



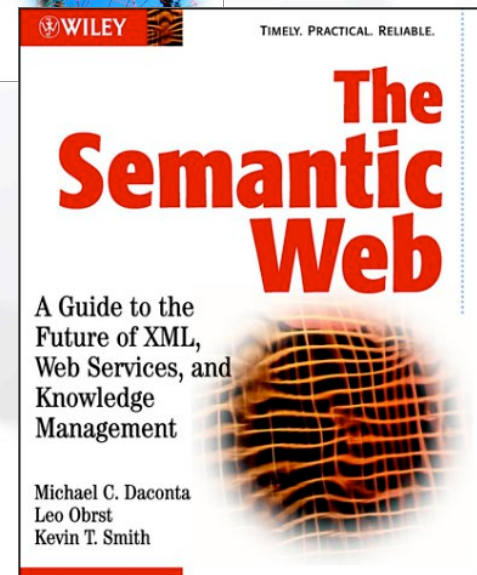
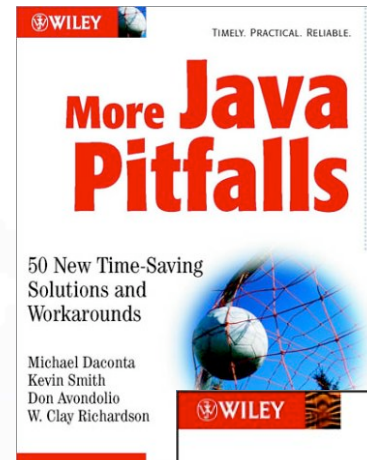
# **The emerging Semantic Web and its Benefits for Homeland Security**

Michael C. Daconta  
Chief Scientist, APG  
McDonald Bradley, Inc.  
June, 2003



# Introduction

- **Michael C. Daconta**
- Director, Semantic Web Technologies & Chief Scientist, Advanced Programs Group, MBI
- Chief DIA Architect, VKB & Collateral Space/NCES
- Author/co-author of 10 technical books
- Inventor of Fannie Mae XML Electronic Mortgage Standards





# Agenda

- What is the Semantic Web?
  - Vision
  - Smart Data Continuum
  - Taxonomies, Ontologies, Inference
- How can we apply Semantic Web Technologies to Homeland Defense?
  - Semantic Interoperability
  - Semantic Search
  - Web Service Orchestration





