

# Managing and publishing standardized data catalogues to support BIM processes

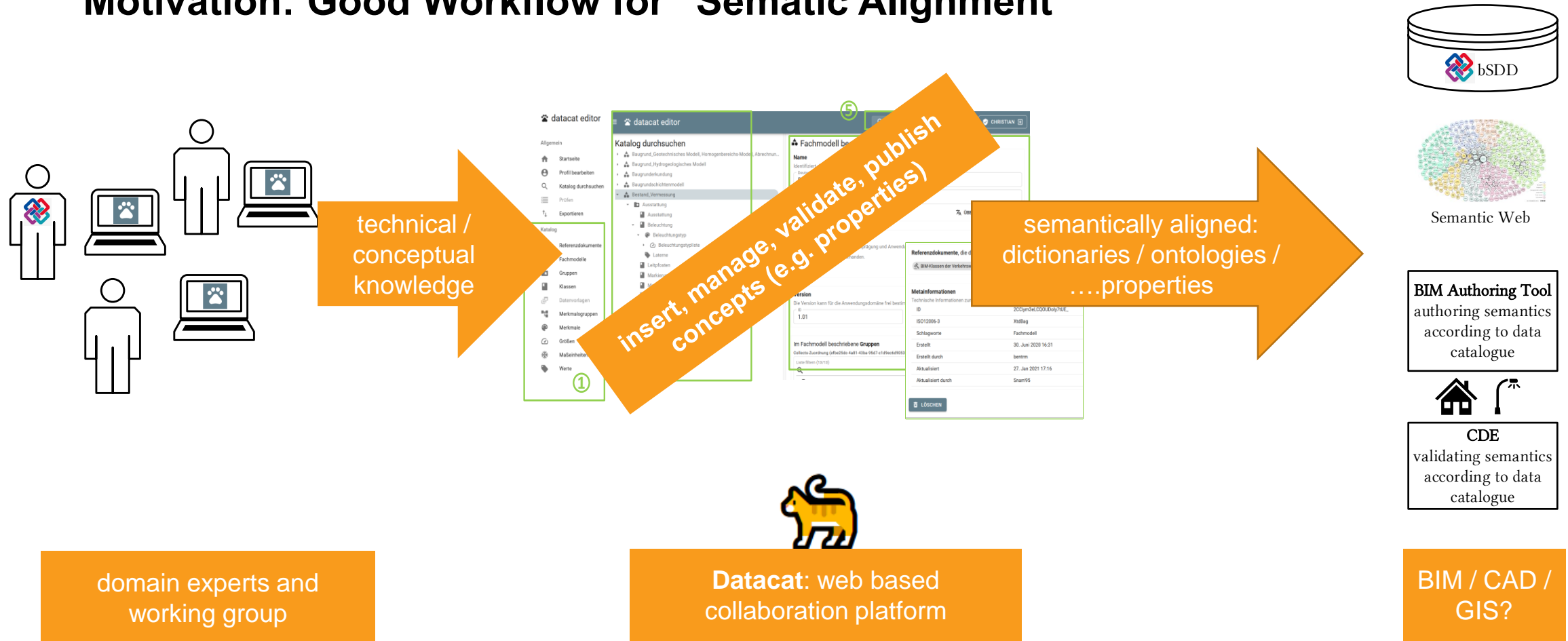
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*38th International Conference of CIB W78, Luxembourg, 13-15 October*

