

Introduction to the Semantic Web and FOAF

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Overview

Web 1.0

Web 2.0

Web 3.0

Motivation

Semantic Web layer cake

FOAF

FOAF Ontology

FOAF network

FOAF Use Case

Web 1.0

Web 1.0

- ▶ Invented 1991

Web 1.0

- ▶ Invented 1991
- ▶ Tim Berners-Lee



Document Web

Document **Web**

- ▶ **Web** of documents

Document **Web**

- ▶ **Web** of documents
- ▶ Connected by **URL** (Uniform resource locator)

Document Web

Document Web

- ▶ Web for **documents**

Document Web

- ▶ Web for **documents**
- ▶ Specifies **looks**

Document Web

- ▶ Web for **documents**
- ▶ Specifies **looks**
- ▶ HTML, CSS

Web as a simple graph

Web as a simple graph

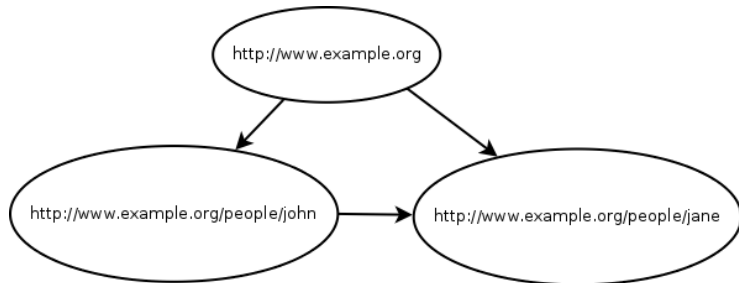
- ▶ Pages as graph nodes

Web as a simple graph

- ▶ Pages as graph nodes
- ▶ Links as graph links

Web as a simple graph

- ▶ Pages as graph nodes
- ▶ Links as graph links



Web 2.0

Application Web

Web 2.0

Application Web

- ▶ Web applications

Web 2.0

Application Web

- ▶ Web applications
- ▶ AJAX, JavaScript frameworks...

Web 2.0

Application Web

- ▶ Web applications
- ▶ AJAX, JavaScript frameworks...
- ▶ *jargon*

Web 1.0/2.0

Machine unreadable

Web 1.0/2.0

Machine unreadable

- ▶ Lacks semantics

Web 1.0/2.0

Machine unreadable

- ▶ Lacks semantics
- ▶ No page (graph node) description

Web 1.0/2.0

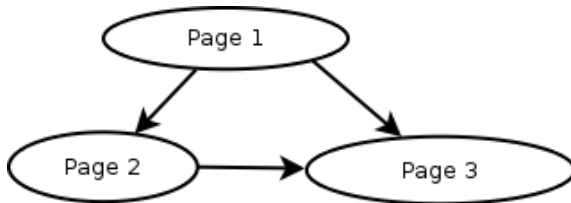
Machine unreadable

- ▶ Lacks semantics
- ▶ No page (graph node) description
- ▶ No link (graph link) description

Web 1.0/2.0

Machine unreadable

- ▶ Lacks semantics
- ▶ No page (graph node) description
- ▶ No link (graph link) description



Semantic Web

Semantic Web

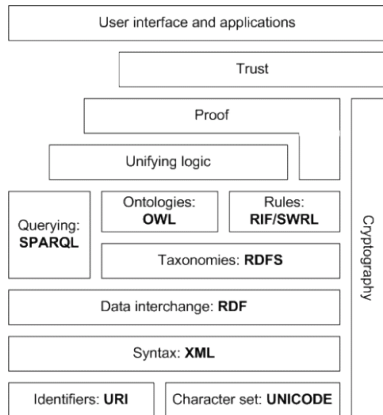
▶ **Data** Web

Semantic Web

- ▶ **Data** Web
- ▶ Machine readable

Semantic Web layer cake

- ▶ Layers of abstraction
- ▶ Hierarchy of languages



Layer 0: Identifiers & Character set

Unicode

Display and manipulate text in most world languages.

