

A Java-based EPICS Archive Viewer with SOAP Interface for Data Retrieval

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In advanced physics experiment systems like a large particle accelerators, it is important that physicists can easily analyze device behavior based on archived data to achieve an optimal result of the experiment. Standard network and software technologies such as Web, XML, Java, etc would be employed to enable a wider range of environment for analysis tools. To this end a Java tool for displaying EPICS ChannelArchiver has been developed for the KEKB injector linac. The EPICS Archive Viewer is implemented as a pure Java code which utilizes a high-quality commercial software package for charting (JClass Chart). The viewer retrieves archive data by interfacing with an extensible set of "archive data providers". Current implementation includes providers for SOAP and CGI protocols and also allows support for custom, "in-house" archive data providers (e.g. a provider that relies on CORBA/IIOP). The server-side of SOAP archive data provider is represented by a backend service object deployed within the AXIS/Tomcat container. The implementation of all viewer modules is highly portable and offers a potential for data sharing among organizations via the emerging Web Services standards.

Introduction

◆ Experiment Efficiency for B-Factory

KEKB Electron Positron Asymmetric Collider

⇒ Stable Operation of Linac

Further Improvement

with **2-bunch** and/or **Continuous Injection**

◆ Analysis of Archived Data

Very Important But...

There are Several Different Archives, Viewers

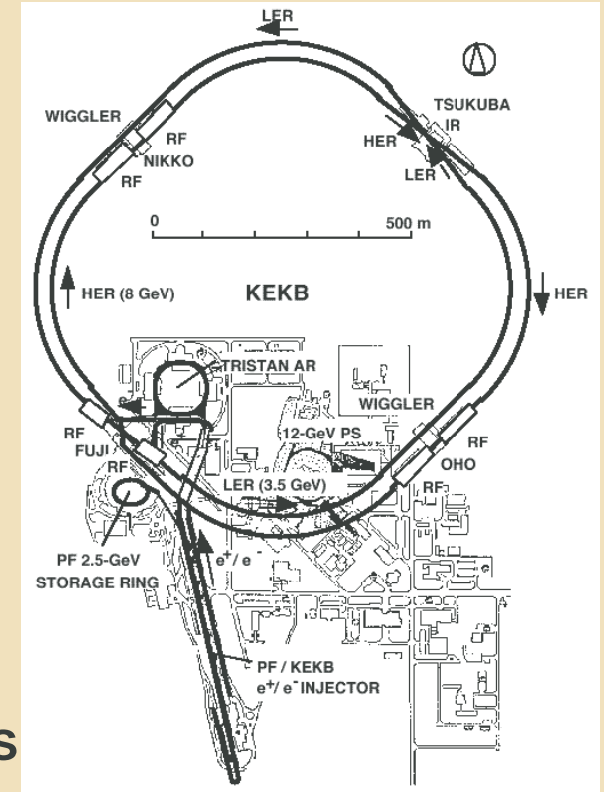
Designed to be **Optimal for Specific Needs**

Management is a Nightmare

◆ EPICS Archiver Introduction

EPICS Gateway from Linac Controls to Channel Access

There are Several Different Tools Available



Web Services

◆ Need for Data Exchange (Archive Viewing) over Firewalls

- ◆ http, XML (and Java) are Preferable over Internet
- ◆ Well-defined by Sun and others

Java Community Process, Java Web Services Developer Pack

- ◆ Sun releases Reference Implementation JAX-RPC RI
- ◆ Multi-Platform (including Microsoft) and Multi-Language

◆ Open Source Implementation

- ◆ AXIS of Apache Software Foundation
- ◆ Freely Distributed
- ◆ Actively being Developed
- ◆ Employed by Several Vendor Implementations

Viewer Implementation

- ◆ Pure Java Application

 - Can be Executed as Applet in a Browser with Java Plug-in

- ◆ User Interface Implemented with Java Swing

- ◆ Need for Good Plotting Package

 - Chose Commercial Component JClass JChart

 - Has Many Features for our Needs

 - One License Covers any Number of Clients

- ◆ Can Connect to Different Archive Data Providers

 - SOAP Data Provider

 - CGI Data Provider (EPICS Archiver CGI)

