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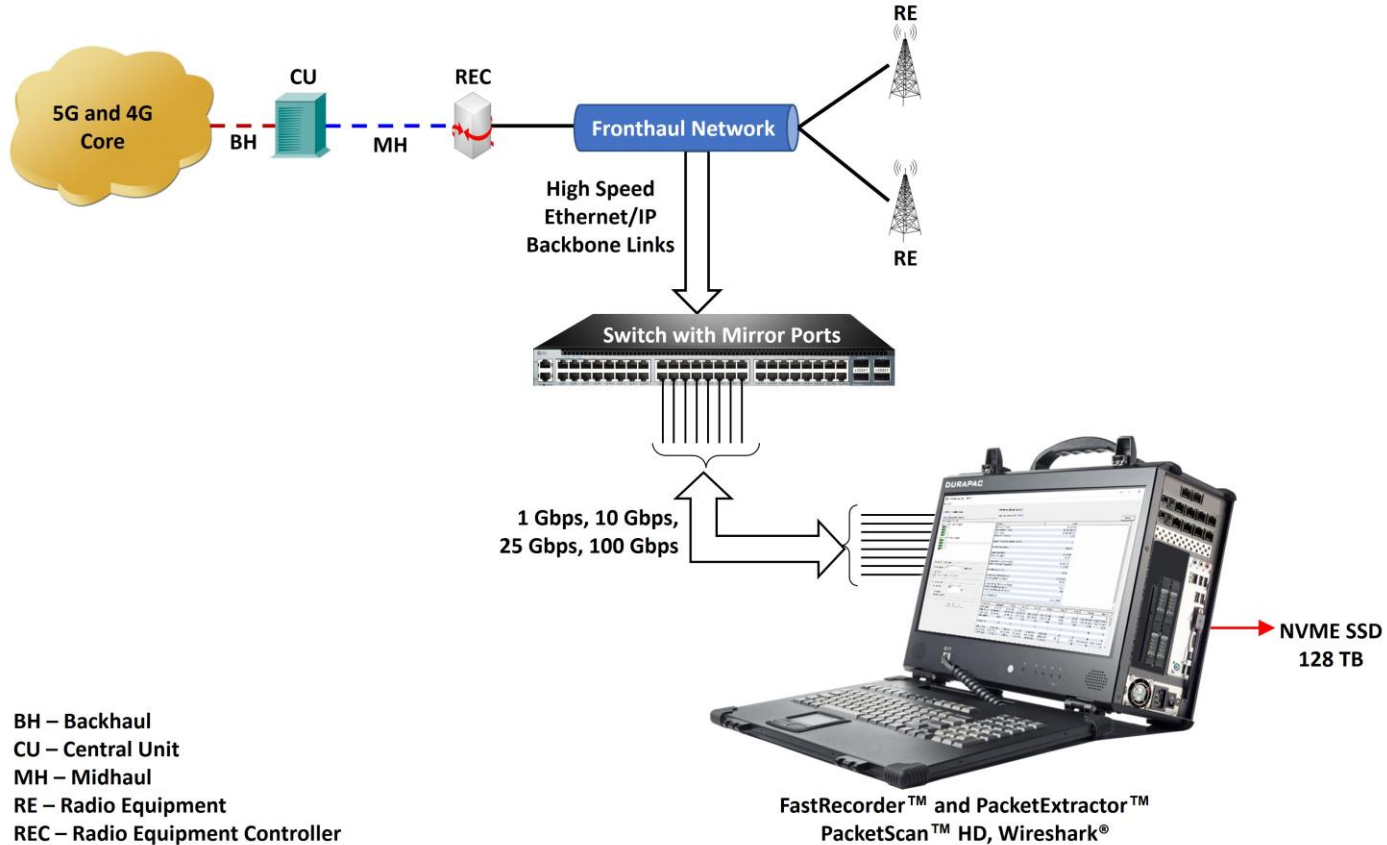
# eCPRI Protocol Analysis

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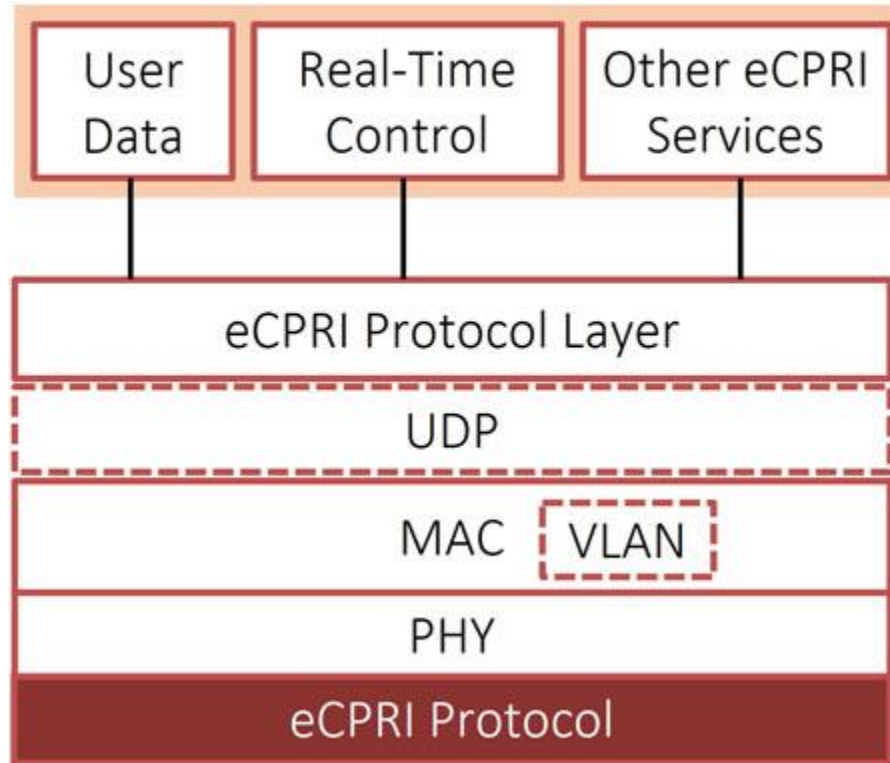
818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878  
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: [info@gl.com](mailto:info@gl.com)  
Website: <https://www.gl.com>

