

Knowledge Graphs

Lecture Overview

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Knowledge Graphs

Information Service Engineering



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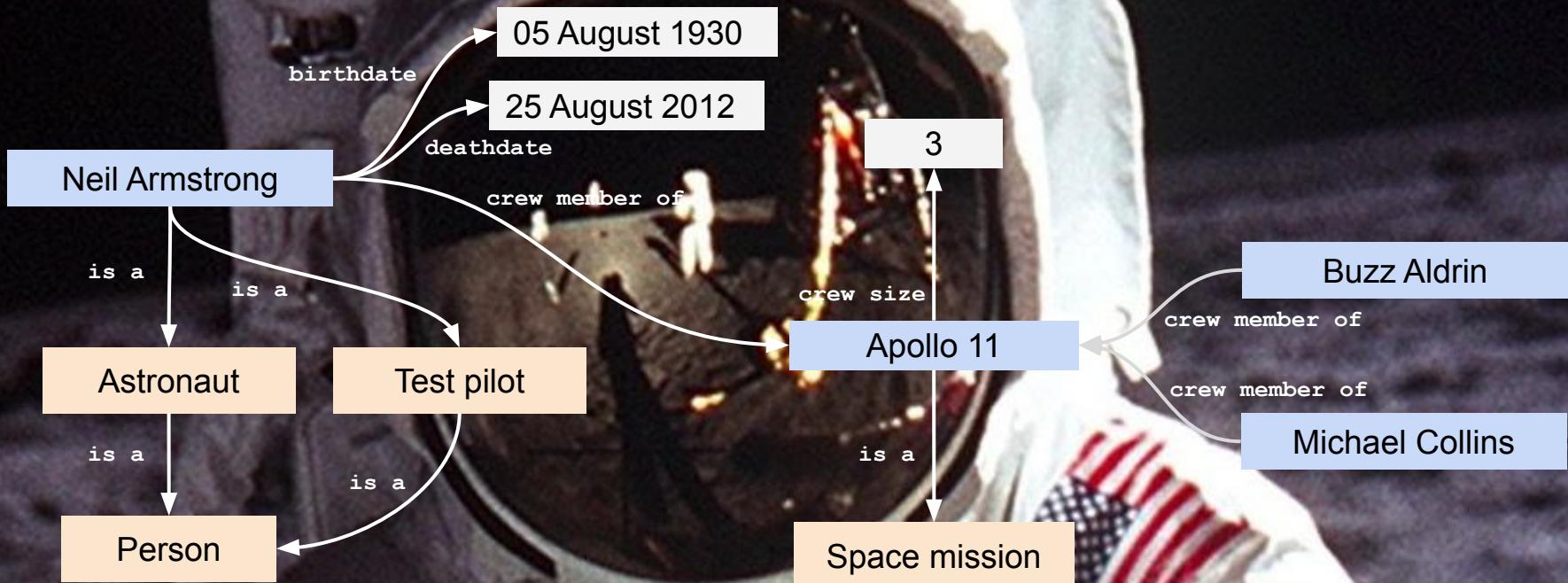
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<http://linkeddata.org/>

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Who is “Neil Armstrong”?



