Remote Access at the CLS

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M. Fuller, S. McIntryre (University of Western Ontario)

Where is Saskatoon?

Scientific American May 2008

Science 2.0 – The Risk and Reward of Web-Based Research

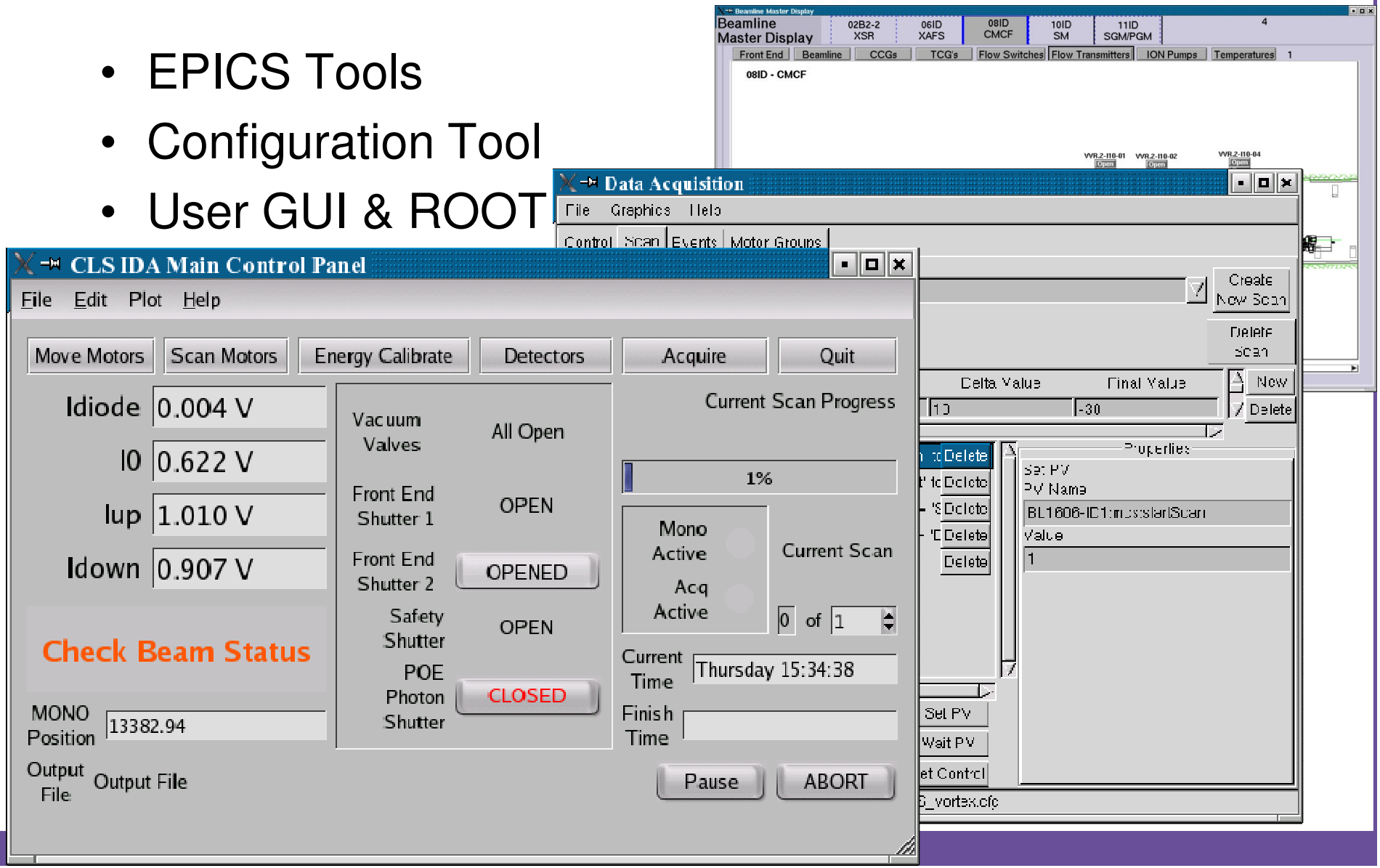
"Our real mission isn't to publish journals but to facilitate scientific communication" *Timo Hannay – Head of Web Publishing at Nature Publishing Group*

What Is the Web 2.0?

- In plain English ….
  - Automating tedious tasks using web technology
  - Tools to help people and software collaborate

Traditional Beamline Controls

- EPICS Tools
- Configuration Tool
- User GUI & ROOT

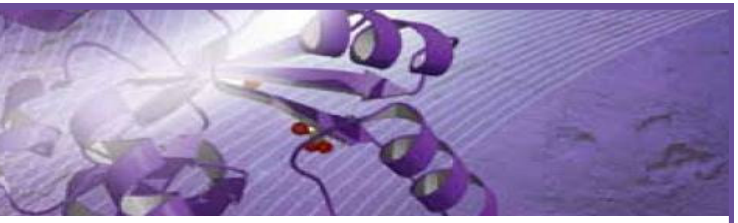


Why move away from the traditional method?

- For some beamlines, want to avoid the travel time.
- It does not support off-site collaboration.
- It does not support off-site data access.

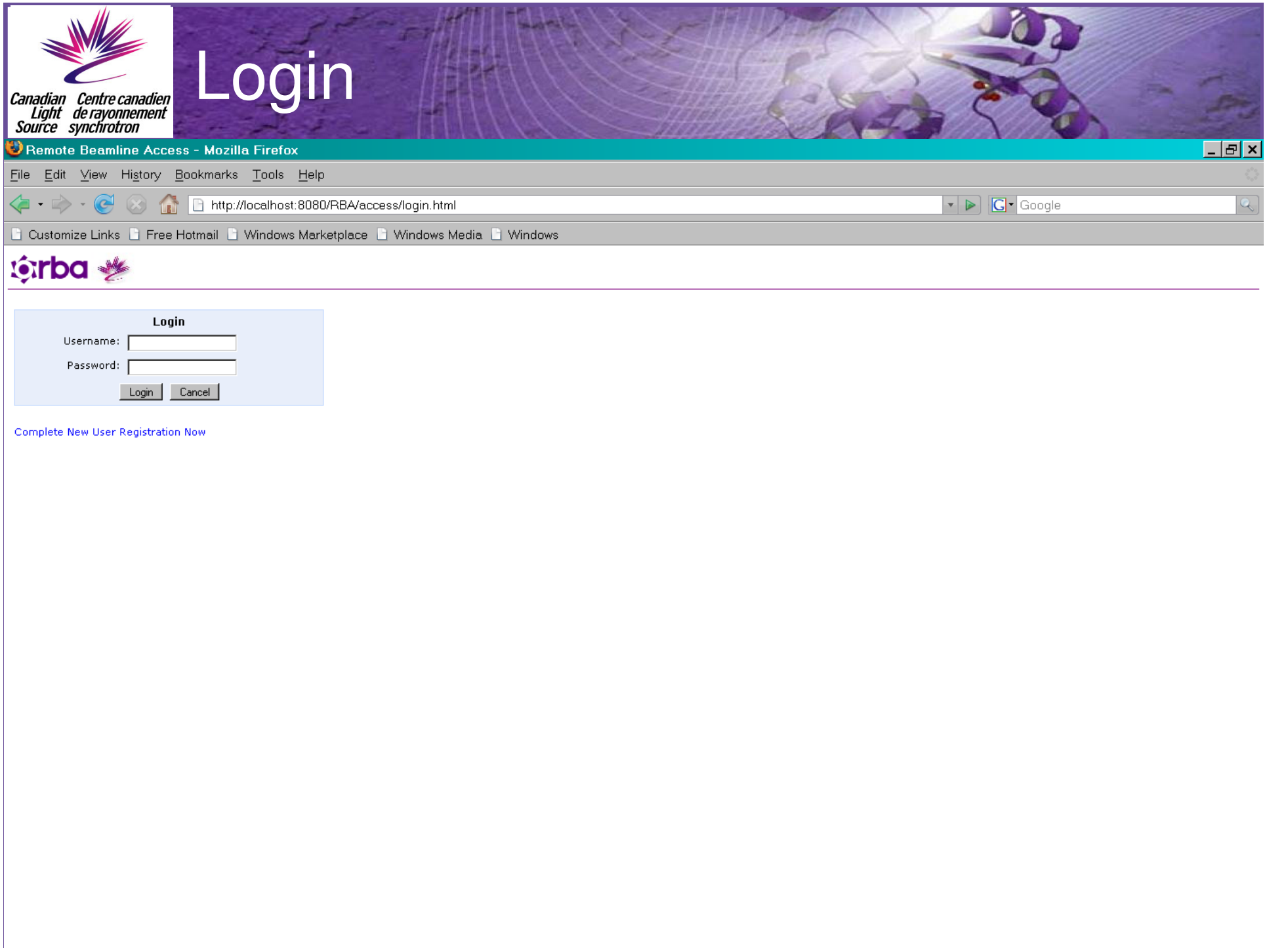
- Therefore we started the:
  - Remote Beamline Access Project (2005-2006)

