Building the International Virtual Observatory Alliance (IVOA)

Programmatic Challenges

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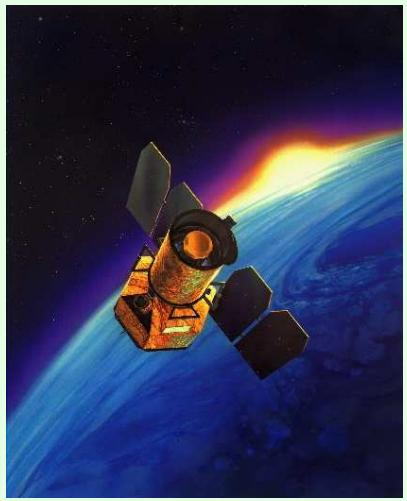
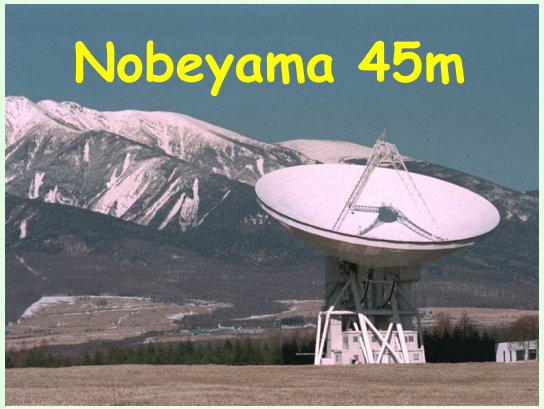
Data Resources in the World

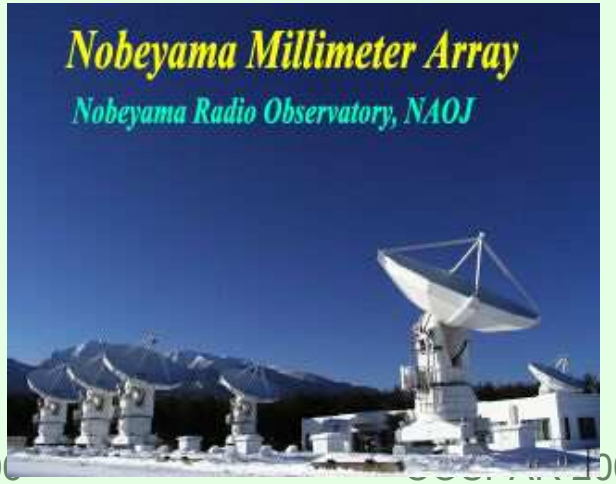
- ESO VLT @ Paranal
- ESO telescopes @ La Silla
- Telescopes in Mauna Kea
  Subaru, Keck, JCMT, CSO, SMA,,,
- Telescopes on board satellites
  HST, GALEX,,,,



Data Resources in NAOJ

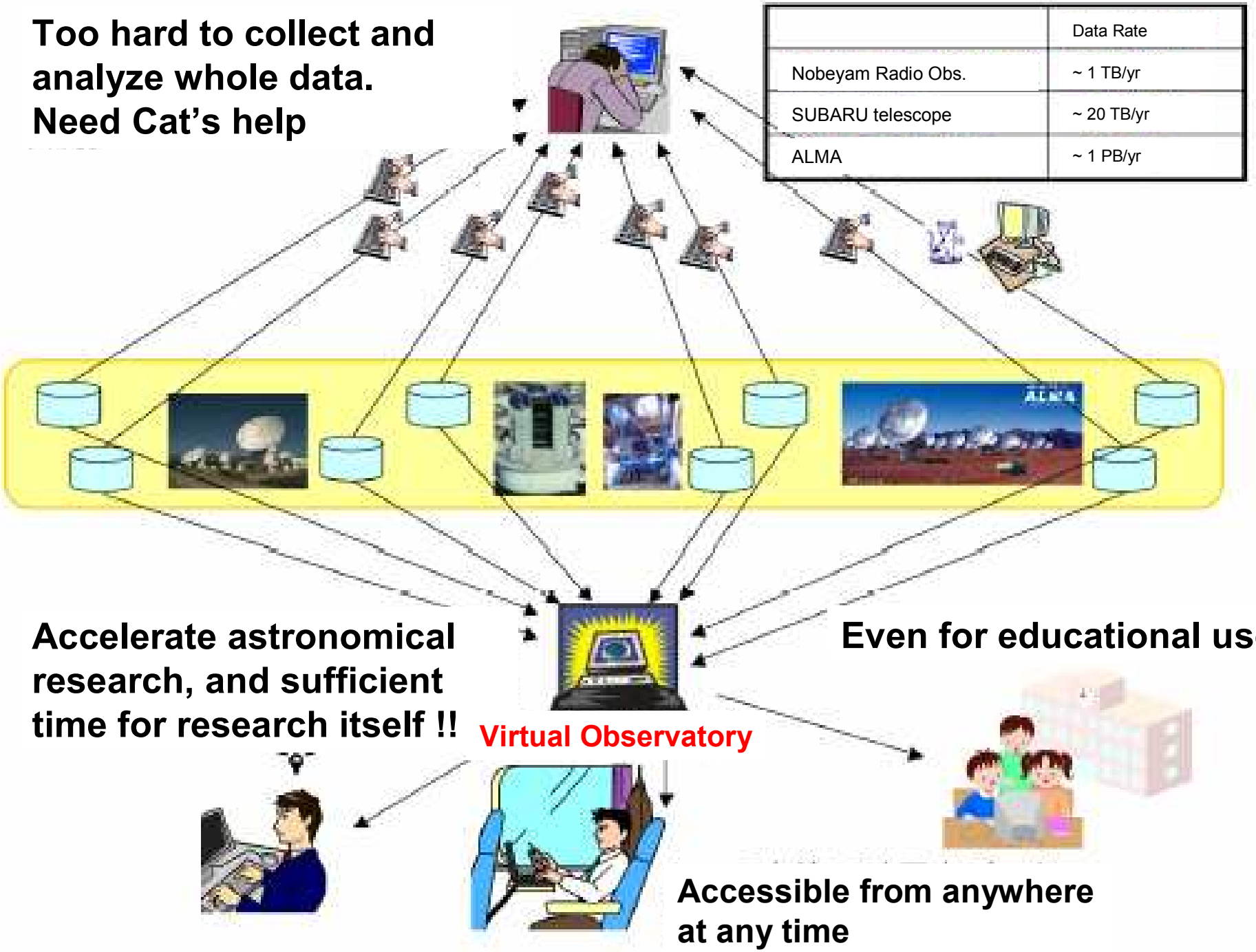
- Subaru 8.2m Optical-Infrared Telescope
- Kiso 105cm Schmidt Camera
- Okayama 188cm Optical Telescope
- Nobeyama 45m Radio Telescope
- Nobeyama Millimeter Array
- Nobeyama Radioheliograph
- VSOP
- VERA
- *ALMA*





