

Protégé-OWL and the Semantic Web

8th Int. Protégé Conference, Madrid, July 2005

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The Semantic Web

Vision



Standards



Technology



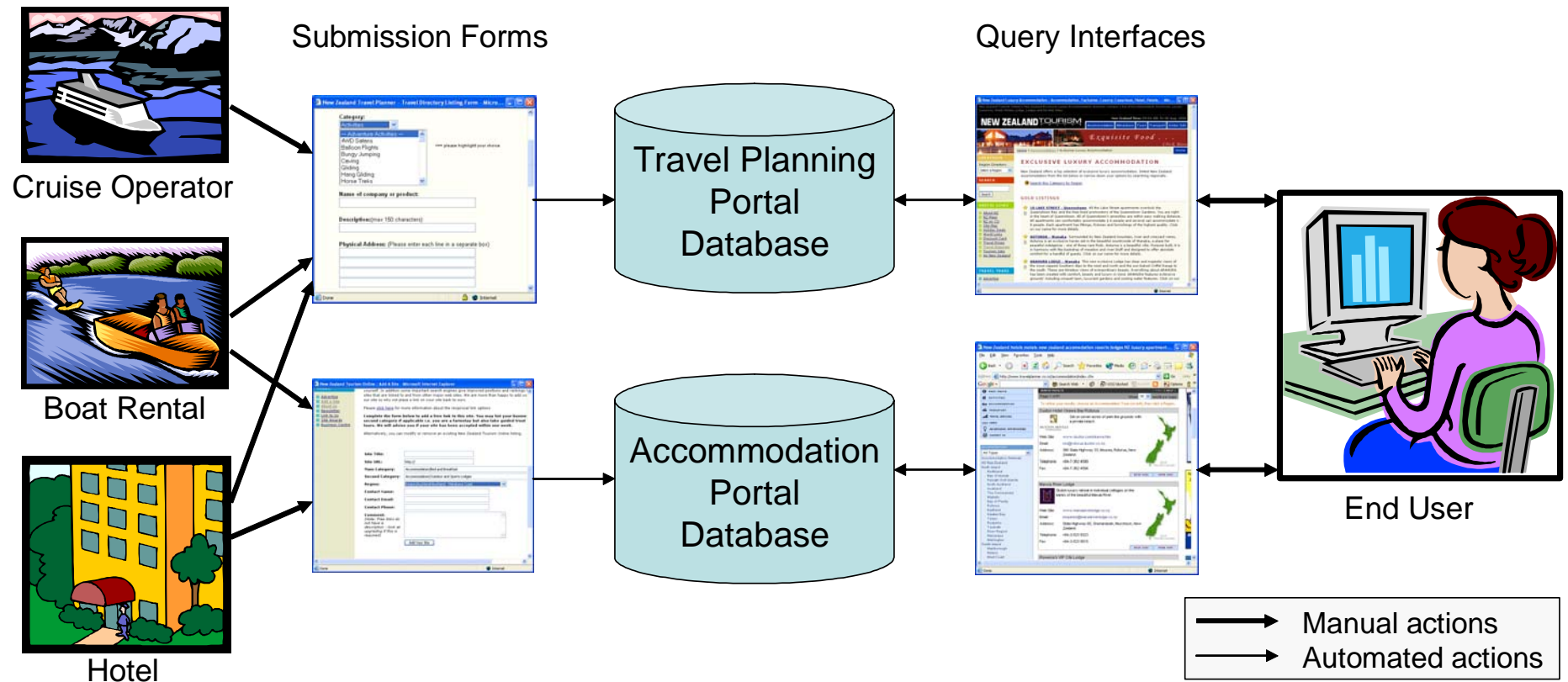
Example Scenario

The image displays two overlapping screenshots of early 2000s web browsers, illustrating an example scenario for a web application.

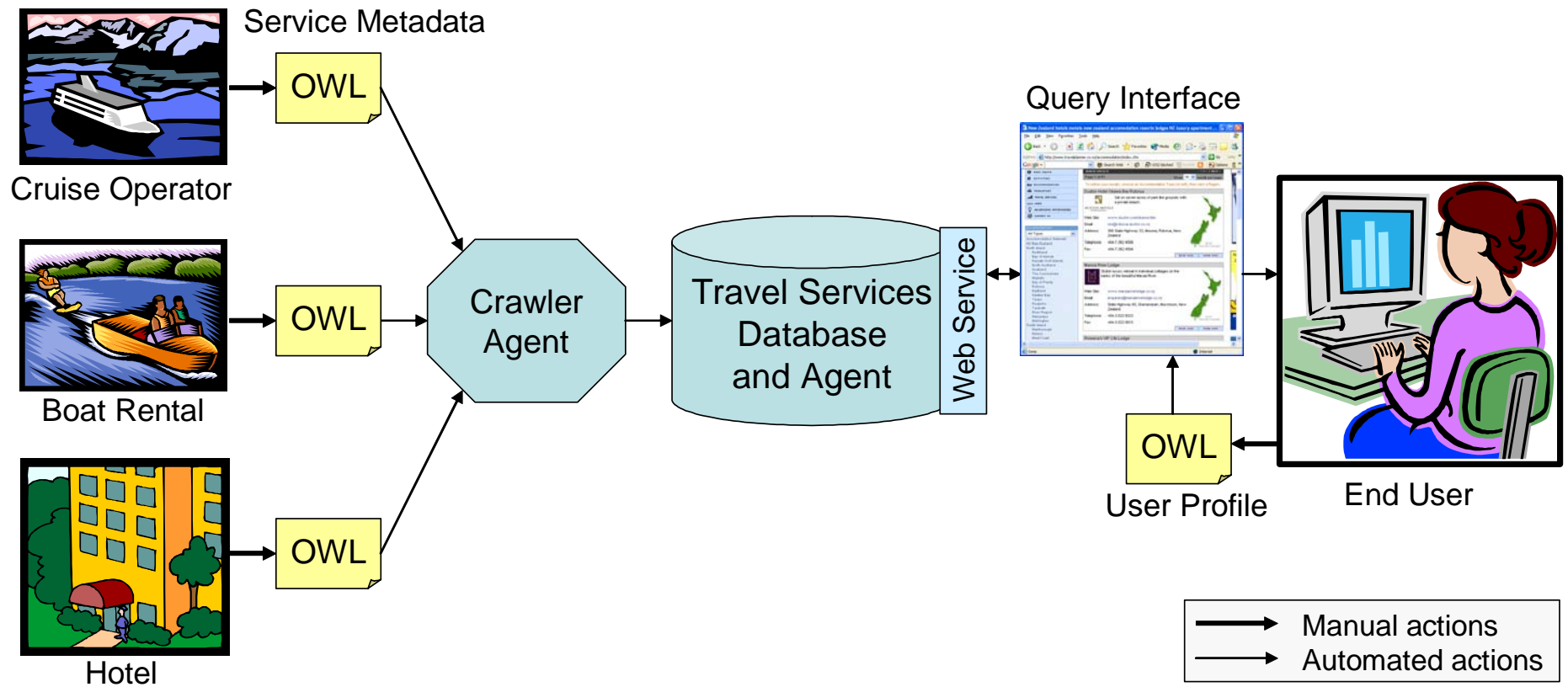
Left Browser Window: The title bar reads "New Zealand Tramping : Tramp, Walk, Walks, Walking, Guide, Guides, Guided, Hike, Hiking, Glacie - Microsoft Intern...". The address bar shows "http://www.tourism.net.nz/attractions-and-activities/tram...". The page features a "NEW ZEALAND TOURISM ONLINE" banner with a hot air balloon. Below the banner, there are sections for "LOCATIONS" (Region Directory), "SEARCH" (Search Web), and "USEFUL LINKS" (About NZ, NZ Maps, NZ on CD, Site Map, Holiday Deals, World Links, Discount Card, Travel Prizes, Travel Enquiries, Tourism Jobs, Air New Zealand). The main content area is titled "TRAMPING, HIKING" and includes a "GOLD LISTINGS" section with entries for "ABEL TASMAN WILSON'S", "ACTIVE NEW ZEALAND", and "ADVENTURE NEW ZEALAND".

