Asynchronous Transfer Mode
ATM Protocol Analysis and Emulation

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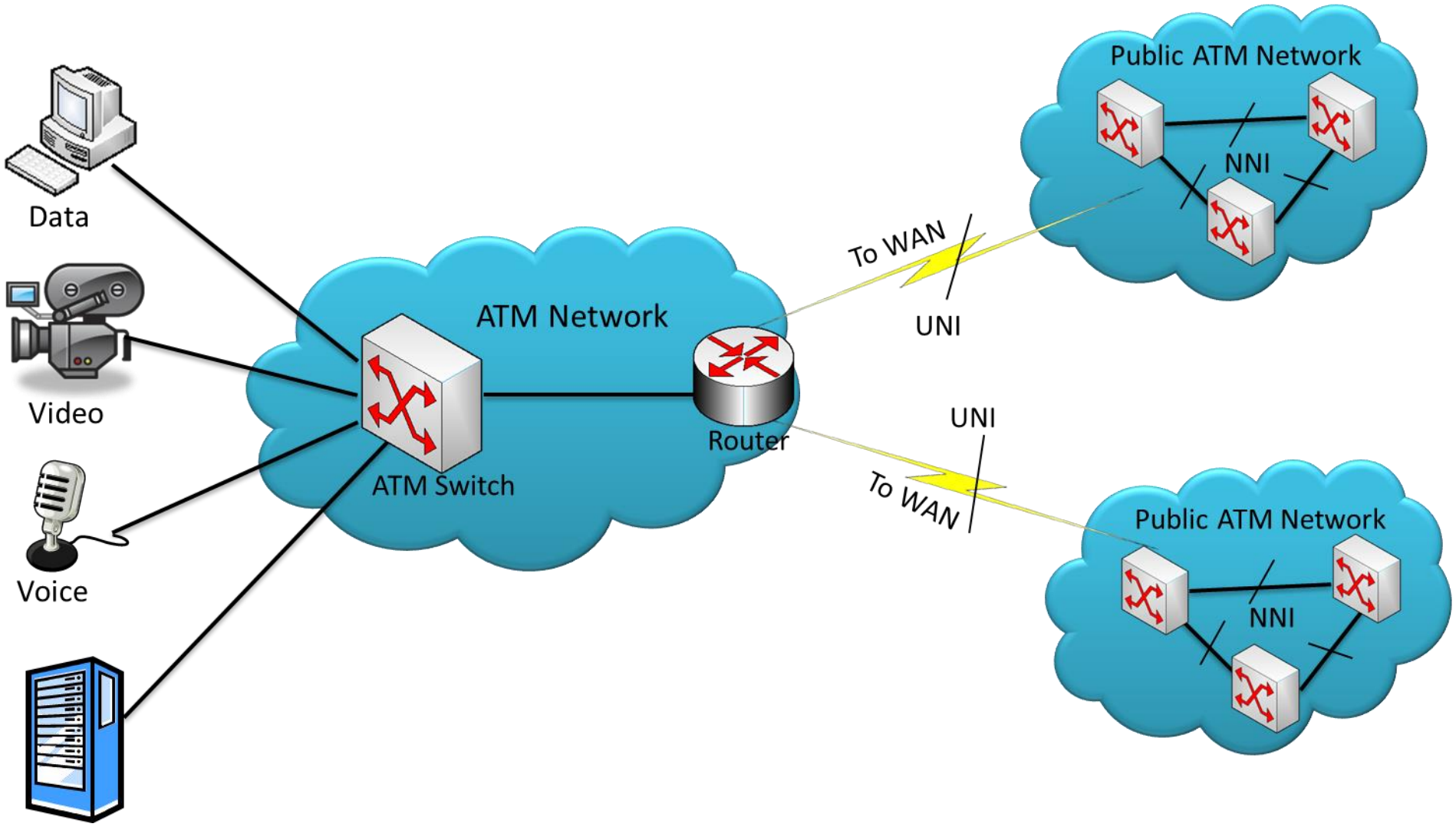
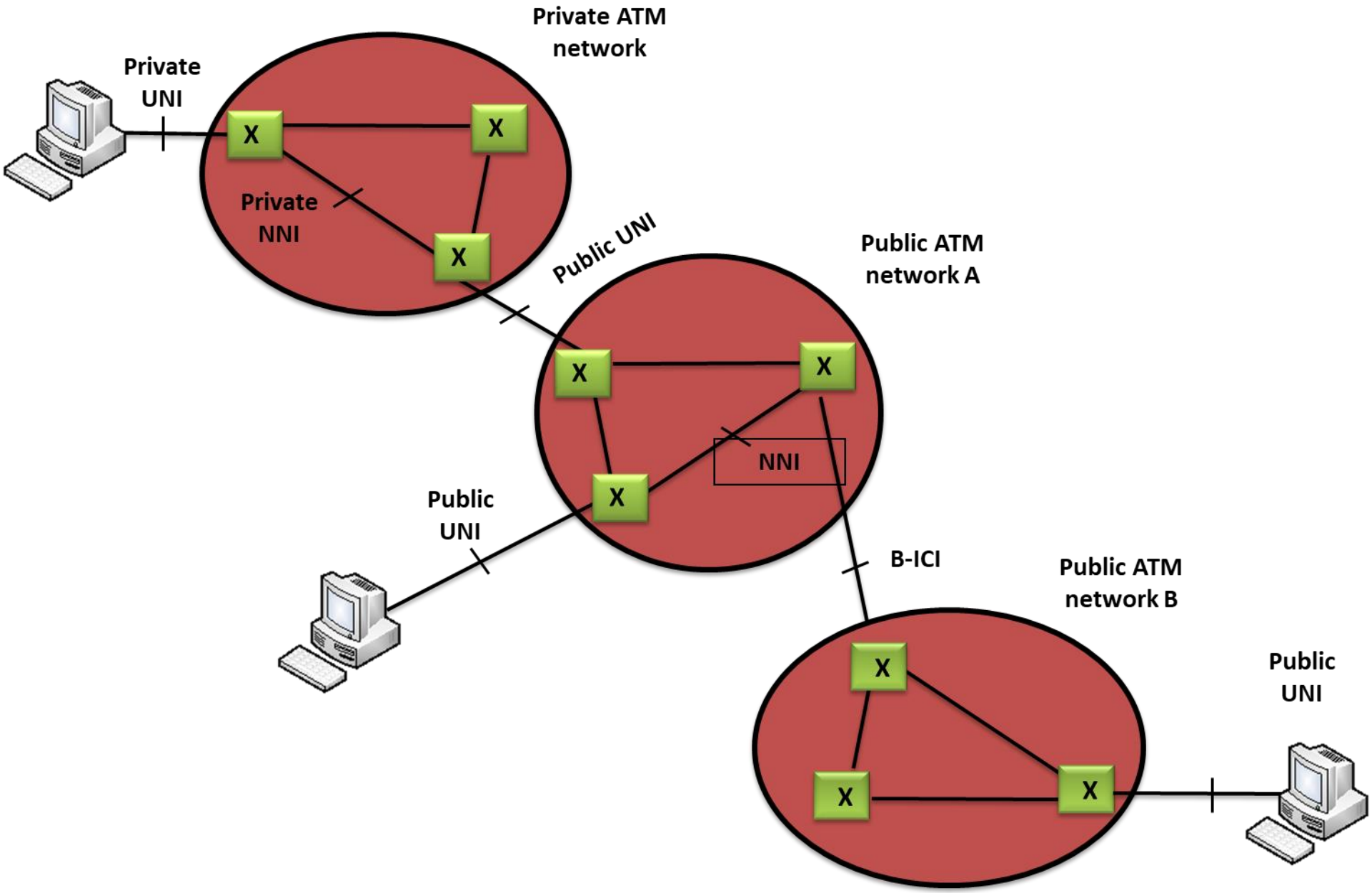
What is ATM ?

- 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

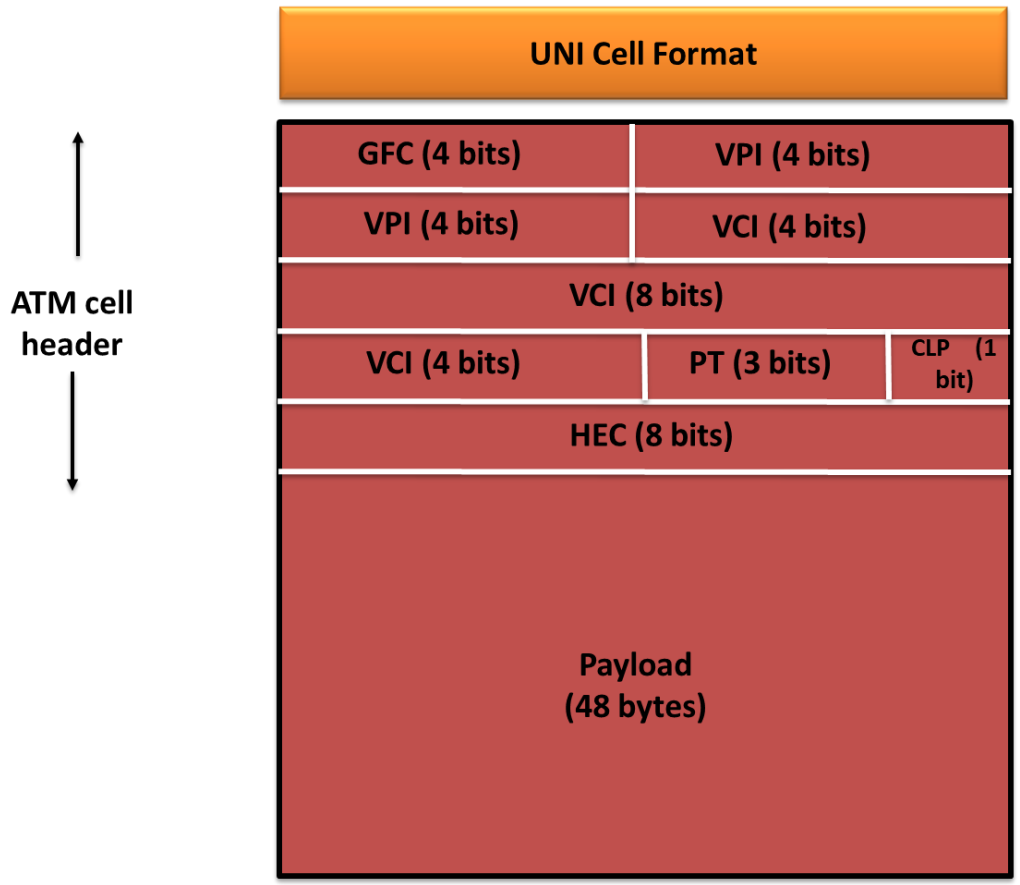


ATM Network Interface

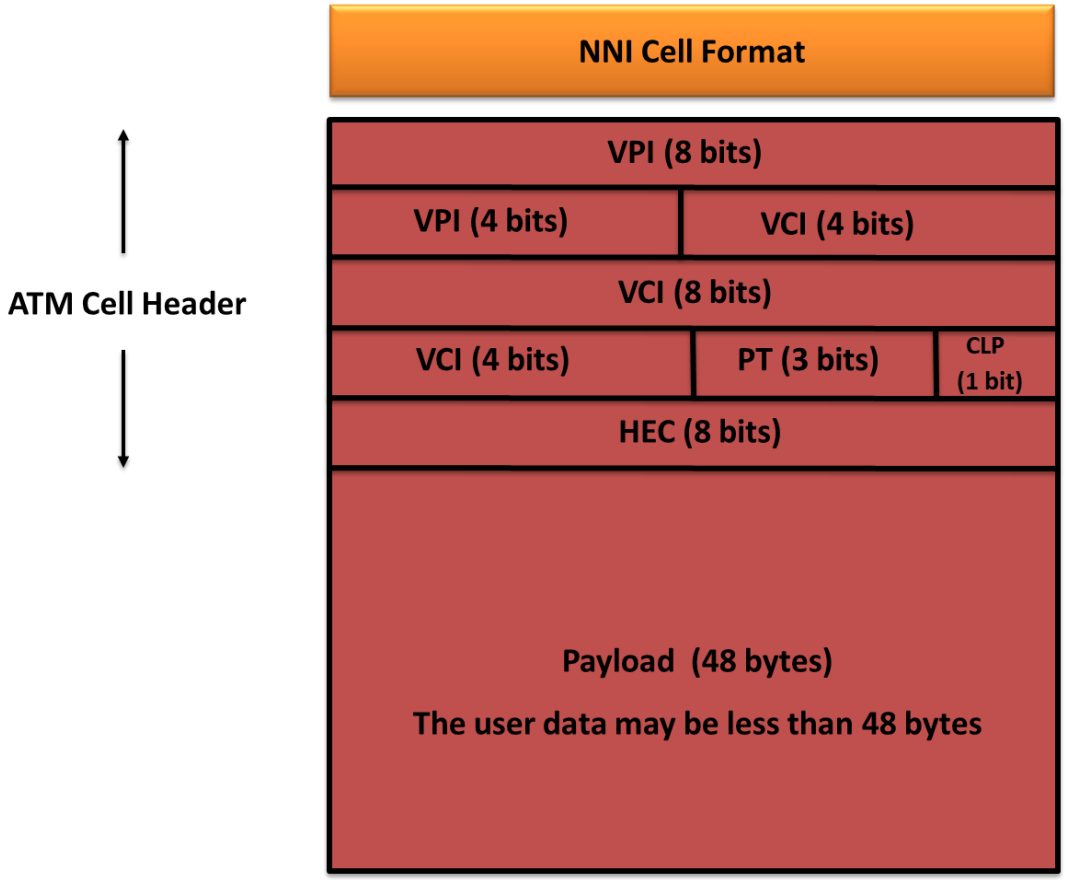


UNI and NNI ATM Cell

UNI (User-Network Interface)



NNI (Network-Network Interface)



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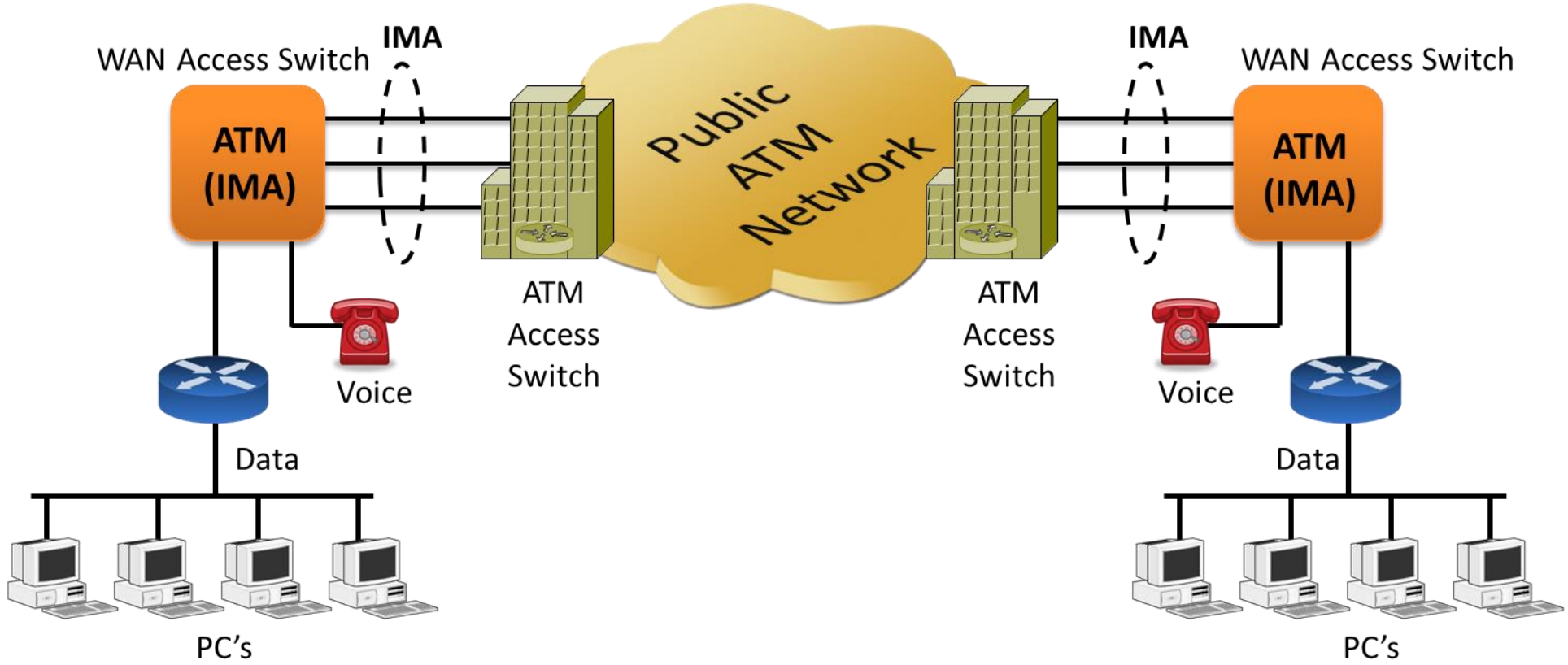
IMA Network

