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# Asynchronous Transfer Mode ATM Protocol Analysis and Emulation

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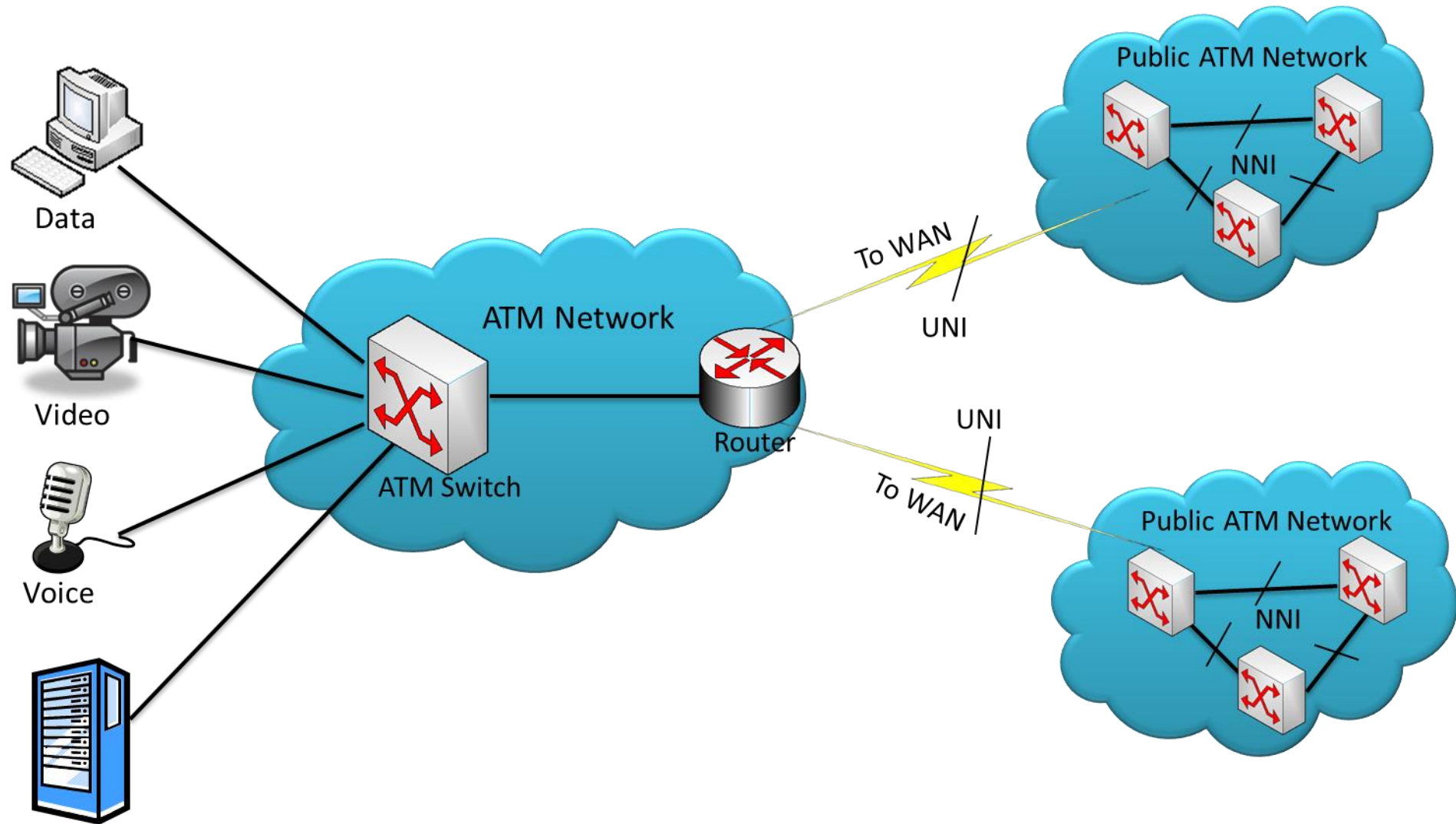


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Website: <https://www.gl.com>

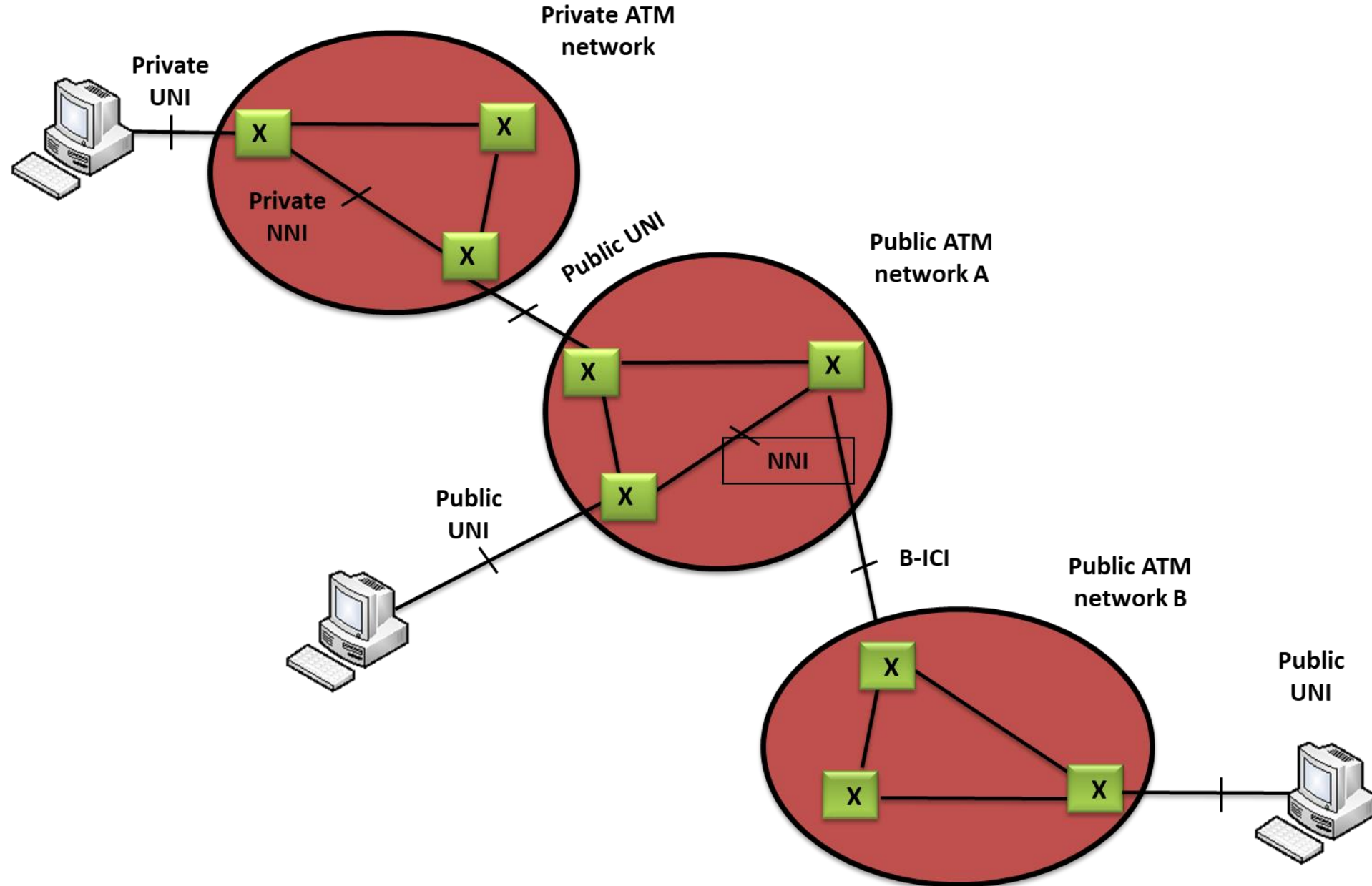
# What is ATM ?

- Asynchronous Transfer Mode (ATM) is a switching and multiplexing technology
- Flexible network that carries voice, video, and data, quickly and efficiently
- Circuit switch and Packet switch network
- Protocol standards are developed by ITU; Consists of 3 layers – ATM Adaptation Layer (AAL), ATM layer, and Physical layer
- 2 levels – Transport and Switching; carries all traffic on a stream of fixed-size ATM cells
- ATM is a core protocol used in SONET / SDH backbone of the PSTN
- Support for multimedia traffic, efficient bandwidth management for burst traffic and for LAN/WAN architecture and high performance via hardware switching

