# FastRecorder™ and PacketExtractor™ for Monitoring IP Networks

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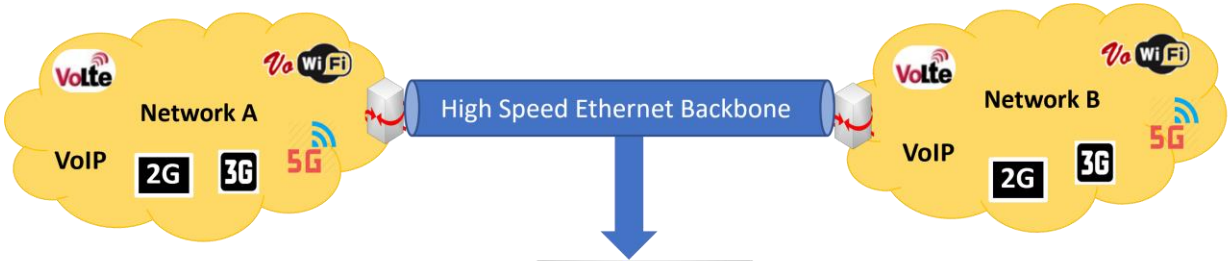
# Overview




Switch with Mirror Port

2 x 100 GigE / 2 x 40 GigE / 4 x 10/25 GigE /
2 x 10/25 GigE / 2 x 1/10 GigE / 8 x 10 GigE


Up to 8 Capture Ports

Up to 240 TB Storage

- Nano second timestamping
- Wirespeed filtering
- Packet slicing
- Continuous lossless capture
- Error free capture
- Time synchronization for collocated probes

Portable High Speed Capture System

PacketScan™ HD

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# PacketScan™ HD, FastRecorder™ & PacketExtractor™

## (2x1/10 GigE, 8x10 GigE, 2x10/25 GigE, 4x10/25 GigE, 2x40 GigE, 2x100 GigE)



**Also available as a rack mounted unit

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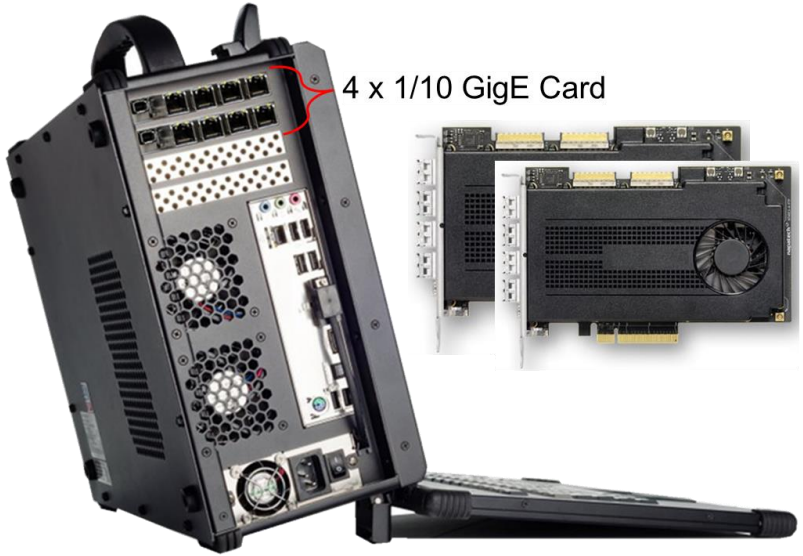
# PacketScan™ HD, FastRecorder™ & PacketExtractor™ 2 (4 x 1/10 GigE)




**PacketScan™ HD - Lunch Box**


Lunchbox specs are:

- Intel Xeon Silver 4210
- 64GB RAM
- 500GB SSD for OS
- 4x 3.84TB NVME SSD

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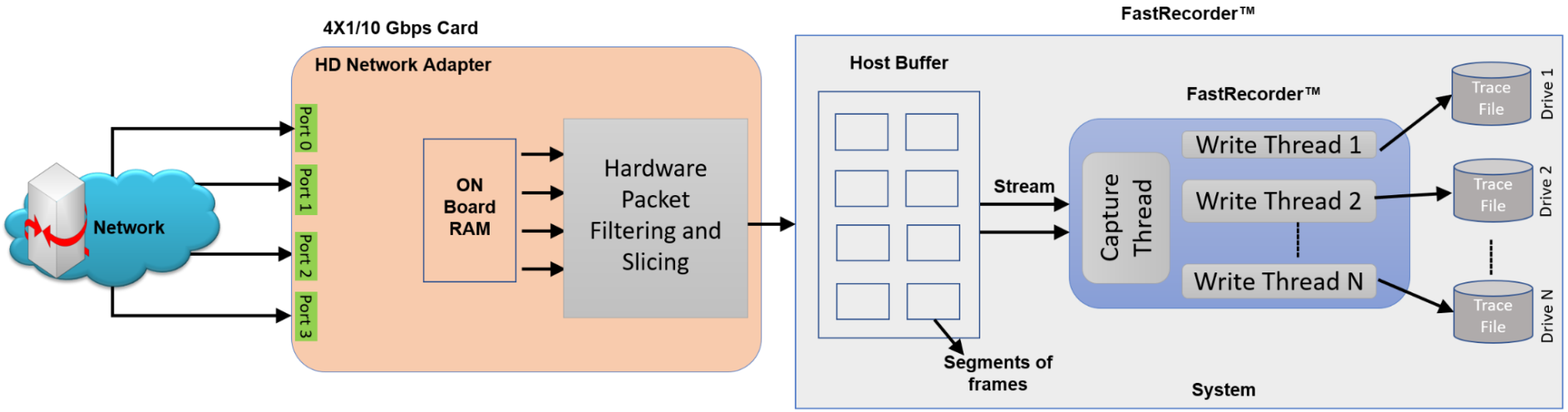
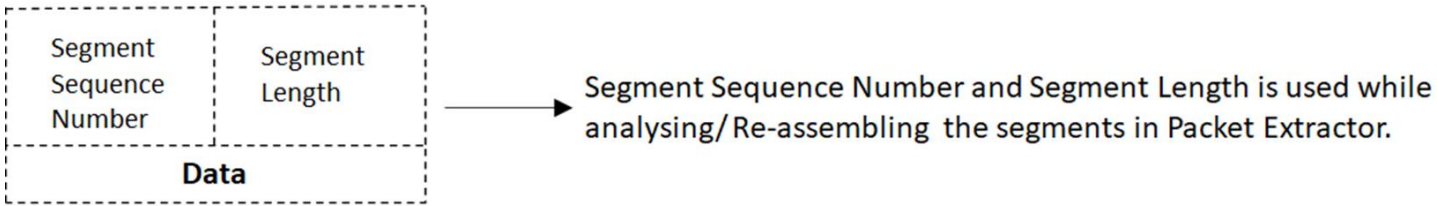
# What the Software Does?

- The Record feature includes a powerful Hardware Filter that allows user to filter out unwanted traffic, and continuously capture the traffic of interest
- The previously recorded traffic is extracted into single or multiple files and can be analyzed using GL's PacketScan™ and Wireshark® application
- Can create own filters using custom filter option which provides flexibility to check the fields and use the logical AND, OR conditions more efficiently
- Trigger based Start or Stop writing to disk based on the condition is configured based on Capture Rate, Filter Rate, per-port Capture Rate, and Filter Rate
- E-mail alert for specified trigger condition
- Supports Encapsulating Security Payload (ESP) protocol to decrypt ESP packets on both IPv4 and IPv6 by providing ESP SAs value
- Supports Data and Rate analysis
- BERT verification analyzes the received BERT pattern and provides various vital measurements

# FastRecorder™ Architecture




Buffer segments stored internally in files:

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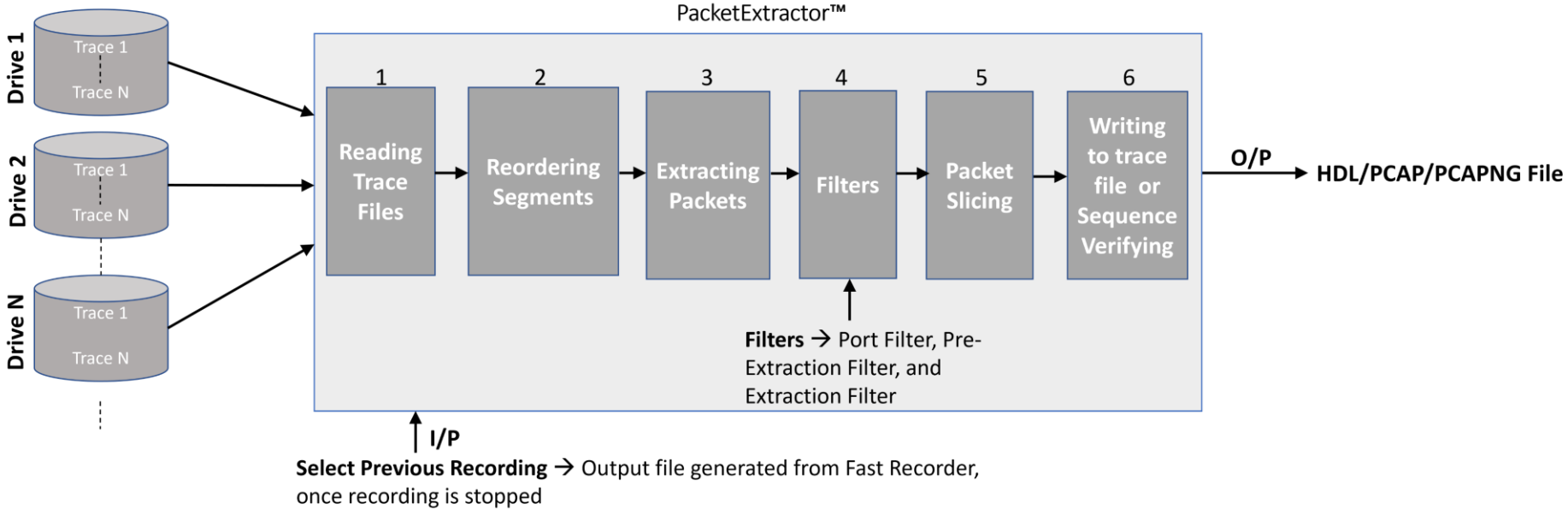
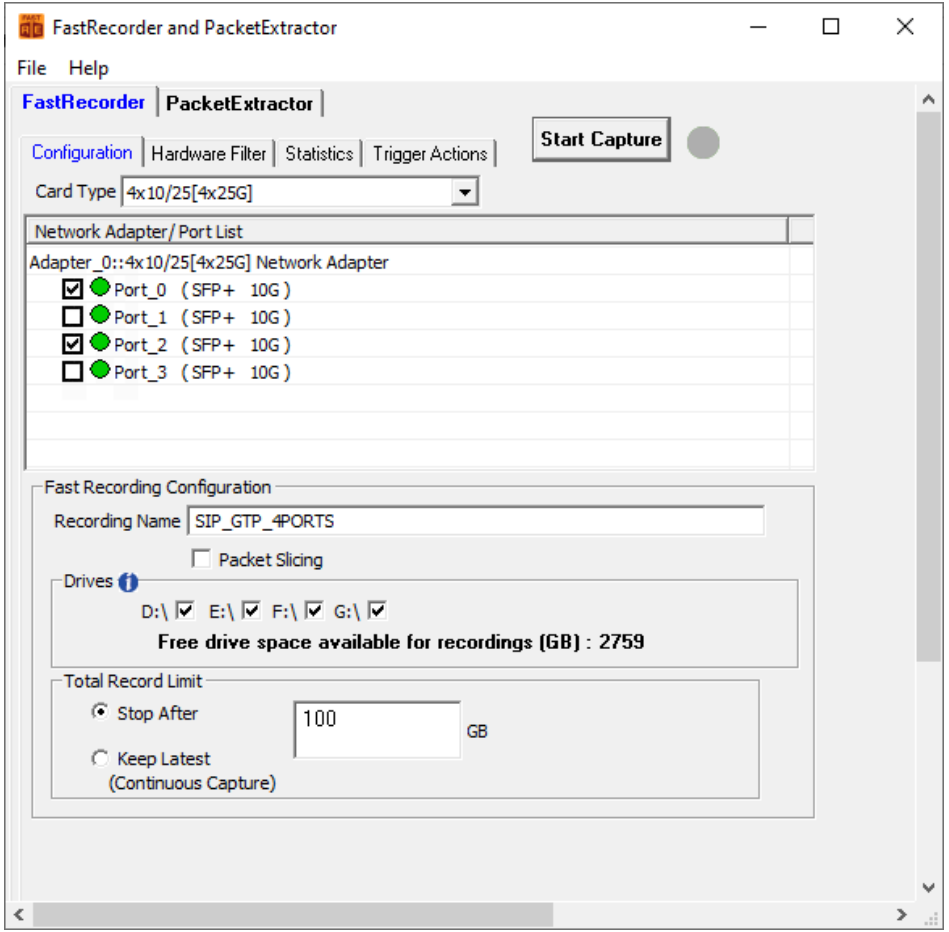
# PacketExtractor™ Architecture



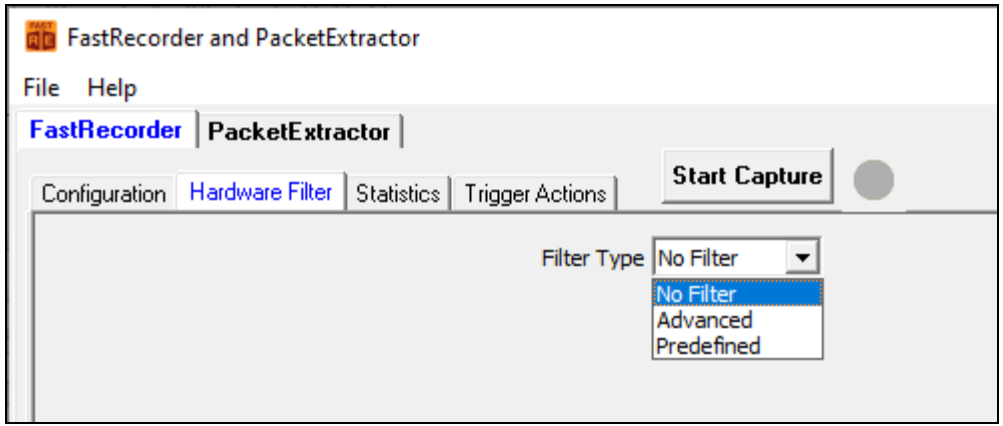
# FastRecorder™ Operations

- FastRecorder™ application provides various options to capture the high-density real-time traffic on disk drives and store the recorded traffic into a file
- The application can capture the traffic continuously until user stops the recorder or specify the size limit to stop the traffic capture



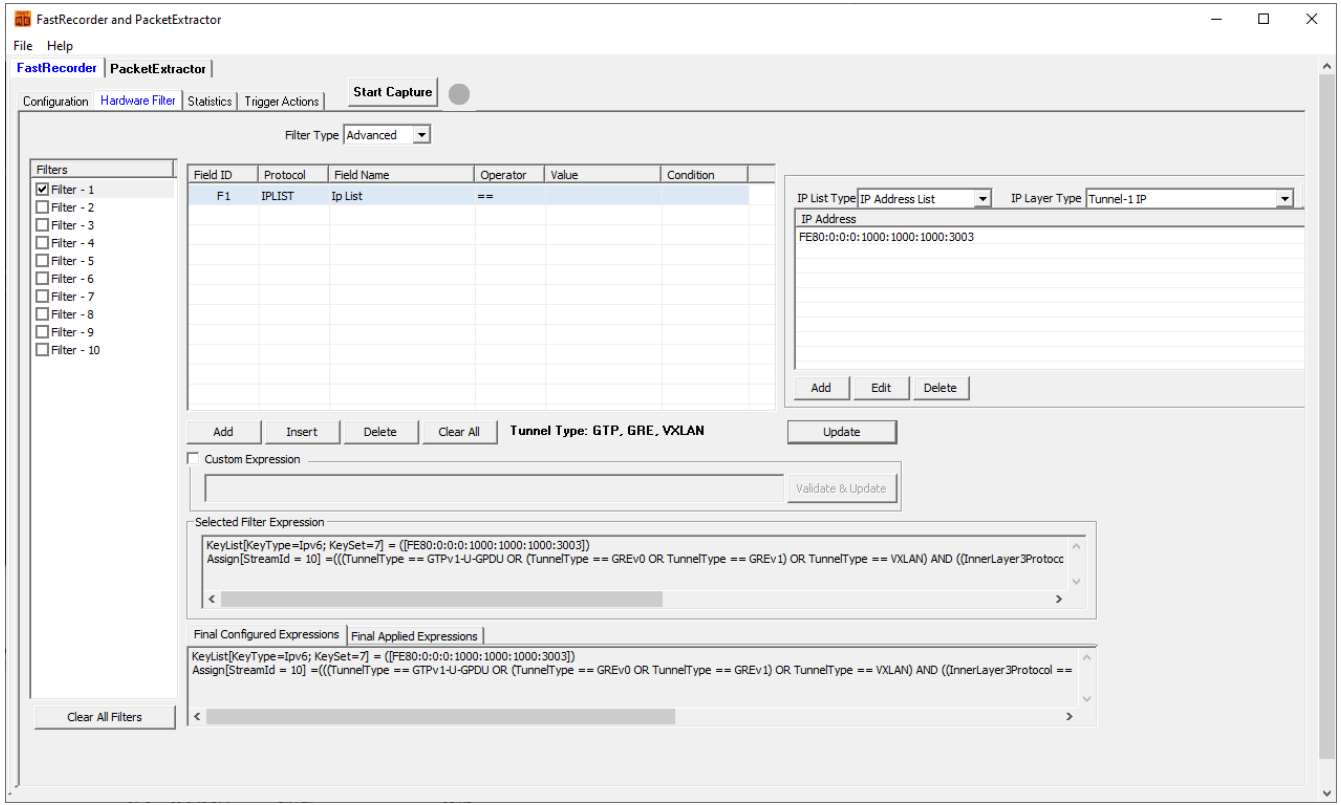
# Hardware Filters

- Hardware filters options are useful to capture traffic based on user interest
- User can select Filter Type as per the test requirements



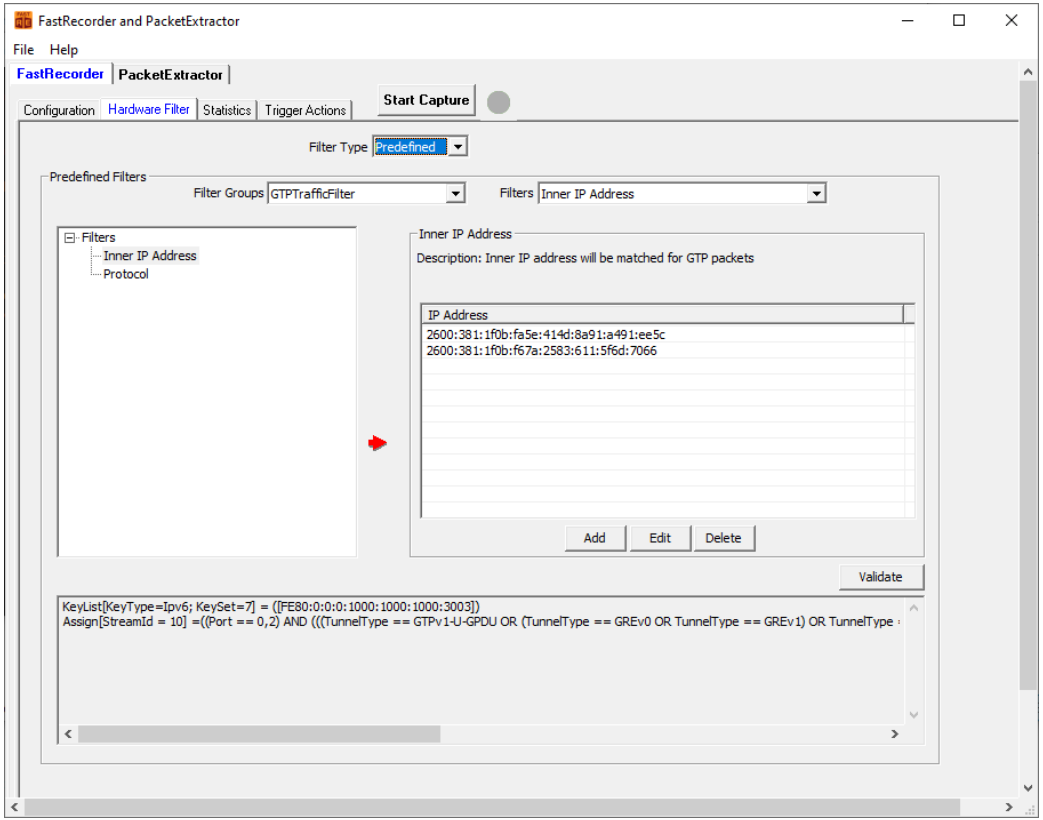
# Advanced Hardware Filter Type

- Up to 10 filters can be defined based on various parameters in the protocol layers
- User can configure the parameters as per test requirements



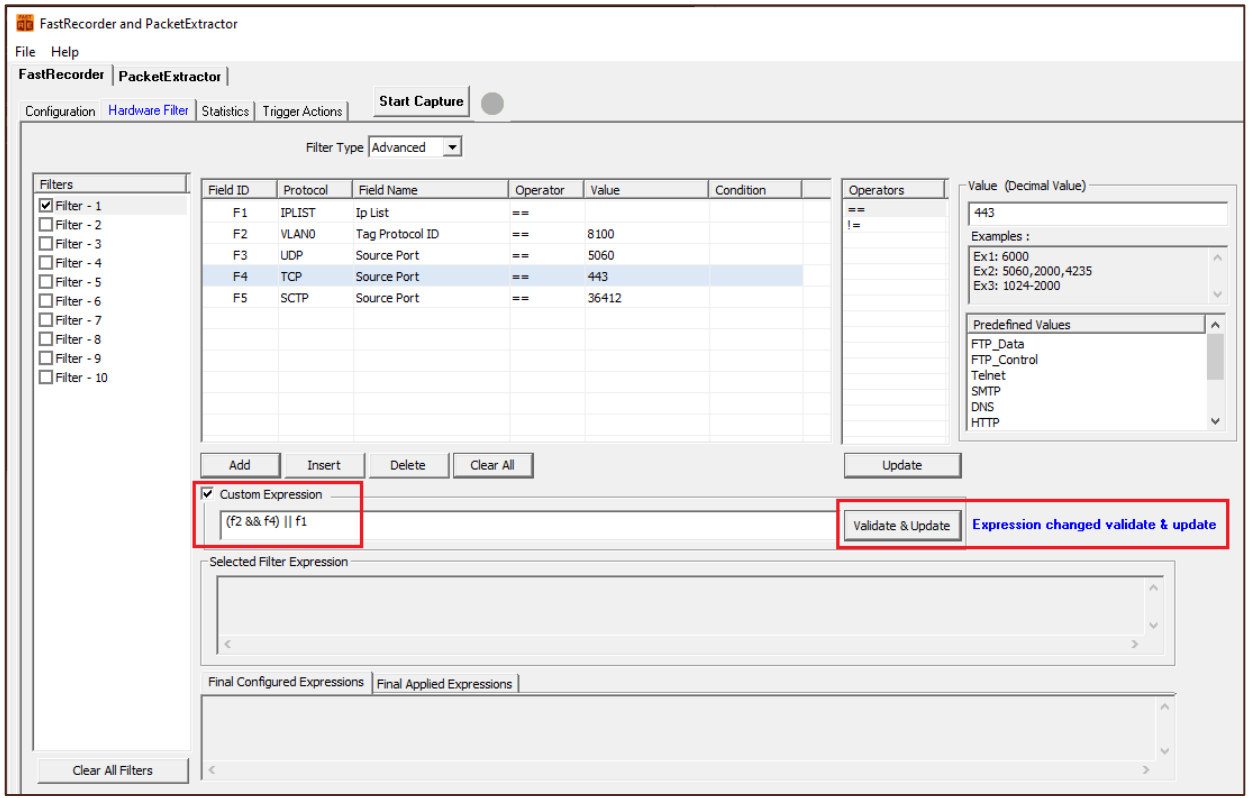
# Predefined Hardware Filter Type

- User can also use **Predefined** hardware filters. These are custom defined filters
- Application provides a framework to create custom filters as per requirements and group them
- By default, it provides configurations for IP addresses and protocol combinations. Wherein user can configure IP address and protocol for the traffic of interest

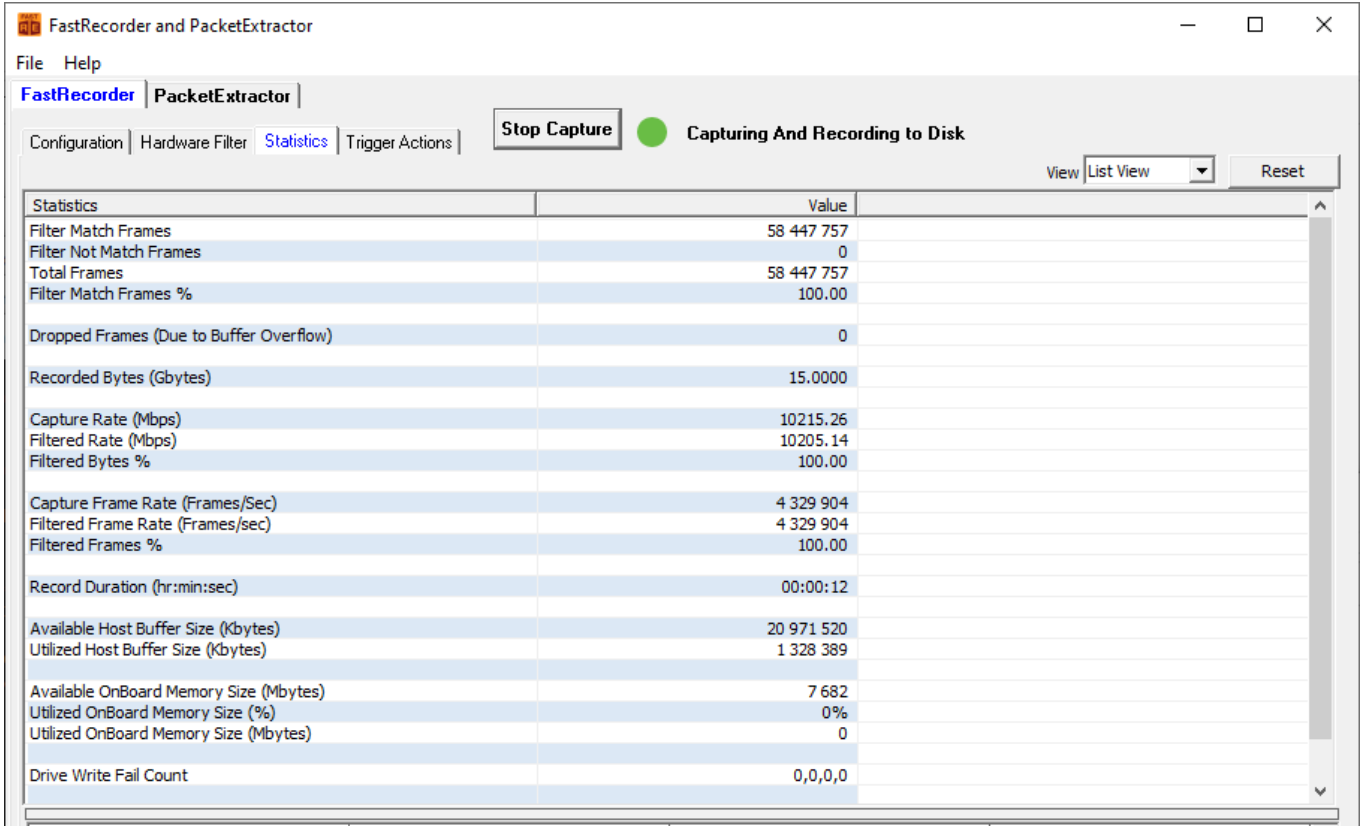


# Custom Expression Filter

- User can create combination of hardware filters using **&&** and **||** operators to get the final expression



