Learning Module 5. Metadata for Semantic Web

Week 5 Presentation
Evolution to Semantic Web

Web 1.0
("Syntactic" Web)

Web 2.0
(still "Syntactic" Web but with social component)

Web 3.0 (Semantic Web)

We are here

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Major problem with Syntactic Web

Markup (HTML) consists of:
- rendering information (e.g., font size and color)
- hyperlinks to related content.

Semantic content:
- accessible to humans
- BUT not (easily) accessible to computers

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What information humans & machines see?

Humans

The 78th ASIS&T annual meeting conference
Hyatt Regency hotel
Saint Louis, Missouri, USA
6-10 November 2015

Template for submission in PDF
Submission types are Papers, Panels,
Workshops, Tutorials, Posters, Demos, and Videos

Submissions due April 30 and July 1
Authors notified of acceptance decisions by
June 11 or July 30
Final versions of accepted submissions due by
July 15 or August 20

Conference chairs include Lisa Given, Brian Detlor, Hazel Hall, Allison Brettle...

Computers
Partial solution vs. real solution to this problem

<table>
<thead>
<tr>
<th>Partial solution: semantic markup with XML, e.g.:</th>
<th>Real solution: Semantic Web</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;conferenceName&gt;</code>&lt;conferenceName&gt;</td>
<td>Published on the Web computer-processable descriptions of:</td>
</tr>
<tr>
<td><code>&lt;conferenceLocation&gt;</code>&lt;conferenceLocation&gt;</td>
<td>• Web <strong>documents</strong>, and</td>
</tr>
<tr>
<td><code>&lt;conferenceDates&gt;</code>&lt;conferenceDates&gt;</td>
<td>• <strong>Concepts</strong> from the real world:</td>
</tr>
<tr>
<td><code>&lt;template&gt;</code>&lt;template&gt;</td>
<td>• <strong>People</strong></td>
</tr>
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<td><code>&lt;submissionTypes&gt;</code>&lt;submissionTypes&gt;</td>
<td>• <strong>Organizations</strong></td>
</tr>
<tr>
<td><code>&lt;submissionDeadlines&gt;</code>&lt;submissionDeadlines&gt;</td>
<td>• <strong>Topics</strong></td>
</tr>
<tr>
<td><code>&lt;notificationDates&gt;</code>&lt;notificationDates&gt;</td>
<td>• <strong>Things</strong></td>
</tr>
<tr>
<td><code>&lt;conferenceChairs&gt;</code>&lt;conferenceChairs&gt;</td>
<td></td>
</tr>
</tbody>
</table>

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Towards Semantic Web: **Linked Data**

Term coined by Tim Berners-Lee (2006)

Powerful mechanism for connecting disparate and heterogeneous data

- Structured data for the Semantic Web
1. Use **URI**s as names for things
2. Use HTTP **URI**s so that people can look up those names
3. When someone looks up a **URI**, provide useful information
4. Include links to other **URI**s

- From **hypertext** links (linking documents) to **hyperdata** links (linking data)

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Linked Data in 2007: 12 nodes

Linked Data in 2014: 570 nodes


Publications domain

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Linked Data relies on **RDF: Resource Description Framework language**

In RDF, everything can be represented as an **RDF statement**: subject-predicate-object

*Subject* has a *property* with value “*object*”

• *Resource* – the *subject* of a Statement
• *Property* – the *predicate* of a Statement
• *Property value* – the *object* of a Statement

Example Statement: “The subject of this lecture is Linked Data”

*Subject*: this lecture
*Predicate*: subject
*Object*: Linked Data
RDF Triple = single RDF statement

Resource (subject) → Property (predicate) → Value (object)

BOOK (subject) → TITLE (predicate) → Harry Potter and the Chamber of Secrets (object)

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RDF Graphs with "literal" nodes

Series (collection) of RDF statements / triples

Harry Potter and the Chamber of Secrets

Scholastic

Potter, Harry

Rowling, J.K.