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

VO– New Research Infrastructure in the 21st Century

A collection of integrated astronomical data archives and software tools that utilize computer networks to create an environment in which research can be conducted.

http://www.encyclopedia.com/html/v1/virtobserv.asp

International Endorsements

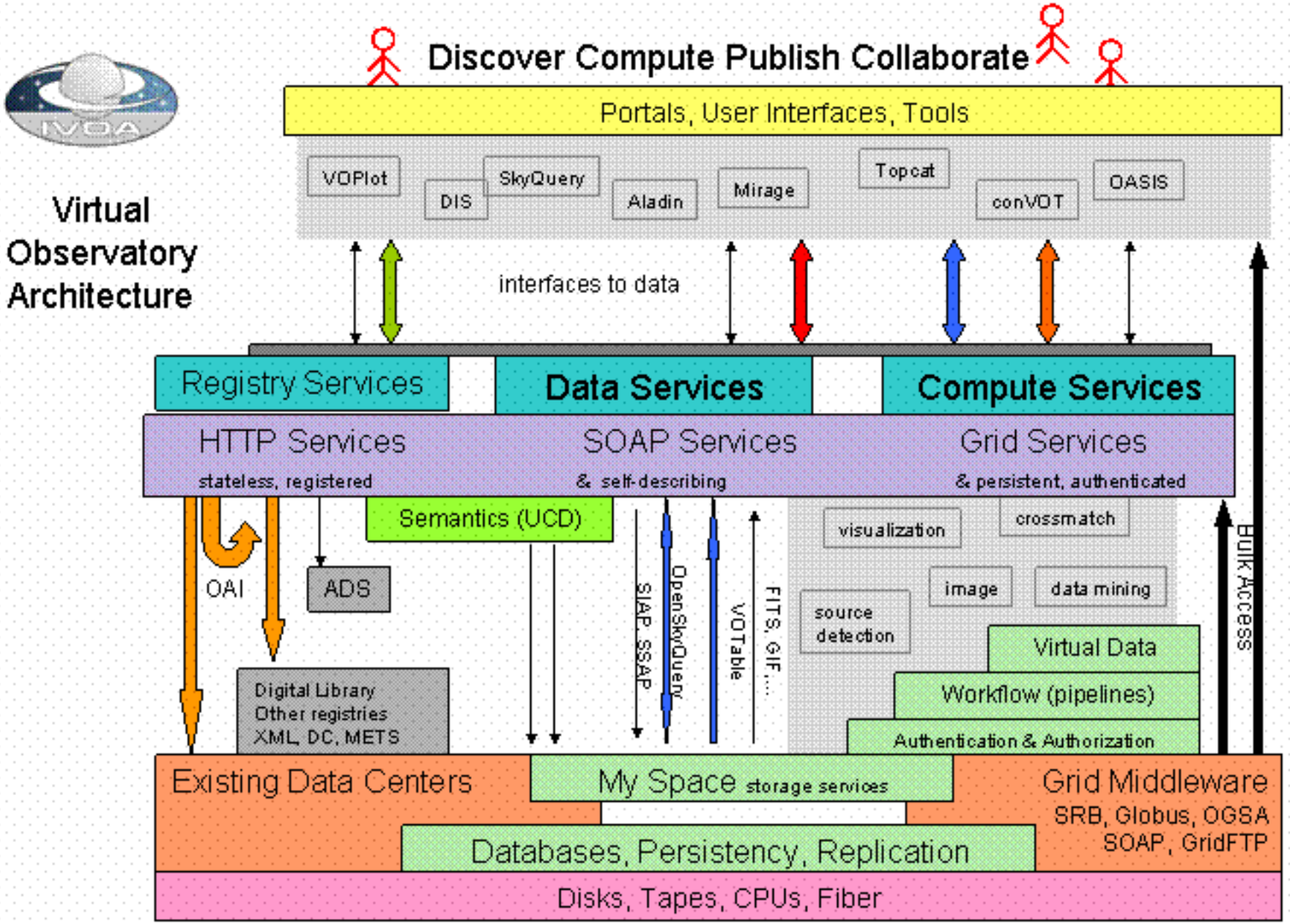
- IAU XXVth GA Res. (2003 Jul.)
- OECD Rec. (‘04 Aug)
  - place archives that may be accessible via internet
  - provide adequate funding as long-term issues

