Semantics at AI11

- **Norman Gray: AstroDAbis: stand-off tagging for astronomy**
- **Peter Fox (Skype): Semantic Data Frameworks Come of Age**
- **Guillermo Cabrera: RDF Representation of Astronomical Images**
- **Alberto Pepe: Analysis and visualization of collaboration networks in astronomy**
- **Discussion: Semantic Astronomy - what are the key research problems for the next three years? Emerging topics, funding, community engagement, developing the profession, recognition...**

Semantic Astronomy workshop: discuss!

Matthew Graham (Caltech, USA)
Norman Gray (Glasgow, UK)
Tara Murphy (Sydney, Australia)

Astroinformatics 2011, Sorrento, 2011 Sep 28

why hasn't semweb taken off in astro?

We have the intuition that SemWeb techniques will be massively powerful in astronomy. So why isn't everyone convinced?

- Technological conservatism? Not really.
- Technology cliff? Possibly...
- Lack of basics? Build it and they will come?
- Lack of convincing stories/problems/solutions

semweb strengths and weaknesses

Strengths

- Comfortable with ragged/heterogeneous/distrib data
- Aims for machine ‘understanding’
- Good at statements of the bleedin’ obvious

Weaknesses

- Not good at very high volume
- Technology not as mature as RDBMSs

That’s ‘understanding’ in quotes: truth-preserving inference
‘statements of the obvious’: blackHole isA compactObject

discussion

- Very useful discussion session
- Googledoc notes at `http://bit.ly/o7N7V6`
- More actions and followup suggested, details should appear in that googledoc

AstroDAbis: tagging neighbours remotely through TAP and LOD

Norman Gray (Glasgow, UK) & Bob Mann (ROE, UK)

Astroinformatics 2011, Sorrento

the problem, ii

- Cross-match or neighbour tables are archive-specific
- ...and not shared
- ...and can't be inter-archive
- AstroDAS system: Bose, Mann & Prina-Ricotti (2006) adapted DAS to OpenSkyQuery

BioDAS: biology community has a system which allows for distributed annotation of genetic sequences

Binary relations...

ident	subjcol	subjid	objcol	objid	rel
123	cat1	'abcd'	cat2	'efgh'	'contain'

ident	subjcol	subjid	tag
123	cat1	'abcd'	quasar

...and unary relations

so, astrodabis

- Astronomer can annotate ObjId X in catalogue A with tag “quasar”
- Astronomer can jointly annotate ObjId X in catalogue A, and Y in B, saying they are the same, or within a given distance of each other
- Catalogues A and B don’t have to be in the same archive, and the annotations are shareable through TAP and Linked-Data

```
<http://example3.org/foo/123>
  tagged [
    tag “quasar”;
    tagger <http://astrodabis/u/99> ];
  hasNeighbour [
    obj <http://example4.org/bar/456>;
    sepArcsec “10”;
    tagger <http://astrodabis/u/99> ];
  inPaper <http://ads/2001bibcode>.

<http://example1.org/messier/31>
  owl:sameAs <http://example2.org/ngc/224>.
```

@normangray
http://nxg.me.uk/norman/
http://astrodabis.jiscinvolve.org

Schema still provisional
Illustrated as Linked Data; stress available through TAP
Built to be extensible – links to SIMBAD & dbpedia?
Don’t have to be in same catalogue

Semantic Data Frameworks Come of Age

Astroinformatics 2011

September 28, 2011

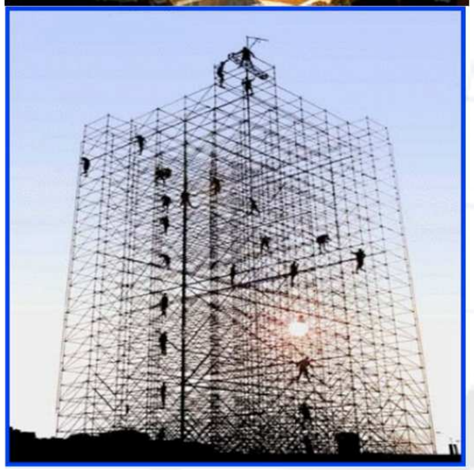
Peter Fox (RPI) pfox@cs.rpi.edu
Tetherless World Constellation and the SESF team: Patrick West, Eric Rozell, Stephan Zednik, Han Wang, Rajashree Deka, Linyun Fu, Deborah McGuinness and Jim Hendler …

Introduction

- The origins of this effort and rise
- Why frameworks and not systems?
- Moving from core semantics to framework semantics – integration and configuration
- The design and development method
- Open source ontologies and software!
- A role for participation

