LDAC/CBIM Summer School Hackathon 2022

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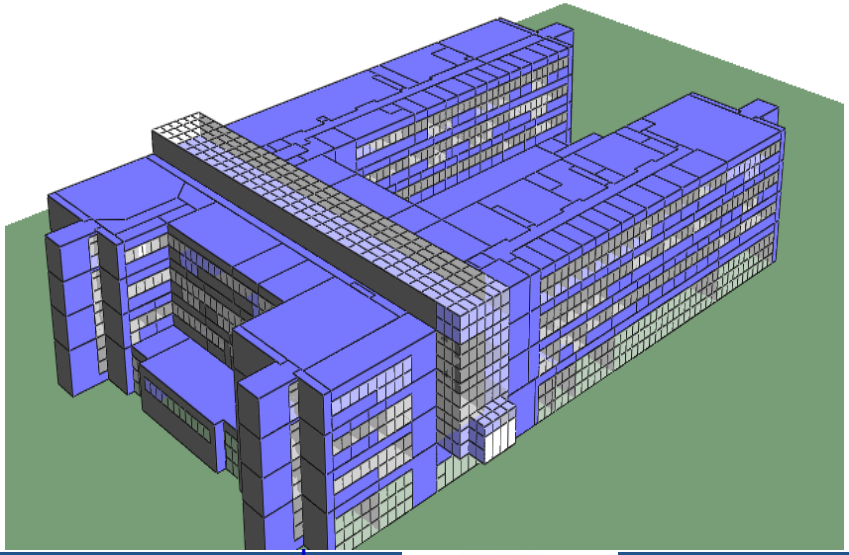
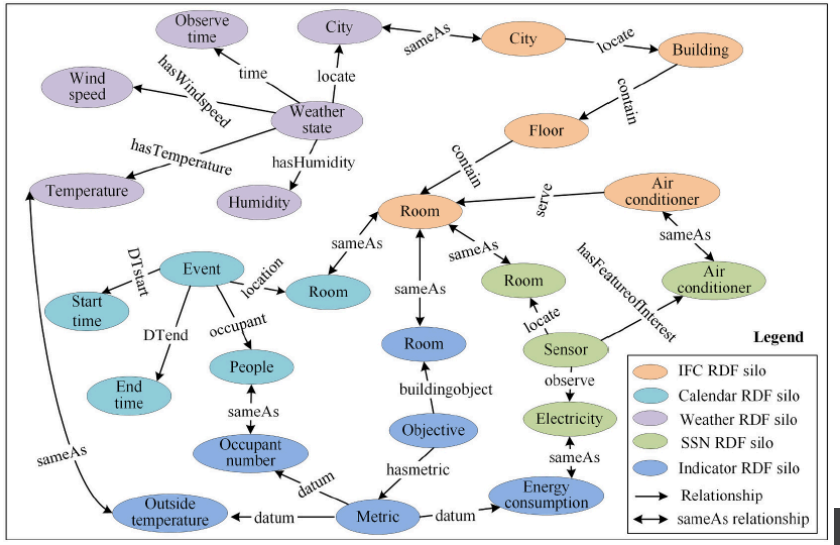




Universidad Politécnica de Madrid

June 6th-10th, 2022

CBIM - European Training Network

Cloud-based Building Information Modelling

ENERGY INSTITUTE UCD

Hackathon outline

- Agenda
- Challenges
- Team formation
- Exercise and Rules
- Grading criteria

Hackathon Aims

By completing this Hackathon, you will gain experience and competencies in:

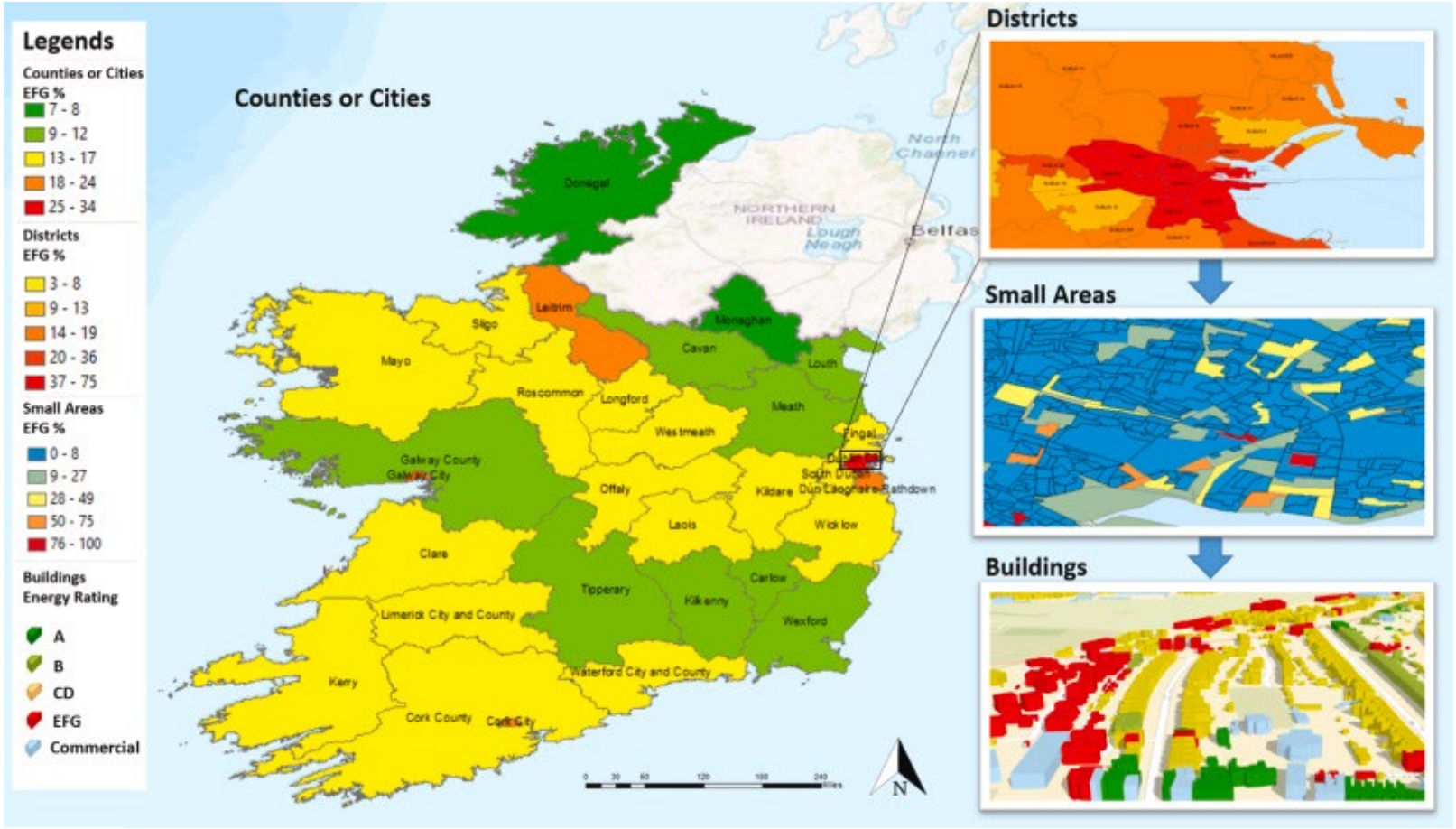
- **Collaborating** on real world problems to deliver experience-based learning.
- In tackling real-world problems you will need to **identify information deliverables**, **develop a methodology** in the context of your specific technical challenge and **produce a technical solution**.
- You will develop your skills both in class and through **self-directed learning**.
- You should be prepared to be **inquisitive and work hard**, but most of all enjoy the unique opportunity to learn new skills with new friends.

