



Representing Digital Twins and their information resources with WoT

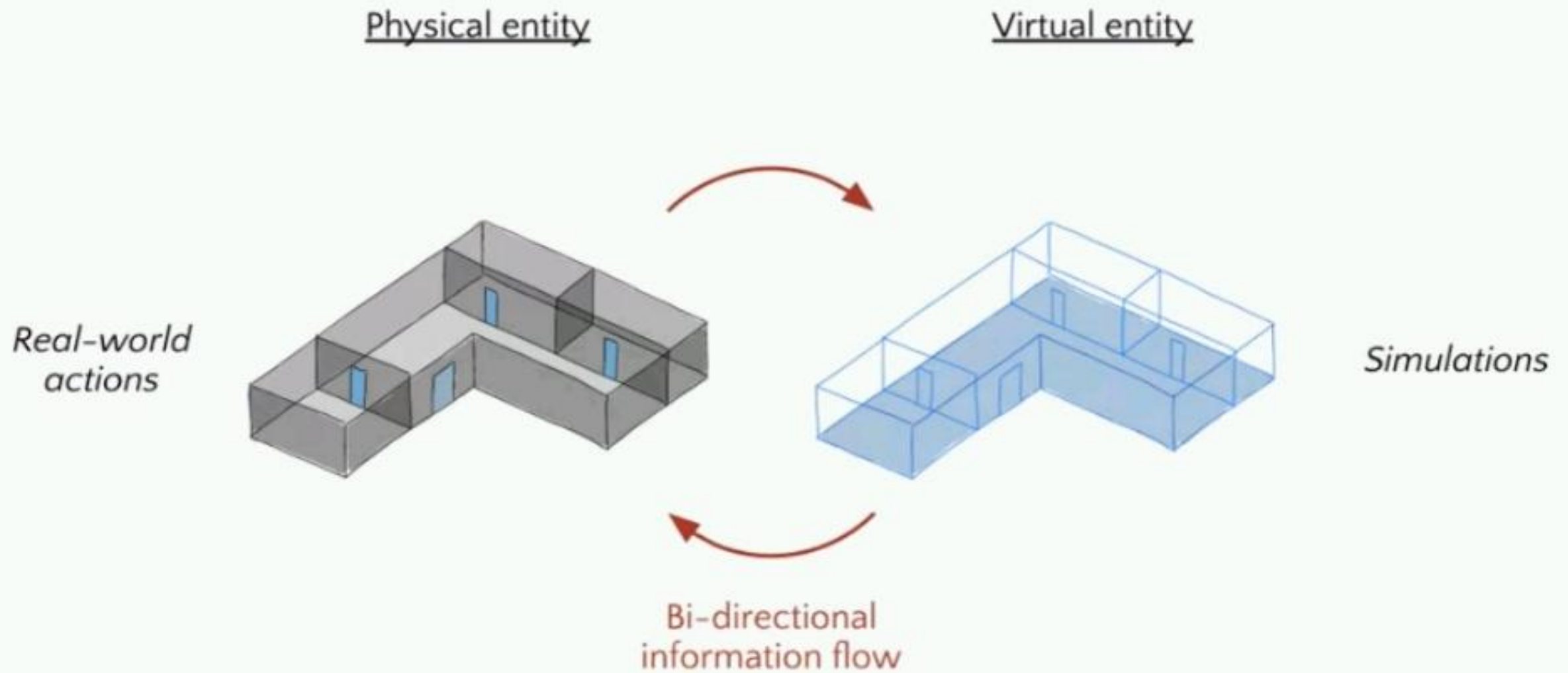
Ontology Engineering Group,
Universidad Politécnica de Madrid

Salvador González Gerpe, Andrea Cimmino, Socorro Bernardos,
Raúl García-Castro, María Poveda-Villalón

