MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

LNA LABORATÓRIO NACIONAL DE ASTROFÍSICA

Introdução ao Uso de Ferramentas do Observatório Virtual

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Introdução ao Uso de Ferramentas do VO

- Apresentação
- Objetivos
- Parte Técnica (1):
  - Definição, objetivos e arquitetura.
  - Exemplos: Registry.
  - Exemplos: DataScope.
  - Exemplos: OpenSkyQuery.
  - Exemplos: Montage.
  - Exemplos: *cone searches*.

Introdução ao Uso de Ferramentas do VO

- Parte Técnica (2):
  - Tenho *mesmo* que aprender a programar?
  - Programação em Java.
  - Motivação (por que Java?)
  - Exemplos: Aplicação simples gráfica em Java.
  - Exemplos: *Script* (linha de comando) em Java.
  - Exemplos: Web Services em Java (cliente).
  - Exemplos: Web Services em Java (servidor).
  - Exemplos: Aplicação simples para a Web (JSP).

Introdução

Objetivos

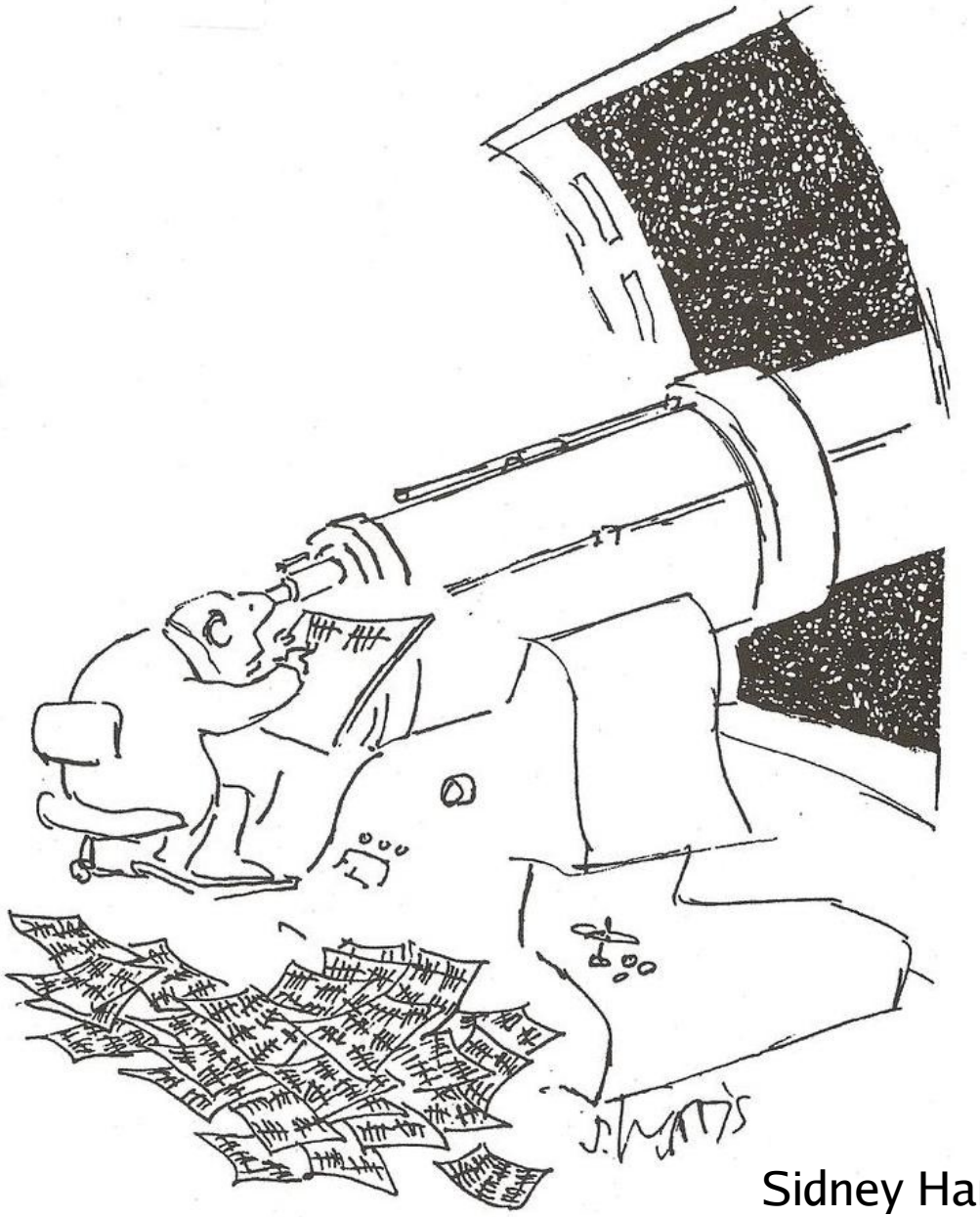
- Apresentar conceitos básicos de Observatórios Virtuais (VOs).
  - Foco maior em o que é e para que pode ser usado (e ***como*** usar).
- Mostrar como usar ferramentas de VOs e como agregá-las.
  - Reuso de ferramentas já prontas.
  - Reuso de serviços.
- Levantar demandas, dúvidas, expectativas, etc.
  - É preciso aproximar pessoal de desenvolvimento/TI de usuários? Como?

O Curso

- Informativo, prática “na teoria” (i.e. sem laboratório).
  - Alguns exemplos simples serão apresentados.
- Não temos a presunção de:
  - Estar 100% corretos,
  - Ter 100% das respostas,
  - Cobrir 100% dos tópicos,
  - Ser 100% úteis.

O que é um Observatório Virtual?

O que é o VO?



Sidney Harris

O que é o VO?

- De http://www.euro-vo.org/:
  - Um observatório virtual (VO) é uma coleção de ferramentas de software e arquivos interoperando e usando a Internet para criar um ambiente de pesquisa científica no qual programas de pesquisa astronômica possam ser conduzidos.
  - Da mesma forma que um observatório real consiste de telescópios, cada um com uma coleção única de instrumentos astronômicos, o VO é uma coleção de centros cada um com uma coleção única de dados, software e capacidades de processamento.

O que é o VO?

- *Robert Hanisch:* Um conjunto de padrões internacionais para descoberta, troca, interconexão e análise de dados astronômicos acessíveis pela Internet.

- O que **não é** o VO:
  - Repositório **centralizado** de dados.
  - Entidade reguladora da qualidade dos dados.

O que é um VO (para a computação)?

- Categoria de *Laboratório Virtual*.
  - Pessoa-a-repositório, pessoa-a-metamáquina.
- ***Metamáquinas***:
  - Grandes bases de dados (possivelmente distribuídas).
  - Algoritmos de transformação.
  - Grande poder computacional.
  - (Idealmente) acesso através de poucas interfaces.

Porque VOs?

- Compartilhar de dados e recursos.
- Agregar valor de forma transparente.

- Suponha que tenhamos os dados de um *survey* que pode ser útil para a comunidade científica.
  - É bem simples colocar estes dados na Web!
  - Isto realmente permite o uso em pesquisas científicas? Os dados estão *realmente* prontos para ser usados?
  - **Podemos usar padrões de formatos e protocolos para que outros softwares possam usar os dados diretamente.**

Porque VOs?

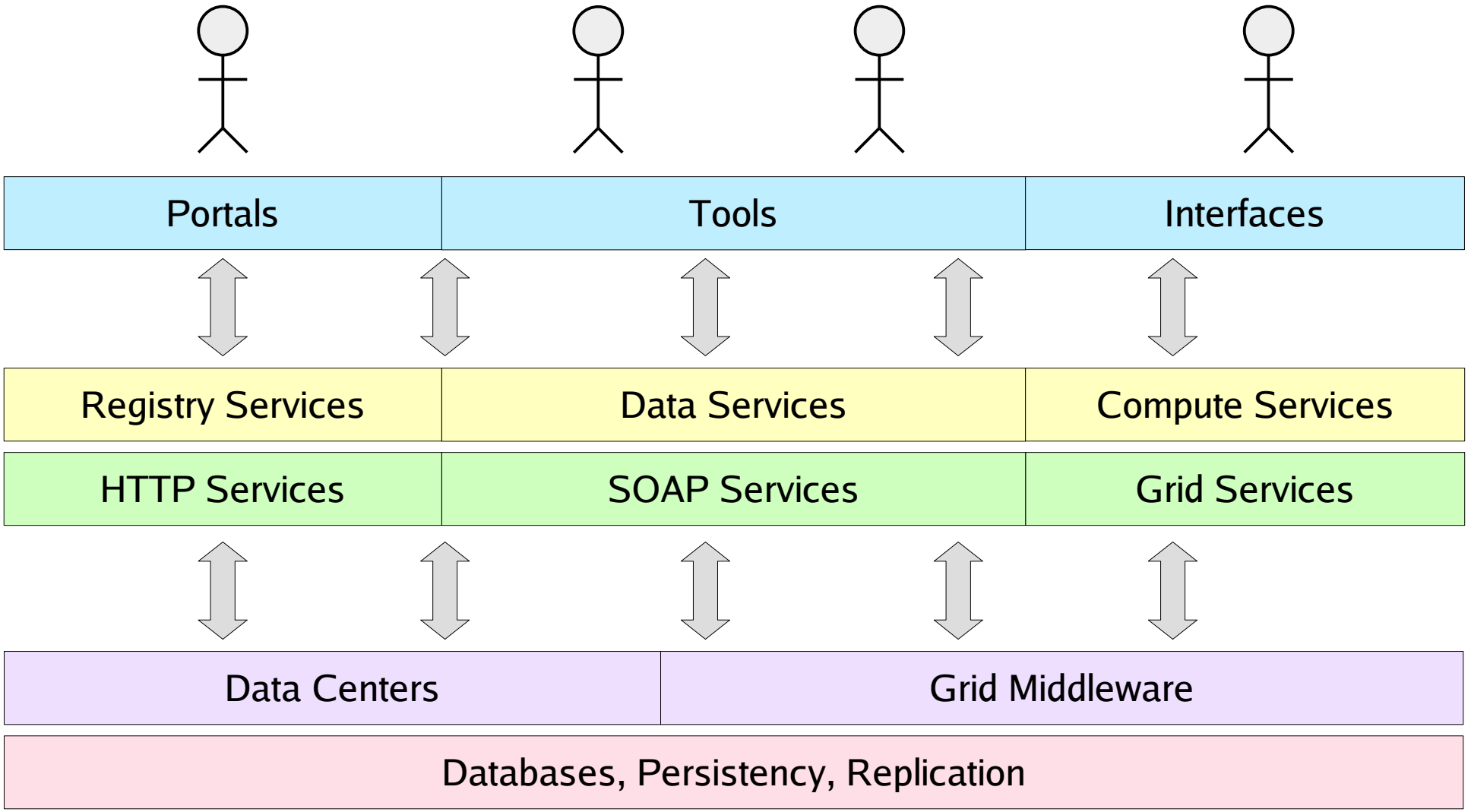
- O mesmo vale para algoritmos interessantes ou recursos computacionais...
  - ... com algumas ressalvas!

- Possibilita:
  - Uniformização dos dados (facilita criação e uso de ferramentas).
  - Processamento automático.
  - Reprodução.

Em um VO...

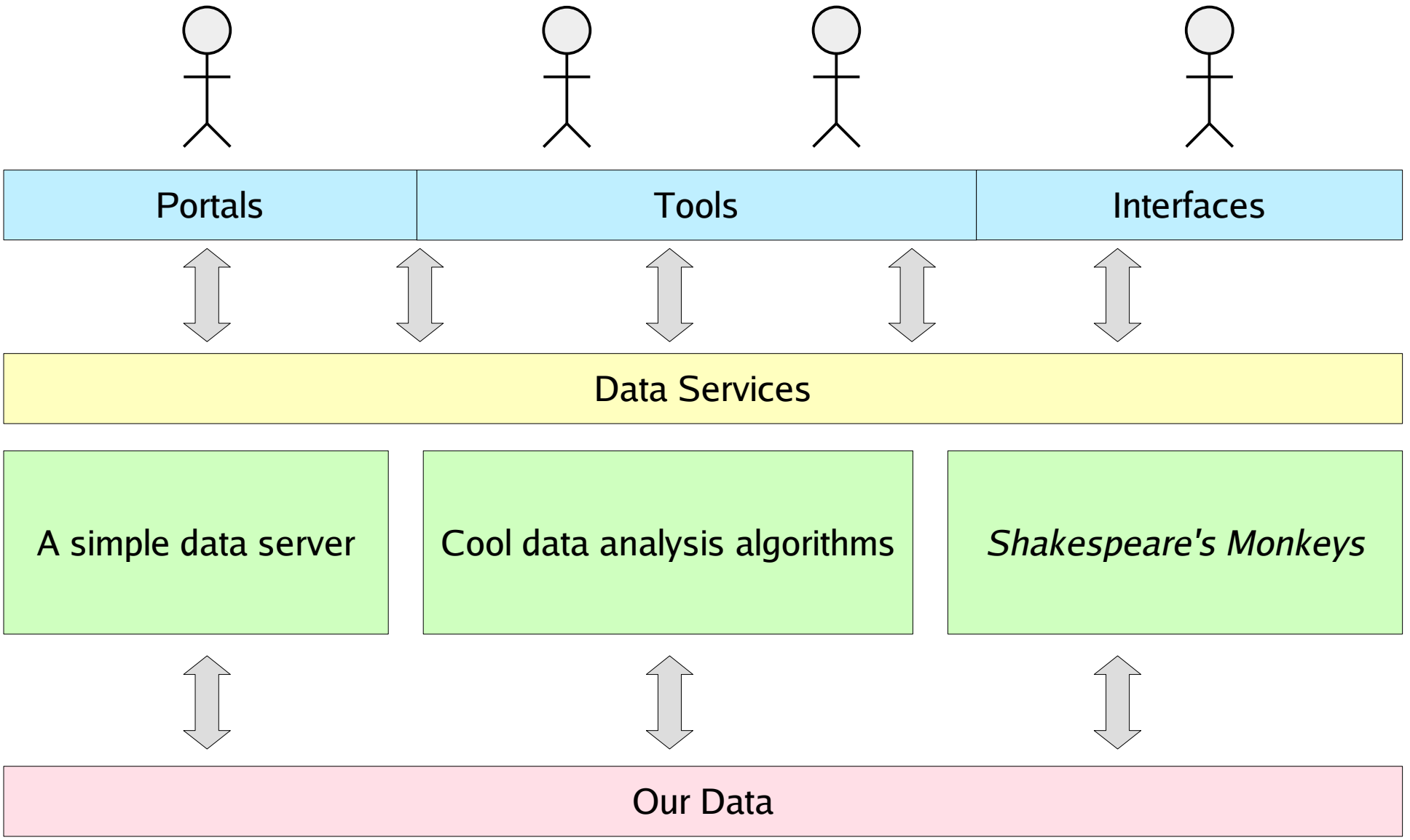
- ... assim como na Web, a interface para os dados/sistemas devem ser úteis para humanos, mas também acessíveis diretamente por computadores (leia-se XML), assim podemos automatizar algumas tarefas.
- Internamente, o formato, métodos de armazenagem, algoritmos, linguagens, etc. não precisam ser padrão...
  - ...embora existam padrões de dados e sistemas que devem ser seguidos por várias razões (padronização, portabilidade, replicabilidade, etc.)

Arquitetura Simplificada



Adaptado de http://www.ivoa.net/Documents/Notes/IVOArch/IVOArch-20040615.html

Arquitetura Simplificada



Usando ferramentas de um VO

Por onde começar?

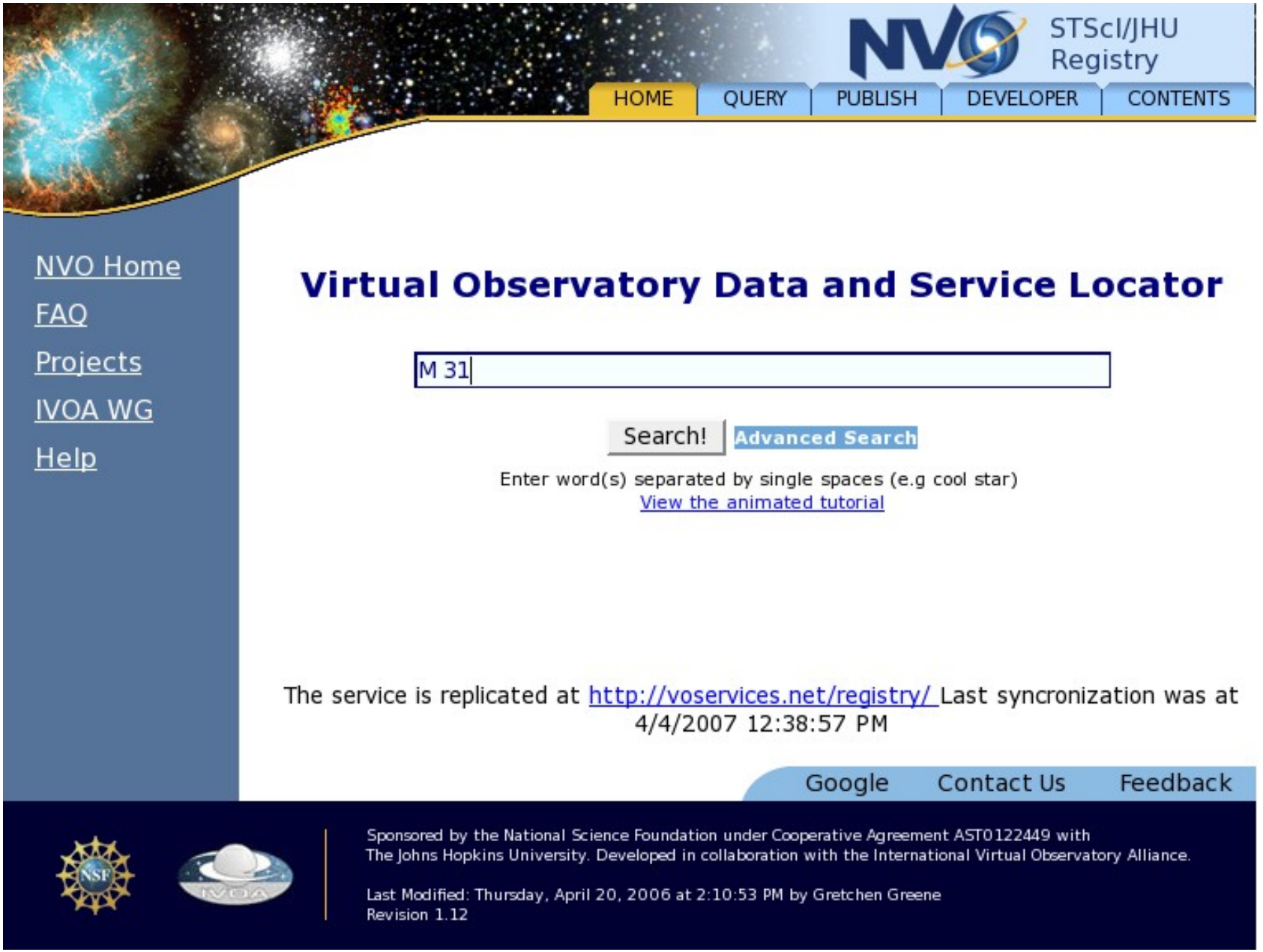
- *NVO (US National Virtual Observatory)*

http://www.us-vo.org/

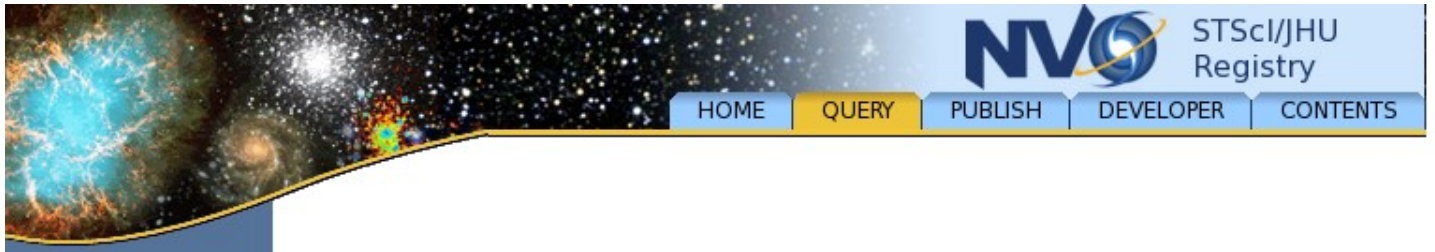
O *Registry*

- Catálogo de arquivos de dados astronômicos e serviços.
  - Pode conter outros dados sobre instituições, instrumentos, etc.
- Contém *resources* e também metadados de serviços e arquivos.
  - Por exemplo, através do *registry* podemos obter a URL de um *cone search*.
- *Páginas amarelas*.
- Busca por termos, categorias de *resources*, etc.

