1-06-2021

W3C LBD CG

2nd Focus Group Workshop

Agenda

- Introduction of new members
- Summarization and follow-up of pitches from last time:
  - Pitch 1 - Pouya Zangeneh
  - Pitch 2 - Jeroen Werbrouck
  - Pitch 3 - Richard Pinka
  - Pitch 4 - Conor Shaw
- New pitches:
  - Pitch 5 - Al-Hakam Hamdan
    - Q&A/Discussion
  - Pitch 6 - Mathias Bonduel
    - Q&A/Discussion
- Focus Group Discussion - Interests & expectations of CG participants
- Further topics

Intro

- **1st Focus Group Workshop**

- **Call for ‘Focus Group Pitches’**
  - Applications made via Form
  - Open to CG members as well as external participants

Focus Group Workshops

- **Goals**
  - Formation of relevant ‘Focus Groups’
  - Discussion & exchange of CG members
  - Open to individual initiatives
  - Possible goals
    - preparing a research paper,
    - initiating a research project
    - applying for funding ..
- **Date**
  - regular LBD CG calls
  - using MS Teams

UPonto Uniform Project Ontology

The fourth industrial revolution has affected most industries, including construction and those within the delivery chain of megaprojects. These major paradigm shifts , however, did not considerably improve the track record in predicting project outcomes and estimating required resources. One reason is the lack of unified data definitions and expandable knowledge representation across project lifecycle to represent megaprojects for analytics. This paper proposes and evaluates a unified ontology for project knowledge representation that facilitates data collection, processing, and utilization for industrial megaprojects through their lifecycle. The proposed **Uniform Project Ontology, or UPonto**, provides a data infrastructure for project analytics by enabling logical deductions and inferences, and flexible expansion and partitioning of the data utilizing linked data and the semantic web. The ontology facilitates cost normalization processes, temporal queries, and graph queries using SPARQL, while defining universal semantics for a wide range of project risk factors and characteristics based on comprehensive research of the empirical project risk and success literature augmented by practical considerations gained through expert consultations. UPonto forms the basis for a project knowledge graph to utilize unstructured data; it as well provides semantic definitions for smart IoT agents to consume project risk data and knowledge.

https://doi.org/10.1016/j.aei.2020.101164

Focus Group Pitch ⏯ no.1

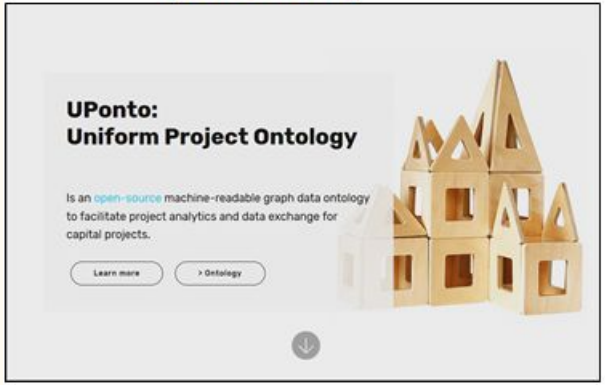
- **Focus topic**
  - **KOS: Ontologies for Project Risk Analytics of Large Projects**
- **Presentation title**
  - **UPonto: Uniform Project Ontology**
- **Presented by**

  - Pouya Zangeneh
  - University of Toronto, Canada
  - Mail: p.zangeneh@mail.utoronto.ca

