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Semantic Web

Lecture XIII – 25.01.2010

Tools

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Today's lecture

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#	Date	Title
1	12.10,2009	Introduction
2	12.10,2009	Semantic Web Architecture
3	09.11.2009	RDF and RDFs
4	09.11.2009	Web of hypertext (RDFa, Microformats) and Web of data
5	23.11.2009	Semantic Annotations
6	23.11.2009	Repositories and SPARQL
7	07.12.2009	OWL
8	07.12.2009	RIF
9	11.01.2010	Web-scale reasoning
10	11.01.2010	Social Semantic Web
11	11.01.2010	Ontologies and the Semantic Web
12	**25.01.2010**	**SWS**
13	**25.01.2010**	**Tools**
14	**25.01.2010**	**Applications**
15	TBD	Exam

Agenda

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1. Motivation
2. Technical solutions and illustrations
   1. Protégé
   2. Collaborative Protégé
   3. Semantic Media Wiki
   4. Web Service Modeling Toolkit (WSMT)
3. Extensions (Overview)
4. Summary
5. References

MOTIVATION

Motivation

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- Ontology editors
- Ontology alignment
- Semantic wikis (see lecture on Social Semantic Web)
- Games for semantic content creation (see lecture on Social Semantic Web)
- Reasoners
- Storage
- Semantic annotation tools for different types of content (see lecture on semantic annotation)
- Semantic Web service development tools

www.semanticweb.org

TECHNICAL SOLUTION AND ILLUSTRATIONS: TOOLS

Selection of tools

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- Protege
- Semantic MediaWiki
- Web Service Modeling Toolkit

Protégé/Collaborative Protégé

Protégé-Facts

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- Free, open source ontology editor and knowledge-base ramework.
- Based on Java.
- Written as a collection of plug-ins which can be replaced singly or as a whole.
- Extensible.
- Provides a plug-and-play environment.
- Can be customized in order to provide domain-friendly support.
- Available at http://protege.stanford.edu/

Protégé Facts

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- Supports the creation, visulization and manipulation of ontologies.
- Supports a variety of formats like RDF(S), OWL and XML Schema.
- Enables rapid prototyping and application development.

There are two different ways to modell ontologies:

- Frame based via the Protégé-Frames editor
- In OWL via the Protégé-OWL editor

Protégé Frame-based editor

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- Construction and population of ontologies that are frame-based.
- Conformant to OKBC (Open Knowledge Base Connectivity Protocol).
  - An ontology is a set of classes.
  - These are structured in a subsumption hierarchy.
  - To each class a set of slots to express properties and relationships is assigned.
  - Each class has a set of instances (individuals which hold concrete values of the properties of the respective class.

Protégé-Frame-based editor

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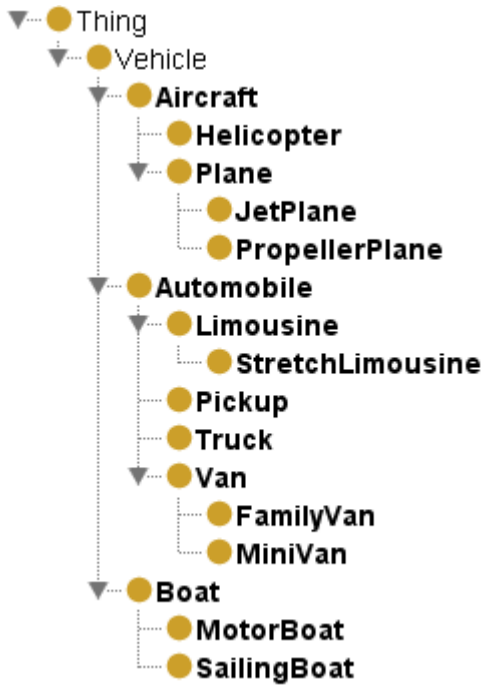
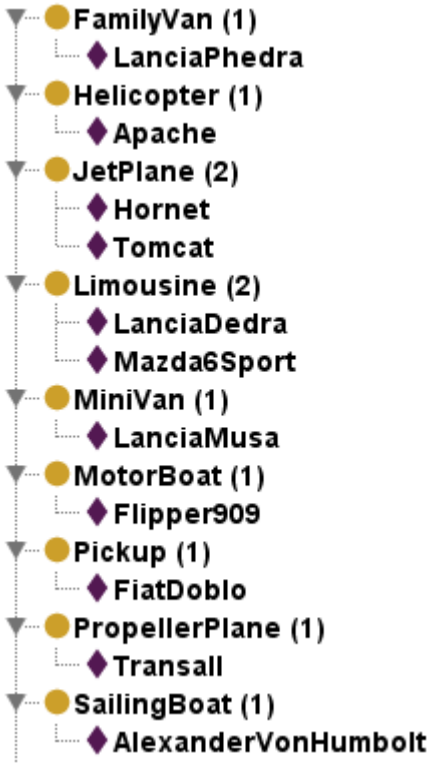
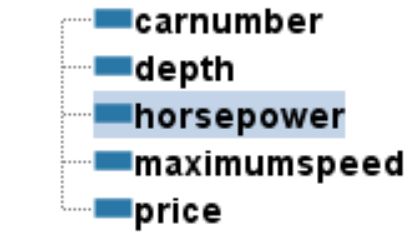
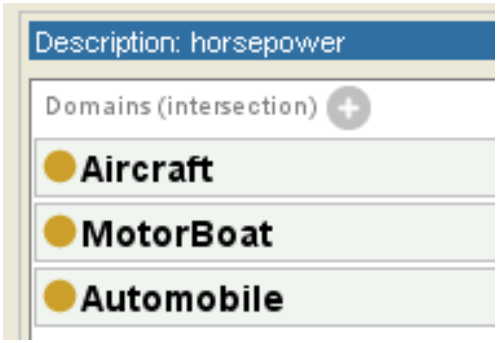
- Classes structured in a taxonomy
- Instances assigned to classes
- Properties assigned to classes









Protégé OWL editor

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- Protégé-OWL editor is an extension of Protégé that supports the Web Ontology Language (OWL).
- An OWL ontology may include descriptions of classes, properties and their instances.
- OWL formal semantics specifies how to derive its logical consequences.
- Those are facts not literally present in the ontology, but entailed by the semantics.