# Network Architecture



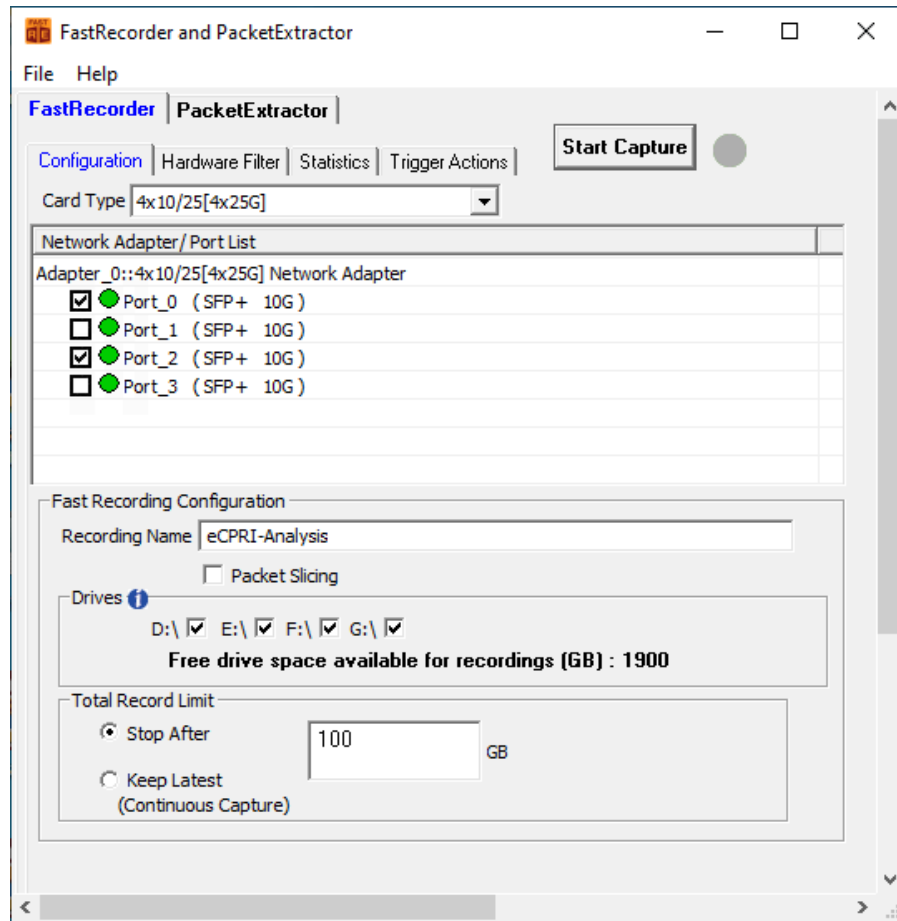
# eCPRI Protocol Stack

eCPRI Services

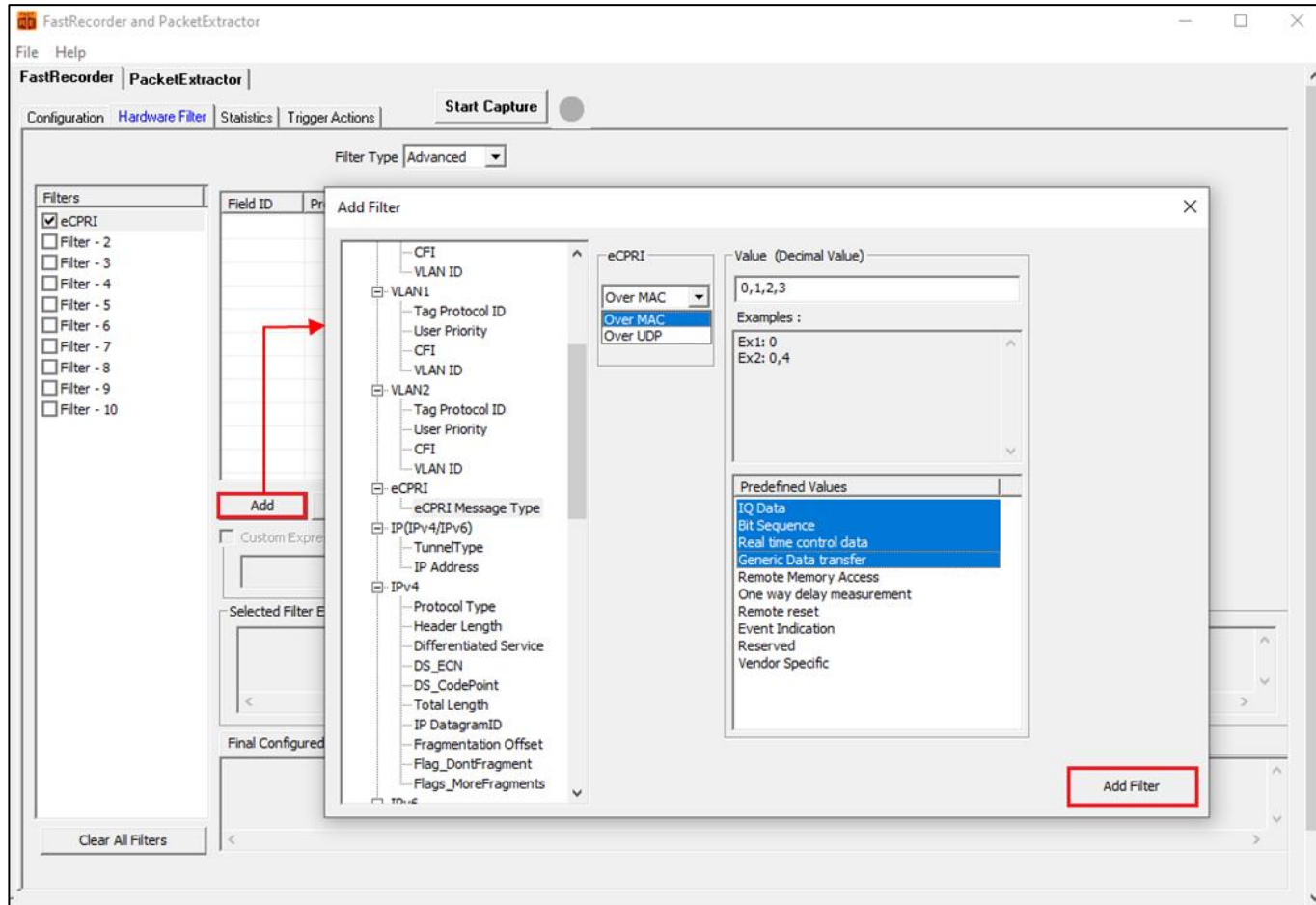


# Monitoring eCPRI on FastRecorder™ Application

- FastRecorder™ and PacketExtractor™ analyzer supports **eCPRI** analysis feature to monitor **eCPRI** traffic for packet impairments such as Missed Packets, Out of Order, Duplicate Packets, One-Way Delay etc.



# Configuring Hardware Filter for eCPRI Analysis



# Invoking eCPRI Application

The screenshot displays the 'FastRecorder and PacketExtractor' application window. The 'PacketExtractor' tab is active, showing recording information for a file named 'eCPRI-Analysis'. The recording started at 2022-12-19 04:07:36 and ended at 2022-12-19 04:08:29, with a duration of 00:00:53 and a size of 0.188 MB. The 'Limit Criteria' section shows 'Duration' selected with a limit value of 00:00:53. The 'Operation' dropdown