Introduction to Linked Open Data

Uldis Bojārs, National Library of Latvia
Christina Harlow, Stanford University
Huda Khan, Cornell University

SWIB 2017, 4 December 2017
Hamburg, Germany
Workshop Resources: bit.ly/SWIBLODintro
Workshop Etiquette
(influenced by the Hacker School Rules)

- Feel free to ask questions
- Help others where you can
- Be open to different domain expertise & experiences
- Be kind

More info on the “Hacker School Rules”:

https://www.recurse.com/blog/38-subtle-isms-at-hacker-school
https://www.recurse.com/manual#sub-sec-social-rules
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:00 - 13:15</td>
<td>General Workshop Introduction</td>
</tr>
<tr>
<td>13:15 - 14:00</td>
<td>RDF Introduction: Create Your Graph</td>
</tr>
<tr>
<td>14:00 - 14:30</td>
<td>Linked Data Intro.: Link Your Graph to Your Group</td>
</tr>
<tr>
<td>14:30 - 15:30</td>
<td>Linked Data &amp; Semantic Web: Expanding Your Graph</td>
</tr>
<tr>
<td>15:30 - 16:00</td>
<td>30 minute break, cake served in the foyer</td>
</tr>
<tr>
<td>16:00 - 16:15</td>
<td>Linked Open Data &amp; Licensing: License Your Graph</td>
</tr>
<tr>
<td>16:15 - 17:15</td>
<td>Linked Data Experimentation: SPARQL &amp; Vis.</td>
</tr>
<tr>
<td>17:15 - 17:30</td>
<td>15 minute break</td>
</tr>
<tr>
<td>17:30 - 18:00</td>
<td>Linked Data Examples, Resources &amp; Datasets</td>
</tr>
<tr>
<td>18:00 - 19:00*</td>
<td>Wrap-up &amp; Help Moving Forward (optional)</td>
</tr>
</tbody>
</table>

*optional
Our Goals for this Workshop

- Introduce & Leverage the RDF data model
- Create & Refine RDF Documents
- Explain Fundamentals of Linked Data Technologies
- Introduce & Discuss Basic Issues of Linked Open Data
- Apply Open Data Principles to RDF data
- Understand Advantages of Modeling in RDF
- Understand Advantages of Publishing Linked Data
- Share LOD Tools, Projects, Resources, Examples
Your goals for this Workshop?

- Why are you attending this workshop?
- What are your goals - immediate or long-term?
- What's your level of comfort & experience with Linked Data?
RDF Introduction: Create Your Graph
Facilitator’s Example

@prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
@prefix schema: <http://schema.org/> .

z:ub schema:name "Uldis" .
z:ub schema:location "Riga" .

z:ch schema:name "Christina" .
z:ch schema:location "San Francisco" .

z:hk schema:name "Huda" .
z:hk schema:location "Ithaca" .

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Facilitator's Example

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z:hk schema:name "Huda" .
z:hk schema:location "Ithaca" .

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Resource Description Framework (RDF)

The Resource Description Framework (RDF) is used to describe arbitrary things.

RDF is based on the concept of triples, which consist of subject, predicate and object. It is an abstract model for which several notations exist. Today we will be using Turtle for our RDF serialization.
Your turn!

1. Fill out your name tag.
2. Then transfer your nametag data into the Etherpad of your group.

https://pad.riseup.net/p/swib-17-ws
Linked Data Introduction:
Link Your Graph to Your Group Member’s
Facilitator’s Example

@prefix z: <https://pad.riseup.net/p/swib-17-ws-z#> .
@prefix schema: <http://schema.org/> .

z:ub schema:name "Uldis" .
z:ub schema:location "Riga" .
z:ub schema:knows z:ch .
z:ub schema:knows z:hk .

z:ch schema:name "Christina" .
z:ch schema:location "San Francisco" .

z:hk schema:name "Huda" .
z:hk schema:location "Ithaca" .

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Facilitator’s Example

@prefix z: <http://etherpad.lobid.org/p/swibl6-ws-z#> .
@prefix schema: <http://schema.org/> .

z:ub schema:name "Uldis" .
z:ub schema:location "Riga" .
z:ub schema:knows z:ch .
z:ub schema:knows z:hk .

z:ch schema:name "Christina" .
z:ch schema:location "San Francisco" .

z:hk schema:name "Huda" .
z:hk schema:location "Ithaca" .

