CSc 8711
Databases and the Web

Syed Haque

shaque4@student.gsu.edu

Department of Computer Science

Georgia State University

Atlanta, GA 30303

OWL API

Outline

- INTRODUCTION
- OWL API BACKGROUND AND PHILOSOPHY
- OWL API
- EXAMPLES
- REFERENCES

Introduction – OWL API

- Familiarity with Java
- (Some) Familiarity with Semantic Web Technologies:
  - RDF
  - RDF Schema
  - OWL
- Being at least aware of the existence of:
  - Description Logics

Ontology in Computer Science

- An ontology is an engineering artifact:
  - It is constituted by a specific vocabulary used to describe a certain reality, plus
  - a set of explicit assumptions regarding the intended meaning of the vocabulary
- Thus, an ontology describes a formal specification of a certain domain:
  - Shared understanding of a domain of interest
  - Formal and machine manipulable model of a domain of interest

Building a Semantic Web

- Annotation
  - Associating metadata with resources
- Integration
  - Integrating information sources
- Inference
  - Reasoning over the information we have.
  - Could be light-weight (taxonomy)
  - Could be heavy-weight (logic-style)
- Interoperation and Sharing are key goals

Languages

- Work on Semantic Web has concentrated on the definition of a collection or “stack” of languages

- The languages provide basic machinery that we can use to represent the extra semantic information needed for the Semantic Web：

- XML, RDF, RDF(S), OWL, …..

Why (Formal) Semantics?

- Increased formality makes languages more amenable to machine processing (e.g. automated reasoning).
- The formal semantics provides an unambiguous interpretation of the descriptions.

  – What does an expression in an ontology language mean?

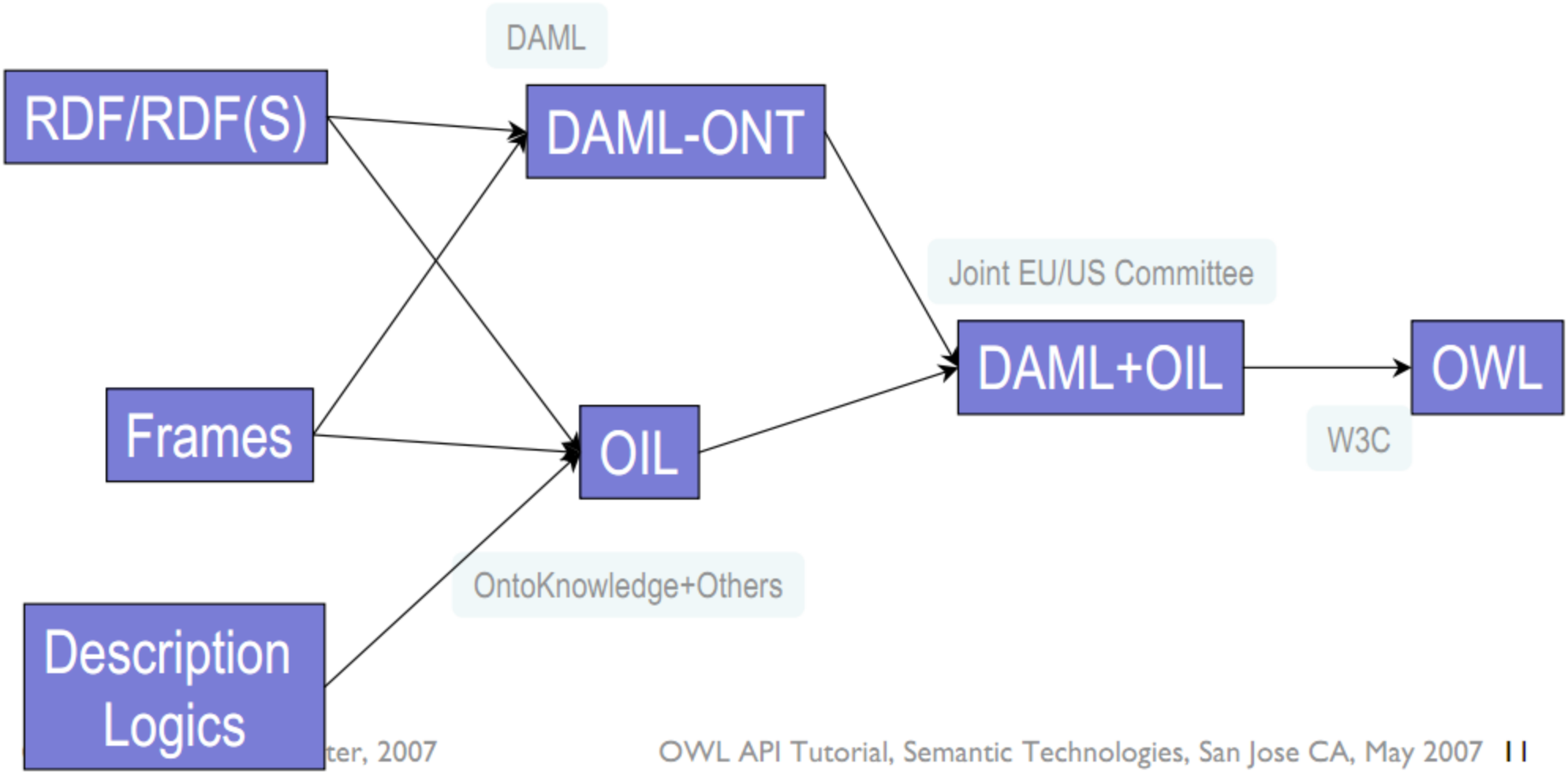
  – The semantics of a language tell us precisely how to interpret a complex expression.
- Well defined semantics are vital if we are to support machine interpretability

