Remote Access at the CLS

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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
• 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:
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
Login

Username: [ ]
Password: [ ]

Login  Cancel

Complete New User Registration Now
Project: My 4th Project

Name*: My 4th Project

Organization Name: IBM

Start Date: 2006-09-20

End Date: 2006-09-25

Notes: This is my fourth project.
EPICS Connection to Beamline
### Selecting a Scan Region

**Session:** session1  **Sample:** (no sample loaded)

#### Position

<table>
<thead>
<tr>
<th>X</th>
<th>0.0</th>
<th>0.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

#### Camera

<table>
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<tr>
<th>Zoom</th>
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<th>1.0</th>
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</thead>
<tbody>
<tr>
<td>Focus</td>
<td>1.0</td>
<td>1.0</td>
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</tbody>
</table>

#### Scan

<table>
<thead>
<tr>
<th>From</th>
<th>(-88.8, 32.4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To</td>
<td>(96.4, 50.0)</td>
</tr>
<tr>
<td>Expos</td>
<td>0</td>
</tr>
<tr>
<td>Step Size</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>2</td>
</tr>
</tbody>
</table>

15 min. 2 sec
### Experiment Data: ScanPoint_4

<table>
<thead>
<tr>
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<th>ScanPoint_4</th>
</tr>
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<tbody>
<tr>
<td>Type</td>
<td>scanpoint</td>
</tr>
<tr>
<td>Collected Date</td>
<td>2007-04-20 21:52:42:0500</td>
</tr>
</tbody>
</table>

**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
• 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

UI - jscript
rest
Spring MVC

J2EE - SPRING
Web Server
Application Logic
POJOs
Persistence - Spring DB
RDBMS
MS - SQL or MySQL

EPICS → Spring Bridge
Beamline - EPICS
SOAP
Other Services - SOAP, etc.
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
This solution allows any one research workstation, at right, to connect to one of the two beamline computers at the CLS. This solution can be extended to allow multiple connections through each LPA816e Lightpath Director.
Lightpath Accelerator controls a software virtual cross-connect that commands UCLP.

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