Digital Twin Web

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March 8th 2021

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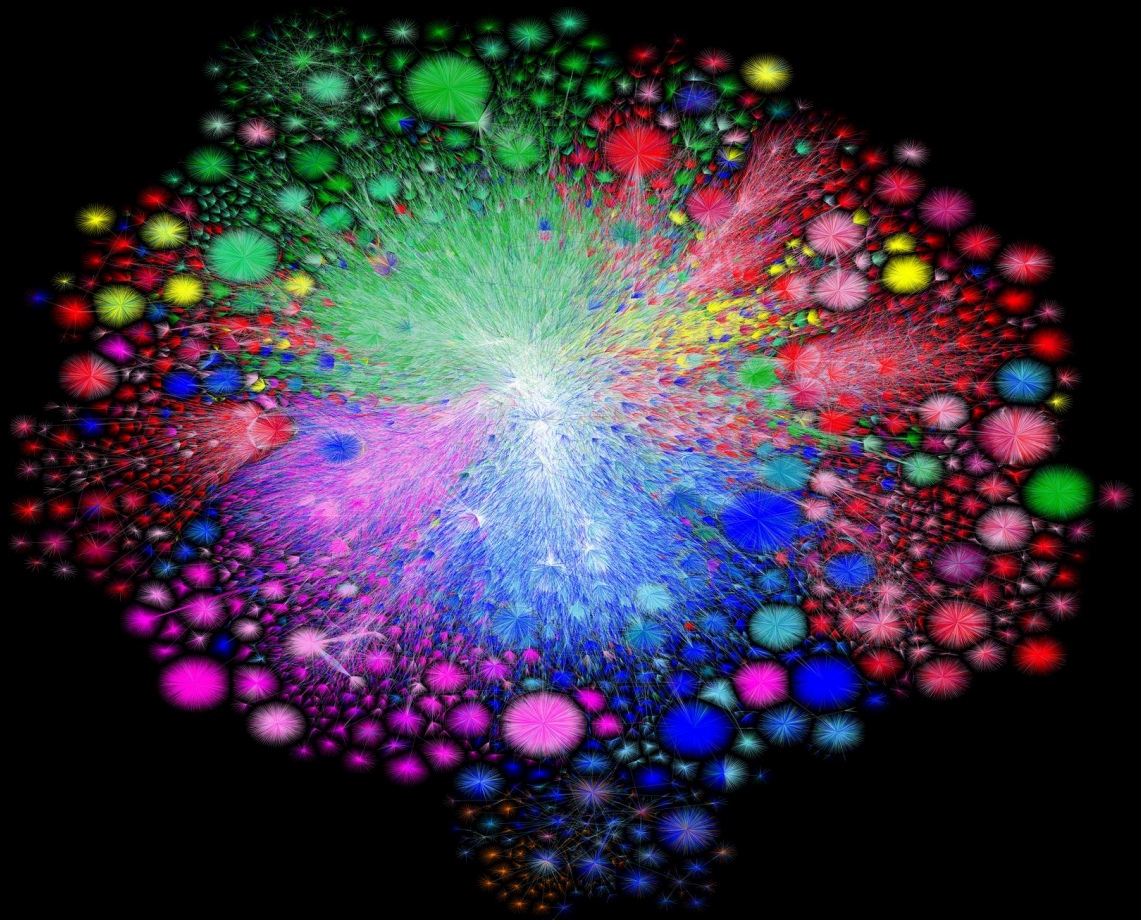


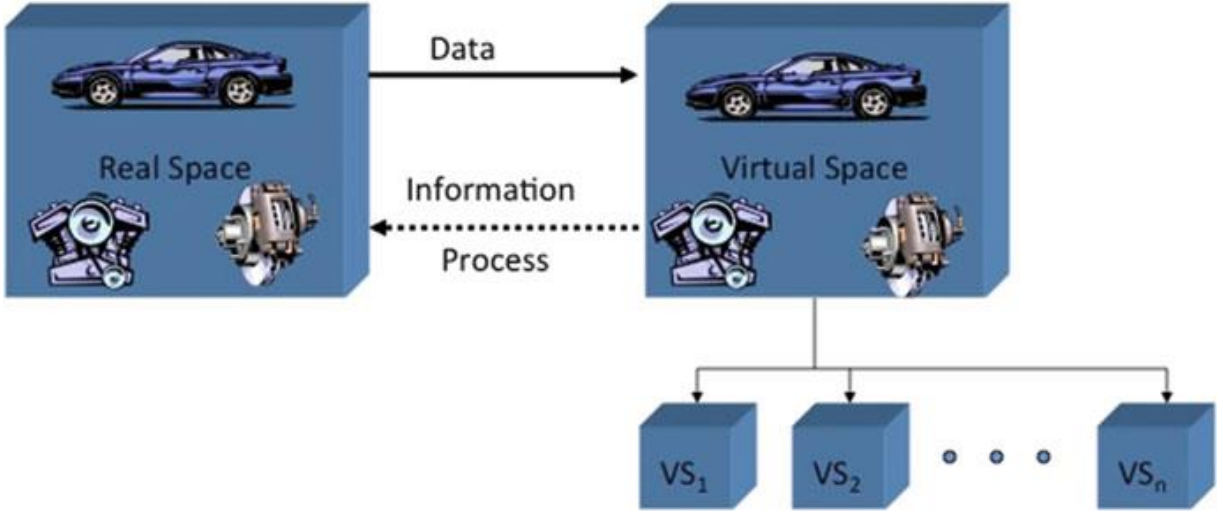
The Internet in 2021
Barrett Lyon / The Opte Project

Agenda

1. Current state of digital twins
2. Digital Twin Web
3. Next steps (How to get there?)

Current state of digital twins

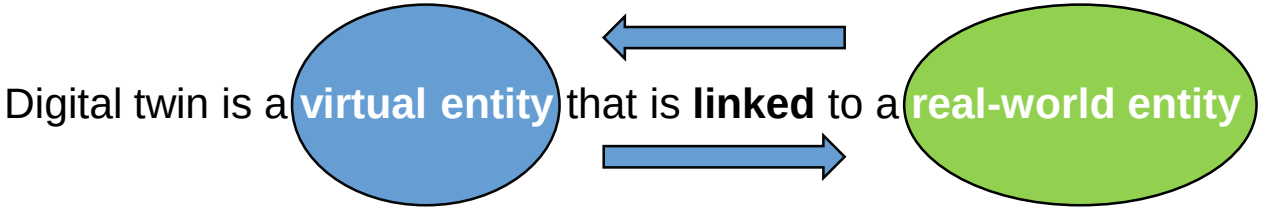
Origins of the concept:

