

REMOTE ACCESS TO THE CANADIAN LIGHT SOURCE*

E. Matias[#], D. Chabot, D. Maxwell, D. Medrano, Canadian Light Source, University of Saskatchewan, Saskatoon Canada

C. H. Armstrong, IBM Canada, Markham, Canada

M. Fuller, S. McIntyre, University of Western Ontario, London, Canada

Abstract

As part of a collaboration between the CLS, the University of Western Ontario, IBM and BigBangwidth a beamline remote access system has been demonstrated on the CLS VESPERS beamline and the alft x-ray facilities. This system utilizes web-browsers as a thin client that can be connected to servers at the CLS over conventional Ethernet or User Configuration Light Paths. The RBA system is based on the concept of a Service Oriented Architecture and provides access control, data acquisition, data storage and based visualization. More recently the system has been modified to permit experimental data to be streamed into third party analysis tools such as Quartz Imaging X-one. This system is now being extended to form the basis for ScienceStudio and integrated experiment management system.

ARCHITECTURE

The architecture is based on recent development in service oriented architectures. Figure 1 presents a conceptual overview of the system architecture that can be partitioned into the following constituent parts:

- User Interface - Users interact with the system through a web browser that acts as the user agent to the UI services component. The browser communicates with the UI Services either over the Internet or over User Configurable Light Paths (UCLP).
- The UI Services manage the user's interaction with the system. The (web browser) clients interact with the UI services to obtain content, e.g. web pages and XML, and for servicing events from the user.
- The Application Service provides the mechanism to create, retrieve, and modify metadata relating to experiments such as projects, sessions, samples, etc. The metadata assists in organizing and automating, and improving the experiment process and data.
- The Data Base holds all experiment metadata and data. All metadata and data for a given Project or Session is provided to users in the form of a "zip archive" available directly from the User Interface. RBA system metadata, such as configuration data, is held in static xml files within each component. The service bus provides communication between services and components either within the system, or

when integrating with external systems. Internal services are reusable services that other services can leverage such as user authentication and authorization, session management, system logging and database access. Current examples integrated external services are the UCLP reservation service and X-one data analysis package.

- The underlying beamline control system is implemented using EPICS based Input/Out Controllers (IOCs).

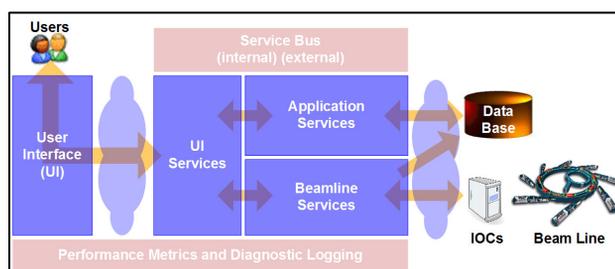


Figure 1: RBA Conceptual Architecture

IMPLEMENTATION ON VESPERS

VESPERS (V_Ery Sensitive Elemental and Structural Probe Employing Radiation from a Synchrotron) is an X-ray microscope beamline that will be in official use at CLS by late 2008. The VESPERS beamline provides x ray fluorescence (XRF), Laue diffraction (XRD), XANES and EXAFS information from the same microscopic spot [1].

The RBA software allowing remote collection and saving of individual XRF spectra from VESPERS has just been successfully tested on a web based link between CLS and the University of Western Ontario (UWO). Latency is not noticeable. Spectra were collected and rapidly downloaded at the UWO terminal.

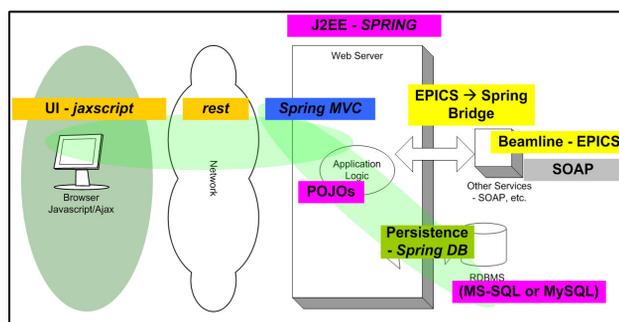


Figure 2: RBA Implementation

* This work was performed by Canadian Light Source, which is supported by NSERC, NRC, CIHR, and the University of Saskatchewan.