Your challenges should you chose to accept them

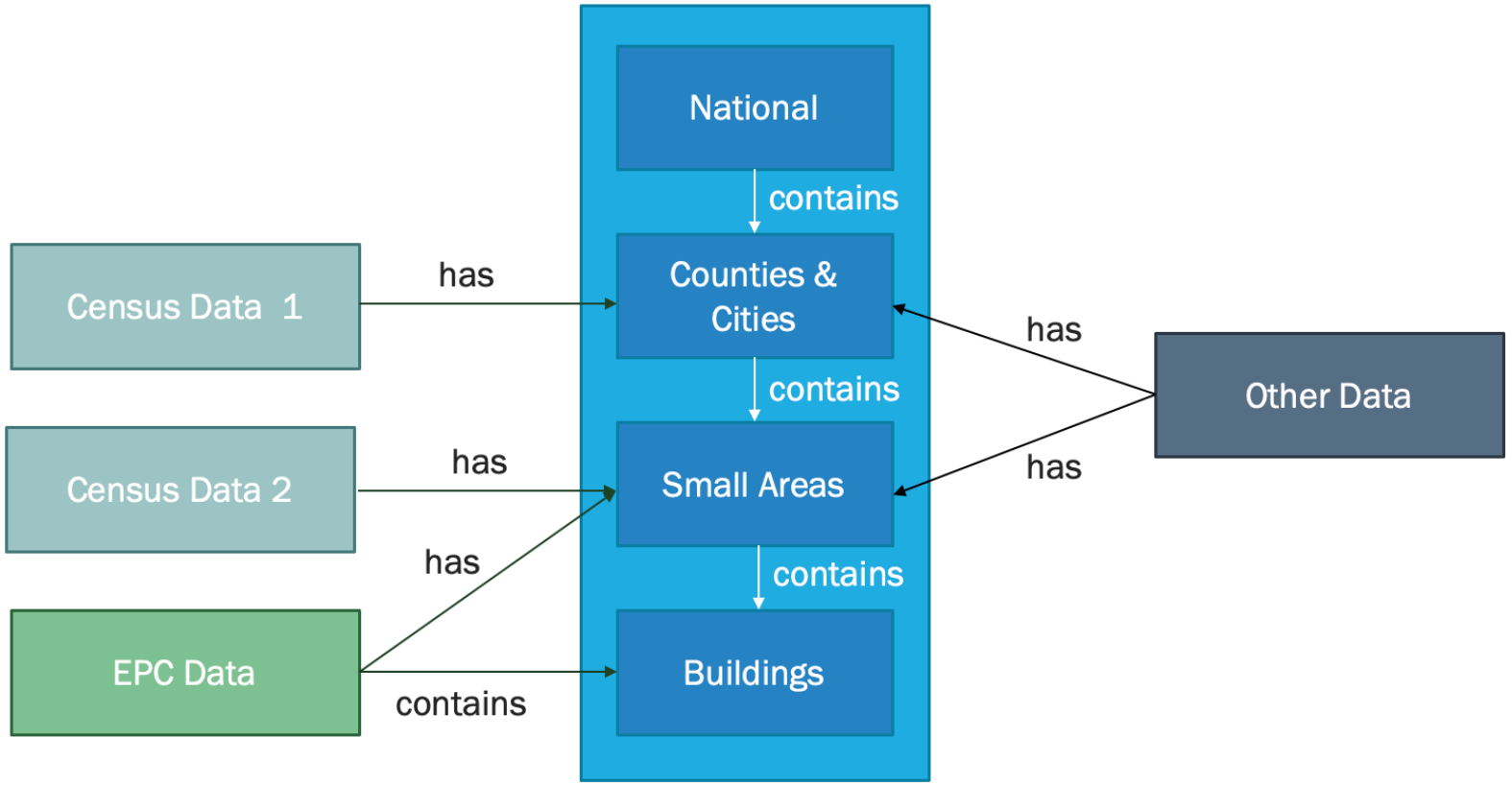
- Challenge Descriptions are available from: https://github.com/SSoLDAC-2022

