



EPICS and Conlog

The EPICS logo consists of a horizontal black line with four small squares hanging from it. From left to right, the squares are blue, yellow, green, and red. The blue and yellow squares are positioned above the line, while the green and red squares are positioned below it.

Michael Thomas

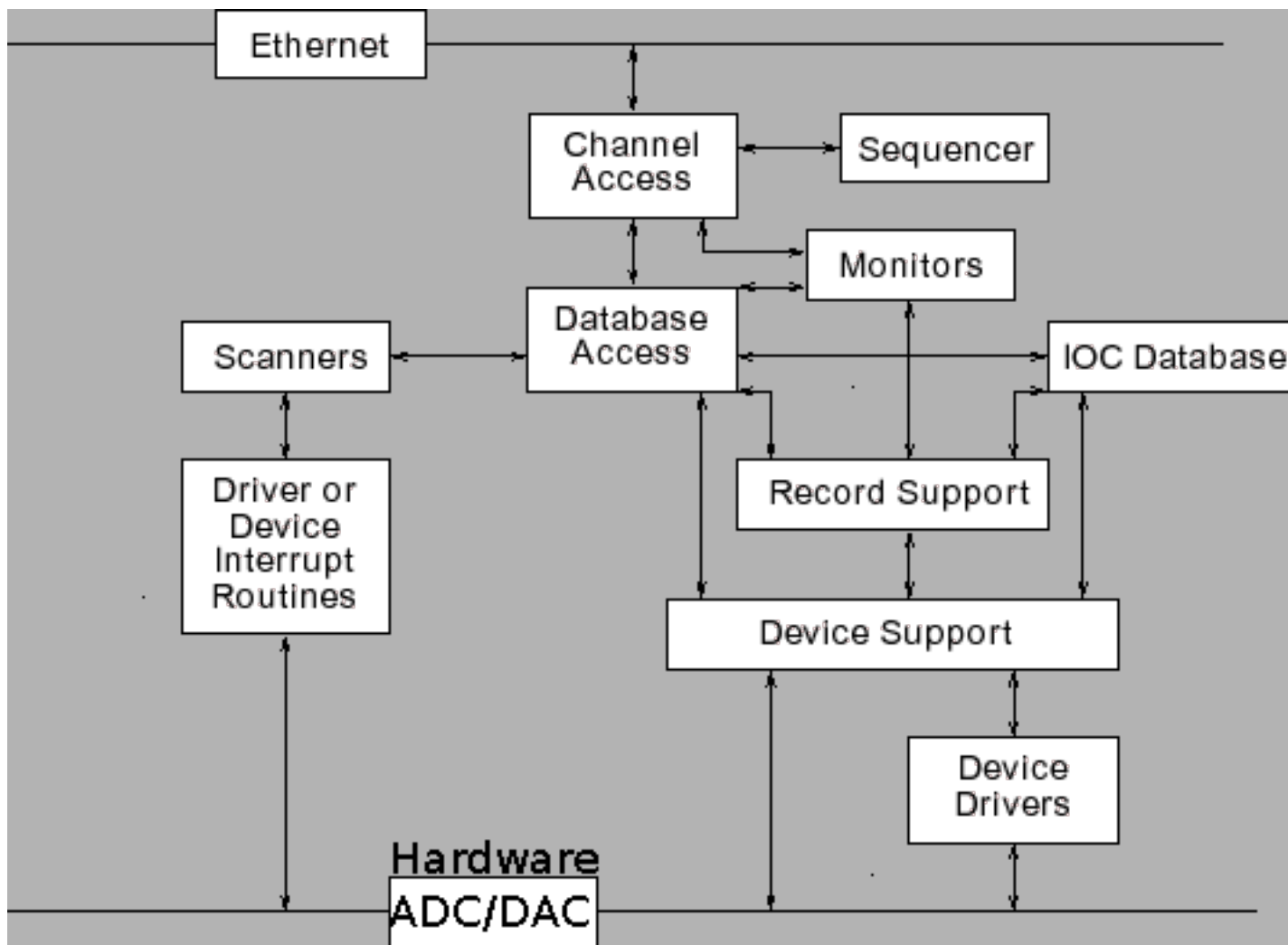
What is it?

“EPICS is a set of software tools and applications which provide a software infrastructure for use in building distributed control systems to operate devices such as Particle Accelerators, Large Experiments and major Telescopes.”

