O7.9 Development of Japanese Virtual Observatory (JVO): Experience on Interoperation with other Virtual Observatories and its Future Plan

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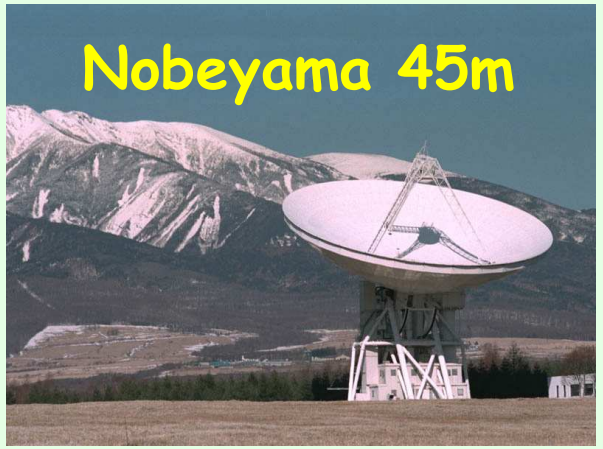
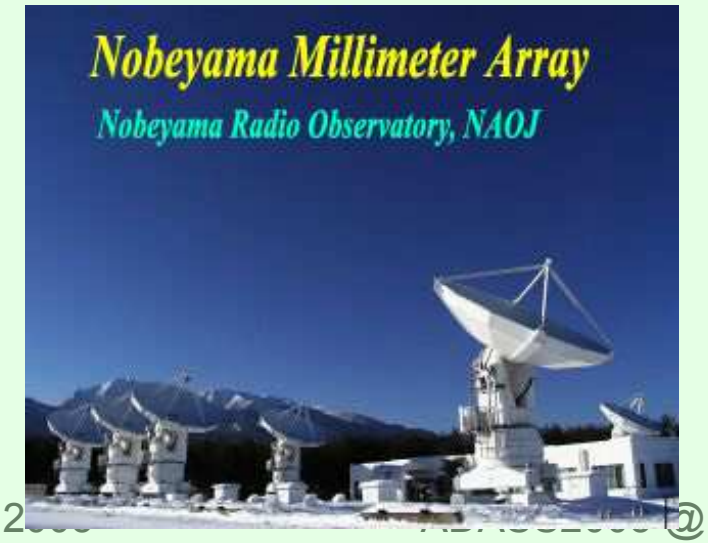
Data Resources in NAOJ

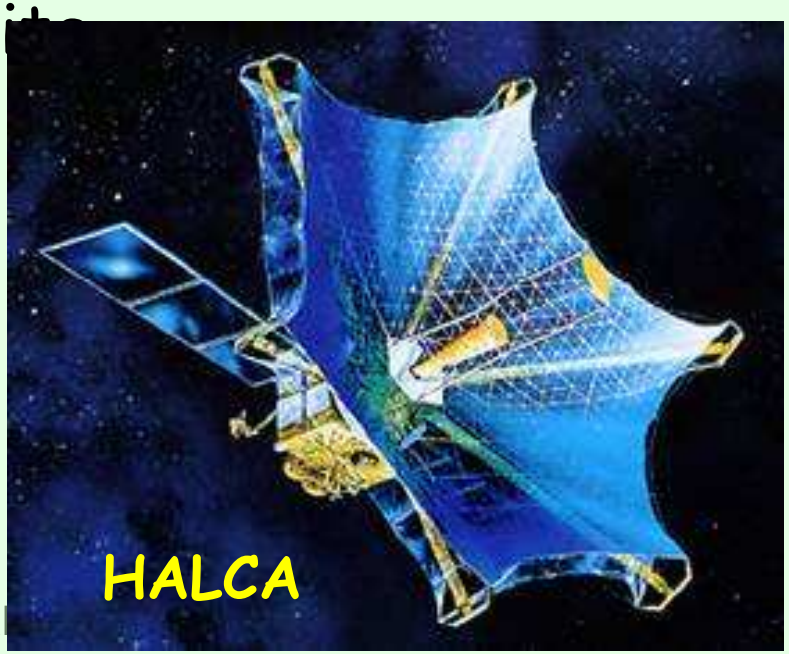
- Subaru 8.2m Optical-Infrared Telescope
- Kiso 105cm Schmidt Camera
- Okayama 188cm Optical Telescope
- Nobeyama 45m Radio Telescope
- Nobeyama Millimeter Array
- Nobeyama Radioheliograph
- VSOP
- VERA
- *ALMA*





Data Resources in JAXA/ISAS

- *ASCA* X-ray astronomy satellite
- *YOHKO* solar physics satellite
- *Ginga* X-ray astronomy satellite
- *HALCA* VLBI satellite
- *Geotail* geomagnetosphere satellite
- *Akebono* aurora observation satelli
- *ASTRO-F* *Infrared satellite*
- *ASTRO-E2* X
- *SOLAR-B*

