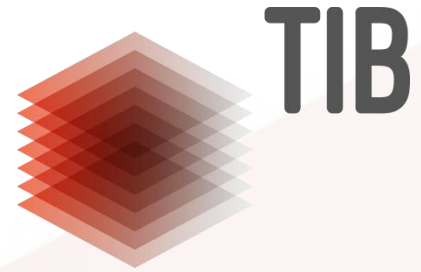LEIBNIZ INFORMATION CENTRE
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Ontology Mappings

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Content

- Motivation

- Definition

- Approach

- A short demo

- Reference

Motivation

Manufacturing process in industry 4.0 [1]:

- As an example Fischertechnik (FT) simulation production factory [1] is shown in Figure 1.

- An example of **integration and Interrelation** in manufacturing process (MP)
  - Bearing failure detection problem [1].
  - Faulty bearing should be replaced - not too early and not too late [1].
  - If this failure occurred unexpectedly then replacing parts (bearing) may not be available [1].
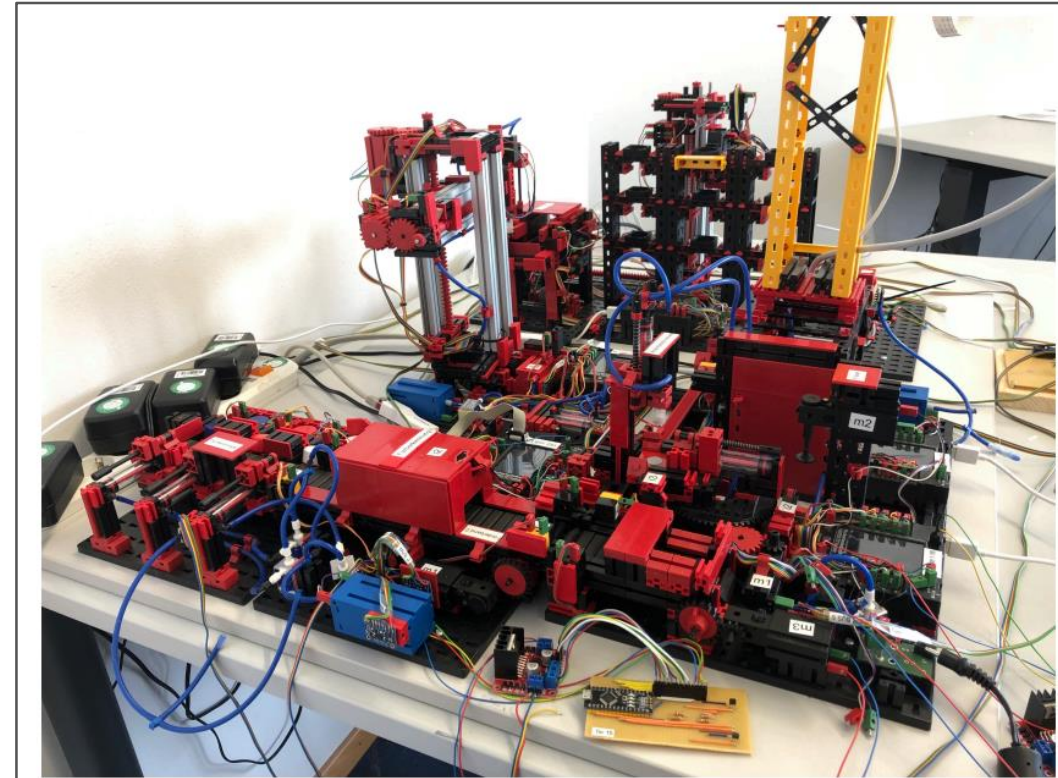

Figure 1. The FT Factory Simulation Model [1]

Motivation

- How ontologies can help in above use case?
    - Find similar machine or alternative routes to replace faulty parts [1].
    - To support employees to monitor MP [1].

- To address above use case solution is to **<u>align</u>** ontologies for manufacturing systems [1].
    - Fischertechnik (FT) simulation production factory [1].
    - **FTOnto :** Domain Ontology for a FT Simulation Production Factory [1].

Definition

Definition: **Correspondence** (**mapping**) problem [2]

- Given two ontologies o1 and o2, **correspondence** is a tuple <id, e, e', r, n> such that:
  - **id** is an identifier of the correspondence
  - **e** and **e'** are entities (classes, properties of the first and second ontology respectively)
  - **r** is a relation holding between e and e' such as equivalence, subsumption, disjointness
  - **n** is confidence measure between [0,1] holding for correspondence between e and e'.