is set to 'eCPRI Analysis'. A red box highlights this dropdown, with an arrow pointing to the 'eCPRI Analysis - Sequence Analysis' window.

**Recording Information**

Record Name: **eCPRI-Analysis**

Record Start Time: **2022-12-19 04:07:36**      Record End Time: **2022-12-19 04:08:29**

Record Duration: **00:00:53**      Record Size: **0.188 MB**

☐ PreExtraction Filter

Start Time:       End Time:

**Limit Criteria**

☐ All      Limit Value:  HH:MM:SS

☒ Duration

☐ Extracted Size

☐ Extracted Packet Count

Operation: **eCPRI Analysis**

**eCPRI Analysis - Sequence Analysis**

File   Settings   Options

Links: **192.168.1.55:64000<—>192.168.1.57:64000**

Message Statistics   Events   All Links Statistics

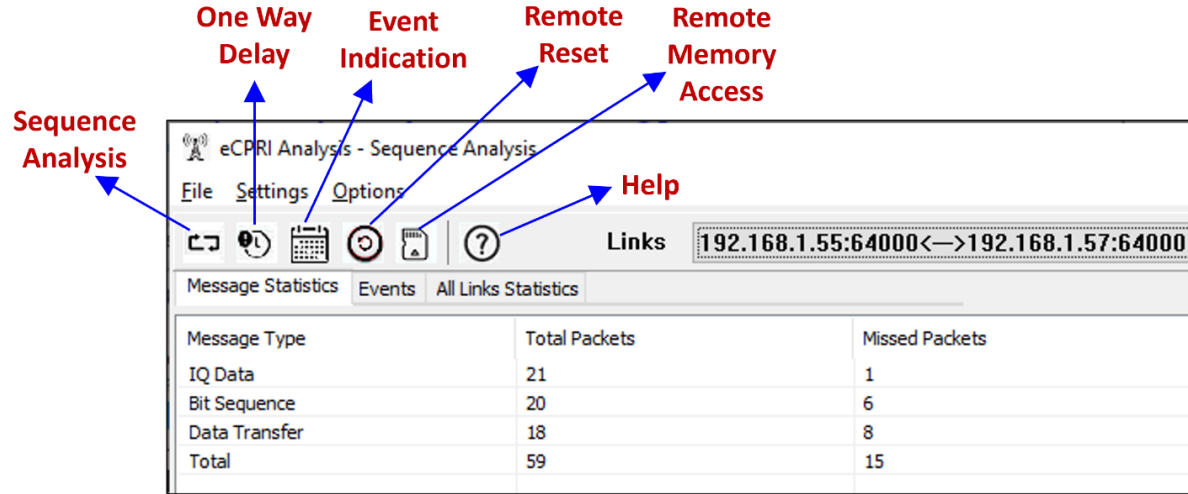
Message Type	Total Packets	Missed Packets	Out Of Order Packets	Duplicate Packets
IQ Data	0	0	0	0
Bit Sequence	40	2	6	19
Data Transfer	36	2	7	15
Total	76	4	13	34

