Justifying the Use of the CIM in the Utility Enterprise

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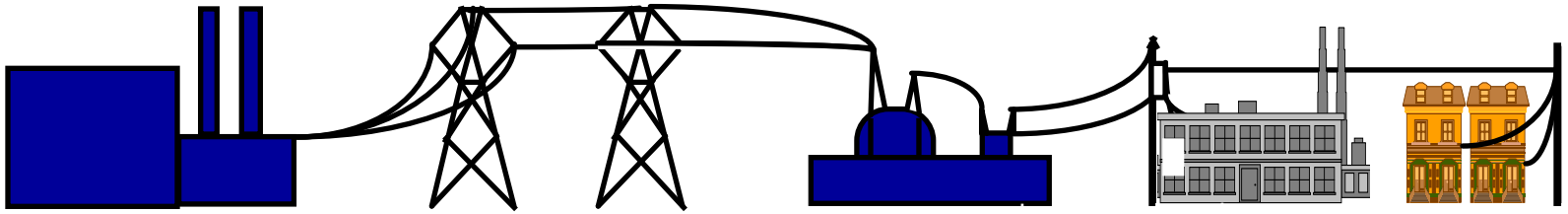
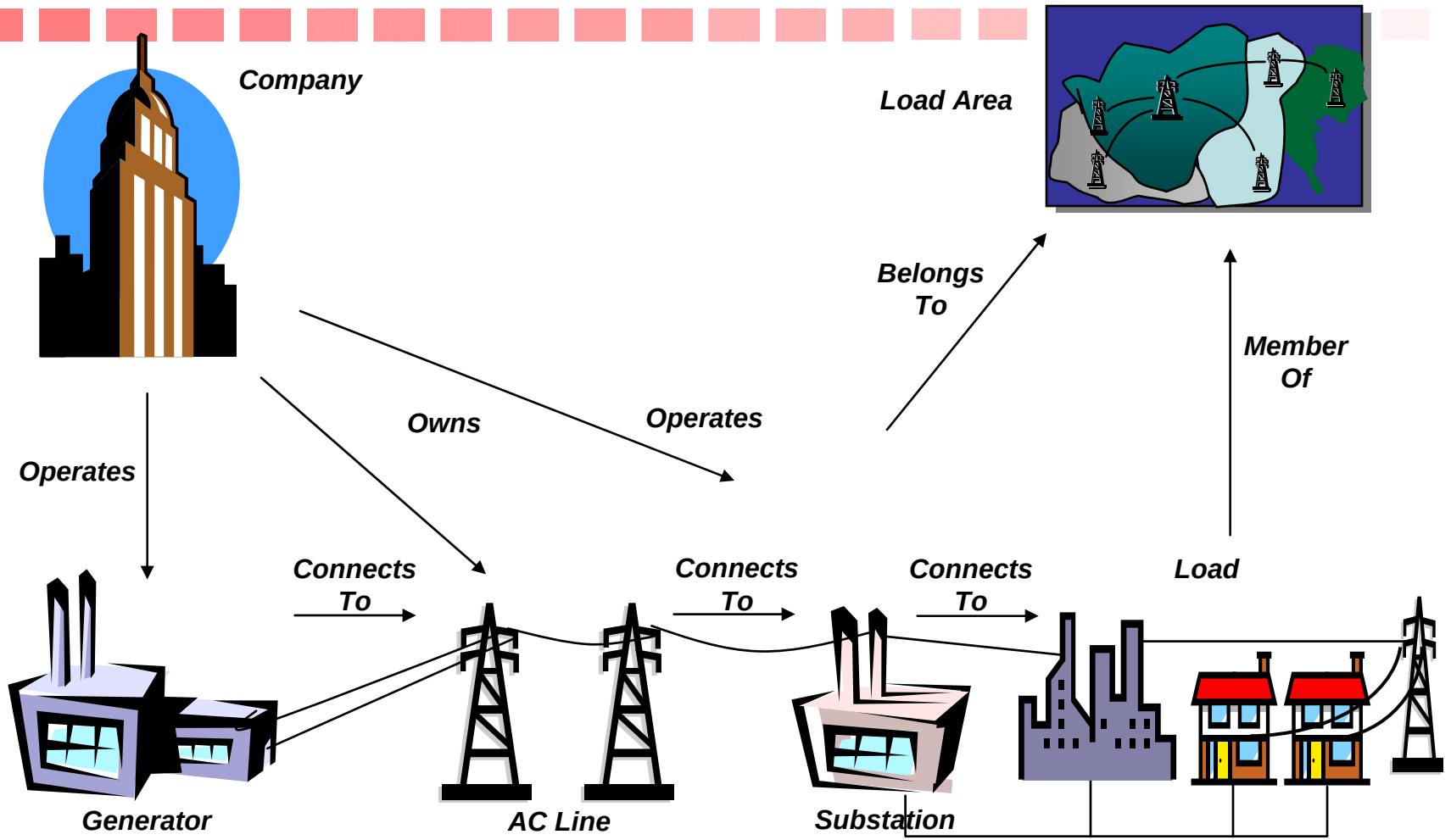


