RDF-based Object Type Libraries

in construction project settings

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TAXONIC

WHO WE ARE

Founded in 2012 as a Dutch consultancy specializing in knowledge engineering

Practical application of knowledge graphs

Reseller and implementation partner TopQuadrant's TopBraid suite for local customers

Meet the speakers

Eliana Papoutsoglou
Linked data consultant
Taxonic

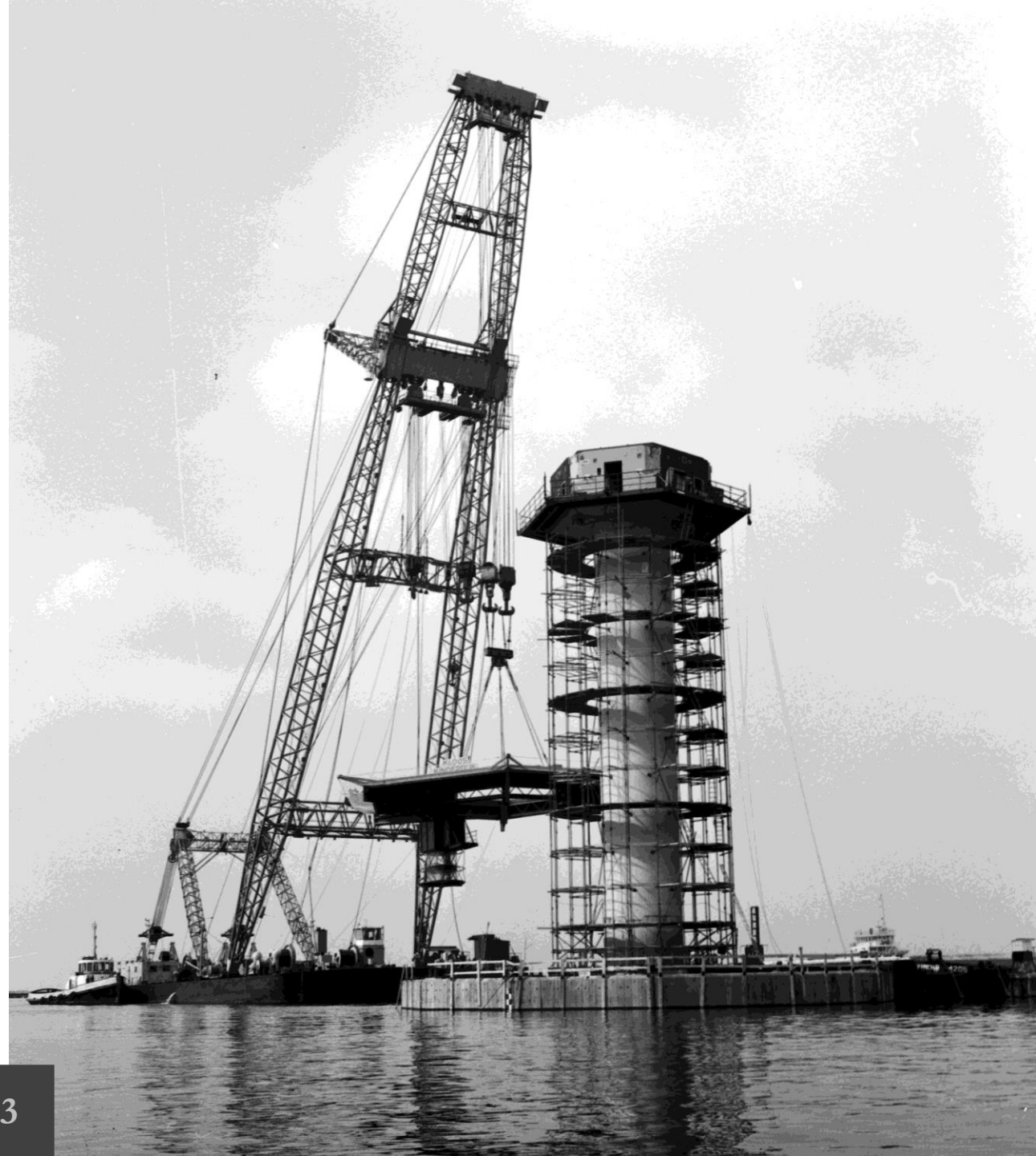
Jan Voskuil
Ontologist | CEO
Taxonic

Agenda

1. **Introduction**
