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# Semantic Technology

*Evolution, Revolution, or Intelligent Design?*

# RDF/OWL: What's the big deal?

## Foundations

- Decades of AI research on Knowledge Representation
- Stable SQL database and OOP application platforms – all open source!
- Stable naming and data exchange platform: URI + XML (with namespaces)

## RDF – Resource Description Framework

- Programmer's view: RDF represents OOP-ish graphs without "behavior"
  - Supports column (SQL), hierarchy (XML), and graph (OOP) paradigms
  - RDF triples are 1) self contained, 2) namable with URIs, 3) easy to combine
    - Note subtyping of properties!
- Knowledge view: RDF represents assertions about resources
  - Meta-models (RDFS) and regular-models use same mechanisms
  - All model and meta-model semantics are decoupled from representation

## OWL – Web Ontology Language

- Description Logic over distributed models, grounded in RDF
  - OWL "concepts" (classes, properties, and individuals) are RDF resources
  - Relationships between concepts are defined with yet more resources
  - Reasoners can infer more concepts, models can be checked for consistency

# Ontology Applications

## Enterprise and Global Architectures

- Vocabulary management (encompasses glossary, taxonomy)
- Different contexts can use linked or mapped ontologies
- Natural fit with Web Services, registries, and BPM
  - See OWL-S: Semantic Markup for Web Services

## Knowledge Capture and Retrieval

- Ontologies represent domains of human knowledge
- Existing webified assets can be tagged noninvasively
- Query using concepts and/or metadata

## Everyday Programming Tasks

- Experimental models, proofs-of-concept
- Mappings between systems
- Application configuration models
- Software artifact and process management
- (*you knew it was coming*)...Testing and QA!

# What is Protégé?

What, Who, When, Where?

- Authoring tool for ontologies and related artifacts
- Built to support knowledge capture from domain experts
- Developed over many years (since 89?) at Stanford Medical Informatics, many plugins contributed by others
- Open Source Java Application since about 99

## Principal Features

- Interactively define classes, forms, and prototype individuals
- Rich forms may contain tables, graphs, images, web pages
- Visualize models using Ontoviz, ezOWL, TGViz, Jambalaya, etc.
- Query model, work with many types of rulesets and scripts (see next slide)
- Manage ontology relationships, ontology libraries, ontology mappings

## Technical

- Store models in database, RDF/XML (filesystem or http), text files
  - User interface information is stored separately
- Read/Write UML and XMI, Generate Java classes, Generate HTML
- Well-defined plugin architecture for Tabs, Slots, Backends, Import/Export

# Rules, Scripting, Programming

## Of Strategic Importance

- OWL description logic, implemented via a reasoner like Pellet or Racer
- SWRL – Semantic Web Rules Language (check out SweetRules!)
  - combines OWL with RuleML, Protégé SWRL plugin editor is now bundled
- RuleML – General inference rule interchange via XML, supported by Mandarax, etc.

## Other Declarative Avenues

- Query Tab (queries can be saved, and results can be exported)
- Protégé Axiom Language (PAL)
- Tabs for Algernon (LISP based), Jess, CLIPS, Prolog, F-Logic

## Imperative Programming Hooks

- Script plug-in supports BeanShell, Python, Ruby, Groovy, Perl
- For Java programs using Jena, Protégé will generate constants
  - Can also use JSave plugin t
- Need more binding data (e.g. column name)? Use meta-model customizations!
- XSLT is your friend!
- Note: some visualizers can export to SVG, PNG, etc.

# Other Editors?

**From Mindswap (Univ. of Maryland)**

- SWOOP
  - Web browser feel
  - Switch between ontologies easily
  - Uses pellet reasoner
- PhotoStuff
  - Nifty little tool for associating ontology instances with image regions

**Also Popular**

- IsaViz (Uses GraphViz)