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Linked Data

When using RDF, things are named by Uniform Resource Identifiers (URIs). By describing and linking things, graphs emerge.

Social networks such as Facebook or LinkedIn are well-known examples of this approach.
"Uldis" schema:name :ub schema:knows "Christina" :ch schema:name

:ub schema:location "Riga"

:ch schema:location "San Francisco"
Graphs Let Europeana Grow...
Your turn!

Introduce yourself to the other members of your group. After doing so, document your new acquaintances in the Etherpad data using `schema:knows`.
Linked Data
Introduction:
Link Your Graph to Members of other Groups

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Facilitator’s Example

@prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
@prefix a: <https://pad.riseup.net/p/swib-17-ws-a#> .
@prefix schema: <http://schema.org/> .

...[truncated example data]

z:ch schema:name "Christina" .
z:ch schema:location "San Francisco" .
z:ch schema:knows z:ub .
z:ch schema:knows z:hk .

z:hk schema:name "Huda" .
z:hk schema:location "Ithaca" .
z:hk schema:knows z:ub .
z:hk schema:knows z:ch .

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Facilitator’s Example

@prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
@prefix schema: <http://schema.org/> .

z:ub schema:name "Uldis".
z:ub schema:location "Riga".
z:ub schema:knows z:ch.
z:ub schema:knows z:hk.

z:ch schema:name "Christina".
z:ch schema:location "San Francisco".
z:ch schema:knows z:ub.
z:ch schema:knows z:hk.

z:hk schema:name "Huda".
z:hk schema:location "Ithaca".
z:hk schema:knows z:ub.
z:hk schema:knows z:ch.

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The simple power of the Link

Even a single link can greatly expand a graph, because many new connections can join the network.
Your turn!

Extend your set of acquaintances linking out to people beyond your group. As before, document these new connections in the Etherpad.
Turtle RDF Serialization & Syntax

- **Turtle (Terse RDF Triple Language):** format for expressing data in RDF.
- Each RDF triple starts on new line & ends with a full stop (.)
- **URIs:** Enclosed in angle brackets, i.e. `<http://www.ex.com/ex>`
- **Literals** are written *usually* using double-quotes ("").
- Blank spaces / white spaces (outside of Literal quotes) are only to separate components of RDF statement.
- **Comments:** Preceded by ‘#’ & continue to end of line.
- **Prefixes:** Letters preceding colon that are an abbreviation for an ontology namespace URI defined above in the Turtle document.
- **Online Turtle Validator:** [http://ttl.summerofcode.be/](http://ttl.summerofcode.be/)
Linked Data & Semantic Web: Expanding Your Graph
Facilitator’s Example
Facilitator’s Example

About: Riga
An Entity of Type: city, from Named Graph: http://dbpedia.org, within Data Space: dbpedia.org

Riga (/ˈriːɡa/; Latvian: Rīga, pronounced [ˈriːɡa]) is the capital and the largest city of Latvia. With 696,593 inhabitants (2015), Riga is the largest city of the Baltic states and home to one third of Latvia’s population. The city lies on the Gulf of Riga, at the mouth of the Daugava. Riga’s territory covers 307.17 km² (118.60 sq mi) and lies between 1 and 10 metres (3.3 and 32.8 ft) above sea level, on a flat and sandy plain. Riga is a member of Eurocities, the Union of the Baltic Cities (UBC) and Union of Capitals of the European Union (UCEU).

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dbo:PopulatedPlace/area</td>
<td>1.0E-6</td>
</tr>
<tr>
<td>dbo:PopulatedPlace/areaMetro</td>
<td>10133.0</td>
</tr>
<tr>
<td>dbo:PopulatedPlace/areaTotal</td>
<td>304.0</td>
</tr>
<tr>
<td>dbo:PopulatedPlace/populationMetroDensity</td>
<td>101.4</td>
</tr>
</tbody>
</table>

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Facilitator’s Example

@prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
@prefix schema: <http://schema.org/> .
@prefix dbr: <http://dbpedia.org/resource/> .
@prefix wikidata: <http://www.wikidata.org/entity/> .

z:ub schema:name "Uldis" .
z:ub schema:location dbr:Riga .
z:ub schema:knows z:ch .
z:ub schema:knows z:hk .