# ATM Network Model

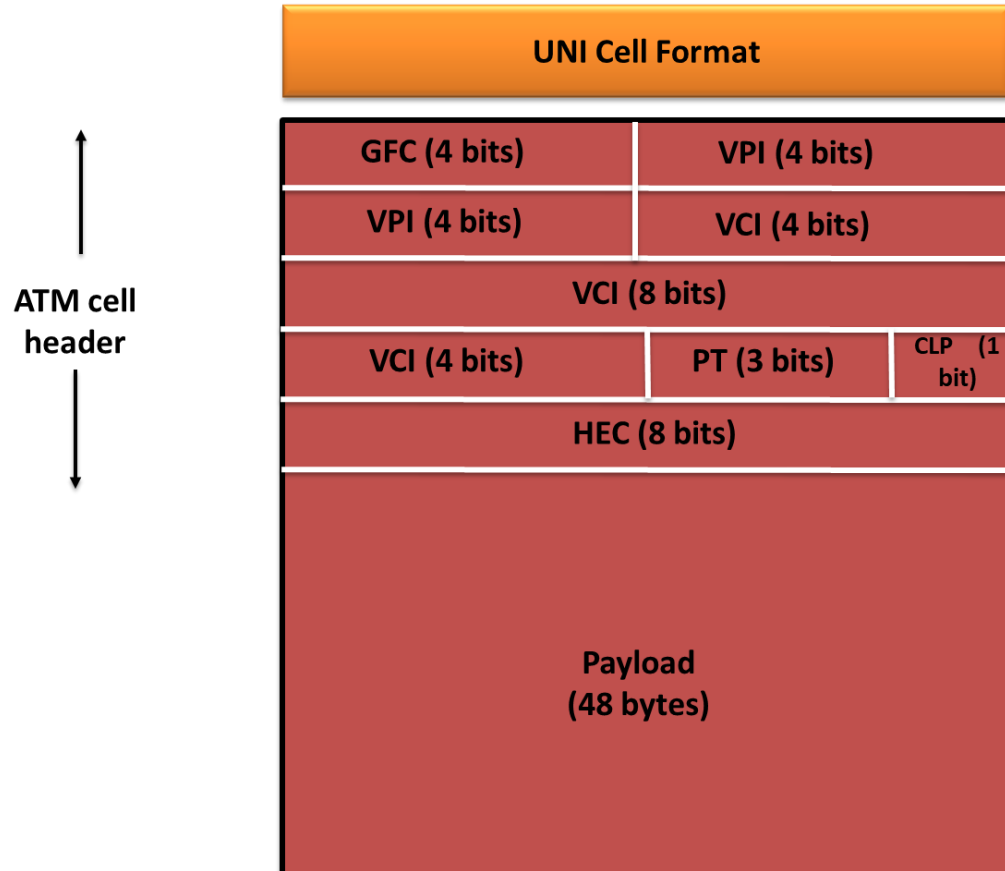


# ATM Network Interface

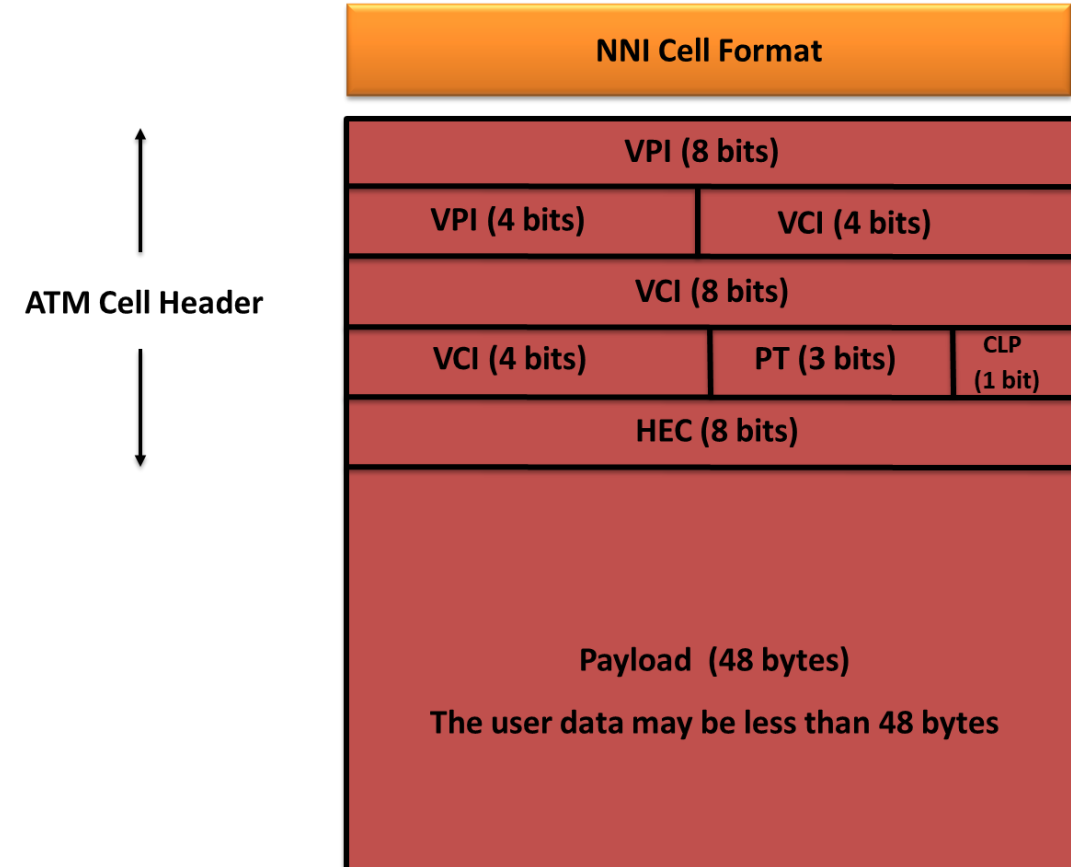


# UNI and NNI ATM Cell

## UNI (User-Network Interface)

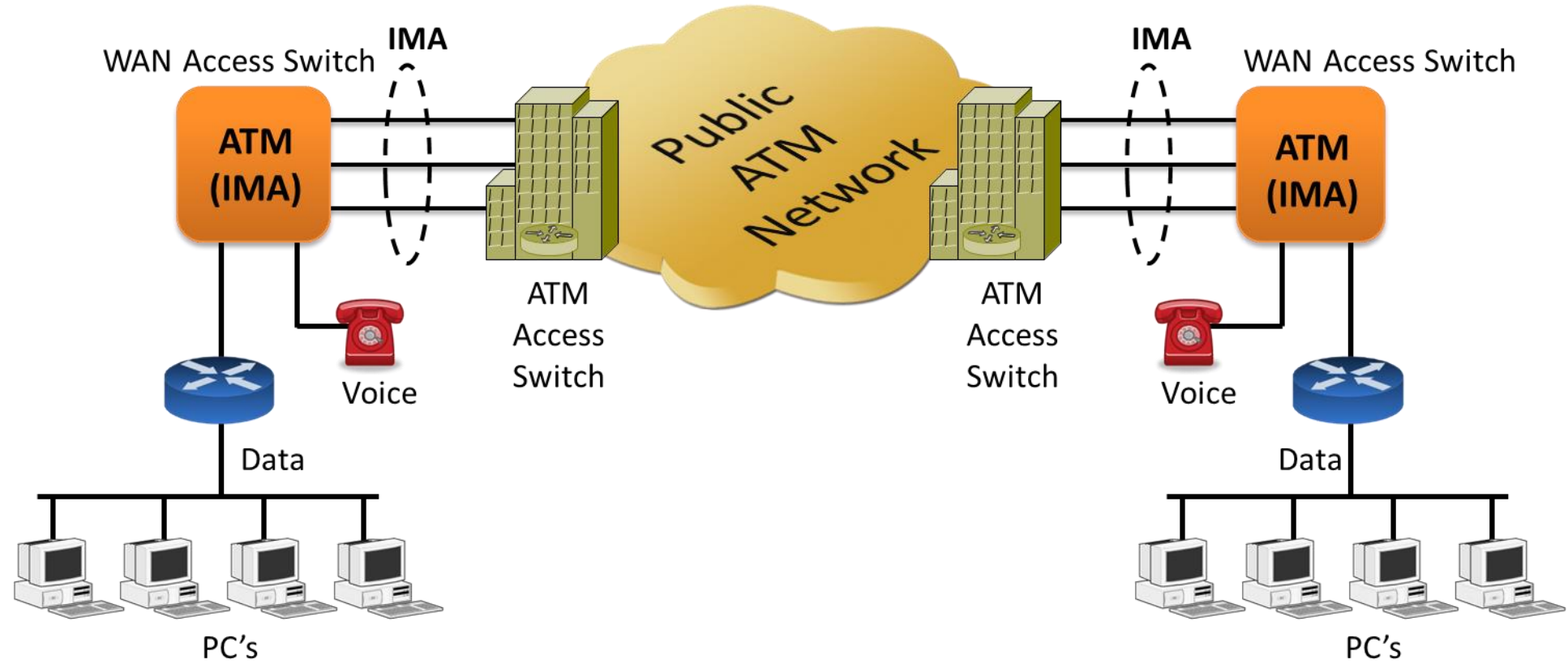


## NNI (Network-Network Interface)

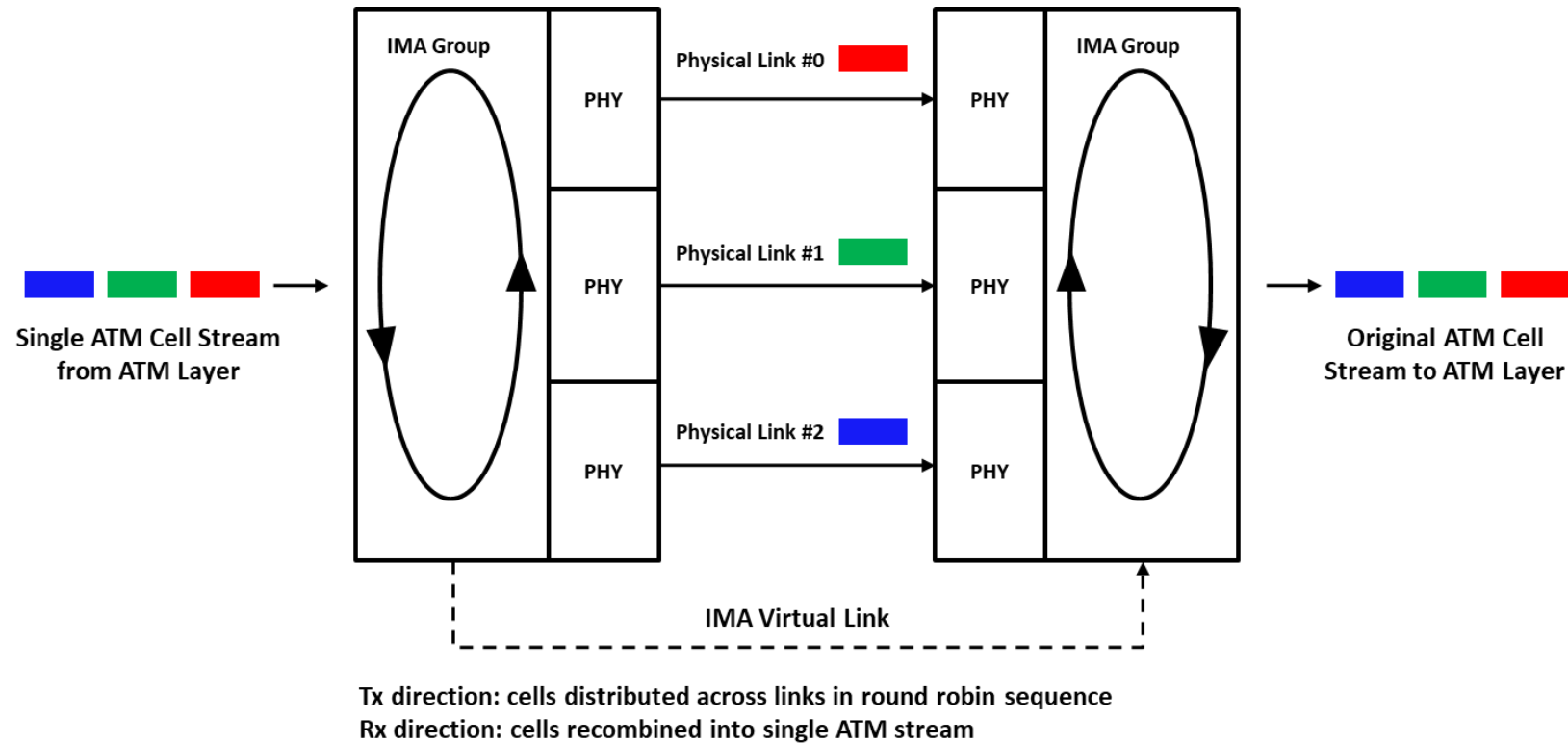


# IMA Network

## General ATM IMA Network



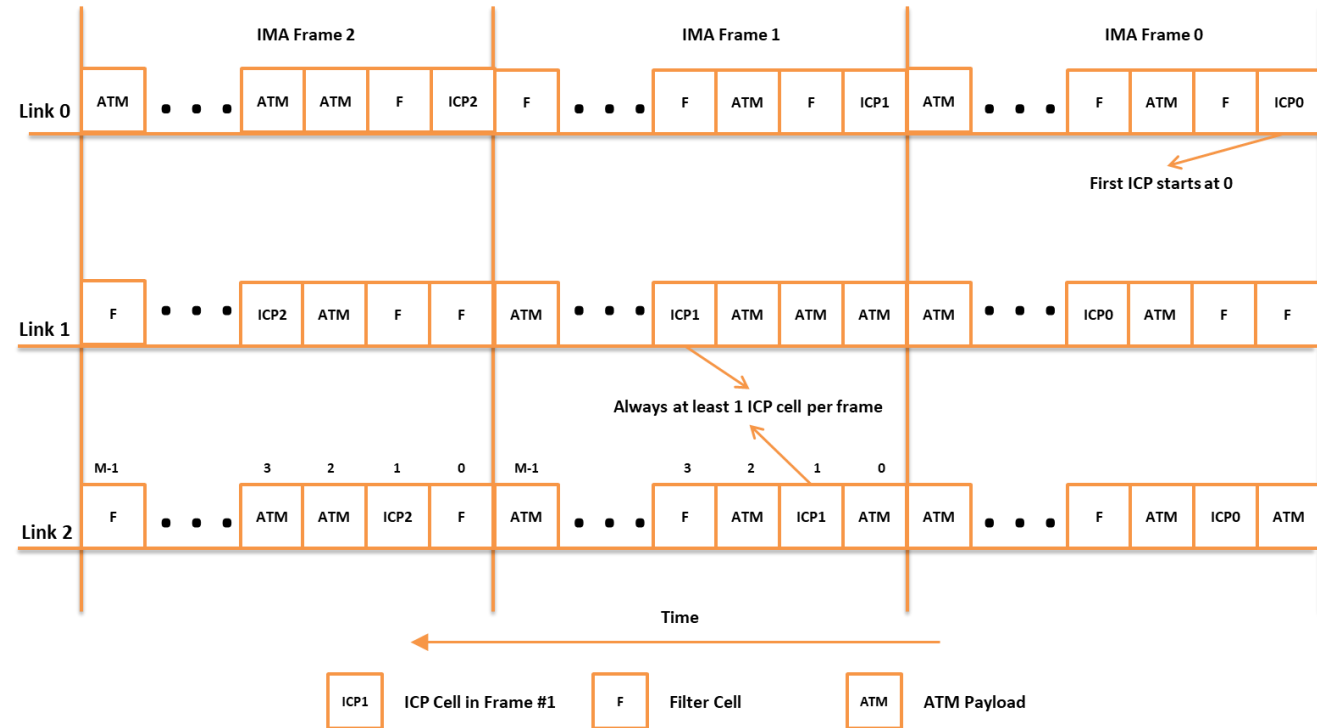
# Inverse Multiplex over ATM (IMA)



- ATM Inverse Multiplexing technique involves inverse multiplexing and de-multiplexing of ATM cells in a cyclical fashion
- IMA combines multiple T1 or E1 links to form a single high-speed connection
- IMA provides flexible bandwidth options to achieve rates between the DS1/E1 and DS3/E3

# IMA Frames

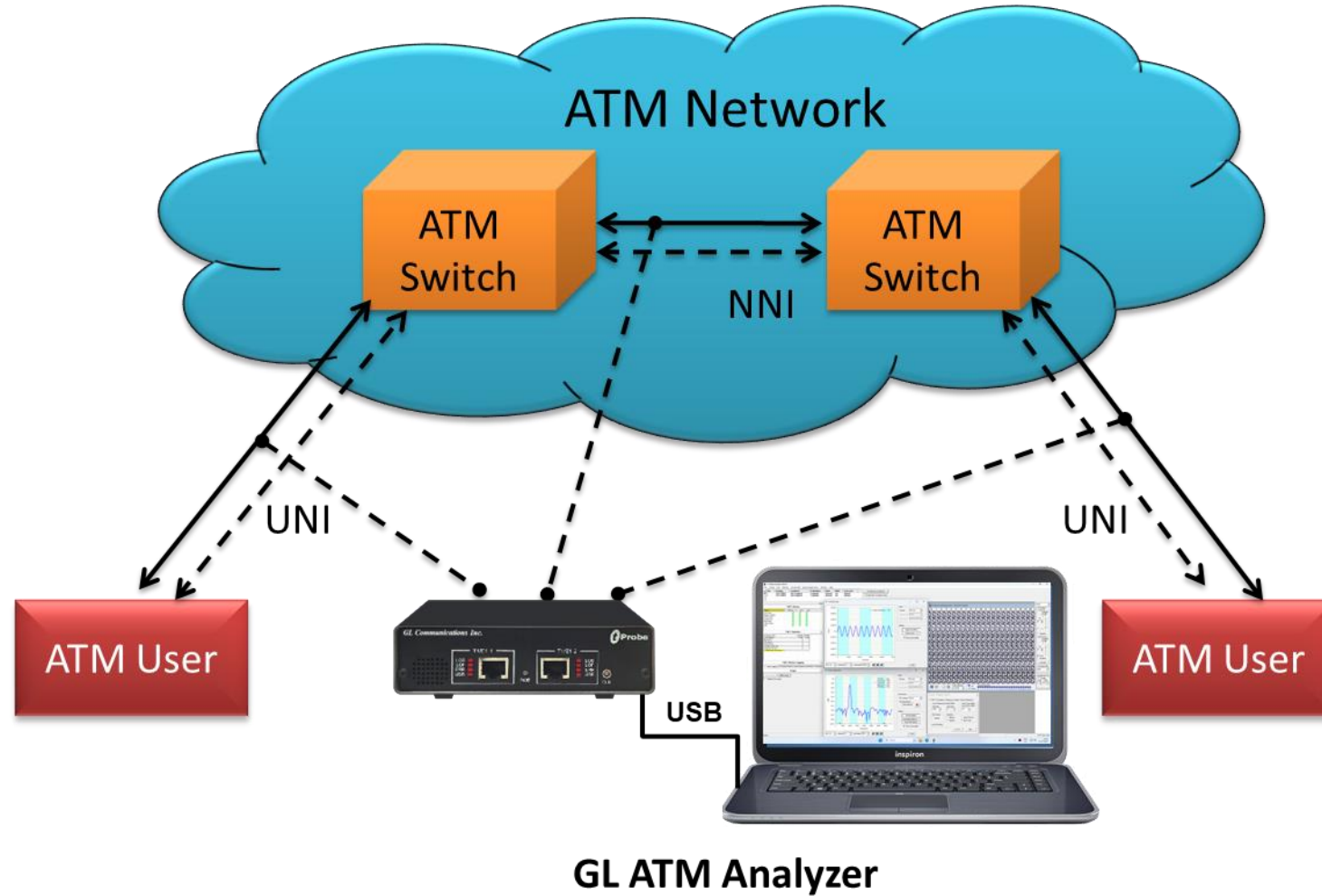
- IMA links transmit IMA control protocol (ICP) cells on each link in a group - once per IMA frame
- ICP cells define and separate IMA frames and enable reconstruction of the original ATM cell stream
- IMA group can have a frame size of 32, 64, 128, or 256. If an IMA frame length is of 128 cells, one out of every 128 cells on a physical link is an ICP cell
- If no ATM layer cells are being sent, then an IMA filler cell is transmitted to provide a constant stream at the physical layer. Filler cells are discarded by the receiver





# GL's ATM Analysis

# GL's ATM Protocol Analyzer



- The protocol analysis tool is used to study the total system effect of a particular network protocol

# Applications

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

# Features

- Perform real-time / offline / remote analysis
- Consolidated GUI – Summary of all decodes, detail and hex-dump views of each frame, statistics view, and call detail record views
- Fine tune results with filtering and search capability
- Extensive statistics measurement ability
- Any protocol field can be added to the summary view, filtering, and search features providing users more flexibility to monitor required protocol fields
- Call trace capability based on UNI signaling parameters, VPI/VCI etc.
- 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

# Features (Contd.)

- Ability to configure .ini file for PVC carrying UNI signaling messages to get the proper decoding options
- Supports search and filtering capabilities
- CRC verification for AAL5 carrying packet data
- Captures, decodes, filters, and reassembles AAL2 and AAL5 frames in real-time, from within the ATM cells according to user defined VPI/VCi
- Capturing and reassembling frames that were transmitted with Inverse Multiplexing. IMA combines up to 8 T1 E1 links to form a single high-speed connection with flexible bandwidth options
- Unscrambling of ATM cells based on SDH  $X^{43} + 1$  algorithm
- Recorded raw data can be played back using raw data playback application