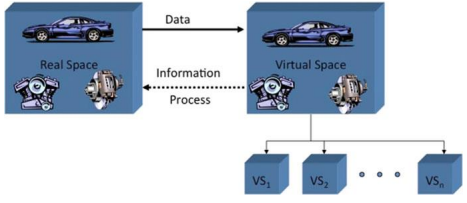


Conceptual ideal for PLM by Dr. Michael Grieves in 2002.
https://doi.org/10.1007/978-3-319-38756-7_4

Current state of digital twins

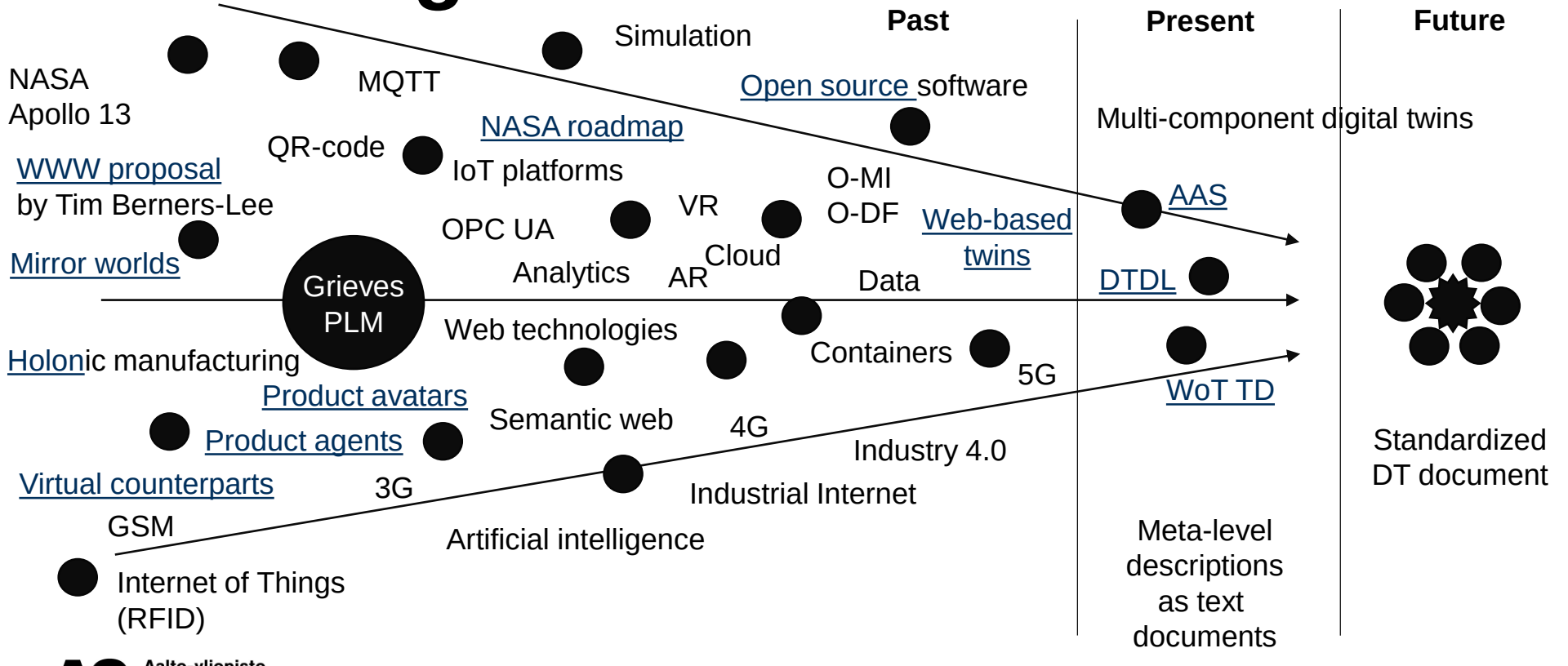
Towards a general definition:





Definitions seem to be converging to this type of definition, see e.g. Industrial Internet Consortium and Digital Twin Consortium definitions.