Challenge 1

Challenge 1 Context



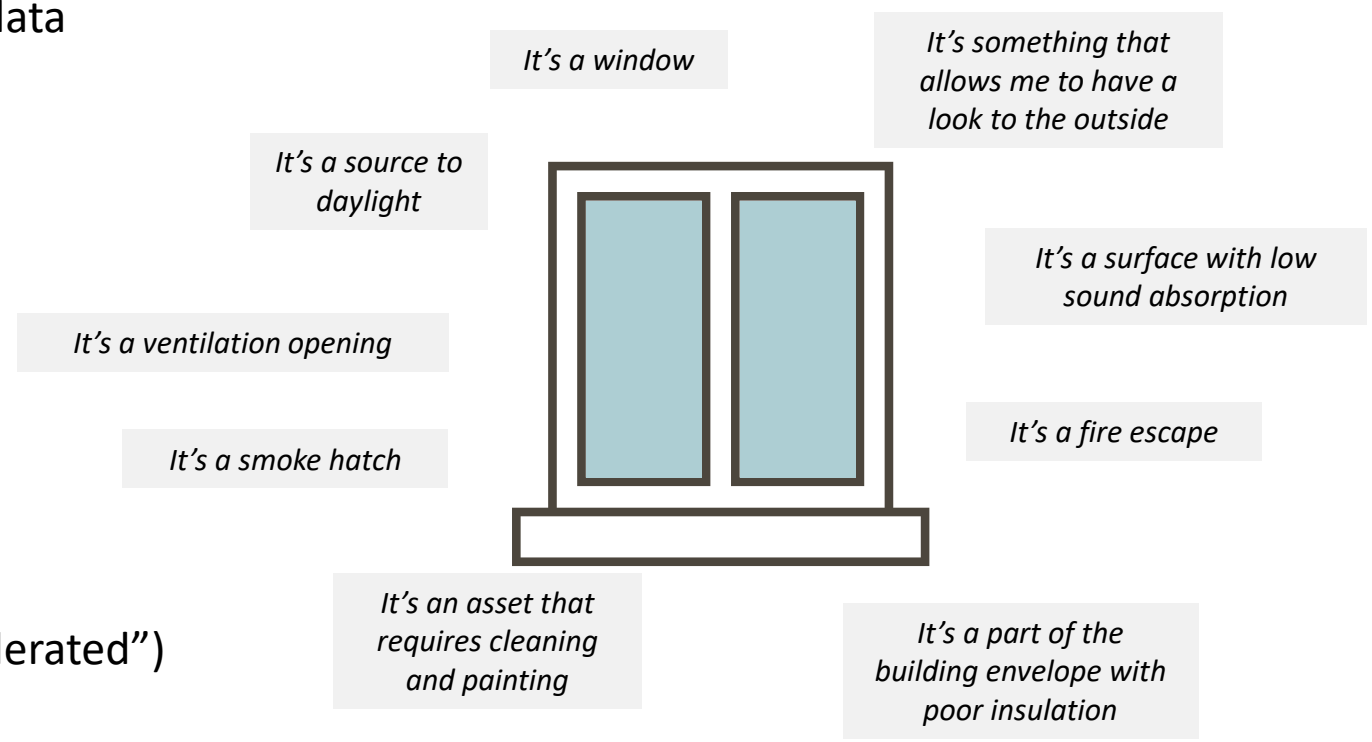
Challenge 1 Scope of information available



Challenge 2

Challenge 2: Grouping and Submodels in AEC design projects

- Convert IFC models to LBD
- Define stakeholder-specific “views” on the project data, based on the LBD ontologies
- Connect geometric identifiers with semantic data
- Design a user-friendly GUI to:
    1. Define “views” as a domain expert
    2. Visualise the results



- OPTIONAL: include multiple RDF sources (“federated”)

https://github.com/SSoLDAC-2022/Challenge-2

Two approaches

1

There are 5 types of doors in the project:
A, B, C, D and E

Properties described at type level are also valid for the instances of that type

Besides type properties, the elements also have instance properties

2

All doors are unique but with grouping mechanisms it's possible to batch-assign properties

For **practitioner A** it's only important to distinguish based on frame color

For **practitioner B** it's relevant whether the door is placed in an the facade, in an apartment or in a common area

