Dr. Ir. Andries van Renssen

Principal Consultant Information Management

# Shell Global Solutions

## Consultancy & Services
## for
## Data Exchange and Data Integration

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# The Gellish Language

## a structured subset of natural languages

- Gellish English
- Gellish Nederlands
- Gellish Deutsch
- Etc.
- Gellish numeric

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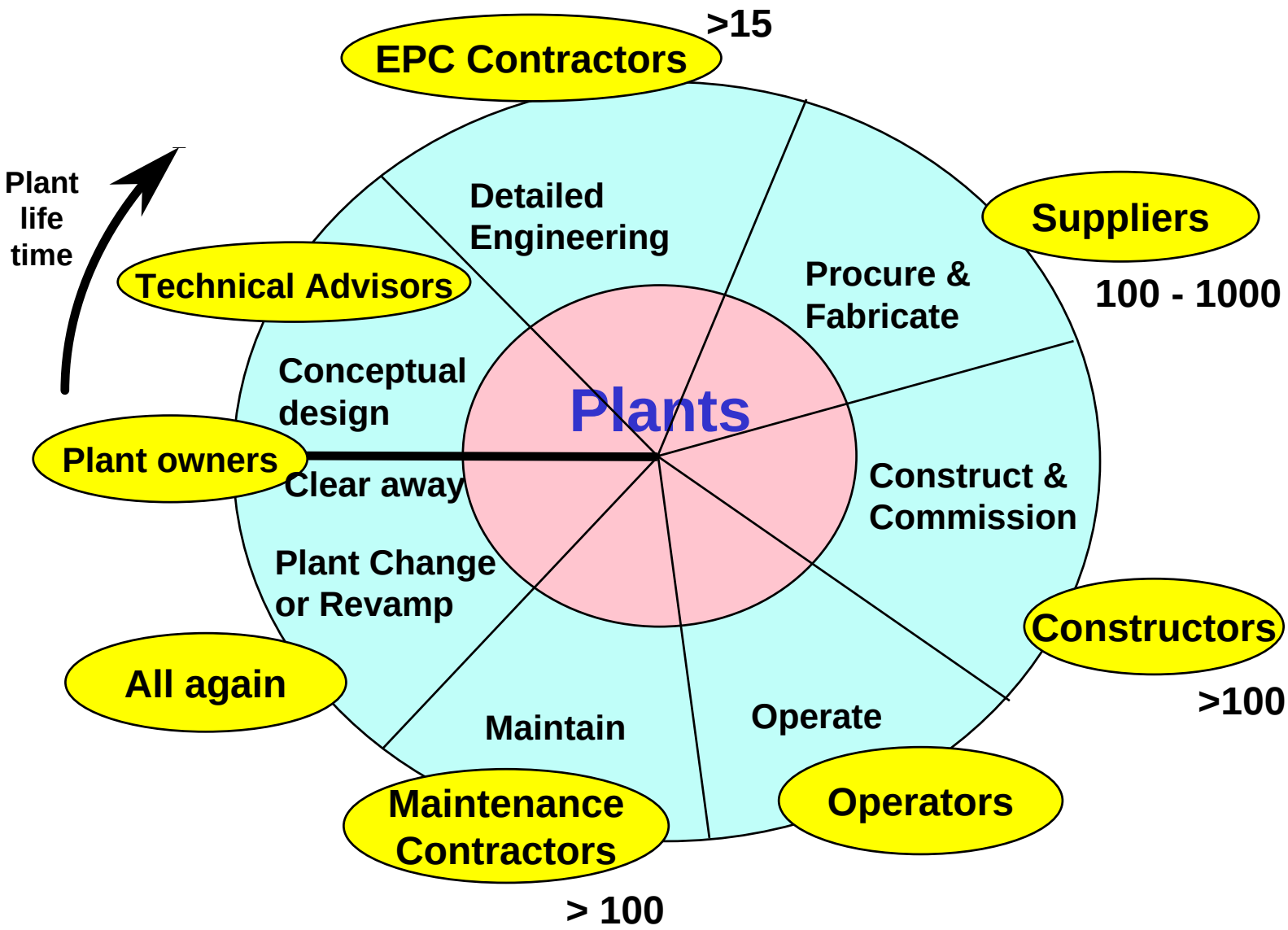
# The Business Issue: Communication on Product Data





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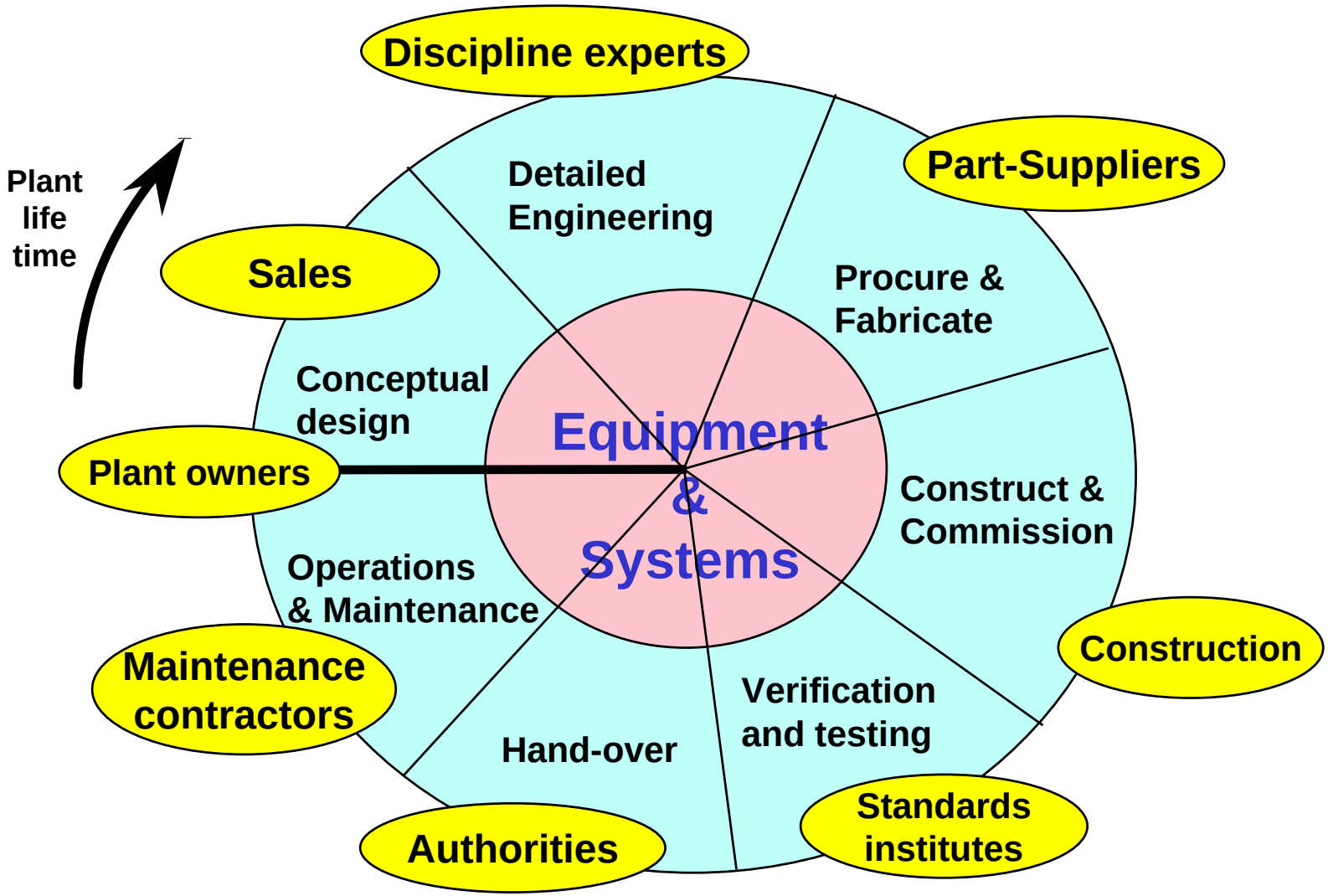
# The Business Issue: Communication on Product Data

## Suppliers perspective





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# The Data Exchange & Data Integration issue

1. **Standard engineering terminology is needed**
   - There is no standard electronic Business/Engineering dictionary available
     - Ecl@ss, Rosettanet, Trade Ranger, UNSPSC, …, STEPlib / ISO 15926-4
     - All proprietary data and based on proprietary data models

2. **Data structures are problematic**
   - Data models are different and proprietary: communication barriers
   - Data models are domain specific: e.g. ISO 10303 (STEP), ISO 13584 (PLIB)
   - Data models are inflexible, fixed patterns rather than a full language

3. **Generic standard data models are difficult to implement**
   - E.g. ISO 10303-221 (AP221), ISO 15926-2

4. **XML does not provide standardization of application data**
   - Neither data modeling languages nor data models define application terms
     - E.g. UML, XML-schema, EXPRESS

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# The Gellish Language as a solution

1. **Open Source language definition**
   - **Open Source Licensed**
     **http://www.opensource.org/docs/definition.php**
   - **https://sourceforge.net/projects/gellish**
     **contains the Gellish English language definition**
     **with Dictionary / Taxonomy / Knowledge base with engineering terminology**