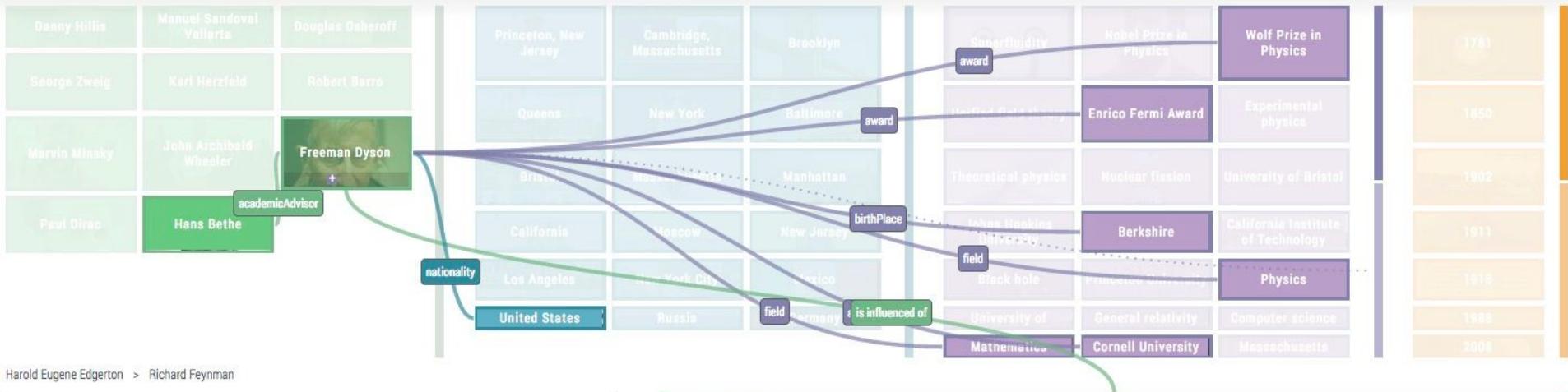
Knowledge Graph Applications

Innovative Information Systems



<http://scih.org/richard-feynman/>

Relation Browser Timeline



Harold Eugene Edgerton > Richard Feynman

15 Recommended Articles:

- #1 Frederick Reines And The Neutrino
- #2 Sin Itiro Tomonaga And Quantum Electrodynamics
- #3 Felix Bloch And The Nuclear Magnetic Resonance Method
- #4 George Gamow And His Fundamental Views On The Foundations Of Science
- #5 Robert Mulliken And The Molecular Orbitals
- #6 Hans Bethe And The Energy Of The Stars

Richard Feynman



Richard Phillips Feynman (/fɛɪnmən/; May 11, 1918 – February 15, 1988) was an American theoretical physicist known for his work in the path integral formulation of quantum mechanics, the theory of quantum electrodynamics, and the physics of the superfluidity of supercooled liquid helium, as well as in particle physics (he proposed the parton model). For his contributions to the development of quantum electrodynamics, Feynman, jointly with Julian Schwinger and Sin-Itiro Tomonaga, received the Nobel Prize in Physics in 1965. He developed a widely used pictorial representation scheme for the mathematical expressions governing the behavior of subatomic particles, which later became known as Feynman diagrams. During his lifetime, Feynman became one of the best-known scientists in the world. In a 1999 poll of 130 leading physicists worldwide by the British journal DBpedia: Richard Feynman



The Semantic Web Technology Stack (not a piece of cake...)

Most apps use only a subset of the stack

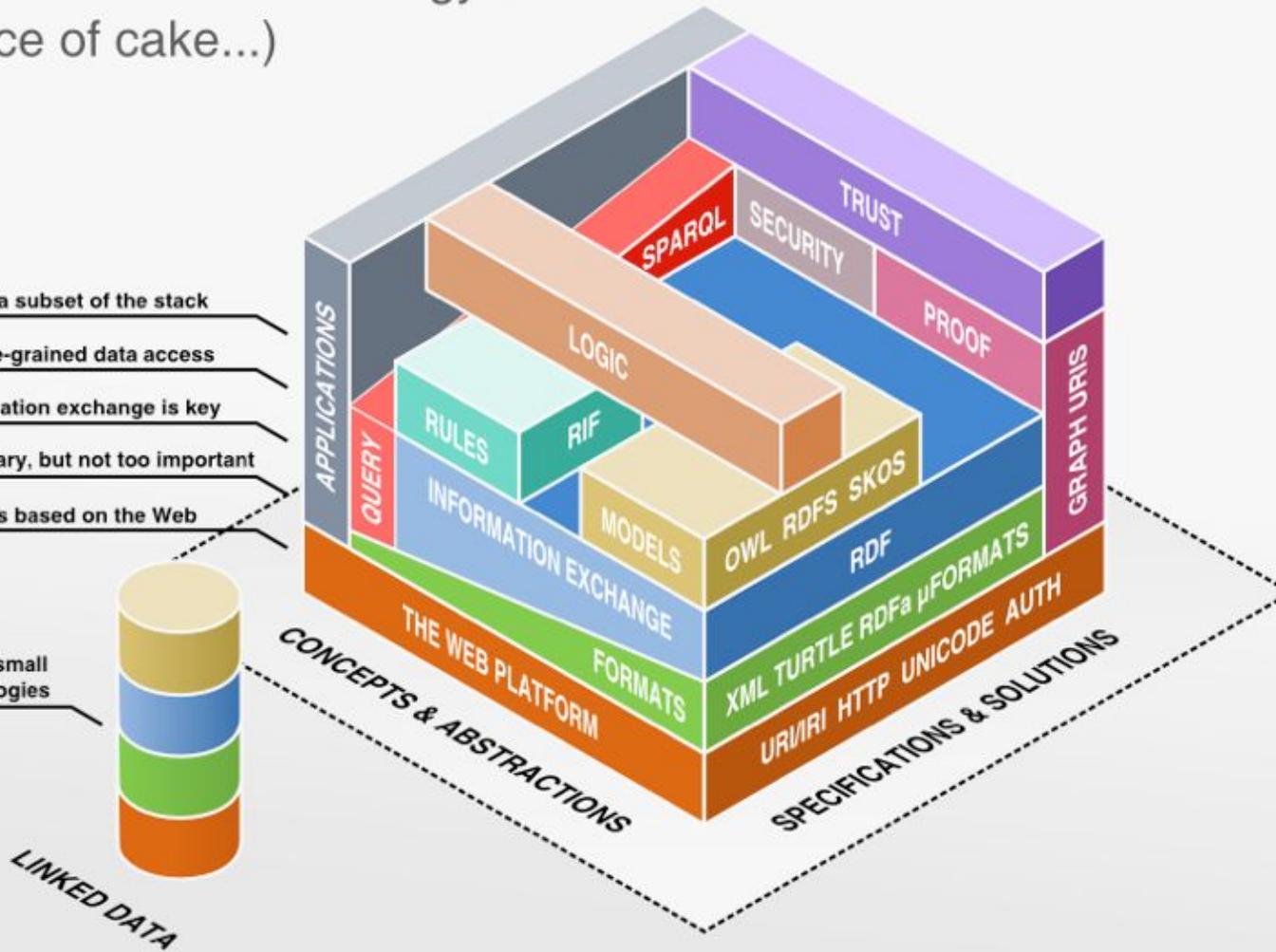
Querying allows fine-grained data access

