# A STANDARD-BASED ONTOLOGY NETWORK FOR INFORMATION REQUIREMENTS IN DIGITAL CONSTRUCTION PROJECTS

Martina Mellenthin Filardo, **Liu Liu**, Philipp Hagedorn, Sven Zentgraf, Jürgen Melzner & Markus König

# Current Status & Motivation

**Which information is needed for construction projects?**
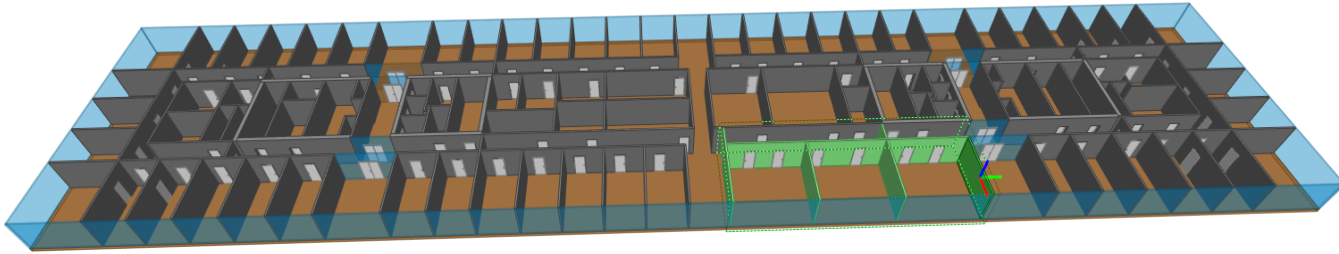


Illustration of a project deliverable

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# Current Status & Motivation

**Definition of information requirements**



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# Current Status & Motivation

**Definition of information requirements**

norms & standards

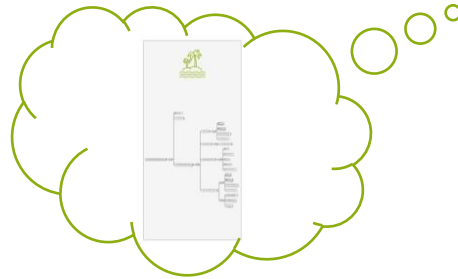A standard-based ontology network for information requirements in digital construction projects | LDAC 2024
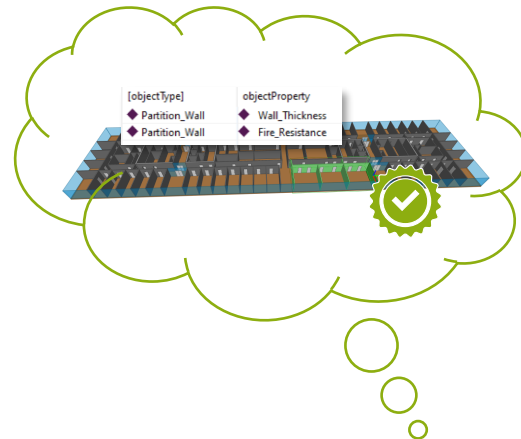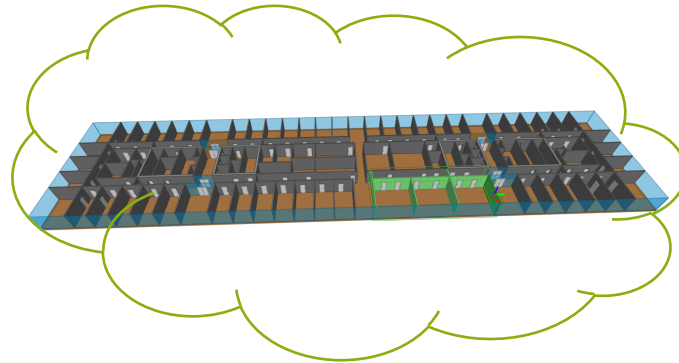
# Current Status & Motivation

**Definition of information requirements**

Best case: standardized schemas for information requirements

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# Current Status & Motivation

**Definition of information requirements**



schemas from
norms & standards

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# Current Status & Motivation

**Definition of information requirements**

| [objectType] | objectProperty |
|---|---|
| ◆ Partition_Wall | ◆ Wall_Thickness |
| ◆ Partition_Wall | ◆ Fire_Resistance |