   Rethinking asset information management

2. **Demo**
   Seamless information exchange in construction projects

3. **Evolving usage**
   Innovative usage scenarios



Datafication

FROM DOCUMENTS TO DATA

Documents still rule
Large infra projects use up to 10M documents

Manual processes
Computers offer tremendous potential

Move towards data
Computers understand data, not text

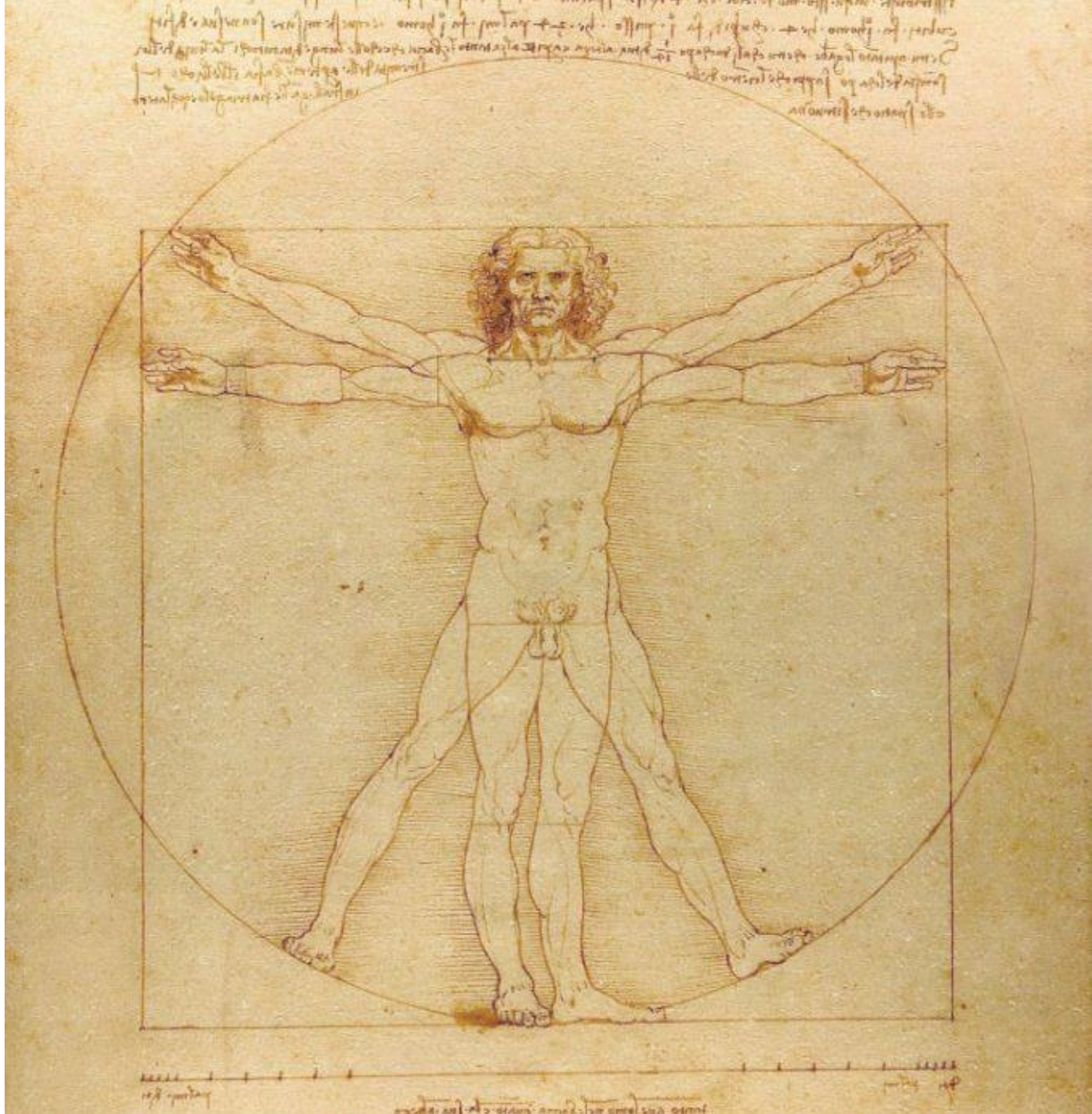
Datafication

EASIER SAID THAN DONE

Black hole
Data without data model are unusable