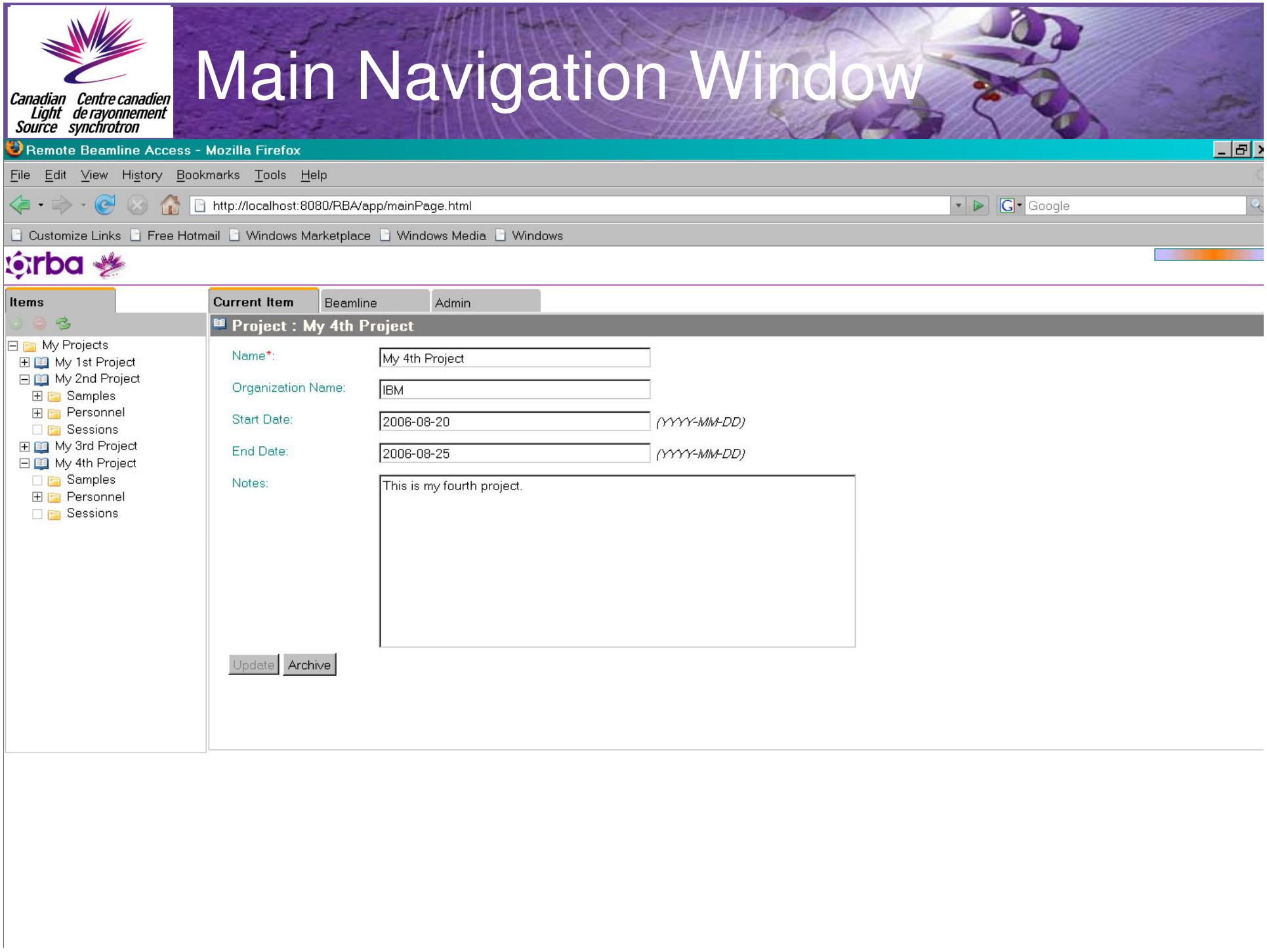
RBA Project Team



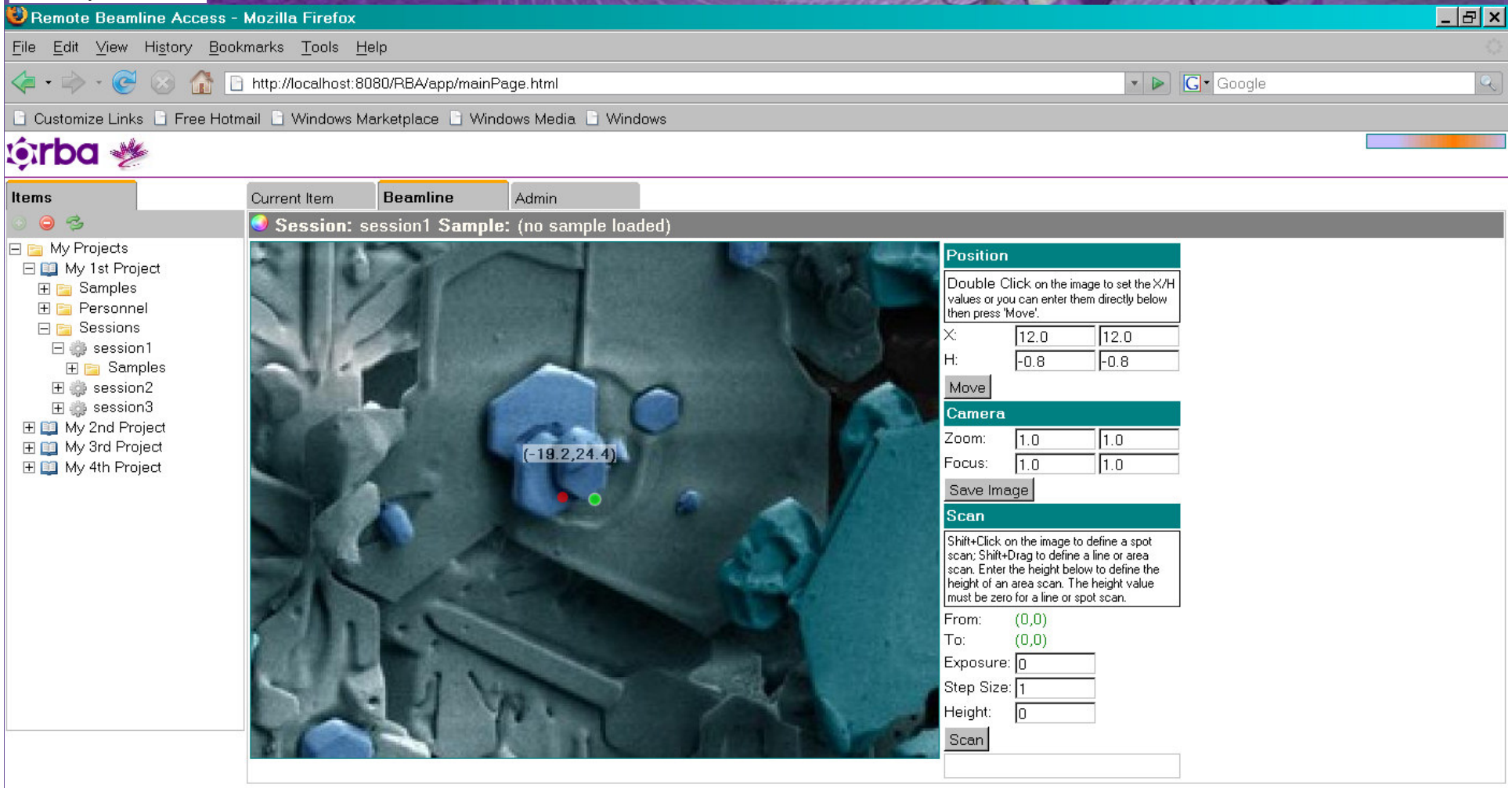
- CANARIE Funded Project
- Canadian Light Source
  - **Dionisio Medrano (System Analyst)***
  - **Daron Chabot (System Analyst)***
  - **Jason Chan (Intern)***
  - Elder Matias (Project Leader/Manager)
  - Michel Fodje (CMCF Beamline Scientist)
  - Renfei Feng (VESPERS Beamline Scientist)
  - Jason Cyrenne (Networking)
  - Bob Harvey (Networking)
  - 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