 - Using Class name and Location (URL) as Parameters

Server Implementation

- ◆ **Apache Server and CGI/Perl (CGI Provider)**

 - CGI Script Utilizes C/Perl
to call libIO to access Archived Data

- ◆ **SOAP Server (SOAP Provider)**

 - Apache AXIS/Tomcat and Java
Server-side Component Utilizes JNI Wrapper
for libIO to access Archived Data

- ◆ **Other Provider**

 - Can be Implemented
Accepting Class Name and URL
Such as CORBA/IIOP Provider...

Archiver Implementation

- ◆ EPICS Channel Archiver Engine

 - As Distributed in EPICS

- ◆ Channel Access (CA) Server

 - Built with EPICS 3.14 iocsh

 - Old CA Server was Built with EPICS 3.12 PCAS

 - Much Easier with iocsh

 - Implemented Device Supports

 - to Access Linac Control Data

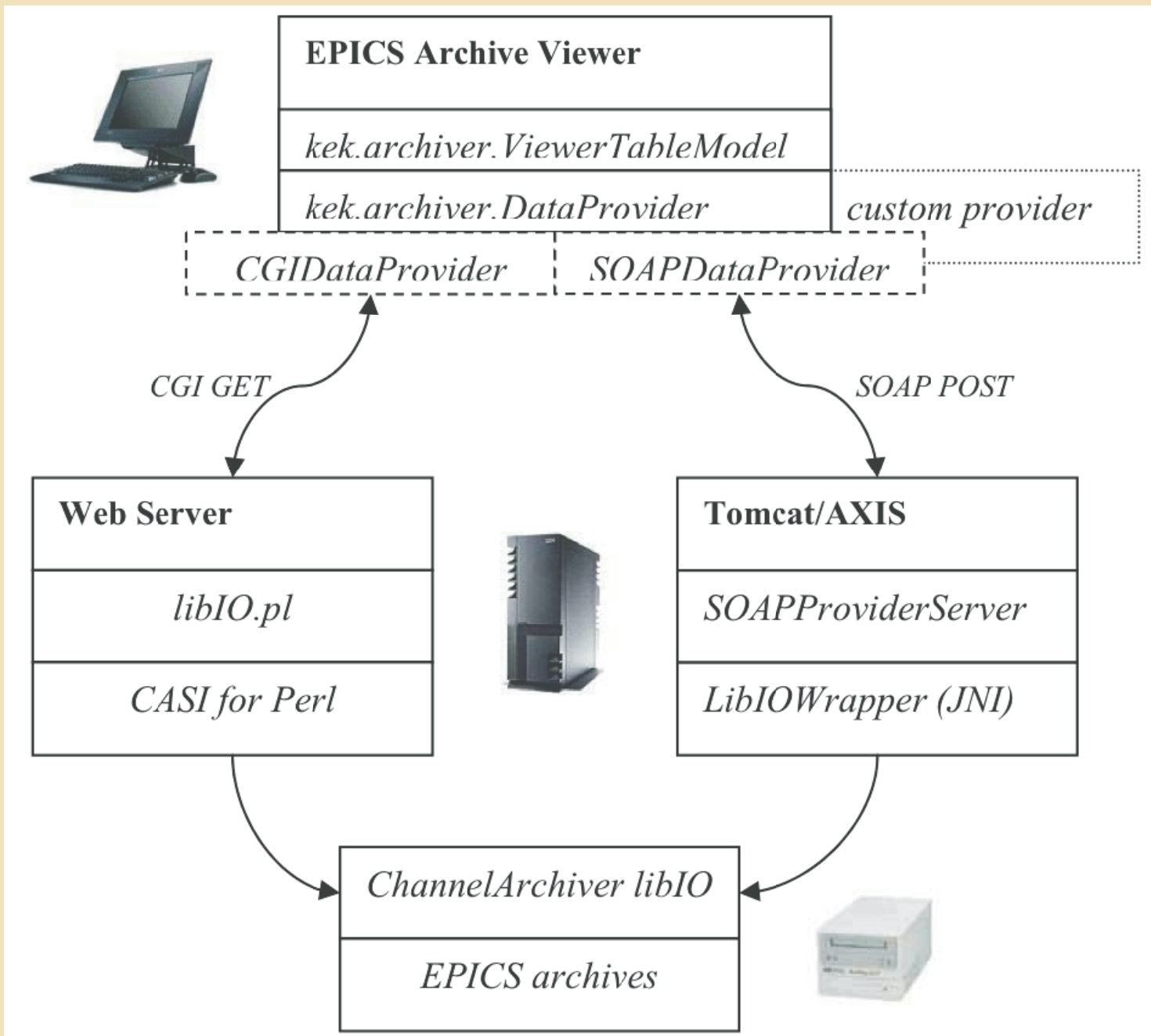
 - via RPC/Cache Mechanism

- ◆ More Data will be Added

 - Channel Names are Modified

 - to Accomodate both New and Old CA Servers

Outline



SOAP Request

◆ Easy to Debug with ASCII Messages

```
POST /axis/services/EPICSArchiveService HTTP/1.0
Content-Type: text/xml; charset=utf-8
Accept: application/soap+xml, application/dime, multipart/related, text/*
User-Agent: Axis/1.1beta
Host: acacia.linac.kek.jp
Cache-Control: no-cache
Pragma: no-cache
SOAPAction: ""
Content-Length: 904

<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Body>
    <ns1:getData soapenv:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
      xmlns:ns1="http://www.linac.kek.jp/SOAPProviderServer/">
      <arg0 xsi:type="xsd:string">furukawa/furukawa test</arg0>
      <arg1 xsi:type="xsd:string"></arg1>
      <arg2 xsi:type="xsd:dateTime">2002-03-26T08:05:00.000Z</arg2>
      <arg3 xsi:type="xsd:dateTime">2002-03-26T08:10:00.000Z</arg3>
      <arg4 href="#id0"/>
    </ns1:getData>
    <multiRef id="id0" soapenc:root="0"
      soapenv:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
      xsi:type="ns2:Vector"
      xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
      xmlns:ns2="http://xml.apache.org/xml-soap"/>
  </soapenv:Body>
</soapenv:Envelope>
```