2. **Gellish Forum**
   - **Quality assurance**
   - **Application support**

3. **Based on and including concepts from**
   - **ISO 10303, 15926, 13584, 12006.**
   - **IEC 60050, ISO 31, ISO 1000, ISO 1131-3, ISO 1998**
     **and various other sources.**

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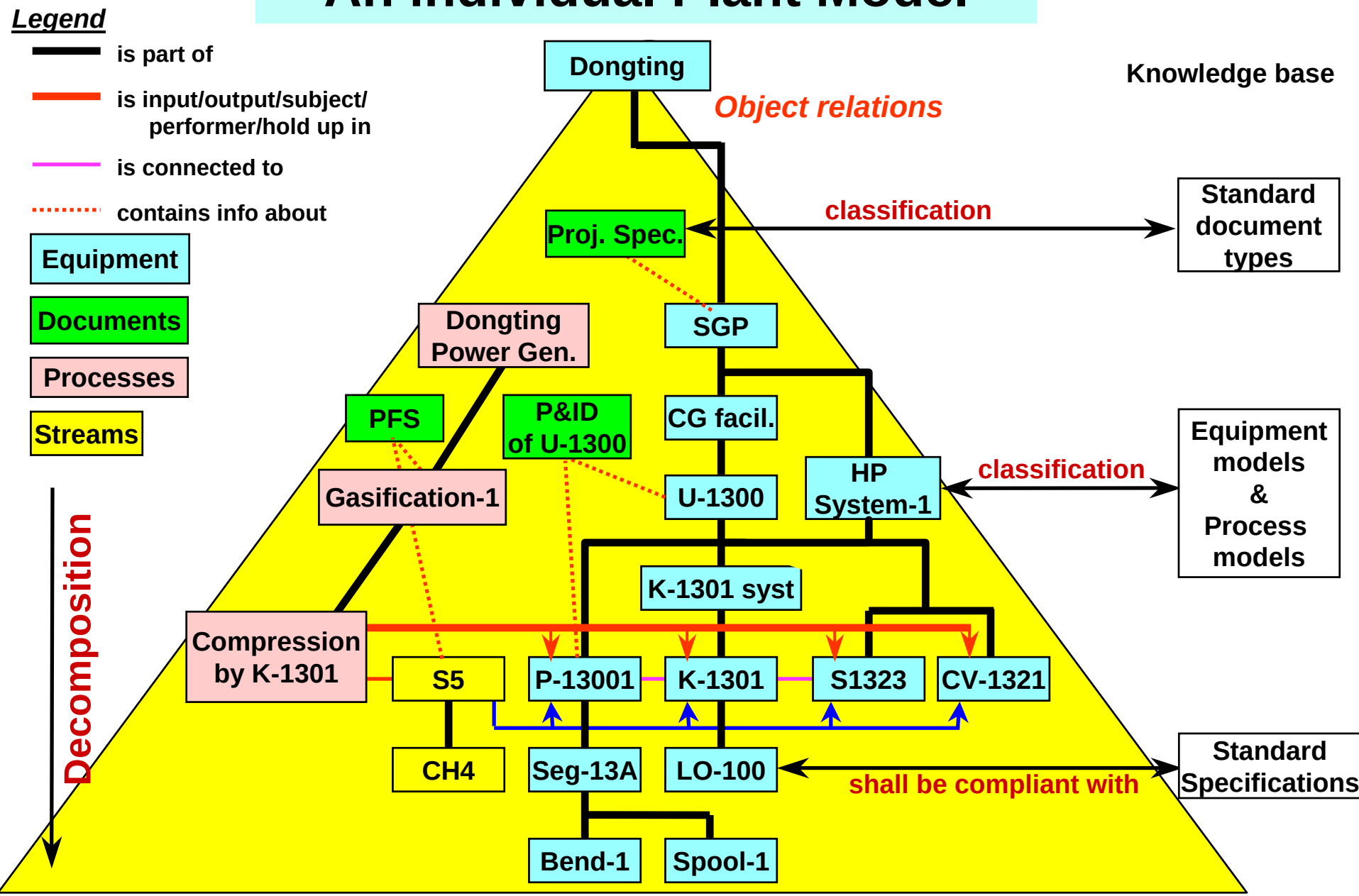
# An individual Plant Model

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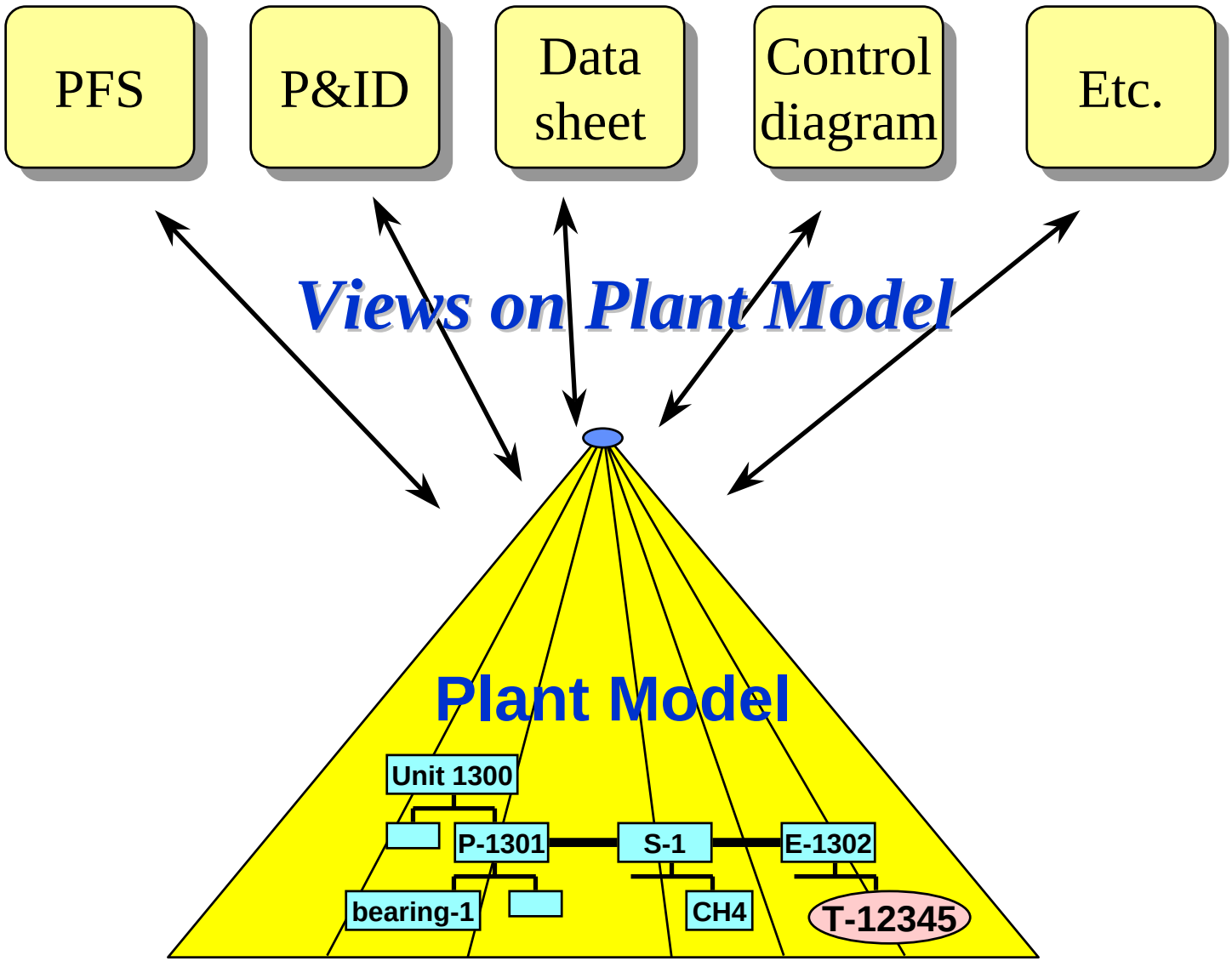
# Data Consistency through Data Integration