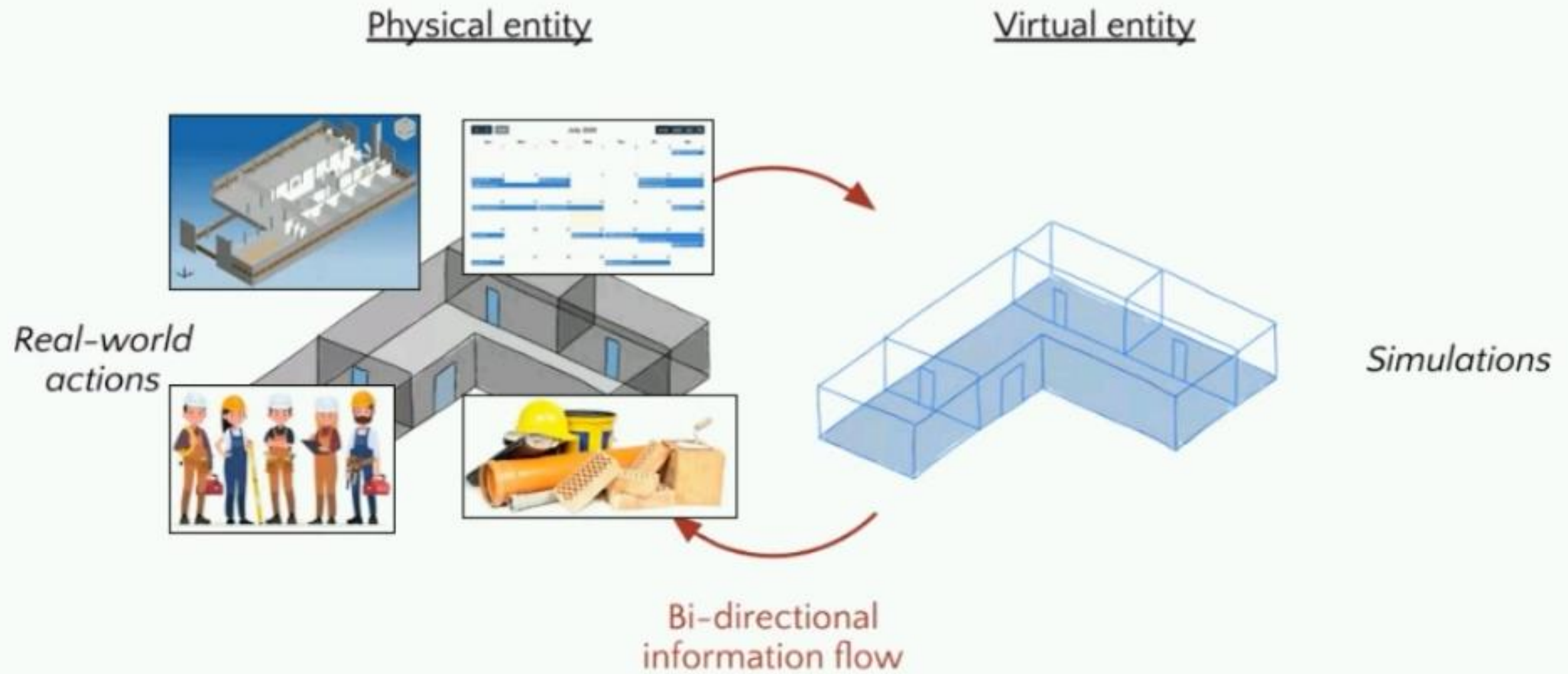
✉ salvador.gonzalez.gerpe@upm.es

📅 16/06/2023



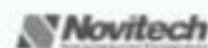
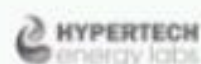


What are Digital Twins?



