ACCORD

Semantisation of Rules for Automated Compliance Checking

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UKRI Innovate UK

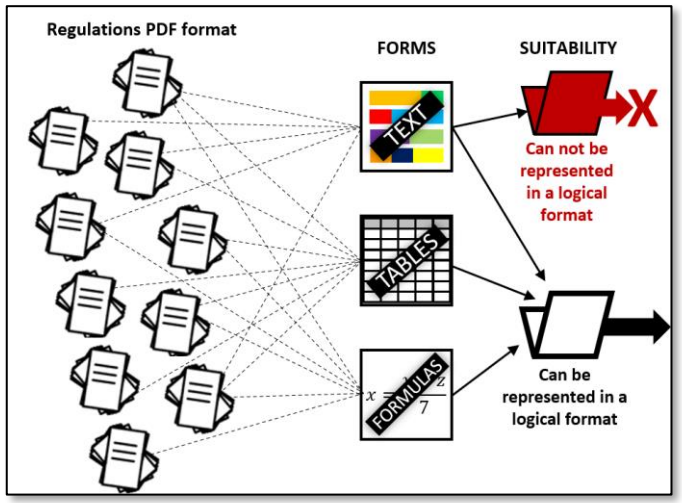
ACCORD

- ACCORD Overall Objective
  - Develop a semantic framework for European Digital Building Permitting processes, regulations, rules, data and tools…

- WP2 Semantisation of regulation and open format for machine-readable rules
  - Objective 1: Development of Semantic Models
  - Objective 2: Development of a Rule Language
  - Objective 3: Development of Artificial Intelligence Models
  - Objective 4: Development of a Rule Formalisation Tool

How do we aim to formalize rules?

- Methodology for digitising and formalising rules
- Core and Domain Ontology
- Domain Specific Language for Rules
- Rule Formalisation Tool



Annotator

Rule Formalization tool

NLP process

Pre-Processing

Information Extraction

Post-Processing

Rule-Generation

Regulation document in PDF

Select regulation

Formalization in clause forms

Conversion to Machine Readable Format

Validating Conversion

RASE practitioner

Addition of RASE Data

RULE Expert

Creation of Rules

Machine-readable inference rules DB

Rules (format 1)

Rules (format 3)

Rules (format 2)

