Financial Industry Business Ontology in Operations

Demystifying Financial Services Semantics Conference

David Newman

Strategic Planning Manager, Vice President

Enterprise Architecture, Wells Fargo Bank

March 13, 2012

Disclaimer

- The content in this presentation represents only the views of the presenter and does not represent or imply acknowledged adoption by Wells Fargo Bank. Examples used within are purely hypothetical and are used for illustrative purposes only and are not intended to reflect Wells Fargo policy or intellectual property.

Industry Team Collaborating on Semantics OTC Derivatives POC

Name	Organization	Role
David Newman	Wells Fargo	Lead
Mike Bennett	EDM Council	Core Team
Elisa Kendall	Thematix	Core Team
Jim Rhyne	Thematix	Core Team
Mike Atkin	EDM Council	EDMC Stakeholder
Anthony Coates	UBS	Core Team
Dave McComb	Semantic Arts	Core Team
Marc Gratacos	ISDA	Subject Matter Expert
Andrew Jacobs	UBS	Core Team
Mike Uschold	Semantic Arts	Core Team
Pete Rivett	Adaptive	Core Team
Martin Sexton	London Market Systems	Subject Matter Expert
Harsh Sharma	Citi	OMG Stakeholder
Kevin Tyson	JP Morgan Chase	Core Team
Marcelle von Wendland	Fincore	Subject Matter Expert
David Schaengold	Revelytix	Vendor Partner

"We can't solve problems by using the same kind of thinking we used when we created them." *—Albert Einstein*

Key Regulatory Requirements Influencing Semantics OTC POC

1) Define Uniform and Expressive Financial Data Standards

Ability to enable standardized terminology and uniform meaning of financial data for interoperability across messaging protocols and data sources for data rollups and aggregations

2) Classify Financial Instruments into Asset Classes*

Ability to classify financial instruments into asset classes and taxonomies based upon the characteristics and attributes of the instrument itself, rather than relying on descriptive codes

3) Electronically Express Contractual Provisions**

Ability to encode concepts in machine readable form that describe key provisions specified in contracts in order to identify levels of risk and exposures

4) Link Disparate Information for Risk Analysis *

Ability to link disparate information based upon explicit or implied relationships for risk analysis and reporting, e.g. legal entity ownership hierarchies for counter-party risk assessment

5) Meet Regulatory Requirements, Control IT Costs, Incrementally Deploy

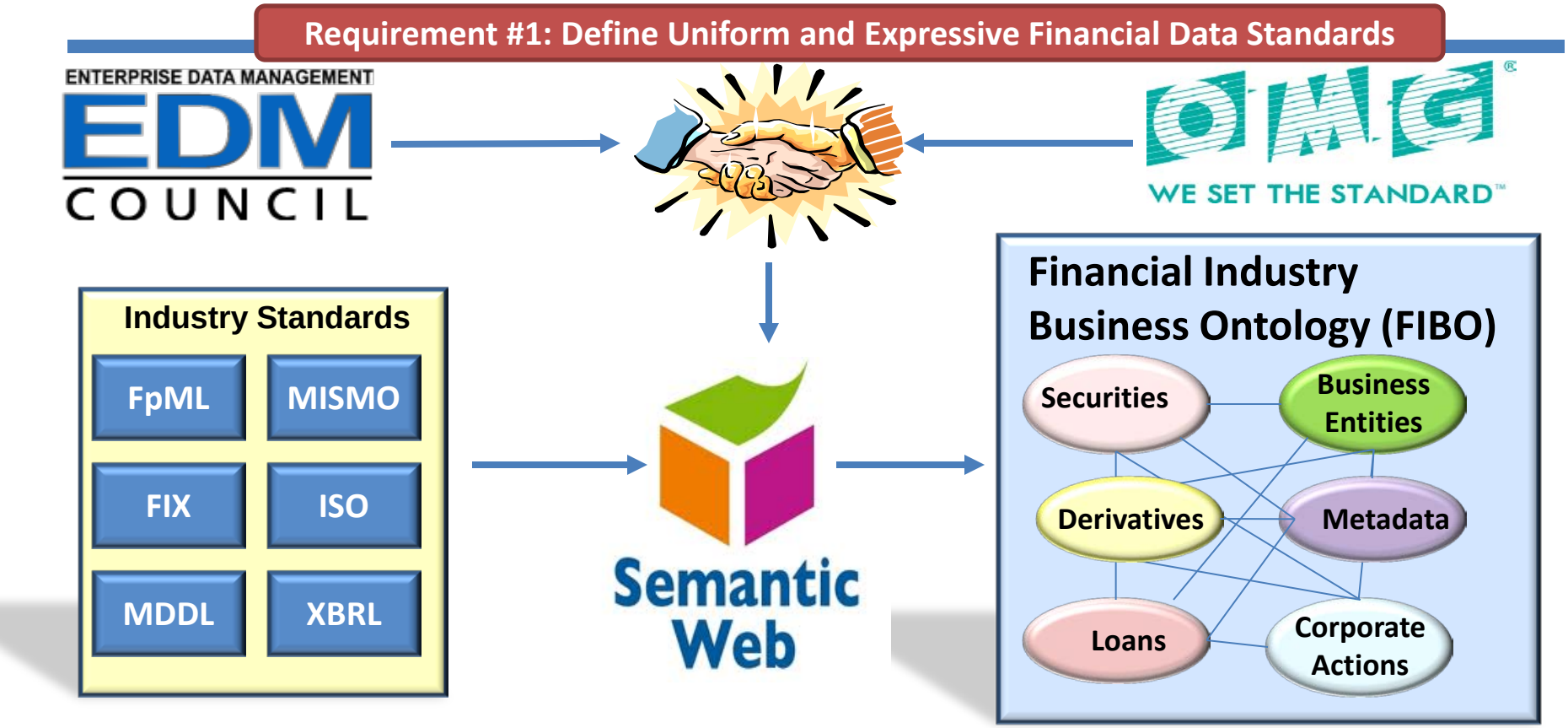
Ability to define data standards, store and access data, flexibly refactor data schemas and change assumptions without risk of incurring high IT costs and delays, evolve incrementally

