Semantic Technology Primer

The basics:

What is Semantic Technology Exactly?

Semantics is the study of meaning. It's as old as the ancient Greeks. For most of us it was a deadly dull sub-discipline of philosophy, to be avoided. But it turns out that we can't avoid it. We are drowning in a sea of data which occasionally is generously referred to as "information." But the truth is that almost all of it must be interpreted by humans to be of any use. The growth and availability of data and, therefore, our need to consider it in decision-making and planning is growing exponentially, and our systems, rather than helping with this, are for the most part contributing to the problem.
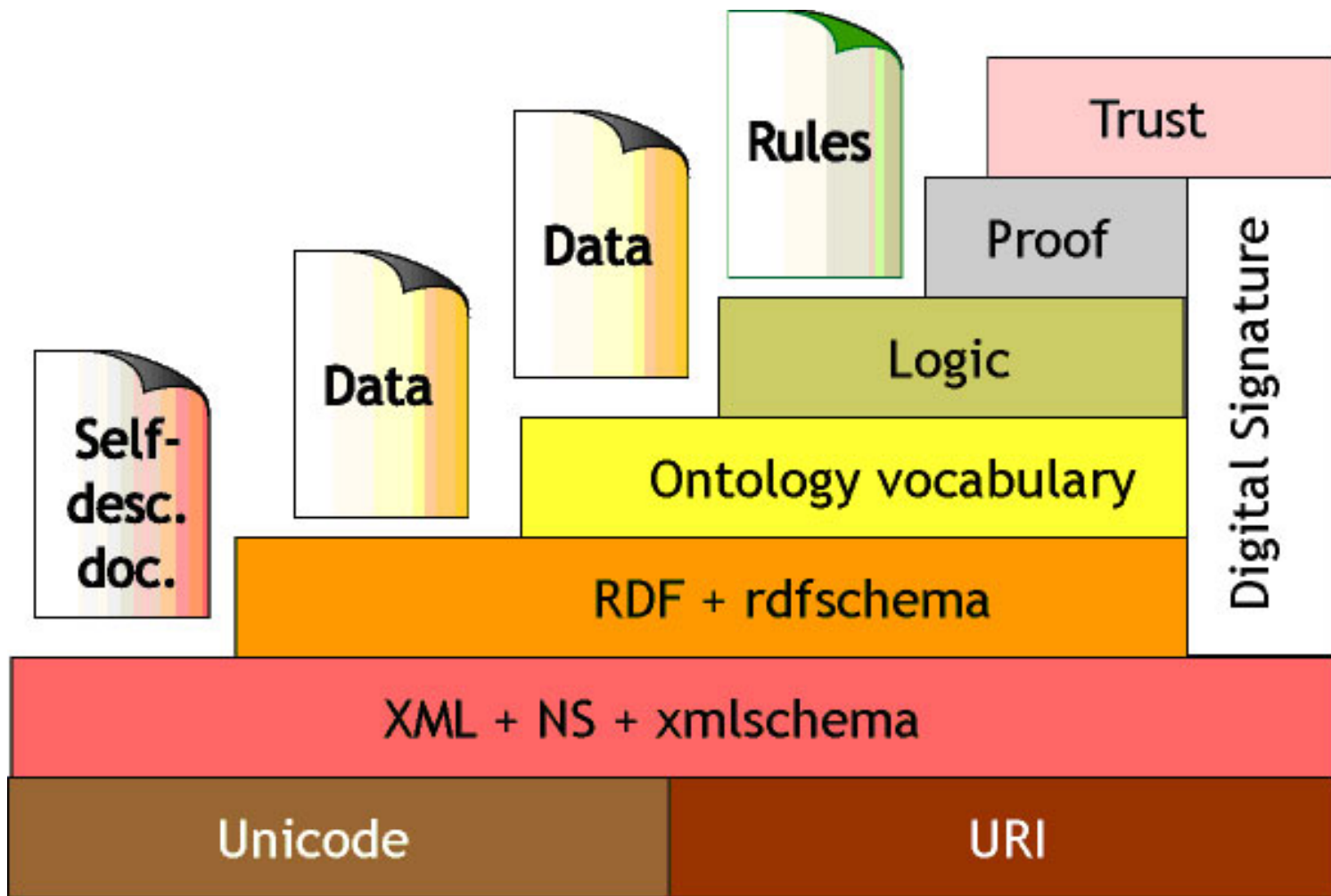
And Semantic Technologies?

Semantic technologies include software standards and methodologies that are aimed at providing more explicit meaning for the information that's at our disposal. This takes different forms depending on where in the information cycle the semantic technology is applied and which area of the problem it is addressing; as we'll get into later in this paper, there are some commonalities between the technologies but also many differences.

The Semantic Web

Not long after he invented and unleashed the World Wide Web, Tim Berners-Lee realized that the limit to the effectiveness of the World Wide Web would be that while billions of documents could be linked and indexed, they relied on human interpretation to do anything with them. In the mid-nineties he began an initiative to promote research and standards under the banner of "the Semantic Web." After an incredible amount of research and development, the Semantic Web community has coalesced around three key standards: RDF, RDFS and OWL. These standards are the Darwinian survivors of intense competition among dozens of competing standards and approaches, and at that level, represent some of the best current thinking on this topic. Perhaps more importantly, the adoption by the W3C sends a clear message to vendors and consumers that in the future, all products and technologies in this space will, in order to be compatible, have to embrace these standards.

