DEXPI® Data Exchange in the Process Industry

IDO Training - 20260421

Life cycle for IDO – Aligned requirements- fPVN results

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DEXPI® Data Exchange in the Process Industry

Agenda

- fPVN WP 3 – the task
- Life cycle approaches
- Pump life cycle story as example
- fPVN WP 3 results - Modelling with IDO
- Conclusion

fPVN

flexible Production Value Network

WP 3 – the task

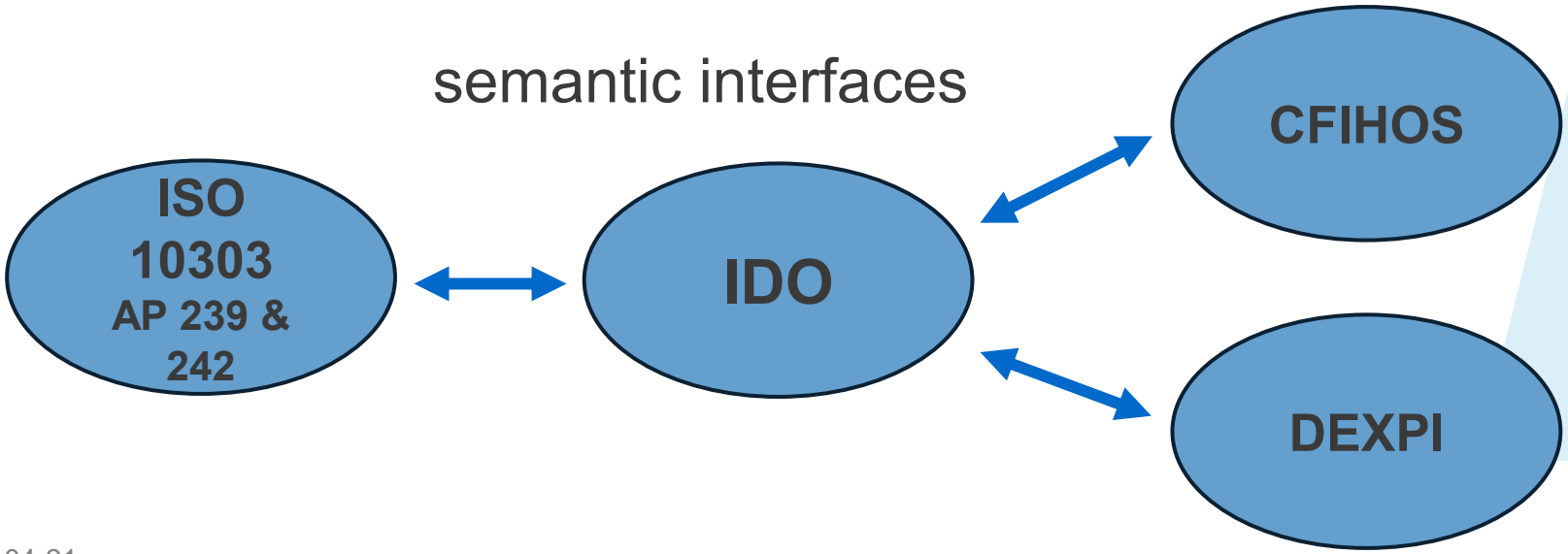
Arrowhead fPVN Project

- 43 partners from 3 European countries participate.
- Coordinated by Luleå University of Technology (Sweden).
- Funded under EU research and innovation programs.
- Project runs from June 2023 to August 2026.

Arrowhead fPVN Project - WP 3

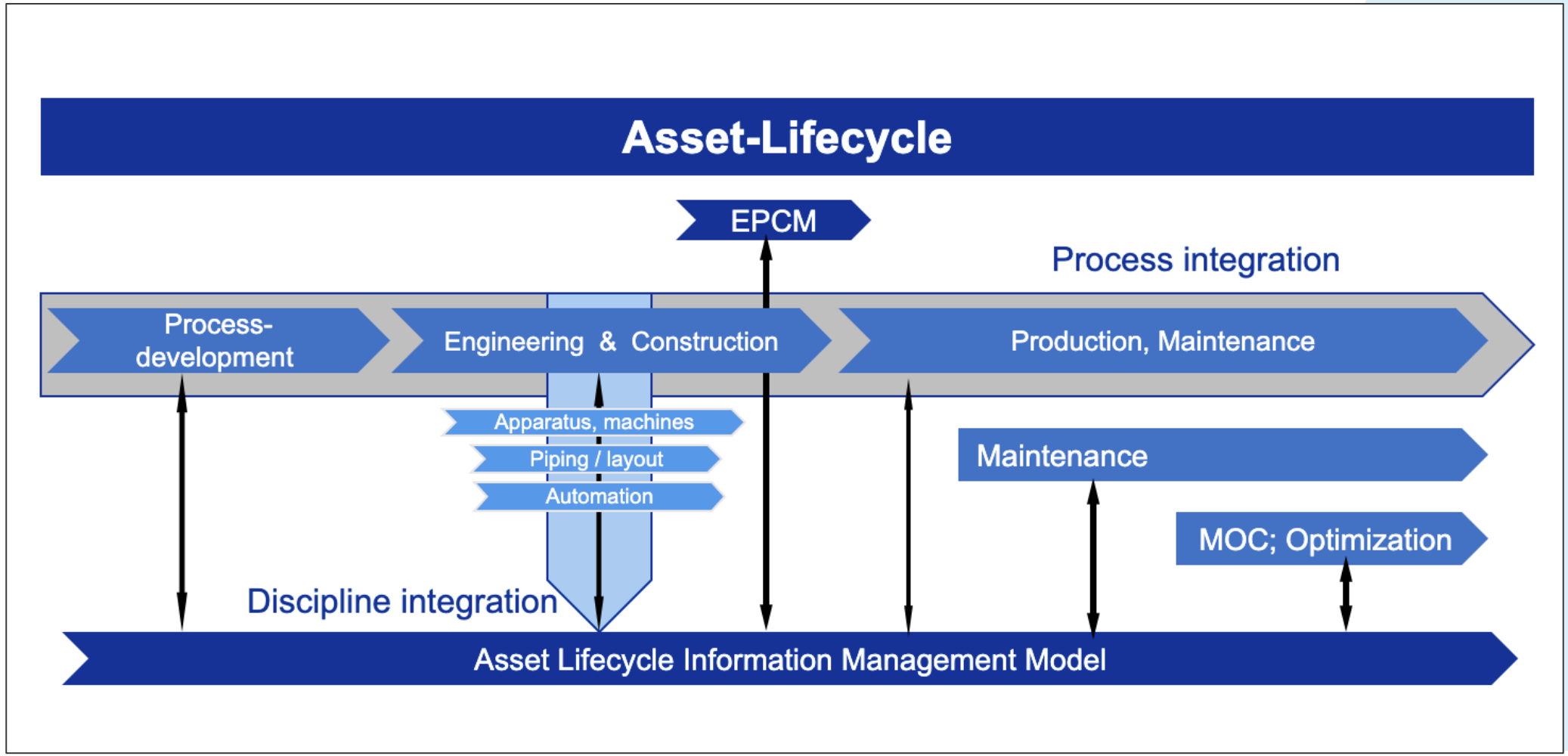
WP3 — Major Industrial Data Models

- **Purpose:** Define and select a set of *major standardized data models* that the project will support and work with.
- **Activities:**
  - Survey industrial data model languages.
  - Provide guidelines and tooling support for use cases.
  - Analyse differences and relationships between models.
- **Outcome:** A major industrial data model landscape and guidelines for use case alignment.

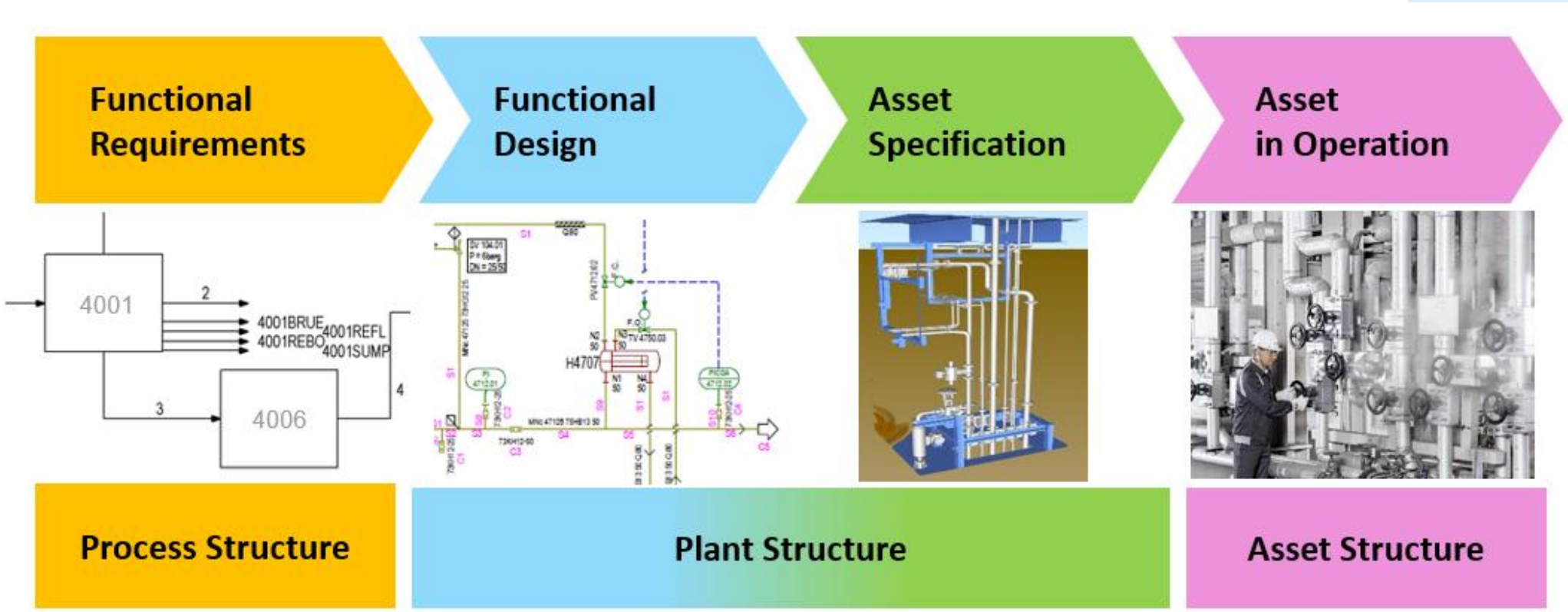


Life cycle approaches

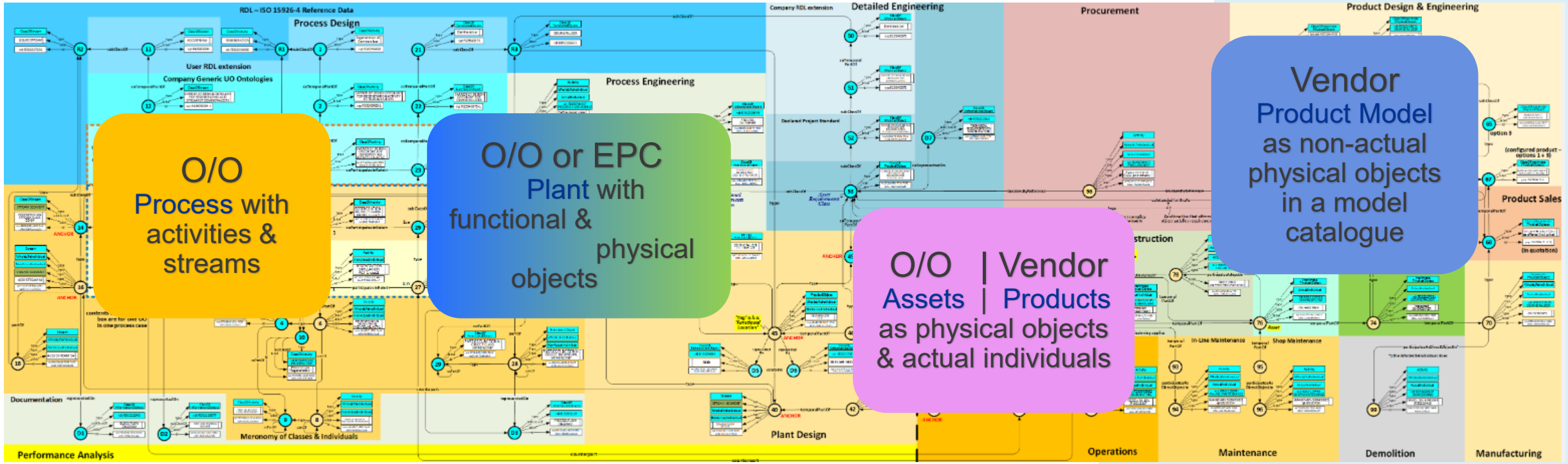
Integrated Asset Lifecycle Information Management (simplified)- Process Industry