# FastRecorder™ Statistics




| Statistics | Value |
|---|---|
| Filter Match Frames | 58 447 757 |
| Filter Not Match Frames | 0 |
| Total Frames | 58 447 757 |
| Filter Match Frames % | 100.00 |
| | |
| Dropped Frames (Due to Buffer Overflow) | 0 |
| | |
| Recorded Bytes (Gbytes) | 15.0000 |
| | |
| Capture Rate (Mbps) | 10215.26 |
| Filtered Rate (Mbps) | 10205.14 |
| Filtered Bytes % | 100.00 |
| | |
| Capture Frame Rate (Frames/Sec) | 4 329 904 |
| Filtered Frame Rate (Frames/sec) | 4 329 904 |
| Filtered Frames % | 100.00 |
| | |
| Record Duration (hr:min:sec) | 00:00:12 |
| | |
| Available Host Buffer Size (Kbytes) | 20 971 520 |
| Utilized Host Buffer Size (Kbytes) | 1 328 389 |
| | |
| Available OnBoard Memory Size (Mbytes) | 7 682 |
| Utilized OnBoard Memory Size (%) | 0% |
| Utilized OnBoard Memory Size (Mbytes) | 0 |
| | |
| Drive Write Fail Count | 0,0,0,0 |

# FastRecorder™ - Per Port and Aggregated Statistics

| Port Statistics | Aggregate | Port-0 (10G) | Port-2 (10G) |
|---|---|---|---|
| Filter Match Frames | 106 071 592 | 9 642 812 | 96 428 780 |
| Filter Not Match Frames | 0 | 0 | 0 |
| Total Frames | 106 071 592 | 9 642 812 | 96 428 780 |
| Filter Match Frames % | 100.00 | 100.00 | 100.00 |
| | | | |
| Dropped Frames (Due To Port Buffer Ov... | 0 | 0 | 0 |
| | | | |
| Capture Rate(Mbps) | - | 937.07 | 9370.22 |
| Filtered Rate (Mbps) | - | 937.07 | 9370.22 |
| | | | |
| Port Link Status | - | Up | Up |
| Port Link Down Count | - | 0 | 0 |
| | | | |
| L1/L2 ERROR Counters:- | | | |
| L2 Drop Events | 0 | 0 | 0 |
| CRC | 0 | 0 | 0 |
| Alignment | 0 | 0 | 0 |
| Code Voilation | 0 | 0 | 0 |
| Fragments | 0 | 0 | 0 |
| Jabbers | 0 | 0 | 0 |
| Collisions | 0 | 0 | 0 |
| | | | |
| FRAME-LENGTH Counters:- | | | |
| 64 Byte | 0 | 0 | 0 |
| 65-127 Byte | 0 | 0 | 0 |
| 128-255 Byte | 114 800 | 10 400 | 104 400 |
| 256-511 Byte | 105 324 842 | 9 574 937 | 95 749 905 |
| 512-1023 Byte | 517 050 | 47 025 | 470 025 |
| 1024-1518 Byte | 114 900 | 10 450 | 104 450 |
| 1519-2047 Byte | 0 | 0 | 0 |
| 2048-4095 Byte | 0 | 0 | 0 |
| 4096-8191 Byte | 0 | 0 | 0 |
| 8192-Max Byte | 0 | 0 | 0 |
| Undersized Frames | 0 | 0 | 0 |
| Oversized Frames | 0 | 0 | 0 |
| | | | |
| VLAN Frames | 0 | 0 | 0 |
| MPLS Frames | 0 | 0 | 0 |
| | | | |
| Temperature(C) | - | 45.0 | 48.8 |
| | | | |
| Stats Error Count | | | |

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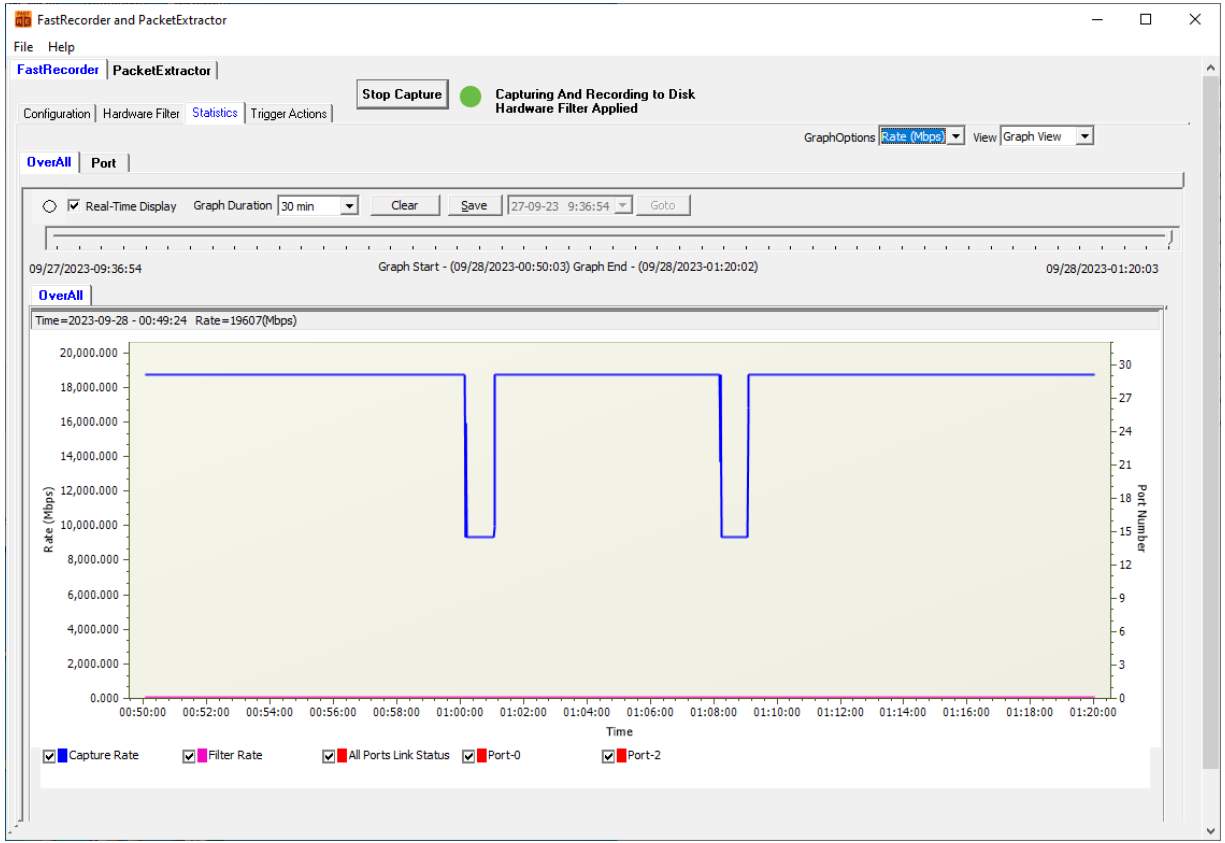
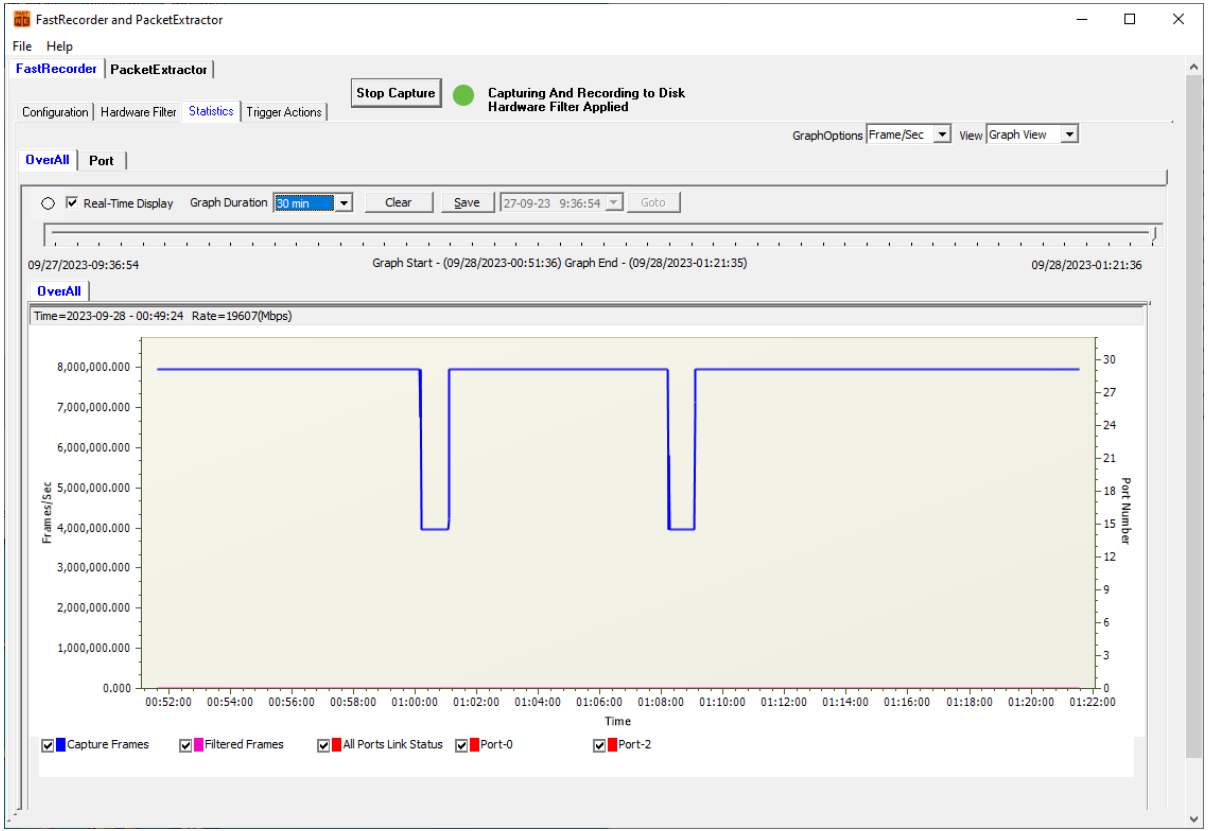
# Real time and Historical Graph

- Real time display of graph (Time v/s Rate), Capture Rate and Filter Rate



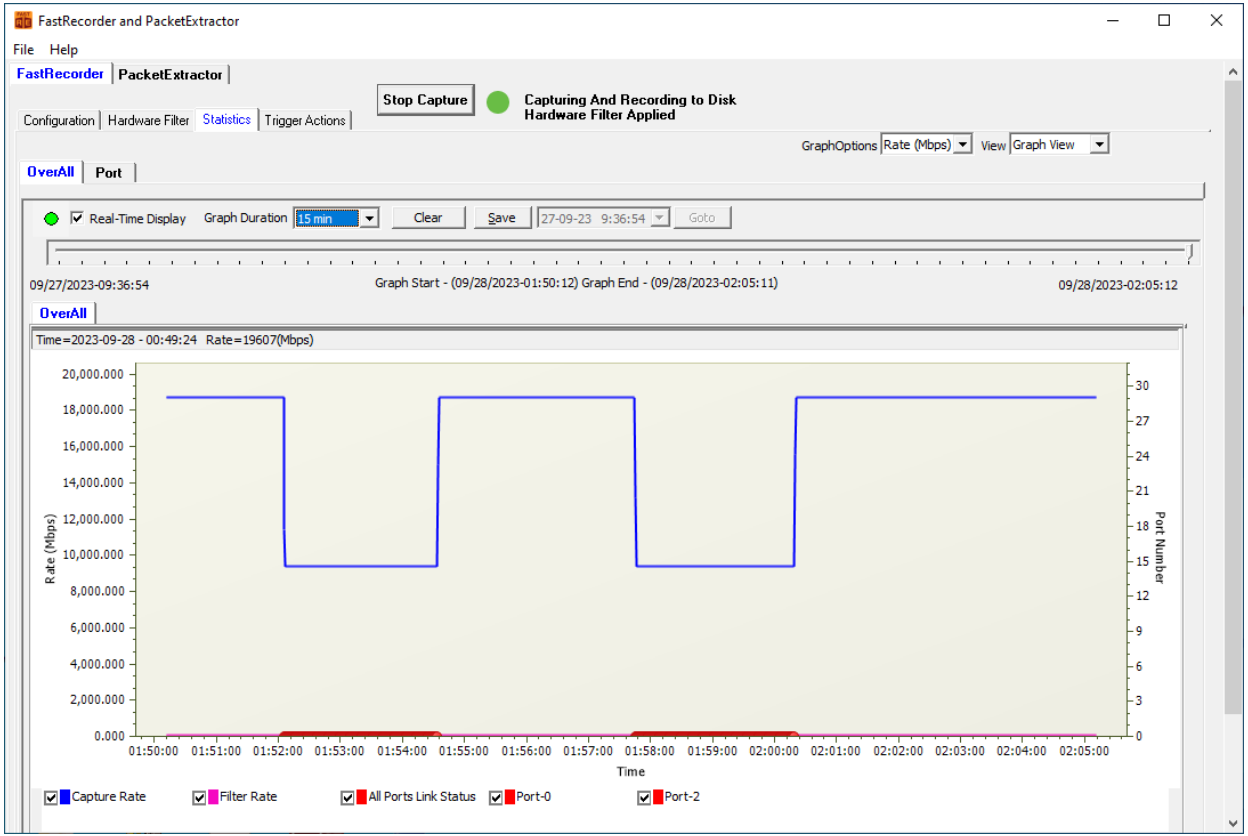
# Realtime and Historical Graph (Contd.)

- Overall capture and frame rate for Frame/Secs



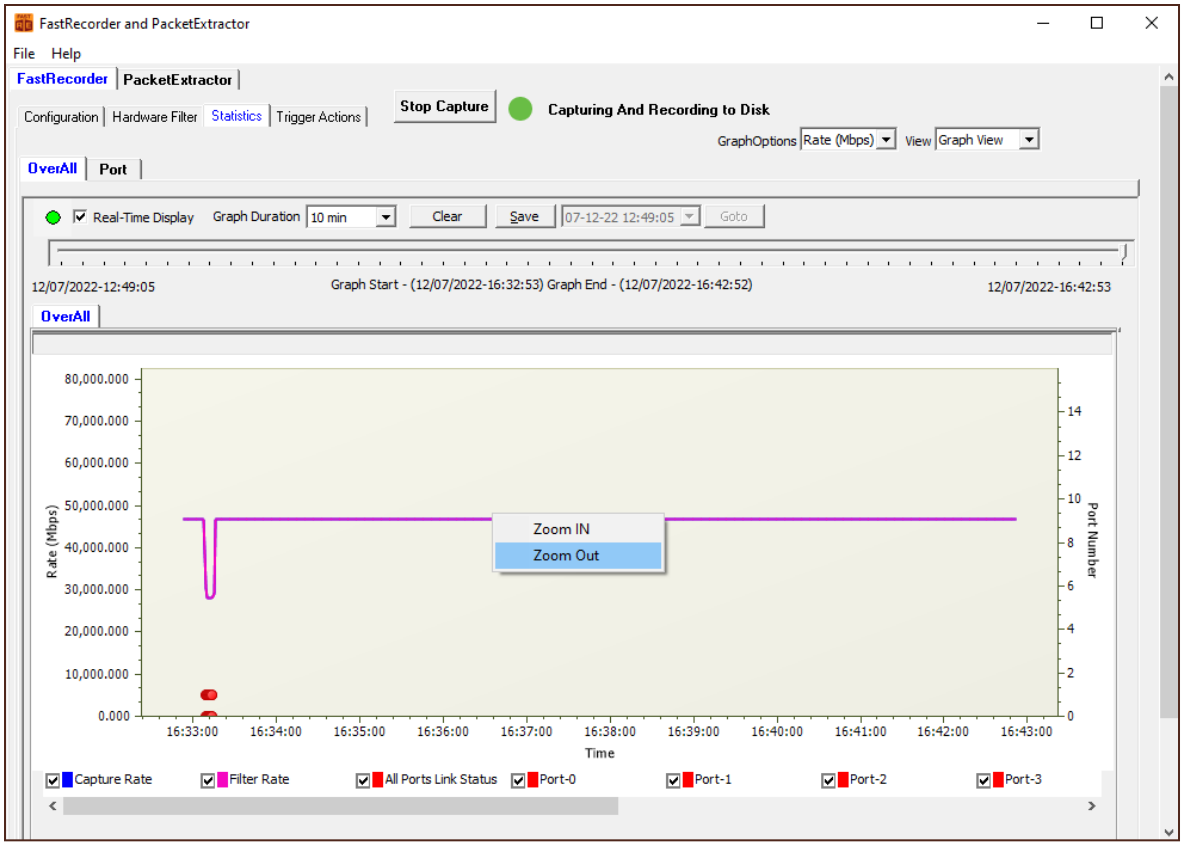
# Graphs - Port Link Down

- Port State is changed to **Red** indicating that the Port is down



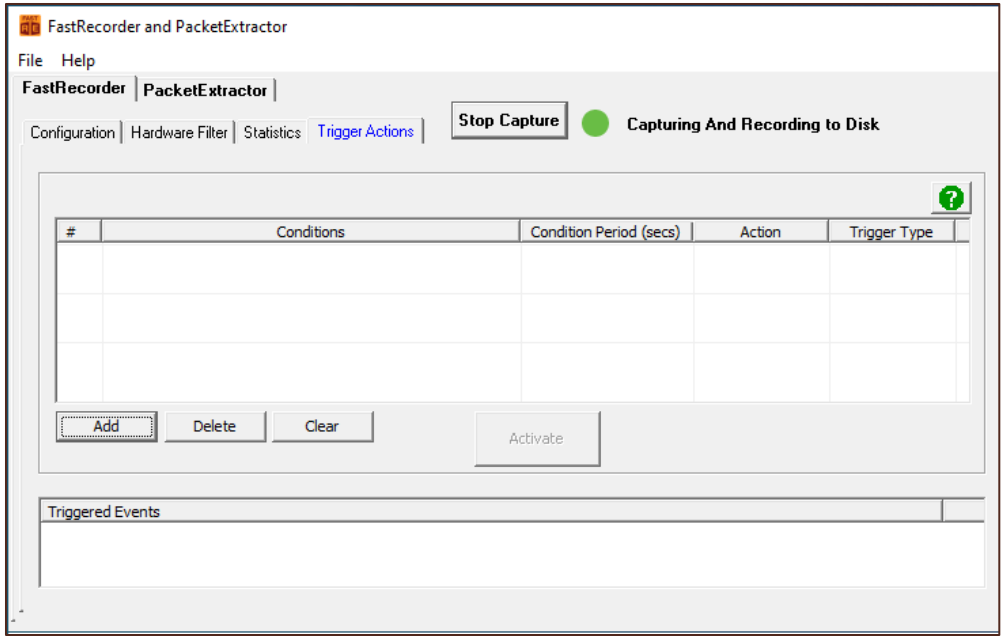
# Graphs - Zoom IN and Zoom Out

- User can click on the required area on the graph and select **Zoom IN** or **Zoom Out** as required



# Trigger based Start/Stop Recording

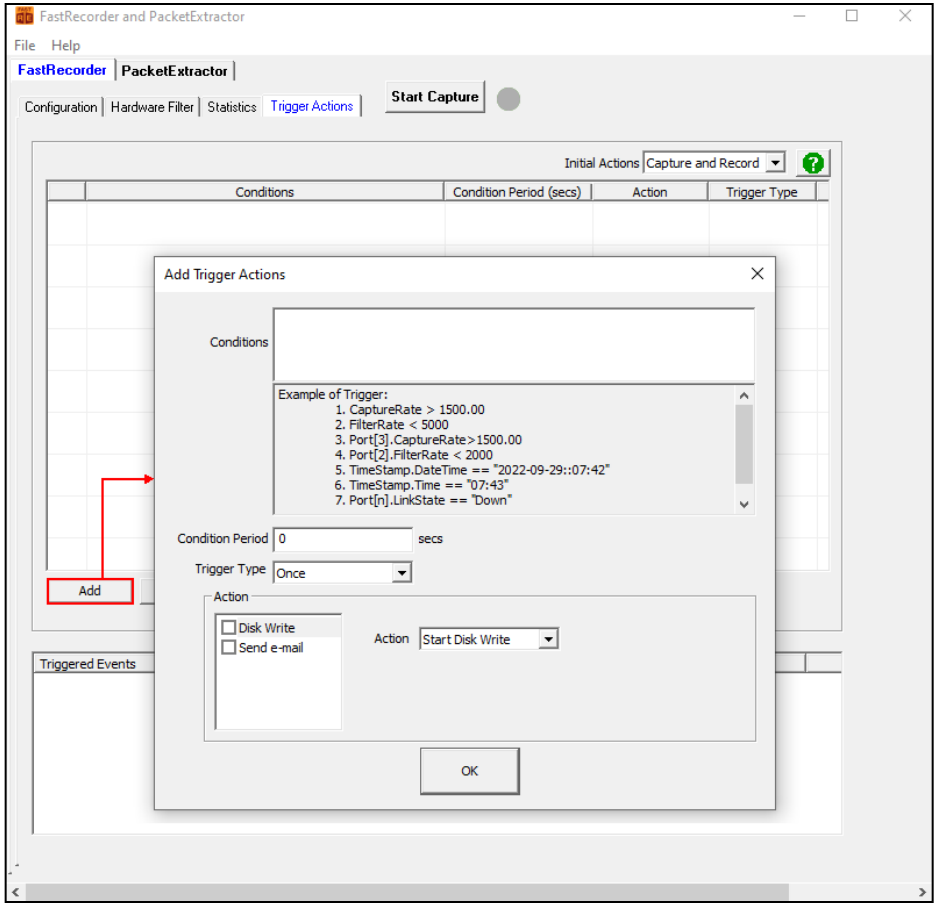
- User can specify the triggers to perform action based on the following conditions
  - CaptureRate (Mbps)
  - FilterRate (Mbps)
  - Port[n].CaptureRate (Mbps)
  - Port[n].FilterRate (Mbps): where n is port number
  - TimeStamp based



# Adding Trigger Actions

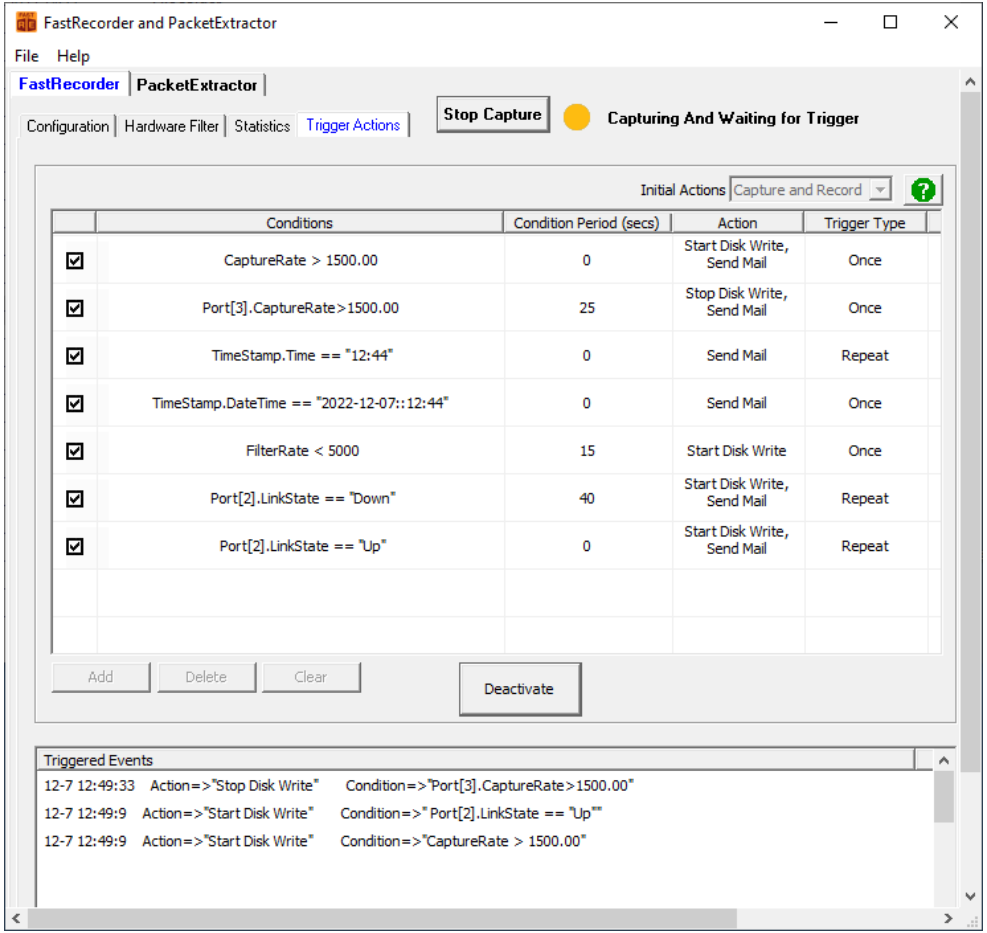
On the **Add Trigger Actions** window,

- Enter the **Conditions**
- Specify the **Condition period** in seconds
- From the Trigger Type drop-down list select **Once** or **Repeat** as required
- Under **Action** option, check **Disk Write** option
- From the Action drop-down list select **Start Disk Write** or **Stop Disk Write** option as required
- Click on **OK**