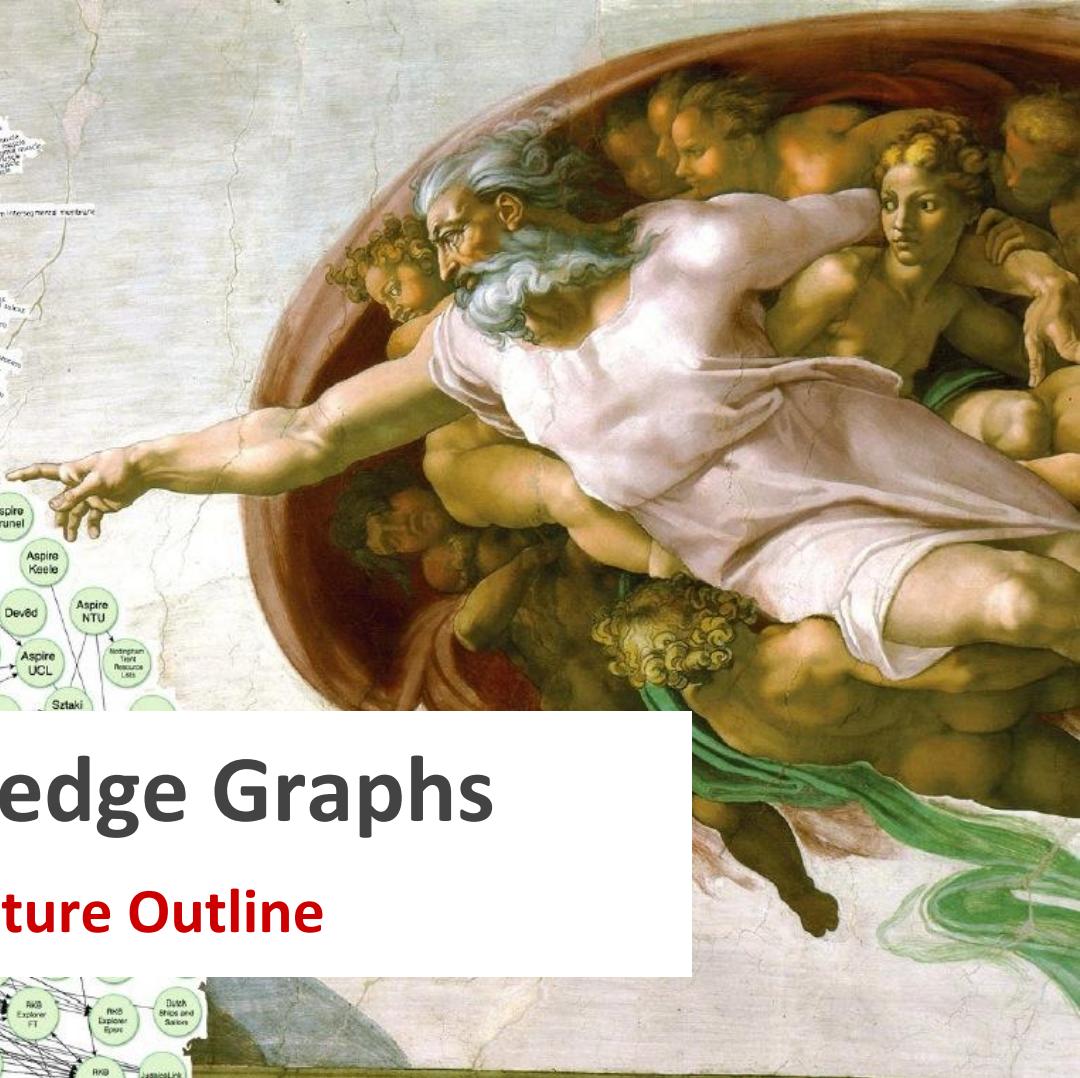
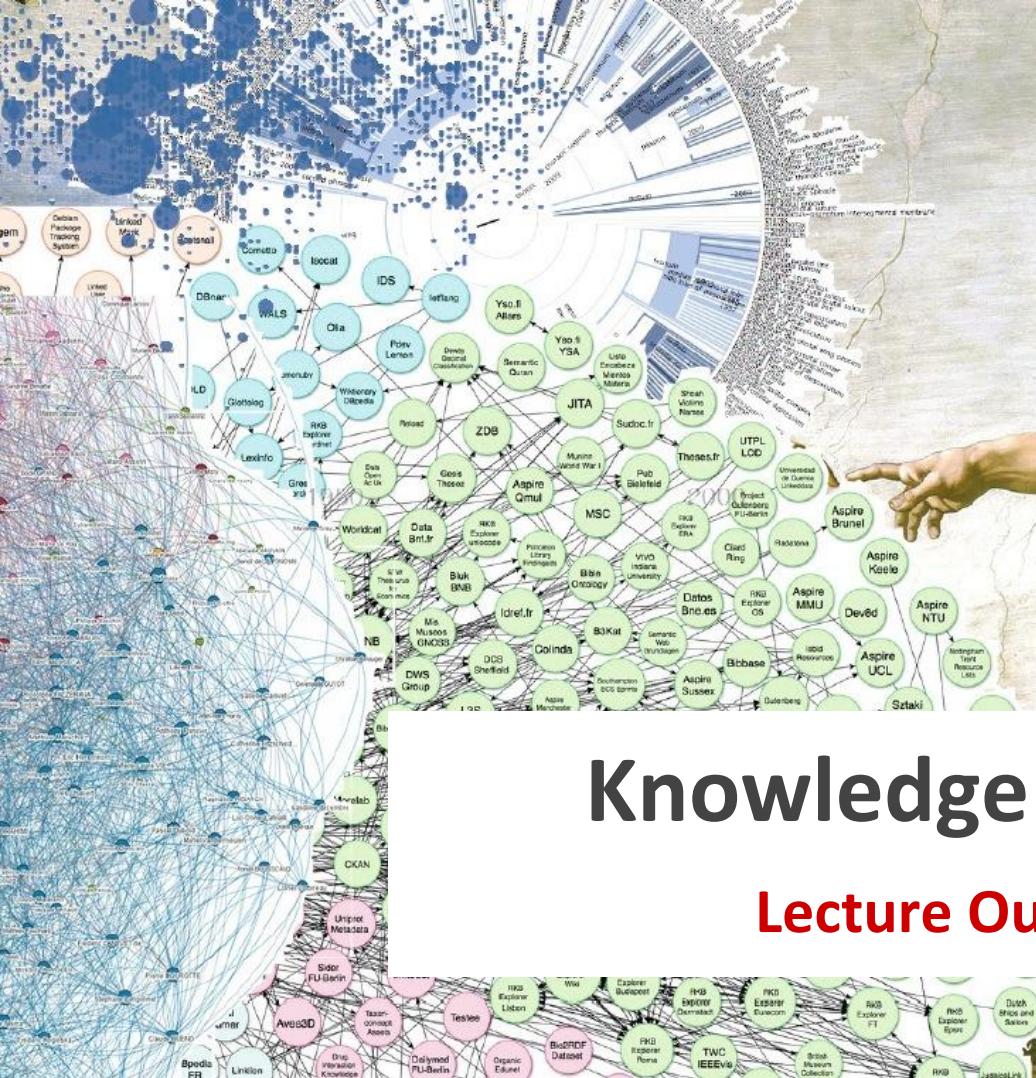
Standardized information exchange is key

