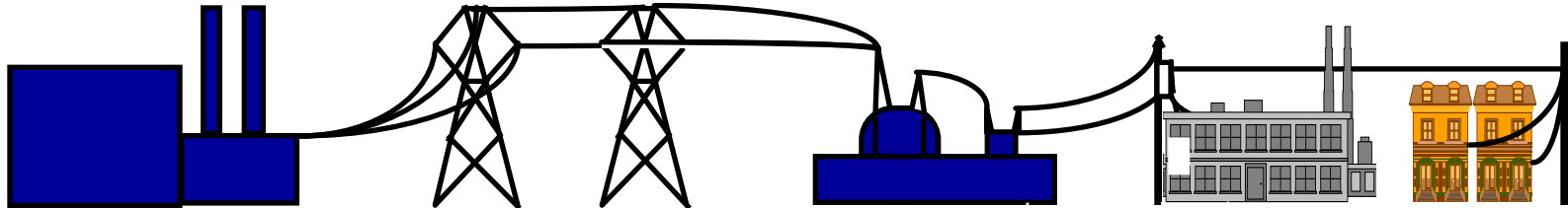


Justifying the Use of the CIM in the Utility Enterprise

IEEE Power System Conference and Exhibit
Seattle, Washington

March 18, 2009

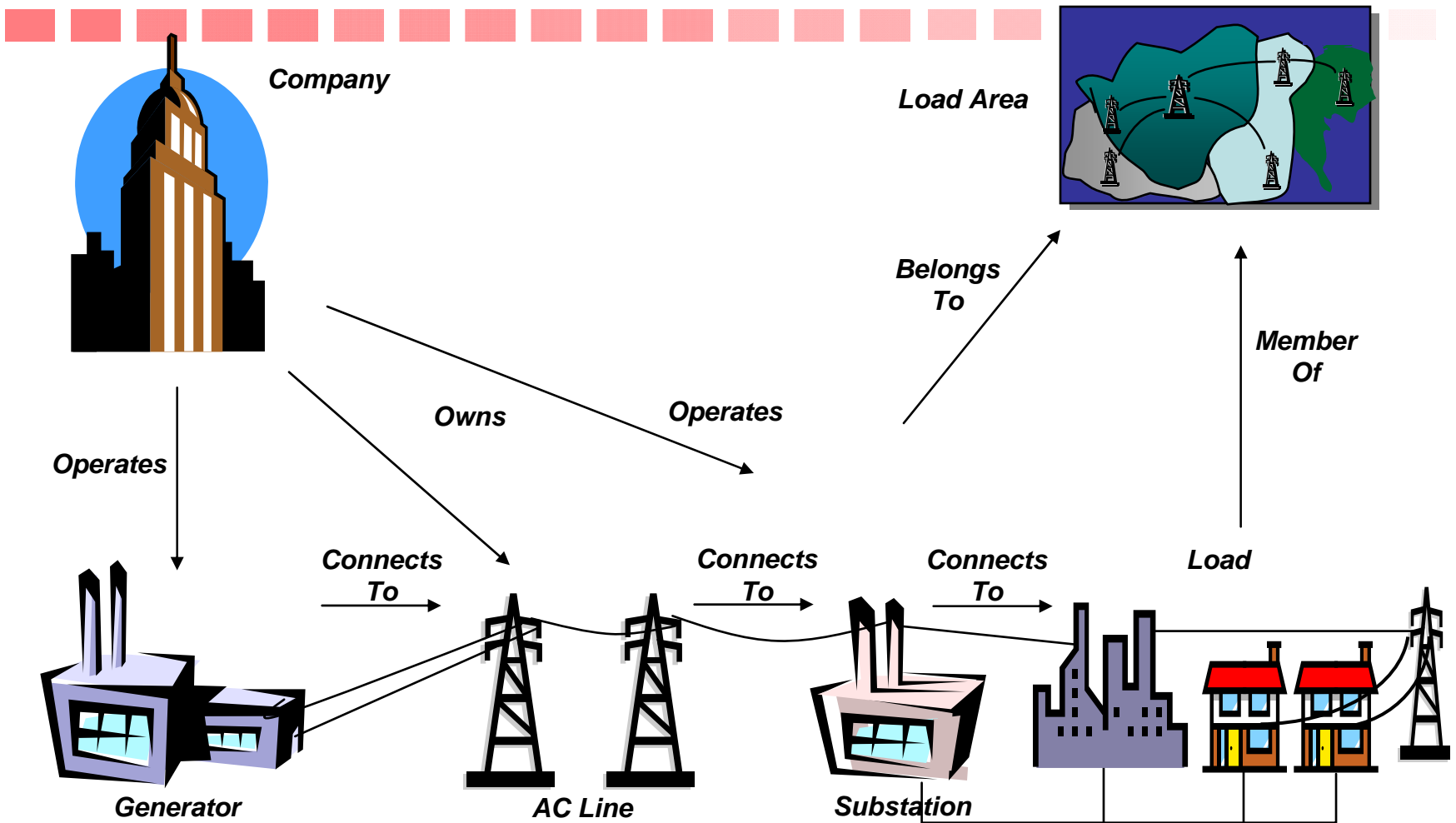
Terry Saxton
Vice President, Special Projects
Xtensible Solutions