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RDF Graphs: URIs instead of “literals”

4 LD principles:
1. Use URIs as names for things
2. Use HTTP URIs so that people can look up those names
3. When someone looks up a URI, provide useful information
4. Include links to other URIs

http://id.loc.gov/authorities/names/nb2007012944.html
http://id.loc.gov/authorities/subjects/sh85129426
http://id.loc.gov/vocabulary/relators/pbl
http://id.loc.gov/vocabulary/relators/author
http://id.loc.gov/authorities/names/n85195338.html
http://id.loc.gov/authorities/names/n97108433.html
http://id.loc.gov/authorities/names/no2006054546.html
http://purl.org/dc/terms/title

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Example: subject authority record as linked data

Linked Data principles:
1. Use URIs as names for things
2. Use HTTP URIs so that people can look up those names
3. When someone looks up a URI, provide useful information
4. Include links to other URIs

RDF statements are expressed syntactically in multiple ways ("serializations"): RDF/XML, N-Triples, JSON
Harry Potter authority record in **JSON syntax**

```json
[ {
    "@id": ":b45authoritiesnamesnb2007012944",
    "@type": [
        "http://www.loc.gov/mads/rdf/v1#Source",
        "http://www.loc.gov/mads/rdf/v1#citation-source": 
            [ 
                { 
                    "@value": "Breaks, 'fillers', endings and introductions for piano, 1927"
                } ],
                "http://www.loc.gov/mads/rdf/v1#citation-status": 
                    [ 
                        { 
                            "@value": "found"
                        } ],
                "@id": ":b16authoritiesnamesnb2007012944",
                "@type": [
                    "http://www.loc.gov/mads/rdf/v1#RWO",
                    "http://xmlns.com/foaf/0.1/Person"
                ],
                "@id": ":b57authoritiesnamesnb2007012944",
                "@type": [
                    "http://www.loc.gov/mads/rdf/v1#Source",
                    "http://www.loc.gov/mads/rdf/v1#citation-source": 
                        [ 
                            { 
                                "@value": "Father of Deptford, 1994:"
                            } ],
                    "http://www.loc.gov/mads/rdf/v1#citation-note": 
                        [ 
                            { 
                                "@language": "en",
                                "@value": "t.p. (Harry Potter)"
                            } ],
                    "http://www.loc.gov/mads/rdf/v1#citation-status": 
                        [ 
                            { 
                                "@value": "found"
                            } ],
                "@id": ":b96authoritiesnamesnb2007012944",
                "@type": [
                    "http://purl.org/vocab/changeset/schema#ChangeSet",
                    "http://purl.org/vocab/changeset/schema#subjectOfChange": 
                        [ 
                            { 
                                "@id": ":id.loc.gov/authorities/names/nb2007012944"
                            } ],
                    "http://purl.org/vocab/changeset/schema#creatorName": 
                        [ 
                            { 
                                "@id": ":id.loc.gov/vocabulary/organizations/uk"
                            } ],
                    "http://purl.org/vocab/changeset/schema#createdDate": 
                        [ 
                            { 
                                "@type": "http://www.w3.org/2001/XMLSchema#dateTime",
                                "@value": "2014-12-19T10:22:55"
                            } ],
                    "http://purl.org/vocab/changeset/schema#changeReason": 
                        [ 
                            { 
                                "@type": "http://www.x3w.org/2001/XMLSchema#string",
                                "@value": "revised"
                            } ],
                "@id": ":b31authoritiesnamesnb2007012944",
                "@type": [
                    "http://www.loc.gov/mads/rdf/v1#Source",
                    "http://www.loc.gov/mads/rdf/v1#citation-source": 
                        [ 
                            { 
                                "@value": "Edinburgh under siege, 2003:"
                            } ],
                    "http://www.loc.gov/mads/rdf/v1#citation-note": 
                        [ 
                            { 
                                "@language": "en",
                                "@value": "t.p. (Harry Potter) back cover (lawyer and writer, other books Blood feud, The Stewarts and Gordons at war in the age of Mary Queen of Scots) BL AL sent 1 May 2007 no reply received"
                            } ],
                    "http://www.loc.gov/mads/rdf/v1#citation-status": 
                        [ 
                            { 
                                "@value": "found"
                            } ]
                        ],
                "@id": ":id.loc.gov/authorities/names/nb2007012944",
                "@type": [
                    "http://www.loc.gov/mads/rdf/v1#PersonalName",
                    "http://www.loc.gov/mads/rdf/v1#Authority"
                ]
            ]
        ]
    ]
```
Harry Potter RDF authority record in **N-Triples** syntax
Harry Potter authority record in **RDF/XML syntax**

