TopQuadrant™

9 April 2014
Athens - Greece

"An industry perspective on deployed semantic interoperability solutions"

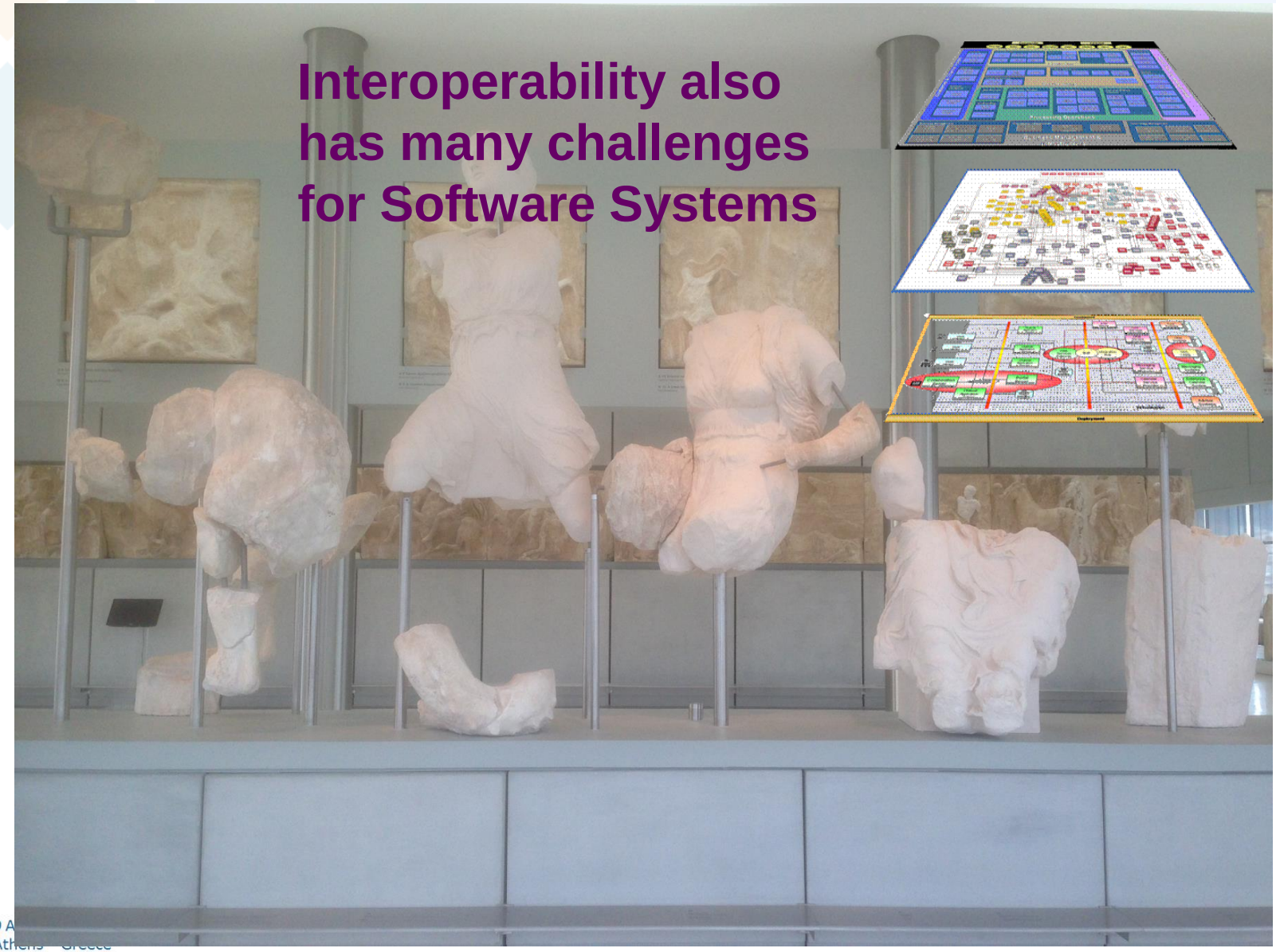
Ralph Hodgson, CTO, TopQuadrant

SEMIC Conference, Athens, April 9, 2014

https://joinup.ec.europa.eu/community/semic/event/semic-2014-semantic-interoperability-conference

v7

Interoperability has many Dimensions



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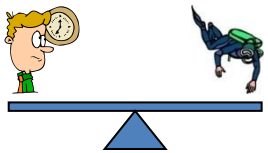
2014

Content

- Introductions
- Defining Interoperability
- Linked Data and Putting Ontologies to Work
- Semantic Interoperability Support with TopBraid Technologies
- Case Studies
- Deeper Dive on One Case Study: EPIM
- Concluding Remarks
- Other Work



Little time to dive deep: "Take-Away" Slide

Introductions

Me - Ralph Hodgson

- *Co-founder and CTO of TopQuadrant, Inc., a US-headquartered company that specializes in semantic solutions, consulting, training, and platforms;*
- *NASA QUDT Ontologies and Handbook Lead*
- *EPIM Lead Semantic Applications Architect and Ontology Modeler*

TopQuadrant

- *Started in in the US in 2001*
- *Innovator of SPARQL-based technologies: SPARQL Inferencing Notation (SPIN), SPARQLMotion, SPARQL Web Pages (SWP), SPARQL Web Applications (SWA)*
- *Vendor of:*
  - *Semantic Technology Solutions,*
  - *TopBraid Products,*
  - *TopBraid Platform,*
  - *IDE Tools,*
  - *Training and Consulting*

TopBraid Life Sciences Insight™

TopBraid Insight™

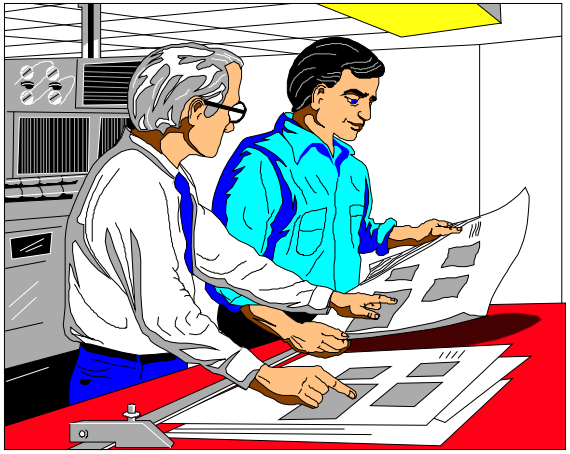
TopBraid Enterprise Vocabulary Net™

TopBraid Live™

TopBraid Composer™

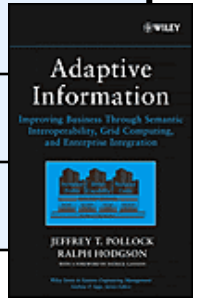
Two Meanings of Interoperabilty

- Interoperable information:
  - The ability of two or more systems or components to exchange information and to use the information that has been exchanged. [IEEE]
- Interoperable components:
  - "interoperable" means to be functionally equivalent or interchangeable components of the system or process in which they are used. [IETF RFC 2026, section 4.1.2]

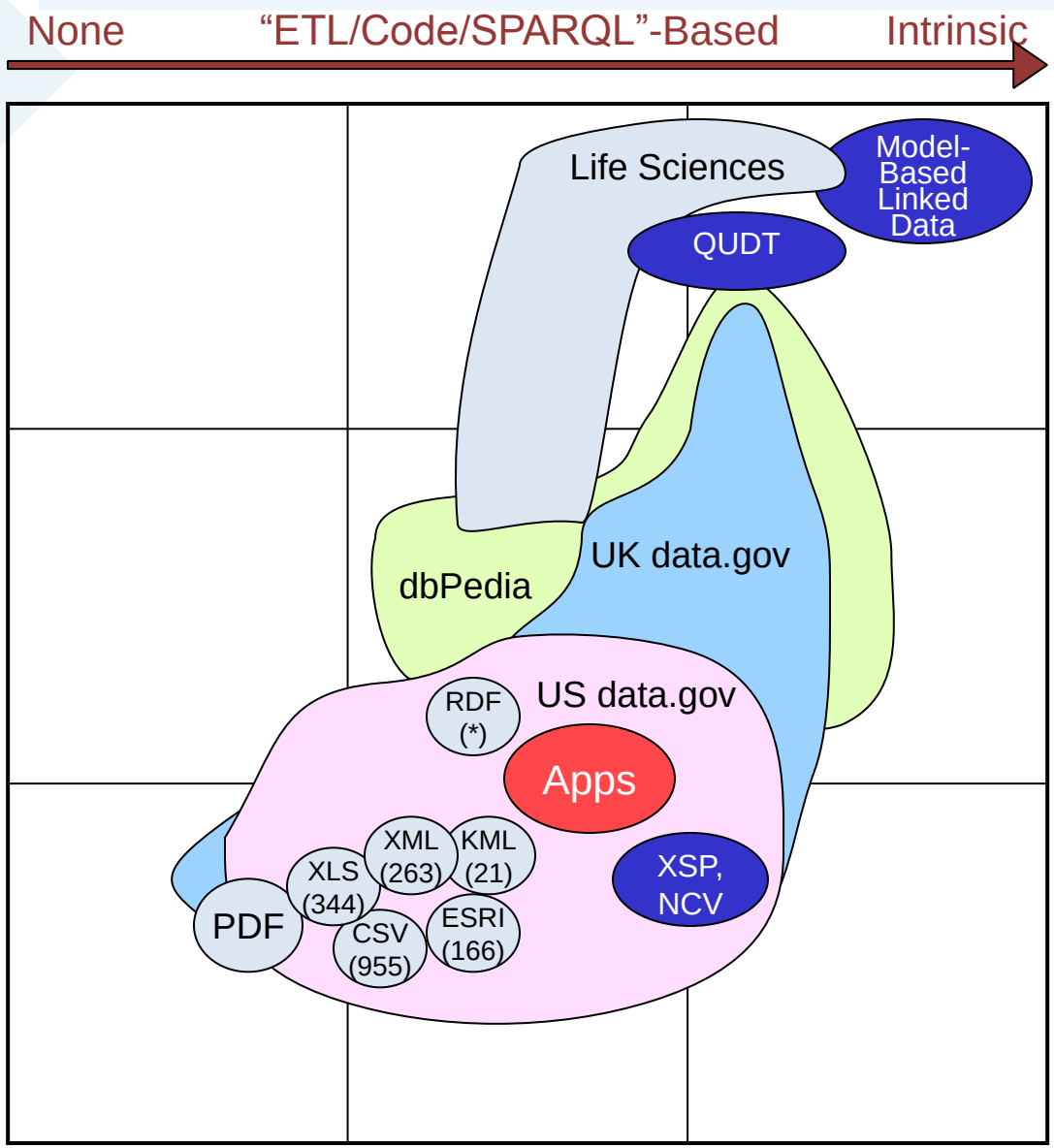


What can go wrong with Data drives the requirements for Semantic Interoperability

