Wireshark CA Plug-in
EPICS Channel Access Dissector

Kazuro Furukawa, KEK
Ron Rechenmacher, Fermilab
Anze Zagar, Cosylab
Klemen Zagar, Cosylab

Background

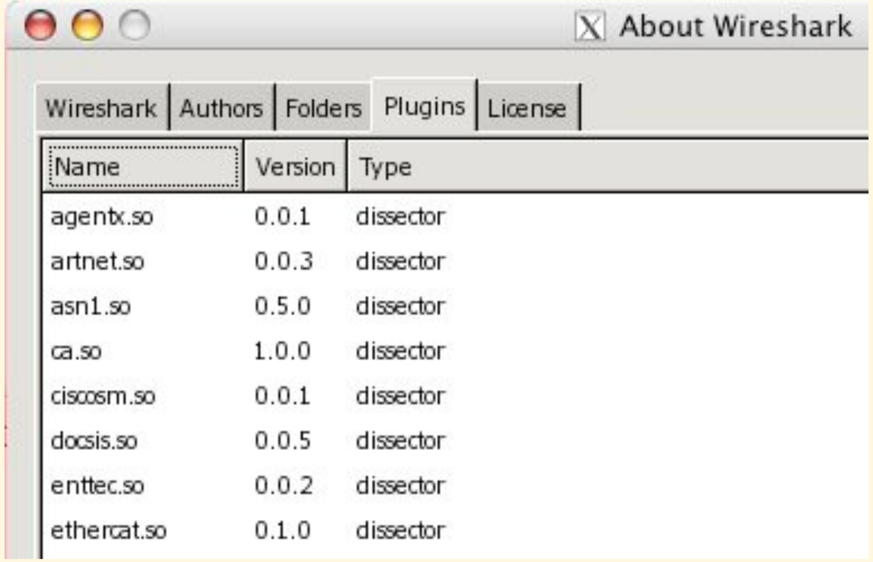
- **Ideas and efforts from several groups in the past**
  - Tech-talk proposal of CA Sniffer from Ned Arnold, APS
  - Implementation of primary CA Plugin for Ethereal by Ron Rechenmacher, Fermilab
  - (Managers love to have analyzers)
- **KEK needed CA analyzer for efficient EPICS operation**
  - Without knowing above efforts
  - Thought about Tcpdump extension for textual processing
  - Discussion at ICALEPCS with Bob Dalesio and Jeff Hill
  - Discussion with Ron Rechenmacher, Fermilab
  - Implementation by Klemen and Anze Zagar, Cosylab

CA Plug-in for Wireshark

- **Wireshark (formally Ethereal)**
  - **Is the most famous network protocol analyzer and is open source**
    - **<http://www.wireshark.org/>**
- **Wireshark Plugin architecture**
  - **EPICS channel access protocol dissection in CA plugin**
    - **Development is well separated from main program**
    - **Plugin distribution is simpler**
      - **Only one file (shared/dynamic library file) for binary distribution**
      - **One plugin directory and a simple patch (Makefile, etc) in a tar file for source**

CA Plug-in for Wireshark

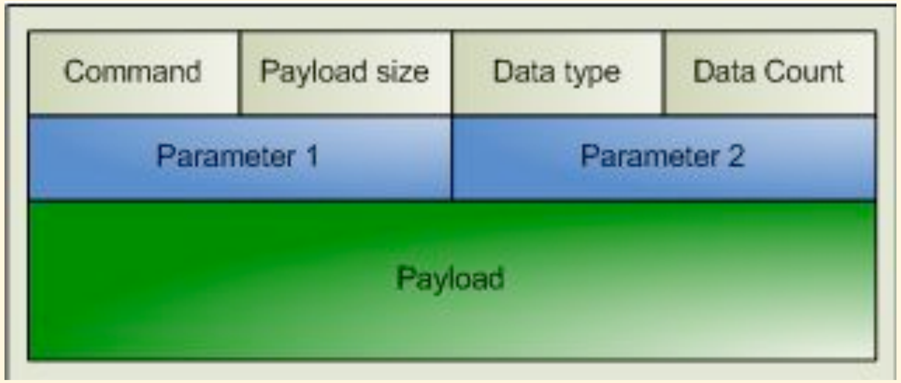
- **Graphical or Textual user interface**
  - **Graphical interface for Online capture and Offline analysis**
    - **With flexible filters**
  - **Textual interface (tshark) for batch operation**
    - **Original intention at KEK was long-term rare event capturing and analysis**
      - **Background operation was preferable**
      - **Almost the same as tcpdump**
      - **Captured data can be analyzed later**
        - **»With Graphical user interface**



