SMART GRID INTEROPERABILITY PANEL

Semantic Overview

Stephan Amsbary - EnerNex
Jay Britton - Alstom

2011.Dec.06 – SGIP F2F
Semantic Working Party

Agenda

- Semantic Overview

  (Jay Britton & Stephan Amsbary)

  - Need (why you should care)
  - Example
  - Intro to semantics and semantic technologies
- Web semantic tool demonstration

  (Ralph Hodgson & Steve Ray)

  - Converted ASHRAE SPC201P from UML to OWL
  - Standard discrepancy discovery
  - Query capabilities
- Next Step Proposal and discussion

Grid-Interop 2011

SGiP

Background

Standards are developed in functional silos

- Each model represents attributes unique for that standard's function
- Ancillary functions are either not addressed or they are described in light of anticipated future use within the functional perspective of that group
- They use different methods to describe their model
- Little or no coordination with other standard bodies

Background (Continued)

Needs to be solved

- Relationships between models are not understood – or worse interpreted incorrectly
- Depth: Many standards are still developing – therefore, many aspects of a model are incomplete or described more fully by another organization (see next)
- Duplication: Standards describe their environment using a model, different models quite often describe identical or similar concepts
- Contradiction: sometimes a model's concept describes elements that contradict how another model addresses it

Implications

Consequences

- Standards take longer to evolve because a SDO group does not understand or unaware of similar work in other standards/SDO
- Functional gaps amongst standards are not understood or seen
- Relationships amongst standards are not realized – model harmonization is cumbersome at best
- Maintaining currency amongst standards does not exist

Implications (Continued)

Solution

- Apply a common semantic method to document each standard's elements – this defines an unambiguous definition of a standard's elements relationships to one another

Result

- Identify identical element across the standards
- Infer relationships that are not explicitly defined amongst standards
- Identify conflicts between models
- Manages the complexity of emerging and evolving standards
  - Accelerates development and harmonizes change
  - Accelerates standards uptake and interoperability

Challenge

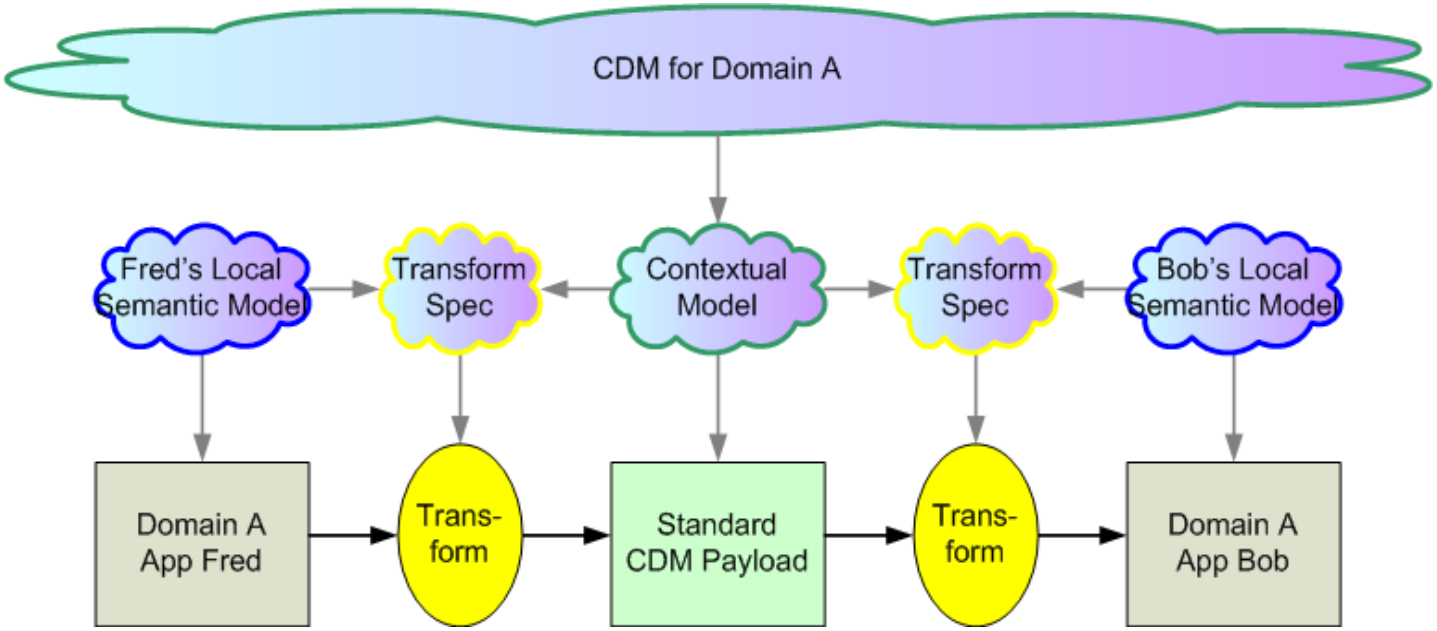
How to reconcile vocabularies, concepts and relations among all the smart grid standards?

