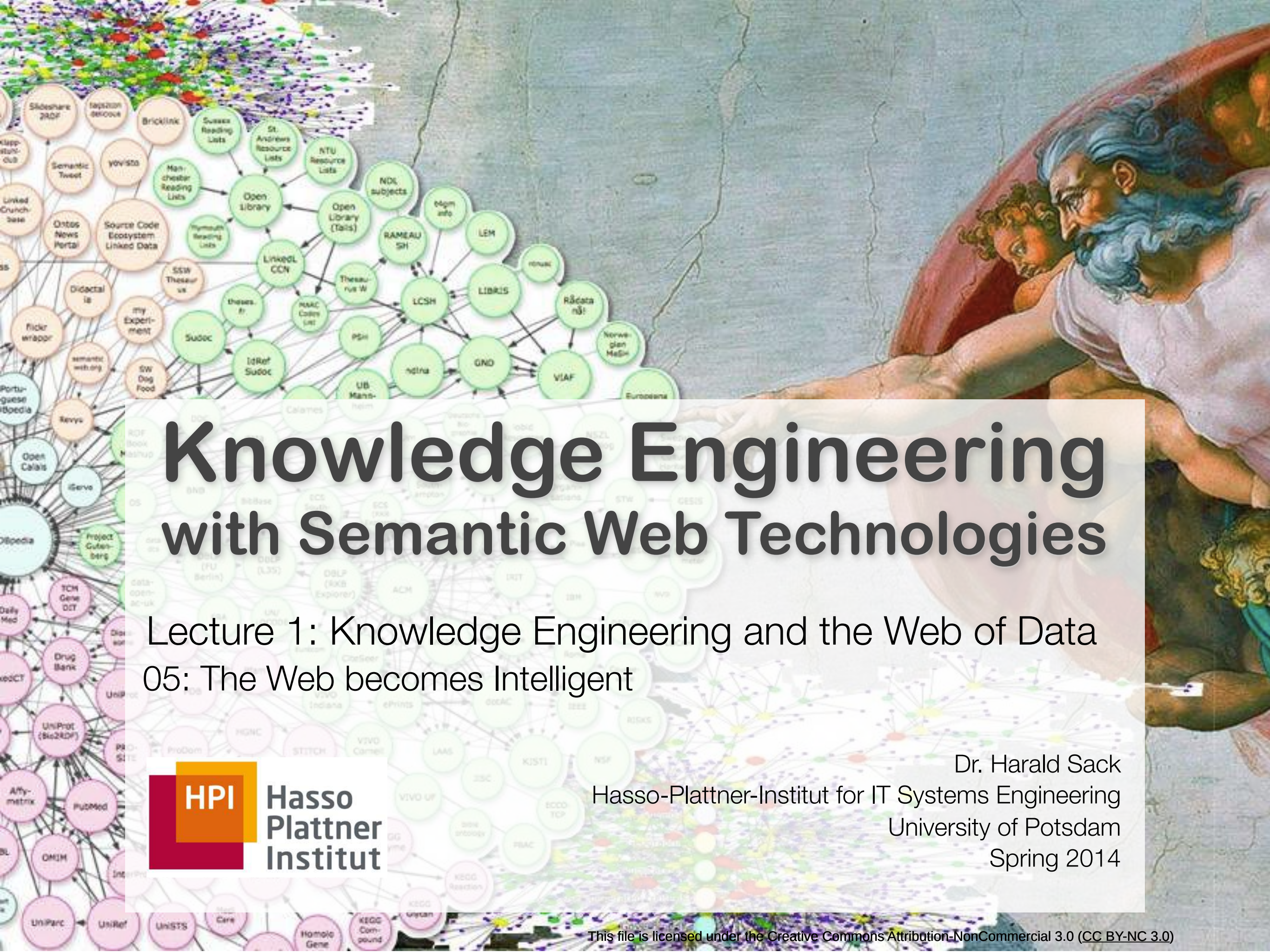




Knowledge Engineering with Semantic Web Technologies

Lecture 1: Knowledge Engineering and the Web of Data
05: The Web becomes Intelligent



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Hasso-Plattner-Institut for IT Systems Engineering
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Spring 2014



Lecture 1: Knowledge Engineering and the Web of Data

Open HPI - Course: Knowledge Engineering with Semantic Web Technologies

Lecture 1: Knowledge Engineering and the Web of Data

From the World Wide Web to the Web of Data



- The **Web of Data** is an upgrade of the Web of Documents
- The Web as a huge decentralised database (knowledge base) of
- machine-accessible data

„The web of human-readable document is being merged with a web of machine understandable data. The potential of the mixture of humans and machines working together and communication through the web could be immense.“

Tim Berners-Lee, The World Wide Web: A very short personal history, May 1998

From the World Wide Web to the Web of Data



„The Web was designed as an information space, with the goal that it should be useful not only for human-human communication, but also that machines would be able to participate and help... “