Name	Version	Type
agentx.so	0.0.1	dissector
artnet.so	0.0.3	dissector
asn1.so	0.5.0	dissector
ca.so	1.0.0	dissector
ciscosm.so	0.0.1	dissector
docsis.so	0.0.5	dissector
enttec.so	0.0.2	dissector
ethercat.so	0.1.0	dissector

CA Plugin

- Dissects all CA packet header
  - Commands/replies and parameters
    - In Channel Access Protocol specification
      - <http://epics.cosylab.com/cosyjava/JCA-Common/Documentation/CAproto.html>
- Also tracks PV/Channel names along virtual circuit
  - Each packet only contains ID (CID/SID/SubscriptionID)
    - Indispensable for human-readable analysis
- Does not dissect payload
  - Use other EPICS tools
    - For data contents



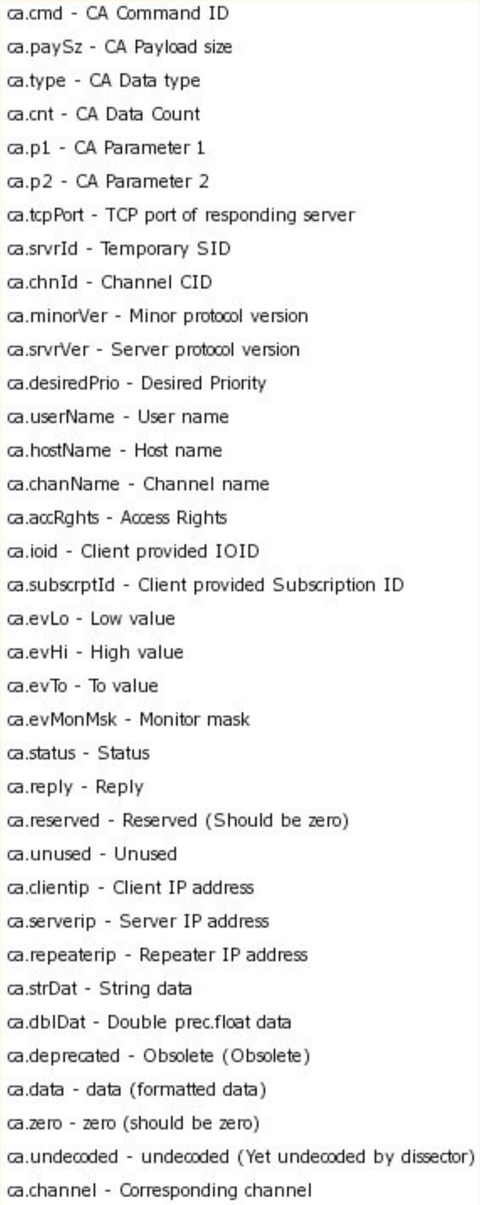
<table>
<tr><td>Command</td><td>Payload size</td><td>Data type</td><td>Data Count</td></tr>
<tr><td colspan="2">Parameter 1</td><td colspan="2">Parameter 2</td></tr>
<tr><td colspan="4">Payload</td></tr>
</table>

Installation

- **Binary installation**
  - **Install normal Wireshark 0.99.8 or 0.99.7**
  - **Install CA plugin binary**
    - **From <http://www-linac.kek.jp/cont/epics/wireshark/>**
    - **Windows, Linux, MacOSX (x86/ppc) for now**
- **Building from source**
  - **Get Wireshark (0.99.8 or 0.99.7)**
  - **Expand CA plugin source**
  - **Apply patch**
  - **Normal building procedure**
    - **<http://www-linac.kek.jp/cont/epics/wireshark/> for details**
    - **Gtk+ and packet capture software are required**

