMU/8000 | 160 | Session In P... | 21.51 | |
| 43 | 56450 | 1832... | PCMU/8000 | 160 | In Sequence | 10.71 | |
| 45 | 56451 | 1832... | PCMU/8000 | 160 | In Sequence | 21.46 | |
| 48 | 56452 | 1832... | PCMU/8000 | 160 | In Sequence | 21.48 | |
| 52 | 56453 | 1832... | PCMU/8000 | 160 | In Sequence | 21.50 | |
| 54 | 56454 | 1832... | PCMU/8000 | 160 | In Sequence | 21.47 | |
| 56 | 56455 | 1832... | PCMU/8000 | 160 | In Sequence | 21.50 | |
| 58 | 56456 | 1832... | PCMU/8000 | 160 | In Sequence | 21.49 | |
| 59 | 56457 | 1832... | PCMU/8000 | 160 | In Sequence | 10.73 | |

| Heading | Value |
|-------------------------|---------------|
| SSRC | 957412353 |
| Source IP Address | 192.168.1.231 |
| Destination IP Address | 192.168.1.237 |
| Source Port | 26550 |
| Destination Port | 21708 |
| RTP Packets Count | 1886 |
| RTCP Packets Count | 3 |
| Packets With Marker Bit | 1 |
| Total Audio Bytes | 301760 |
| RTCP Sender's Reports | 3 |
| RTCP Receiver's Reports | 0 |

| Heading | Value |
|-------------------------|---------------|
| SSRC | 957785601 |
| Source IP Address | 192.168.1.237 |
| Destination IP Address | 192.168.1.231 |
| Source Port | 21708 |
| Destination Port | 26550 |
| RTP Packets Count | 1887 |
| RTCP Packets Count | 2 |
| Packets With Marker Bit | 1 |
| Total Audio Bytes | 301920 |
| RTCP Sender's Reports | 2 |
| RTCP Receiver's Reports | 0 |

RTP Statistics | RTCP | Gap Graph | Jitter Graph | Gap Distribution Graph | Jitter Distribution Graph | MOS Graph | Quality Factors | Inband Events

RTP Statistics

- RTP Statistics displays details such as Source / Destination IP Address, Source / Destination Port, RTP / RTCP Packets Count, Packets with Marker Bits, Total Audio Bytes, RTCP Sender's and Receiver's Reports, count and percent of Out of Sequence packets, Missing Packets, Discarded Packets, & Duplicate Packets, and MOS-CQ \ Conversational R, MOS-LQ \ Listening R, G.107 R, and Nominal MOS \ Nominal R

| Heading | Value | Heading | Value |
|-----------------------------|---------------|-----------------------------|---------------|
| SSRC | 3514759169 | SSRC | 1149281025 |
| Source IP Address | 192.168.1.232 | Source IP Address | 192.168.1.199 |
| Destination IP Address | 192.168.1.199 | Destination IP Address | 192.168.1.232 |
| Source Port | 1024 | Source Port | 1024 |
| Destination Port | 1024 | Destination Port | 1024 |
| RTP Packets Count | 710 | RTP Packets Count | 665 |
| RTCP Packets Count | 2 | RTCP Packets Count | 2 |
| Packets With Marker Bit | 1 | Packets With Marker Bit | 0 |
| Total Audio Bytes | 113600 | Total Audio Bytes | 106400 |
| RTCP Sender's Reports | 2 | RTCP Sender's Reports | 2 |
| RTCP Receiver's Reports | 0 | RTCP Receiver's Reports | 0 |
| Out Of Sequence Packets \ % | 179 \ 21.78 | Out Of Sequence Packets \ % | 0 \ 0.00 |
| Missing Packets \ % | 112 \ 13.63 | Missing Packets \ % | 246 \ 27.00 |
| Duplicate Packets \ % | 0 \ 0.00 | Duplicate Packets \ % | 223 \ 24.48 |
| MOS-CQ \ Conversational R | 1.75 \ 35 | MOS-CQ \ Conversational R | 1.16 \ 18 |
| MOS-LQ \ Listening R | 1.79 \ 36 | MOS-LQ \ Listening R | 1.18 \ 19 |
| G.107 R | 34 | G.107 R | 17 |
| Nominal MOS \ Nominal R | 4.20 \ 93 | Nominal MOS \ Nominal R | 4.20 \ 93 |
| Discarded Packets | 15 \ 1.82 | Discarded Packets | 0 \ 0.00 |

◀ ▶ RTP Statistics RTCP Gap Graph Jitter Graph Gap Distribution Graph Jitter Distribution Graph MOS Graph Quality Factors Inband E

RTCP Details

- Provides Senders and Receivers report , SDES item, and Bye packet in tabular format
- Senders and Receivers report includes details such as frame number, RTP Timestamp, SSRC, Packet count, Sender's SSRC, Fraction Lost, Cumulative Fraction Lost, Jitter, Last SR timestamp, and Delay since last SR
- SDES Item includes details such as frame number, SSRC/CSRC, SDES type, and Content/SDES Item
- Bye packet includes frame number, SSRC, and Reason for leaving

The screenshot displays the 'Traffic Analyser - Detail View' window. The top menu bar includes 'File', 'View', 'Detail View', 'Settings', and 'Help'. Below the menu is a toolbar with various icons. The main window is divided into several sections. The top section shows 'Call Summary', 'Registraton Summary', and 'Alert Summary'. Below this is a table of packet details. The bottom section shows a 'Sender Report' table and a 'Receiver Report' table. The 'Sender Report' table has columns: Frame ..., Sender's ..., RTP Tim..., Packets ..., Octet ..., SSRC, and Fraction... The 'Receiver Report' table has columns: Frame ..., Sender's ..., RTP Tim..., Packets ..., Octet ..., SSRC, and Fraction... The bottom of the window features a tabbed interface with tabs for 'RTCP', 'Gap Graph', 'Jitter Graph', 'Gap Distribution Graph', 'Jitter Distribution Graph', 'MOS Graph', 'Quality Factors', 'Inband Events', and 'RTP Ev'.

| Packet # | Seque... | RTP... | Payload T... | Payl... | Packet Se... | Gap(... | G... |
|----------|----------|--------|--------------|---------|----------------|---------|-------|
| 44 | 8020 | 144... | PCMU/80... | 160 | Session In ... | 0.00 | 0... |
| 46 | 8021 | 144... | PCMU/80... | 160 | Session In ... | 21.48 | 20... |
| 47 | 8022 | 144... | PCMU/80... | 160 | In Sequence | 10.74 | 20... |
| 49 | 8023 | 144... | PCMU/80... | 160 | In Sequence | 22.47 | 20... |
| 53 | 8024 | 144... | PCMU/80... | 160 | In Sequence | 21.49 | 20... |
| 55 | 8025 | 144... | PCMU/80... | 160 | In Sequence | 21.45 | 20... |
| 57 | 8026 | 144... | PCMU/80... | 160 | In Sequence | 21.49 | 20... |
| 60 | 8027 | 144... | PCMU/80... | 160 | In Sequence | 21.47 | 20... |

| Packet # | Seque... | RT... | Payload ... | Payl... | Packet S... | Gap(... | G... |
|----------|----------|--------|-------------|---------|---------------|---------|-------|
| 41 | 56448 | 183... | PCMU/8... | 160 | Session In... | 0.00 | 0... |
| 42 | 56449 | 183... | PCMU/8... | 160 | Session In... | 21.51 | 20... |
| 43 | 56450 | 183... | PCMU/8... | 160 | In Sequen... | 10.71 | 20... |
| 45 | 56451 | 183... | PCMU/8... | 160 | In Sequen... | 21.46 | 20... |
| 48 | 56452 | 183... | PCMU/8... | 160 | In Sequen... | 21.48 | 20... |
| 52 | 56453 | 183... | PCMU/8... | 160 | In Sequen... | 21.50 | 20... |
| 54 | 56454 | 183... | PCMU/8... | 160 | In Sequen... | 21.47 | 20... |
| 56 | 56455 | 183... | PCMU/8... | 160 | In Sequen... | 21.50 | 20... |

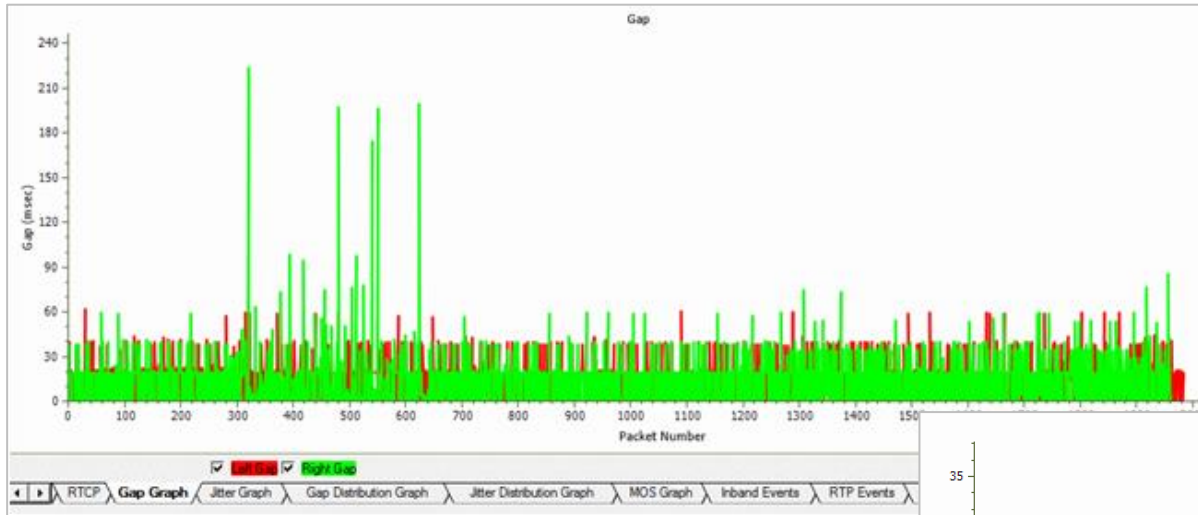
| Frame ... | Sender's ... | RTP Tim... | Packets ... | Octet ... | SSRC | Fraction... |
|-----------|--------------|------------|-------------|-----------|-----------|-------------|
| 1859 | 957412353 | 1832527... | 452 | 72320 | 957785... | 24 |
| 5774 | 957412353 | 1832672... | 1358 | 217121 | 957785... | 23 |
| 8858 | 957412353 | 1832787... | 2080 | 332641 | 957785... | 23 |

| Frame ... | Sender's ... | RTP Tim... | Packets ... | Octet ... | SSRC | Fraction... |
|-----------|--------------|------------|-------------|-----------|-----------|-------------|
| 1847 | 957785601 | 1446638... | 451 | 72160 | 957412... | 23 |
| 5737 | 957785601 | 1446782... | 1352 | 216320 | 957412... | 24 |

