Tools and Services at NSLSII

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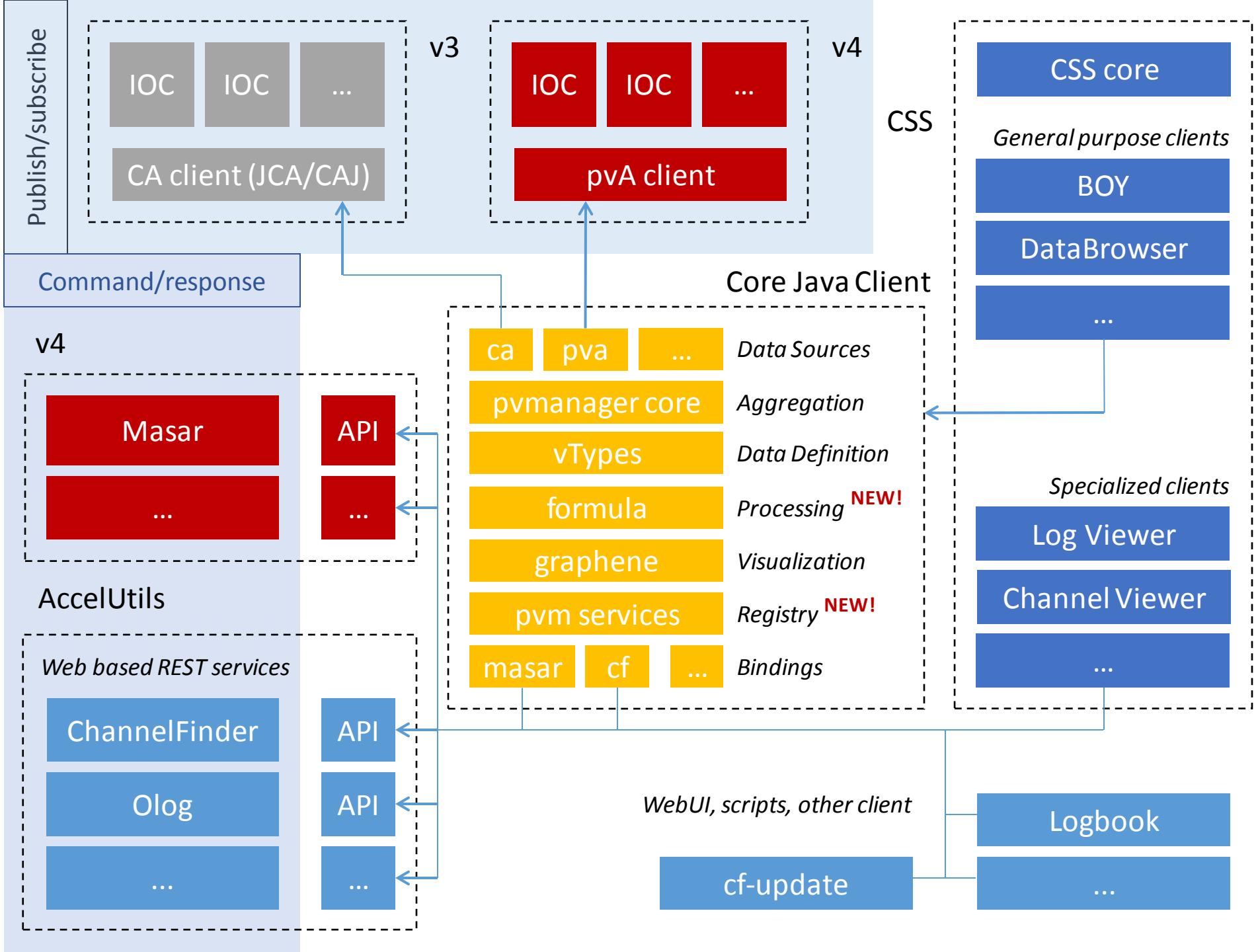
Publish/subscribe
v3
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CA client (JCA/CAJ)
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pvA client
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General purpose clients
BOY
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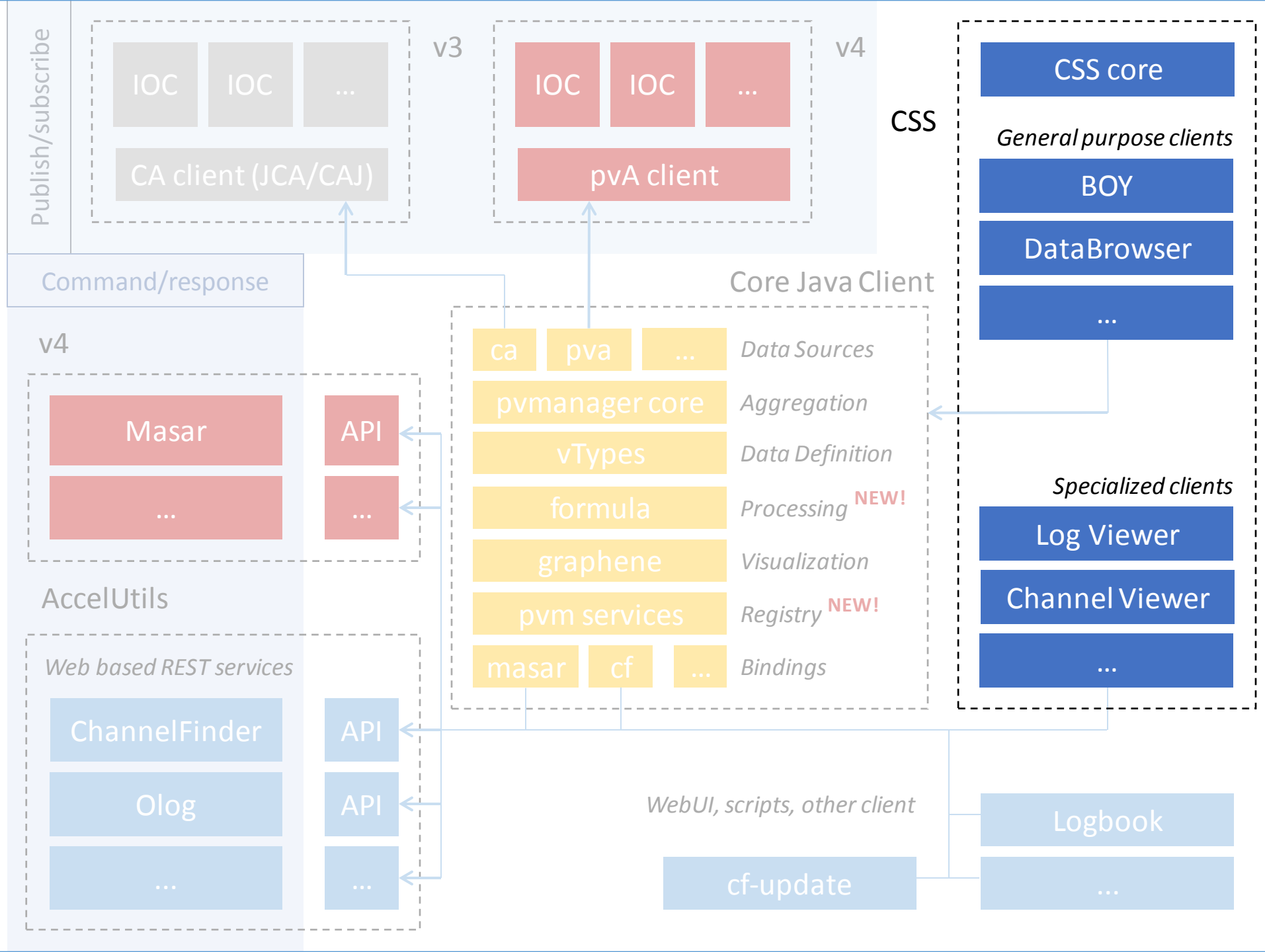
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CS-Studio

