A Critical Comparison of Approaches to Resource Name Management within the IEC Common Information Model

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Overview

- Who we are
- Legacy, Challenges & Progress so far
- Use case
- CIM 15
  - naming classes
- Architecture
  - Semiotic triangle, OMG model layers architecture
- Overlapping models and alignment
- Conclusions
About National Grid

- GB - we run national gas and electricity transmission systems
- US - we provide power directly to millions of customers.

Electricity:
- Transmission (owned & operated)
- Transmission (operated)
Legacy

- Key operational systems map with point-to-point links reflecting the number of data flows between respective systems (analysis in 2010);
- Point-point data flows between a range of systems with proprietary methodologies / interfaces;
- We are far from Canonical Data Model;
- Information is redundant and hard to maintain;
- Proprietary systems keeps their own version of truth about the same reality;
Some of the challenges

- Systems Interoperability
  - Trace resource genealogy
  - Resources Identity – Name coupling
  - Model boundary alignments

- Canonical Data Model
Progress so far

- **iEMS – Data Historian CPSM2010 (CIM14v15)**
  - Transfers full power system network model to Data Historian.
  - .EQ file contains ~200,000 objects but covers only ~10% EMS data points.
  - Real-time data sent via API.

- **iEMS – EBS CPSM2010 (CIM14v15)**
  - Same file used as for Data Historian, ie full power system network model.
  - Registration Database merged with EMS CIM model

- **Planning model – ENTSO – Ed.1 (CIM14v02)**
  - Transfer reduced day ahead power system model to Coresco
  - (.EQ ~24,000 objects, .TP and .SV)

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Timelines:

- **EMS CIM Adaptor available**
- **iEMS–RDB model merged**
- **OLTA – Coreso Testing & Go-live**
- **EBS Start**
- **DH Start**
- **EMS CIM Adaptor available**
- **iEMS–RDB model merged**
- **OLTA – Coreso Testing & Go-live**
- **EBS Testing & Go-live**
Use case: starting to merge data models

- Multi-party requirement to validate, compare, merge and edit CIM XML data models;

- Operational requirement from Data Historian to merge and validate EMS CIM data model with RDB CIM data model: Balancing Market Units (BMU)
CIM 15: naming class structures

- An instance, on average, can have from 6-10 attributes including IdentifiedObject.name
- CIM15 adds new 3 classes to support naming which means sizewise Data Models are going to be, at least 30-40% bigger.
Architecture: the Semiotic Triangle

UML
Modelling Language

represents

stands for

abstracts

COM/XML file: IEC 61970

CIM/XML file: IEC 61970

EMS (instance)
OMG’s layer model architecture

- Concepts and things are in two different layers – two layer architecture with instanceof linkage; stands for from the semiotic triangle equates with each of instanceof

(a) The only relationship permitted between layers is instanceof
(b) Instanceof is not permitted within a single layer
Resource trajectory

RDF/XML layers combined with TC57 Layered Reference Architecture

It helps us to understand:

- Technology layers and their borders where instantiation happens
- Resource journey through technology layers against OMG layers and TC57 Layered Reference Architecture

M3 Metametamodel

CIM: IEC61970 & Ext.

Profiles: CPSM, ENTSOs Extensions

Schemas: RDFS, XSD

Namespaces

Instances mRID + name

M0 Data

Values & Quantities
Identity – Name coupling

- Identities (persistent rdf:IDs) are system dependent and are for machine consumption.
- Names (IdentifiedObject.name) are given by humans to things from reality for humans to interpret.
- Names must be coupled with Identities for correct human and machine interpretation.
- Namespace provides resource genealogy at the syntactic level.

M1 Data Model
CIM/XML file

Instance of

Names

M0 Data Values & Qtys

Reality

Identity

–

Name coupling
Namespaces trace resource genealogy

.merge via boundary data model

CIM adaptors will provide CIM/XML data models

Planning

Market

Real Time

M1 Data Model

CIM/XML file

Instance of

M0 Data

Values & Quantities
Namespaces reference CIM meta-model

- **M2**
  - Meta-Model
  - UML CIM

- **M1**
  - Data Model
  - CIM/XML file

- **IdentifiedObject**
  - aliasName : String [0..1]
  - mRID : String [0..1]
  - name : String [0..1]

- **Instance of**
  - Market
    - CIM15V33
  - Real Time
    - CIM14V15
  - Planning
    - CIM14V02
Alignment of overlapping (merged) models

- Power system information models of different granularity need unique name-mRID pairs to be aligned.

- Example: Substation boundary data model contains pairs of rdf:ID and name of the substations; one model is giving the mRIDs to the merged model.
Boundary data model alignment options

- Human interaction can be minimized by using a reference set of meta-data - e.g. Substation GPS coordinates in both information models.

- And/Or an algorithm which crawls connectivity and containment within the models to be aligned. Connectivity patterns are identified and suggested as common objects to a human operator.
Conclusions

- Current CIM naming architecture adds verbosity to information models.
- Namespace containment supports resource name genealogy and can offer precision in merged file information extraction from repository.
- Could mean CIM namespace is restricted to meta-model identification.
Thank you

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