SVAR – Systematic Verification and Acceptance of Requirements

Reference group meeting

October 11, 2024

Reference group

Pia Schönbeck – Sponsor. Project lead in systemic requirement management.

~~Oskar Permwall~~ – Specialist in systemic requirement management

Marit Jidemo – Business developer in information management.

Erik Häggström – Area responsible (Background in BIM/GIS, information management in BIM

Rastkar Rauf – technical engineer, Digital project management

Susanne Van Raalte – BIM strategist

Karin Anderson – BIM specialist

Agenda

- Progress report
  - Objective 1: ACC Capability Maturity Model
  - Objective 2: TRVInfra requirements verifiability
  - Objective 2: Machine readable formats for requirements
  - Objective 3: Demonstration of verification methods
- Synergies with other ongoing projects in Trafikverket
- Reminder about “Champions”

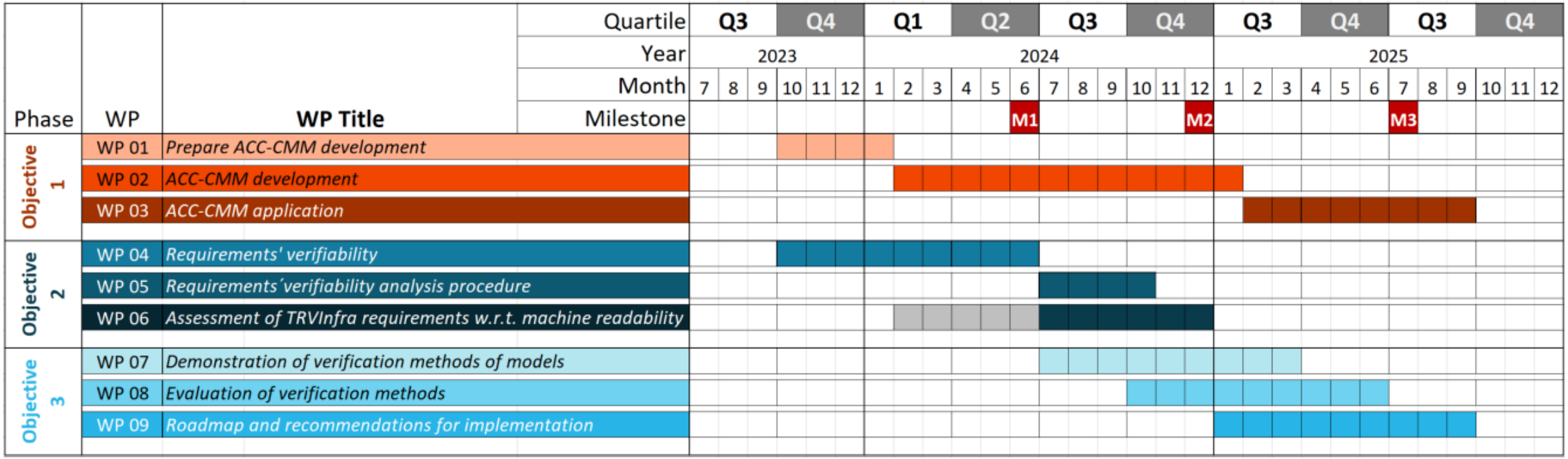
Project overview

Duration: October 1, 2023 – September 30, 2025

Three objectives, each with three work packages.

- **Objective 1:** Development of an Automated Compliance Checking Capability Maturity Model (ACC-CMM)
- **Objective 2:** Understand to what degree the compliance checking of requirements (TRVInfra, project-specific) is automatable
- **Objective 3:** Develop procedures for automated, reusable, verification of requirements

Project Schedule



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Objective 1: ACC Capability Model

