UCL

DEPARTMENT OF CIVIL, ENVIRONMENTAL & GEOMATIC ENGINEERING

# Infrastructure Research Ontologies

DAFNI

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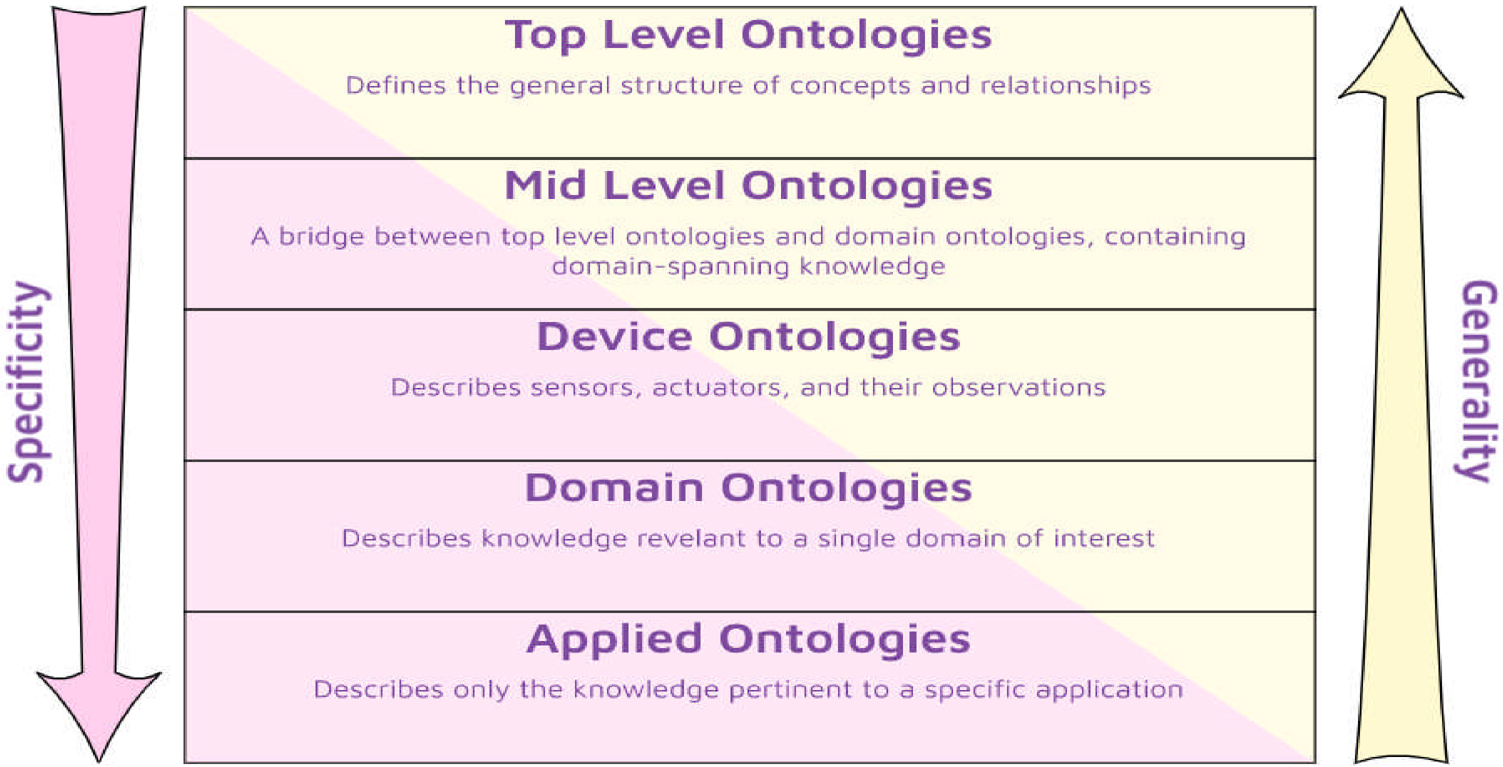
# Collaborative work on data and ontologies

