RBA – Remote Beamline Access

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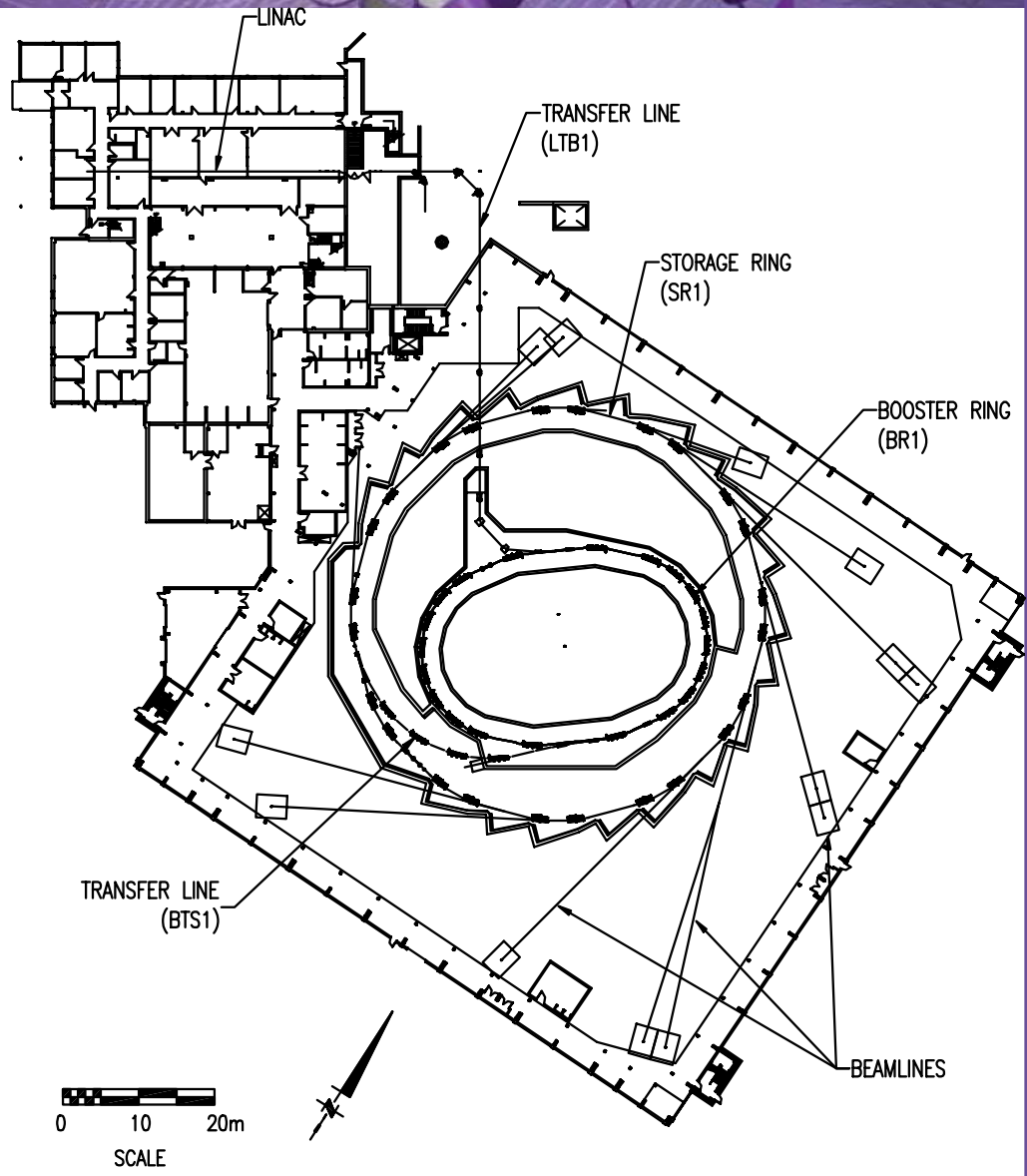
Canadian Light Source, Inc. - University of Saskatchewan

The CLS Facility

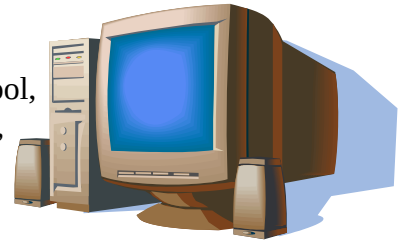
- 1964-1999
  - Medium Energy Physics
- 2000-2003
  - LTB1 (Transfer Line)
  - BR1 (Booster Ring)
  - BTS1 (Transfer Line)
  - SR1 (Storage Ring)
  - Diagnostic Beamlines
    - OSR
    - XSR
- 2002-….
  - Scientific Beamlines
    - Phase 1 – 7 beamlines
    - Phase 2 – 6 beamlines
    - Phase 3 – 6 beamlines



EPICS @ CLS

Canadian Light Source / Centre canadien de rayonnement synchrotron

EDM,
StripTool,
Matlab,
Root,
IDA,
etc….



Operator Workstation
Scientific Linux

Touch Panels (EDM)

Windows Server
Alarm Server

ODBC

MS-SQL Server

ODBC

IRMIS
Scientific Linux

SOAP

IRMIS Web-service

Channel Access

Gateway
Data Archiver

IOC
Linux/RTEMS

IOC
Linux

IOC
Linux

IOC
Linux/RTEMS

IOC
Linux/RTEMS

GPIB

1 Gig
SIS Link

Profibus
TCP/IP

Modbus
TCP/IP

Single Board
Computer
(RTEMS)

VME
VME64x

Firewire
Camera

Siemens
S7/300 PLC
S7/400 PLC
(Cryogenics
and RF)

Telemecanique
Momentum PLC
(Machine Protection
and Services)

Moxa IOC

RS-232

Remote Access Project Delivery Team

- CANARIE Funded Project
  - Project Funding
  - Operator of Canada's Advance Research Network
- Canadian Light Source
  - **Dionisio Medrano (System Analyst)***
  - **Daron Chabot (System Analyst)***
  - **Jason Chan (Intern)***
  - Elder Matias (Project Leader/Manager)
  - Michel Fodje (CMCF Beamline Scientist)
  - Renfei Feng (VESPERS Beamline Scientist)
  - Jason Cyrenne (Networking)
  - Bob Harvey (Networking and Database)
  - Russ Berg (EPICS/CMCF)
- IBM Canada
  - **Chris Armstrong (System Architect)***
  - **John Haley (System Analyst/Architect)***
- University of Western Ontario
  - **Marina Fuller (Requirements and Testing)***
  - Stewart McIntyre (User Champion VESPERS)
  - Gary Good (System Support)
- Alberta Synchrotron Institute
  - Ernst Bergman (User Champion CMCF)
- Big Bangwidth
  - Stuart Lomas (Networking)
  - Steve Hyatt (UCLP WebServices Software)

* Full Time

Project Terms of Reference

- Project funded by:
  - CANARIE
  - IBM
  - Canadian Light Source
  - Bigbangwidth
  - University of Western Ontario
- Unified Process (UP) and Unified Modeling Language (UML) software engineering approach
- Open source
- Initial project duration 14 months
- Service Oriented Architectures (SOA)
- Web Services

Project Plan

- Determine the State of the Art
  - CLS Hosted an eScience Workshop - Fall 2005
- Sept-Dec. 2005
  - Developed Requirements – Use Cases
  - Evaluate SOAP and other transport protocols for EPICS PVs over wide area networks
    - Selected: rest – ajax
  - Evaluate Collaboration Tools
    - Selected Lotus Sametime
  - EPICS Collaboration Meeting Talk, CERN in Geneva