***Swap Data Recordkeeping and Reporting Requirements, CFTC, Dec 8, 2010**

***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**

Financial Industry Business Ontology (FIBO)



FIBO: Industry initiative to extend financial industry data standards using *semantic web principles* for heightened data *expressivity, consistency, linkage and rollups*
Semantics is *synergistic, complementary and additive* to existing data standards and technology investments in data management!

Integrating Knowledge with Data Enhances Data Maturity and Understanding

Requirement #1: Define Uniform and Expressive Financial Data Standards

```
- <swap>
  - <!--
        PartyA pays the floating rate every 6 months, based on 6M EUR-L
                    on an ACT/360 basis
    -->
  - <swapStream>
      <payerPartyReference href="party1" />
      <receiverPartyReference href="party2" />
    - <calculationPeriodDates id="floatingCalcPeriodDates">
      - <effectiveDate>
          <unadjustedDate>1994-12-14Z</unadjustedDate>
        - <dateAdjustments>
            <businessDayConvention>NONE</businessDayConvention>
          </dateAdjustments>
        </effectiveDate>
      - <terminationDate>
          <unadjustedDate>1999-12-14Z</unadjustedDate>
        - <dateAdjustments>
            <businessDayConvention>MODFOLLOWING</businessDayConvention>
          - <businessCenters id="primaryBusinessCenters">
```

Equivalent classes

Interest_Rate_Swap_Contract
and (has_Swap_Leg some Fixed_Interest_Cashflow_Terms_Set)
and (has_Swap_Leg some Variable_Interest_Cashflow_Terms_Set)

Superclasses

Interest_Rate_Swap_Contract

Inherited anonymous classes

has_Swap_Leg some Interest_Cashflow_Terms_Set

Members

Swap_Contract-SC2
Swap_Contract-SC6

<u>XML Approach:</u> requires external programmatic logic to make sense of the XML content to identify that the data refers to an interest rate swap

<u>Semantic Approach:</u> allows a machine to automatically understand that the data refers to an interest rate swap without requiring external programmatic logic to interpret the data

