Archiver Appliance Report
Fall 2012

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NATIONAL ACCELERATOR LABORATORY

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Our top 5 Objectives

- Scale to 1-2 millions PV's
- Fast data retrieval
- Users add PV's to archiver
- Zero oversight
- Flexible configurations on a per PV basis

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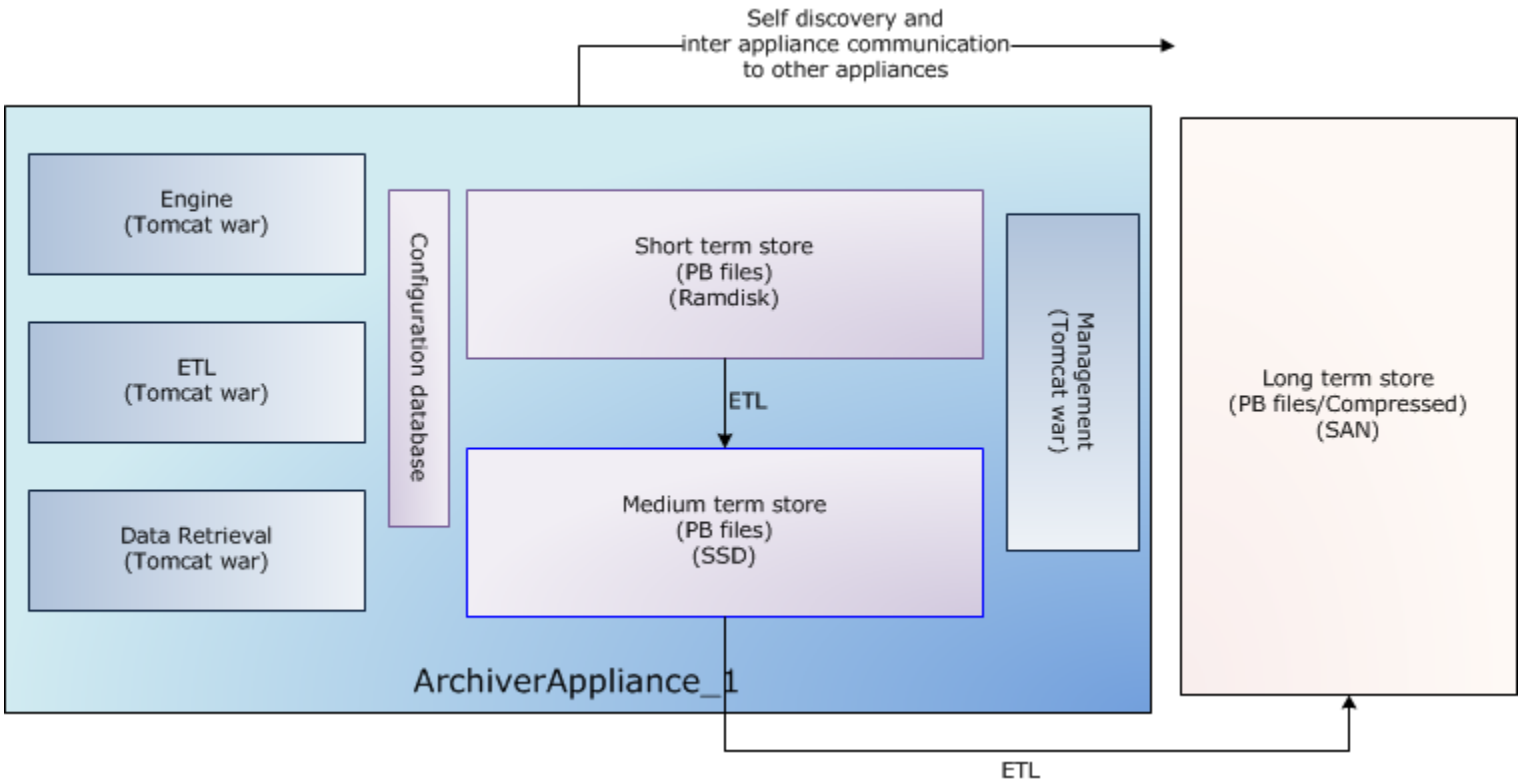
Components



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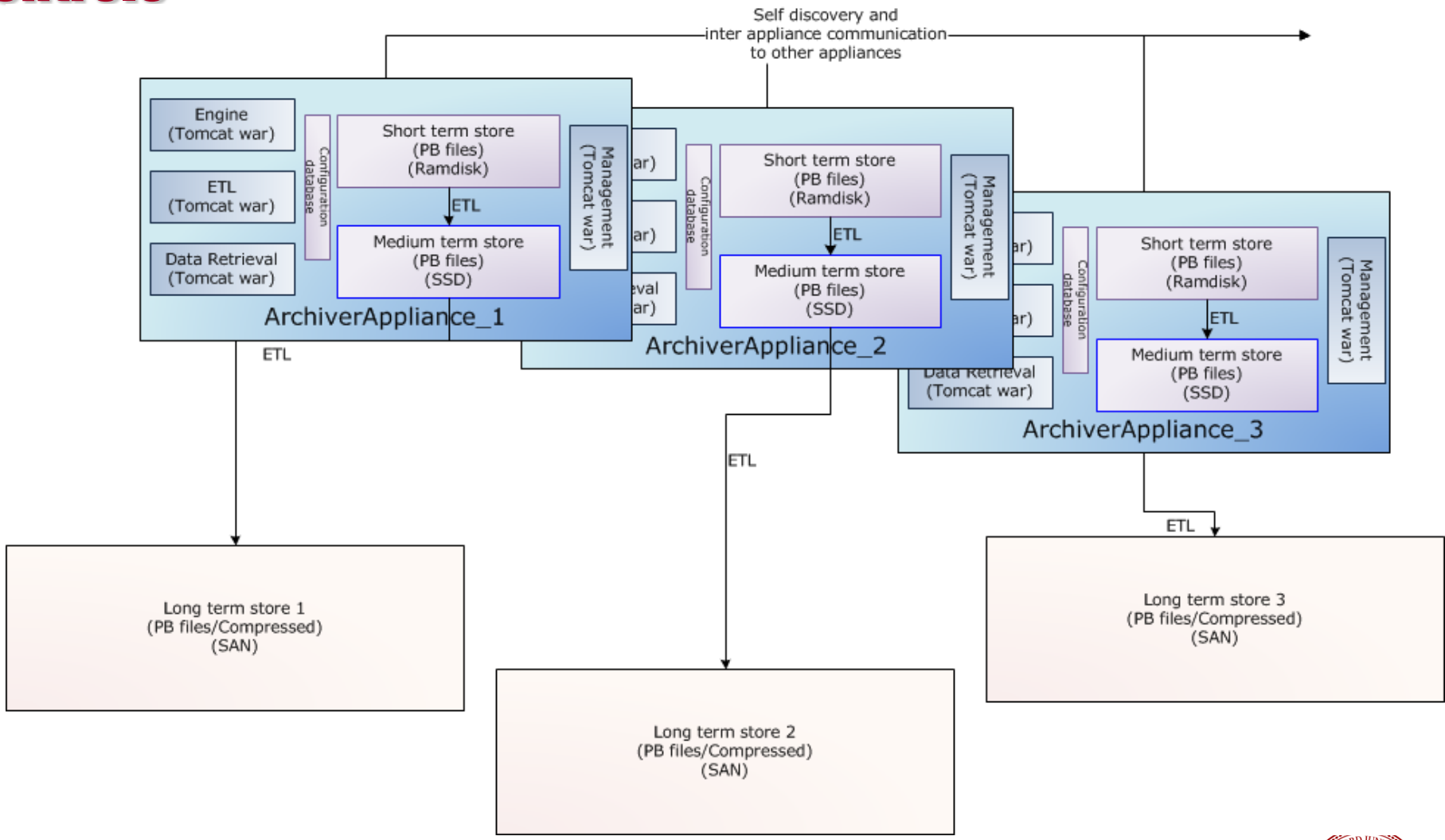
Controls

One possible cluster config



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Retrieval

- Clients
  - ArchiveViewer - Initial focus.
  - CSS DataBrowser
- Multiple MIME formats
  - RAW (PB over HTTP)
    - Efficient but requires client code
  - JSON
  - SVG
  - Matlab
  - Others can be easily added (HDF5?)

