

# Knowledge Graphs

## Lecture 2 - Basic Semantic Technologies

### 2.1 How to Identify and Access Things

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# Knowledge Graphs

## Lecture 2: Basic Semantic Technologies

### 2.1 How to Identify and Access Things

### 2.2 How to Represent Simple Facts with RDF

### 2.3 RDF Turtle Serialization

### 2.4 RDF Complex Data Structures

### 2.5 Model Building with RDFS

### 2.6 Logical Inference with RDF(S)

### Excursion 1: RDFa - RDF and the Web

What is this?

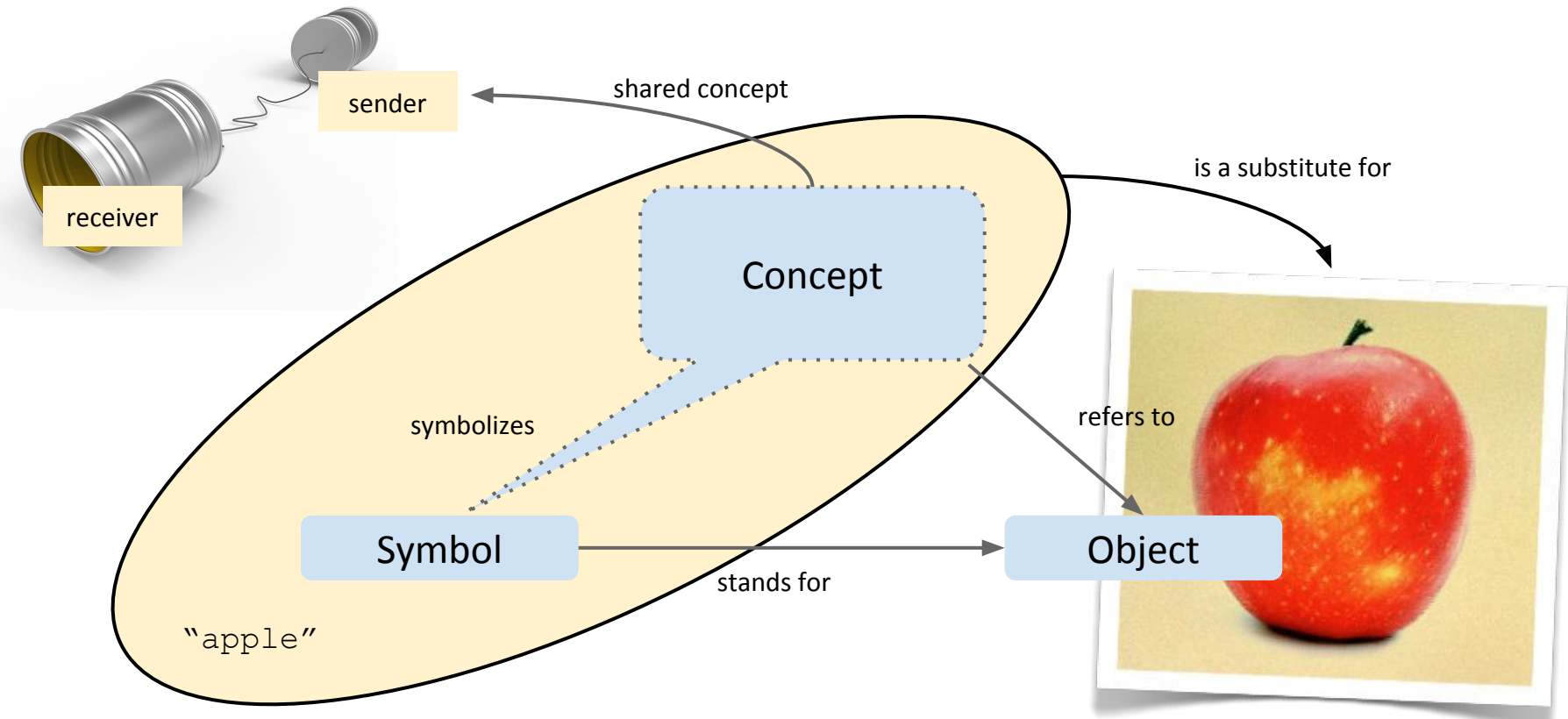






*Ceci n'est pas une pomme.*

# Semiotic Triangle



[1,2]