schemas from
norms & standards

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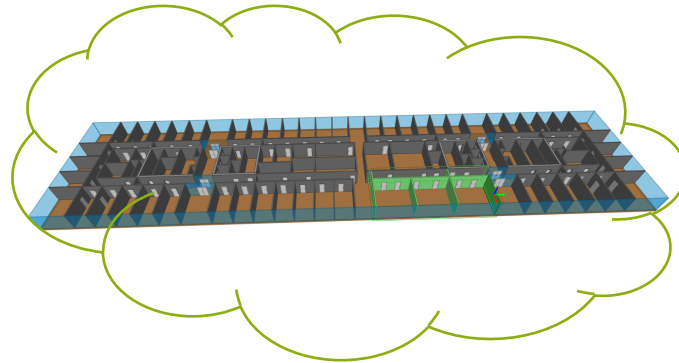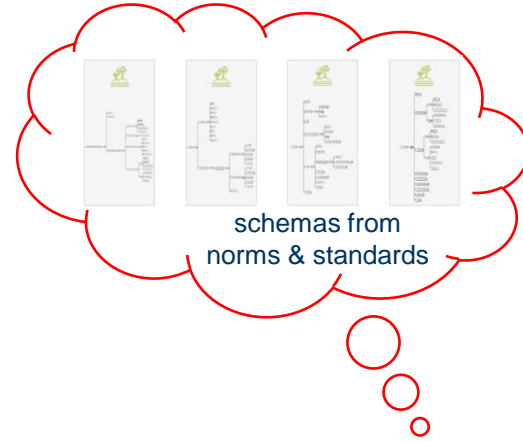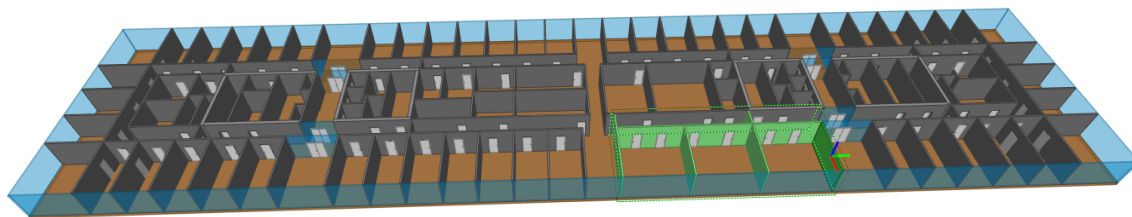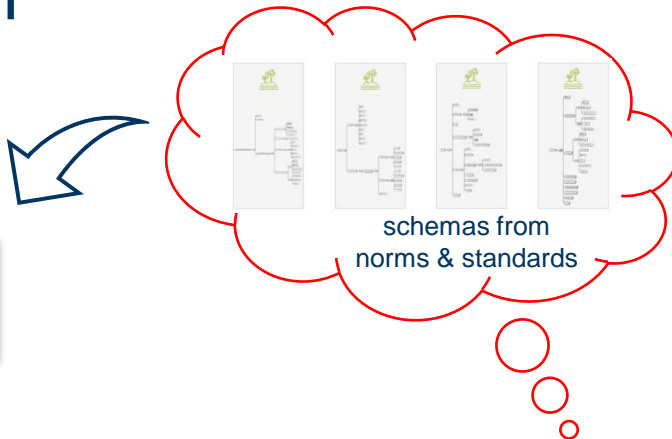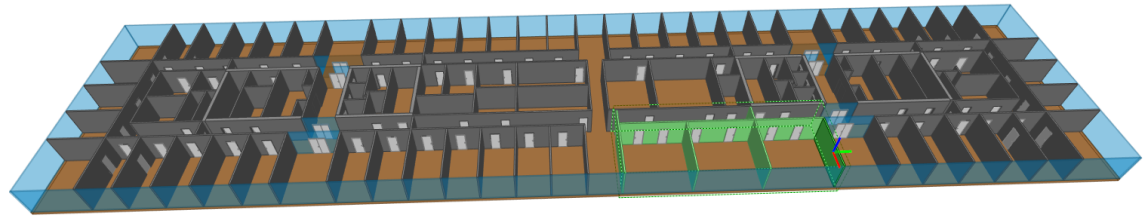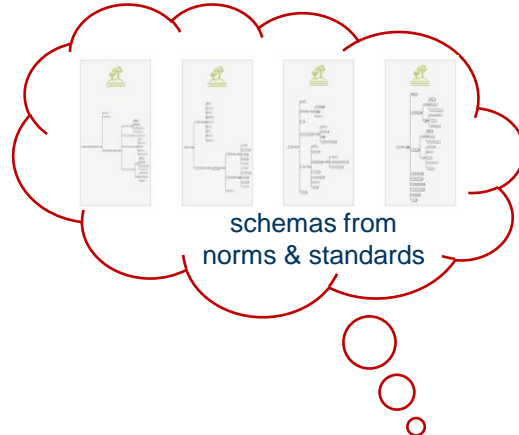
# Currents Status & Motivation

**Definition of information requirements should be…**

… based on comprehensive available standards for the information delivery process,

… aligned with various individual and isolated technical implementations,

… queryable for automated information processing.

→ So we need an:

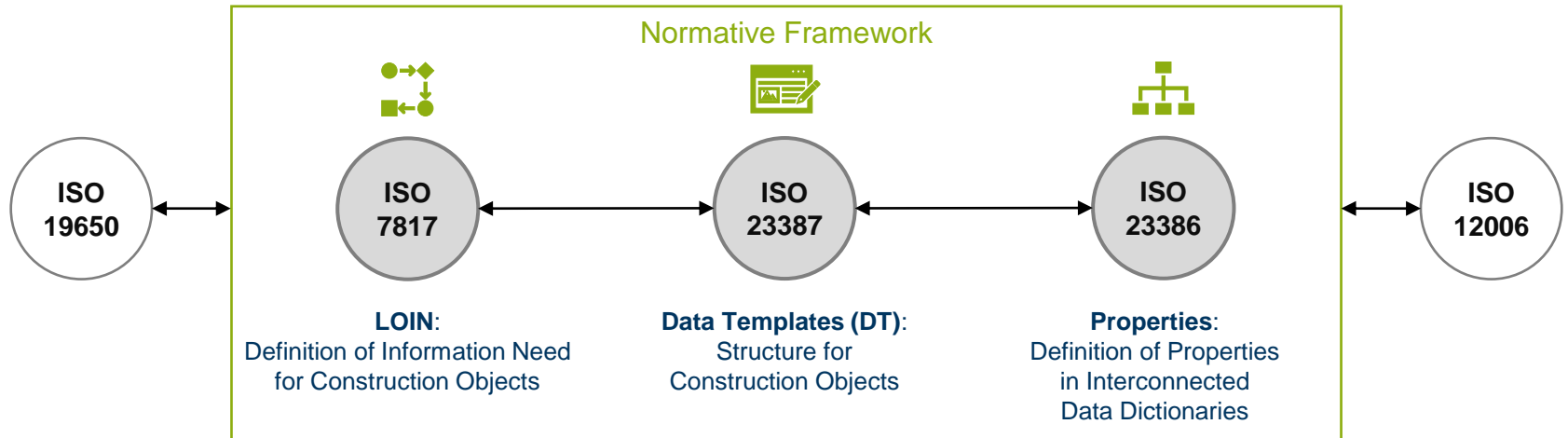**Implementation of ISO standards for the information delivery process using Linked Data**