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Retrieval goals

- Goal
  - 1 days worth of raw data in 500ms or less
  - 1 years worth of sparsified data in 500ms or less.
- Still staying substantially within goal

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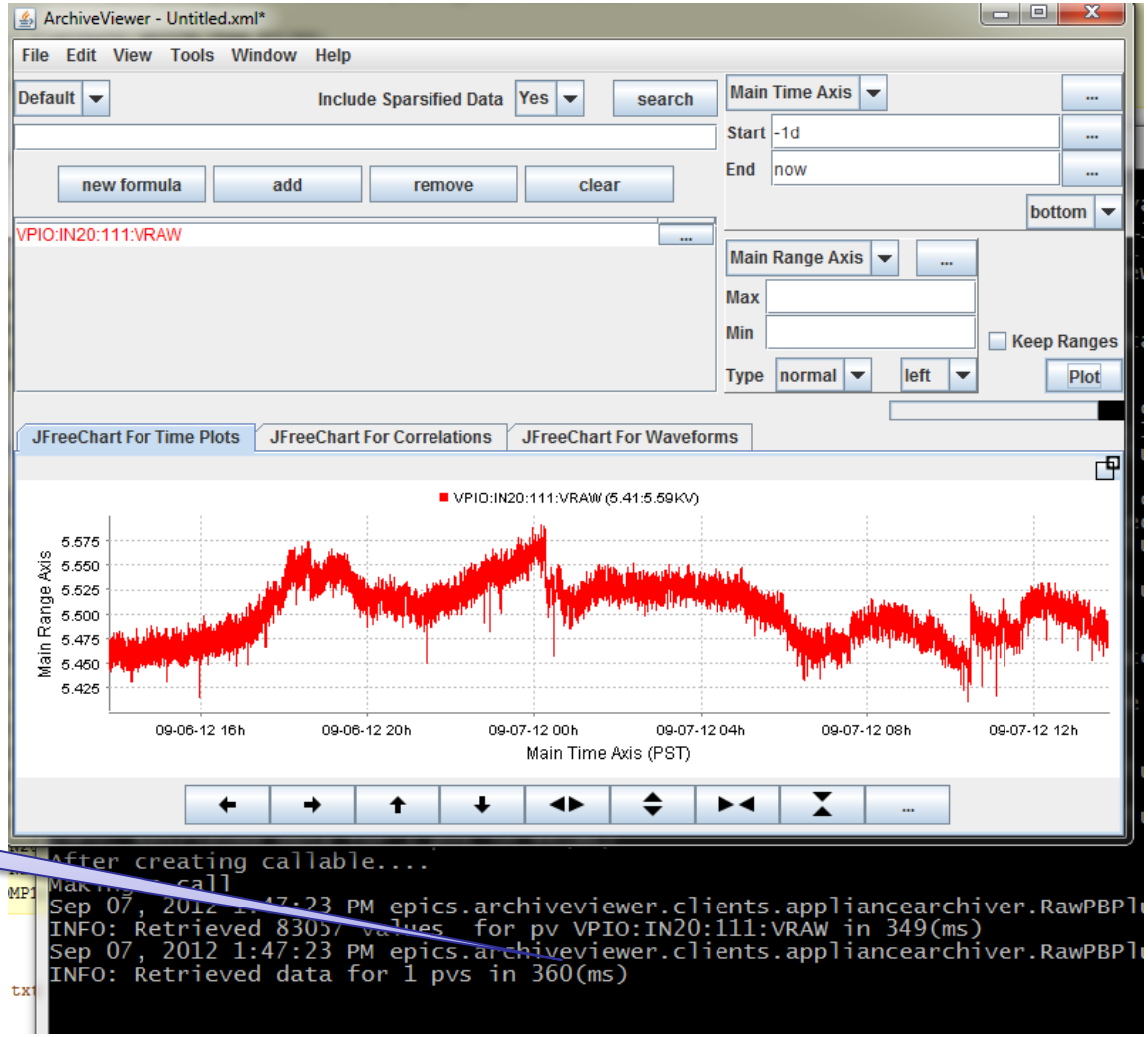
Retrieval (Actual)

Controls



Retrieval time 360 (ms)

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Sparsification

- Many sparsification operations possible
  - Can be cached/stored or computed runtime
  - Caching is optional on a per PV basis
  - Runtime computation can be done in parallel if memory permits
  - Can configure default sparsification operator on a per site basis.

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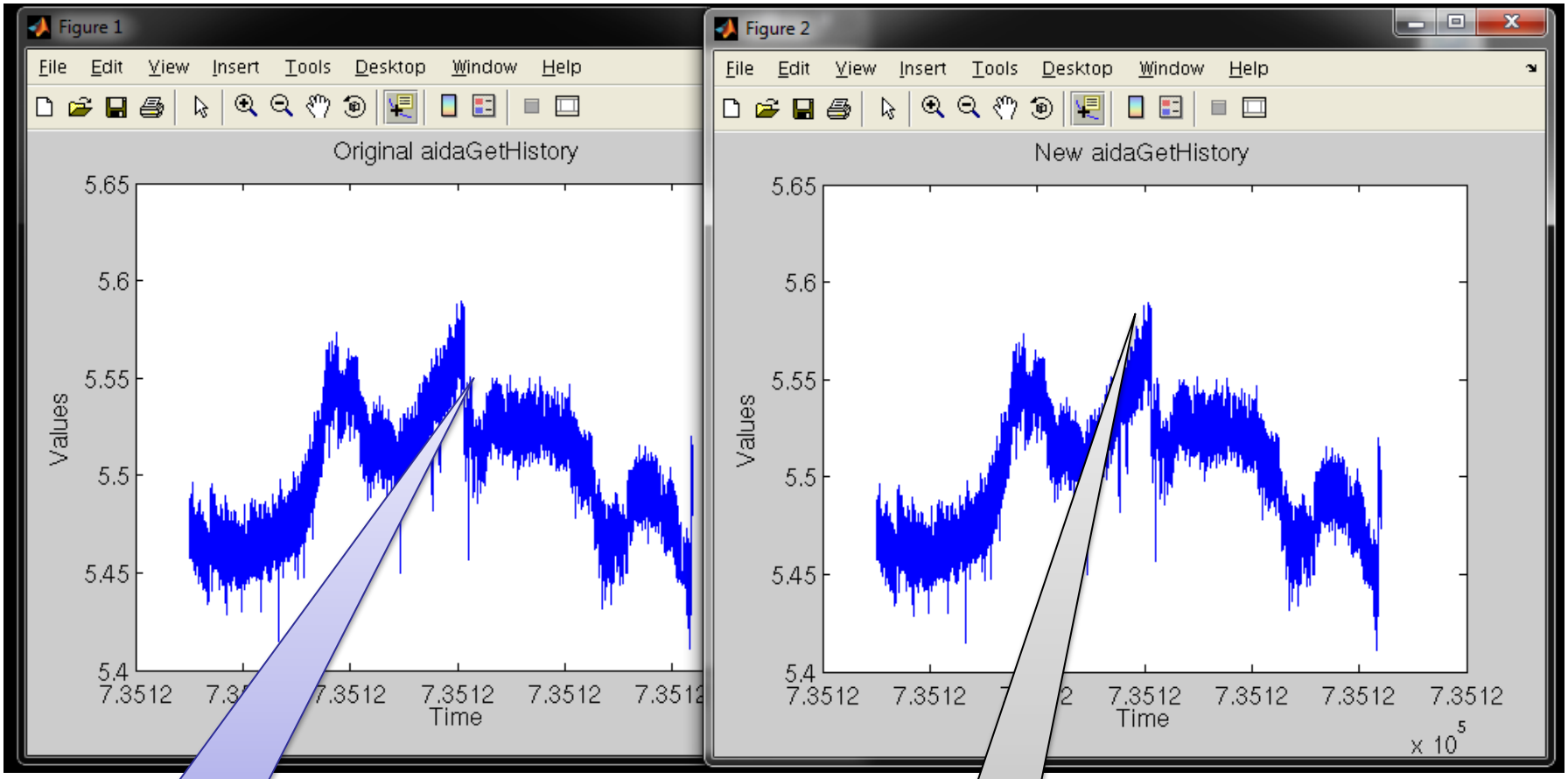
Controls