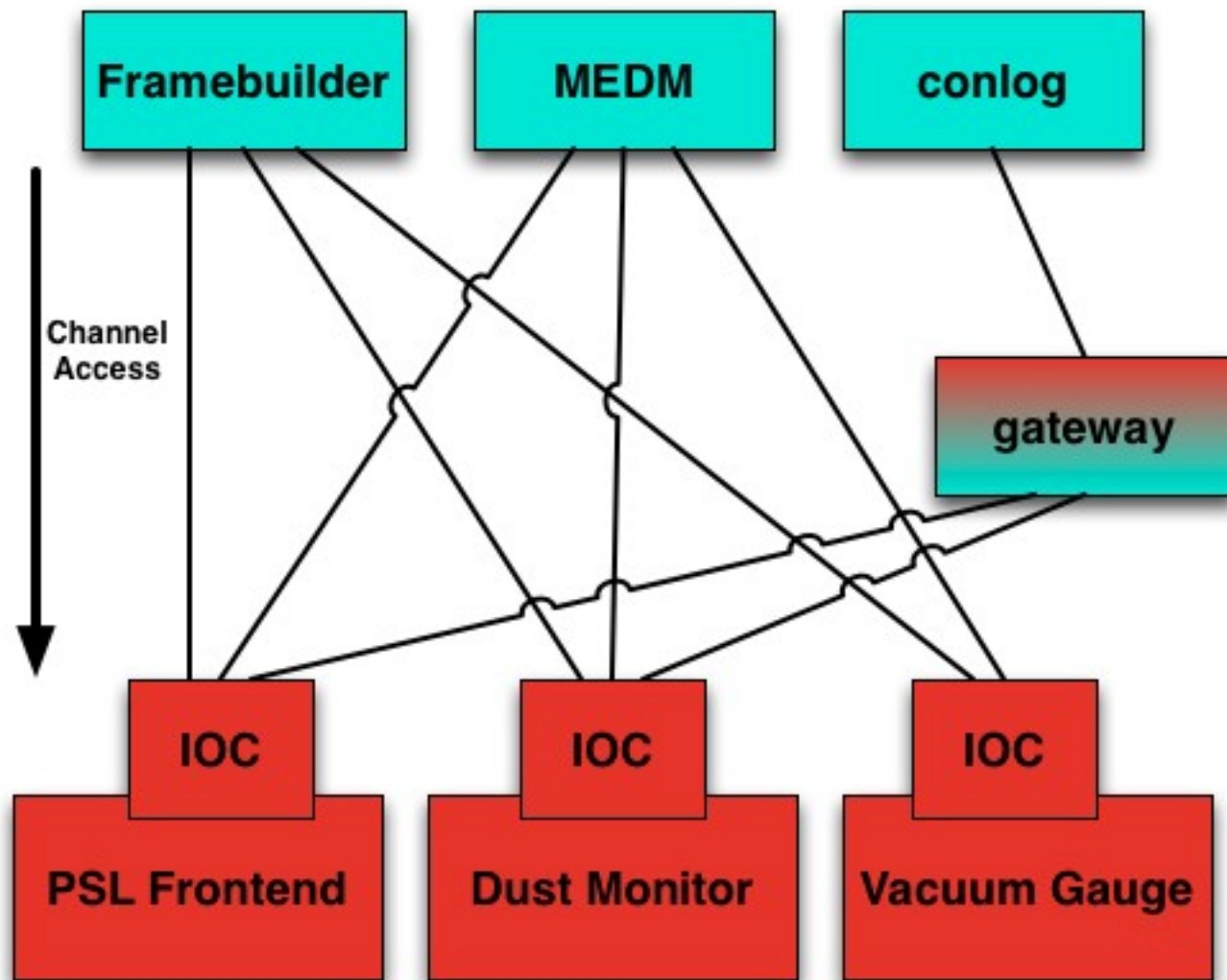
- **Experimental Physics and Industrial Control System**
- **Input/Output Controller**
- **Channel Access**
- **Process Variable**
- **Motif Editor and Display Manager**
- **CONfiguration LOGger**

- The IOC provides a uniform network-enabled interface to the underlying hardware
- Epics provides drivers for many common types of hardware: serial ports, modbus, etc.
- Epics provides an API for developing custom hardware drivers (eg frontend computer)