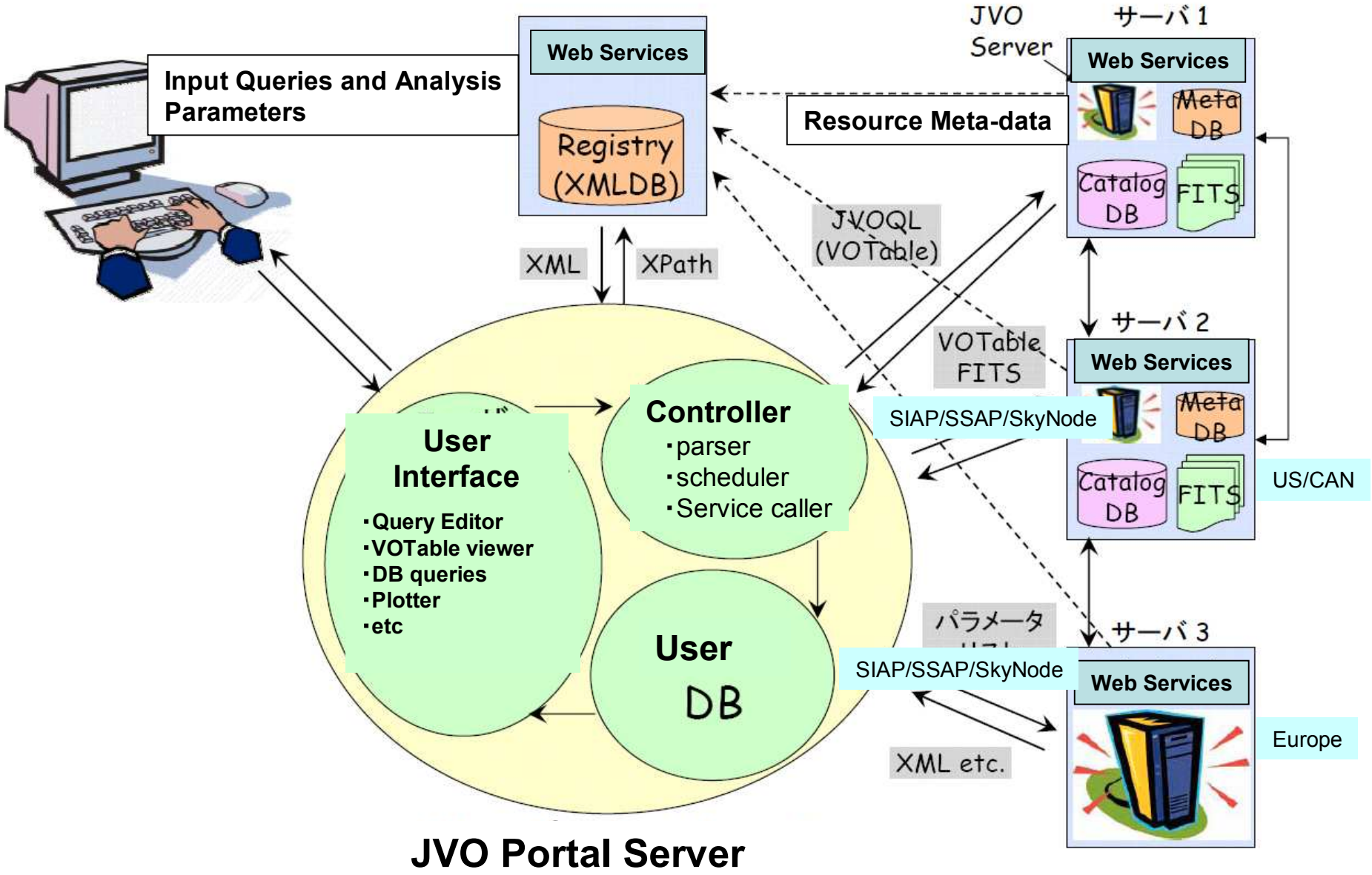


VO Projects in the world

- 17 countries and a region
- International Virtual Observatory Alliance (IVOA) Standards to interoperate VOs
- Japan – Language to access federated DB

