Toolset for collaborative distributed web ontology development

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Outline

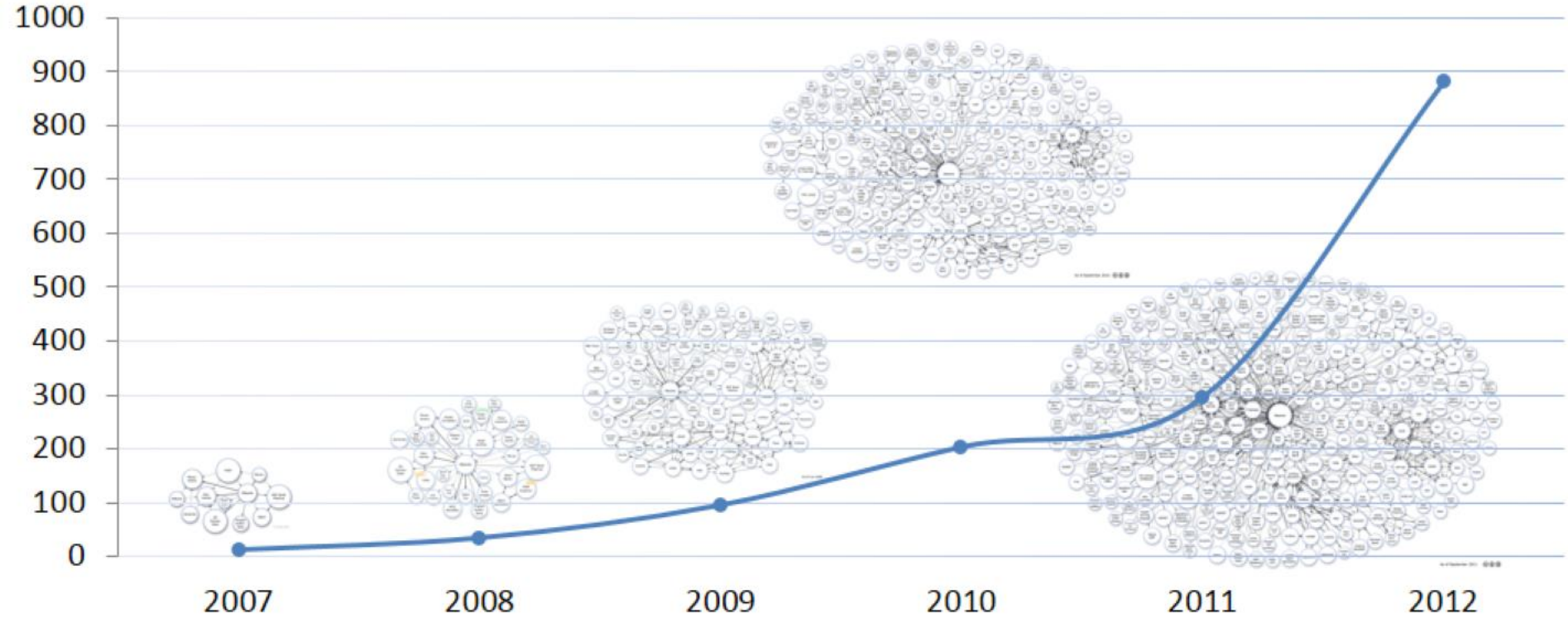
- Introduction
  - Web Ontologies
  - Applications of Ontologies
  - Ontology Authoring (single-handed)
- Collaborative Ontology Development
  - Approaches
  - Current Challenges
  - Existing Tools
- The Proposed Solution
  - Approach
  - Components
  - Basic Algorithms
  - Screenshots

