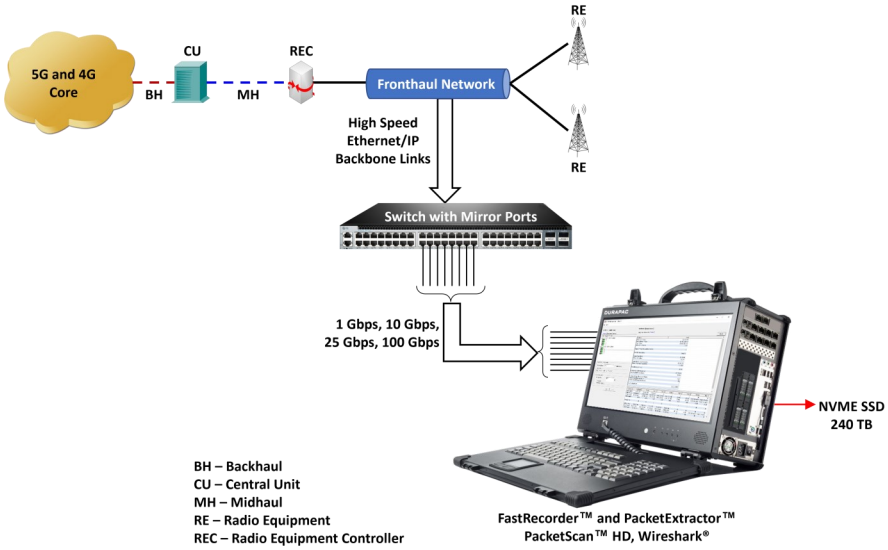
eCPRI Protocol Analysis



Overview

The Enhanced Common Public Radio Interface (eCPRI) is an industry cooperation aimed at defining publicly available specifications for the key internal interface of radio base stations, such as eCPRI connecting the eCPRI Radio Equipment Control (eREC) and the eCPRI Radio Equipment (eRE) via Fronthaul Transport Network. Fronthaul networks are required to meet high rates, stringent reliability, and latency requirements. eCPRI protocol can be transmitted over UDP and MAC layers. eCPRI contains User Data, Real-time Control, and other eCPRI services.

GL's eCPRI protocol analysis tool can perform unlimited wirespeed capturing of eCPRI traffic, up to the hard drive limit. This tool enables users to monitor and analyze eCPRI traffic and verify the interoperability, latency, and reliability of the fronthaul transport interface. Also, generates statistics on eCPRI message types such as IQ Data, Bit Sequence, Generic Data Transfer, Remote Memory Access, One-way Delay Measurement, Remote Reset, and Event Indication. Furthermore, the tool supports for monitoring eCPRI traffic, allowing for the detection and analysis of packet impairments like Missed Packets, Out of Order, Duplicate Packets, and One-Way Delay, among others.

GL's FastRecorder™ and PacketExtractor™ solution also have been enhanced to capture and extract eCPRI traffic. Additionally, the high-density Ethernet monitoring appliance, PacketScan™ HD, offers decoding, monitoring, and analysis capabilities for the eCPRI protocol.

Main Features

- Monitor and decode eCPRI traffic to identify packet impairments, such as Missed Packets, Out of Order Packets, Duplicate Packets, and One-Way Delay
- Provides the message statistics for Sequence Analysis, One-Way Delay Measurement, Event Indication, Remote Reset, and Remote Memory Access
- Supports eCPRI analysis for each IPv4 and IPv6 pair address
- The All Links statistics enable sequence analysis for all available eCPRI links
- Supports One-Way Delay calculation in microseconds
- Supports identification of hardware faults, software faults, or vendor-specific faults for a selected Element ID
- Provides graphical representation of Remote reset statistics
- Supports Remote Memory Access statistics for each Element ID and also total statistics for all the elements

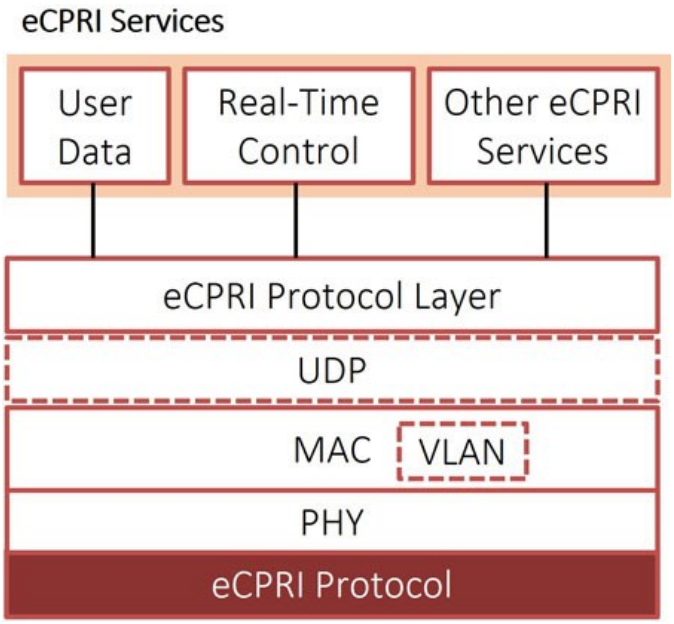
For more details, refer to eCPRI Protocol Analysis webpage.