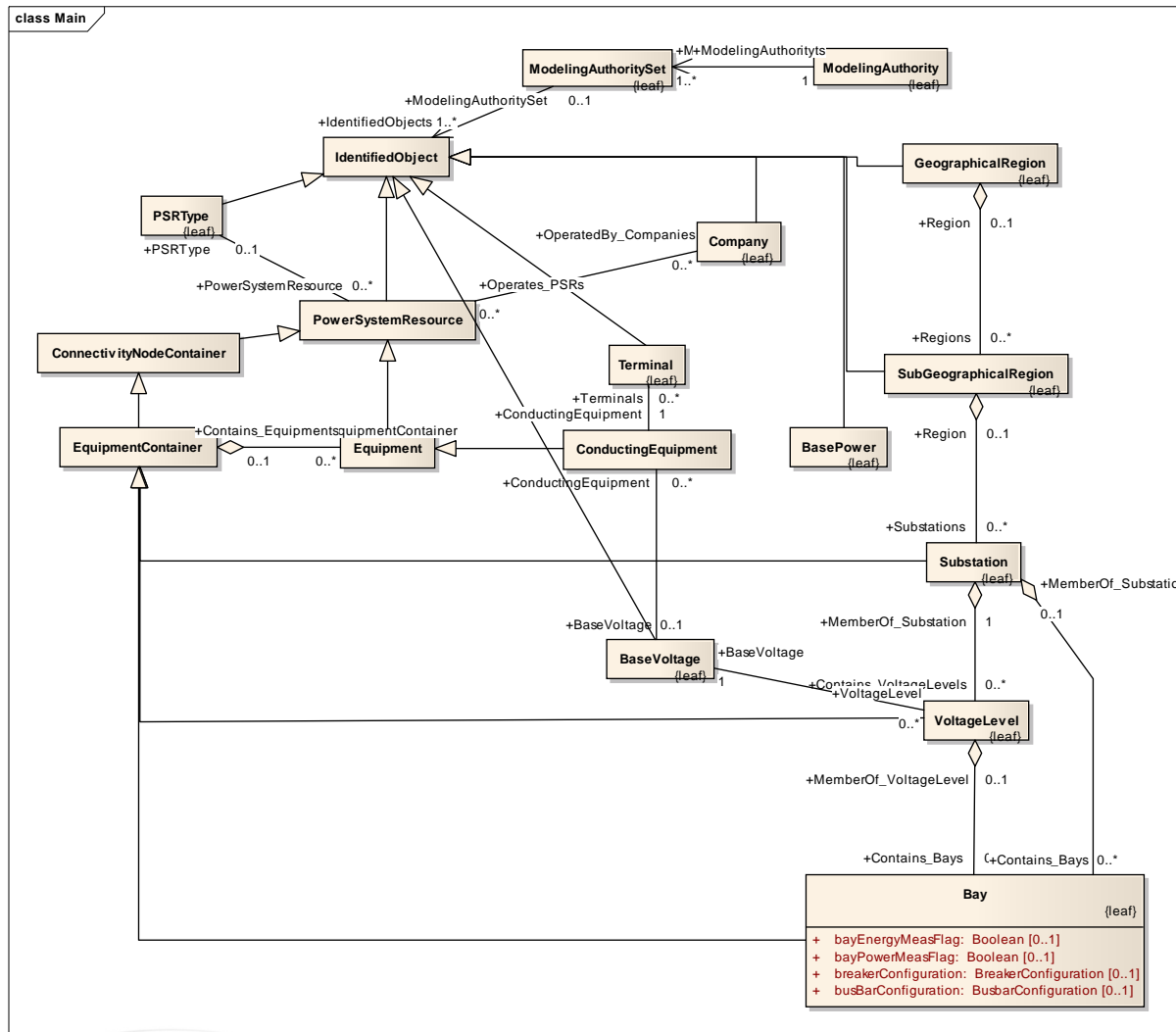
Presentation Contents

- First step to justifying use of CIM is to understand what it ***means*** to ***use*** the CIM standards
 - What are the CIM standards?
 - What are they good for?
 - Where can they be used?
 - Misconceptions about CIM use
- Role in Smart Grid
- Example use in utilities today

Sample Power System Model



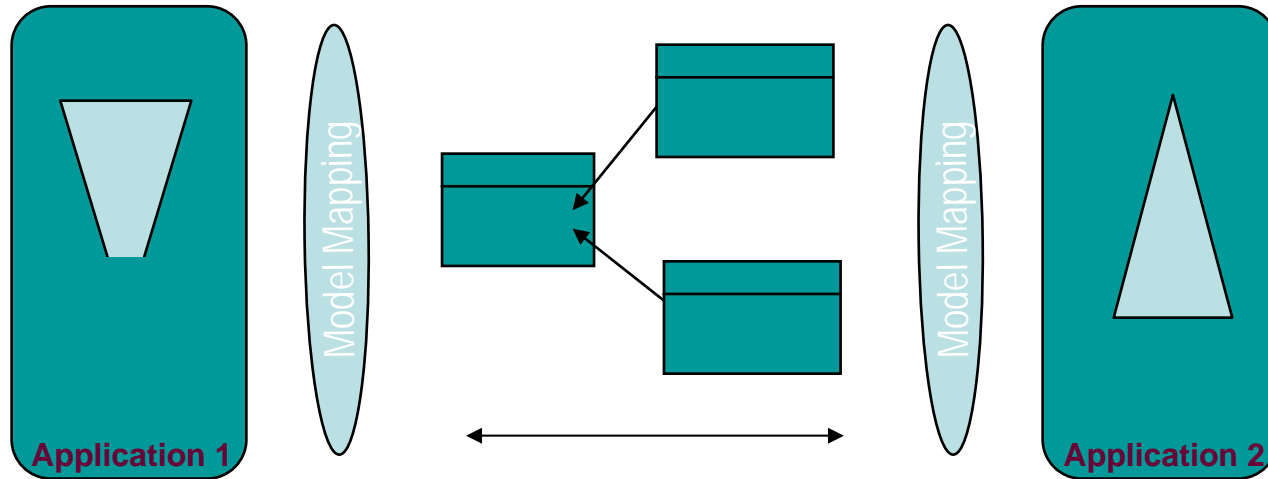
CIM UML Class Diagram



The IEC Common Information Model (CIM) - What Is It?

- A Unified Modeling Language (UML) based information model representing real-world objects and information entities exchanged within the value chain of the electric power industry
 - Maintained by IEC in Sparx Enterprise Architect modeling tools
- Enable integration of applications/systems
 - Provides a common model behind all messages exchanged between systems
- Applies primarily to system interfaces
- Enable data access in a standard way
 - Common language to navigate and access complex data structures in any database
 - Provides a hierarchical view of data for browsing and access with no knowledge of actual logical schema
 - Inspiration for logical data schemas (e.g., for an operational data store)
- Not tied to a particular application's view of the world
 - But permits same model to be used by all applications to facilitate information sharing between applications