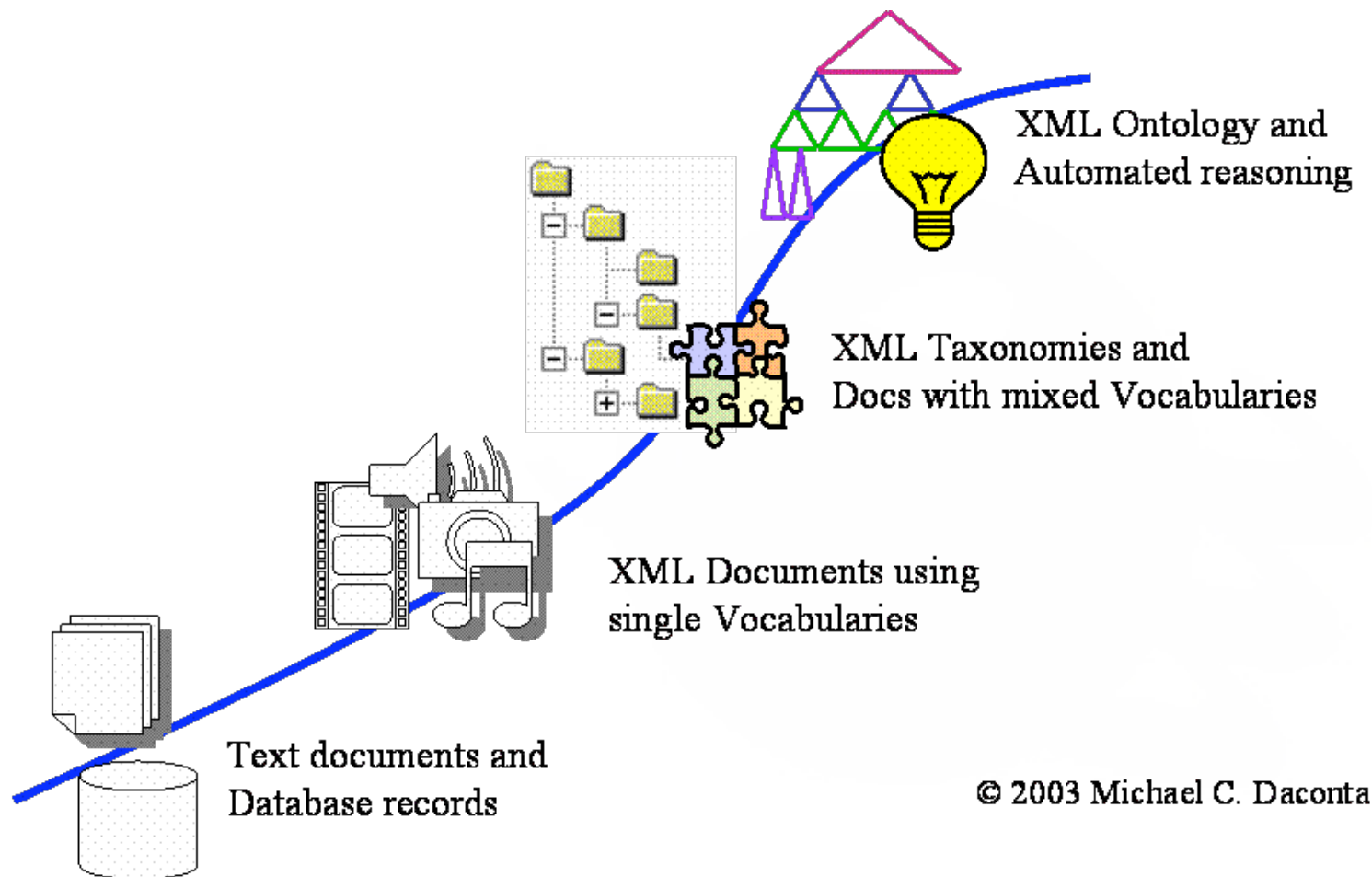
# What is the Semantic Web

- A machine-processable web of data.
  - Tim Berners-Lee's Vision
  - Smart Data Continuum
  - Taxonomies
  - Ontologies
  - Inference





# The Smart Data Continuum



© 2003 Michael C. Daconta

The trend is to put the “smarts” in the data, not in the applications.



