

Introduction to Linked Open Data

bit.ly/SWIBLODintro

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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>

Schedule

13:00 - 13:15	General Workshop Introduction
13:15 - 14:00	RDF Introduction: Create Your Graph
14:00 - 14:30	Linked Data Intro.: Link Your Graph to Your Group
14:30 - 15:30	Linked Data & Semantic Web: Expanding Your Graph
15:30 - 16:00	<i>30 minute break, cake served in the foyer</i>
16:00 - 16:15	Linked Open Data & Licensing: License Your Graph
16:15 - 17:15	Linked Data Experimentation: SPARQL & Vis.
17:15 - 17:30	<i>15 minute break</i>
17:30 - 18:00	Linked Data Examples, Resources & Datasets
18:00 - 19:00*	Wrap-up & Help Moving Forward (<i>optional</i>)

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" .
```

Facilitator's Example

B I U S



```
1 @prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#>
2 @prefix schema: <http://schema.org/> .
3
4 z:ub schema:name "Uldis" .
5 z:ub schema:location "Riga" .
6
7 z:ch schema:name "Christina" .
8 z:ch schema:location "San Francisco" .
9
10 z:hk schema:name "Huda" .
11 z:hk schema:location "Ithaca" .
```

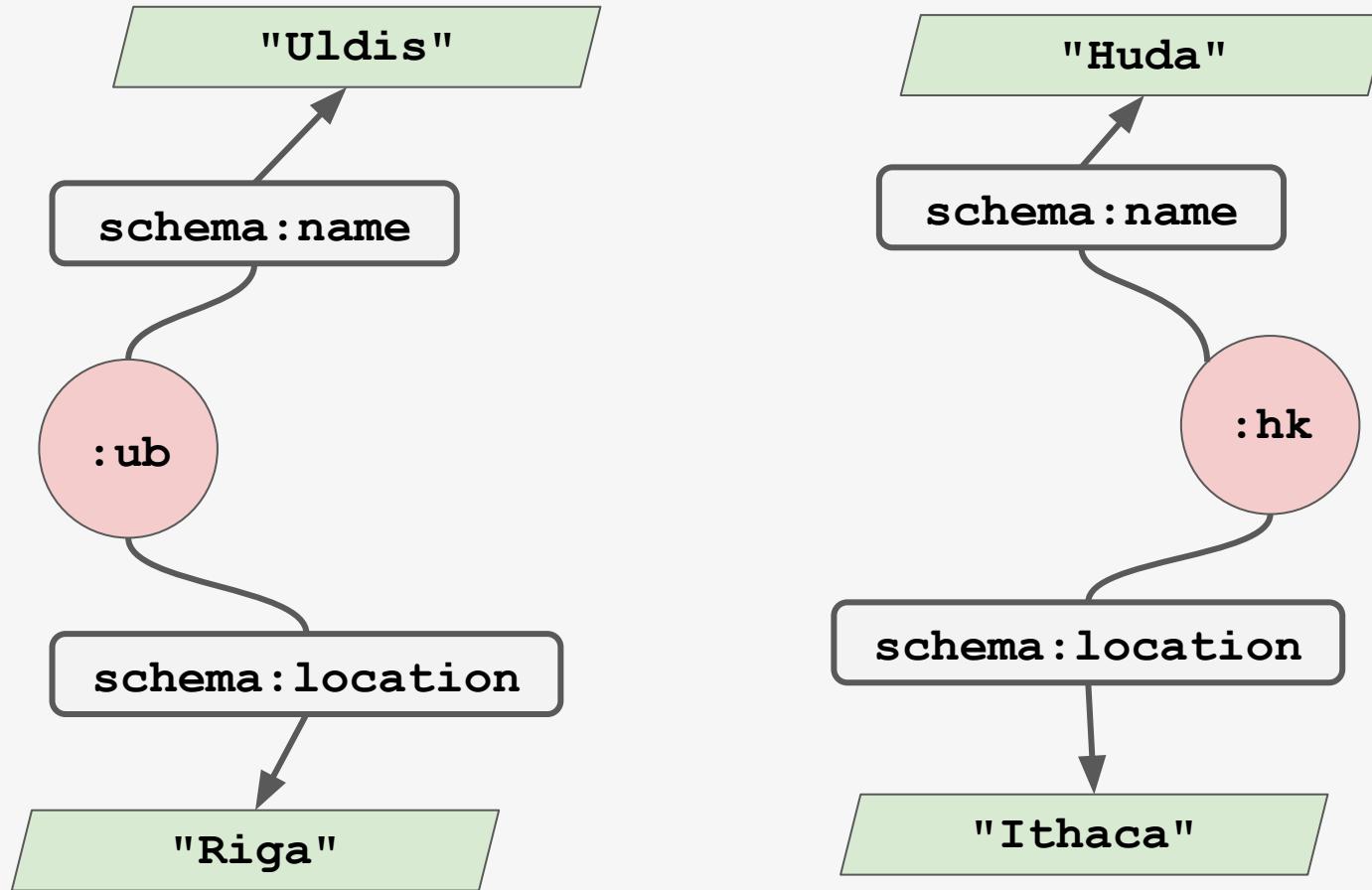
Christina

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" .
```

Facilitator's Example

B I U S



```
1 @prefix z: <http://etherpad.lobid.org/p/swib16-ws-z#> .  
2 @prefix schema: <http://schema.org/> .  
3  
4 z:ub schema:name "Uldis" .  
5 z:ub schema:location "Riga" .  
6 z:ub schema:knows z:ch .  
7 z:ub schema:knows z:hk .  
8  
9 z:ch schema:name "Christina" .  
10 z:ch schema:location "San Francisco" .  
11  
12 z:hk schema:name "Huda" .  
13 z:hk schema:location "Ithaca" .
```

