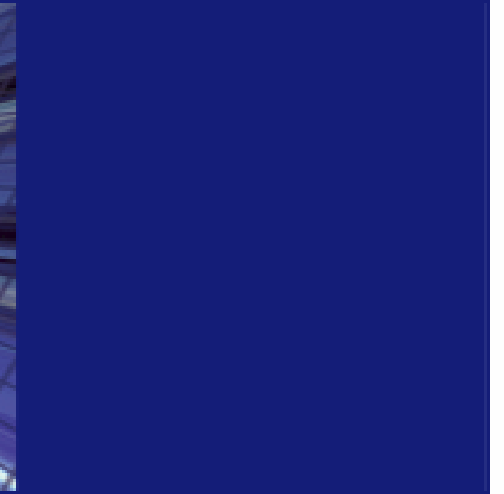
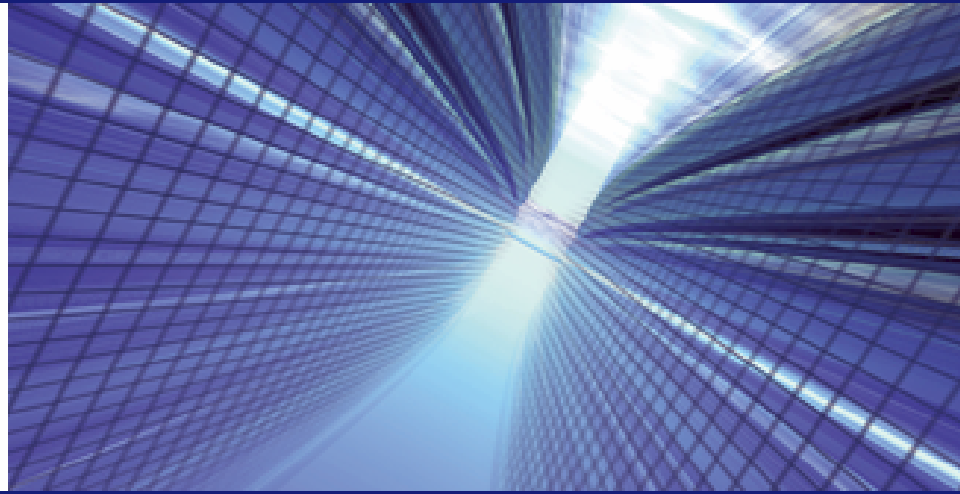




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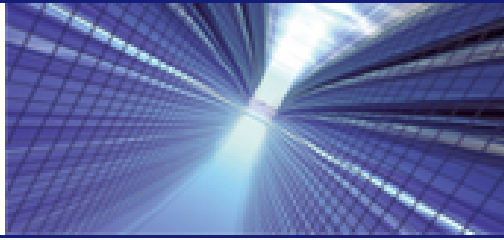
Hands on Session:

Ontology Engineering using Next Generation Semantic Web Technologies

Enrico Motta, Mathieu d'Aquin

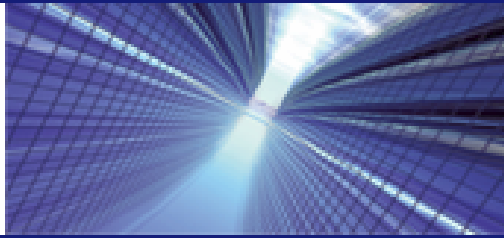
The Knowledge Media Institute, The Open University

e.motta@open.ac.uk, m.daquin@open.ac.uk



Outline

- **Scenario: Picture Annotation with Tags**
Where we discuss bringing semantics to multimedia
- **Goals of the Hands On Session**
Where we discuss what we will learn
- **Schedule**
Where we structure the session
- **Brief Description of the Tools**
Where we look at the technical/technological aspects
- **Discussion**
Where we reflect on what we have done

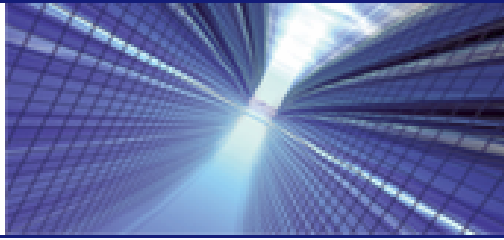


Real life scenario

- Enhancing the **Corel Stock Photo Library** with an ontology
- The **Corel Stock Photo Library**:
 - Collection of CD's containing 100 images, each of a certain theme
 - Used in many publications to demonstrate the performance of information retrieval systems
- We are working with a subset of:
 - 5,000 images
 - 108 visual terms (annotations of the images) related to animals and plants



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Some examples



clouds hills sun tree

A photograph of a sunset over a landscape. The sun is low on the horizon, casting a warm orange glow. Silhouettes of trees and hills are visible against the bright sky.

dunes pattern sand
valley

A photograph of a vast sand dune landscape. The dunes are covered in a rhythmic, wavy pattern of sand, with mountains visible in the background under a clear sky.

coral ocean
reefs

A close-up photograph of a coral reef. The coral is a vibrant yellow-orange color, with a complex, branching structure.

bear ice polar snow

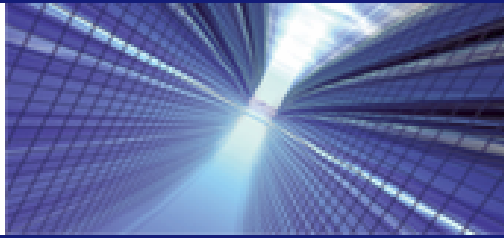
A photograph of a polar bear resting on a piece of ice. The bear is white, and the ice is surrounded by dark water.

formation plane
prop sky

A photograph of four biplanes flying in a formation. They are leaving white smoke trails behind them against a clear blue sky.

