Semantic Web T  LS

Presented at the
DARPA DAML PI Conference
By
BBN Technologies
www.bbn.com
16 October 2003

Top Level Agenda

- **Background**
  - Cola Atkinson
- **DAML → OWL Conversion**
  - Troy Self
- **Tools Inventory & Assessment**
  - Howard Bender
- **DAML Web Site → Direction**
  - Cola Atkinson
- **Discussion**
  - Feedback Solicited

BACKGROUND

DAML Program Goals

- **The goal of the DAML program is to create technologies that will enable software agents to dynamically identify and understand information sources, and to provide interoperability between agents in a semantic manner.**

1. Create an Agent Mark-Up Language (DAML) built upon XML that allows users to provide machine-readable semantic annotations for specific communities of interest.

2. Create tools that embed DAML markup on to web pages and other information sources in a manner that is transparent and beneficial to the users.

3. Use these tools to build up, instantiate, operate, and test sets of agent-based programs that markup and use DAML.

4. Measure, via empirical experimentation, the productivity improvements provided by these tools.

5. Apply these tools to third party agent development, military-specific problems, and support for the intelligence community so as to evolve DAML technologies towards large-scale use.

6. Transition DAML to the commercial and military markets via partnerships with industrial and defense-related (Command & Control (C2) and intelligence) organizations.

Relevant Events

- **DARPA DAML Objective 1 Achieved by the Community**
  - Create an Agent Mark-Up Language
  - DAML → DAML+OIL → OWL
- **W3C Candidate Recommendation**
  - Last Call for documents 31 March 2003
  - Candidate Recommendation 18 August 2003
- **OWL Conversion Directive from April 2003 PI Mtg**
  - Convert DARPA funded DAML products to OWL within 60 days
  - Includes data, ontologies, tools & other applications
- **Follow up message from DARPA PM 8/21/2003**
  - "At the October PI meeting I would like all active program software and ontologies to be fully OWL."
- **BBN's Recent Focus**
  - Continue Language, Rules and Services work
  - Owl Conversion for www.daml.org
  - Tools Inventory and Assessment
  - Support planning for the outyears

DAML → OWL
Conversion Effort
Lessons Learned

Presented by Troy Self
tself@bbn.com
16 October 2003

Objective

- **Comply with DARPA PMO requirement to convert all .daml files on www.daml.org to .owl files.**
  - Convert all BBN cognizant ontologies, instance data, tools & applications
  - Develop and post lessons learned for benefit of daml community
  - Provide conversion support as required to community

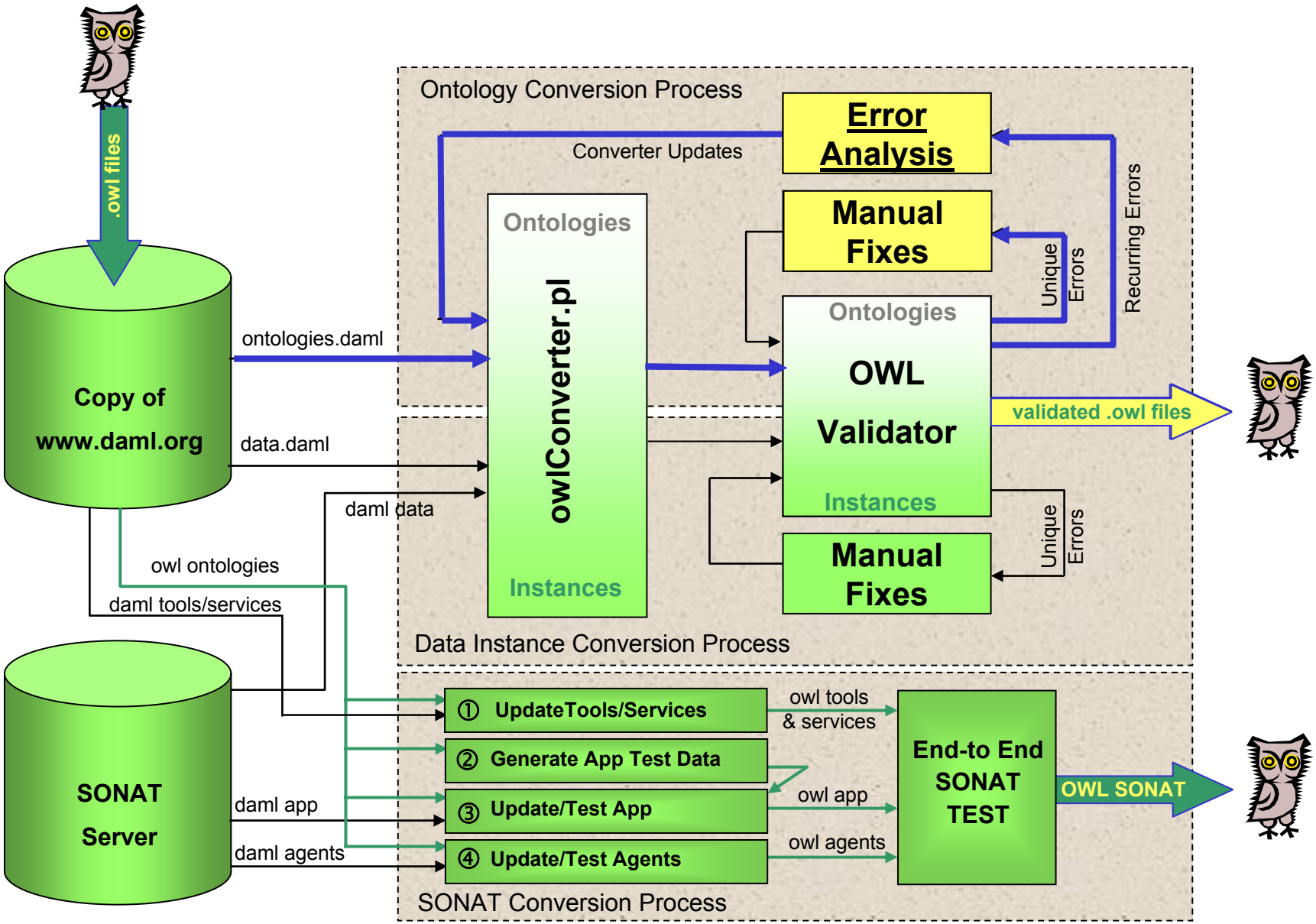
Issues

- **Lots of .daml**
  - 172 Ontologies
  - 1027 Instance files
  - 15 Tools
  - 12 Agents
  - SONAT demonstration
- **Conversion tools lag behind evolving OWL Working Drafts**
- **Limited tool support for rdf:datatype**
- **Getting Apache to favor .owl over .daml**

Approach

- Start with the .daml files on or referenced on www.daml.org
- Use MINDSWAP's owlConverter.pl to convert .daml files to .owl files
- Validate resulting files using the OWL Validator tool
- Identify recurring error types and modify converter to handle
- Iterate conversion process until only unique errors remain
- Manually fix unique errors and validate

.daml → .owl Conversion Process



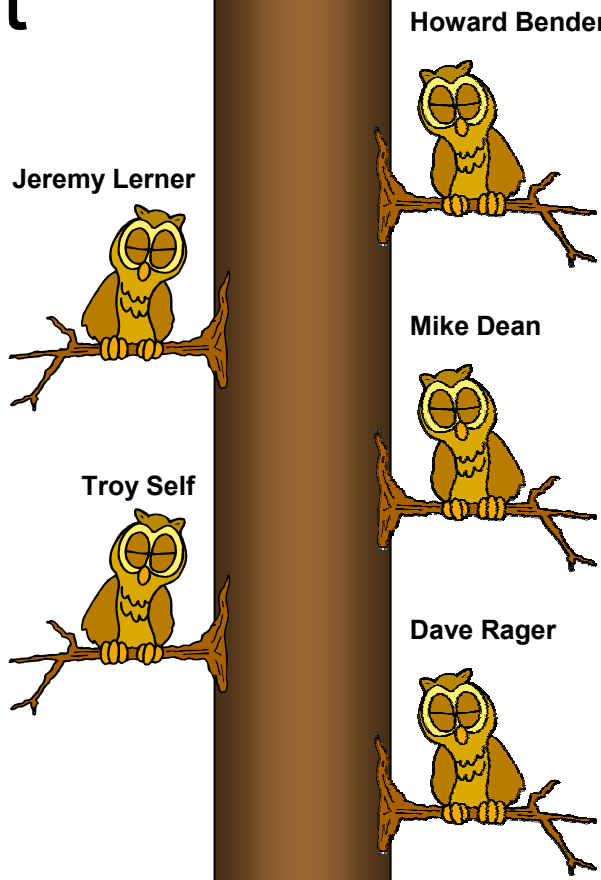
Outcomes

- All 1200 .daml files converted to .owl files
- Improved owlConversion tools
- All www.daml.org content is valid OWL
- Updated Apache's Content-Negotiation Module
- Lessons learned document on web site

Lessons Learned

- **Many errors in data files are due to errors in their respective ontologies.**
  - Validate/Fix ontologies first
- **The owlConverter cannot handle files with no line-breaks.**
  - Ensure line-breaks exist first
- **The addition of xml:base to RDF 2003 was very helpful**
  - Added to all converted OWL files
- **owl:imports wants an owl:Ontology**
  - Add the owl:Ontology definition to data files if necessary
- **Some errors are out of your control**
  - Manually validate the file or instruct the validator to ignore
- **Invalid DAML makes the process more difficult**
  - Ensure that the DAML content is valid before converting