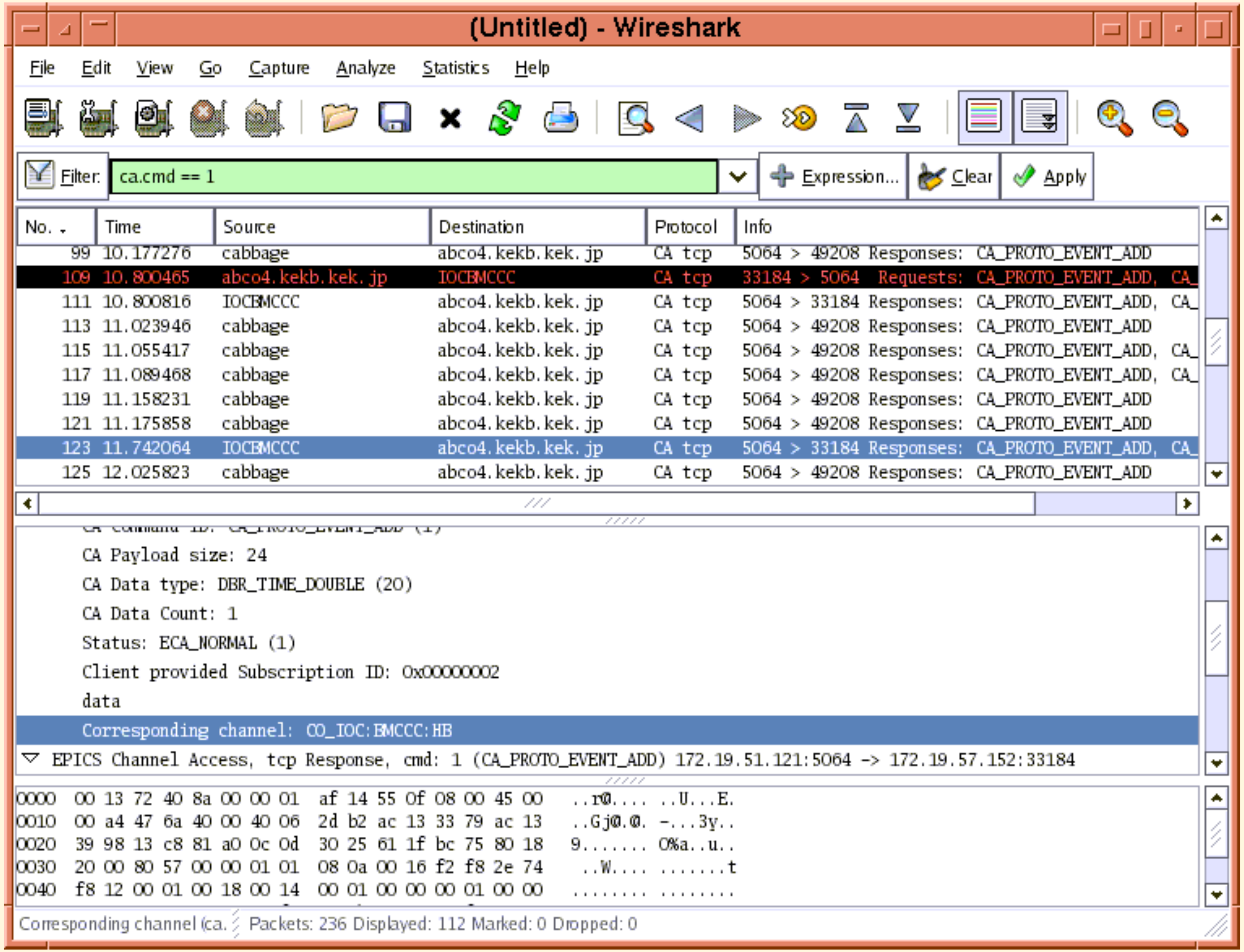
Simple Usage for EPICS

- Invoke Wireshark
- Capture options
  - Capture Filter: “port 5064 or port 5065”
- Start capture
- (Stop capture)
- Apply display/analysis filter
  - Filter examples
    - ca.cmd==1
      - Symbolic names like CA_PROTO_EVENT_ADD in Helper
    - ca.chanName==“fred” or ca.channel==“fred”
      - Packets related to a PV named fred
    - ca.channel matches “^VAC:IP.*:Pressure”
    - ca.channel contains “VAC:IP”
      - PV name string or regular-expression matching



