UNIVERSITY OF AMSTERDAM

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Literature Study Presentation

The Semantic Web Status

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Outline

- Research Questions
- Semantic Web In the 2000s
- Web 3.0 In the 2020s
- Linked Data Semantic Integration
- Future Trend
- Conclusion
- Discussion

Research Questions

RQ1: What is the current status of the Semantic Web in applications?

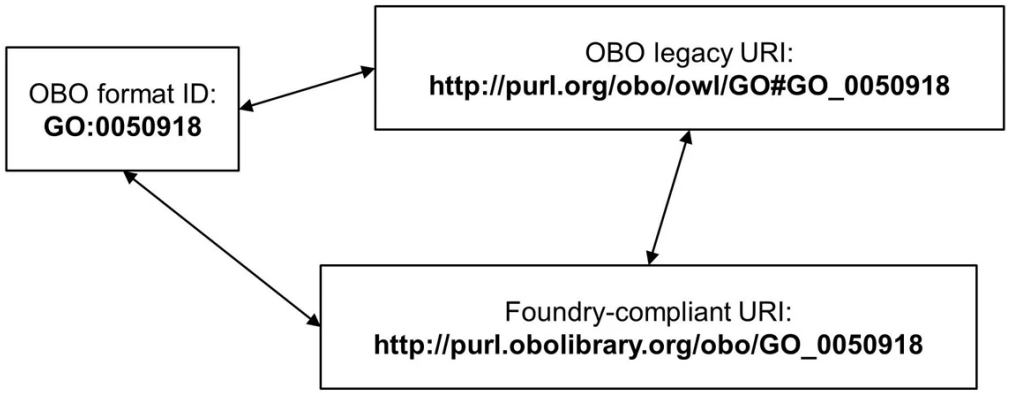
RQ2: How Linked Data organizes information on the Semantic Web?

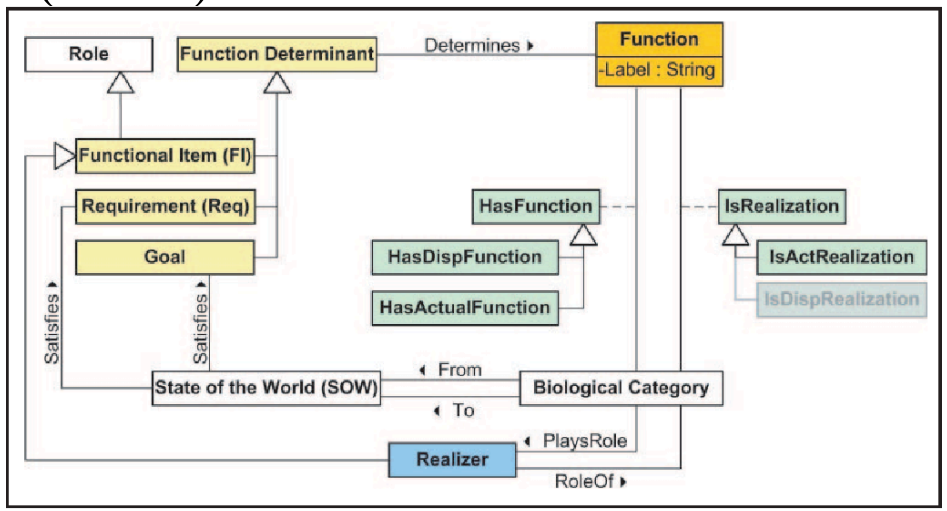
RQ3: What is the challenges in widely using the Semantic Web in enterprise?