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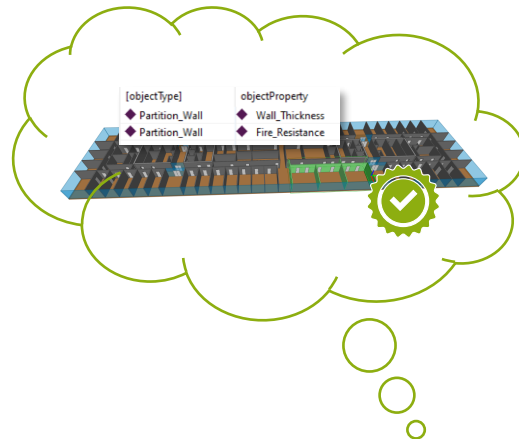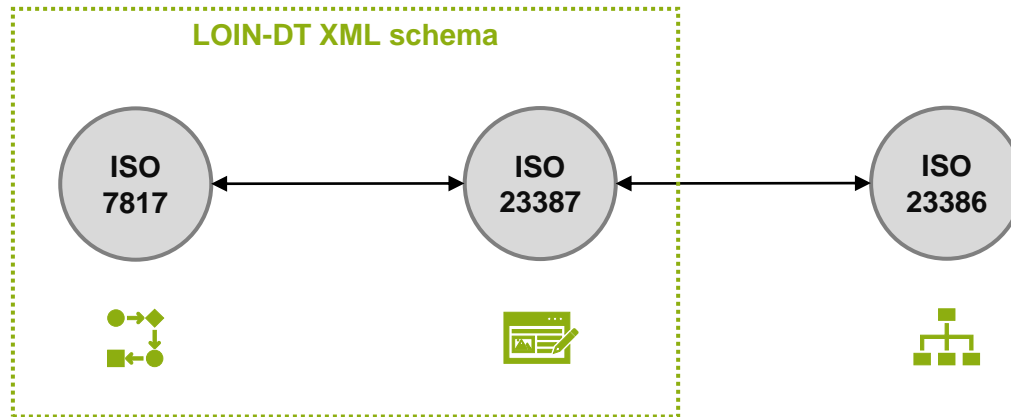
# Background

## Normative Framework

- Standards for the information delivery process
- Focusing on three ISO standards for information requirements definition



**LOIN**:
Definition of Information Need
for Construction Objects

**Data Templates (DT)**:
Structure for
Construction Objects

**Properties**:
Definition of Properties
in Interconnected
Data Dictionaries

# Background

**Preliminary Works**

- Existing technical implementations for the chosen standards
- Both XML schemas and OWL-based ontologies



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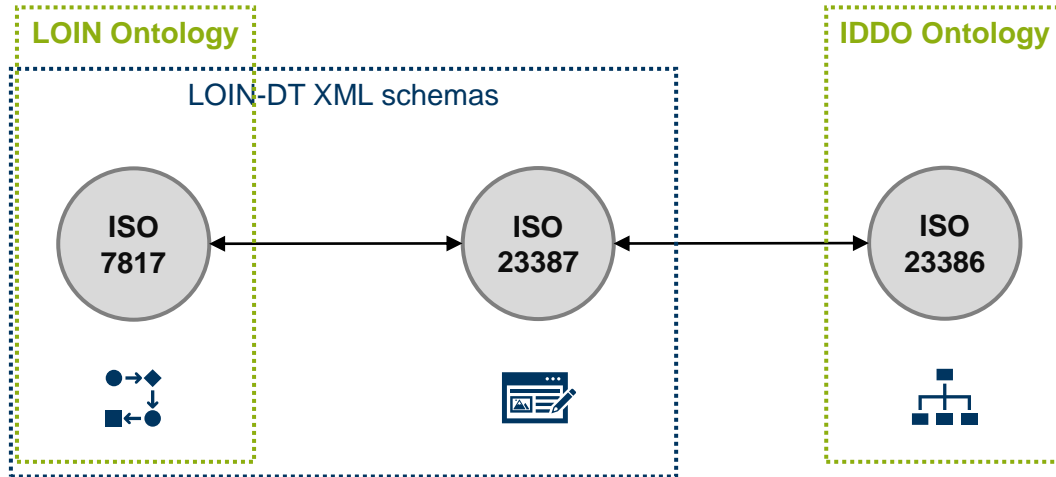
# Objective