General ATM IMA Network



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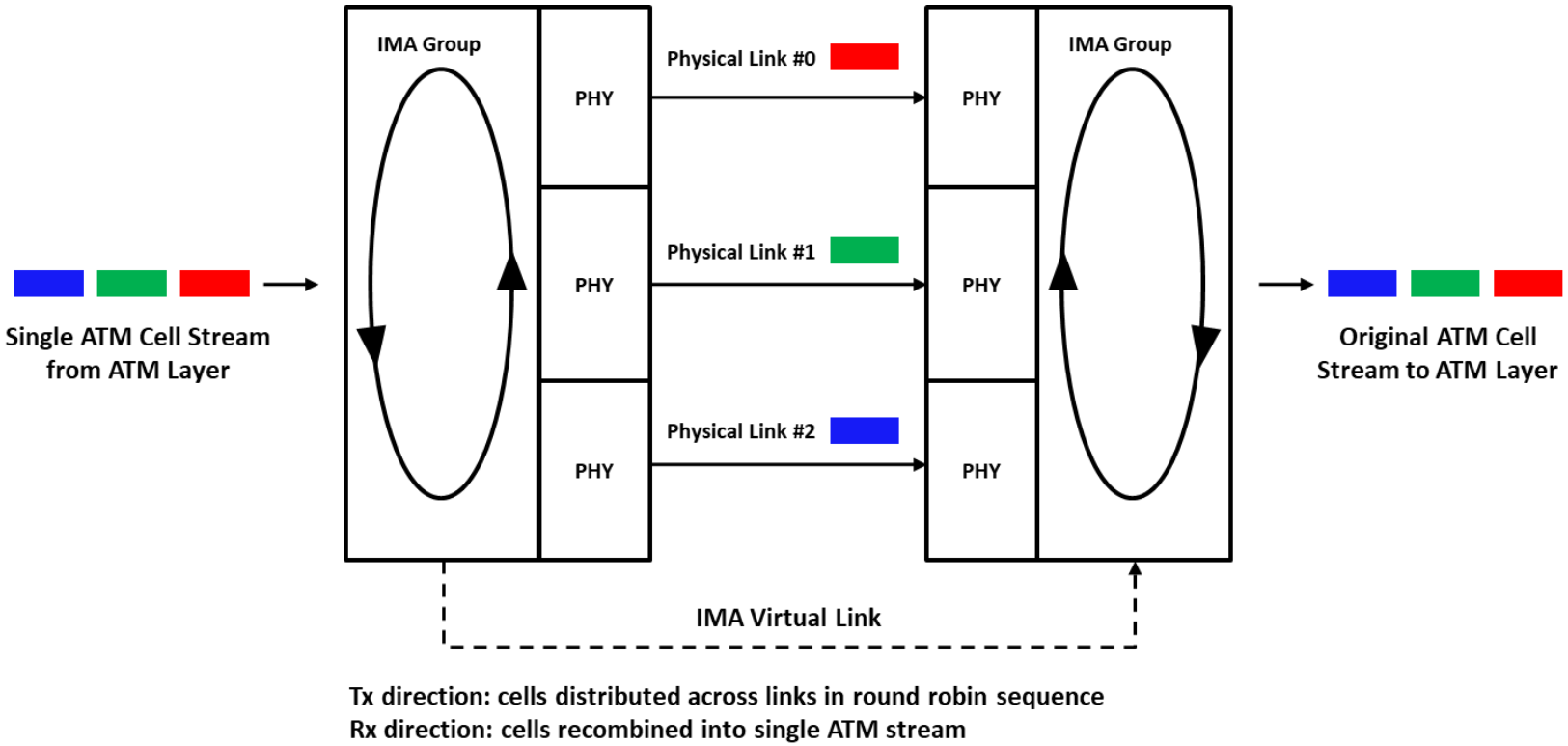
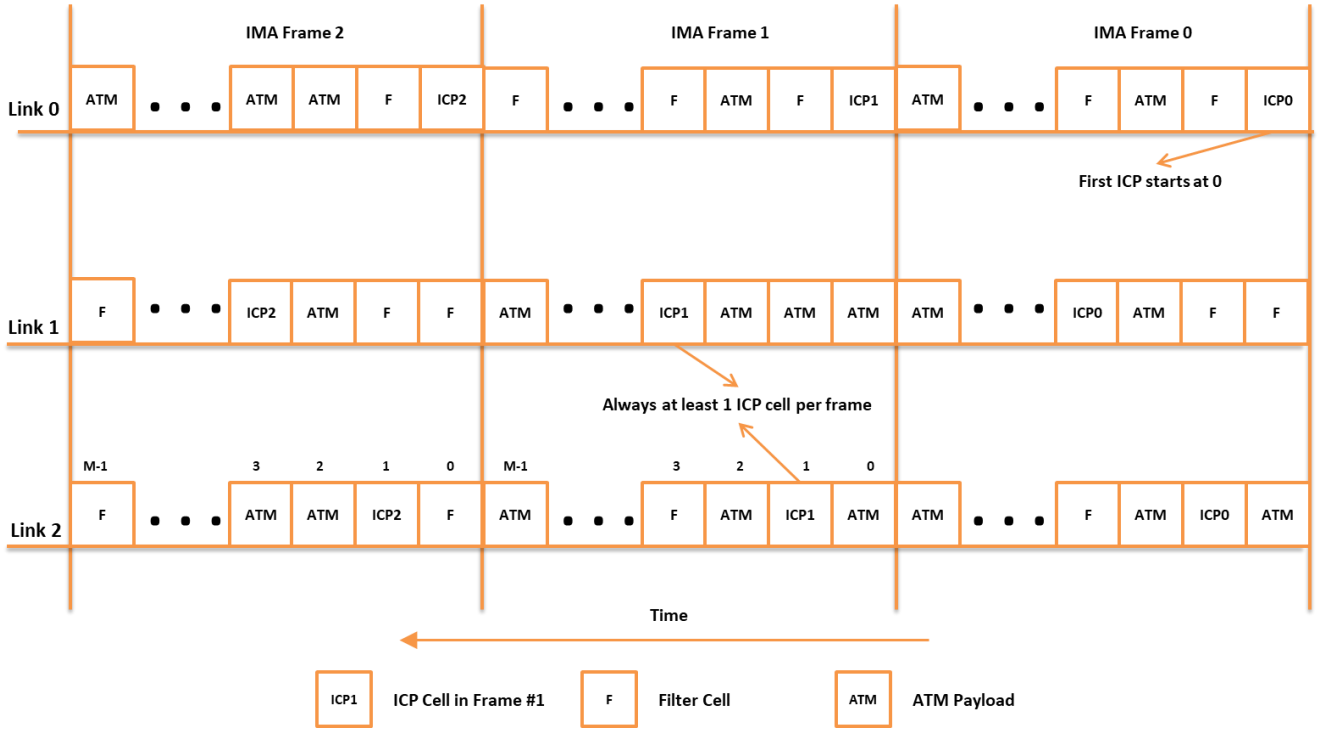
Inverse Multiplex over ATM (IMA)



- 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

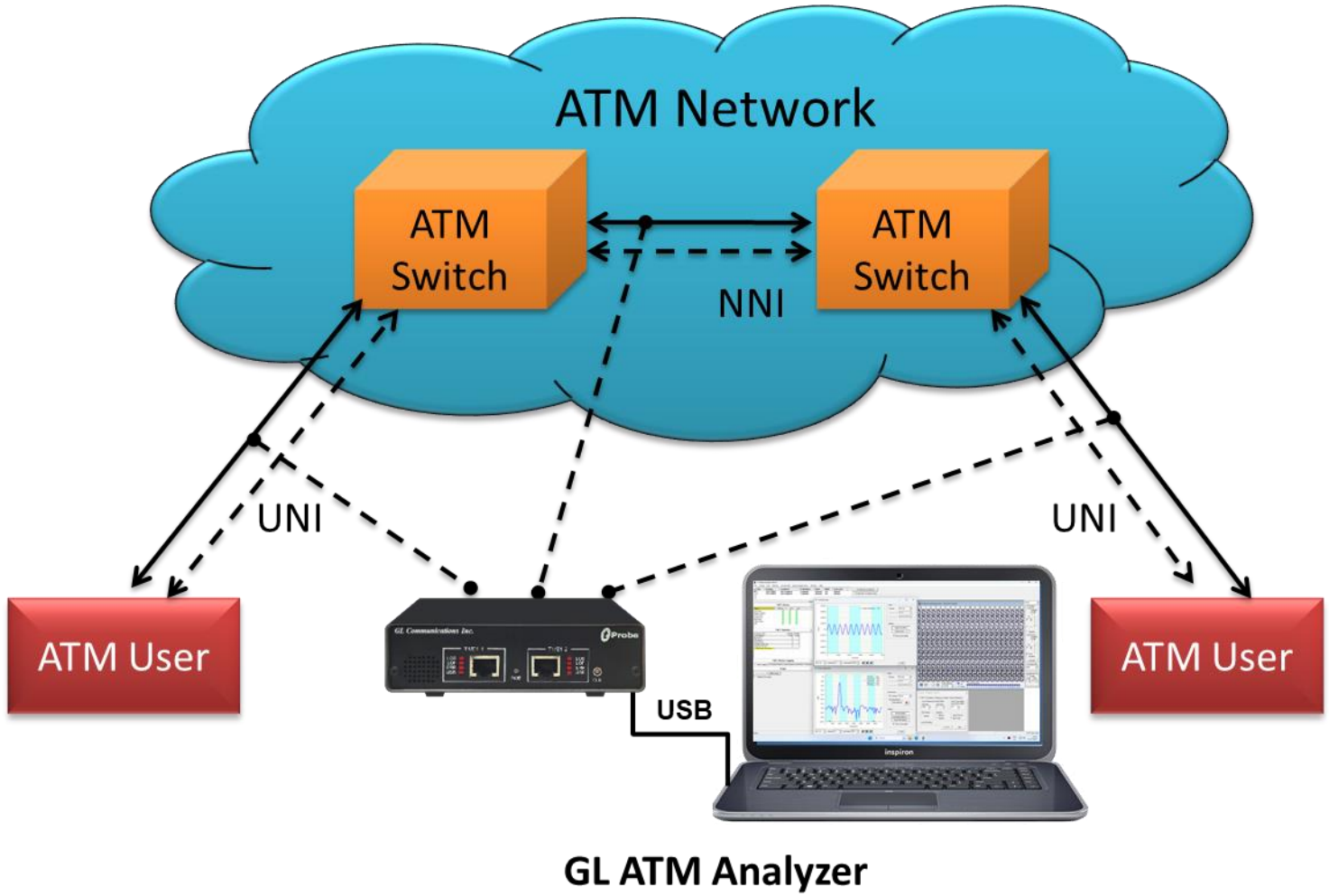
IMA Frames

- 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

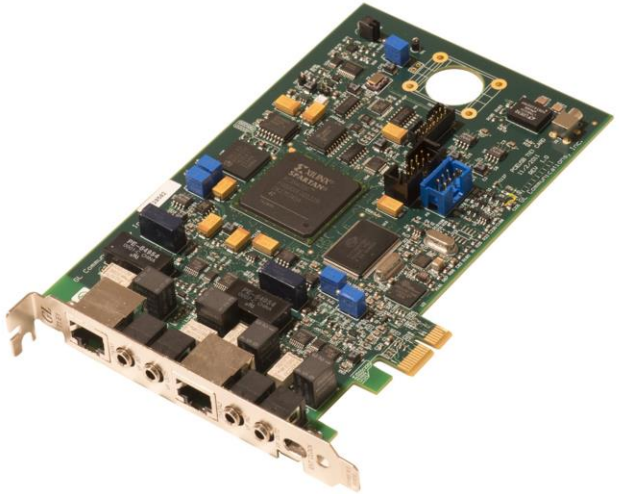
Supported Platforms

Front Panel

Back Panel

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

Quad / Octal T1 E1 PCIe Card



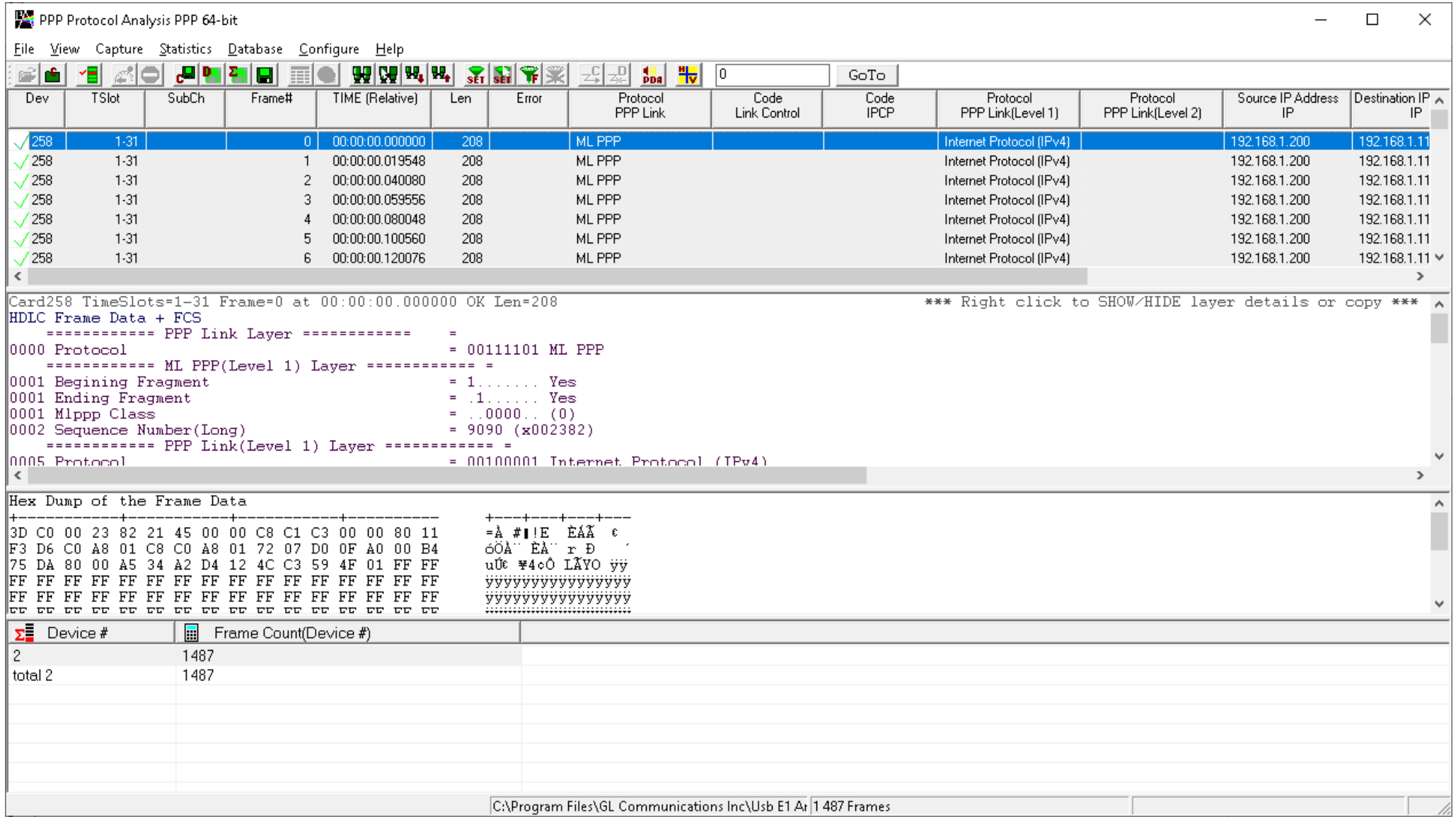
Dual T1 E1 Express (PCIe) Board

tScan16™ with
16-port T1 E1 Breakout Box

Supported Adaptation Layers (AAL)

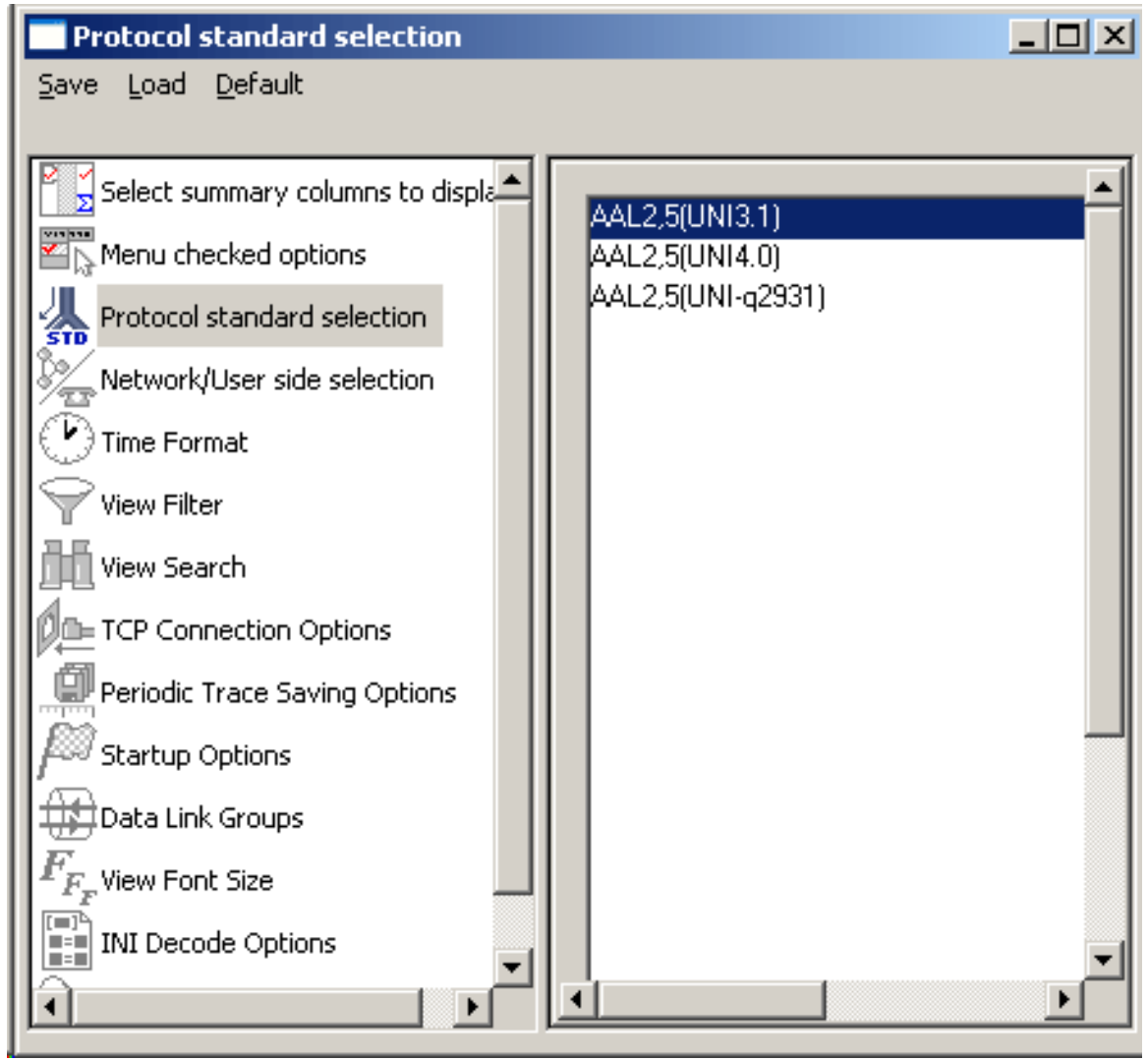
- AAL 1
  - AAL1, a connection-oriented service, is suitable for handling circuit emulation and constant bit rate sources (CBR), such as voice and videoconferencing
- AAL2
  - used for variable bit rate (VBR) services, Typically includes services characterized as packetized voice or video that do not 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