UPonto Uniform Project Ontology

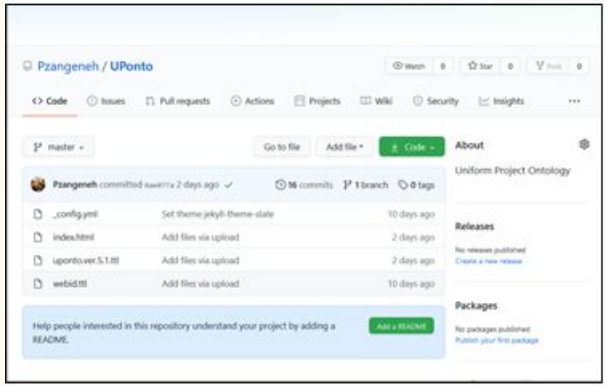
Focus Group Pitch ⏯ no.1

uponto.link/

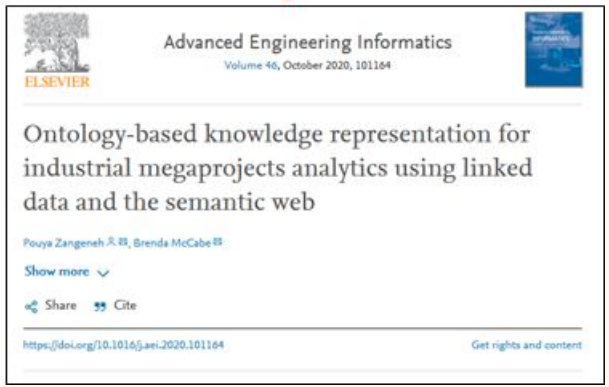


uponto.link/ontology/

github.com/Pzangeneh/UPonto/

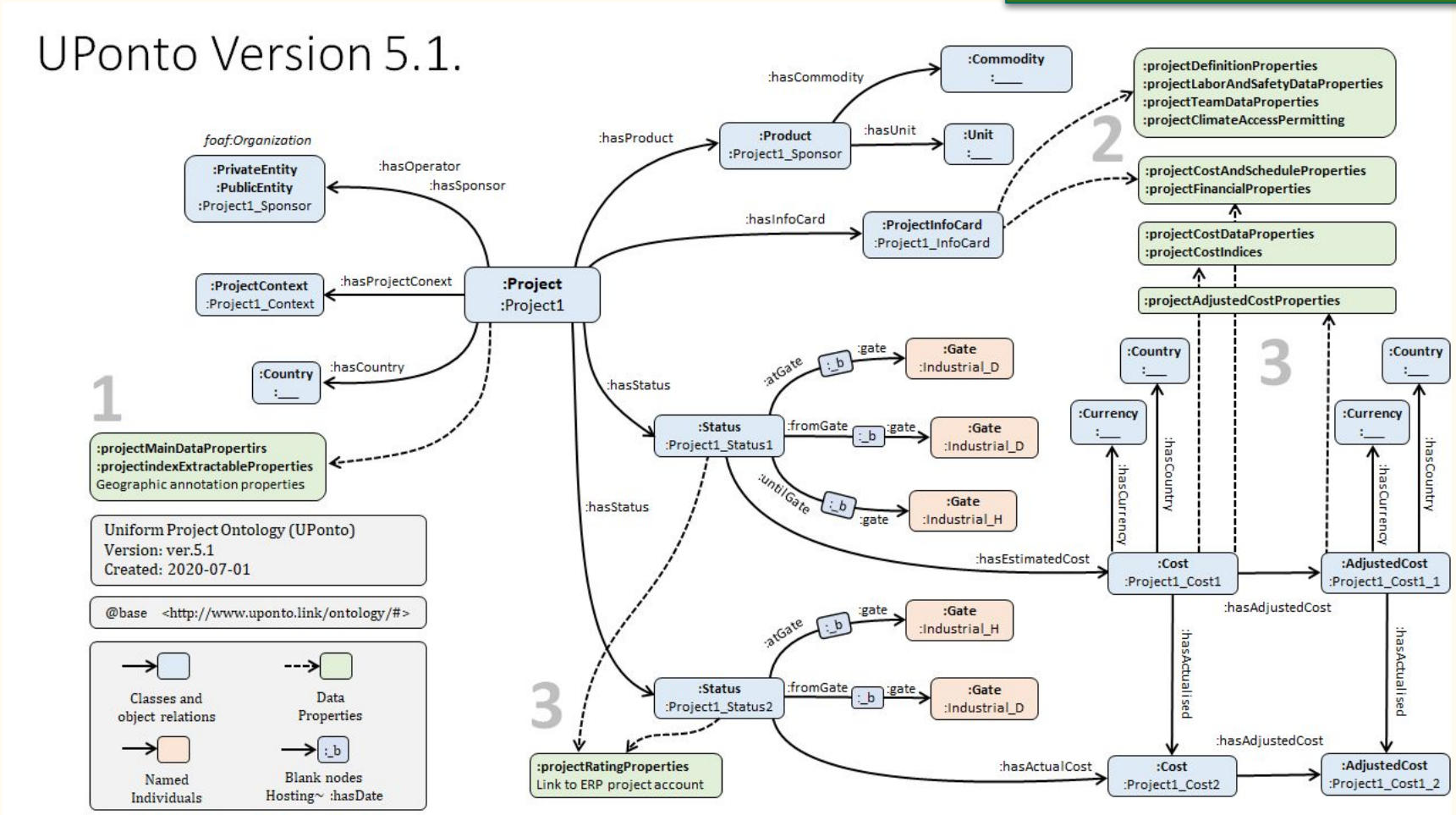


Paper



UPonto Uniform Project Ontoloy

Focus Group Pitch ⏯ no.1



UPonto Uniform Project Ontology

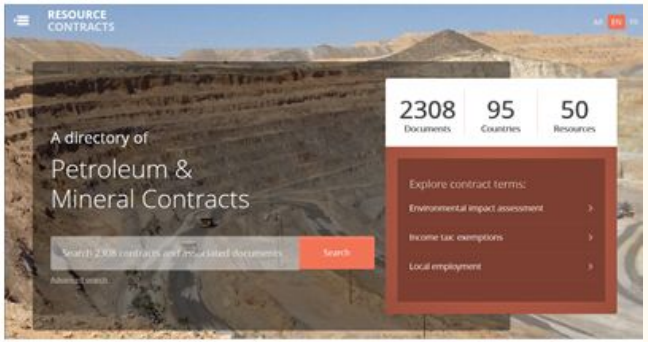
Focus Group Pitch ⏯ no.1

Collaboration with Columbia Center on Sustainable Investment

- The project was carried out as a visiting scholar semester in Columbia Law school.
- Extractive Industries Transparency Initiative (EITI) is a global standard for the good governance of oil, gas and mineral resources.
- Proposed in 2002 by the UK government at the World Summit on Sustainable Development in Johannesburg.
- Voluntarily adopted by 52 countries.
- Is developed and overseen by an international multi-stakeholder board, consisting of representatives from:
  - Governments,
  - Extractives companies,
  - Civil society organisations, *such as Natural Resource Governance Institute (NRGI)*
  - Financial institutions, and,
  - International organisations.

EITI Extractive Industries Transparency Initiative

Resource Contracts

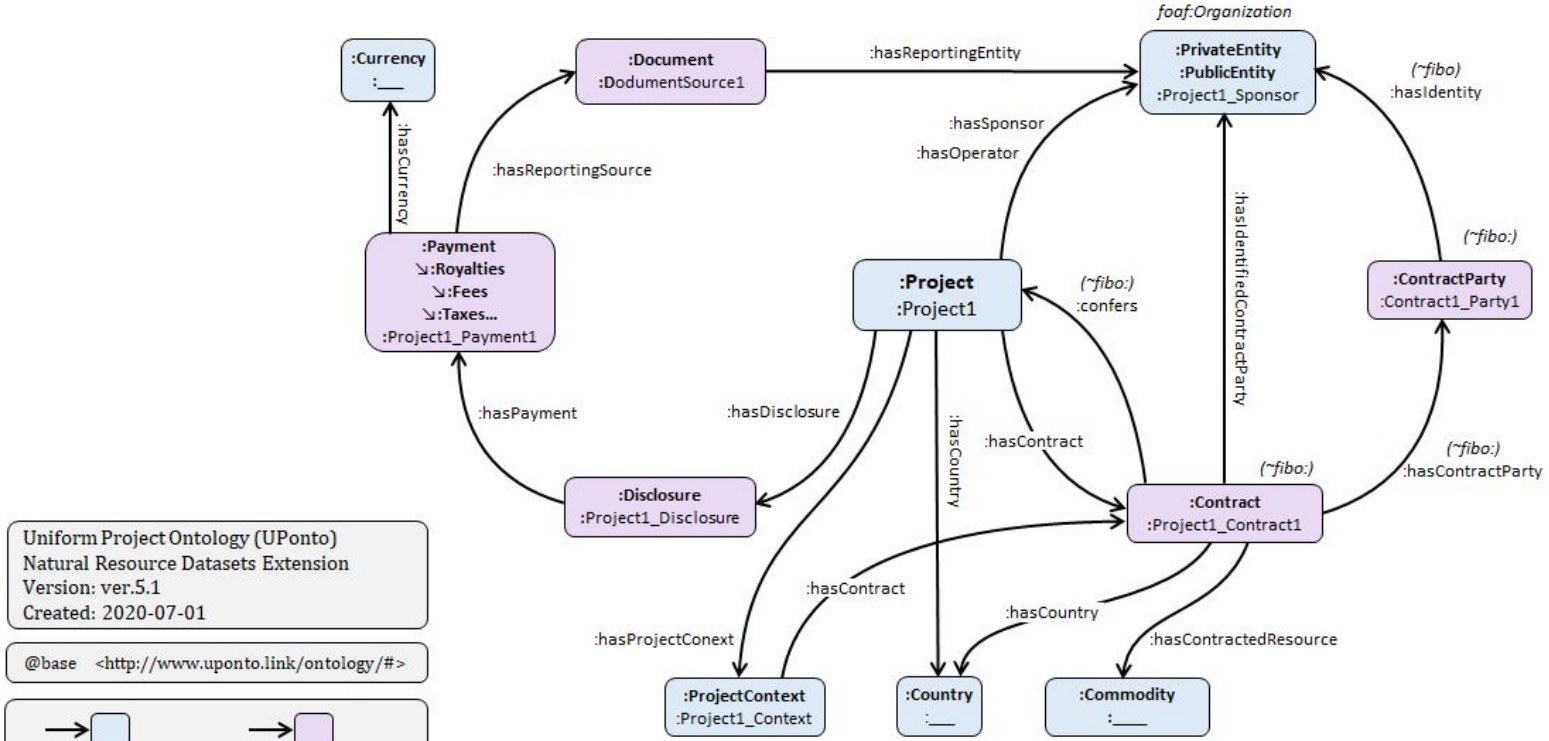


Resource Projects

UPonto Uniform Project Ontology

Focus Group Pitch ⏯ no.1

Natural Resource Datasets Extension



Federated data management

While the construction sector is one of the most decentralised economic sectors, digital management of its data largely happens in a centralised fashion. Currently, Common Data Environments require stakeholders of a construction project to upload their data to a central service in the cloud. Depending on the project consortium, another CDE service may be chosen. With Semantic Web technologies, however, it essentially does not matter where your data is stored on the Web: if it can be dereferenced, it can be found and used. With this in mind, a federated organisational structure becomes possible, where not only contextual data is federated (as is now already the case, e.g. with geospatial data, governmental data, product data...), but also project-specific data. By managing projects in-house instead of uploading to cloud CDEs, a stakeholder office may as well be able to link several projects together in order to draw bird's-eye conclusions and lessons for future projects. Domain-agnostic Web technologies such as WebID-OIDC, Linked Data Platform, SHACL etc., can be combined with LBD vocabularies and industry standards (ISO 19650, ISO 21597 (ICDD)) to define common data structures for federated building models. However, “federation” not only applies to data, but also to microservices, which may range from semantic enrichment services over general data management aids to rule/regulation checking mechanisms. How to agree on common data models while leveraging the "semantic freedom" of Linked Data? How to automate chains of federated microservices to work together in larger use cases? How to integrate common BIM practices/tools in a federated context? (..)

