W3C LBD Community Group
Minutes - Call 20/04/2021

Attendees:

- Karl Hammar (Jönköping University)
- Anna Wagner (Individual affiliated to PROSTEP)
- Katja Breitenfelder (Fraunhofer IBP, TU Munich)
- Mathias Bonduel (KU Leuven & Neanex Technologies)
- Salvatore Cataldi (BELIMO Automation AG)
- Joel Bender (Cornell University)
- Alex Donkers (Eindhoven University of Technology)
- Philipp Spelten (HS Bonn & Fraunhofer SCAI)
- Sarah Heiler (Fraunhofer IBP)
- Edlira Vakaj (Birmingham City University, UK)
- Mads Holten Rasmussen (NIRAS, Denmark)
- María Poveda-Villalón (Universidad Politécnica de Madrid)
- Jyrki Oraskari (RWTH Aachen University)
- Calin Boje (Luxembourg Institute of Science and Technology)
- Hervé Pruvost (Fraunhofer IIS EAS)

Presentation slides

- https://www.researchgate.net/publication/339947551_Linked_Product_Data_Describing_Multi-Functional_Parametric_Building_Products_using_Semantic_Web_Technologies

Date and time

- 20/04/2021, Tuesday, 15:00-16:30@UTC/ 17:00-18:30@CEST/ 08:00-09:30@PST

Moderators

1. Karl Hammar

Agenda

1. Introduction
2. New participants
3. Presentation ***'Linked Product Data: Describing Multi-Functional and Parametric Building Products'*** **by Anna Wagner**
4. Q&A

Minutes

1. Introduction
2. New participants
   2.1. Sarah Heiler, Fraunhofer IBP, Valley: new to the field, PhD candidate, applied Ontologies and Metadata.
   2.2. Philipp Spelten, Master candidate and colleague of Anna Wagner at PROSTEP
   2.3. Alex Donkers, PhD student, Eindhoven University of Technology, Pieter Pauwel's group.
3. **Presentation *'Linked Product Data: Describing Multi-Functional and Parametric Building Products'* by Anna Wagner**
   3.1. Presentation based on the PhD thesis of Anna Wagner. Presentation slides are available at: https://www.researchgate.net/publication/339947551_Linked_Product_Data_Describing_Multi-Functional_Parametric_Building_Products_using_Semantic_Web_Technologies
   3.2. Challenges -> Concepts -> Implementation (Linked Building Product Data) -> Validation.
   3.3. **Motivation for Uniform Product Descriptions**
      - Stakeholders/ actors: Requirements of engineers/ buyers of building products -> manufacturers of diverse products
      - Need to develop one uniform product description of manufacturers to be integrated in software solutions.
   3.4. **Challenges**
   Only sub-parts of an unique product description would be needed by individual product manufacturers. This is hard to implement based on existing standardized data chemas (IFC etc.).
      - In order to use different data types, manufacturers would have to change the data schema or to extend/ further specification); novel types of properties needed etc.
      - **Concept of linked product data:** Develop a modular, extensible, flexible, queryable, machine-readable, multi-lingual (domain connecting) schema
      - Core schema answering the requirements -> Ontology.
   3.5. **Basics**
   Graph-based data structure, identification via URIs (e.g. URLs), schema extensible by logical axioms (-> Transitivity, property chains), machine-understandable (not just machine-readable -> semantic web assumes information that is stored in the data, not explicitly part of the data)
   3.6. **Implementation of the concept**
      - Limitations: Domains, Taxonomy, Core Structure, aspect of Customisation, Geometry, resuing as much as possible
      - Usage of buildingSMART Data Dictionary (bSDD) as taxonomy
      - 1. BPO: Building Product Ontology (core ontology, flexibel)

- 2. OMG: Ontology for Managing Geometry (newly developed ontology)
- 3. OPS: Ontology for Parametric Systems (newly developed ontology)
- Geometry Ontologies, MathML (for customisation aspects)

3.7. **1. BPO: Building Product Ontology**

Scope: reusable as much as possible; chosen scope: compositional structure (geometry, subparts, interconnections); chosen scope for attributes: limited to non-geometric information. Small scope of final ontology, in lign with Schema.org,

- > Compositional Structure:

  - Align to individual elements, can't be devided into sub-elements
  - to group elements to create assemblies
  - entire product (e.g. PV module) composed by assemblies (but also being an element), transitive modeling -> **"Dynamic entities"** can be assigned, e.g. to calculate number of elements in an entire product, "quantifier". Identifiers can't be assigned to e.g. individual pv module lignes, but the number of elements for further calculations.

