
Faculty Scholarship and Creative Works

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Linked data in the library & OpenRefine

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Linked Data in the Library & OpenRefine

Sai Deng, University of Central Florida Libraries

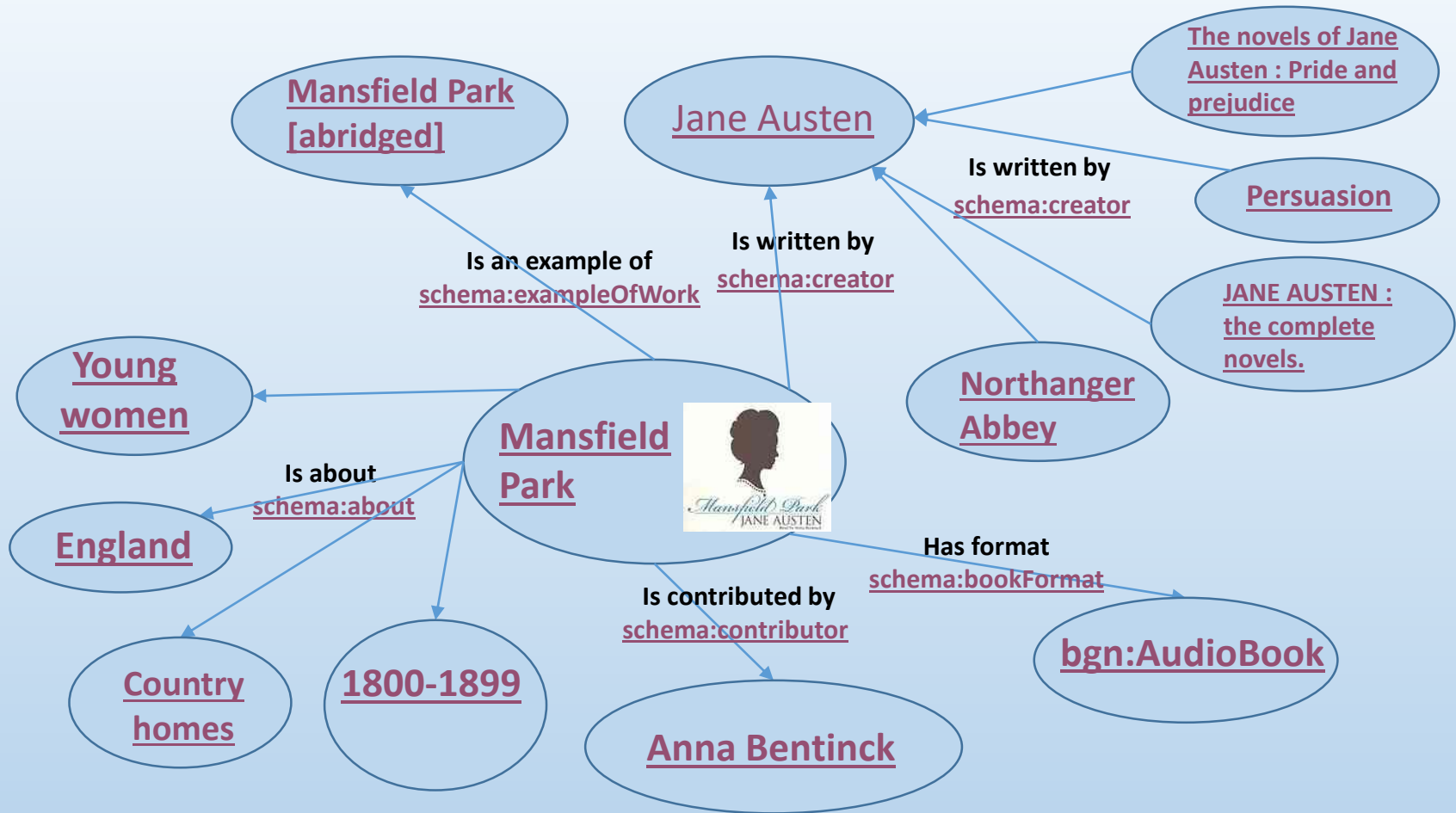
Linked Data

- **Questions to think about:**
 - **Why does linked data matter? How can libraries and librarians embrace linked data?**
- **Linked Data in the Library and the Web**
 - **Cases**
 - **Standards and Vocabularies**
- **Linked Data Design Principles, Building Blocks & Creation**
- **Current Digital Repositories and Linked Data**
- **Data Editing Tool: OpenRefine (Features, Examples)**
- **Possible Ways to Get Involved**

Linked Data

- **Why does linked data matter?**
 - **Change of the web:**
 - Before the web (document silos)
 - Web 1.0 (web of documents)
 - Web 2.0 (social web; application silos)
 - Web 3.0 (semantic web)
 - Web 4.0 (intelligence web)
 - Change from web of “documents” to web of “data”/ “Things” (deconstruct webpages; web semantics: person, place, event, creativeWork...);
 - Allow computers to understand and process data on the web.
- **What is linked data?**
 - It is recommended best practice for **exposing, sharing, and connecting** data, information, and knowledge (**structured data**) on the web;
 - Key technologies: **URIs, HTTP, RDF**. — Wikipedia
 - **Linked data vs. Semantic Web: Pieces vs. whole**
- **Resource Description Framework (RDF): Represent information in triples**
 - **Subject:** a resource, identified with a URI
 - **Predicate:** specification of the relationship
 - **Object:** a resource the subject is related to

Linked Data Examples



*Based on information from worldcat.org. LOD links from this site may change.

Linked Data Examples

- In RDF/XML, e.g.,

```