Semantic Financial Metadata Annotations: *Setting the Standard for Standards*

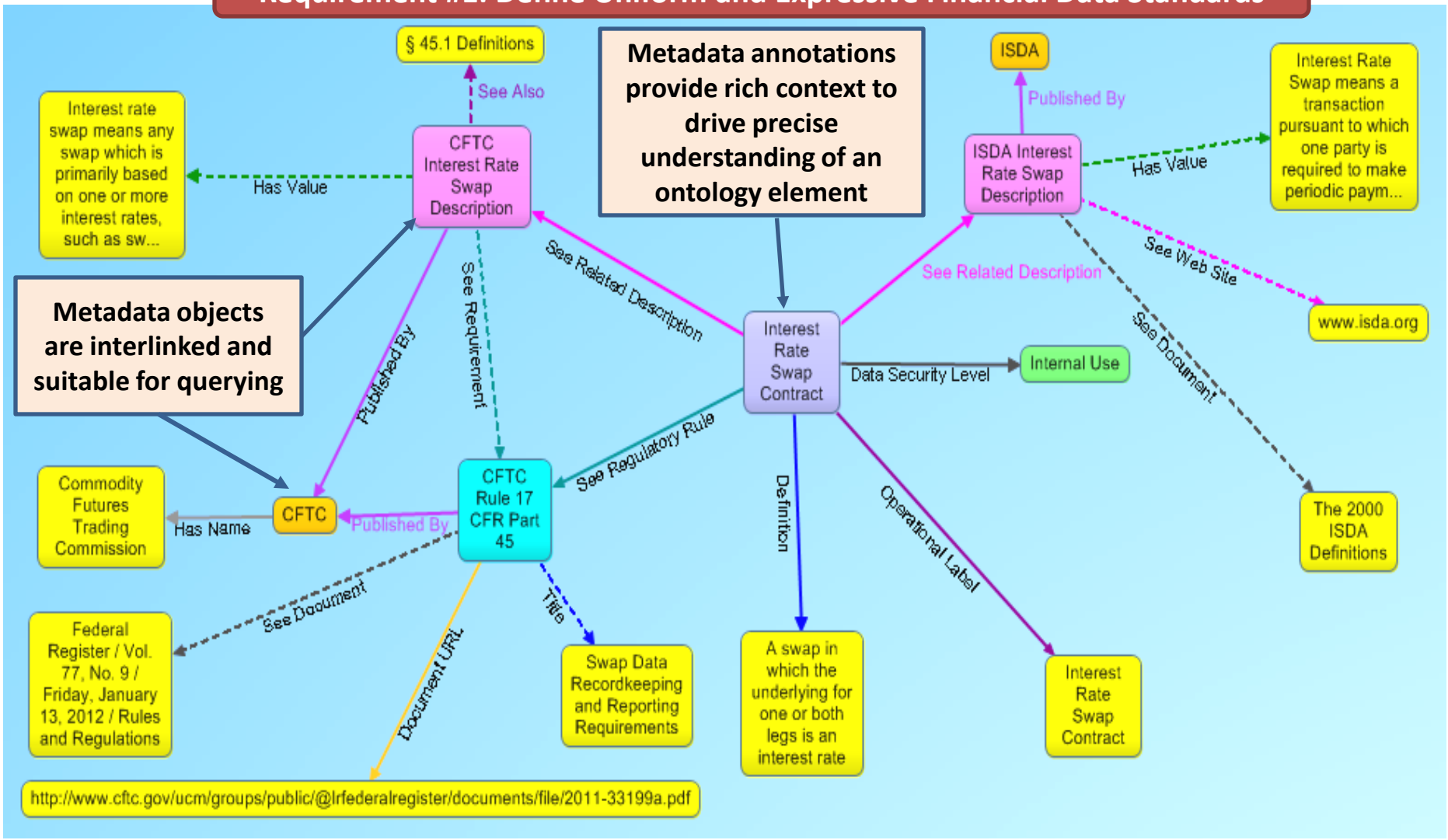
Requirement #1: Define Uniform and Expressive Financial Data Standards

- ✓ In conventional data schemas limited explanatory information or metadata is available, resulting in:
  - the need to access independent metadata tools
  - confusion and data rationalization problems, which incurs errors, delays and cost
- ✓ Semantic metadata is directly *linked* to the elements in the ontology, including specific facts
  - One-stop integrated locus for related knowledge
- ✓ Metadata annotations provides:
  - Data Provenance, source and reference information
  - Cross-reference to data elements in related financial data standards, regulatory rules, business requirements and specifications e.g. FpML, CFTC rules, etc
- ✓ Metadata can be accessed as Linked Open Data