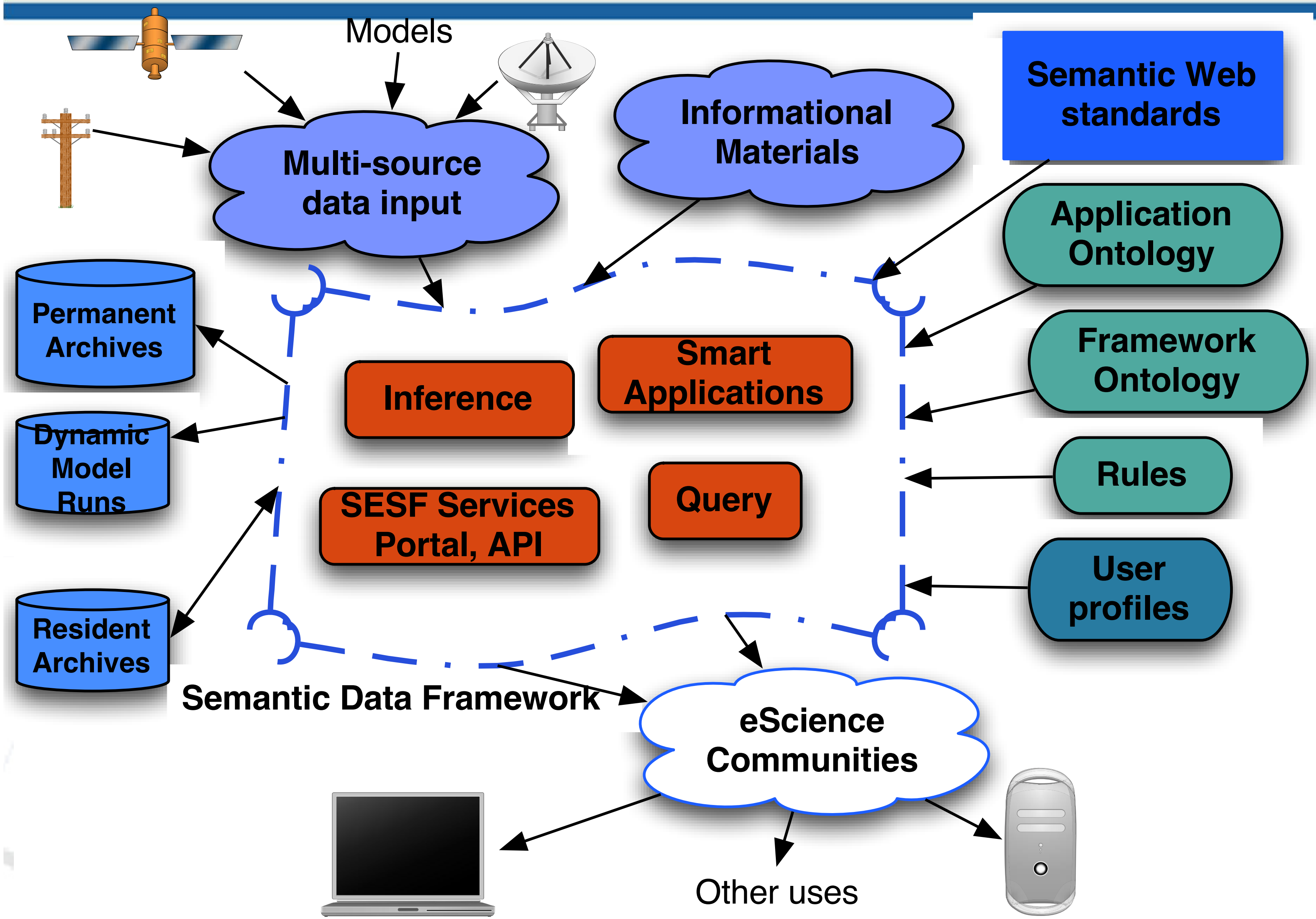
Prior to 2005, we built *systems*

- Rough definitions



  - Systems have very well-define entry and exit points. A user tends to know when they are using one. Options for extensions are limited and usually require engineering
  - Frameworks have many entry and use points. A user often does not know when they are using one. Extension points are part of the design

Framework overview



Real use cases (oceanography)

- Do you have any data online from Hutchins from award number OCE-0423418?
- I want to download (temperature, biology, …) data in the following areas (N. Atlantic, bounding box, where the JGOFS survey was done, …)
- What new data has been added since last year and organize it by project
- Show all the places where the surface temperature in the North Atlantic is 25 deg. C during June
- Find me PAR data from the Southern Ocean

Summary

- Expansion of application integration via ontology-driven mediation means new adopters can enter at application (and not lower) levels
- Frameworks are coming of age because: methods are mature, technology too, and many adopters…
- Good progress on non-specialist/ application use case implementation and vocabulary mediation
- Second phase of testbeds, configuration capability and discovery by December 2011

Astroinformatics 2011

RDF Representation of Astronomical Images

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CMM Center for Mathematical Modeling

Departamento de Ciencias de la Computación UNIVERSIDAD DE CHILE

CONICYT Ministerio de Educación Gobierno de Chile

CERRO TOLOLO NOAO

AURA

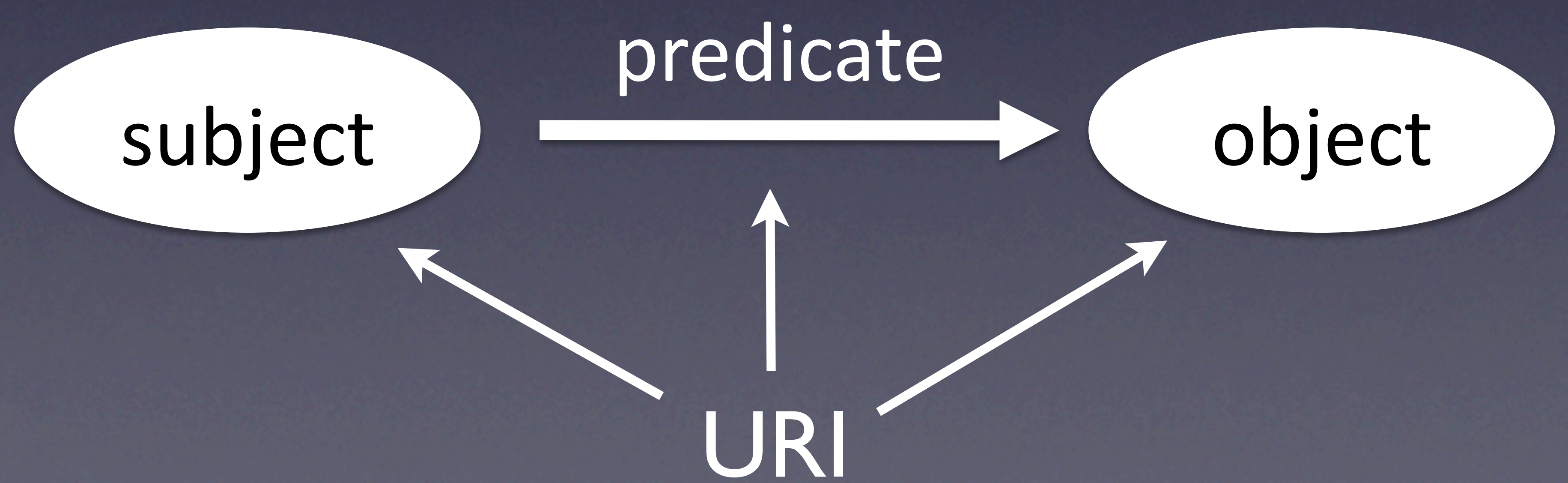
NSF

PROMPT

- 6 telescopes (5 working).
- Location: CTIO (latitud 30:10:03, longitud 70:48:19)
- Visual field: 10 arcmin
- Maximum exposition time: 80 seconds
- Diameter: 0.41 m

Resource Description Framework (RDF)

- World Wide Web (W3C) standard for open linked data representation.
- Language for representing statements about resources as a graph of nodes and arcs representing the resources, and their properties and values.