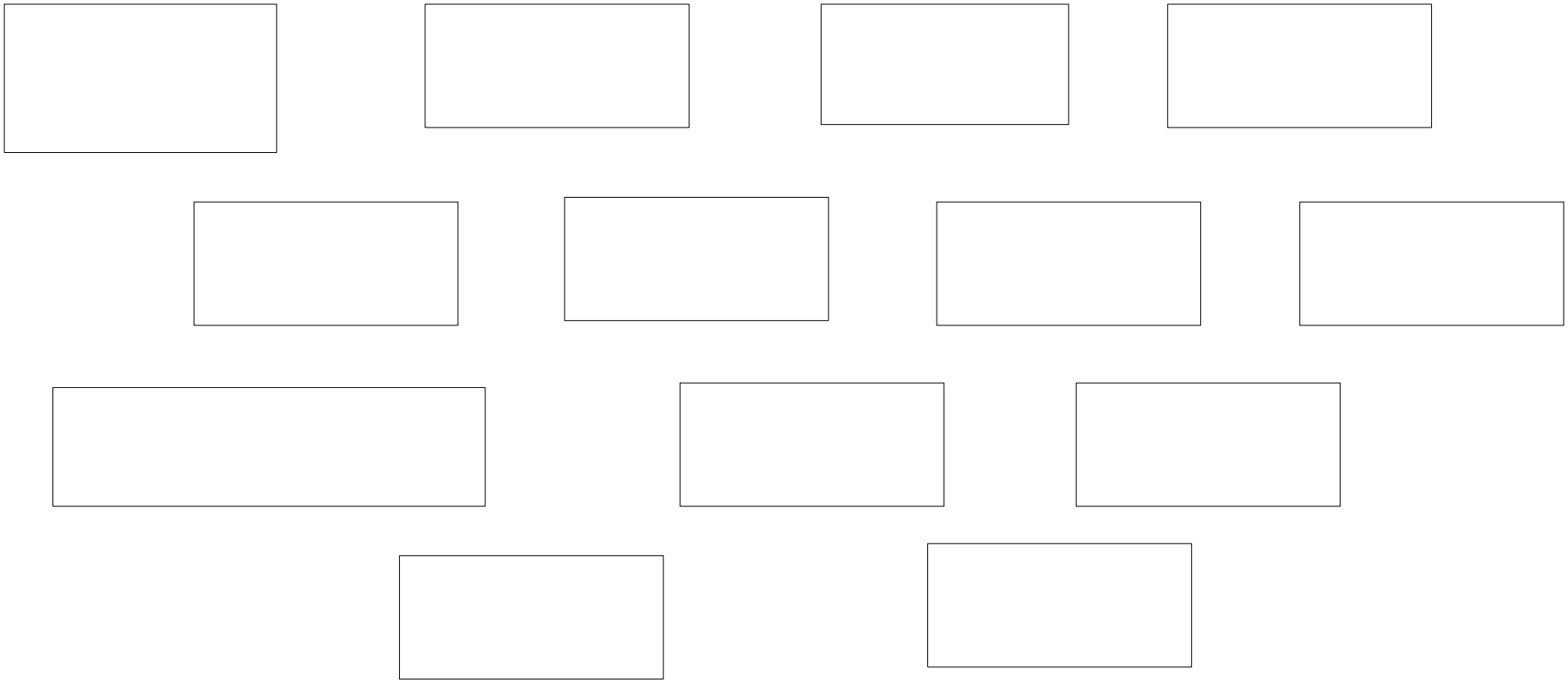
Project Plan

- January - March 2006
  - Refined Requirements
  - Developed System Architecture
  - Evaluated and Selected Frameworks
  - Developed Mock-up User Interfaces
- April – June 2006
  - Presented Project Status at the CLS Users Meeting (VESPERS and CMCF)
    - Mock-up, requirements, architecture
  - Updated based on user feedback

Project Plan

- July – August 2006
  - Implementation
  - Deployment of switches started
- September – December 2006
  - Implementation continued with user testing
  - All switches deployed and tested
  - ALFT X-ray source Installed and used for demonstration
  - November – One hour Presentation at the CIPS ICE Conference in Edmonton
  - December – System Demonstration
  - Project Documentation Finalized and Issued

Project Success Factors



Remote Access

Remote Beamline Access - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost:8080/RBA/access/login.html

Google

Customize Links Free Hotmail Windows Marketplace Windows Media Windows

orba

Login

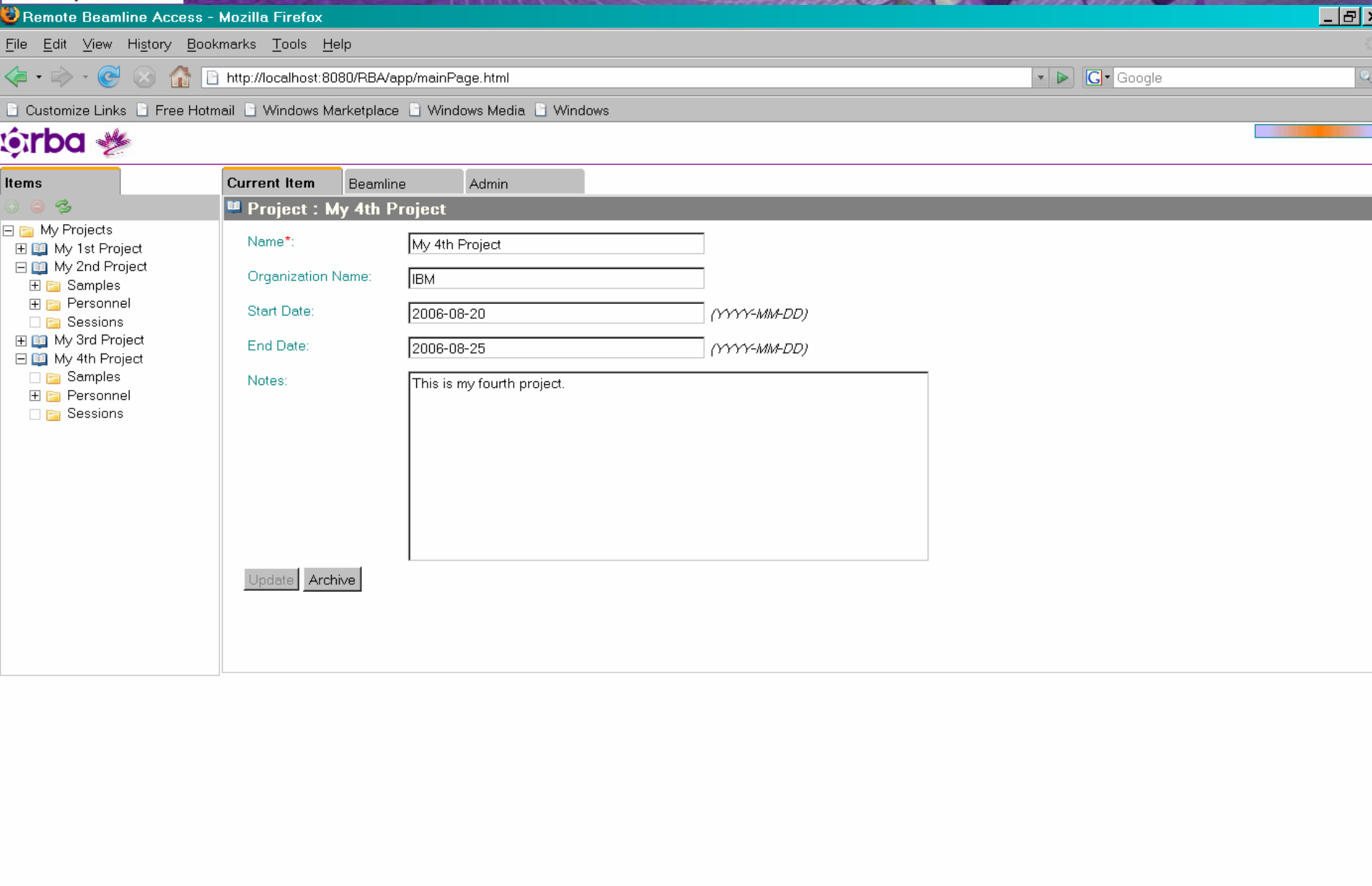
Username:

Password:

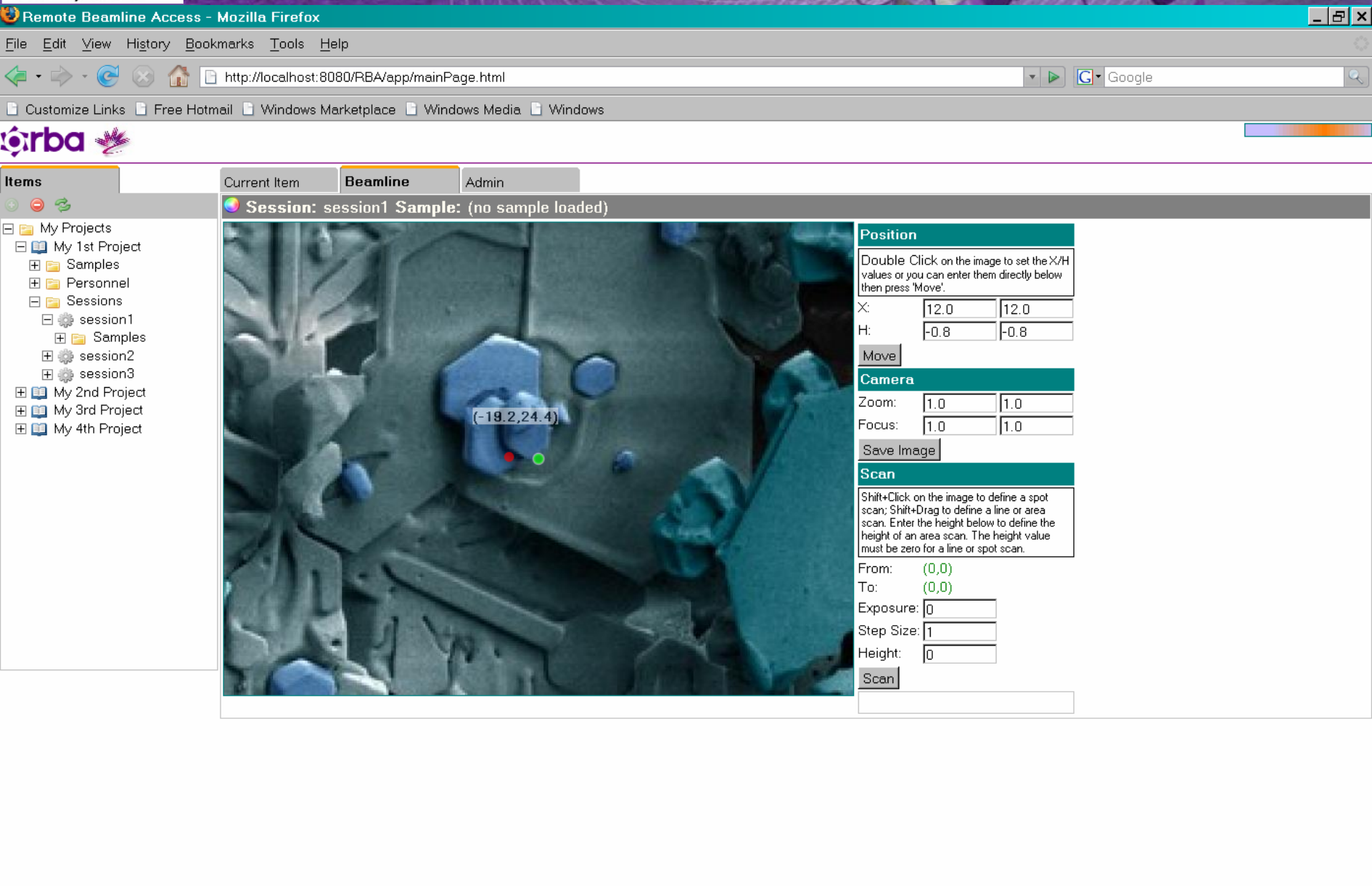
Login Cancel

Complete New User Registration Now

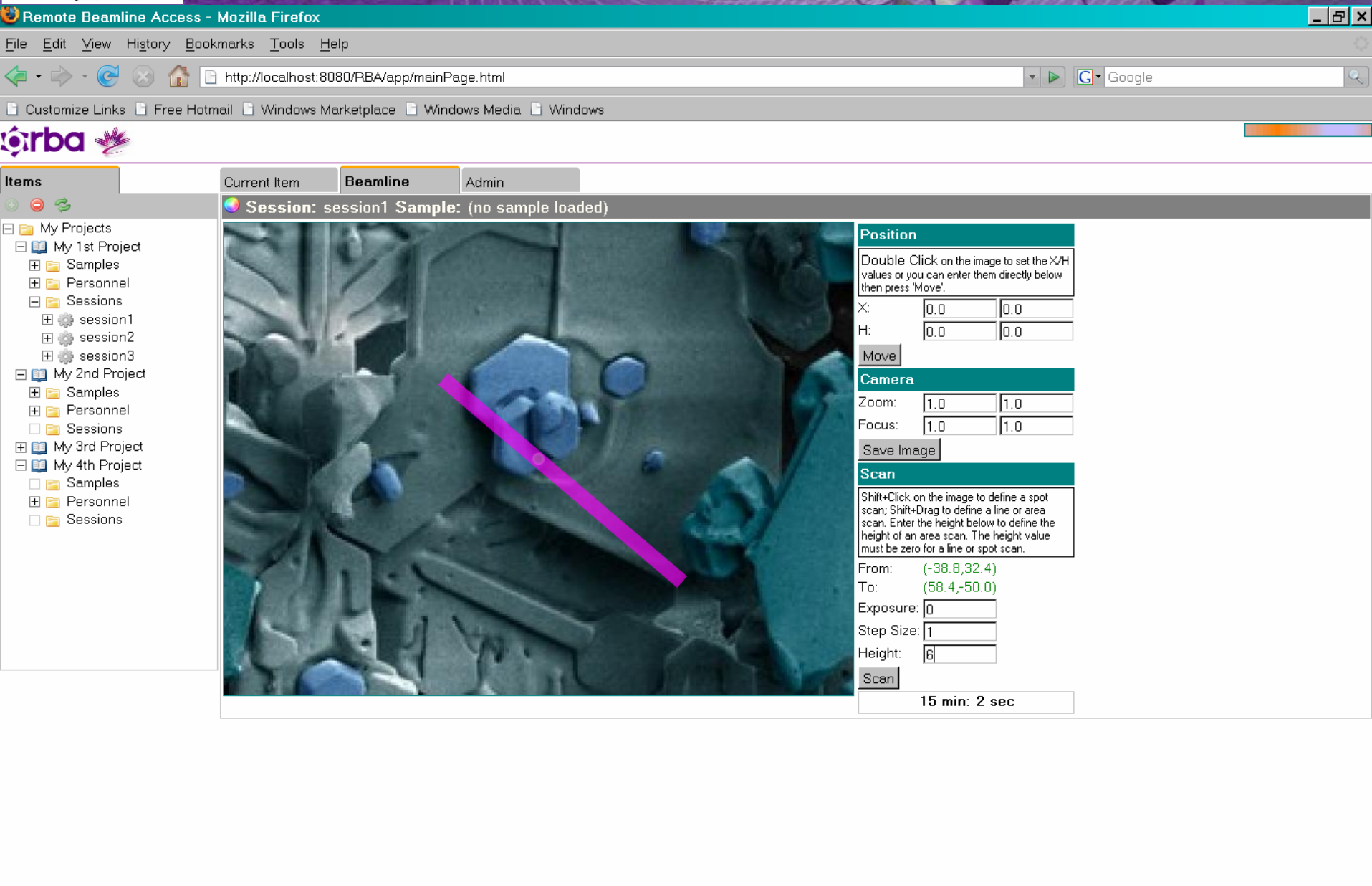
Main Navigation Window



EPICS Connection to Beamline



Selecting a Scan Region



Looking at the Data

Remote Beamline Access - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost:8080/RBA/app/mainPage.html

Customize Links Free Hotmail Windows Marketplace Windows Media Windows

rba

Items

- My Projects
  - My 1st Project
    - Samples
      - unknown1
      - unknown2
      - unknown3
      - unknown4
      - unknown5
    - Personnel
    - Sessions
      - session1
        - Samples
          - unknown1
            - data_run_!
              - Image_202.jpg
              - ScanPoint_1
              - ScanPoint_2
              - ScanPoint_3
              - ScanPoint_4
              - ScanPoint_5
              - ScanPoint_6
              - ScanPoint_7
              - ScanPoint_8
              - ScanPoint_9