The Semantic Web Stack from a 2000 presentation by Tim Berners-Lee (http://www.w3.org/2000/Talks/1206-xml2k-tbl/):

Self-desc. doc.

Data

Data

Rules

Trust

Proof

Logic

Ontology vocabulary

RDF + rdfschema

XML + NS + xmlschema

Unicode

URI

Digital Signature

Since the time of that presentation, RDF and RDFS have gone on to become W3C standards, as has OWL, at the Ontology vocabulary and Logic levels.

How does Semantics compare to what you already know?

Semantic Models are both like and unlike other IT models:

- Like **databases**, ontologies are used by applications at run time (queried and reasoned over). Unlike databases, relationships are first-class constructs.
- Like **object models**, ontologies describe classes and attributes (properties). Unlike object models, ontologies are set-based and dynamic.
- Like **business rules**, they encode rules. Unlike business rules, ontologies organize rules using axioms.
- Like **XML schemas**, they are native to the web (and are in fact serialized in XML). Unlike XML schemas, Ontologies are graphs not trees, and used for reasoning.

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Applications Today

This diagram depicts areas in business and government where semantic technologies are being applied and delivering value today. It is based on more than 100 early adopter case examples from different economic sectors, including: government, financial services, manufacturing, logistics, transport and communications,

energy, health and life sciences, media, and business services. Semantic solutions surveyed delivered 2-10x improvements in measures of performance across the investment lifecycle.

CLICK TO VIEW LARGER IMAGE

Research & Development Efforts

Semantic technologies have become central to a broad range of research and development initiatives. This diagram visualizes the intersections of four major development themes in the semantic wave: networking (e.g., semantic web, grid & p2p), content (e.g., knowledge extraction, semantic enhancement, executable content, semantic search), services (e.g., composite applications, semantic web services), and cognition (e.g. semantic UI, knowledge computing, intelligent agents).

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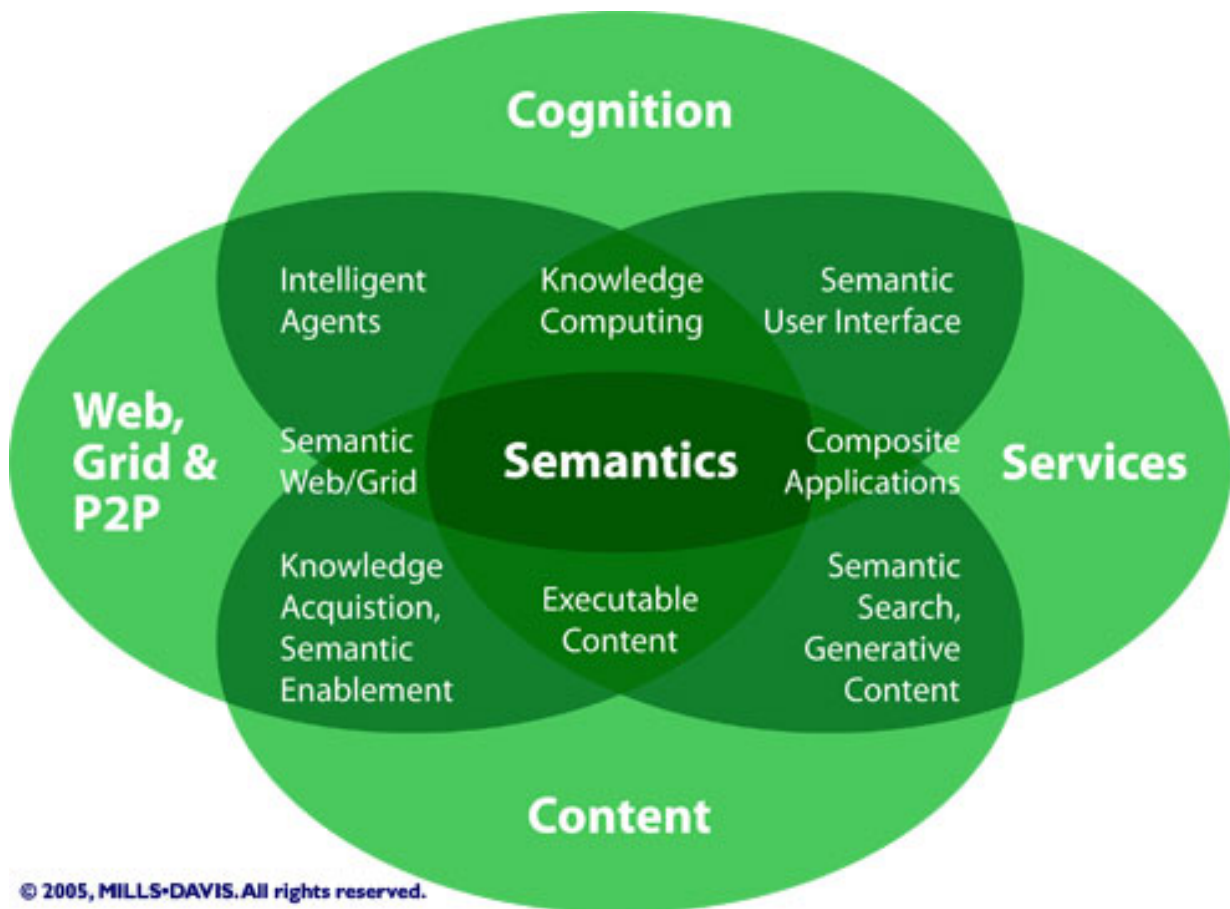
The Semantic Continuum