Formats are necessary, but not too important

The Semantic Web is based on the Web

Linked Data uses a small selection of technologies





Knowledge Graphs

Lecture Outline

Knowledge Graphs

Lecture 1: Knowledge Graphs in the Web of Data

1.1 Data, Information, and Knowledge

1.2 How to Represent Knowledge?

1.3 The Art of Understanding

1.4 Towards a Universal Knowledge Representation

1.5 The Semantic Web

1.6 Linked Data and the Web of Data

Knowledge Graphs

Lecture 2: Basic Semantic Technologies

2.1 How to Identify and Access Things

Querying allows fine-grained data access

2.2 How to Represent Simple Facts with RDF

Standardized information exchange is key

2.3 RDF Turtle Serialization

The Semantic Web is based on the Web

2.4 RDF Complex Data Structures

2.5 Model Building with RDFS

Linked Data uses a small selection of triples

2.6 Logical Inference with RDF(S)

Excursion 1: RDFa - RDF and the Web

Knowledge Graphs

Lecture 3: Querying RDF with SPARQL

Most apps use only a subset of the stack

3.1 How to Query RDF(S)

Querying allows fine-grained data access

Excursion 2: DBpedia Knowledge Graph

Standardized information exchange (RDF)

Excursion 3: Wikidata Knowledge Graph

Formats are excursion, but not the stack

3.2 Complex Queries with SPARQL

3.3 More Complex SPARQL Queries

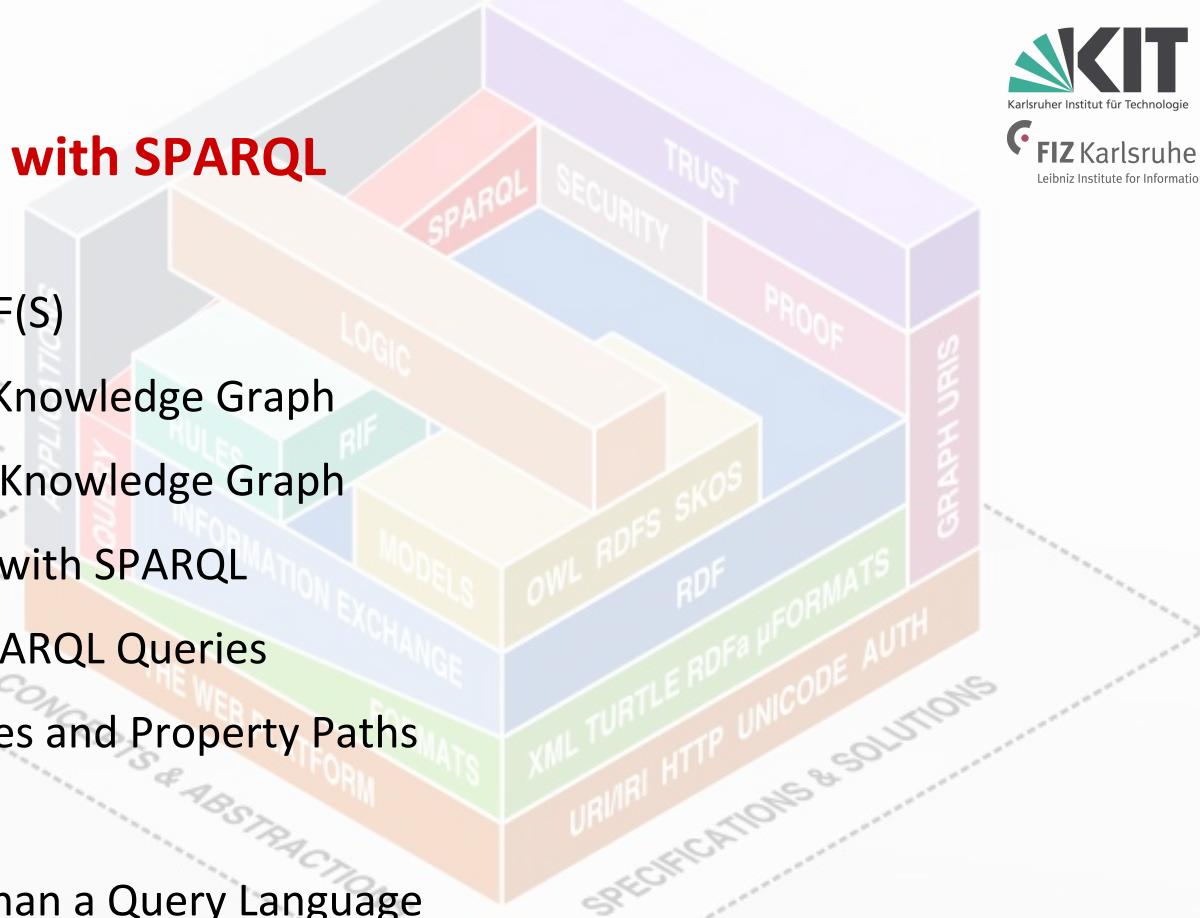
Linked Data is a small selection of technologies

