JACOBS UNIVERSITY

RDF & SPARQL

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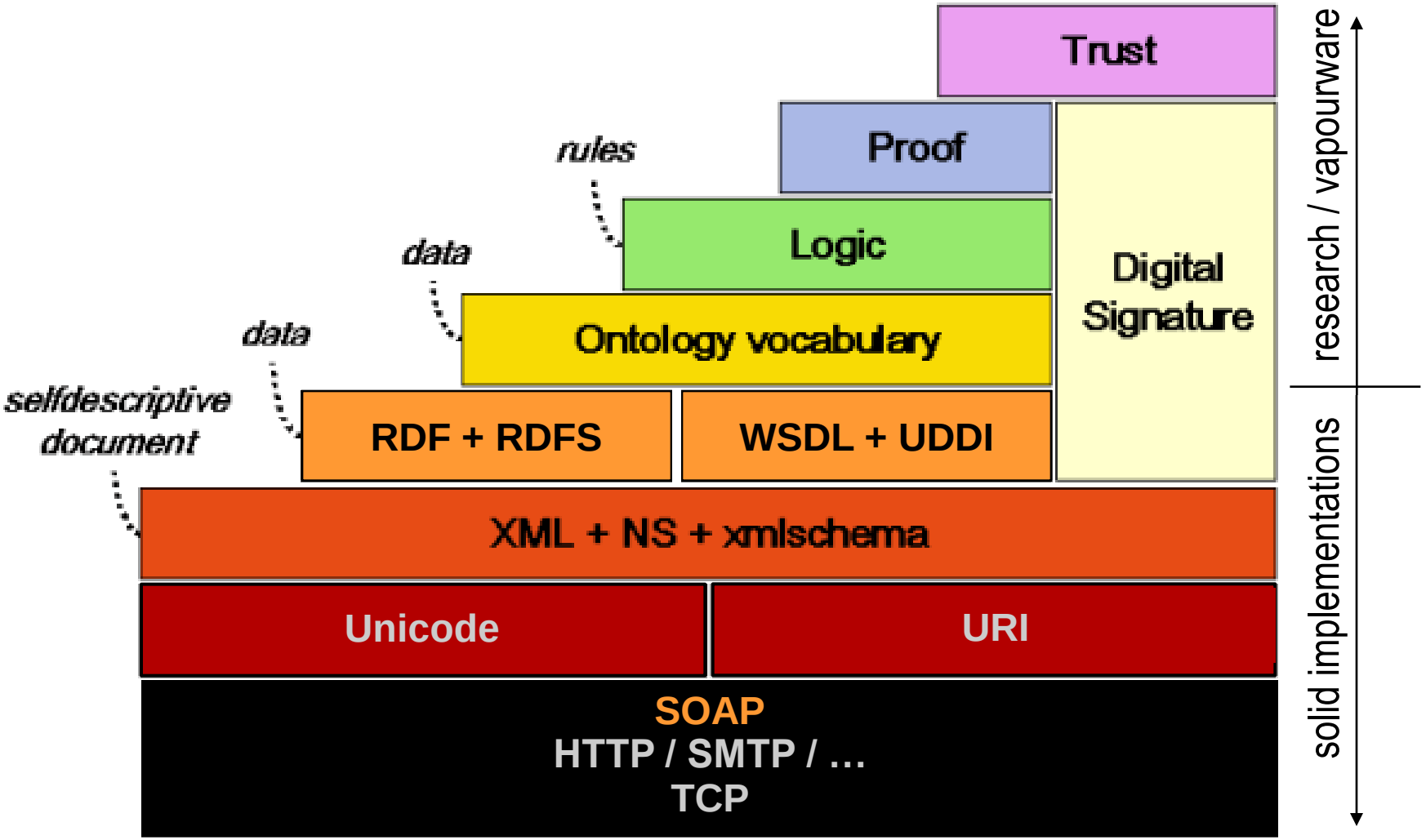
The Semantic Web Stack



RDF

- Resource Description Framework (RDF)
  - framework for describing resources on the web, identified by URIs
    = very simple language for making assertions
  - model for data, and a syntax → independent parties can exchange & use it
  - designed to be read and understood by computers,
    not designed for being displayed to people
- RDF (conceptual model) independent from XML (possible encoding)
- W3C Recommendation, part of W3C's Semantic Web Activity