ACC Capability Maturity Model

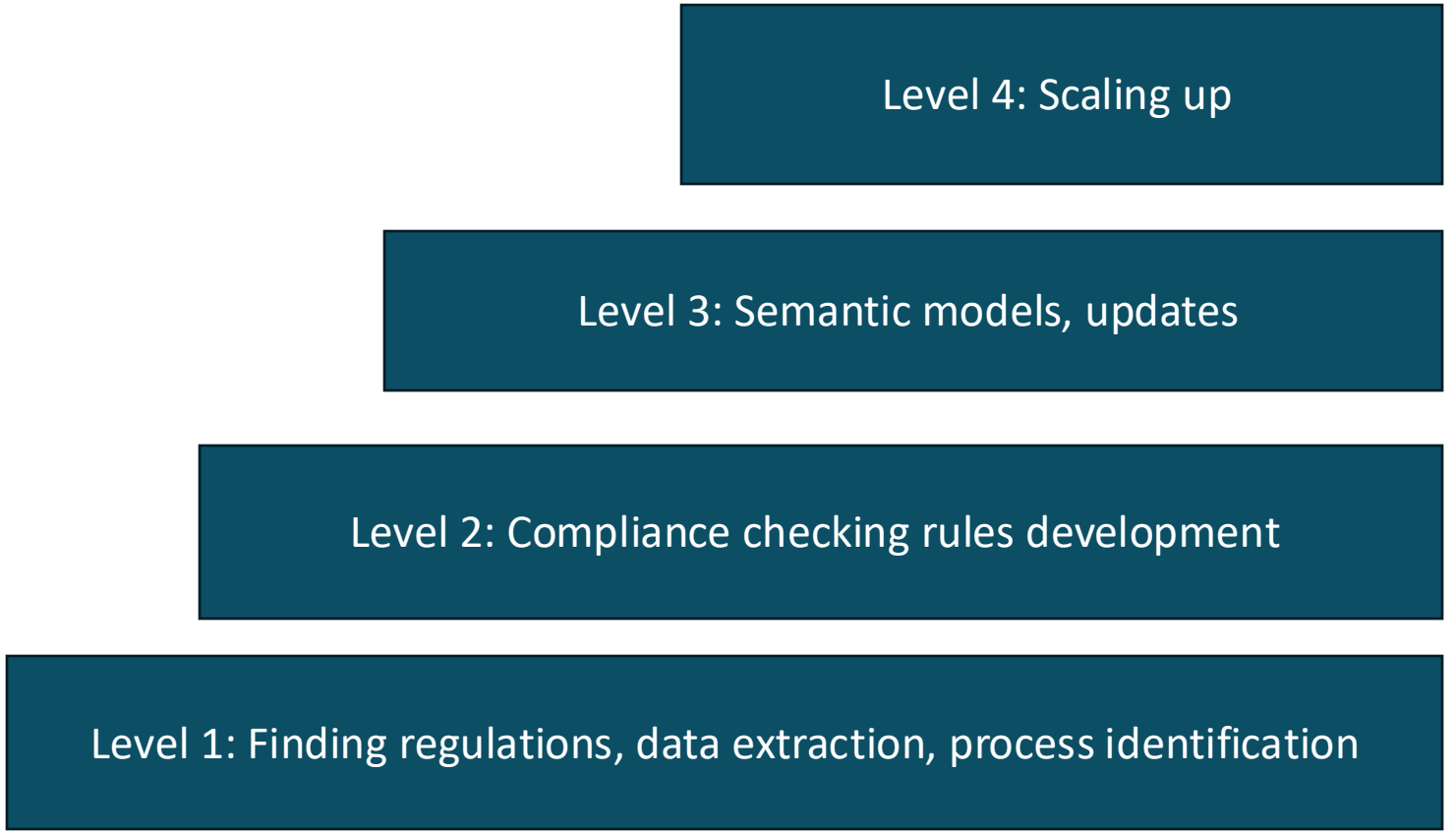
Current: Initial version developed June 2024

Current: Work on consistency and relationships between the stages and activities

Current: Work on a survey about aspects affecting the adoption of ACC systems in Swedish AEC industry

Next Steps: Planned interviews with TRV and Hochtief in Nov 2024 50% time on variables affecting ACC adoption and 50% of the time on our maturity model. Awaiting response from Andreas Martinsson and meeting with Susanne van Raalte

Need help: Names of people we can talk to at TRV ,



Objective 2: TRVInfra requirements verifiability

TRVInfra requirements verifiability

Training data for classifier. Summary:

- Executed 2 pilots (70 requirements classified) by 4 people
- Varying degrees of agreement
- Plan to speed-up the process
- Need to involve Trafikverket for validation

Example (verifiable)

K56589: Genomföringar och anslutningar ska vara utformade så att två stycken 95 mm^2 3-fas kablar kan anslutas.

Target: Product

Nature: Quantitative

Interpretablity: Non-ambiguous

Reference: None

Logic rule: Yes

Example (non-verifiable)

K157806: Jordens halt av stora block (> 630 mm) ska anges om den bedöms överstiga 1 viktprocent.

Target: Documentation

Nature: Quantitative

Interpretablity: Ambiguous (artificial)

There are two aspects that are ambiguous. (1) The dimension of 630mm is not specified (length, diameter, circumference of the block, or something else?). (2) It is not clear where this fact must be documented.

Reference: None

Logic rule: Yes

Example (non-verifiable)

K46926: Dörrar av stål ska vara målade i kulör ljusgrå enligt tillverkarens standard.