The Protégé-OWL editor enables users to:

- Load and save OWL and RDF ontologies.
- Edit and visualize classes, properties, and SWRL rules.
- Define logical class characteristics as OWL expressions.
- Execute reasoners such as description logic classifiers.
- Edit OWL individuals for Semantic Web markup.

Protégé-OWL editor

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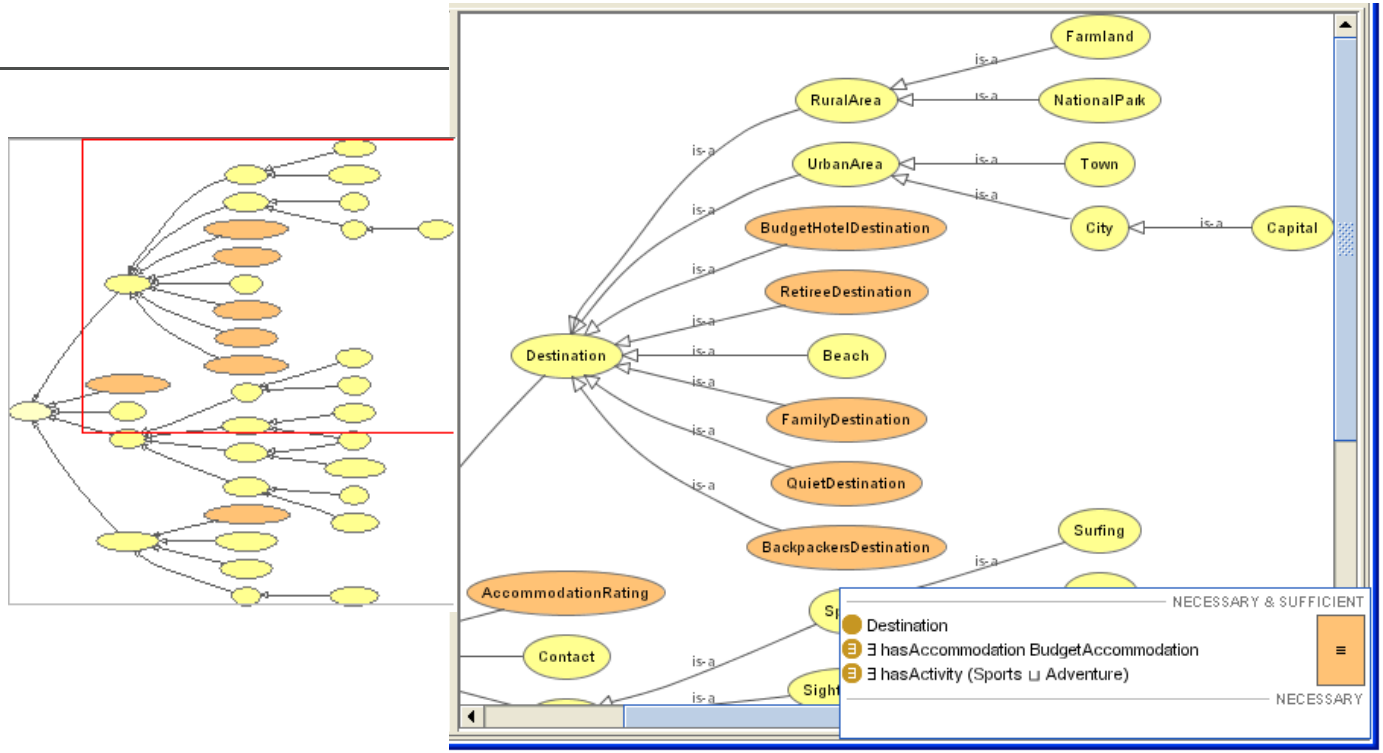
- Graphical representation of taxonomy together with axioms.



SWRL Rules

Name	Expression
Def-hasAunt	hasParent(?x, ?y) ∧ hasSister(?y, ?z) → hasAunt(?x, ?z)
Def-hasBrother	hasSibling(?x, ?y) ∧ Man(?y) → hasBrother(?x, ?y)
Def-hasDaughter	hasChild(?x, ?y) ∧ Woman(?x) → hasDaughter(?x, ?y)
Def-hasFather	hasParent(?x, ?y) ∧ Man(?y) → hasFather(?x, ?y)
Def-hasMother	hasParent(?x, ?y) ∧ Woman(?y) → hasMother(?x, ?y)
Def-hasNephew	hasSibling(?x, ?y) ∧ hasSon(?y, ?z) → hasNephew(?x, ?z)
Def-hasNiece	hasSibling(?x, ?y) ∧ hasDaughter(?y, ?z) → hasNiece(?x, ?z)
Def-hasParent	hasConsort(?y, ?z) ∧ hasParent(?x, ?y) → hasParent(?x, ?z)
Def-hasSibling	hasChild(?x, ?y) ∧ hasChild(?z, ?y) ∧ differentFrom(?x, ?z) → hasSibling(?x, ?z)
Def-hasSister	hasSibling(?x, ?y) ∧ Woman(?y) → hasSister(?x, ?y)
Def-hasSon	hasChild(?x, ?y) ∧ Man(?x) → hasSon(?x, ?y)
Def-hasUncle	hasParent(?x, ?y) ∧ hasBrother(?y, ?z) → hasUncle(?x, ?z)

- Definition of SWRL rules.