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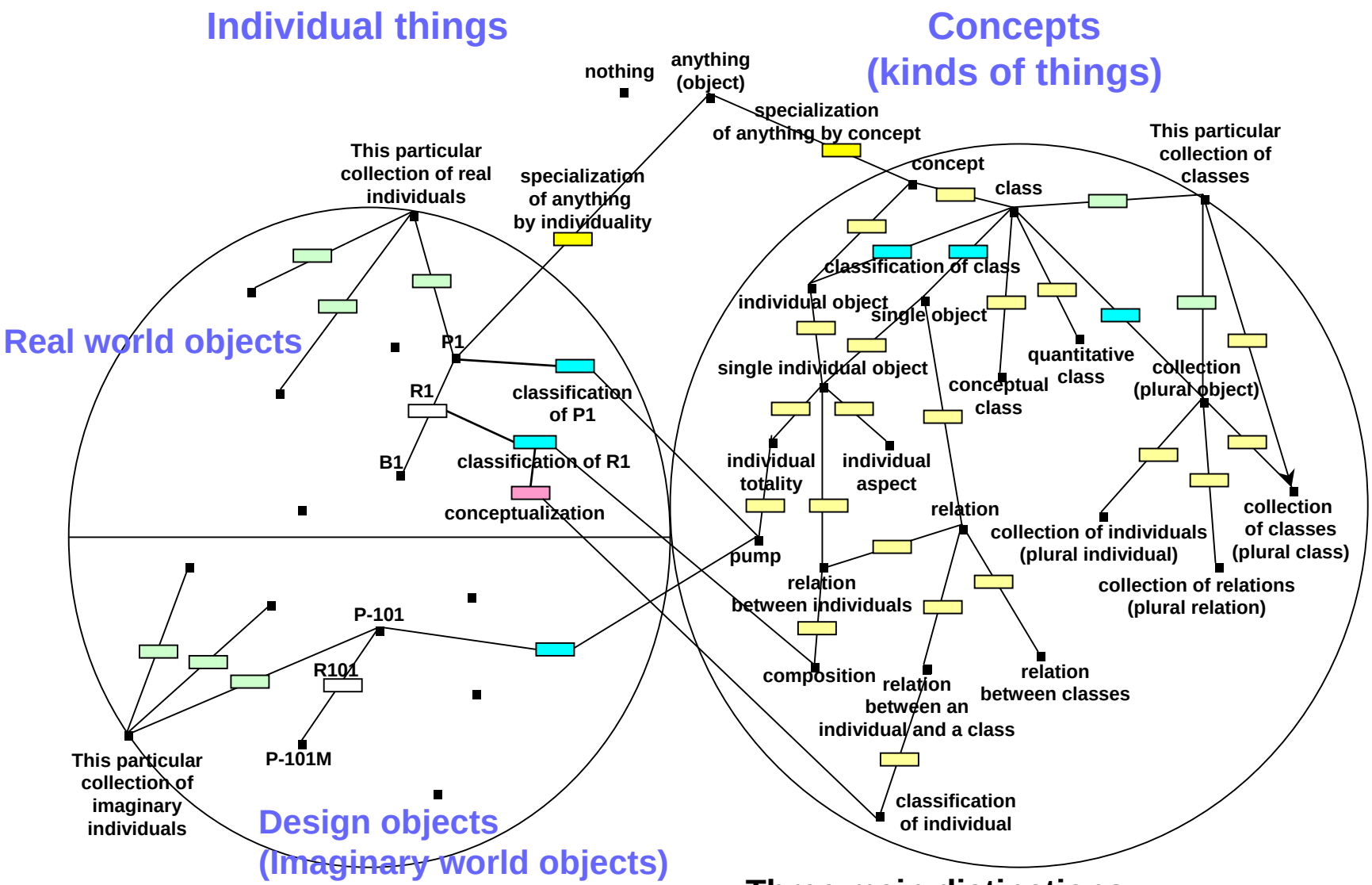
# Product & Knowledge structure




**Three main distinctions:**

1. **Individual things – Kinds of things**
2. **Real things – Imaginary things**
3. **Single things – Plural things**

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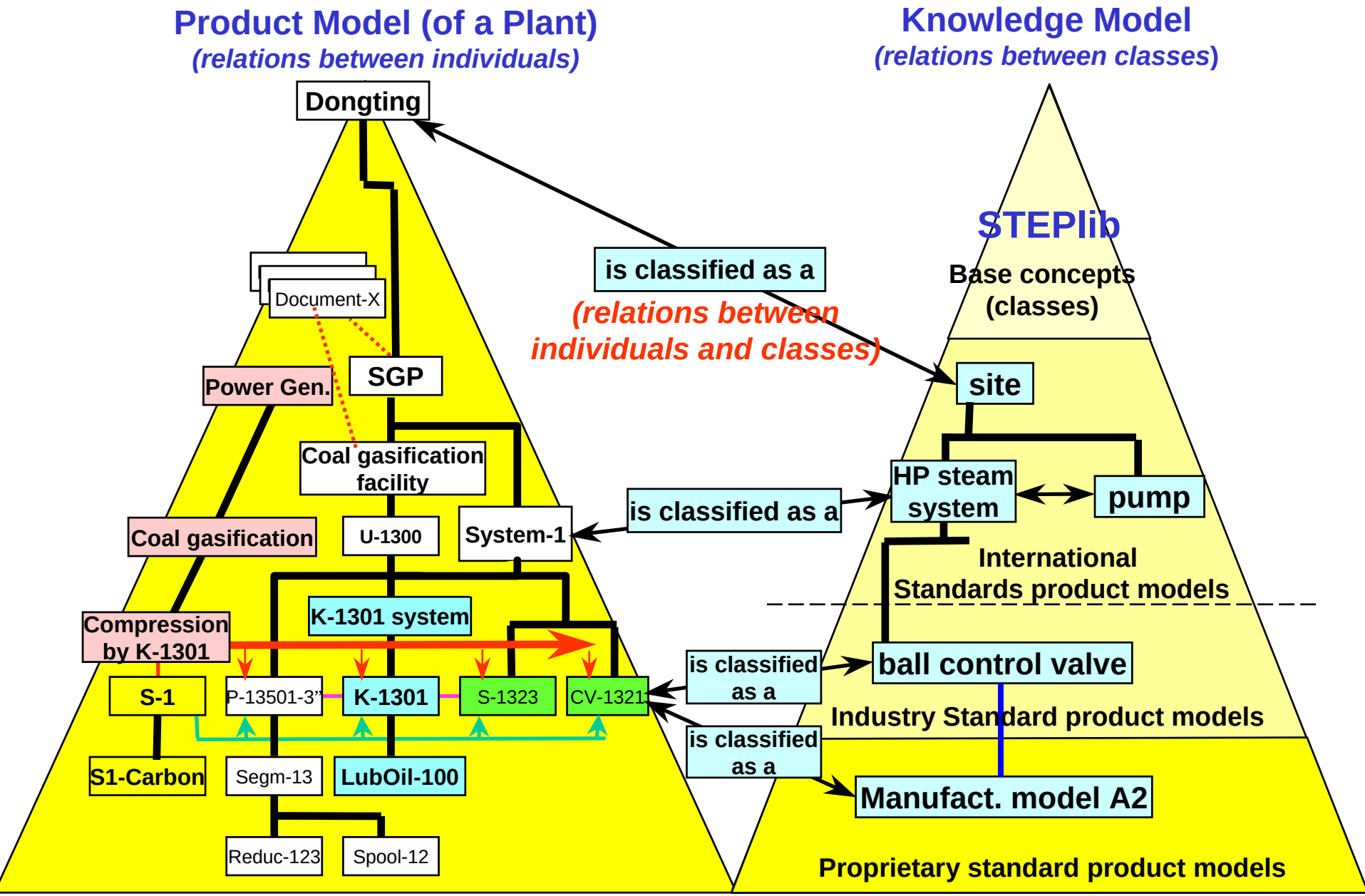
# Relate a Design to the Knowledge Base

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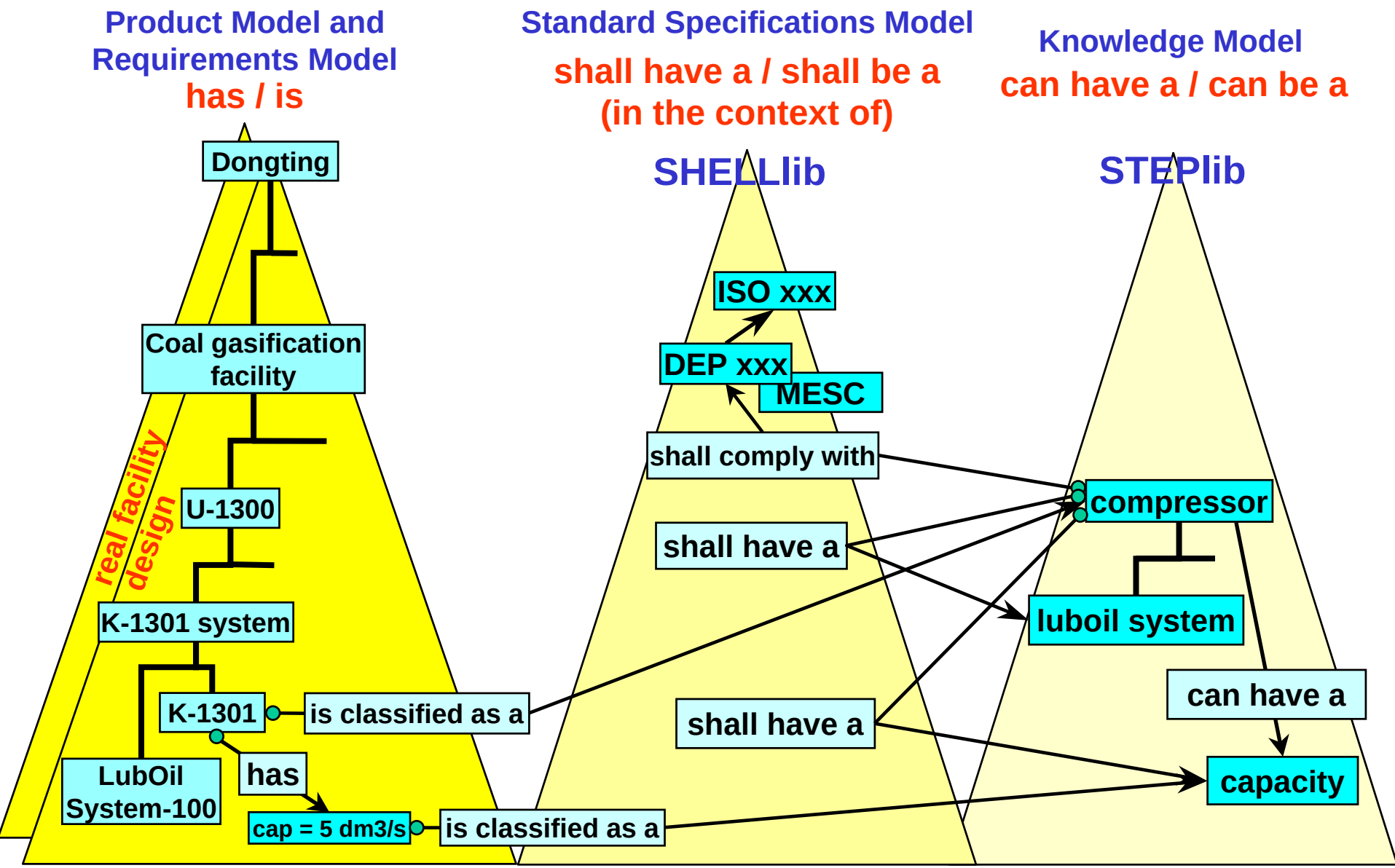
# Integration of Design Information