# Supported Platforms



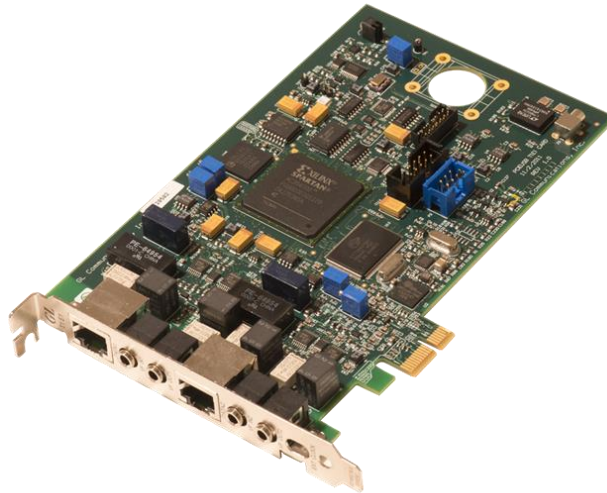
Front Panel

Back Panel

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

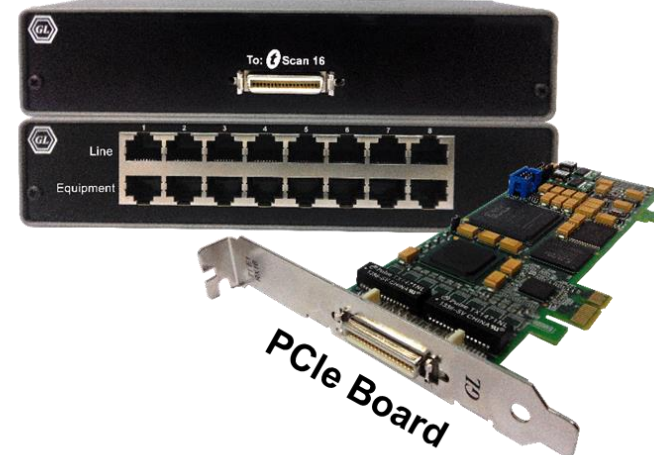


**Quad / Octal T1 E1 PCIe Card**



**Dual T1 E1 Express (PCIe) Board**

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



**PCIe Board**

# Supported Adaptation Layers (AAL)

- AAL 1
  - AAL1, a connection-oriented service, is suitable for handling circuit emulation and constant bit rate sources (CBR), such as voice and videoconferencing
- AAL2
  - used for variable bit rate (VBR) services, Typically includes services characterized as packetized voice or video that do not have a constant data transmission speed but that do have requirements similar to constant bit rate services
- AAL3/4
  - Used for variable bit rate (VBR) services, Used to transmit SMDS packets over an ATM network
- AAL5
  - Used to transfer most non-SMDS data, such as classical IP over ATM and LAN Emulation (LANE)

# GL's ATM Protocol Analyzer Display

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

Hex	ASCII
3D C0 00 23 82 21 45 00 00 C8 C1 C3 00 00 80 11	=A #!E EA c
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	u0c #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
FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	yyyyyyyyyyyyyyyy

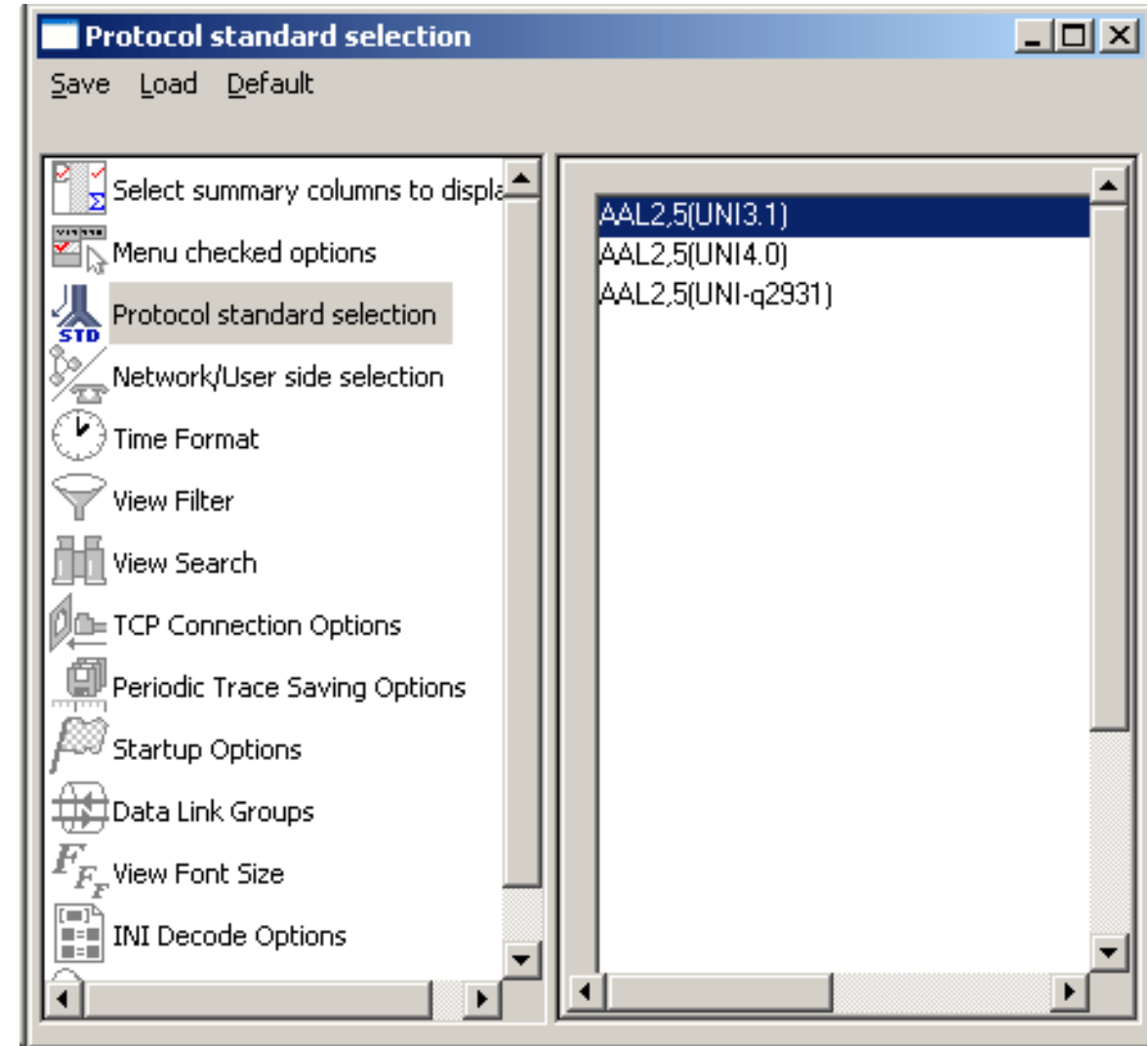
Device #	Frame Count(Device #)
2	1487
total 2	1487

C:\Program Files\GL Communications Inc\Usb E1 Ar 1487 Frames



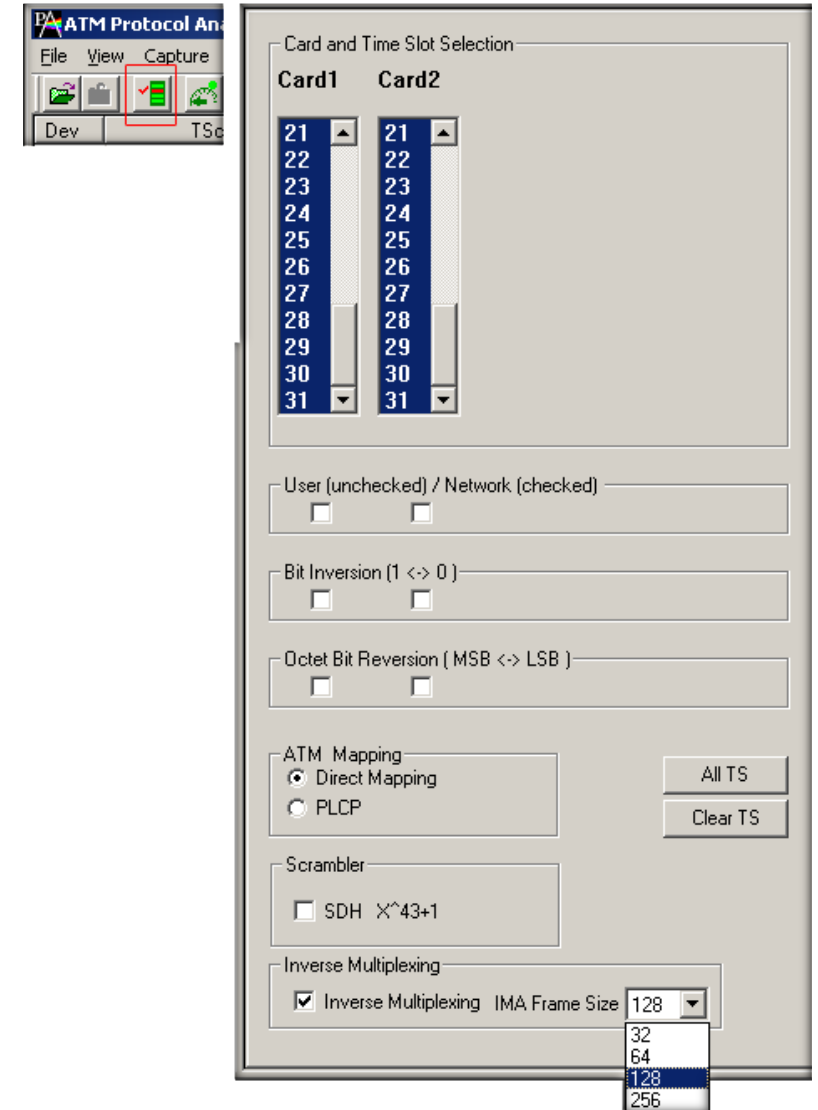
# Protocol Standards

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

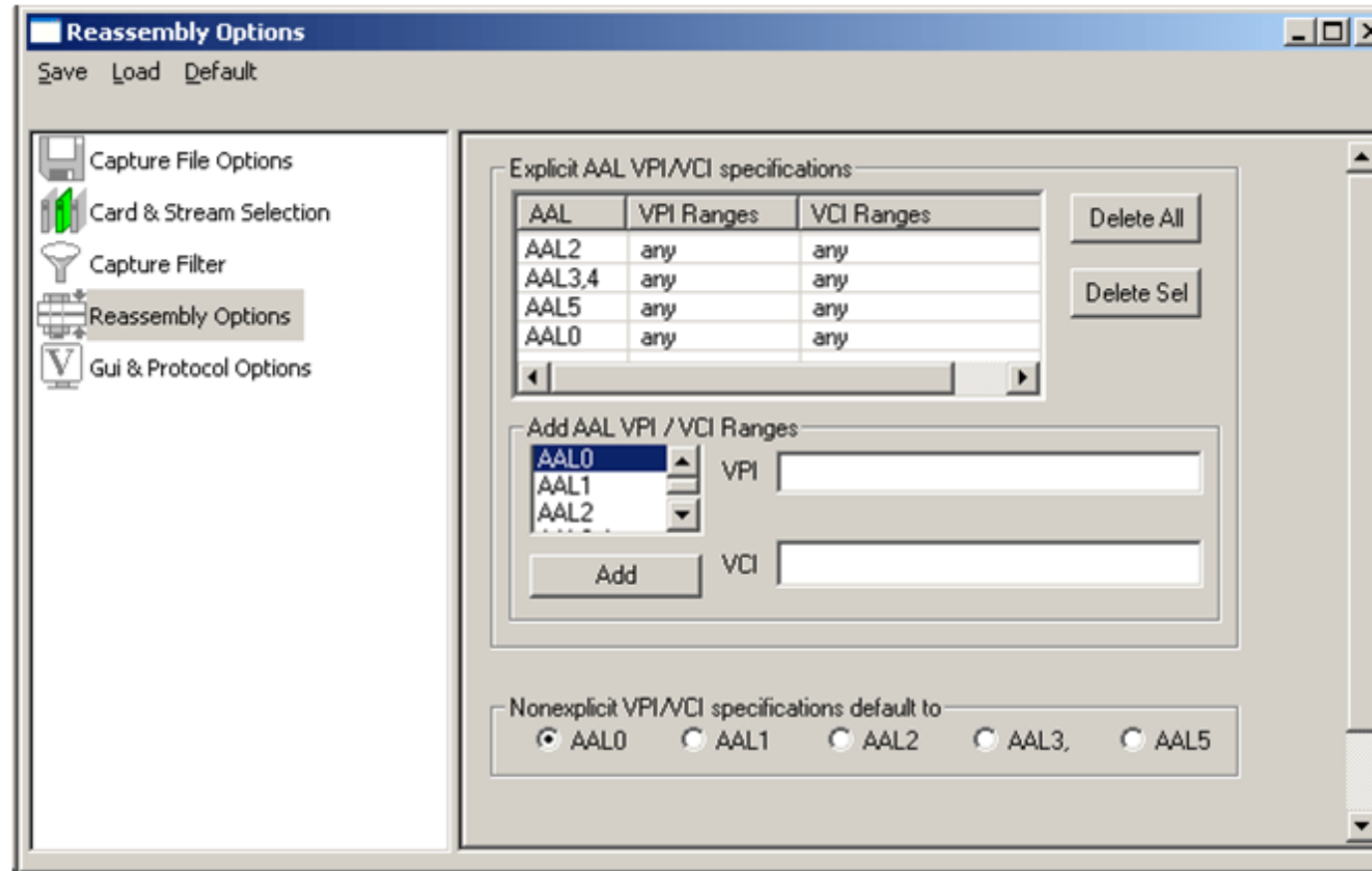


# ATM Stream Interface

- Stream /Interface allows user to specify ports for monitoring, and user/network side capture
- Allows the user to select the time slot on available cards
- Bit inversion option changes each bit in received octets from 0 to 1 and 1 to 0
- Octet bit reversion option changes order of bits in each octet to make the most significant bit to a least significant bit
- ATM Mapping feature decides how ATM cells are mapped to T1 or E1 frame
- Scrambler option will perform descrambling operation when ATM cells are received
- User configurable IMA Frame Length ranging from 32, 64, 128, or 256



# Reassembly Option



- Specify VPI /VCI values to reassemble as per the segmentation and reassembly rules defined by the specified AAL type
- ATM cells not satisfying the user specification will be reassembled as per the default specification

# Call Detail Records

ATM Protocol Analysis AAL2,5(UNI3.1)

File View Capture Statistics Database Call Detail Records Configure Help

DEV	TS...	FRAM...	TIME (Relative)	LEN	ERROR	VPI	VCI	PT	HEC	OSF	AAL Type	Frame T...	CID	LI	UUI
✓ 1	30	0	00:00:00.000000	281		110	25399	6	34		AAL5	CPS-Fra...			
✓ 1	30	1	00:00:00.000000	54		110	25399	6	34		AAL5	CPS-Fra...			
✓ 1	30	2	00:00:00.000000	141		110	25399	6	34		AAL5	CPS-Fra...			
✓ 1	30	3	00:00:00.000000	33		110	25399	6	34		AAL5	CPS-Fra...			
✓ 1	30	4	00:00:00.000000	51		110	25399	6	34		AAL5	CPS-Fra...			
✓ 1	30	5	00:00:38.865750	39		110	25399	6	34		AAL5	CPS-Fra...			