http://www.ivoa.net/

Schematic diagram of JVO



Integration of standard protocols

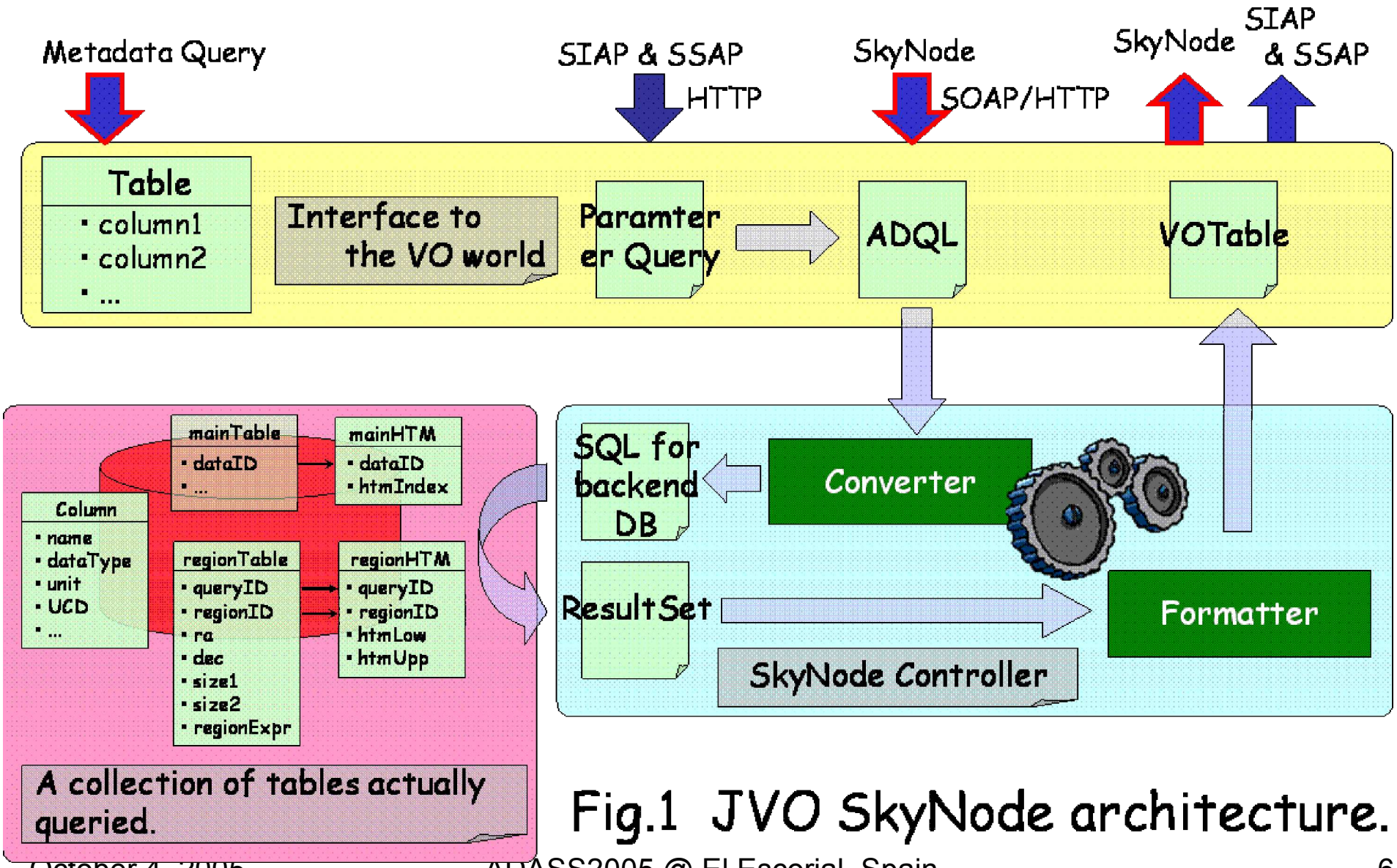
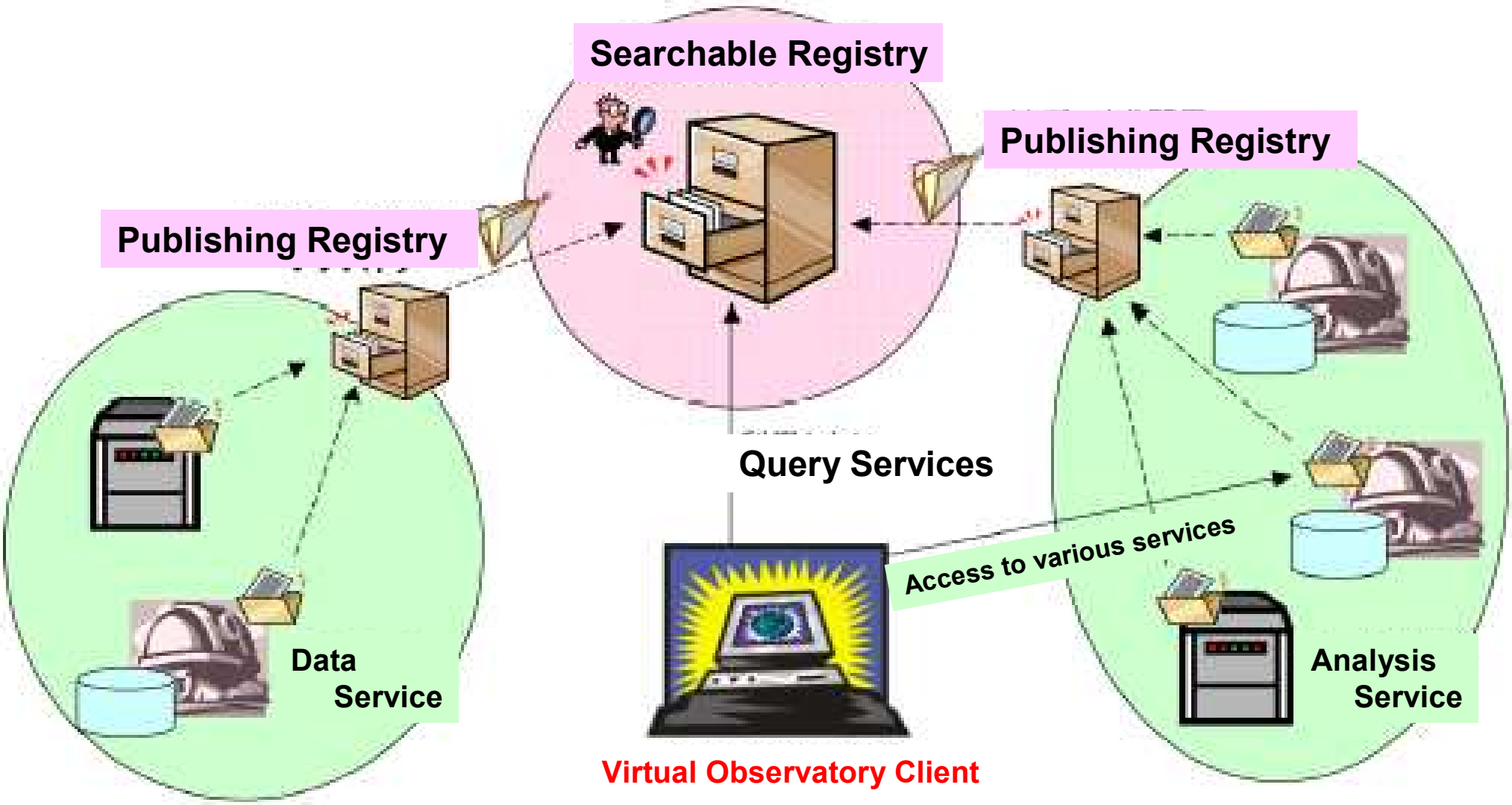
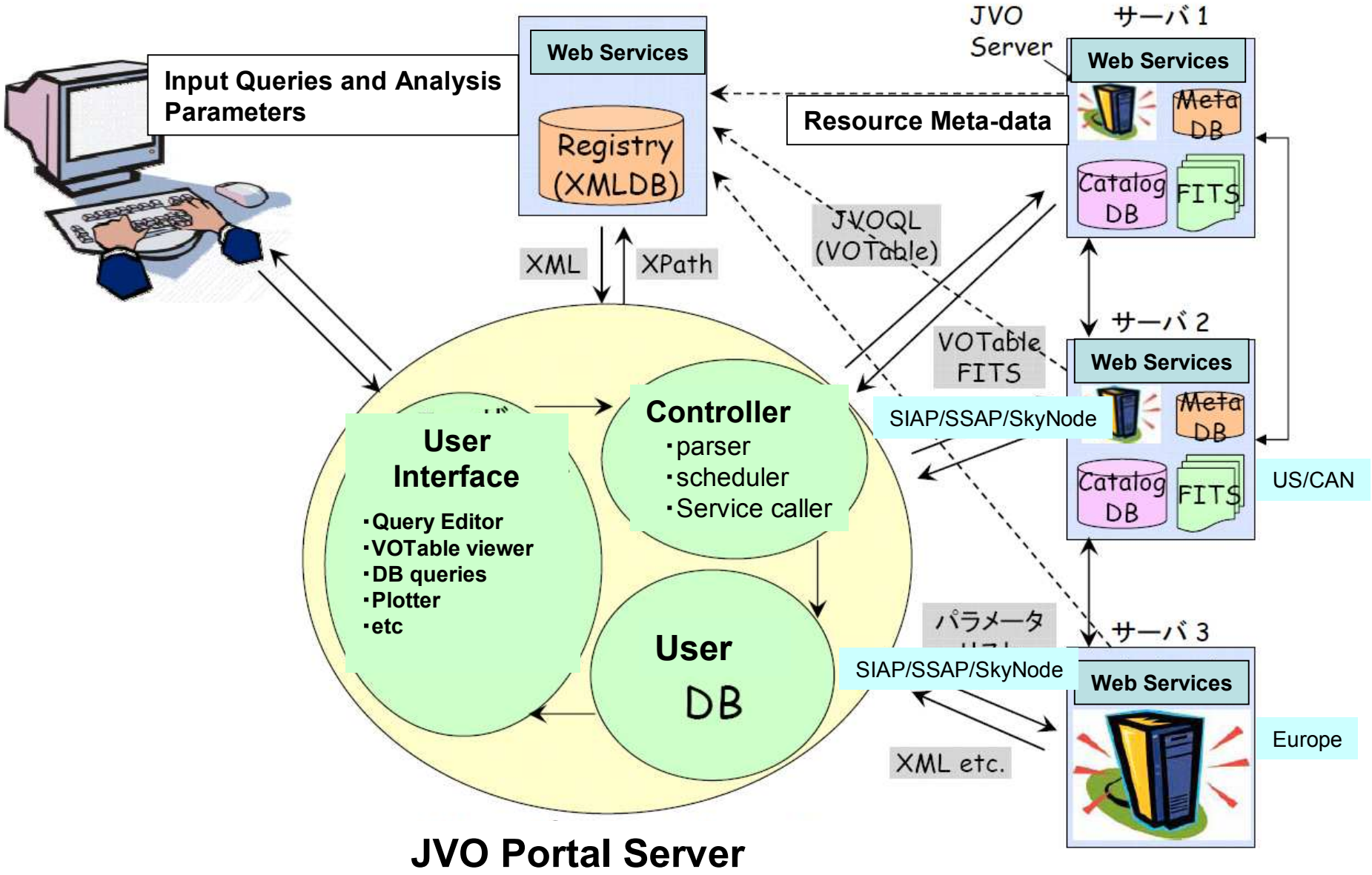


