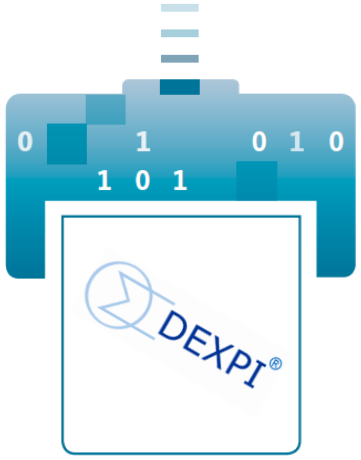
DEXPI Submodel for Asset Administration Shell

Next step in Industry 4.0 for process industry

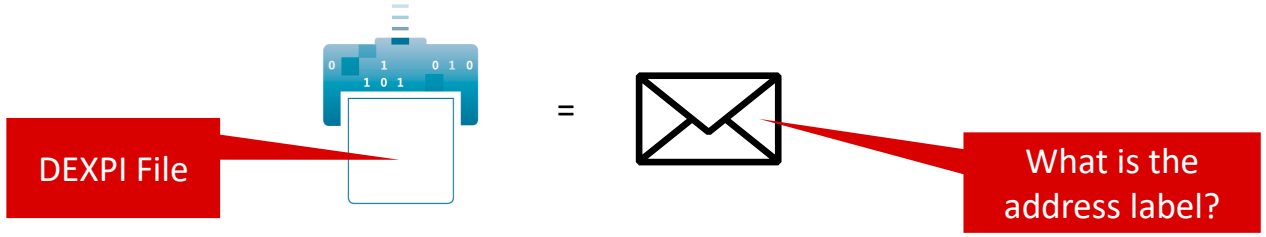
IDTA Submodel Working Group



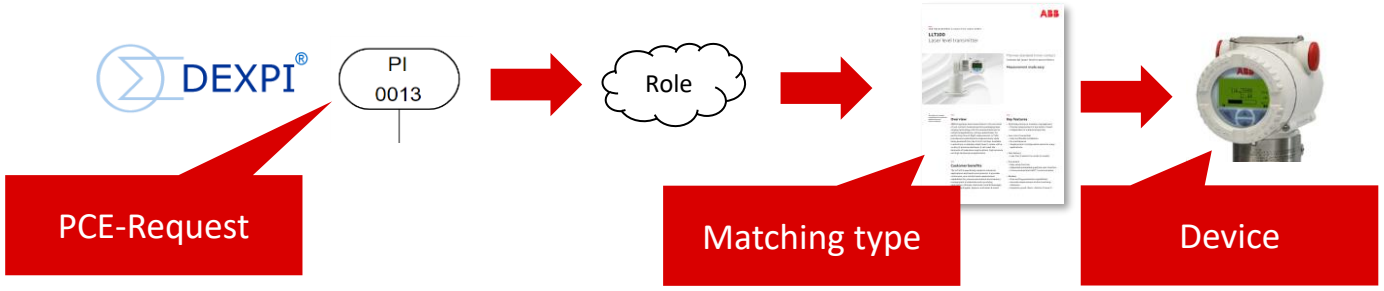
- Kick-off: 3.3.2022
- Connection to DEXPI WGs: Wilhelm Otten
- Group members: ABB, Equinor, Aibel, Oslo University, Magdeburg University, FESTO

Two initial use cases:

– Handover of DEXPI P&I Diagrams. Challenge: how to specify “P&ID” Identity



– Using P&I Diagrams for specifying Roles and Requirements in Asset Lifecycle



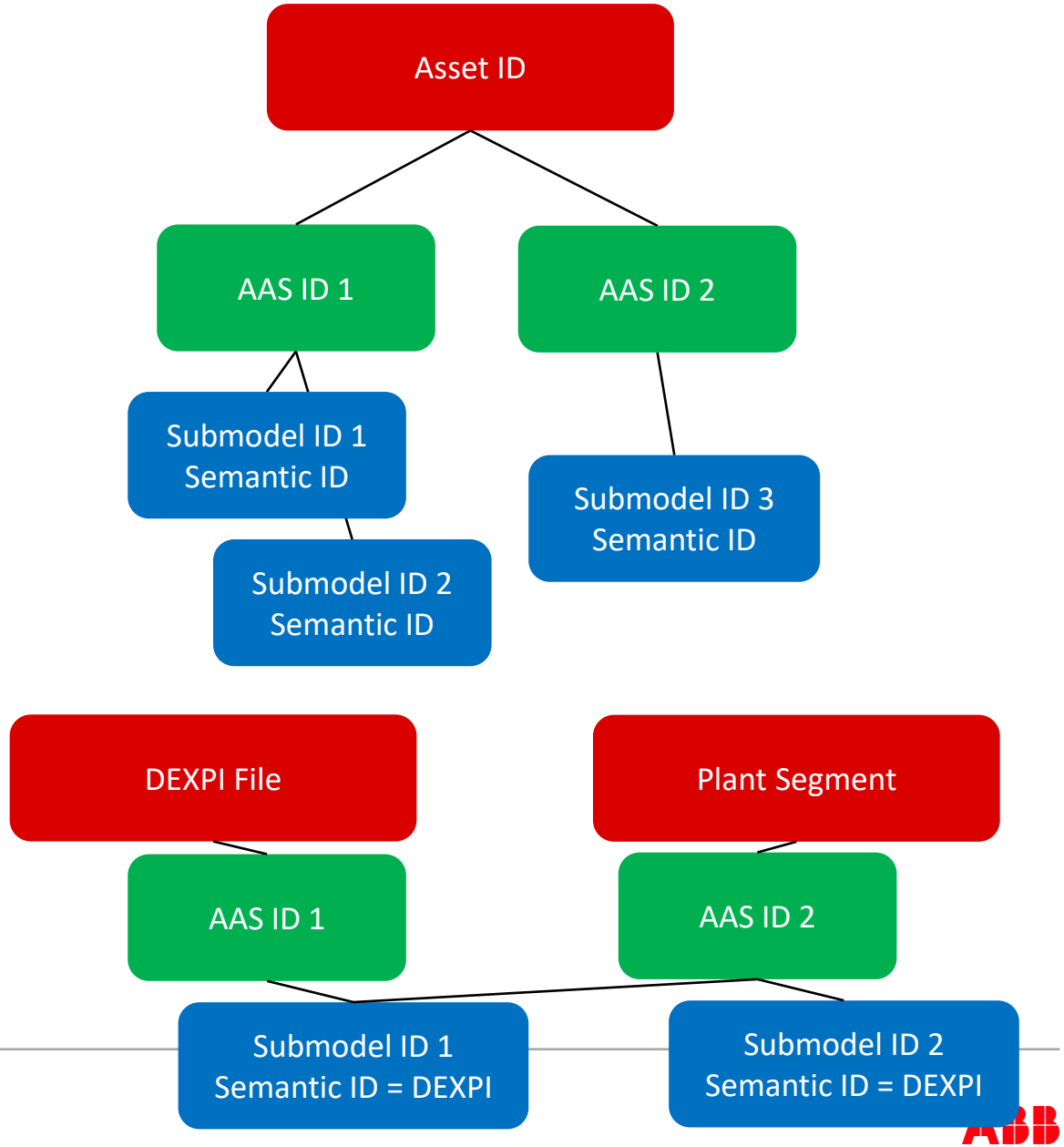
Meeting 06.07.2022

- UC 1 updates
- UC 2 discussion

Problems and discussions observed

Multiple use-cases where it is not clear what the AAS asset is (plant segment or P&ID itself)

- We cannot answer this question since we define a “submodel” without its context (AAS/Asset)
- Still, we could accommodate both use-cases by defining meaning of “empty” values in the DEXPI meta data like “empty” site name means it is a re-usable template



