# Data Interoperability

Developing ontologies for cross domain interoperability –
Energy Equipment Industry and Power System Operation

# Key point

- Introduction to power industry and the type of challenges that IEC Common Information Model (CIM) solves
- What are the key connection point between Energy Equipment Industry and Power System Operation
- Developing ontologies for cross domain interoperability by following FAIR principle and agree on common base ontologies

# Outgoing Liaison from IEC TC57

My IEC Roles

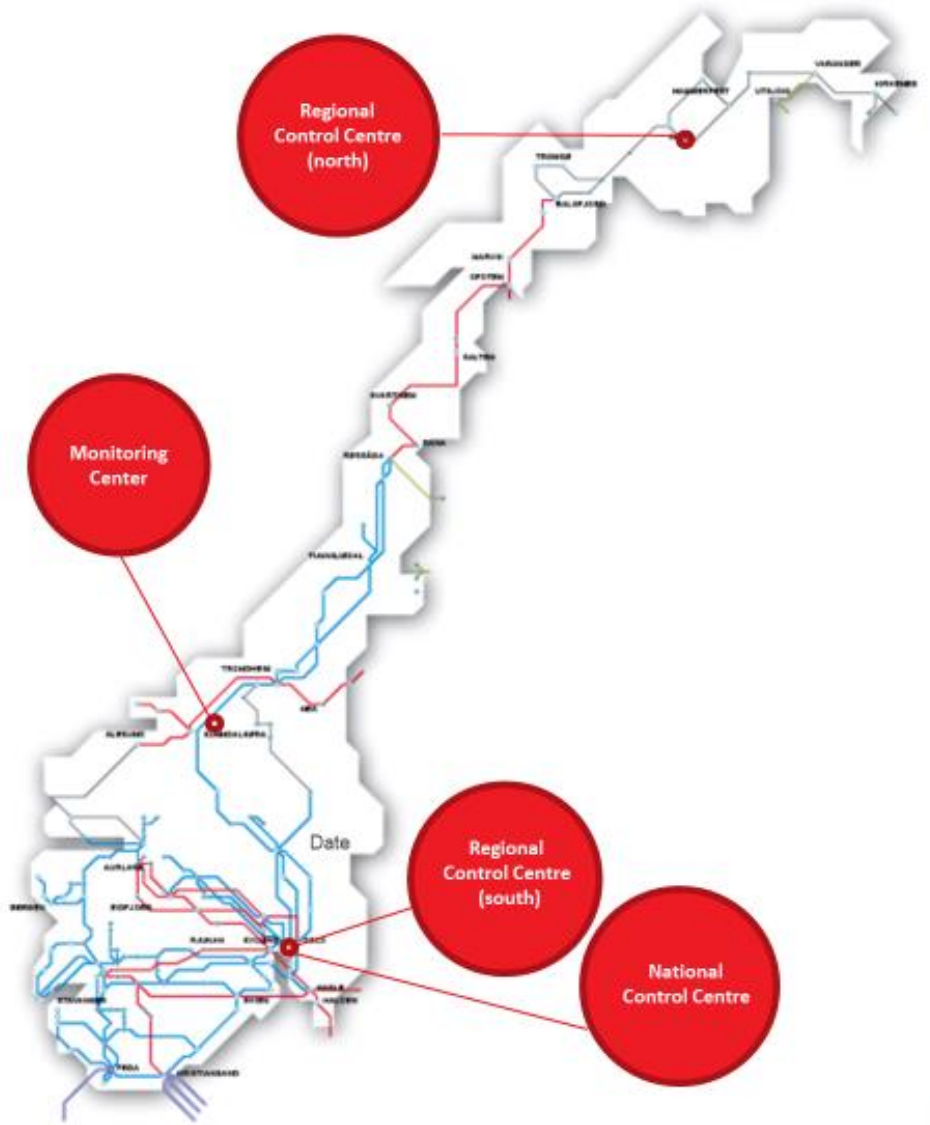
| Group | Role |
|---|---|
| TC 57 | Outgoing liaison to ISO/TC 59/SC 13 |
| TC 57 | Outgoing liaison to ISO/TC 184/SC 4 |
| TC 57/WG 13 | Member |
| TC 57/WG 14 | Member |
| SyC Smart Energy/WG 6 | Member |

[IEC - TC 57 Dashboard > Structure: Subcommittee(s) and/or Working Group(s), Membership, Officers, Liaisons]

| Liaison ISO | | |
|---|---|---|
| ISO/TC 59/SC 13 | Development of building data related standards | Mr Svein Olsen |
| ISO/TC 184/SC 4 | Industrial data | Mr Svein Olsen |

# This is **Statnett**

- Statnett SF is the Norwegian Transmission System Operator (TSO). Statnett SF own, operates and maintains the high voltage power grid in Norway.
- Statnett SF operates and owns about 11 000 km high voltage power line and 166 power transformation substation.
- Statnett SF has the responsible for the power interconnection to Sweden, Finland, Russia, Denmark, Germany, Great Britain and the Nederland's.
- Statnett SF has about 1300 employees and located all over Norway. Main office is in Nydalen, Oslo.
- Statnett is a state enterprise owned by the Norwegian state through the Ministry of Petroleum and Energy.
- Our mission is securing power supply through operations, monitoring and preparedness, facilitating the realisation of Norway's climate objectives, and facilitating creation of value for our customers and the society in general.



Statnett

# Statnett Offshore wind position

- Power grid, production and consumption – onshore or offshore, is ***one power system***.
  - ***Planning*** as one power system
  - ***Operated*** as one power system
  - ***Equal principle*** for market design, system operation and responsibilities
- Norwegian government has suggested in the "Energimeldingen" that Statnett should become the system operator offshore
- Statnett believes that our role as system operator and planning role onshore, give us the capability to see onshore and offshore operation and planning in a common context.