O *Registry*


STScI/JHU
Registry
HOME
QUERY
PUBLISH
DEVELOPER
CONTENTS
NVO Home
FAQ
Projects
IVOA WG
Help
Virtual Observatory Data and Service Locator
M 31
Search!
Advanced Search
Enter word(s) separated by single spaces (e.g cool star)
View the animated tutorial
The service is replicated at http://voservices.net/registry/ Last syncronization was at 4/4/2007 12:38:57 PM
Google
Contact Us
Feedback
Sponsored by the National Science Foundation under Cooperative Agreement AST0122449 with
The Johns Hopkins University. Developed in collaboration with the International Virtual Observatory Alliance.
Last Modified: Thursday, April 20, 2006 at 2:10:53 PM by Gretchen Greene
Revision 1.12

O Registry



NVO Home
FAQ
Projects
IVOA WG
Help

Enter word(s) separated by spaces (e.g cool star)

Text Search M 31 GO! Advanced Search

AND OR Keywords

ResourceType(count) - click to go to this subset - mouseover for more info.

AUTHORITY (2)	CONE (35)	SIAP (1)	SKYSERVICE (1)	SSAP (3)	TABULARSKYSERVICE (1087)

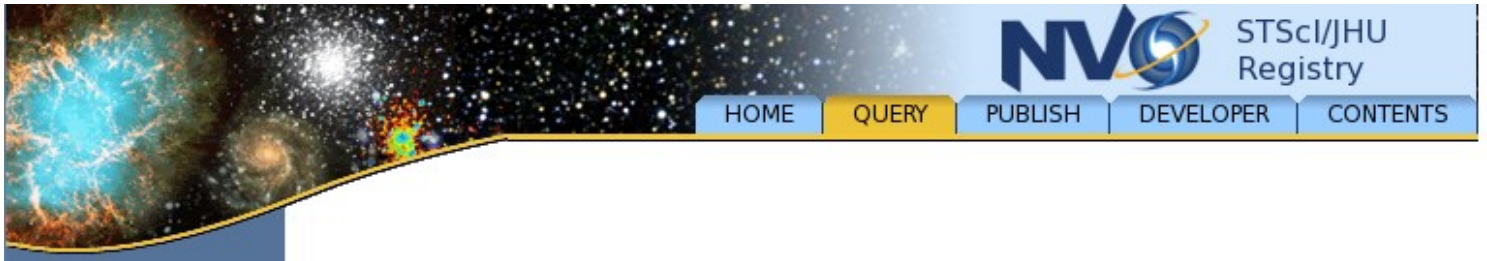
1129 resources. Showing 1 to 20. >>Next

Actions	Title / Description	Subject	ResourceType
View XML Edit Copy Try It!	Copernicus Satellite**(Copernicus)** The Copernicus satellite, otherwise known as the Orbiting Astronomical Observatory 3 (OAO-3), obtained a series of high resolution far- (900-1560 Å) and near- (1650-3150 Å) ultraviolet spectral scans of 551 objects, primarily bright stars, from 1972 to 1981.	Stars, Hot stars, Cool stars, Variable stars	CONE
View XML Edit Copy	The FK5 Extension of the FK4 System (Lattanzi+ 1993) - FK5 Extension at B1950.0 on FK4 system**(I/202/fk5e1950)** The FK5 catalog was expanded from 1535 stars to include an additional 3117 stars which comprise the 'extension' to the new 'Basic' FK5, the revision of the FK4. For the basic FK5 a method of converting from the FK5 system to the FK4 system is provided in the catalog while for the Extension no algorithm was supplied. This catalog consists of two files. One file is the FK5 Extension placed at B1950.0 on the FK4 system. The second file is the FK5 Extension placed at the mean Epoch of place on the FK4 system.	Positional_Data, Stars, Proper_Motions	TABULARSKYSERVICE
View	The FK5 Extension of the FK4 System (Lattanzi+ 1993) -		

ResourceTypes

CONE	Simple Cone Search (IVOA Standard)
CONESEARCH	Simple Cone Search (IVOA Standard)
DATACOLLECTION	A logical grouping of data which, in general, is composed of one or more accessible datasets.(A dataset is a collection of digitally-encoded data with a that is normally accessible as a single unit, e.g. a file.)
HTTP-GET	Simple Web Form
ORGANISATION	A publisher of other resources (At a high level, an organisation could be a university, observatory, or government agency. At a finer level, it could be a specific scientific project, mission, or individual researcher)
OTHER	Other (not recommended)
PROJECT	High level Resource describing project
REGISTRY	A service that provides access to descriptions of resources
SIAP	Simple Image Access Service (IVOA Standard)
SIAP/ARCHIVE	Simple Image Access Service (archive)
SIAP/CUTOUT	Simple Image Access Service (cutout)
SIMPLEIMAGEACCESS	Simple Image Access Service
SKYNODE	SkyNode Service: based on http://www.ivoa.net/internal/IVOA/IvoaVOQL/SkyNodeInterface-0.7.4.pdf
SKYSERVICE	A service for accessing astronomical data
SSAP	Simple Spectral Access Service Resource
SSAP/ARCHIVE	Simple Spectral Access Service Resource (archive)
SSAP/CUTOUT	Simple Spectral Access Service Resource (cutout)
TABULARSKYSERVICE	A service that interacts with one or more specified tables having some coverage of the sky, time, and/or frequency.
WEBSERVICE	XML Web Service, WSDL based

O Registry



NVO Home
FAQ
Projects
IVOA WG
Help

Enter word(s) separated by spaces (e.g cool star)

Text Search GO! Advanced Search

AND OR Keywords

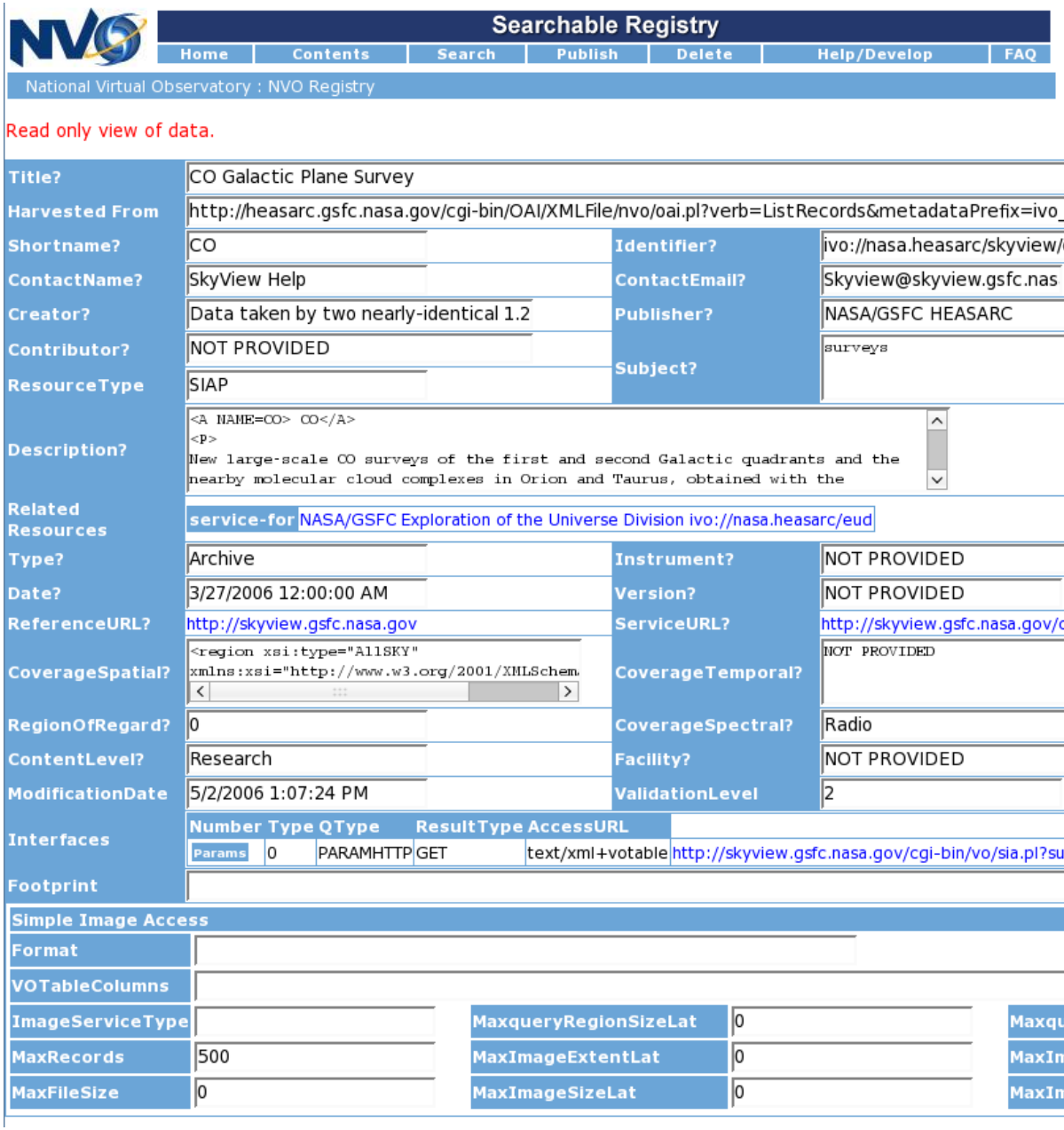
Only one ResourceType *(SIAP)* found.

1 resources. Showing 1 to 1.

Actions	Title / Description	Subject	ResourceType
View **XML** **Edit** **Copy** **Try It!**	CO Galactic Plane Survey**(CO)** CO New large-scale CO surveys of the first and second Galactic quadrants and the nearby molecular cloud complexes in Orion and Taurus, obtained with the Harvard-Smithsonian Center for Astrophysics 1.2 m telescope, have been combined with 31 other surveys obtained over the past two decades with that instrument and a similar telescope on Cerro Tololo in Chile, to produce a new composite CO survey of the entire Milky Way. The survey consists of 488,000 spectra that Nyquist or beamwidth (1/8 deg) sample the entire Galactic plane over a strip 4 deg-10 deg wide in latitude, and beamwidth or 1/4 deg sample nearly all large local clouds at higher latitudes. Compared with the previous composite CO survey of Dame et al. (1987), the new survey has 16 times more spectra, up to 3.4 times higher angular resolution, and up to 10 times higher sensitivity per unit solid angle. Users should be aware that both the angular resolution and the sensitivity varies from re	surveys	SIAP

Found 1 resources. Showing 1 to 1.

O Registry



Searchable Registry

Home | Contents | Search | Publish | Delete | Help/Develop | FAQ

National Virtual Observatory : NVO Registry

Read only view of data.

Title?	CO Galactic Plane Survey		
Harvested From	http://heasarc.gsfc.nasa.gov/cgi-bin/OAI/XMLFile/nvo/oai.pl?verb=ListRecords&metadataPrefix=ivo_vor&from=2006-05-02		
Shortname?	CO	Identifier?	ivo://nasa.heasarc/skyview/co
ContactName?	SkyView Help	ContactEmail?	Skyview@skyview.gsfc.nas
Creator?	Data taken by two nearly-identical 1.2	Publisher?	NASA/GSFC HEASARC
Contributor?	NOT PROVIDED	Subject?	surveys
ResourceType	SIAP		
Description?	<A NAME=CO> CO</A> <P> New large-scale CO surveys of the first and second Galactic quadrants and the nearby molecular cloud complexes in Orion and Taurus, obtained with the		
Related Resources	service-for NASA/GSFC Exploration of the Universe Division ivo://nasa.heasarc/eud		
Type?	Archive	Instrument?	NOT PROVIDED
Date?	3/27/2006 12:00:00 AM	Version?	NOT PROVIDED
ReferenceURL?	http://skyview.gsfc.nasa.gov	ServiceURL?	http://skyview.gsfc.nasa.gov/cgi-bin/vo/sia.pl?survey=CO&
CoverageSpatial?	<region xsi:type="AllSKY" xmlns:xsi="http://www.w3.org/2001/XMLSchem	CoverageTemporal?	NOT PROVIDED
RegionOfRegard?	0	CoverageSpectral?	Radio
ContentLevel?	Research	Facility?	NOT PROVIDED
ModificationDate	5/2/2006 1:07:24 PM	ValidationLevel	2

Interfaces

Number	Type	QType	ResultType	AccessURL
Params	0	PARAMHTTP	GET	text/xml+votable	http://skyview.gsfc.nasa.gov/cgi-bin/vo/sia.pl?survey=CO&

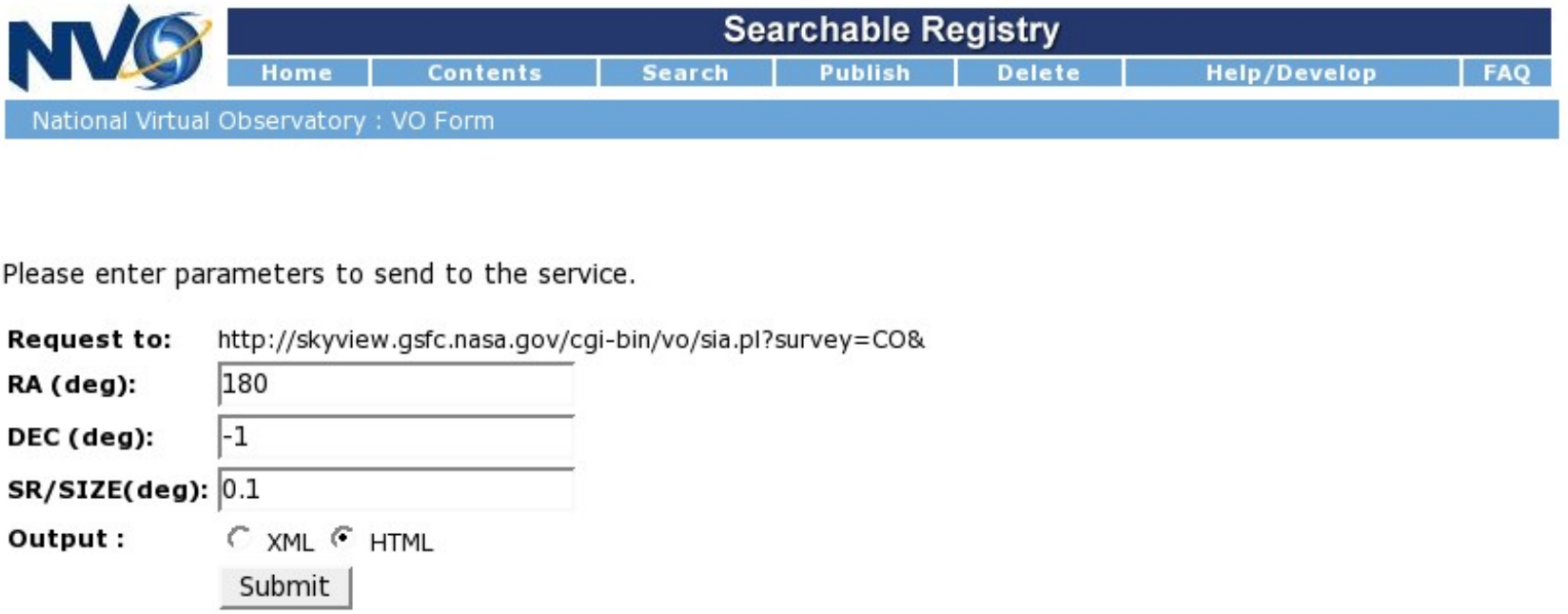
Footprint

Simple Image Access

Format					
VOTableColumns					
ImageServiceType		MaxqueryRegionSizeLat	0	MaxqueryRegionSizeLong	0
MaxRecords	500	MaxImageExtentLat	0	MaxImageExtentLong	0
MaxFileSize	0	MaxImageSizeLat	0	MaxImageSizeLong	0

O *Registry*

- Notas sobre o Registry:
  - Somente catálogo de recursos (*SIAP*, *SSAP*, *Cone Searches*, *TabularSkyService*, etc.)
  - Não existe (ainda) *Quality of Service*!
  - Nem todos os serviços estão normalizados...



DataScope

- Ferramenta unificada de busca.
- Usuário fornece posição, *DataScope* usa o *Registry* para procurar recursos com dados sobre aquela posição.
- Pequenos truques interessantes na implementação:
  - Procura assíncrona.
  - *Cache* de buscas.
  - *Cache* do *Registry*.

DataScope

NATIONAL VIRTUAL OBSERVATORY

VO DataScope Query

NVO Home | Help | VO Tools and Services

Query VO resources for a given region of a sky

Note: DataScope V2.1 released March 26, 2007 (many cosmetic changes and some bug fixes)

What do we know about a given point or region in the sky?

To find out, just enter a target or position. The NVO DataScope will show you the results from hundreds of resources.

Position: M31

Use a target name (e.g., 3c273) or position (e.g., 10 10 10.1, 20 20 20.2)

Size: 0.25 (in degrees, max is 2)

Run query: Submit Query | Reset

Skip cache? ☑ **Refresh registry?** ☐

Do not add to list of recent queries? ☐

Some recent queries:

- NGC 2383 (0.25)
- 266.80, -27.36 (0.1333)
- 123.2218122,15.2898667 (0.0125)
- ic10 (0.25)
- M 31 (0.25)

Positions may be entered in decimal (dd.f, sdd.f) or sexagesimal (hh mm ss.f, dd mm ss.f) notation or as targets recognized by NED or SIMBAD.

The **Size** should be entered in decimal degrees.

Use the **Skip cache** flag to ensure that you get the latest results from all services.

