OWL-T for a Semantic Description of IoT

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ADBIS 2020 - 25-27 August

Outline

1. Introduction
2. Related work
3. Contributions
4. Conclusion

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IoT Context & Challenges

Ever-growing number of things

Figure: Gartner estimation (2021): 20.8 Billion things

However, same challenging concerns as Web services technologies: description, discovery, composition, cognition, vetting, and many others.

⇒ **Importance of semantically describing things in preparation for their discovery and then, composition into complex business scenarios.**

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Related work on semantic IoT

Some approaches describe things for semantic interoperability

⇒ Necessary but not sufficient for service discovery and composition.

Others describe things for semantic discovery and composition

- Things as Services
- Things as Resources

⇒ Not exhaustive description of things

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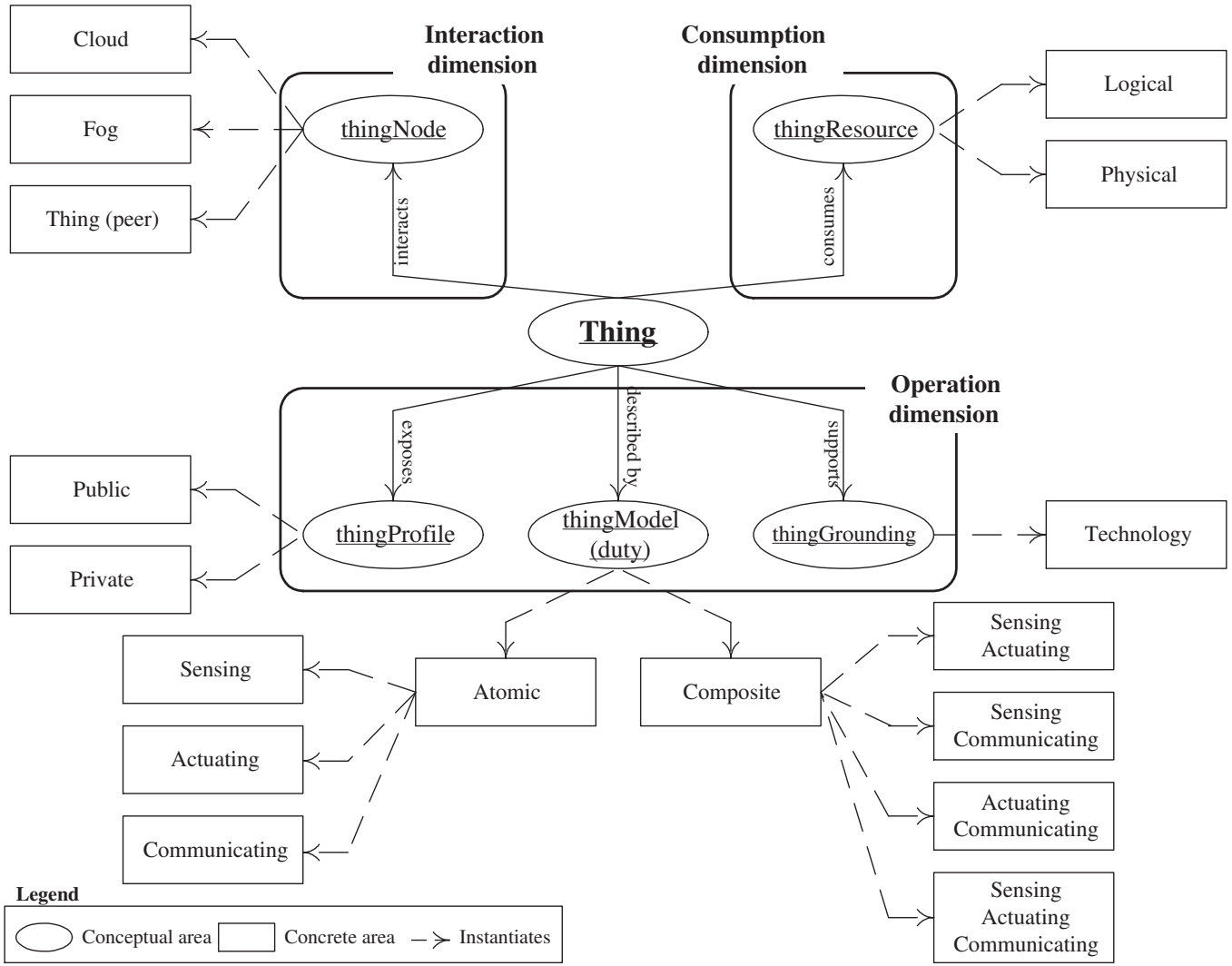
Contributions

Resort to the well-defined standard OWL-S (Ontology Web Language for Services) to develop our Ontology Web Language for Things (OWL-T).