Accumulation of digital twin technologies



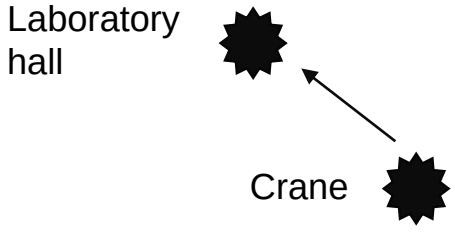
Digital Twin Web

Crane 

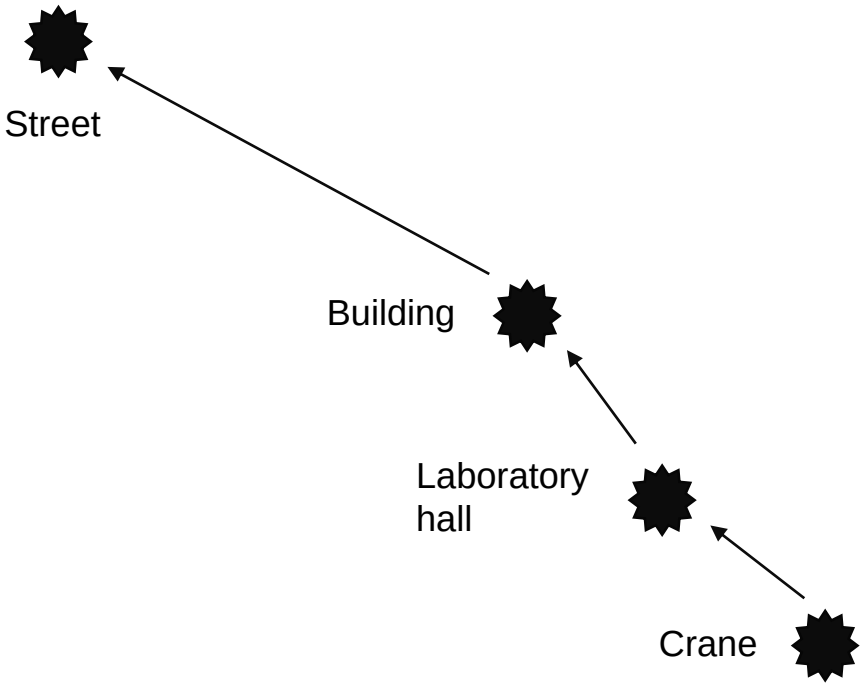