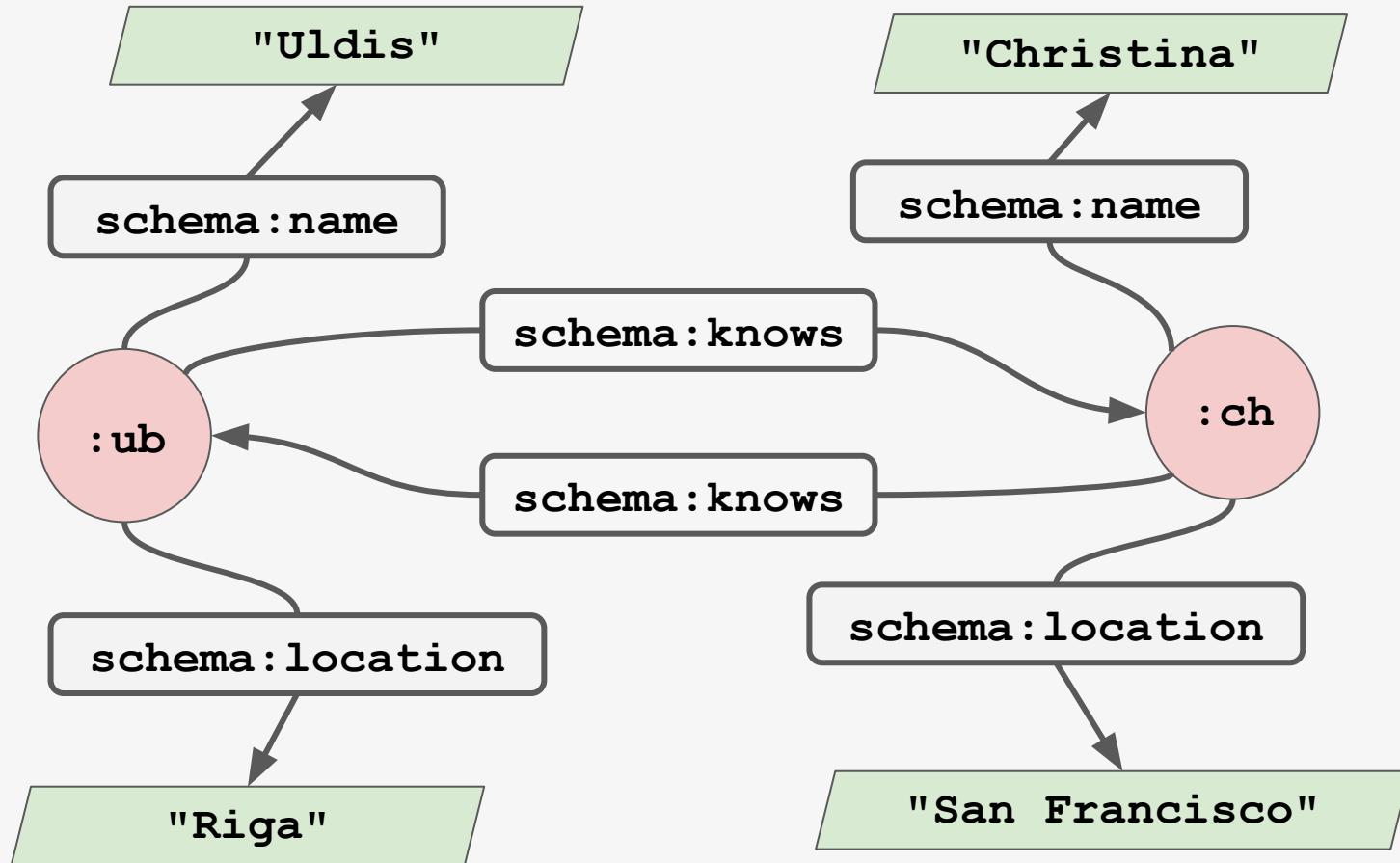


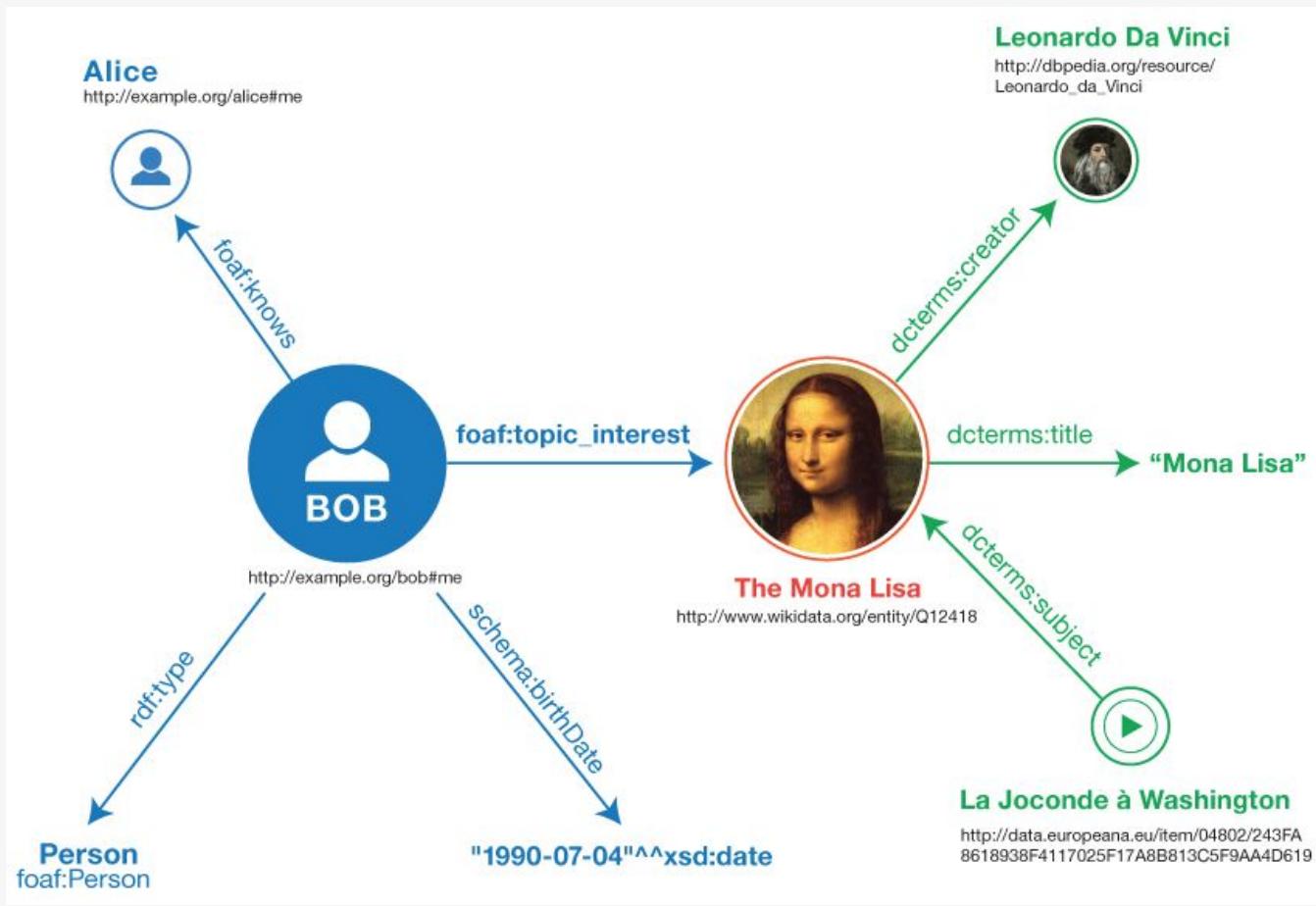
Christina

Linked Data

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

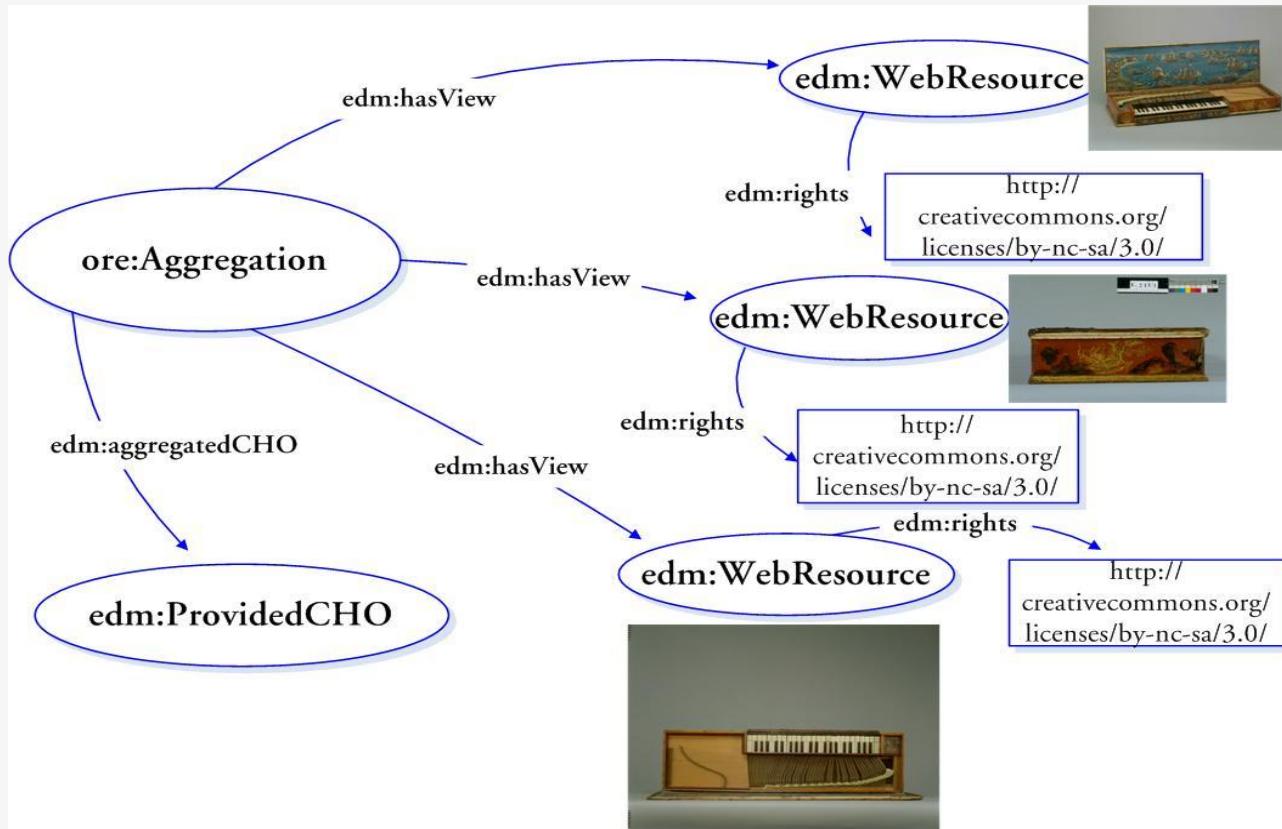
Social **networks** such as Facebook or LinkedIn are well-known examples of this approach.