GL Communications Inc.

818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878, U.S.A

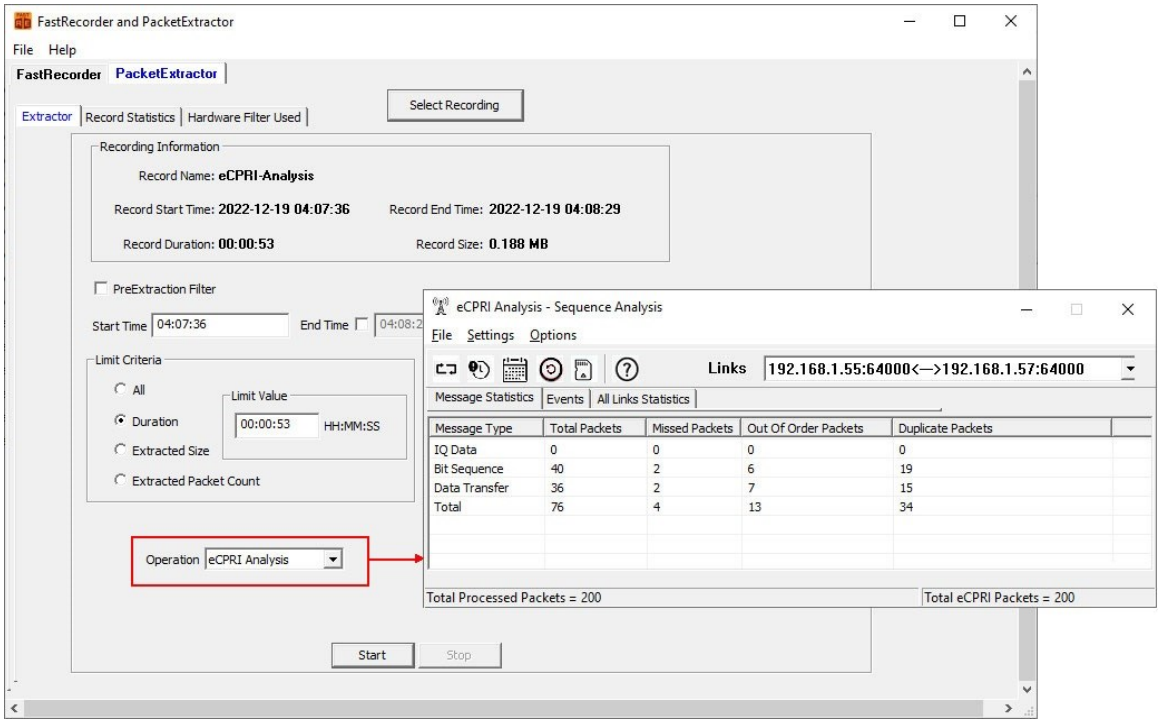
(Web) www.gl.com - (V) +1-301-670-4784 (F) +1-301-670-9187 - (E-Mail) info@gl.com

eCPRI Protocol Stack



Invoking eCPRI Analysis

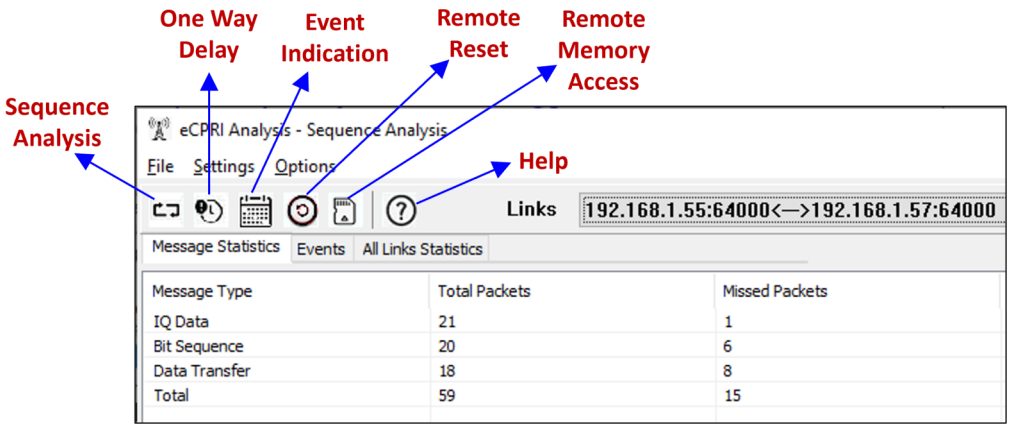
FastRecorder™ and PacketExtractor™ analyzer supports eCPRI analysis to monitor eCPRI traffic for packet impairments such as Missed Packets, Out of Order, Duplicate Packets, One-Way Delay etc.



eCPRI Analysis

GL's eCPRI Analysis application provides the following message statistics.