Data models hard-coded
Data models cannot be exchanged

Knowledge graphs
Knowledge graphs represent data **and** data model

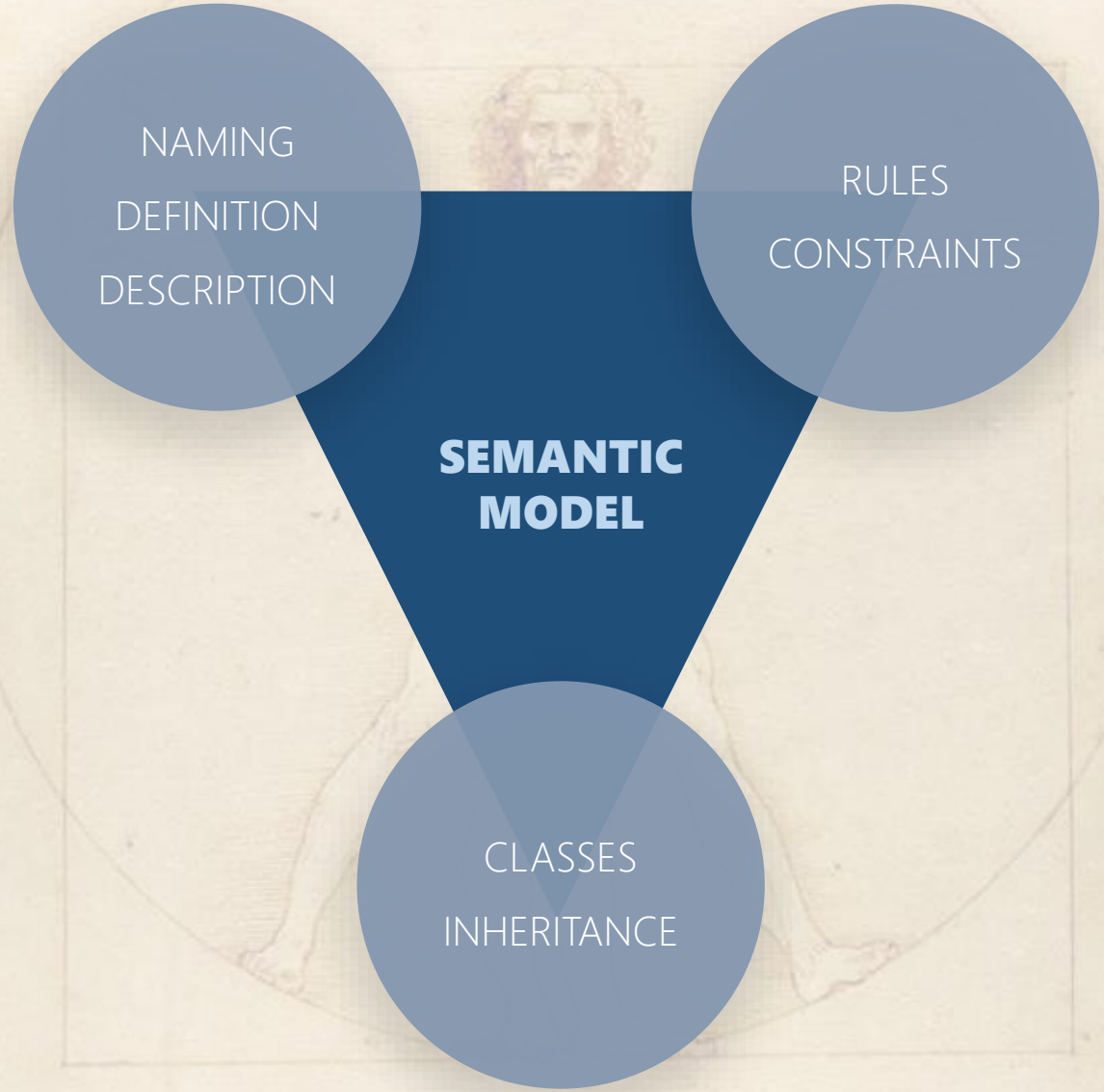


RDF

Exchanging data models

Importance of data models
Data models provide semantics so that computers “understand” data

Semantic triangle
Class hierarchy, definition, constraints



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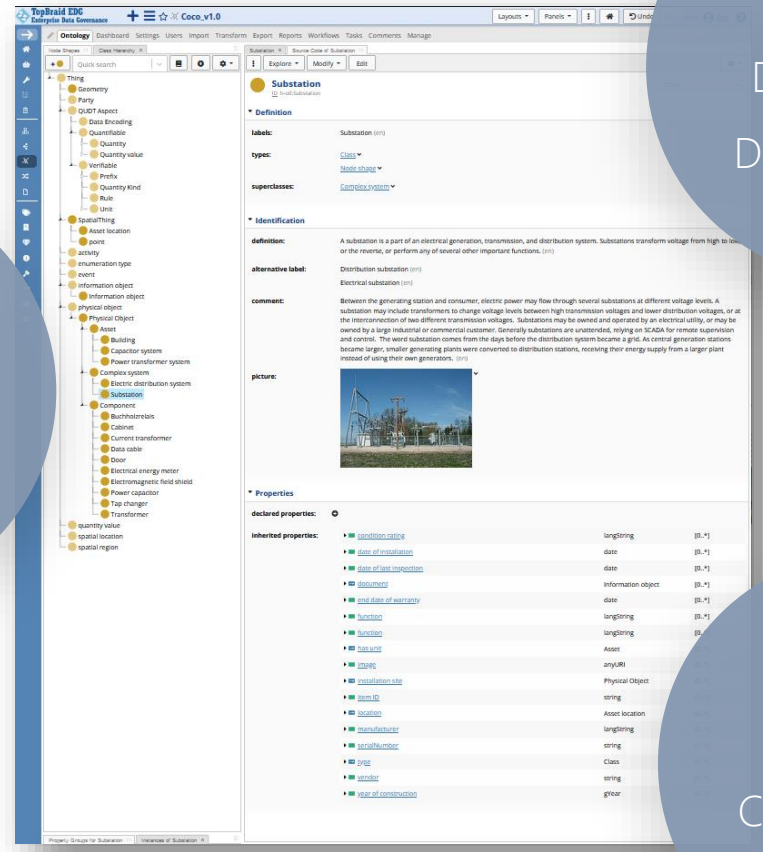
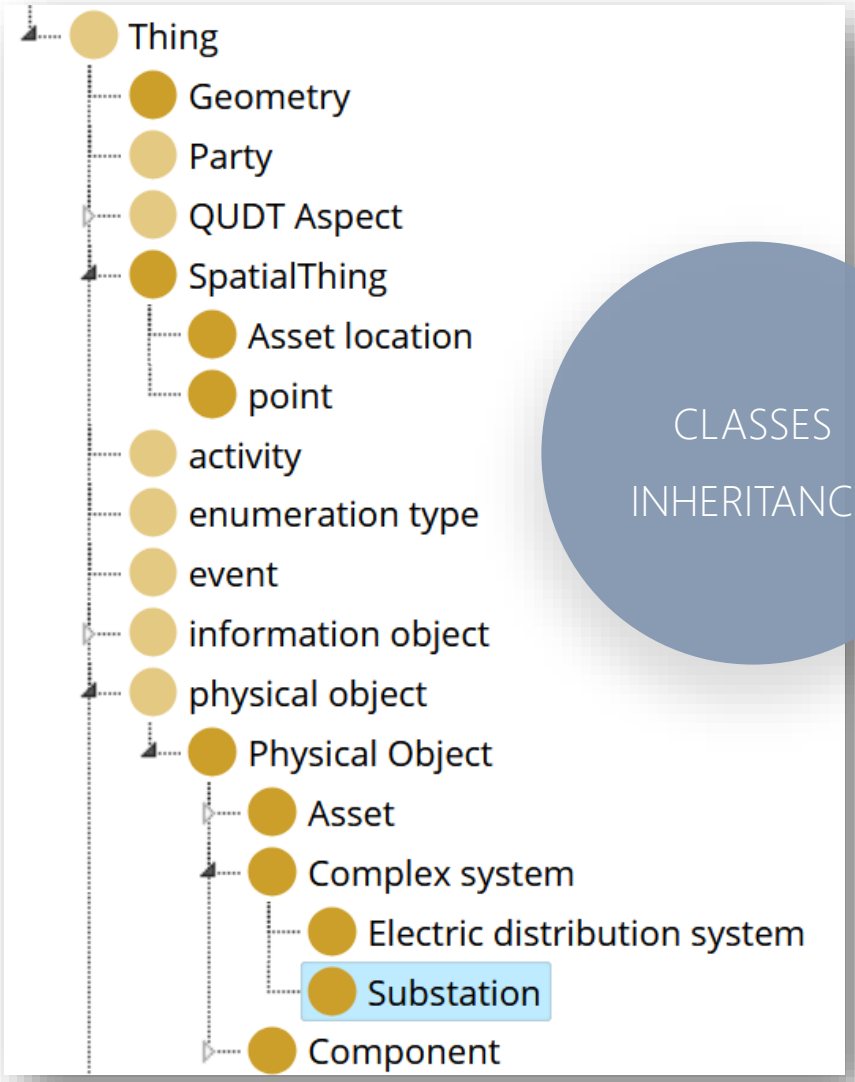
NAMING
DEFINITION
DESCRIPTION