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  <madsrdf:PersonalName rdf:about="http://id.loc.gov/authorities/names/nb2007012944"/>
  <madsrdf:authoritativeLabel xml:lang="en">Potter, Harry</madsrdf:authoritativeLabel>
  <madsrdf:elementList rdf:parseType="Collection">
    <madsrdf:FullNameElement>
      <madsrdf:elementValue xml:lang="en">Potter, Harry</madsrdf:elementValue>
    </madsrdf:FullNameElement>
  </madsrdf:elementList>
  <madsrdf:isMemberOfMADSCollection rdf:resource="http://id.loc.gov/authorities/names/collection_NamesAuthorizedHeadings"/>
</rdf:RDF>
```

- **subject** (same for all statements in this record)
- **predicate**
- **object**
RDF/XML syntax in **authority** and bibliographic (i.e., **descriptive**) metadata records

<table>
<thead>
<tr>
<th>Both Authority and Descriptive Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Starting with <code>&lt;rdf:RDF&gt;</code> and ending with <code>&lt;/rdf:RDF&gt;</code></td>
</tr>
<tr>
<td>• Point to <strong>RDF Namespace</strong>: <code>xmlns:rdf=http://www.w3.org/1999/02/22-rdf-syntax-ns#</code></td>
</tr>
<tr>
<td>• File format: <code>.rdf</code></td>
</tr>
</tbody>
</table>

**MADS Authority Metadata**

Main (root) element in record to define the subject, predicate and object of the statement:

- `<madsrdf:PersonalName rdf:about="...">`
- OR `<madsrdf:CorporateName rdf:about="...">`
- OR `<madsrdf:GeographicName rdf:about="...">` etc.

**Descriptive Metadata**

Main (root) element in bibliographic record to define the subject, predicate and object of the statement:

- `<rdf:Description rdf:about="...">`

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<?xml version="1.0"?>
<!-- xml namespaces: RDF's and DC's -->
<prefix rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"/>
<prefix dc="http://purl.org/dc/elements/1.1/"/>

<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dc="http://purl.org/dc/elements/1.1/">
  <rdf:Description rdf:about="Harry Potter and the Chamber of Secrets">
    <dc:creator>Rowling, J. K.</dc:creator>
    <dc:publisher>Scholastic Press</dc:publisher>
    <dc:subject>Potter, Harry</dc:subject>
    <dc:date>2010-08-15</dc:date>
    <dc:type>book</dc:type>
    <dc:format>text</dc:format>
    <dc:language>en</dc:language>
  </rdf:Description>
</rdf:RDF>
Same basic DC metadata record expressed in RDF/XML: URIs added

```xml
<?xml version="1.0"?>
<rdf:RDF
   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
   xmlns:dc= "http://purl.org/dc/elements/1.1/">
   <rdf:Description rdf:about="http://id.loc.gov/authorities/names/no2006054546.html">
     <dc:creator rdf:resource="http://id.loc.gov/authorities/names/n97108433">
       Rowling, J. K.
     </dc:creator>
     <dc:publisher rdf:resource="http://id.loc.gov/authorities/names/n85195338.html">
       Scholastic Press
     </dc:publisher>
     <dc:subject rdf:resource="http://id.loc.gov/authorities/names/nb2007012944.html">
       Potter, Harry
     </dc:subject>
     <dc:date>2010-08-15</dc:date>
     <dc:type>book</dc:type>
     <dc:format>text</dc:format>
     <dc:language>en</dc:language>
   </rdf:Description>
</rdf:RDF>
```
MODS metadata record (minimal) expressed in RDF/XML (" literals" only)

  <mods:name type="personal" authority="naf">  
    <mods:namePart>Rowling, J. K.</mods:namePart>  
    <mods:role>  
      <mods:roleTerm>Author</mods:roleTerm>  
    </mods:role>  
  </mods:name>  
  <mods:typeOfResource>text</mods:typeOfResource>  
  <mods:originInfo>  
    <mods:publisher>Scholastic Press</mods:publisher>  
    <mods:dateIssued>2010-08-15</mods:dateIssued>  
  </mods:originInfo>  
  <mods:language>  
    <mods:languageTerm authority="marclanguage" type="code">en</mods:languageTerm>  
  </mods:language>  
  <mods:subject authority="lcsh">  
    <mods:topic>Potter, Harry</mods:topic>  
  </mods:subject> </rdf:Description></rdf:RDF>

2 XML namespaces: RDF’s and MODS’s
Same basic MODS metadata record expressed in RDF/XML: **URIs added**

