VIVO

enabling national networking of scientists

VIVO:

Origins, Growth, Challenges, and Opportunities

Jon Corson-Rikert and Brian Lowe

September 27, 2010

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VIVO enabling national networking of scientists

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Talk overview

- VIVO origins and evolution as an application
- Transitioning VIVO to the Semantic Web
- VIVO: Enabling National Networking of Scientists
- Opportunities in the open source Semantic Web and Linked Open Data communities

VIVO origins and motivation

- Genomics and New Life Science faculty initiatives
- Library seeking a role as an information broker
- Needs expressed by faculty
- Favorable response – build it and they will come

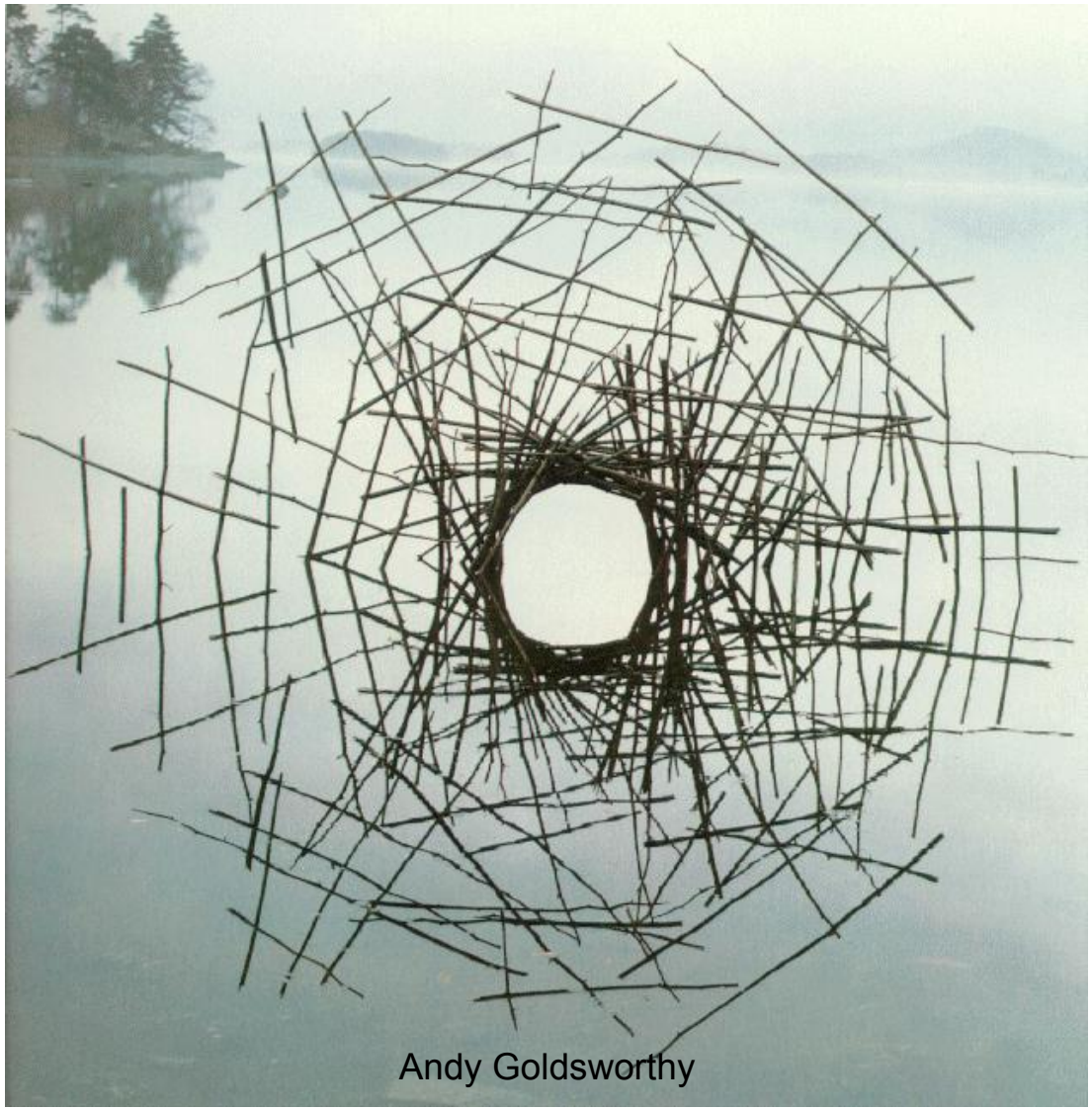
Core ideas

- Research and researchers should be discoverable independently of administrative hierarchies
- Relationships are as interesting as the facts
  - It's the network, not just the nodes
- Static data models are too confining
- Granular data management allows multiple views and re-purposing
- Discovery is improved by linking pages to surrounding context

Individual networks

Andy Goldsworthy

Overlapping connections



VIVO at launch: 2004

- Initially largely hand-curated
- RDB implementation emulating OWL class and property structure
- No standardized import and export of data
- No reasoning
  - Hand classification of data to disciplines
- No SPARQL queries
  - Had to write code to leverage relationships

VIVO by 2006

- Several automated feeds (HR & grants)
- Permission to post article citations from Biosis for 90 days
- Four “portals” within College of Agriculture & Life Sciences
- Attracted support for campus-wide implementation

FOCUS on Cornell University Library

Life sciences libraries aren’t just for books anymore – they’re wired

BY JANET MCCUE, JEAN POLAND AND CAROLYN REID

Among the workplace amenities that life scientists value is a good library, according to a survey published recently by The Scientist. Cornell, which has one of the best library systems in the world, recently enhanced its resources for the life sciences by hiring a bioinformatics and life sciences specialist and offering such new services as VIVO, a Web-based community for the life sciences (see sidebar).

The Scientist survey lists a “well-stocked and well-maintained library” as an important feature. In addition, Cornell’s libraries deliver thousands of electronic journals, databases and resources directly to the desktop.

“Immediate access to the available scientific literature greatly facilitates the scientific process by allowing one to quickly check on a hunch without ever having to leave the lab,” says Stephen Jesch, a Cornell postdoctoral researcher. “Verifying or negating a hunch then allows one to judge efficiently how to proceed with a set of experiments. Moreover, electronic access to research articles makes it easier to stay on top of the current literature.”

As more research on the Ithaca campus is directed toward the biomedical sciences, it’s increasingly important to provide online access to the key medical literature as well. Cornell’s libraries have pooled their resources and, whenever possible, negotiated joint online subscriptions so that biomedical literature is available on the desktops of Cornell researchers in Ithaca, Geneva, N.Y., and New York City; extension educators in the Adirondacks; and also at the Weill Cornell Medical College in Doha, Qatar. For example, Cornell’s libraries have jointly purchased electronic access and complete back files to Methods in Enzymology, a key resource for laboratory research in the life sciences, and coordinated purchases for Nature and Nature Monthlies (i.e., Nature Genetics and Nature Biotechnology), as well as other review journals.

In a recent review of Cornell’s medical journal collection, Cornell librarians found that 75 percent of the some 1,500 specialized titles subscribed to by the Weill Cornell Medical College (WCMC) library are now available to users on the Ithaca campus. These include such popular titles as the New England Journal of Medicine and British Medical Journal, but also all the other key medical journals from major scientific publishers, including Lippincott, Williams and Wilkins, Springer and Wiley, and important society publications from such organizations as the American Association for Cancer Research. Some of the remaining 25 percent are still not available online.

Similarly, Cornell’s libraries are expanding their licenses and revamping their authentication systems so that researchers at WCMC and students in the Tri-Institutional Research Program in New York City can access the resources they need – whether in chemistry or psychology. Librarians also have enhanced Cornell’s document delivery services among the libraries in the Tri-Institutional program, including Rockefeller University and the Memorial Sloan-Kettering Cancer Center, providing faster turnaround time and better user services at each of these locations.

At the same time, library staff members are developing services to foster collaboration within the life sciences community. Researchers or potential graduate students, administrators or undergraduates, for example, can use VIVO to discover who is working on a particular research topic, what a professor or researcher has taught or published recently, where relevant facilities might be and what online tools are available to expedite research.

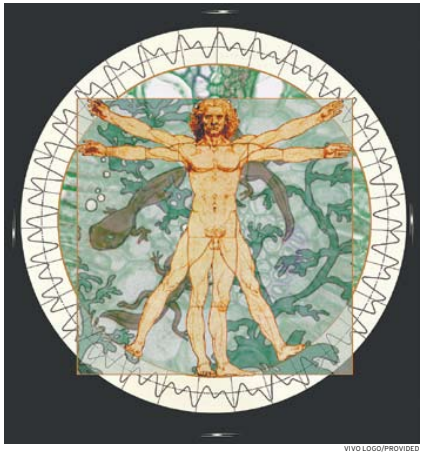
Similarly, library instruction programs have recently expanded and now include workshops at Mann Library, the New York State Agricultural Experiment Station Library in Geneva, the WCMC libraries in New York City and Qatar, the Veterinary Library, the Engineering Library and the Physical Sciences Library. New classes include a collaboration with the Department of Public Health to teach evidence-based medicine to first-year medical students.

In spite of all this new technology, the library remains a place to grab a cup of coffee, huddle with others on a group project or to get help finding articles for a research paper.

Janet McCue is associate university librarian for the life sciences and director of Mann Library; Jean Poland is associate university librarian for associated science and technology libraries; and Carolyn Reid is the Frances and John L. Loeb Librarian of Medicine and director of Weill Cornell Medical Library in New York City. They are members of the Life Sciences Steering Committee.

PROVIDED

Results of plugging the search term *proteom** into the VIVO search engine showing links to key categories.



VIVO LOGO/PROVIDED

Who is doing virtually what, where and how in life sciences at Cornell

BY MEDHA DEVARE

VIVO <http://vivo.library.cornell.edu> creates a virtual life sciences community, bringing together in one Web site all the information needed to figure out who is doing what, where and how in the life sciences at Cornell.

A VIVO search transcends campus, college and department divides to provide an integrated view of the life sciences at Cornell. Students and faculty members can find information on scientists and their research, including grants and recent publications, facilities, undergraduate majors and graduate fields, and seminars and other events. This virtual life sciences collection provides easy access to online databases, software tools and image collections licensed for use by the Cornell community, as well as to important external resources.

Unlike most search engines, VIVO displays results with appropriate cross-referencing to place them in a context that makes sense and saves time. For example, a search for “proteomics” displays listings categorized by:

- “people,” for comprehensive profiles of faculty members working in this field no matter which Cornell college or department they belong to;
- “activities,” for courses, graduate fields and grants related to that subject;
- “events,” for lectures, seminars and workshops;
- “organizations,” for research programs, units or centers;
- “online resources,” for online research tools related to proteomics; and
- “publications,” including recent proteomics-related articles published by Cornell faculty members and news releases and impact statements. Each entry is linked directly to the original resource, which could be the full text of a recent journal article, a new genomics service or a faculty member’s Web page.

VIVO was developed by the library’s Life Sciences Working Group, a committee of librarians and information technology specialists from the Ithaca campus, Weill Cornell Medical College and the New York State Agricultural Experiment Station, Geneva, N.Y.

Unlike most search engines, VIVO displays results with appropriate cross-referencing to place them in a context that makes sense and saves time.

Medha Devare is a bioinformatics and life sciences specialist at Mann Library.

FOCUS on Cornell University Library is compiled by Library Communications. Contact the office at <libcomm@cornell.edu>.

VIVO today

http://vivo.cornell.edu

Cornell University

SEARCH: entire database (jc55) go

VIVO Cornell

VIVO RESEARCH & EXPERTISE ACROSS CORNELL

Home People Events & Seminars Academic Units Research

Logged in as jc55 (Log out) Site Admin About Contact Us

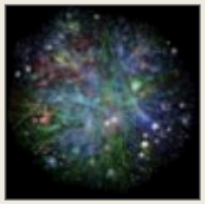
VIVO is a research-focused discovery tool

Browse or search for information about Cornell faculty and staff across all disciplines, departments and colleges.

Search VIVO

Search

Making Headlines view all »



Cornell shares in $7.5 million grant to create safer Internet

The three-year grant will allow Cornell and 10 other institutions to revisit principles that have shaped the Internet through a project called Nebula.

Features: Hakim Weatherspoon Aug. 30

Elephants, unfazed by dynamite blasts, seek to avoid humans

Nearby human activity prompts elephants to dramatically change their behavior, even becoming nocturnal, reports a Cornell study. Photo credit Ruth Starkey.

Features: Peter Wrege Sep. 8

Faculty and Staff

Log in now to manage your page

Manage your page »

Upcoming Seminars view all »

Monday, Sep. 27 2010

7:30 PM AEM 1210 Entrepreneurship and Personal Enterprise Speaker Series presents Jacqueline Novogratz (Open to the public)

Tuesday, Sep. 28 2010

12:20 PM TBA Seminar in Nutritional Sciences

4:15 PM Conversations with Entrepreneurs presents Jim Farrell

6:00 PM CEN NYC: The Convergence of Sustainability, IT and Mainstream Business Practices

Wednesday, Sep. 29 2010

12:30 PM TBA - Molecular Medicine Seminar

Data, data, data

VIVO harvests much of its data automatically from verified sources

- Reduces the need for manual input of data
- Provides an integrated and flexible source of publicly visible data at an institutional level

Internal data sources

External data sources

Individuals may also edit and customize their profiles to suit their professional needs.