RDF 1.1 Primer – Copyright © 2003–2014 W3C
<http://www.w3.org/TR/rdf11-primer/>

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

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 .
```

Facilitator's Example

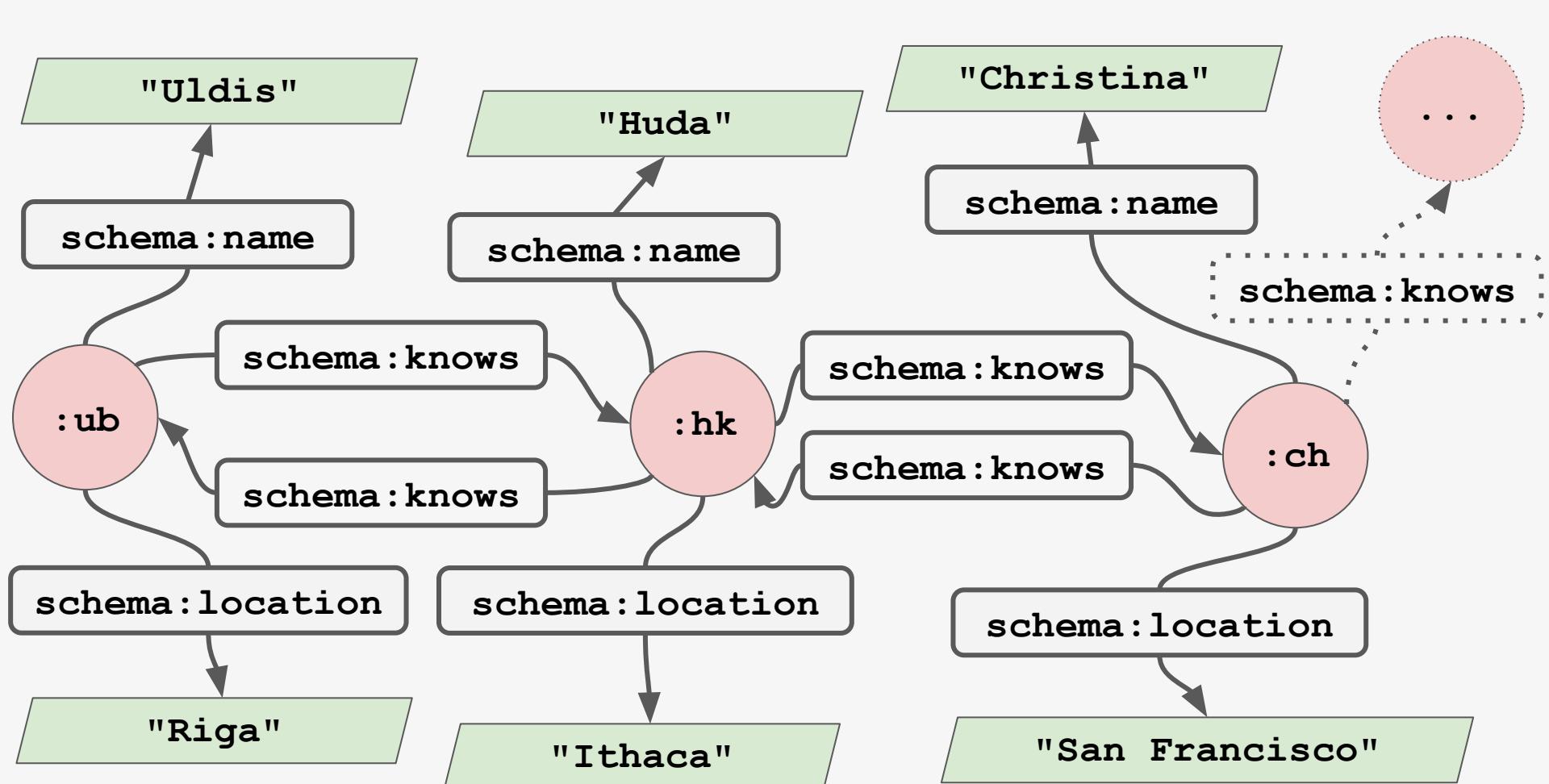
The screenshot shows a web-based code editor interface with a toolbar at the top and a main editing area below. The toolbar includes icons for bold, italic, underline, strikethrough, and various document-related functions. The main area contains a numbered SPARQL query:

```
1 @prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
2 @prefix schema: <http://schema.org/> .
3
4 z:ub schema:name "Uldis" .
5 z:ub schema:location "Riga" .
6 z:ub schema:knows z:ch .
7 z:ub schema:knows z:hk .
8
9 z:ch schema:name "Christina" .
10 z:ch schema:location "San Francisco" .
11 z:ch schema:knows z:ub .
12 z:ch schema:knows z:hk .
13
14 z:hk schema:name "Huda" .
15 z:hk schema:location "Ithaca" .
16 z:hk schema:knows z:ub .
17 z:hk schema:knows z:ch .
```

A sidebar on the right contains a yellow box labeled "Christina".

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/>

Linked Data & Semantic Web: Expanding Your Graph

Facilitator's Example

Screenshot of a Wikipedia article page for "Riga".

The URL in the browser bar is <https://en.wikipedia.org/w/index.php?title=Riga&oldid=7200000>. The page title is "Riga".

The page content starts with a summary: "This article is about the Latvian capital. For other uses, see Riga (disambiguation)."

The main text describes Riga as the capital and largest city of Latvia, with 696,593 inhabitants (2015), and its location on the Gulf of Riga at the mouth of the Daugava.

Below the main text, there is a section about Riga's history, mentioning its founding in 1201, its status as a Hanseatic League member, and its role as the European Capital of Culture in 2014.

The sidebar on the right contains a "Riga" section with a "City" heading and four images: the Freedom Monument, a view of the Old Town, the House of the Blackheads, and another view of the Old Town.

At the bottom of the page, there is a "Contents" section.

Facilitator's Example



A screenshot of a web browser window. The address bar shows 'dbpedia.org/page/Riga'. Below the address bar is a navigation bar with links like 'kmarks', 'weather', 'Stanford', 'Documentation', 'Conferences', 'Tools', 'Hyku', 'DataOps', 'To Read', 'Decolonize Your Diet -', 'Comestible Journal...', and 'Financial'. To the right of the address bar are several icons. The main content area shows the title 'About: Riga' and a paragraph of text about Riga. At the bottom, there is a table of properties and values.

About: Riga

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

Riga (/rī:gə/; Latvian: Rīga, pronounced [rī:ga]) 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).

Property	Value
dbo:PopulatedPlace/area	▪ 1.0E-6
dbo:PopulatedPlace/areaMetro	▪ 10133.0
dbo:PopulatedPlace/areaTotal	▪ 304.0
dbo:PopulatedPlace/populationMetroDensity	▪ 101.4
dbo:abstract	▪ Riga (/rī:gə/; Latvian: Rīga, pronounced [rī:ga]) 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 km ² (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 was founded in 1201 and is a former Hanseatic League member. Riga's historical centre is a UNESCO

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

The screenshot shows a web-based RDF editor interface. At the top, there is a toolbar with various icons for bold, italic, underline, strikethrough, and other document operations. Below the toolbar is a navigation bar with links to 'Secure' and the URL 'https://pad.riseup.net/p/swib-17-ws-facilitators'. The main area contains a SPARQL query and its results.

SPARQL Query:

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

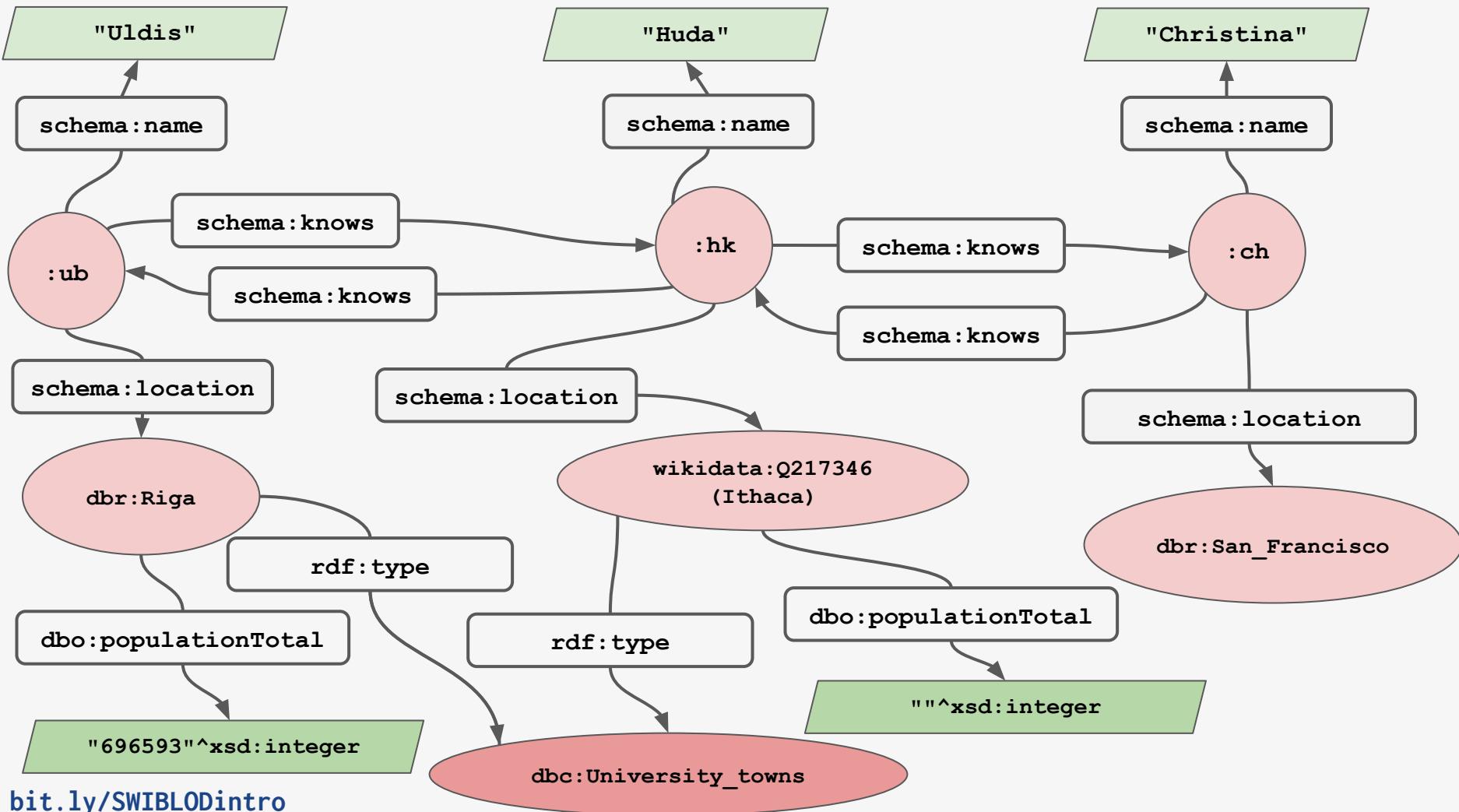
5
6 z:ub schema:name "Uldis" .
7 z:ub schema:location dbr:Riga . dbr:Riga
8 z:ub schema:knows z:ch .
9 z:ub schema:knows z:hk .

10
11 z:ch schema:name "Christina" .
12 z:ch schema:location "San Francisco" .
13 z:ch schema:knows z:ub .
14 z:ch schema:knows z:hk .

15
16 z:hk schema:name "Huda" .
17 z:hk schema:location "Ithaca" .
18 z:hk schema:knows z:ub .
19 z:hk schema:knows z:ch .
```

Results:

A sidebar on the right displays the results of the query. It shows a list of triples with subjects 'z:ub', 'z:ch', and 'z:hk'. Each triple is represented by a yellow box containing the subject, followed by a white box containing the predicate and object. A yellow box labeled 'Christina' is shown next to the triple where the subject is 'z:ch' and the object is 'dbr:Riga'. The entire row for this triple is highlighted with a yellow background.