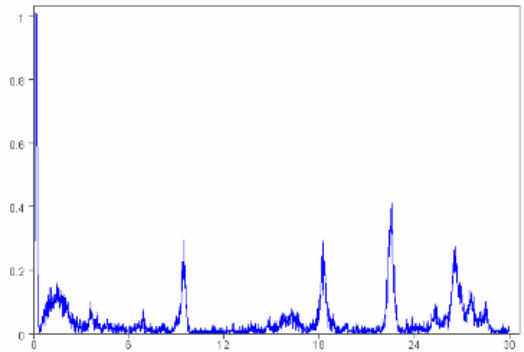
Current Item | Beamline | Admin

Experiment Data : ScanPoint_4

Name*: ScanPoint_4

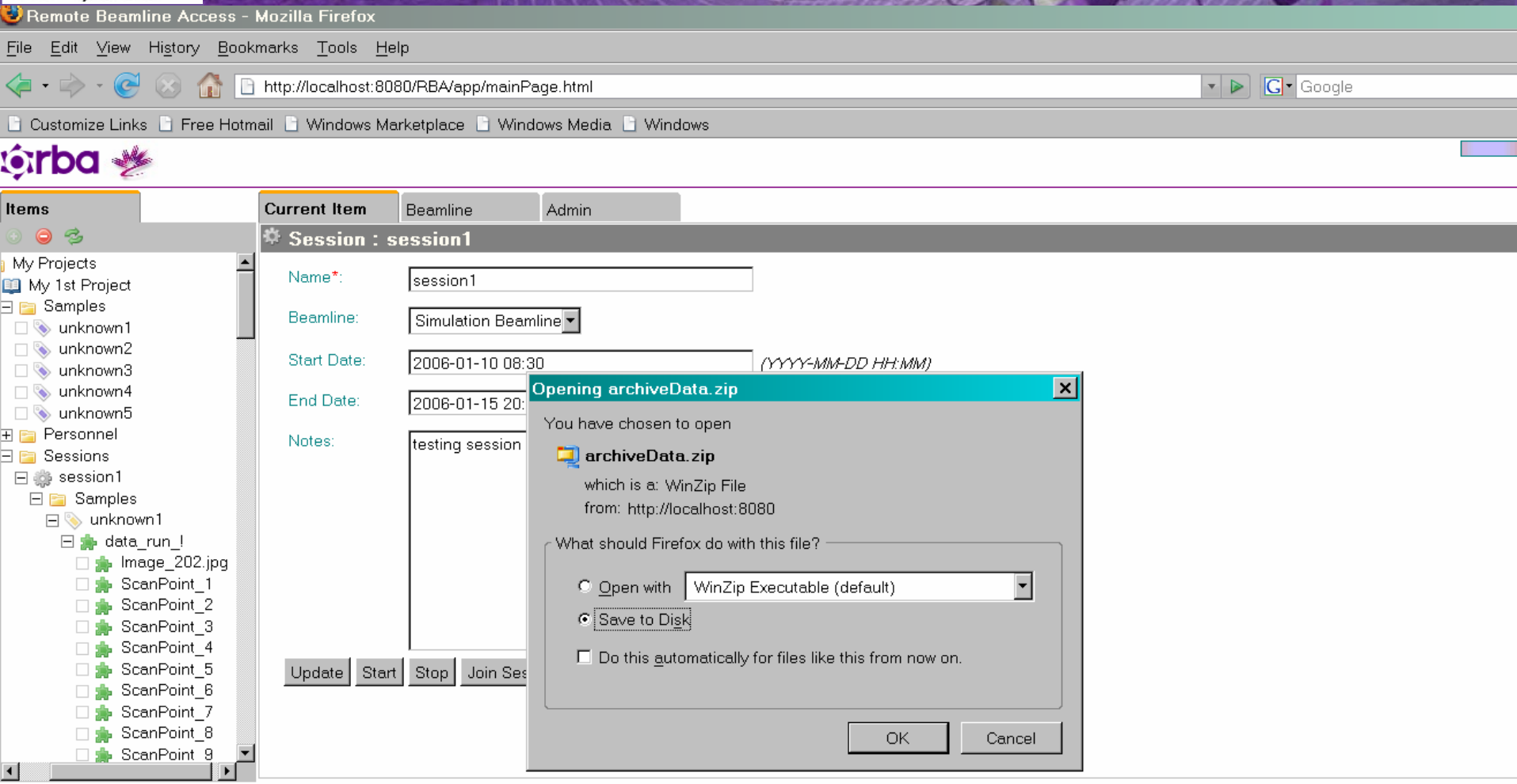
Type: scanpoint

Collected Date: 2007-04-20 21:52:42:0500

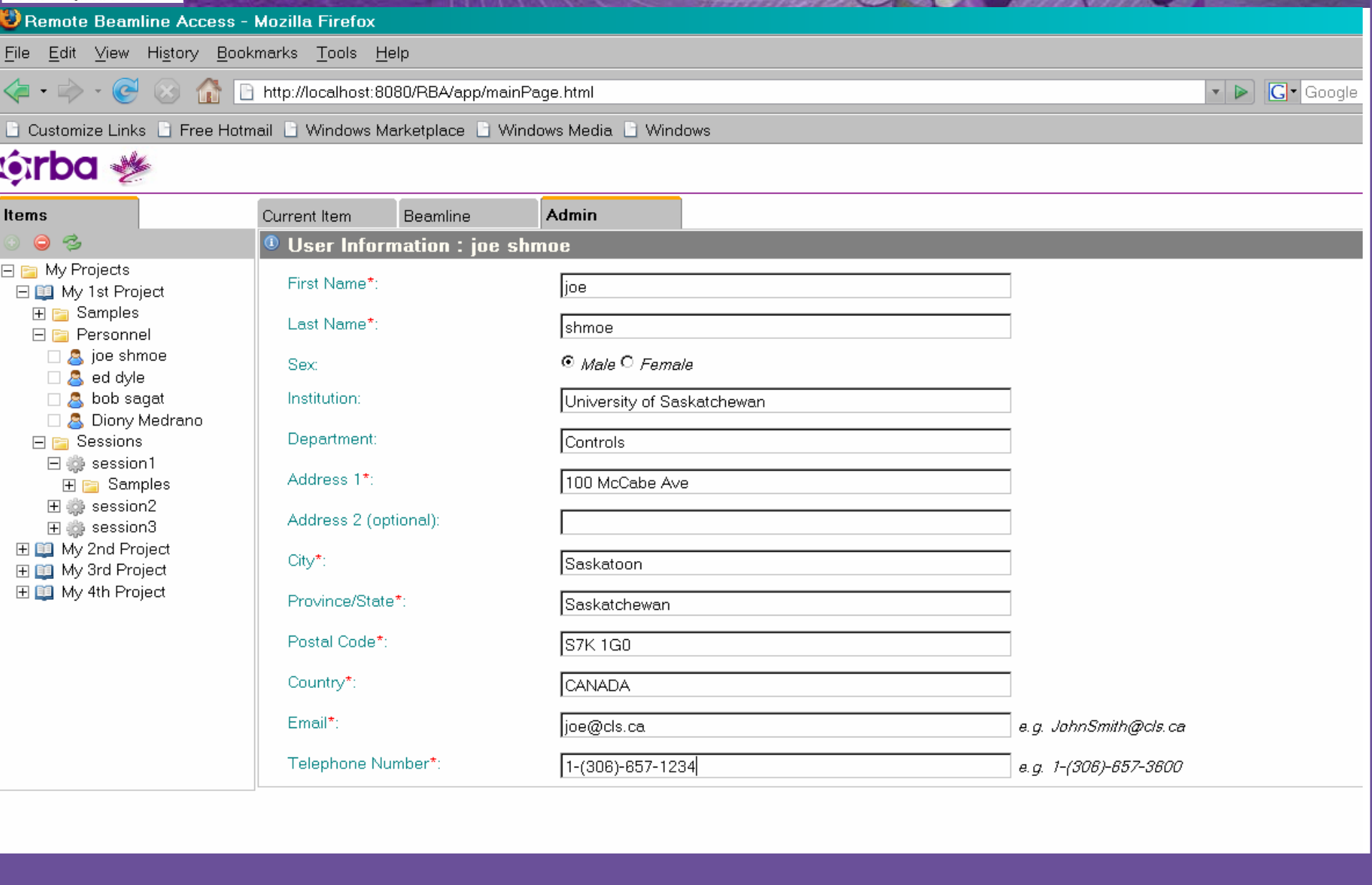


Notes: Strange peak on sample....