Failure Mode	Cause
Data Type	Different primitive or abstract types for same information
Naming and Coding	Synonyms/antonyms have different text labels. Enumerations have different coding schemes
Aggregation: Structure and - Cardinality	Different notions about relationships among concepts in similar data sets. Collections or constraints modeled differently for same information
Generalization	Different abstractions to model same domain
Value Representation	Different choices about what to made explicit
Impedance Mismatch	Fundamentally different data representations
Naming	Synonyms/antonyms exist in same/similar concept instance values
Scaling and Units	Different units of measures - incompatible scales
Confounding	Similar concepts with different definitions
Domain	Fundamental incompatibilities in domains



The Linked Data World (circa-2009)



F (#) Based on data.gov June 2009

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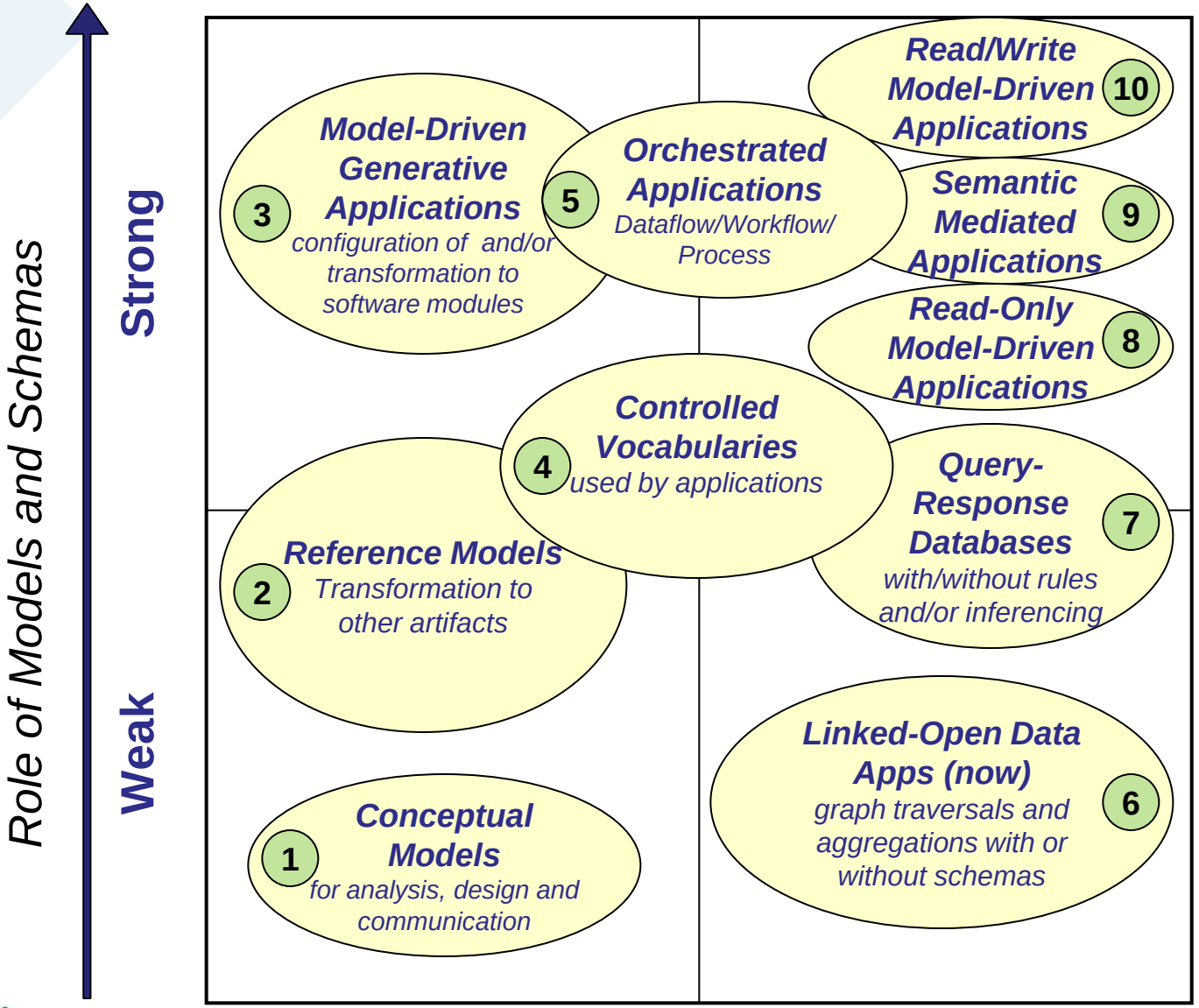
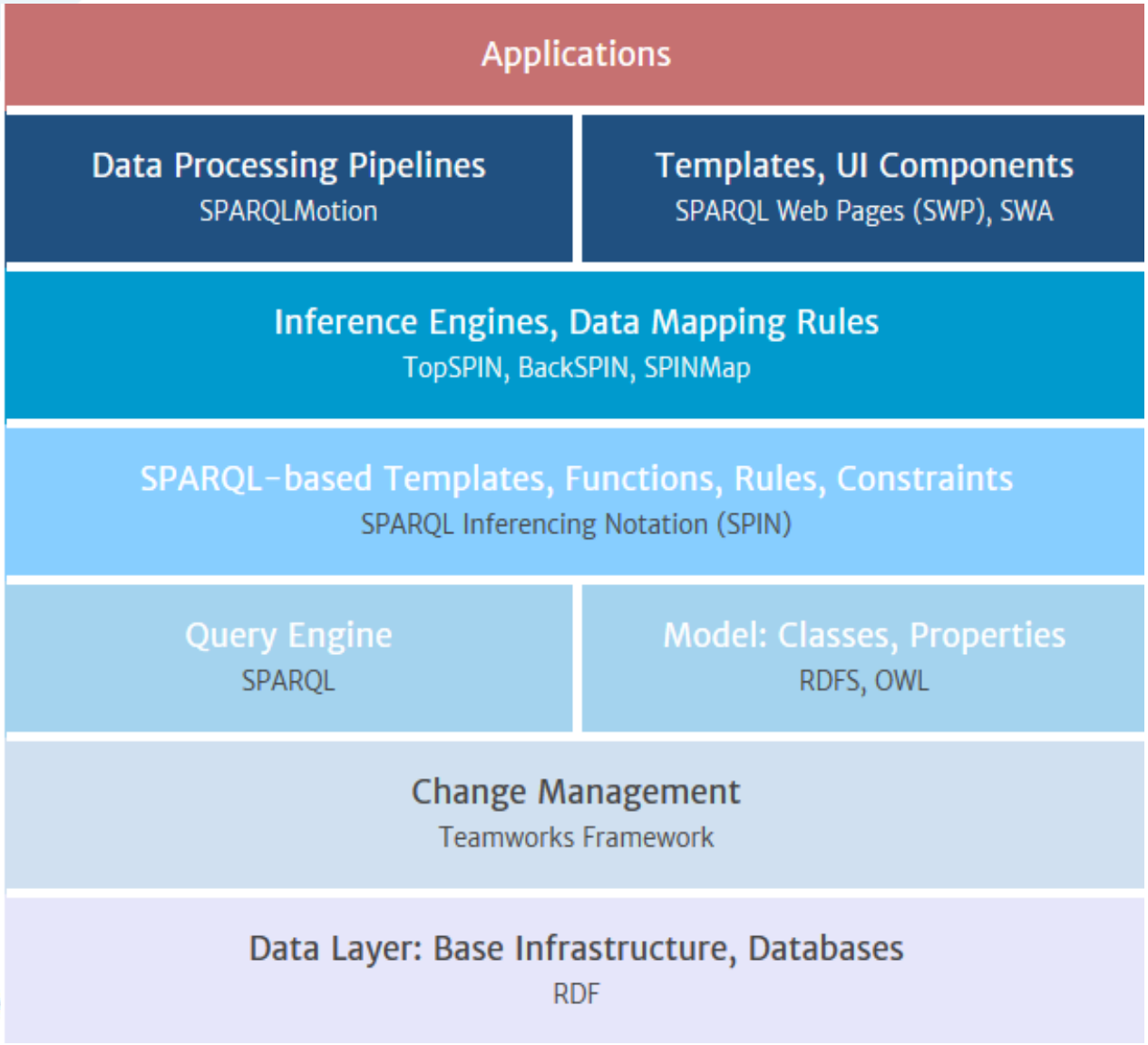
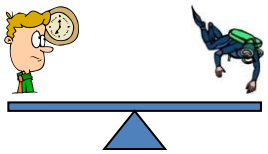
There are a number of ways of using Ontologies for Interoperability



