W3C LBD Community Group
Minutes - Call 19/06/2023

Attendees:

- Mathias Bonduel (Neanex Technologies)
- Alex Donkers (Eindhoven University of Technology)
- Katja Breitenfelder (Fraunhofer IBP / National Academy of Science and Engineering)
- Klaus Linhard (iabi e.V.)
- Jakob Martin (iabi e.V.)
- Marin Ljuban
- Jakob Martin
- Philipp Hagedorn
- Zhangcheng Qiang
- Hervé Pruvost (Fraunhofer IIS/EAS)
- Omar Zerhouni
- Michele Allori (e-Metodi)

Presentation slides

- Marin Ljuban: https://github.com/w3c-lbd-cg/lbd/blob/gh-pages/presentations/20230619_Presentation_Marin Ljuban.pptx

Date and time

- 19/06/2023, Monday, 14:00-15:30@UTC/ 16:00-17:30@CEST/ 07:00-08:30@PDT

Moderators

1. Katja Breitenfelder

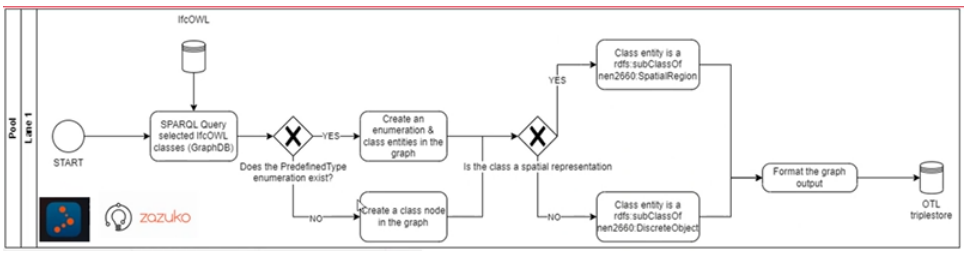
Agenda

1. Introduction of new members
2. Marin Ljuban: “IFC to Linked Data conversion and SHACL validation”
3. Klaus Linhard: “openDBL - Enabling AI-based Querying of Classification Systems (e.g. bsDD) with Ontology-Driven Data Models”
4. Discussion
5. Further topics

Minutes

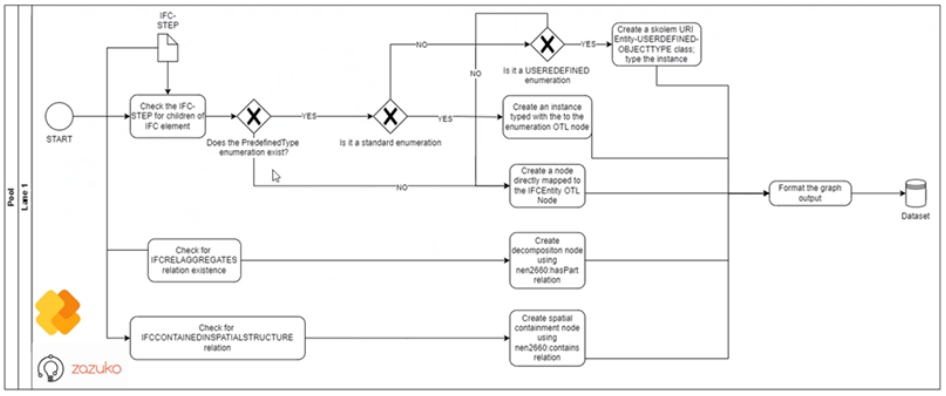
1. **Introduction of new members**
2. **Marin Ljuban: “IFC to Linked Data conversion and SHACL validation**
    a. Marin’s background as professional: BIM design/ consultancy, Mechanical Engineering; postgraduate Master student of the international master programme BIM A+, Linked Data Topic as Master thesis focus. Neanex = industry partner of Master thesis.(