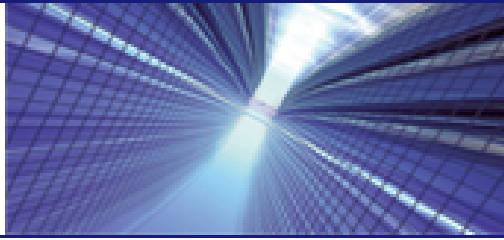
bridge lighthouse
railroad water

A photograph of a coastal scene. A bridge spans a body of water, and a lighthouse is visible on a cliff in the background. The sky is blue with some clouds.



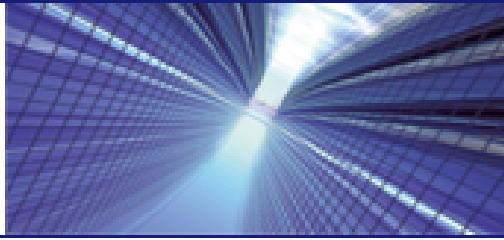
Vocabulary: 108 terms

mountain water tree lake sea
beach people branch leaf
grass palm animals bear
habitat pollination bee petals
blossoms arctic ...



Ontologies for Annotating Picture?

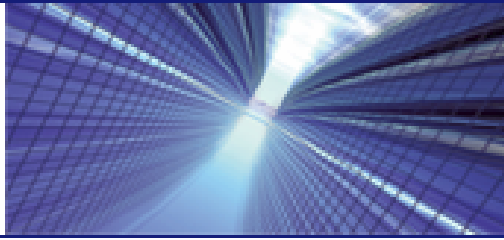
- Ontologies provide an elegant mechanism to formally organize image content in small, logically contained groups (ontological concepts), while enabling them to be linked, merged, and distinguished with other concepts, making possible enhance navigation mechanisms.
- Ontologies enable to infer that pictures implicitly refer to particular concepts, without having to assert it explicitly, semantically improving picture annotation, and therefore search.
- Ontologies provide an accepted standard, allowing other individuals to process the image collection that has been annotated.



Goal of the session

▮ The goal is to build an ontology

- But Why?
 - To experience ontology design and engineering
- And What Else?
 - Combining different sources of knowledge
 - That may be heterogeneous (in format, design, opinion)
 - Implementing your own design choices
 - Exploiting advanced Semantic Web technologies and tools

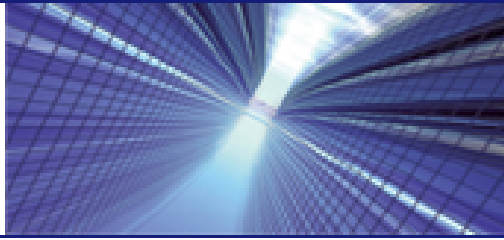


Building An Ontology?

Source Terms/Tags

mountain	mule	butterfly	coral	flowers	Tomato
water	fawn	angelfish	anemone	shrubs	Vegetable
tree	antlers	lion	fish	grizzly	Bee
lake	elk	crab	ocean	cubs	ground
sea	caribou	grouper	sand	plants	forest
people	herd	food	vegetation	rice	fly
branch	moose	Fruit	Wood	lichen	lizard
leaf	mare	cow	cat	pups	goat
grass	foals	vines	tiger	antelope	desert
palm	orchid	Pollination	Bengal	leopard	pepper
birds	lily	Rose	fox	calf	rodent
dog	stems	Tulip	valley	reptile	squirrel
tails	chrysanthemums	horses	sheep	snake	wolf
bear	blooms	petals	den	cougar	bulls
polar	cactus	spider	coyote	porcupine	tortoise
snow	saguaro	elephant	sponges	whales	wings
tundra	giraffe	blossoms	arctic	rabbit	albatross
head	zebra	mushrooms	river	animals	iguana
deer	eagle	lynx	penguin	moss	insect
hawk	Habitat	Species	Country	Japan	Region
Image	Close-up	Man	Woman	Child	August

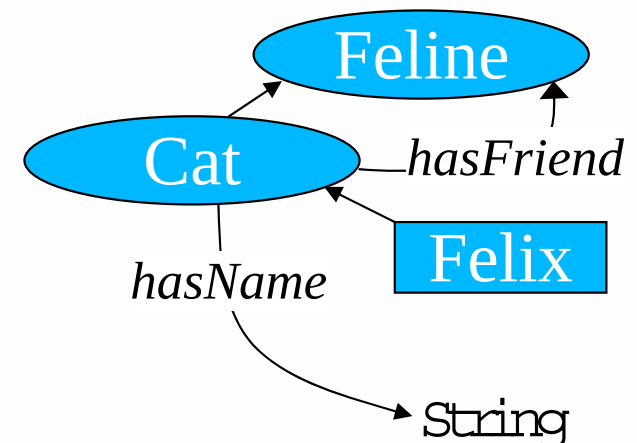
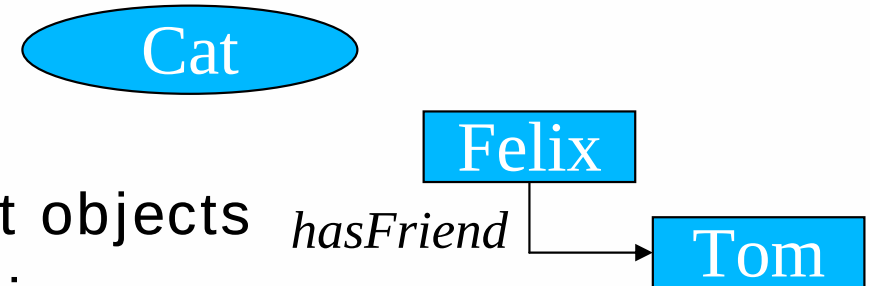
- [illegible]