Anatomy of an IOC



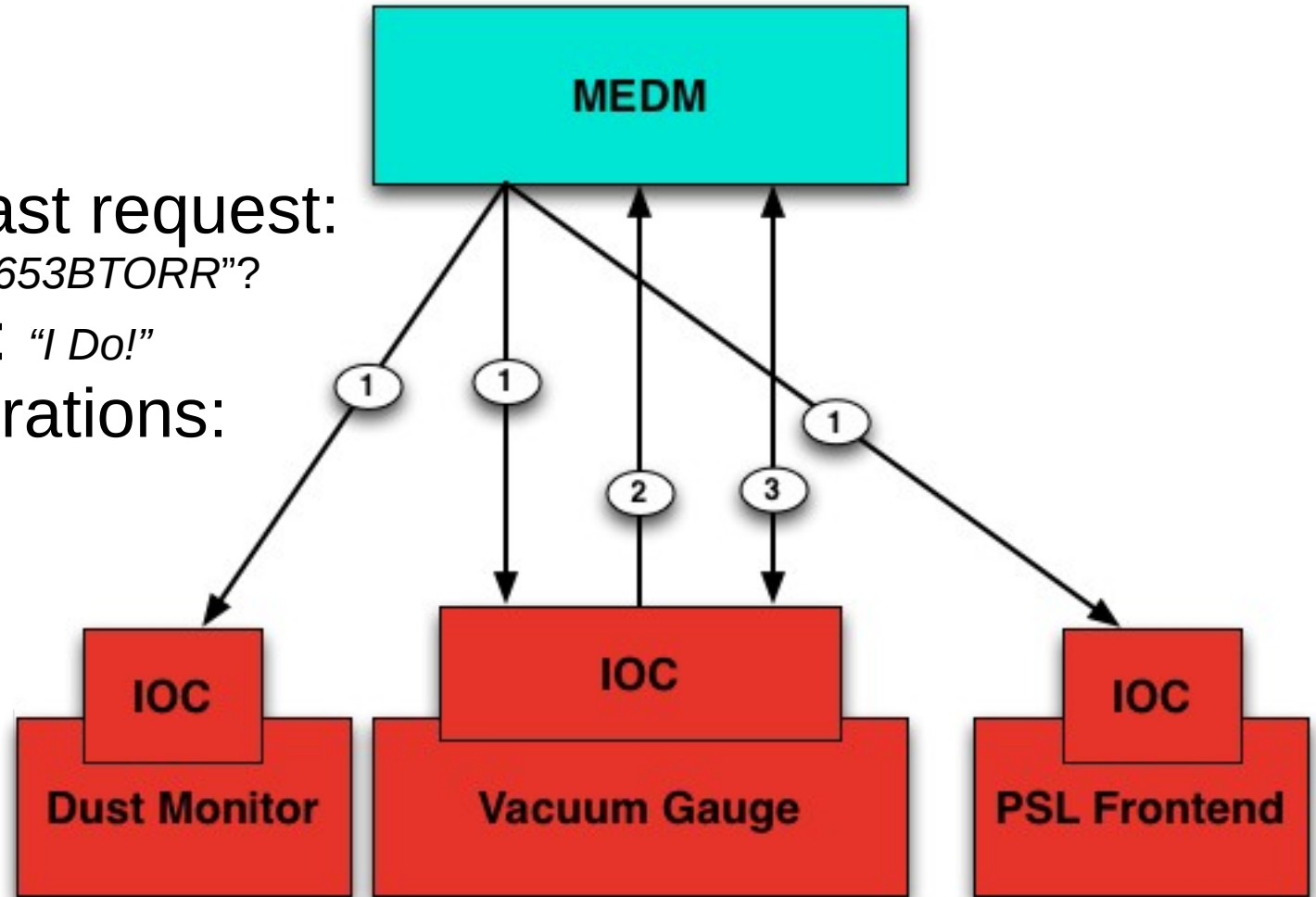
Clients



Servers

Channel Access

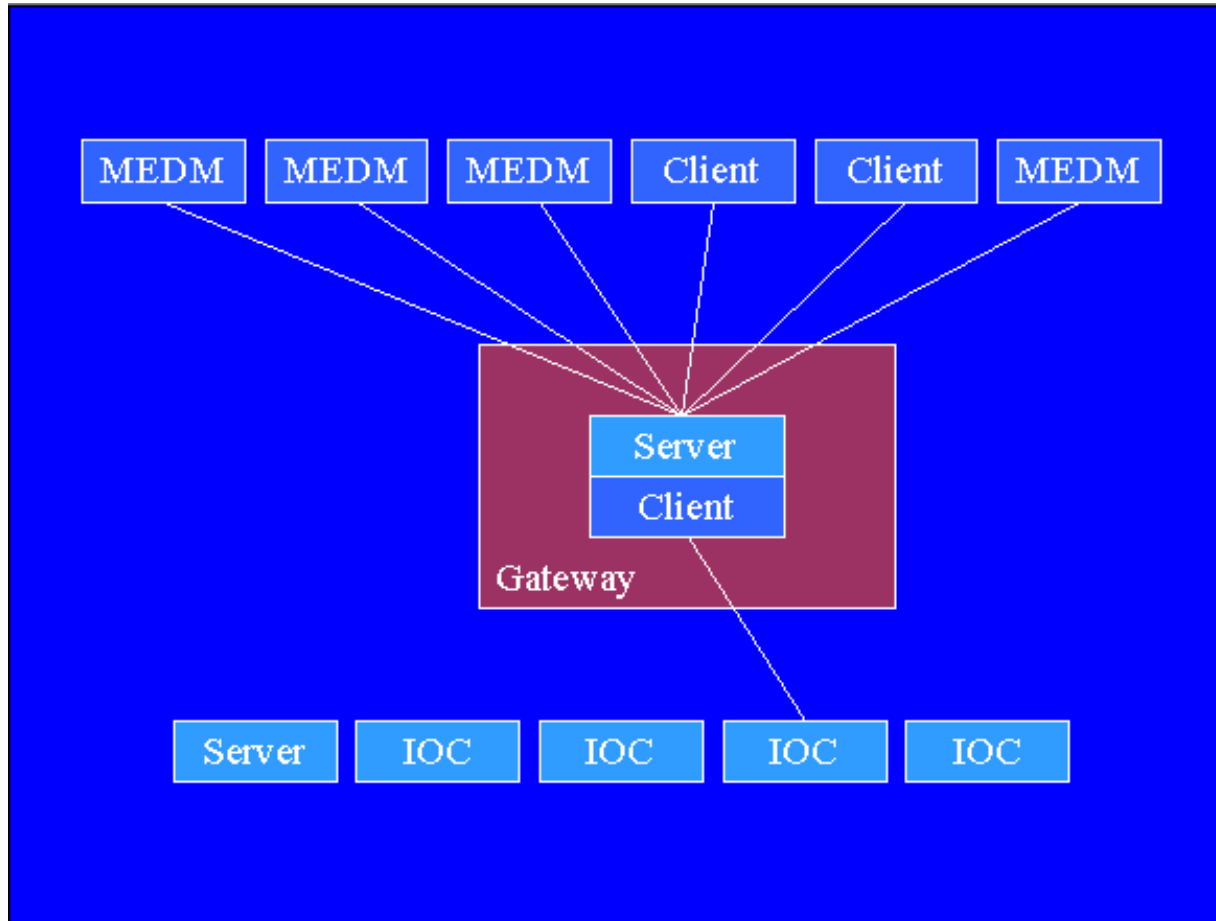
1. Clients broadcast request:
"Who has LVE-MX:X1_653BTORR?"
2. IOC Responds: *"I Do!"*
3. Read/write operations:
"Gimme value!"
"Set this value!"