- An Integrated platform for controls and physics applications
  - Over 2 dozen releases
  - In production 3.1.6, 3.2.15a, and 3.3.10a

CS-Studio Applications

- BOY
- BEAST
- LogViewer
- DataBrowser
- Pretune
- ShiftViewer

BOY: Best OPI Yet

- Approximately 5000 opi screens
- All hosted in a mercurial repository
- NFS mounted onto all machines in the controls network

BOY Screens

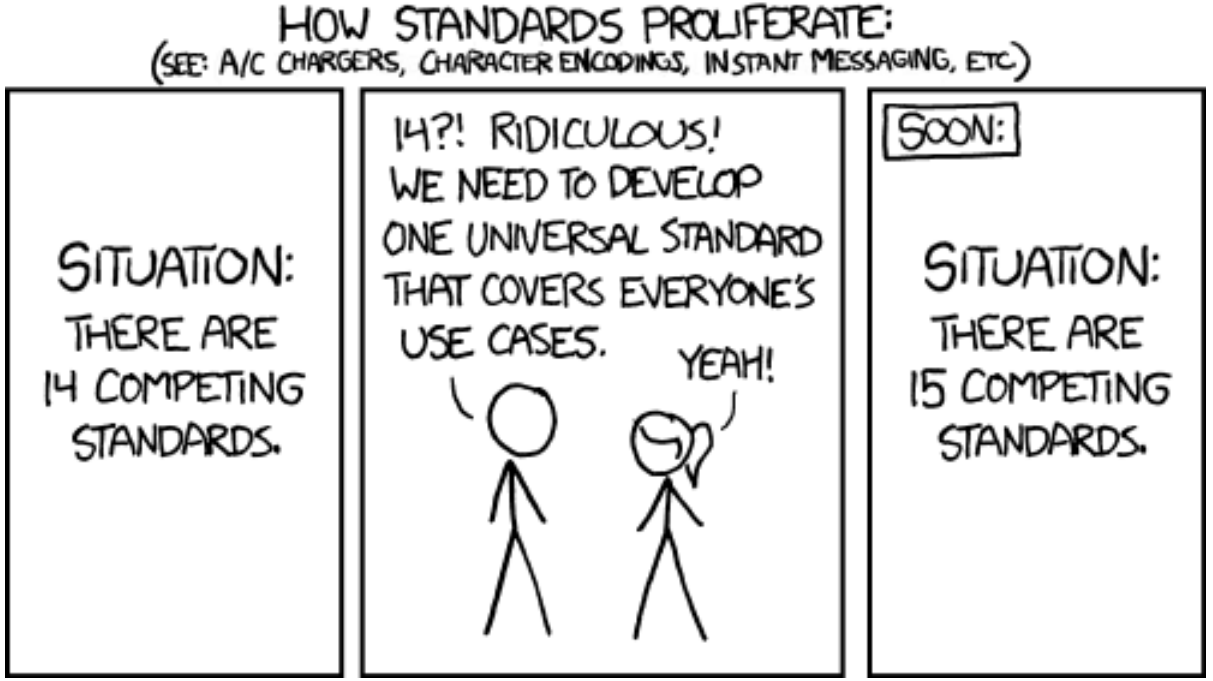
- Engineering ：
  - Developed by the controls engineers / the developers of the device IOC
  - Designed for device control
- Physics:
  - Do the real useful stuff..
  - Created from a list of required interfaces and discussed in AP group meetings
  - Lots of rules, calls to external python scripts
  - Task oriented screens
- Operator:
  - Combine/Summarize a lot of information

~~Issues~~

Interesting Experiences

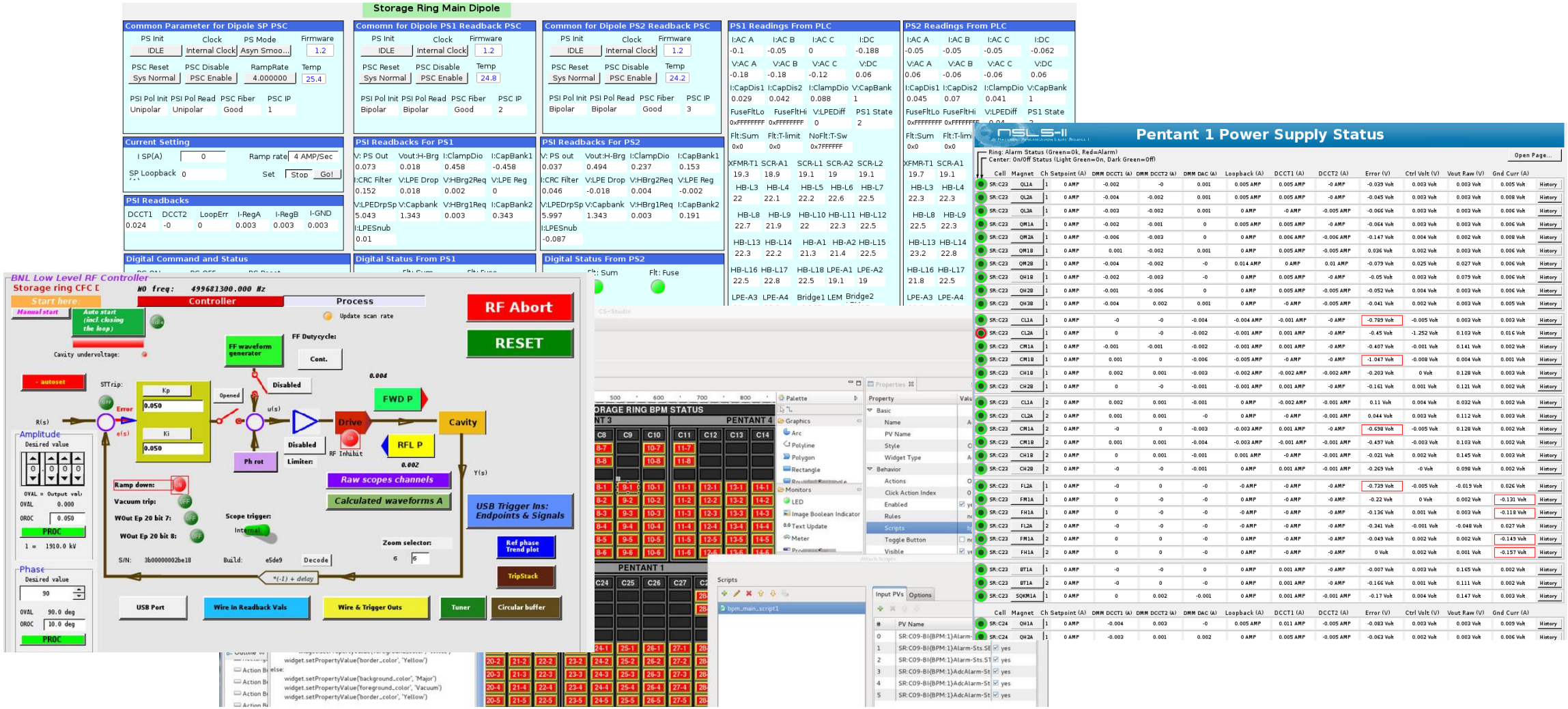
BOY Screen standards:

- A perfect standards are hard to define
- Following standards adds overhead



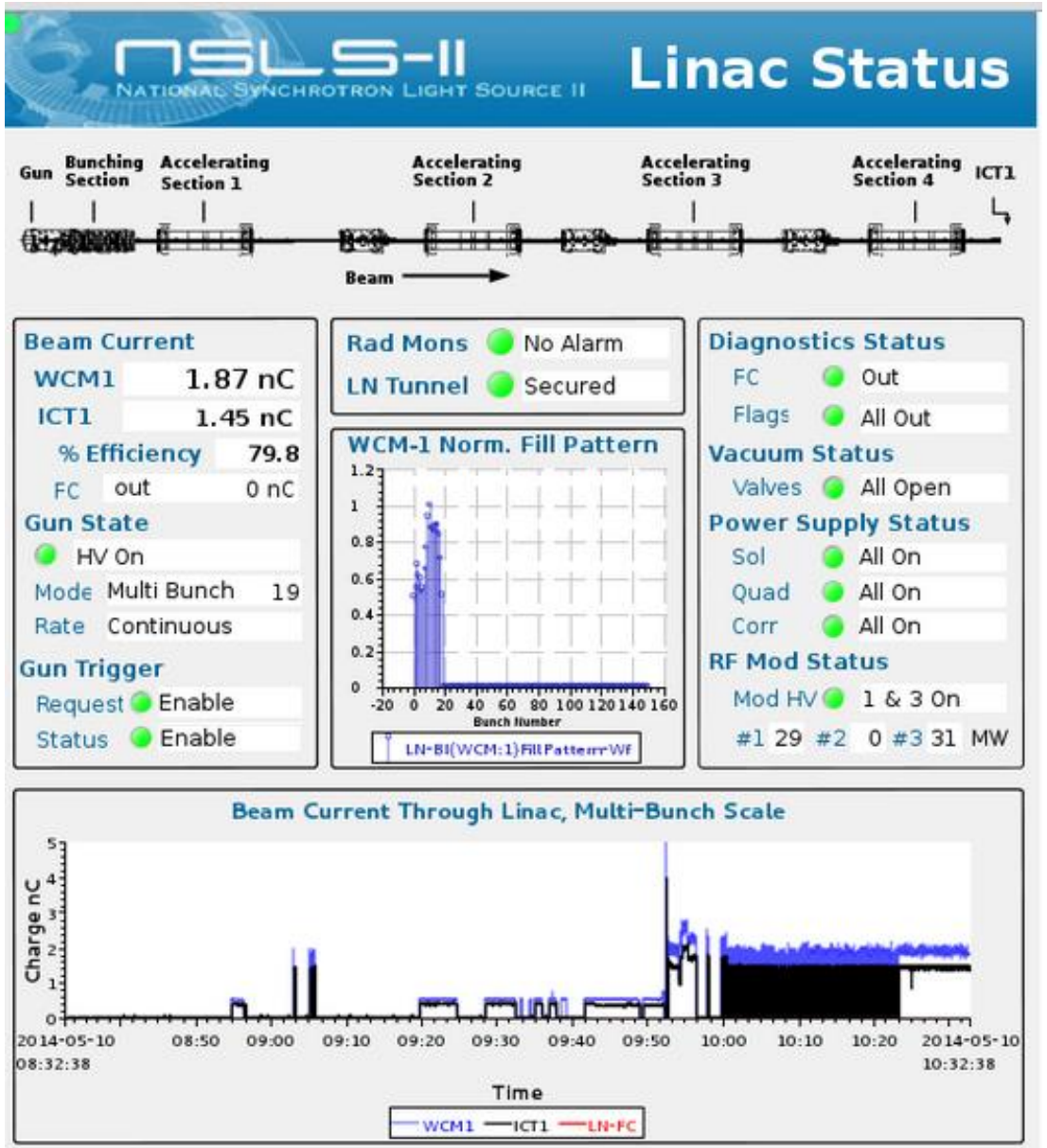
Source: http://xkcd.com/927/

Absence of BOY Screen standards:



Solution*

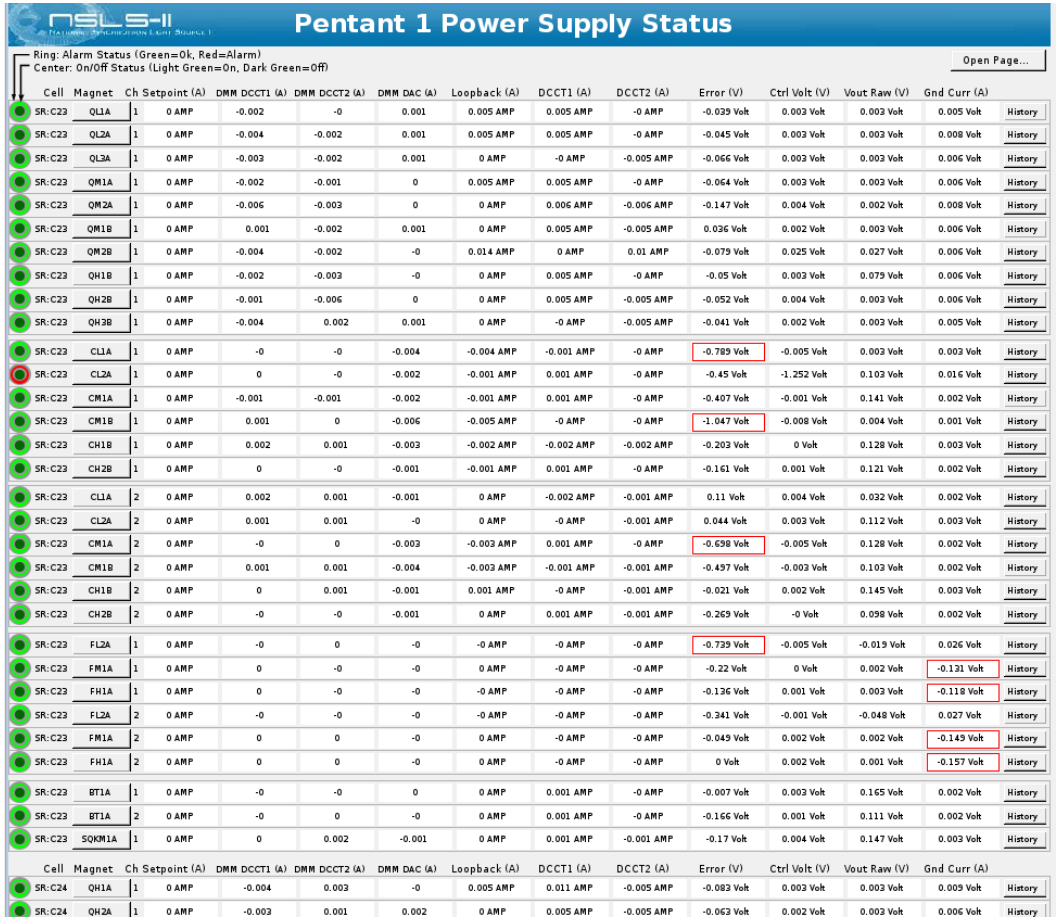
- Guidelines are easier than standards
- Good examples more effective then good standards