b. BIM A+ is not very Linked Data-focused. This is why Marin works together with Neanex as an industry partner to get more insights in the topic
c. How can IFC be lifted to a more generic ontology, enabling connection of BIM models to other information models such as GIS, Electronic document management, Systems engineering, Monitoring and control, etc.
    i. Creation of an OTL from ifcOWL and XML property set files.
    ii. Development of a script that converts IFC-STEP files to an OTL-compliant dataset
    iii. Create SHACL rulesets to enable dataset checking based on local, national or EU regulations
d. The existing IfcOWL ontology will be used as a basis for the OTL.
e. State of the art
    i. Building design process is complex with 10-12 disciplines involved on average. Manual compliance checking comes with low accuracy and high cost.
    ii. Digitization is still scarce, however, Automated Compliance Checking uptake in the last 7 years, combined with the increasing adoption of BIM and GIS.
    iii. ACC is complex and takes both technical and non-technical factors into account.
f. Notable efforts in the EU:
    i. DigiPLACE
    ii. EUnet4DBP
    iii. CHEK
    iv. ACCORD
    v. DigiChecks
g. Findings:
    i. Academic research is steadily growing and pilot deployment gained momentum last year.
    ii. Technological solutions should be based on open standards and easy to use
    iii. A one-fits-all solution is not likely to be viable.
h. Research steps
    i. Rule interpretation & digitalization
    ii. Preparation of 3D city models and geo info
    iii. Pre-consultation & preliminary
    iv. …
i. Linked to EN 17632, BIM - Semantic modeling and linking (SML)
    i. It's a newly published standard enabling more efficient management of projects and the resulting assets. The document specifies how organizations in the built environment should apply linked data to best suit their needs. The application should help integration of complex information models (BIM, GIS, EDM, etc.).
    ii. The standard contains a generic construction ontology, as well as guidelines about modelling patterns and application of levels of semantic modeling capability for different use-cases.
    iii. The Dutch NEN2660 is the predecessor of this standard
    iv. Focus on building elements, properties, materials, etc.
j. Step 1 **Develop an OTL taxonomy**

i. 

ii. The classes in the OTL are linked to NEN2660 terms using rdfs:subClassOf. e.g. otl:ReinforcingBar rdfs:subClassOf nen2660term:DiscreteObject .

k. Step 2 **Parsing IFC-STEP**

i. 

ii. Some of these conversions still have problems. Some data manipulation is necessary to ensure data quality after conversion.

l. Step 3 **IFC-STEP validation**

i. A specific GUID is connected to the OTL. e.g. dis:0213923AemW5908 a otl:DuctSegment-RIGIDSEGMENT

ii. Results are compared to an IFC-to-LBD converter and are similar.

m. Step 4 **SHACL & to be done tasks**

i. Still needs some investigation. Learned a lot at LDAC and the SHACL part of this thesis is now under development.

ii. Need to express the IFC attributes with QUDT as prescribed in EN17632. and then parse the IFC attributes.

iii. Check some ambiguities in the IFC schema. Some are very similar:

coversSpaces_IfcCovering	IfcRelCoversSpaces
coversElements_IfcCovering	IfcRelCoversBldgElements
predefinedType_IfcCovering	IfcCoveringTypeEnum
partitioningType_IfcWindow	WindowTypePartitioningEnu
predefinedType_IfcWindow	IfcWindowTypeEnum
erDefinedPartitioningType_IfcWind	IfcLabel
overallWidth_IfcWindow	IfcPositiveLengthMeasure
overallHeight_IfcWindow	IfcPositiveLengthMeasure
definedType_IfcBuildingElementPr	uildingElementProxyTypeEn
predefinedType_IfcMember	IfcMemberTypeEnum
predefinedType_IfcWall	IfcWallTypeEnum
predefinedType_IfcSlab	IfcSlabTypeEnum

iv. Some inconsistencies in usage of underscores

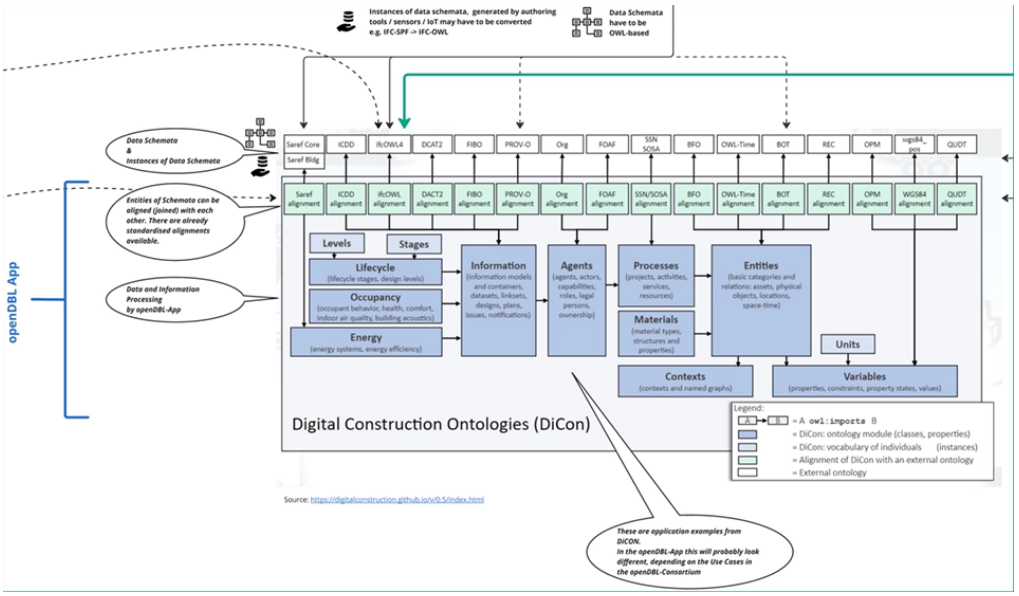
```
otl:Door-TRAPDOOR
otl:Door-SWING_FIXED_RIGHT

otl:Beam-HOLLOWCORE
otl:Beam-T_BEAM

otl:ElectricAppliance-FREESTANDINGWATERCOOLER
otl:ElectricAppliance-FRIDGE_FREEZER
```