...[truncated example data]
Facilitator's Example

```reason
@prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
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@prefix dbr: <http://dbpedia.org/resource/> .
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z:ub schema:name "Uldis".
z:ub schema:location dbr:Riga.
z:ub schema:knows z:ch .
z:ub schema:knows z:hk .

z:ch schema:name "Christina" .
z:ch schema:location "San Francisco" .
z:ch schema:knows z:ub .
z:ch schema:knows z:hk .

z:hk schema:name "Huda" .
z:hk schema:location "Ithaca" .
z:hk schema:knows z:ub .
z:hk schema:knows z:ch .
```

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The Giant Global Graph

By using **HTTP-URIs**, Linked Data builds upon a technology that is proven to **scale** globally. With reference to the World Wide Web, the term **Giant Global Graph** is sometimes used. What is true for the WWW is also true for the GGG: Anyone can say anything about anything.
Linked Data Principles

Tim Berners-Lee

1. Use URIs as names for things
2. Use HTTP URIs so that things can be looked up
3. When someone looks up a URI, provide useful information, using the standards (RDF*, SPARQL)
4. Include links to other things so that they can discover more things.

https://www.w3.org/DesignIssues/LinkedData.html
Your turn!

First, find your location in Wikipedia.

Then, Replace the name of your location in your RDF with a reference to DBpedia (or other vocabulary) using the Wikipedia URL key.
Facilitator’s Example

Music

From Wikipedia, the free encyclopedia.

For other uses, see Music (disambiguation).

Music is an art form and cultural activity whose medium is sound and silence, which exist in time. The common elements of music are pitch (which governs melody and harmony), rhythm (and its associated concepts tempo, meter, and articulation), dynamics (loudness and softness), and the sonic qualities of timbre and texture (which are sometimes termed the “color” of a musical sound). Different styles or types of music may emphasize, de-emphasize or omit some of these elements. Music is performed with a vast range of instruments and vocal techniques ranging from singing to rapping; there are solely instrumental pieces, solely vocal pieces (such as songs without instrumental accompaniment) and pieces that combine singing and instruments. The word derives from Greek μουσική (mousike; “art of the Muses”).[1] In its most general form, the activities describing music as an art form include the production of works of music (songs, tunes, symphonies, and so on), the criticism of music, the study of the history of music, and the aesthetic examination of music. Ancient Greek and Indian philosophers defined music as tones ordered horizontally as melodies and vertically as harmonies. Common sayings such as "the harmony of the spheres" and "it is music to my ears" point to the notion that music is often ordered and pleasant to listen to. However, 20th-century composer John Cage thought that any sound can be music, saying, for example, "There is no noise, only sound."

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Facilitator’s Example

@prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
@prefix schema: <http://schema.org/> .
@prefix dbr: <http://dbpedia.org/resource/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .

z:ub schema:name "Uldis" .
z:ub schema:location dbr:Riga .
z:ub schema:knows z:ch .
z:ub schema:knows z:hk .
z:ub foaf:interest dbr:Music .

...[truncated example data]
Facilitator's Example

`@prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
@prefix schema: <http://schema.org/> .
@prefix dbr: <http://dbpedia.org/resource/> .
@prefix wikidata: <http://www.wikidata.org/entity/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .

z:ub schema:name "Uldis".
z:ub schema:location dbr:Riga.
z:ub schema:knows z:ch.
z:ub schema:knows z:hk.
z:ub foaf:interest dbr:Music.

z:ch schema:name "Christina".
z:ch schema:location dbr:San_Francisco.
z:ch schema:knows z:ub.
z:ch schema:knows z:hk.

z:hk schema:name "Huda".
z:hk schema:location wikidata:Q217346.
z:hk schema:knows z:ub.
z:hk schema:knows z:ch.
Your turn!