# High-Voltage Direct Current (HVDC) Grid

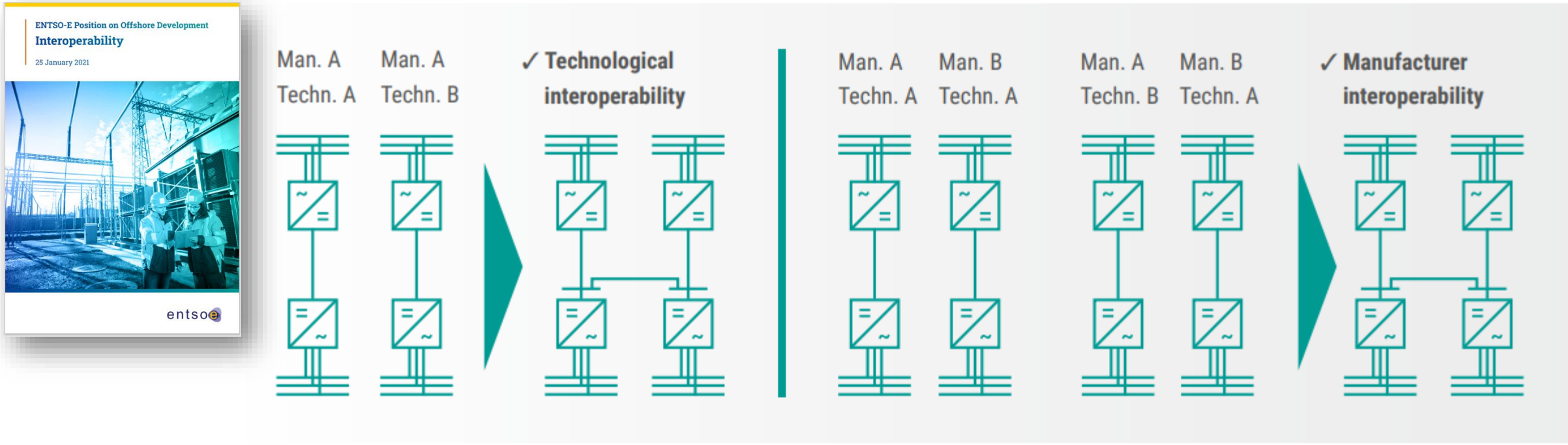
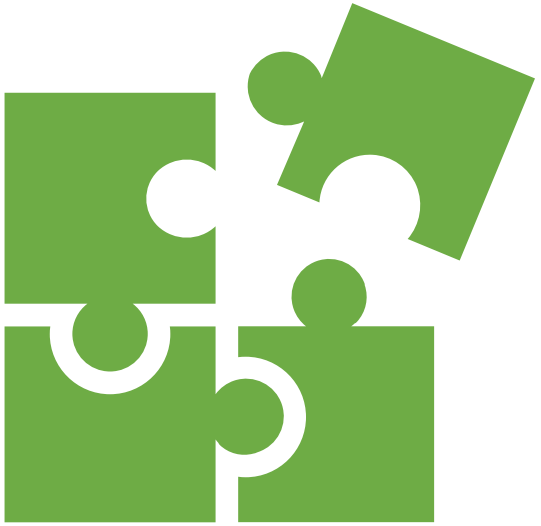



*Figure 3: Exemplary illustration of technological interoperability vs. manufacturer interoperability*

# Created model from the same reality

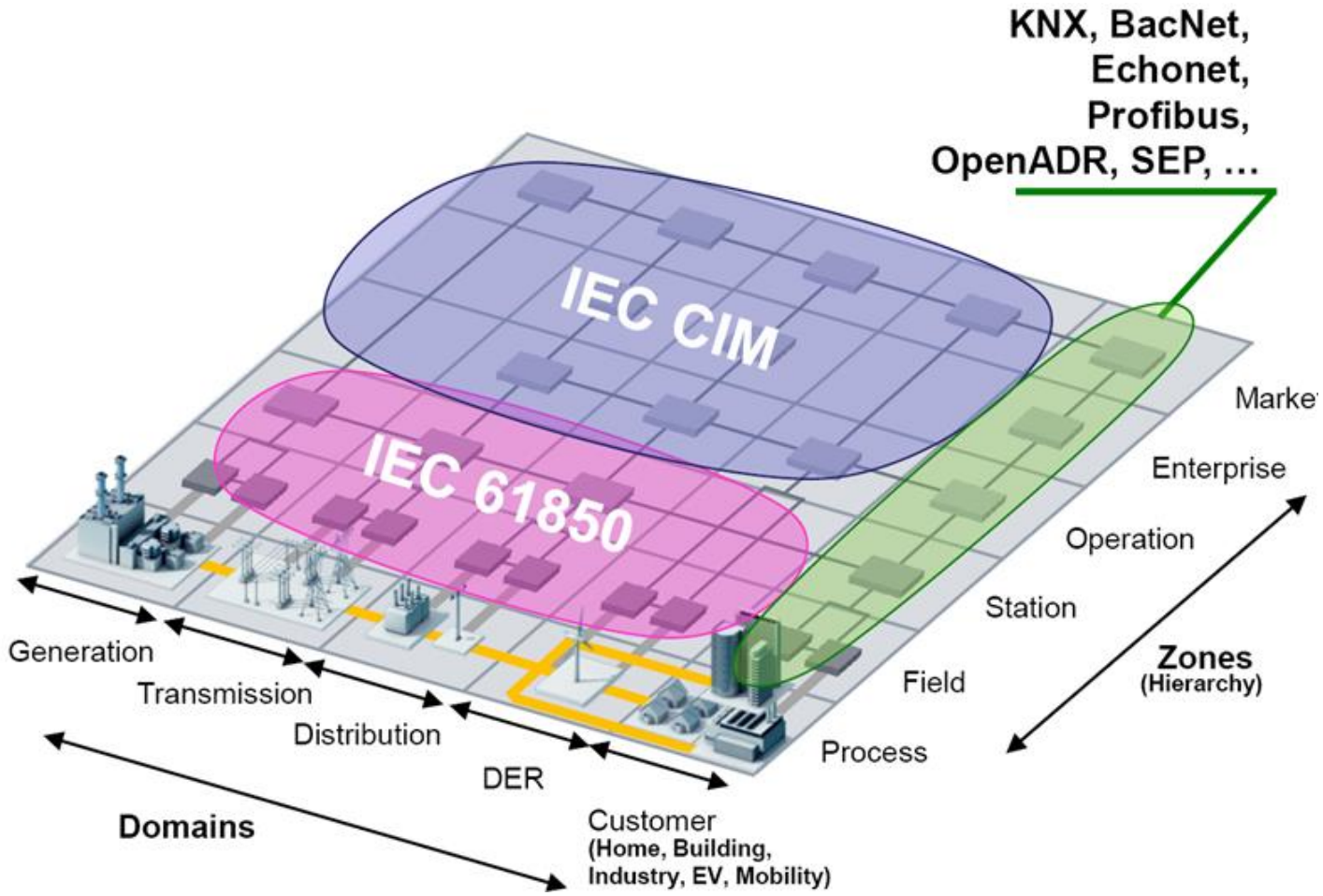
# IEC CIM



- IEC – International Electrotechnical Commission
- CIM – Common Information Model