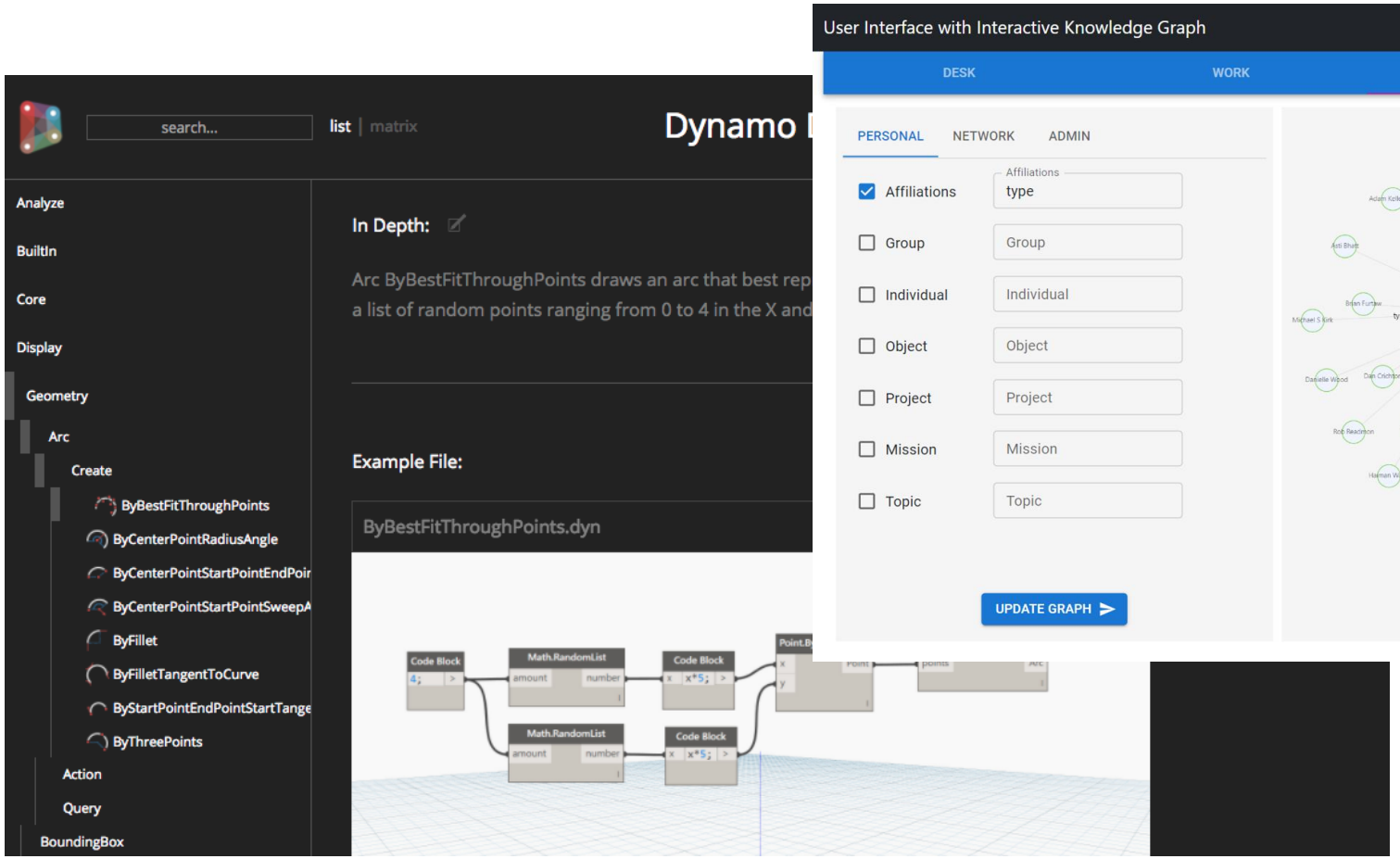
Regulation Expert

SemWeb Expert

Fully-Manual creation of rules

Text 2 Rules Approach 1

- Visual Tool
- Web UI



Text 2 Rules Approach 2:RASE
(Requirement, Applicability, Selection, Exception)

