



Web Search Assistant

A Knowledge Base Application

Ed Powers, Ann Lee, Magdi Kamel
Naval Postgraduate School, Monterey CA



Overview

- Web Search Assistant
- Assumptions and Motivations
- Architecture
- User Interface
- Design Decisions

Web Search Assistant

- What is it for?
 - Assist a user in composing search terms for use in a Web portal
- What does it do?
 - Data Mining of OWL KB
 - Query the KB and find nodes that match user's search term (via Jena)
 - Allow users to traverse the ontology KB graph, including inferred nodes (via Racer)
 - Allow users to lookup the definitions of the terminology they are browsing (via WordNet)
 - Web-based user interface

Web Search Assistant

- How are we assisting Web search?
 - Help a user map a concept or thought to jargon needed for Web search
 - Help a user discover terminology in a domain
 - Help a user feel confident that the terms they are finding are relevant
- Why?
 - Getting productive results from a Web search portal can be difficult when you are unfamiliar with the domain knowledge of a subject
 - No metadata for web content
 - Navigate through brute force indexing

Motivation for Project

- Attempt to create an application that can leverage a KB in a simple way
 - Learn about the middleware tools used to interface with a KB
- Participate in building an application that would be useful enough to motivate further ontology development



Assumptions

- Ontologies are valid and available
- Ontologies are of manageable scale
- Ontologies are marked up in OWL

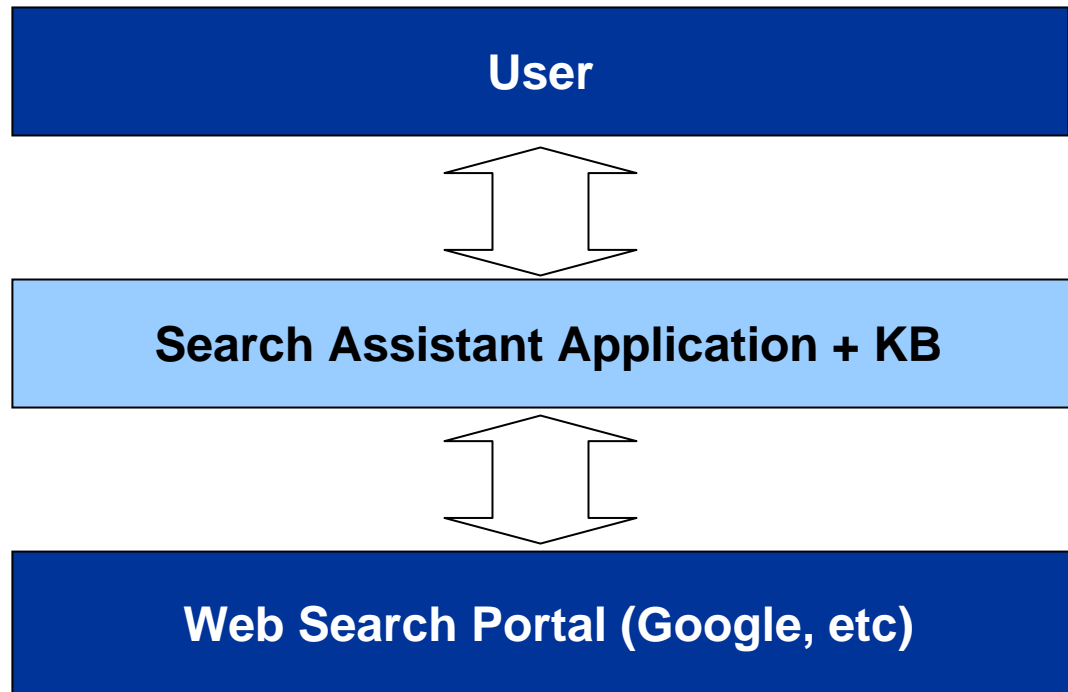
Users

- Who is the audience for the application?
 - Average Web surfer
 - Does not need to know about OWL or other kind of KB
 - Has the need to find terminology to “zero in” on Web content in an unfamiliar domain

