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Managing and publishing standardized data catalogues to support BIM processes

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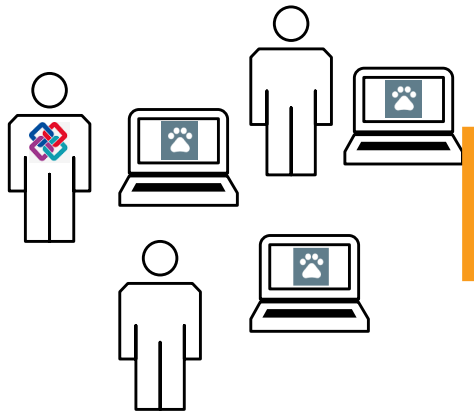
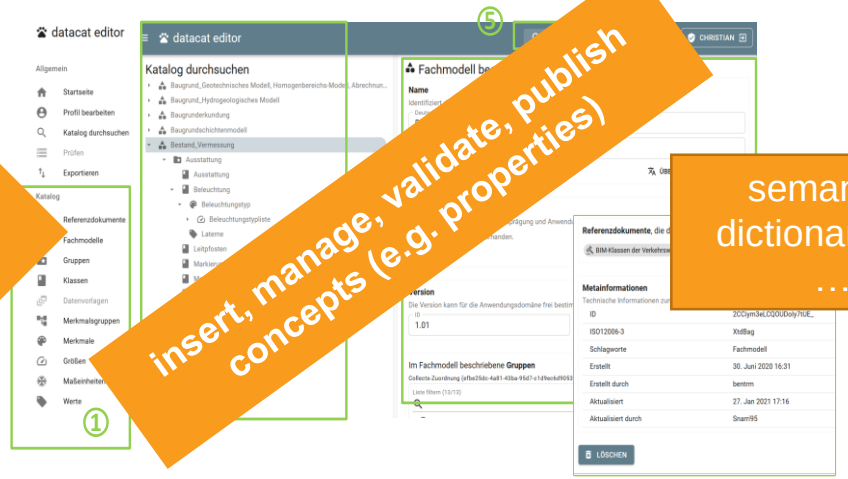
Session 9 - Interoperability and novel data practices

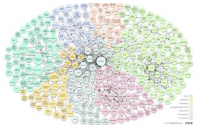
Motivation: Good Workflow for “Sematic Alignment”



technical / conceptual knowledge



semantically aligned: dictionaries / ontologies / ….properties



Semantic Web

BIM Authoring Tool
authoring semantics according to data catalogue

CDE
validating semantics according to data catalogue

domain experts and working group

Datacat: web based collaboration platform

BIM / CAD / GIS?

Motivation: buildingSMART Germany "Transport Routes"

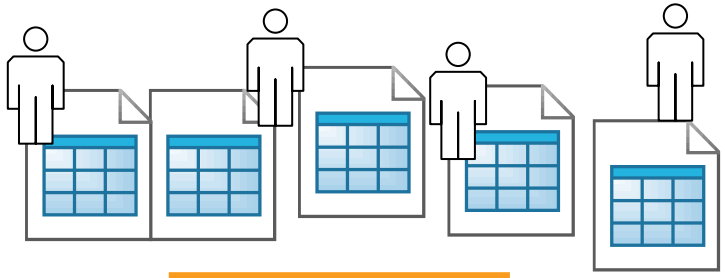
- 7 thematic working groups, 30 companies/institutes, 50 professionals
- **Tasks:** Specification of „BIM-classes“ on **national level**
  - Transport routes / Infrastructure
  - Properties and Property-groups for each class
  - (Assignment to LOIN)

Problem #1: No tool at hand

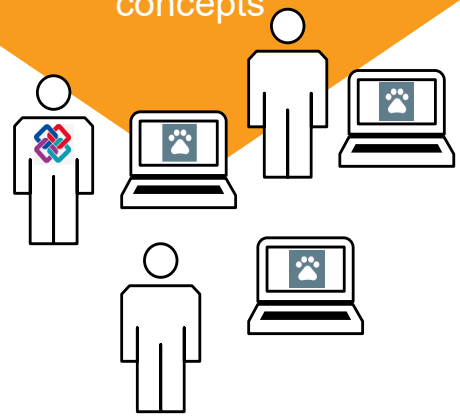
- spreadsheets, (unmanaged) file storage in cloud
- difficult to query/search/filter duplicates and synonyms
- hard to consolidate the result of all seven working groups ☹
- → 