Gateways

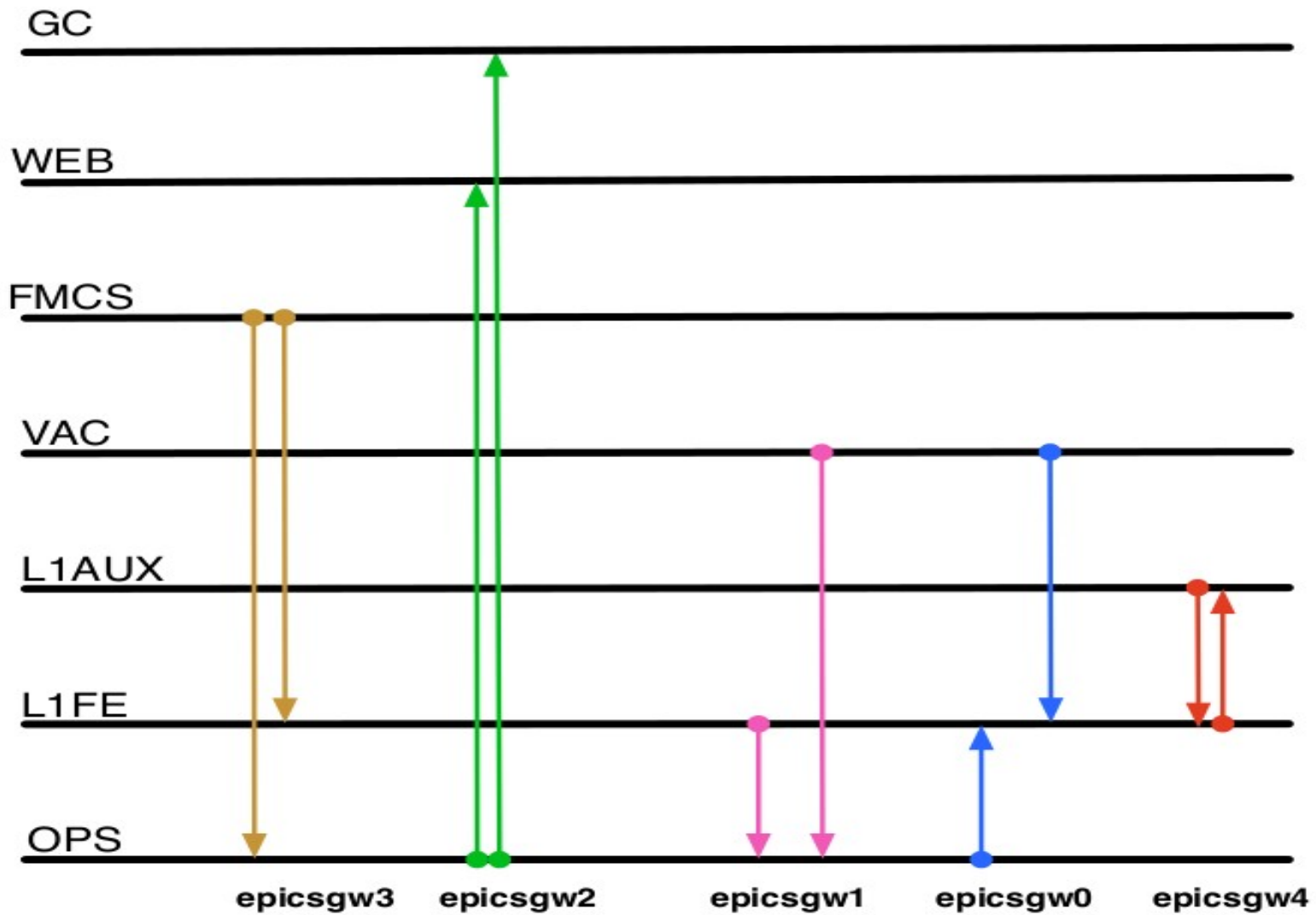
- Provide way to traverse multiple network segments
- Provide additional access control
- Reduce the number of connections to an IOC

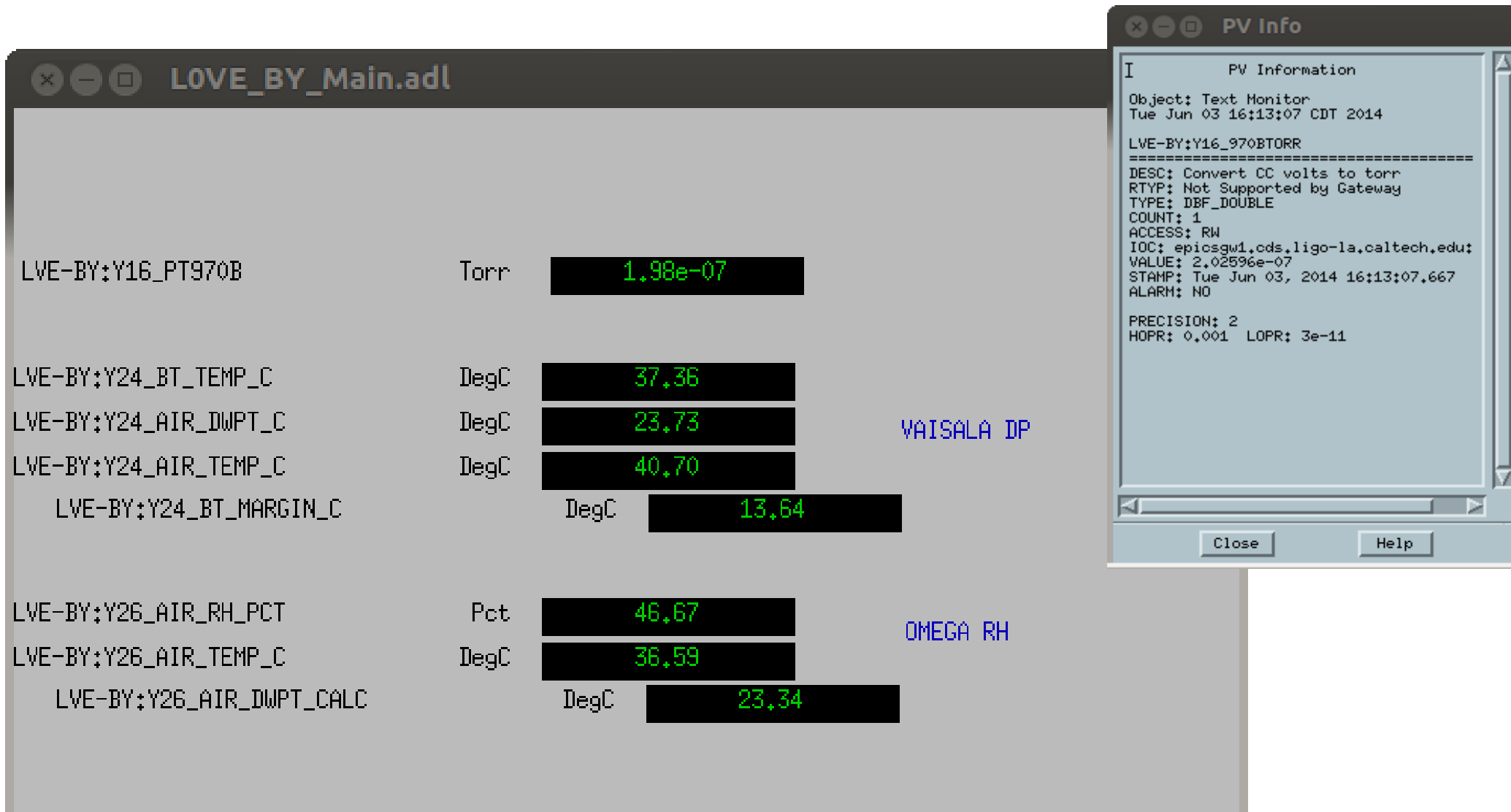
Gateway





Gateways @ LLO





The screenshot displays a MEDM client window titled 'LOVE_BY_Main.adl' showing a table of sensor data. The data is as follows:

Object Name	Unit	Value	Device
LVE-BY:Y16_PT970B	Torr	1.98e-07	
LVE-BY:Y24_BT_TEMP_C	DegC	37.36	VAISALA IP
LVE-BY:Y24_AIR_DWPT_C	DegC	23.73	
LVE-BY:Y24_AIR_TEMP_C	DegC	40.70	
LVE-BY:Y24_BT_MARGIN_C	DegC	13.64	
LVE-BY:Y26_AIR_RH_PCT	Pct	46.67	OMEGA RH
LVE-BY:Y26_AIR_TEMP_C	DegC	36.59	
LVE-BY:Y26_AIR_DWPT_CALC	DegC	23.34	

The 'PV Info' window is open, showing the following information:

```

PV Information
Object: Text Monitor
Tue Jun 03 16:13:07 CDT 2014

LVE-BY:Y16_970BTORR
=====
DESC: Convert CC volts to torr
RTYP: Not Supported by Gateway
TYPE: DBF_DOUBLE
COUNT: 1
ACCESS: RW
IOC: epicsgw1.cds.ligo-la.caltech.edu:
VALUE: 2.02596e-07
STAMP: Tue Jun 03, 2014 16:13:07.667
ALARM: NO

PRECISION: 2
HOPR: 0.001  LOPR: 3e-11
    
```

Sample ADL

```
"text update" {  
    object {  
        x=248  
        y=70  
        width=117  
        height=18  
    }  
    monitor {  
        chan="LVE-BY:Y16_970BTORR"  
        clr=0  
        bclr=14  
    }  
    clrmod="alarm"  
    align="horiz. centered"  
    format="exponential"  
    limits {  
    }  
}
```

- <http://sourceforge.net/apps/trac/cs-studio/wiki/webopi>

The screenshot shows a web browser window with the address bar displaying `160.91.234.145:8086/webopi/WebOPI`. The page is divided into several sections:

- Graphics:** Contains a red oval, a red rectangle, a fishbowl image, a red arrow, a purple arc, and a red hexagon. A 'Title' field is present with 'Text' and 'LinkText' labels.
- Monitors:** Features a green status indicator, a numerical display showing '90,584,000 a.u.', a gauge with '50' and '94' markings, a circular gauge with '70' on the scale, a thermometer showing '19.1' °C, a blue bar chart, and an 'XY Graph' titled 'Intensity Graph' showing a sine wave over time. The graph includes a legend for 'sim://sine(0,100,100,0.1)' and 'Trace 1'.
- Controls:** Includes a red 'STOP' button, a toggle switch, a 'Select Menu...' dropdown, a numeric input field with '0.0', a circular gauge with '65' on the scale, a vertical slider, and a horizontal range slider with labels 'LOLO', 'LO', 'HI', and 'HIHI'.