## Linnaean classification of a house cat

**Kingdom**.....Animalia

**Phylum**.....Chordata

**Class**.....Mammalia

**Order**.....Carnivora

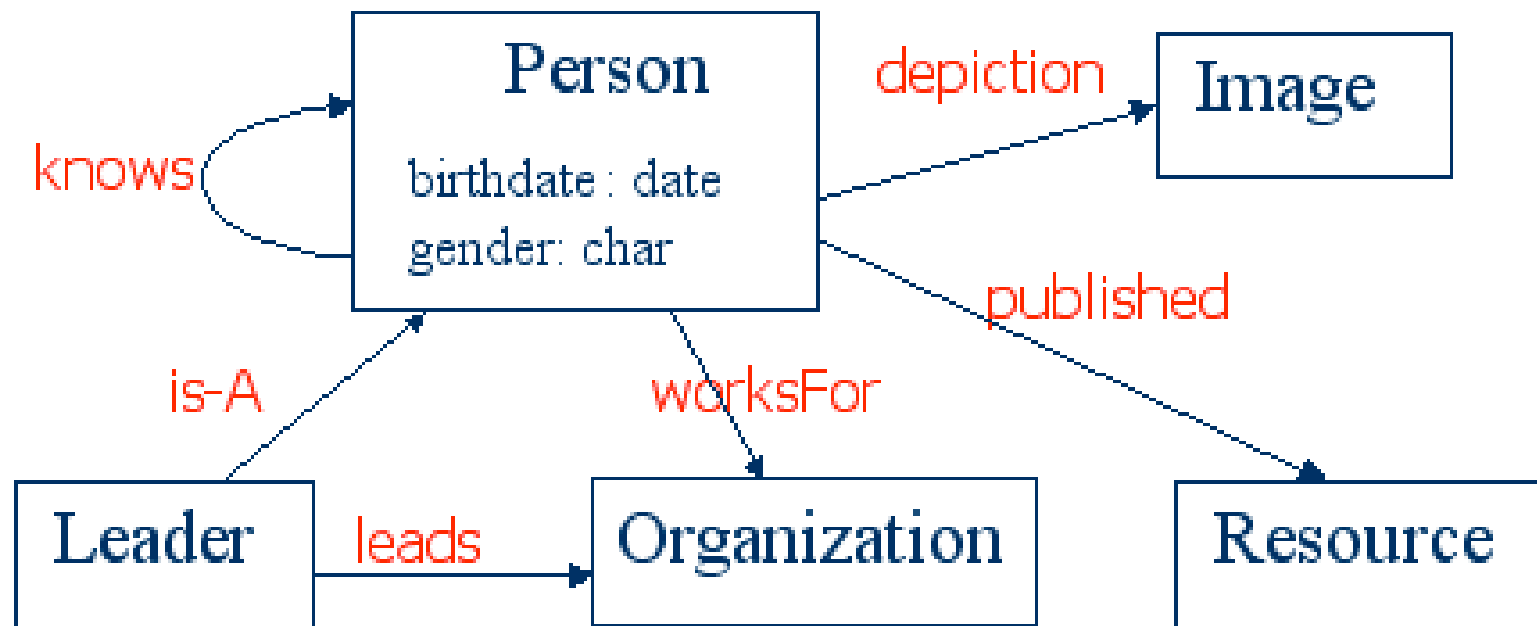
**Family**.....Felidae

**Genus**.....*Felis*

**Species**.....*Felis domesticus*



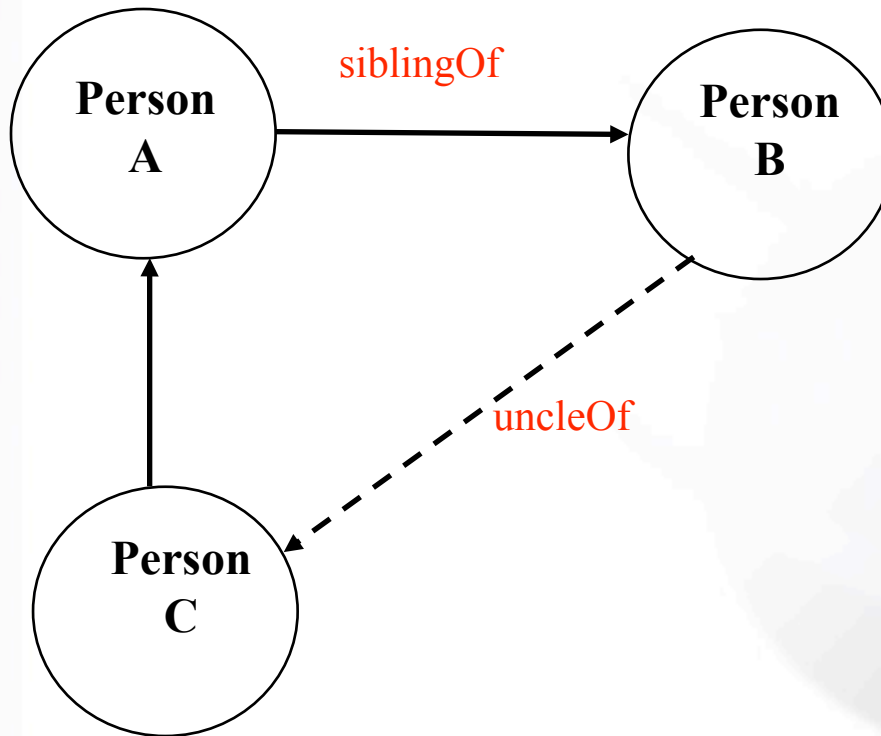
# Ontologies







# Inference = Ontologies + Rules



## Rules

if (C.gender == "male" AND  
C == childOf(A))  
then C = sonOf(A);

if (B.gender == "male" AND  
B == siblingOf(A))  
then B == brotherOf(A);

if (C == sonOf(A) AND  
B == brotherOf(A))  
then B = uncleOf(C);

