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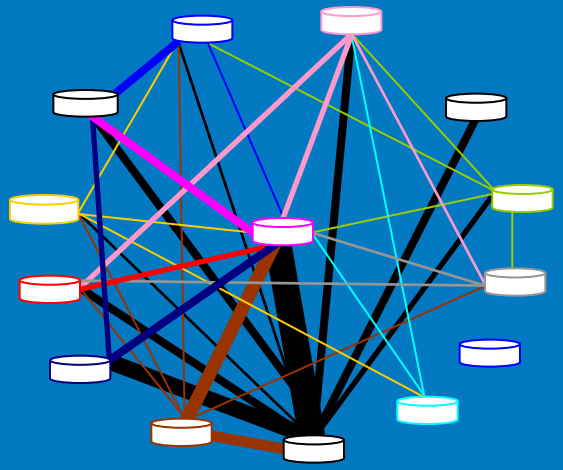
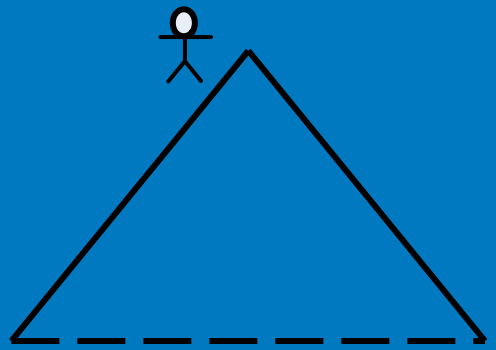
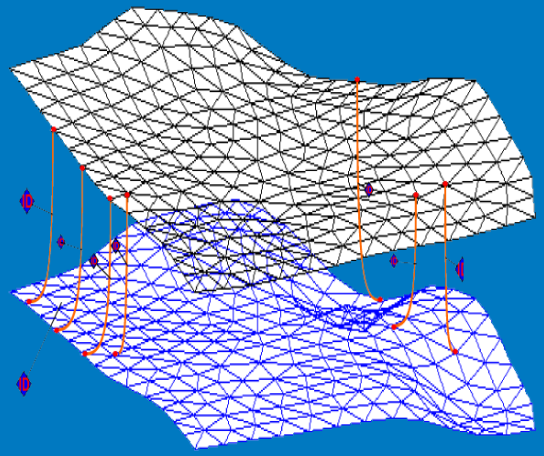
A Critical Comparison of Approaches to Resource Name Management within the IEC Common Information Model