Clients - CLI

- caget
- caput
- ezcaread
- ezcawrite
- cainfo
- cdsutils

```
#!/usr/bin/python

import epics

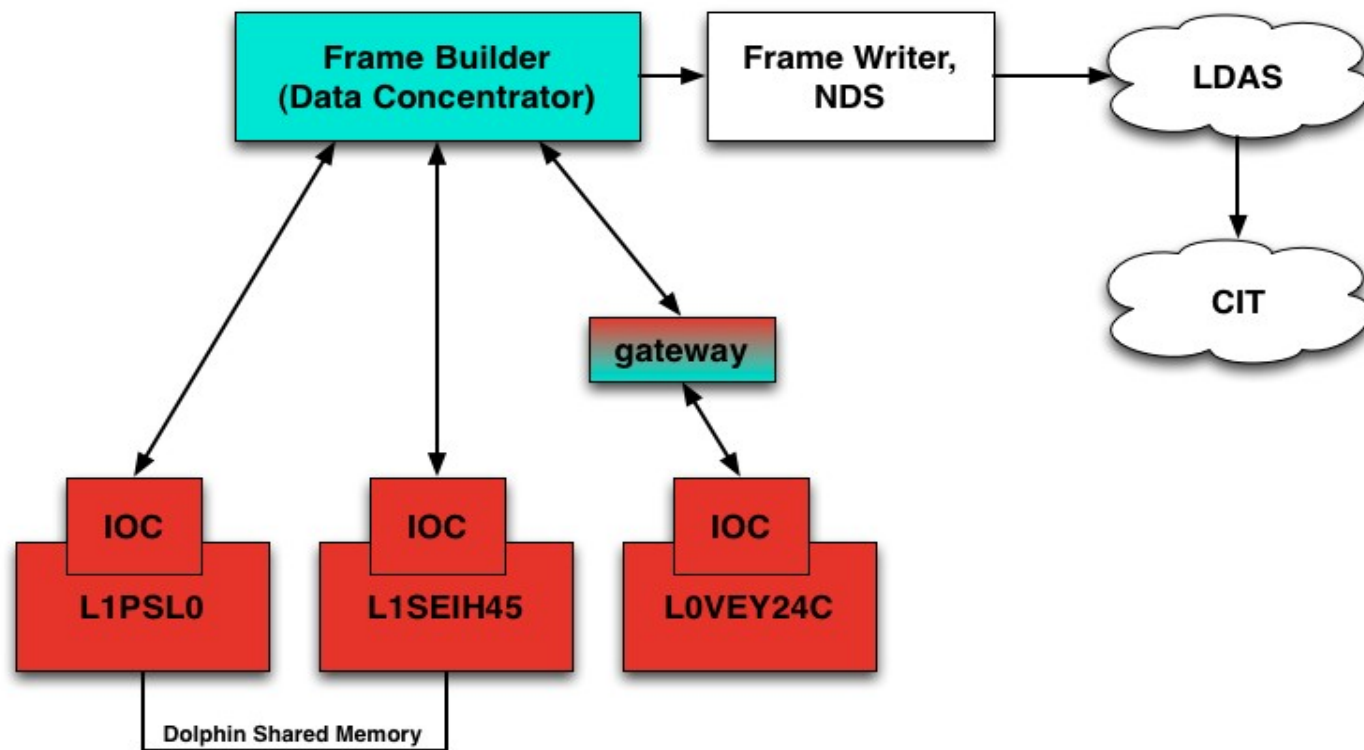
def onConnectionChange(pvName=None, conn=None, **kw):
    sys.stdout.write('%s: PV connection status changed: %s %s\n' %
        (datetime.datetime.today(), pvName, repr(conn)))

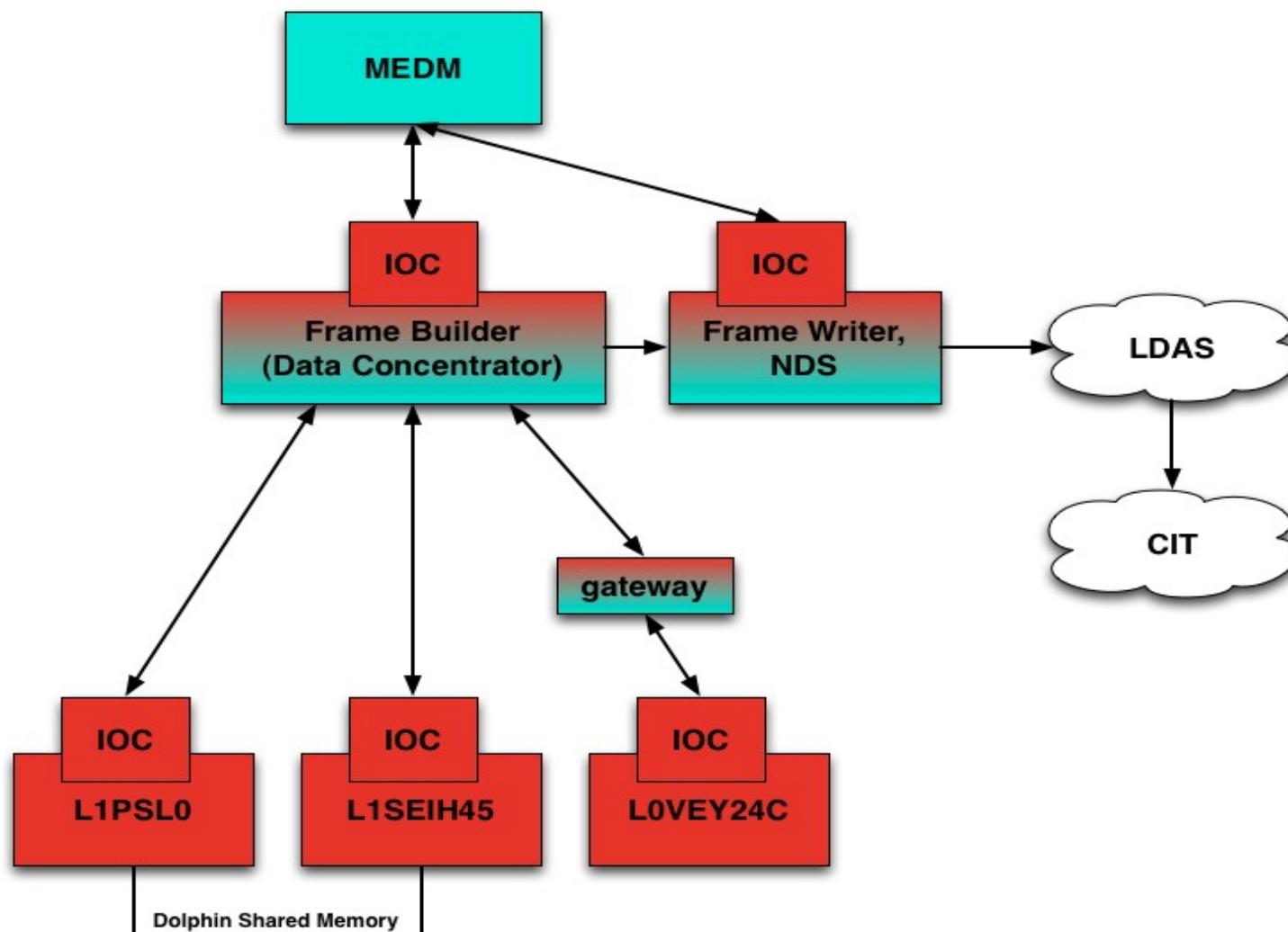
def onValueChange(pvname=None, value=None, host=None, timestamp=None, **kws):
    sys.stdout.write('%s: PV value changed: %s (%s) %s @ %s\n' %
        (datetime.datetime.today(), pvname, host, repr(value),
        datetime.datetime.fromtimestamp(timestamp)))

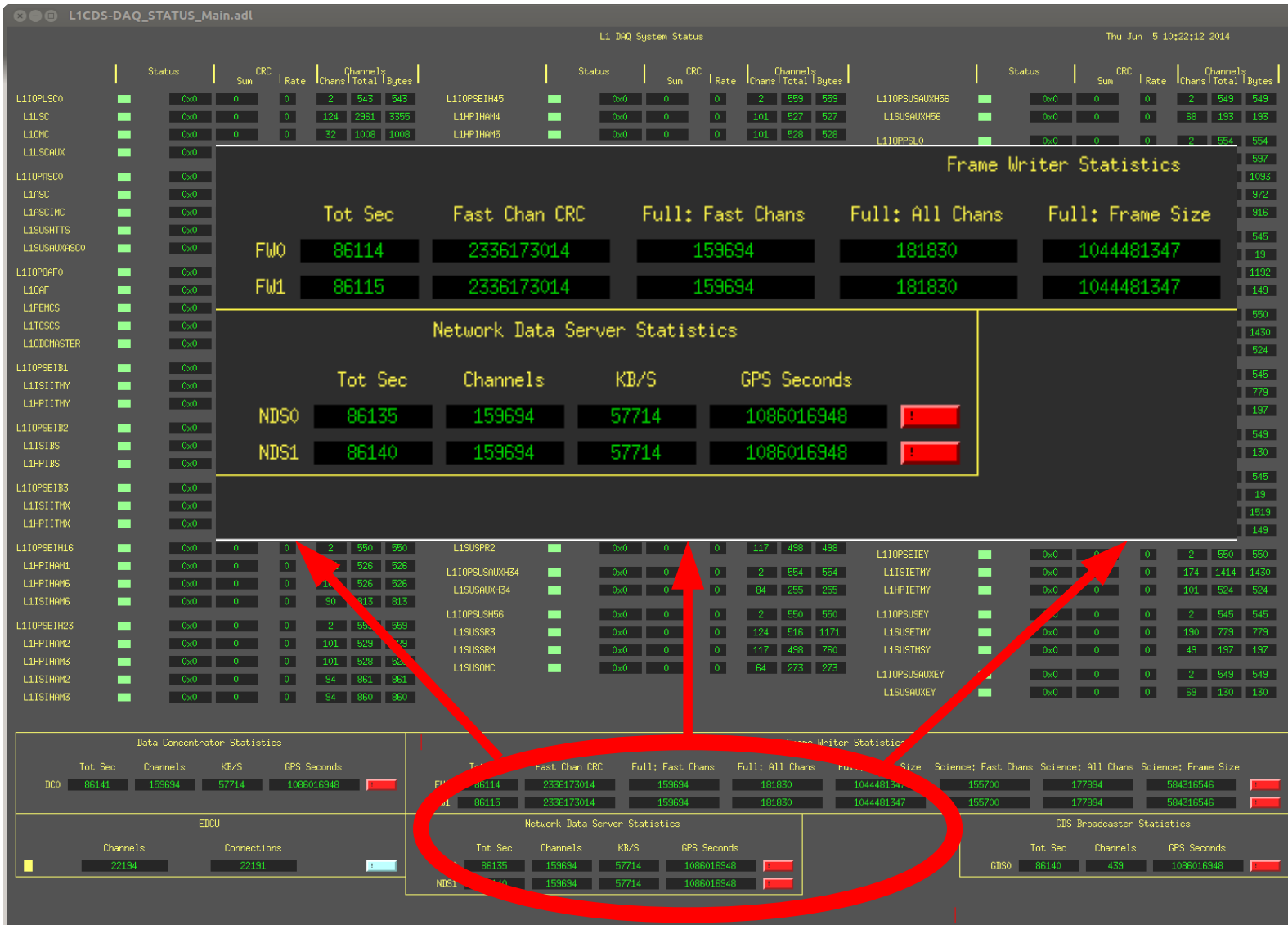
myPV = epics.PV('L0:VIDEO-REQUEST_MONITOR',
    connection_callback=onConnectionChange,
    callback=onValueChange)

while True:
    myPV.get()
    time.sleep(0.1)
```

