



EPRI

ELECTRIC POWER
RESEARCH INSTITUTE

IEC Common Information Model (CIM) & EPRI

CIM Plans Going Forward
Gerald R. Gray, PhD

Agenda

- IEC CIM Background
- EPRI Strategy
 - Education and training
 - Capability development
 - Executing at “opportunity points”
- Visioning
 - Cross domain integration
 - Business efficiency improvements
 - Smart Grid infrastructure

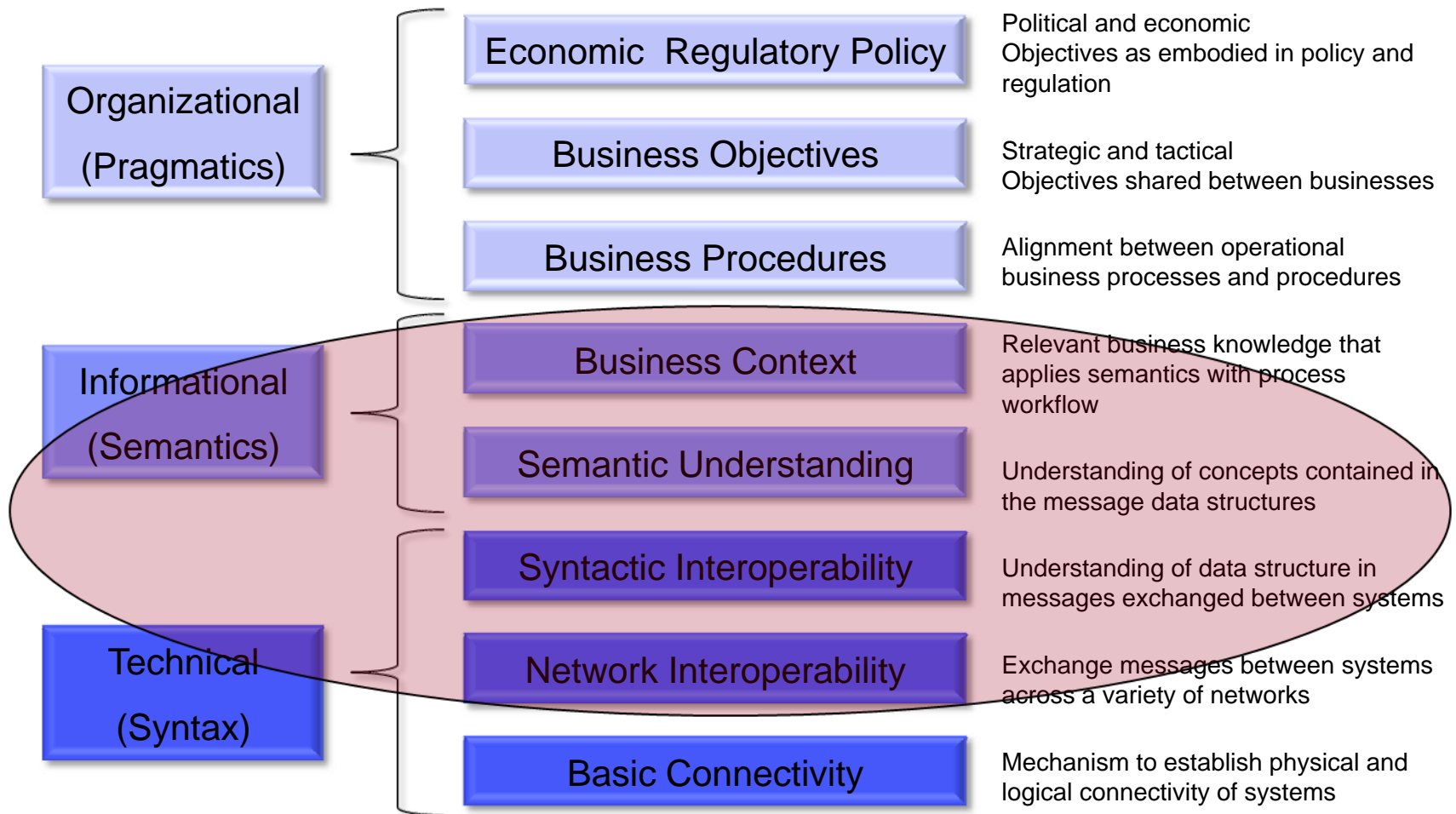
A brief history of CIM

	Timeline
1996	CIM turned over to IEC Technical Committee 57, Working Group 13&14, to advance through standards process
2000	NERC mandates CIM and first IOP test
2003	ISO/RTO Council and EPRI sponsored initiative to expand CIM into Market Operations (IEC 62325)
2005	First edition of IEC 61970-301 CIM Base CIM Users Group established under UCA Users Group
2008	CIM adopted by Union for the Coordination of Transmission of Electricity (UCTE)
2009	NIST identifies CIM as key standard for Smart Grid interoperability
2010	European Network of Transmission System Operators for Electricity (ENTSO-E) migrates to CIM and holds first IOP test

What is the Common Information Model (CIM)?

- Set of standards that:
 - Enable systems integration and information exchange
 - Provides an information model
 - Provides message/file schemas
- Based on Unified Modeling Language (UML)
 - Provides common semantics for all information exchange
 - Not tied to a particular application (model driven)