COGITO → COnstruction-phase diGital Twin mOdel

Project Partners



www.cogito-project.eu



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958330



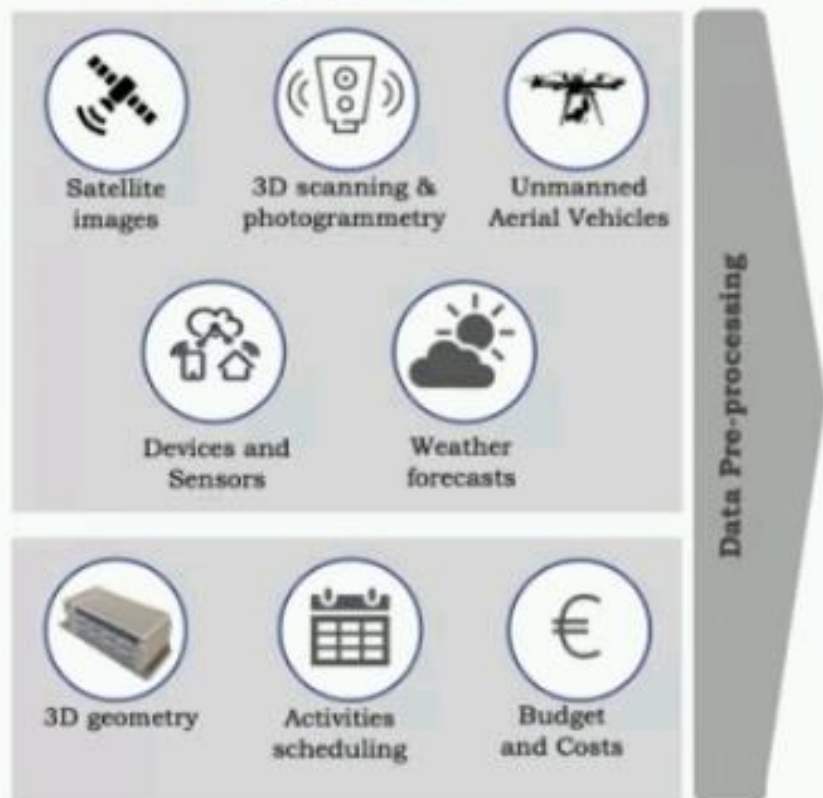
Testlab - Austria

Pilot Site I - Denmark



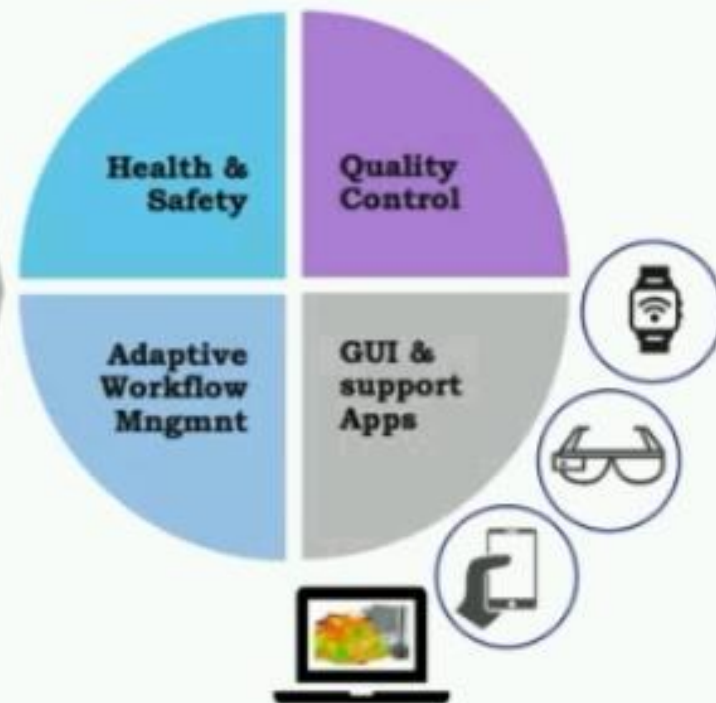
Pilot Site II - Spain

Reality capture tools



Construction Phase Digital Twin Platform

Digital Twin Applications



Linked data

OPEN STANDARDS

W3C Semantic Web

W3C OWL
W3C RDF
W3C SPARQL

ETSI SAREF

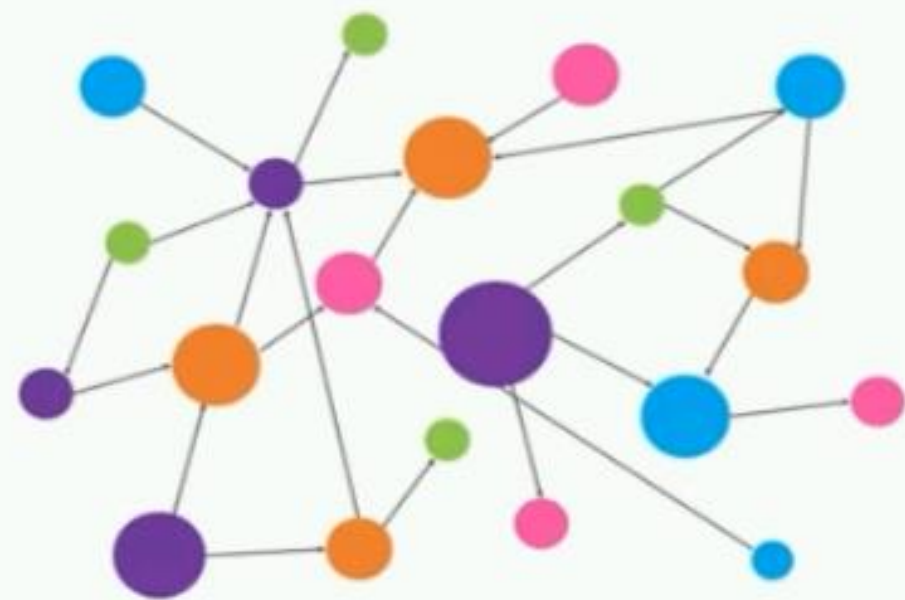
BOT

BRICK

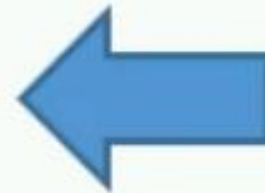
WEB OF THINGS

	Digital Twin	Semantic Digital Twin
Services Layer	✓	✓
Data Layer	✓	✓
Physical Entity Layer	✓	✓
Virtual Entity Layer	✓	✓
Connections Layer	✓	✓
Semantic Interoperability	✗	✓
Discovery Layer	✗	✓
Provenance Layer	✗	✓

Data distribution in COGITO Semantic Digital Twin



Triplestore DB
(Semantically Linked Data;
RDF)



Relational
DB
(Project Data)



Key-Value
DB
(IFC Data)



Timeseries
DB
(IoT Data)