Metadata Grouping

Image

SUNELEV
SIMPLE
CCD-TEMP
NAXIS
DATE-OBS
SET-TEMP
YORGSUBF
JD
DEC
SECPIX
EXPOSURE
HA
TELRA
LST
IMAGETYP
YBINNING
SBSTDVER
OBSID
RA
OBSERVER
TELDEC
NAXIS1
XBINNING
XORGSUBF
NAXIS2
ZA
EPOCH
EXPID
MJD-OBS
AZIMUTH
XPIXSZ
LONGITUD
DATE
AIRMASS
GRBID
BZERO
TIME-OBS
FILTER
YPIXSZ
BITPIX
ELEVATIO
LATITUDE
BSCALE
EXPTIME
FOCUSPOS

Telescope

LATSTR
APTDIA
LONGSTR
APTAREA
SITEELEV
OBSERVAT
FOCALLEN
TELESCOP

Camera

INSTRUME

Software_IC

SWCREATE
SWOWNER

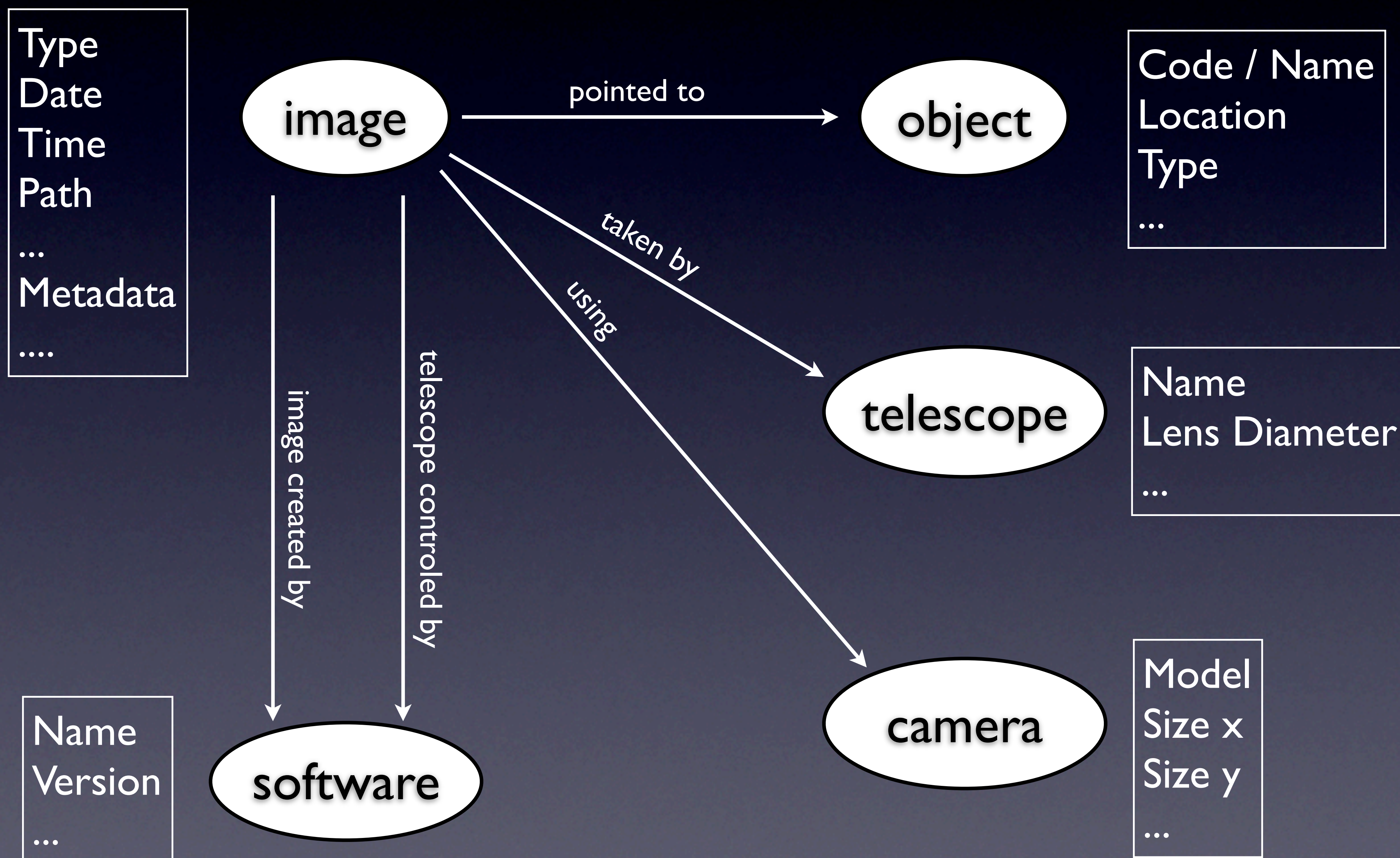
Software_TC

SWVER

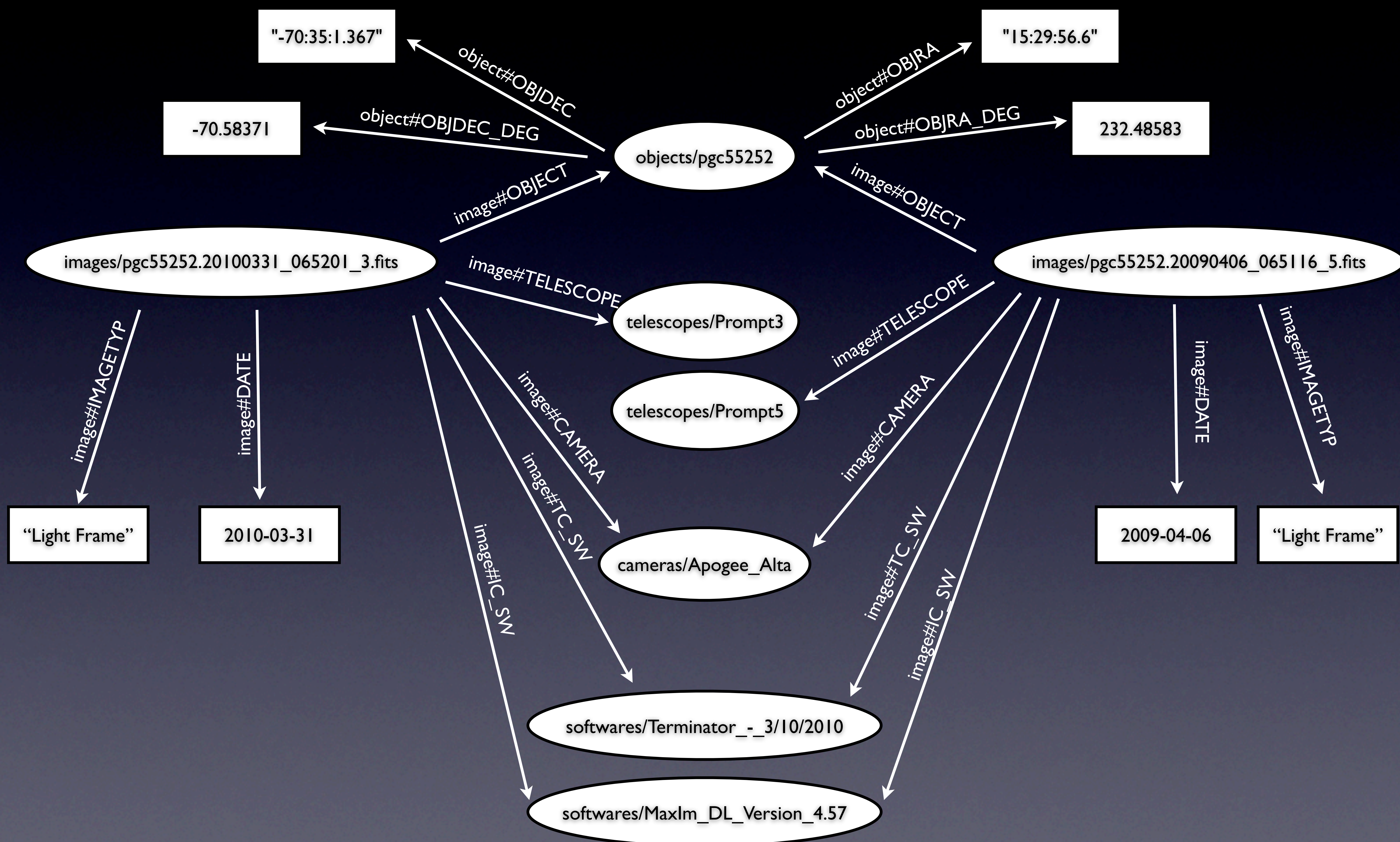
Object

OBJECT
OBJDEC
OBJRA

RDF Model


Type
Date
Time
Path
...
Metadata
....
image
pointed to
object
Code / Name
Location
Type
...
taken by
using
telescope
Name
Lens Diameter
...
image created by
telescope controled by
camera
Model
Size x
Size y
...
Name
Version
...
software