- Two given relations and one inferred relation (uncleOf)



# Inference Demonstration

```
CLIPS 6.0
File Edit Execution Browse Window Help
CLIPS> Defining deftemplate: person
Defining deftemplate: father-of
Defining deftemplate: mother-of
Defining deftemplate: male
Defining deftemplate: female
Defining deftemplate: wife-of
Defining deftemplate: husband-of
Defining deftemplate: brother-of
Defining deftemplate: sister-of
Defining deftemplate: child-of
Defining deftemplate: uncle-of
Defining deffacts: people
Defining defrule: infer-uncles +j+j
TRUE
CLIPS> (reset)
==> f-0      (initial-fact)
==> f-1      (person (name "Samantha Daconta") (gender "female") (age 7))
==> f-2      (person (name "Michael Daconta") (gender "male") (age 37))
==> f-3      (person (name "Joe Daconta") (gender "male") (age 64))
==> f-4      (person (name "Lynne Daconta") (gender "female") (age 34))
==> f-5      (person (name "Frank Daconta") (gender "male") (age 39))
==> f-6      (father-of (father "Michael Daconta") (child "Samantha Daconta"))
==> f-7      (brother-of (person "Frank Daconta") (brother "Michael Daconta"))
==> Activation 0      infer-uncles: f-6,f-7
CLIPS> (run)
FIRE      1 infer-uncles: f-6,f-7
==> f-8      (uncle-of (uncle "Frank Daconta") (child "Samantha Daconta"))
CLIPS> |
```



# Semantic Web for Homeland Defense?

- Semantic Interoperability
- Semantic Search
  - Asymmetric Search
  - Activity-based Search
  - Refined Search
- Web Service Orchestration
- Current Examples



# Why do we need this?



What is Al Qaeda?

Today:

39,800 Matches on 6 March 2002

What is Al Qaeda?

A terrorist organization

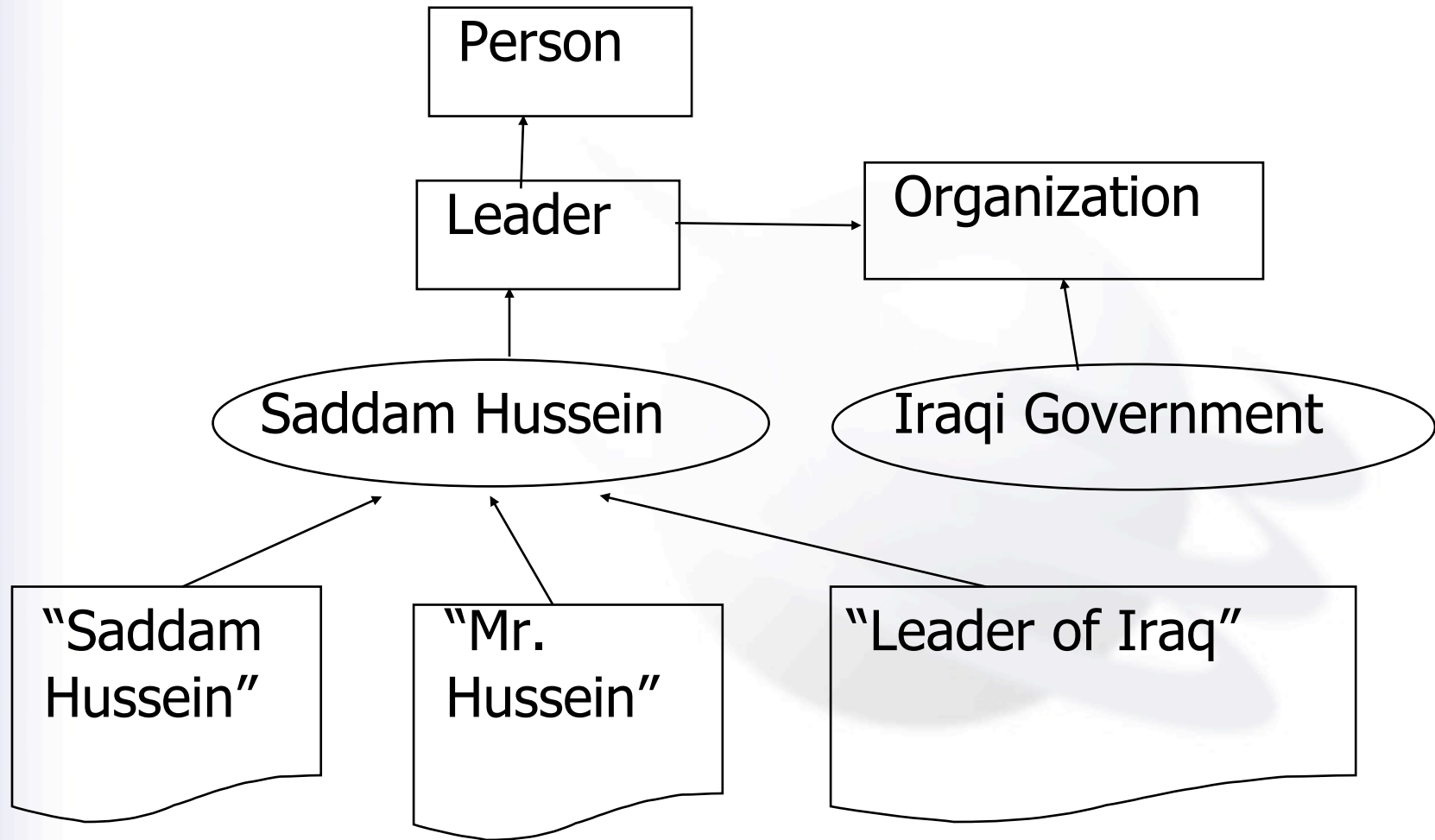
Would you like additional information on?

