

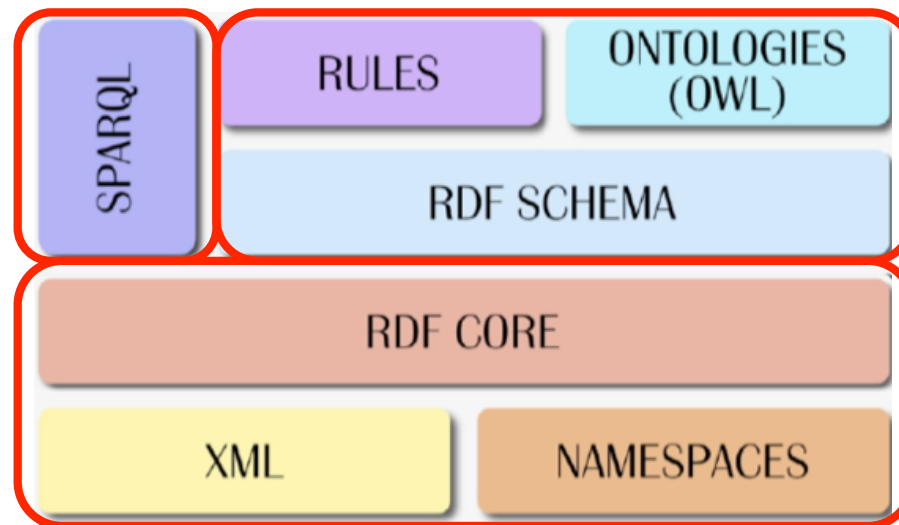


Semantic Web Technologies: Theory & Practice

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The Semantic Web in W3C's view:

3. Shall allow us to ask
structured queries on
the Web

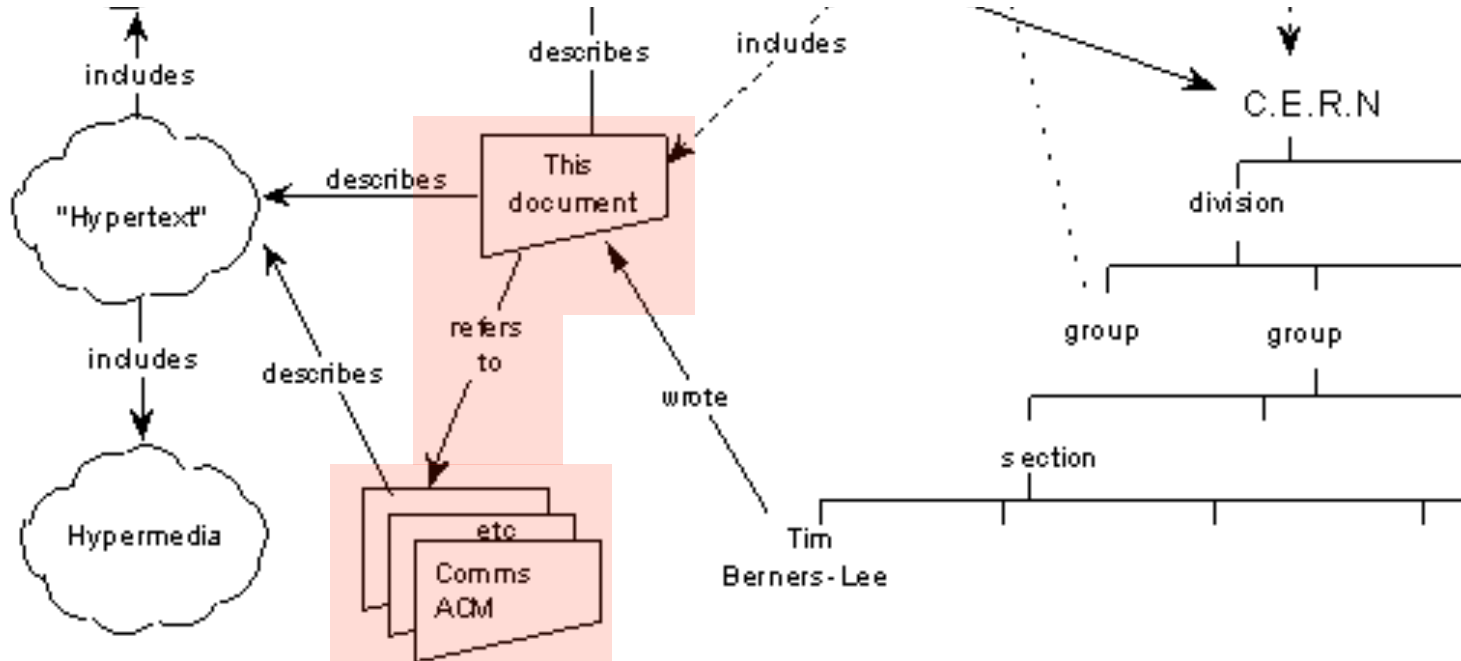


2. Shall allow us to describe
the structure of informa-
tion in machine readable
form: **RDFS+OWL+RIF**

1. Shall allow us to publish
structured information
on the Web: **XML+RDF**



*“This proposal concerns the **management of general information** about accelerators and experiments at CERN [...] based on a **distributed hypertext system**. “*



```
<p>I studied <a href="http://www.tuwien.ac.at">here</a></p>
```