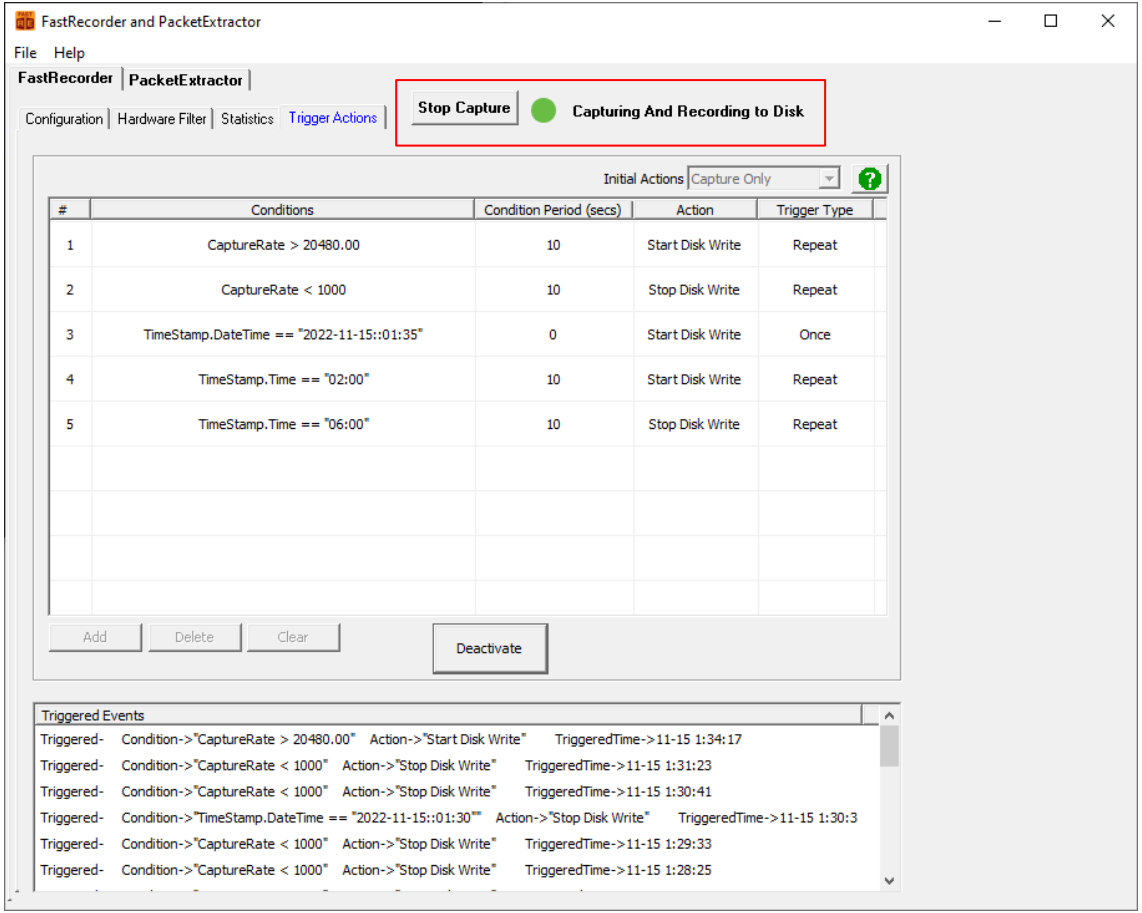


# Activated Trigger Actions

- Once the trigger is successful, the trigger status changes from **Orange** to **Green** color indicating the recording is started



# Activated Trigger Actions (Contd.)

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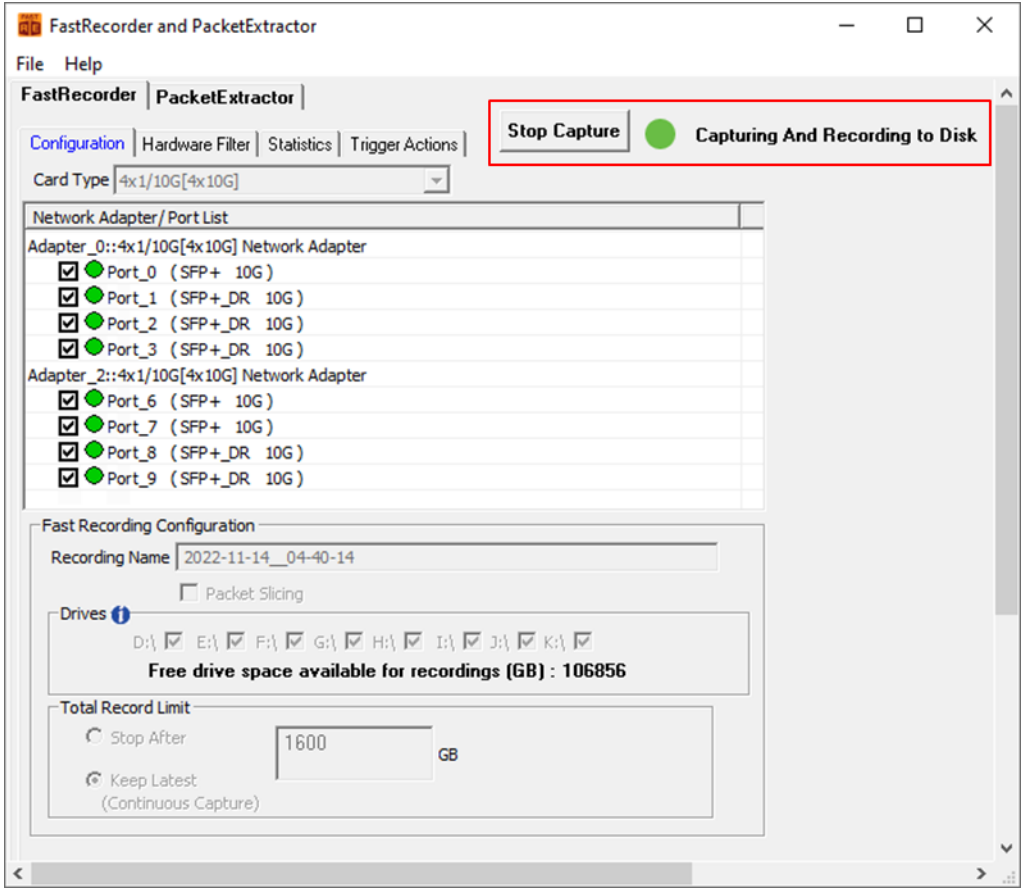
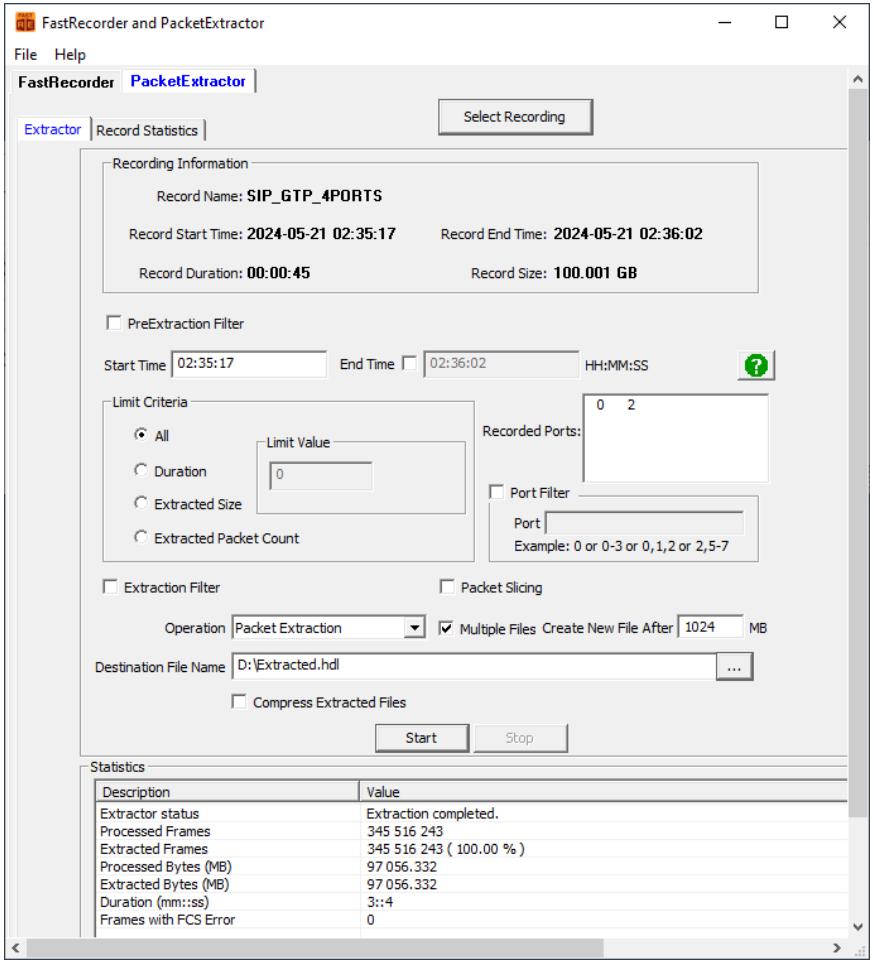
# Recording with Default Name

- User can start the capture without specifying **Recording Name** for which current time is taken as recording name
- Network Adapter - Port List display SFP Types and negotiated rates



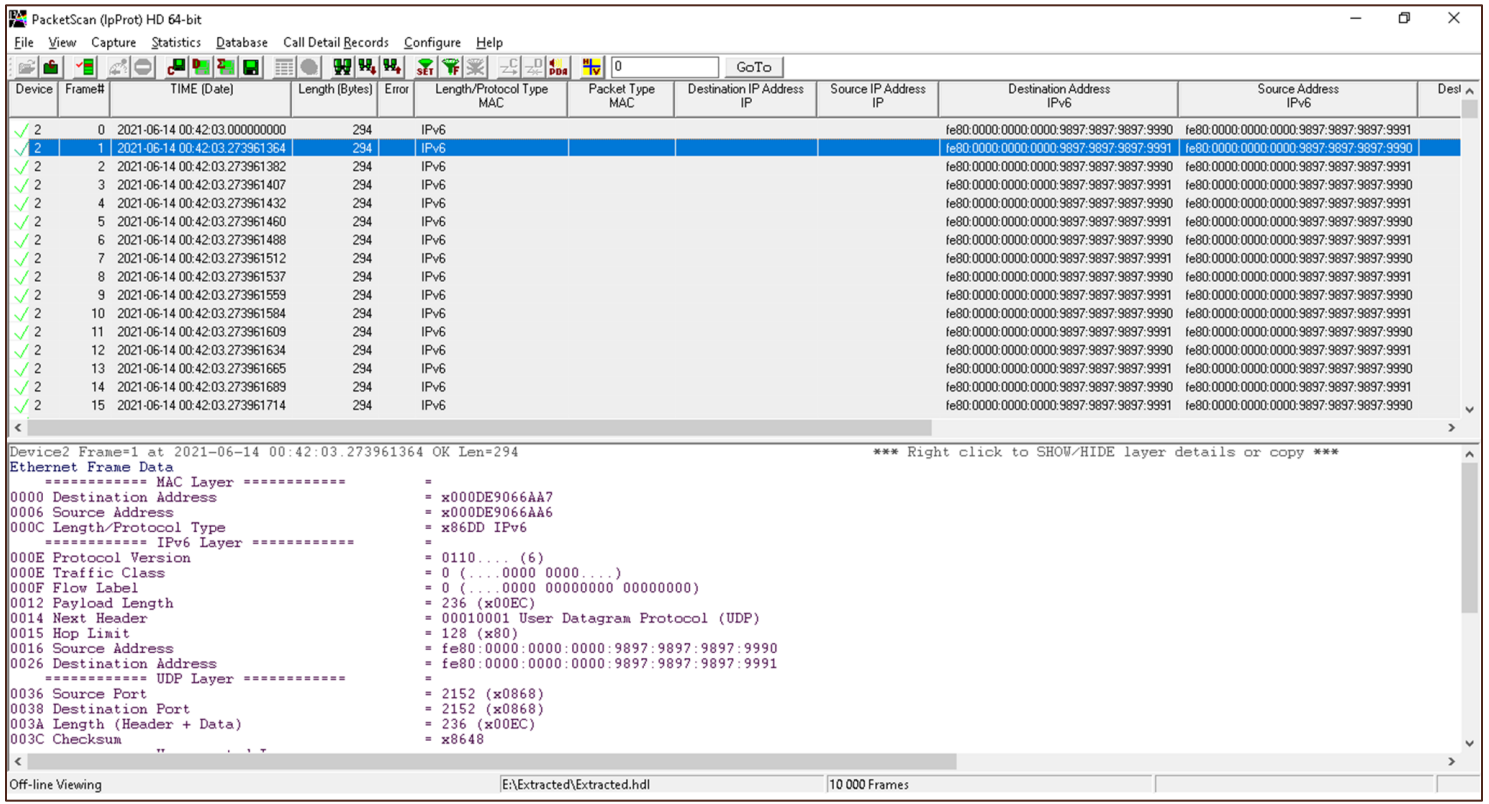
# PacketExtractor™

- PacketExtractor™ configuration settings allows to extract recorded files on the selected HD NIC interface port and required output file format to analyze the results for offline analysis



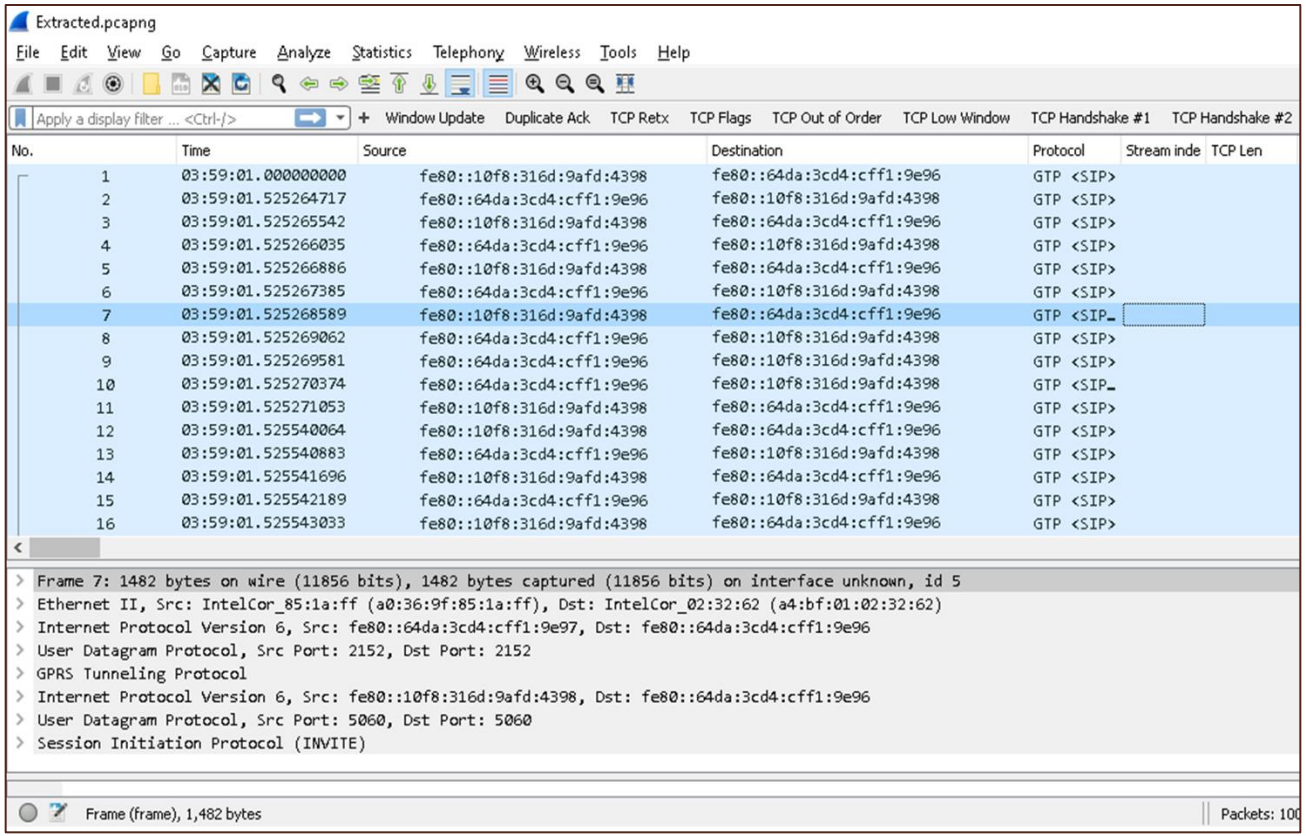
# Analysis of Extracted Traffic using PacketScan™

- The extracted files can be analyzed using **PacketScan™** application (For HDL file format, maximum file size of 10 GB or having less than 75 million frames is supported)

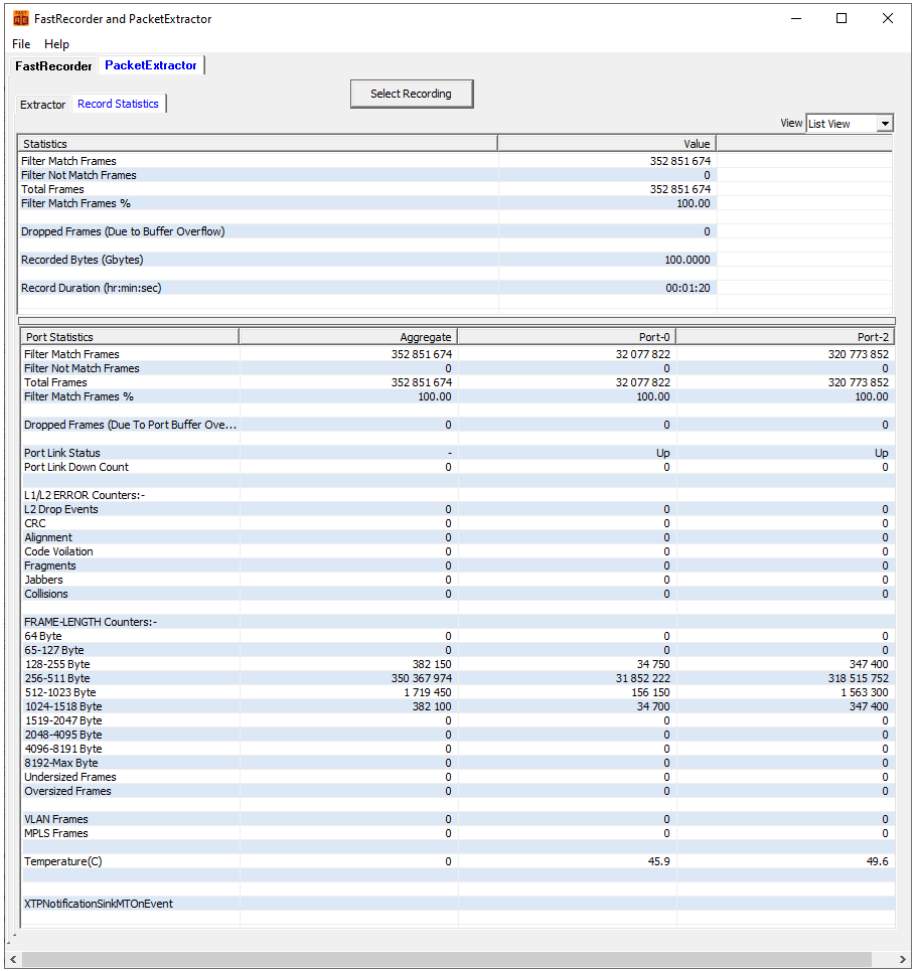


# Analysis of Filtered Traffic in Wireshark®

- The extracted files can be analyzed using Wireshark® application. (For PCAP file format, maximum file size of 5 GB or having less than 53 million frames is supported)



# Recorded Statistics in PacketExtractor™




| Statistics | Value |
|---|---|
| Filter Match Frames | 352 851 674 |
| Filter Not Match Frames | 0 |
| Total Frames | 352 851 674 |
| Filter Match Frames % | 100.00 |
| Dropped Frames (Due to Buffer Overflow) | 0 |
| Recorded Bytes (Gbytes) | 100.0000 |
| Record Duration (hr:min:sec) | 00:01:20 |

| Port Statistics | Aggregate | Port-0 | Port-2 |
|---|---|---|---|
| Filter Match Frames | 352 851 674 | 32 077 822 | 320 773 852 |
| Filter Not Match Frames | 0 | 0 | 0 |
| Total Frames | 352 851 674 | 32 077 822 | 320 773 852 |
| Filter Match Frames % | 100.00 | 100.00 | 100.00 |
| Dropped Frames (Due To Port Buffer Ove... | 0 | 0 | 0 |
| Port Link Status | - | Up | Up |
| Port Link Down Count | 0 | 0 | 0 |
| L1/L2 ERROR Counters:- | | | |
| L2 Drop Events | 0 | 0 | 0 |
| CRC | 0 | 0 | 0 |
| Alignment | 0 | 0 | 0 |
| Code Voilation | 0 | 0 | 0 |
| Fragments | 0 | 0 | 0 |
| Jabbers | 0 | 0 | 0 |
| Collisions | 0 | 0 | 0 |
| FRAME-LENGTH Counters:- | | | |
| 64 Byte | 0 | 0 | 0 |
| 65-127 Byte | 0 | 0 | 0 |
| 128-255 Byte | 382 150 | 34 750 | 347 400 |
| 256-511 Byte | 350 367 974 | 31 852 222 | 318 515 752 |
| 512-1023 Byte | 1 719 450 | 156 150 | 1 563 300 |
| 1024-1518 Byte | 382 100 | 34 700 | 347 400 |
| 1519-2047 Byte | 0 | 0 | 0 |
| 2048-4095 Byte | 0 | 0 | 0 |
| 4096-8191 Byte | 0 | 0 | 0 |
| 8192-Max Byte | 0 | 0 | 0 |
| Undersized Frames | 0 | 0 | 0 |
| Oversized Frames | 0 | 0 | 0 |
| VLAN Frames | 0 | 0 | 0 |
| MPLS Frames | 0 | 0 | 0 |
| Temperature(C) | 0 | 45.9 | 49.6 |
| XTPNotificationSinkMTOnEvent | | | |

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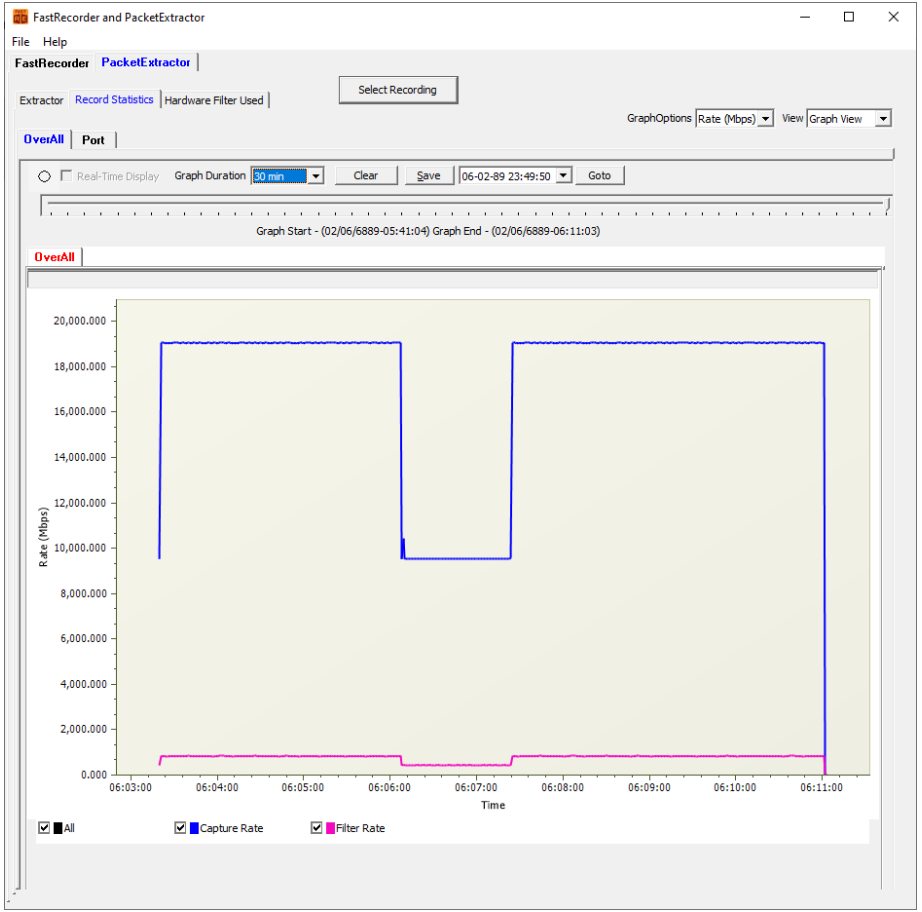
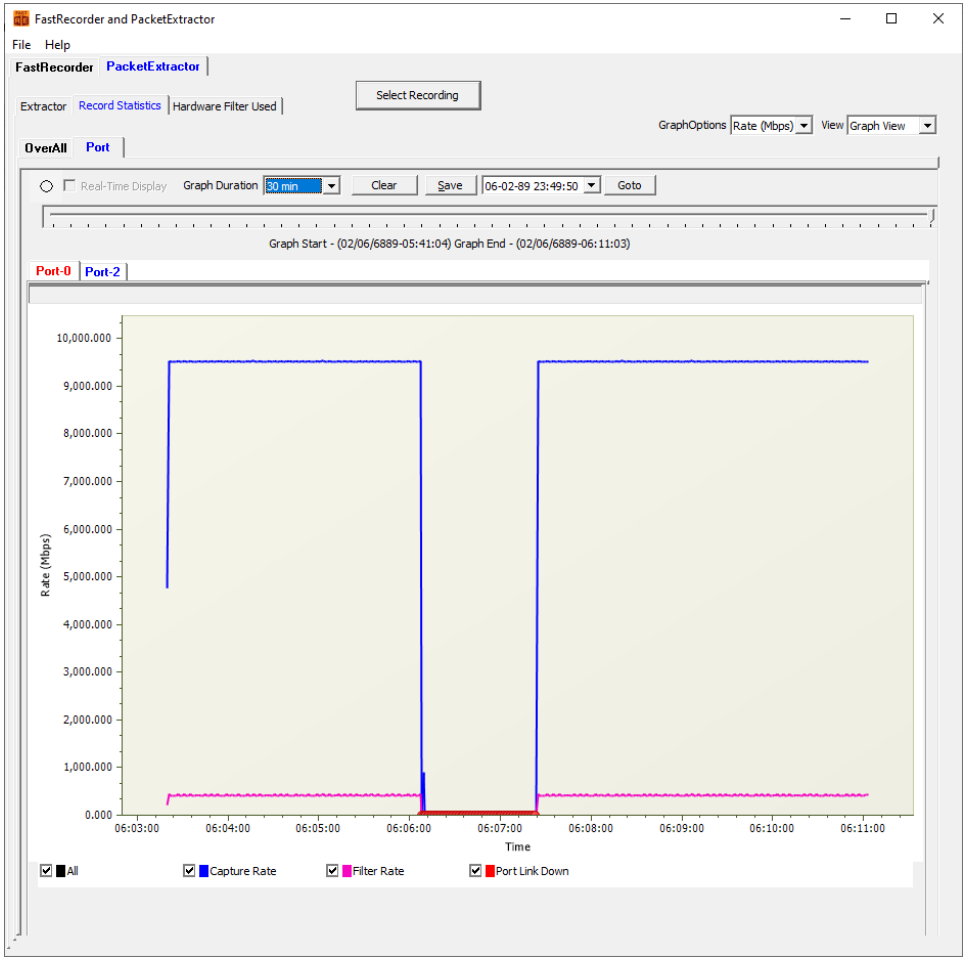
# PacketExtractor™ - Overall Graph View