SOAP Reply

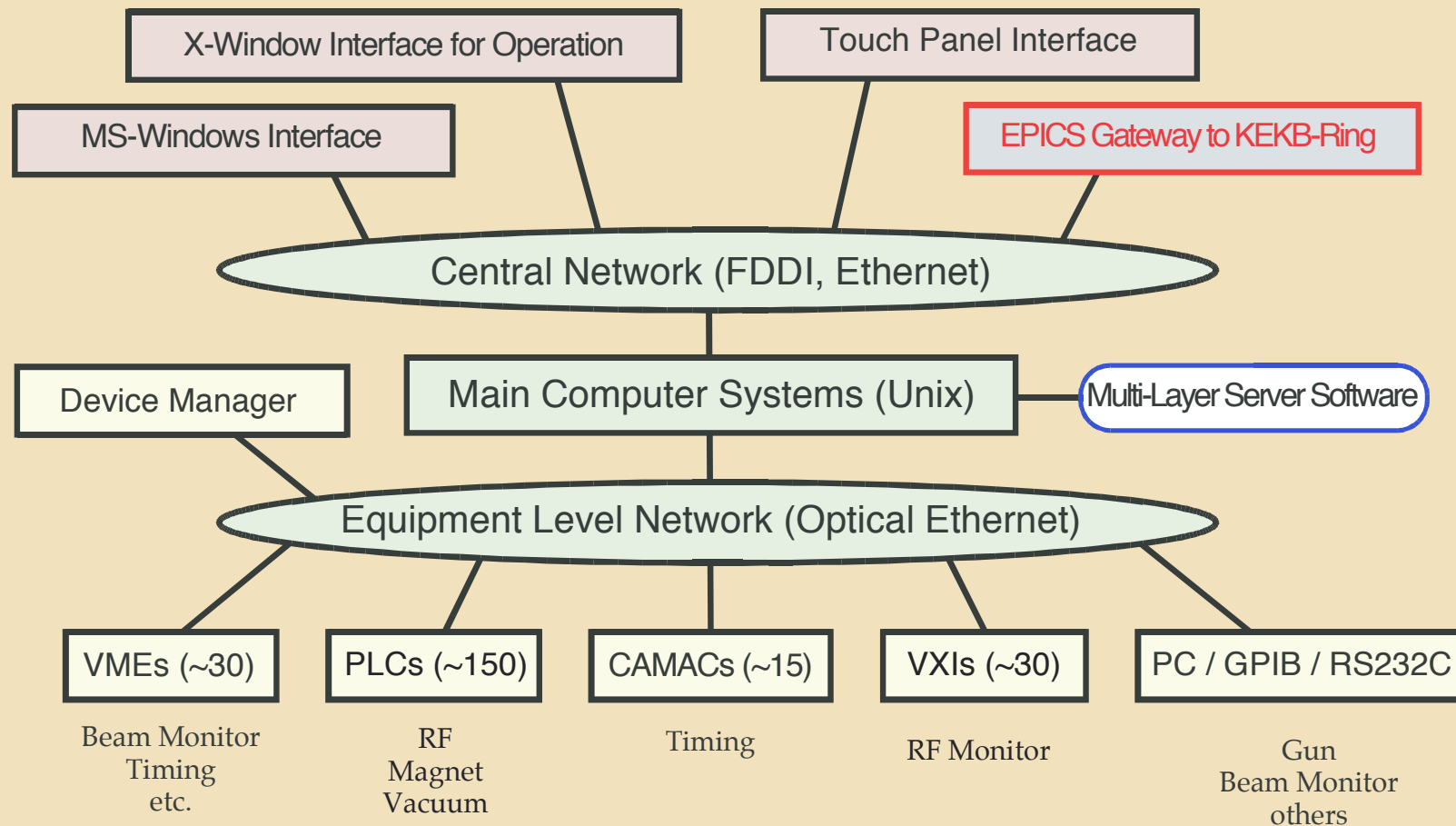
```

HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8
Date: Thu, 30 Jan 2003 06:07:53 GMT
Server: Apache Coyote/1.0
Connection: close

<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope
  xmlns:soapenv=http://schemas.xmlsoap.org/soap/envelope/
  xmlns:xsd=http://www.w3.org/2001/XMLSchema
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Body>
    <ns1:getDataResponse
      soapenv:encodingStyle=http://schemas.xmlsoap.org/soap/encoding/
      xmlns:ns1="http://www-linac.kek.jp/SOAPProviderServer/">
      <getDataReturn xsi:type="soapenc:Array"
        soapenc:arrayType="ns1:ChannelDataHolder[3]"
        xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/">
        <item href="#id1"/>
        <!-- + 2 hrefs -->
      </getDataReturn>