Semantic Web In the 2000s – 1/2

Requirement

- Integration of knowledge
- Ontologies
- Open Biological and Biomedical Ontologies (OBO)





Burek, Patryk et al. "A top-level ontology of functions and its application in the Open Biomedical Ontologies." *Bioinformatics* 22 14 (2006): e66-73 .
Tirmizi, S.H., Aitken, S., Moreira, D.A. et al. Mapping between the OBO and OWL ontology languages. J Biomed Semant 2, S3 (2011). https://doi.org/10.1186/2041-1480-2-S1-S3

Semantic Web In the 2000s – 2/2

Knowledge Representation

- Resource Description Framework (RDF)
- Web Ontology Language (OWL)

```
# A DBpedia SPARQL query for finding all cities with a population exceeding 5 million
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
PREFIX dbpedia: <http://dbpedia.org/resource>
PREFIX dbpprop: <http://dbpedia.org/property>
SELECT DISTINCT ?citylabel ?countrylabel ?pop
WHERE {
    ?city rdf:type dbpedia-owl:City.
    ?city rdfs:label ?citylabel.
    ?city dbpedia-owl:country ?country.
    ?country rdfs:label ?countrylabel.
    ?city dbpedia-owl:populationTotal ?pop .
    FILTER ( LANG(?countrylabel) = 'en' and LANG(?citylabel) = 'en' and ?pop>5000000)
}
```

An Example OWL ontology

```
<owl:Class rdf:ID="Person" />
<owl:Class rdf:ID="Man">
    <rdfs:subClassOf rdf:resource="#Person" />
    <owl:disjointWith rdf:resource="#Woman" />
</owl:Class>
<owl:Class rdf:ID="Woman">
    <rdfs:subClassOf rdf:resource="#Person" />
    <owl:disjointWith rdf:resource="#Man" />
</owl:Class>
<owl:Class rdf:ID="Father">
    <rdfs:subClassOf rdf:resource="Man" />
    <owl:Restriction owl:minCardinality="1">
        <owl:onProperty rdf:resource="#hasChild" />
    </owl:Restriction>
</owl:Class>
<owl:ObjectProperty rdf:ID="hasChild">
        <rdfs:domain rdf:resource="#Parent" />
        <rdfs:range rdf:resource="#Person" />
</owl:ObjectProperty>
```

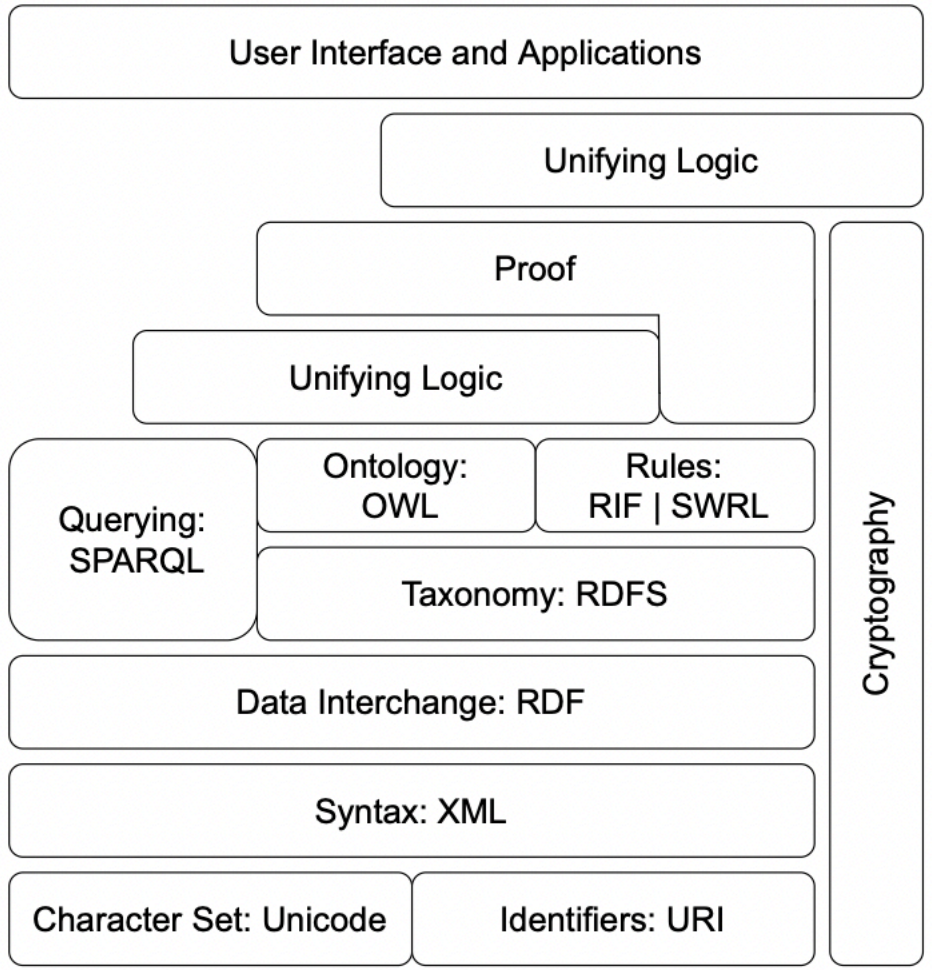
Sample Code https://devopedia.org/semantic-web#qst-ans-6