polleres.net#me

Document

www.tuwien.ac.at

Document

Globally Unique identifiers

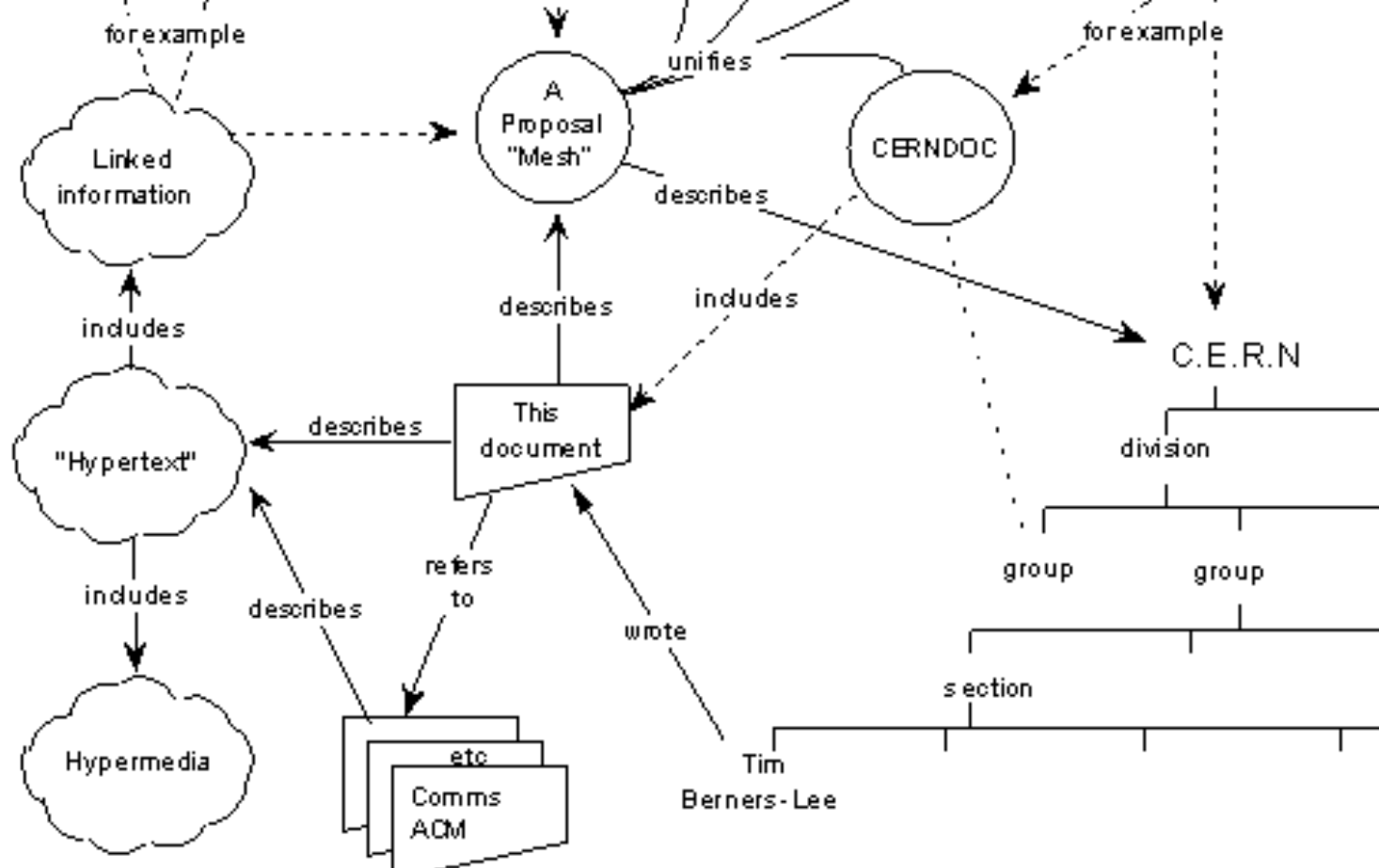
URIs

Links between Documents (href)

A common protocol

HTTP





```
<p about="#me">I studied <a rel="foaf:schoolHomepage" href="http://www.tuwien.ac">here</a></p>
```