    </ns1:getDataResponse>
    <multiRef id="id1" soapenc:root="0"
      soapenv:encodingStyle=http://schemas.xmlsoap.org/soap/encoding/
      xsi:type="ns2:ChannelDataHolder"
      xmlns:soapenc=http://schemas.xmlsoap.org/soap/encoding/
      xmlns:ns2="http://www-linac.kek.jp/SOAPProviderServer/">
      <name xsi:type="xsd:string">furukawa:jane</name>
      <y data xsi:type="soapenc:Array" soapenc:arrayType="xsd:double[300]">
        <item>7.6112</item>
        <!-- + 299 items -->
      </y data>
      <x time xsi:type="soapenc:Array" soapenc:arrayType="xsd:double[300]">
        <item>1.01712990099506E12</item>
        <!-- + 299 items -->
      </x time>
    </multiRef>
    <!-- + 2 multirefs -->
  </soapenv:Body>
</soapenv:Envelope>

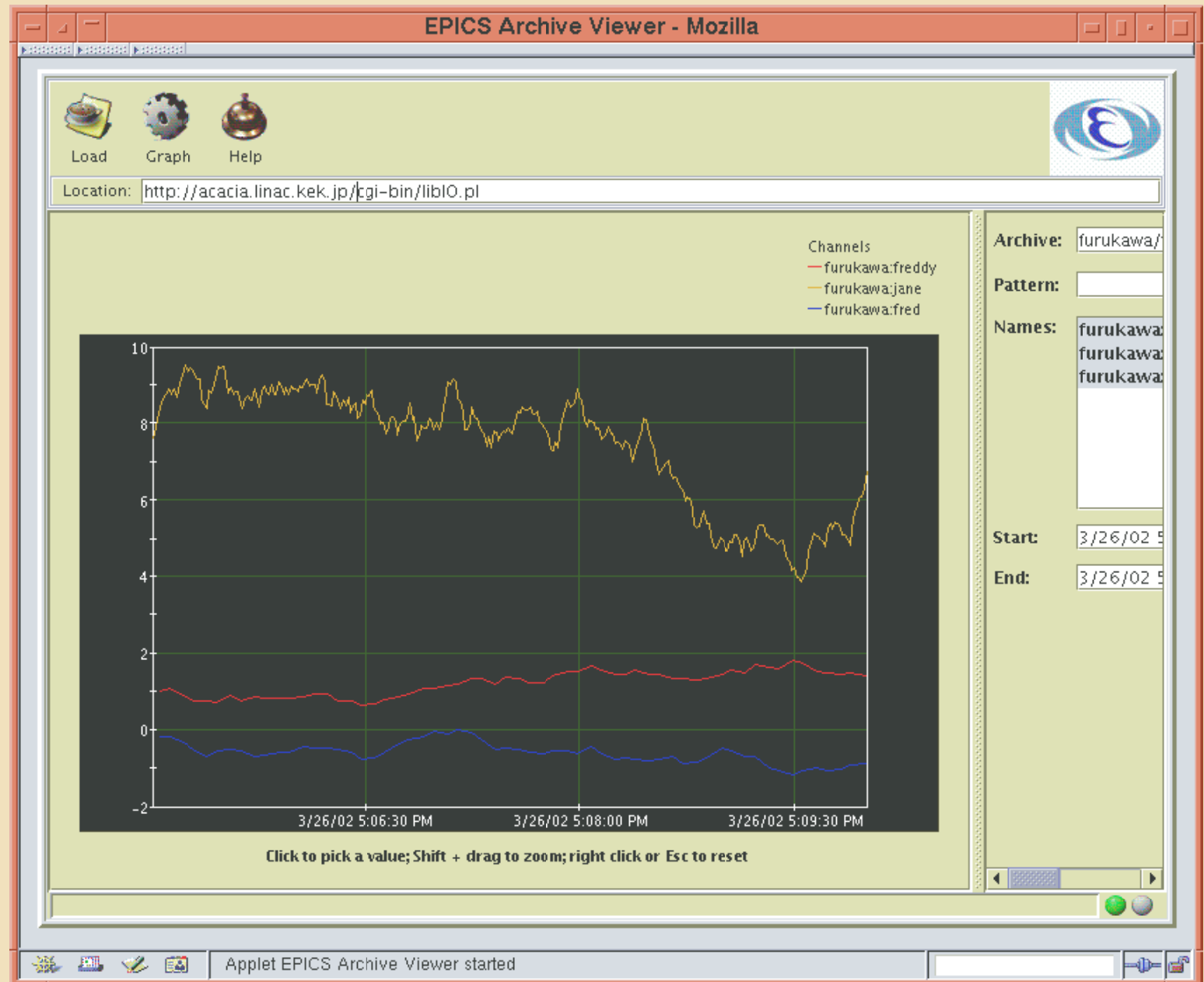
```