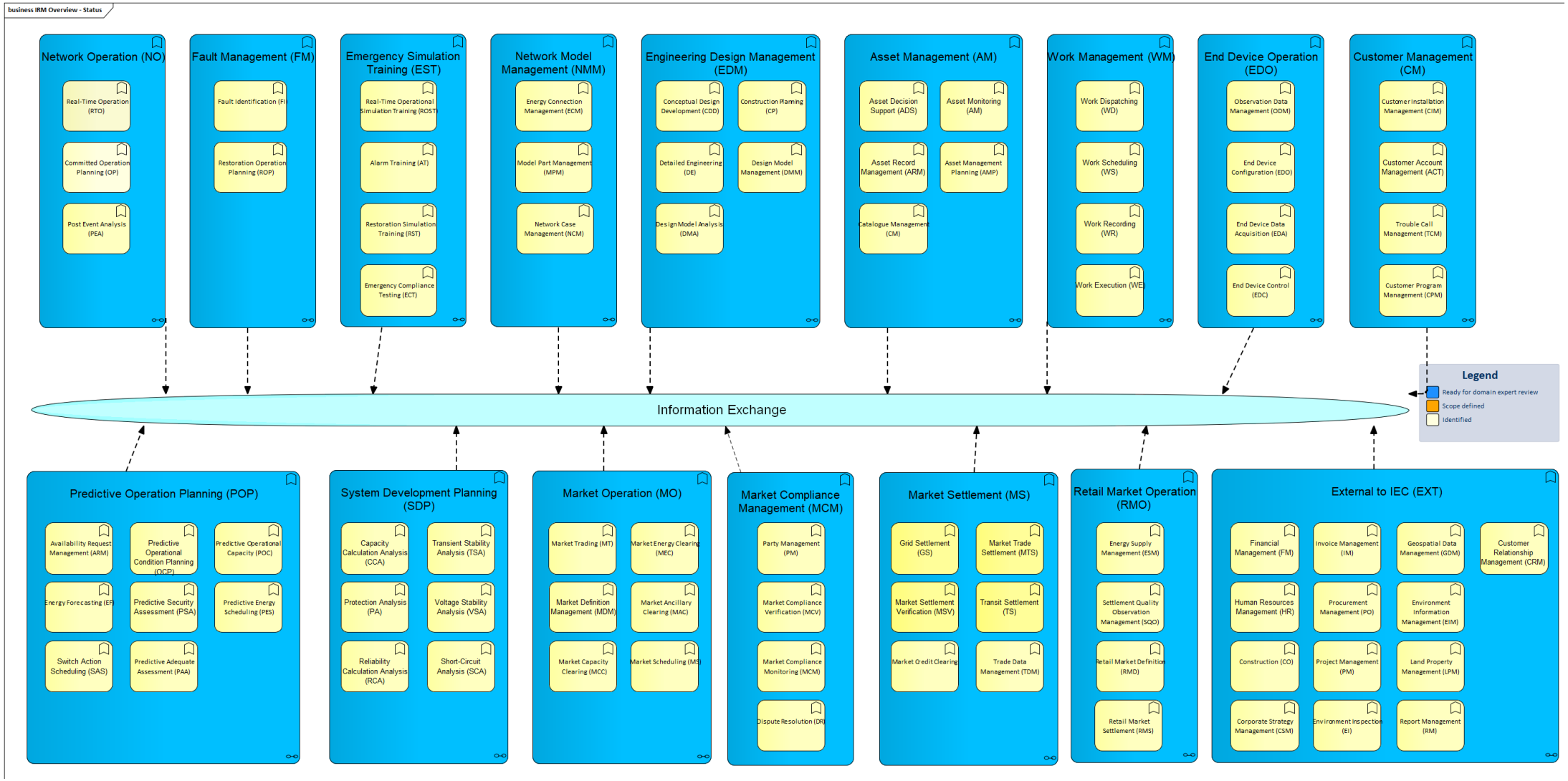
**Common Information Model (CIM)**
refers to the work and standards created by IEC TC57 in the 61970-, 61968- and 62325-series with the purpose of creating and sharing the use of a common canonical data model describing the electrical grid and relevant utility operations

# Coverage by semantic standards



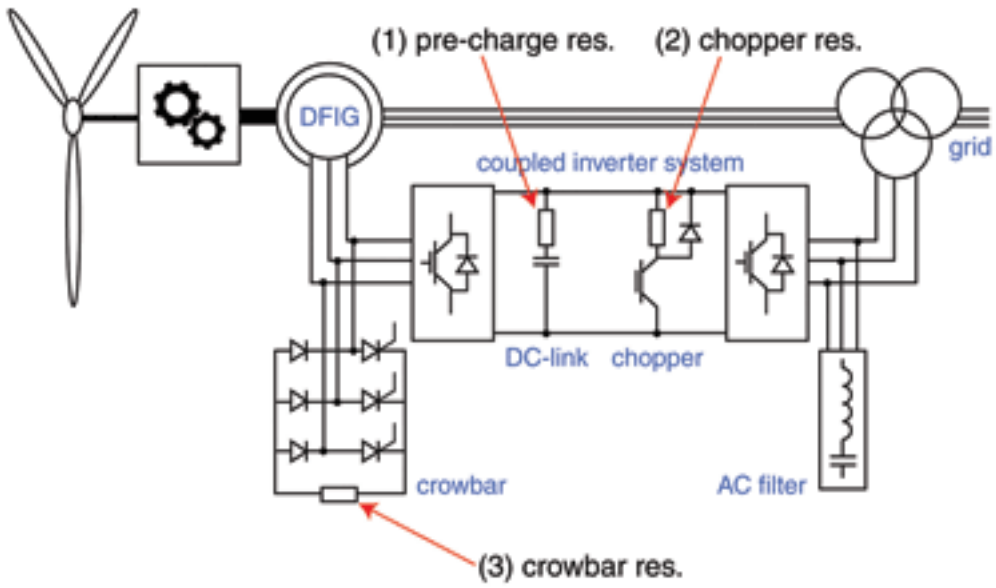
# IEC CIM Interface Reference Model (IRM) - Business Functions