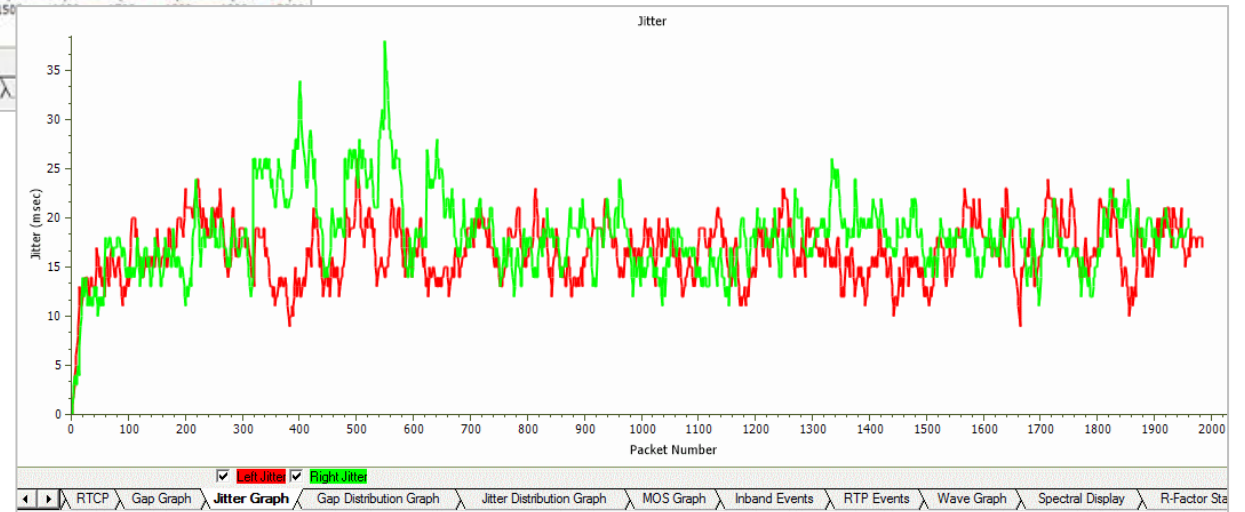
Gap and Jitter Graph

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

Gap Graph

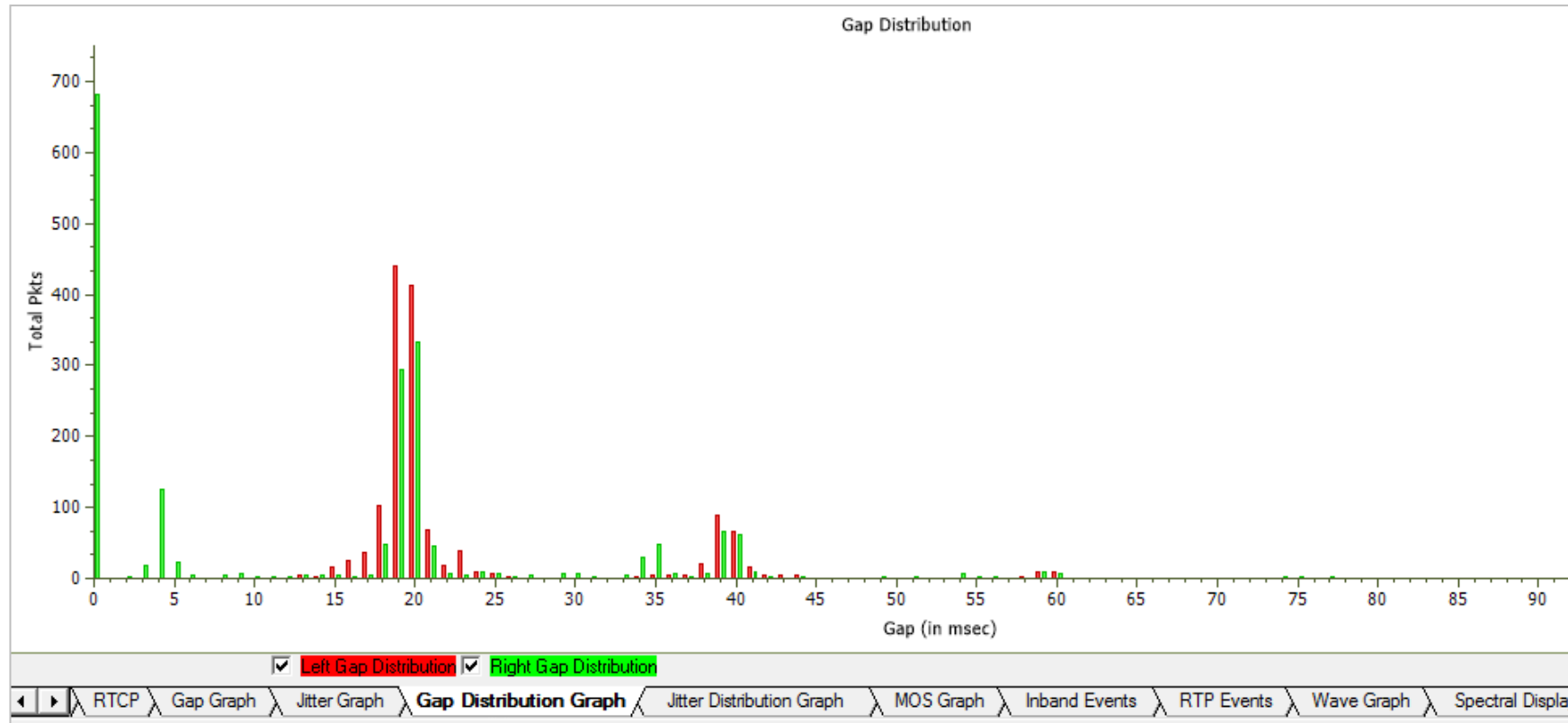


Jitter Graph



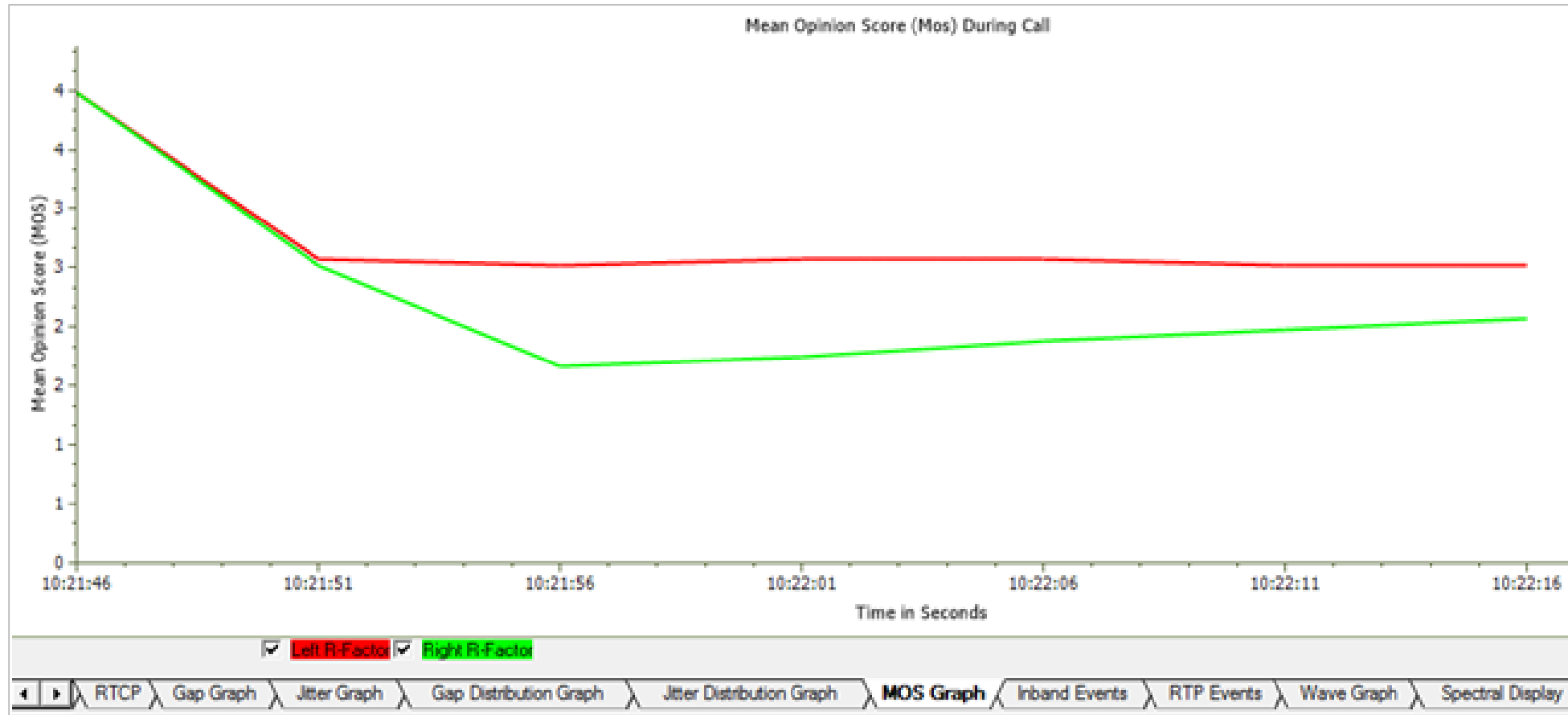
Gap and Jitter Distribution Graph

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



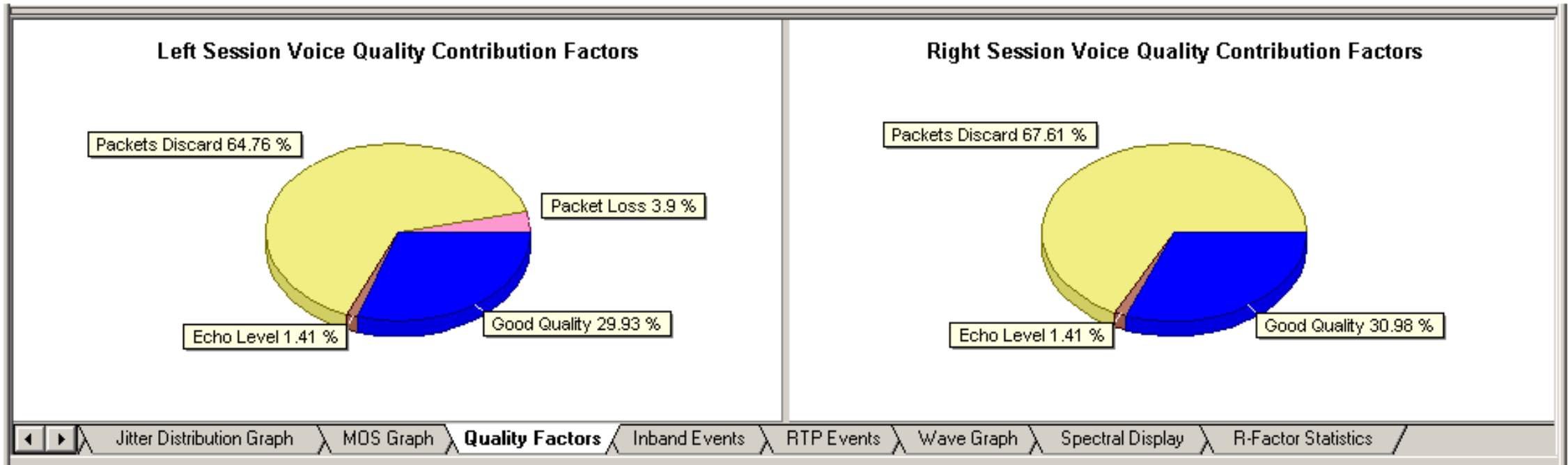
MOS Graph

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



Quality Factors

- Quality Factors graph plots and compares Good Quality packets, Packets Discarded, and Echo level against total Packets for each individual sessions



