


RacerPro Demos

STS

Software Technology & Systems Group
Technical University of Hamburg-Harburg (TUHH)
Hamburg, Germany

Note: RacerPro ©
Racer Systems GmbH & Co. KG
www.racer-systems.com
Blumenau 50
22089 Hamburg, Germany

RacerPro is ...

- ... a Description Logic System for $\mathcal{ALCQHI}_{\mathcal{R}^+}(\mathcal{D}^-)$ (aka $\mathcal{SHIQ}(\mathcal{D}^-)$)
 - TBox: Terminological Box, defines domain vocabulary: “A mother is a woman and a parent”
 - Ontology: Formal Specification of a Conceptualization (Gruber)
 - ABox: Assertional Box, “Intelligent Database”, Individuals and Relationships
- Reasoning about descriptions and information
 - “Mother without children” \Rightarrow 
 - “Betty is a female human with a child” \Rightarrow “Betty is a mother”

RacerPro is ...

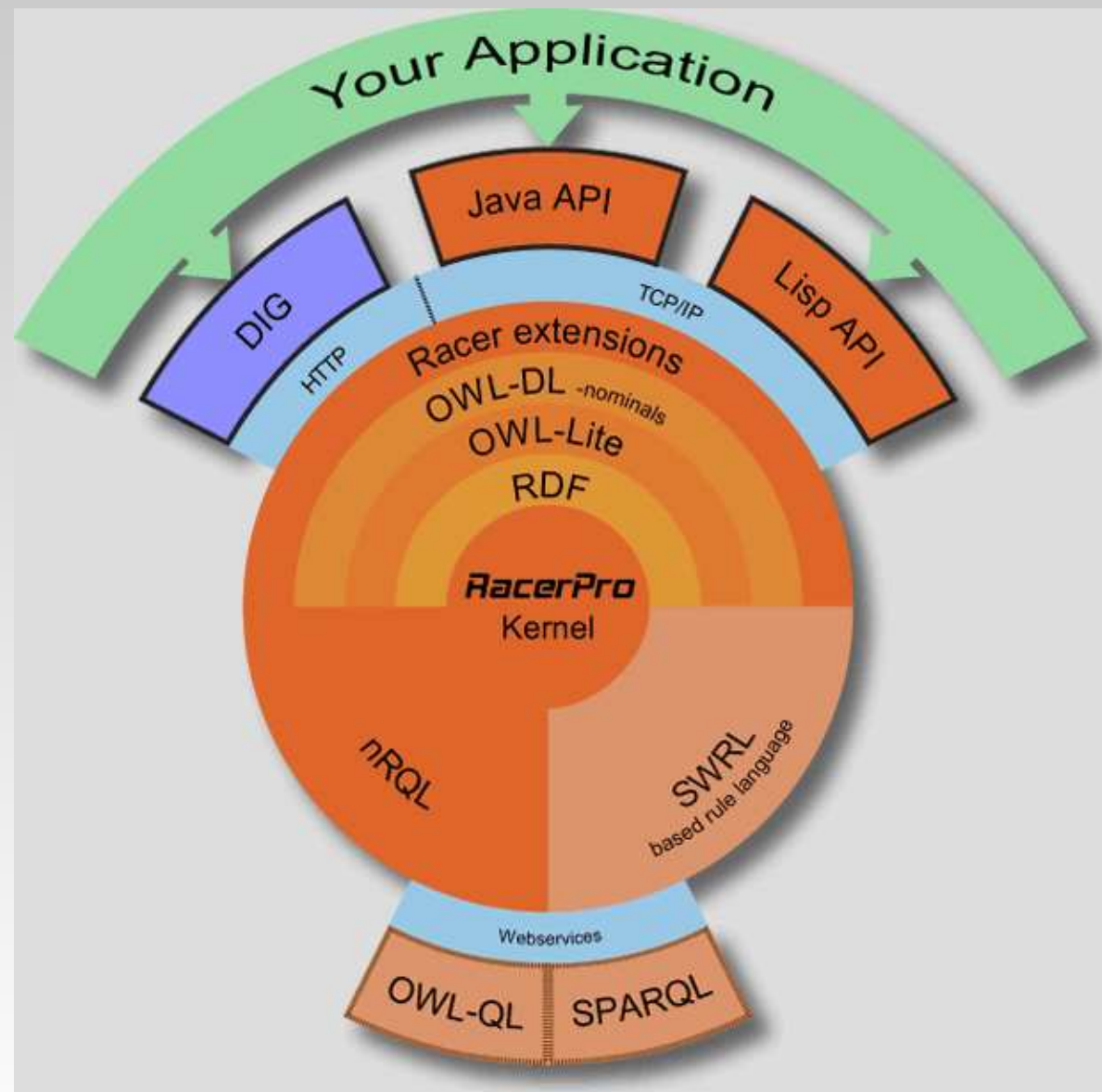
- ... a Semantic Web reasoning engine and repository, supports W3C standards
 - Web Ontology Language
 - OWL Lite
 - OWL DL ($\approx \mathcal{SHOIQ}(Dn)$)
 - Resource Description Framework (RDF)
 - Preliminary support for OWL QL (RacerManager semantic middleware)