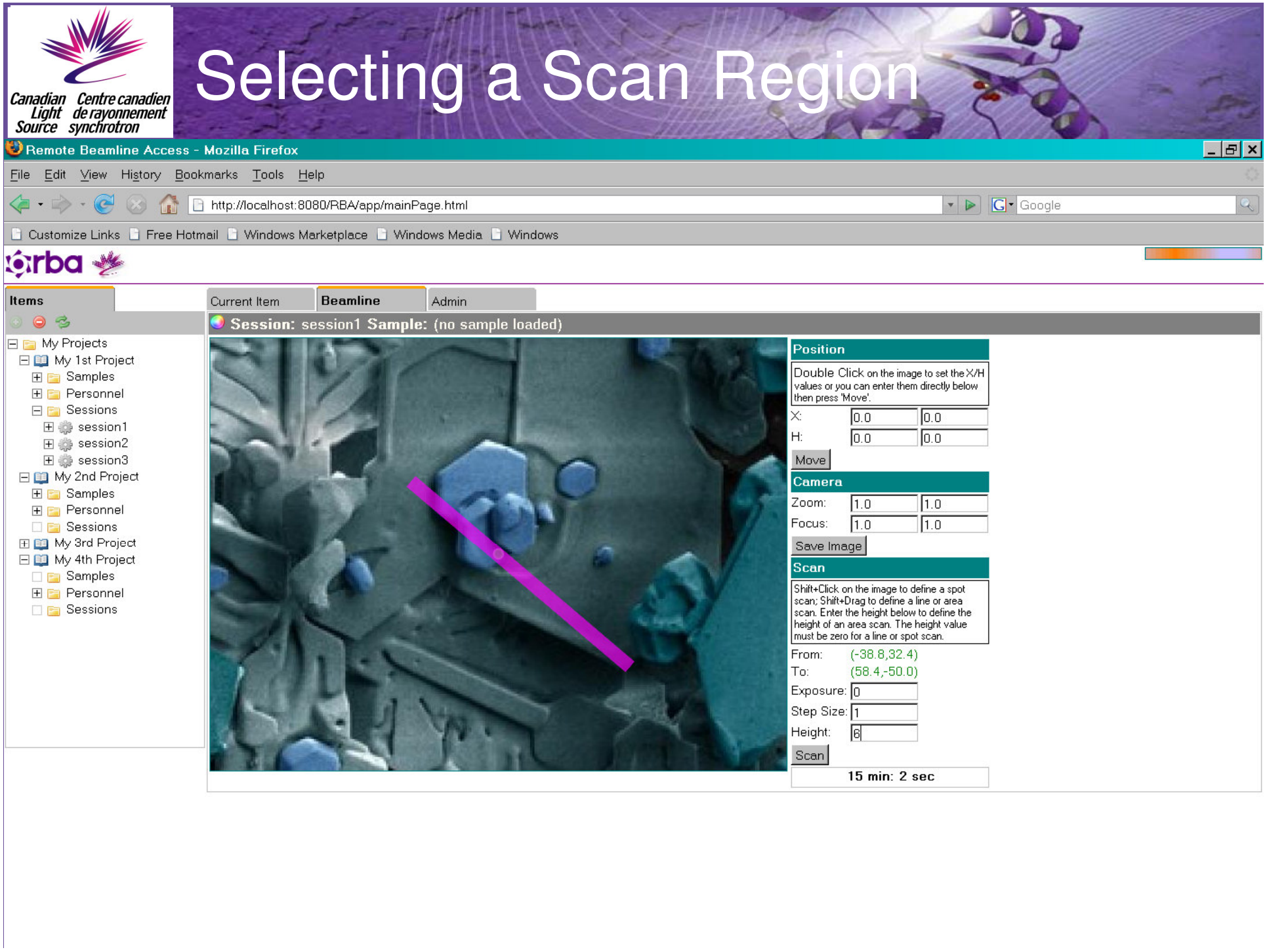

Canadian Light Source
Centre canadien de rayonnement synchrotron
Login
Remote Beamline Access - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost:8080/RBA/access/login.html
Google
Customize Links Free Hotmail Windows Marketplace Windows Media Windows
orba
Login
Username:
Password:
Login
Cancel
Complete New User Registration Now


Canadian Light Source
Centre canadien de rayonnement synchrotron
Main Navigation Window
Remote Beamline Access - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost:8080/RBA/app/mainPage.html
Google
Customize Links Free Hotmail Windows Marketplace Windows Media Windows
orba
Items
Current Item
Beamline
Admin
My Projects
My 1st Project
My 2nd Project
Samples
Personnel
Sessions
My 3rd Project
My 4th Project
Samples
Personnel
Sessions
Project : My 4th Project
Name*:
My 4th Project
Organization Name:
IBM
Start Date:
2006-08-20
(YYYY-MM-DD)
End Date:
2006-08-25
(YYYY-MM-DD)
Notes:
This is my fourth project.
Update
Archive

EPICS Connection to Beamline



Selecting a Scan Region



Looking at the Data

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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

orba

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

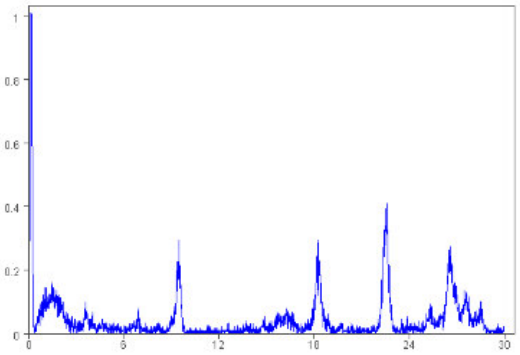
Current Item | Beamline | Admin

Experiment Data : ScanPoint_4

Name*: ScanPoint_4

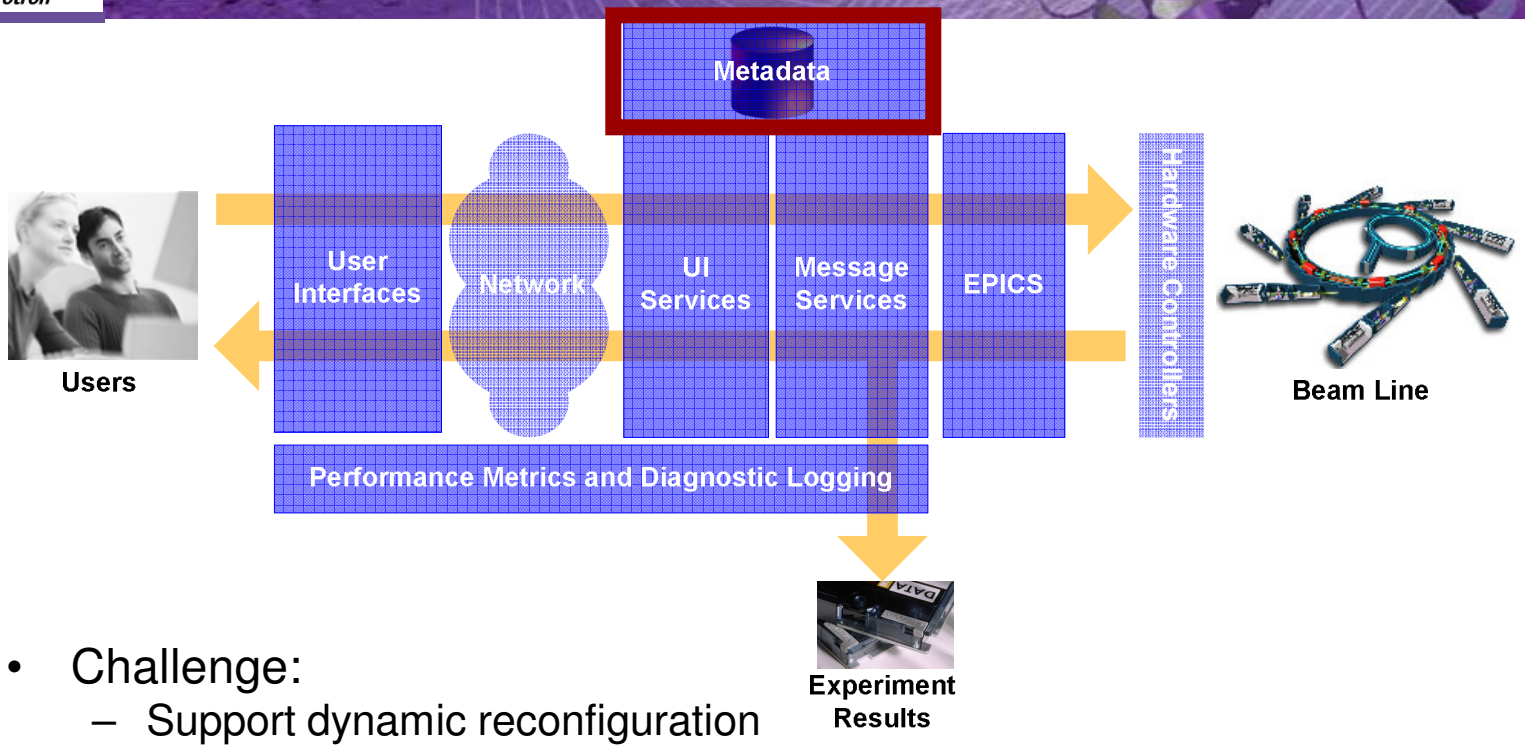
Type: scanpoint

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



Notes: Strange peak on sample....