Target: Product

Nature: Qualitative

Interpretablity: Ambiguous (artificial)

This requirement could be made unambiguous by specifying the color using a standard way (e.g. Pantone). The general question is whether clarity is wanted or if natural ambiguity is fine to allow for solution openness. In this case, the color is not a matter of solution openness (what is the problem that is solved?), but simply under-specification.

Reference: External

Logic rule: Yes

Next steps

- Classify more requirements to create a large enough training set
  - Strategy currently under evaluation: use pilot results (agreements and disagreements) to identify requirements that:
    a) Are likely not controversial: only I classify them
    b) Are likely to lead disagreement: we (BTH and HTV) discuss them
- Involve Trafikverket in the validation of the consolidated data set

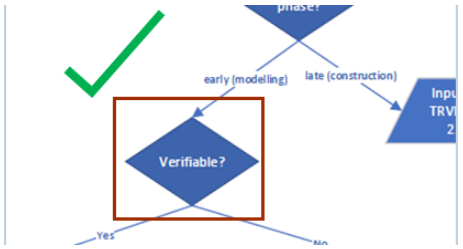
Objective 2: Machine-readable requirements

Objective 3: Demonstration of verification methods

Work Package 6
Current Approach / Activities

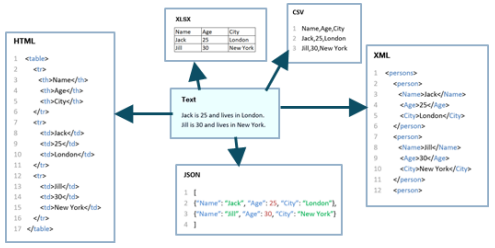
Work Packages 4/5 (Input)

List of verifiable Requirements



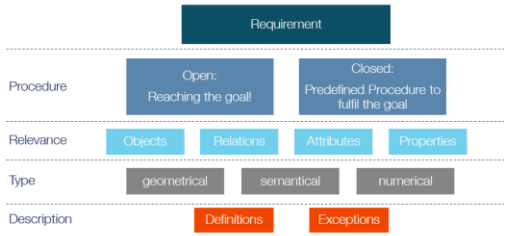
Work Package 6

Methods to make Requirements machine readable



Work Package 7/8

Proof of Concept for Verification



Work Package 6
Machine Readability – Ontology Approach

Prerequisite: **WP4 Classification**

K32047	Bridge part must be compliant with …
K82394	The signalling device for the access …
…	

- Qualitative/ Quantitative
- Product/ Process
- Ambiguous/ Non ambigious
- Logic Rule
- ….