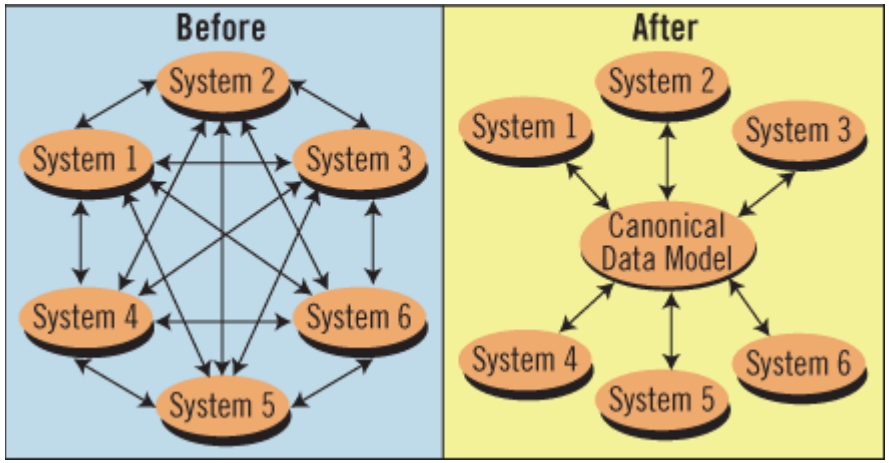
- Currently 268 standards in the SGIP Catalog of Standards
  - Overlapping, different, sometimes contradictory vocabularies and definitions
- We need a way to manage
  - Differences
  - Constraints on usage
  - Relationships between vocabularies

Grid-Interop 2011

SGiP

Semantic integration within a unified domain (one CDM)