3.4 SPARQL Subqueries and Property Paths

3.5 RDF Databases

3.6 SPARQL is more than a Query Language

LINKED DATA



Knowledge Graphs

Lecture 4: Knowledge Representation with Ontologies

Most apps use only a subset of the stack

4.1 A Brief History of Ontologies

Querying allows fine-grained data access

4.2 Why we do need Logic

Standardized information exchange is key

Excursion 4: A Brief Recap of Essential Logics

The Semantic Web is based on the Web

Excursion 5: Description Logics

4.3 First Steps in OWL

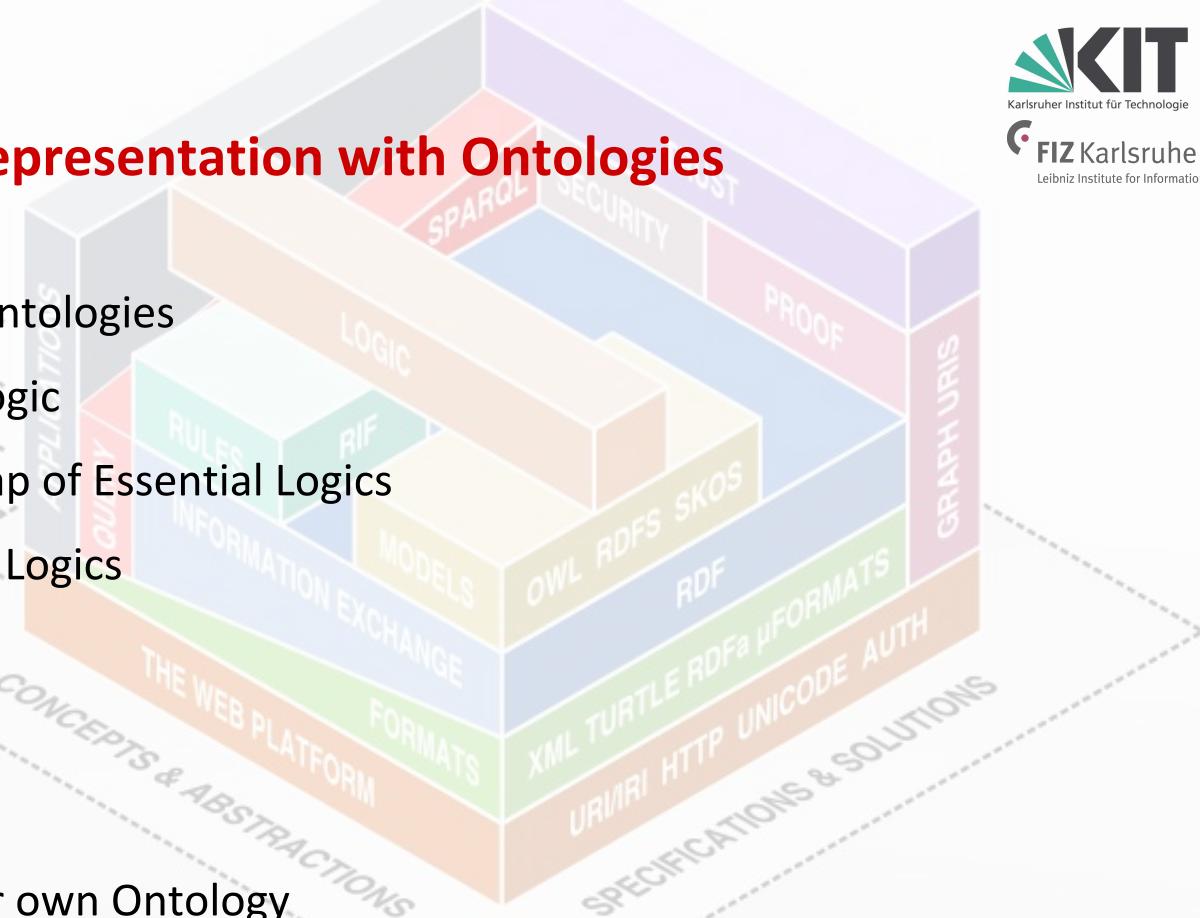
Linked Data uses a small selection of technologies