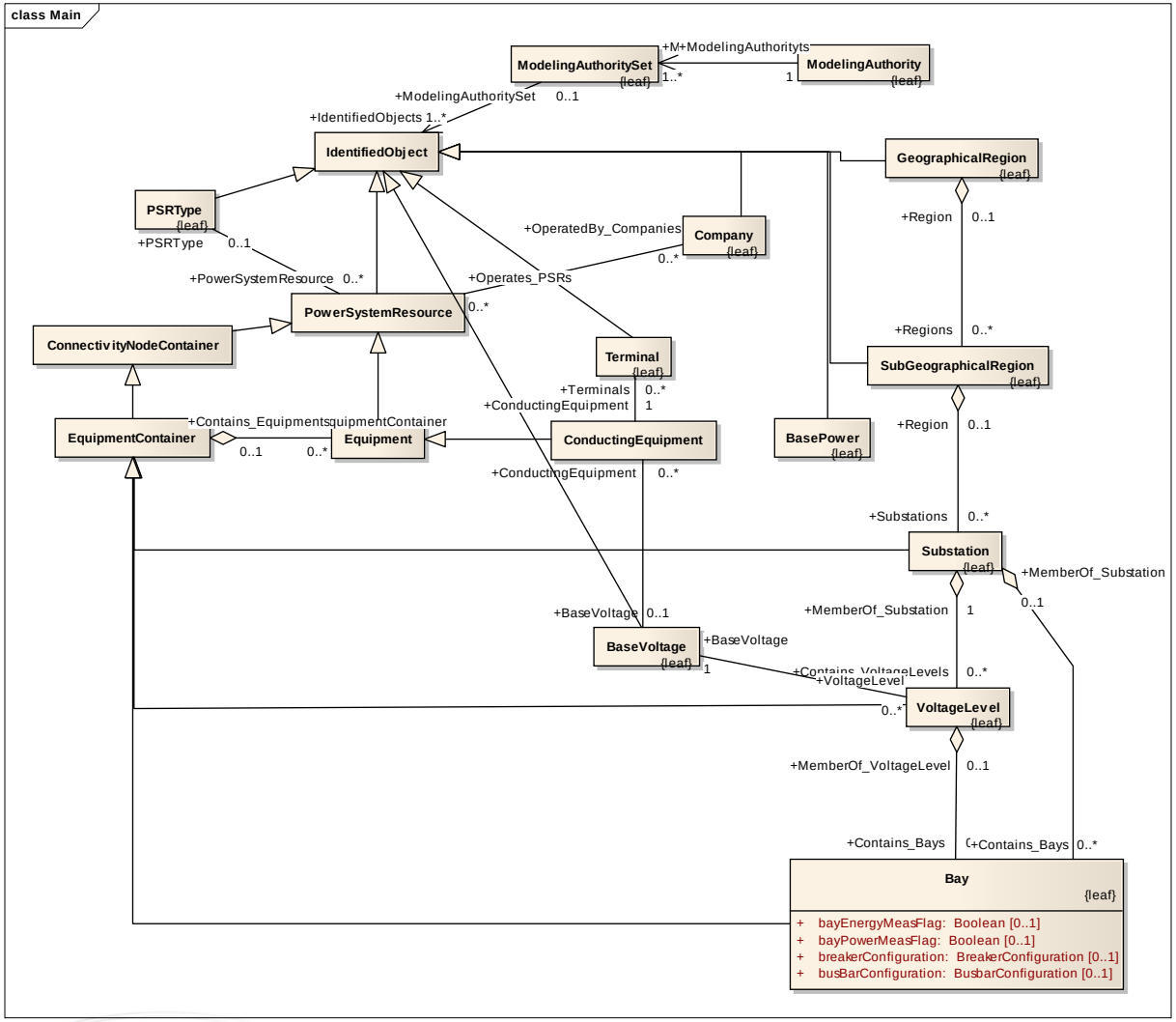
Presentation Contents

- 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



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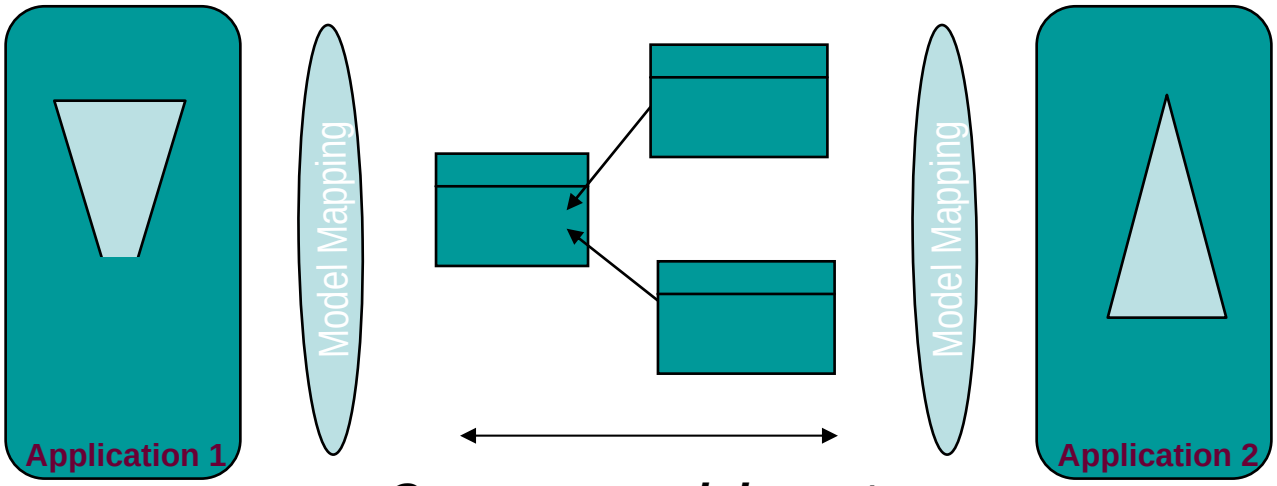
The IEC Common Information Model (CIM) - What Is It?

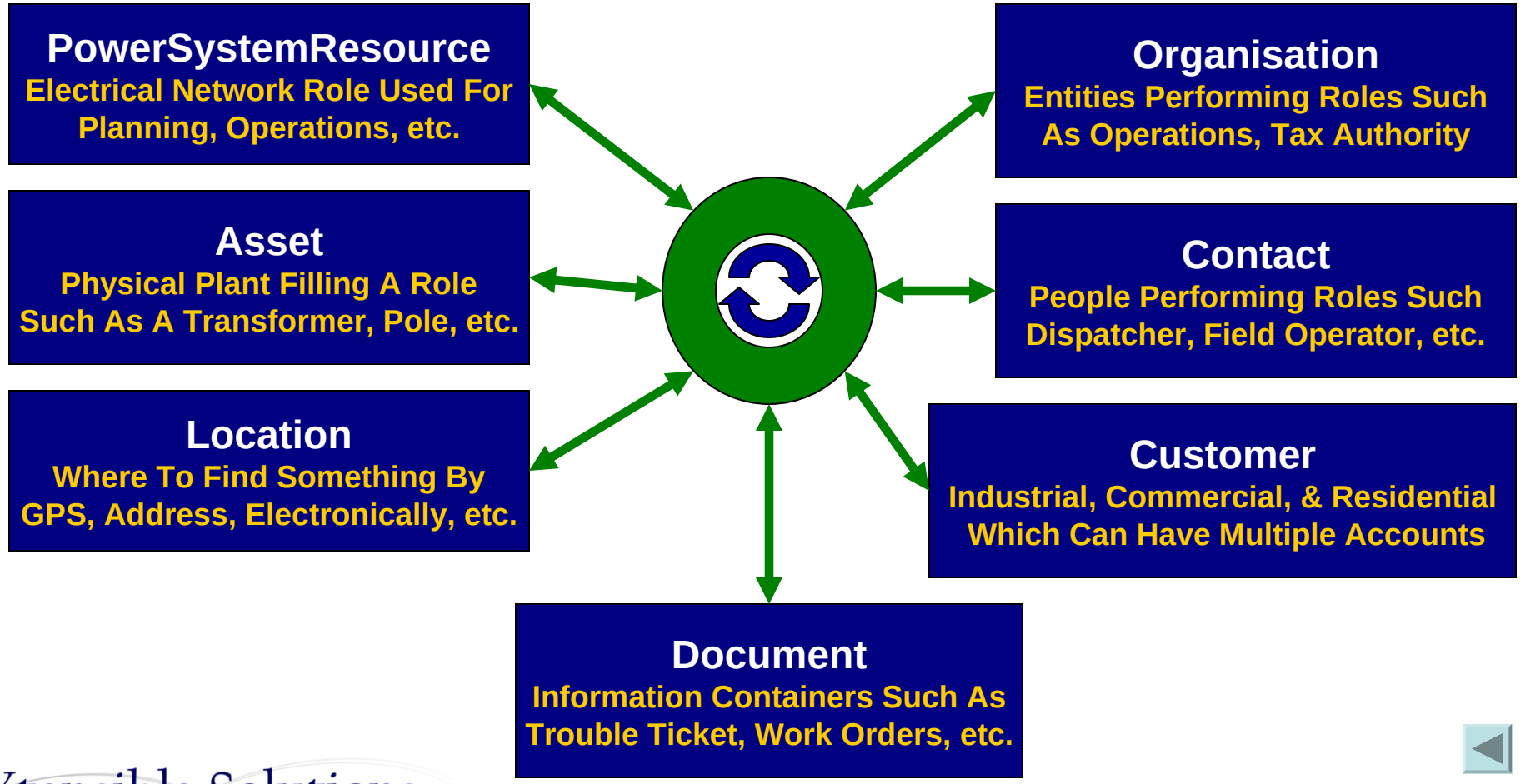
- A Unified Modeling Language (UML) based information model representing real-world objects and information entities exchanged within the value chain of the electric power industry
  - Maintained by IEC in Sparx Enterprise Architect modeling tools
- Enable integration of applications/systems
  - Provides 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