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Unicode

Display and manipulate text in most world languages.

URI

Uniquely identify Web resources:

- ▶ URL `http://example.org/people/john`
- ▶ URN `urn:issn:1535-3613`

Layer 1: Syntax

Layer 1: Syntax

XML

Structure data

Layer 1: Syntax

XML

Structure data

XML Schema

Specifies type of XML document

Layer 1: Syntax

XML

Structure data

XML Schema

Specifies type of XML document

XML Namespace

Removes ambiguity with unique naming

Layer 2: Data interchange

RDF

Represents a graph Statements in the form of triplets

Layer 3: Taxonomies & Queries

Layer 3: Taxonomies & Queries

RDF Schema

Vocabulary for RDF

Layer 3: Taxonomies & Queries

RDF Schema

Vocabulary for RDF

SPARQL

Query language

Layer 4: Ontologies & Rules

Layer 4: Ontologies & Rules

OWL

Extends on RDFS

Layer 4: Ontologies & Rules

OWL

Extends on RDFS

RIF/SWRL

- ▶ SWRL: rule language
- ▶ RIF: rule interchange
- ▶ (SQWRL for reasoning)

An alternative look on the layer cake...



FOAF Ontology

FOAF Ontology

- ▶ An OWL based ontology

FOAF Ontology

- ▶ An OWL based ontology
- ▶ Ontology for the **social web**

FOAF Ontology

Key entities

- ▶ Agent, Person, Group, Document, Project
- ▶ foaf:Agent, foaf:Person, foaf:Group, foaf:Document, foaf:Project

FOAF Ontology

Key entities

- ▶ Agent, Person, Group, Document, Project
- ▶ **foaf:Agent**, **foaf:Person**, **foaf:Group**,
foaf:Document, **foaf:Project**
- ▶ foaf namespace = <http://xmlns.com/foaf/0.1/>

FOAF Ontology

Key entities

- ▶ Agent, Person, Group, Document, Project
- ▶ foaf:**Agent**, foaf:**Person**, foaf:**Group**,
foaf:**Document**, foaf:**Project**
- ▶ OWL classes
- ▶ Person is an Agent subclass
- ▶ Document and Project are subclasses of owl:Thing

FOAF Ontology

Person properties

Data properties

FOAF Ontology

Person properties

Data properties

- ▶ First name, foaf:firstName

FOAF Ontology

Person properties

Data properties

- ▶ First name, foaf:firstName
- ▶ Last name, foaf:lastName

FOAF Ontology

Person properties

Data properties

- ▶ First name, foaf:firstName
- ▶ Last name, foaf:lastName
- ▶ Mail, foaf:mbox

FOAF Ontology

Person properties

Data properties

- ▶ First name, foaf:firstName
- ▶ Last name, foaf:lastName
- ▶ Mail, foaf:mbox
- ▶ Nick, foaf:nick

FOAF Ontology

Person properties

Data properties

- ▶ First name, foaf:firstName
- ▶ Last name, foaf:lastName
- ▶ Mail, foaf:mbox
- ▶ Nick, foaf:nick
- ▶ Homepage, foaf:homepage

FOAF Ontology

Person properties

Data properties

- ▶ First name, foaf:firstName
- ▶ Last name, foaf:lastName
- ▶ Mail, foaf:mbox
- ▶ Nick, foaf:nick
- ▶ Homepage, foaf:homepage
- ▶ Age, foaf:age

FOAF Ontology

Person properties

Data properties

- ▶ First name, foaf:firstName
- ▶ Last name, foaf:lastName
- ▶ Mail, foaf:mbox
- ▶ Nick, foaf:nick
- ▶ Homepage, foaf:homepage
- ▶ Age, foaf:age
- ▶ ...