VIVO as harvester

Faculty updates

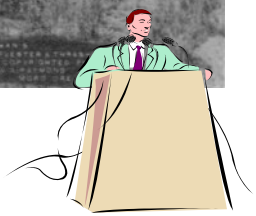
Campus directory

News Service RSS feed

Events calendar
Departmental seminars

Course listings

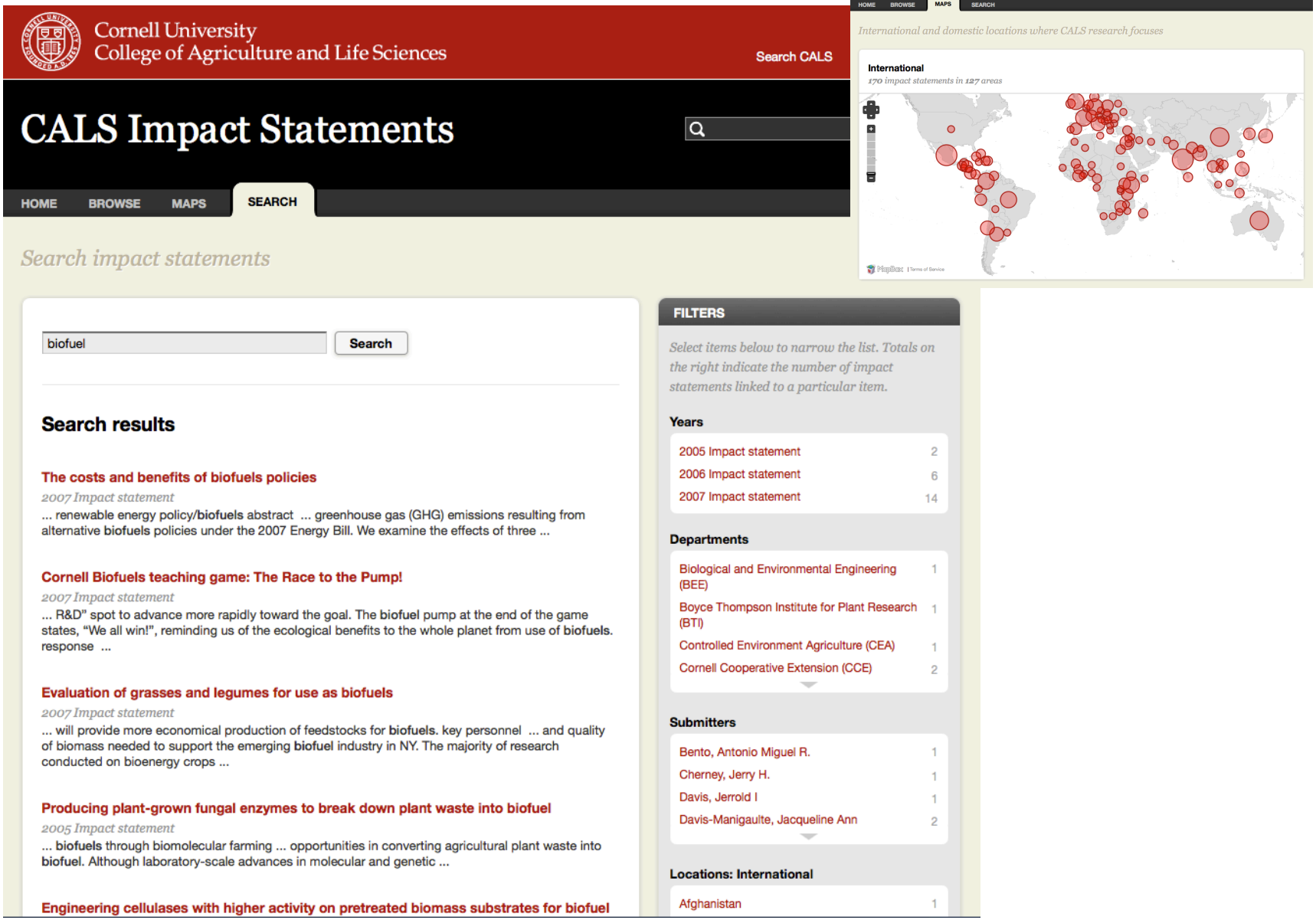
Grants



Conference presentations

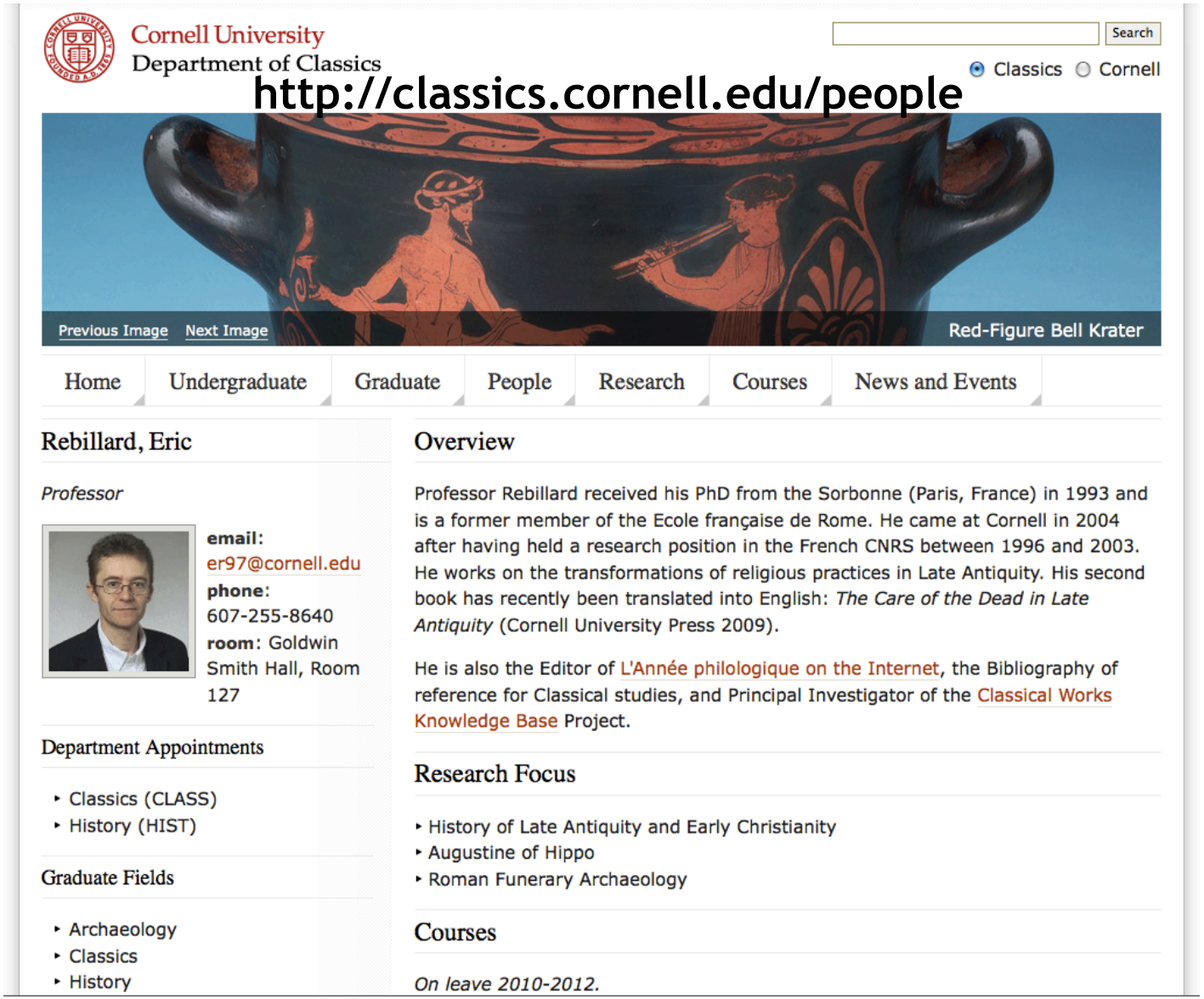
VIVO as disseminator

VIVO as disseminator



VIVO as disseminator

VIVO as disseminator



Disciplinary portals

- Filtered campus-wide views of social sciences, physical sciences & engineering, humanities, medical/veterinary, plus and "all" portal
  - People, departments, events, centers, facilities
- In anticipation of strong differences in content and faculty desire for disciplinary coherence
  - Brand identification of VIVO with life sciences
- Librarian curators with student assistants worked with faculty and departments to solicit ideas & feedback

Lessons learned

- The “all” portal had the most interest and traffic
- Much less than anticipated call for separation
- Impossible to define edges
  - Arbitrary
  - Inconsistent
  - Manual
  - Downstream effects
- More consequences from getting it wrong
  - “You'll understand that as a scientist, I'm not crazy about inaccuracy.”

Faculty reporting

- Year-long evaluation of VIVO as an instrument for capturing faculty reporting data
- Implemented self-editing with university single sign-on authentication
- Joint team with college business and IT staff to define desired data elements
- Eventually mutual cold feet
  - Colleges needed reporting by defined period and private data – 7 of them chose Activity Insight
  - Library not eager to be associated with metrics
- VIVO chosen as a “lite” alternative for web profile data

Relationship to central administration

- Strong interest from vice provosts for life sciences, social sciences, and Ithaca-Weill partnerships
  - Proposed VIVO initially as a core facility
- Modest foundation funding reallocated
- Advisory committee established
- Seen as the new phone book
  - Basic facts of employment, courses, grants
  - Opt-out rather than opt-in
  - Fix it yourself
- Never a clear moment when “ready”

Challenges

- Keeping VIVO up to date
- Managing expectations
- Balancing administrative SORs against requirements for public-facing websites
  - Always easier to build a shadow system or custom website
  - Real issues of branding, message, coherence
  - “We already have web pages!”
- Data integrity in cross-linking
  - Harder to hide broken data, duplicates
- Data that’s visible becomes cleaner data

Internal sustainability questions

- Moving targets
  - University communications needs
  - Data security and stewardship concerns
  - Central systems of record migrations (Kuali finance)
  - Hub vs. spokes – changing IT governance
  - Research office compliance issues

- Changing views of research libraries
  - Mostly positive response to engagement

How else can VIVO help Cornell?

- Fostering collaboration and synergy through greater awareness
- Reducing duplication of research
- Determining strategic trends based on strengths and weaknesses of the network
- Identifying missing expertise
- Improving responsiveness to calls for proposals
- Facilitating team formation
- Providing a marketing tool for research

Adapted from Molcho, Gil. “Formulating an expertise map in the VRL-KCiP,” in Methods and Tools for Effective Life-Cycle-Management, Alain Bernard and Serge TichKiewich, editors, Springer-Verlag, 2008

Motivations beyond Cornell

- Competition – follow the lead of Harvard, Stanford, …
- Outcome-based evaluations need data
  - NIH CTSA program and others
  - Bibliometric analysis
- NIH publication deposit mandate
- NSF data management plan requirements
- Gradual awareness of Linked Open Data

VIVO proposal, 2006

- Cornell University needs a single access point on the Web for anyone seeking information on scholarly activity at Cornell. This single point of access needs to consistently convey a sense of one Cornell, despite its size, complexity, and many interdisciplinary programs, and to direct users efficiently to the individuals, programs, departments, or other points of contact they seek.

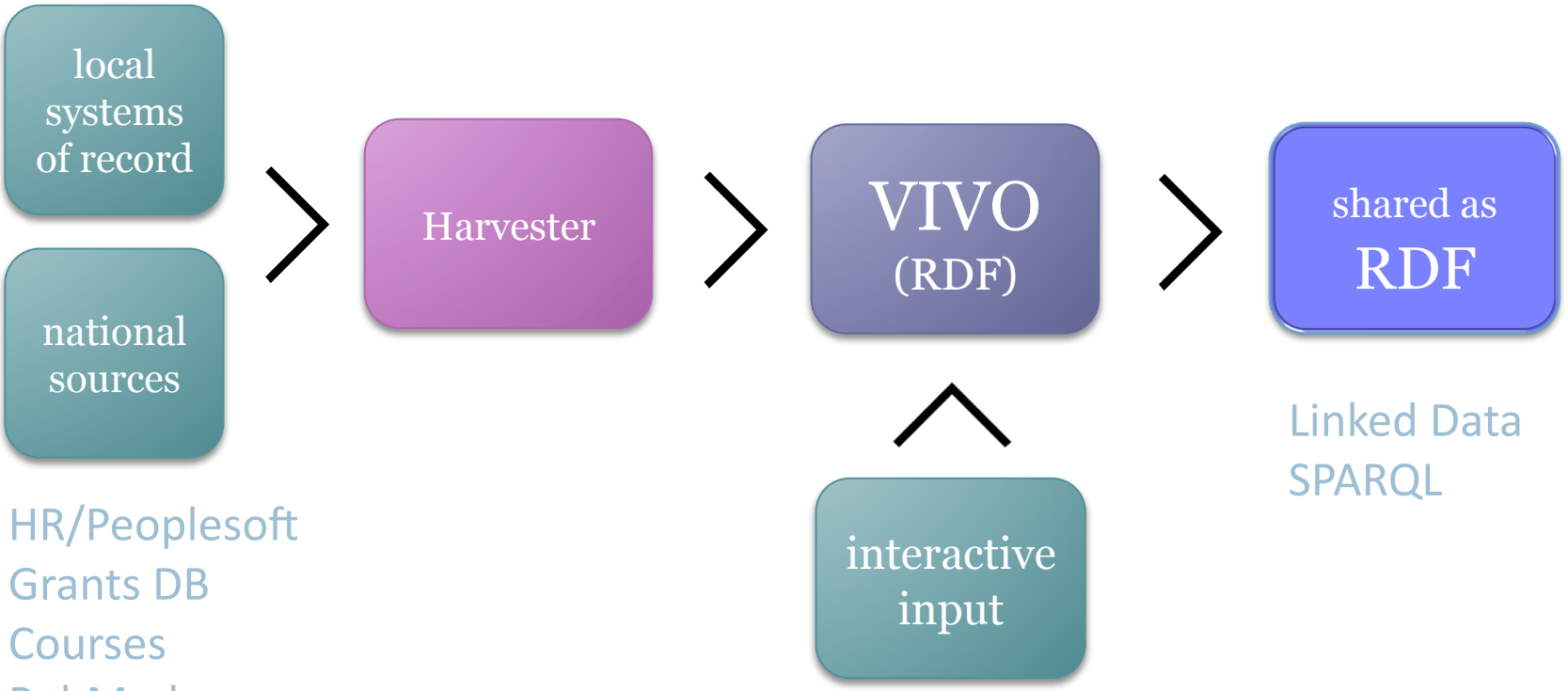
Cornell Strategic Plan, 2010

- The central theme of this plan can be captured by a single phrase, One Cornell. Think of Cornell University as a single entity, embedded in but transcending and overarching colleges and units. The "greater sum" that represents this One Cornell is the primary focus of this plan.
- [Achieving Cornell's aspirations] will require … more developed connections among and between the impressive strengths that are distributed across academic units on campus.

Transitioning VIVO to the Semantic Web

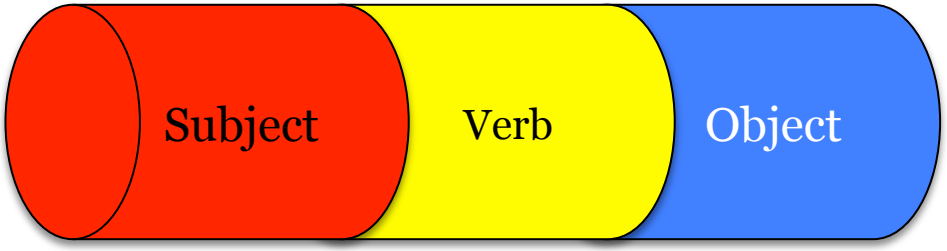
- Motivations
  - Using and extending standard ontologies (AKT, SWRC)
  - Ability to import and export a standard data format
  - Ability to use reasoning to reduce dependence on hand classification
  - Ability to leverage SPARQL for queries
    - Query the data, not the model
- Approach to conversion (2007)
  - Leave the interface largely the same
  - Modify editor to use OWL classes, properties, and axioms
  - Transplant app onto Jena open source libraries

VIVO conceptual architecture



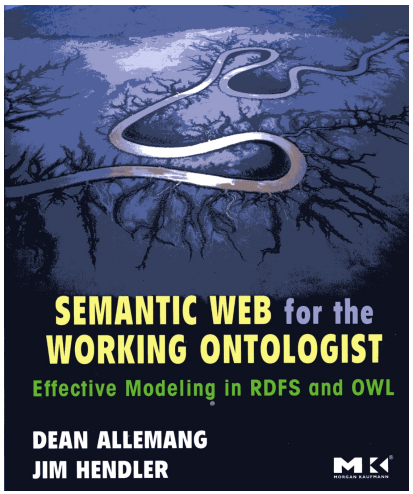
Verified Information Sources

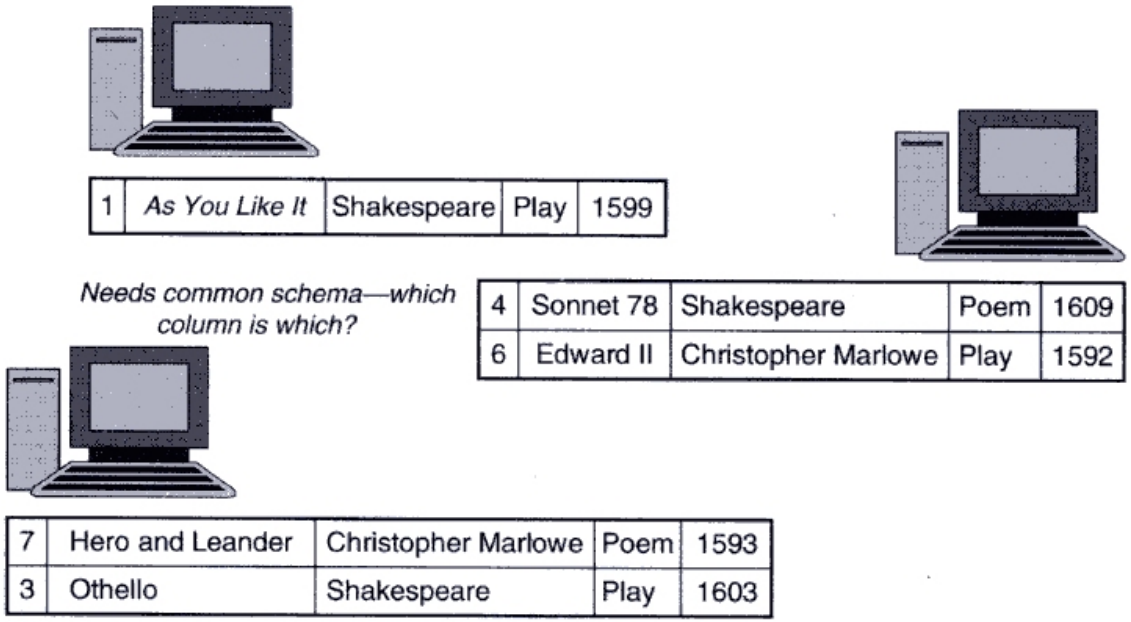
Why RDF?