Tim Berners-Lee, Semantic Web Roadmap, Sept 1998

From the World Wide Web to the Web of Data

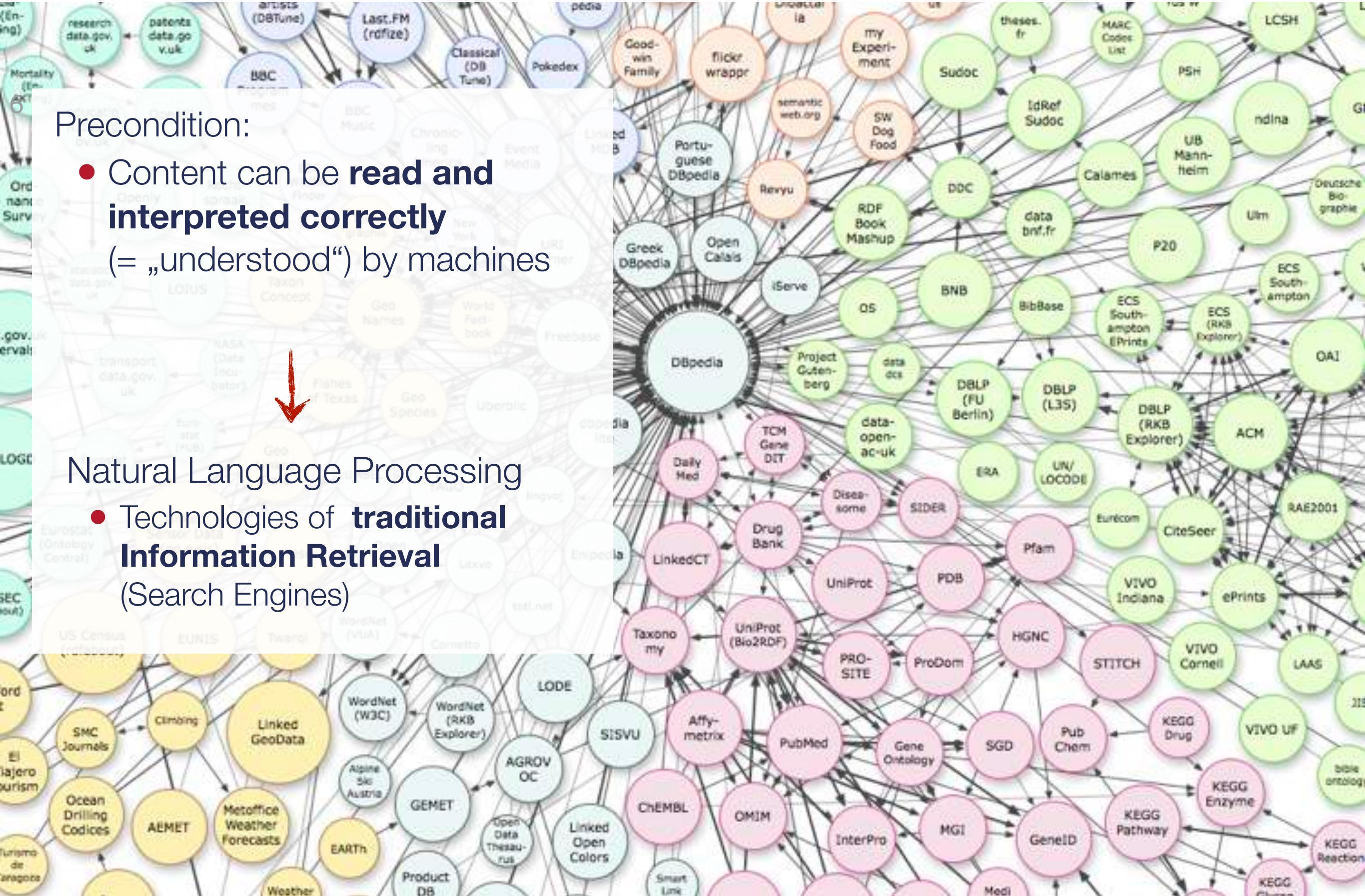
Precondition:

- Content can be **read and interpreted correctly** (= „understood“) by machines



Natural Language Processing

- Technologies of **traditional Information Retrieval** (Search Engines)



From the World Wide Web to the Web of Data

Precondition:

- Content can be **read and interpreted correctly** (= „understood“) by machines



Natural Language Processing

- Technologies of **traditional Information Retrieval** (Search Engines)

Semantic Web

- Natural language web content will be **explicitly annotated with semantic metadata**
- Semantic metadata encode the **Meaning (Semantics)** of the content and can be read and interpreted correctly by machines

P A R E N T A L

A D V I S O R Y

E X P L I C I T S E M A N T I C S

“Understanding” Content on the Web



**HEISENBERG
CAN WAIT.**

**SUNDAY NIGHT FOOTBALL
#SNF**

“Understanding” Content on the Web



Text: „**Heisenberg** can wait?“

Entity Mapping
Disambiguation



“Understanding” Content on the Web



Text: „**Heisenberg** can wait?“

Entity Mapping
Disambiguation

Benjamin Heisenberg ?

a film director

“Understanding” Content on the Web



Text: „**Heisenberg** can wait?“

Entity Mapping
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Benjamin Heisenberg ?

a film director

Jochen Heisenberg ?

a physicist

“Understanding” Content on the Web



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a physicist and Nobel
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Walter White

lead character of
Breaking Bad

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- **Disambiguation**

solution of linguistic ambiguities

“Understanding” Content on the Web



Text: „**Heisenberg** can wait?“



Walter White

Entity

- The **Meaning (Semantics)** of entities and classes must be defined explicitly.

“Understanding” Content on the Web



Text: „**Heisenberg** can wait?“



Walter White

Entity



is a

Fictional Character

Class

- The **Meaning (Semantics)** of entities and classes must be defined explicitly.

“Understanding” Content on the Web



Text: „**Heisenberg** can wait?“



Walter White

Entity



is a

Fictional Character

Class



is subclass of

Person

Class

- The **Meaning (Semantics)** of entities and classes must be defined explicitly.