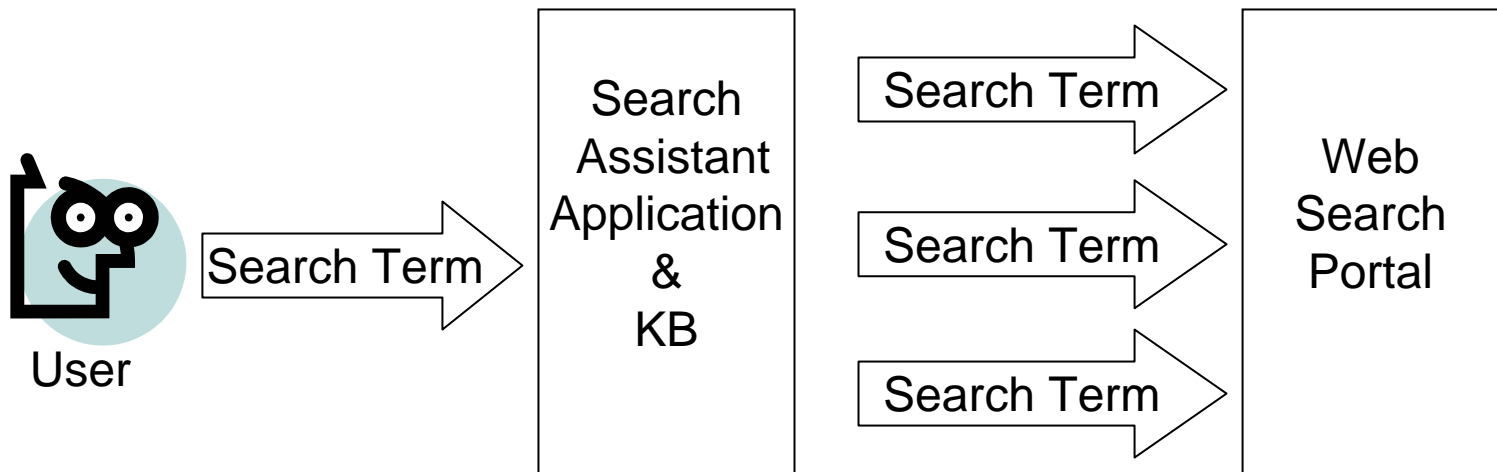
Web Search Assistant

- What are the benefits of OWL Ontologies?
 - Depict explicit Knowledge Representation (KR) of domain
 - Represent a real world domain in terms of objects and properties
 - Use of semantics to depict relationships between classes and between individuals
 - Ontologies are machine processed stores of human interpreted knowledge
 - OWL is extended RDF/XML and is suitable for Web medium