Collaborative Protégé

- is an extension to Protégé.
- supports collaborative ontology editing.
- supports annotation of ontologies and ontology changes.
- supports searching and filtering of annotations.
- supports a voting mechanisms for changes.
- provides two different ways to enable collaborative ontology editing.
  - Multi-user mode
  - Standalone mode

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Multi-user mode:

- Ontology is hosted on server.
- Multiple clients can edit ontology simultaneously.
- Changes introduced by one client become visible to the others immediately.
- Preferred mode Collaborative Protégé should be run in.

Standalone mode:

- Multiple users access one ontology in succession.
- Ontologies are stored on a shared drive.
- Users access the same project files.
- Parallel access is not possible.

Collaborative Protégé con't

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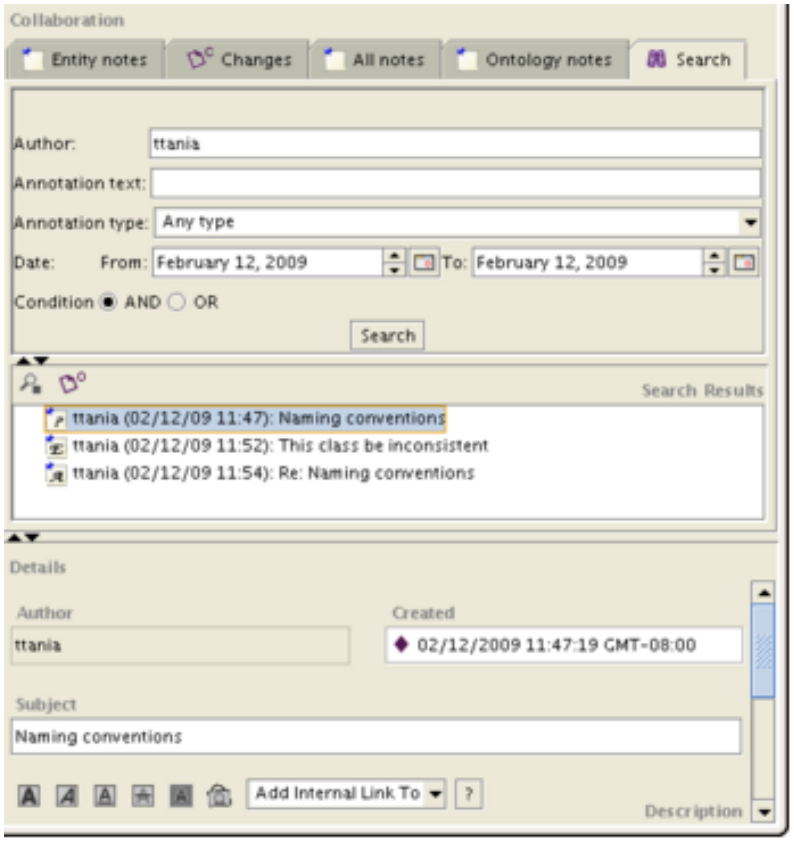
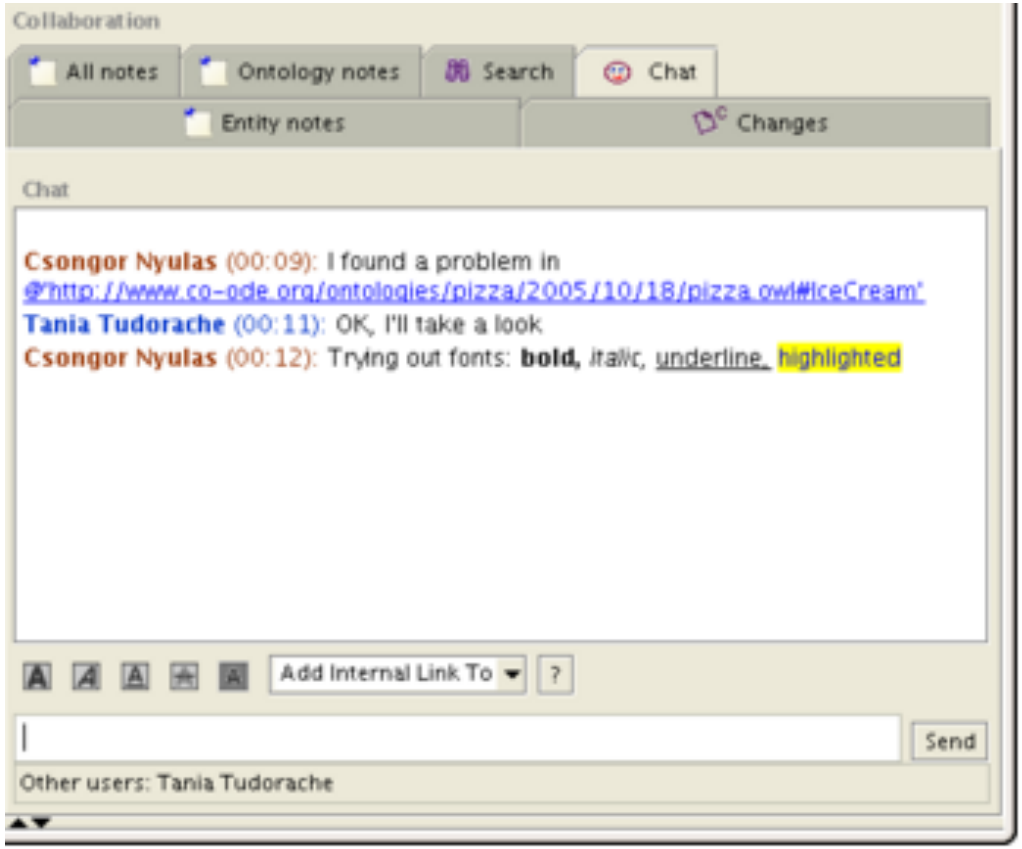
- Searching notes from other users based on certain criteria.



- Chating with other users while working on one ontology.