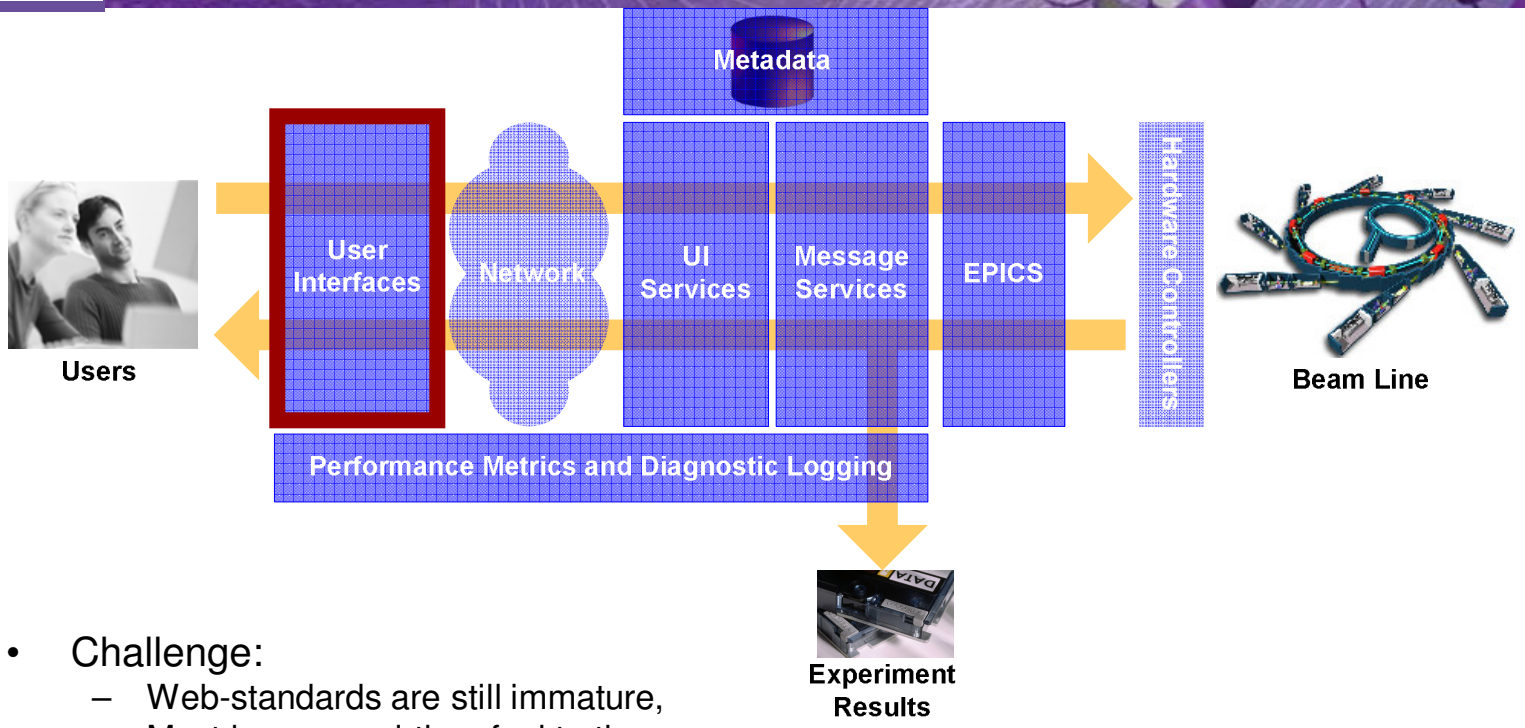
Component Overview



- 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

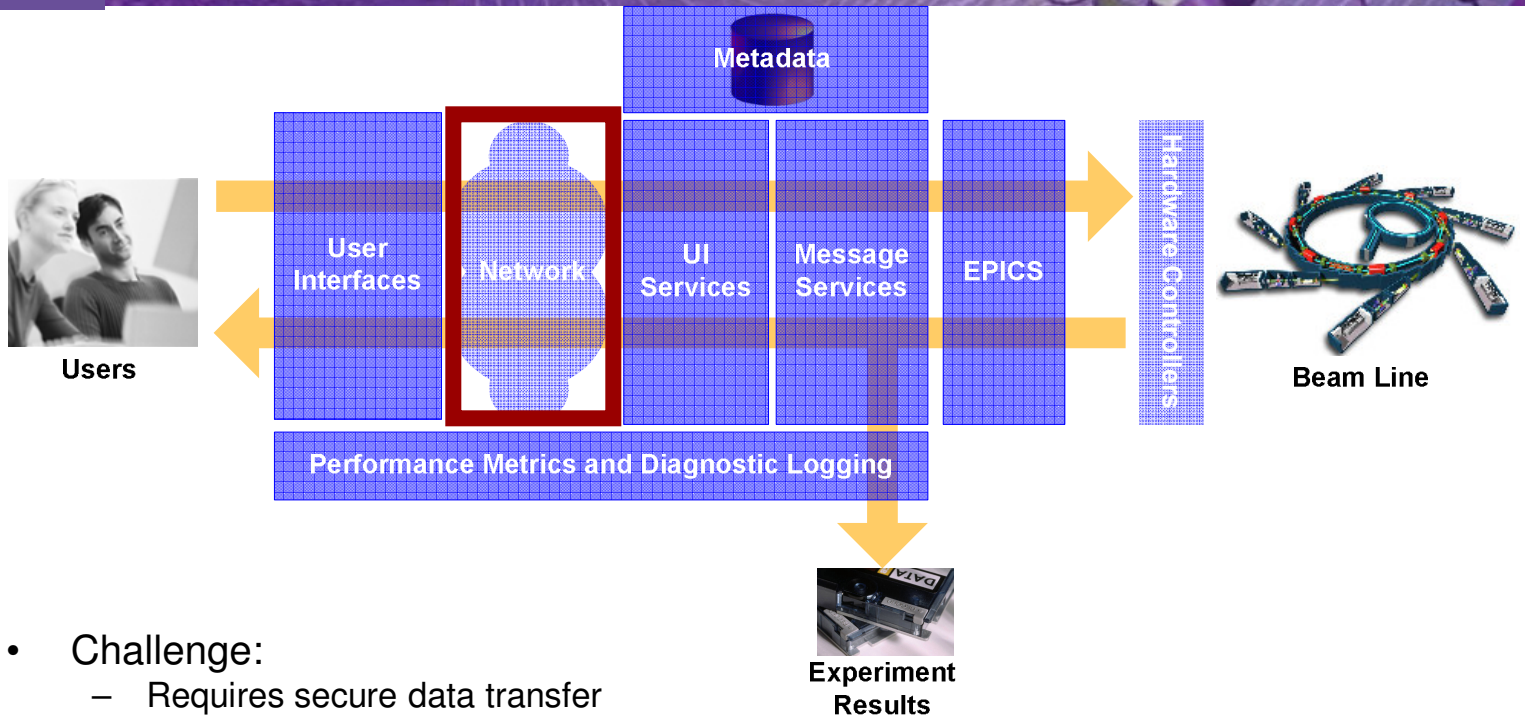
- Solution
  - XML based configuration information instead of hard-coding

Component Overview



- Challenge:
  - Web-standards are still immature,
  - 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 (Firefox) all others at users own risk