CLASSES
INHERITANCE



RULES
CONSTRAINTS



CLASSES
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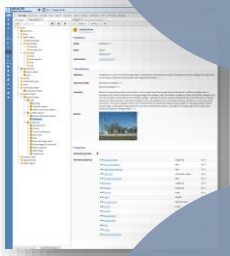
DESCRIPTION



RULES
CONSTRAINTS

Substation

ID h-otl:Substation

Class

Definition

labels: Substation (en)

types: Class

Node shape

superclasses: Complex system

NAMING

DEFINITION

DESCRIPTION

Identification

definition: A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. (en)

alternative label: Distribution substation (en)

Electrical substation (en)

description: Between the generating station and consumer, electric power may flow through several substations at different voltage levels. A substation may include transformers to change voltage levels between high transmission voltages and lower distribution voltages, or at the interconnection of two different transmission voltages. Substations may be owned and operated by an electrical utility, or may be owned by a large industrial or commercial customer. Generally substations are unattended, relying on SCADA for remote supervision and control. The word substation comes from the days before the distribution system became a grid. As central generation stations became larger, smaller generating plants were converted to distribution stations, receiving their energy supply from a larger plant instead of using their own generators. (en)

picture:

SES

ANCE

RULES

CONSTRAINTS

Properties

declared properties:

inherited properties:

condition rating	langString	[0..*]
date of installation	date	[0..*]
date of last inspection	date	[0..*]
document	Information object	[0..*]
end date of warranty	date	[0..*]
function	langString	[0..*]
function	langString	[0..*]
has unit	Asset	[0..*]
image	anyURI	[0..*]
installation site	Physical Object	[0..*]
item ID	string	[1..1]
location	Asset location	[0..*]
manufacturer	langString	[0..*]
serialNumber	string	[1..1]
type	Class	[0..*]
vendor	string	[0..*]
year of construction	gYear	[0..1]