www.sts-tu-harburg.de/~at.kaya/racerManager

- Preliminary support for SWRL
- Expressive query language nRQL
 - ABox query language
 - RDF & OWL query language

RacerPro: System Overview

Racer



OWL Reasoning

- “A vegetarian is defined as an animal that eats no other animals, or parts of animals.”
- “Cows are naturally vegetarians”
- “A mad cow is a cow that has been eating the brains of sheep.”
- “Sheep are animals.”
- \Rightarrow “There are no mad cows!” (inference)
- OWL modeling support with RacerPro:
 - Identification of inconsistent classes during modeling (e.g. “mad cow”)
 - Computation of logically implied inheritance relationships (“Taxonomy”)

OWL Modeling with Protégé

Racer

The screenshot displays the Protégé 3.2 beta OWL editor interface for a project named 'people-pets'. The main window is divided into several panes:

- Subclass Explorer (Left):** Shows the 'Asserted Hierarchy' for the project. The hierarchy starts with 'owl:Thing' at the root, followed by 'adult', 'animal', 'cat', 'duck', 'giraffe', 'person', 'sheep', 'tiger', 'vegetarian', and 'cow'. The 'cow' class is highlighted, and its subclasses 'mad_cow' and 'Axiom_1' are listed below it.
- Subclass Explorer (Middle):** Shows the 'Inferred Hierarchy' for the project. The hierarchy starts with 'owl:Thing' at the root, followed by 'adult', 'Axiom_1', 'animal', 'cat', 'dog', 'duck', 'person', 'pet', 'tiger', 'vegetarian', and 'cow'. The 'cow' class is highlighted, and its subclasses 'mad_cow' and 'giraffe' are listed below it.
- Class Editor (Right):** Shows the 'CLASS EDITOR' for the class 'mad_cow' (instance of owl:Class). The 'Name' field is set to 'mad_cow'. The 'rdfs:comment' field contains the text 'A mad cow is a cow that has been eating the brains of sheep.' The 'Annotations' table shows the following data:

Property	Value	Lang
rdfs:comment	A mad cow is a cow that has been eating the brains of sheep.	
rdfs:label	A mad cow is a cow that h...	

The 'Properties' table shows the following data:

Property	Value	Lang
eats	brain and (part_of some sheep)	
eats	not animal	[from vegetarian]
eats	not (part_of some animal)	[from vegetarian]
eats	owl:Thing	[from animal]
- Classification Results (Bottom):** Shows the 'Classification Results' for the class 'mad_cow'. The results are as follows:

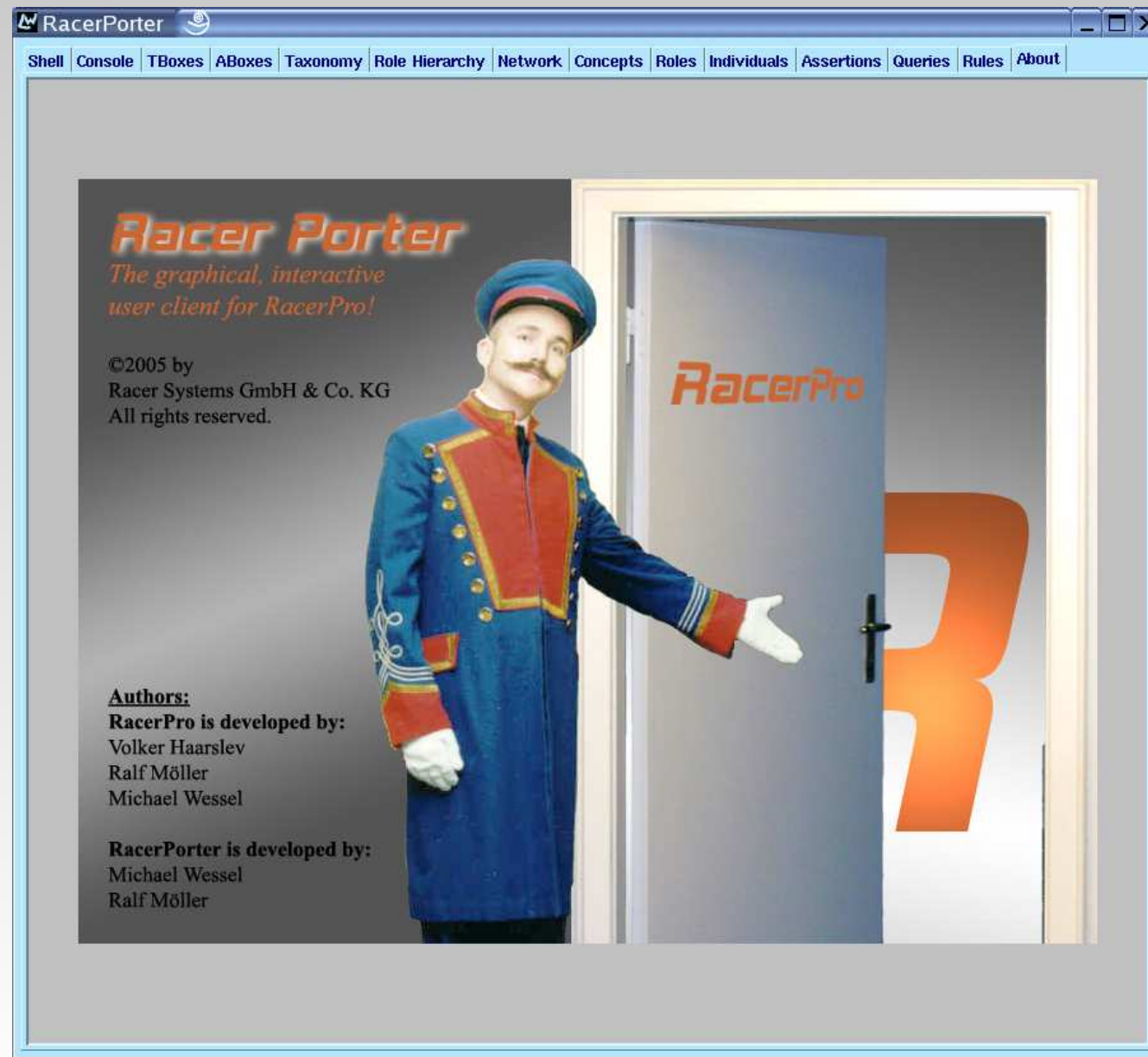
Class	Changed direct superclasses
animal	Moved from owl:Thing to Axiom_1
animal_lover	Moved from person to pet_owner
bus_driver	Moved from person to driver
cat_owner	Moved from person to cat_liker, pet_owner
dog	Moved from owl:Thing to animal
dog_owner	Moved from person to pet_owner, dog_liker
driver	Moved from adult, person to grownup
giraffe	Moved from animal to vegetarian
haulage_truck_driver	Moved from person to haulage_worker, driver
lorry_driver	Moved from person to driver
mad_cow	Inconsistent
man	Moved from person, adult to grownup
old_lady	Moved from person, female to woman, cat_owner