Plant life cycle concept ENPRO / DEXPI



Life cycle approach for the Process Industry - ISO 15926



Pumping as an activity

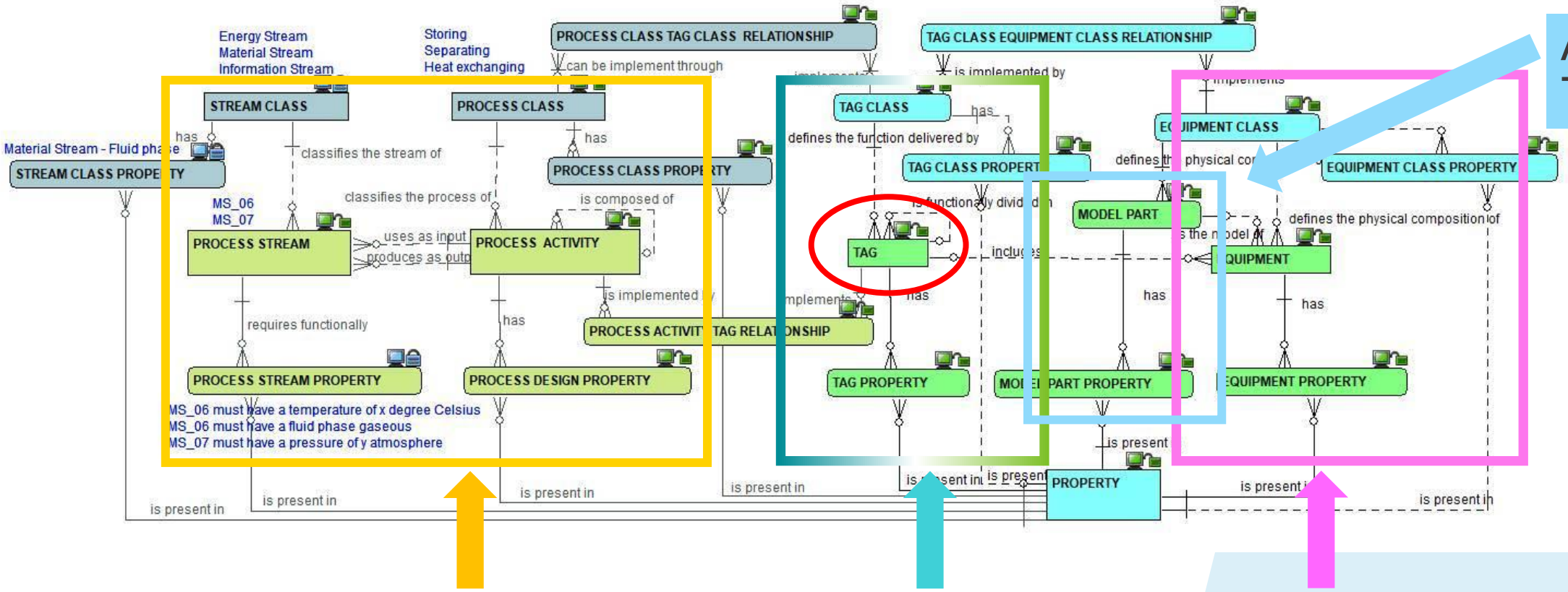
a Pump and a Centrifugal Pump as specified objects

Centrifugal Pump in the physical plant

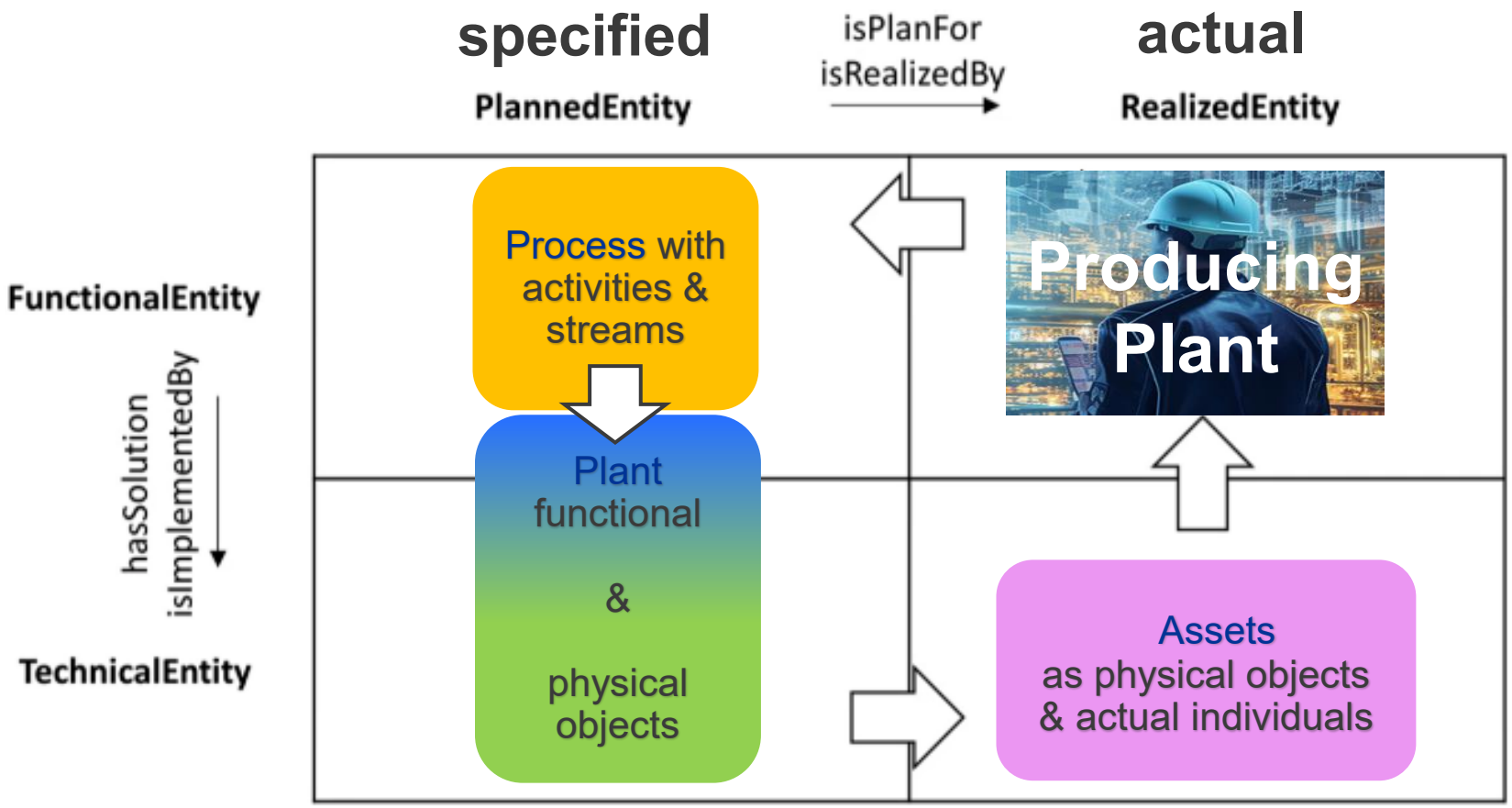
Centrifugal Pump(s) offered by devices vendors

Life cycle approach: CFIHOS

CFIHOS
Capital Facilities Information HandOver Specification



Life cycle approach: BIM and Process Industry



Life cycle approach: Process Industry

Life cycle approaches of

- ISO 15926
- CFIHOS
- DEXPI
- BIM

are quite aligned

DEXPI

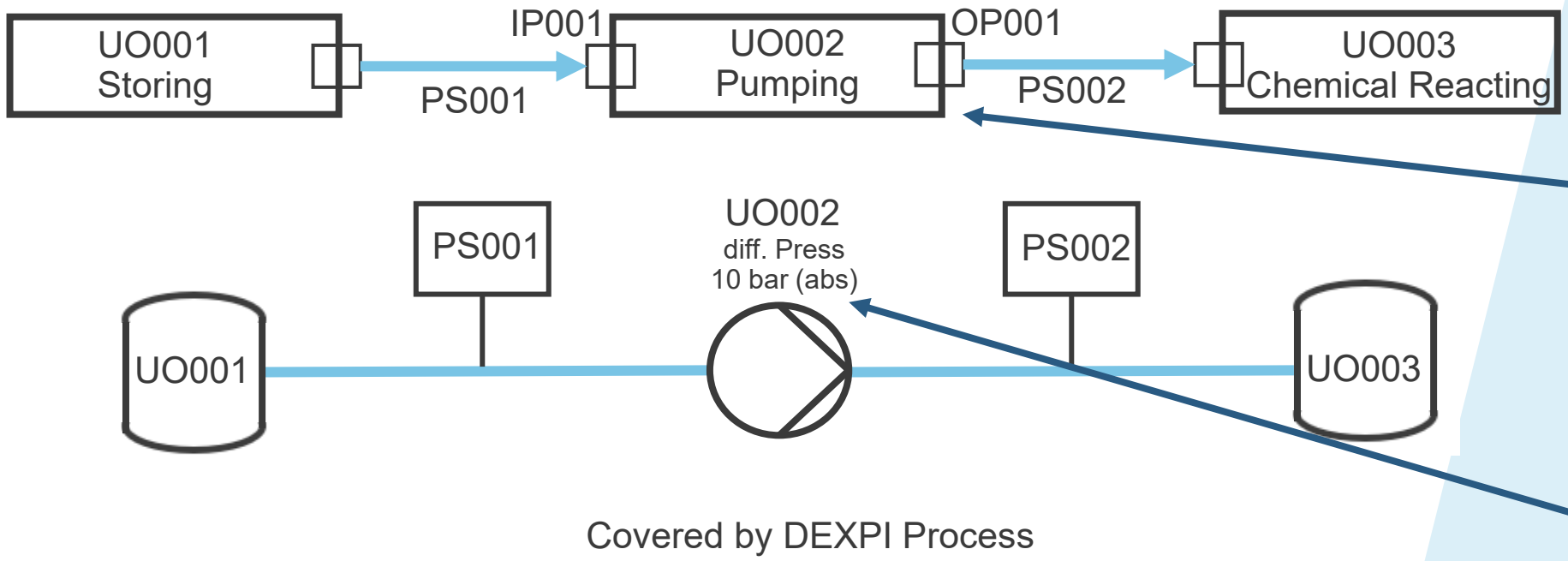
Pump life cycle story as example

Pump life cycle story

Process

Process

Process PR001 with the Process Step PST01:



Process break down structure

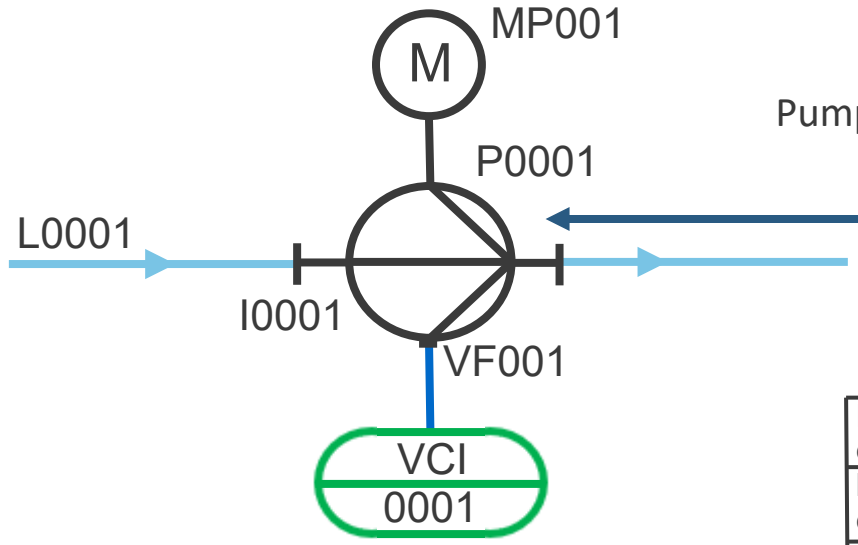
Process objects and their components

Properties with their values

Pump life cycle story

Plant

Process Plant | Process Plant PP001 with Plant Section SE001



Pump P0001

Pressure difference	13,5	bar	abs
lower limit design Press	- 0,2	bar	gauge
upper limit design Press	30	bar	gauge

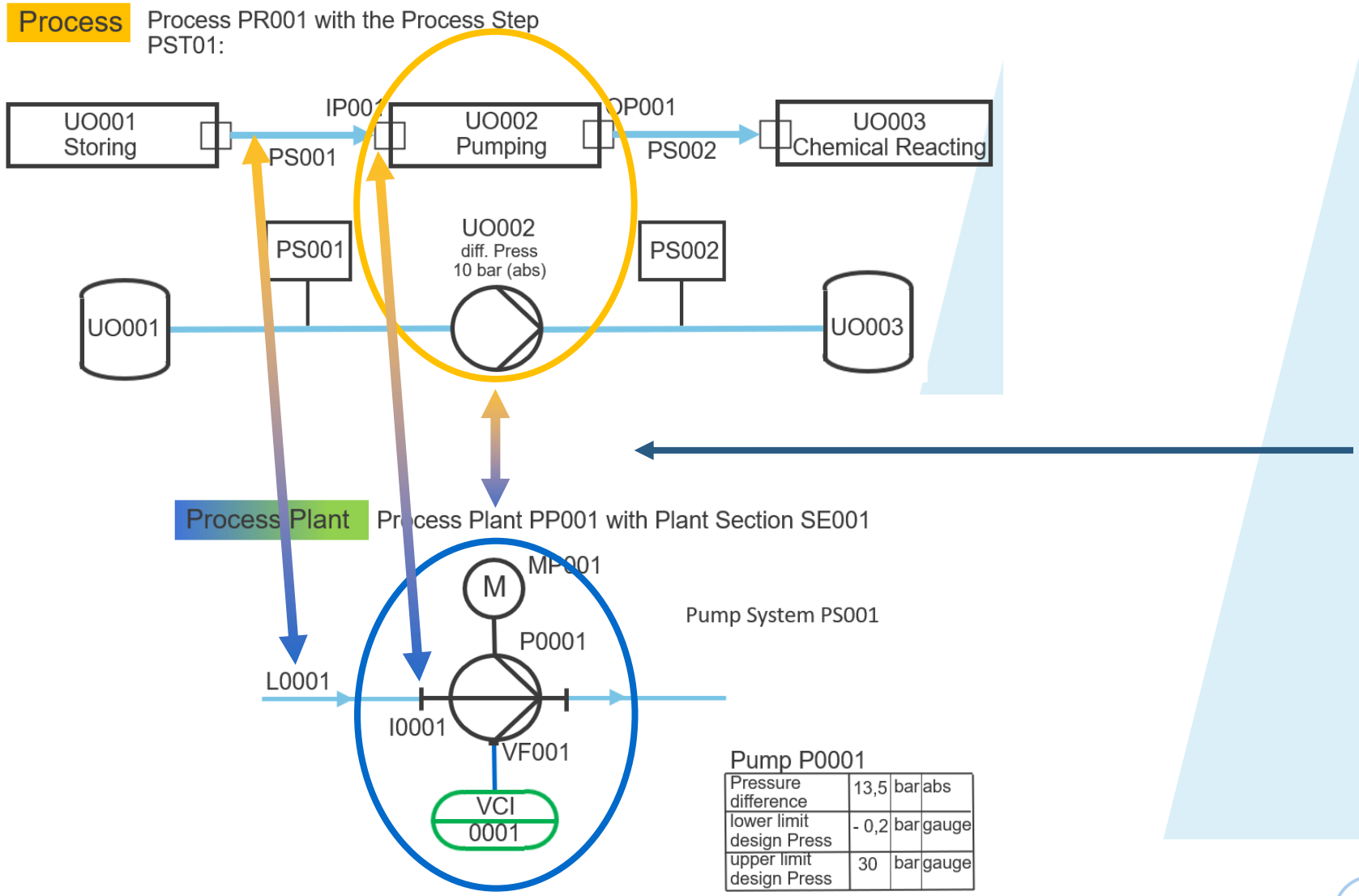
Covered by DEXPI Plant

Plant break down structure

Plant objects and their components

Properties with their values

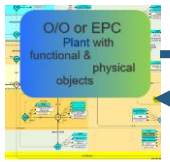
DEXPI Process and DEXPI Plant to IDO



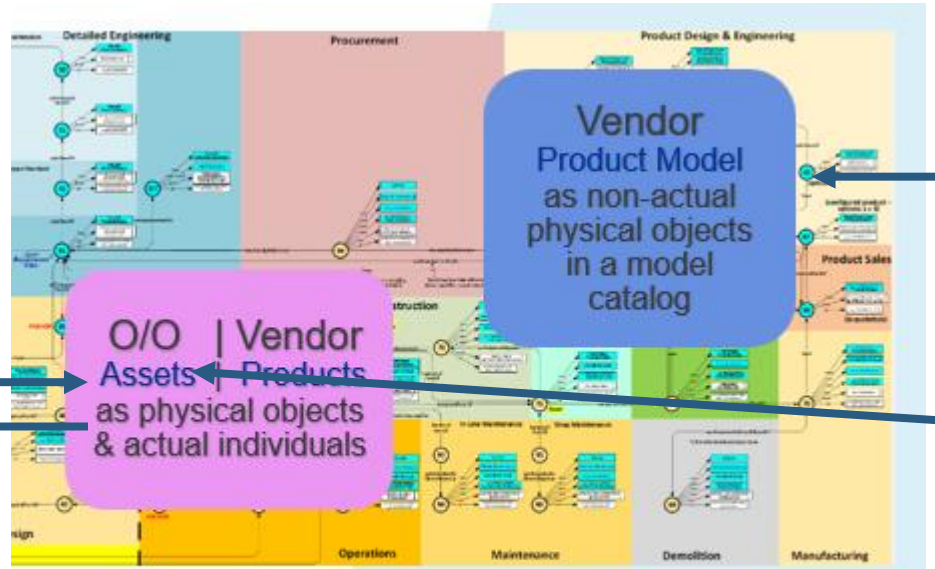
Relations between process objects and plant objects

Beyond DEXPI Process and DEXPI Plant

Relations between asset and plant objects



a Pump and a Centrifugal Pump as specified objects



Centrifugal Pump in the physical plant

Centrifugal Pump(s) offered by devices vendors

Objects as product models and instances

Assets Objects

fPVN WP 3

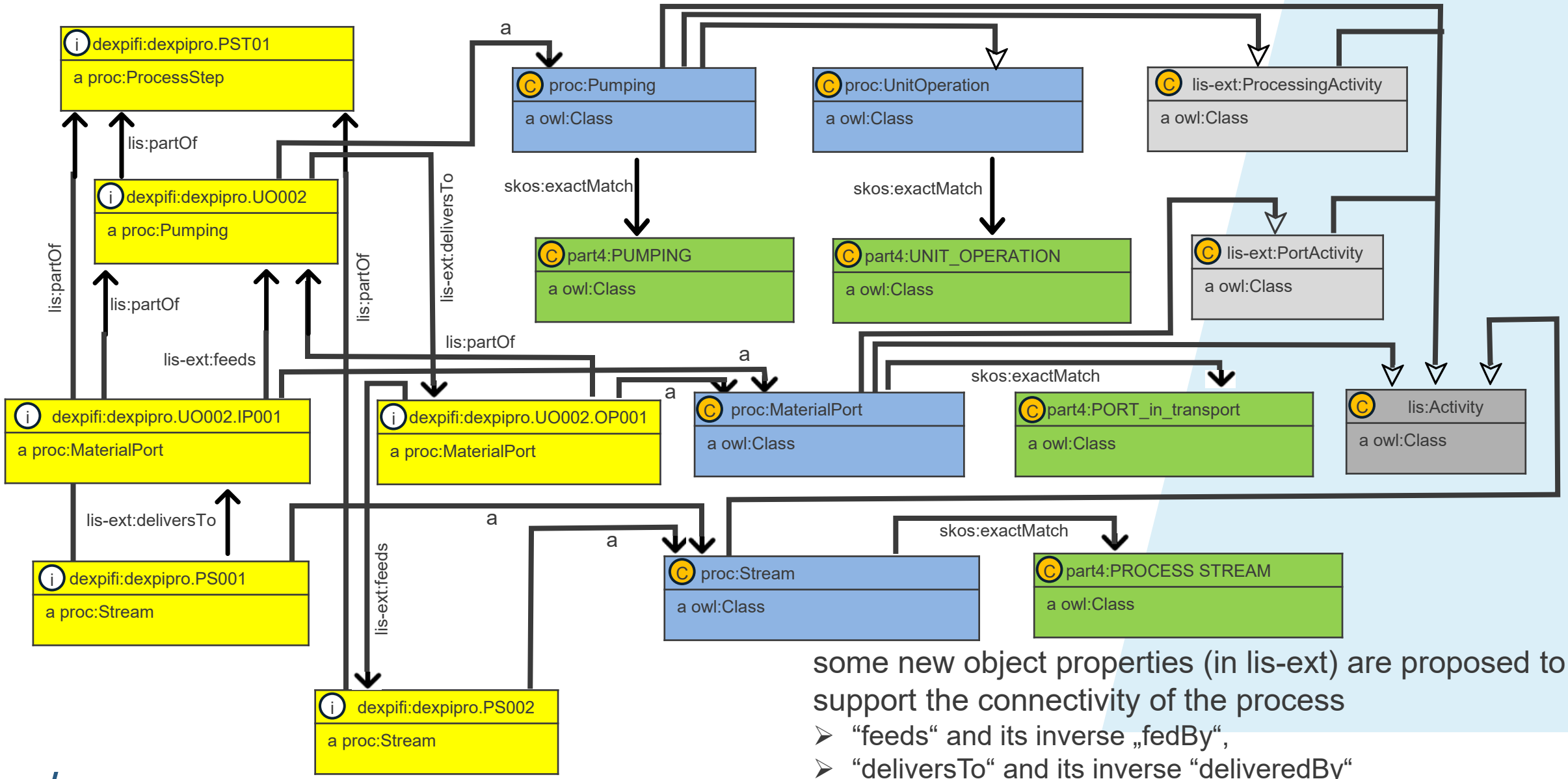
results - Modelling with IDO

Required process classes

part 4	DEXPI class	proc:	IDO
PROCESS	Process	Process	Activity
PROCESS STEP	ProcessStep	ProcessStep	Activity
UNIT OPERATION	UnitOperation	UnitOperation	Activity
PUMPING	Pumping	Pumping	Activity
CHEMICAL REACTING	Reacting Chemicals	Reacting Chemicals	Activity
STORING	StoringMaterial	StoringMaterial	Activity
PORT	Port	Port	Activity
PORT(transport)	MaterialPort	MaterialPort	Activity
INLET PORT	Port with role „Target“ (direction: IN)		Activity
OUTLET PORT	Port with role „Source“ (direction: OUT)		Activity
Stream	Process Connection	Process Connection	Activity
PROCESS STREAM	Stream	Stream	Activity