OWL Tools
Inventory & Assessment



Presented by Howard Bender
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16 October 2003

OBJECTIVES

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- **Start process of defining & building a user friendly web-based development resource environment to promote education, use & transition of Semantic Web technologies**
  - Near-term goals:
    - Identify available OWL-compliant tools
    - Organize available tools into development process categories
    - Conduct initial gap assessment by category
    - Solicit additional input from the semantic web community
  - Long-term goals
    - Support DARPA in developing strategy to close the gaps
    - Implement CougaarForge-like developer resource environment

Conduct an inventory & initial assessment of tools available or referenced on www.daml.org

ISSUES

ISSUES

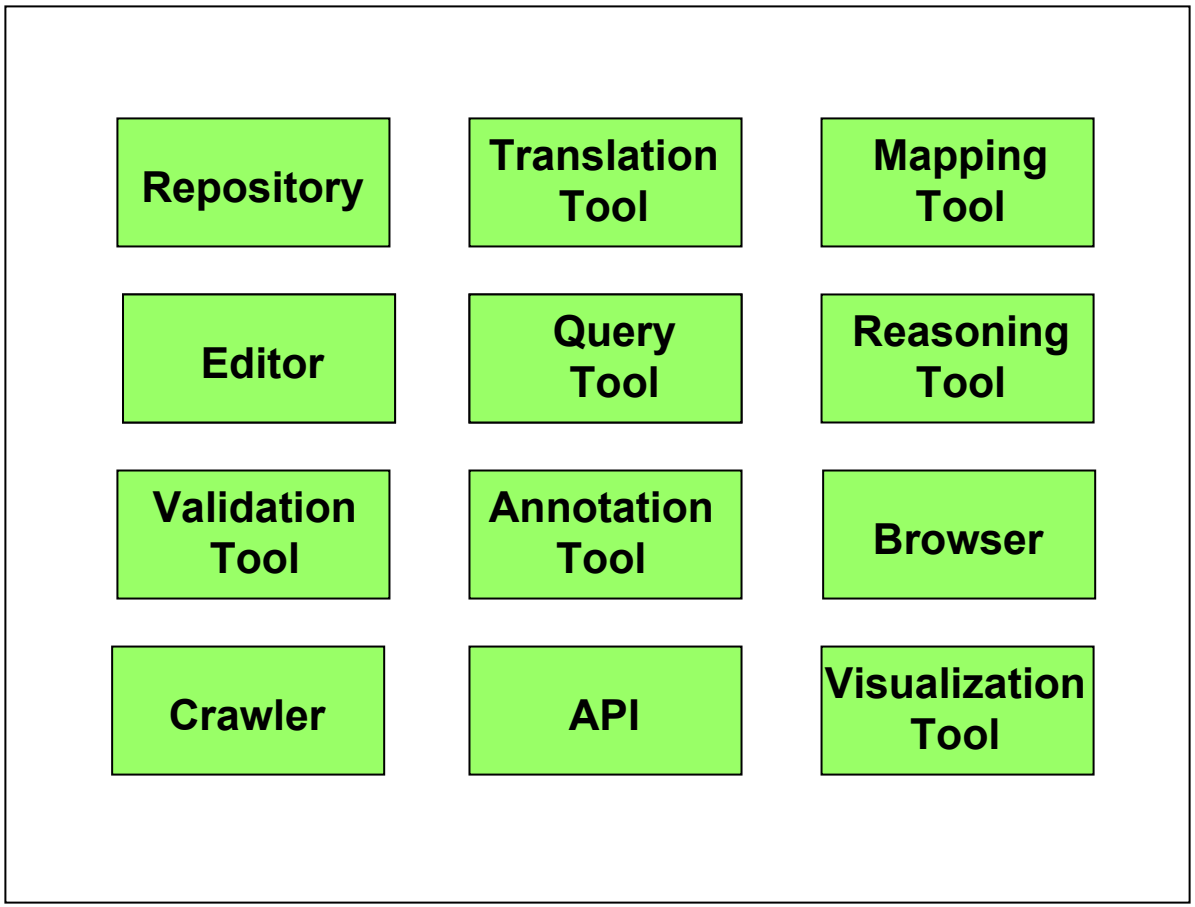
- **Lots of items on the Tools page**
- **Not all OWL compliant**
- **Organized into a large number of ad hoc categories**
- **Quality is highly variable**
  - Some tools are full products
  - Some tools are continuing research efforts
  - Some tools are one-time exercises or proofs-of-concept
- **Some useful tools are not listed**
- **There is an obvious lack of easy-to-use tool "sets" that work seamlessly together**

APPROACH

APPROACH

- **Define a manageable set of tool categories based on development process workflows**
- **Inventory collection of tools available or identified on www.daml.org**
- **Sort inventory list into tool/process categories**
- **Develop simple use cases for comparing tools**
- **Top level assessment of tools in each category**
  - OWL Compliant
  - Basic functionality
  - Usability
- **Conduct initial gap assessment**
- **Present results & solicit feedback**

Define Tool Categories



Inventory Tools on DAML Web Site

1 AeroDAML
2 Algae
3 Articulation Service
4 BrownSauce
5 Chimaera
6 ConsVISor
7 cwm
8 D2RMAP
9 DAML API
10 DAML Crawler
11 DAML DB
12 DAML dotnetAPI
13 DAML Emacs Mode
14 DAML Markup Tool
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16 DAML Sidebar
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85 Wilbur RDF Toolkit
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87 XML Schema to DAML Translator