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

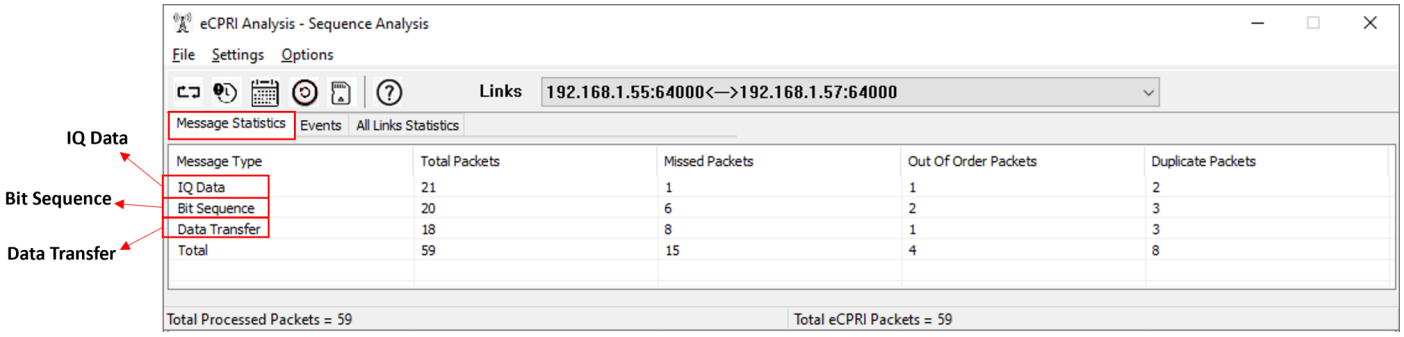


Sequence Analysis

The **Sequence Analysis** feature 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.

Message statistics

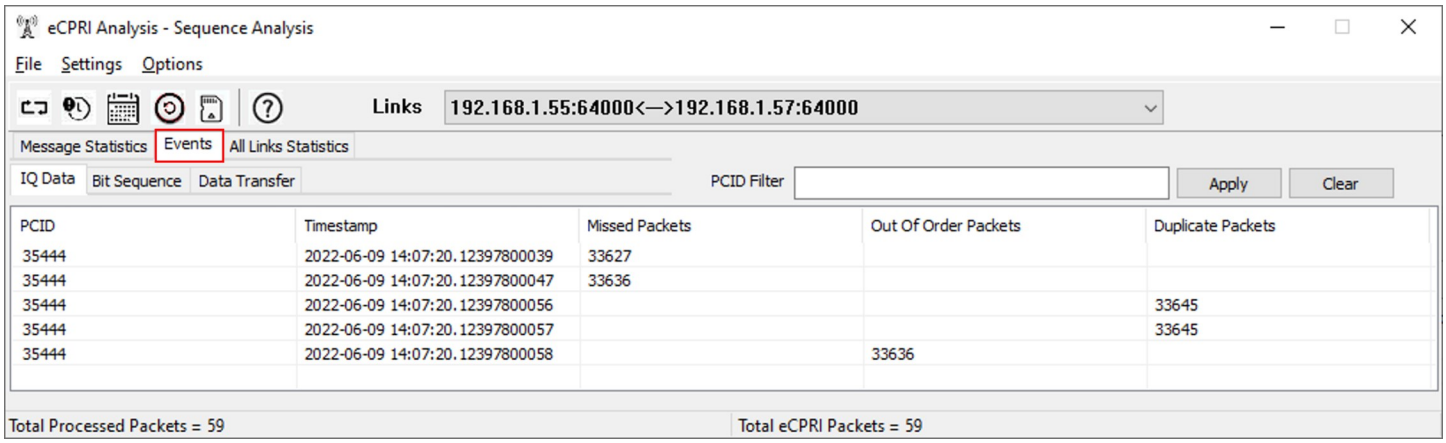
Display IQ Data, Bit Sequence, Data Transfer, Total Packets, Missed Packets, Out of Order Packets, and Duplicate Packets for each link selected in the Link selection drop down list.