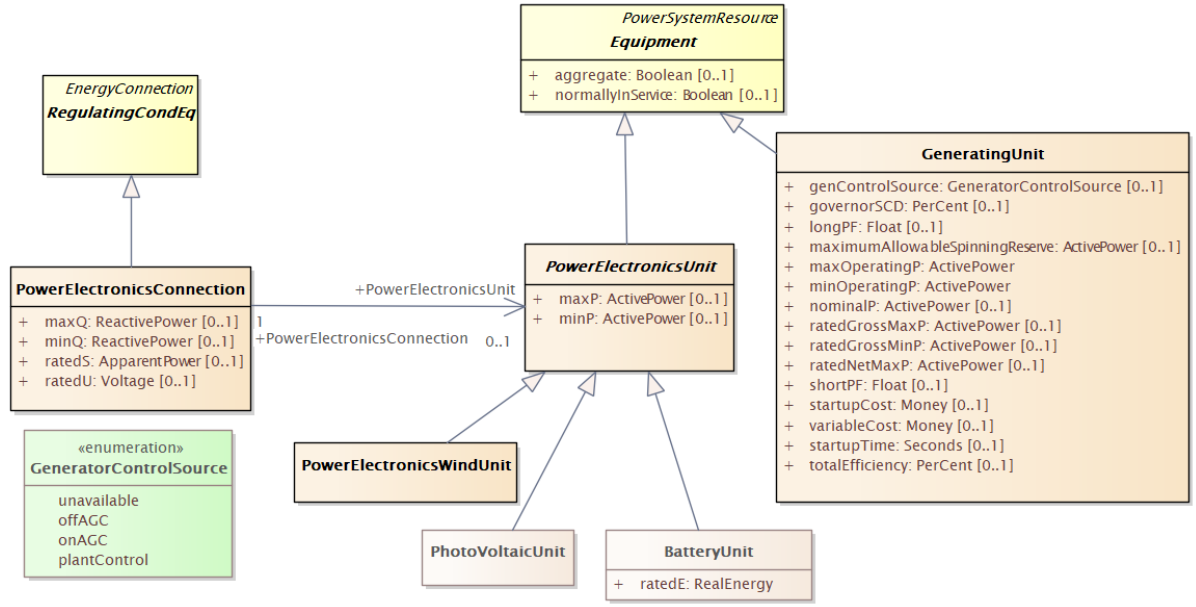
IEC 61968-1:2020



# UML description a Wind unit impact on the Power System

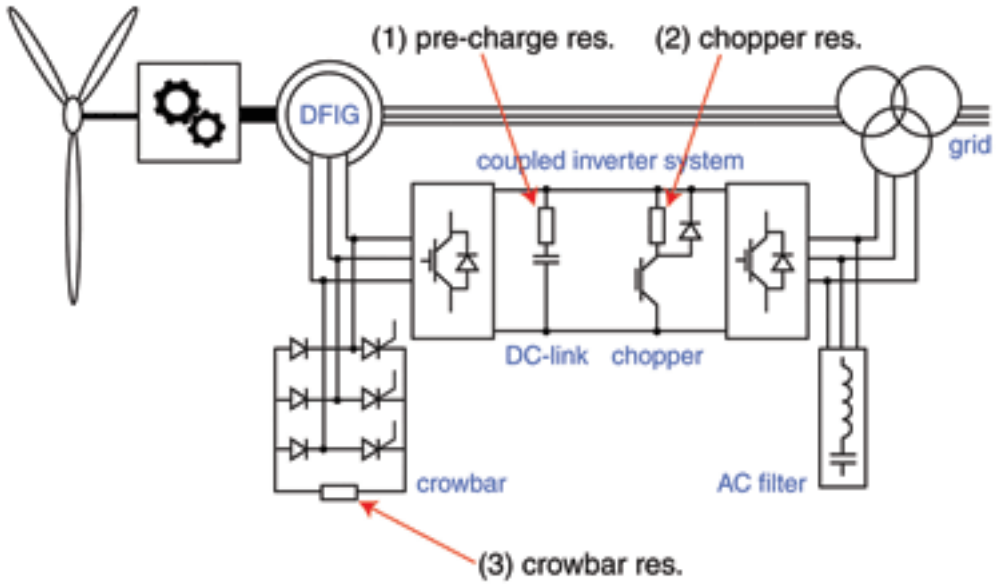
Figure 1



# UML description a Wind unit dynamic stability

Figure 1

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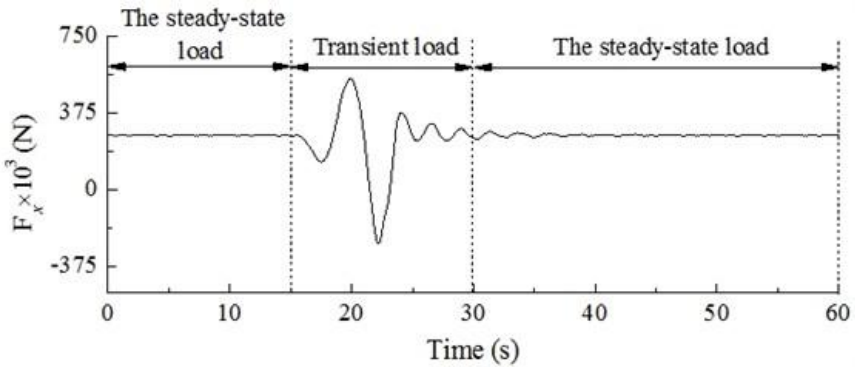