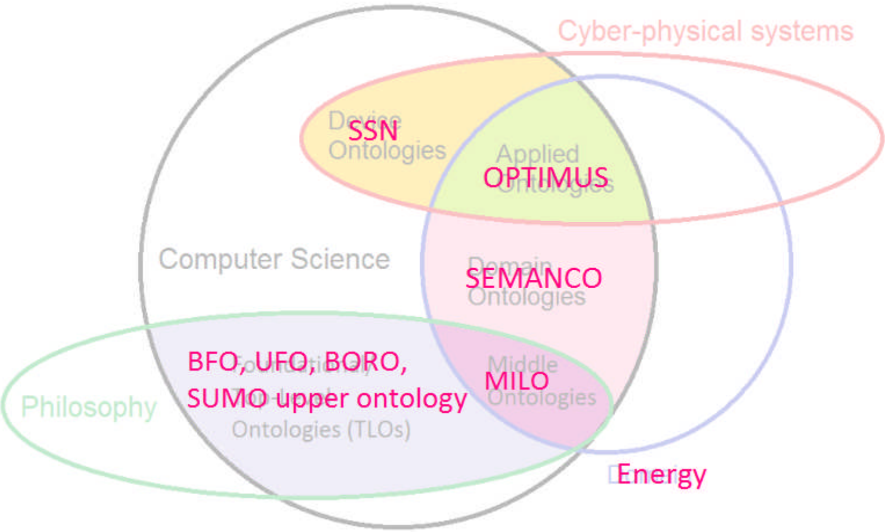
# Ontologies in infrastructure

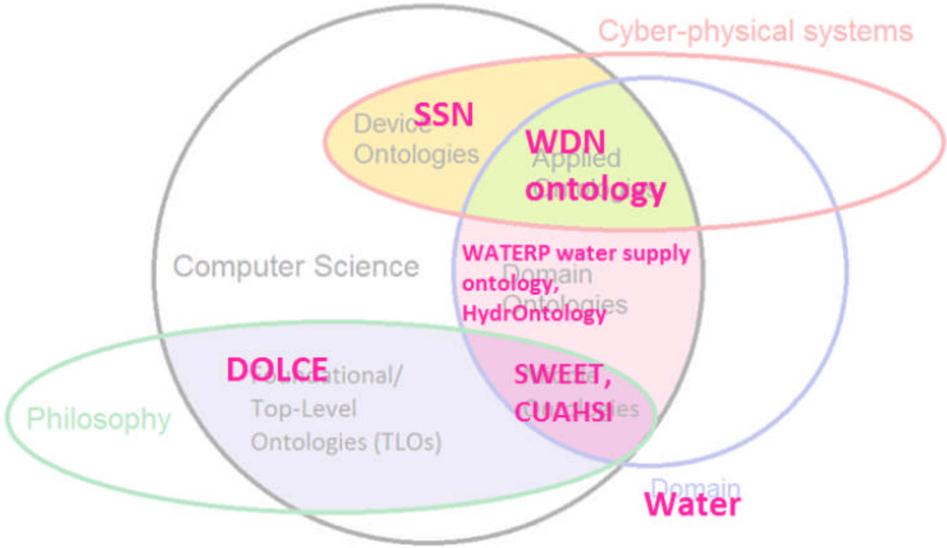
*The set of things whose existence is acknowledged by a particular theory or system of thought*" (Lowe, 1995)

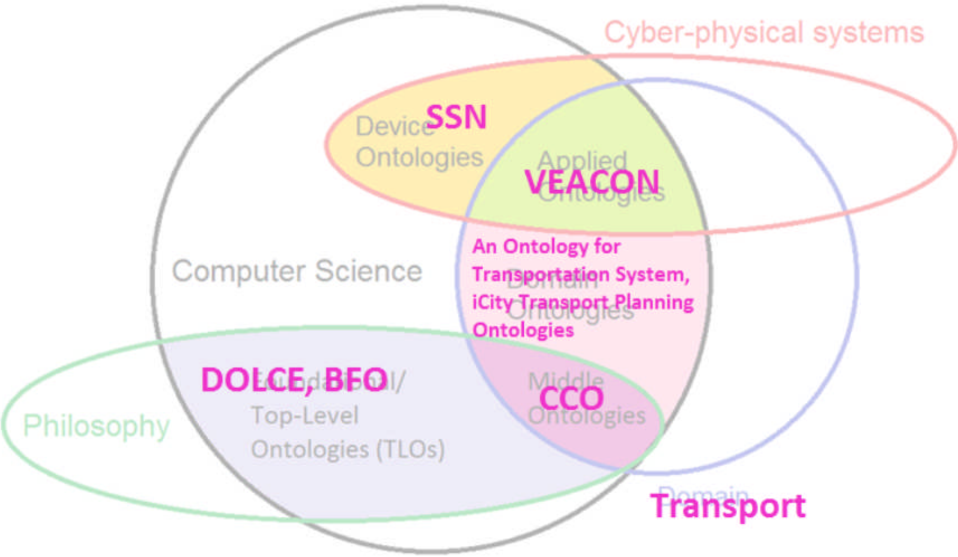
For reuse and interoperability, the **top categorical level** becomes particularly relevant as it helps to ensure semantic consistency and coherence.



# Literature review - sectoral analyses



# In practice

- All industrial sectors have some activity in ontological engineering
- Some city scale ontologies omit top level ontological 'things' so the use of mid level ontology should be avoided
- Use case for autonomous vehicles on smart motorways has a solution using the CDBB information management framework
- Interoperability is not aided by multiple top level ontologies (TLOs)
- Explicit ontological commitment (enabled by a TLO) is necessary for standardisation and enables *intentional* matching of ontologies and could be implemented by automated reasoning
- 4D industry data models could indicate how to create a top level ontology
- Organisations must invest in the whole life cost of innovation in information management, and develop their maturity to adopt and operate ontologies, technologies and devices
- Mechanisms to evolve, replace, retire and introduce novelty into ontologies are needed and must be baked into standards
- How we develop ontologies, what sources of knowledge we choose, how we interpret truth, must be in scope of ontology engineering

# Recommendations

- R1. Practice 'dog-fooding' (using ontologies ourselves) in particular on a cross-sector, cross-scale use case with industry input
- R2. Conduct explicit mapping of infrastructure use cases to ontological levels, scale, etc.
- R3. Consider explicitly defining geospatial schemes (e.g. NUTS) and semantic sensor network architectures for infrastructure models using digital twins
- R4. Do not attempt to convert legacy models for inclusion in an infrastructure ontology (instead focus on datasets that are input to the legacy models)
- R5. Do not accept data for sharing unless the ontology of the dataset is provided (or a method to reconcile the same things in different organisations is available)
- R6. Address some of the gaps in knowledge by providing information on known ontologies and digital twins
- R7. Align to the CDBB Top Level Ontology and Information Management Framework
- R8. Use 4D industry data models to inform a top level ontology
- R9. Support organisations to build their maturity to adopt and operate conceptualisations, technologies and devices

# Next steps

- *Searchable repository and links*
- *Use case focussed demonstrator*
- *Build a network of collaborators*
- *Co-create new governance and business models: meso/mid level*
- *Journal paper*

See the report at https://dafni.ac.uk/dafni-champions-2-2/dafni-champions-infrastructure-research-ontologies-2/