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Development of Federated Database System in Astronomy (Virtual Observatory)

～Demonstration of Science Use Cases ～

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http://jvo.nao.ac.jp/

The virtual observatory (VO) is designed to provide astronomers with seamless access to astronomical DBs distributed all over the world. It is considered to be an indispensable system for the modern astronomy that produces huge amount of data day by day, therefore development of and collaboration on VOs have been advanced in leading countries of the world. We are developing Japanese VO (JVO), and we have already succeeded to interconnect with some other VOs since 2004. In the last year, we improved its performance of the JVO system, and upgraded the system toward future open use. Especially, we have implemented a workflow system to invoke data retrieval and analysis services. The workflow description language is described based on the BPEL4WS. In this conference, we will demonstrate the JVO portal system, and will perform some astronomical science use cases by executing the workflows and accessing to the astronomical DBs in the world. The basic concept and the structure of the VO system may be applied to other fields of science.

Present Situation of Astronomical Data

Too hard to collect and analyze whole data.

Need Cat's help!

Modern astronomy produces huge amount of data day by day

Astronomical data are distributed all over the world

Nobeyama ~ 1TB/year Subaru ~ 20TB/year ALMA ~ 1PB/year

VO makes the digital universe in computers by using the database technologies and through which we observe the universe.

Virtual Observatory

Even for educational use.

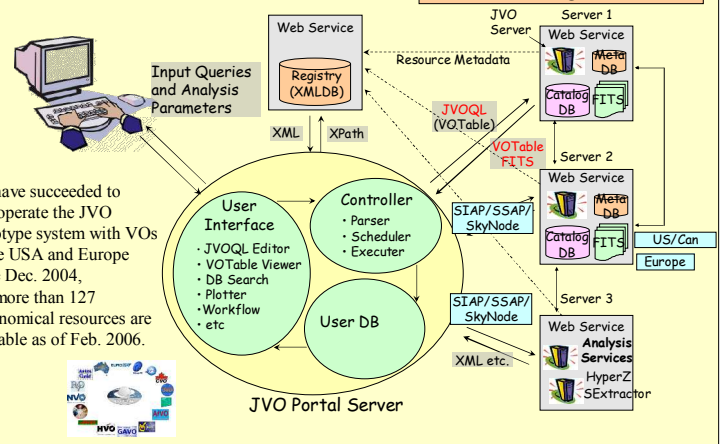
Accelerate astronomical research, and sufficient time for research itself !

Accessible from anywhere at any time.

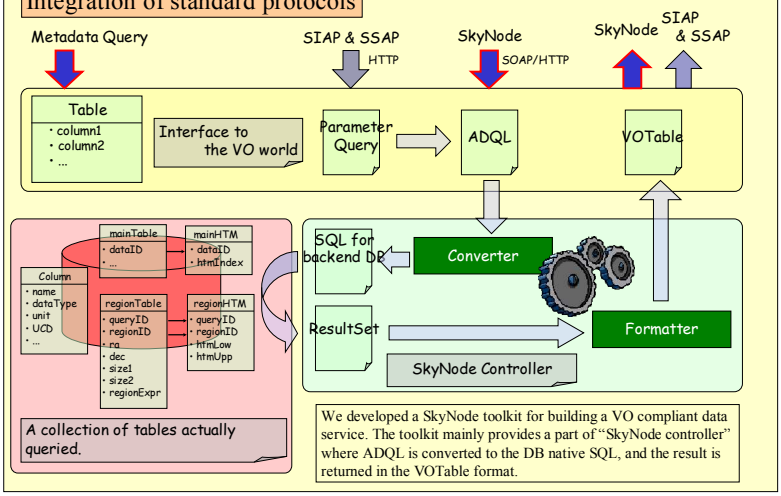
Architecture of JVO portal server

We have succeeded to interoperate the JVO prototype system with VOs in the USA and Europe since Dec. 2004, and more than 127 astronomical resources are available as of Feb. 2006.

Schematic diagram of JVO



Integration of standard protocols



We developed a SkyNode toolkit for building a VO compliant data service. 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.

The Implementation of Workflow

c.f., 4A-o5 Kawanomoto et al.

Defect of VO of previous versions

- Can not treat complex analysis flow
  - No loop operation, no conditional expression
- Human hands should be needed.
  - Can not run task automatically.

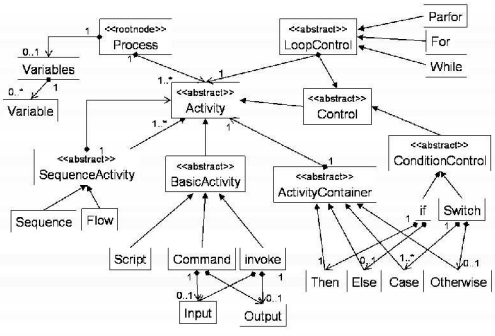
Workflow description language is required urgently.

Design of Workflow

The following items were taken into account

- Described in XML.
- Users can construct a workflow by editing Templates, or writing workflow from scratch.
- Available services are found from VOResource.
- Usage of a service is also found from VOResource.
- Service Provider can register their services easily.

Schema Diagram of Workflow Description Language



XML Schema diagram of JVO Workflow Language

To achieve our requirement, we are designing a workflow language in XML. Its schema is based on other workflow systems such as BPEL4WS.

This language is capable of :

- Variable definition (variable)
- Controls (Loop, Condition)
- Parallel execution
- Invoke external services
- Invoke built-in Java Classes

1. Workflow engine converts XML-based workflow into groovy script.
2. The portal server of JVO runs generated groovy script

The originality of research is required of researcher by construction of workflow.

Science Use Case