Semantic Interoperability with the TopBraid Technology Stack





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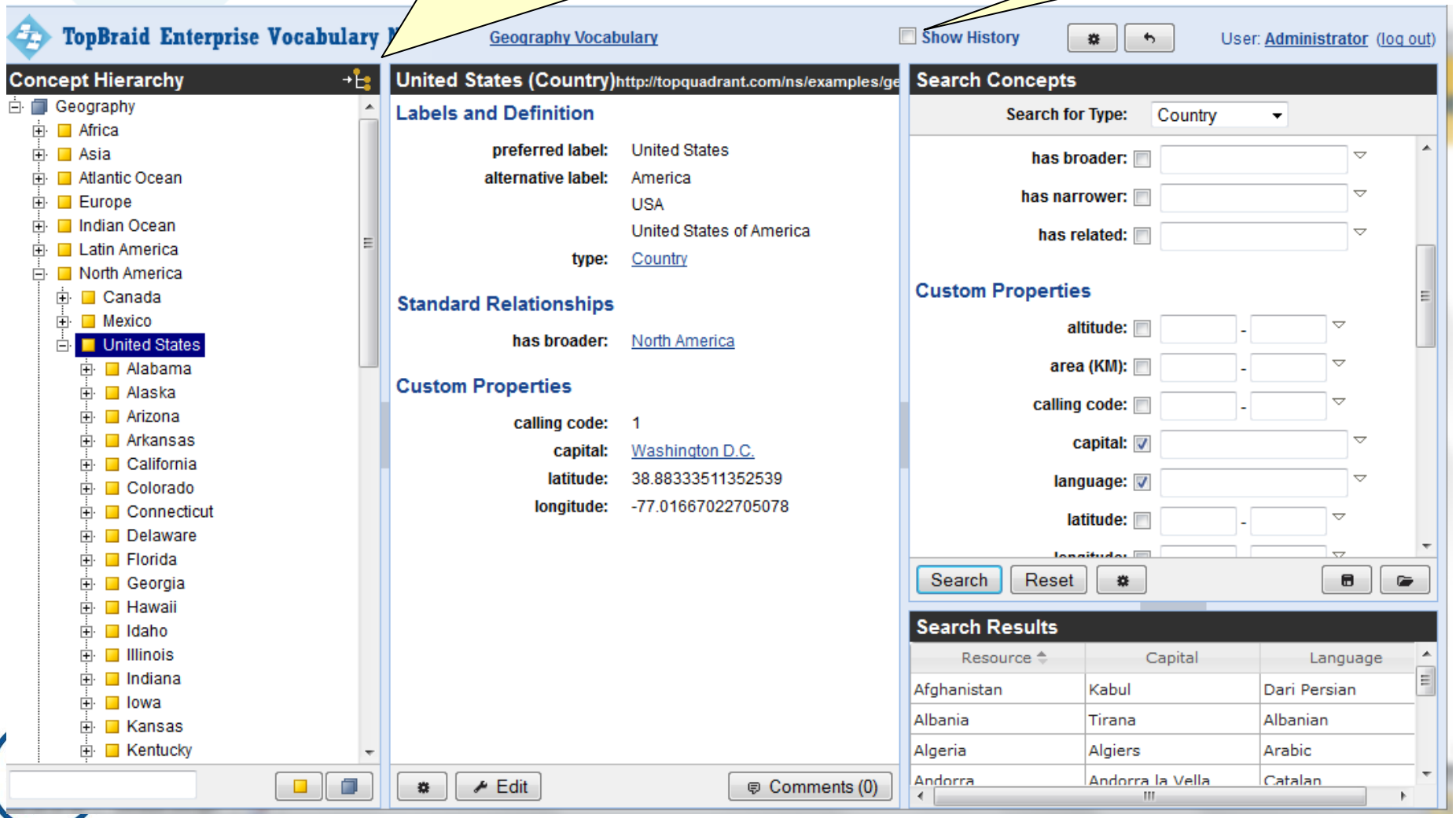
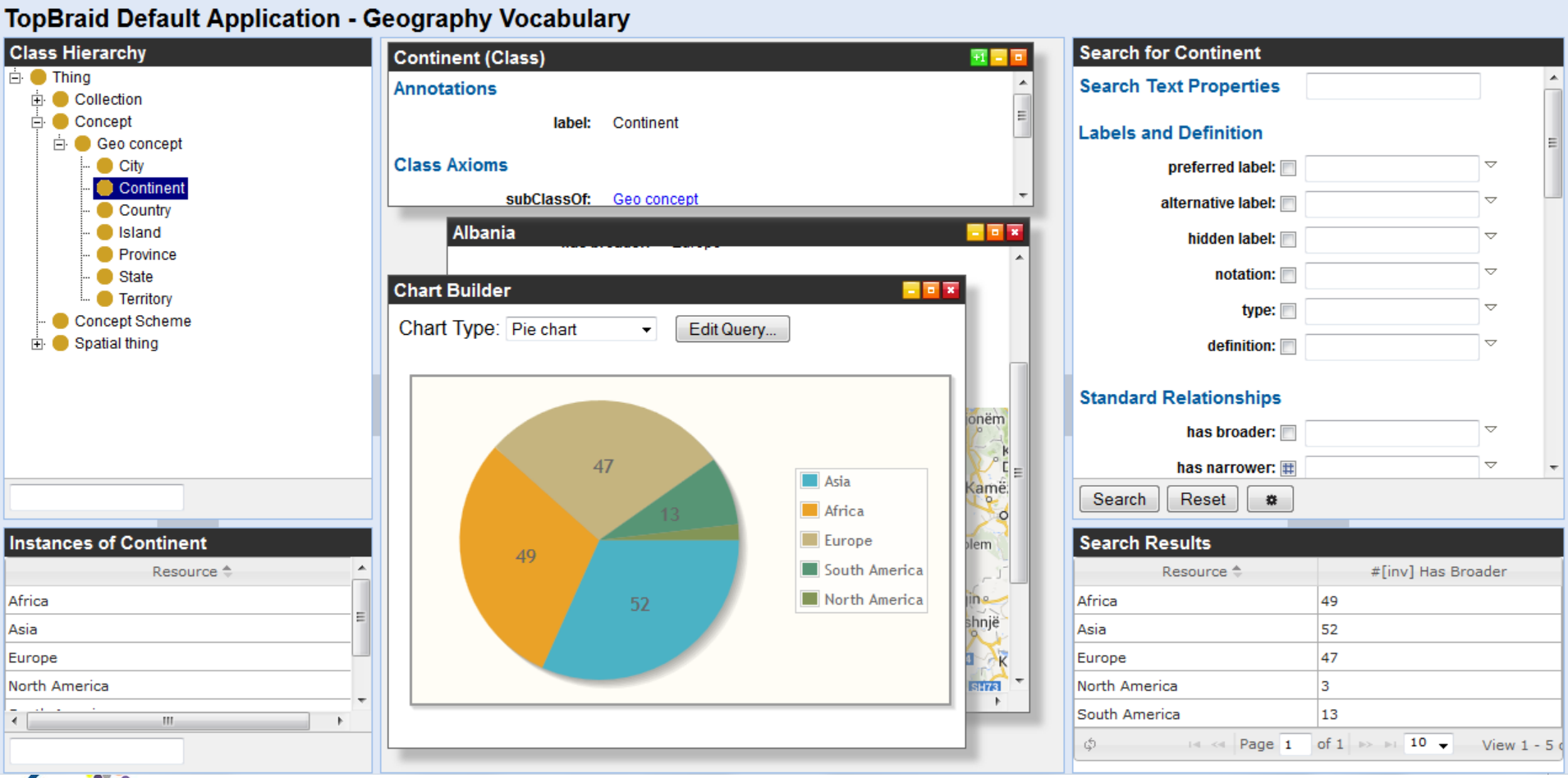
TopBraid EVN: Viewing and editing

Switching between reference data (terms) and schema (classes, properties) editing

Each item has an audit trail



Achieving UI component interoperability through TopBraid SWA (SPARQL Web Applications)



Illustrative Enterprise Customers

Digital Media

OECD
BETTER POLICIES FOR BETTER LIVES

THOMSON REUTERS

Alcatel·Lucent

U.S. AIR FORCE

PEARSON

MAYO CLINIC

THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS

Life Sciences

AstraZeneca

VISTAKON
DIVISION OF Johnson & Johnson

P&G

ucb

Lilly

syngenta
GLOBAL

Other

EPIM
E&P Information Management Association

ONTARIO TEACHERS' PENSION PLAN

NASA

EURIWARE

J.P.Morgan

LOCKHEED MARTIN
We never forget who we're working for®

These companies are using TopBraid to:

- **Mayo Clinic:** "re-integrate and enhance access to knowledge across research, education and clinical practice"
- **Syngenta:** "help scientists to develop insights into research data using databases and information sources – both internal and external"
- **EPIM:** "establish a standards-based knowledge platform for data exchange –receiving, validating, storing, analyzing and transmitting reports"
- **OTPP:** "enable data to be searched without a PhD in SQL"

Case Study #1: Mayo Clinic

Went Live 5 January 2014 with over 5.6 million page views per day!