Sort Available Tools into Categories

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58 OWLP
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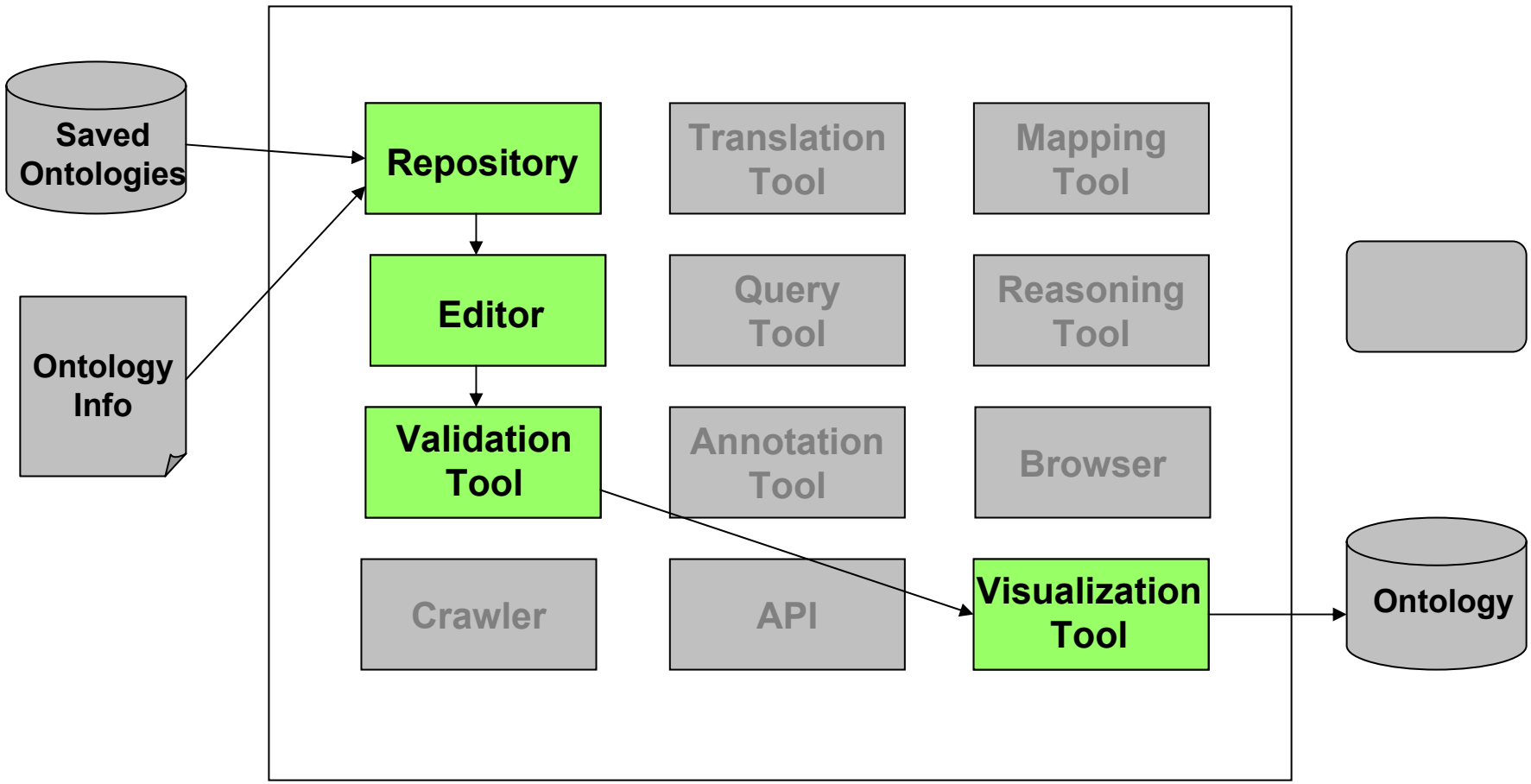
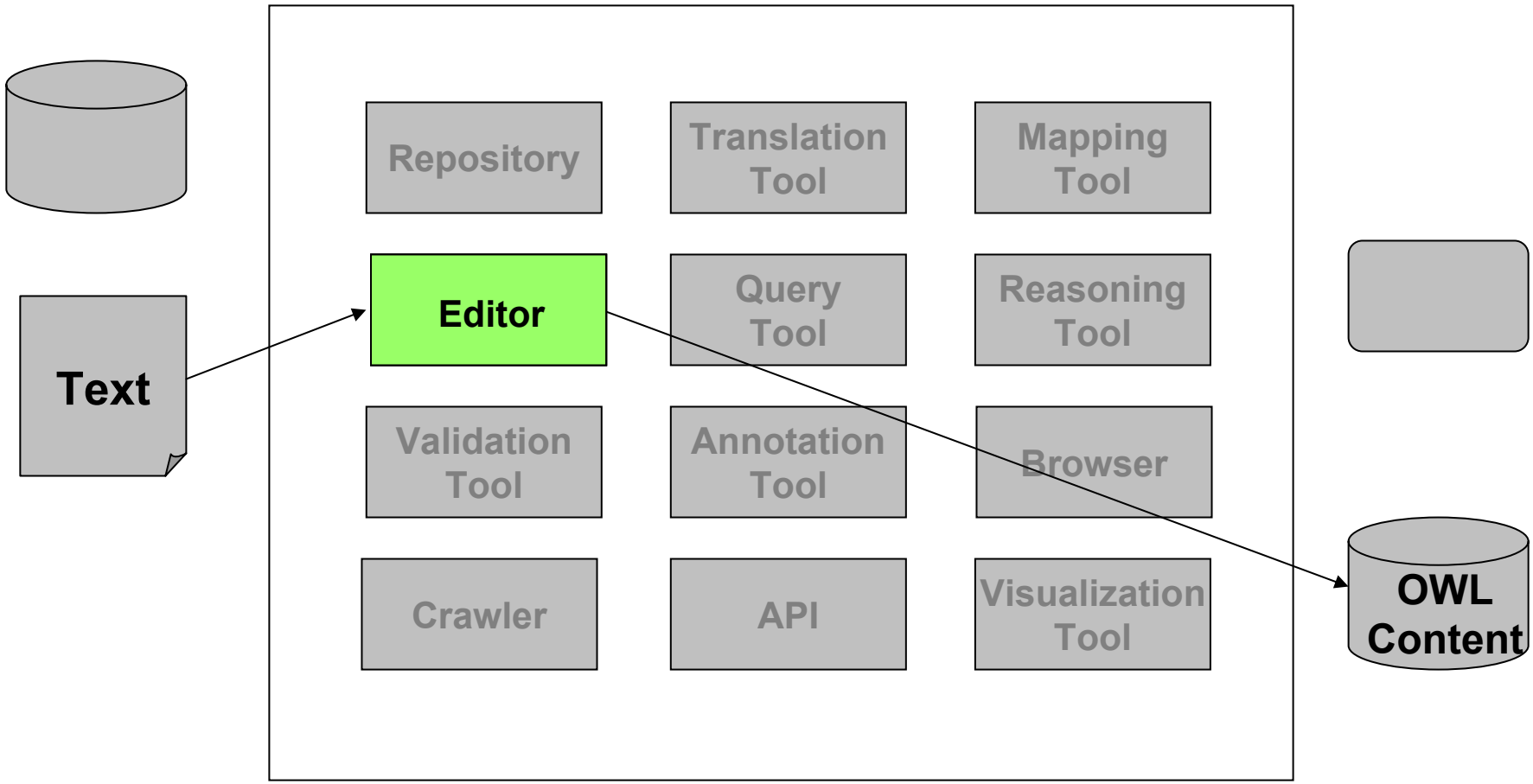
Develop Use Cases

- **Create an Ontology**
- **Create Instance Data**
  - Manually
  - Automatically (from a database)
  - From XML
  - Other
- **Query Over Distributed Data**
- **Create an Application that Employs Reasoning**