```xml
<?xml version="1.0"?>
  <rdf:Description rdf:about="http://id.loc.gov/authorities/names/no2006054546.html">
    <mods:name type="personal" authority="naf" valueURI="http://id.loc.gov/authorities/names/n97108433"/>
      <mods:namePart>Rowling, J. K.</mods:namePart>
      <mods:role><mods:roleTerm valueURI="http://id.loc.gov/vocabulary/relators/aut">>>Author</mods:roleTerm></mods:role>
  </.mods:name>
  <mods:typeOfResource>text</mods:typeOfResource>
  <mods:originInfo>
    <mods:publisher rdf:resource="http://id.loc.gov/authorities/names/n85195338.html"/>
      Scholastic Press</mods:publisher>
    <mods:dateIssued>2010-08-15</mods:dateIssued>
  </mods:originInfo>
  <mods:language>
    <mods:languageTerm authority="marclanguage" type="code" valueURI="http://id.loc.gov/vocabulary/languages/eng"/>eng</mods:languageTerm>
  </mods:language>
  <mods:subject authority="lcsh" rdf:resource="http://id.loc.gov/authorities/names/nb2007012944.html"/>
    <mods:topic>Potter, Harry</mods:topic>
  </mods:subject>
</rdf:Description>
</rdf:RDF>
```
Key components of ontology

**Individuals**
- objects in the world
- belong to classes (members of the class)
- are related to other objects and to data values via properties

**Classes**
- a collection of individuals (object, things, ...)
- a way of describing part of the world
- an object in the world
- e.g., pet, huskie

**Properties**

**Axioms**
Example of individual

**Luna** (my dog)
Member of classes & subclasses:
- Pets
- Females
- Dogs
  - Huskies

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Examples of class: FRBR model ontology

Image

URI: http://purl.org/vocab/frbr/core#Image

Semantics

Being a member of this class implies also being a member of expression.

Expression

URI: http://purl.org/vocab/frbr/core#Expression

A class whose members are a realization of a single work usually in a physical form. This class corresponds to the FRBR group one entity 'Expression'.

Semantics

Being a member of this class implies also being a member of endeavour. No member of this class can also be a member of work, item or manifestation. Having a realization of, an embodiment, an abridgement, an abridgement of, a revision of, a translation, a translation of, an arrangement, an arrangement of or a realizer implies being a member of this class. Things are a member of this class if they are the value of a realization, an embodiment, an abridgement, an abridgement of, a revision, a revision of, a translation, a translation of, an arrangement, an arrangement of or a
Key components of ontology (2)

**Individuals**
- objects in the world
- belong to classes (members of the **class**)
- are related to other objects and to data values via **properties**

**Classes**
- a collection of **individuals** (object, things, . . .)
- a way of describing part of the world
- an object in the world
- e.g., pet, huskie

**Properties**
- an object in the world
- a way of describing a kind of relationship between **individuals**
- a collection of relationships between **individuals** (and data)
- e.g., has pet

**Axioms**
- Statements that are assumed to be true without proof

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Example of **property**: FRBR model ontology

translation of

**URI:** [http://purl.org/vocab/frbr/core#translationOf](http://purl.org/vocab/frbr/core#translationOf)

A property representing an expression that is translated.

**Semantics**

Having this property implies being an `expression`. Every value of this property is an `expression`. It is a sub-property of `related endeavor` and the inverse of `translation`.

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Examples of **axiom**: FRBR model ontology

**translation of**

**URI:** [http://purl.org/vocab/frbr/core#translationOf](http://purl.org/vocab/frbr/core#translationOf)

A property representing an expression that is translated.

**Semantics**

Having this property implies being an **expression**. Every value of this property is an **expression**. It is a sub-property of **related endeavour** and the inverse of **translation**.

**expression**

**URI:** [http://purl.org/vocab/frbr/core#Expression](http://purl.org/vocab/frbr/core#Expression)

A class whose members are a realization of a single work usually in a physical form. This class corresponds to the FRBR group one entity 'Expression'.

**Semantics**

Being a member of this class implies also being a member of **endeavour**. No member of this class can also be a member of **work**, **item** or **manifestation**. Having a realization of, an embodiment, an abridgement, an abridgement of, a revision, a revision of, a translation, a translation of, an arrangement, an arrangement of or a realizer implies being a member of this class. Things are a member of this class if they are the value of a realization, an embodiment of, an abridgement, an abridgement of, a revision, a revision of, a translation, a translation of, an arrangement, an arrangement of or a...
Ontology example: **SKOS**

(Simple Knowledge Organization System)

describes thesauri and taxonomies

**Core vocabulary:**

- **Classes:**
  - Concept
  - Collection

- **Properties:**
  - broader
  - narrower
  - subject
  - related

**SKOS Namespace:** http://www.w3.org/2004/02/skos/core#

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<?xml version="1.0" encoding="UTF-8"?>
  <skos:concept>
    <skos:prefLabel>Photographs</skos:prefLabel>
    <skos:scopeNote>The word PHOTOGRAPHS is a general designation for any photographic process. The narrower term includes both physical media and genre categories. </skos:scopeNote>
    <skos:broadер>Pictures</skos:broadер>
    <skos:narrower>Daguerreotypes</skos:narrower>
    <skos:narrower>Digital photographs</skos:narrower>
    <skos:narrower>Negatives</skos:narrower>
    <skos:narrower>Photographic prints</skos:narrower>
    <skos:related>Montages</skos:related>
  </skos:concept>
</xml>
Basic SKOS examples in XML and RDF/XML

