

A roadmap toward a unified ontology for building service systems in the AECO Industry: TSO and FSO

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Challenge: Complexity management

Can these competency questions be answered?

- Which building service systems are in the project?
- How is the hierarchical subdivision of the service systems?
- How are these systems interconnected?
- How is the flow of matter, energy and data through these systems?



etc.



State of the Art

- Several ontologies have been developed to improve interoperability within the AECO industry.
- Ontologies related to building service systems are among others:
 - ifcOWL
 - REC
 - BRICK
 - SAREF
 - SEAS
 - FSO
 - TSO

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• All of them consist of hierarchical, structrual and functional concepts



Main Concepts – TSO v0.3.0

A tso:System is a model of a whole which is isolated from the world or a supersystem, which may consists of interconnected components or sub-systems and has attributes such as inputs, outputs and states.





Main Concepts – FSO v0.1.0

A fso:System is defined as a collection of components that can have attributes such as design properties attached to it.

fso:Components are tangible components that participate in the flow of energy or matter.







Application example

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Hierachical concept – Terminology





Topological concept – Terminology



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Topological concept – Application Example



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Functional concept – Terminology





Functional concept – Application Example





BS-Visualizer (<u>https://bs-visualizer.web.app</u>)





Alignment

Alignment between FSO v0.1.0 and TSO v0.3.0

FSO		TSO
fso:System	rdfs:subClassOf	tso:System
fso:DistributionSystem	owl:equivalentClass	tso:DistributionSystem
fso:SupplySystem	owl:equivalentClass	tso:SupplySystem
fso:ReturnSystem	owl:equivalentClass	tso:ReturnSystem
fso:Component	owl:equivalentClass	tso:Component
fso:isSubSystemOf	rdfs:subPropertyOf	tso:subSystemOf
fso:isComponentOf	rdfs:subPropertyOf	tso:subSystemOf
fso:hasSubSystem	rdfs:subPropertyOf	tso:hasSubSystem
fso:hasComponent	rdfs:subPropertyOf	tso:hasSubSystem
fso:connectedWith	owl:equivalentProperty	tso:connects



Roadmap toward a unified ontology

- Expressiveness vs. Simplicity/Useability
- Proposal of a modular structure
- Lightweight core module contains top level hierarchical, topological, and functional aspects, which are valid for all disciplines
- Further hierarchical, topological, and functional aspects which are valid for all disciplines be defined in a hierarchical, topological and functional ontology pattern
- Classifications of systems and concepts which are necessary to describe specific aspects of disciplines are defined in separate domain ontologies
- Building Service Systems Ontology BOS



Roadmap toward a unified ontology





Conclusion & Future Work

- The structured comparison of the two ontologies highlighting their respective strengths and weaknesses
- TSO (<u>https://w3id.org/tso#</u>) has a strong scientific backgroud and a high expressiveness
- FSO (<u>https://w3id.org/fso#</u>) has a strong practical background and a high simplicity
- TSO and FSO as starting points for the unified "shared" conceptualization BOS
- Discuss concepts in the W3C LBDCG and with stakeholders from ontologies such as SEAS, SAREF, BRICK, REC and ifcOWL