Stefan Pantea, Nigel Hargreaves

CIM Users Group

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Overview

- Who we are
- Legacy, Challenges & Progress so far
- Use case
- CIM 15

  - naming classes

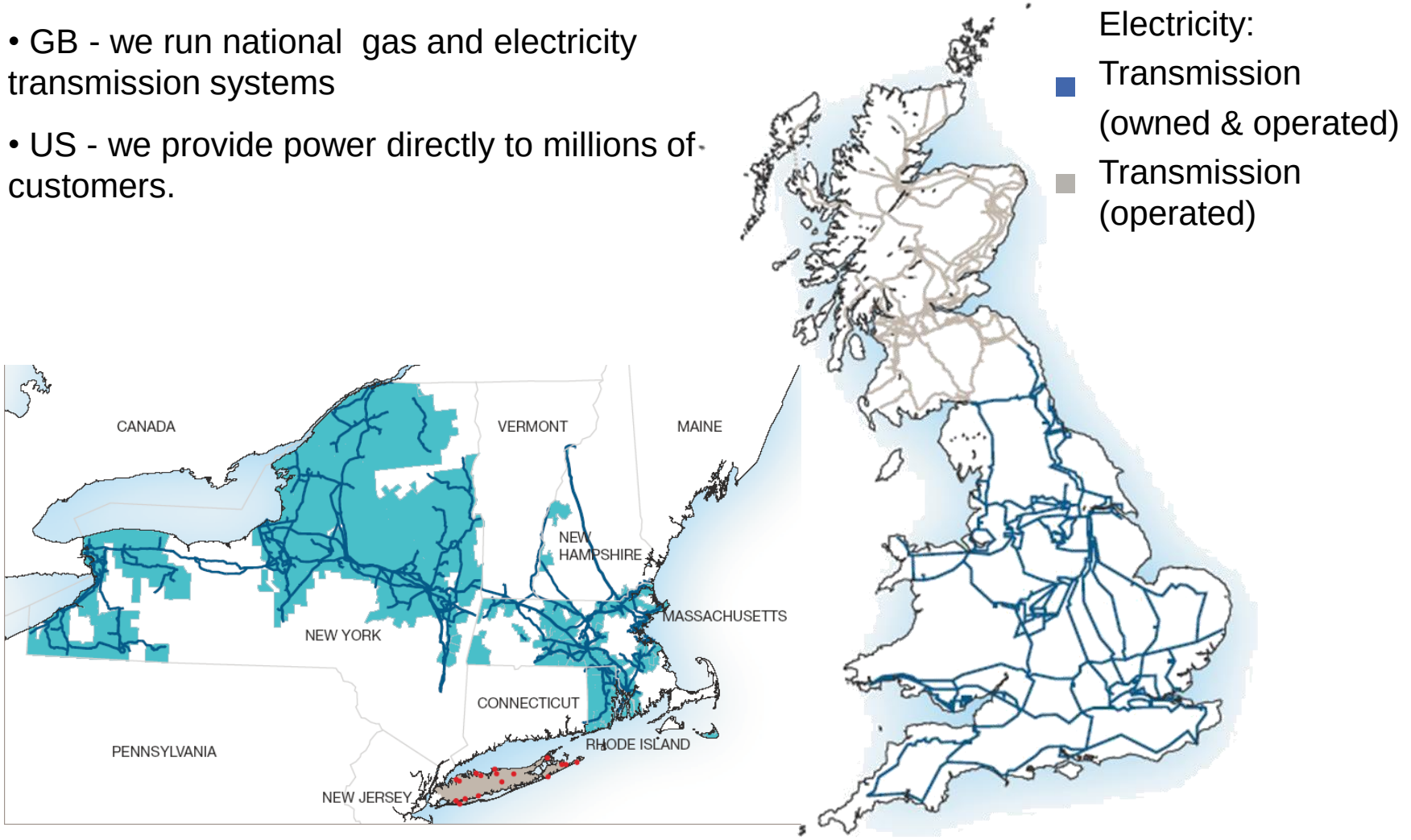
- Architecture

  - Semiotic triangle, OMG model layers architecture

- Overlapping models and alignement
- Conclusions

About National Grid

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



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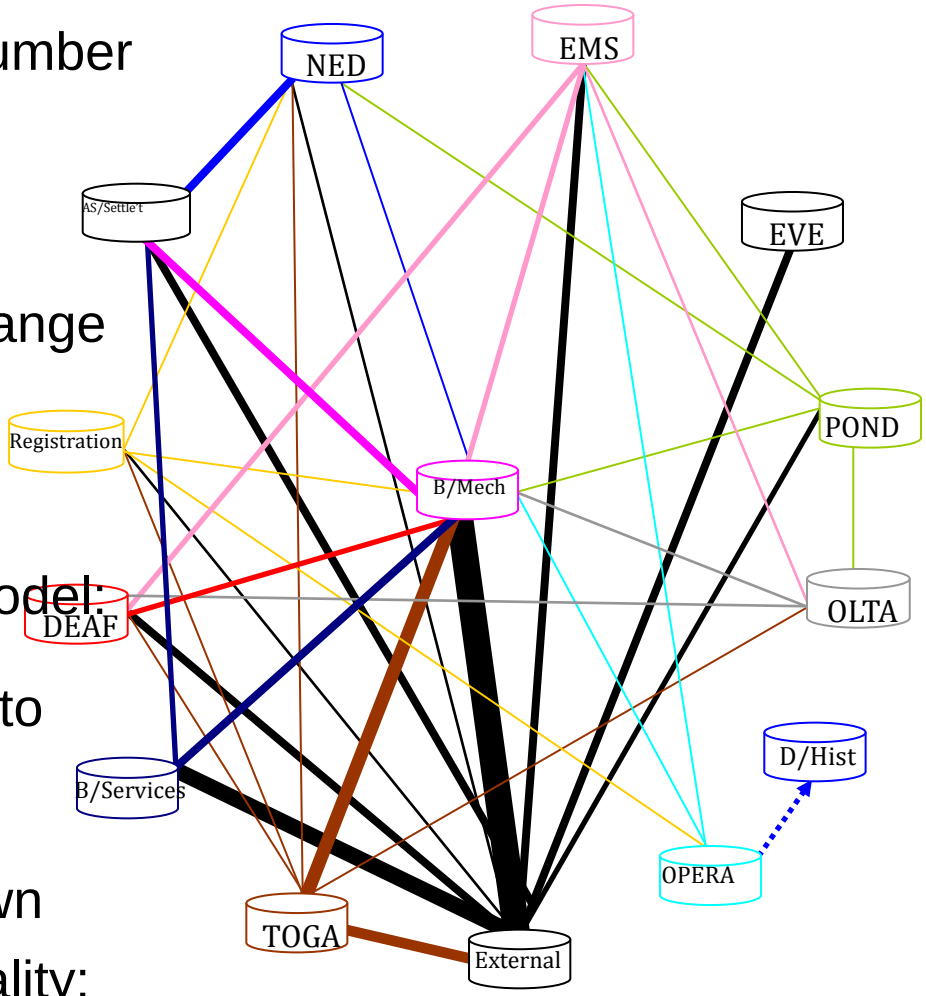
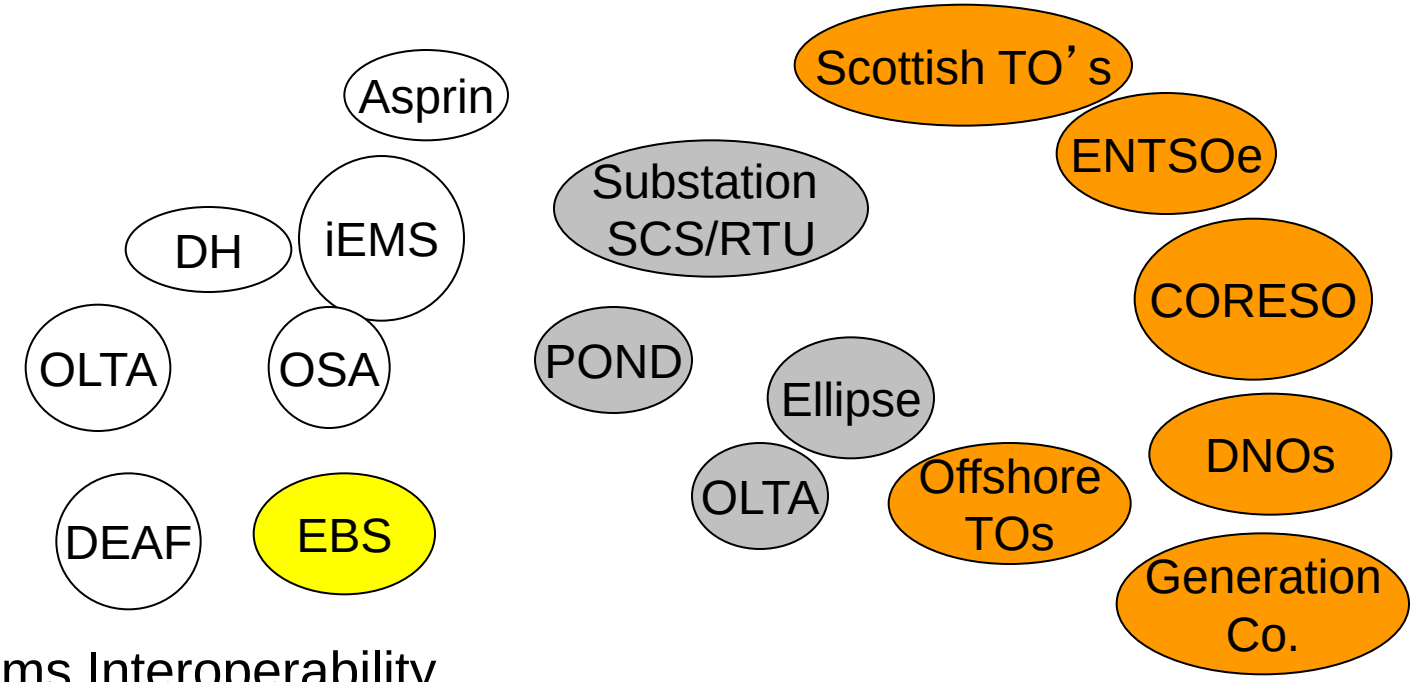
Legacy