# Uniform Resource Identifier

- A **Uniform Resource Identifier (URI)** defines a simple and extensible schema for worldwide unique identification of abstract or physical resources (RFC 3986).

https://www

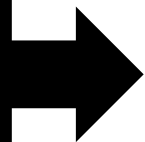
# Uniform Resource Identifier

- A **Uniform Resource Identifier (URI)** defines a simple and extensible schema for worldwide unique identification of abstract or physical resources (RFC 3986).
- A **Resource** can be every object with a clear identity (according to the context of the application)
  - as e.g., web pages, books, locations, persons, relations among objects, abstract concepts, etc.
- URI concept is already established in various domains, as e.g.,
  - the Web (URL),
  - Books and publications (ISBN, ISSN),
  - Digital Object Identifier (DOI).

# URL

identify  
what exists  
on the web

<https://www.mywebsite.org/>



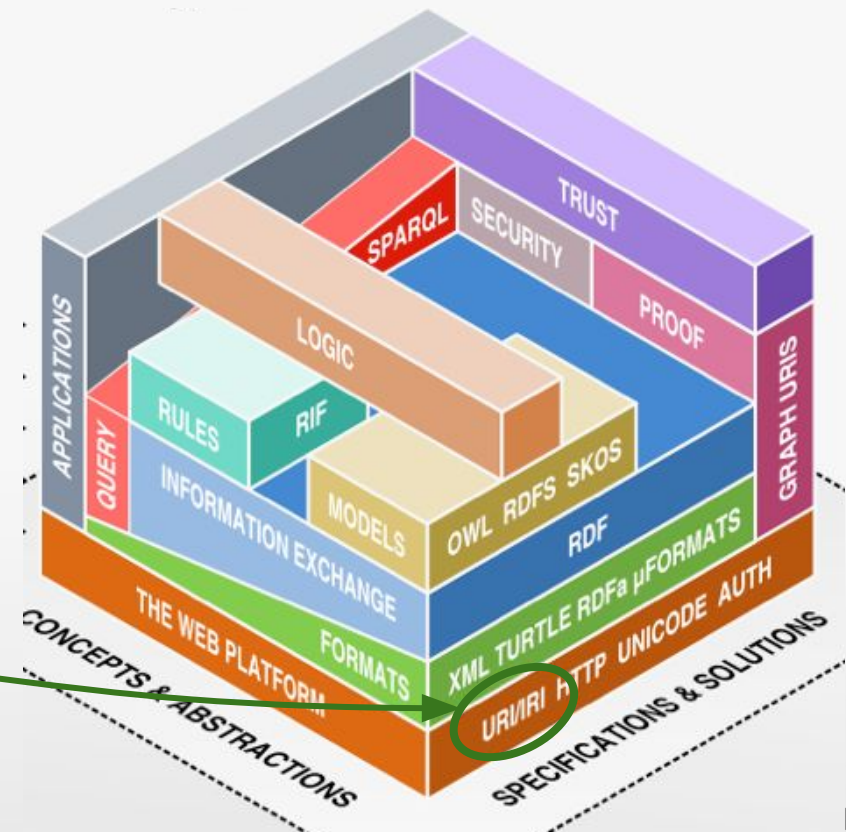
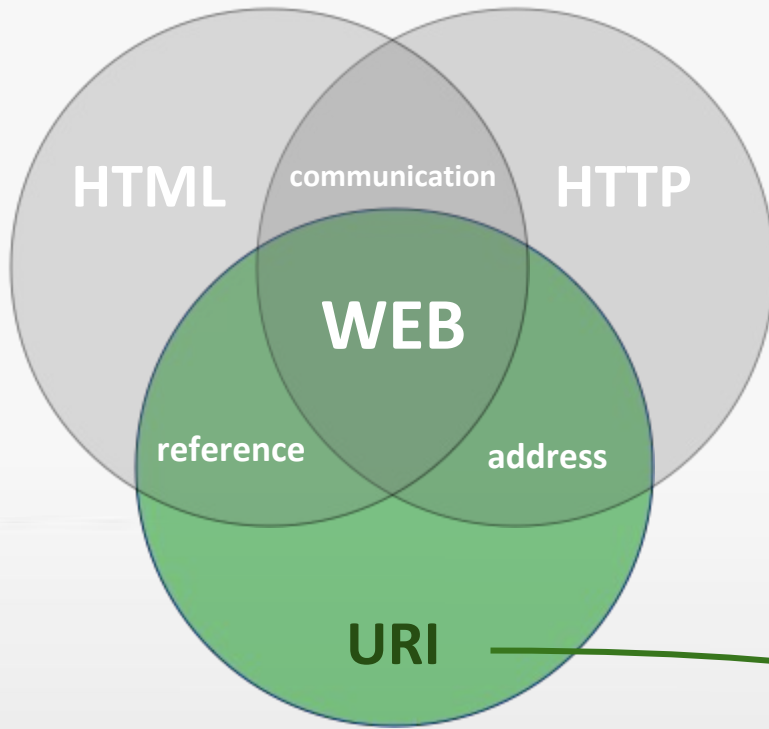
# URI