polleres.net#me

xmlns.com/foaf/0.1/schoolHomepage

www.tuwien.ac.at

Person

Document

Globally Unique identifiers

Typed Links between Entities

A common protocol

URIs

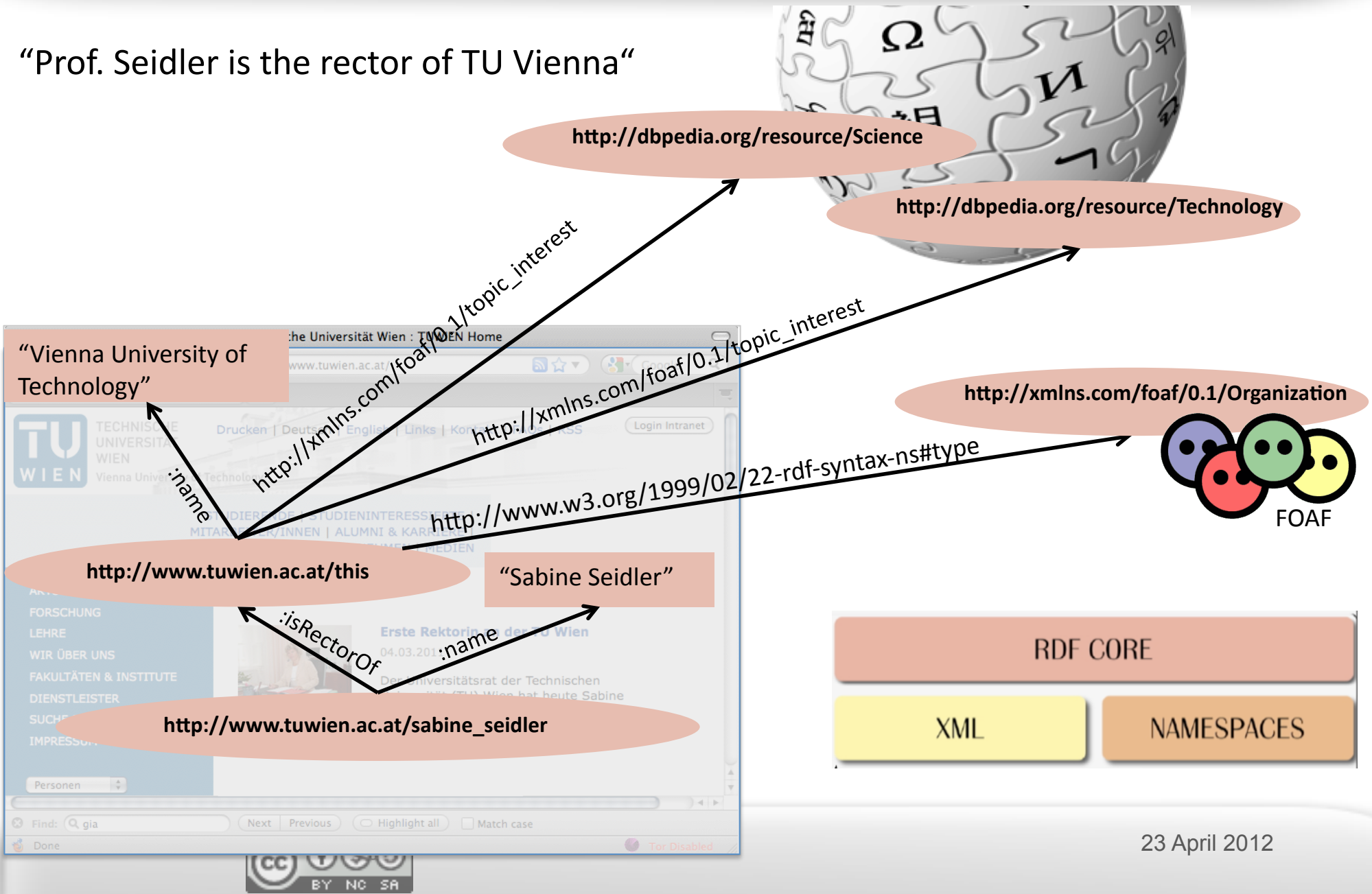
RDF

HTTP



1. Publish Structured Data on the Web

“Prof. Seidler is the rector of TU Vienna”



RDF

```
<http://www.tuwien.ac.at/person1> :name "Sabine Seidler" .  
<http://www.tuwien.ac.at/person1> :isRectorOf <http://www.tuwien.ac.at/this> .  
<http://www.tuwien.ac.at/this> :name "Vienna University Of Technology" .  
<http://www.tuwien.ac.at/this> rdf:type <http://xmlns.com/foaf/0.1/Organization> .
```

.1/Organization

The screenshot shows a web browser window with a search bar containing 'gia'. The page content includes a navigation menu on the left with items like 'FORSCHUNG', 'LEHRE', and 'WIR ÜBER UNS'. The main content area features a news article titled 'Erste Rektorin der TU Wien' dated '04.03.2011'. The article text mentions 'Der Universitätsrat der Technischen Universität Wien hat heute Sabine Seidler zur ersten weiblichen Rektorin ernannt'. The browser's status bar at the bottom shows 'Done' and 'Tor Disabled'.

<http://www.tuwien.ac.at/this>

"Sabine Seidler"