For **practitioner C** it's relevant to group by hinge side

Element type

- Door
- Window
- Wall
- Roof
- Slab
- Pipe
- Duct
- Fitting

Element properties

- Width
- Height
- Frame-thikness
- Glazing-area
- Fire rating
- Sill height

Resulting groups

Windows A
12pcs

Width: 900 mm
Height: 2100 mm

Windows B
5pcs

Width: 1500 mm
Height: 1800 mm

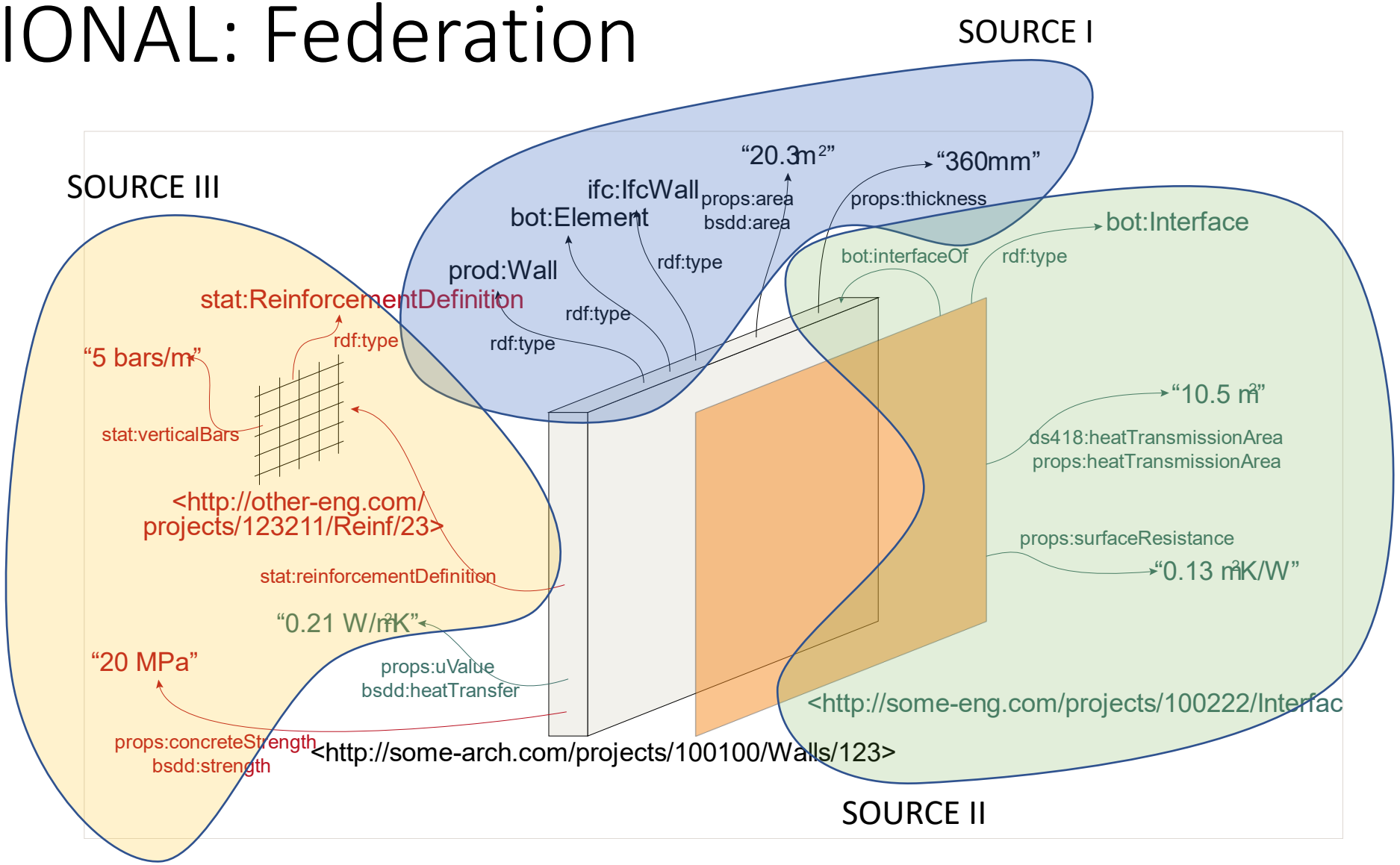
Windows C
32pcs

Width: 1200 mm
Height: 1400 mm

So this is your grouping definition

Which properties do you wish to attach to instances of each group? U-value? Price? Maintainance cost?