Sequence Analysis (*Contd.*)

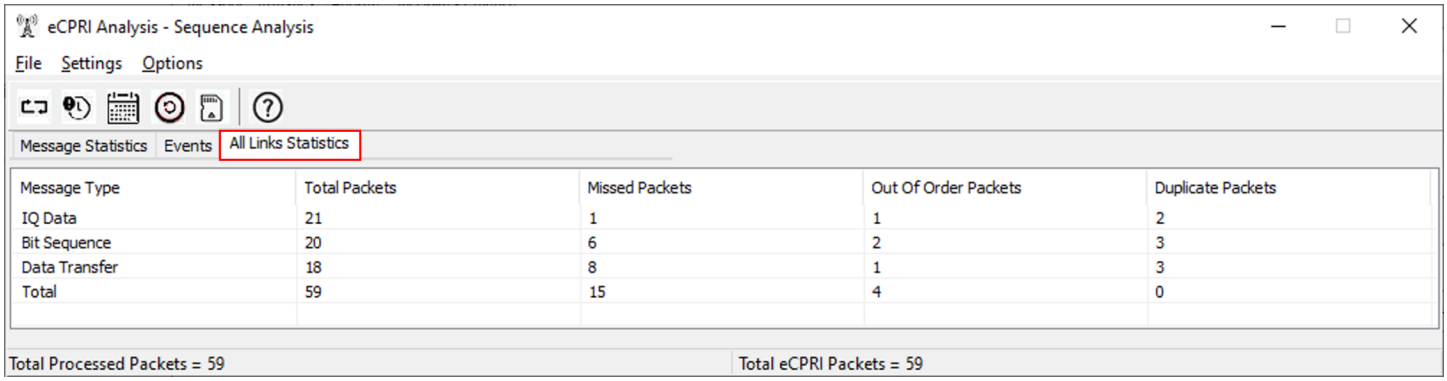
Events

Display Packet Statistics like Missed Packets (Provides the range if more than one packet is missed), Duplicate Packets and Out of Order Packets Sequence Number for each PCID at the time of occurrence for IQ, Bit Sequence, and Data Transfer respectively in their tabs.



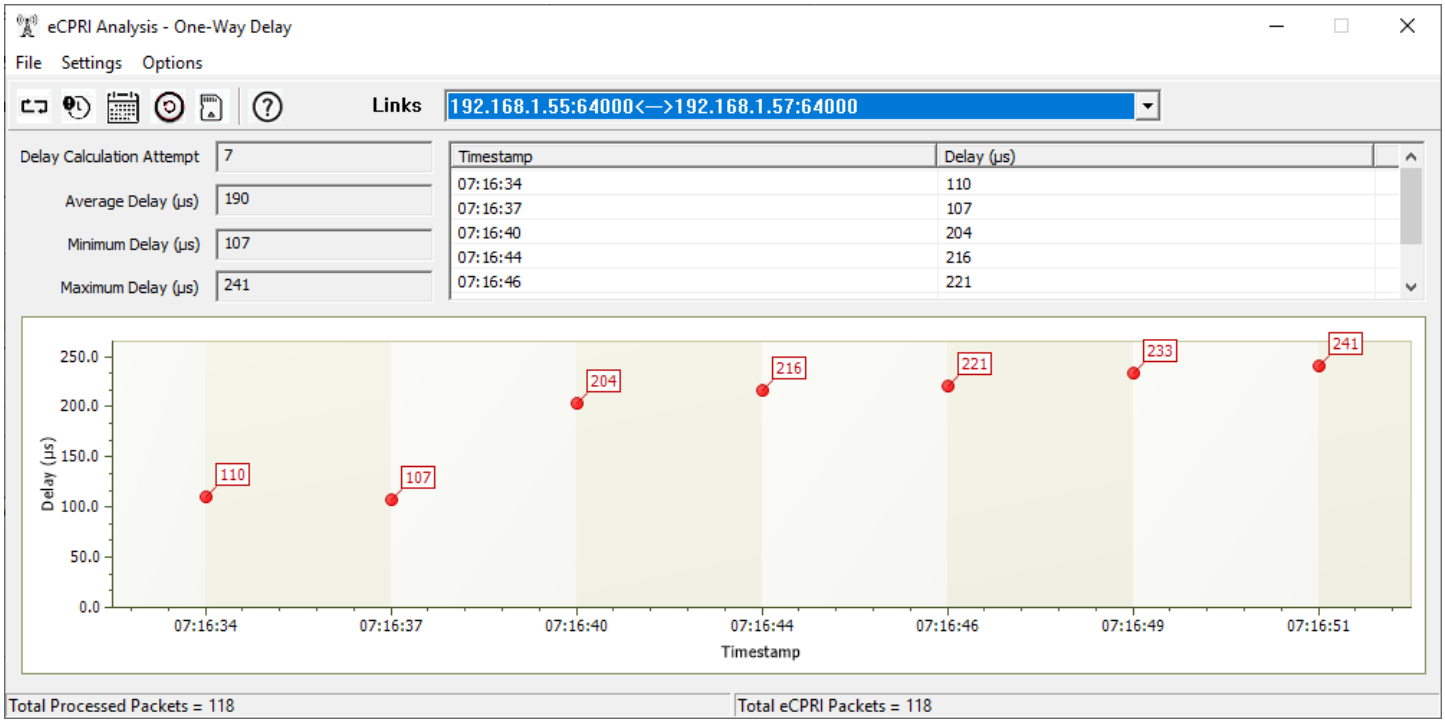
All Links Statistics

The **All Links Statistics** tab provides a 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 link.