Process modelled as activity network

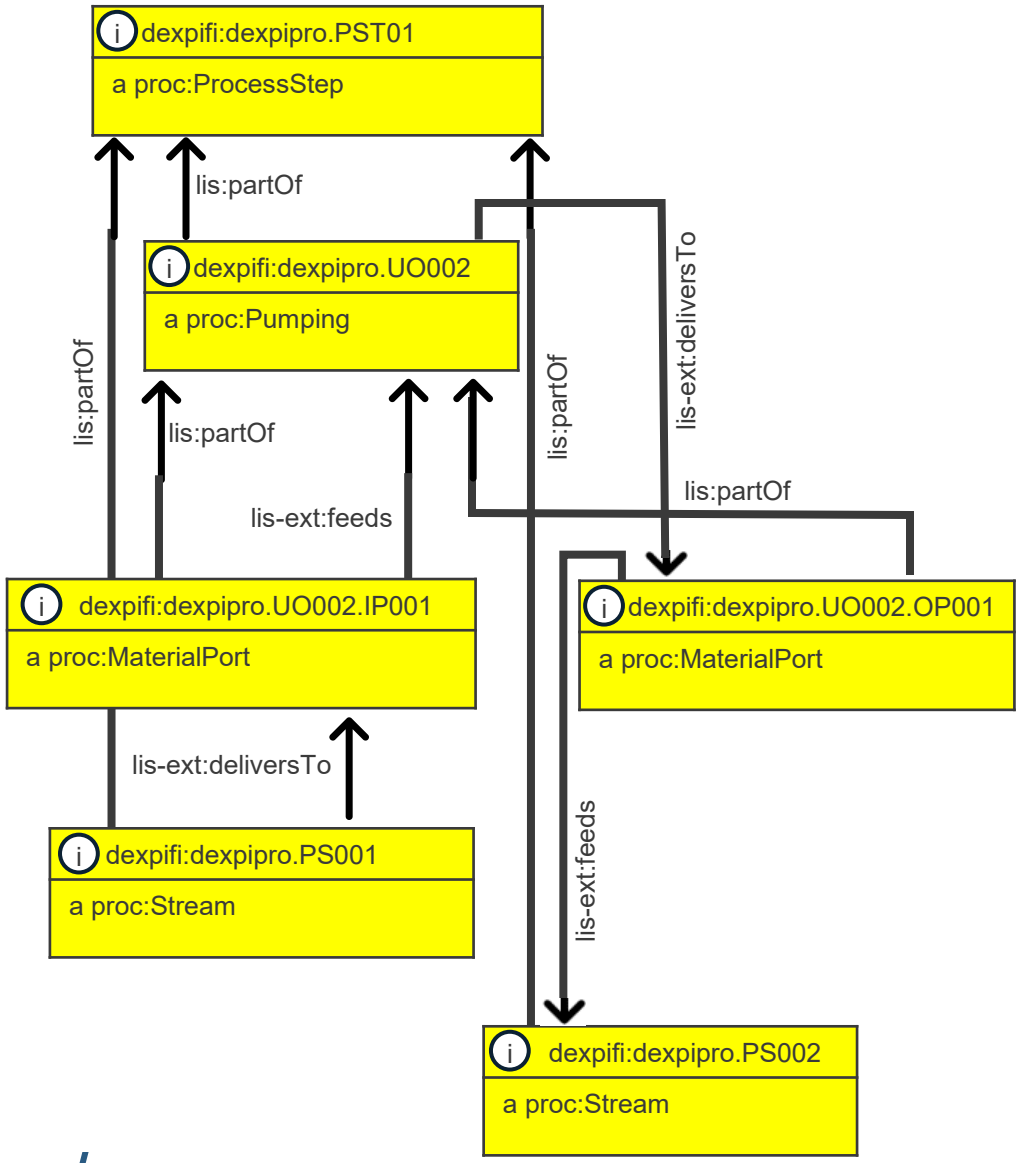
Modelling pattern: Pumping UO002 (full picture)



some new object properties (in lis-ext) are proposed to support the connectivity of the process

- “feeds“ and its inverse „fedBy“,
- “deliversTo“ and its inverse “deliveredBy“
- all with domain and range definitions

Modelling pattern: Pumping UO002



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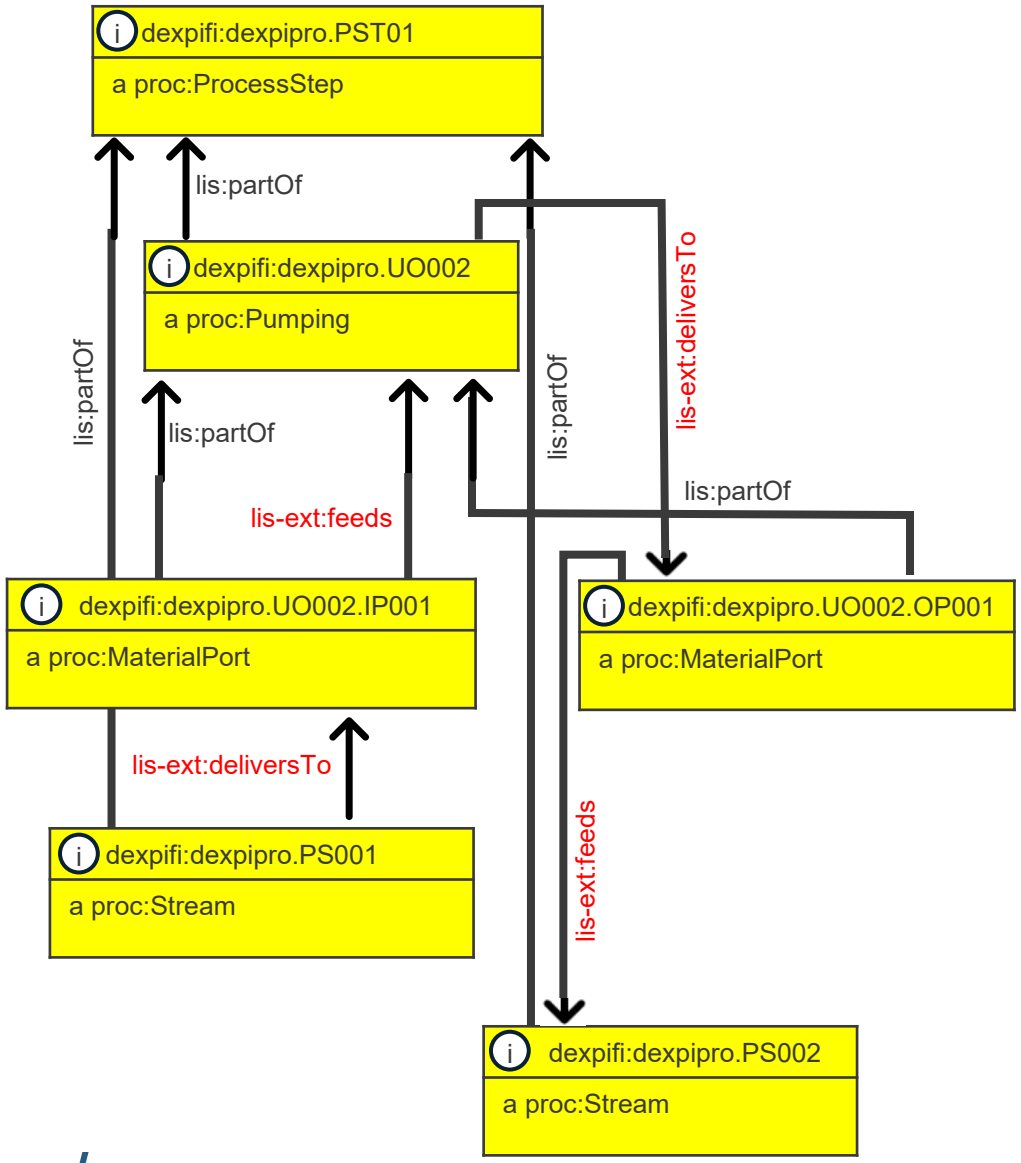

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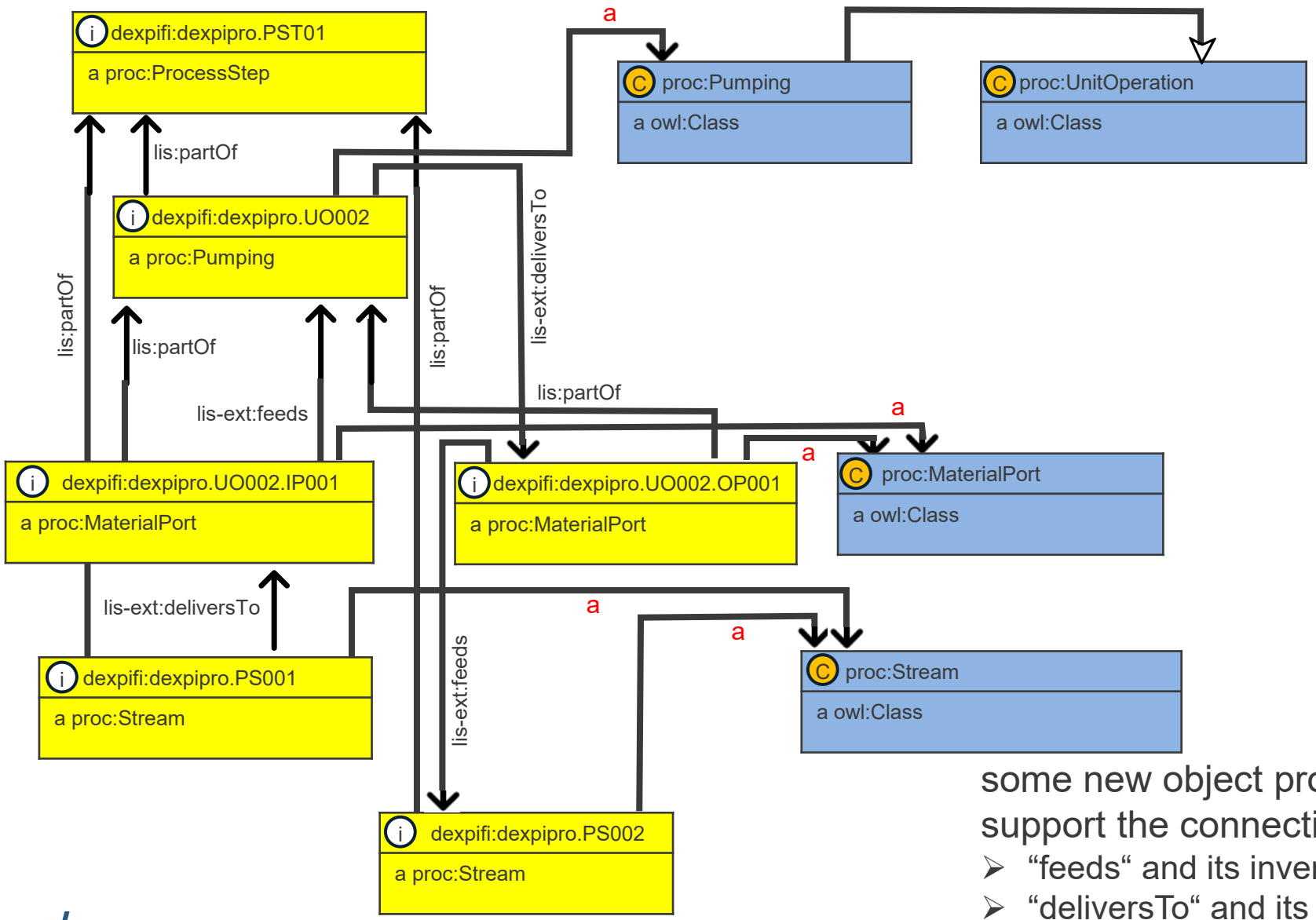