OPTIONAL: Federation



Challenge 3

Integration of trajectory-based data into 4D BIM Semantic Digital Twin

Challenge 3

Universidad Politécnica de Madrid

University College London

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958310

COGITO

CONSTRUCTION PHASE
DIGITAL TWIN MODEL

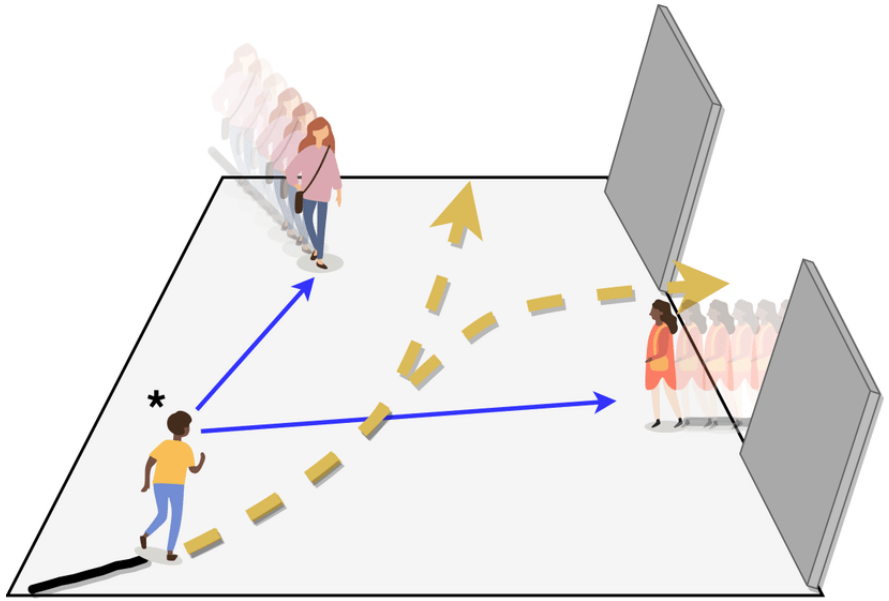
cogito-project.eu

Motivation

COGITO

4D BIM Knowledge Graph
IFC + schedules (tasks, working, …)

Motivation



Trajectory data brings value to the construction in both the building phase and during its usage when concluded. For instance, during the construction being aware of the trajectories of people, vehicles, or even heavy-weight materials can avoid collisions increasing the overall safety and decreasing the risks associated.

The challenge

- Integrate data of trajectories into the context of a 4D BIM Knowledge Graph
- How to exploit the 4D BIM + Trajectories Knowledge Graph.
- Explore visualization and/or simulations tolos .