identify  
on the web  
what exists

[https://fiz-karlsruhe.de/harald\\_foaf.rdf#me](https://fiz-karlsruhe.de/harald_foaf.rdf#me)



# Basic Architecture of the Web of Data



URI

Resource

<http://en.wikipedia.org/wiki/Earth/>

identifies

Designatum

describes

represents (stands for)

Representation

Designator

defines

**Metadata:**

Content-type: text/html

**Data:**

```
<!DOCTYPE html>
<html class="client-nojs" lang="en" dir="ltr">
<head>
<meta charset="UTF-8"/>
<title>Earth - Wikipedia</title>
...
</html>
```

The Earth is described  
(designated) by a web page.

# What if a URI does not exist (yet)?

- Define a URI by yourself:
  - **avoid overlaps** → use your own website as namespace
  - enable **documentation at the same place** → HTTP Content Negotiation
- Use **separate URIs** for the **resource (*Designatum*)** and **its documentation (*Designator*)** via
  - HTTP Content Negotiation and/or
  - URI references (e.g. via "#" fragment identifier)



# HTTP Content Negotiation

Let's try an example:

- I want to have **information** about the Earth from DBpedia.

1 HTTP GET request  
Accept Header: text/html

<http://dbpedia.org/resource/Earth>

URI represents *Designatum*

2 HTTP/2 303 See Other

<http://dbpedia.org/page/Earth>

3 URI represents *Designator*

HTTP GET request  
Accept Header: text/html

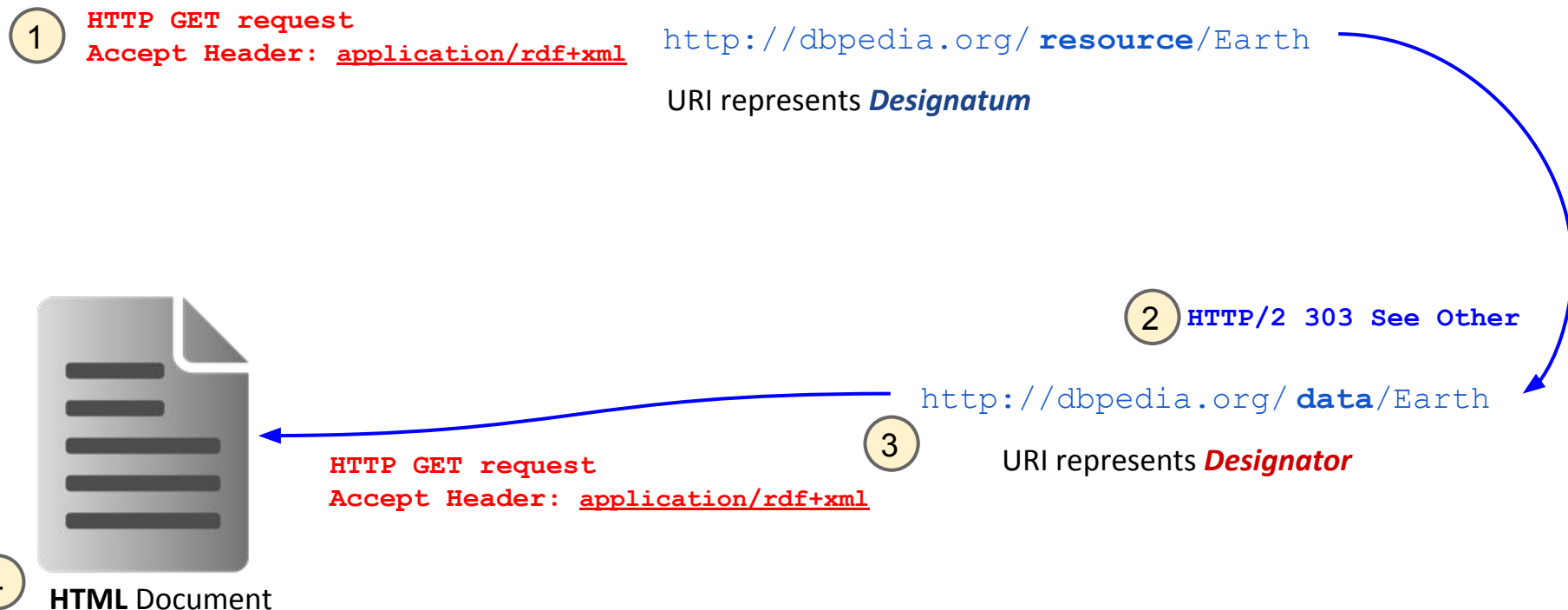


4 HTML Document

# HTTP Content Negotiation

Let's try another example:

- I want to have **machine readable information** about the Earth from DBpedia.



# HTTP Content Negotiation

## Let's try it ourselves:

- I want to have **information** about the Earth from DBpedia.

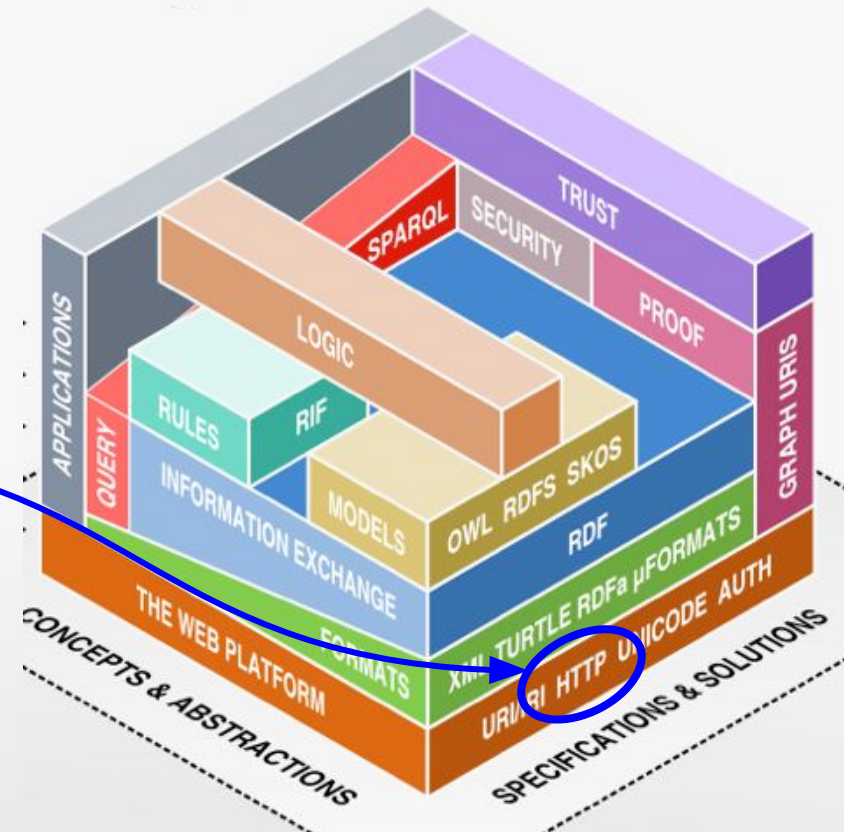
```
curl -L -H "Accept: text/html" http://dbpedia.org/resource/Earth
```