Ontologies

Formal description of a domain understood by both humans and computers

Web Ontologies

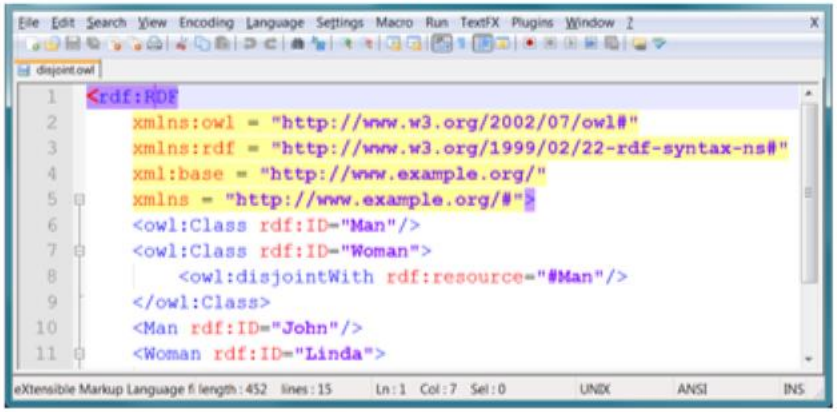
- Make up the Semantic Web

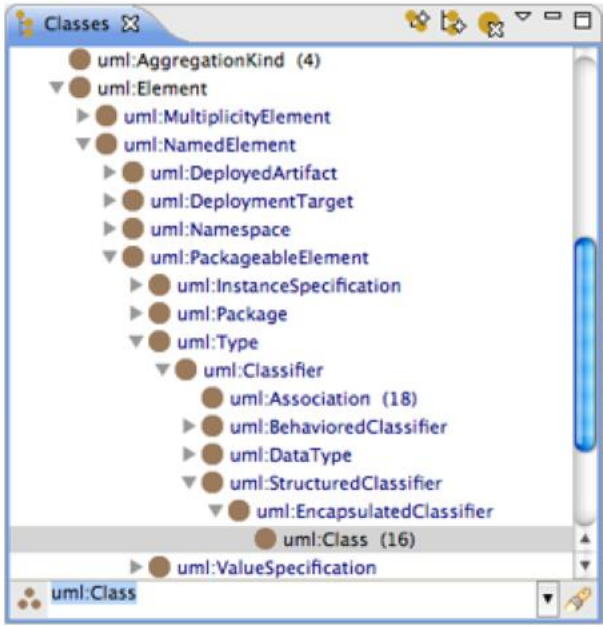


Applications of Ontologies

- Biology, Genetics, Medicine, Healthcare
  - OBO, GALEN, Uberon, MedO, Gene Ontology, SNOMED-CT
- Oil-and-Gas Production
  - POSC Caesar Association, EPIM ReportingHub, ISO 15926
- Basis of large-scale webportals
  - BBC World Cup 2010 portal, PLOS Publishing
- Integration of heterogeneous distributed knowledge
  - SADI, NASA POPS, CRUZAR
- Describing entities in social networks
  - NASA POPS, Facebook Graph API
- Basis of knowledge search tools
- Optimization of traditional search engines
- Personal information management with semantic search

Ontology Authoring





Collaborative Ontology Development

- Synchronous editing
  - One central repository
  - Changes are immediately seen by all developers
  - No special tools are required for comparing and merging
  - Persistent connection to the repository is required
  - Change logging tools are required

Collaborative Ontology Development (continuation)

- Asynchronous editing
  - No need in persistent repository connection
  - It is possible to check changes before committing
  - Higher reliability
  - Is widely used in software development
  - Special tools for comparing and merging of ontologies are required

Tasks

- Version control
  - Change log for an ontology
  - Change log for a single entity
  - Changes search by entity
  - Comparing versions of ontologies
- Collaborative editing
  - Three-way merging of ontologies
  - Conflict resolution
  - Issue tracking