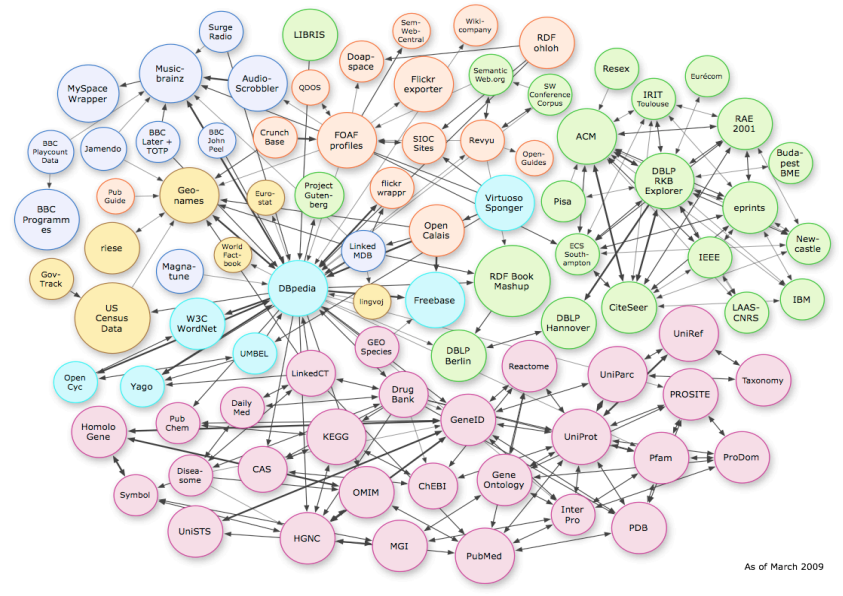
:isRectorOf

:name

<http://www.tuwien.ac.at/person1>

RDF is the basis for Linked Data:

1. Everything gets a URI (conferences, people, talks, ...)
2. These URIs are linked via RDF describing relations
3. Relations are URIs again (e.g. :name)
4. When I dereference the URIs, I should find more information about them



As of March 2009



2. RDF can be described in terms of Schema Information (in “Semantic Web speak” these schemata are called Ontologies)

8

```
:person1      :isRectorOf   :tuwien.  
...  
:person9225749 :lecturesAt   :tuwien.  
:person9225749 :name        "Axel Polleres".
```

RDF Data & OWL & Rules means implicit knowledge! (inference)

```
 $\forall X \forall Y (worksWith(Y, X) \rightarrow Organisation(X))$   
 $\forall X \forall Y (isRectorOf(Y, X) \rightarrow worksWith(X, Y))$   
 $\forall X \forall Y \forall Z (isRectorOf(X, Z) \wedge isRectorOf(Y, Z) \rightarrow X = Y)$ 
```

ExternalLecturer(P)

$\leftarrow lecturesAt(P, U), \text{ not } worksWith(P, U).$

```
:tuwien      rdf:type   :Organisation .  
:person1     :worksWith :tuwien .  
:person9225749 rdf:type   :ExternalLecturer .
```

RULES

ONTOLOGIES
(OWL)

RDF SCHEMA

23 April 2012

2. Structured queries over Web data

SPARQL

- SPARQL = “SQL look-and-feel query language for the Web”
- allows us to ask structured queries such as:
“Persons who work for a technology organization”

```
SELECT ?P
{
  ?P rdf:type :Person.
  ?P :worksWith ?O .
  ?O :topic_interest dbpedia:Technology
}
```

