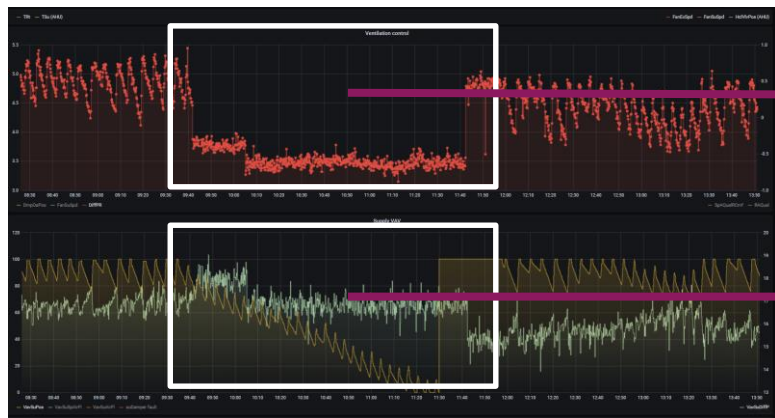# Knowledge Graphs and Reasoning for Building Automation

Prof. Dr. Daniel P. Politze, Dr. Maria Husmann

25. Januar 2022

Motivation / Today's Situation

- Collection and Analysis of Data from Sensors and Devices

- Context i.e. the specific installation and application is not explicitly modeled (pictures/plans and/or knowledge of the technical operator)

The <u>room pressure</u> dropped slightly.

The <u>supply Vav damper</u> was closing (why?) (but still it had no impact on the airflow.)

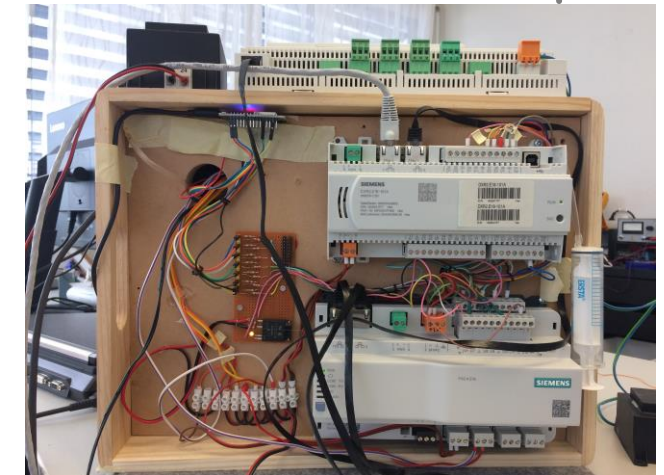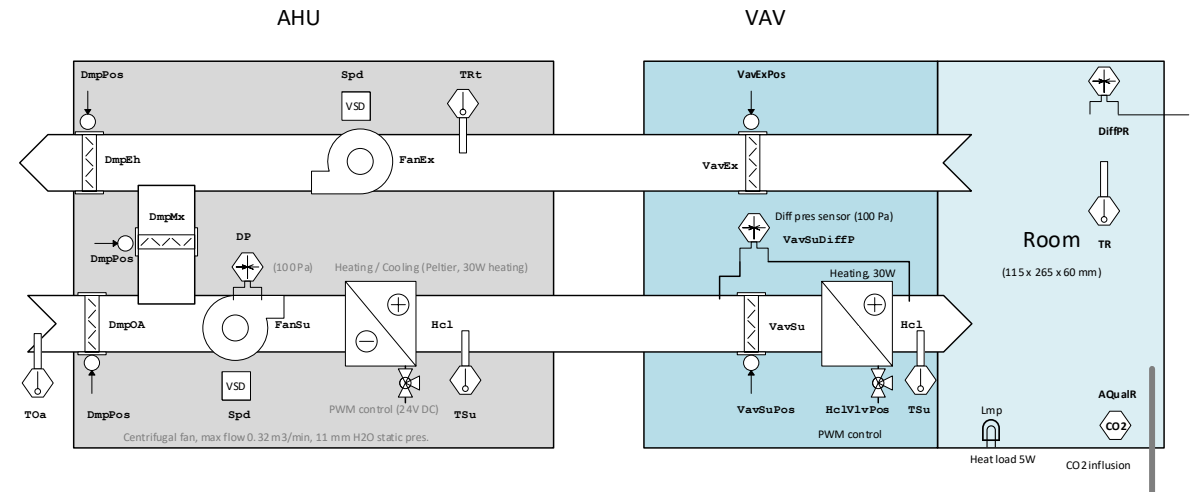Are those data points related to the same room?