Standardized
DT document

...with
identifier
&
identity

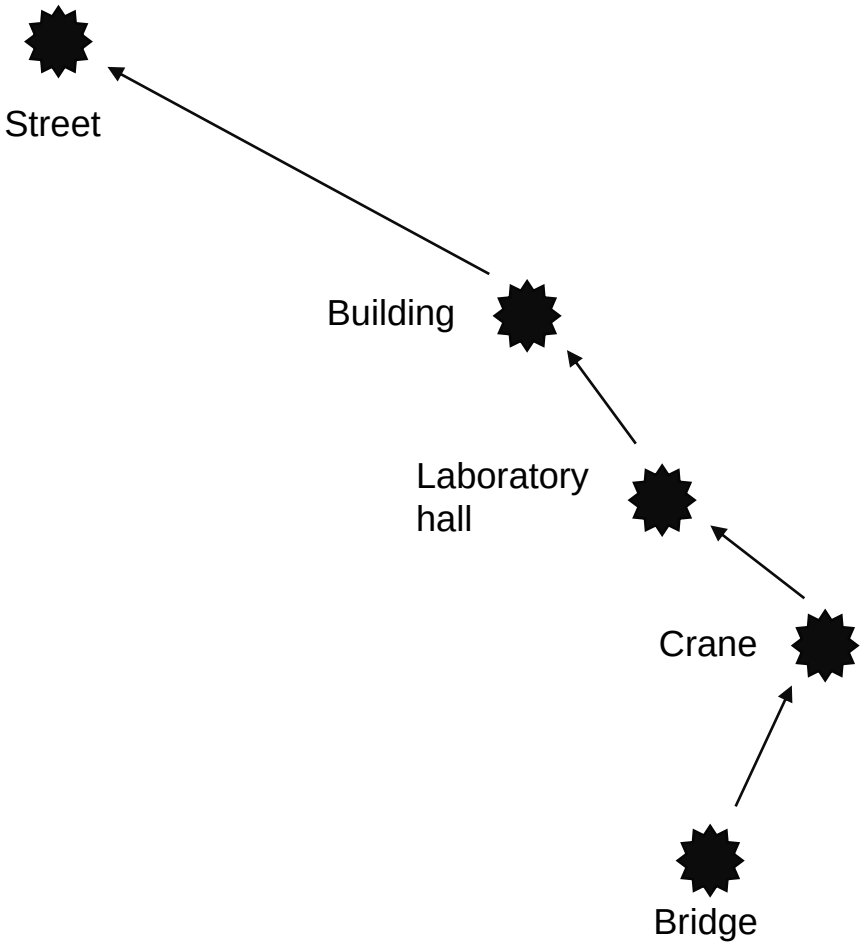
DTW



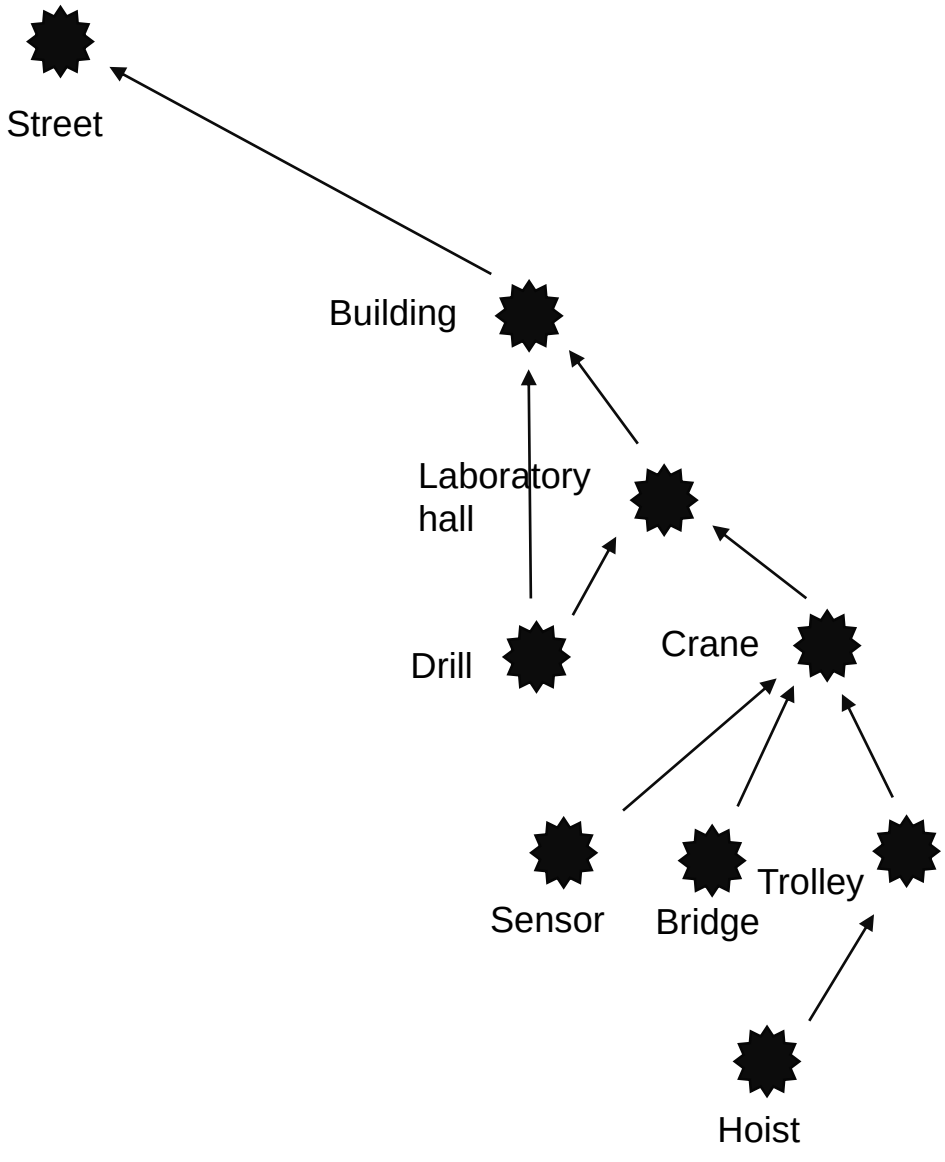
DTW



