Control System Studio
- CSS -
Overview

Kay Kasemir, Ph.D.
ORNL/SNS
kasemirk@ornl.gov

July 2011 at
What is CSS?

a) To End Users:
   – Integrated control system user interface

b) To Developers:
   – A Collaboration
   – An Architecture
   – A Toolkit

http://www.wendolene.co.uk/Pictures/Happy.jpg
Original EPICS Operator Interface

- primarily for Linux/X11
- Many disjoint tools
  - Static layout
  - Inconsistent Look
  - Online help?
  - Data exchange: at best copy/paste PV names
### Example Work Flow: React to Alarm

CSS includes an alarm system.

Operator notices an alarm…
Example Work Flow: React to Alarm..

Context menu of alarm…
(“right click”)
Example Work Flow: React to Alarm...

Inspect history of PV, annotate, …
Finally: Data Browser → E-Log

After inspecting alarm PV’s history, post commented plot to E-Log!
A Collaboration

- Started 2006 between DESY and SNS
  - Joined by CLS, APS, BNL, Diamond, ..., KEK/J-PARC?

- https://sourceforge.net/apps/trac/cs-studio/wiki
  - Code repository, Wiki, Mailing lists

- Growing presence at EPICS meetings
  - Benefits from Eclipse community:
    - Participants from ~30 countries
A Control System Architecture

- Portable environment (Windows, Linux, OS X)
- Excellent (free!) development tools

- Extensible bundling: Plug-Ins, Extension points, Registry
- Rich Client Platform (RCP) for windows, menus, online help, preferences, online update, ...
CSS: A Software Toolkit

- It’s BIG
  - Repository: ~ 1.500.000 lines of Java Code

- Structured
  - 70 ‘core’ plugins, about 300 total
  - About 40% of code is comments and formatting

- You pick what you need
  - SNS uses ~300.000 (20%)

Perl cloc tool on July 2011 cs-studio3.0 repo and SNS source snapshot, excluding zip files
CSS Plugin Examples

- Library Plug-Ins
  - Control system data types (PV, Sample, ...), Life data access, Historic Data Access, Logbook, E-Mail, Authentication, Authorization, ...
  - Extension Points
    - Life data: Channel Access, Simulated, Local PVs
    - Historic Data: XML-RPC, RDB, ...
    - Authentication: Kerberos, LDAP, ...

- Application Plug-Ins
  - Strip-Chart: Data Browser
  - OPI: SDS, BOY
  - Alarms: NAMS, BEAST
  - Archive: DESY Archive, BEAUTY
  - Utilities: Probe, Clock, PV Tree, Psychiatrist

Basic CSS Tools

Probe
- Current value of a PV

EPICS PV Tree
- Trace PV links

Both:
- Resize
- Drop-downs keep previous entries
Localization

CSS Translations
- All: (US) English
- Most: German
- Few: French, Chinese

Could be 日本!
Data Browser

Plot ‘live’ and historic data over time
Data Browser

Archive search, Plot Configuration
Alarm System (BEAST)

Tabular or Tree view, voice annunciations, ...

Select by Name, Description

Sort by Time, Severity, ...

Acknowledge
Flexible Layout

- Panels can be closed, reopened, repositioned
- Multiple Perspectives
  - Name, Save, Restore
- Multiple document instances share same configuration panels
CSS PV Exchange

- PV in \textit{any} CSS Tool ➔ Context Menu ➔ Select other PV Tools
  - Opens other tool with that PV
### PV Fields Viewer

#### Detailed configuration info for a PV

@SNS: Info in Oracle, live data from EPICS
PV Fields Viewer: Site-Specific?

Fine, but how would I benefit from an SNS-specific tool?

It’s “Pluggable”!

You can provide the glue code to your EPICS config in RDB, LDAP, text files
Integrated Help, Preferences

- Uniform access to settings, searchable help
  - Applications
  - Support Libraries
    - Logging
    - Control System access

EPICS Library

This provides the ChannelAccess (CA) client library for accessing Process Variables on EPICS IOCs via the network.

Preferences

There are two main items to configure:

- JCA Context
  There is a pure Java as well as a JNI implementation available. The pure Java version is the default because it is easier to install and should work "out of the box", while the JNI implementation might provide maximum compatibility with existing EPICS installations.
  - `add_list` and `auto_add_list`
  - If all CA servers (IOCs) are on the same subnet as the computer running the CSS application, you can stay with the default: Empty `add_list`, using `auto_add_list`. Otherwise, if you need to access PVs on a gateway or in another subnet, list the IP addresses of IOCs or IOC subnets in the `add_list` and un-check the `auto_add_list` for details on this as well as the remaining settings, refer to the EPICS Channel Access reference manual.