Fig.1 JVO SkyNode architecture.

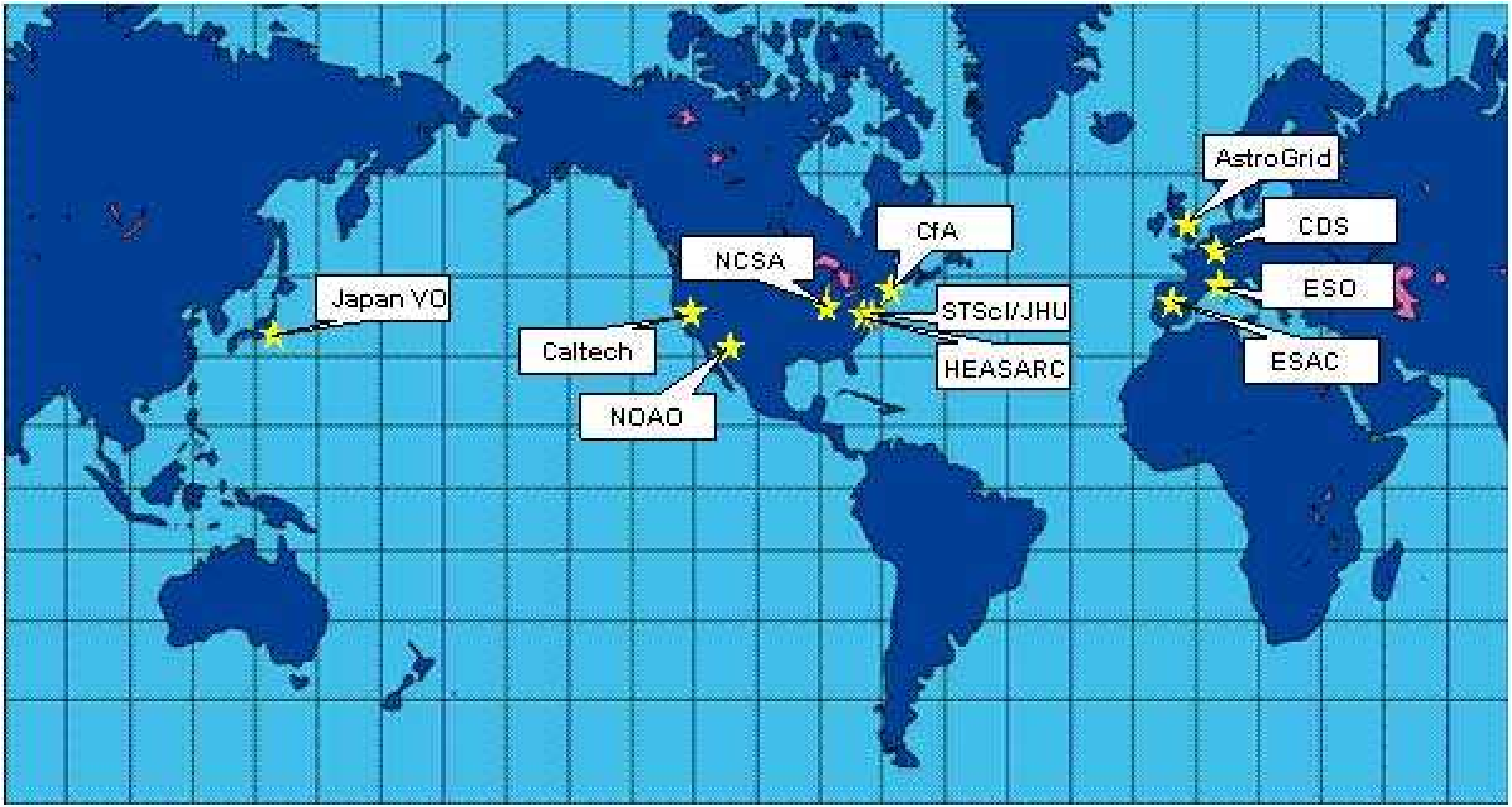
Exchange of Meta Data:OAI-PMH



Schematic diagram of JVO



Interconnected VOs in the World



Successful Interoperations

- Accesses from / to other VOs in Europe and US have been available since Dec 2004
- Publishing & Searchable Registries
- 117 resources are accessible as of today

70	○	More Info	HyperLeda FITS Archive Simple Spectrum Data Access	SIAP	URL	
71	○	More Info	Sloan Digital Sky Survey DR3- Filter z	SIAP	URL	
72	○	More Info	Sloan Digital Sky Survey DR3- Filter g	SIAP	URL	
73	○	More Info	Sloan Digital Sky Survey DR3- Filter i	SIAP	URL	
74	○	More Info	2MASS All-Sky Quicklook Image Service	SIAP	URL	
75	○	More Info	INES: The IUE Newly Extracted Spectra	SIAP	URL	
76	○	More Info	ASCA SIA Service	SIAP	URL	
77	○	More Info	MAST Image Scrapbook	SIAP	URL	
78	○	More Info	JVO Publishing Registry	Registry	URL	
79	○	More Info	NCSA Radio Astronomy Imaging Registry	Registry	URL	
80	○	More Info	Minnesota Automated Plate Scanner	Registry	URL	
81	○	More Info	CADC Registry	Registry	URL	
82	○	More Info	Astrogrid Full Registry	Registry	URL	

Elapsed time to querying US VOs

wavelength	Survey name	server	time (sec)
X-ray	Chandra	cda.harvard.edu	1.715
Infrared	2MASS	mercury.cacr.caltech.edu	3.536
Radio	VLA	adil.ncsa.uiuc.edu	7.115

Best Records -- Some servers may be overloaded from time to time

JVO is seen from the UK VO

AstroGrid Registry — AstroGrid

Server
- Home
- Admin

Investigate
- IVORN Lookup
- Browse
- Query
- Keyword Query

Register
- Enter Resource

Registry Browser

Version: 0.9

Find IVORNs including: jvo [List]

Browse for another version 0.9 [List]