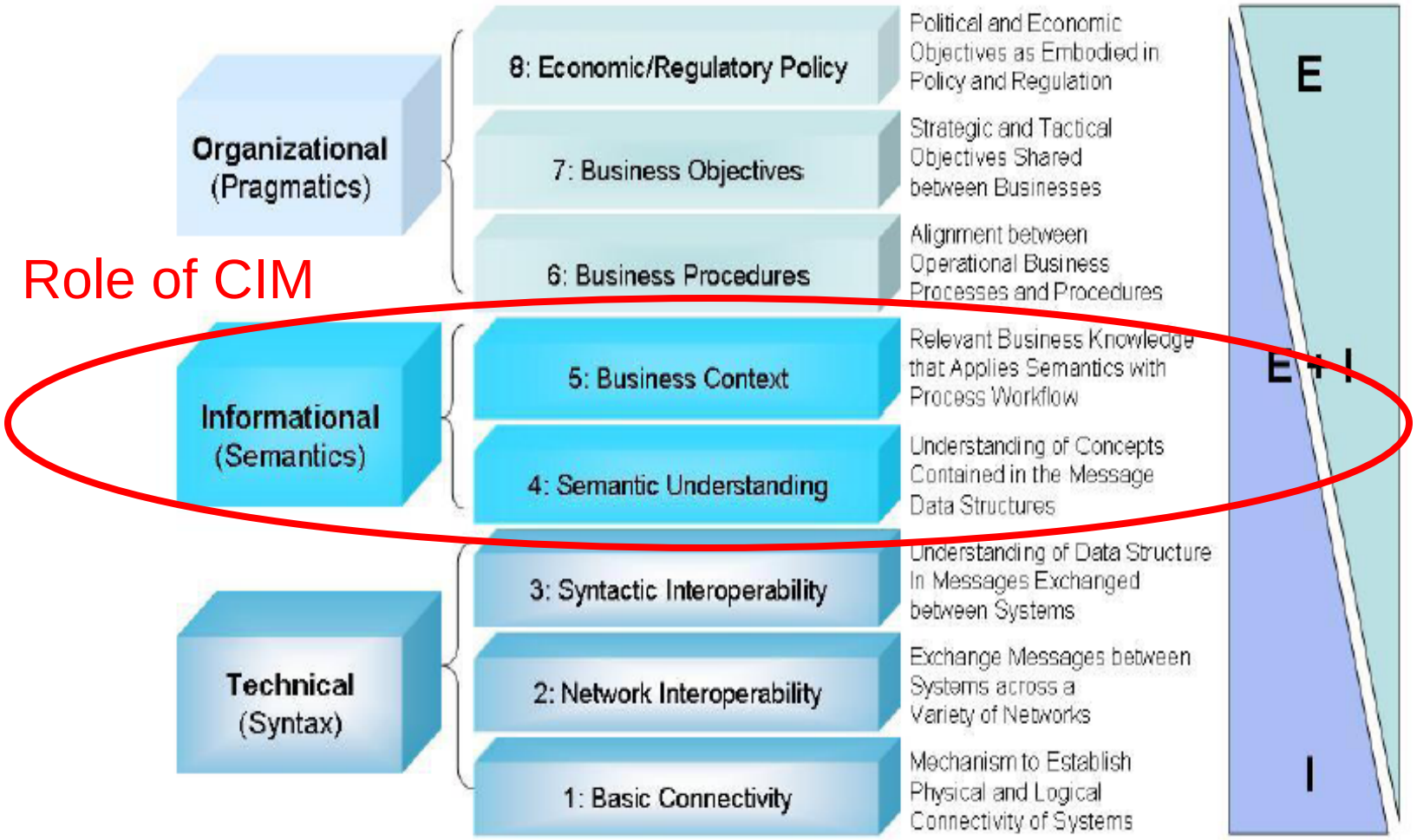
The CIM and Related Standards

- 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



Role of CIM

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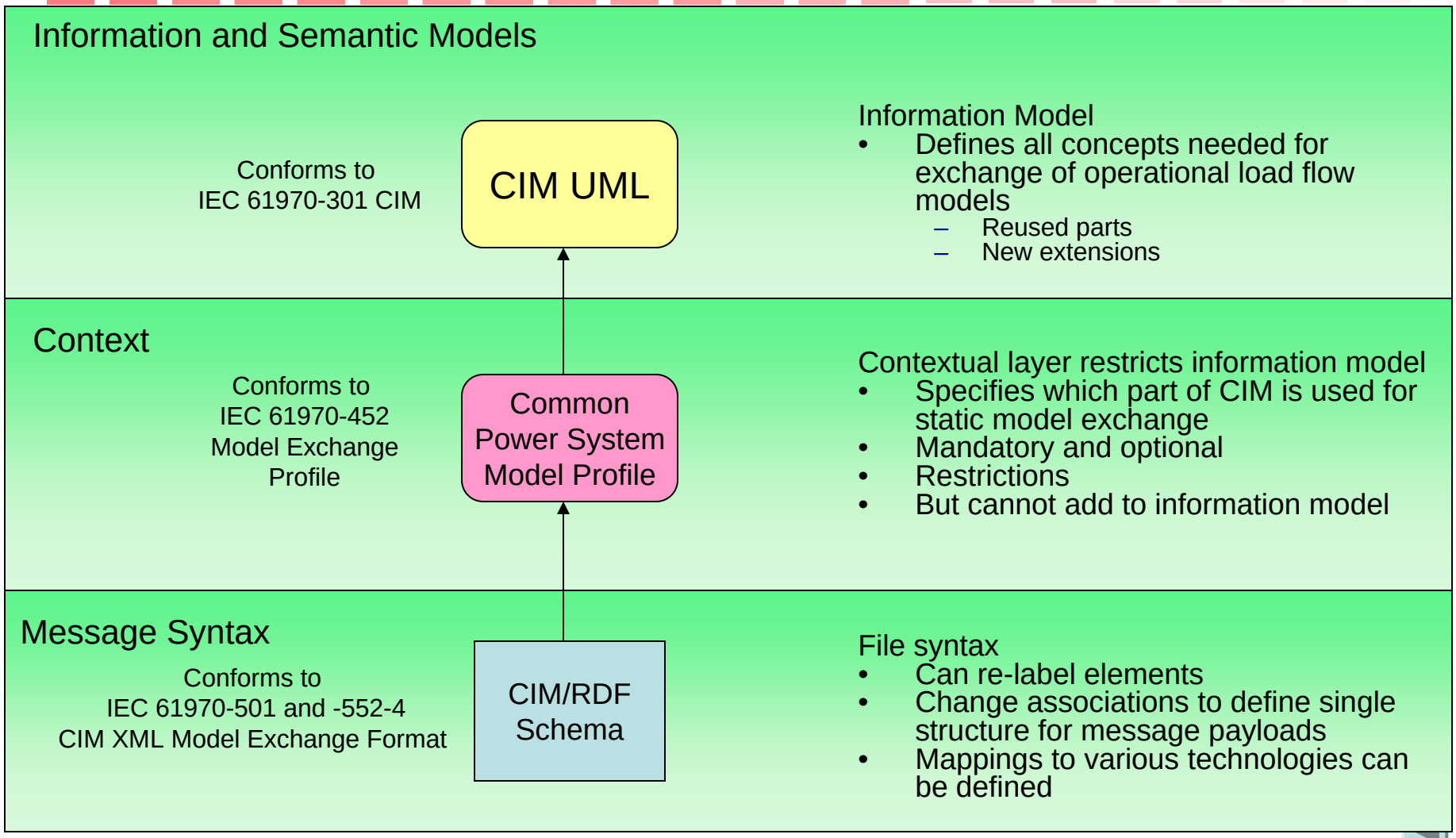
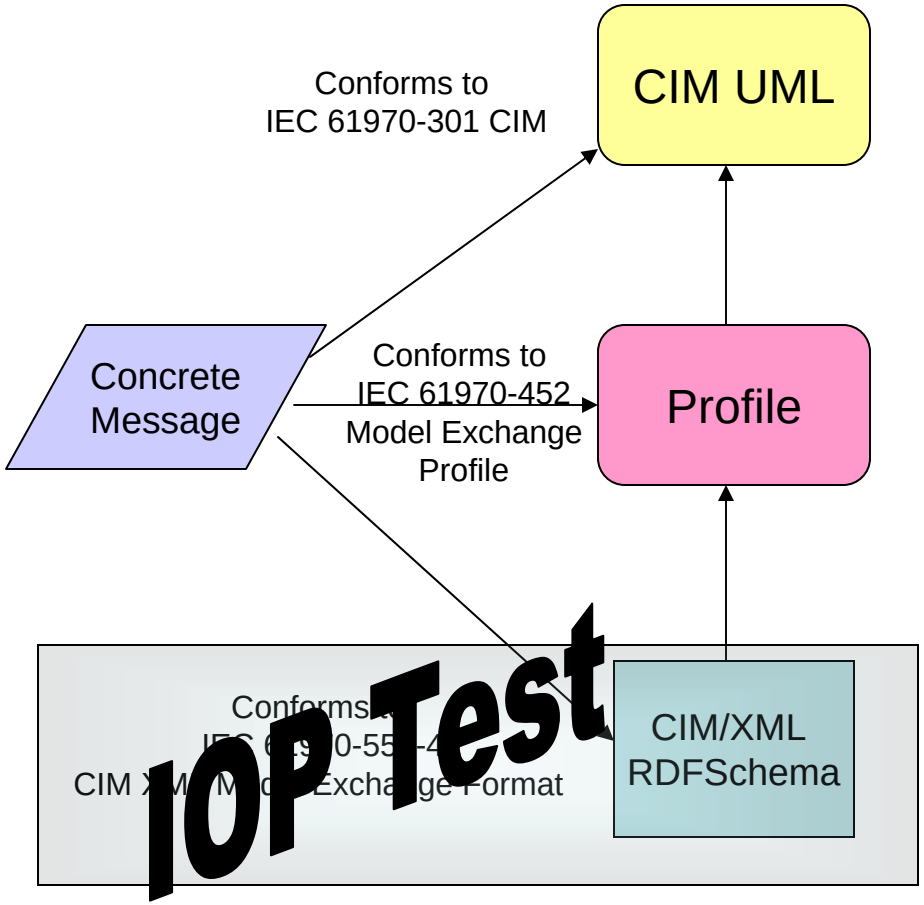
Example: Power Flow Network Model Exchange