BIM Data Post-processing Services

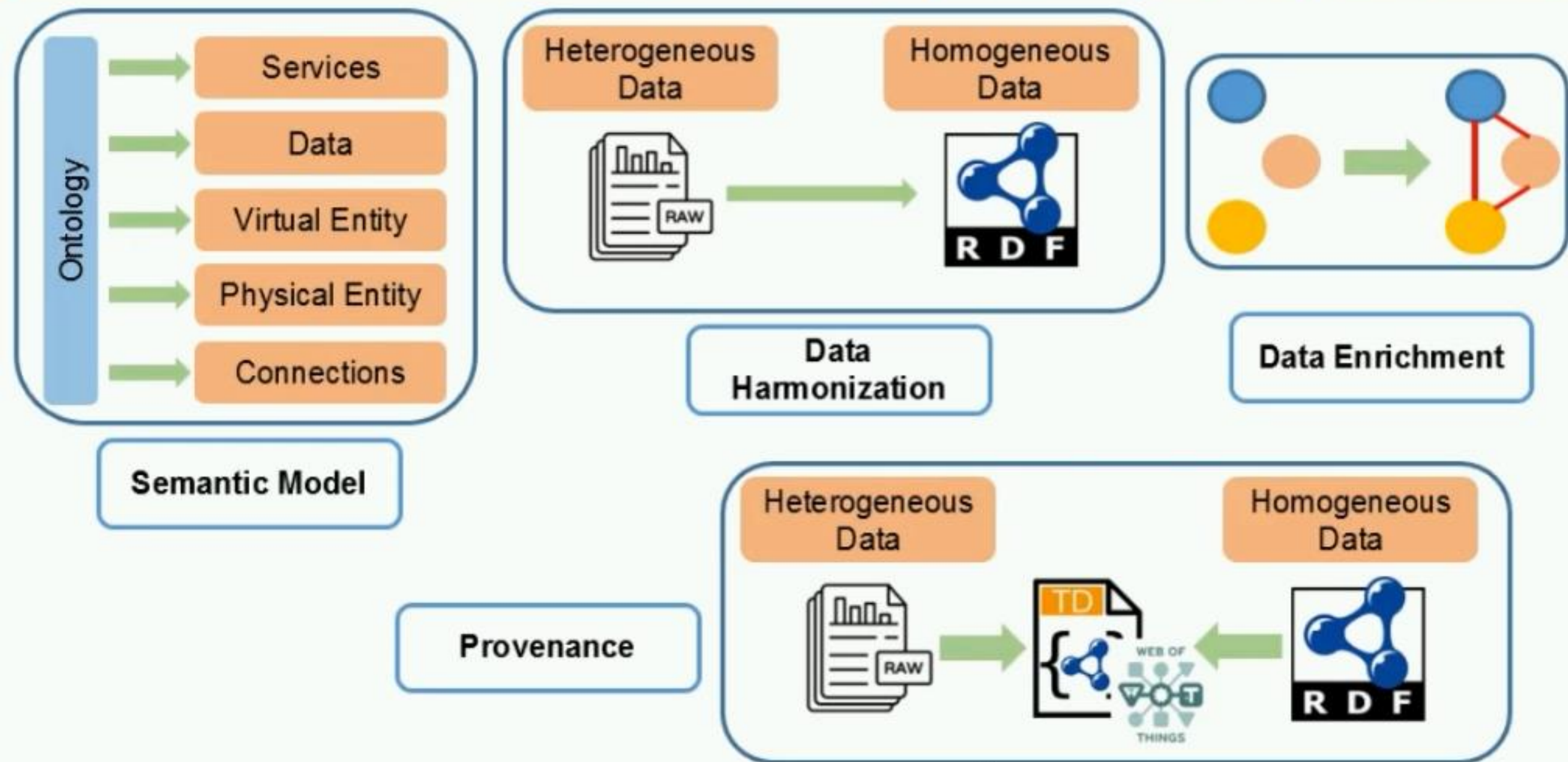


Extraction, Transformation &
Loading Services