Semantic Media Wiki

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Semantic Media Wiki

- Extension of Media Wiki (Wikipedia).
- Tool for semantic annotation of Wiki content
- Search, organise, tag, browse, evaluate and share content.
- Adding semantic annotations to the traditional Media Wiki.
- Enables machines to understand and evaluate texts.
- Available at http://semantic-mediawiki.org/wiki/Semantic_MediaWiki

Semantic Media Wiki provides:

- Autmatically-generated lists: manually updated lists are error prone, computationally created lists are always up-to-date and can be customized easily.

- Visual display of information: additionally to lists SMW provides much richer views like calendars, timelines, graphs, maps and others.

- Improved data structure: reduces complexity by using queries to structure data, provides templates to create structure and forms which facilitate the addition of semantic information.

Semantic Media Wiki Benefits

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- Searching information: users can access information through the formulation of their own queries.
- Inter-language consistency: redundant data distributed over different languages can be expressed semantically. That ensures consistency among the used languages and enables the reuse of information.
- External reuse: SMW can serve as a source of data for certain applications by providing the means to export content in formats like CSV, JSON and RDF.

Semantic Media Wiki Namespaces

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- In SMW, content is divided by using namespaces.
- Those are e.g. „Category:“, „Property:“, „Special:“, „Help:“, „User:“.
- Some of them are editable by every user, some cannot be edited at all and some other need authentication before being displayed.
- When a page is edited, the old version is not deleted.
- This enables recovery in case of vandalism or spam.
- Each page can contain text, images, files, internal and external links...

Semantic Media Wiki Editing

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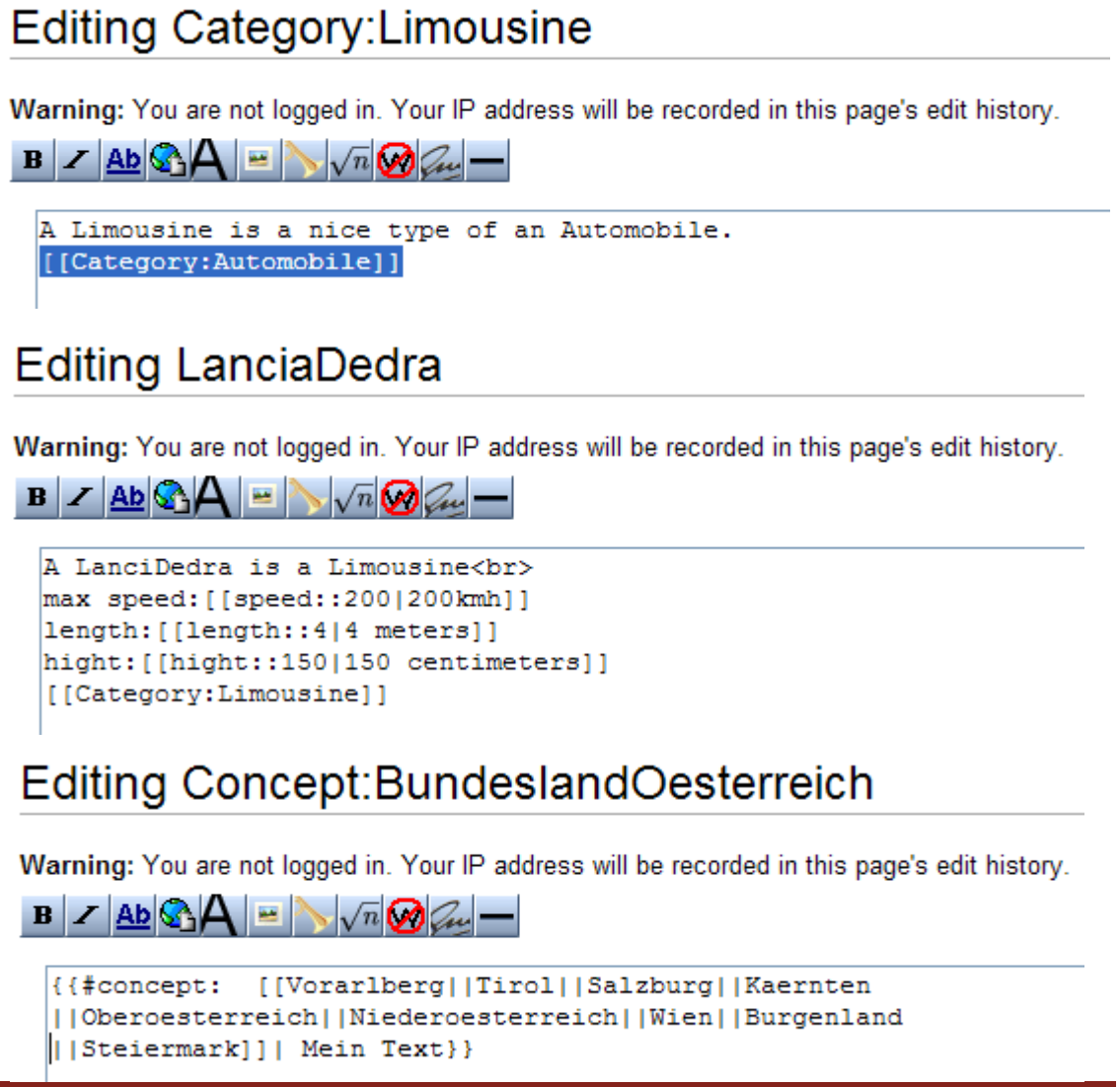
- Creating a taxonomy of categories via [[Category:Supercategory]]
- Typing of an element via [[Category:CategoryXYZ]]
- Assigning property/value pairs via [[PropertyXYZ::Value]]
- Creating concepts for automatic list generation via {{#concept: [[List elements]]}}



