LINKED BUILDING DATA COMMUNITY GROUP

# THE W3C LINKED BUILDING DATA COMMUNITY GROUP


Chairs:

- Kris McGlinn, Trinity College Dublin, Ireland
- Georg Ferdinand Schneider, Schaeffler Technologies AG & Co. KG, Germany
- Maxime Lefrançois, MINES Saint-Étienne, France
- Mads Holten Rasmussen, NIRAS, Danemark

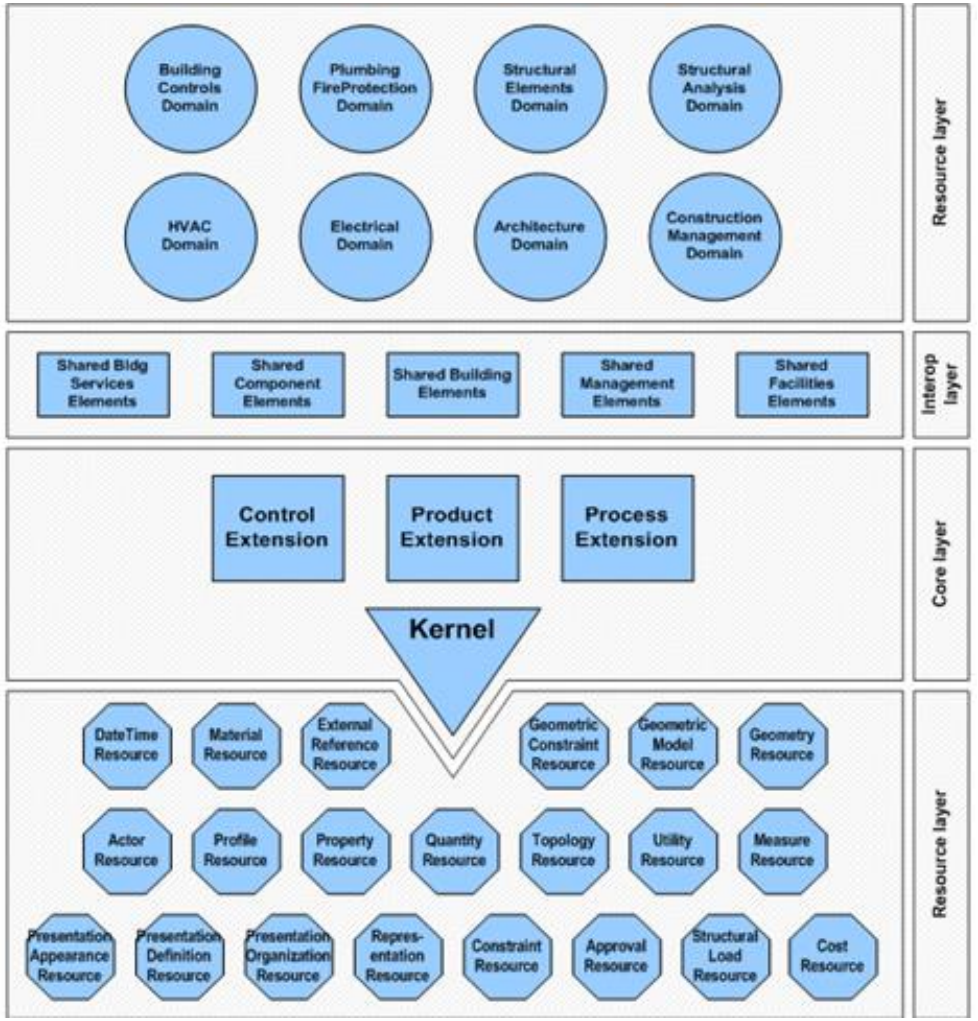

*This presentation has contributions from several members of the community group*

# THE CURENT PROBLEM:
# INDUSTRY FOUNDATION CLASSES (IFC)

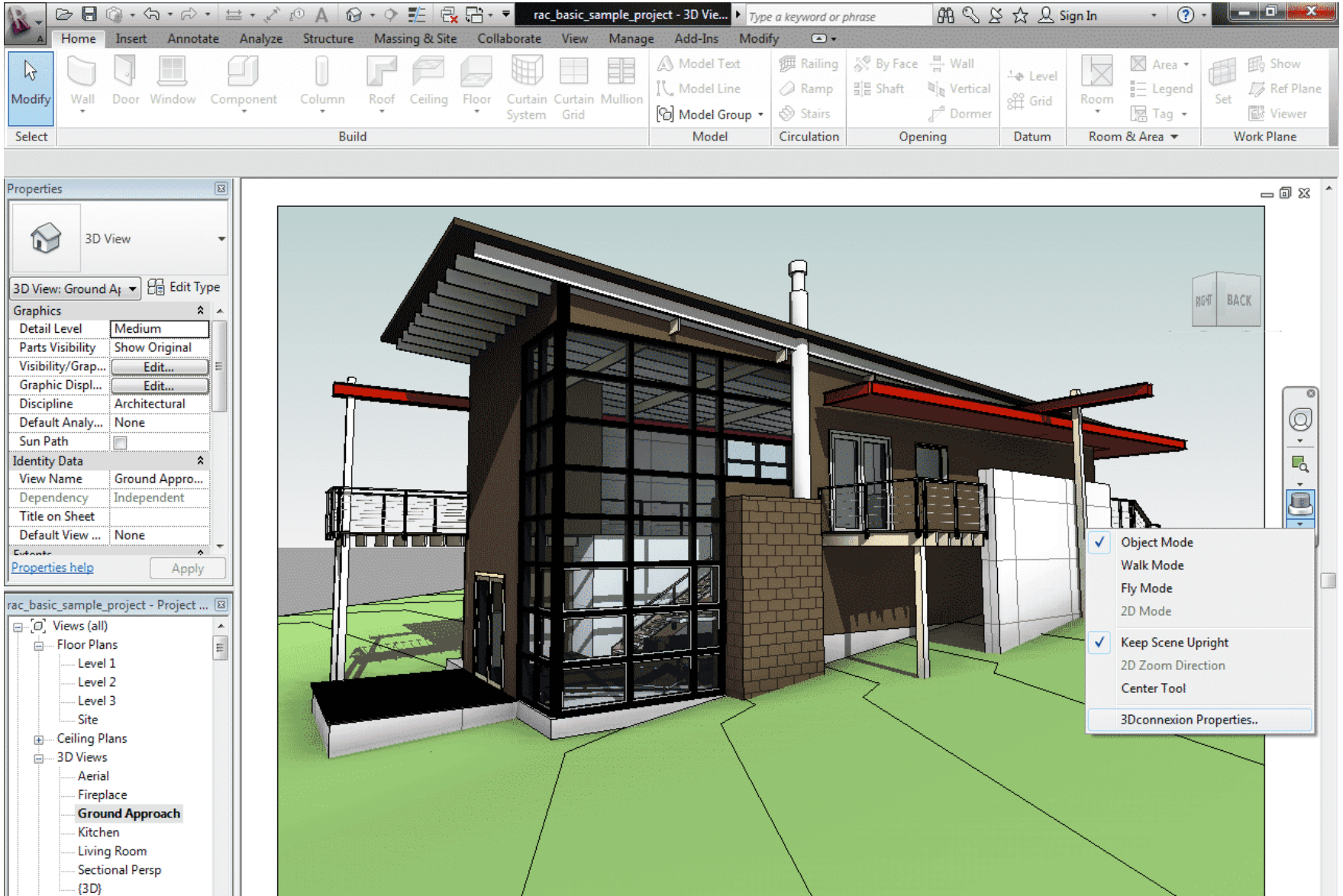
There exists a standard, but:

- not modular
- not extensible
- not simple enough to use

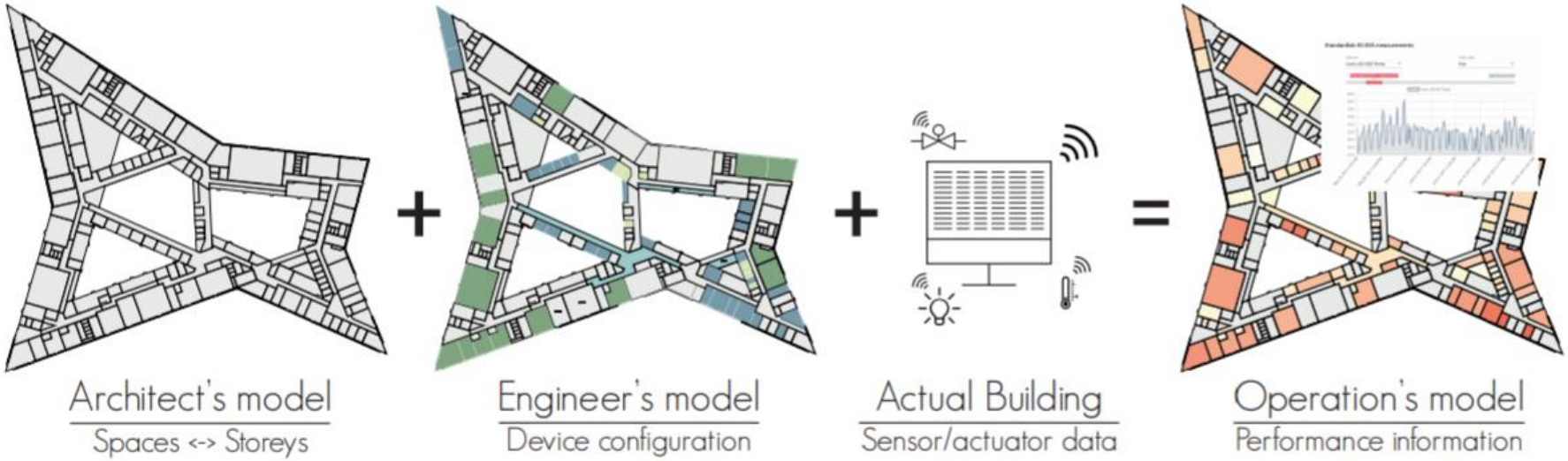
- AND not Web-compliant !



# BUILDING INFORMATION MODELLING (BIM)



# BUILDING LIFE CYCLE




Vast amounts of heterogeneous data produced during the **life cycle of a building:**

- product data (building elements)
- sensor measurements data
- usage data
- intelligent domotic system data
- geographical data, weather data, ...

# INDUSTRIAL POINT OF VIEW

The Linked Data and Knowledge Graph technologies create opportunities for the industry:

- indoor navigation
- energy efficiency simulation
- web-based facility management
- and many more (cf. prop-tech)

# WHAT IS OUR MISSION

Bring together experts in the area of Building Information Modeling (BIM), who are working to address the challenge of managing the huge amount of data that is generated across the building life cycle.

We want to provide a forum for bringing together researchers and practitioners who are working on advancing the field.

# https://www.w3.org/DesignIssues/LinkedData.html ADAPTED TO BUILDING DATA

- Using URIs as names for building-related things such as: rooms, walls, products, elements, enable different parties to provide complementary descriptions of the same uniquely identified entities in different knowledge graphs.
- Using HTTP URIs for these things enables the authority responsible for these URIs to provide reference information about this entity when one looks it up on the Web. For example, products in a catalogue, building appliances, or even the building itself.
- Providing information using common standards (RDF, SPARQL) and common Knowledge Graph models enable semantic interoperability between data sources.
- Include links to other URIs can help to discover more things, such as a link to the catalogue an appliance has been chosen from, or a link to the Web of Things Servient that enables it to interact with this appliance.