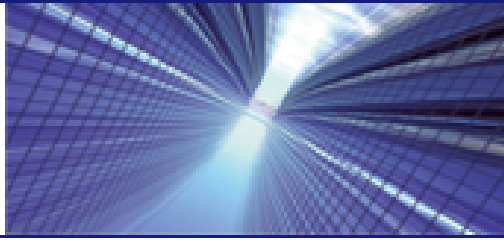


Building an ontology? What does it mean?

Ontology: classes, properties and individuals.

- **Classes** represent sets of objects
- **Individuals** (instances) represent objects
- **Properties** (slots) represent relations between objects
- Classes are organized in a **hierarchy** (subClassOf), and linked by **axioms** (disjointWith, equivalent)
- Properties are applicable to classes (**domain**) and take values (**range**) in classes or datatypes (e.g. String)
- Individuals have types and properties





Building an ontology? What does it mean?

- **Identifying** the relevant classes

Ex: *Cat, Mouse, Feline, Animal, Cheese*

- **Organizing** them in a hierarchy (from most general to most specific)

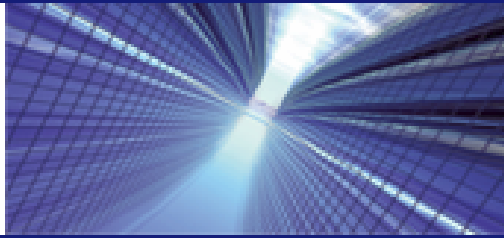
Ex: *Cat subClassOf Feline subClassOf Animal, Mouse subClassOf Animal*

- **Relating** them through other axioms

Ex: *Cat disjointWith Mouse, Cat equivalentTo FelisSilvestrisCatus*

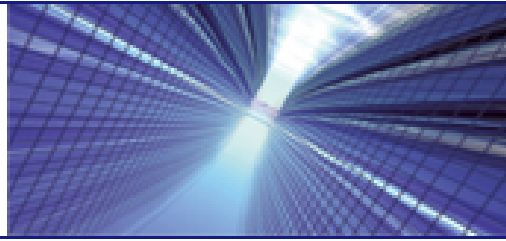
- **Relating** them through properties (or slots)

Ex: *Animal - hasName -> String, Animal - hasParent -> Animal, Cat - hasFriend -> Feline*



Building an ontology? What does it mean?

- Later steps (that we won't have the time to do):
 - **Populating** the ontology with individuals
Ex: Felix is a Cat, Mickey is a Mouse
 - **Describing** Individuals using Properties
Ex: Mickey hasName "Mickey Mouse", Felix hasParent FelixsDad, Felix hasFriend Tom
 - **Evaluating** the Ontology
Is it well designed? Is it covering the domain?
 - **Deploying** the Ontology
Published on the (Semantic) Web.
Exploited in a semantic application.



Building An Ontology? Knowledge Sources

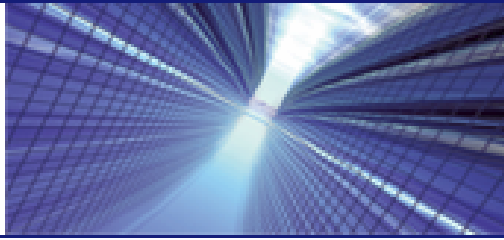
Where to find the knowledge to include in the ontology?

- Whenever you like, but in particular
 - On the **Web**, using google, Wikipedia, etc.
 - On the **Semantic Web**, using Watson.



<http://watson.kmi.open.ac.uk>

- [illegible]



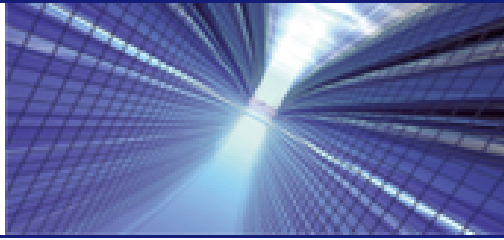
Session Schedule

- **Set up: 15 minutes**
 - Check the installation
 - Find the files
 - Familiarize with the tools
- **Hard work: 60 minutes**
 - Building an ontology...
- **Wrap up: 15 minutes**
 - Discussions