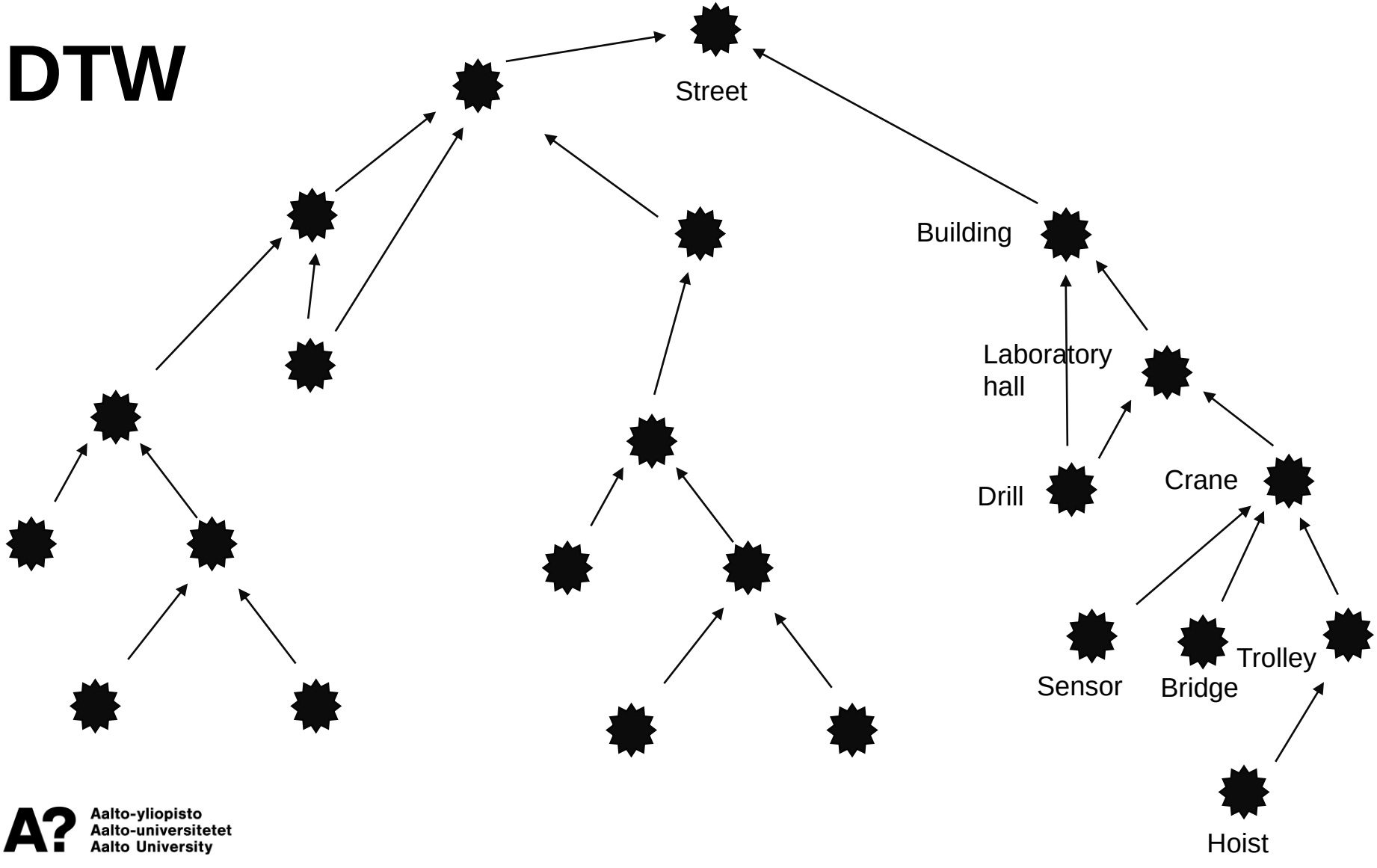
DTW



DTW


Street
Building
Laboratory hall
Drill
Crane
Sensor
Bridge
Trolley
Hoist

DTW


Street