- User can view the capture rate and filter rate of the recording

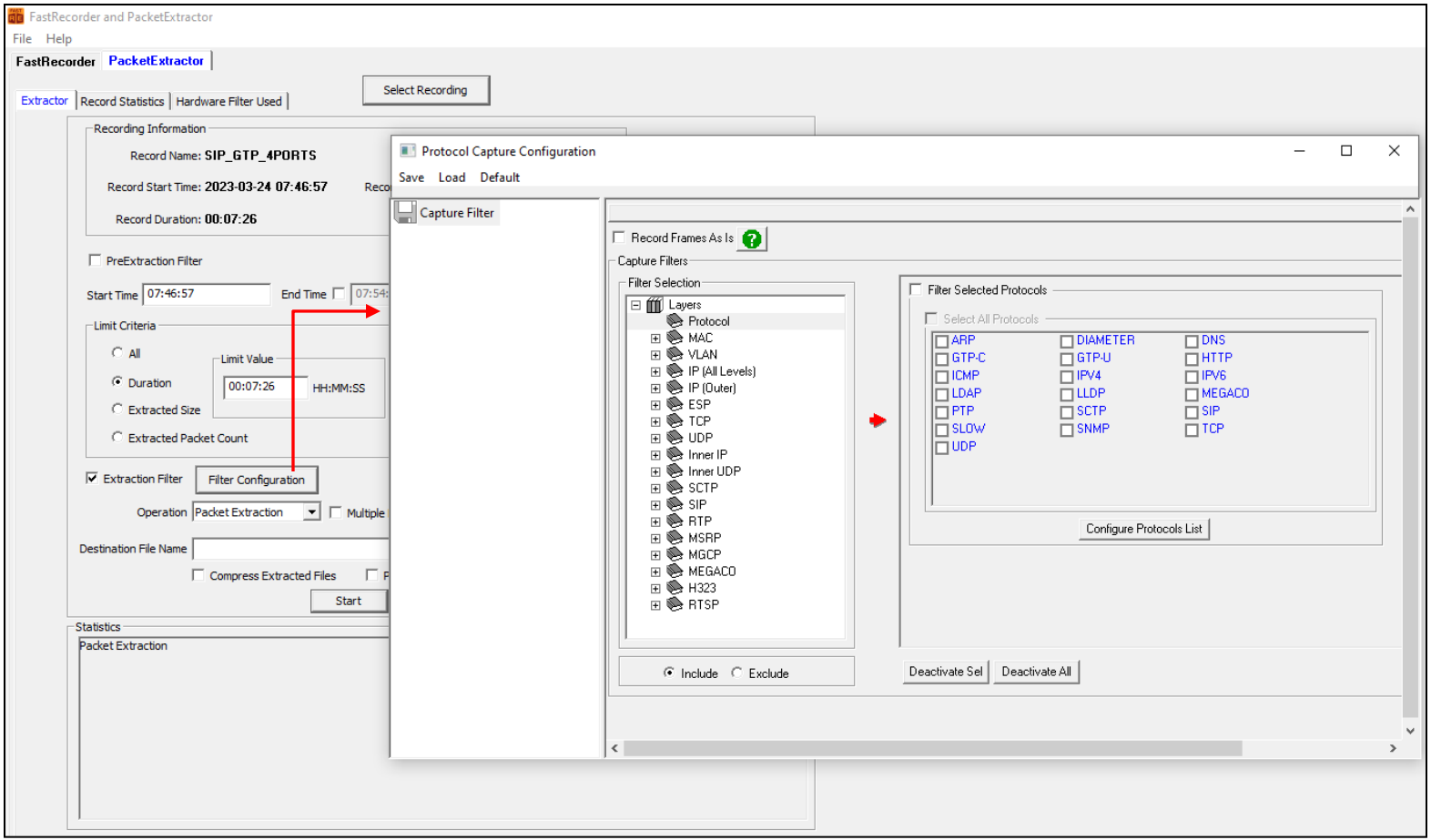


# PacketExtractor™ - Port View

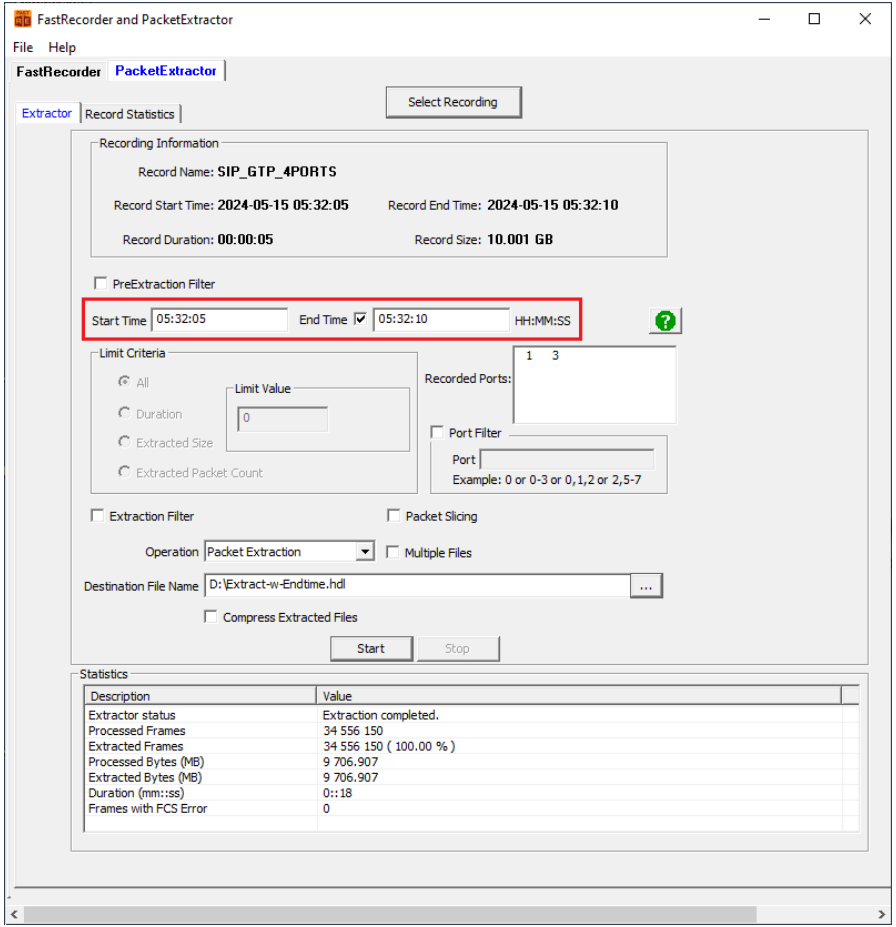
- User can view the per port **capture rate** and **filter rate** of the recorded file



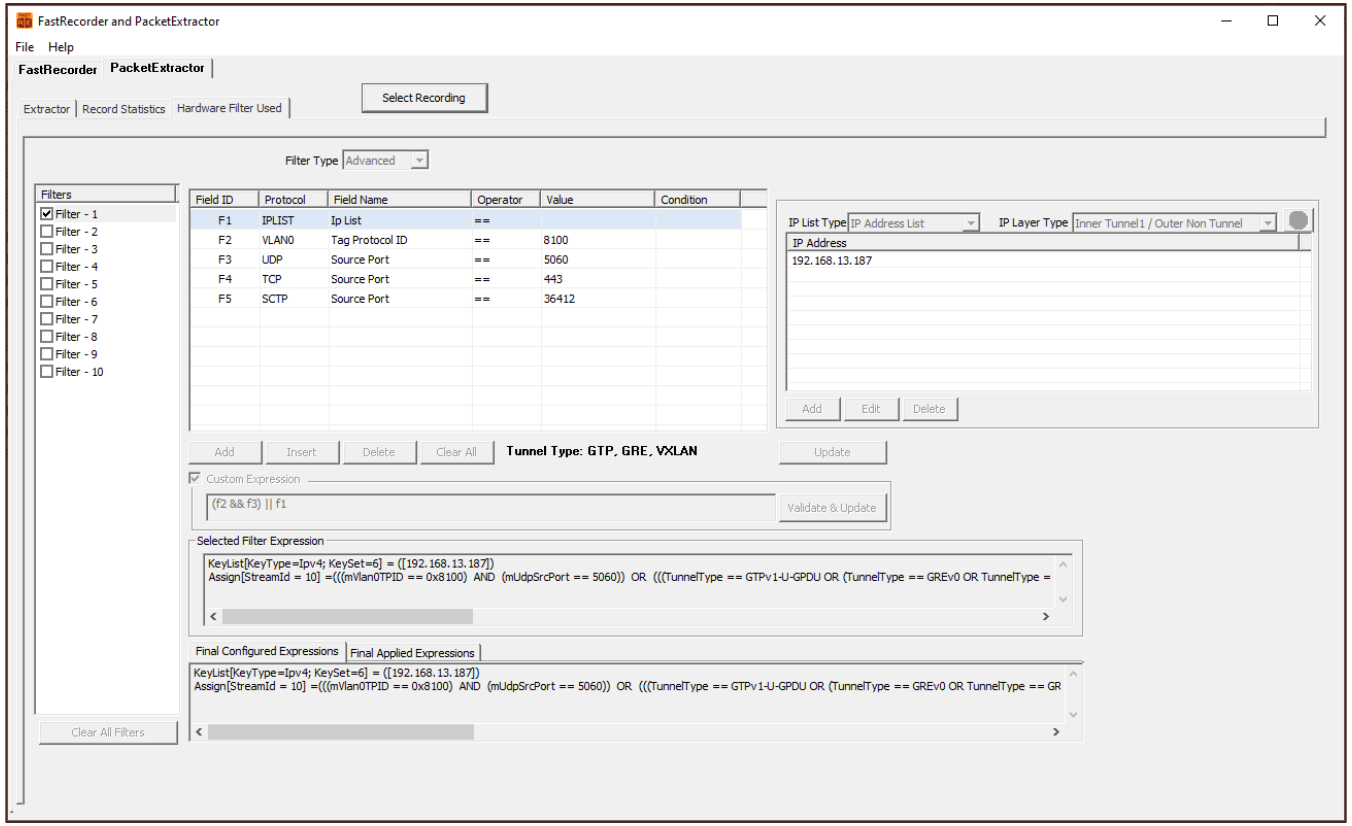
# Packet Extraction from the Recordings with Filter



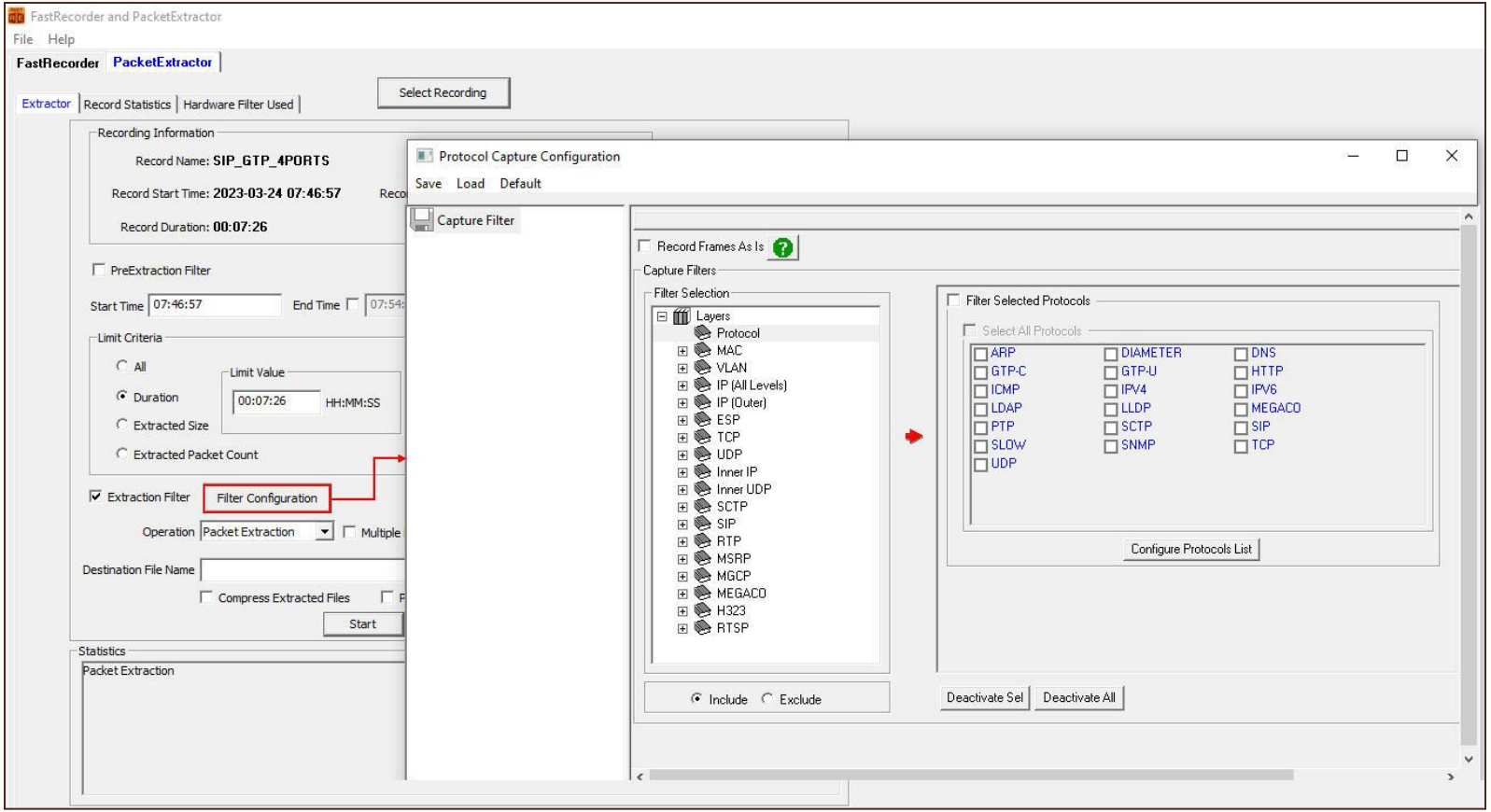
# Specifying End Time for Packet Extraction



# Hardware Filter Used while Recording



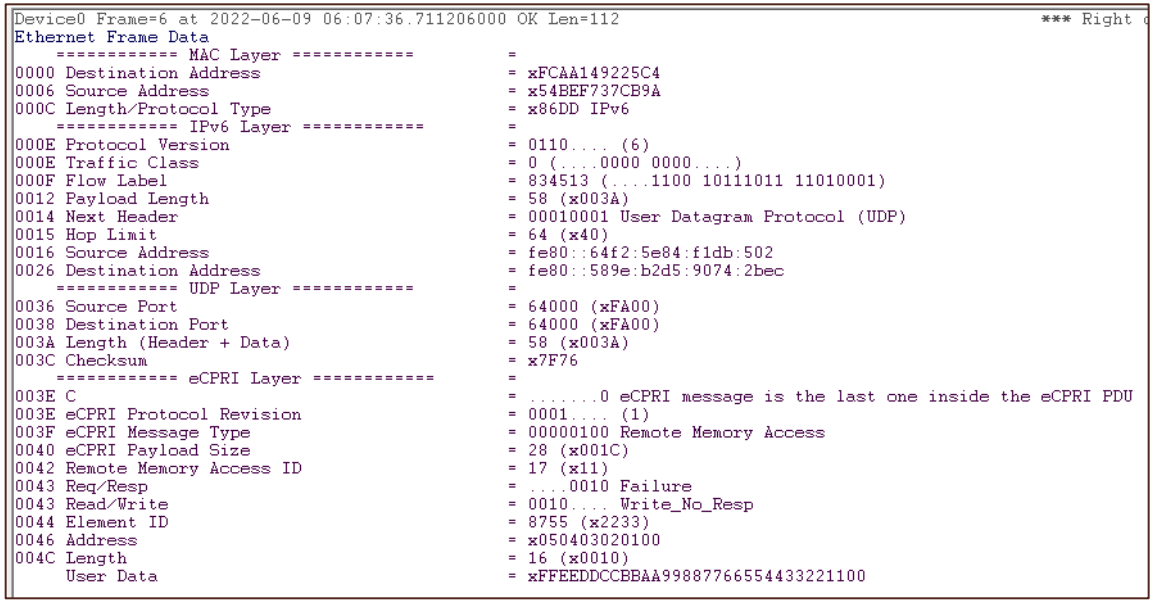
# eCPRI Analysis



# View eCPRI Layer Decode Details in PacketScan™

## Over UDP

- From the desktop, invoke **PacketScan™** analyzer
- Goto **File** → **Offline**, browse and select any one of the extracted ***.hdl** file from the **D:\Exracted** folder. Click on **Open**
- Observe the **eCPRI** layer decode details as shown



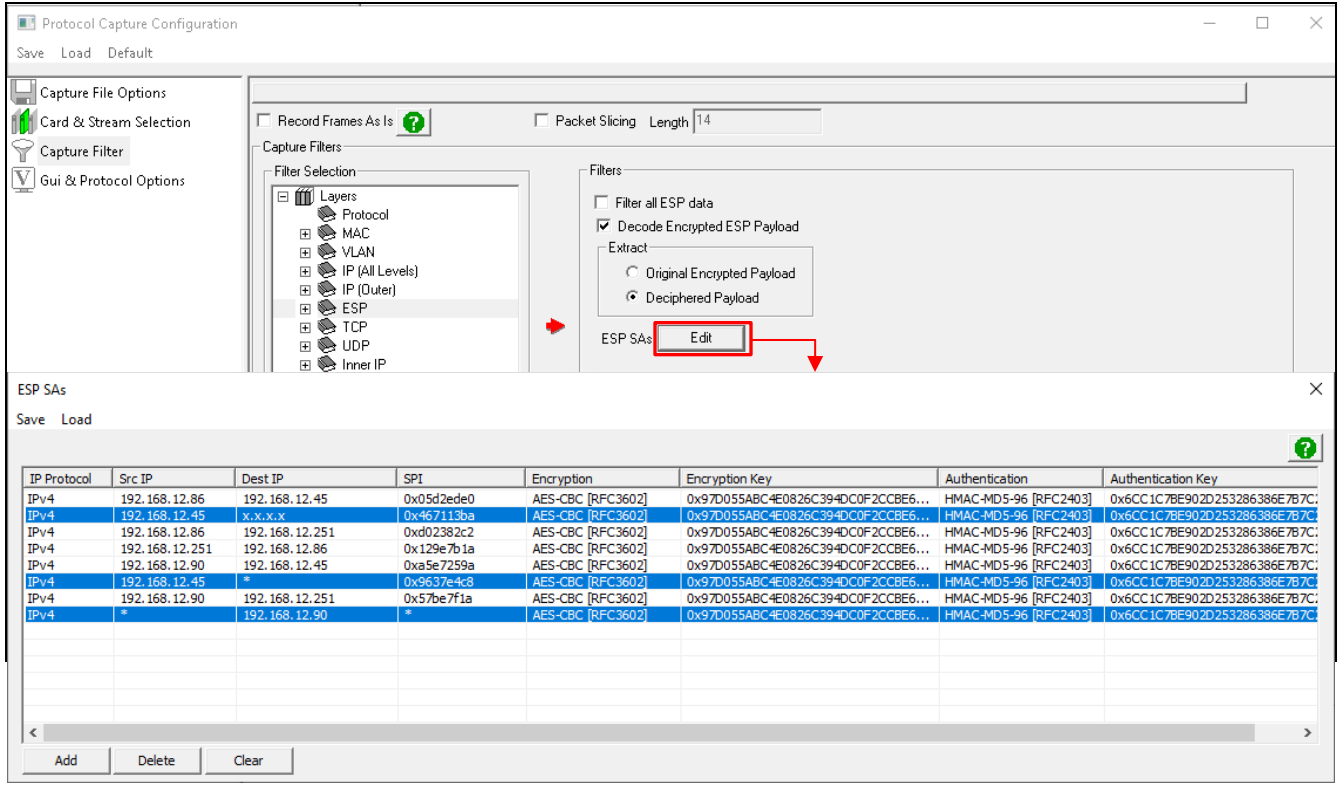
# View eCPRI Layer Decode Details in PacketScan™ (Contd.)

## Over MAC

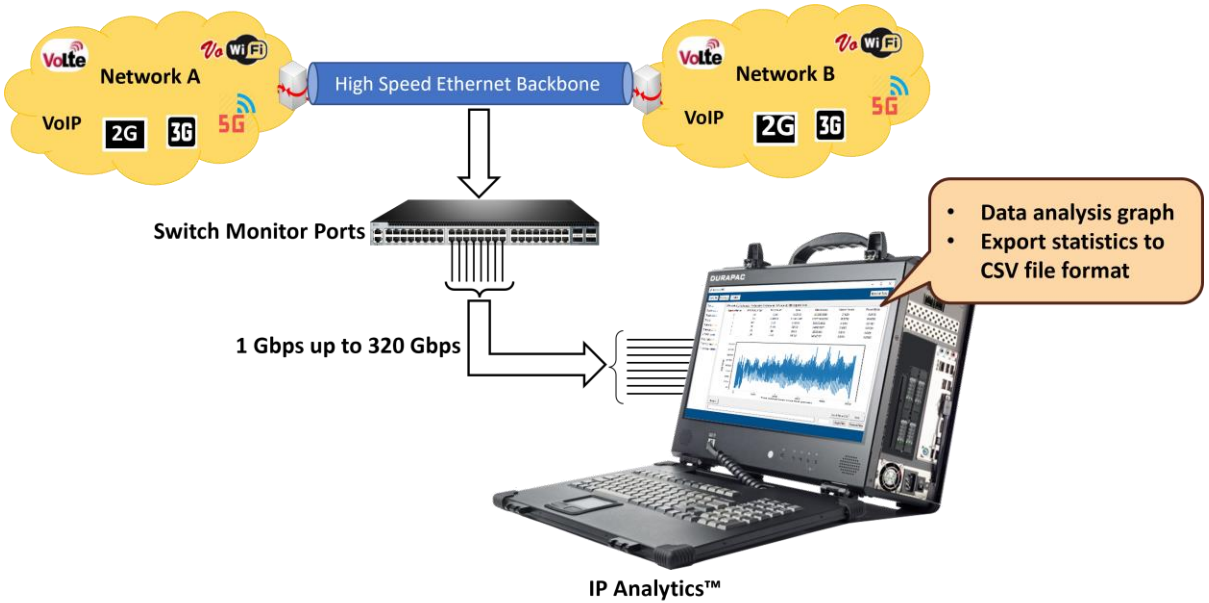
```
Device0 Frame=0 at 2019-02-13 11:36:46.000000000 OK Len=64                    *** Right
Ethernet Frame Data
     ============ MAC Layer ============          =
0000 Destination Address                          = x008016000000
0006 Source Address                               = x008016884EFF
000C Length/Protocol Type                         = xAEFE eCPRI
     ============ eCPRI Layer ============        =
000E C                                            = .......0 eCPRI message is the last one inside the eCPRI PDU
000E eCPRI Protocol Revision                      = 0001.... (1)
000F eCPRI Message Type                           = 00000000 IQ Data
0010 eCPRI Payload Size                           = 20 (x0014)
     eCPRI Payload                                = x123487650F0E0D0C0B0A09080706050403020100
     ============ O-RAN Fronthaul CUS Layer ============ =
     ecpriPcid                                    =
0012  BandSector_ID                               = ..010010 (18)
0012  DU_Port_ID                                  = 00...... (0)
0013  RU_Port_ID                                  = ....0100 (4)
0013  CC_ID                                       = 0011.... (3)
     ecpriSeqid                                   =
0014  Sequence ID                                 = 135 (x87)
0015  Subsequence ID                              = .1100101 (101)
0015  E bit                                       = 0....... More fragments follow
0016 FilterIndex                                  = ....1111 Reserved
0016 payloadVersion                               = .000.... (0)
0016 dataDirection                                = 0....... UpLink
0017 frameId                                      = 14 (x0E)
0018 subframeId                                   = 0000.... (0)
0018 slotId                                       = 52 (....1101 00......)
0019 startSymbolid                                = ..001100 (12)
001A sectionId                                    = 176 (00001011 0000....)
001B symInc                                       = .....0.. use the current symbol number
001B rb                                           = ....1... every other RB used
001B startPrbu                                    = 521 (......10 00001001)
001D numPrbu                                      = 8 (x08)
     udCompHdr                                    =
001E  udCompMeth                                  = ....0111 Reserved
001E  udIqWidth                                   = 0000.... I and Q are each 16 bit wide
      Dump                                        = x050403020100
```

# Encapsulated Security Payload (ESP) Deciphering

- Supports Encapsulating Security Payload (ESP) to decrypt ESP packets on both IPv4 and IPv6 by providing ESP SAs value



# IP Analytics™

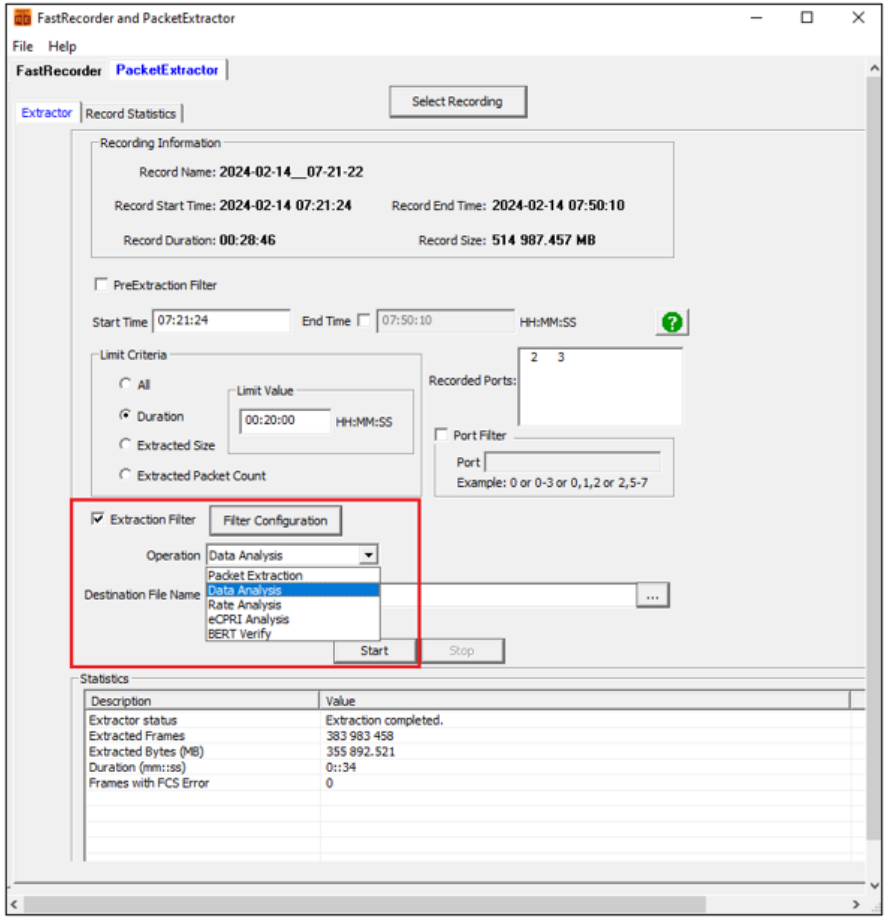



- IP Analytics™ (Optional with FastRecorder™ and PacketExtractor™) serves as a critical tool for meticulous monitoring and optimization
- It involves scrutinizing data flows to uphold the integrity of voice, video, and data services, ensuring adherence to predefined performance benchmarks
- Through continuous evaluation of metrics such as Quality of Service and packet loss, network operators can fine-tune their infrastructure, guaranteeing an unparalleled user experience

