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
Components

Controls

- Engine (Tomcat war)
- ETL (Tomcat war)
- Data Retrieval (Tomcat war)
- Short term store (PB files) (Ramdisk)
- Medium term store (PB files) (SSD)

Self discovery and inter appliance communication to other appliances

Long term store (PB files/Compressed) (SAN)

ETL

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Luofeng Li
Mike Zelazny
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?)
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
Controls

Retrieval (Actual)

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Retrieval time 360 (ms)
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.
Retrieval from Matlab (.mat)

ChannelArchiver

Using .mat format

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Retrieval from Python (.json)
Engine – New features since April 2012

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

## Pause and resume archiving pv-1

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

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Name</td>
<td><code>luofeng0:step0</code></td>
</tr>
<tr>
<td>Instance archiving PV</td>
<td><code>cdix03</code></td>
</tr>
<tr>
<td>Archival params creation time</td>
<td>Jun/26/2012 15:02:53 PDT</td>
</tr>
<tr>
<td>Archival params modification time</td>
<td>Jun/26/2012 15:03:38 PDT</td>
</tr>
<tr>
<td>Archiver DBR type (from typeinfo)</td>
<td><code>DBR_SCALAR_DOUBLE</code></td>
</tr>
<tr>
<td>Is this a scalar?</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of elements</td>
<td>1</td>
</tr>
<tr>
<td>Precision</td>
<td>0.0</td>
</tr>
<tr>
<td>Units</td>
<td></td>
</tr>
<tr>
<td>Have we paused archiving this pv</td>
<td>No</td>
</tr>
<tr>
<td>Sampling method</td>
<td><code>MONITOR</code></td>
</tr>
<tr>
<td>Sampling period</td>
<td>1.0</td>
</tr>
<tr>
<td>Seconds to buffer samples</td>
<td>10</td>
</tr>
<tr>
<td>Additional fields being archived</td>
<td><code>LOLO, HIGH, LOPR, LOW, HOPR, HIHI</code></td>
</tr>
<tr>
<td>Extra info - MDEL</td>
<td>0.0</td>
</tr>
<tr>
<td>Extra info - ADEL</td>
<td>0.5</td>
</tr>
<tr>
<td>Extra info - SCAN</td>
<td>10 second</td>
</tr>
<tr>
<td>Extra info - RTYP</td>
<td><code>calc</code></td>
</tr>
</tbody>
</table>

---

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Luofeng Li  
Mike Zelazny
Pause and resume archiving pv-2
Conditional archiving web page

- Specify the sampling period for these PVs
  - Choose the sampling mode for these PVs: Monitor
  - Set the sampling period for these PVs: 1 (secs)
  - Enter PV name to conditionally archive these PVs (can be blank): luofeng:enable0

Controls
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SLAC
NATIONAL ACCELERATOR LABORATORY
Conditional archiving-2

- `luofeng:enable0 controls luofeng0:step0`
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

```python
66 pvRTYP=pvInfo["RTYP"]
67 archiveFields=[]
68 if pvRTYP="ai":
69     archiveFields=['HIHI', 'HIGH', 'LOW', 'LOLO', 'LOCR', 'HOPR']
70 elif pvRTYP="so":
71     archiveFields=['HIHI', 'HIGH', 'LOW', 'LOLO', 'LOCR', 'HOPR', 'ERVH', 'DEVL']
72 elif pvRTYP="calc":
73     archiveFields=['HIHI', 'HIGH', 'LOW', 'LOLO', 'LOCR', 'HOPR']
74 elif pvRTYP="calcout":
75     archiveFields=['HIHI', 'HIGH', 'LOW', 'LOLO', 'LOCR', 'HOPR']
76 elif pvRTYP="longin":
77     archiveFields=['HIHI', 'HIGH', 'LOW', 'LOLO', 'LOCR', 'HOPR']
78 elif pvRTYP="longout":
79     archiveFields=['HIHI', 'HIGH', 'LOW', 'LOLO', 'LOCR', 'HOPR', 'ERVH', 'DEVL']
80 elif pvRTYP="dfanout":
81     archiveFields=['HIHI', 'HIGH', 'LOW', 'LOLO', 'LOCR', 'HOPR']
82 elif pvRTYP="sub":
83     archiveFields=['HIHI', 'HIGH', 'LOW', 'LOLO', 'LOCR', 'HOPR']
84 pvPolicy["archiveFields"] = archiveFields
```
Test against LCLS production

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

- **Instance Name**: test-arch
- **Status**: Working
- **PV Count**: 116878
- **Connected**: 102255
- **Event Rate**: 3.531.11
- **Data Rate (GB/year)**: 2.360.67
- **Engine write**: 0.61