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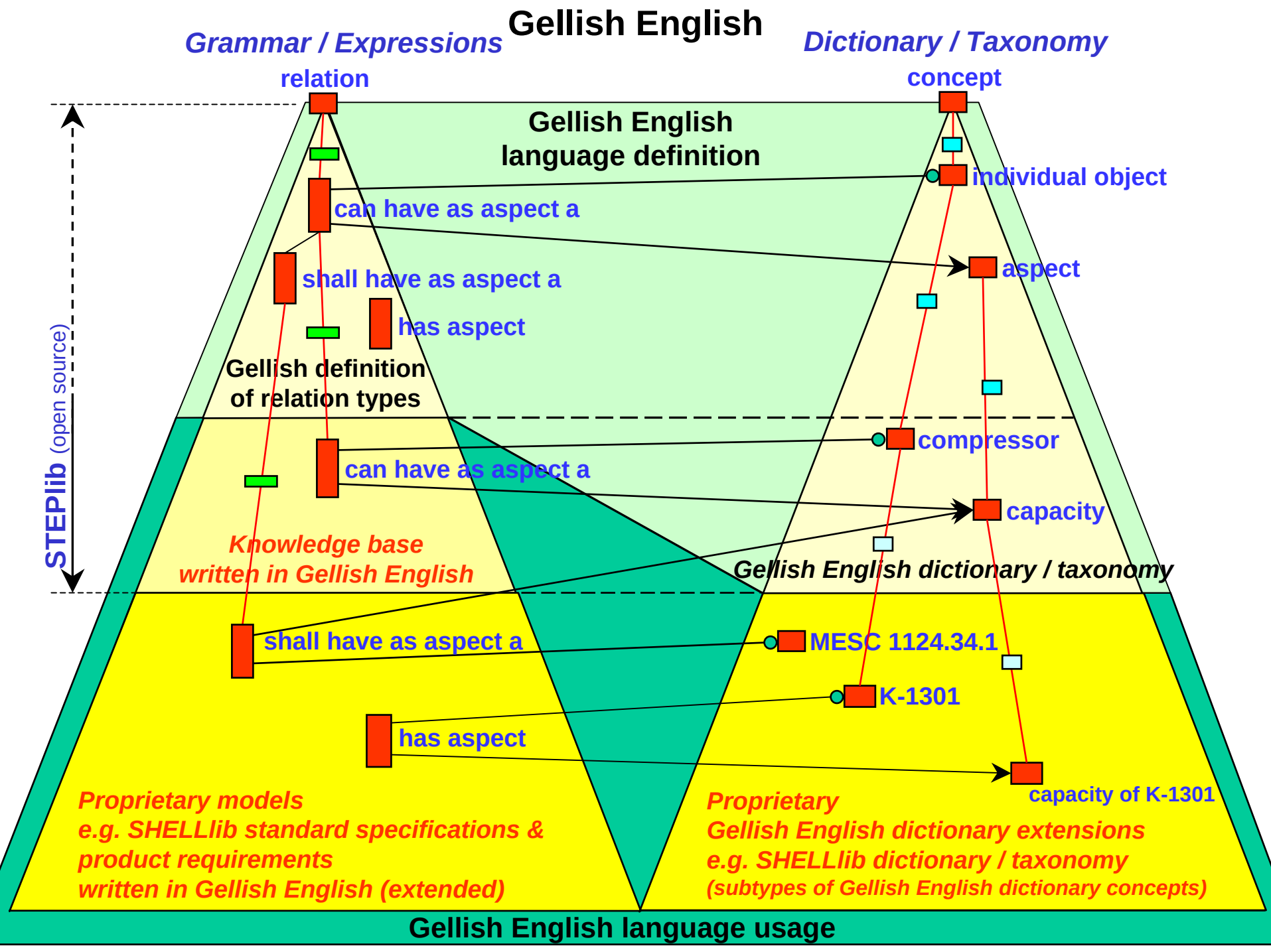
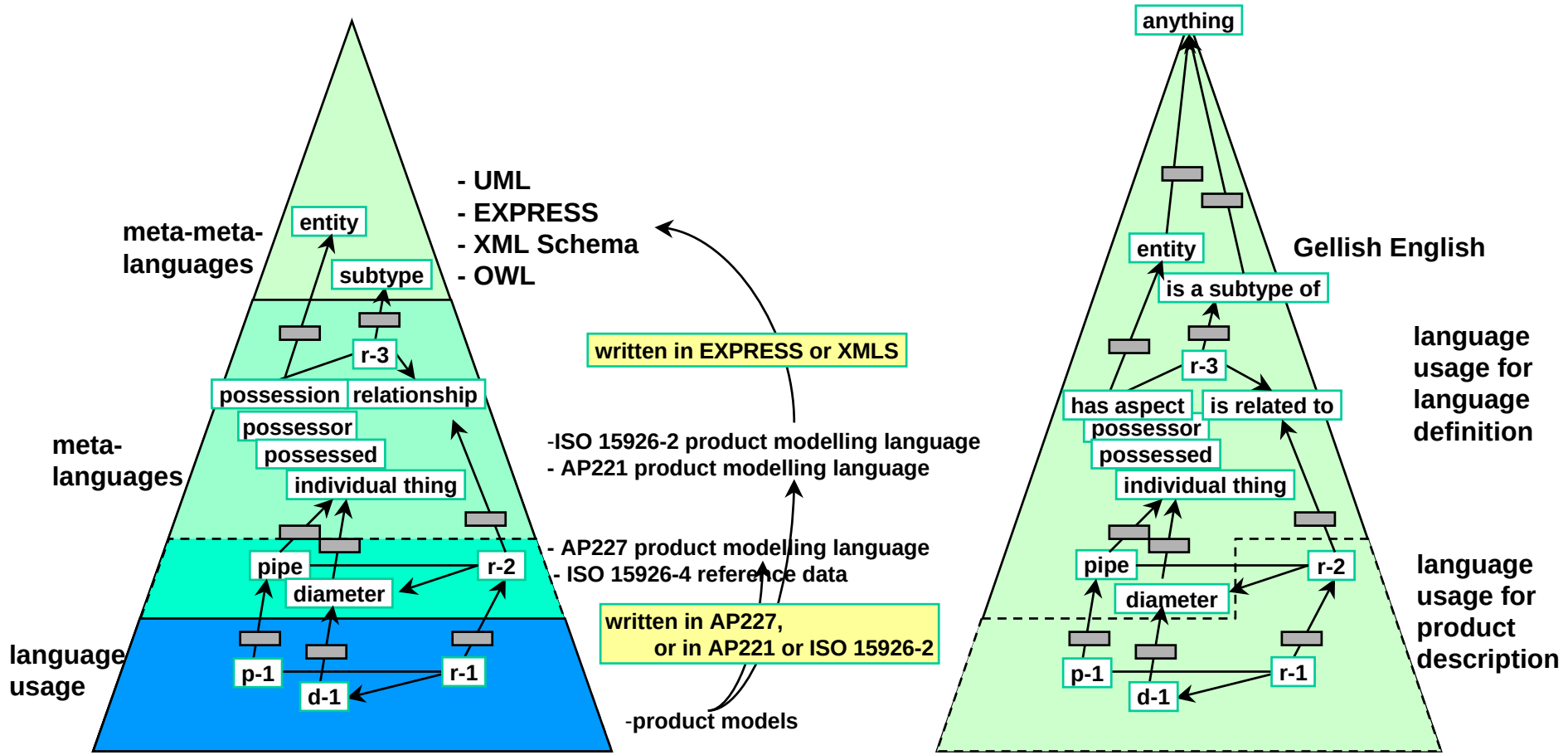