Workflow for Use Case 1

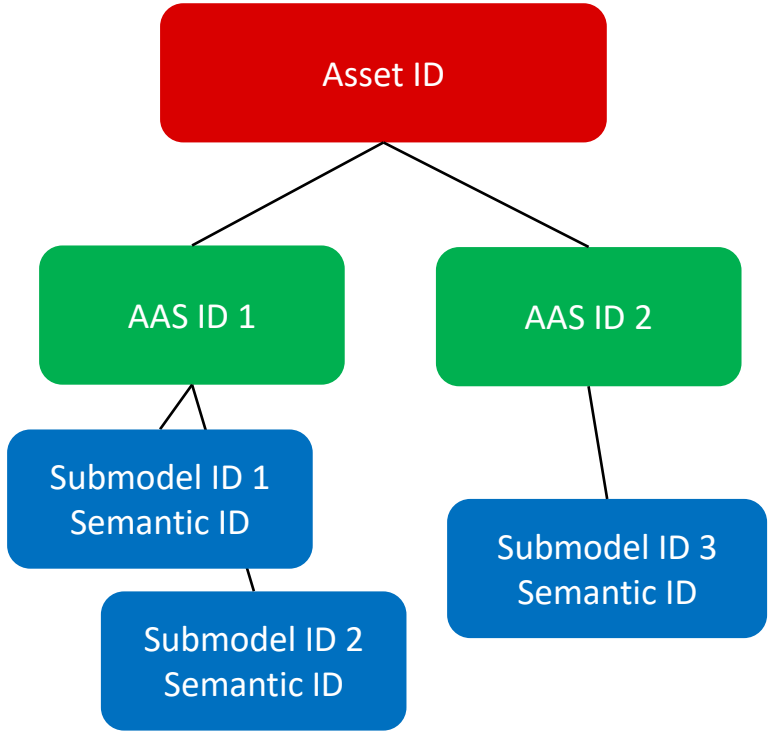
Greenfield

1. Operator
- Operator creates an internal “plant structure” within of the project = “contract”
- Operator creates an AAS for plant segment -> Asset ID + content of ISA-95 structure as specified in DEXPI meta-model
  - DEXPI meta-model part for the submodel is filled out
    - Plant name
    - …

2. Transmit this AAS to the engineering contractor

3. Engineering contractor
- Out of the received AAS, an empty DEXPI created containing consistent meta-data
- Contractor adds “content” into the DEXPI file and packs it into SM which are consistent with the received information