v. The use of STANDARD and ELEMENTED as enumeration or as entity:

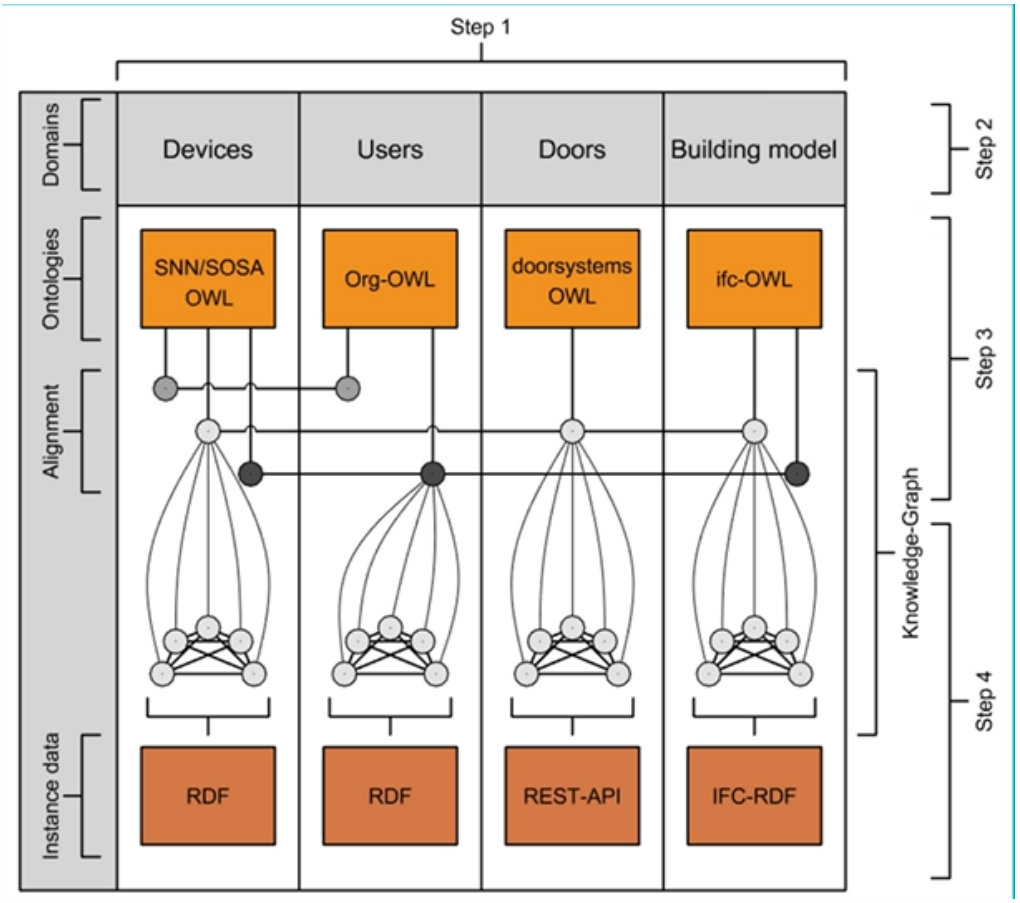
```
otl:WallStandardCase
otl:Wall-STANDARD

otl:WallElementedCase
otl:Wall-ELEMENTEDWALL

otl:SlabElementedCase

otl:PlateStandardCase

otl:ColumnStandardCase

otl:BeamStandardCase

otl:DoorStandardCase

otl:WindowStandardCase
```

