

# Thanks to our Sponsors



# A brief history of Protégé

- 1987 PROTÉGÉ runs on LISP machines
- 1992 PROTÉGÉ-II runs under NeXTStep
- 1995 Protégé/Win runs under ... guess!
- 2000 Protégé-2000 runs under Java
- 2005 Protégé 3.0 emerges with
  - A new UI
  - Solid support for OWL
  - A burgeoning user community

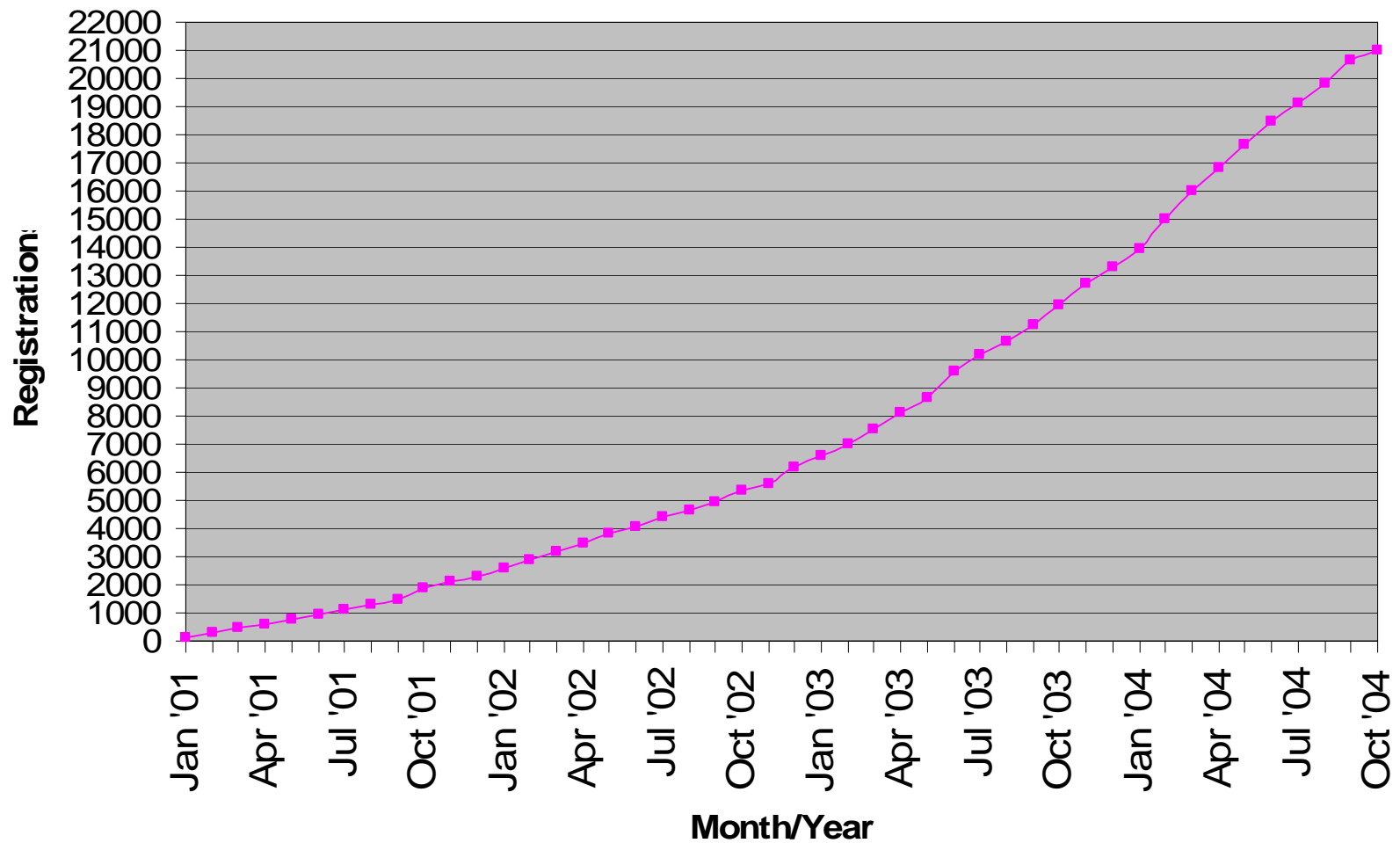
# PROTÉGÉ (ca. 1987)

- Offered a built-in ontology of the skeletal-plan refinement problem-solving method
- Required users to subclass this ontology to define domain-specific referents
- Made major assumptions:
  - A single problem-solving method
  - Domain ontologies that were proper subclasses of the method ontology
  - A limited set of data types and corresponding UI conventions for KA

The image shows a screenshot of the PROTÉGÉ user interface. At the top, the title "PROTÉGÉ" is displayed. Below it, there is a status bar with the text "p-OPAL HTN \*NEW\*" and a mouse cursor. The main menu consists of several options: "Editor Name" (with a shaded box), "PLANNING ENTITIES", "TASK-LEVEL ACTIONS", "INPUT DATA", "Data Types", "Structured Data", and "Methods". At the bottom, there are three checkboxes: "Invoke Editor", "Save and Exit", and "Fast Shut Down". The text "Last Edited:" is visible at the very bottom.

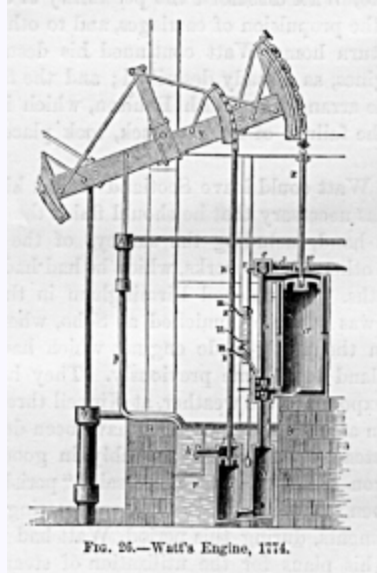
## Total Protege Registrations

Through 10/13/04



# From Cottage Industry to the Industrial Age:

*New Infrastructure for Ontology Authoring  
and Dissemination*



Mark A. Musen  
Stanford University  
*Musen@Stanford.EDU*

# Major technologies have radically changed our culture

- Agriculture
- The printing press
- The Industrial Revolution
- The World Wide Web

# Major technologies have radically changed our culture

- Agriculture
- The printing press
- The Industrial Revolution
- The World Wide Web
- Computer-based representation of and access to knowledge?



*Die sancti patris d. peritima*

**D**omine  
mei in  
corde tuo  
arguas  
me in  
seculum  
et in  
seculum  
et in  
seculum

Domine  
mei in  
corde tuo  
arguas  
me in  
seculum  
et in  
seculum  
et in  
seculum

et digne mei domine quoniam  
indignus sum digne mei domine  
quoniam indignus sum digne  
domine mea. Et digne  
mea digne est male sed tu do  
mine usque. Domine  
domine et tempus animam meam  
salvare me fac propter multas  
iniquitates meas. Amen.

Domine  
mei in  
corde tuo  
arguas  
me in  
seculum  
et in  
seculum  
et in  
seculum





# The locus of knowledge publication determines knowledge “ownership”

- When textual information could be reproduced only by hand, knowledge effectively was owned by institutions such as the Church
- When textual information could be printed, knowledge was owned by those with printing presses and a means of distribution
- When textual information could be posted to the Web, knowledge began to become democratized

# Knowledge workers seem trapped in a pre-industrial age

- Most ontologies are of relatively small scale
- Most ontologies are built and refined by small groups working arduously in isolation
- Success rests heavily on the particular talents of individual artisans, rather than on standard operating procedures
- There are few technologies on the horizon to make this process “faster, better, cheaper”