- ☐ Membership
- ☐ Locations
- ☐ Structure
- ☐ Finances
- ☐ Tactics
- ☐ Other terrorist organizations

Tomorrow:



# Semantic Interoperability



- 3 separate syntaxes → same “thing”
- Eliminate ambiguity!



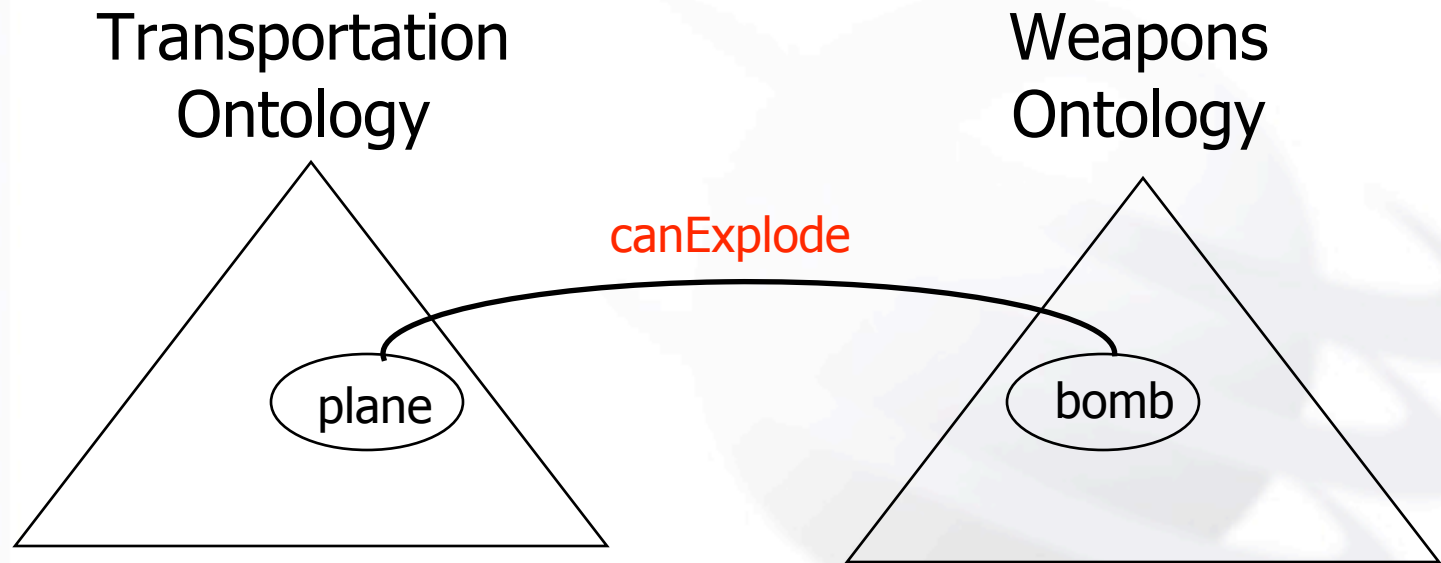
# For Our Security ... Luck is not enough!



