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LiRoT: A lightweight incremental reasoner for the Web of Things

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CoSWoT
- Platform for the WoT
- Use Semantic Web technologies (ontologies, reasoning)
- Constrained and heterogeneous devices
- Decentralized architecture
- Applications in smart building and agriculture

Challenges and hypotheses
- Traditional reasoners are built for desktop computers or servers
- Targeted platforms are more constrained (desktop computer: ≈ 10GB RAM vs. ESP32: 320KB SRAM)

→ Reduce reasoning memory footprint
- Small datasets (≈ 1000 explicit facts)
- Dynamic data → incremental reasoning

Conclusions
- Optimizing RETE reduces the memory footprint significantly
- On laptop and with small datasets (scope of CoSWoT), LiRoT performs better than Jena and RDFox
- LiRoT is the only reasoner to run on Arduino platforms

Future works
- Conversion of the algorithm to:
  - WASM for GPU
  - VHDL for FPGA

Publications and references
Do Arduinos dream of efficient reasoners?
Extended Semantic Web Conference 2022
A. Bento, L. Médini, K. Singh, F. Laforest

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Experimentations

Rule-based reasoning
- RDF data is stored in triples (e.g. coswot:Room1Thermometer1 rdf:type sosa:Sensor)
- Generic rules (multiple conditions with variables) are applied to explicit triples to derive new information (implicit triples). Example of a rule:

(\(?v\) owl:someValuesFrom \(?w\)) \(\land \) (\(?v\) owl:onProperty \(?p\)) \(\land \) (?u ?p ?x) \(\rightarrow \)
(\(?u\) rdf:type \(?v\))