Linac Control System



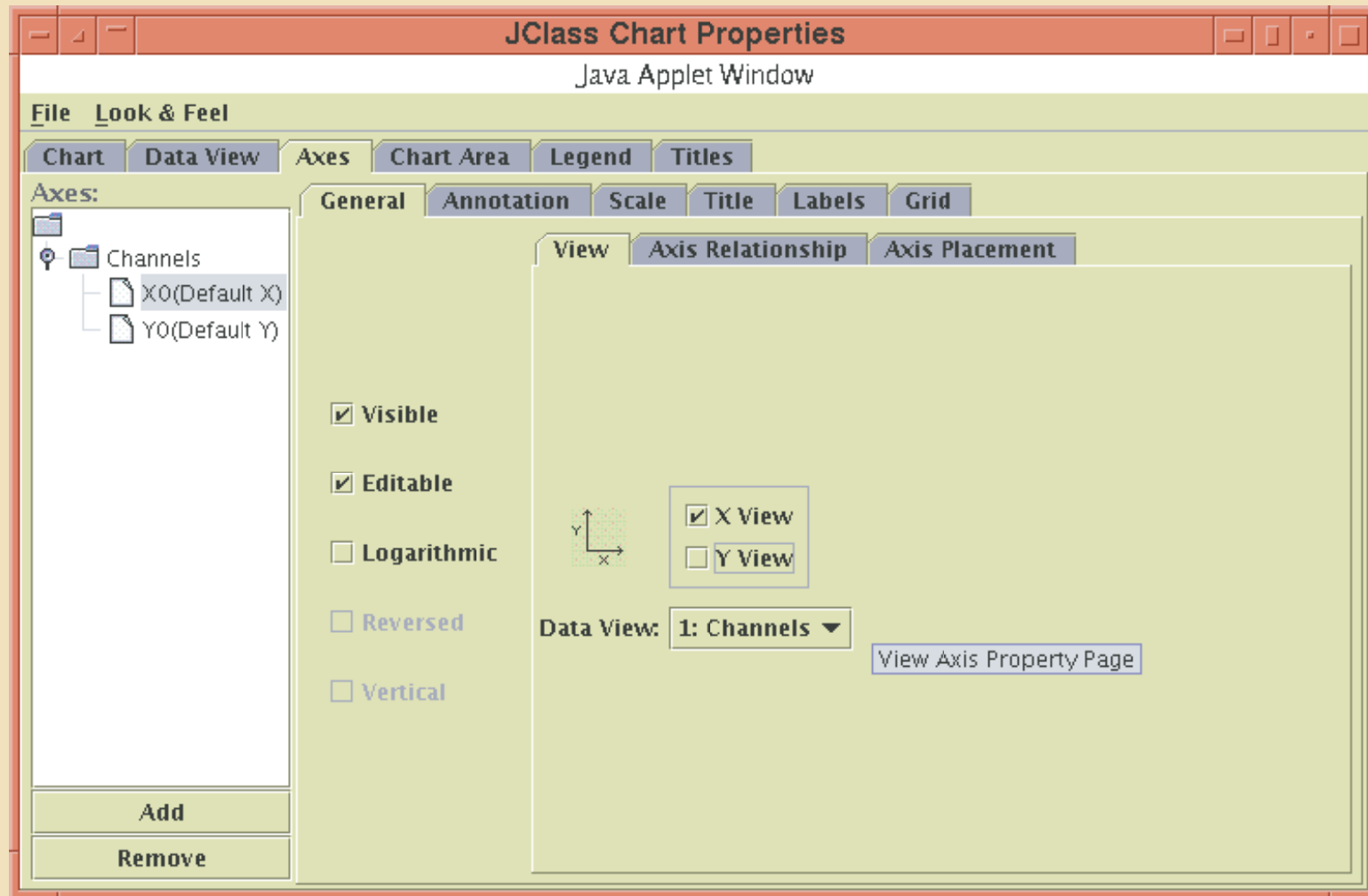
- ◆ Red Box is the Gateway from Linac to EPICS
This time EPICS 3.14 iocsh was employed