Existing Tools

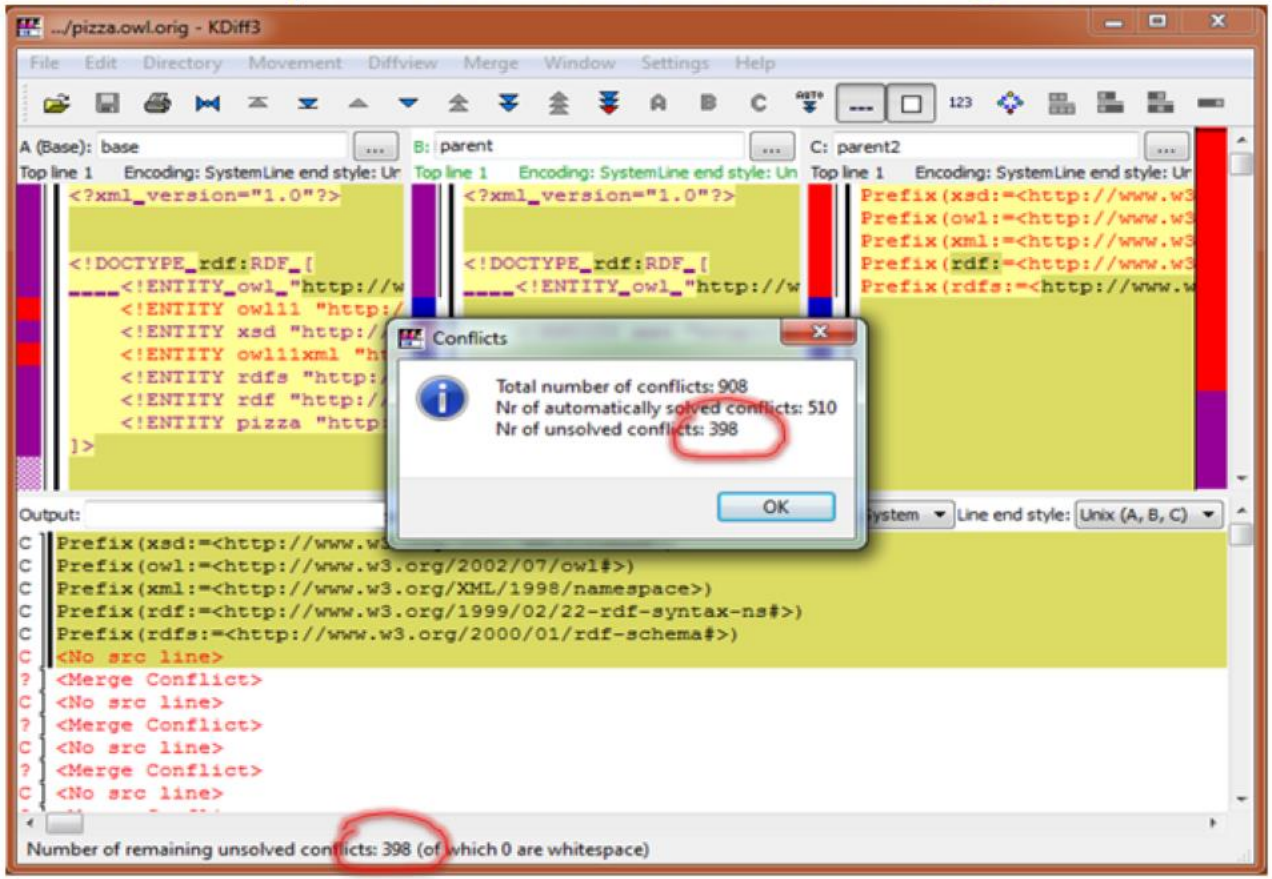
- In-browser editors – synchronous editing
  - Web Protégé, Wiki@nt
- Distributed version control – asynchronous editing
  - Git, Mercurial, Bazaar, Darcs
- Ontology comparison tools
  - OWLDiff, OwlPatch, Ecco

Version Control Systems

- Are already used for ontology development:
  - Collections Ontology
  - Music Ontology
  - Math Model Ontology
  - Rat Genome Database
  - uberon – uber-anatomy ontology
  - ontoads – astronomical ontologies
  - LKIF – basic legal concepts
  - ogms – general medical science ontology

Version Control Systems (continuation)