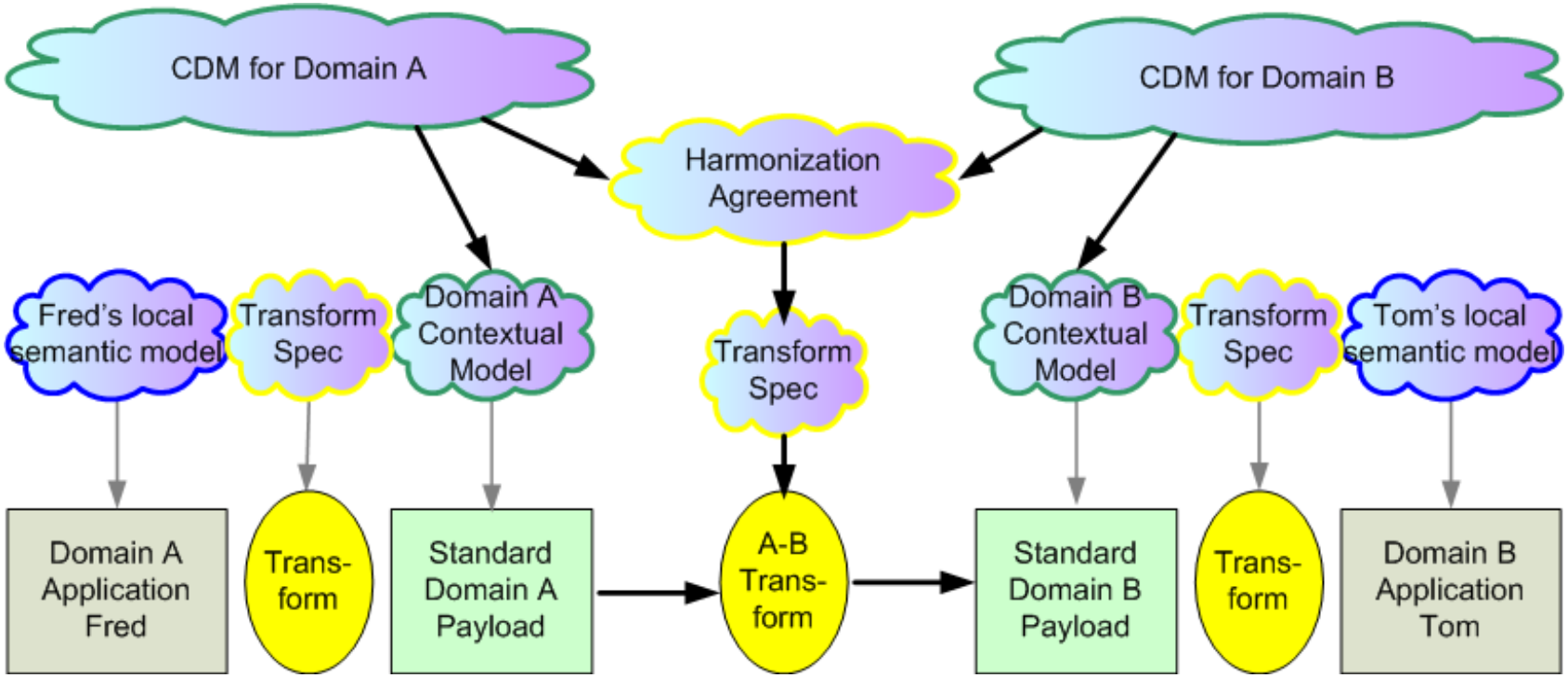




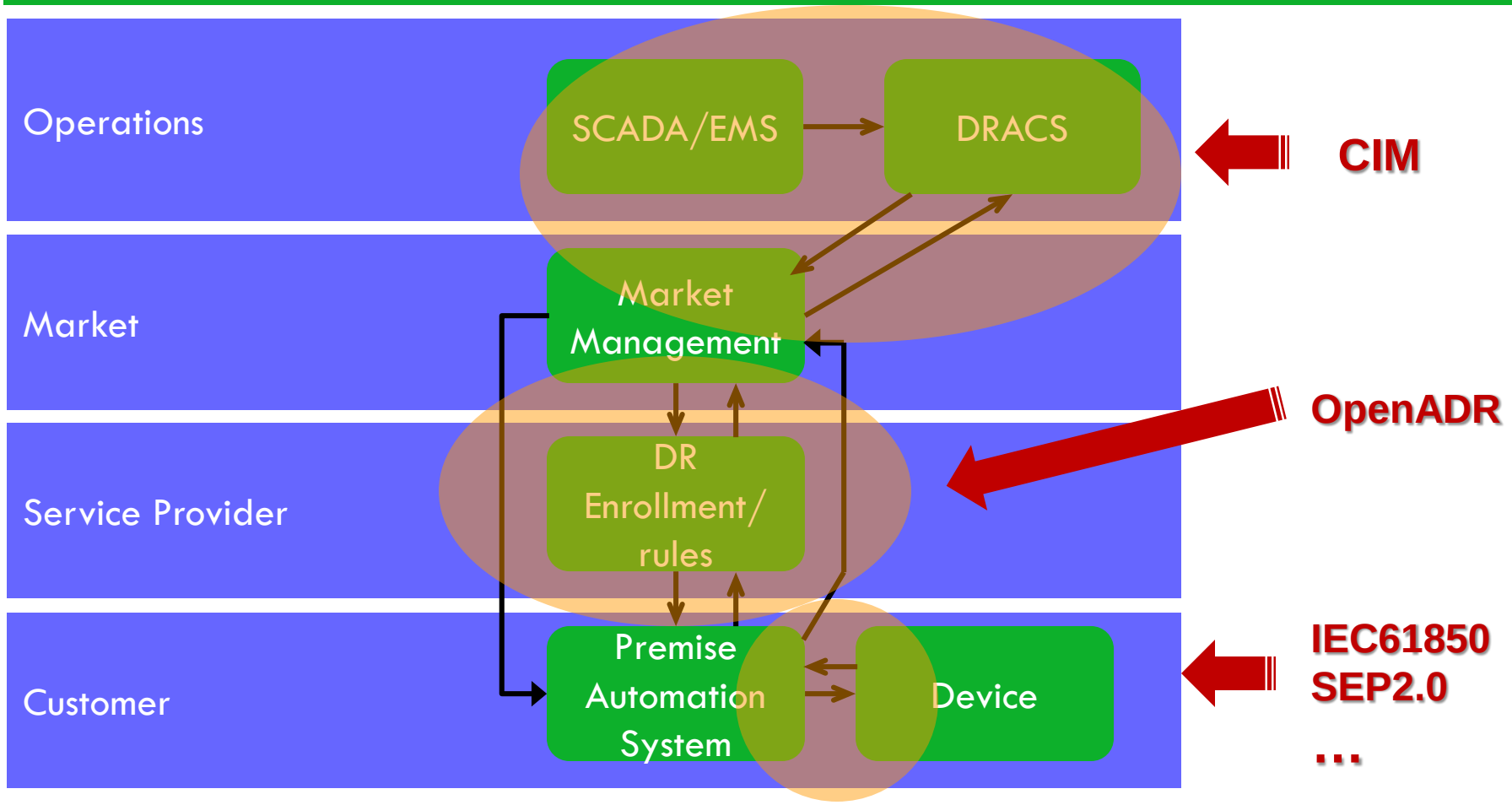
Grid-Interop 2011

SGiP

Semantic integration between harmonized domains (two CDMS)



Demand Response Pricing Use Case Example

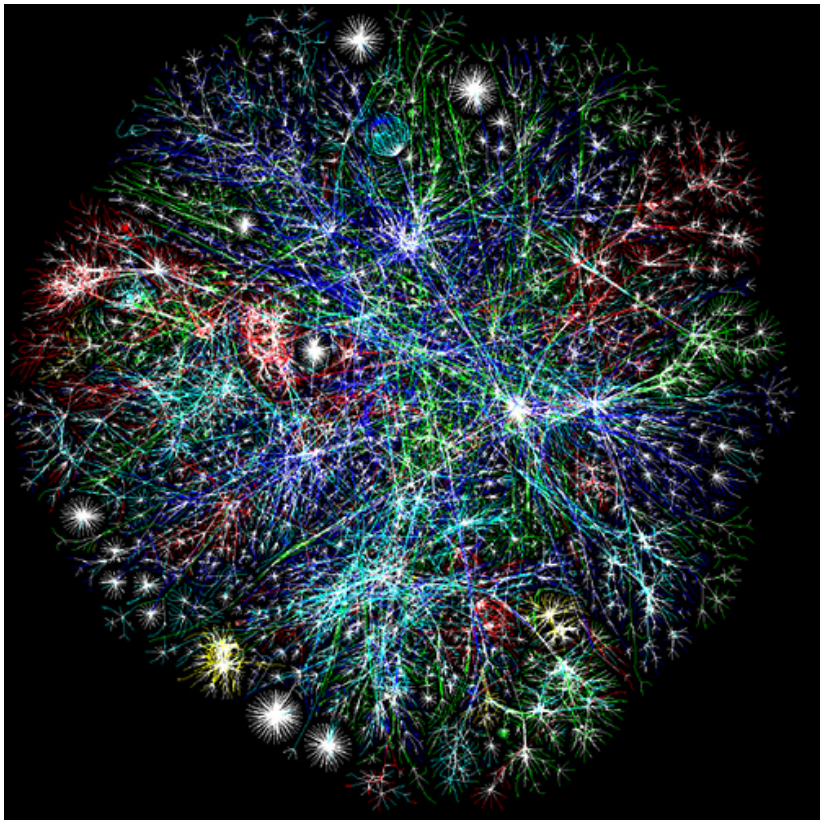


Grid-Interop 2011

SGiP

Need for a Semantic Vocabulary

- Natural Language is Ambiguous
  - One Reality, Multiple Views of It
  - Meaning is *Relative* to a Perception
  - Perception is Contextualization
- Ambiguity can be eliminated with Contextualization
- Contextualization can be defined through Relations



Grid-Interop 2011

SGiP

Vocabulary and Semantics

Information Challenges

- Ambiguous Semantics
  - Inter-domain communications
- Multiple Technologies
  - Consistency
- Partially Known Value-Chain
  - Cross Business-Unit Operational implications
- Low Data Quality
  - Decisions/Trust-Risk
- Poor Data Specification
  - Expectations