“Understanding” Content on the Web

- The Meaning (Semantics) is expressed with the help of well suited knowledge representations (**Ontologies**)



Walter White

(entity)



is a

Fictional Character

(class)

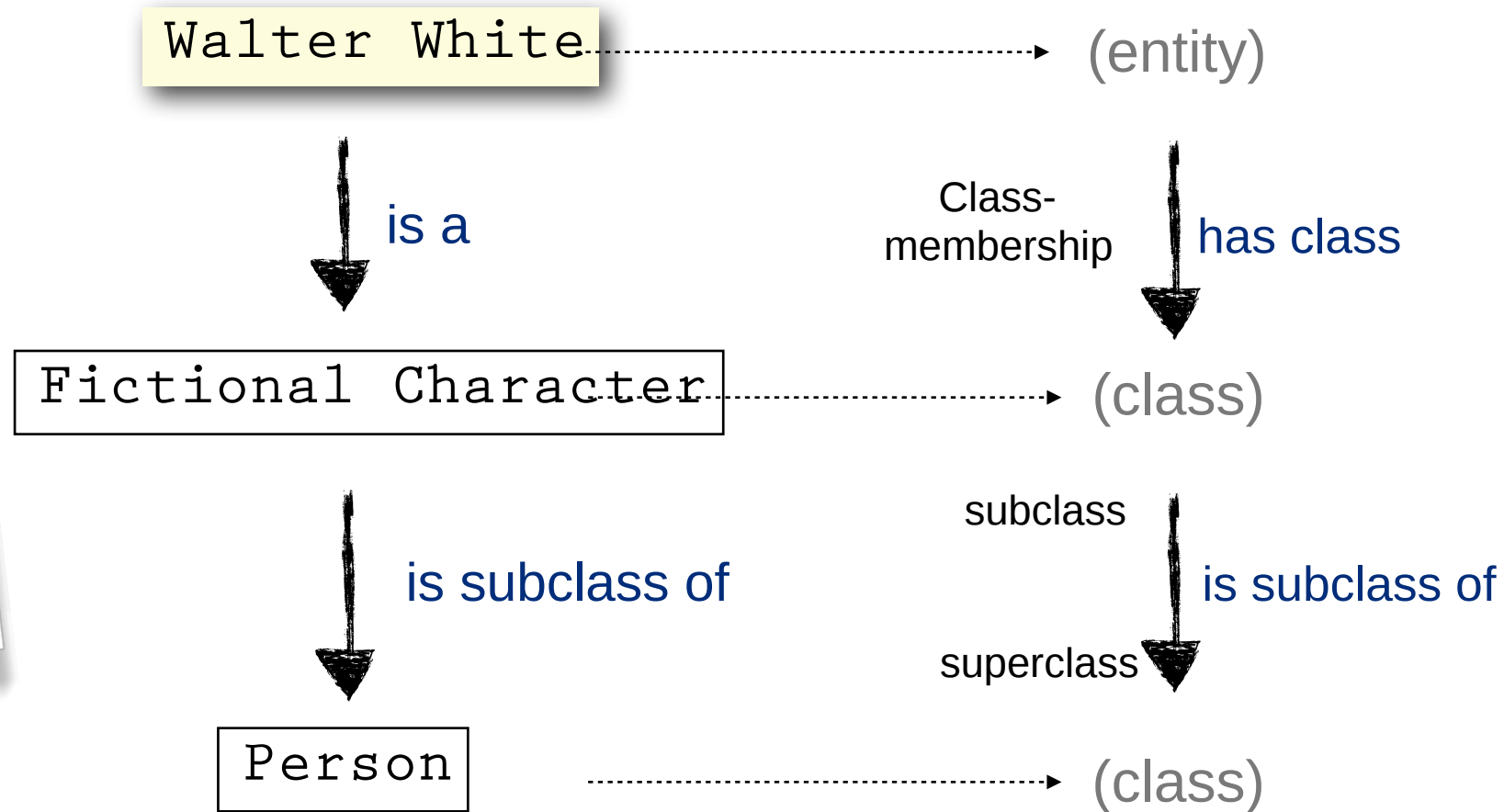
Class-
membership



has class

“Understanding” Content on the Web

- The Meaning (Semantics) is expressed with the help of well suited knowledge representations (**Ontologies**)



- The Meaning (Semantics) is expressed with the help of well suited knowledge representations (**Ontologies**)