Enhance your profile with interest you have. Again, refer to DBpedia (or other) entries to do so, remembering to use URIs, not URLs.

http://ttl.summerofcode.be
Other Element (Predicate, Field) Sets

- FOAF (Friend of a Friend)
- vcard (people and organisations)
- schema.org
- geo (to express geo-coordinates)
- Void (to describe datasets)
- Prov (provenance information)
- ... and many more.

See:
  - Linked Open Vocabularies (LOV) to look up ontologies & vocabularies
  - prefix.cc to look up namespaces
Library-Related Element Sets

- **Dublin Core Metadata Terms**
- **Simple Knowledge Organisation System (SKOS)**
  - Examples of Vocabularies using SKOS: Agrovoc, STW Thesaurus for Economics, many small controlled vocabularies (for example, RDA value vocabularies)
- **GND Ontology, Getty Authorities Ontology**
- **RDA Elements sets**
- **EDM (Europeana Data Model)**
- **BIBFRAME (Version 2.0)**
- And a growing number more...
(Instance) Datasets

- DBpedia, Wikidata
- BNF, BL, BNE, DNB, LoC, ...
- GeoNames
- VIAF

See datahub.io for many more ...
30 minutes Break
(Return at 15:50)
Linked Open Data & Data Licensing
“Open”?

“Open data and content can be freely used, modified, and shared by anyone for any purpose”

The Open Definition
Openness involves...

- **Access**: no passwords, quantity restrictions, etc.
- **License**: only allowed restrictions are *attribution* and *share-alike*, i.e.:
  - CC0, CC-BY, CC-BY-SA
  - *no* non-commercial (NC) licenses
- **Formats**: no proprietary formats without freely accessible specification. Supports reuse of data
Some Data License Options

- **Public Domain Dedication and License (PDDL)**: “Public Domain for data/databases”, opendatacommons.org/licenses/pddl/
- **Open Data Commons Attribution (ODC-By)**: “Attribution for data/databases”, opendatacommons.org/licenses/by/
- **Open Database License (ODC-ODbL)**: “Attribution Share-Alike for data/databases”, opendatacommons.org/licenses/odbl/
- **CC0 1.0 Universal**: “Creative Commons public domain waiver”, creativecommons.org/publicdomain/zero/1.0/
Licensing data

@prefix cc: <http://creativecommons.org/ns#> .

<http://zbw.eu/stw>
  cc:attributionName "ZBW - Leibniz Information Centre for Economics"@en, "ZBW - Leibniz-Informationszentrum Wirtschaft"@de ;
  cc:attributionURL "http://zbw.eu" ;
  dcterms:rights "see cc:license"@en, "siehe cc:license"@de ;
  cc:license <http://opendatacommons.org/licenses/odbl/1-0/> ;
...

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http://zbw.eu/stw/version/latest/download/about.en.html
Facilitator’s Example

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@prefix schema: <http://schema.org/> .
@prefix dbr: <http://dbpedia.org/resource/> .
@prefix wikidata: <http://www.wikidata.org/entity/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix dcterms: <http://purl.org/dc/terms/> .

<> dcterms:creator z:ub .
<> dcterms:creator z:ch .
<> dcterms:creator z:hk .
<> schema:license <https://creativecommons.org/publicdomain/zero/1.0/>.

z:ch schema:name "Christina" .
z:ch schema:location "Ithaca" .
... [truncated example data]
Facilitator’s Example

```sparql
@prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
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@prefix foaf: <http://xmlns.com/foaf/0.1/>.
@prefix wikidata: <http://www.wikidata.org/entity/>.

<> dcterms:creator z:ub .
<> dcterms:creator z:ch .
<> dcterms:creator z:hk .
<> schema:license <https://creativecommons.org/publicdomain/zero/1.0/>.

z:ub schema:name "Uldis" .
z:ub schema:location dbr:Riga .
z:ub schema:knows z:ch .
z:ub schema:knows z:hk .
z:ub foaf:interest dbr:Music .

z:ch schema:name "Christina" .
z:ch schema:location dbr:San_Francisco .
z:ch schema:knows z:ub .
z:ch schema:knows z:hk .
z:ch foaf:interest dbr:Music .
z:ch foaf:interest wikidata:Q28865 .

z:hk schema:name "Huda" .
z:hk schema:location wikidata:Q217346 .
z:hk schema:knows z:ub .
z:hk schema:knows z:ch .
z:hk foaf:interest dbr:Music .
```