- RASE: A method of adding logical concepts to regulations

REQUIRED / REQUIREMENT

SELECTED / SELECTION

EXCEPTED / EXCEPTION

APPLIES / APPLICATION

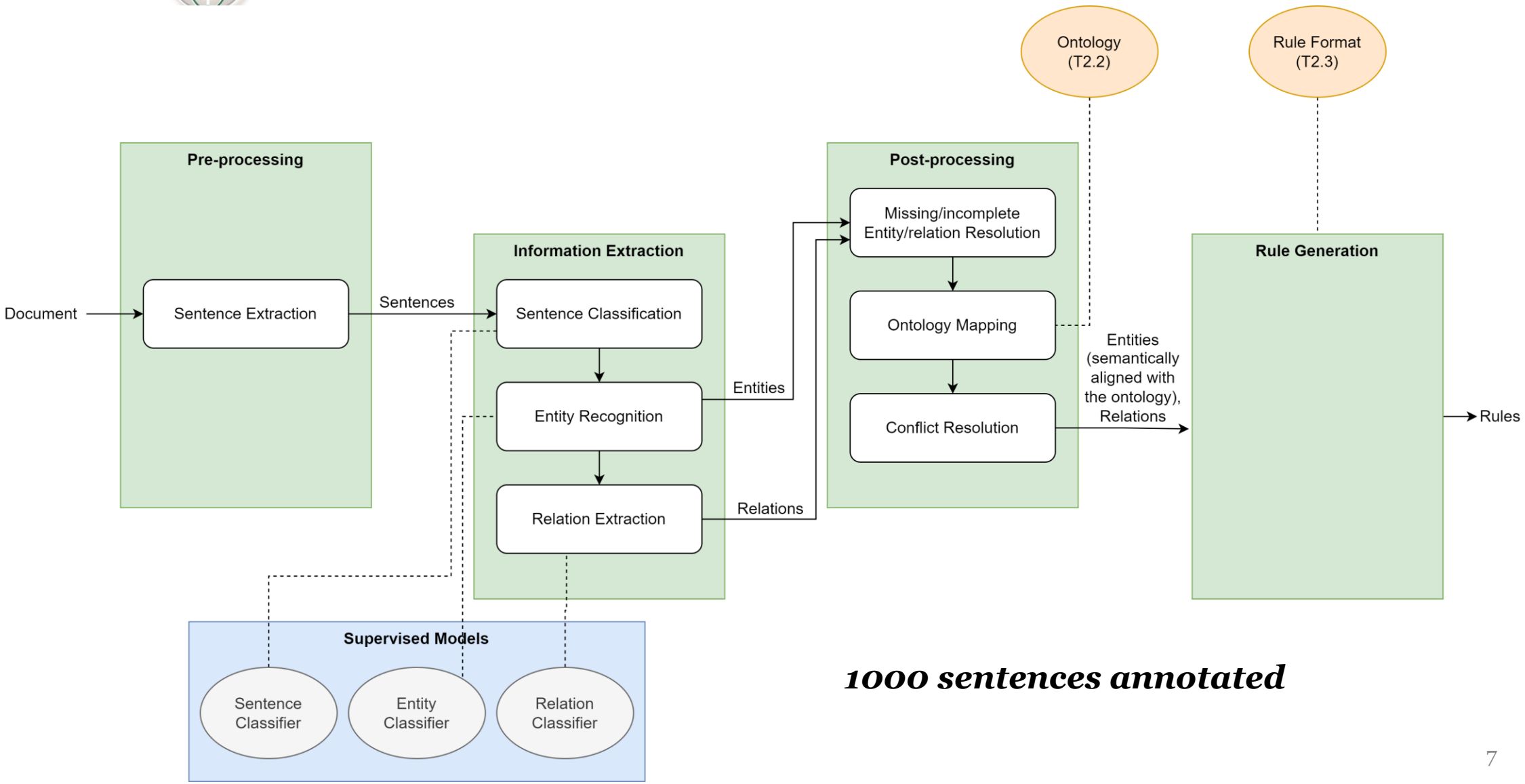
When systems are capable of being fired by more than one fuel , then:

a. Where a biomass heating appliance is supplemented by an alternative appliance (e.g. gas), the CO2 emission factor for the overall heating system should be based on a weighted average for the two fuels based on the anticipated usage of those fuels. The BER submission should be accompanied by a report , signed by a suitably qualified person, detailing how the combined emission factor has been derived .

b. Where the same appliance is capable of burning both biomass fuel and fossil fuel , the CO2 emission factor for dual-fuel appliances should be used, except where the building is in a smoke control area , when the anthracite figure should be used.

c. In all other cases , the fuel with the highest CO2 emission factor should be used.

Text 2 Rules Approach 3:NLP



1000 sentences annotated

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Ontology Competency Questions

- **Compliance**
  1. How to define the metadata of a Document that informs/dictates compliance checking?
  2. What is the coverage of a Document per Administrative Area?
  3. What are the parts of a document, their unic identifier and order?
  4. What type for information (Statement) does a Document contain?
  5. What type of check needs to be performed for a Statement to comply?
  6. Required data to perform a check.
  7. …
- **Permitting**
  1. What are the stages of the Permitting process per Administrative Area?
  2. What evidence is required in each stage?
  3. …