Set up	15h00
Working Hard on building a nice Ontology	15h15
Wrap up	16h15
	16h30



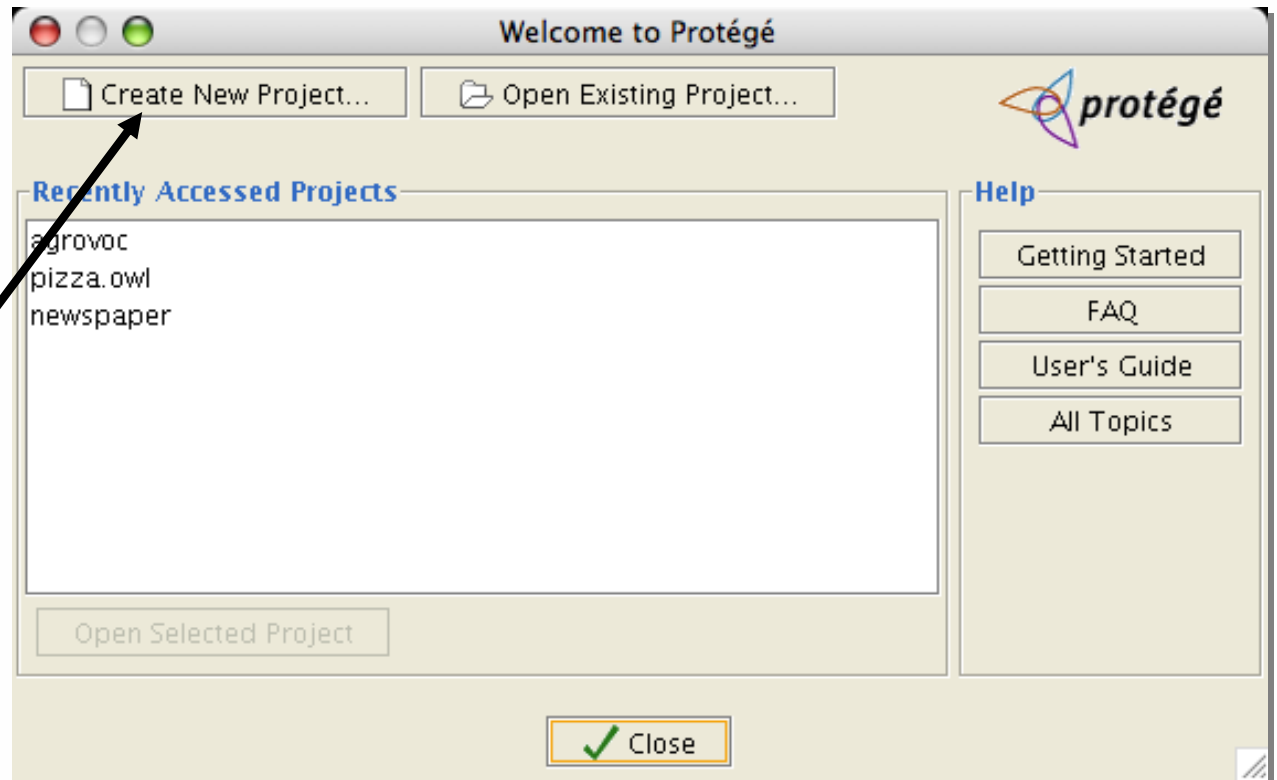
The Open University

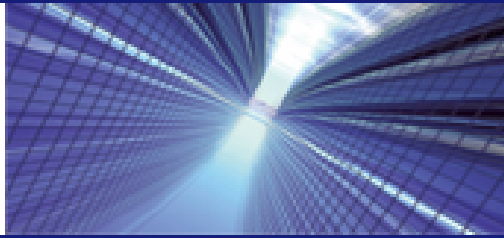


Using Protégé

Open Protégé....

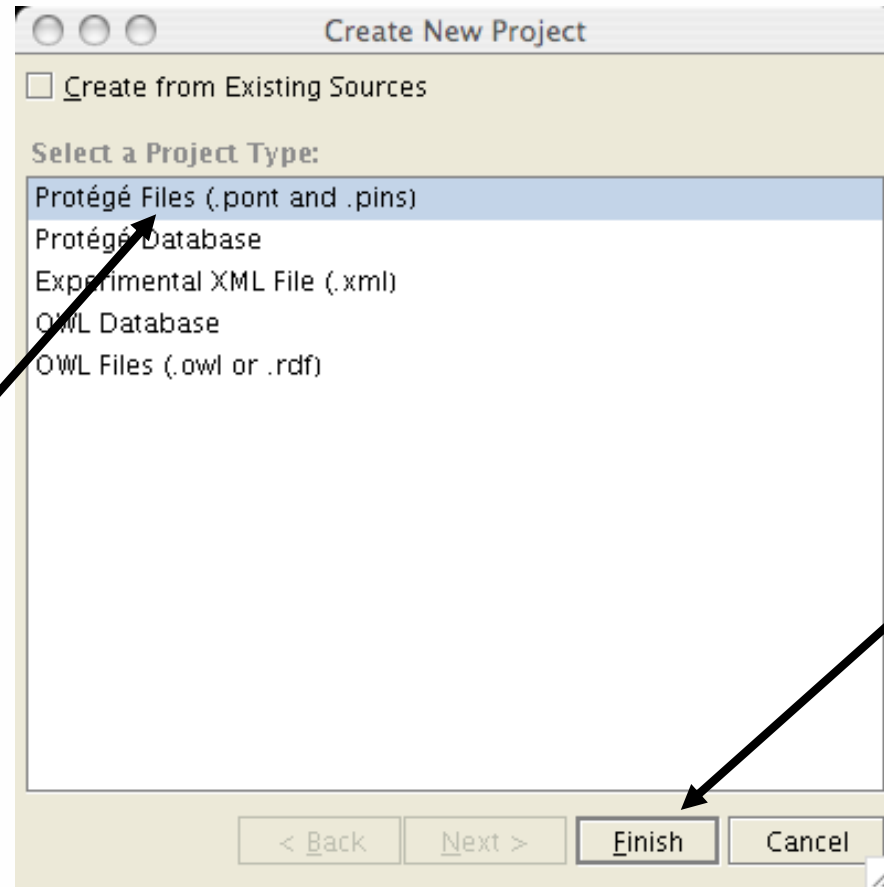
You will get to this window.
Choose “create a new Project”