Gellish English
Grammar / Expressions
Dictionary / Taxonomy
relation
concept
Gellish English
language definition
individual object
can have as aspect a
aspect
shall have as aspect a
has aspect
Gellish definition
of relation types
compressor
can have as aspect a
capacity
STEPlib (open source)
Knowledge base
written in Gellish English
Gellish English dictionary / taxonomy
shall have as aspect a
MESC 1124.34.1
K-1301
has aspect
capacity of K-1301
Proprietary models
e.g. SHELLlib standard specifications &
product requirements
written in Gellish English (extended)
Proprietary
Gellish English dictionary extensions
e.g. SHELLlib dictionary / taxonomy
(subtypes of Gellish English dictionary concepts)
Gellish English language usage

# Meta languages

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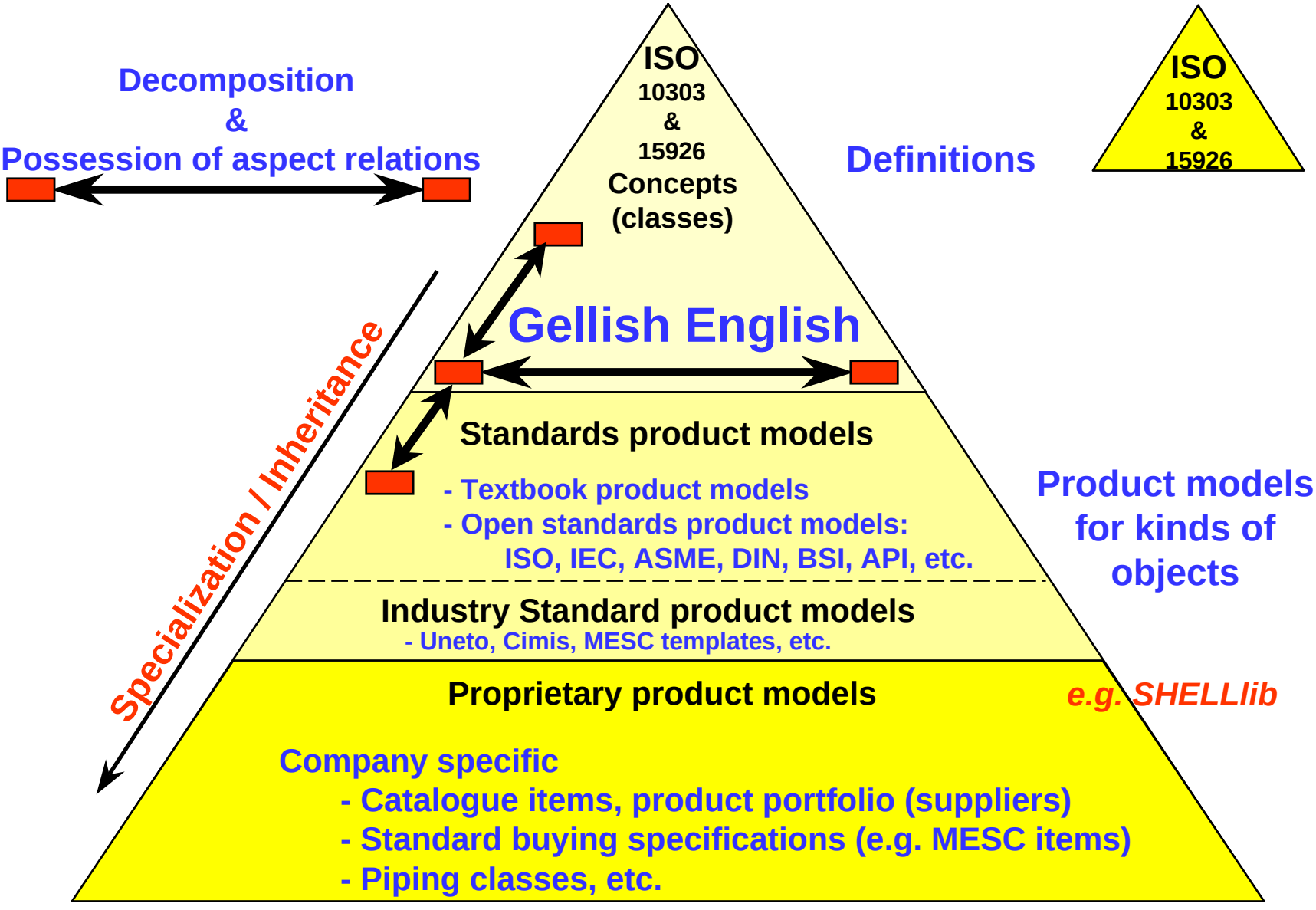
# Standard Product models & Knowledge models expressed in Gellish English

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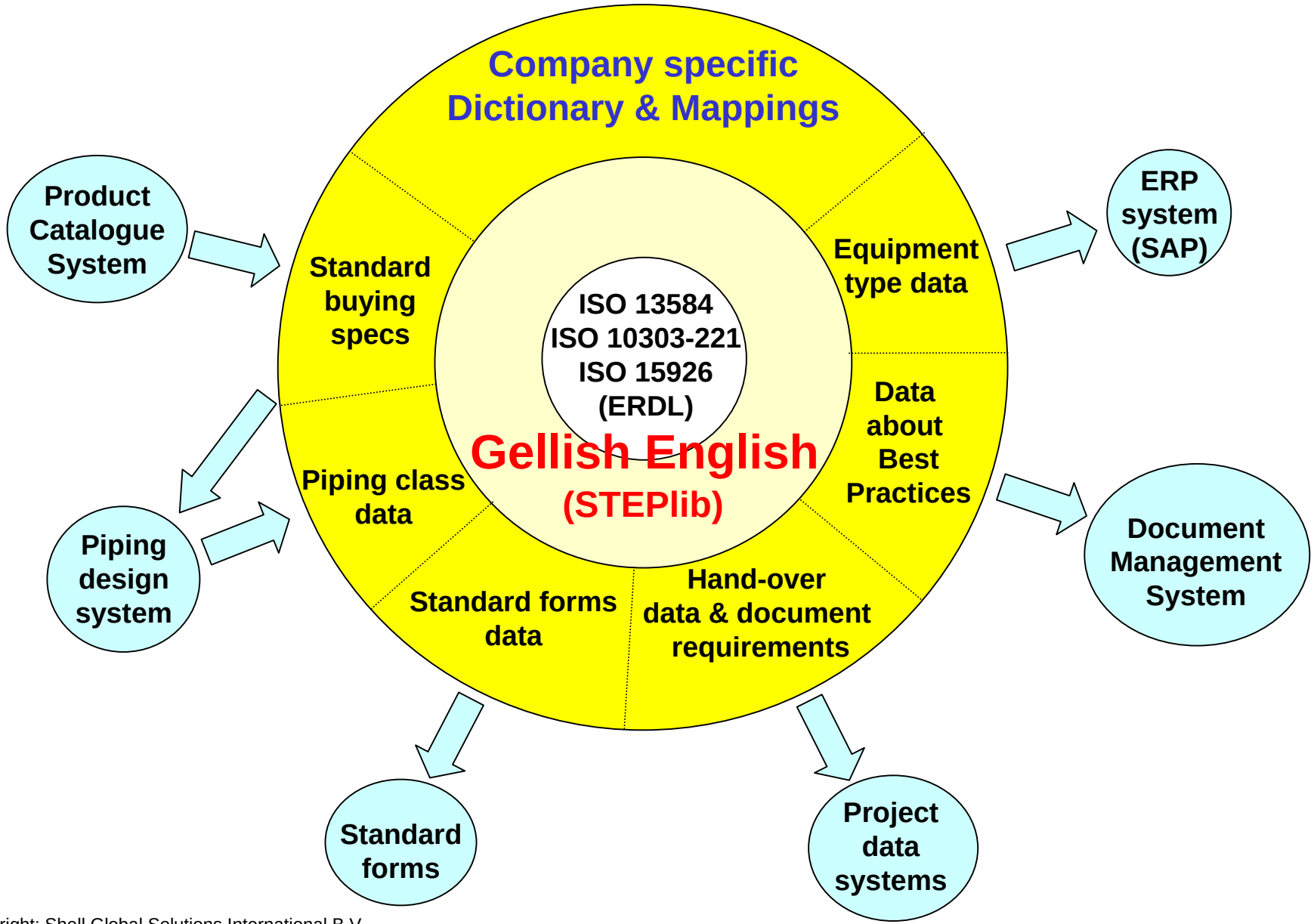
# Relate your Company Dictionary to ISO standards