VO Projects in the world

- 16 countries and a region
- International Virtual Observatory Alliance (IVOA)
  Standards to interoperate VOs

http://www.ivoa.net/

Virtual Observatory Architecture



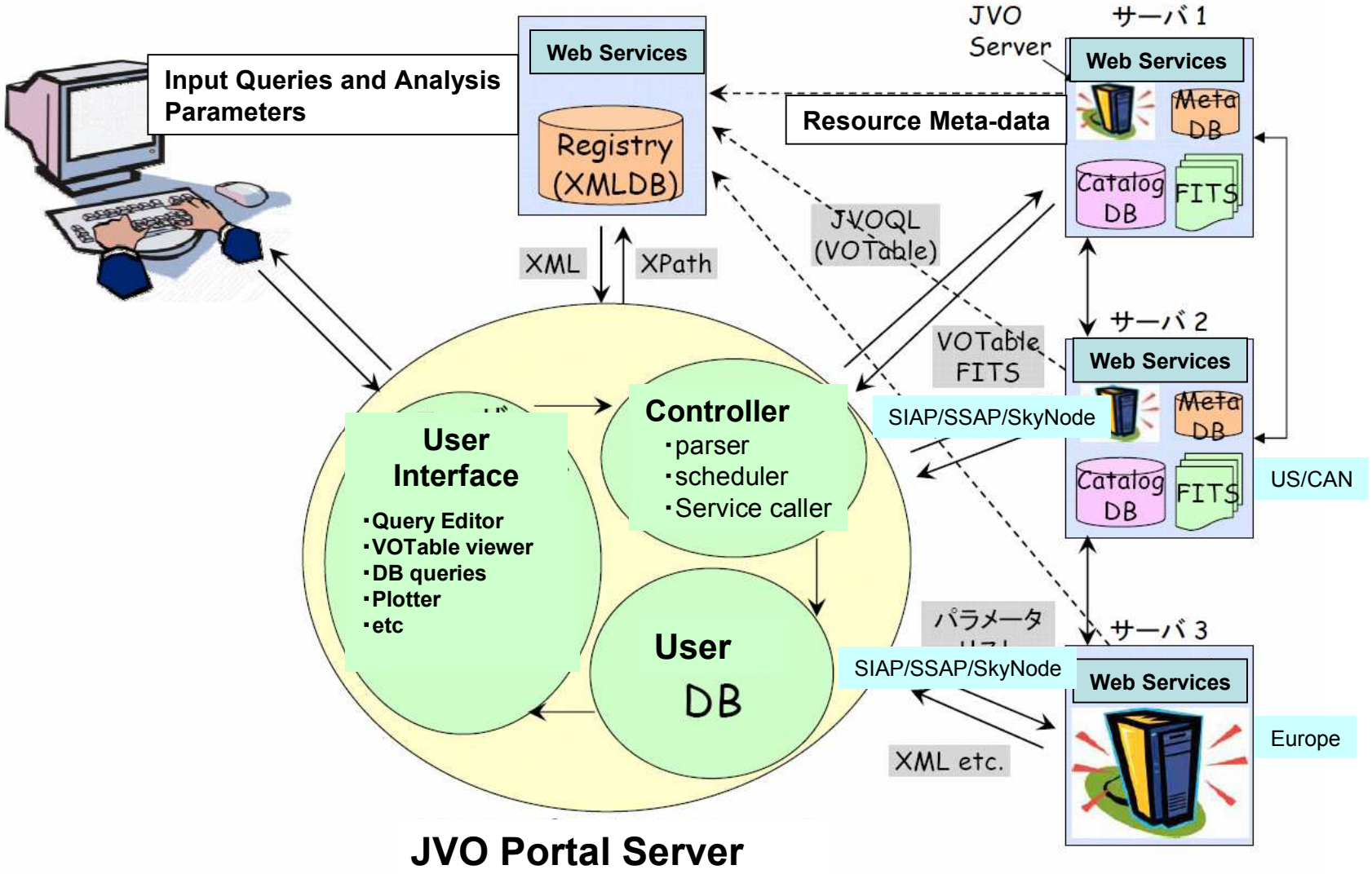
Standardization in IVOA

- Query Language to Federated DBs (VOQL)
- Access resource meta-data based on the OAI-PMH
- Access Images, Spectra, Catalogues, etc:
  SkyNode, SIAP, SSAP, STC, etc.
- Unified Attribute Names:
  UCD (Unified Contents Descriptions)
- Output format: VOTable (XML)
- and so on

