The Financial Industry Business Ontology

Ontology Summit 2013:
Ontology Evaluation Across the Ontology Lifecycle

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2008 Global Financial Crisis Stimulated Need for Improved Financial Data Standards

• Financial industry needs better data standards for:
  – identification of legal entities, their jurisdictions and ownership control hierarchies
  – Identification of financial contracts and instruments
  – classification and data linkage for aggregation
  – actionable risk intelligence

“The most significant lesson learned from the global financial crisis that began in 2007 was that banks’ information technology (IT) and data architectures were inadequate to support the broad management of financial risks. Many banks lacked the ability to aggregate risk exposures and concentrations quickly and accurately at the bank group level, across business lines and between legal entities.”

Principles for effective risk data aggregation and risk reporting
Basel Committee on Banking Supervision, June 2012
Regulatory Data Challenges

• Per FSB and Basel, global SIFIs must comply with risk data aggregation requirements by early 2016.
  ✓ A bank should establish integrated data taxonomies across the banking group, which includes information on the characteristics of the data (metadata)
  ✓ Risk data must be complete and captured/aggregated across the enterprise
  ✓ Risk data must be accurate and the firm must be able to reconcile/validate reports
Business Data Challenges

Current State of Business Data
- Data incongruity and fragmentation often found across silos
- Limited data standards
- Data rationalization problems
- Costly application program logic required to process data into concepts
- Brittle schemas are costly to change
- Rigid and limited taxonomies

Desired State of Business Data
- Data linkage and integration *despite* silos
- Open global *reusable* data standards
- Alignment based on *meaning*
- Highly expressive data schemas with built in *rules* that reflect *concepts*
- Flexible changeable schemas
- Rich multi-level taxonomies
How Should These Data Challenges Be Resolved?

✓ How should financial data standards be defined?
✓ How should the financial industry tackle these risk data management, aggregation and reporting challenges?
✓ What technologies should be employed to fulfill these requirements?
Semantic Web Technology can be Used to Resolve These Data Challenges

The Enterprise Data Management (EDM) Council and the Object Management Group (OMG) believe that semantic web technology

– is a *transformational* technology for defining financial data standards
– can map to and supplement existing legacy financial data standards
– is a prudent investment to better enable risk data aggregation and analytics
– can be implemented unobtrusively and incrementally with legacy data
FIBO: An Emerging Open Financial Industry Data Standard

Collaborative industry initiative to describe financial data standards using *semantics*

Open semantic financial data standards are exchangeable across financial institutions and regulatory authorities for data confidence, consistency and transparency
Multiple Financial Institutions are Contributing to the FIBO Standard

✓ Wells Fargo chairs the EDM Council’s Semantic Technology Program, interfaces directly with regulatory authorities and leads the working group that is responsible for constructing the operational capabilities of FIBO

✓ Institutions providing business and/or technical resources to define and develop FIBO
Regulatory Agencies Interested in FIBO

- CFTC has expressed strong interest in FIBO’s instrument taxonomy and data definitions for swap rules

- OFR has expressed interest in FIBO’s taxonomy and data definitions for liquidity, stress test reporting, and living will

- Other regulatory agencies expressing direct interest in semantic financial data standards via FIBO
FIBO Business Conceptual and Operational Ontologies are Two Sides of the Same Coin

- **FIBO Business Conceptual Ontologies**
  - Human facing
  - Visual blueprint
  - Standard terms and definitions for business concepts
  - Broad based expressions of conceptual specifications, provenance, linkage and context of business constructs

- **FIBO Operational Ontologies**
  - Machine facing (OWL)
  - Derived from FIBO Conceptual Ontologies
  - Optimized for performance and scalability. Fewer abstractions. Inferred relations, mappings.
  - Classification, data linkage, validation and semantic query.
  - Deliver executable functionality to regulators and firms to enable data linkage, transparency and risk analytics
Target Operational Capabilities of FIBO

1. Provide standard definitions of financial contracts, concepts and business rules; financial instrument taxonomies, integrated metadata and links to related data e.g. policy and compliance rules; for human and machine consumption

2. Integrate with other global data standards to maximize commonality and reuse

3. Classify financial instruments into categories and flags instruments that lack compliance to data standards to better ensure reliability and conformity

4. Provide semantic mapping from disparate siloed data to a common business data standard for integration

5. Enable visualizations for taxonomies, financial instruments, all forms of data relationships

6. Enable risk data aggregations across multiple dimensions and taxonomies

7. Provide risk intelligence e.g. identifying risk exposures across legal entity ownership hierarchies and their counterparties
Semantic Processing *Reasons* over Data to Infer New Meanings and Relationships

**Semantic reasoning**

1. **Inferred**
   - Leg1 is inferred to be a FloatingRateLeg because any leg tied to an index is semantically defined as floating.