- Semantic description of things from 3 dimensions: interaction, consumption, and operation
- Concepts to answer 5 questions related to thing discovery:
  1. with whom does a thing interact?
  2. what resources does a thing consume?
  3. what does a thing do?
  4. how does a thing work?
  5. how is a thing invoked?

OWL-T's Overview



Interaction dimension

Shed light on the stakeholders that form a thing's ecosystem and hence, will engage in interactions with the thing.

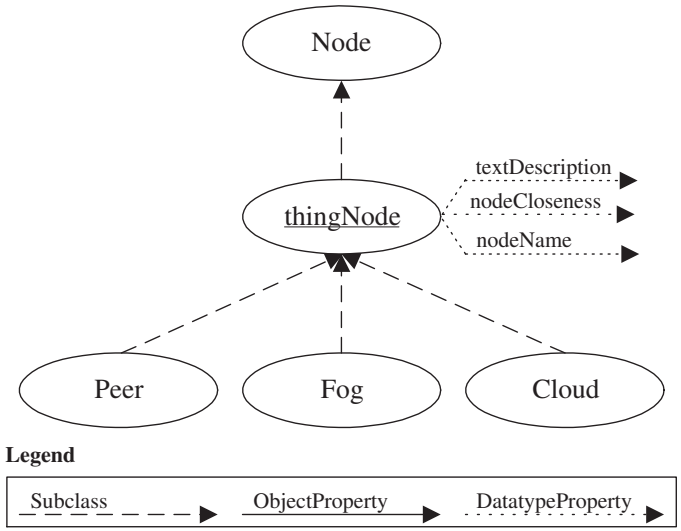


Figure: OWL-T interaction representation

Operation dimension

Shed light on the capabilities of a thing in terms of

- *What they do* - **thingModel** (duty)
- *How they do what they do* - **thingProfile**
- *How they are deployed* - **thingGrounding**

What are a thing's duties?