Right Browser Window: The title bar reads "whitewater rafting new zealand river raft adventure New Zealand nz rivers shotover wairoa river - Microsoft Interne...". The address bar shows "http://www.travelplanner.co.nz/activities/index.cfm?area=&sss=5%7C1%7C12&rid=8iid=". The page features a "GALLERY" section with links to "FAST FACTS", "ACTIVITIES", "ACCOMMODATION", "TRANSPORT", "TRAVEL SERVICES", "LINKS", "ADVERTISING OPPORTUNITIES", and "CONTACT US". The main content area is titled "River Valley Ventures" and includes a "Rangitata Rafts" section. The "River Valley Ventures" section describes a "truly unique slice of kiwiana" and lists contact information: Web Site: www.rivervalley.co.nz, Email: thelodge@rivervalley.co.nz, Address: RD 2, Taihape, New Zealand, Telephone: +64-6-388 1444, Fax: +64-6-388 1859. The "Rangitata Rafts" section describes a "full days experience" and lists contact information: Web Site: www.rafts.co.nz, Email: RangitataRafts@xtra.co.nz, Address: RD 20, Peel Forest, Geraldine, South Canterbury, New Zealand, Telephone: +64-3-696 3534, Fax: +64-3-696 3534. The page also includes a "Hidden Valleys NZ Ltd" section and a "Lost?" section.