Architecture



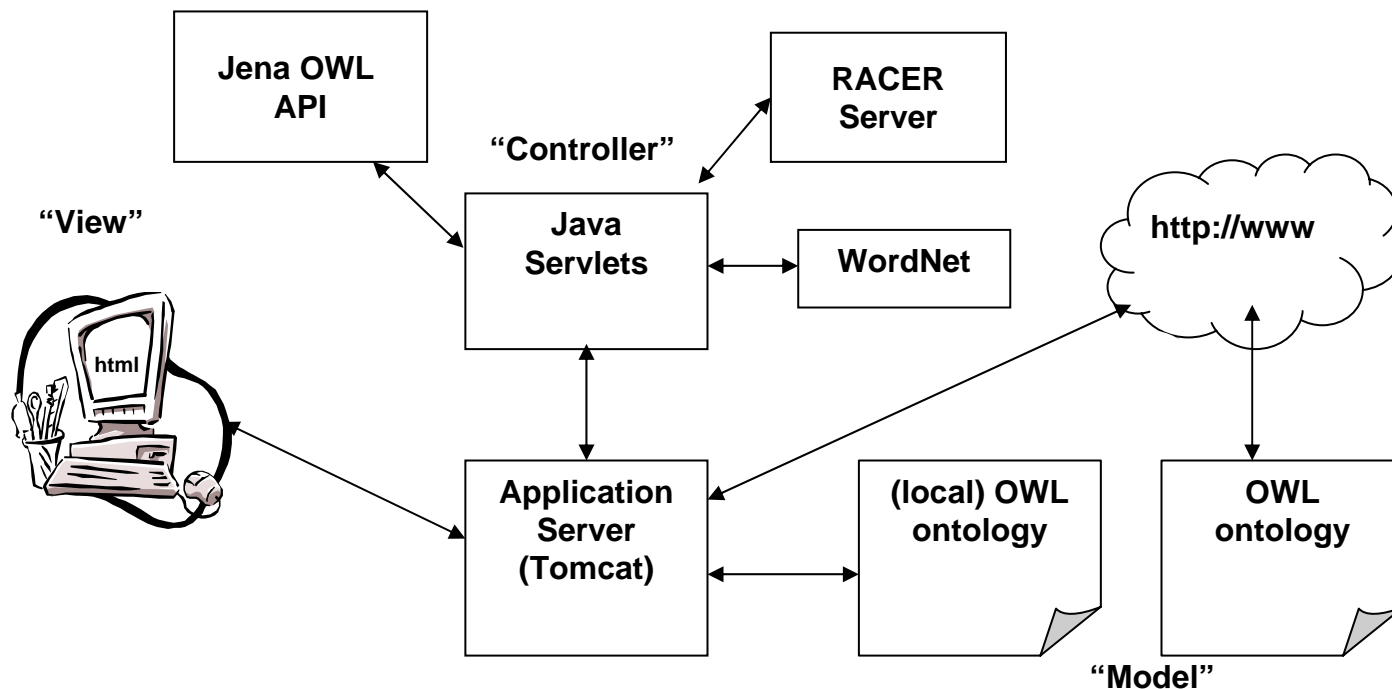
Architecture



Architecture

- Tomcat Application Server
 - Java Servlets
- Racer Server
 - JRacer API
- Jena Libraries
 - OWL API
- WordNet
 - JWNL Java WordNet DB Interface

Architecture: Model, View, Controller



Example of Geography Ontology

Geography Protégé 2.1.1 (file:\C:\Documents%20and%20Settings\Ann%20Lee\My%20Doc...

Project Edit Window OWL Wizards Code Help

OWLClasses Properties Forms Individuals Metadata

Subclass Relationship City_State (type=owl:Class)

Asserted Hierarchy

- owl:Thing
 - Body_of_Land
 - Archipelago
 - City
 - Capital_City
 - City_State
 - Continent
 - Country
 - City_State
 - Desert
 - Island
 - Mountain
 - Peninsula
 - Plateau
 - Rainforest
 - State
- Body_of_Water
- Salt_Content
- Climate
- Country_Descriptors
- Longitude
- Latitude

Name: City_State

rdfs:comment

Annotations

Property	Value	Lang
----------	-------	------

Asserted Inferred

Asserted Conditions

NECESSARY & SUFFICIENT

- City
- Country

NECESSARY

- hasCapital = 1 [from Country]

INHERITED

- \exists hasCountry Country [from City]
- locatedIn \supseteq Country [from City]
- locatedIn \supseteq Continent [from Country]

Properties

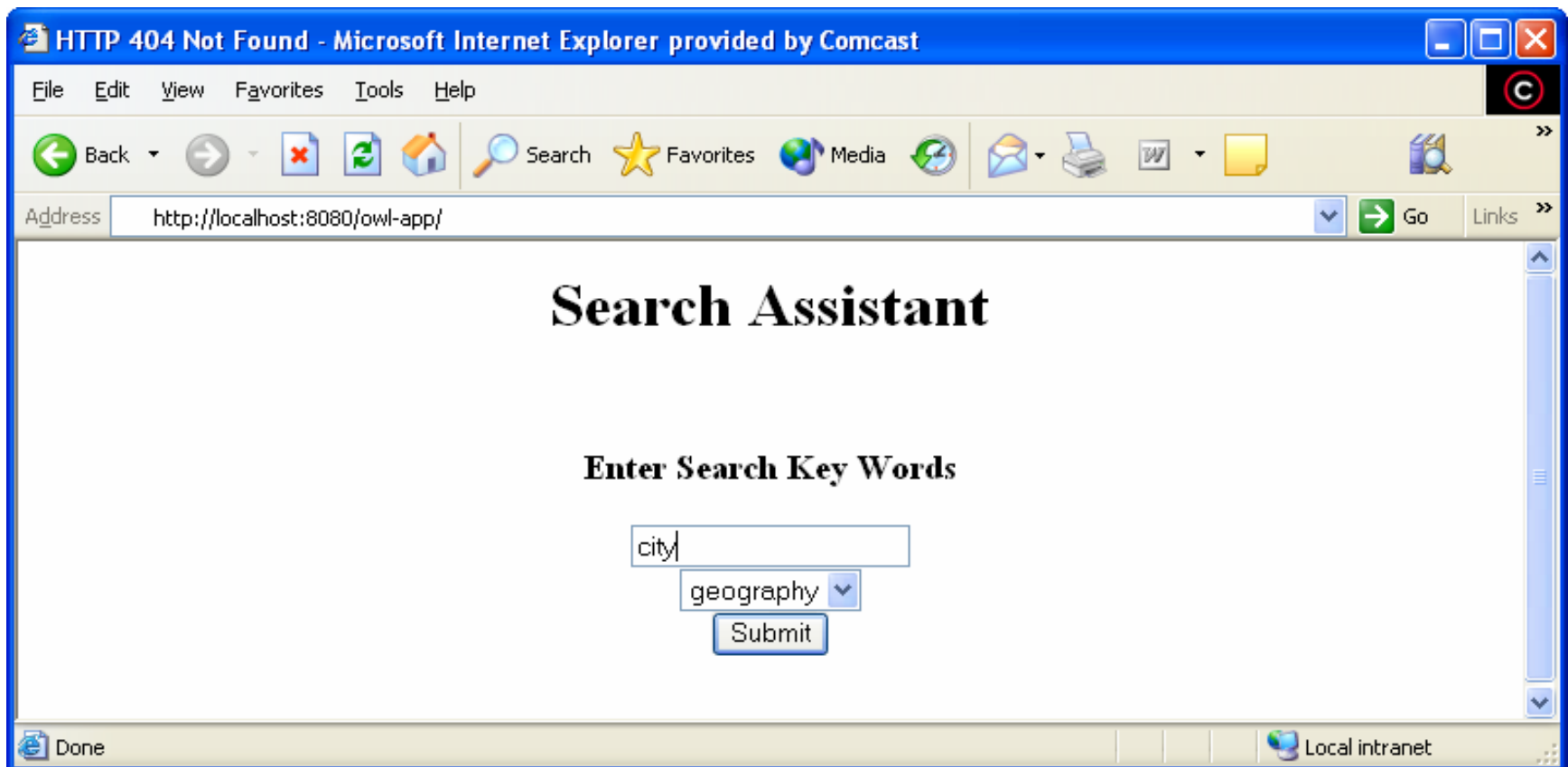
- hasCapital
- hasCountry
- locatedIn
- hasPresident