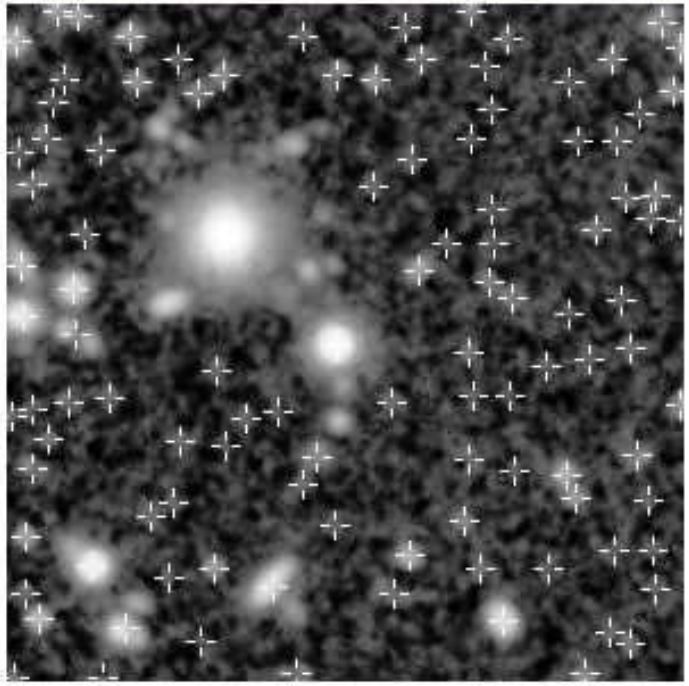
Title	Type	AuthorityID	ResourceKey	Up
JVO Publishing Registry	vg:Registry	o	publishingregistry	200 16
JVO Publishing Registry	vg:Registry	jvo	publishingregistry	200 21
the Subaru/XMM-Newton Deep Survey (SXDS) SkyNode Service	sn:OpenSkyNode	jvo/skynode	sxds	200 20
Subaru/XMM-Newton Deep Survey 01	jsn:OpenSkyNodeJ	jvo/skynodej	sxds	200 20
JVO	vr:Organisation	jvo	jvo	200 18
the Subaru/XMM-Newton Deep Survey (SXDS) SIA Service	sia:SimpleImageAccess	jvo/siap	sxds	200 20
JVO Authority	vg:Authority	jvo	null?!	200 21

QSO searches

Image Viewer

Status | Registry | Search | Result | Database | QSO Search | Image Viewer | Logout

Name	Origin	Scale	Contrast
fits0	http://gridq.dc.nao.a	hist	min = 0.0 max = 65529.0 auto = true



Scale : hist eq.

Contrast : auto
min = 0.0
max = 65529.0

Submit

VOTable : votable0

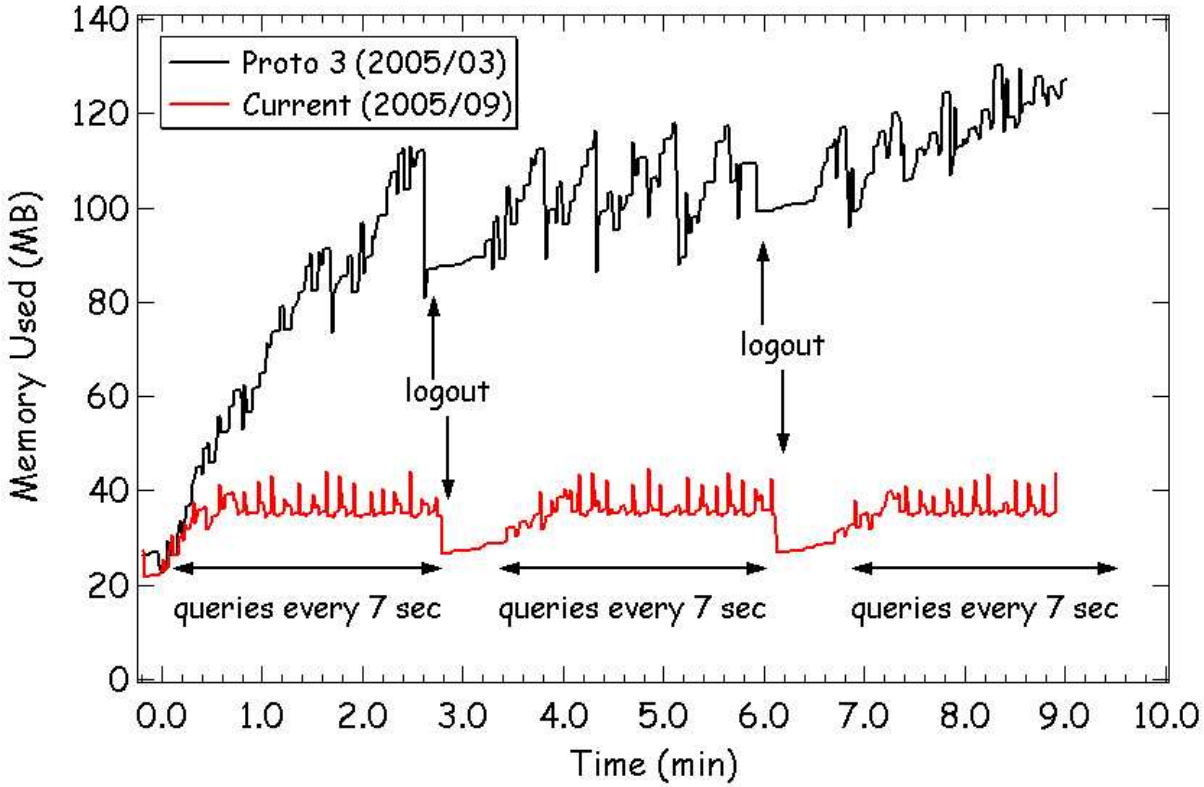
Overplot

User ID	User Name	Group	Last Login
ohishi	Masatoshi Ohishi	jvo	Tue Mar 29 20:13:07 JST 2005

Total memory = 266403kB Used memory = 162745kB (61%)

Such results can be obtained only in a few minutes

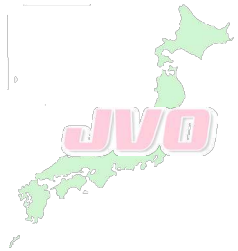
Performance Improvement



- Memory consumption was too large.
- AXIS implementation
- Introduced memory garbage →stable operation