# Data Analysis

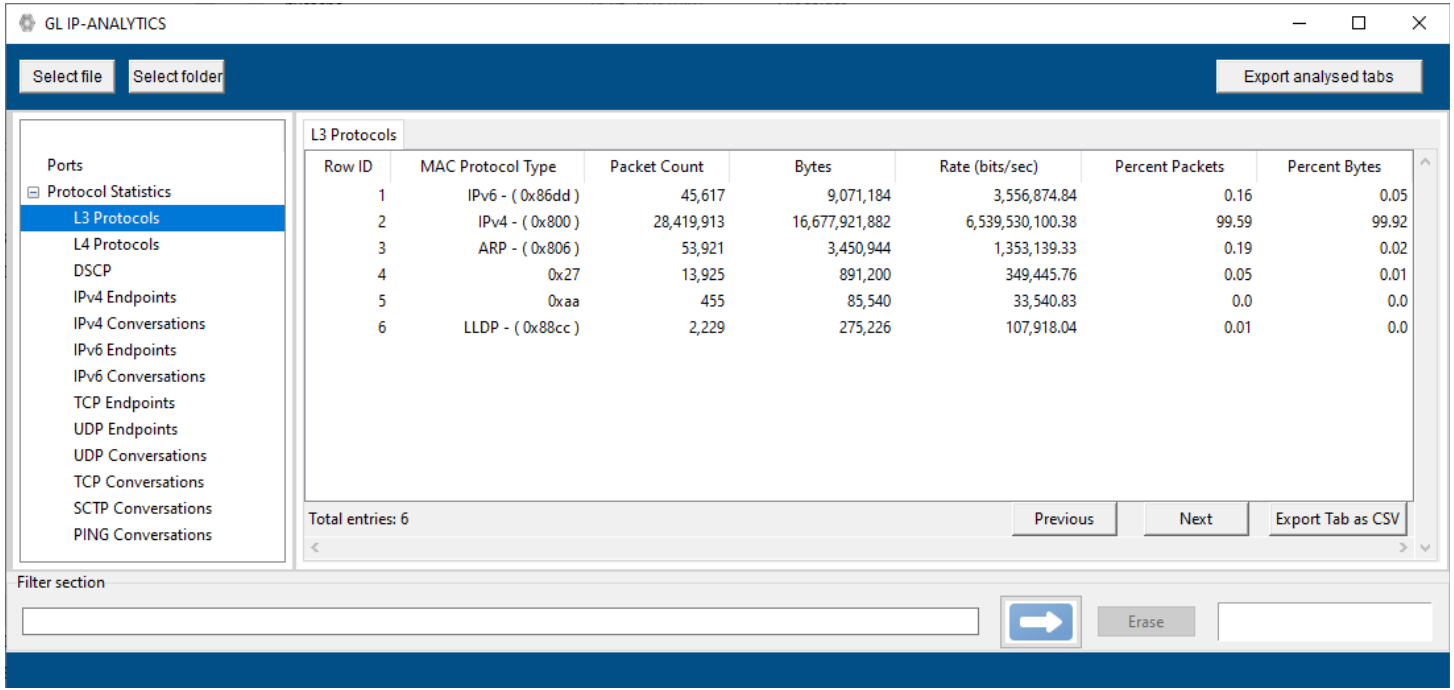
# Selecting Data Analysis Option

- Users can perform **Data Analysis** using the PacketExtractor™ application

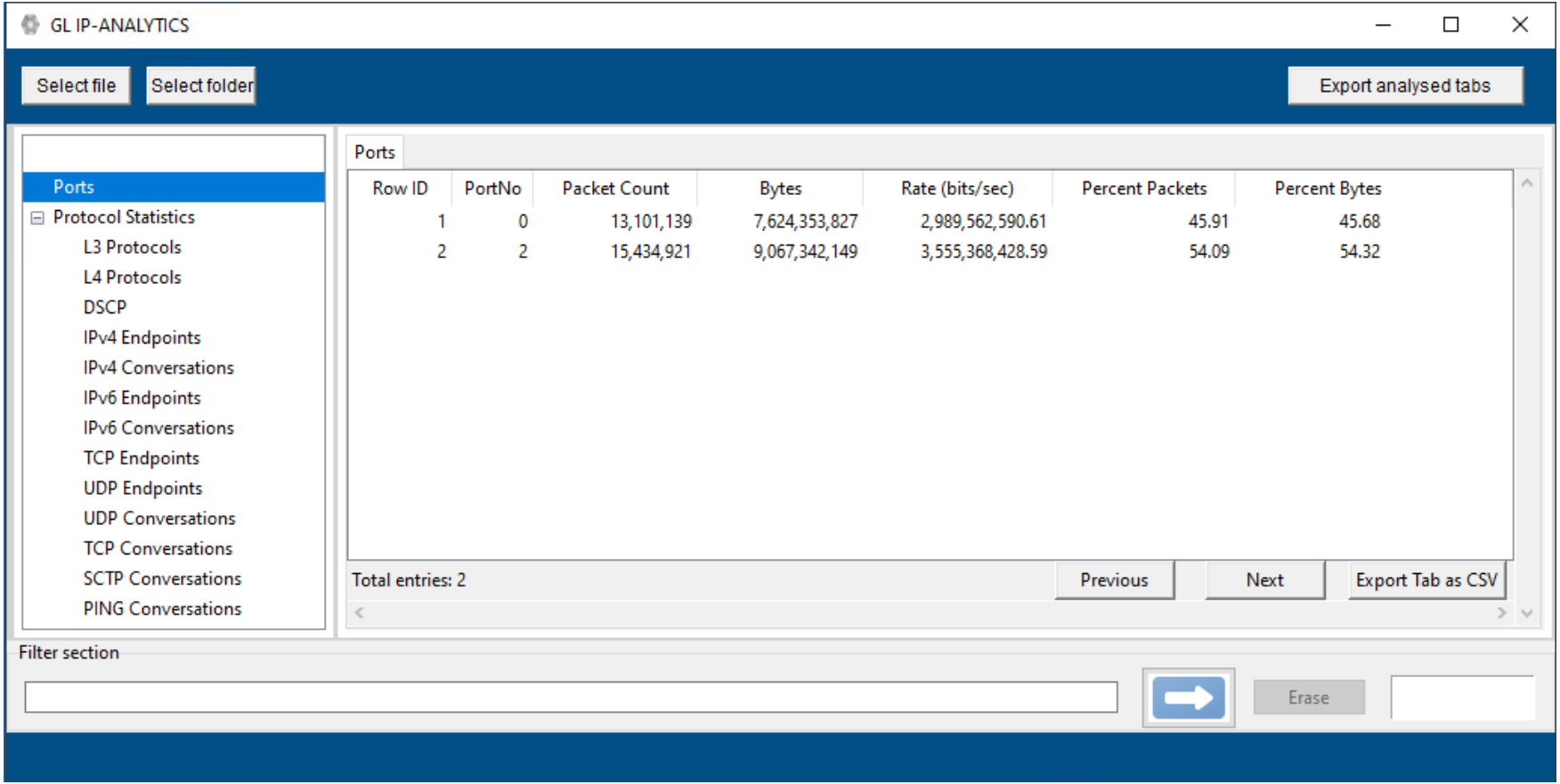


# GL IP Analytics™ Tool

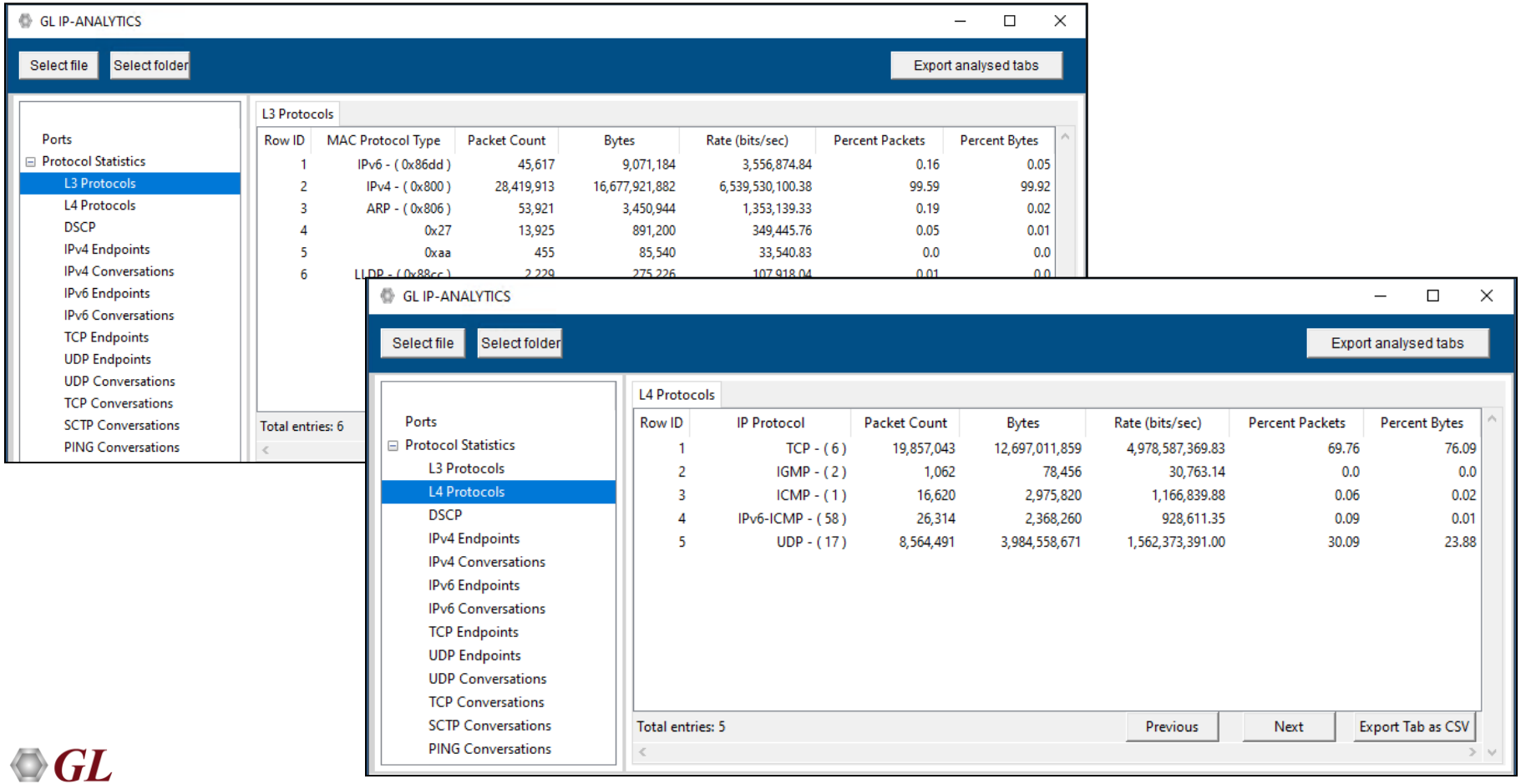
- Executing **Python scripts** will invoke the **GL IP Analytics™** window to perform data analysis
- This analysis will display Ports, L3 Protocols, L4 Protocols, DSCP, IPv4 Endpoints, IPv4 Conversations, IPv6 Endpoints, IPv6 Conversations, TCP Endpoints, UDP Endpoints, UDP Conversations, TCP Conversations, SCTP Conversations, and Ping Conversations statistics



# Port Statistics



# Outer Protocol Statistics – L3 and L4

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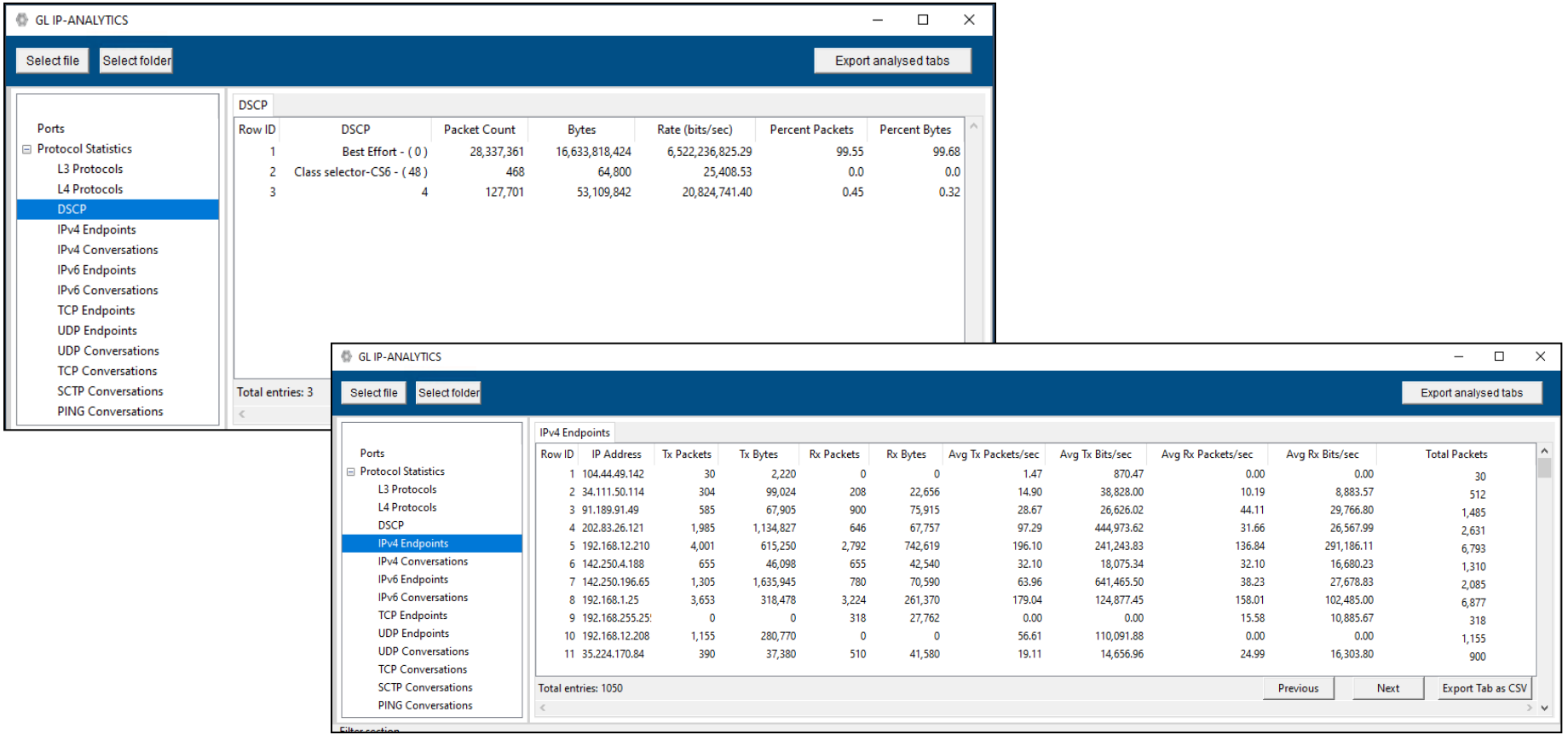
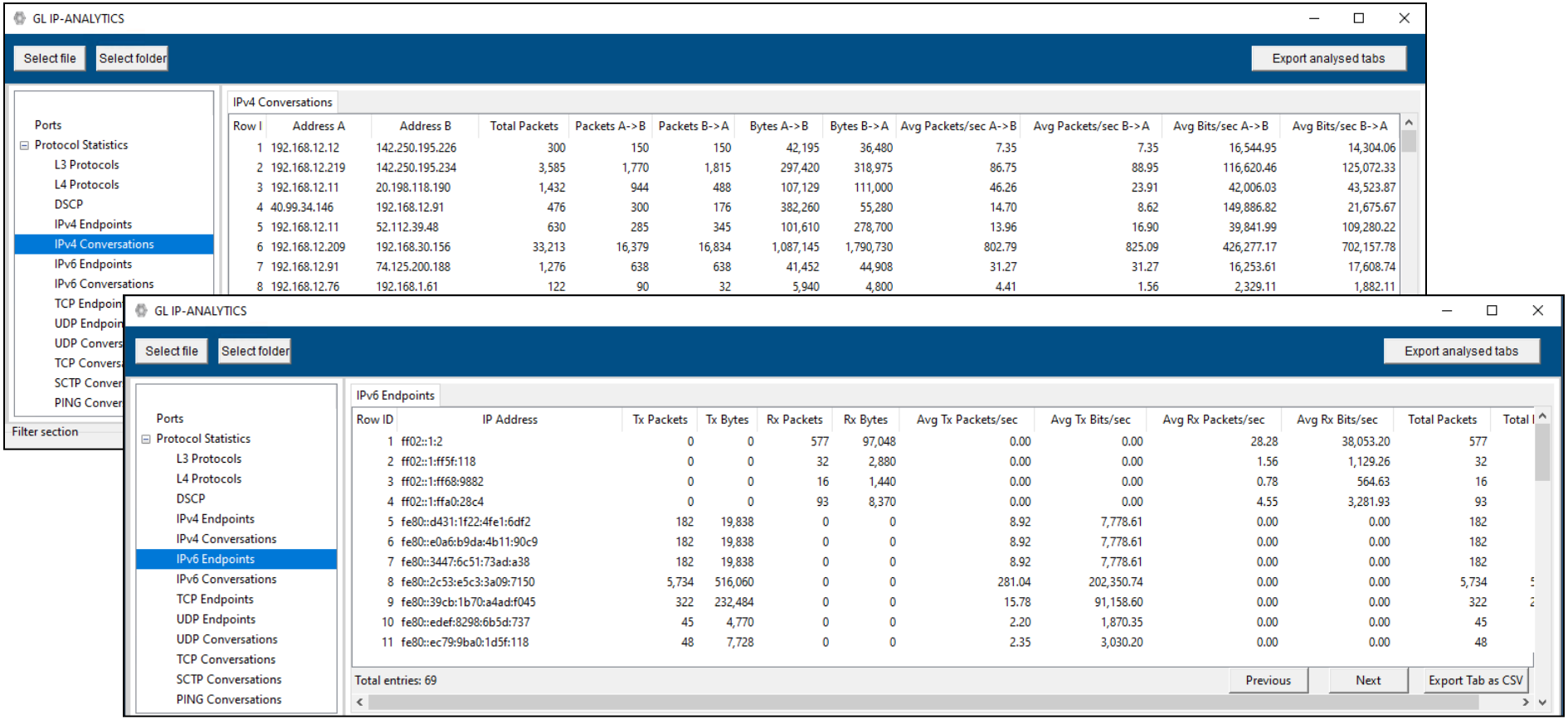
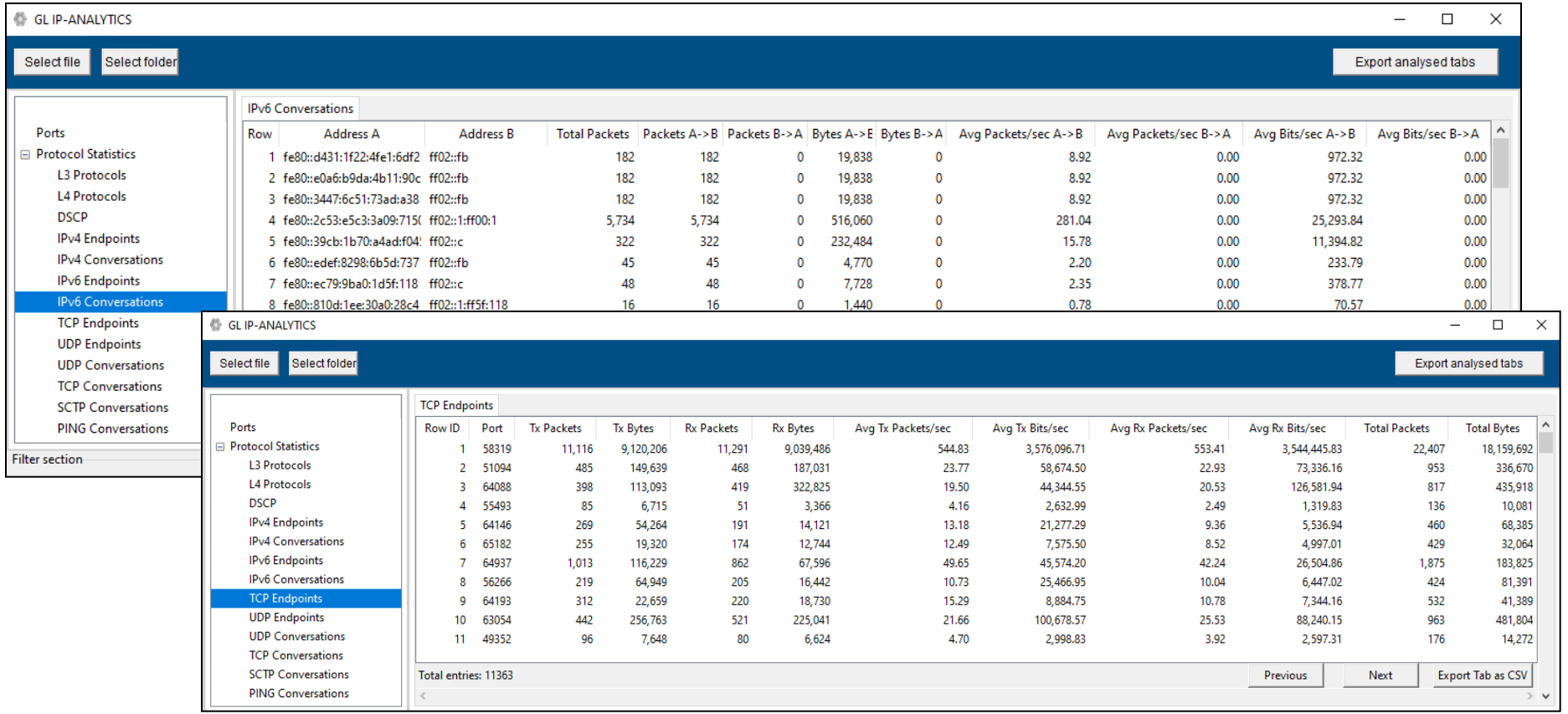
# Outer Protocol Statistics – DSCP and IPv4 Endpoints



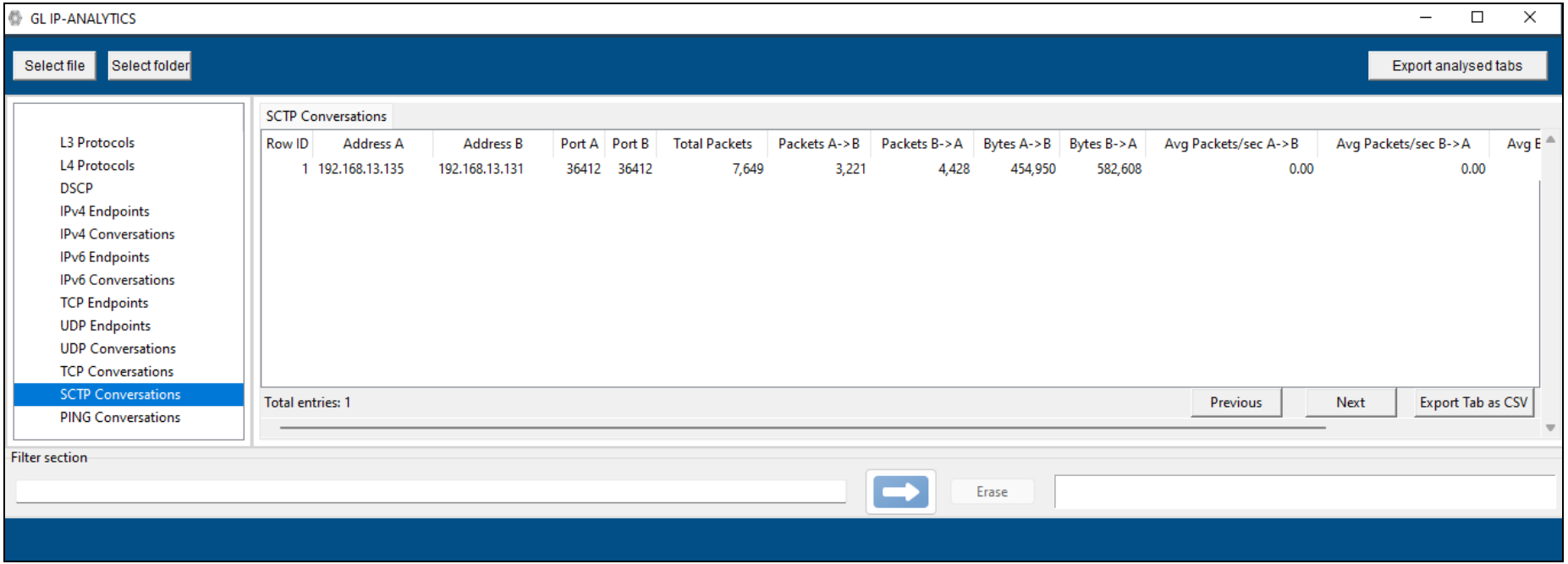
# Outer Protocol Statistics – IPv4 and IPv6



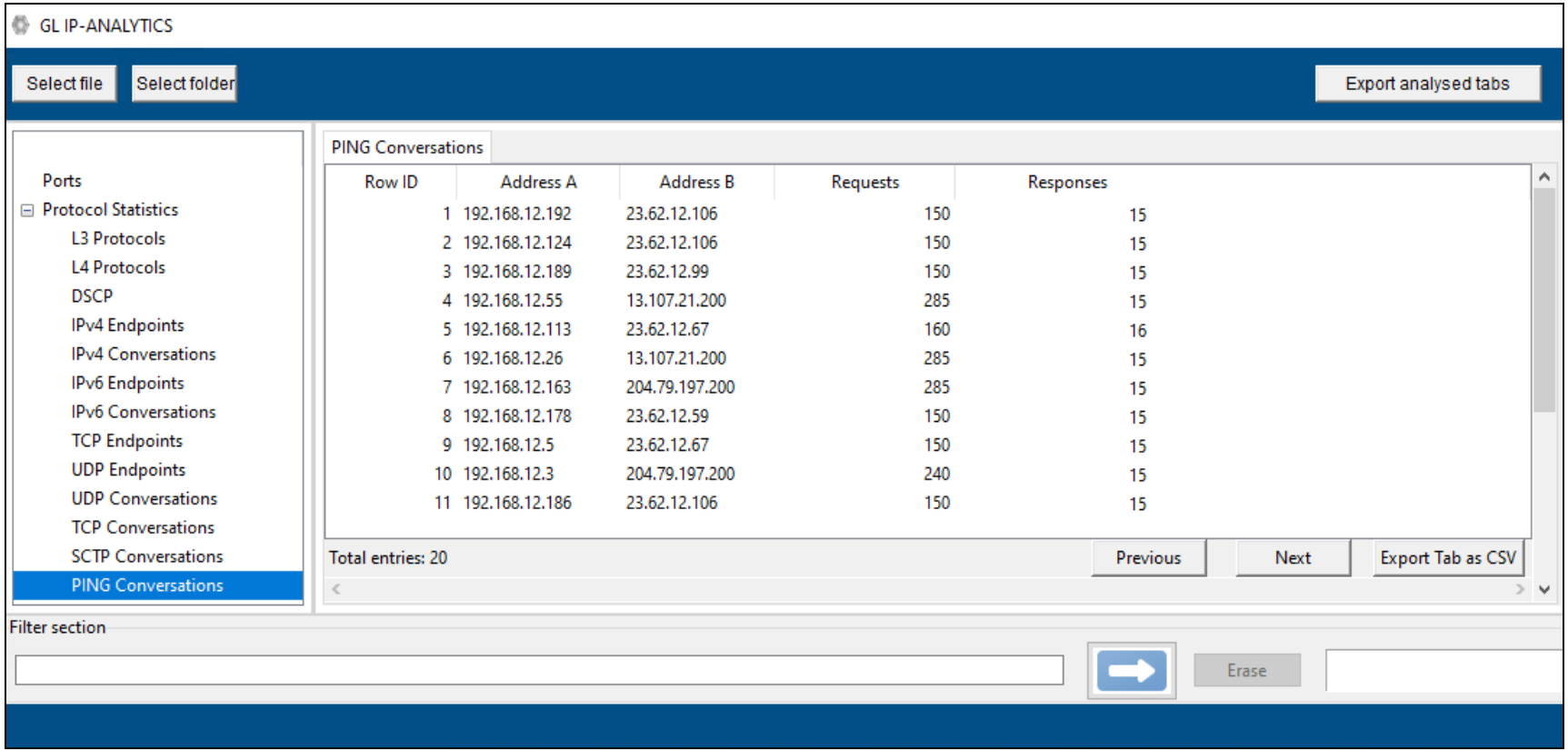
# Outer Protocol Statistics – IPv6 and TCP