DataScope

Data found(15) No data (43) Errors(2) Waiting(524) 10% complete

Position:M 31 Resources/hits: 584/4558 Cache age:-0.06 hours

Summary | Resources | Data Table | No Data | Still Processing | Errors | Help

Summary of Request and Selections

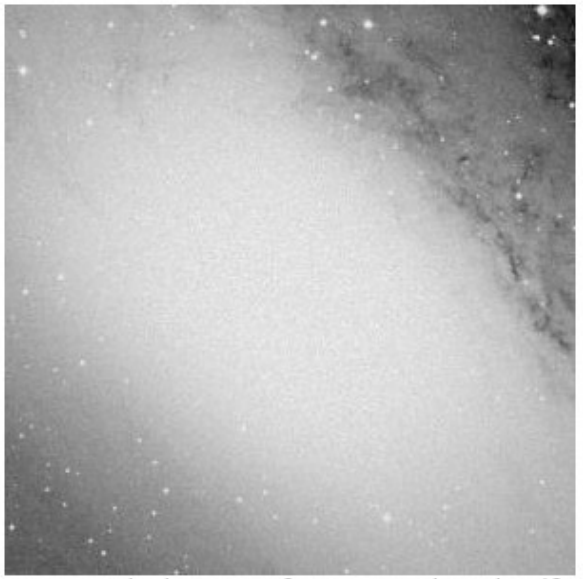
Request parameters	
Target: M 31	
00 42 44.31	41 16 09.4
10.684625	41.269278
Size:	0.25
All known resources re-queried	

No resources currently selected

Analysis Options

Aladin Applet Aladin script

Save as tar



DSS1 Optical Image of Requested Region (from *SkyView*)

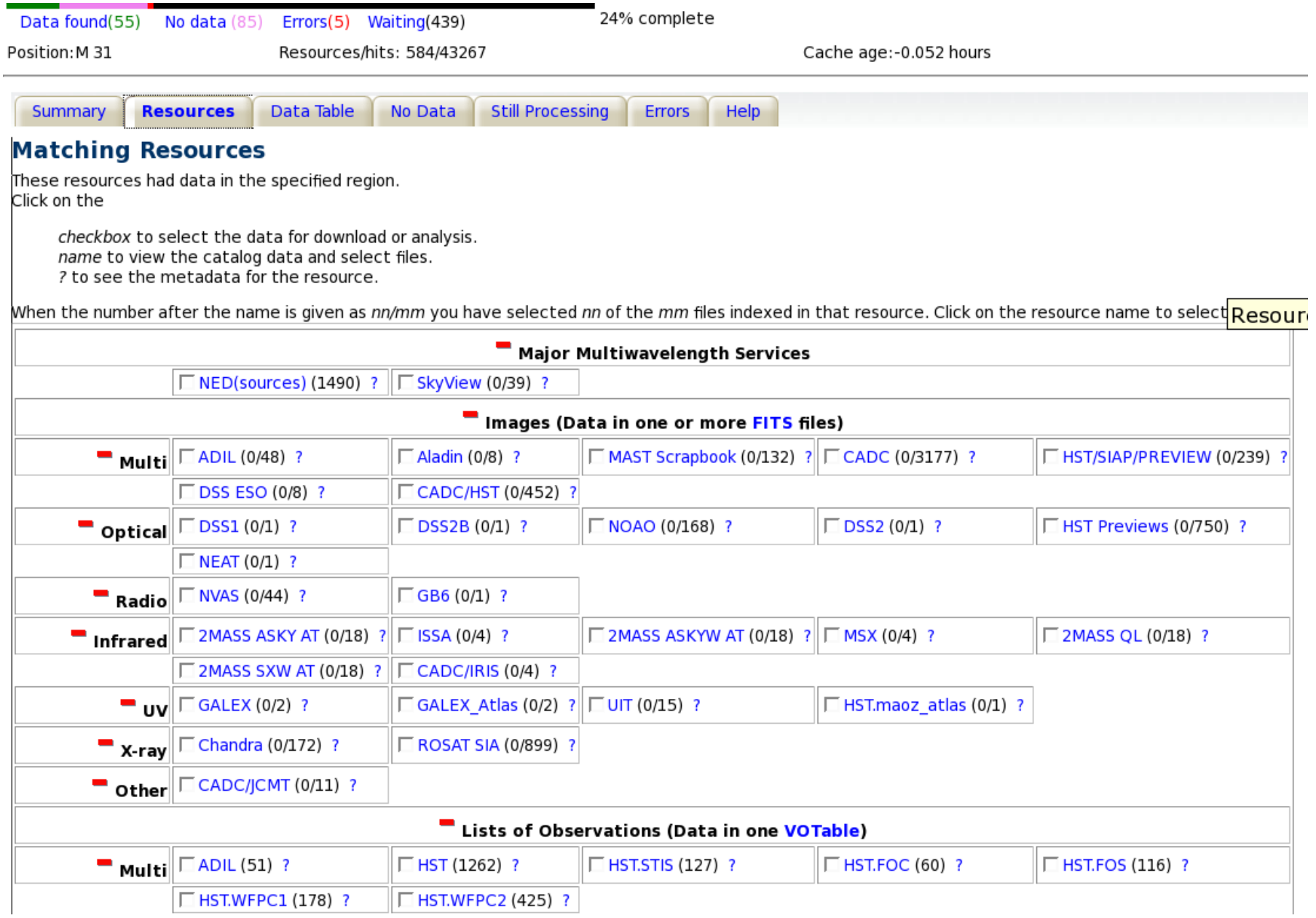
Hosted by the Astrophysics Science Division
and the High Energy Astrophysics Science Archive Research Center (HEASARC) at NASA/ GSFC

HEASARC Director: Dr. Nicholas E. White,

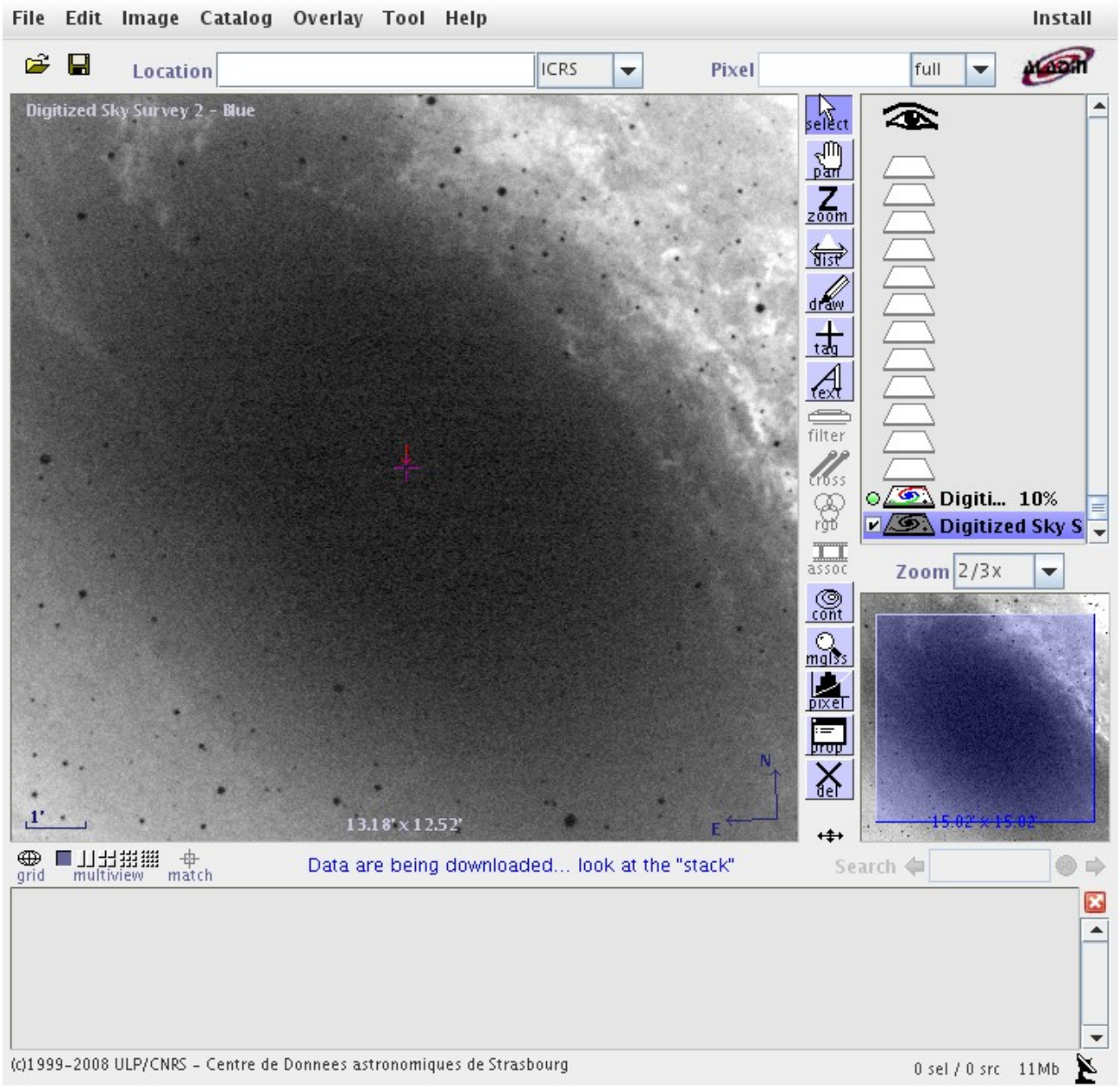
HEASARC Associate Director: Dr. Roger Brissenden,
Responsible NASA Official: Phil Newman

Privacy, Security, Notices

DataScope


Data found(55) No data (85) Errors(5) Waiting(439) 24% complete
Position:M 31 Resources/hits: 584/43267 Cache age:-0.052 hours
Summary Resources Data Table No Data Still Processing Errors Help
Matching Resources
These resources had data in the specified region.
Click on the
checkbox to select the data for download or analysis.
name to view the catalog data and select files.
? to see the metadata for the resource.
When the number after the name is given as nn/mm you have selected nn of the mm files indexed in that resource. Click on the resource name to select
Resour
Major Multiwavelength Services
NED(sources) (1490) ? SkyView (0/39) ?
Images (Data in one or more FITS files)
Multi ADIL (0/48) ? Aladin (0/8) ? MAST Scrapbook (0/132) ? CADC (0/3177) ? HST/SIAP/PREVIEW (0/239) ?
DSS ESO (0/8) ? CADC/HST (0/452) ?
Optical DSS1 (0/1) ? DSS2B (0/1) ? NOAO (0/168) ? DSS2 (0/1) ? HST Previews (0/750) ?
NEAT (0/1) ?
Radio NVAS (0/44) ? GB6 (0/1) ?
Infrared 2MASS ASKY AT (0/18) ? ISSA (0/4) ? 2MASS ASKYW AT (0/18) ? MSX (0/4) ? 2MASS QL (0/18) ?
2MASS SXW AT (0/18) ? CADC/IRIS (0/4) ?
UV GALEX (0/2) ? GALEX_Atlas (0/2) ? UIT (0/15) ? HST.maoz_atlas (0/1) ?
X-ray Chandra (0/172) ? ROSAT SIA (0/899) ?
Other CADC/JCMT (0/11) ?
Lists of Observations (Data in one VOTable)
Multi ADIL (51) ? HST (1262) ? HST.STIS (127) ? HST.FOC (60) ? HST.FOS (116) ?
HST.WFPC1 (178) ? HST.WFPC2 (425) ?

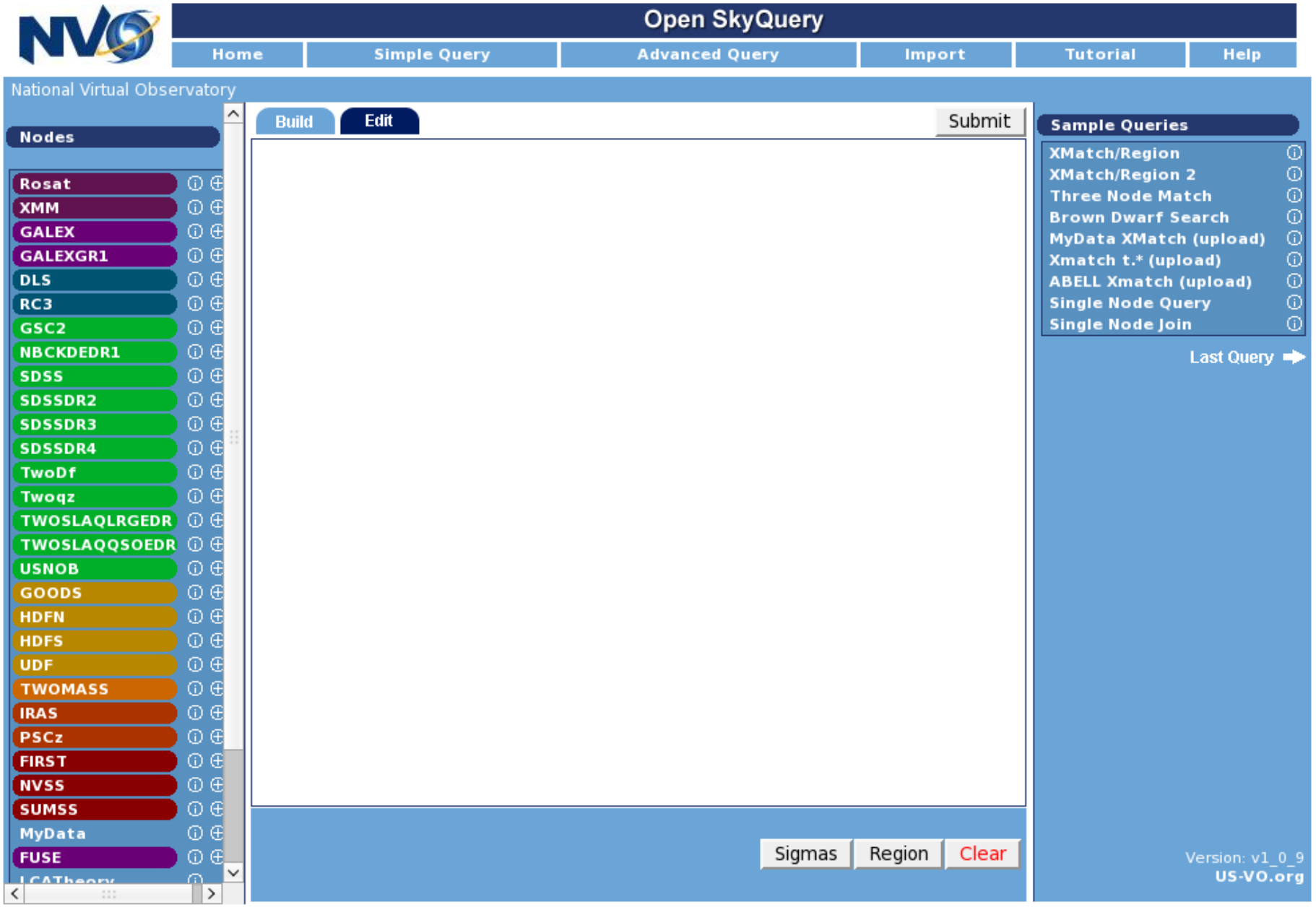
DataScope / Aladin



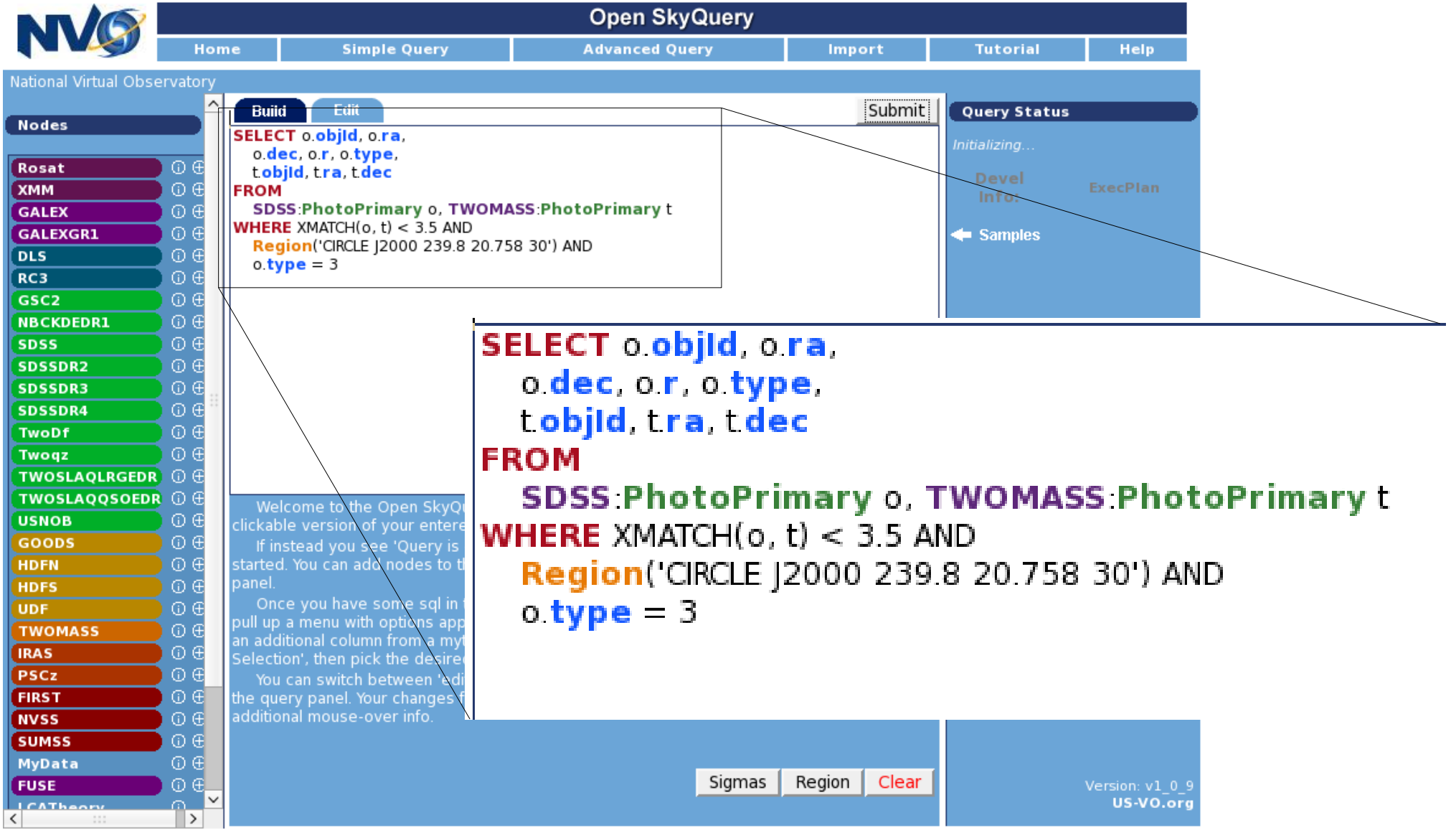
OpenSkyQuery

- Interface para busca em bancos de dados distribuídos (*SkyNodes*).
- Permite busca em catálogos ***e*** *crossmatching*.
- Permite *crossmatching* usando catálogos fornecidos pelo usuário.
- *SkyNodes* listados no *Registry*.
- Interface Web e *Web Services* (para desenvolvimento).