- Feasible only for small and easy-to-understand installations

- How to deal with complex and complicated installation i.e. in larger buildings

SIEMENS
Ingenuity for life

OST

Approach: Knowledge Graphs as a Semantic Overlay

- Knowledge Graphs serve as an additional semantic-layer to describe

  - the relationships between the existing devices in the installation

  - the application-specific semantics such as rooms, floors, buildings
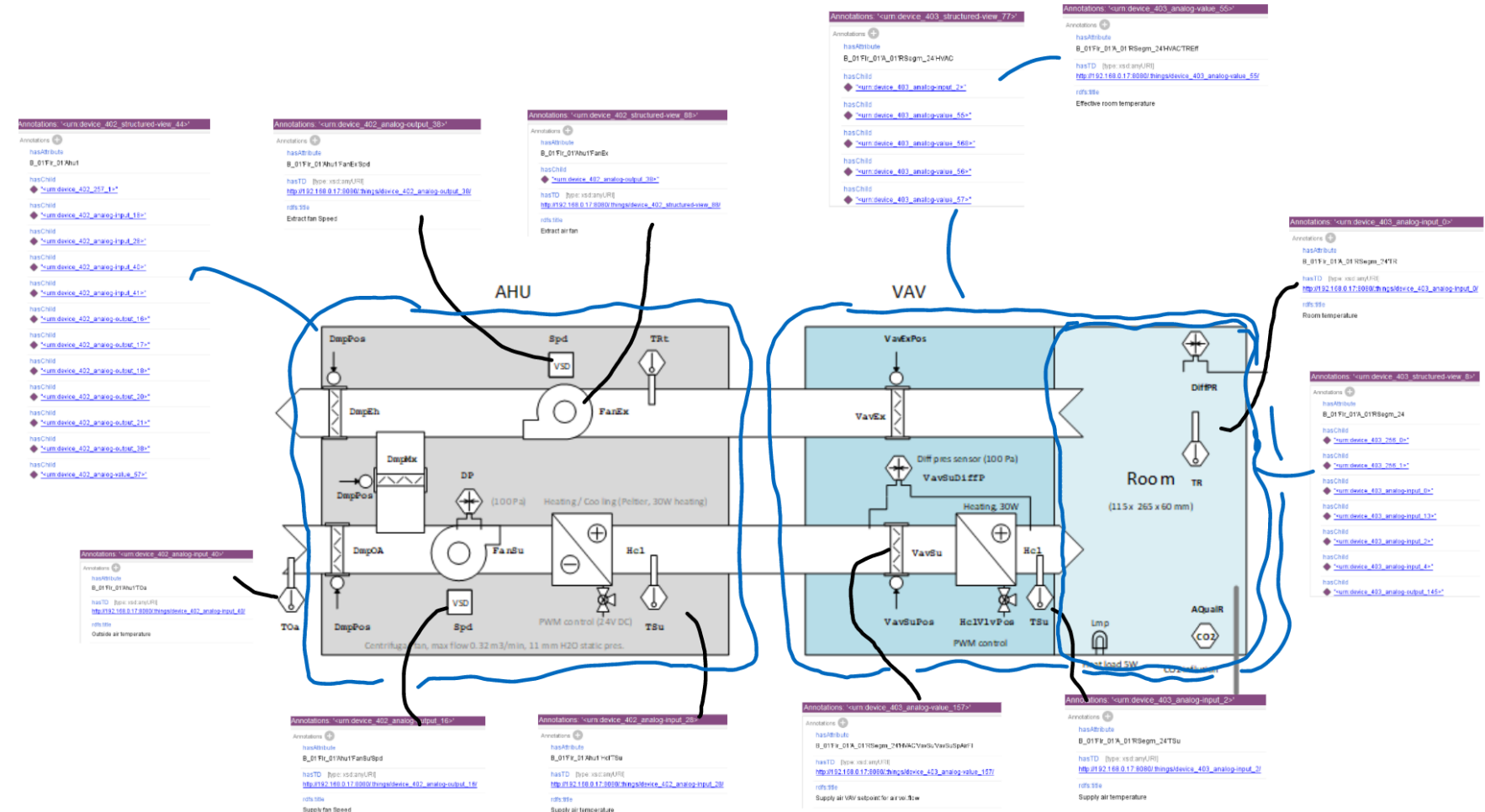
  in a computer-readable way.

- The captured semantic metadata will then enable data analysis that takes domain knowledge into account

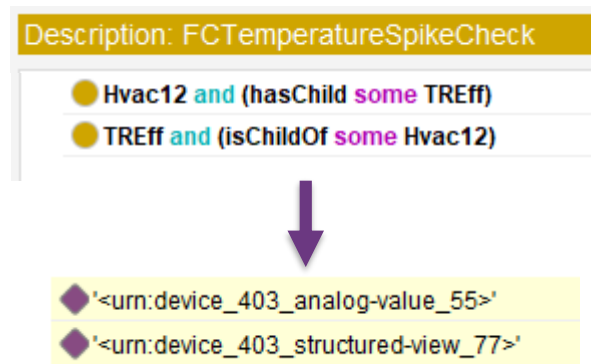- A small but realistic use-case has been used in a first stage

SIEMENS
Ingenuity for life

OST

Basis: Proper Annotation of the Installation

- Devices

- Data Points

- Rooms

- Systems
  (e.g HVAC, AHU)

- Relationships

- …

Current Research: Rule Modeling & Reasoning

- **Besides installation knowledge, there exist rules (very simple to high complex):**
  "We should check the effective room temperature for abrupt changes (spikes)"

- **How can we incorporate these "rules" into the existing Knowledge Graph?**

- **How can we now find the devices and sensors that belong together?**

Modeling the rules and apply a reasoner

```
SPARQL:
# Temperature_Spike_Check


SELECT DISTINCT ?HVAC ?RoomTemperature WHERE {
    ?HVAC a baap:Hvac12 .
    ?RoomTemperature a baap:TREff .
    ?HVAC baap:hasChild ?RoomTemperature .
}
```

Querying the Knowledge Graph

SIEMENS
Ingenuity for life

OST

Contact Details

Prof. Dr. Daniel P. Politze
Innovations- und Informationsmanagement

OST – Ostschweizer Fachhochschule
Oberseestrasse 10
Postfach 1475
CH-8640 Rapperswil
Telefon: +41 55 222 46 05
Fax: +41 55 222 44 00
E-Mail: daniel.politze@ost.ch
Internet: www.ost.ch

SIEMENS
Ingenuity for life

OST