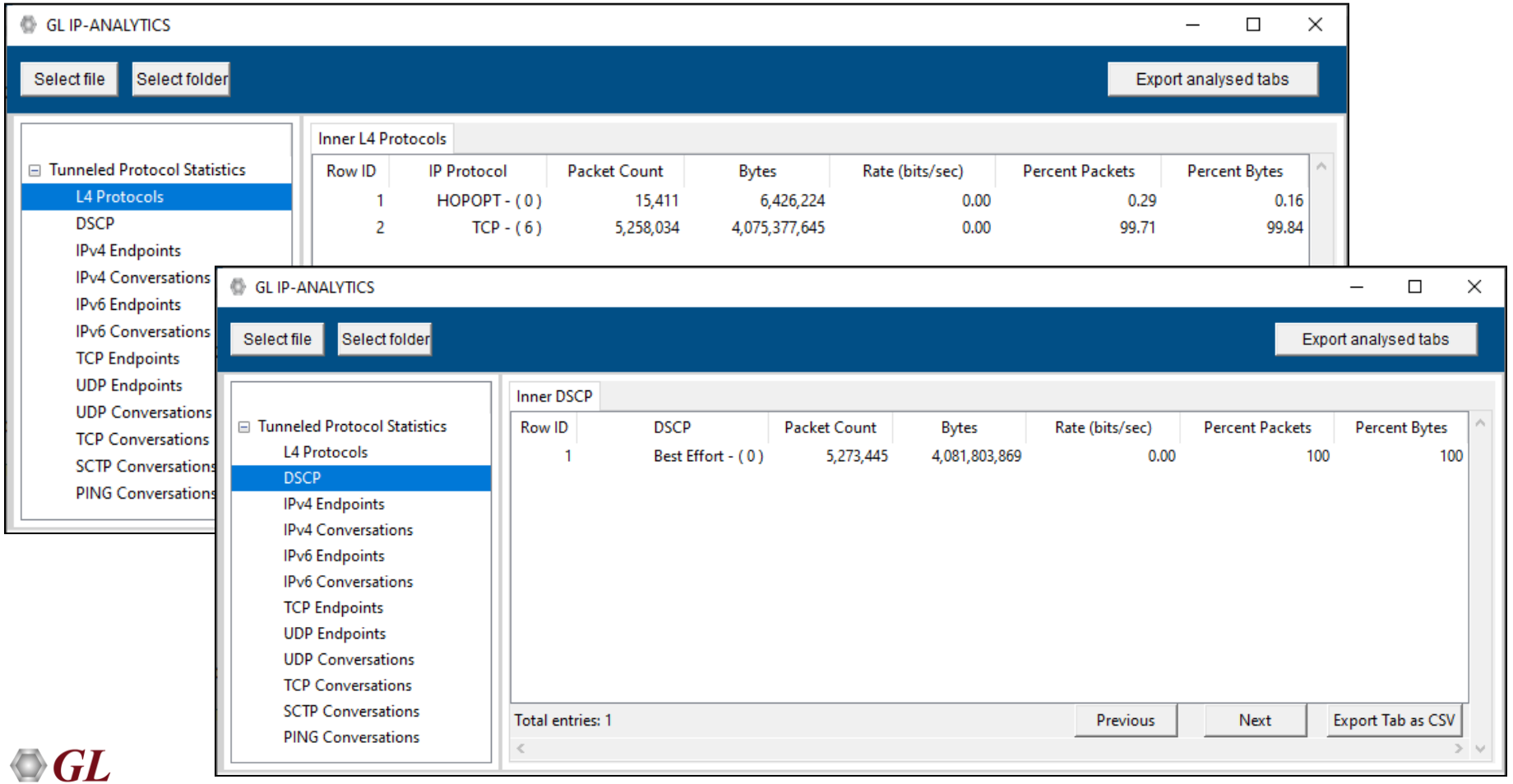
# Outer Protocol Statistics – SCTP



# Outer Protocol Statistics – PING Conversations



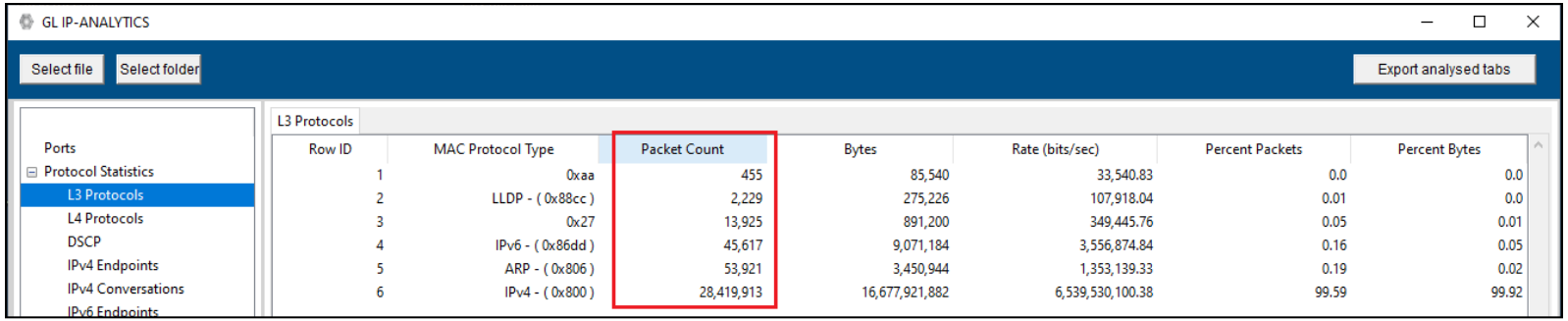
# Tunneled Protocol Statistics



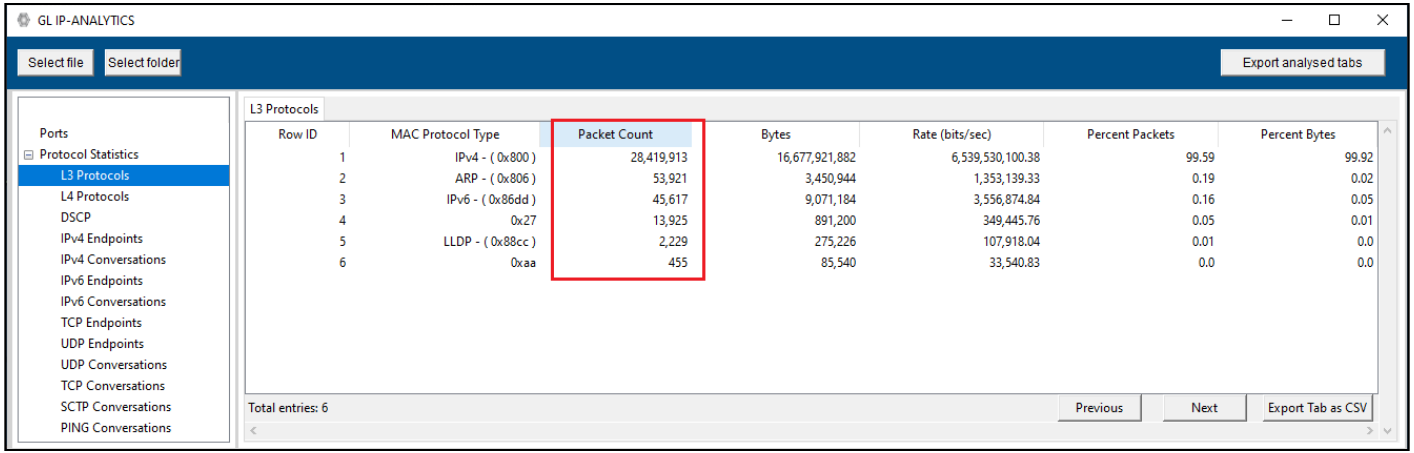
# Sorting of Columns (Tabs)

- Click on required tab (column) to sort it in either ascending or descending order

**Display of columns in Ascending order**

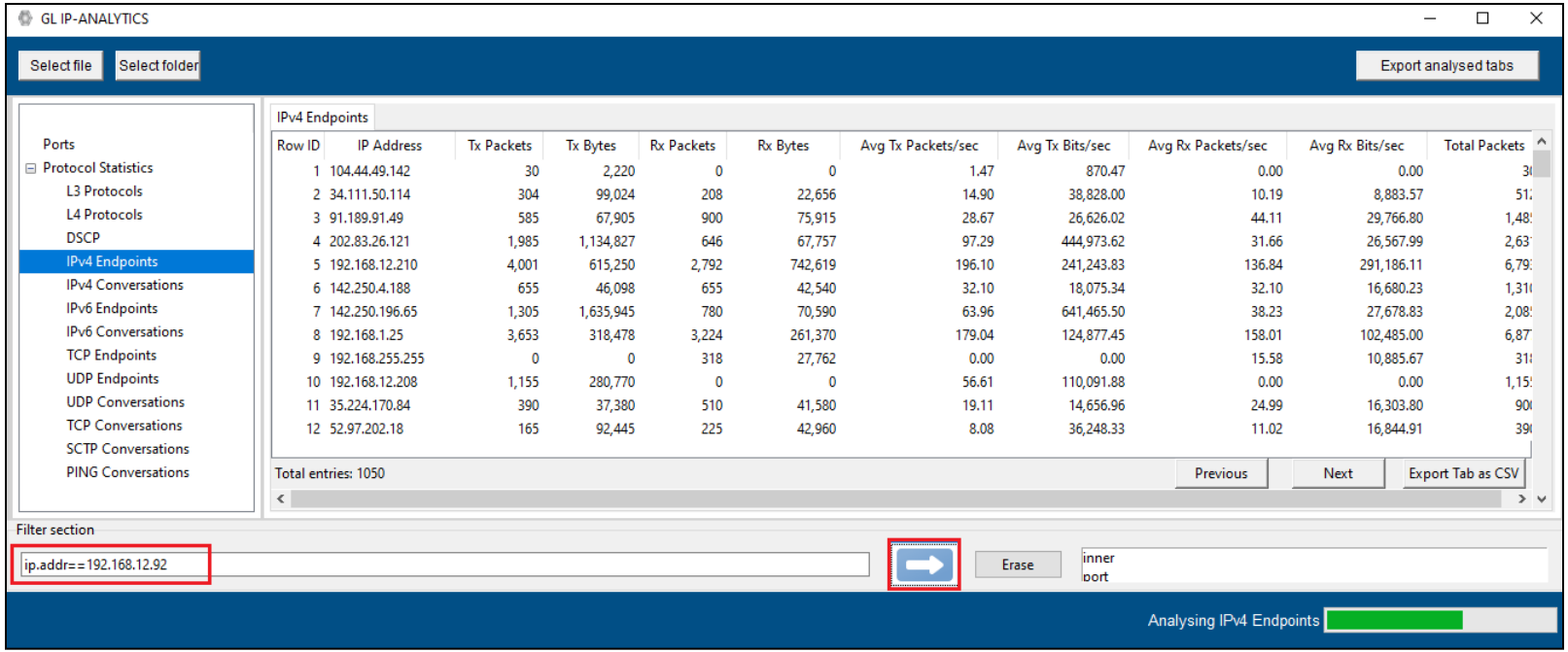



**Display of columns in Descending order**



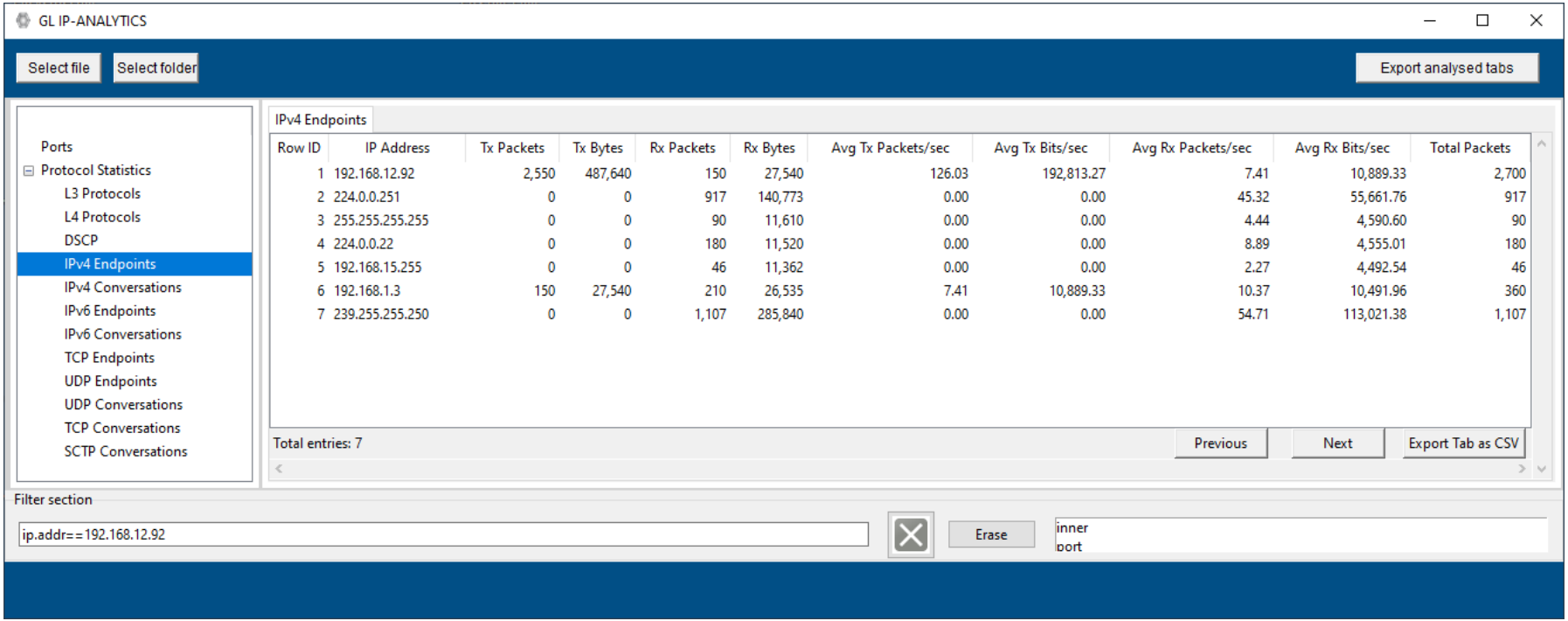
# Applying Filter

- Filter the required data by specifying filter expression syntax for Outer and Tunneled protocol statistics
- In this example, filter is applied for IPv4 end points by providing following expression “ip.addr==192.168.12.92”, click on the right arrow button to filter the data

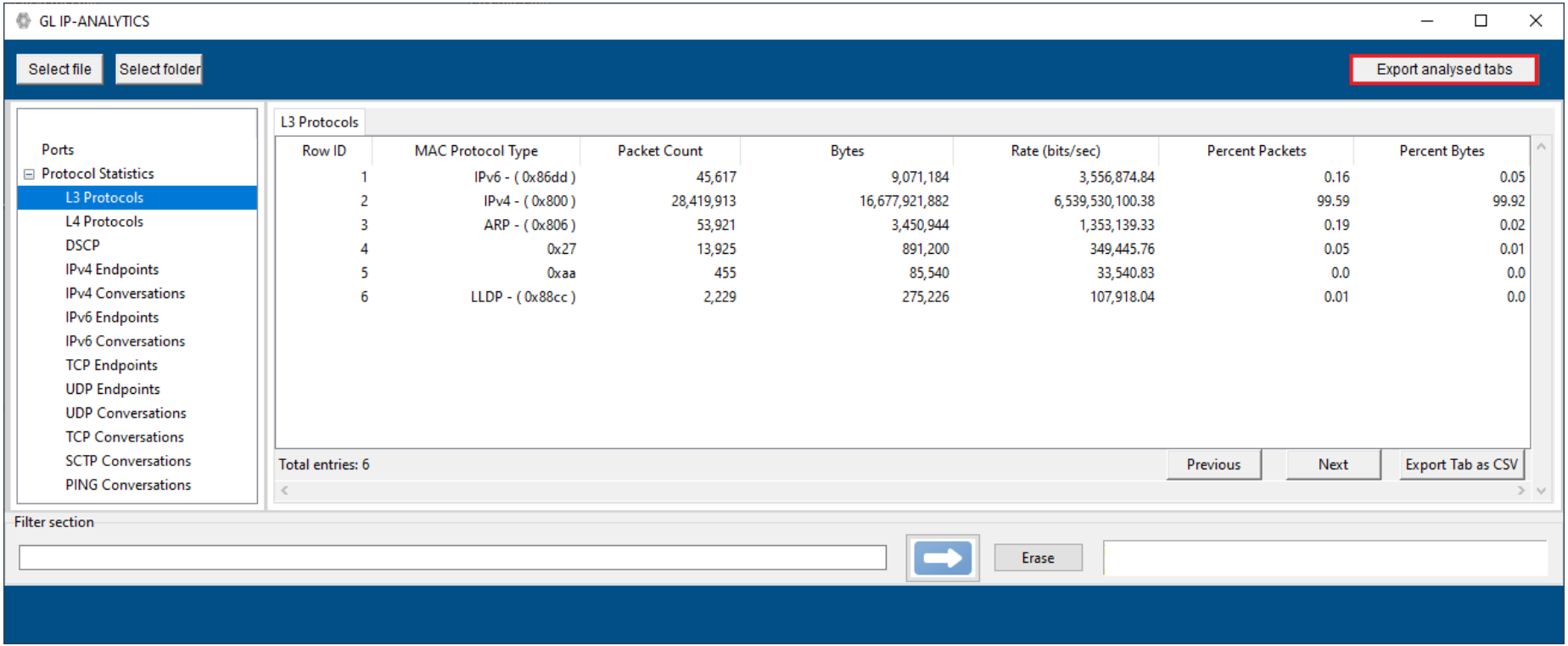


# Display of Applied Filter

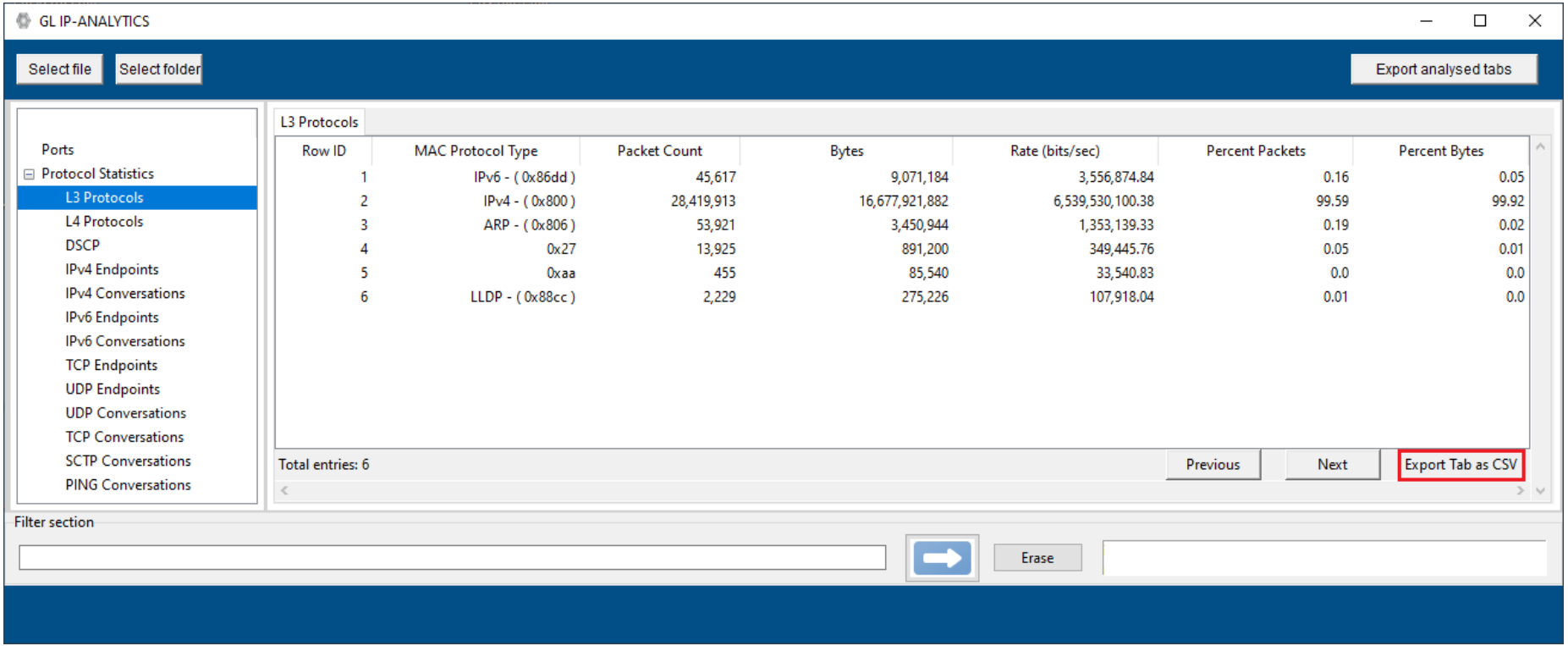
- Observe the applied filter is as shown below



# Exporting Analyzed Tabs to CSV File Format

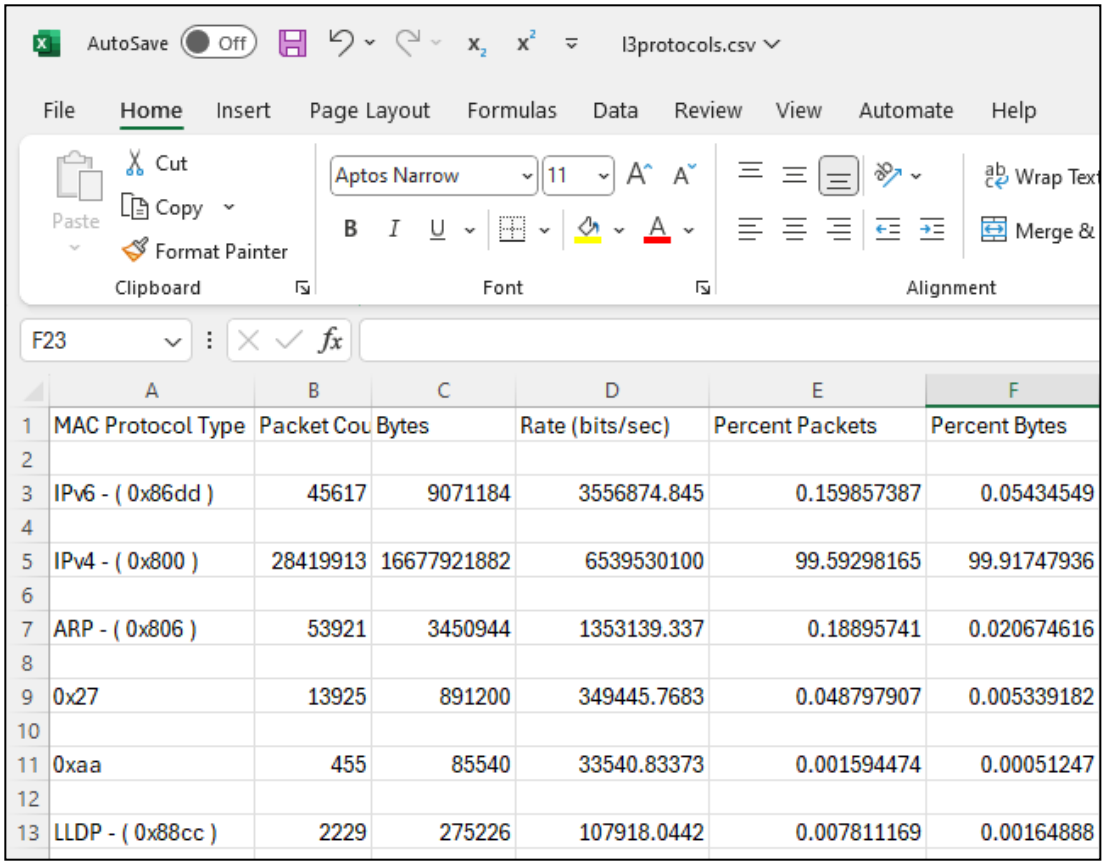


# Export Tabs as CSV



# Export Tab to CSV (Contd.)

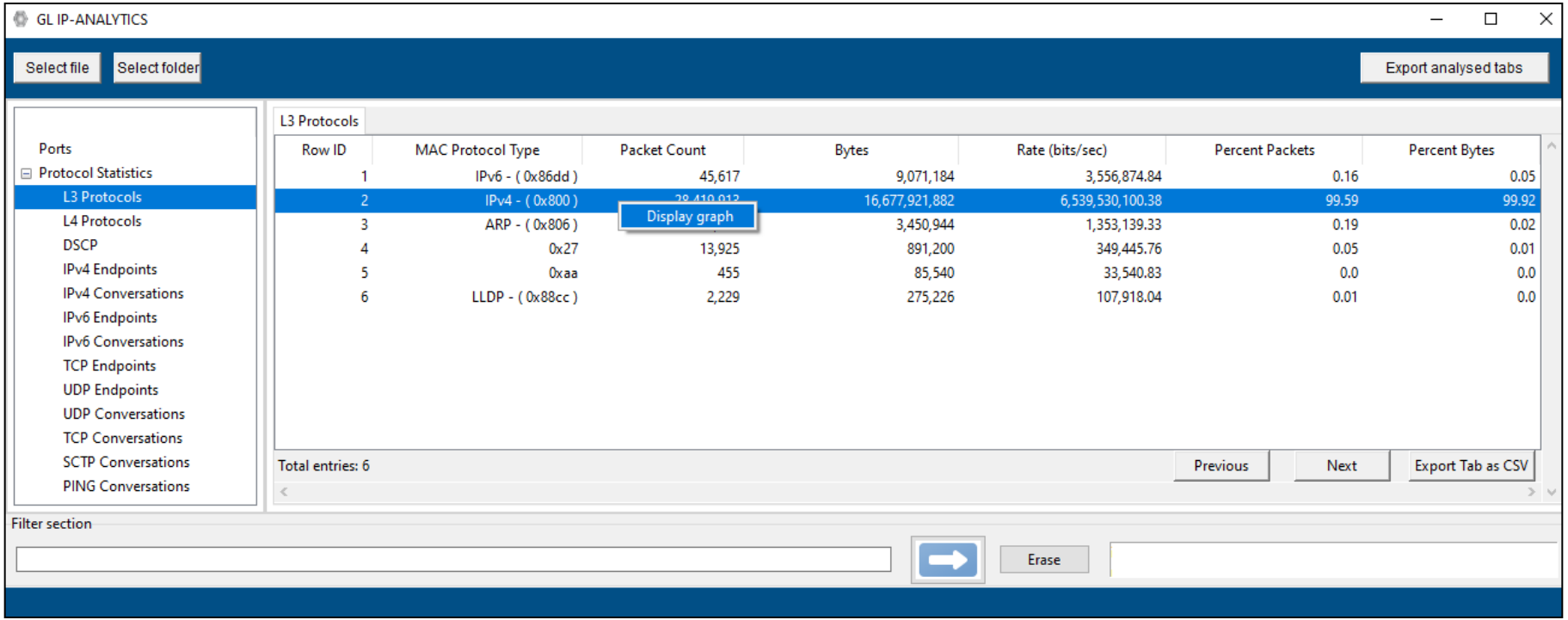
- The sample exported CSV file is shown below