- Don’t fit for ontology development
  - Use text representation of ontologies



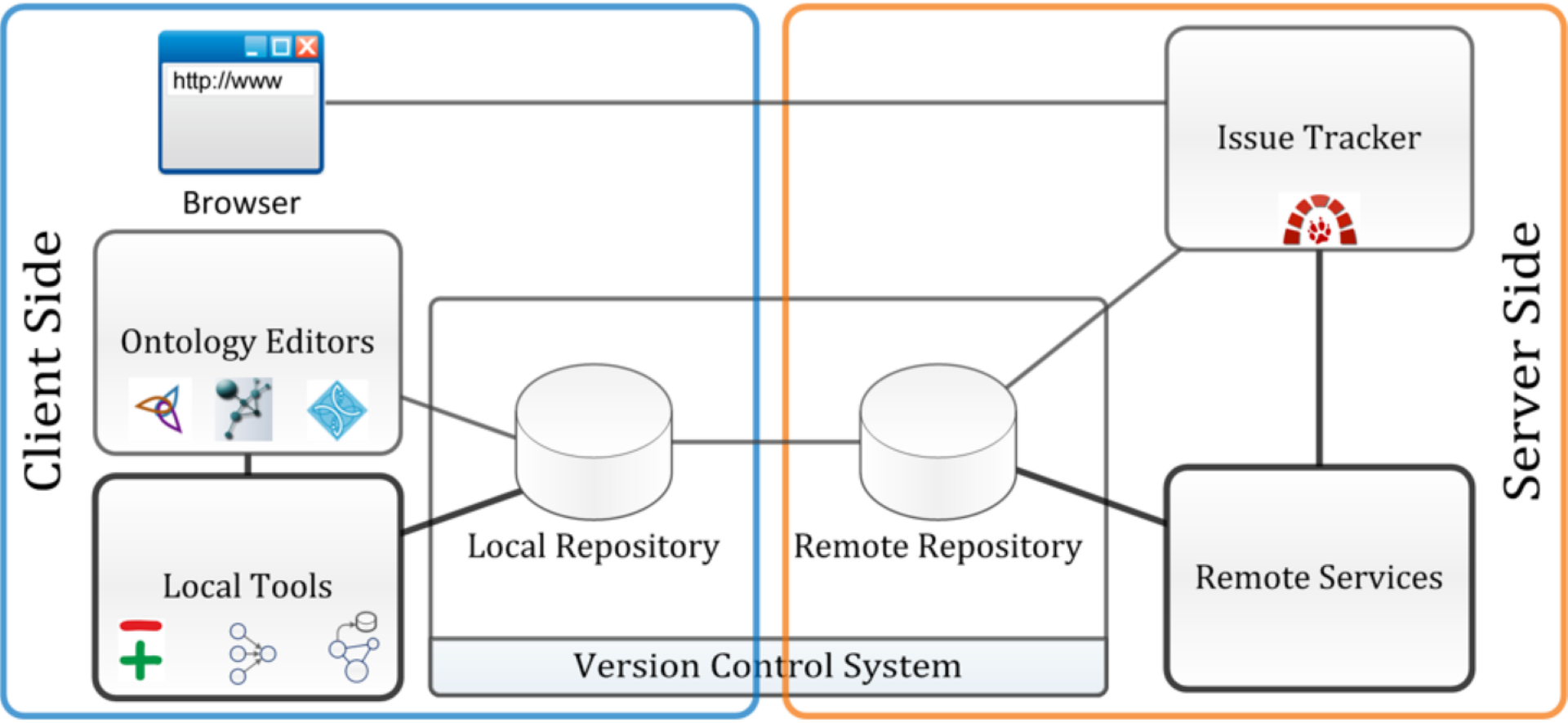
The Proposed Solution

- Develop algorithms and tools for comparing and three-way merging of ontologies
- Integrate the tools with a DVCS
- Integrate the tools with an issue tracker