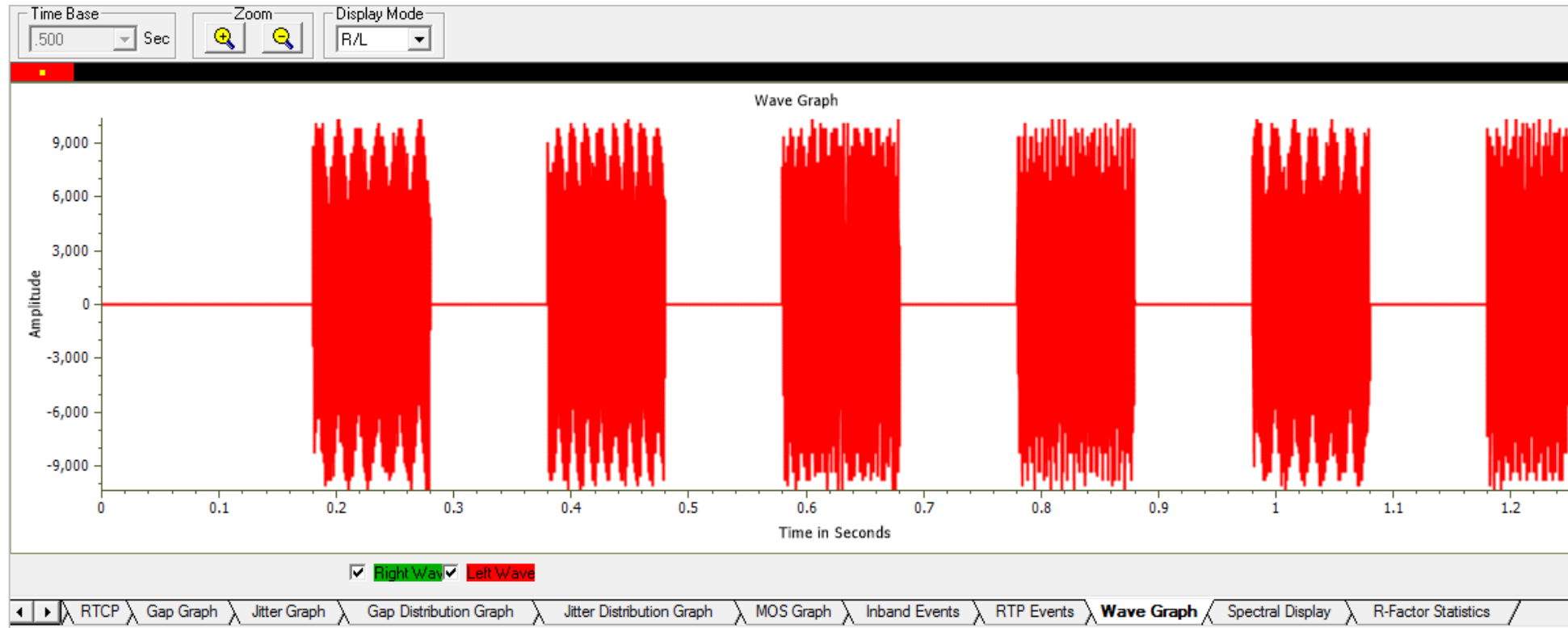
Inband and RTP Events

- In-band Event tab displays inband DTMF and MF digits as they are received on selected RTP stream
- RTP Events tab displays all Out of band RTP events defined in RFC 2833

| TimeStamp | Event | Volume [-dB] | Duration | TimeStamp | Event | Volume [-dB] | Duration |
|-----------------|---------------|--------------|----------|-----------------|---------------|--------------|----------|
| 10:06:31.000853 | Comfort Noise | 88 | 0 | 10:06:32.000571 | Comfort Noise | 85 | 0 |
| 10:06:32.000779 | Comfort Noise | 91 | 0 | 10:06:32.000797 | Comfort Noise | 85 | 0 |
| 10:06:32.000854 | Comfort Noise | 85 | 0 | 10:06:32.000904 | Comfort Noise | 85 | 0 |
| 10:06:32.000876 | Comfort Noise | 85 | 0 | 10:06:33.000850 | Comfort Noise | 88 | 0 |
| 10:06:33.000880 | Comfort Noise | 85 | 0 | 10:06:34.000886 | Comfort Noise | 88 | 0 |
| 10:06:33.000177 | Comfort Noise | 85 | 0 | 10:06:34.000980 | Comfort Noise | 91 | 0 |
| 10:06:33.000853 | Comfort Noise | 88 | 0 | 10:06:35.000044 | Comfort Noise | 85 | 0 |
| 10:06:34.000648 | Comfort Noise | 85 | 0 | 10:06:35.000044 | Comfort Noise | 85 | 0 |
| 10:06:34.000745 | Comfort Noise | 88 | 0 | 10:06:35.000259 | Comfort Noise | 85 | 0 |
| 10:06:34.000842 | Comfort Noise | 88 | 0 | 10:06:35.000787 | Comfort Noise | 88 | 0 |
| 10:06:34.000949 | Comfort Noise | 88 | 0 | 10:06:35.000808 | Comfort Noise | 85 | 0 |
| 10:06:35.000046 | Comfort Noise | 88 | 0 | 10:06:36.000456 | Comfort Noise | 85 | 0 |
| 10:06:35.000142 | Comfort Noise | 88 | 0 | 10:06:36.000456 | Comfort Noise | 88 | 0 |
| 10:06:35.000239 | Comfort Noise | 88 | 0 | 10:06:36.000456 | Comfort Noise | 88 | 0 |
| 10:06:36.000099 | Comfort Noise | 85 | 0 | 10:06:36.000456 | Comfort Noise | 88 | 0 |
| 10:06:36.000561 | Comfort Noise | 88 | 0 | 10:06:36.000456 | Comfort Noise | 88 | 0 |
| 10:06:37.000948 | Comfort Noise | 85 | 0 | 10:06:36.000790 | Comfort Noise | 88 | 0 |
| 10:06:38.000045 | Comfort Noise | 85 | 0 | 10:06:37.000660 | Comfort Noise | 85 | 0 |
| 10:06:38.000152 | Comfort Noise | 85 | 0 | 10:06:38.000264 | Comfort Noise | 85 | 0 |
| 10:06:38.000249 | Comfort Noise | 85 | 0 | 10:06:38.000779 | Comfort Noise | 88 | 0 |

Wave and Spectral Graphs

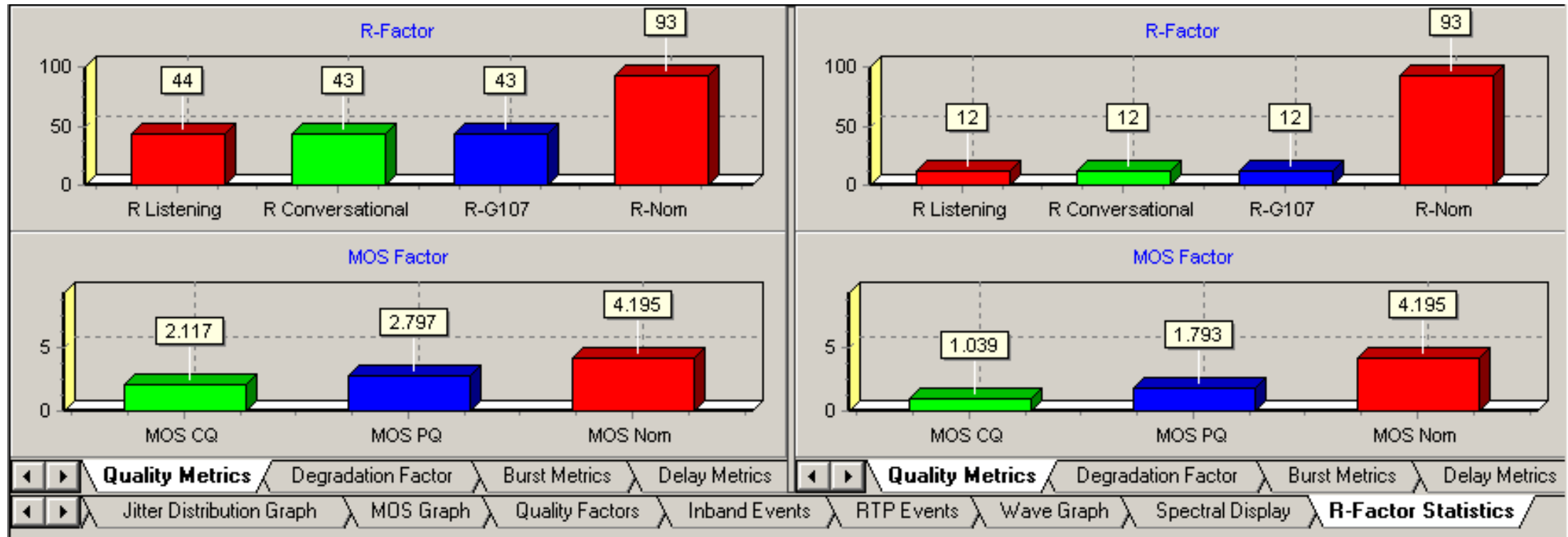
- Wave graph - Displays the amplitude of the incoming signal in a selected call as a function of time
- Spectral Display - Displays the power of incoming signal while the capturing is going on as a function of frequency



R-Factor Statistics – Quality Metrics

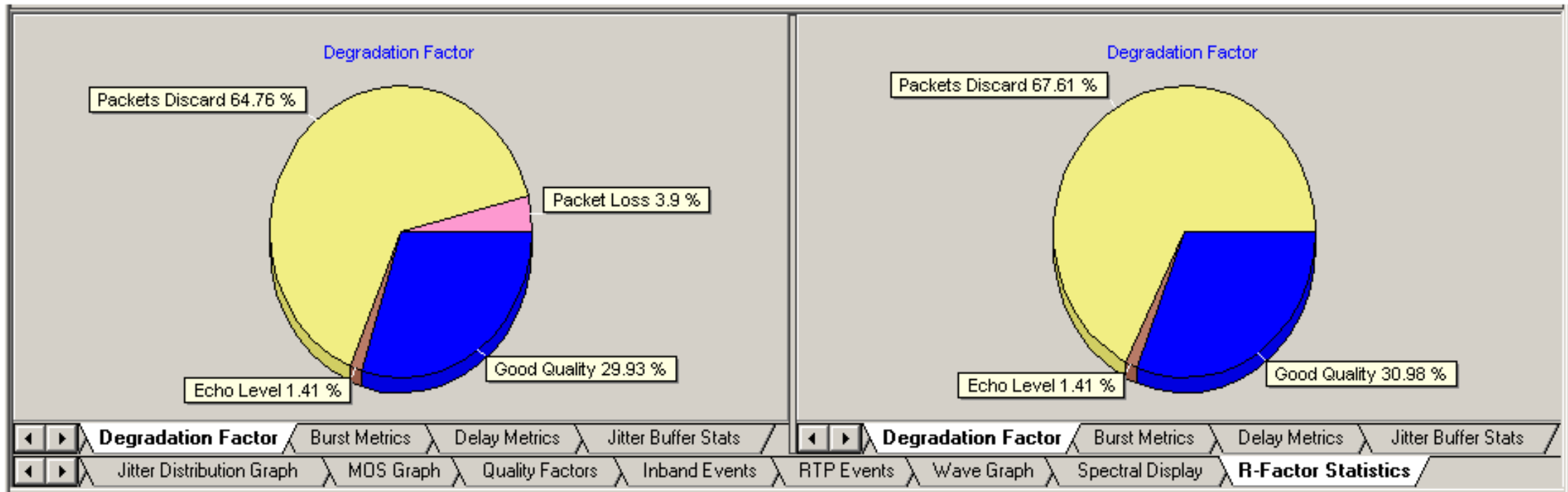
Quality Metrics based on E-model - R-Factor and MOS Factor