One-Way Delay Measurement

One-Way delay measurement is used to estimate the delay between two eCPRI nodes. The One-Way Delay window 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.

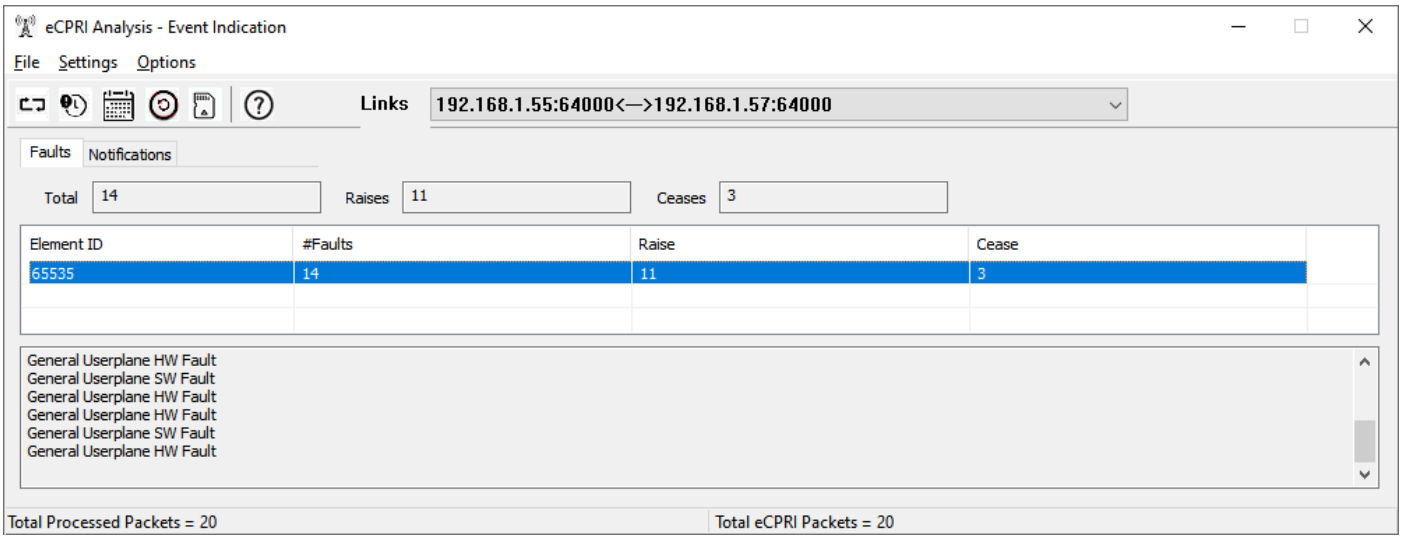


Event Indication

Event Indication is a feature used to indicate 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.

Faults

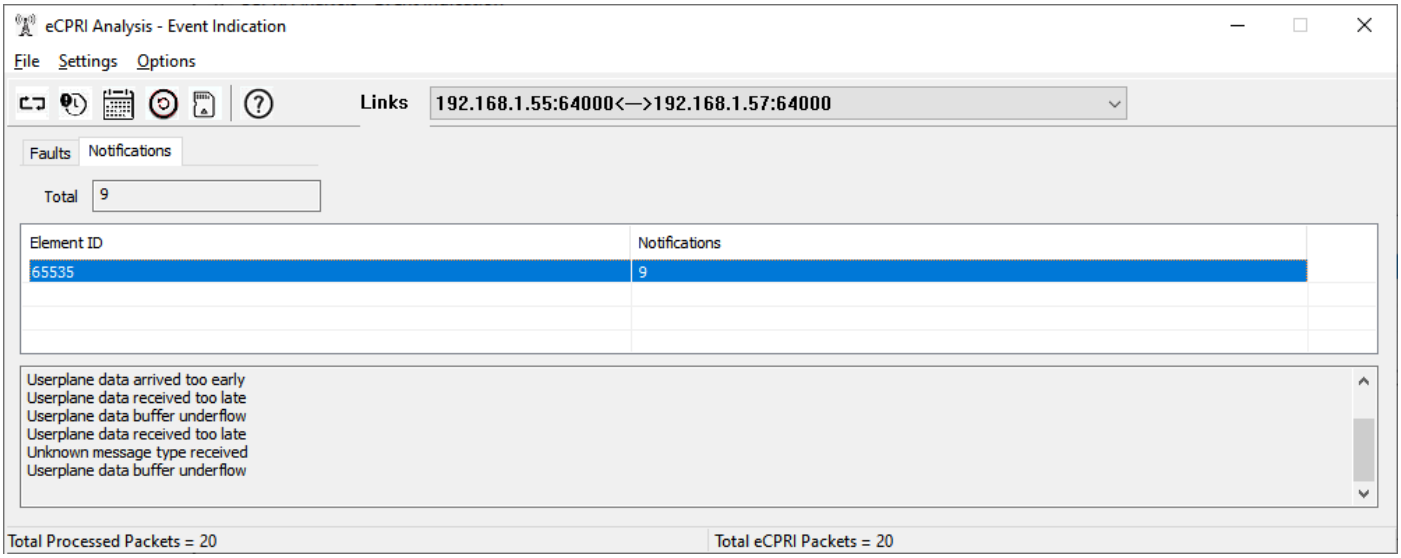
The **Faults** tab displays the total number of faults, as well as the number of raises and ceases. Additionally, the tab shows these statistics for each element represented by the Element ID in a tabular column. The Faults tab also displays any hardware, software, or vendor-specific faults for the selected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