- 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



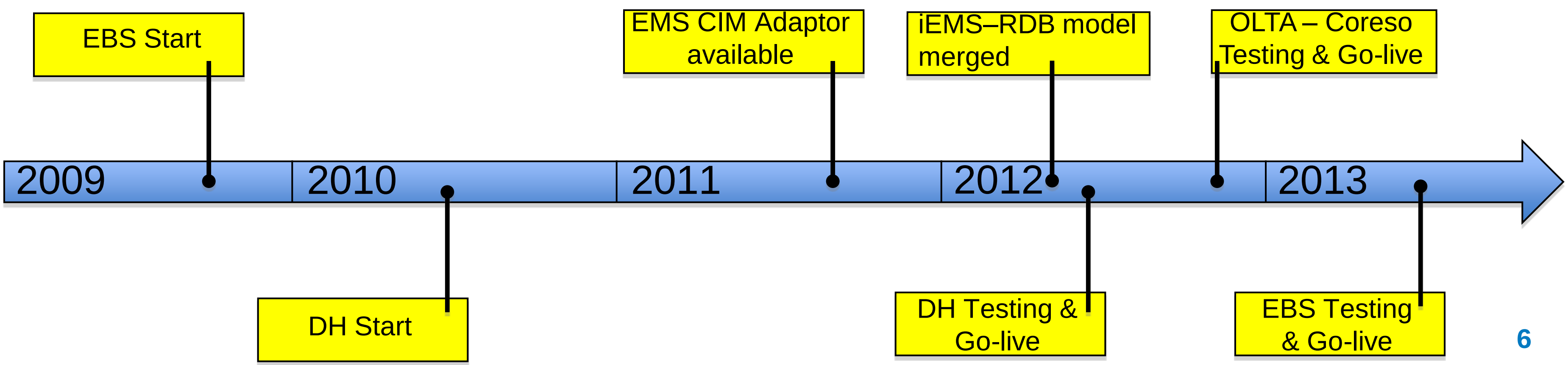
- Systems Interoperability
  - Trace resource genealogy
  - Resources Identity – Name coupling
  - Model boundary alignments
- Canonical Data Model

Asset Management
Electricity Market
Network Operations
External entities

Progress so far

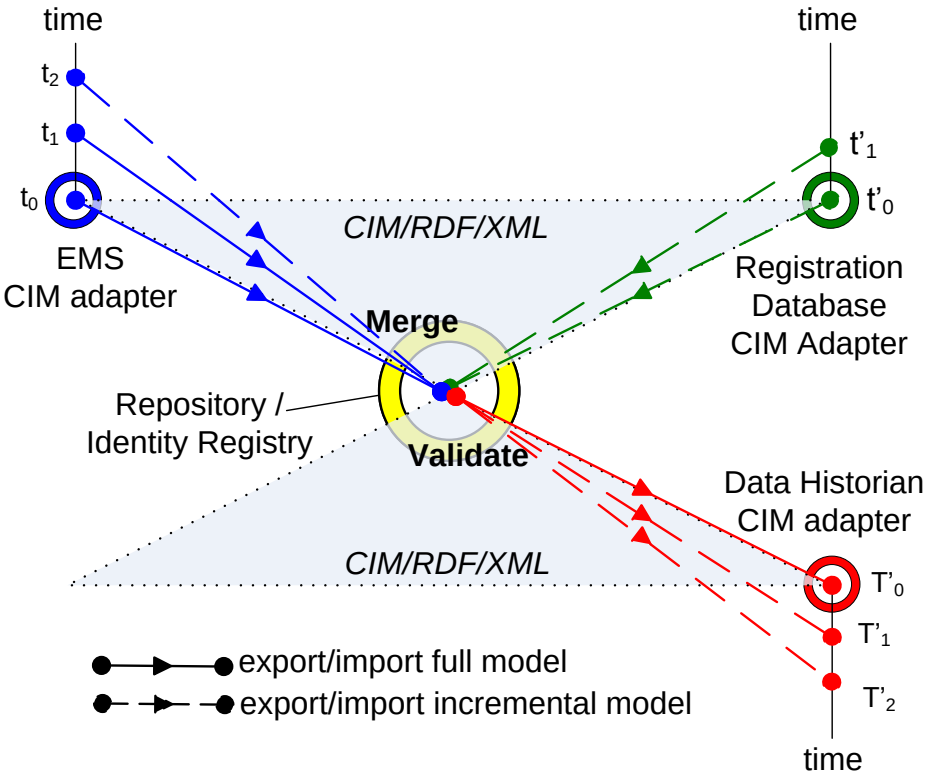
iEMS+DB - GPSM2010 (CIM14v15) / Data Historian ENTSO-E 2010 (CIM14v02)

- Transfers full power system network model to Data Historian / to Coreso
- Same file used as for Data Historian, ie full power system network model.
- EQ file 24,000 objects, TP and SV but covers only ~10% EMS data points.
- (Registration Database, merged with) EMS CIM model
- Real-time data sent via API.