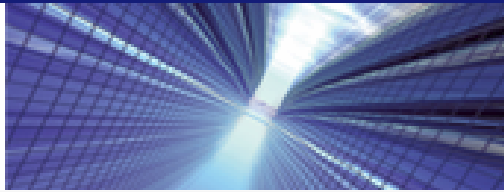


Using Protégé

Here you have
to choose the
format.
Choose
“Protégé Files”



And click
on Finish



Using Protégé

Add/delete Classes

The screenshot shows the Protégé 3.1.1 interface. The **CLASS BROWSER** on the left displays a class hierarchy: **:THING** (parent), **:SYSTEM-CLASS** (child of :THING), **Animal** (child of :SYSTEM-CLASS), **Mouse** (child of Animal), **Feline** (child of Animal), and **Cat** (child of Feline). The **CLASS EDITOR** on the right is for the **Cat** class. It shows the **Name** as **Cat**, **Documentation** as **Cat, like felix**, and **Role** as **Concrete**. The **Template Slots** table lists slots **eats** and **hasName** with cardinality **single** and type **Instance of :THING** and **String** respectively. The **Superclasses** list at the bottom shows **Feline**.

Class hierarchy

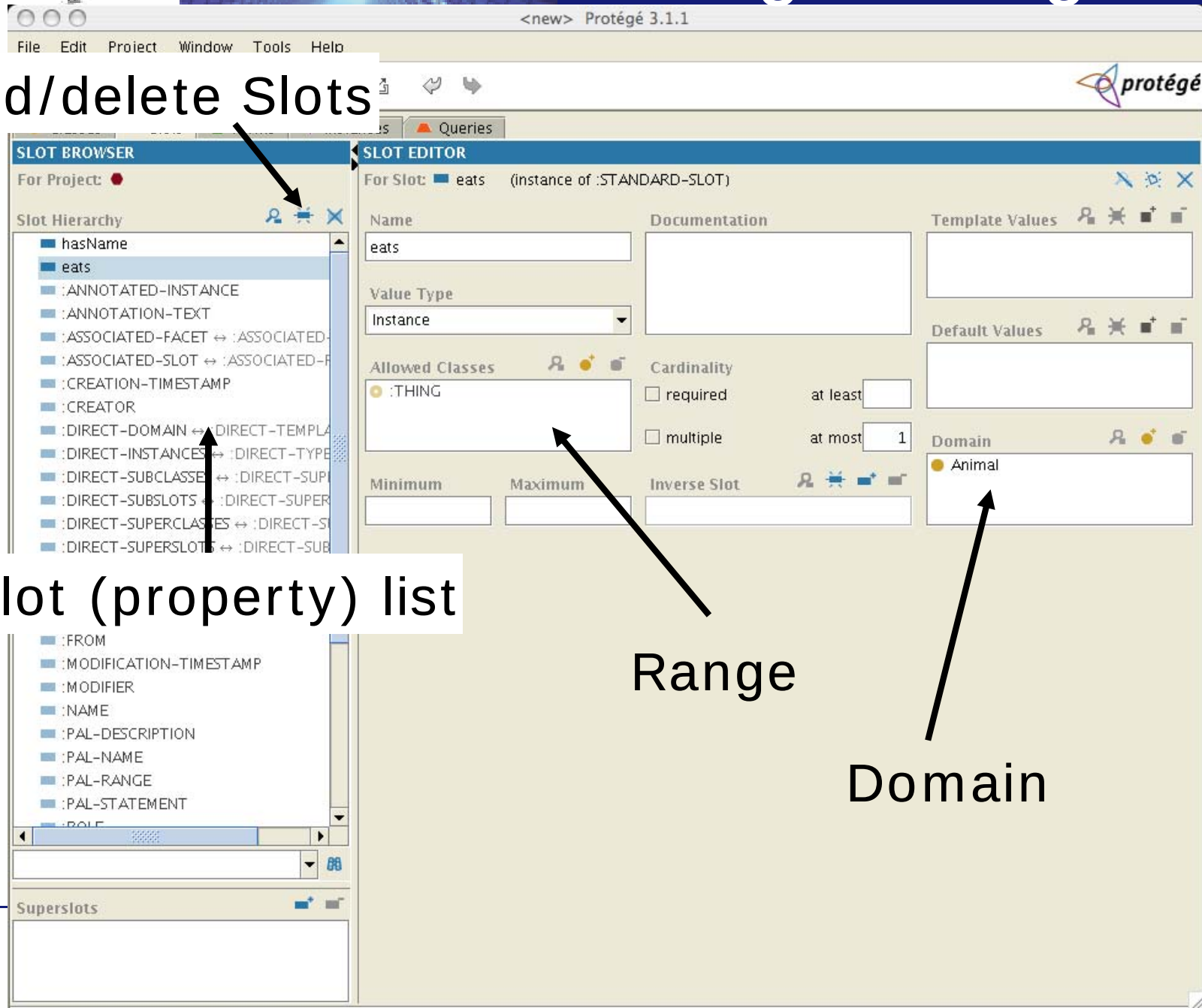
Class description

Class Slots

Name	Cardinality	Type	Other Facets
eats	single	Instance of :THING	
hasName	single	String	