Total Processed Packets = 200      Total eCPRI Packets = 200

# Shortcut Icons of eCPRI Message Statistics

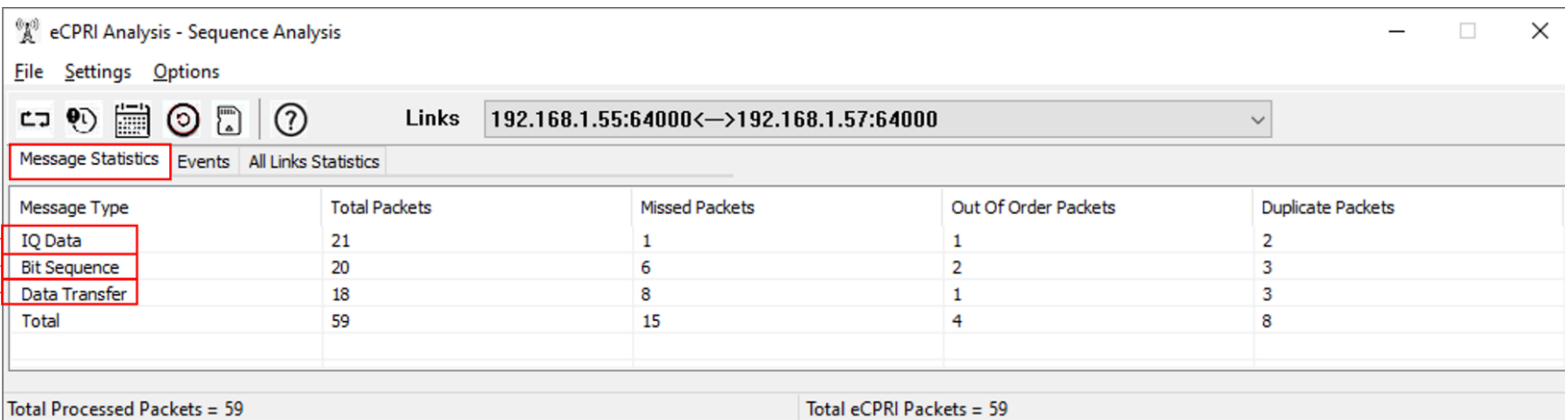
eCPRI application provides the following message statistics.

- Sequence Analysis
- One-Way Delay Measurement
- Event Indication
- Remote Reset
- Remote Memory Access



# Sequence Analysis

- Analyzes the packet sequences of eCPRI Message types such as IQ Data, Bit Sequence, and Data Transfer, and generates packet statistics based on PCID, SEQID, and Data samples
- The analysis results are displayed in separate tabs, including **Message Statistics**, **Events**, and **All Links Statistics**



IQ Data

Bit Sequence

Data Transfer

Message Type	Total Packets	Missed Packets	Out Of Order Packets	Duplicate Packets
IQ Data	21	1	1	2
Bit Sequence	20	6	2	3
Data Transfer	18	8	1	3
Total	59	15	4	8