Event Indication (*Contd.*)

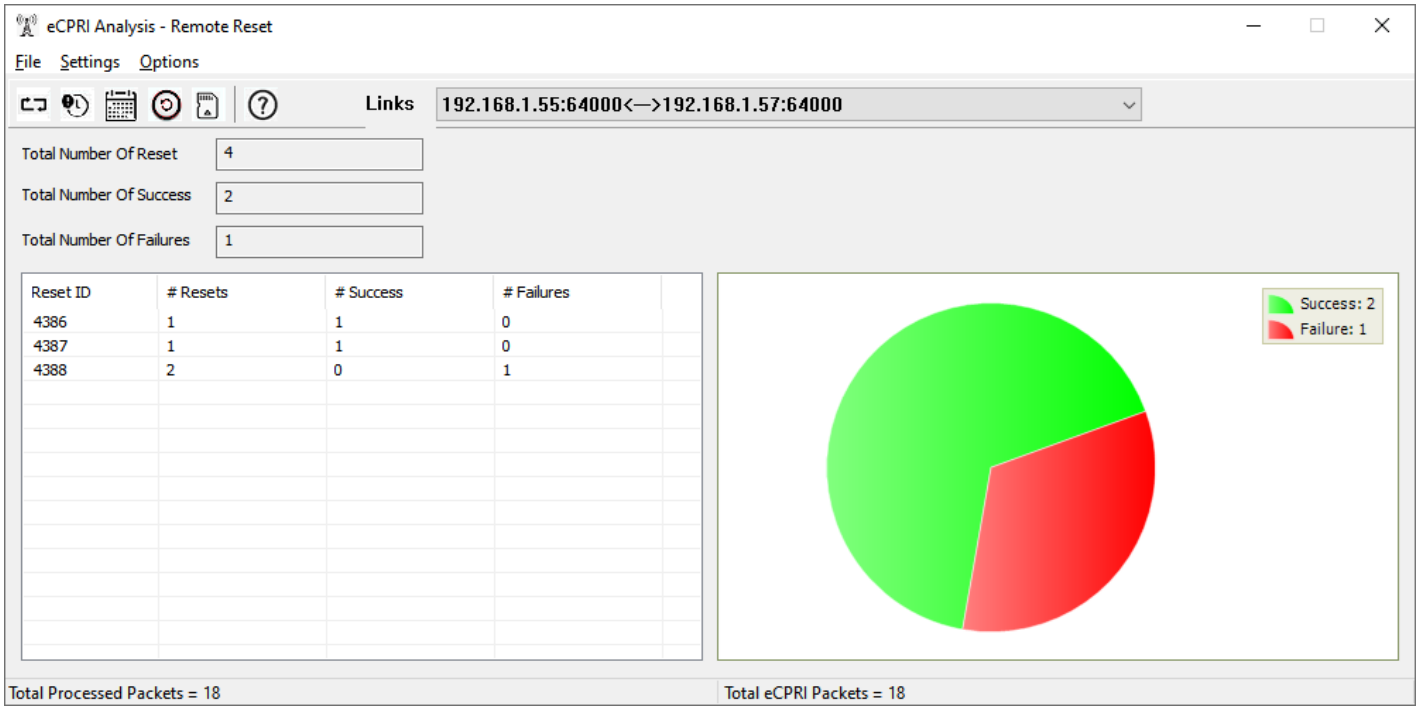
Notifications

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.