OpenSkyQuery



OpenSkyQuery



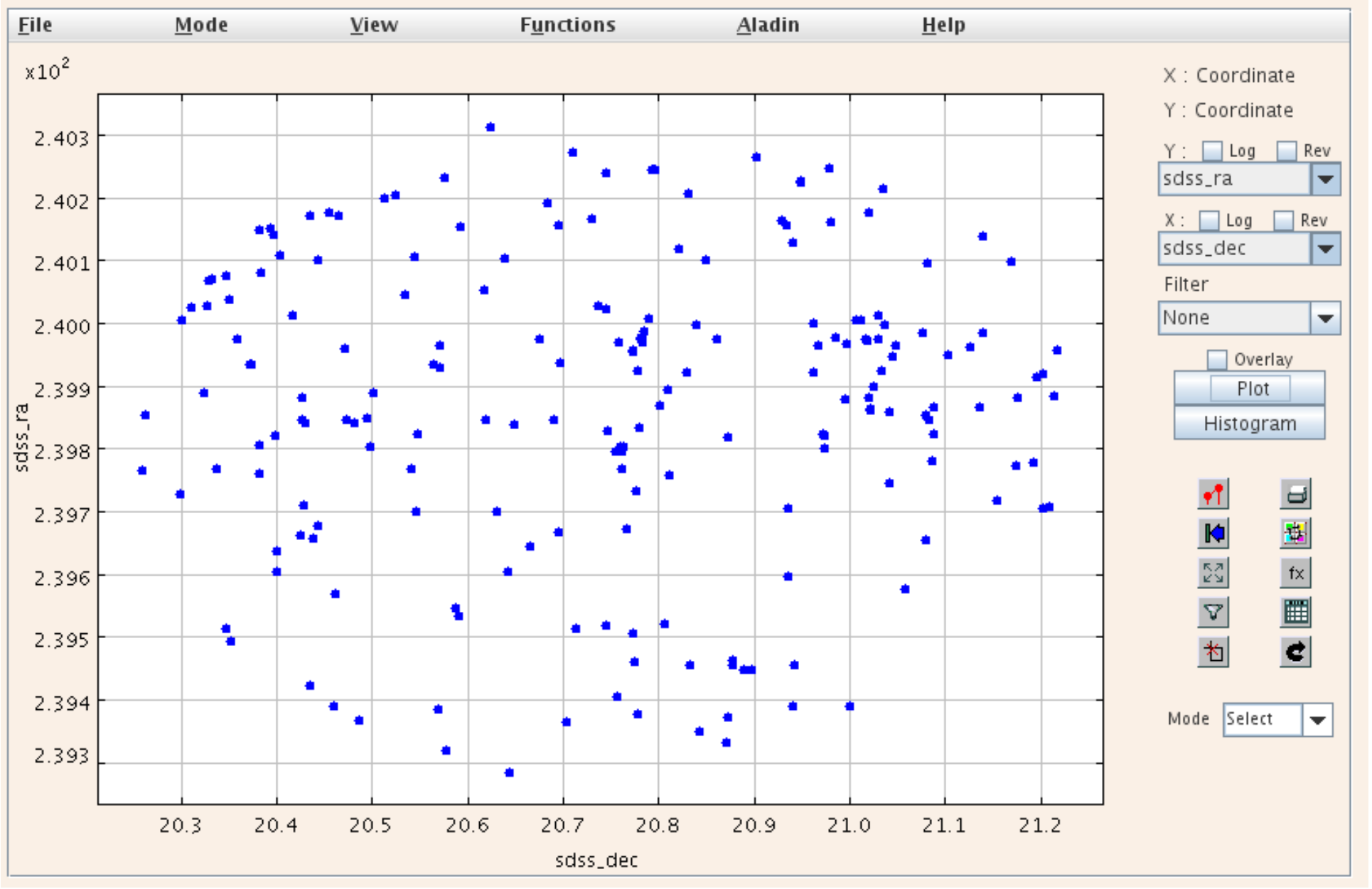
OpenSkyQuery

HTML Save

Only the first 128 of 205 rows are displayed for this query. Please click 'Save' to get all 205 rows.

sdss_objid	sdss_ra	sdss_dec	sdss_r	sdss_type	twomass_objid	twomass_ra	twomass_dec	chisq
587739380460224651	240.098489381	34 21.1686921186573	17.16852	3	677376799	240.099633	21.168362	6.30929565429688
587739380460159313	239.95615851784	21.2167648556323	22.34621	3	677356204	239.955597	21.217705	5.86172485351563
587739380460224893	240.137588403	05 21.1390677576319	17.75484	3	677376755	240.137545	21.139156	0.0477447509765625
587739406266990876	239.716890739	24 21.1541955657506	19.13663	3	677344646	239.71672	21.154362	0.2685546875
587739406266990900	239.778520704	34 21.1917755764194	18.69041	3	677344574	239.778467	21.191765	0.0132598876953125
587739406266990650	239.704727439	03 21.2029324730595	17.34323	3	677335022	239.70468	21.202965	0.0152587890625
587739406266990655	239.707634280	789 21.2092717704007	17.31683	3	677335036	239.707522	21.209183	0.09527587890625
587739406267056190	239.883419375	901 21.2133120659219	.726648	3	677356195	239.883412	21.213394	0.0342254638671875
587739406267056224	239.823861129	109 21.0883447806712	16.64035	3	677344756	239.824095	21.088125	0.485565185546875
587739406267056228	239.846261196	584 21.0831284342173	18.40555	3	677355959	239.84629	21.083088	0.0119171142578125
587739406267056229	239.853025034	017 21.0799485262243	18.63584	3	677355942	239.853039	21.079882	0.02325439453125
587739406267056263	239.867156712	701 21.0878104525062	16.53478	3	677355972	239.867326	21.087929	0.197463989257813
587739406267056377	239.781848308	126 21.0869019173937	16.65353	3	677344762	239.781867	21.086872	0.0060272216796875
587739406267056476	239.859732186	125 21.0422239053833	18.23047	3	677355866	239.859744	21.042299	0.0292205810546875
587739406267056442	239.918185292	427 21.2023894130064	17.10104	3	677356175	239.918215	21.202379	0.0044097900390625
587739406267056325	239.772797078	787 21.1735928856914	18.52365	3	677344615	239.772891	21.173786	0.227630615234375

OpenSkyQuery



Montage

- Ferramenta para agregar imagens em mosaicos.
- Preserva fidelidade de calibração e astrometria.
- Aceita parâmetros do usuário para projeção, coordenadas e escala espacial.
- Suporta paralelismo (MPI) e grid (Pegasus).

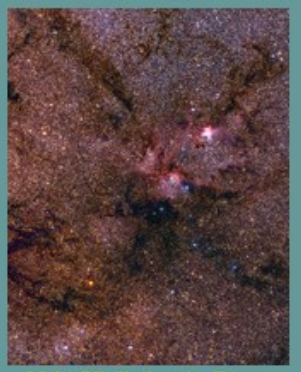
Montage

Image Mosaic Service

New user? Create Account | Login | Preferences ... | Job Status | Help

SDSS mosaics made prior to 27Mar2008 have an incorrect value for the MAGZP parameter in their FITS header. It should be 28.03 for all bands.

Returns science-grade mosaics that preserve fluxes and astrometry and rectify backgrounds to a common level.



2MASS Galactic Plane Three-Color Mosaic

Coordinate / Object: 239.8000000, +20.7583333

Survey / Band: HST Phase 2 (GSC2)

Region Size (deg): 0.2 1.0 Max

Pixel Resolution: 1 arcsec (2MASS / some DSS)

Coordinate System: FK5 - Equatorial J2000

Label (optional):

Users are currently limited to 10 simultaneous jobs. Results will be kept for about three days and then purged.

Submit

Coordinate Examples: 289.3848 11.9674 eq | 46.5377 -0.2518 ga | 19h17m32s 11d58m02s Equ J2000 | M 31

Powered by Montage

Montage

Image Mosaic Service

1 request matches your criteria.

(This page is updated every 15 seconds.)

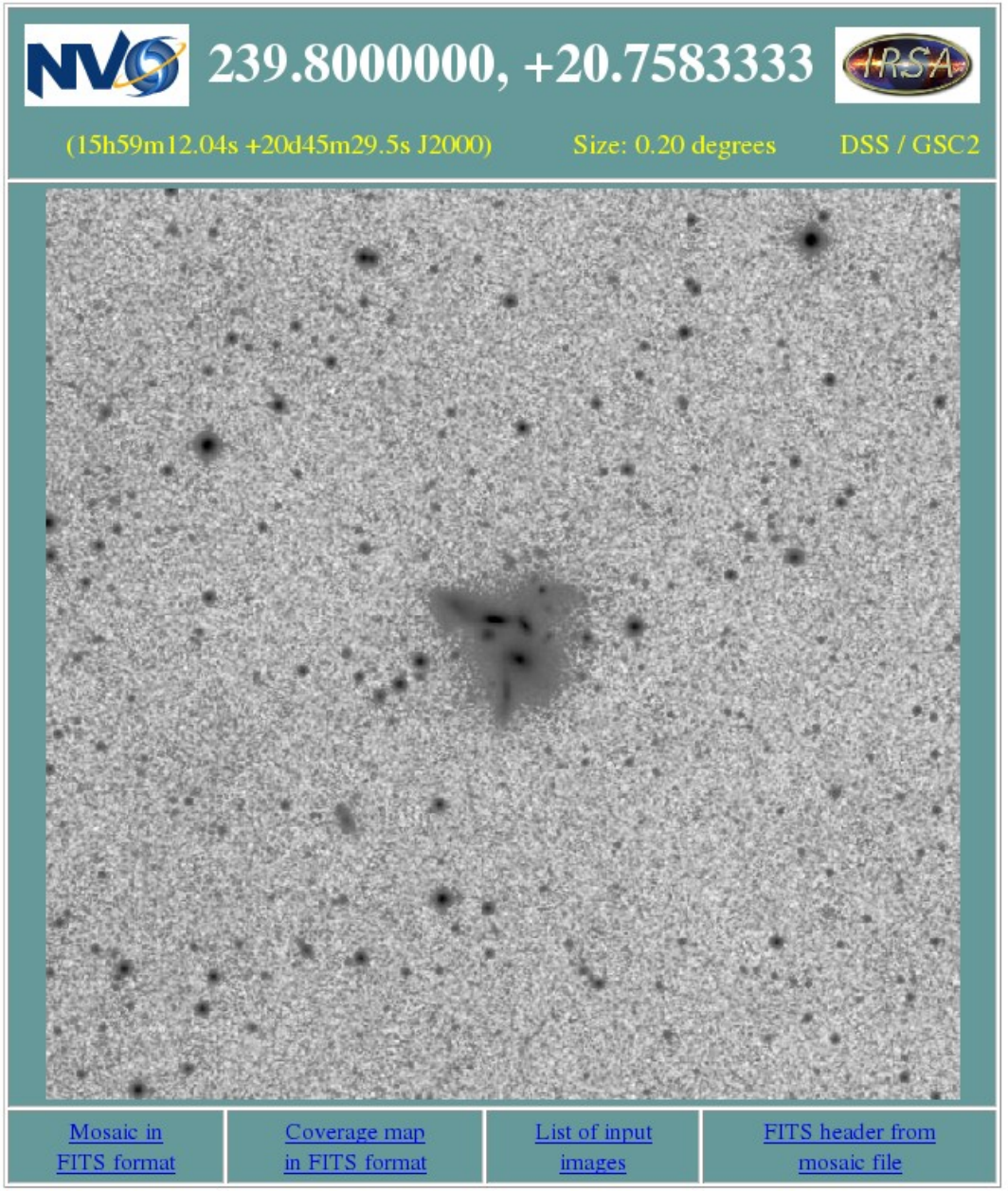
Request ID	Status	Message	Result page	Time
☐ 4697	PROCESSING	Input parameter file created		Mon Mar 31 13:38:49 PST 2008

Note: The results files associated with jobs will be purged after 72 hours. The associated entries are left in this database for a little longer for job tracking purposes; these will have stale "Result page" links.

You can delete jobs (even the running ones) using the checkboxes and the Cancel button below.

Cancel Back to main page Job Status Filter Refresh Job Status Helpdesk

Montage


239.8000000, +20.7583333
(15h59m12.04s +20d45m29.5s J2000)
Size: 0.20 degrees
DSS / GSC2
Mosaic in FITS format
Coverage map in FITS format
List of input images
FITS header from mosaic file

Exemplos: *Cone Search*

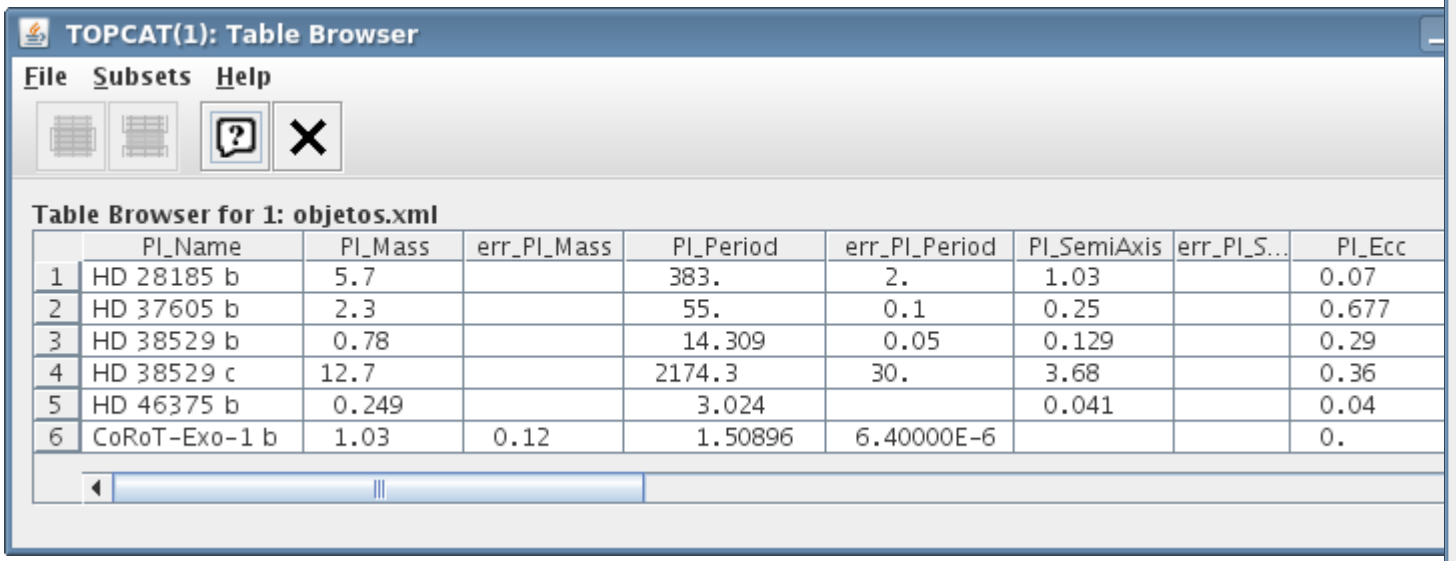
- Busca, em um catálogo, por objetos localizados perto de uma coordenada (com um raio de busca).
- Serviços acessíveis a partir de URL no formato http://<base>?RA=<ra>&DEC=<dec>&SR=<r> .
- Devem retornar uma VOTable (XML).

Exemplos: *Cone Search*

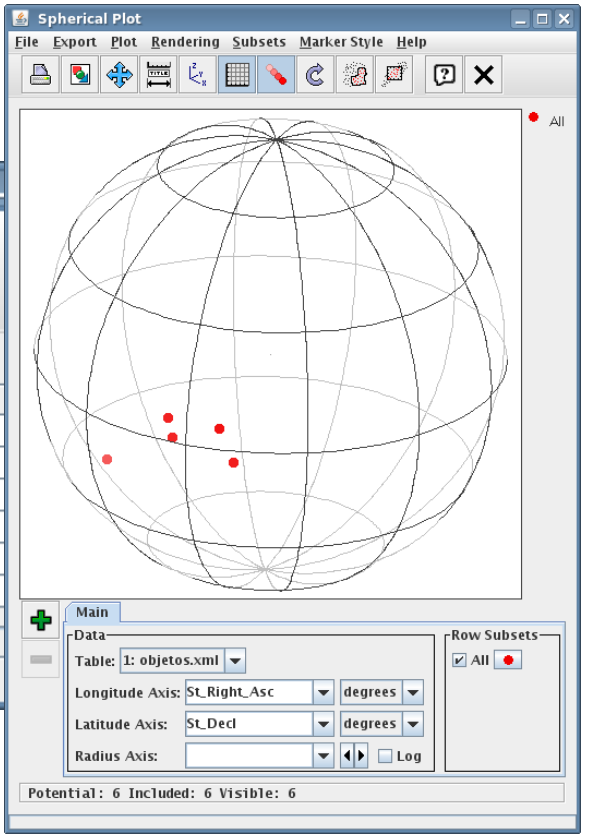
- Quais são as URLs para <base>?
- Procuramos no *Registry*: procure por entradas com **ResourceType = Cone** em www.us-vo.org.
  - Pegue a ServiceURL em “View”.
- Alguns exemplos:
  - Exoplanet Catalog: http://vo.obspm.fr/exoplanetes/encyclo/cone_search_cgi.php .
  - Sloan Digital Sky Survey (DR6): http://casjobs.sdss.org/vo/dr6cone/sdssConeSearch.asmx/ConeSearch?

Exemplos: *Cone Search*

- Podemos fazer via ferramentas prontas...
  - wget -q -O objetos.xml "http://vo.obspm.fr/exoplanetes/encyclo/cone_search_cgi.php?RA=84.0533894&DEC=-1.2019197&SR=20" .
- Visualizando VOTable em TOPCAT:



	PI_Name	PI_Mass	err_PI_Mass	PI_Period	err_PI_Period	PI_SemiAxis	err_PI_S...	PI_Ecc
1	HD 28185 b	5.7		383.	2.	1.03		0.07
2	HD 37605 b	2.3		55.	0.1	0.25		0.677
3	HD 38529 b	0.78		14.309	0.05	0.129		0.29
4	HD 38529 c	12.7		2174.3	30.	3.68		0.36
5	HD 46375 b	0.249		3.024		0.041		0.04
6	CoRoT-Exo-1 b	1.03	0.12	1.50896	6.40000E-6			0.



Outros serviços: *WESIX*

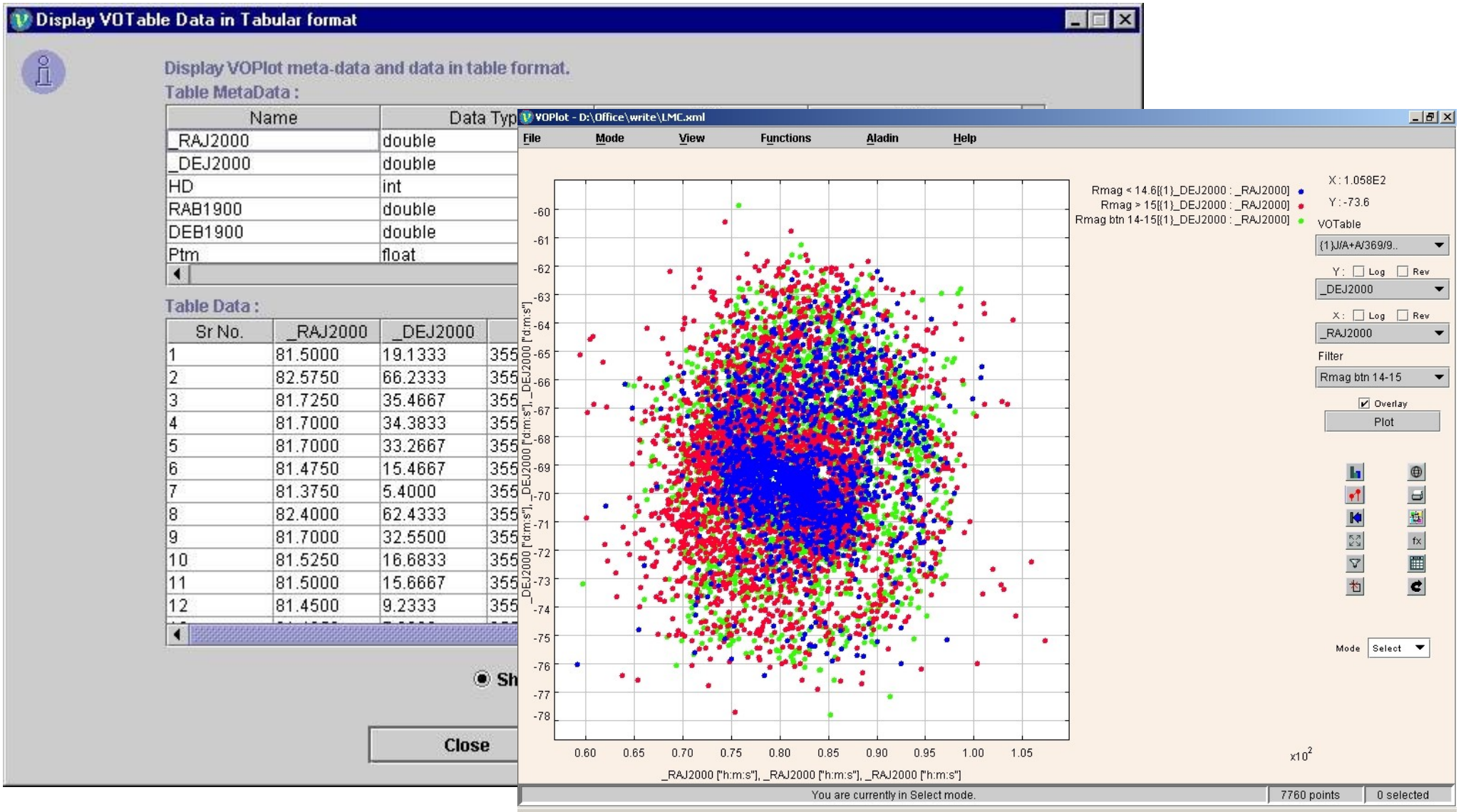
- **WESIX**: *Web Enabled Source Identifier with X-Matching*.
- Identifica objetos em imagens, usa OpenSkyQuery para fazer *crossmatching* com catálogos.
- Tem versões baseadas na Web e disponíveis como *web services*.