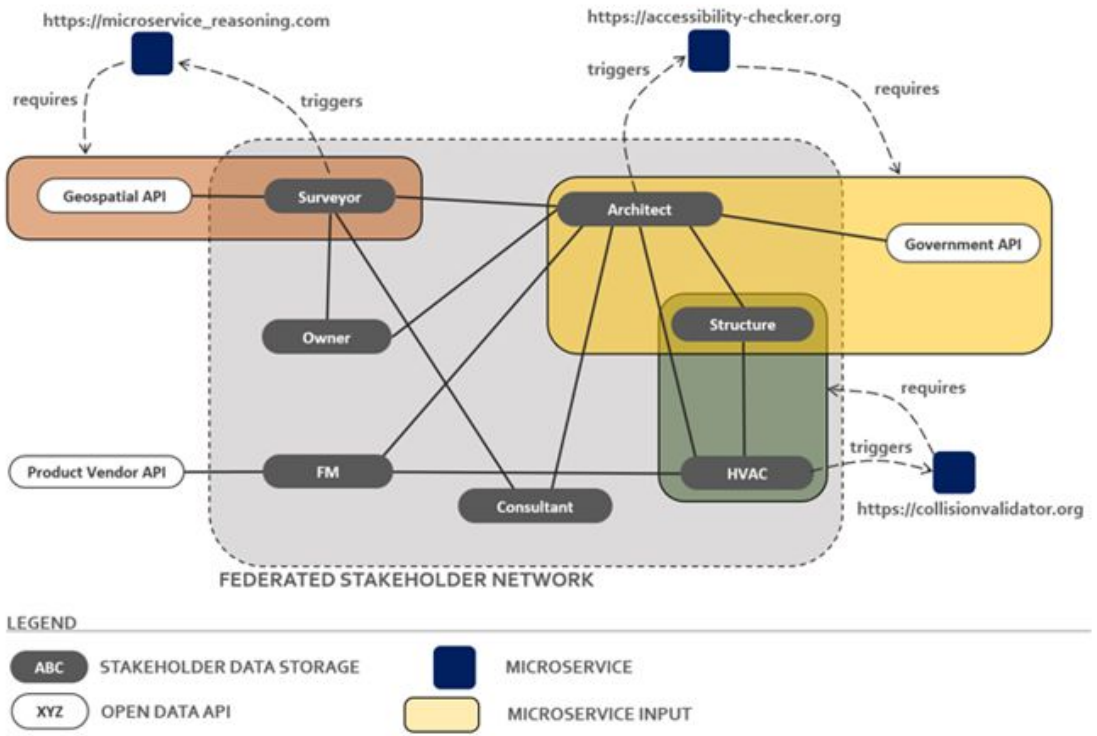
Focus Group Pitch ⏯ no.2

- **Focus topic**
  - **Federated management of heterogeneous building data**
- **Presentation title**
  - **Federated data management**
- **Presented by**
  - Jeroen Werbrouck
  - Ghent University, Belgium
  - Mail: jeroen.werbrouck@urgent.be

Federated data management: projects

Focus Group Pitch ⏯ no.2

- Separate data from services
- Data = project-specific + context
- "Federated CDE":
  - URL-based **data structure**
    - No duplication
  - Ecosystem of LD-webservices
    - Project content
    - Project management



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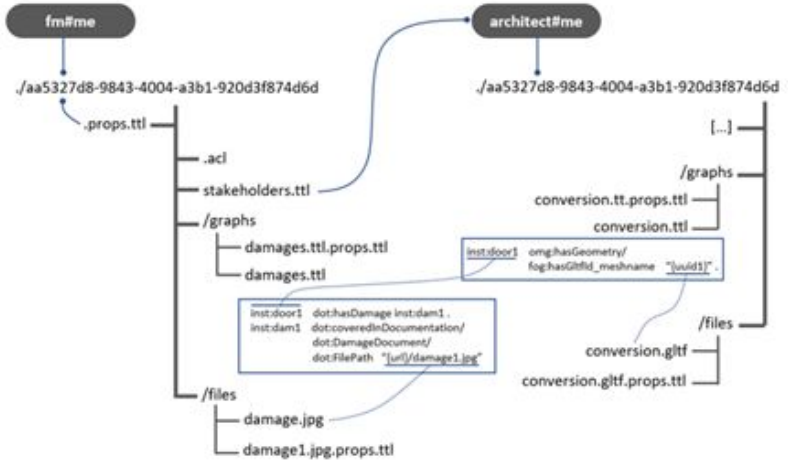
Federated data management

- Relating heterogeneous data over the Web
  - RDF, imagery, geometry, point clouds, spreadsheets …
  - Resource hosting: LDP, triple store, data dump …
  - Resource/Container organisation: ICDD, Solid Interop, (custom) …
  - Project structure: stakeholder network, project planning, sync services …
  - Data structure: ontologies, schema's …



Federated data management: services

- Project management services
  - Data synchronisation/validation
  - Stakeholder network management
  - Notifications
- Project content services
  - Headless: simulations, regulation checking, …
  - GUI: semantic enrichment, source linking, geometric modifications …

© TNO, BIM bots (source: time.tno.nl)

How about L(B)D bots?

How do these services interact/integrate?

How can they be combined to address larger (cross-domain) use cases?

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HVAC tabular product data FCU unit design

Focus Group Pitch ⏯ no.3

- **Focus / Presentation topic**
  - **HVAC tabular product data FCU unit Design/Operation parameters**
- **Presented by**
  - Richard Pinka
  - https://research.richardpinka.eu/services_details_use-case2.html
  - Mail: richard.pinka@gmail.com

HVAC tabular product data FCU unit design

Focus Group Pitch ⏯ no.3

FCU unit

Basic (static) parameters: weight, name, connection diameters, dimensions of FCU , Dimensions of service space...

But operational parameters : (in DESIGN and OPERATION afterwards)

Fancoil operation parameters

static parameters

FCU unit

operationParameter

- operatingProfileName
- operationParameterTIMEDATE
- mediumType
- ECWT_entering_cooling_medium_temperature
- EHWT_entering_heating_medium_temperature
- LCWT_leaving_cooling_medium_temperature
- LHWT_leaving_heating_medium_temperature
- EAT_entering_air_temperature
- LAT_leaving-SUPPLY_air_temperature
- EAH_entering_air_Rhumidity
- disposible_air_pressure
- CCoil_water_pressure_drop
- HCoil_water_pressure_drop
- CCoil_water_flow
- HCoil_water_flow
- fan_speed
  - Sound_power_level_octave_HZ
  - Overall_sound_power_level_Lw
  - Overall_sound_power_level_rated_Lw
  - sound_pressure_level
  - sound_NC
  - sound_NR
- Cooling_capacity_total
- Cooling_capacity_sensible
- fan_RPM

							VÝMĚNÍK PRO CHLAZENÍ					VÝMĚNÍK PRO TOPENÍ				Lp
TYP Velikost	R#	U Volt	N ot/min	OP Pa	Pabs W	Qa m3/h	Pt W	Ps W	Ts °C	Qe m3/h	dP kPa	P W	Ts °C	Qe m3/h	dP kPa	ISO oktáv NR
CELINE 34D HEE	V5	8.2	1250	31	109	1120	2 340	2 340	18.0	0.320	7.04	4 280	33.7	0.316	17.6	47
	V4	6.5	1000	18	52	865	2 160	2 160	16.6	0.320	7.07	3 920	35.8	0.316	17.6	41
	V3	5.4	840	12	30	705	2 010	2 010	15.5	0.320	7.10	3 610	37.5	0.316	17.5	37
	V2	4.1	665	6	16	520	1 790	1 700	14.2	0.320	7.15	3 150	40.4	0.316	17.5	31
	V1	3.3	550	4	10	400	1 600	1 480	12.8	0.320	7.19	2 750	42.8	0.316	17.4	27
CELINE 44C HEE	V5	7.7	1170	23	102	1190	2 450	2 450	18.0	0.353	4.38	3 470	31.0	0.277	2.64	45
	V4	5.7	895	12	42	870	2 220	2 220	16.5	0.353	4.42	3 160	33.0	0.277	2.64	38
	V3	4.7	745	8	25	705	2 050	2 050	15.3	0.353	4.44	2 940	34.7	0.277	2.63	34
	V2	3.6	595	4	13	525	1 820	1 820	13.6	0.353	4.48	2 610	37.0	0.277	2.62	29