Retrieval from Matlab (.mat)



ChannelArchiver

Using .mat format

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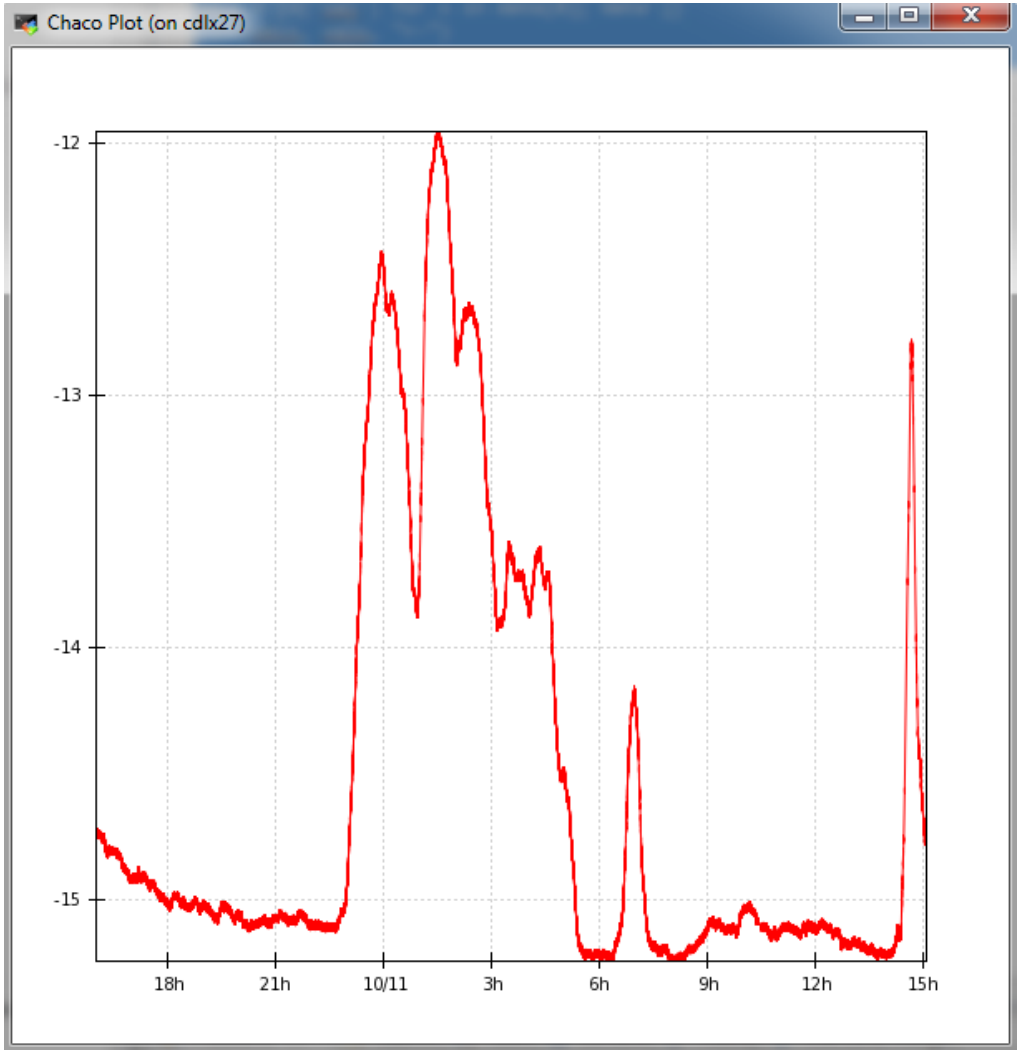
Controls

Retrieval from Python (.json)



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Controls

Engine – New features since April 2012

- Archiving EPICS metadata like HIHI, LOLO
- Conditional archiving
- Pause/resume
- Support for aliases

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Pause and resume archiving pv-1

Controls

Home Reports Metrics Storage Policies Appliances Integration

Here are the complete details of the PV **luofeng0:step0**.

Attribute	Detail
PV Name	luofeng0:step0
Instance archiving PV	cdlx03
Archival params creation time:	Jun/26/2012 15:02:53 PDT
Archival params modification time:	Jun/26/2012 15:08:38 PDT
Archiver DBR type (from typeinfo):	DBR_SCALAR_DOUBLE
Is this a scalar:	Yes
Number of elements:	1
Precision:	0.0
Units:	
Have we paused archiving this pv:	No
Sampling method:	MONITOR
Sampling period:	1.0
Seconds to buffer samples:	10
Additional fields being archived:	LOLO,HIGH,LOPR,LOW,HOPR,HIHI
Extra info - MDEL:	0.0
Extra info - ADEL:	0.5
Extra info - SCAN:	10 second
Extra info - RTYP:	calc

Change archival parameters
Pause archiving
Resume archiving
Stop archiving
Consolidate data