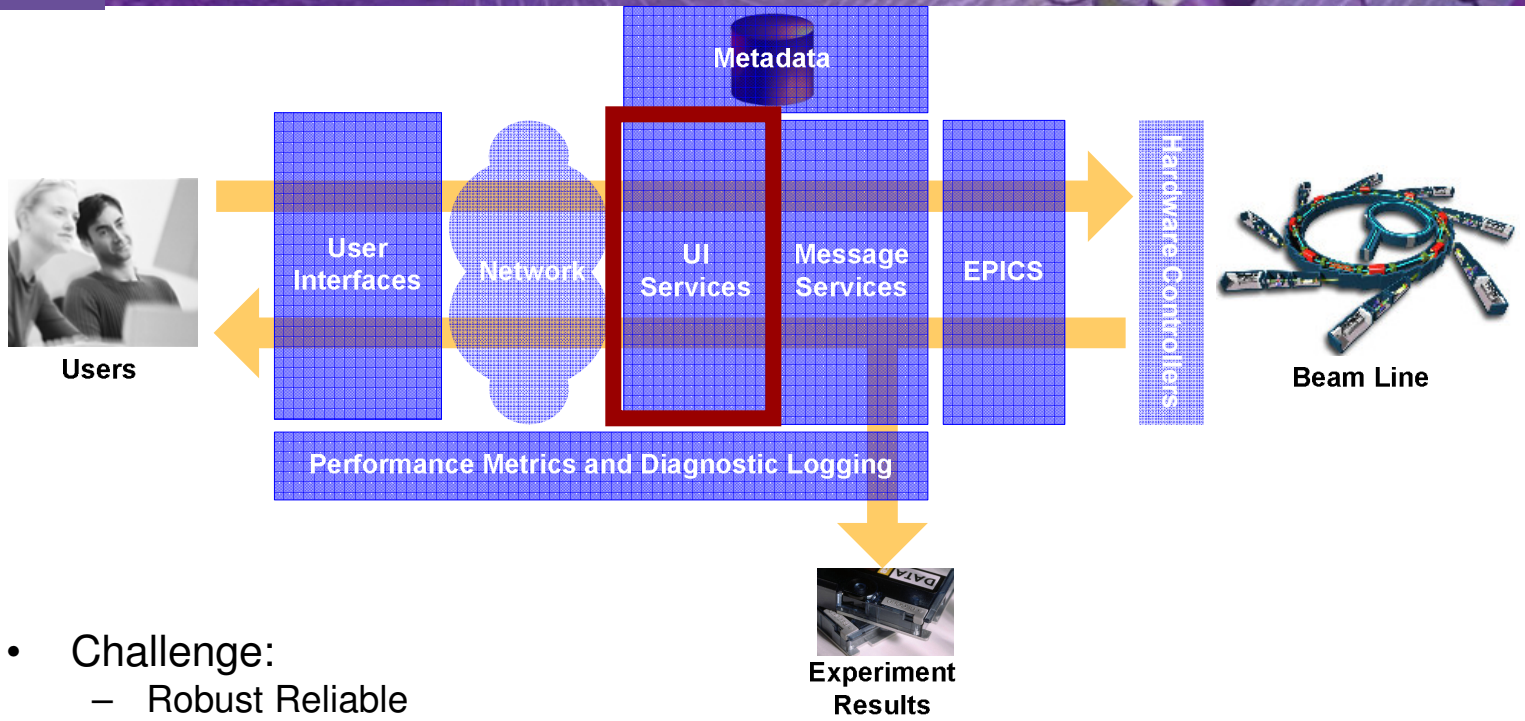
Component Overview



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

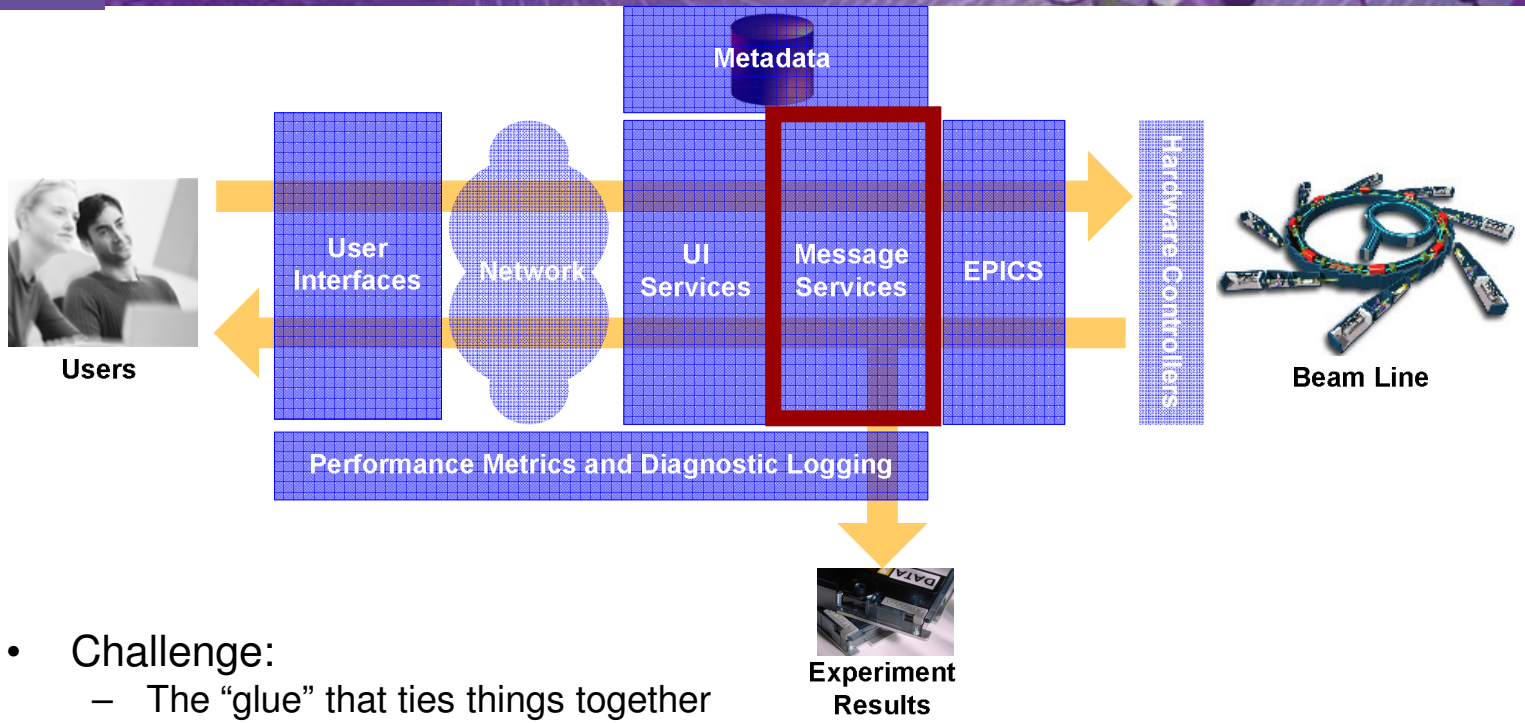
- Solution
  - LightPath and LighPath Accelerator Technology
  - CANet4 with International connections