# A Portion of the OBO Library

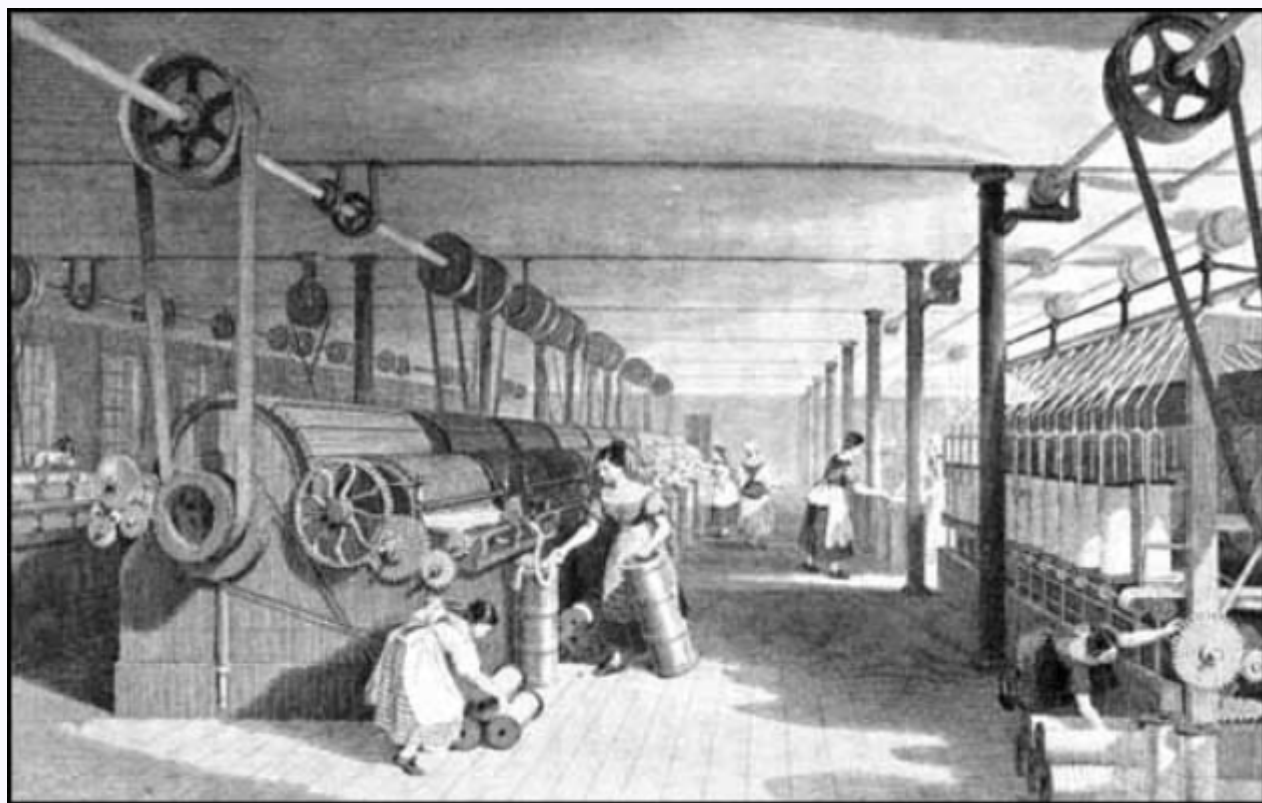
Domain	Prefix	Ontology	Defs file
Arabidopsis gross anatomy	TAIR	arabidopsis anatomy.ontology	arabidopsis anatomy.definitions
Arabidopsis development	TAIR	arabidopsis development.ontology	arabidopsis development.definitions
Cell type	CL	cell.obo	included in cell.obo
Cereal plant gross anatomy	GRO	anatomy gr ont	anatomy gr def
Cereal plant development	GRO	temporal gr ont	temporal gr def
Cereal plant trait ontology	TO	trait ontology	trait definitions
Chemical entities of biological interest	CHEBI	ontology.obo	included in ontology.obo
Protein covalent bond	CV	[none]	[none]
Protein-protein Interaction	MI	psi-mi.dag	psi-mi.def
Maize gross anatomy	ZEA	Zea mays anatomy ontology.txt	Zea mays anatomy ontology definitions.txt
Dictyostelium anatomy	DDANAT	anatomy.ontology	anatomy.definitions
Drosophila gross anatomy	FBbt	fly anatomy.ontology	fly anatomy.definitions
Habronattus courtship		protege source	included in protege source
Loggerhead nesting		protege source	included in protege source
Human anatomy and development	EV	ontologies	[none]
Microarray experimental conditions		MGEDOntology.daml	included in MGEDOntology.daml
Physical-chemical methods and properties	FIX	fix.ontology	[none]
Fungal gross anatomy	FAO	fungai anatomy.ontology	fungai anatomy.definitions
Molecular function	GO	gene_ontology.obo	included in gene_ontology.obo
Biological process	GO	gene_ontology.obo	included in gene_ontology.obo
Cellular component	GO	gene_ontology.obo	included in gene_ontology.obo





# Throughout this cottage industry

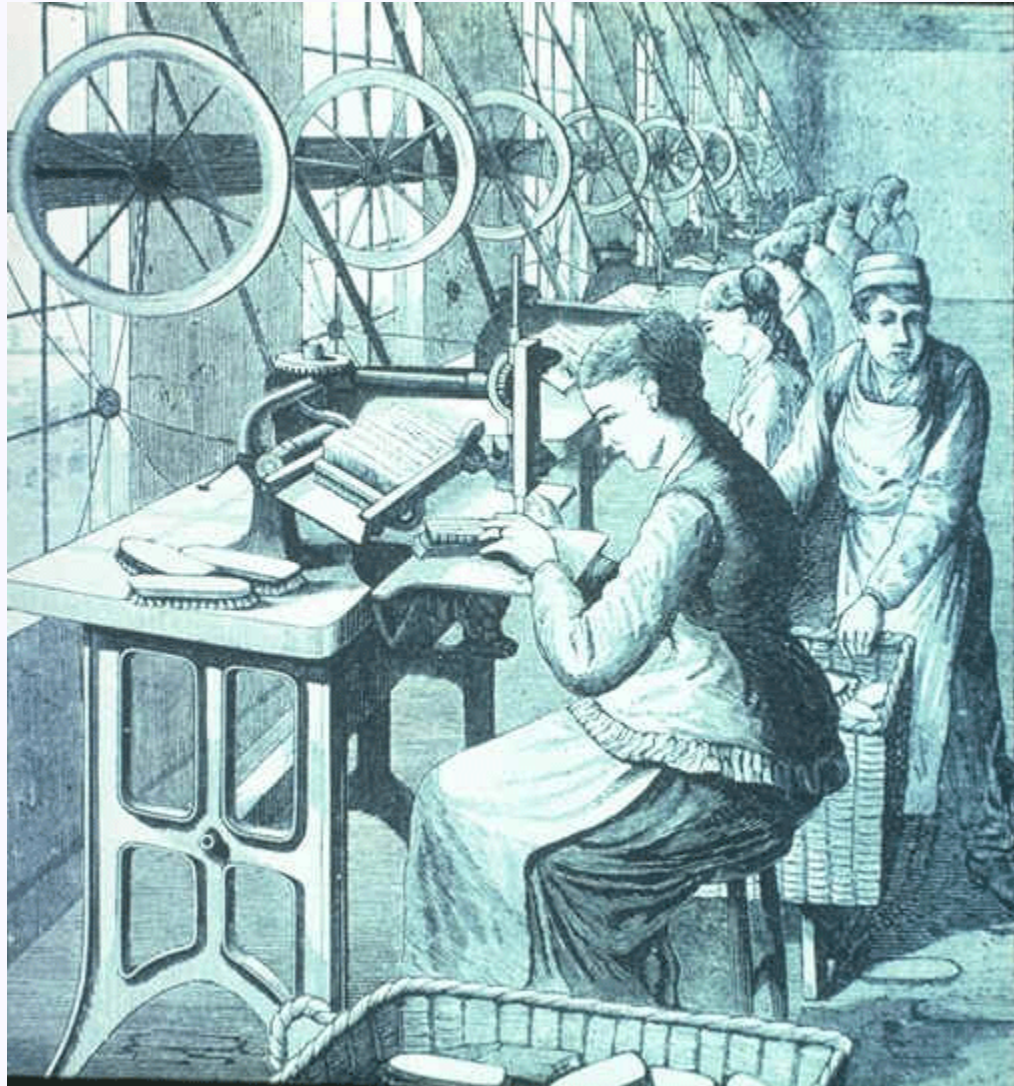
- Lots of ontology development, principally by content experts with little training in conceptual modeling
- Use of development tools and ontology-definition languages that may be
  - Extremely limited in their expressiveness
  - Useless for detecting potential errors and guiding correction
  - Nonadherent to recognized standards
  - Proprietary and expensive