Data as rows in one table

- Value pairs sharing an identifier per row
- Each table in each application has own schema





1	*As You Like It*	Shakespeare	Play	1599

Needs common schema—which column is which?

4	Sonnet 78	Shakespeare	Poem	1609
6	Edward II	Christopher Marlowe	Play	1592

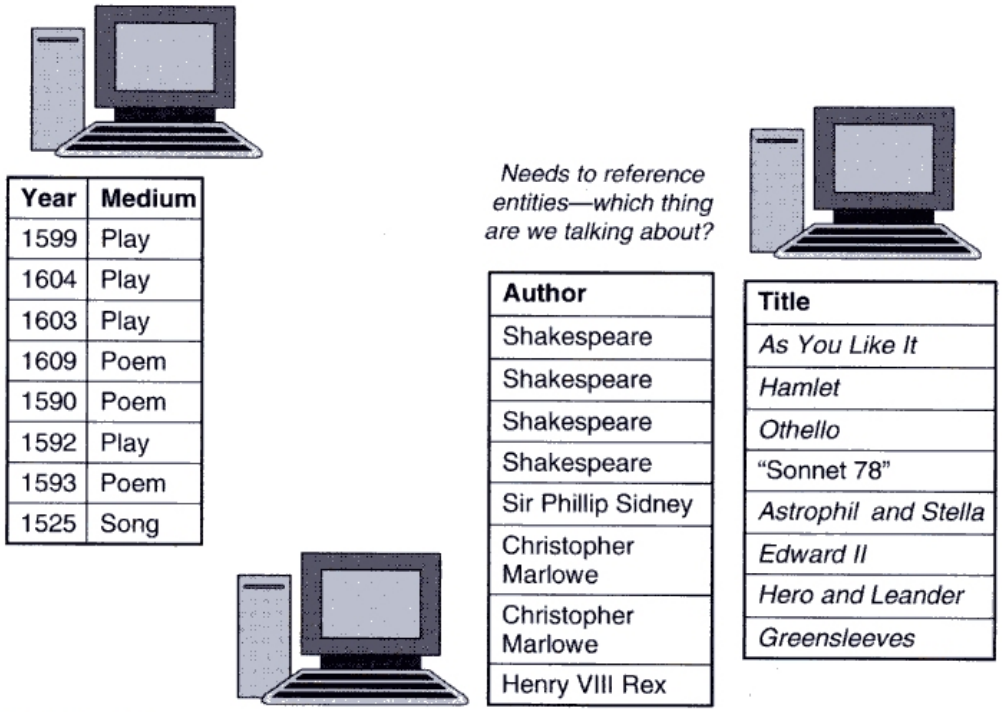
7	Hero and Leander	Christopher Marlowe	Poem	1593
3	Othello	Shakespeare	Play	1603

FIGURE 3-1

Distributing data across the Web, row by row.

Allemang, D. and Hendler, J., Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann, 2007

Data as columns in tables (silos)



Year	Medium
1599	Play
1604	Play
1603	Play
1609	Poem
1590	Poem
1592	Play
1593	Poem
1525	Song

Needs to reference entities—which thing are we talking about?

Author
Shakespeare
Shakespeare
Shakespeare
Shakespeare
Sir Phillip Sidney
Christopher Marlowe
Christopher Marlowe
Henry VIII Rex

Title
As You Like It
Hamlet
Othello
"Sonnet 78"
Astrophil and Stella
Edward II
Hero and Leander
Greensleeves

FIGURE 3-2

Distributing data across the Web, column by column.

Allemang, D. and Hendler, J., Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann, 2007

Data as self-contained cells

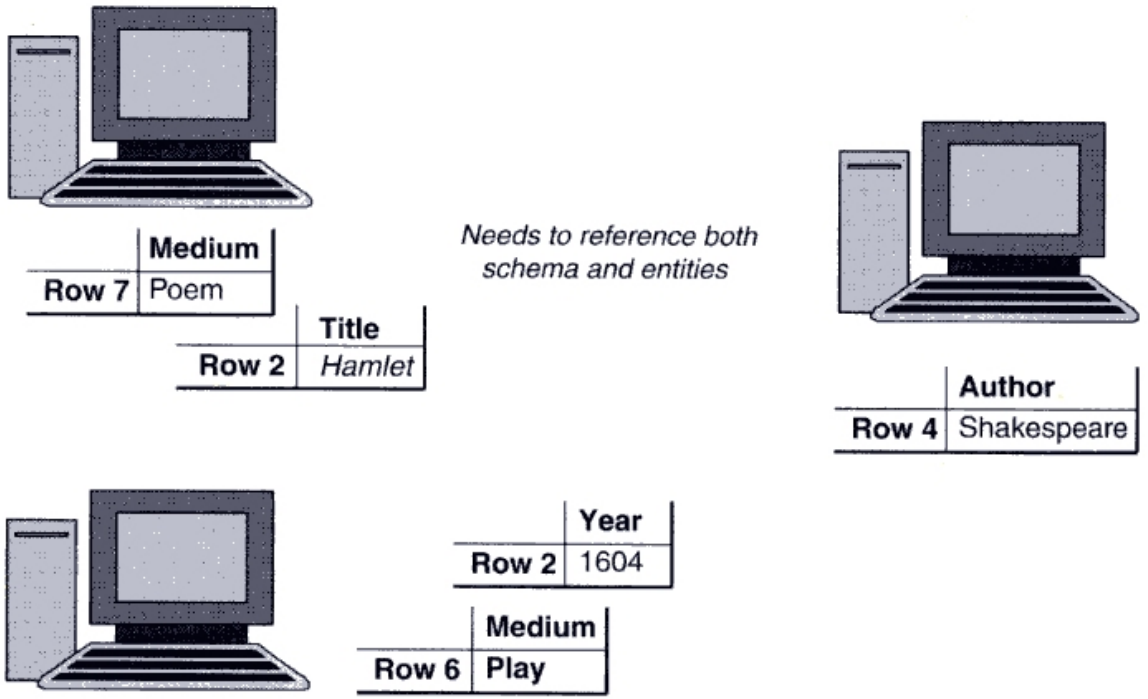


FIGURE 3-3

Distributing data across the Web, cell by cell.

Allemang, D. and Hendler, J., Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann, 2007

Cells as triples

Table 3-3 Sample Triples

Subject	Predicate	Object
Shakespeare	Wrote	King Lear
Shakespeare	Wrote	Macbeth
Anne Hathaway	Married	Shakespeare
Shakespeare	Lived In	Stratford
Stratford	Is in	England
Macbeth	Set in	Scotland
England	Part of	The UK
Scotland	Part of	The UK

… and as a graph

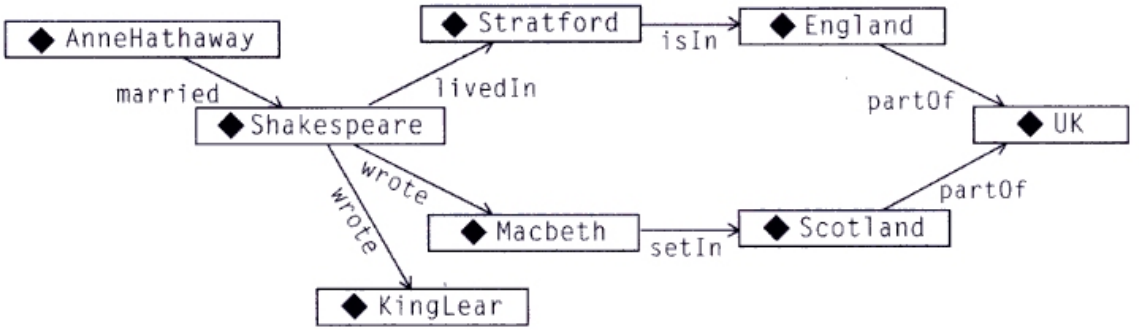
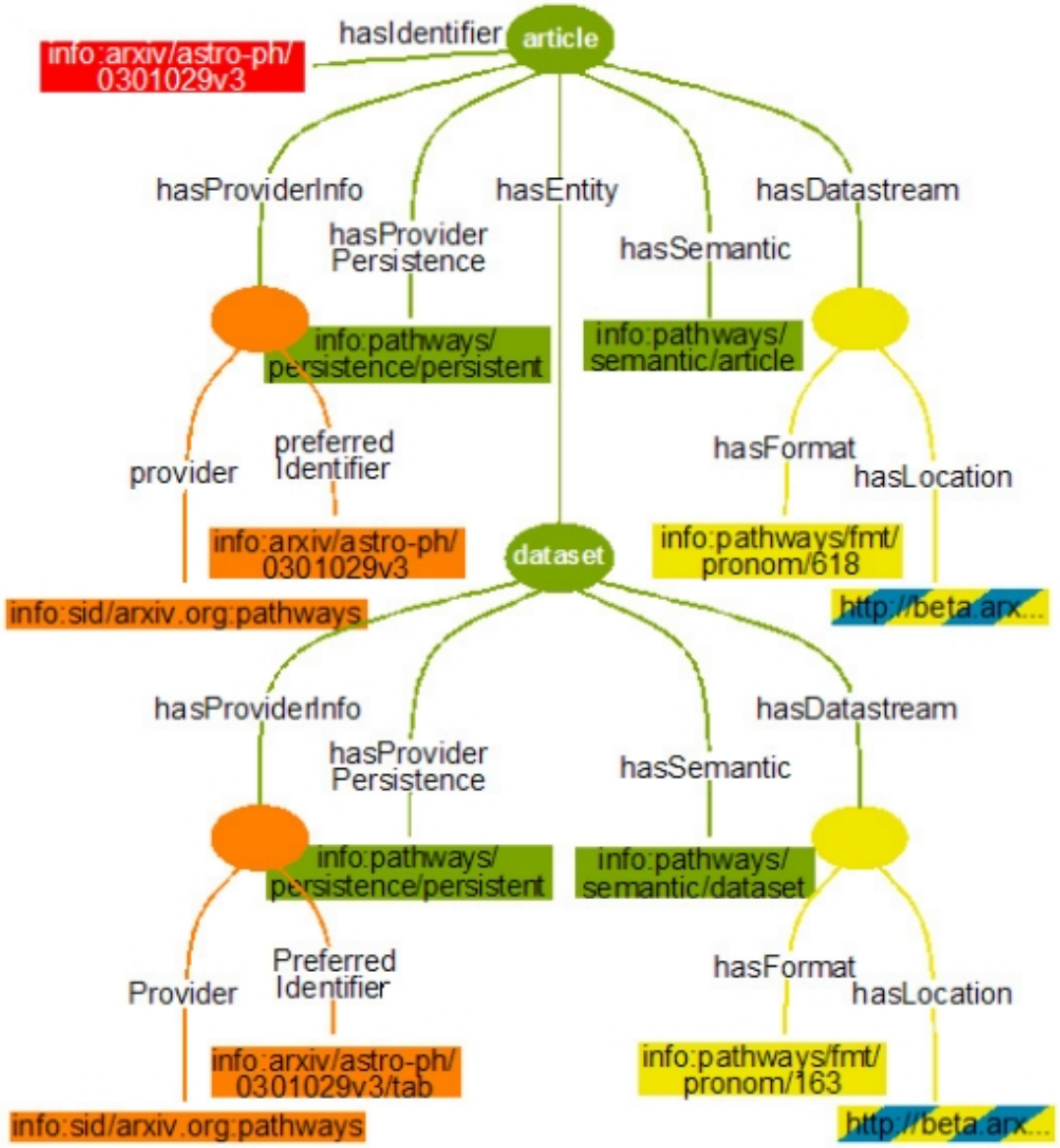


FIGURE 3-4

Graph display of triples from Table 3-3. Eight triples appear as eight labeled edges.