[#]elder.matias@lightsource.ca

Figure 3 illustrates the RBA operator interface. The concept of a tree based browser (shown on the left) has been introduced to permit users to effectively navigate between data from different experiments. The sample positioning and definition of region of interest for a scan can be adjusted using the mouse directly on the video display or by chaining the parameters on the right.

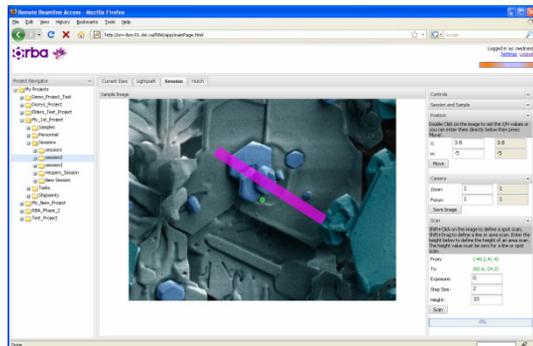


Figure 3: Screen Shot of RBA

USER CONFIGURABLE LIGHT PATHS

On some national research networks UCLP technology [2] is a viable option to permit synchrotron users to establish secure, dedicated, point-to-point connections between their home institution and the synchrotron. These types of connection provide dedicated 1 or 10 Gigabit point-to-point connections. This becomes useful for beamline applications that require multiple channels of streaming video or the transfer of large volumes of data. The second benefit of UCLP technology is that since it is segregated from conventional internet traffic it provides a high level of data security.

The CANARIE network provides UCLP access between universities as part of a wide area network. On nine campuses across Canada Bigbandwidth accelerator switches were installed permitting fibre optic connections from the CANARIE point-of-presence to the researchers desktop computer. Using SOA the Bigbandwidth switches and the CANAIRE wide area network are abstracted out and can be accessed using SOAP. Connections are established either on demand or by monitoring load between UCLP enabled machines and switching from packet to UCLP based on demand.

FUTURE WORK

It is clear that effective remote access requires tight coupling between the synchrotrons user office database,

long term data storage and data analysis capabilities. It is also common for synchrotron users to make use of multiple and diverse experimental facilities as part of a research program. With these goals in mind UWO, CLS, Concordia University and IBM have undertaken a new project called ScienceStudio to integrate the functionality of RBA with these facilities.

The underlying database schema in RBA has now been modified to accommodate user office proposal, beam scheduling, and user training information. Work is ongoing in establishing the business rules associated with this functionality and the user interface.

Instead of directly accessing EPICS process variables it become clear that an object oriented data abstraction layer would provide a better abstraction from the underlying EPICS control system. In Java a generic beamline model has now been developed. Work is now ongoing in integrating this model into RBA.

CLS has for many years used a common scanning library, implemented in C, that is embedded in many of the beamline data acquisition applications. The scanning library is driven by a configuration file that identifies the EPICS process variables to use to control the scan as well as store the experimental data. Work has started on porting the library to Java so that it can be embedded into ScienceStudio.

Current plans are to place RBA and eventually ScienceStudio into full production use as the primary user interface for the VESPERS beamline. Work is ongoing in extending the system to also perform a similar function for the protein crystallography beamlines at the CLS.

REFERENCES

- [1] R. Feng, A Gerson, G.E. Ice, R. Reiningger, B. Yates and N.S. McIntyre, VESPERS-A Beamline for Combined XRF and XRD Measurements, AIP Conference Proceedings, 879, 872-874 (2007).
- [2] User-managed end-to-end lightpath provisioning over CA*net4 by J. Wu, S. Campbell, J. M. Savoie, H. Zhang, G. v. Bochmann and B. St.Arnaud; proceedings of the National Fiber Optic Engineers Conference (NFOEC), Orlando, FL, USA, Sept 7-11, 2003, pp. 275-282.