Linked Open Data

Semantic Metadata for Interest Rate Swap Contract

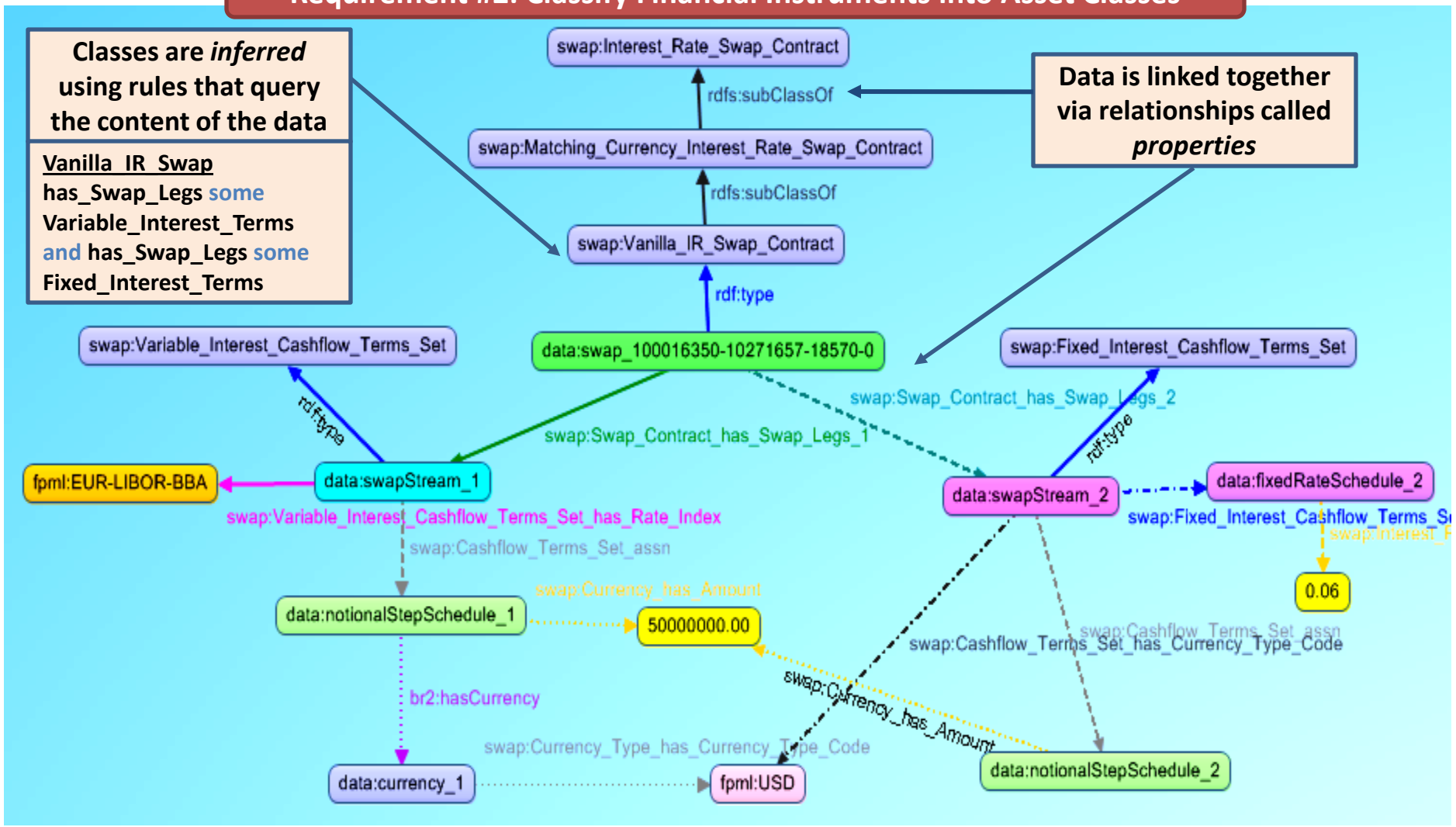
Requirement #1: Define Uniform and Expressive Financial Data Standards



* Gruff 3.0 courtesy of Franz, Inc.

Semantics can *operationally* classify undifferentiated Swaps and show relationships

Requirement #2: Classify Financial Instruments into Asset Classes

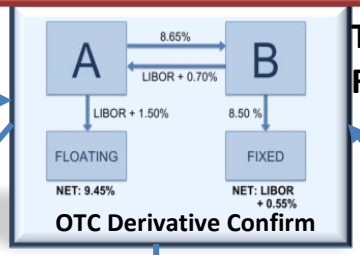


* Gruff 3.0 courtesy of Franz, Inc.

Semantic Representation of Contractual Provisions for Risk Classification

Requirement #3: Electronically Express Contractual Provisions

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



Transaction Repository, et.al.

FpML

Capture Semantics of Contract Provisions

FIBO Ontology

Operational Ontology

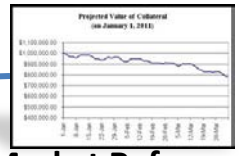
Counterparties

Events

Downgrade Counterparty Credit

Reduce Value of Collateral

Credit Rating Agency



Market Reference Data

Define Axioms

Identify Key Contractual Events

Classify Contract Type

Identify Key Contractual Actions

Default Events

Termination Events

Increase Collateral

Transfer Payments

Infer Counterparty Exposures

Classify Counterparties into Risk Categories for Analytics

Risk Analyst

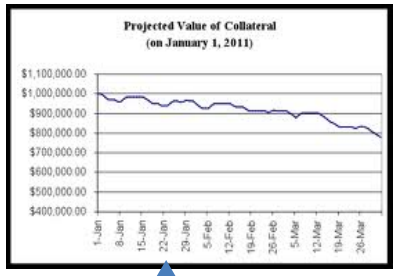
*Report on OTC Derivatives Data Reporting and Aggregation Requirements, the International Organization of Securities Commissioners (IOSCO), August 2011