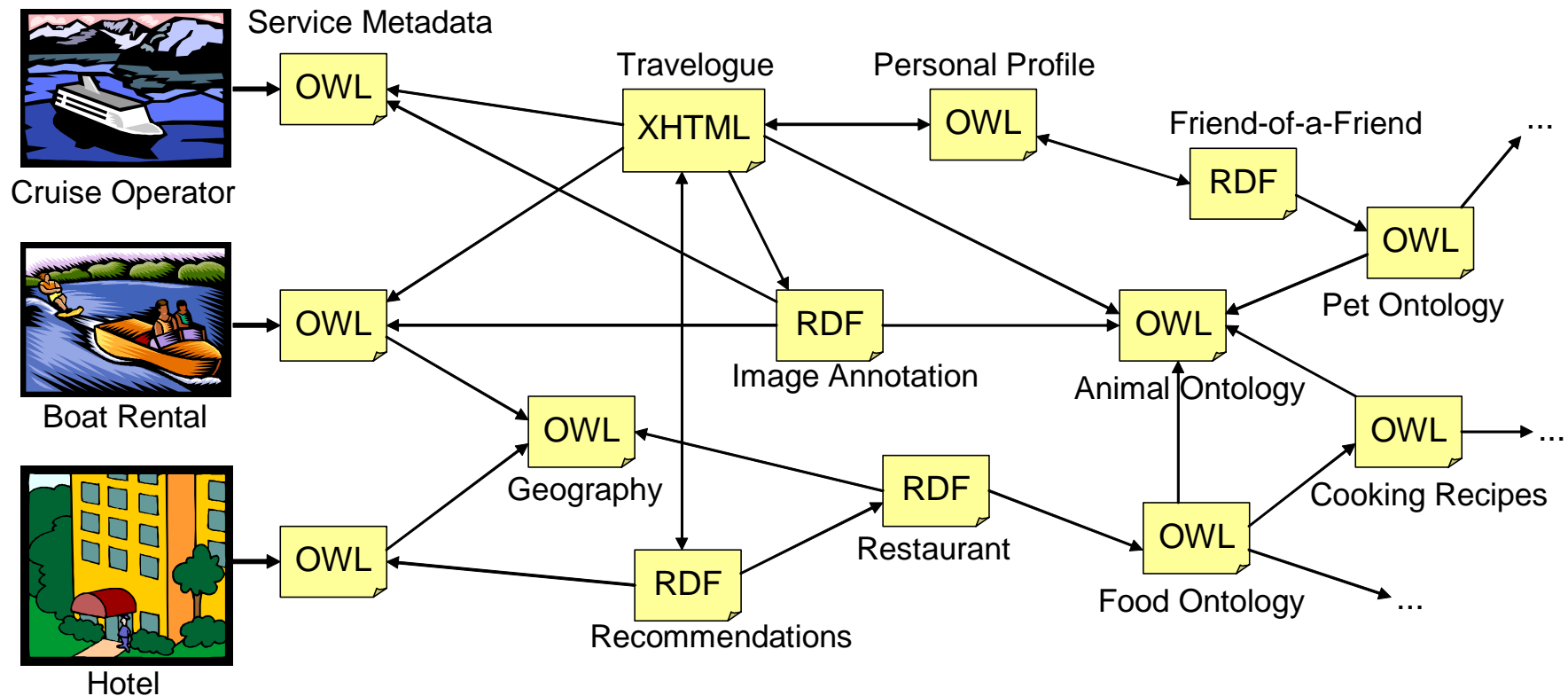
Traditional Web Architecture



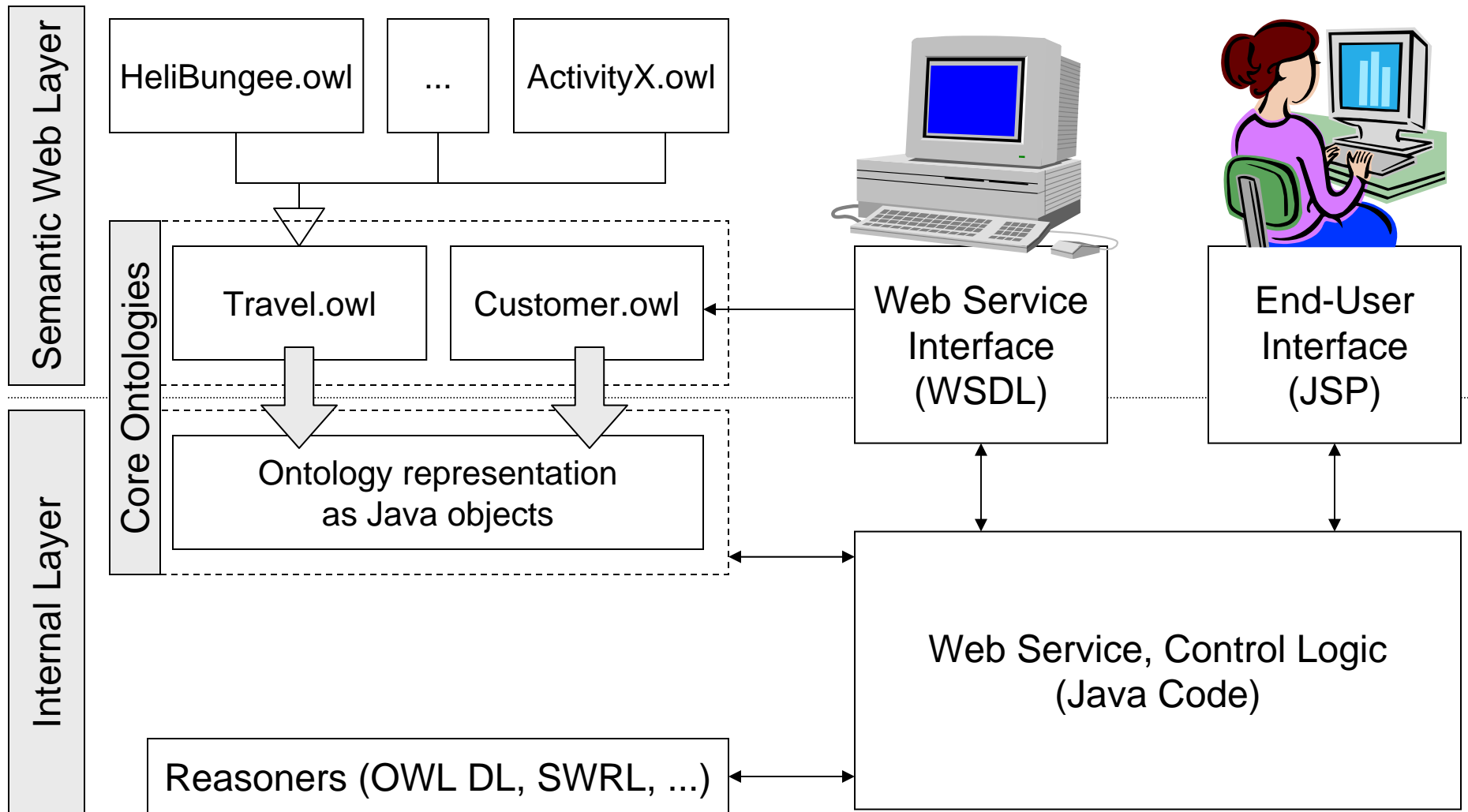
Semantic Web Architecture



Semantic Web Evolution



Software Architecture (1)



Protege-OWL

travel Protégé 3.1 (file: C:\protege-owl\owl\travel.pprj, OWL Files (.owl or .rdf))

File Edit Project OWL Code Window Tools Help

owl:Classes Properties Forms Individuals Metadata

SUBCLASS RELATIONSHIP CLASS EDITOR

For Project: travel

Asserted Hierarchy

- owl:Thing
 - Accommodation
 - BedAndBreakfast
 - BudgetAccommodation
 - Campground
 - Hotel
 - AccommodationRating
 - Activity
 - Contact
 - Destination
 - BackpackersDestination
 - Beach
 - BudgetHotelDestination
 - FamilyDestination**
 - QuietDestination
 - RetireeDestination
 - RuralArea
 - UrbanArea
 - City
 - Town

For Class: FamilyDestination (instance of owl:Class)

Name: FamilyDestination

SameAs: DifferentFrom:

Annotations

Property	Value	Lang
rdfs:comment	A destination with at le...	

Asserted Inferred

Asserted Conditions

- Destination — NECESSARY & SUFFICIENT
 - hasAccommodation ≥ 1
 - hasActivity ≥ 2
- NECESSARY

Properties

- hasAccommodation (multiple Accommodation) ≥ 1
- hasActivity (multiple Activity) ≥ 2
- hasPart (multiple Destination)

Disjoints

- RetireeDestination

Logic View Properties View

Protege-OWL Classification

The screenshot displays the Protege 3.1 OWL editor interface. The main window is titled "travel Protégé 3.1 (file:\C:\protege-owl\owl\travel.pprj, OWL Files (.owl or .rdf))". The interface includes a menu bar (File, Edit, Project, OWL, Code, Window, Tools, Help) and a toolbar with various icons for file operations and editing.

The "SUBCLASS RELATIONSHIP" panel is active, showing the "Asserted Hierarchy" for the project "travel". The hierarchy is as follows:

- Destination
 - BackpackersDestination
 - Beach
 - BudgetHotelDestination
 - FamilyDestination
 - QuietDestination
 - RetireeDestination
- RuralArea
- UrbanArea
 - City
 - Capital
 - Town

The "CLASS EDITOR" panel is also visible, showing the "Capital" class. The "Name" field is set to "Capital", and the "rdfs:comment" field is empty. The "Asserted Conditions" section shows a list of conditions, including "NECESSARY & SUFFICIENT" and "NECESSARY".

The "Classification Results" panel at the bottom shows the following table:

Class	Changed superclasses
Campground	Moved from Accommodation to BudgetAccommodation
Capital	Added RetireeDestination
NationalPark	Added BackpackersDestination
RetireeDestination	Moved from Destination to QuietDestination
Safari	Inconsistent

Protege-OWL Individuals

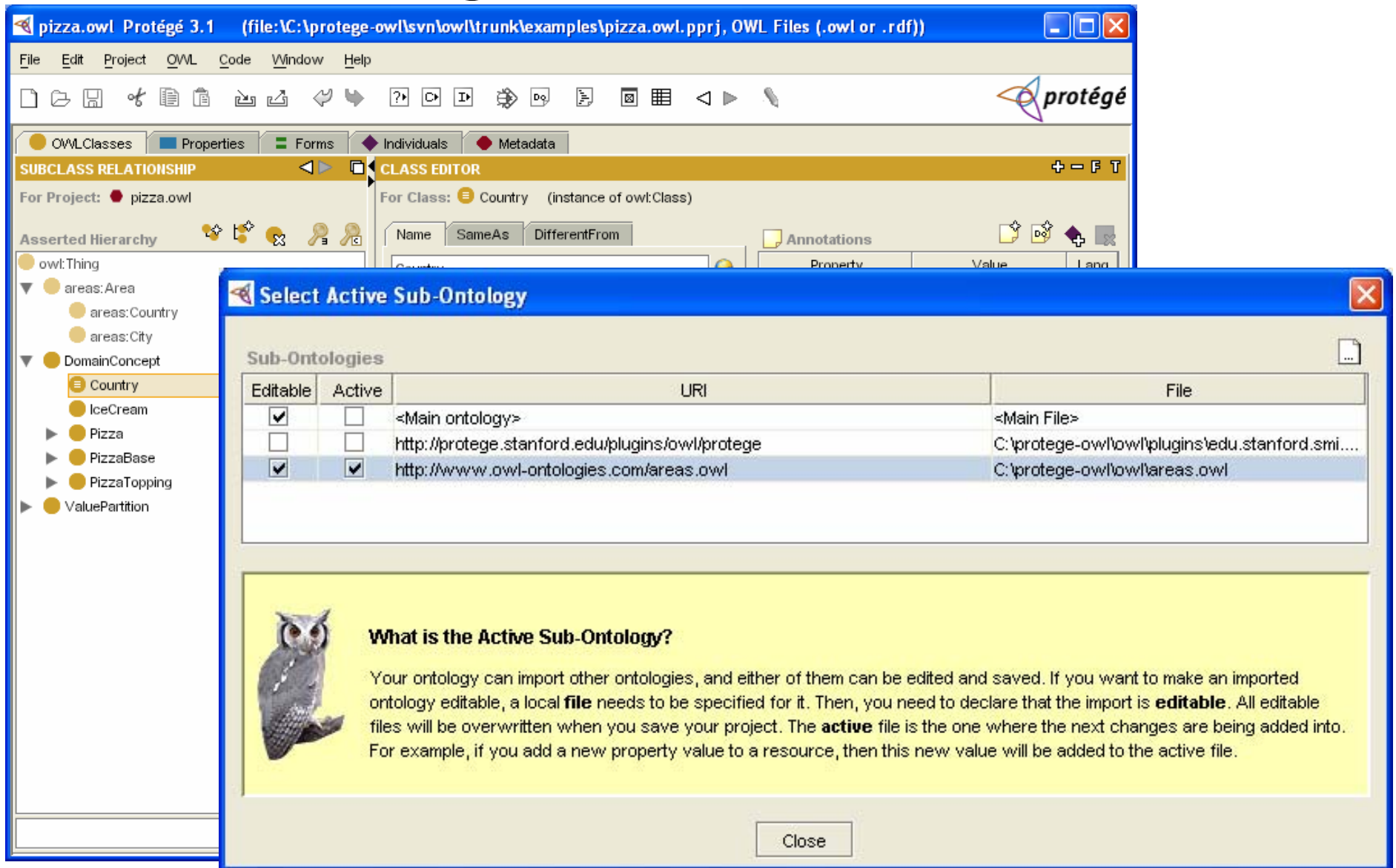
The screenshot displays the Protege 3.1 OWL editor interface. The title bar indicates the project is 'travel' and the file is 'C:\protege-owl\owl\travel.pprj'. The main menu includes File, Edit, Project, OWL, Code, Window, Tools, and Help. The toolbar contains various icons for file operations and editing.