Ontology FUNDAMENTALS

base class **Statement**

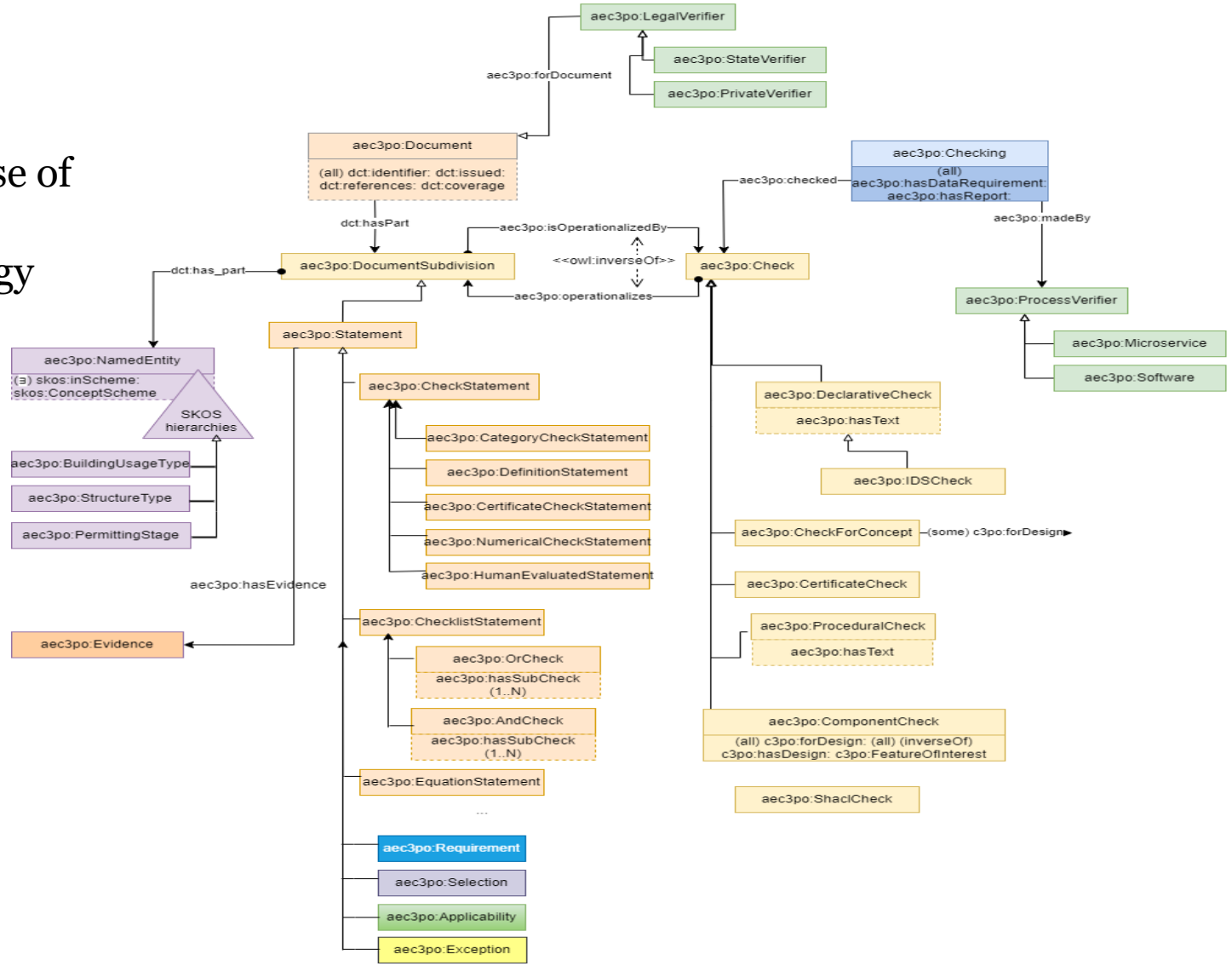
something said in a building compliance-related document

property categories

statement types	what is this statement?
source	where does this statement come from?
check	how do you check the compliance?
inputs	where does data come from?
info	AEC information relating to this statement
permitting	how do you meet permitting requirements?