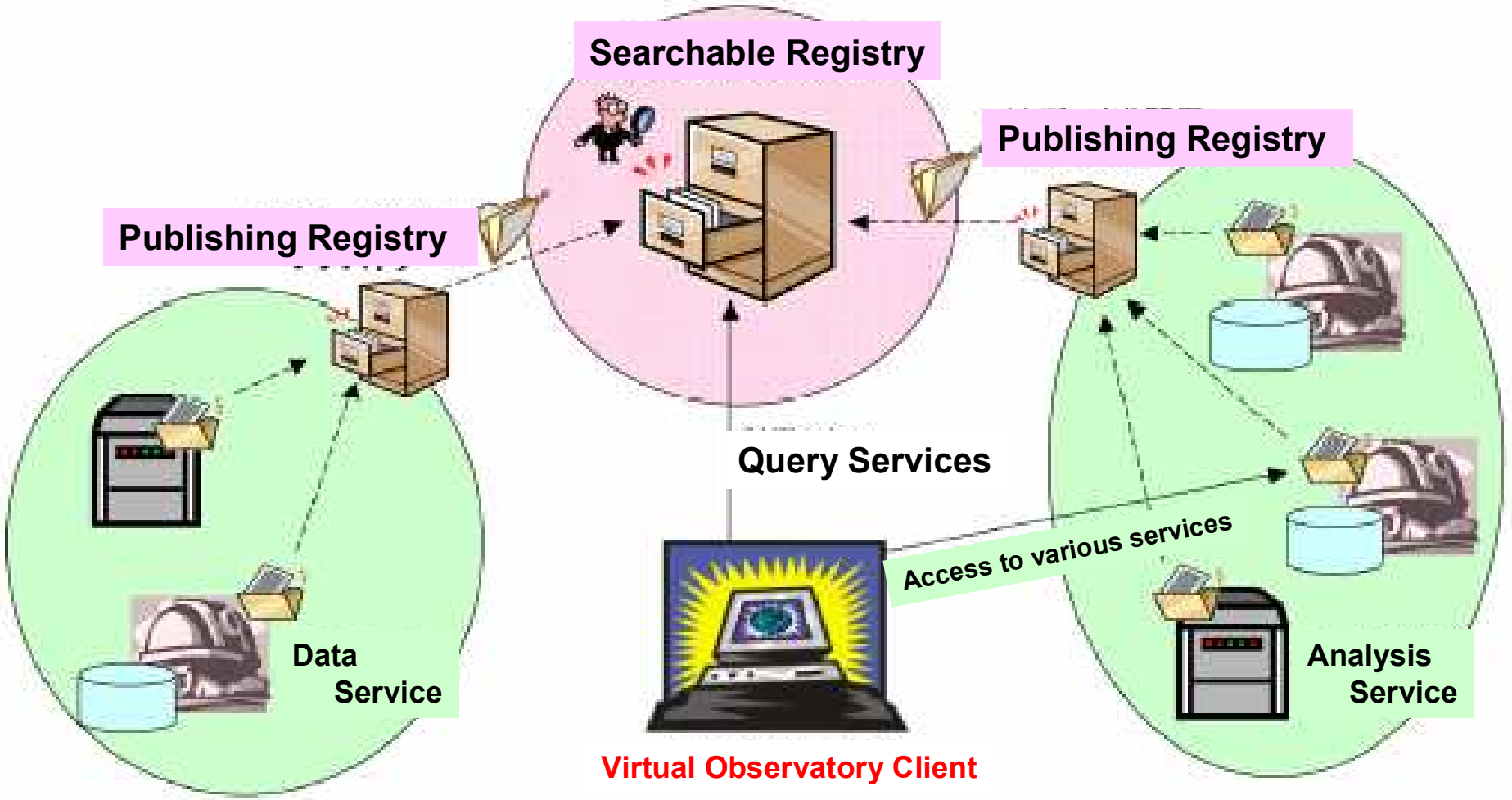
IVOA Interoperability WS

- Twice a year
- Discussions toward standardization
- Human network as a basis for cyber network