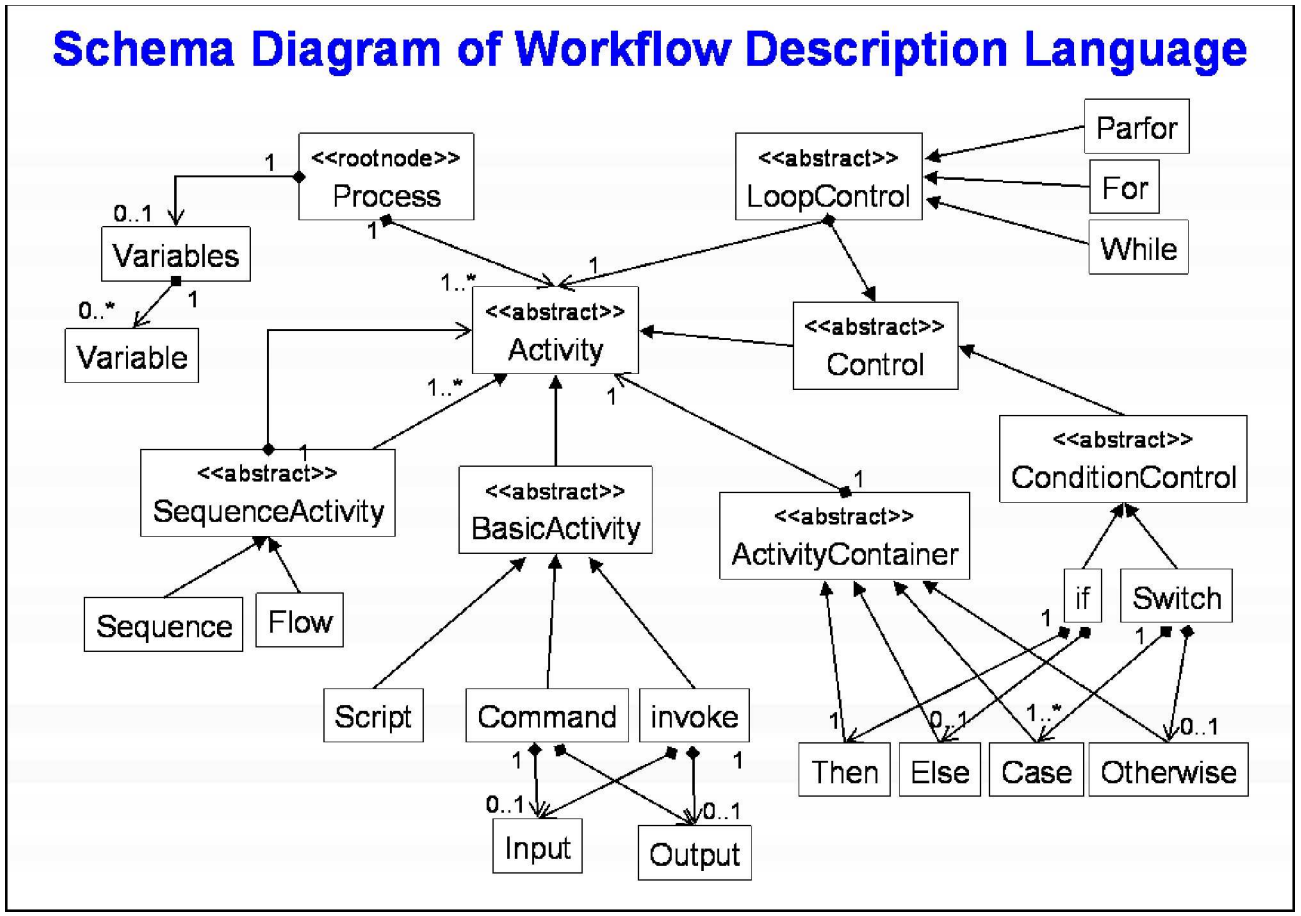
Visit P.105 : Shirasaki et al. for details

Future Prospects



- Started to design / implement operational system
  - More User-friendly interfaces
  - Add analysis engines by Java-wrapping
  - Single-Sign-on, authentication by Grid tool
  - Download to / Upload from user machines
  - Science corresponding to use cases !!
  - Design workflows
- Experimental operation – March 2006 (hopefully)
- Technologies sharing in AP region (East Asia)

Workflow Description Language

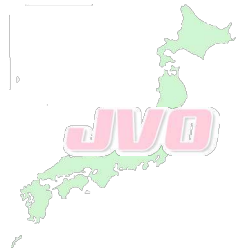


Visit P.107 : Tanaka et al. for details

Based on BPEL4WS

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

JVO collaborators



Project Scientists

NAOJ

- Mizumoto
- Oe
- Shirasaki
- Tanaka
- Honda
- Kawanomoto

ICRR

- Yasuda

Ochanomizu U.

- Masunaga

System Engineers

Fujitsu Ltd.

- Monzen
- Kawarai
- Ishihara
- Tsutsumi

SEC Ltd.

- Morita
- Nakamoto
- Kobayashi
- Yoshida

Supporter

NII

- Miura

Acknowledgement

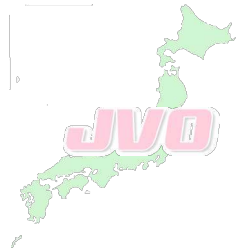
- Core-to-Core Program of the JSPS
- Grant-in-Aid by the MEXT
- NAOJ
  - funding, personnel, etc.