**Joint Study on the Feasibility of Mandating Algorithmic Descriptions for Derivatives, SEC/CFTC, April 2011

Note: OTC POC Future Phase

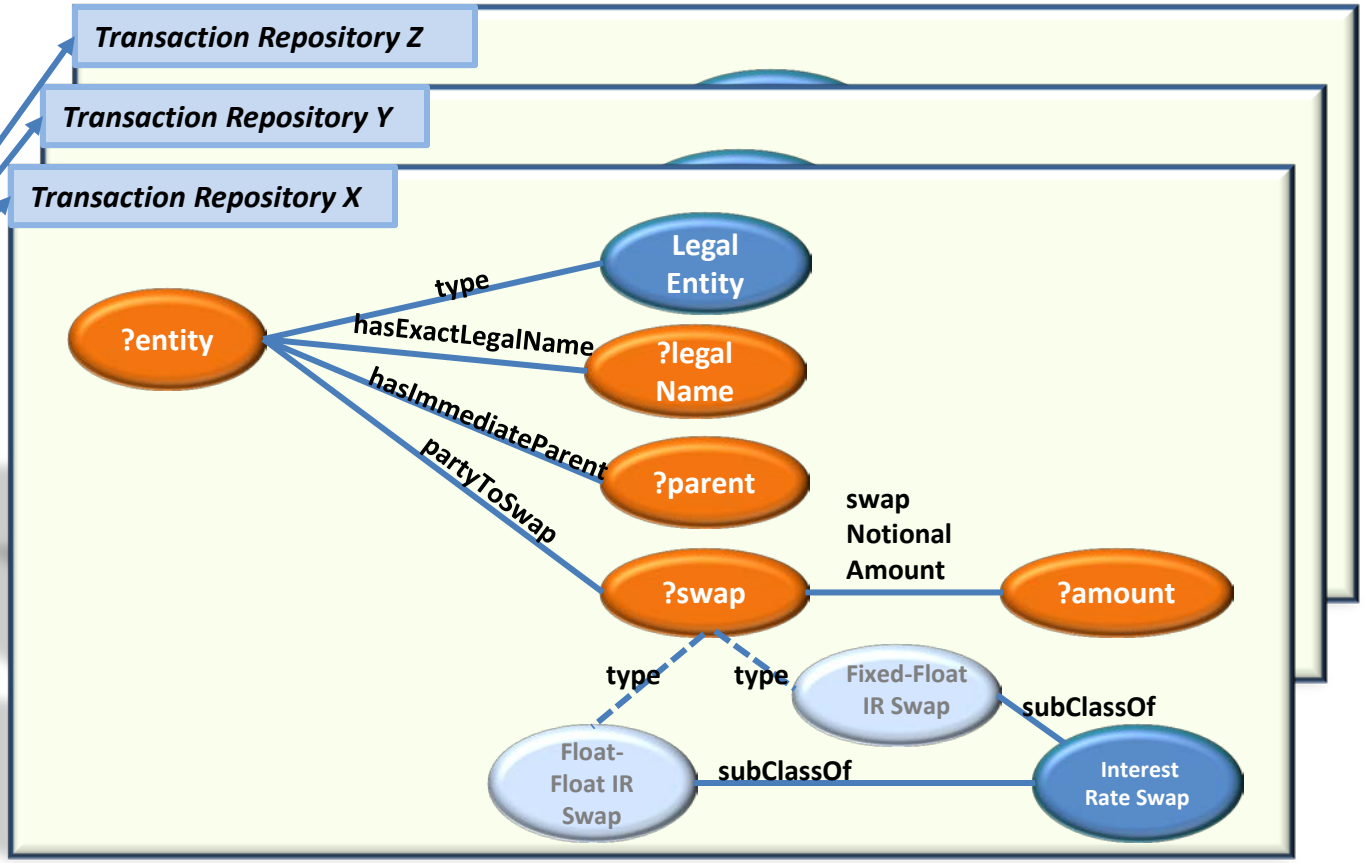
Semantics offers Advanced Query Capabilities