- R-Factor display statistics such as R Listening, R Conversational, R-G107, and R-Nominal values
- MOS Factor display current values such as MOS CQ, MOS PQ, and MOS Nominal values during a call



R-Factor Statistics – Degradation Factor

- Quality Factors graph plots and compares Good Quality packets, Packets Discarded, Packet Loss, and Echo level against Total Packets for each individual sessions



R-Factor Statistics – Burst Metrics

- Burst metrics displays the statistics for Burst R, Burst Count, Average Burst Loss Rate, Average Burst Packet Count, Average Burst Length, Gap R, Average Gap Loss Rate, Average Gap Packet Count, Average Gap Length, Average Loss/Discard Rate, Average Net Loss Rate, and Average Discard Rate

| | | | |
|------------------------|---------|------------------------|---------|
| Burst R | 43 | Burst R | 12 |
| Burst Count | 1 | Burst Count | 1 |
| Avg Burst Loss Rate | 10.82 % | Avg Burst Loss Rate | 56.65 % |
| Avg Burst Packet count | 3383 | Avg Burst Packet count | 3511 |
| Avg Burst Length | 3383 | Avg Burst Length | 3511 |
| Gap R | 92 | Gap R | 92 |
| Avg Gap Loss Rate | 0.00 % | Avg Gap Loss Rate | 0.00 % |
| Avg Gap Packet Count | 5 | Avg Gap Packet Count | 1 |
| Avg Gap Length | 5 msec | Avg Gap Length | 1 msec |
| Avg Loss/Discard Rate | 10.80 % | Avg Loss/Discard Rate | 56.63 % |
| Avg Net Loss Rate | 9.85 % | Avg Net Loss Rate | 56.23 % |
| Avg Discard Rate | 0.94 % | Avg Discard Rate | 0.40 % |

Burst Metrics

Delay Metrics

Jitter Buffer Stats

Jitter Distribution Graph

MOS Graph

Quality Factors

Inband Events

RTP Events

Wave Graph

Spectral Display

R-Factor Statistics

R-Factor Statistics – Delay Metrics

- Delay metrics displays the statistics for Average / Maximum Round Trip Delay, Average / Maximum One Way Delay, Average / Maximum Originating / Terminating End system Delay, and Average / Maximum Packet Variation Delay

| | | | |
|----------------------------|----------------|----------------------------|----------------|
| Avg Round Trip Delay | n/a | Avg Round Trip Delay | n/a |
| Max Round Trip Delay | n/a | Max Round Trip Delay | n/a |
| Avg One Way Delay | 40 | Avg One Way Delay | 43 |
| Max One Way Delay | 40 | Max One Way Delay | 43 |
| Avg Orig.End System Delay | n/a | Avg Orig.End System Delay | n/a |
| Max Orig.End System Delay | n/a | Max Orig.End System Delay | n/a |
| Avg Term.End System Delay | 21 | Avg Term.End System Delay | 27 |
| Max Term.End System Delay | 41 | Max Term.End System Delay | 41 |
| Avg Packet Delay Variation | 4.169000 msec | Avg Packet Delay Variation | 4.202000 msec |
| Max Packet Delay Variation | 55.653000 msec | Max Packet Delay Variation | 30.332000 msec |

< >

Burst Metrics **Delay Metrics** Jitter Buffer Stats

Jitter Distribution Graph MOS Graph Quality Factors Inband Events RTP Events Wave Graph Spectral Display **R-Factor Statistics**

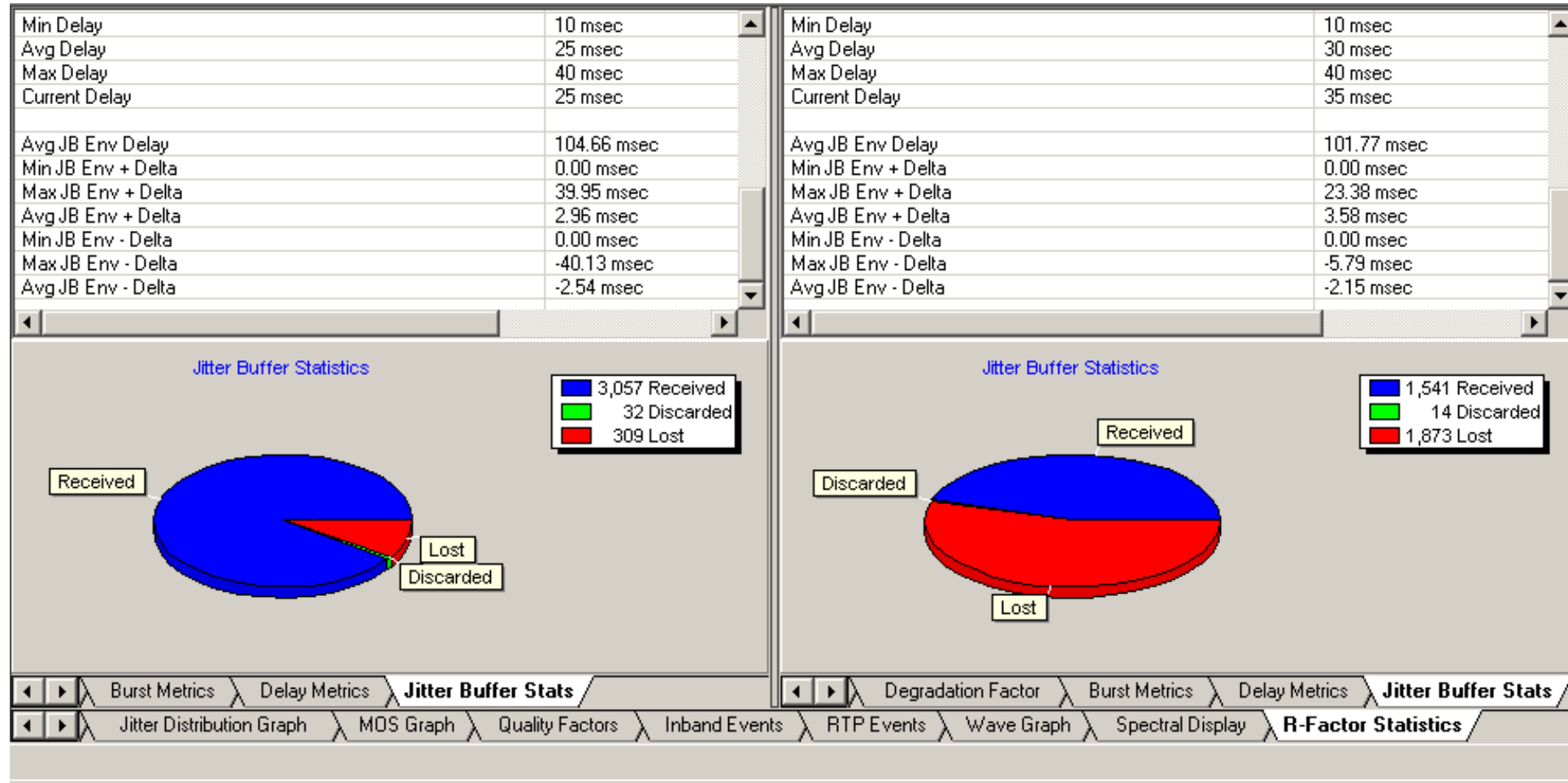
< >

Burst Metrics **Delay Metrics** Jitter Buffer Stats

Jitter Distribution Graph MOS Graph Quality Factors Inband Events RTP Events Wave Graph Spectral Display **R-Factor Statistics**

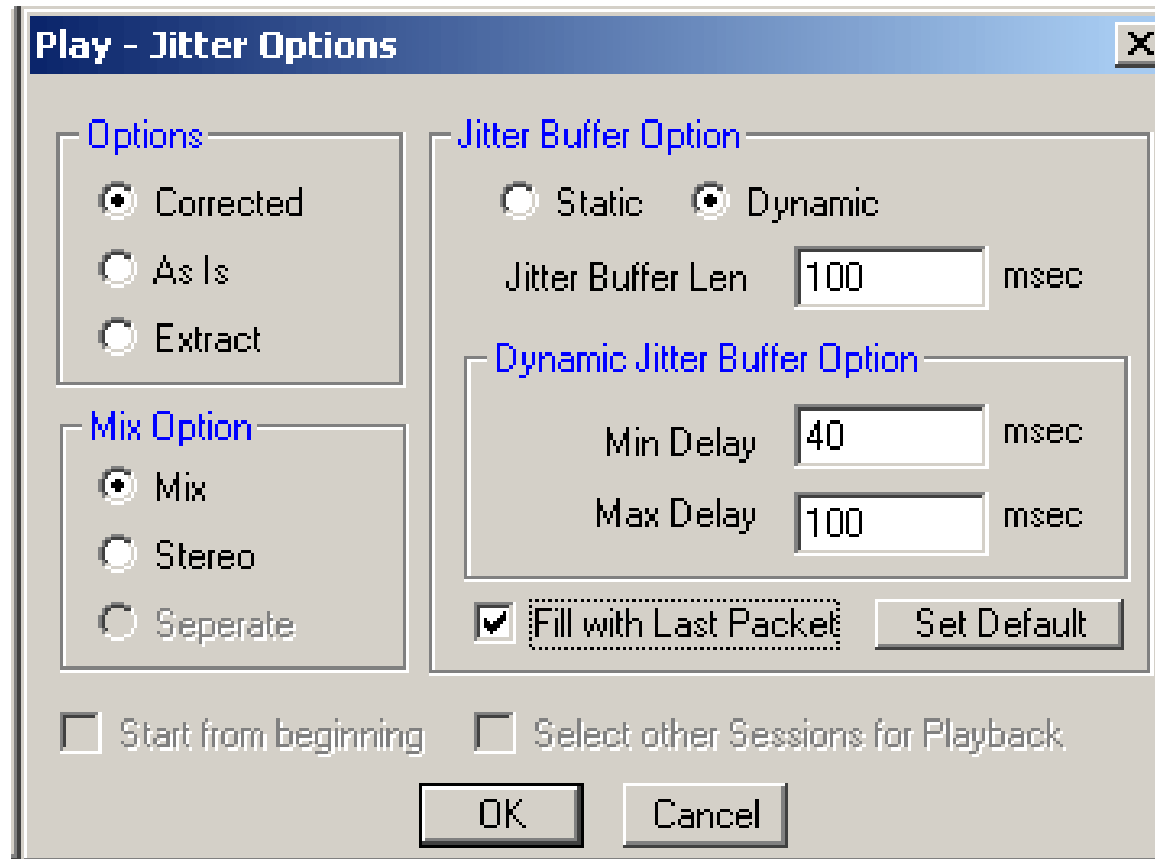
R-Factor Statistics – Jitter Buffer Statistics