*Session 9 - Interoperability and novel data practices*




# Motivation: Good Workflow for “Sematic Alignment”



# Motivation: “Transport Routes”

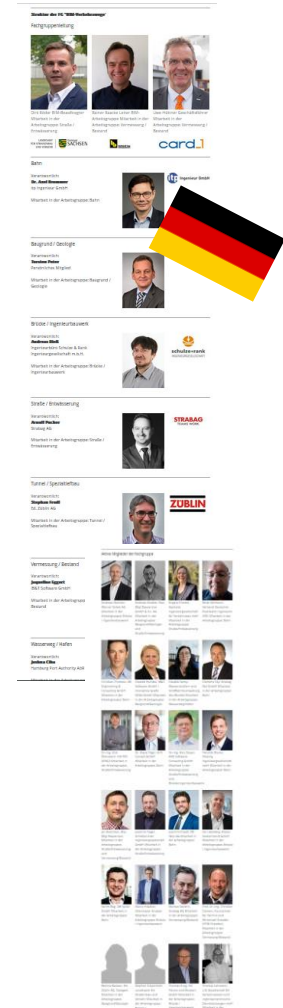
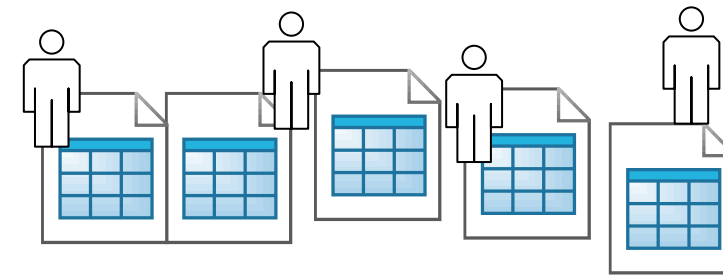
- 7 thematic working groups, 30 companies/institutes, 50 professionals
- **Tasks:** Specification of „BIM-classes“ on **national level**
  - Transport routes / Infrastructure
  - Properties and Property-groups for each class
  - (Assignment to LOIN)