RULES
CONSTRAINTS

NAMING
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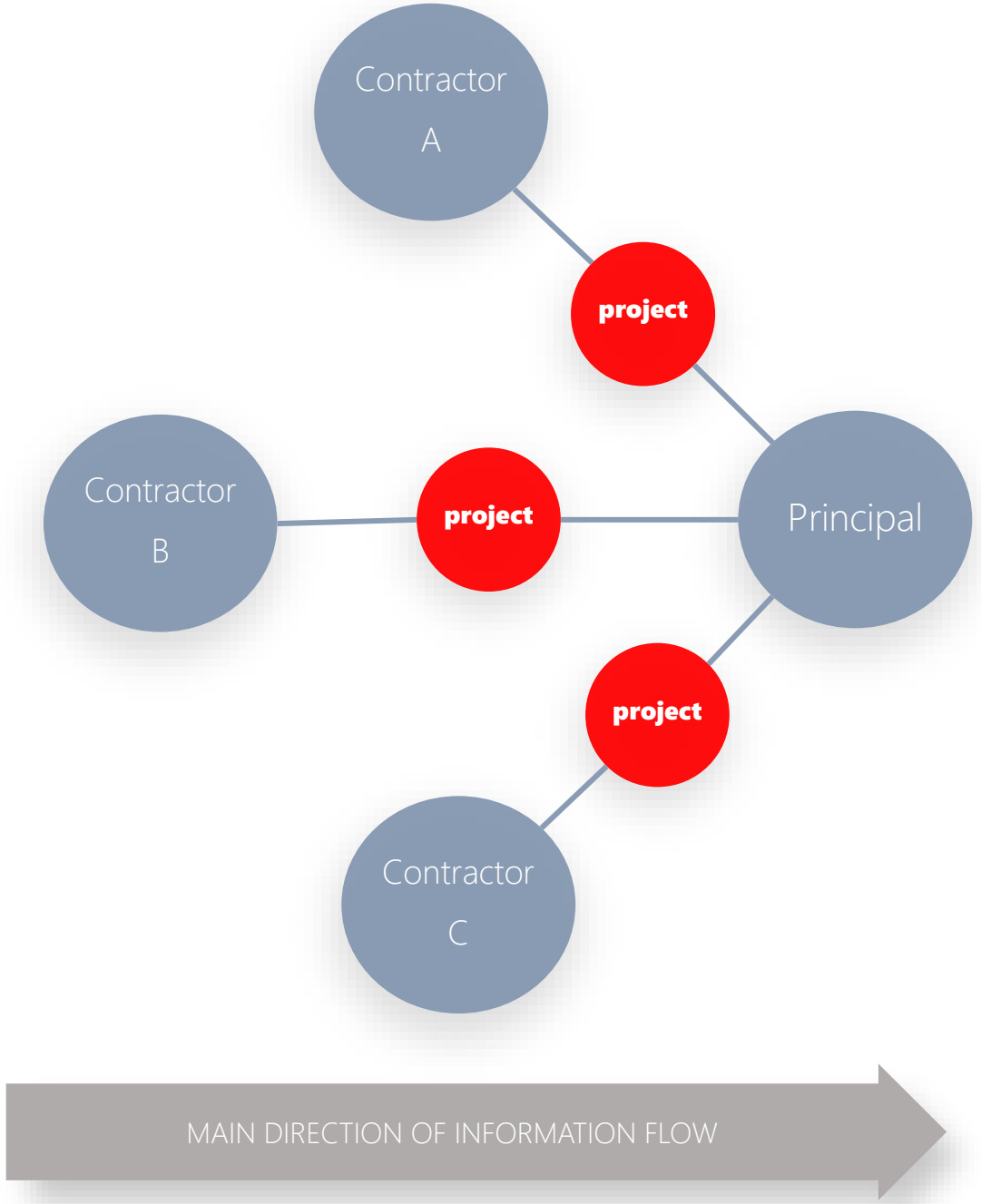
DESCRIPTION

CLASSES
INHERITANCE

USING GRAPHS

The principal's perspective



Exchangeable models
Object Type Library
Engineering Class Library
Reference Data Library
Ontology