<rdf:Description rdf:about="http://www.worldcat.org/oclc/930255038">  
  <schema:name xml:lang="en">Mansfield Park</schema:name> ...  
  <schema:about  
rdf:resource="http://experiment.worldcat.org/entity/work/data/1120181956  
#Topic/young_women"/>  
  <schema:bookFormat rdf:resource="http://bibliograph.net/AudioBook"/>...  
</rdf:Description>...
```

- In JSON-LD, e.g.,

```
{ "@id" :  
"http://experiment.worldcat.org/entity/work/data/1120181956#Topic/yo  
ung_women", "@type" : "schema:Intangible", "name" : { "@language" :  
"en", "@value" : "Young women" }  
},...
```

- In N-triples, e.g.,

```
<http://www.worldcat.org/oclc/930255038>  
<http://schema.org/about>  
<http://experiment.worldcat.org/entity/work/data/1120181956#Topic/you  
ng_women>...
```

Linked Data and the Library Community

- **What have libraries been doing with linked data in recent years?**
 - **Preparing for linked data:**
 - Add linked open data (LOD) links to bibliographic records (e.g., \$0 in MARC records);
 - Control terms and add LOD links to metadata in digital repositories.
 - **Convert bibliographic and authority records into linked data set:**
 - WorldCat Linked Data, e.g., Works;
Explore: <http://experiment.worldcat.org/entity/work/data/1080130963>
 - Linked Data for Production (LD4P): prepared data for SHARE-VDE
 - **Collaborate to develop tools, discovery systems and collections;**
 - **Promote ORCID, ISNI and Identity Management;**
 - **Use open data and linked open data to support research;**
 - **Resources**
 - **Library Linked Data Incubator Group: Datasets, Value Vocabularies, and Metadata Element Sets.** <https://www.w3.org/2005/Incubator/lld/XGR-lld-vocabdataset-20111025/>
 - **Transforming Library Metadata into Linked Library Data. Introduction and Review of Linked Data for the Library Community, 2003–2011.**
<http://www.ala.org/alcts/resources/org/cat/research/linked-data>