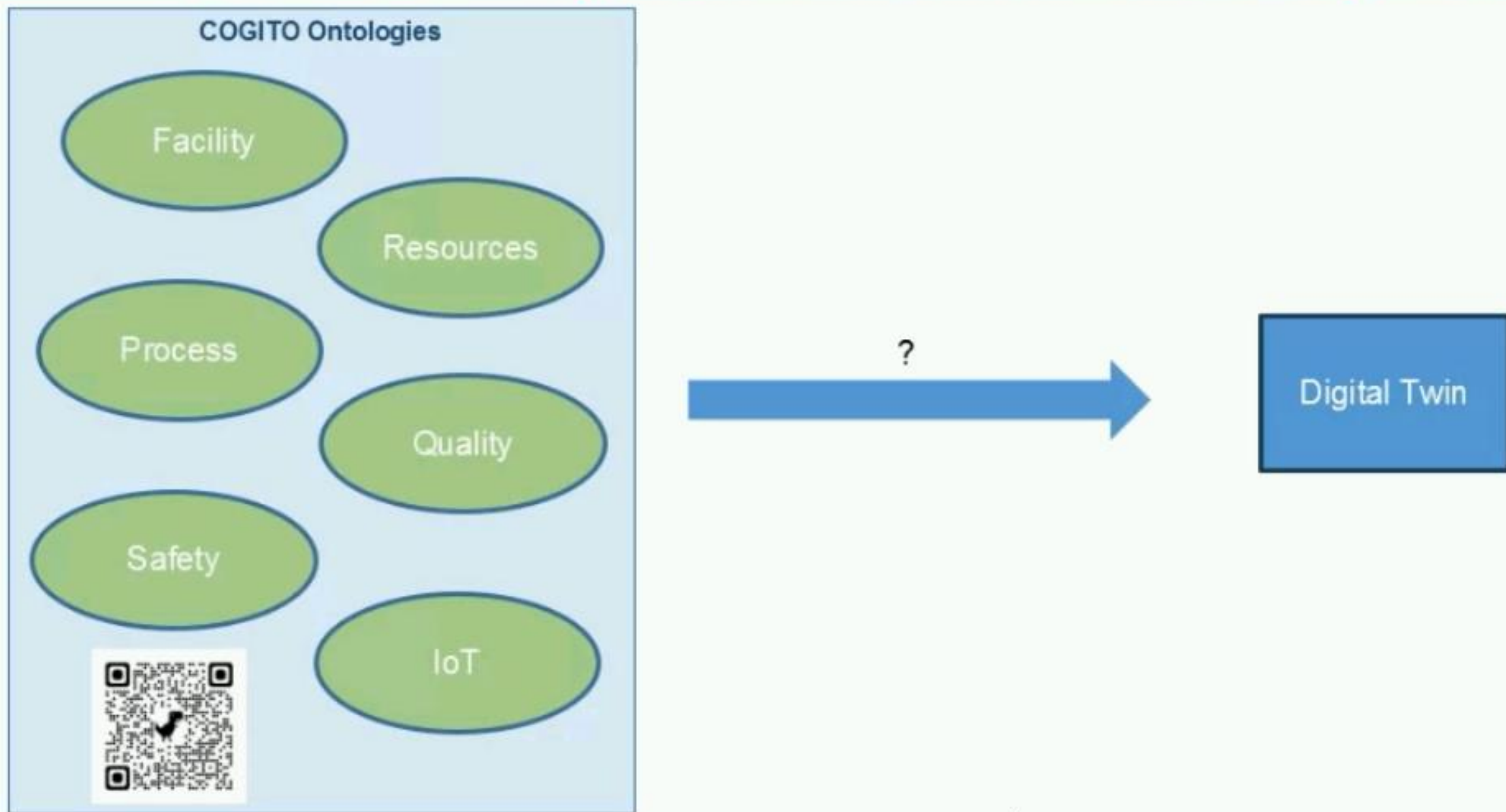


Data Management Services

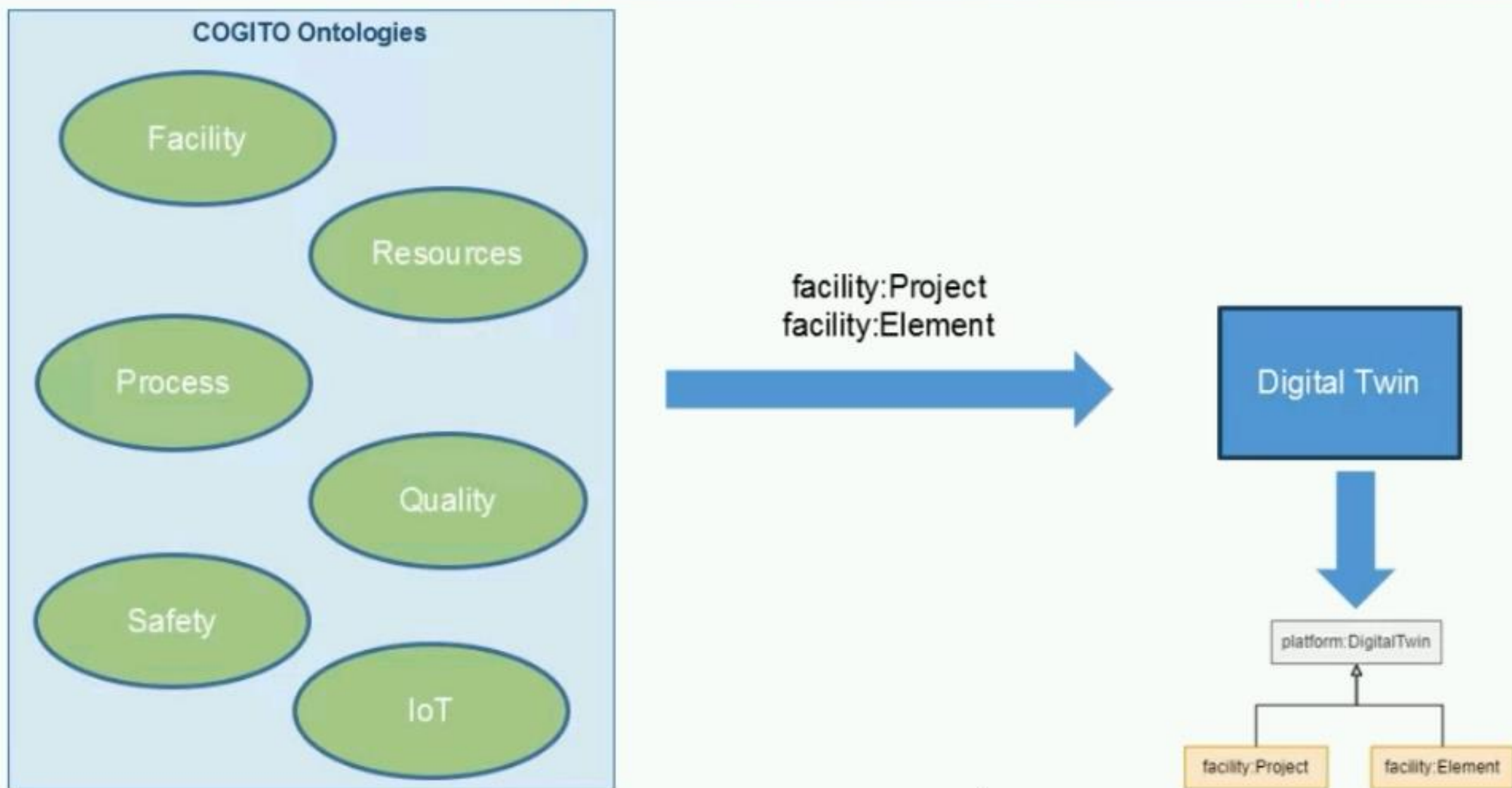
Semantic Interoperability in Digital Twins