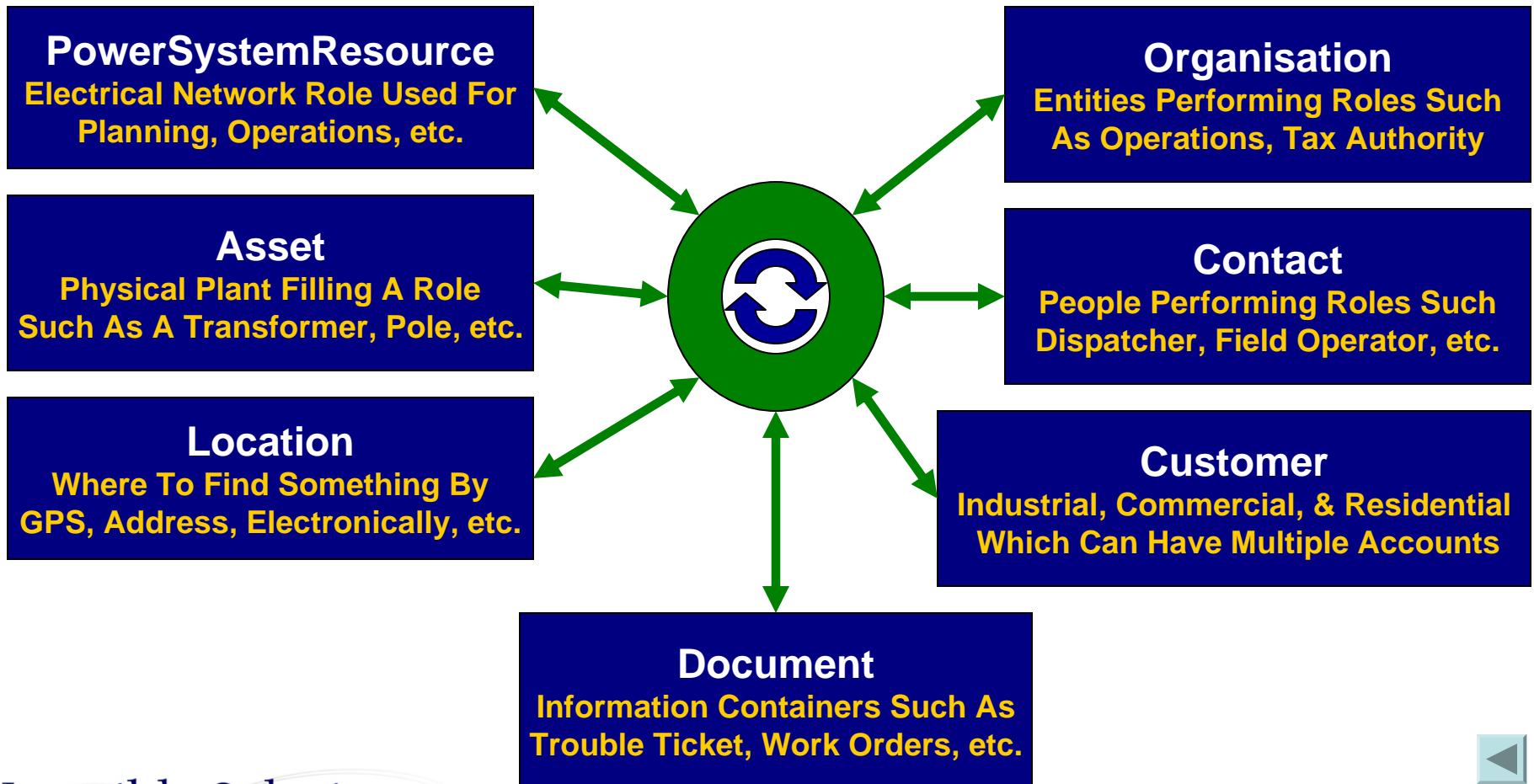
Application of Information Model



Common model creates understanding and provides a common language for information exchange



Foundational Relationships Of The CIM



The CIM and Related Standards

- But the CIM standards are more than just an abstract **information model** expressed in UML
- **Profiles** specifying a subset of the CIM classes and attributes for specific business context at a specific system interface
- **Implementation models**, such as use of XML to create serialized files and messages
 - Standards for power system models
 - Standards for information message payloads
- Also, the CIM UML can be extended
 - Standard extensions for new functional areas
 - Private extensions for specific utility requirements



How Are CIM Standards Used?

- Unlike most standards we use
 - Ex: ICCP/TASE.2 Communication Protocol standard
 - Fixed functionality, very **stable**, easy to test **compliance**, but **inflexible**
- CIM standards can be strictly applied and tested for compliance
 - Ex: CIM/XML Power system model exchange
 - Product interfaces can be developed and tested for compliance
 - Subject of several EPRI-sponsored interoperability tests for specific interface definition
- CIM can also be used as basis for an Enterprise Semantic Model (ESM) which includes other models/semantics from other sources
 - Ex: Sempra Information Model (SIM)
 - Interfaces are usually project-defined, so no standard tests
 - System interfaces are managed and tested for each project
- Bottom line: CIM standards are different and much more powerful
 - Can be applied in many ways to support many types of functions/applications



GridWise Interoperability Framework

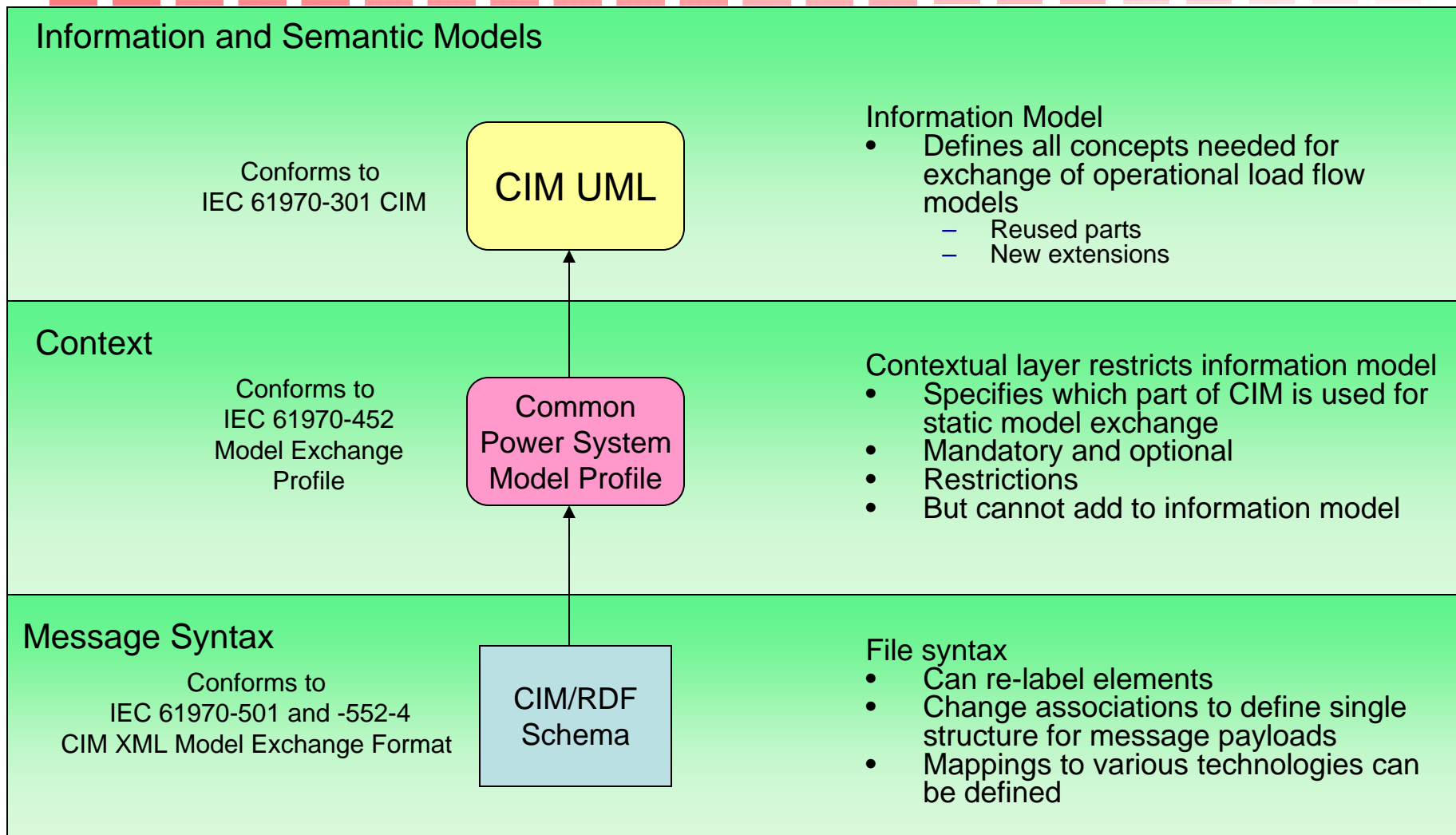


How Are CIM Standards Used?