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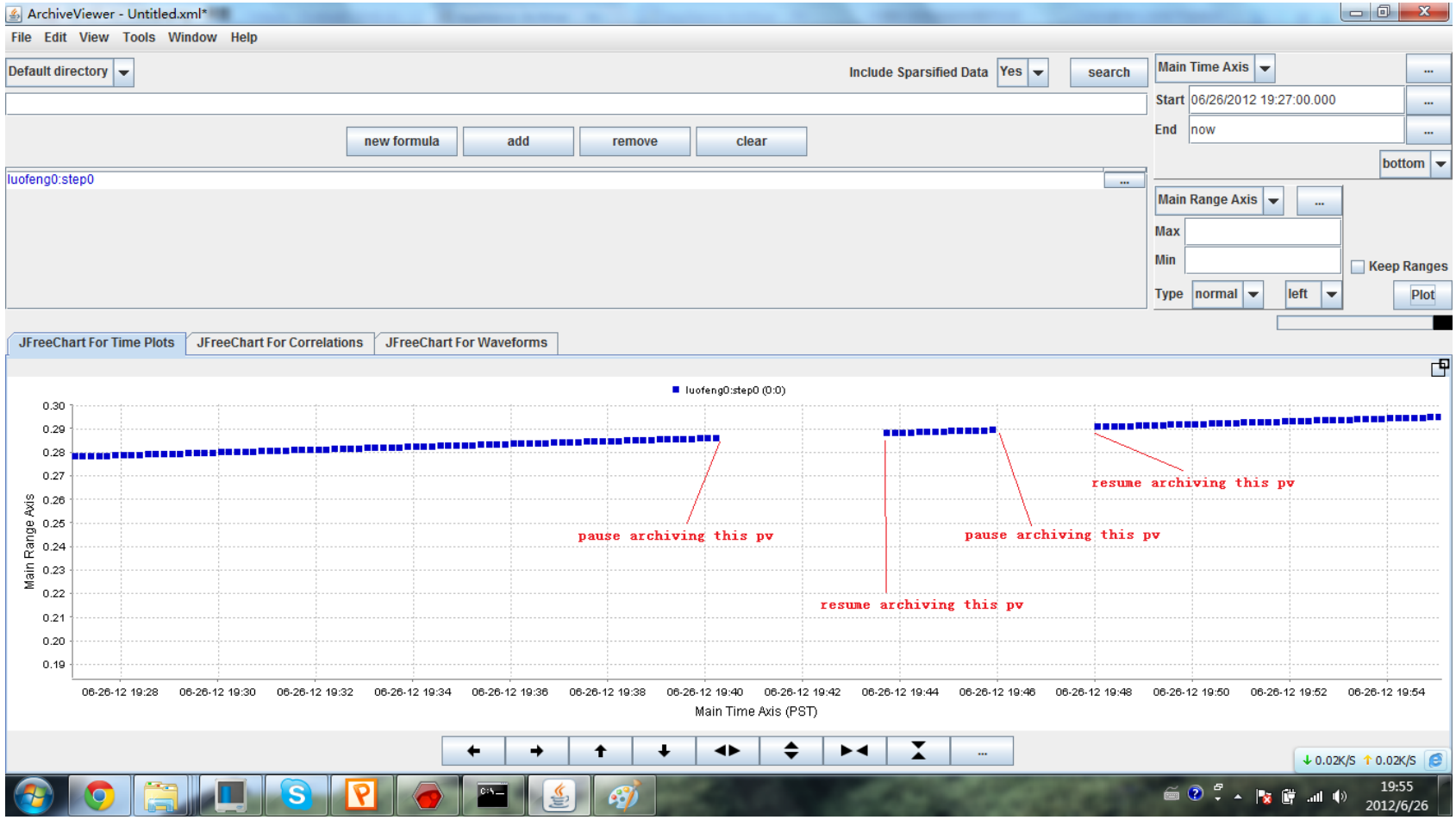
Pause and resume archiving pv-2

Controls



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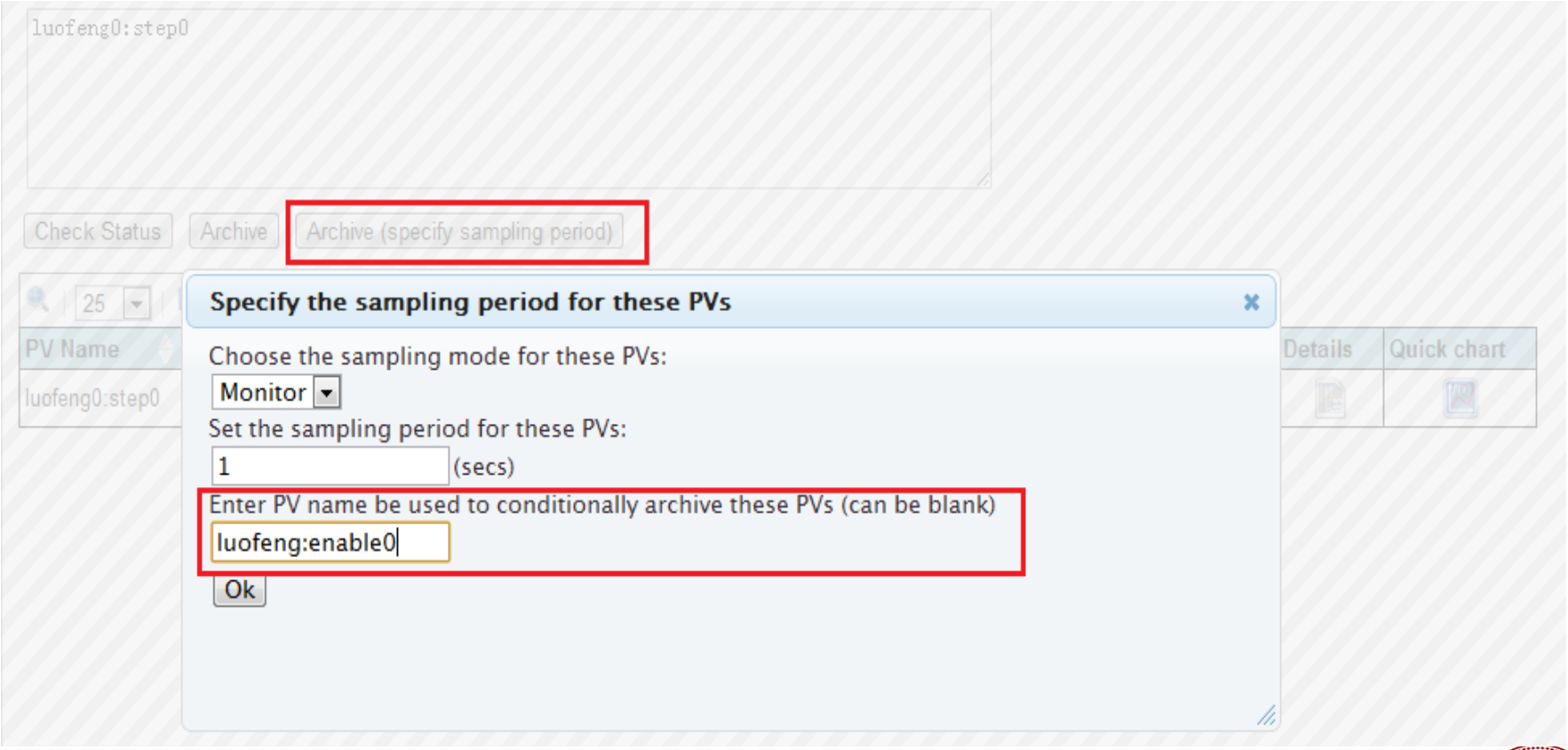
Conditional archiving-1