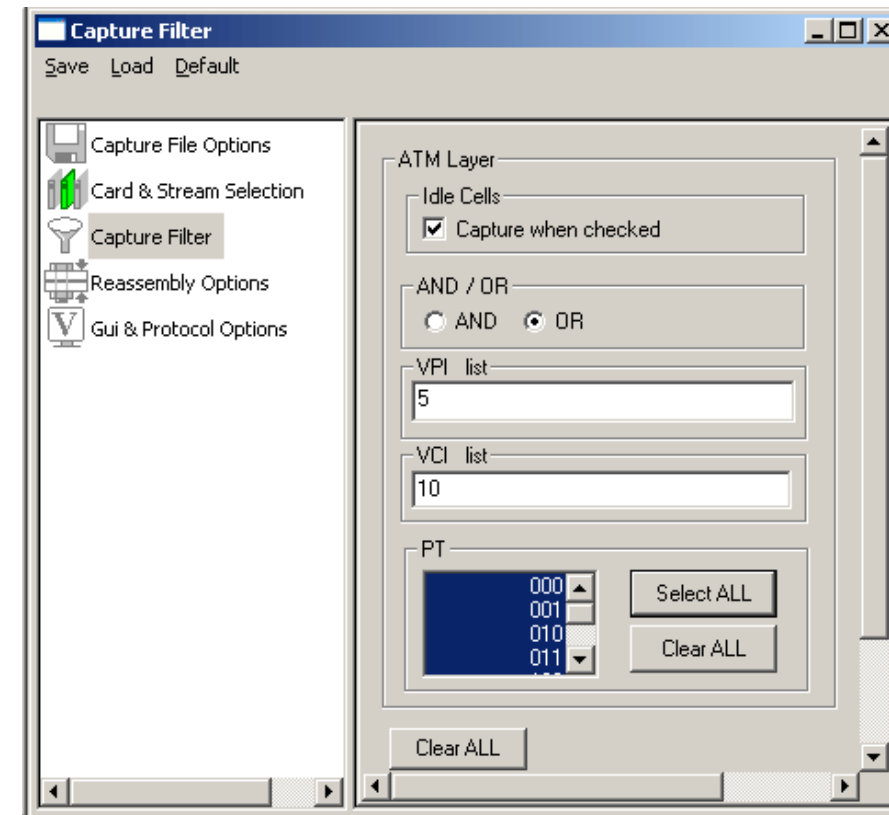
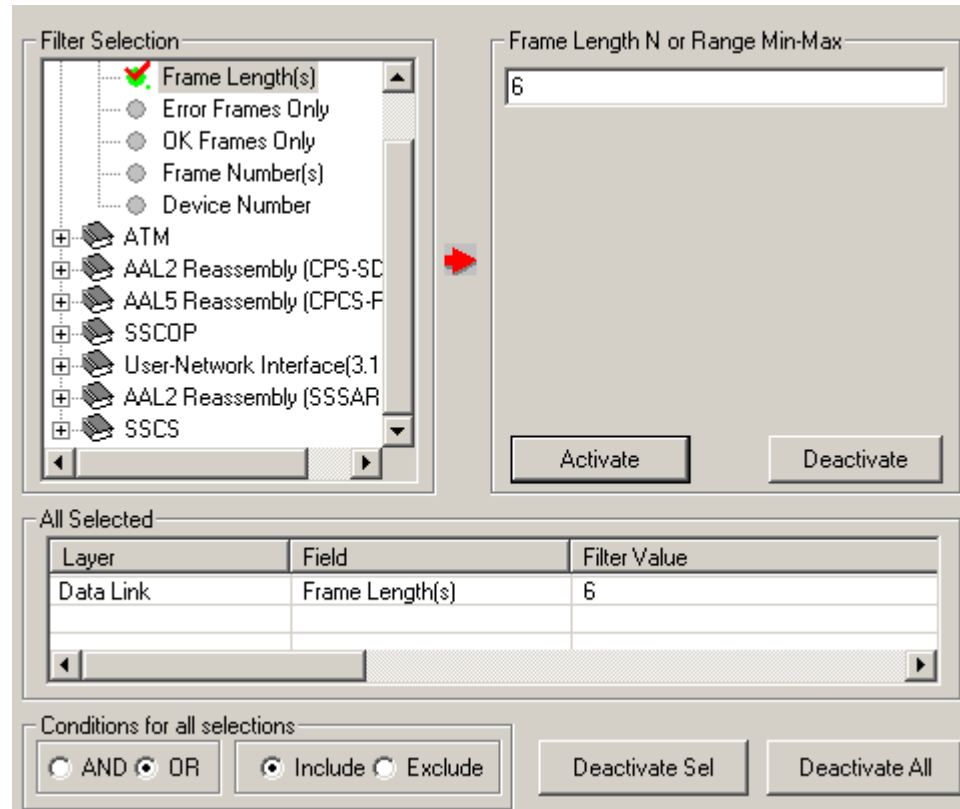
Call ID	Call Status	Calling Num	Called Num	Call Start Date & Time	Call Duration	Release Complete Cause	DevNo	CRV	VCI	VPI
0	Completed			2003-08-29 13:28:11.736500	00:00:38.865750	Normal call clearing	1	1286	25399	110

E:\Src\Test Scripts\ATMCall.hdl 6 Frames

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

# Filter Frames

## Real-time Capture Filter



- Isolate certain specific frames from all frames in real-time as well as offline
- Real-time Filter applies to the frames being captured and is based on the VPI and VCI values
- The frames can also be filtered after completion of capture according to Dev#, Time Slot, Frame #, Time, Length, Error, VPI/VCI, PT (Payload Type), HEC, OSF, AAL Type, Frame Type, CID, LI, CPI, UII, and more

# Search Frames

Filter Selection

- ☒ AAL2,5(UNI3.1)
  - ☒ Data Link
  - ☒ ATM
    - ☒ VPI
    - ☐ VCI
    - ☐ PT
    - ☐ HEC
    - ☐ OSF
    - ☐ AAL Type
    - ☐ Frame Type
- ☒ AAL2 Reassembly (CPS-SC)
- ☒ AAL5 Reassembly (CPCS-F)

VPI Value

3

Activate Deactivate

All Selected

Layer	Field	Filter Value
Data Link	Frame Length(s)	6
ATM	VPI	3

Conditions for all selections

☐ AND ☒ OR ☒ Include ☐ Exclude Deactivate Sel Deactivate All

- 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

ATM Protocol Analysis AAL2,5(UNI3.1) 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

Dev	TScout	Frame#	TIME (Relative)	Len	Error	Frame Type	VCI	VPI	F
✓ 2	24	0	00:00:00.000000	53		ATM-Cell	0	0	0
✓ 2	24	1	00:00:00.000276	53		ATM-Cell	0	0	0
✓ 2	24	2	00:00:00.000552	53		ATM-Cell	0	0	0
✓ 2	24	3	00:00:00.000828	53		ATM-Cell	0	0	0
✓ 2	24	4	00:00:00.001104	53		ATM-Cell	0	0	0
✓ 2	24	5	00:00:00.001380	53		ATM-Cell	0	0	0
✓ 2	24	6	00:00:00.001656	53		ATM-Cell	0	0	0
✓ 2	24	7	00:00:00.001932	53		ATM-Cell	0	0	0

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

Use Ctrl, Shift for Extended Selection

ATM::Frame Type  
ATM::PT  
ATM::VCI  
ATM::VPI

OK Select All Cancel

Analyzer GUI and Protocol Configuration

Save Load Default

Select summary columns to di...  
Menu checked options  
Protocol standard selection  
Network/User side selection  
Time Format  
View Filter  
View Search  
TCP Connection Options  
Periodic Trace Saving Options  
Startup Options  
Data Link Groups  
View Font Size  
INI Decode Options  
Define Summary Columns  
Aggregate Summary Columns  
Capture Options

Filter Selection

- ✓ AAL2,5(UNI3.1)
- Data Link
- ATM
- QAM
- AAL2 Reassembly (CPS-SC)
- SSCS
- AAL5 Reassembly (CPCS-F)
- SSCOP
- User-Network Interface(3.1)
- Multi Protocol Encapsulatio
- IP
- UDP

Value Selection

Activate Deactivate

All Selected

Layer	Field	Filter Value
ATM	Frame Type	ATM-Cell
ATM	PT	0

Conditions for all selections

AND OR Include Exclude

Deactivate Sel Deactivate All

# Search Criteria From Screen Selection

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

The screenshot shows the 'ATM Protocol Analysis AAL2,5(UNI3.1) 64-bit' window. The packet list table is as follows:

Dev	TScout	Frame#	TIME (Relative)	Len	Error	Frame Type	VCI	VPI	F
✓ 2	24	0	00:00:00.000000	53		ATM-Cell	0	0	0
✓ 2	24	1	00:00:00.000276	53		ATM-Cell	0	0	0
✓ 2	24	2	00:00:00.000552	53		ATM-Cell	0	0	0
✓ 2	24	3	00:00:00.000828	53		ATM-Cell	0	0	0
✓ 2	24	4	00:00:00.001104	53		ATM-Cell	0	0	0
✓ 2	24	5	00:00:00.001380	53		ATM-Cell	0	0	0
✓ 2	24	6	00:00:00.001656	53		ATM-Cell	0	0	0
✓ 2	24	7	00:00:00.001932	53		ATM-Cell	0	0	0

A context menu is open over the selected row (Frame 3), with options: 'Search Selected Value', 'Set Search Criteria as Sel Values', and 'Set Filter Criteria as Sel Values'. A red arrow points from 'Set Search Criteria as Sel Values' to a dialog box titled 'Use Ctrl, Shift for Extended Selection'. The dialog box contains a list of search criteria: 'ATM::Frame Type', 'ATM::PT', 'ATM::VCI', and 'ATM::VPI'. The 'ATM::VCI' option is selected. The dialog has 'OK', 'Select All', and 'Cancel' buttons. A red arrow points from the 'OK' button to the 'Analyzer GUI and Protocol Configuration' window. In this window, the 'Filter Selection' tree shows 'AAL2.5(UNI3.1)' expanded, with 'Data Link', 'ATM', 'DAM', 'AAL2 Reassembly (CPS-SC)', 'SSCS', 'AAL5 Reassembly (CPCS-F)', 'SSCOP', 'User-Network Interface(3.1)', 'Multi Protocol Encapsulation', 'IP', and 'UDP' listed. The 'Value Selection' table is empty. The 'All Selected' table is highlighted with a red box and contains the following data:

Layer	Field	Search Value
ATM	Frame Type	ATM-Cell
ATM	VCI	0

Below the 'All Selected' table, there are radio buttons for 'AND' and 'OR' conditions, and radio buttons for 'Include' and 'Exclude' options. There are also 'Deactivate Sel' and 'Deactivate All' buttons.



# Statistics

- Statistics is an important feature available in protocol 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 of the network based on protocol fields and different parameters

Statistics

Field Names

Layers

- Physical Link
  - Device #
  - Error Code
  - TS Count
  - Time Stamp
- ATM
- AAL2 Reassembly (CPS-SDU)
- AAL5 Reassembly (CPCS-PDU)
- SSCOP
- User-Network Interface(3.1)
- AAL2 Reassembly (SSSAR-SDU)
- SSCS

Device #

Use Type (single selection)

Total

Key

Field

Statistic Type(s) (calculated, multiple selection)

Frame Count

Frame Percent

Byte Count

Byte Percent

Range List

☐ Cumulative ☒ Separate

Add/Mod Remove

Selected Statistic Information

Layer	Field Name	Use Type	Statistic Type
Physical ...	Device #	Key	Frame Count
Physical ...	Time Stamp	Total	Frame Count

Remove Sel

Remove All

Apply

# Define Summary Columns

Selection of Summary Column

Output display in analyzer

The screenshot shows the 'ATM Protocol Analysis AAL2,5(UNI-q2931)' window. On the left is a toolbar with various options. The 'Define Summary Columns' option is highlighted with a red box. In the center, the 'Defined Protocol Summary Fields for AAL2,5(UNI-q2931)' dialog is open, showing a list of fields with checkboxes. The 'CLP' field is checked and highlighted with a red box. Below the dialog, the main data table is displayed, showing columns for Dev, TScout, Frame#, TIME (Relative), HEC, CLP, Len, Error, VPI, VCI, PT, OSF, and AAL Type. The 'CLP' column is highlighted with a red box. Below the table, the 'ATM Frame Data' section shows details for a specific frame, including VPI, VCI, PT, CLP, and HEC values. The 'Hex Dump of the Frame Data' section shows the raw data in hexadecimal and ASCII format.