Spontaneous pitch

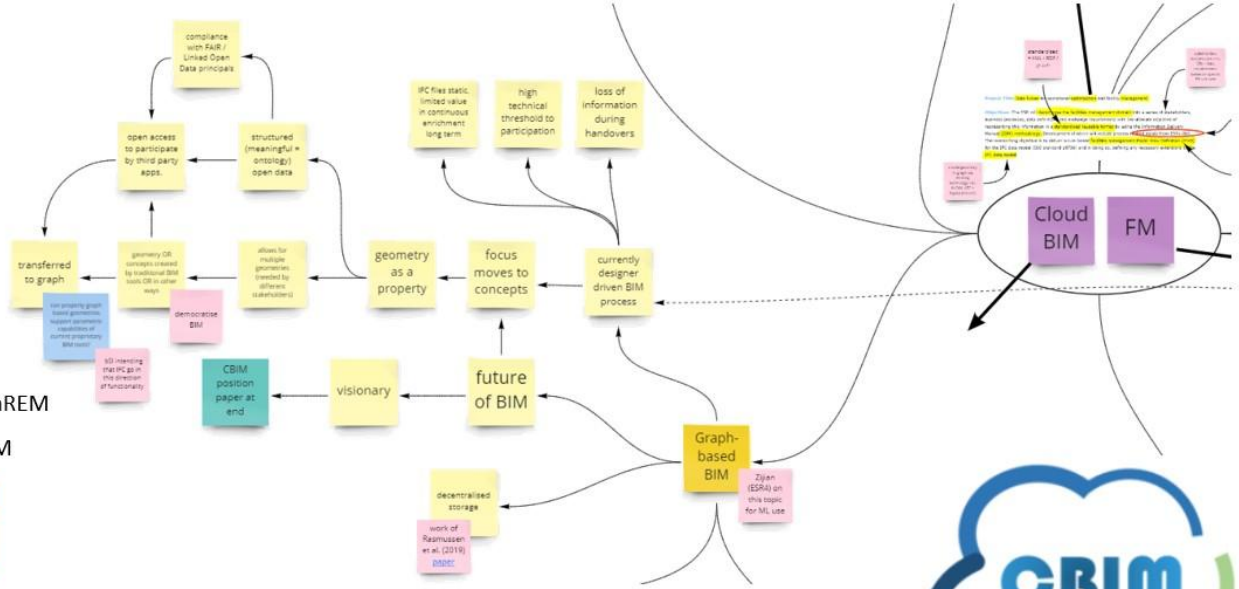
Focus Group Pitch ⏯ no.4

- **Focus area**
  Democratising participation in FM services through graph-based building information enrichment
- **Presentation topic**
  Graph-based building information enrichment for FM services
- **Presented by**
  - Conor Shaw, PhD cand. Cloud-based BIM, University College Dublin
  - Mail: conor.shaw@ucd.ie

Spontaneous pitch

Focus Group Pitch ⏯ no.4

Democratising participation in FM services through graph-based building information enrichment



Conor Shaw B.Sc Arch Tech, M.Sc ConREM

Doctoral Researcher, Cloud-based BIM

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European Commission

This project is receiving funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 860555.

The Damage Topology Ontology (DOT)

The Damage Topology Ontology (DOT) is presented, a web ontology that provides terminology to represent construction-related damages and their topology as well as relations to affected construction elements and spatial zones. Besides the topology, classes and properties for documentation management and a minimal structural assessment have been proposed in DOT. In this regard, DOT provides all classes and properties needed for practical use in construction inspections and damage assessment. The ontology is developed to be used with the modular Linked Building Data ontologies structure, where DOT works as core damage ontology which can be extended with multiple modules related to detailed damage classification, damage assessment, mechanical degradation and other application scenarios. Geometrical damage representations are separated from the topology, so that it is possible to initially record damages during the inspection without any geometrical properties and link it later with a corresponding representation using terminology from geometry-related ontologies. In conclusion, DOT can be applied as a stand-alone web ontology to represent damages in a machine-interpretable format and replace conventional record approaches. Therefore, a generic terminology is used that enables the inclusion of various types of damage, which can be extended with domain-specific information.

Above abstract copied from:

A.-H. Hamdan, M. Bonduel, and R. J. Scherer, "An ontological model for the representation of damage to constructions," in Proceedings of the 7th Linked Data in Architecture and Construction Workshop (LDAC), CEUR Workshop Proceedings, 2019, vol. 2389, pp. 64–77, [Online]. Available: http://ceur-ws.org/Vol-2389/05paper.pdf.

Focus Group Pitch ⏯ no.5

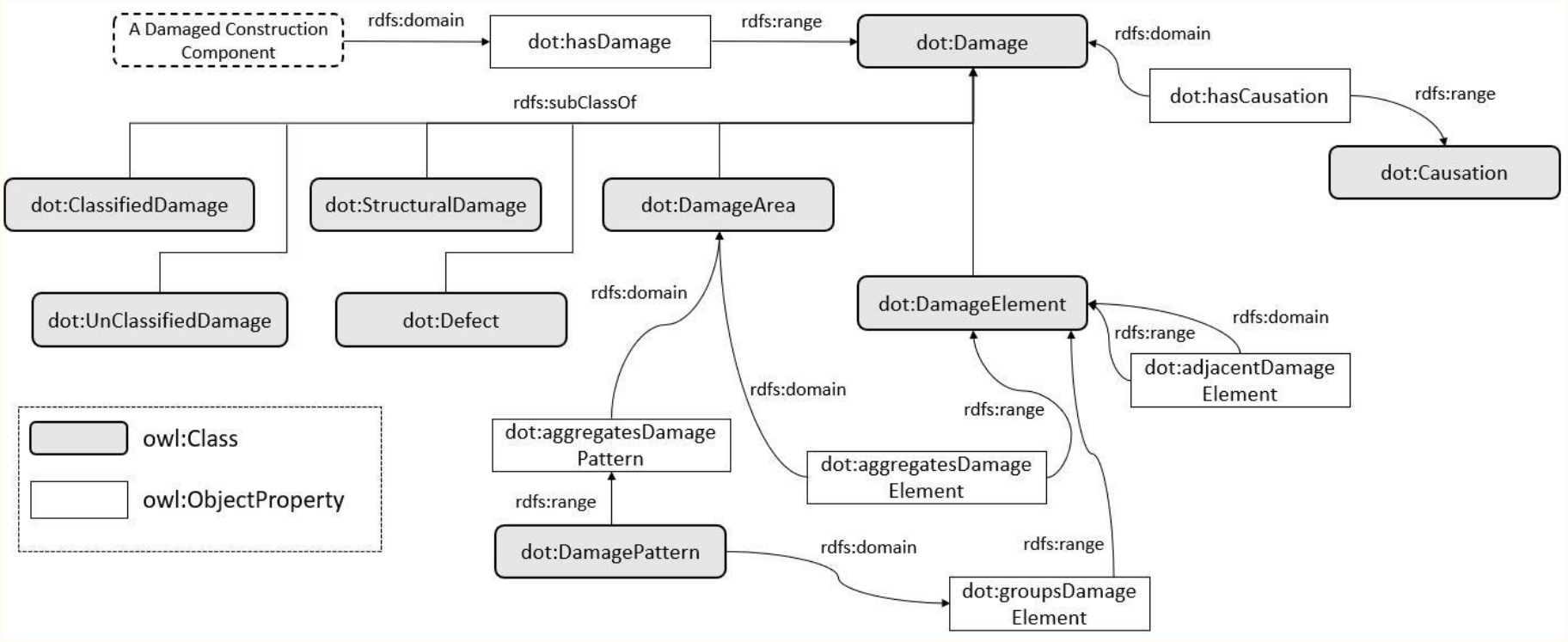
- **Focus topic**
  - **Construction Damage descriptions**
- **Presentation title**
  - **The Damage Topology Ontology (DOT)**
- **Presented by**

  - Al-Hakam Hamdan
  - TU Dresden, Germany
  - Mail: al-hakam.hamdan@tu-dresden.de