Walter White

is a

Fictional Character
from New Mexico

Fictional Schoolteacher

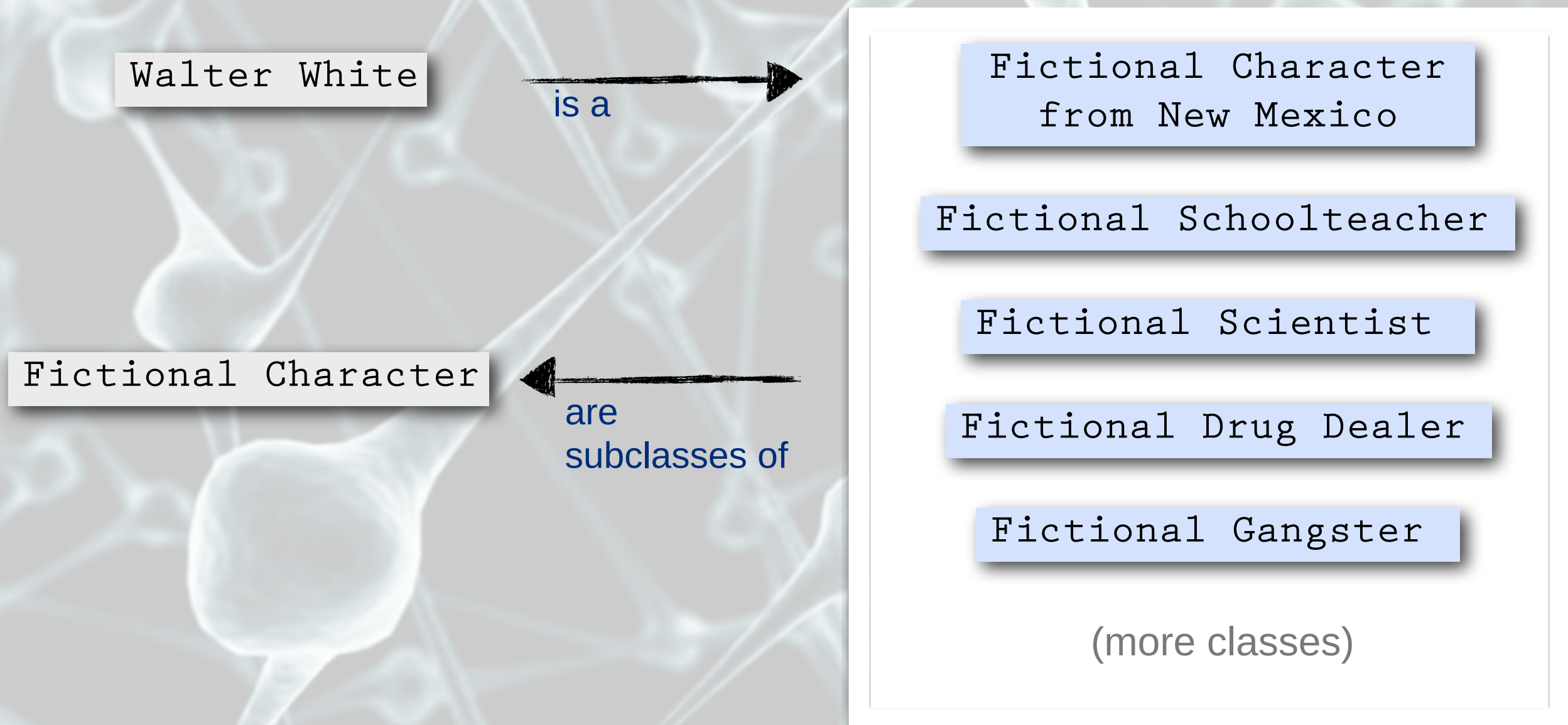
Fictional Scientist

Fictional Drug Dealer

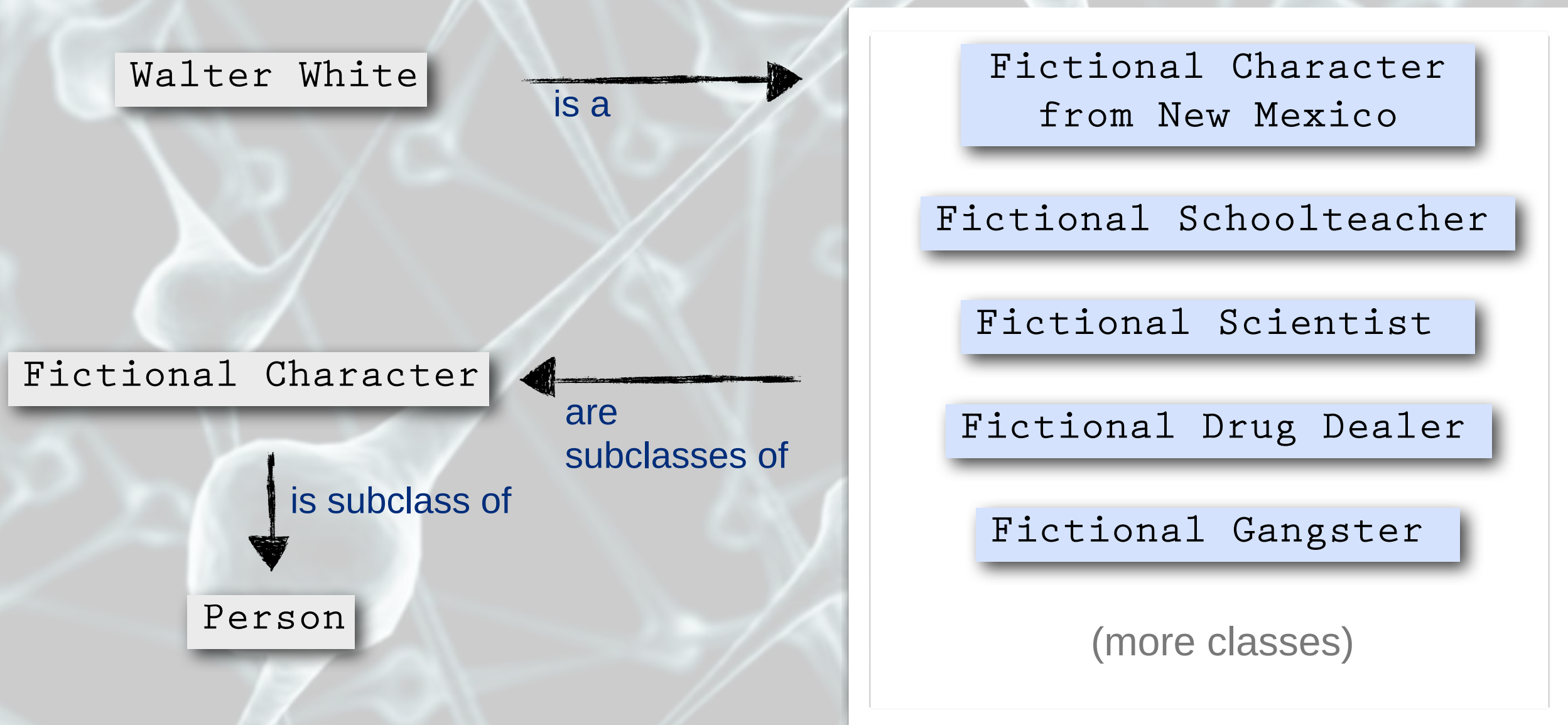
Fictional Gangster

(more classes)