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)



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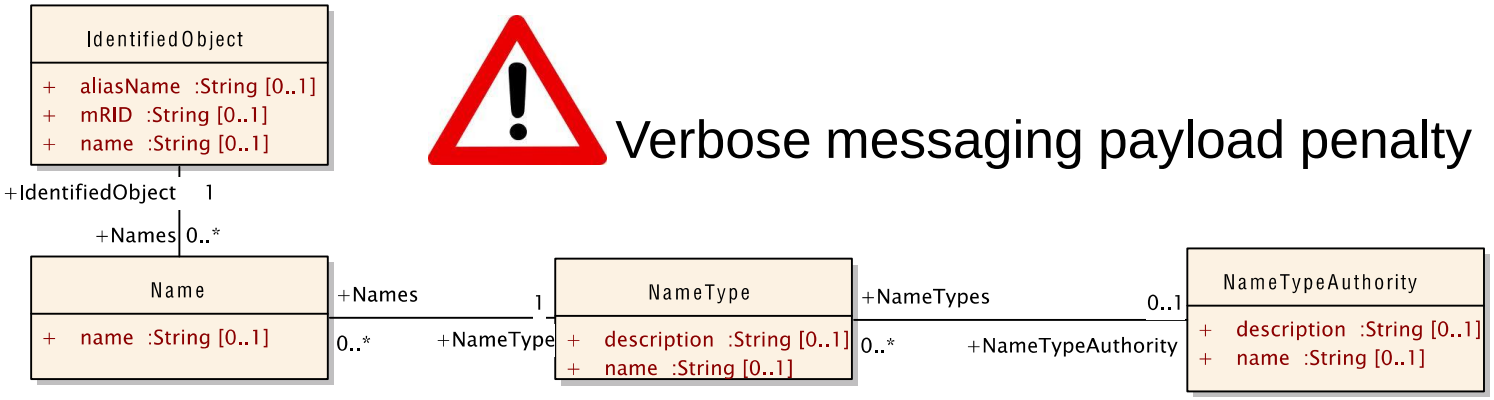
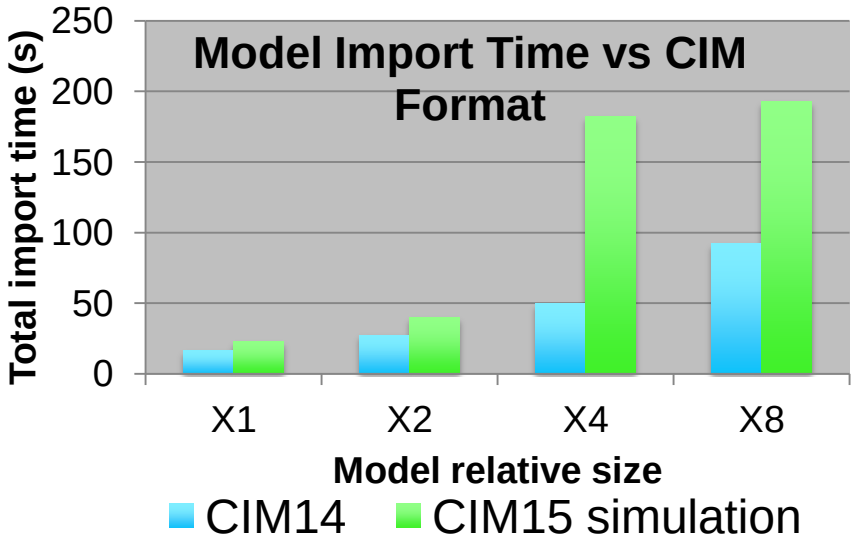
CIM 15 : naming class structures



Verbose messaging payload penalty

- 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.



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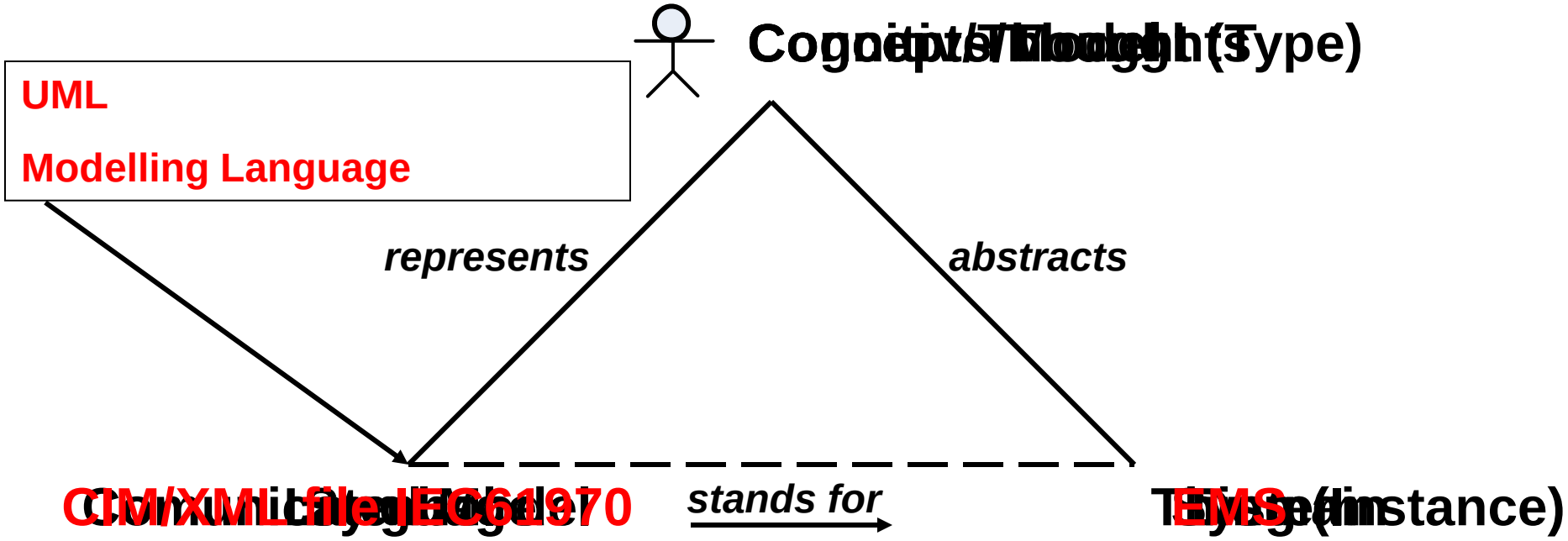
Architecture: the Semiotic Triangle