Disjoints

Logic View Properties View

User Interface

- Initial screen is simple input HTML form



User Interface

Web Search Assistant - Microsoft Internet Explorer provided by Comcast

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media Print Mail

Address Go Links >>

Search Assistant

Search String: "City"

"City" is a Class

Parents of "CITY"	Children of "CITY"	Siblings of "CITY"	Instances of "CITY"	Attributes of "CITY"
Body of land Def Sel	Capital City Def Sel	Country Def Sel	Mexico City Def Sel	Located in Country Def Sel
	City State Def Sel	Continent Def Sel	Rio de Janeiro Def Sel	
		State Def Sel	Cape Town Def Sel	

My Computer

User Interface

Web Search Assistant - Microsoft Internet Explorer provided by Comcast

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media

Address Go Links >>

Search Assistant

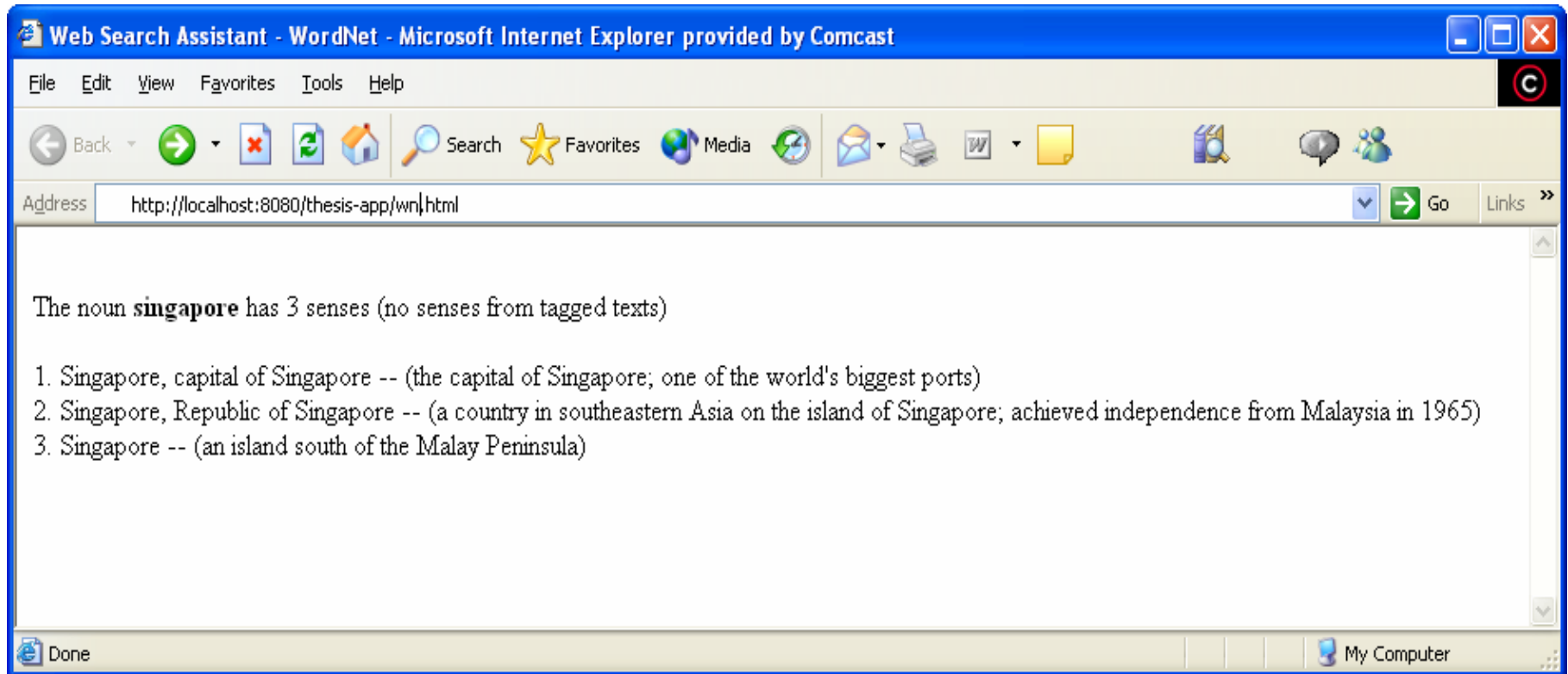
Search String: "City State"