Outros serviços: *NESSSI*

- **NESSSI**: *NVO Extensible, Scalable, Secure Service Infrastructure*.
- Interface para submissão segura de serviços em grid.
- Disponível via Web ou *web services*.
- Serviços disponíveis:
  - *Image Cutout*.
  - Mosaicos DPOSS.

Outros serviços e aplicações

- VOPlot



Desenvolvimento de Software para VOs

Desenvolvimento de software para VOs

- Existem muitas ferramentas prontas com diversas finalidades, geralmente genéricas.
- *Biology easily has 500 years of exciting problems to work on.* – Donald E. Knuth.
- Finalidades específicas precisam de ferramentas específicas!
  - Clientes especializados para obter dados de diversas fontes (agregadores ou agentes).
  - Algoritmos específicos que usam dados do VO.
  - Servidores para disponibilizar dados em padrões VO.
  - Etc.

Que linguagem usar?

- Experiência em ensino: **a que você já sabe**.
- Linguagens e ambientes para os quais já existem ferramentas: Java, Python, IDL.
- Linguagem dominante para *frameworks*: Java.
- Para aplicações científicas: C, Python, etc.
- Ambientes para astronomia: IRAF, IDL, AIPS, etc.

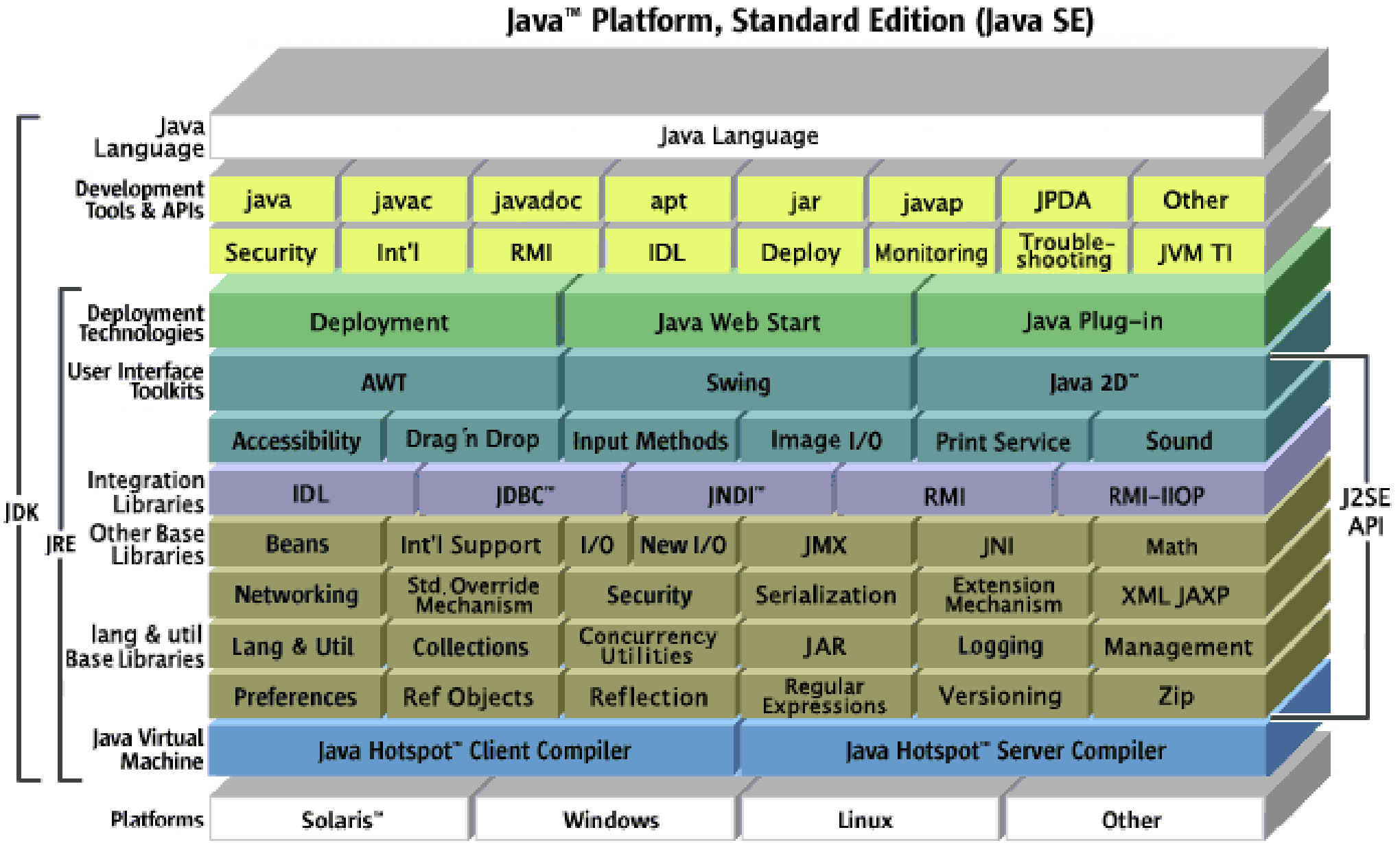
Veremos exemplos em...

- **Java.**
- Fácil de entender, fácil de compartilhar, *fácil de achar programadores com alguma proficiência*.
- Portátil, linguagem é a mesma para aplicações desktop, *applets* e cliente-servidor.
- Zero royalties!
- Riqueza está nas APIs.

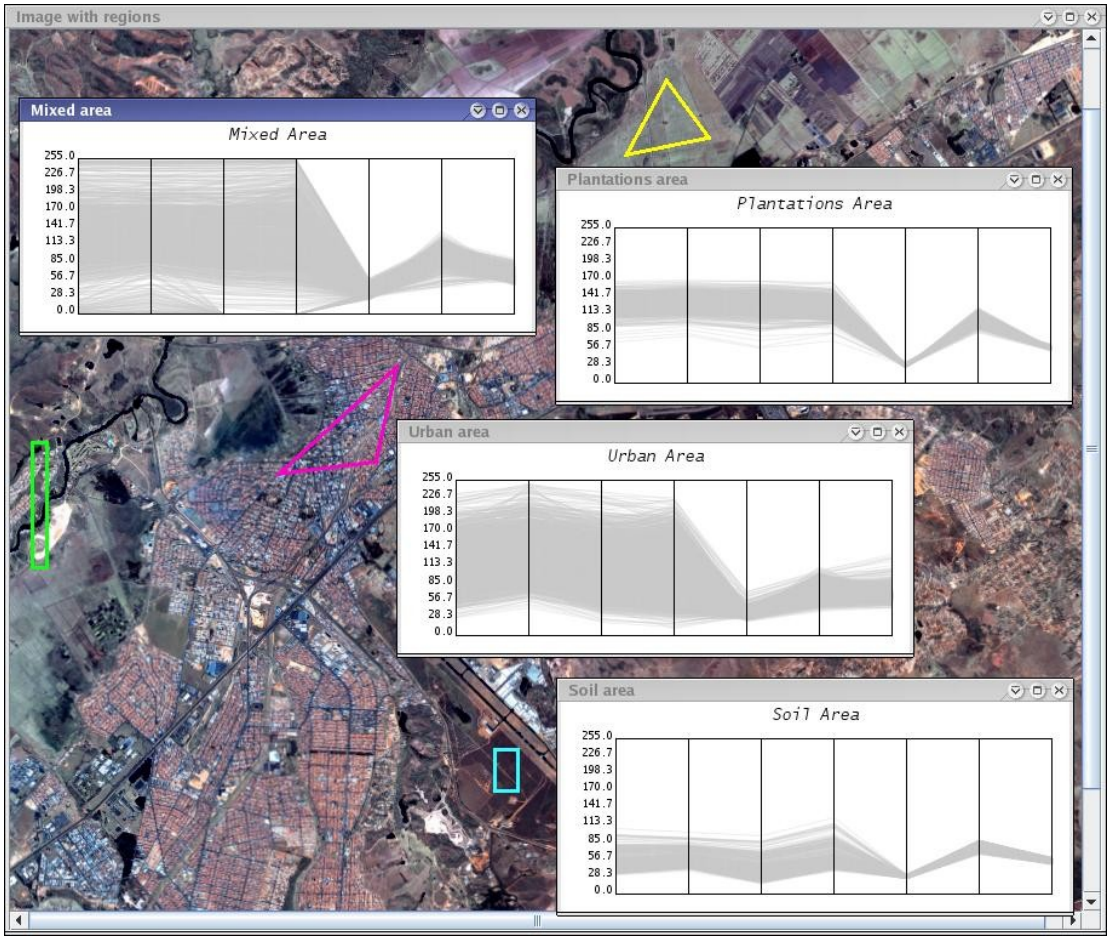
Java

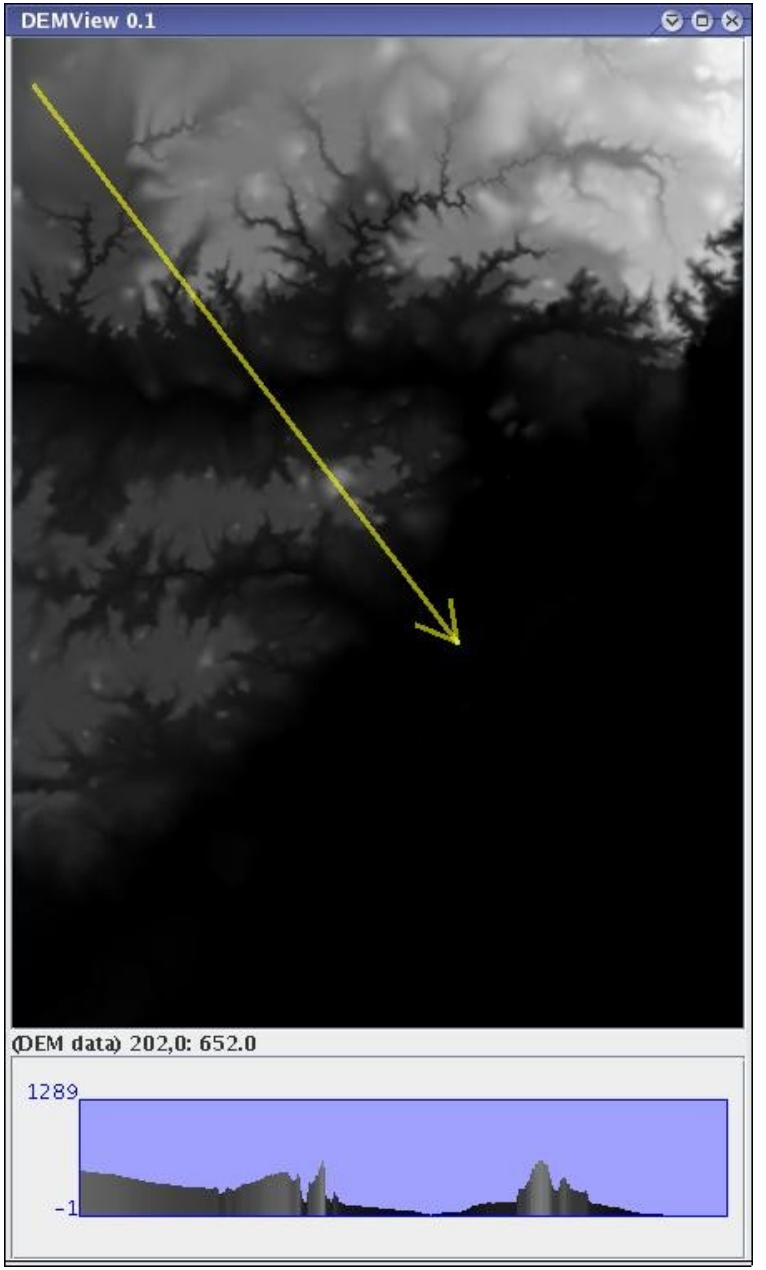
- Simples, orientada a objetos.
- Herdou muitos conceitos de C, C++, outras.
- Código compilado para *bytecodes*, interpretado por uma máquina virtual.
- *Bytecodes* compatíveis entre sistemas operacionais*.
- Base compatível entre máquinas virtuais.
- APIs dependem da finalidade, mas código de negócio é portátil!
- Otimização de *bytecodes* melhora a performance.

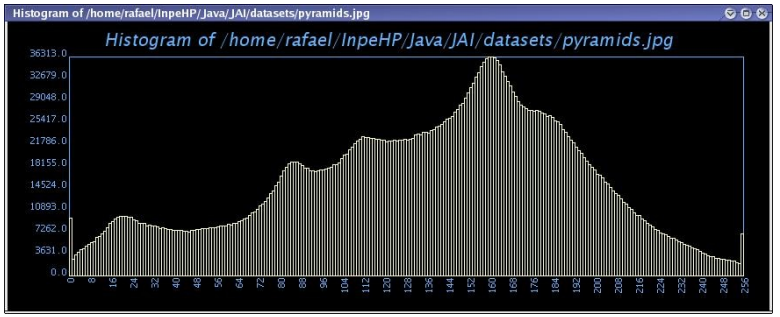
A plataforma Java



Java: Interfaces Gráficas (Swing)





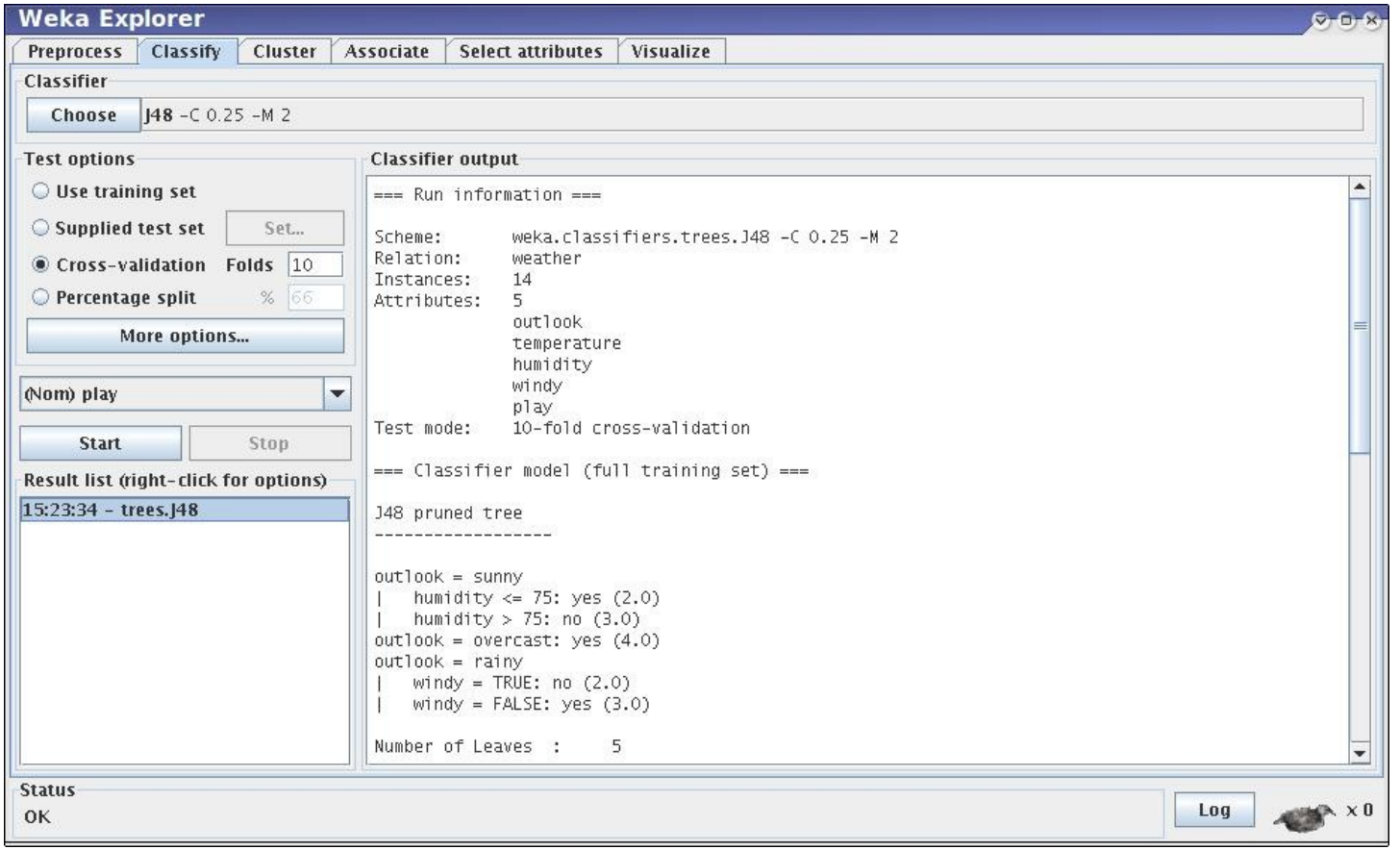


Java: Processamento de Imagens

- API JAI (*Java Advanced Programming*)
  - Representação, I/O, operadores, algoritmos para processamento de imagens de grande porte.
  - Sem suporte direto para FITS.