Requirement #4: Link Disparate Information for Risk Analysis



Risk Analyst

Query all Transaction Repositories to report on the sum total of aggregate exposure for all counterparties and their parents involved in all swaps associated with an interest rate swap taxonomy

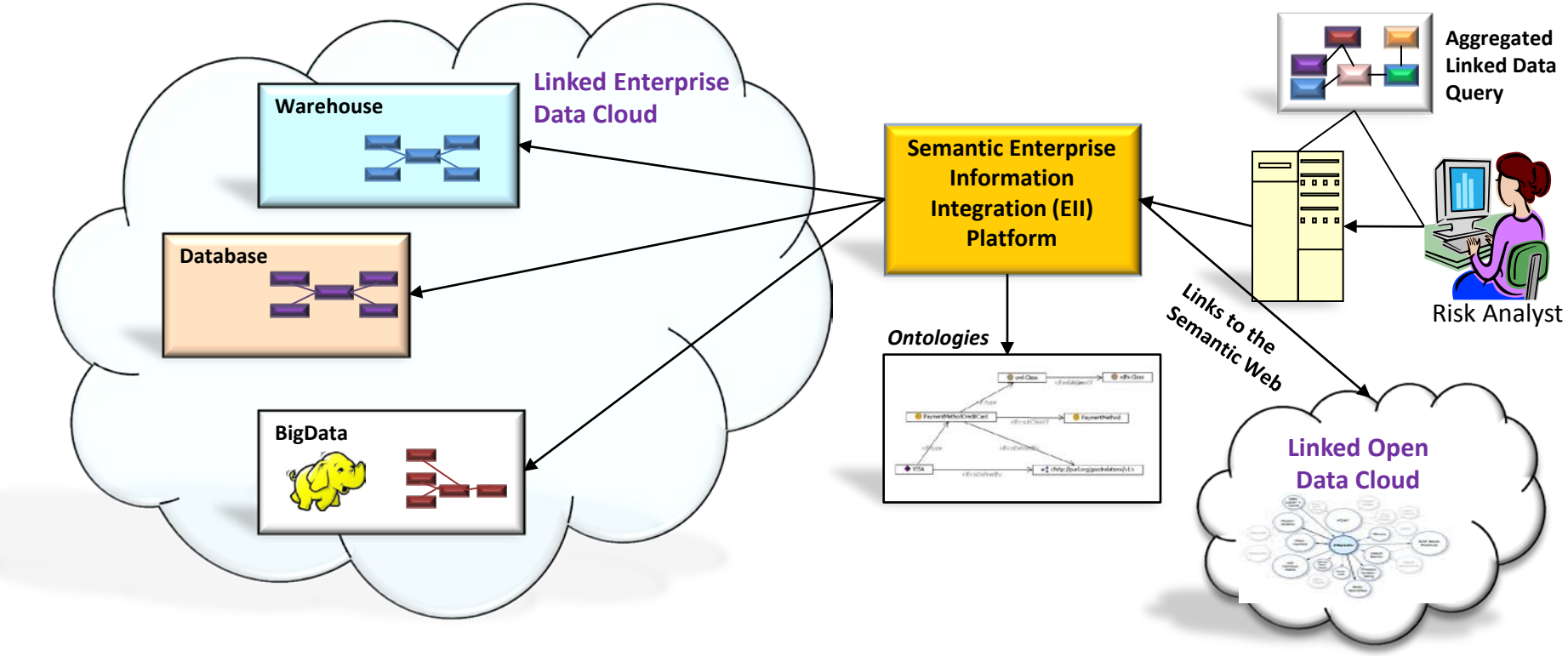


- Data is queried using graph pattern matching techniques vs. relational joins
- Queries can process inferred data and highly complex and abstract data structures
- Queries can federate across semantic endpoints (using SPARQL 1.1)
- Data can be aggregated and summarized (using SPARQL 1.1)

