DMQ4: Instruments & Sensors for online remote access

1. Objective

The objective of DMQ4 is to provide online, remote access to pilot working instruments and sensors. According to the architecture of Dart, DMQ4 works between the Readers layer and the Data Source Layer, which likes a bridge between the users and the resource data. Note that the data DMQ4 interested are just the raw data in high speed storage, not including the analysed data in tiered storage.

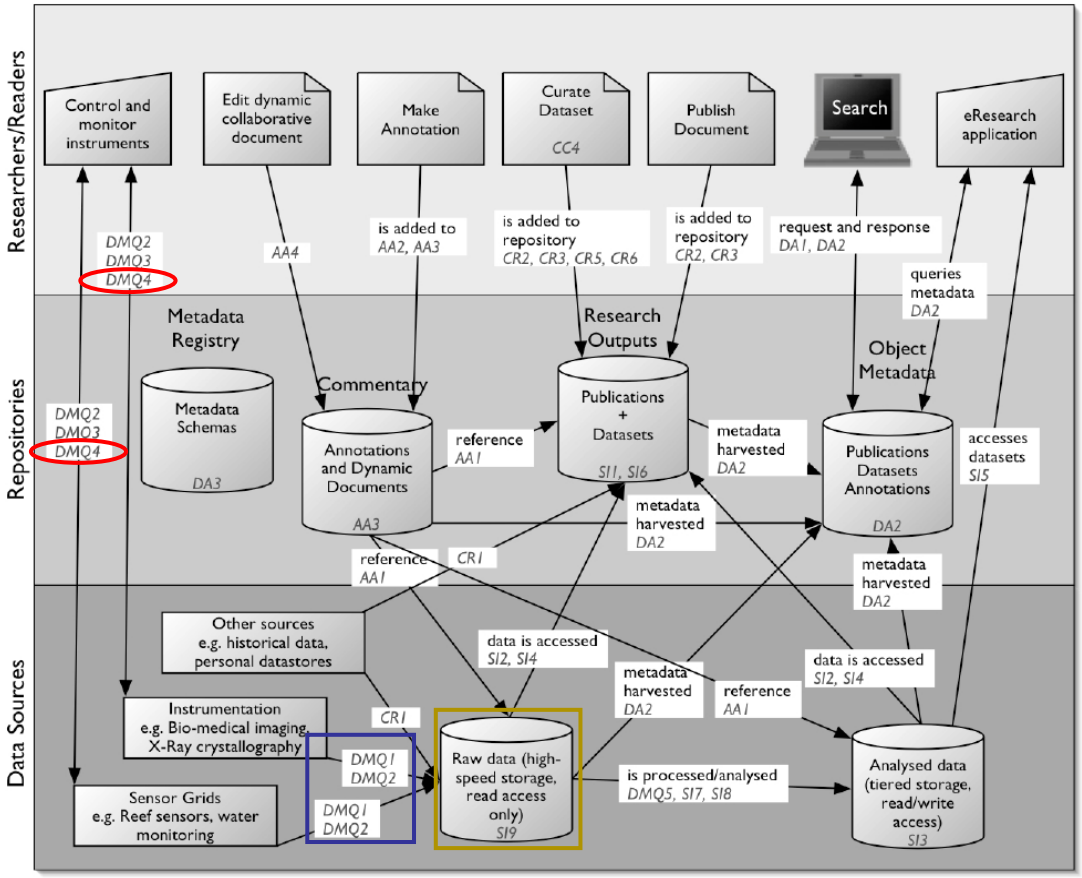

Figure 1: Dart High-Level Architecture

To implement the objective of DMQ4, we deploy the objective toward two directions.

- **Part 1**: Developing visualization tools for past data collected from instruments and sensors.
  The goal is to provide the users a friendly and powerful interface to dynamic request past data in a particular period or satisfying some special constraints. This part work is expected to deliverable in the life-time of Dart.

- **Part 2**: Data processing and data mining for living data streams generated from instruments and sensors.
  The goal is to monitor and analyse especially interesting or emergent data from extensive data streams on-the-fly. Complex software engineering is necessary in order to put in place the real-time manipulation of data streams. To deliver a production service from this part work is likely to take more than 2 years for a basic level of production service with support for tele-presence and virtual laboratory frameworks.