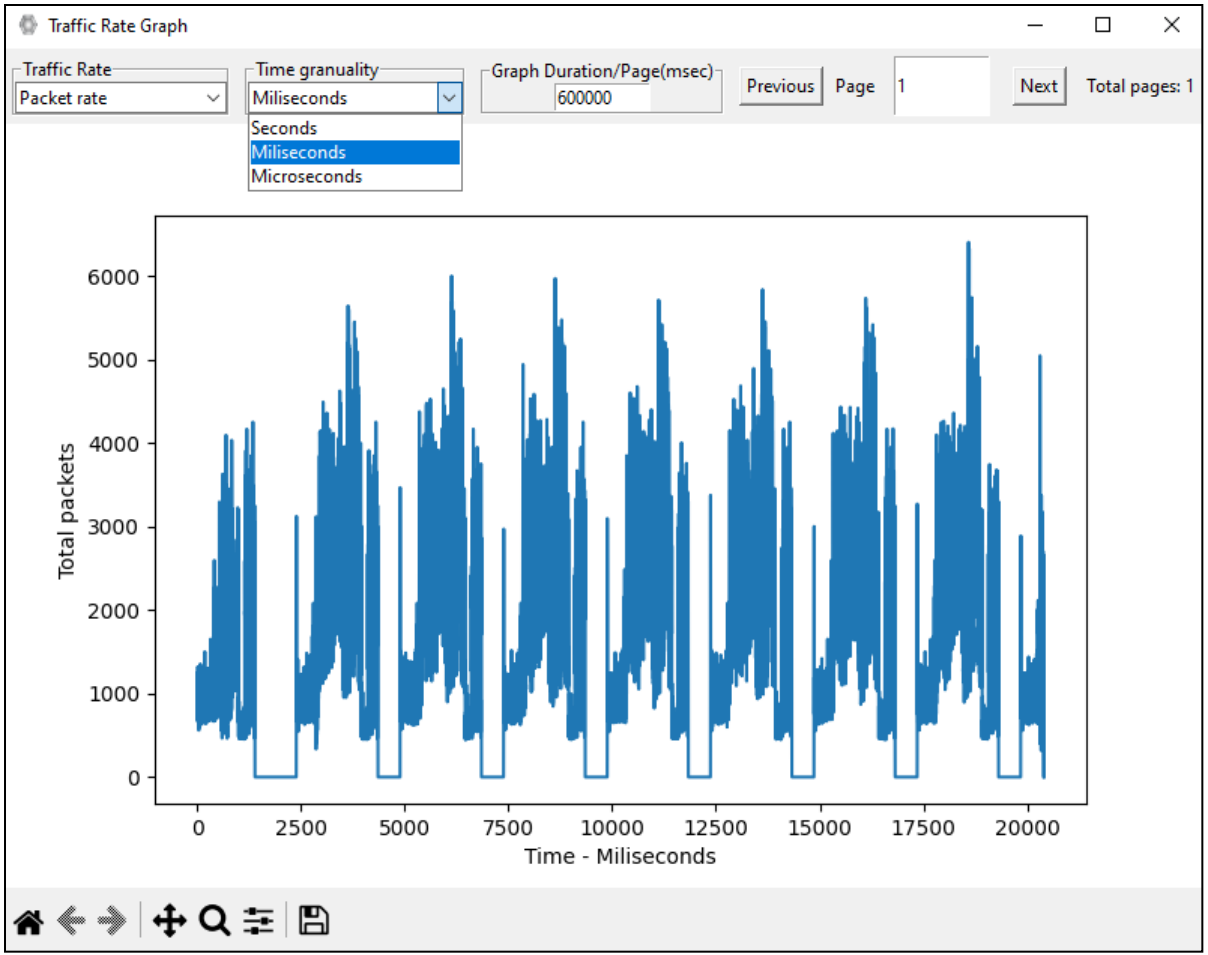

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | MAC Protocol Type | Packet Cou | Bytes | Rate (bits/sec) | Percent Packets | Percent Bytes |
| 2 | | | | | | |
| 3 | IPv6 - ( 0x86dd ) | 45617 | 9071184 | 3556874.845 | 0.159857387 | 0.05434549 |
| 4 | | | | | | |
| 5 | IPv4 - ( 0x800 ) | 28419913 | 16677921882 | 6539530100 | 99.59298165 | 99.91747936 |
| 6 | | | | | | |
| 7 | ARP - ( 0x806 ) | 53921 | 3450944 | 1353139.337 | 0.18895741 | 0.020674616 |
| 8 | | | | | | |
| 9 | 0x27 | 13925 | 891200 | 349445.7683 | 0.048797907 | 0.005339182 |
| 10 | | | | | | |
| 11 | 0xaa | 455 | 85540 | 33540.83373 | 0.001594474 | 0.00051247 |
| 12 | | | | | | |
| 13 | LLDP - ( 0x88cc ) | 2229 | 275226 | 107918.0442 | 0.007811169 | 0.00164888 |

# Data Analysis Graph

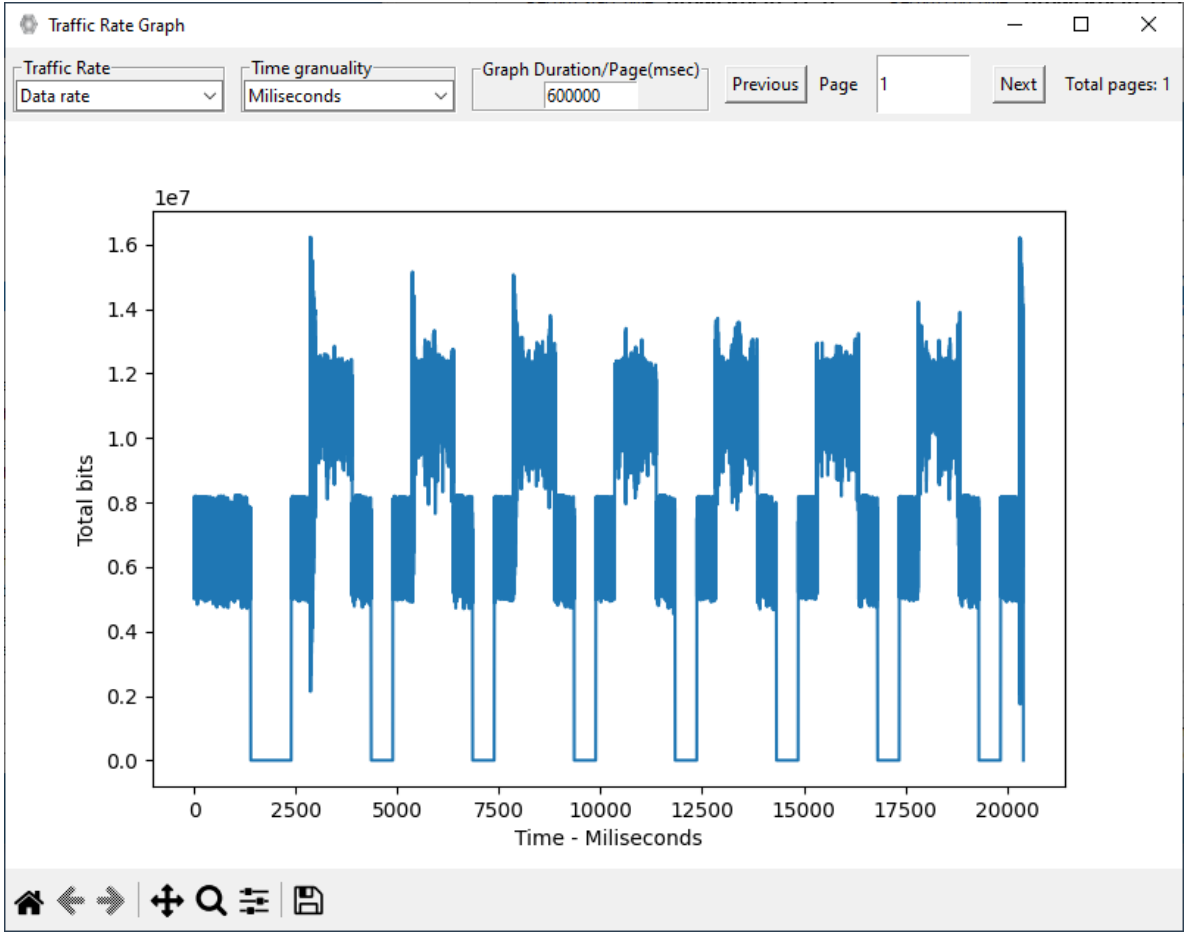
- Right-click on the selected row, and choose **Display graph** to view the Data and Rate graphs



# Display of Packet Rate Over Time Graph



# Display of Data Rate Over Time Graph

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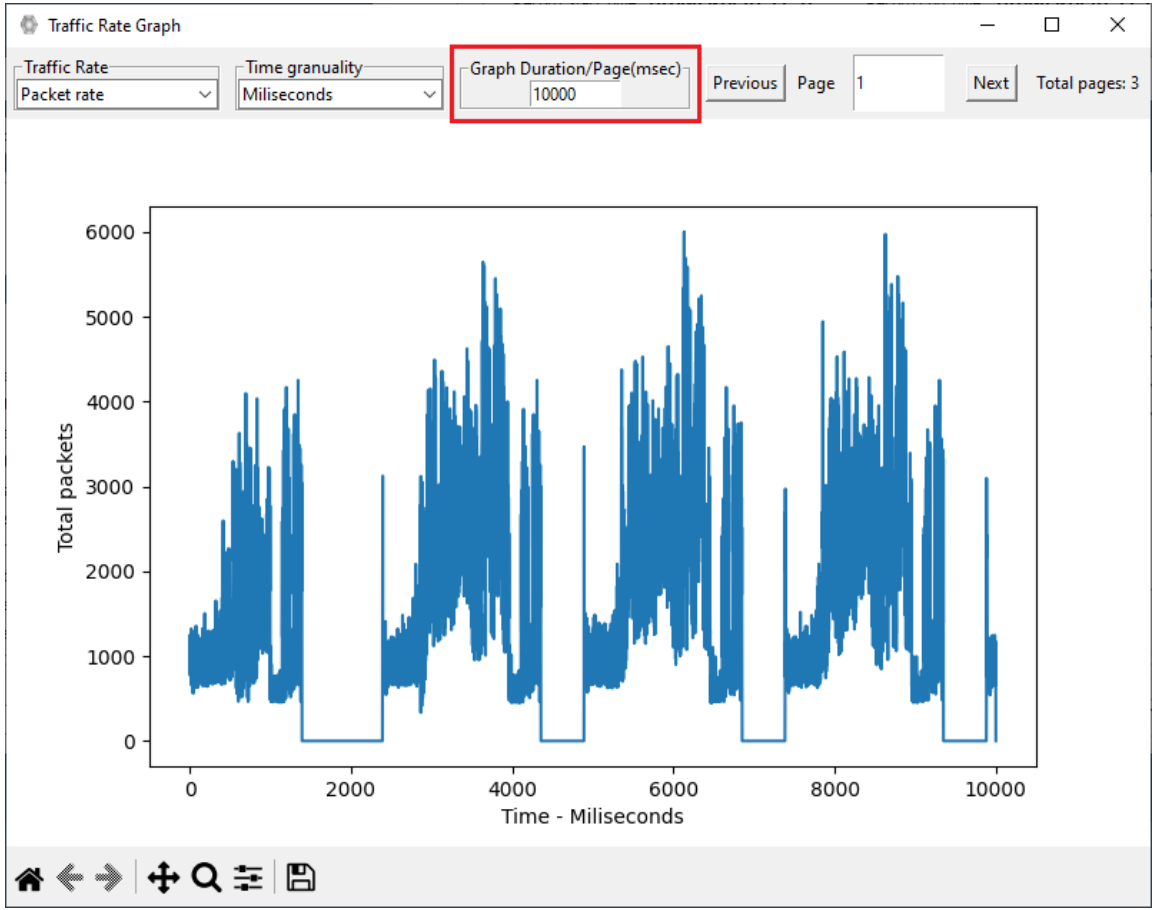
# Graph Duration/Page(msec) Option

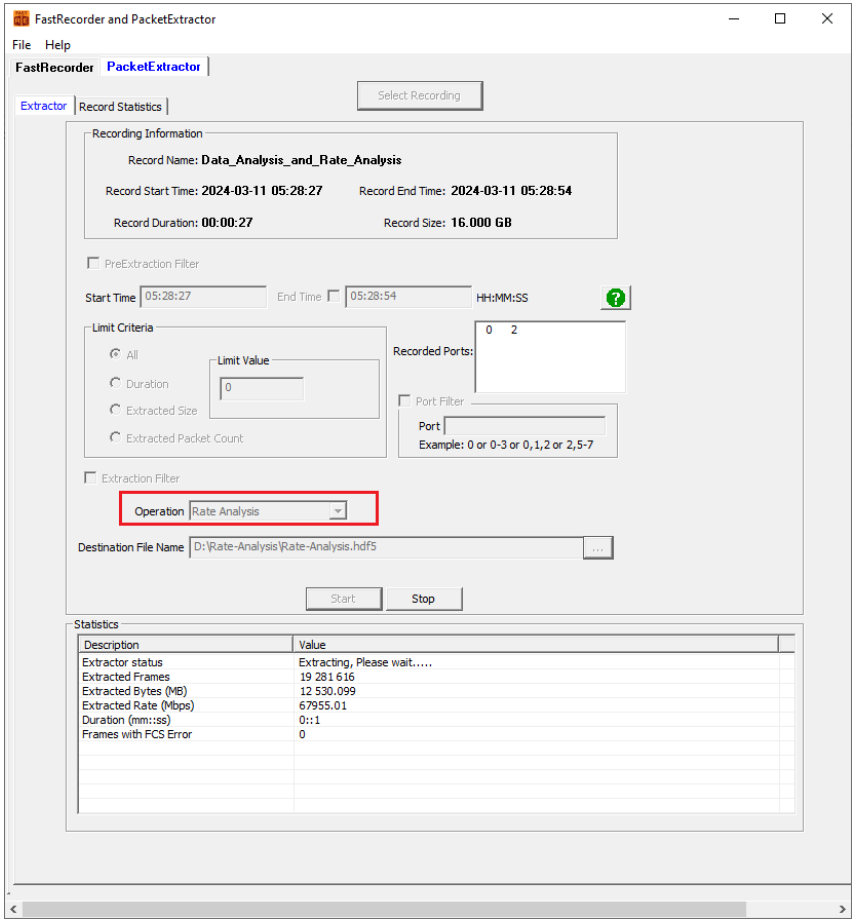
- Enter **Graph Duration/Page(msec)** to change the time interval (by default, graph duration is set to **600000**) as required and click on **Enter**
- In this case, the time interval is set to 10000 msec. The graph will be displayed up to the specified time interval (**10000** msec). Refer to the screenshot



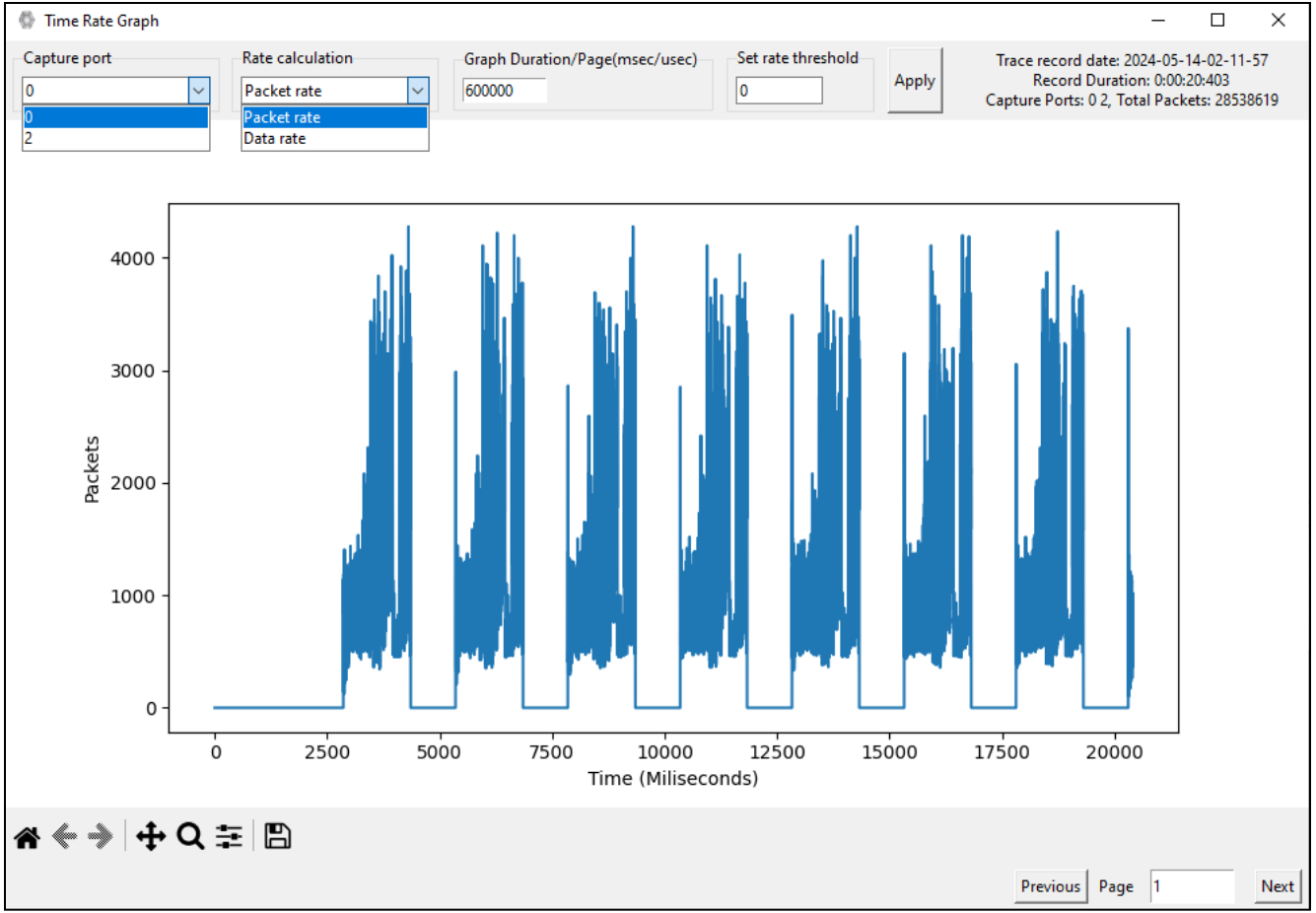
# Rate Analysis

# Rate Analysis in PacketExtractor™

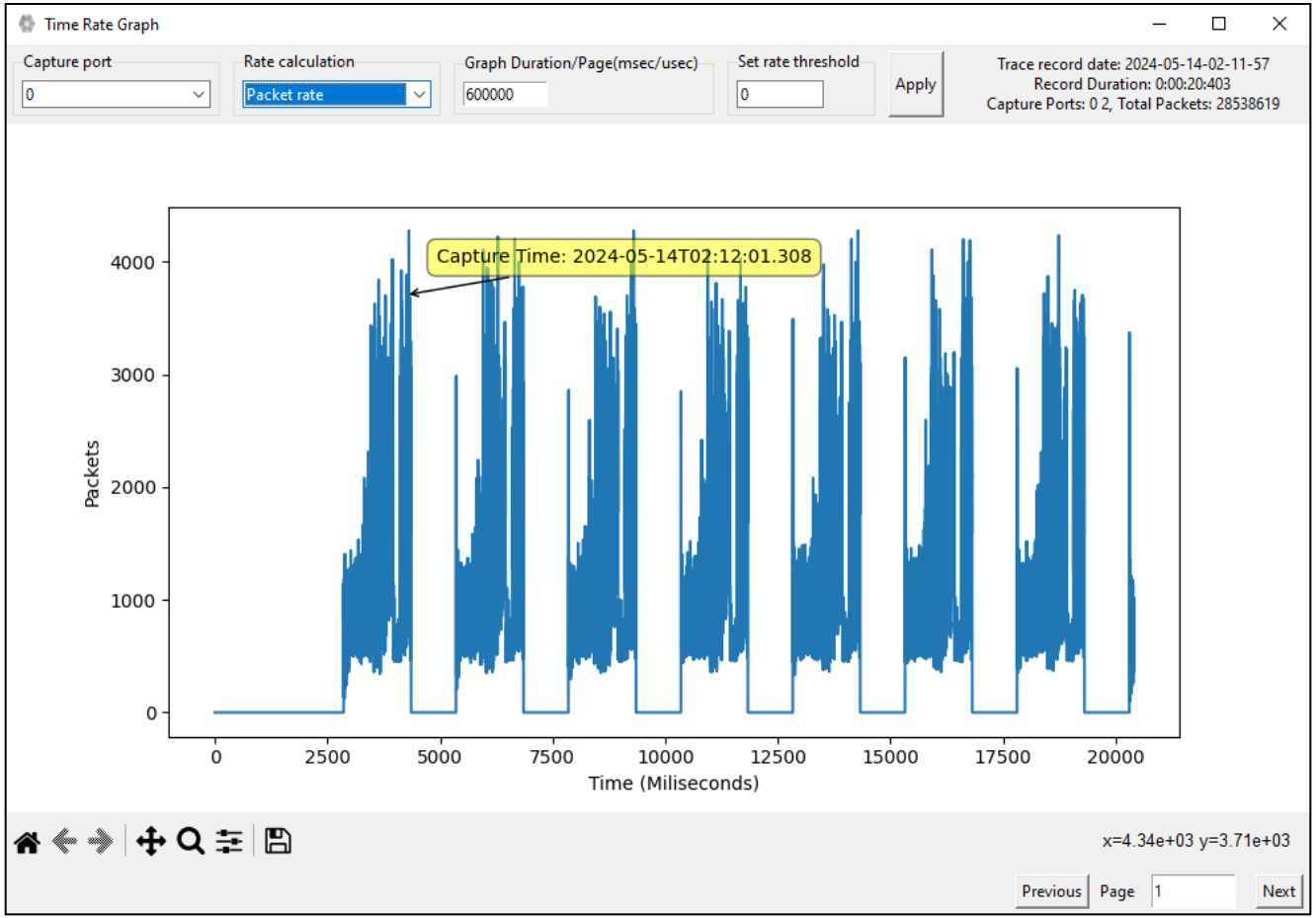
- Users can perform **Rate Analysis** using the PacketExtractor™ application



