Channel Access and Client Tools

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Channel Access

- The EPICS “software bus”
- Used to read and write values to/from Process Variables
- To many people, Channel Access is EPICS
  - Especially those that have no IOC experience
  - “Integrate X into EPICS” often means “Be able to control X via CA”
- CA is not defined by a protocol specification
  - EPICS Core Developers maintain CA client and server libraries in EPICS Base
    - Any client version can connect to and communicate with any server version
  - Other client and server implementations exist
    - These may not interoperate as well with other versions
What is a Process Variable (PV)

- “A named item of data, with associated optional attributes”
  - Data is an Integer, Floating point number, enumeration value or string, or an array of any of those types
  - Possible attributes include timestamp, alarm status/severity, precision, engineering units string, list of enumeration strings, operator/control/ alarm limits
  - The specific attributes you can fetch along with the data are restricted to some predefined subsets of those available
Channel Access in One Slide

Channel Access Server

Process Variables:
- S1A:H1:CurrentAO
- S1:P1:x
- S1:P1:y
- S1:G1:vacuum

Channel Access Client

Who has a PV named “S1A:H1:CurrentAO”?
I do.

What is its value?
25.5 AMPS

Change its value to 30.5
OK, it is now 30.5

30.5 is too high. It is now set to the maximum value of 27.5.

You are not authorized to change this value

Notify me when the value changes
It is now 20.5 AMPS
It is now 10.5 AMPS
It is now -0.0023 AMPS

“connection request” or “search request”
“get” or “caGet”
“put” or “caPut”
“set a monitor”

“put complete”
“post an event” or “post a monitor”

“connection request” or “search request”
“get” or “caGet”
“put” or “caPut”
“set a monitor”
Tools Described in This Presentation

- Command-line tools provided with EPICS Base
  - caget
  - caput
  - camonitor
  - cainfo
- Various clients provided as EPICS Extensions
  - MEDM
  - EDM
  - StripTool
  - ALH
More Information & Tools

- The EPICS website provides a wealth of information
  http://www.aps.anl.gov/epics/
- All EPICS Extensions programs here have a link or a page there
- There are many other tools described/linked there too

- Base command line tools are usually found at
  - ...epics/base-<version>/bin/<platform>/<executable>
    - /opt/epics/base-3.14.12.4/bin/linux-x86_64/...

- Extensions programs are usually installed in
  - ...epics/extensions/bin/<platform>/<executable>
    - /opt/epics/extensions/bin/linux-x86_64/...
  - Platforms are linux-x86_64, darwin-x86, win32-x86, etc.
Command-Line Tools

- There used to be several versions of these tools
- We will discuss the ones that come with EPICS Base
- The tools we will cover are:
  - `caget`
    - *Gets the value of one or more process variables*
  - `caput`
    - *Sets the value of one process variable*
  - `camonitor`
    - *Monitors value changes of one or more process variables*
  - `cainfo`
    - *Gets information about one or more process variables*
- All accept `-h` to display usage and options

- NOTE: Some sites may have much older versions of these programs in their default Unix search path.
Caget Example

- Get the values of two process variables
  caget S35DCCT:currentCC S:SRlifeTimeHrsCC

- Returns
  S35DCCT:currentCC       102.037
  S:SRlifeTimeHrsCC       7.46514
Caput Example

- Set the value of a process variable
  `caput Xorbit:S1A:H1:CurrentAO 1.2`

- Returns
  Old : Xorbit:S1A:H1:CurrentAO  0
  New : Xorbit:S1A:H1:CurrentAO  1.2
Camonitor Example

- Monitor two process variables
  ```
camonitor evans:calc evans:bo01
  ```

- Returns
  ```
evans:calc  2004-08-05 17:23:04.623245 1
evans:bo01  2004-08-05 17:23:04.623245 On
evans:calc  2004-08-05 17:23:05.123245 2
evans:bo01  2004-08-05 17:23:05.123245 Off
evans:calc  2004-08-05 17:23:05.623245 3
evans:calc  2004-08-05 17:23:06.123245 4
evans:calc  2004-08-05 17:23:06.623233 5
```

- Use Ctrl-C to stop monitoring
**Cainfo Example**

- Get information about a process variable
  
  ```
  cainfo S35DCCT:currentCC
  ```

- Returns
  
  **State:** connected  
  **Host:** ctlapps4l188:5064  
  **Access:** read, no write  
  **Data type:** DBR_DOUBLE (native: DBF_DOUBLE)  
  **Element count:** 1

- Some additional information can be found using Probe
Extensions

The following list gives access to individual pages for most of the standard EPICS host tools and CA clients. Note that some of the minor pages linked below do not appear in the sidebar on the left.

Some of this software can be downloaded from the individual web-pages linked below, and the collection of tools from APS are also available bundled together. See the Extensions Download page for details.

If your extension does not appear in this list, or there’s something wrong with an entry on this page, please send me an email, giving a URL for your web-site if applicable.

Config Files

- Extensions build config files (R3.13)
- Extensions build configure files (R3.14)

Standalone CA Clients

- ALH: Alarm Handler
- BURT: Backup and Restore Tool
- CAEX: Channel Access Examples
- CAPod: Channel Access projects for Apple iOS devices (SF)
- caQDM: An NEDM replacement based on Qt (PSI)
- CASR: Host-based Save/Restore
- CA Watcher: Channel Access monitor and alarm handler (BESSY)
- Channel Archiver (SF)
- Channel Watcher (SLAC)
- CSS: Control System Studio (SF)
- EDM: Extensible Display Manager (ORNL)
- MEDM: Motif Editor and Display Manager
- NAL: Nagios Alarm Handler (INFN)
- Probe: Motif Channel Monitoring program
- StripTool: Strip-chart plotting tool

CA Server Interfaces and Applications

- EpicsSharp: CA libraries and Gateway in native C# (SF)
- CAS: Channel Access Server Library
- CaSnooper: Channel Access Broadcast Monitoring Tool
- caxy: CA tunneling over ssh (SLAC)
- JCAS: Pure Java Channel Access Server Library (SF)
- Gateway: Process Variable Gateway
- Nameserver: Channel Access Nameserver
- RCM: Bu Bu Bu BINDings for the Channel Access Server (Google)
MEDM

- Stands for Motif Editor and Display Manager
- Created in 1990, still used at many facilities worldwide
- Written in C, very hard to extend and modify
- The principal human interface to the APS control system
MEDM Screens

- And thousands of others
**EDM**

- Extensible Display Manager (C++, still based on Motif)
- Created at SNS (Oak Ridge) in 2001, used at many EPICS sites
- All widgets are loaded from shared libraries and versioned
- Administrator can make additional widgets available without rebuilding EDM
EDM Screens

(SNS Linac test)

(Matthias Steiner, Nat'l Superconducting Cyclotron Lab., Michigan State University)
StripTool

- Plots process variables in real time on a strip chart
- Heavily used at APS and older sites
ALH (Alarm Handler)

- Monitors the operation of the machine
- Notifies control-room operators when abnormal conditions arise
- Provides guidance, logs operator acknowledgements and other actions