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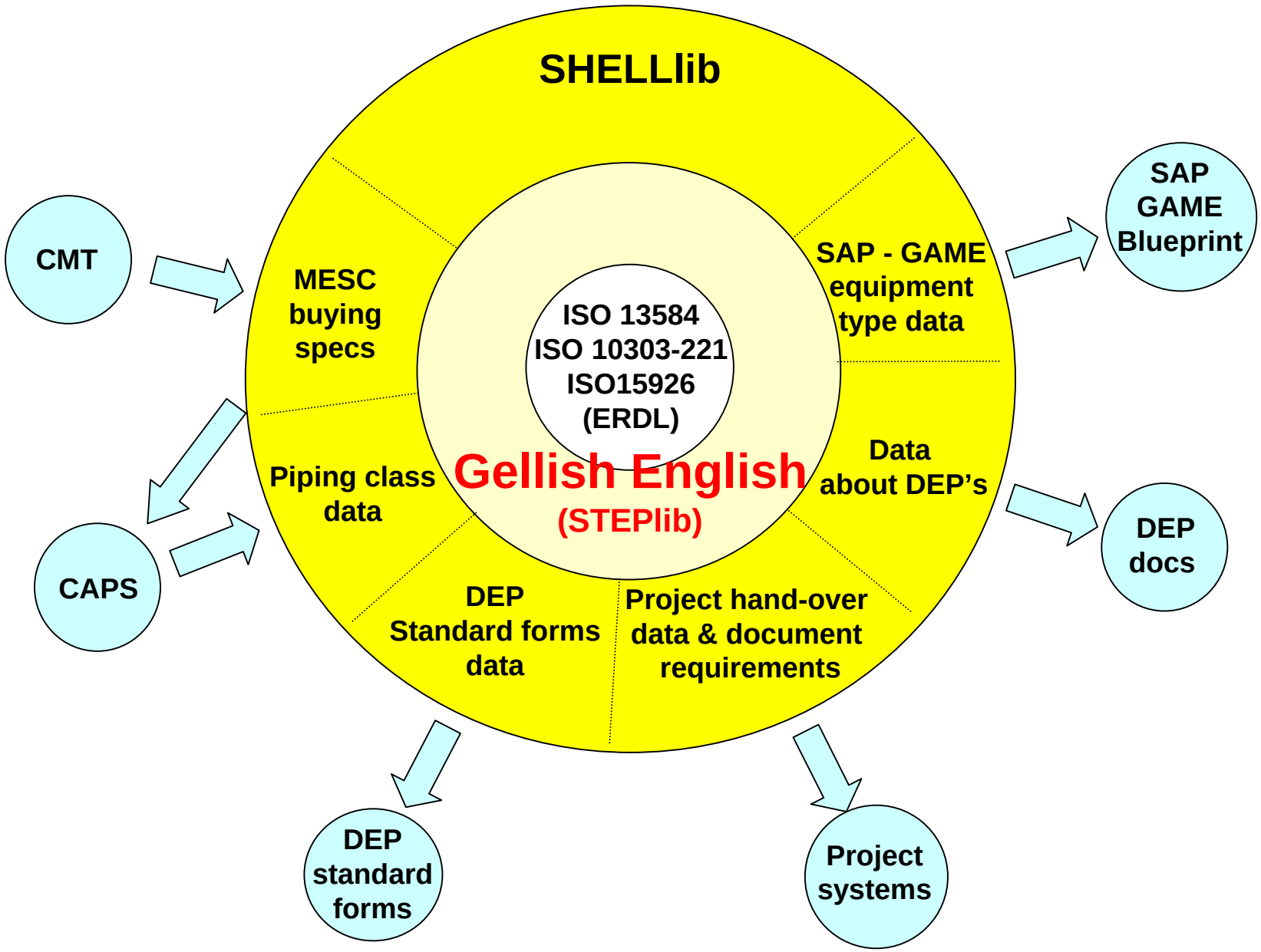
# Top view: SHELLlib and ISO standards

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# The Gellish language

## Gellish Language definition: Dictionary / Taxonomy

- Object types, incl. document types, activity types, etc.
- Aspect types,
- Relation types
  - Relations between concepts
  - Relations between individual objects
  - Relations between individual objects and concepts

## Language usage: Gellish Table (syntax)

| Left hand object | Relation type | Right hand object | UoM |
|---|---|---|---|
| K-1301 | is part of | U-1300 | |
| K-1301 | is classified as a | compressor | |
| K-1301 | has as aspect | capacity of K-1301 | |
| capacity of K-1301 | is classified as a | capacity (mass flow rate) | |
| capacity of K-1301 | is quantified as | 46 | kg/s |

## Language usage: STEPlib Knowledge base:

| Left hand object | Relation type | Right hand object |
|---|---|---|
| compressor | can have as aspect a | capacity (mass flow rate) |
| is part of | is a specialization of | relation between individuals |

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# Private extensions of the Gellish language

**Requirements** e.g. Hand-over requirements

| Left hand object | Relation type | Right hand object |
|---|---|---|
| compressor | shall have as aspect a | capacity (mass flow rate) |
| equipment | shall be part of a | system |
| equipment | shall be element of a | maintenance unit |

- **Company Standards** e.g. Standard product models
  Mappings to/from system e.g. SAP
  Standard Buying descriptions (e.g. MESC)
  Piping classes

- **Catalogue items** e.g. Vendor catalogues

**E.g. Your company specific Private Extension**

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# Knowledge expressed in Gellish

## Subsets of Gellish Knowledge Base (STEPlib):

1. **List of concepts with their names**

| | | |
|---|---|---|
| English | 70073 | coriolis mass flow meter |
| English | 70073 | coriolis flow meter |

2. **Dictionary**

| | | |
|---|---|---|
| English | 70073 | coriolis mass flow meter is a specialization of a mass flow meter intended to apply the Coriolis principle to measure a mass flow rate. |

3. **Taxonomy**

| | | | | | |
|---|---|---|---|---|---|
| English | 70073 | coriolis mass flow meter | is a specialization of | 70590 | mass flow meter |
| English | 70590 | mass flow meter | is a specialization of | 70143 | flow meter |

4. **Ontology or Knowledge models ('smart dictionary')**

| | | | | | |
|---|---|---|---|---|---|
| English | 70143 | flow meter | can have as part a | 10131 | straightener |
| English | 10131 | straightener | can have as aspect a | 551353 | length |

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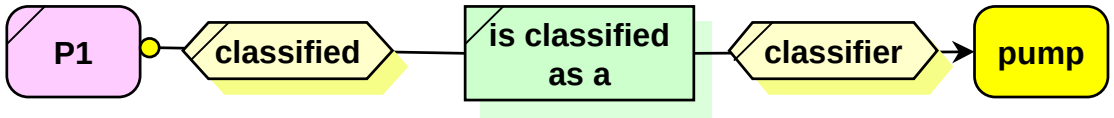
# Representation in a Gellish Table

## A universal single table

## (summary)




| 54 | 16 | 2 | 101 | 1 | 60 | 3 | 15 | 201 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Language | Context | Left hand object ID | Left hand object name | Fact ID | Relation type ID | Relation type name | Right hand object ID | Right hand object name | Status |
| english | proj A | 101 | P-1 | 201 | 1225 | is classified as a | 130058 | centrifugal pump | accepted |

| 72 | 73 |
|---|---|
| Left hand role ID | Left hand role name |
| 501 | classified P-1 |

| 74 | 75 |
|---|---|
| Right hand role ID | Right hand role name |
| 601 | classifier centrifugal pump |

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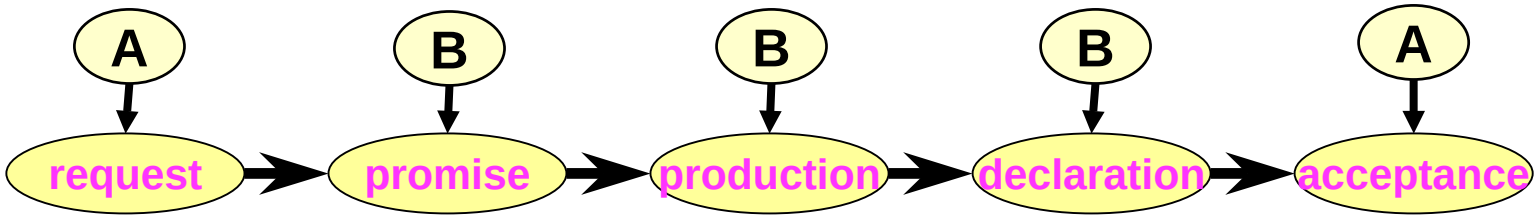
# Gellish Table

## Knowledge model of a Business Process

## according to the 'DEMO' methodology




| | | |
|---|---|---|
| request | can precede a | promise |
| promise | can precede a | production act |
| production act | can precede a | declaration |
| declaration | can precede a | acceptance |
| | | |
| person | can request to perform a | production act |
| person | can be requested to perform a | production act |
| person | can promise to perform a | production act |
| request | can result in a fact of type | A has requested to perform Xi |
| request | can result in a fact of type | B is requested to perform Xi |
| promise | can result in a fact of type | B has promised to perform Xi |
| production act | can result in a fact of type | B has produced Xr |
| production act | can have as output a | product |

*- blue text = Gellish standard relation type*
*- purple text = Gellish standard concept*