Example FOAF Person

```
<foaf:Person>  
  <foaf:name>John Doe</foaf:name>  
  <foaf:firstName>John</foaf:firstName>  
  <foaf:lastName>Doe</foaf:surname>  
  <foaf:nick>johndoe</foaf:nick>  
</foaf:Person>
```

FOAF Ontology

Entity relationships

Object properties

FOAF Ontology

Entity relationships

Object properties

- ▶ John knows Jane, foaf:knows (Person->Person)

FOAF Ontology

Entity relationships

Object properties

- ▶ John knows Jane, foaf:knows (Person->Person)
- ▶ John is a member of the Semantic Interest Group, foaf:member (Person->Group)

FOAF Ontology

Entity relationships

Object properties

- ▶ John knows Jane, foaf:knows (Person->Person)
- ▶ John is a member of the Semantic Interest Group, foaf:member (Person->Group)
- ▶ John made a book called "Semantic Web for Dummies", foaf:made, (Agent->Thing)

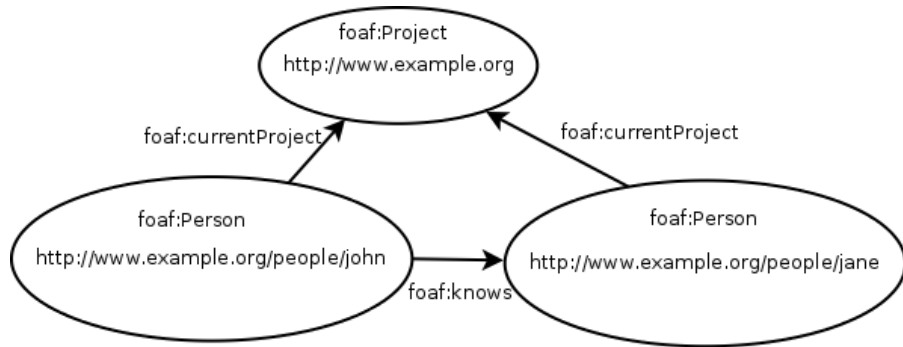
FOAF Ontology

Entity relationships

Object properties

- ▶ John knows Jane, foaf:knows (Person->Person)
- ▶ John is a member of the Semantic Interest Group, foaf:member (Person->Group)
- ▶ John made a book called "Semantic Web for Dummies", foaf:made, (Agent->Thing)
- ▶ John is working on a project "The New SQWRL reasoner", foaf:currentProject, (Person->Thing)

FOAF Semantic Network



Using FOAF data

Using FOAF data

- ▶ XML tools with RDF/XML

Using FOAF data

- ▶ XML tools with RDF/XML
- ▶ With SPARQL

Using FOAF data

- ▶ XML tools with RDF/XML
- ▶ With SPARQL
- ▶ Transform to proprietary format

List people's names and emails

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

List people who know someone named John

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name
WHERE {
    ?person a foaf:Person.
    ?person foaf:name ?name.
    ?john a foaf:Person.
    ?john foaf:name "John".
    ?person foaf:knows ?john.
}
```

FOAF Use Case

FOAF Use Case

- ▶ Rank people based on their popularity

FOAF Use Case

- ▶ Rank people based on their popularity
- ▶ Use data from FOAF networks

Implementation

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- ▶ Crawl through available FOAF sites

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- ▶ Crawl through available FOAF sites
- ▶ Load FOAF using an RDF/OWL parser

Implementation

- ▶ Crawl through available FOAF sites
- ▶ Load FOAF using an RDF/OWL parser
- ▶ Query interesting data with SPARQL

Implementation

- ▶ Crawl through available FOAF sites
- ▶ Load FOAF using an RDF/OWL parser
- ▶ Query interesting data with SPARQL
- ▶ Extract to a proprietary format

FOAF data

FOAF as a graph

FOAF data

FOAF as a graph

- ▶ foaf:Person entities as graph nodes

FOAF data

FOAF as a graph

- ▶ foaf:Person entities as graph nodes
- ▶ foaf:knows relationships as graph links

FOAF data

FOAF as a graph

- ▶ foaf:Person entities as graph nodes
- ▶ foaf:knows relationships as graph links
- ▶ Algorithms for graph analysis (HITS, PageRank)

The End