- To jump to #1 result in a google search you press the **“I’m Feeling Lucky”** button!
- #1 Reason for ontologies -- eliminate syntactic ambiguity!



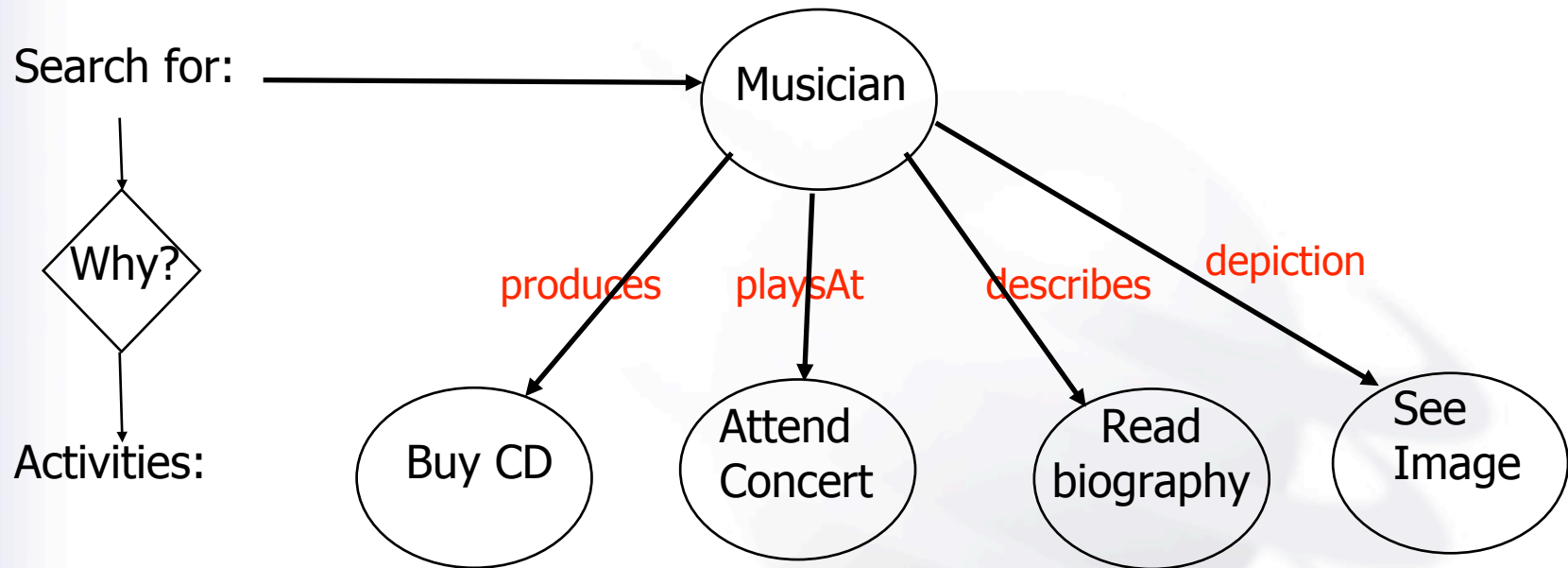
# Asymmetric Search



- “Search by association” is the “killer-app” for robust ontologies.