Ex: Power Flow Network Model Exchange

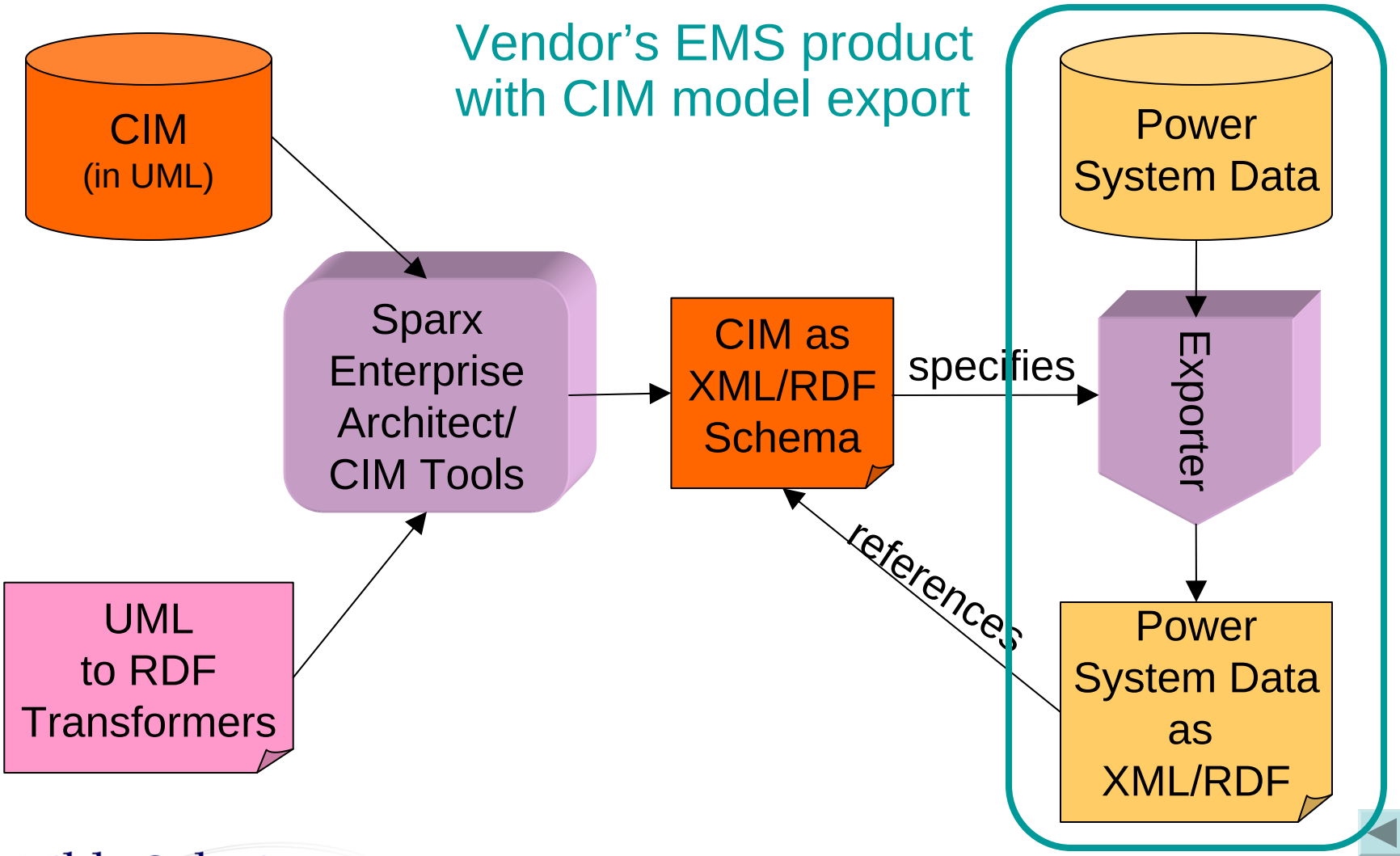


Information Model
- Defines all concepts needed for exchange of operational load flow models
  - Reused parts
  - New extensions

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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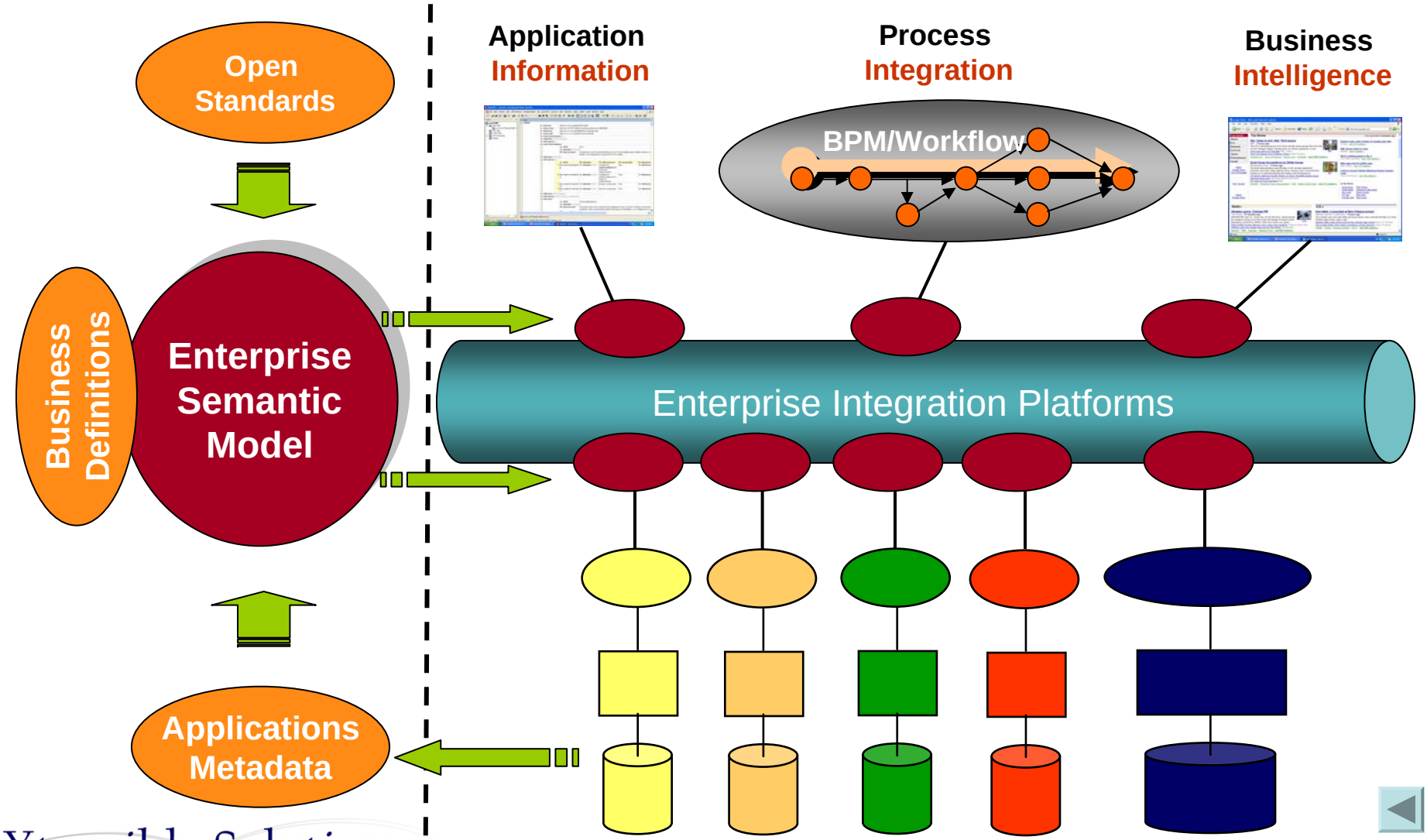
Role of Enterprise Semantic Model