Semantic Media Wiki Browsing

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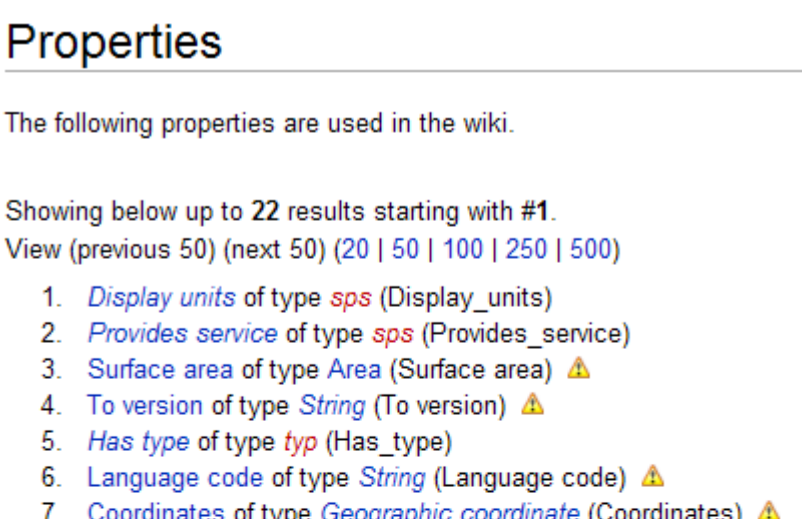
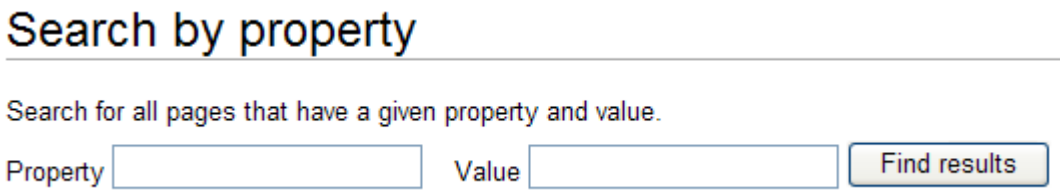
- Semantic browsing via Special:Browse interface.

- Viewing all properties, types and values via Special:Properties (not only for properties but many more).



- The factbox summarizes the semantic data of each page.

- Simple search interfaces for different types of searches.



Semantic Media Wiki Searching

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- Inline queries dynamically include query results into pages. A query created by one user can then be used by many others.

```
{{#ask: [[Category:City]] [[located in::Germany]]
| ?population
| ?area#km² = Size in km²
}}
```

	Population	Size in km²
Berlin	3,391,407	891.69 km²
Hannover	515,772	
Munich	1,259,677	310.46 km²
Stuttgart	595,452	207.458 km²

- Concepts store queries on pages which can be viewed as dynamic categories. Concepts are computationally created collections of pages.

```
{{#concept:  [[Category:Event]] [[start date::> Jan 1 2008]] [[start date::< Dec 31 2008]]
| Events in the year 2008 that have been announced on semanticweb.org.
  To add more events, go to the page "Events" on semanticweb.org.
}}
```

- The Special:Ask page uses a query and additional options to display information in a structured, however not persistent manner.

Query

```
[[Located in::Germany]]
```

Additional printouts (optional)

```
?Category
```

[Add sorting condition]

Find results | Hide query | Querying help

Previous **Results 1– 5** Next (**20** | 50 | 100 | 250 | 500)

	Category
Baden-Württemberg	Category:Sample pages
Berlin	Category:City Category:Sample pages
Hannover	Category:City Category:Sample pages
Munich	Category:City Category:Sample pages
Stuttgart	Category:City Category:Sample pages

Previous **Results 1– 5** Next (**20** | 50 | 100 | 250 | 500)

Web Service Modeling Toolkit

WSMT Scope and Functionality

- The WSMT is an Integrated Development Environment (IDE) for the development of Semantic Web Services
- Aims to support the engineer through the Software Development Cycle (SDC) of Semantic Web Services
  - Improve Engineer Productivity
  - Aid in adoption of WSMO, WSML, SEE
  - High quality tools
  - Eclipse based
- Development of WSMO Semantic Descriptions through WSML
  - Ontologies
  - Goals
  - Web Services
  - Mediators
- Interfacing with Semantic Execution Environments
  - WSMX
  - IRSIII
- Creation of Mediation Mappings between Ontologies
  - Abstract Mapping Language (AML)

WSMT Perspective

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- Semantic Execution Environments need Ontologies, Goals, Web Services, and Mediators in order to function
- Provide support to the engineer in creating these descriptions
- Provide mechanisms for browsing semantic descriptions to aid in developer understanding
- Abstract the developer from the underlying syntax
- Assist in the validation and testing of semantic descriptions