- Plots and compares packets received, packets discarded, and packets lost against total Packets for each individual sessions. Also provides a tabular data on average



Play to Speaker

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



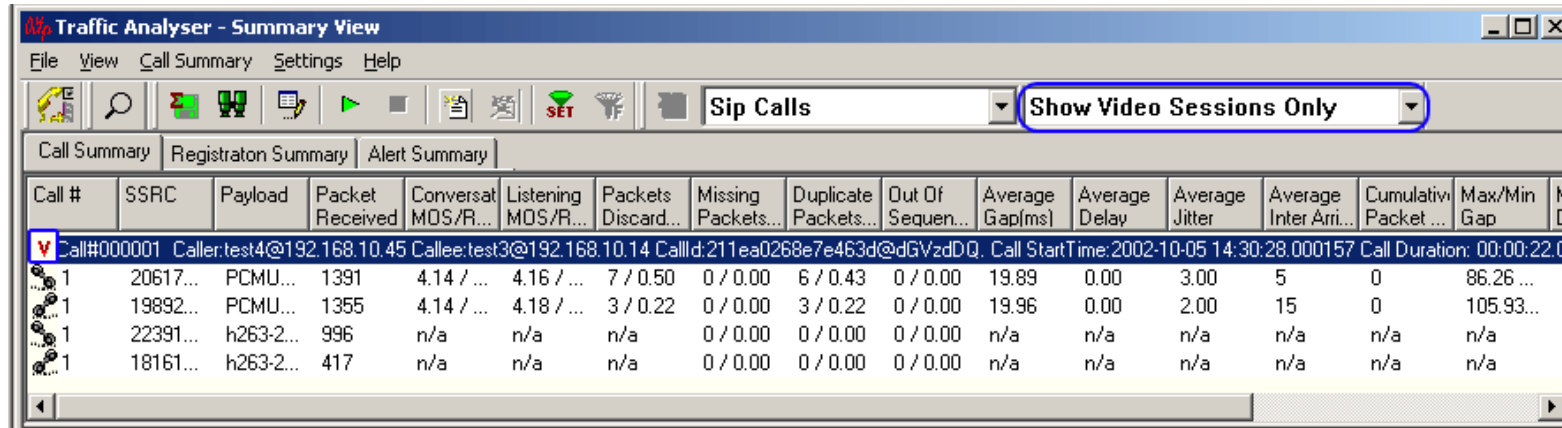
Write to File

- Provides various options to save the captured file in a required format
- Uses the files with voice quality analysis software to investigate more about the quality of voice in the network
- Records the RTP stream to a file in *.wav format

The screenshot shows a Windows-style dialog box titled "Write To File - Jitter Options". It contains several sections for configuring file saving options:

- Options:** Three radio buttons: "Corrected" (selected), "As Is", and "Extract".
- Mix Option:** Three radio buttons: "Mix" (selected), "Stereo", and "Seperate".
- Jitter Buffer Option:** Two radio buttons: "Static" (selected) and "Dynamic". Below them is a text box for "Jitter Buffer Len" set to "100" with "msec" as the unit.
- Dynamic Jitter Buffer Option:** Two text boxes: "Min Delay" set to "40" msec and "Max Delay" set to "100" msec.
- A checkbox labeled "Fill with Last Packet" is checked, with a "Set Default" button next to it.
- A checkbox labeled "Start from beginning" is unchecked.
- File Record:** A checkbox "Use SSRC for File Name" is unchecked. Below it is a text box containing the file path "D:\Program Files\GL Communications Inc\PacketScan\Exempl...".
- A checkbox labeled "Invoke Cool Edit after write" is unchecked.
- At the bottom are "OK" and "Cancel" buttons.

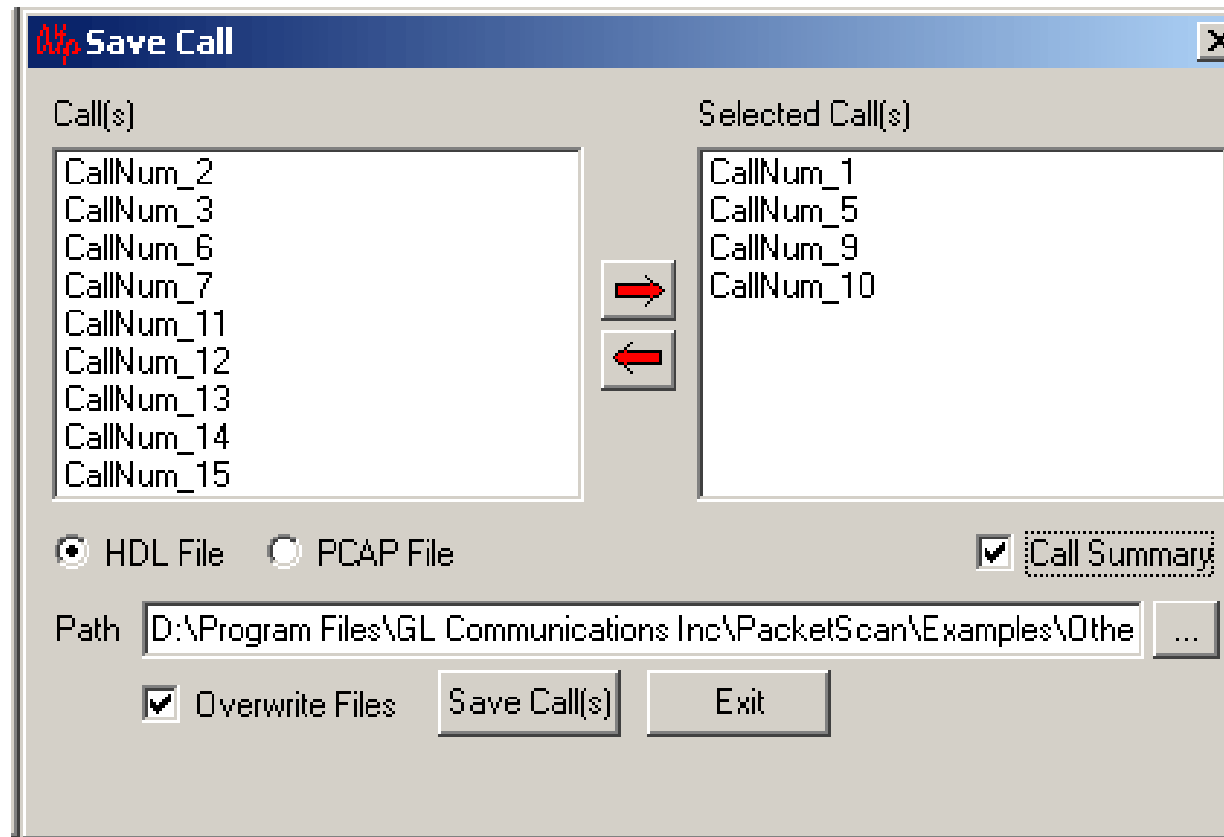
Record Video



- Record video option is available for both Auto Detected RTP Calls and SIP Calls
- Records audio and video data of a session to a file in QuickTime format
- Supported Video Codecs are:
 - H263+
 - H263++ CIF 190 kbps
 - H263++ CIF 350 kbps
 - H263++ CIF 512 kbps
 - H263++ QCIF 128 kbps
 - H263++ QCIF 64 kbps
 - H263++ QCIF 80 kbps
 - H264 is an industry standard codec for video compression, the codec offers better compression performance over previous standards