Client - DAQ



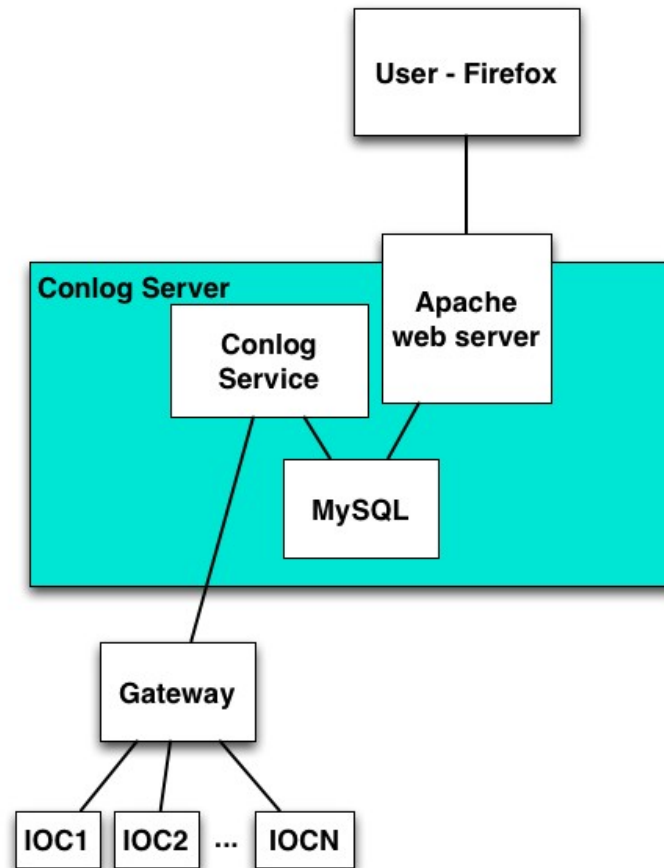




Clients - conlog

- Configuration Logger
- Records all changes of configuration (ie not readback) channels
- Faster than reading frame files
- <https://llocds.ligo-la.caltech.edu:8443/conlog/index.php>

Conlog Architecture



The screenshot shows a web browser window with the address bar displaying `https://llocds.ligo-la.caltech.edu:8443/conlog/index.php`. The page title is "CONLOG".

Database:
A dropdown menu is set to "l1conlog".