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.

**30 minutes Break
(Return at 16:00)**

Facilitator's Example

https://en.wikipedia.org/wiki/Music

Not logged in Talk Contributions Create account Log in

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."^[2]

Music



A painting on an ancient Greek vase depicts a music lesson (c. 510 BCE).

Medium	Sound, silence, time
Originating culture	Various
Originating era	Paleolithic era

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 .  
Z:ub foaf:interest dbr:Semantic_Web .
```

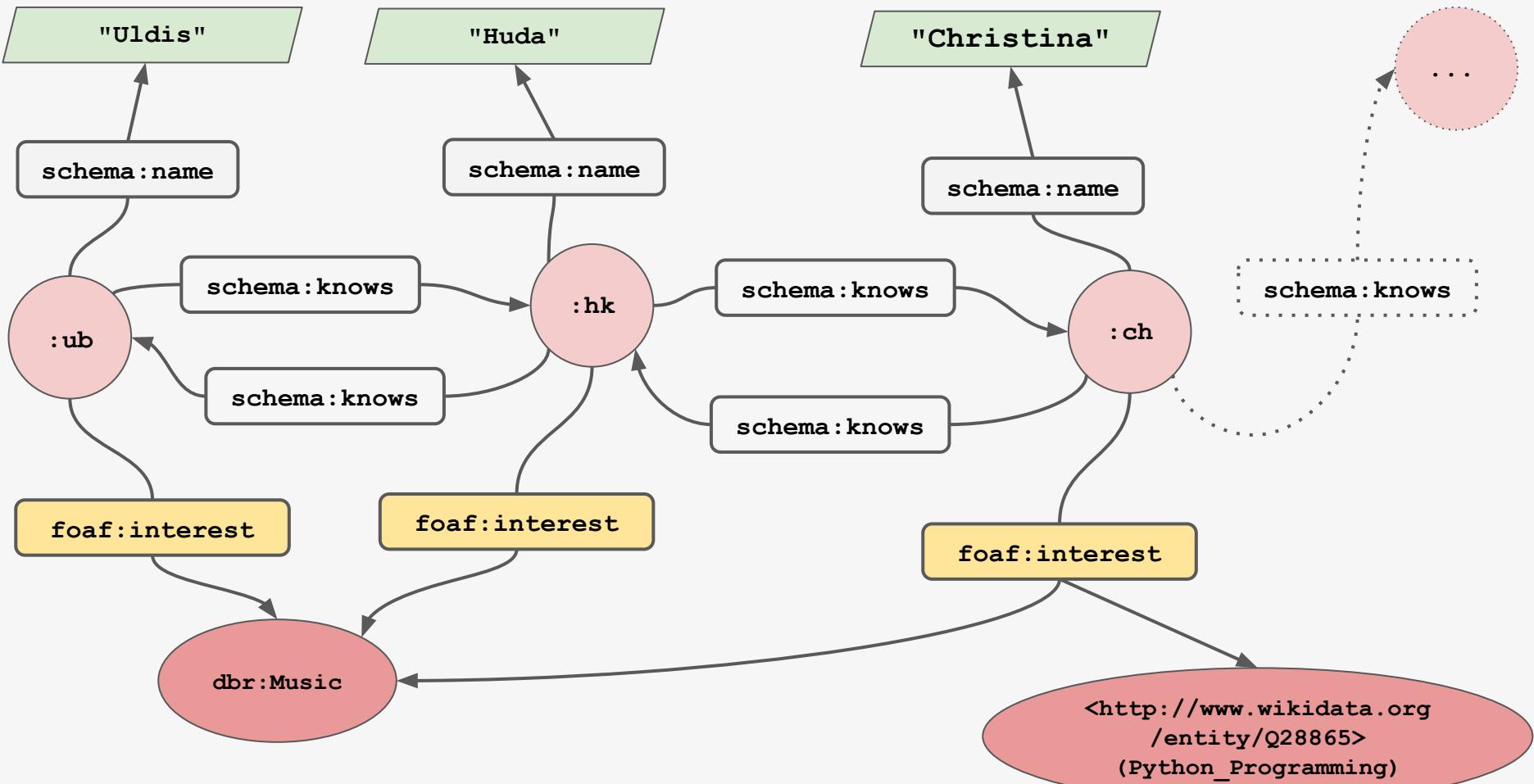
... [truncated example data]

Facilitator's Example

The screenshot shows a web-based code editor with the following interface elements:

- Header: Secure <https://pad.riseup.net/p/swib-17-ws-facilitators>
- Toolbar: Apps, Bookmarks, weather, Stanford, Documentation, Conferences, Tools, Hyku, DataOps, To Read, G Decolonize Your Diet -
- Text Editor: A code editor displaying an RDF triples file. The code is color-coded: blue for prefixes and yellow for statements. Line numbers are on the left.

```
1 @prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators# .  
2 @prefix schema: <http://schema.org/> .  
3 @prefix dbr: <http://dbpedia.org/resource/> .  
4 @prefix wikidata: <http://www.wikidata.org/entity/> .  
5 @prefix foaf: <http://xmlns.com/foaf/0.1/> .  
6  
7 z:ub schema:name "Uldis" .  
8 z:ub schema:location dbr:Riga .  
9 z:ub schema:knows z:ch .  
10 z:ub schema:knows z:hk .  
11 z:ub foaf:interest dbr:Music .  
12 z:ub foaf:interest dbr:Semantic_Web .  
13  
14 z:ch schema:name "Christina" .  
15 z:ch schema:location dbr:San_Francisco .  
16 z:ch schema:knows z:ub .  
17 z:ch schema:knows z:hk .  
18  
19 z:hk schema:name "Huda" .  
20 z:hk schema:location wikidata:Q217346 .  
21 z:hk schema:knows z:ub .  
22 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.

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](#))
 - SKOS schemas in BARTOC: [http://bartoc.org/en/search/advanced?f\[0\]=field_format%3A24](http://bartoc.org/en/search/advanced?f[0]=field_format%3A24)
- 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 ...

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

STW Thesaurus for Economics (v 9.0, 2015-06-15) • Suggestions and comments to the [thesaurus team](#) •
Mailing lists: [stw-announce](#), [stw-user](#)
ZBW - Leibniz Information Centre for Economics - [Imprint](#)



The STW Thesaurus for Economics is licensed under an [Open Database License \(ODbL\) 1.0](#). Permissions beyond the scope of this license are available at [ZBW](#).

```
@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/> ;  
...  
...
```

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/> .  
@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

B I U S C

```
1 @prefix z: <https://pad.riseup.net/p/swib-17-ws-facilitators#> .
2 @prefix schema: <http://schema.org/> .
3 @prefix dbr: <http://dbpedia.org/resource/> .
4 @prefix wikidata: <http://www.wikidata.org/entity/> .
5 @prefix foaf: <http://xmlns.com/foaf/0.1/> .
6 @prefix dcterms: <http://purl.org/dc/terms/> .

7
8 <> dcterms:creator z:ub .
9 <> dcterms:creator z:ch .
10 <> dcterms:creator z:hk .
11 <> schema:license <https://creativecommons.org/publicdomain/zero/1.0/>.

12
13 z:ub schema:name "Uldis" .
14 z:ub schema:location dbr:Riga .
15 z:ub schema:knows z:ch .
16 z:ub schema:knows z:hk .
17 z:ub foaf:interest dbr:Music .
18 z:ub foaf:interest dbr:Semantic_Web .

19
20 z:ch schema:name "Christina" .
21 z:ch schema:location dbr:San_Francisco .
22 z:ch schema:knows z:ub .
23 z:ch schema:knows z:hk .
24 z:ch foaf:interest dbr:Music .
25 z:ch foaf:interest wikidata:Q28865 .

26
27 z:hk schema:name "Huda" .
28 z:hk schema:location wikidata:Q217346 .
29 z:hk schema:knows z:ub .
30 z:hk schema:knows z:ch .
31 z:hk foaf:interest dbr:Music .
```

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 Candidate 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 `dcterms:creator`) and apply a CC0 or another license as you see fit (add `schema:license`).