- I want to have **machine readable information** about the Earth from DBpedia.

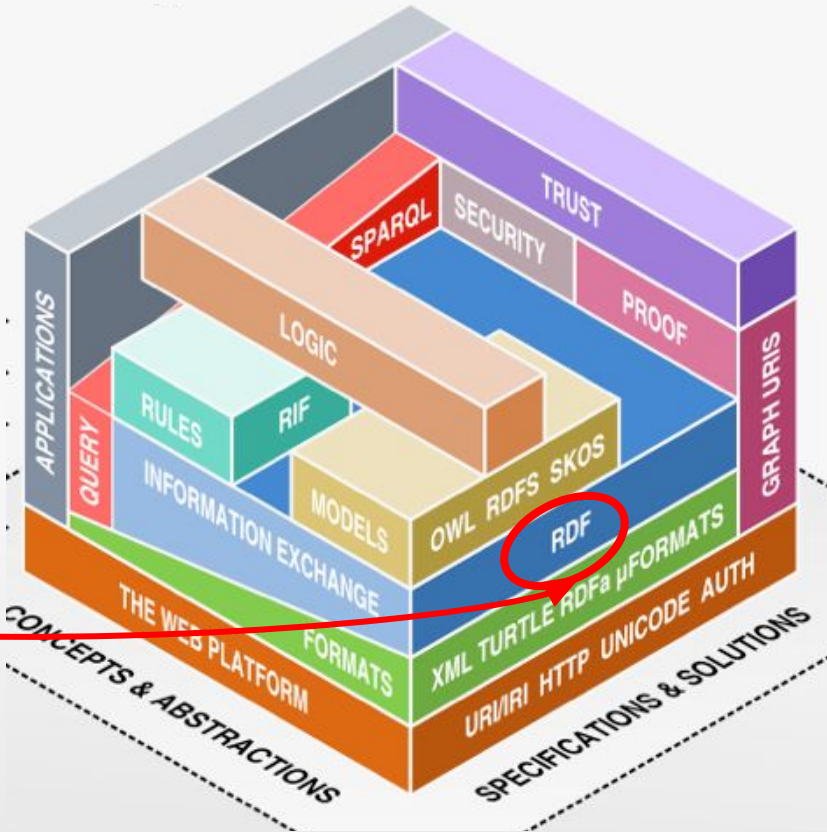
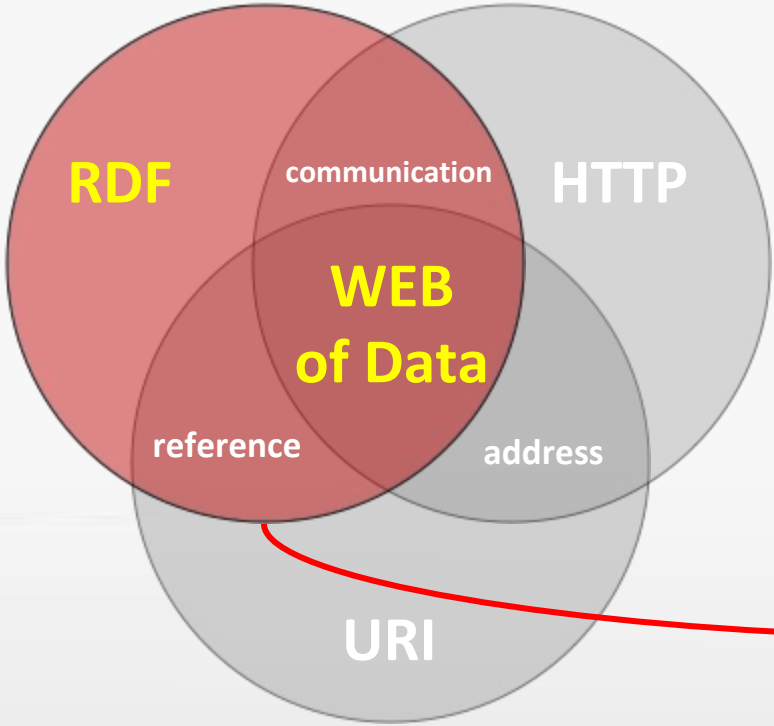
```
curl -L -H "Accept: application/rdf+xml" http://dbpedia.org/resource/Earth
```