RDF Model



"-70:35:1.367"
"15:29:56.6"
object#OBJDEC
object#OBJRA
-70.58371
object#OBJDEC_DEG
object#OBJRA_DEG
232.48583
objects/pgc55252
image#OBJECT
image#OBJECT
images/pgc55252.20100331_065201_3.fits
images/pgc55252.20090406_065116_5.fits
image#TELESCOPE
telescopes/Prompt3
image#TELESCOPE
telescopes/Prompt5
image#IMAGETYP
image#DATE
image#CAMERA
image#CAMERA
image#DATE
image#IMAGETYP
"Light Frame"
2010-03-31
image#TC_SW
cameras/Apogee_Alta
2009-04-06
"Light Frame"
image#IC_SW
image#TC_SW
image#IC_SW
softwares/Terminator_-_3/10/2010
softwares/MaxIm_DL_Version_4.57

SPARQL Queries

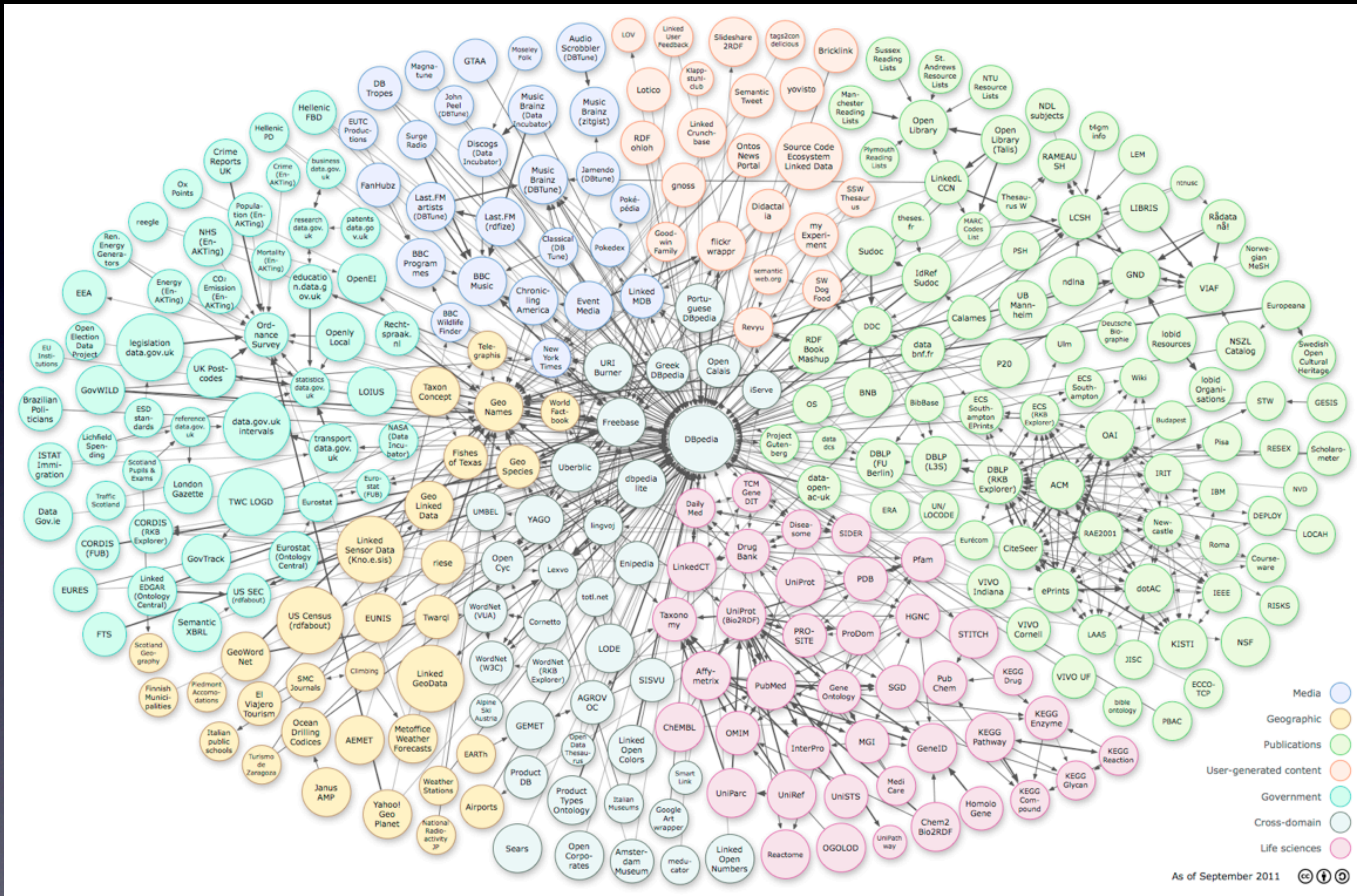
- All images from NGC1260 obtained between the 15th and the 25th of September, 2006:

```
SELECT DISTINCT ?i WHERE
{ ?i nsi:OBJECT nsos:NGC1260.
  ?i nsi:DATE ?d.
  FILTER(?d <="2006-09-25").
  FILTER(?d >="2006-09-15").
}
```