- Conditional archiving web page



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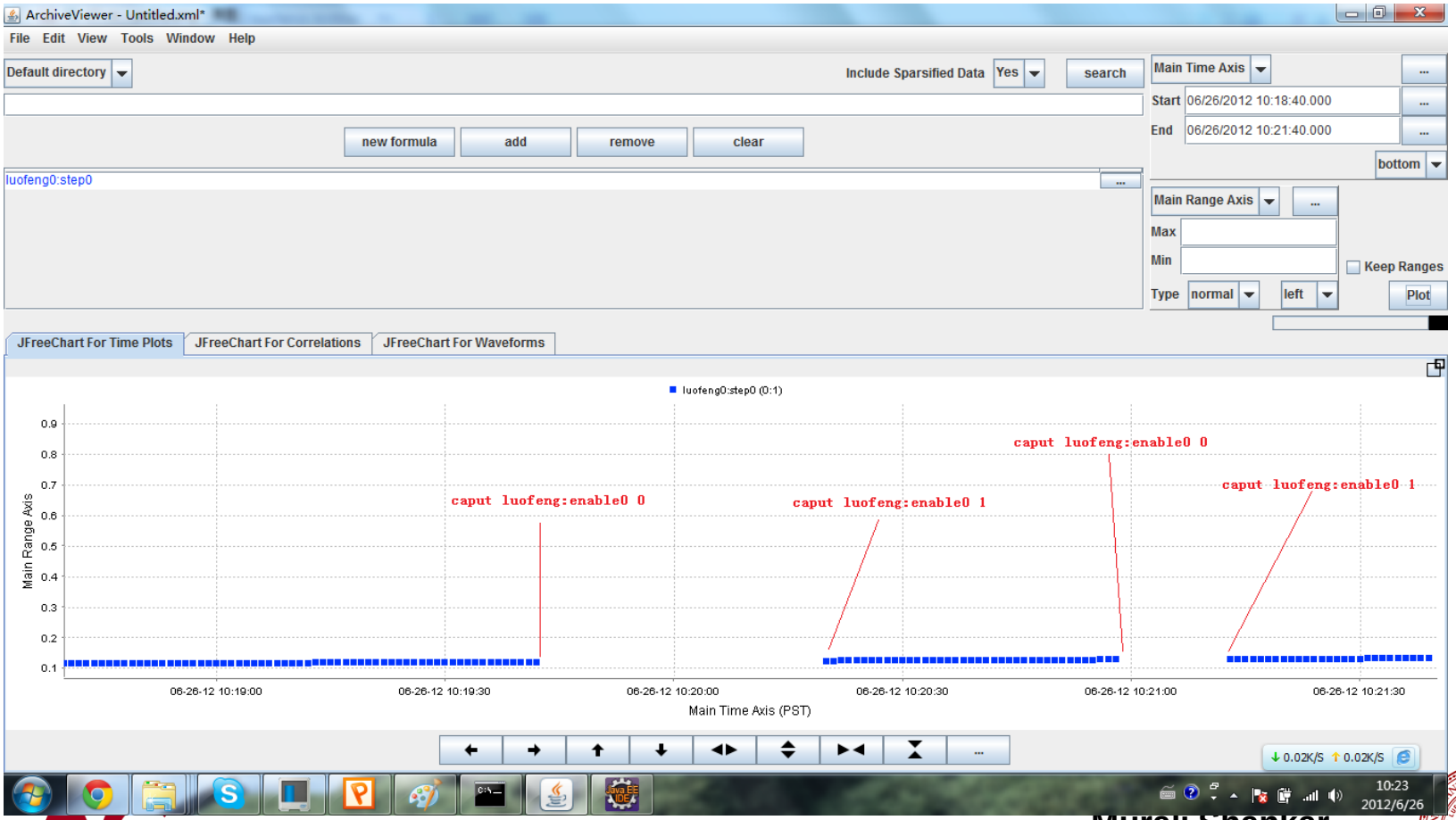
Conditional archiving-2

Controls

- `luofeng:enable0` controls `luofeng0:step0`



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Controls

Archiving EPICS metadata

- Support for archiving EPICS fields other than .VAL as part of a policy
  - Can be specified in the UI
  - Can also be specified in the policy based on RTYP
  - For example, for "ai" PV's archive
    - HIHI
    - LOLO

```
pvRTYP=pvInfo["RTYP"]
archiveFields=[]
if pvRTYP=="ai":
    archiveFields=['HIHI','HIGH','LOW','LOLO','LOPR','HOPR']
elif pvRTYP=="ao":
    archiveFields=['HIHI','HIGH','LOW','LOLO','LOPR','HOPR','DRVH','DRVL']
elif pvRTYP=="calc":
    archiveFields=['HIHI','HIGH','LOW','LOLO','LOPR','HOPR']
elif pvRTYP=="calcout":
    archiveFields=['HIHI','HIGH','LOW','LOLO','LOPR','HOPR']
elif pvRTYP=="longin":
    archiveFields=['HIHI','HIGH','LOW','LOLO','LOPR','HOPR']
elif pvRTYP=="longout":
    archiveFields=['HIHI','HIGH','LOW','LOLO','LOPR','HOPR','DRVH','DRVL']
elif pvRTYP=="dfanout":
    archiveFields=['HIHI','HIGH','LOW','LOLO','LOPR','HOPR']
elif pvRTYP=="sub":
    archiveFields=['HIHI','HIGH','LOW','LOLO','LOPR','HOPR']
pvPolicy["archiveFields"]=archiveFields
```

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Test against LCLS production

Controls

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Instance Name	Status	PV Count	Connected	Event Rate	Data Rate (GB/year)	Engine write t
test-arch	Working	116878	102255	3,531.11	2,360.67	0.61

PVs

Here are the some detailed metrics of the appliance **test-arch**

Attribute	Detail
Appliance Identity	test-arch
Total PV count	116878
Disconnected PV count	14623
Connected PV count	102255
Total channels	597898
Event Rate (in events/sec)	3,531.11
Data Rate (in bytes/sec)	80,376.53
Data Rate in (GB/day)	6.47
Data Rate in (GB/year)	2,360.67
Time consumed for writing samplebuffers to STS (in secs)	0.61