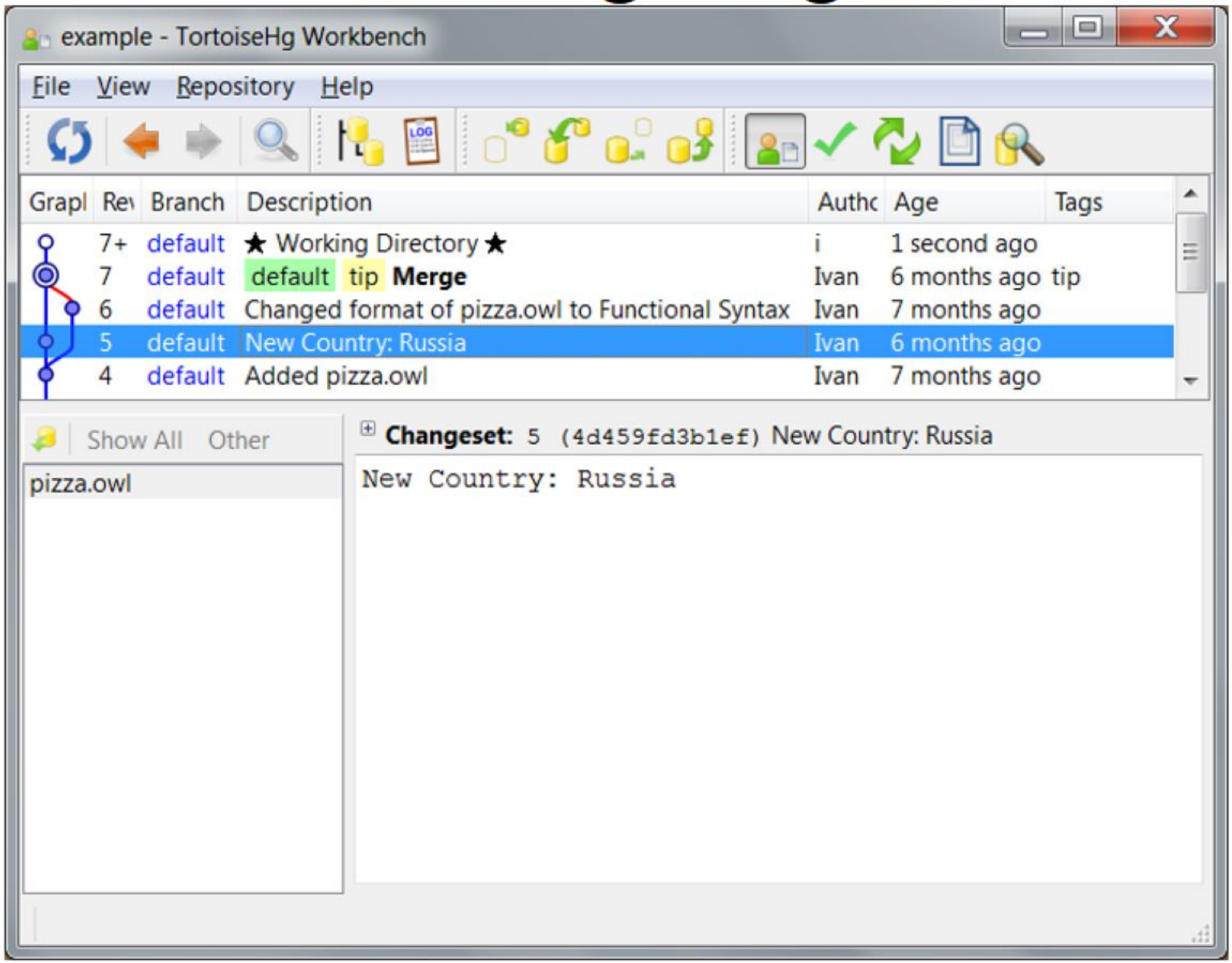
The Proposed Solution (continuation)

- Allows for distributed ontology development
- Does not restrict language expressiveness
- Allows each developer to use his accustomed ontology editor
- Allows for integration with existing issue tracking systems

Components of the System



Change Log


example - TortoiseHg Workbench
File View Repository Help
Grapl Re\ Branch Description Authc Age Tags
7+ default ★ Working Directory ★ i 1 second ago
7 default default tip Merge Ivan 6 months ago tip
6 default Changed format of pizza.owl to Functional Syntax Ivan 7 months ago
5 default New Country: Russia Ivan 6 months ago
4 default Added pizza.owl Ivan 7 months ago
Show All Other
pizza.owl
Changeset: 5 (4d459fd3b1ef) New Country: Russia
New Country: Russia