ca.cmd - CA Command ID
ca.paySz - CA Payload size
ca.type - CA Data type
ca.cnt - CA Data Count
ca.p1 - CA Parameter 1
ca.p2 - CA Parameter 2
ca.tcpPort - TCP port of responding server
ca.srvrId - Temporary SID
ca.chnId - Channel CID
ca.minorVer - Minor protocol version
ca.srvrVer - Server protocol version
ca.desiredPrio - Desired Priority
ca.userName - User name
ca.hostName - Host name
ca.chanName - Channel name
ca.accRghts - Access Rights
ca.ioid - Client provided IOID
ca.subscrptId - Client provided Subscription ID
ca.evLo - Low value
ca.evHi - High value
ca.evTo - To value
ca.evMonMsk - Monitor mask
ca.status - Status
ca.reply - Reply
ca.reserved - Reserved (Should be zero)
ca.unused - Unused
ca.clientip - Client IP address
ca.serverip - Server IP address
ca.repeaterip - Repeater IP address
ca.strDat - String data
ca.dblDat - Double prec.float data
ca.deprecated - Obsolete (Obsolete)
ca.data - data (formatted data)
ca.zero - zero (should be zero)
ca.undecoded - undecoded (Yet undecoded by dissector)
ca.channel - Corresponding channel