Ontology OWL Semantic Web Spring 2007 Computer Engineering https://slidetodoc.com/ontology-owl-semantic-web-spring-2007-computer-engineering/

Web 3.0 In the 2020s – 1/4

A Structural Model

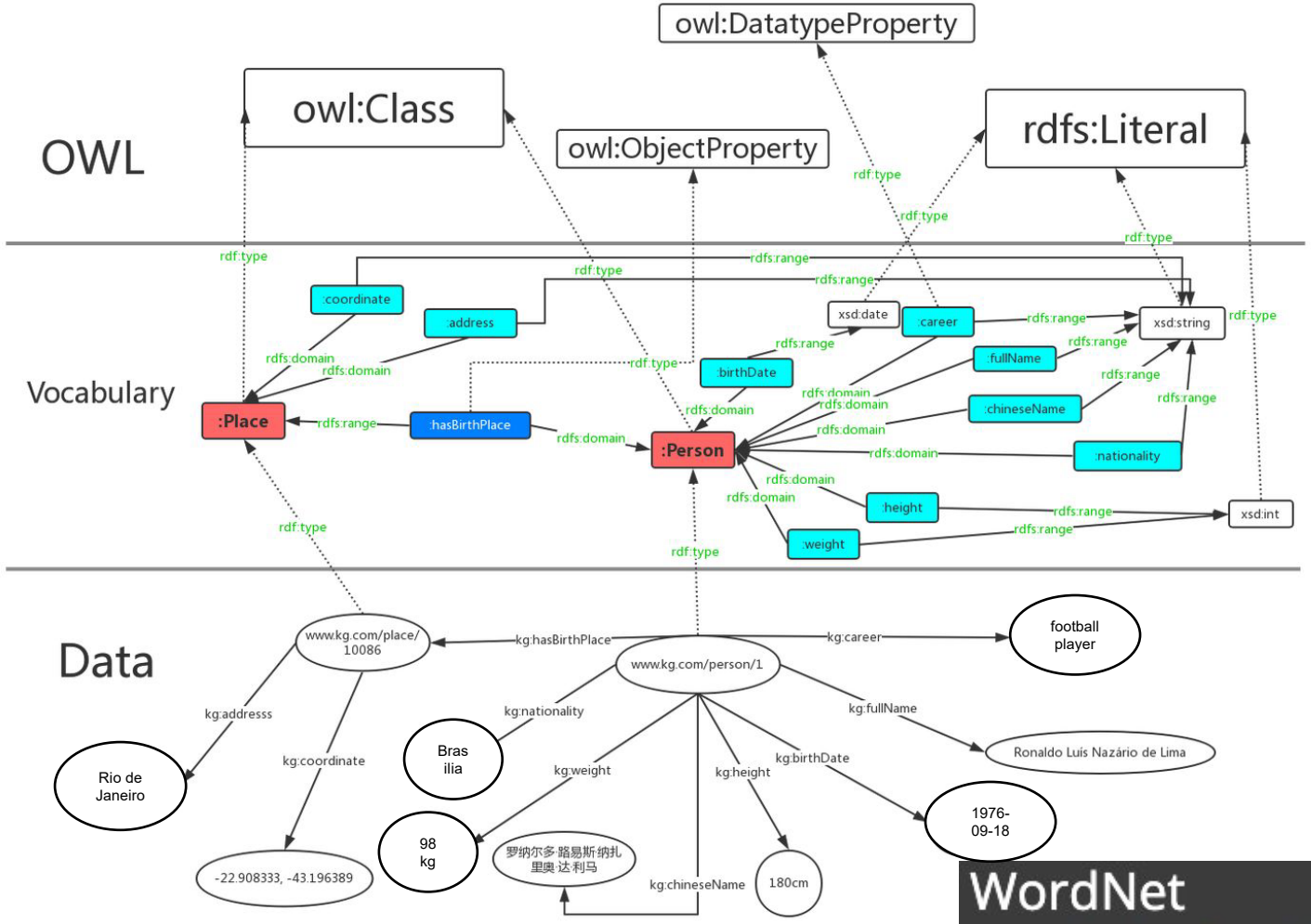
- Open Systems Interconnection (OSI) inspired
- Encapsulation and Layers
- Interact and Cooperate