## Based on the normative framework

- Ontology harmonization with relevant norms & standards
- Development of new ontology aligned with existing ontologies



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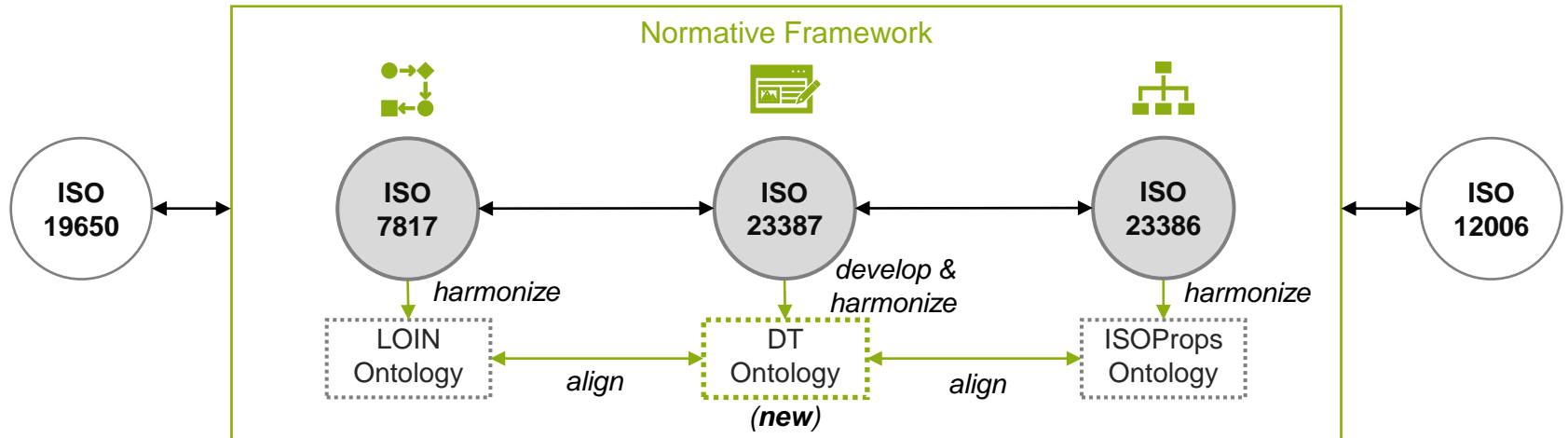
# Methodology

- Content analysis of standards defined in the normative framework

- Peer discussions regarding standards for:
    - Understanding used mechanisms
    - Identifying dependencies between standards

- Harmonization of existing ontologies with the related standards

- Development of the new ontology for data templates (ISO 23387)

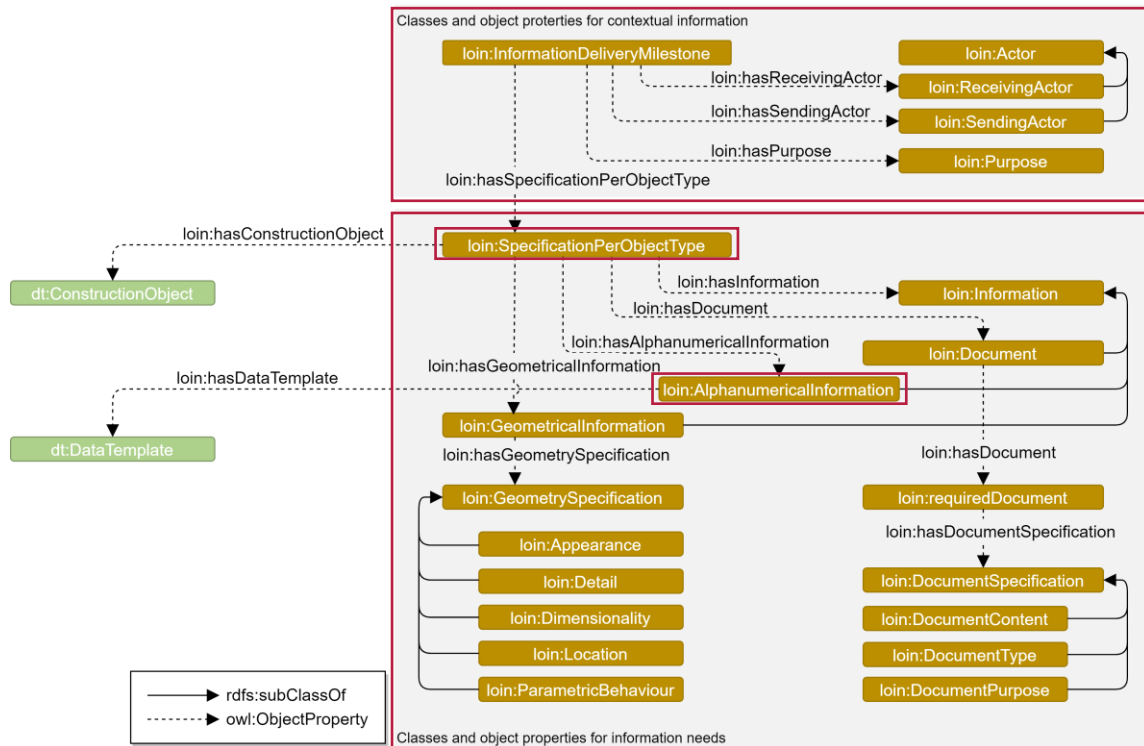- Alignment of existing and new ontologies
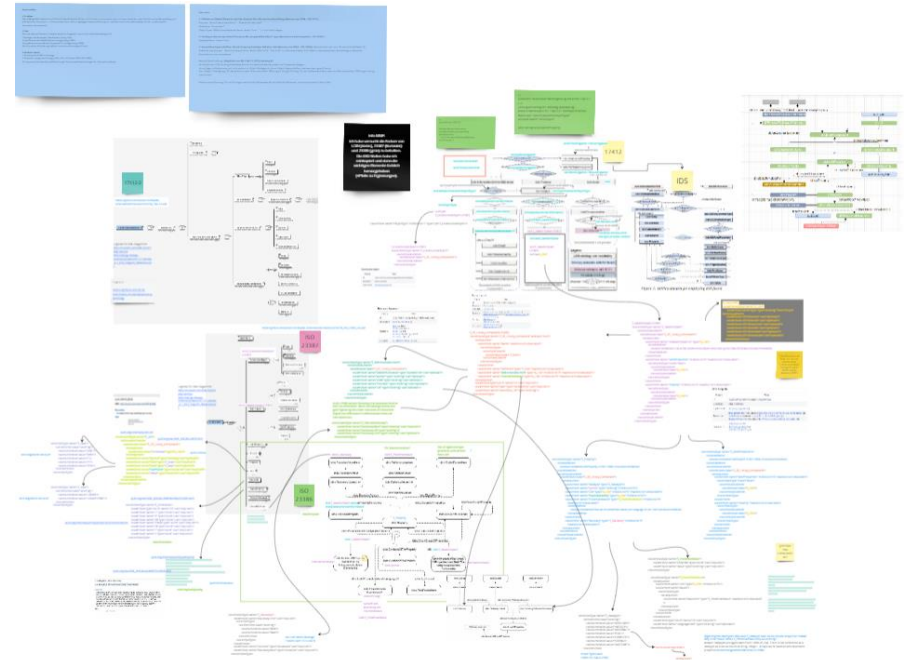