Remote Reset

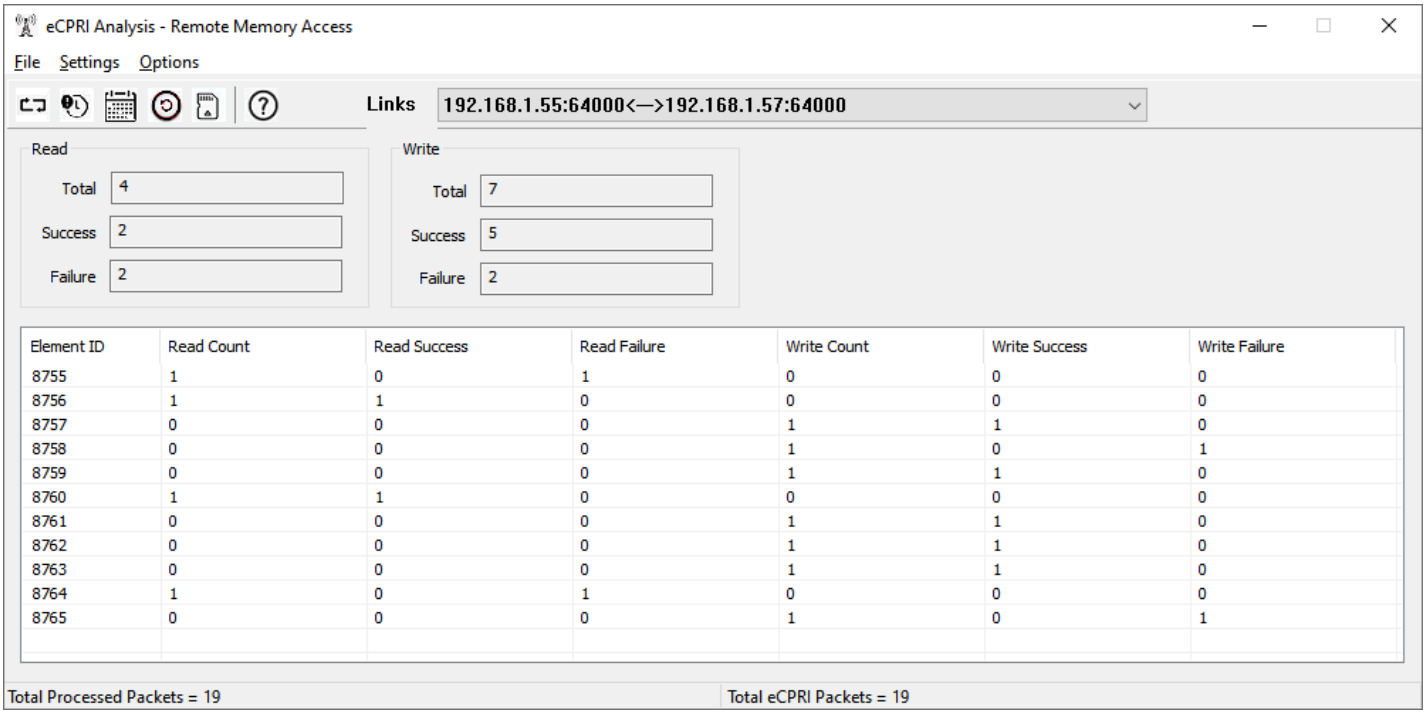
Remote Reset is a feature used to reset one eCPRI node from another. An eREC can trigger a Remote Reset request to reset an eRE. The Remote Reset feature displays statistics for each Reset ID, including the total number of successful and failed resets, as well as the total number of resets with successful and failed outcomes. The statistics are shown both in a PIE graph and in a tabular column.



Remote Memory Access

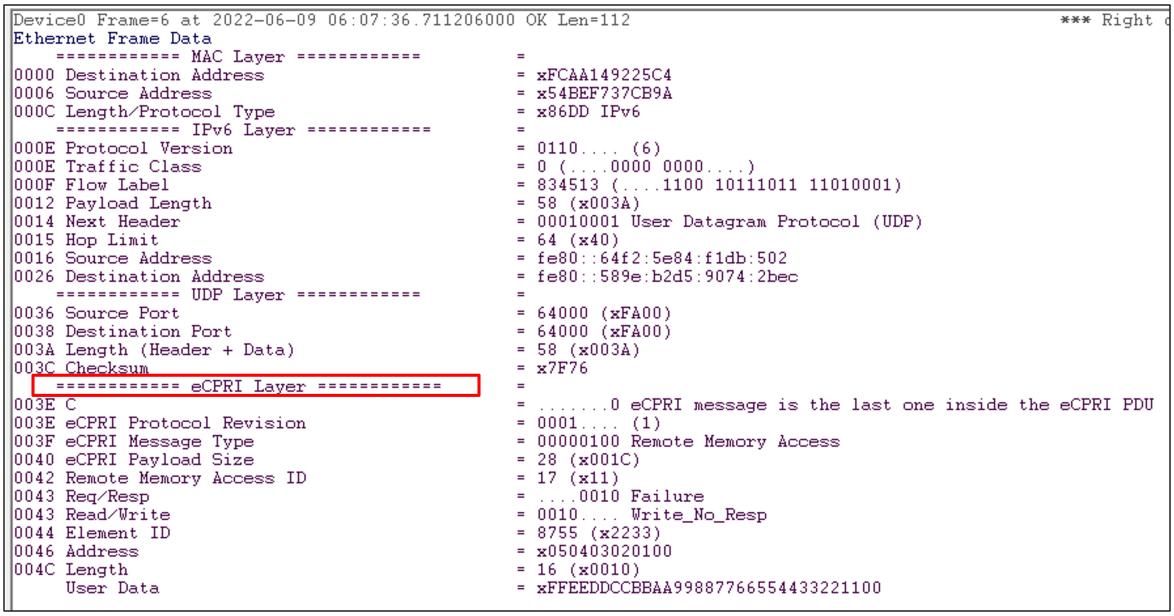
Remote Memory Access allows the user to read from or write to a specific memory address on another eCPRI node. Any interface node, whether it's an eRE or eREC, can use this feature by sending a Read or Write Request. Then, the node waits for a Response to confirm that the operation was successful.