Note that changes require a restart of the application, they do not take effect at runtime!

Default Settings
BOY – Best OPI, Yet

Operator Interface Editor

Runtime

Similar to EDM, MEDM, SDS, DM2K, but possibly better
OPI Editor
Simple Things are Easy

1. Drag a widget, e.g. Knob, from palette to editor
2. Enter the PV name in Properties view
3. Click the “Run” button to execute!

What you will get

✓ PV value as text and via knob position
✓ PV severity reflected in border color
✓ PV name and value shown in tool-tip
✓ PV’s display limits set the knob’s default range
✓ Indicate ‘disconnected’ state via a pink border
✓ Widget will be greyed-out if read-only
Editing Features

Add Widgets

- Drag & Drop from Palette
- Copy/paste, Ctrl+Drag existing widgets to duplicate

- Snap to grid, guideline, other widgets
- Align, distribute

Select multiple widgets to

- Edit common properties
- Adjust size or move around
Screen Navigation

- Idea: Minimize number of open screens.
- Similar to Web Browser links:
  - Default: Related displays replace the current display.
  - Optional open in ‘tabs’ or new window
  - Allow previous/next navigation over display history
Send PV name to other CSS tools

Use common CSS Process Variable context menu to send PV name to other CSS tools
Rules, Scripts

Rules create dynamic displays
  – Easy: PV → Widget Property

Scripts can to “anything”
  – Read PVs,
    change widget properties, open dialog, ...
  – JavaScript or Python (Jython)
SNS Examples

SNS Timing Receiver Test Bench

Board Info:
- Board ID: SNS Timing Receiver VME Board V2325
- Board Rev: -
- Base Address: 0x0
- Firmware Version: FW v 0.xx Date 02 24 2011
- Board SN: 0x0
- Geo Address: 0x8

<table>
<thead>
<tr>
<th>Event #</th>
<th>Delay Turns 0-95535</th>
<th>Delay 1/64th Turn 0-63</th>
<th>Delay Time us</th>
<th>Pulse Width 1/64th Turn 0-262143</th>
<th>Pulse Width Time us</th>
<th>Enable Output</th>
<th>Inverted Output</th>
<th>1 Shot Enable Output</th>
<th>Manual Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH2</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH3</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ScratchPad:
- 0xC8: 0xCFA71
- 0xCFA6D: 0xCFA71

Auto Test

Grouping Container:
- Temp Limit Set: 55.0
- Temperature: 25.38 C

Write Data to Arbitrary Address:
- Offset Address: 0xC8
- Data to Write: 0xCFA6D

Not logged in
SNS Examples

- Top-level displays created by operators
SNS “Steering” Tool

Try to get spot into the green, at least into orange

Tim Southern, Nick Luciano
Two Views of CSS

Developer
- Understands Toolkit, Architecture, Java, Eclipse
- Installs CSS in control room
- Offers CSS download for local office users
- Extends CSS for local needs

End User
- Uses CSS

http://www.wendolene.co.uk/Pictures/Happy.jpg
Hardest Part: Starting Site-Specific Setup

1. Decide which parts of SNS you need
2. Web site: Initial download
… Site-Specific Setup

1. Select..

2. Web site

3. Product: Tools and settings for your users at your site
... Site-Specific Setup

1. Select
2. Web site
3. Product for your site
4. Automated updates
Need Site-Specific Setup

Developer: Select,… automated updates

End User: Happy

Steep Learning Curve for Developers

– … but also many Books, online Tutorials
– Invest to learn it, and you’ll like it
So What is CSS?

Various control-system tools combined into a consistent product

Excellent for end-users!

Based on
Links

- **CSS**
  - [http://sourceforge.net/apps/trac/cs-studio](http://sourceforge.net/apps/trac/cs-studio)

- **Eclipse**

- **Similar projects, Beam Line Data Acquisition**
  - **GDA: Diamond Light Source, UK**
    [http://www.opengda.org/](http://www.opengda.org/)
  - **GumTree: ANSTO, Australia**
    [http://docs.codehaus.org/display/GUMTREE/Home](http://docs.codehaus.org/display/GUMTREE/Home)