RDF Data Model

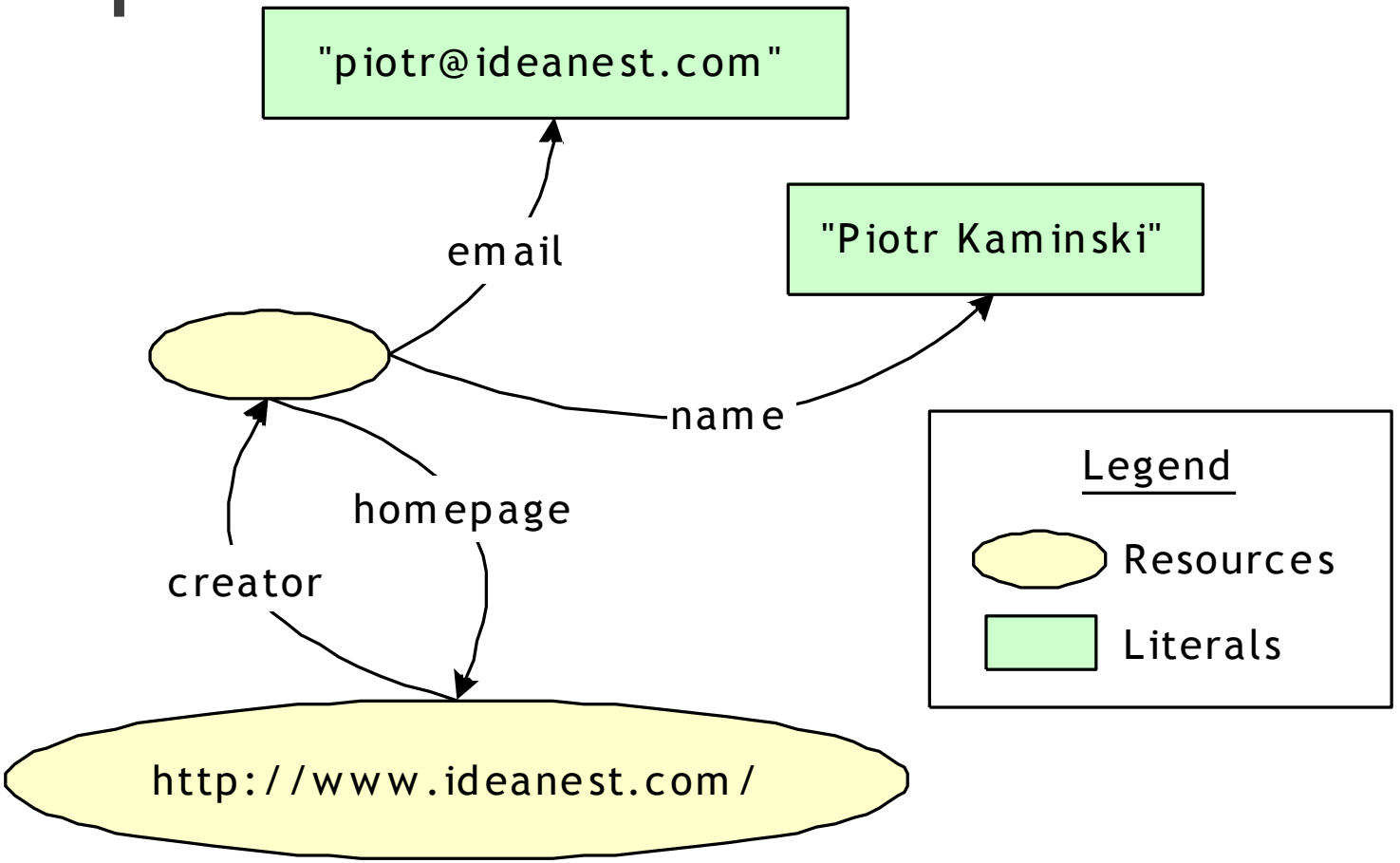
- Conceptual model: directed, labeled graphs
- RDF statements consist of
  - resources (= nodes)
  - which have properties
  - which have values (= nodes, strings)

= subject = object
= predicate = attribute
= object = value

OO Model in Databases?