4.4 More OWL

4.5 OWL and beyond

4.6 How to Design your own Ontology

LINKED DATA



Knowledge Graphs

Lecture 5: Knowledge Graph Applications

5.1 Ontologies in Action

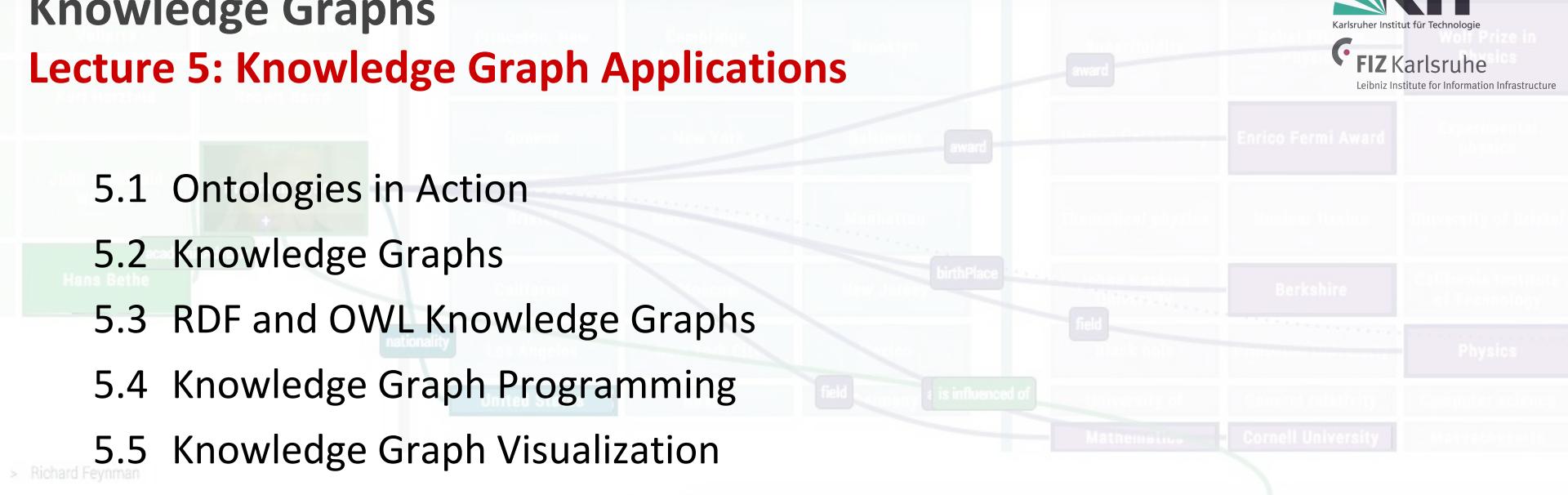
5.2 Knowledge Graphs

5.3 RDF and OWL Knowledge Graphs

5.4 Knowledge Graph Programming

5.5 Knowledge Graph Visualization

5.6 Knowledge Graph Analytics



Richard Feynman



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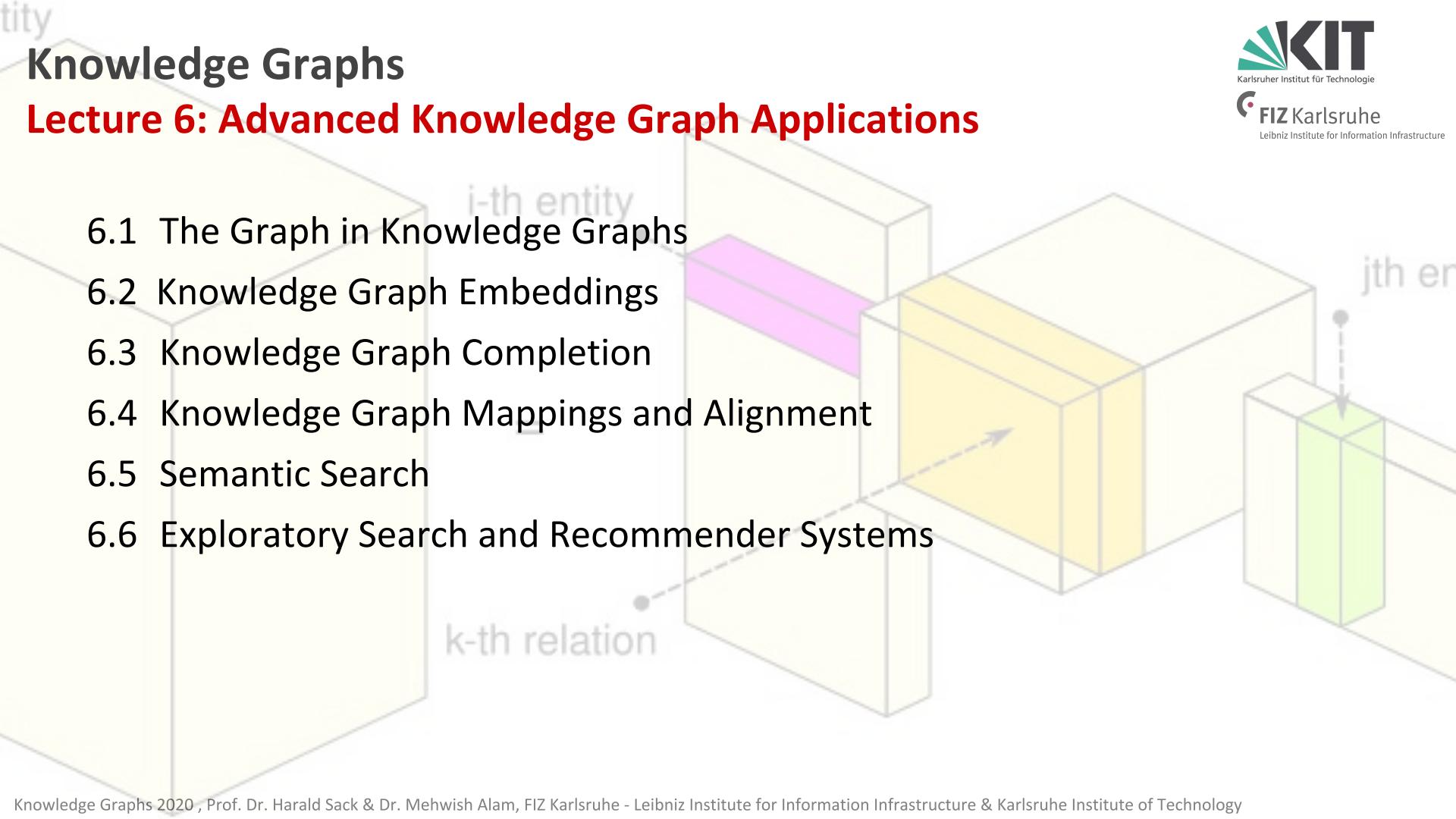
DBpedia: Richard Feynman



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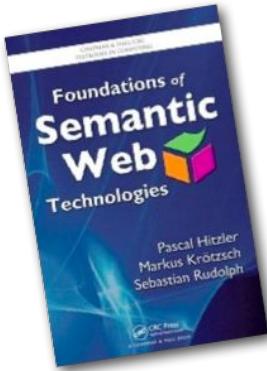
Lecture 6: Advanced Knowledge Graph Applications

- 6.1 The Graph in Knowledge Graphs
- 6.2 Knowledge Graph Embeddings
- 6.3 Knowledge Graph Completion
- 6.4 Knowledge Graph Mappings and Alignment
- 6.5 Semantic Search
- 6.6 Exploratory Search and Recommender Systems

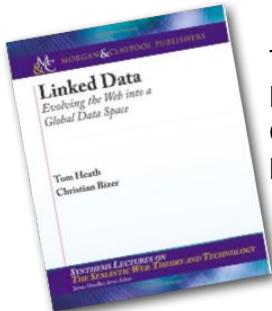


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A Brief Bibliography



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Morgan & Claypool, 2011.