Internal overview of relations between standards
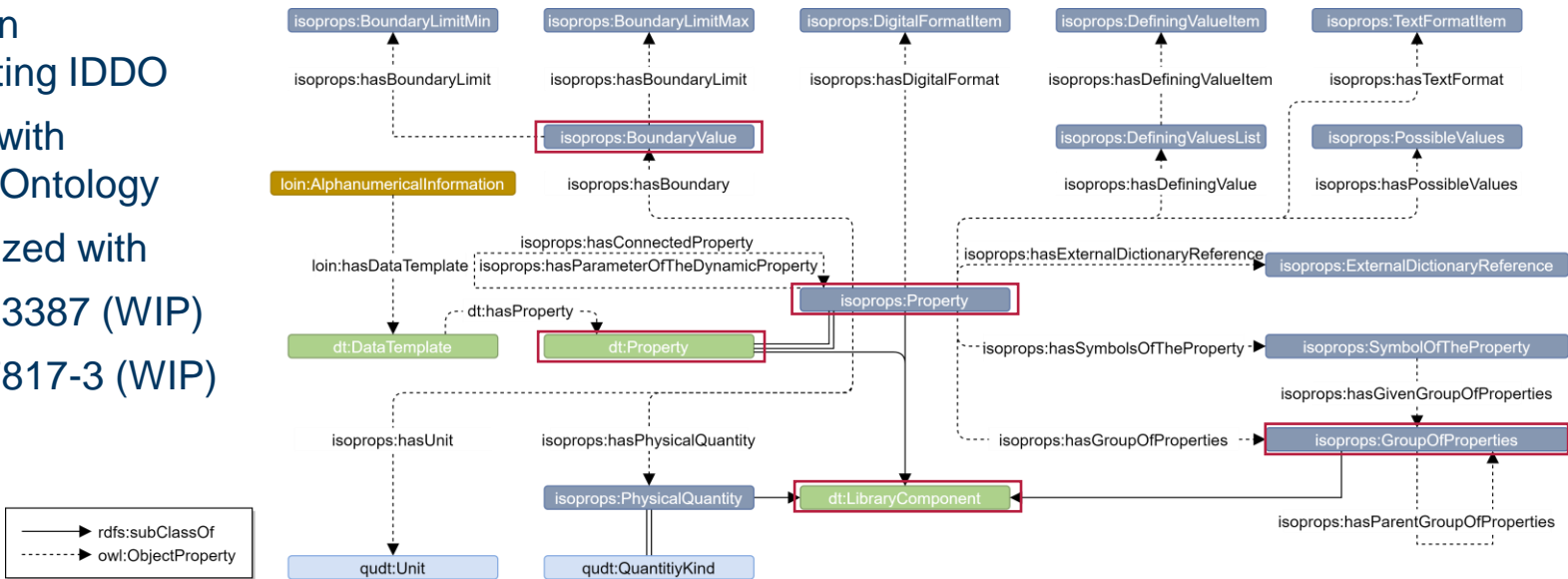
# Results

## LOIN Ontology

- Based on pre-existing LOIN Ontology (2023)