Using Protégé

Add/delete Slots





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Using Protégé

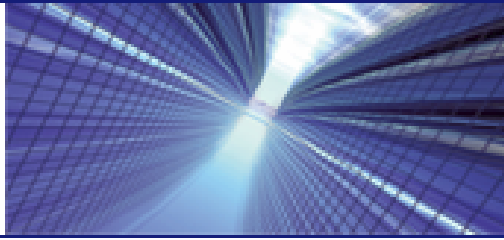
The screenshot displays the Protégé 3.1.1 application window. The interface is divided into three main panes:

- CLASS BROWSER:** Shows the Class Hierarchy. The hierarchy is as follows:
 - :THING
 - :SYSTEM-CLASS
 - Animal
 - Mouse (2)
 - Feline
 - Cat (1)

An arrow points from the text "Class Hierarchy" to the Class Browser pane.

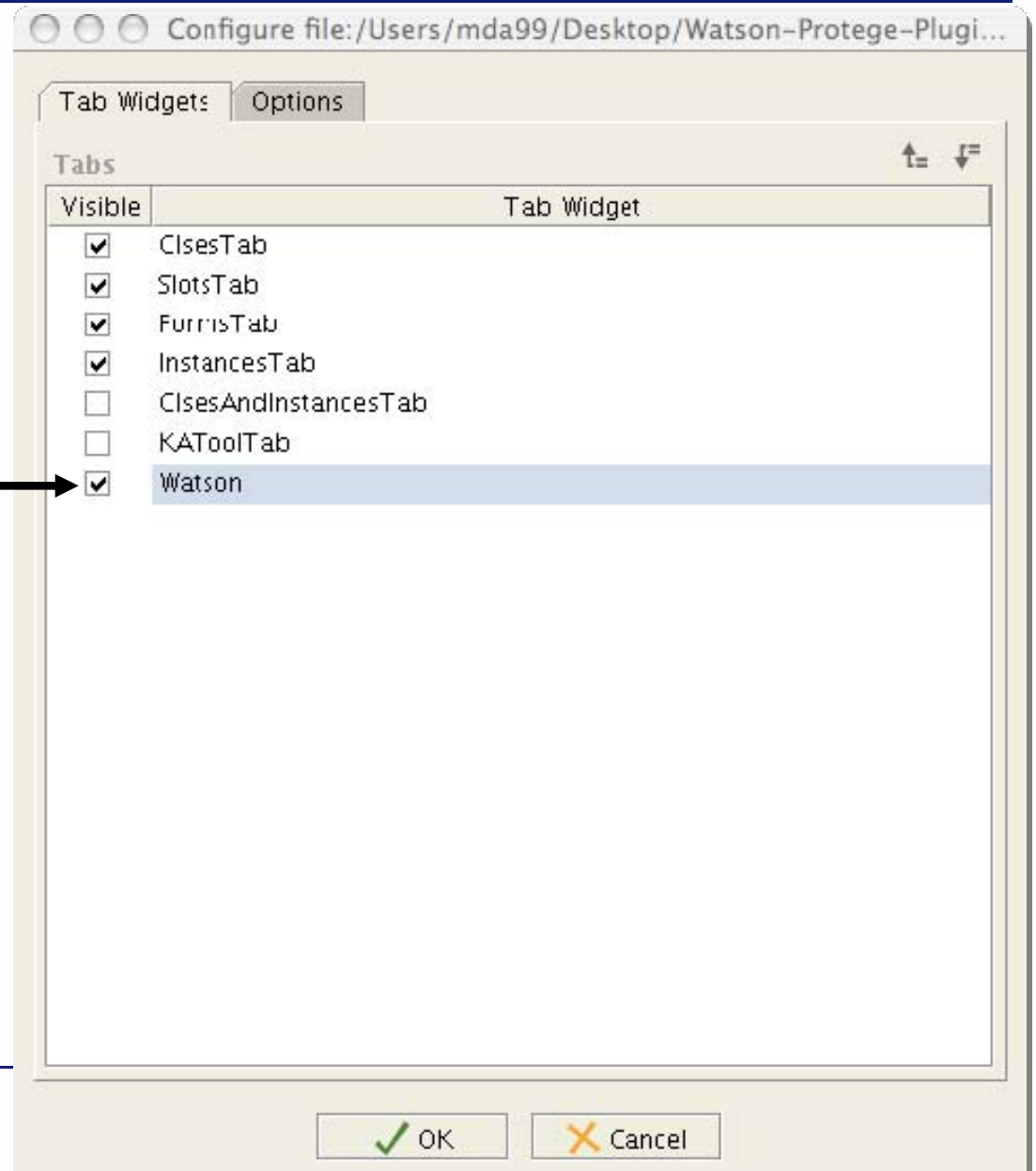
- INSTANCE BROWSER:** Shows the Instance Browser for the selected class, "Cat". It lists instances, including "KB_197421_Instance_7". An arrow points from the text "Add/delete Instances" to the instance list.
- INSTANCE EDITOR:** Shows the Instance Editor for the selected instance, "KB_197421_Instance_7". It displays the instance's properties, such as "HasName" (Felix the cat) and "Eats" (KB_197421_Instance_8). An arrow points from the text "Instance description" to the instance editor pane.