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Other GLAM-focused Open Data/Licenses

- RightsStatement.org (for Digital Objects)
- Europeana Dataset
- DPLA (Digital Public Library of America) Dataset
- Getty Vocabularies & Ontology
- Data on the Web Best Practices W3C Recommendation Section on Licensing
- Share-PSI (Public Sector Information) Localised Guide Pages for Open Data
Moving towards 5 Star Linked Data

★ make your stuff available on the Web (whatever format) under an open license

★★ make it available as structured data (e.g., Excel instead of image scan of a table)

★★★ make it available in a non-proprietary open format (e.g., CSV as well as of Excel)

★★★★ use URIs to denote things, so that people can point at your stuff

★★★★★ link your data to other data to provide context
Your turn!

Allow the reuse of your data. In order to do so, document your authorship (add `dct:creator`) and apply a CC0 or another license as you see fit (add `schema:license`).
Linked Data Experimentation: SPARQL & Visualization(s)
About LODLive

- Uses Linked Data standards (RDF, SPARQL) to browse RDF data.
- Spread Linked Data Ideas through Easy & Reusable Interface.
- Browse by Querying Endpoint for Specific Resource or Start from a Given Example URI.
- LODLive built with:
  - jQuery plug-in (lodlive-core.js)
  - JSON configuration map (lodlive-profile.js)
  - HTML page with a few images (sprites)
  - Few other jQuery public plug-ins
LODLive Viz

Browse, collect and view the group graphs we have created
LODLive live demo

Try this first:
http://cmharlow.webfactional.com/lodlive/app_en.html

Back-up (try second):
SPARQL / Fuseki

Browse, collect and query the group graphs we have created:

http://cmharlow.webfactional.com/fuseki/
Select /swib-workshop and query
Scattered machine readable descriptions are useful, but we can do better! RDF is a distributed data model which makes it easy to combine descriptions. Special databases called triplestores exist that allow to query the aggregated data using the query language SPARQL.
SPARQL Query General Form

PREFIX test: <http://testNamespace.edu>

SELECT ?variable FROM <http://testNamespace.edu/dataset.rdf>
WHERE {
}
ORDER by ?variable
# SPARQL: Names of the participants

```sparql
PREFIX schema: <http://schema.org/>

SELECT * WHERE {
    ?person schema:name ?name .
}
```

<table>
<thead>
<tr>
<th>person</th>
<th>name</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#kub">https://pad.riseup.net/p/swib-17-ws-facilitators#kub</a></td>
<td>&quot;Udoa&quot;</td>
</tr>
<tr>
<td><a href="http://etherpad.lobid.org/p/swib16-ws-zhub">http://etherpad.lobid.org/p/swib16-ws-zhub</a></td>
<td>&quot;Ucis&quot;</td>
</tr>
<tr>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#ich">https://pad.riseup.net/p/swib-17-ws-facilitators#ich</a></td>
<td>&quot;Christina&quot;</td>
</tr>
<tr>
<td><a href="http://etherpad.lobid.org/p/swib16-ws-zich">http://etherpad.lobid.org/p/swib16-ws-zich</a></td>
<td>&quot;Christina&quot;</td>
</tr>
<tr>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#hkc">https://pad.riseup.net/p/swib-17-ws-facilitators#hkc</a></td>
<td>&quot;Huda&quot;</td>
</tr>
<tr>
<td><a href="http://etherpad.lobid.org/p/swib16-ws-zhkc">http://etherpad.lobid.org/p/swib16-ws-zhkc</a></td>
<td>&quot;Jana&quot;</td>
</tr>
<tr>
<td><a href="http://etherpad.lobid.org/p/swib16-ws-bfhoj">http://etherpad.lobid.org/p/swib16-ws-bfhoj</a></td>
<td>&quot;Olaf&quot;</td>
</tr>
<tr>
<td><a href="http://etherpad.lobid.org/p/swib16-ws-b#lag">http://etherpad.lobid.org/p/swib16-ws-b#lag</a></td>
<td>&quot;Astrid&quot;</td>
</tr>
</tbody>
</table>
Acquaintances

```sparql
# Acquaintances of workshop participants
PREFIX schema: <http://schema.org/>
SELECT * WHERE {
}
```