Name matching:
Three radio buttons are present: "Globbing" (unselected), "Regular expression" (unselected), and "List" (selected).

A text area contains the following text:
L1: CAM-ETMY_EXP
L1: CAM-ETMX_EXP

Time zone:
A dropdown menu is set to "Server local".

Search type:
Four radio buttons are present:
1. "Return the value and status of each matching process variable at a given time:" (selected). Below it is a text input field containing "06/03/2014 00:00:00".
2. "Compare the value and status of each matching process variable between two different given times:" (unselected). Below it are two text input fields, both containing "MM/DD/YYYY HH:MM:SS".
3. "Return all the values and statuses of each matching process variable between two different given times:" (unselected). Below it are two text input fields, both containing "MM/DD/YYYY HH:MM:SS".
4. "Return all the intervals during which the value and status of each matching process variable did not change between two different given times:" (unselected). Below it are two text input fields, both containing "MM/DD/YYYY HH:MM:SS".

At the bottom of the form are "Reset" and "Submit" buttons.

Below the form, there is a link: "Report bugs at [CDS CONLOG Bugzilla](#)".

At the very bottom, a shell header is visible: `$Header: http://redoubt.ligo-wa.caltech.edu/svn/projects/trunk/epics/apps/conlog/tags/conlog-1.3.0/www/index.php 2797 2014-03-03 20:34:12Z patrick.thomas@LIGO.ORG $`

List Channels

Name matching:

- Globbing
- Regular expression
- List

```
L1:CAM-ETMY_EXP  
L1:CAM-ETMX_EXP
```

Select times

Search type:

- Return the value and status of each matching process variable at a given time:

- Compare the value and status of each matching process variable between two different given times:

- Return all the values and statuses of each matching process variable between two different given times:

- Return all the intervals during which the value and status of each matching process variable did not change between two different given times:



Results

Jun 03 2014 00:00:00 CDT

Name	Time	Event	Value	Alarm Status	Alarm Severity	Error
L1:CAM-ETMX_EXP	May 29 2014 06:37:21 CDT	update	100000	NO_ALARM	NO_ALARM	
L1:CAM-ETMY_EXP	May 29 2014 10:32:55 CDT	update	100000	NO_ALARM	NO_ALARM	



Glob patterns

Name matching:

- Globbing
- Regular expression
- List

```
L1:CAM-*_EXP
```

Jun 03 2014 00:00:00 CDT

Name	Time	Event	Value	Alarm Status	Alarm Severity	Error
L1:CAM-AS_EXP	Jun 02 2014 23:46:00 CDT	update	1816.9	NO_ALARM	NO_ALARM	
L1:CAM-BS_EXP	May 29 2014 06:37:21 CDT	update	1e+06	NO_ALARM	NO_ALARM	
L1:CAM-ETMX_EXP	May 29 2014 06:37:21 CDT	update	100000	NO_ALARM	NO_ALARM	
L1:CAM-ETMY_EXP	May 29 2014 10:32:55 CDT	update	100000	NO_ALARM	NO_ALARM	
L1:CAM-IM4_TRANS_EXP	May 29 2014 06:37:21 CDT	update	0	NO_ALARM	NO_ALARM	
L1:CAM-ITMX_EXP	May 31 2014 20:47:27 CDT	update	81690.1	NO_ALARM	NO_ALARM	
L1:CAM-ITMY_EXP	May 31 2014 01:08:31 CDT	update	30281.7	NO_ALARM	NO_ALARM	
L1:CAM-MC1_EXP	May 29 2014 06:37:21 CDT	update	100000	NO_ALARM	NO_ALARM	
L1:CAM-MC1_LAV_EXP	May 29 2014 06:37:21 CDT	update	50000	NO_ALARM	NO_ALARM	
L1:CAM-MC2_EXP	Jun 02 2014 12:42:31 CDT	update	1000	NO_ALARM	NO_ALARM	
L1:CAM-MC2_LAV_EXP	May 29 2014 06:37:21 CDT	update	35211.3	NO_ALARM	NO_ALARM	
L1:CAM-MC3_EXP	Jun 01 2014 13:07:11 CDT	update	500	NO_ALARM	NO_ALARM	
L1:CAM-MC_REFL_EXP	May 29 2014 06:37:21 CDT	update	16000	NO_ALARM	NO_ALARM	
L1:CAM-MC_TRANS_EXP	May 29 2014 06:37:21 CDT	update	13380	NO_ALARM	NO_ALARM	
L1:CAM-OMC_REFL_EXP	May 29 2014 06:37:21 CDT	update	0	NO_ALARM	NO_ALARM	
L1:CAM-OMC_TRANS_EXP	May 31 2014 01:49:01 CDT	update	9859.2	NO_ALARM	NO_ALARM	
L1:CAM-PR2_EXP	May 29 2014 06:37:21 CDT	update	9971.8	NO_ALARM	NO_ALARM	
L1:CAM-PR3_EXP	May 29 2014 06:37:21 CDT	update	1e+06	NO_ALARM	NO_ALARM	
L1:CAM-PRM_EXP	May 29 2014 06:37:21 CDT	update	100000	NO_ALARM	NO_ALARM	
L1:CAM-PRM_REFL_180_EXP	May 29 2014 06:37:21 CDT	update	3000	NO_ALARM	NO_ALARM	
L1:CAM-PRM_REFL_90_EXP	May 29 2014 06:37:21 CDT	update	43662	NO_ALARM	NO_ALARM	
L1:CAM-PSL_EXP	May 29 2014 06:37:21 CDT	update	0	NO_ALARM	NO_ALARM	
L1:CAM-SPARE1_EXP	May 29 2014 06:37:21 CDT	update	200	NO_ALARM	NO_ALARM	
L1:CAM-TEMP1_EXP	May 29 2014 06:37:21 CDT	update	0	NO_ALARM	NO_ALARM	
L1:CAM-TEMP2_EXP	May 29 2014 06:37:21 CDT	update	0	NO_ALARM	NO_ALARM	