2. **Inferred**
   - Data for an undefined Swap Contract before semantic reasoning performs classification and identification.

3. **Inferred**
   - Swap is inferred to be a Fixed-Float IR Swap because one leg was inferred to be fixed and one leg was inferred to be floating fulfilling the definitions in the ontology.

4. **Inferred**
   - isTradingWith is a new property relationship that is inferred based on a semantic rule.
Legal Entity Ownership and Control Relationships can be Queried and Displayed

Semantic web enables data visualizations which are more holistic and descriptive than basic columnar views

FIBO aligns with LEI
Visualization of a credit default swap, and the data types and classifications of many key attributes

FIBO Identifies Instrument Contractual Terms and Attributes: Signature of a CDS
FIBO Identifies Ultimate Parents, their Descendants and Trading Counterparties

This capability allows for the rollup of both positions and exposures of the subsidiaries to the level of the ultimate parent for risk analysis.
FIBO Can Play a Useful Role in Risk Intelligence

- ISDA Master Agreement
  - Schedules
- Credit Support Annex
  - Schedules

Capture Semantics of Contractual Provisions

Axioms and Rules

- Identify Key Contractual Events
- Identify Key Contractual Actions
- Classify Contract Type by Cash Flow

Transaction Repository, et.al.

OTC Derivative Confirm

Events

- Downgrade Counterparty Credit
- Reduce Value of Collateral

Counterparties

Classify Counterparties into Risk Categories for Analytics

Infer Counterparty Transitive Exposures

Infer Capital, Liquidity Risks et al.

Risk Analyst

Market Reference Data

Credit Rating Agency

Financial Shocks

FpML


**Report on OTC Derivatives Data Reporting and Aggregation Requirements, the International Organization of Securities Commissioners (IOSCO), August 2011

***Joint Study on the Feasibility of Mandating Algorithmic Descriptions for Derivatives, SEC/CFTC, April 2011
Visualization of Ownership Hierarchies and Exposures to Counterparties

Solid blue lines represent ownership and control relations. Violet lines represent exposures due to trading.
Proposed FIBO Architecture for Institutional and Macroprudential Oversight

Financial Institutions

- Legacy Database(s)
- Swap Trade & Regulatory Reporting
- Semantic Information Integration Platform

Institutional Risk Analyst

- FpML
- Ontologies

Regulatory Agencies

- Legacy Database(s)
- Swap Data Repository Database(s)
- Semantic Information Integration Platform
- Legal Entity Data Provider(s)
- Semantic Triple Store

Regulatory Risk Analyst

- Semantic Network Graph Analysis
- Trusted Financial Linked Data Cloud

Mapping

Semantic Information Integration Platform enhances data quality and fidelity between institutions and regulators, improving confidence and reducing perception of risk.
FIBO Operational Ontologies are Highly Modular and Reusable
FIBO Defines Multi-faceted Poly-hierarchical Classifications of Swap Contracts
FIBO Uses OWL 2 DL to Describe Necessary and Sufficient Conditions for Contracts

The simplest - and most common - type of credit default swap is one where there is just one reference entity. This is called a single-name credit default swap. The reference entity can be any borrower, but is most often one of a few hundred widely traded companies (corporate or financials) or a handful of governments (sovereigns). Credit default swaps can be used to transfer types of credit risk other than borrowings (such as trade debt), but these contracts are not standard and are rarely seen in practice.

A single name credit default swap acts like an insurance contract against the default of a reference entity. The buyer of protection (known in the contract as the 'fixed rate payer') makes periodic premium payments to the seller of protection (the 'floating rate payer').
Current Quality Measures for FIBO

- Conceptual Ontologies
  - Visual Modeling
  - Consensus input and extrinsic validation by business domain SMEs from the financial industry
  - Formal and rigorous standardization and review processes via OMG

- Operational Ontologies
  - Consensus input and extrinsic validation by technology and ontology SMEs from the financial and vendor communities
  - Validation of executable reference operational ontologies developed as prototypes of specific use cases
Intrinsic Quality Control Direction for FIBO Ontologies

- Intent is to analyze FIBO using intrinsic ontology evaluation tools depending upon availability:
  - OOPS! (OntOlogy Pitfall Scanner!) – sample tested already
  - OntoQA
  - OQuaRE
  - OntoClean
  - Other tools as they emerge