Allemang, D. and Hendler, J., Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann, 2007

A populated graph of triples



Van de Sompel, H., Lagoze, C., Bekaert, J., Liu, X., Payette, S., Warner, S., An Interoperable Fabric for Scholarly Value Chains, D-Lib Magazine, October, 2006

Querying triples

- By individual URI (subject or object)
  - Everything about one event, a grant, a person
- By property relationship (verb)
  - All organizations that are *part of* another
- By type
  - Everything with an rdf:type of Event, Grant, or Project
- By combinations of the above
- SPARQL leverages the RDF format to focus on data rather than schema

Data integration without a common format

Log jam, looking up the dalles, Taylor's Falls, St. Croix River, MN. Photo by F.E. Loomis

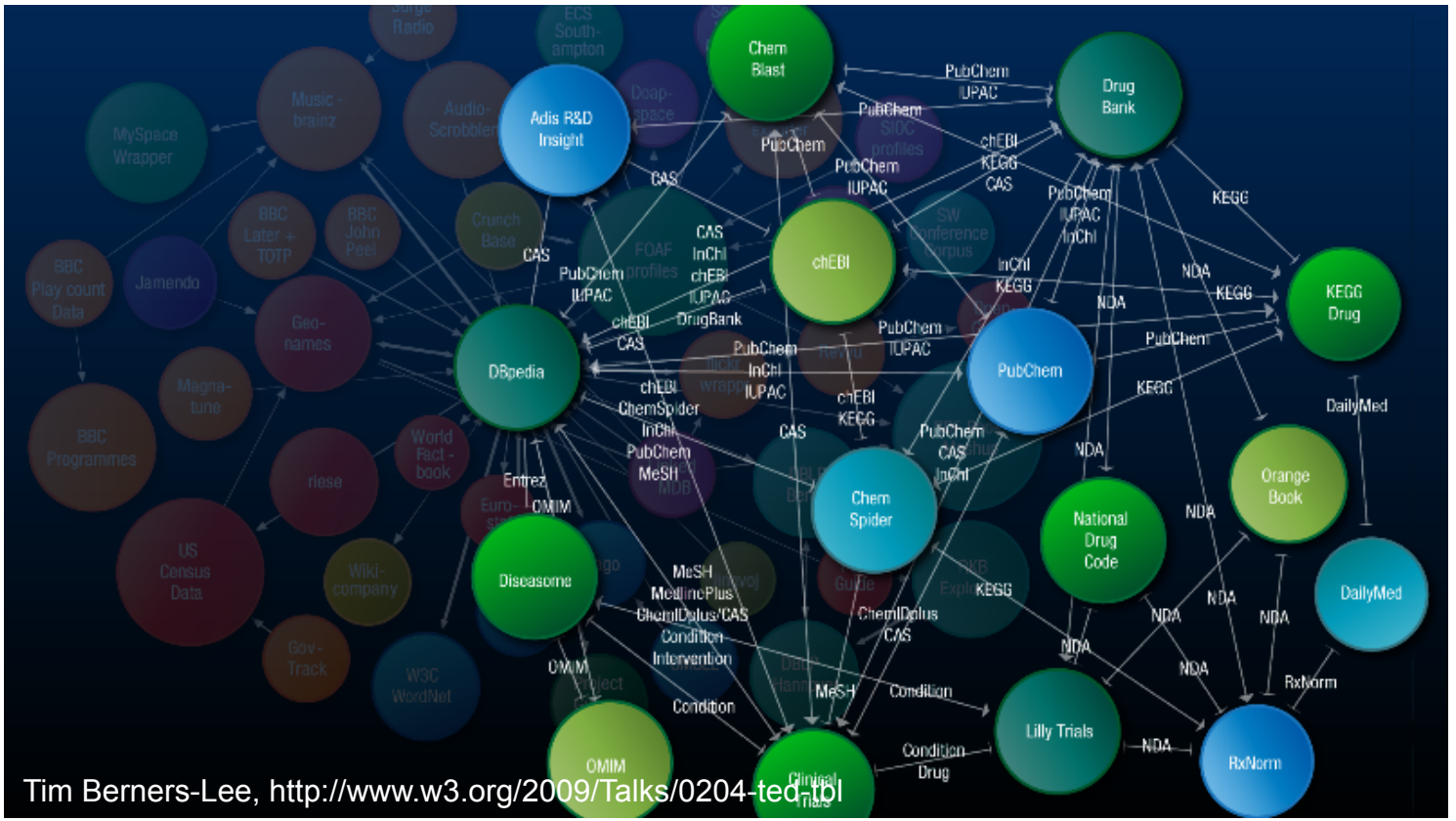
Benefits of the Linked Data approach

	Traditional data integration	Linked data approach
Data structure	Predominantly relational; focus is on sets of similar data	More flexible: focus is on relationships between things regardless of similarity
Date integration method	Extract from original source, transform to local data	Link to source of data using data definitions in shared ontology
Data integration scalability	Each new data source expands costs exponentially	New data sources are accessible at minimal cost, and business domains share the federation cost
Contextual richness	Constrained by costs and central staff workloads	Benefits from the network effect: context gets added with new data and linkages
Information source bias	Internal	Internal and external
Business unit involvement	Report requestors	Managers of their own ontology and external data-linking activities
Standardization method	One standard, no exceptions, loss of valuable information context	Explicitly allows both standard data and contextual information

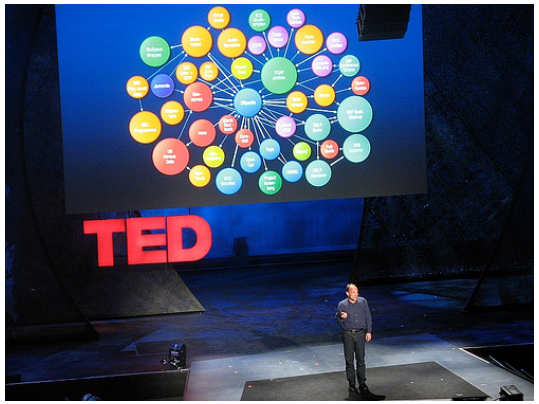
PricewaterhouseCoopers, *Spinning a Data Web, http://www.pwc.com/extweb/pwcpublications.nsf/docid/C85F6867F37F5307852575BA00633F F7. Accessed June 25, 2009.*

VIVO and Linked Open Data

- VIVO enables authoritative data about researchers to become part of the Linked Open Data (LOD) cloud



Linked Data principles



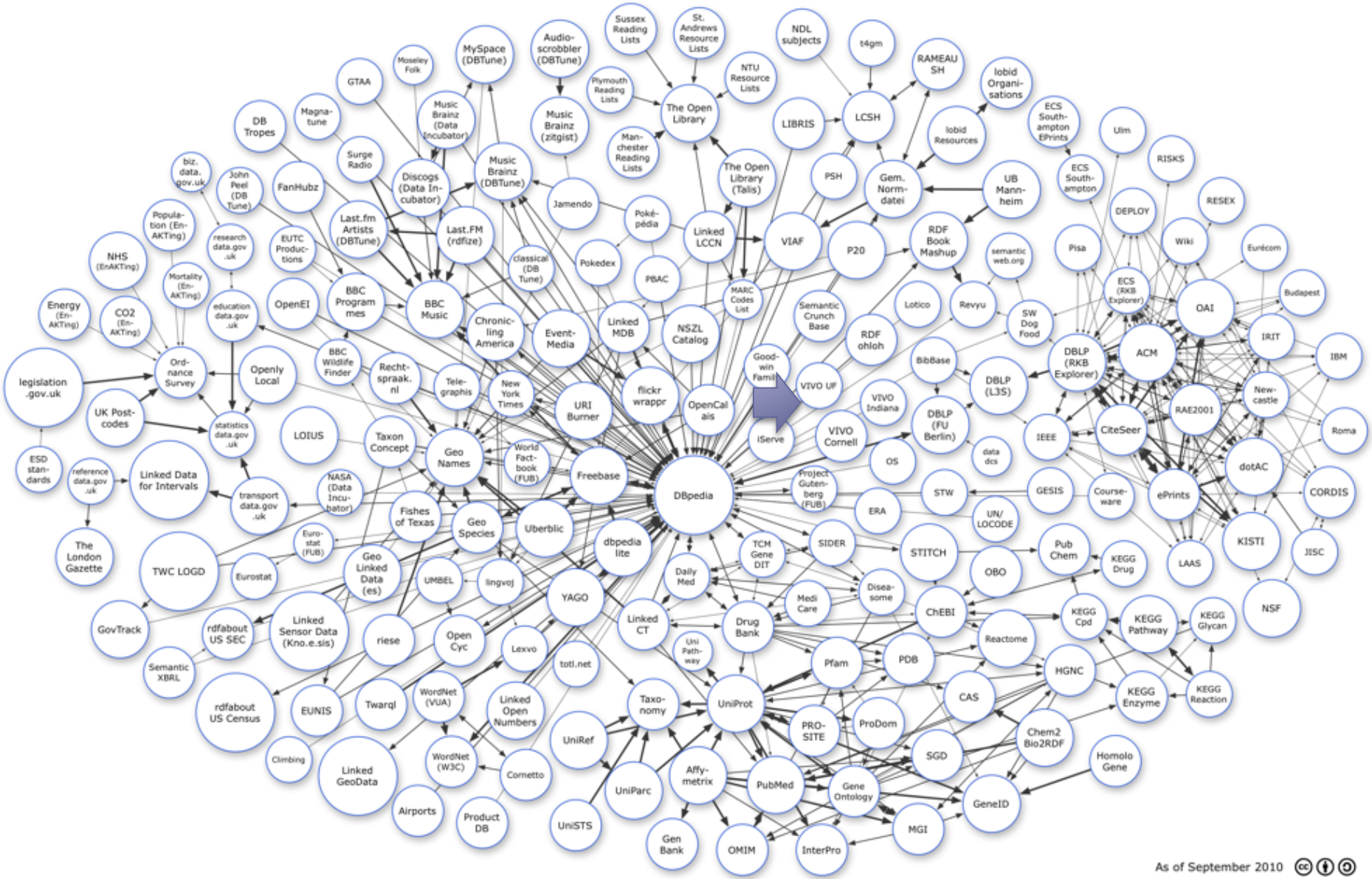
Tim Berners-Lee:

- Use URIs as names for things
- Use HTTP URIs so that people can look up those names
- When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL)
- Include links to other URIs so that people can discover more things

http://www.w3.org/DesignIssues/LinkedData.html

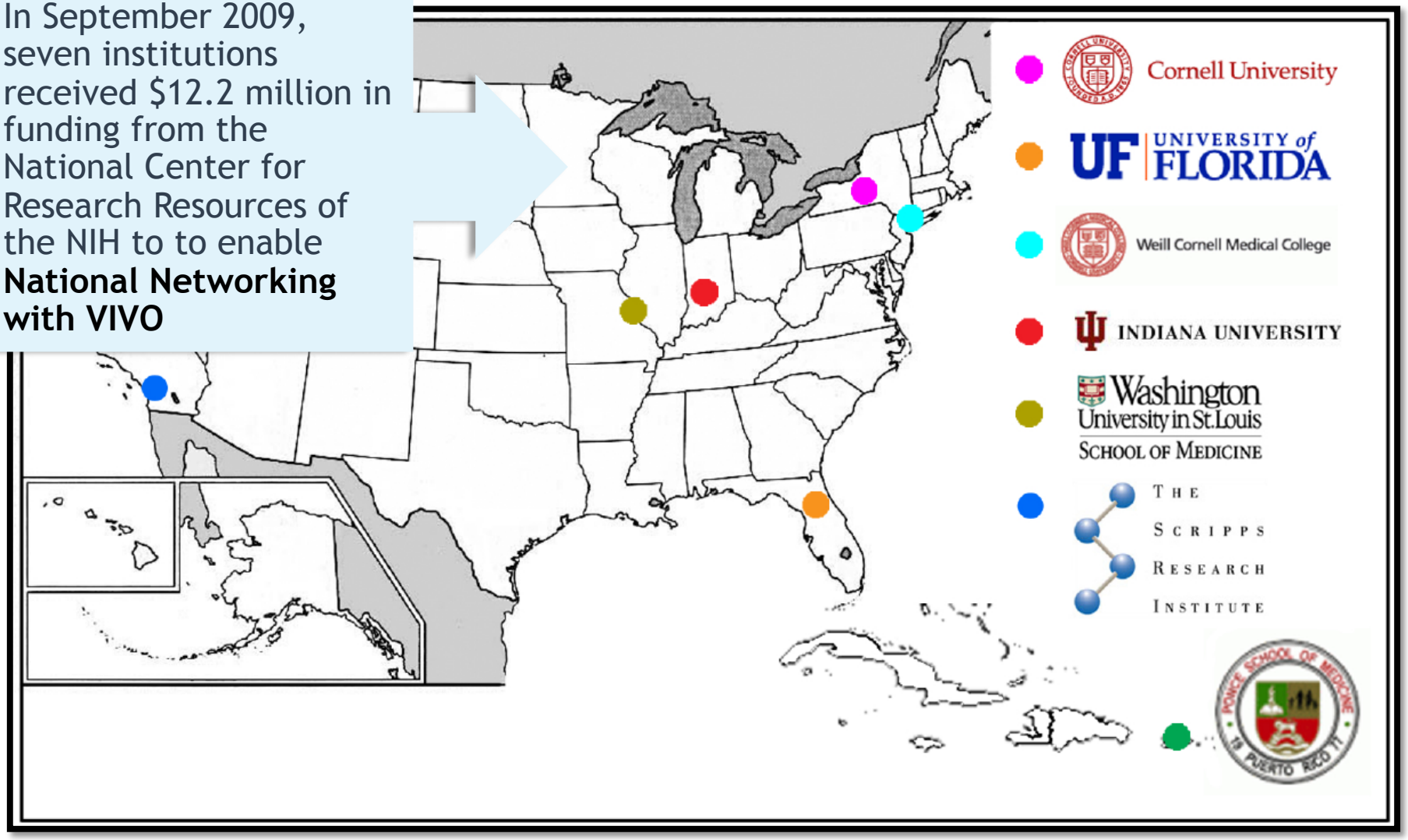
http://linkeddata.org

VIVO *in* the LOD cloud

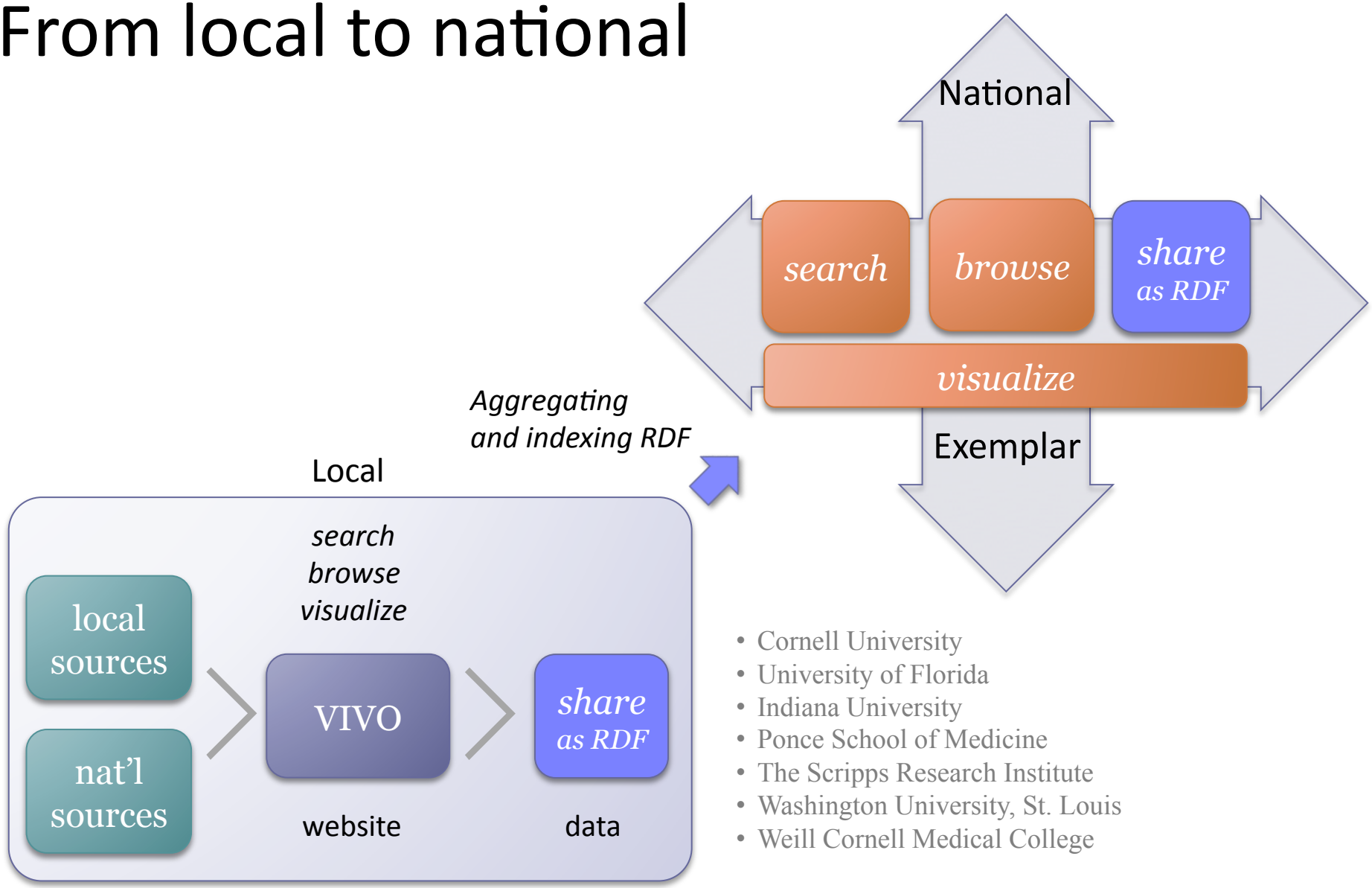


Enabling National Networking of Scientists

In September 2009, seven institutions received $12.2 million in funding from the National Center for Research Resources of the NIH to to enable **National Networking with VIVO**