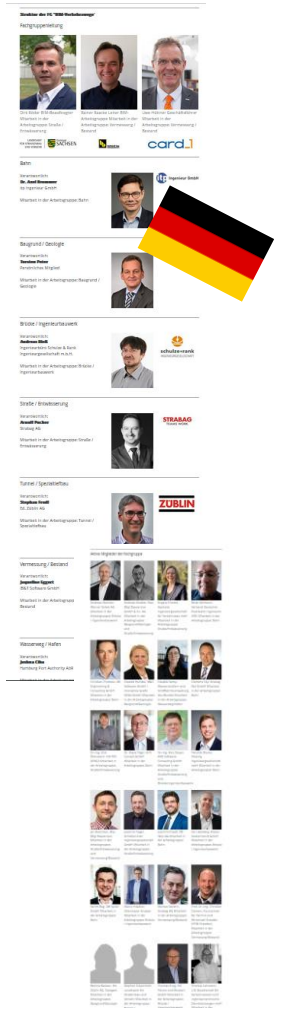
Problem #2: Willingness for digital collaboration based with meta-concepts

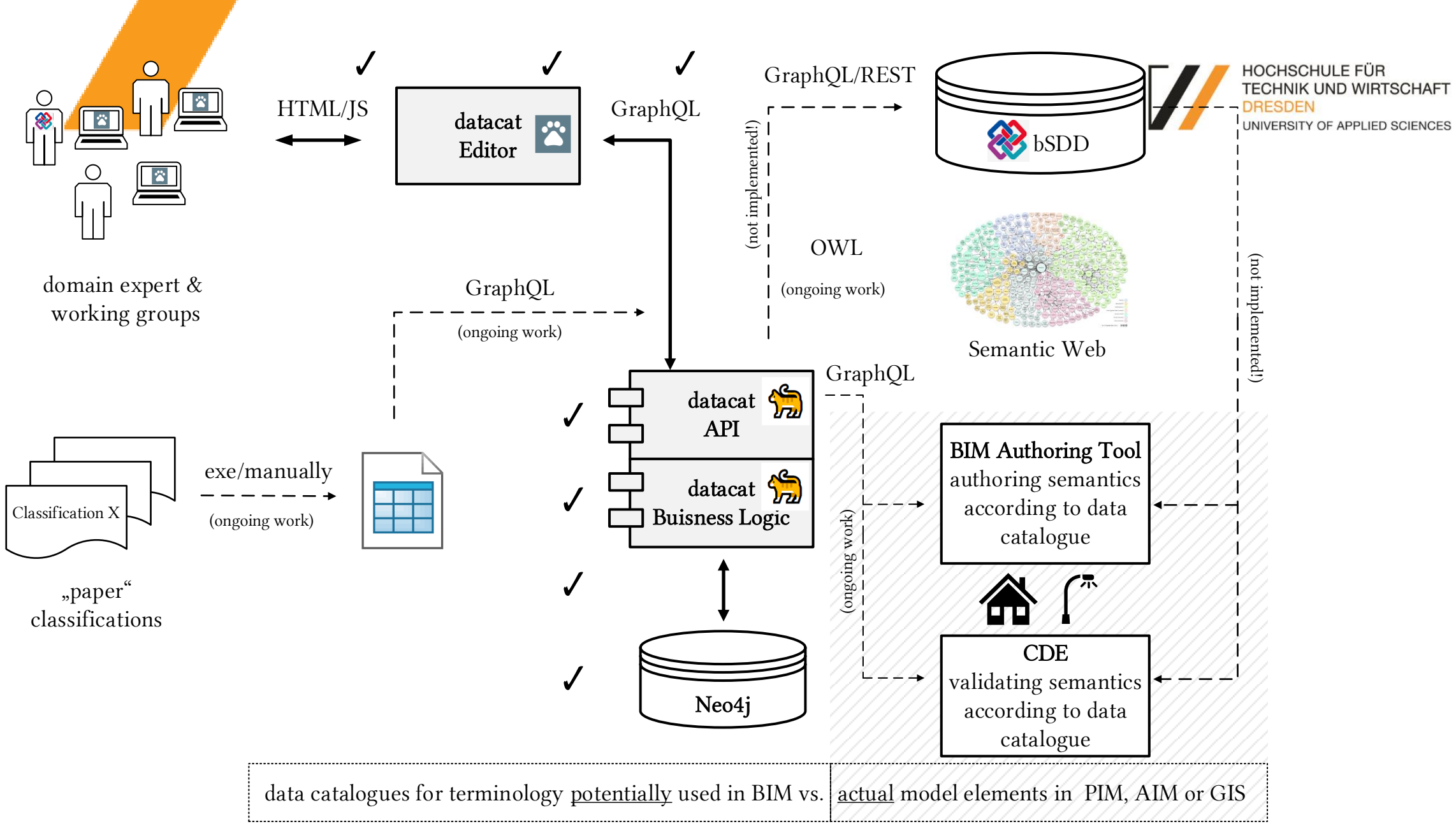
- → ?