Channels

Thru CA gateway

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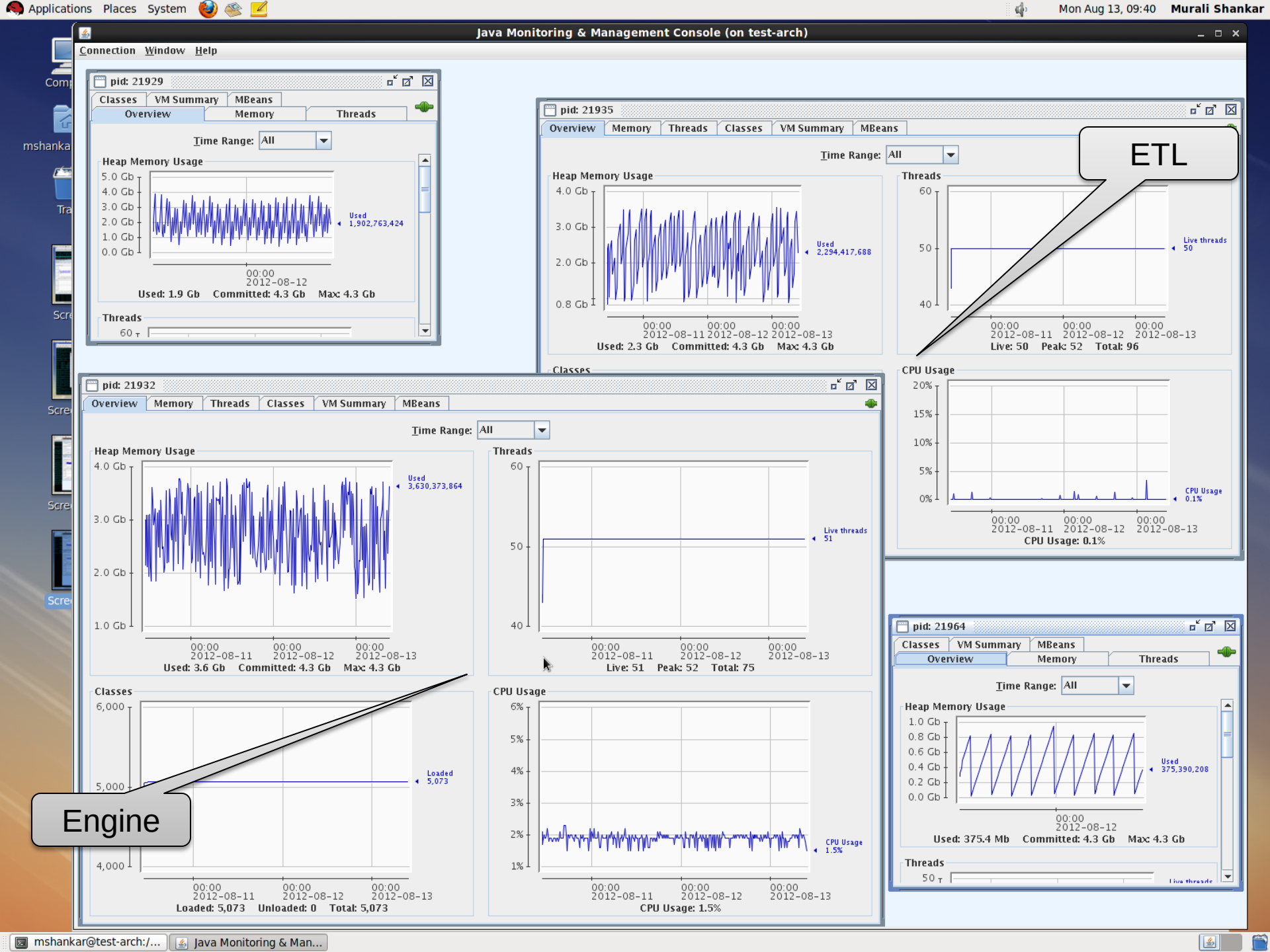
Applications Places System
Mon Aug 13, 09:40 Murali Shankar
Java Monitoring & Management Console (on test-arch)
Connection Window Help
pid: 21929
Classes VM Summary MBeans
Overview Memory Threads
Time Range: All
Heap Memory Usage
Used 1,902,763,424
Used: 1.9 Gb Committed: 4.3 Gb Max: 4.3 Gb
Threads
pid: 21935
Overview Memory Threads Classes VM Summary MBeans
Time Range: All
Heap Memory Usage
Used 2,294,417,688
Used: 2.3 Gb Committed: 4.3 Gb Max: 4.3 Gb
Threads
Live threads 50
Live: 50 Peak: 52 Total: 96
CPU Usage
CPU Usage 0.1%
CPU Usage: 0.1%
ETL
pid: 21932
Overview Memory Threads Classes VM Summary MBeans
Time Range: All
Heap Memory Usage
Used 3,630,373,864
Used: 3.6 Gb Committed: 4.3 Gb Max: 4.3 Gb
Threads
Live threads 51
Live: 51 Peak: 52 Total: 75
Classes
Loaded 5,073
Loaded: 5,073 Unloaded: 0 Total: 5,073
CPU Usage
CPU Usage 1.5%
CPU Usage: 1.5%
Engine
pid: 21964
Classes VM Summary MBeans
Overview Memory Threads
Time Range: All
Heap Memory Usage
Used 375,390,208
Used: 375.4 Mb Committed: 4.3 Gb Max: 4.3 Gb
Threads
mshankar@test-arch:/...
Java Monitoring & Man...

Controls

Stress and performance tests-1

- Test Environment *Desktop Box*
  - Computer Performance
    - Dell T3500
    - Intel(R) Xeon(R) CPU*4 Cores E5507 @ 2.27GHz
    - Physical Memory 4G(2G for JVM and 2G for short term storage)
    - Disk 7200rpm,250G,Average Seek Time 8.9ms,Average Write Time 10.9ms,Average Latency 4.2ms
  - OS
    - Red Hat ES 5.1.19.6 32bit
  - SoftIOC
    - EPICS3.14.8.2
    - pv's name is like luofeng0:step0
    - 200 pvs share the same first prefix
  - Others
    - JDK1.7
    - JVM -XX:MaxPermSize=128M -Xmx2G
    - Tomcat 7
    - Jconsole in JDK1.7
    - All webapps in one VM

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Controls

Stress and performance tests-2

pv @1HZ partition 5 minutes without compressing pb files , with 6 meta fields archived								
pv num	event rate Hz	max size of short term storage	average cpu	max memory size	average time of buffer to STS	Average time of STS to MTS	Average time of MTS to LTS	running time of test
5,000	4,994	45M	5%	900M	0.3s	4s	6s	5 hours
10,000	9,989	123M	10%	2G	0.57s	9s	63s	18 hours

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Controls

Stress and performance tests-3

pv @1HZ partition hour without compressing pb files,with 6 meta fields archived								
pv num	event rate Hz	max size of short term storage	average cpu	max memory size	Average time of buffer to STS	Average time of STS to MTS	Average time of MTS to LTS	running time of test
5,000	4,994	199M	5%	900M	0.37s	3s	9s	6 hours
10,000	9,989	583M	10%	2G	0.76s	24s	127s	60 hours

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Controls

Stress and performance tests-4

pv @0.1HZ partition hour for short term storage and medium term storage, partition day for long term storage ,without compressing pb files,with 6 meta fields archived								
pv num	event rate Hz	max size of short term storage	average cpu	max memory size	average time of buffer to STS	average time of STS to MTS	average time of MTS to LTS	running time of test
20,000	2,000	235M	12%	2G	1.15s	7s	372s	66 hours
40,000	4,003	469M	25%	2G	2.78s	61s	3377s (56 minutes)	19 hours