Success Factors

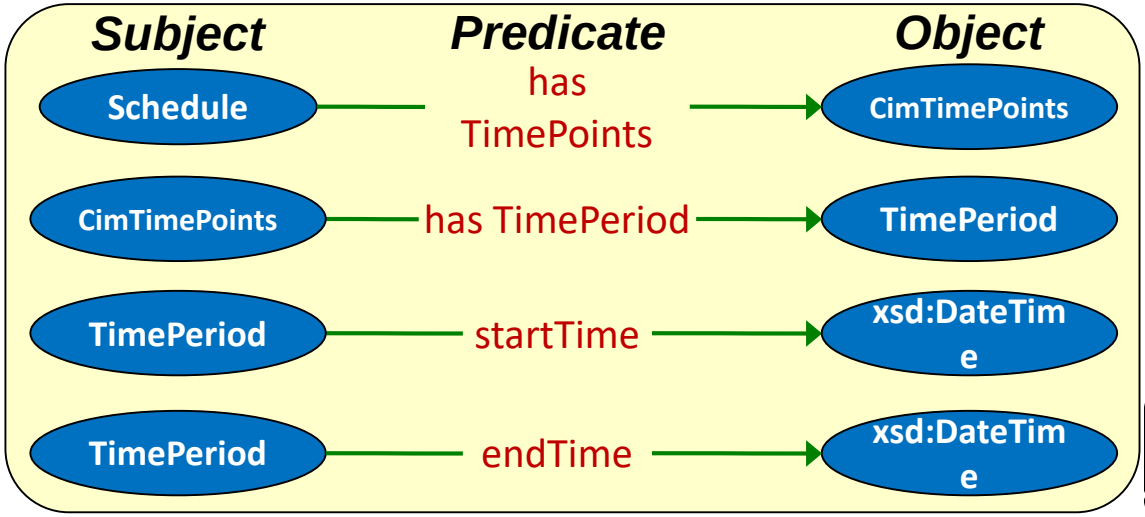
- Well defined vocabulary and semantics
- Eliminate technology dependencies/disparities
- Precise Relations
- Clear Expectations

Grid-Interop 2011 ™

SGiP

What is Semantic Technology?

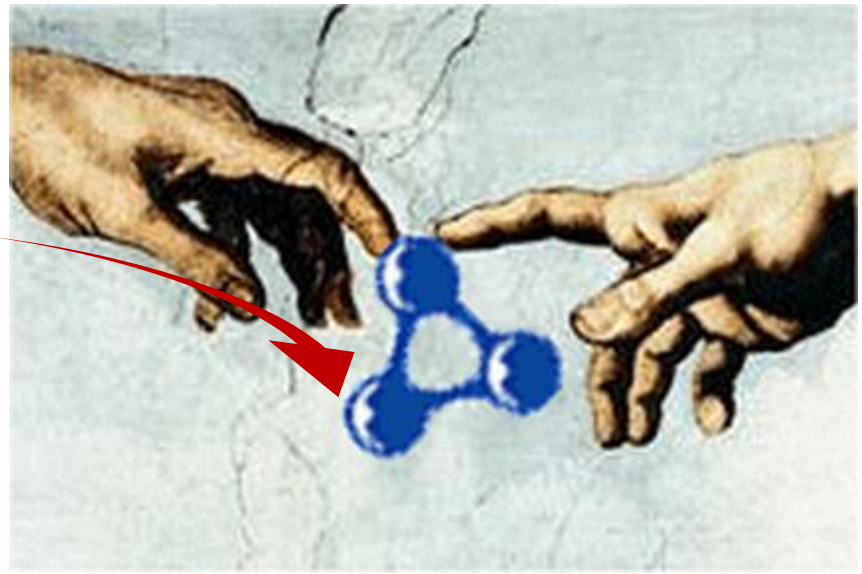
- *Semantic Technology allows the meaning of and associations between information to be represented precisely and, used in a run-time environment*
- Semantic Technology represents information in a neutral form called Triples that consist of a Subject, a Predicate and an Object. Each of these can have properties that infer new information. Each has a unique identity, enabling merging of different datasets.



Semantic Modeling Language

Need for *actionable* vocabulary beyond model languages such as Universal Modeling Language (UML)

- Open Source managed by W3C a non-propriety file format
- Ontology Web Language (OWL) is more expressive than UML



Actionable

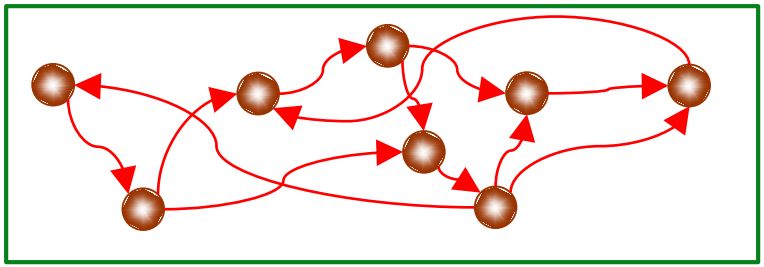
- Simple Structure
  - Subject, Verb, Object (triple) which is stored in a Resource Description Framework (RDF) for access
  - Triplets can be transparently merged across data sources
- Provides formal verification across diverse vocabularies
- If it's Web addressable, its available for use
- Analysis/query (SPARQL)