Change Log in an Issue Tracker

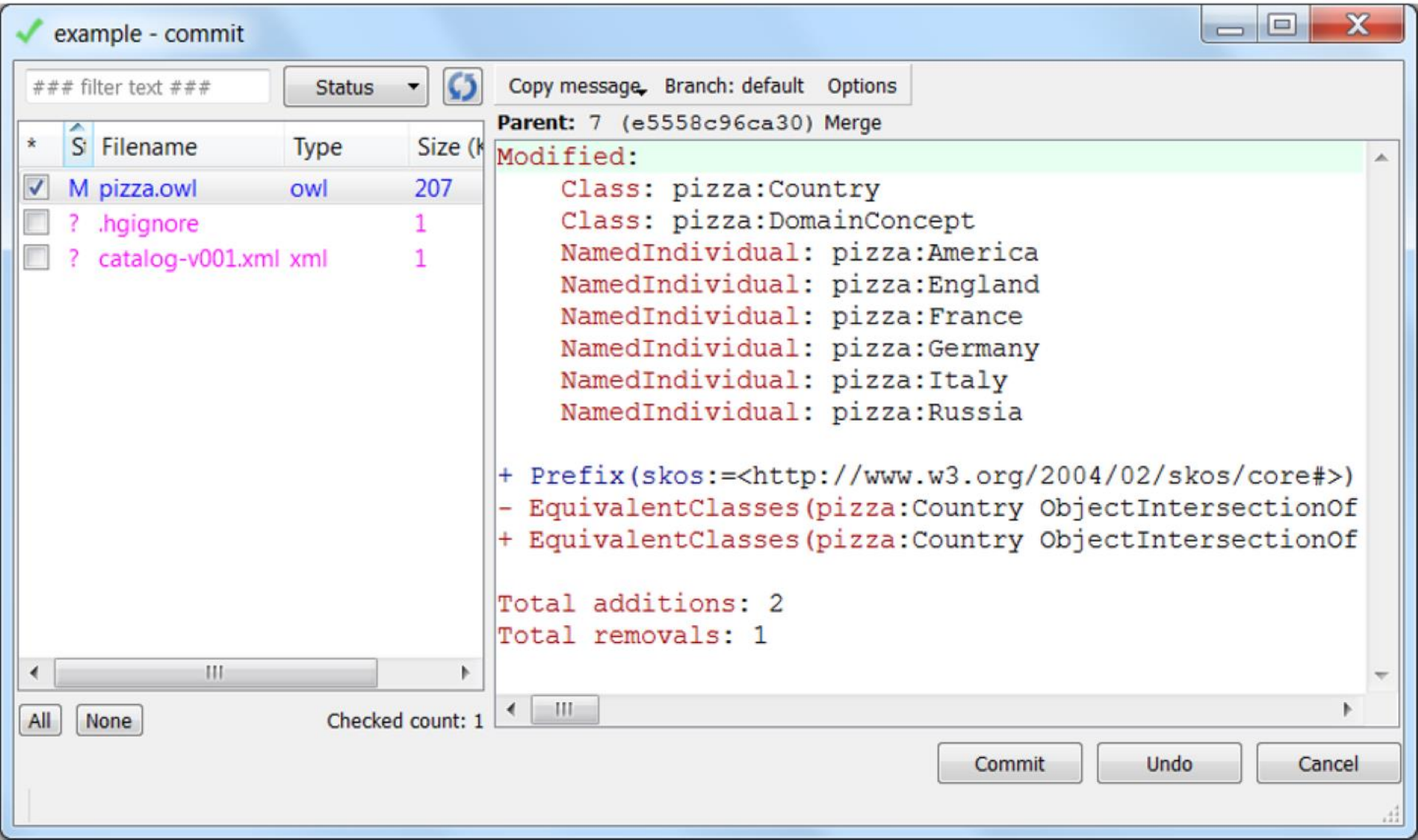
Latest revisions

#	Date	Author	Comment
7:e5558c96ca30	09/02/2011 03:11 pm	Ivan	Merge
6:d7f952a3934a	08/23/2011 10:35 am	Ivan	Changed format of pizza.owl to Functional Syntax
5:4d459fd3b1ef	08/23/2011 11:45 am	Ivan	New Country: Russia
4:c67844c07976	08/23/2011 11:19 am	Ivan	Added pizza.owl
3:50e082c38d7f	08/15/2011 01:12 pm	i	M test.owl
2:8f0ce19e0940	08/15/2011 01:10 pm	i	M test.owl
1:606a52fd49d9	08/15/2011 01:08 pm	i	test.owl
0:7c839490080d	08/15/2011 12:58 pm	i	Added stub for checker