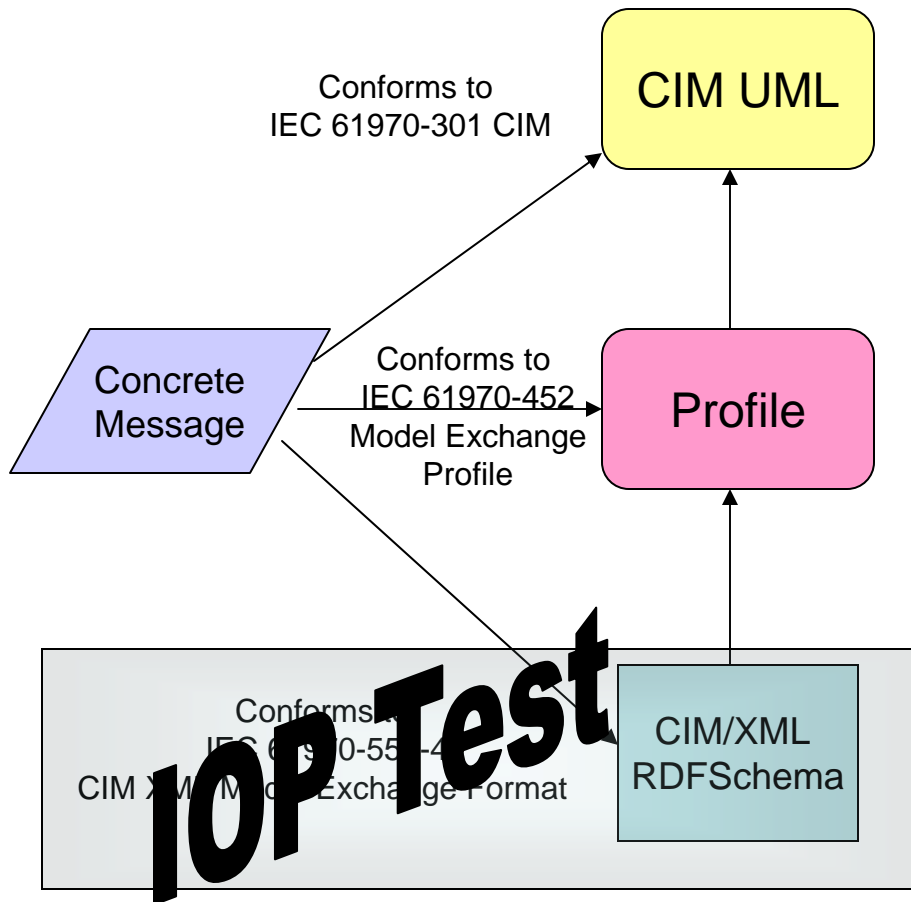
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Example: Power Flow Network Model Exchange



Ex: Power Flow Network Model Exchange



Information Model

- Defines all concepts needed for exchange of operational load flow models
 - Reused parts
 - New extensions

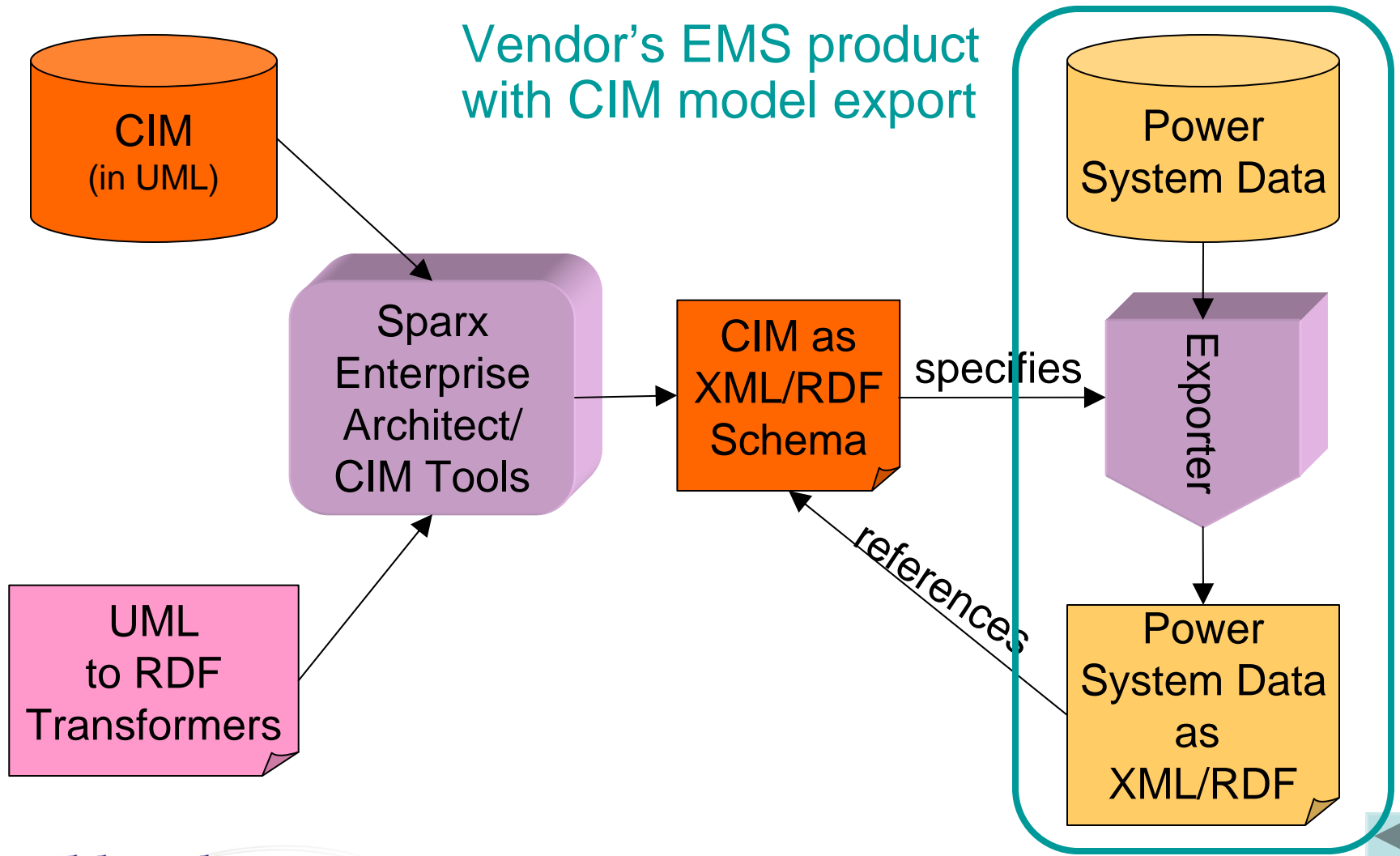
Contextual layer restricts information model

- Specifies which part of CIM is used for static model exchange
- Mandatory and optional
- Restrictions
- But cannot add to information model

File syntax

- Can re-label elements
- Change associations to define single structure for message payloads
- Mappings to various technologies can be defined