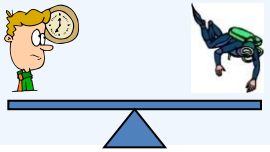
Enhance Value of Mayo's Knowledge

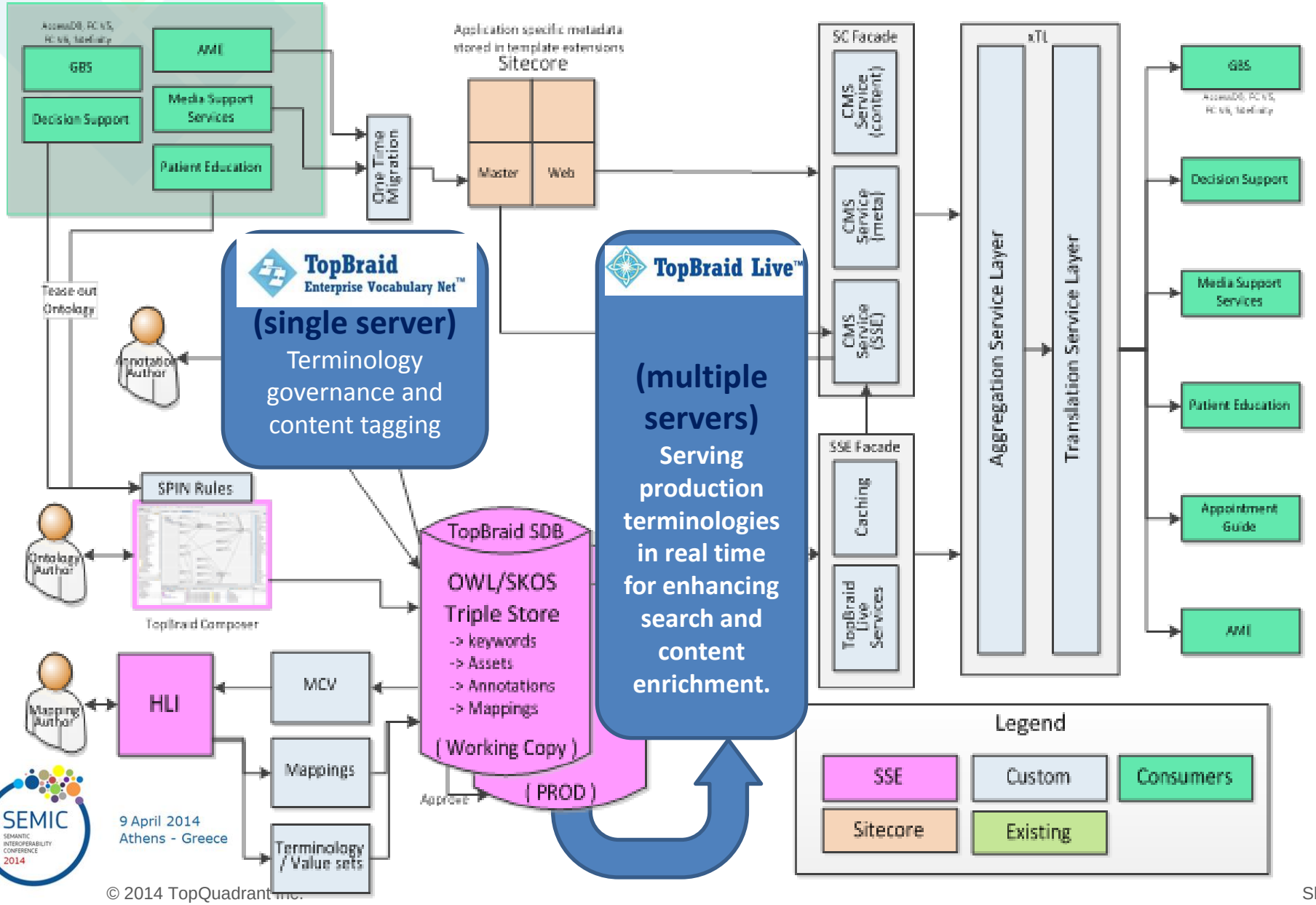
Initiative: Knowledge Content Management System (KCMS)

- Enhanced Search
- Taxonomy management
- Run-time terminology services

Interoperability through terminologies for content and data aggregation, meta-data management and governance

Conceptual Architecture





EVN enables service-based interoperability using template SPARQL queries

skostemplate:ConceptsAndBroaderConceptsForResourceAndProperty (spin:SelectTemplate)

Given a resource and a property, return all vocabulary concepts, and all concepts broader than the matched concepts, referenced by the resource/property pair.

Arguments

arg:property (rdf:Property): The property.
arg:resource (rdfs:Resource): The URI of the content object.

Service Syntax

```
template/skostemplate/ConceptsAndBroaderConceptsForResourceAndProperty?property=...&resource=...
```

or

```
template?_template=skostemplate:ConceptsAndBroaderConceptsForResourceAndProperty&property=...&resource=...
```

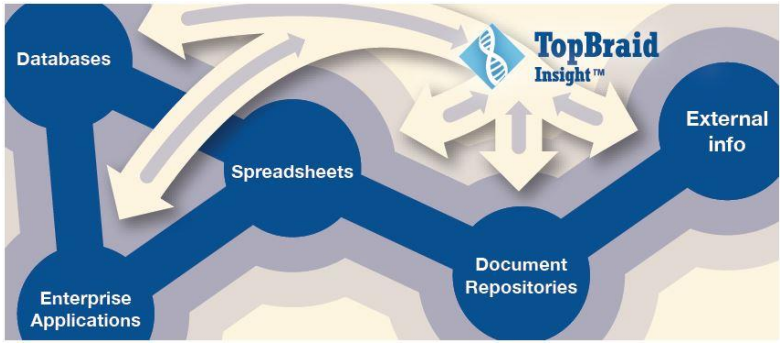
Template Body

```
SELECT DISTINCT ?concept
WHERE {
    ?resource ?property ?broaderConcepts .
    ?broaderConcepts (skos:broader)* ?concept .
    ?concept a ?type .
    ?type (rdfs:subClassOf)* skos:Concept .
}
```

- TopBraid EVN ships with over 30 template services.
- Customers implement their own services based on SPARQL templates.

Case Study #2: Syngenta

- Many disconnected and diverse data sources
- Need to gain insights by aggregating, aligning and exploring data as if it were from one data source



Interoperability through model-driven mappings and a unified way of interpreting data from different data sources

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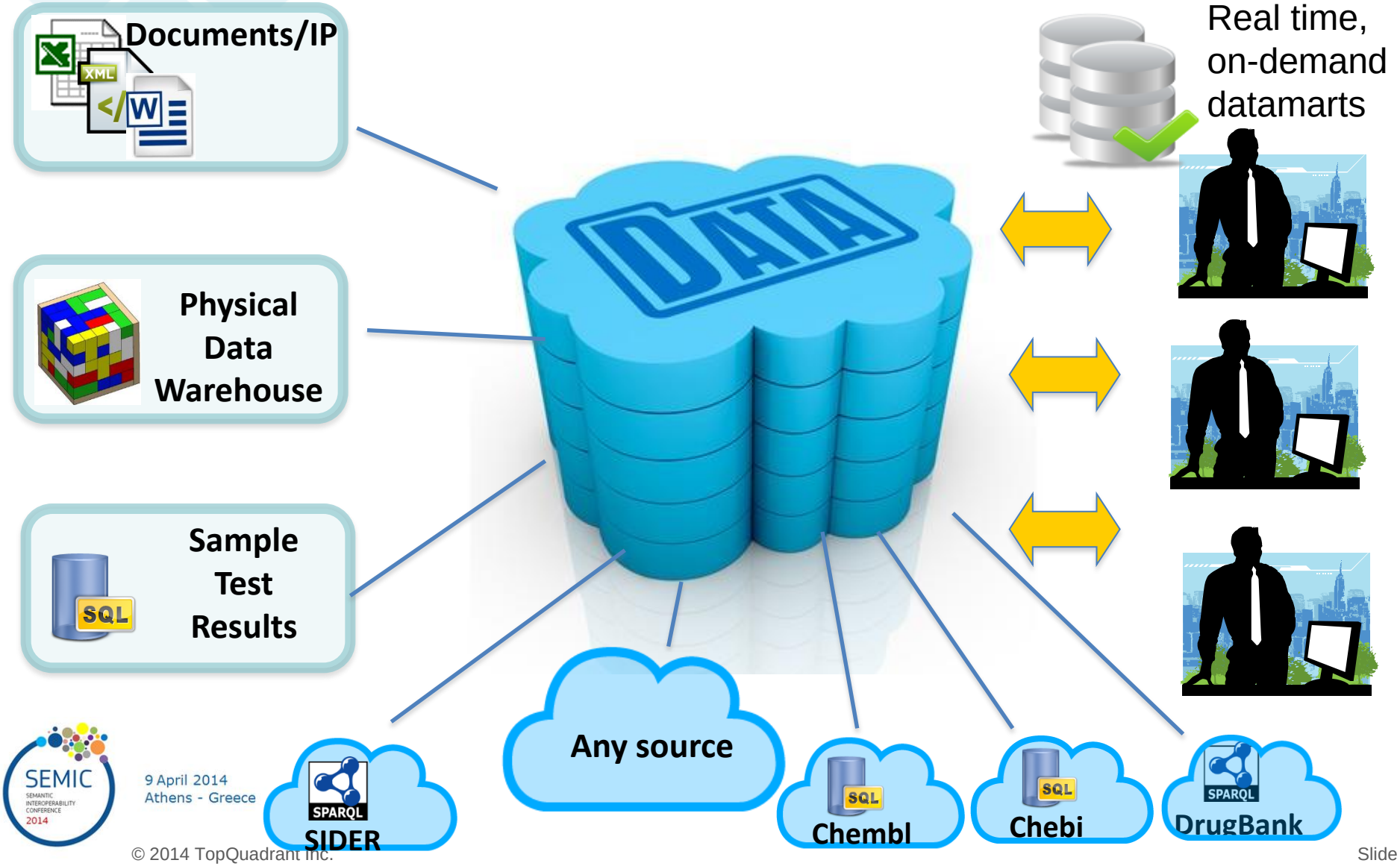
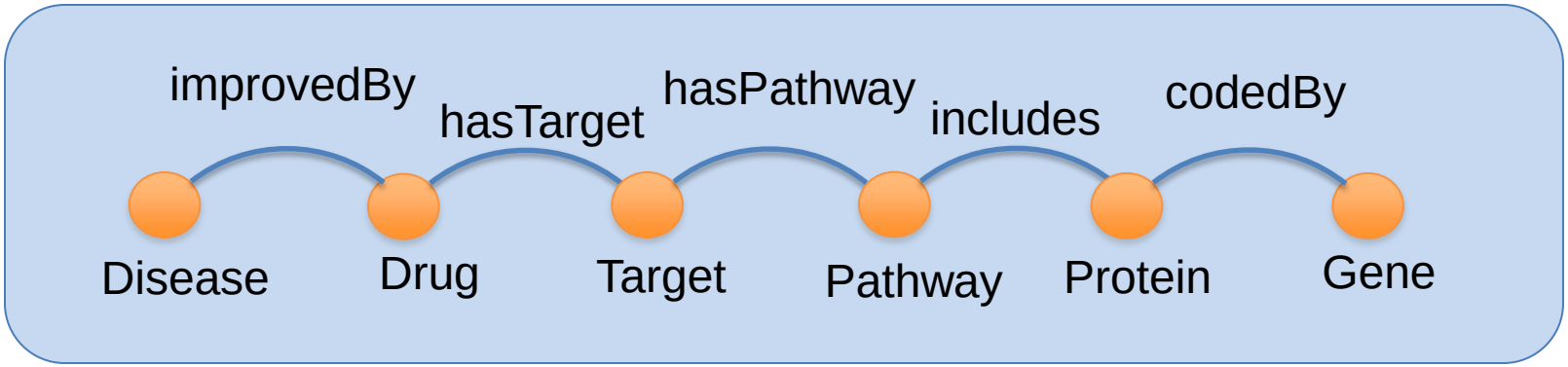
TopBraid Insight provides a layer of connection and meaning to the user and insulates them from the tedious mechanics of data access.