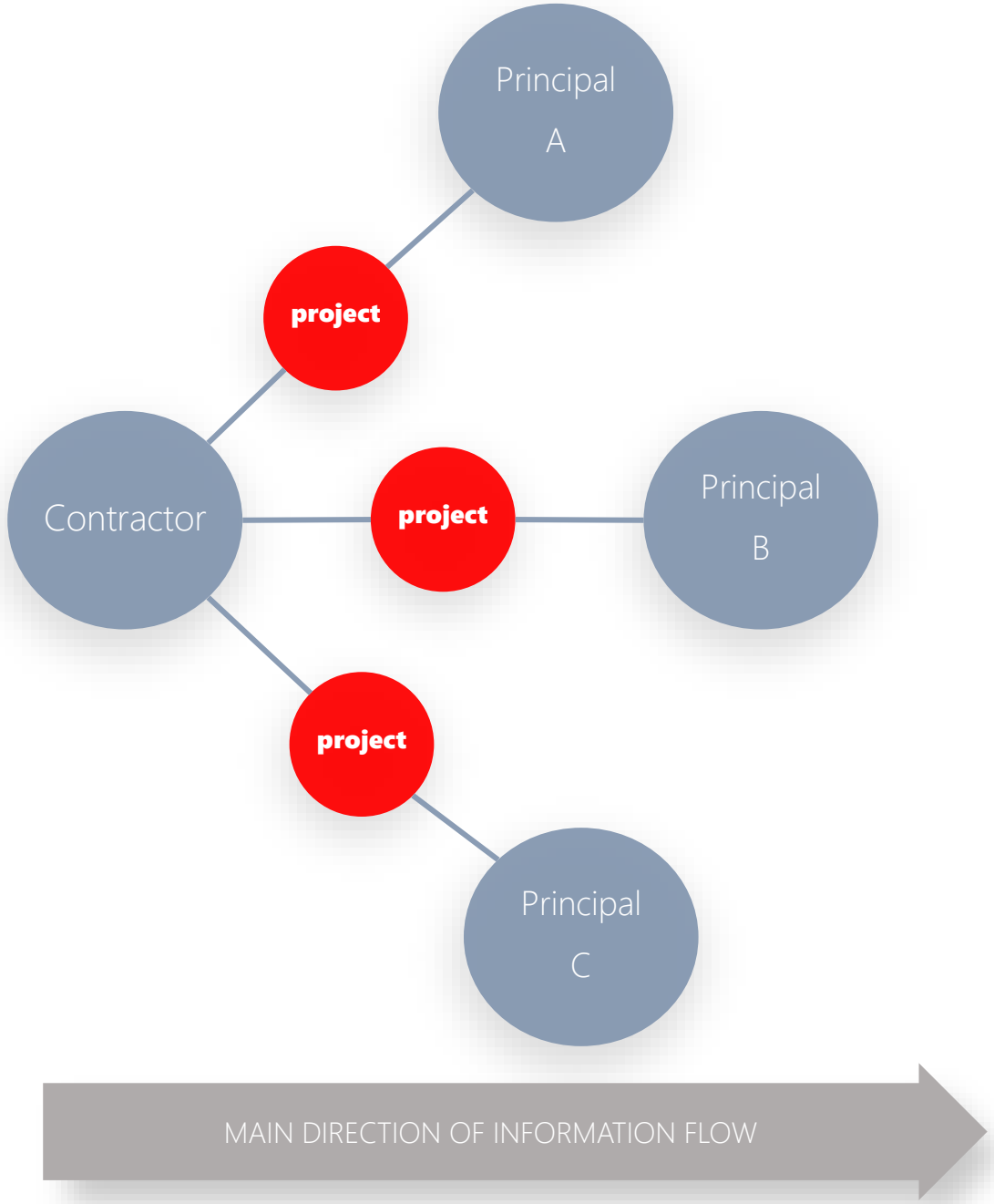
Many examples
Schiphol AIM project

USING GRAPHS

The contractor's perspective

Many exchangeable models
Each project a different OTL

Integration with IT-systems
Knowledge graphs solve this problem



Graph coalescence

Combining graphs

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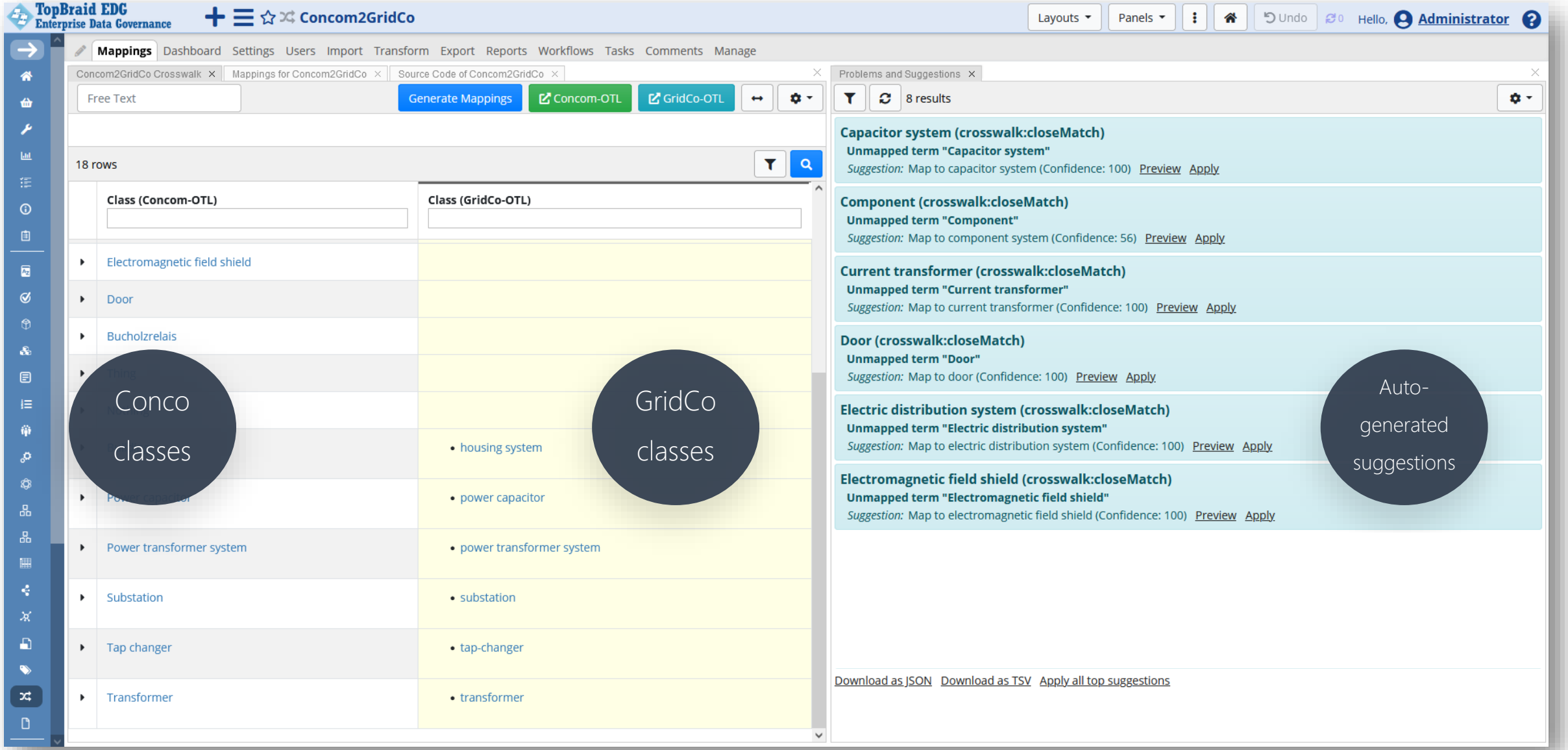