◆ Archive Viewer Tool with JChart



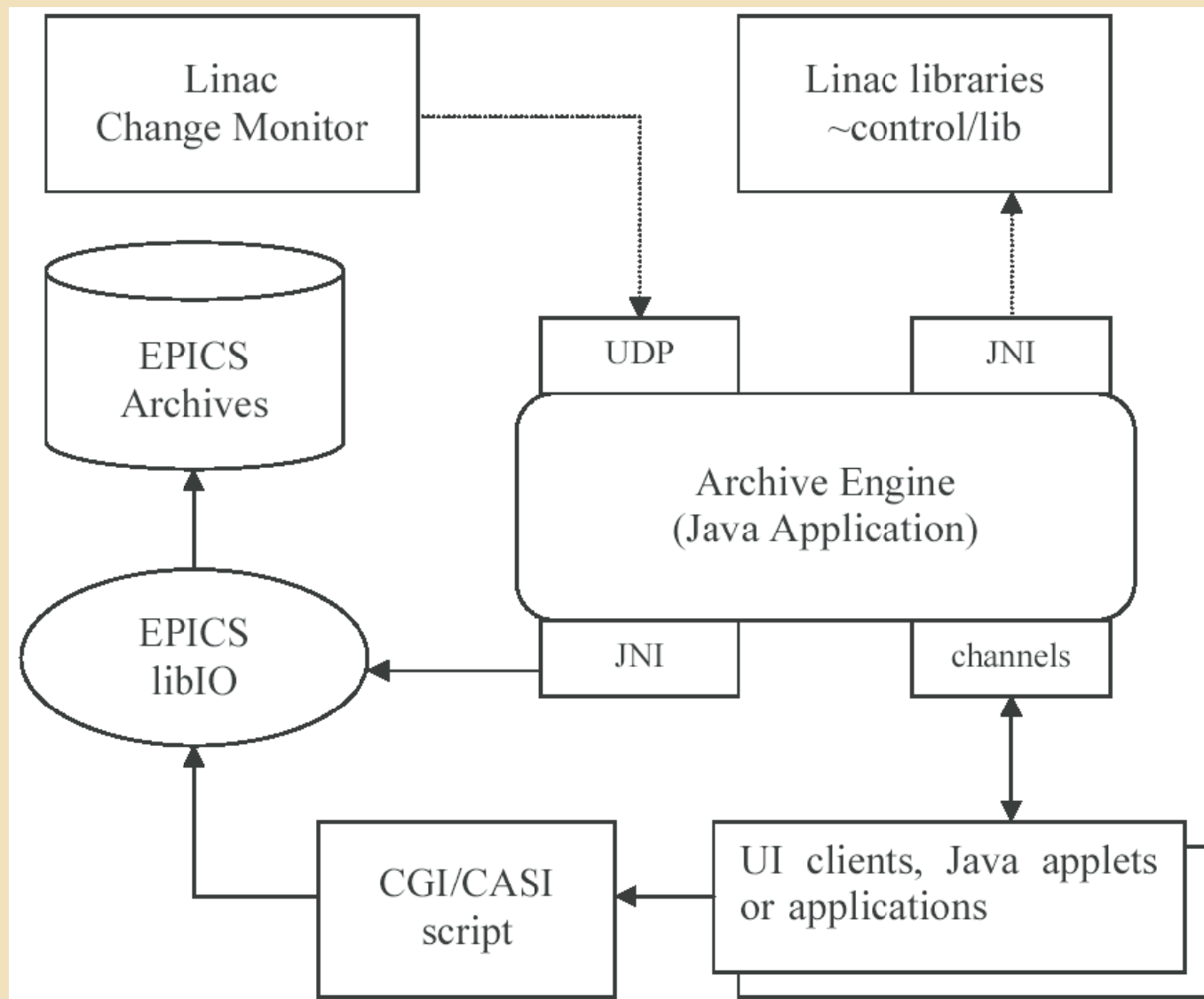
◆ Many Different Plot Attributes can be Modified
in the Viewer Tool

Several Mouse Controls are Available like Zooming...