* contingent on cooperation between physicist, engineers and operators

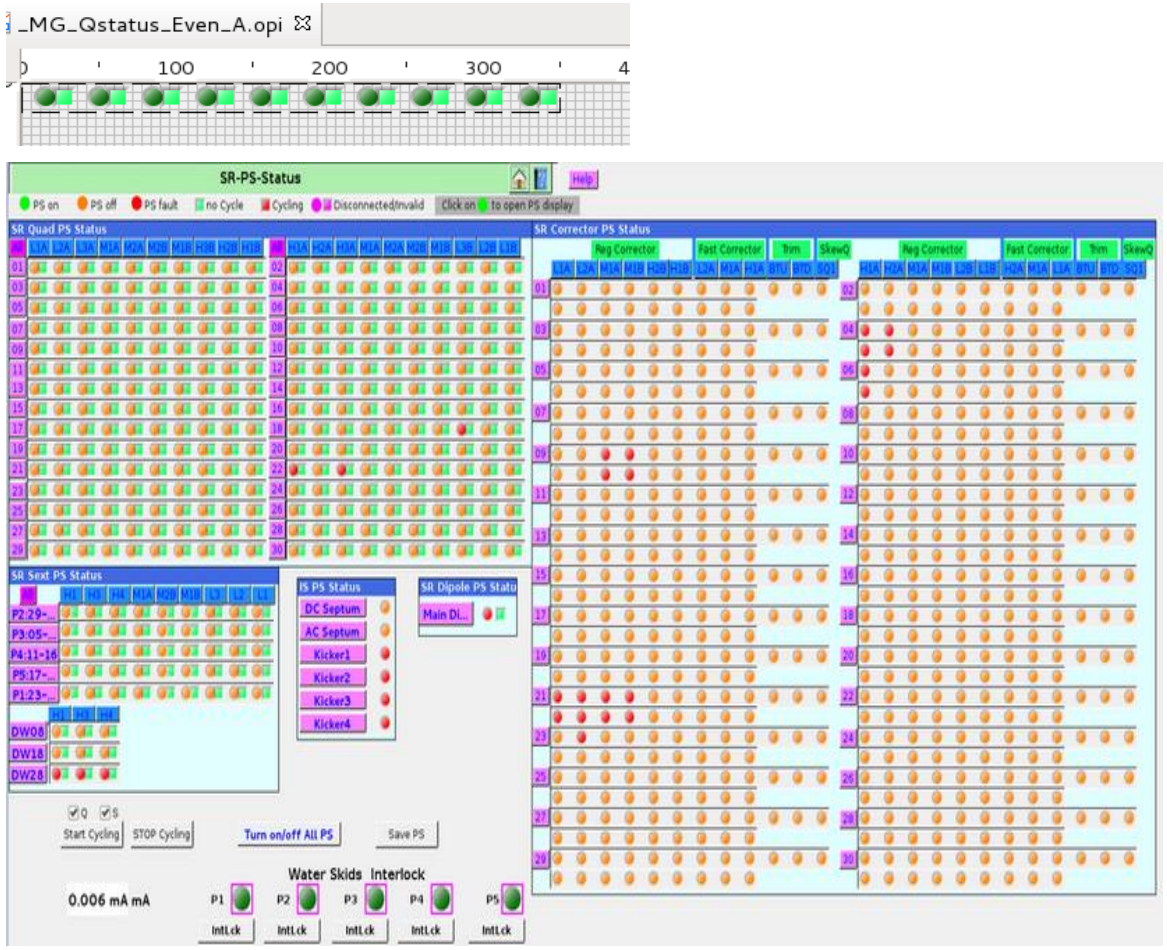
Good and Bad Practices:

- PV naming convention + Macros + Linking containers
  - Reusable pieces
  - Easily modified



Good and Bad Practices:

- PV naming convention + Macros + Linking containers + Rules
  - 2000 + pvs with over 800 rules
- Solution:
  - Multistate LED + formulas



Good and Bad Practices:

- Avoid Scripts/Rules unless absolutely necessary
  - Should this be implemented in an IOC?
  - Is there a PvManager formula I can use?
  - Can I use rules? (Have I allocated a large enough PermGen space)
  - Use a script

Data Connection Layer:

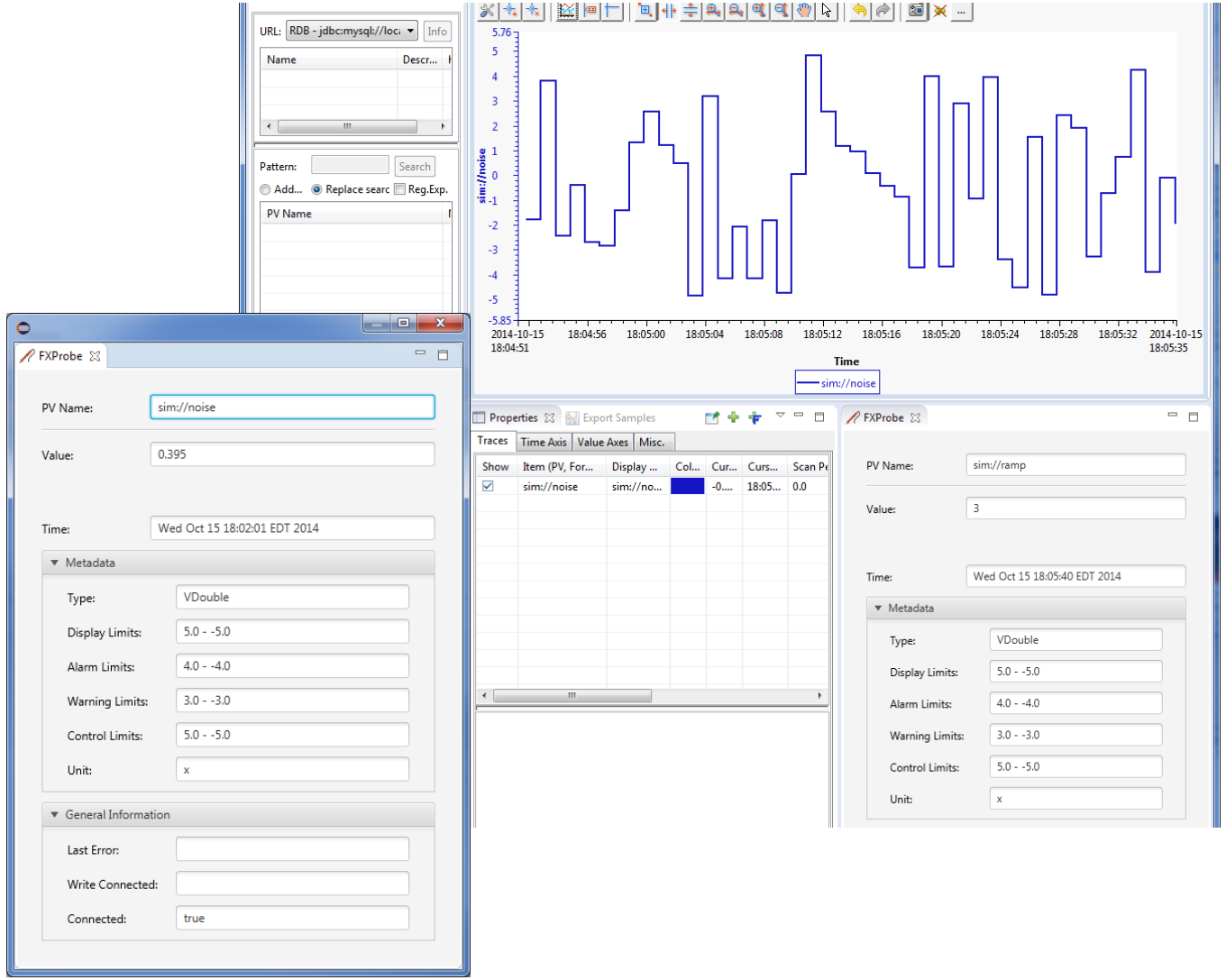
- 3.1.x
  - Use PVManager to address threading issues, source rate throttling
- 3.2.x
  - PVManager with formula functions to provide and alternative to rules and scripts
  - Graphene prototype for displaying large waveforms
- 3.3.x
  - Passive scanning: switch from active polling of the queue to notification model
  - More graphene plots