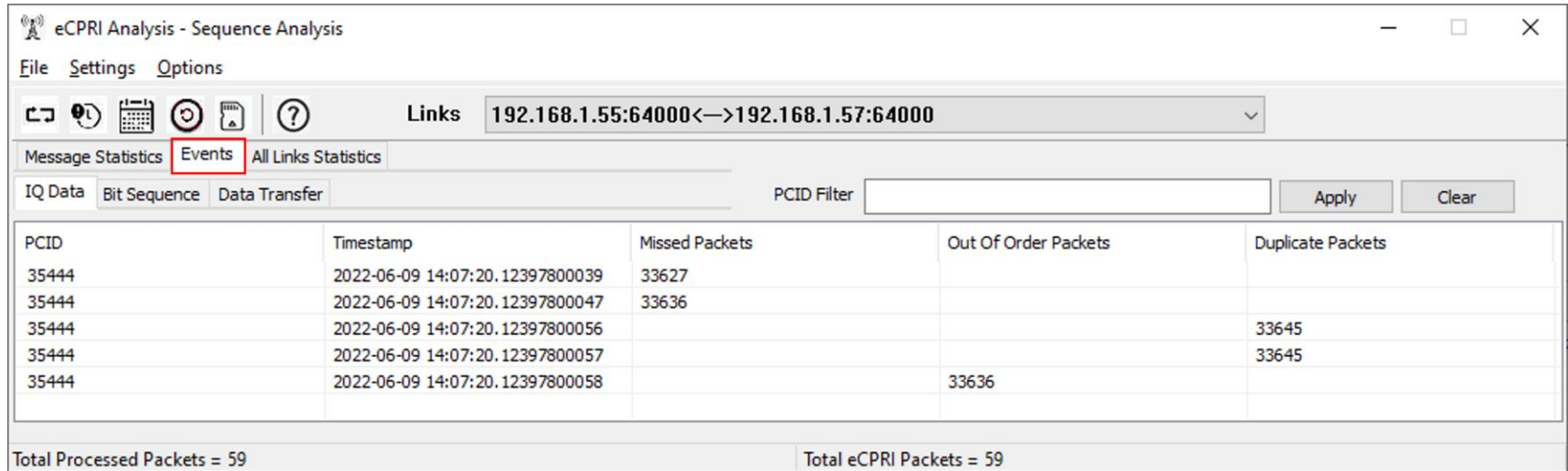
Total Processed Packets = 59

Total eCPRI Packets = 59



# Events

- The **Events** tab displays Packet Statistics like
  - Missed Packets (Provides the range if more than one packet is missed),
  - Duplicate Packets
  - Out of Order Packets Sequence Number for each PCID at the time of occurrence for IQ, Bit Sequence, and Data Transfer respectively



eCPRI Analysis - Sequence Analysis

File Settings Options

Links 192.168.1.55:64000<—>192.168.1.57:64000

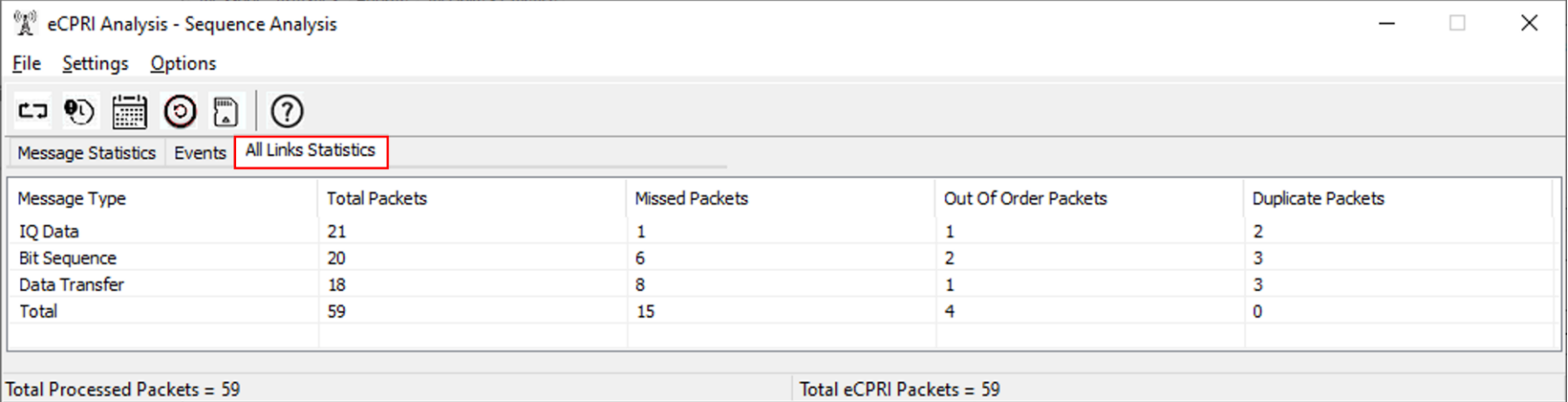
Message Statistics **Events** All Links Statistics

IQ Data Bit Sequence Data Transfer PCID Filter [ ] Apply Clear

PCID	Timestamp	Missed Packets	Out Of Order Packets	Duplicate Packets
35444	2022-06-09 14:07:20.12397800039	33627		
35444	2022-06-09 14:07:20.12397800047	33636		
35444	2022-06-09 14:07:20.12397800056			33645
35444	2022-06-09 14:07:20.12397800057			33645
35444	2022-06-09 14:07:20.12397800058		33636	