Conclusions

- Interoperable model of astronomical images metadata.
- Extensible, flexible and decentralized.
- Possibility to query data across sources.
- Use of latest semantic data technology.
- Simple to implement.

http://linkeddata.org/



Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. http://lod-cloud.net/

USING ADS to explore collaboration networks in astronomy.

ALBERTOPEPE
Harvard-Smithsonian Center for Astrophysics

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ABOUT PEOPLE PROJECTS PUBLICATIONS PRESENTATIONS EVENTS LINKS TWITTER

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Latest news

doug_burke: Should we argue for low-fat citations then? RT @michellehudson: #hudc11 I support citations that are human and machine eatable.

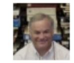
doug_burke: Attribution to Citizen Scientists (more than 200000 of them) from Galaxy Zoo is art http://zoo1.galaxyzoo.org/Volunteers.aspx #hudc11

doug_burke: How Astronomers (well, one of them) think about long-term naming of URIs/resources (an early draft) http://bit.ly/gCtQhL #hudc11

doug_burke: TA: RT @normangray: @doug_burke http://www.astro.gla.ac.uk/users/norman/ivoa/long-term-uris.html (still very drafty)

doug_burke: @normangray where is your "persistence" document (I'm not dreaming that you wrote one, am I)?


Alberto Accomazzi
Project Manager, Astrophysics Data System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Digital Resources Librarian, John G. Wolbach Library


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Astrophysicist, Smithsonian Astrophysical Observatory


Alberto Conti
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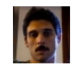
Mercé Crosas
Director, Product Development, IQSS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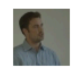
Postdoctoral Research Fellow, High Energy Astrophysics division, CfA


Rahul Dave
Computational Scientist, Astrophysics Data System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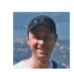
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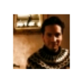
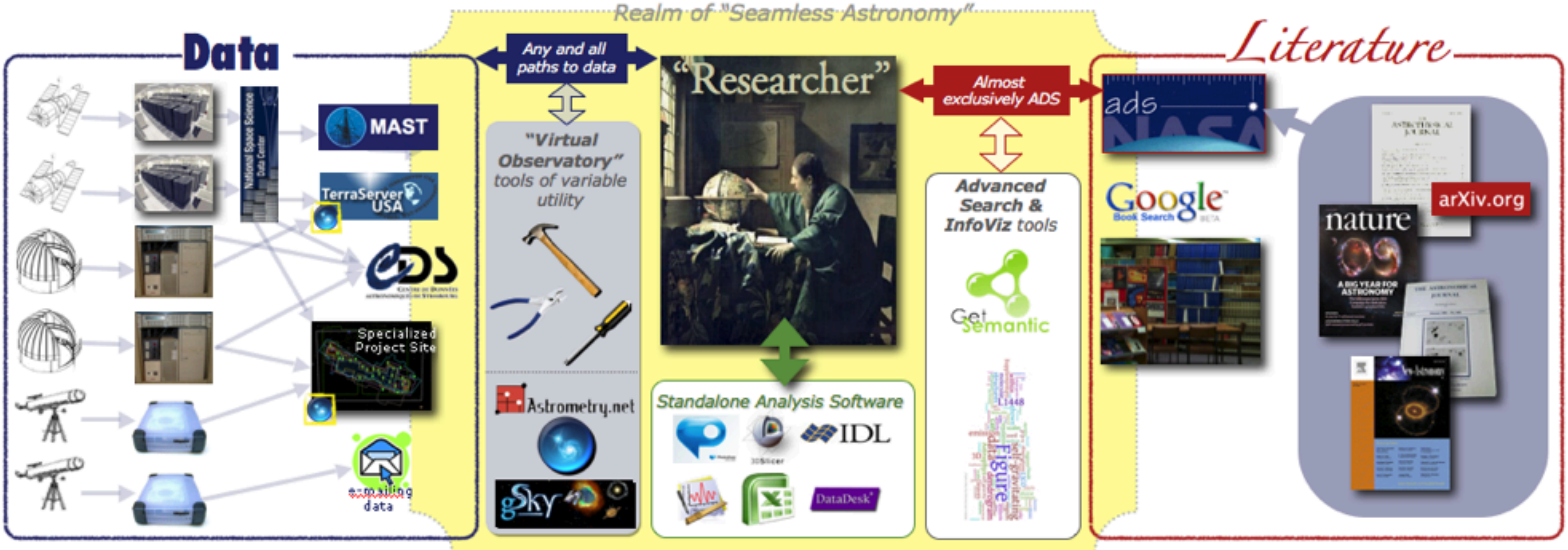
August Muench
Research astronomer, Smithsonian Astrophysical Observatory