View differences

View all revisions | View revisions

Creating a New Ontology Version



Ontology Versions Comparison

Overview | Activity | Issues | New issue | Gantt | Calendar | News

Revision 5:4d459fd3b1ef pizza.owl

```
- Prefix(owl11:=<http://www.w3.org/2006/12/owl11#>)
- Prefix(owl11xml:=<http://www.w3.org/2006/12/owl11-xml#>)
+ Declaration(NamedIndividual(Russia))
+ ClassAssertion(owl:Thing Russia)
+ ClassAssertion(Country Russia)
+ DifferentIndividuals(America England France Germany Italy Russia )
+ Declaration(AnnotationProperty(owl:versionInfo))
- DifferentIndividuals(America England France Germany Italy )
+ Declaration(NamedIndividual(America))
+ Declaration(NamedIndividual(England))
+ Declaration(NamedIndividual(France))
+ Declaration(NamedIndividual(Germany))
+ Declaration(NamedIndividual(Italy))
+ Declaration(AnnotationProperty(rdfs:comment))
+ Declaration(AnnotationProperty(rdfs:label))
```

Change Log for Single Entity

Overview | Activity | Issues | New issue | Gantt | Calendar | News | Documents | Wiki | Files | Owlmine

Class: <http://www.co-ode.org/ontologies/pizza/pizza.owl#Country>

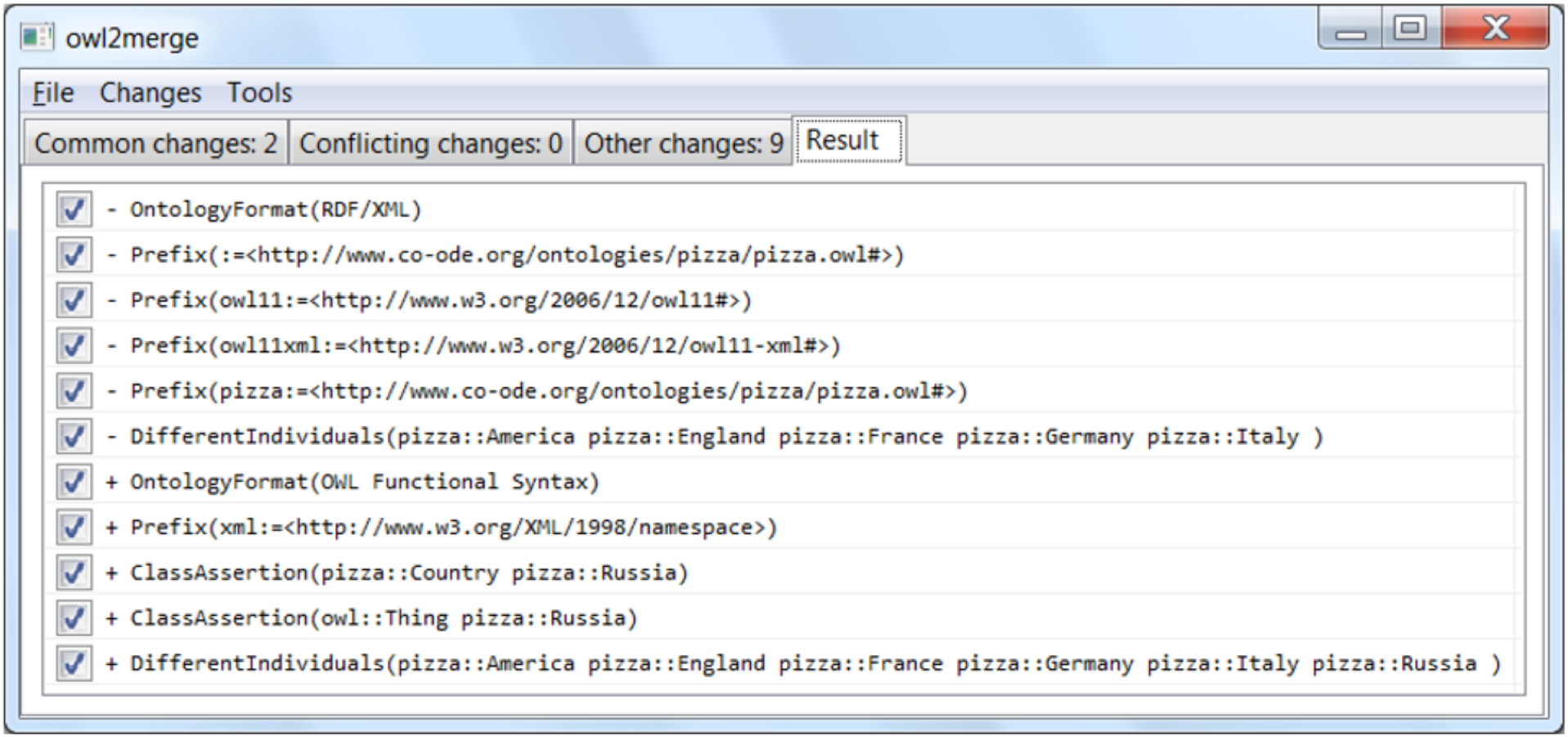
Modified in 5:4d459fd3b1ef : /pizza.owl

```
+ ClassAssertion(Country Russia)
```