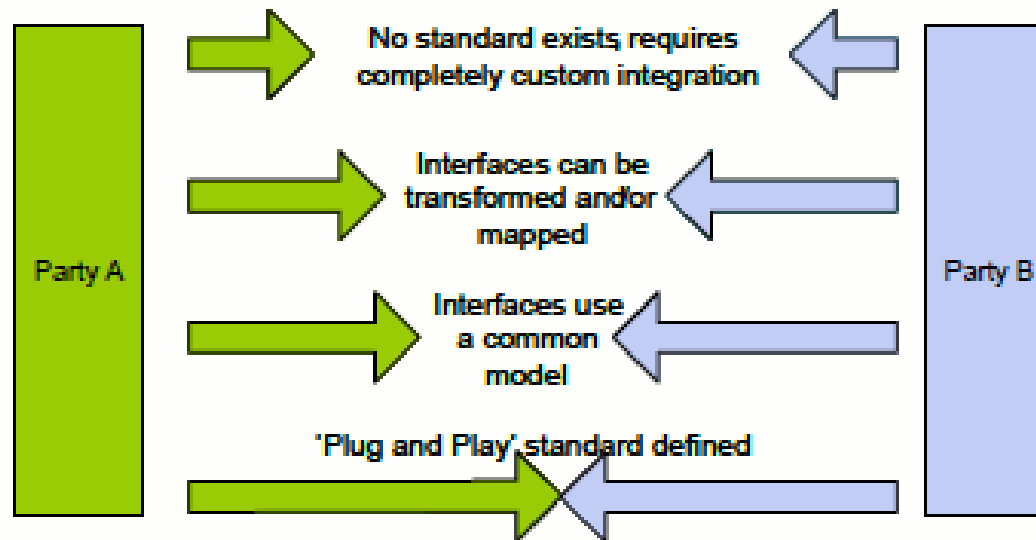
CIM relation to the GWAC Stack



Source: Gridwise Architecture Council