# WHO WE ARE (2020)

started Dec. 2014
now 143 participants
18th biggest W3C CG

# HOW WE WORK

- W3C entrypoint: https://www.w3.org/community/lbd/
- Group entrypoint: https://w3c-lbd-cg.github.io/lbd
- On GitHub https://github.com/w3c-lbd-cg

- Public mailing list
- Regular online calls (every 2 weeks), minutes public, joint note-taking
- Laisons with other groups and initiatives :
  BuildingSMART, ETSI SmartM2M, OGC, AFNOR, CEN, ISO, RealEstateCore, AIOTI WG3, ASHRAE 223 Semantic Interoperability, Brick Schema, AACE International, German expert groups "BIM und Holzbau" ("BIM and wood") and "Stahlbauforum" ("Steel construction")

# LINKS TO EXISTING STANDARDISATION GROUPS

ISO TC59 SC13 : ISO 21597 Information Container for Data Drop (Parts 1&2), ISO 23262 GIS and BIM interoperability (TR)
ISO TC184 SC4 : WG12 T1 « Geometry Topology Ontology Feasibility »

buildingSmart Data Dictionary (bSDD)
Linked Data Working Group (LDWG)

CEN TC 442 Building Information Modelling – WG4 Support Data Dictionaries “Semantic Modeling & Linking Guide”
CEN TC 205 WG19 Reference Ontology for Smart Appliances (CENELEC)

ETSI SmartM2M SAREF (Smart Applications Reference ontology)
https://saref.etsi.org/

ASHRAE 135/223P BACnet Semantic Interoperability Working Group
https://www.ashrae.org/technical-resources/standards-and-guidelines/titles-purposes-and-scopes#223P

PPBIM : Dictionary of properties, Infrastructure, Processes
IDMI : Geometry Ontology

French national plan for buildings’ digital transition

# POSSIBLE LINKS TO OTHER W3C GROUPS

W3C

| Interest Groups | | | Working Groups | | | Community Groups | | |
|---|---|---|---|---|---|---|---|---|
| Dataset Exchange | **Web of Things** | **Spatial Data on the Web** | Automotive (V2Building?) | Data Exchange | **Web of Things** | Schema.org | Blockchain | **Automotive ontology** |

# WHAT WE PRODUCE

Some of us push their work in the group

W3C Community Group Draft Report

# Linked Building Data Community Group Use Cases & Requirements

Draft Community Group Report 19 October 2018

**Latest editor's draft:**

-Étienne)

**Repository:**

We are on GitHub



## Abstract

This document describes use cases that demand a combination of linked data technologies for the building domain. It underpins the collaborative work of the Linked Building Data Community Group operated by the W3C.

## Status of This Doc

This specification was pu
it on the W3C Standards
(CLA) there is a limited o
Groups.

If you wish to make comm

TABLE



overview of the structure of the document
(at https://w3c-lbd-cg.github.io/lbd/UseCasesAndRequirements/ )

Comprehensive use case gathering is conducted across the LBD community, and also wider research and industrial communities (as part of the h2020 SWIMing project)

Used to identify deliverables and their scope in the charter

Currently **54 use cases, 7 requirements**

# BOT (BUILDING TOPOLOGY ONTOLOGY)

overview of the structure of the document (at https://w3id.org/bot/ )

W3C Community Group Draft Report

TABLE OF CONTENTS



## Building Topology Ontology

Draft Community Group Report 18 September 2020

**Latest editor's draft:**
https://w3c-lbd-cg.github.io/lbd/bot/

**Implementation report:**
https://w3c-lbd-cg.github.io/lbd/bot/

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Georg Ferdinand Schneider (Fraunhofer Institute for Building Physics, Technische Hochschule Nürnberg)



### Abstract

The Building Topology Ontology (BOT) is a minimal ontology for describing the core topological concepts of a building.

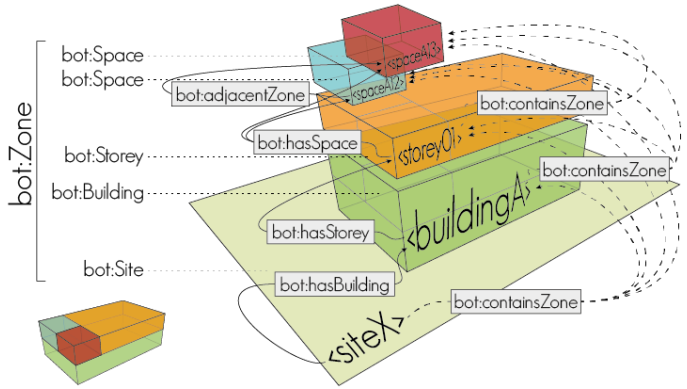
The namespace for BOT terms is `https://w3id.org/bot#`

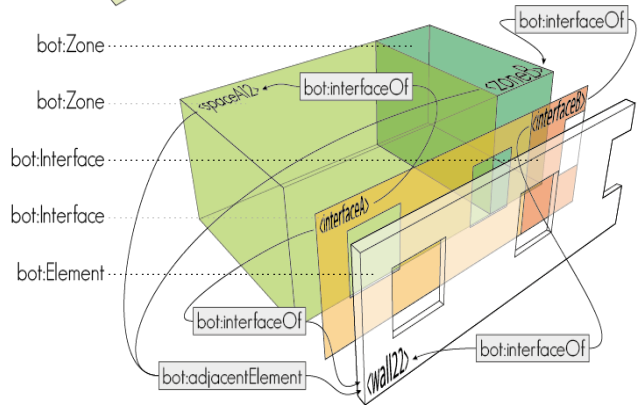
The suggested prefix for the BOT namespace is `bot`

The Turtle version of the BOT ontology is available at http://www.w3id.org/bot/bot.ttl