Alberto Pepe
Postdoctoral Research Fellow, Harvard University



Courtesy: Alyssa Goodman

2. DATA

In this paper, we use the ^{12}CO(1–0) and ^{13}CO(1–0) data collected for Perseus as part of the COordinated Molecular Probe Line Extinction Thermal Emission (COMPLETE) Survey of Star Forming Regions,[6] described in detail by Ridge et al. (2006b). The ^{12}CO and ^{13}CO molecular line maps were observed between 2002 and 2005 using the 14 m Five College Radio Astronomy Observatory (FCRAO) telescope with the SEQUOIA 32-element focal plane array. The receiver was used with a digital correlator providing a total bandwidth of 25 MHz over 1024 channels. The ^{12}CO $J = 1$–0 (115.271 GHz) and the ^{13}CO $J = 1$–0 (110.201 GHz) transitions were observed simultaneously using an on-the-fly (OTF) mapping technique. The beam telescope at these frequencies is about 46″. Both maps of ^{12}CO and ^{13}CO are essential for a thorough study of the outflow and cloud properties. The ^{12}CO(1–0) is a good tracer of the cool and massive molecular outflows and provides the information needed to study the impact of these energetic phenomena on the cloud. The ^{13}CO(1–0) provides an estimate of the optical depth of the ^{12}CO(1–0) line and can be used to probe the cloud structure and kinematics.

Observations were made in $10' \times 10'$ maps with an effective velocity resolution of 0.07 km s^{-1}. These small maps were then patched together to form the final large map of Perseus, which is about $6°.25 \times 3°$. Calibration was done via the chopper-wheel technique (Kutner & Ulich 1981), yielding spectra with units of T_A^*. We removed noisy pixels that were more than 3 times the average rms noise of the data cube, the entire map was then resampled to a 46″ grid, and the spectral axis was Hanning smoothed[7] (necessary to keep the cubes to a size manageable by with astronomical data by Borkin et al. (2005) to study the hierarchical structure of star-forming cores and velocity structure of IC 348 with ^{13}CO(1–0) and C^{18}O(1–0) data.

We divided the Perseus cloud into six areas (with similar cloud central LSR velocities) for easier visualization and outflow search in 3D Slicer (see below). The borders of these areas are similar to those named by Pineda et al. (2008), who also based their division mainly on the cloud's central LSR velocity. The regions, whose outlines are shown in Figure 1, overlap between 1 and 3 arcmin to guarantee complete analysis. This overlap was checked to be sufficient based on the fact that new and known outflows which crossed regions were successfully double-identified.

For each area, an isosurface (constant intensity level) model was generated in 3D Slicer, using the ^{12}CO(1–0) map. The threshold emission intensity level chosen for each isosurface model was the lowest level of emission above the rms noise level for that particular region. This creates a three-dimensional model representing all of the detected emission. The high-velocity gas in this three-dimensional space can be identified in the form of spikes, as shown for the B5 region in Figure 2, which visually stick out from the general distribution of the gas. These sharp protrusions occur since one is looking at the radial velocity component of the gas along the line of sight, thus causing spikes wherever there is gas at distinct velocities far away from the main cloud velocity. Instead of having to go through each region and carefully examine each channel map, or randomly scroll through the spectra by hand, this visualization allows one to instantly see where the high-velocity points are located (see also Borkin et al. 2007, 2008).

6 See http://www.cfa.harvard.edu/COMPLETE.

7 See http://www.cfa.harvard.edu/COMPLETE/projects/outflows.html for a link to the molecular line maps.

8 This work is done as part of the Astronomical Medicine project (http://am.iic.harvard.edu) at the Initiative in Innovative Computing at Harvard (http://iic.harvard.edu). The goal of the project is to address common research challenges to both the fields of medical imaging and astronomy including visualization, image analysis, and accessibility of large varying kinds of data.