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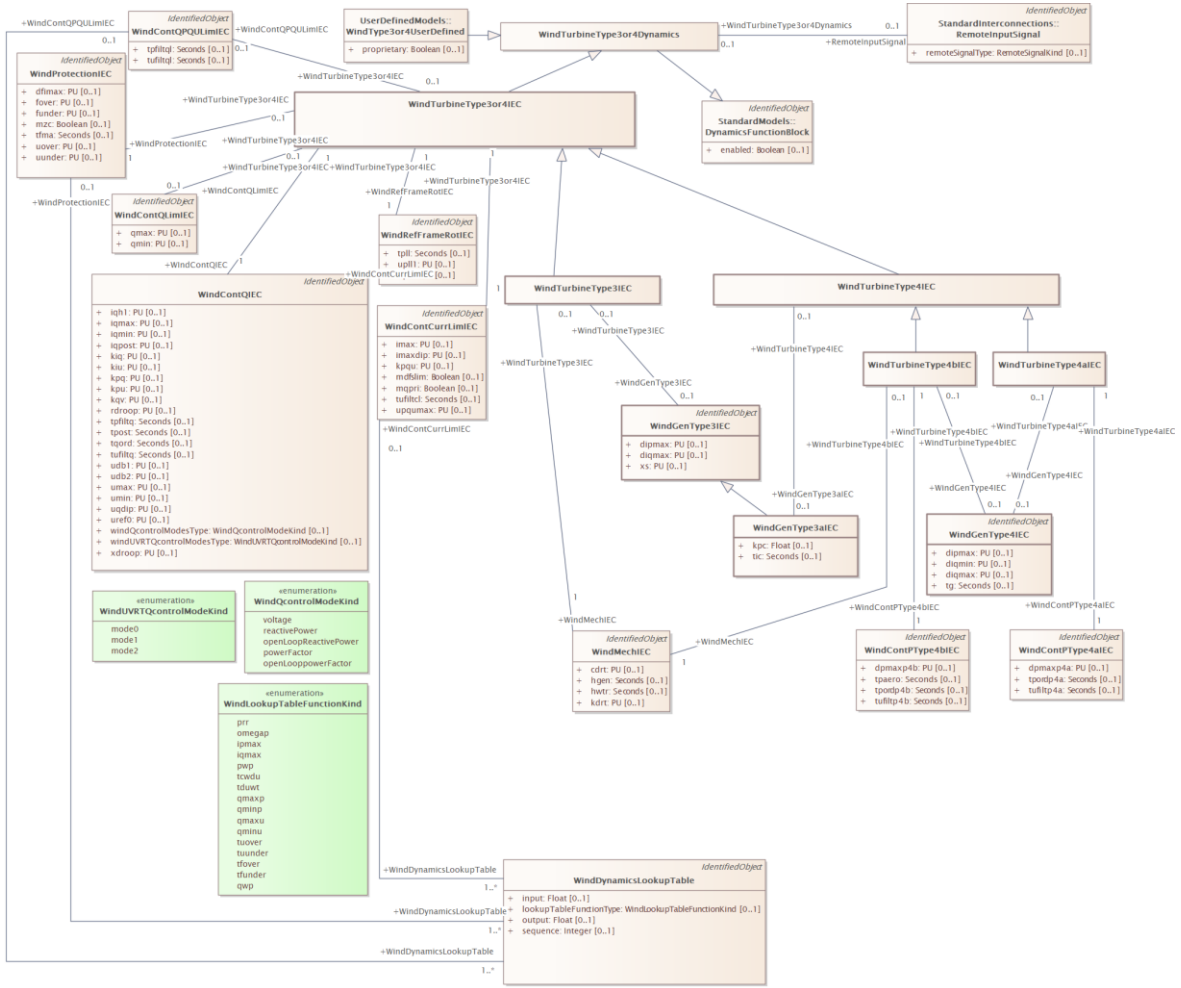