3. Questions for Marin Ljuban

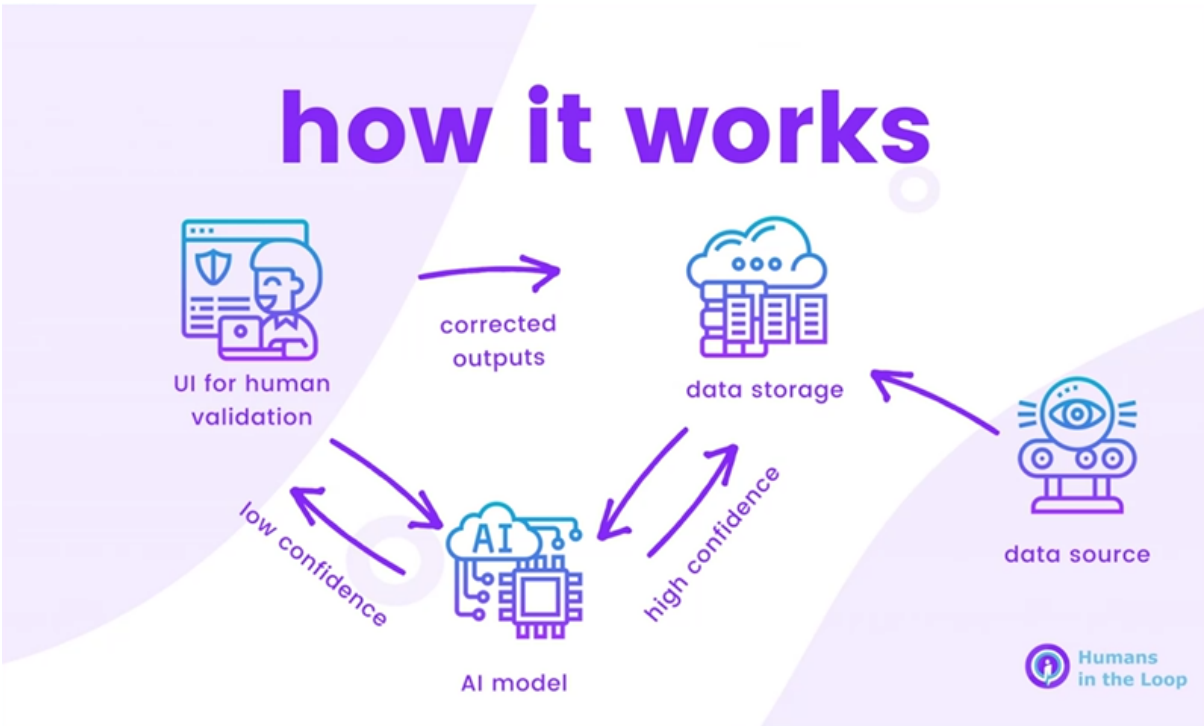
a. [Klaus]: There are initiatives that split the IfcOWL in three parts. Did you consider this?
b. [Marin]: Not considered. I like to discuss this later with you.
c. [Zhangcheng]:
d. Thanks for the presentation. It could be better to provide the relevant references in the slides.
e. [Alex]: Do you try to align your work with the recent EU initiatives?
f. [Marin]: That work is very recent. This is why we co
g. [Alex]: Do you plan to reach out to them afterwards?
h. [Marin]: We would publish this openly.
i. [Klaus]: Can we expect a broader type of conversational tool?
j. [Marin]: This is working in a sense. An MSc thesis is limited by time, so it is hard to promise a fully working software tool.
k. [Michelle]: Would such a tool be accessible to the public?
l. [Marin]: If it happens, we will inform you.
m. [Alex]: A tutorial is available on GitHub with a very basic tool. Feel free to add your tool to this GitHub repo.
n. [Marin]: Good idea.
o. [Katja]: What about the testing/validation of the developed tool? You mentioned some mock-ups (some simple BIM models). It is enough to prove the overall OTL?
p. [Marin]: The overall goal is to align IFC to the new EN 17632 ontology. Maybe, others can later do it with GIS. The strength of Linked Data is that others can use the EN 17632 as an umbrella ontology so that we can more easily link different initiatives.
q. [Michele]: Was the project made with Blender BIM?
r. [Marin]: The model was created in Revit, but metadata was added in Blender BIM because it provides a user interface for IFCOpenShell.