### Status of This Document

This specification was published by the Linked Building Data Community Group. It is not a W3C Standard nor is it on the W3C Standards Track. Please note that under the W3C Community Contributor License Agreement




*Mads Holten Rasmussen, Maxime Lefrançois, Georg Ferdinand Schneider, Pieter Pauwels (2020). BOT: the Building Topology Ontology of the W3C Linked Building Data Group, Semantic Web Journal, IOS Press*

# BOT (BUILDING TOPOLOGY ONTOLOGY)

- Outgoing links
  - | BOT Resource URI | Predicate | Aligned Resource URI |
    |---|---|---|
    | bot:Zone | rdfs:subClassOf | brick:Location |
    | bot:Zone | rdfs:subClassOf | dogont:Environement |

- Incoming links
  - | Aligned Resource URI | Predicate | BOT Resource URI |
    |---|---|---|
    | brick:Building, dogont:Building, dogont:Flat, ifc:IfcBuilding, rooms:Building, saref4bldg:Building | rdfs:subClassOf | bot:Building |
    | brick:Equipment, brick:Point, dogont:Controllable, dogont:Device, dogont:UnControllable, dogont:TechnicalSystem ifc:IfcElement, rooms:Desk, saref4bldg:PhysicalObject, saref4bldg:Sensor, saref4bldg:Actuator, | rdfs:subClassOf | bot:Element |
    | ifc:IfcSite, rooms:Site | rdfs:subClassOf | bot:Site |
    | brick:Basement, brick:Outside, brick:Room, brick:Space, brick:Wing, brick:Zone, dogont:Room, ifc:IfcSpace, rooms:Room, saref4bldg:BuildingSpace | rdfs:subClassOf | bot:Space |
    | brick:Floor, dogont:Storey, ifc:BuildingStorey, rooms:Floor, rooms:FloorSection | rdfs:subClassOf | bot:Storey |
    | dogont:BuildingEnvironement | rdfs:subClassOf | bot:Zone |
    | brick:contains, saref4bldg:contains | rdfs:subPropertyOf | bot:containsElement |
    | dogont:hasWallOpening | rdfs:subPropertyOf | bot:hosts |
    | rooms:contains, saref4bldg:hasSpace | rdfs:subPropertyOf | bot:containsZone |

"The Building Topology Ontology (BOT) is a simple ontology defining the core concepts of a building."

bot: https://w3id.org/bot#
brick: https://brickschema.org/schema/1.0.2/Brick#
dogont: http://elite.polito.it/ontologies/dogont.owl#
ifc: http://www.buildingsmart-tech.org/ifcOWL/IFC4_ADD2#
rdfs: http://www.w3.org/2000/01/rdf-schema#
rooms: http://vocab.deri.ie/rooms#
saref4bldg: https://saref.etsi.org/saref4bldg/

# BOT (BUILDING TOPOLOGY ONTOLOGY)

- Simple geolocation

  bot:hasZeroPoint links to wsg84:Point

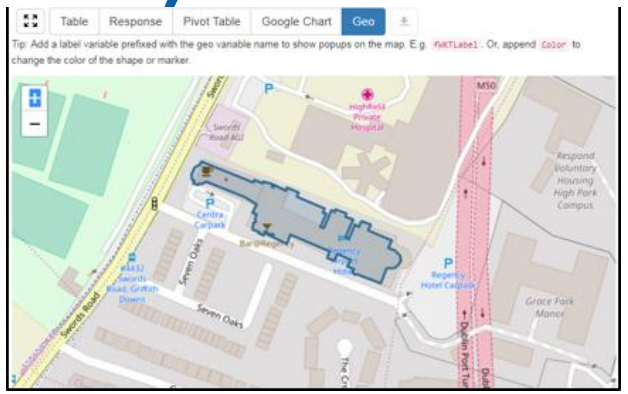
- 2D geospatial data

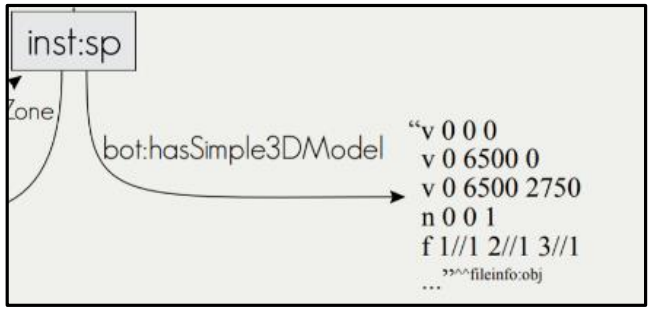
  bot:Building is a subclass of geo:Feature, and can have geometry, which can be expressed as GeoSPARQL WKT.

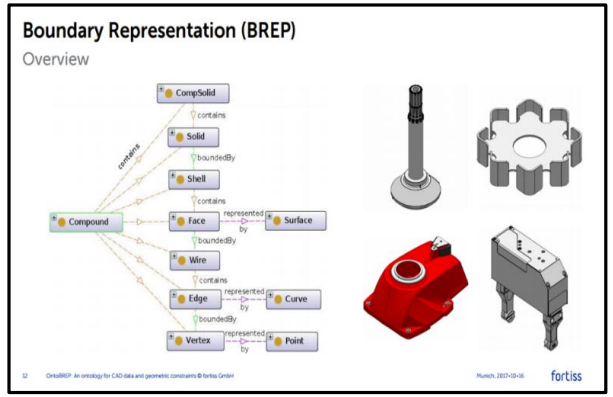
- 3D geometry

  bot:hasSimple3DModel links to a literal that encodes 3D geometry (e.g., OBJ model)

  bot:has3DModel links to a resource that further describes the 3D geometry with another vocabulary (e.g., the Geom ontology - http://rdf.bg/geometry.ttl )