The interface is divided into several panes:

- CLASS BROWSER:** Shows the class hierarchy for the project 'travel'. The hierarchy starts with 'owl:Thing' and branches into 'Accommodation', 'AccommodationRating (3)', 'Activity', 'Contact', and 'Destination'. 'Destination' further branches into 'BackpackersDestination', 'Beach (2)', 'BudgetHotelDestination', 'FamilyDestination', 'QuietDestination', 'RetireeDestination', 'RuralArea (2)', and 'UrbanArea'. 'RuralArea' branches into 'Farmland' and 'NationalPark (2)'. 'UrbanArea' branches into 'City (1)' and 'Capital (2)'. 'City' branches into 'Capital (2)' and 'Town (1)'. The 'Capital (2)' class is currently selected.
- INSTANCE BROWSER:** Shows instances for the selected class 'Capital'. The instances listed are 'Canberra' and 'Sydney'. The 'Sydney' instance is currently selected.
- INDIVIDUAL EDITOR:** Allows editing the selected individual 'Sydney'. It shows the name 'Sydney' and a text area for 'rdfs:comment'. Below this, there are three property editors: 'hasAccommodation' (with value 'FourSeasons'), 'hasPart' (with values 'BondiBeach' and 'CurrawongBeach'), and 'hasActivity'.

The bottom status bar shows the current class 'Capital' and some navigation icons.

Working with Multiple Files



The screenshot shows the Protégé 3.1 interface. The main window is titled 'pizza.owl Protégé 3.1 (file: C:\protege-owl\svn\owl\trunk\examples\pizza.owl.pprj, OWL Files (.owl or .rdf))'. The left pane shows the 'Asserted Hierarchy' for the 'pizza.owl' project, listing classes like 'owl:Thing', 'areas:Area', 'areas:Country', 'areas:City', 'DomainConcept', 'Country', 'IceCream', 'Pizza', 'PizzaBase', 'PizzaTopping', and 'ValuePartition'. The 'CLASS EDITOR' is open for the 'Country' class, showing tabs for 'Name', 'SameAs', 'DifferentFrom', and 'Annotations'. A 'Select Active Sub-Ontology' dialog box is overlaid on the main window. It contains a table of sub-ontologies with columns for 'Editable', 'Active', 'URI', and 'File'.

Editable	Active	URI	File
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<Main ontology>	<Main File>
<input type="checkbox"/>	<input type="checkbox"/>	http://protege.stanford.edu/plugins/owl/protege	C:\protege-owl\owl\plugins\edu.stanford.smi...
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	http://www.owl-ontologies.com/areas.owl	C:\protege-owl\owl\areas.owl

What is the Active Sub-Ontology?

Your ontology can import other ontologies, and either of them can be edited and saved. If you want to make an imported ontology editable, a local **file** needs to be specified for it. Then, you need to declare that the import is **editable**. All editable files will be overwritten when you save your project. The **active** file is the one where the next changes are being added into. For example, if you add a new property value to a resource, then this new value will be added to the active file.

Close

Protege-OWL for RDF(S)

The screenshot shows the Protege 3.1 interface with the following components:

- Window Title:** travel-rdf Protégé 3.1 (file:VC:\protege-owl\owl\travel-rdf.pprj, OWL Files (.owl or .rdf))
- Menu Bar:** File, Edit, Project, OWL, Code, Window, Tools, Help
- Toolbar:** Standard file and editing icons.
- Tab Bar:** OWLClasses, Properties, Forms, Individuals, Metadata
- Left Panel (Subclass Relationship):**
 - For Project: travel-rdf
 - Asserted Hierarchy:
 - owl:Thing
 - Accommodation
 - AccommodationRating
 - Activity
 - Contact
 - Destination
 - BackpackersDestination (selected)
 - Beach
 - BudgetHotelDestination
 - FamilyDestination
 - QuietDestination
 - RetireeDestination
 - RuralArea
 - Farmland
 - NationalPark
 - UrbanArea
 - City
 - Capital
 - Town

- Right Panel (Class Editor):**
- For Class: BackpackersDestination (instance of rdfs:Class)
- Name: BackpackersDestination
- SameAs: (empty)
- DifferentFrom: (empty)
- Annotations:

Property	Value	Lang
rdfs:comment	A destination that prov...	
- rdfs:comment: A destination that provides budget accommodation and offers sport or adventure activities.
- rdfs:subClassOf:
 - Destination
- Properties:

Property	Cardinality	Type
hasAccommodation	Multiple	Accommodation
hasActivity	Multiple	Activity
hasPart	Multiple	Destination

Protege-OWL for SWRL












family.swrl Protégé 3.1 (file:\C:\protege-owl\owl\family.swrl.pprj, OWL Files (.owl or .rdf))