Selecting EVENT_ADD command/response



Filter: ca.cmd == 1

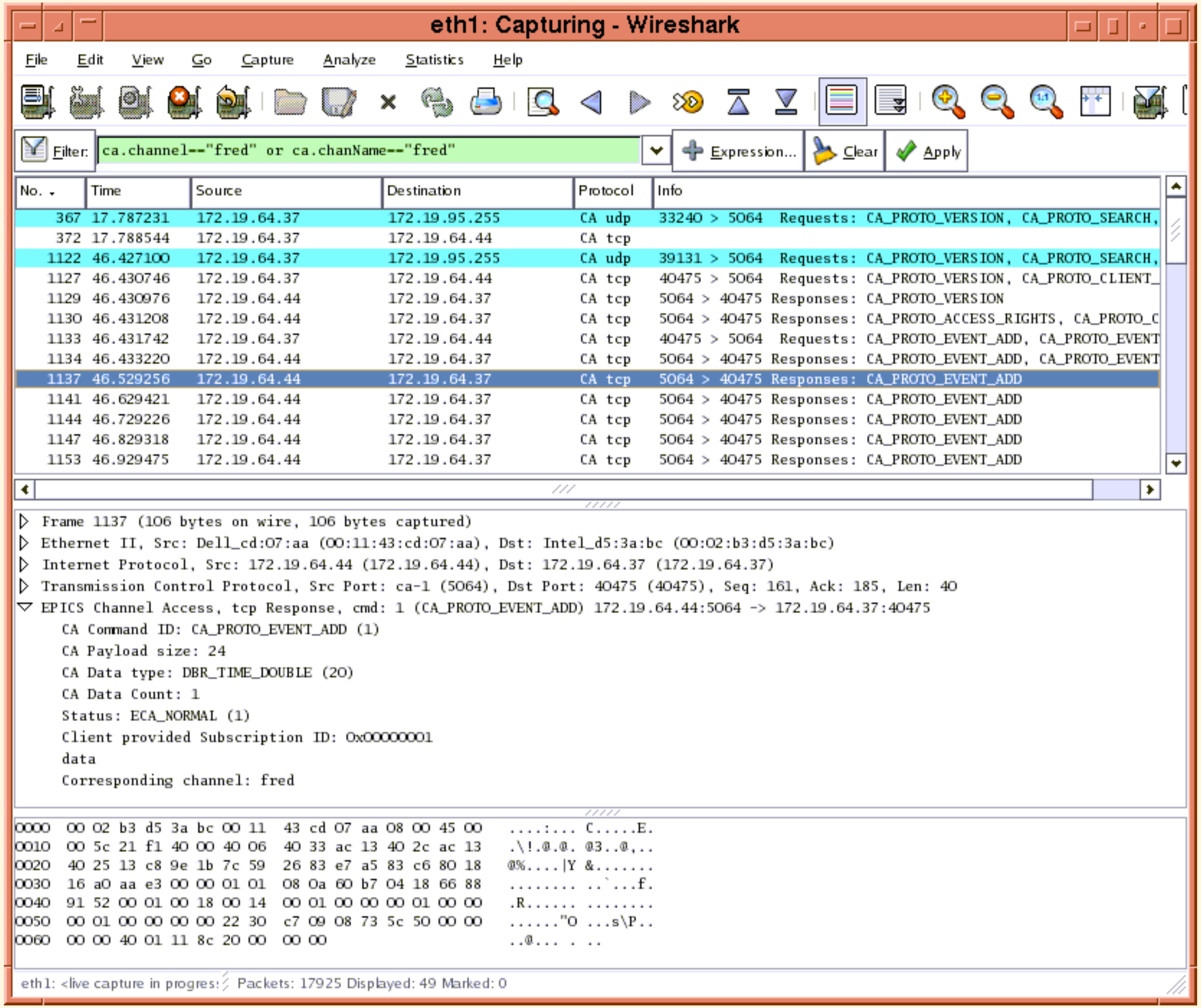
No.	Time	Source	Destination	Protocol	Info
99	10.177276	cabbage	abco4.kekb.kek.jp	CA tcp	5064 > 49208 Responses: CA_PROTO_EVENT_ADD
109	10.800465	abco4.kekb.kek.jp	IOCBMCCC	CA tcp	33184 > 5064 Requests: CA_PROTO_EVENT_ADD, CA_
111	10.800816	IOCBMCCC	abco4.kekb.kek.jp	CA tcp	5064 > 33184 Responses: CA_PROTO_EVENT_ADD, CA_
113	11.023946	cabbage	abco4.kekb.kek.jp	CA tcp	5064 > 49208 Responses: CA_PROTO_EVENT_ADD
115	11.055417	cabbage	abco4.kekb.kek.jp	CA tcp	5064 > 49208 Responses: CA_PROTO_EVENT_ADD, CA_
117	11.089468	cabbage	abco4.kekb.kek.jp	CA tcp	5064 > 49208 Responses: CA_PROTO_EVENT_ADD, CA_
119	11.158231	cabbage	abco4.kekb.kek.jp	CA tcp	5064 > 49208 Responses: CA_PROTO_EVENT_ADD
121	11.175858	cabbage	abco4.kekb.kek.jp	CA tcp	5064 > 49208 Responses: CA_PROTO_EVENT_ADD
123	11.742064	IOCBMCCC	abco4.kekb.kek.jp	CA tcp	5064 > 33184 Responses: CA_PROTO_EVENT_ADD, CA_
125	12.025823	cabbage	abco4.kekb.kek.jp	CA tcp	5064 > 49208 Responses: CA_PROTO_EVENT_ADD

```
    CA Command ID: CA_PROTO_EVENT_ADD (1)
    CA Payload size: 24
    CA Data type: DBR_TIME_DOUBLE (20)
    CA Data Count: 1
    Status: ECA_NORMAL (1)
    Client provided Subscription ID: 0x00000002
    data
    Corresponding channel: CO_IOC:BMCCC:HB
▽ EPICS Channel Access, tcp Response, cmd: 1 (CA_PROTO_EVENT_ADD) 172.19.51.121:5064 -> 172.19.57.152:33184
```

```
0000  00 13 72 40 8a 00 00 01  af 14 55 0f 08 00 45 00   ..r@.... ..U...E.
0010  00 a4 47 6a 40 00 40 06  2d b2 ac 13 33 79 ac 13   ..Gj@.@. -...3y..
0020  39 98 13 c8 81 a0 0c 0d  30 25 61 1f bc 75 80 18   9....... 0%a..u..
0030  20 00 80 57 00 00 01 01  08 0a 00 16 f2 f8 2e 74    ..W.... .......t
0040  f8 12 00 01 00 18 00 14  00 01 00 00 00 01 00 00   ........ ........
```

Corresponding channel (ca. Packets: 236 Displayed: 112 Marked: 0 Dropped: 0

Selecting “fred” related packets



eth1: Capturing - Wireshark
File Edit View Go Capture Analyze Statistics Help
Filter:
Expression...
Clear
Apply