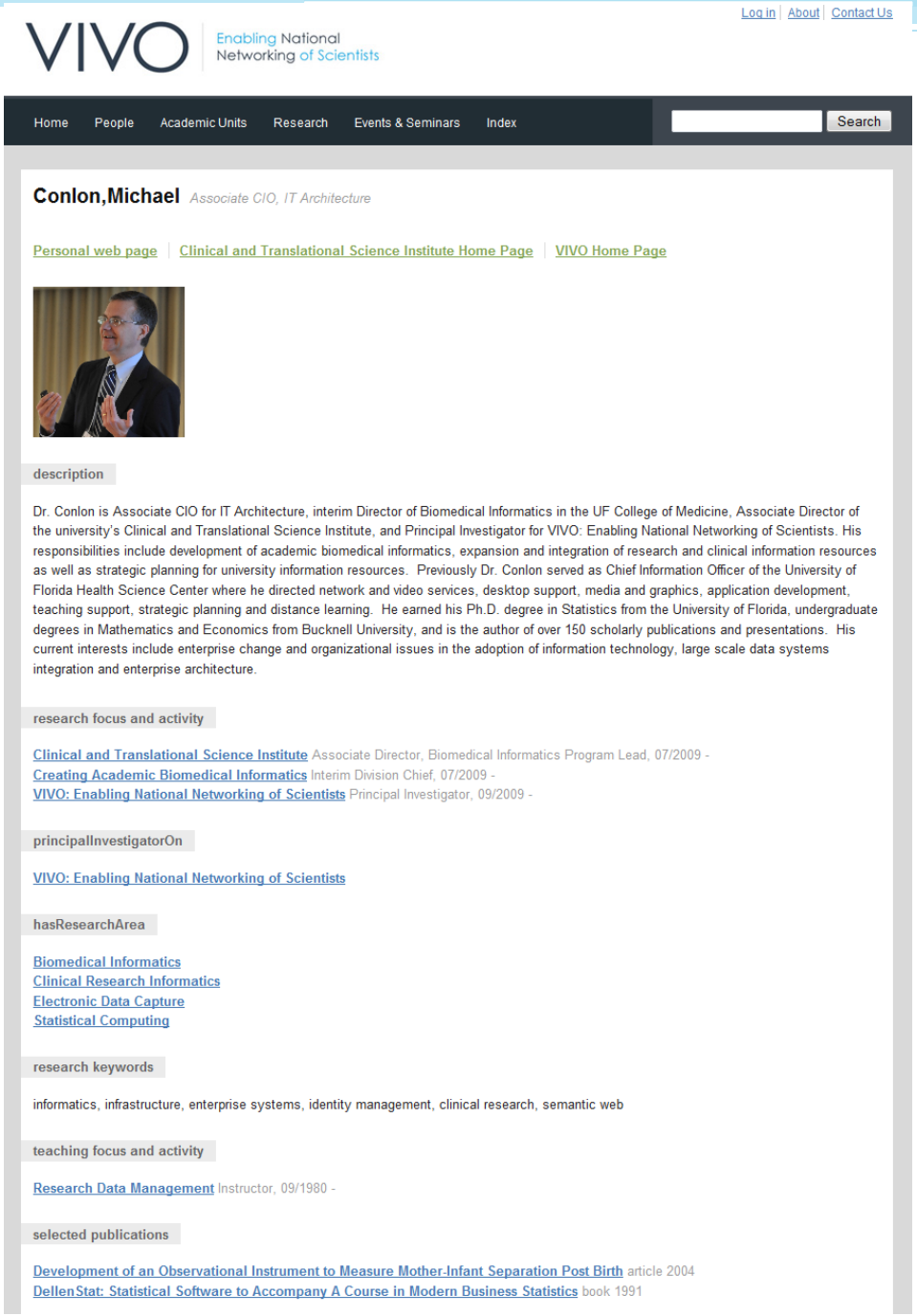


From local to national

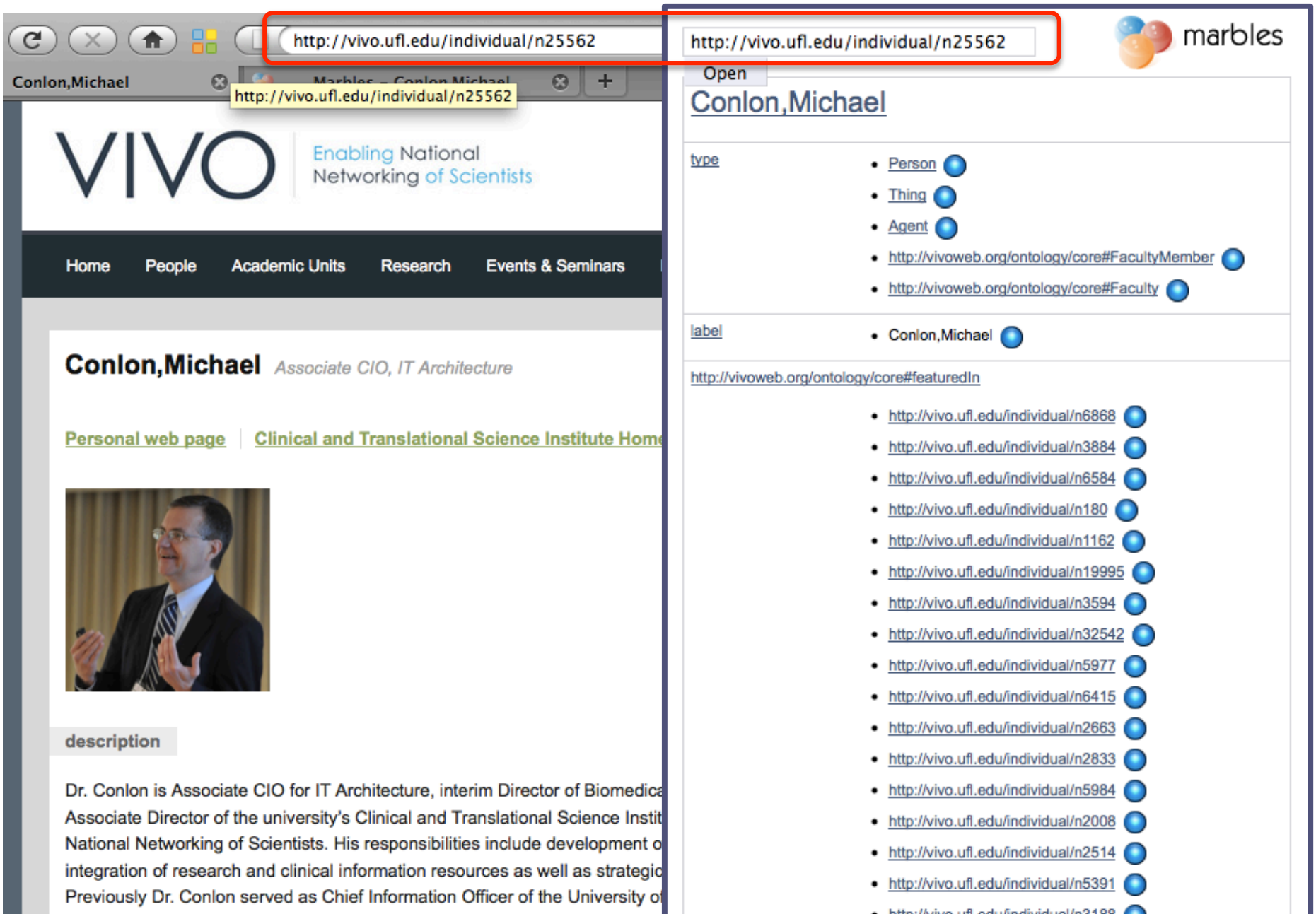


- Cornell University
- University of Florida
- Indiana University
- Ponce School of Medicine
- The Scripps Research Institute
- Washington University, St. Louis
- Weill Cornell Medical College

