FIBO™ A Common Language for the Financial Industry

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SVP, Strategic Planning Manager, Enterprise Architecture
Chair, Semantic Technology Program, Enterprise Data Management Council

September, 2014
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2008 Global Financial Crisis Stimulated Need for a Common Financial Language

- Financial industry needs expressive global 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

“One of the most significant lessons 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
Key Uses Cases for FIBO

• Legal Entity Identifier
• BCBS-239 (Risk Data Aggregation)
• Regulatory Reporting
• Regulatory Compliance
• Financial Risk Management
• Enterprise Data Harmonization
Semantic Web Technology can be Used to Meet These Regulatory and 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
– is a prudent forward-leaning information management investment that will support our evolving data needs for many years to come
– can map to and supplement existing legacy financial data standards
FIBO: A Semantically Defined Common Financial Language and Model

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
Multiple Regulatory Agencies *Interested* in FIBO

OFR

CFTC

SEC

OCC

FRB

ECB

FSA

FSB
What is semantic technology?

**Common Machine Understanding**

Knowledge Base = specification of concepts

**Common Human Understanding**

Data no longer “strings” of bits and bytes

Data = “things” in meaningful relations

Web of linked “Things”

**Reduced software costs**

Faster time to market

Insights from Reasoning and Inferences

Data = “things” in meaningful relations
Ontologies Describe the *Meaning* of Things

Concept of “Employment”

Subject <<Class>> Person

Predicate <<PropertyClass>> worksFor

Object <<Class>> Company

Data (Assertion)

Subject <<Class>> Person

Predicate <<PropertyClass>> employs

Object <<Class>> Employer

Predicate <<PropertyClass>> isEmployedBy

Object <<Class>> Employee

Data (Assertion)

Data (Assertion)
FIBO Foundations

- FIBO Foundations provides the basic conceptual “Glue”
- Common abstractions grounded in law and business
FIBO Business Entities

- Types of corporate structure
- Organizational hierarchies / relationships
FIBO Indices and Indicators

- Types of index, rate etc.
- Publishers, setters of those

FIBO Indices and Indicators Ontology

- Indicators
- Foreign Exchange
- Interest Rates
- Economic Indicators
- Basket Indices
  - Including publishers

Future
FIBO Securities and Equity

- Terms common to all securities
- Equity securities (shares)
FIBO Provisional Roadmap

<table>
<thead>
<tr>
<th>2012</th>
<th>2013</th>
<th>2014-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
</tr>
</tbody>
</table>
| FIBO-Foundations  
Global Terms and modeling framework | Industry review | OMG finalization | Final |
| FIBO Business Entity  
Domain ontology | Industry review | OMG finalization | Final |
| FIBO Derivatives  
Domain ontology | Industry review | OMG finalization | Final |
| FIBO Loans  
Domain ontology | Industry review | OMG finalization | Final |
| FIBO Securities  
Domain ontology | Industry review | OMG finalization | Final |
| FIBO Market Data, CAE, Portfolio, Payments  
Other Domain ontologys | Industry review | OMG finalization | Final |

Q1, Q2, Q3, Q4, 2012, 2013, 2014-2016
## FIBO Development Scenario (September 2014)

### Reference Data (product) Semantics

<table>
<thead>
<tr>
<th>Phase</th>
<th>Domain</th>
<th>Sub-Domain</th>
<th>Dependency</th>
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<td>Other (i.e. general purpose, construction, student, miscellaneous)</td>
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</tbody>
</table>

**OMG** = in standards process; **RDF/OWL** = in Web Ontology Language; **Beta** = Model Reviewed by SMEs; **Model** = Modeled in Enterprise Architect;
# FIBO Development Scenario (September 2014)

## Reference Data (product) Semantics

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# FIBO Development Scenario (September 2014)

## Market Data (time and date) Semantics

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<td>Debt Temporal Terms</td>
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<tr>
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</table>

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### Process Related Semantics

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<td>Common Issuance Process Terms</td>
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<tr>
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<tr>
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<tr>
<td>Securities Transactions</td>
<td><em>includes trade, post trade, clearing, settlement</em></td>
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<tr>
<td>OTC Derivatives Transactions</td>
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<td>Payments Processing</td>
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<td>Portfolio and Holdings</td>
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</tbody>
</table>

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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

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

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

Provide semantic mapping from FIBO elements to other standards e.g. ISDA UPI taxonomy, FpML, MISMO, XBRL, etc for automatic linkage and integration

Leverage and integrate with other global data standards to maximize commonality and reuse (W3C, ISO, schema.org)

Enable risk data aggregations across multiple dimensions and taxonomies

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

Fixed Float IR Swap (Ontology)

<table>
<thead>
<tr>
<th>Machine Facing Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swap_Contract and</td>
</tr>
<tr>
<td>hasLeg FixedRateLeg and</td>
</tr>
<tr>
<td>hasLeg FloatingRateLeg</td>
</tr>
</tbody>
</table>

Human Facing Definition

An interest rate swap in which fixed interest payments on the notional are exchanged for floating interest payments.