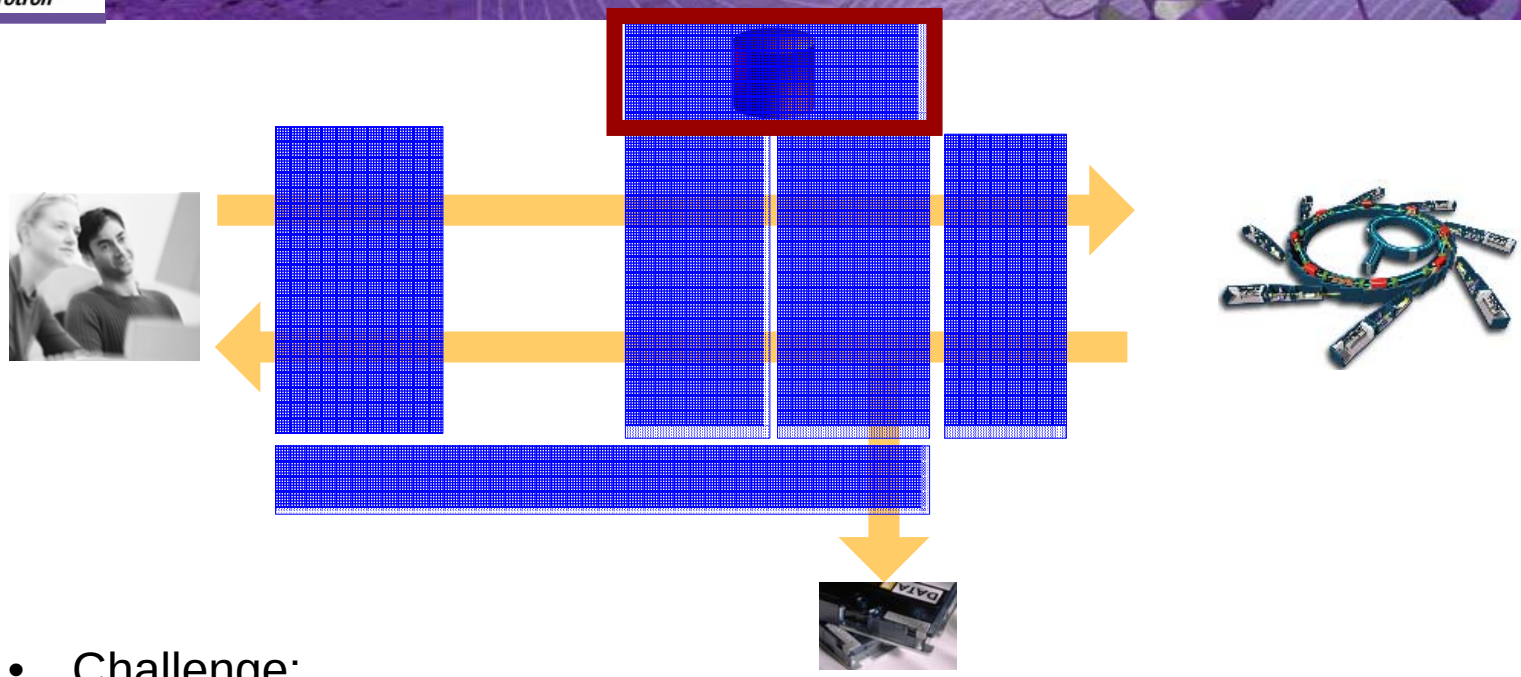
Downloading the Data



Sample Database



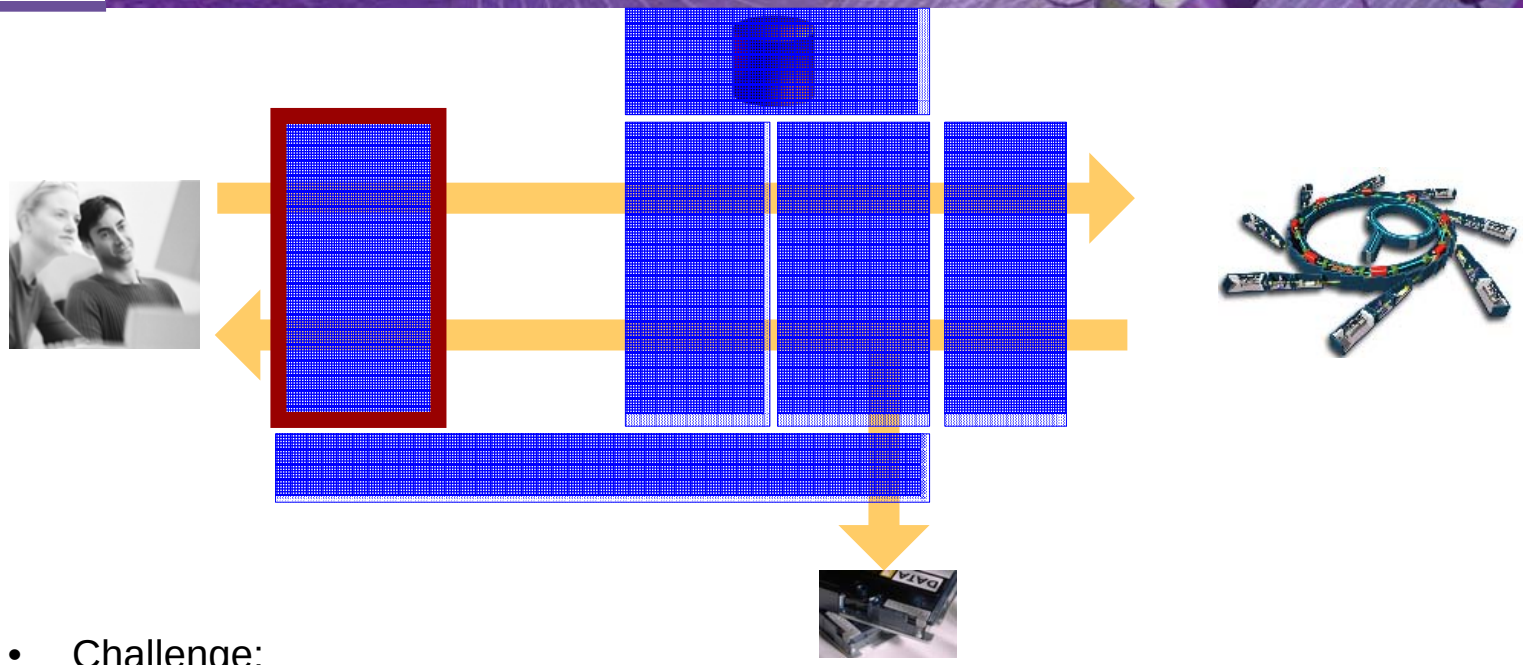
Component Overview



- Challenge:
  - Support dynamic reconfiguration
  - Support on-line changes in a 24/7 environment
  - Provide flexibility and ease in reconfiguring the environment
  - Separation of meta data from presentation

- Solution
  - XML based configuration information instead of hard-coding

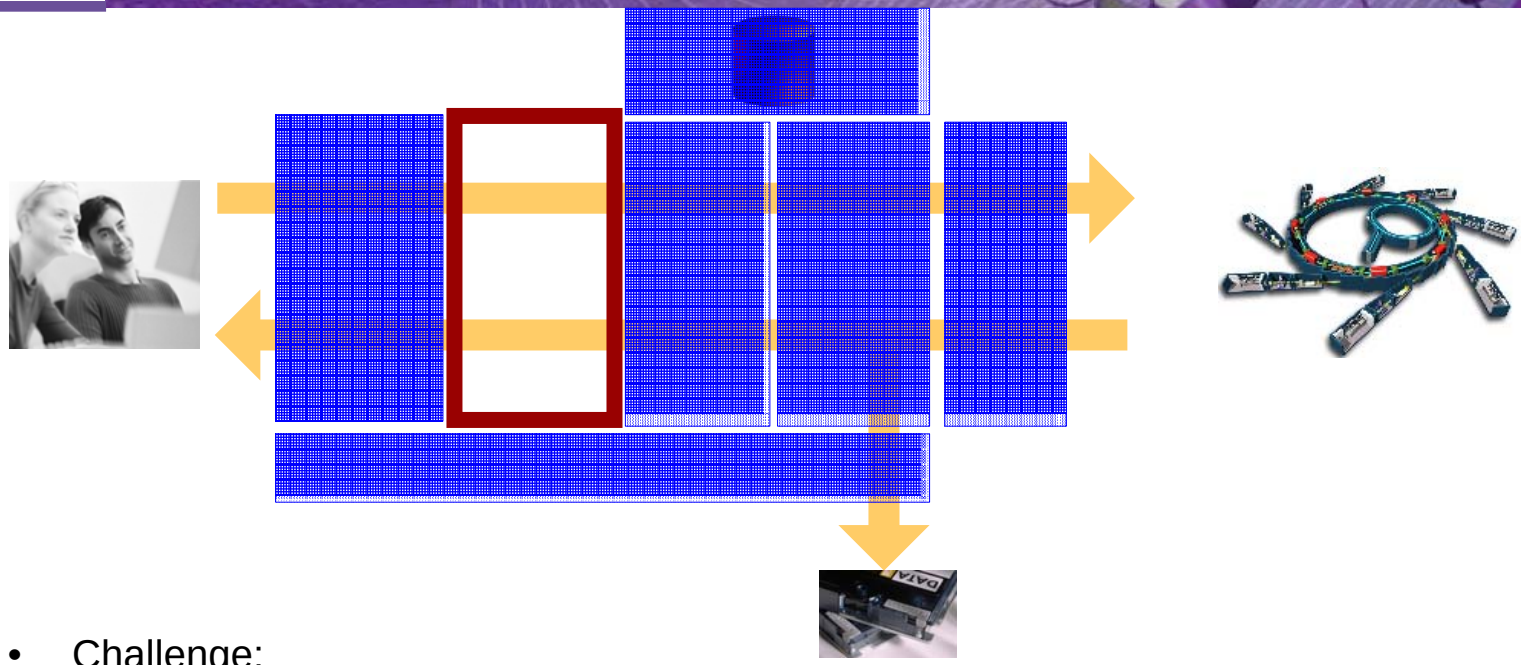
Component Overview



- Challenge:
  - Web-standards are still not mature
  - Must have a real-time feel to the user
  - Diverse client hardware/software independently selected at each university

- Solution
  - Thin-client browser (Java Script)
  - AJAX used to provide real-time like interface with Spring Framework
  - Identified a single supported browser (Fire-fox) all others at users own risk

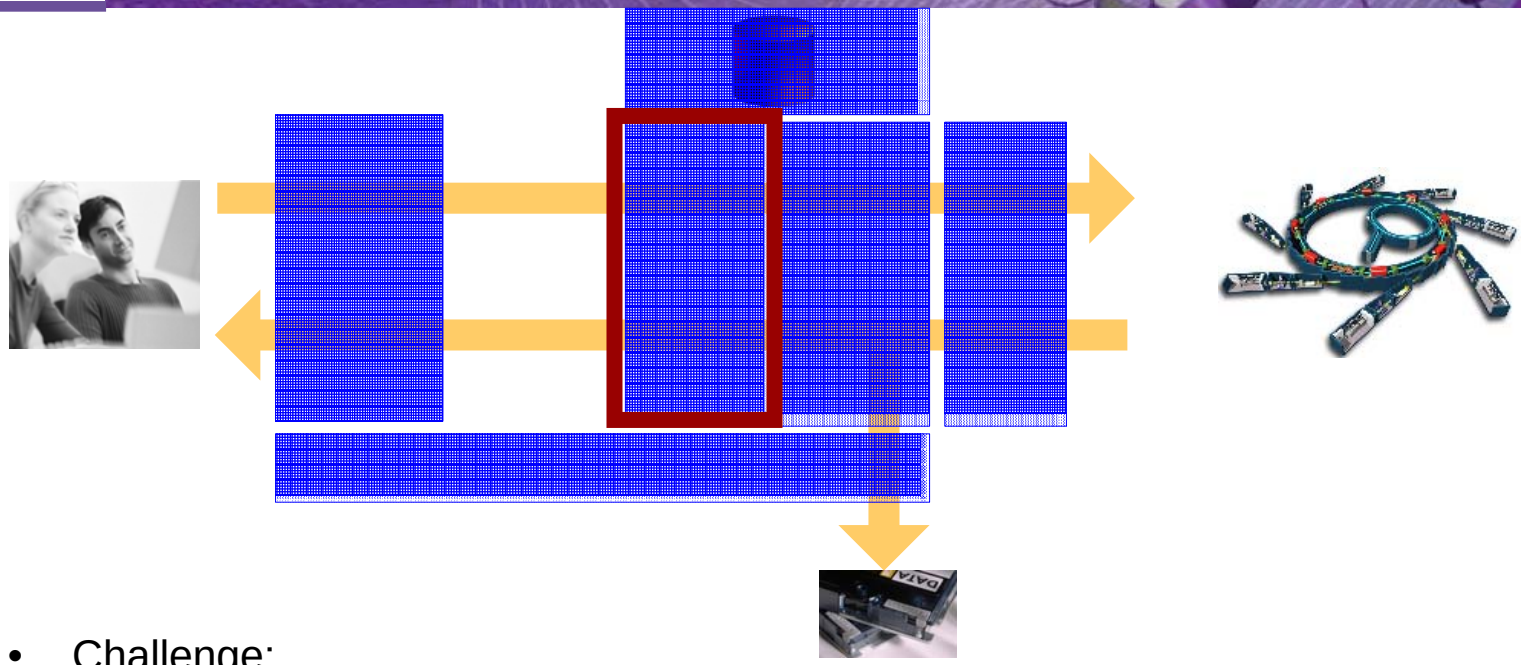
Component Overview



- Challenge:
  - Requires secure data transfer
  - Real-time performance – Guaranteed Quality of Service
  - Users located at major research Universities, Institutes in Canada and Australia