Grid-Interop 2011

SGiP

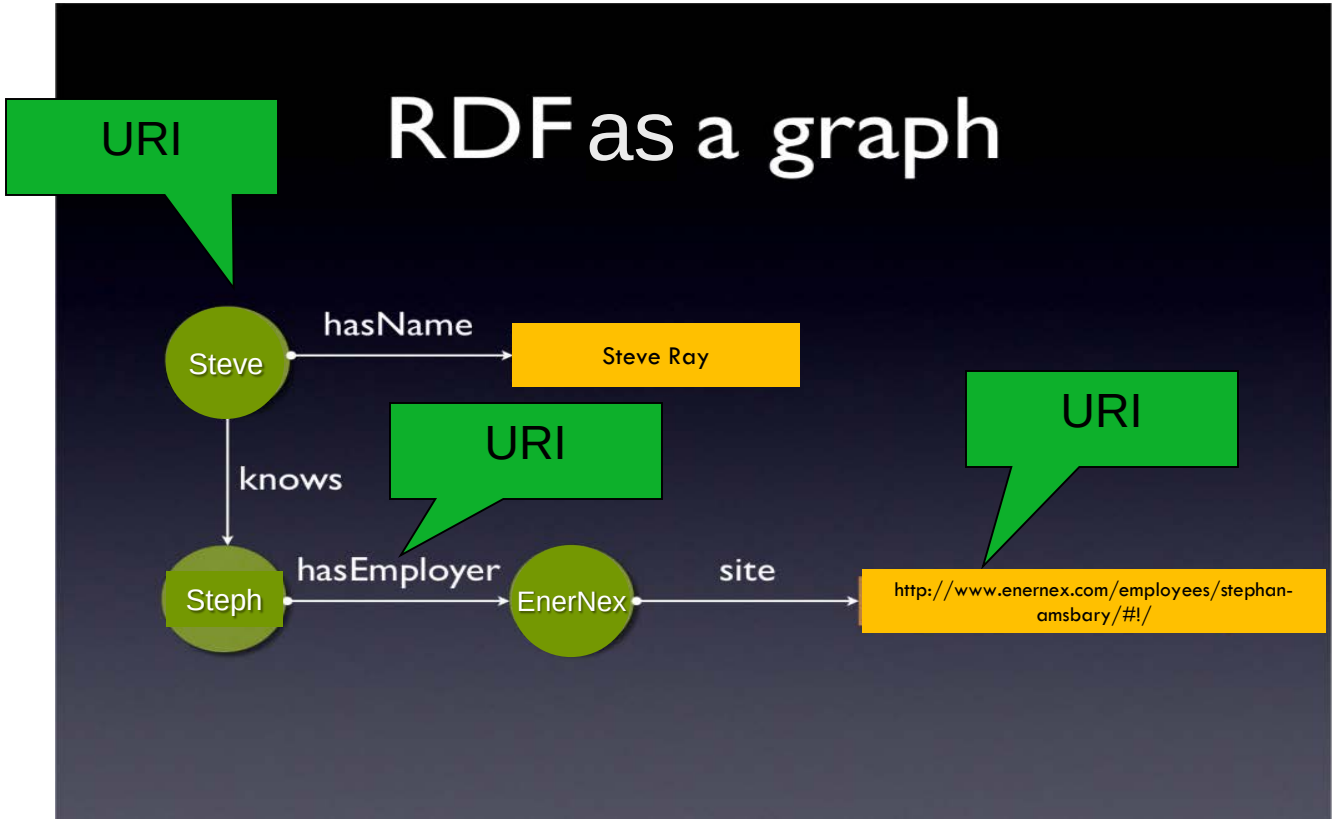
What Problems can be Solved by Semantic Technology

- Terms and relationships alignment
- Generation of controlled vocabularies
- Universal Identifiers are required
- Aggregation of data from disparate sources
- “Smart Data” - Infer new information from data
- Generation of consistent (XML) Schemas
  - Component-Based