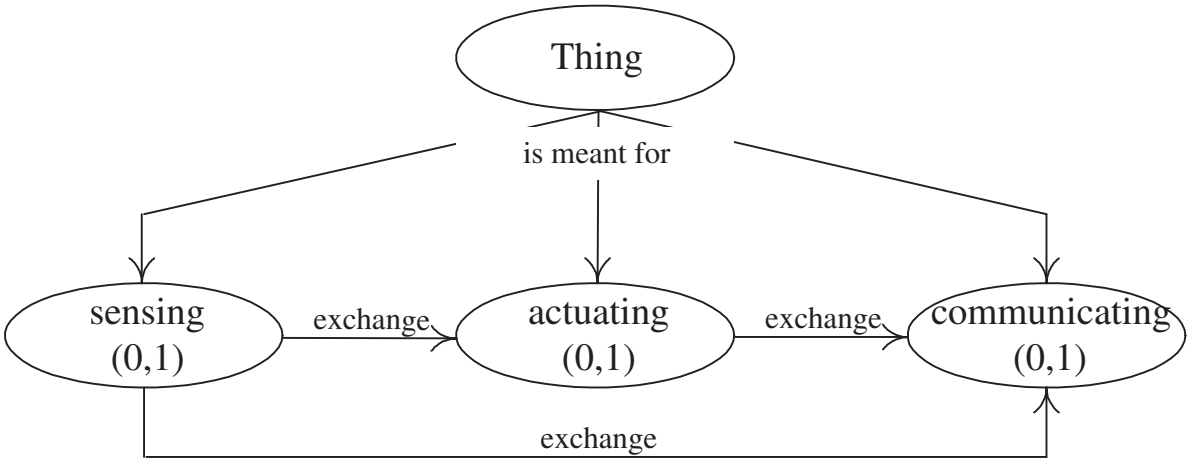


Figure: Representation of a thing's atomic duties

Operation dimension - Thing Model

What things do

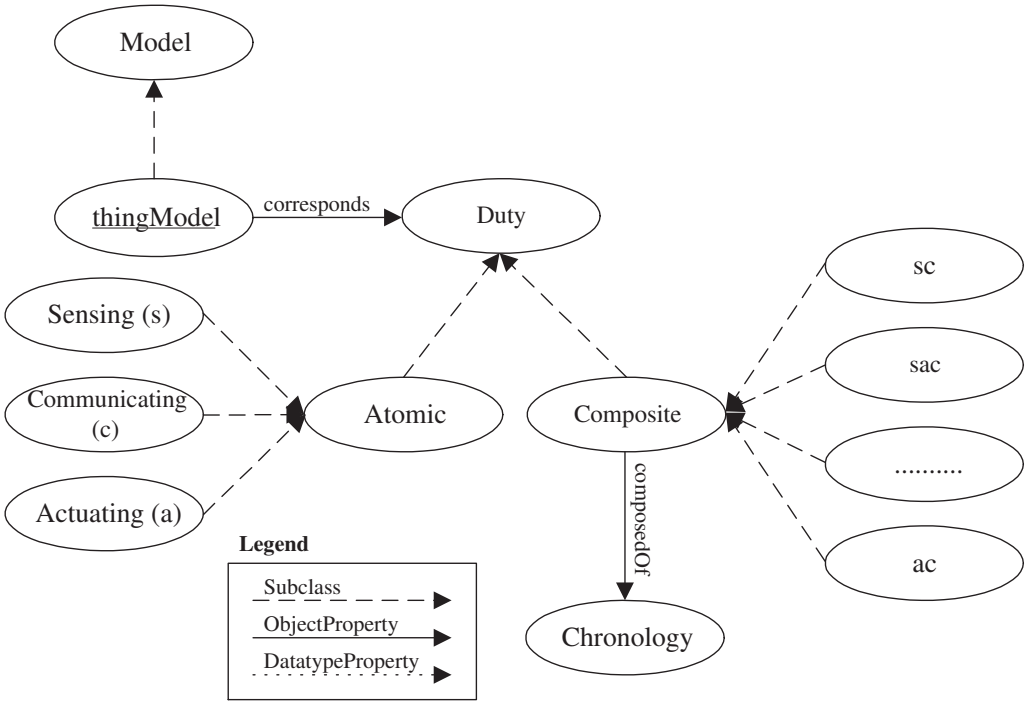


Figure: OWL-T model representation

Operation dimension - Thing Profile

How things do what they do

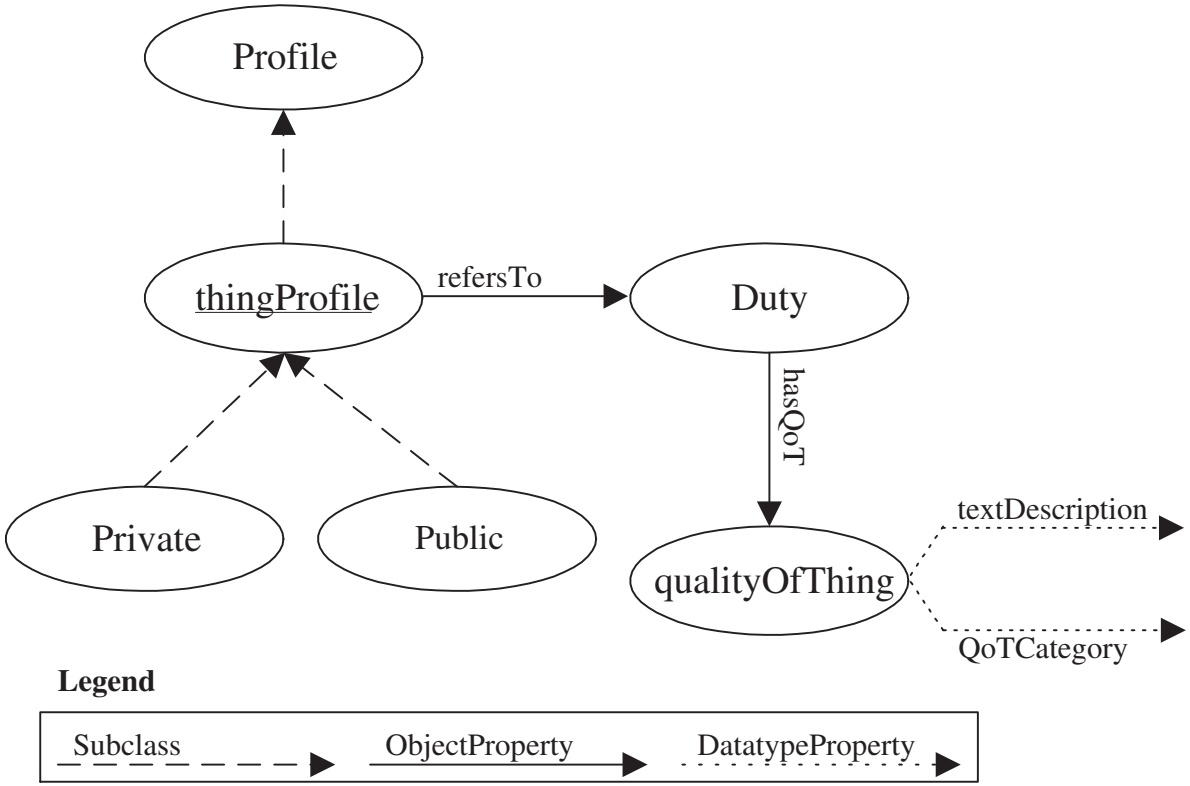