Ontology Based Querying

- Benefits: Use domain specific vocabulary for queries
- Detection of inconsistent queries
- Handling of incomplete and unknown information
- Example:
 - “Minnie is known to be elderly and female”
 - \Rightarrow “Minnie is an old lady!” (inference)
 - “Minnie has Tom as a pet”
 - Nothing is known about Tom
 - \Rightarrow “Tom must be a cat, since old ladies are cat lovers!” (inference)

RacerPorter GUI

Racer



Minnie is elderly and female

Racer

RacerPorter

Shell Console TBoxes ABoxes Taxonomy Role Hierarchy Network Concepts Roles Individuals Assertions Queries Rules About

TBox: people-pets.owl ABox: people-pets.owl

Concept: (old_lady) Role:

Individual: Minnie Query / Rule:

☐ Simplify Names

```
(Daily_Mirror *TOP*)
(Daily_Mirror *TOP*)
(Dewey duck)
(Fido dog)
(Flossie cow)
(Fluffy tiger)
(Fred person)
(Huey duck)
(Joe (AT-MOST 1 has_pet))
(Joe person)
(Kevin person)
(Louie duck)
(Mick male)
(Minnie female)
(Minnie elderly)
(Q123_ABC white_thing)
(Q123_ABC van)
(Rex dog)
(The42 (SOME service_number (EQUAL RACER-INTERNAL%HAS-INTEGER-VALUE 42)))
(The42 bus)
(The_Guardian broadsheet)
(The_Sun tabloid)
(The_Times broadsheet)
```

◆ Concept A ◆ Role A ◆ Attribute A ◆ Constraint A ◆ Annotation CA ◆ Annotation RA

Refresh Clear Log Quit

RacerPro Log

```
((|http://www.w3.org/2000/01/rdf-schema#label| ("Minnie"))
(|http://www.w3.org/2000/01/rdf-schema#comment| ("")))
:ANNOTATION-DATATYPE-PROPERTY-FILLERS
((|http://www.w3.org/2000/01/rdf-schema#label| ("Minnie"))
(|http://www.w3.org/2000/01/rdf-schema#comment| ("")))
:ANNOTATION-PROPERTY-FILLERS
NIL
:DIRECT-TYPES
:TO-BE-COMPUTED)
```

Minnie has Tom as a pet

Racer

The screenshot shows the RacerPro application window. The top menu bar includes: Shell, Console, TBoxes, ABoxes, Taxonomy, Role Hierarchy, Network, Concepts, Roles, Individuals, Assertions, Queries, Rules, and About. The main interface is divided into several sections:

- Form Section:** Contains fields for TBox (people-pets.owl), ABox (people-pets.owl), Concept (old_lady), Role, Individual (Minnie), and Query / Rule.
- Query Section:** A large text area containing a list of queries. The query `((Minnie Tom) has_pet)` is highlighted with a blue background and a dashed border.
- Navigation Section:** A row of buttons: Concept A, Role A, Attribute A, Constraint A, Annotation CA, and Annotation RA.
- Buttons:** Refresh, Clear Log, and Quit.
- RacerPro Log:** A text area at the bottom showing the execution log, including URIs for Minnie and various system messages like `:ANNOTATION-DATATYPE-PROPERTY-FILLERS` and `:TO-BE-COMPUTED`.