- <u>**Alignment**</u> is a set of **correspondence** between entities belonging to the **matched** ontologies [2].
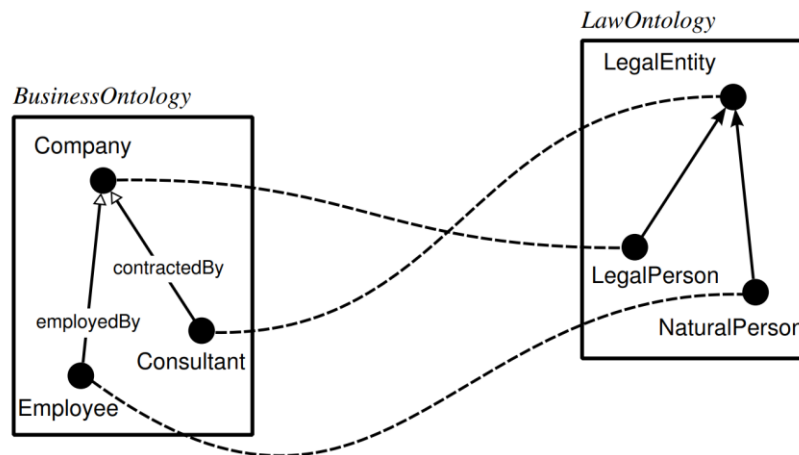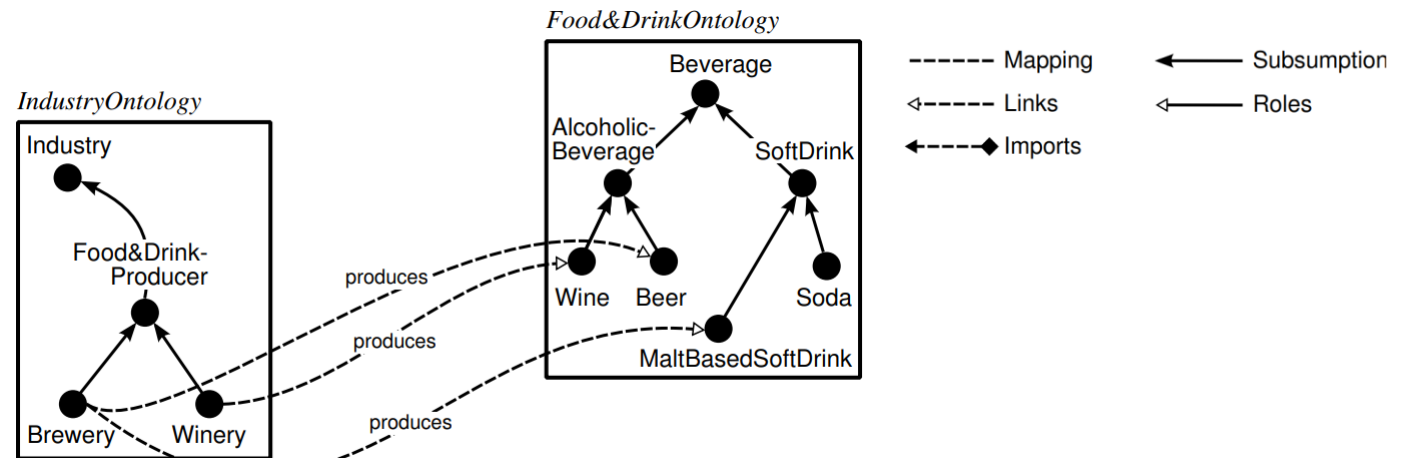

Figure 2. Ontology mapping [4]   Figure 3. Ontology linking [4]

Approach

Requirements for mappings:

- **Produce and display** mappings between ontologies

- **Validate** existing mapping using inference engine [3].

- **Repair** detected unsatisfiable classes in produced mappings [3].

A short demo

Reference

[1] Klein, P., Malburg, L. and Bergmann, R., 2019, September. FTOnto: A Domain Ontology for a Fischertechnik Simulation Production Factory by Reusing Existing Ontologies. In *LWDA* (pp. 253-264).

[2] Euzenat J, Meilicke C, Stuckenschmidt H, Shvaiko P, Trojahn C. Ontology alignment evaluation initiative: six years of experience. Journal on data semantics XV. 2011:158-92.

[3] Jiménez-Ruiz E, Cuenca Grau B. Logmap: Logic-based and scalable ontology matching. In The Semantic Web–ISWC 2011: 10th International Semantic Web Conference, Bonn, Germany, October 23-27, 2011, Proceedings, Part I 10 2011 (pp. 273-288). Springer Berlin Heidelberg.

[4] Homola M, Serafini L. Towards formal comparison of ontology linking, mapping and importing. InProcs. of the 23rd International Workshop on Description Logics (DL2010) 2010 (Vol. 573).

THANK YOU

QUESTIONS!