Figure: OWL-T profile representation

Operation dimension - Thing Grounding

How things are deployed

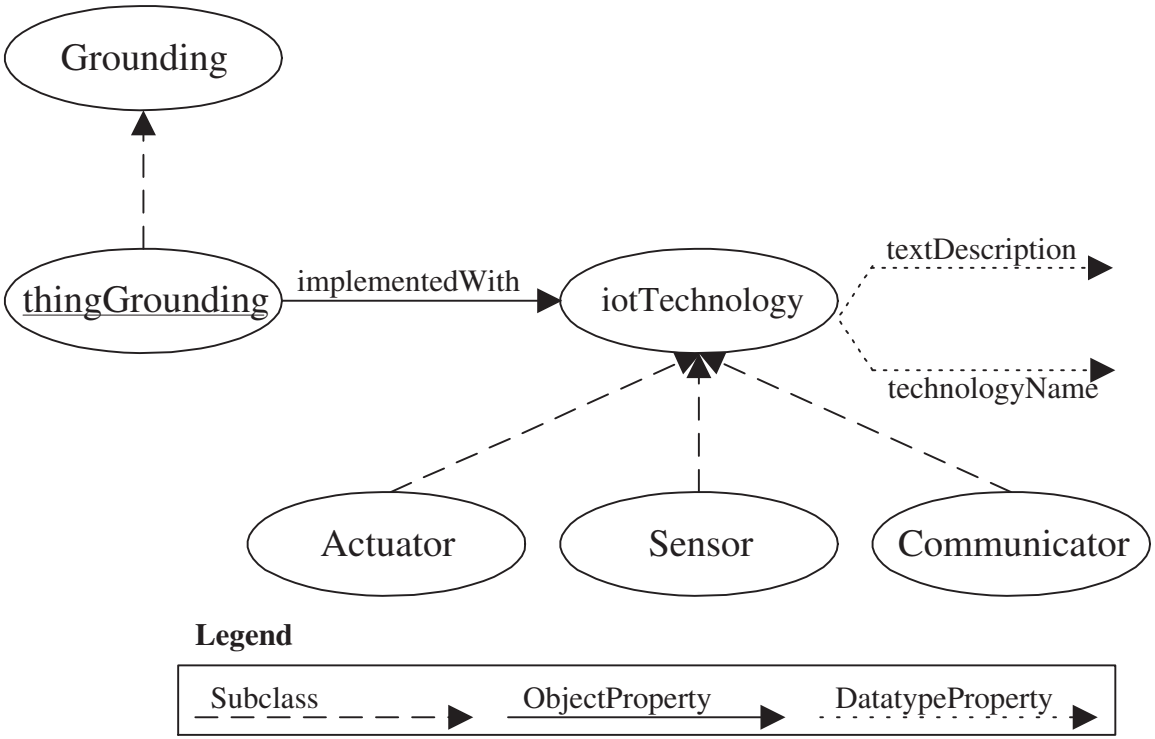


Figure: OWL-T grounding representation

Consumption dimension

Shed light on the resources that a thing requires so that the thing functions with respect to the respective needs of the interaction and operation dimensions.