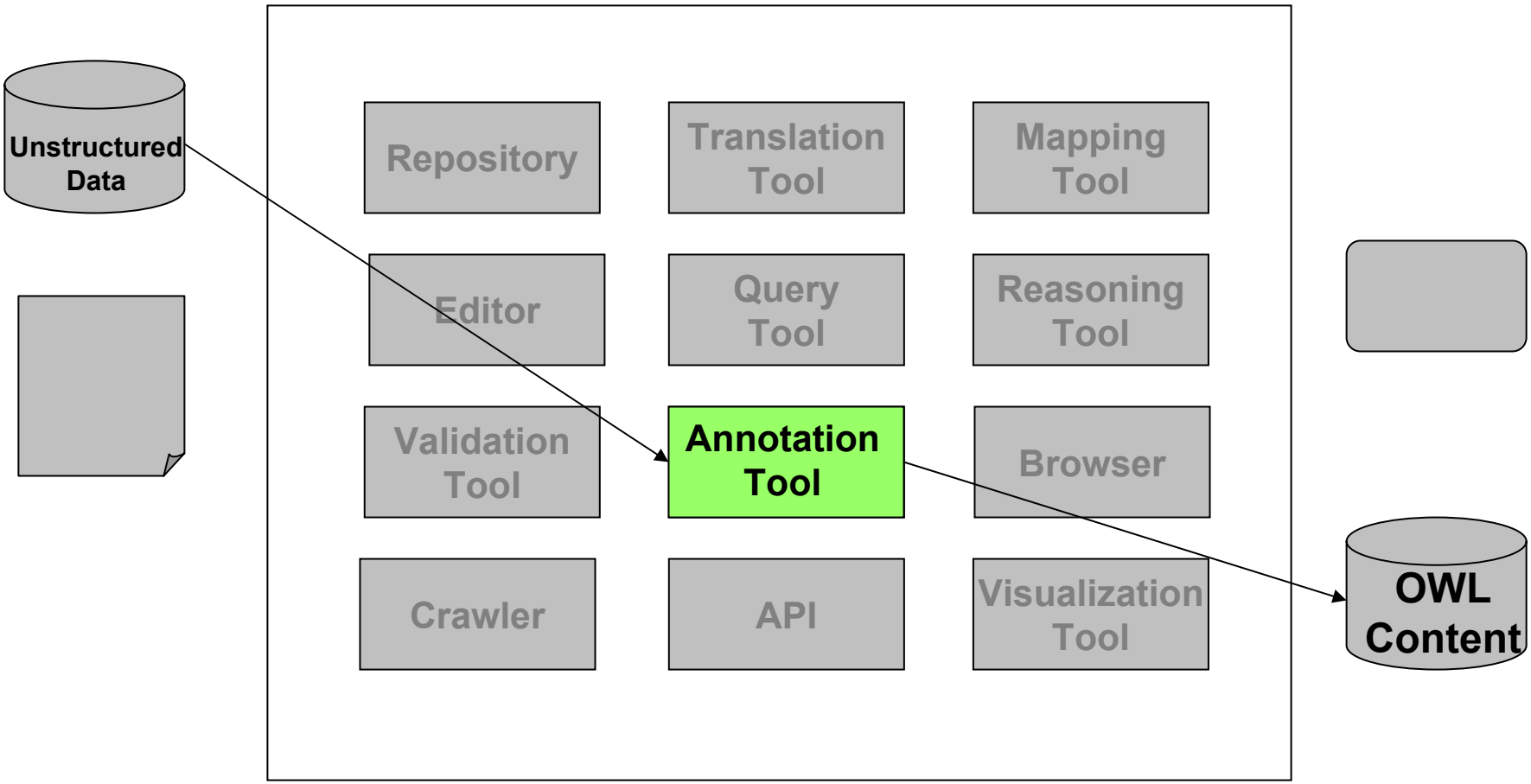
CREATE AN ONTOLOGY



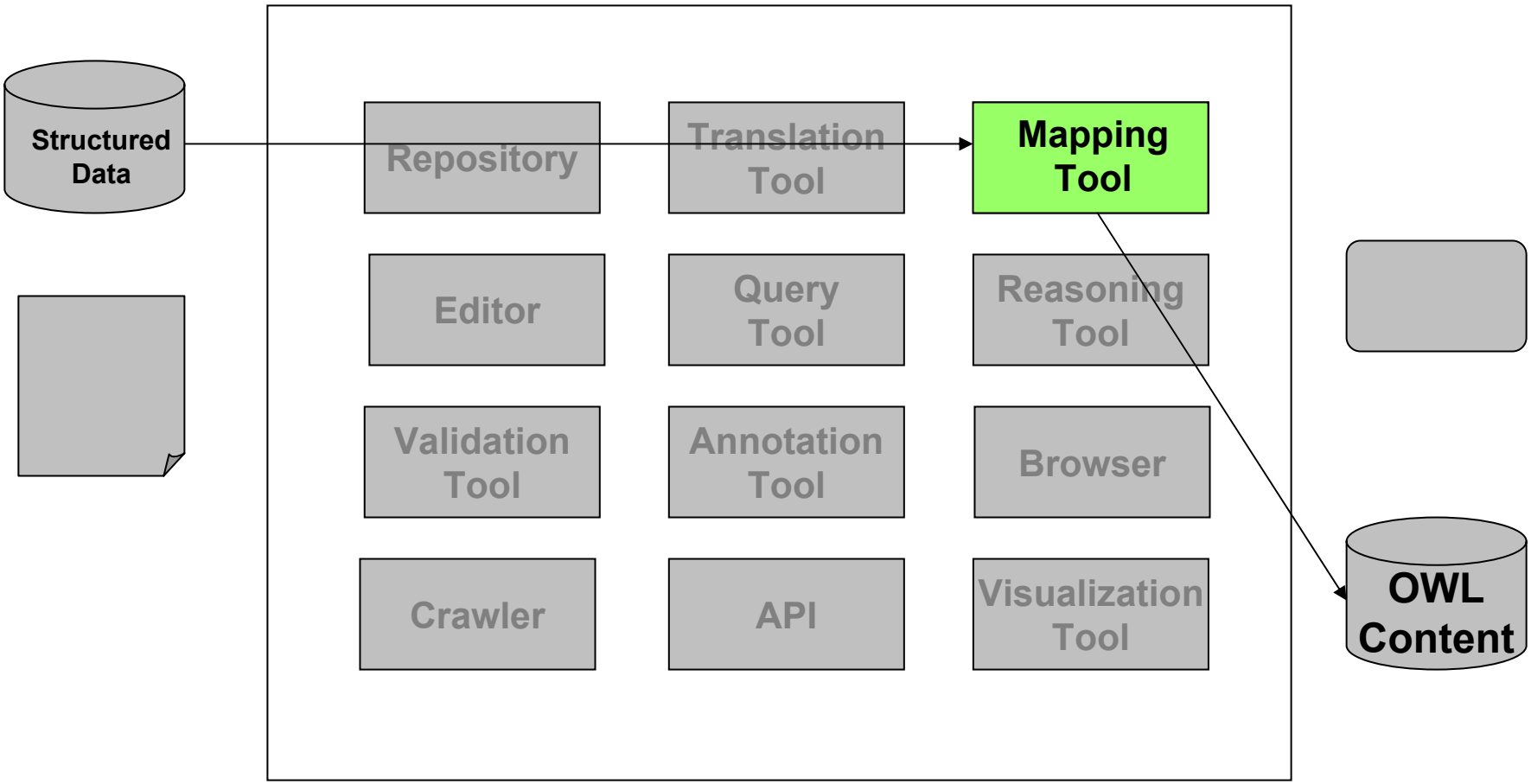
CREATE INSTANCE DATA MANUALLY



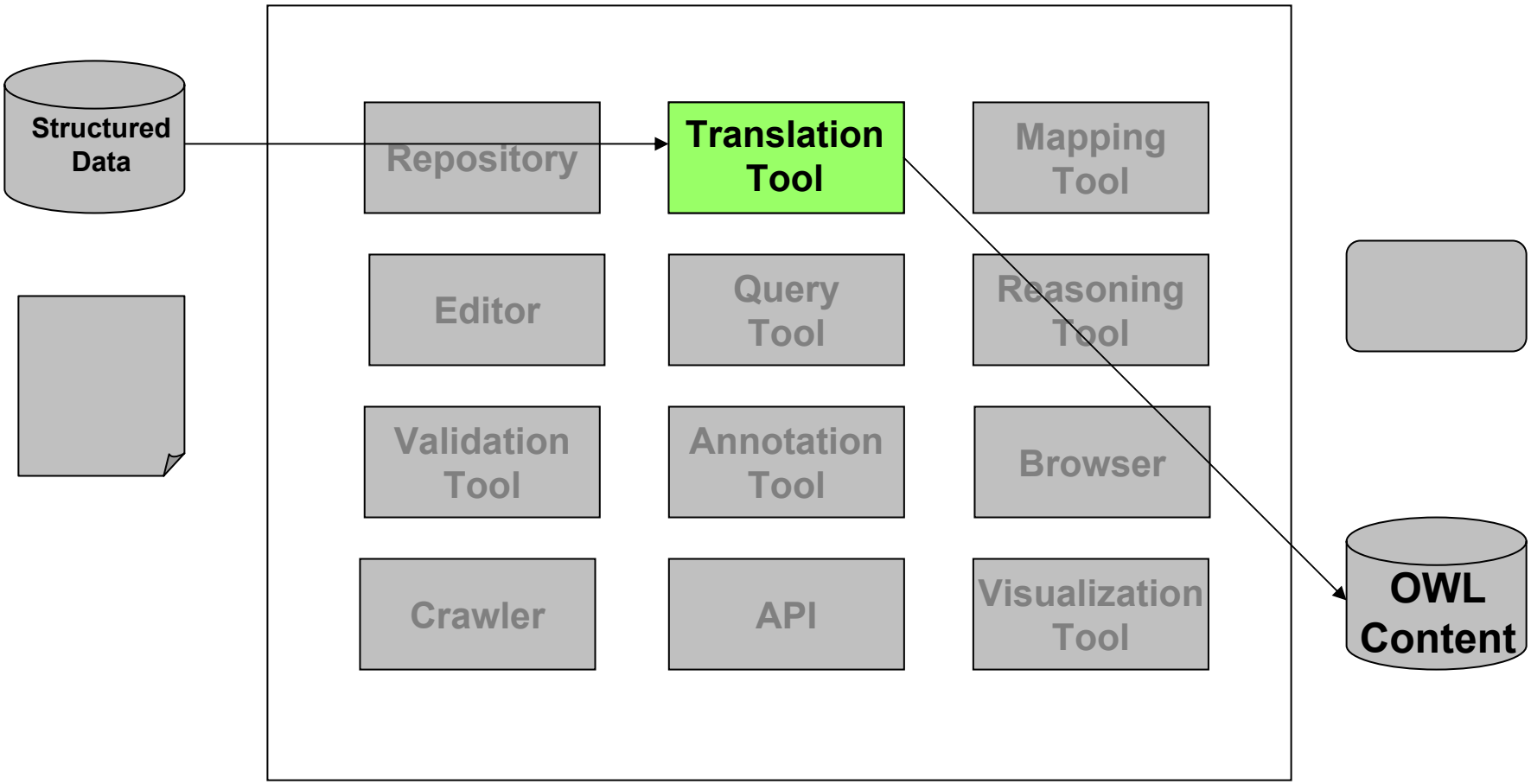
CREATE INSTANCE DATA AUTOMATICALLY



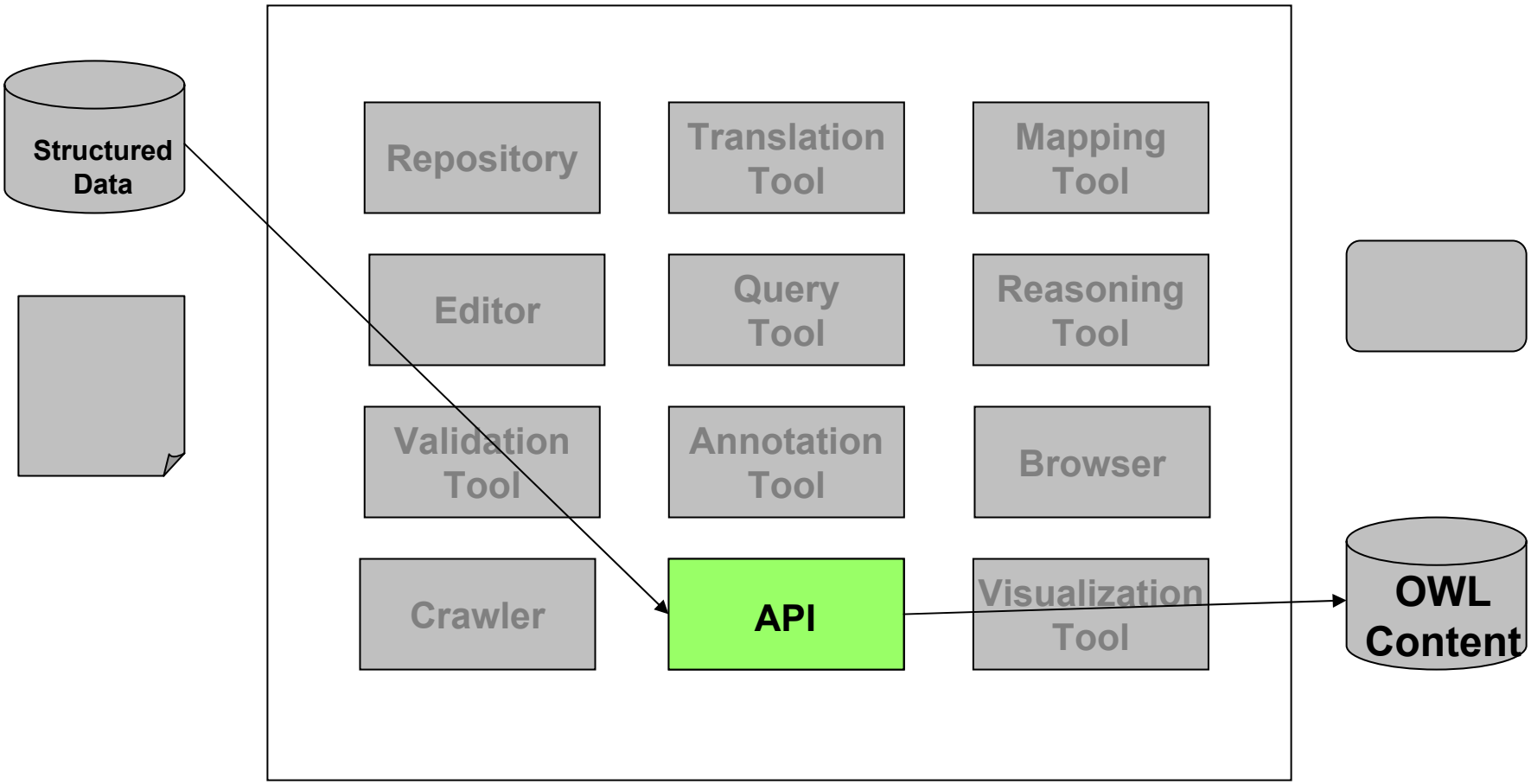
CREATE INSTANCE DATA FROM A DATABASE



CREATE INSTANCE DATA FROM XML



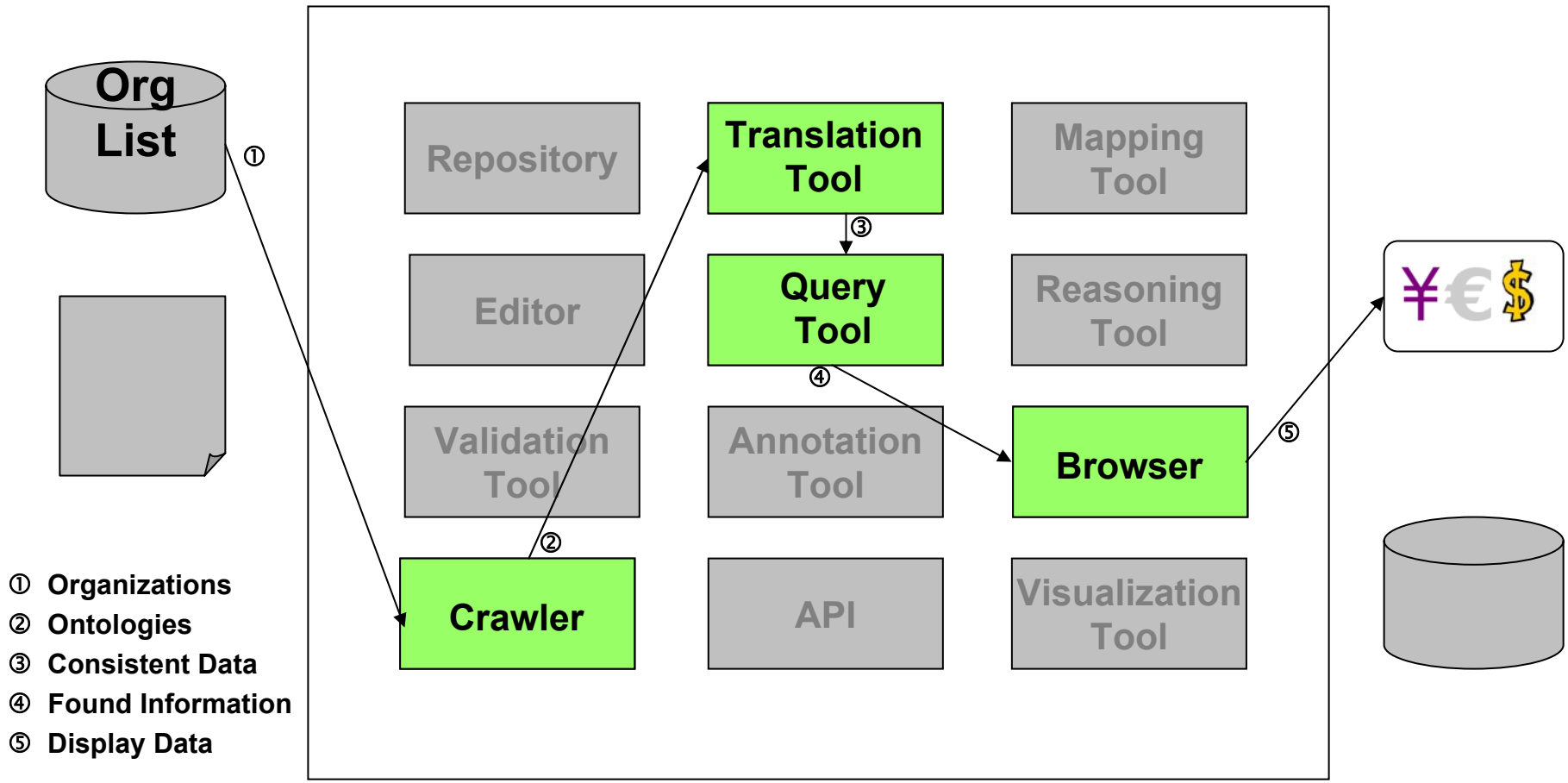
CREATE INSTANCE DATA FROM OTHER DATA



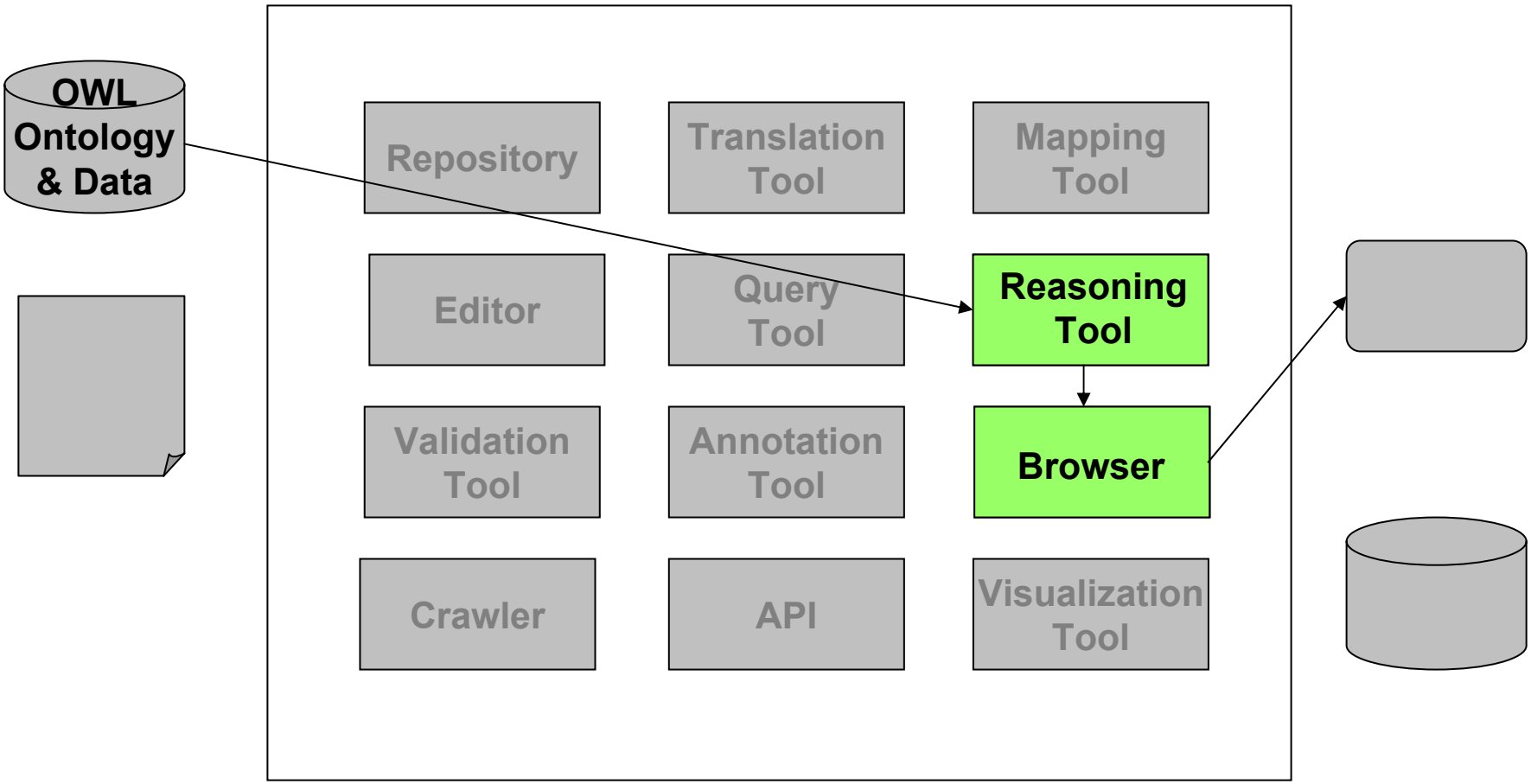
QUERY OVER DISTRIBUTED DATA

Question: Find all the organizations with grant money available for OWL research

Supposition: Granting organization data is in OWL form



CREATE AN APPLICATION THAT EMPLOYS REASONING



TOOL ASSESSMENT APPROACH

- Categorize Tools
- Identify needed capabilities
- Define Test Criteria

Categories

Scenarios

Test Cases

Test Tools

Assess Tools

Assess Categories

Make Recom-mendations

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TEST CRITERIA

- **Editors & Annotation Tools**
  - Can the editing tool automatically generate Class, Property, Restriction, and Instance markup tags in documents?
  - Can the editing tool perform the following editing functions: run, quit, cut text and objects, paste text and objects, copy text and objects, insert text and objects, delete text and objects, undo, highlight syntax/visualization, rename a field, set/change a document namespace?
  - Can the editing tool validate and write OWL data both from a pre-loaded file and from a newly created file?
  - Can the editing tool accept both short-hand and non short-hand OWL notation for both ontology and data files?
  - Can the editing tool read both large and small documents in both OWL and non-OWL formats?