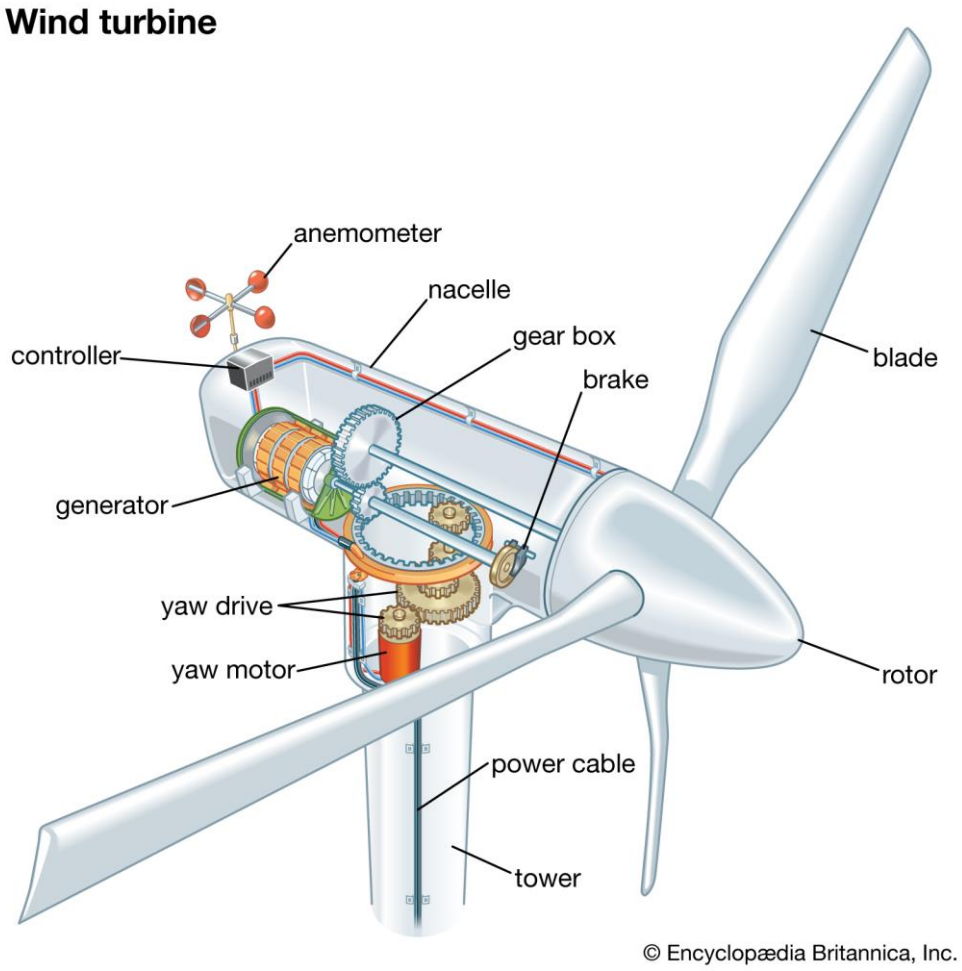
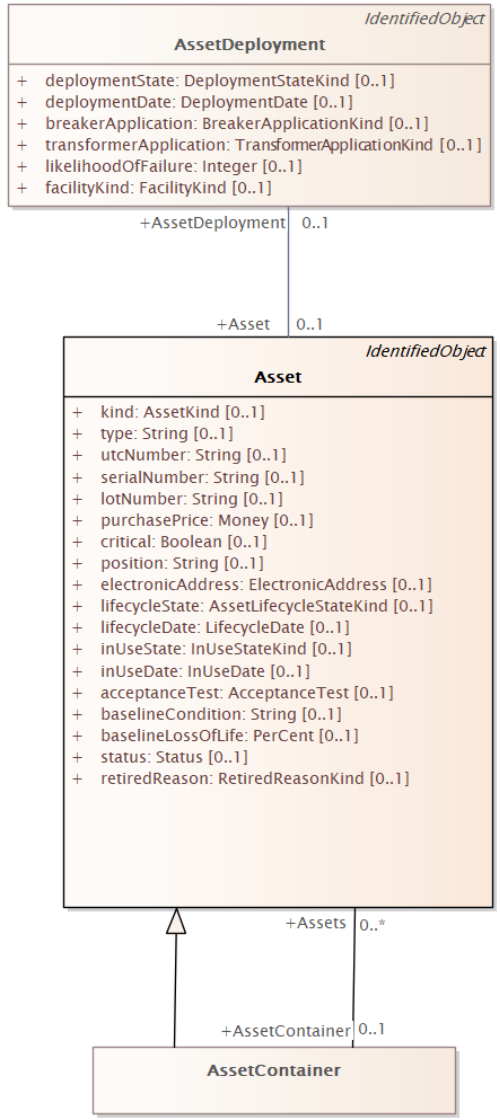
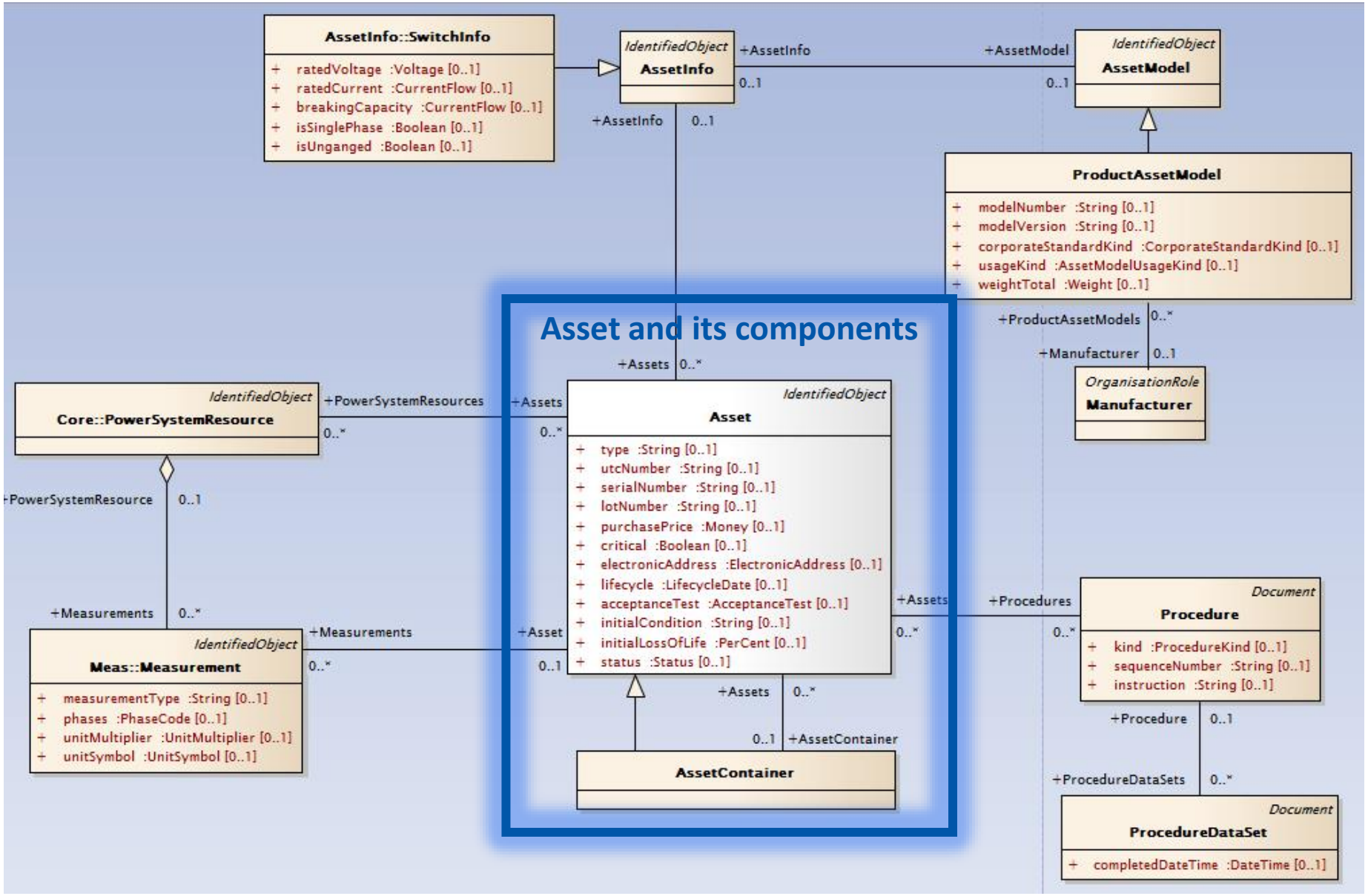