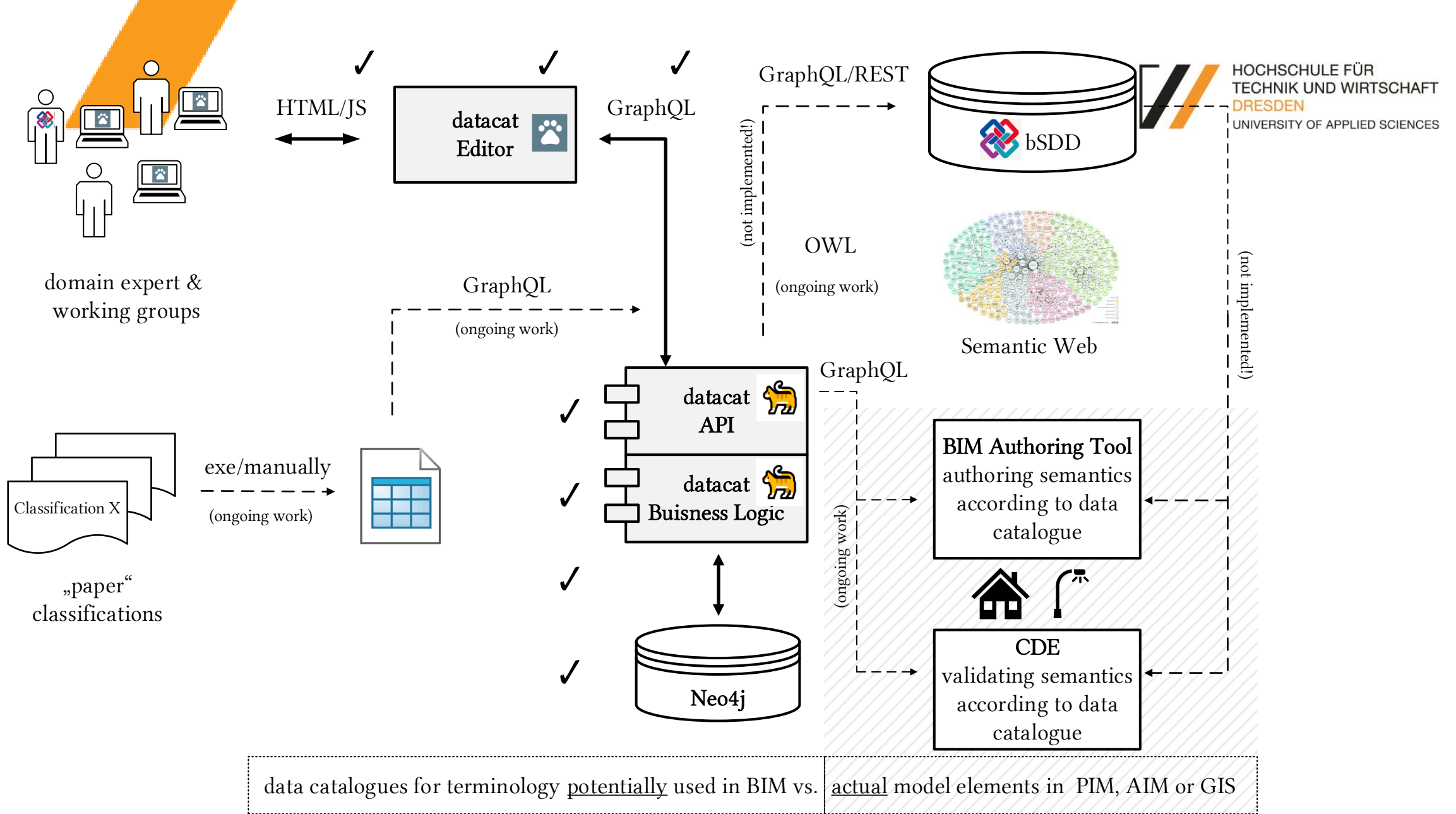
## Problem #1: No tool at hand

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

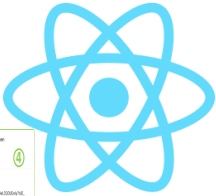
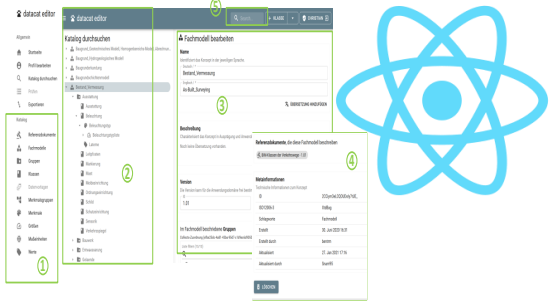
## Problem #2: Willingness for digital collaboration based with meta-concepts

- → ?