Important URLs regarding DOT

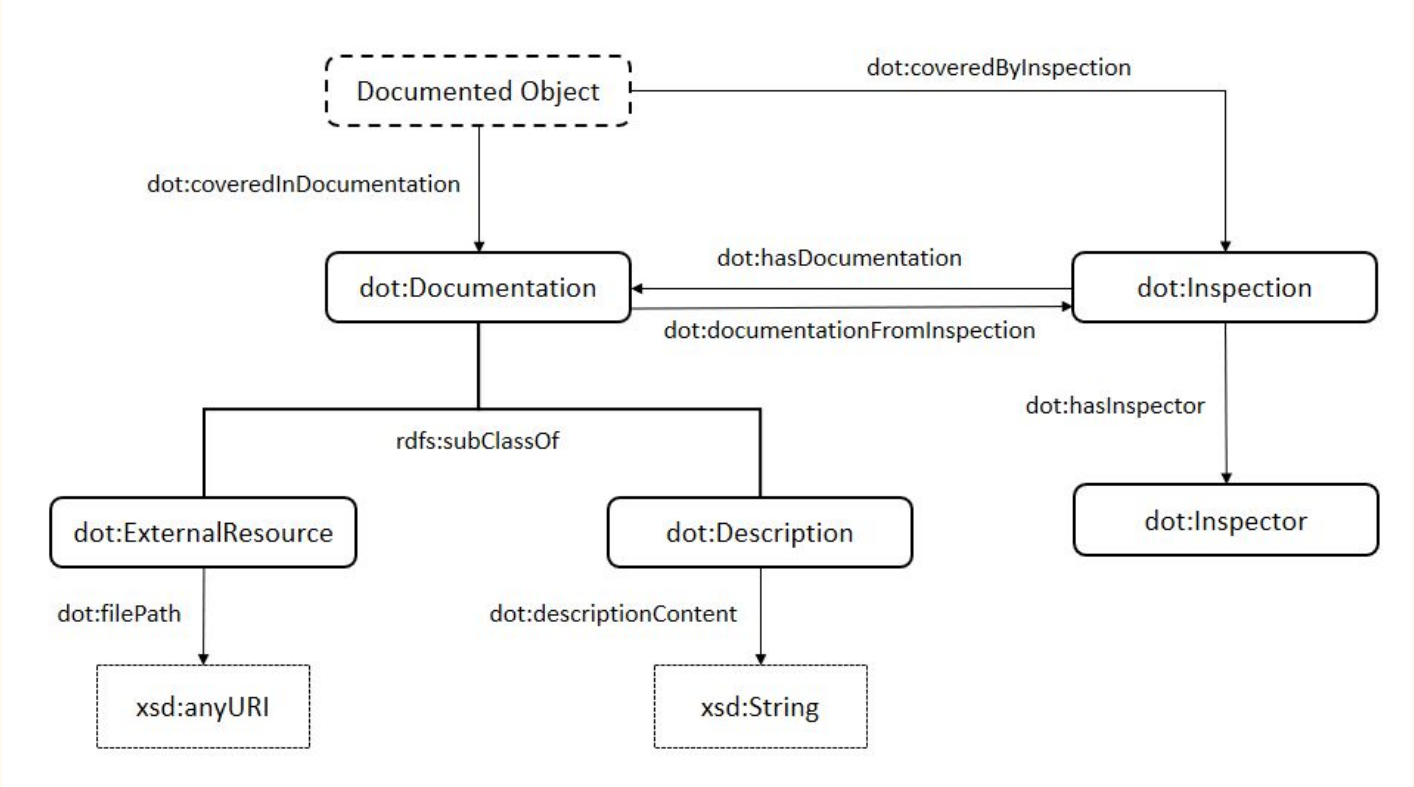
- Namespace (& Documentation URL): https://w3id.org/dot#
- Github repository: https://github.com/Alhakam/dot
- SPARQL Visualizer Demo: https://madsholten.github.io/sparql-visualizer/?file=https:%2F%2Fraw.githubusercontent.com%2FAlhakam%2Fdot%2Fmaster%2FABox-Examples%2Fdot-demo.json
- LDAC 2019 paper covering first version of DOT: http://ceur-ws.org/Vol-2636/06paper.pdf

DOT classes & properties

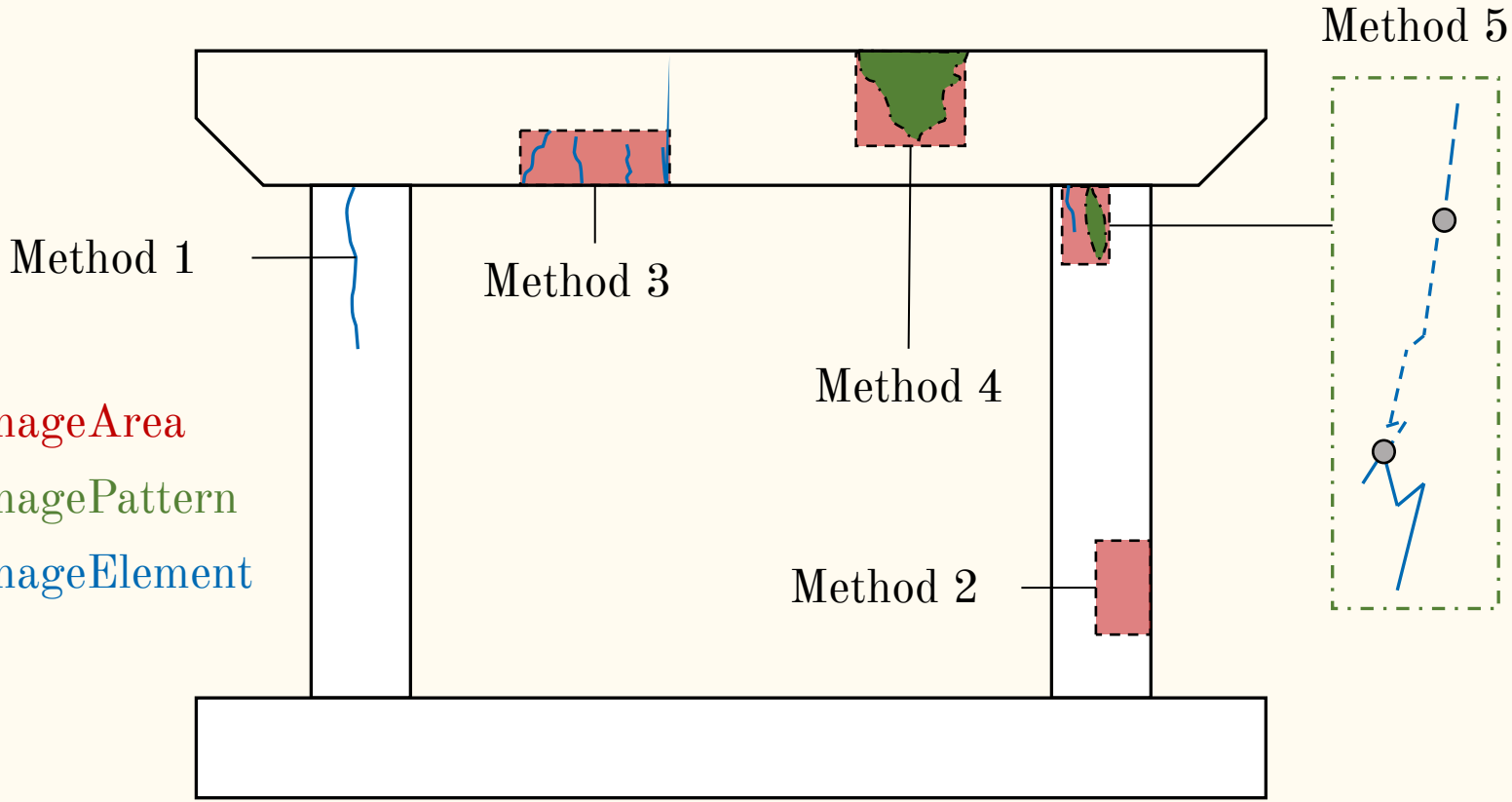


note: geometry can be linked to a dot:Damage instance by reusing available geometry linking approaches (ICDD, OMG/FOG, GeoSPARQL, etc.)