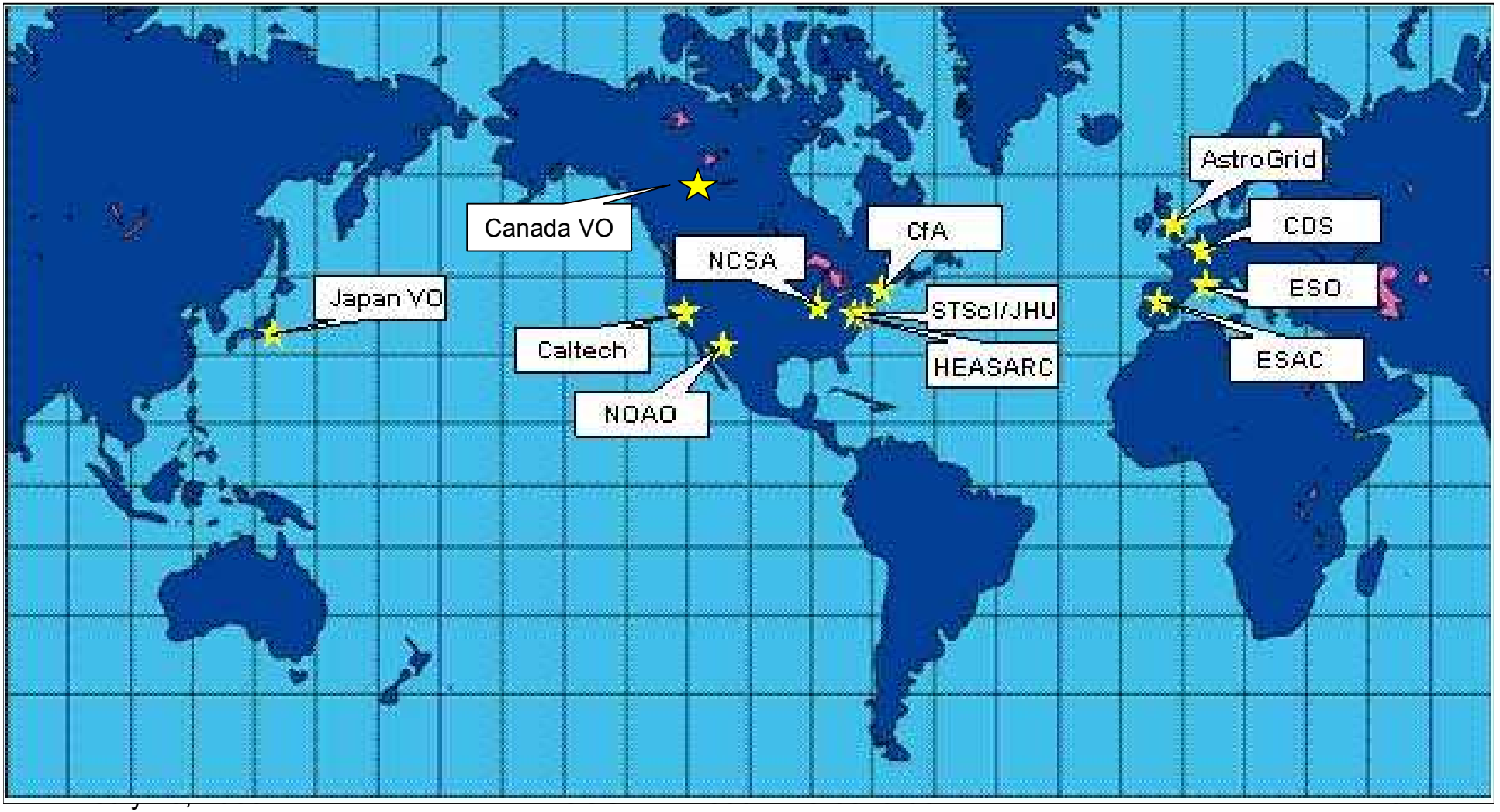
Schematic diagram of VOs



Exchange of Meta Data:OAI-PMH

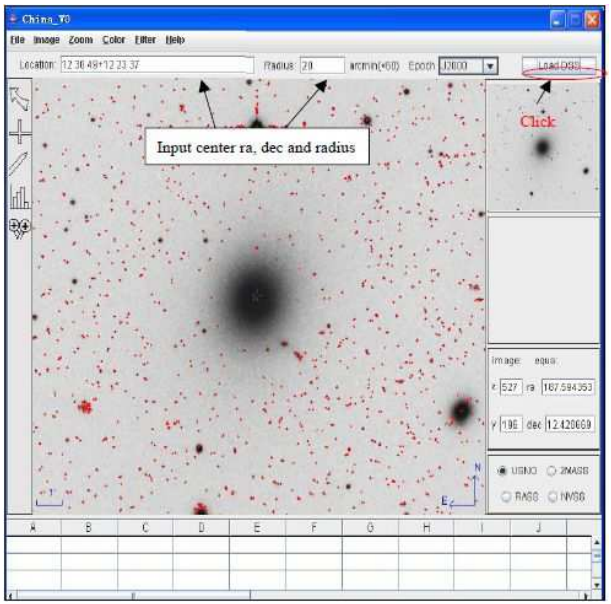


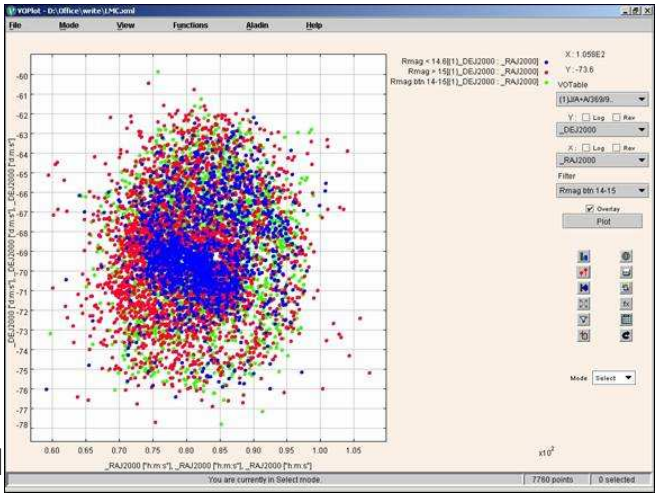
Interconnected VO Data services in the World