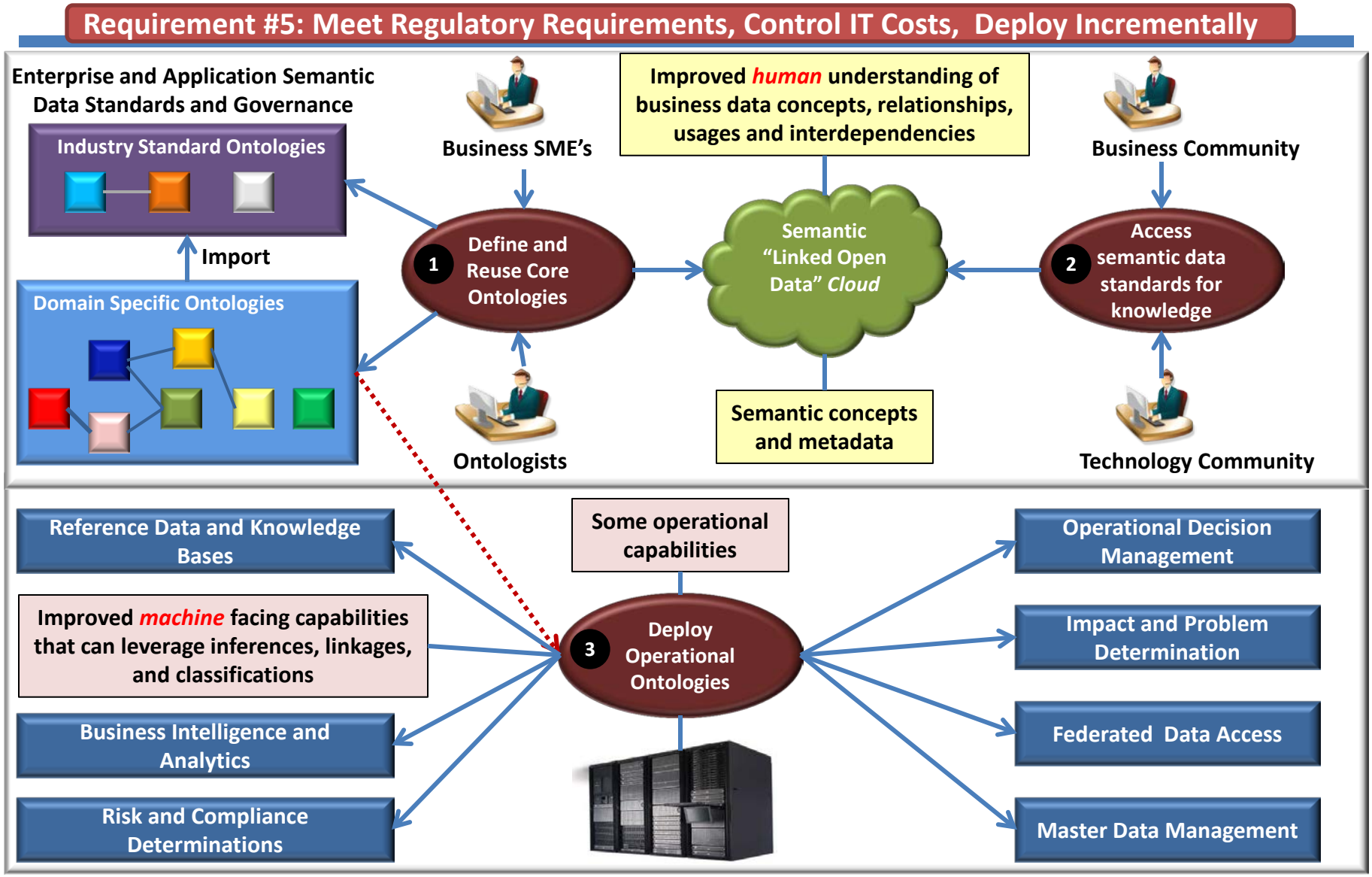
Semantic Tools Offer Federation via Linked Data