Additional Classes and Properties for Documentation & Inspection

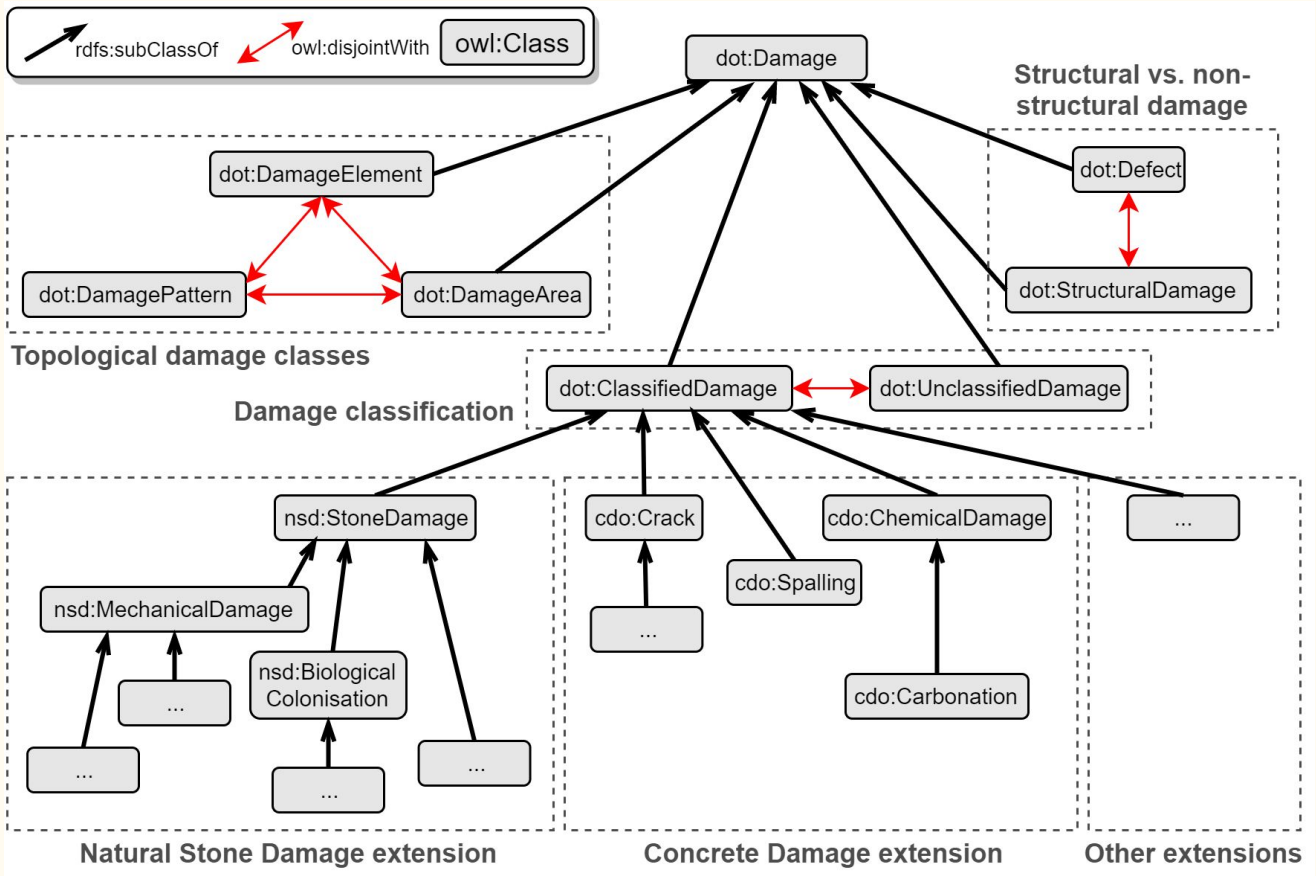


Damage modeling with DOT



- dot:DamageArea
- dot:DamagePattern
- dot:DamageElement

Extensions of DOT



Classification extensions

- Natural Stone Damage (NSD): not public
- Concrete Damage Ontology (CDO): link
- MDCS damage atlas Ontology (MDCS-O): link
- Monumentenwacht Vlaanderen Damage Ontology (MDV-D): link

Other extensions

- Damage Mechanics Ontology (DMO): link
- ASB-ING Assessment Ontology: link
- Uncertain Damage Ontology (UDO): link

Known projects applying DOT concepts

Focus Group Pitch ⏯ no.5

- Application of DOT for representing detected bridge damages and evaluation of them via SHACL rules
  - Project: https://www.wisib.de/
- Representation of Natural Stone Damages based on the ICOMOS damage glossary
  - Project: https://www.bim-sis.de/
- Ontology-based APIs to exchange Building Digital Twin data: DOT applied for exchanging inspection and damage data
  - Project: https://sphere-project.eu/ (H2020)
- BIM and Linked Data for energy renovations: capturing and describing of degradations on building components
  - Project: https://bim4ren.eu/ (H2020)
- Inspection of bridges: automatic recognition and classification of damages
  - Project: https://dc.rwth-aachen.de/de/forschung/twingen
- PhD research Al-Hakam Hamdan
  - title: “An ontology-based approach for automatized evaluation of damages in a digital data environment”
- PhD research Mathias Bonduel (2021)
  - title: “A Framework for a Linked Data-based Heritage BIM”

The Construction Tasks Ontology (CTO)

The final part of the literature review presented in Section 8.2.1 indicates that the concept of construction tasks is required for a wide variety of use cases in the construction industry. Therefore, a dedicated and modular ontology named CTO (Construction Tasks Ontology) is proposed to cover the overlap between individual ontologies described in literature. The concise CTO module directly addresses Req-D-4 and is designed to be compatible with other modular ontologies selected and developed for this thesis. CTO provides a solid basis for usage in a wide variety of construction projects ranging from new constructions and renovations over inspections, maintenance, restorations to demolition projects.

Text copied from Mathias Bonduel's PhD dissertation:
M. Bonduel, "A Framework for a Linked Data-based Heritage BIM," KU Leuven, 2021 [Online]. Available: https://lirias.kuleuven.be/handle/123456789/674476.