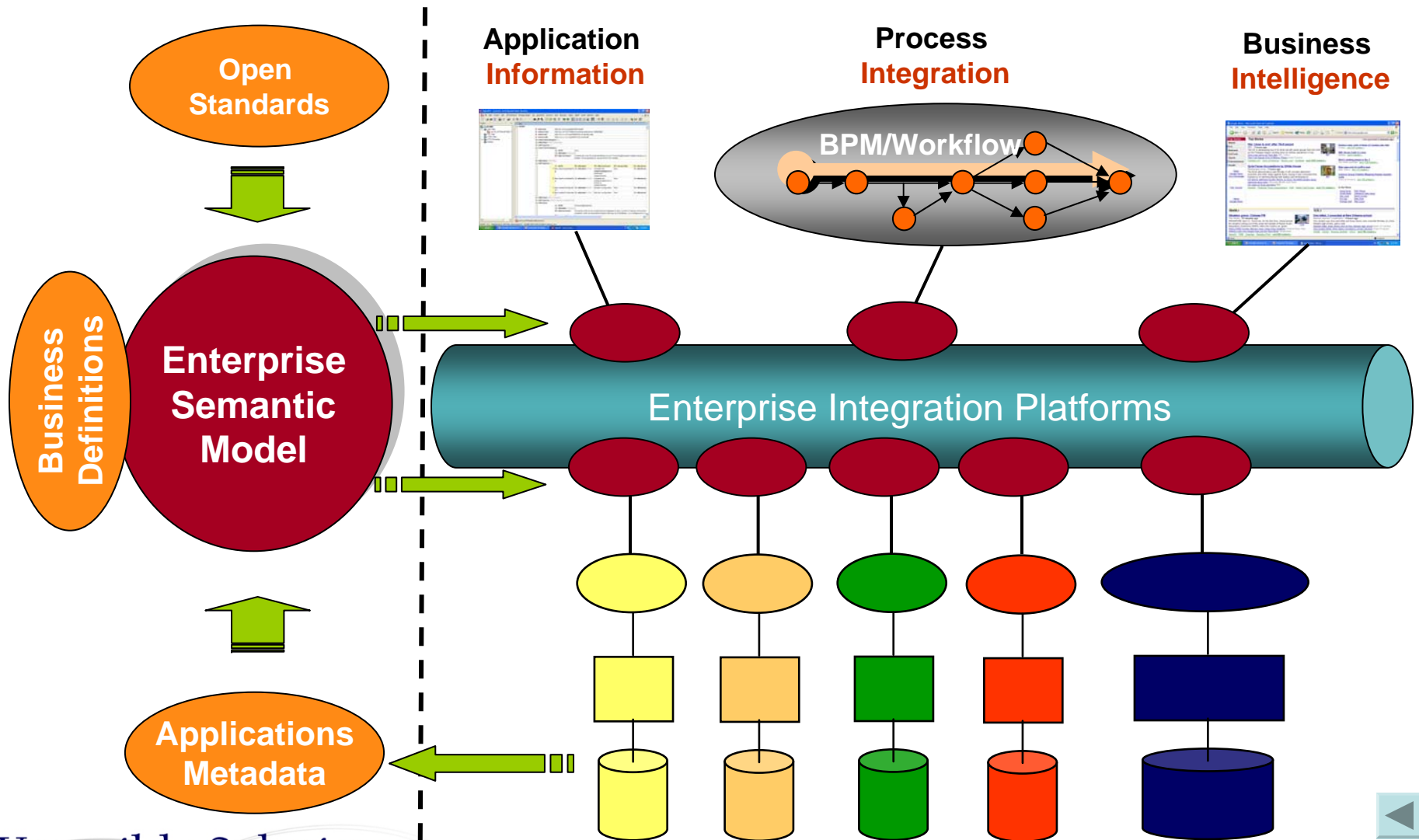
Basics: From CIM UML to RDF/XML



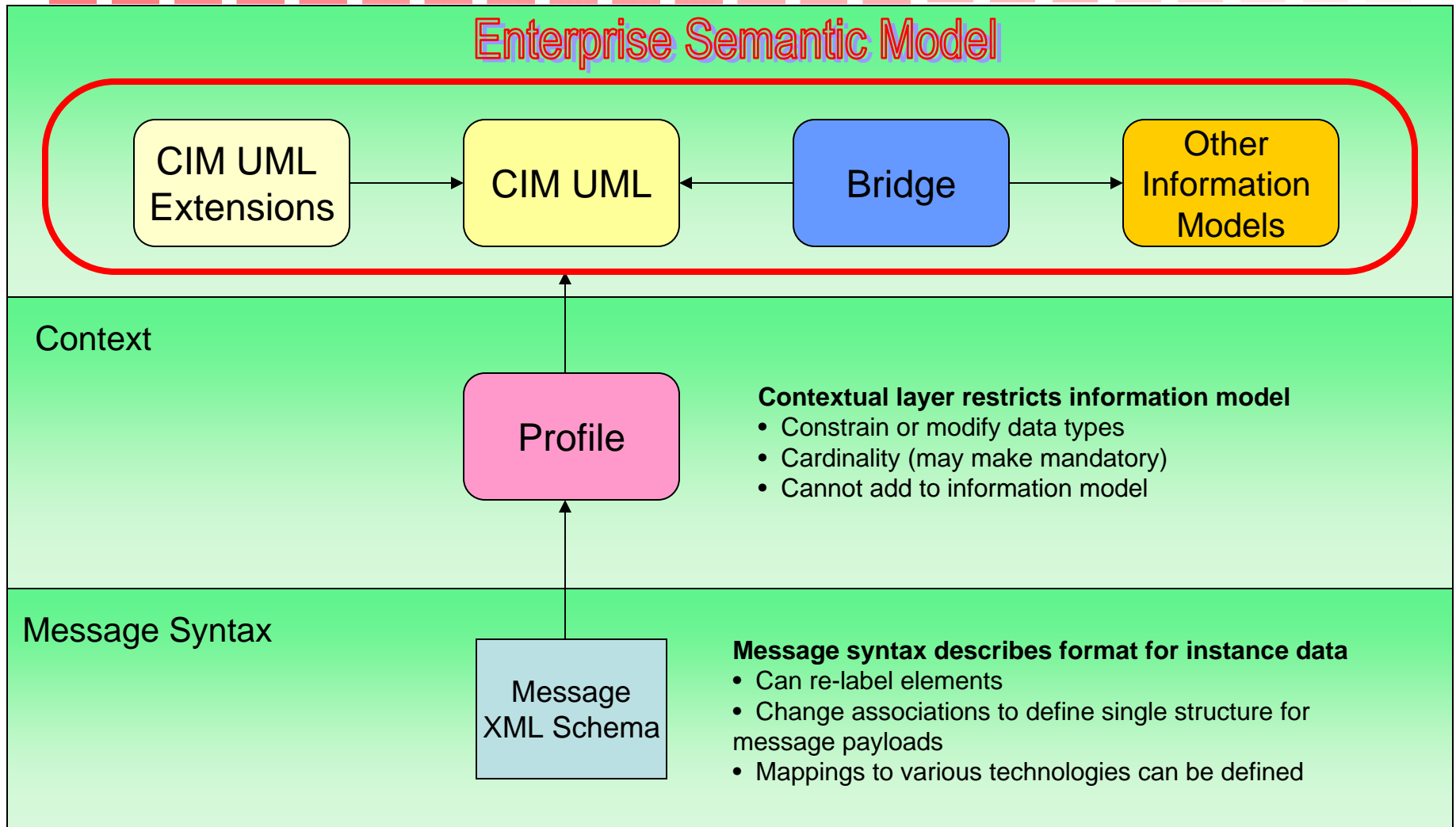
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Role of Enterprise Semantic Model