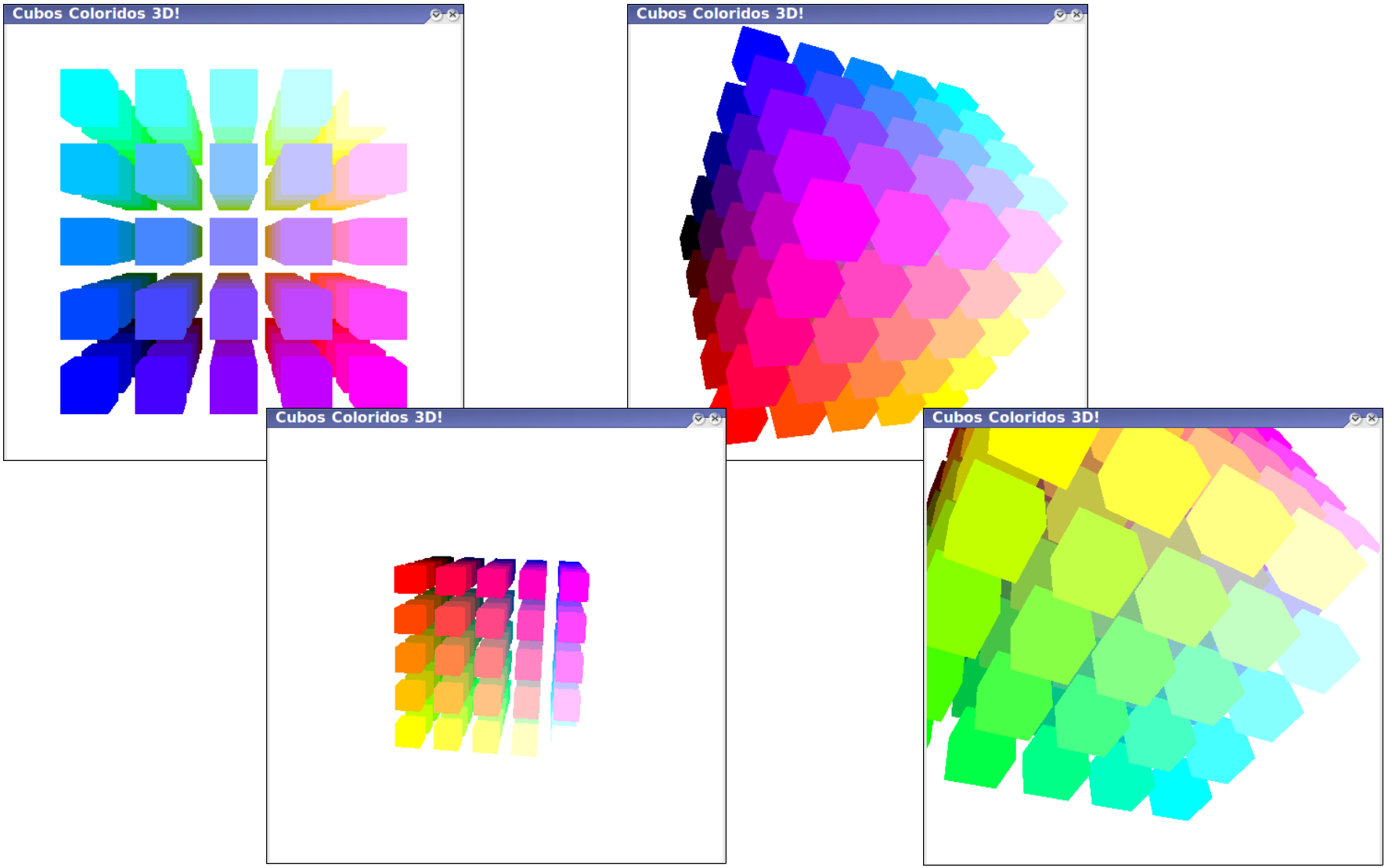
Java: Mineração de Dados

- API WEKA (*Waikato Environment for Knowledge Analysis*): muitos algoritmos de mineração de dados, ambiente de prototipação.
- Veja também RapidMiner!



Java: Visualização/3D

- Java3D, JOGL



Java: Outros

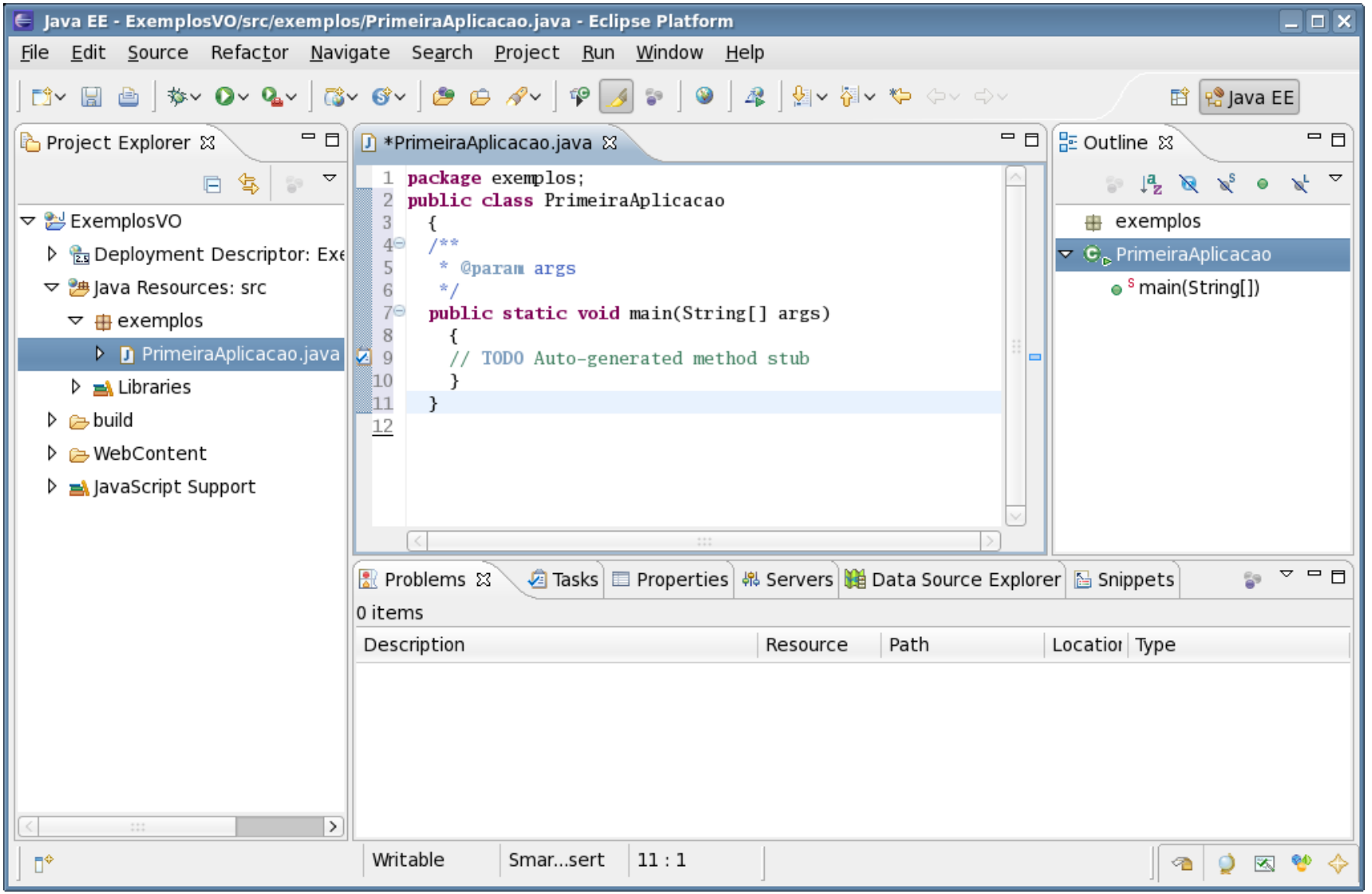
- Redes neurais (JOONE), Algoritmos genéticos (JGAP), anilhamento simulado (JSimul).
- Computação distribuída e de alta performance (GRID): COLT, Globus.
- Computação distribuída P2P (JXTA, Firefish, Scishare).
- Representação e visualização de grafos (JGraph).
- Formatos para entrada e saída de gráficos: Batik (SVG), PDF (iText).

Ainda Java

- Mesma linguagem para desenvolvimento de aplicações em servidores e *web services*.
- APIs podem ou não ser compatíveis.
- ~~Complexidade~~ Simplicidade: desde *scripts* simples até aplicações em *N* camadas.
- Por ser portátil praticamente independe de arquitetura.

Ambientes para Desenvolvimento

- Netbeans, JCreator, **Eclipse**.

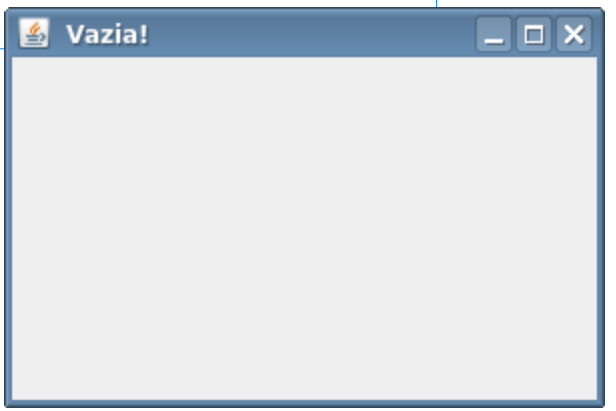


Exemplos: Classe Executável

```
package exemplos;

import javax.swing.JFrame;

public class PrimeiraAplicacao
  {
  public static void main(String[] args)
    {
    System.out.println("Hello World!");
    }
  }
```

Exemplos: Classe Executável

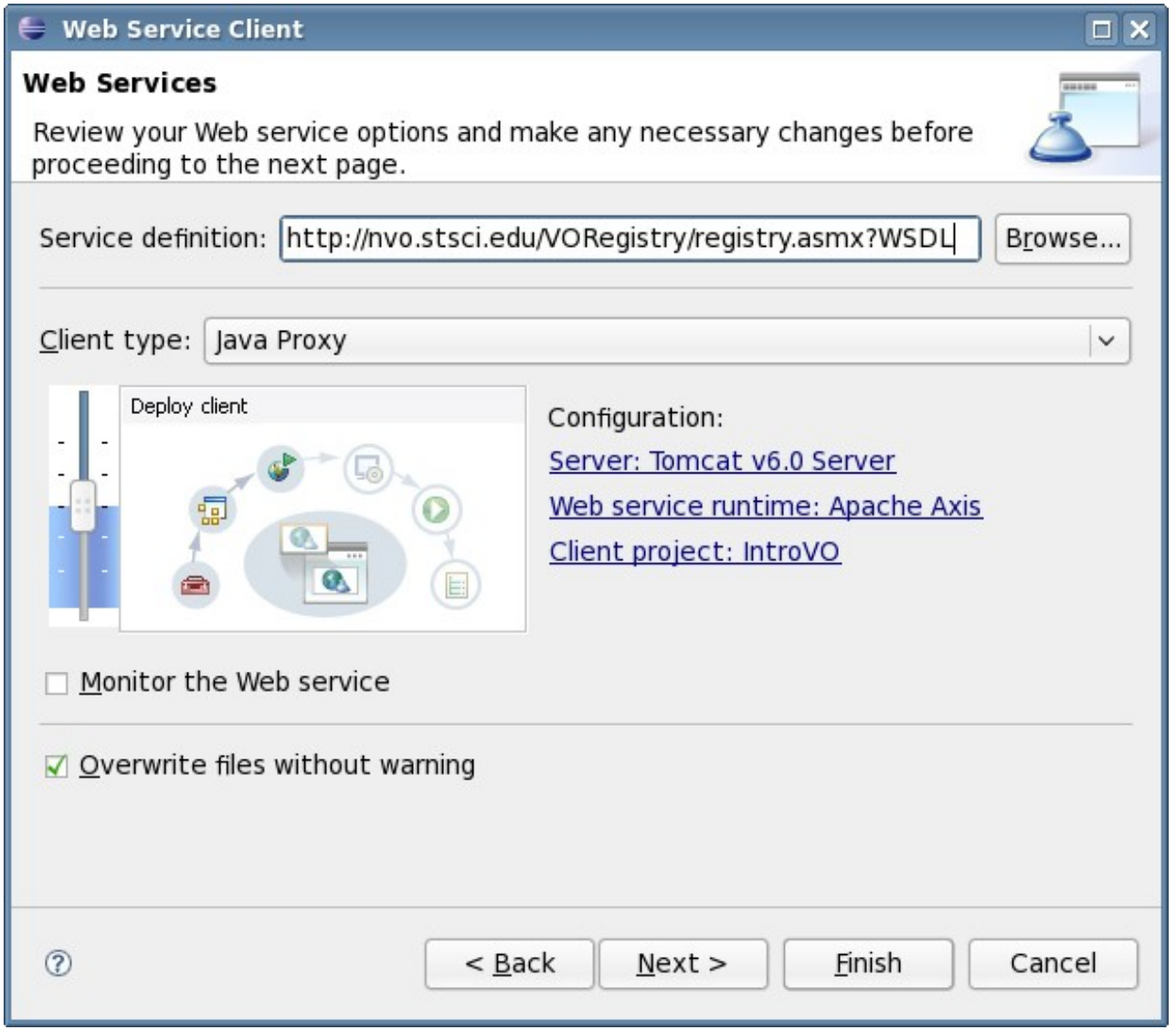
```
package exemplos;

import javax.swing.JFrame;

public class SegundaAplicacao
  {
  public static void main(String[] args)
    {
    // Criamos uma JFrame para a GUI.
    JFrame frame = new JFrame("Vazia!");
    frame.setVisible(true);
    frame.setSize(300,200);
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    }
  }
```



Orientação a Objetos na prática!

Exemplos: Explorando o *Registry*

- Cliente de *web service*: Eclipse cria tudo automaticamente!



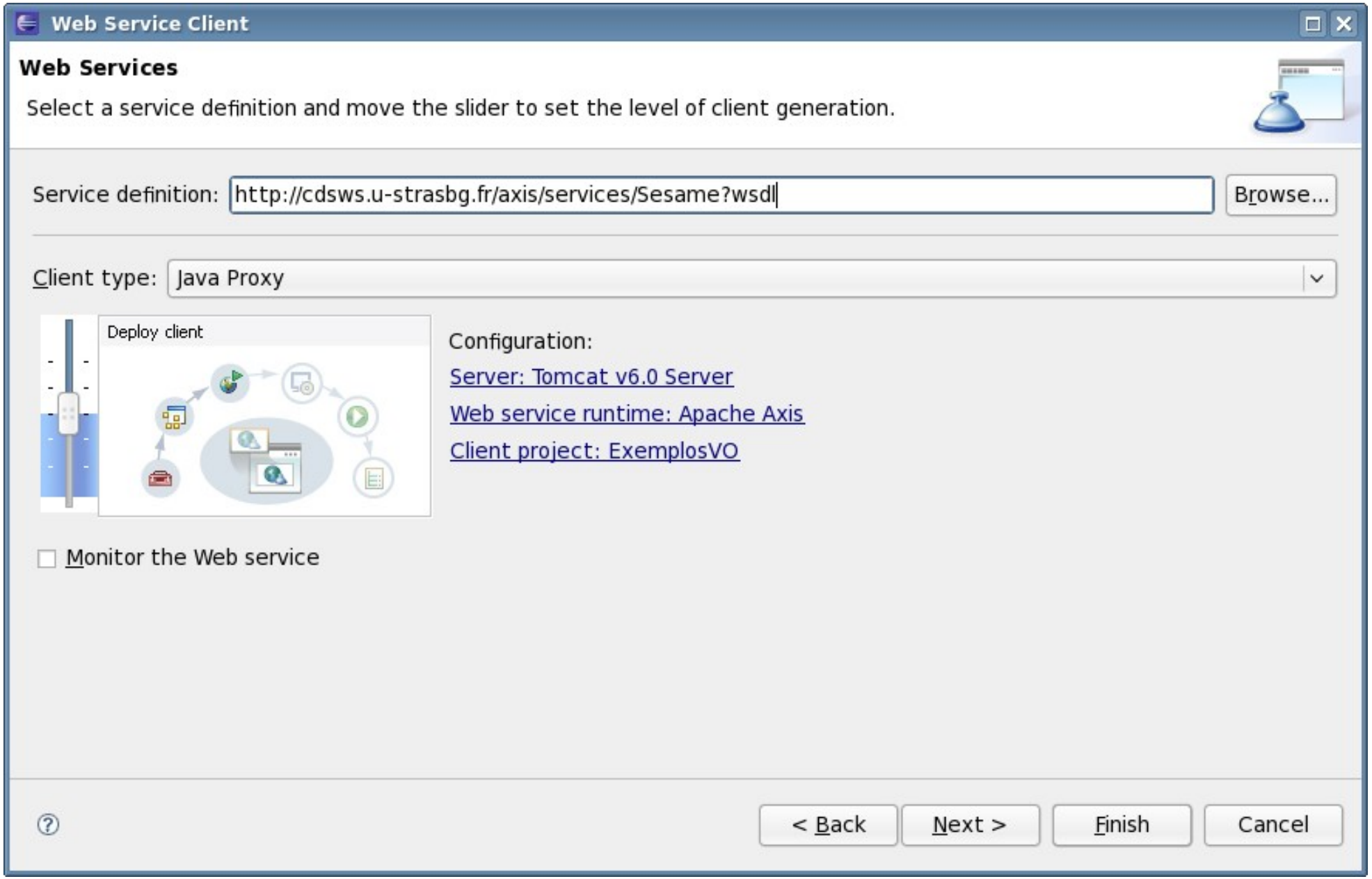
Exemplos: Explorando o *Registry*

```
public class RegistryList
  {
  public static void main(String[] args)
    throws ServiceException, RemoteException
    {
    // Um localizador para obter instâncias dos stubs.
    RegistryLocator loc = new RegistryLocator();
    // Um stub para os serviços.
    RegistrySoap reg = loc.getRegistrySoap();
    // Busca direta nos resources, usando SQL.
    SimpleResource[] res =
      reg.queryRegistry("ResourceType like 'SIAP'");
    // Quantos resources conseguimos?
    System.out.println(res.length);
    // Imprimimos algumas informações sobre eles.
    for(SimpleResource sr:res)
      System.out.println(sr.getTitle()+": "+sr.getReferenceURL());
    }
  }
```

Exemplos: Explorando o *Registry*

```
90
SIA Service for Subaru/XMM-Newton Deep Survey 01:
the Subaru/XMM-Newton Deep Survey (SXDS) SIA Service:
the Subaru/XMM-Newton Deep Survey (SXDS) SIA Service:
NCSA Astronomy Digital Image Library Simple Image Access:
http://adil.ncsa.uiuc.edu/help/help_newquery.html
The IRAS Galaxy Atlas: http://irsa.ipac.caltech.edu/data/IGA
Spitzer First Look Survey (FLS) -- Ancillary VLA Data:
http://irsa.ipac.caltech.edu/data/SPITZER/FLS_VLA
2MASS 6X Lockman Hole Ancillary Data Atlas:
http://irsa.ipac.caltech.edu/data/LH
The Mid-Infrared Galaxy Atlas: http://irsa.ipac.caltech.edu/data/MIGA

...

CADC/MACHO Image Search: http://www.cadc-ccda.hia-iha.nrc-
cnrc.gc.ca/cvo/siap/
CADC/IRIS Image Search: http://www.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/cvo/siap/
VO-Paris MAMA ESO R Atlas: http://vo.obspm.fr/sia/eso-r.html
VO-Paris Southern ATlas SRC-J: http://vo.obspm.fr/sia/src-j.html
ESO Science Archive Image Service: http://archive.eso.org/cms/tools-
documentation/which-data-are-available/
```