WSMT Text Editor and Form Based Editor

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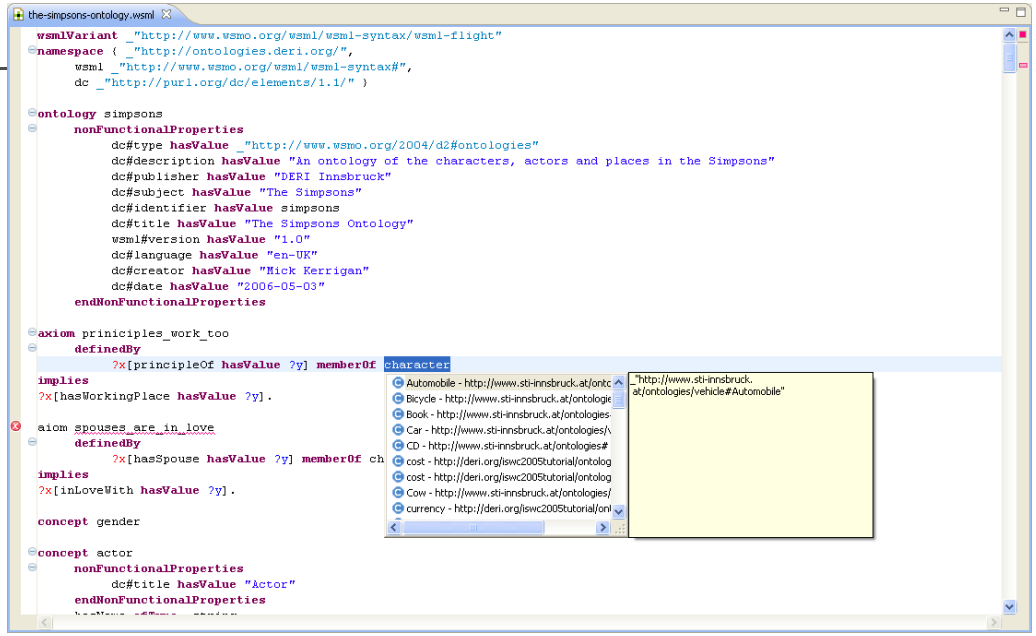
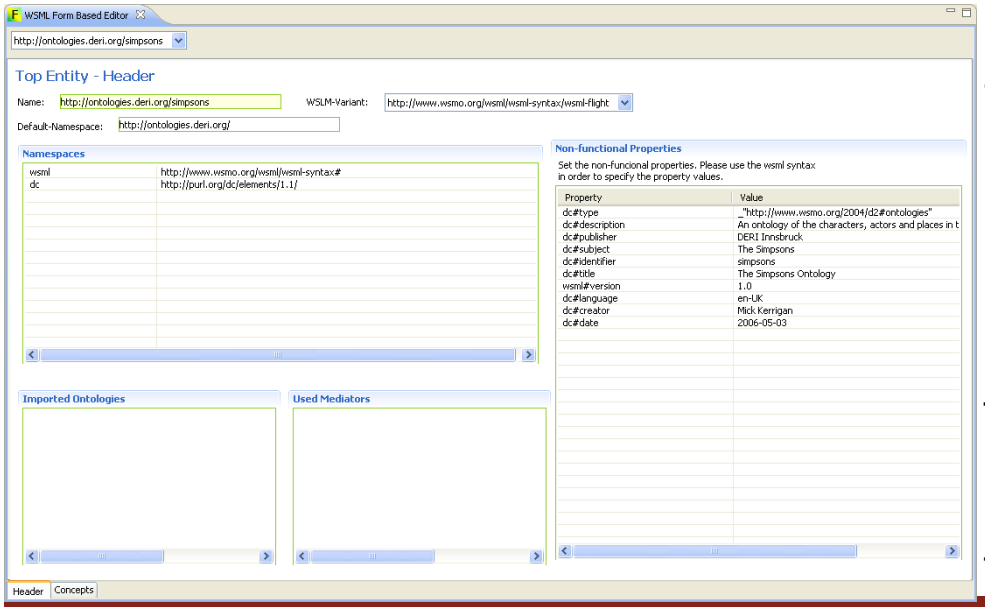
- Abstracting from syntax is good but…
- Existing developers familiar with the syntax
- Certain tasks are just easier with a textual representation
- WSML Human Readable Syntax is designed to be light
- Must support the more experienced developer