Distance to integrate

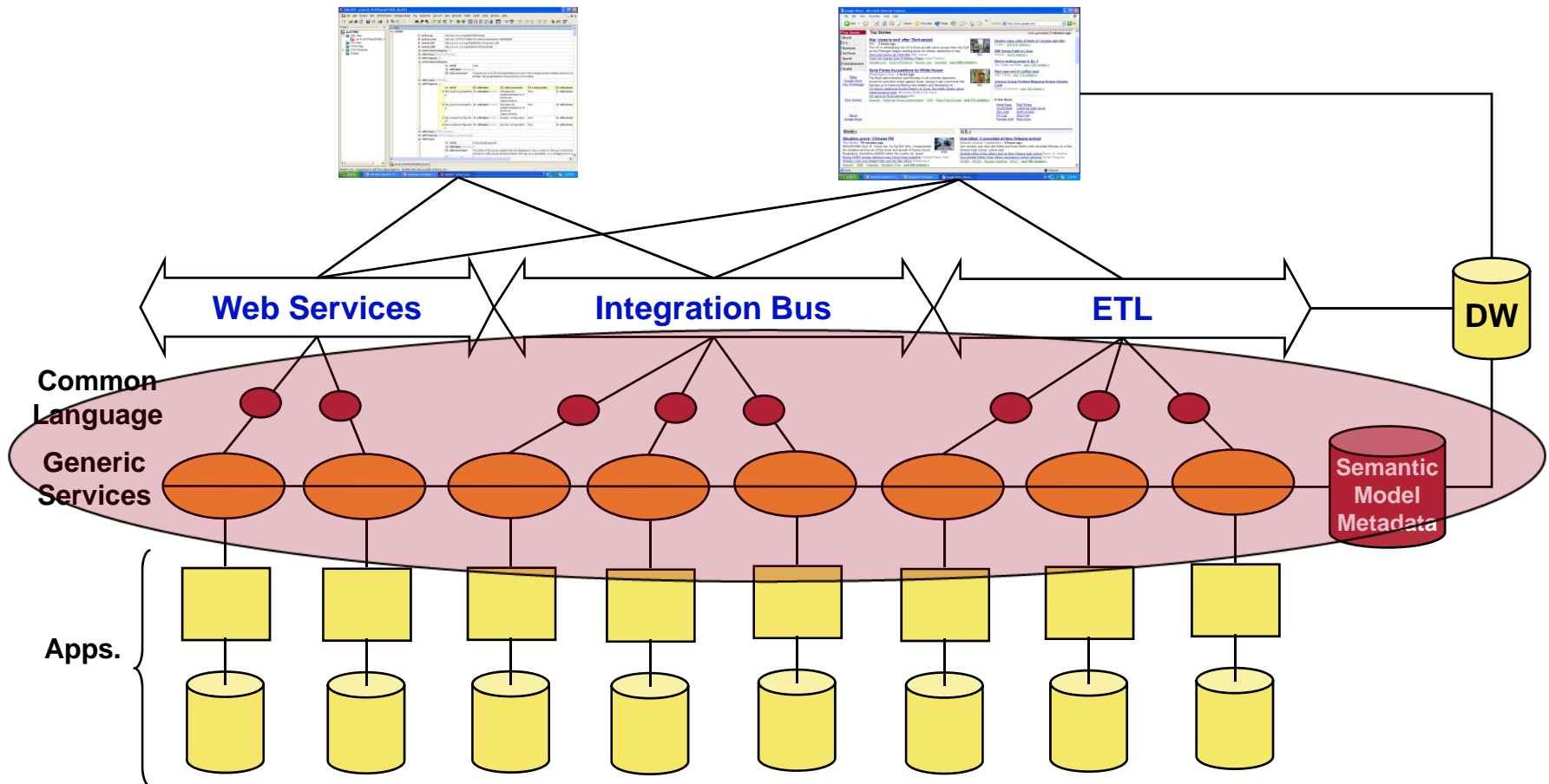
- CIM reduces, but does not eliminate, the distance to integrate