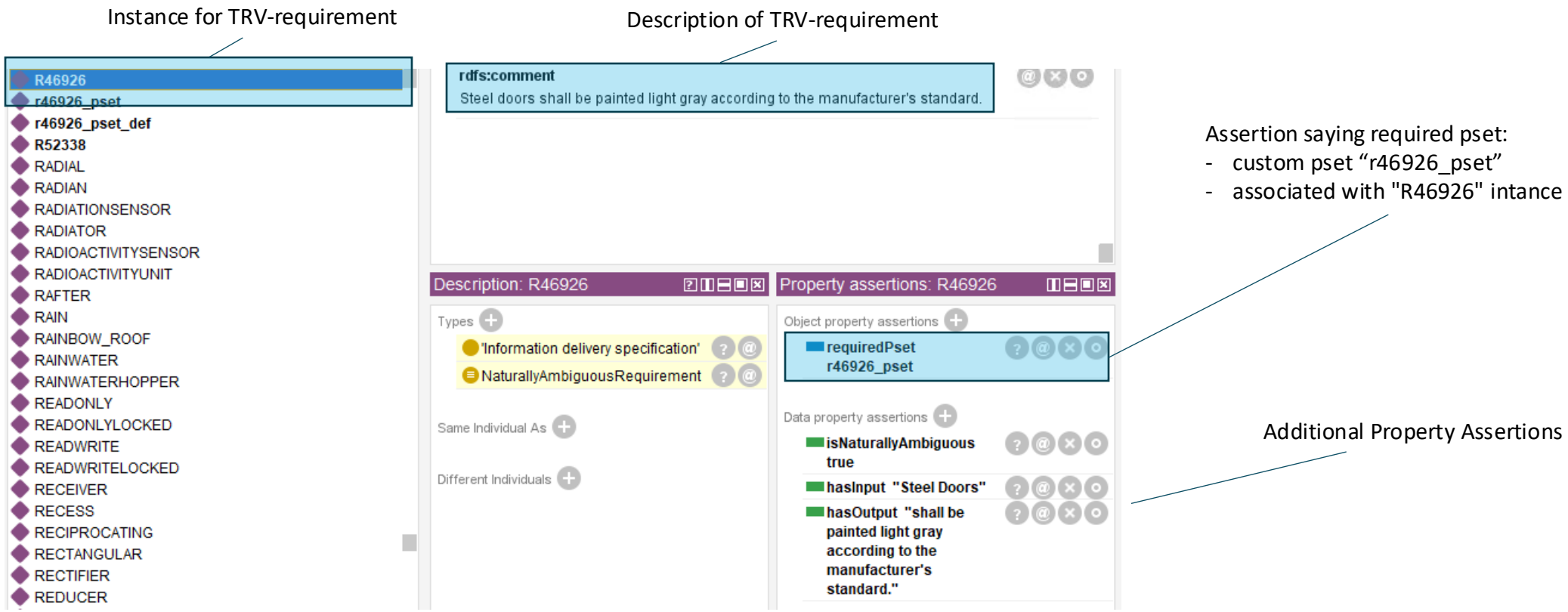
Classification

- Product
- Logical
- Non-ambigious

➡ Define & Setup Example: **WP6 Machine Readability**

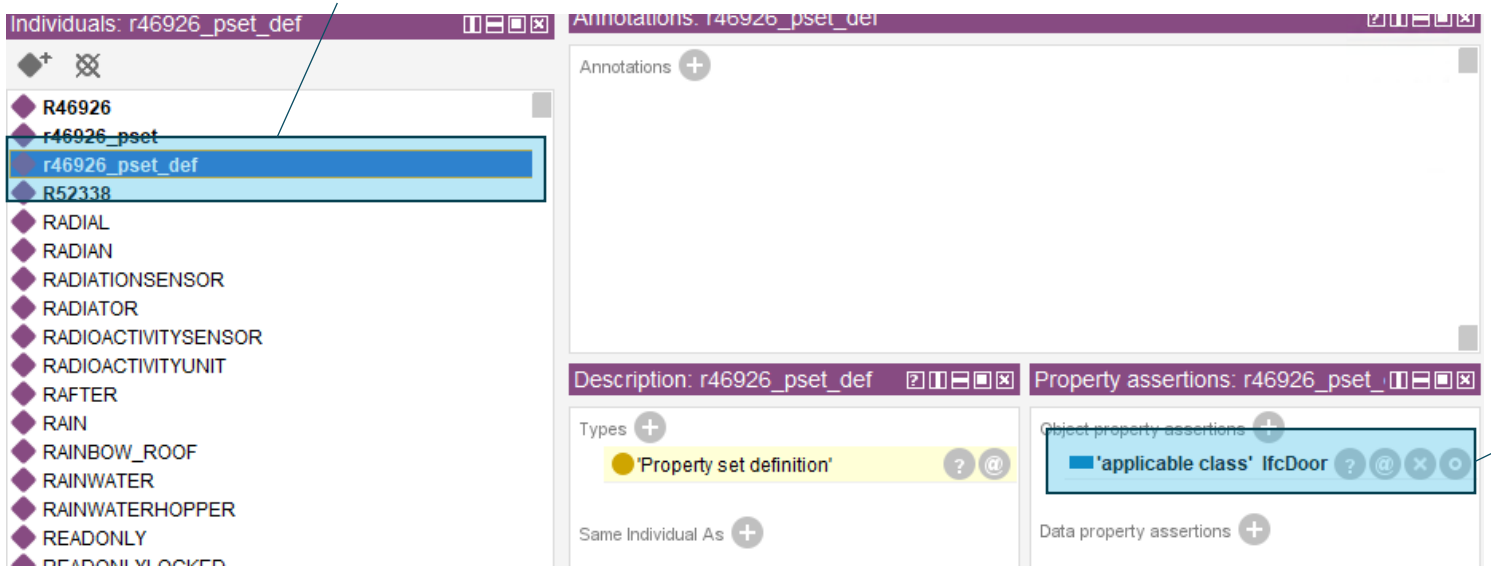
➡ Practical Approach: **WP7 Demonstration**

Work Package 6
Machine Readability – Ontology Editor



Work Package 6
Machine Readability – Ontology Editor

Property Set Definition to R46926_pset



Description of Property Set: stating which ifc class this specification applies to (among other things)

Transferring textual requirement into machine readable format
Definition of relevant instances and their relations
Building the SVAR Ontology