https://w3id.org/lbd/aec3po

Glimpse of the ontology



AEC Compliance Checking and Permitting Ontology

Ontology Core Concepts

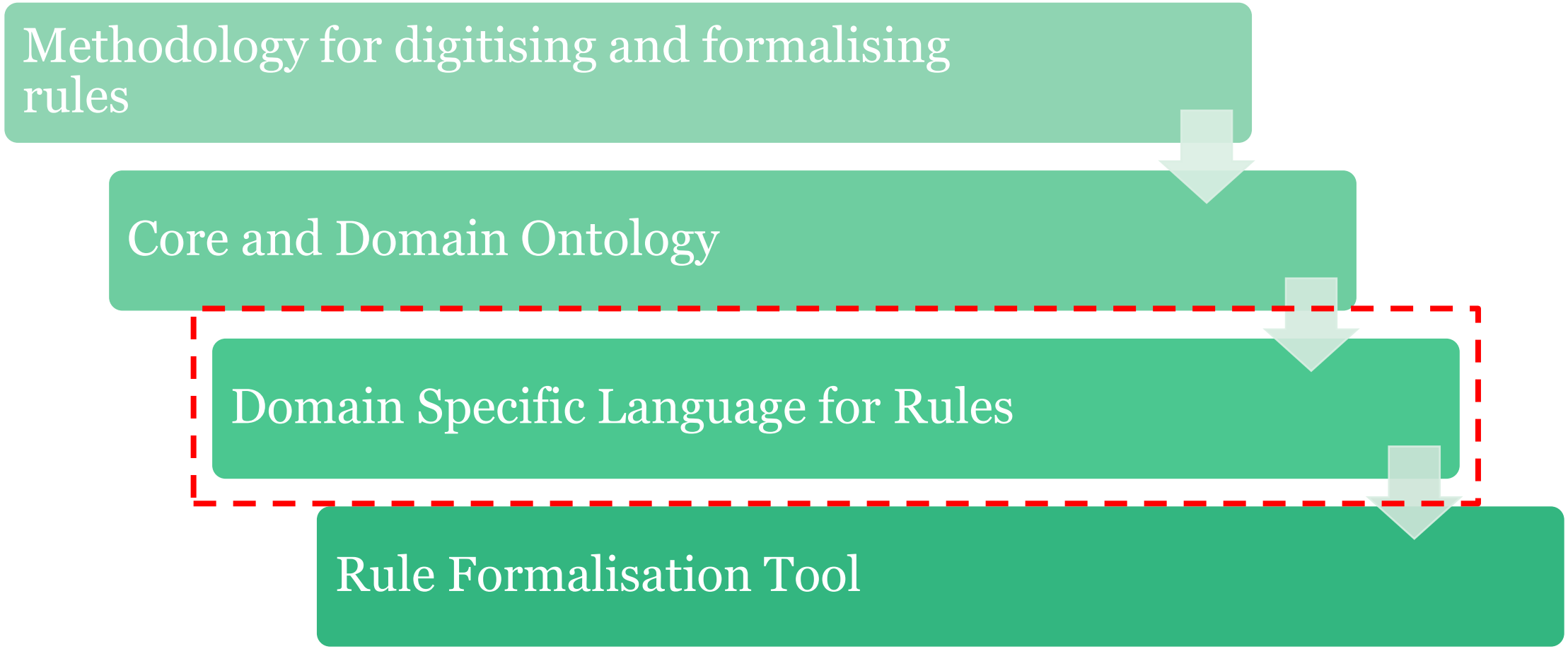
Main concepts:

- aec3po:Document
  - aec3po:DocumentSubdivision
  - aec3po:Statement
- aec3po:FeatureOfInterest
- aec3po:Check
- aec3po:Design
- aec3po:Verifier
- …