Need to **convince** engineering professionals to collaborate web based with “meta-concepts”






HTML/JS
datacat Editor
GraphQL
GraphQL/REST
bSDD
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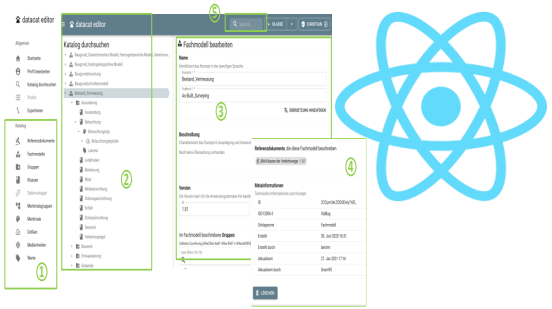
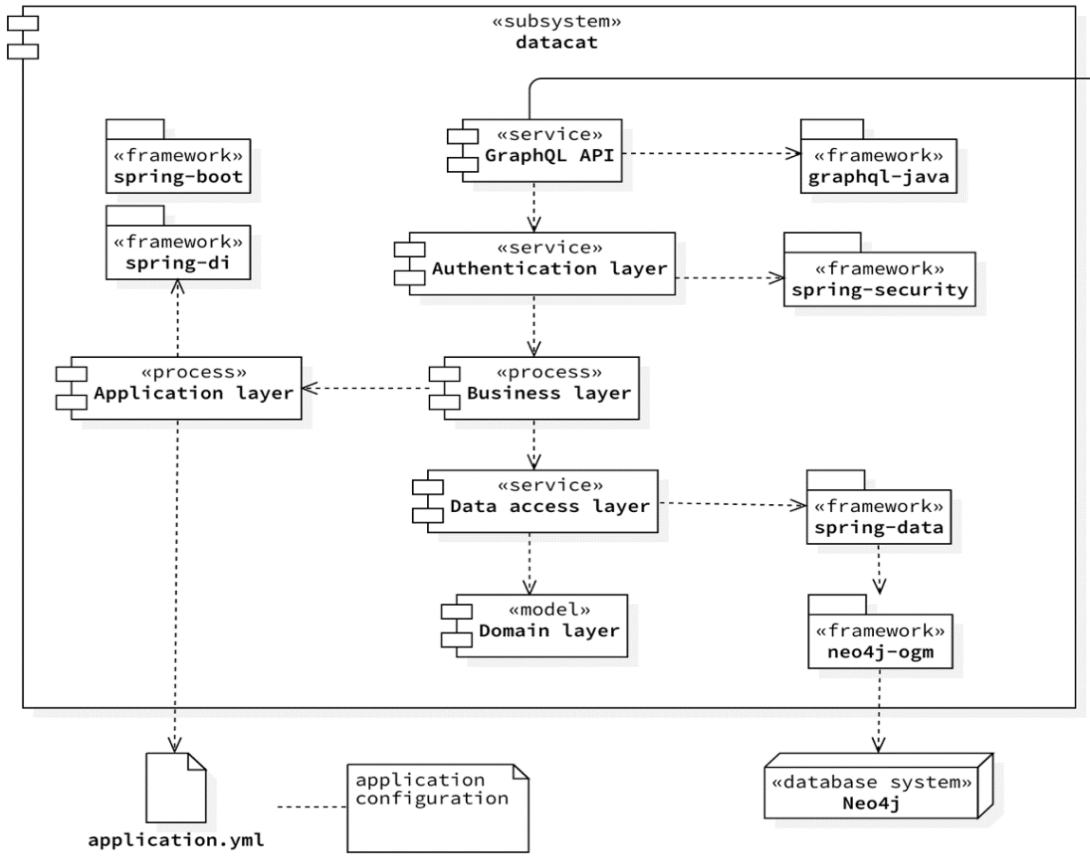
(not implemented!)
OWL
(ongoing work)
Semantic Web
(not implemented!)
domain expert & working groups
GraphQL
(ongoing work)
GraphQL
datacat API
datacat Buisness Logic
Classification X
exe/manually
(ongoing work)
„paper“ classifications
Neo4j
(ongoing work)
BIM Authoring Tool
authoring semantics according to data catalogue
CDE
validating semantics according to data catalogue
data catalogues for terminology potentially used in BIM vs.
actual model elements in PIM, AIM or GIS

technical result == open source software stack





GitHub

https://github.com/DD-bim/

Semantic alignment

#1 Outside IFC:

→ IFC semantic expressiveness is limited
→ With the user-defined property sets, IFC can be extended generically
→ However, the semantic interoperability is then no longer guaranteed
→ The standardization of semantics within a BIM project or an application domain **must therefore take place outside of IFC**

#2 Cross-Domain Semantic Interoperability

→ The “aligned” vocabulary is **agnostic to** software and application domain / software: BIM, CAD, GIS, CAFM,…..
→ The “aligned” vocabulary is **used by** software and application domain / software: BIM, CAD, GIS, CAFM,…..

#3 Cross-Catalog Meta-Interoperability

→ E.g. for linking / transfer to different catalogues
→ E.g. for linking / publish catalogue with the bsDD
→ do not reinvent the wheel!
→ uses existing meta-concepts for dictionaries/taxonomies/ontologies

ISO Standards for (BIM) data catalogues

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ISO12006-3 (IFD)

Expert knowledge ⟷ Building codes

IFC

Data Templates for construction objects (concepts and principles)

Expert process to describe author and maintain properties

Data templates for construction objects

IFC exchange structure for product data templates

CEN/TC 442/WG 4

ISO 23387

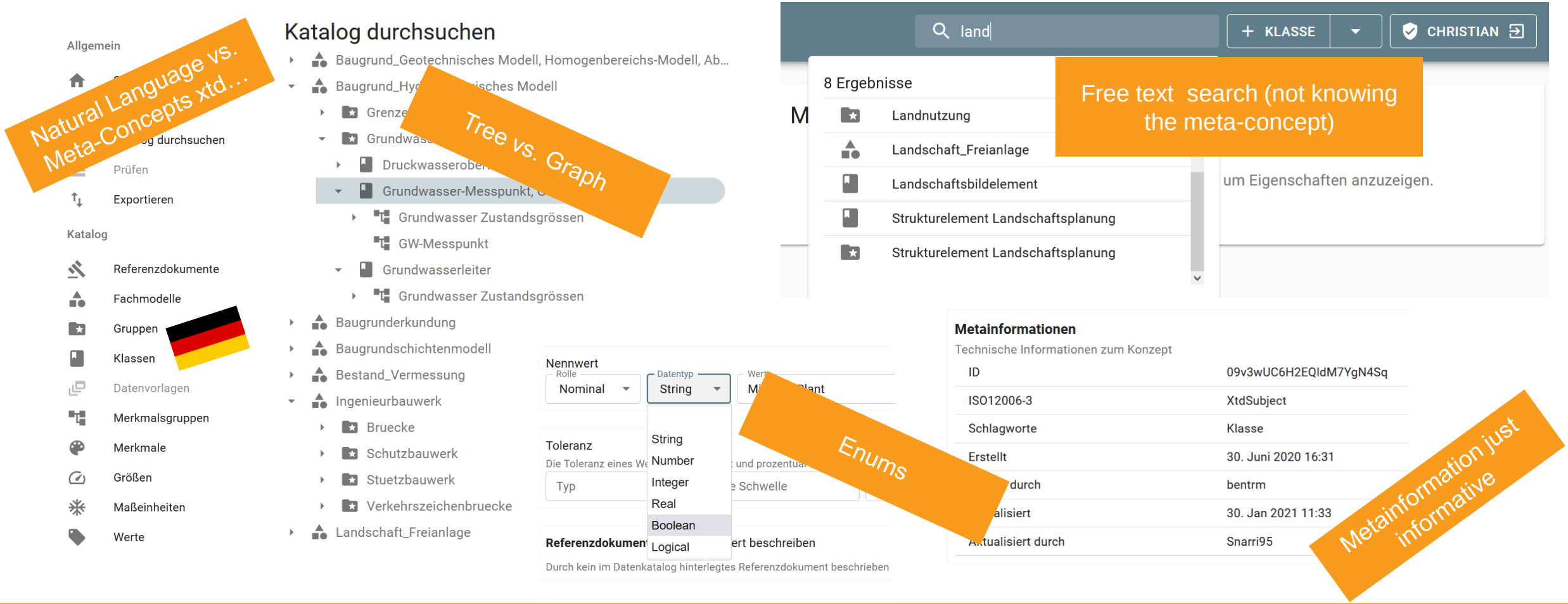
ISO 23386

Who? E.g.