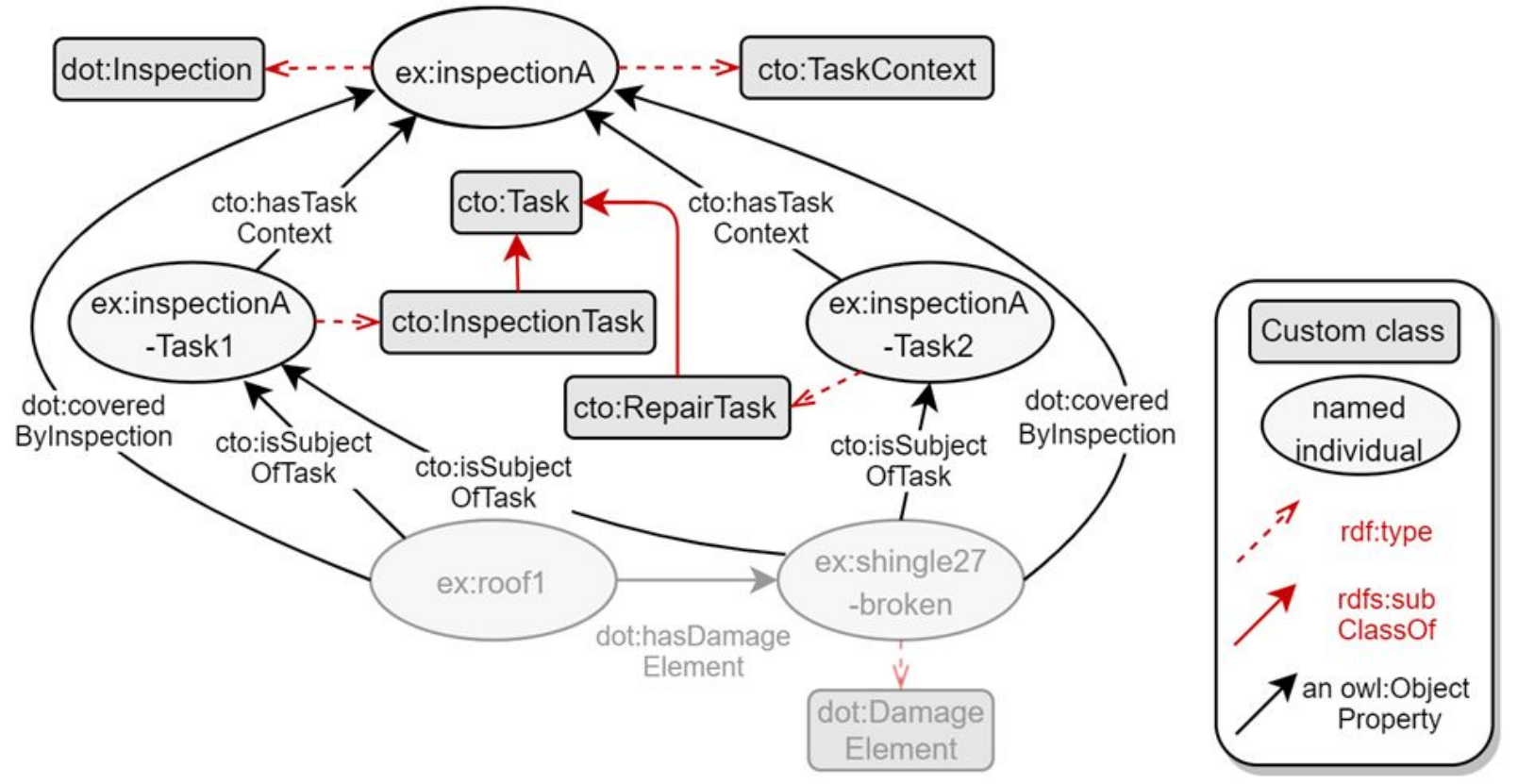
Focus Group Pitch ⏯ no.6

- **Focus topic**
  - **Construction Tasks descriptions**
- **Presentation title**
  - **The Construction Tasks Ontology (CTO)**
- **Presented by**
  - Mathias Bonduel
  - KU Leuven & Neanex Technologies, Belgium
  - Mail: mathias.bonduel@neanex.com

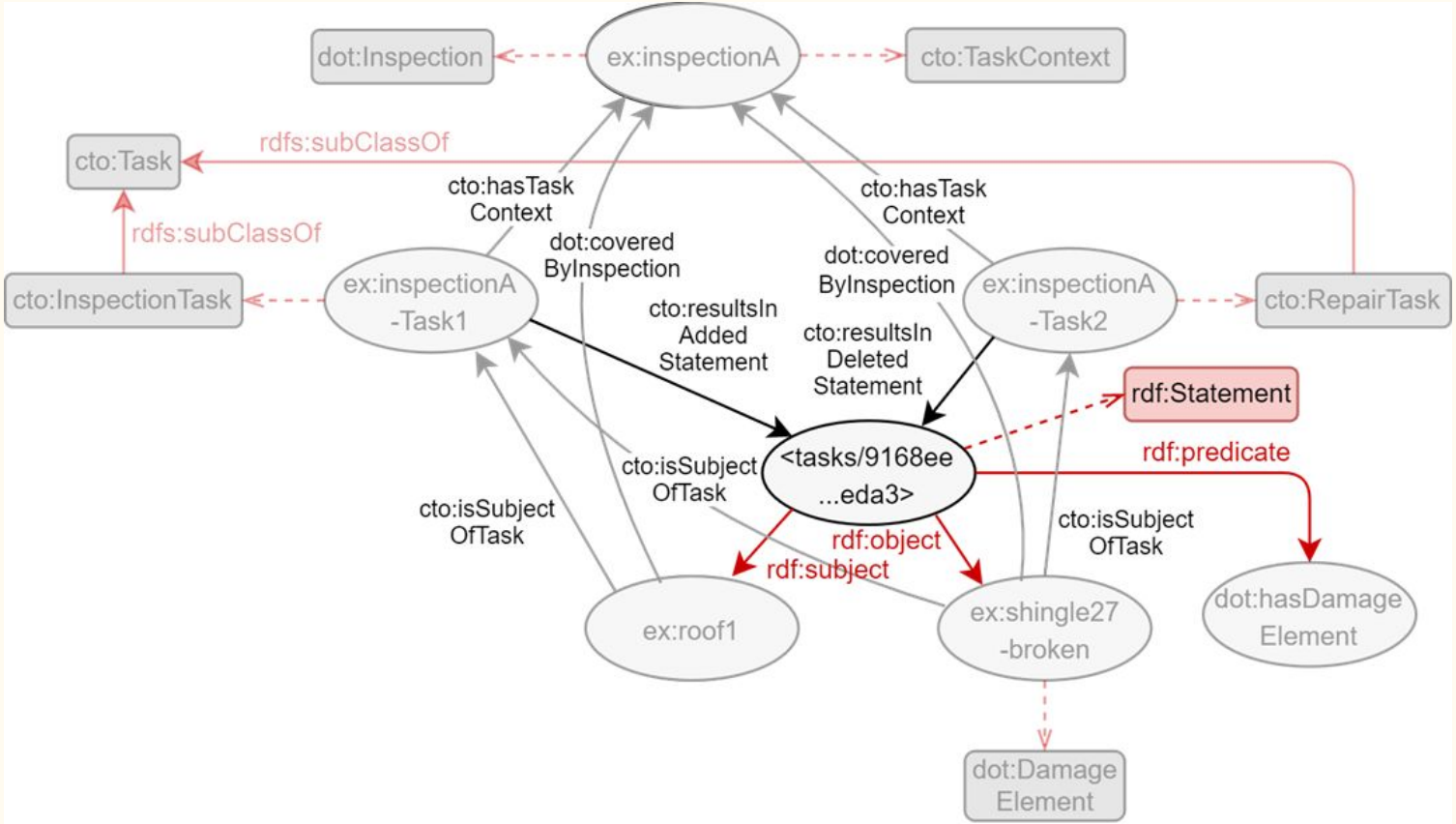
Important URLs regarding CTO

- Namespace (& Documentation URL): https://w3id.org/cto#
- Github repository: https://github.com/mathib/cto-ontology
- SPARQL Visualizer Demo: <*under construction*>
- Part of PhD dissertation: "A Framework for a Linked Data-based Heritage BIM"

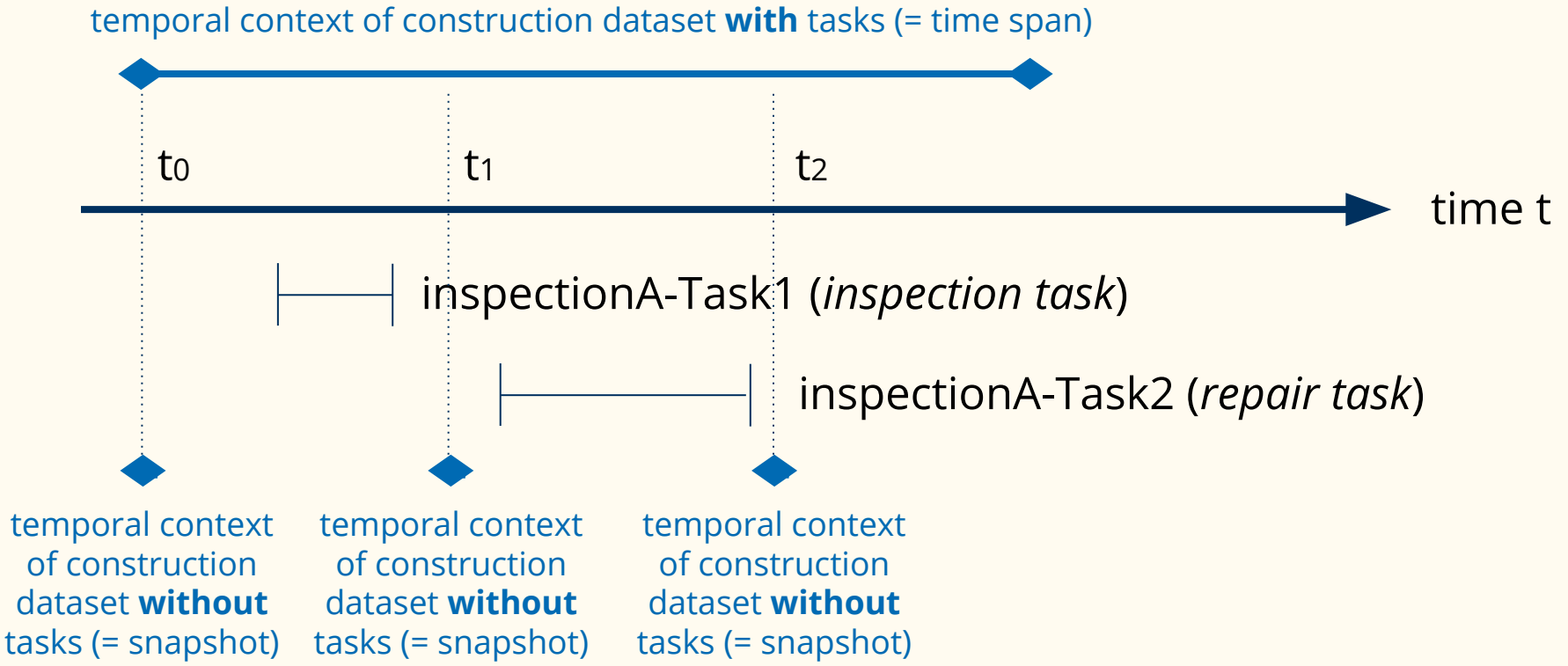
Classes for construction tasks: modification, removal, installment, repair and inspection task