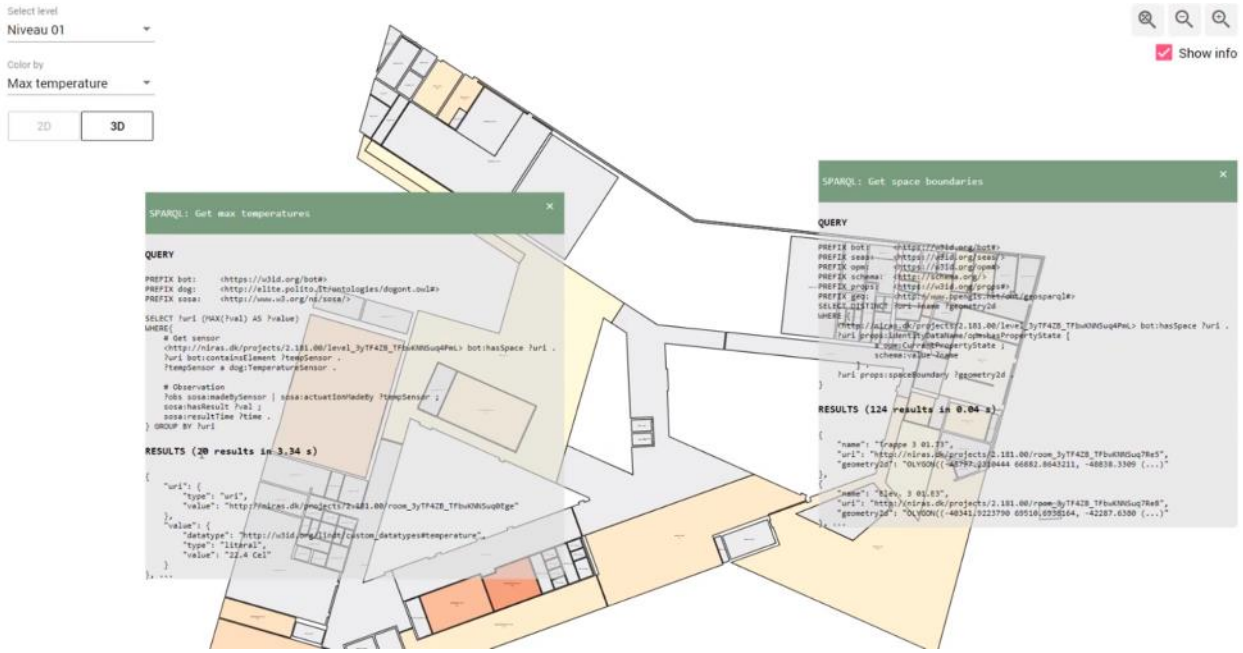



# SOME IMPLEMENTATIONS AND TOOLS

What our community members built

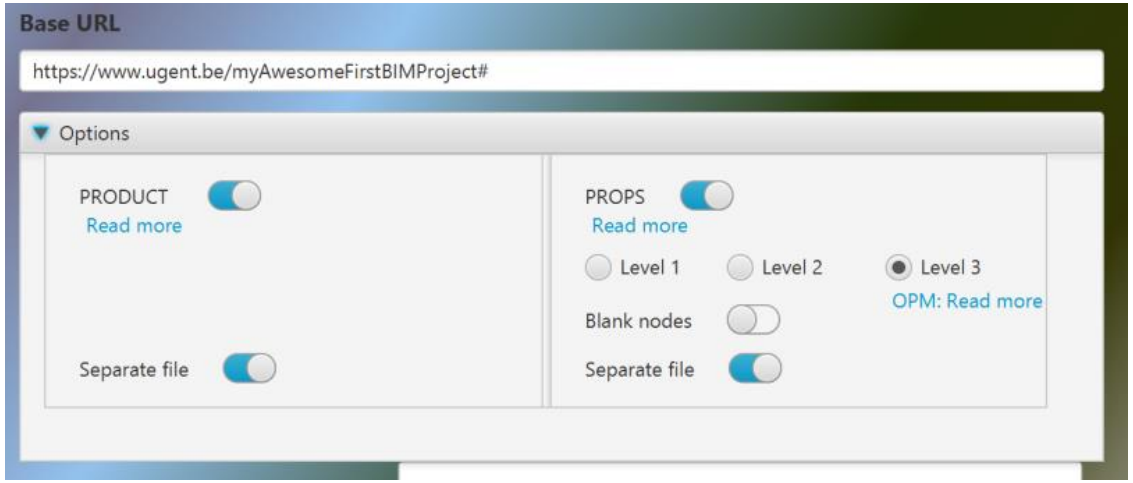
# BOT + SOSA + GEOMETRY

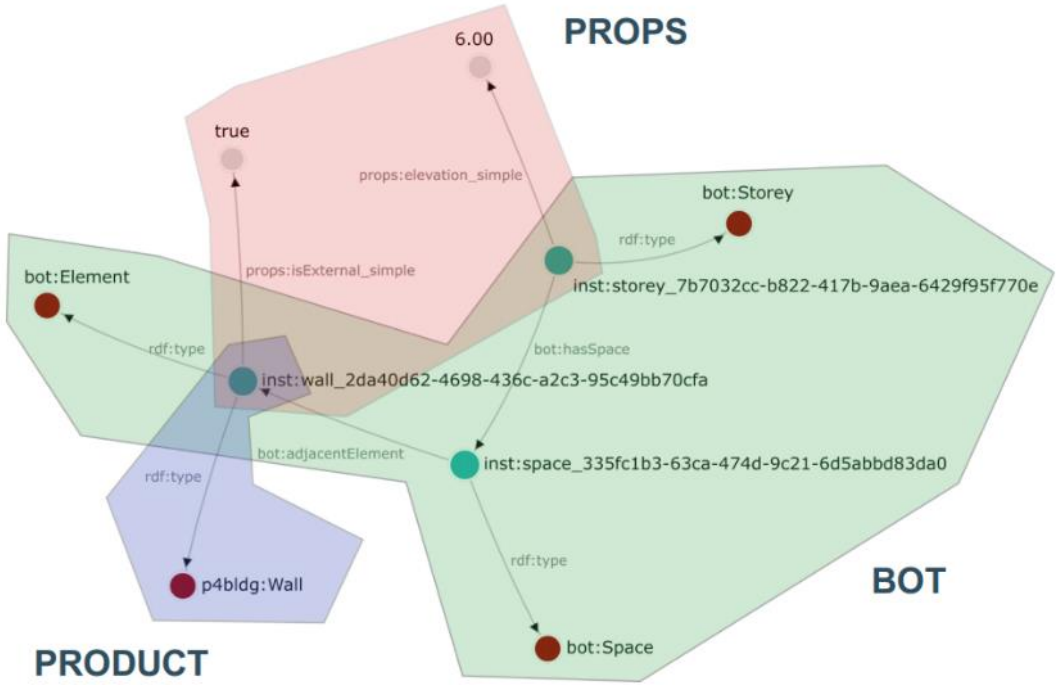





https://youtu.be/P_38gIvrbmg