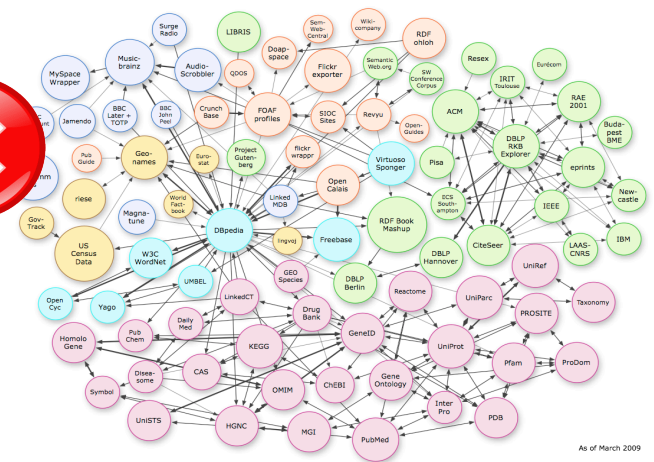
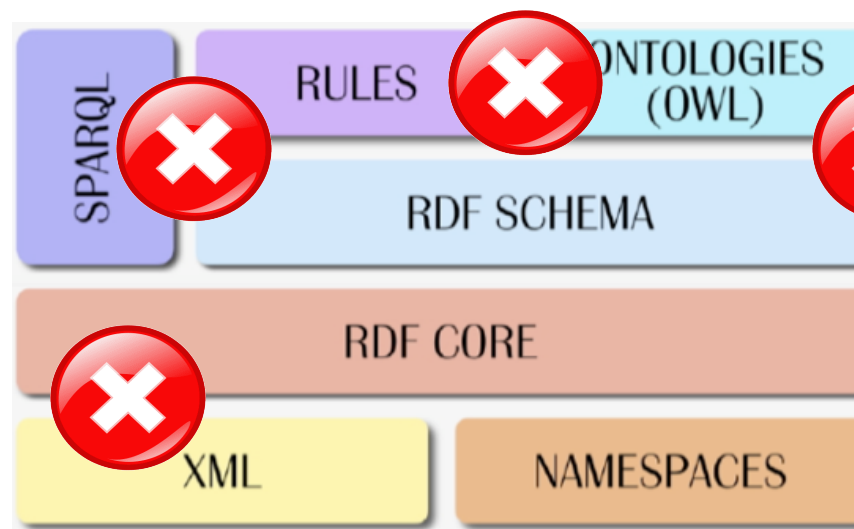
Unions of conjunctive queries, but also advanced features such as outer joins (OPTIONAL), value filtering, etc.

New:

SPARQL1.1 is a W3C Recommendation since March 2013!

How do the standards interplay?

- Challenges:
 - 1) Querying XML & RDF alongside
 - 2) Querying RDF Data & Rules & Ontologies
 - 3) Data on the Web is NOT clean/consistent!



This lecture:

- We will learn:
 - How to use those standards
 - Theoretical foundations of these standards
 - How inferencing over and querying Web Data works
 - Practical applications of Linked Data
- Course Web page:
http://www.polleres.net/teaching/SemWebTech_2013/

Organization:

- Schedule/Dates:
 - 7 lecture dates, that we need to agree upon now (blocked in April & May)
 - Final presentations (in June)
- Communication:
 - via TISS forum or email directly to me: axel.polleres@siemens.com
 - via the course homepage (see prev. slide)
- Evaluation:
 - **Small** Homework for each lecture
 - Final Project OR Presentation on a theoretical topic (groups of two allowed):
 - E.g. you read some paper and give an overview presentation
 - E.g. foundations of SPARQL1.1, Rules on the Web
 - or you do a nice project based on Linked Data
 - (should use more than one RDF dataset, should involve some SPARQL, OWL, etc.)
 - Optional Exam

Dates (pick 7):

- *Disclaimer (might need later rescheduling)*
- Mon 22.4.2013 8:00-10:00 [EI 10 Fritz Paschke HS](#)
- Fri 3.5.2013 9:00-11:00 [Hörsaal 12](#)
- Mon 6.5.2013 8:00-10:00 [EI 10 Fritz Paschke HS](#)
- Mon 13.5.2013 8:00-10:00 [EI 10 Fritz Paschke HS](#)
- Fri 17.5.2013 9:00-11:00 [Hörsaal 12](#)
- Mon 3.6.2013 8:00-10:00 [EI 10 Fritz Paschke HS](#)
- Mon 10.6.2013 8:00-10:00 [EI 10 Fritz Paschke HS](#)
- Lecture rooms will be announced on the TISS-Forum and the lecture homepage!
- Final presentations date to be decided! Preferably second half of June.
- Mon 24.6. 9:00-12:00 [Theresianumgasse HS 1](#) & 15:00-18:00 [Seminarraum 187/2](#)
- Tue 25.6. 9:00-12:00 [Theresianumgasse HS 1](#)