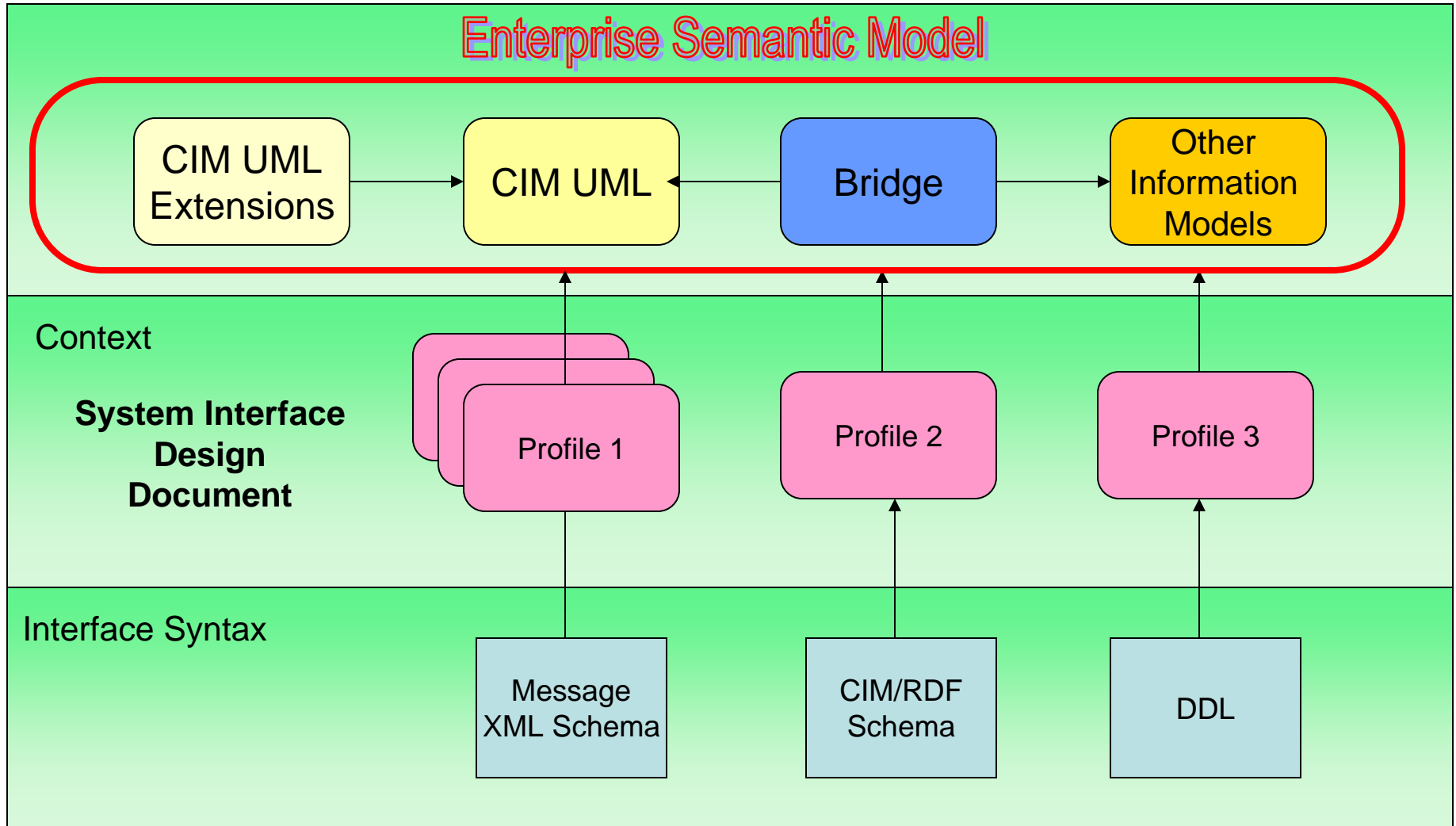


Semantic Models and Profiles

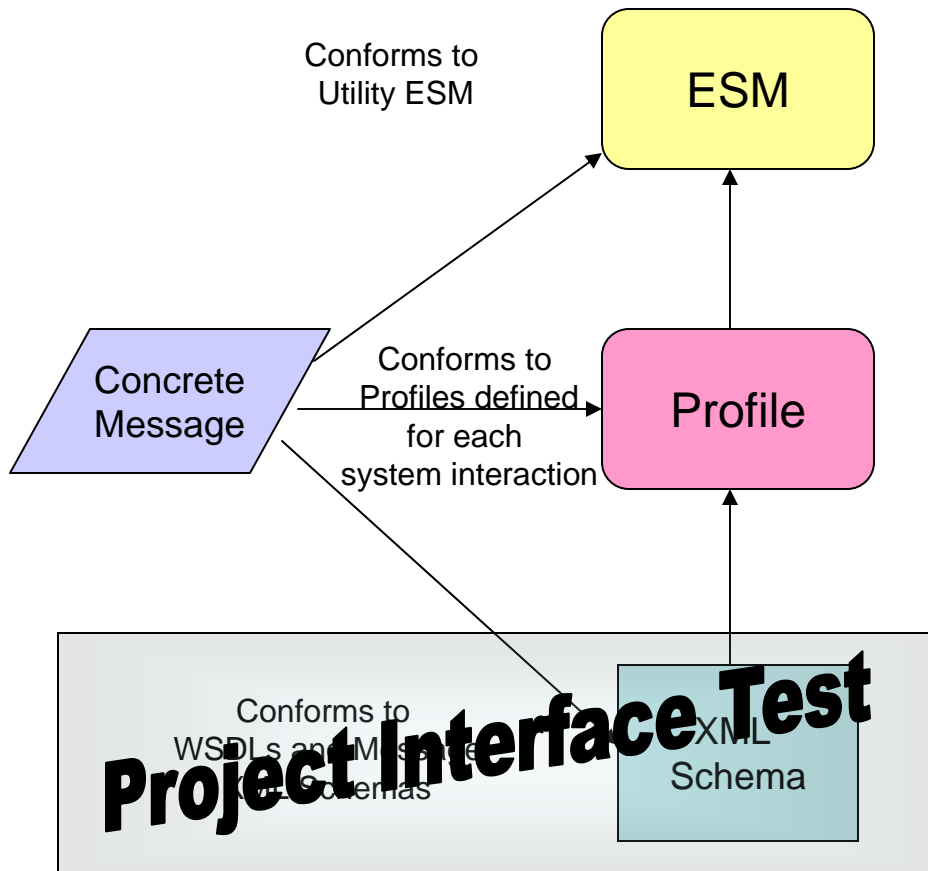


Let's Apply to a Utility Project

- Interface Architecture



Ex: Project Interaction Test



Enterprise Semantic Model

- Defines all concepts needed for Enterprise
 - Reused parts
 - New extensions for project