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

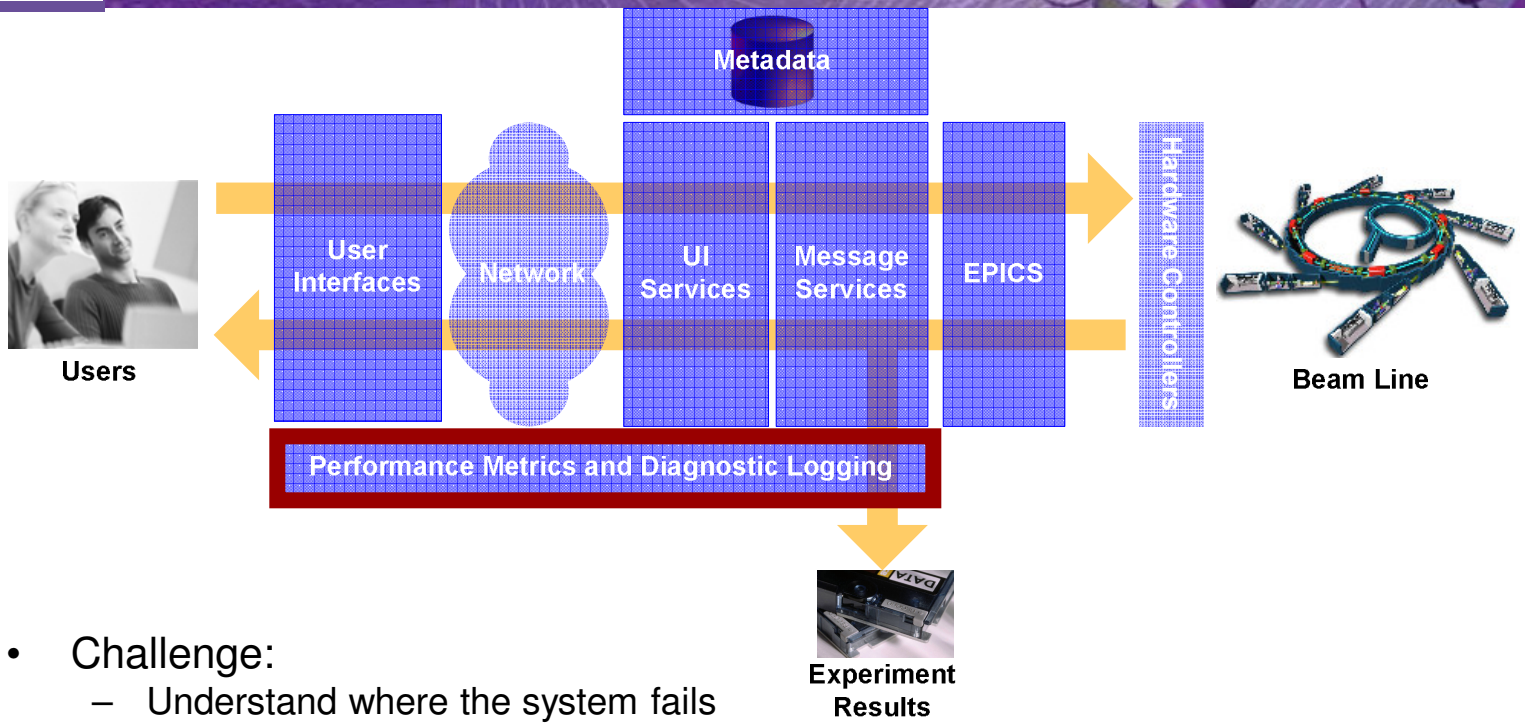
Component Overview



- 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

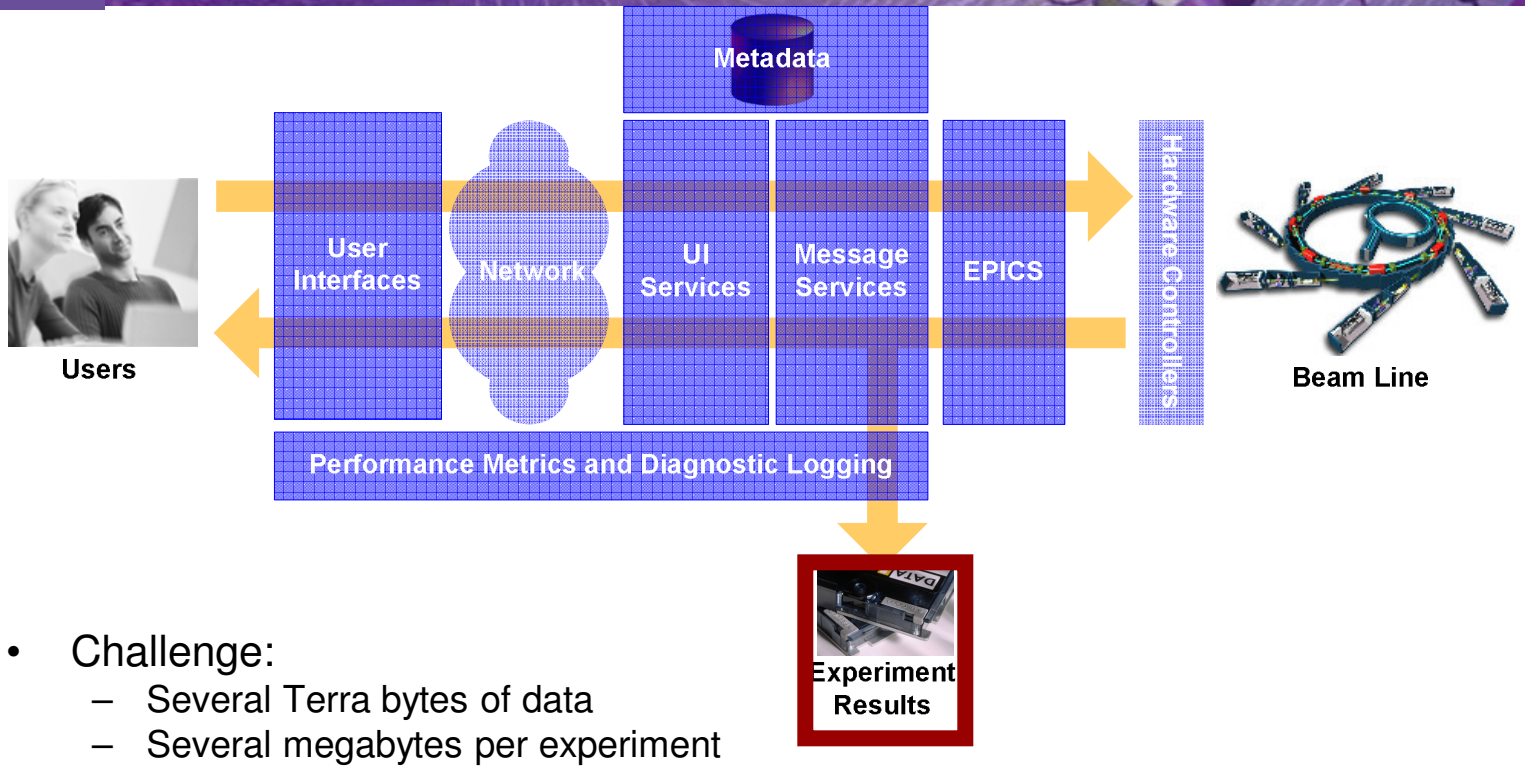
Component Overview



- 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

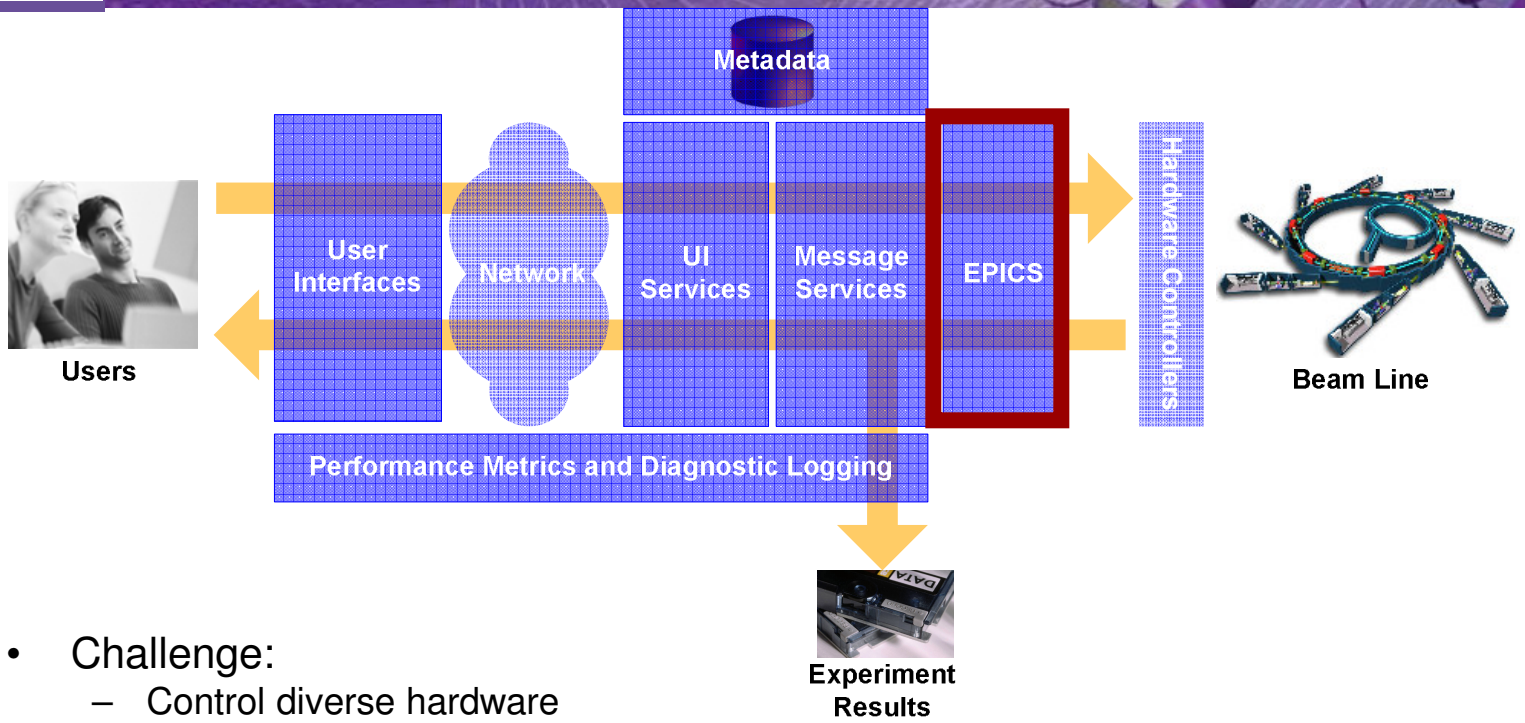
Component Overview



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

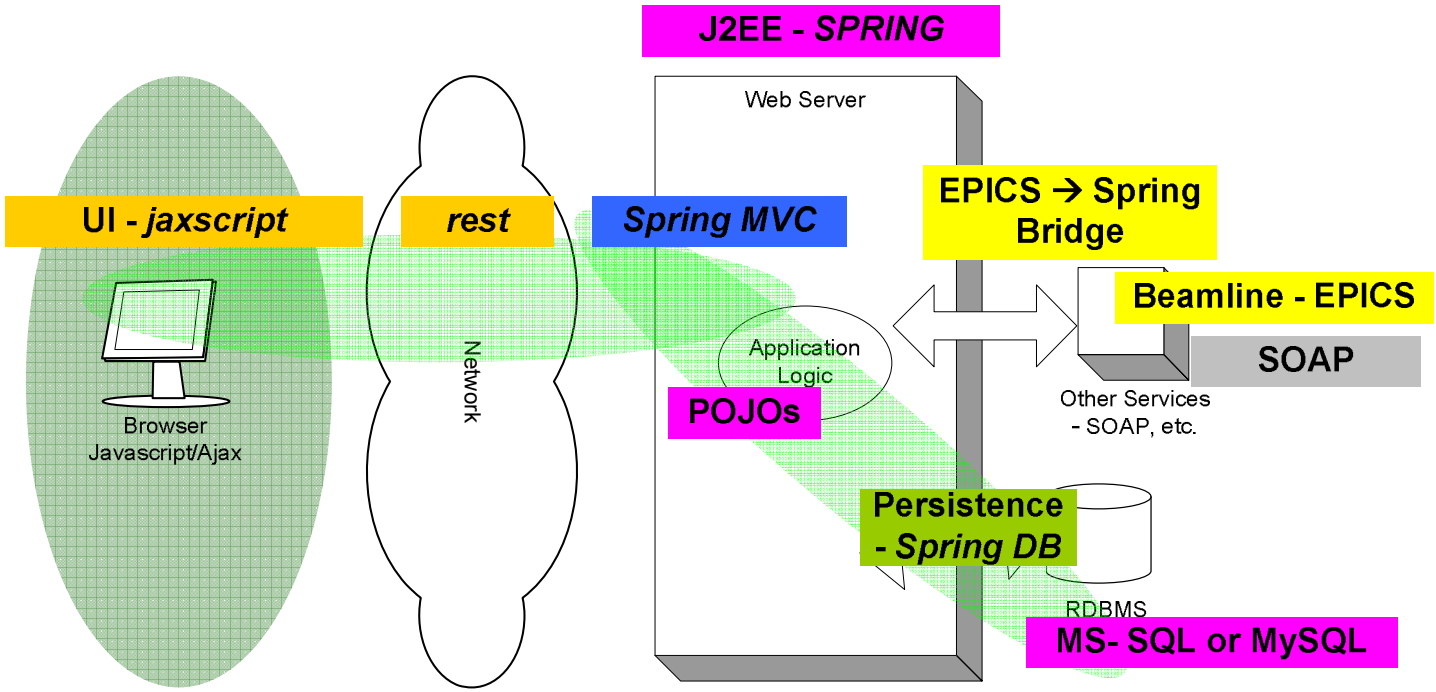
- Solution
  - Storage Area Network (SAN)
  - Light-paths to permit the rapid transfer of data to the user home institution

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
- Next Step, Beamline Abstraction Layer

Remote Beamline Access Prototype Architecture



Moving Forward….

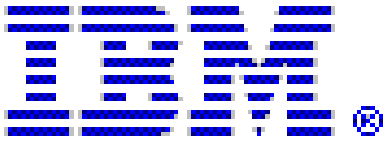
- We wrapped up RBA in 2007 – the proof of concept worked.
- We now need to move forward with building the production system.

- ScienceStudio: Aug 2008- Dec. 2010

ScienceStudio Project Team

Partners

- Canadian Light Source
- IBM Canada
- University of Western Ontario
- Concordia University
- SharcNET
- Other?



New Requirements

- New User Office Functionality
  - Proposal submission
  - Peer review
  - User Feedback Tracking
  - Experiment Management
  - User Training/ Safety Testing
- Remote Beamline Access
- Integration with grid data-storage
- Grid computing