- Solution
  - LightPath and LighPath Accelerator Technology
  - CANet4 with International connections

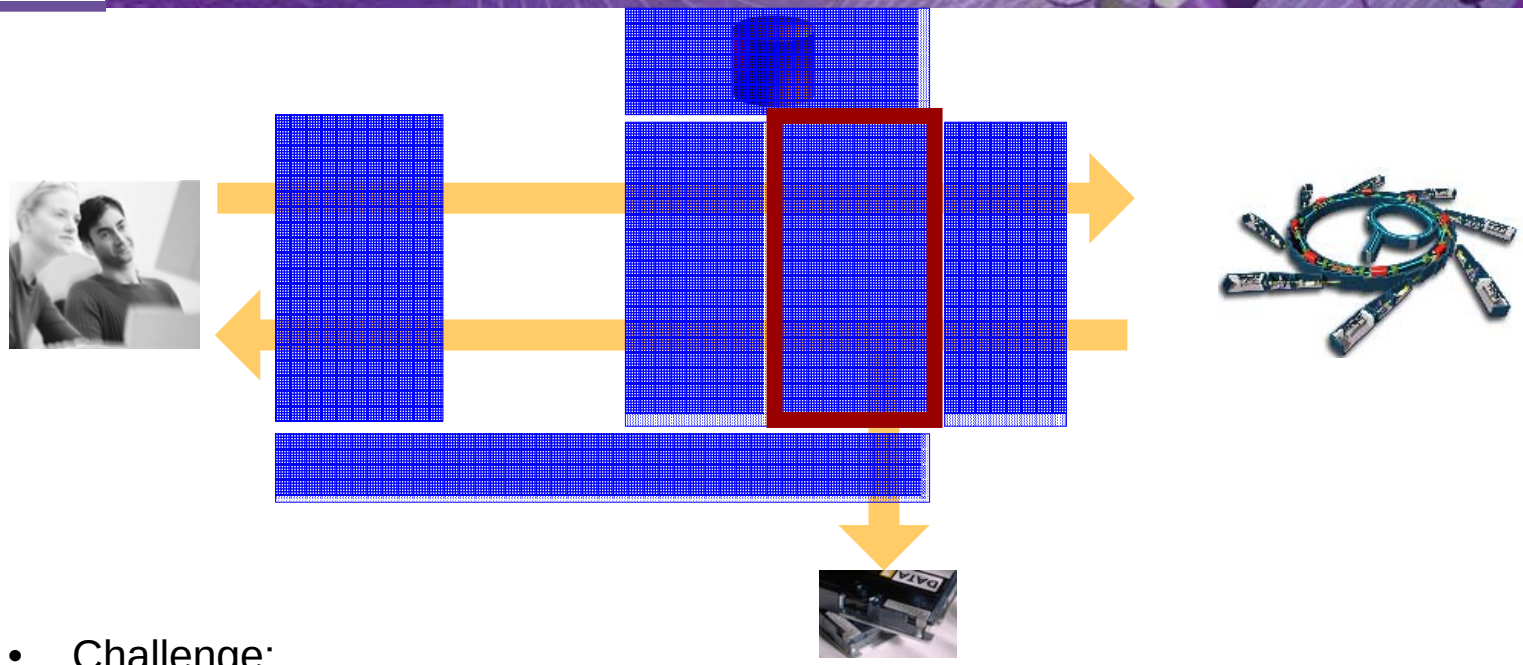
Component Overview



- Challenge:
  - Robust Reliable
  - User performance requirements are unknown
  - Support on-line changes, since the Facility Operates 24/7 with limited outage periods
  - Common interface presented to the user

- Solution
  - Websphere Hosted
  - Provides Services for Managing Users and Presentation of Data to the User
  - Spring Framework and Custom Java Classes

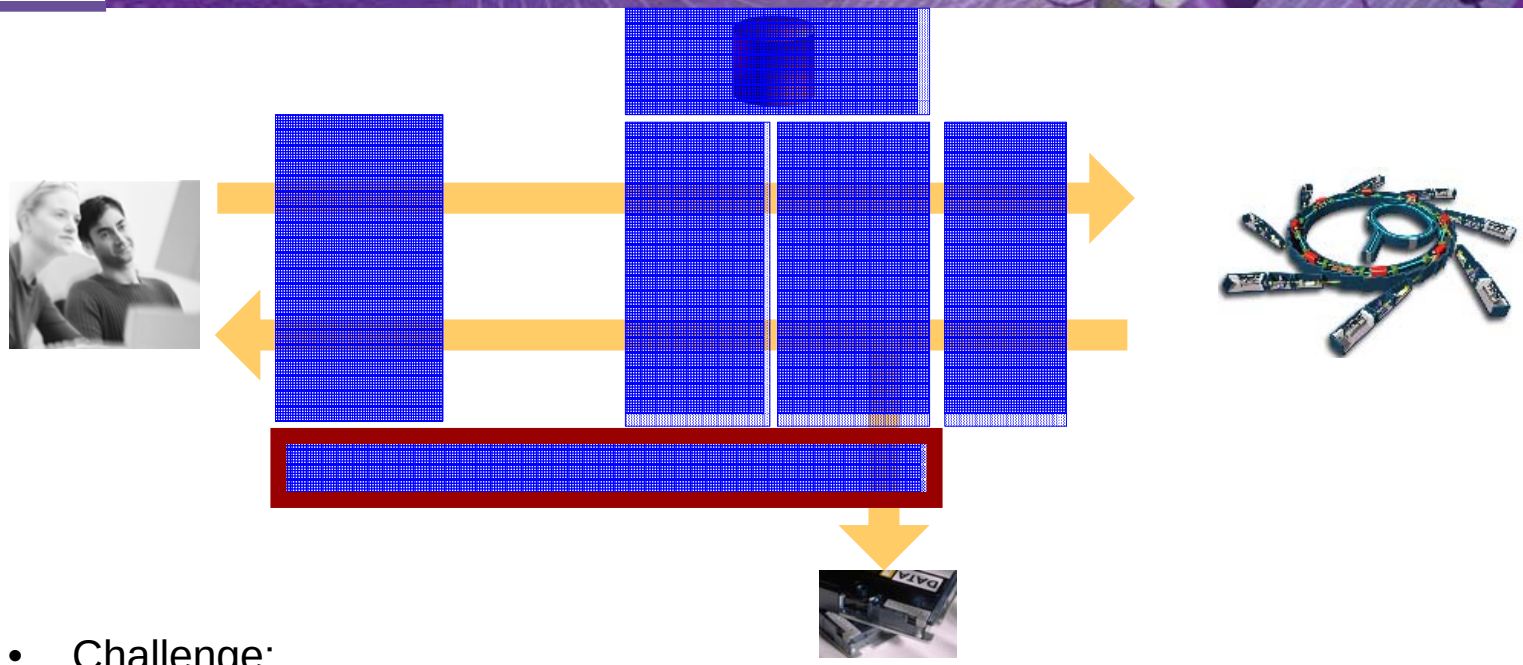
Component Overview



- Challenge:
  - The “glue” that ties things together
  - Ability to Interface to both Internal and External Services
  - Reliable, flexible, ability to deal with services connecting and disconnecting gracefully

- Solution
  - Provides internal and external services to communicate with other systems, analysis codes etc.
  - Web-services for diverse and distributed services