Filter: `ca.channel--"fred" or ca.chanName--"fred"`

```
No. .  Time       Source        Destination    Protocol  Info
  367  17.787231  172.19.64.37  172.19.95.255  CA udp    33240 > 5064  Requests: CA_PROTO_VERSION, CA_PROTO_SEARCH,
  372  17.788544  172.19.64.37  172.19.64.44   CA tcp
 1122  46.427100  172.19.64.37  172.19.95.255  CA udp    39131 > 5064  Requests: CA_PROTO_VERSION, CA_PROTO_SEARCH,
 1127  46.430746  172.19.64.37  172.19.64.44   CA tcp    40475 > 5064  Requests: CA_PROTO_VERSION, CA_PROTO_CLIENT_
 1129  46.430976  172.19.64.44  172.19.64.37   CA tcp    5064 > 40475 Responses: CA_PROTO_VERSION
 1130  46.431208  172.19.64.44  172.19.64.37   CA tcp    5064 > 40475 Responses: CA_PROTO_ACCESS_RIGHTS, CA_PROTO_C
 1133  46.431742  172.19.64.37  172.19.64.44   CA tcp    40475 > 5064  Requests: CA_PROTO_EVENT_ADD, CA_PROTO_EVENT
 1134  46.433220  172.19.64.44  172.19.64.37   CA tcp    5064 > 40475 Responses: CA_PROTO_EVENT_ADD, CA_PROTO_EVENT
 1137  46.529256  172.19.64.44  172.19.64.37   CA tcp    5064 > 40475 Responses: CA_PROTO_EVENT_ADD
 1141  46.629421  172.19.64.44  172.19.64.37   CA tcp    5064 > 40475 Responses: CA_PROTO_EVENT_ADD
 1144  46.729226  172.19.64.44  172.19.64.37   CA tcp    5064 > 40475 Responses: CA_PROTO_EVENT_ADD
 1147  46.829318  172.19.64.44  172.19.64.37   CA tcp    5064 > 40475 Responses: CA_PROTO_EVENT_ADD
 1153  46.929475  172.19.64.44  172.19.64.37   CA tcp    5064 > 40475 Responses: CA_PROTO_EVENT_ADD
```

```
▷ Frame 1137 (106 bytes on wire, 106 bytes captured)
▷ Ethernet II, Src: Dell_cd:07:aa (00:11:43:cd:07:aa), Dst: Intel_d5:3a:bc (00:02:b3:d5:3a:bc)
▷ Internet Protocol, Src: 172.19.64.44 (172.19.64.44), Dst: 172.19.64.37 (172.19.64.37)
▷ Transmission Control Protocol, Src Port: ca-1 (5064), Dst Port: 40475 (40475), Seq: 161, Ack: 185, Len: 40
▽ EPICS Channel Access, tcp Response, cmd: 1 (CA_PROTO_EVENT_ADD) 172.19.64.44:5064 -> 172.19.64.37:40475
    CA Command ID: CA_PROTO_EVENT_ADD (1)
    CA Payload size: 24
    CA Data type: DBR_TIME_DOUBLE (20)
    CA Data Count: 1
    Status: ECA_NORMAL (1)
    Client provided Subscription ID: 0x00000001
    data
    Corresponding channel: fred
```

```
0000  00 02 b3 d5 3a bc 00 11  43 cd 07 aa 08 00 45 00   ....:... C.....E.
0010  00 5c 21 f1 40 00 40 06  40 33 ac 13 40 2c ac 13   .\!.@.@. @3..@,..
0020  40 25 13 c8 9e 1b 7c 59  26 83 e7 a5 83 c6 80 18   @%....|Y &.......
0030  16 a0 aa e3 00 00 01 01  08 0a 60 b7 04 18 66 88   ........ ..`...f.
0040  91 52 00 01 00 18 00 14  00 01 00 00 00 01 00 00   .R...... ........
0050  00 01 00 00 00 00 22 30  c7 09 08 73 5c 50 00 00   ......"0 ...s\P..
0060  00 00 40 01 11 8c 20 00  00 00                     ..@... . ..
```

eth1: <live capture in progres: Packets: 17925 Displayed: 49 Marked: 0

Hints

- Combination with CA Snooper may enhance network trouble-shooting
- Expression button helps filter expression construction
- tshark may be used to capture packets, and later Wireshark can be used to analyze them
- Data contents dissection necessary?

Summary

- Wireshark CA plugin was build with efforts by many people

- It may be used for the efficient operation of EPICS system and for the trouble-shooting

- Please send any comments to
  - < kazuro.furukawa @ kek.jp >

Thank you