Potential Alignments:

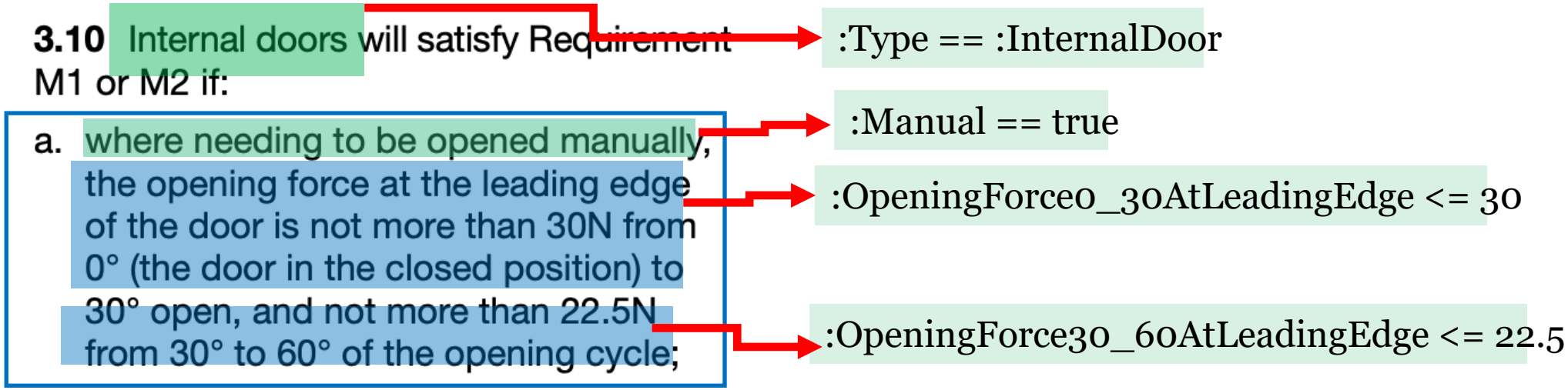
- Schema.org
- Dublin Core
- ELI
- ifcOWL
- Semantic BSDD

How do we aim to formalize rules?



Domain Specific Language

- AEC3PO
- Dictionary of terms from AECC



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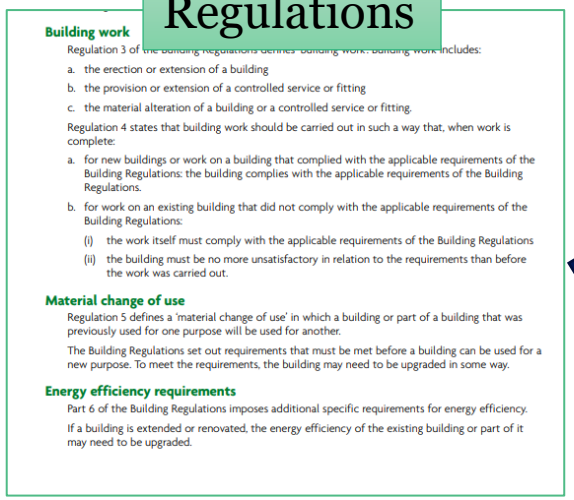
Rule Formalisation Tool

Regulations



Building work

Regulation 3 of the Building Regulations defines 'building work'. Building work includes:

a. the erection or extension of a building

b. the provision or extension of a controlled service or fitting

c. the material alteration of a building or a controlled service or fitting.

Regulation 4 states that building work should be carried out in such a way that, when work is complete:

a. for new buildings or work on a building that complied with the applicable requirements of the Building Regulations: the building complies with the applicable requirements of the Building Regulations.

b. for work on an existing building that did not comply with the applicable requirements of the Building Regulations:

(i) the work itself must comply with the applicable requirements of the Building Regulations

(ii) the building must be no more unsatisfactory in relation to the requirements than before the work was carried out.