"City State" is a Class

Parents of "CITY STATE"	Children of "CITY STATE"	Siblings of "CITY STATE"	Instances of "CITY STATE"	Attributes of "CITY STATE"
City Def Sel		Capital City Def Sel	Singapore Def Sel	Located in Country Def Sel
			Vatican City Def Sel	Located in Continent Def Sel
				Has Capital Def Sel
				Has President Def Sel
				Has Language Def Sel

Done My Computer

User Interface



User Interface

Search Assistant

Search String: "City State"

"City State" is a Class

Parents of "CITY STATE"	Children of "CITY STATE"	Siblings of "CITY STATE"	Instances of "CITY STATE"	Attributes of "CITY STATE"
City Def Sel		Capital City Def Sel	Singapore Def Sel	Located in Country Def Sel
			Vatican City Def Sel	Located in Continent Def Sel
				Has Capital Def Sel
				Has President Def Sel
				Has Language Def Sel

User Interface

The screenshot shows a Microsoft Internet Explorer window titled "Web Search Assistant - Microsoft Internet Explorer provided by Comcast". The address bar contains the URL "http://localhost:8080/thesis-app/index.html/response3.html". The main content area displays the following information:

Search Assistant

[Empty search input field]

Search String: "Singapore"

"Singapore" is an Instance belonging to Class: City States

Class of "SINGAPORE"	Parent Class of "SINGAPORE"	Siblings of "SINGAPORE"	Attribute names of "SINGAPORE"	Attributes values of "SINGAPORE"
City State Def Sel	City Def Sel	Vatican City Def Sel	Located in Country Def Sel	Singapore Def Sel
	Country Def Sel		Located in Continent Def Sel	Asia Def Sel
			Has Capital Def Sel	Singapore Def Sel
			Has President Def Sel	S.R. Nathan Def Sel

The browser's taskbar at the bottom shows the "My Computer" icon.

User Interface

Web Search Assistant - Microsoft Internet Explorer provided by Comcast

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Refresh Print Mail New Tab

Address <C:\NPS\Ed\thesis\Conference-paper\response3.html> Go Links >>

Search Assistant

Singapore Asia S.R. Nathan

Search String: "Singapore"

"Singapore" is an Instance belonging to Class: City States

Class of "SINGAPORE"	Parent Class of "SINGAPORE"	Siblings of "SINGAPORE"	Attribute names of "SINGAPORE"	Attributes values of "SINGAPORE"
City State Def Sel	City Def Sel	Vatican City Def Sel	Located in Country Def Sel	Singapore Def Sel
	Country Def Sel		Located in Continent Def Sel	Asia Def Sel
			Has Capital Def Sel	Singapore Def Sel
			Has President Def Sel	S.R. Nathan Def Sel

My Computer

Design Decisions Pending. . .

- How much of the restrictions and OWL semantics would be helpful to the users?
 - cardinality
 - equivalentClass
 - differentFrom
 - sameAs
- Visual reference to KB graph traversal



Conclusions

- Build it and they will come. . .



Questions/Comments