File Edit Project OWL Code Window Tools Help

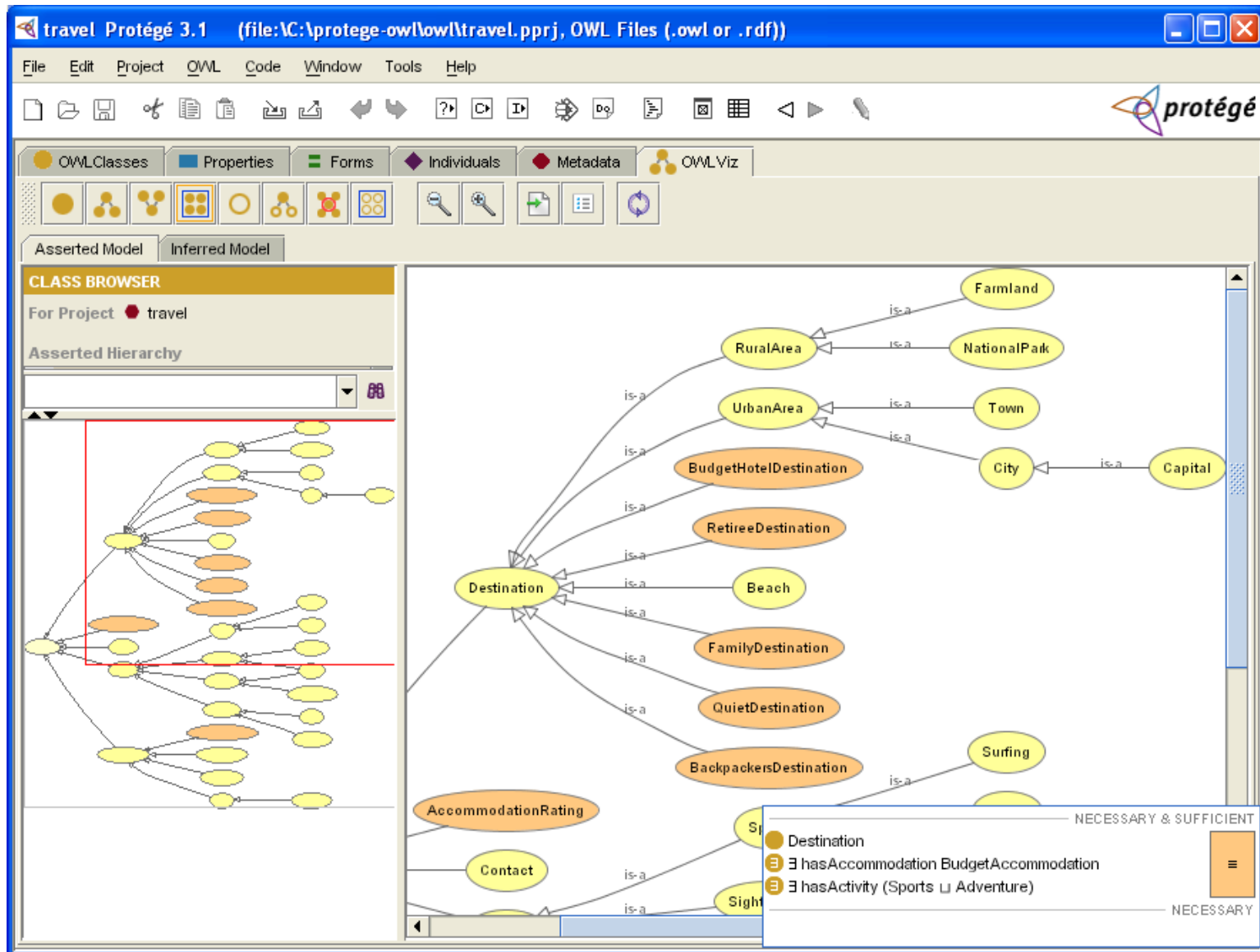
OWLClasses Properties Forms Individuals Metadata SWRL Rules

SWRL Rules

Name	Expression
Def-hasAunt	$\rightarrow \text{hasParent}(?x, ?y) \wedge \text{hasSister}(?y, ?z) \rightarrow \text{hasAunt}(?x, ?z)$
Def-hasBrother	$\rightarrow \text{hasSibling}(?x, ?y) \wedge \text{Man}(?y) \rightarrow \text{hasBrother}(?x, ?y)$
Def-hasDaughter	$\rightarrow \text{hasChild}(?x, ?y) \wedge \text{Woman}(?x) \rightarrow \text{hasDaughter}(?x, ?y)$
Def-hasFather	$\rightarrow \text{hasParent}(?x, ?y) \wedge \text{Man}(?y) \rightarrow \text{hasFather}(?x, ?y)$
Def-hasMother	$\rightarrow \text{hasParent}(?x, ?y) \wedge \text{Woman}(?y) \rightarrow \text{hasMother}(?x, ?y)$
Def-hasNephew	$\rightarrow \text{hasSibling}(?x, ?y) \wedge \text{hasSon}(?y, ?z) \rightarrow \text{hasNephew}(?x, ?z)$
Def-hasNiece	$\rightarrow \text{hasSibling}(?x, ?y) \wedge \text{hasDaughter}(?y, ?z) \rightarrow \text{hasNiece}(?x, ?z)$
Def-hasParent	$\rightarrow \text{hasConsort}(?y, ?z) \wedge \text{hasParent}(?x, ?y) \rightarrow \text{hasParent}(?x, ?z)$
Def-hasSibling	$\rightarrow \text{hasChild}(?x, ?y) \wedge \text{hasChild}(?z, ?y) \wedge \text{differentFrom}(?x, ?z) \rightarrow \text{hasSibling}(?x, ?z)$
Def-hasSister	$\rightarrow \text{hasSibling}(?x, ?y) \wedge \text{Woman}(?y) \rightarrow \text{hasSister}(?x, ?y)$
Def-hasSon	$\rightarrow \text{hasChild}(?x, ?y) \wedge \text{Man}(?x) \rightarrow \text{hasSon}(?x, ?y)$
Def-hasUncle	$\rightarrow \text{hasParent}(?x, ?v) \wedge \text{hasBrother}(?v, ?z) \rightarrow \text{hasUncle}(?x, ?z)$

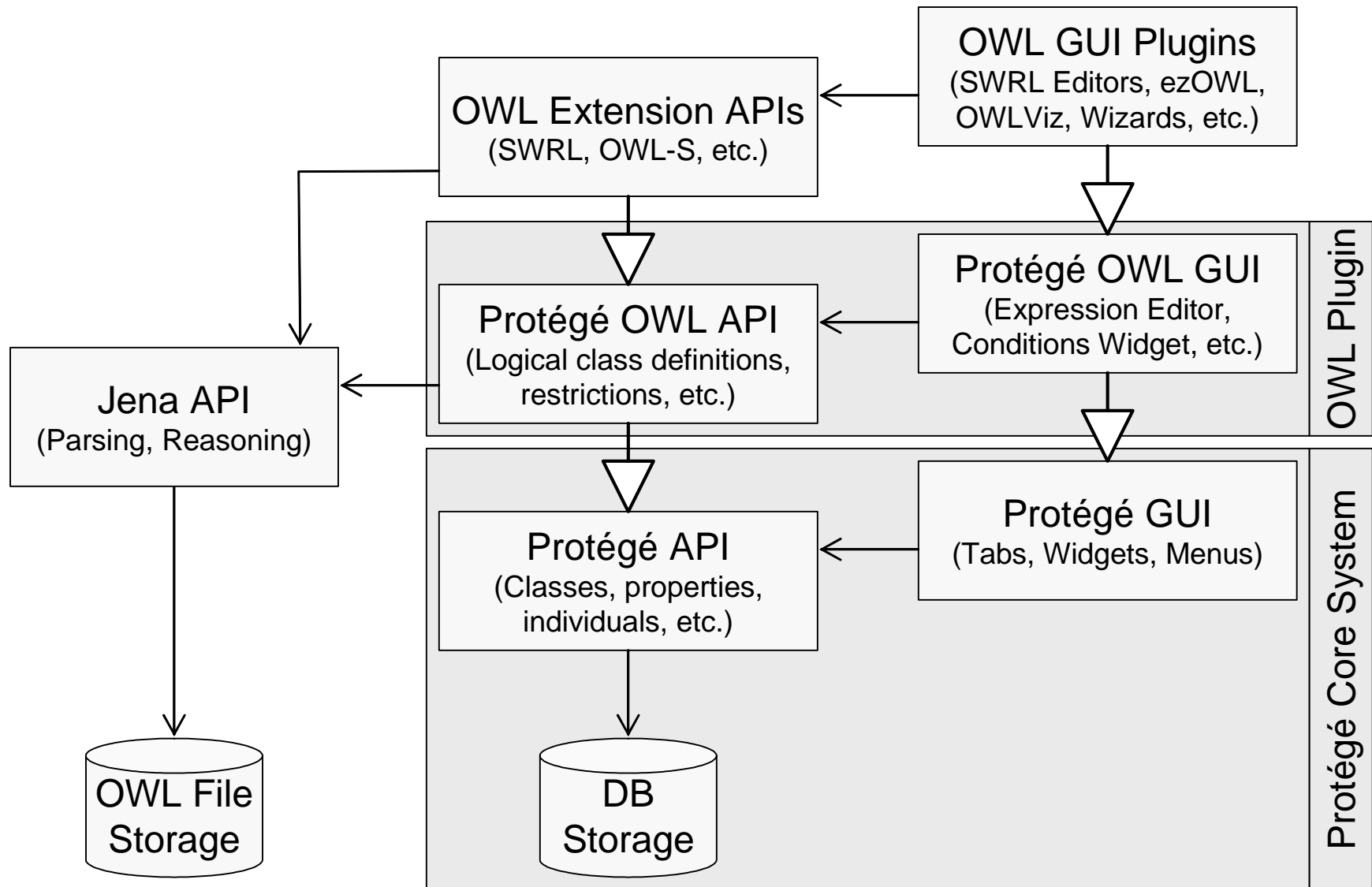
SWRL Rule Editor toolbar:          
 \wedge \rightarrow () [] \leftarrow