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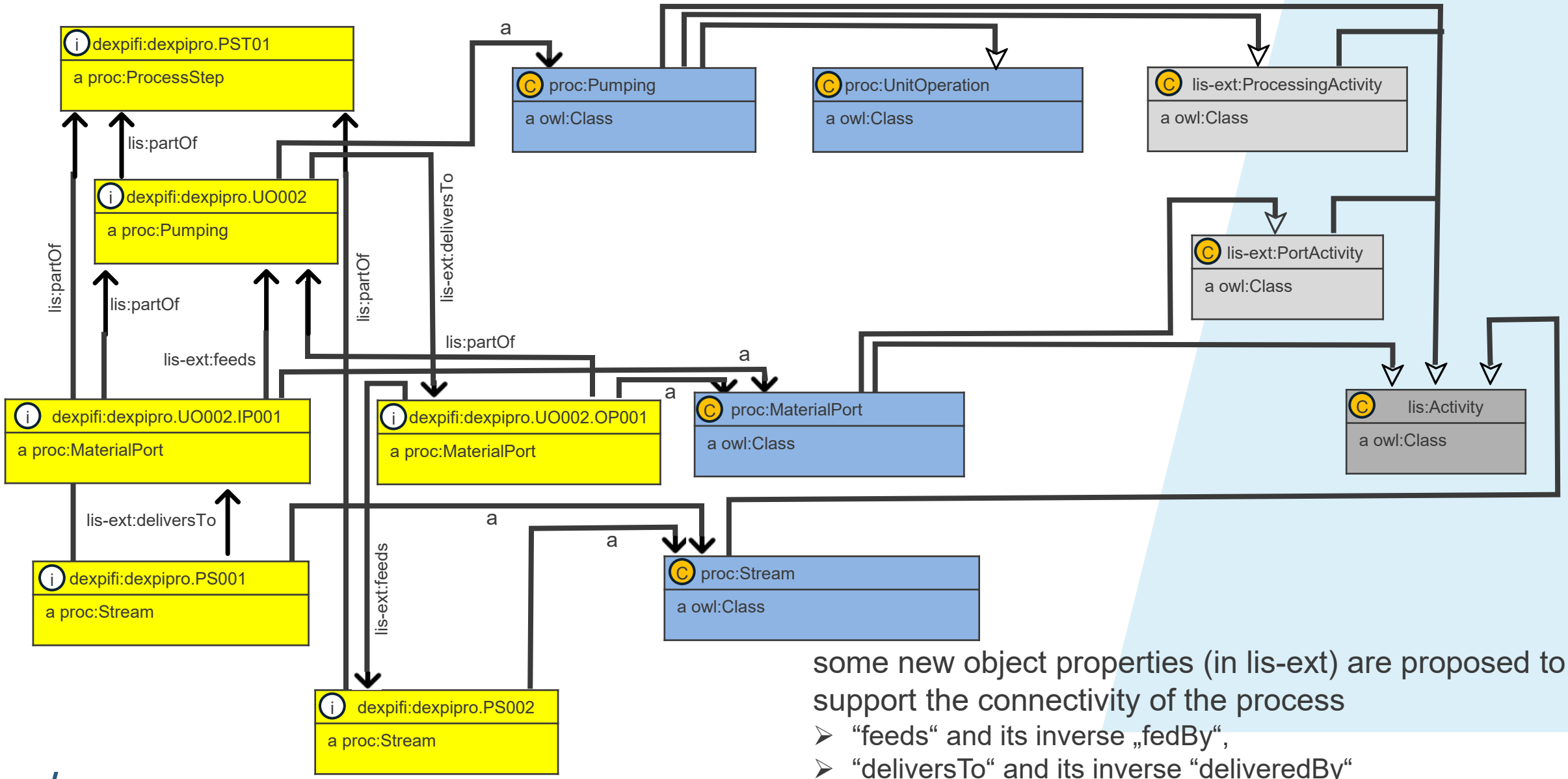

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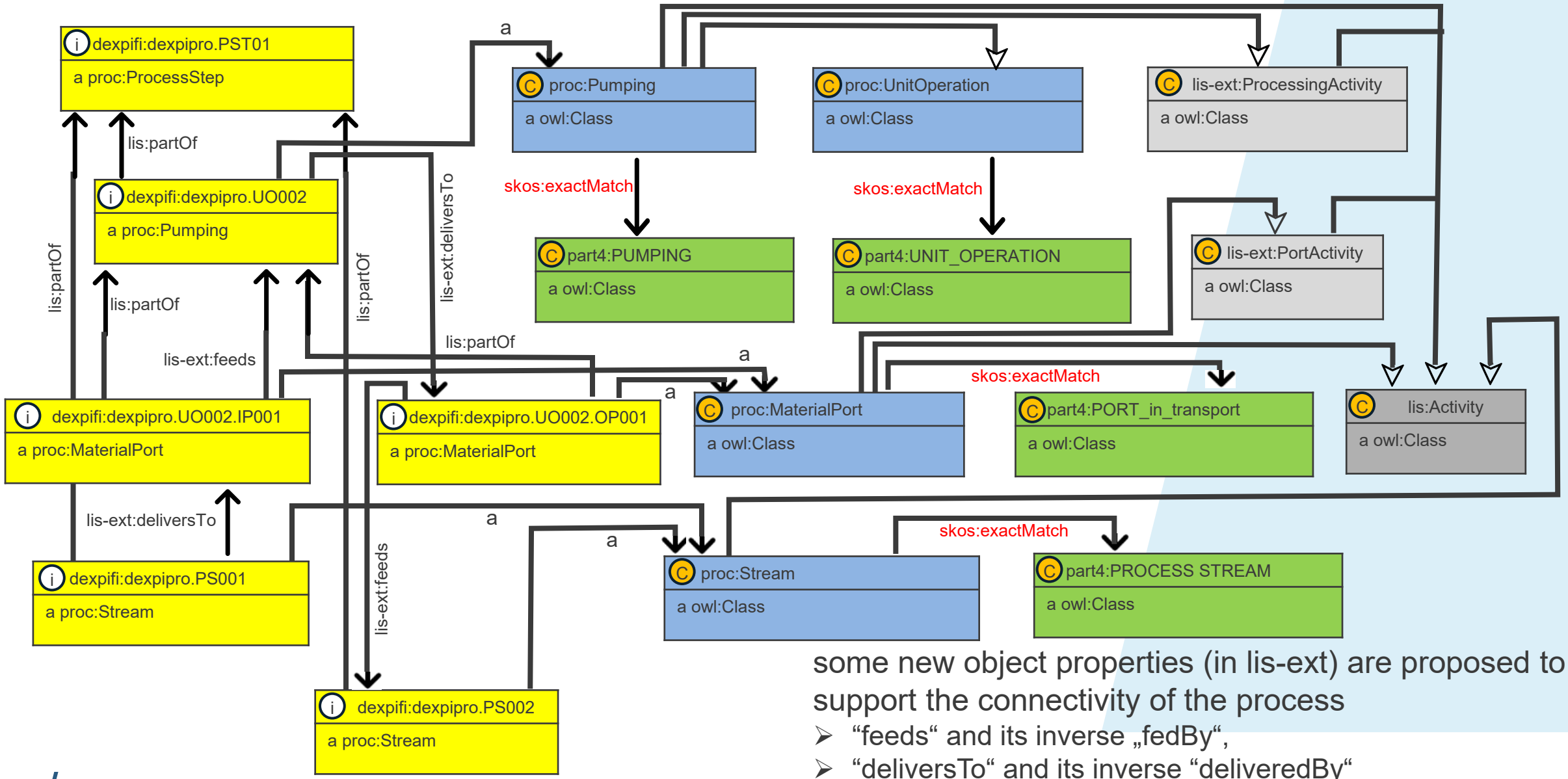

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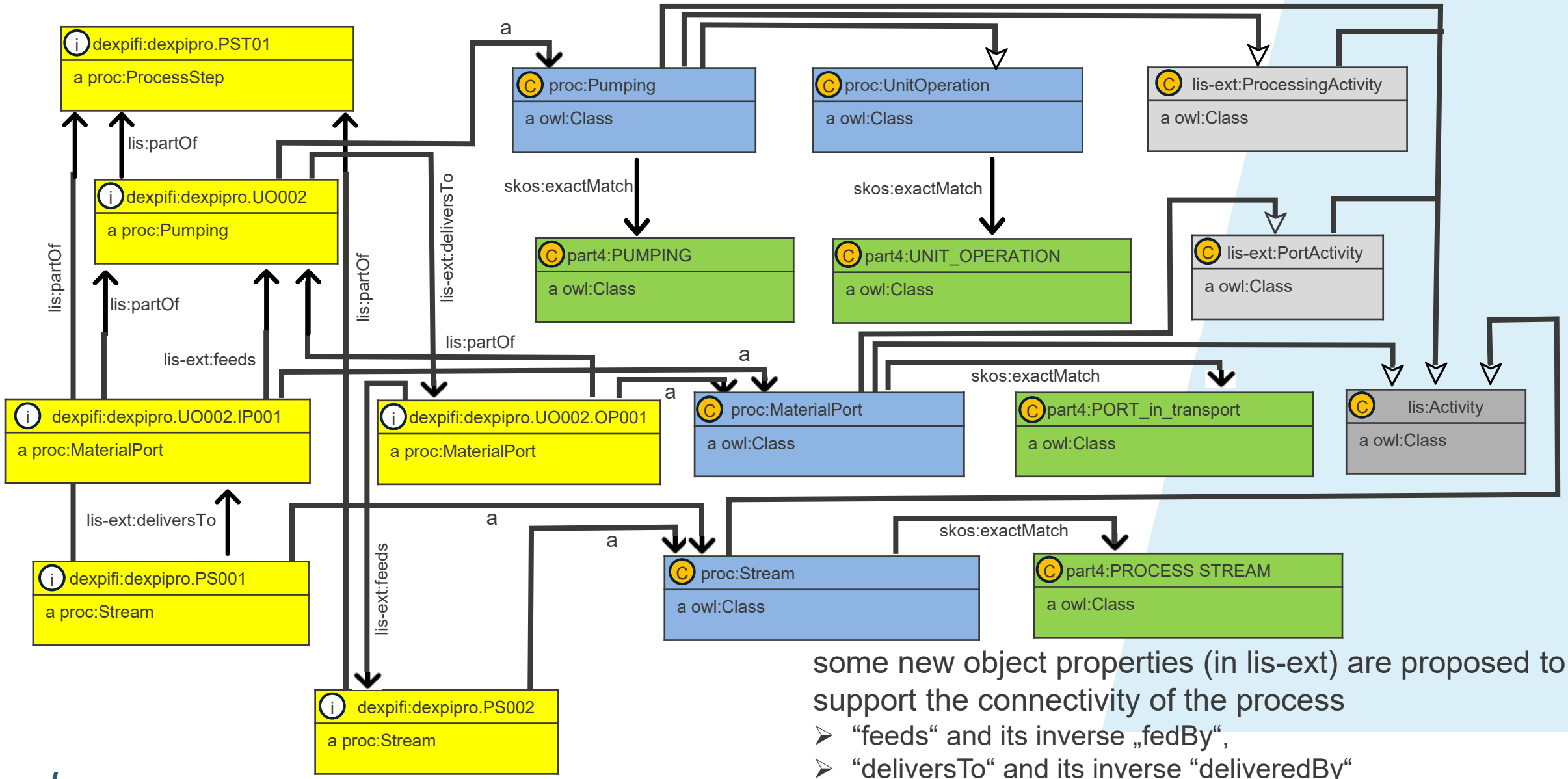