Dev	TScout	Frame#	TIME (Relative)	HEC	CLP	Len	Error	VPI	VCI	PT	OSF	AAL Type
1	24	0	00:00:00.000000	0	1	11		14	1223	4		AAL2
1	24	1	00:00:00.000000	0	1	13		14	1223	4		AAL2
1	24	2	00:00:00.000000	0	1	13		14	1223	4		AAL2
1	24	3	00:00:00.000000	0	1	14		14	1223	4		AAL2
1	24	4	00:00:00.000000	0	1	14		14	1223	4		AAL2
1	24	5	00:00:00.000000	0	1	14		14	1223	4		AAL2
1	24	6	00:00:00.000000	0	1	13		14	1223	4		AAL2
1	24	7	00:00:00.000000	0	1	13		14	1223	4		AAL2

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

ATM Frame Data

```

===== ATM Layer =====
VPI          = 14 (00000000 1110....)
VCI          = 1223 (....0000 01001100 0111....)
PT           = ....100. (4)
CLP          = .....1 (1)
HEC          = 00000000 (0)
    
```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+
00 E0 4C 79 00 A2 0B F5 C1 02 23                àLy c 8A #
    
```

Off-line Viewing [C:\Program Files\GL Communications] 17 Frames

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

# 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 a network analysis tool. The top window, 'Aggregate Summary Columns', is a configuration dialog with a sidebar of options and a main table for defining aggregate groups. The bottom window, 'ATM Protocol Analysis AAL2,5(UNI3.1) 64-bit', shows a packet capture table with columns for device, timestamp, frame number, length, error, and various ATM-specific fields. A red box highlights the 'Group~0' column in the table, which shows 'ATM-Cell -> 0' for the first seven frames and 'ATM-Cell -> 124' for the eighth frame. Below the table, a detailed view of the ATM frame data is shown for the selected frame (Frame 0).

**Aggregate Summary Columns Dialog:**

Name	Display Format	Summary Columns	Separator
Group~0	Concat	Frame Type_ATM VCI_ATM	--->
Group~1	Overlay	VPI_ATM	&
Group~2	<Col_Alias>Value	Ether Type_Multi Protocol Encapsulation	

**ATM Protocol Analysis AAL2,5(UNI3.1) 64-bit Window:**

Dev	TScout	Frame#	TIME (Relative)	Len	Error	Group~0	Frame Type ATM	VCI ATM	VPI ATM	PT ATM
✓ 2	24	0	00:00:00.000000	53		ATM-Cell -> 0	ATM-Cell	0	0	0
✓ 2	24	1	00:00:00.000276	53		ATM-Cell -> 0	ATM-Cell	0	0	0
✓ 2	24	2	00:00:00.000552	53		ATM-Cell -> 0	ATM-Cell	0	0	0
✓ 2	24	3	00:00:00.000828	53		ATM-Cell -> 0	ATM-Cell	0	0	0
✓ 2	24	4	00:00:00.001104	53		ATM-Cell -> 0	ATM-Cell	0	0	0
✓ 2	24	5	00:00:00.001380	53		ATM-Cell -> 0	ATM-Cell	0	0	0
✓ 2	24	6	00:00:00.001656	53		ATM-Cell -> 124	ATM-Cell	124	1	0
✓ 2	24	7	00:00:00.001932	53		ATM-Cell -> 0	ATM-Cell	0	0	0
✓ 2	24	8	00:00:00.002208	53		ATM-Cell -> 0	ATM-Cell	0	0	0

Device2 TScout=24 Frame=0 at 00:00:00.000000 OK Len=53

\*\*\* Right click to SHOW/H

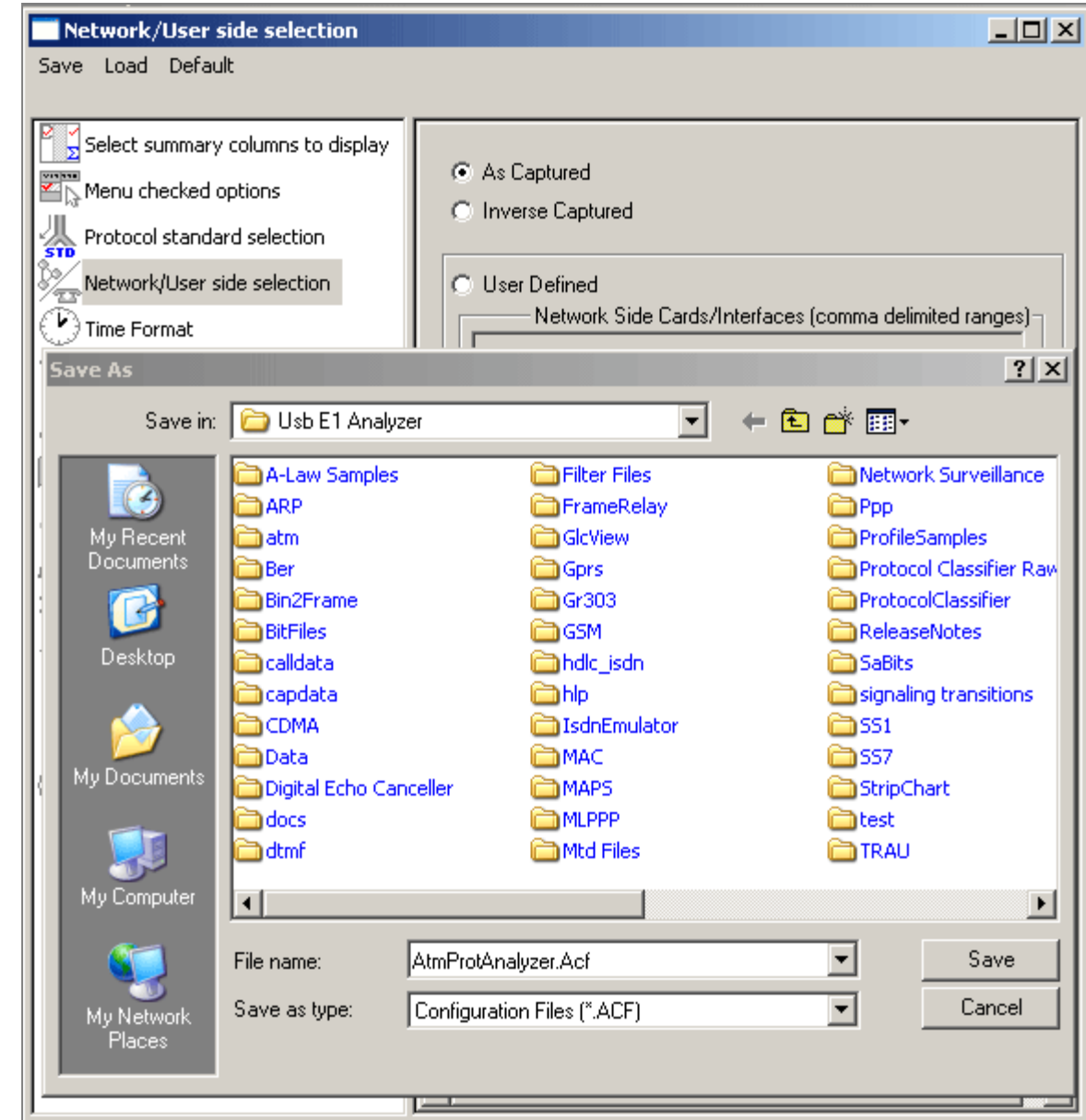
**ATM Frame Data**