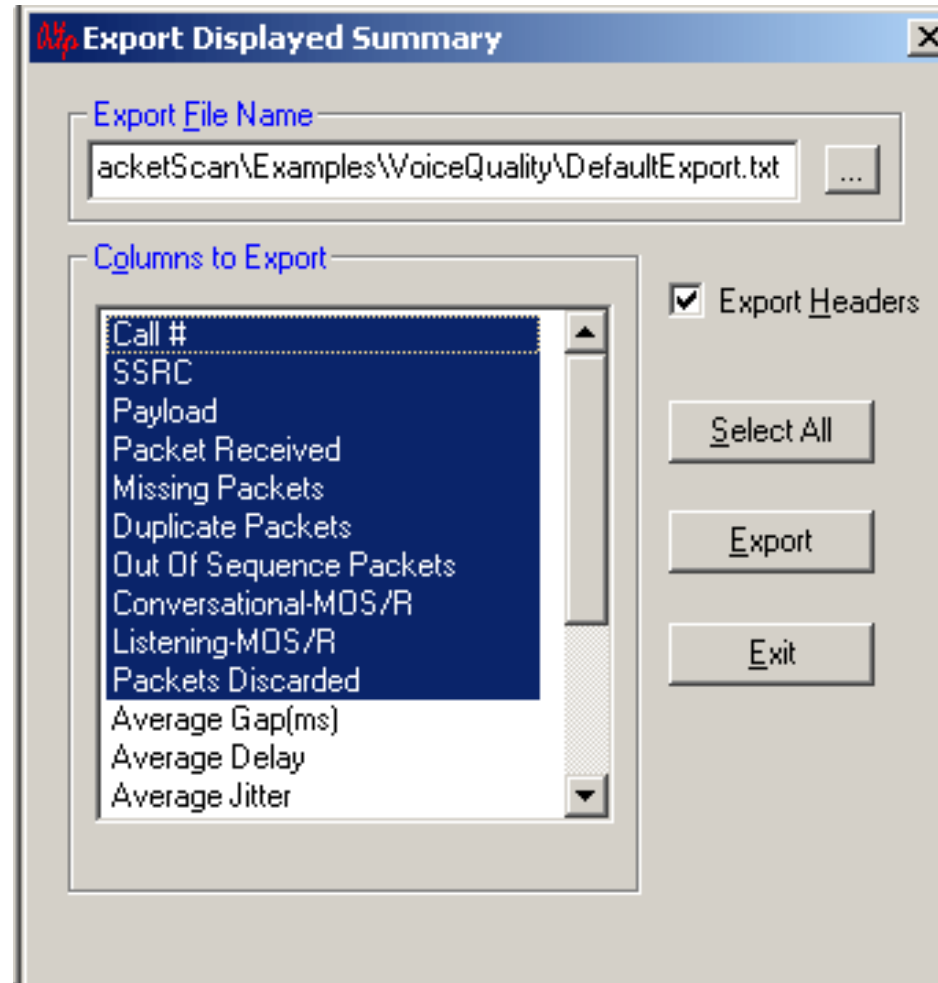
Save Call

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



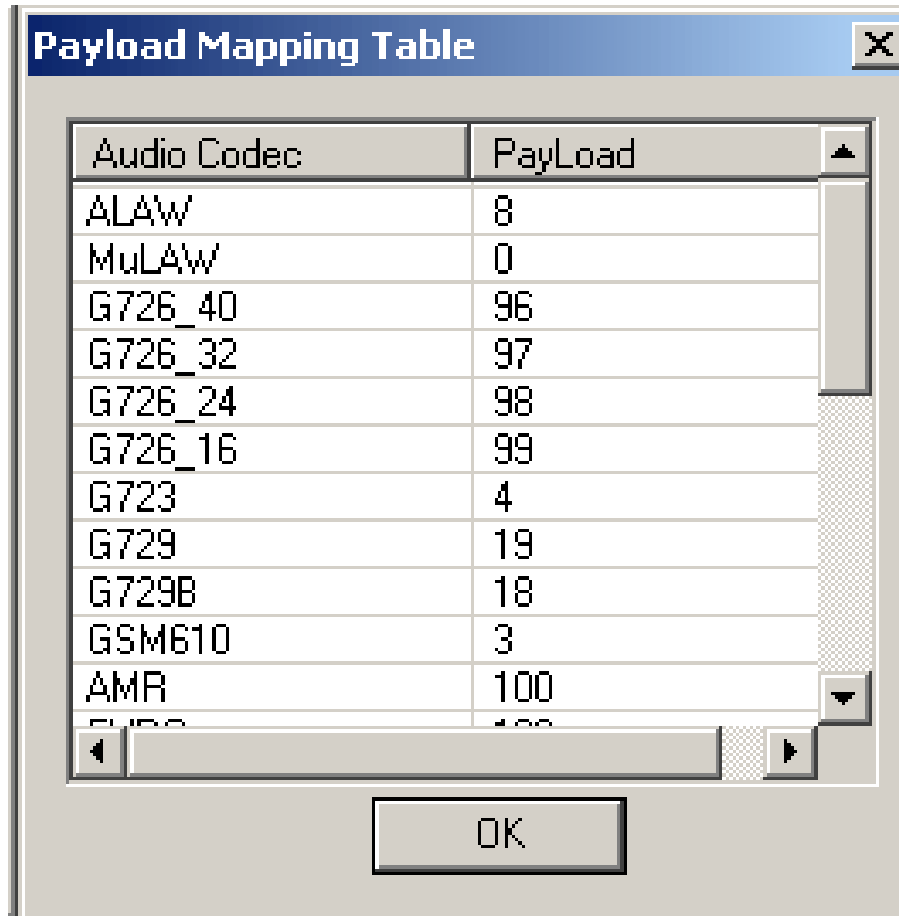
Export Displayed Summary

- Saves the call records and statistics to a comma-separated file
- Imports the exported summary into a database or spreadsheet for post processing



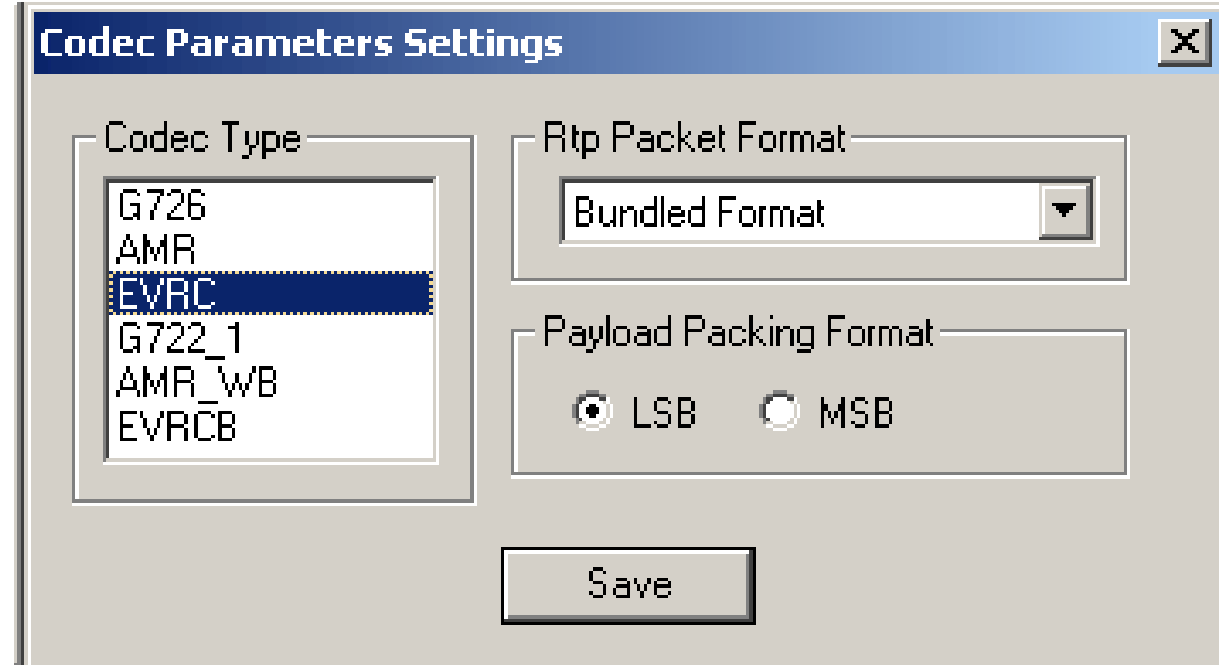
Dynamic Payload Mapping and Codec Packing

- Dynamic payload assignments are made at call setup based on receive side assignment
- Dynamic payload mapping is used to define payload type for supported codecs
- Additional parameters can be set to codecs such as G726, AMR, EVRC, EVRCB, EVRC-C, G722.1, and AMR-WB using codec parameter settings



| Audio Codec | PayLoad |
|-------------|---------|
| ALAW | 8 |
| MuLAW | 0 |
| G726_40 | 96 |
| G726_32 | 97 |
| G726_24 | 98 |
| G726_16 | 99 |
| G723 | 4 |
| G729 | 19 |
| G729B | 18 |
| GSM610 | 3 |
| AMR | 100 |
| EVRC | 101 |

OK



Codec Parameters Settings

Codec Type: G726, AMR, **EVRC**, G722_1, AMR_WB, EVRCB

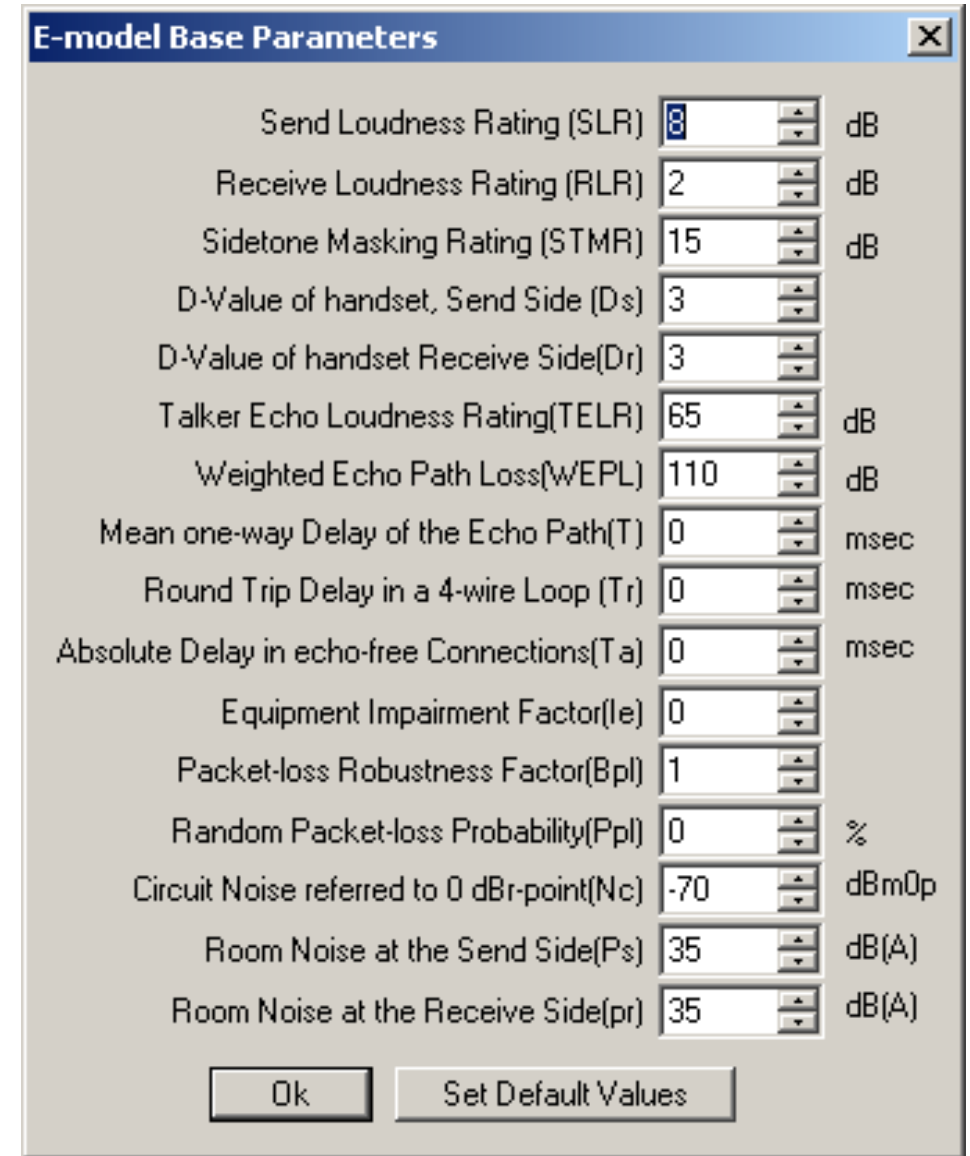
Rtp Packet Format: Bundled Format

Payload Packing Format: ☒ LSB ☐ MSB

Save

E-Model Base Parameters

- E-Model (ITU – T Rec. G. 107 [1]) is a transmission-planning tool
- Provides a prediction of the expected voice quality
- Considers many basic parameters in estimating voice quality



The screenshot shows a dialog box titled "E-model Base Parameters" with a close button (X) in the top right corner. The dialog contains a list of parameters, each with a numerical input field and a unit. The parameters and their values are:

| Parameter | Value | Unit |
|---|-------|-------|
| Send Loudness Rating (SLR) | 8 | dB |
| Receive Loudness Rating (RLR) | 2 | dB |
| Sidetone Masking Rating (STMR) | 15 | dB |
| D-Value of handset, Send Side (Ds) | 3 | |
| D-Value of handset Receive Side(Dr) | 3 | |
| Talker Echo Loudness Rating(TELR) | 65 | dB |
| Weighted Echo Path Loss(WEPL) | 110 | dB |
| Mean one-way Delay of the Echo Path(T) | 0 | msec |
| Round Trip Delay in a 4-wire Loop (Tr) | 0 | msec |
| Absolute Delay in echo-free Connections(Ta) | 0 | msec |
| Equipment Impairment Factor(Ie) | 0 | |
| Packet-loss Robustness Factor(Bpl) | 1 | |
| Random Packet-loss Probability(Ppl) | 0 | % |
| Circuit Noise referred to 0 dB-point(Nc) | -70 | dBmOp |
| Room Noise at the Send Side(Ps) | 35 | dB(A) |
| Room Noise at the Receive Side(pr) | 35 | dB(A) |

At the bottom of the dialog, there are two buttons: "Ok" and "Set Default Values".