  - Here some “template DEXPI” can be used, here some references are needed
- Contactor is free to create an own AAS (with an own ID), but we assume that Asset ID of the plant segment is contained

4. AAS is sent back to operator
  - Asset ID match, also identification submodel matches



Towards a consistent list of identification properties

EnterpriseIdentificationCode :
EnterpriseName :

SiteIdentificationCode :
SiteName :

IndustrialComplexIdentificationCode :
IndustrialComplexName :

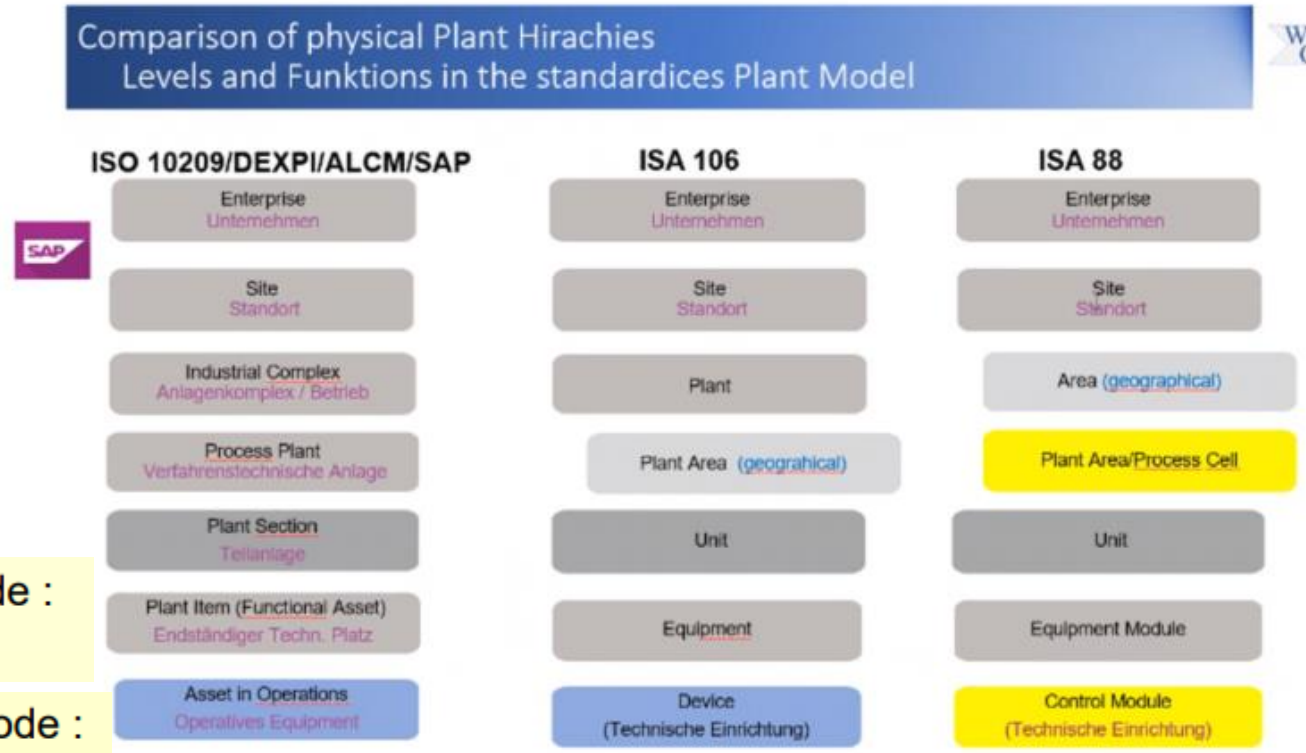
ProcessPlantIdentificationCode :
ProcessPlantName :