4. **Klaus Linhard: “openDBL - Enabling AI-based Querying of Classification Systems (e.g. bsDD) with Ontology-Driven Data Models”**
    a. Klaus Linhard. Works since several years in BIM development. Also supporting working groups in defining MVD and other IFC-related things.
    b. Jakob Martin. Colleague of Klaus. Was writing an MSc thesis on BIM, AI and attribute-based mapping. Now doing a PhD at iabi.
    c. The project:
    d. The project (EU Funded) still has 36 months left. openDBL.
    e. First main goal: ontology driven dynamic data model, that serves not only IFC but multiple domains over the whole building life cycle.
    f. The main problem is that we can find 98% mapping of static information, and in each project we do it again. We try to replace this with AI-Automated dynamic mapping.
    g. bSDD is very interesting in the scope of this project.
    h. To do so, the DiCon is used. However, the project should not be limited to one ontology.
    i. 

    j. An IDM is created. Requirements are identified. Then, ontologies are being explored to create a data model that fits the requirements. Then, these ontologies are aligned.

k. 

l. Klaus hopes that we as an LBD community can come up with use-cases.
m. Mapping between bSDD and IfcOWL is still vague. Hopefully, the LBD community can help with this.
n. Second main goal: AI as a dynamic mapping of classification systems with human in the loop.



o. Humans should play a role in the AI-decision making. The human can use expert domain knowledge to review the outputs of the AI-system.
p. We started with Neo4J and then switched to Ontotext (GraphDB).

5. **Questions for Klaus**
   a. (Alex:) Human in the loop: will there be AI based checks for each object/ entity? What it exactly the expected “work” of the AI? Answer: e.g. you are searching for a wall in bsDD / You are searching in different classification. The AI will give an overview of existing classifications and the user can choose / decide on the relevant one. The user should also be able to overview new additions/ versions to the individual classifications.
   Where in the process of (ifc) modeling the AI comes in? A: door ontology should be recognized and identified by the AI that is applied in a project as a “new” ontology.
   b. (Mathias) It is more a tool for aligning ontologies? The idea of instance data to be aligned in file. Bringing the information to the user is the goal. AI has to prove a certain certainty to be applicable. Human in the loop would be the user to train the AI in order to provide a better use of AI (information outputs). The user can choose him-/herself what information is selected to be “added” to the building model. The human is the decider.
   c. Would the AI be used to map ontologies on a higher level to an existing model? translating tool for ontologies? or something more technical? It ois work in progress. One central goa isl to become rid of static mapping.
   Mathias: Map objects to conceptual classes (of ontologies) e.g.
   the bsDD is meant to be a “meta ontology” to a certain extent/ a data space schema for bsDD for structuring different ontologies it receives internally.
   d. Feedback (Mathias): Classification jobs for invisual objects and the user would like to know which class it belongs to / and the alignment between distinctive classes.
   e. Katja: Is the expected output a decision support (system) answering to the different (to-be) defined requirements you are collecting eight now? A: Yes. Q: Are so searching for use cases still? A: No. We would be interested to add developed used cases to the LBD CG use case collection.
   f. Michele Allori (project member): Does someone know about a tool to query the variety of data (linked to graph data basis): “Another hurdle for us right now is querying data from Ifc regarding the different elements of buildings, this is because the humans creatign the queries need to be both familiar with the query languages and the ifc Schema (i,e. finding the height of a wall requires more than 6 links from the wall instance to the actual property)”
   A (LBD CG): https://ld-bim.web.app/
   https://github.com/jyrkioraskari/IFCtoLBD
   https://ifcjs.github.io/info/
   https://github.com/AlexDonkers/Frontends-and-LBD/

   Currently they are using BOT and IfcOWL.
   g. Q: Who is the end-user writing these queries? A: Most of these models will be developed in the backoffice. A: Yes, this is in the scope
   h. Klaus Q: GraphQL for example it first depends on the conversion. A: GraphQL has an autofillin mode. But if you have a larger schema to be conferred it will get to complex. A decent schema would be a better decision on a long run. And of course the results depend o the converted data to RDF.

6. **Discussion**
7. **Further topics**

Next Call

- 17/07/2023, Monday, 14:00-15:30@UTC/ 16:00-17:30@CEST/ 07:00-08:30@PDT

  Agenda: TBD

  We are interested in getting suggestions from the community about potential agenda items and **Elevator Pitches** for the following calls. Please send your suggestions to the chairs or to internal-lbd@w3.org, whether you have a short presentation to bootstrap the discussion, and an approximate duration you think the discussion will last.

Previous minutes

https://github.com/w3c-lbd-cg/lbd/tree/gh-pages/minutes