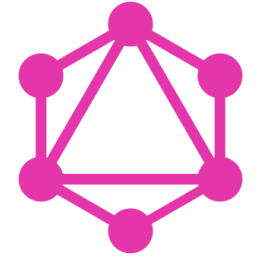
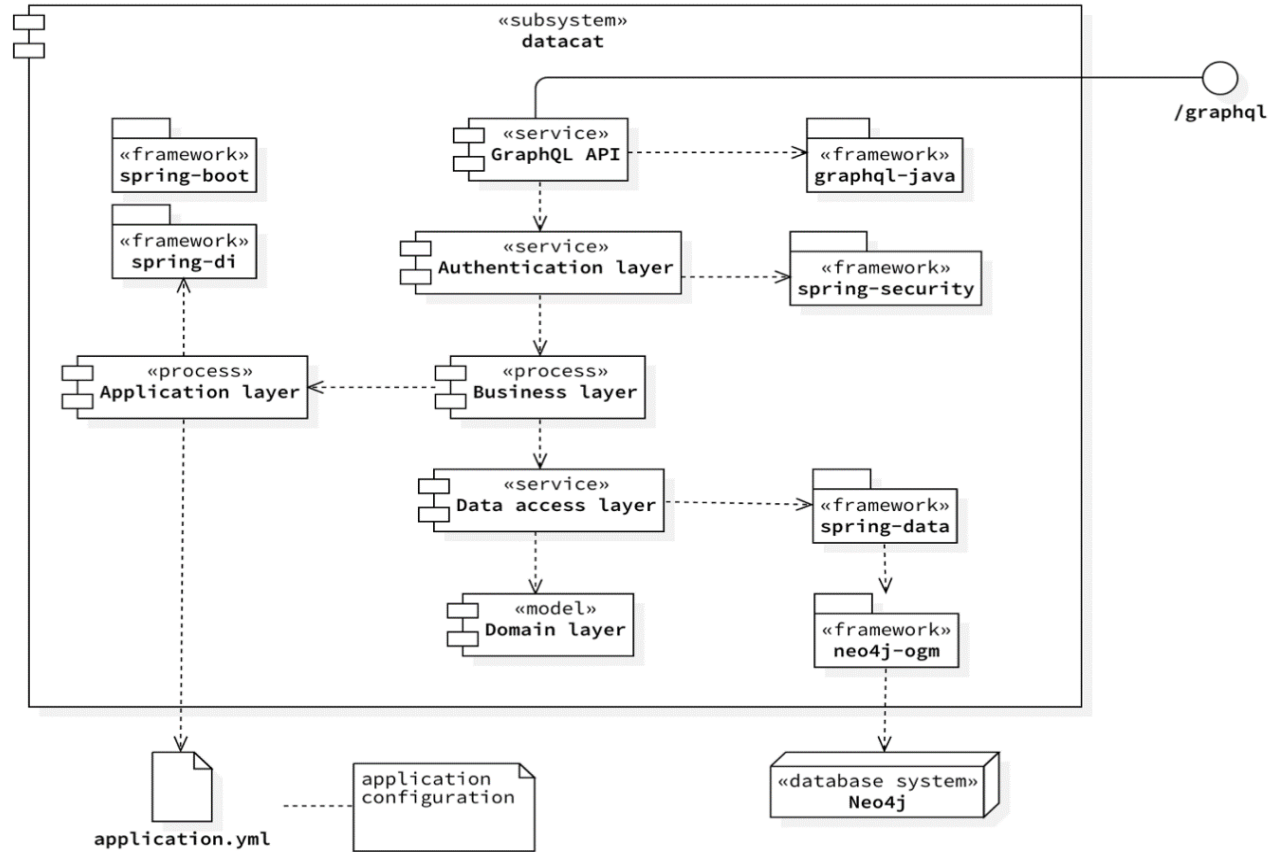


# technical result == open source software stack



# 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

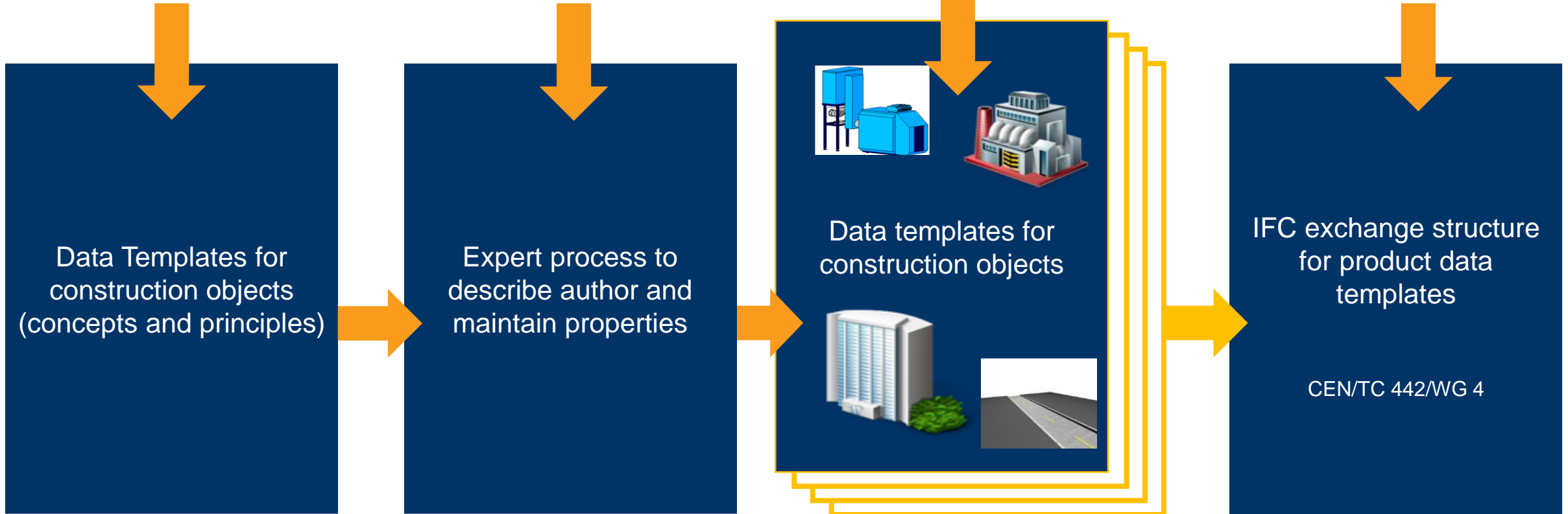
# ISO Standards for (BIM) data catalogues