Exemplos: Resolvendo Nomes com Sesame



Exemplos: Resolvendo Nomes com Sesame

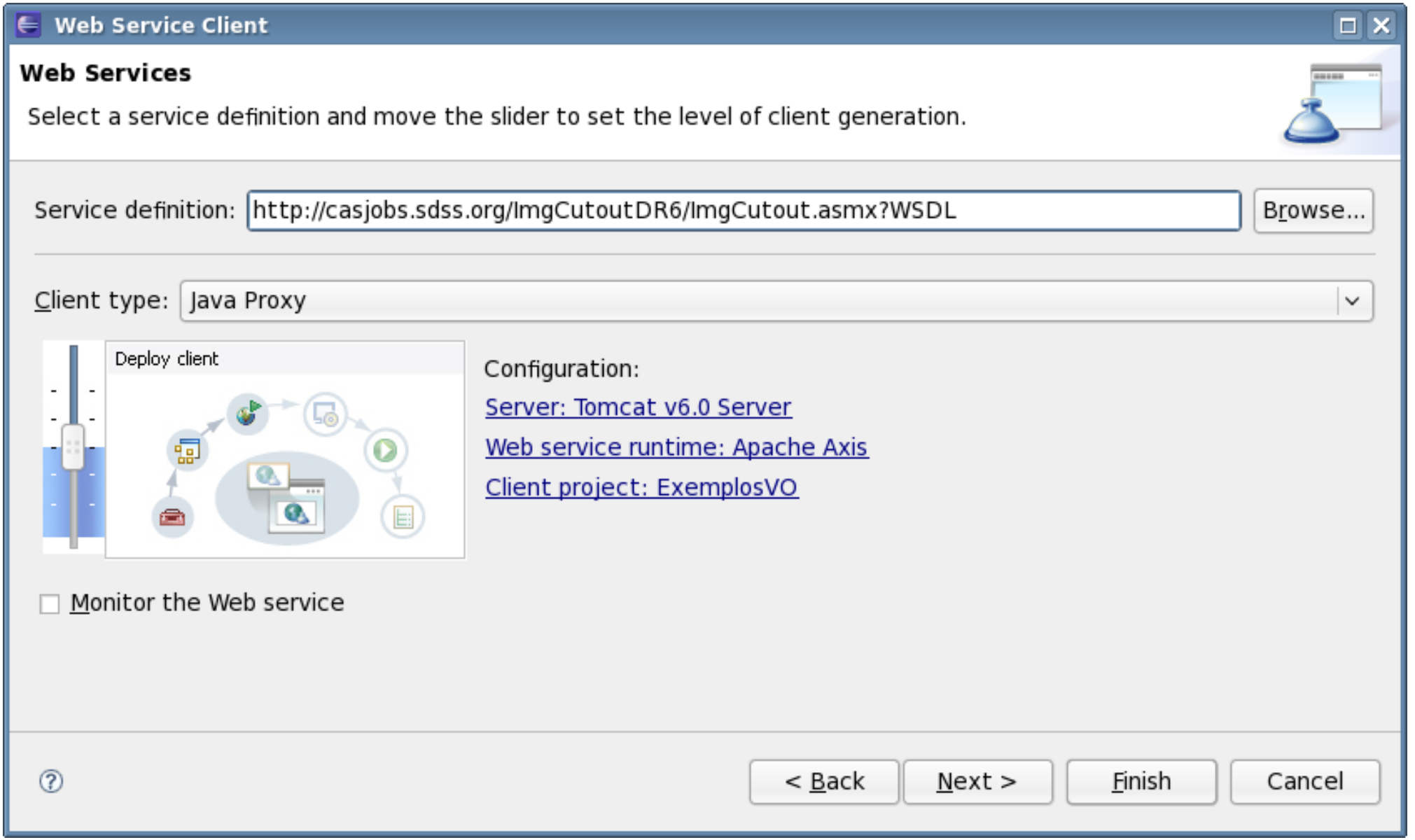
```
package exemplos;

import java.rmi.RemoteException;

import javax.xml.rpc.ServiceException;

import Sesame_pkg.Sesame;
import Sesame_pkg.SesameService;
import Sesame_pkg.SesameServiceLocator;

public class ResolveNomes
  {
  public static void main(String[] args) throws ServiceException, RemoteException
    {
    String nome = "M101";
    // Cria o localizador
    SesameService locator = new SesameServiceLocator();
    // Cria a interface
    Sesame sesame = locator.getSesame();
    // Resolve o nome no formato texto
    String resultado = sesame.sesame(nome);
    System.out.println(resultado);
    }
  }
```

Exemplos: Resolvendo Nomes com Sesame

```
public static void main(String[] args) throws ServiceException, RemoteException
  {
  String nome = "M101";
  // Cria o localizador
  SesameService locator = new SesameServiceLocator();
  // Cria a interface
  Sesame sesame = locator.getSesame();
  // Resolve o nome no formato texto
  String resultado = sesame.sesame(nome);
  System.out.println(resultado);
  }
```

```
# M101     #Q22075
#=Simbad: 1
%J 210.8021250 +54.3480833 (6) = 14 03 12.51   +54 20 53.1
%J.E [10800.00 10800.00  90] D 1999ApJS..125..409C
%V v +241 D [~] 2004AJ....127.2031K
%T Sc
%I.0 APG 26
%C IG
%@ 8504,0
#---ServerTime(ms): 0
```

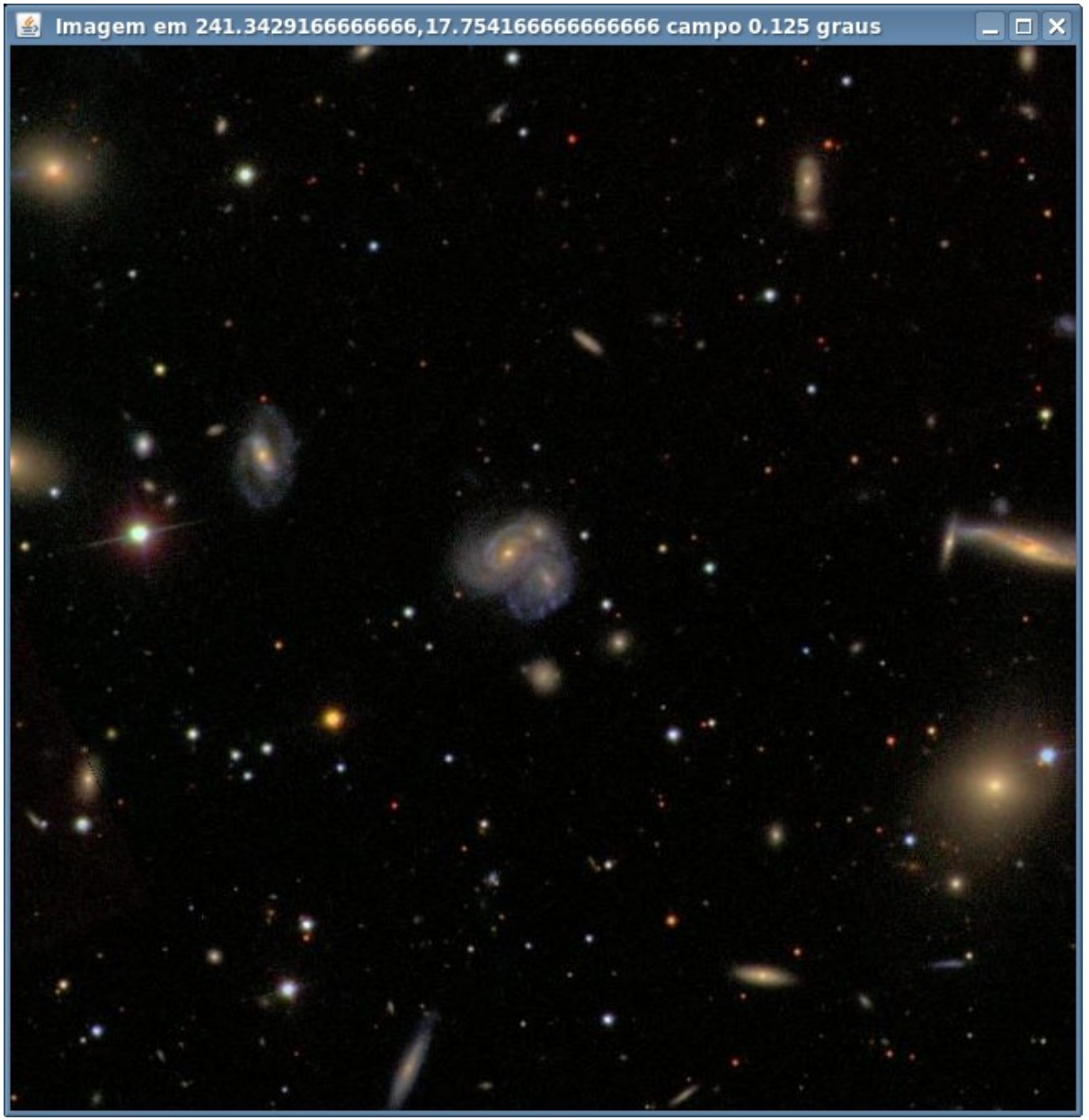
Exemplos: Obtendo imagens (JPEG) do SDSS



Exemplos: Obtendo imagens (JPEG) do SDSS

```
public class SDSSImageViewer
  {
  public static void main(String[] args) throws IOException
    {
    double ra = Conversions.parseRA("16:05:22.30");
    double dec = Conversions.parseDEC("17:45:15");
    int pixels = 640;          double campo = 1/8.;
    // Criamos o proxy para o serviço.
    ImgCutoutSoapProxy ic = new ImgCutoutSoapProxy();
    // Campo em arcsec/pixels
    double ccampo = campo*(3600./pixels);
    // Obtemos os bytes da imagem e criamos um BufferedImage.
    byte[] image = ic.getJpeg(ra,dec,ccampo,pixels,pixels,"");
    BufferedImage bi = ImageIO.read(new ByteArrayInputStream(image));
    // Criamos uma JFrame para a GUI.
    JFrame frame = new JFrame("Imagem em "+ra+","+dec+" campo "+campo+" graus");
    // Maneira mais simples de mostrar um BufferedImage pequeno.
    ImageIcon icon = new ImageIcon(image);
    JLabel label = new JLabel(icon);
    // Composição da GUI.
    frame.getContentPane().add(label);
    frame.setVisible(true);
    frame.pack();
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    }
  }
```

Exemplos: Obtendo imagens (JPEG) do SDSS



Exemplos: *Cone Searches*

- Exemplo adaptado do *US VO Summer School 2006* (www.us-vo.org)
- Precisamos do pacote ivoa-{versão}.jar e de várias classes.

Exemplos: *Cone Searches*

```
package exemplosCone;

public class ConeSearch
  {
  public static void main(String[] args) throws Exception
    {
    // Qual URL usaremos?
    String serviço =
        "http://casjobs.sdss.org/vo/dr6cone/sdssConeSearch.asmx/ConeSearch";
    // Quais coordenadas e raio?
    double ra = 185.7913549820207; double dec = 15.765330014737584;
    double sr = 0.1;
    // Cria uma conexão ao serviço.
    ConeConnection cone = new ConeConnection(serviço);
    // Prepara a query.
    ConeQuery query = cone.getConeQuery(ra, dec, sr);
    // Executa a query e recupera os resultados.
    System.out.println("# Query: "+query.getQueryString(0));
    QueryResponse qr = query.execute();
```

Exemplos: *Cone Searches*

```
    if (qr.getRecordCount() <= 0)
      System.out.println("Nenhum registro encontrado.");
    else
      {
      int nrec = qr.getRecordCount();
      QueryRecord r = qr.getRecord(0);
      int nattr = (r != null) ? r.getAttributeCount() : 0;
      System.out.println(nrec+" registros contendo "+nattr+" atributos cada.");
      System.out.println("----------------------------");
      // Mostra registros.
      for (int i=0;i < qr.getRecordCount();i++)
        {
        r = qr.getRecord(i);
        String s_id, s_ra, s_dec, s_class;
        QRAttribute v;
        s_id = ((v = r.getAttribute("ID_MAIN")) != null) ? v.stringValue() : "<none>";
        s_ra = ((v = r.getAttribute("POS_EQ_RA_MAIN")) != null) ?
           v.stringValue() : "<unknown>";
        s_dec = ((v = r.getAttribute("POS_EQ_DEC_MAIN")) != null) ?
           v.stringValue() : "<unknown>";
        s_class = ((v = r.getAttribute("CLASS_OBJECT")) != null) ?
           v.stringValue() : "<unknown>";
        System.out.println("id="+s_id +"\tra="+s_ra+"\tdec="+s_dec+"\tclasse="+s_class);
        }
      }
    }
  }
```

Exemplos: *Cone Searches*

```
# Query: http://casjobs.sdss.org/vo/dr6cone/sdssConeSearch.asmx/ConeSearch?
RA=185.79135498202 07&DEC=15.765330014737584&SR=0.1
929 registros contendo 19 atributos cada.
---------------------------
id=587738570314482615 ra=185.795092879666  dec=15.7658914208506 classe=GALAXY
id=587738570314481959 ra=185.794353468369  dec=15.7626569394439 classe=STAR
id=587738570314481727 ra=185.785877498836  dec=15.7681200222715 classe=STAR
id=587738570314482284 ra=185.793149803237  dec=15.7602919689139 classe=STAR
id=587738570314482610 ra=185.78662808731   dec=15.7625693670059 classe=STAR
id=587738570314482801 ra=185.797149257061  dec=15.7706101754262 classe=GALAXY
id=587738570314481815 ra=185.779749206756  dec=15.7588272801349 classe=STAR
id=587738570314482273 ra=185.785996685106  dec=15.7756804664342 classe=GALAXY
id=587738570314482274 ra=185.78597421253   dec=15.7538965928261 classe=STAR
id=587738570314482301 ra=185.799595728543  dec=15.775053440813  classe=GALAXY
id=587738570314482798 ra=185.791774989619  dec=15.7559997969252 classe=GALAXY
id=587738570314482799 ra=185.791806982947  dec=15.7548507552474 classe=GALAXY
id=587738570314482803 ra=185.80297707425   dec=15.7704947797825 classe=STAR
id=587738570314482895 ra=185.782885964098  dec=15.7672255822748 classe=GALAXY
id=587738570314481730 ra=185.799510546679  dec=15.7514282745969 classe=STAR
id=587738570314481819 ra=185.792277714013  dec=15.783240553641  classe=STAR
id=587738570314482053 ra=185.77418881866   dec=15.7704041953724 classe=STAR
id=587738570314482224 ra=185.771817615242  dec=15.759928463987  classe=GALAXY
id=587738570314482241 ra=185.775887054934  dec=15.7665234185597 classe=GALAXY
id=587738570314482243 ra=185.776647534036  dec=15.7531484790299 classe=GALAXY
id=587738570314482263 ra=185.783144396059  dec=15.7811034050993 classe=GALAXY
...
```

Exemplos: *Cone Searches* (2)

```
package exemplosCone;

import java.io.*;
import java.net.URL;

public class SimpleConeSearch
  {
  public static void main(String[] args) throws IOException
    {
    // Qual URL usaremos?
    String serviço =
      "http://casjobs.sdss.org/vo/dr6cone/sdssConeSearch.asmx/ConeSearch";
    // Quais coordenadas e raio?
    double ra = 185.7913549820207; double dec = 15.765330014737584;
    double sr = 0.1;
    URL url = new URL(serviço+"?RA="+ra+"&DEC="+dec+"&SR="+sr);
    BufferedReader in =
       new BufferedReader(newInputStreamReader(url.openStream()));
    String inputLine;
    String xml = "";
    while ((inputLine = in.readLine()) != null) xml += inputLine;
    in.close();
    System.out.println(xml);
    }
  }
```

Exemplos: *Cone Searches* (2)

```
<?xml version="1.0" encoding="utf-8"?>
<VOTABLE xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://vizier.u-strasbg.fr/xml/VOTable-1.1.xsd">
  <DESCRIPTION>ConeSearch results from the Sloan Digital Sky Survey</DESCRIPTION>
  <INFO name="rowcount, table 0" value="929" />
  <RESOURCE>
    <TABLE>
      <PARAM unit="degrees" datatype="float" name="inputRA" value="185.791354982021" />
      <PARAM unit="degrees" datatype="float" name="inputDEC" value="15.7653300147376" />
      <PARAM unit="degrees" datatype="float" name="inputSR" value="0.1" />
      <FIELD ID="OBJID" datatype="long" ucd="ID_MAIN" />
      <FIELD ID="RA" datatype="double" ucd="POS_EQ_RA_MAIN" />
      <FIELD ID="DEC" datatype="double" ucd="POS_EQ_DEC_MAIN" />
      <FIELD ID="TYPE" datatype="char" ucd="CLASS_OBJECT" />
      <FIELD ID="U" datatype="float" ucd="PHOT_SDSS_U FIT_PARAM" />
      <FIELD ID="G" datatype="float" ucd="PHOT_SDSS_G FIT_PARAM" />
      <FIELD ID="R" datatype="float" ucd="PHOT_SDSS_R FIT_PARAM" />
      <FIELD ID="I" datatype="float" ucd="PHOT_SDSS_I FIT_PARAM" />
      <FIELD ID="Z" datatype="float" ucd="PHOT_SDSS_Z FIT_PARAM" />
      <FIELD ID="ERR_U" datatype="float" ucd="PHOT_SDSS_U ERROR" />
      <FIELD ID="ERR_G" datatype="float" ucd="PHOT_SDSS_G ERROR" />
      <FIELD ID="ERR_R" datatype="float" ucd="PHOT_SDSS_R ERROR" />
      <FIELD ID="ERR_I" datatype="float" ucd="PHOT_SDSS_I ERROR" />
      <FIELD ID="ERR_Z" datatype="float" ucd="PHOT_SDSS_Z ERROR" />
      <FIELD ID="PSFMAG_U" datatype="float" ucd="PHOT_SDSS_U" />
      <FIELD ID="PSFMAGERR_U" datatype="float" ucd="PHOT_SDSS_U ERROR" />
      <FIELD ID="PSFMAG_G" datatype="float" ucd="PHOT_SDSS_G" />
      <FIELD ID="PSFMAGERR_G" datatype="float" ucd="PHOT_SDSS_G ERROR" />
      <FIELD ID="PSFMAG_R" datatype="float" ucd="PHOT_SDSS_R" />
      <FIELD ID="PSFMAGERR_R" datatype="float" ucd="PHOT_SDSS_R ERROR" />
      <FIELD ID="PSFMAG_I" datatype="float" ucd="PHOT_SDSS_I" />
      <FIELD ID="PSFMAGERR_I" datatype="float" ucd="PHOT_SDSS_I ERROR" />
      <FIELD ID="PSFMAG_Z" datatype="float" ucd="PHOT_SDSS_Z" />
      <FIELD ID="PSFMAGERR_Z" datatype="float" ucd="PHOT_SDSS_Z ERROR" />
      <DATA>
..
```

Exemplos: *Cone Searches* (2)

```
<DATA>
   <TABLEDATA>
     <TR>
       <TD>587738570314482615</TD>
       <TD>185.795092879666</TD>
       <TD>15.7658914208506</TD>
       <TD>GALAXY</TD>
       <TD>25.01533</TD>
       <TD>23.99307</TD>
       <TD>22.21262</TD>
       <TD>22.39946</TD>
       <TD>21.49776</TD>
       <TD>1.035026</TD>
       <TD>0.4957244</TD>
       <TD>0.1679916</TD>
       <TD>0.2977116</TD>
       <TD>0.3798911</TD>
       <TD>24.70237</TD>
       <TD>0.6390687</TD>
       <TD>24.18151</TD>
       <TD>0.3416954</TD>
       <TD>22.93768</TD>
       <TD>0.1675067</TD>
       <TD>22.74282</TD>
       <TD>0.20921</TD>
       <TD>22.0005</TD>
       <TD>0.2806336</TD>
     </TR>
```

Exemplo: Servidor de *Cone Search*

- Protótipo do SoarVO

Exemplo: Servidor de *Cone Search*

```
<div class="form">
  <form action="conesearch.jsp" method="get">
  <b>Cone Search: </b>
    RA:<input type="text" name="RA" value="166" size="10">
    DEC:<input type="text" name="DEC" value="-21" size="10">
    Radius:<input type="text" name="SR" value="5" size="6">
    Format:<select name="FORMAT">
      <option value="html">HTML</option>
      <option value="votable">VOTable</option>
      <option value="csv">CSV</option>
      <option value="map">Map</option></select>
    <input type="submit">
  </form>
</div>
```

Exemplo: Servidor de *Cone Search*

```
<%
String format = request.getParameter("FORMAT");
String sra = request.getParameter("RA");
if (sra == null) sra = "";
String sdec = request.getParameter("DEC");
if (sdec == null) sdec = "";
String srad = request.getParameter("SR");
if (srad == null) srad = "";
String params = "?RA="+sra+"&DEC="+sdec+"&SR="+srad;
if (format == null) format = "";
if (format.equals("html"))
   response.sendRedirect("conesearch_html.jsp"+params);
if (format.equals("votable"))
   response.sendRedirect("conesearch_votable.jsp"+params);
if (format.equals("map"))
   response.sendRedirect("conesearch_map.jsp"+params);
if (format.equals("csv"))
   response.sendRedirect("conesearch_csv.jsp"+params);
%>
```

Exemplo: Servidor de *Cone Search*

```
String sra = request.getParameter("RA");
String sdec = request.getParameter("DEC");
String sradius = request.getParameter("SR");
double ra = 0;
double dec = 0;
double radius = 0;
try
  {
  ra = Double.parseDouble(sra);
  dec = Double.parseDouble(sdec);
  radius = Double.parseDouble(sradius);
  }
catch (Exception e)
  {

  }
out.println(ConeSearchService.doConeSearchAsCSVTable(application,
                                                     ra,dec,radius));
```

Exemplo: Servidor de *Cone Search*

```
StringBuffer sb = new StringBuffer(1024*50);
int contador = 0;
try
  {
  Connection conn = (Connection)app.getAttribute("dbconnection");
  Statement stmt = conn.createStatement();
  // Executamos o comando.
  ResultSet rs = stmt.executeQuery("select * from files;");
  String resSQL = "";
  while(rs.next())
    {
    String file_id = rs.getString("FILE_ID");
    double ra = rs.getDouble("ORA");
    double dec = rs.getDouble("ODEC");
    String projeto = rs.getString("PROJID");
    // math stuff
    double dist = Math.sqrt((ira-ra)*(ira-ra)+(idec-dec)*(idec-dec));
    if (dist <= radius)
      {
      sb.append(file_id+","+ra+","+dec+","+projeto+"\n");
      contador++;
      }
    }
  }
catch (SQLException e) { }
return sb.toString();
```

Exemplo: Servidor de *Cone Search*

Ministério da Ciência e Tecnologia

SOARVO

The Southern Astrophysical Research Telescope Virtual Observatory

59 registros.