With TopBraid Insight, interoperability means that data sources with different schemas to participate in queries that are written using a unified model representation



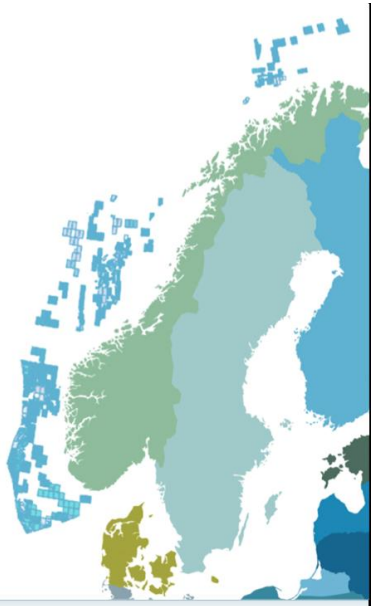
- Multiple queries may be involved by exploring links
- Federated data sources are often relational
  - some may be SPARQL endpoints and other sources

Case Study #3: EPIM – the Norwegian E & P Information Management Association

EPIM
E&P Information Management Association

EPIM is the instrument for the operators on the Norwegian Continental Shelf to secure efficient information sharing among all relevant stakeholders by providing cost effective and user friendly common digital solutions based on international standards

- EPIM ReportingHub (ERH)
- License2Share (L2S)
- EqHub
- EnvironmentWeb



EPIM E&P Information Management Association

Interoperability through semantic transformation of XML data translated to instances of ISO15926 ontologies and alignment with NPD Facts, government registry of the exploration and production operators on the Norwegian continental shelf.

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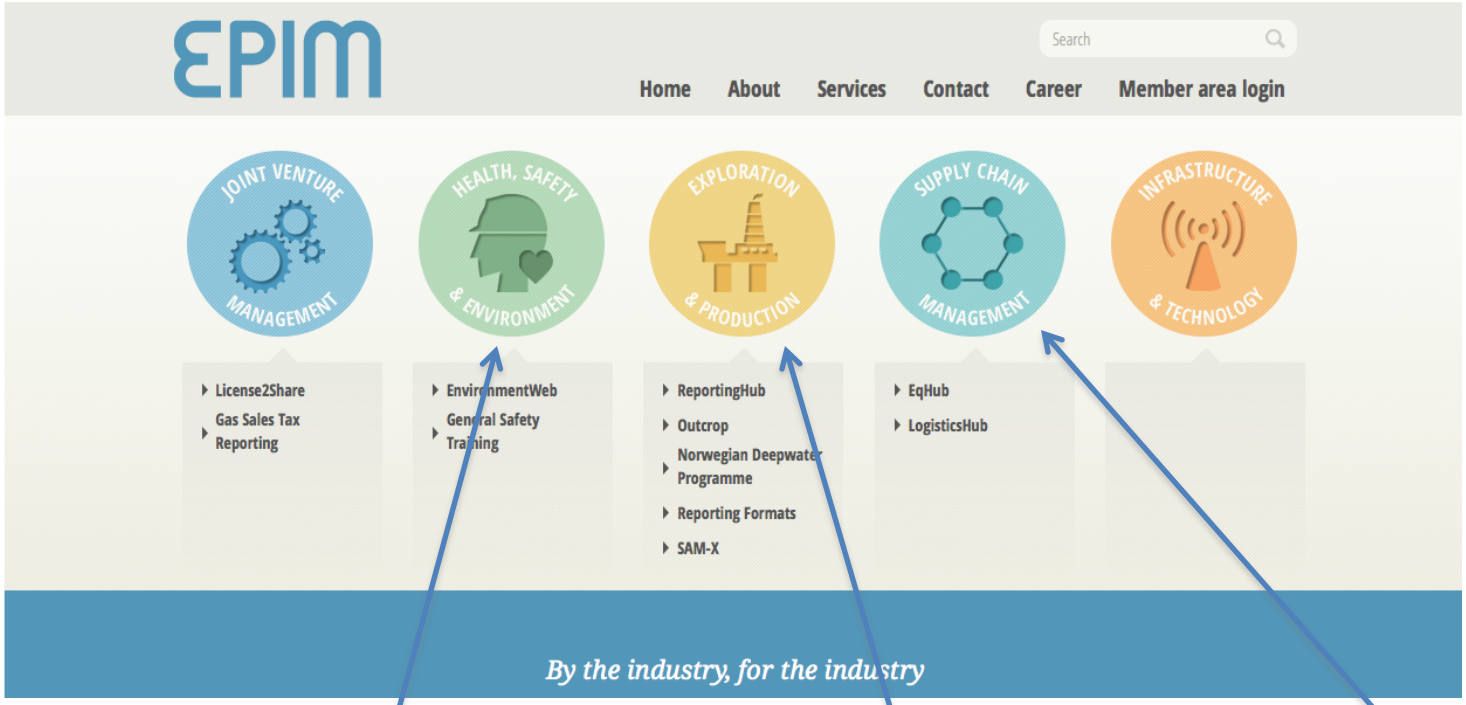
EPIM's Vision for Oil & Gas Solutions

- Build a shared suite of knowledge based-applications using Semantic technology and industry-standard domain concepts
  - i.e. a **Semantic Ecosystem** for the Oil and Gas Industry on the Norwegian Continental Shelf



EnvironmentHub

ReportingHub

LogisticsHub

EPIM ReportingHub (ERH) Architecture – in production for nearly two years now

Operators on the NCS

XML DDR

XML MPR

XML DPR

Semantic Processing

ERH EPIM ReportingHub

TopBraid Live™

ISO 15926 Inside

15926

Semantic Analytics

Authorities

XML DDR

XML MPR

NORWEGIAN PETROLEUM DIRECTORATE

PETROLEUM SAFETY AUTHORITY NORWAY

License Partners

ERH EPIM ReportingHub

XML <xml /> PDF Document

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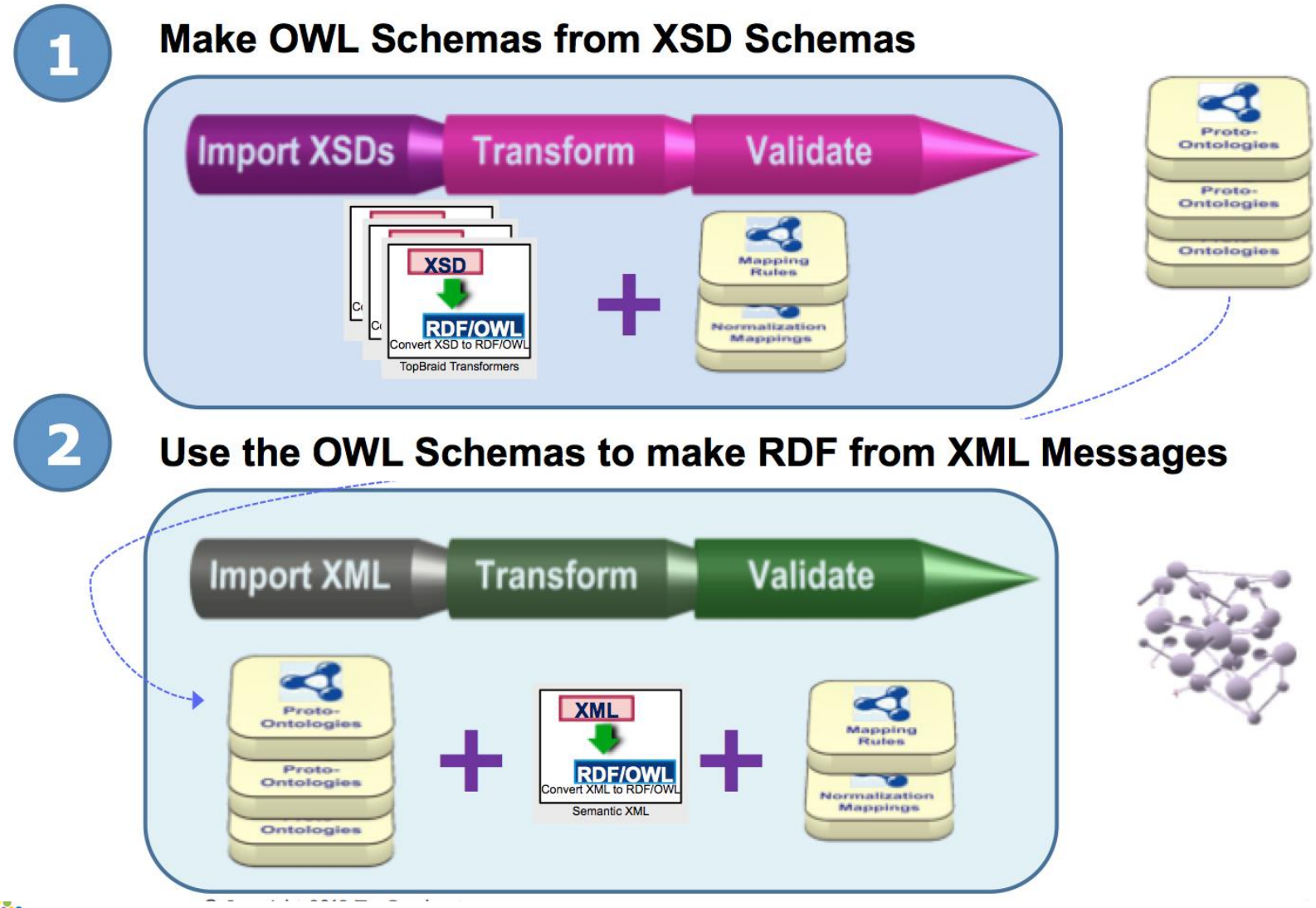
Interoperability by Co-existing in the XML World