Total Processed Packets = 59 Total eCPRI Packets = 59

# All Links Statistics



eCPRI Analysis - Sequence Analysis

File Settings Options

Message Statistics Events **All Links Statistics**

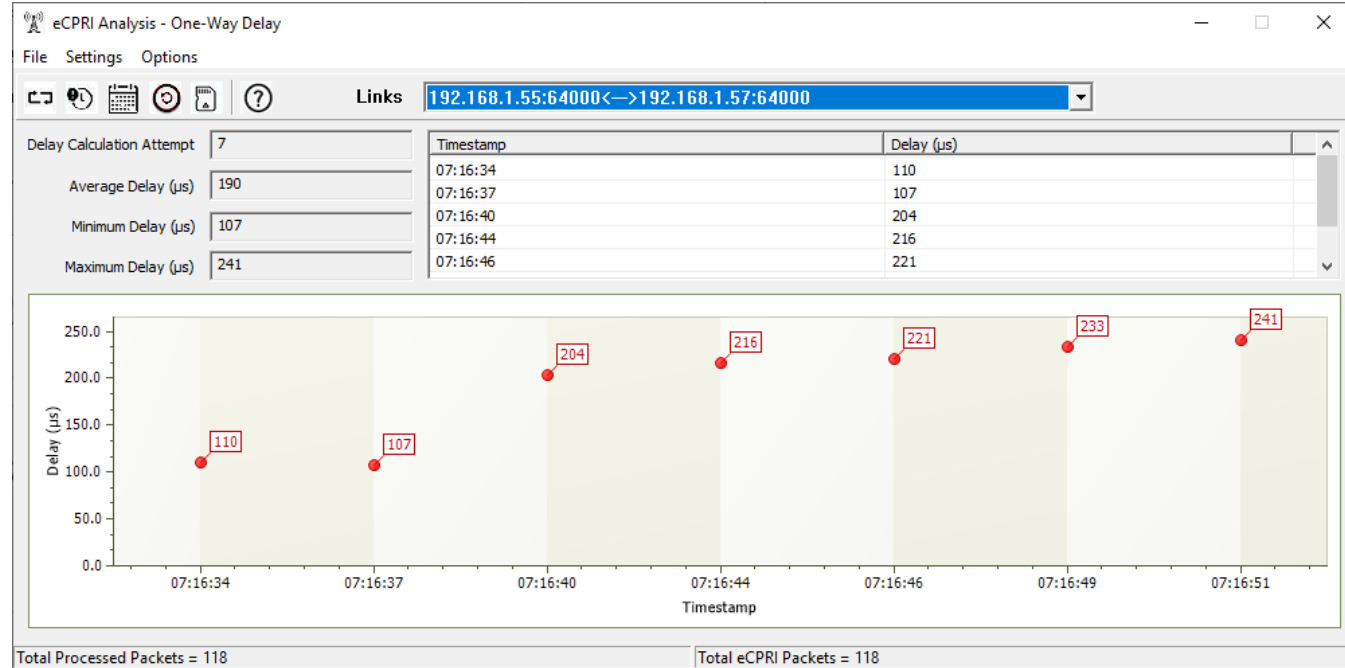
Message Type	Total Packets	Missed Packets	Out Of Order Packets	Duplicate Packets
IQ Data	21	1	1	2
Bit Sequence	20	6	2	3
Data Transfer	18	8	1	3
Total	59	15	4	0

Total Processed Packets = 59 Total eCPRI Packets = 59

- Displays sequence analysis for all available eCPRI links. This tab shows the aggregation of IQ Data, Bit Sequence, Data Transfer, Total Packets, Missed Packets, Out of Order Packets, and Duplicate Packets for each message type across all links

# One-Way Delay Measurement

- Displays the number of delay attempts, the average delay, and the minimum and maximum delay in microseconds
- The delay values are plotted on a Point graph, which calculates the values at different intervals. The same values are also added to a table for each link



# Event Indication

- Indicates events that occurred between two eCPRI nodes
- An event in Event Indication can contain one or more faults (raises/ceases) or notifications related to user data processing
- The **Faults** and **Notifications** are displayed in separate tabs in this dialog

eCPRI Analysis - Event Indication

File Settings Options

Links 192.168.1.55:64000<—>192.168.1.57:64000

Faults Notifications

Total 14 Raises 11 Ceases 3

Element ID	#Faults	Raise	Cease
65535	14	11	3

General Userplane HW Fault  
General Userplane SW Fault  
General Userplane HW Fault  
General Userplane HW Fault  
General Userplane HW Fault  
General Userplane SW Fault  
General Userplane HW Fault

Total Processed Packets = 20 Total eCPRI Packets = 20

# Fault Indication

The screenshot shows the 'eCPRI Analysis - Event Indication' window. The 'Faults' tab is selected and highlighted with a red box. The window displays a summary of fault statistics and a detailed table of faults for a specific element.

**Summary Statistics:**

- Total: 14
- Raises: 11
- Ceases: 3

**Table of Faults:**

Element ID	#Faults	Raise	Cease
65535	14	11	3

**General Userplane Faults:**

- General Userplane HW Fault
- General Userplane SW Fault
- General Userplane HW Fault
- General Userplane HW Fault
- General Userplane SW Fault
- General Userplane HW Fault