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Required classes – specified Plant

part 4	DEXPI class	spla:	IDO
PROCESS PLANT	ProcessPlant	specified_ProcessPlant	System
PLANT SECTION	PlantSection	specified_PlantSection	System
PUMP SYSTEM	System	specified_System	System
PUMP	Pump	specified_Pump	System
CENTRIFUGAL PUMP	CentrifugalPump	specified_CentrifugalPump	InanimatePhysicalObject
PROCESS NOZZLE	ProcessNozzle	specified_ProcessNozzle	InanimatePhysicalObject
PIPING NETWORK SYSTEM	PipingNetworkSystem	specified_PipingNetworkSystem	System
ELECTRIC MOTOR	Motor	specified_Motor	System
ALTERNATING CURRENT MOTOR	AlternatingCurrentMotor	specified_AlternatingCurrentMotor	InanimatePhysicalObject
INSTRUMENTATION FUNCTION	InstrumentationFunction	specified_InstrumentationFunction	System
PROCESS SIGNAL GENERATING FUNCTION	ProcessSignalGenerating Function	specified_ProcessSignalGeneratingFunction	System
MEASURING SYSTEM	MeasuringSystem	specified_MeasuringSystem	InanimatePhysicalObject
VESSEL	Vessel	specified_Vessel	System
TANK	Tank	specified_Tank	InanimatePhysicalObject
PRESSURIZED CONTAINER	PressureVessel	specified_PressureVessel	InanimatePhysicalObject

Plant with functional & physical objects

Required classes - Asset (physical equipment)

part 4	pequi:	IDO
PROCESS PLANT	actual_ProcessPlant	InanimatePhysicalObject
PLANT SECTION	actual_PlantSection	InanimatePhysicalObject
CENTRIFUGAL PUMP	actual_CentrifugalPump	InanimatePhysicalObject
ALTERNATING CURRENT MOTOR	actual_AlternatingCurrentMotor	InanimatePhysicalObject
MEASURING SYSTEM	actual_MeasuringSystem	InanimatePhysicalObject

Assets
as physical objects
& actual individuals

Same IDO classification ‘InanimatePhysicalObject’ for specified and physical equipment on class level

IDO relations to connect the Objects of the three information structures

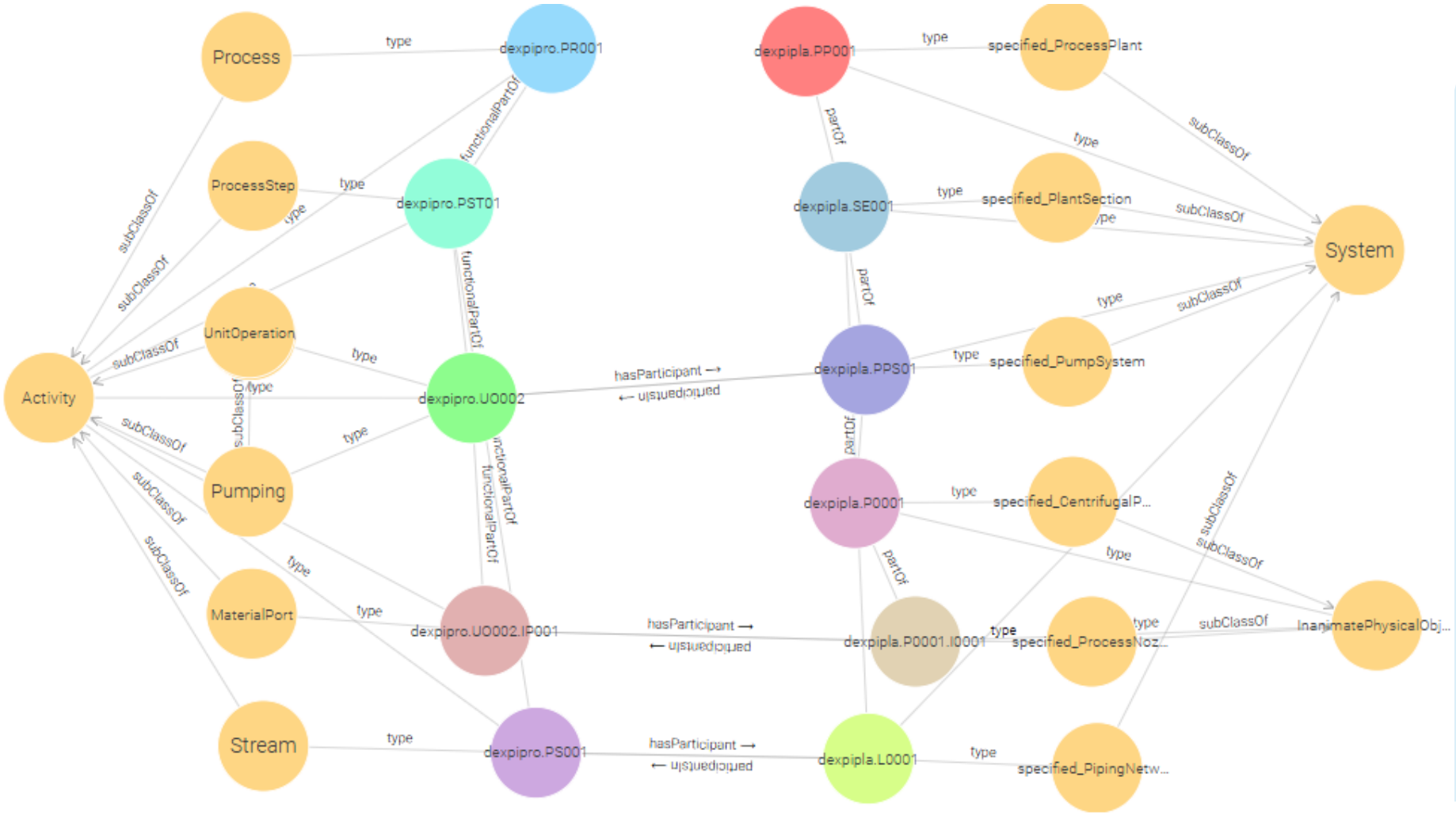
On instances level use of IDO object properties:

from lis:implementedBy (or its inverse) the IDO classification

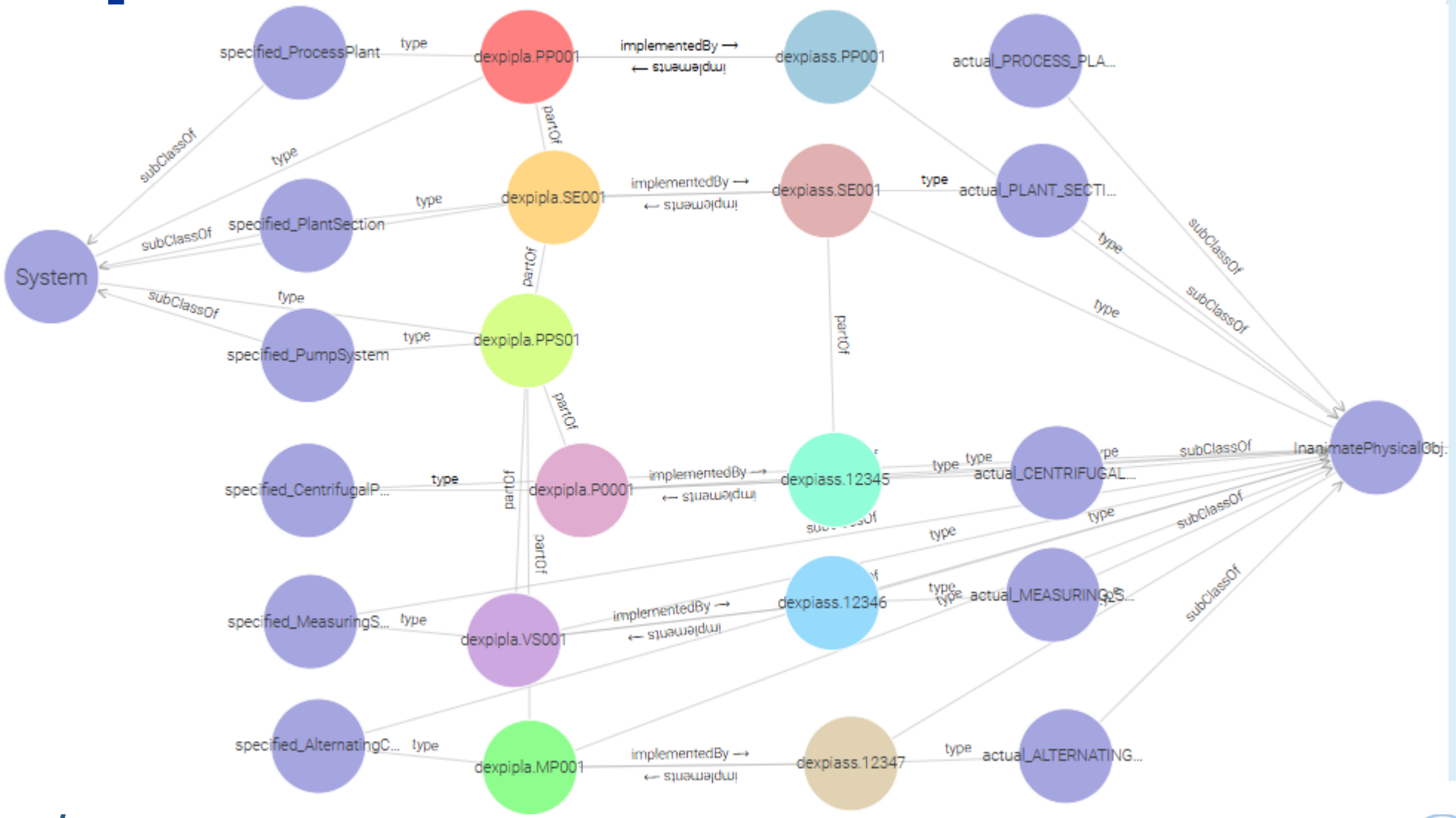
lis:specified and lis:actual

is inferred on instance level

Solution with IDO: Process and specified Plant



Solution with IDO: specified Plant and actual Plant



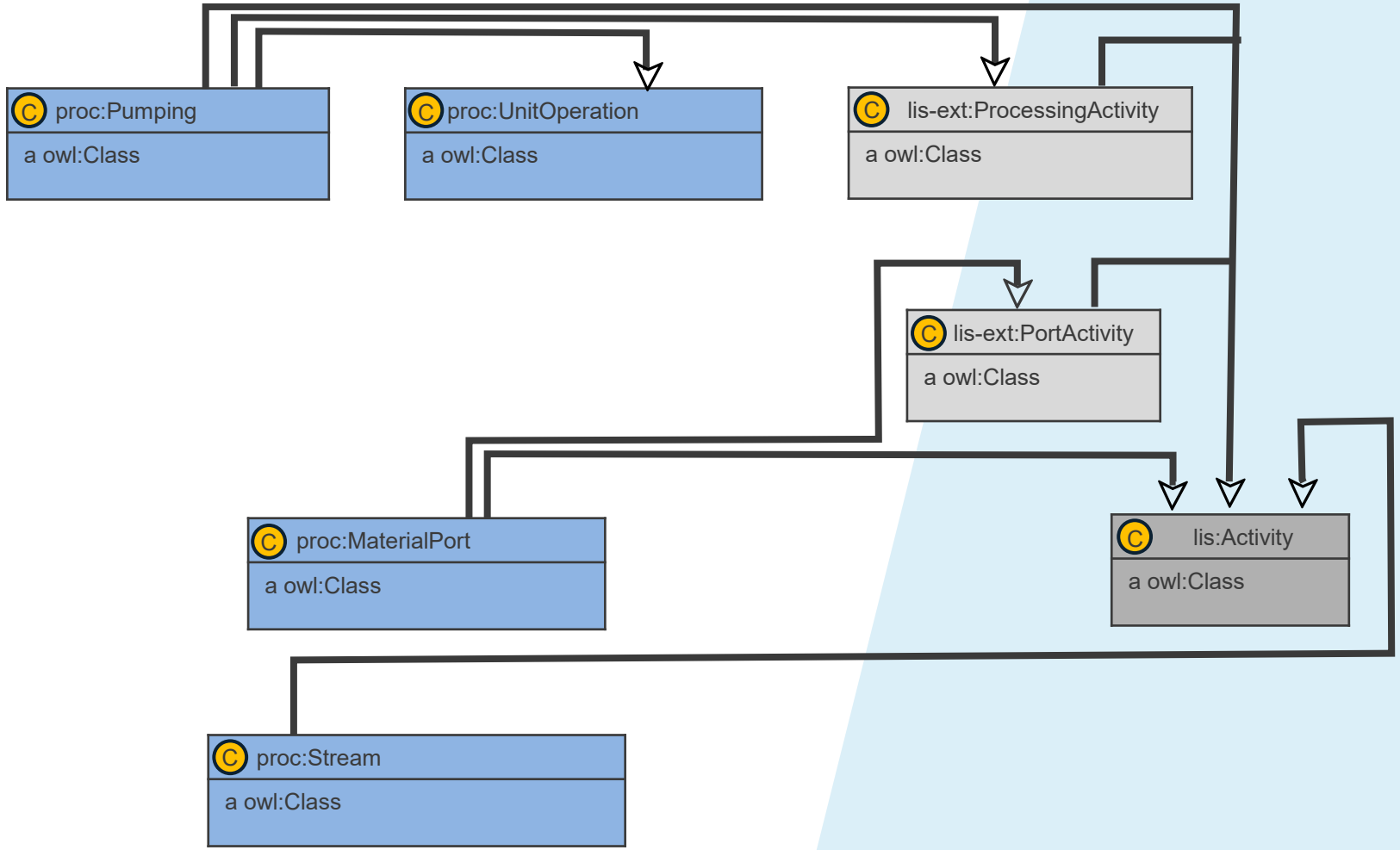
Conclusion

Conclusion

- process structure is modelled as complete activity network
  - some new object properties are required to support the internal structure
- classes of a specified plant are modelled with lis:System and lis:inanimatedPhysicalObject
- classes of an actual plant are modelled with lis:inanimatedPhysicalObject
  - no IDO distinction between specified and actual on class level
- lis:hasParticipant, lis:participatesIn and lis:implementedBy, lis:implements support connectivity between the three information structures
  - on instance level the distinction between specified and actual will be inferred

Backup

Modelling pattern: Pumping UO002



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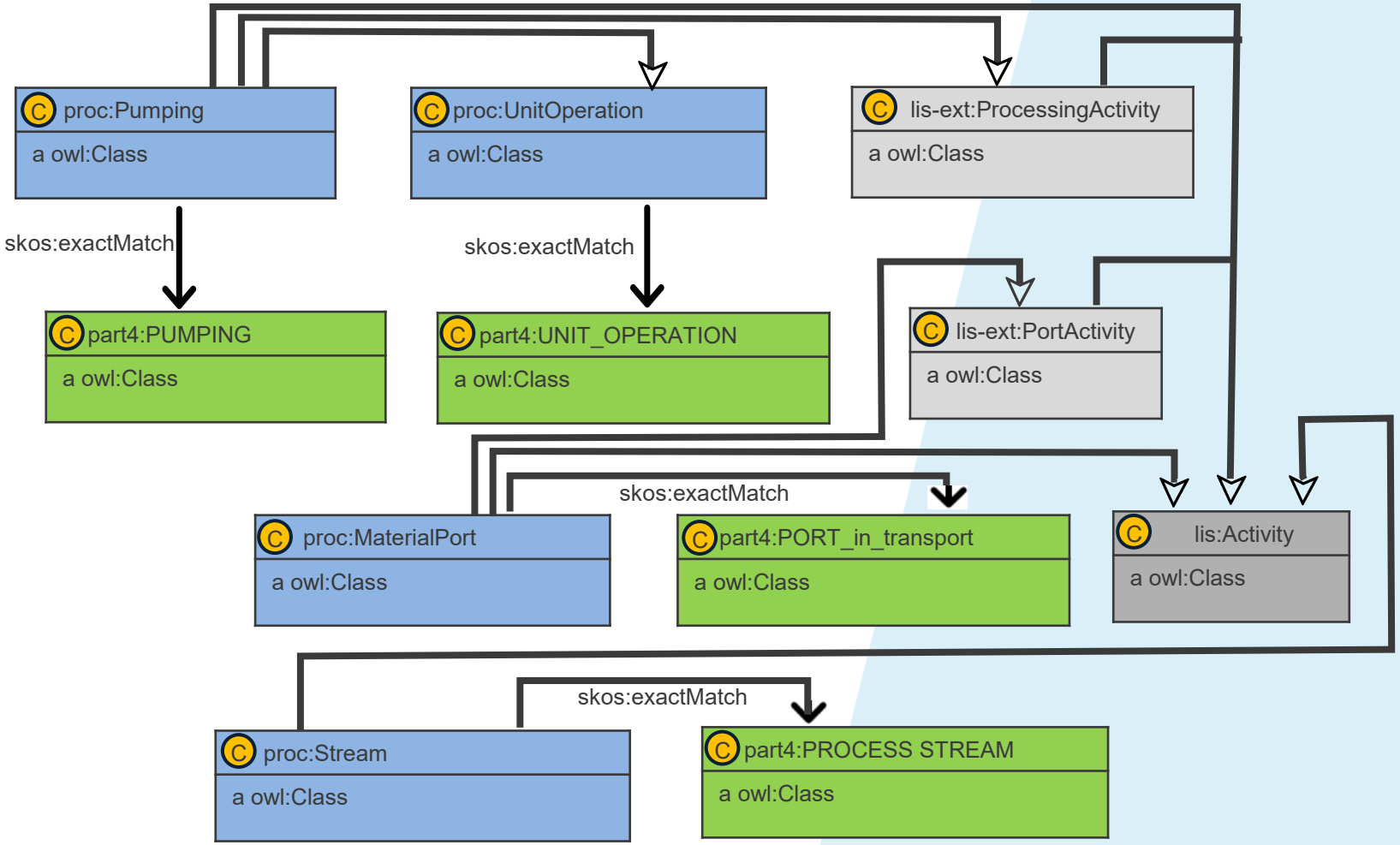

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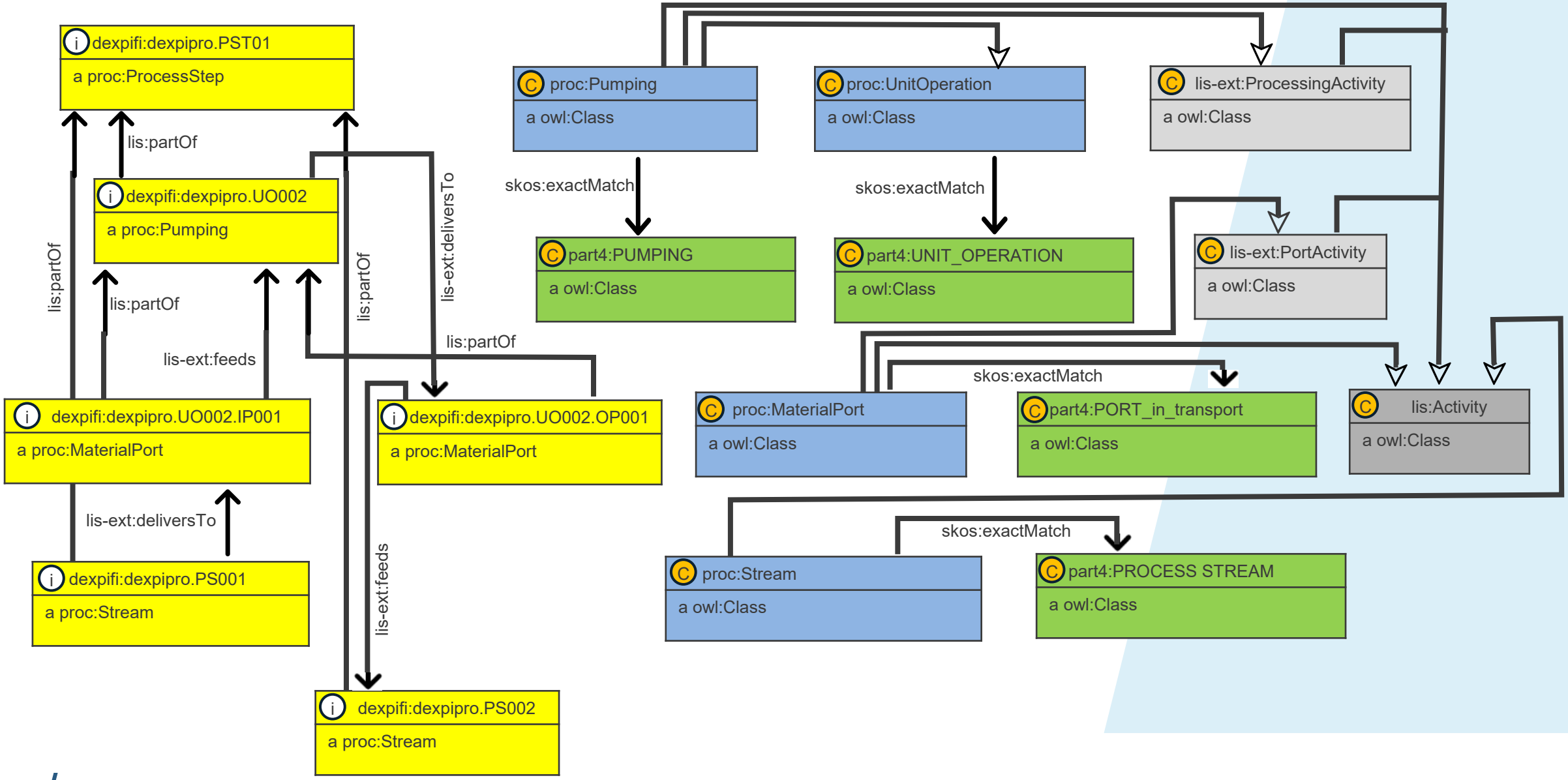