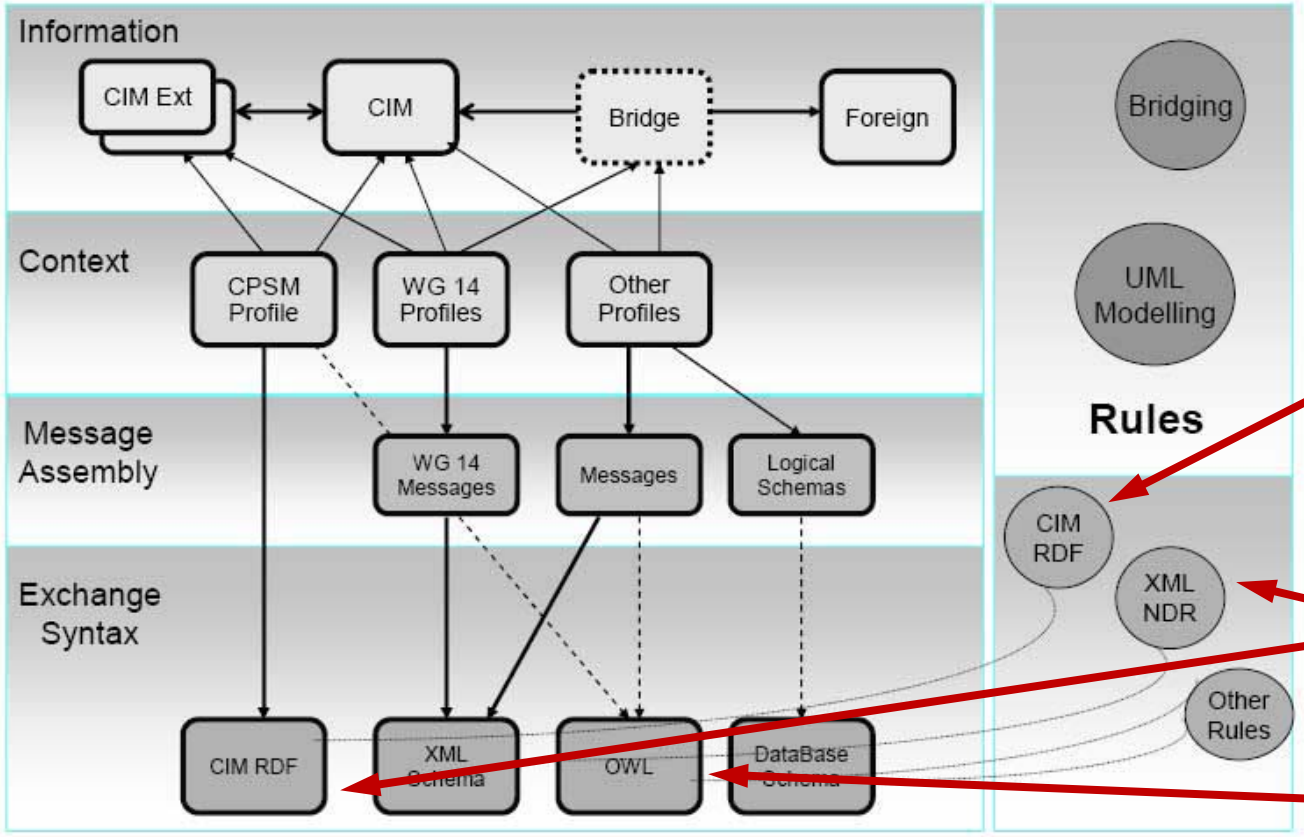


RDF Example

Three triplets



Next Generation CIM*



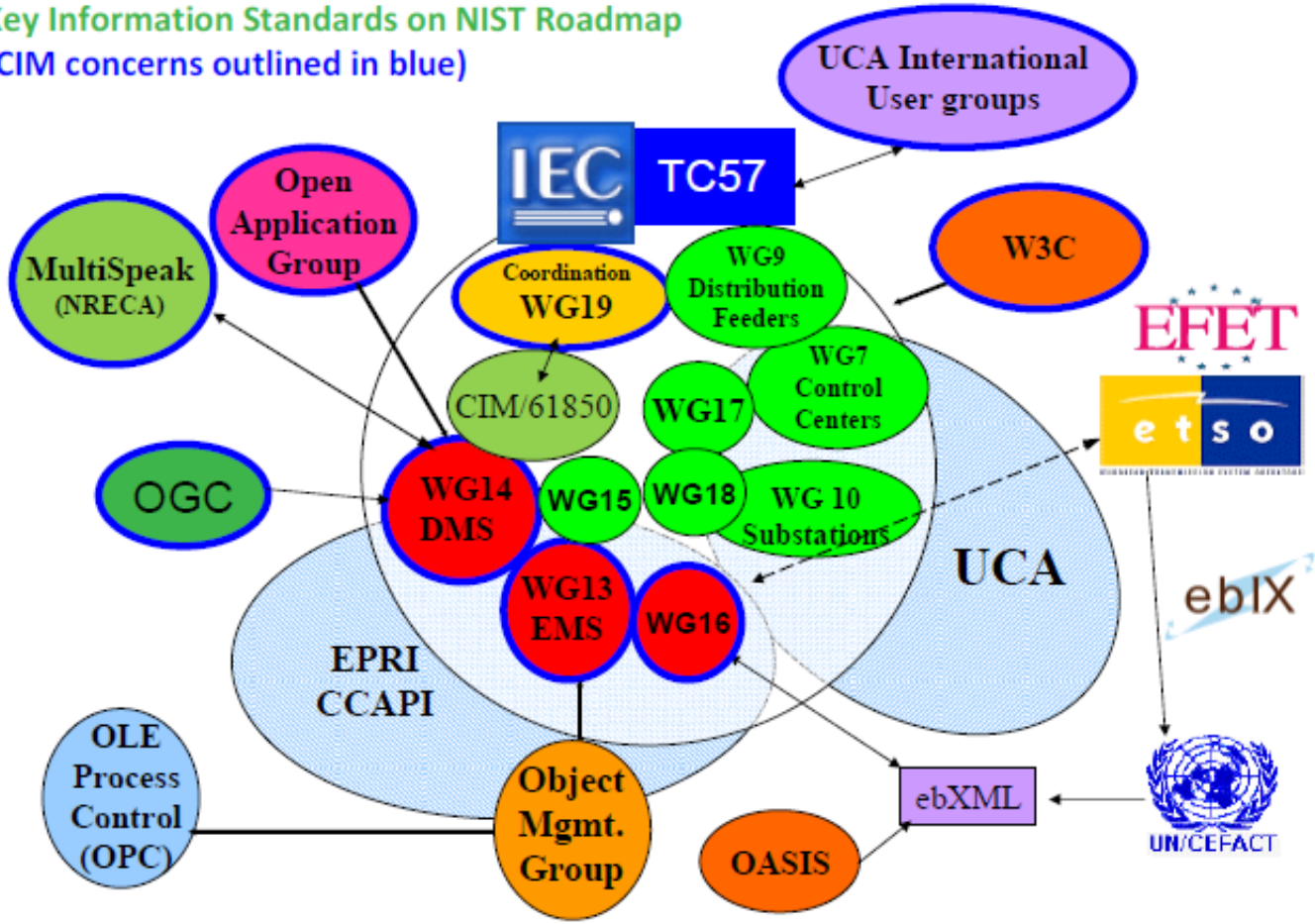
Names and Design Rules (NDR)

Resource Definition Framework (RDF)

Ontology Web Language (OWL)

***IEC Smart Grid Standardization Roadmap**
SMB Smart Grid Strategic Group (SG3) June 2010; Edition 1.0

Key Information Standards on NIST Roadmap
(CIM concerns outlined in blue)



Grid-Interop 2011

SGiP

SGiP SMART GRID INTEROPERABILITY PANEL

WEB Semantic Tool Demonstration

Roger Hodgson - TopQuadrant
Steve Ray - CMU

2011.Dec.06 – SGIP F2F
Semantic Working Party

SMART GRID INTEROPERABILITY PANEL

Next Step Proposal

2011.Dec.06 – SGIP F2F
Semantic Working Party

How to proceed?

- Work on a use case that is relevant (example used earlier)?
  - Align vocabularies
  - Capture relationships and constraints
  - Create mappings among standards
  - Use Web Semantic Technology to document resulting taxonomy/ontology
- Translate Herb's and Terry's CIM/61850 harmonization's whitepaper into web semanbtics – does it make sense?

Methodology?

- Similar to Conceptual Architecture activities
- Schedule work sessions – nominated by SGAC
  - SGAC lead
  - Member of SDO/SDO/PAP
  - Volunteers from SGIP and SGIP
- Results voted upon by SGAC (and of course SDO/SSO) and entered into CoS

Questions

EnerNex
Electric Research, Engineering, and Consulting

STEPHAN AMSBARY
Director, Utility Enterprise Architecture

Stephan@EnerNex.com
Phone: +1.828.559.1110
FAX: 865.218.8999
1993 Grants Mountain Rd, Marion, NC, 28752-9513