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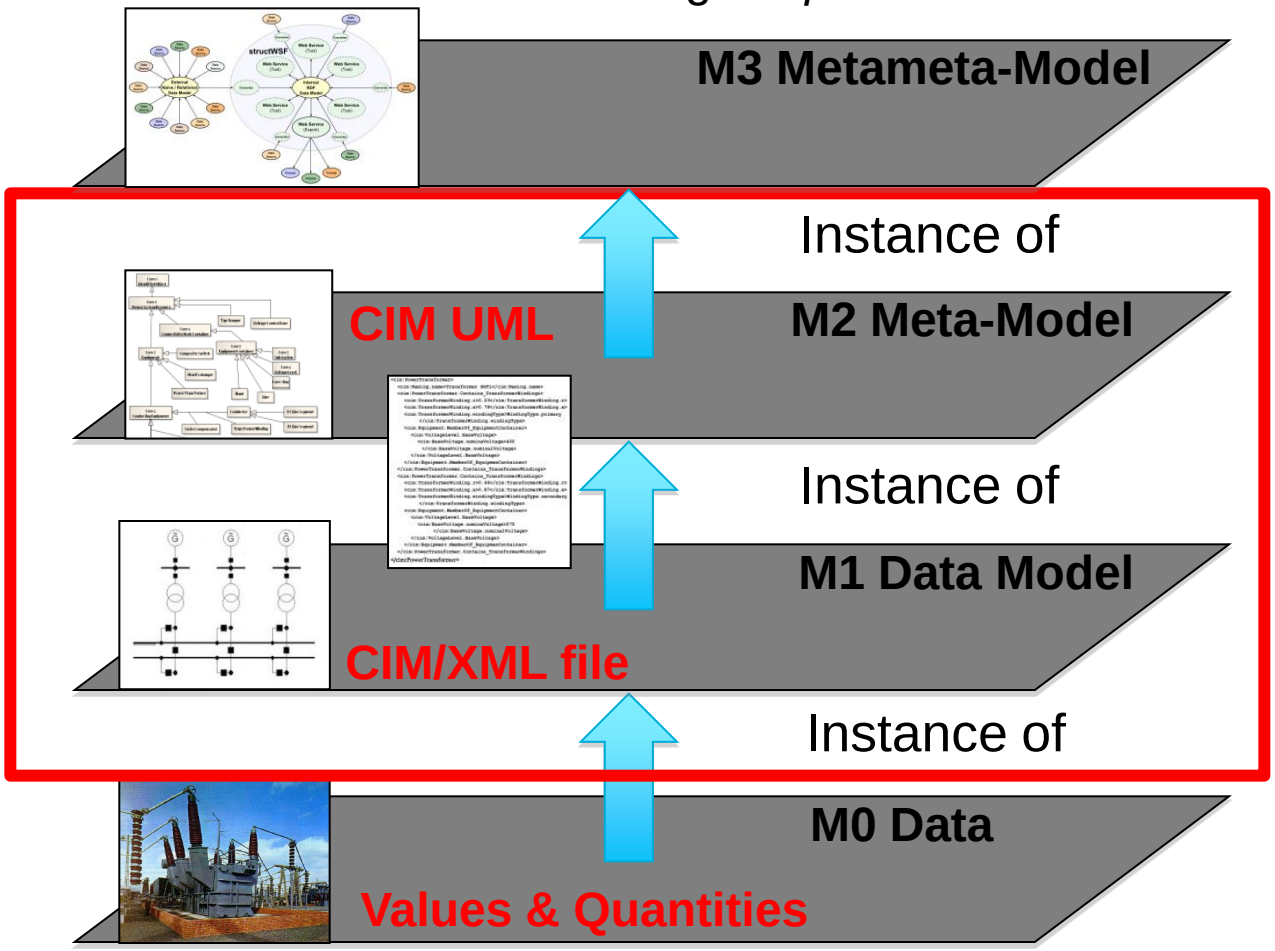
OMG's layer model architecture

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

(a) the only relationship permitted between layers is instance*of*
(b) instance*of* is not permitted within a single layer