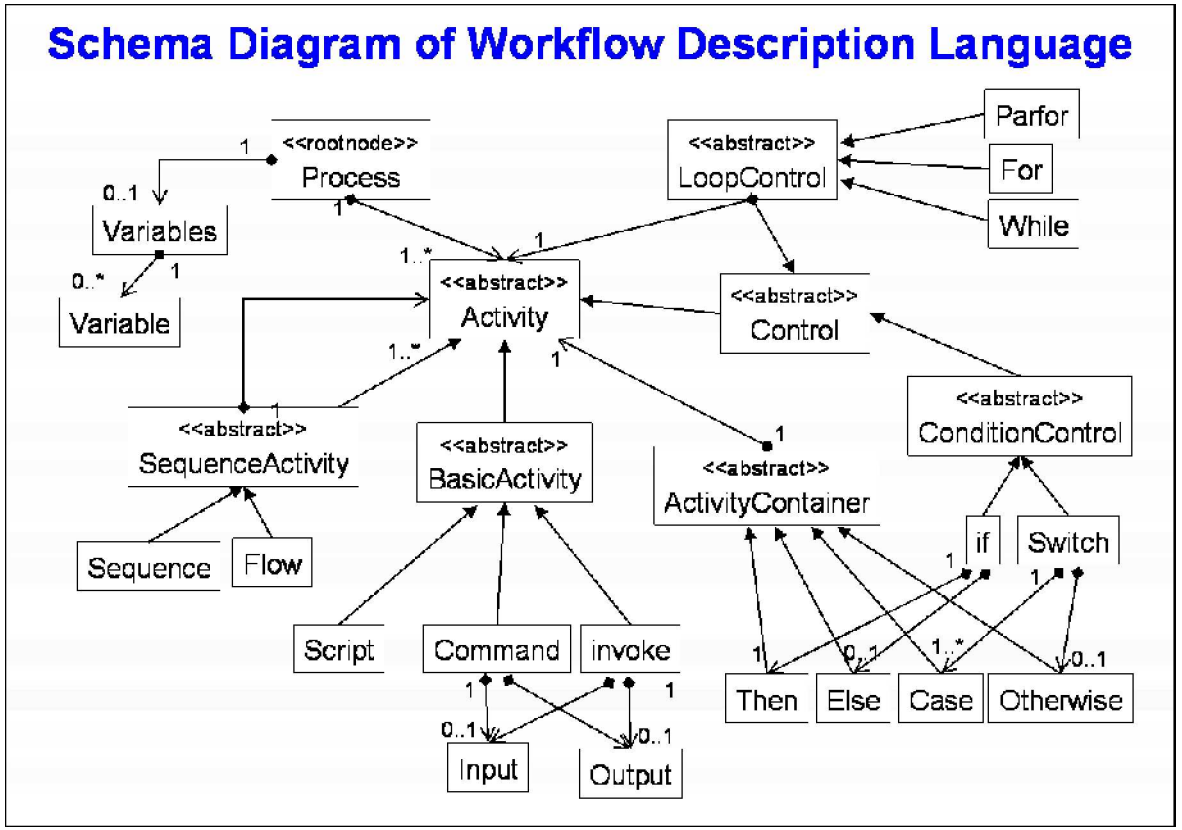
Software Tool providers

- VO-China
  - VOFilter : VOTable → OpenOffice data
  - VOIMPAT : Image processing and analysis tool
  - ,,,
- VO-India
  - VO-Plot: to plot contents in VOTable
  - ,,,