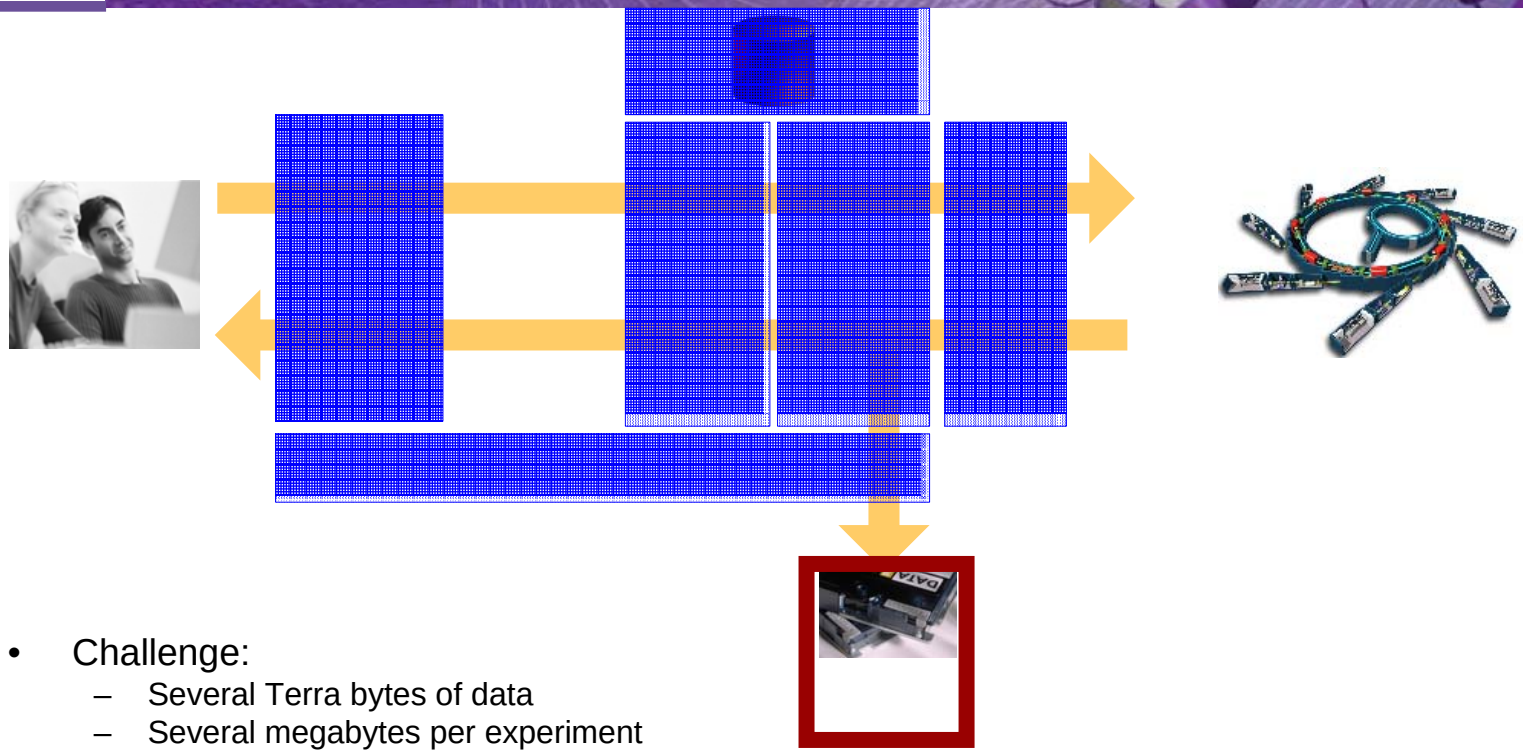
Component Overview



- Challenge:
  - Understand where the system fails
  - Achieve performance objectives
  - Allocate resources to performance only where there is a clear measurable benefit

- Solution
  - Build in some basic auditing to determine bottlenecks and trace faults

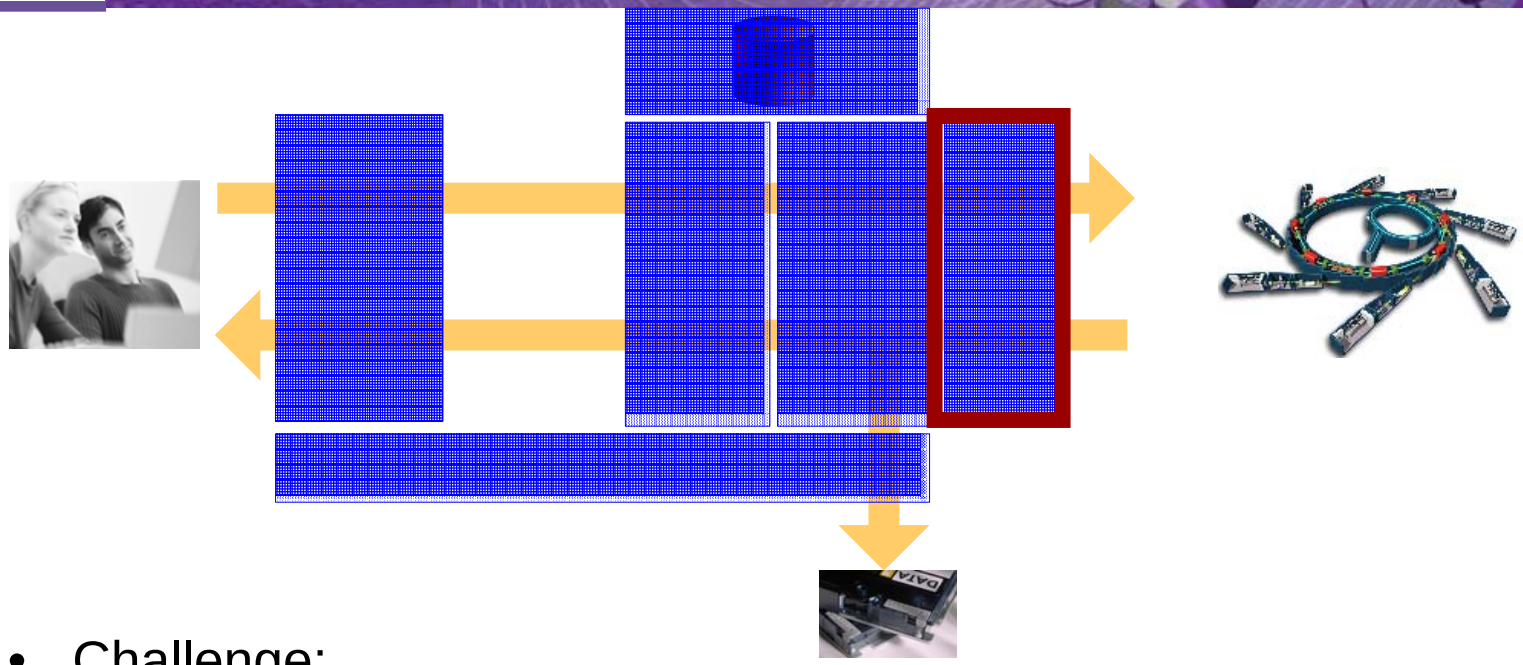
Component Overview



- Challenge:
  - Several Terra bytes of data
  - Several megabytes per experiment
  - Provide good performance

- Solution
  - Storage Area Network (SAN)
  - Light-paths to permit the rapid transfer of data to the user home institution
  - Working on central “National” Grid Storage Facility

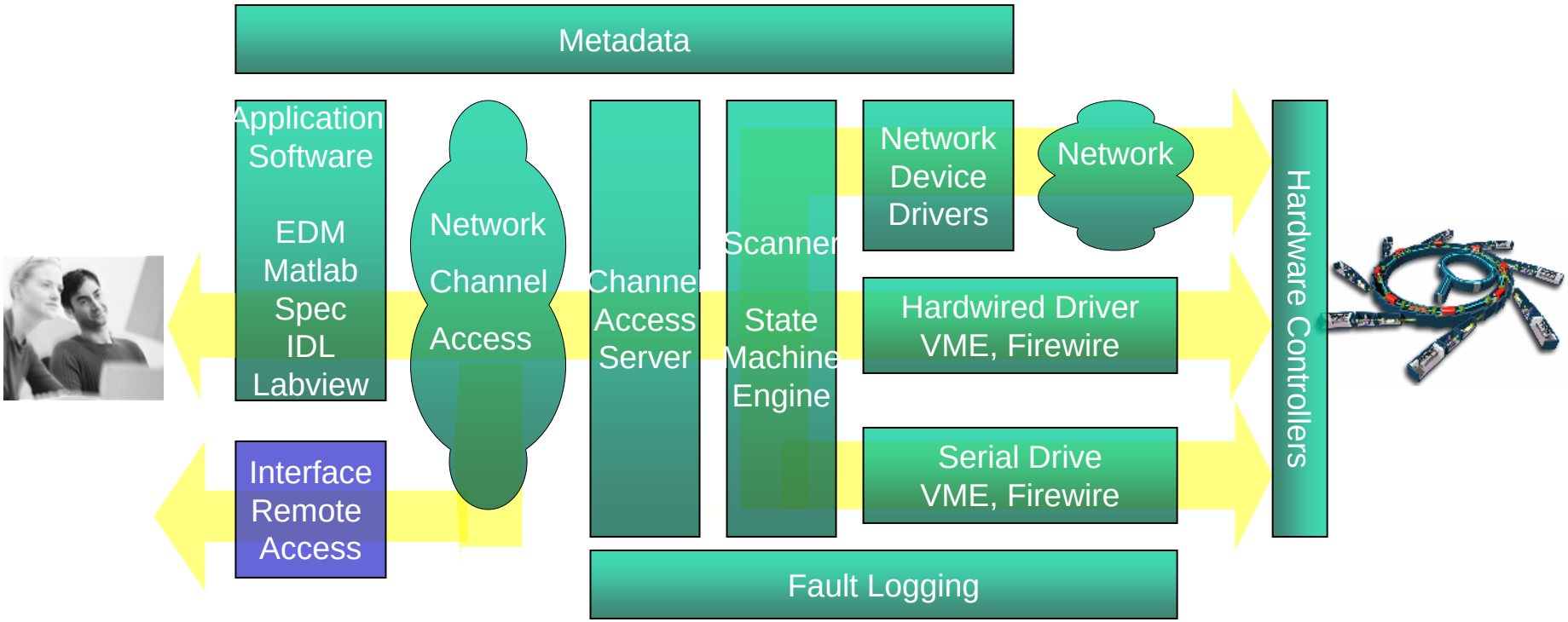
Component Overview



- Challenge:
  - Control diverse hardware
  - Implement motion control and data acquisition algorithms
  - Support both local and remote access