# IFCTOLBD CONVERTER




- ifcOWL Abox graph: 17428.0 KB in Turtle (227143 triples)

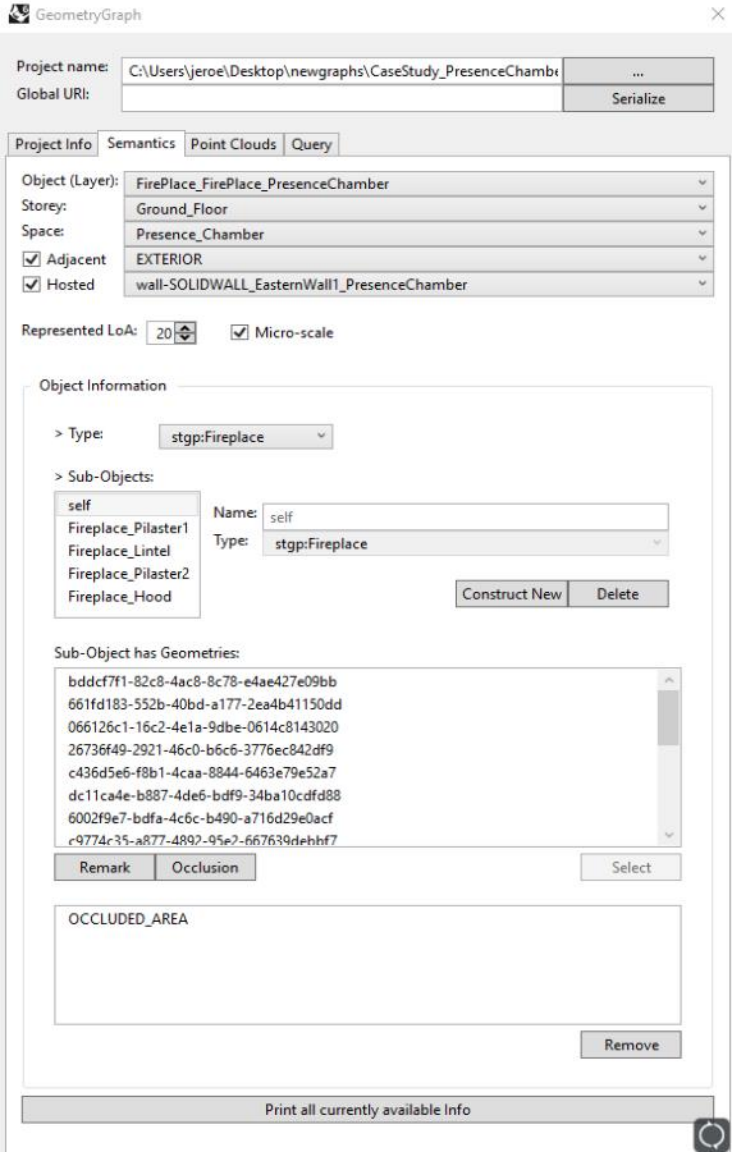
83% less triples

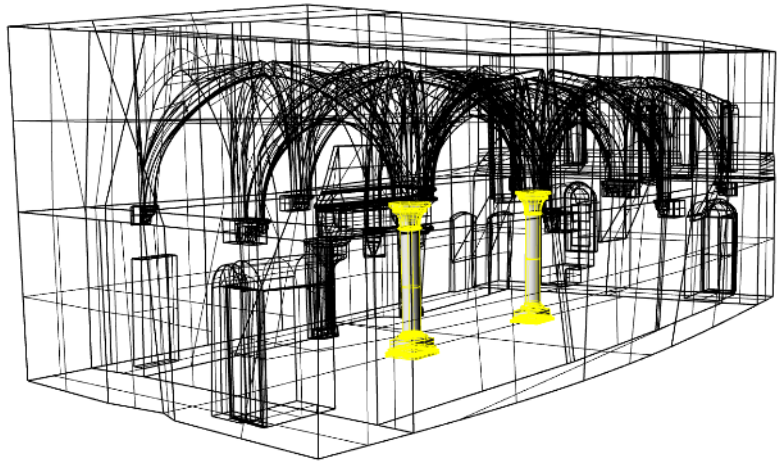
**Table 3:** IFCtoLBD converter output results per module