TopBraid EDG
Enterprise Data Governance
Concom2GridCo
Layouts
Panels
Undo
Hello, Administrator
Mappings
Dashboard
Settings
Users
Import
Transform
Export
Reports
Workflows
Tasks
Comments
Manage
Concom2GridCo Crosswalk
Mappings for Concom2GridCo
Source Code of Concom2GridCo
Free Text
Generate Mappings
Concom-OTL
GridCo-OTL
18 rows
Class (Concom-OTL)
Class (GridCo-OTL)
Electromagnetic field shield
Door
Bucholzrelais
housing system
power capacitor
Power transformer system
power transformer system
Substation
substation
Tap changer
tap-changer
Transformer
transformer
Conco classes
GridCo classes
Problems and Suggestions
8 results
Capacitor system (crosswalk:closeMatch)
Unmapped term "Capacitor system"
Suggestion: Map to capacitor system (Confidence: 100) Preview Apply
Component (crosswalk:closeMatch)
Unmapped term "Component"
Suggestion: Map to component system (Confidence: 56) Preview Apply
Current transformer (crosswalk:closeMatch)
Unmapped term "Current transformer"
Suggestion: Map to current transformer (Confidence: 100) Preview Apply
Door (crosswalk:closeMatch)
Unmapped term "Door"
Suggestion: Map to door (Confidence: 100) Preview Apply
Electric distribution system (crosswalk:closeMatch)
Unmapped term "Electric distribution system"
Suggestion: Map to electric distribution system (Confidence: 100) Preview Apply
Electromagnetic field shield (crosswalk:closeMatch)
Unmapped term "Electromagnetic field shield"
Suggestion: Map to electromagnetic field shield (Confidence: 100) Preview Apply
Auto-generated suggestions
Download as JSON
Download as TSV
Apply all top suggestions

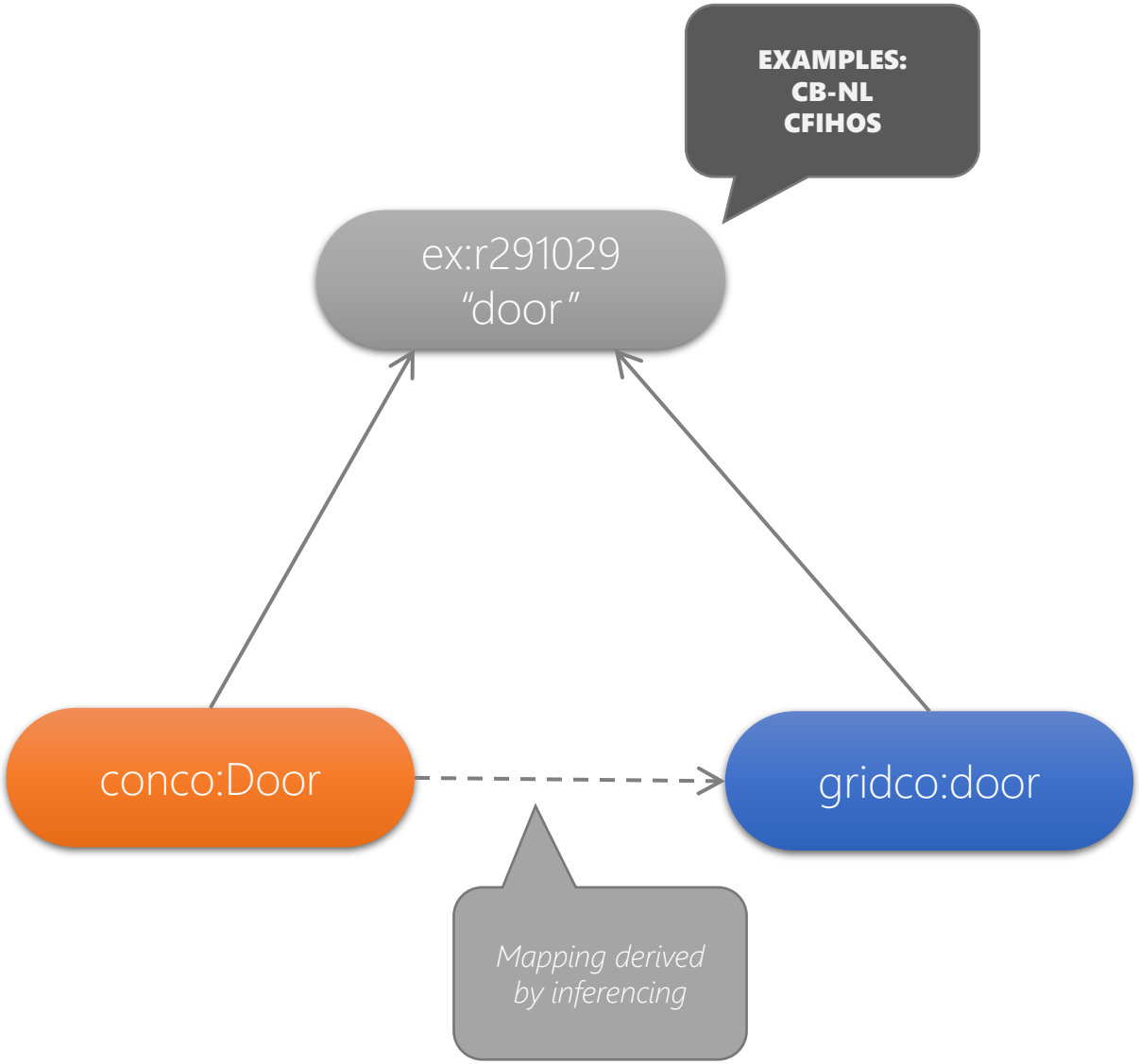
MAPPING RULES

HOW MAPPINGS ARE GENERATED

Simple similarity of labels
This is used in the demo

Adding more labels
More matches (also false positives)