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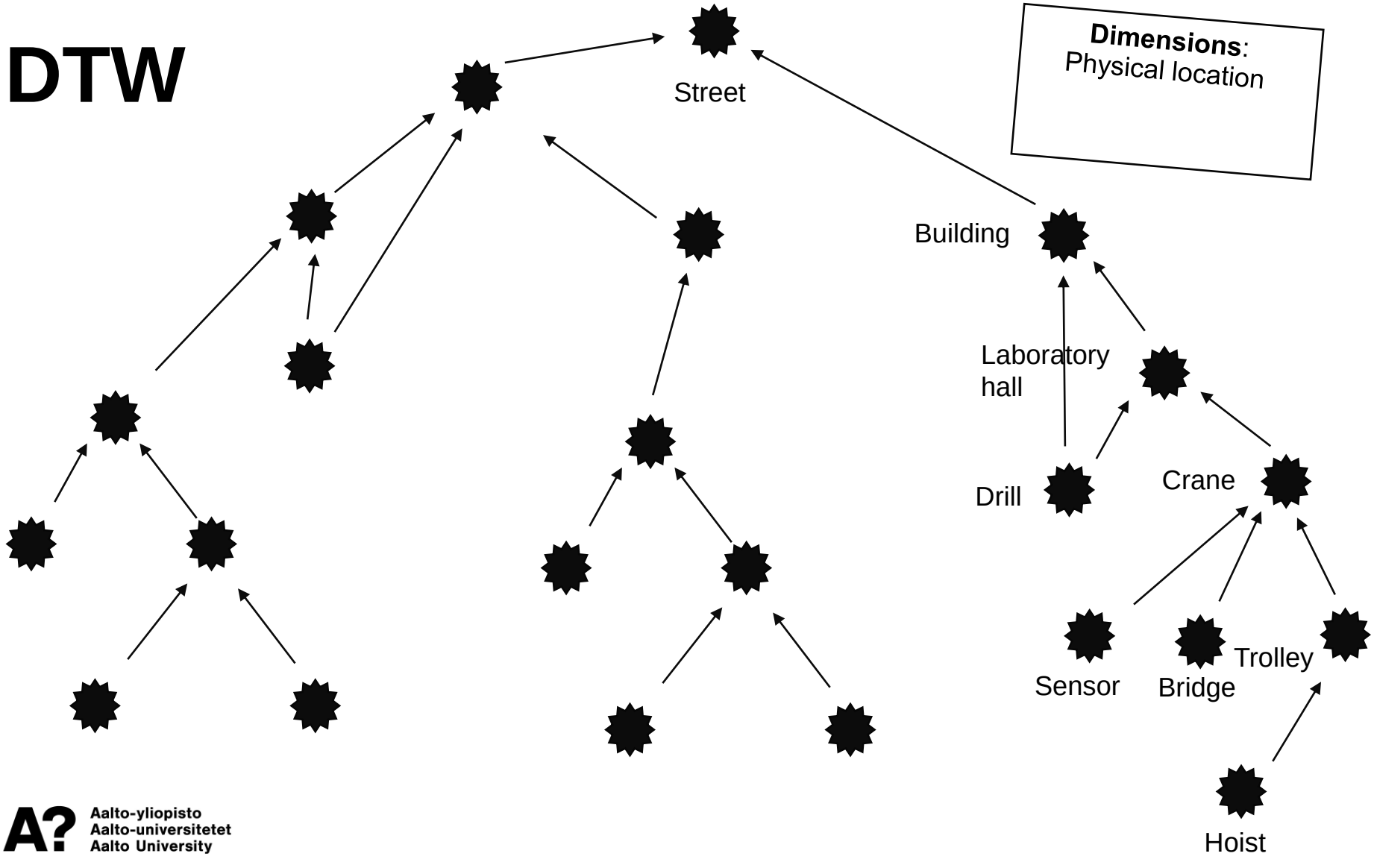
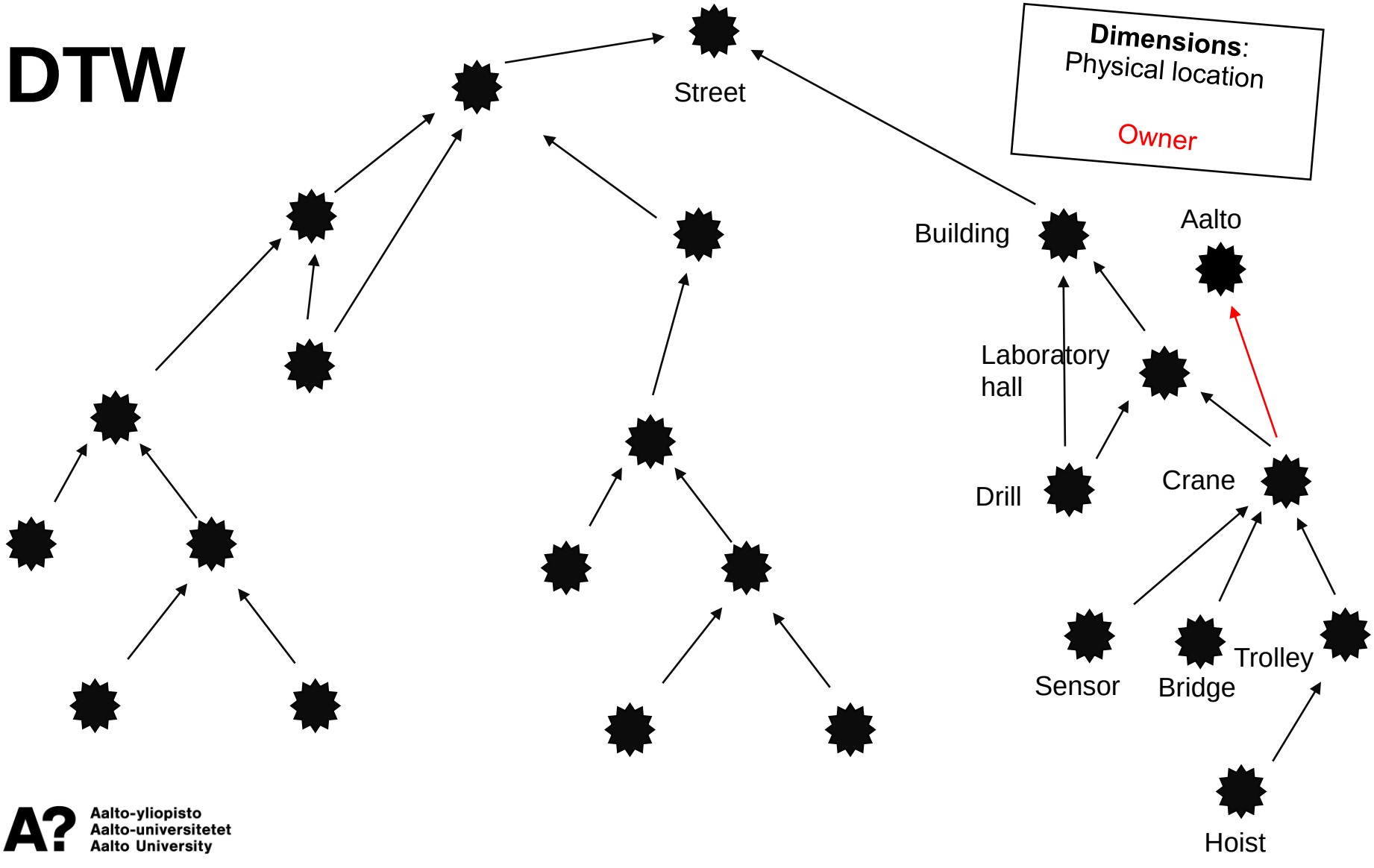
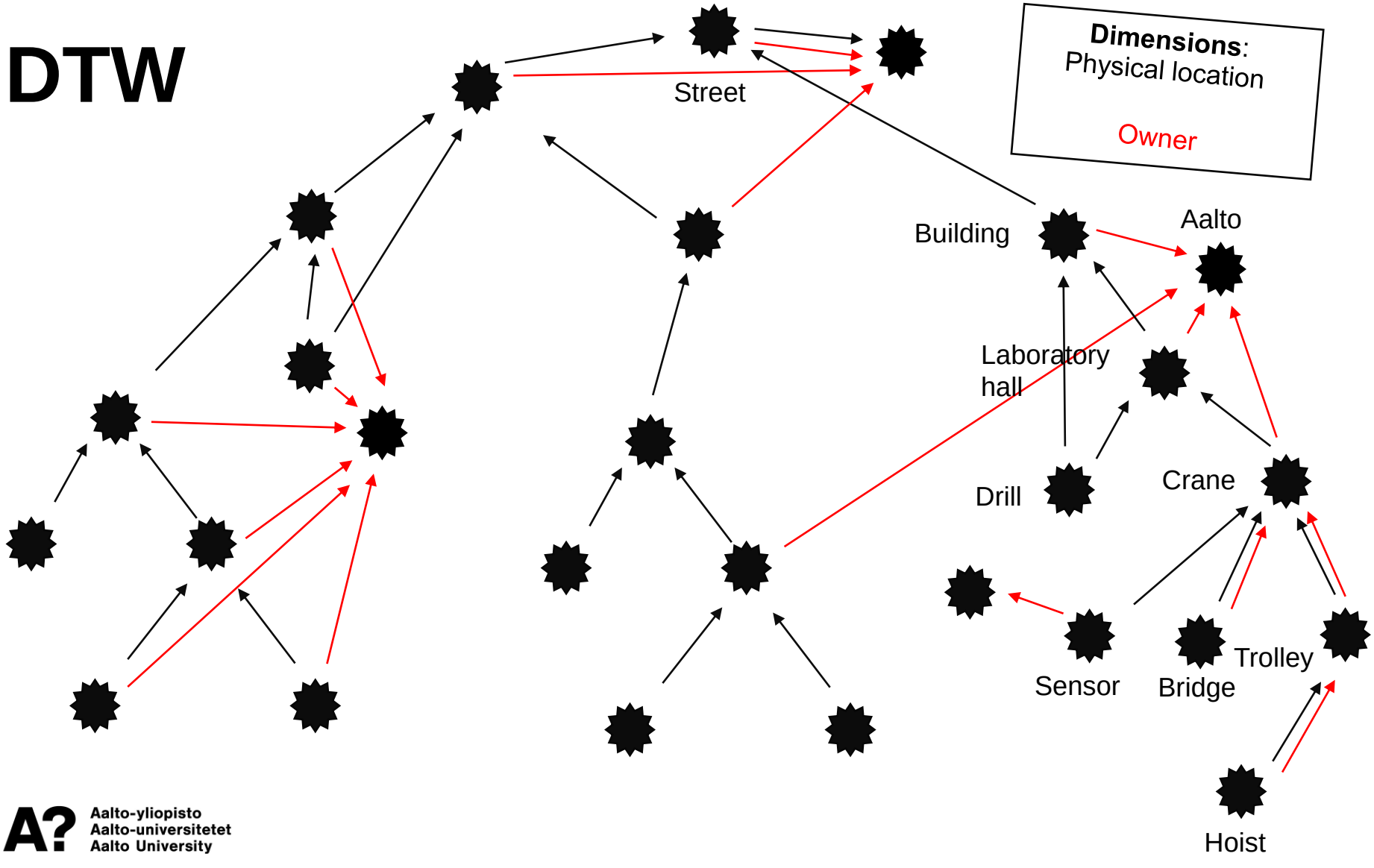
DTW