TEST CRITERIA

- **Browsers & Visualization Tools**
  - Can the browser perform normal browsing functions such as Open, Close, Save As, Print?
  - Does the browser offer editing operations such as Copy, Select All, Find?
  - Can the browser load and visualize OWL ontologies and data?
  - Can the browser merge sources from different files that use the same ontology into a single browser window?
  - Can the browser navigate between URIs in the same directory and across namespaces?
  - Can the browser point to Class or Instance fields?
  - Can the browser show reified statements produced by an ontology?
  - Can the visualization tool perform refreshing and the operations advertised by the tool?
  - Can the visualization tool gracefully handle invalid data, inform the user, and request alternative actions?
  - Can the visualization tool view multiple files concurrently?

TEST CRITERIA

- **APIs**
  - Can the API read, parse and write OWL files?
  - Can the API modify (add, delete, change) OWL data?
- **Crawlers**
  - Can the crawler automatically search and find OWL information on the Web?
- **Query & Reasoning Tools**
  - Can the query tool search for information based on user-specified requests?
  - Can the reasoning tool accept an OWL file as a knowledge base?
  - Can the reasoning tool successfully use rules with the tool and information from the knowledge base?
  - Can the reasoning tool add new rules?

TEST CRITERIA

- **Repositories**
  - Can the repository initialize the data store upon first use?
  - Can the repository handle changes to the ontology?
  - Can the repository read data, write data, update data, and delete data?
  - Can the repository resolve concurrent access by multiple clients?
  - Can the repository perform the following reasoning: subClassOf transitivity, sameAs, transitiveProperty?
  - Can the repository provide for secure transactions?
  - Can the repository return the results of a simple query within 1 second?
  - Can the repository store data with greater than 1 million statements?

TEST CRITERIA

- **Translation & Mapping Tools**
  - Can the translation tool translate non-OWL to OWL for both data and ontologies?
  - Can the mapping tool indicate OWL-to-OWL equivalences and mapped relationships?
- **Validation Tools**
  - Can the validation tool recognize errors and point to the specific line in error?
  - Can the validation tool load ontologies created at another site?
  - Can the validation tool validate cardinality and property semantic values?
  - Can the validation tool process ontologies in either OWL-Lite, OWL-DL, or OWL-Full, depending on the specifications of the tool?
  - Can the validation tool validate ontologies written in either long form or short-hand form?

TOOL ASSESSMENT APPROACH

- Categorize Tools
- Identify needed capabilities
- Define Test Criteria

Categories

Scenarios

Test Cases

Test Tools

Assess Tools

Assess Categories

Make Recom-mendations

TOOL DESCRIPTIVE INFORMATION COLLECTED

- Tool Category
- Tool Description
- OWL Compliance
- Include Ontologies, Data, or Both
- Requirements (operating environment)
- Installation Instructions
- Restrictions on Use
- Address of Web Site
- Open Source Status
- Location of Documentation
- Point-of-Contact

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RESULTS

OWL Compliance Survey

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	No.	%
OWL Compliant	42	48
Not OWL Compliant	34	39
In Progress	4	5
Not Applicable	7	8

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SOME LESSONS LEARNED

LESSONS LEARNED

- Many tools require a substantial technical software background to operate
- Tool quality is widely variable
- Many tools have little documentation
- Many tools have too many dependencies
- Tools were not designed to work together

Current collection of tools does not provide the quality or breadth of support that will be required to meet DARPA's objectives.

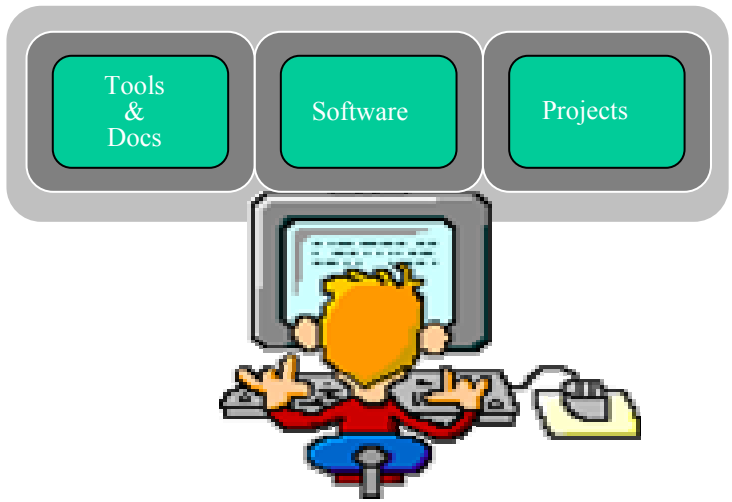
RESOURCES

RESOURCES

- **Web Sites**
  - Tools - http://www.daml.org/tools/
    - Maintained by Mike Dean (mdean@bbn.com)
  - OWL Implementation Page
    http://www.w3.org/2001/sw/WebOnt/impls
- **Tools Tutorial**
  - Semantic Web Tools Tutorial by Mike Dean & Jim Hendler
    http://www.daml.org/2003/05/swmu-tools-tutorial/Overview.html
- **Papers**
  - Semantic Web Lifecycle Support
    http://www.daml.org/2003/08/lifecycle/
  - Semantic Web Tools for Enhanced Authoring
    by Robert McCool, Richard Fikes, Deborah McGuinness
    http://www-ksl.stanford.edu/KSL_Abstracts/KSL-03-07.htmls
  - Software developer roadmap - http://www.daml.org/roadmap.html

www.daml.org
Site Direction

Presented by Cola Atkinson
catkinson@bbn.com
16 October 2003



SemWeb Central

Objective

- *"Create a new and more professional open source site for program-developed software, including support for download, email lists, bug tracking, versioning, compilation, documentation, license management, sample application and so forth."*

". . . make it easy for people who are not on the DARPA/EU payroll to test drive the semantic web . . . "

Issues

- Current web site is not very user friendly
- Current web site does not conform to emerging practices of the open source community
- Current web site lacks a tools strategy that provides:

  ". . . a solid, easy to use, and straightforward collection of tools that support typical OWL workflows."
- Current web site lacks a useful ontology registry
- Site administration is a currently a collateral duty with predictable results

". . . Current web site is not a place for the uninitiated."

Approach

- **Create a centralized web resource for the semantic web community (with an appropriate site name)**
- **Set up central online repository for tool source code & community documentation.**
- **GForge Web-based Solution**
  - Low barrier of entry for contributors
  - Commercial grade software life cycle management tools
  - Open-sourced (with trusted users having commiter rights)
  - Proven collaboration tools
  - Project owners administer their own mailing lists, access control, Wikis, etc.
- **Potentially use CougaarForge as a model**

GForge Solution Would Include:

- **Project management**
  - Task/timeline control, user/group access privileges
- **Source code management & version control**
  - CVS, ViewCVS, Security (SSH)
- **Defect & enhancement request management**
- **Project web site for DAML funded development efforts**
- **Document (version) hosting/release**
- **Collaboration**
  - Mailman (mailing lists)
  - Wiki
  - Jabber (instant messaging)
- **Code sharing**

Additional Potential Capability

(InfoEther Service)

- **Project Dashboard**
  - Automated project build support
  - Automated execution of regression testing
- **Project/source quality analysis with PMD**
  - Custom rules for semweb community
- **SemWeb enhancements to GForge**
  - OWL representations of GForge data (People, Projects, Source code, Bugs, etc.)
  - Commit back into GForge project for widespread use
    - Sharp
    - Phillips
    - UltraLog
    - NASA