COGITO

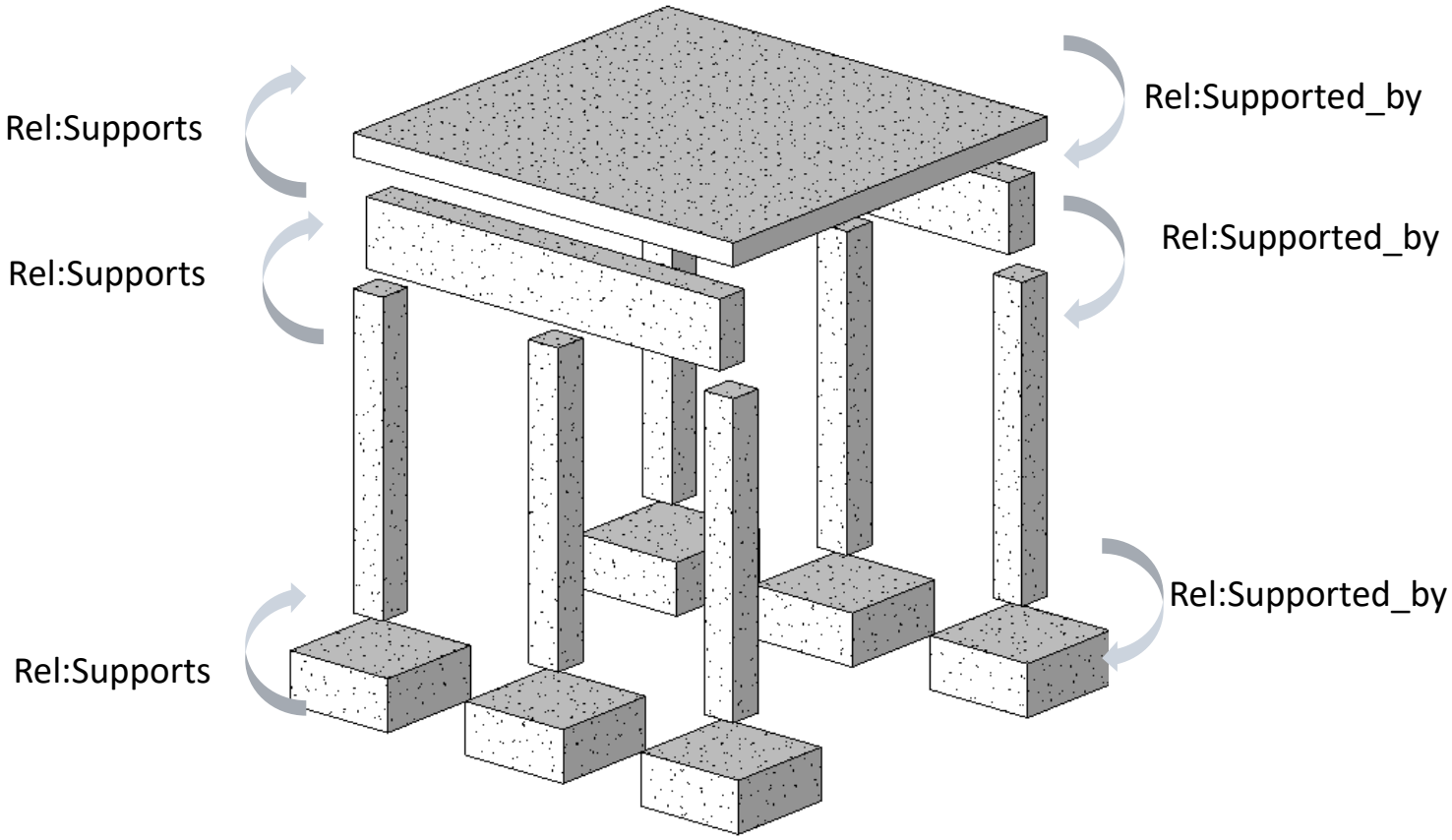
Tasks related

1. Ontology developing:
   - Use the 4D BIM COGITO ontology; develop a suitable extension if needed
2. Data semantization:
   - Translate and link heterogeneous data into RDF
3. Data queries:
   - Develop some SPARQL queries to exploit RDF data
4. Data visualisation:
   - Explore visualisation and/or simulation tools for the RDF. For instance, 3D models, real-time simulation of walkers, etc..

Challenge 4

Challenge 4 – Semantic Enrichment

Semantic Enrichment is a process designed to automatically infer new information based on the information stored in a BIM model, and provide an explicit representation of that information to facilitate its use in a target application or procedure.



Challenge tasks

Identify the types of relationships (‘supports/supported_by’) between each pair of structural elements.

Supplement a structural model with ‘supports/supported_by’ relationships between each pair of structural elements.

Work flow

1. Process the ifc files in the data set to identify the types of relationships between every pair of objects

2. Supplement all models in the data set with identified relationships (either directly to ifc, or based on the CBIM ontology)

3. Train a ML or GNN model based on the labeled data set from step 2 to classify the relationships between every pair of objects)

Questions

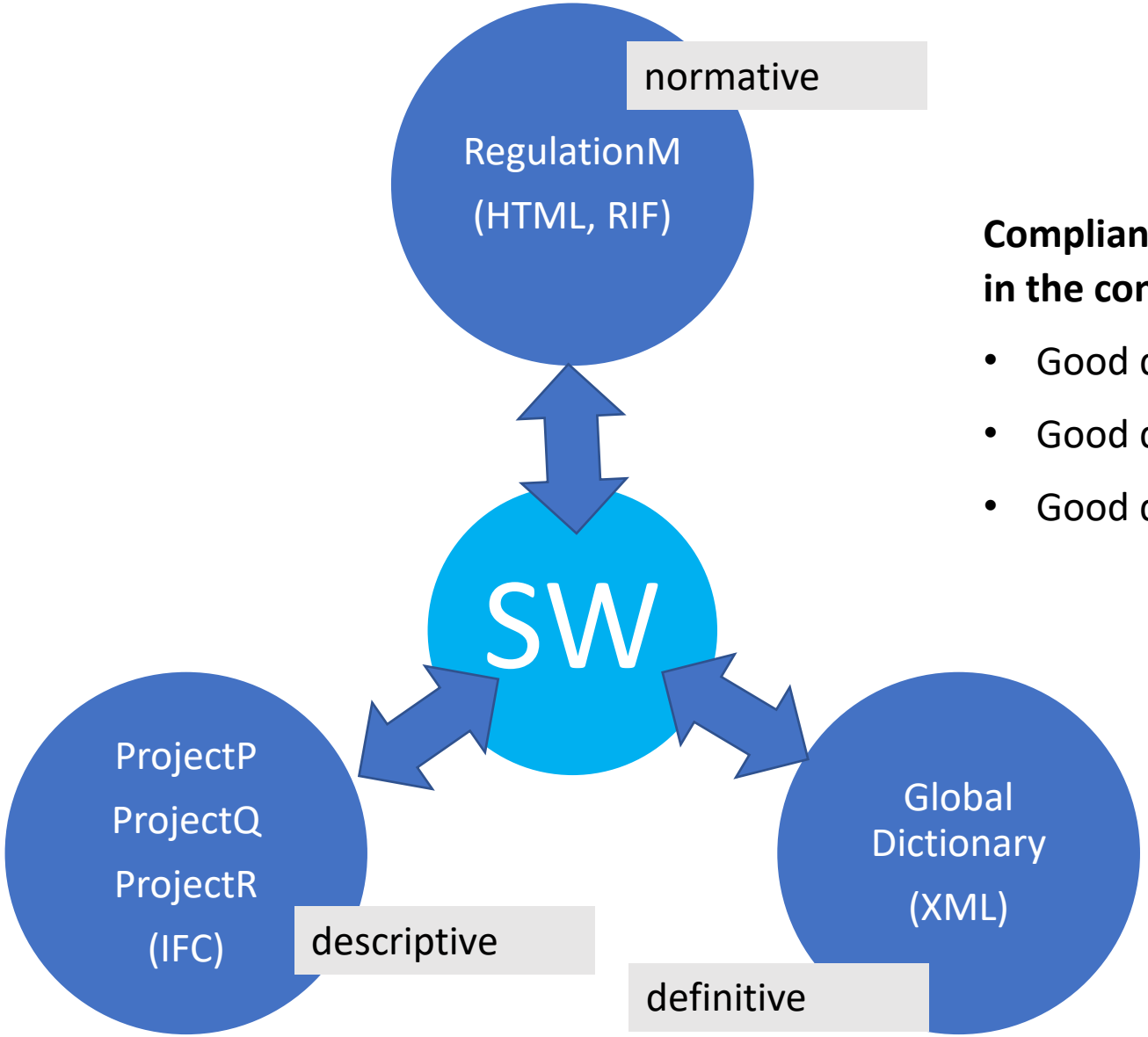
1. What are the key challenges in each of the inference approaches (rule based, ML based, GNN)?