Dimensions:
Physical location
Street
Building
Laboratory hall
Drill
Crane
Sensor
Bridge
Trolley
Hoist

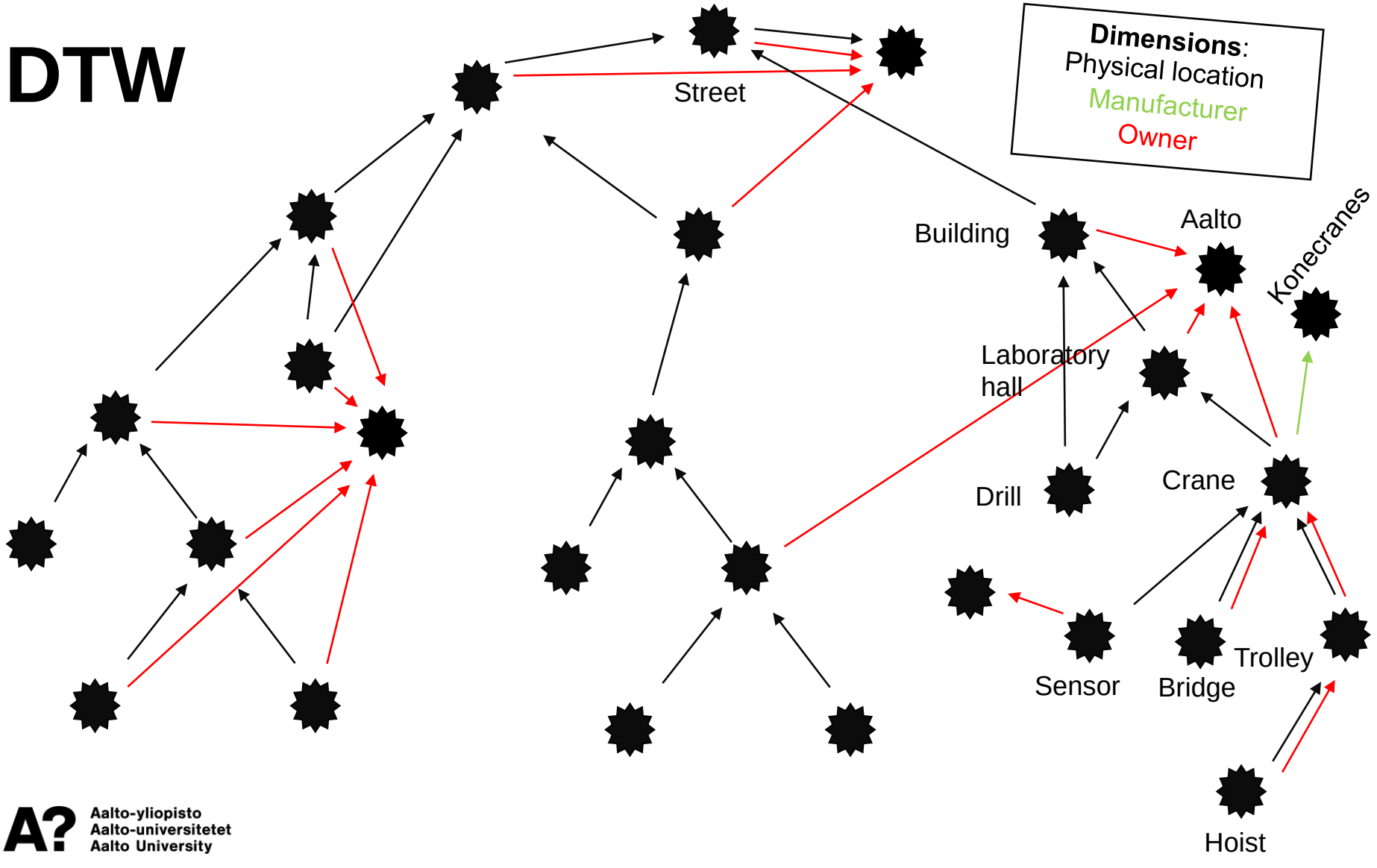
DTW


Street
Dimensions:
Physical location
Owner
Building
Aalto
Laboratory
hall
Drill
Crane
Sensor
Bridge
Trolley
Hoist

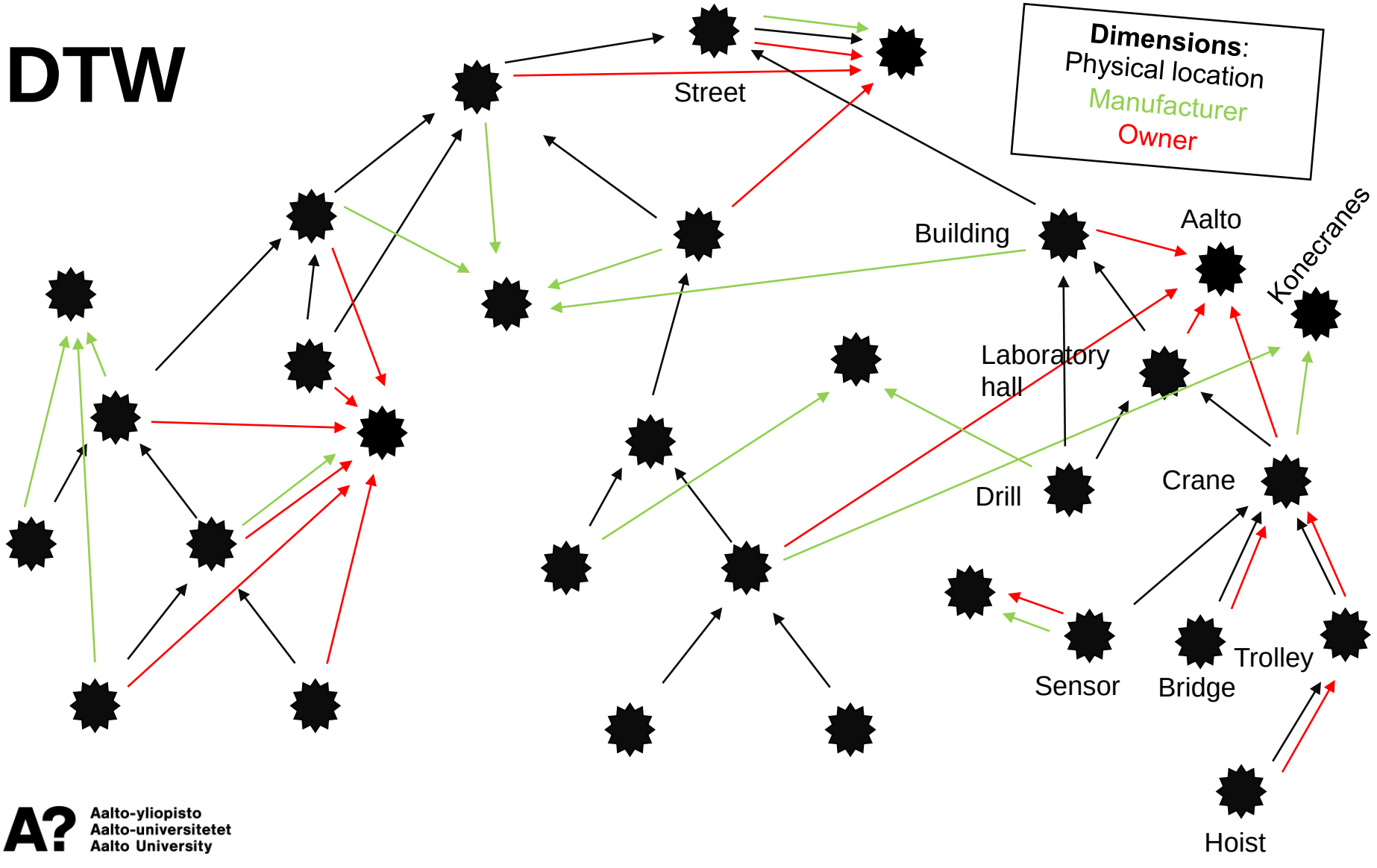
DTW


Dimensions:
Physical location
Owner
Street
Building
Aalto
Laboratory hall
Drill
Crane
Sensor
Bridge
Trolley
Hoist

DTW


Dimensions:
Physical location
Manufacturer
Owner
Street
Building
Aalto
Konecranes
Laboratory hall
Drill
Crane
Sensor
Bridge
Trolley
Hoist