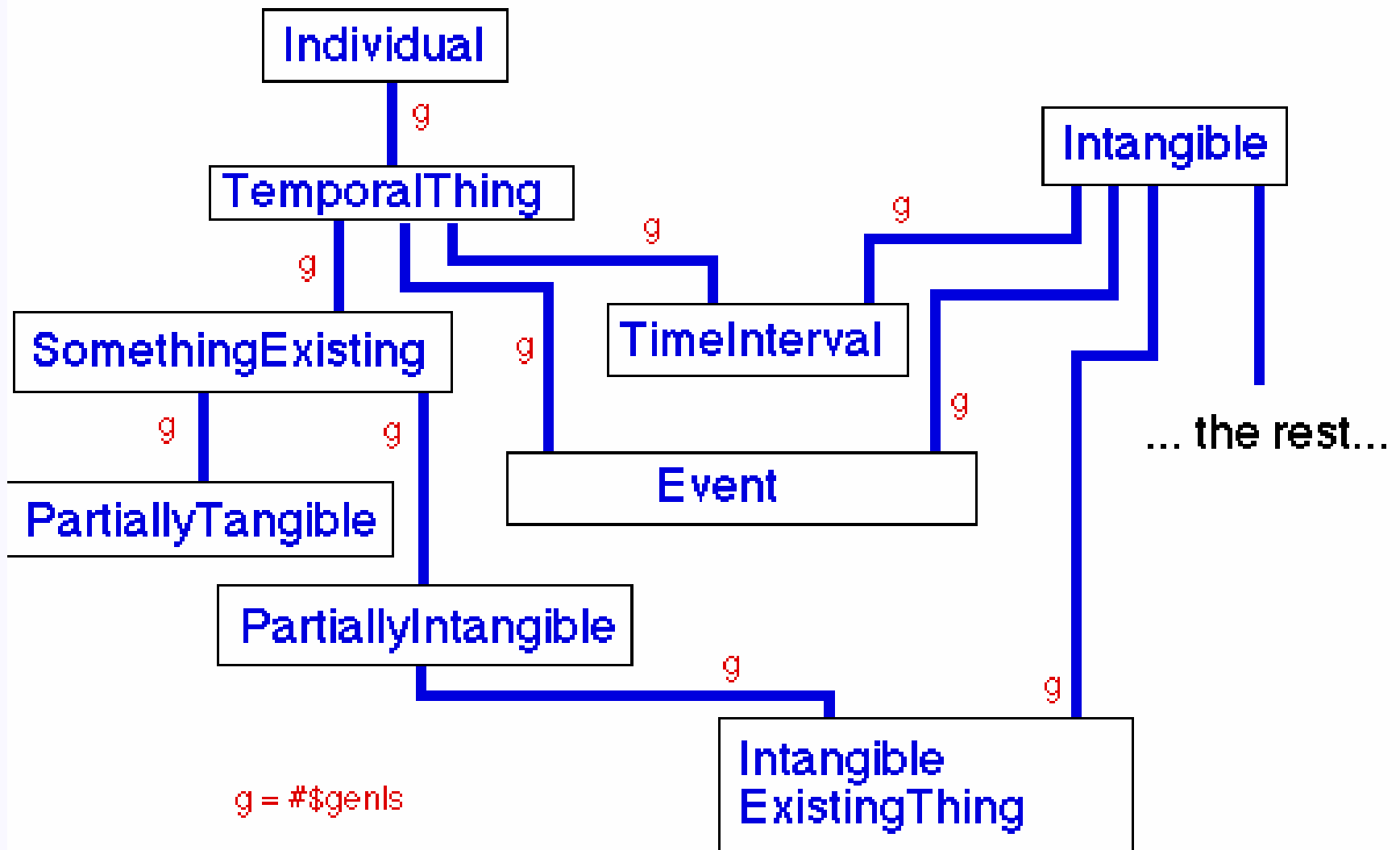
# Our community needs

- Technologies
  - To help build and extend ontologies
  - To locate ontologies and to relate them to one another
  - To visualize relationships and to aid understanding
  - To facilitate evaluation and annotation of ontologies
- Processes
  - To aid in ontology management and evolution
  - To enable end users to incorporate ontologies in their professional activities





Some people think that we are  
already there ...



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# Ontologies need to support multiple end-user goals

- Summarization and annotation of data
- Integration of data from multiple sources
- Support for natural-language processing
- Mediation among different software components
- Formal specification of professional knowledge

# The paradox of ontology development

- Ontologies became popularized in domains such as biomedicine in part because tools such as DAG-Edit made development extremely manageable
- Developers of editing tools and languages have rushed to make their approaches accommodate more expressivity and to offer more power—and to comply with industry standards
- The result is the “Microsoft Word” problem

# The NCI Thesaurus in OWL

Thesaurus Protégé 3.0 beta (file:\C:\projects\owl\Thesaurus.pprj, OWL Files)

File Edit Project OWL Code Window Help

owl:Thing

- Abnormal\_Cell\_Kind
- Anatomy\_Kind
- Biological\_Process\_Kind
- Chemicals\_and\_Drugs\_Kind
- Chemotherapy\_Regimen\_Kind
- Clinical\_or\_Research\_Activity\_Kind
- Diagnostic\_and\_Prognostic\_Factors\_Kind
- Drug\_Mechanism\_of\_Action\_Kind
- Drug\_Physiologic\_Effect\_Kind
- EO\_Anatomy\_Kind
- EO\_Findings\_and\_Disorders\_Kind
  - Experimental\_Organism\_Diagnoses
    - Experimental\_Allergic\_Encephalomyelitis
  - Mouse\_Pathologic\_Diagnoses
    - Mouse\_Cancer-Related\_Conditions
      - Benign\_Plasma\_Cell\_Proliferations\_of
        - Hyperplasia\_of\_the\_Mouse\_Intestinal
        - Hyperplasia\_of\_the\_Mouse\_Pulmonar
        - Melanocytic\_Proliferative\_Disorders\_c
      - Mouse\_Noncancerous\_Conditions
        - Benign\_Conditions\_of\_the\_Mouse
        - Congestion\_of\_the\_Mouse\_In

CLASS EDITOR

For Class: Benign\_Conditions\_of\_the\_Mouse\_Intestinal\_Tract (instance of owl:Class)

Name SameAs DifferentFrom

Benign\_Conditions\_of\_the\_Mouse\_Intestinal\_Tract

rdfs:comment

Annotations

Property	Value	Lang
D code	C22102	
D DesignNote	Autonomous new grov...	
D Display_Name	Benign Conditions of th...	
D FULL_SYN	<term-name>Benign Co...	
D FULL_SYN	<term-name>Benign Co...	
D hasType	primitive	
D Preferred_Name	Benign Conditions of th...	

Properties and Restrictions

- ☐ rEO\_Disease\_Has\_Associated\_EO\_Anatomy (someValuesFrom Gastrointestinal\_Tract\_MMHCC, someValuesFrom
  - ☐ Gastrointestinal\_Tract\_MMHCC
  - ☐ Digestive\_System\_MMHCC [from Mouse\_Digestive\_System\_Disorder]
- ☐ rEO\_Disease\_Has\_Associated\_Cell\_Type
- ☐ rEO\_Disease\_Has\_Property\_or\_Attribute
- ☐ rEO\_Disease\_Maps\_to\_Human\_Disease

Superclasses

- Mouse\_Noncancerous\_Conditions
- Mouse\_Digestive\_System\_Disorder

Disjoints

Logic View Properties View

# We need steam engines for ontology development

- DAGs are too simple for developers to define specific concepts in machine-processable terms
- OWL is much too complex for most developers to use correctly
- There are no *scalable* tools that address the early, conceptual modeling stage
- How can we maximize expressivity while helping developers to manage complexity?

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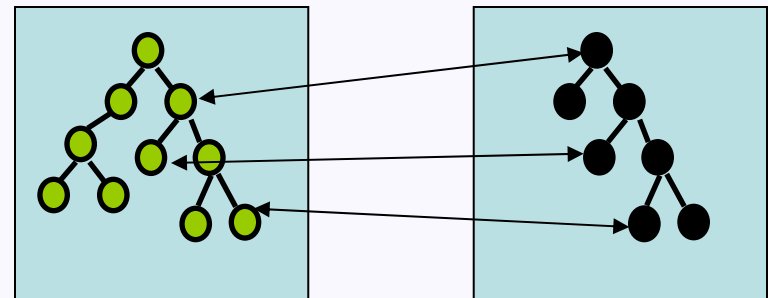


# We need to relate ontologies to one another

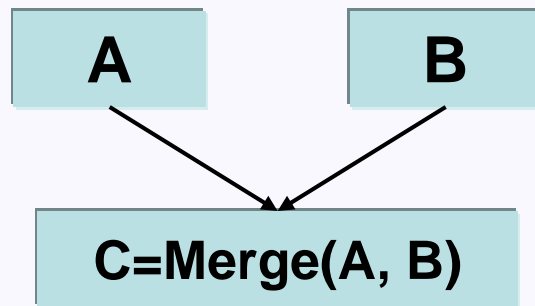
- We keep reinventing the wheel  
(e.g., how many different anatomy ontologies do we need?)
- We don't even know what's out there!
- We need to be able to make comparisons between ontologies automatically
- We need to keep track of ontology history and to compare versions

# We need to compute both similarities and differences

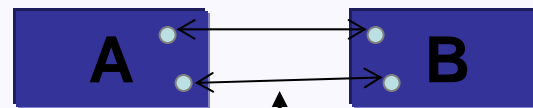
- Similarities
  - Merging ontologies
  - Mapping ontologies
- Differences
  - Versioning