This diagram depicts a spectrum of information sharing capabilities. Moving from lower right to upper left of the diagram, we see that more expressive forms of metadata and semantic modeling encompass the simpler forms, and extend their capabilities. From bottom-to-top, the amount, kinds, and complexity of metadata and modeling increases. From left-to-right, capabilities for intelligent search, retrieval, discovery of relevant information, question answering, and autonomous action advance.

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Source: Dr. Leo Obrst, Mitre; Mills Davis, Project10X
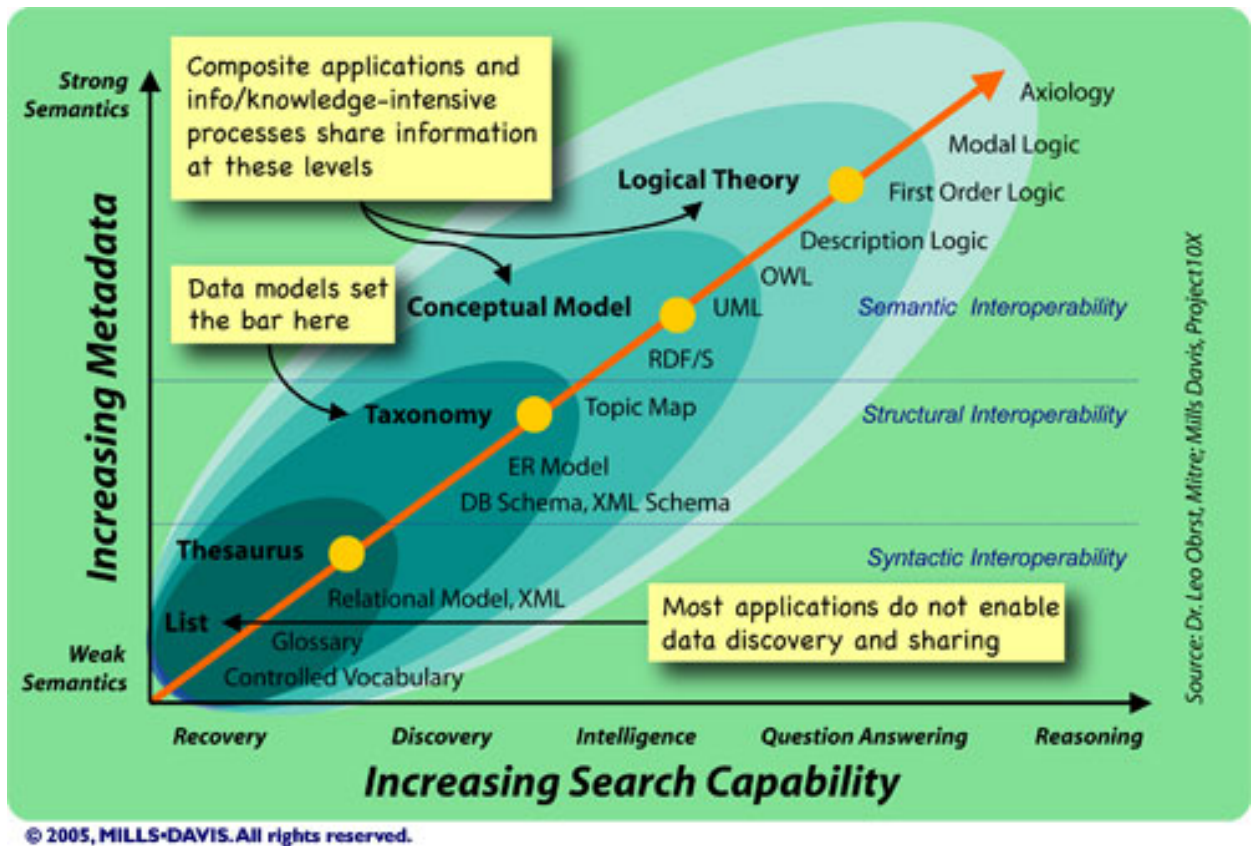
For More Information on Semantics:

"The CIO's Guide to Semantics," by Dave McComb. -- A FREE white paper from the Chairman of the Semantic Technology Conference.

Why is Business Semantics the New Hot Topic? - 2004 Interview with Dave McComb, published in DM Review's DM Direct Newsletter

Join the conversation at **Dave's Semantic Technology Blog**.

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