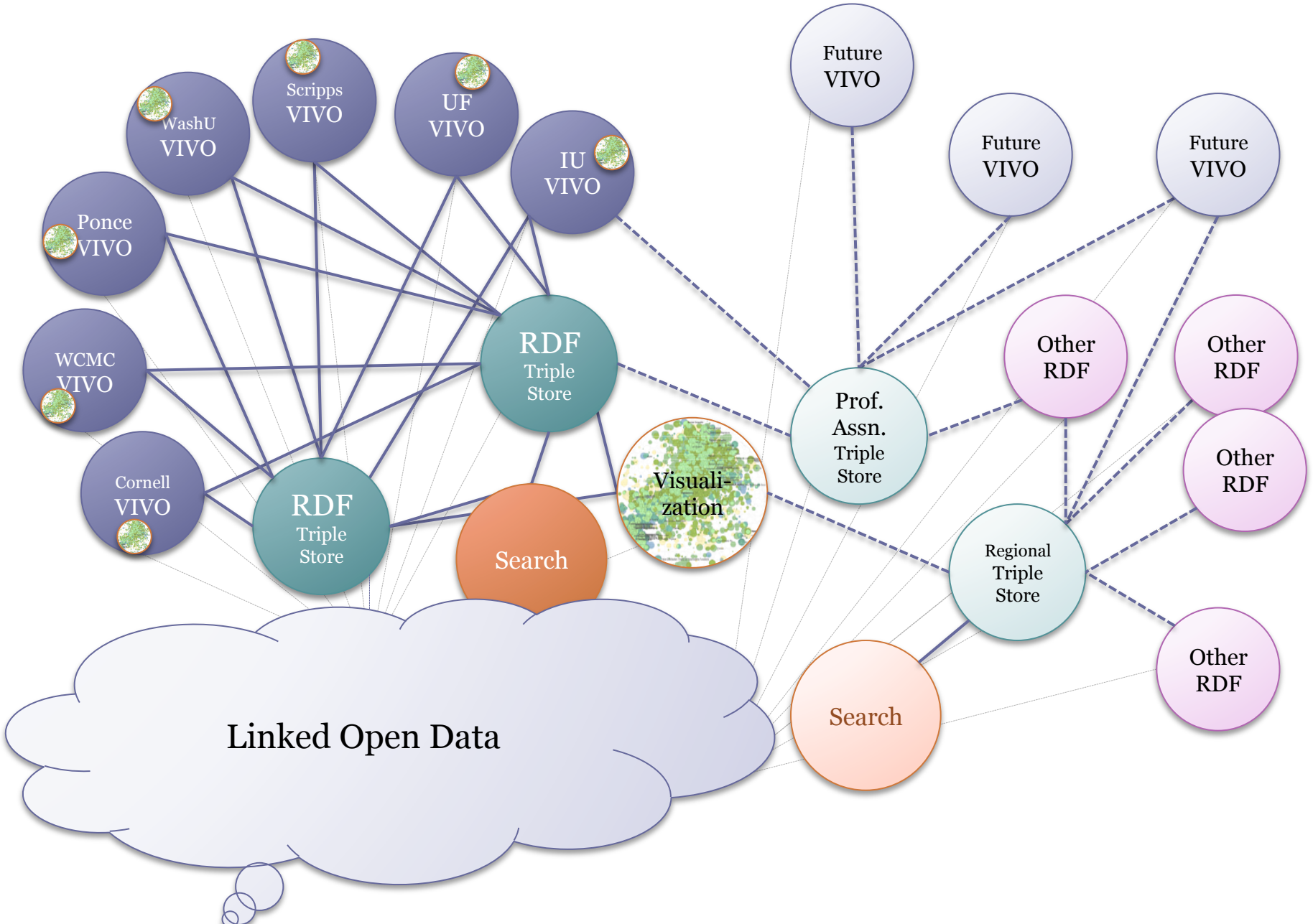
Mike Conlon's VIVO profile



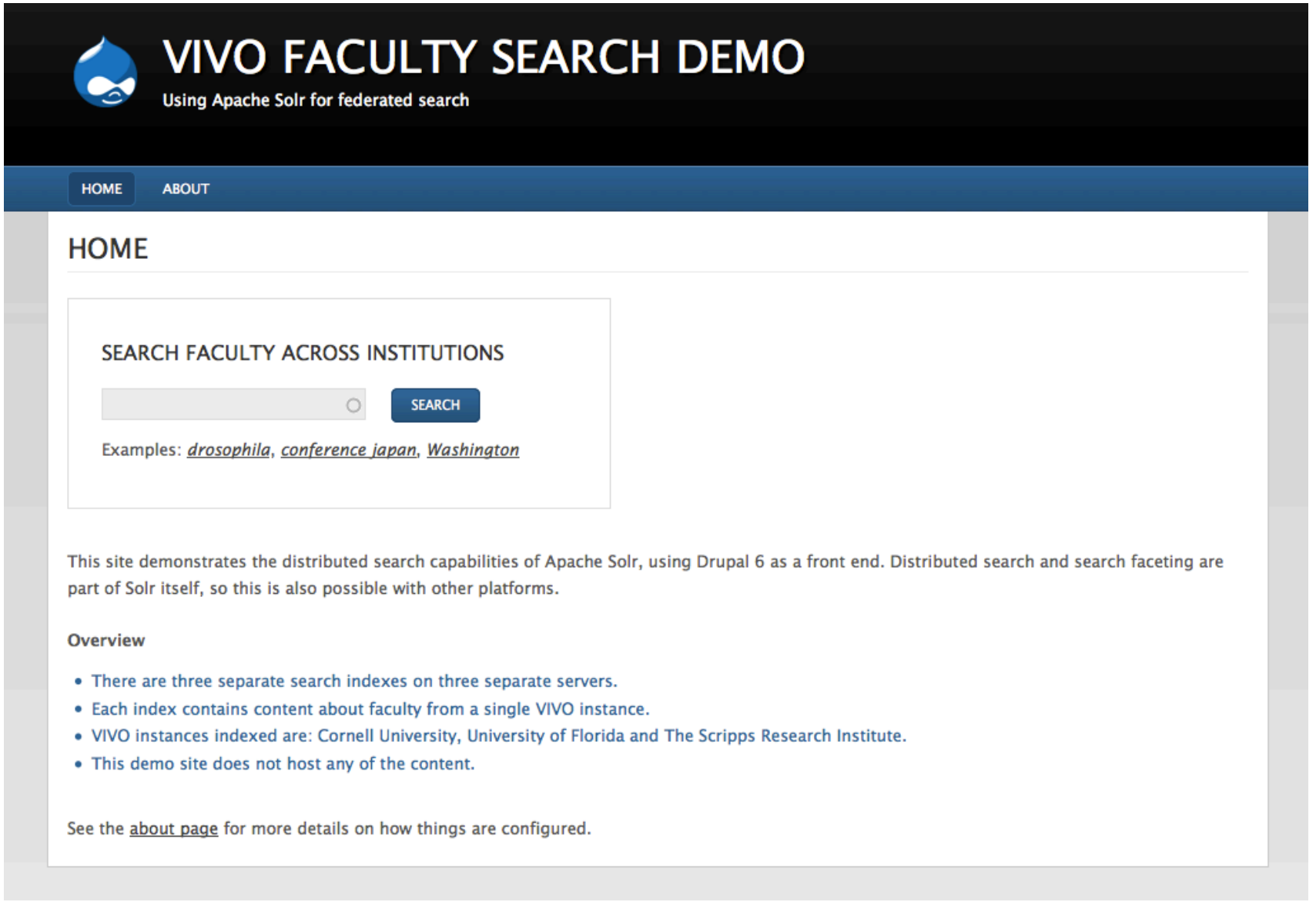
Mike Conlon's profile as Linked Data



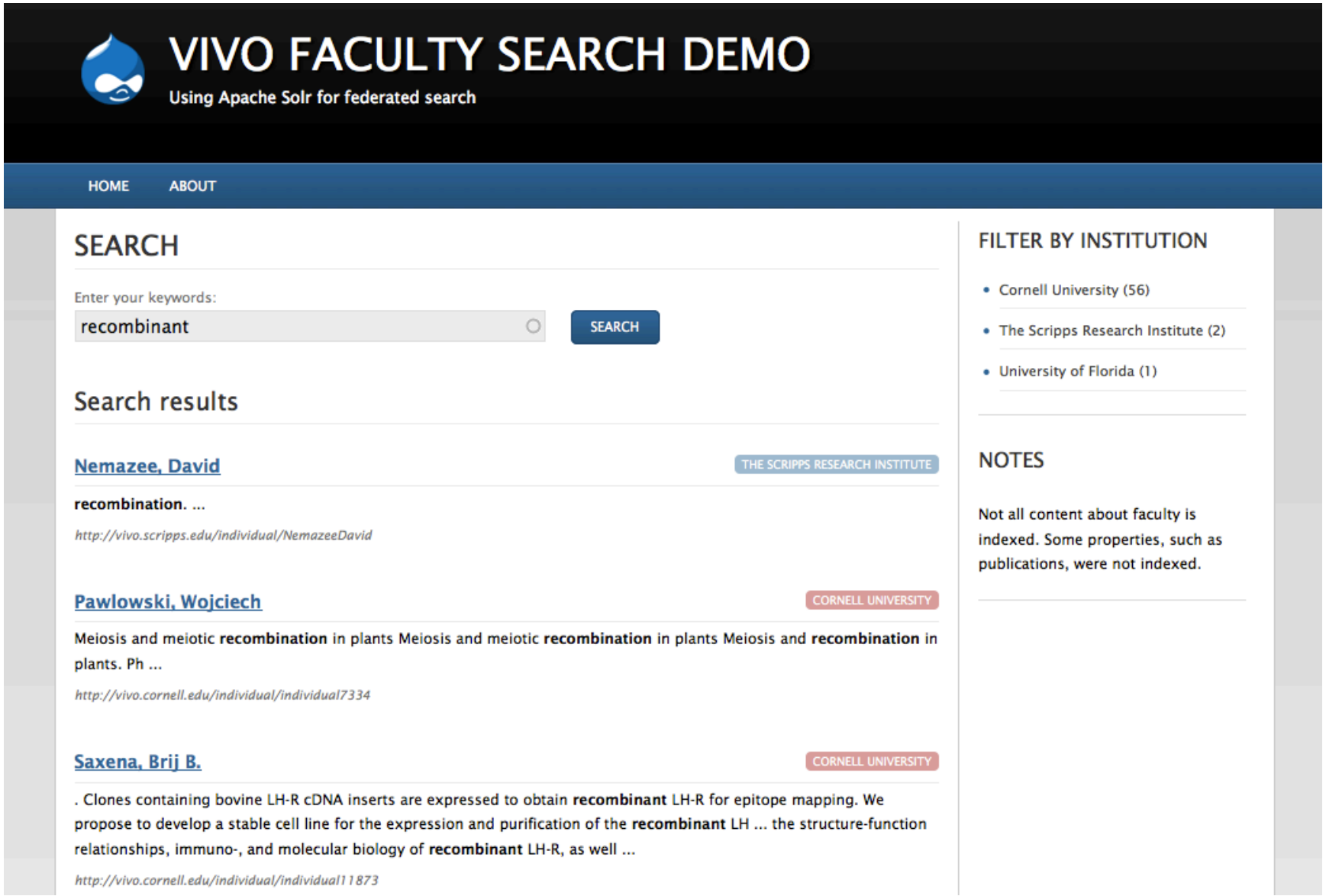
National networking



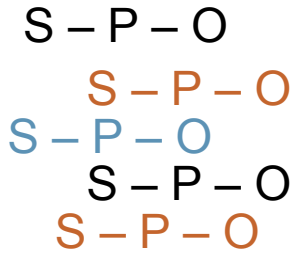
National network search



Solr/Drupal prototype



The Semantic Web: big pile o' triples



- You don't need a schema to start storing data
- Just add triples
- If you can write it as a simple statement, you can say it in RDF.

The Semantic Web: Linked Data ideas

- Use established, widely-recognized vocabularies (ontologies) wherever possible

BUT

- Get your data out there! Turn it into triples.
- We don't all need perfect agreement on perfect ontologies to start sharing data.

Integration without complete transformation

cornell:individual19133 core:teaches cornell:class10666 .

cornell:class10666 rdfs:label “MSE 2920 – Research Involvement IIB” .

cornell:class10666 stars:class_CourseIDandClassNbr "353880-16764” .

cornell:class10666 stars:class_classCourseId “353880” .

Integration by linking: one approach

cornell:individual19133 core:teaches cornell:class10666 .

cornell:class10666 rdfs:label “MSE 2920 – Research Involvement IIB” .

cornell:class10666 owl:sameAs
<http://courses.cornell.edu/class-353880-16764>

Integration by linking: another approach

cornell:individual19133 core:teaches
<http://courses.cornell.edu/class-353880-16764> .

The Semantic Web: VIVO core ontology

- Helps us build a national network
- Query data consistently across institutions
- For integrating data, not prescribing how things should be
- Institution retains control over details of how its people and organizations are represented

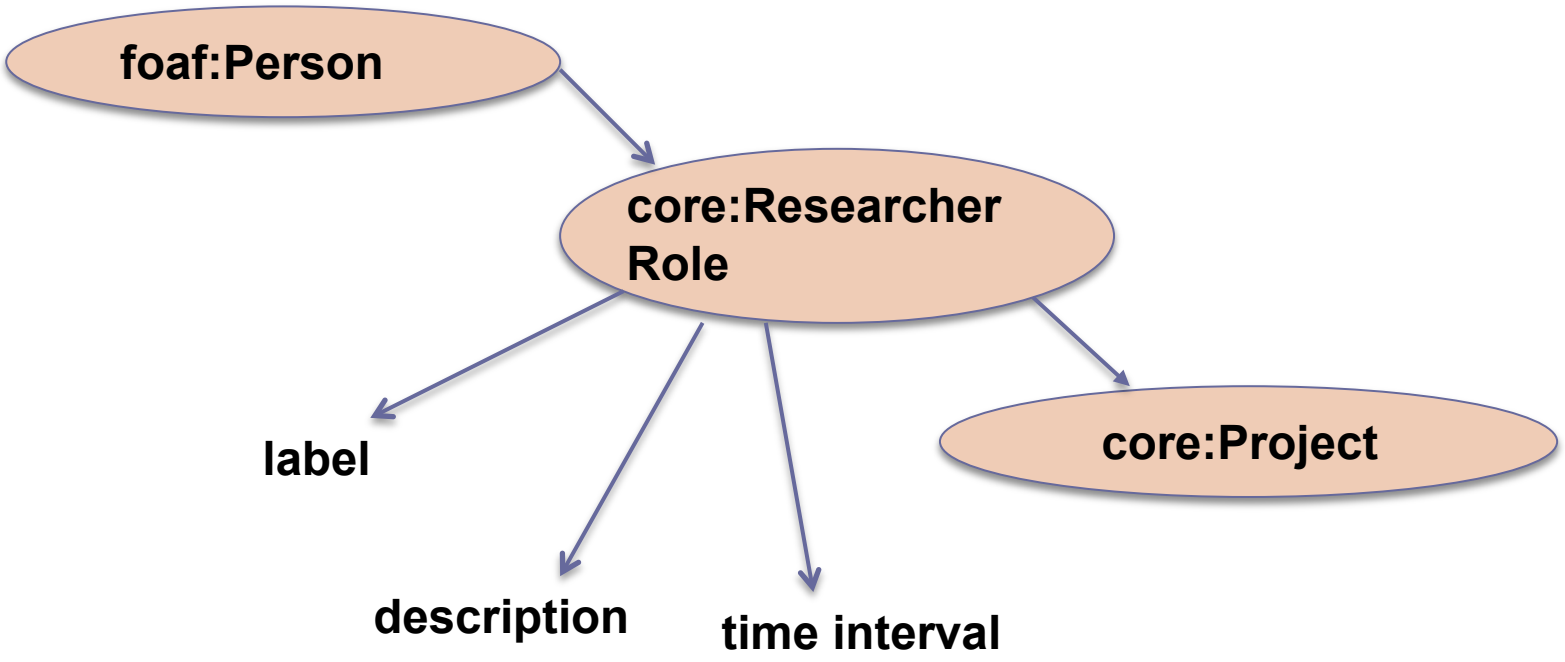
VIVO core ontology

- Main areas of information modeled:

People –	Grants/Contracts
- Background	Courses
- Research Activities	Organizations
- Publications	Events

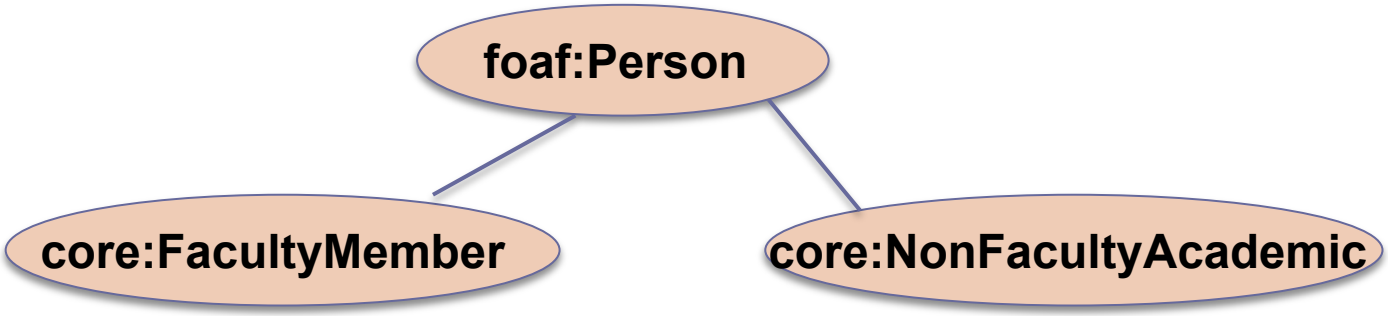
VIVO core ontology: roles and context

- Sometimes need more than just a simple triple.



VIVO core ontology: the librarian problem

- Many academic institutions have librarians, but where do we represent them in the ontology?



VIVO core ontology: the librarian problem

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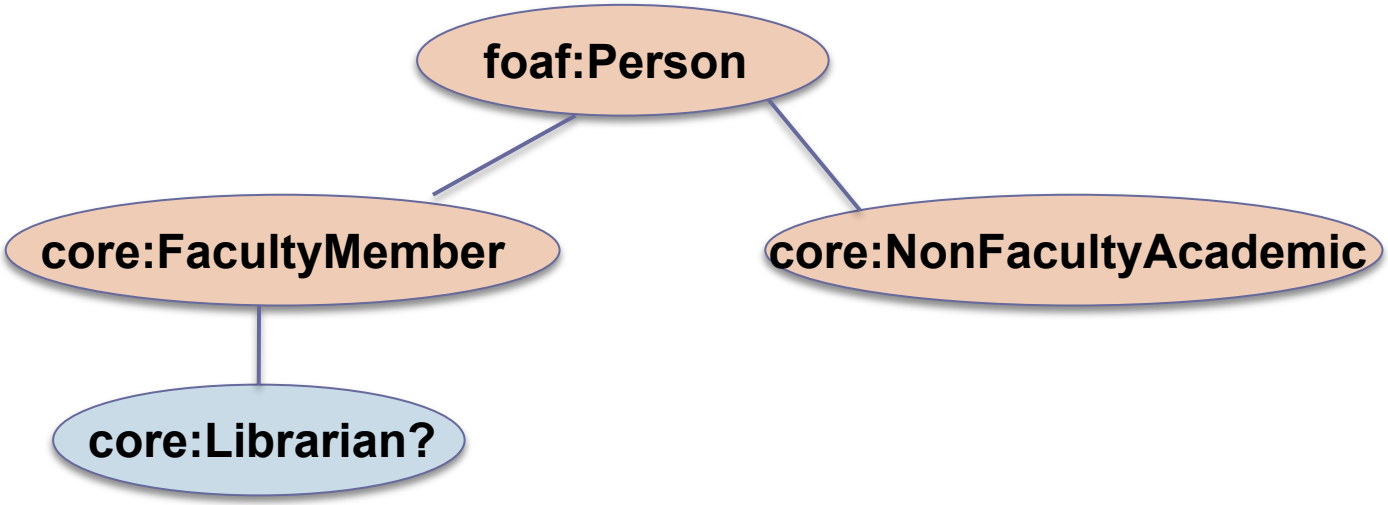
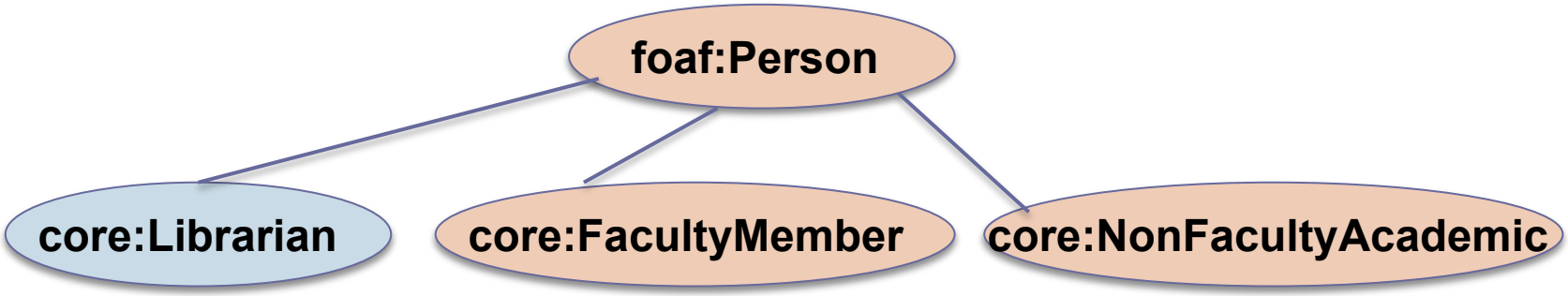