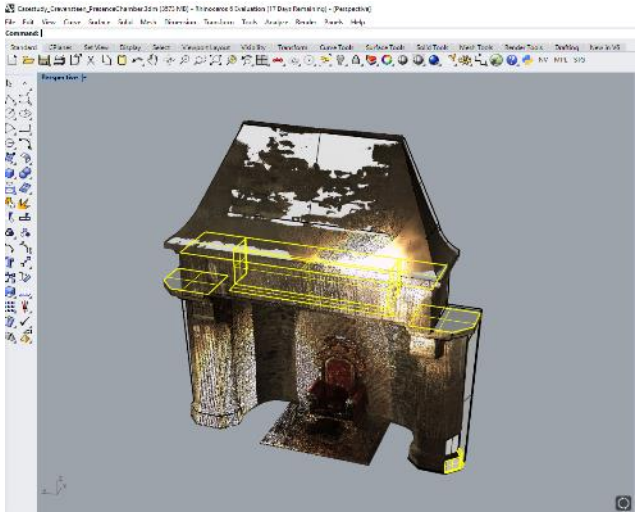
| BOT | PRODUCT | | PROPS | TOTAL |
|---|---|---|---|---|
| 45.5 KB (729 triples) | 18.8 KB (263 triples) | PROPS L1 | 397.7 KB (6099 triples) | 441.2 KB (7091 triples) |
| | | PROPS L2 | 1665.3 KB (19831 triples) | 1708.4 KB (20823 triples) |
| | | PROPS L3 | 3399.0 KB (38128 triples) | 3442.4 KB (39120 triples) |

https://github.com/jyrkioraskari/IFCtoLBD

# SCAN TO LBD GRAPH

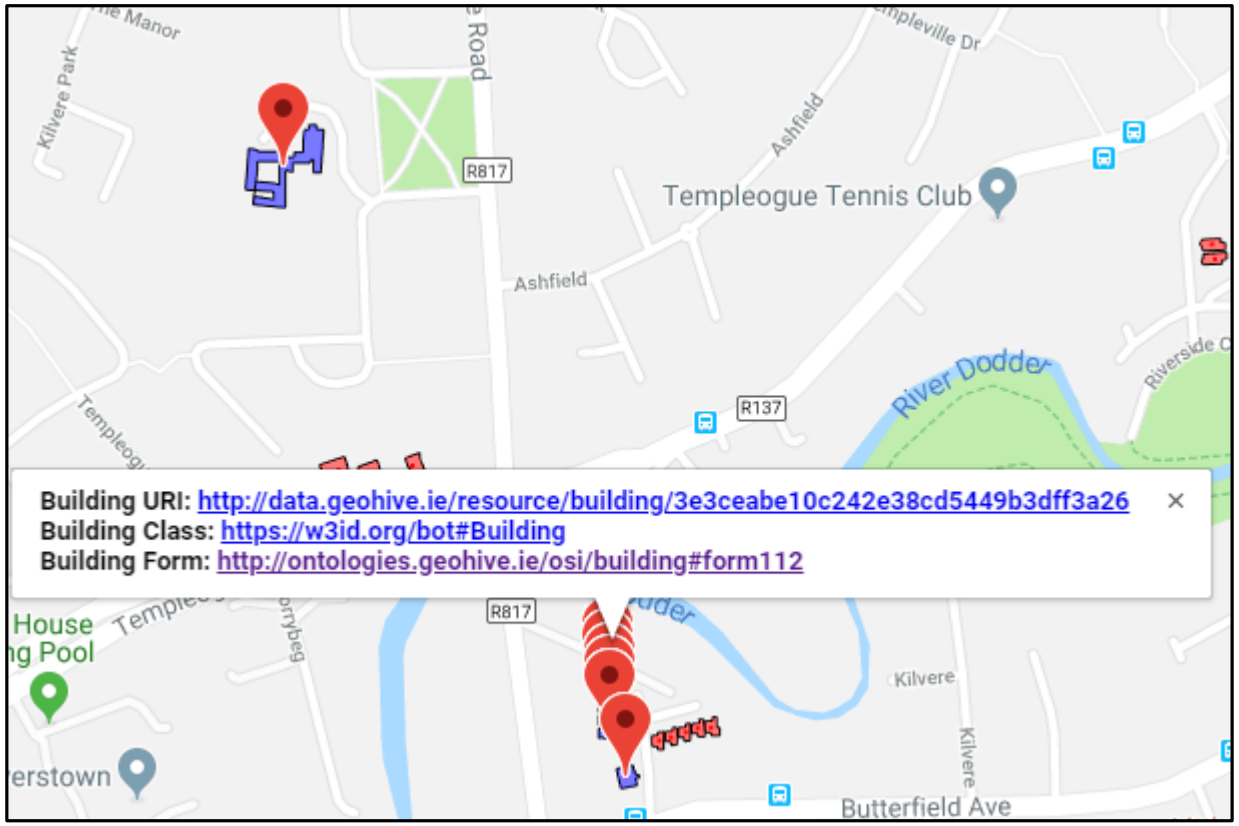




# BOT WITH ADDED GEOSPATIAL

- Using BOT to interlink Ordinace Survey Ireland building data (>3.5 million buildings)
- Provide a registry of authoratative URI's for Irish building stock.