PlantAreaIdentificationCode :
PlantAreaName :

ProcessCellIdentificationCode :
ProcessCellName :

PlantSectionIdentificationCode :
PlantSectionName :

UnitIdentificationCode :
UnitName :

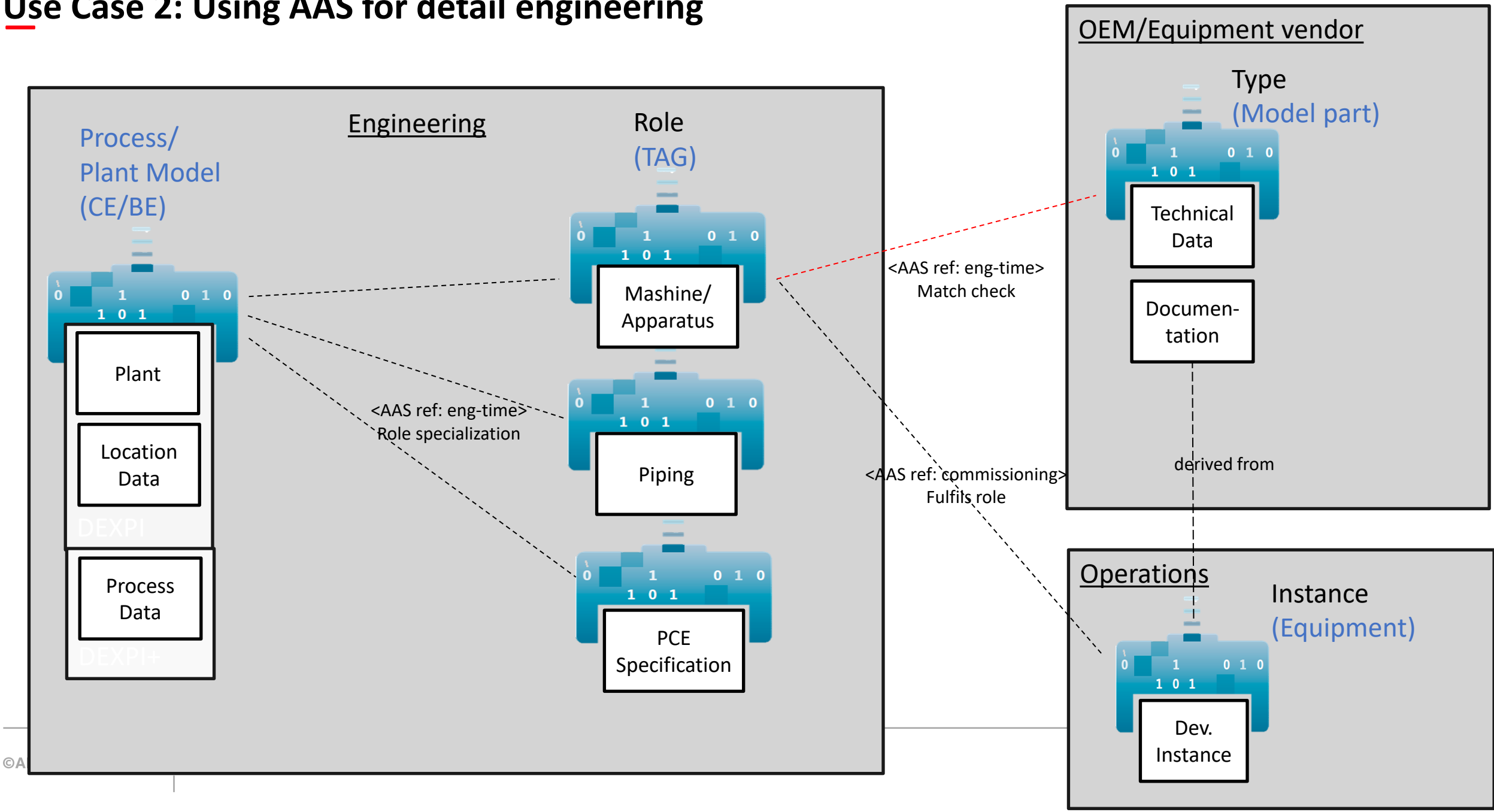


Plant system?

Plant train?

Use Case 2

Use Case 2: Using AAS for detail engineering



Use Case 2: Using AAS for detail engineering

Engineering

CAE System
(Process/Plant Model)

Plant

Location Data

DEXPI

Process Data

DEXPI+

Submodel: PCE Requests (part of DEXPI submodel)

PCE Req - ID

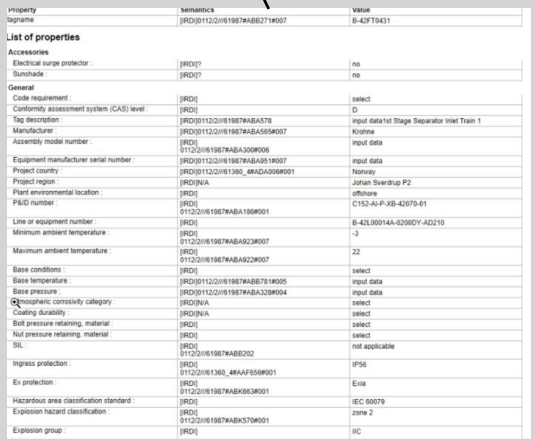
NE159

From Simulation, lab, …

Role
(TAG)

PCE Specification

<AAS ref: eng-time>
Role specialization



<AAS ref: eng-time>
Match check

<AAS ref: commissioning>
Fulfils role

OEM/Equipment vendor

Type
(Model part)

Technical Data

Documen-tation

derived from

Operations

Instance
(Equipment)