- Aligned with new DT Ontology

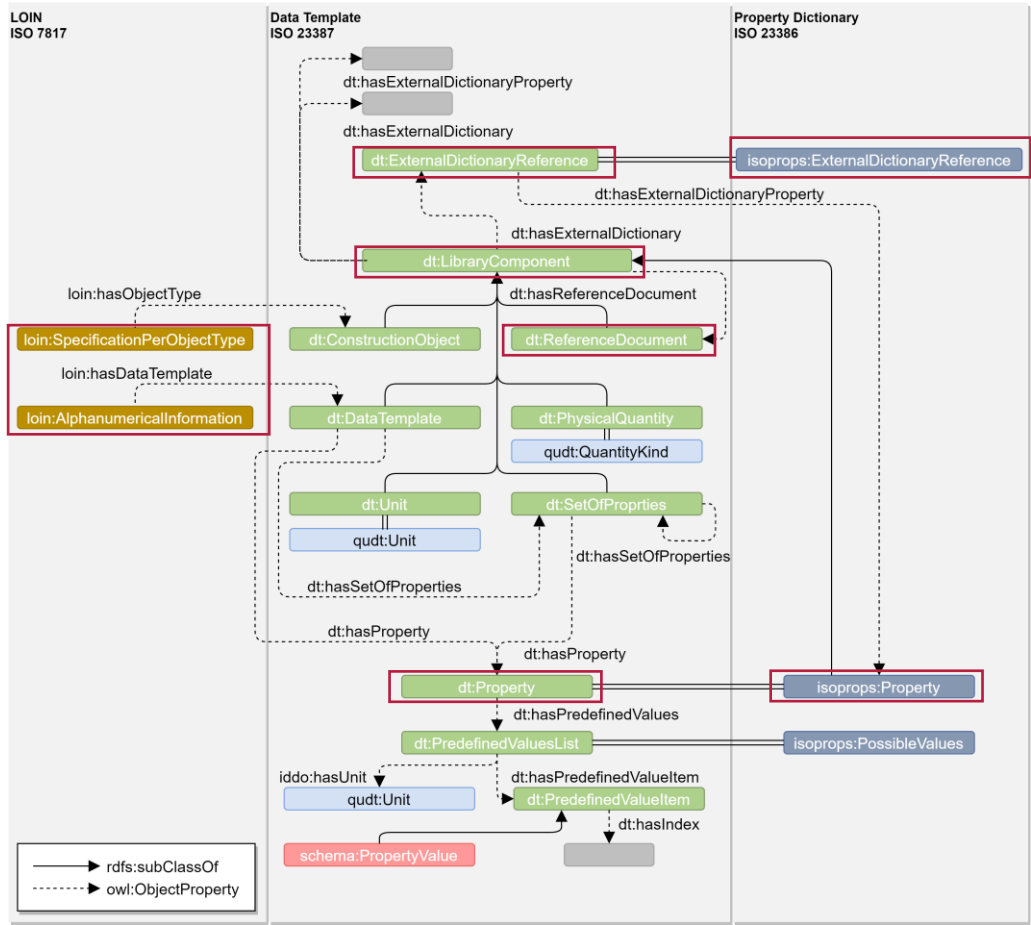- Harmonized with
  - ISO 23386
  - ISO 23387

# Results

## ISOProps Ontology

- Based on pre-existing IDDO
- Aligned with new DT Ontology
- Harmonized with
  - ISO 23387 (WIP)
  - ISO 7817-3 (WIP)



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# Results

**DT Ontology:**

- Based on ISO 23387 compliant schema (WIP)

- Harmonized with
  - ISO 7817-3 (WIP)
  - ISO 23386

- Uses pre-existing ontologies (e.g., QUDT)