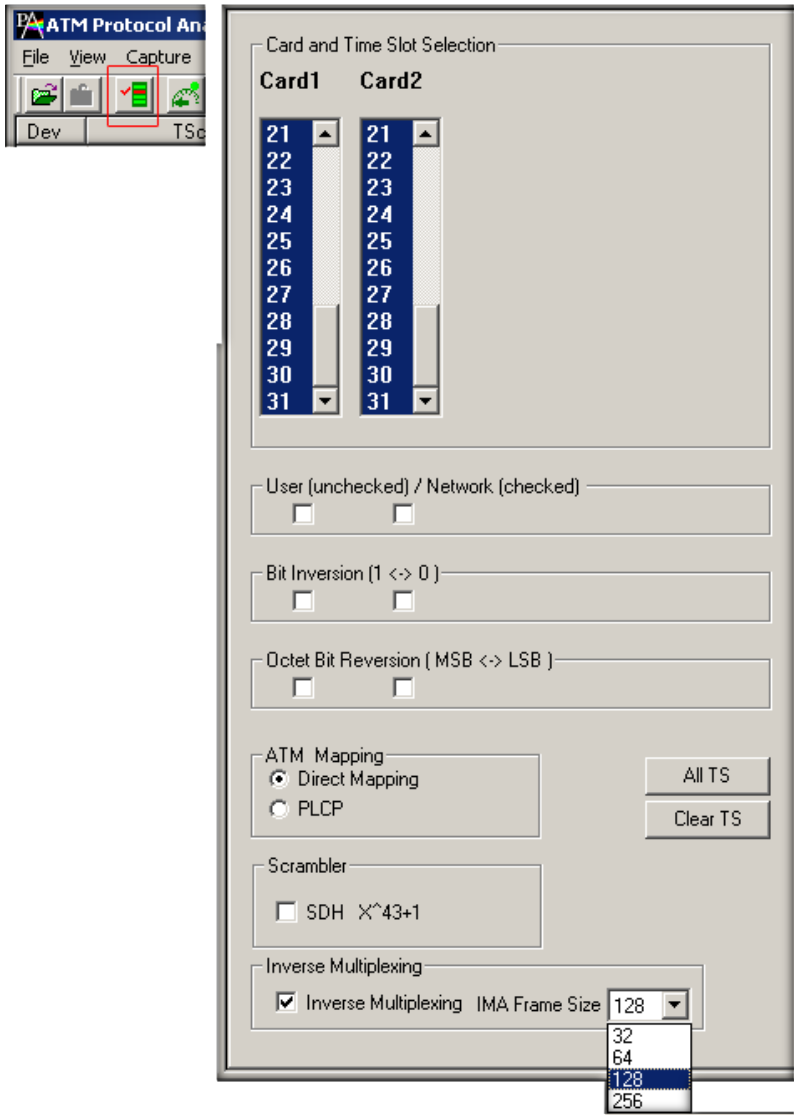
Protocol Standards

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

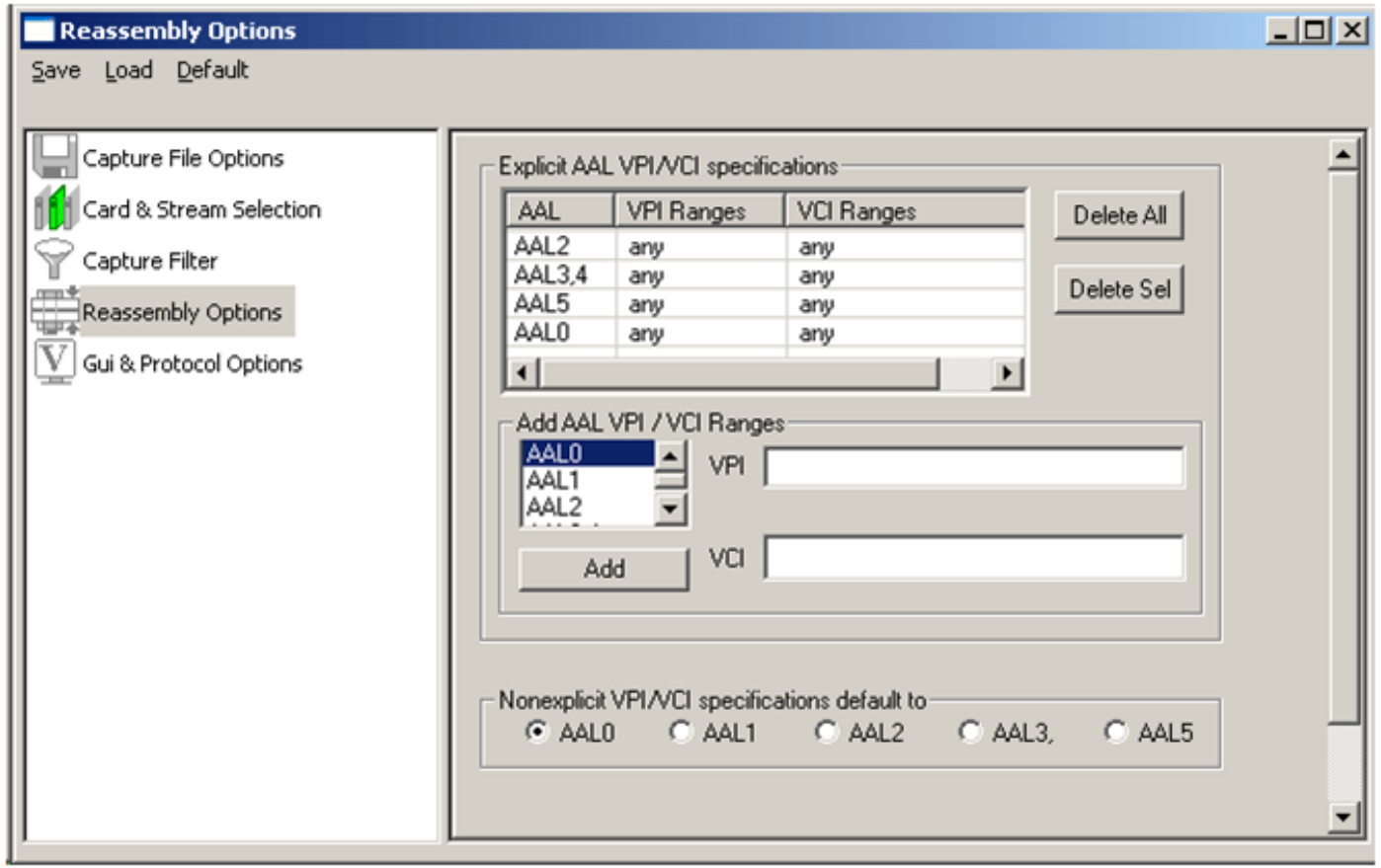


ATM Stream Interface

- 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

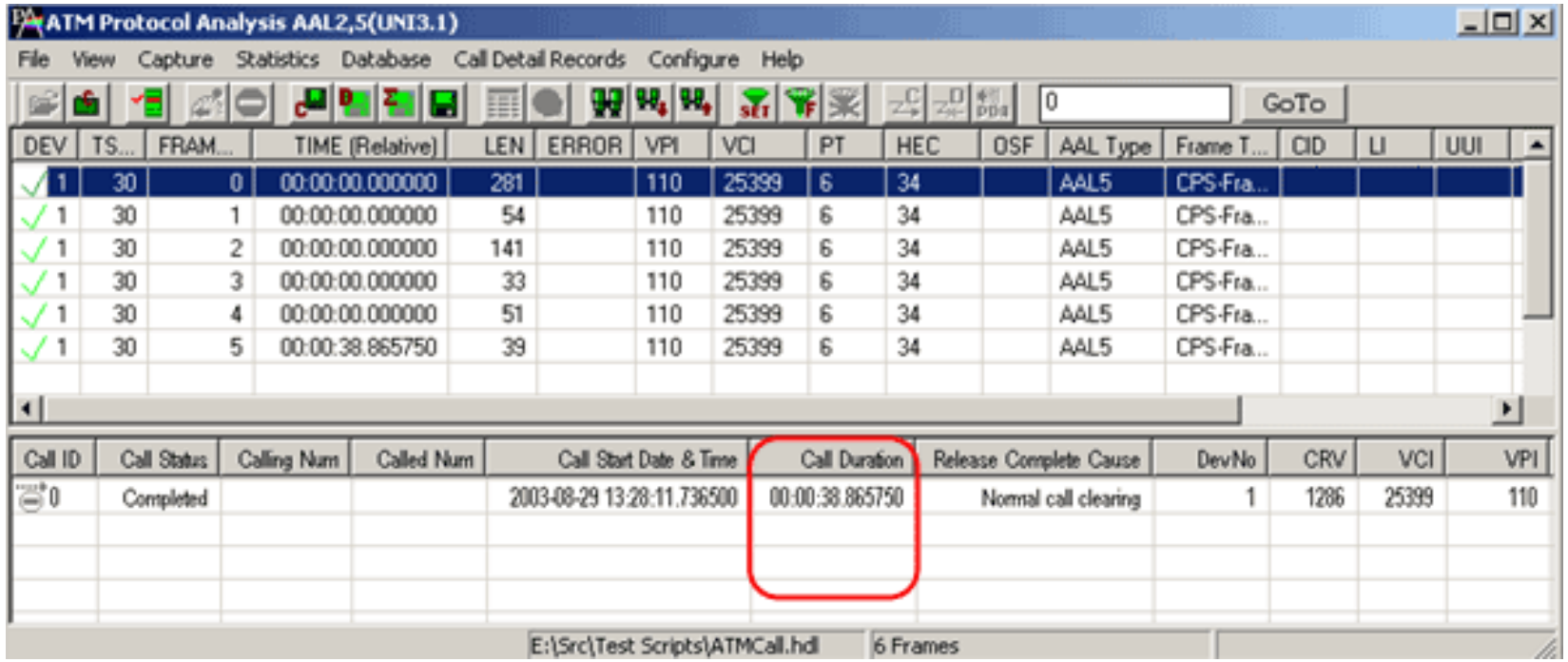


Reassembly Option



- 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

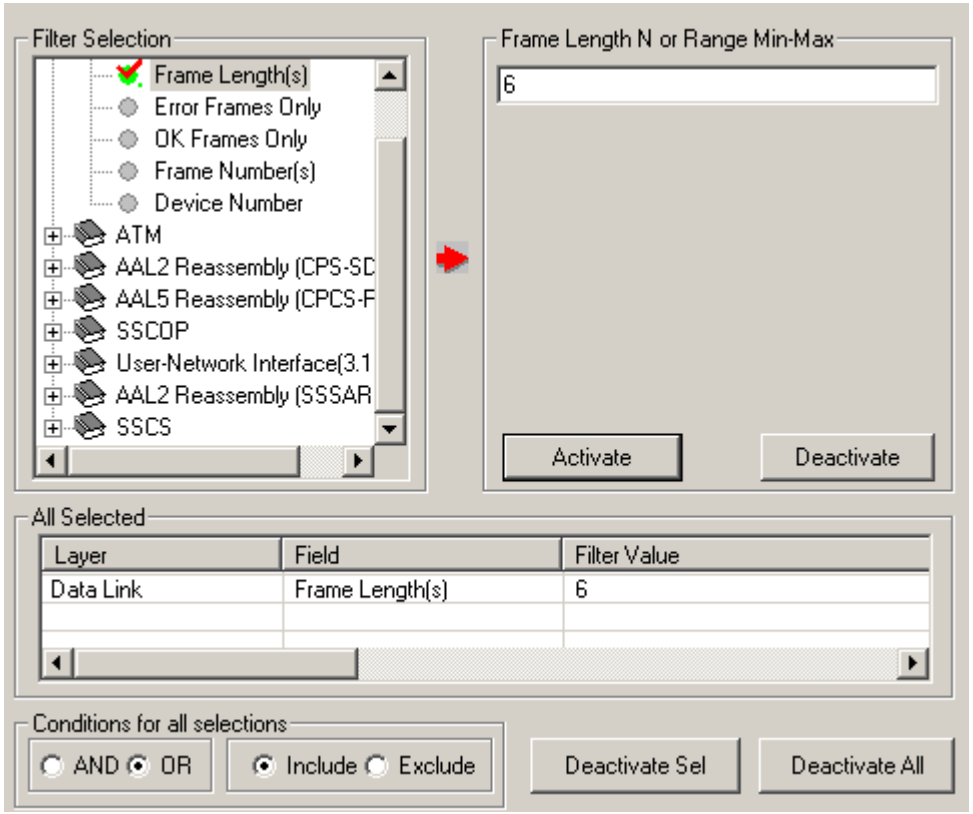
Call Detail Records

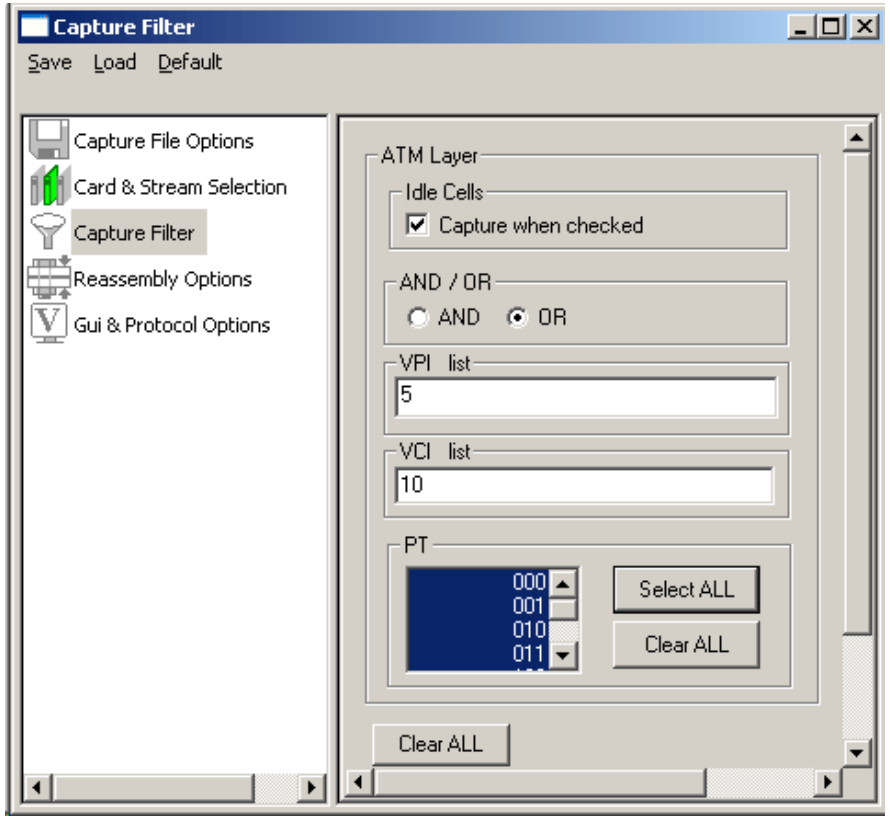


- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, CRV, release complete cause etc. are displayed