Definition of concept old lady

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RacerPorter

Shell Console TBoxes ABoxes Taxonomy Role Hierarchy Network Concepts Roles Individuals Assertions Queries Rules About

TBox people-pets.owl ABox people-pets.owl

Concept (old_lady) Role

Individual Minnie Query / Rule

☐ Simplify Names

(female) — (woman) — (old_lady)
(male) — (man) — (white_van_man)
(haulage_worker) — (haulage_truck_driver)
(publication) — (newspaper) — (broadsheet) — (quality_broadsheet)
(publication) — (magazine) — (tabloid) — (red_top)
(white_thing)
(leaf)
(adult) — (grownup) — (woman) — (old_lady)
(adult) — (grownup) — (man) — (white_van_man)
(adult) — (elderly) — (old_lady)
(adult) — (driver) — (van_driver) — (white_van_man)
(adult) — (driver) — (lorry_driver)
(adult) — (driver) — (bus_driver)
(adult) — (driver) — (haulage_truck_driver)
(vehicle) — (bicycle)
(vehicle) — (lorry)
(vehicle) — (truck)
(vehicle) — (car)
(vehicle) — (bus)
(vehicle) — (van)
(company) — (haulage_company)
(company) — (bus_company)
(brain)
(honey)
(*TOP* TOP)

Tree Depth UNBOUNDED Tree Graph Bottom? Horizontally Vertically

Focus Reset Clear Log Concept Query Coherent? Classify Quit

RacerPro Log

```
:TOLD-PRIMITIVE-DEFINITION
(AND (OR (AND (ALL
  [http://cohse.semanticweb.org/ontologies/people#has_pet|
  [http://cohse.semanticweb.org/ontologies/people#cat|]
  (SOME [http://cohse.semanticweb.org/ontologies/people#has_pet|
    [http://cohse.semanticweb.org/ontologies/people#animal|]))
  (AND [http://cohse.semanticweb.org/ontologies/people#person|
    [http://cohse.semanticweb.org/ontologies/people#female|
    [http://cohse.semanticweb.org/ontologies/people#elderly|]))
  :SYNONYMS
```

Minnie is an old lady!

Racer

RacerPorter

Shell Console TBoxes ABoxes Taxonomy Role Hierarchy Network Concepts Roles Individuals Assertions Queries Rules About

TBox: people-pets2.owl ABox: people-pets2.owl

Concept: (old_lady) Role:

Individual: Query / Rule:

☐ Simplify Names

(female) — (woman) — (old_lady)
(male) — (man) — (white_van_man)
(haulage_worker) — (haulage_truck_driver)
(publication) — (newspaper) — (broadsheet) — (quality_broadsheet)
(publication) — (magazine) — (tabloid) — (red_top)
(white_thing)
(leaf)
(adult) — (grownup) — (woman) — (old_lady)
(adult) — (grownup) — (man) — (white_van_man)
(adult) — (grownup) — (driver) — (van_driver) — (white_van_man)
(adult) — (grownup) — (driver) — (lorry_driver)
(adult) — (grownup) — (driver) — (bus_driver)
(adult) — (grownup) — (driver) — (haulage_truck_driver)
(adult) — (elderly) — (old_lady)
(vehicle) — (bicycle)
(vehicle) — (lorry)
(vehicle) — (truck)
(vehicle) — (car)
(vehicle) — (bus)
(vehicle) — (van)
(company) — (haulage_company)
(company) — (bus_company)
(bone)
(unborn) — (kid)

(*TOP* TOP)

Tree Depth: UNBOUNDED Tree Graph Bottom? Horizontally Vertically

Focus Reset Clear Log Concept Query Coherent? Classify Quit

RacerPro Log

```
(((*BOTTOM* BOTTOM)))  
3 ? (RETRIEVE  
  (?X)  
  (?X |http://cohse.semanticweb.org/ontologies/people#old_lady|)  
  :ABOX  
  |/home/mi.wessel/people-pets2.owl|)  
3 > (((?X |http://cohse.semanticweb.org/ontologies/people#Minnie|)))
```


Graphical network display

Racer

The screenshot shows the RacerPro graphical network display interface. The window title is "RacerPorter". The top menu bar includes: Shell, Console, TBoxes, ABoxes, Taxonomy, Role Hierarchy, Network, Concepts, Roles, Individuals, Assertions, Queries, Rules, and About. The "Network" tab is selected.