# Different tasks lead to different tools

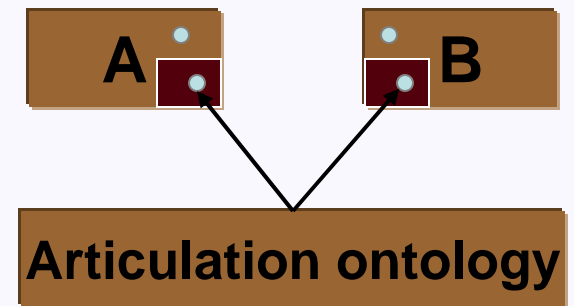


iPROMPT, Chimaera



Map(A, B)

Anchor-PROMPT, GLUE  
FCA-Merge



ONION

# Industrialization requires

- Common platforms for locating, comparing, and integrating ontologies
- Environments for ontology engineering that are as comprehensive and robust as our environments for software engineering
- Technologies that can work with ontologies distributed anywhere in cyberspace

# Ontology development is already a global activity!

egypt\_crop\_pests4 Protégé 3.0 beta (file:\C:\projects\owl\egypt\_crop\_pests4.pprj, OWL Files)

File Edit Project OWL Code Window Help

owl:Thing owl:Thing

أجزاء النبات

أنواع التربة

الآفات المحصولية

الطيور

حشائش

حشرة

الرخويات

حشرات آكلة الجذور

حشرات آكلة السوق

حشرات آكلة للأوراق

حشرات العفص

حشرات ناقية الخشب

حشرات ضارة بالبذور

حشرات ماصة

حشرات متلفة للثمار

حشرات مخربة للأزهار

عناكب

قوارض

مرصية

نيماتودا

المبيدات الزراعية

المحاصيل

محاصيل الفمكة

CLASS EDITOR

For Class: (instance of owl:Class) الآفات\_المحصولية

Name SameAs DifferentFrom

الآفات\_المحصولية

rdfs:comment

يقصد بها الحشرات الاقتصادية والعناكب والأمراض النباتية) الفطرية والبكتيرية والفيروسية) والحشائش والنيماتودا والقوارض والطيور والرخويات الضارة بالزراعة.

Annotations

Property	Value	Lang
rdfs:comment	والرخويات الضارة بالزراعة...	

Asserted Inferred

Asserted Conditions

NECESSARY & SUFFICIENT

NECESSARY

owl:Thing	E
الآفات_المحصولية	E
String# الاسم	E
String# الاسم العلمي	E
String# الأهمية الاقتصادية	E
String# الظروف الملائمة لانتشار الإصابة	E
النباتات_المعرضة_للمحاصيل	E
String# طرق الوقاية والمكافحة	E
مناطق_الآفة_المناطق_الزراعية	E
نوع_الآفة = 1	E

Properties

أسباب_الإصابة	(single String)
أعراض_الإصابة	(single String)
الأجزاء_المعرضة_للإصابة	(multiple String)
الاسم	(single String)
الاسم_العلمي	(single String)
الأهمية_الاقتصادية	(single String)
الظروف_الملائمة_لانتشار_الإصابة	(single String)

Disjoints

Logic View Properties View

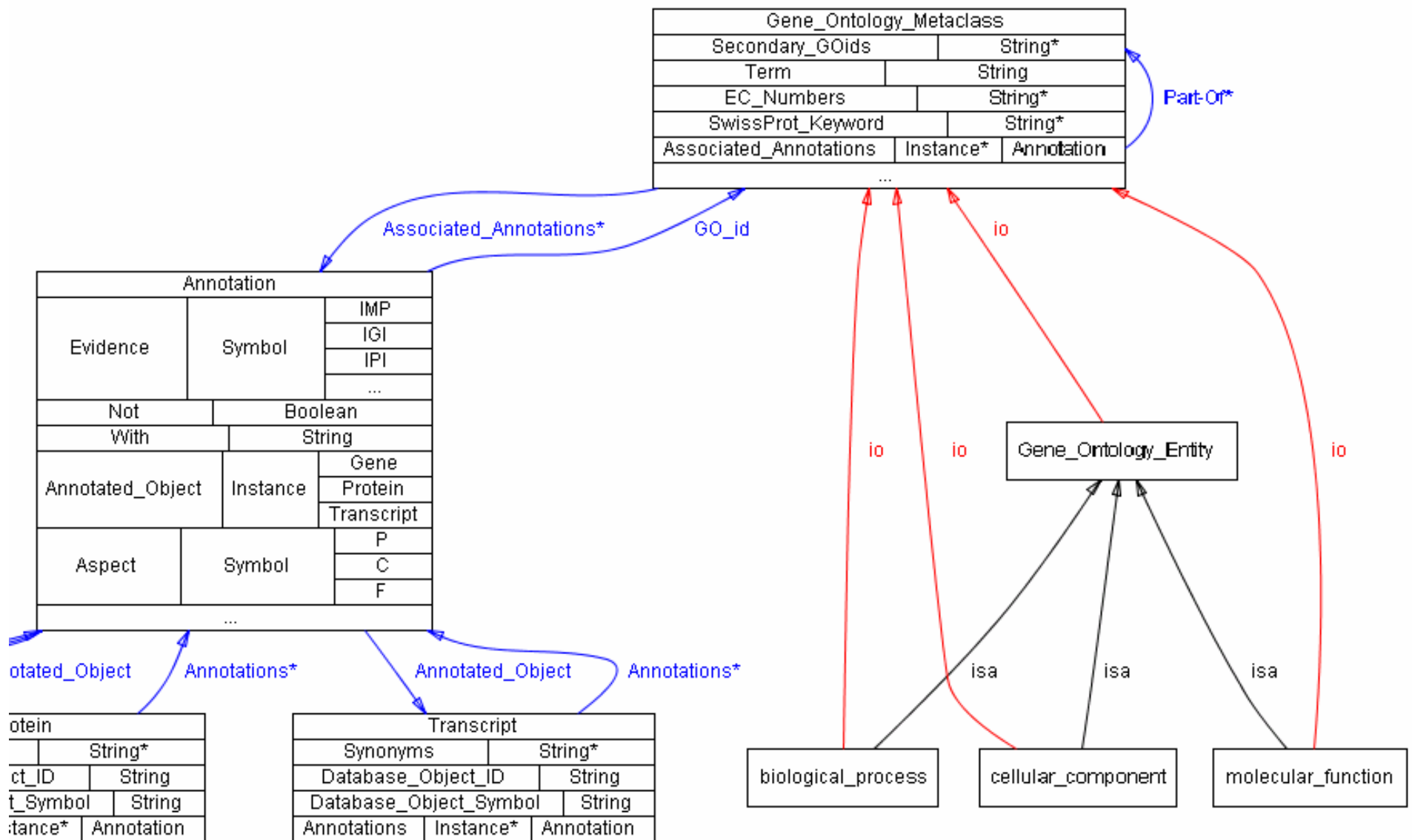
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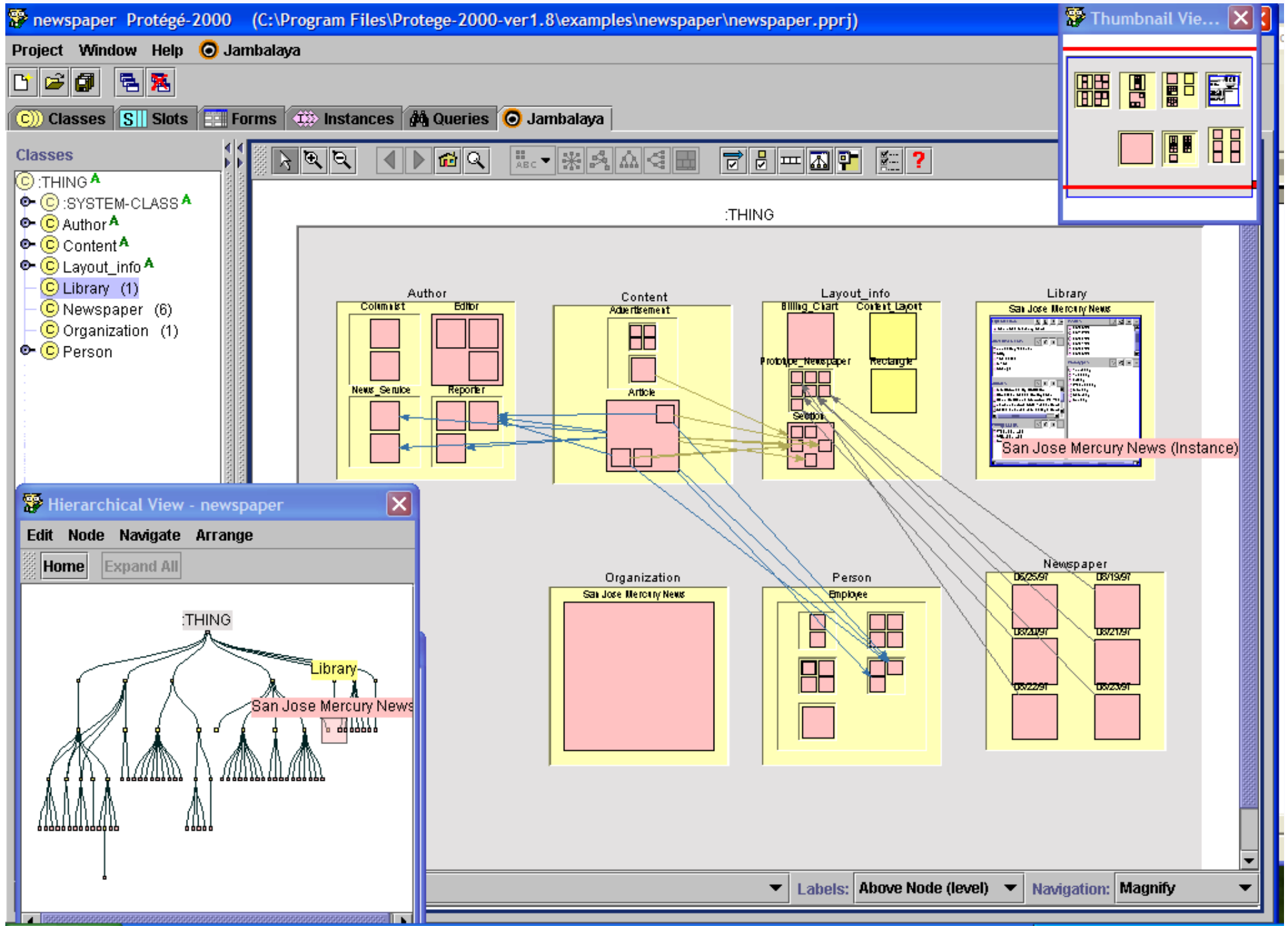
# Ontology engineering requires management of complexity