Workflow Description Language



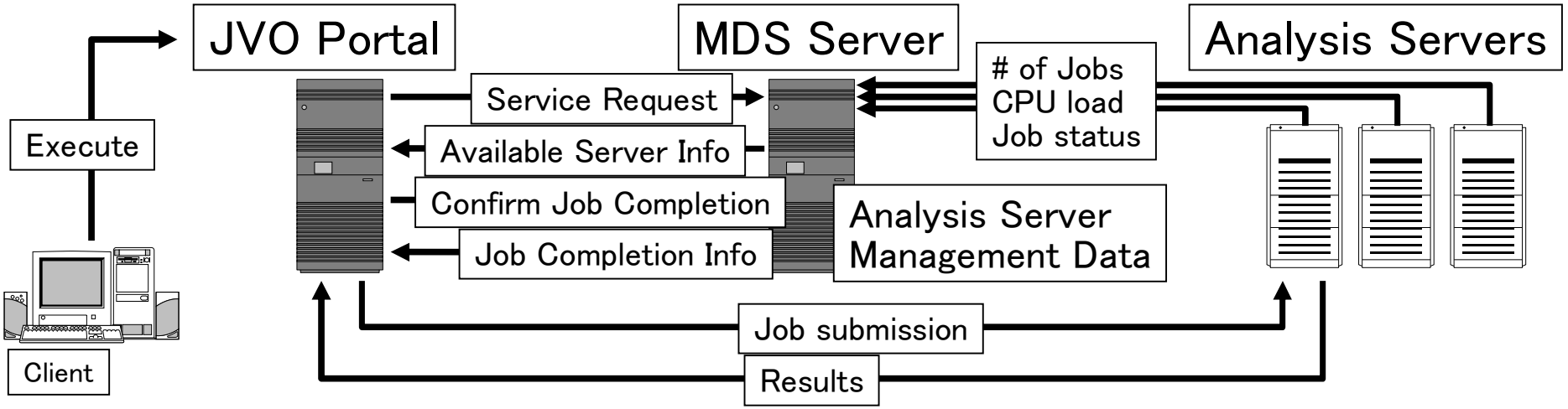
Based on BPEL4WS

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

Management of Multiple Servers

- Data Analysis services under JVO
  - SExtractor (Image → Catalog)
  - HyperZ (Catalog → photometric redshift)
    - In operation on multiple servers

→ Monitor and Discovery Service (MDS) server



Parallel Executions on Multiple Servers are available

Workflow Status

Status | Registry | Search | Workflow | Result | Database | QSO | DataViewer | Link | MemoryMonitor | Logout

⇒ All | Detail

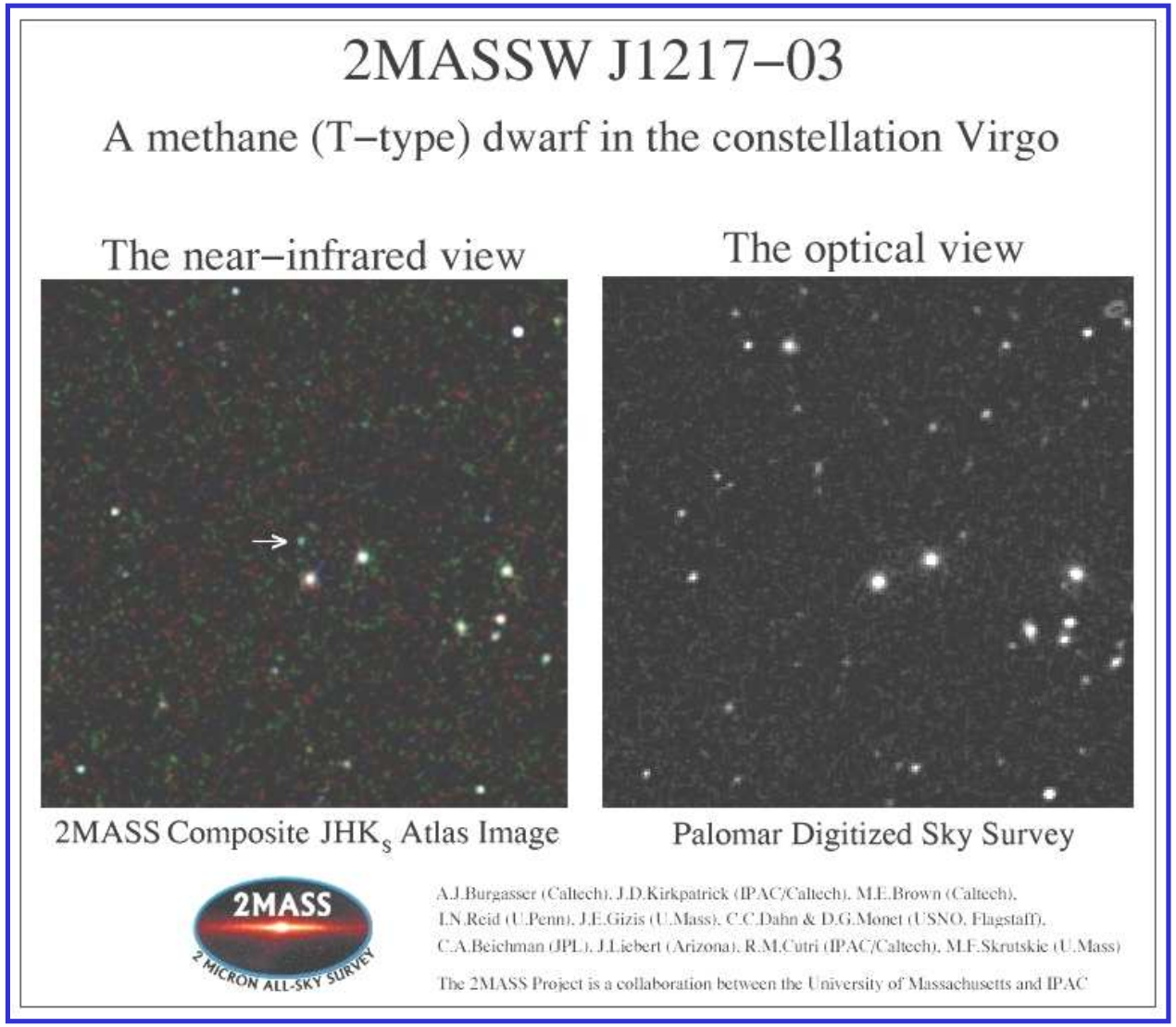
Workflow Name : work_20060123200255167

Activity Name	Host	Elapsed Time (s)	Flag	Status
1_executeQuery	cda.harvard.edu	1.93		success
		0.0		success
2_executeQuery	jvo.nao.ac.jp	2.143		success
		0.0		success
3_executeQuery	pma.iso.vilspa.esa.es	4.632		success
		0.0		success
4_executeQuery	www.cadc-ccda.hia-iha.nrc-cnrc.gc.ca	0.0		executing
		0.0		waiting
5_executeQuery		0.0		waiting