- The Meaning (Semantics) is expressed with the help of well suited knowledge representations (**Ontologies**)

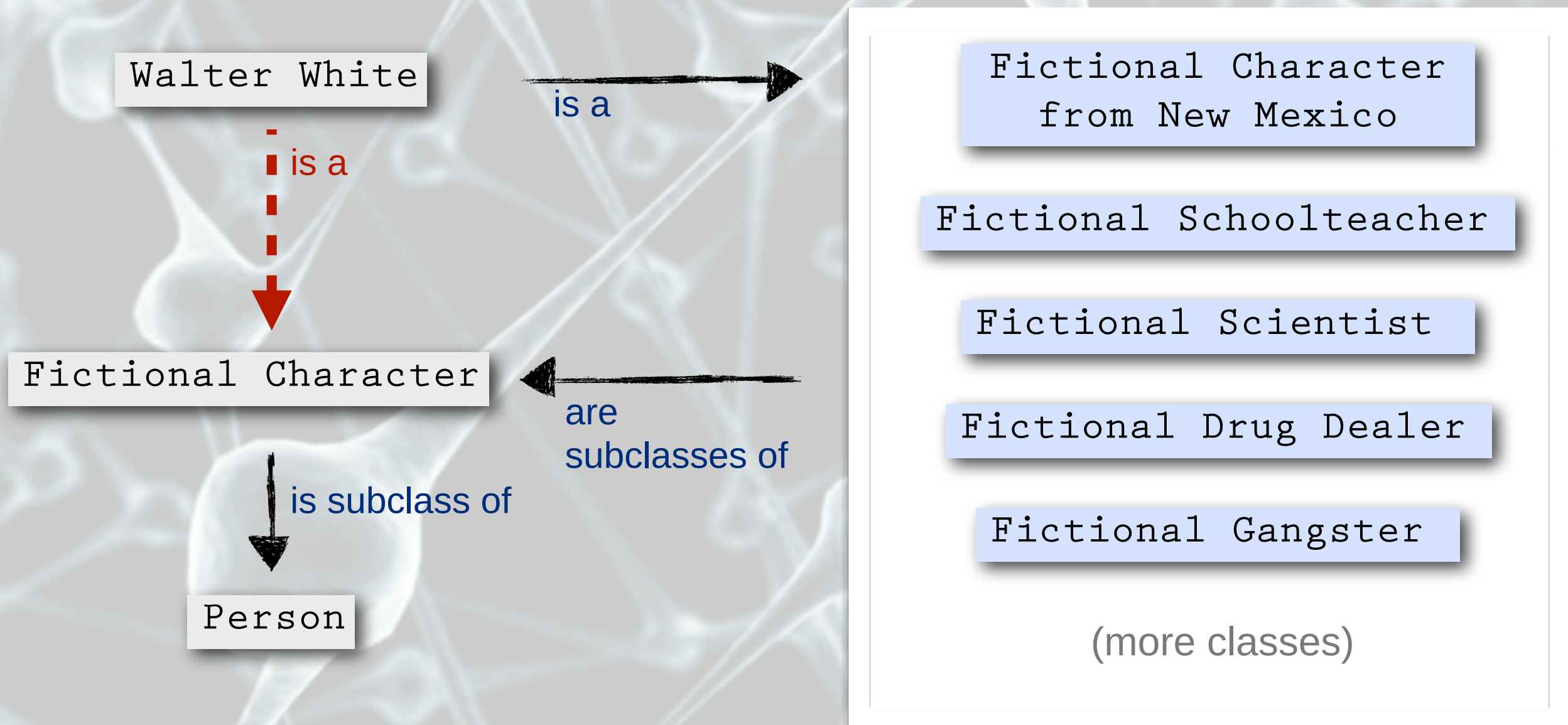


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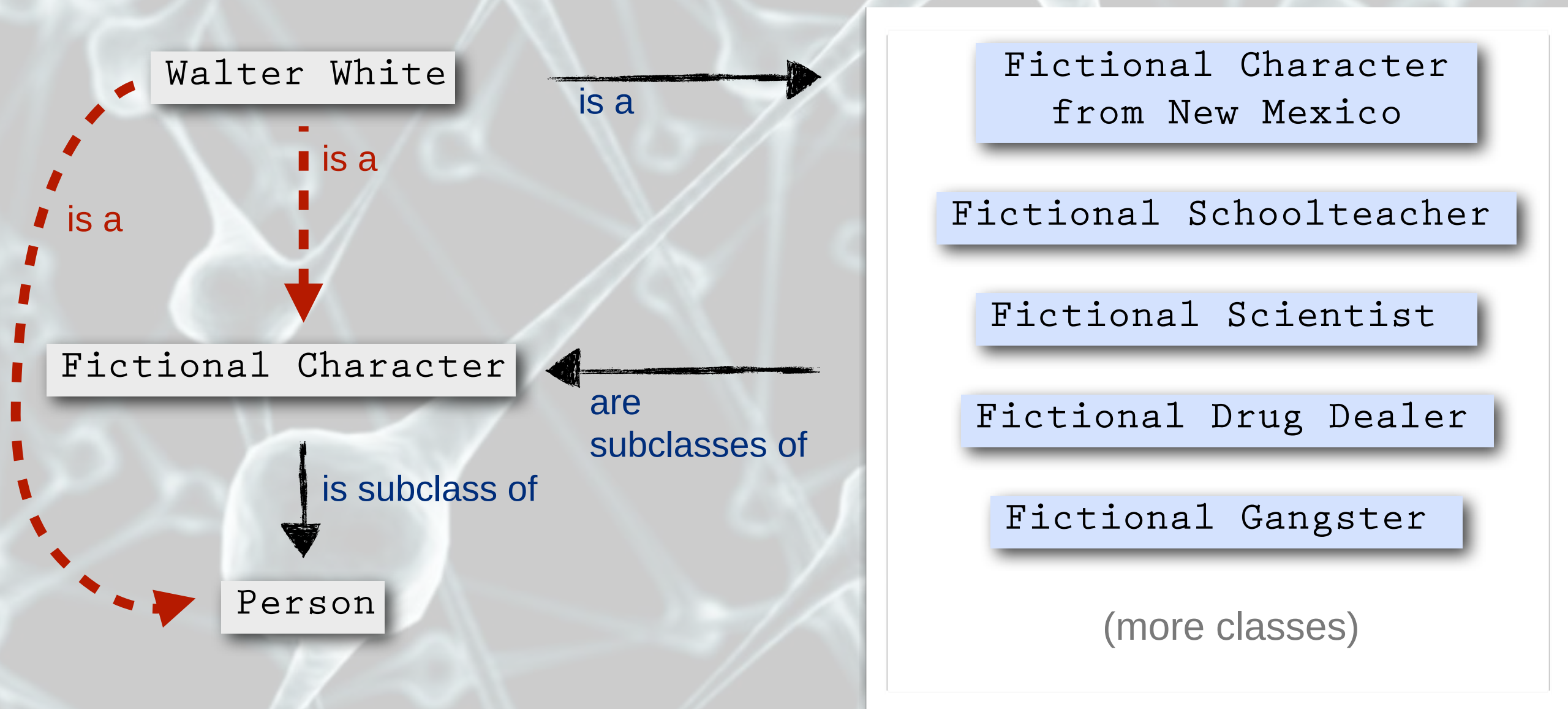


“Understanding” Content on the Web