Web 3.0 In the 2020s – 2/4

Metadata Registration

- Tagging: Subject indexing
- Taxonomy
- Ontology



WordNet
A Lexical Database for English

https://zhuanlan.zhihu.com/p/32122644

Web 3.0 In the 2020s – 3/4

Linked Data

- Simplistic, shallow representation
- Principles
  - URIs
  - HTTP
  - SPARQL
  - Links to other URIs
- Schema.org / Wikidata
- Shallow non-expressive schema

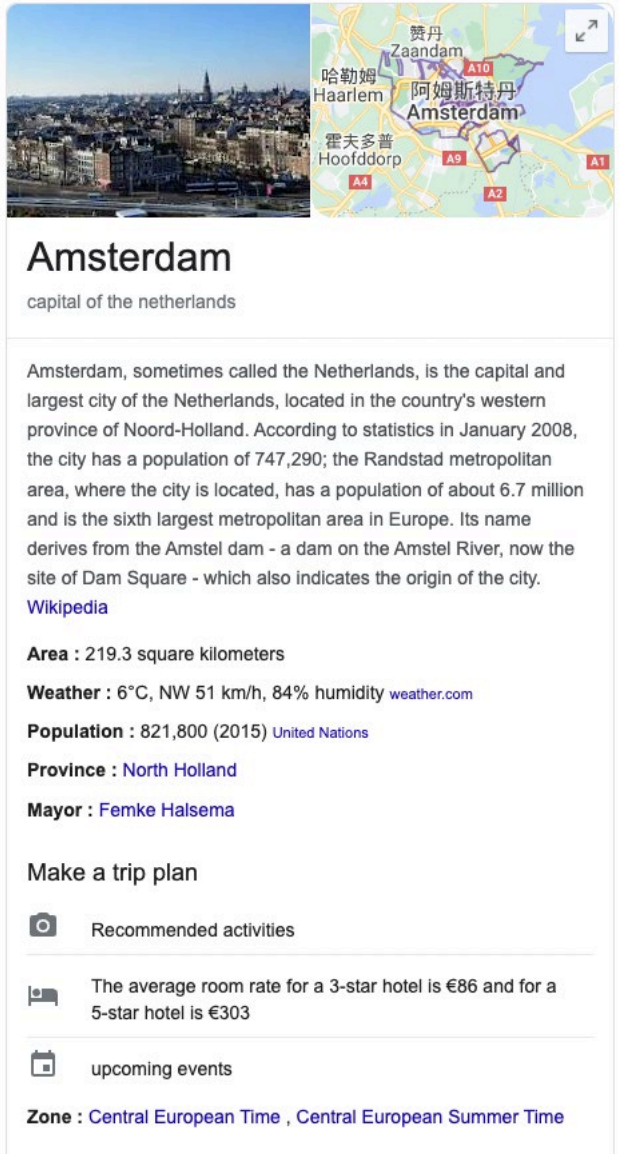
schema.org

WIKIDATA

Web 3.0 In the 2020s – 4/4

Knowledge Graphs

- Google
- Searching Amsterdam
- Apple Siri / Microsoft / Open Graph
- Research and Development