On the left side, there are input fields for:

- TBox: people-pets.owl
- Concept: (old_lady)
- Individual: Minnie

On the right side, there are input fields for:

- ABox: people-pets.owl
- Role: (empty)
- Query / Rule: (empty)

Below these fields is a checkbox labeled "Simplify Names".

The main display area shows a network graph with the following nodes and edges:

- The_Times
- The_Sun
- Flossie
- The_Guardian
- Fluffy
- Kevin
- The42
- Fido —(is_pet_of)→ Joe
- Rex —(is_pet_of)→ Mick —(drives)→ Q123_ABC —(reads)→ Daily_Mirror
- Tibbs —(is_pet_of)→ Fred
- Huey —(is_pet_of)→ Walt —(likes has_pet)→ Dewey —(likes has_pet)→ Louie
- Tom —(is_pet_of)→ Minnie

At the bottom, there is a "RacerPro Log" section with a scrollable text area containing the following log entries:

```
(http://cohse.semanticweb.org/ontologies/people#female))
:ROLE-FILLERS
((http://cohse.semanticweb.org/ontologies/people#has_pet|
  (http://cohse.semanticweb.org/ontologies/people#Tom|))
  (http://cohse.semanticweb.org/ontologies/people#likes|
    (http://cohse.semanticweb.org/ontologies/people#Tom|)))
:TOLD-ATTRIBUTE-FILLERS
NIL
:TOLD-DATATYPE-FILLERS
((http://www.w3.org/2000/01/rdf-schema#label| ("Minnie"))
```

No knowledge concerning Tom

Racer

The screenshot shows the RacerPro interface with the following components:

- Shell** tab selected, showing a table with columns: TBox, Concept, Individual, ABox, Role, and Query / Rule.
- Table Data:**

TBox	Concept	Individual	ABox	Role	Query / Rule
people-pets.owl	(old_lady)	Tom	people-pets.owl		
- Query Results:** A list of individuals in the ontology, including (Flossie cow), (Fluffy tiger), (Fred person), (Huey duck), (Joe (AT-MOST 1 has_pet)), (Joe person), (Kevin person), (Louie duck), (Mick male), (Minnie female), (Minnie elderly), (Q123_ABC white_thing), (Q123_ABC van), (Rex dog), (The42 (SOME service_number (EQUAL RACER-INTERNAL%HAS-INTEGER-VALUE 42))), (The42 bus), (The_Guardian broadsheet), (The_Sun tabloid), (The_Times broadsheet), (Tibbs cat), (Tom *TOP*), (Tom *TOP*), and (Walt person).
- Navigation:** A row of buttons for navigating between different types of results: Concept A, Role A, Attribute A, Constraint A, Annotation CA, and Annotation RA.
- Buttons:** Refresh, Clear Log, and Quit.
- RacerPro Log:** A log window showing the query execution details, including the query string and the results.

Tom is a cat!

Racer

RacerPorter

Shell Console TBoxes ABoxes Taxonomy Role Hierarchy Network Concepts Roles Individuals Assertions Queries Rules About

TBox: people-pets.owl ABox: people-pets.owl

Concept: Role:

Individual: Tom Query / Rule:

☐ Simplify Names

Daily_Mirror
Dewey
Fido
Flossie
Fluffy
Fred
Huey
Joe
Kevin
Louie
Mick
Minnie
Q123_ABC
Rex
The42
The_Guardian
The_Sun
The_Times
Tibbs
Tom
Walt

Refresh Clear Log Direct Types All Types Consistent? Realize Quit

RacerPro Log

```
:TO-BE-COMPUTED)
24 ? (INDIVIDUAL-TYPES
    |http://cohse.semanticweb.org/ontologies/people#Tom|)
24 > ((|http://cohse.semanticweb.org/ontologies/people#cat|)
      (|http://cohse.semanticweb.org/ontologies/people#animal|)
      (*TOP* TOP)
      (|http://cohse.semanticweb.org/ontologies/people#pet|))
```