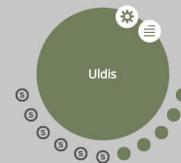
Linked Data Experimentation: SPARQL & Visualization(s)

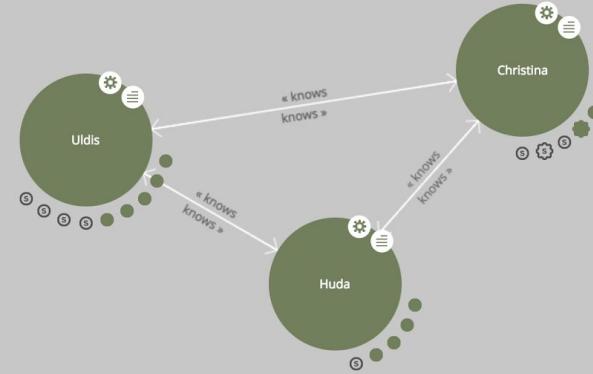
About LODLive

- 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
- <http://en.lodlive.it/> & <https://github.com/dvcama/LodLive>

LODLive Viz

Browse, collect and view the group graphs we have created

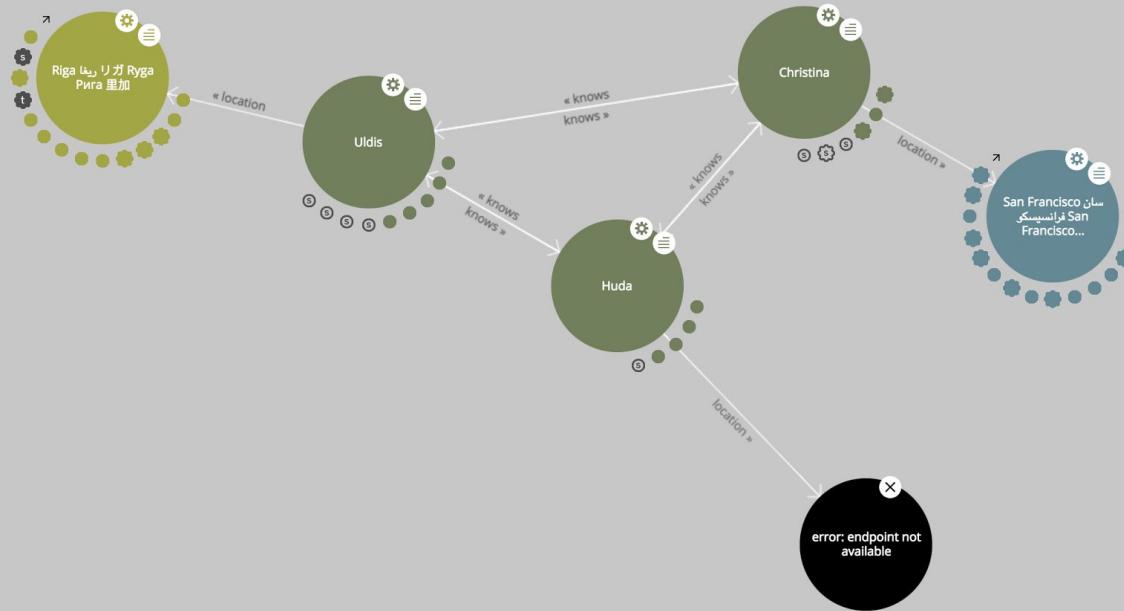


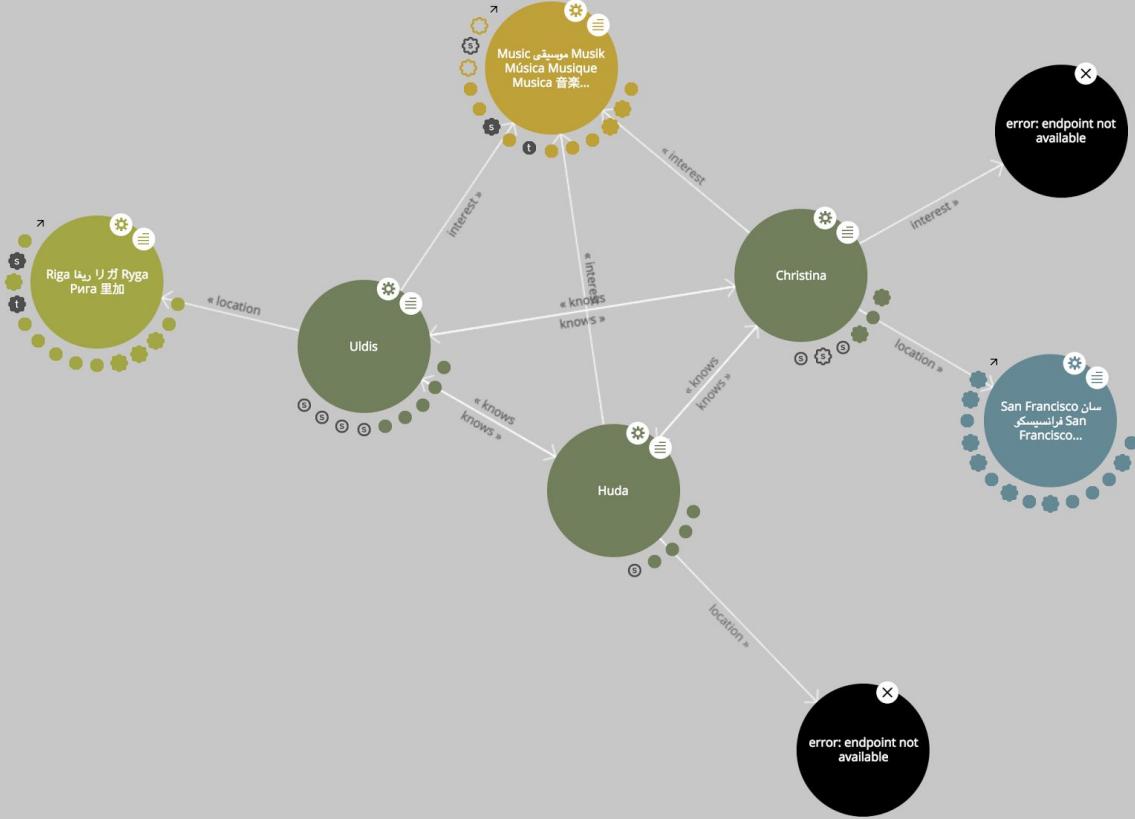


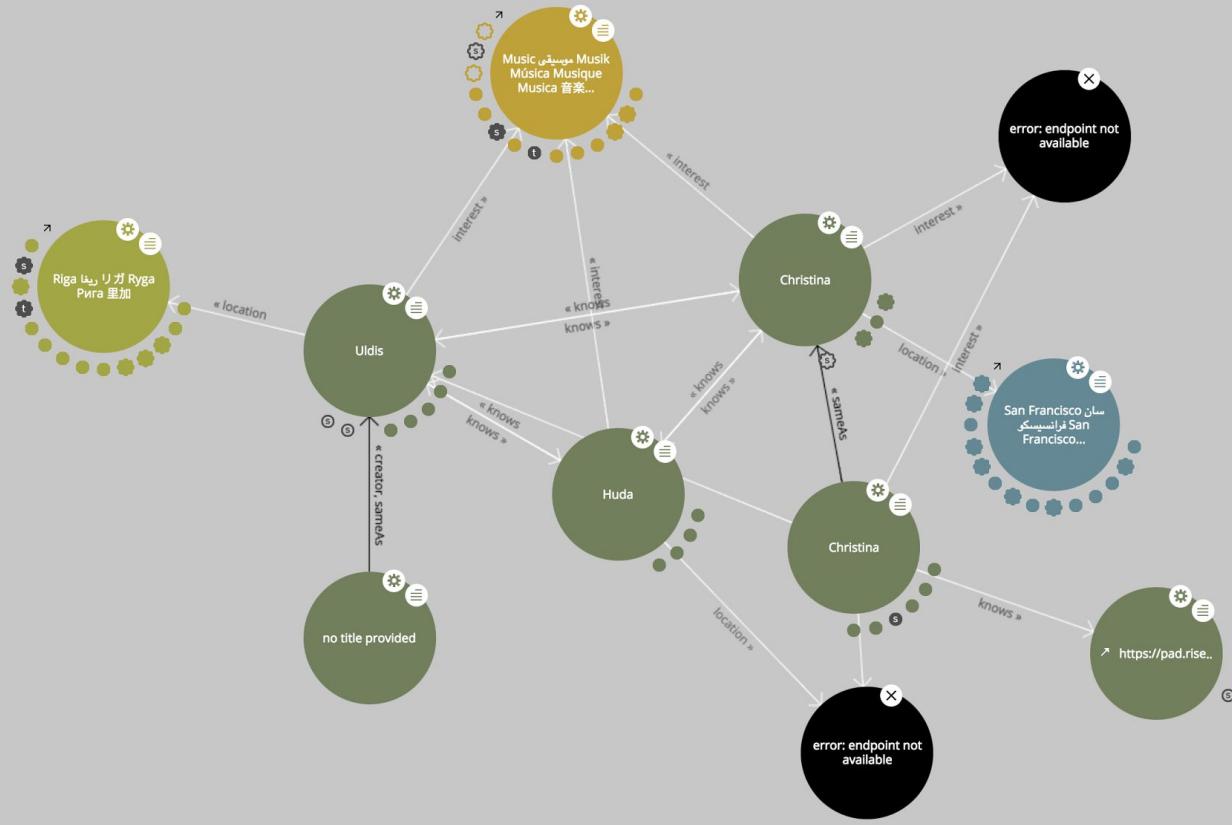
<http://cmharlow.webfactional.com/fuseki/swib-workshop/sparql>

Christina

<https://pad.riseup.net/p/swib-17-ws-facilitators#ch>







LODLive live demo

Try this first:

http://cmharlow.webfactional.com/lodlive/app_en.html

Back-up (try second):

<http://en.lodlive.it/?http://dbpedia.org/resource/Riga>

SPARQL / Fuseki

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

<http://cmharlow.webfactional.com/fuseki/>

Select /swib-workshop and query

Triplestores & SPARQL

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 {
    ?variable ?predicate ?obj .
}

ORDER by ?variable
```

SPARQL: Names of the participants

SPARQL ENDPOINT: swib-workshop
CONTENT TYPE (SELECT): JSON
CONTENT TYPE (GRAPH): Turtle