ISO12006-3 (IFD) 

Expert knowledge

Building codes

IFC 



ISO 23387

ISO 23386

Who? E.g. How? E.g.



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



# Frontend (hiding complexity from the user!)

Natural Language vs. Meta-Concepts xtd...

Tree vs. Graph

Enums

Metainformation just informative

- Allgemein
- Katalog durchsuchen
- Prüfen
- Exportieren
- Katalog
- Referenzdokumente
- Fachmodelle
- Gruppen
- Klassen
- Datenvorlagen
- Merkmalsgruppen
- Merkmale
- Größen
- Maßeinheiten
- Werte

### Katalog durchsuchen

- Baugrund\_Geotechnisches Modell, Homogenbereichs-Modell, Ab...
- Baugrund\_Hydrologisches Modell
  - Grenze
  - Grundwasser
    - Druckwasserober...
    - Grundwasser-Messpunkt, C...
    - Grundwasser Zustandsgrößen
      - GW-Messpunkt
    - Grundwasserleiter
      - Grundwasser Zustandsgrößen
- Baugrunderkundung
- Baugrundschichtenmodell
- Bestand\_Vermessung
- Ingenieurbauwerk
  - Bruecke
  - Schutzbauwerk
  - Stuetzbauwerk
  - Verkehrszeichenbruecke
- Landschaft\_Freianlage

land

+ KLASSE

CHRISTIAN

8 Ergebnisse

- Landnutzung
- Landschaft\_Freianlage
- Landschaftsbildelement
- Strukturelement Landschaftsplanung
- Strukturelement Landschaftsplanung

um Eigenschaften anzuzeigen.

Nennwert

Rolle: Nominal

Datentyp: String

Wert: ...

Toleranz

Die Toleranz eines Wertes

Typ: ...

Referenzdokument

Durch kein im Datenkatalog hinterlegtes Referenzdokument beschrieben

### Metainformationen

Technische Informationen zum Konzept

ID	09v3wUC6H2EQIdM7YgN4Sq
ISO12006-3	XtdSubject
Schlagworte	Klasse
Erstellt	30. Juni 2020 16:31
Erstellt durch	bentrm
Validiert	30. Jan 2021 11:33
Aktualisiert durch	Snarri95





# GraphQL API (hiding complexity from the developer!)

**Queries**

- findClassifications(input: FilterInput!): XtdClassificationConnection!
- getMeasure(id: ID!): XtdMeasureWithUnit
- findMeasure(id: ID!, input: FilterInput!): XtdMeasureWithUnitConnection!
- findMeasureProperty(id: ID!, input: FilterInput!): XtdMeasurePropertyConnection!
- getSubject(id: ID!): XtdSubject
- findSubjects(input: FilterInput!): XtdSubjectConnection!
- getUnit(id: ID!): XtdUnit
- findUnits(input: FilterInput!): XtdUnitConnection!
- getValue(id: ID!): XtdValue
- findValues(input: FilterInput!): XtdValueConnection!
- getBag(id: ID!): XtdBag
- findBags(input: FilterInput!): XtdBagConnection!