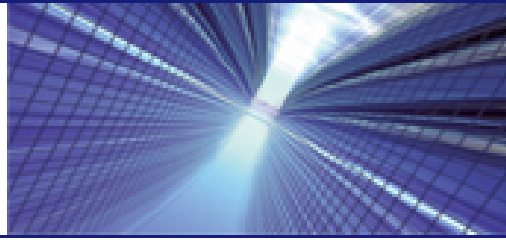
At the bottom of the interface, there is a "Types" pane showing the selected class, "Cat".



Using the Watson Protégé Plugin

In the Project Menu,
chose configure and
tick Watson





Using the Watson Protégé Plugin

3) Obtain descriptions of existing entities

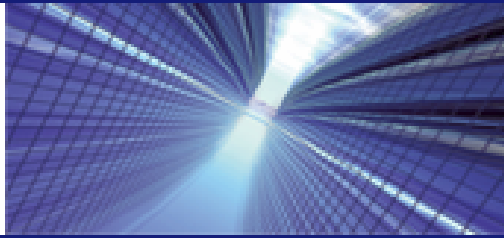
1) Select a class or a slot

2) Click search.
Wait...

The screenshot shows the Protégé 3.1.1 interface with the 'animals' project. The 'Classes' tab is selected in the 'Watson Ontology Reuse' panel. The 'Class Browser' on the left shows a hierarchy where 'cat' is selected under 'animal'. The 'Watson Search' panel at the bottom shows the search term 'cat, cat'. The main panel displays 'Existing descriptions of the class cat' with a table of results. Arrows from the text instructions point to the 'cat' class in the hierarchy, the 'Search' button, and the 'Existing descriptions of the class cat' table.

Existing descriptions of the class cat		
subClassOf	animal	add
creator	"robertsa"	add
comment	""	add
creationDate	"2002-01-25T11:42:23Z"	add
label	"cat"	add
http://www.mindswap.org/2003/owl/pet#Cat		
subClassOf	Animal	add
PetCat	subClassOf	add
label	"Cat"	add
http://cohse.semanticweb.org/ontologies/people#cat		
subClassOf	animal	add
Tibbs	type	add
creationDate	"2003-12-03T15:38:19Z"	add
creator	"seanb"	add
comment	""	add
label	"cat"	add
http://kmi-web05.open.ac.uk:81/cache/3/d95/e13d/b1fbf/6c61e15e52/07dcfd169738ec4f4#cat		
subClassOf	animal	add
comment	""	add

4) Add elements of description to your ontology



Discussion

Topic of your choice or amongst the following

1) How would you evaluate your ontology?

- Is your ontology very different from the ones of other persons? How would you compare?

2) What kind of knowledge representation issues did you encounter?

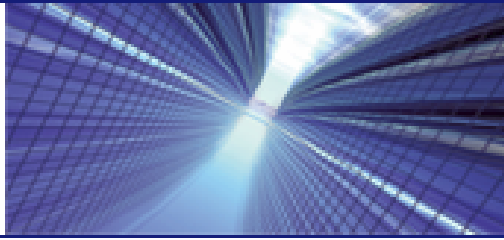
- Did you make particular design choices? Were there other solutions?

3) Are the tools suitable? Helpful?

- Is Protégé easy to use? Powerful enough for your ontology? What about the Watson Protégé plugin?



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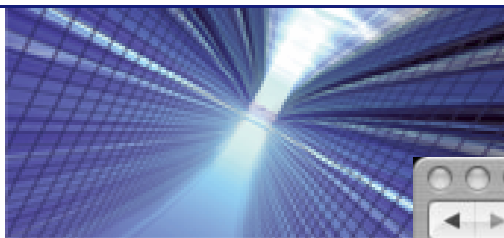


To be continued...

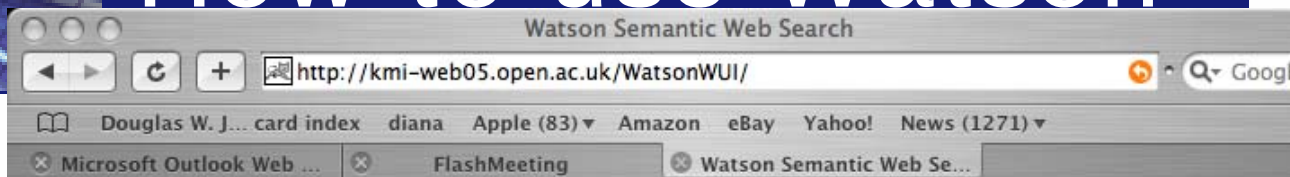
Further questions, discussions
can be sent to
m.daquin@open.ac.uk



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How to use Watson



[Read this](#) - [Check your ontology](#) - [Website](#) - [Blog](#)

cat

[Search Watson](#)

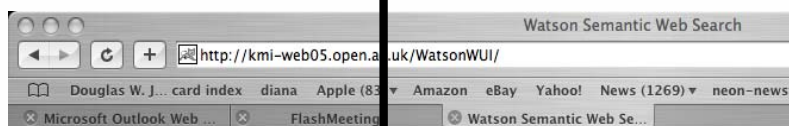
Found 79 semantic documents - [Restrict Search](#)