- How can we keep track of hundreds, or even thousands, of relationships?
- How can we understand the implications of changes to a large ontology?
- How can we know where ontologies are underspecified? And where they are over constrained?

# AT&T's GraphViz system







# It's a bad sign that there are so many alternatives

- How do we know which visualization system is the “right” one for our situation?
- Why is there no visualization system that is uniformly loved and appreciated?
- Why can't we apply the same energy to the problem of ontology visualization that we apply to that of visualizing huge data sets?

# Our community needs

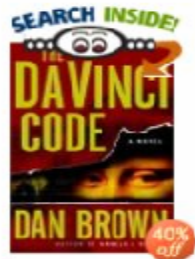
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# Ontologies are not like journal articles

- It is difficult to judge methodological soundness simply by inspection
- We may wish to use an ontology even though some portions
  - Are not well designed
  - Make distinctions that are different from those that we might want

# Ontologies are not like journal articles II

- The utility of ontologies
  - Depends on the task
  - May be highly subjective
- The expertise and biases of reviewers may vary widely with respect to different portions of an ontology
- Users should want the opinions of more than 2–3 hand-selected reviewers
- Peer review needs to scale to the entire user community

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teamed with amazon.com**Shop  
now**Join [Amazon Prime](#) and ship Two-Day for free and Overnight for \$3.99.**The Da Vinci Code**by [Dan Brown](#) "Robert Langdon awoke slowly..." ([more](#))[Search inside this book](#)[See 1 customer image](#)[Share your own customer  
images](#)**List Price:** \$24.95**Price:** **\$14.97** & Eligible for **FREE Super Saver Shipping** on orders over \$25. [See details](#)**You Save:** \$9.98 (40%)**Availability:** Usually ships within 24 hours from Amazon.com**Want it delivered Monday, February 28?** Order it in the next 20 hours and 14 minutes, and choose **One-Day Shipping** at checkout. [See details](#)[417 used & new](#) from \$6.95**Edition:** Hardcover★★★★★ **Unbelievable Book**, February 16, 2005Reviewer: [Mohamed Abdulmalik](#) (Kingdom of Bahrain) - [See all my reviews](#)

REAL NAME

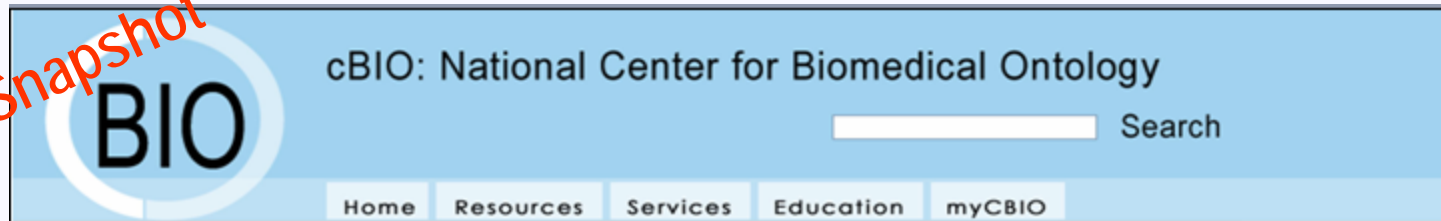
There is no question that everybody should read this book. It is very entertaining and full of very peculiar facts (assuming that they are true). The writer skilfully turns religious history (highly sensitive and mostly boring subject to read) into a page turning thriller. I highly recommend it.

I have a general advise though, make sure that you read it on a weekend, as you will not be able to put it down. I read it on a business trip with near disastrous consequences.

Was this review helpful to you? ☒ yes ☐ no ([Report this](#))★★★★★ **Don't Take It as Gospel**, November 9, 2003Reviewer: [Leslie Strang Akers](#) (Riverside, CA) - [See all my reviews](#)

In the beginning I was intrigued by the premise set down in THE DA VINCI CODE, but my initial interest turned first to annoyance and then by the time I got to the info on Disney was laughing so hard at the absurdity of the whole novel. First of all, this is a work of fiction, so let's deal with that part. Far from being the taut, fast-paced thriller that the potenti reader is lead to believe it is, TDVC is turgid, jerky, and filled with clichés. The characters are characterless and stupid, merely cardboard for the author to push around like pawn a chessboard. Langford, a Harvard professor, can't distinguish between backwards English and a Semitic language. Sophie, a French police cryptologist, doesn't have the brains to figure out that an armor truck from a Swiss bank might be lo-jacked. These are only two of the many idiotic things the main characters aren't intelligent enough to figure out. The characters ponder clues ad nauseum, which turns a 300-page book into 454 pages. I don't know if the author is writing down to his audience, or if he really thinks that gifted people are idiot savants. Whatever it is, it's exasperating.

Solution Snapshot



## The MGED Ontology

by [EMBL](#) "The primary purpose of the MGED Ontology is to provide standard" ([more](#))

**MGED**



Search inside  
this Ontology

List Price: \$0

Price: \$0 & Eligible for **FREE Access**

You Save: \$0

Availability: Usually available 24/7 on cBIO.org

Edition: Pragmatic

2 of 3 people found the following review helpful:

★★★★★ **A Great resource**, Aug 11, 2004

Reviewer: [Catherine](#) Ball (Stanford, CA USA) - [See all my reviews](#)

TOP 500 REVIEWER REAL NAME

MGED Ontology aims to facilitate the sharing of microarray data generated by functional genomics and proteomics experiments....

Was this review helpful to you? ☐ yes ☐ no ([Report this](#))

1 of 1 people found the following review helpful:

★★★★★ **Needs considerable improvement**, November 9, 2003

Reviewer: [Barry](#) Smith (Buffalo, NY) - [See all my reviews](#)

MGED ontology is indeed an essential part of any solution to the problems of Microarray analysis – but only if it is understood in the right sort of way. Ontological engineering, should in every case go hand in hand with a sound ontological theory....

# In an “open” rating system:

- Anyone can annotate an ontology to say anything that one would like
- Users can “rate the raters” to express preferences for those reviewers whom they trust
- A “web of trust” may allow users to create transitive trust relationships to filter unwanted reviews

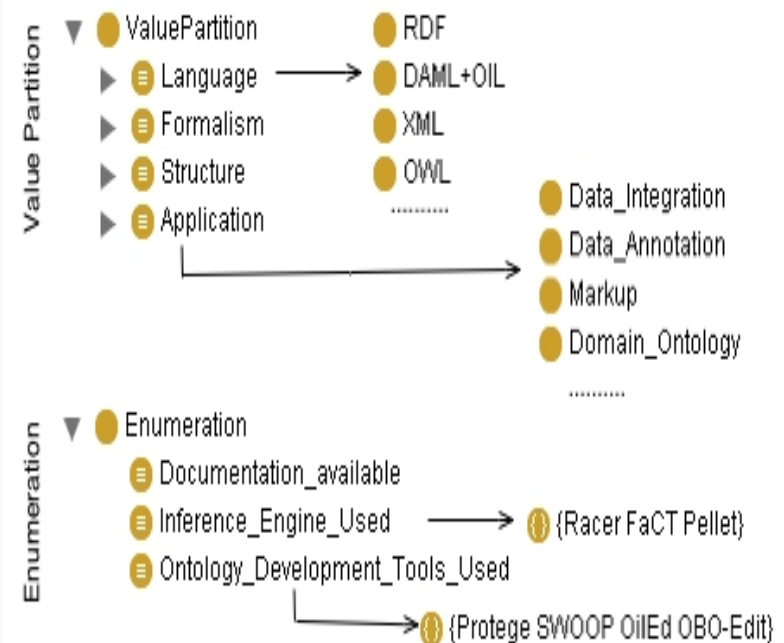


# Qualitative Review Criteria

- What is the level of user support?
- What documentation is available?
- What is the granularity of the ontology content in specific areas?
- How well does the ontology cover a particular domain?
- In what applications has the ontology been used successfully? Where has it failed?