2. What sets of rules can be used to infer the relationship type in a rule-based approach? What are the attributes that can be useful for inferencing with ML or GNNs?

3. Suggest a workflow where the inferred relationships can be useful.

Challenge 5

Ontology-based Compliance Checking



Compliance checking is the "ultimate" challenge for automation in the construction sector

- Good quality building models
- Good quality prescriptive (and performance) regulations.
- Good quality dictionary/thesaurus

Ontology-based Compliance Checking

Challenges

- Handling three kinds of knowledge
  - Normative regulation
    - AND, OR, NOTAND, NOTOR
  - Definitive dictionary
    - Applicable and equivalent terms
  - Descriptive project
    - Direct and inherited attributes
- Detecting
  - Agreement
  - Insufficient information
  - Disagreement

Steps

- convert the datasets into ontologies
- find a suitable set of links for the datasets.
- explore the information
- Is project P, Q or R
  - a pass,
  - a fail
  - or undecidable?

Team formation

Summer School/Hackathon Programme

Introduce Challenges

Mingle and form teams

Teams finalised

	Monday 6 june	Tuesday 7	Wednesday 8	Thursday 9	Friday 10	
9:00 - 9:30		Introduction			Hackathon: development	9:00 - 10:00
9:30 - 10:30		Hackathon presentation and team formation	Keynote: Mads Holten Rasmussen	Keynote: Dimitrios Rovas	Coffee	10:00 - 10:30
10:30 - 11:00		Coffee	Coffee	Coffee	Hackathon: presentations	10:30 - 13:00
11:00 - 13:00		Lesson: Linked Data foundations, RDF and SPARQL Pieter Pauwels	Lesson: Ontologies María Poveda Villalón	Lesson: Generation and linking Andrea Cimmino		
13:00 - 14:30		Lunch	Lunch	Lunch	Lunch	13:00 - 14:30
14:30 - 16:30		Lesson: Publication and use Jakob Beetz	Hackathon: development	Hackathon: development	Closing	14:30 - 15:30
16:30 - 17:00		Coffee	Coffee	Coffee		
17:00 - 19:00	Registration (17:00 - 20:30)	Hackathon: development	Hackathon: development	Social activity: Trip to Segovia		
19:00 - 20:00		Social activity: hike	Social activity			
20:00 - 20:30						
20:30	Dinner					

Team Formation

- Each challenge must have at least one team, we will try not to overburden one challenge
- 5 tables within the coffee room (1 per challenge)
- Speed data-ing at each table, move around as needed.
- Teams to be finalized as soon as quickly as we can.

Final Presentations

- 10 minutes in duration with 5 minutes for questions

Presentation (20%)	Concept (20%)	Implementation (30%)	Exploitation (10%)	Impact (20%)

Do the participants have any questions for the organisers?