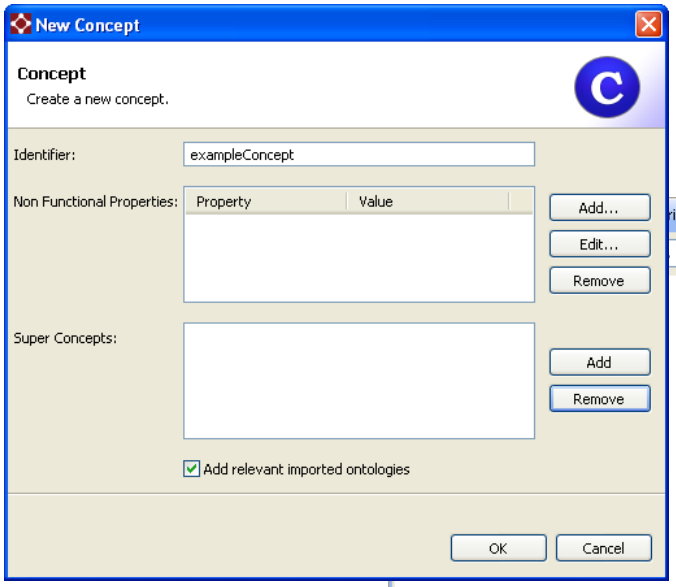


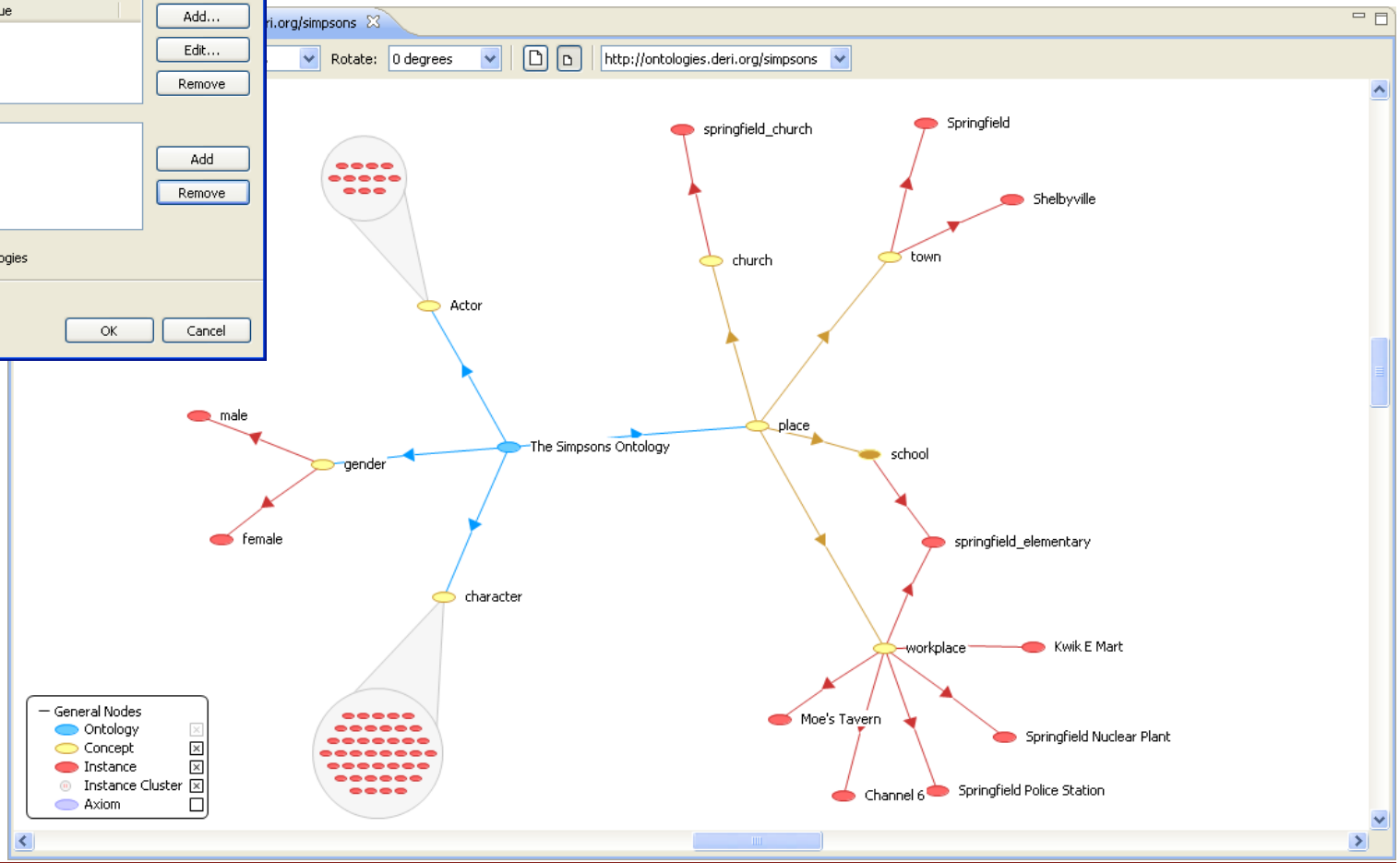


- Abstracts developers from the WSML syntax allowing them to focus on the modeling task at hand
  - Improved Developer focus
  - Reduced Errors in semantic descriptions
  - Less keystrokes improves speed of creation
- Descriptions are broken up into tabs to keep the forms small
- Forms consist of Text fields, combo boxes and tables

WSMT Entity creation and WSMT Navigator

- Entity creation
  - WSMT Navigator





WSMT Interoperability and Validation

- WSML ontologies can be transformed to OWL and RDFS to enable Web compliance
- WSMT can perform this transformation within the WSML Navigator
- Existing RDFS or OWL files can be transformed into a WSML representation
- WSML can be transformed in the RDFS or OWL depending on the WSML variant

WSMT Interoperability and Validation

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- WSMO4J parser used to validate syntax
- WSMO4J validator used to validate semantics
  - Ensures features within the semantic description match that of the specified WSML Variant (Errors)
  - Checks for unrecommended usage of WSML Features (Warnings)
- Discovery engine used to validate Web Services and Goals
  - Compliance to structure of discovery approaches
- All files automatically checked as they are changed
- Immediate feedback to the user in each editor

WSMT-Testing

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- Testing software usually involves deploying it and ensuring that it functions as expected
- Involves a costly Deploy-Test-Redeploy cycle
- Support within an IDE for testing software in its natural habitat can vastly reduce this iterative process
  - Reduces the cost of development
  - Improves developer productivity
  - Reduced developers involvement in tedious tasks
- Correctness of a semantic description is more than just having a valid description