Highlighting “types” of Tom

Racer

RacerPorter

Shell Console TBoxes ABoxes Taxonomy Role Hierarchy Network Concepts Roles Individuals Assertions Queries Rules About

TBox people-pets.owl ABox people-pets.owl

Concept (cat) Role

Individual Tom Query / Rule

☐ Simplify Names

Tree Depth UNBOUNDED Tree Graph Bottom? Horizontally Vertically

Focus Reset Clear Log Concept Query Coherent? Classify Quit

RacerPro Log

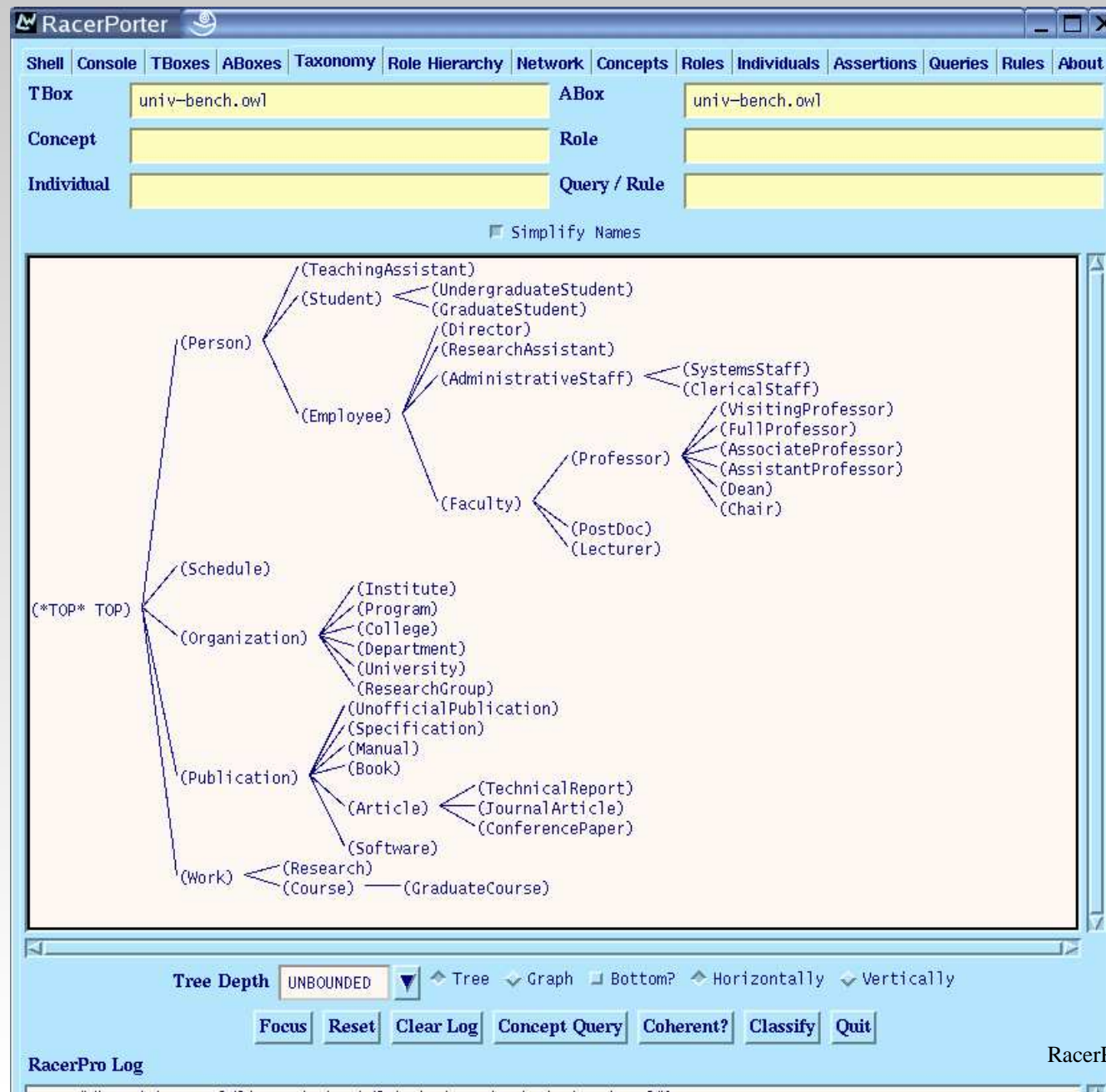
```
BOTTOM)))  
26 ? (RETRIEVE  
  (?X  
    (?X |http://cohse.semanticweb.org/ontologies/people#cat|)  
    :ABox  
    |/home/mi.wessel/people-pets.owl|)  
26 > (((?X |http://cohse.semanticweb.org/ontologies/people#Tibbs|))  
      ((?X |http://cohse.semanticweb.org/ontologies/people#Tom|)))
```