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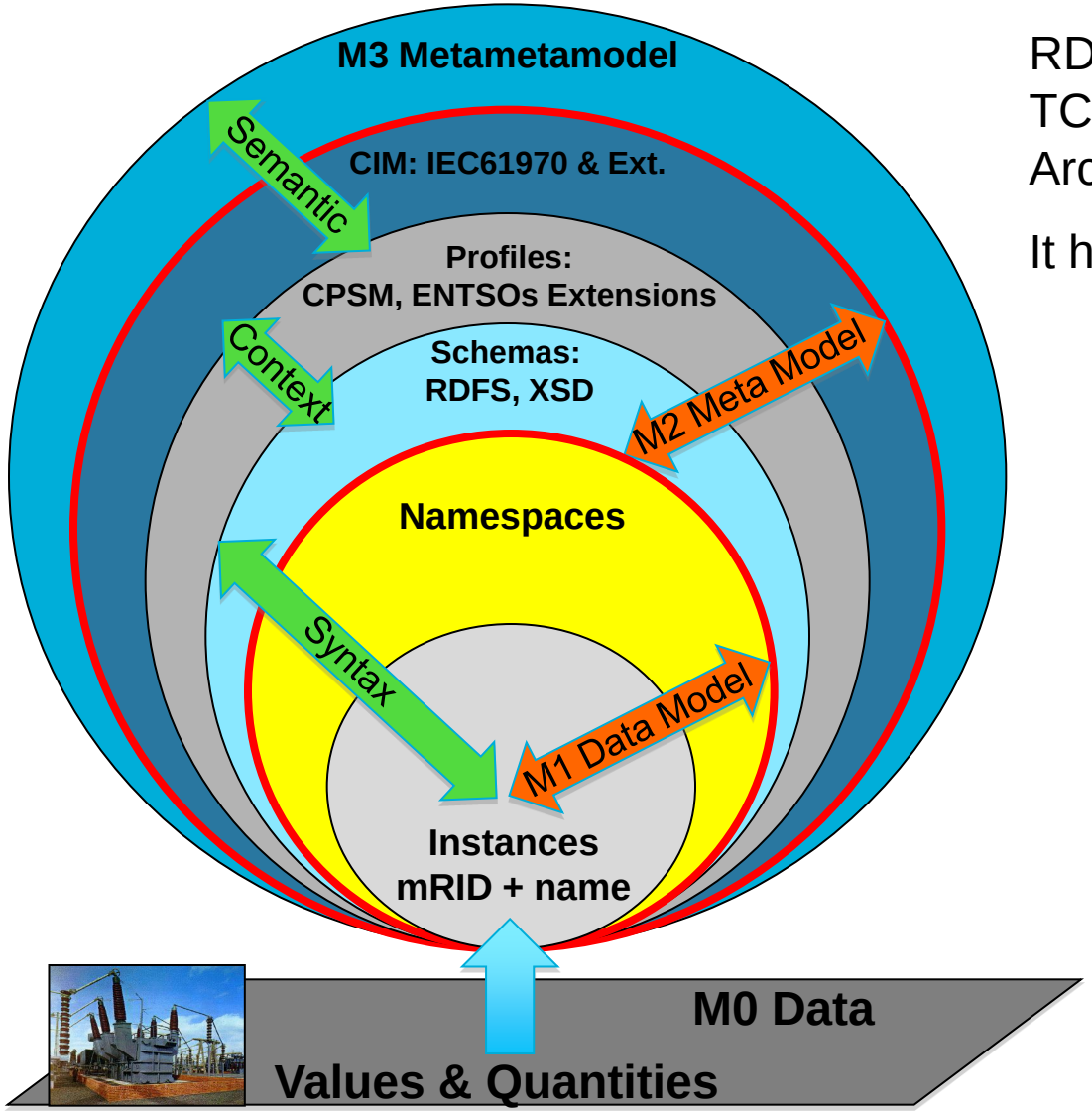
Resource trajectory



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

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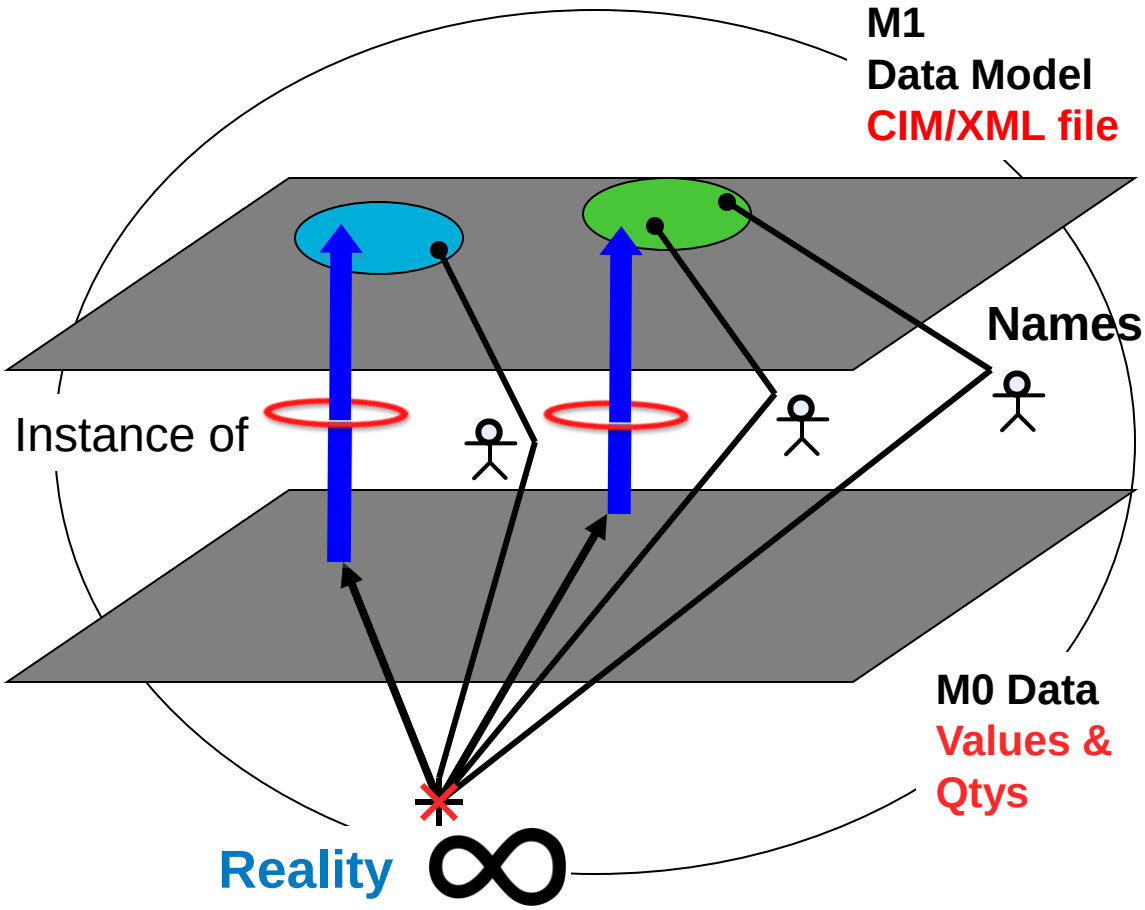
Identity – Name coupling



- 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

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Namespaces trace resource genealogy