Near Term Task for Implementation

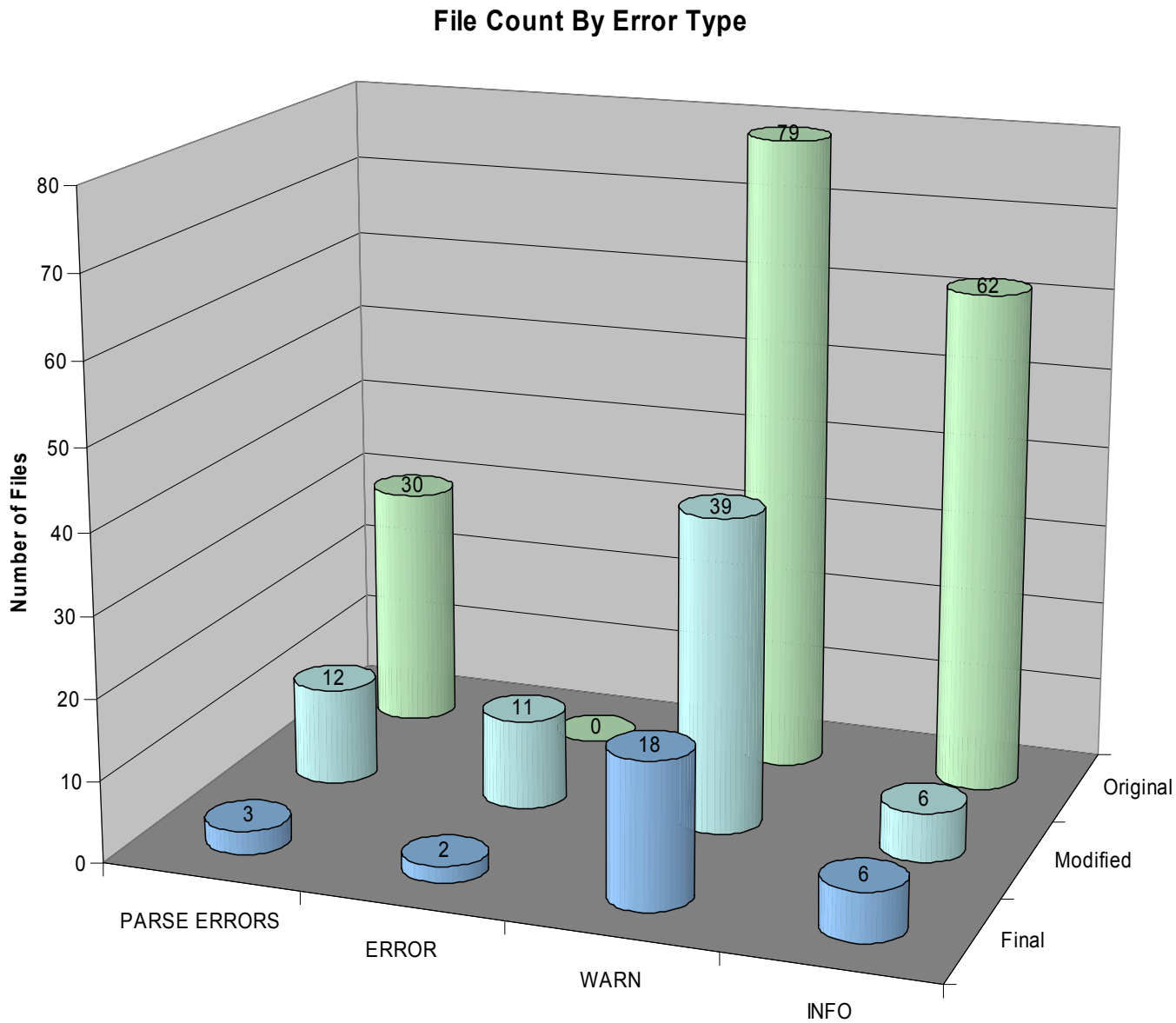
- Procure server & Internet domain names
- Configure OS/Security
- Install & configure GForge, Apache, Jabber, Mailman, Wiki, Postgres, CVS, etc
- Import existing tools of proper quality
- Build projects for documentation consolidation
- Move mailing lists from DAML.org
- Migrate relevant HTML content from DAML.org to appropriate projects under new service
- Reach out to the community to introduce them to the new resource capabilities

What Can You Do to Help

- Subscribe to and participate in related discussions at owl-forge@daml.org
- Help identify additional site functionality unique to this community
- Propose projects that will help fill the holes
- Plan to contribute tools and ontologies to the open source site
- Help promote site awareness

Discussion?

Error Analysis Statistics



DAML Home

The DARPA Agent Markup Language Homepage

The DARPA Agent Markup Language (DAML) Program officially began in August 2000. The goal of the DAML effort is to develop a language and tools to facilitate the concept of the Semantic Web. Mark Greaves is the DARPA Program Manager for DAML.

Why Use DAML?

A set of Roadmaps have been tailored for different user communities to help them access and use the contents of this site more efficiently. The Roadmaps should be particularly useful for new visitors to the DAML web site.

Site Links

- About DAML
- New User Roadmap
- daml-help mailing list
- Announcements
- HotDAML Newsletters
- DAML in the News
- Upcoming Events
- Downloads
- DAML Briefings
- DAML Publications
- Related Links
- Site Map
- Search the Site
- Past DAML Meetings
- DAML Researchers
- DAML Language (DAML+OIL)
- DAML Services (DAML-S)
- DAML Query (DQL)
- DAML Rules
- DAML Time Ontology
- DAML Ontology Library
- DAML Crawler
- DAML Tools
- DAML Logos
- DAML Applications
- DAML Data Sets
- DAML Use Cases
- Homework Assignments

Recent Announcements

2003-08-19: The OWL Web Ontology Language is now a W3C Candidate Recommendation. See here for details.

2003-05-08: Mark Greaves has been named to succeed Murray Burke as DAML Program Manager, effective 6 June 2003.

2003-05-07: A beta release of DAML-S 0.9 (and OWL-S 0.9), a new release of DAML Services, is now available.

2003-04-21: Due to facility moves and network service changes at the host site, www.daml.org will be down briefly on 22 April between 5:30 pm to 7:30 pm EST and then again for an undetermined time between 8:00 AM and 7:00 PM EST on the 23rd of April. In addition, you may experience slower response times due to network sharing during the period between these two service times. If you experience any www.daml.org access or performance problems after the service periods above, please contact the daml webmaster. Thank you for your patience during this transition period. Brandon Amundson DAML Webmaster

2003-04-07: An updated version of the DAML Query Language (DQL) is now available here.

2003-03-31: Roger Costello and David Jacobs have published an OWL Tutorial.

... all announcements

DAML Tools

DAML Tools

Home | About DAML | Announcements | Roadmap | Site Search

Tools used by various participants in the DAML program.

Summaries

- DAML-specific tools
- DAML-specific tools by category
- All tools
- All tools by category

Send additions/updates/corrections to tools@daml.org.

You may also view this list in XML, DAML and OWL formats or using Spectacle.

A wishlist of desired tools is also being maintained.

DAML-specific Tools

1. AeroDAML
2. Algae
3. Articulation Service
4. Chimaera
5. ConsVISor
6. cwm
7. D2R MAP
8. DAML/XSLT Adapter
9. DAML+OIL Ontology Checker
10. DAML+OIL Plugin for Protege 2000
11. DAML API
12. Damlator Translation Engine
13. DAML Crawler
14. DAML DB
15. DAML dotnetAPI
16. DAML Emacs Mode
17. DAMLJessKB
18. DAML Markup Tool
19. DAML Semantic Search Service
20. DAML Sidebar
21. DAML UML Enhanced Tool (DUET)
22. DAML Validator
23. DAML Viewer
24. DAML VisuaLinks
25. dbview
26. Drive
27. dumpont

DAML Tools by Category

DAML-specific Tools by Category

Category	Tool
Annotation	MnM
Annotation	Ontomat
Annotation	Trellis
Application Server	Spectacle:Server
DAML Annotation	AeroDAML
DAML API	DAML API
DAML API	DAMLJessKB
DAML API	Jena
DAML Browser	DAML Markup Tool
DAML Browser	DAML Sidebar
DAML Browser	HyperDAML
DAML Browser	OntoDoc
DAML Browser	Spectacle:Server
DAML Crawler	DAML Crawler
DAML Crawler	RDF Crawler
DAML Editor	DAML Emacs Mode
DAML Graph Visualization	DAML VisuaLinks
DAML Graph Visualization	IsaViz
DAML Graph Visualization	Object Viewer
DAML Graph Visualization	SemTalk
DAML Graph Visualization	VisioDAML
DAML Markup tool	Semantic Markup, Ontology and RDF Editor (SMORE)
DAML Transformation	DAML/XSLT Adapter
DAML Validator	DAML Validator
DAML Viewer	DAML Viewer
DAML Viewer	PalmDAML
DAML Viewer	Spectacle:Server
Database Interface	dbview
Export	OWL Converter
Import	Excel to RDF converter
Import	PDDL to DAML Translator
Import	RDF Web Scraper
Import	Uml2Daml Converter
Import	Unicorn System
Import	XML Schema to DAML Translator
Inference Engine	cwm
Inference Engine	Euler proof mechanism

A Potential Direction for SemWeb-Central

- **The software development process is a potential first application area for the Semantic Web**
- **Open-source projects have an incredible amount of content that if transformed into OWL would be a major knowledge base for building high-impact SemWeb applications.**
- **Using OWL to represent open-source software project entities**
  - People, Projects, Source files, Bugs, Tasks, etc
- **Build SemWeb software project analysis tools that use these OWL documents**
- **Let the open-source contributors use SemWeb tools to facilitate their development efforts increasing the interest by software developers in SemWeb applications.**

CougaarForge

Cognitive Agent Architecture

Login Status:
NOT LOGGED IN
Login
New User via SSL

CougaarForge
Home
Code Snippets
Project Openings
Hosted Projects List

Search
Software/Group
People
Search

Welcome to CougaarForge!

Welcome to the Cognitive Agent Architecture (Cougaar) Open Source Project site. Cougaar has a Java-based architecture for the construction of large-scale distributed agent-based applications. It is the product of a multi-year DARPA research project into large scale agent systems and includes not only the core architecture but also a variety of demonstration, visualization and management components to simplify the development of complex, distributed applications.

Here is the Cougaar FAQ, latest release, JavaDoc, and Wiki.