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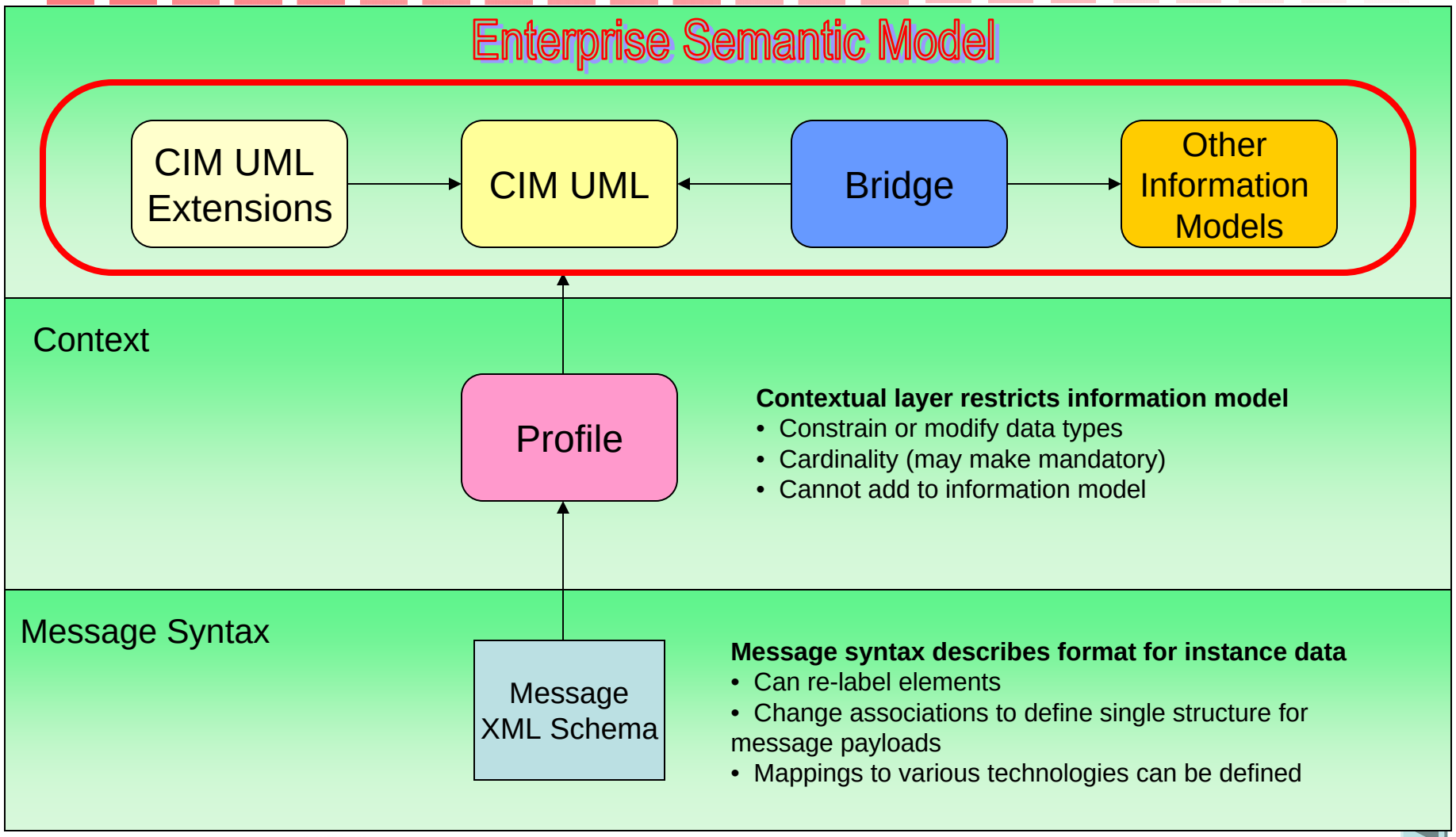