- Aligned with
  - LOIN Ontology
  - ISOProps Ontology



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# Demonstration

## Use case for information requirement definition

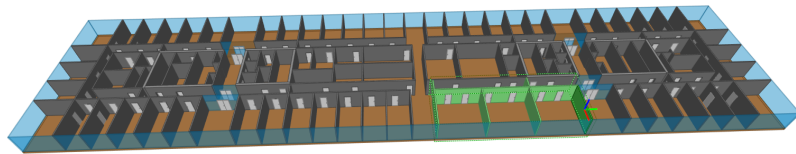- Fire safety in a public building
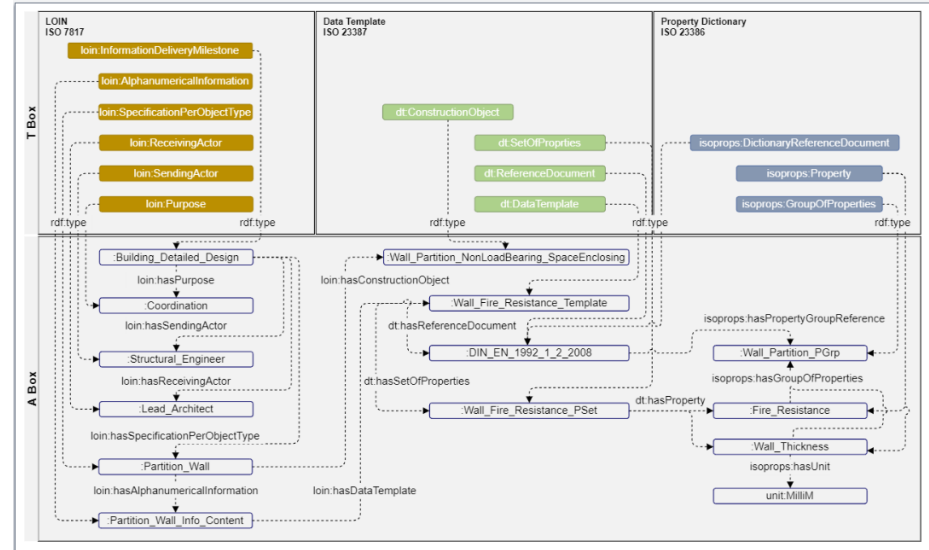- Requirements from DIN EN 1992-1-2
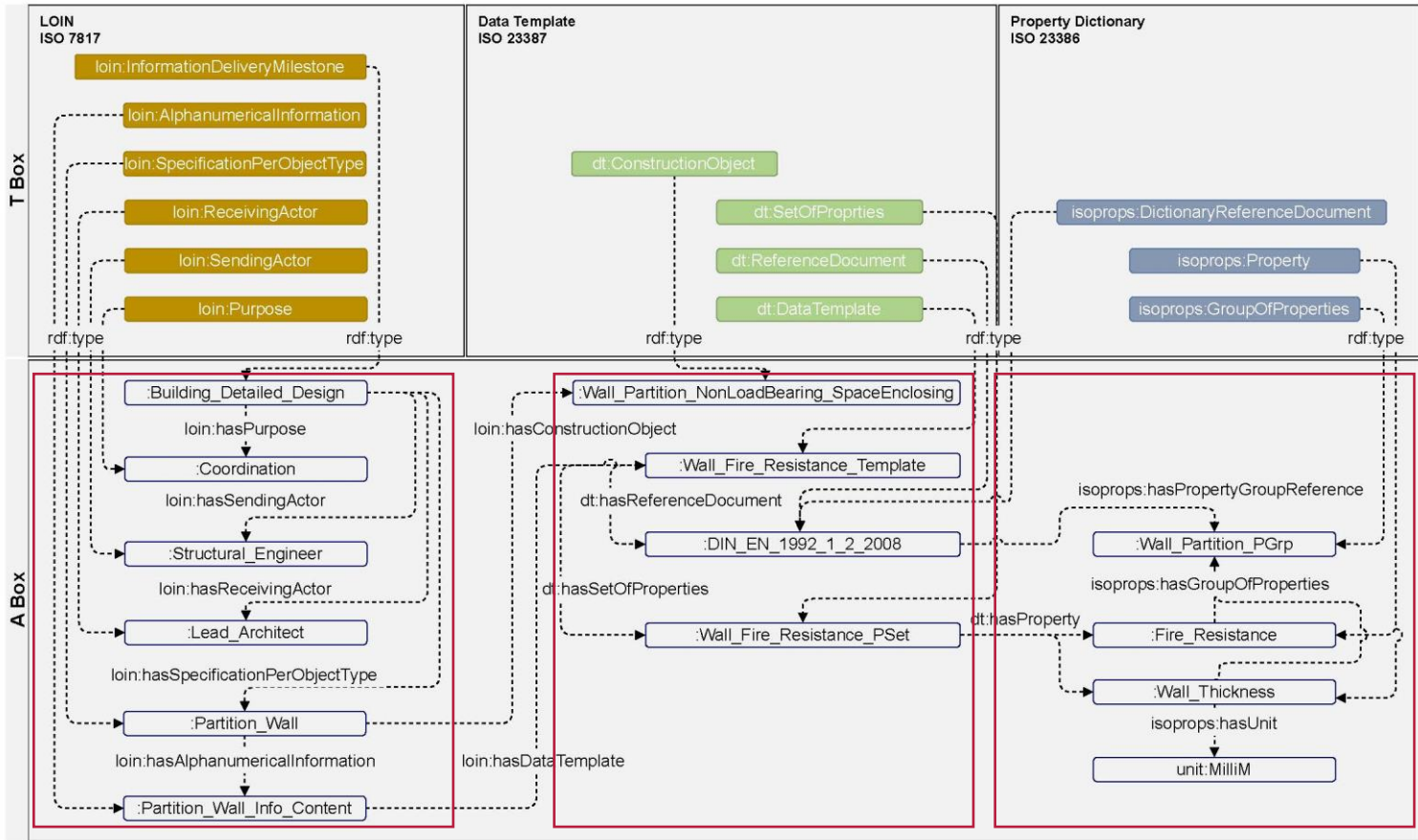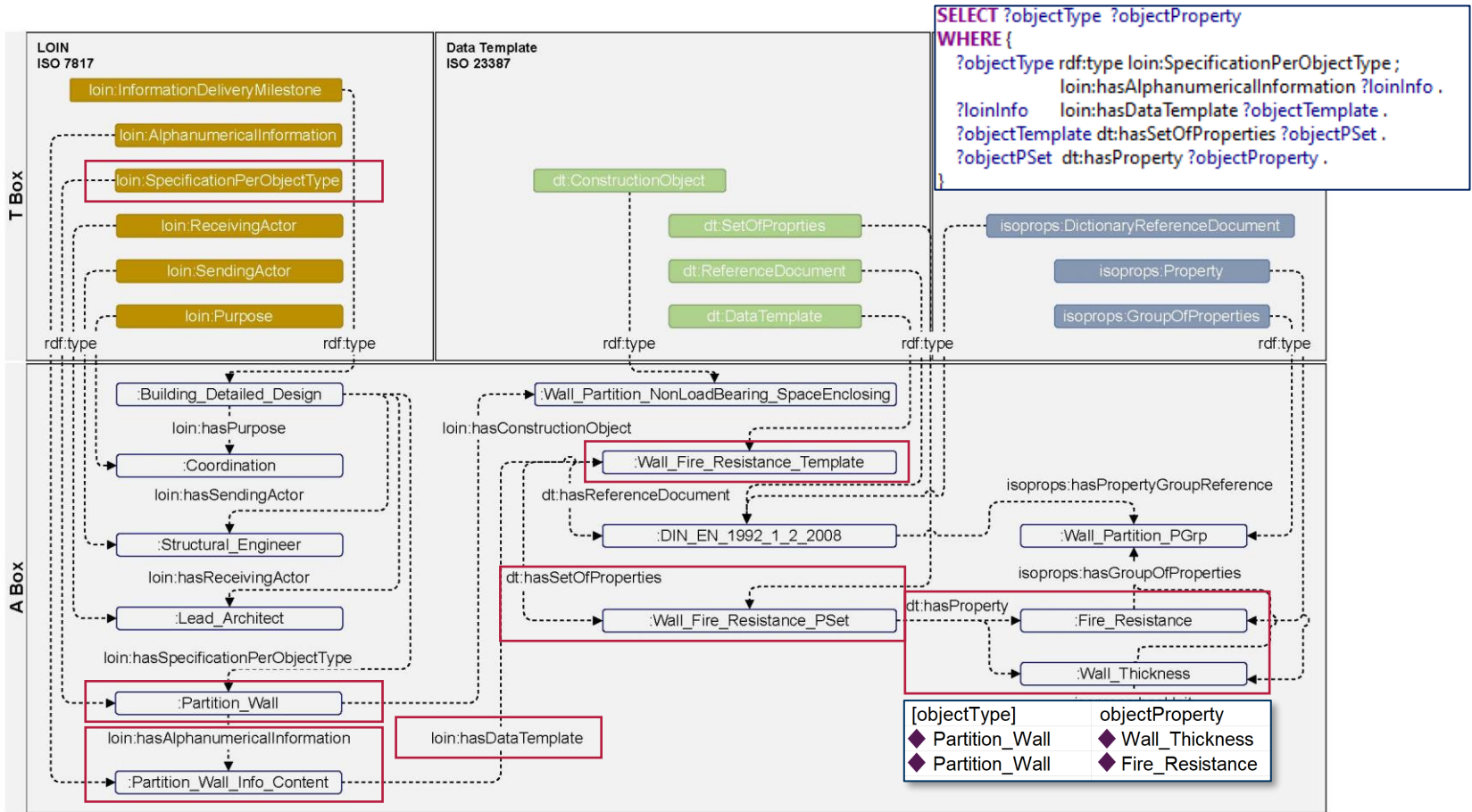- Non-load-bearing, space-enclosing wall