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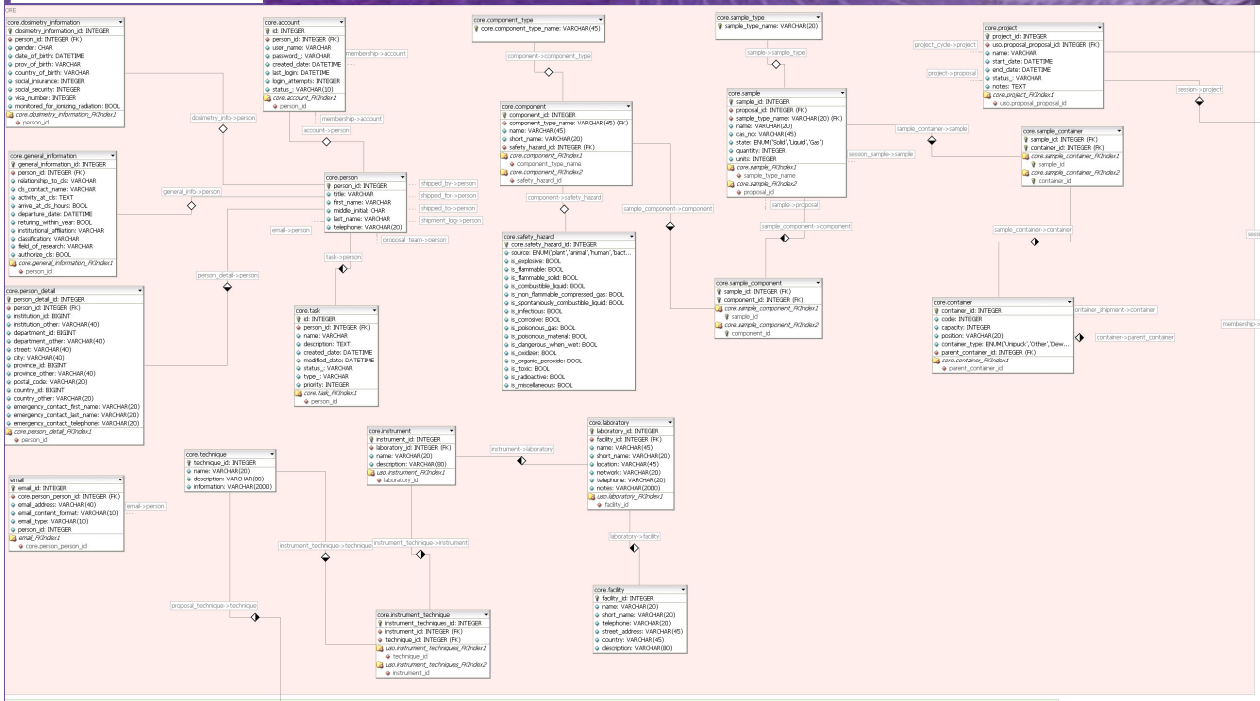
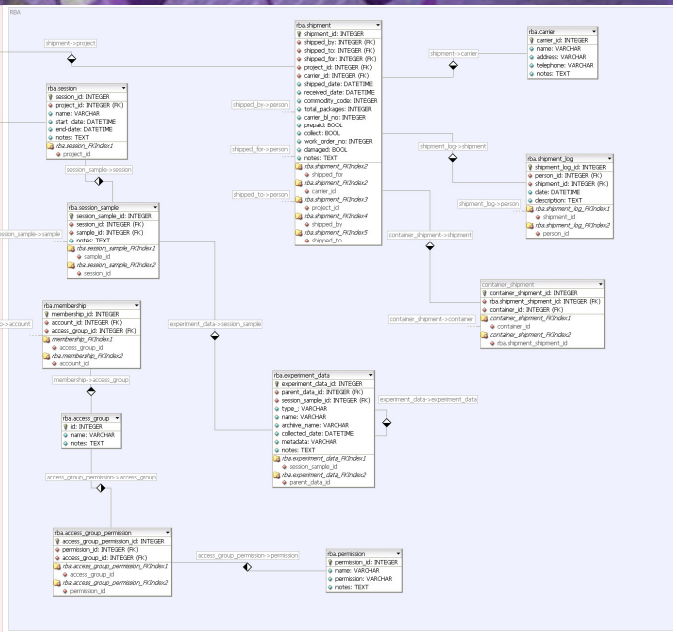
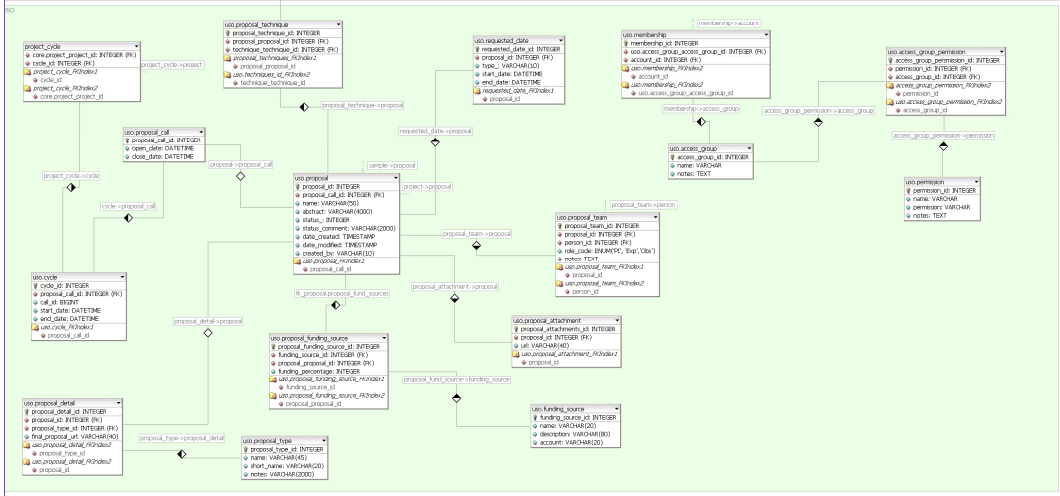
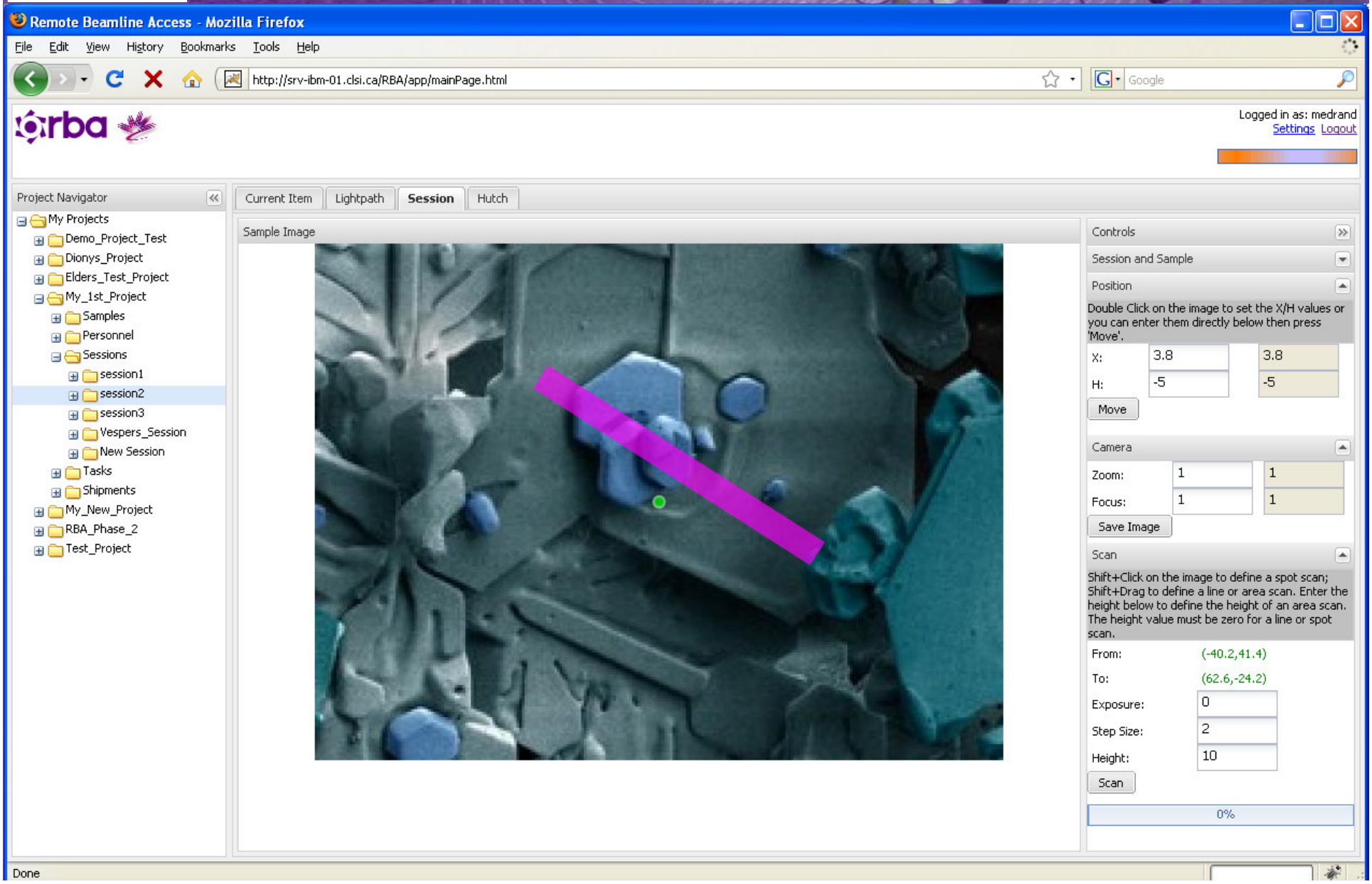
New Information Model