**Query Results**

Showing 1 to 50 of 102 entries

<table>
<thead>
<tr>
<th>who</th>
<th>whom</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#ch">https://pad.riseup.net/p/swib-17-ws-facilitators#ch</a></td>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#ub">https://pad.riseup.net/p/swib-17-ws-facilitators#ub</a></td>
</tr>
<tr>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#lk">https://pad.riseup.net/p/swib-17-ws-facilitators#lk</a></td>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#ub">https://pad.riseup.net/p/swib-17-ws-facilitators#ub</a></td>
</tr>
<tr>
<td><a href="http://etherpad.lobid.org/p/swib16-ws-z#ch">http://etherpad.lobid.org/p/swib16-ws-z#ch</a></td>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#ub">https://pad.riseup.net/p/swib-17-ws-facilitators#ub</a></td>
</tr>
<tr>
<td><a href="http://etherpad.lobid.org/p/swib16-ws-z#lk">http://etherpad.lobid.org/p/swib16-ws-z#lk</a></td>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#ub">https://pad.riseup.net/p/swib-17-ws-facilitators#ub</a></td>
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<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#ub">https://pad.riseup.net/p/swib-17-ws-facilitators#ub</a></td>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#lk">https://pad.riseup.net/p/swib-17-ws-facilitators#lk</a></td>
</tr>
<tr>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#ch">https://pad.riseup.net/p/swib-17-ws-facilitators#ch</a></td>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#lk">https://pad.riseup.net/p/swib-17-ws-facilitators#lk</a></td>
</tr>
<tr>
<td><a href="http://etherpad.lobid.org/p/swib16-ws-z#ub">http://etherpad.lobid.org/p/swib16-ws-z#ub</a></td>
<td><a href="https://pad.riseup.net/p/swib-17-ws-facilitators#lk">https://pad.riseup.net/p/swib-17-ws-facilitators#lk</a></td>
</tr>
</tbody>
</table>

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https://pad.riseup.net/p/swib-17-ws
Acquaintances by name

```sql
# Acquaintances of workshop participants by name
PREFIX schema: <http://schema.org/>
SELECT ?namewho ?namewhom WHERE {
  ?namewho schema:name ?namewhom .
}
```

<table>
<thead>
<tr>
<th>namewho</th>
<th>namewhom</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Christina&quot;</td>
<td>&quot;Uldis&quot;</td>
</tr>
<tr>
<td>&quot;Huda&quot;</td>
<td>&quot;Uldis&quot;</td>
</tr>
<tr>
<td>&quot;Christina&quot;</td>
<td>&quot;Uldis&quot;</td>
</tr>
<tr>
<td>&quot;Jara&quot;</td>
<td>&quot;Uldis&quot;</td>
</tr>
<tr>
<td>&quot;Uldis&quot;</td>
<td>&quot;Christina&quot;</td>
</tr>
<tr>
<td>&quot;Huda&quot;</td>
<td>&quot;Christina&quot;</td>
</tr>
<tr>
<td>&quot;Uldis&quot;</td>
<td>&quot;Christina&quot;</td>
</tr>
<tr>
<td>&quot;Jara&quot;</td>
<td>&quot;Huda&quot;</td>
</tr>
<tr>
<td>&quot;Uldis&quot;</td>
<td>&quot;Huda&quot;</td>
</tr>
</tbody>
</table>

# Localities and Countries

```sql
PREFIX schema: <http://schema.org/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?person ?place ?country
WHERE {
}
```

<table>
<thead>
<tr>
<th>Person</th>
<th>Place</th>
<th>Country</th>
</tr>
</thead>
</table>
Shared Interests

PREFIX schema: <http://schema.org/>
PREFIX dbo: <http://dbpedia.org/ontology/>
PREFIX z: <https://pad.riseup.net/p/swib-17-ws-facilitators#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT * WHERE {
    z:sub foaf:interest ?interest .
    ?person foaf:interest ?interest .
    FILTER (?person != z:sub)
}