Added in 4:c67844c07976 : /pizza.owl

```
+ ClassAssertion(Country America)
+ Declaration(Class(Country))
+ ClassAssertion(Country Italy)
+ ClassAssertion(Country France)
+ EquivalentClasses(Country ObjectIntersectionOf(DomainConcept ObjectOneOf(America England France Germany Italy)) )
+ ClassAssertion(Country Germany)
+ ClassAssertion(Country England)
```

Three-Way Merge Tool



Issue Tracking

ctivity | Issues | New issue | Gantt | Calendar | News | Documents | Wiki | Files | Owlmine | Reposito

Tracker * Ontologies

Private

Subject * Typo

Description

B I U S C H1 H2 H3 pre

Text formatting

The name of the [http://www.co-ode.org/ontologies/pizza/pizza.owl#russia russia] individual is mistyped it should begin with a capital letter.

Status * New

Priority *

Assignee

Parent task

Start date 2012-09-03

Due date

Estimated time Hours

Issue Tracking

Issue #2 created.

Ontologies #2

Update | Log time | Watch | Copy | Delete

Typo

« Previous | 1 of 2 | Next »

Added by Redmine Admin less than a minute ago.

Status:	New	**Start date:**	09/03/2012
Priority:	Normal	**Due date:**	
Assignee:	-	**% Done:**	0%
Category:	-	**Spent time:**	-
Target version:	-		

Description Quote

The name of the russia entity is mistyped.
It should begin with a capital letter.

Subtasks Add

Related issues Add

Issues

View all issues
Summary
Calendar
Gantt

Watchers (0)

Conclusion

- Collaborative Distributed Web Ontology Development
  - Version Control
  - Collaborative Editing
- Increases ontology development efficiency
- Was used in the “Intellectual Field” project

Cognitive Systems and Knowledge Management Group

- Collaborative ontology development tools
- Security of ontological knowledge bases
- Information systems based on ontological knowledge bases and Semantic Web technologies
  - Decision support system
  - E-library system

http://portal.tpu.ru/SHARED/i/I/eng/research/group

Horizon 2020

- Priority: Industrial Leadership
  - Leadership in enabling and industrial technologies
- Theme:
  Information and Communication Technologies
- Prospective content of Calls for Proposals:
  Future and Emerging Technologies
  - Radical breakthroughs in ICT increasingly rely on deep synergies with other disciplines (for instance, biology, chemistry, nanoscience, neuro- and **cognitive science**, ethology, social science, economics) and with the arts and humanities.

Russian Foundation for Basic Research

- Continuous joint competitions of the Russian Foundation for Basic research (RFBR) and Austrian Science Fund (FWF)
  - (07) Information and Telecommunication systems
  - No time limits for submitting the applications
  - Duration of project: 3 years
  - Examination of applications: 4-5 months

Questions?

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