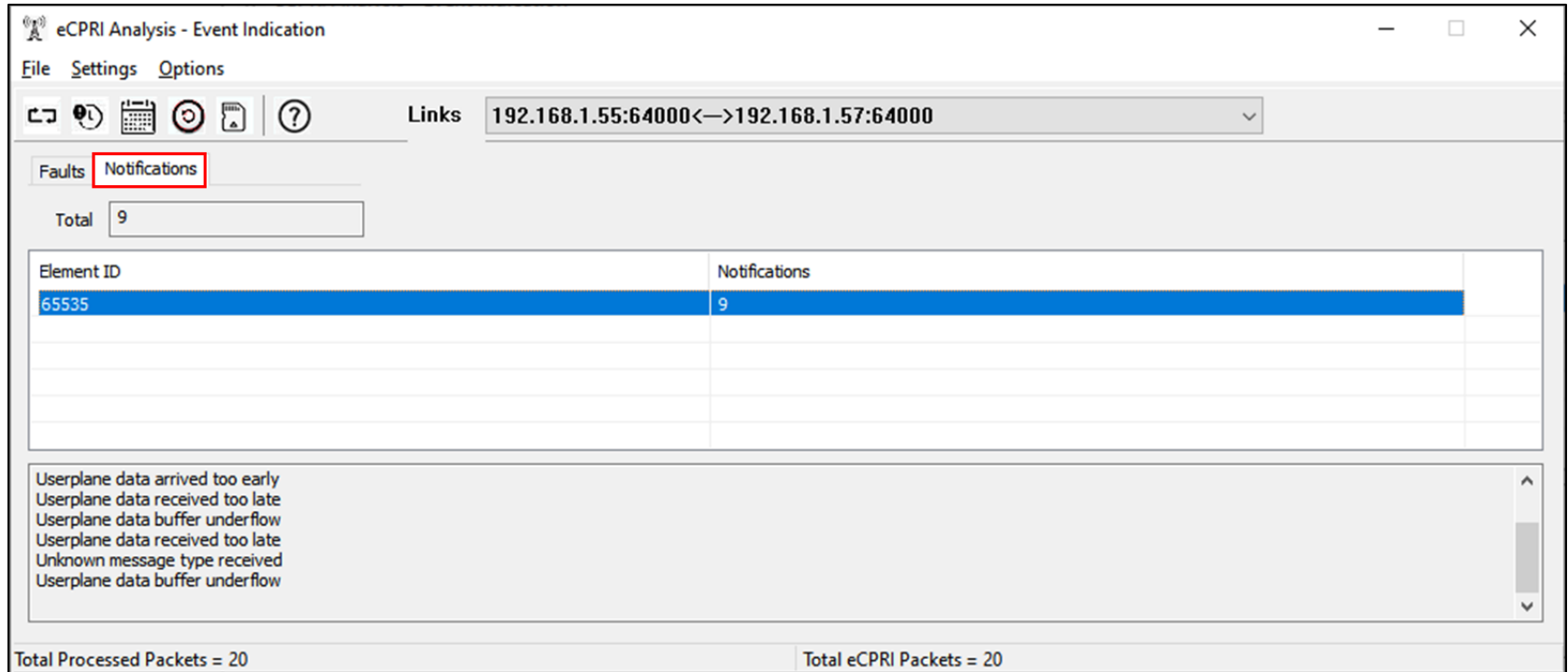
**Footer:**

- Total Processed Packets = 20
- Total eCPRI Packets = 20

- Displays the total number of faults, as well as the number of raises and ceases. Additionally, the tab shows these statistics for each element represented by the Element ID in a tabular column
- The **Faults** tab also displays any hardware, software, or vendor-specific faults for the selected Element ID

# Notifications

- The **Notification** tab shows the total number of notifications, as well as notifications for each Element ID displayed in a tabular column
- In addition, the **Notification** tab displays User Plane Data issues for the selected Element ID, such as Data arriving too late, Data Buffer Overflow, Data Buffer Underflow, and Data arriving too early



eCPRI Analysis - Event Indication

File Settings Options

Links 192.168.1.55:64000<—>192.168.1.57:64000

Faults **Notifications**

Total 9

Element ID	Notifications
65535	9

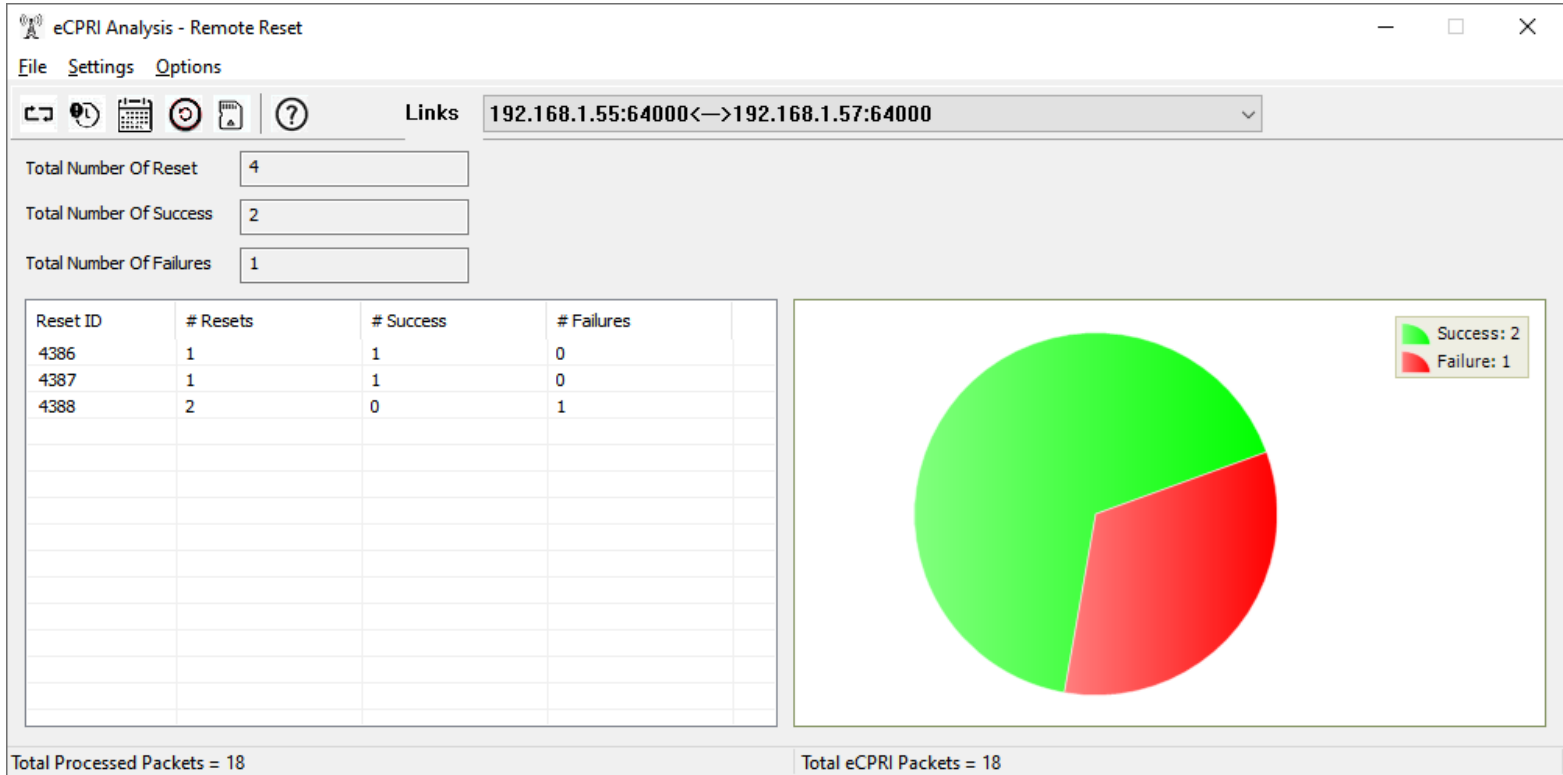
Userplane data arrived too early  
Userplane data received too late  
Userplane data buffer underflow  
Userplane data received too late  
Unknown message type received  
Userplane data buffer underflow