**Mutations**

- addDescription(input: AddDescriptionInput!): AddDescriptionPayload
- deleteDescription(input: DeleteDescriptionInput!): DeleteDescriptionPayload
- setTolerance(input: SetToleranceInput!): SetTolerancePayload
- unsetTolerance(input: UnsetToleranceInput!): UnsetTolerancePayload

**Filter**

- query: String
- idIn: [ID!]
- idNotIn: [ID!]
- tagged: [ID!]
- pageNumber: Int
- pageSize: Int

readme

Filter headings

- datacat API**
- Dependencies
- Development
- Create new Docker image
- Authentication
- Administration
  - List users
  - Assign user roles
- Lock & unlock users

**Assign user roles**

Currently, users can register themselves via clients. After validating a read-only users. Only admin users are allowed to verify use the /graphql interface of the datacat editor client:

```
mutation {
  updateAccountStatus(input: {
    username: "test"
    status: Verified
  }) {
    username
    status
  }
}
```

This mutation will assign the "USER" role to the user.

**Lock & unlock users**

```
mutation {
  lockAccount(username: "username") {
    username
    locked
  }

  unlockAccount(username: "username") {
    username
    locked
  }
}
```

Locked users are not able to log in to access the catalog.

**Delete account**

snippets

<https://www.datacat.org/graphql>

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



# Limitations / Discussion / Outlook

## Discussion – conceptual design decisions

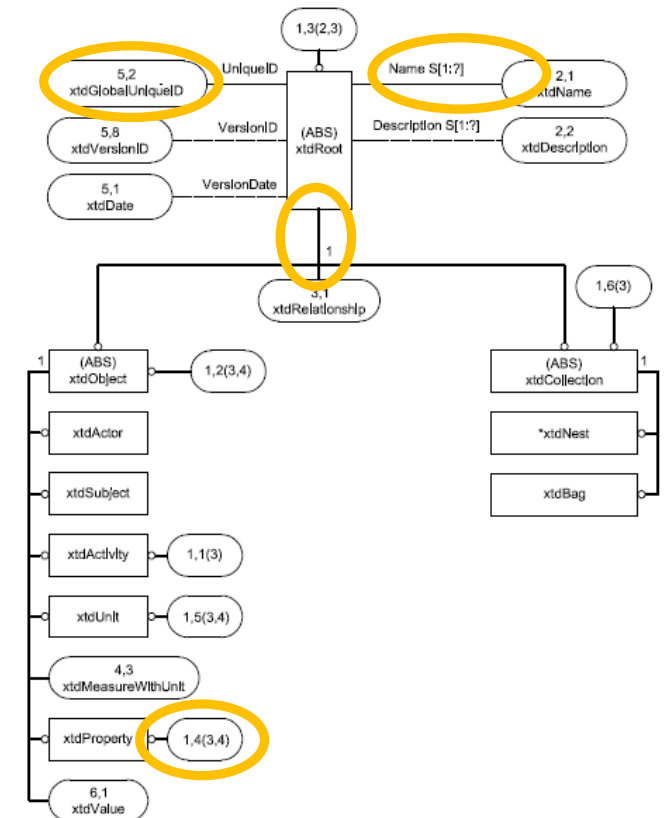
**GUID.** standardized UUID (128bit-numbers) vs. compressed IFC identifier format (special Base-64)

**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 authentication/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,.....

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

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## 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” 😊