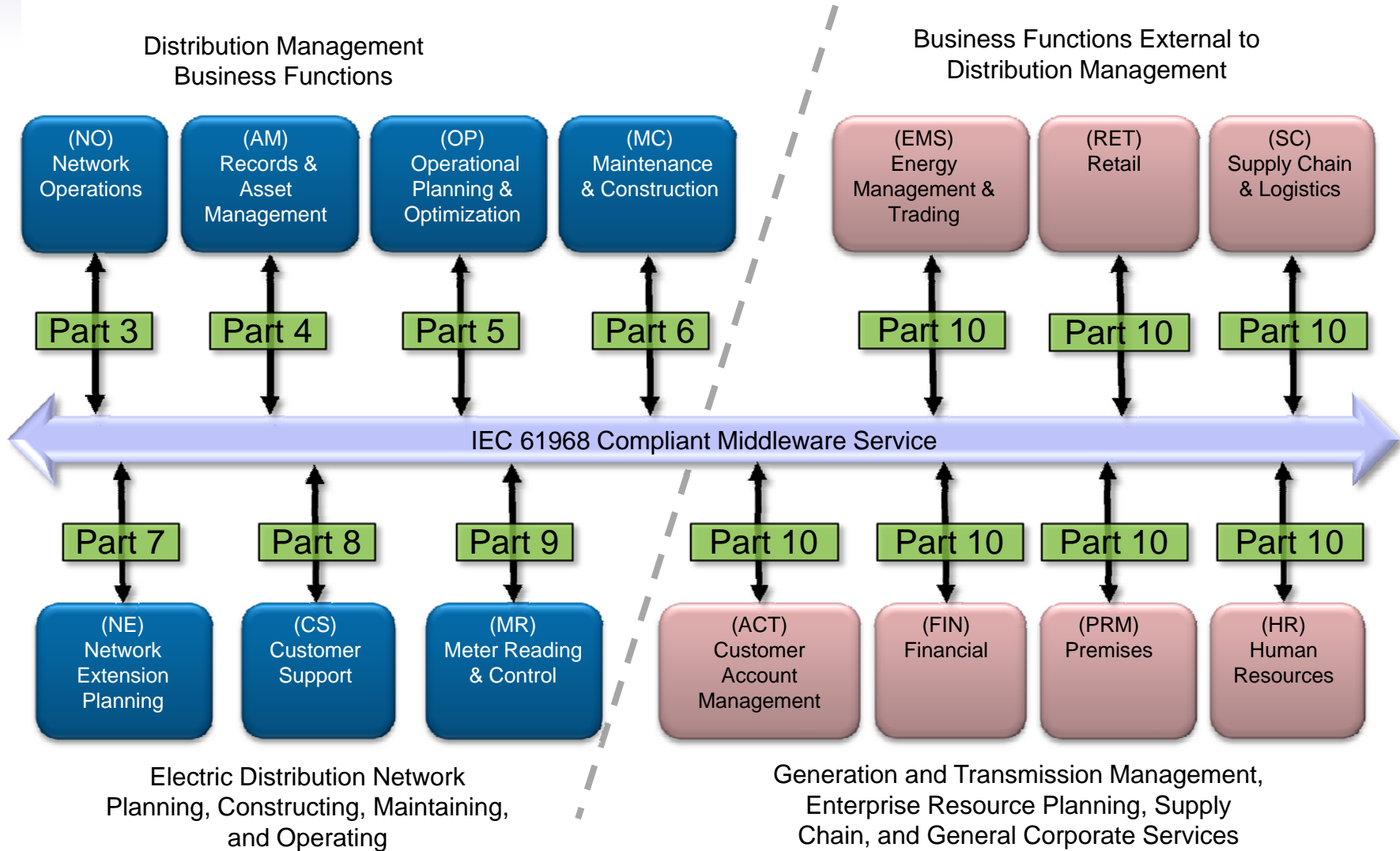
CIM : Semantic layer in Enterprise Architecture

Composite Applications

Business Intelligence



IEC 61968-1 Interface Reference Model

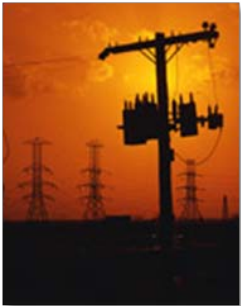


Semantic Model

- Vocabulary of basic terms
 - Precise specification about meaning and how they relate to each other
- How it is used
 - A given business domain is defined
 - Model expressed in knowledge representation language
 - Concepts, relationships, rules
 - Organized in a discreet layer for information systems use
- More scalable and maintainable way to manage enterprise data than one-to-one mapping

Modeling the real world

Poles...



Transformers...



Schedules...