```xml
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:skos="http://www.w3.org/2004/02/skos/core#">
  <rdf:Description rdf:about="http://id.loc.gov/authorities/sh93008774#concept">
    <rdf:type rdf:resource="http://www.w3.org/2004/02/skos/core#Concept"/>
    <skos:prefLabel>Rare vertebrates</skos:prefLabel>
    <skos:altLabel>Threatened vertebrates</skos:altLabel>
    <skos:altLabel>Endangered vertebrates</skos:altLabel>
    <skos:altLabel>Vanishing vertebrates</skos:altLabel>
    <skos:broader rdf:resource="http://id.loc.gov/authorities/sh85111441#concept"/>
    <skos:narrower rdf:resource="http://id.loc.gov/authorities/sh91001130#concept"/>
    <skos:narrower rdf:resource="http://id.loc.gov/authorities/sh85111442#concept"/>
    <skos:narrower rdf:resource="http://id.loc.gov/authorities/sh89003521#concept"/>
    <skos:narrower rdf:resource="http://id.loc.gov/authorities/sh86007975#concept"/>
    <skos:narrower rdf:resource="http://id.loc.gov/authorities/sh92002314#concept"/>
    <skos:inScheme rdf:resource="http://id.loc.gov/authorities/sh93008774#"/>
  </rdf:Description>
</rdf:RDF>
```
RDF Graphs and ontologies: Harry Potter and the Chamber of Secrets

http://id.loc.gov/authorities/names/n97108433

http://xmlns.com/foaf/0.1/person

http://vivoweb.org/ontology/core#informationResourceInAuthorship

http://id.loc.gov/authorities/names/no2006054546.html

http://vivoweb.org/ontology/core#InformationResource

http://purl.org/ontology/bibo/book
Ontology example: **FOAF (Friend Of A Friend)**: one of the first Linked Data nodes

http://xmlns.com/foaf/0.1/ (FOAF “Vocabulary”)

- **Class** names capitalized
  - e.g., **Person**

- **Property** names in lower case
  - e.g., **homepage**
FOAF example visualized as RDF graphs

foaf:Person

rdf:type

foaf:knows

foaf:name

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mailto: Oksana.Zavalina@unt.edu

Carole L. Palmer

mailto: clpalmer@uw.edu

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Creating FOAF ontology entry for yourself with FOAF-a-Matic

Introduction

FOAF-a-matic is a simple and straightforward tool for creating a Friend of a Friend (FOAF) description. It allows you to easily generate a FOAF description of yourself. The FOAF-a-Matic interface is designed to be user-friendly, making it easy to fill in the details of your personal and professional life.

In short, FOAF-a-matic helps you create a FOAF description of yourself. Whether you're identifying yourself as a member of a specific community or just describing your interests, FOAF-a-matic is a useful tool.

The FOAF-a-Matic interface is user-friendly and designed to be straightforward. Simply fill in the details of your personal and professional life, and FOAF-a-matic will generate a FOAF description.

People You Know

Tell FOAF-a-matic about some people you know. You don't need to add every person you know; FOAF-a-matic is designed to make this process easy.

Generate Results

Now you've filled in the details you're ready to turn into FOAF...

What Next?

Publish Your FOAF description

This is the easy part. Simply copy the generated FOAF description from the text box above and paste it into a file. Put the file on your website somewhere where it's publicly accessible. It's a good idea to name this file "foaf.rdf" as then a Google search can be used to help discover FOAF files across the web.

Your FOAF description is now ready, you just need people to come along and read it...

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Ontology example: my resulting FOAF ontology entry in RDF/XML