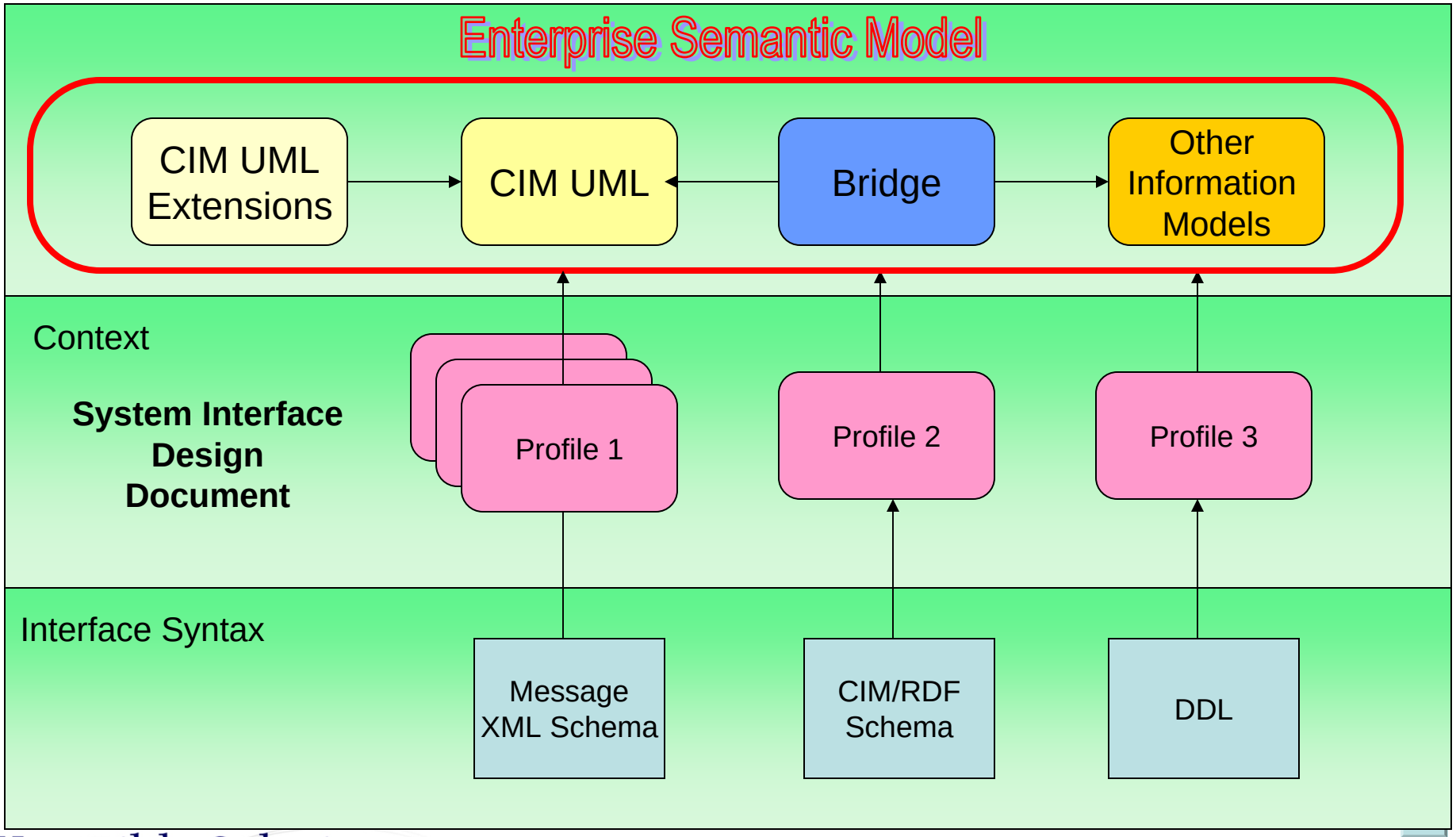
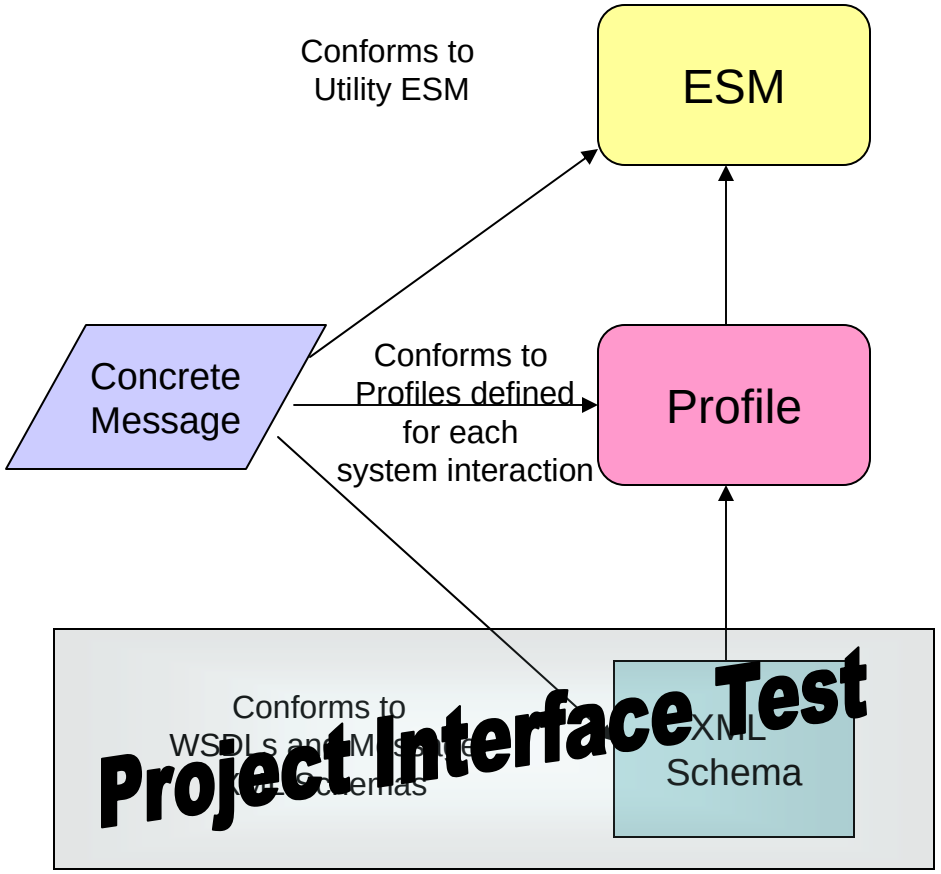
Semantic Models and Profiles



