RDF, OWL And SPARQL

Ontologies, Standards, Triples, Datatypes, RDF, RDF Schema, OWL, Entities, SPARQL, Reasoning

This course provides a guided tour of the world of knowledge representation and reasoning, from an ontology perspective. We will see that a graph is the most scalable, extensible and distributed form of knowledge representation and facilitates knowledge reasoning to incorporate additional facts.

W3C has defined a layered set of standards related to defining and querying ontologies. We will discover how each standard builds on a foundation to add more ontology-related functionality and together they define a comprehensive solution to ontology management.

Resources are identified with internationalized URIs (IRIs). We start with an agreed set of basic datatypes (number types, strings, URI, dates), then use them to define simple statements in the form of triples (subject-predicate-object), then build groups of such statements into graphs, and then combine multiple graphs into datasets.

We add a query engine in front of such datasets to make them accessible to distributed clients. We can define rules to add more control over ontology interaction. We support knowledge reasoning via inferencing.

Target Audience

Software engineers and knowledge engineers who wish to learn more about creating and interrogating ontologies using the latest W3C standards

Prerequisites

A software engineering background with some experience of creating semantic models

Contents of One-Day Training Course

Ontologies

Representing knowledge
The knowledge graph
Description Logics (DL)
Reasoning about knowledge
Tour of the world of ontologies

Ontology Standards

W3C has been very active in defining a suite of standards related to ontologies
Review of W3C layered standards

Protégé Tooling

Stanford University has created the Protégé tool (http://protege.stanford.edu) - "A free, open-source ontology editor & framework for building intelligent systems"

XML Datatypes

The common primitives (int, string, date) for ontologies and the knowledge graph
Value space vs. lexical space
Facets for specialization

Introduction to RDF

Role of Resource Description Framework
Statement: subject, predicate, object
Managing triples

RDF Schema

Extending the RDF vocabulary
Defining classes and their properties
Reification

Introduction to OWL

Web Ontology Language (OWL) expands the vocabulary for representing knowledge
Tour of OWL capabilities – axioms, etc.
Literals/datatypes/dataranges/expressions

OWL Entities

Named Individual
Class
Datatype
Object Property
Data Property
Annotation Property

SPARQL Introduction

SPARQL is to ontologies what SQL is to a relational database – a flexible language to query and update knowledge graphs

Advanced SPARQL

Result formats
Update
Federated queries

Existing Datasets

Exploring available big datasets, e.g.:
- Dbpedia (http://wiki.dbpedia.org/)
- Wikidata (https://www.wikidata.org)

Reasoning & Rules

Inferencing over ontologies
Discovering new relationships
Defining rules using RIF

Ontologies & Machine Learning

Some folks think of ontologies as competing with ML – we look at this question and how to use them together

Ontology Design

Review of how to create ontologies using what we have learnt

Project

Designing a large software solution incorporating ideas explored in this course