# Ontologies need standard meta-data

- For provenance information
- For indexing
- For alignment with other ontologies
- For peer review



Search for Ontologies

Navigate Knowledge Zone

Browse Ontologies

Survey

Knowledge Zone Search & Browse interface.

Please fill this survey:

- To improve Knowledge Zone
- To improve the representation of trust in Knowledge Zone
- To help gather data for a new extended topic specific modeling of trust in open rating systems

The screenshot shows a web browser window titled "Knowledge Zone - One Stop Shop for Ontologies - Mozilla Firefox". The address bar shows the URL "http://smi-protege.stanford.edu:8080/knowledgeZone/survey.html". The page header includes the Knowledge Zone logo and navigation links: "PROTEGE HOME | SEARCH & BROWSE | SUBMIT ONTOLOGY | STATISTICS | FAQ & NEWS".

The main content area is titled "survey" and contains several sections:

- Related to Knowledge Zone**
  - Question: "If you were to create an annotation of your ontology, which additional metadata, not covered by Knowledge Zone, would you ask for?"
  - Question: "Are there any other topics you would be able to comment on besides the ones given in Knowledge Zone?"
- Related to Trust**
  - Question: "If you were to give a definition of trust, what would it be?"
  - Question: "Would you describe yourself as" (with a dropdown menu)
  - Question: "Do you think you would be more likely to trust the statement of a person you know than somebody else?" (with a dropdown menu)
  - Question: "Would you be more likely to rely on the judgment of a renowned expert in a certain area of expertise or would you rather believe a contrary statement from a person you know and trust?" (with a dropdown menu)
  - Question: "If a lot of people believe a person was an expert in a certain domain and trust his views, are you also likely to trust him?" (with a dropdown menu)
- Related To Open Rating Systems**
  - Text: "Open rating systems are platforms where people write reviews about objects (e.g. books, movies, ontologies) and every user can comment on these reviews. This way these systems try to find the best reviews by using feedback from the entire user community. Examples would be amazon.com or epinions.com."
  - Text: "Would you agree on the following statements regarding trust in open rating systems?"
  - Question: "Trust in open rating systems corresponds to the feeling that the information delivered by a certain reviewer will be correct and useful." (with a dropdown menu)
  - Question: "If somebody has delivered a good review in the past, he is likely to write a good review in the future." (with a dropdown menu)
  - Question: "If I do not like one review by a certain reviewer, I would want to block all of his reviews, regardless of the fact that some might be useful to me." (with a dropdown menu)

At the bottom of the survey form is a button labeled "submit your responses".

The footer of the page includes the navigation links again, the copyright notice "Copyright © 2005 Stanford Medical Informatics", and logos for "W3C XHTML 1.0" and "W3C CSS".

Knowledge Zone Survey Page.

Metadata gathered

Knowledge Zone - One Stop Shop for Ontologies - Mozilla Firefox

http://www.protege.stanford.edu/ontology/knowledgezone/submit.html

knowledge zone one stop shop for ontologies

PROTEGE HOME | SEARCH & BROWSE | SUBMIT ONTOLOGY | STATISTICS | FAQ & NEWS

submit your ontology

METADATA  
CORE  
ADDITIONAL

Welcome kaustubh. If you're not kaustubh, [click here](#)

**Core Ontology Metadata**

Name of your Ontology

URI of your Ontology

Domain Covered By the Content of your Ontology

Intended Application(s) For your Ontology

Keywords (Used to Index Ontology)

The Way your Ontology is Structured

Language Used to Represent your Ontology

The Way your Ontology is Represented Conceptually

OWL DL

Topic Maps

URL To the Homepage of your Ontology

Description About your Ontology

**Additional Ontology Metadata**

**Author Information**

Name

**Version Information**

Current Version Number

**Author Information**

Name

Organization the Author is Affiliated With

Date your Ontology Was Created

Contact Information

Date your Ontology Was Last Modified

**Quantitative Information**

Number of Concepts

Number of Relations

Number of Instances

Number of Dependencies

**Qualitative Information**

Development State of Ontology

Does the Reasoner Infer that your Ontology is Consistent

Ontology Contains No Syntax Errors

How Well is the Domain Covered by your Ontology

**Maintenance Information**

Licensing Costs

Available Under the Following License(s)

OpenLDAP License

OpenSSL License

Public Domain

Ways To Access your Ontology

Web Resource

References/Provenance

**Usage Information**

Documentation Available

Methodology & Methods Used To Develop your Ontology

Tools Used To Develop your Ontology

Example Use / Existing Applications of your Ontology

submit your ontology

PROTEGE HOME | SEARCH & BROWSE | SUBMIT ONTOLOGY | STATISTICS | FAQ & NEWS

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W3C XHTML W3C CSS

Topic Maps are an ISO standard for the representation and interchange of knowledge, with an emphasis on the findability of information. The standard is formally known as ISO/IEC 13290:2003. A topic map can represent information using topics (representing any concept, from people, countries, and organizations to software modules, individual files, and events), associations (which represent the relationships between them), and occurrences (which represent relationships between topics and information resources relevant to them). For more information click the info button.

Info-Button provides context-sensitive help

Knowledge Zone Submit Interface.

Knowledge Zone - One Stop Shop for Ontologies - Mozilla Firefox

http://www.protege.stanford.edu/8000/KnowledgeZone/OntologyMetadata/ontologyid=1

knowledge zone one stop shop for ontologies

PROTEGE HOME | SEARCH & BROWSE | SUBMIT ONTOLOGY | STATISTICS | FAQ & NEWS

EXPLORE THE ONTOLOGY  
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### MGED Ontology

Information Provided by the Author

Core Ontology Metadata

<b>Name of Ontology</b> MGED Ontology	<b>URI of Ontology</b> <a href="http://cvs.sourceforge.net/viewcvs.py/*checkout*/mged/www/ontologies/MGEDOntology.daml">http://cvs.sourceforge.net/viewcvs.py/*checkout*/mged/www/ontologies/MGEDOntology.daml</a>
<b>Domain Covered By the Content of Ontology</b> Science	<b>Intended Application(s) For Ontology</b> Annotation
<b>Keywords (Used to Index Ontology)</b> Gene Expression, Experiment, BioAssay, Array	<b>The Way Ontology is Structured</b> Ontology
<b>Language Used to Represent Ontology</b> OWL DL	<b>The Way Ontology is Represented Conceptually</b> Description Logic
<b>URL To the Homepage of Ontology</b> <a href="http://mged.sourceforge.net/ontologies/index.php">http://mged.sourceforge.net/ontologies/index.php</a>	

**Description of Ontology**

The primary purpose of the MGED Ontology is to provide standard terms for the annotation of microarray experiments. These terms will enable structure queryview of elements of the experiments. Furthermore, the terms will also enable unambiguous descriptions of how the experiment was performed. The terms will be provided in the form of an ontology which means that the terms will be organised into classes with properties and will be defined. A standard ontology format will be used. For descriptions of biological material (biomaterial) and certain treatments used in the experiment, terms may come from external resources that are specified in the Ontology. Software programs utilizing the Ontology are expected to generate forms for annotation, populate databases directly, or generate files in the established MAGB-ML format. Thus, the Ontology will be used directly by investigators annotating their microarray experiments as well as by software and database developers and therefore will be developed with these very practical applications in mind.