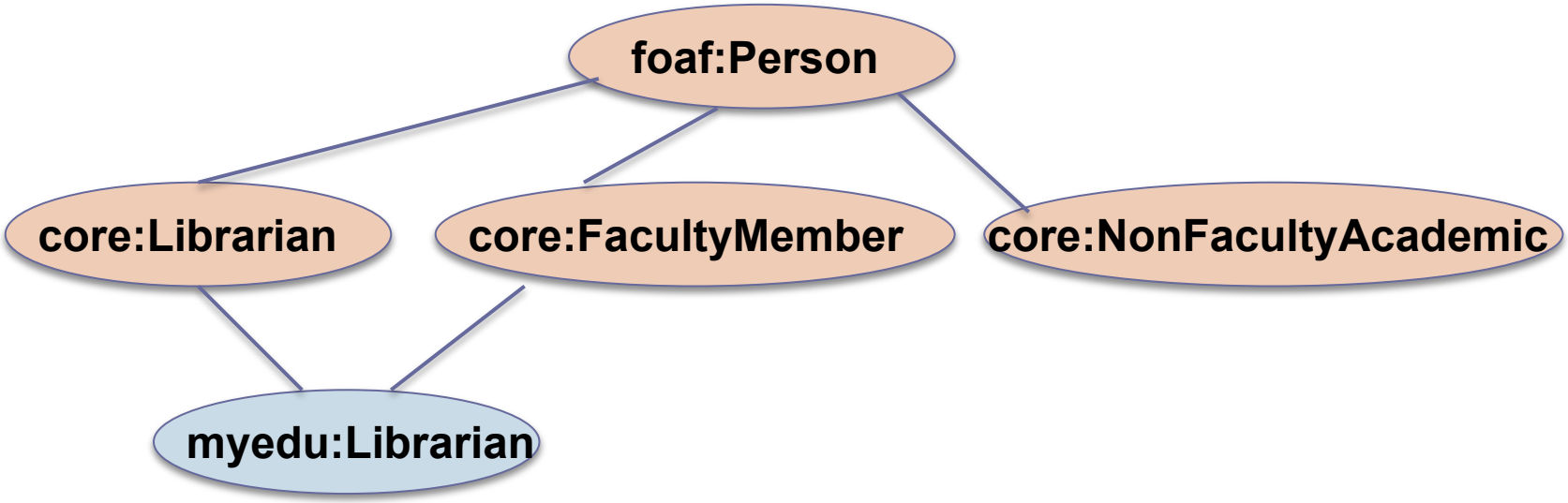
VIVO core ontology: the librarian problem

- This arrangement should work across institutions.



VIVO core ontology: the librarian problem

- Local extension avoids asserting multiple types.



The Semantic Web: ontologies

- Ontologies help us make sense of the triples
- Tell us what a triple “means” (and what’s implied – but not explicitly stated – by that triple)
- Ontologies don’t tell us what triples we’re “allowed” to write

Role of the ontology

- ObjectProperty ex:hasPet
  - Domain foaf:Person
  - Range ex:Animal

```
:JohnDoe ex:hasPet ex:fuelInjector2397 .
ex:fuelInjector rdf:type
  ex:FuelInjector .
```

Is this an error? ***Well, maybe.***

Role of the ontology

- The ontology becomes *inconsistent* if ex:Animal and ex:FuelInjector are declared to be *disjoint.*

  (Or if disjointness is asserted further up the hierarchy, e.g. LivingThing disjointWith CarPart)

- Otherwise, we just get an inference that the fuel injector is also an animal.

DataStaR

http://datastar.mannlib.cornell.edu/

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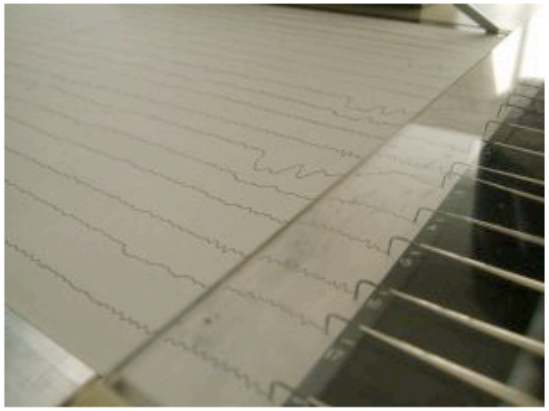

Welcome to DataStaR, a **Data Sta**ging **R**epository hosted by Albert R. Mann Library, at Cornell University.

The purpose of DataStaR is to support collaboration and data sharing among researchers during the research process, and to promote publishing or archiving data and high-quality metadata to discipline-specific data centers, and/or to Cornell's own digital repository (eCommons@Cornell). Read more about DataStaR.

Are you a Cornell researcher with data you'd like to share with collaborators, or make publicly available? Contact us.

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Limnological summary and depth profile for six standard sampling sites on Oneida Lake, New York, 1975 - 2006 *data set*

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title

Limnological summary and depth profile for six standard sampling sites on Oneida Lake, New York, 1975 - 2006

abstract

The Cornell Biological Field Station (CBFS) serves as a primary field site for aquatic research at Cornell University (more information can be found at http://www.dnr.cornell.edu/fieldst/cbfs.htm) and is part of the Department of Natural Resources, College of Agriculture and Life Sciences. The centerpiece of the station's research program is a 50-year database on the food web of Oneida Lake, New York, that has been collected with support from the Cornell University Brown Endowment and from the New York State Department of Environmental Conservation. The data are collected by personnel from the Cornell Biological Field Station and include limnology, benthos, zooplankton, phytoplankton, and fish survey data, primarily from Oneida Lake and spanning 1957 to the present. This data package includes three tables. The first is a summary of limnological data gathered during standard sampling of Oneida Lake from 1975 - 2006. The second provides profile data by depth for temperature, dissolved oxygen, pH, and conductivity. A supplemental table provides the coordinates of the six sampling sites.

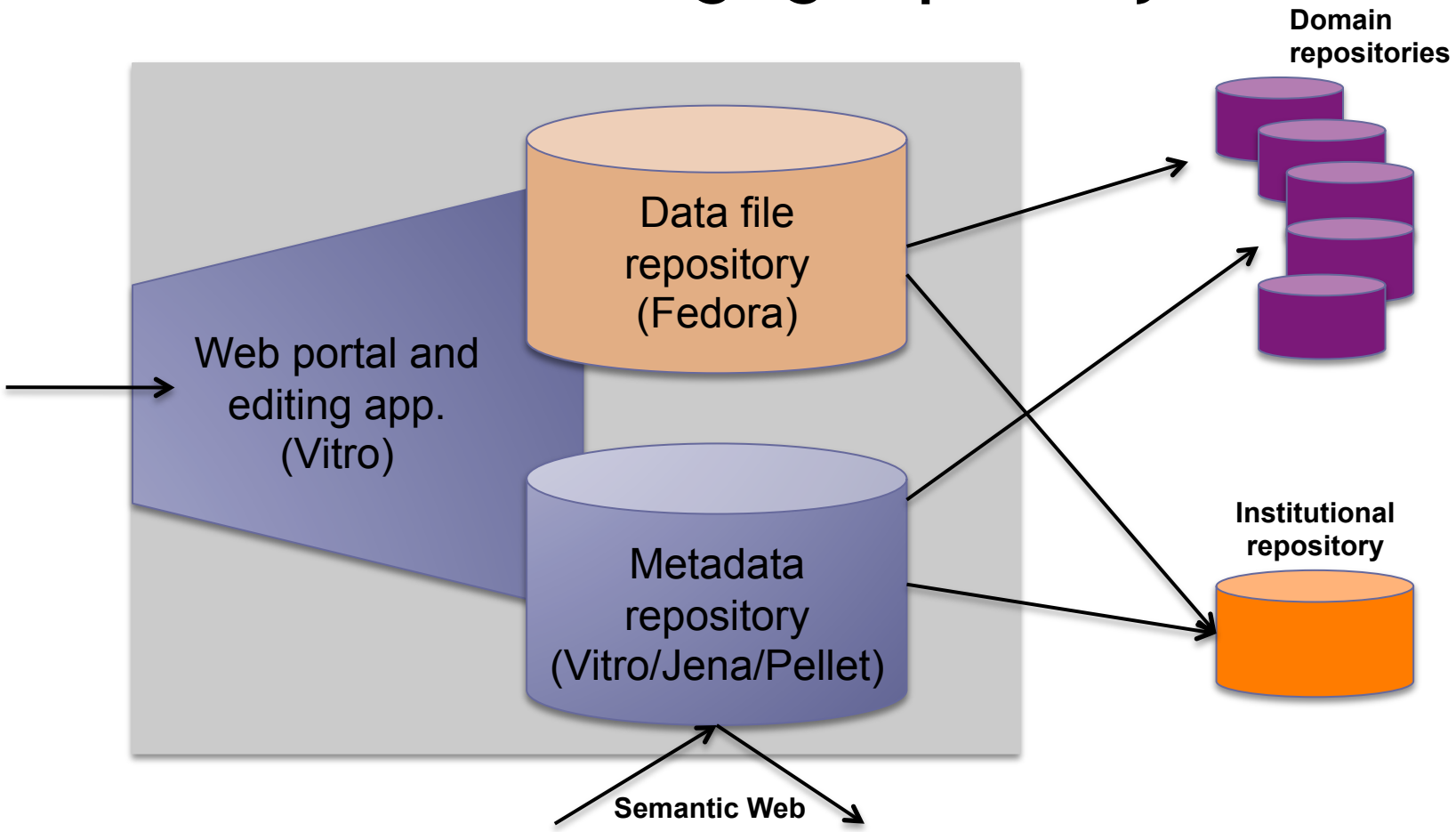
owner

Mills, Edward
Rudstam, Lars

primary contact person

Holeck, Kristen

DataStaR: A Data Staging Repository



VIVO in Australia

- Australian universities also using VIVO for metadata about research data
- VIVO attractive to local institutions because the data is managed in the context of a researcher's other activities (publications, etc.)
- OAI repository add-on creates a more traditional "metadata record" for national commons

VIVO: parallel goals

- Build **ontology** and **linked data** to enable national network and external applications
- Build web application for human consumption on traditional web pages
- Rich web of data is filtered and constrained only where necessary for a particular application

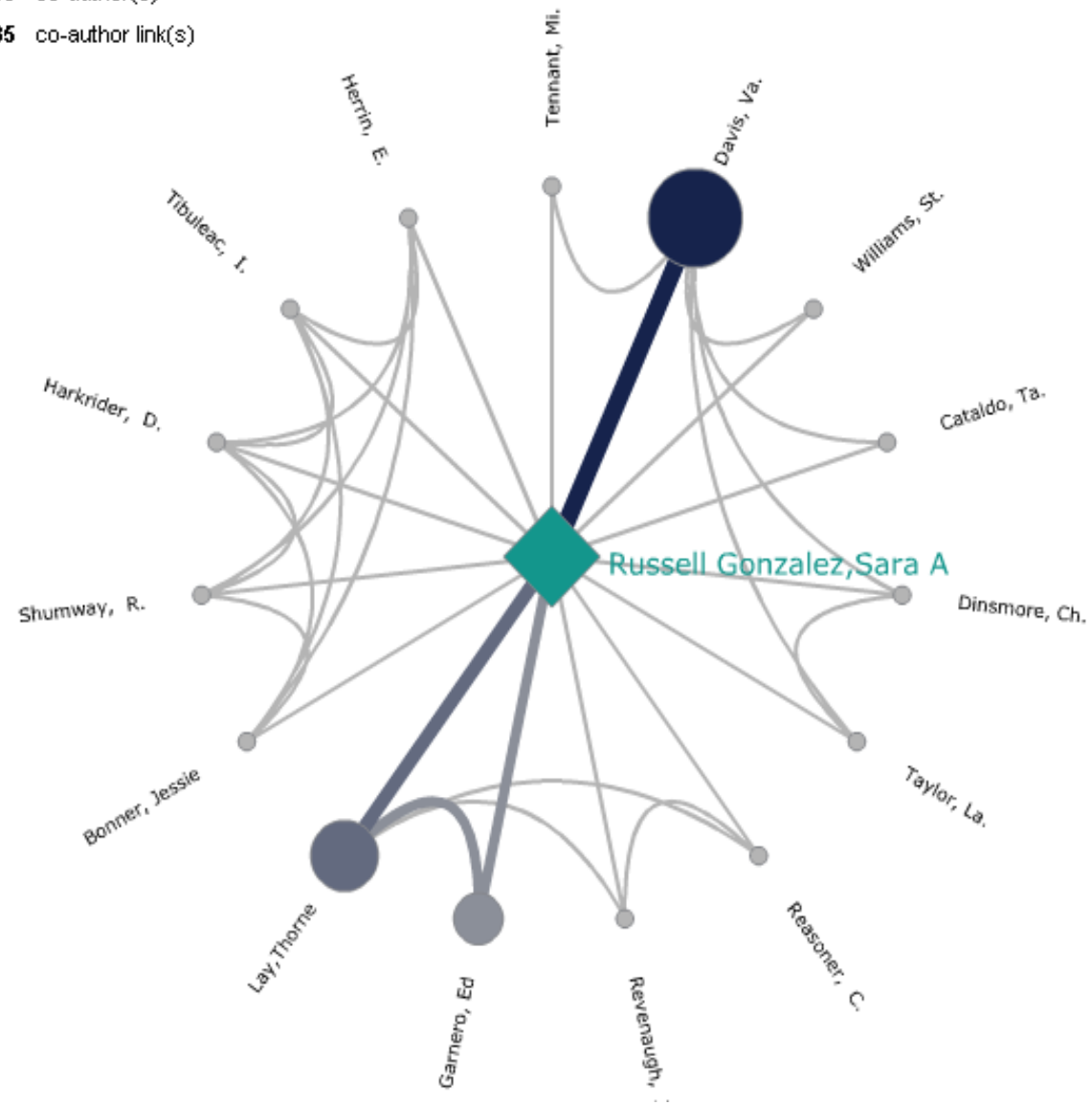
Visualization

- Completed Work
  - Co-Author visualization
  - Sparklines
  - VIVO world activity map

Co-Author Network (GraphML File)

15 co-author(s)

35 co-author link(s)

