Ontologies for Web Services

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Definitions

- Knowledge representation means that knowledge is formalized in a symbolic form, that is, to find a symbolic expression that can be interpreted. – Klein and Methlie
- Knowledge engineering is the application of logic and ontology to the task of building computable models of some domain for some purpose. – John Sowa
- An ontology is a specification of a conceptualization. – Tom Gruber

What are Ontologies?

- An ontology specifies a rich description of the:
  - Terminology
  - Concepts
  - Relationships between the concepts
  - Rules

  relevant to a particular domain or area of interest

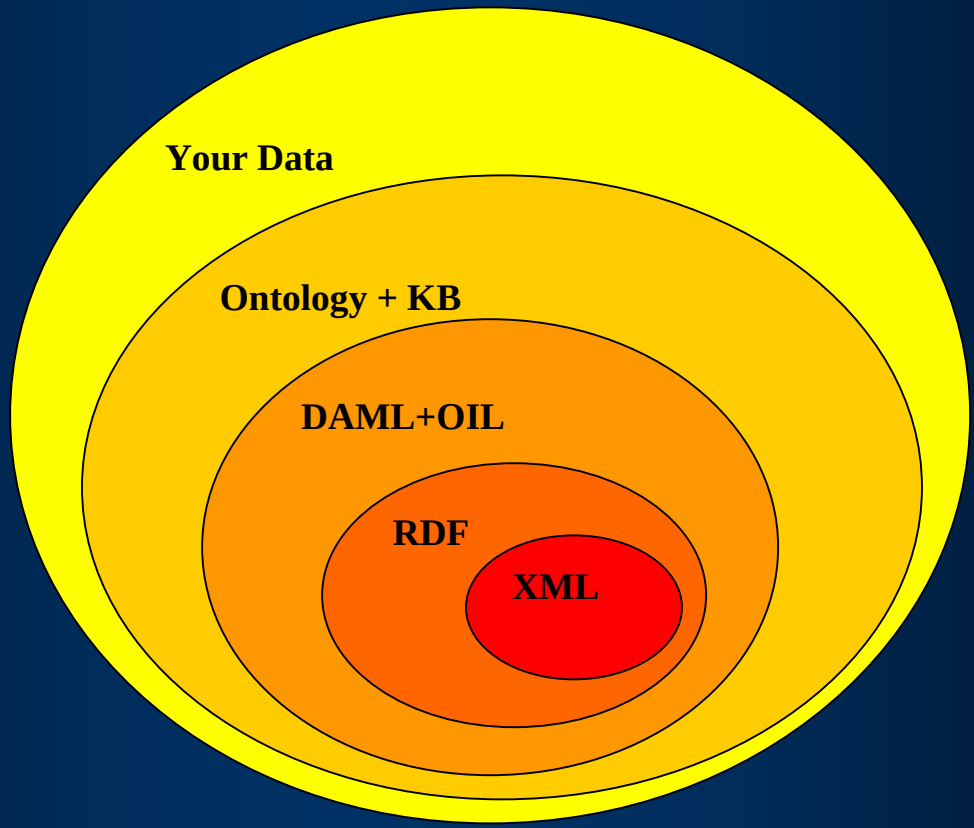
Kinds of Ontologies

- An *Upper-Level* ontology defines the base concepts upon which other ontologies are created.
- A *domain* ontology, which we might also call a *classic* ontology, defines the terminology and concepts relevant to a particular topic or area of interest.
- A *process* ontology defines the inputs, outputs, constraints, relations, terms, and sequencing information relevant to a particular business process or set of processes.
- An *interface* ontology defines the structure and content restrictions relevant for a particular interface *(e*.g., application programming interface (API), database, scripting language, etc.).
- A *role-based* ontology defines terminology and concepts relevant for a particular end-user (person or consumer application).

KR Domain Overview

- Early work on KR done by the Artificial Intelligence community
- KR domain has historically neglected common software engineering discipline
- Mapping between KR concepts and software engineering concepts not always straight forward
- Granularity of ontology models varies greatly between organizations

Why Not XML?



- Ontologies allow you to access and share more of your data.
- Ontologies improve accuracy, promote completeness
- Ontologies are more flexible than simple tags
- Ontologies provide semantics to the information “between the tags”

Use of Ontologies on the Web

- Improves the accuracy of web searches by searching for concepts instead of keywords.
- Allows systems that were independently developed to work together to exchange information.
- Facilitates the use of agents to collect, process, and exchange information.
- Helps tackle complicated questions whose answers do not reside on a single web page.

Ontology Development Issues

- Ontology methodology fragmentation – DAML should help
- Poor tool support
- Lack of existing ontology base
- Scale of ontologies – need a component-based approach
- Scope of ontologies – where do you stop?

Motivation to use UML for Ontology Development

- Importance of knowledge representation (ontologies) increasing
- No existing commercial tools for Ontology modeling
- Pool of experienced ontologists small
- Population of UML experienced engineers is growing
- Need to make Ontology modeling accessible to domain experts

UML Profile for Ontologies

Frame-Based KR (Ontology) Element	UML Metamodel Element(s)	UML Stereotype
Ontology	Package	Ontology
Class	Package Class	ClassFrame OntologyClass
Relation	Package Class Association	RelationFrame Relation Domain
Function	Package Class Association Association Operation	FunctionFrame Function Domain Range Function
Individual	Class Association	Individual IndividualOf
Slot	Class Association	SlotRelation HasSlot
Facet	Attribute	Facet
Axiom	Operation, External File	Axiom

Issues Encountered Implementing the UML Profile as a Rose add-in

- Conceptual differences between the KR and UML domains
- Limitations in tool support impacted implementation of ontology modeler add-in, and therefore impacted the profile itself