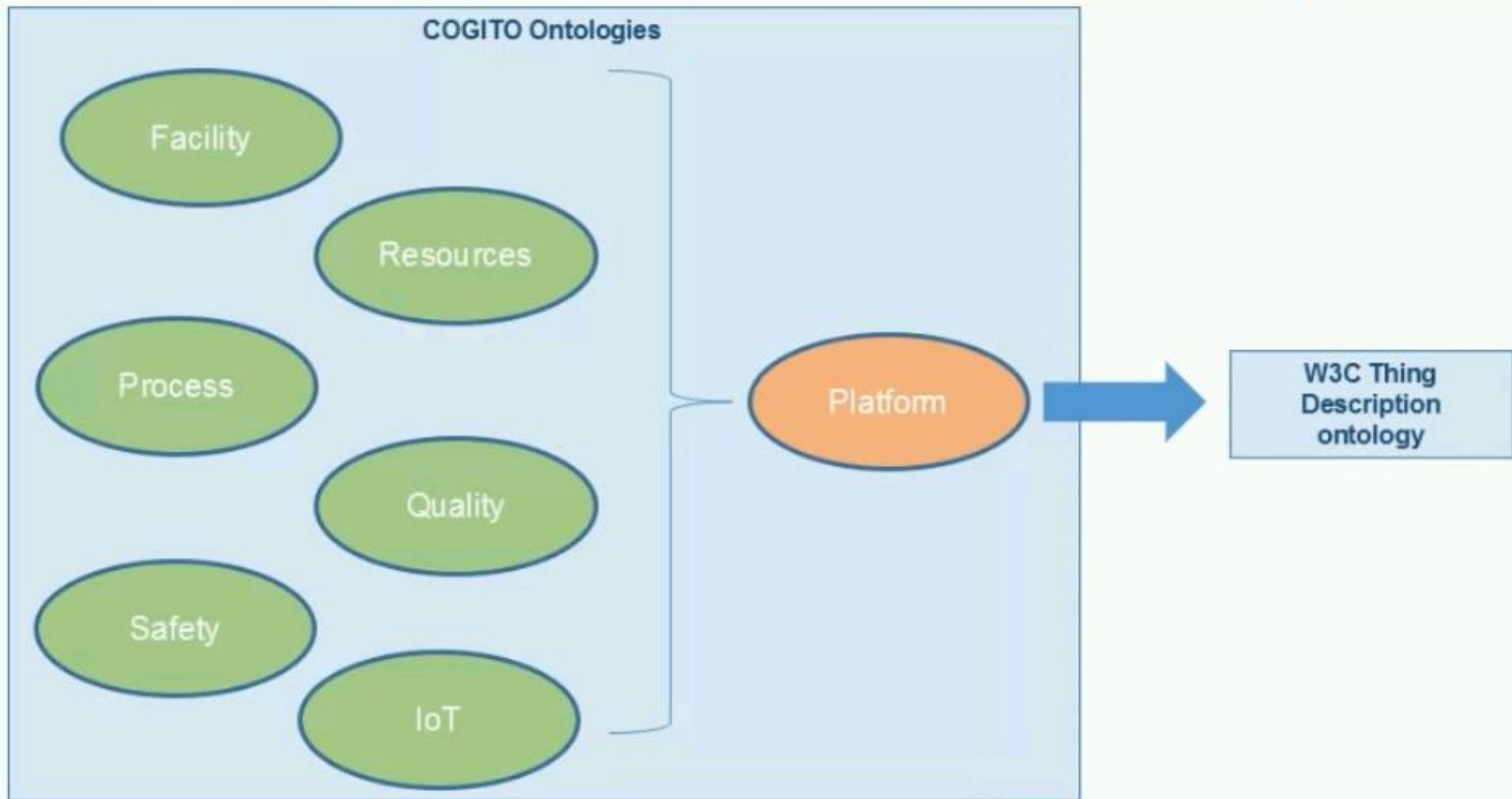


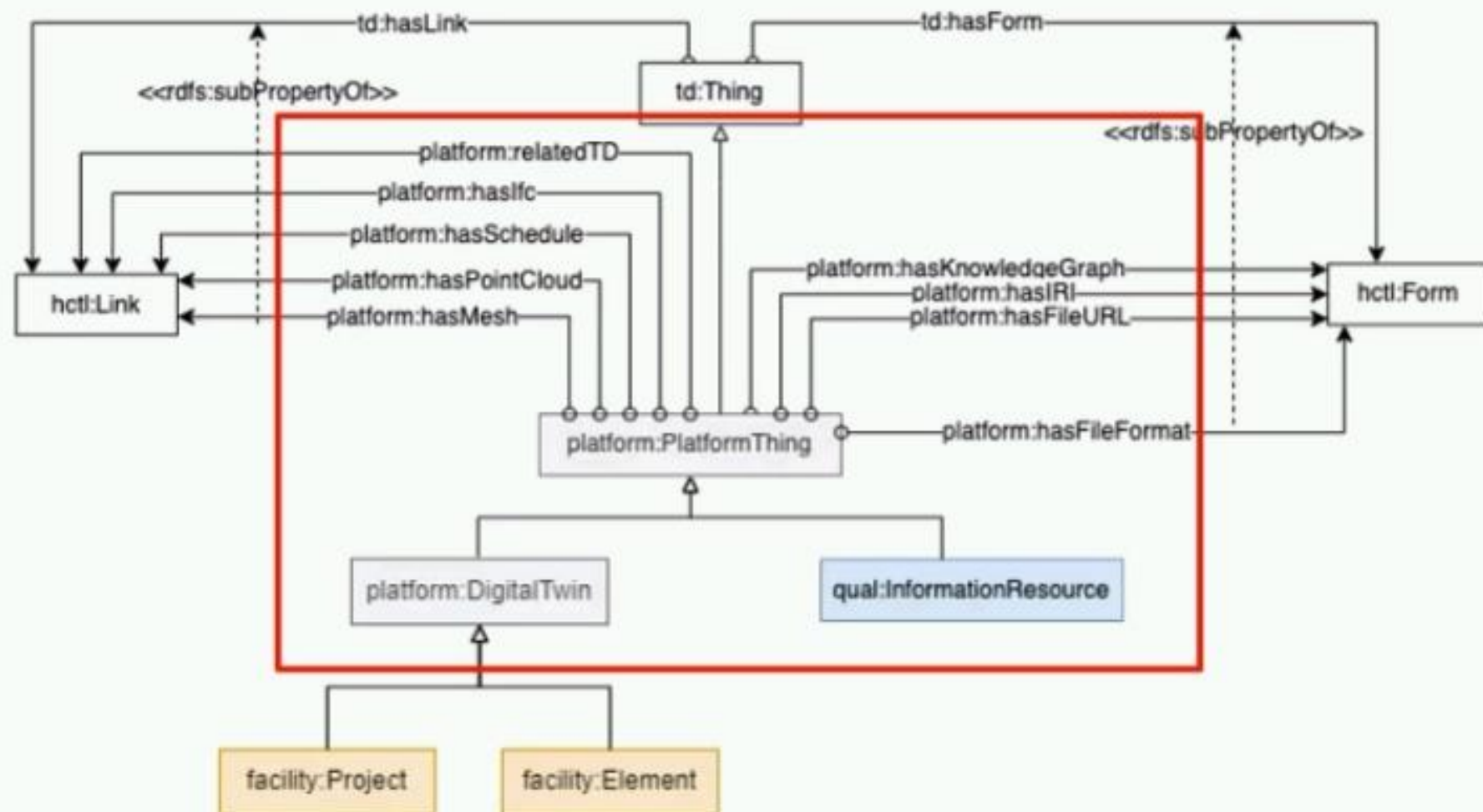
COGITO ontologies classes described as Digital Twins