SWT:

- A limited widget set
  - Using native widget results in the lowest common denominator
  - Poor performance on Linux machines
- JavaFX to the rescue
  - Part of jdk 8
  - Richer and easier to use widget set
    - TreeTable, Table with embedded controls
  - JavaFX and SWT share the UI thread
    - Can be easily embedded into SWT/Jface composites/views

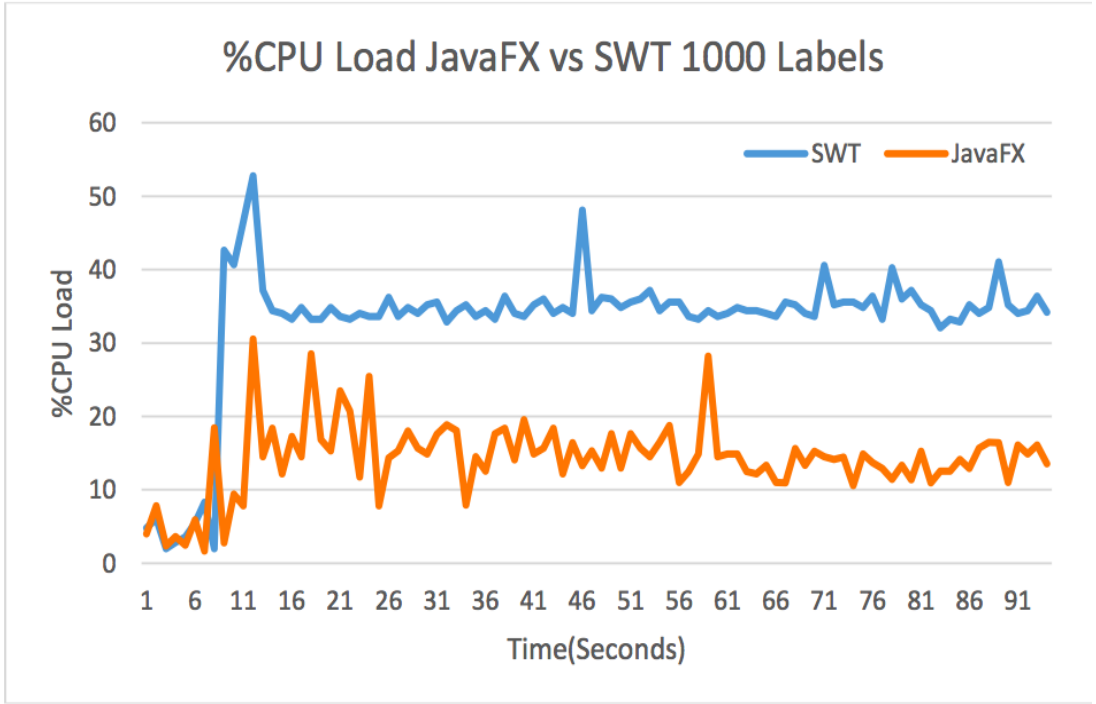
JavaFX in eclipse

- Share the same UI thread
- Relatively easy to embed
  - Require e(fx)clipse

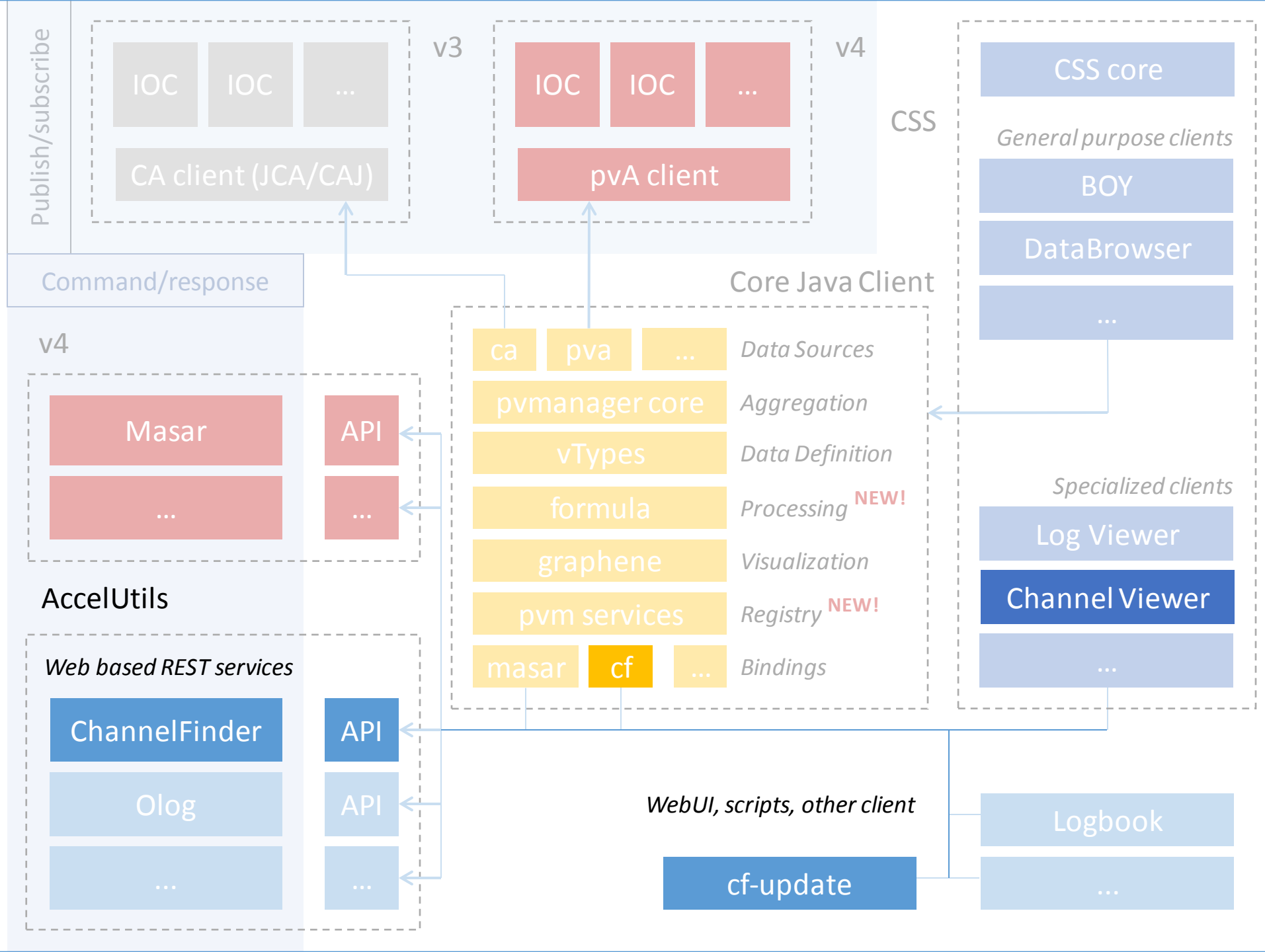


JavaFX preliminary comparisons

- 1000 label widgets updating at 1Hz



SWT Average = 32.834% (starting at t = 16) = 34.978%
JavaFX Average = 14.232% (starting at t = 16) = 15.140%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Motivation and Objectives

- A flat name space restricts seriously:
  - Clients need to know all channel names beforehand
  - Portable generic clients must be simple
  - Apps need full configuration or framework supplied service
- Develop a Directory Service
  - Generic
    - No dependency on installation and local conventions
  - Simple and fast (enough)
    - Use standards wherever possible
  - Provides "query-by-functionality"

Directory Data

- Set of **Channels** (unique names)
- Each Channel has an arbitrary number of **Properties** (name/value pairs) and **Tags** (names)
- Each Channel, Property, or Tag has an **Owner** (group) to allow basic access control
- All names and values are strings

Directory Data example

```