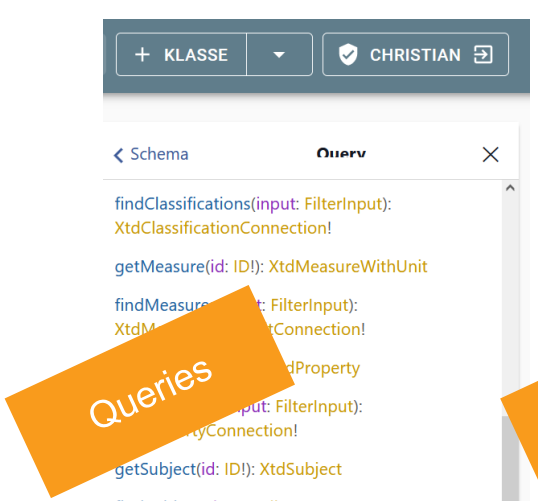
How? E.g.

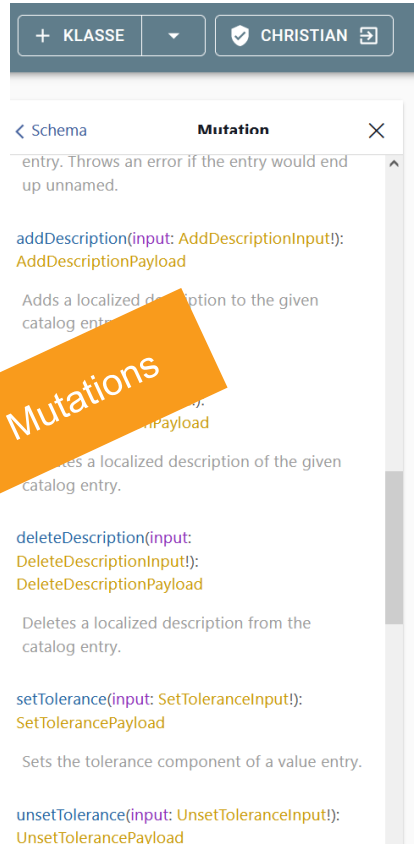
https://buildingsmart.github.io/ProductData/

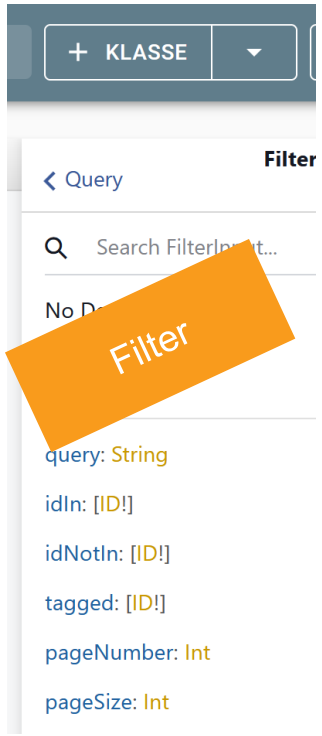
Frontend (hiding complexity from the user!)

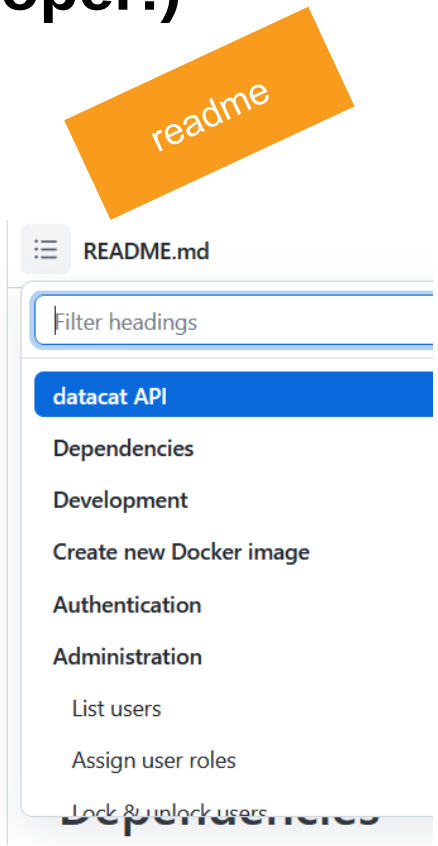


GraphQL API (hiding complexity from the developer!)