Reference URLs

JVO – http://jvo.nao.ac.jp/index-e.html

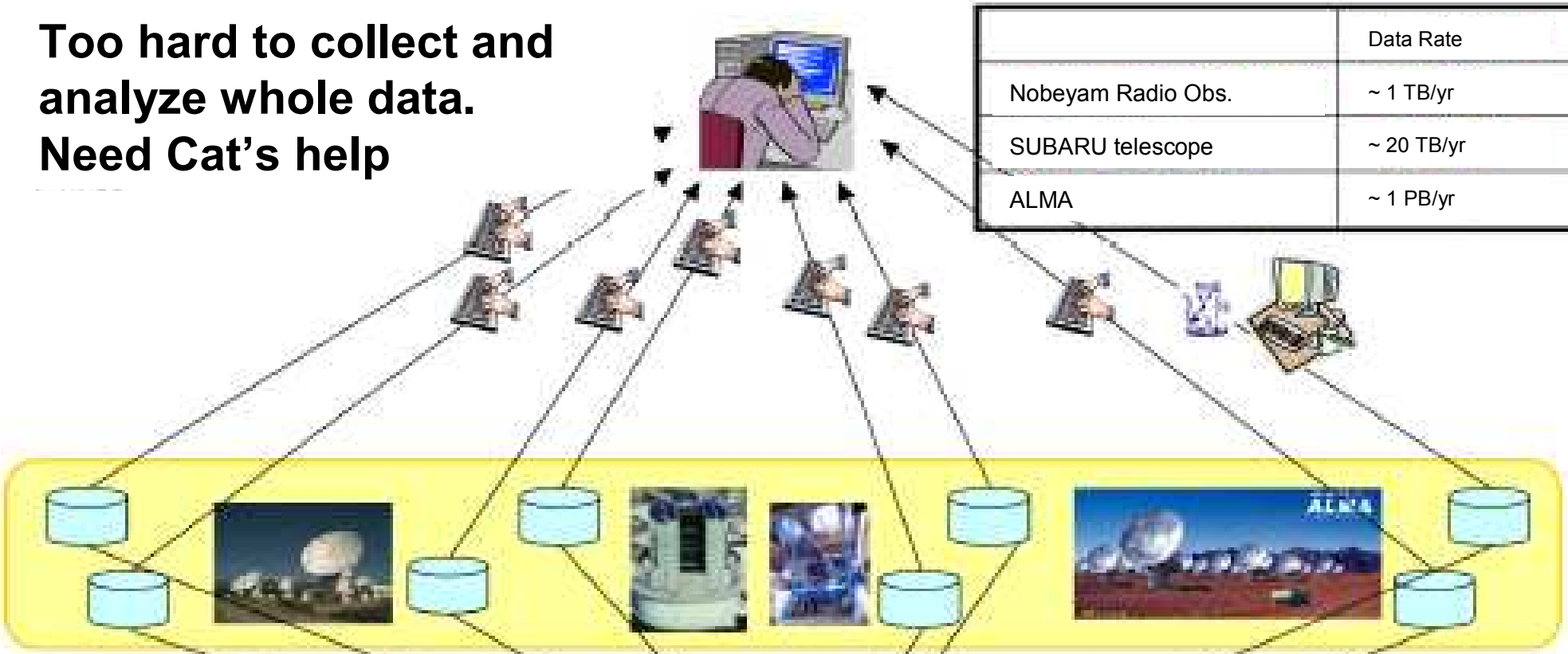
IVOA – http://www.ivoa.net/

there are links to other VO projects in the world


JVO

Too hard to collect and analyze whole data. Need Cat's help

	Data Rate
Nobeyam Radio Obs.	~ 1 TB/yr
SUBARU telescope	~ 20 TB/yr
ALMA	~ 1 PB/yr



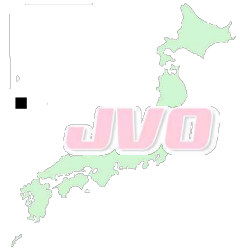
Accelerate astronomical research, and sufficient time for research itself !!

Virtual Observatory

Even for educational use

Accessible from anywhere at any time

What is the Virtual Observatory… and what it is not…



The VO is:

- A set of international standards to share complex data
- A modular set of tools to work with distributed data
- A simple environment to publish data to
- An essential part of the research astronomer's toolkit
- A catalyst for world-wide access to astronomical archives
- A vehicle for education and public outreach

The VO is not:

- A replacement for building new telescopes and instruments
- A centralized repository for data
- A data quality enforcement organization

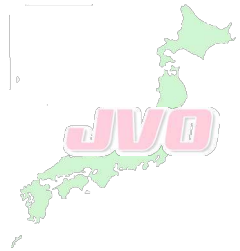
Standardization in IVOA

- Query language to distributed DBs (VOQL)
- Meta-data : contents, protocol to interchange
  based on OAI-PMH
- Protocols to retrieve images, spectra, and so on
  SkyNode, SIAP, SSAP, STC, etc.
- Unified attribute names in DBs
  UCD (Unified Contents Descriptions)
- Output Format : VOTable (XML)
  incorporates FITS
- etc

International Endorsements

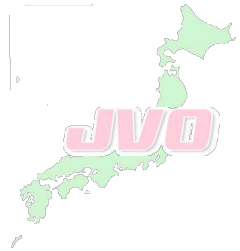
- IAU XXVth GA Res. (2003 Jul.)
- OECD Rec. (‘04 Aug)
  - place archives that may be accessible via internet
  - provide adequate funding as long-term issues

DBs available under JVO



- Subaru SupCAM (partial)
- SXDS
- SMOKA (catalog)
- SDSS – images/spectra
- 2MASS
- JAXA/ISAS – ASCA
  - More to come

Analysis Tools



- Sextractor – extract source parameters
  generate personal catalogs
- HyperZ – derive photometric Z
- Aladin – Image viewer
- VOPlot – Plot VOTables
- SpecView – Spectral Energy Distribution
  generator
- More to be added
  - Legacy softwares, Data mining, personal DBs, etc.