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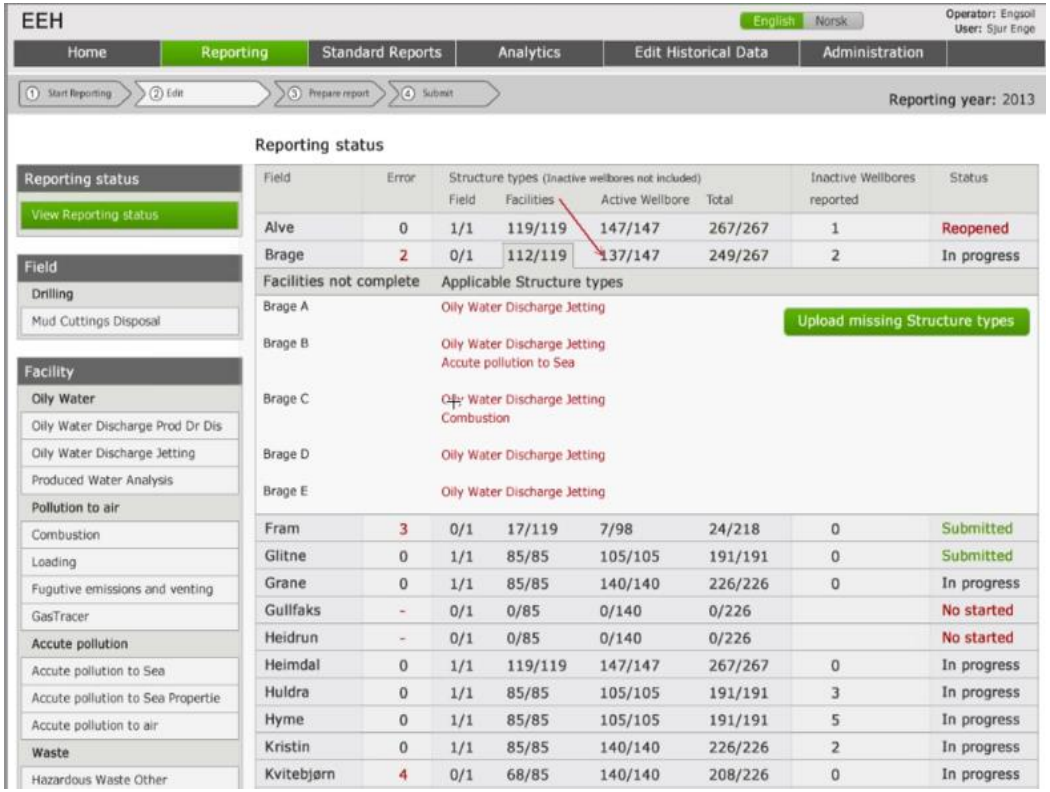
EPIM Environment Hub (EEH)

Reporting of emissions and contaminants to sea and air



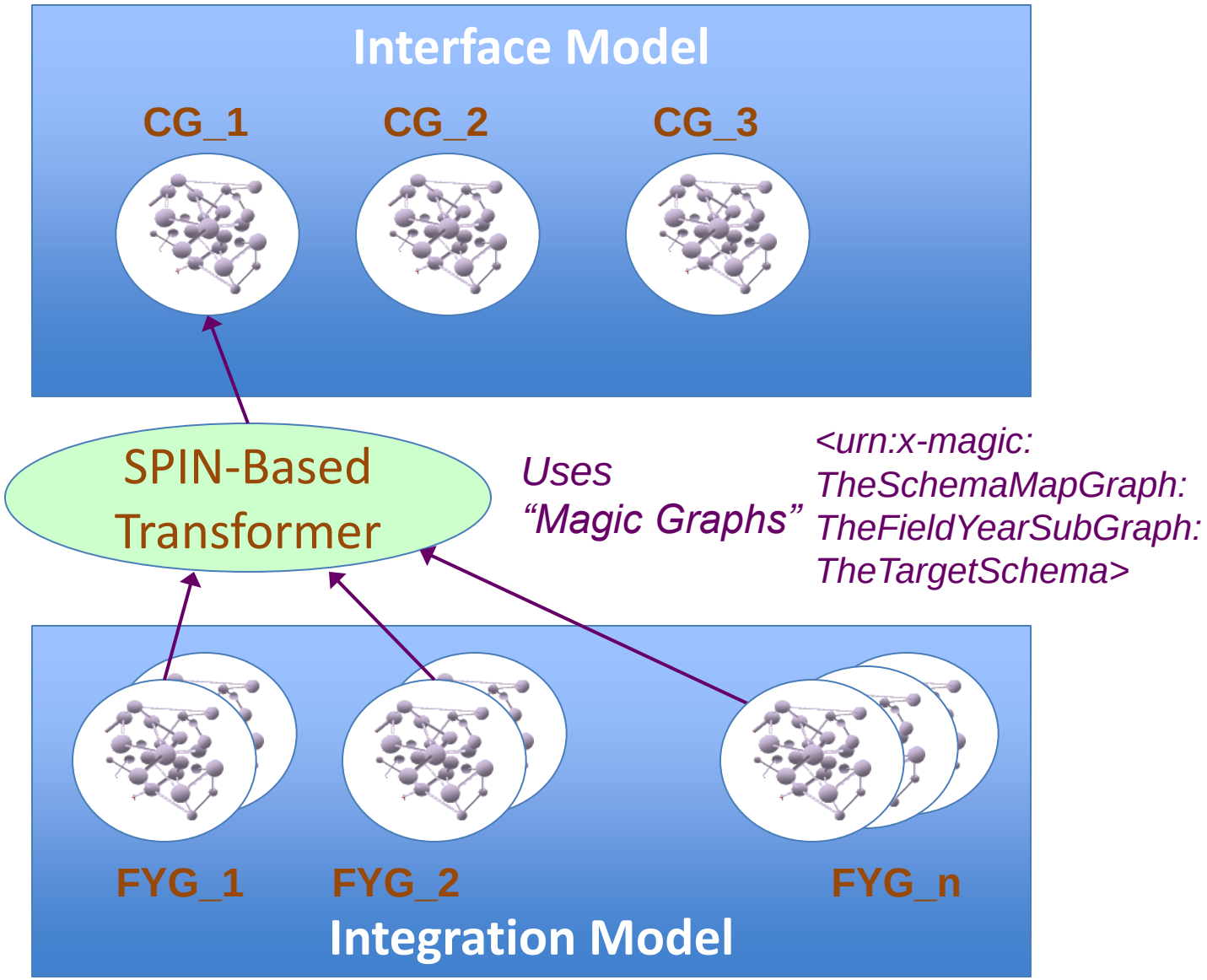
Interoperability through semantic transformation of XML data translated to instances of ISO15926 ontologies and alignment with NPD Facts, government registry of the exploration and production operators on the Norwegian continental shelf.

Interoperability Using Transformations based on “Magic Graphs”

Simple View Ontologies for UI, reporting and analytics

SPARQL Query-View-Transformation

ISO-15926 4D Ontologies



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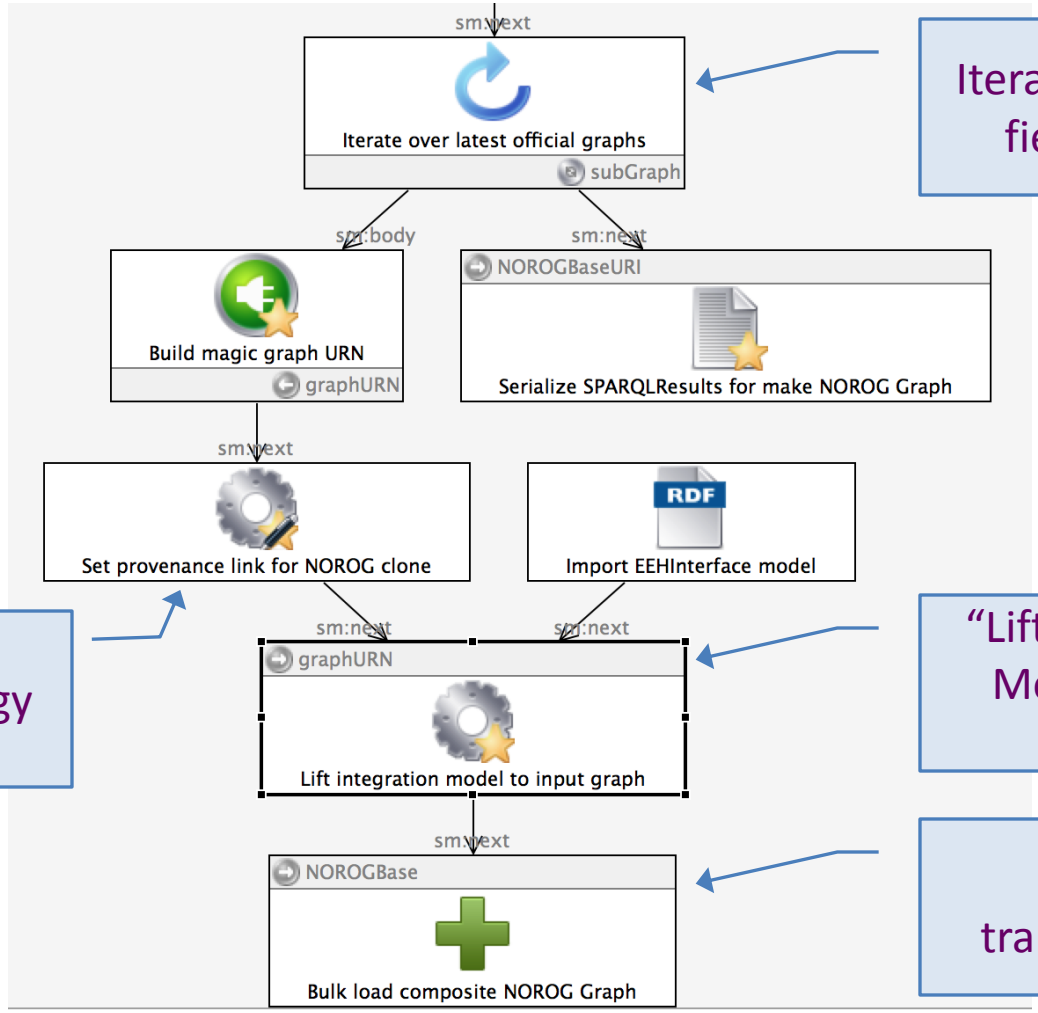
Transforming is controlled by a SPARQLMotion Web Service (1 of 2)

SPARQL Views: Lifting the ISO 15926 Data Graphs into the Interface Model Representation.