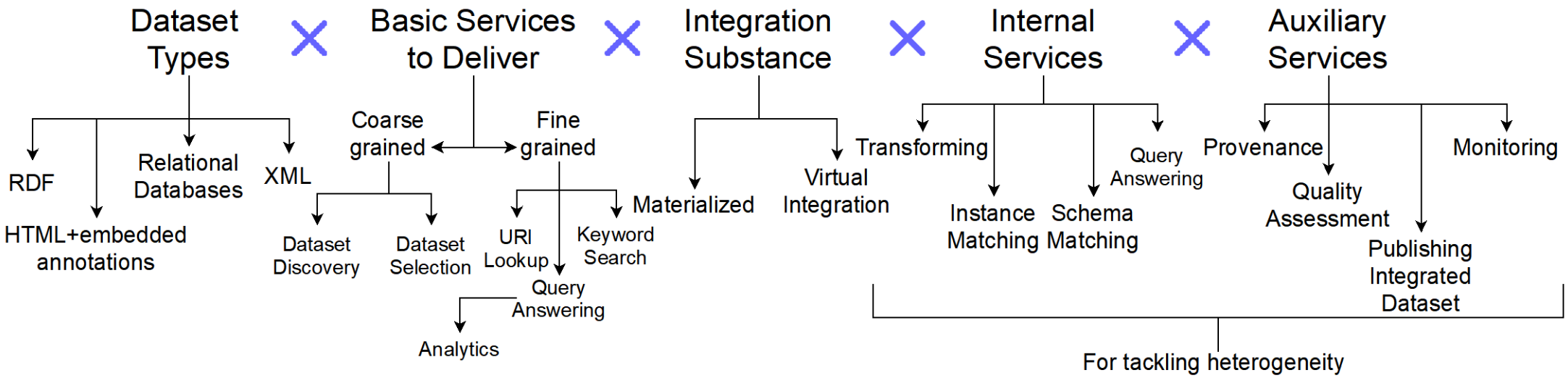


https://www.google.com/search?q=Amsterdam

Linked Data Semantic Integration – 1/4

Semantic Integration

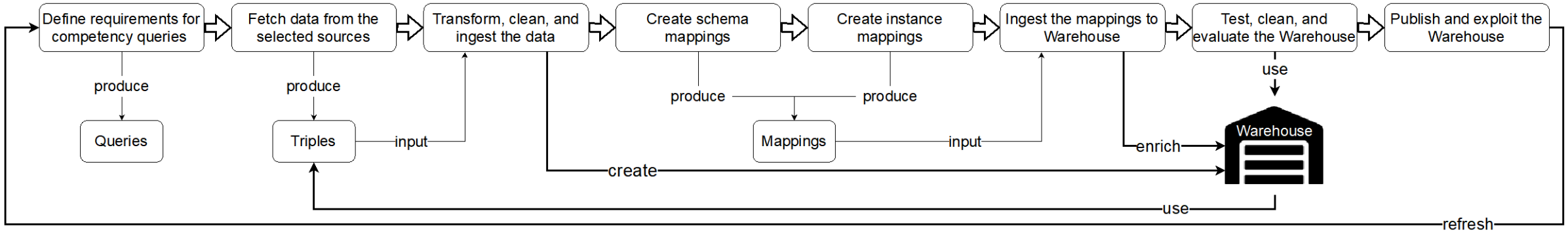
- Landscape overview



Linked Data Semantic Integration – 2/4

Internal Services

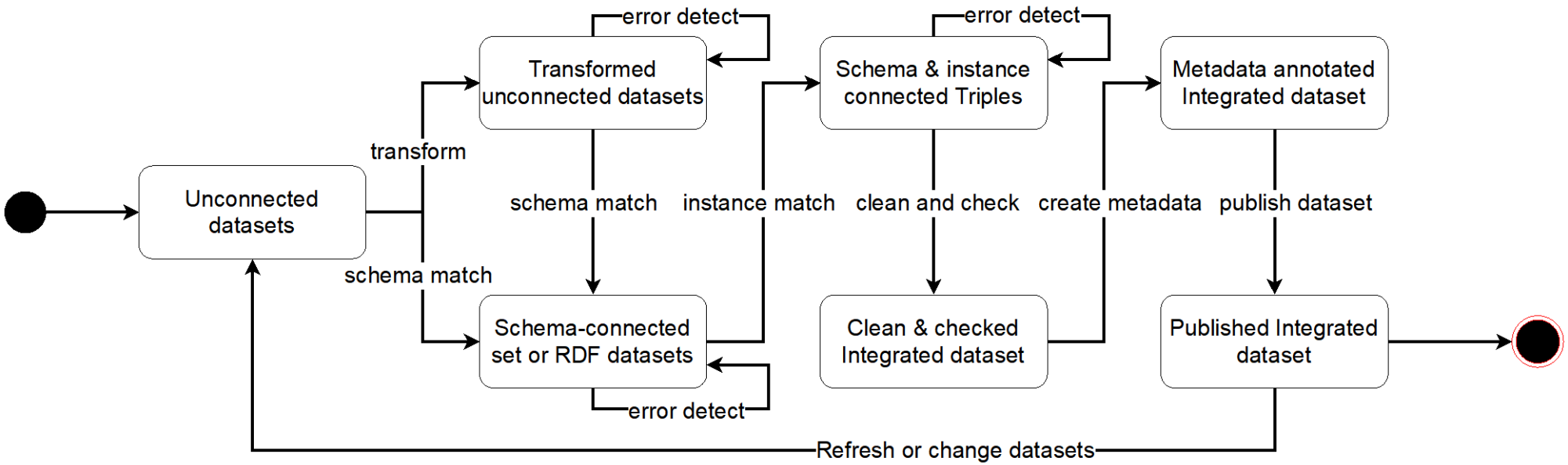
- Step 1: Top-level Ontology-based or Competency Query-based Integration