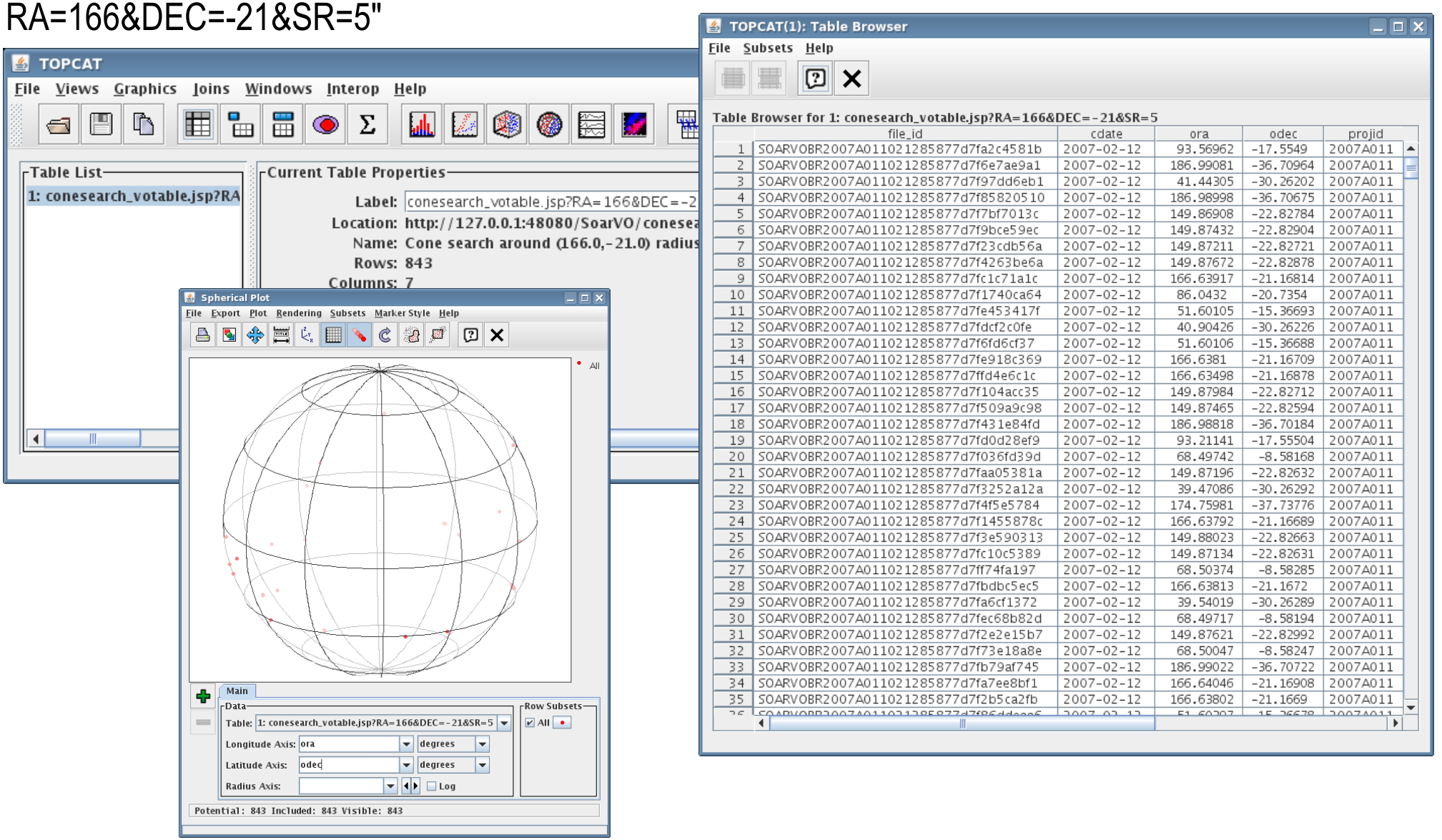
File ID	RA	DEC	Project
SOARVOBR2007A011021285877d7fc1c71a1c	166.639170833333	-21.1681438888889	2007A011
SOARVOBR2007A011021285877d7fe918c369	166.638095833333	-21.1670863888889	2007A011
SOARVOBR2007A011021285877d7ffd4e6c1c	166.634975	-21.1687802777778	2007A011
SOARVOBR2007A011021285877d7f1455878c	166.637925	-21.1668902777778	2007A011
SOARVOBR2007A011021285877d7fbdbc5ec5	166.638129166667	-21.1672044444444	2007A011
SOARVOBR2007A011021285877d7fa7ee8bf1	166.6404625	-21.1690775	2007A011
SOARVOBR2007A011021285877d7f2b5ca2fb	166.638025	-21.1669041666667	2007A011
SOARVOBR2007A011021285877d7f90e77082	166.634470833333	-21.1693236111111	2007A011
SOARVOBR2007A011021285877d7fa3e3d09a	166.640725	-21.1684516666667	2007A011
SOARVOBR2007A011021285877d7fe64750ad	166.640970833333	-21.1685972222222	2007A011
SOARVOBR2007A011021285877d7fbef5a760	166.640483333333	-21.1689858333333	2007A011
SOARVOBR2007A011021285877d7f7cb1c7cf	166.639495833333	-21.1683561111111	2007A011
SOARVOBR2007A011021285877d7fb6e030b2	166.637875	-21.1668508333333	2007A011
SOARVOBR2007A011021285877d7f78a70c78	166.619958333333	-21.1681113888889	2007A011
SOARVOBR2007A011021285877d7fed237ec0	166.620033333333	-21.1681436111111	2007A011
SOARVOBR2007A011021285877d7f749c5121	166.63805	-21.1670147222222	2007A011
SOARVOBR2007A011021285877d7fd61c6351	166.642129166667	-21.1680091666667	2007A011
SOARVOBR2007A011021285877d7f5d9535b2	166.638083333333	-21.1671225	2007A011
SOARVOBR2007A011021285877d7f2f675e52	166.64075	-21.168445	2007A011
SOARVOBR2007A011021285877d7f337219a9	166.640458333333	-21.1690388888889	2007A011
SOARVOBR2007A011021285877d7f8ba36c90	166.638108333333	-21.1668811111111	2007A011
SOARVOBR2007A011021285877d7f93b8e33e	166.636275	-21.1682566666667	2007A011
SOARVOBR2007A011021285877d7f4a793518	166.640420833333	-21.1689525	2007A011
SOARVOBR2007A011021285877d7fab7ac540	166.640225	-21.1694575	2007A011
SOARVOBR2007A011021285877d7f75d599bc	166.637658333333	-21.1686669444444	2007A011
SOARVOBR2007A011021285877d7faabffead	166.633229166667	-21.1683936111111	2007A011
SOARVOBR2007A011021285877d7f36fe52f8	166.646179166667	-21.1692322222222	2007A011
SOARVOBR2007A011021285877d7f79e05513	166.640416666667	-21.1692086111111	2007A011
SOARVOBR2007A011021285877d7fd211a7fa	166.638108333333	-21.1671855555556	2007A011

Exemplo: Servidor de *Cone Search*

```
- <VOTABLE version="1.1" xsi:schemaLocation="http://www.ivoa.net/xml/VOTable/v1.1 http://www.ivoa.net/xml/VOTable/v1.1">
  _ <!--
      !  VOTable written by STIL version 2.6-7 (uk.ac.starlink.votable.VOTableWriter)
      !  at 2008-09-08T17:07:55
      !
    -->
  - <RESOURCE>
    - <TABLE name="Cone search around (166.0,-21.0) radius 5.0">
        <FIELD arraysize="*" datatype="char" name="file_id"/>
        <FIELD arraysize="*" datatype="char" name="cdate"/>
        <FIELD datatype="double" name="ora"/>
        <FIELD datatype="double" name="odec"/>
        <FIELD arraysize="*" datatype="char" name="projid"/>
        <FIELD arraysize="*" datatype="char" name="filename"/>
        <FIELD datatype="int" name="filesize"/>
      - <DATA>
        - <TABLEDATA>
          - <TR>
              <TD>SOARVOBR2007A011021285877d7fa2c4581b</TD>
              <TD>2007-02-12</TD>
              <TD>93.5696208333333</TD>
              <TD>-17.554905</TD>
              <TD>2007A011</TD>
              <TD>2007-02-12/2007A011/s07a_0212.0007.fits.gz</TD>
              <TD>1935291</TD>
            </TR>
          - <TR>
              <TD>SOARVOBR2007A011021285877d7f6e7ae9a1</TD>
              <TD>2007-02-12</TD>
              <TD>186.990808333333</TD>
              <TD>-36.7096383333333</TD>
```

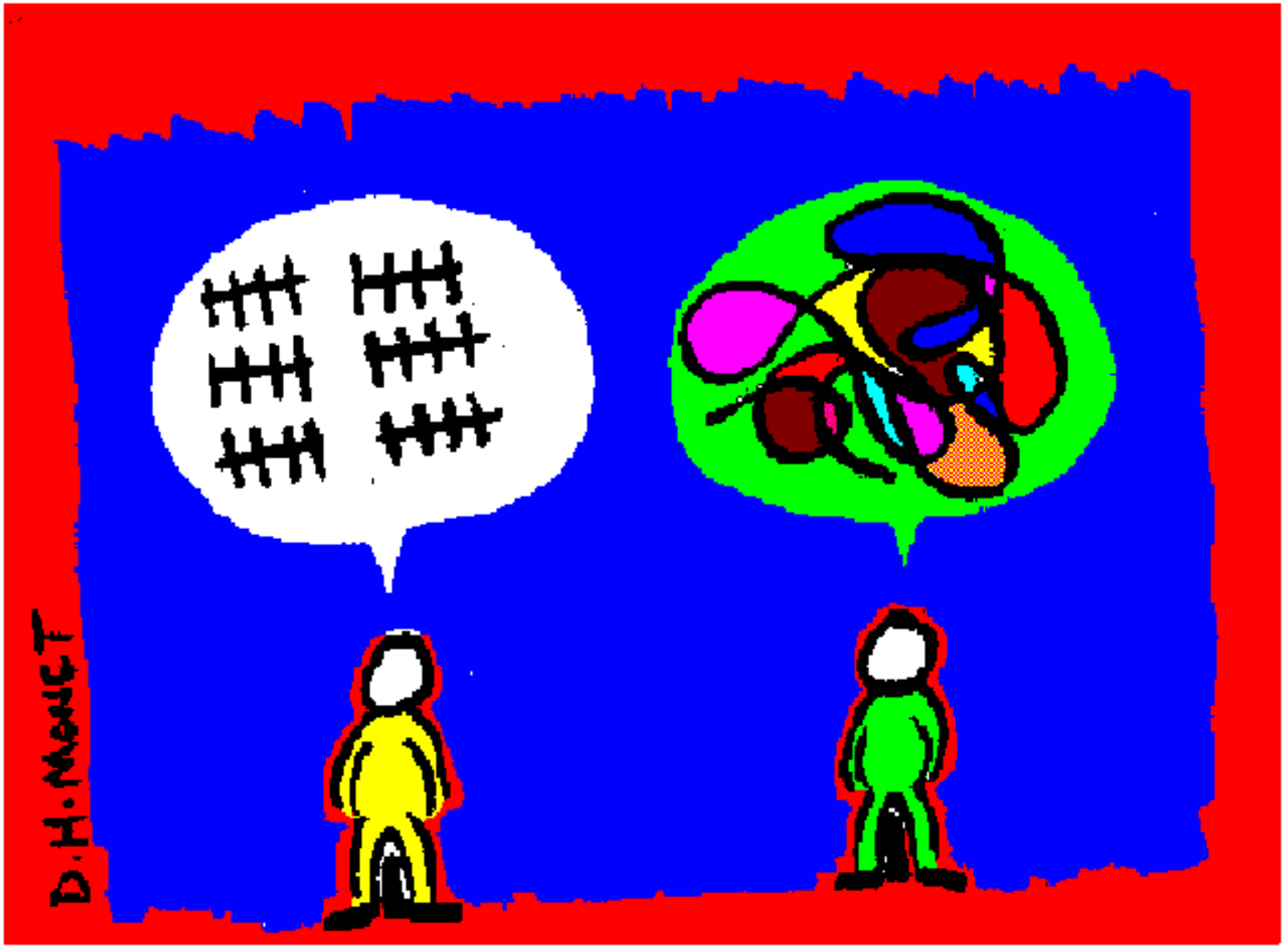
Exemplo: Servidor de *Cone Search*

java -jar topcat-full.jar "http://127.0.0.1:48080/SoarVO/conesearch_votable.jsp?RA=166&DEC=-21&SR=5"



	file_id	cdate	ora	odec	projid
1	SOARVOBR2007A011021285877d7fa2c4581b	2007-02-12	93.56962	-17.5549	2007A011
2	SOARVOBR2007A011021285877d7f6e7ae9a1	2007-02-12	186.99081	-36.70964	2007A011
3	SOARVOBR2007A011021285877d7f97dd6eb1	2007-02-12	41.44305	-30.26202	2007A011
4	SOARVOBR2007A011021285877d7f85820510	2007-02-12	186.98998	-36.70675	2007A011
5	SOARVOBR2007A011021285877d7f7bf7013c	2007-02-12	149.86908	-22.82784	2007A011
6	SOARVOBR2007A011021285877d7f9bce59ec	2007-02-12	149.87432	-22.82904	2007A011
7	SOARVOBR2007A011021285877d7f23cdb56a	2007-02-12	149.87211	-22.82721	2007A011
8	SOARVOBR2007A011021285877d7f4263be6a	2007-02-12	149.87672	-22.82878	2007A011
9	SOARVOBR2007A011021285877d7fc1c71a1c	2007-02-12	166.63917	-21.16814	2007A011
10	SOARVOBR2007A011021285877d7f1740ca64	2007-02-12	86.0432	-20.7354	2007A011
11	SOARVOBR2007A011021285877d7fe453417f	2007-02-12	51.60105	-15.36693	2007A011
12	SOARVOBR2007A011021285877d7fdcf2c0fe	2007-02-12	40.90426	-30.26226	2007A011
13	SOARVOBR2007A011021285877d7f6fd6cf37	2007-02-12	51.60106	-15.36688	2007A011
14	SOARVOBR2007A011021285877d7fe918c369	2007-02-12	166.6381	-21.16709	2007A011
15	SOARVOBR2007A011021285877d7ffd4e6c1c	2007-02-12	166.63498	-21.16878	2007A011
16	SOARVOBR2007A011021285877d7f104acc35	2007-02-12	149.87984	-22.82712	2007A011
17	SOARVOBR2007A011021285877d7f509a9c98	2007-02-12	149.87465	-22.82594	2007A011
18	SOARVOBR2007A011021285877d7f431e84fd	2007-02-12	186.98818	-36.70184	2007A011
19	SOARVOBR2007A011021285877d7fd0d28ef9	2007-02-12	93.21141	-17.55504	2007A011
20	SOARVOBR2007A011021285877d7f036fd39d	2007-02-12	68.49742	-8.58168	2007A011
21	SOARVOBR2007A011021285877d7faa05381a	2007-02-12	149.87196	-22.82632	2007A011
22	SOARVOBR2007A011021285877d7f3252a12a	2007-02-12	39.47086	-30.26292	2007A011
23	SOARVOBR2007A011021285877d7f4f5e5784	2007-02-12	174.75981	-37.73776	2007A011
24	SOARVOBR2007A011021285877d7f1455878c	2007-02-12	166.63792	-21.16689	2007A011
25	SOARVOBR2007A011021285877d7f3e590313	2007-02-12	149.88023	-22.82663	2007A011
26	SOARVOBR2007A011021285877d7fc10c5389	2007-02-12	149.87134	-22.82631	2007A011
27	SOARVOBR2007A011021285877d7ff74fa197	2007-02-12	68.50374	-8.58285	2007A011
28	SOARVOBR2007A011021285877d7fbdbc5ec5	2007-02-12	166.63813	-21.1672	2007A011
29	SOARVOBR2007A011021285877d7fa6cf1372	2007-02-12	39.54019	-30.26289	2007A011
30	SOARVOBR2007A011021285877d7fec68b82d	2007-02-12	68.49717	-8.58194	2007A011
31	SOARVOBR2007A011021285877d7f2e2e15b7	2007-02-12	149.87621	-22.82992	2007A011
32	SOARVOBR2007A011021285877d7f73e18a8e	2007-02-12	68.50047	-8.58247	2007A011
33	SOARVOBR2007A011021285877d7fb79af745	2007-02-12	186.99022	-36.70722	2007A011
34	SOARVOBR2007A011021285877d7fa7ee8bf1	2007-02-12	166.64046	-21.16908	2007A011
35	SOARVOBR2007A011021285877d7f2b5ca2fb	2007-02-12	166.63802	-21.1669	2007A011

Comentários Finais



home.ca.inter.net/~dmonet/cartoon/archive/b10.gif

Perguntas e Respostas

- Quais são as demandas e expectativas da comunidade astronômica em relação ao VO?
- Como a comunidade de computação pode ajudar a atendê-las?
- O que você gostaria de ver em um curso mais longo/detalhado?

Para saber mais...

- *US NVO* (http://www.us-vo.org/)
- *Cooking with Sloan* (http://cas.sdss.org/dr6/en/help/cooking/)
- *VO Shortcuts* (http://www.us-vo.org/shortcuts/)
- *Web Services for the Virtual Observatory* (http://voservices.org/)
- *Tutoriais e artigos* (http://www.lac.inpe.br/~rafael.santos)