```xml
<rdf:RDF
    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:foaf="http://xmlns.com/foaf/0.1/"
    xmlns:admin="http://webns.net/mvcb/"
>
    <foaf:PersonalProfileDocument rdf:about=""/>
    <foaf:maker rdf:resource="#me"/>
    <foaf:primaryTopic rdf:resource="#me"/>
    <admin:errorReportsTo rdf:resource="mailto:leigh@ldodds.com"/>
</foaf:PersonalProfileDocument>

<foaf:Person rdf:ID="me">
    <foaf:name>Oksana Zavalina</foaf:name>
    <foaf:title>Dr</foaf:title>
    <foaf:givenname>Oksana</foaf:givenname>
    <foaf:family_name>Zavalina</foaf:family_name>
    <foaf:mbox_sha1sum>2d5bd379ef984c77b32b7f58da5a4ea044f24810</foaf:mbox_sha1sum>
    <foaf:homepage rdf:resource="http://courses.unt.edu/ozavalina/"/>
    <foaf:workplaceHomepage rdf:resource="http://lis.unt.edu/"/>
    <foaf:knows>
        <foaf:Person>
            <foaf:name>Carole Palmer</foaf:name>
            <foaf:mbox_sha1sum>fb9e1a095acbafc95f20bef6b6bfa8d8c29bacab</foaf:mbox_sha1sum>
        </foaf:Person>
    </foaf:knows>
    <foaf:knows>
        <foaf:Person>
            <foaf:name>Allen Renear</foaf:name>
            <foaf:mbox_sha1sum>7f1f8eb0543b8b81d51f96064be0082b4b6c4145</foaf:mbox_sha1sum>
        </foaf:Person>
    </foaf:knows>
    <foaf:knows>
        <foaf:Person>
            <foaf:name>Kathryn La Barre</foaf:name>
            <foaf:mbox_sha1sum>747175913a6529cae9e71eec86703d505186e62</foaf:mbox_sha1sum>
        </foaf:Person>
    </foaf:knows>
</foaf:Person>
</rdf:RDF>
```
OWL = Web Ontology Language

• rich set of concepts for defining ontology classes and properties
  • more: class equivalence, intersections and unions, primary keys, cardinality restrictions

• 3 OWLs: Full, DL, and Lite
• OWL is built on RDF/RDFS
• Both use the same data model:

  - OWL extends vocabulary:
    - e.g., separates property into object property and data type property

  - OWL adds axioms to express more complex relations of classes and properties (e.g., equivalent, disjointWith, etc.)
2 Kinds of Properties in OWL

ObjectProperty relates one Resource to another Resource:

```
<owl:ObjectProperty rdf:ID="hasPet">
  <rdfs:range rdf:resource="#animals"/>
  <rdfs:domain rdf:resource="#humans"/>
  <owl:inverseOf rdf:resource="#isAPetOf"/>
</owl:ObjectProperty>
```

DatatypeProperty relates a Resource to a Literal or an XML Schema data type:

```
<owl:DatatypeProperty rdf:ID="age">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema
    #nonNegativeInteger"/>
</owl:DatatypeProperty>
```
OWL uses RDF/XML-based syntax

• Header:

```xml
<rdf:RDF
  xmlns:owl = "http://www.w3.org/2002/07/owl#"
  xmlns:rdf = "http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs = "http://www.w3.org/2000/01/rdf-schema#"
  xmlns:xsd = "http://www.w3.org/2001/XMLSchema#">
</rdf:RDF>
```

• OWL Class elements examples:
  – `owl:subClassOf`:

```xml
<owl:Class rdf:ID="huskies">
  <rdfs:subClassOf rdf:resource="#dogs"/>
</owl:Class>
```

  – `owl:disjointWith`:

```xml
<owl:Class rdf:about="#huskies">
  <owl:disjointWith rdf:resource="#spaniels"/>
  <owl:disjointWith rdf:resource="#bullTerriers"/>
  <owl:disjointWith rdf:resource="#pekingeseDogs"/>
</owl:Class>
```

  – `owl:equivalentClass`:

```xml
<owl:Class rdf:ID="huskies">
  <rdfs:equivalentClass rdf:resource="#siberianHuskies"/>
</owl:Class>
```
Metadata scheme expressed as ontology in RDF/XML

Example: DC Terms Data Model

http://dublincore.org/2012/06/14/dctterms.rdf
DC Terms Data Model:
Examples of metadata elements

```xml
<rdf:Description rdf:about="http://purl.org/dc/terms/creator">
  <rdfs:label xml:lang="en">Creator</rdfs:label>
  <dc:comment xml:lang="en">An entity primarily responsible for making the resource.</dc:comment>
  <dcterms:description xml:lang="en">Examples of a Creator include a person, an organization, or a service.</dcterms:description>
  <dcterms:isDefinedBy rdf:resource="http://purl.org/dc/terms/>
  <dcterms:issued rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2008-01-14</dcterms:issued>
  <dcterms:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
  <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#creatorT-002"/>
  <rdfs:range rdf:resource="http://purl.org/dc/terms/Agent"/>
  <rdfs:subPropertyOf rdf:resource="http://purl.org/dc/terms/contributor"/>
  <owl:equivalentProperty rdf:resource="http://xmlns.com/foaf/0.1/maker"/>
</rdf:Description>
```

```xml
<rdf:Description rdf:about="http://purl.org/dc/terms/issued">
  <rdfs:label xml:lang="en">Date Issued</rdfs:label>
  <dc:comment xml:lang="en">Date of formal issuance (e.g., publication) of the resource.</dc:comment>
  <dcterms:isDefinedBy rdf:resource="http://purl.org/dc/terms/>
  <dcterms:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
  <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#issued-003"/>
  <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
  <rdfs:subPropertyOf rdf:resource="http://purl.org/dc/terms/elements/1.1/date"/>
  <rdfs:subPropertyOf rdf:resource="http://purl.org/dc/terms"/>
</rdf:Description>
```
Future of library cataloging

FRBR family of models

+ **RDA** (new cataloging code that replaced AACR2; relational; based on FRBR)

+ **Linked Data** (RDF, Ontologies, etc.)

= Future of Cataloging

---

**Bibliographic Framework for the Digital Age (2011)**

**BIBFRAME model (2012)**

BIBFRAME Model

<table>
<thead>
<tr>
<th>RDF data triple</th>
<th>subject—predicate—object</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRBR data triple</td>
<td>entity—relationship—attribute</td>
</tr>
<tr>
<td>BIBFRAME data triple</td>
<td>resource—relationship—property</td>
</tr>
</tbody>
</table>

http://bibframe.org/

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Example: MARC record 899216441 (Whiplash)

Dr. Oksana L. Zavalina, © 2015-2016
Example: MARC record 899216441 (Whiplash)

**Data model/ Ontology in action:**

**Individual** Miles Teller belongs to **class** Person

**Properties:** Label; authorizedAccesPoint; HasAuthority

**MARC XML:**