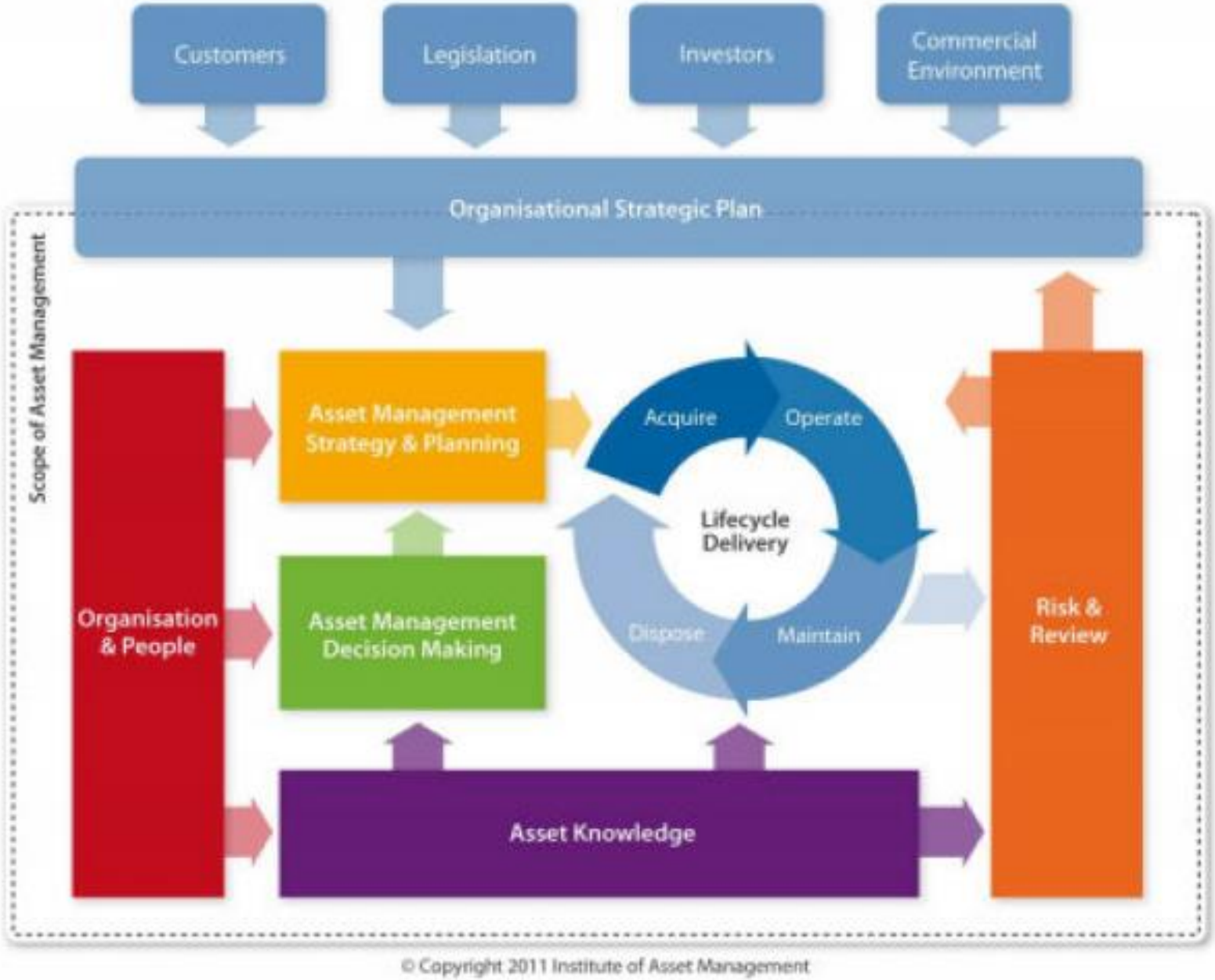
# UML description a Wind turbine



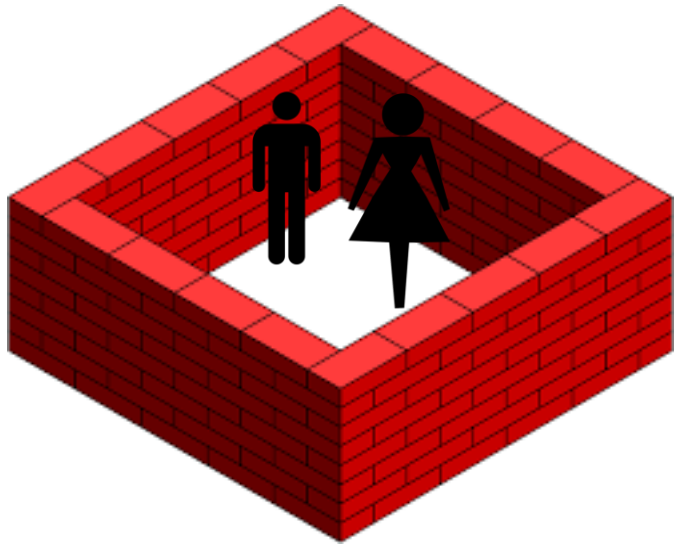
# CIM Support for Asset Health Information



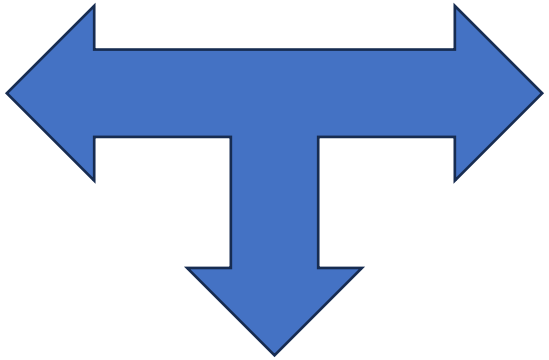




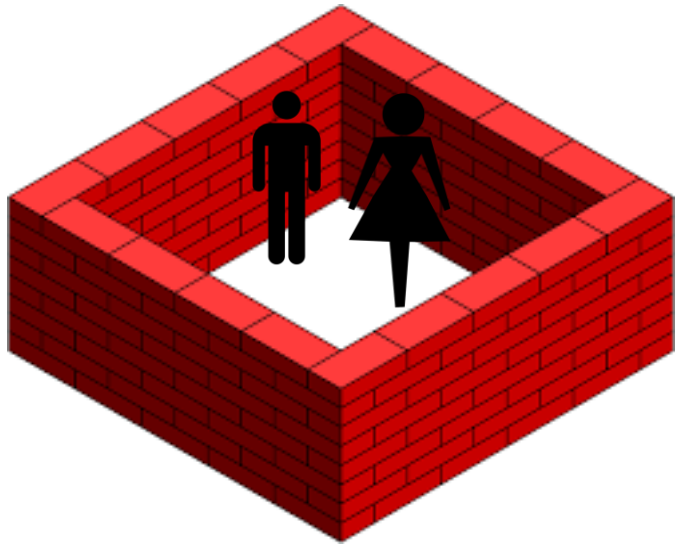
Manufacturing



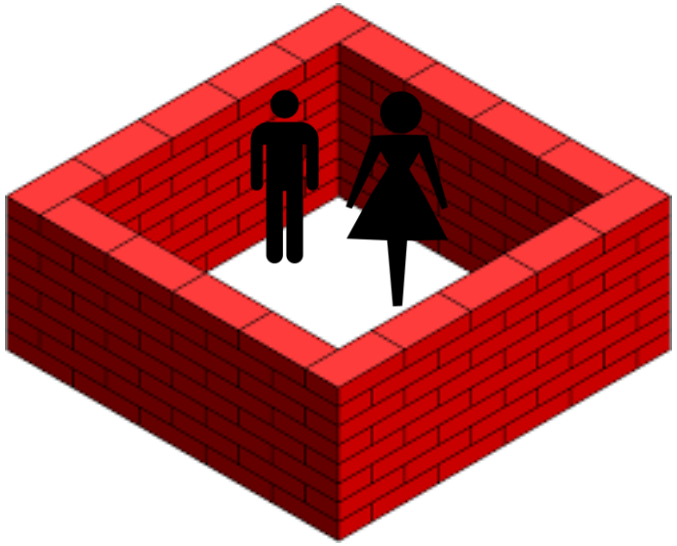
Industrial Data Ontology (IDO)