Total Processed Packets = 20

Total eCPRI Packets = 20

# Remote Reset

- Displays statistics for each Reset ID, including the total number of successful and failed resets, as well as the total number of resets with successful and failed outcomes. The statistics are shown both in a PIE graph and in a tabular column



# Remote Memory Access

- Displays statistics for each Element ID, as well as the total number of successful and failed read and write operations
- The statistics include the total Read Count, Read Success, Read Failure, Write Count, Write Success, and Write Failure for each Element ID, as well as the total statistics for all the elements

The screenshot shows a software window titled "eCPRI Analysis - Remote Memory Access". It has a menu bar with "File", "Settings", and "Options". Below the menu is a toolbar with icons for a folder, a magnifying glass, a calendar, a circular arrow, a document, and a question mark. A "Links" dropdown menu shows the address "192.168.1.55:64000<—>192.168.1.57:64000".

Below the toolbar, there are two sections for statistics:

- Read:** Total 4, Success 2, Failure 2.
- Write:** Total 7, Success 5, Failure 2.

Below these sections is a table with 7 columns: Element ID, Read Count, Read Success, Read Failure, Write Count, Write Success, and Write Failure. The table contains 11 rows of data for Element IDs 8755 through 8765.

Element ID	Read Count	Read Success	Read Failure	Write Count	Write Success	Write Failure
8755	1	0	1	0	0	0
8756	1	1	0	0	0	0
8757	0	0	0	1	1	0
8758	0	0	0	1	0	1
8759	0	0	0	1	1	0
8760	1	1	0	0	0	0
8761	0	0	0	1	1	0
8762	0	0	0	1	1	0
8763	0	0	0	1	1	0
8764	1	0	1	0	0	0
8765	0	0	0	1	0	1

At the bottom of the window, there are two status bars: "Total Processed Packets = 19" on the left and "Total eCPRI Packets = 19" on the right.



# Analysis of eCPRI Decodes in Offline PacketScan™ HD

## Over UDP

```
Device0 Frame=6 at 2022-06-09 06:07:36.711206000 OK Len=112 *** Right c
Ethernet Frame Data
===== MAC Layer =====
0000 Destination Address = xFCAA149225C4
0006 Source Address      = x54BEF737CB9A
000C Length/Protocol Type = x86DD IPv6
===== IPv6 Layer =====
000E Protocol Version    = 0110.... (6)
000E Traffic Class       = 0 (...0000 0000....)
000F Flow Label          = 834513 (...1100 10111011 11010001)
0012 Payload Length      = 58 (x003A)
0014 Next Header         = 00010001 User Datagram Protocol (UDP)
0015 Hop Limit           = 64 (x40)
0016 Source Address      = fe80::64f2:5e84:f1db:502
0026 Destination Address = fe80::589e:b2d5:9074:2bec
===== UDP Layer =====
0036 Source Port         = 64000 (xFA00)
0038 Destination Port    = 64000 (xFA00)
003A Length (Header + Data) = 58 (x003A)
003C Checksum            = x7F76
===== eCPRI Layer =====
003E C                   = .....0 eCPRI message is the last one inside the eCPRI PDU
003E eCPRI Protocol Revision = 0001.... (1)
003F eCPRI Message Type   = 00000100 Remote Memory Access
0040 eCPRI Payload Size   = 28 (x001C)
0042 Remote Memory Access ID = 17 (x11)
0043 Req/Resp             = ....0010 Failure
0043 Read/Write           = 0010.... Write_No_Resp
0044 Element ID           = 8755 (x2233)
0046 Address              = x050403020100
004C Length               = 16 (x0010)
User Data                 = xFFEEDDCCBBAA99887766554433221100
```

# Analysis of eCPRI Decodes in Offline PacketScan™ HD

## 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
```

Thank you