```xml
19 <marc:datafield tag="700" ind1="1" ind2="" >
  <marc:subfield code="a">Teller, Miles</marc:subfield>
</marc:datafield>
```

**BIBFRAME RDF/XML:**

```xml
  158 <bf:hasAuthority rdf:resource="http://id.loc.gov/authorities/subjects/authority/1250913273"/>
159 </bf:Person>
```

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Annotation - Class

Resource that asserts additional information about other BIBFRAME resource.

More specific Annotation types

<table>
<thead>
<tr>
<th>Property</th>
<th>Label / Description</th>
<th>Subclass Of</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoverArt</td>
<td>Cover Art Annotation / Link to a cover illustration of an instance.</td>
<td>Annotation</td>
</tr>
<tr>
<td>HeldMaterial</td>
<td>Material held / Summary holdings information.</td>
<td>Annotation</td>
</tr>
<tr>
<td>Review</td>
<td>Review Annotation / Critique of a resource, such as a book review, analysis, etc.</td>
<td>Annotation</td>
</tr>
<tr>
<td>Summary</td>
<td>Summary Annotation / Description of the content of a resource, such as an abstract, summary, etc.</td>
<td>Annotation</td>
</tr>
<tr>
<td>TableOfContents</td>
<td>Table of Contents Annotation / Table of Contents information for a resource</td>
<td>Annotation</td>
</tr>
</tbody>
</table>

http://bibframe.org/vocab/Annotation.html
## Work - Class

http://bibframe.org/vocab/Work.html

Resource reflecting a conceptual essence of the cataloging resource.

### Properties used with Work: Resource reflecting a conceptual essence of the cataloging resource.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
<th>Associated Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>accompaniedBy</td>
<td>Accompanied by / Resource that has an accompanying resource which adds to it</td>
<td>relatedTo</td>
</tr>
<tr>
<td>accompanies</td>
<td>Accompanies / Resource that adds to or is issued with the described resource</td>
<td>relatedTo</td>
</tr>
<tr>
<td>expressionOf</td>
<td>Expression of / Expression has a related work. For use to connect Works under FRBR/RDA rules.</td>
<td>relatedTo, Work</td>
</tr>
<tr>
<td>hasExpression</td>
<td>Expressed as / Work has a related expression. For use to connect Works under FRBR/RDA rules.</td>
<td>relatedTo, Work</td>
</tr>
<tr>
<td>hasInstance</td>
<td>Instance of Work / Work has a related Instance/manifestation. For use to connect Works to Instances in the BIBFRAME structure.</td>
<td>relatedTo, Instance</td>
</tr>
</tbody>
</table>

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**More information on BIBFRAME: its 2 official websites**

<table>
<thead>
<tr>
<th>Bibliographic Framework Initiative</th>
<th><a href="http://www.loc.gov/bibframe/">http://www.loc.gov/bibframe/</a></th>
<th>General information, reports, webcasts, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demos <a href="http://bibframe.org/demos/">http://bibframe.org/demos/</a></td>
<td>Tools:</td>
</tr>
<tr>
<td></td>
<td>Tools:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Comparison Service <a href="http://bibframe.org/tools/compare/">http://bibframe.org/tools/compare/</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Transformation Service <a href="http://bibframe.org/tools/transform/start">http://bibframe.org/tools/transform/start</a></td>
<td></td>
</tr>
</tbody>
</table>

We use in Exercise 5
BIBFRAME Transformation Service

MARC to BIBFRAME Transformation Service

This service transforms a file of MARCXML records to BIBFRAME.

See also: Comparison Service

Copy and paste a MARCXML here, then select "Submit MARCXML".

LIMITATION: Files larger than 2 MB will be rejected.

NOTICE: Information entered in this form will be used for the transformation service. It will be stored on the server for a period of time, after which it will be publicly available, even if not publicly advertised.

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