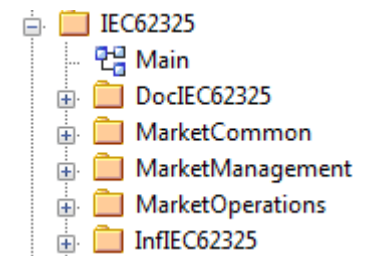
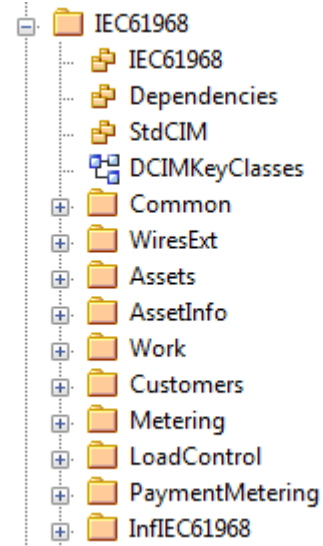
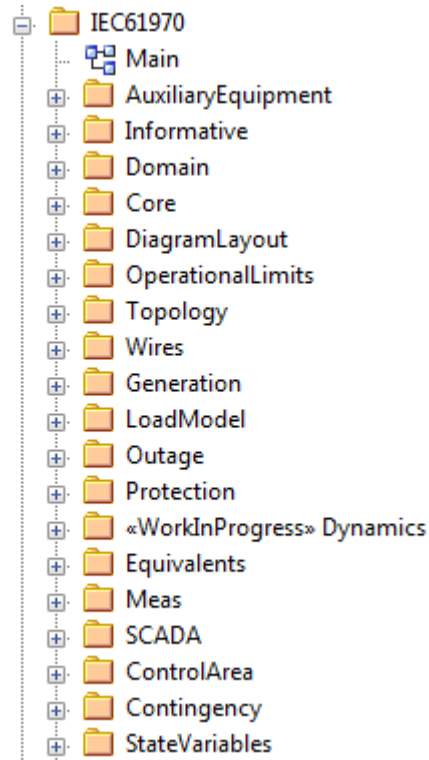
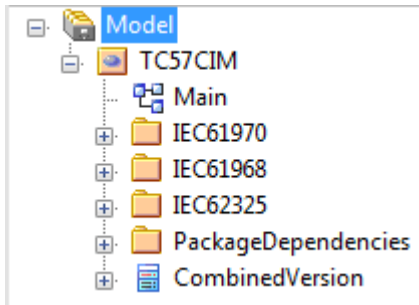