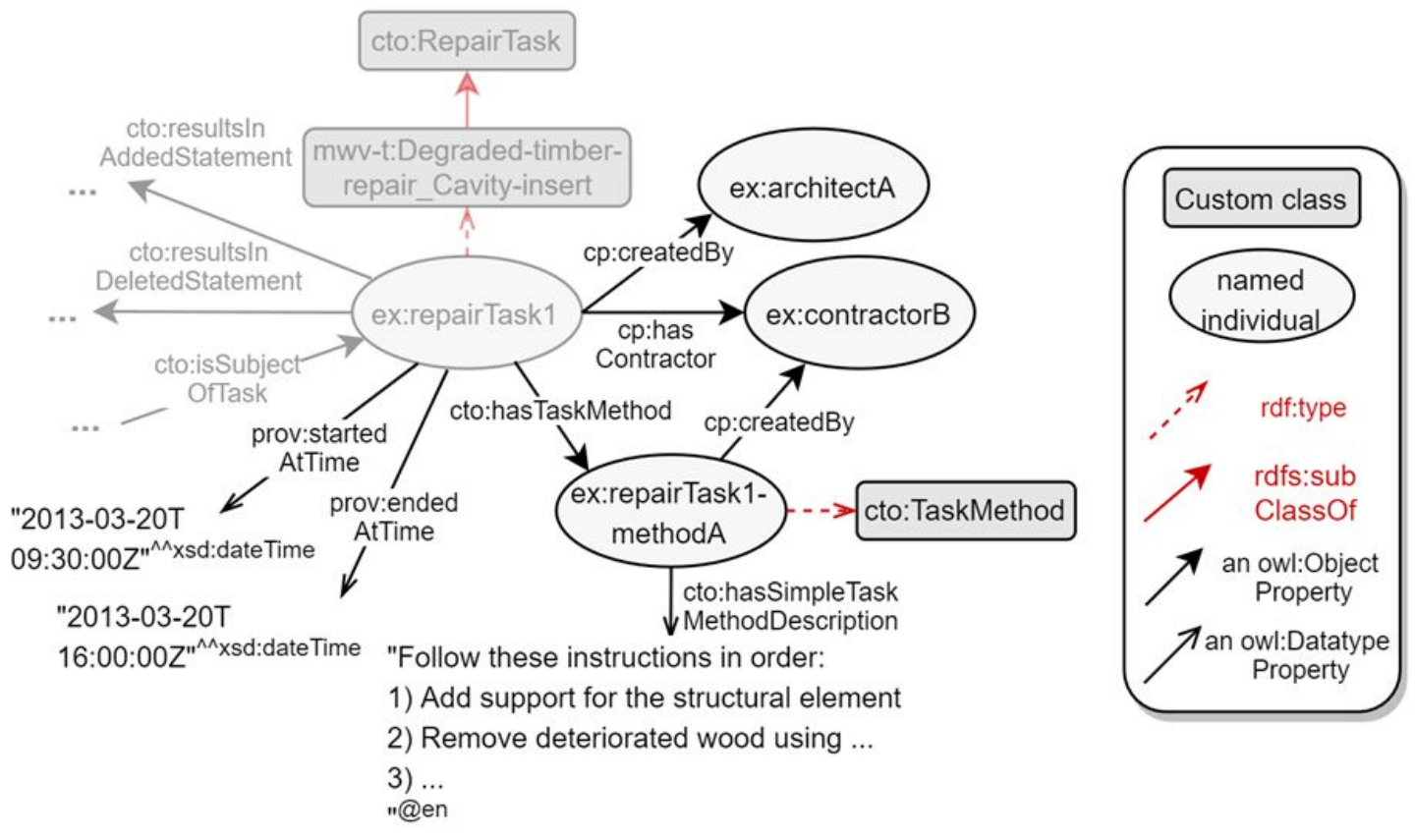
Modeling the consequences of tasks on the construction description



Construction project timeline: planning and tracking tasks and evaluating construction descriptions at certain points in time

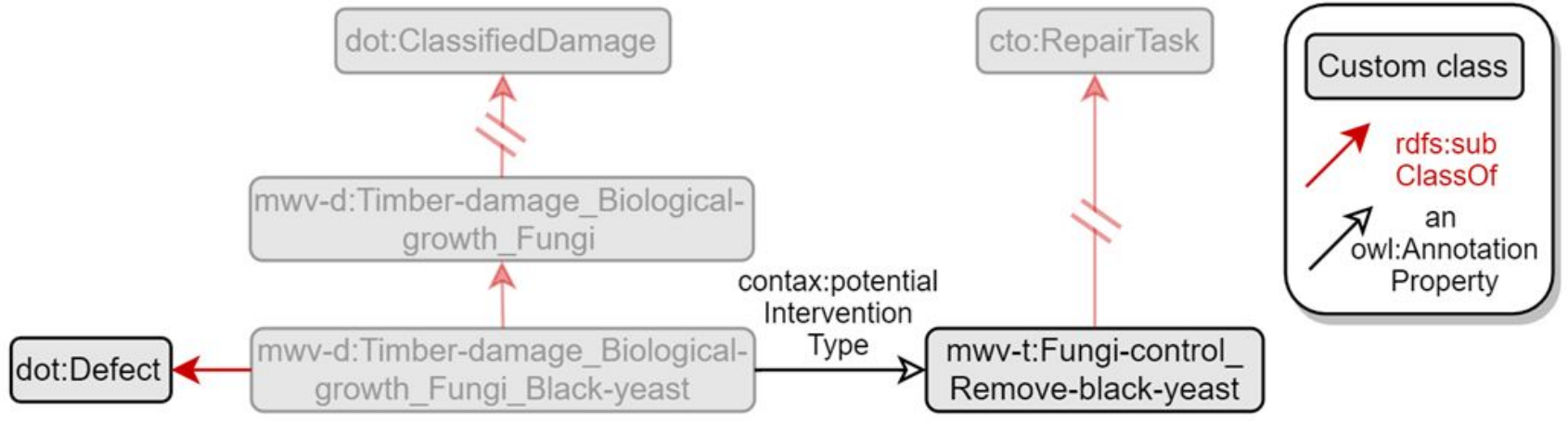


CTO task method and task provenance



Extensions for the classification of reparation tasks

Focus Group Pitch ⏯ no.6



Classification extensions:

- Monumentenwacht Vlaanderen Tasks taxonomy (MWV-T): link

(annotation on damage classes: ConTax ontology: link)

Focus Group Discussion

Interests of CG Participants

- **Potential Focus Groups of the LBD CG**