Contextual layer restricts ESM

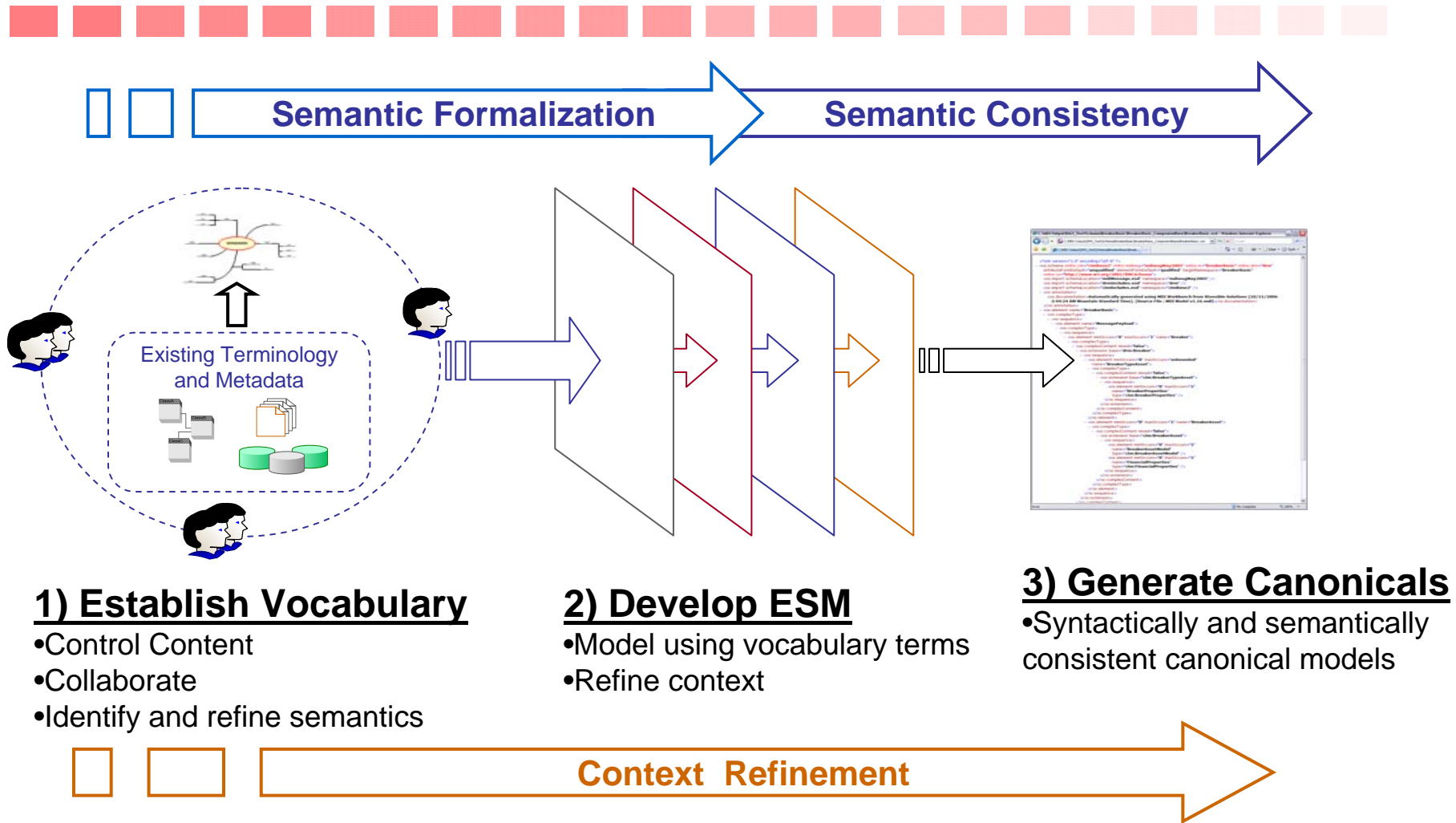
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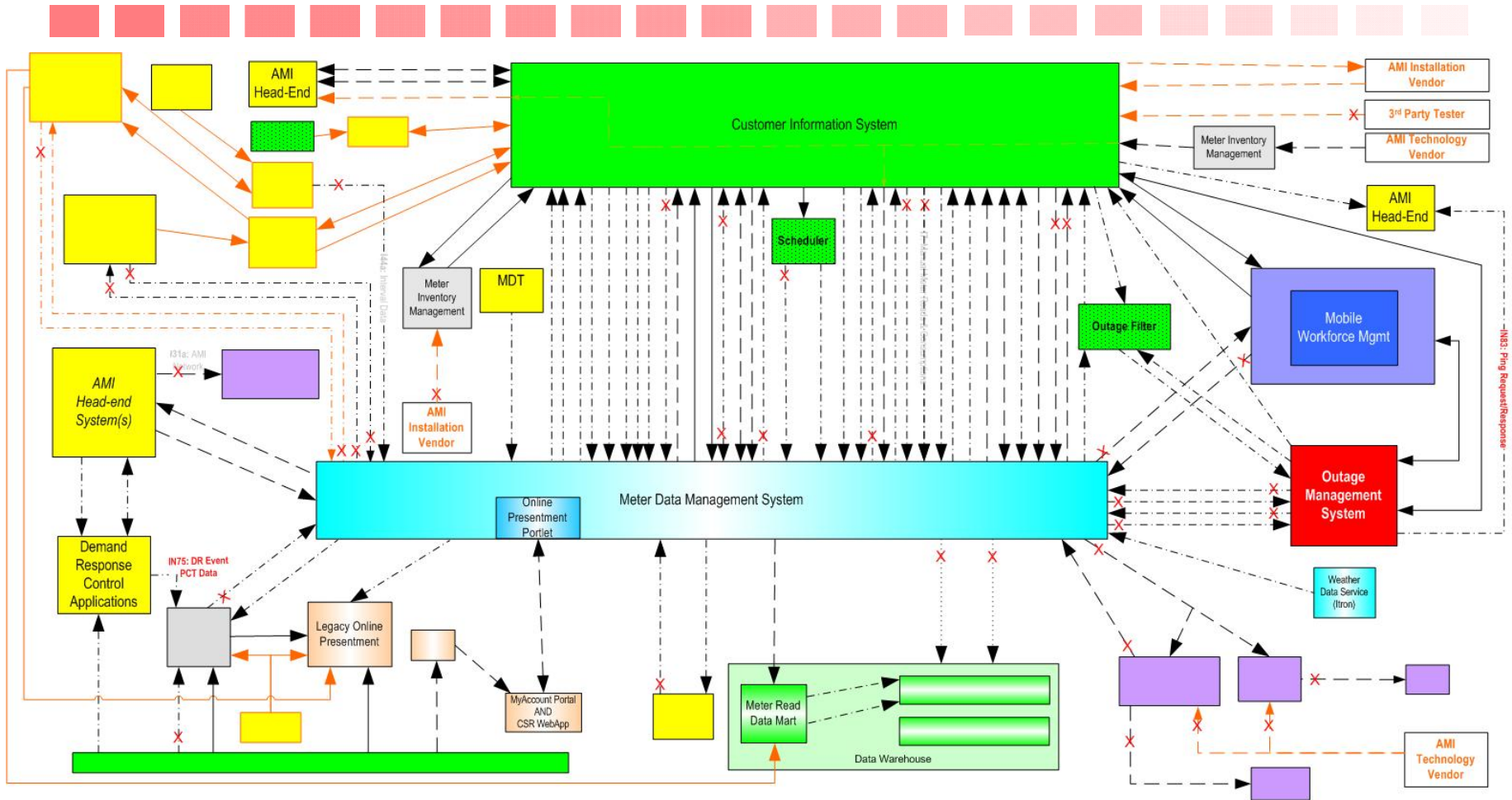
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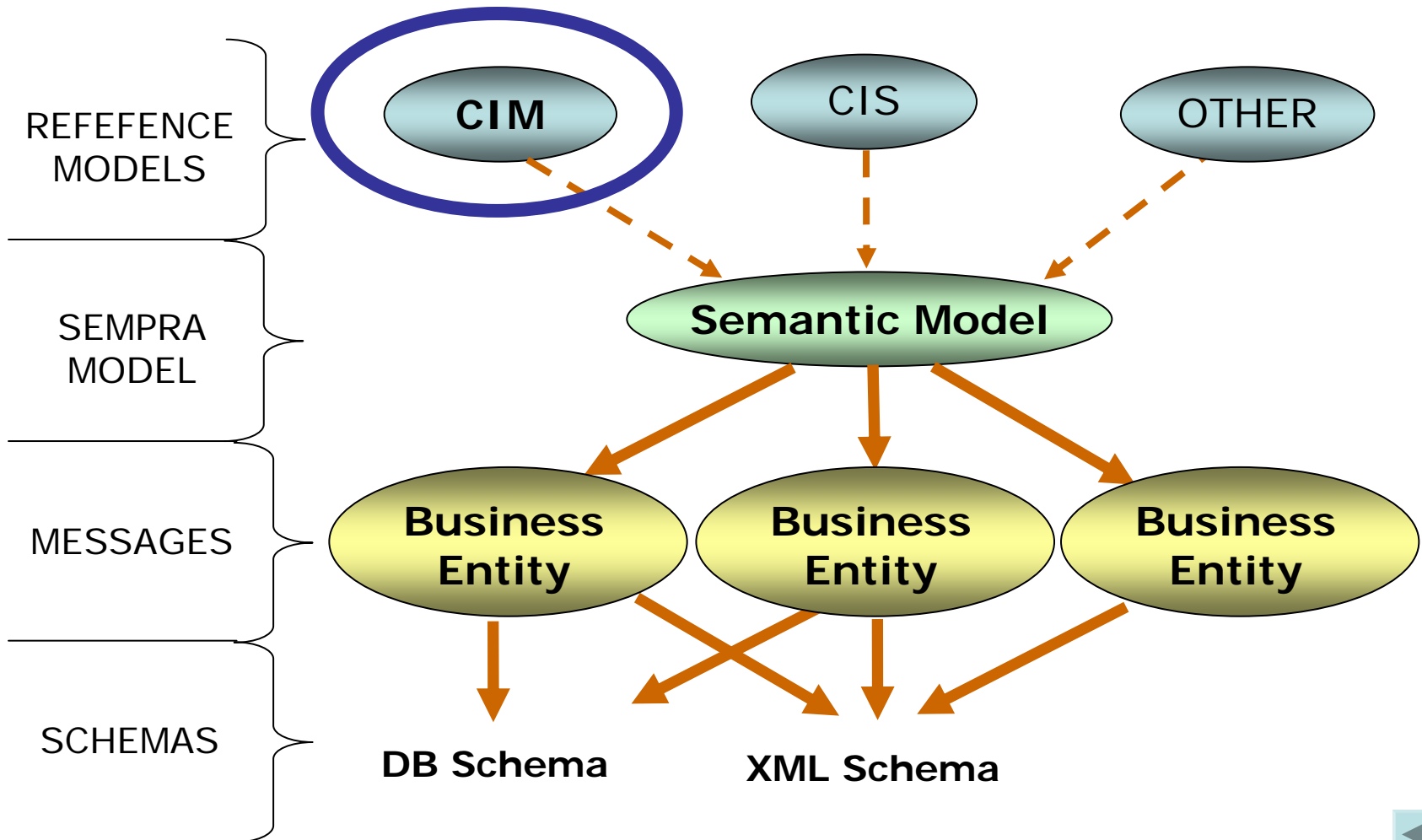
Building and Using an ESM – Xtensible MD3i