Additional Ontology Metadata

<b>Author Information</b>	<b>Version Information</b>
<b>Name</b> Chris Stoeckert	<b>Current Version Number</b> 1.12
<b>Organization the Author is Affiliated With</b> MGED Ontology Working Group	<b>Date Ontology Was Created</b> 11/4/2002
<b>Contact Information</b> <a href="mailto:mged-ontologies@list.sourceforge.net">mged-ontologies@list.sourceforge.net</a>	<b>Date Ontology Was Last Modified</b> 9/6/2004
<b>Quantitative Information</b>	<b>Qualitative Information</b>
<b>Number of Concepts</b> 271	<b>Development State of Ontology</b> Gold / release (final version)
<b>Number of Relations</b> 45	<b>Does the Reasoner Infer that Ontology is Consistent</b> Yes
<b>Number of Instances</b> 108	<b>Ontology Contains No Syntax Errors</b> Yes
<b>Number of Dependencies</b>	<b>How Well it to the Domain Covered by Ontology</b> Very Good
<b>Maintenance Information</b>	<b>Usage Information</b>
<b>Licensing/Costs</b>	<b>Documentation Available</b>
<b>Available Under the Following License(s)</b> Mozilla	<b>Methodology Used To Develop Ontology</b> other
<b>Ways To Access Ontology</b> Web Resource	<b>Tools Used To Develop Ontology</b> Protégé
<b>References/Provenance</b>	<b>Example Use / Existing Applications of Ontology</b>
<b>User Reviews</b>	
27 of 49 people found the following review helpful:	
★★★★★ Excelente, 1 Jul 2005 14:21:38 GMT Reviewer: kautubh See all my reviews Microarray.....See Details	
Was this review helpful to you? <input type="radio"/> yes <input type="radio"/> no	

Metadata  
associated with  
the Ontology

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User Ratings of  
Reviews

Knowledge Zone Presentation of Selected Ontology With Reviews.

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SHOPPING ONTOLOGIES

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SURVEY

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MGED Ontology added by kaustubh

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TAMBIS added by kaustubh

2 TAMBIS aims to aid researchers in biological science by providing a single access point for biological information sources round the world. The access point will be a single interface (via the World Wide Web) which acts as a single information source. It will find appropriate sources of information for user queries and phrase the user questions for each source, returning the results in a consistent manner which will include details of the inform.....

GandrKB added by Holger Lewen

3 An ontology and knowledge base describing gene functions enabling biologists to annotate (multiple) genes on Affymetrix Microarrays per simple drag and drop. Annotation-concepts and genes can be linked for fast and intuitive context-exploration and extensive querying. Generated gene annotations can be interactively explored as semantic networks with advanced visualisation tools.

Ontology for Geographic Information - Metadata ( ISO 19115:2003 ) added by Holger Lewen

4 Ontology for ISO 19115. Vocabulary terms are declared using OWL language to support RDF applications.

Foundational Model of Anatomy added by Daniel Rubin

5 The Foundational Model of Anatomy(FMA) is an evolving computer-based knowledge source for bioinformatics; it is concerned with the representation of classes and relationships necessary for the symbolic modeling of the structure of the human body in a form that is understandable to humans and is also navigable by machine-based systems. Specifically, the FMA is a domain ontology that represents a coherent body of explicit declarative knowledge abo.....

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Knowledge Zone Search & Browse interface.

# Bringing ontologies to the industrial age will require:

- Environments that support community-based peer review
- Standard meta-data for storing reviews and annotations
- Environments for both ontology engineering and ontology access that can take advantage of these meta-data



# Our community needs

- Technologies
  - To help build and extend ontologies
  - To locate ontologies and to relate them to one another
  - To visualize relationships and to aid understanding
  - To facilitate evaluation and annotation of ontologies
- Processes
  - To aid in ontology management and evolution
  - To enable end users to incorporate ontologies in their professional activities

We have growing experience with large-scale ontology engineering

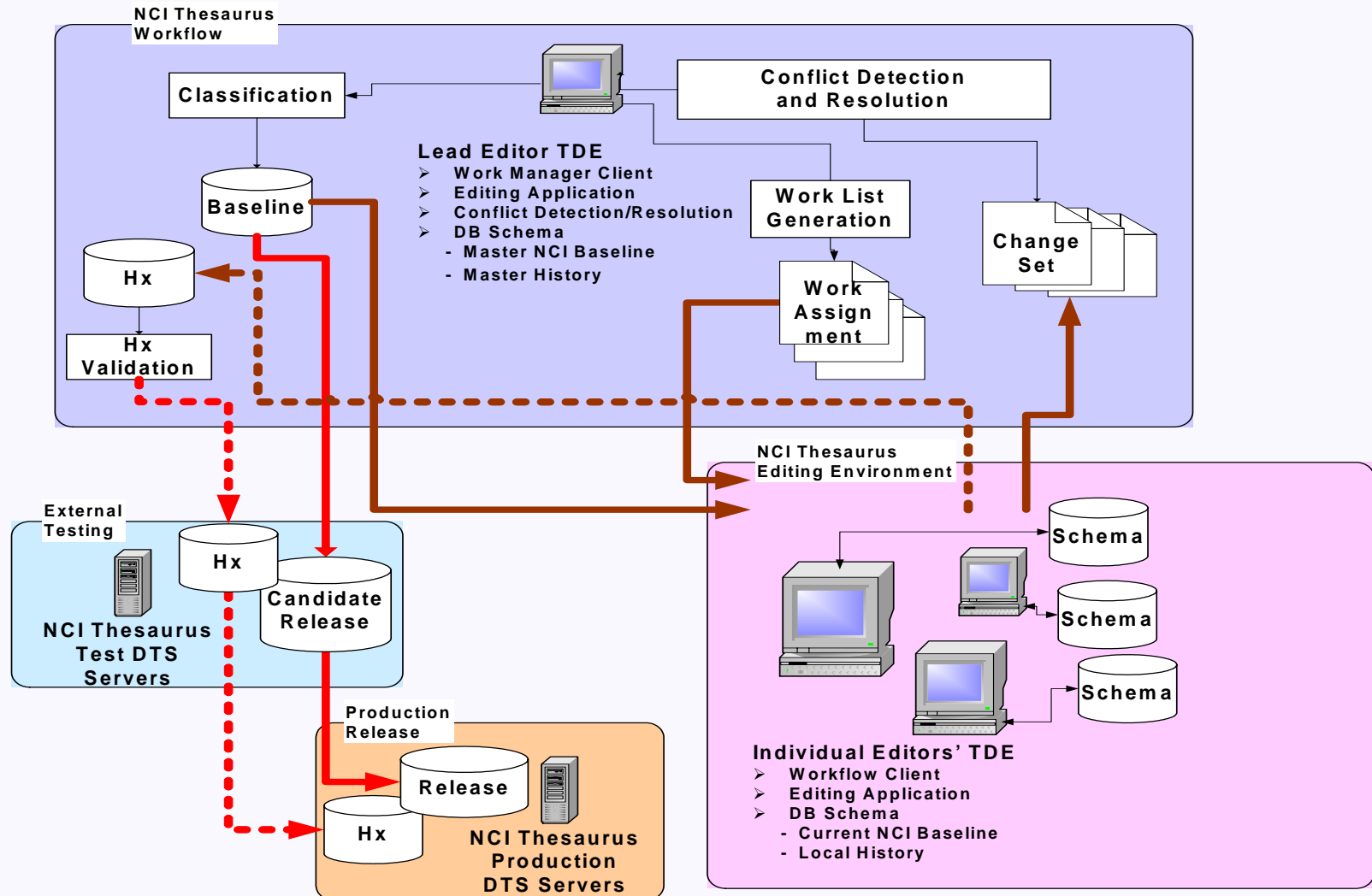
- CYC
- Open Directory Project
- Gene Ontology Consortium
- NCI Thesaurus

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The web organized by topic into categories.

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# Evaluation of development processes remains a problem

- What are appropriate outcome metrics for judging success?
- How do we distinguish the contribution of the *process* from that of particular tools?
- How do we distinguish the contribution of the *process* from that of individual participants?