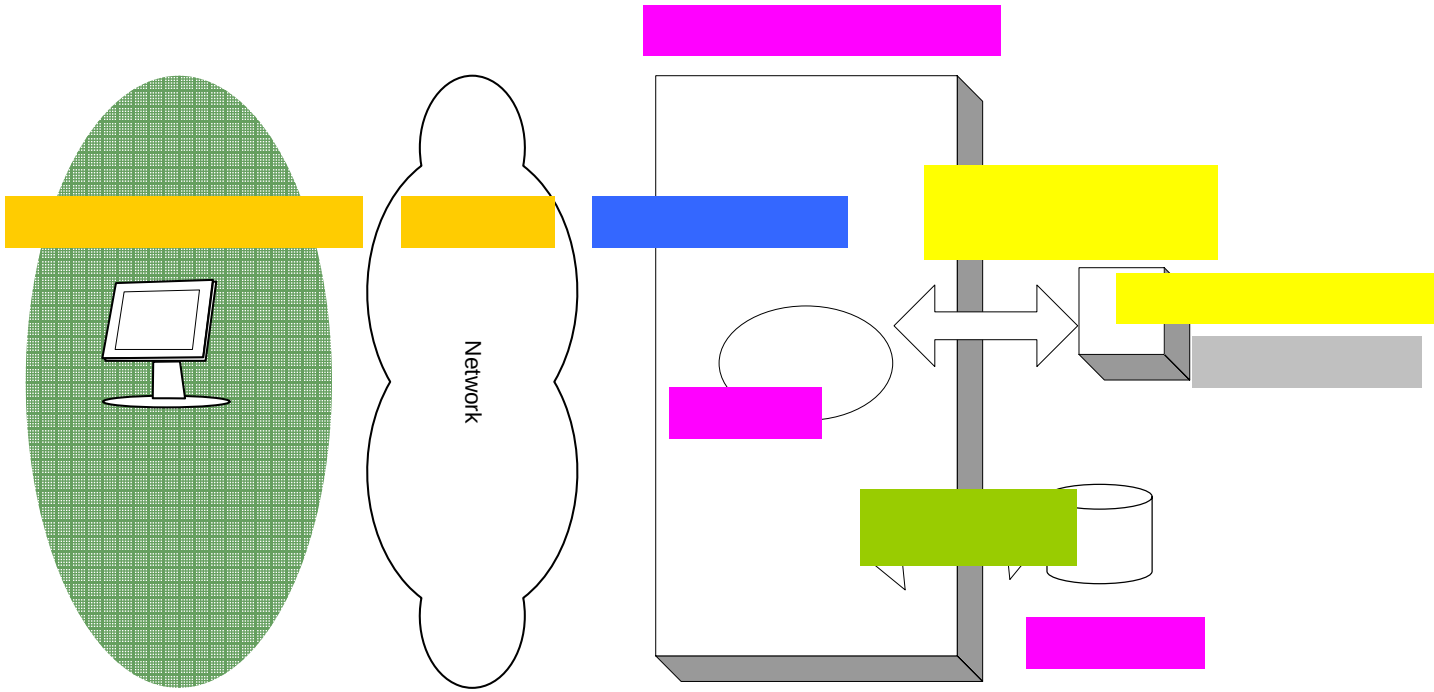
- Solution
  - EPICS (framework extensively used at synchrotrons around the world)
  - Integrate vendor and other libraries as needed

EPICS Overview

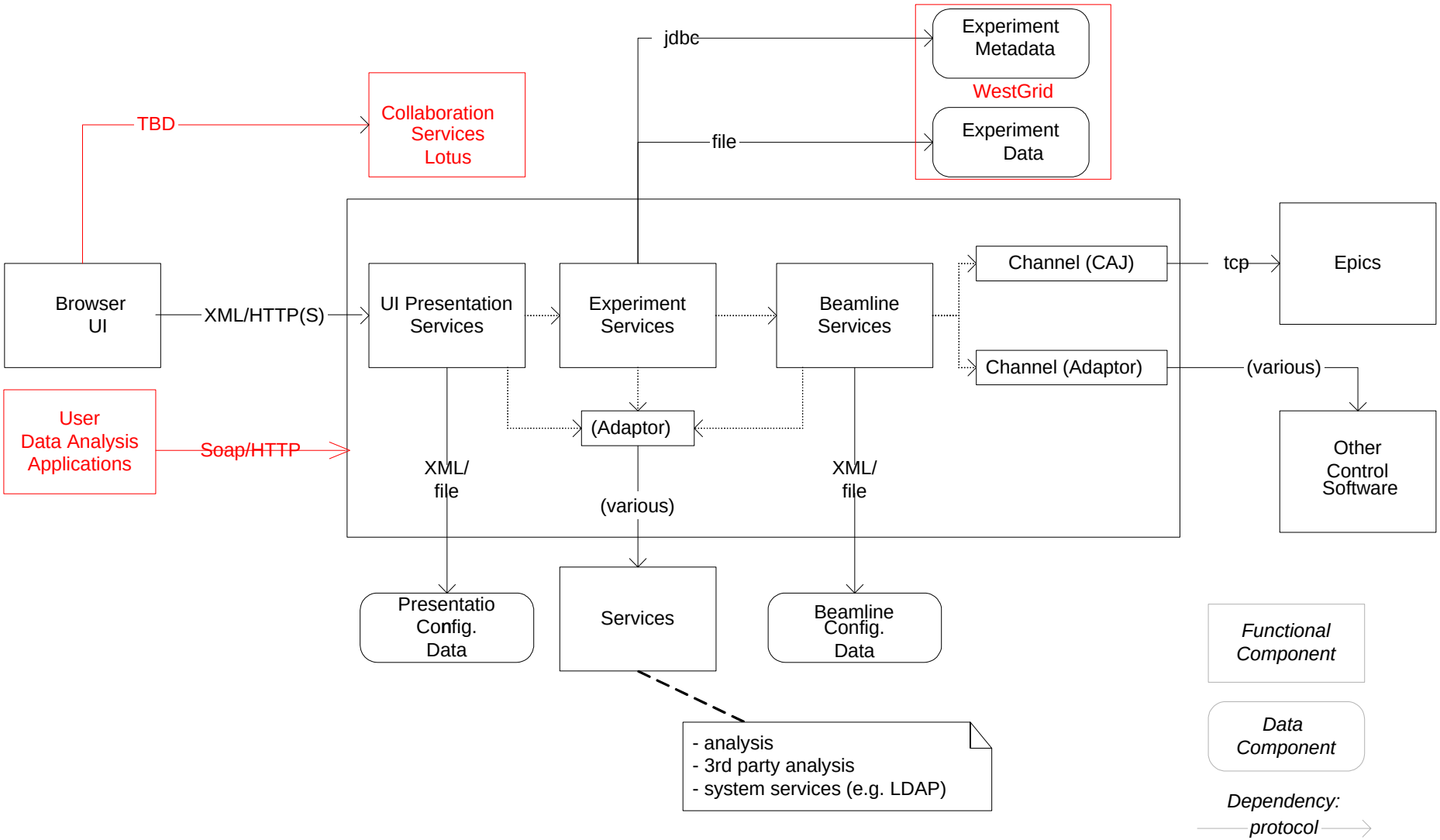


Can you look at EPICS in the same way?

Remote Beamline Access Prototype Architecture



System Structure



rating LPA with UCLP

Lightpath Accelerator controls a software virtual cross-connect that commands UCLP.

In effect, CA*Net4 is treated as a single lightpath cross-connect

UCLP commands

BigBangwidth

real device

CANARIE

virtual device

BigBangwidth

real device

WAN routed network

Layer 2/3 Switch

Layer 2/3 Switch

domain manager process

Project Plan

- January – March 2007
  - Contract signed with Quartz Imaging to provide integration of X-one (analysis package)
  - Beginning work on data storage as part of WestGrid
  - Bug-fixes, integration with other packages
  - Evaluating User Office – Workflow Integration
  - Evaluating expanding use of IBM Rational Tools (workflow modeling)
  - Evaluating expansion to other beamlines

Next Step….

- Some User Management Functions?
- Video/Audio Conferencing?
- Additional Data Analysis?
- WestGrid data storage?
- Collaborations?
  - Other machines?
  - Integration with CCS?
  - Leverage technology with IRMIS?

The End

Thank you.