 QUERY RESULTS

Showing 1 to 10 of 10 entries

<table>
<thead>
<tr>
<th>person</th>
<th>interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>z:hk</td>
<td><a href="http://dbpedia.org/resource/Music">http://dbpedia.org/resource/Music</a></td>
</tr>
<tr>
<td>z:ch</td>
<td><a href="http://dbpedia.org/resource/Music">http://dbpedia.org/resource/Music</a></td>
</tr>
<tr>
<td></td>
<td><a href="http://dbpedia.org/resource/Music">http://dbpedia.org/resource/Music</a></td>
</tr>
<tr>
<td></td>
<td><a href="http://dbpedia.org/resource/Music">http://dbpedia.org/resource/Music</a></td>
</tr>
<tr>
<td></td>
<td><a href="http://dbpedia.org/resource/Music">http://dbpedia.org/resource/Music</a></td>
</tr>
</tbody>
</table>

https://pad.riseup.net/p/swib-17-ws
Metropolitans (Cities of certain size)
SPARQL live demo

Your turn!

Explore your social network using the SPARQL-Endpoint and the interactive LodLive visualization. Details & links: https://pad.riseup.net/p/swib-17-ws
Overview of Some (More) Linked Data Technologies
SPARQL & Triplestores

- Triplestores are like SQL databases, but Optimised to manage Triples or RDF statements
- SPARQL isn’t just for Querying – e.g. SPARQL update
- Triplestores versus Graph Stores
- Some Triplestores:
  - Apache Jena Fuseki
  - Apache Jena TDB
  - Blazegraph
  - Virtuoso, Stardog, Marmotta, …
Subset of Random Other RDF Tech

- **W3C RDF Validator** (expects RDF/XML)
- **Turtle Validator**
- **SHACL** (Shapes Constraint Language), **ShEx** (Shapes Expr.)
- **Structured Data (RDFa) Linter** (See what structured data machines can pick up from your website)
- **Python RDFLib** (Library for working with RDF in Python)
- **Ruby RDF.rb** (Library for working with RDF in Ruby)
- **Raptor** (RDF Parsers written in C that are used in many other programming libraries with RDF)
15 minutes Break
(Return at TBD)
Linked Data
Examples, Resources & Projects

bit.ly/SWIBLODintro
Linked Jazz: Network Viz

linkedjazz.org/network/

bit.ly/SWIBLODintro
Linked Jazz: Ecco!

linkedjazz.org/tools/ecco/

bit.ly/SWIBLODintro
NYPL Labs B.I.L.L.I.I.
(Bibliographic Identifiers for Library Location Information)

AM1-501
Museums, Collectors and collecting

A museum is an institution that cares for (conserves) a collection of artifacts and other objects of scientific, artistic, cultural, or historical importance and makes them available for public viewing through exhibits that may be permanent or temporary. Most large museums are located in major cities throughout the world and more local ones exist in smaller cities, towns and even the countryside. Museums have varying aims, ranging from serving researchers and specialists to

bookerhaki.com

billi.nypl.org

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ls.ext RDF Cataloging Client

vimeo.com/192831354 / github.com/digibib/ls.ext
Linked Art Data Model

The desired target model for Linked Open Data in the Art domain is one with the following properties:

- Captures as much of the information that we know about the resources as possible
- Can be productively used via easy to implement services
- Provides interoperability with other related data sets
- Solves actual challenges, which are documented as use cases

Successful models are developed:

- Iteratively (we will not get it right the first time)
- Responsively (we will change the model in response to feedback and concerns)
- Responsibly (we will consider changes and features carefully with respect to complexity and value)
- Collaboratively (we will engage with the community, projects and individuals early and often)

Model Fundamentals

Following the existing norms of the community, our starting point consists of:

- CIDOC-CRM as the core ontology, giving an event-based paradigm
  - We use a streamlined profile of CIDOC-CRM to ensure consistency and comprehension.
- The Getty Vocabularies as core sources of identity
  - Please see the vocabularies best practice discussion.
- JSON-LD as the primary target serialization
  - We use a specific context designed to be easy to implement.