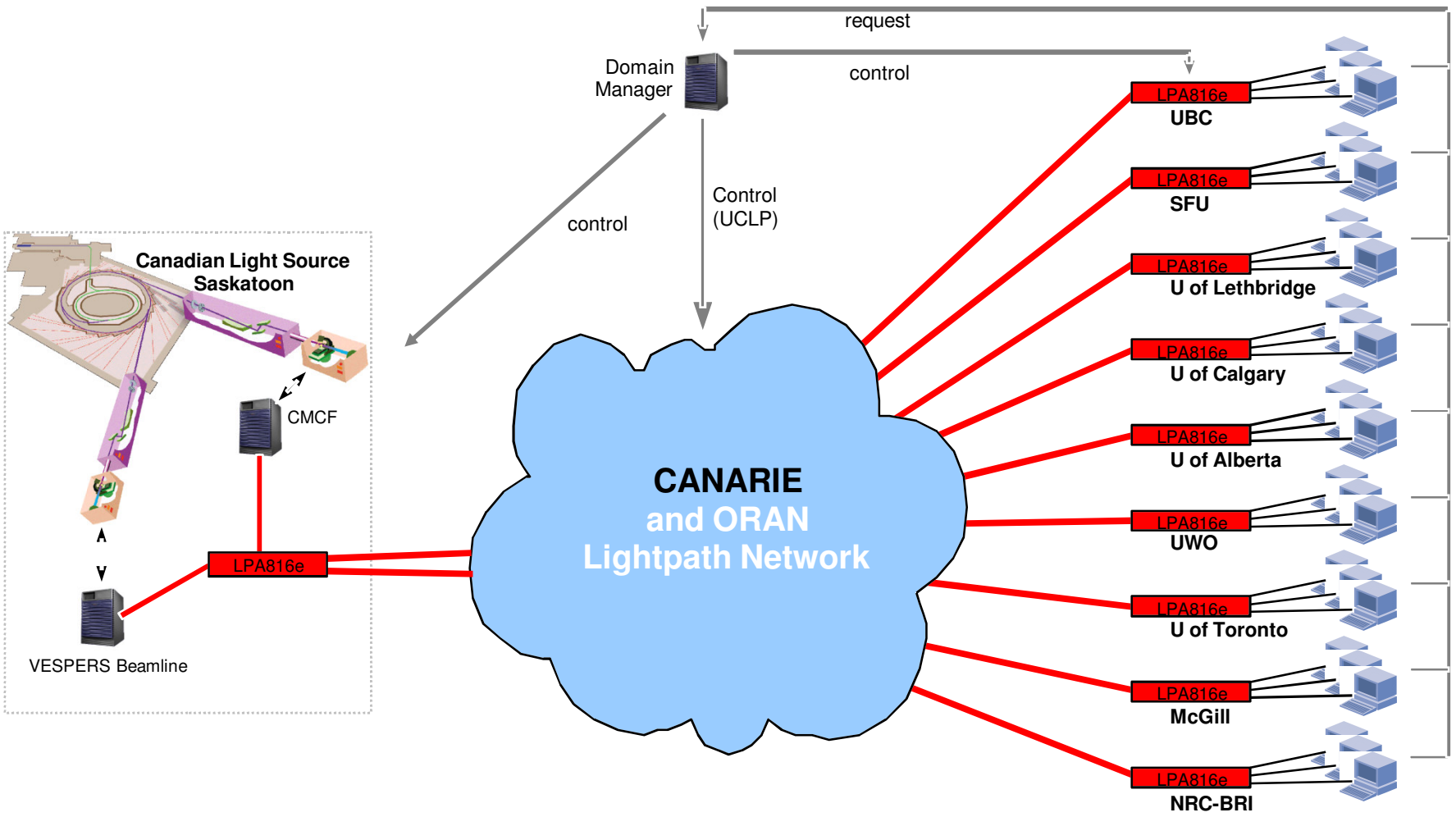




ScienceStudio



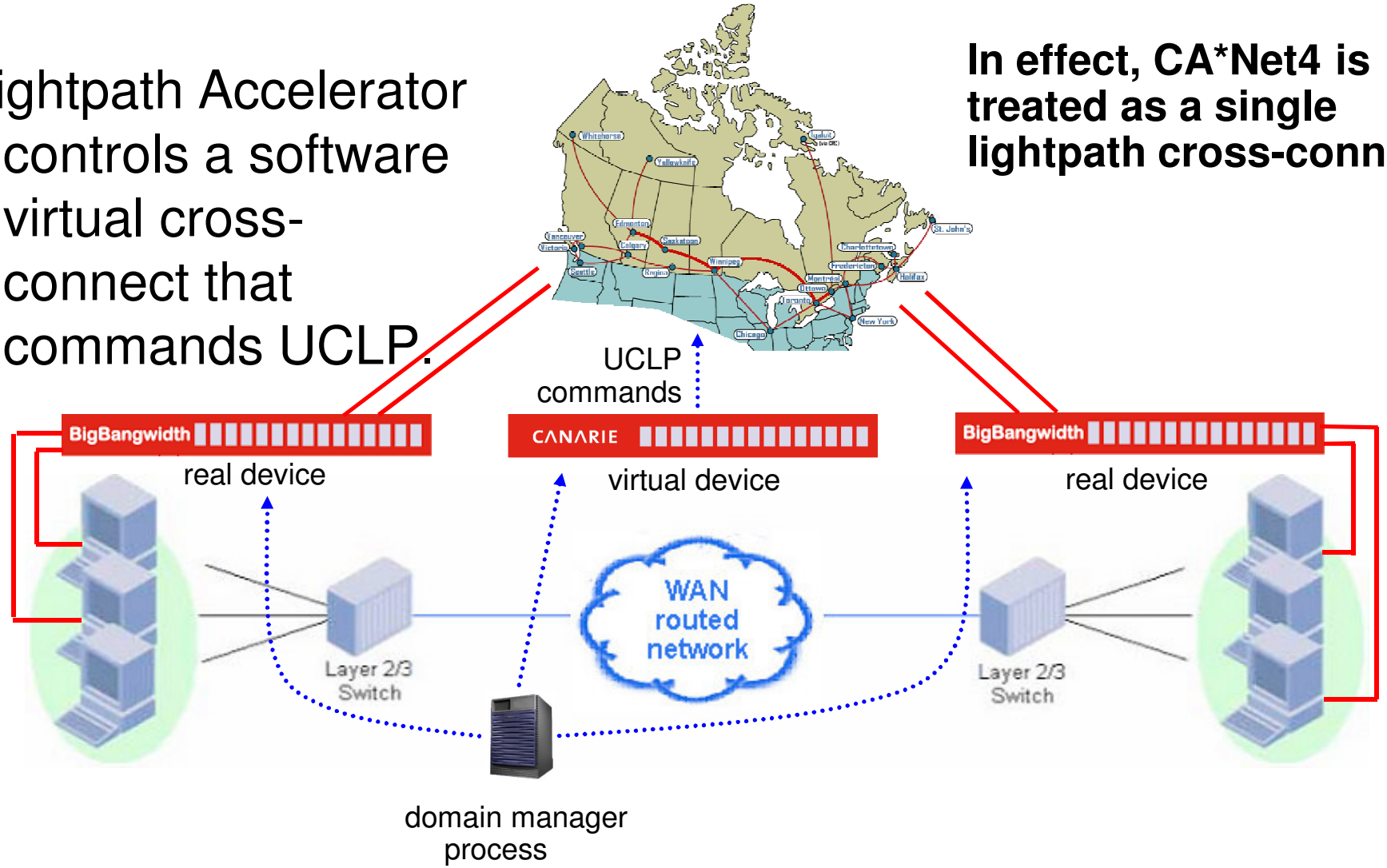
Network Architecture



Integrating LPA with UCLP

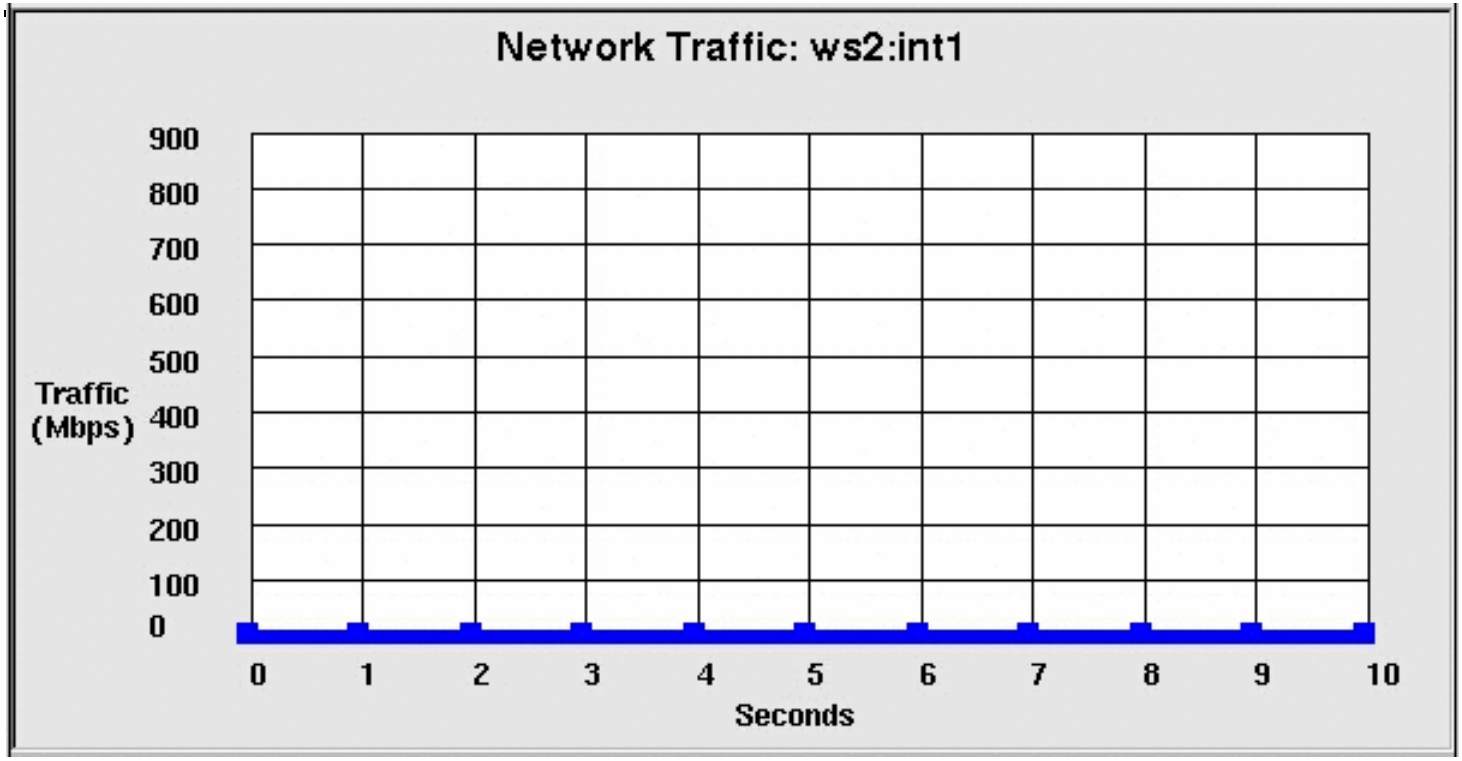
Lightpath Accelerator controls a software virtual cross-connect that commands UCLP.

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



Lightpath Accelerator Operation

This graph shows the traffic each second as a stream is recognized and moved from the LAN (blue) to a lightpath (red).



The End

Thank you.