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
- Specifies which part of ESM is used for specific system interaction
- Mandatory and optional
- Restrictions
- But cannot add to information model

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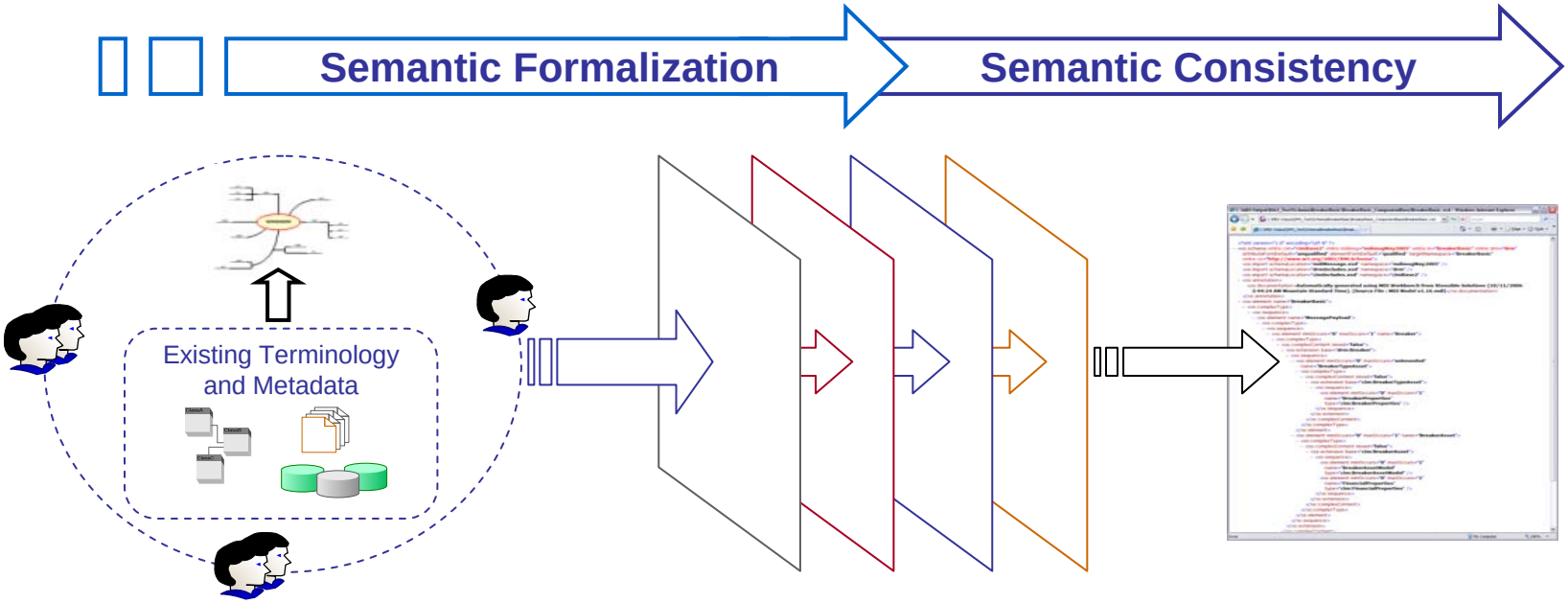
Building and Using an ESM – Xtensible MD3i