- > Interconnections:

  - introduction of the concept of "Component connections": modelling individual connections between entities (e.g. to be used in HVAC). Definition of "Fixed Attributes" and "Ranged Attributes".

3.8. **2. OMG: Ontology for Managing Geometry**

Ontology developed commonly with Mathias Bonduel. Connecting / Relating Geometry Descriptions (alignement to SEAS). Problem: A product is needed in 3 different applications. Each application needs different geometry kernels, is in the need of certain geometry kernel functions and has best use concepts. -> Geometry descriptions in different schemas needed for describing a product.

- > OMG implemented in three levels in order to optimise complexity for individual use cases (avoiding over-complicated schemas).

  - Level 1: Direct connection (object - Geometry Description)
  - Level 2: Objectified connection (-> Geometry Nodes for each Geometry Description)
  - Level 3: Twice objectified connection, allows defining a "Geometry State" of individual Geometry Nodes (e.g. use case HBIM).

3.9. **3. OPS: Ontology for Parametric Systems**

Scope: Defining Parametric Systems and Variables Connecting Constraints. The concept includes Efficiency of Parametric systems (example: Solar cell / solar energy), Constant, Object, Fixed Variable, Adjustable Variable, Variable Boundary, Constraints; modelling of mathematical systems.

3.10. **Evaluation: Example implementation**
Evaluation criteria: Extensive product descriptions, Modularity, Freedom of modelling, Parametric product descriptions, uniform querying and reasoning (using model mockups of pv modules).

3.11. **Conclusion**
All evaluated criteria could be met by flexible and modular product description. Integration of product data into Linked Building Data, application of Linked Data facilities distributed data storage systems, dissemination of introduced ontologies in corresponding working groups. Ongoing research project.

4. Q&A

4.1. (Mads) is into building up a triple store and would be interested in testing parametric rules in reasoning. Triple store developed C++ based, RDFox by Oxford Semantics, really fast. (Anna) within the upcoming months there will be meetings in the framework of the ongoing research project with diverse manufacturers involved. Would like to stay in contact for further exchange. (Mads & Anna) **International alignment of ontologies is needed.**

4.2. (Anna, Karl, Mads) Future calls should be recorded if the community agrees on it.

4.3. (Mathias) Pieter Pauwels provided object classification for IFC already (IFC 4). It should be called “Product” being available in Pieter Pauwels’s Github repository. (Mads) proposes that this should be managed by the Community Group. (Anna) Jacob intends to translate the bsDD. Anna recommends to look in the chapter of “taxonomies” of her PhD.

4.4. (Alex Donkers - Chat) Pieter Pauwels developed BEO and MEP ontology for building elements and mechanical elements based on IFC:
https://pi.pauwel.be/voc/buildingelement/index-en.html
https://pi.pauwel.be/voc/distributionelement/index-en.html

4.5. (Anna: answer) will check with her research team options of alignment and optimisation of ontologies (e.g. combining BPO and BOT) -> standardization.

4.6. (Anna: answer) Product modeling efforts based on flat schemas (e.g. schema.org) are not sufficient, might be useful for mass products but not suitable for AEC industry or other complex systems: complexity of elements, assemblies of elements, products, building components etc. (Mathias) agrees, e.g. modeling of different graphs is needed. (Anna) BPO would allow exporting a BPO element containing assemblies (..).

4.7. (Karl) is chairing an “Workshop on ontology design and patterns”: usage of explicit/ implicit ontology pattern (e.g. question of temporal indexing as one possible design choice. It would be an interesting discussion. (Mathias) works on similar questions - level 3 -in the domain of HBIM (heritage buildings). Management of data sets on different levels is needed. (Mads) RDFox, possible to create a shortcut between instance and property node.

4.8. (Calin) stresses the simplicity of product data model and implementation on different levels. Has Anna looked into recent efforts towards standardization of product data templates making usage of bsDD? -> How should construction

companies manage the product properties descriptions?
Parametric Modeling: Why do you need a pointer to the value assigned to an object? (Anna) link to the value in the product description, non geometric properties (e.g. nominal output of a module). Properties to be aware of either in geometric or non-geometric terms.

4.9. (Edlira Vakaj - Chat) is working on a Product ontology as well but in a domain specific context - Design for Manufacturing and Assembly for Offsite Housing Construction. We associate the Product (Wall panels, pods etc.) with their production line. Would be great to compare-align by adding the manufacturing flavor. (LBD CG) agrees that this should be discussed further.

Next Call

- 04/05/2021, Tuesday, 15:00-16:30@UTC/ 17:00-18:30@CEST/ 08:00-09:30@PST

  Agenda: 1st Focus Group Workshop

  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://www.w3.org/community/lbd/meeting-minutes/