- Ex: "*http://www.w3.org/TR/REC-rdf-syntax/ has the author Ora Lassila*"

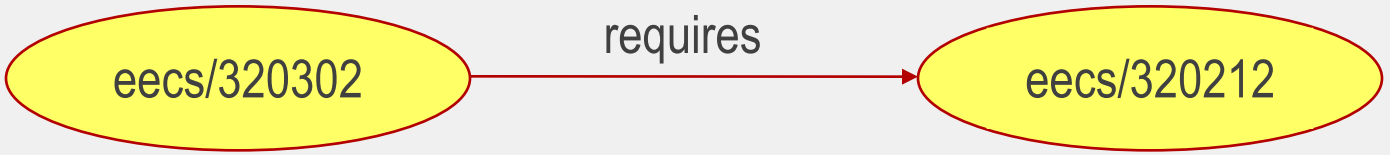
RDF Example



- literals are primitive values
- anonymous *bnodes* are identified by properties

Alternative RDF Representations

Graphs:



Notation3:

```
@prefix in:http://www.iu-bremen.de/ .
in:eecs/320302 in:requires in:eecs/320212 .
```

compact & readable alternative to RDF's XML syntax

XML:

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:in="http://www.iu-bremen.de/">
    <rdf:description rdf:about="http://www.jacobs-university.de/eecs/320302">
        <in:requires rdf:resource="http://www.jacobs-university.de/eecs/320212"/>
    </rdf:description>
</rdf:RDF>
```

RDF doc root

{ }:

```
{ "http://www. jacobs-university.de/eecs/320302“, requires,
  “http://www. jacobs-university.de/eecs/320212“ }
```

SPARQL

- = Simple Protocol and RDF Query Language
  - W3C recommendation
- = QL for RDF
  - extract information in the form of URIs, blank nodes, plain and typed literals
  - extract RDF subgraphs
  - construct new RDF graphs based on information in the queried graphs

- *Let's taste the flavor...*

From SQL To SPARQL

```
SELECT name, email
FROM Person
```

From SQL To SPARQL

```
SELECT ?name ?email
WHERE {
    ?person     rdf:type        foaf:Person.
    ?person     foaf:name       ?name.
    ?person     foaf:mbox       ?email.
}
```

From SQL To SPARQL

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name ?email
WHERE {
    ?person     rdf:type foaf:Person.
    ?person     foaf:name       ?name.
    ?person     foaf:mbox       ?email.
}
```

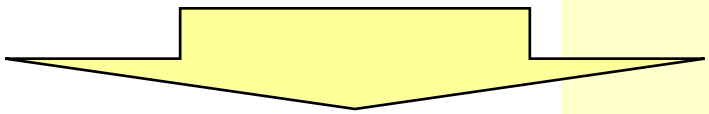
SPARQL – Example 1

- Data (1 triple):

```
<http://example.org/book/book1>
<http://purl.org/dc/elements/1.1/title>
"SPARQL Tutorial" .
```

- Query:

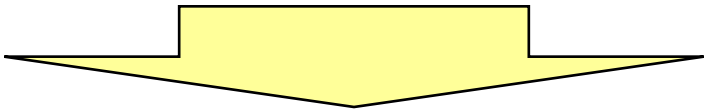
```
SELECT ?title
WHERE
      {
            <http://example.org/book/book1>
            <http://purl.org/dc/elements/1.1/title>
            ?title .
      }
```



title
"SPARQL Tutorial" .

SPARQL – Example 2

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
_:a    foaf:name     "Johnny Lee Outlaw" .
_:a    foaf:mbox     <mailto:jlow@example.com> .
_:b    foaf:name     "Peter Goodguy" .
_:b    foaf:mbox     <mailto:peter@example.org
_:c foaf:mbox        <mailto:carol@example.org
```