```
===== ATM Layer =====
0000 GFC          = 0000.... (0)
0000 VPI          = 0 (...0000 0000....)
0001 VCI          = 0 (...0000 00000000 0000....)
0003 PT           = ....000. (0)
0003 CLP          = .....0 (0)
0004 HEC          = 01010101 (85)
```

Off-line Viewing. C:\Program Files\GL Communications Inc\12 775 Frames

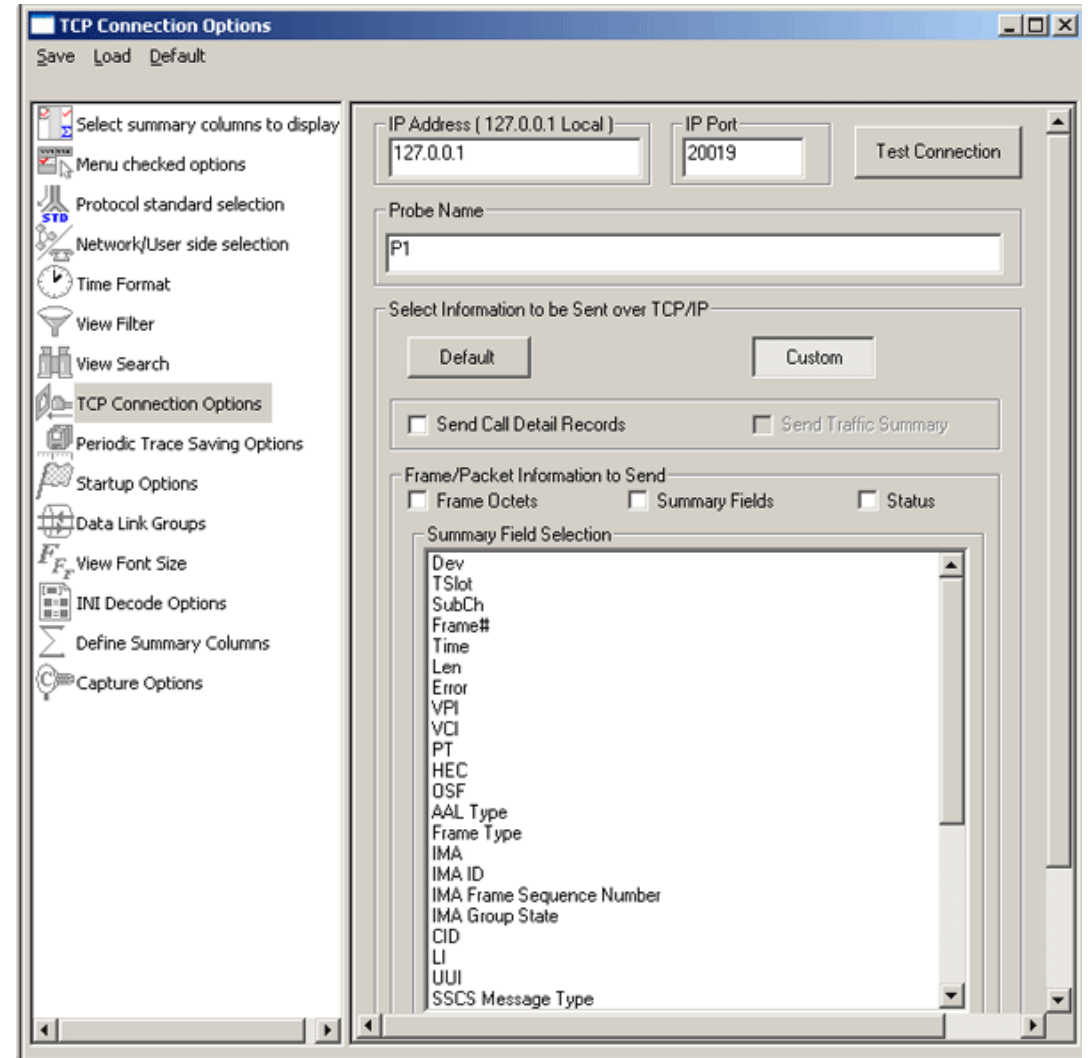
# Save/Load All Configuration Settings

- Provides a consolidated interface for GUI and protocol settings required in the analyzer such as protocol selection, periodic saving options, etc.
- Configuration settings can be saved to a file, loaded from a configuration file, or just revert to the default values using the default option



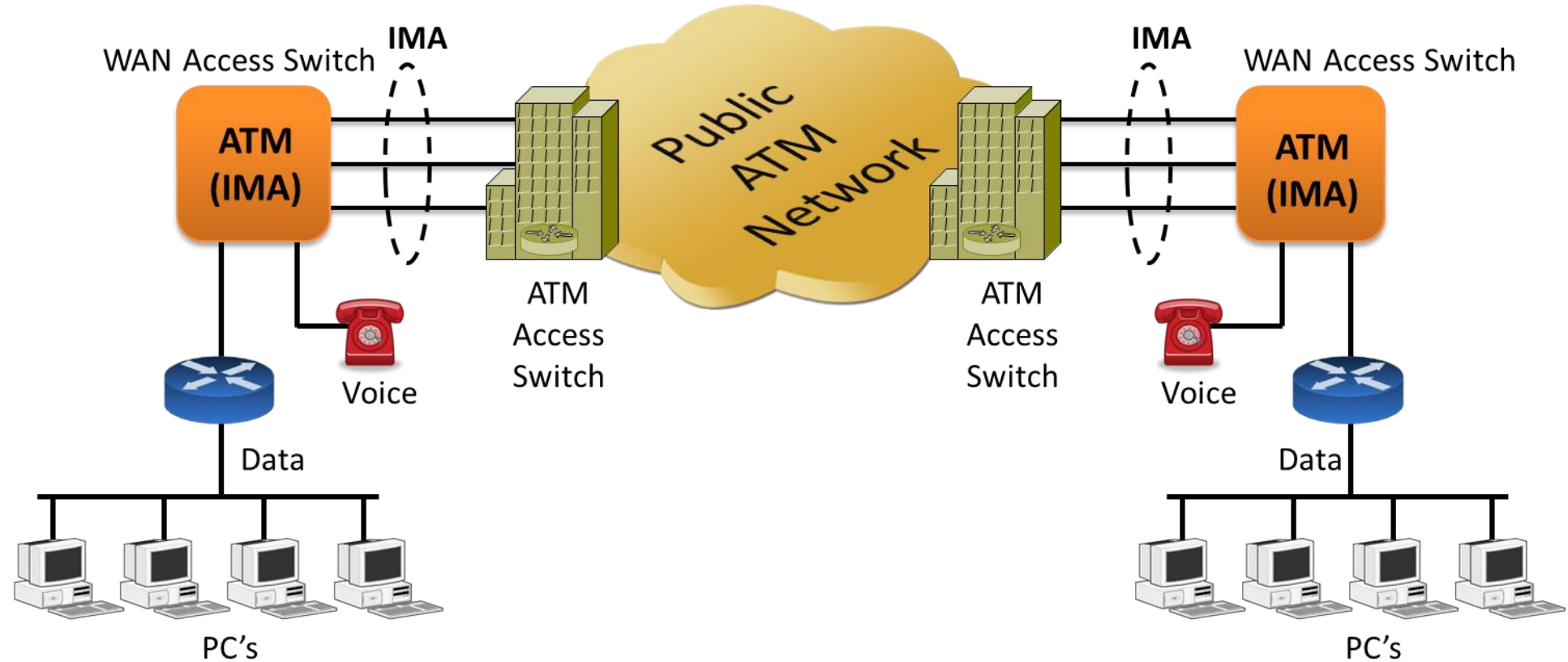
# TCP Connection Options

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



# GL's Inverse Multiplexing for ATM (IMA) Emulator Using Client-Server

# IMA Network



- GUI based WCS client, which simulates IMA Emulation
- Capable of generating and receiving ATM traffic
- 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 IMA simulation
- Supports 16 T1 E1 ports
- Support for Full or Fractional Timeslots for ATM Link
- Supports hyper channels with discontinuous (sparse) timeslots
- Supports IMA Frame Length ranging from 32, 64, 128, or 256
- Dynamically add/remove (Open/Close) of ATM links without loss in data
- Multiple IMA groups can be created in IMA Simulation
- Create and delete Virtual Channels on IMA group
- Generate and verify end to end traffic on each Virtual Channel
- User configurable ATM (AAL5, and AAL2) packet size
- IMA supports AAL2 which provides bandwidth-efficient transmission of low-rate, short and variable length packets in delay sensitive applications

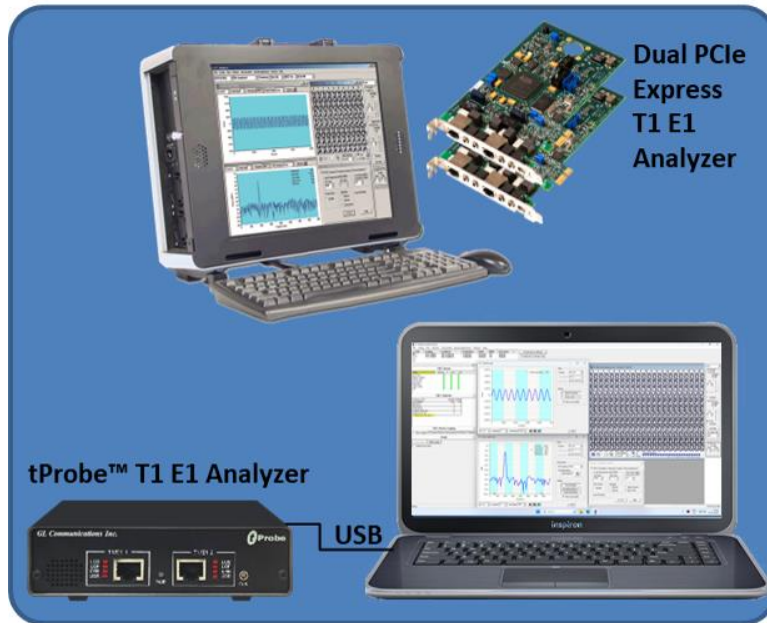


# Features (Contd.)

- Payload traffic generation and verification using Sequence number, HDL file (containing packets/frames), Flat Binary file, and User defined frame (ASCII HEX file) for each Virtual Channel independently
- Transmit and receive Ethernet traffic over T1 E1 links through bridge mode
- Provides detailed statistics for IMA group and for each Virtual Channel
- Provides end to end traffic verification statistics
- Ideal solution for automated testing using command line scripts

# Windows Client Server IMA Emulator

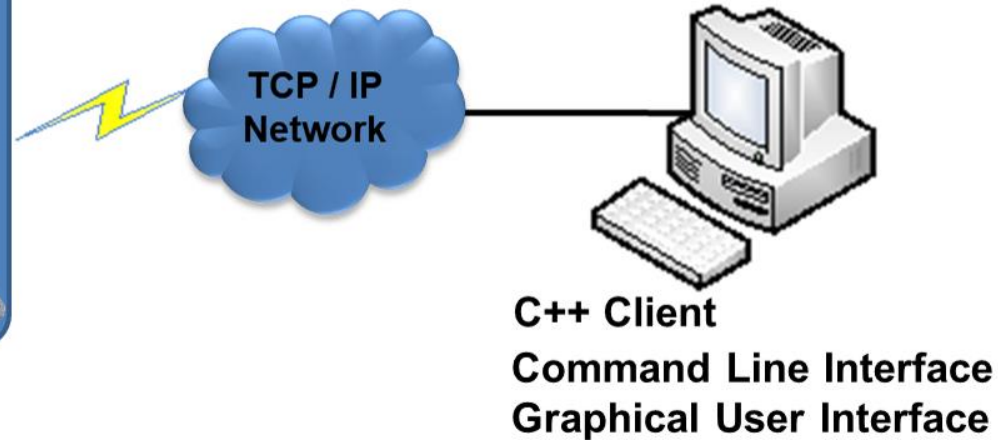
## GL's T1 E1 Server



### Supported Platforms-

- Dual T1 E1 Express (PCIe) Cards
- Portable USB based T1 E1 Analyzer

## GL's IMA Emulation

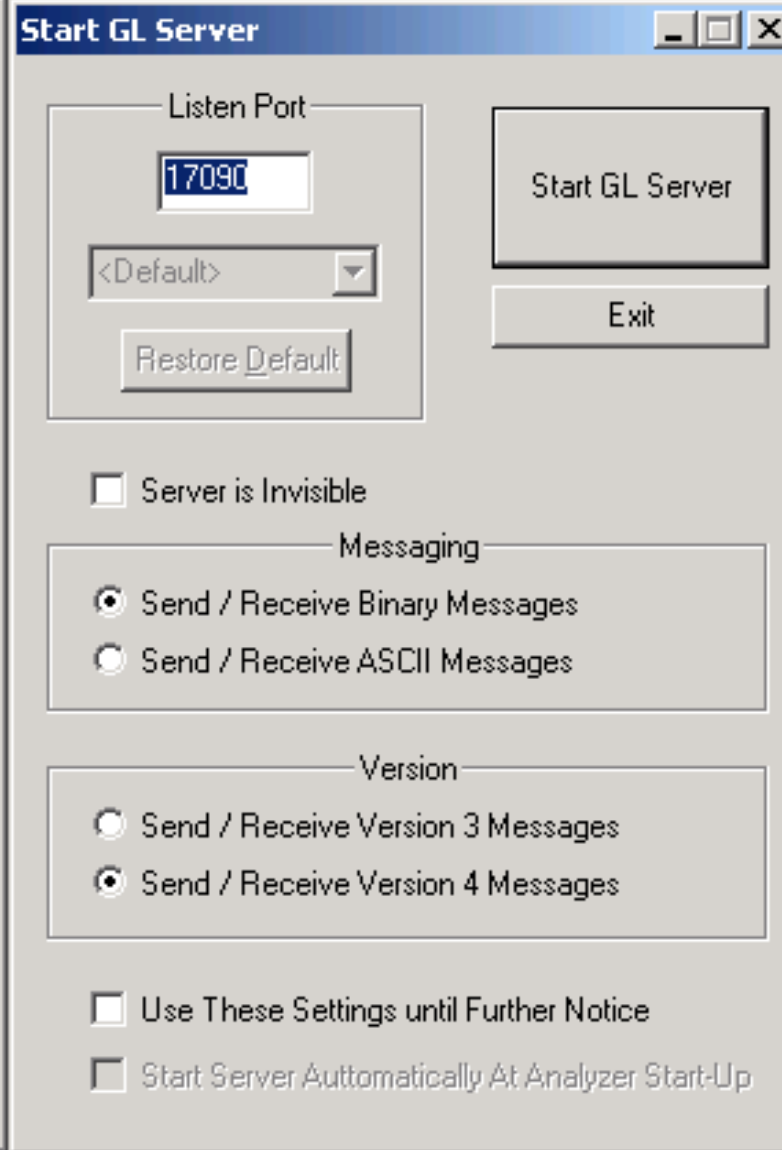


# Features

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	✓

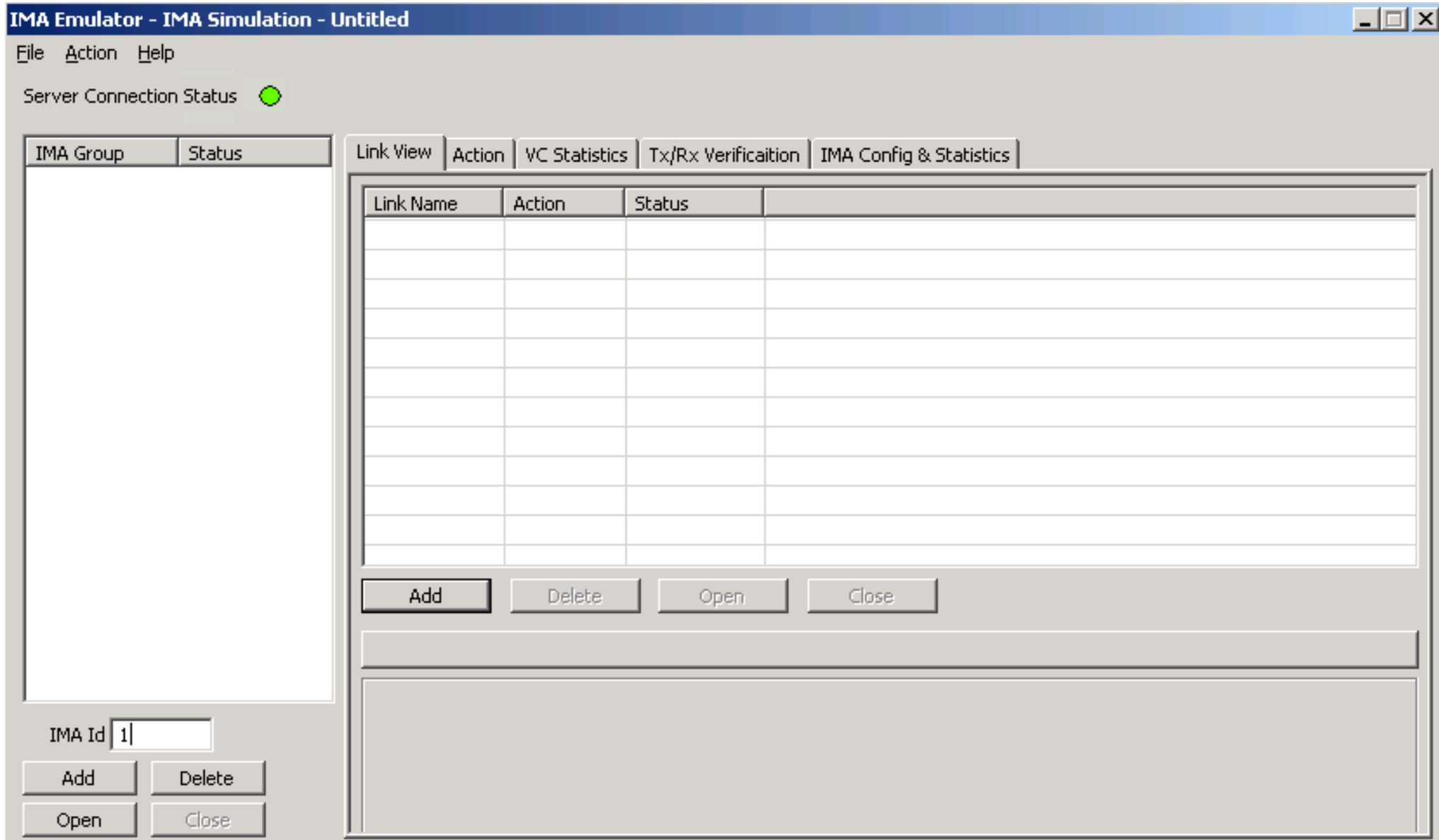
# Starting the Server

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



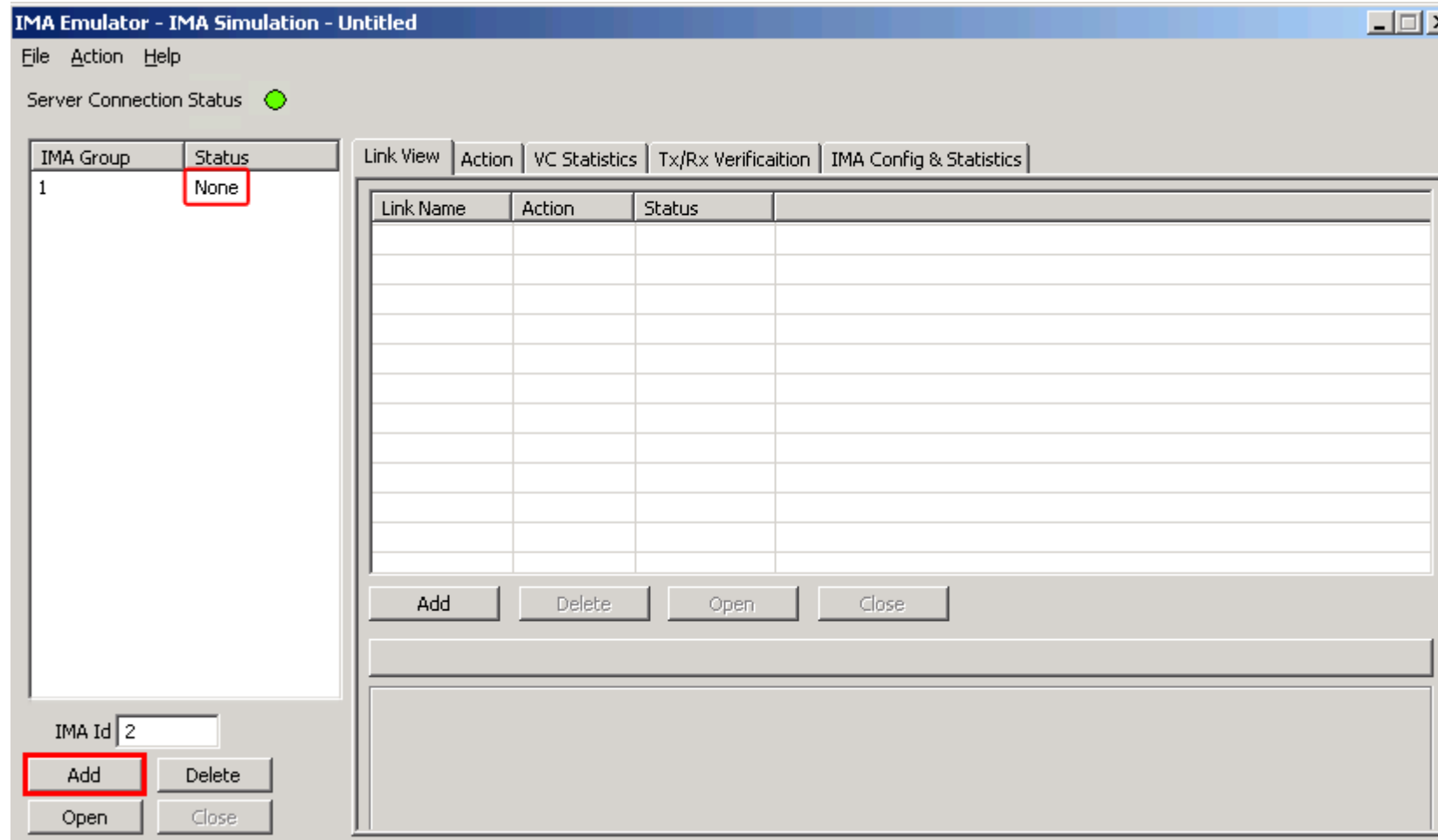
The screenshot shows a Windows-style dialog box titled "Start GL Server". It contains several configuration options for starting the server. At the top left, there is a "Listen Port" section with a text box containing "17090", a dropdown menu set to "<Default>", and a "Restore Default" button. To the right of this section are two buttons: "Start GL Server" and "Exit". Below the "Listen Port" section is a checkbox labeled "Server is Invisible". Further down is a "Messaging" section with two radio button options: "Send / Receive Binary Messages" (which is selected) and "Send / Receive ASCII Messages". Below that is a "Version" section with two radio button options: "Send / Receive Version 3 Messages" and "Send / Receive Version 4 Messages" (which is selected). At the bottom, there are two more checkboxes: "Use These Settings until Further Notice" and "Start Server Automatically At Analyzer Start-Up".