Project Integration Architecture



Data Architecture – Model



Use of ESM to Implement a Service Oriented Architecture (SOA)

- 
- CAISO designed a new power market system
 - Multi-year program that involved many vendors, new systems, as well as numerous legacy systems
 - Includes EMS, Full Network Model, Outage Management, PI Historian, Market Systems, many others
 - External interfaces to Market Participants included
 - Integration Competency Center decided on a Service Oriented Architecture (SOA) for the integration framework
 - Require all new applications and systems to be “Integration Ready” with service-enabled interfaces
 - Use only standard CAISO-defined services
 - Payloads based on the CIM
 - Based on Web services
 - CIM and Model Driven Integration (MDI) methodology used to define information exchange

CAISO Project Statistics

22 Systems

- Dispatch System
- MP Report Interface
- Load Forecast
- Transmission Capacity Calculator
- Real Time Nodal System
- Settlement and Market Clearing
- Bid Interface and Validation
- Default Energy Bids
- Real Time Metering
- Adjusted Metering
- Market Participants
 - Bidding
 - Market Results
 - Settlement
 - Outage Scheduling
 - Dispatch Signals
- Forward Market Nodal System
- EMS
- OASIS
- Interchange Scheduling System
- Congestion Revenue Rights
- Intermittent Resources
- Compliance
- RMR Validation
- Generation Outage Scheduling
- Transmission Outage Scheduling
- Market Quality System (ATF updates)

7 Vendors

- Siemens - Market Systems
- ABB - EMS system
- Areva - Settlement System
- Legacy - CAISO system
- Nexant - Congestion Revenue Rights System
- MCG - Interchange Scheduling System
- Potomac - Default Energy Bids

Apr 130 integrations between the 22 systems

Apr 75 message schemas

Apr 175 service definitions

Apr 450 publisher/consumer testable data transfers between systems

Pacificorp Use of CIM

- PacifiCorp is successfully using CIM to design both interfaces and databases
 - CIM was adopted in 1999 as PacifiCorp's application integration standard
 - Used for both messaging and database design for new projects
 - Existing interfaces are reworked when the need arises
- Model Driven Integration based on the CIM viewed internally as “Best Practice”
 - Having a common vocabulary reduces semantic misinterpretation
 - Reusing messages minimizes integration costs
 - Minimal knowledge of internal application designs required
 - Xtensible MDI Workbench used for message creation, management, and maintenance
- CIM is here to stay
 - CIM is standard design practice
 - PacifiCorp vendors are getting used to the idea
 - PacifiCorp's data warehouse is based on the CIM
 - EMS/SCADA system (Ranger) uses a CIM-based data maintenance tool



Adopting Enterprise Information Management



Organization Adoption of CIM in an EIM Context

Driving Forces

1. Consistent enterprise-wide data
2. One version of the truth
3. Access to data regardless of source
4. Business transformation agility
- 5. Reduced project implementation costs**
6. Reduced maintenance costs
7. Reduced IT risks
- 8. Availability of external services**
9. Scalable business process automation
10. Scalable business activity monitoring
11. Accurate reporting – regulatory, KPIs
- 12. Mergers and acquisitions**

Status Quo

Restraining Forces

- 1. Lack of stable industry standard definitions**
2. Vendor's way = lower project costs
- 3. Vendors pushing for 'proprietary lock-in'**
4. Consultants pushing to be 'thought leaders'
5. Hours-sold revenue driving System Integrators
6. Internal system experts want to remain experts
- 7. Project managers striving for control**
8. Inertia – why change?
- 9. Our situation's unique – standards hinder us**

Addressing Objections to the Use of the CIM Standards

- Claim: CIM is not stable
 - Fact: The CIM UML model *is* evolving as new applications are identified
 - Fact: Only small part of CIM information model is used for a given interface, so change of information model unlikely to affect specific interface.
 - Solution: Version control - tie interface designs to project specifications, not directly to standard
- CIM is too complex to learn and contains many parts I do not need
 - Fact: The overall CIM UML model is large and complex
 - Reality: A typical interface requires only very small subset of information model
- CIM creates too much overhead in message content
 - Fact: Only instantiated concrete class/attributes are actually sent in a message instance
 - Reality: Message payload is no larger than any XML formatted message
- I don't want to add in an extra step of converting to CIM for system integration
 - Fact: There is an extra step of mapping to CIM for one connection
 - Reality: Consequence of not mapping to a common language is solution that does not scale:
 - $n(n-1)$ instead of $2n$ connection mappings
- I can't expect my vendors to adopt the CIM model for their interface
 - Fact: Only a few parts of the CIM need to be "Known" by the vendor
 - Reality: Approach is to specify the mappings to a common language (CIM) as part of the interface contract
- I don't want to convert all my metadata to the CIM
 - Fact: CIM is a starter kit
 - Reality: Use CIM as appropriate for building your own ESM – far better than starting from scratch
- CIM does not contain everything I need or in the form I need for my interfaces
 - Fact: CIM UML is extensible
 - Reality: Many utilities still use the CIM as a starting point, using namespaces to maintain traceability



Questions?



- Contact tsaxton@xtensible.net
- Thank you

Merci