Linked Data Semantic Integration – 3/4

Internal Services

- Step 2: Automatic General Purpose Integration



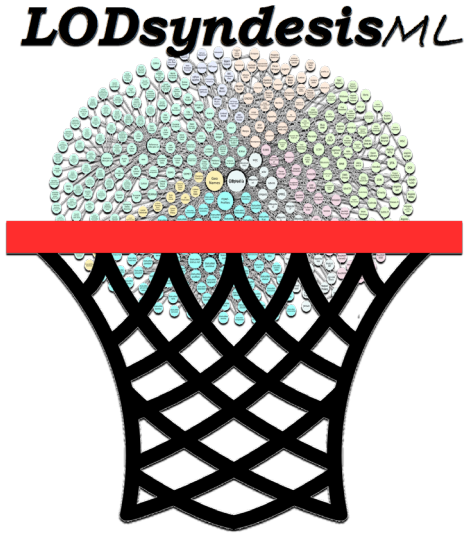
- Step 3: Composite Processes

Linked Data Semantic Integration – 4/4

Integration Tools

- MatWare

- LODsyndesis



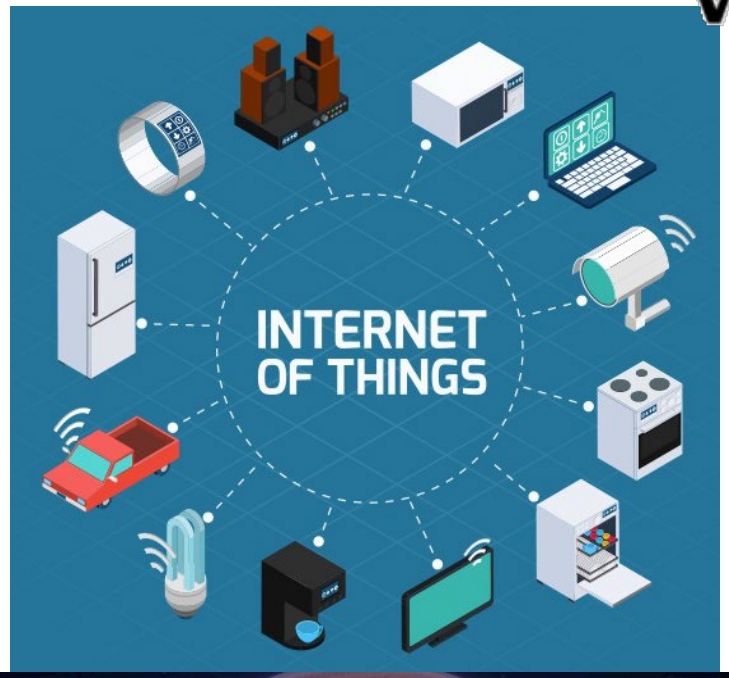
Future Trend

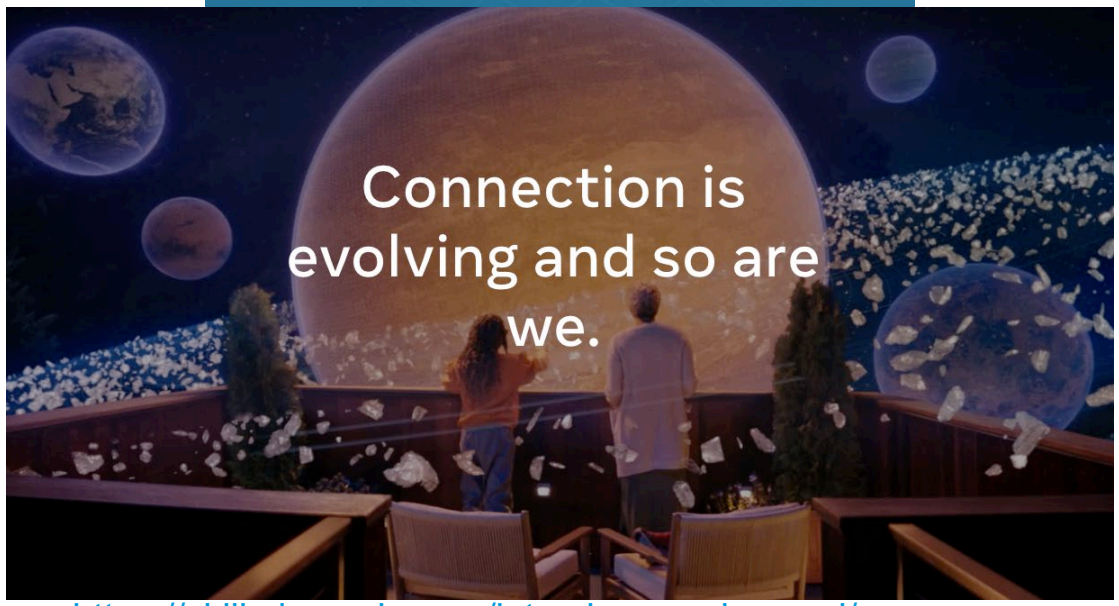
Improvement

- Natural Language Processing
- Machine Learning (Deep learning)
- Internet of Things(IoT)
- Ubiquitous Data Streams(UDS)

Challenges

- Large scale
- Automated process
- Virtual World





https://skillsdynamix.com/iot-using-raspberry-pi/
https://about.facebook.com/meta/

Conclusion

RQ1: What is the current status of the Semantic Web in applications?

- Information management: data sharing, discovery, integration, and reusing
- Mainstream in IT
- Applications

RQ2: How Linked Data organizes information on the Semantic Web?

- Five dimensions
- Integration substance
- Scale issue

RQ3: What is the challenges in widely using the Semantic Web in enterprise?

- Interdisciplinary issue
- Large-scale integration
- Manual operation

Discussion

The Next Step…

- Automated pipeline for Data Integration

- Semantic Artificial Intelligence (Semantic AI)

What is Semantic AI? The Fusion of Machine Learning and Knowledge Graphs https://www.poolparty.biz/semantic-ai/

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Thanks for Your Listening!

Question… ?

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