- The Meaning (Semantics) is expressed with the help of well suited knowledge representations (**Ontologies**)

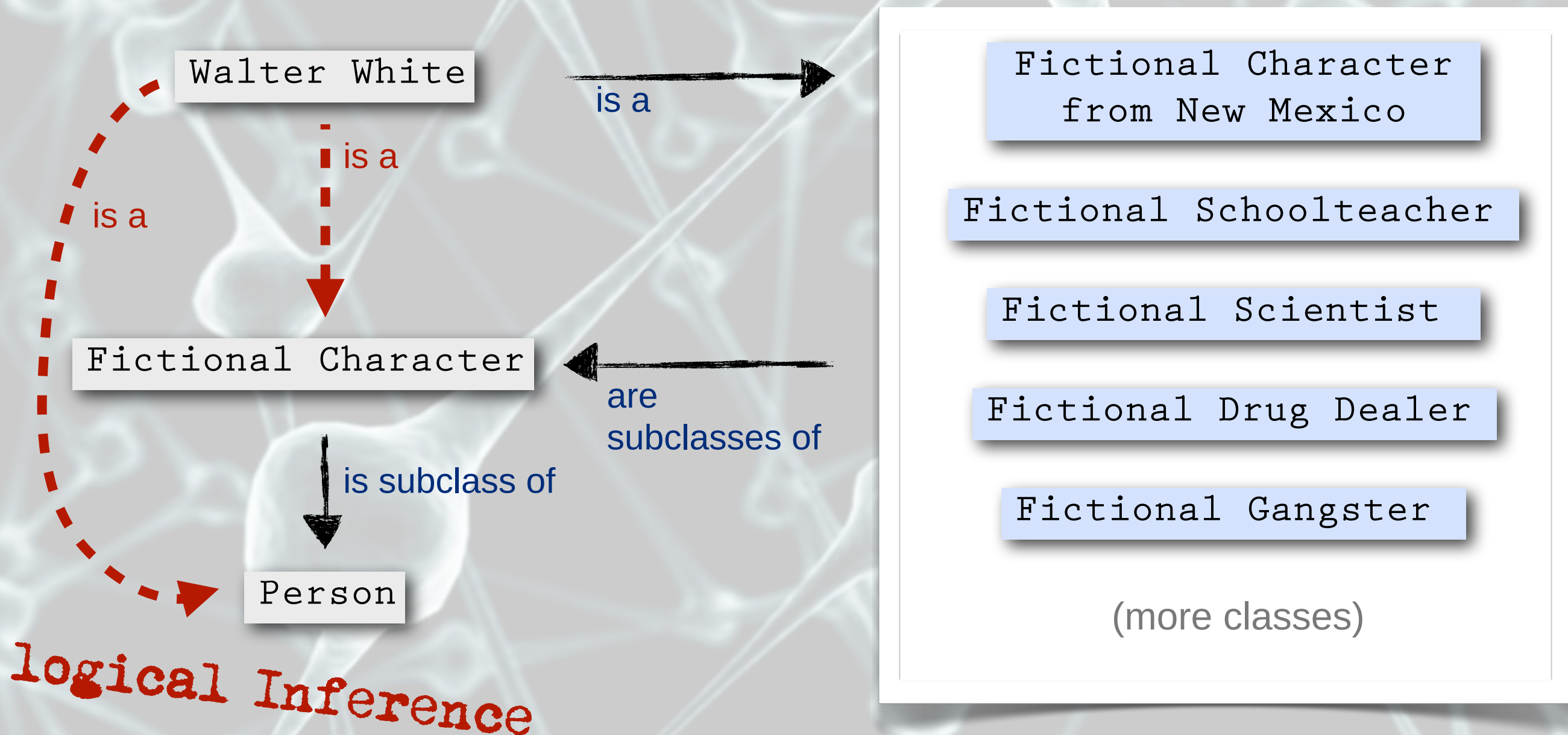


- The Meaning (Semantics) is expressed with the help of well suited knowledge representations (**Ontologies**)