# Activity-based Search



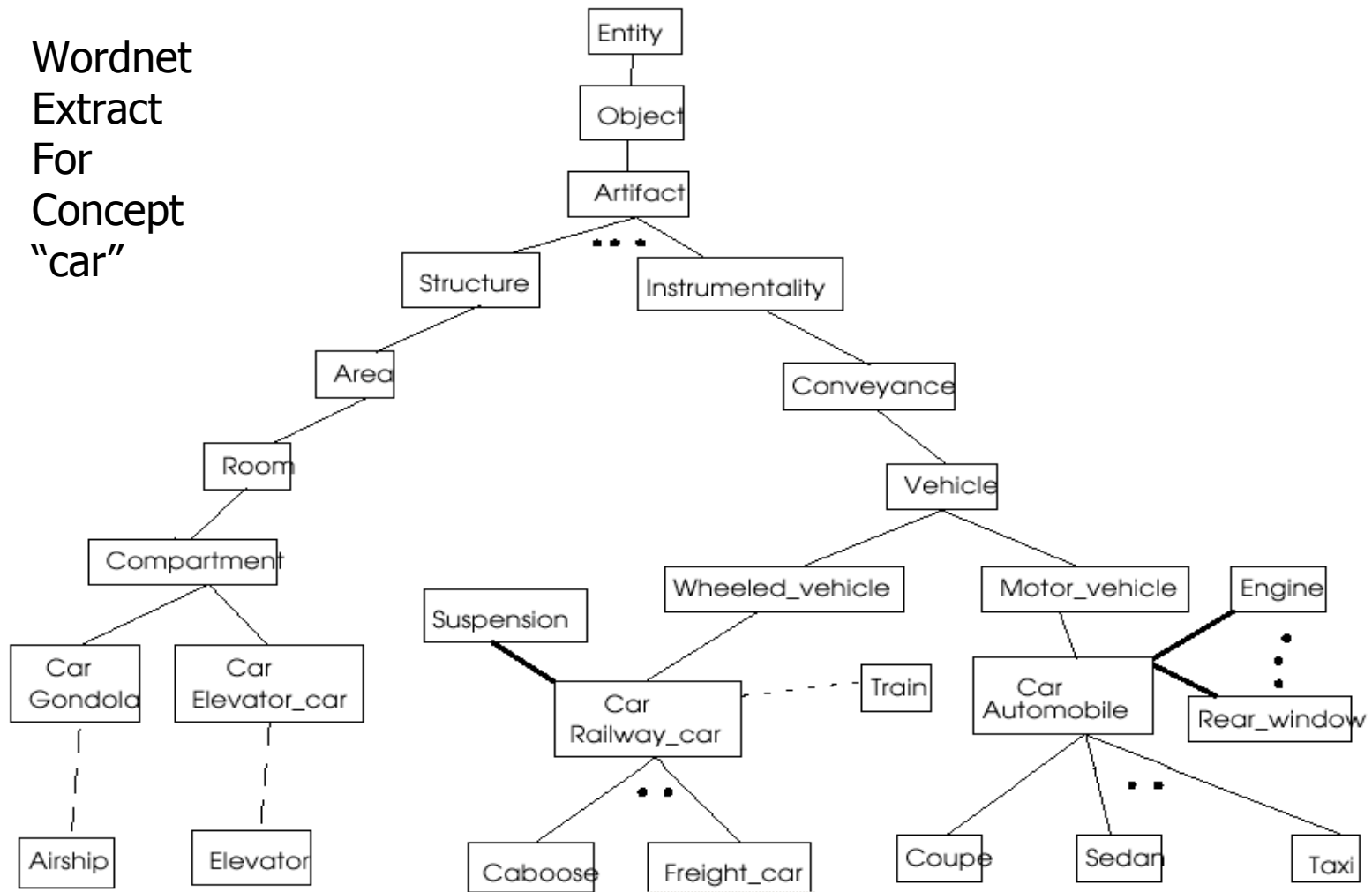
➤ Demos of Activity based search at <http://tap.stanford.edu>