<channel name="V:1-SR-BI:SUPER{BPM:4}SA:X" owner="cf-update">
<properties>
        <property name="elemName" value="bpm:4" owner="cf-update"/>
        <property name="elemIndex" value="400" owner="cf-update"/>
        <property name="elemPosition" value="5.208" owner="cf-update"/>
        <property name="pvStatus" value="Active" owner="cf-update"/>
</properties>
<tags>
        <tag name="aphla.sys.SR" owner="operator"/>
</tags>
```

Query Example

- *SR:*C01**

  All pvs from storage ring cell 1

- *SR:*C01*&elemName=bpm:4**

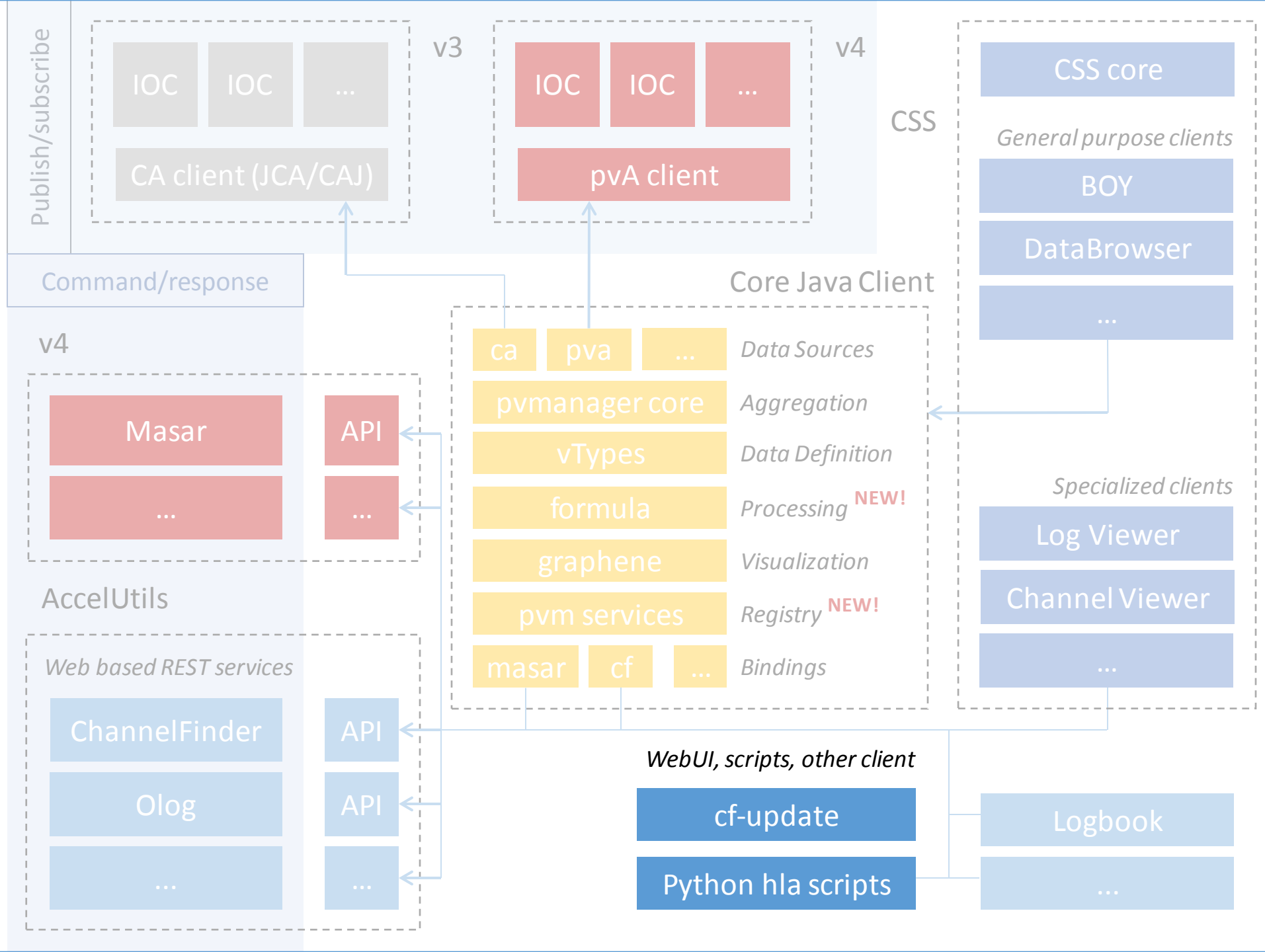
  All pvs from storage ring cell 1 belonging to element bmp:4

- *SR:*C01*&elemName=bpm:4*&pvStatus=active*

  All pvs from storage ring cell 1 belonging to element bmp:4 and with pvStatus active

- *SR:*C01*&elemName=bpm:4&tag=aphla.sys.SR*

  All pvs from storage ring cell 1 belonging to element bmp:4 with tag aphla.sys.SR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Populating ChannelFinder

- cf-update
  - Adds new channels
  - Manages existing channels
    - Orphaned channels
    - Moved channels
- Python scripts
- cf-properties (under development)

Example st.cmd

```
dbLoadRecords("gauss.db","P=ktest")

epicsEnvSet("EPICS_HOSTNAME", "dev32new")
epicsEnvSet("EPICS_IOCNAME", "gauss")

iocInit()

# pipe the output of the dbl command to a file
# the file name should follow the convention 'myHostName.myIOCName.dbl'
# write the file to a well know directory on which the cfmonitor deamon is running
dbl > $(CF_UPDATE_DIR)/$(EPICS_HOSTNAME).$(EPICS_IOCNAME).dbl
```