# IMA Simulator GUI



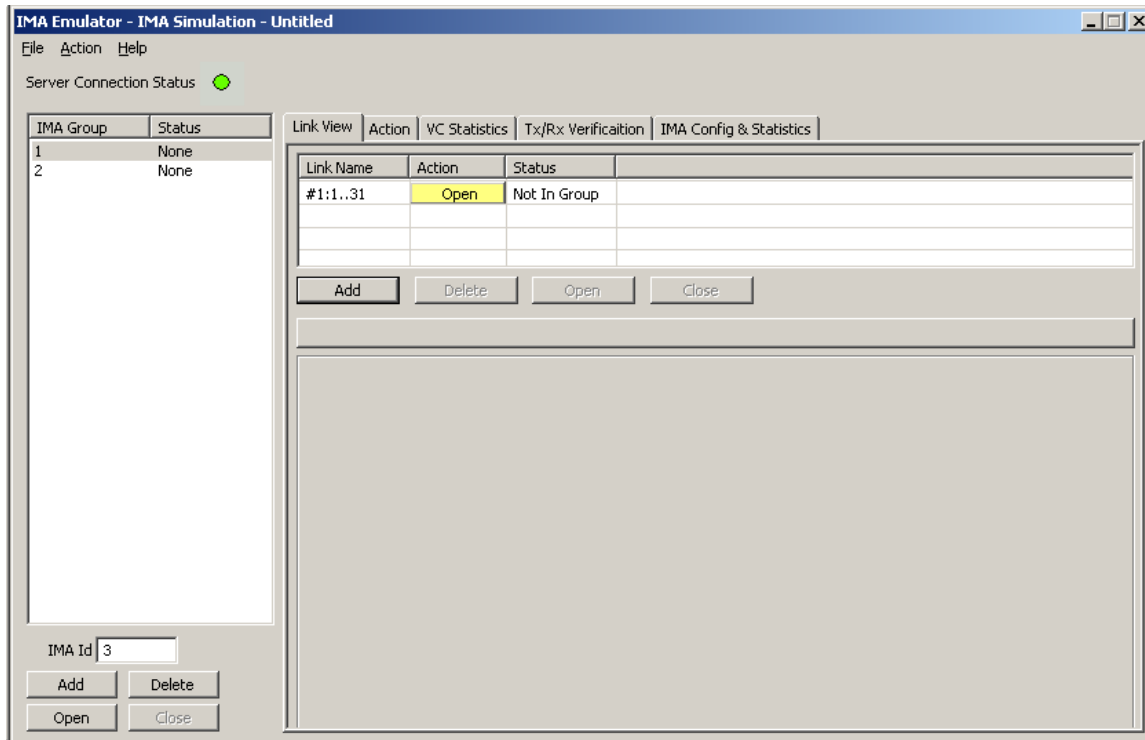
# Adding Group

- On the left pane, click on Add button to add several ATM links

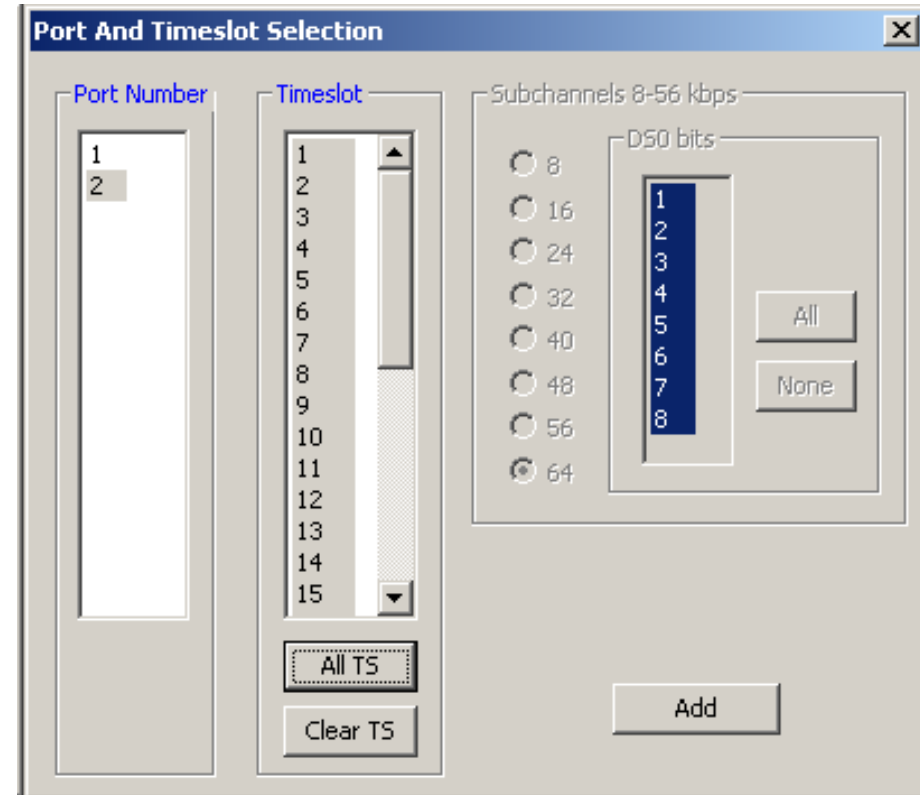


# Adding links to form an IMA Group

## Added Links



## Link Selection




- Various links (of any bandwidth varying from 64Kbps to  $n \times 64\text{Kbps}$  or sub channels) can be added to form an IMA Group. Within a group all links should be of equal bandwidth
- IMA group, channels into a single network-layer channel

# Opening the IMA Group

IMA Emulator - IMA Simulation - Untitled

File Action Help

Server Connection Status 

IMA Group	Status
1	None
2	None

IMA Id

Add Delete

Open Close

Link View Action VC Statistics Tx/Rx Verificaiton IMA Config & Statistics

Link Name	Action	Status
#1:1..4	Open	Not In Group
#1:5..8	Open	Not In Group


Add Delete Open Close



# IMA Group Operational Mode

IMA Emulator - IMA Simulation - Untitled

File Action Help

Server Connection Status 

IMA Group	Status
1	Operational
2	Operational

IMA Id

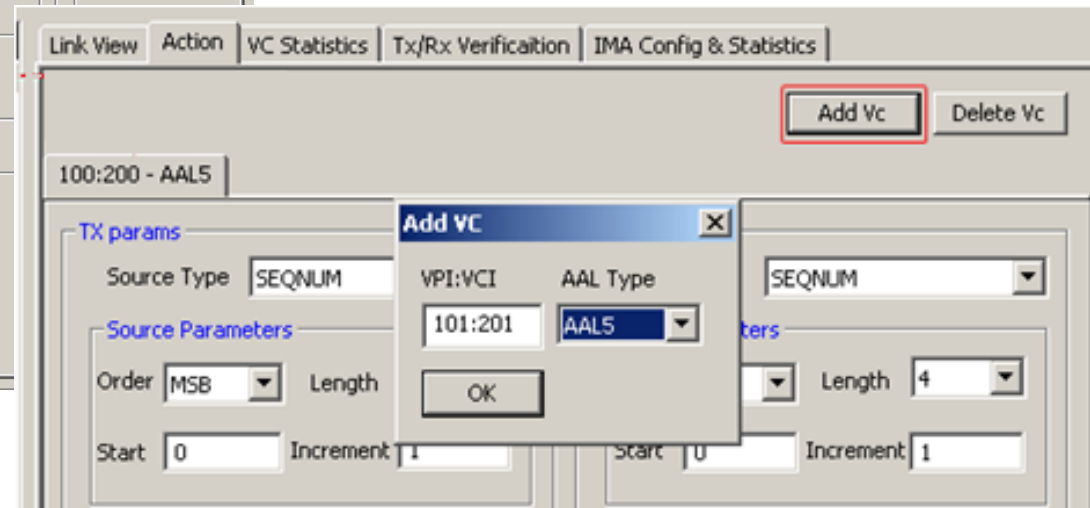
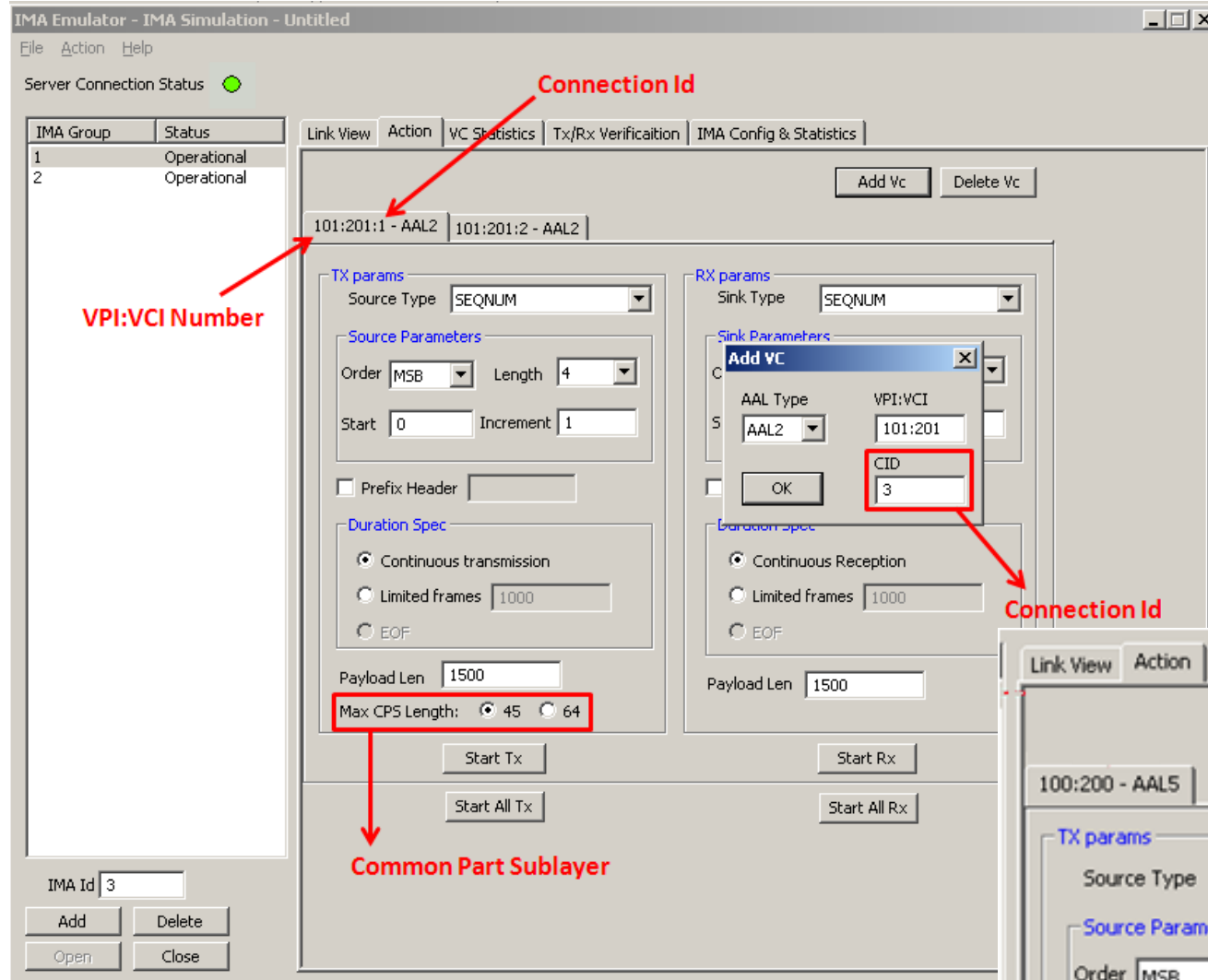
Add Delete Open Close

Link View Action VC Statistics Tx/Rx Verification IMA Config & Statistics

Link Name	Action	Status
#1:1..4	Close	Active
#1:5..8	Close	Active

Add Delete Open Close

# Adding VC For Tx and Rx



# Adding VC For Tx and Rx

- In IMA Simulation virtual channels are added on the selected IMA Group
- IMA Simulation supports AAL0, AAL2, and AAL5 type frames
- Different types of Payloads can be selected for each VC Such as Sequence number, HDL file (containing packets/frames), Flat Binary file, and User defined frame (ASCII HEX file) for each Virtual Channel independently
- For AAL2, one can create multiple VCs of same VPI:VCI values with a unique Connection ID for each group. Up to 255 VCs can be created with the same VPI:VCI number

# Tx and Rx Parameters

## AAL 0,5

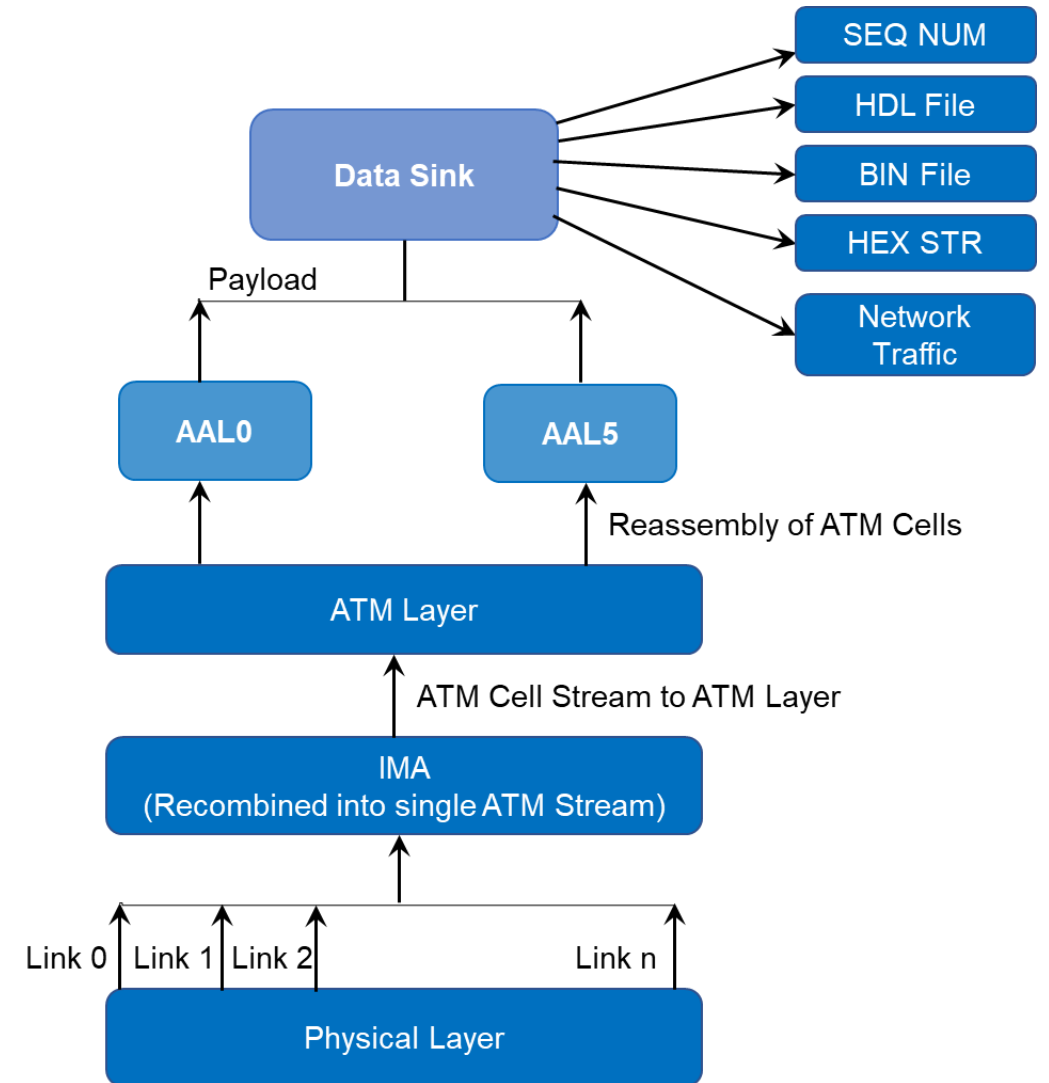
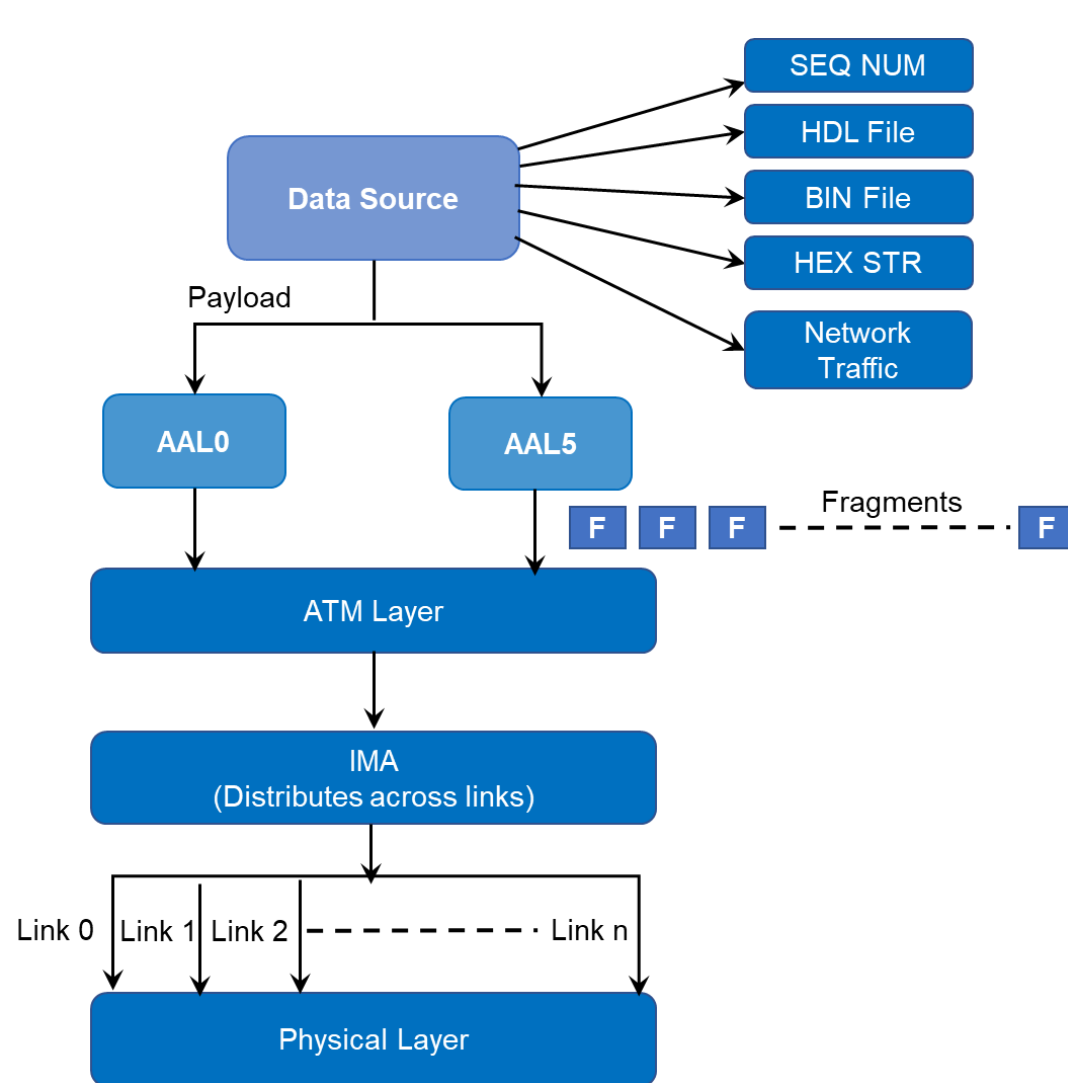
The screenshot shows the AAL 0,5 configuration window with two main sections: TX params and RX params. Both sections have a Source Type dropdown set to SEQNUM. The Source Parameter dropdown is open, showing options: SEQNUM, HDLFILE, BINFILE, HEXSTR, and NETWORK TRAFFIC. The Order is set to MSB. The Start is 0 and Increment is 1. The Prefix Header checkbox is unchecked. The Duration Spec section has three radio buttons: Continuous transmission (selected), Limited frames (1000), and EOF. The Payload Len is 1500. At the bottom, there are buttons for Start Tx, Start Rx, Start All Tx, and Start All Rx.

## AAL 2

The screenshot shows the AAL 2 configuration window with two main sections: TX params and RX params. Both sections have a Source Type dropdown set to SEQNUM. The Source Parameter dropdown is open, showing options: SEQNUM, HDLFILE, BINFILE, and HEXSTR. The Order is set to MSB. The Start is 0 and Increment is 1. The Prefix Header checkbox is unchecked. The Duration Spec section has three radio buttons: Continuous transmission (selected), Limited frames (1000), and EOF. The Payload Len is 1500. At the bottom, there are buttons for Start Tx, Start Rx, Start All Tx, and Start All Rx.

- Tx parameters are used to generate the ATM traffic and Rx parameters are used as reference to verify the received frames. The results of the verification are displayed in Tx/Rx Verification tab

