Control System Studio
- CSS -
Operational Integrated Environment

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with input from Xihui Chen (SNS), Kunal Shroff (BNL)

Oct. 2012 EPICS Meeting, PAL, Korea
CSS for ASKAP

Original EPICS Operator Interfaces

Many disjoint tools
- Static layout
- Inconsistent Look
- Online help?
- primarily for Linux/X11
PV Name Exchange?

- Note PV associated with Alarm
- Start StripTool
  - Add PV to StripTool
- Start Archive viewer
  - Add PV ..
CSS Work Flow: React to Alarm

CSS includes an alarm system.
Operator notices an alarm…
CSS Example: React to Alarm!

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

Inspect history of PV, annotate, ...
Finally: Make Logbook Entry

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

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

- http://sourceforge.net/apps/trac/cs-studio
  - Wiki, Mailing lists
  - Source code: https://github.com/ControlSystemStudio
CSS: Control System Architecture

- Portable environment (Windows, Linux, OS X)
- Free development tools
- Plug-Ins, Extension points, Registry
- Rich Client Platform (RCP): Windows, menus, help, preferences, online update, ...
CSS: Software Toolkit

It’s BIG

– Repository: ~ 1.500.000 lines of Java Code

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

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

- **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, ...
Basic CSS Tools

Probe

- Current value of a PV

EPICS PV Tree

- Trace PV links

Both:

✓ Resize
✓ PV Name
  Drop-down
  history
Localization

CSS Translations

- All: (US) English
- Most: German
- One: Chinese
- Next: Korean?
Data Browser

Plot ‘live’ and ‘archived’ data over time
Data Browser: Search Archive, Config. Plot
Alarm System (BEAST)

Tabular or Tree view, voice annunciations, ...

Select by Name, Description

Sort by Time, Severity, ...

Acknowledge
BOY – Best OPI, Yet

Operator Interface Editor

Runtime
SNS Examples

- Top-level displays created by operators
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 any CSS Tool ➔ Context Menu ➔ Select other PV Tools
  - Opens other tool with that PV
(SNS) 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

PV Fields API
“get info for PV Name”

SNS Implementation
Get info from Oracle

Your Implementation
Get info from …
CSS Integration at NSLS-II (BNL)

Data Sources
- CA
- Sim
- Test
- pvA

Aggregation
- pvManager

Data Definition
- vTypes

Visualization
- Graphene

Core Client Technologies

CSS Core
- ChannelFinder Integration
- Olog Integration
- BOY
- DataBrowser

Command/response
- Masar
- ...

Publish/subscribe

AccelUtils
- Web based REST services
  - ChannelFinder
  - Olog
  - ...

Java/Python
- API
- ...

Web UI and other clients
- Logbook
- ...

Scripts and utilities
- cf-update
- ...

Managed by UT-Battelle for the Department of Energy
Channel Viewer

<table>
<thead>
<tr>
<th>Channel Name</th>
<th>cell</th>
<th>girder</th>
<th>elemType</th>
<th>elemName</th>
<th>elemPosition</th>
<th>elemField</th>
<th>elemIndex</th>
<th>system</th>
<th>elem</th>
</tr>
</thead>
<tbody>
<tr>
<td>V:1-SRC01-MG:G2(QL2:134)Fld:SP</td>
<td>C01</td>
<td>G2</td>
<td>QUAD</td>
<td>q12g2c01a</td>
<td>31.6966</td>
<td>k1</td>
<td>134</td>
<td>V:1-SR</td>
<td>0.448</td>
</tr>
<tr>
<td>V:1-SRC01-MG:G2(QL3:145)Fld:SP</td>
<td>C01</td>
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Kunal Shroff (BNL)
Channel Tree by Property
Channel Orchestrator / Line Plot

Query: `elemType=BPM tags=aphla.sys.V1SR elemField=y`
Other “Pluggable” Examples

- **APIs**
  - Live Data Access
  - Historic Data Access
  - Authentication
  - ...

- **Implementations**
  - EPICS Channel Access, Simulated
  - Chan.Arch XML-RPC, RDB, ...
  - Kerberos, LDAP
  - ...

![Diagram of API and Implementations](image-url)
CSS Continues to Evolve: PV Access

- **org.csstudio.utility.pv**
  - Basic PV ‘subscribe’ mechanism
  - Provides EPICS time, severity, status, meta data
  - “Works” for BOY, AlarmServer, ArchiveEngine, ...