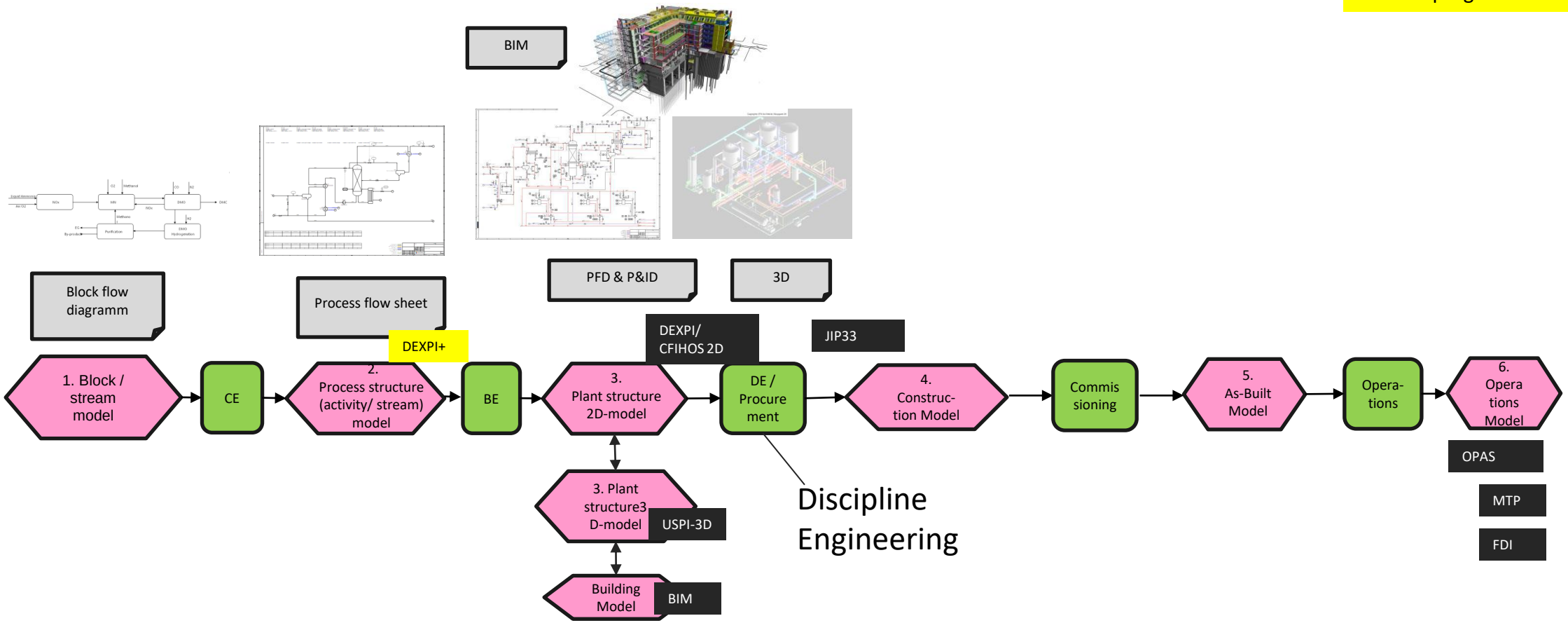
Dev. Instance

Back-up

Integrated Engineering
Process and Data Management

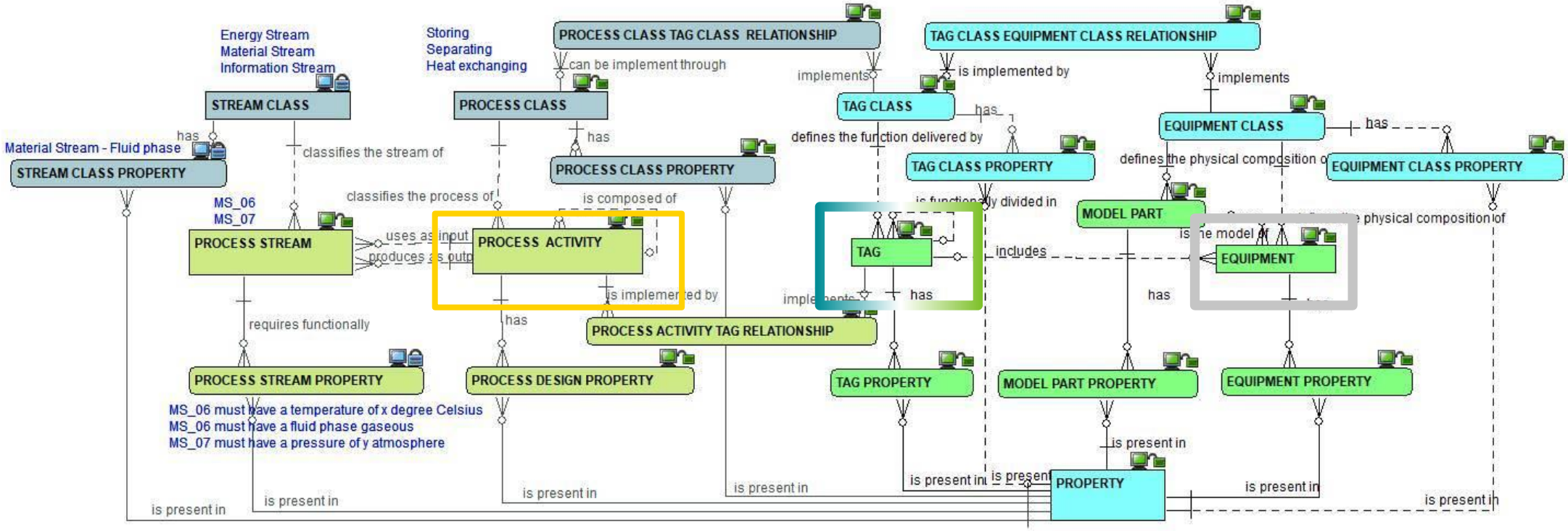
Asset Life Cycle

Work in progress



One integrated data model/base and CAE-landscape using this common data model/base

„Lifecycle“ in CFIHOS (Entwurf)

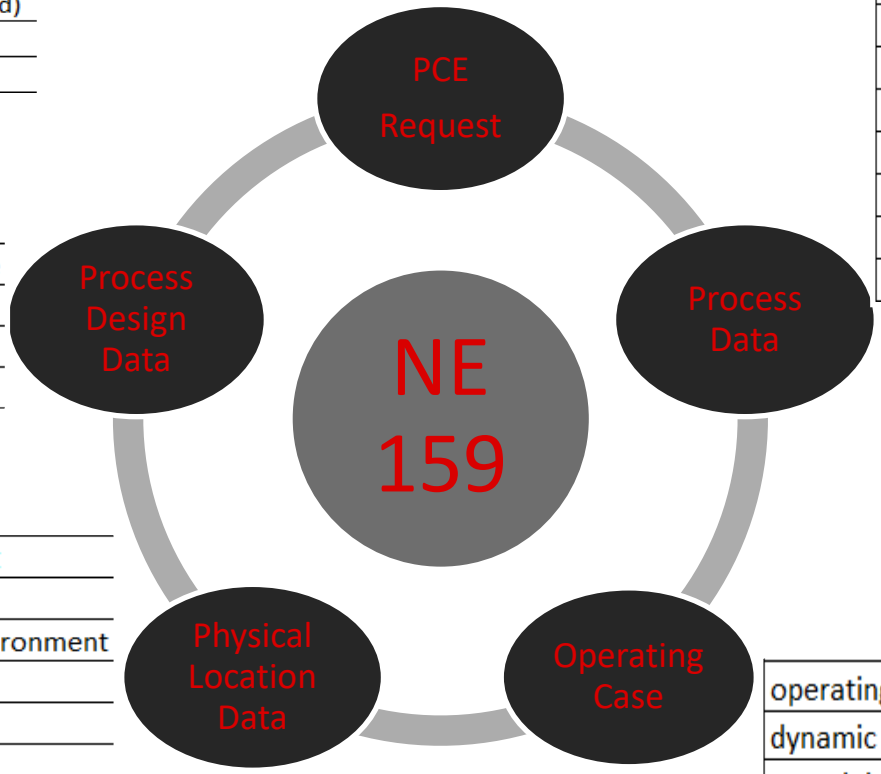


NE159 – Process design data

PCE Request
PCERequest Name
PCE category
PCE functions
function location (central, panel, field)
PCELoopName
R&I diagram number

Process Design Data
maximum required measured value
minimum required measured value
measured value usually required

Process Data
negative environmental conditions
identification of process material
Minimum actual density in process
Maximum actual density in process
Minimum dynamic viscosity in process
Maximum dynamic viscosity in process
Gas mass fraction at inlet
Liquid mass fraction at inlet
Solids mass fraction at inlet
Vapor mass fraction at inlet