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, UUI, and more

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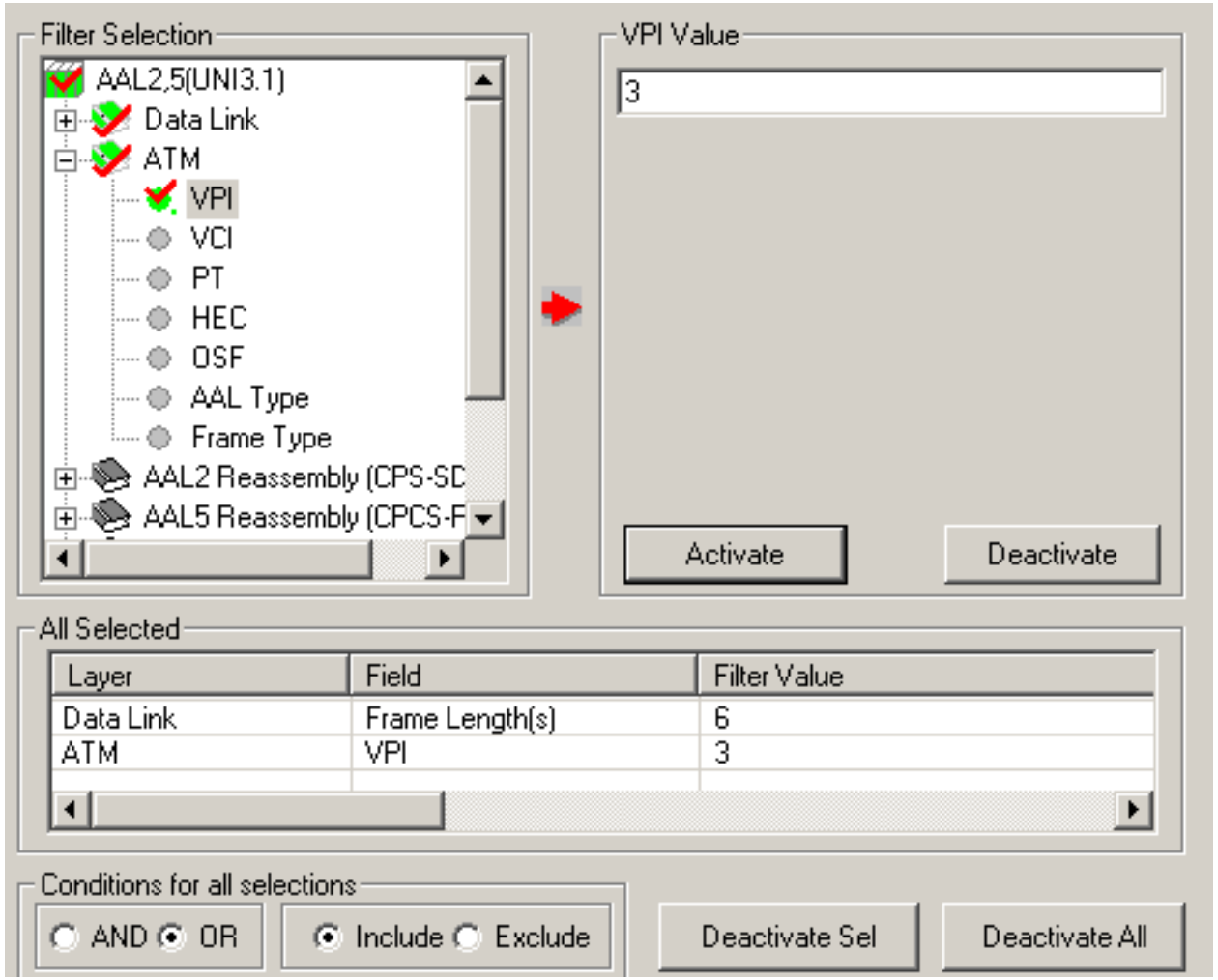
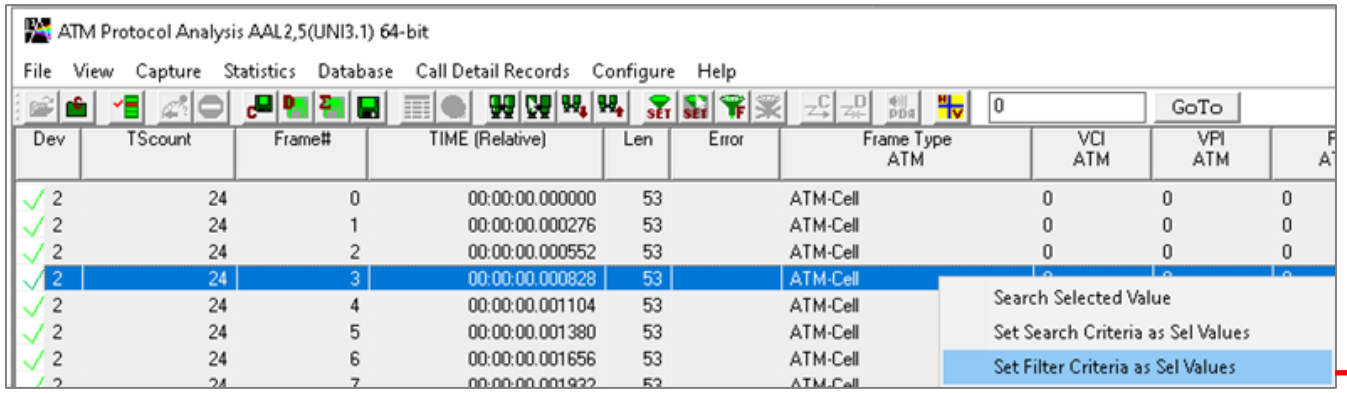
Search Frames

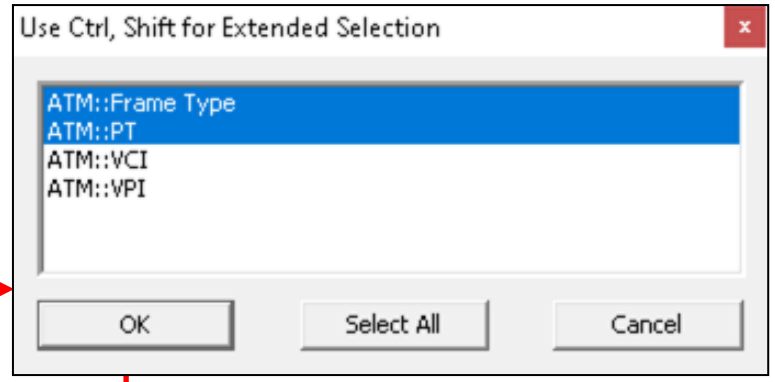


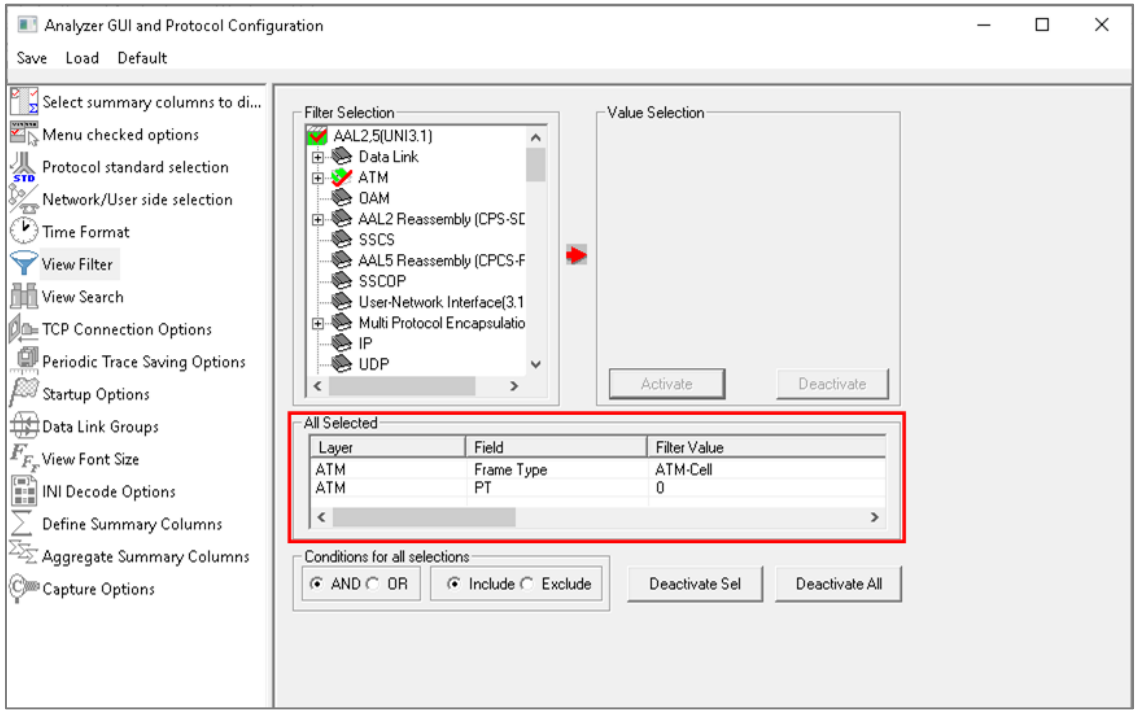
- Search features helps users to search for a particular frame based on specific search criteria

Filtering Criteria From Screen Selection

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

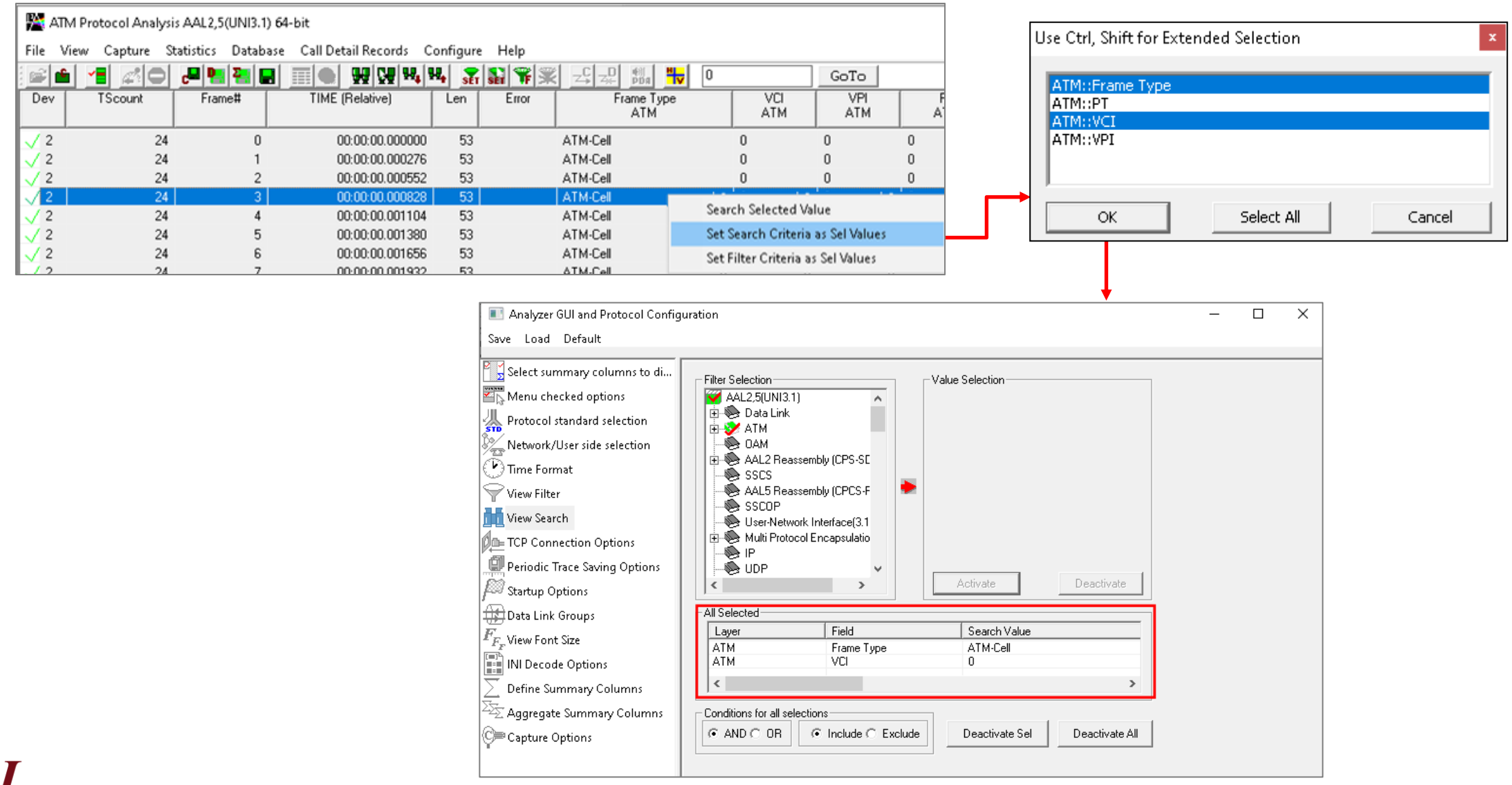






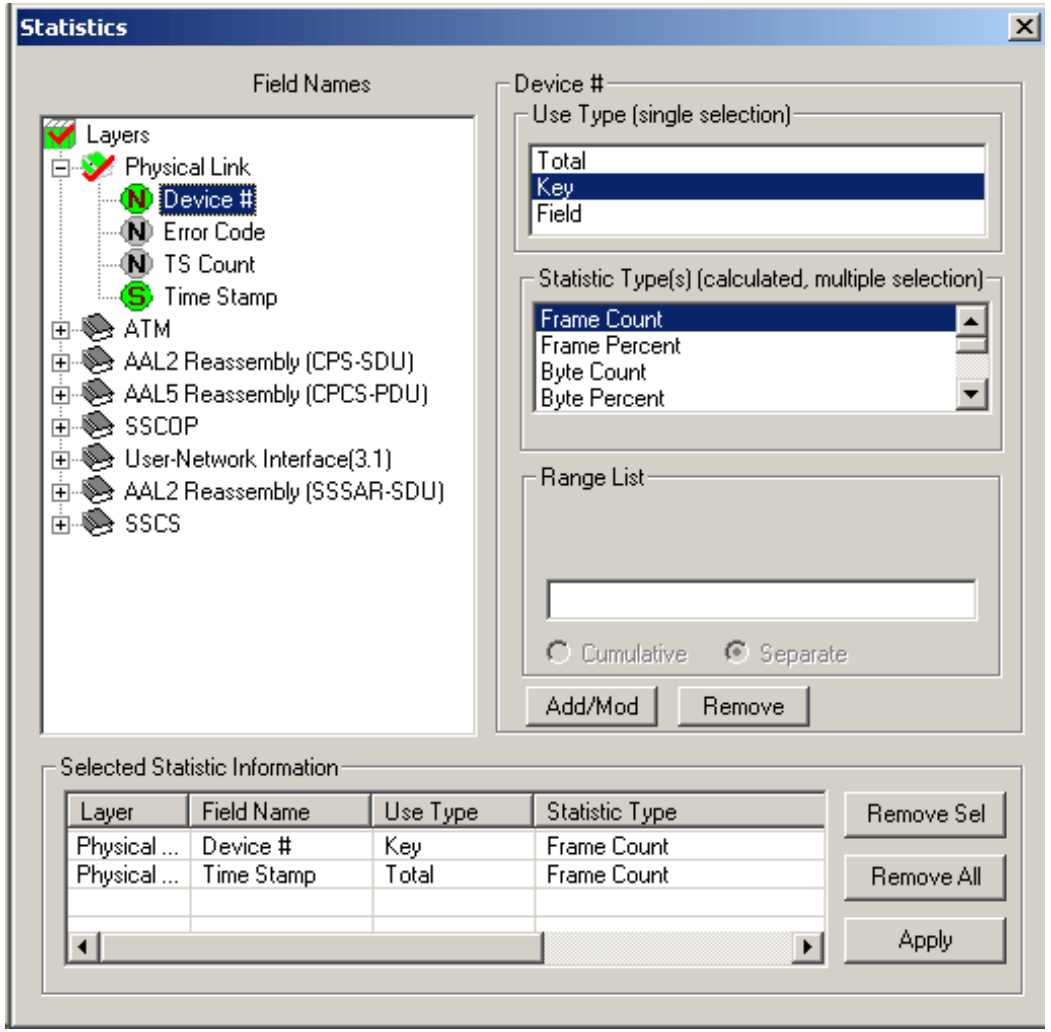
Search Criteria From Screen Selection

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



Statistics

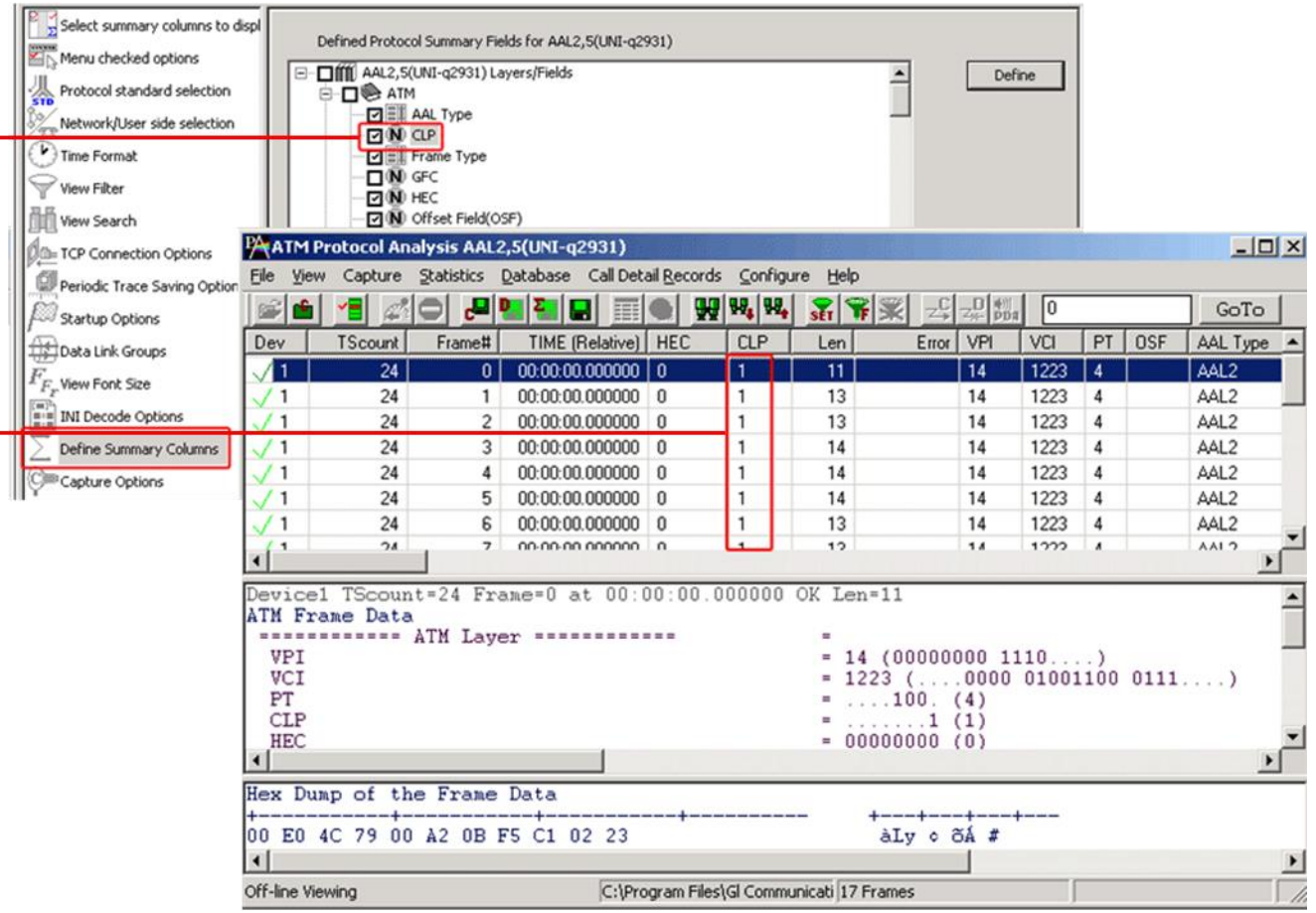
- Statistics is an important feature available in protocol analyzer and can be obtained for all frames both in real-time as well as offline mode
- Numerous statistics can be obtained to study the performance of the network based on protocol fields and different parameters