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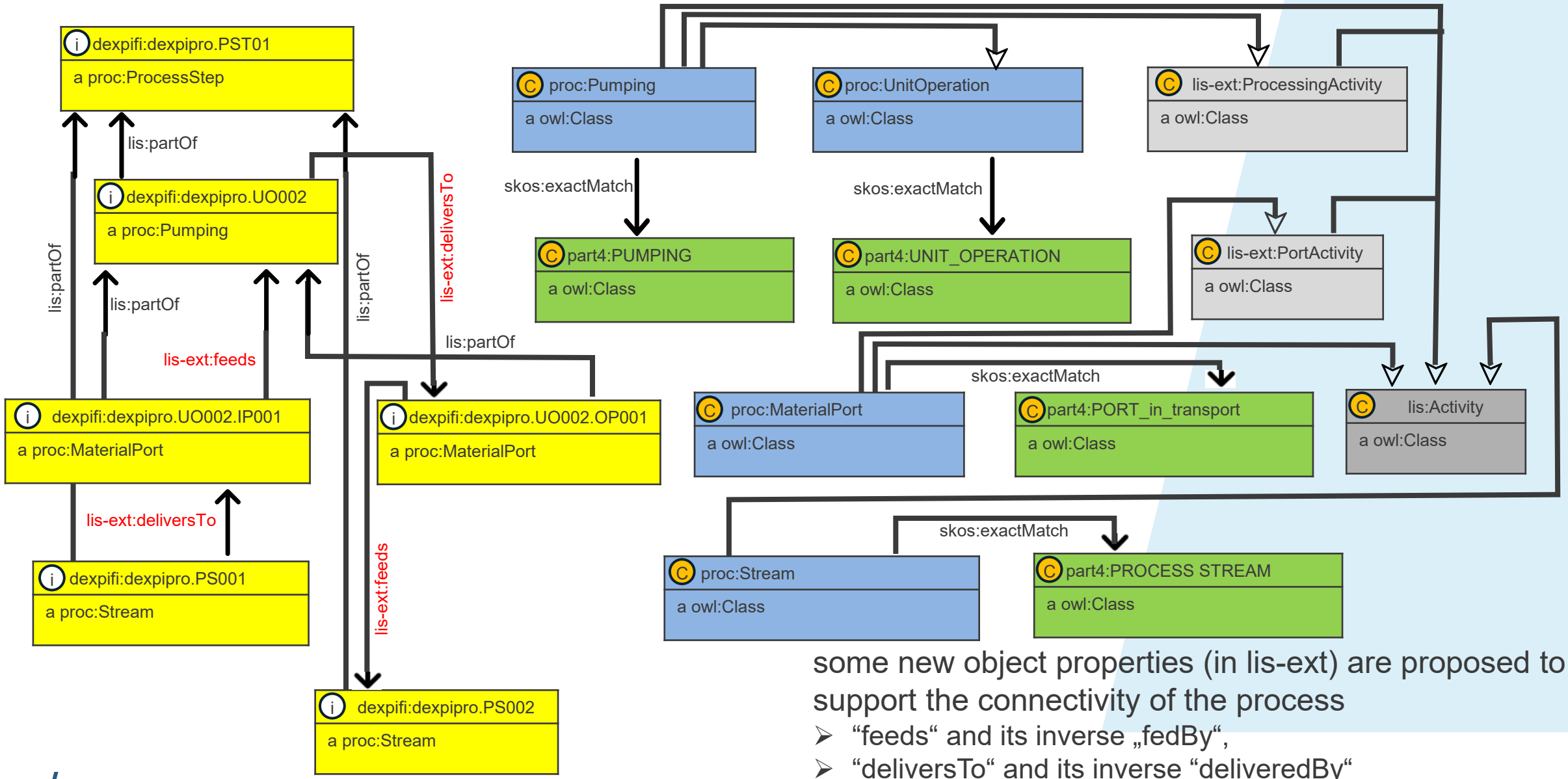

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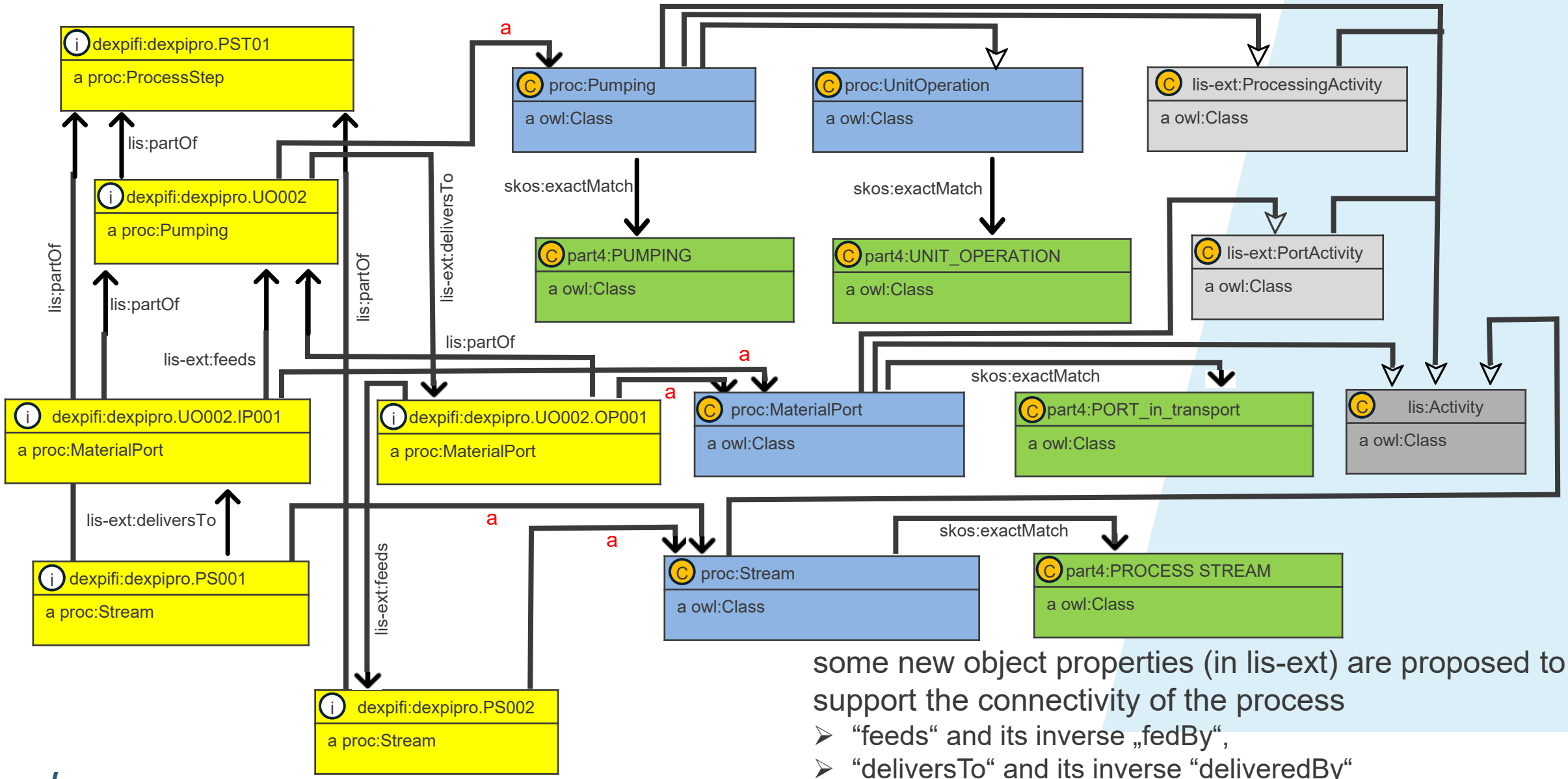

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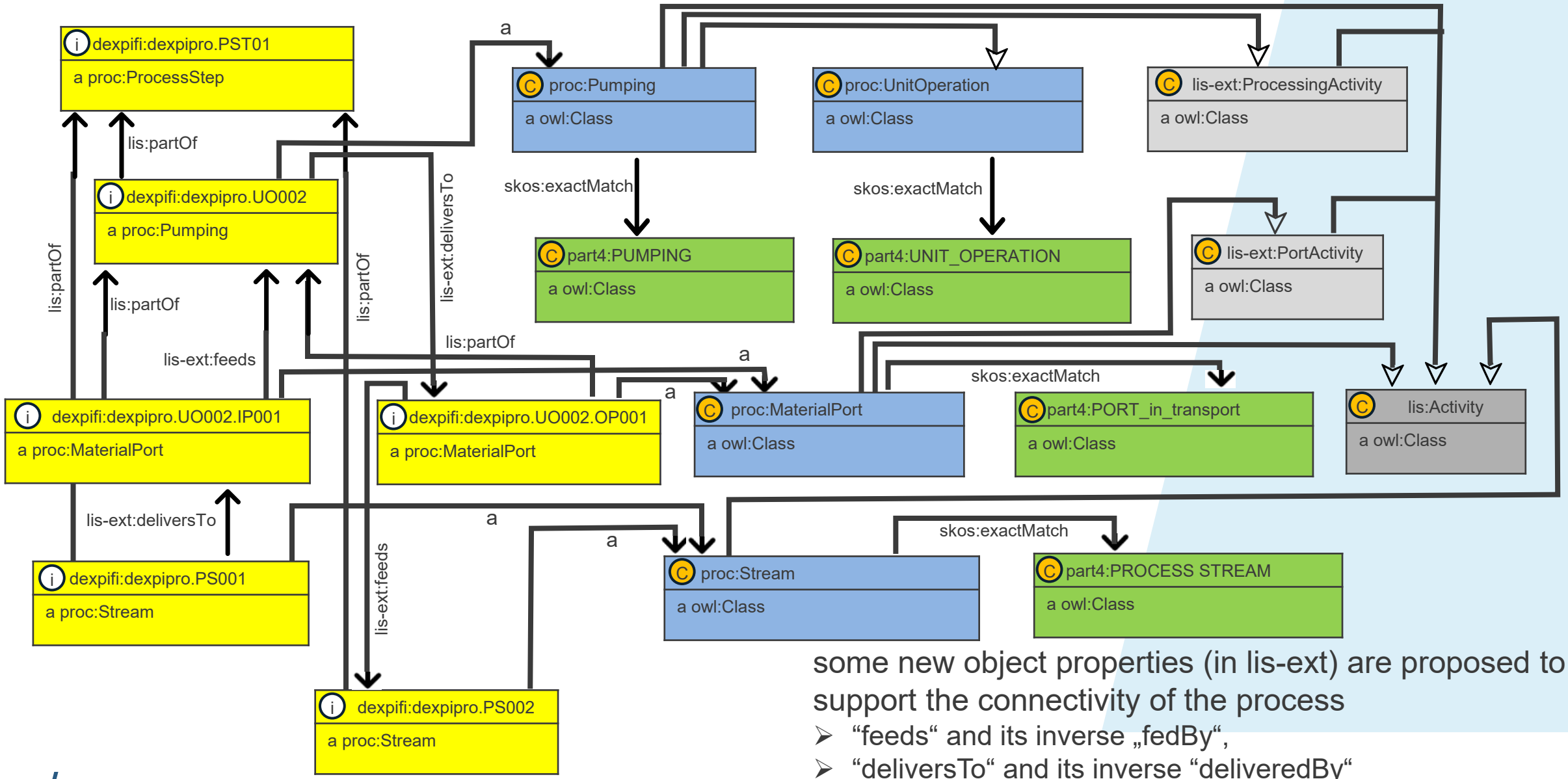

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