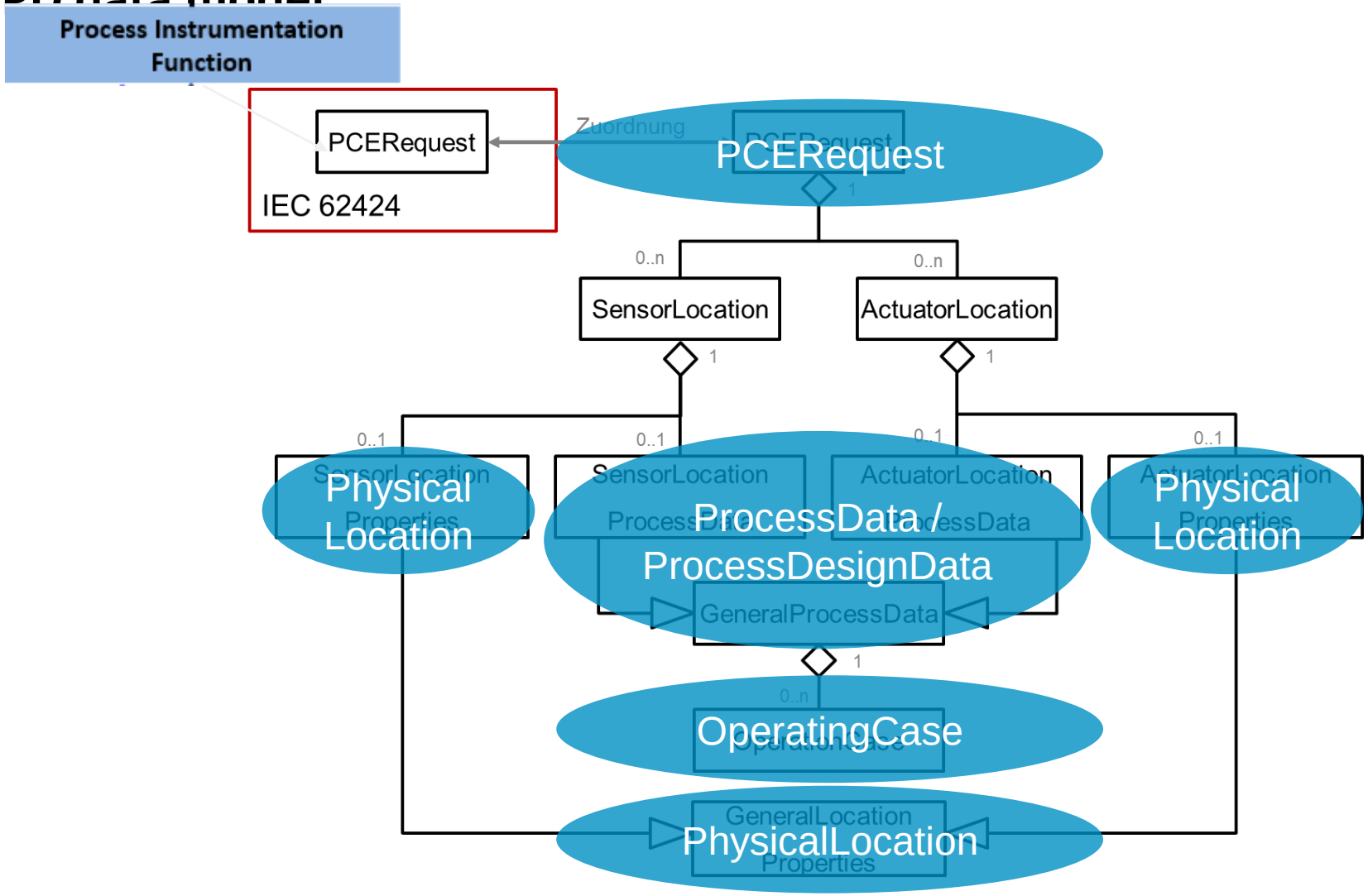


Process Design Data
maximum allowable gauge pressure
minimum allowable gauge pressure
maximum allowable temperature
minimum allowable temperature

Physical Location Data
gas explosion group in environment
gas explosion zone in environment
explosion temperature class in environment
method of insulation
thickness of insulation
R&I diagram number
pipe nominal size
pipe nominal rating
pipe class specification
identifier of pipe

Operating Case
operating case: mass flow rate
dynamic viscosity at an operation case
actual density at an operation case
temperature at an operation case
possible absolute pressure at device inlet
pressure drop at upper range-limit of flow rate

NE 159 – PD data model



NE 159 – Implementation

Requirements on PD data model

- CAE-system-independent and not bound to a specific file format
- Project-specific extensions possible

Application of PD data model

- Implementation of PD data model in CAE systems for Process Design and PCT Hardware Planning
- Development of IT-supported methods to consolidate the data