Define Summary Columns

Selection of Summary Column

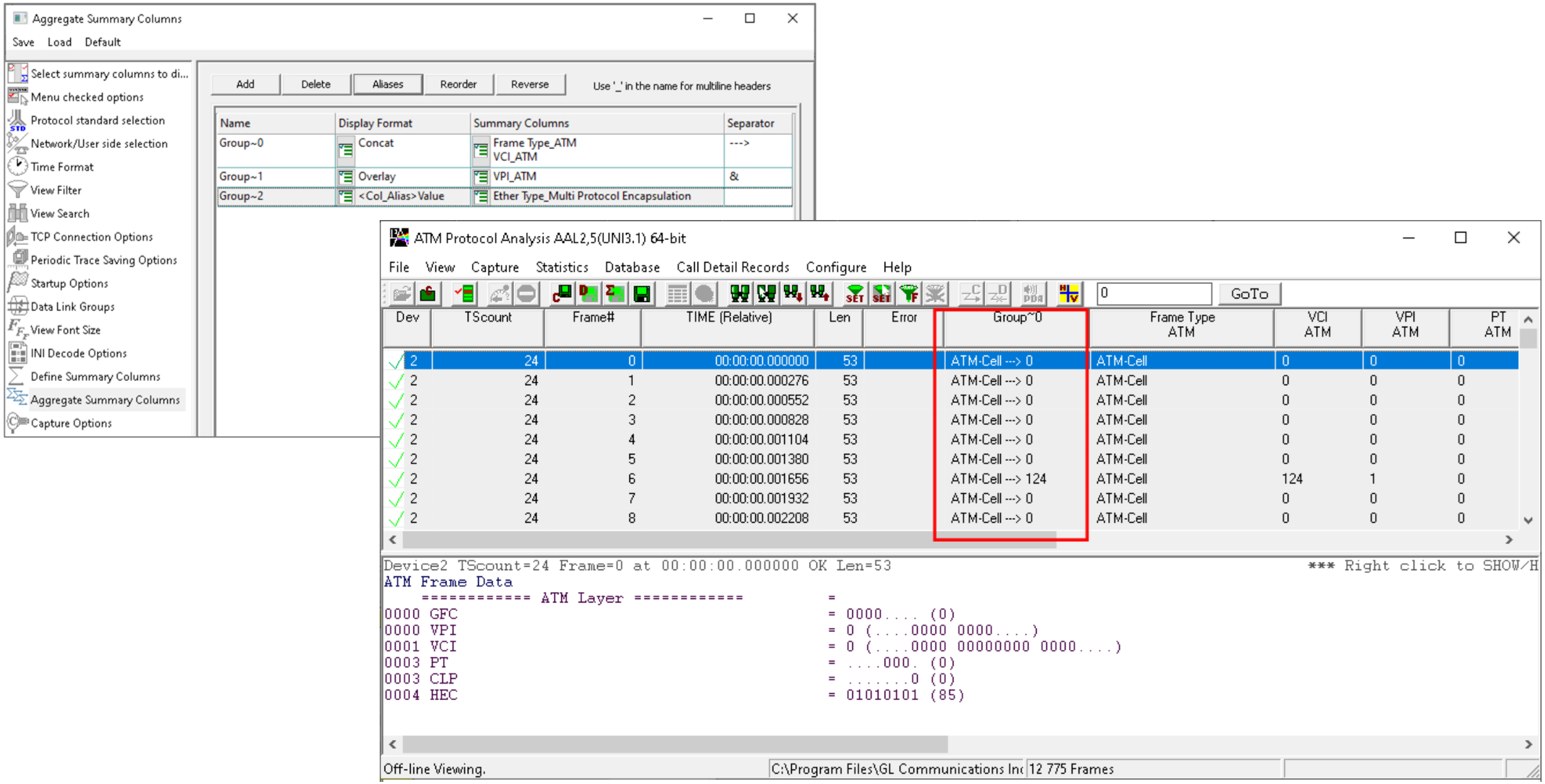
Output display in analyzer



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

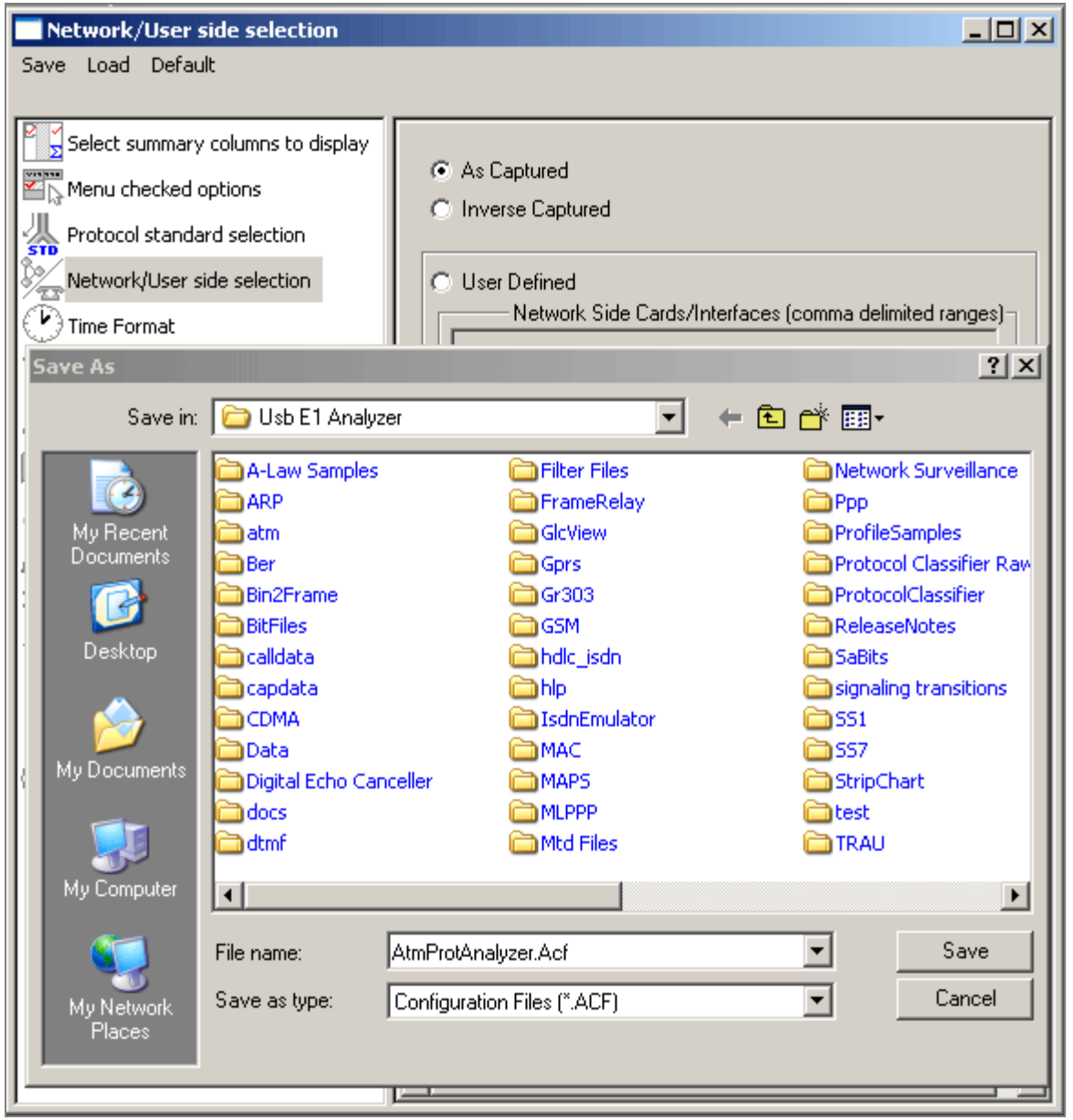
Aggregate Group Column

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



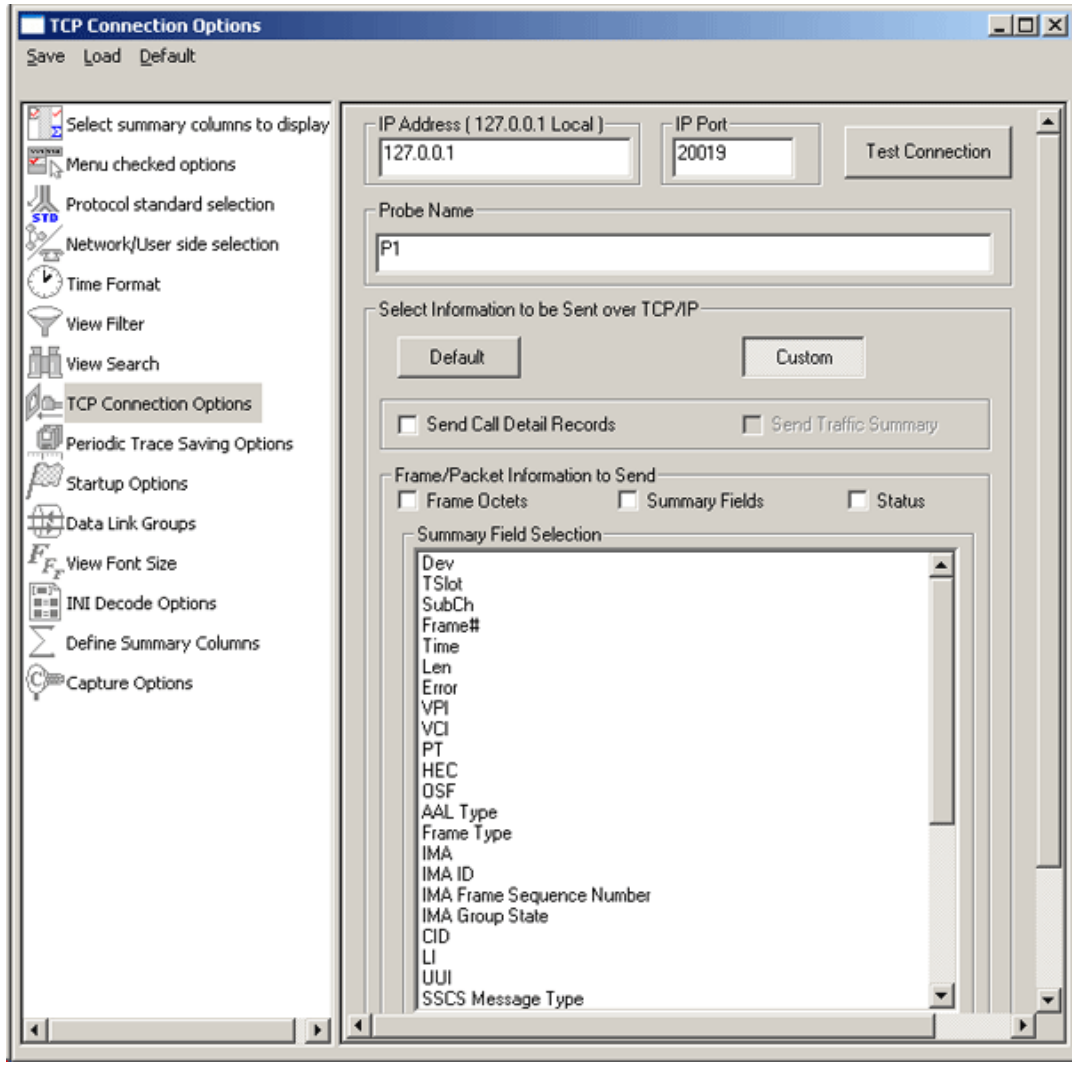
Save/Load All Configuration Settings

- 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



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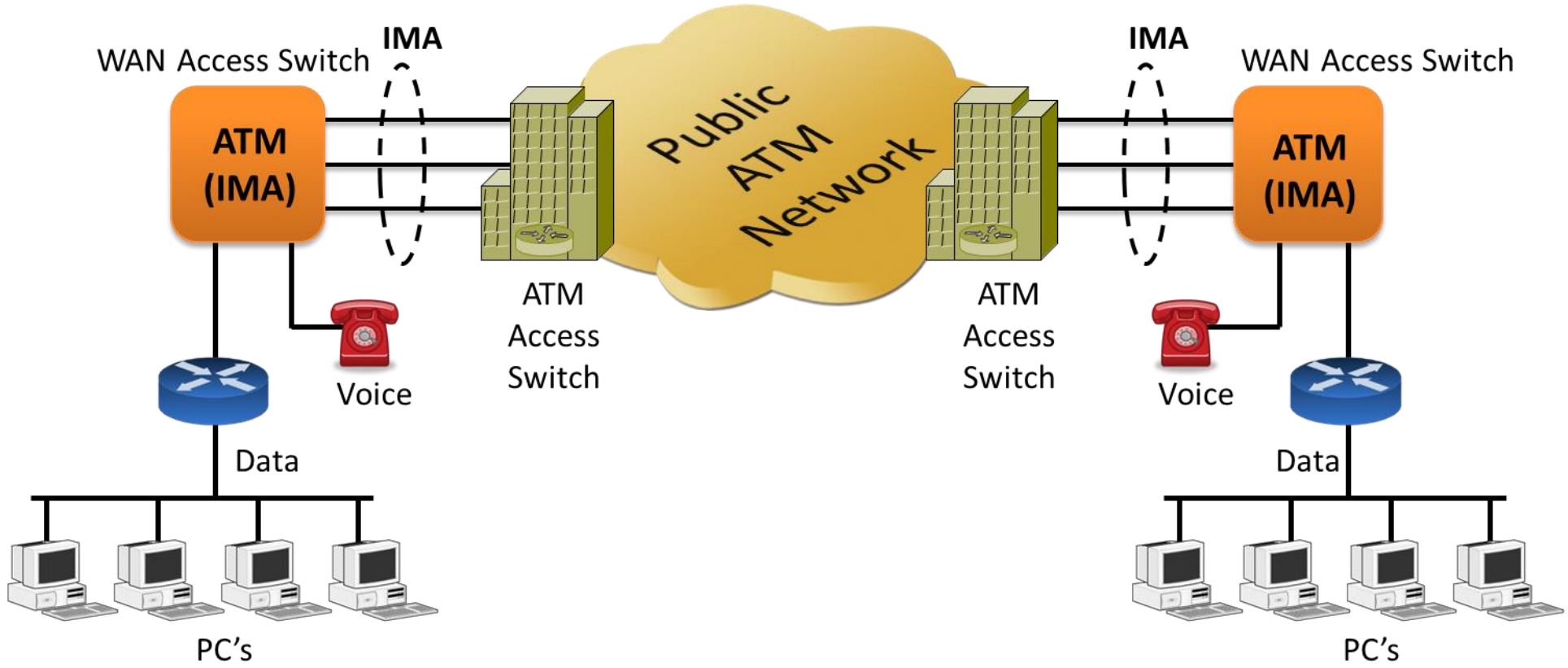
GL's Inverse Multiplexing for ATM (IMA) Emulator Using Client-Server