  – They remove ambiguities in the interpretation of the descriptions.

OWL

- OWL is a language for representing Ontologies in a Web context
  - Web Ontology Language

- A W3C Recommendation
  - Since February 2004


DAML
RDF/RDF(S)
DAML-ONT
Joint EU/US Committee
DAML+OIL
OWL
Frames
OIL
W3C
OntoKnowledge+Others
Description Logics

Points from History

- Influence of frame based modelling approaches
  – Classes, slots, fillers
- Influence of logical foundations
  – Well-formed semantics
  – Inference
- Influence of Web Languages
  – RDF, RDF(S)

OWL API

- OWL allows us to describe a domain in terms of :
  - Individuals
  - Classes
  - Properties
- Plus a collection of axioms describing how these classes, individuals, properties etc. should be interpreted

Why build an OWL API?

- The use of a higher level data model can help to insulate us from the vagaries of concrete syntax.
- make it clear what is happening in terms of functionality.
- increase the likelyhood of interoperating applications.
- Ontology level objects made it easy to write code spotting “internal errors”

ASSUMPTIONS

- Primarily targeted at OWL-DL
- Java based:
  - Interfaces
  - Java reference implementation – Main memory based
  - INFRASTRUCTURE – THIN OR THICK

OWL Implementation

- Modelling
- Parsing
- Serializing
- Manipulation/Change
- Inference

OWL Abstract Syntax

- Provides a definition of the language in terms of the constructs and assertions allowed.

- Semantics are then defined in terms of this abstract syntax.

- OWL API data model is based largely on this abstract syntax presentation.
  - Conceptually cleaner.
  - Syntax doesn't get in the way

Overall Philosophy

- The OWL API is targeted primarily at representing OWL-DL
- An Ontology is represented as a collection of axioms that assert information about the classes, properties and individuals that are in the ontology

Basic Data Structures

- Classes to Help
  - Create
  - Manipulate
  - Parse
  - Render
  - Reason about those structures

- At its heart, the OWL API provides data structures representing OWL ontologies

- The basic data structure represents the objects in the ontology and corresponds roughly to the abstract syntax of OWL.

Logical and Physical Mapping

- The API defines the notion of logical and physical URIs
- Logical: the URI used to name the ontology
- Physical: the location where the ontology was retrieved from
- An OntologyURIMapper is then used to map between physical and logical URIs
- Allows for local copies or repositories of ontologies

Classes

- OWLOntology
- OWLClass
- OWL Entity
- OWLProperty
- OWLObjectProperty
- OWLDataProperty
- OWLAxiom

Inference

- OWLClassReasoner
- OWLConsistencyChecker
- OWLIndividualReasoner
- OWLPropertyReasoner

Reasoner Implementations

- Pellet
- FaCT++
- Hermit

Managing Ontologies

- The model data structures provide representations of the basic building blocks.
- Management and creation of ontologies is controlled by an OWLOntologyManager. This replaces OWLConnection/OWLManager in the original implementation
- The Manager is responsible for keeping track of the ontologies and concrete formats for storage of the ontologies.
- Handles Ontology changes

References

[1] http://owlapi.sourceforge.net/index.html
[2] http://en.wikipedia.org/wiki/Semantic_Web
[3] http://www.w3.org/2007/OWL/wiki/Document_Overview
[4] http://sourceforge.net/projects/owlapi/
[5] http://owl.man.ac.uk/api/readme.html
[6] http://wonderweb.semanticweb.org/
[7] http://www.co-ode.org/