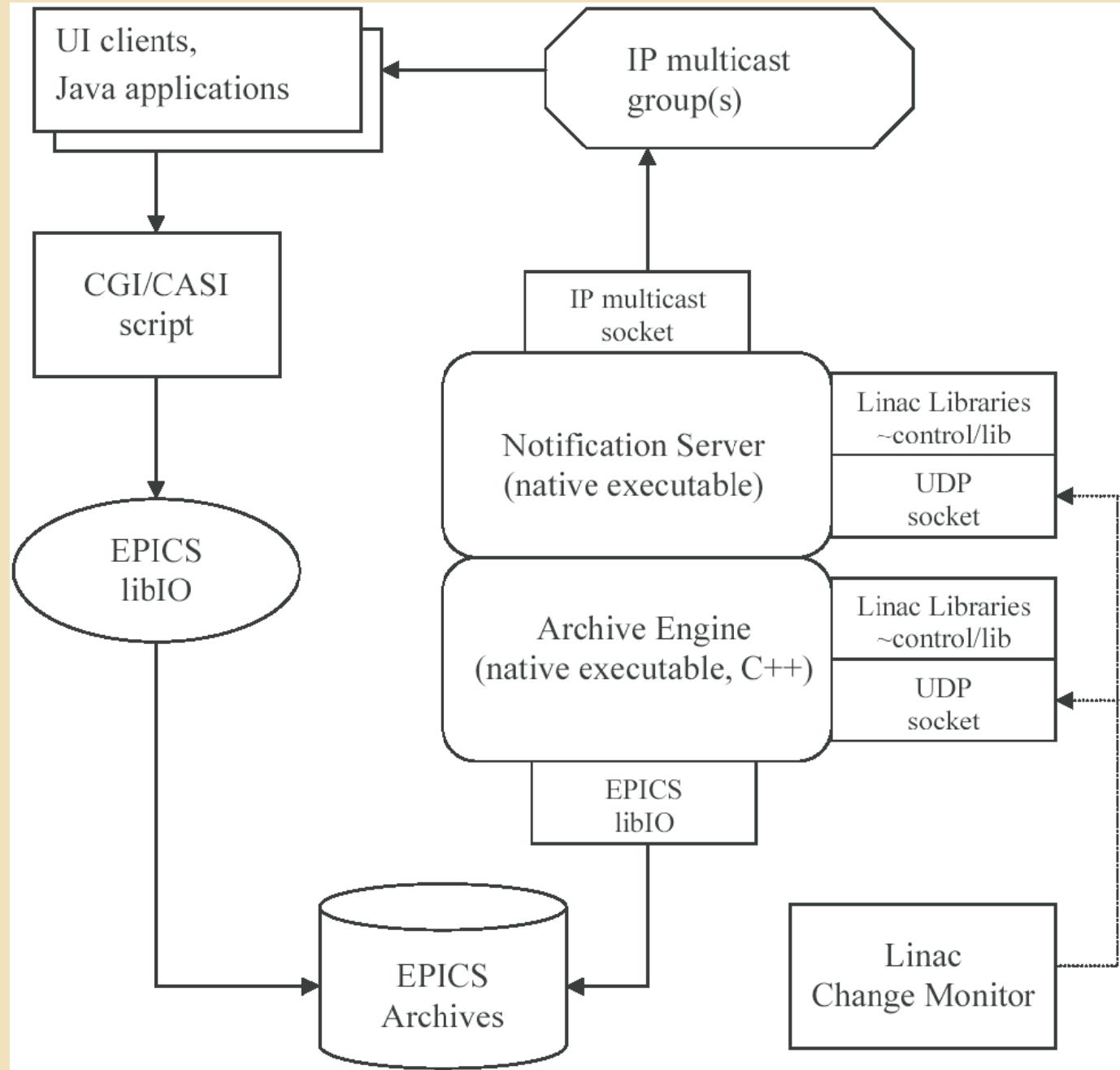
Alternative Scenarios

◆ How to Support Realtime Updates



Alternative Scenarios

- ◆ How to Support Realtime Updates



Conclusion

◆ System Works as Expected

Channel Access Server, Archiver Engine,
SOAP-based Archive Server, CGI-based Server,
SOAP-based Archive Viewer, CGI-based Viewer
Combination works
Expect to be Useful in Accelerator Operation

◆ Performance Comparizon

Transferred Data is Twice Larger in SOAP
and Slightly Slower

◆ May Pass through Firewalls

Need more Configuration

◆ May Run on Wider Environment

Java, http, is Helpful

Thank you ...