More Info

Enter Keywords

- 1- <http://www.mindswap.org/2003/submit-rdf/952.rdf>
 - 2 KB - OWL,RDF (OWL FULL) - AL(D)
 - o http://www.example.org/#Danny_Ayers_Cat
 - Label: Danny Ayers Cat
 - Comment:
 - 2- <http://www.cs.vu.nl/~ronny/ontologies/agent1.daml>
 - o <http://kmi-web05.open.ac.uk:81/cache/8/5e4/cb4f/fb2c8/649beac226/254795f56a3497bca#cat>
 - Label: cat
 - Comment:
 - 3- <http://kmi-web05.open.ac.uk:81/cache/b/0b5/f3c4/00feb/c4a5a705d9/75176b488f7b19e36>
 - o <http://cohse.semanticweb.org/ontologies/people#cat>
 - o http://cohse.semanticweb.org/ontologies/people#person_with_dog_and_cat
 - 4- http://fr.jurispedia.org/index.php/Special:ExportRDF/Acte_de_gouvernement_%28fr%29?xmlmime=rdf
 - 3 KB - RDF,OWL (OWL Lite) - AL
 - o http://fr.jurispedia.org/index.php/_Cat-C3-A9gorie-3AFrance
 - o http://fr.jurispedia.org/index.php/_Cat-C3-A9gorie-3ADroit_public_-28fr-29
 - o http://fr.jurispedia.org/index.php/_Cat-C3-A9gorie-3ADroit_administratif_-28fr-29
 - 5- http://fr.jurispedia.org/index.php/Special:ExportRDF/Aide%3AMod%C3%A8les_s%C3%A9mantiques_xmlmime=rdf
 - o http://fr.jurispedia.org/index.php/_Cat-C3-A9gorie-3ASMW

List of ontologies and entities.
Click on the URI to get metadata



watson
exploring the semantic web

[Read this](#) - [Check your ontology](#) - [Website](#) - [Blog](#)

cat mouse

[Restrict Search](#)

- o file:G:\public_html\tutorial\animals-simple-properties.daml#cat

How to use Watson

Look up for an ontological entity - Watson Web Interface

http://kmi-web05.open.ac.uk/WatsonWUI/entity_look_up.html#ht

Douglas W. J... card index diana Apple (83) Amazon eBay Yahoo! News (1271)

 Details for <http://cohse.semanticweb.org/ontologies/people#cat>
[Back](#)

- In <http://www.cs.man.ac.uk/~horrocks/Teaching/cs646/Labs/people+pets.daml>
 - Class
 - label: cat
 - creator: seanb
 - creationDate: 2003-12-03T15:38:19Z
 - comment:
 - subClassOf: <http://cohse.semanticweb.org/ontologies/people>
- In <http://kmi-web05.open.ac.uk:81/cache/0/c07/1f24/5d910/a3a7e2>
 - Class
 - comment:
 - label: cat
 - disjointWith: <http://cohse.semanticweb.org/ontologies/people>
 - subClassOf: <http://cohse.semanticweb.org/ontologies/people>
- In <http://cohse.semanticweb.org/ontologies/people>
 - Class
 - label: cat

Metadata about
an entity

Metadata about
an ontology

Ontology Details

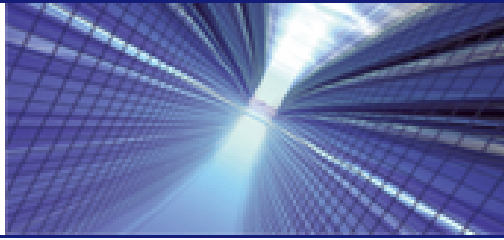
http://kmi-web05.open.ac.uk/WatsonWUI/onto_check.html#http://www.cs.m

Douglas W. J... card index diana Apple (83) Amazon eBay Yahoo! News (1271)

 Details for <http://www.cs.man.ac.uk/~horrocks/Teaching/cs646/Labs/people+pets.daml>
[Back](#)

[Get cached file](#) - [Query with SPARQL](#) -

Size of the file	78 KB
Representation languages	RDF,RDF-S,DAML+OIL
OWL sub-language	-
Employed DL	ALH(D)
Number of classes	59
Number of properties	15
Number of individuals	19
Locations	http://www.cs.man.ac.uk/~horrocks/Teaching/cs646/Labs/people+pets.daml



Categories

- The collection is divided into the following categories:

Sunrises & Sunsets

Hong Kong

Images of Thailand

Los Angeles

Underwater Reefs

Tropical Plants

English country gardens

Arabian Horses

Wildlife of Galapagos

North America Deer

African specialty animals

Images of Death Valley

Swimming Canada

Land of the Pyramids

Alaskan Wildlife

Indigenous People

Mayan and Aztec Ruins

Air shows

Denmark

Ireland

Bridges

New York City

Polar Bears

Steam Trains

Spirit of Buddha

California Coasts

Bears

Images of France

Foxes & Coyotes

Nesting Birds

Israel

Ice & Frost

Beaches

Zimbabwe

Tigers

Nepal

Peru

Canadian Rockies

Fiji

Holland

Auto racing

Rural France

Namibia

Hawaii

Greek Isles

North American Wildlife

Flowers

Bonny Scotland

Aviation Photography