1) Establish Vocabulary

- Control Content
- Collaborate
- Identify and refine semantics

2) Develop ESM

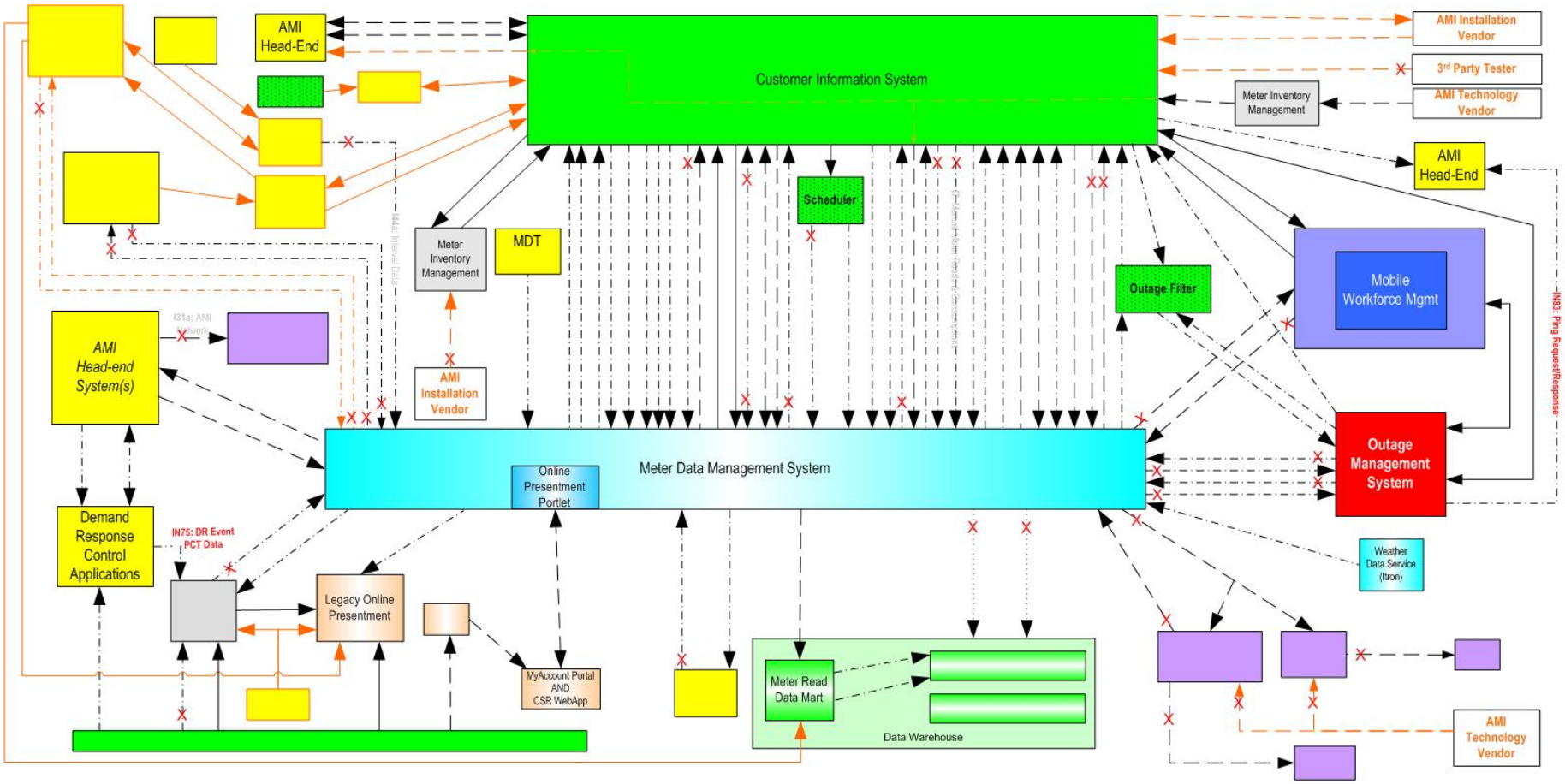
- Model using vocabulary terms
- Refine context

3) Generate Canonicals

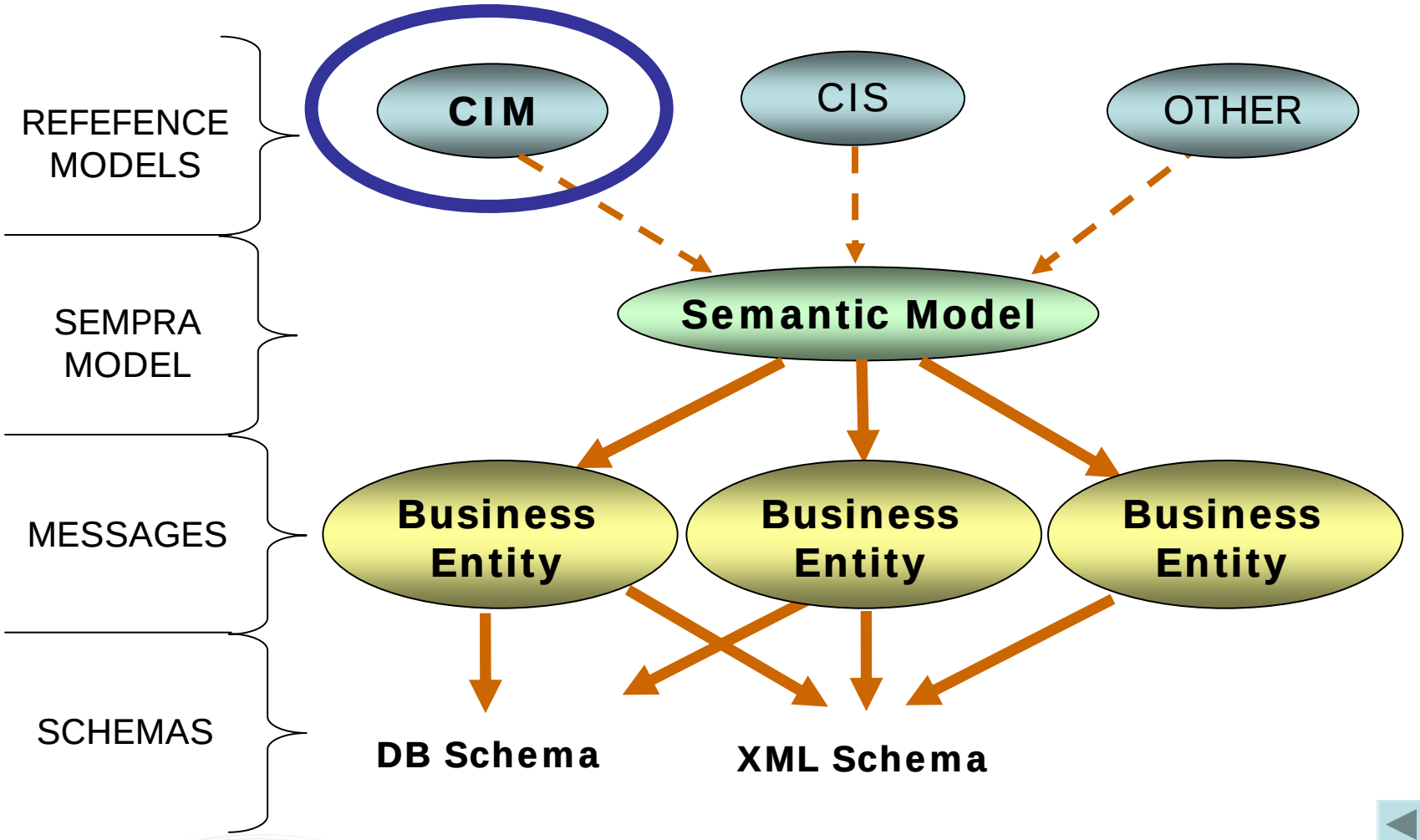
- Syntactically and semantically consistent canonical models

Context Refinement

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

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
- 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)

Appr 130 integrations between the 22 systems

Appr 75 message schemas

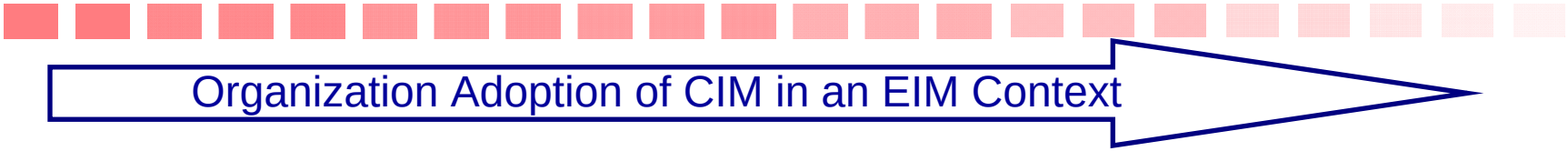
Appr 175 service definitions

Appr 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



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 to complex too 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