Protege-OWL Plugins

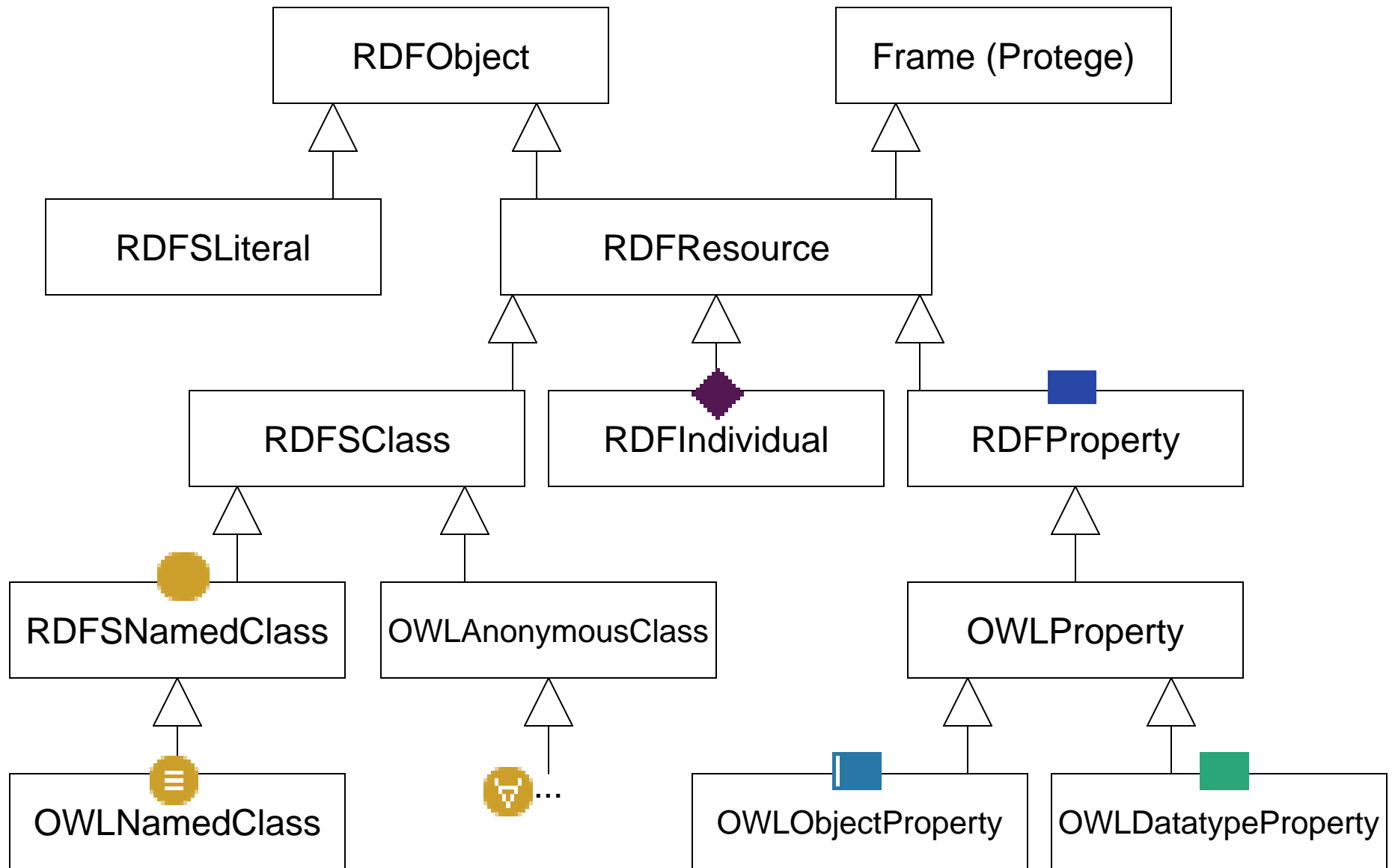


<http://www.co-ode.org>

Protege-OWL Architecture



Protege-OWL API (Model)



Protege-OWL API Example

```
JenaOWLModel owlModel = ProtegeOWL.createJenaOWLModel();
```

```
RDFSNamedClass personClass =
```

```
    owlModel.createRDFSNamedClass("Person");
```

```
RDFProperty ageProperty = owlModel.createRDFProperty("age");
```

```
ageProperty.setRange(owlModel.getXSDint());
```

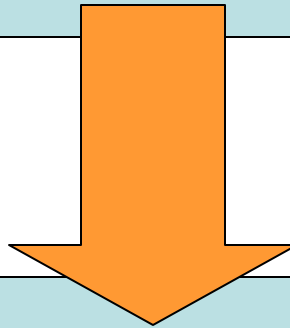
```
ageProperty.setDomain(personClass);
```

```
RDFIndividual individual = personClass.createRDFIndividual("Holger");
```

```
individual.setPropertyValue(ageProperty, new Integer(34));
```