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# Gellish Table
## Knowledge model of a Vessel

| | | | | | |
|---|---|---|---|---|---|
| 520243 | vessel | can be a part of a | 160104 | process unit |
| 160177 | material | can have as aspect a | 550020 | mass |
| 550020 | mass | can be expressed on scale | 570039 | kg |
| 520243 | vessel | can have as aspect a | 550102 | design pressure |
| 550031 | pressure | can be expressed on scale | 570393 | barga |
| 520204 | shell | can be a part of a | 520243 | vessel |
| 520204 | shell | can have as aspect a | 550206 | outside diameter |
| 550188 | diameter | can be expressed on scale | 570423 | mm |

*- blue text = Gellish standard relation type*
*- purple text = Gellish standard concept*
*- red text = Gellish standard unique identifiers*

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# Gellish Table
## Requirements model of a Vessel

| | | | | | |
|---|---|---|---|---|---|
| 520243 | vessel | shall be a part of a | 160104 | process unit |
| 520243 | vessel | shall be classified as a subtype of | 520243 | vessel |
| 520243 | vessel | shall be described by a | 910171 | description |
| 520243 | vessel | shall be referenced on a | 490040 | construction drawing |
| 490196 | drawing | shall be classified as a subtype of | 490196 | drawing |
| 520243 | vessel | shall have as aspect a | 550020 | mass |
| 550020 | mass | shall be expressed on scale | 570039 | kg |
| 520243 | vessel | shall have as aspect a | 550102 | design pressure |
| 550031 | pressure | shall be expressed on scale | 570393 | barga |
| 520243 | vessel | shall be made of a | 552856 | material of construction |
| 520243 | vessel | shall be compliant with a | 910174 | design rule |
| 520204 | shell | shall be classified as a subtype of | 520204 | shell |
| 520204 | shell | shall be a part of a | 520243 | vessel |
| 520204 | shell | shall have as aspect a | 550206 | outside diameter |
| 550188 | diameter | shall be expressed on scale | 570423 | mm |

*- blue text = Gellish standard relation type*
*- purple text = Gellish standard concept*
*- red text = Gellish standard unique identifiers*

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# Gellish Table
## Product model of a Vessel

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | *V-6060* | is part of | 1 | Blow Down Unit 6050 | | |
| 2 | *V-6060* | is classified as a | 520121 | horizontal vessel | | |
| 2 | *V-6060* | is described by | 5 | flare knock out drum | | |
| 2 | *V-6060* | is referenced on | 4 | FPS120/22/31 SRP | | |
| 4 | *FSP120/22/31..* | is classified as a | 490040 | construction drawing | | |
| 2 | V-6060 | has as aspect | 6 | m of V-6060 | | |
| 6 | m of V-6060 | is classified as a | 550020 | mass | | |
| 6 | m of V-6060 | is quantified as | 924238 | 19000 | 570039 | kg |
| 2 | V6060 | has as aspect | 7 | dp of V-6060 | | |
| 7 | dp of V-6060 | is classified as a | 550102 | design pressure | | |
| 7 | dp of V-6060 | is quantified as | 920104 | 4 | 570393 | barga |
| 2 | V-6060 | is made of | 280043 | carbon steel | | |
| 2 | V-6060 | shall be compliant with | 8 | R-550352 | | |
| 8 | R-550352 | is classified as a | 910174 | design rule | | |
| 3 | shell-1 | is classified as a | 520204 | shell | | |
| 3 | shell-1 | is part of | 2 | V-6060 | | |
| 3 | shell-1 | has as aspect | 9 | OD of shell-1 | | |
| 9 | OD of shell-1 | is classified as a | 550206 | outside diameter | | |
| 9 | OD of shell-1 | is quantified as | 10 | 4124 | 570423 | mm |

*- black text = user supplied*
*- blue text = Gellish types of relations*
*- purple text = Gellish standard concepts*
*- red text = Gellish unique identifier (standard & user defined)*

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# Example of standard Gellish English types of relations

## Examples for the expression of facts about Individuals

... is identified by ...
... is classified as ...
... is a part of ...
... has as property ...
... has as quality ...
... is described by ...
... is connected to ...
... is placed relative to ...
... is a version of ...
... is derived from ...
... is spare for ...
... is defined in/on ...
... is referenced in/on ...
... is made of ...

... is approved for ...
... is created / terminated at ..
... is valid since / until ...
... is involved in ...
... is owned by ...
... is operated by ...
... is maintained by ...
... happened at ...
... is cause of ...
... is included in ...
... is required as input for /
as output for ...
... is presented by ...
... is carrier of ...
... is a realisation of ...


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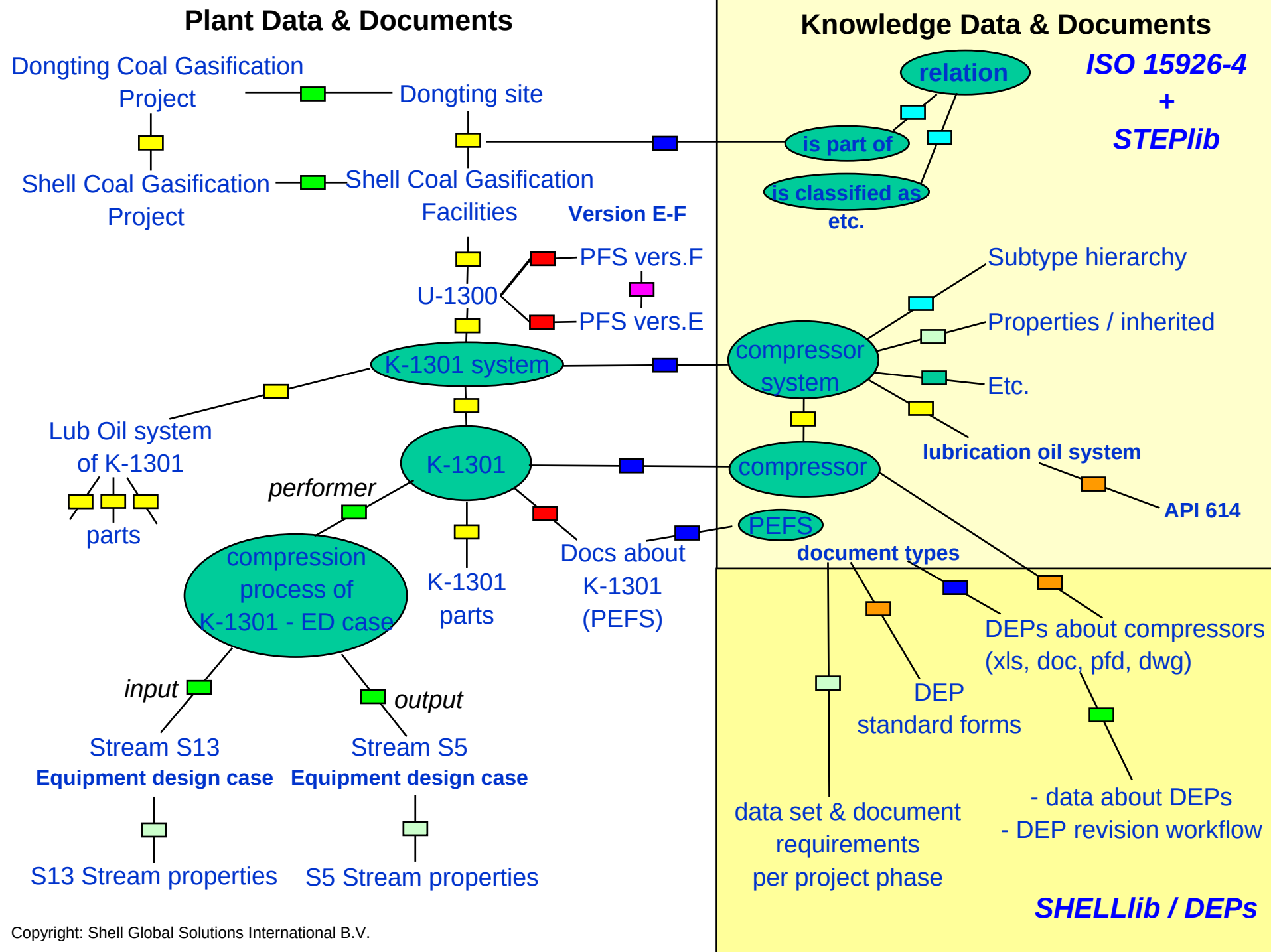


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# Demonstration topics

| | | |
|---|---|---|
| 1. | Plant objects have classifications | K-1301 |
| 2. | Classes have ‘knowledge models’, hierarchy, inheritance of aspects | compressor knowledge |
| 3. | Classes relate to DEPs and/or external standards | DEPs on compressors |
| 4. | Equipment ‘shall be compliant to’ a DEP, because of its classification | View DEP on compressors |
| 5. | Generate and fill-in a ‘data sheet view’ based on a knowledge model | Create compressor K-1302 |
| 6. | Generate a ‘summary sheet view’ of objects of a type, with/without subtypes | List of compressors |
| 7. | Asset breakdown | Dongting site / browser |
| 8. | Project breakdown related to Asset breakdown and Organizations | Shell CGF project |
| 9. | View documents about process units (PFS, PEFS), incl. versions | U-1300 > T-..v E, view F |
| 10. | Equipment is related as performer to process | K-1301 > gas compression |
| 11. | Processes operate on input / output streams | gas compression > S5, S13 |
| 12. | Stream data form a material balance | S5 properties, S13 props |
| 13. | Stream data is not duplicated when shown as process data for equipment | K-1301 properties |