Third party taxonomies
Transitive closure



Unified approach

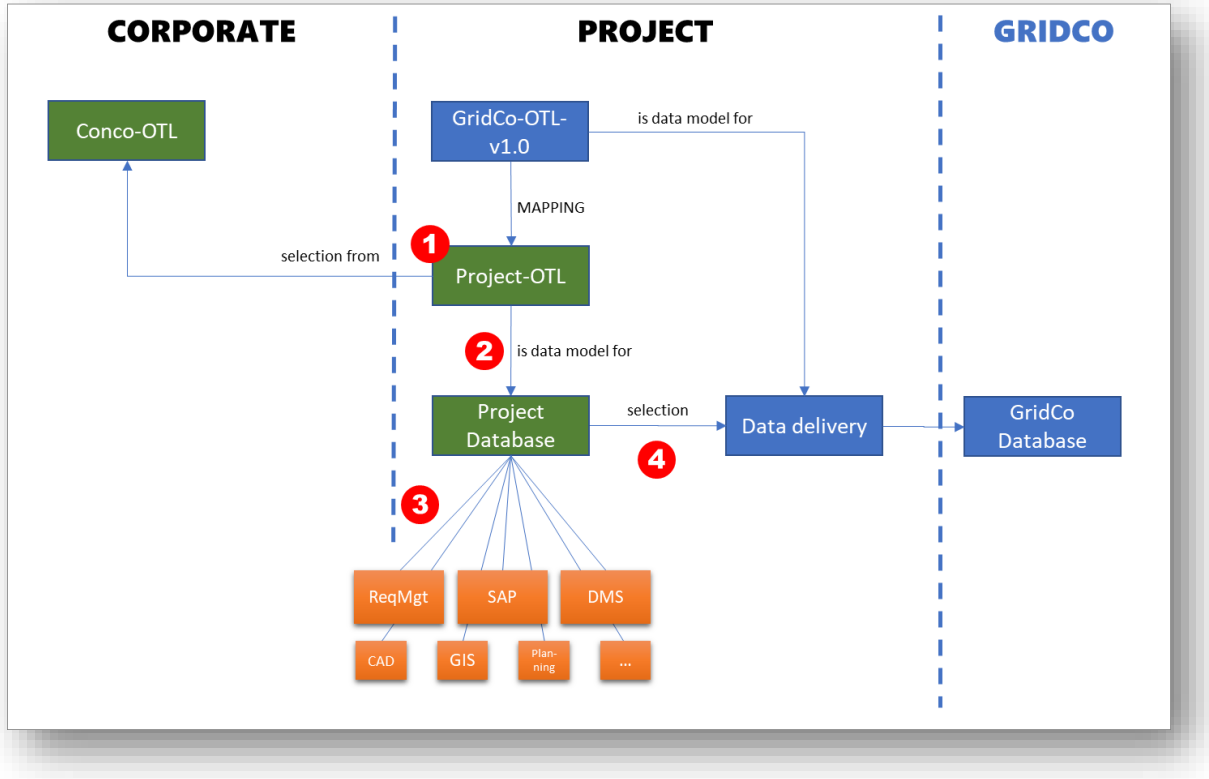
Combining graphs

1. **Project OTL**
   Combining two OTLs and mappings

2. **Project database**
   Conco-OTL is the leading model

3. **Integration with back-end IT**
   Interfaces reusable across projects

4. **Data delivery**
   Reusable SHACL Rules for executing the mapping rules

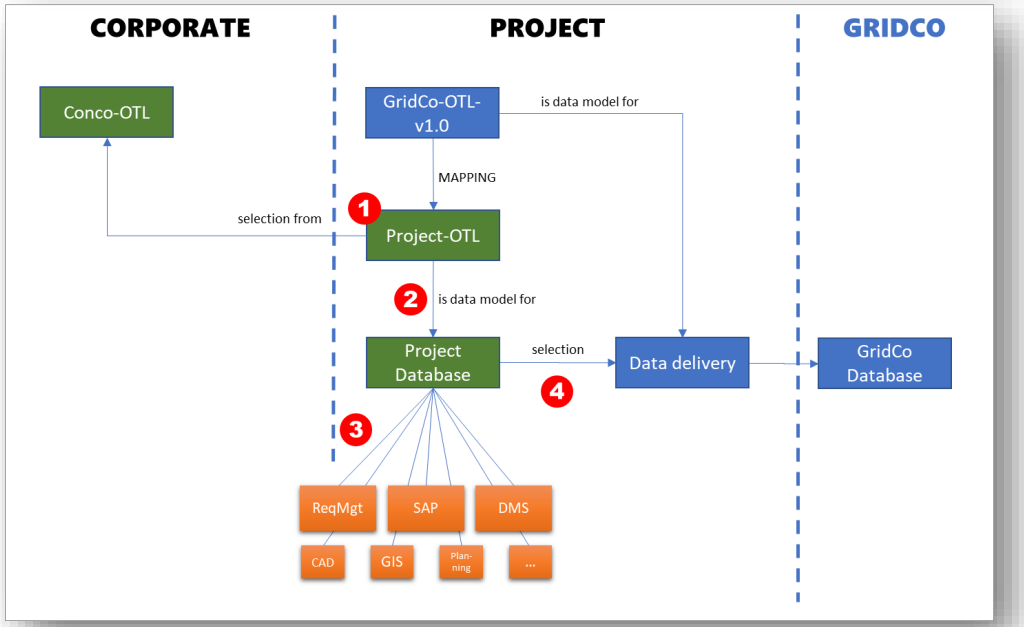


TAKE-AWAYS

Key points

- One standardized work process
- Based on mappings
- Data integration across projects

Knowledge graphs crucially express data and data models in a unified way



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