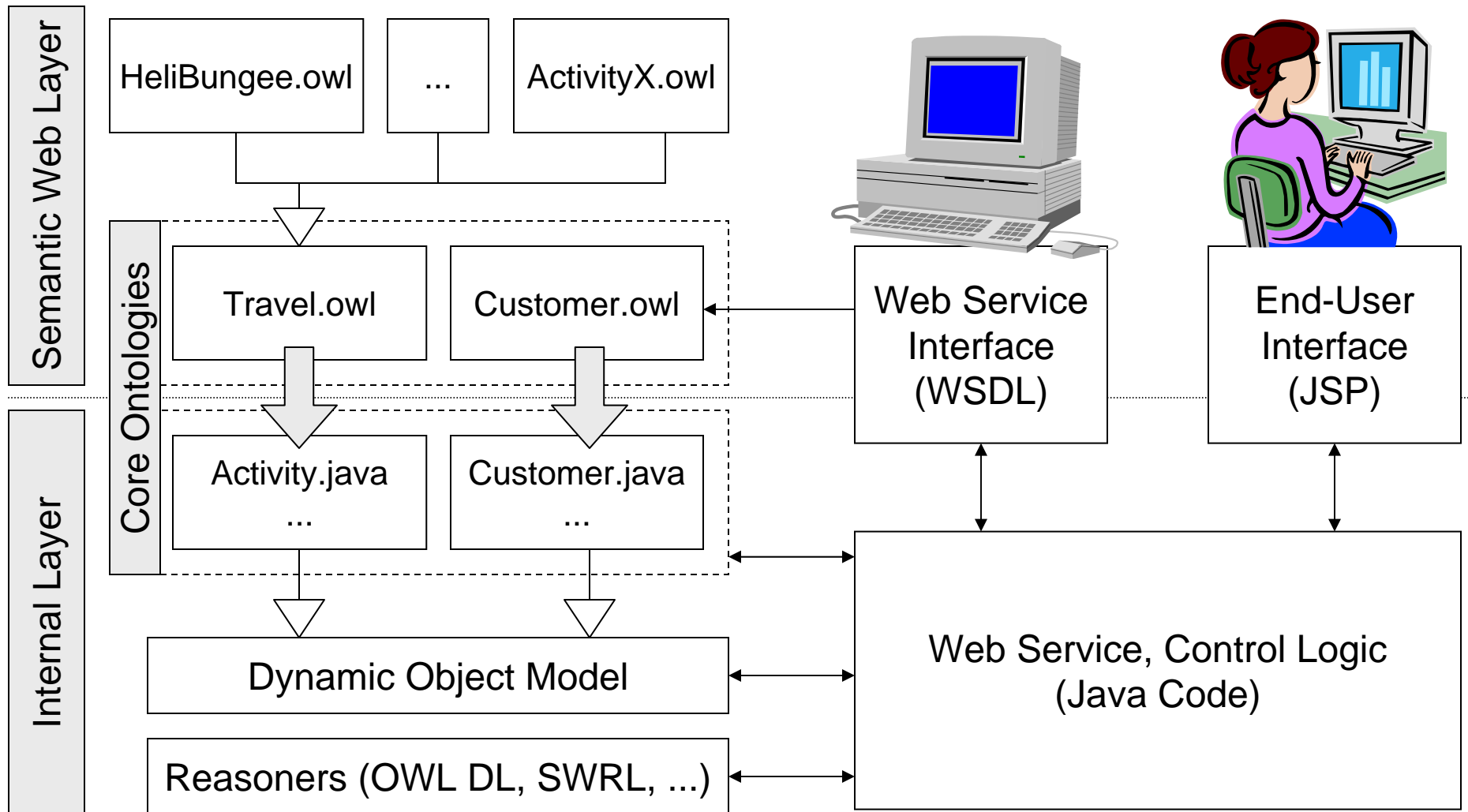
Java Code Generation

```
RDFIndividual individual = personClass.createRDFIndividual("Holger");  
individual.setPropertyValue(ageProperty, new Integer(34));
```



```
Person individual = factory.createPerson("Holger");  
individual.setAge(34);
```

Software Architecture (2)



Tab Widgets

ProjectPlugins

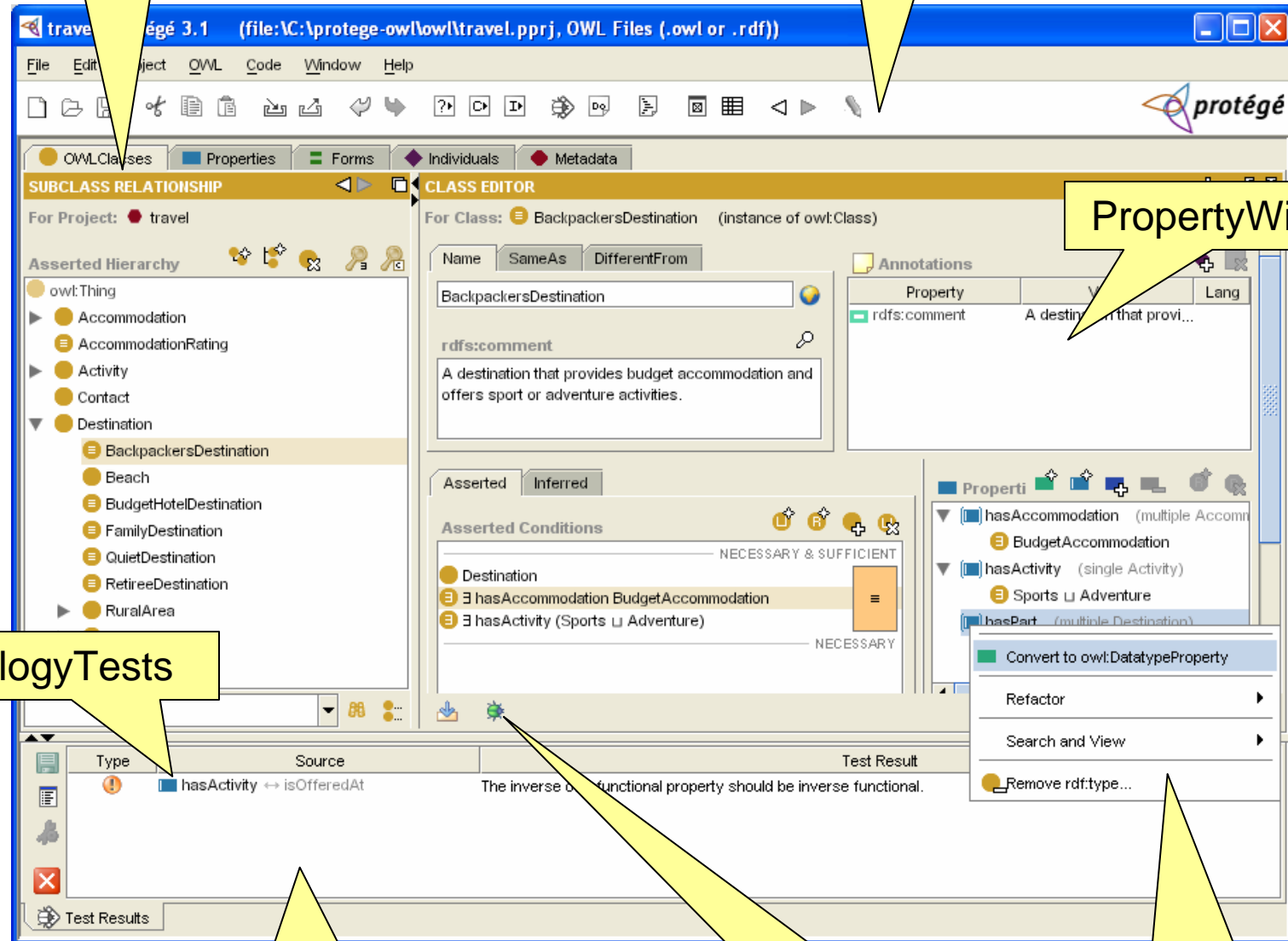
PropertyWidgets

OntologyTests

ResultPanels

ResourceActions

ResourceActions



Configuring Protege

demo Protégé 3.0 (file:\C:\Nick\Applications\Protege_3.0_with_termbuilder\plugins\uk.ac.man.cs.mig.coode.protege.termbuilder\demo.pprj,...)

File Edit Project OWL Code Window Help Tools

protégé

OWL Terms

SUBCLASS RELATIONSHIP

For Project: demo

Asserted Hierarchy

- owl:Thing
 - preferred name (in your language) [2]
 - Another Class
 - preferred name (in your language) [2]

CLASS EDITOR

For Class: a human readable label (instance of owl:Class, internal name is iota-0)

ID: iota-0

Documentation: A demonstration Class

Notes: TODO: untangle - additional parent added [Another Class]
TODO: Remember to make some more classes

concept Name: a human readable label

terms:preferredTerm: preferred name (in your language)