DTW


Dimensions:
Physical location
Manufacturer
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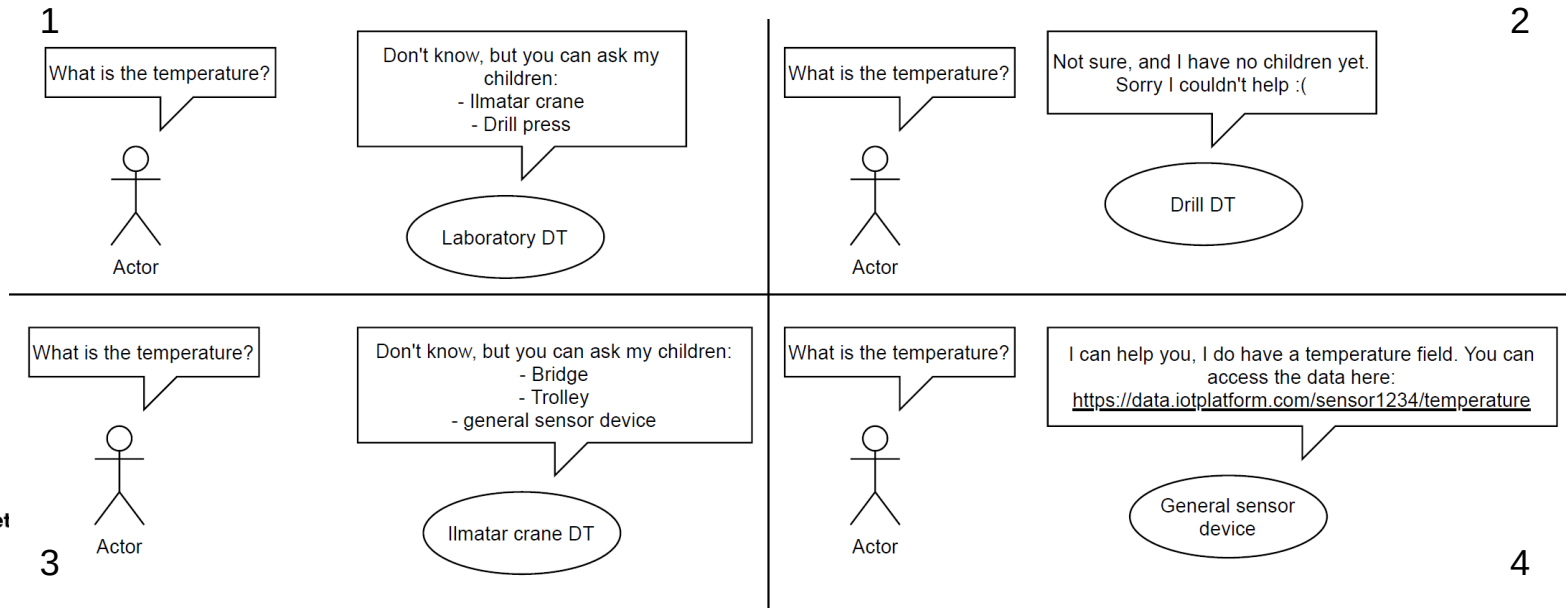
Street
Building
Aalto
Konecranes
Laboratory hall
Drill
Crane
Sensor
Bridge
Trolley
Hoist

Example case: temperature query

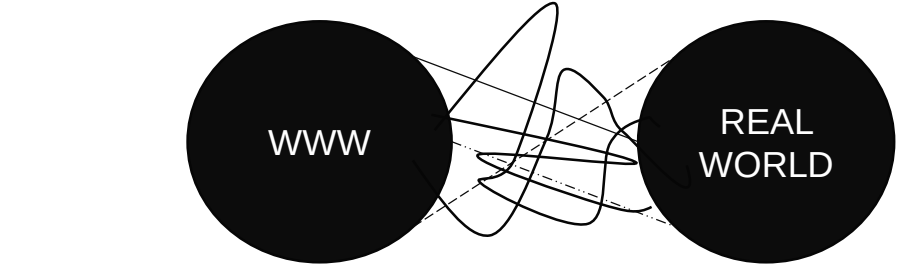
We want to know the temperature of the *laboratory*, but the digital twin of the laboratory does not have the attribute ”temperature”.

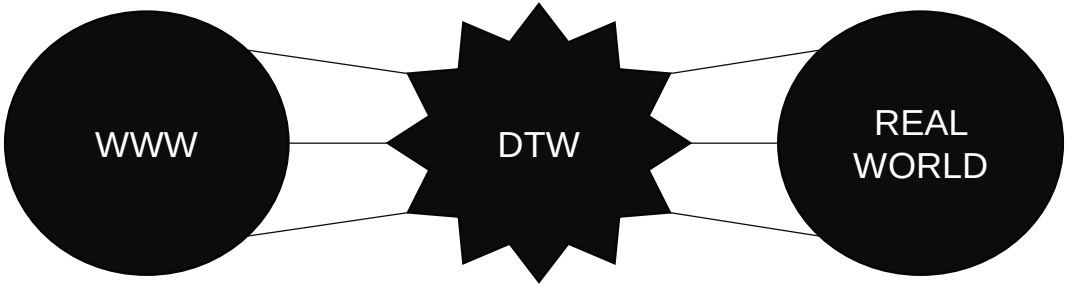
We can still ask the laboratory for the temperature. The query will be forwarded to (location) children of the lab, i.e. the Ilmatar crane, a drill press, etc. Finally a DT gives a link to the data.



Digital Twin Web

- **...connects the World Wide Web to the real world**
  - Mirrors the real world
  - Links to WWW resources
- **Human AND machine readable**
- **Multi-dimensional**
  - Location, owner...
- **Supports discovery**
- **Needs standards!**





Next steps (How to get there?)

1. **Internet-connected twins**
   - Minimum requirement, APIs and/or web pages
2. **Simple twins (Meta-level twins)**
   - Text description document with pointers to complicated stuff
3. **Public twins**
   - Public real entity => public twin
   - Identifier http://d-t.fi/konecranes-K16052

=> Coming soon: Twinbase

```
version: "1.0"
privacy: "public"
id: "http://d-t.fi/ilmatar-K16052"
name: "Ilmatar crane"
description: "The documentation of Ilmatar overhead crane"


contact:
  name: "John Doe"
  email: "john.doe@aalto.fi"


manufacturer: "Konecranes"
features:
  - name: "OSEMA"
    description: "OSEMA allows managing retrofitted sensors
      attached to the crane."
    address: "https://example.sensor.fi/sensors/browse"
    apiAddress: "https://digi.kaksonen.fi/api/v1.0/"
    requirement: "User account is needed."
    documentation: "https://github.com/AaltoIIC/
      OSEMA/blob/master/Documentation.md"
    keywords:
      - "sensor"
      - "management"
      - "retrofit"
      - "sensors"
      - "data"
  - name: "MindSphere"
```

https://doi.org/10.1109/ACCESS.2020.3045856

Twinbase

Open-source platform for the Digital Twin Web

- **Built with git**
- **Distributes DT documents**

Almost ready to be published...

To hear more, sign up to the DigiTwin email list via twinbase.org

(connection is not secure, but works)

Questions?

Juuso Autiosalo

March 8th 2021

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