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

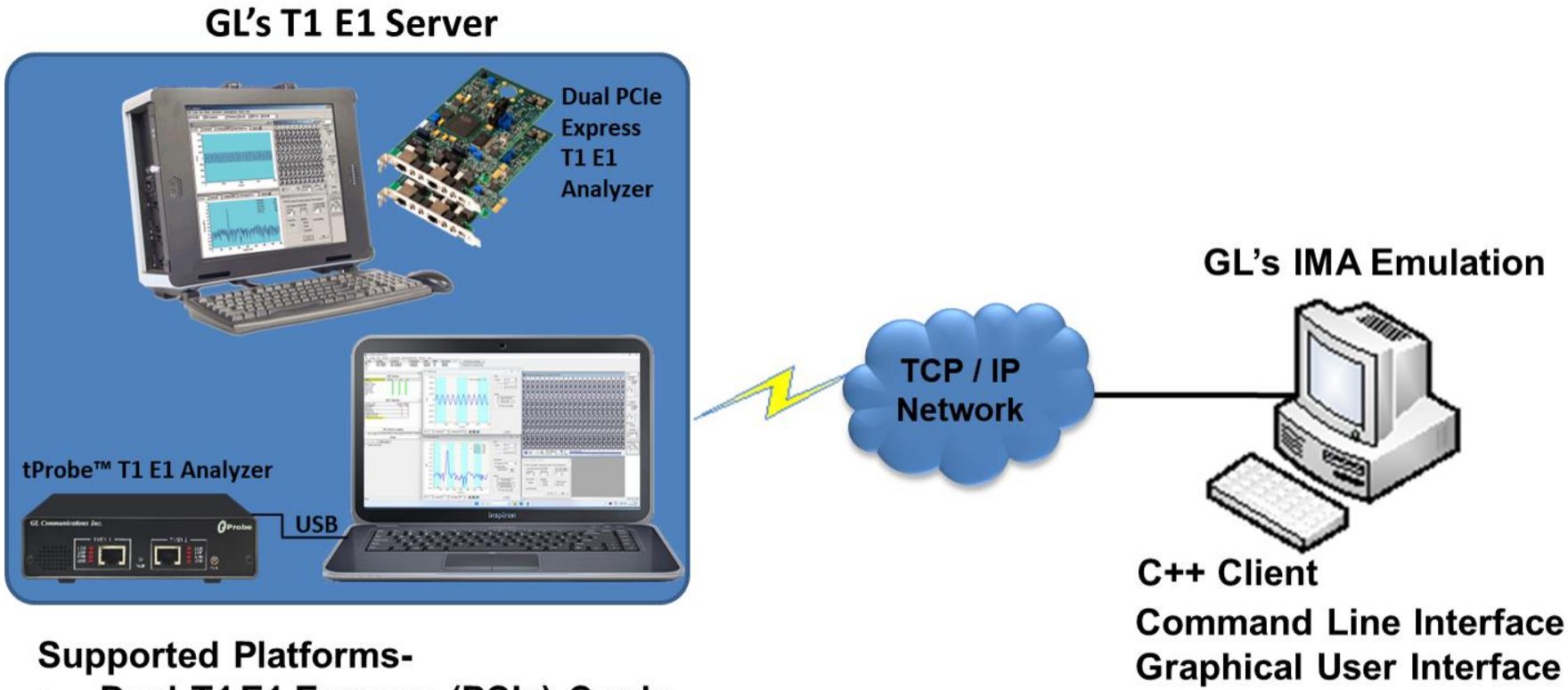
Features

- 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



Supported Platforms-

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

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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	✓

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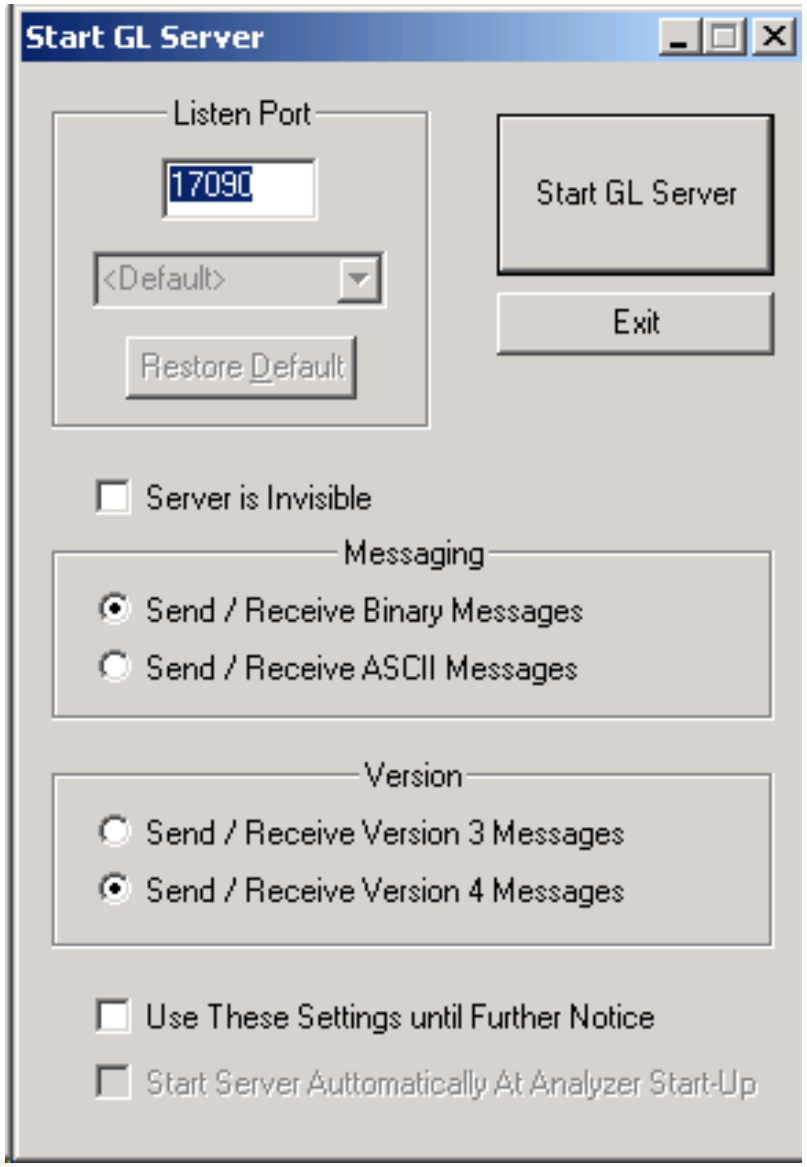
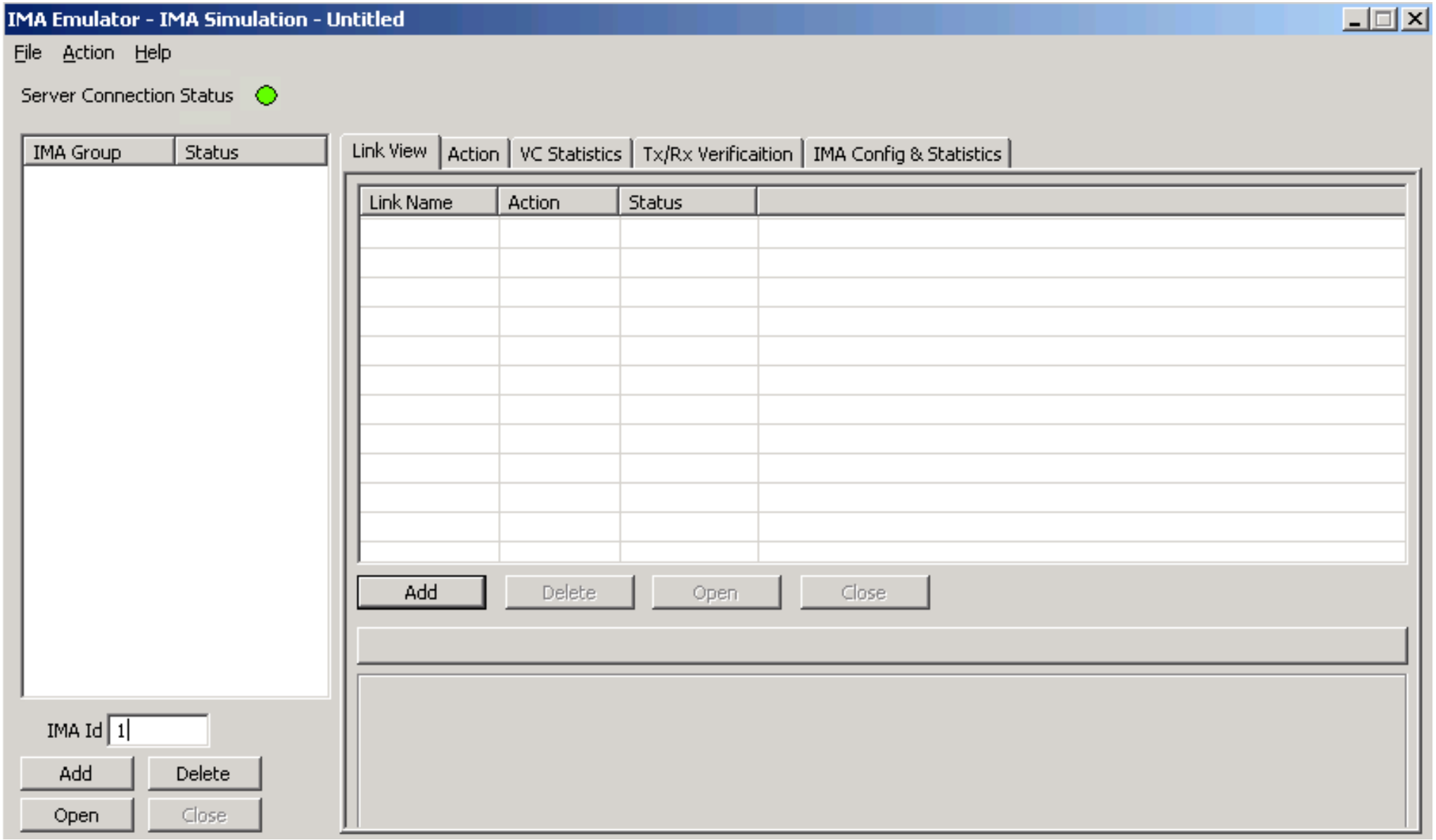
Starting the Server