Terms:synonym

Language	Value
en	an alt name
fr	un autre nom

Snomed ref: SOME_OUTSIDE_ID

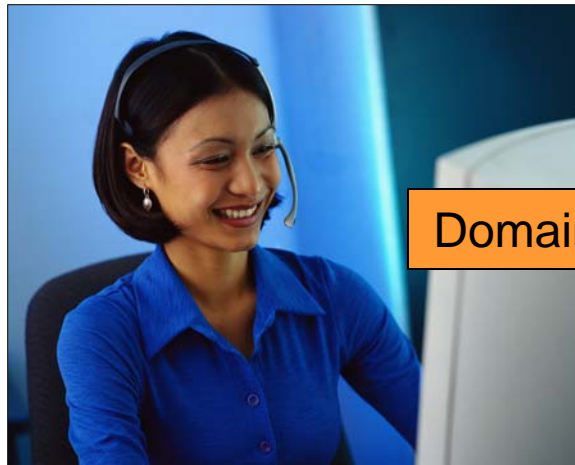
Superclasses: Another Class, owl:Thing

CONDITIONS

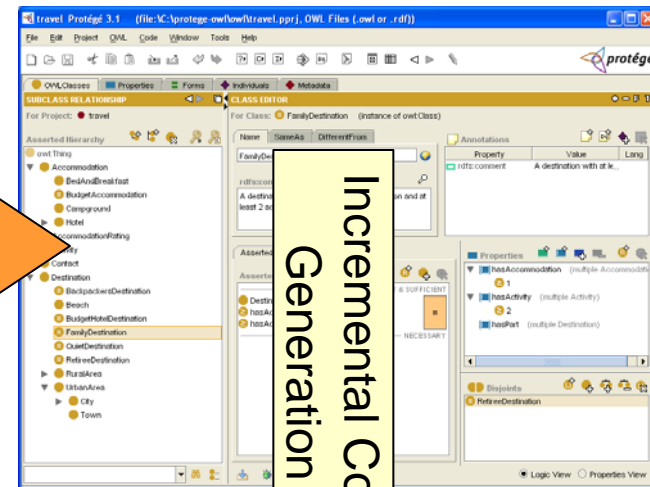
Type	Modifier	Property	Value
	only	hasPart	Another Class
AND	does not	hasPart	preferred name (in your language) [2]
AND	optionally	has_a	Another Class
AND	definitely	hasPart	Another Class

definitely
optionally
only
does not

Protege-Driven Development



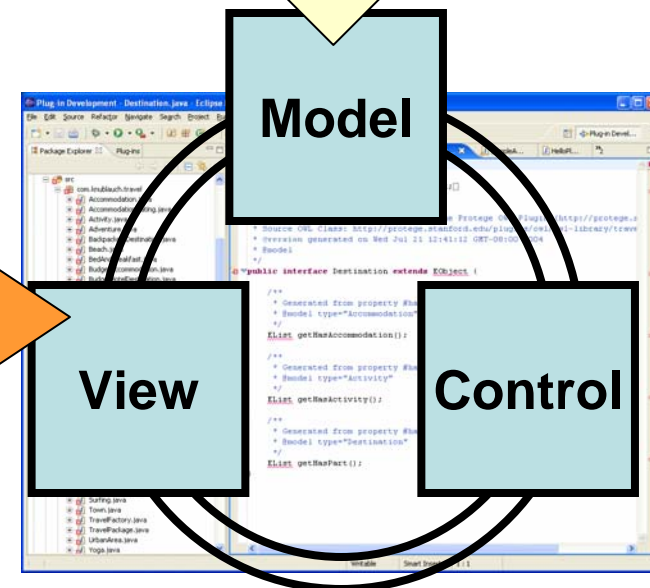
Domain Modeling



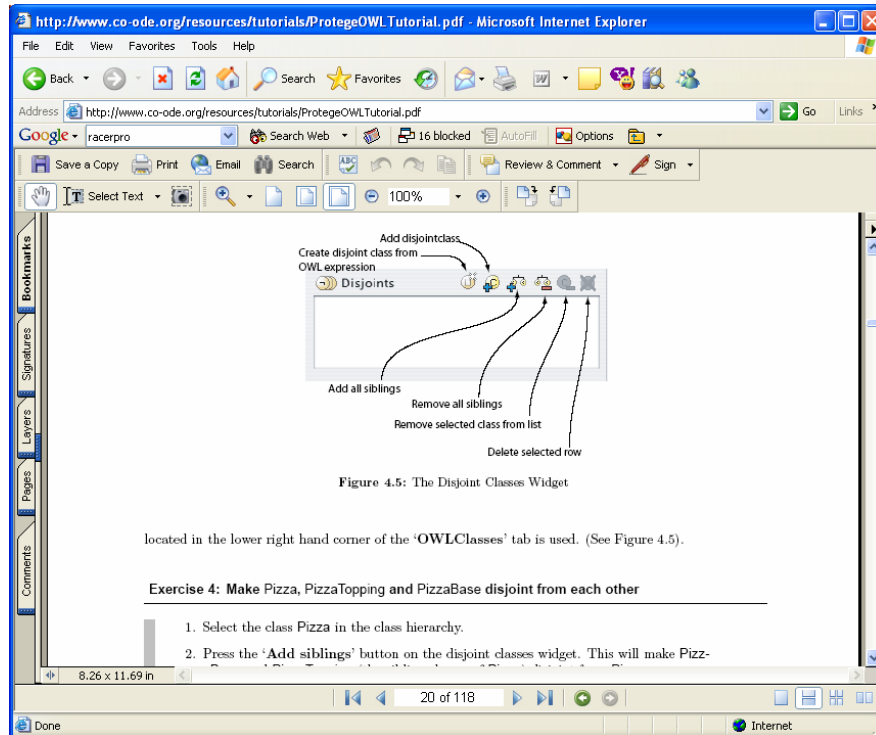
Incremental Code Generation



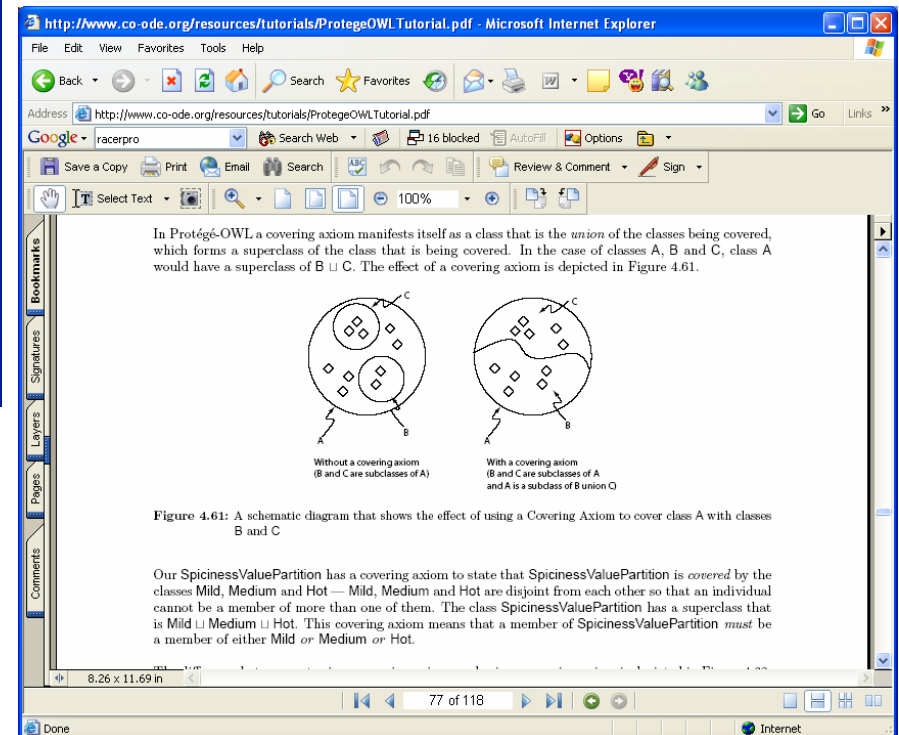
Programming



Further Reading (1)



<http://www.co-ode.org>



Further Reading (2)

