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Japanese Virtual Observatory (JVO) : implementation of VO standard protocols

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Abstract

We developed the third prototype toward a Japanese Virtual Observatory (JVO). IVOA standards, such as Simple Image Access and ADQL, were adopted to the system for the first time. We also constructed an OAI-PMH publishing registry, a web service based searchable registry, and VO data services based on SIA and SkyNode protocols. Most of the components were build by using open software, except for an XML database used for searchable registry.

We present features of the JVO proto 3 system and results of a performance measurement.

1. Data Service

We are developing a **SkyNode toolkit** for building a VO compliant data service. First primitive version was released this May, and **the second release is expected in this October**. Fig.1 shows its architecture of JVO Skynode. The toolkit mainly provides a part of "SkyNode controller" where ADQL is converted to the DB native SQL, and the result is returned in the VOTable format.

Data resources currently available from JVO are: (1) Subaru Deep field survey catalogs and images, (2) Subaru SuprimeCam Open Data Archive, (3) QSO catalog compiled by Veron et al. and copied from VizieR, (4) SDSS DR2. Etc...

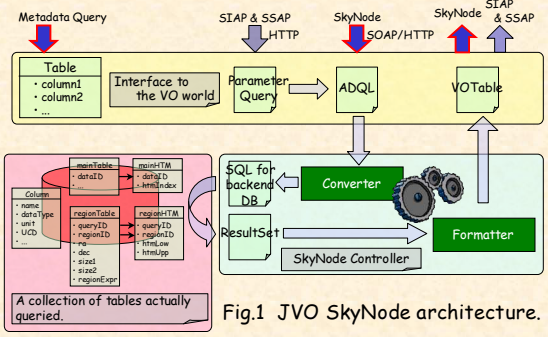
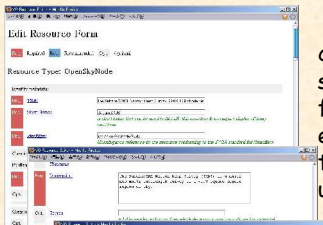


Fig.1 JVO SkyNode architecture.

2. Registry Service

We have constructed a publishing registry and a searchable registry. The publishing registry was made by using a NVO software, and which was slightly modified to adapt the recent VOResource schema. Metadata of data resources are registered through the web form Interface, and these data are distributed by the OAI-PMH protocol to the VO. Searchable registry collects metadata from the publishing registry not only of JVO but also of the other VO projects. A native XML DB, Karearea® (SEC), is used for managing the collected metadata.



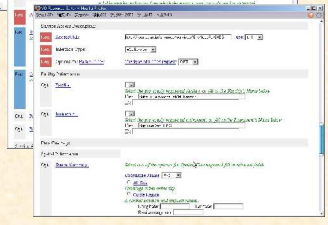


Fig.2 Publishing Registry

Our searchable registry also collects table matadata from skynodes. These data are used for resolving the service endpoint URL from the SQL table name, and for assisting a user to make a query.

The implemented WS interfaces enables a keyword-based search and an identifier-based search. ADQL search interface is under preparation.

Fig.3 Searchable Registry

3. VO Portal Service

A VO Portal service provides a seamless access to the distributed astronomical databases. JVO portal accepts JVO query language (JVOQL) which has similar syntax with the VO standard. JVOQL can describe a cross match query not only for the catalog services but also for image and spectrum services. As an example, JVOQL shown in a snap shot image of the right figure describes a query to X-ray, IR, and optical catalog services and an optical image service. JVOQL is divided into queries for each data service.

Each query is translated to VO standard query formats, ADQL, SIAP and SSAP, according to the service type.

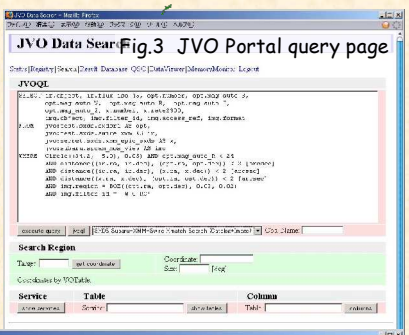


Fig.3 JVO Portal query page

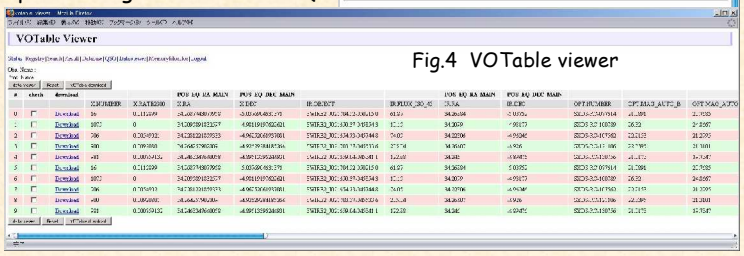


Fig.4 VOTable viewer

Fig.5 Image viewer

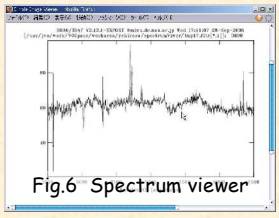


Fig.6 Spectrum viewer

4. Performance test

Performance are measured to construct robust and reliable data services. Especially a memory usage is the most critical one to deal with a huge number of accesses, and it was expected that, in our AXIS implementation, a lot of memory are used for XML to Java object deserialization. We noticed that proto3 is consuming a lot of memory and they are not freed. This is now fixed by making a constraint on the memory usage of each user and an active GC.

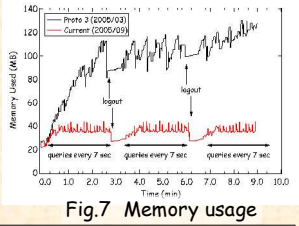


Fig.7 Memory usage

5. Science use case

We applied this VO system to the study of environment of QSOs by combing the QSO catalog data service and Subaru image data service. Since we don't have a reduced data archive yet, raw data of pre-selected five fields are retrieved from the SMOKA and MASTARS service operated by NAOJ, and they are reduced with a standard analysis tool and registered as a skynode database. The fields are selected through cross-matching between QSO database and SuprimeCam frame database. A workflow for this study is as follows:

1. Select QSO coordinates from the QSO database
2. Search multi-bands imaging data which covers the QSO regions
3. Create a catalog from the imaging data by invoking a SExtractor Web service.
4. Estimate the objects' photoZ around the QSO
5. Clustering Analysis

We succeeded to federate the catalog and image data service. By incorporating the workflow system that is under development, all the procedure will be done in an automatic way.

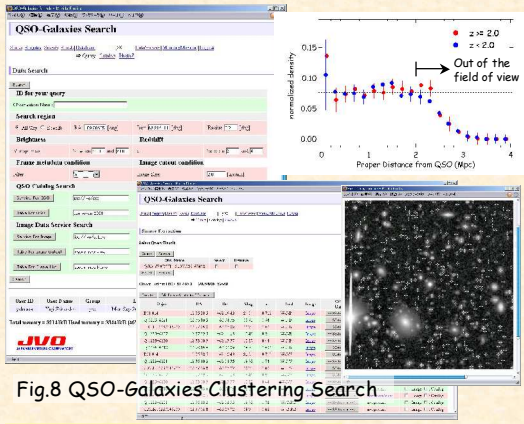


Fig.8 QSO-Galaxies Clustering Search

6. Future Plan

We are now developing an operational system aiming at an alpha version release in the end of this physical year (~2006/3). More user friendly interface for query and data visualization will be provided in this version. We will start a data service of Subaru SuprimeCam reduced image from 2006/4.