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

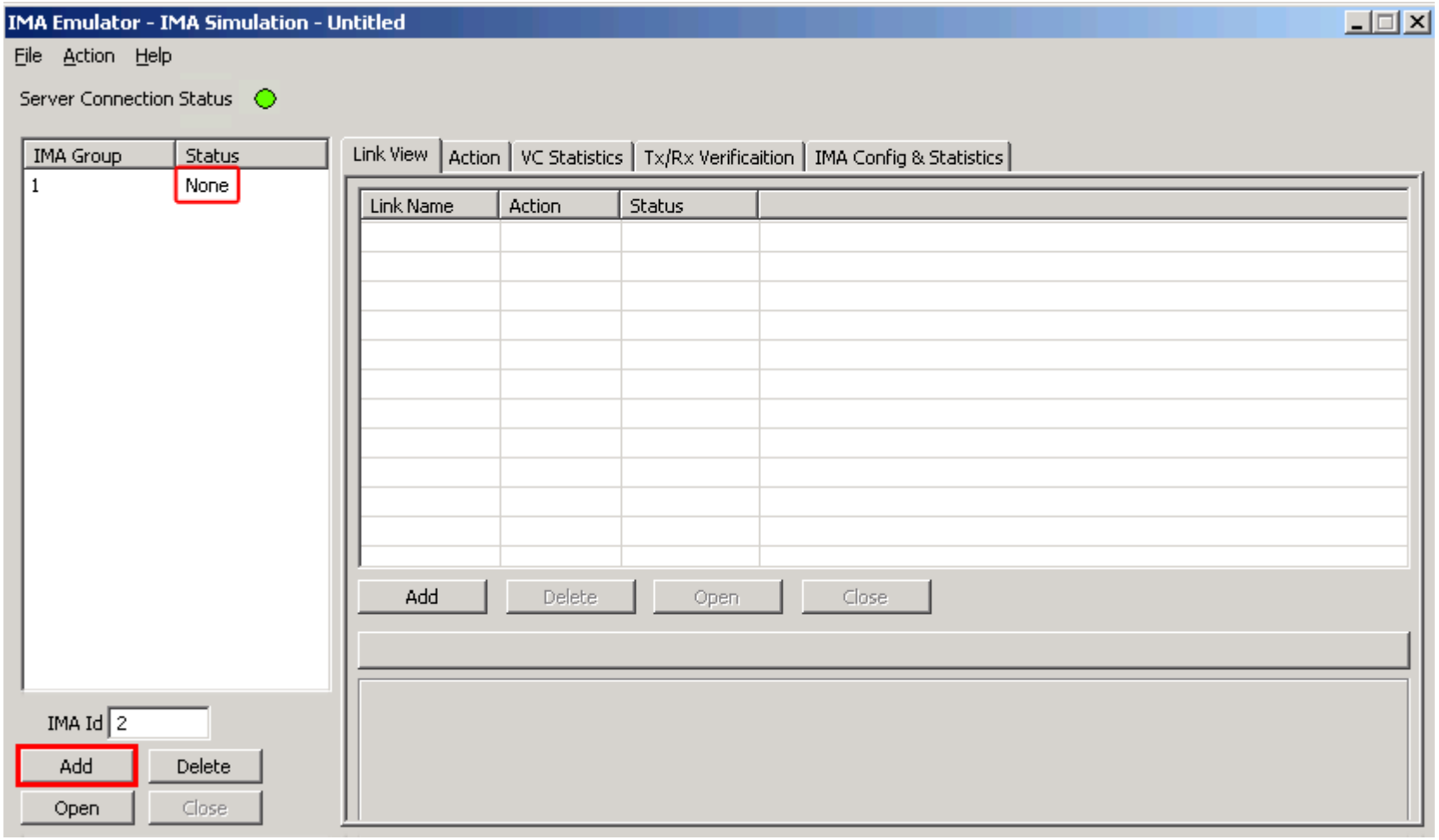


IMA Simulator GUI



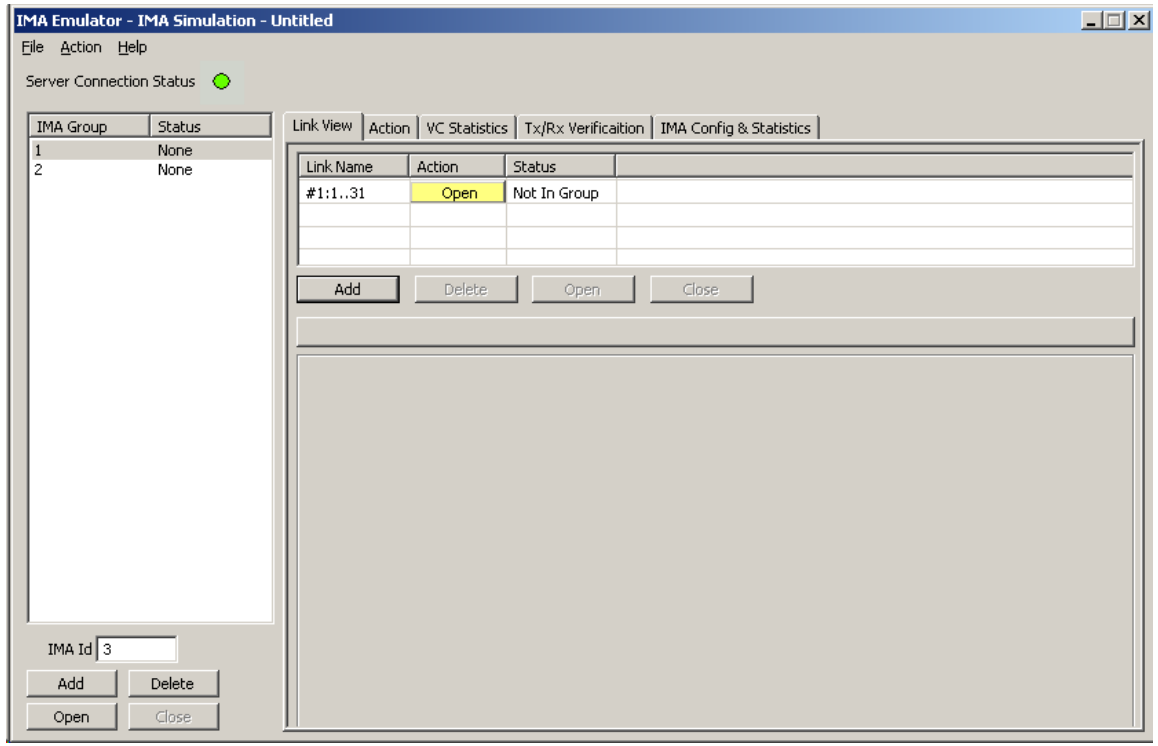
Adding Group

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

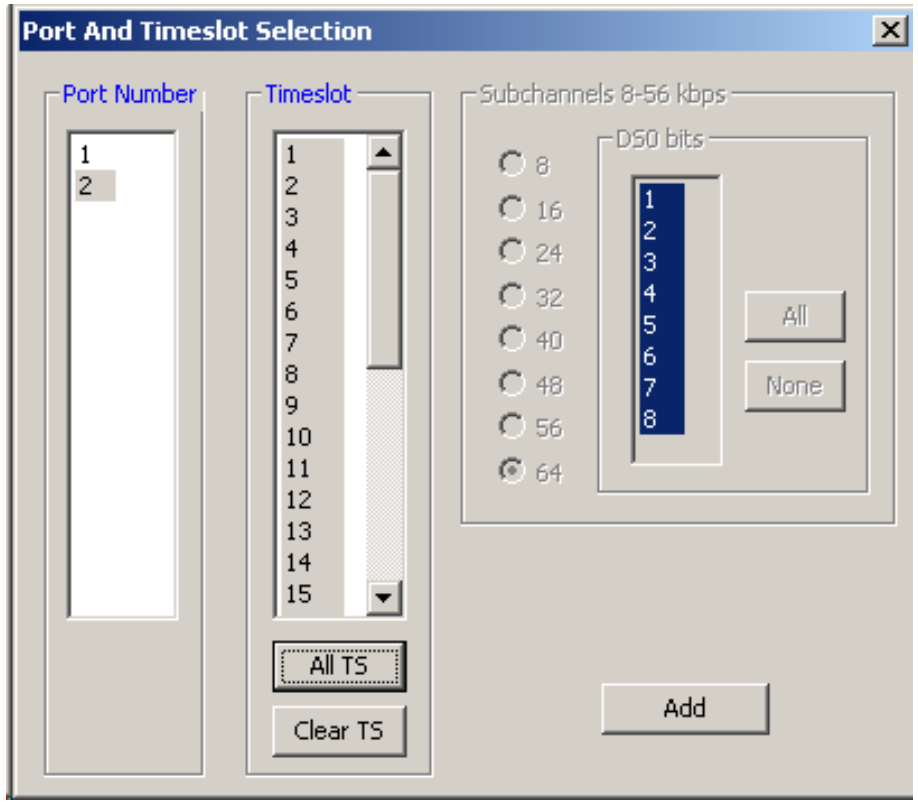


Adding links to form an IMA Group

Added Links

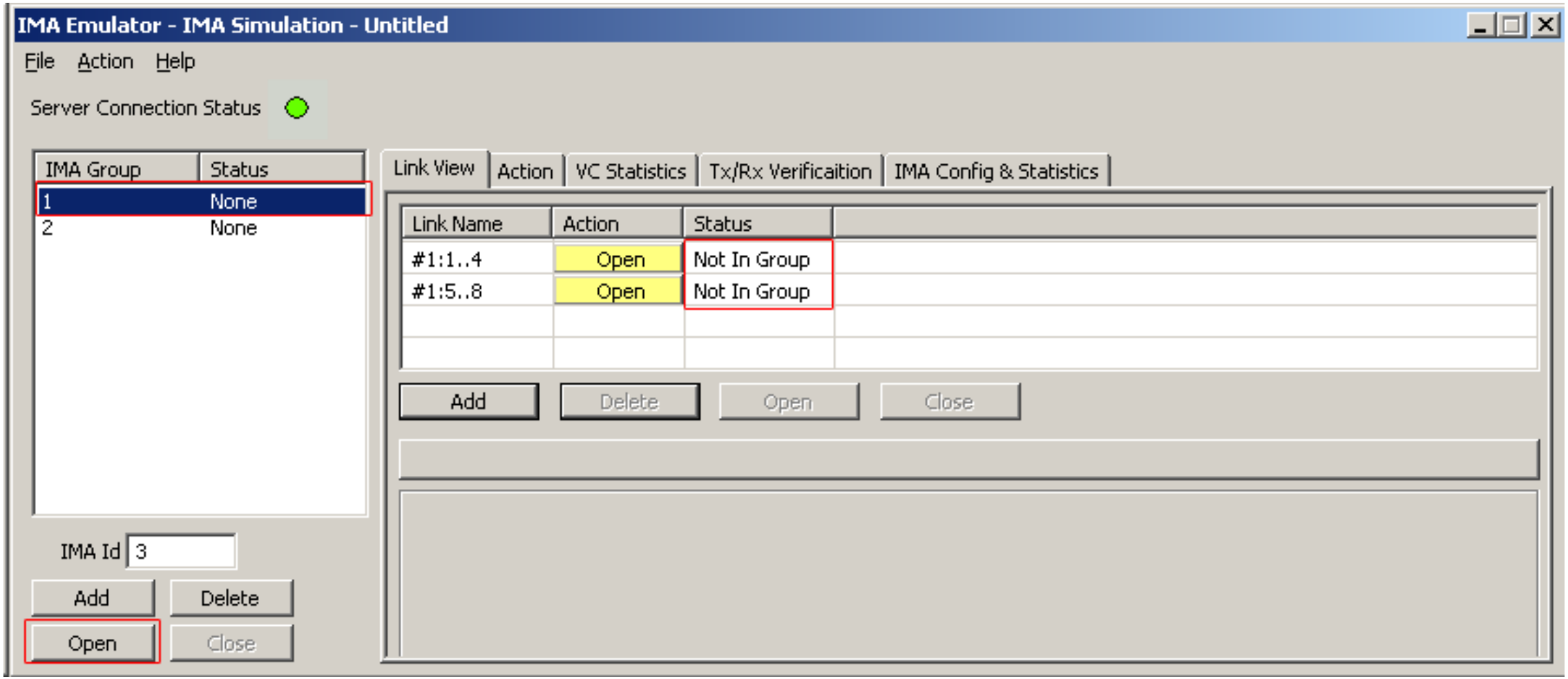


Link Selection

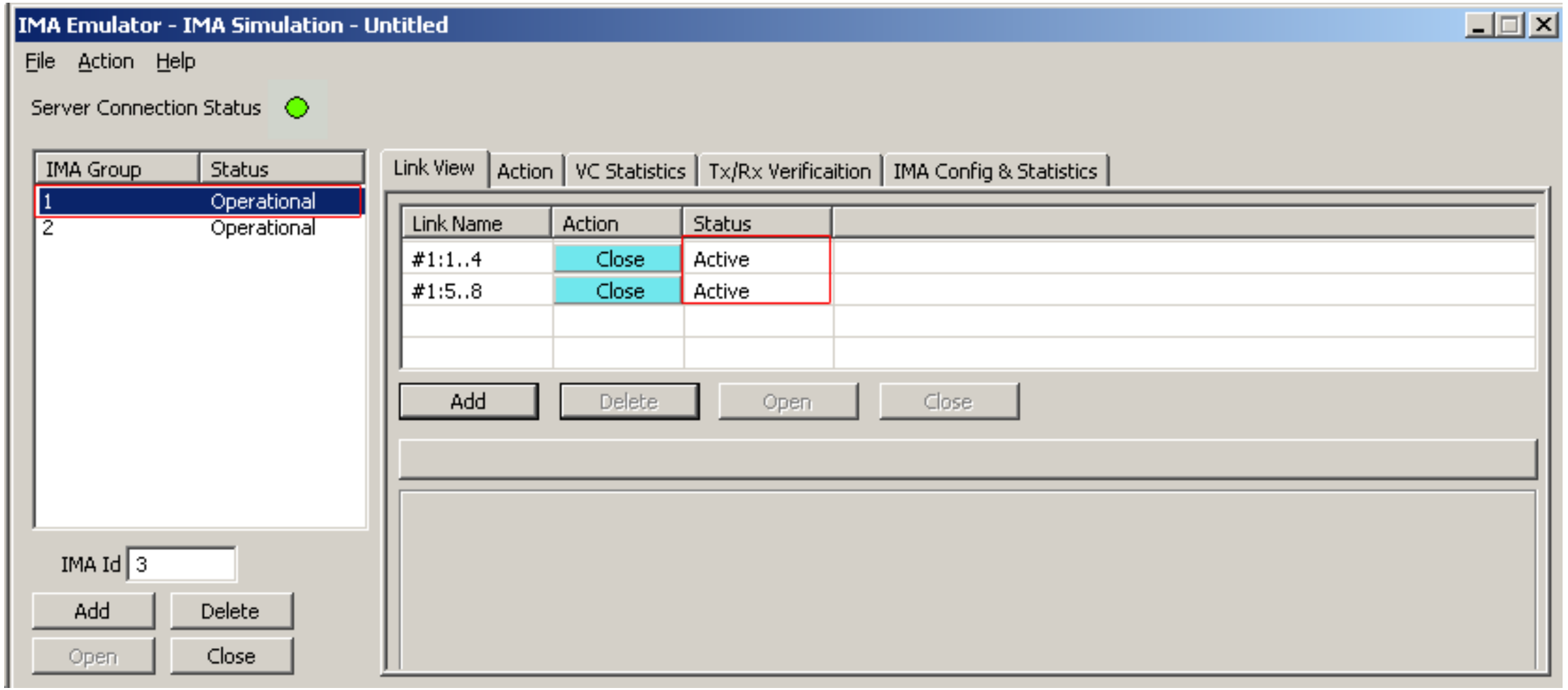


- Various links (of any bandwidth varying from 64Kbps to n*64Kpbs or sub channels) can be added to form an IMA Group. Within a group all links should be of equal bandwidth
- IMA group, channels into a single network-layer channel

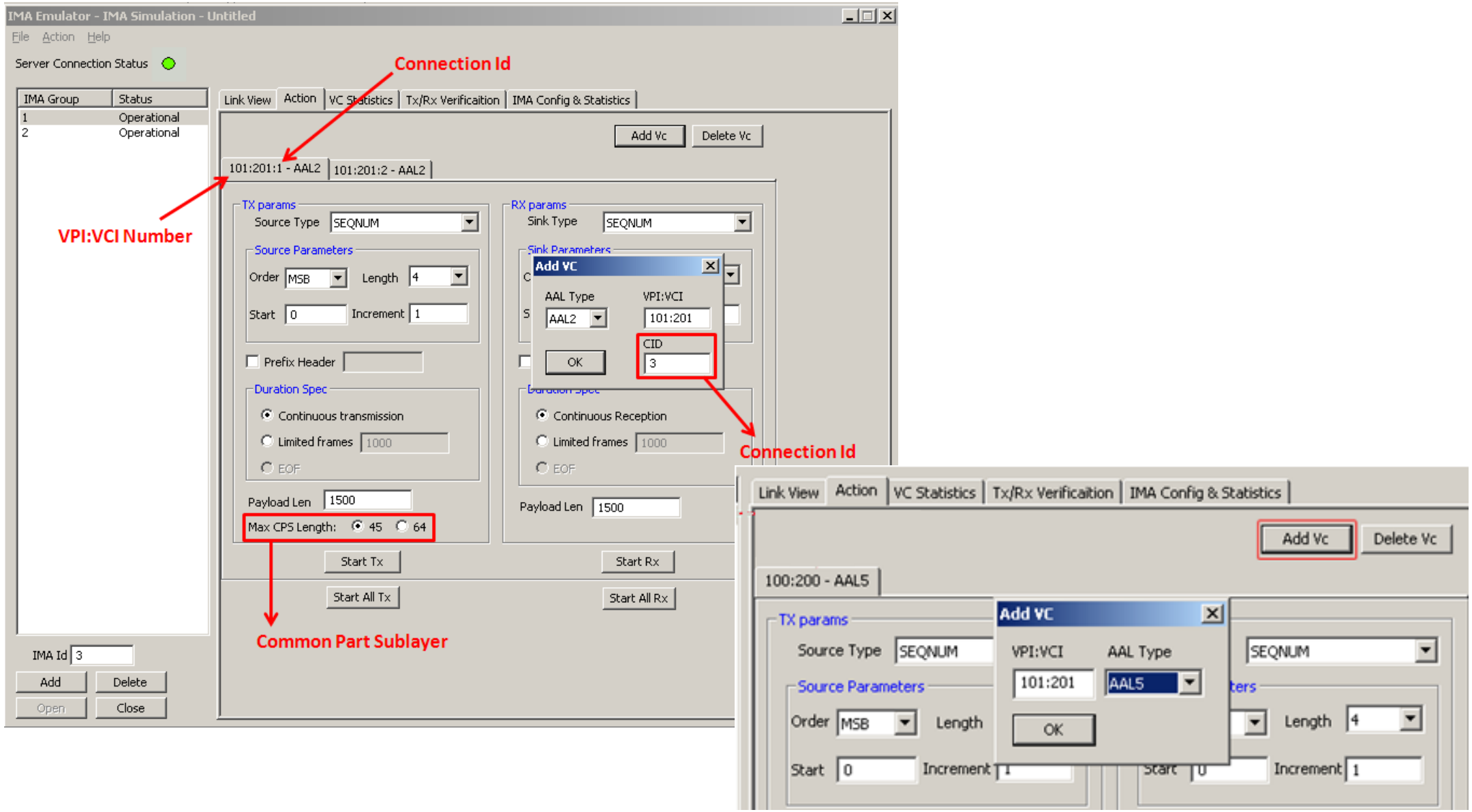
Opening the IMA Group



IMA Group Operational Mode



Adding VC For Tx and Rx

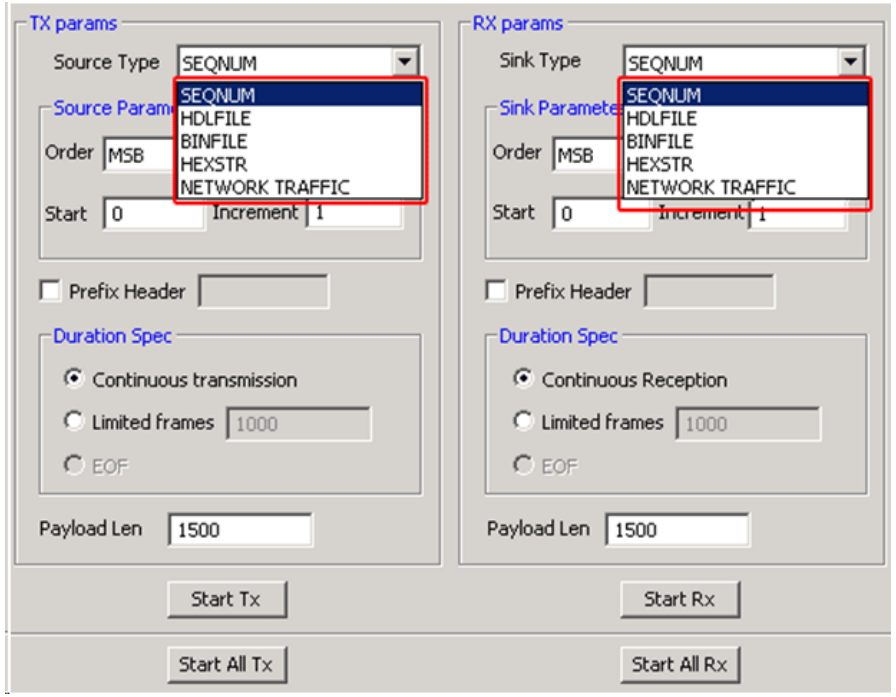


Adding VC For Tx and Rx

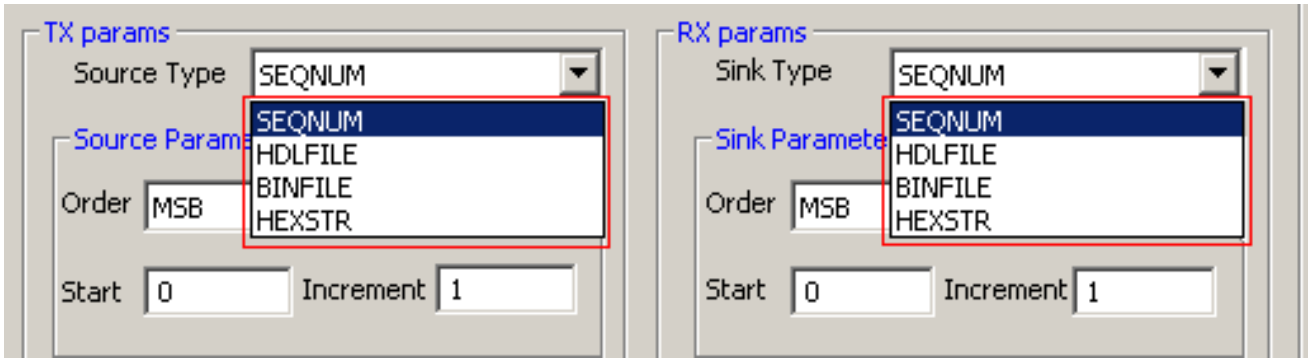
- In IMA Simulation virtual channels are added on the selected IMA Group
- IMA Simulation supports AAL0, AAL2, and AAL5 type frames
- Different types of Payloads can be selected for each VC Such as Sequence number, HDL file (containing packets/frames), Flat Binary file, and User defined frame (ASCII 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

