The Financial Industry Business Ontology

Financial Industry Semantics
Mike Bennett, EDM Council
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Overview

• Classification – Aaron Loehrlein
• Knowledge representation
• Classification Examples
• The Financial Industry Business Ontology (FIBO)
• From business semantics to an operational ontology – David Newman
Positioning: Conceptual Model for Data

Conceptual Model (Semantics) → Realise → Logical Model (Design) → Implement → Physical Model (Implementation specific)
## Development Lifecycle for Data

<table>
<thead>
<tr>
<th>Level (from Zachman)</th>
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Conceptual Model Requirements

• Must be owned and validated by business
  – Manage the “Language interface” between tech and business subject matter experts
  – Everything should be in English
    • No techie terms and casing like “objectProperty”
  – Everything should be reviewable
    • Spreadsheets
    • dialect-free diagrams
Why does this Matter?

• Unambiguous shared meaning is a pre-requisite for many data centric applications (including semantic tech)

• Knowledge representation is not a technology exercise

• Semantics should be validated by business domain experts
• “A formal specification of a conceptualization”

• But
  – What formalization?
  – What conceptualization?

– That defines what sort of ontology
Some Terms

• **Taxonomy**
  – A structured classification scheme
    • Linnaeus Taxonomy of Species
    • Taxonomy of Financial Instruments

• **Ontology**
  – Adds formal properties to a taxonomy
  – Describes real world things

• **Vocabulary or Lexicon**
  – Deals with the words for things
Taxonomy:
- system that can be used to group, arrange, and describe items according to meaningful principles, and which provides users with an overview of the domain being organized
  - Lambe (2009)

A taxonomy uses a classification scheme to arrange the items in the domain of discourse

A Taxonomy forms the basis for any ontology
• For any model we may ask:
  – What is that to which the model elements correspond?
  – What is the formal grounding of the symbols in the model

• For an ontology:
  – The things to which the model elements refer are real things in the domain of discourse
  – The grounding is formal logic
Possible classes of Thing

- “Everything is a Thing”
  - That is, a set of which something may be a member
- Disposed taxonomically in an “is a” hierarchy
• Putting something into RDF/OWL does not make it meaningful

• So, what is a meaningful model
  – 1. Formal relationship between model and subject matter:
    • “Everything is a Thing”
  – 2. Formal notation grounded in common logic
  – 3. Abstraction of kinds of thing into their simplest possible building blocks
    • Contracts, Parties, Legal Entities etc.
Formal Logic

• Lets us assert the existence of things
• Lets us state, for given things, facts about them
  – These are properties
  – How it looks:
    \[ \forall x \forall y (P(f(x)) \rightarrow \neg (P(x) \rightarrow Q(f(y), x, z))) \]

• You would not want to present these to business subject matter experts!
Theory of Meaning – in English

• The model consists of:
  – Things
    • A Thing is a set theory construct
    • Arranged in a hierarchy called a “Taxonomy”
      – Like taxonomy of species
  – Facts
    • Simple facts (names, dates etc.)
      – e.g. “Issue Date” is a date
    • Relationship Facts (relate one thing to another thing)
      – e.g. “Share confers Voting Rights”
      – Things so referenced are also in taxonomic hierarchies
  – Other set theory concepts
    • Disjoints, Unions
Developing Business Semantics

• The OWL language forces us to ask the following questions of a given thing:
  – What sort of thing is it? (taxonomy)
  – What properties distinguish it from other things? (ontology)

• The result is a classification hierarchy of the things we are interested in
Example: Interest Rate Swap

• What sort of things is this?
  – It’s a swap contract
    • Which is a derivative contract
      – Which is an economic contract
        » Which is a Contract
        » Which is a thing
  – It’s an Interest Rate Derivative contract
    • Which is a derivative contract
      – See above
IR Swap – as a type of Swap

Diagram:
- Contract
  - Bilateral Contract
    - Economic Contract
      - Derivative Contract
        - Swap Contract
          - Interest Rate Swap Contract
Swaps in Context

Diagram:
- Contract
- Bilateral Contract
- Economic Contract
- Derivative Contract
  - Option Contract
  - Forward Contract
  - Swap Contract
  - Swaption Contract
  - Interest Rate Swap Contract
IR Swap – as a type of IR Derivative
Classification Facets

• Asking “What kind of Thing is this?” may yield different answers depending on what’s of interest
• These are distinct facets by which the subject matter is classified
  – Example: a whale is both a *mammal* (Linnaeus) and a *marine animal*
• Securities may be classified according to cashflow behaviors (for investors) or according to risk factors (risk and compliance)
From Taxonomy to Ontology

• Ontology: the study of what is
• Ontologies (plural): the real world universe as it is referred to in a computer application
  – Informal: every application has an ontology, whether it’s documented or not
  – Formal: uses formal logic in some notation
• Semantic Web
  – Uses a formalism which can be reasoned over
Ontology

• Adds properties
  – Assertions about what it means to be a member of a given class
  – What is it about this thing which distinguishes it from other things?
A swap is a contract and a transaction in which two parties agree to exchange cashflows

- The *Contract* underpins a *Transaction*
- A *Transaction* consists of two *Events*
  - In a Swap, the *Events* are called *Legs*
- Each transaction *Event* embodies a *Commitment*
  - In the case of a swap leg, a commitment to make some cashflow payment over time
- Each *Commitment* is expressed in some *Contractual Terms*
Financial Industry Business Ontology

Industry Standards
- XBRL
- ISO 20022
- FpML
- MDDL

Original Content
- Theory of meaning

SemWeb OWL constructs

SME Reviews

User Commitments

Boxes & Lines

XLS

Archetypes
- Sub-set for readability

UML Tools

RDF/OWL

ODM

ODM v1.1
FIBO Applications

Conventional Tech  ❯  FIBO  ❯  Semantic Web

MDR  ➔  Repository  ➔  MDR

Semantic Data Model  ➔  Logical Data Model  ➔  Physical Data Model

Model Driven Development

FIBO

OWL Model

Reasoners  ➔  Linked Data

Semantic Query

XLS  ➔  Mapping
FIBO Applications

• As a common reference point
  – Mapping, integration
  – Replaces ad hoc spreadsheets with a formal project deliverable
  – Extend locally for concepts within the firm

• Model Driven Development
  – Position as “Business conceptual model”
  – Manage the “language interface” between Business and IT

• Semantic Technology applications
  – Implemented across conventional data stores
  – New application infrastructures (Triple stores)
Conceptual and Operational Ontology

• Conceptual Ontology
  – Includes concepts like rights, obligations
    • Meaning is grounded in law
  – Does not care if it is decidable or how long it takes to reason over it

• Operational Ontology
  – Must conform with the stated technical constraints
    • Reasoning
    • Decidability
  – Combines
    • ontology (classes) with
    • “individuals” (instance data in triple store format)

• How to get from one to the other?
How to get from one to the other

- Select a single classification facet
- Collapse the taxonomy above the domain
- Ignore terms which do not correspond to data
  - Rights and obligations
  - Policies, strategies, goals
- Identify those terms which correspond to instance data
  - For most rights and obligations, some data signature is likely to be present
- Use property chaining in the conceptual ontology to relate several more abstract but meaningful properties, with one concrete and data-focused property which can be processed.
Main Take-away Points

- An ontology extends a taxonomy which is organized according to some classification principles
- An ontology is not another sort of data model

Syntax is not semantics!

Ways to leverage FIBO
- Common semantics in conventional tech
- Semantic Technology applications
- Others e.g. big data, agent based programming

Regulators and the industry are paying attention!