https://www.datacat.org/graphiql

https://github.com/dd-bim/datacat

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Limitations / Discussion / Outlook

Discussion – conceptual design decisions

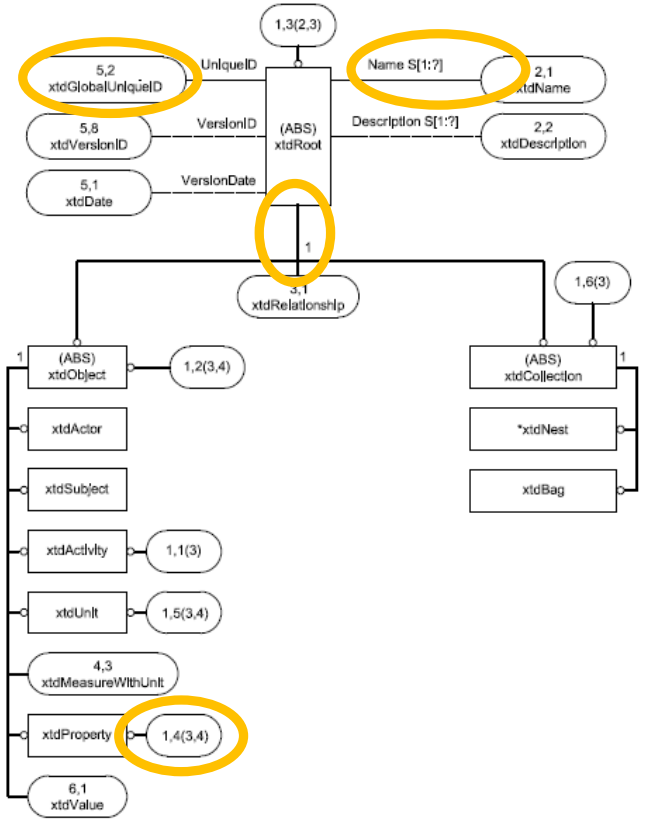
GUID. standardized UUID (128bit-numbers) vs. compressed IFC identifier format (special Base-64)

Optional Properties. In ISO12006-3 there are no rules or attributes in place that allow to designate optional properties. (In contrast to ISO23386 “mandatory” and “calculated”). These are essential for data catalogues!

Inheritance of xtdRelationship. datacat relationships do not inherit directly from xtdRoot as described in ISO 12006-3. In order to avoid that a xtdRelationship may relate to another xtdRelationship.

Multilingualism. ISO 12006-3 specifies multilingualism of names and descriptions. In addition datacat allows to querying with a language priority list ([‘de-at’, ‘de’, ‘en’])

Values and Measures. ISO 12006-3 describes multiple ways to designate the relationship between an arbitrary measure (xtdMeasureWithUnit) AND the concept of values (xtdAssignsValues) and units (xtdAssignsUnit). Datacat ignores the entity components of xtdMeasureWithUnit



Current Limitation / Further Developments

General IT-Feature:

- testing: catalogue import and collaboration (however, the server is very stable!)
- better authentification/authorization
- comprehensive wiki/documentation for users, admins and developers

Exchange:

- Import: Well defined process to insert existing classification schemas (“standard” csv ☹)
- Export: Concepts as UML/XMI and ontologies (e.g. based on http://www.linkedbuildingdata.net/ISOTC59/12006-3#)
- Notifications: Slack, e-Mail

Conceptual:

- Validation of catalogues, versioning of catalogues
- Adding ISO23386 Metadata for catalog management
- Update to new version ISO23387:2020
- Tagging: LOIN, BIM-profile, use-case,….

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https://github.com/DD-bim/

City2BIM
- IfcTerrain (GUI,CMD)
- CityBIM Autodesk Revit Plugin
  - Georeferencing
  - Terrain Import (2.5D)
  - CityGML Import (3D)
  - ALKIS/XPlanung GML Import (2D)
  - datacat

IfcGeorefChecker
- Checker (GUI,CMD)
- BuildingLocator (GUI)

datacat
- **Software stack for data catalogues**

Questions:

1) Would our tool “datacat” help in your daily work?

2) Which tool is used for pre-standardization by working groups in your country/profession?

3) Are there better approaches how to programmatically merging and linking data catalogues (classification systems)? … that are usable by “non-high-profile-academics” ☺