Latest News

Conference Papers are now online
Todd Wright - 2003-10-02 12:25 - Cougaar
Cougaar slides from JavaOne 2002 are now online in http://docs.cougaar.org
(0 Comments) [Read More/Comment]

Bug Fix Release 1.0.1
Matt Abrams - 2003-09-03 16:27 - Cougaar IDE
A new minor release, 1.0.1, is available that fixes a bug related to launching cougaar nodes on Linux and Mac machines.
(0 Comments) [Read More/Comment]

Release 1.1
Tim Tschampel - 2003-08-22 22:58 - BOL2
The Publisher functionality is now fully implemented and the BOL Guide is now included in the release.
(0 Comments) [Read More/Comment]

- **1.0 Alpha Release** *2003-08-15 17:13*
- **Scheduled downtime August 8 2003** *2003-08-06 15:34*
- **Initial Release** *2003-07-31 15:15*
- **Initial Import** *2003-07-29 14:10*
- **CougaarForge domain name change** *2003-07-15 17:24*
- **Cougaar 10.2.1 is on CougaarForge...** *2003-06-24 15:57*
- **Scheduled downtime 6/20/2003 from 0700 to 0710** *2003-06-19 16:08*

[News archive]

Need Help?
Post a message to CougaarForge Support

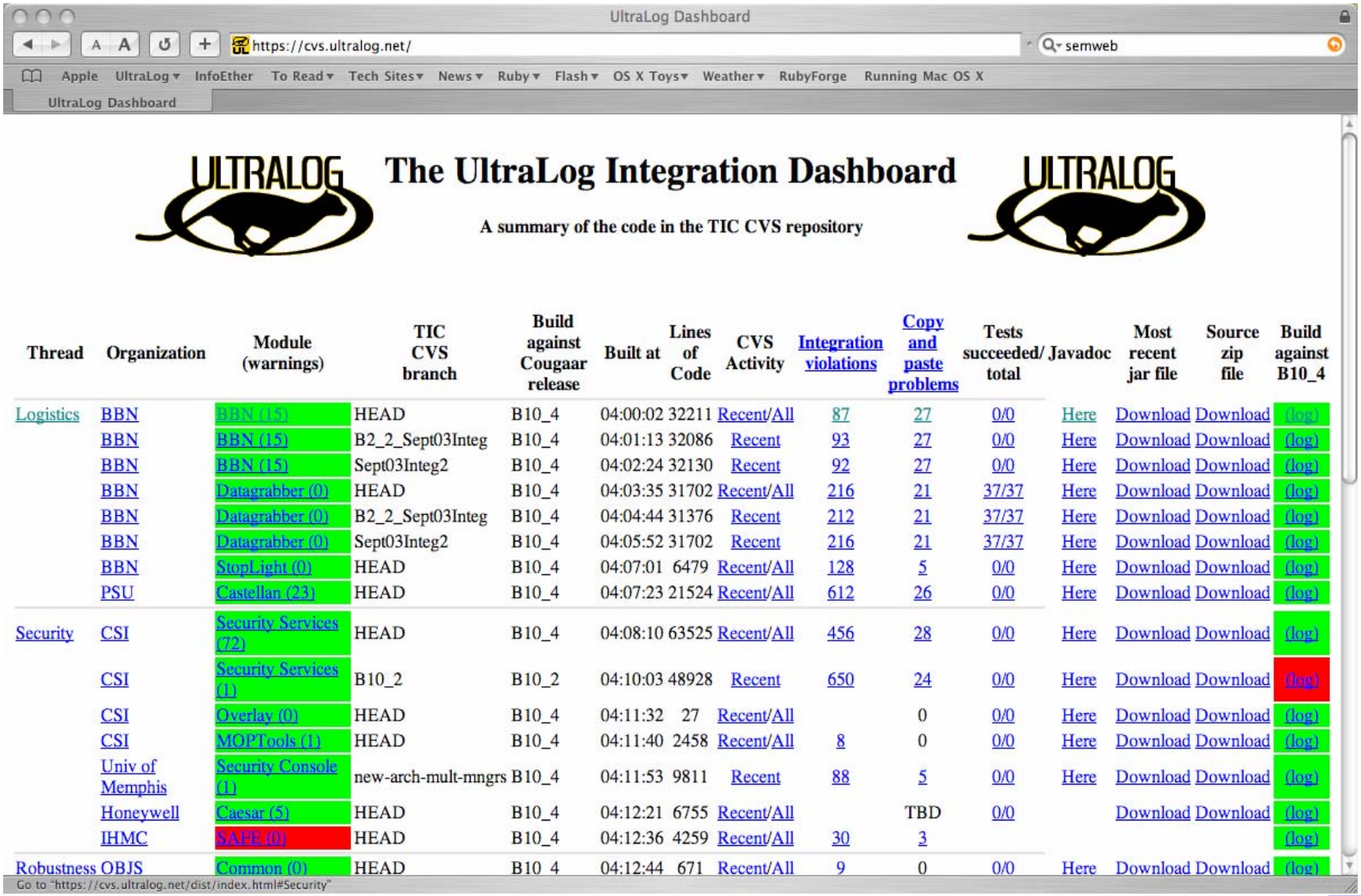
Hosted Projects
COUGAAR
Tutorials
Cougaar Micro Edition
CougaarUnit
Cougaar UI
CSMART
Books On Line II
Cougaar IDE
Vishnu Scheduler
General Logistics Module
Quality Of Service
Core
Web Server
Aggregation Agent
Builder
Communities
Planning
Utilities
Service Discovery
Yellow Pages
Ruby cvs-exp wrapper
Delta/Blackjack
Legacy projects (COABS, SAM, Predictive Assessment, BPDT, Contracts)

CougaarForge Statistics
Hosted Projects: **23**
Registered Users: **167**
Usage statistics

Top Project Downloads
(578) Cougaar
(169) Cougaar IDE
(164) BOL2
(86) Cougaar MicroEdition
(35) Cougaar Unit
(17) Cougaar Legacy
(9) DELTA and BlackJack Generic Components
[More]

Most Active This Week
(100%) Cougaar
(83.33%) Cougaar IDE
(66.66%) BOL2
(50%) CSMART
(33.33%) Tutorials

Projects Dashboard



Thread	Organization	Module (warnings)	TIC CVS branch	Build against Cougaar release	Built at	Lines of Code	CVS Activity	Integration violations	Copy and paste problems	Tests succeeded/ total	Javadoc	Most recent jar file	Source zip file	Build against B10_4
Logistics	BBN	BBN (15)	HEAD	B10_4	04:00:02	32211	Recent/All	87	27	0/0	Here	Download	Download	(log)
	BBN	BBN (15)	B2_2_Sept03Integ	B10_4	04:01:13	32086	Recent	93	27	0/0	Here	Download	Download	(log)
	BBN	BBN (15)	Sept03Integ2	B10_4	04:02:24	32130	Recent	92	27	0/0	Here	Download	Download	(log)
	BBN	Datagrabber (0)	HEAD	B10_4	04:03:35	31702	Recent/All	216	21	37/37	Here	Download	Download	(log)
	BBN	Datagrabber (0)	B2_2_Sept03Integ	B10_4	04:04:44	31376	Recent	212	21	37/37	Here	Download	Download	(log)
	BBN	Datagrabber (0)	Sept03Integ2	B10_4	04:05:52	31702	Recent	216	21	37/37	Here	Download	Download	(log)
	BBN	StopLight (0)	HEAD	B10_4	04:07:01	6479	Recent/All	128	5	0/0	Here	Download	Download	(log)
	PSU	Castellan (23)	HEAD	B10_4	04:07:23	21524	Recent/All	612	26	0/0	Here	Download	Download	(log)
Security	CSI	Security Services (72)	HEAD	B10_4	04:08:10	63525	Recent/All	456	28	0/0	Here	Download	Download	(log)
	CSI	Security Services (1)	B10_2	B10_2	04:10:03	48928	Recent	650	24	0/0	Here	Download	Download	(log)
	CSI	Overlay (0)	HEAD	B10_4	04:11:32	27	Recent/All		0	0/0	Here	Download	Download	(log)
	CSI	MOPTools (1)	HEAD	B10_4	04:11:40	2458	Recent/All	8	0	0/0	Here	Download	Download	(log)
	Univ of Memphis	Security Console (1)	new-arch-mult-mngrs	B10_4	04:11:53	9811	Recent	88	5	0/0	Here	Download	Download	(log)
	Honeywell	Caesar (5)	HEAD	B10_4	04:12:21	6755	Recent/All		TBD	0/0		Download	Download	(log)
	IHMC	SAFE (0)	HEAD	B10_4	04:12:36	4259	Recent/All	30	3					(log)
Robustness	OBJS	Common (0)	HEAD	B10_4	04:12:44	671	Recent/All	9	0	0/0	Here	Download	Download	(log)

Software Build & Continuous Integration Dashboard

PMD… a Case Study

- **NIST study:**
  - $59.5B lost due to software defects annually
  - Software market $180B/year
  - Therefore 1/3 of value is lost
  - Increasing code quality would have major monetary impact
- **Needed a source code quality analyzer**
- **Commercial tools did not meet requirements**
- **InfoEther built "PMD" for UltraLog program**
- **Open-Sourced on SourceForge.net**

http://pmd.sourceforge.net/integratinos.html