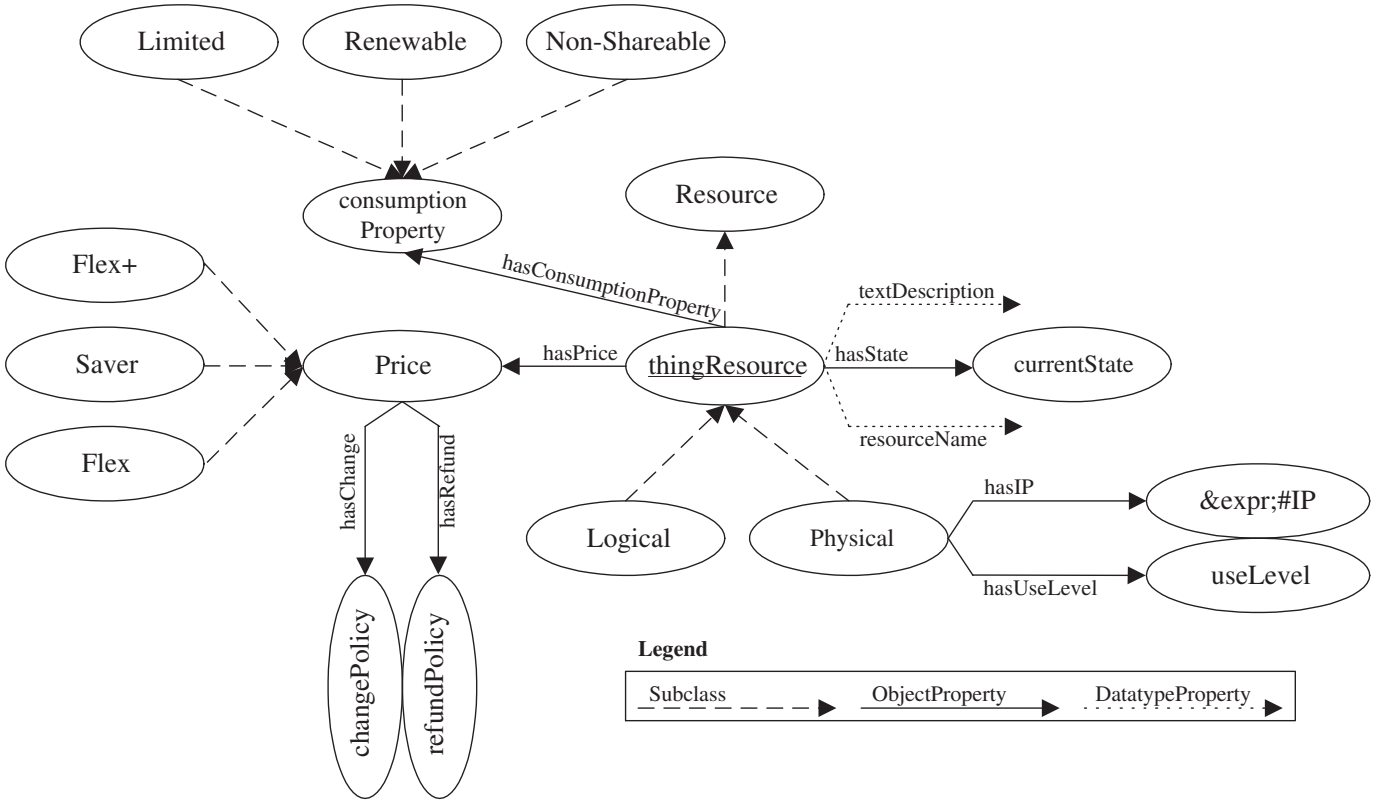


Figure: OWL-T consumption representation

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Conclusion

To sum-up

- A comprehensive description of things in terms of with whom they interact, what resources they consume, what they do, how they work, and how they are invoked.
- A novel ontology OWL-T to allow injecting semantics into IoT.

Future work

- Technically demonstrate OWL-T through a case study.
- Examine OWL-T-based thing composition in compliance with the interaction dimension.