http://linked.art/

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LDF Server: OrgRef to VIVOs

Linked Data Fragments server

OrgRef to VIVOs
Query OrgRef to VIVOs by triple pattern

subject: http://www.wikidata.org/entity/Q1012699
predicate: 
object: 

Find matching triples

Matches in OrgRef to VIVOs for { <http://www.wikidata.org/entity/Q1012699> ?p ?o } 
Showing triples 1 to 6 of 6 with 100 triples per page.
Q1012699 isniId "0000000404647119".
Q1012699 viafId "244777805".
Q1012699 wikiPageID "1680840".
Q1012699 label "Bryant University".
Q1012699 sameAs unitid_217165.
Q1012699 url "http://www.bryant.edu".

ldf-vivo.herokuapp.com/orgref

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Gold Rush® BIBCAT

Project Links
- Github Code Repository
- XML Siteindex

Build-Measure-Learn Iteration Two

Build Workflow
1. Run marcbibframe2 XSLT transform on XML record
2. Add Alliance updates including replacing bib:instance and bib:item iris with SEO friendly URLs
3. Run Alliance specific Instance Processor
4. Generates link to Institution's ILS or Discovery layer
5. Run Alliance Item processor on each bib:item
6. Run LOC BIBFRAME to BIBFRAME Lean RML Map
7. Run Alliance Deduplication on Lean BIBFRAME Graph
8. Ingest Lean BIBFRAME Graph into RDF triplestore

Pilot Triplestore Statistics

<table>
<thead>
<tr>
<th>Library</th>
<th># Source MARC</th>
<th># Triples</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Colorado Boulder</td>
<td>54,007</td>
<td></td>
</tr>
<tr>
<td>Colorado College</td>
<td>57,471</td>
<td></td>
</tr>
<tr>
<td>SUNY - Buffalo</td>
<td>15,650</td>
<td></td>
</tr>
</tbody>
</table>

Build-Measure-Learn Iteration One

This first iteration is to build a sitemap interface for search engines to index selected University of Colorado and Colorado College Linked Data that has been transformed from MARC 21 records to BIBFRAME 2.0 entities hosted and published by Colorado Alliance.

Pilot Triplestore Statistics

http://bibcat.org/
Box Name

http://opaquenamespace.org/ns/boxName

Sub Property Of:
http://opaquenamespace.org/ns/boxName

Range:

Domain:

Label: Box Name [English [en]]

Alternate Name:

Date:

Comment: Identifier on the box holding the physical archival item. [English [en]]

Is Replaced By:
Getty Vocabs Model

vocab.getty.edu
2.2 Descendants of a Given Parent

Let's look for AAT descendants of 300194567 "drinking vessels". This finds "rhyta" and other interesting records, including "Fichtelgebirgshumpen":

```
select * { ?x gvp:broadernExtended aat:300194567; skos:inScheme aat: ; gvp:prefLabelGVP/xli:literalForm ?1} 
```
Europeana Data Model
Europeana SPARQL Endpoint

PREFIX edm: <http://www.europeana.eu/schemas/edm/>
SELECT ?DataProvider WHERE { ?Aggregation edm:dataProvider ?DataProvider }

Sponging: Use only local data (including data retrieved before), but do not retrieve more
Results Format: HTML
Execution timeout: 0 milliseconds (values less than 1000 are ignored)
Options: Strict checking of void variables

europeana.ontotext.com
bit.ly/SWIBLODintro
DPLA Ingestion3

github.com/dpla/ingestion3
DPLA Color Browse

497 images containing darkgreen

[Images of various dark green documents and illustrations]

colorbrowse.club

bit.ly/SWIBLODintro
Moving Forward with Linked Open Data
Your turn!

Explore any of the previous projects & examples given.

Then, in your groups, discuss your own potential uses of LOD. What projects could you see for using this? What support would you need to make it happen?
Checking Back In...

Returning to the Goals from the Introduction...

Do you feel like you learned what you expected? Needed? Any remaining questions?
Thank you! Question?

Questions? Now and here or anytime to:

uldis.bojars@gmail.com
cmharlow@stanford.edu
hjk54@cornell.edu

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