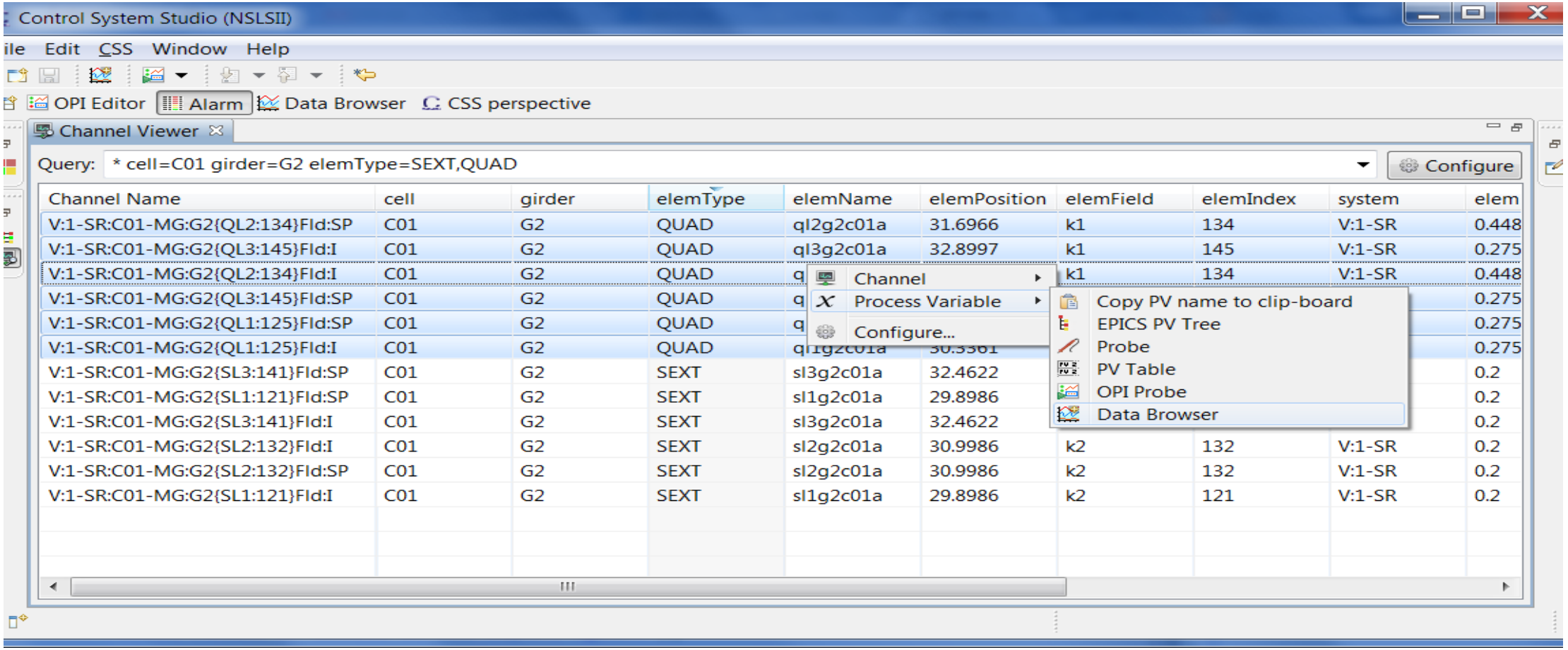
Under the Hood

- The cf_monitor daemon monitors $(CF_UPDATE_DIR) directory and envokes an updare task when
  - A new *.dbl file is created in the dir
  - An existing *.dbl file is modified
- The update task handles
  - Uses the filename to obtain the hostName, iocName property values
  - New channels – creates new channels with hostName, iocName, pvStatus and time properties
  - Orphaned channels – pvStatus property is updated
  - Moved channels – ensures that the hostName, iocName properties are update when channels are moved
  - Unchanged channels
- In all cases existing properties(excluding hostName, iocName, pvStatus, time) and tags are left unaffecteds