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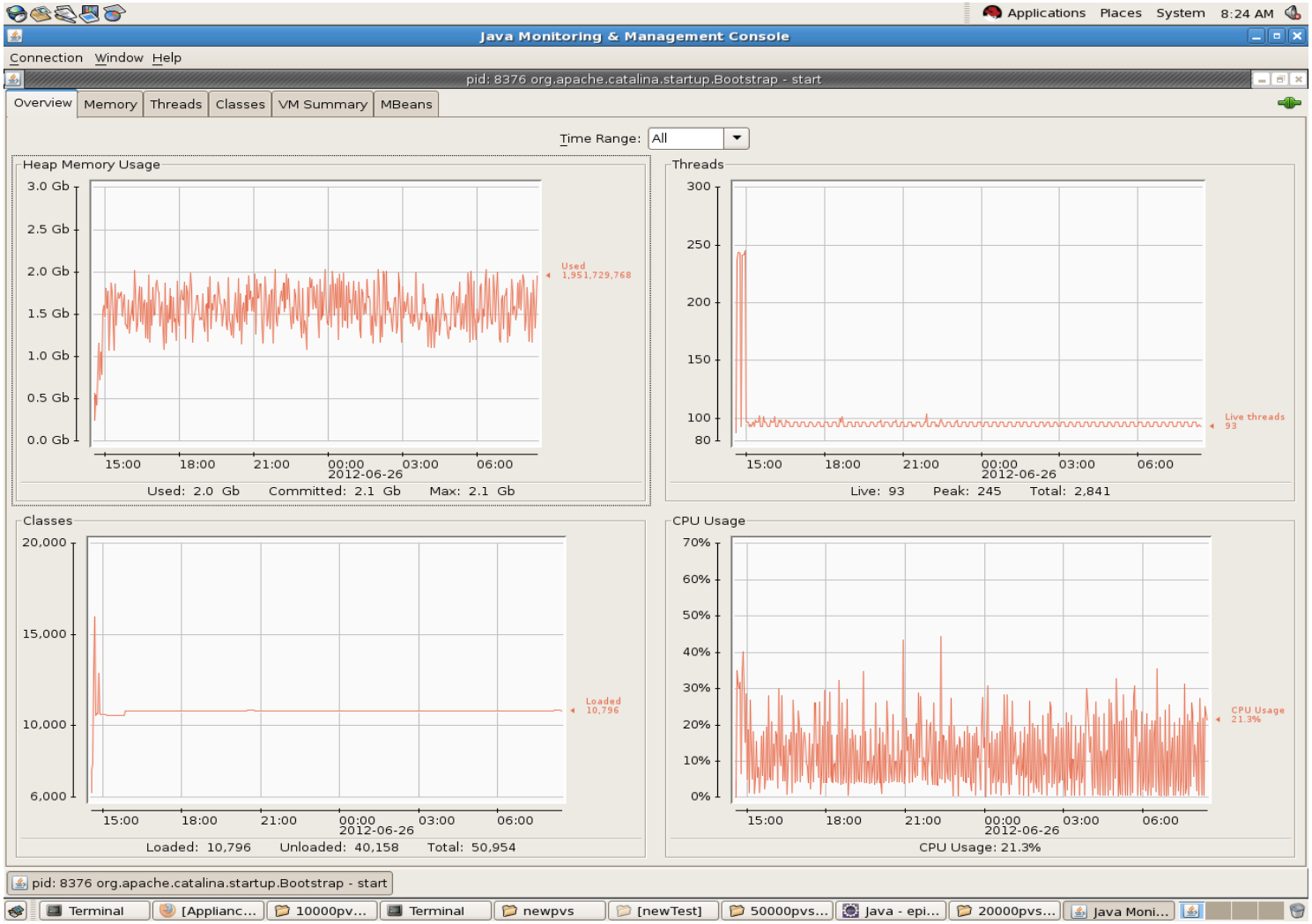
Stress and performance tests-5

Controls



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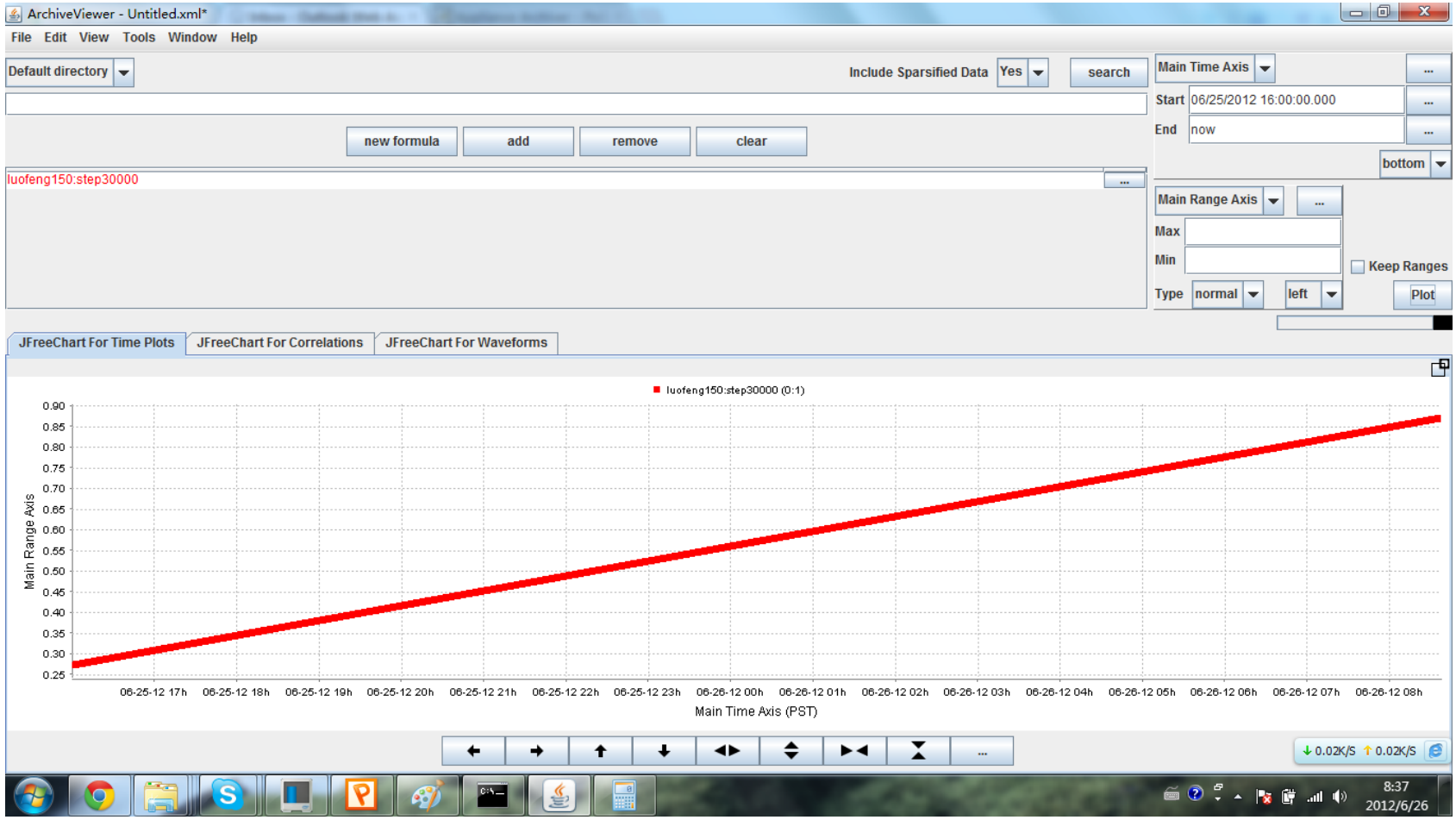
Stress and performance tests-6

Controls



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Stress and performance tests-7

- Result
  - The system runs stably without losing data
  - All pv connections recover on IOC boot
  - No severe exceptions
  - No memory leak
  - ETL jobs are scheduled continously
  - No deadlock between threads