“Understanding” Content on the Web

- The Meaning (Semantics) is expressed with the help of well suited knowledge representations (**Ontologies**)



“Understanding” Content on the Web

- The Meaning (Semantics) is expressed with the help of well suited knowledge representations (**Ontologies**)

Walter White

is a

Person



birthPlace



Location

Person



birthDate



Date/Time

Person



mother



Person

Person



father



Person

(classes)

(properties)

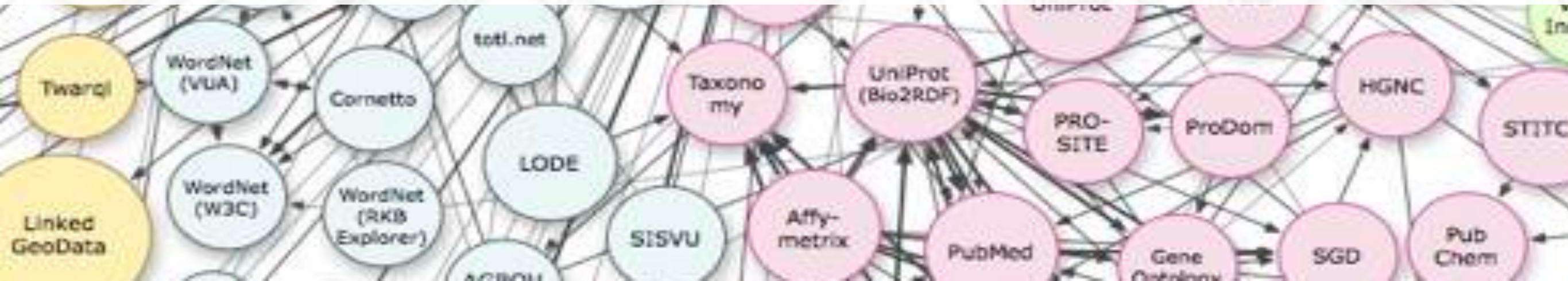
(classes)

What is the Semantic Web?



„The Semantic Web is an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation"'

Tim Berners-Lee, James Hendler, Ora Lassila: The Semantic Web, Scientific American, 284(5), pp. 34-43(2001)



The Semantic Web - a Web of Data

- The Meaning of Information (Semantics) is made explicit by **formal (structured) and standardized knowledge representations (Ontologies)**.
- Thus it will be possible,
 - to process the meaning of information automatically
 - to relate and integrate heterogeneous data
 - to deduce implicate (not evident) information from existing (evident) information in an automated way

The Semantic Web is kind of a **global database** that contains a **universal network of semantic propositions**.

Semantic Web

...towards an „intelligent“ Web

17

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

Most apps use only a subset of the stack

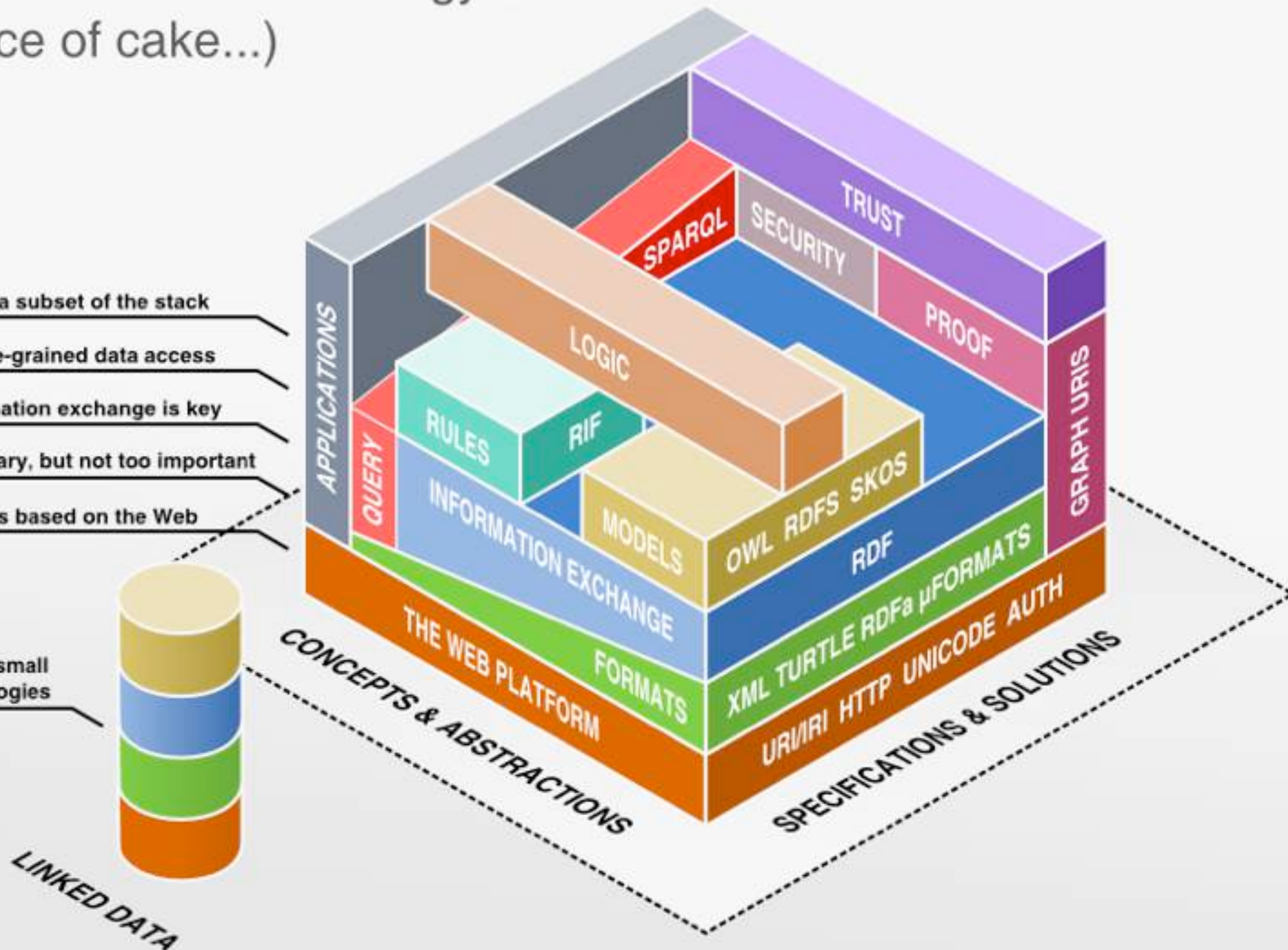
Querying allows fine-grained data access