Cancel Results

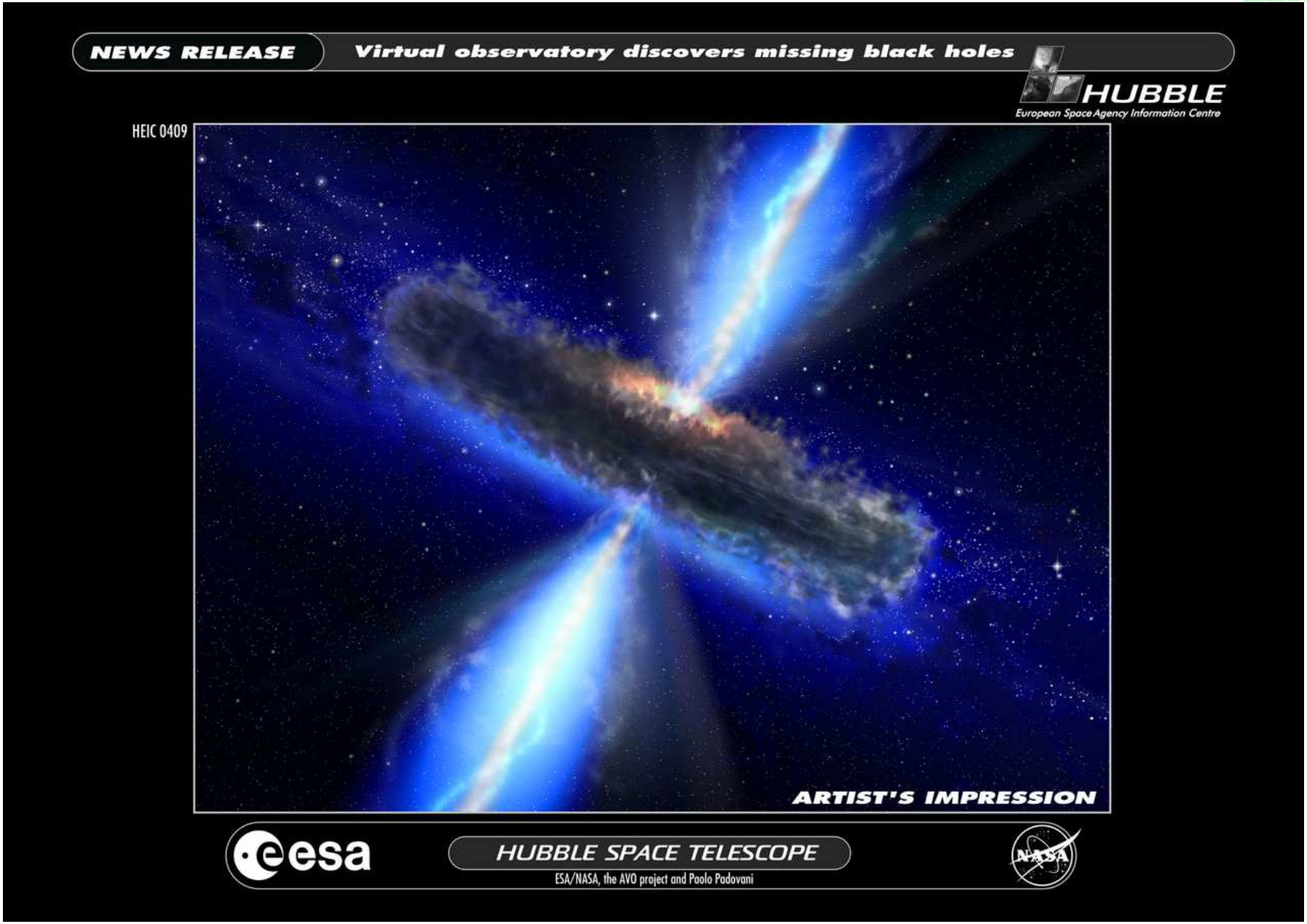
User ID	User Name	Group	Last Login
ohishi	Masatoshi Ohishi	jvo	Mon Jan 23 19:56:18 JST 2006

Discovery of a Brown Dwarf: SDSS/2MASS



discoveries like this much easier if databases jointly queryable

Detection of MANY Type II Quasars



Latest Science outputs

- Aug 2006 – VO Special Session @IAU GA
  - 5 days session
- 200+ participants registered already
  - ~30 science talks out of ~50
  - ~100 posters

New Moves

- Some VO projects move from R&D phase to operations phase
  - UK, Japan, US, EU,,,
- New VO projects
  - Brazil, Chinese Taipei, Blugaria, Tagikistan, Ireland, Czech,,,

Items to be done

- Distributed Storage to store query/analysis results
- Secure access to VOs : single-sign-on
- Other Standardizations
  - Standard application interface
- Advertisement to Data Centers
  - data centers need implement VO interfaces
- VO schools for astronomers

http://www.ivoa.net/