COGITO ontologies classes described as Digital Twins

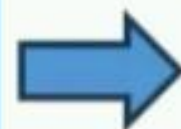








Triplestore DB
(Semantically Linked
Data; RDF)



Relational
DB
(Project Data)



Key-Value
DB
(IFC Data)



Timeseries
DB
(IoT Data)



BIM Data Post-processing Services

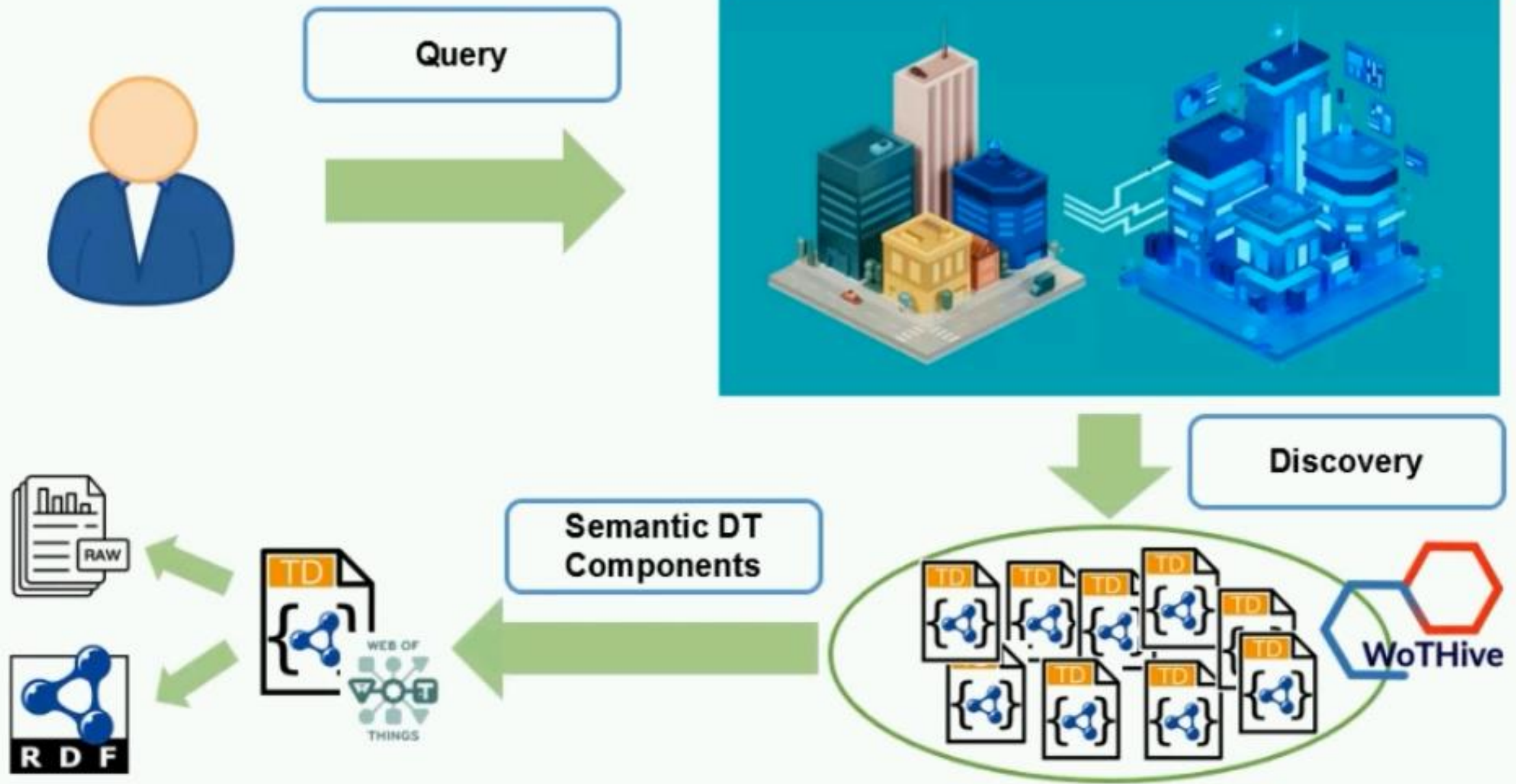


Extraction, Transformation &
Loading Services



Data Management Services

COGITO Semantic Digital Twin backbone based on WoT



- Digital Twins have **lots of data** and has **to be handled**.
- The development of a **Semantic Digital Twin** allows the management of all data to be **semantically interoperable**.
- In order to **not lose the heterogeneous data** belonging to the main entities described as Digital Twins, a **WoT-based backbone** has been developed, allowing the **maintenance of the provenance** belonging to **all the data of the defined Digital Twin**.
- In addition, thanks to the **WoT layer** given by the Thing Descriptions, **discovery** can be performed in order to **obtain all the information concerning a particular Digital Twin** in a more straightforward form.