# Refined Search

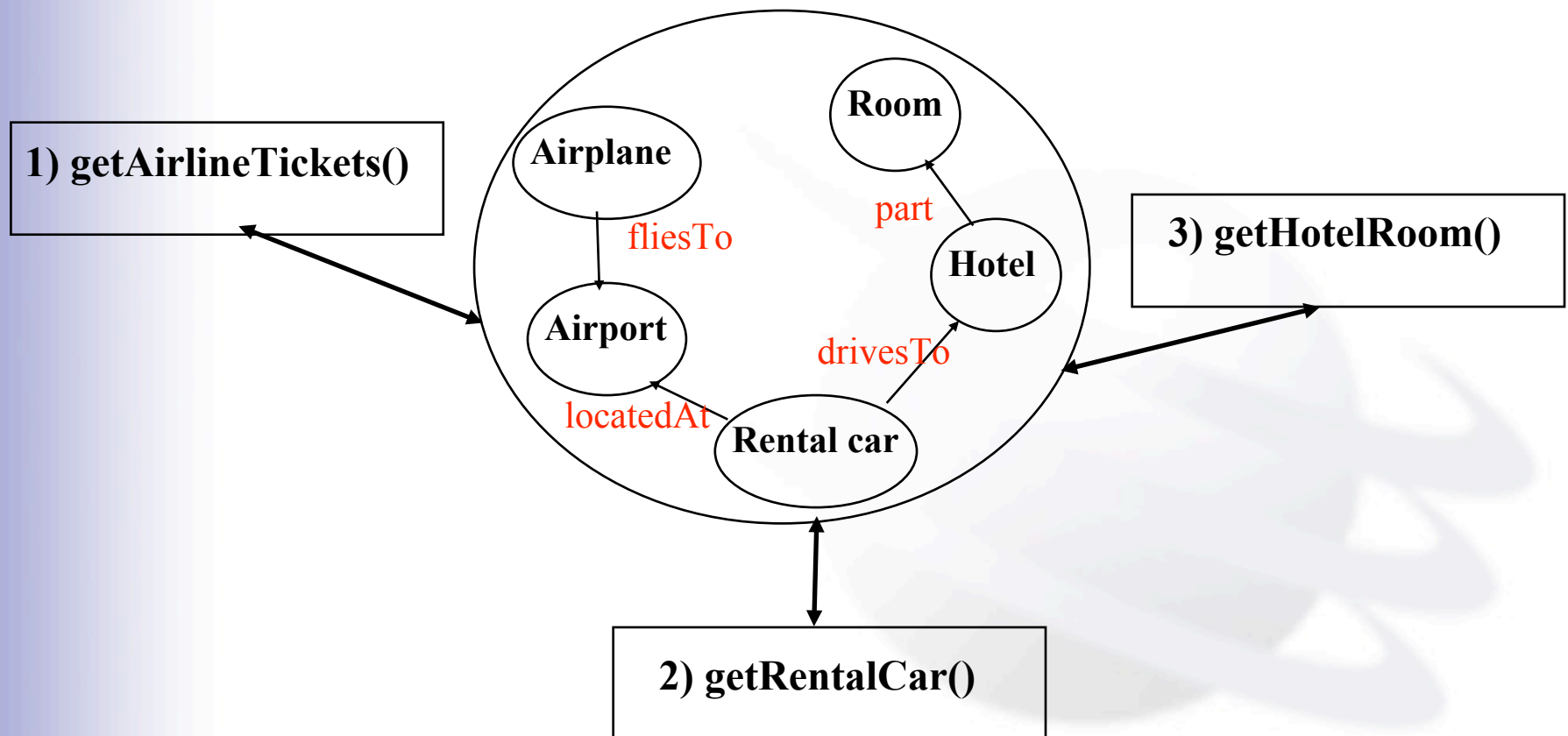
Wordnet  
Extract  
For  
Concept  
"car"



➤ Expand/Narrow Search Terms via an Ontology



# Web Service Orchestration



- Canonical Example: Trip reservations for airline, rental car and hotel need to be orchestrated.



## Some Examples

- WordNet
- [www.TheyRule.net](http://www.TheyRule.net)
- [www.OpenCyc.org](http://www.OpenCyc.org)
- Standard Upper Merged Ontology (SUMO)
- US National Cancer Institute Ontology
  - ~17,000 classes
  - >1 million synonyms and definitions
- [www.mindswap.org](http://www.mindswap.org)
- Many More!!



## Visit Us at Our Booth!

- McDonald Bradley, Inc. is at Booth #661
- MBI is a fast-growing, woman-owned small business.
- Semantic Web Contracts
  - DIA's Virtual Knowledge Base (VKB)
  - Net-centric Enterprise Services (NCES)
- We can help you leverage Semantic Web Technologies!