2. Interface with Other Packages

DMQ4 accesses the data received from sensors/instruments. Data in Part1 are past, static data which may be stored in SI9; while data in Part2 are on-line, dynamic data which need to be visited directly from DMQ1 and DMQ2. Thus, DMQ4 has interfaces with the following three packages (and their objectives):

- **DMQ1**: Connect instruments and sensors effectively to the network
- **DMQ2:** Ensure effective and reliable connection of selected instruments and sensors to SRB via CIMA middleware, and efficient use via changed work practices.
- **SI9:** Scope and pilot storage infrastructure requirements

3. Techniques and Software Involved in

To implement the objective of DMQ4, many techniques and softwares are involved in.

3.1 Techniques for Interfaces

Among them, CIMA and SRB are two important techniques need to be surveyed and studied to complete the interface with other packages.

- **CIMA**: Common Instrument Middleware Architecture
  CIMA is designed and developed by Indiana University. This work also achieves the support of the National Middleware Initiative (US). CIMA is a framework for making instruments and sensors network accessible in a standard-based, uniform way, and for interacting remotely with instruments and the data they produce. CIMA is currently implemented in beta testing mode in a Crystallography application at the Indiana University Molecular Structure Center with applications to other instruments and sensors in development. JCU also have finished a large part of installation of CIMA.
  http://www.instrumentmiddleware.org/metadot/index.pl?iid=2119&isa=Category

- **SRB**: Storage Resource Broker
  SRB is developed at the San Diego Supercomputing Center (SDSC), US. SRB is a Data Grid Management System (DGMS) or simply a logical distributed file system based on a client-server architecture which presents the user with a single global logical namespace or file hierarchy. SRB, in conjunction with MCAT, provides a means for accessing data objects and resources through

querying their attributes instead of knowing their physical names and/or locations. SRB was funded through a series of research/development proposals and have had several versions.
http://www.sdsc.edu/srb/

3.2 Techniques for Developing Visualization Tools

To developing friendly and powerful visualization tools for the users, many last techniques will be adopted in our work. In the following, we list the main techniques:

- **SMIL:** The Synchronized Multimedia Integration Language
  The Synchronized Multimedia (SYMM) Working Group of W3C designed the SMIL for choreographing multimedia presentations where audio, video, text and graphics are combined in real time. SMIL is a W3C Recommendation that enables authors to specify and control the precise time a sentence is spoken and make it coincide with the display of a given image. Till now, SMIL 1.0 and SMIL 2.0 had been completed; SMIL 2.1 is currently in producing.
  http://www.w3.org/AudioVideo/

- **SVG**: Scalable Vector Graphics
  SVG provides a way of using the particular grammar imposed by XML to draw two-dimensional graphics, animate them, make them responsive to external events, generate new SVG on-the-fly, and interact with other languages and environments. SVG 1.1 is a W3C Recommendation and forms the core of the current SVG developments. SVG 1.2 is the specification currently being developed as is available in the draft form.
  http://www.w3.org/Graphics/SVG/

- **DHTML**: Dynamic HTML
  DHTML is a set of innovative features proposed by Microsoft. DHTML documents are self-contained, using styles and a little script to process user input and directly manipulate the HTML tags, attributes, styles, and text in the HTML document. Thus, DHTML document can provide outstanding interactive ability and improve server performance by reducing requests to the server and, subsequently, server load.
  http://msdn.microsoft.com/library/default.asp?url=/workshop/author/behaviors/reference/time2/htime_node_entry.asp

- **HTML+TIME**: Timed Interactive Multimedia Extensions for HTML
  HTML+TIME was first released in Microsoft Internet Explorer 5. Its documents have been submitted to W3C for comment by W3C members. HTML+TIME adds timing and media synchronization support to HTML pages. Using a few XML-based elements and attributes, HTML+TIME enable the authors to add images, video, and sounds to an HTML page and to synchronize them with HTML text elements over a specified amount of time. HTML+TIME 2.0 is based on the HTML+SMIL language profile in the SMIL 2.0.
  http://msdn.microsoft.com/library/default.asp?url=/workshop/author/behaviors/reference/time2/htime_node_entry.asp

3.3 Techniques for Data Processing and Data Mining for Living Data Streams

To fulfil data processing and data mining for living data streams created from sensors and instruments, three main research fields need to be literature reviewed – Grid DB, Sensor Network and Data stream. (We will rich this part in the future).