Graphical OWL Querying

- OWL Tree: Graphical interactive query composition and result browsing
- Background ontology: Lehigh University Benchmark (LUBM) Ontology
- Modeling of a university (classes for professors, courses, students, ...)
- “Real” web resources → “real” Semantic Web application!
- Queries are translated into nRQL queries, processed by RacerPro w.r.t. the background ontology
- Presentation given by RIKA students (?)

LUBM Background Ontology

Racer



Interactive Query Composition

Racer


http://owltree.in-terminus.net/OWLTree/index.jsp - Konqueror

Dokument Bearbeiten Ansicht Gehe zu Lesezeichen Extras Einstellungen Fenster Hilfe

Adresse: <http://univ-bench.owl%23GraduateCourse&addconcept.x=8&addconcept.y=11>

SuSE eBay Deutschland V...ste: michaelwessel CodeWeavers - Account file:/home >>

OWL-Tree



University Information System

Welcome to the homepage of the new university information system. The date you will see here is no real-life data. Currently this are only dummy information. Thanks for your understanding.

[Enable expert mode](#)

FullProfessor - +

L teacherOf GraduateCourse - +

[Absenden](#)

[Get a url \(link\) to preserve the complete state.](#)

If you want to throw away the complete tree and start all over please click [<<here>>](#).

Info:

Your choice:

- Start the query by clicking "submit query"
- Add a new Branch on a node by clicking on the plus sign (+) next to it
- Delete a branch by clicking the minus sign (-) next to it

Query Result

http://owltree.in-terminus.net/OWLTree/queryresult.jsp - Konqueror

Dokument Bearbeiten Ansicht Gehe zu Lesezeichen Extras Einstellungen Fenster Hilfe

Adresse: http://owltree.in-terminus.net/OWLTree/queryresult.jsp

SuSE eBay Deutschland V...ste: michaelwessel CodeWeavers - Account file:/home >>

OWL-Tree

University Information System

FullProfessor ☐

L teacherOf GraduateCourse ☐

Show selected nodes Zurücksetzen

#	FullProfessor	GraduateCourse
0	Prof. Dr. Joachim W. Schmidt <input type="button" value="Details"/>	Einführung in Datenbanksysteme <input type="button" value="Details"/>
1	Prof. Dr. Joachim W. Schmidt <input type="button" value="Details"/>	GraduateCourse1 <input type="button" value="Details"/>
2	Prof. Dr. Ralf M?ller <input type="button" value="Details"/>	GraduateCourse2 <input type="button" value="Details"/>
3	FullProfessor2 <input type="button" value="Details"/>	GraduateCourse3 <input type="button" value="Details"/>

Ontology-based GIS

- DLMAPS = Description Logic Maps
- Map Data ©Amt für Geoinformation und Vermessung Hamburg
- DISK (“Digitale Stadtkarte”)
- Uses RacerPro as ontology server and reasoning engine
- Remodeling of “Objektschlüsselkatalog” (geographic categories) as RacerPro ontology
- Representation of map objects in an ABox
- Hybrid representation: additional spatial layer
- Spatio-thematic hybrid queries

www.sts.tu-harburg.de/~mi.wessel/dlmaps/dlmaps.html