Objective 3

Develop procedures for automated, reusable, verification of requirements

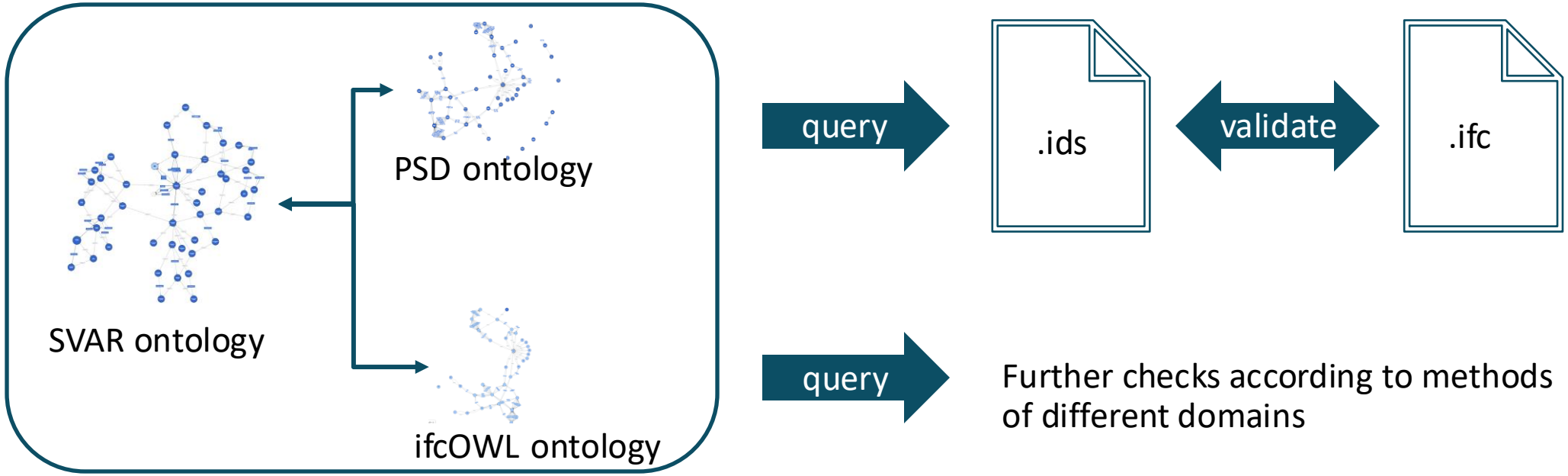
Work Package 07 – Demonstration of verification methods of models

Work Package 08 – Evaluation of verification methods

Work Package 09 – Roadmap and recommendations for implementation

Work Package 7
Demonstration – Linked Data Approach

Requirements enriched with concepts from AEC domain



Work Package 7

TRV Requirements as Information Delivery Specifications

STEP 1

SVAR ontology

K32047	Bridge part must be compliant with …
K82394	The signalling device for the access …
K46926	Steel doors shall be painted light gray according to the manufacturer's standard.

TRV00236 –Requirement Instances

Ifc4-psd:requiredPset

r46926_pset

STEP 2

r46926_pset

Ifc4-psd:propertySetDef

r46926_pset_def

Ifc4-psd:applicableClass

ifc:IfcDoor

Ifc4-psd:requiredProp

Pset_DoorCommon:IsExternal

Pset_DoorCommon:etc

.ids

Work Package 8
Evaluation / First Findings

- Requirements other than Product/Logical Rule/Non-ambiguous will be a challenge
- Only Product requirements are verifiable with IDS, several more approaches to be respected
- Looking on a single requirement is often not target-orientated, due to missing context
- References mentioned in a requirement are useful for the recipient, but not for automation (Documents/Drawings/Other)

- Shift from IFC Constraints to Information Delivery Specifications (IDS)

Work Package 8
Evaluation / Open Questions

- Is there a current 3D Model as Demonstrator existing?
- The generation of the provided IDS file may be a help for us:
    - What is the process?
    - Based on which requirements?
    - Which Software application (IDS Generator/Model Checks)
- Is there a CAD Standard (IFC Specification) existing?
- Is the TRV Ontology published?

Synergies with other projects

- Upcoming:
  - Förstudie: Intelligent lösning för kvalitetssäkrad livscykelhantering av krav (Jesper Kornestedt)
- Potential:
  - Vinnova, under the umbrella program of advanced digitalization: research project with Celeris (Anders Ekman), BTH and Trafikverket.

Champions for project outcomes

Motivation: critique from previous research projects that results are not transferred to TRV

Idea: have one person from TRV "champion" the results and drive dissemination/adoption in TRV *after* the project

Goal: find in 2024 champion(s), based on the results we achieve.

Ambition: start in 2025 with dissemination/promotion, before the project ends in September

Next steps

- Summary of action points for All
- Date for next reference group meeting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