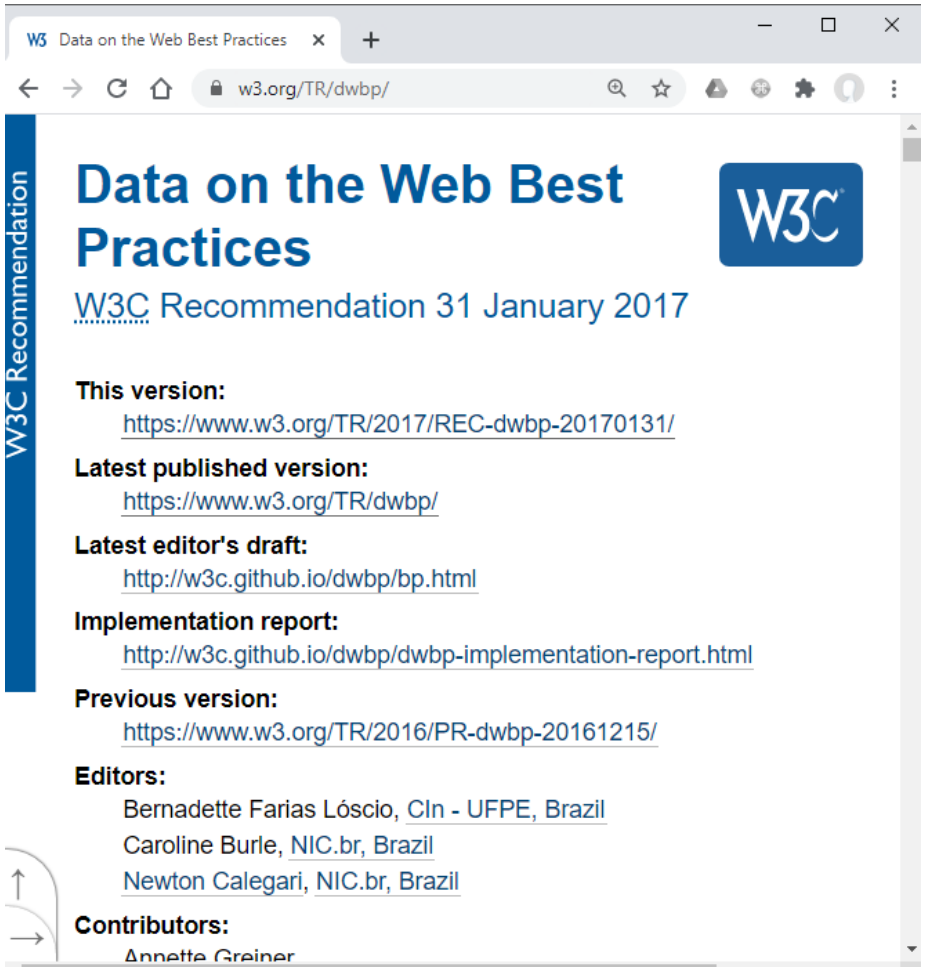

- http://geovis.adaptcentre.ie/
  - Username: odef_adapt
  - Password: geo123
- https://www.scss.tcd.ie/~mcglink/video/tutorial/geovis/geovis.html

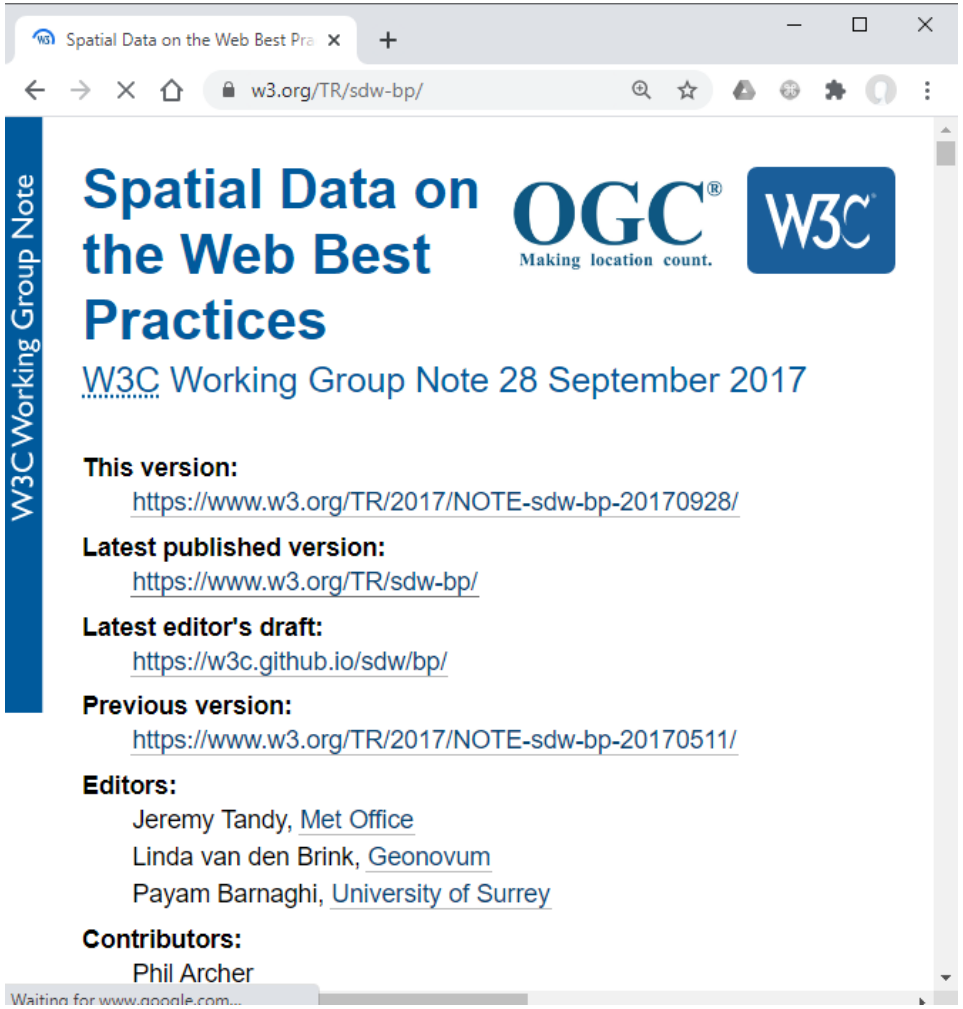
# WHERE WE ARE HEADING AT?

Community as a platform and forum to gather experts and interested persons

→ Spin-off working group ? Pushing items to existing groups ?

# BUILDING DATA ON THE WEB BEST PRACTICES ?




... (?)