Transformer Winding

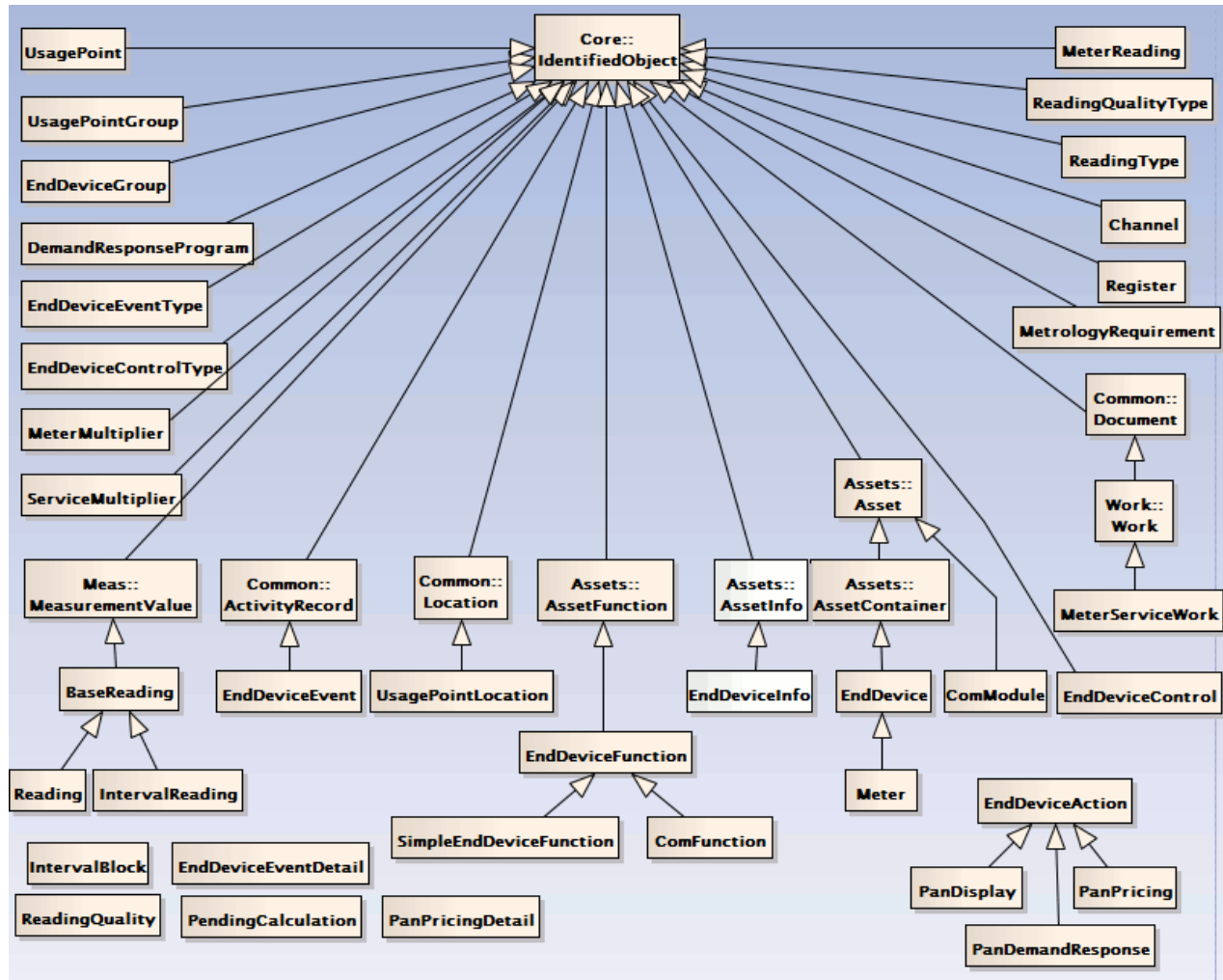
- b: Susceptance
- insulationKV: Voltage
- connectionType: WindingConnection
- emergencyMVA : ApparentPower
- g: Conductance
- grounded: Boolean
- r: Resistance
- r0: Resistance
- ratedKV: Voltage
- rated MVA: ApparentPower
- rground: Resistance
- shortTermMVA: ApparentPower
- windingType: WindingType
- x: Reactance
- x0: Reactance
- xground: Reactance

- CIM models...
 - Physical assets or...
 - More abstract concepts
- Represents these things in a way that information can be exchanged

A peek at the model

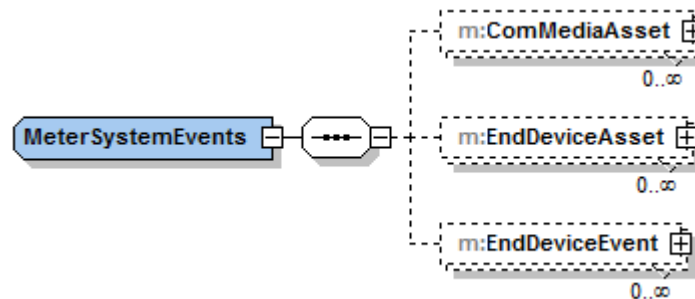


Deeper ... Metering



More than an information model

- Profiles – specify a subset of CIM classes used in a specific context
- Implementation models
 - RDF schema-based standards for power system model exchange
 - XML schema-based standards for message payloads



TC57 Layered Architecture

Information and Semantic Models

Information Model

Generalized model of all utility objects and their relationships
Application independent