WSMT Testing Ontologies, Web Services and Goals

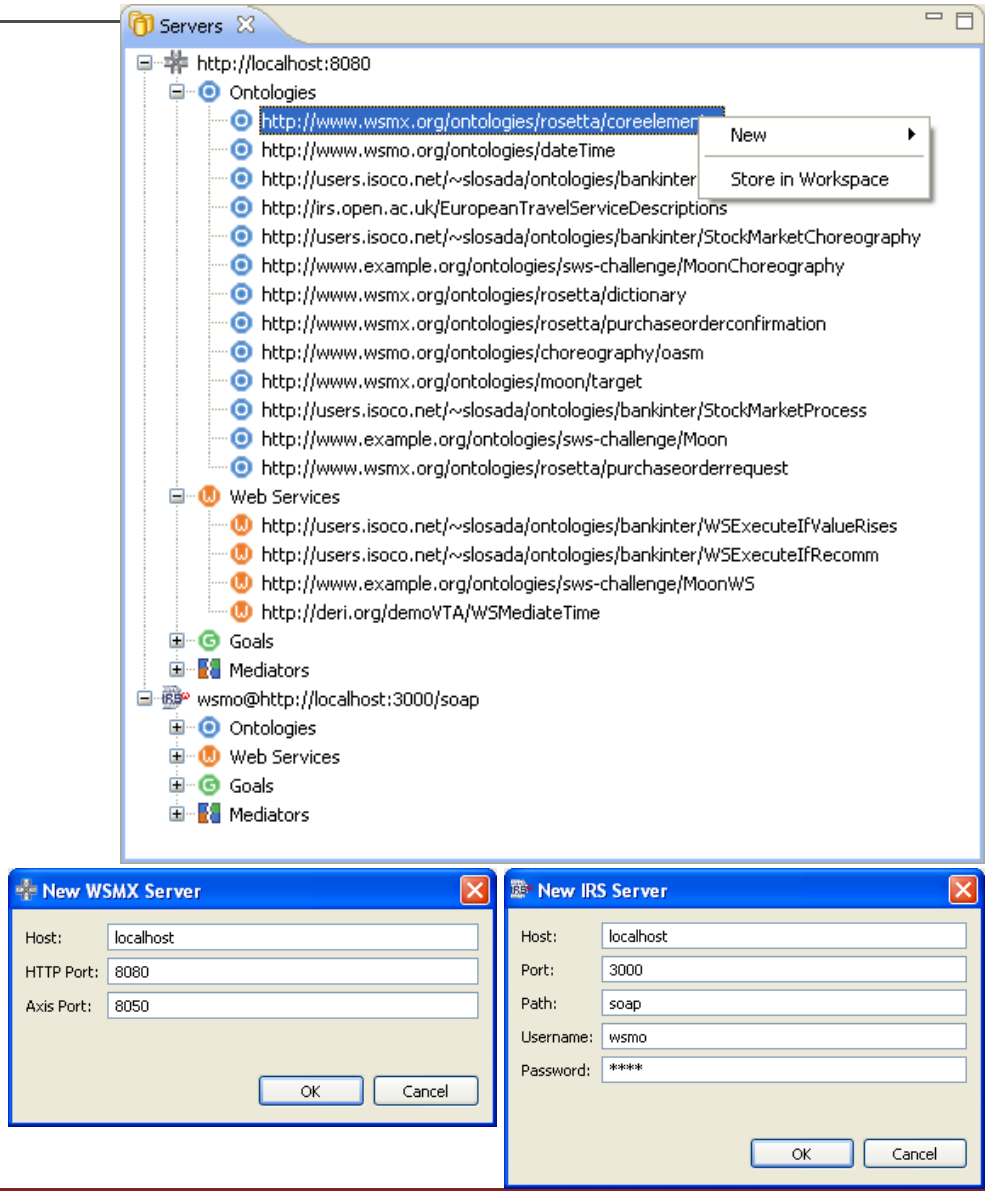
- Ontologies underlie every other semantic description in WSML
- The developer needs to be sure that each ontology behaves as expected when used in a reasoner
  - Is the ontology consistent?
  - Does is answer queries in the manner expected?
- Access to reasoners for each of the WSML Variants is thus required within the WSMT
- Allow users to perform reasoning operations over the ontology currently being edited

WSMT Testing Ontologies, Web Services and Goals

- A Semantic Web Service that does not match the Goals it is expected to match could result in the loss of a lot of money
- Developers need to ensure that the Web Service descriptions that create match Goals as expected
- Tool support reduces the number of interactions with a testing SEE
- Quite likely that provider will issue sample Goals with their Web Service descriptions.
- Ensuring your Web Service descriptions are found by your competitors sample Goals could provide a competitive advantage.

WSMT-Interfacing with a SEE

- In order for a SEE to correctly function the necessary Ontologies, Goals, Web Services and Mediators need to be available to it
- Manually deploying descriptions to a SEE or manually retrieving them in order perform maintenance is a tiresome and lengthy process
- Automated tools for interfacing with the Web Services exposed by a SEE enable these actions to be reduced to one or two clicks of a mouse.
- The SEE perspective contains all the functionality necessary to deliver this tool support to the developer



EXTENSIONS

Ontology editors (Extensions)

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- Protege (today) http://protege.stanford.edu
- Neon Toolkit: www.**neon-toolkit**.org
- myOntology: www.myontology.org
- Semantic Media Wiki
  - HALO extension http://www.mediawiki.org/wiki/Extension:Halo_Extension
  - Ontology editor extension http://smw-active.sti-innsbruck.at
- DOGMA Modeler http://starlab.vub.ac.be/website/node/47
- OntoStudio http://www.ontoprise.de/
- TopBraid Composer http://www.topbraidcomposer.com/

Ontology alignment (Extensions)

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- Various algorithms and methods
- AUTOMS
- FOAM
- ... Many more
- Alignment API http://alignapi.gforge.inria.fr/
  - Allows using various algorithms for alignment
- http://ontologymatching.org

Reasoners (Extensions)

- AllegroGraph http://agraph.franz.com/
- Fact http://www.cs.man.ac.uk/%7Ehorrocks/FaCT/
- Pellet http://clarkparsia.com/pellet
- Racer http://www.racer-systems.com/
- IRIS http://www.sti-innsbruck.at/
- OWLIM http://http//ontotext.com/owlim/
- KAON http://kaon2.semanticweb.org/

Storage (Extensions)

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- OWLIM http://http//ontotext.com/owlim/
- Sesame http://openrdf.org/
- YARS http://sw.deri.org/2004/06/yars/
- Allegrograph http://agraph.franz.com/
- Jena http://jena.sourceforge.net/
- Virtuoso http://virtuoso.openlinksw.com/
- Redland http://librdf.org/

SUMMARY

Summary

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- Tools addressing different areas of semantic technologies:
  - Ontology editors
  - Ontology alignment
  - Semantic wikis (see lecture on Social Semantic Web)
  - Games for semantic content creation (see lecture on Social Semantic Web)
  - Reasoners
  - Storage
  - Semantic annotation tools for different types of content (see lecture on semantic annotation)
  - Semantic Web service development tools
- An up-to-date overview: http://semanticweb.org
- Today‘s selection:
  - Protege
  - Semantic MediaWiki
  - WSMT

References

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- Racer http://www.racer-systems.com/
- IRIS http://www.sti-innsbruck.at/
- OWLIM http://http//ontotext.com/owlim/
- KAON http://kaon2.semanticweb.org/
- OWLIM http://http//ontotext.com/owlim/
- Sesame http://openrdf.org/
- YARS http://sw.deri.org/2004/06/yars/
- Allegrograph http://agraph.franz.com/
- Jena http://jena.sourceforge.net/
- Virtuoso http://virtuoso.openlinksw.com/
- Redland http://librdf.org/

Next Lecture

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Questions?

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