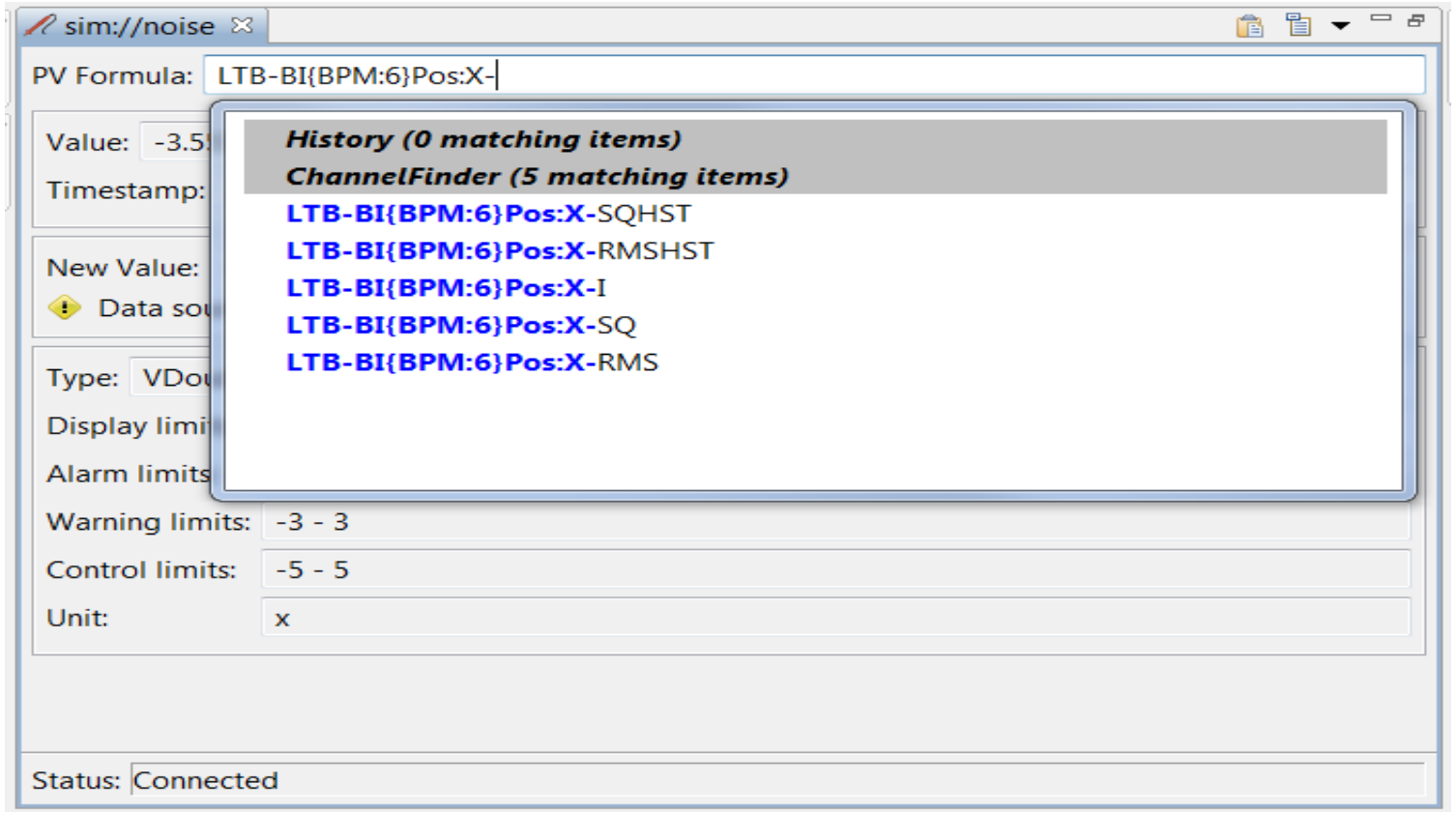
device FM1G4C02A

Channel Name	SR:C02-MG:G04A{HFCor:FM1} Fld-I	SR:C02-MG:G04A{HFCor:FM1} Fld-SP	SR:C02-MG:G04A{HFCor:FM1} Fld-I	SR:C02-MG:G04A{HFCor:FM1} Fld-SP
handle	READBACK	SETPOINT	READBACK	SETPOINT
elemName	FXM1G4C02A		FYM1G4C02A	
elemType	HFCOR		VFCOR	
elemField	x		y	
devName	FM1G4C02A			
sEnd	65.5222			
cell	C02			
girder	G4			
symmetry	A			
length	0.044			
ordinal	263		264	
tags	eget	eput	eget	eput
	x		y	
	sys.SR			

ChannelViewer



Auto-complete



PVManager Formula

- =cf(“* elemType=HFCOR handle=SETPOINT tags=sys.SR”)

Queries ChannelFinder and returns a VTable consisting of all of channels for the setpoint pvs for all horizontal fast correctors in the storage ring

Even more Interesting Experiences

ChannelFinder data

- Over 180k channels
- Over 1.2 million instances of channel + tag/property

- Service response (Query + Parsing) in the order of seconds

MongoDB

- Embedded (denormalized) data model
  - Ideal for one-to-many relationships between entities.
  - provides better performance for read operations, as well as the ability to request and retrieve related data in a single database operation.
  - Embedded data models make it possible to update related data in a single atomic write operation.

```
// channels
{
        name: “channel name”
        owner: “channel owner”
        properties: [{name: “property name”,
        owner: “property owner”,
        value: “property value”,
        _id: properties._id},……]
        tags: [tags._id,…..]
}
// tags
{
        name: “Tag name”,
        owner: “Tag owner”,
        _id: ID
}
// properties
{
        name: “Property name”,
        owner: “Property owner”,
        _id: ID
}
```

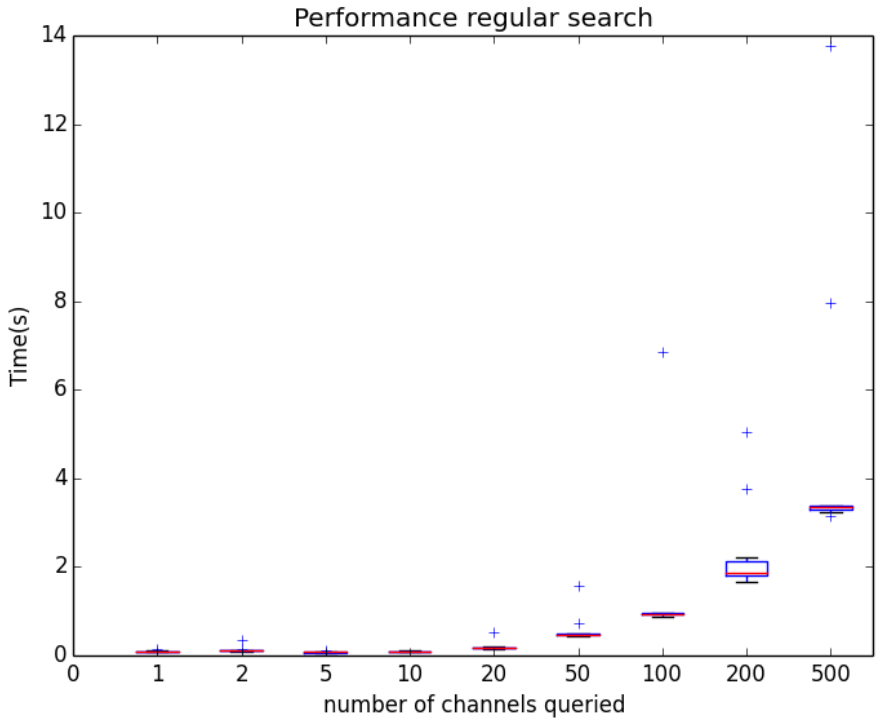
Performance Environment

- Database
  - 150k channels
  - 15 million channel-properties/channel-tags

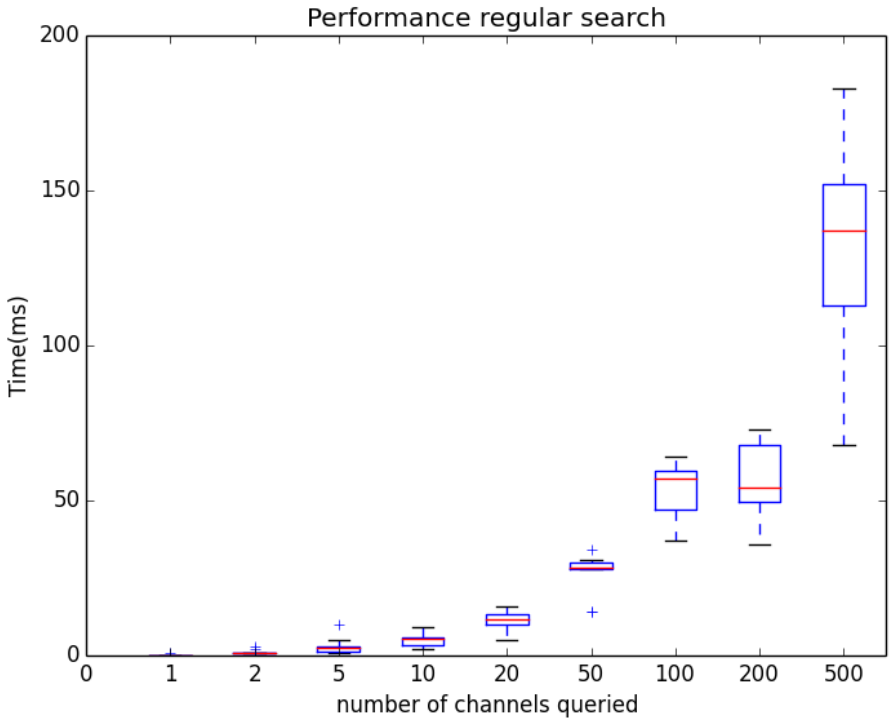
- Queries
  - Search based on channel names and property values

Mysql Vs MongoDB

Mysql



MongoDB



Questions?

Links:

Control System Studio

- http://controlsystemstudio.org/

ChannelFinder

- http://channelfinder.sourceforge.net/
- https://github.com/ChannelFinder/ChannelFinderService

Performance Tests

- https://github.com/shroffk/cf-mongo-java-test
- https://github.com/mskinner5278/cf-mongo-test

JavaFx

- https://github.com/sjdallst/FXvsSWTProfiling
- http://www.eclipse.org/efxclipse