```
1 # Names of Workshop Participants
2 PREFIX schema: <http://schema.org/>
3 SELECT * WHERE {
4   ?person schema:name ?name .
5 }
```

QUERY RESULTS

Table Raw Response

Showing 1 to 25 of 25 entries

person	name
1 <https://pad.riseup.net/p/swib-17-ws-facilitators#ub>	"Uldis"
2 <http://etherpad.lobid.org/p/swib16-ws-z#ub>	"Uldis"
3 <https://pad.riseup.net/p/swib-17-ws-facilitators#ch>	"Christina"
4 <http://etherpad.lobid.org/p/swib16-ws-z#ch>	"Christina"
5 <https://pad.riseup.net/p/swib-17-ws-facilitators#hk>	"Huda"
6 <http://etherpad.lobid.org/p/swib16-ws-z#jh>	"Jana"
7 <http://etherpad.lobid.org/p/swib16-ws-b#oj>	"Olaf"
8 <http://etherpad.lobid.org/p/swib16-ws-b#ag>	"Astrid"

Search: Show 50 entries

Acquaintances

SPARQL ENDPOINT: swib-workshop | CONTENT TYPE (SELECT): JSON | CONTENT TYPE (GRAPH): Turtle

```
1 # Acquaintances of workshop participants
2 PREFIX schema: <http://schema.org/>
3 SELECT * WHERE {
4   ?who schema:knows ?whom .
5 }
```

getQueryResults

Table Raw Response

Showing 1 to 50 of 102 entries

who	whom
1 <https://pad.riseup.net/p/swib-17-ws-facilitators#ch>	<https://pad.riseup.net/p/swib-17-ws-facilitators#ub>
2 <https://pad.riseup.net/p/swib-17-ws-facilitators#hk>	<https://pad.riseup.net/p/swib-17-ws-facilitators#ub>
3 <http://etherpad.lobid.org/p/swib16-ws-z#ch>	<https://pad.riseup.net/p/swib-17-ws-facilitators#ub>
4 <http://etherpad.lobid.org/p/swib16-ws-z#jh>	<https://pad.riseup.net/p/swib-17-ws-facilitators#ub>
5 <https://pad.riseup.net/p/swib-17-ws-facilitators#ub>	<https://pad.riseup.net/p/swib-17-ws-facilitators#ch>
6 <https://pad.riseup.net/p/swib-17-ws-facilitators#hk>	<https://pad.riseup.net/p/swib-17-ws-facilitators#ch>
7 <http://etherpad.lobid.org/p/swib16-ws-z#ub>	<https://pad.riseup.net/p/swib-17-ws-facilitators#ch>

Search: Show 50 entries

Acquaintances by name

SPARQL ENDPOINT: swib-workshop | CONTENT TYPE (SELECT): JSON | CONTENT TYPE (GRAPH): Turtle

```
1 # Acquaintances of workshop participants by name
2 PREFIX schema: <http://schema.org/>
3 SELECT ?namewho ?namewhom WHERE {
4   ?who schema:knows ?whom .
5   ?who schema:name ?namewho .
6   ?whom schema:name ?namewhom .
7 }
```

QUERY RESULTS

Table Raw Response

Showing 1 to 50 of 95 entries

namewho	namewhom
1 "Christina"	"Uldis"
2 "Huda"	"Uldis"
3 "Christina"	"Uldis"
4 "Jana"	"Uldis"
5 "Uldis"	"Christina"
6 "Huda"	"Christina"
7 "Uldis"	"Christina"
8 "Jana"	"Christina"
9 "Uldis"	"Huda"

Localities and Countries

PREFIXES
rdf rdfs owl xsd +

SPARQL ENDPOINT: swib CONTENT TYPE (SELECT): JSON CONTENT TYPE (GRAPH): Turtle

```
2
3 ← PREFIX schema: <http://schema.org/>
4 ← PREFIX dbo: <http://dbpedia.org/ontology/>
5
6 ← SELECT * WHERE {
7   ?person schema:location ?place .
8   ?place dbo:country ?country .
9 }
```

QUERY RESULTS
Table Raw Response ↻

Showing 1 to 9 of 9 entries

person	place	country
1 <http://etherpad.lobid.org/p/swib16-ws-g#ls>	<http://dbpedia.org/resource/Gothenburg>	<http://dbpedia.org/resource/Sweden>
2 <http://etherpad.lobid.org/p/swib16-ws-z#ub>	<http://dbpedia.org/resource/Riga>	<http://dbpedia.org/resource/Latvia>
3 <https://pad.riseup.net/p/swib-17-ws-facilitators#ub>	<http://dbpedia.org/resource/Riga>	<http://dbpedia.org/resource/Latvia>
4 <http://etherpad.lobid.org/p/swib16-ws-b#ml>	<http://dbpedia.org/resource/Budapest>	<http://dbpedia.org/resource/Hungary>
5 <http://etherpad.lobid.org/p/swib16-ws-f#kp>	<http://dbpedia.org/resource/Stockholm>	<http://dbpedia.org/resource/Sweden>
6 <http://etherpad.lobid.org/p/swib16-ws-f#hs>	<http://dbpedia.org/resource/Stockholm>	<http://dbpedia.org/resource/Sweden>

Search: Show 50 entries

Shared Interests

```
1 # Shared Interests of workshop participants
2 PREFIX schema: <http://schema.org/>
3 PREFIX dbo: <http://dbpedia.org/ontology/>
4 PREFIX z: <https://pad.riseup.net/p/swib-17-ws-facilitators#>
5 PREFIX foaf: <http://xmlns.com/foaf/0.1/>
6 SELECT * WHERE {
7   z:ub foaf:interest ?interest .
8   ?person foaf:interest ?interest .
9   FILTER (?person != z:ub)
10 }
```



QUERY RESULTS

Table Raw Response 

Showing 1 to 10 of 10 entries

Search: Show 50 entries

interest	person
<http://dbpedia.org/resource/Music>	<http://etherpad.lobid.org/p/swib16-ws-c#rr>
<http://dbpedia.org/resource/Music>	z:hk
<http://dbpedia.org/resource/Music>	<http://etherpad.lobid.org/p/swib16-ws-z#jh>
<http://dbpedia.org/resource/Music>	z:ch
<http://dbpedia.org/resource/Music>	<http://etherpad.lobid.org/p/swib16-ws-e#ml>
<http://dbpedia.org/resource/Music>	<http://etherpad.lobid.org/p/swib16-ws-z#ub>
<http://dbpedia.org/resource/Music>	<http://etherpad.lobid.org/p/swib16-ws-b#ag>

bit.ly/SWIBLODintro

<https://pad.riseup.net/p/swib-17-ws-sparql>

Metropolitans (Cities of certain size)

SPARQL ENDPOINT: swib

CONTENT TYPE (SELECT): JSON

CONTENT TYPE (GRAPH): Turtle