Context

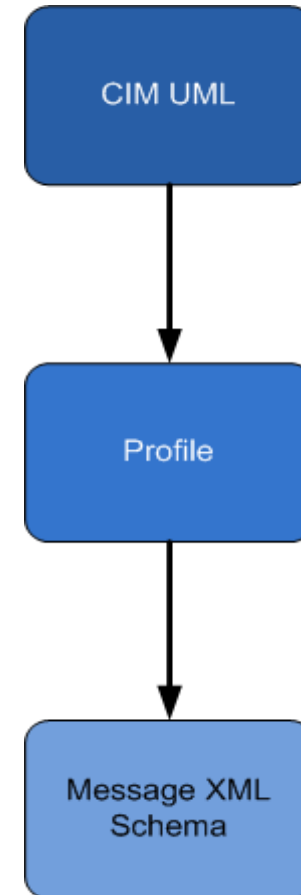
Contextual layer restricts information model

Constrain or modify data types
Cardinality (may make mandatory)
Cannot add to information model

Message Syntax

Message syntax describes format for instance data

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



Organizations using CIM

Organization	Type	How
AEP	Utility	Distribution, Customer, Market (Retail Service Provider)
CAISO	ISO	Market, Transmission
CenterPoint	Utility	Transmission
Consumers Energy	Utility	Distribution, Customer
DTE	Utility	Distribution, Customer
Edf, ERDF	Utility	Distribution
ENTSO-E	Similar to ISO	Transmission, Market
ERCOT	ISO	Transmission, Market
NYISO	ISO	Transmission, Market
Oncor	Utility	Transmission
Pacificorp	Utility	Transmission, Distribution
Progress Energy	Utility	Distribution
SCE	Utility	Transmission, Distribution, Customer, Back Office
Seattle City Light	Utility	Distribution
Sempra (SDG&E)	Utility	Distribution, Customer

CIM use in the organization

- Power System engineers
- Enterprise Architects
- Information Architects
- Data Architects
- Systems Integrators
- Application related:
 - Distribution Management
 - Outage Management
 - Energy Management
 - Asset Management
 - ...

CIM Acceptance

- 50+ applications based on CIM
- 40+ suppliers sell CIM based applications/products
- Endorsed by other standards organizations
 - MultiSpeak, Zigbee, UCTE...
- Foundation for information exchange between utilities and external organizations
- Foundational building block for utility information architecture
- CIM User Group available for assistance with issues

For more information

- [International Electrotechnical Committee \(IEC\)](#)
- [CIM User Group – Draft documents](#)
- [CIM User Group – combined model \(61968, 61970, 62325\)](#)

EPRI Education & Training

- Partner with CIM User Group to:
 - Create meeting summaries
 - Sponsor web site improvements
 - Hold joint training activities
- CIM for Zombies
 - 180 pages of practical guidance
 - Using profiles
 - Using XML/RDF files
 - Out this fall!

Capability Development

- Increasing IEC Working Group involvement
 - WG13 (IEC 61970)
 - WG14 (IEC 61968)
 - WG16 (IEC 62325)
 - WG19 (Architecture and rules)
- Goal: Be the CIM “Go To” resource for members
 - Increasing internal training
 - Adding technical depth
 - Engaging other EPRI programs in CIM use:
 - Grid Ops & Planning, Distribution, Smart Grid Demos
 - Hands-on activities in the Smart Grid substation lab

Execution

- Real projects that use CIM:
 - Field force visualization project (2011 supplemental)
 - Transformer Health in the Transmission Control Center (2011 – 2012 supplemental)
 - CIM SCADA Interface (2011 implementation in SG substation lab)
 - CIM/IEC 61850 Harmonization
 - Real-time data exchange starting in SG substation lab
 - Network Model Manager
 - Planned for 2012
 - Test Harness
 - Building out end-to-end infrastructure
 - CIM for Weather, CIM for Dynamics...
 - Investigating ways to expand the CIM

Visioning

- Cross-domain integration
 - Transmission/Distribution
 - Market to Customer
 - Field to Back-Office
- Business efficiency improvements
 - Data glut – how to get useful information
- Infrastructure to support the smart grid
 - Standards will be integral part of getting from here to tomorrow...
- Grid Transformation (Technology and Innovation project)
 - Workshop in Chicago coming up...

Together...Shaping the Future of Electricity