Real Time

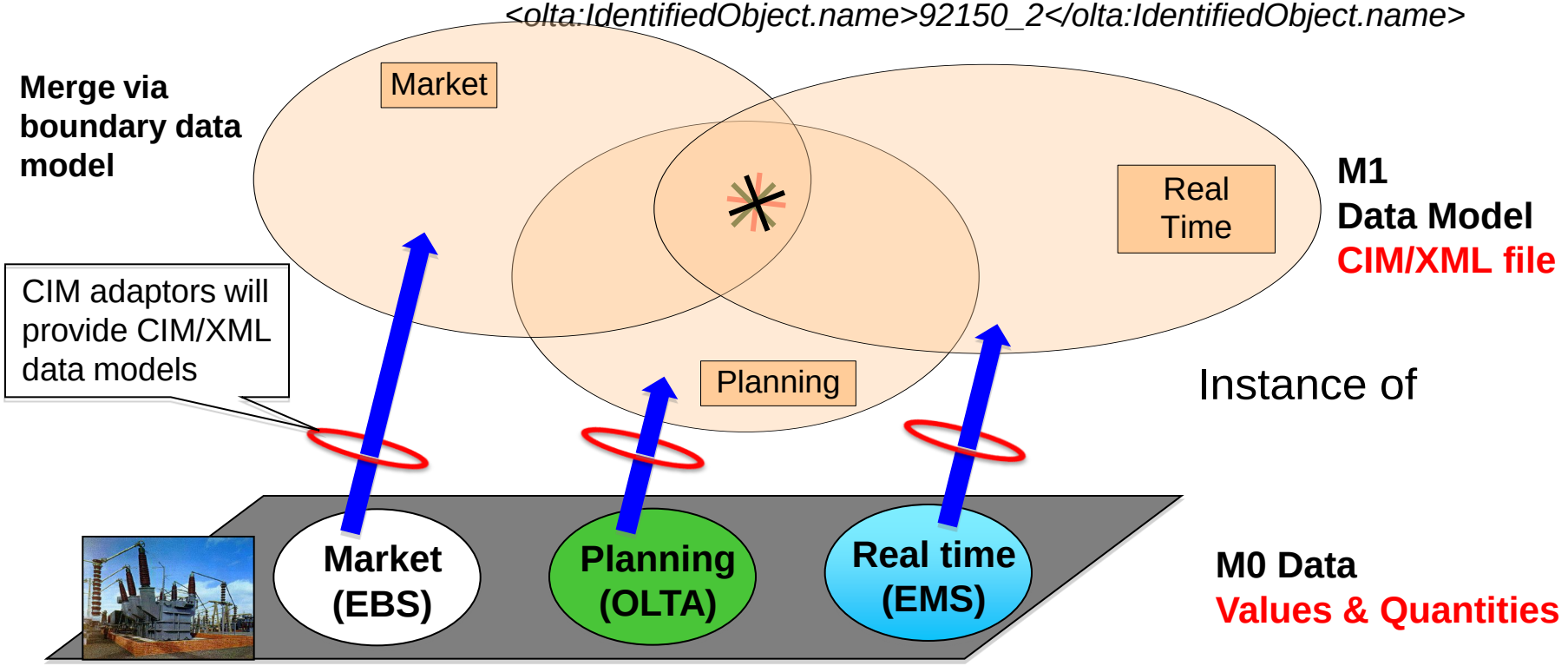
```
<iems:Analog rdf:ID="GBNGEMS_TelemtryAnalogPoint92150">
        <iems:IdentifiedObject.name>92150</iems:IdentifiedObject.name>
</iems:Analog>
```

Planning

Market

```
<rdf:Description rdf:about="#GBNGEMS_TelemtryAnalogPoint92150">
        <ebs:Analog rdf:ID="GBNGEBS_TelemtryAnalogPoint92150"/>
        <ebs:IdentifiedObject.name>92150_1</ebs:IdentifiedObject.name>
        <olta:Analog rdf:ID="GBNGOLTA_TelemtryAnalogPoint92150"/>
        <olta:IdentifiedObject.name>92150_2</olta:IdentifiedObject.name>
```

Merge via boundary data model



M1 Data Model
CIM/XML file

Instance of

M0 Data
Values & Quantities

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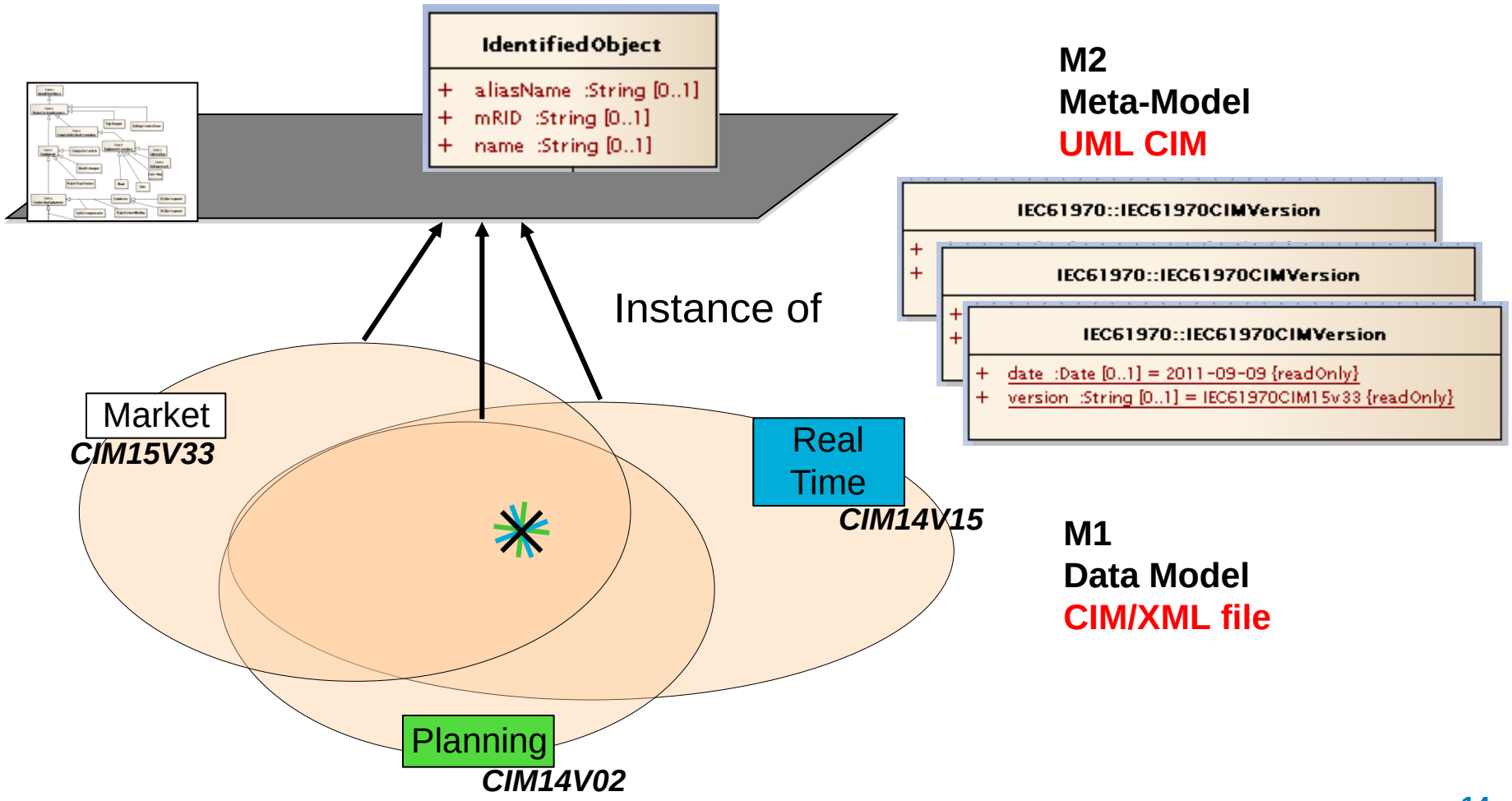
Namespaces reference CIM meta-model