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance Identity</td>
<td>test-arch</td>
</tr>
<tr>
<td>Total PV count</td>
<td>116878</td>
</tr>
<tr>
<td>Disconnected PV count</td>
<td>14623</td>
</tr>
<tr>
<td>Connected PV count</td>
<td>102255</td>
</tr>
<tr>
<td>Total channels</td>
<td>597898</td>
</tr>
<tr>
<td>Event Rate (in events/sec)</td>
<td>3.531.11</td>
</tr>
<tr>
<td>Data Rate (in bytes/sec)</td>
<td>80,376.53</td>
</tr>
<tr>
<td>Data Rate in (GB/day)</td>
<td>6.47</td>
</tr>
<tr>
<td>Data Rate in (GB/year)</td>
<td>2,360.67</td>
</tr>
<tr>
<td>Time consumed for writing samplebuffers to STS (in secs)</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Thru CA gateway

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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
### Stress and performance tests - 2

**Controls**

<table>
<thead>
<tr>
<th>pv num</th>
<th>event rate Hz</th>
<th>max size of short term storage</th>
<th>average cpu</th>
<th>max memory size</th>
<th>average time of buffer to STS</th>
<th>Average time of STS to MTS</th>
<th>Average time of MTS to LTS</th>
<th>running time of test</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000</td>
<td>4,994</td>
<td>45M</td>
<td>5%</td>
<td>900M</td>
<td>0.3s</td>
<td>4s</td>
<td>6s</td>
<td>5 hours</td>
</tr>
<tr>
<td>10,000</td>
<td>9,989</td>
<td>123M</td>
<td>10%</td>
<td>2G</td>
<td>0.57s</td>
<td>9s</td>
<td>63s</td>
<td>18 hours</td>
</tr>
</tbody>
</table>

**pv @1HZ partition 5 minutes without compressing pb files, with 6 meta fields archived**
### Stress and performance tests

**Controls**

<table>
<thead>
<tr>
<th>pv num</th>
<th>event rate Hz</th>
<th>max size of short term storage</th>
<th>average cpu</th>
<th>max memory size</th>
<th>Average time of buffer to STS</th>
<th>Average time of STS to MTS</th>
<th>Average time of MTS to LTS</th>
<th>running time of test</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000</td>
<td>4,994</td>
<td>199M</td>
<td>5%</td>
<td>900M</td>
<td>0.37s</td>
<td>3s</td>
<td>9s</td>
<td>6 hours</td>
</tr>
<tr>
<td>10,000</td>
<td>9,989</td>
<td>583M</td>
<td>10%</td>
<td>2G</td>
<td>0.76s</td>
<td>24s</td>
<td>127s</td>
<td>60 hours</td>
</tr>
</tbody>
</table>

**pv @1HZ partition hour** without compressing pb files, with 6 meta fields archived.
### Stress and performance tests

**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.

<table>
<thead>
<tr>
<th>pv num</th>
<th>event rate (Hz)</th>
<th>max size of short term storage (M)</th>
<th>average cpu (%)</th>
<th>max memory size (G)</th>
<th>average time of buffer to STS (s)</th>
<th>average time of STS to MTS (s)</th>
<th>average time of MTS to LTS (s)</th>
<th>running time of test (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20,000</td>
<td>2,000</td>
<td>235</td>
<td>12</td>
<td>2</td>
<td>1.15</td>
<td>7</td>
<td>372</td>
<td>66</td>
</tr>
<tr>
<td>40,000</td>
<td>4,003</td>
<td>469</td>
<td>25</td>
<td>2</td>
<td>2.78</td>
<td>61</td>
<td>3377 (56 minutes)</td>
<td>19</td>
</tr>
</tbody>
</table>
Stress and performance tests-5
Stress and performance tests-6

Controls

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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 continuously
– No deadlock between threads
Proxy Channel Archiver data server

Controls

Add Channel Archiver Data Server

We were able to establish a connection to the Channel Archiver Data Server at http://lclsarchsrv/cgi-bin/ArchiveDataServer.cgi. Please select the archives you want to serve.

LCLS01-2012_03_28
LCLS02-2012_03
LCLS03-2012_01
LCLS04-2011_12
LCLS05-2011_10
LCLS06-2011_09

Ok
Proxy CA comparison

Original

Proxied

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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
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
Quickstart / evaluate

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

```
[mshankar@dlx27 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 26628655 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@dlx27 quickstart_test]$ ./quickstart.sh apache-tomcat-7.0.27.tar.gz
Using org.epics.archiverappliance.config.persistence.InMemoryPersistence as the persistence layer
```

40494 [http-bio-17655-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
Documentation

Controls

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

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

- In alpha release
- Production deployment
Questions