9 http://www.slicer.org/

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DATA CITATIONS

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PAPER CITATIONS

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LINK ANALYSIS

A study of hyper-link references to data in papers

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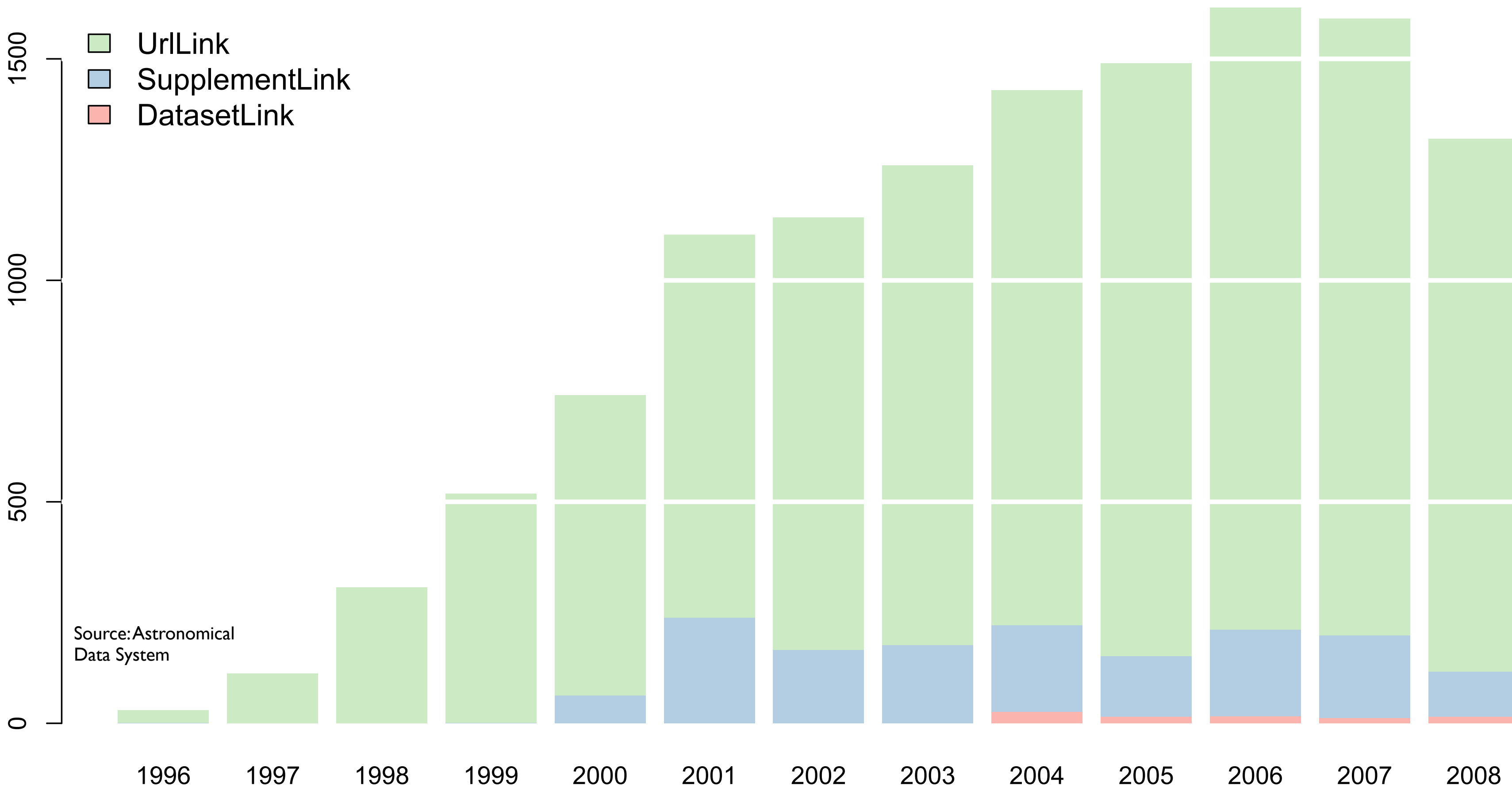

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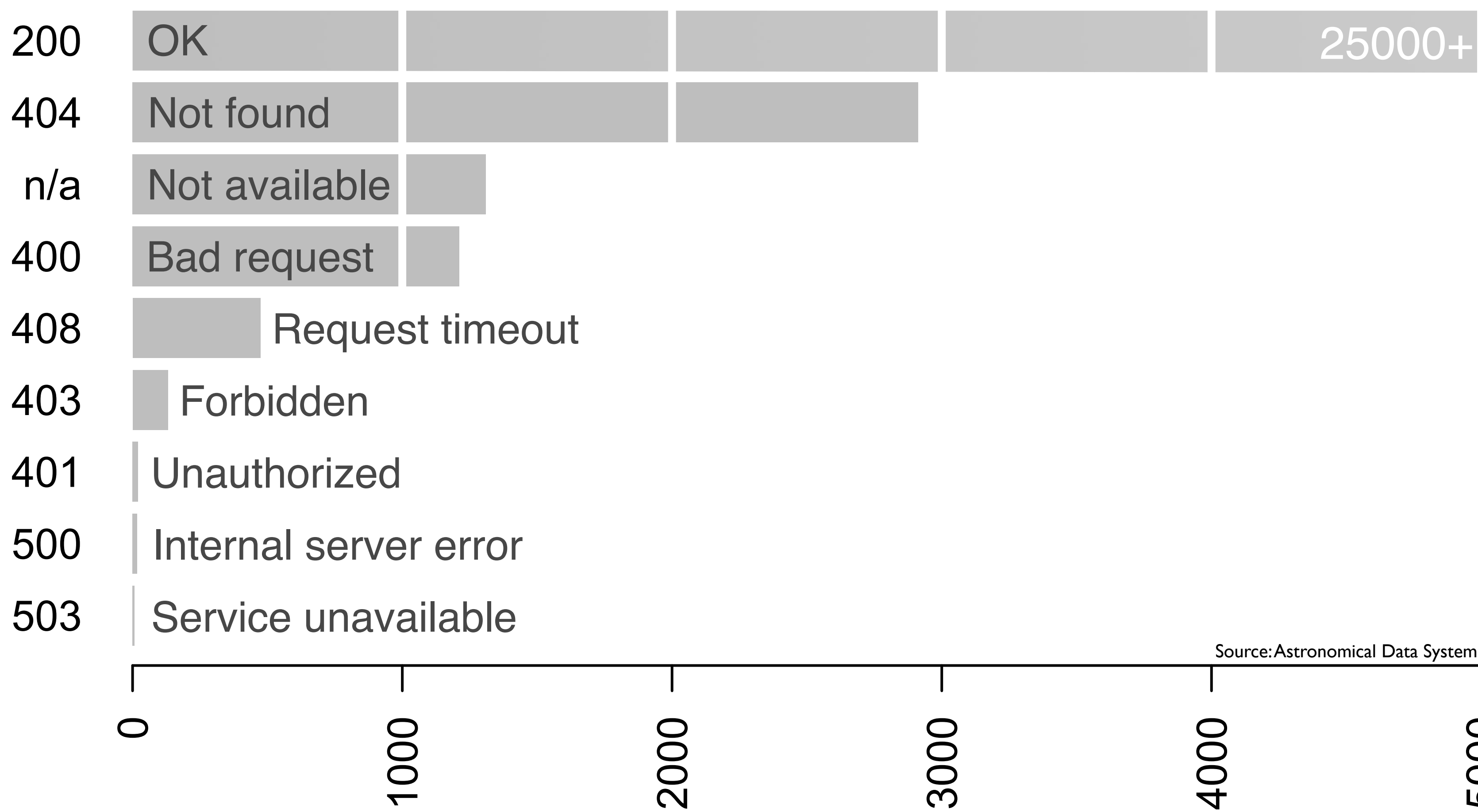

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DATA?