# Transmit and Receive Function



# VC Statistics

## AAL0, AAL5

IMA Emulator - IMA Simulation - test

File Action Help

Server Connection Status ●

IMA Group	Status
1	Operational
2	Operational

Link View Action VC Statistics Tx/Rx Verification IMA Config & Statistics

Reset

VC	Tx Frames	Tx Frags	Tx Octets	Rx Frames	Rx Frags	Rx Octets	Lost Frags
100:200	5393	172576	8283648	5168	165376	7938048	0
101:201	5361	171552	8234496	5135	164347	7888656	0
Total	10754	344128	16518144	10303	329723	15826704	0

AAL Type 2

IMA Emulator - IMA Simulation - Untitled

File Action Help

Server Connection Status ●

IMA Group	Status
1	Operational
2	Operational

Link View Action VC Statistics Tx/Rx Verification IMA Config & Statistics

Reset

VC	Tx Frames	Tx Frags	Tx Octets	Rx Frames	Rx Frags	Rx Octets	Lost Frags
101:201:1	10731	364854	19906005	10733	364922	19909715	0
101:201:2	10732	364888	19907860	10733	364924	19909821	0
Total	21463	729742	39813865	21466	729846	39819536	0

IMA Id 3

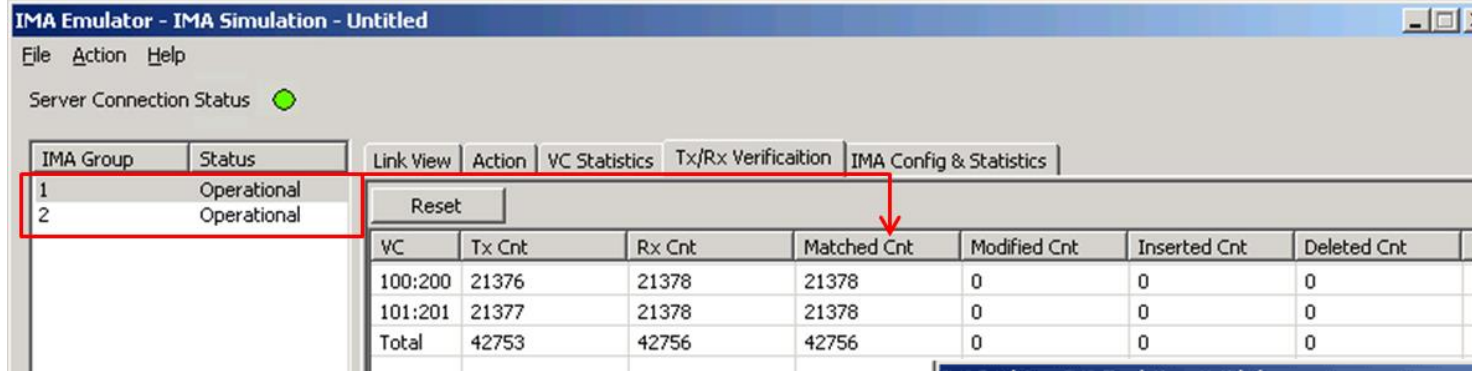
Add Delete

Open Close

- The Statistics for each of the added VCs are available in VC Statistics tab. It shows the VC statistics for the selected IMA group
- The statistics include:
  - Number of Transmitted , Received frames, Fragments, Octets, and Lost fragments

# Tx/Rx Verification

## AAL0, AAL5



IMA Emulator - IMA Simulation - Untitled

File Action Help

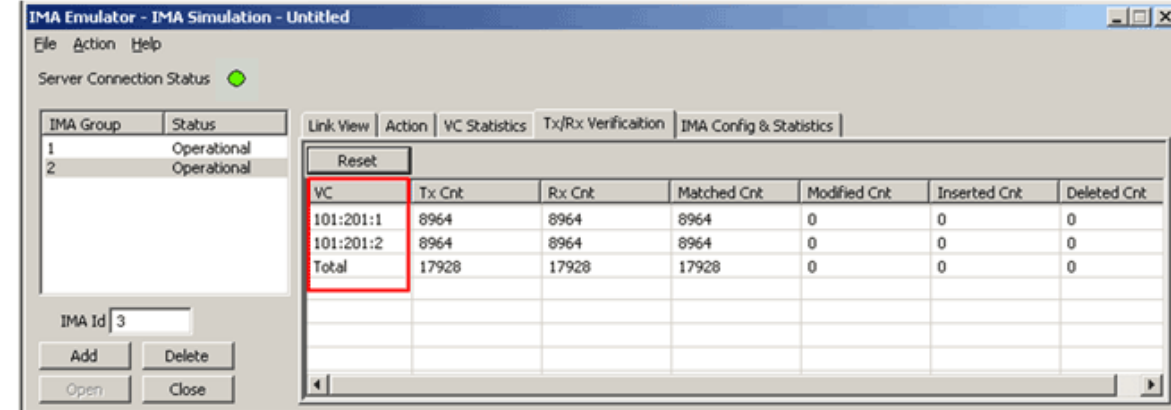
Server Connection Status ●

IMA Group	Status
1	Operational
2	Operational

Reset

VC	Tx Cnt	Rx Cnt	Matched Cnt	Modified Cnt	Inserted Cnt	Deleted Cnt
100:200	21376	21378	21378	0	0	0
101:201	21377	21378	21378	0	0	0
Total	42753	42756	42756	0	0	0

## AAL Type 2



IMA Emulator - IMA Simulation - Untitled

File Action Help

Server Connection Status ●

IMA Group	Status
1	Operational
2	Operational

Reset

VC	Tx Cnt	Rx Cnt	Matched Cnt	Modified Cnt	Inserted Cnt	Deleted Cnt
101:201:1	8964	8964	8964	0	0	0
101:201:2	8964	8964	8964	0	0	0
Total	17928	17928	17928	0	0	0

IMA Id 3

Add Delete

Open Close

- The results of the verification for each of the added VCs are available in Tx/Rx Verification
- The statistics include:
  - The Number of VCs Created, Transmitted Frame Count, Received Frame Count, Matched Frame Count, Modified Frame Count, Deleted Frame Count, and Inserted Frame Count

# IMA Group Config and Statistics

- Group Statistics will show statistics of transmitted frames, received frames, transmitted octets, and received octets for a selected IMA group
- User can enable or disable ICP for an IMA Group
- User selectable IMA frame size can be applied for the selected Group
- Group Symmetry Modes, by default it supports only Symmetrical Config and Operation

Server Connection Status ●

IMA Group	Status
1	Operational
2	Operational

Link View | Action | VC Statistics | Tx/Rx Verification | IMA Config & Statistics

IMA Group Statistics

Number of Frames transmitted: 2361 Reset

Number of Frames Received: 2040

Number of Octets transmitted: 3541500

Number of Octets received: 3060000

IMA Group Config

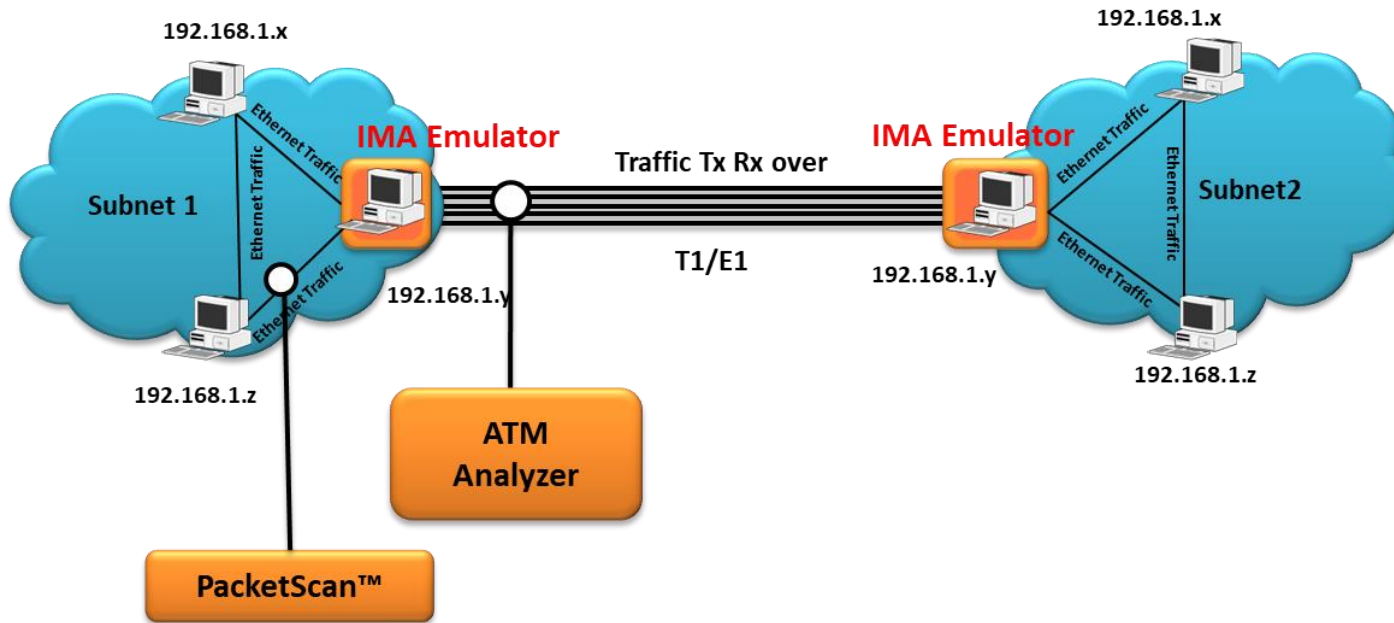
ICP: Enable

IMA Frame Length: 128

Group Symmetry Modes: Symmetrical Config & Operation



# IMA Emulator in Bridge Mode



TX params

Source Type

Source Parameters

Adaptor Name

...

- When the emulator is configured to act as bridge between two networks, all traffic received from the network is encapsulated into AAL5 and the ATM cells are streamed over T1 E1 links
- The Emulator on another network removes ATM header, converts to Ethernet and streams to the destination

Thank you