VQMon Settings

- Sets jitter buffer emulator settings to emulate received VoIP call
- Static or dynamic buffer can be set depending upon the requirement

VqMon Settings

Jitter Buffer Emulator - Summary

Type: **Adaptive** (dropdown)

Minimum: **40** ms

Nominal: **40** ms

Maximum: **100** ms

Jitter Buffer Emulator - Detail Analysis

Type: **Adaptive** (dropdown)

Minimum: **40** ms

Nominal: **40** ms

Maximum: **100** ms

VQMon Standards

☐ Japan ☒ North America

Ok **Set Default**

Trigger and Action Settings

Triggers and Action Settings - Untitled

File

Trigger List

- ☒ Trigger1

Enter Trigger Name

Trigger1

Add Delete

Filter Selection

- ☒ SIP
 - ☒ Calling Party
 - ☐ Called Party
 - ☐ Fax Calls
 - ☐ Incomplete Calls
 - ☐ Failed Calls
 - ☐ Sip Error Code
 - ☐ Call Duration (mins)
 - ☐ Session Request Delay (msecs)
 - ☐ Session Disconnect Delay (msecs)

Enter String Value

1000@192.168.1.183

Activate DeActivate

Conditions

☐ And ☒ Or

Action

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

Save Call To File Options

File Name Mask

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

Files Destination Directory

C:\Program Files\GL Communications ...

Save Options

☒ HDL File

☐ PCAP File

☐ Call Summary

Create File Options -- If File Exists

☒ Overwrite ☐ Skip Operation ☐ Append Sequence Number

Ok Cancel

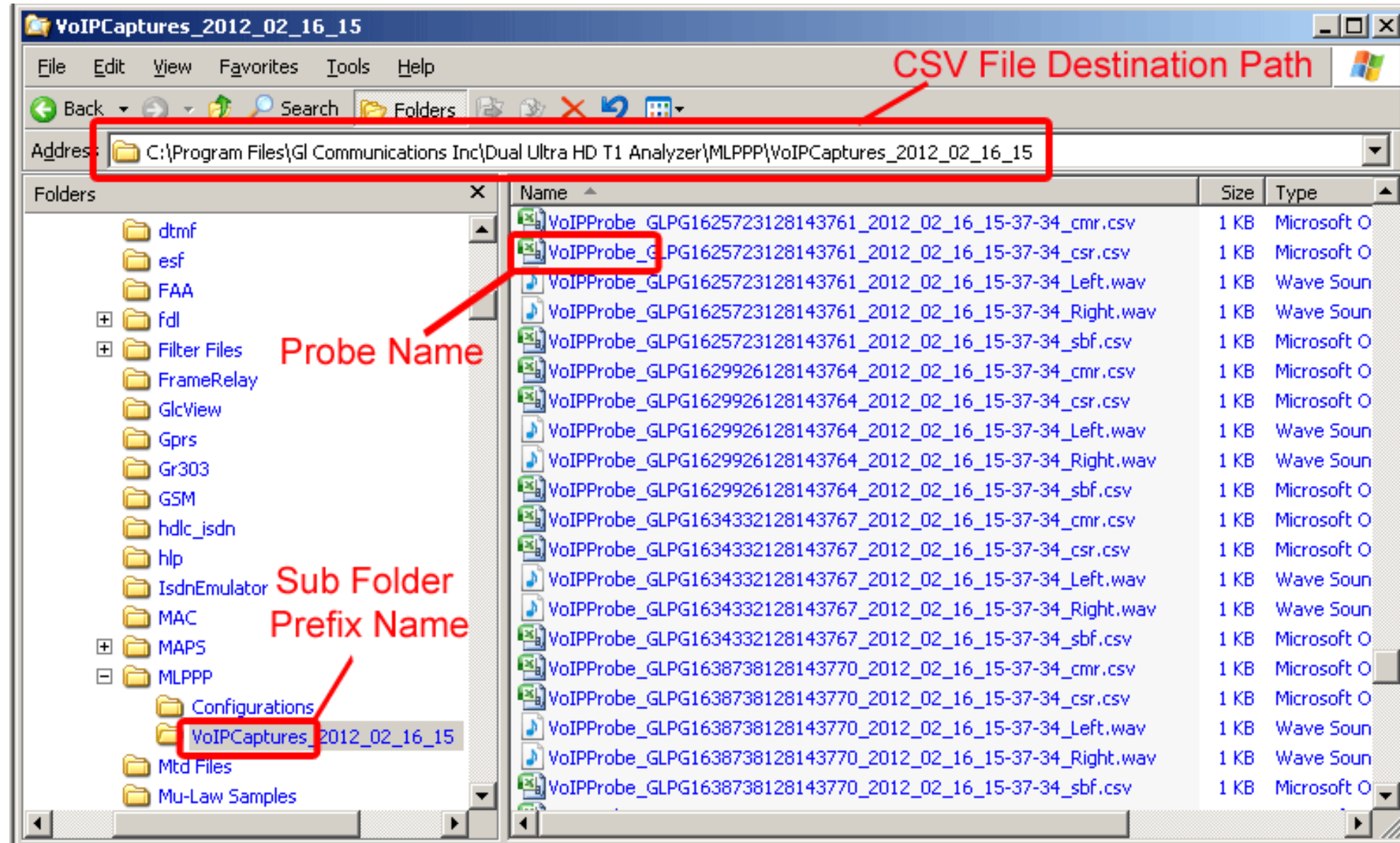
- Sets the triggers and actions criteria to further filter calls and perform additional actions on these subset of completed calls
- Triggers on certain SIP, RTP, MEGACO, and H323 parameters
- It allows users to specify the formats and the type of calls to be saved as *.hdl, or *.pcap, and/or *.wav format
- Triggering factors includes calling number, called number, incomplete calls, fax calls, call duration, MOS factor, sip error code, average jitter, and more
- Actions include saving call to a file, recording audio to a file, sending an email, posting alert summary, and viewing custom calls in summary view
- Call detail record trigger option will output three types of Comma Separated Value (CSV) files such as Call Master Record, Call Side Record, and Call Events Record. Each set of CSV file is specific to an individual call

Call Detail Record (CSV)

The screenshot shows a configuration window titled "Action". On the left, there is a list of actions with checkboxes: ☒ Save Call, ☒ Audio Recording, ☒ User Defined, ☒ Send e-mail, ☒ Alert Summary, and ☒ Call Detail Record. On the right, there are several settings:
 - Checkboxes for ☒ Call Side Record, ☒ Call Master Record, and ☒ Call Events Record.
 - A "Probe Name" field containing "VolPProbe".
 - A "CSV Files Destination Directory" field containing "C:\Program Files\GL Communications" with a browse button "...".
 - A "Use Sub Folders" checkbox which is checked.
 - A "Folder Prefix" field containing "VolPCaptures" and a "Create Subfolder Every" dropdown set to "1" with "hr" (hours) next to it.
 - A section titled "Create File Options -- If File Exists" with three radio buttons: ☒ Overwrite, ☐ Skip Operation, and ☐ Append Sequence Number.

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

CSV Outputs



Alert Summary

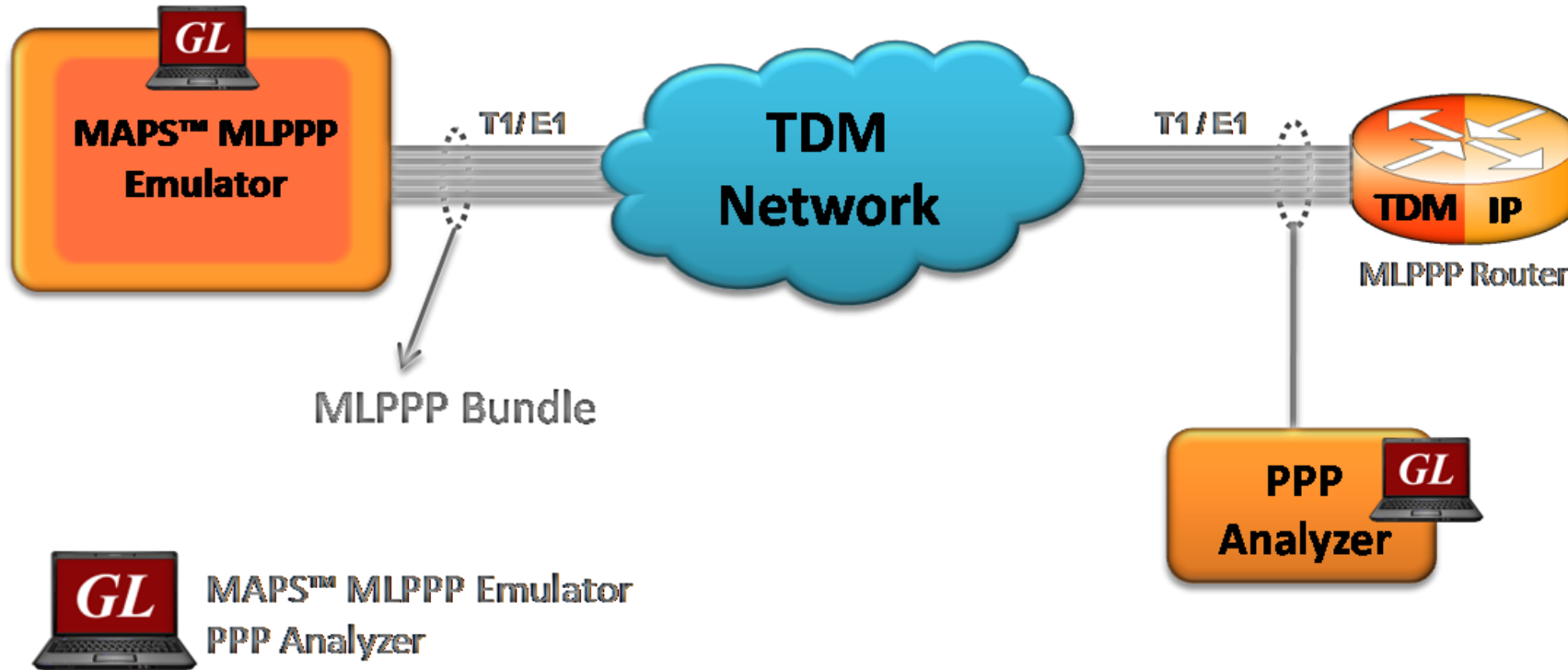
- Generates alerts when particular vital parameters go beyond a specified value
- Provides an active list of the alerts for the events in a tabular column
- Displays the summary of call#, user-defined message, threshold value, actual value for which the alert occurred, callee, caller, and callid