The Remote Memory Access feature 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.



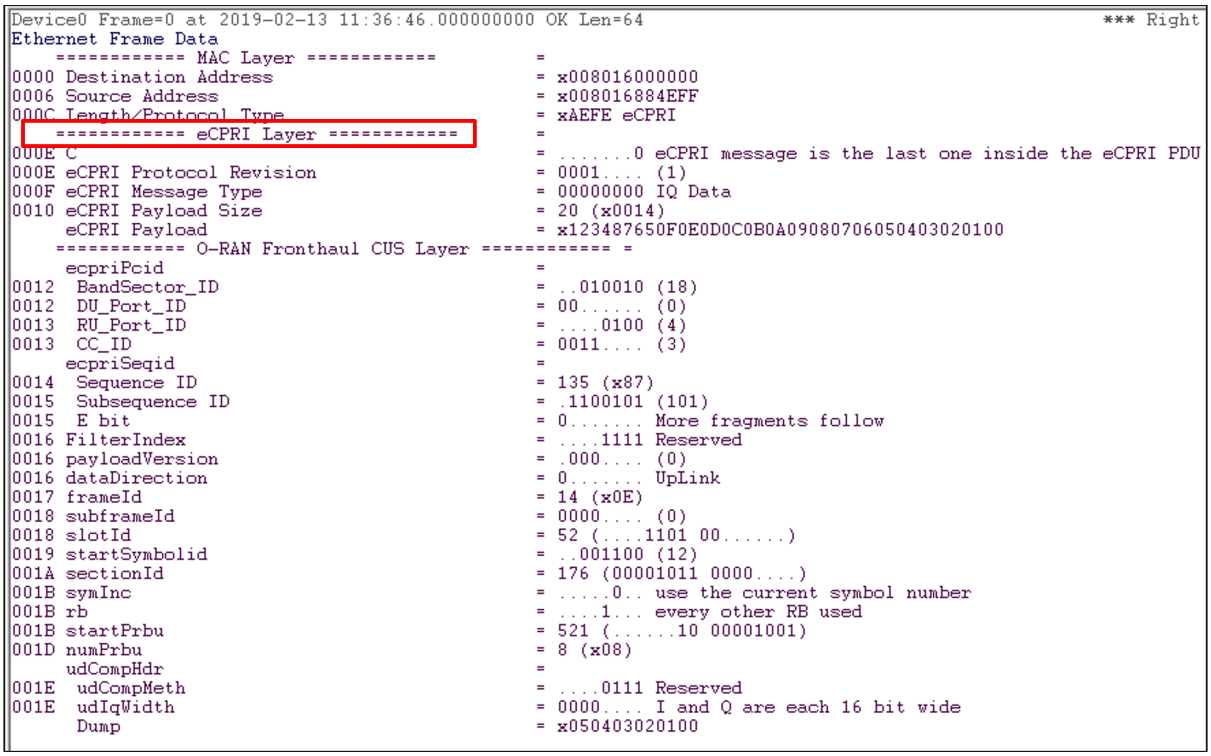
Analysis of eCPRI Decode using PacketScan™ HD Application

Analysis of eCPRI Decode over UDP



```
Device0 Frame=6 at 2022-06-09 06:07:36.711206000 OK Len=112                    *** Right
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 Decode 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
```

Buyer's Guide

Item No	Product Description
PKV123	FastRecorder™ and PacketExtractor™ for Monitoring IP Networks (requires any one of PKV120, PKV120p, PKV122, PKV122p, PKV124, PKV124p) PacketRecorder™ and PacketReplay™ (requires any one of PKV120, PKV120p, PKV122, PKV122p)

Item No	Related Software
PKV122	PacketScan™ HD – High Density IP Traffic Analyzer w/ 2x10GigE
PKV124	PacketScan™ HD – High Density IP Traffic Analyzer w/ 2x40/100GigE
PKV100	PacketScan™ (Real-time and Offline)
PKV101	PacketScan™ - Offline
PKV170	NetSurveyorWeb™

Note: PCs which include GL hardware/software require Intel or AMD processors for compliance.

For more details, refer to eCPRI Protocol Analysis webpage.