```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name ?mbox
WHERE
        {
                ?x foaf:name ?name .
                ?x foaf:mbox ?mbox
        }
```

name	*mbox*
"Johnny Lee Outlaw“	<mailto:jlow@example.com>
"Peter Goodguy“	<mailto:peter@example.org>

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Recap: where do we stand with Semantic Web Services?

Step 1: What We See

WWW2002

The eleventh international world wide web conference

Sheraton waikiki hotel, Honolulu, hawaii, USA

7-11 may 2002, 1 location 5 days learn interact

Registered participants coming from

australia, canada, chile denmark, france, germany, ghana, hong kong,, norway, singapore, switzerland, the united kingdom, the united states, vietnam, zaire

Register now

On the 7th May Honolulu will provide the backdrop of the eleventh international world wide web conference. This prestigious event..

Speakers confirmed

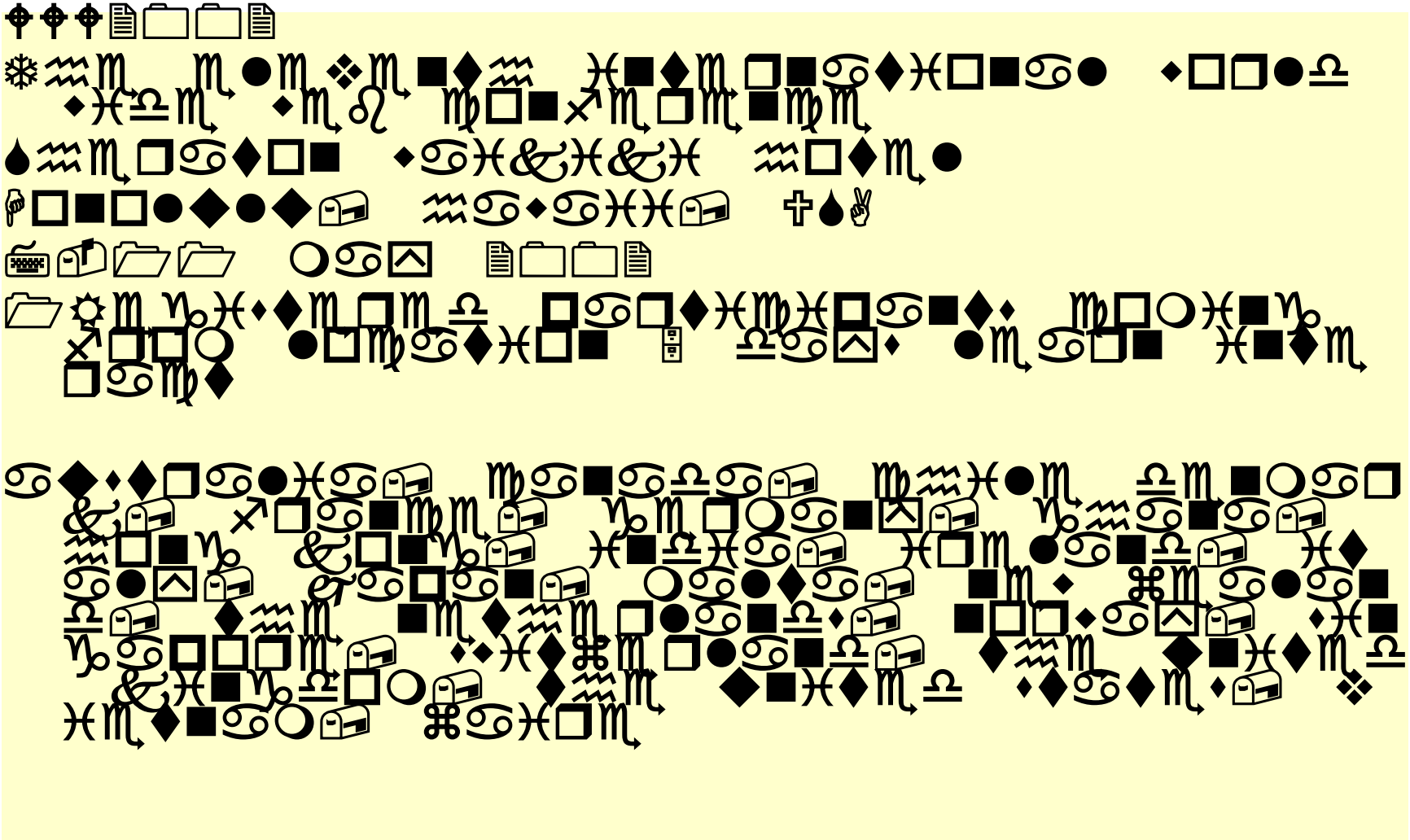
Tim Berners-Lee

Tim is the well known inventor of the Web, …

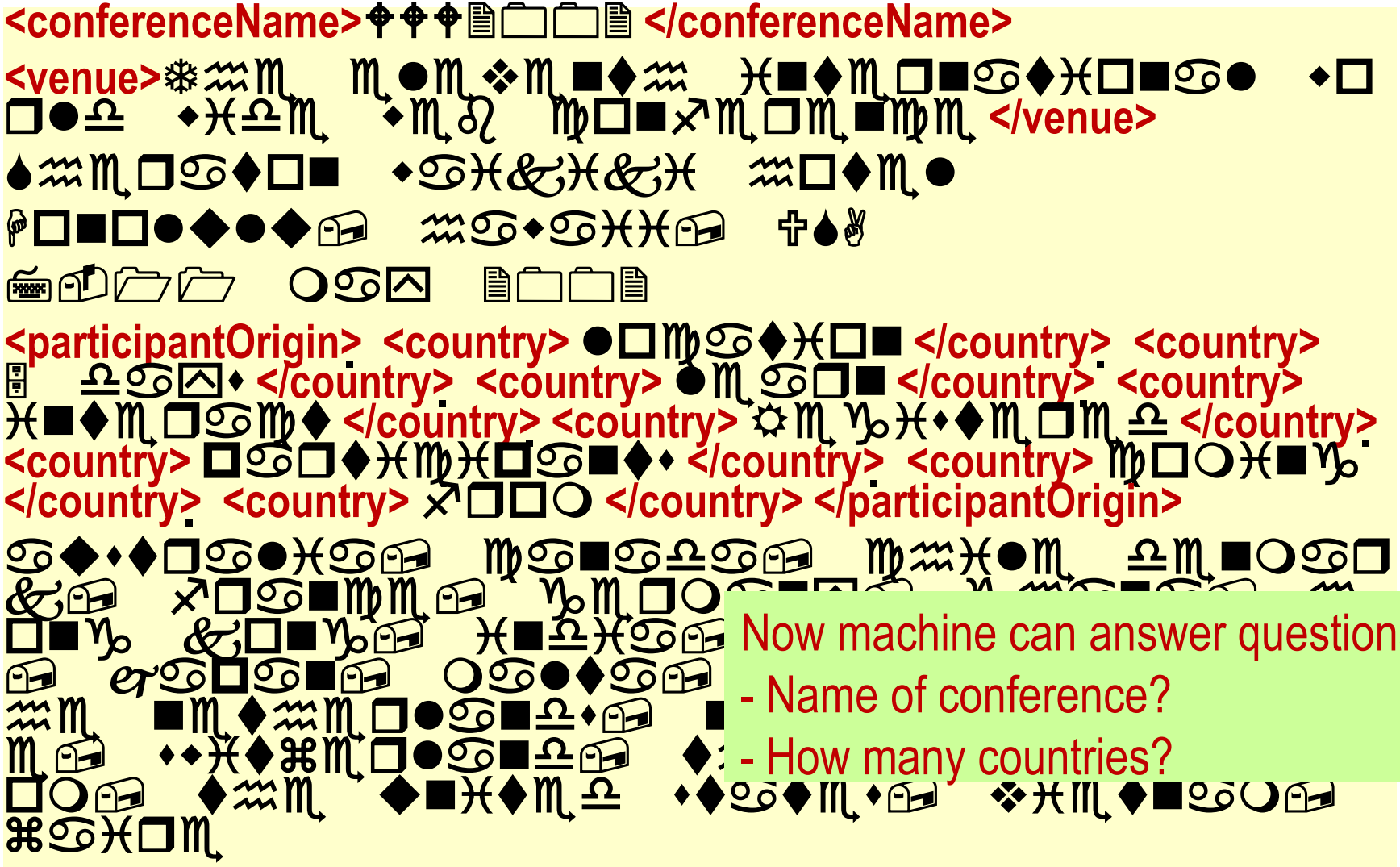
Ian Foster

Ian is the pioneer of the Grid, the next generation internet …

Step 1: What a Machine Sees



Step 1: What a Machine Sees with XML



Step 2: Understand the Unknown

"Find Prof. Cook, a professor at U Washington,
earlier a senior lecturer at his alma mater in Australia"

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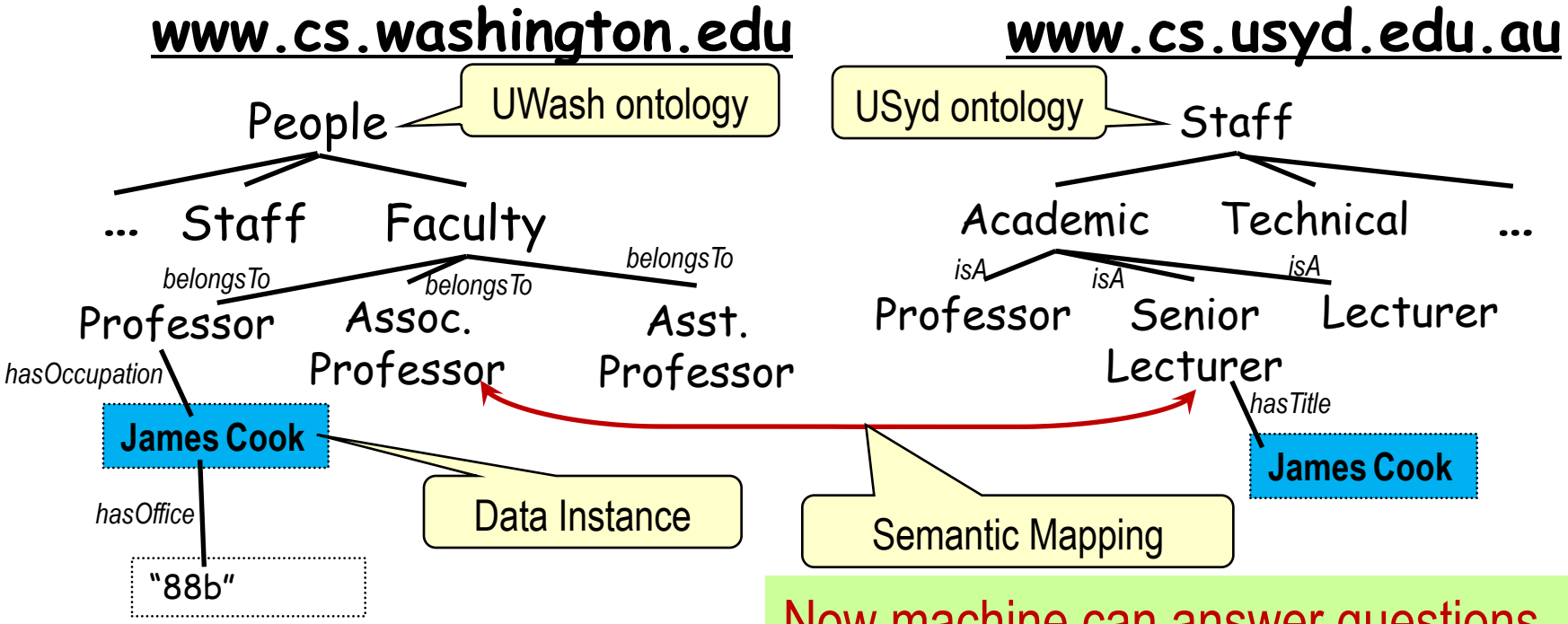

Now machine can answer questions on concept worlds („ontologies")

RDF - Examples of Use

- Describing properties for shopping items
  - such as price and availability
- Describing time schedules for web events
- Describing information about web pages
  - such as content, author, created and modified date
- Describing content and rating for web pictures
- Describing content for search engines
- Describing electronic libraries

Resources

- www.w3.org/RDF/Validator (online RDF validator)
- http://homepages.cwi.nl/~lynda/spool/sw-tue-2003.ppt
- www.ltg.ed.ac.uk/~ht/ora-rdf-dagstuhl.ppt
- www.w3c.org/RDF/Metalog
- Implementations:
  - FOSS: Apache Jena (Java), Sesame (Java), RDF-Query (Perl), Dydra (cloud), ...
  - Commercial: Oracle Semantic Technologies, OpenLink Virtuoso, ...
  - See also: Planet RDF, Triplr