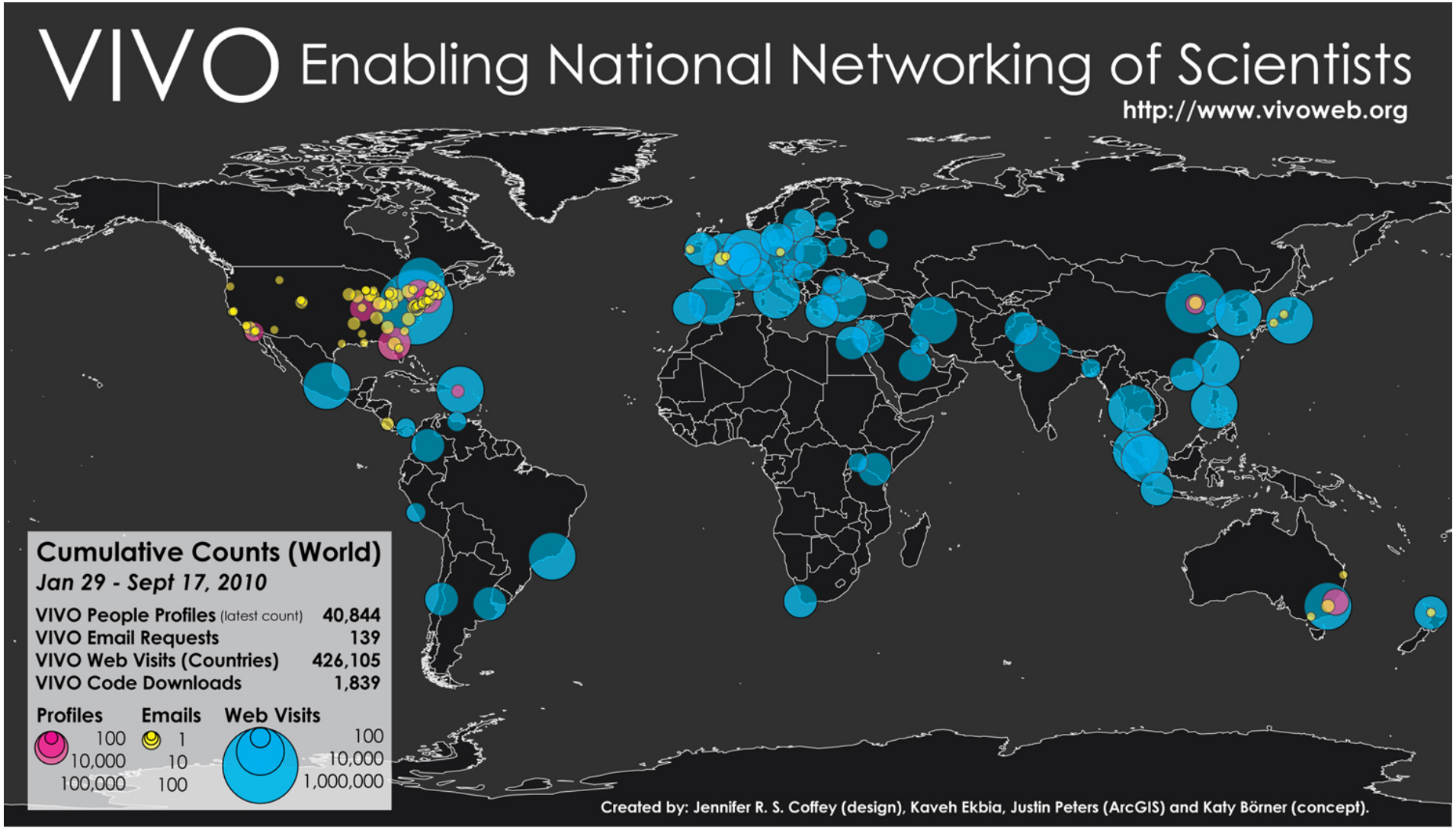


Russell Gonzalez,Sara A

Physical Sciences Librarian

VIVO profile | Co-author network

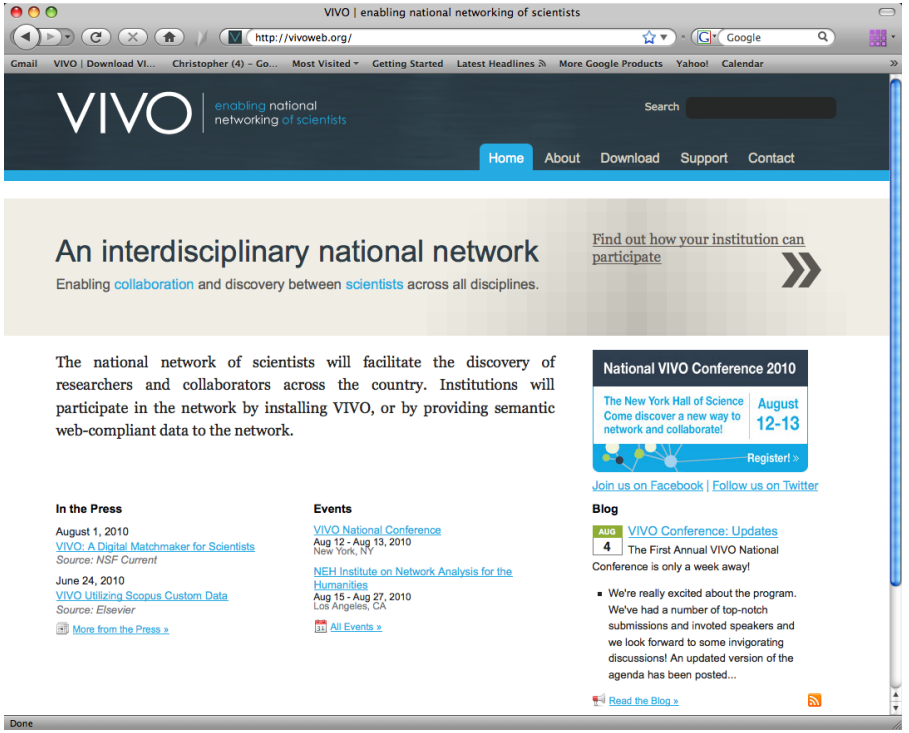
9	Publication(s)
15	Co-author(s)
1998	First Publication
2010	Last Publication


VIVO Enabling National Networking of Scientists
http://www.vivoweb.org
Cumulative Counts (World)
Jan 29 - Sept 17, 2010
VIVO People Profiles (latest count) 40,844
VIVO Email Requests 139
VIVO Web Visits (Countries) 426,105
VIVO Code Downloads 1,839
Profiles
100
10,000
100,000
Emails
1
10
100
Web Visits
100
10,000
1,000,000
Created by: Jennifer R. S. Coffey (design), Kaveh Ekbia, Justin Peters (ArcGIS) and Katy Börner (concept).

Get involved with VIVO

- As an:
  - adopter,
  - data provider, or
  - application developer

- Open source code (BSD) and ontology available via



http://vivoweb.org

Get involved with VIVO

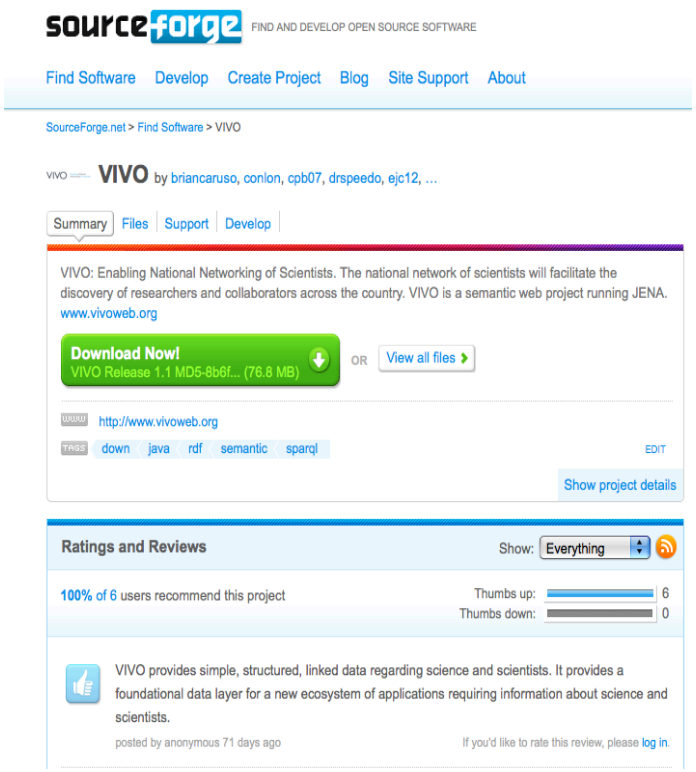
Goals:

Open development community

Full transparency

- Design documents
- Goals / future direction
- Documentation
- Bugs
- Source code access
- Ontology access
- Utilities and community
- Developed tools for VIVO

http://sourceforge.net/projects/vivo/



Get involved with VIVO

- irc.freenode.net #vivo
- Ask questions
- Get answers
- Submit feedback
- Collaborate with other VIVO community developers

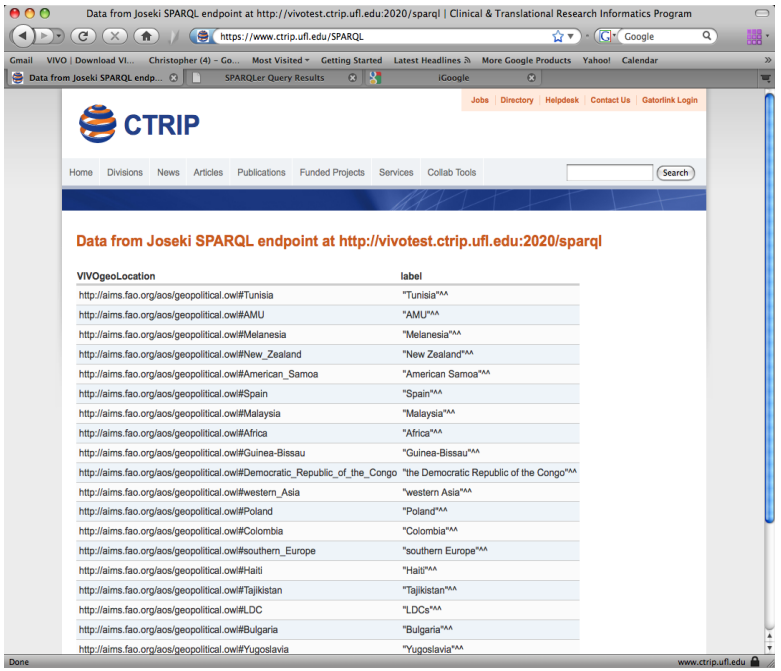
Live VIVO Developers

http://webchat.freenode.net/?channels=VIVO

Get involved with VIVO

- Collaborate
- Use our Linked Data
- Consume VIVO data for your own tools

VIVO data in DRUPAL portal



From SPARQL endpoint

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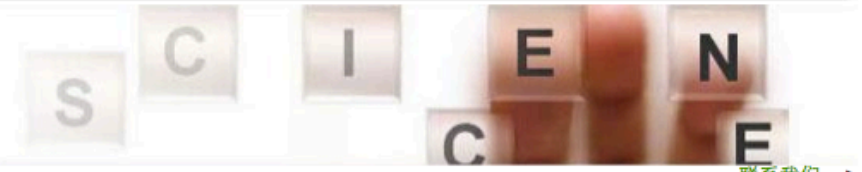
Subject knowledge Environment，CAS



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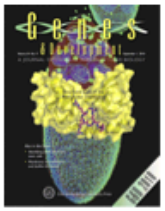
- 
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- 水体污染与控制治理知识环境建成了
- 陈德桂研究组发现新组蛋白去甲基化酶及其调控机理 | 2010-6-25
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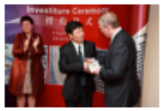
- 
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- 武汉物理和数学研究所生物分子核磁共振研究组招聘启事 | 2010-6-28
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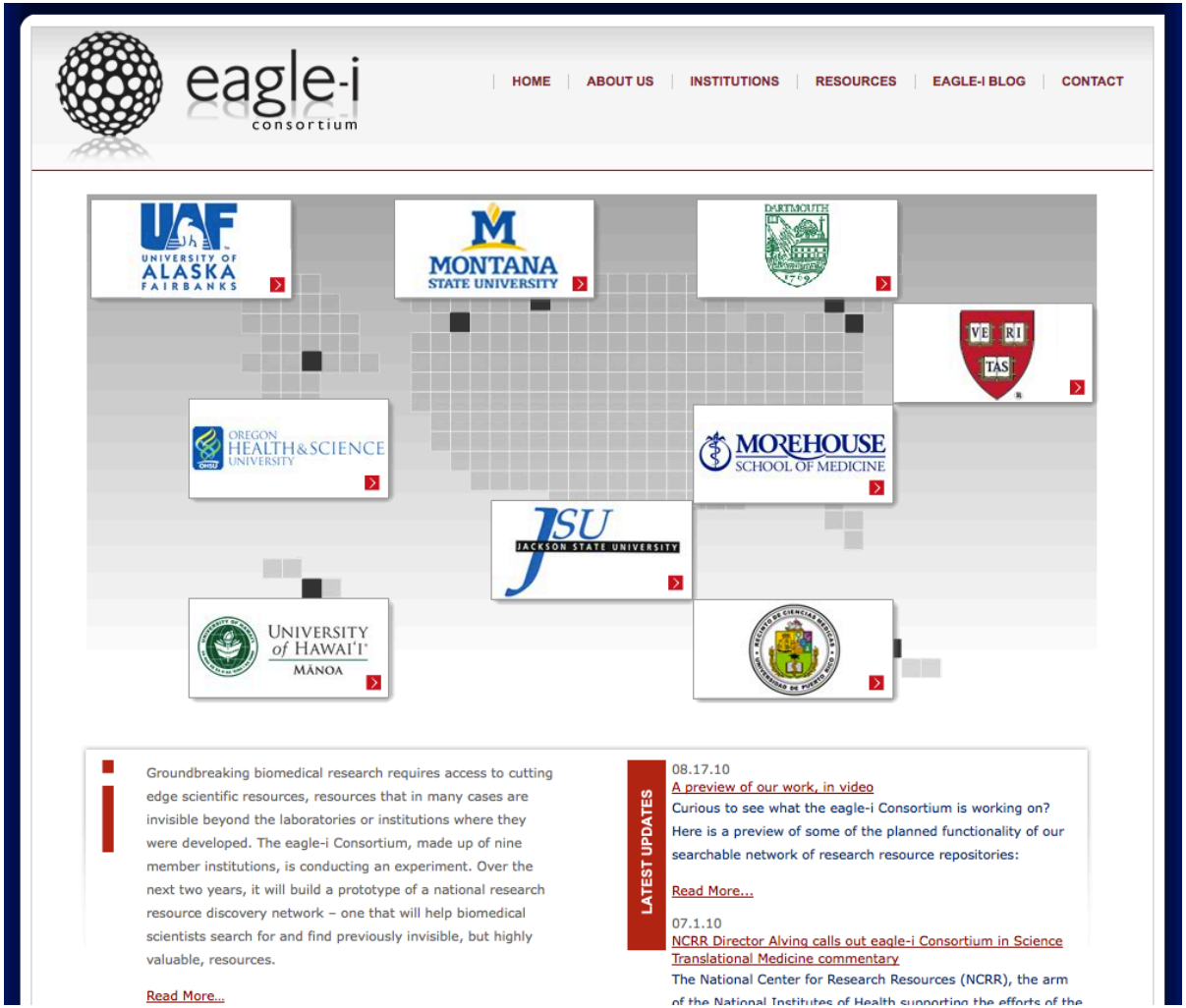
Biomedical and Health Knowledge Environment

Melbourne Central Research Data Registry

VIVO sister project – eagle-i



Thank you