Who the hell needs description logics anyway?

Contribution by Stefan Decker
DERI, NUI Galway
Real People (not AI Researchers) have real problems!

“Is my data compliant with that Ontology (schema)?”

“How do I tell my customers how to send me data?”
Description Logics –
Axioms about the world

• Ontology Definition: A busy father is a male person with at least 2 children

• Single Fact: Stefan is a busy father

• Question: Is my data compliant to the ontology?
Real People: Children Missing in Data!
AI Researcher: Sure!
Children are: Skolem constant 1 and Skolem Constant 2
About Missing Boats...
An OWL 2 Far?
ISWC2008 Panel

Michel Dumontier, PhD
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Goals for the Semantic Web

• Provide a common knowledge representation (syntax & semantics)
• Facilitate publishing, data integration and information retrieval
• Make possible semantically interoperable web applications and services
• Enable question answering across global knowledge
The Semantic Web

A significant advance in knowledge management

- the KR (RDF/OWL) via typing and naming (URIs) trivializes data integration
- explicit formal semantics enables reasoning and inference of global knowledge
- RDFS, adds substantial background knowledge via types, and makes possible queries at various levels of knowledge granularity
- OWL increases our ability to more accurately capture knowledge, constrains meaning (minimizes misunderstanding), enables quality assurance, semantic equivalence and instance classification
Comments on Semantic Web Languages

• **Standardization via the W3C** is one of the most powerful aspects of the semantic web effort

• Continue **research and development** to address unfulfilled needs and knowledge inconsistencies
  – Needs for (geo)spatial-temporal reasoning, probabilistic, quantitative reasoning, trust and disagreement

• **Alternatives** should be strongly considered as candidates for new specifications, provided they formally address interoperability
Current challenges

• **Modeling quality is poor**
  – *Ill-prepared* to accurately represent using (SW) language
  – **URIs:** Mint your own or defer to authority? URI equivalence and reference is still an outstanding community challenge
  – **KR:** different modeling leads to incompatible or hard to integrate knowledge
  – Increasingly expressive OWL ontologies actually *decrease* the ability to integrate data unless you exactly conform (need for modularity/repair)

• **Performance is a major hurdle**
  – large graphs are expensive to query (new technologies are getting better)
  – expressive ontologies are expensive locally, nvmd at the SW scale
  – *need infrastructure for deploying SW knowledge*
    • modularity and distributed reasoning for query answering
An OWL 2 Far
ISWC 2008 panel

Tim Finin, UMBC
28 October 2008
Dude, where’s my KR Language?

• OWL is the KR language of choice in 2008
  — It’s a well designed KR language
  — It has lots of open source reasoners, tools, etc.
  — It’s marginalized much of the ‘competition’

• But it is ill suited for many application
  — It’s too much for some, though RDF & N3
    provide a “worse is better’ alternative
  — It’s too little for others

• Maybe we’re a victim of our own success
Has OWL won the KR wars?

• Researchers used to have many KR systems with different properties to choose from
• Today, the default KR language for new projects seems to be OWL
• The ubiquitous nature of the Web and natural desire for reuse and interoperability have put an emphasis on standards
• Moving us toward a KR monoculture
• Monocultures can be limiting & even dangerous
An example with unmet needs

• Populating a KB from text
  – A project at the Human Language Technology Center of Excellence at JHU
  – Read a stream of text documents; extract entities, relations, and events; add/update KB

• OWL has poor support for some key needs
  – Managing contradictory inputs
  – Centrality of provenance, attribution
  – Representing uncertainty
  – Temporal qualification
Another example with unmet needs

Self configuring network routers running in a coalition environment demonstrating constraints on border gateway protocol. Distributed SWRL policies converge to configurations. Joint work between Shared Spectrum Co. and UMBC supported by DARPA STTR.
Let a couple of flowers bloom

• The Web might be a universal information infrastructure
• But OWL wasn’t designed to be a universal KR language
• We should recognize that OWL doesn’t address many needs and encourage experimentation
• While preserving an OWL standard that meets specific Semantic Web requirements (what are they?)
An OWL 2 Far?

Ian Horrocks

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October 28, 2008
Is OWL(2) useful in applications?

Absolutely!
- Representing incomplete and semi-structured information
- Developing large and complex vocabularies, e.g., in bio-medicine, geology, astronomy, aerospace, ...
- Schema/Data integration
- ...
- UK NHS £6 billion IT project uses an OWL ontology
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**Is it a universal panacea?**

- Of course not!
Is OWL(2) too expressive?

- No!
## Is OWL(2) too expressive?

- **No!**
  - Some applications need all of OWL’s features
    - and some need even more
  - Some applications need only a subset of OWL’s features
    - but probably not the same features
    - interoperability provided by OWL
  - OWL2 has “Profiles” with attractive computational properties
    - union of these profiles roughly equivalent to full OWL
OWL Fallacies

OWL(2) is based on a strange/exotic logic. OWL(2) is just good old fashioned First Order Logic studied by many of us in college. OWL(2) uses a fragment of FOL that is well suited to ontology languages for which query answering is dedicable that works well in practice. Such FOL fragments are known as Description Logics.
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OWL FALLACIES

OWL DOESN’T SCALE

- OWL tools can *already* deal with
  - Ontologies with 100s of thousands of classes
  - Datasets with 100s of millions of triples
- OWL2 has several “Profiles” with nice computational properties
  - OWL2 QL has same worst case complexity as RDBs
  - OWL2 EL & RL both have polynomial worst case complexity
OWL Fallacies

OWL doesn’t work well in application x

Therefore, OWL is useless
OWL Fallacies

**OWL doesn’t work well in application**

- Therefore, OWL is useless

**I have seen some badly designed OWL ontologies**

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OWL FALLACIES

OWL doesn’t work well in application \( \times \)

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I have seen some badly designed OWL ontologies

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I prefer language \( \times \)

- Therefore, OWL is useless
OWL(2) is not a universal panacea, **but:**

- Is already deployed in a wide range of applications
- Is an investment in the future of the Semantic Web
- Is a tremendous success for Semantic Web research
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Semantic Web community should spend more time boasting about OWL and less time bitching about it!