Illustration of a project deliverable

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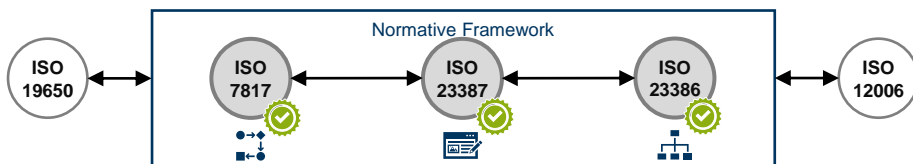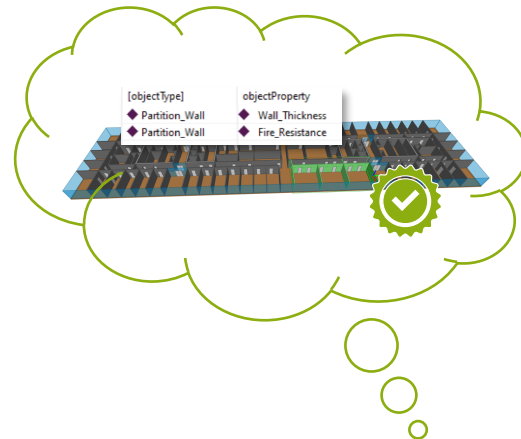
# Conclusion & Outlook

- Successful harmonization with the main standards in the information delivery process

  - LOIN (updated)

  - ISOProps (updated)

  - DT (new)

- Modular, extendable and reusable ontology network

- Successful demonstration



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# Conclusion & Outlook

- Future research should consider:
  - Updating possible normative changes and revisions within the network
  - Extending the network to include other and new standards

- Welcome industrial developments:
  - Tools to facilitate industrial adoption both for description and querying of information requirements
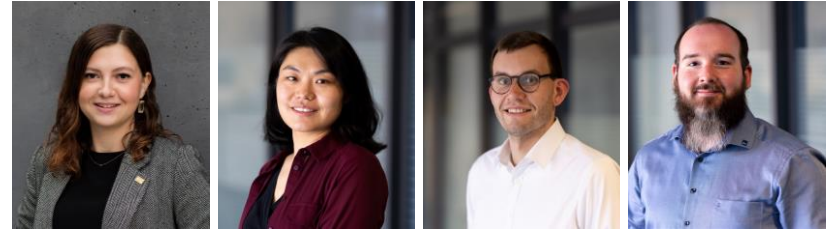  - Adoption of data templates by manufacturers

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