Standardized information exchange is key

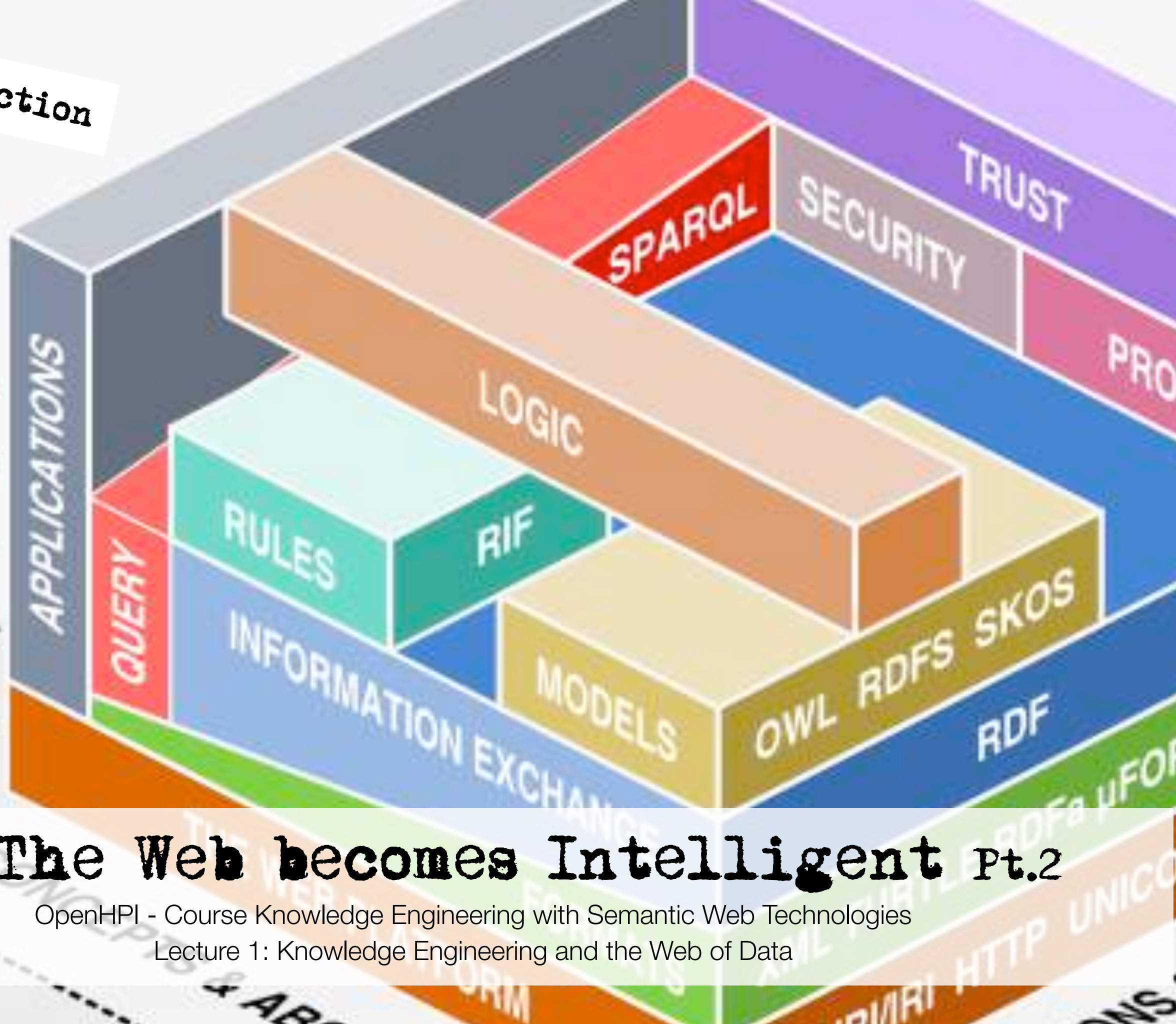
Formats are necessary, but not too important

The Semantic Web is based on the Web

Linked Data uses a small
selection of technologies



Next section



06: The Web becomes Intelligent Pt.2

OpenHPI - Course Knowledge Engineering with Semantic Web Technologies

Lecture 1: Knowledge Engineering and the Web of Data