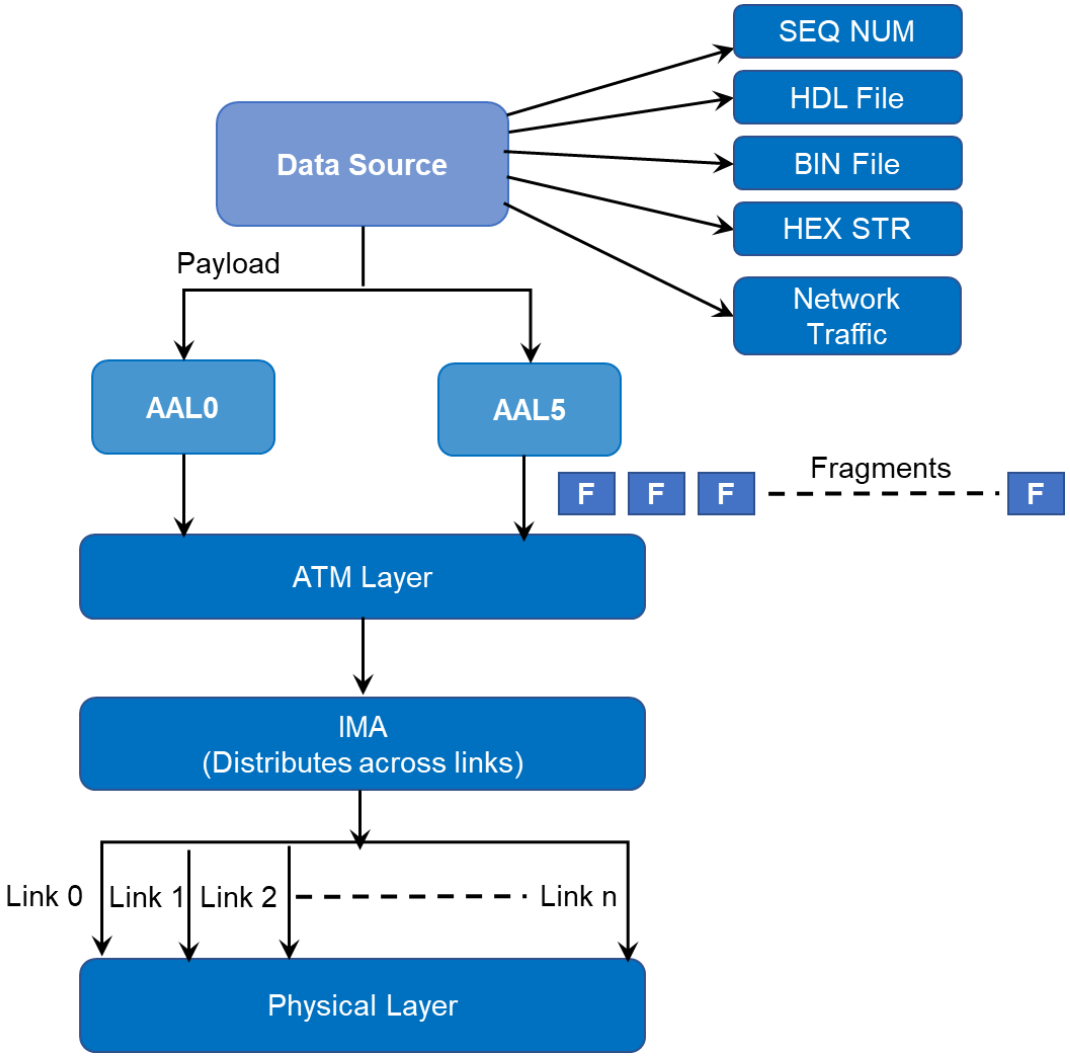


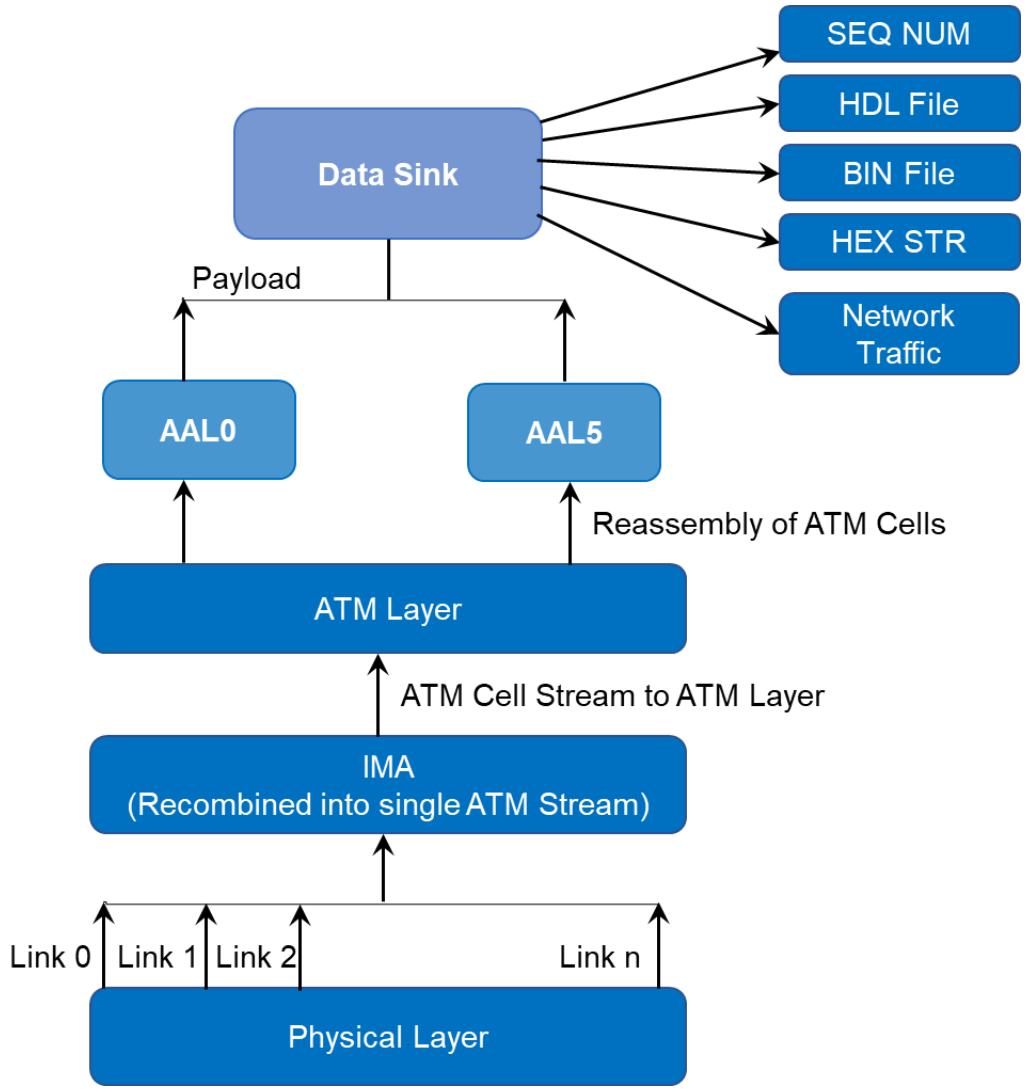
AAL 2



- 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

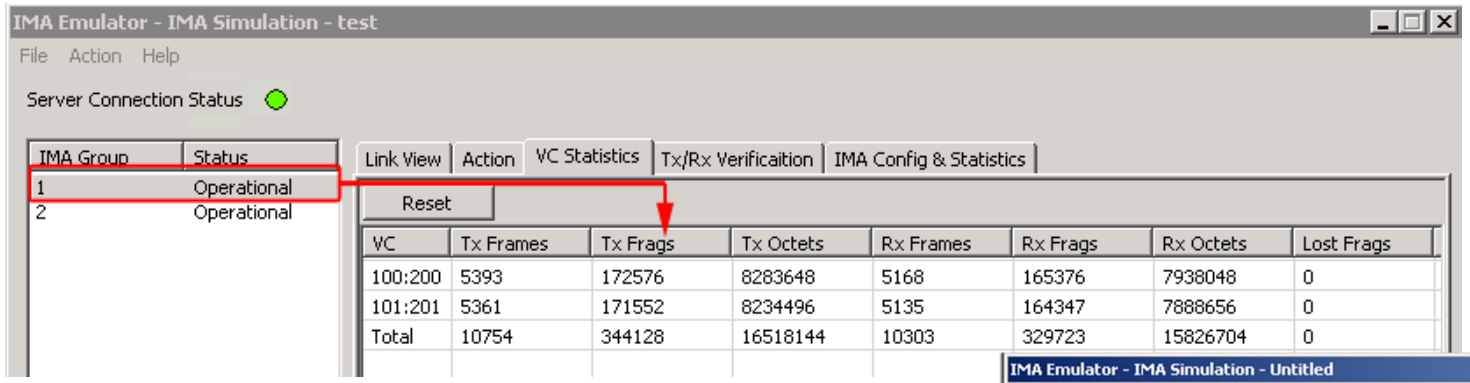
Transmit and Receive Function



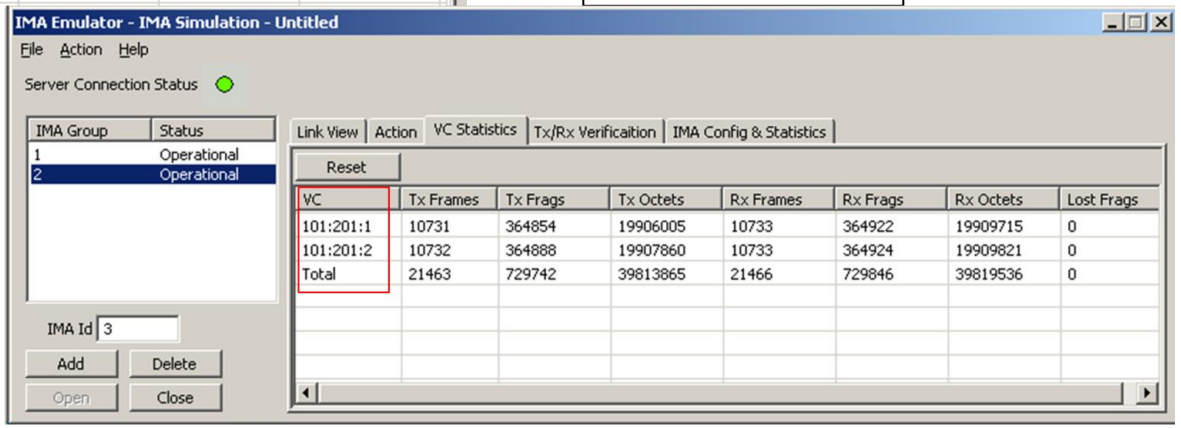


VC Statistics

AAL0, AAL5



AAL Type 2

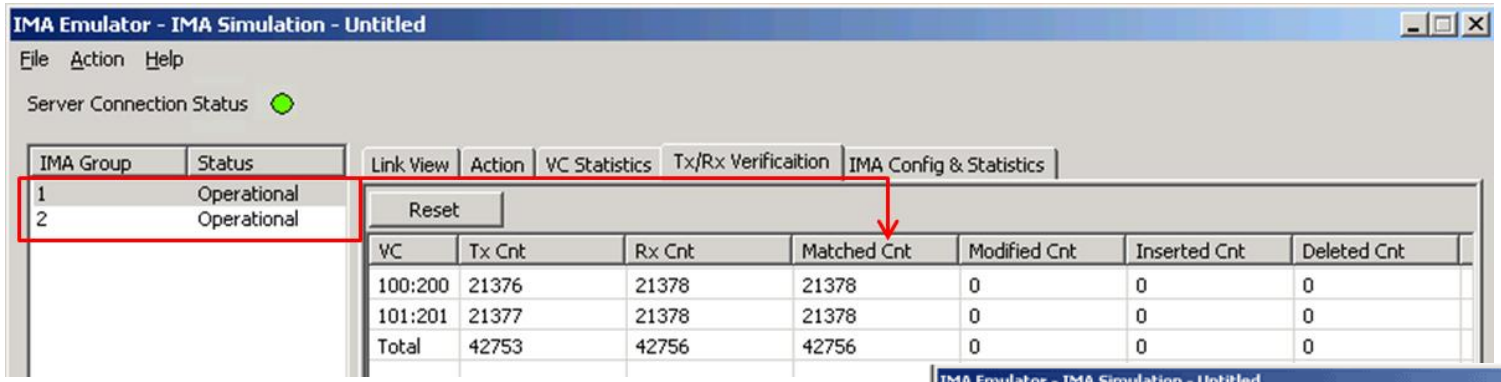


- The Statistics for each of the added VCs are available in VC Statistics tab. It shows the VC statistics for the selected IMA group
- The statistics include:
  - Number of Transmitted , Received frames, Fragments, Octets, and Lost fragments

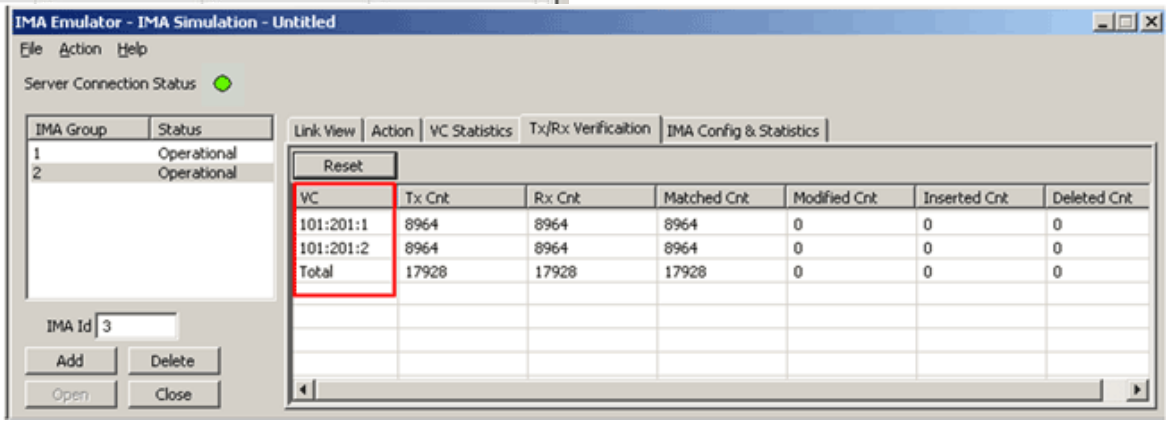
GL Communications

Tx/Rx Verification

AAL0, AAL5



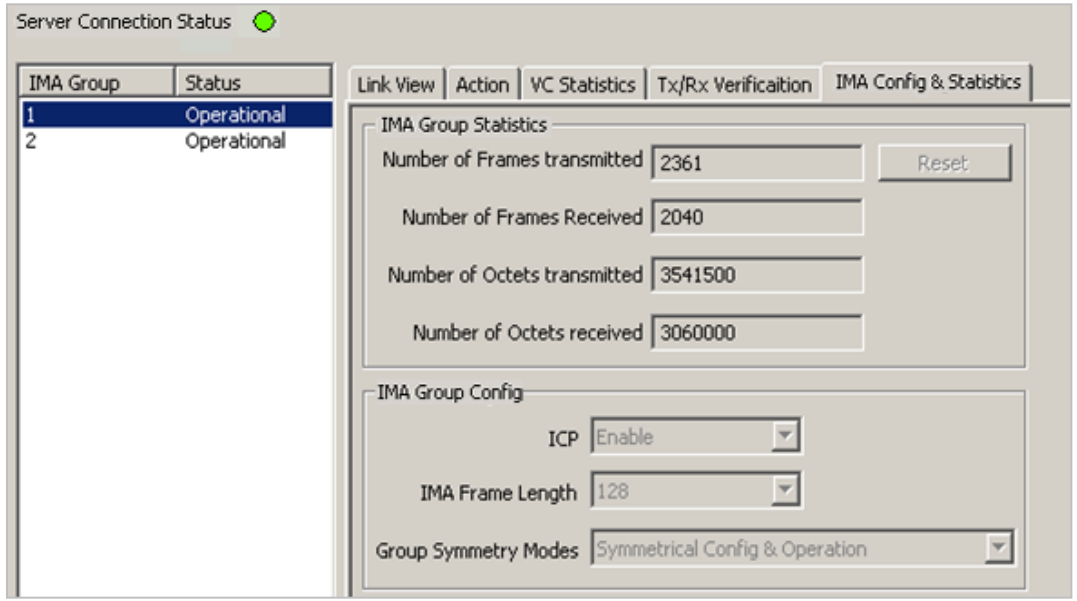
AAL Type 2



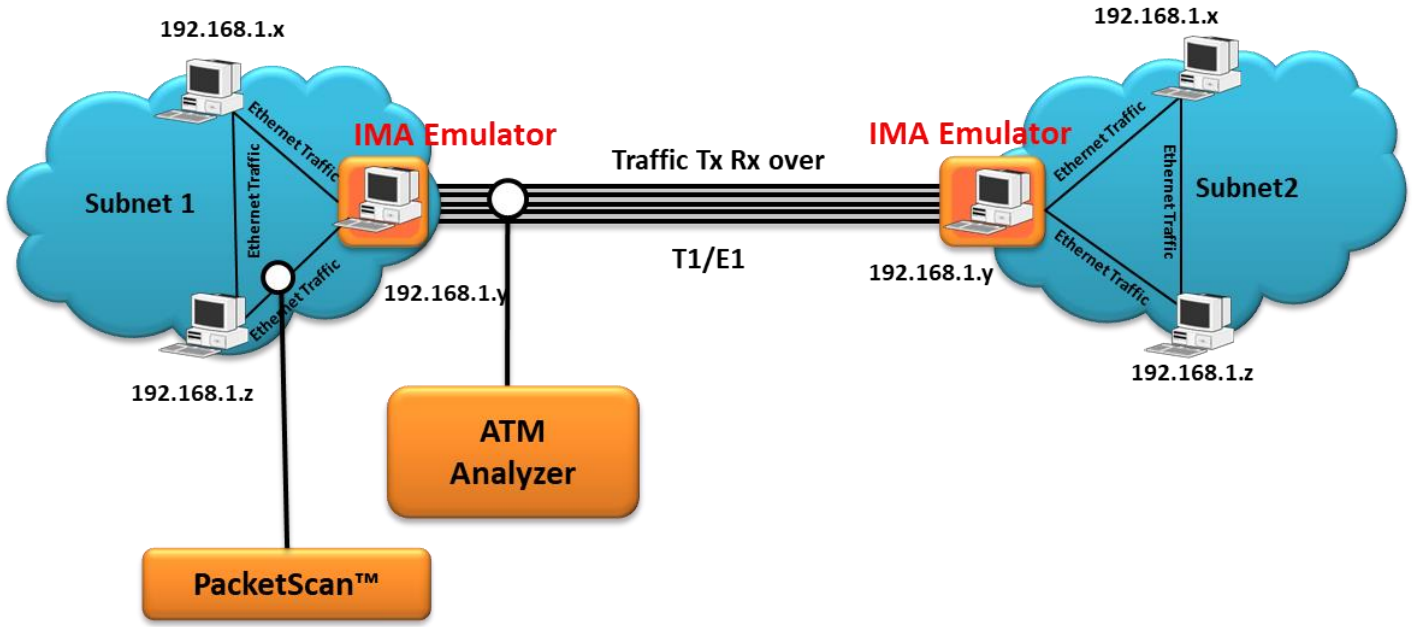
- The results of the verification for each of the added VCs are available in Tx/Rx Verification
- The statistics include:
  - The Number of VCs Created, Transmitted Frame Count, Received Frame Count, Matched Frame Count, Modified Frame Count, Deleted Frame Count, and Inserted Frame Count

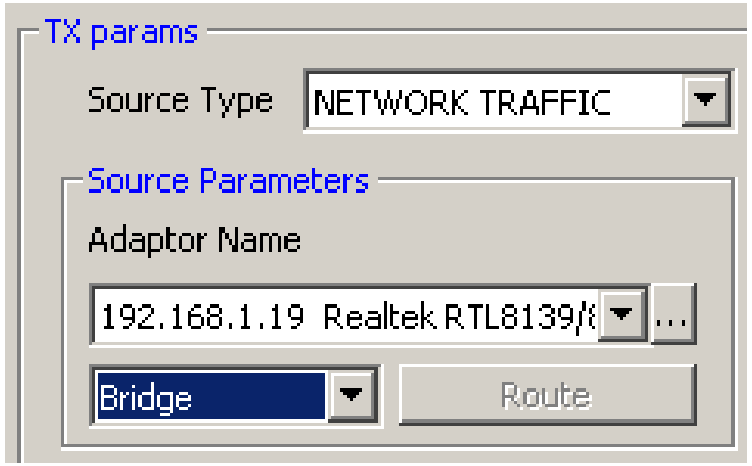
IMA Group Config and Statistics

- 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



IMA Emulator in Bridge Mode





- 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