- **org.csstudio.utility.pvmanager**
  - Allows code like
    ```
    PVManager.read(mapOf(newValuesOf(channels("channel1", "channel2", "channel3"))).maxRate(ofHertz(1));
    ```
  - To do: write support, EPICS severity/status, ..
Evolving: Logbook support

a) Current CSS Logbook API
   - Basic support for sending current alarms, OPI screenshot, ...
     to logbook

b) NSLS-2, FRIB “OLog”
   - ‘Tags’, ..

Combined:
   - ‘Tags’ and other entry properties
   - Logbook Reader
### Shift Summary 6/15/2012

Charles Gardner and Feng Gao:

Today we studied on LLRF behaviors on AC power cycling.

1. All five LLRFs AC power was cycled locally for 10 times, the output phase against M.O. did not jump.
2. For Kly1 LLRF AC power was also cycled 3 times using EDM GUI, no phase jump.
3. SPB amplifier AC power was also cycled 3 times, the phase of the output RF power did not jump.
4. The LLRFs and amplifiers were cooled down during lunch time for 1 hour and a half then turned back on, no phase jump.
5. SPB amplitude was change from 0.1 to 0.23, the phase shifts is on the jitter level.

**Date:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>Owner</th>
<th>Logbooks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 5, 2012</td>
<td>Shift Summary 6/15/2012 Charles Gardner and Feng Gao: Today we...</td>
<td>shroffk</td>
<td>Operations</td>
</tr>
<tr>
<td>Oct 5, 2012</td>
<td>510 pc at ICT1. 500pc at FC2. Here is the spectrum, 0.18% FWHM, and 90...</td>
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CSS and Olog

![CSS and Olog](image.png)
Integrated Help, Preferences

- Uniform access to settings, searchable help
  - Applications
  - Support Libraries
    - Logging
    - Control System access
SNS Plan: CSS for Instrument Automation

- Detector
  - Instrument Events
- Aggregator
- Data Stream
- Translation Service
- Nexus
- Sample Environment
- Equipments
- Scan Server
- Histogram Service
- Mantid
- EPICS IOCs
- GUI: CSS
  - Channel Access
"Scan" from BOY

1. Configure
2. Start
3. Monitor
Submit Scan from Table Example

Point by Point Scan

<table>
<thead>
<tr>
<th>Points</th>
<th>xpos</th>
<th>ypos</th>
<th>setpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point 1</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Point 2</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Point 3</td>
<td>2</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Point 4</td>
<td>3</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Point 5</td>
<td>4</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Point 6</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Point 7</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Scan: Running

Motor Trace

Motor Position

setpoint: 10
readback 15.00

Current Running
Point by Point Scan
Current: Set 'ypos' = 5.0 (wait for 79%)
Scan Monitor

List Scans on Server

- **Idle**: To be executed next
- **Running**: With progress report
- **Finished, Failed**: Past runs
Scan Editor

- “Undo”
- Drag/drop commands or PV names (also as XML text)
- Device PVs (or alias) can be picked from beamline-specific configuration
Scan Plot

- Plot variables used by scan
- Get data from Running or Finished scans
Simulation Mode

- Simulated PV changes
- Estimates times
Monitor, Adjust Live Scan

Scan Info

Active Command

Adjust properties of live scan
Scripted Scan

Jython editor, debugger

Jython console

... or use ‘vi’, shell
Thick Client vs. Web

✓ CSS: Integrated, rich, portable

Still: Needs to be installed on each user’s computer..

Accessible from phones, tablets, toasters?

OK, nobody asked about the toaster, yet. But it’s getting there, see www.theonion.com
Web OPI

CSS is Desktop app, will probably remain so, but

*.opi files can be viewed online!
Site-Specific Setup

1. **Product:**
   Tools and settings for your users at your site.

   Decide which parts of CSS you need.
Site-Specific Setup

1. Product for your users

2. Web site: Initial download
... Site-Specific Setup

1. Product
2. Web site
3. Automated updates
Need Site-Specific Setup

Developer:

End User: Happy

Steep Learning Curve for Developers

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

Integration of various control-system tools into a consistent product

Excellent for end-users!

Links

- CSS
  - SNS Products to try:  
    http://ics-web.sns.ornl.gov/css
  - Guide book, source-to-product:  
    http://cs-studio.sourceforge.net/docbook/
  - CSS Wiki:  
    http://sourceforge.net/apps/trac/cs-studio

- Eclipse
  - http://www.eclipse.org/