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# The Gellish Website

http://sourceforge.net/project/showfiles.php?group_id=28353

Later: gellish.sourceforge.net

**Gellish**

- Language definition (TOPini + Domain ontologies)
- Knowledge Base

**Documentation:**

- Gellish Table definition
- Gellish English Application Manual
- Gellish Dictionary Extension Manual (GUIDE on STEPlib)
- Example: Lubrication Oil System

- Gellish Browser: www.STEPlib.com

**Gellish Forum contact: Andries.vanRenssen@Shell.com**

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# Scope of the Gellish Smart Dictionary

- Plants and Systems
- Civil, Structural & Architectural
- Connection material
- Electrical
- Heat transfer equipment
- Instrumentation and Control & IT
- Movement systems
- Piping
- Protection material
- Rotating equipment
- Solids handling
- Valves
- Static Equipment, Vessels
- Transport
- Geographical objects

- Organizations
- Information / Encoding
- Information carriers (Doc. types)

- Activities
- Procedures
- Events
- Industrial processes
- Control processes
- Natural processes
- Roles of objects

- Construction material
- Process material
- Energy
- Signals

- Properties
- Units of measure

- Geometric objects (Types of Symbols)

2 feb 1996

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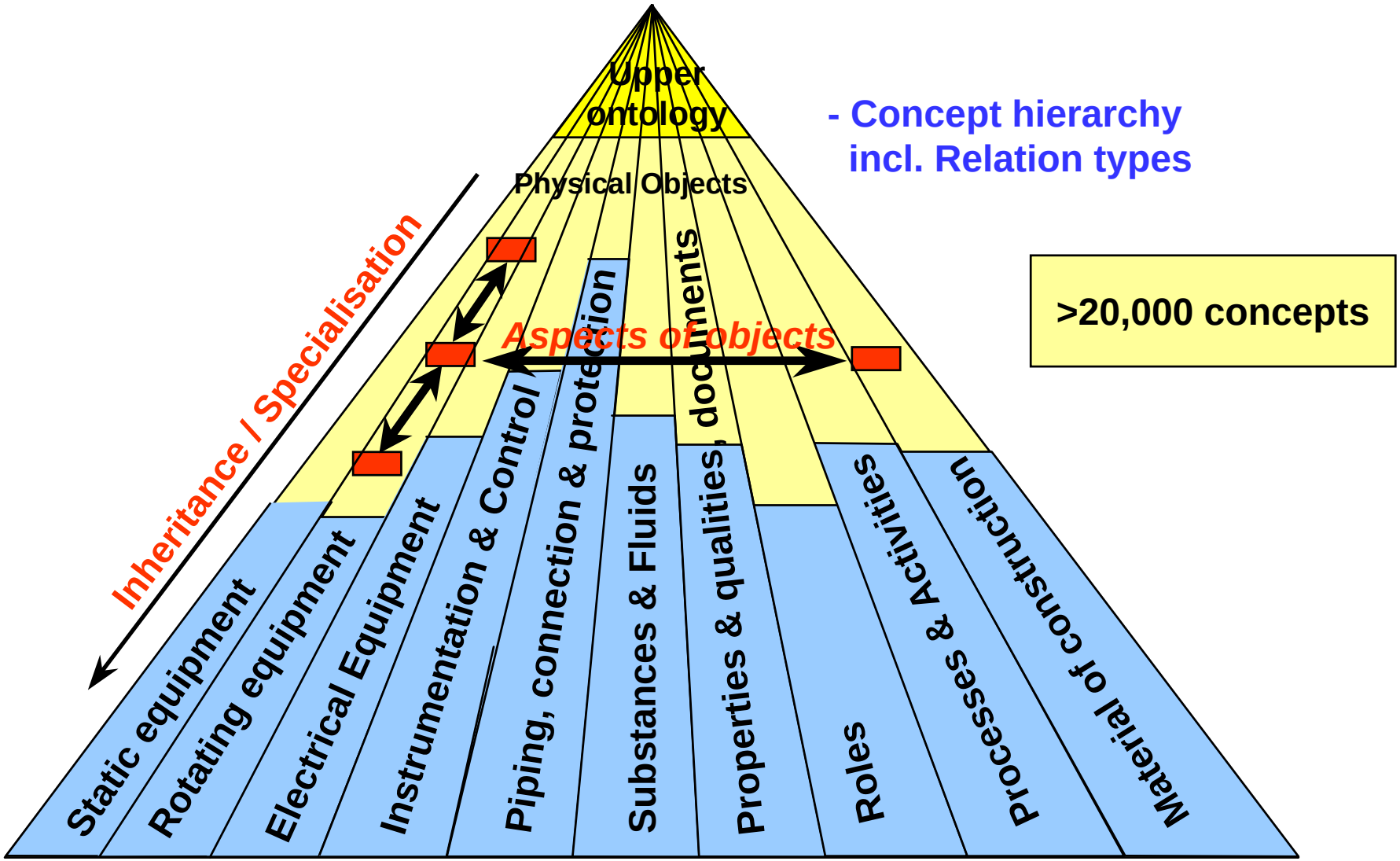
# Structure of the Gellish Dictionary / Taxonomy / Ontology

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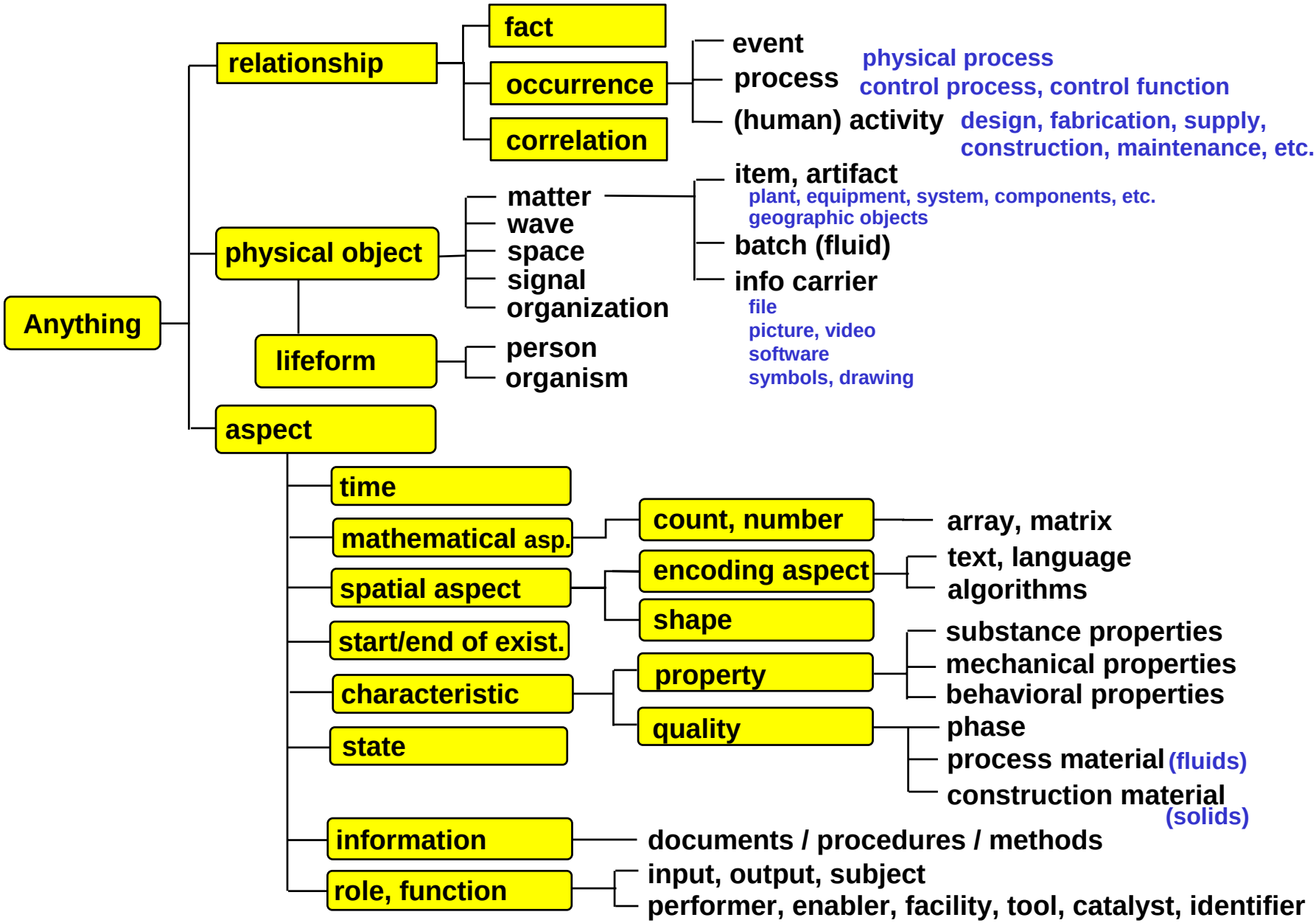
# Structure of the Gellish Dictionary / Taxonomy

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