```
2
3 PREFIX schema: <http://schema.org/>
4 PREFIX dbo: <http://dbpedia.org/ontology/>
5
6 SELECT * WHERE {
7   ?person schema:location ?place .
8   ?place dbo:populationTotal ?population .
9   FILTER (?population > 100000) .
10 }
11
```

QUERY RESULTS

Table Raw Response

Showing 1 to 9 of 9 entries

person	place	population
1 <http://etherpad.lobid.org/p/swib16-ws-g#ls>	<http://dbpedia.org/resource/Gothenburg>	"549789"^^xsd:nonNegativeInteger
2 <http://etherpad.lobid.org/p/swib16-ws-z#ub>	<http://dbpedia.org/resource/Riga>	"696593"^^xsd:nonNegativeInteger
3 <https://pad.riseup.net/p/swib-17-ws-facilitators#ub>	<http://dbpedia.org/resource/Riga>	"696593"^^xsd:nonNegativeInteger
4 <http://etherpad.lobid.org/p/swib16-ws-b#ml>	<http://dbpedia.org/resource/Budapest>	"1759407"^^xsd:nonNegativeInteger

Search: Show 50 entries

SPARQL live demo

cmh2166.webfactional.com:20761

Username: fuseki Password: SWIBLODworkshop

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, ...

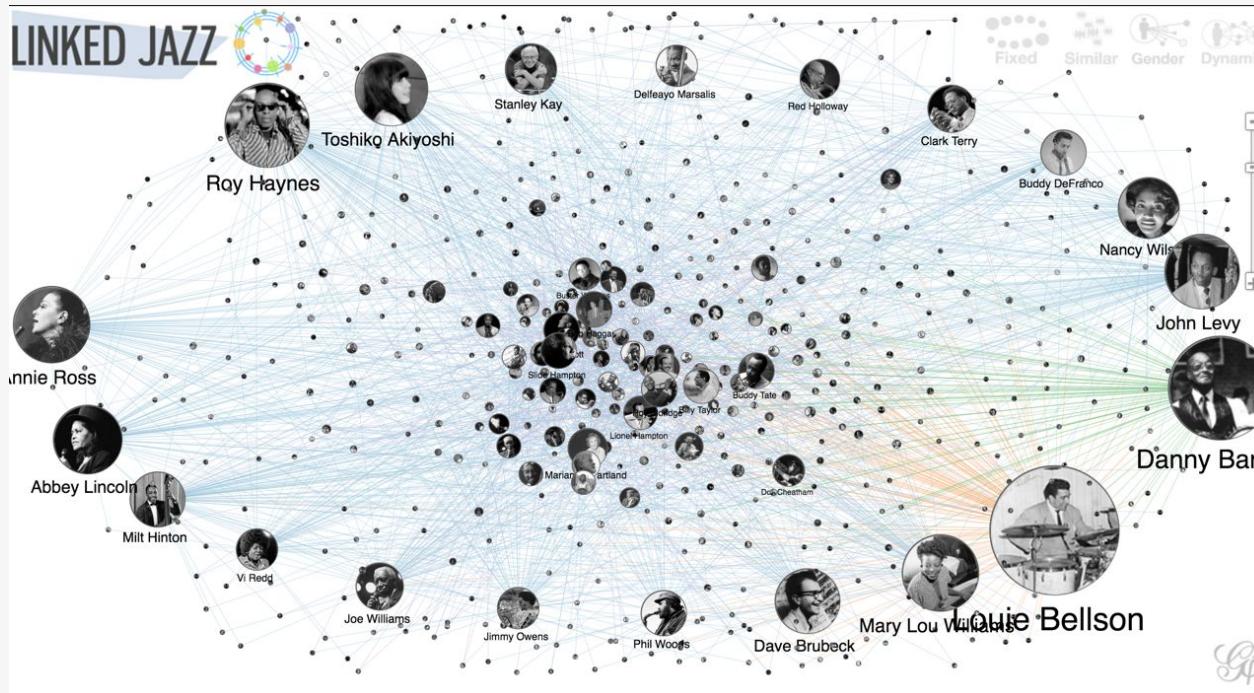
Subset of Random Other RDF Tech

- [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

Linked Jazz: Network Viz



linkedjazz.org/network/

Linked Jazz: Ecco!



Bruce, Kate, 1858-1946 | Bruce, Kate [Personal]

Titles:

- A child of the ghetto
- Judith of Bethulia
- Through the breakers
- Unidentified Paper Print box V
- Unidentified Tayler no. 10: Those who pay

Description: Silent film actress

American silent film actresses People from Columbus, Indiana 1868 births Actresses from

Use Term [A key] Back [space key]

linkedjazz.org/tools/ecco/

NYPL Labs B.I.L.L.I.

(Bibliographic Identifiers for Library Location)

AM1-501

Museums. Collectors and collecting

Wiki

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

[Expand](#)

[From Wikipedia](#)



Image source.

Holdings Count

Thousands of resources.

Note

No Notes found.

Broader Classmarks

[General Works](#)

└ Museums. Collectors and collecting

billi.nypl.org

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/>

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

BibCat

Gold Rush® BIBCAT

Project Links

- [Github Code Repository](#)
- [XML Siteindex](#)

Build-Measure-Learn Iteration Two

Build Workflow

1. Run [marc2bibframe2](#) XSLT transform on XML record
2. Add Alliance updates including replacing bf:instance and bf: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 bf: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

Library	# Source MARC	# Triples
University of Colorado Boulder	54,007	
Colorado College	57,471	
SUNY - Buffalo	15,650	

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/>

Opaque Namespace

opaquenamespace.org

Vocabularies

Predicates

Login

Box Name

<http://opaquenamespace.org/ns/boxName>

Sub Property Of:

isPartOf

<http://opaquenamespace.org/ns/boxName>

Range:

Domain:

Label:

Box Name [English \[en\]](#)

Alternate Name:

Date:

Comment:

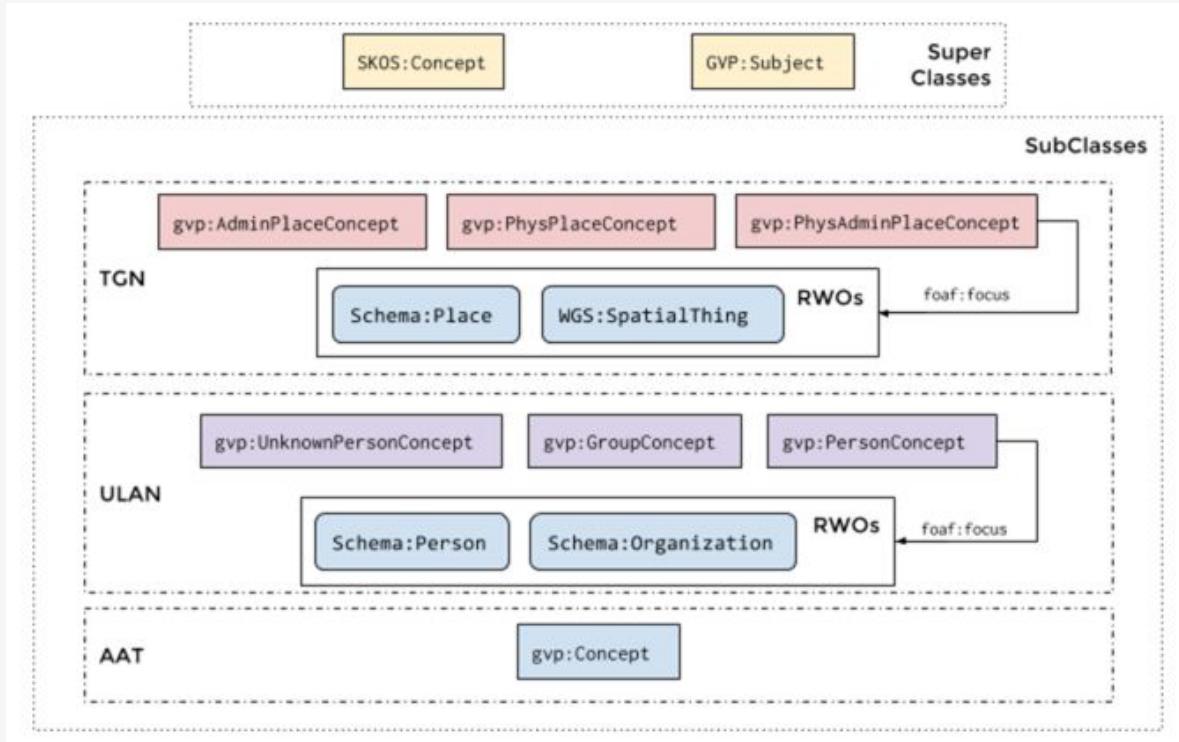
Identifier on the box holding the physical archival item. [English \[en\]](#)

Is Replaced By:

bit.ly/SWIBLODintro

opaquenamespace.org

Getty Vocab Model



vocab.getty.edu

Getty Vocababs SPARQL Endpoint

Getty Vocabularies: LOD SPARQL Queries Any ▾ Search... Search Brief ▾

1.2 Revisions
1.2.1 Version 3.0
1.2.2 Version 3.1
1.2.3 Version 3.2
1.2.4 Version 3.3

2 Finding Subjects
2.1 Top-level Subjects
2.2 Descendants of a Given Parent
2.3 Subjects by Contributor Id
2.4 Subjects by Contributor Abbrev
2.5 Preferred Ancestors
2.6 Full Text Search Query
2.7 Stop-Word Removal
2.8 Case-insensitive Full Text Search Query
2.9 Exact-Match Full Text Search Query
2.10 Find Person Occupations by broaderExtended
2.11 Find Person Occupations by Double FTS
2.12 Find Quartz Timepieces by Double FTS
2.13 Find Subject by Exact English PrefLabel
2.14 Find Subject by Language-Independent PrefLabels
2.15 Combination Full-Text and Exact String Match
2.16 Find Subject by Any Label
2.17 Find Ordered Subjects
2.18 Find Ordered Collections

Query:

```
1 select * {  
2   ?x a gvp:Subject; dct:contributor aat_contrib:10000088;  
3   gvp:broaderExtended aat:300033618;  
4   gvp:prefLabelGVP/xl:literalForm ?1}
```

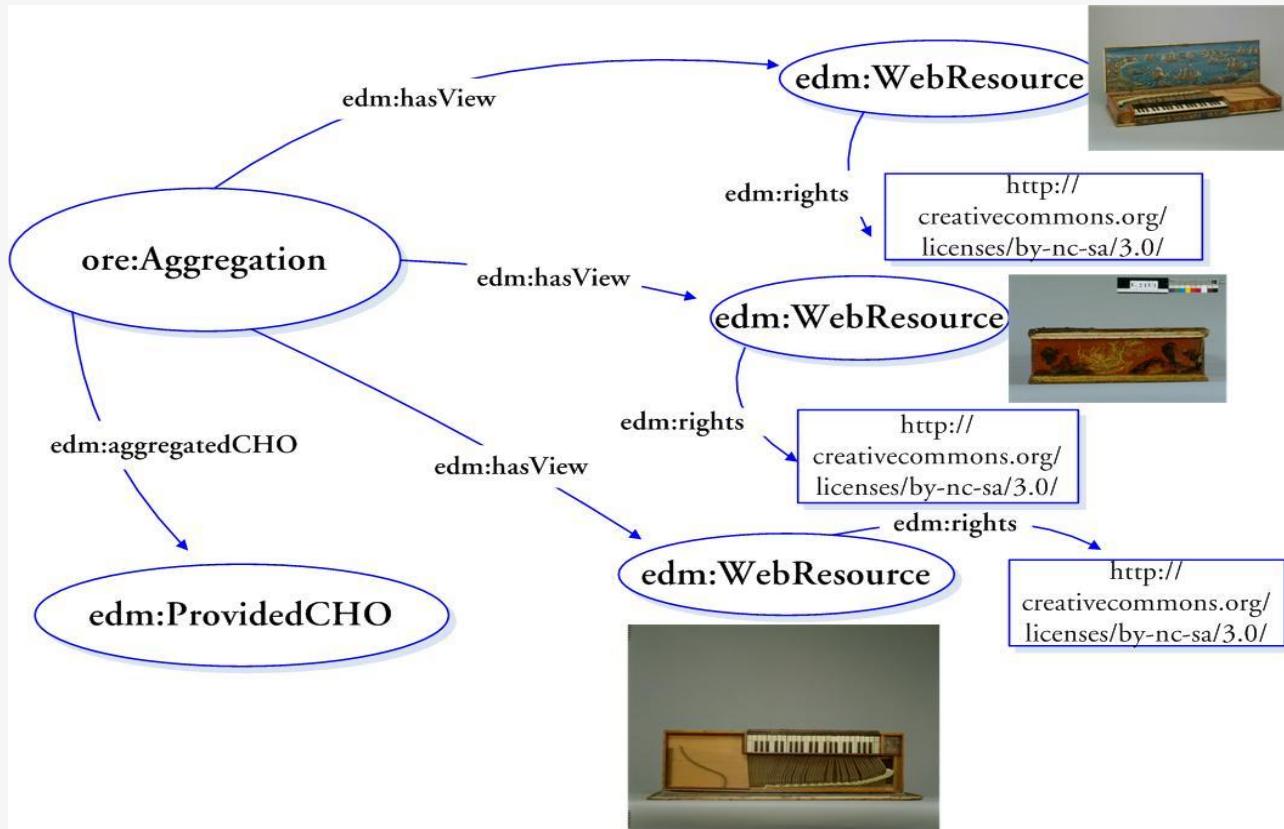
Include inferred Expand results over equivalent URIs **Submit**

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 "Fichtelgebirgehumpen":