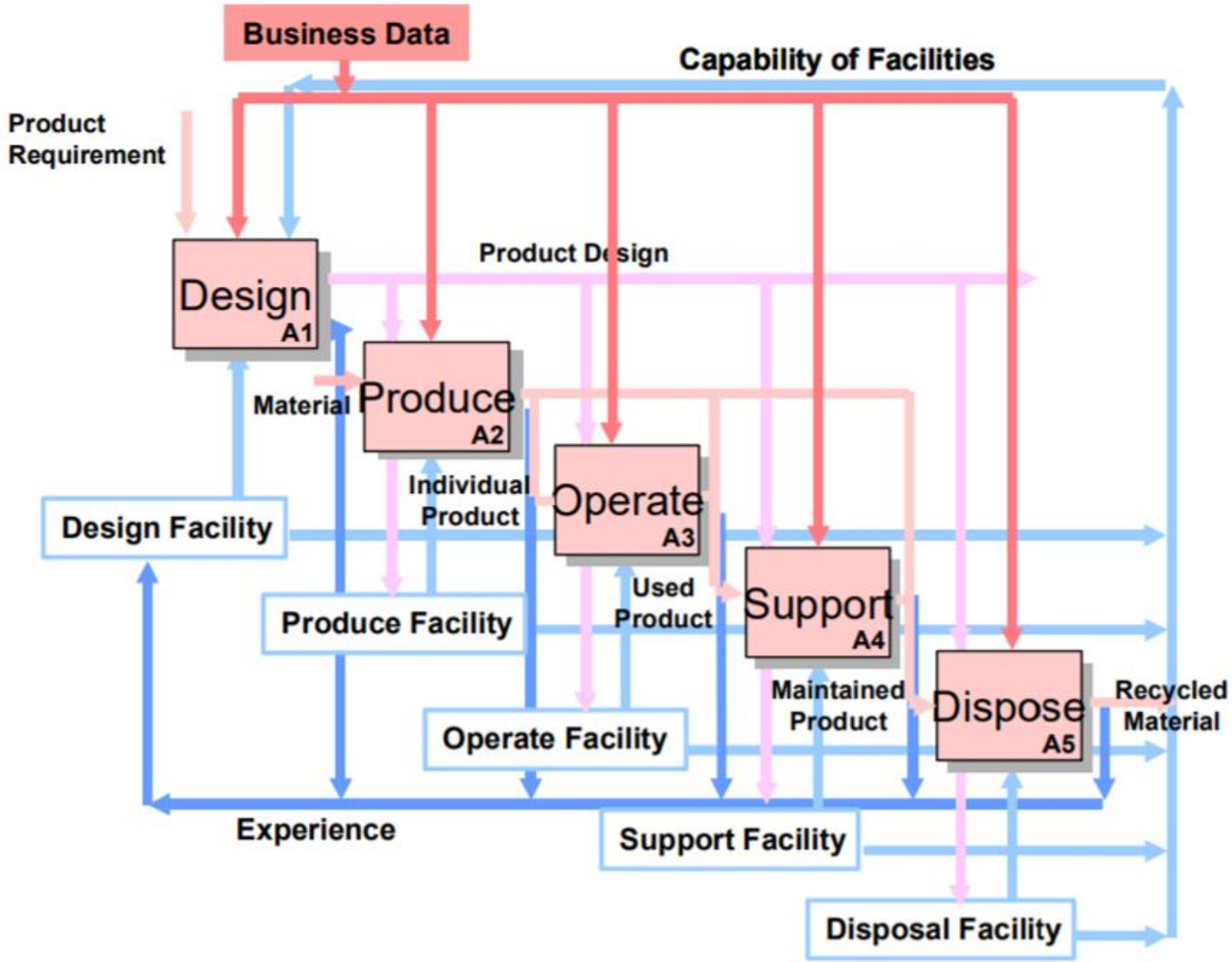
Operation



Engineering and Construction



# Life Cycle Activity Model



# IEC SRD 63417:ED1 Guide and Plan to Develop Smart Energy Ontologies

## What is a Systems Reference Deliverable?

Systems Reference Deliverable (SRD) is a deliverable produced by Systems Committees only. A SRD is a guidance document on the use and application of specific standards in the SyC domain. A SRD can be a normative document. SyCs may produce multiple SRDs that address, but are not limited to:

- Standards Mapping
- Roadmap(s)
- Databases
- Architectures
- Profiles
- Interfaces and transfer functions across domain
- Use Cases
- Domain Definition

# IEC SRD 63417:ED1

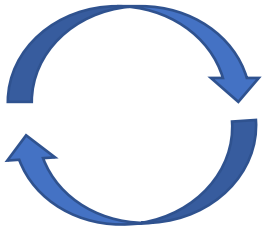
- 4.3 Languages used within ontology.
  - 4.3.1 General
  - 4.3.2 RDF/RDFS
  - 4.3.3 OWL/RDFS-Plus
  - 4.3.4 SHACL
  - 4.3.5 SPARQL
  - 4.3.1 XKOS
  - 4.3.2 SKOS-reference
  - 4.3.3 DCAT
  - 4.3.4 The Reified Requirements Ontology
  - 4.3.5 Schema.org
  - 4.3.6 Articulation of languages in semantic through the semantic web layer cake

# IEC SRD 63417:ED1

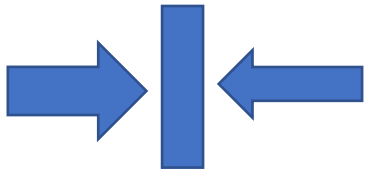
- 4.5 Relevant work on ontologies in cross-domains with Smart Energy
  - 4.5.1 LOV4IoT Energy Ontology catalog
  - 4.5.2 OpenADR
  - 4.5.3 QUDT
  - 4.5.4 GeoSPARQL
  - 4.5.5 W3C SSN
  - 4.5.6 The Organization Ontology
  - 4.5.7 BRIDGE

# Ontology Interoperability

Reuse



Align



Inspire

# Key take aways

- IEC Common Information Model (CIM) is the planning, operational, product/datasheet and maintenance model for the power system.
- Investigating if IEC CIM can fit into Industrial Data Ontology (IDO) and be the industry standard for power systems.
- Align or inspired by Asset Information Modelling Framework (IMF) to have interoperability on product/datasheet and maintenance model.
- To achieve interoperability, we need to reuse relevant vocabulary and ontologies like QUDT and GeoSPARQL.