Iterate over all official field-year graphs

Use of W3C Provenance Ontology for traceability

"Lift" the Integration Model using SPIN transforms

Bulk Load the transformed triples

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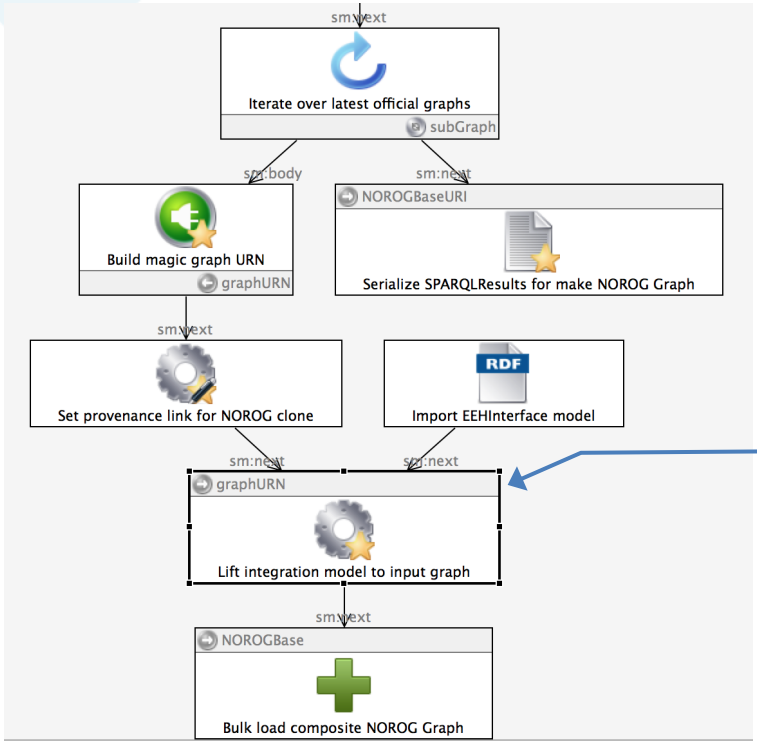
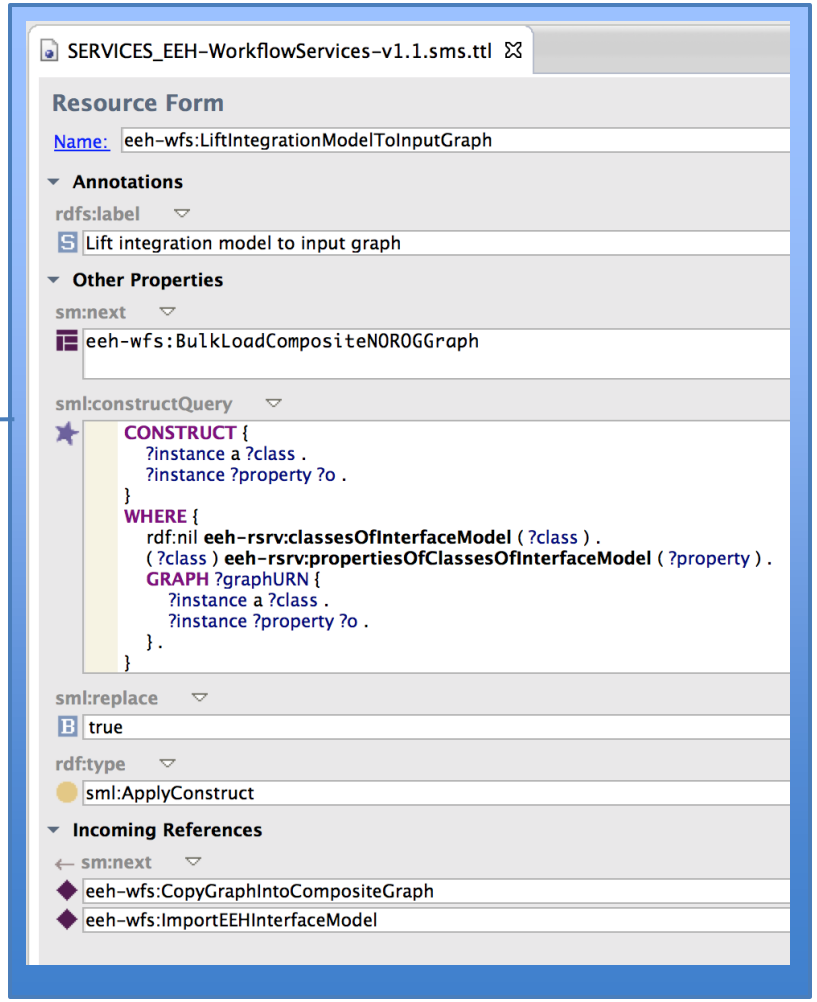
Transforming is controlled by a SPARQLMotion Web Service (2 of 2)

SPARQL Views: Lifting the ISO 15926 Data Graphs into the Interface Model Representation.





- Total triples in the Integration Model (ISO-15926 Ontologies): ~ 4,000,000
- Total triples in the Interface Model: ~400,000

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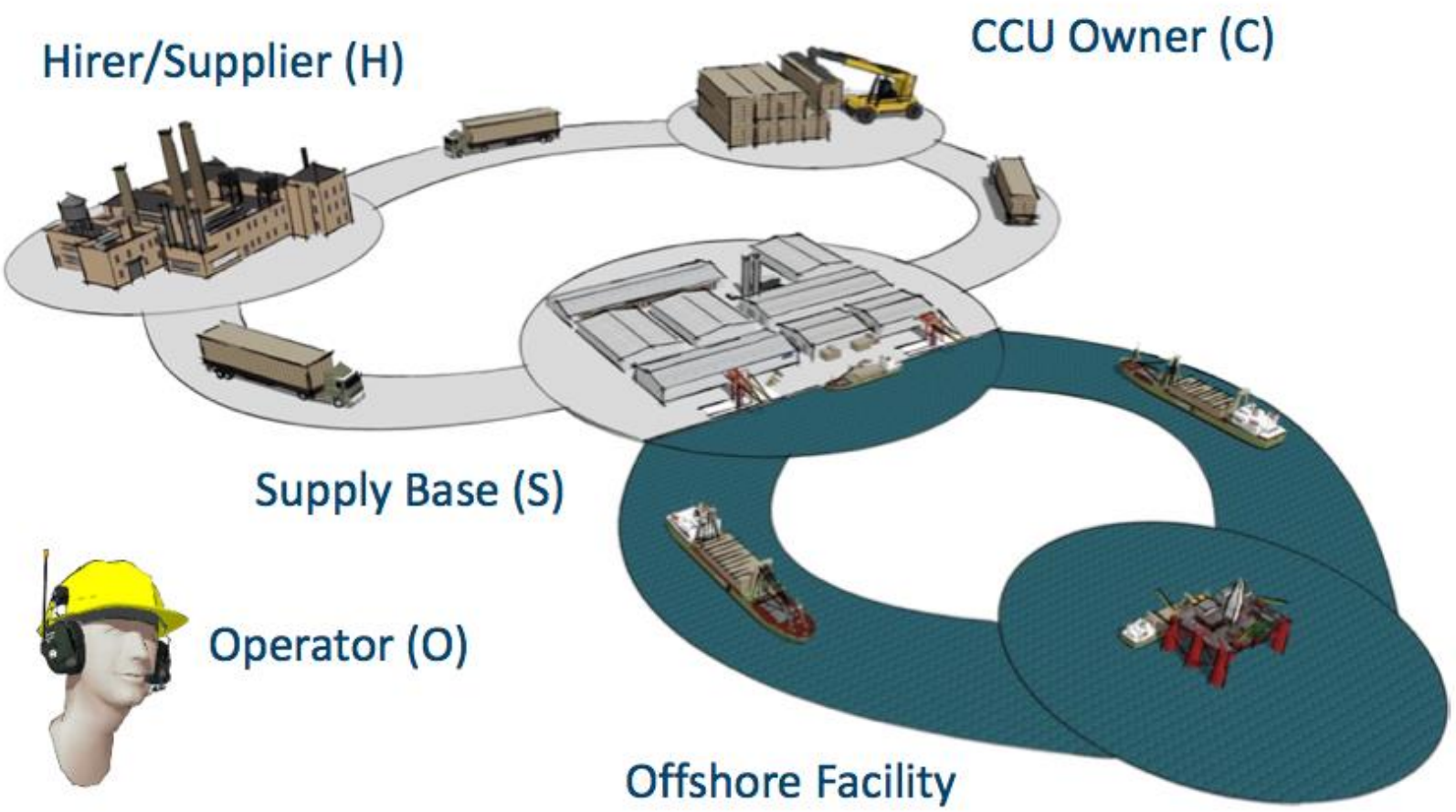
EPIM Logistics Hub (ELH)