Material change of use

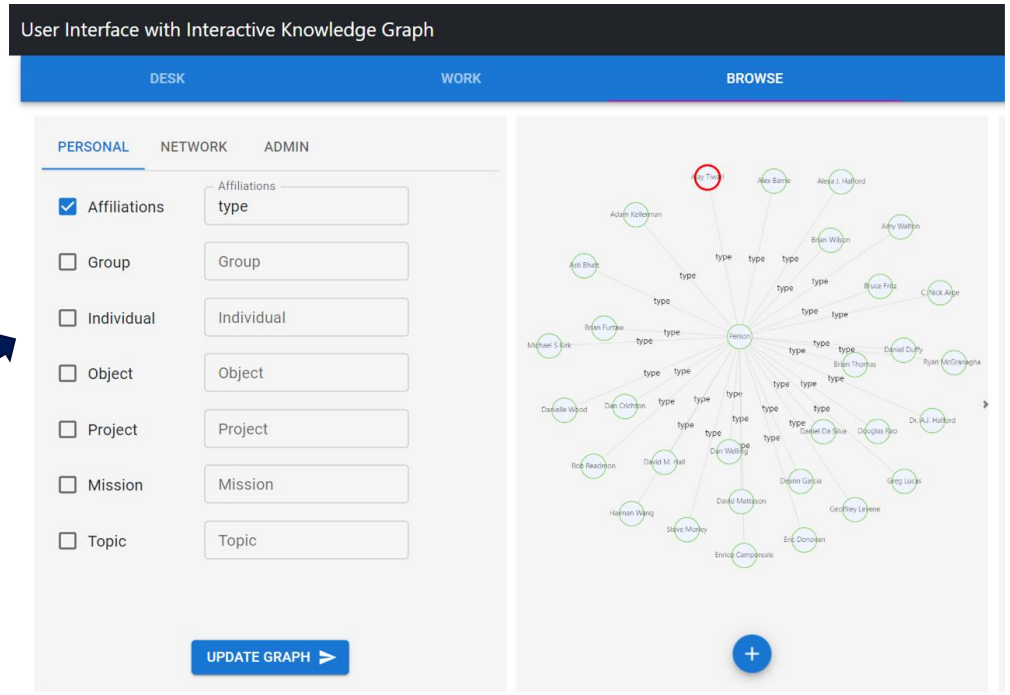
Regulation 5 defines a 'material change of use' in which a building or part of a building that was previously used for one purpose will be used for another.

The Building Regulations set out requirements that must be met before a building can be used for a new purpose. To meet the requirements, the building may need to be upgraded in some way.

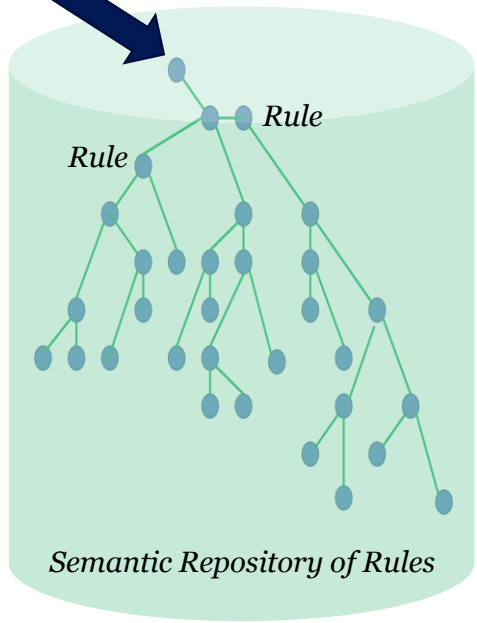
Energy efficiency requirements

Part 6 of the Building Regulations imposes additional specific requirements for energy efficiency.

If a building is extended or renovated, the energy efficiency of the existing building or part of it may need to be upgraded.



Rule Formalisation Tool UI



Thank you!

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