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

MAPS™ MC-MLPPP Conformance Testing

MAPS™ MC-MLPPP Conformance Testing

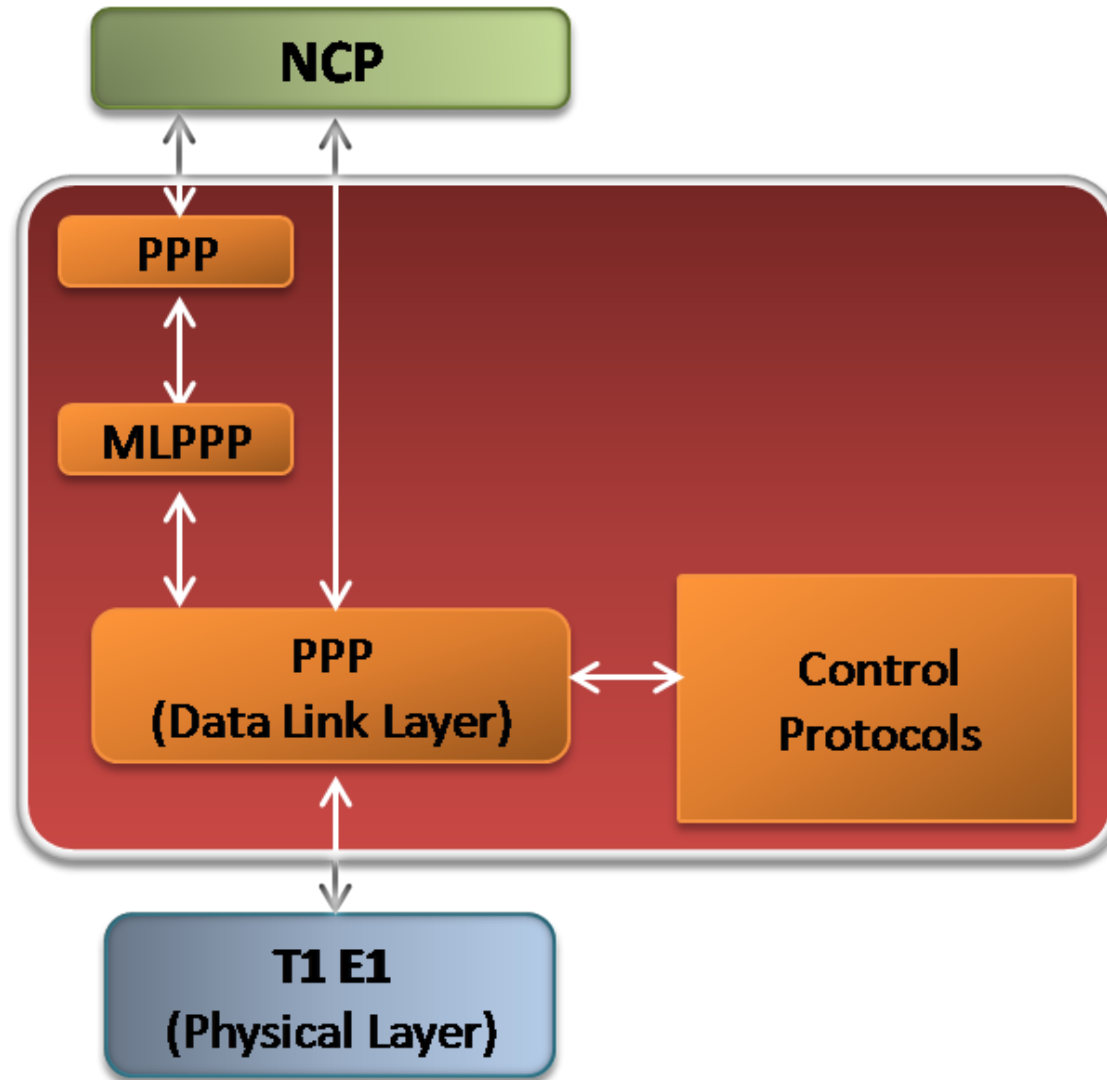
- MAPS™ MLPPP is an advanced tool for MLPPP simulation over TDM (T1 E1) that can simulate peer endpoints (Router or a Switch), with MLPPP signaling specification conforms to IETF standards



Features

- Performs MC-MLPPP as well as PPP simulation over TDM (T1/E1)
- Supports LCP with the following negotiation options
 - PPP options: MRU (Maximum Receive Unit), ACFC (Address and Control Field Compression), PFC (Protocol Field Compression), and Magic Number
 - MLPPP Options: MRRU (Maximum Received Reconstructed Unit), Short Sequence Number Format, Long sequence header format, Endpoint Discrimination, and Multi-class option
 - Multi-Class Options: Multilink Header Format
- Supports the following NCPs -
 - IPCP - RFC 1332 (The PPP Internet Protocol Control Protocol) and RFC 1877 (PPP Internet Protocol Control Protocol Extensions for Name Server Addresses) standards
 - PPPMuxCP - RFC 3153 (PPP Network Control Protocol for PPP Multiplexing) standard
- Supports IP compression negotiation option conforming to RFC 3544
- Supports full or fractional timeslots for PPP Link
- Ideal solution for automated testing using command line scripts

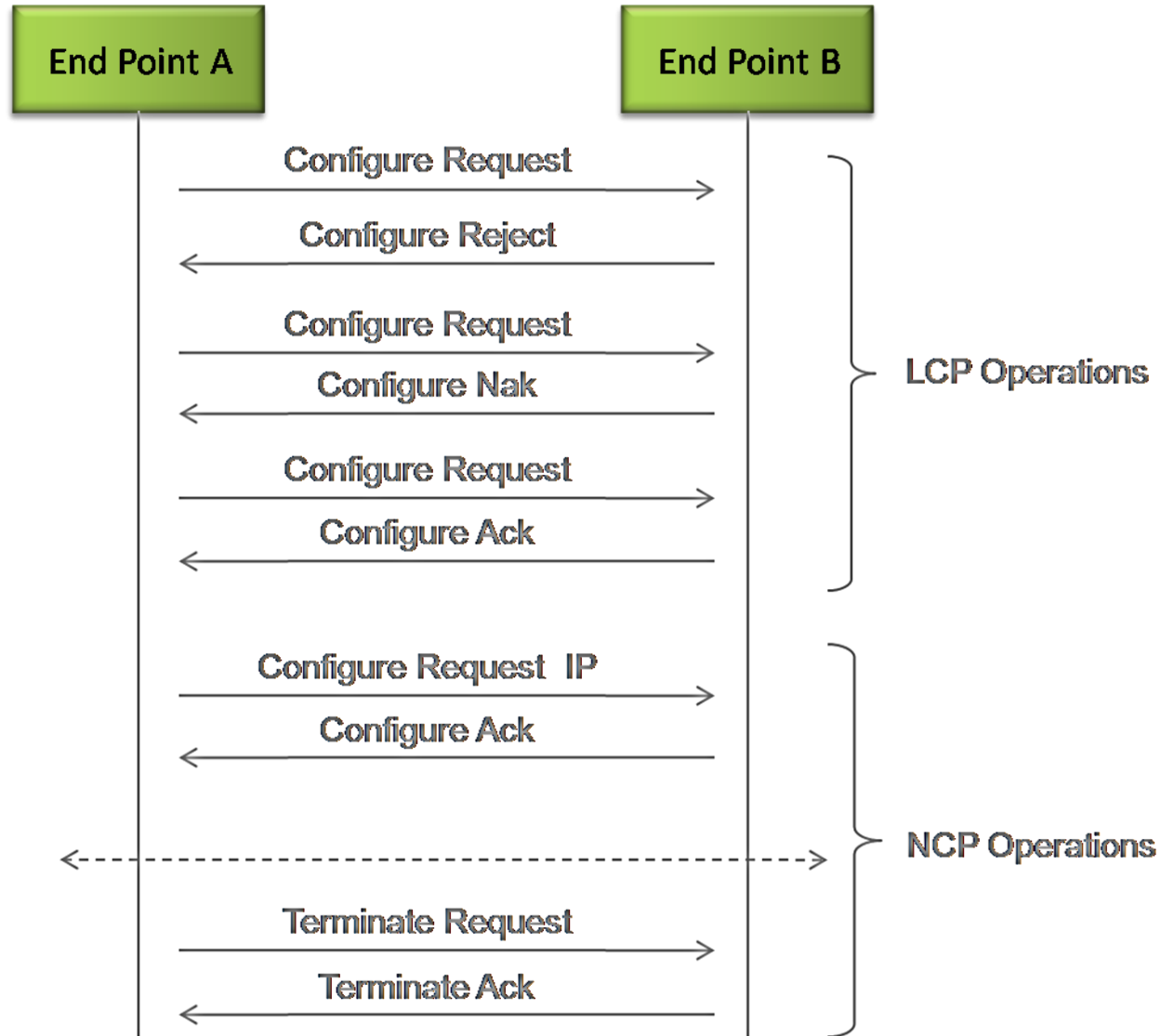
Protocol Stack



Supported Protocol Standards

| Supported Protocols | Standard / Specification Used |
|---|-------------------------------|
| Point-to-Point Protocol | RFC1661 |
| Multi-Link PPP | RFC1990 |
| Multi-Class Extension to Multi-Link PPP | RFC2686 |
| IPCP | RFC1332 |
| IPCP Extensions | RFC1877 |
| PPPMuxCP | RFC3153 |

Typical MLPPP Negotiation Operations



Call Generation and Call Reception

Active Calls ←

→ **Completed Calls**

Load Scripts and Profiles

Script Contents

Executing Commands

Receiving Scripts

Message Sequence of a selected call

Message Decodes of the selected ISDN message

Call Generation - Untitled

| Sr ... | Script Name | Profile | Call Info | Script Execution | Status | Events | Events Profile | Result | Total Iteratio... | Completed Iterati... |
|--------|-------------------|----------------------|-----------|------------------|--------------|--------|----------------|---------|-------------------|----------------------|
| 1 | OpenStateTest.gls | Profile_openState... | | Abort | Request Sent | None | | Unknown | 1 | 0 |

Buttons: Add, Delete, Insert, Start, Abort, Refresh, Start All, Abort All

☐ View Executing Line

Script Contents

```

acksent="No" ;
IDSent=$Identifier;
MRU=1500;
send "Configure-Request" "ConfigureRequestImport""StreamId"=StreamId retxmit Timer (10,TimeSpan sec);
Eventlog ("ConfigReq Sent");
Status="Request Sent" ;
RecvTime=30 ;
"MainLoop":
recv msg wait RecvTime sec;
if (MsgReceived)
    
```

Call Reception

| Sr No | Script Name | Call Info | Script Execution | Status | Events | Events Profile | Results |
|-------|--------------------------------------|-----------|------------------|--------|--------|----------------|---------|
| 1 | TestLoopBackUsingPeerMagicNumber.gls | | Completed | | None | | Fail |
| 2 | TestLoopBackUsingPeerMagicNumber.gls | | Completed | | None | | Pass |
| 3 | TestLoopBackUsingPeerMagicNumber.gls | | Completed | | None | | Pass |
| 4 | TestLoopBackUsingPeerMagicNumber.gls | | Completed | | None | | Unknown |
| 5 | TestLoopBackUsingPeerMagicNumber.gls | | Completed | | None | | Unknown |
| 6 | TestLoopBackUsingPeerMagicNumber.gls | | Completed | | None | | Fail |

Buttons: Abort, Auto Trash, Trash

Message Sequence of a selected call

MAPS DUT

```

Configure-Request 14:22:37.375000
Configure-Ack     14:22:37.375000
Configure-Request 14:22:37.375000
Configure-Nak     14:22:40.890000
    
```

Message Decodes of the selected ISDN message

```

===== PPP Link Layer =====
Address Compression Choice = 1111... No Address Co
Address                    = 11111111 Broadcast Ad
CC                          = 00000011 UnSequenced I
ProtoCol Field Selection   = .....0 ProtocolField
Protocol                   = 11000000 00100001 Lin
===== Link Control Layer =====
Code Type                  =
Code                       = 00000001 Configure-Re
Identifier                  = 1 (x01)
Length                     = 18 (x0012)
Magic-Number               =
IE id                      = 00000101 Magic-Number
Length of Options          = 6 (x06)
    
```


Thank You!