# Time Rate Graph

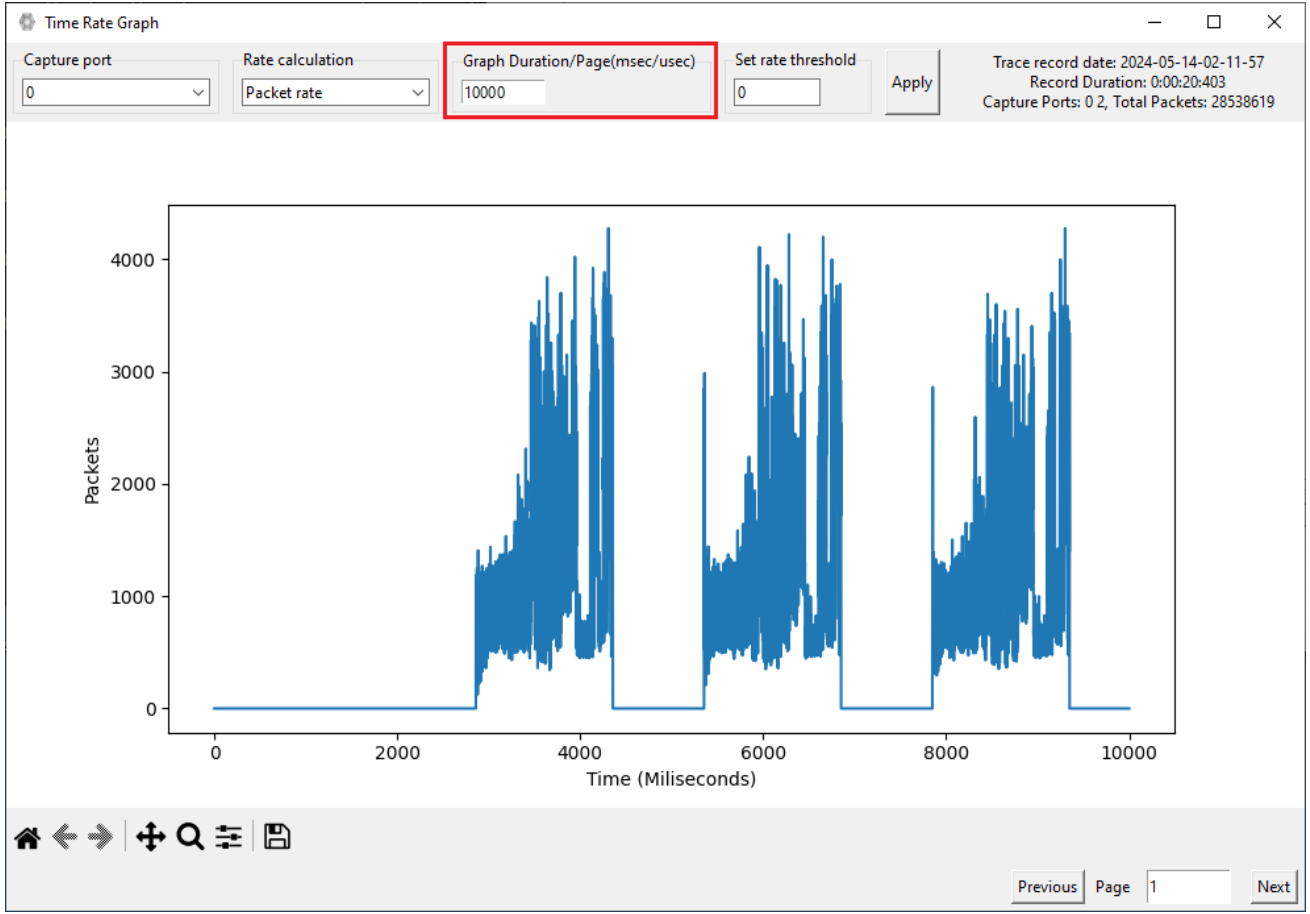


# Display of Capture Timestamp



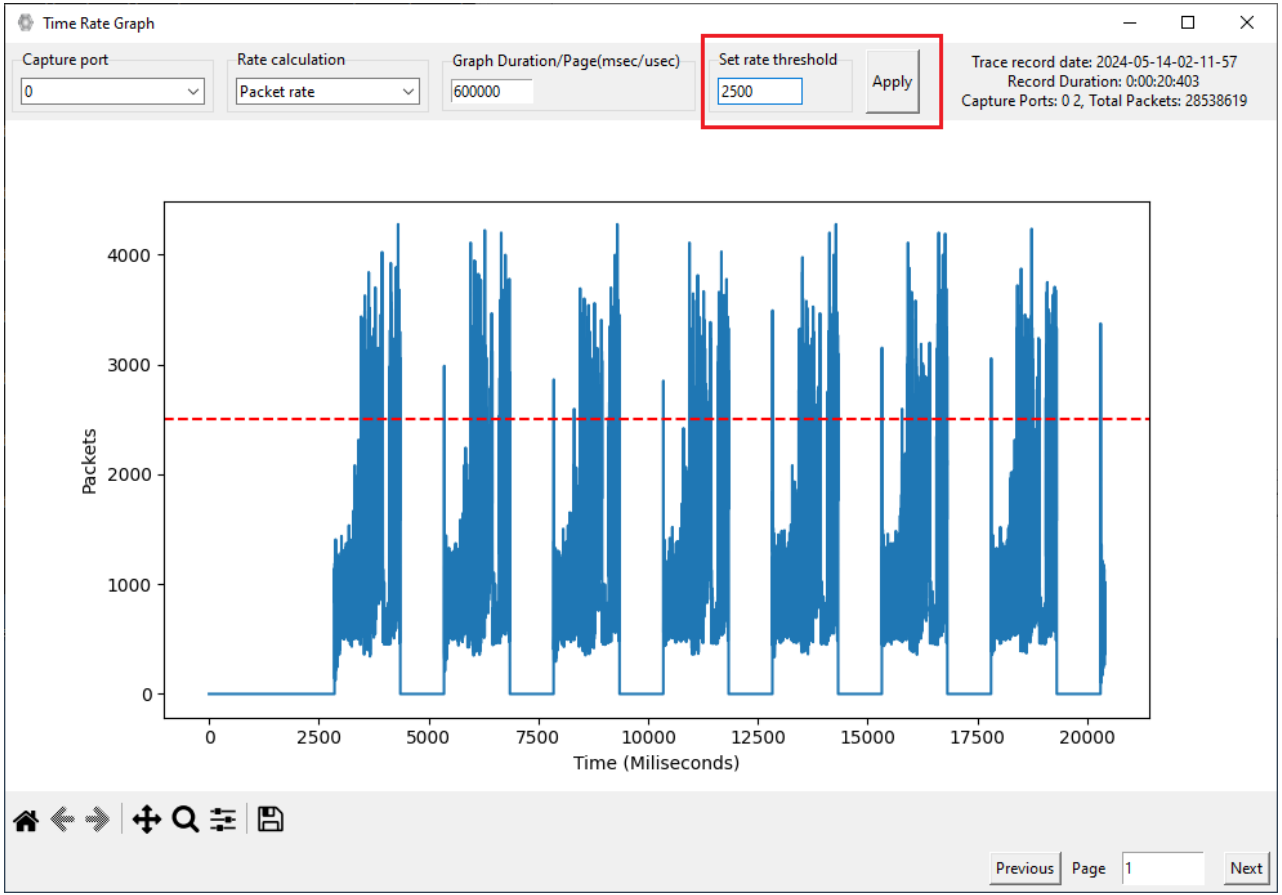
# Graph Duration/Page

- In this case, the time interval is set to **10000** msec. The graph will be displayed up to the specified time interval (10000 msec)



# Rate Threshold

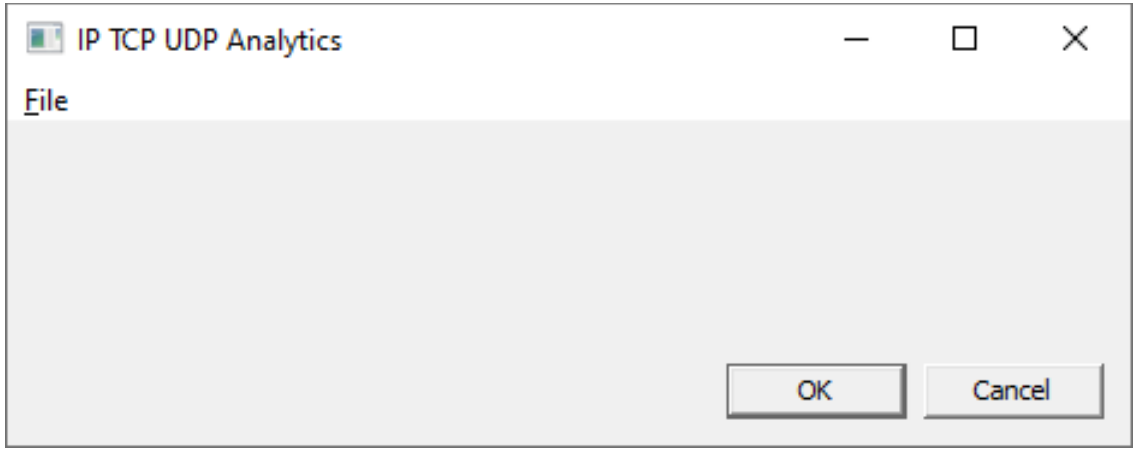
- Enables users to define a threshold value for displaying a horizontal line across the y-axis
- This allows users to easily visualize rates exceeding the threshold.
- Enter the desired Rate Threshold and click on **Apply**. Observe the plotted threshold line for the configured rate as depicted



# Data Analysis using IP TCP UDP Tool

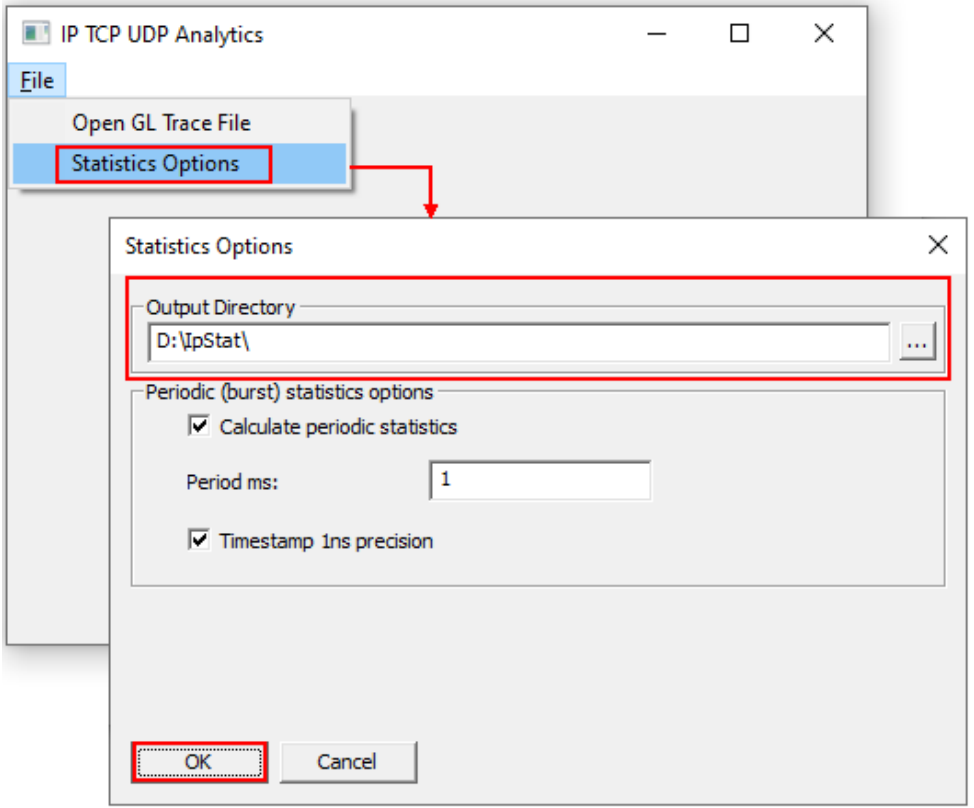
# Invoking IP TCP UDP Analysis Tool

- **IP TCP UDP Analysis tool** is used to convert *.hdl file to *.csv file format
- Go to the following path "**C:\Program Files\GL Communications Inc\FastRecorderAndPlayback**"
- Right-click on **IpTcpUdpAn.exe** and select **Run as Administrator** option to run the application
- The **IP TCP UDP Analytics** window appears as shown



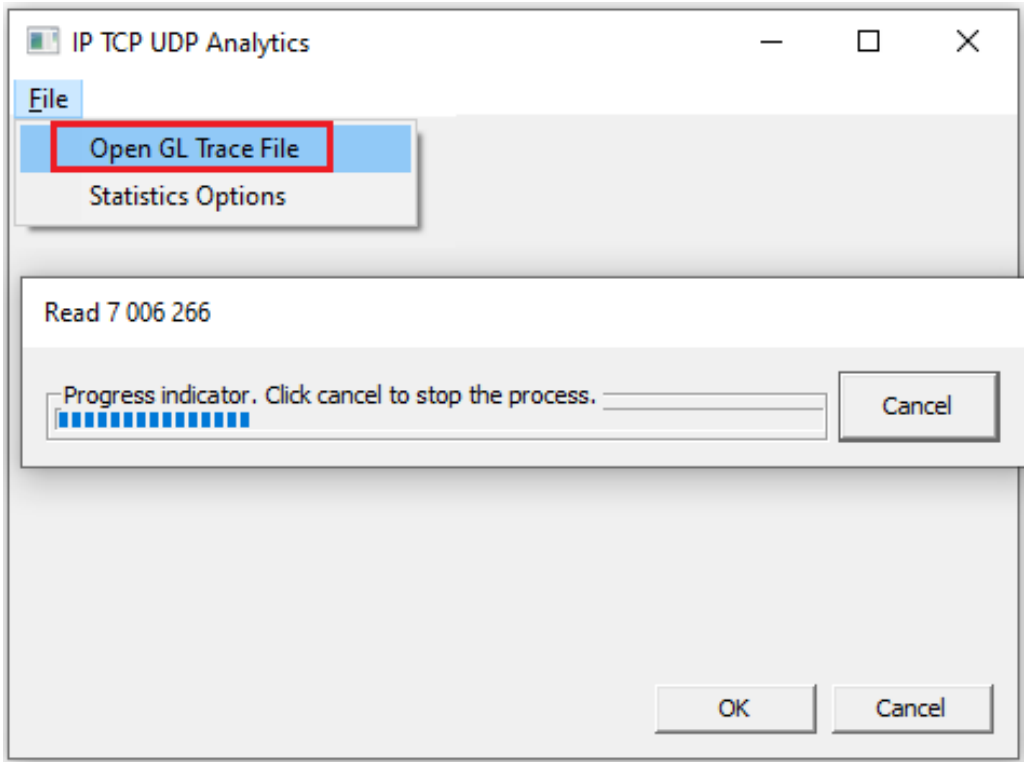
# Configuring IP TCP UDP Analysis Tool

- In the **IP TCP UDP Analytics** window, configure the parameters as required



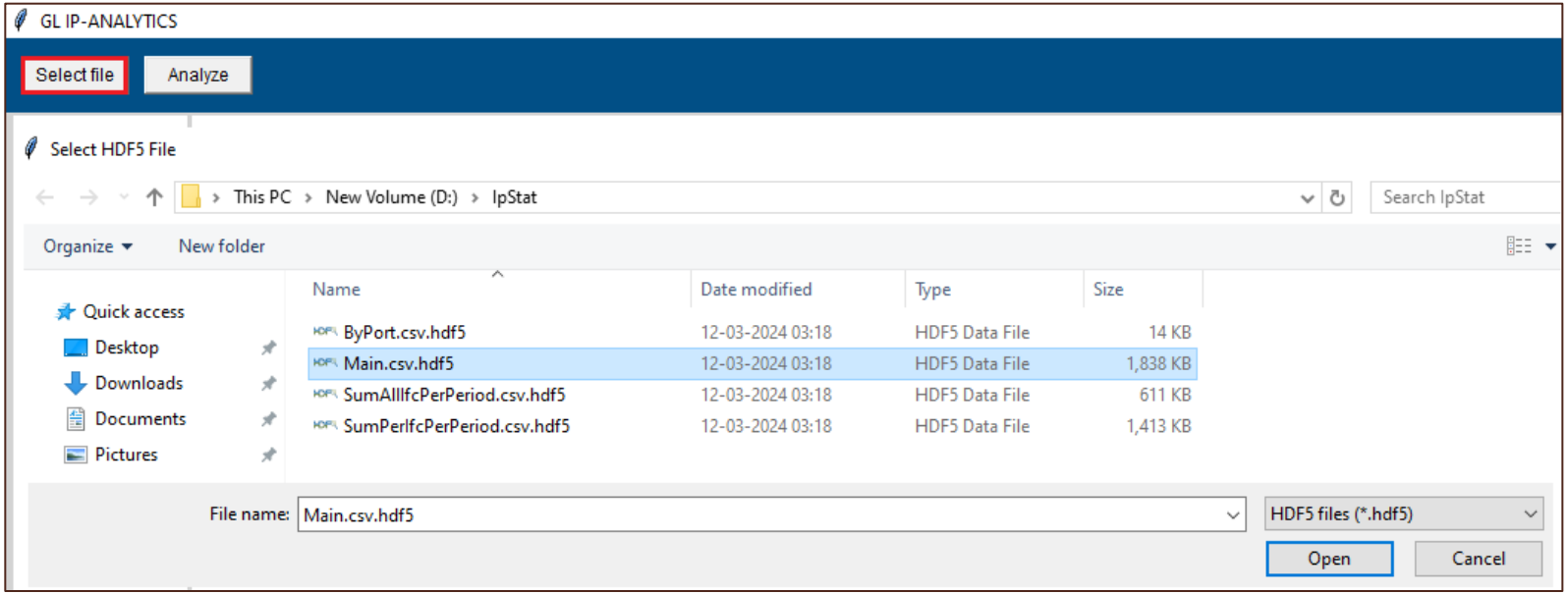
# Configuring IP TCP UDP Analysis Tool (Contd.)

- Go to **File → Open GL Trace File** to browse and select the extracted *.hdl file. In this instance, the *.hdl file is selected as **Data-Analysis.hdl**
- Observe the Progress indicator
- After converting the extracted *.hdl file to csv, the below message will pop-up. Click on **OK** to continue



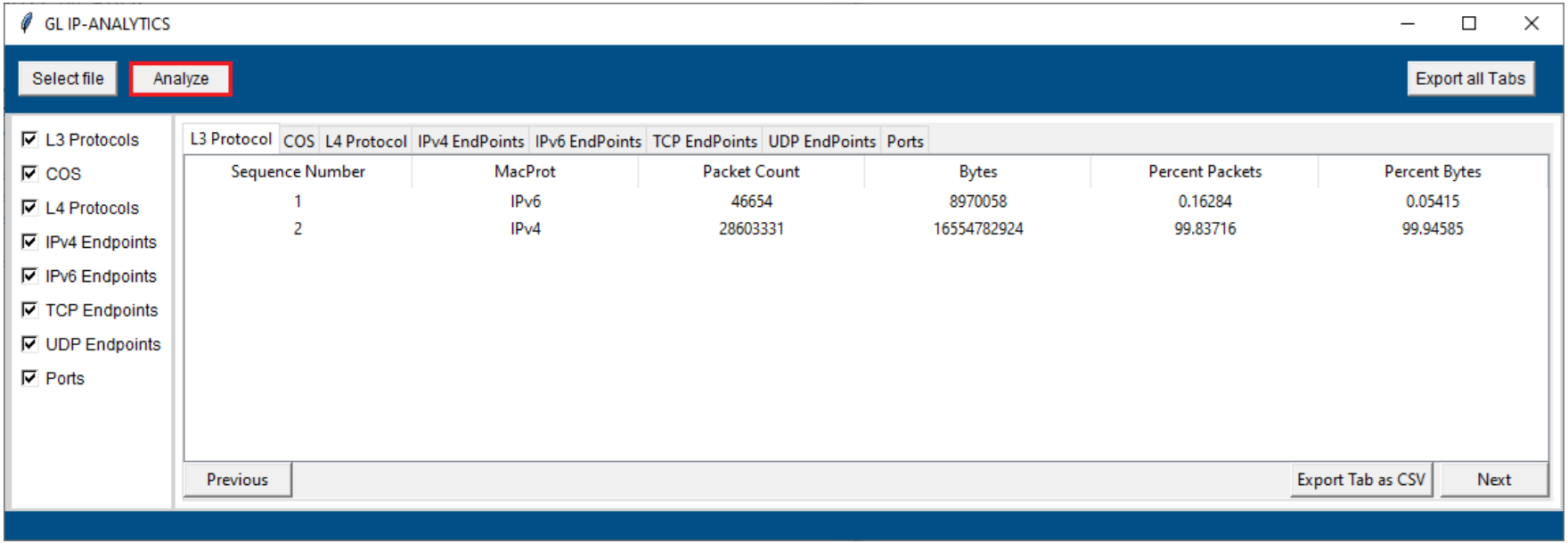

# GL IP Analytics™

- Upon execution of Python scripts, this will invoke the **GL IP-ANALYTICS™** window. Click on **Select File** button to browse and select *.hdf5 file. In this instance, the **D:\IpStat\ Main.csv.hdf5** file is selected



# GL IP Analytics™ (Contd.)

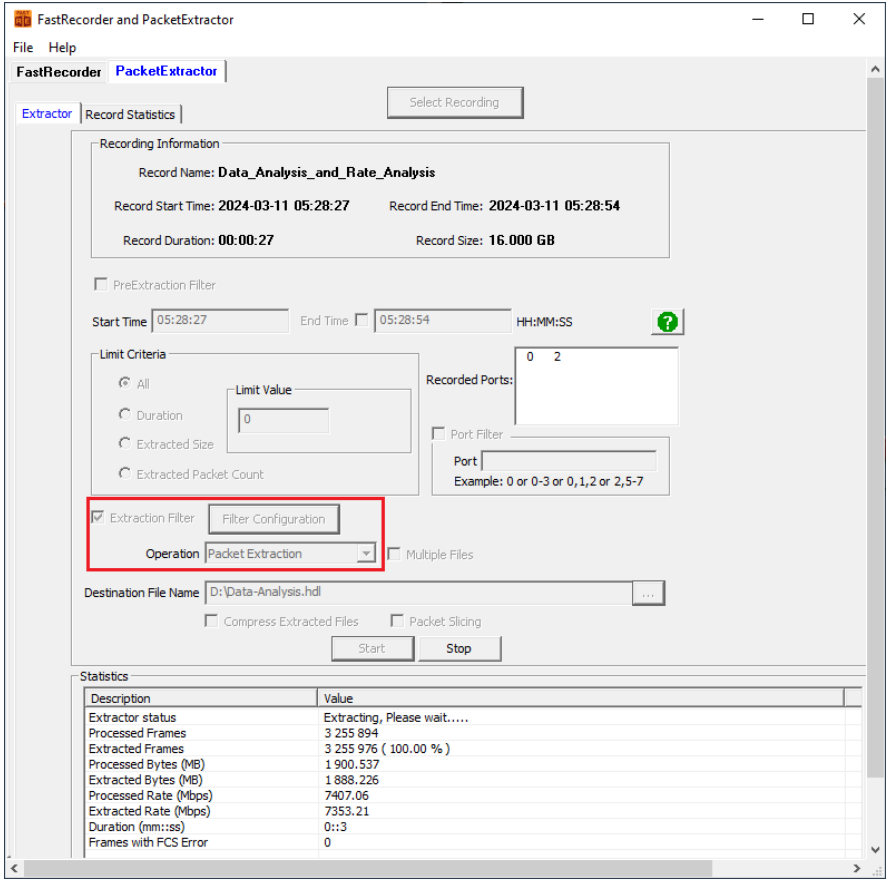
- Click on **Analyze**. This analysis will display L3, COS, L4, IPv4 Endpoints, IPv6 Endpoints, UDP Endpoints, TCP Endpoints, and Ports statistics. Observe the progress bar at the bottom left side indicating the progress
- After completion, observe the statistics as shown below is selected



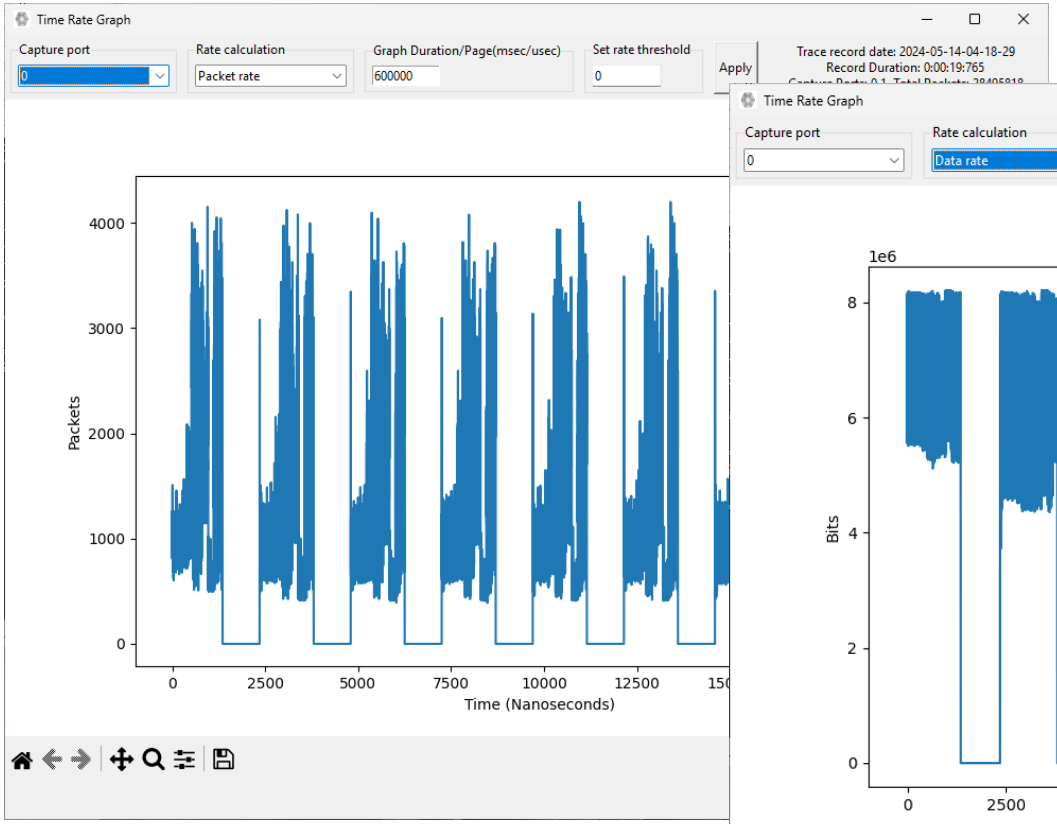
# Rate Analysis using IP TCP UDP Tool

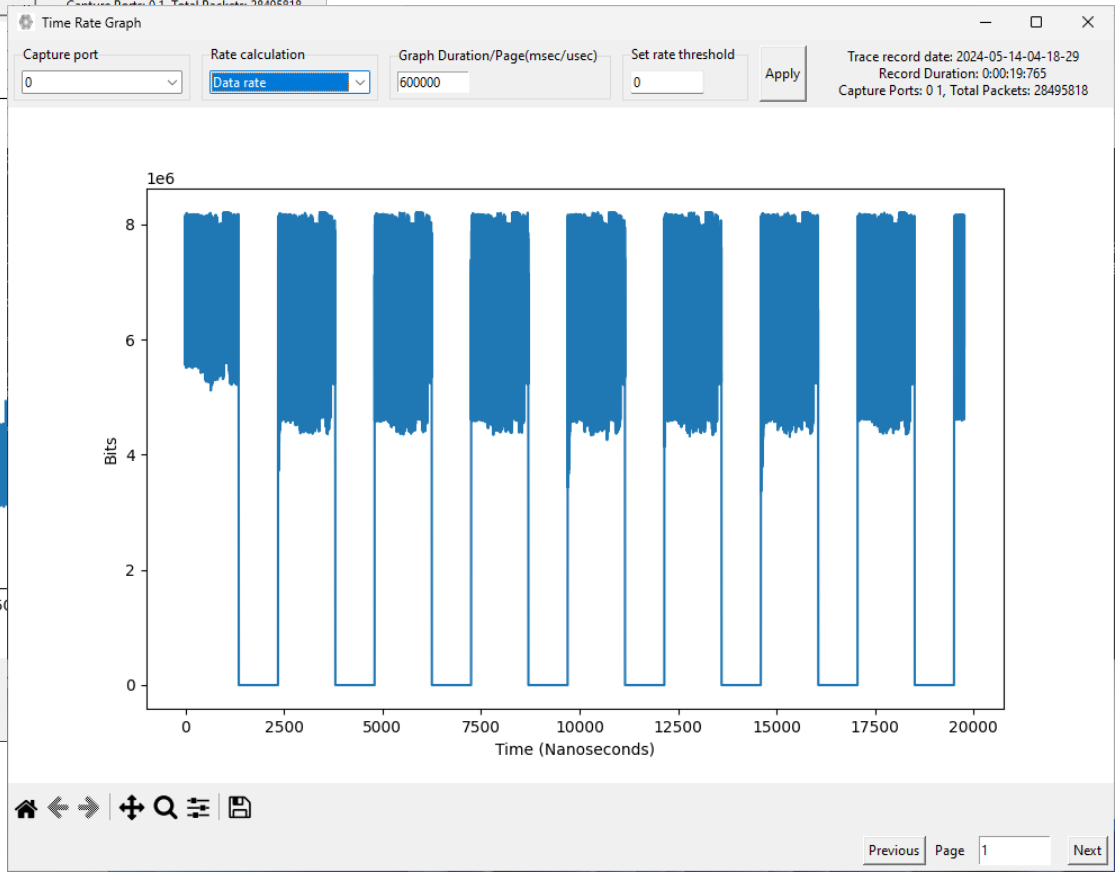
# Rate Analysis using IP TCP UDP Tool

- Users can use the existing HDL format. If not, extract the recoded data into *.hdl format using PacketExtractor™ application



# Packet Rate and Data Rate Graphs

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# Thank you