Offshore Supply Chain: CCU Tracking

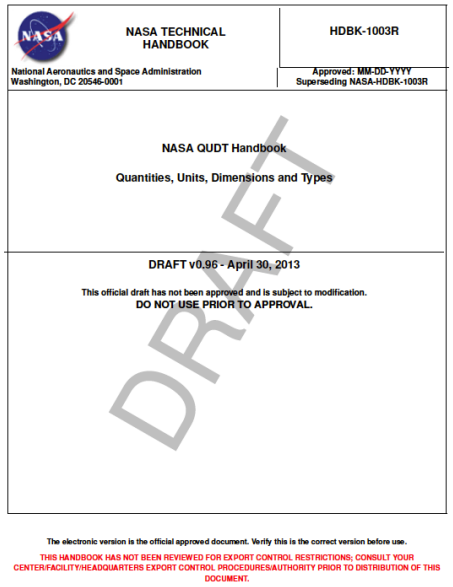
computas



Concluding Remarks

- The focus given was addressing the data variety and veracity challenges in interoperability
- Interoperability has different solution types
- Model-driven applications exploit the real power of semantic web technologies for interoperability
  - SPARQL is more than a query language
  - Customers use SPARQL and Semantic Web Technologies for rules, constraint checking, transformations, dataflow orchestration, user interfaces, authorization checking, …

Other Relevant Work (1)



NASA TECHNICAL HANDBOOK

HDBK-1003R

National Aeronautics and Space Administration
Washington, DC 20546-0001

Approved: MM-DD-YYYY
Superseding NASA-HDBK-1003R

NASA QUDT Handbook

Quantities, Units, Dimensions and Types

DRAFT v0.96 - April 30, 2013

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htttp://qudt.org

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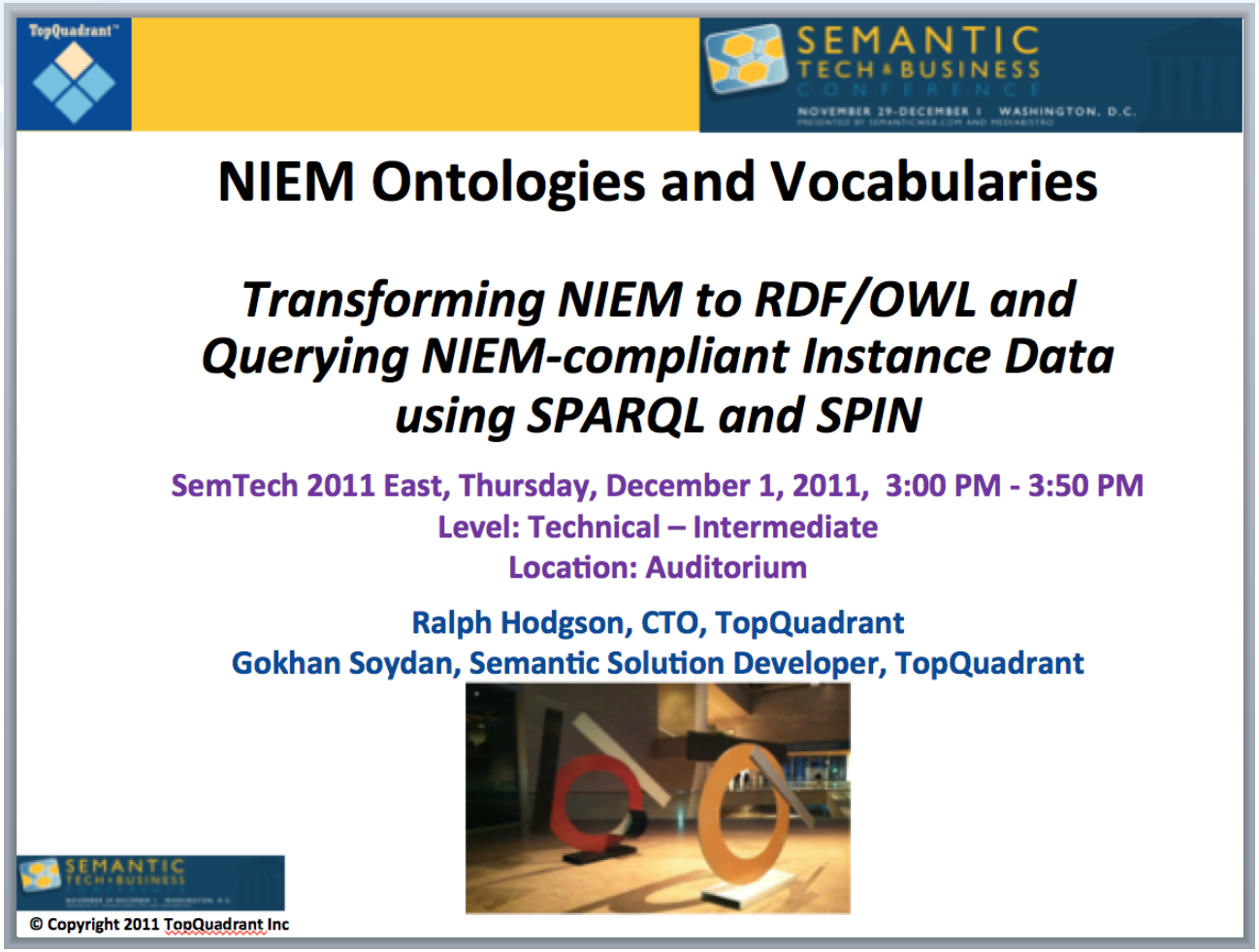
Other Relevant Work (2)



http://www.scribd.com/doc/174434077/SEMTECH2011E-NIEM-Ontologies-and-Vocabularies-TopQuadrant

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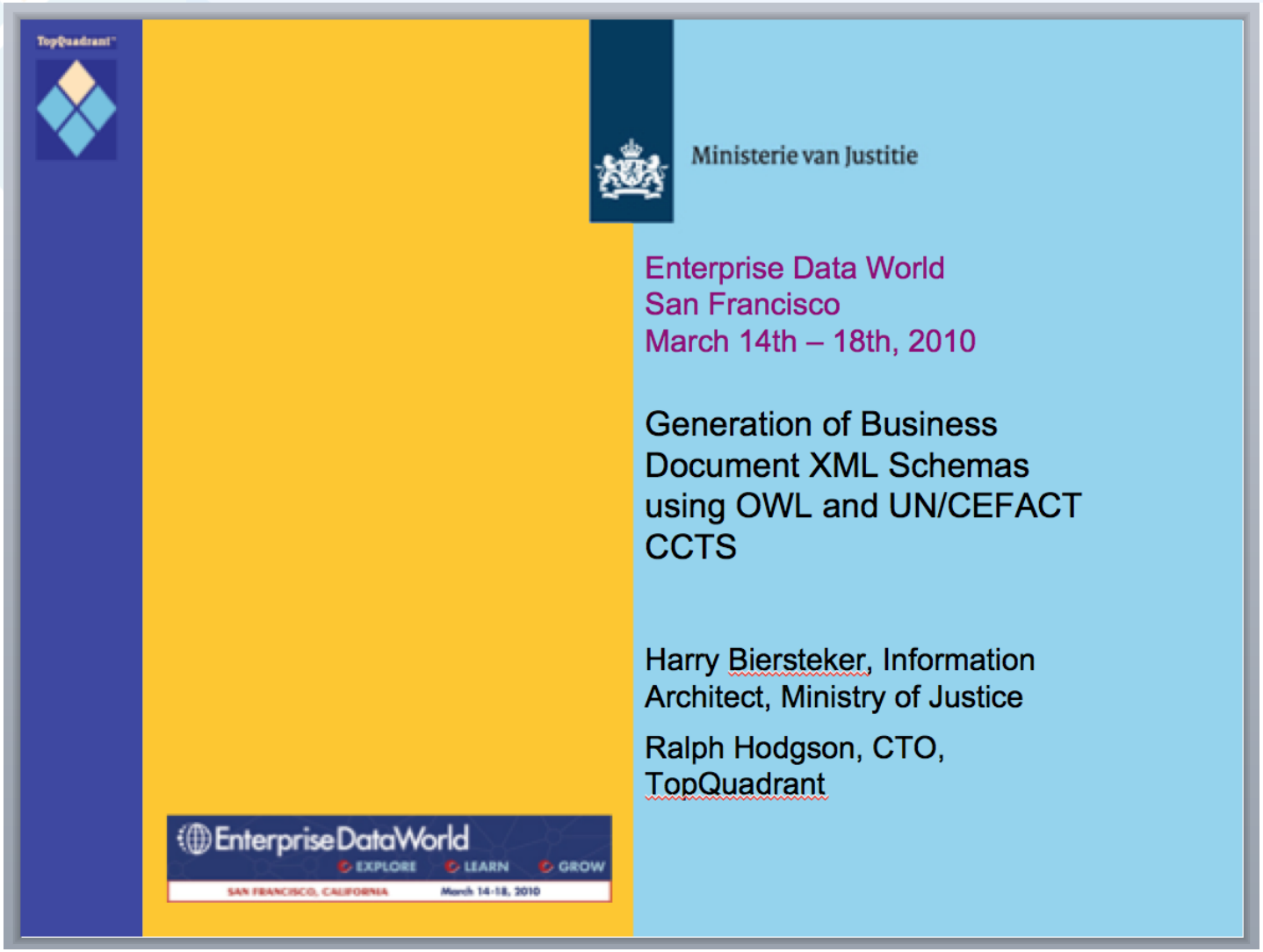
Other Relevant Work (3)



http://www.scribd.com/doc/29565138/The-Netherlands-MoJ-and-TQ-Presentation-at-EDW2010

Thank You

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- www.linkedmodel.org

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