```
select * {?x gvp:broaderExtended aat:300194567; skos:inScheme aat: ; gvp:prefLabelGVP/xl:literalForm ?1}
```

vocab.getty.edu

Europeana Data Model



Europeana SPARQL Endpoint

Virtuoso SPARQL Query Editor

[About](#) | [Namespace Prefixes](#) | [Inference rules](#)

Default Data Set Name (Graph IRI)

Query Text

```
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)

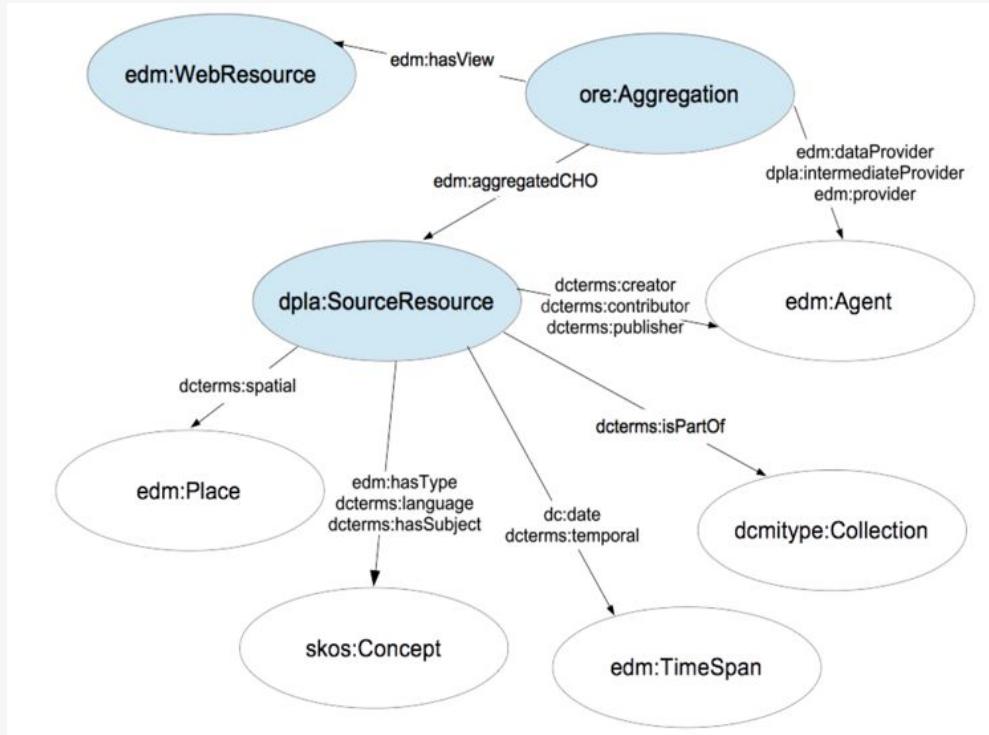
Options:

Strict checking of void variables Log debug info at the end of output (has no effect on some queries and output formats)

europeana.ontotext.com

bit.ly/SWIBLODintro

DPLA Model



<dp.la/info/wp-content/uploads/2015/03/MAPv4.pdf>

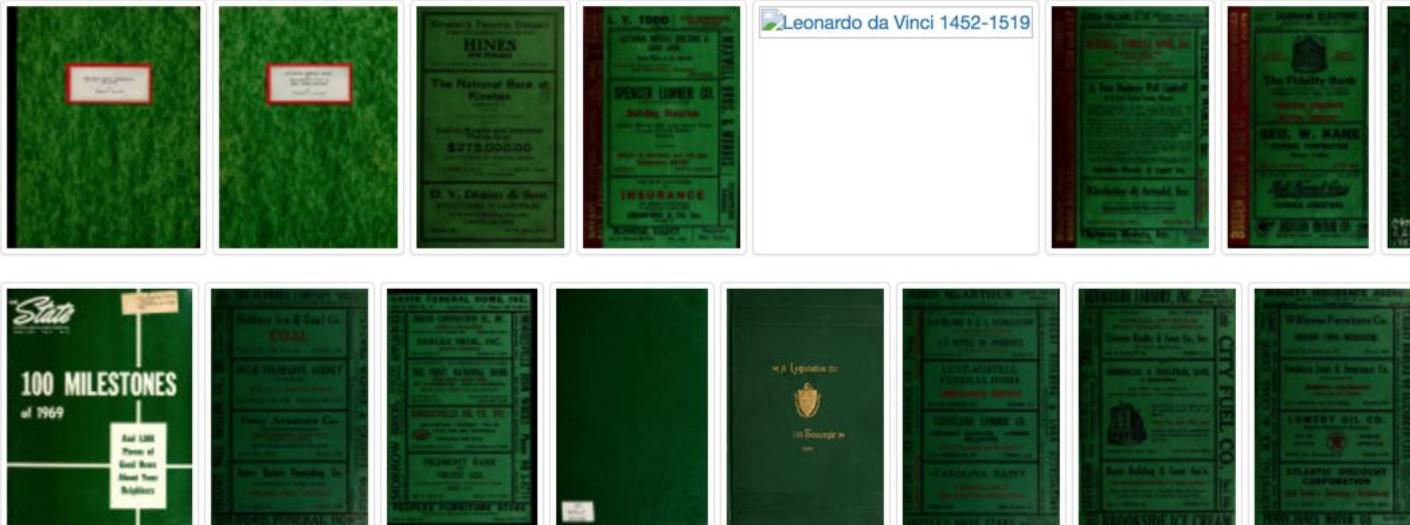
DPLA Ingestion3

github.com/dpla/ingestion3

DPLA Color Browse



497 images containing darkgreen



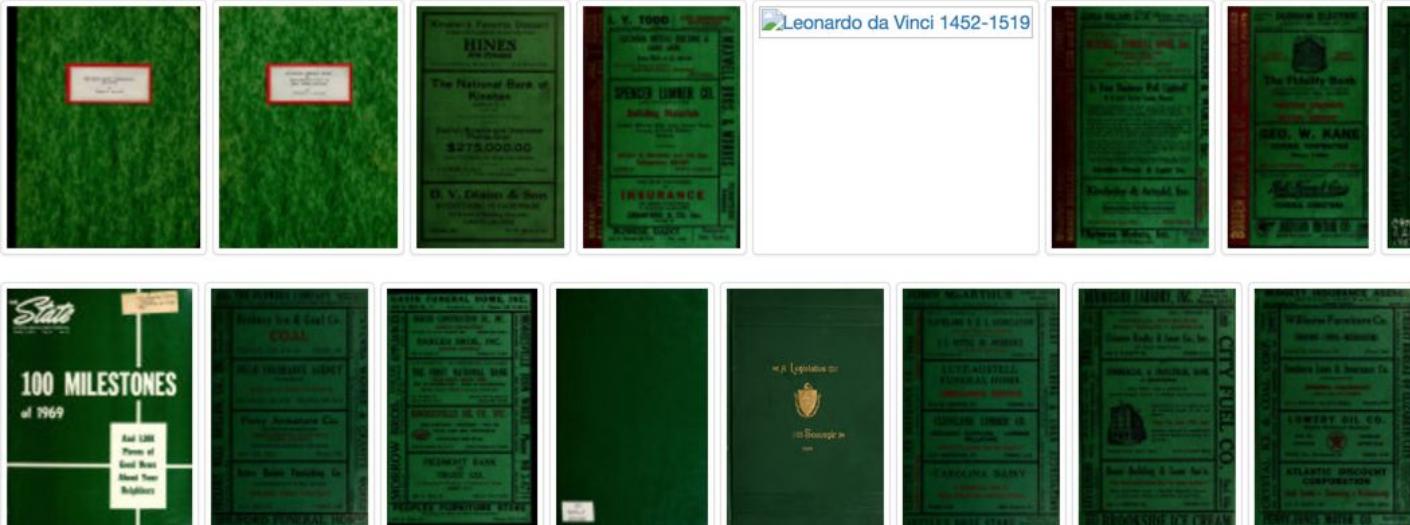
colorbrowse.club

bit.ly/SWIBLODintro

DPLA Color Browse



497 images containing darkgreen



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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