Requirement #4: Link Disparate Information for Risk Analysis

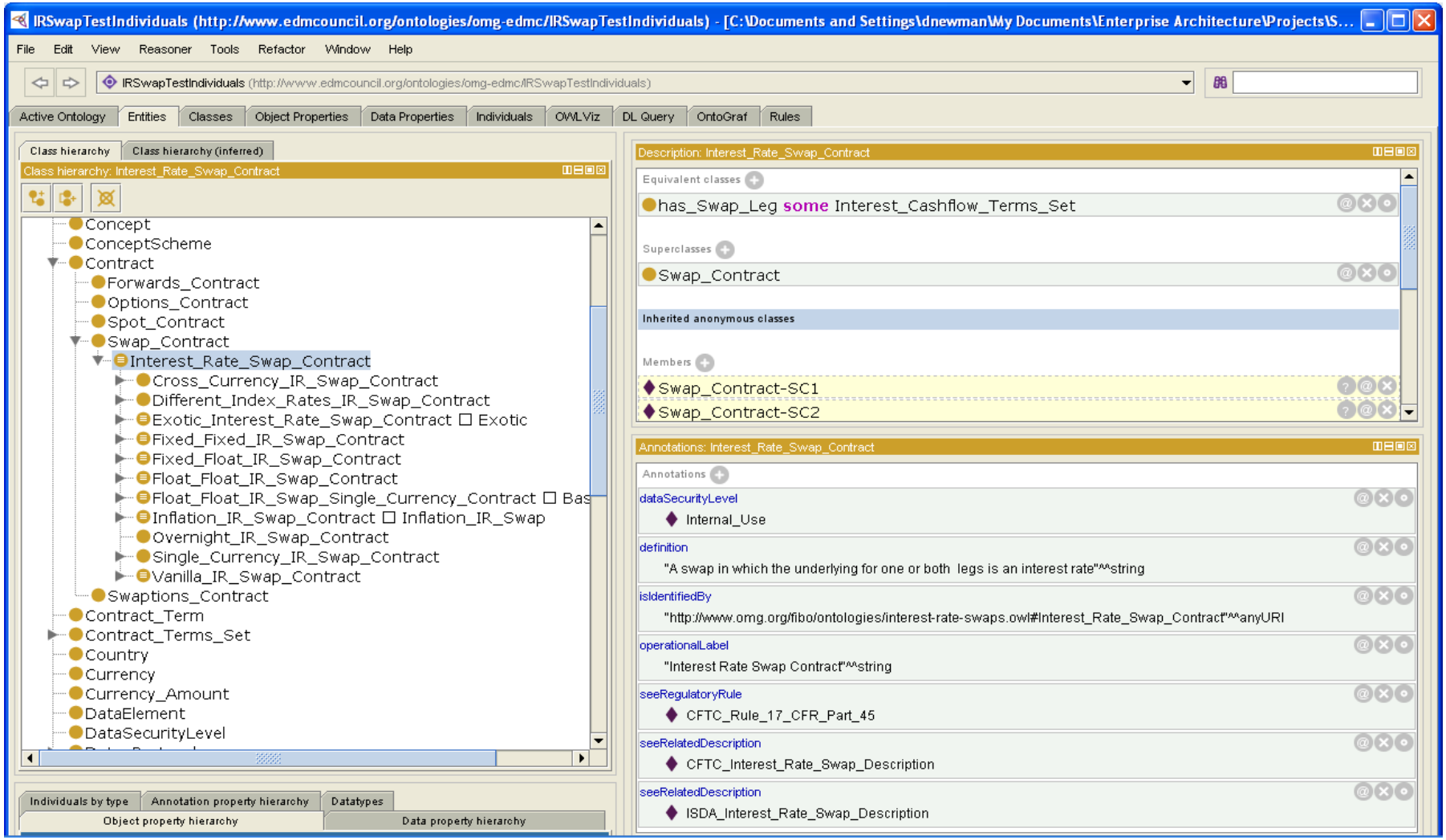
- Semantically defined data that is ***Web*** addressable and "inter-linked"
  - Transcends organizational boundaries and provides universal access to data wherever it resides internally within the network (and externally via "Linked Open Data")
  - Obtains data directly from its source (transparent to location, platform, schema, format)
  - Can support access, queries and rollups across disparate non-semantic data bases



Phases of Adoption



OTC Derivatives Semantic POC Demonstration



*Protégé courtesy of Stanford University and the University of Manchester

Panelists to Discuss Applying FIBO for Systemic Risk Analysis

David Newman
Moderator
OTC POC Lead

David Newman is Vice President and Strategic Planning Manager of Enterprise Architecture at Wells Fargo Bank. David also chairs the Semantic Technology program for the Enterprise Data Management Council and is leading a collaborative effort with the Object Management Group to develop operational ontologies for FIBO.

Jim Rhyne
OTC POC Team

Jim Rhyne is a partner at Thematix Partners, LLC. Jim focuses on commercial and marketing-oriented applications of semantic technology. Jim worked previously for IBM, where he held the executive rank of Distinguished Engineer. Jim holds a Ph.D. in Computer Science in computational linguistics and AI.

Elisa Kendall
OTC POC Team

Ms. Kendall, also a partner with Thematix, has over 30 years professional experience in the design, development and deployment of enterprise-scale information management systems, with emphasis on complex taxonomy, ontology and knowledge-based systems design.

Mark Temple-Raston
SME

Mark is a Senior Vice President at Citigroup and is responsible for Data Management globally in Enterprise Architecture and IT Governance. Prior to this assignment, he was responsible for running Technology Standards and Technology Life-cycle Management globally at Citigroup. Mark holds a Ph.D. in Applied Mathematics and Theoretical Physics .

Suresh Nair
SME

Suresh G. Nair is the Chief Architect for Financial Services at Mphasis, an HP company. Suresh has over 23 years of experience in the IT industry, with over 15 years as an enterprise architect. Suresh has been an active user of Semantic modeling and tuple based data graphs since the early 90s.