Human Facing Definition

An interest rate swap in which fixed interest payments on the notional are exchanged for floating interest payments.

Machine Facing Definition

Fixed Float IR Swap (Ontology)

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

Leg1 is inferred to be a FloatingRateLeg because any leg tied to an index is semantically defined as floating

Leg2 is inferred to be a FixedRateLeg because any leg tied to an interest rate is semantically defined as fixed

Data for an undefined Swap Contract before semantic reasoning performs classification and identification

1. Semantic reasoning

2. Semantic reasoning

3. Semantic reasoning

4. Semantic reasoning

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

An interest rate swap in which fixed interest payments on the notional are exchanged for floating interest payments.

Human Facing Definition

An interest rate swap in which fixed interest payments on the notional are exchanged for floating interest payments.

Machine Facing Definition

Fixed Float IR Swap (Ontology)
FIBO Derivatives Contract Taxonomy (partial view)

- Poly-hierarchical class
  - Swap_Contract
  - Rate_Based_Swap_Contract
  - Rate_Based_Derivatives_Contract
  - Interest_Rate_Derivatives_Contract
  - Interest_Rate_Swap_Contract
  - Cross_Currency_IR_Swap_Contract

- Faceted class
  - Interest_Rate_Based_Swap_Contract
  - Fixed_Float_IR_Swap_Contract
  - Currency_IR_Swap_Contract

- Faceted class
  - Fixed_Float_IR_Swap_Different_Currencies_Contract
  - Cross_Currency_IR_Swap_Different_Currencies_Contract

- Poly-hierarchical class
  - Fixed_Float_IR_Swap_Different_Currencies_Single_Step_Notional_Contract

FIBO detects different currencies

FIBO performs semantic reasoning to infer the class of the swap

Classification and class names are based upon the attributes of the contract

FIBO maps this to the ISDA Fixed-Float-Cross-Currency Swap

Is both a Swap Contract and a Rate Based Derivatives Contract

Facets provide different views of the same instruments
FIBO Can Play a Useful Role in Risk Intelligence

Capture Semantics of Contractual Provisions

Axioms and Rules
- Identify Key Contractual Events
- Identify Key Contractual Actions

Default Events
- Increase Collateral
- Transfer Payments

Termination Events

Transaction Repository, et.al.

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.

Credit Rating Agency

Market Reference Data

FpML

Credit Support Annex
- Schedules

ISDA Master Agreement
- Schedules

OTC Derivative Confirm

Classify Contract Type by Cash Flow


**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
Proposed FIBO Architecture for Institutional and Macroprudential/Regulatory Oversight

Semantically defined financial data standards enhances data quality and fidelity between institutions and regulators, improving confidence and reducing perception of risk.

FIBO PROVIDES A COMMON LANGUAGE ACROSS ALL PARTIES
Appendix

FIBO

Financial Industry Business Ontology
FIBO Describes Business Concepts for Human and Machine Understanding

Protégé Ontology Editor Tool

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.
FIBO has a Highly Expressive Financial Instrument Taxonomy

FIBO has a Rich Multi-Tiered Taxonomy that can be used to Classify and Aggregate Data at Many Levels and Across Many Facets (subset of taxonomy shown in diagram)

FIBO maps to other product taxonomies e.g. ISDA

Gruff SPARQL query tool and Allegrograph Triple Store from Franz, Inc
FIBO Provides Comprehensive Visualizations of Business Concepts

FIBO enables high level concepts e.g. a Fixed Float IR Swap, along with its key related concepts, to be queried for access and viewing.

This example is the result of a single query against the FIBO semantic glossary.

- **Fixed Float IR Swap Contract**: A legal person that is a party to the swap. Each party can interchangeably be a payer of a net cashflow and be a receiver of a net cashflow.

- **Swap Party**: Requires

- **Interest Rate**: Requires

- **Notional Step**: Requires

- **Currency Amount**: Requires

- **Currency**: Requires

- **An interest rate swap**: Contract in which fixed interest payments on the notional are exchanged for floating interest payments.

- **A cashflow contractual provision**: Which defines fixed interest payments and terms for the payment of that interest.

- **The rate of interest which is to be paid on the principal on each interest payment date.**

- **The amount of money which is to be paid on the principal on each interest payment date.**

- **A cashflow contractual provision in which variable interest is paid on some notional amount, linked to some underlying interest reference rate.**

- **A rate of Interest paid by or agreed among some bank or set of banks.**

- **The measure which is an amount of money specified in monetary units.**

Defining terms:

- **Floating Interest Rate Cashflow Term**
- **Fixed Interest Cashflow Term**
- **Swap Party**
- **Notional Step**
- **Currency Amount**
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.
FIBO Identifies Ultimate Parents, their Descendents 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.

The table shows a sample of the data, including the ultimate parent, its descendants, the trading counterparties, and the details of the swap contracts, such as the classification, currency, and notional amount.
Visualization of Ownership Hierarchies and Exposures to Counterparties

Solid blue lines represent ownership and control relations. Violet lines represent exposures due to trading.
Network Centrality Measures for Business Entities

* Screen shots from R-Studio