Title:	The COM ETE Survey utflow n P us
Authors:	Arce, Héc G.; Borkin, M elle A Goodi , Alyssa A Pineda, Jai E.; H Michae .
Affiliation:	AA(Depa ent of Astron , Y P.O. Box 8101, N 06520, SA hector.arce@yale.edu), AB(School of Engineeri and Applied ence Harvard Un sity, 29 xford St t, Cambridg MA 02138, USA), AC(Harvard-Smithsonian Center for 0 Gar Street, Camb ge, MA 2138, A), AD(Harv -Smi onian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA), AE(Surgical Planning Laboratory, Department of Radiology, Brigham and Women's Hospital, 75 Francis Street, Boston, MA 02115, USA ; Initiative in Innovative Computing, Harvard University, 60 Oxford Street, Cambridge, MA 02138, USA)
Publication:	The Astrophysical Journal, Volume 715, Issue 2, pp. 1170-1190 (2010). (ApJ Homepage)
Publication Date:	06/2010
Origin:	IOP
ApJ Keywords:	ISM: clouds, ISM: individual objects: Perseus, ISM: jets and outflows, ISM: kinematics and dynamics, stars: formation, turbulence
DOI:	10.1088/0004-637X/715/2/1170
Bibliographic Code:	2010ApJ...715.1170A

DATAVERSE

Professional archives focus on long term access by the wider community

- Persistent identifiers
- Fixity
- Backups and recovery
- Metadata standards
- Conversion standards
- Preservation standards

… but do not attract maximum contribution from data owners

$\neq$

Data owners focus on recognition and control

- Branding and visibility
- Data discovery
- Ease of use
- Scholarly citation
- Control over updates
- Terms of access and use

… but do not assure long-term use as would a professional archive

Courtesy: Mercé Crosas

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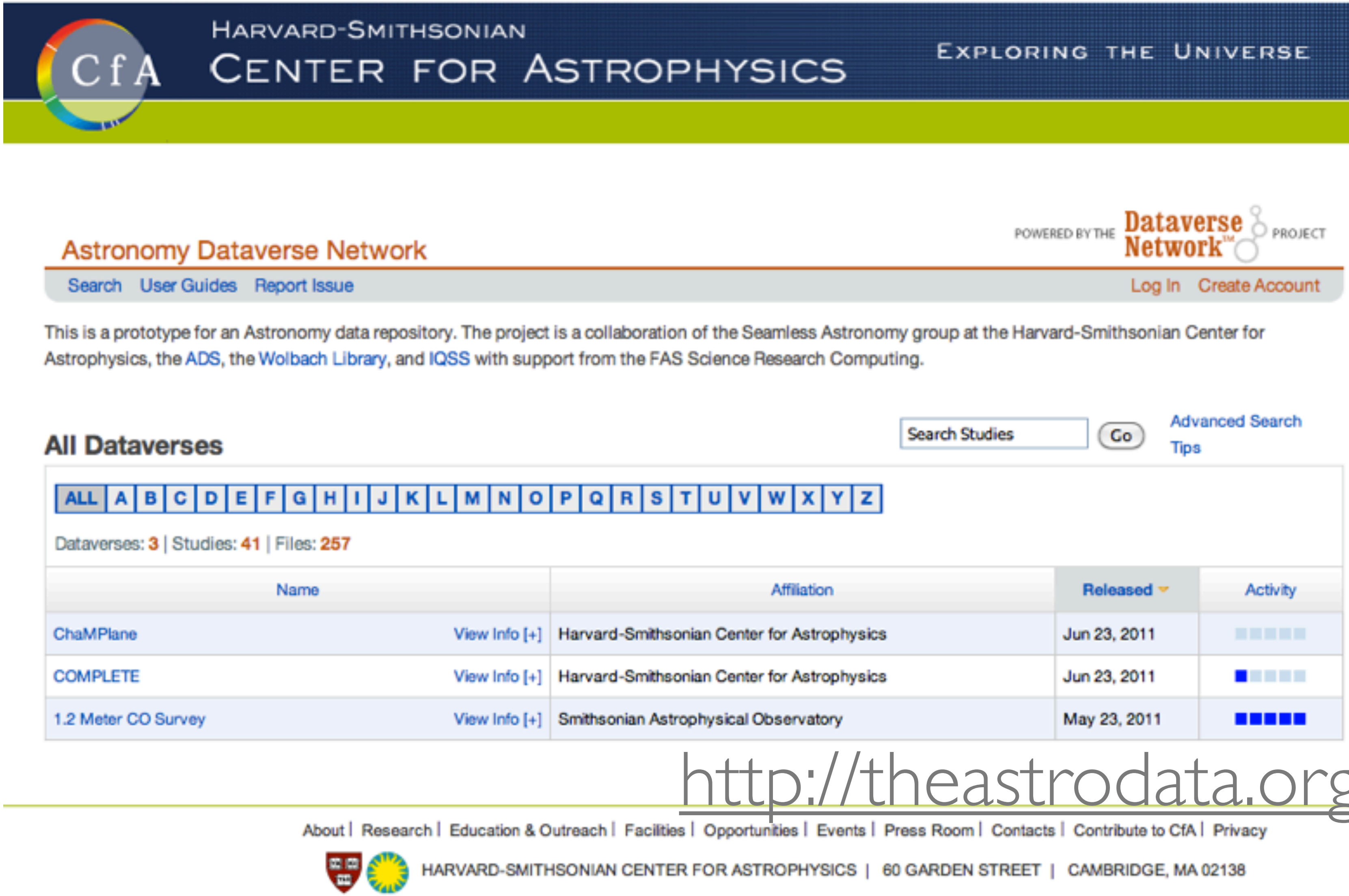

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1.2 Meter CO Survey	View Info [+]	Smithsonian Astrophysical Observatory	May 23, 2011	

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http://theastrodata.org

Discussion

- **Virtual grad-student!**
- **What is the low-hanging fruit?**
- **Why aren't we doing this already?**
  - **Most astronomers are simply unaware**
- **Make Wolfram Alpha, Google, Bing, WWT (!!), etc. aware of Astrosemantics**
- **Find a "killer app" or a problem, to clearly show the utility of this new approach**
  - ***Take a seminal paper and reproduce it using only IVAO tools [Alberto Conti]***
- ***Write a simple, astronomy orientedd document about astrosemantics***
  - [***http://www.researchgate.net/topic/AstroSemantics***](http://www.researchgate.net/topic/AstroSemantics)