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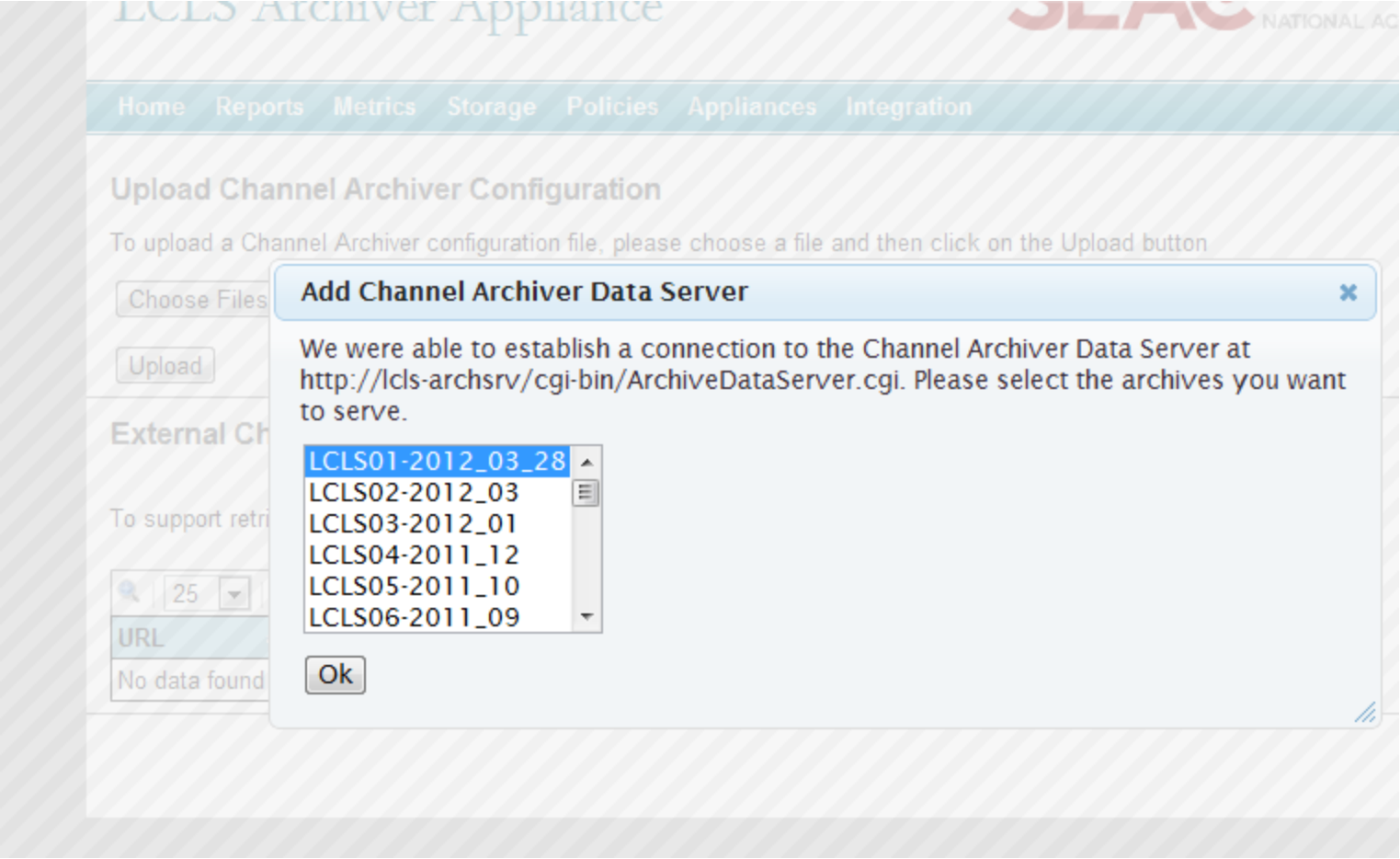
Controls

Proxy Channel Archiver data server



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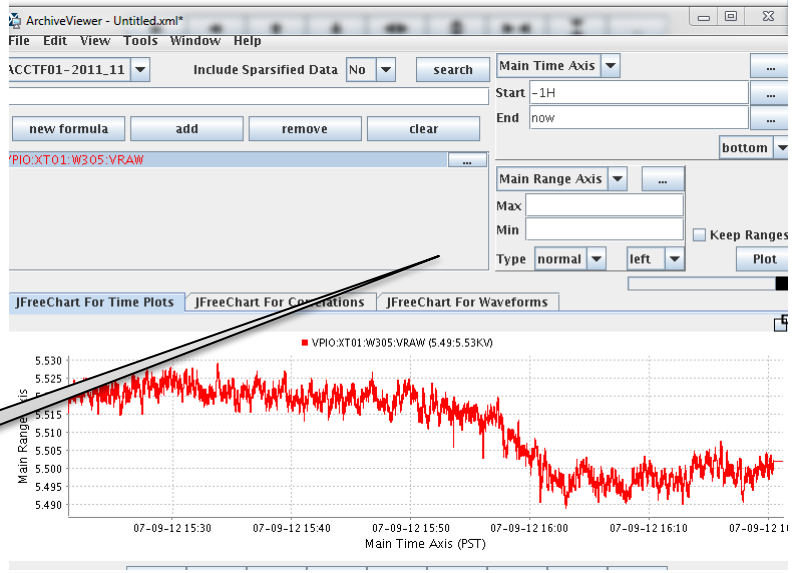
Controls

Proxy CA comparision

Proxied



Original

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Controls

Various ways to persist config

- Using MySQL
  - Easily extensible to other DB's
- Unit tests and quickstart use in-memory
  - Basically, no persistence
  - Some unit tests use JDBM2 for persistence
- Easy to add another persistence mechanism

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Continuous Integration

- Using Jenkins
  - 70+ Unit tests
  - Many of them are end to end tests
- Daily builds
  - Snapshots uploaded to sourceforge
  - Documentation uploaded to sourceforge

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Controls

Quickstart / evaluate

- Download archiver appliance and tomcat
- Run using
  - ./quickstart.sh apache-tomcat-7.0.27.tar.gz

```
[mshankar@cdlx27 quickstart_test]$ ls -ltr
total 217840
-rw-r--r-- 1 mshankar cd   7645670 Aug 20 13:36 apache-tomcat-7.0.27.tar.gz
-rwxr-xr-x 1 mshankar cd      5924 Sep 24 16:57 quickstart.sh*
-rw-r--r-- 1 mshankar cd  26628666 Oct 11 14:28 retrieval.war
-rw-r--r-- 1 mshankar cd  27965298 Oct 11 14:28 engine.war
-rw-r--r-- 1 mshankar cd  26625699 Oct 11 14:28 etl.war
-rw-r--r-- 1 mshankar cd  26651339 Oct 11 14:28 mgmt.war
-rw-r--r-- 1 mshankar cd 107274410 Oct 11 15:48 archappl_v0.0.1_SNAPSHOT_11-October-2012T14-28-14.tar.gz
[mshankar@cdlx27 quickstart_test]$ ./quickstart.sh apache-tomcat-7.0.27.tar.gz
Using org.epics.archiverappliance.config.persistence.InMemoryPersistence as the persistence layer
```

```
42589 [http-bio-17665-exec-3] INFO  config.org.epics.archiverappliance.config.DefaultConfigService  - Start complete for webapp E
TL
40494 [http-bio-17665-exec-6] INFO  config.org.epics.archiverappliance.mgmt.MgmtRuntimeState  - All components in this appliance
have started up. We should be ready to start accepting UI requests
```


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Controls

Documentation

- Quickstart script and guide
- Install guide
- Details/Features
- Customization guide
- User Guide
- Need to complete
  - Sys admin guide
  - Developers Guide

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Features that need work

- Compression
  - NIO2 ZIPFS provider still deemed experimental
- CSS data browser integration

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Next steps

- In alpha release
- Production deployment

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Questions

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