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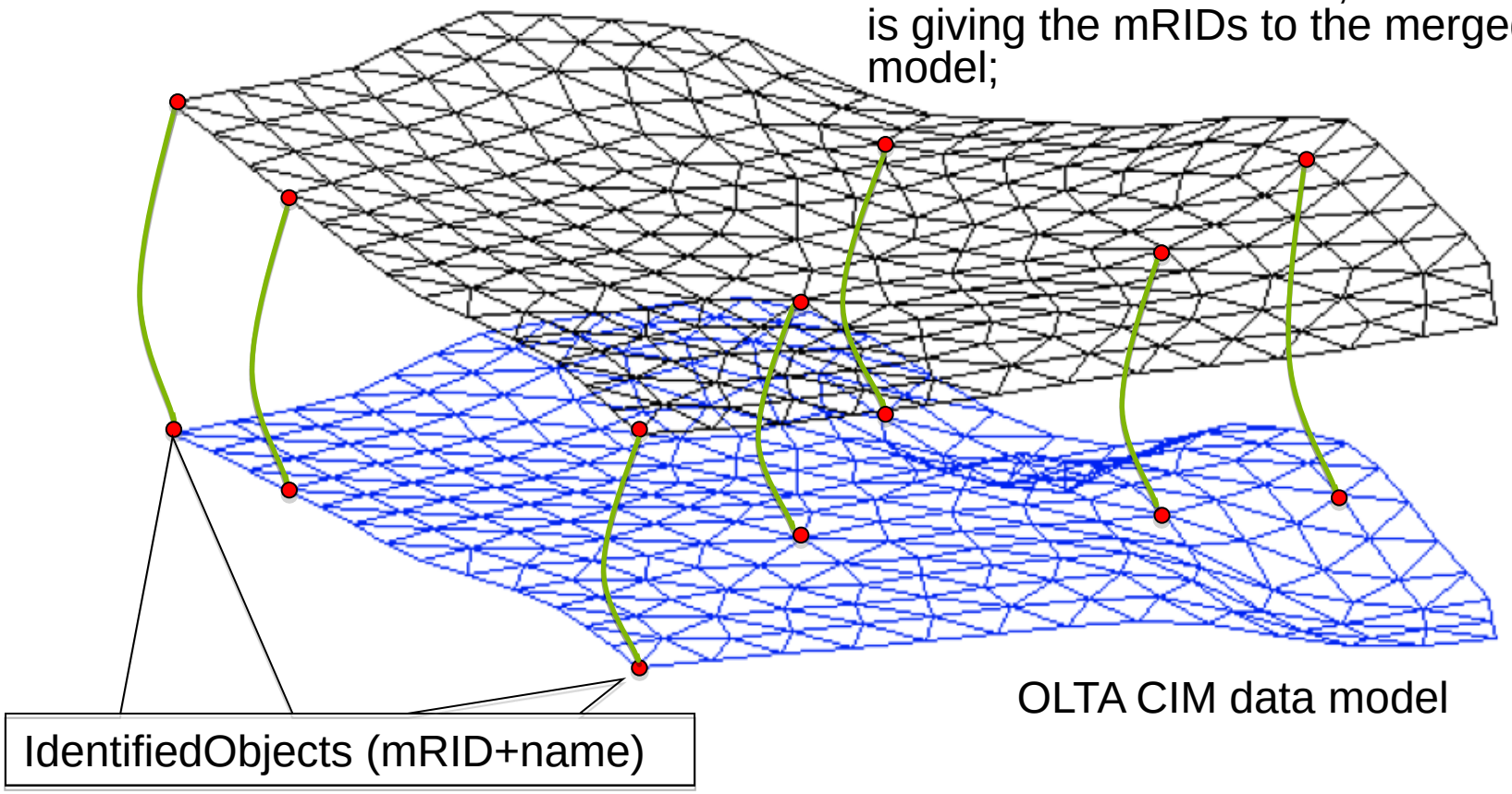
Alignment of overlapping (merged) models

- Power system information models of different granularity need unique name-mRID pairs to be aligned
  - eg. Substation boundary data model contains pairs of rdf:ID and name of the substations; one model is giving the mRIDs to the merged model;



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Boundary data model alignment options

- Human interaction can be minimized by using a reference set of meta-data - eg. 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.

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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

stefan.pantea@nationalgrid.com
nigel.hargreaves@brunel.ac.uk