A Venn diagram illustrating the relationship between HTML, HTTP, and URI. Three overlapping circles are shown: a light gray circle on the left labeled 'HTML', a blue circle on the top right labeled 'HTTP', and a light gray circle on the bottom labeled 'URI'. The intersections are labeled as follows: the intersection of HTML and HTTP is labeled 'communication'; the intersection of HTTP and URI is labeled 'address'; the intersection of HTML and URI is labeled 'reference'; and the central intersection where all three circles meet is labeled 'WEB'.



# Basic Architecture of the Web of Data







# Representing simple Facts with RDF

Next Lecture...



### Picture References:

- [1] Johannes Osterhoff, *Ceci n'est pas une pomme*, in Harald Sack, *Semantic Web Technologien*, HPI lecture 2010/11
- [2] Phone Conversation Indicating Chit Chat And Discussion, CCO  
<https://www.pigsels.com/en/public-domain-photo-jrdox>
- [3] The new https protocol, Fabio Lenari, [CC-BY-SA]  
<https://commons.wikimedia.org/wiki/File:Internet2.jpg>
- [4] "The Blue Marble" is a famous photograph of the Earth taken on December 7, 1972, by the crew of the Apollo 17 spacecraft en route to the Moon at a distance of about 29,000 kilometres (18,000 mi). It shows Africa, Antarctica, and the Arabian Peninsula, NASA, public domain  
[https://commons.wikimedia.org/wiki/File:The\\_Earth\\_seen\\_from\\_Apollo\\_17.jpg](https://commons.wikimedia.org/wiki/File:The_Earth_seen_from_Apollo_17.jpg)
- [5] Benjamin Nowack, *The Semantic Web - Not a Piece of cake ...*, at bnode.org, 2009-07-08 , [CC BY 3.0]  
<http://bnode.org/blog/2009/07/08/the-semantic-web-not-a-piece-of-cake>
- [6] Trichon, La galerie du travail manuel, dans le palais du Champ-de-Mars.(1879), Brown University Library [Public domain]  
[https://commons.wikimedia.org/wiki/File:La\\_galerie\\_du\\_travail\\_manuel,\\_dans\\_le\\_palais\\_du\\_Champ-de-Mars.jpg](https://commons.wikimedia.org/wiki/File:La_galerie_du_travail_manuel,_dans_le_palais_du_Champ-de-Mars.jpg)