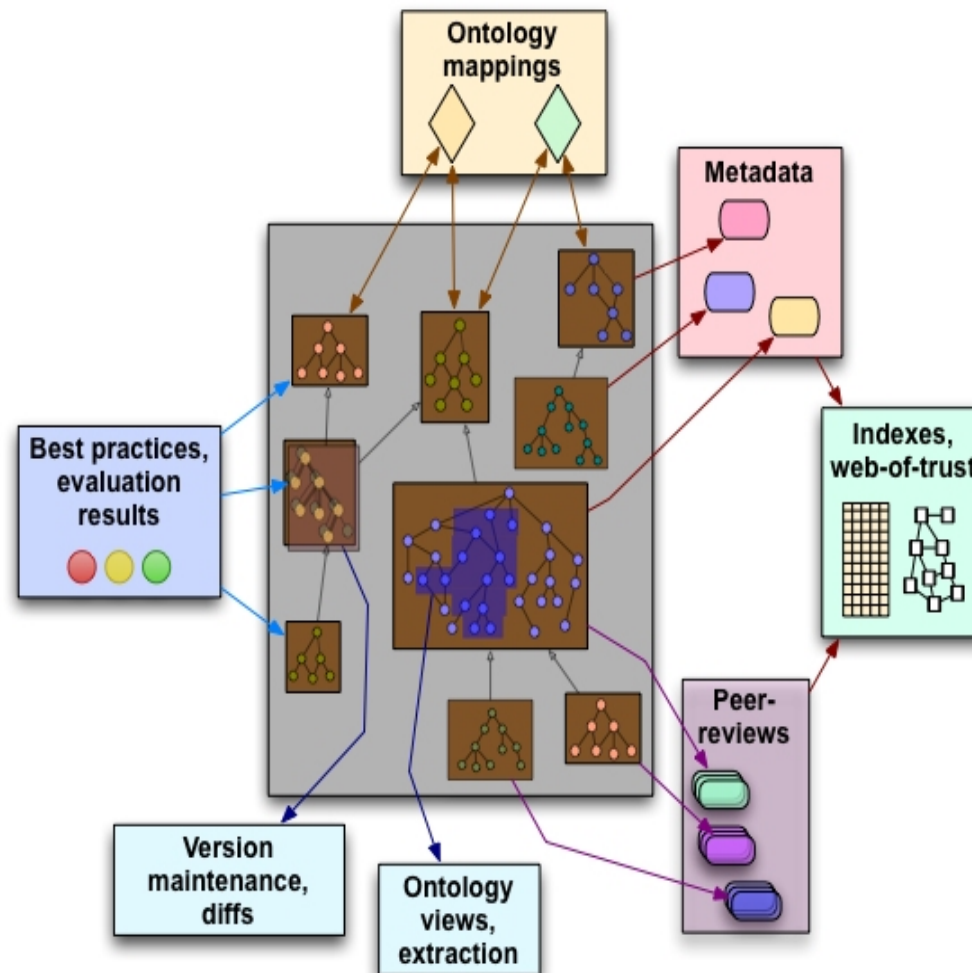
# Our community needs

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# A Portion of the OBO Library

Domain	Prefix	Ontology	Defs file
Arabidopsis gross anatomy	TAIR	arabidopsis anatomy.ontology	arabidopsis anatomy.definitions
Arabidopsis development	TAIR	arabidopsis development.ontology	arabidopsis development.definitions
Cell type	CL	cell.obo	included in cell.obo
Cereal plant gross anatomy	GRO	anatomy gr ont	anatomy gr def
Cereal plant development	GRO	temporal gr ont	temporal gr def
Cereal plant trait ontology	TO	trait ontology	trait definitions
Chemical entities of biological interest	CHEBI	ontology.obo	included in ontology.obo
Protein covalent bond	CV	[none]	[none]
Protein-protein Interaction	MI	psi-mi.dag	psi-mi.def
Maize gross anatomy	ZEA	Zea mays anatomy ontology.txt	Zea mays anatomy ontology definitions.txt
Dictyostelium anatomy	DDANAT	anatomy.ontology	anatomy.definitions
Drosophila gross anatomy	FBbt	fly anatomy.ontology	fly anatomy.definitions
Habronattus courtship		protege source	included in protege source
Loggerhead nesting		protege source	included in protege source
Human anatomy and development	EV	ontologies	[none]
Microarray experimental conditions		MGEDOntology.daml	included in MGEDOntology.daml
Physical-chemical methods and properties	FIX	fix.ontology	[none]
Fungal gross anatomy	FAO	fungai anatomy.ontology	fungai anatomy.definitions
Molecular function	GO	gene_ontology.obo	included in gene_ontology.obo
Biological process	GO	gene_ontology.obo	included in gene_ontology.obo
Cellular component	GO	gene_ontology.obo	included in gene_ontology.obo

# Toward industrial-strength ontology repositories



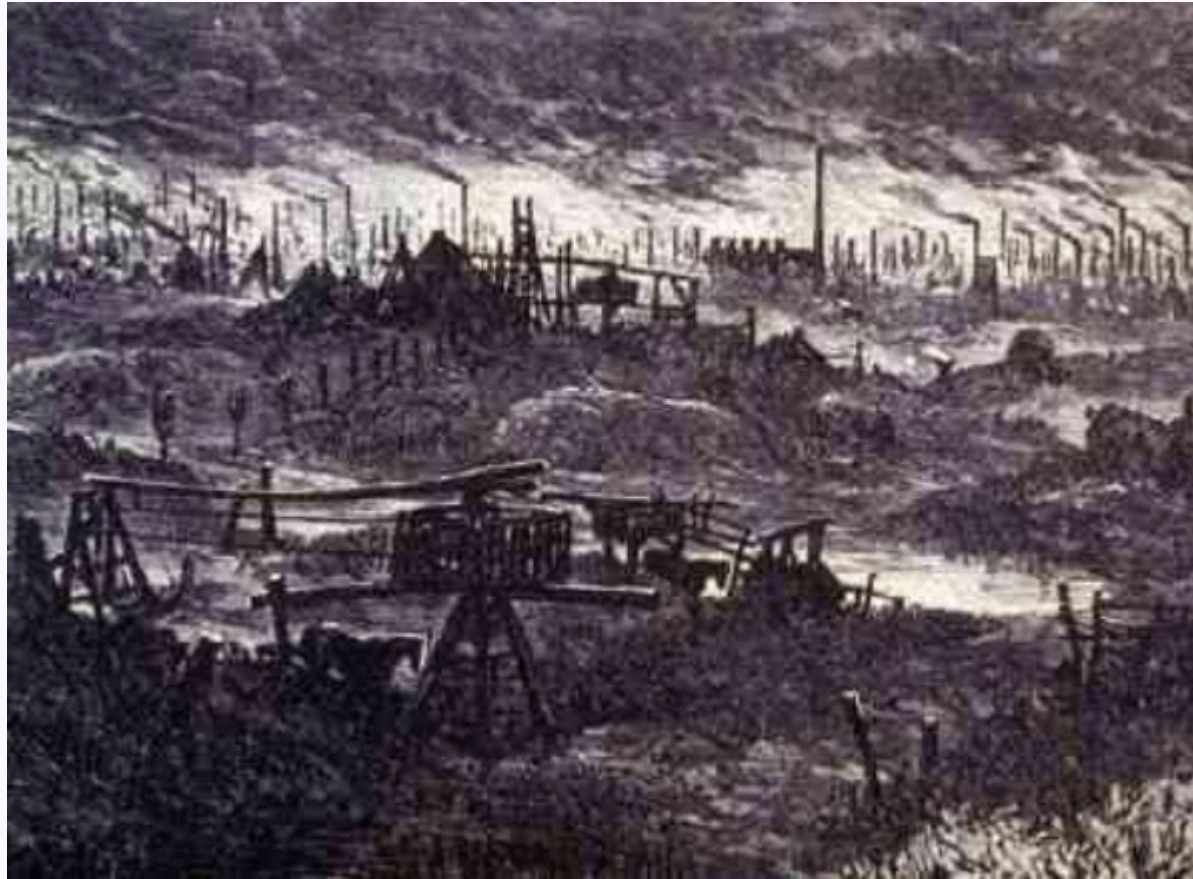


# The Industrial Revolution: The Good News

- Standardized, interchangeable parts
- Technologies for creating new technologies
- Tremendous increase in output
- Unparalleled incentives for innovation

# The Industrial Revolution: The Bad News

- Decreased importance of skill and judgment of individual artisans
- Increased abilities of managers to define and control activities of laborers
- Loss of skills and judgment to deal with failures in processes that have been automated
- More mundane work



# Moving from cottage industry to the industrial age

- There must be widely available tools that are
  - open-source
  - easy to use
  - adhere to standards
- There must be a large community of workers who
  - use the tools
  - can provide feedback to one another and to the tool builders

# Moving from cottage industry to the industrial age II

- Government and professional societies must set expectations regarding the need for appropriate standards
- Government and professional societies must invest in educational programs targeted for
  - Ontology developers
  - Ontology consumers
- Demonstration projects must document the strengths and weaknesses of tools, processes, and languages

# A thousand flowers are blooming!

- Ontologies are being developed by interested groups from every sector of academia, industry, and government
- Many of these ontologies have been proven to be extraordinarily useful to wide communities
- We finally have tools and representation languages that can enable us to create durable and maintainable ontologies with rich semantic content

# The foundation is in place

- Scientific culture now recognizes the importance of ontologies
- We are beginning to articulate best practices for ontology construction
- We have a burgeoning cottage industry at work

We need to move beyond individual, one-off ontologies and one-off tools to:

- Integrated ontology libraries in cyberspace
- Meta-data standards for ontology annotation
- Comprehensive methods for ontology indexing and retrieval
- Easy-to-use portals for ontology access, annotation, and peer review
- End-user platforms for putting ontologies to use for
  - Data annotation
  - Decision support
  - Natural-language processing
  - Information retrieval
  - And applications that we have not yet thought of!