Linked Data Vocabularies

- **Names, Subjects, Thesauri and Value Vocabularies**
 - **LC Linked Data Service: Authorities and Vocabularies** <https://id.loc.gov/>
 - **FAST: Faceted Application of Subject Terminology** <http://id.worldcat.org/fast>
 - **GeoNames** <http://www.geonames.org/ontology/documentation.html>
 - **DOI (as linked data)** <http://dx.doi.org>
 - **Virtual International Authority File (VIAF)** <https://viaf.org/>
 - **Worldcat Identities** www.worldcat.org/identities
 - **International Standard Name Identifier (ISNI)** <http://www.isni.org/>
 - **Open Researcher and Contributor ID (ORCID)** <https://orcid.org/>
- **Metadata Element Sets and RDF Vocabularies**
 - **DCMI Metadata Terms** <http://dublincore.org/documents/dcmi-terms/>
 - **Creative Commons Rights Expression Language (CC REL)**
https://wiki.creativecommons.org/wiki/CC_REL
 - **Friend-of-a-Friend** <http://www.foaf-project.org/>
 - **Metadata Authority Description Schema in RDF** <http://www.loc.gov/standards/mads/rdf/>
 - **Schema.org Vocabulary** <http://schema.org/docs/gs.html#schemaorg>
 - **Simple Knowledge Organization Systems (SKOS)** <https://www.w3.org/2004/02/skos/>
- **The Linked Open Data Cloud** <http://linkeddata.org/>

Linked Data Implementations & Resources

Libraries, Archives and Museums Community

- [Europeana](#)
- [DPLA](#)
- [LIBRIS](#)
- [British National Bibliography](#)
- [Open Library](#)
- [BIBFRAME](#)
 - [SHARE-VDE \(Virtual Discovery Environment\)](#)
- [OCLC Linked Data Wikibase](#)
- [Library.Link Network](#)



The Web and the Library Community

- [DBpedia](#)
- [Google Knowledge Graph](#)
- [Facebook's Open Graph](#)
- [Schema.org](#)
 - [Bibliographic Extension](#)
 - [Extend Schema.org for archives](#)



Other Linked Data Resources & Implementations

- [DATA.GOV](#)
- [Data Linkage Infrastructure - Census Bureau](#)
- [LinkedGeoData.org](#)



Small Scale Linked Data Projects

- University of North Texas Libraries: [UNT Names](#)
- NCSU Libraries: [Organization Name Linked Data](#)

Linked Data Implementations

- Google Knowledge Graph

The screenshot shows a Google search for "jane austen". The search results include a Wikipedia entry, a "Quotes" section, a "Books" section, and a "People also search for" section. The Knowledge Graph is displayed on the right side of the page, showing a portrait of Jane Austen and a list of her works.

Google jane austen

All News Books Images Videos More Settings Tools

About 62,200,000 results (0.58 seconds)

Jane Austen - Wikipedia
https://en.wikipedia.org/wiki/Jane_Austen
Jane Austen (16 December 1775 – 18 July 1817) was an English novelist known primarily for her six major novels, which interpret, critique and comment upon ...
Period: 1787 to 1809–11 Resting place: Winchester Cathedral, Hampsh...

Quotes View 7+ more

There is no cham equal to tenderness of heart.

It is a truth univer of a good fortune,

Ah! There is nothi

1 novels on gther of

Books View 45+ more

Pride and Prejudice 1813

Emma 1815

Persuasion 1817

Sense and Sensibility 1811

Northanger Abbey 1817

People also search for View 65+ more

Emma Thompson

Charlotte Brontë

Charles Dickens

Emily Brontë

Virginia Woolf

s first Jane Austen novel purchase

Jane Austen Novelist

Jane Austen was an English novelist known primarily for her six major novels, which interpret, critique and comment upon the British landed gentry at the end of the 18th century. [Wikipedia](#)

Born: December 16, 1775, Steventon, United Kingdom
Died: July 18, 1817, Winchester, United Kingdom
Movies: [Becoming Jane](#), [Pride & Prejudice](#), [Sense and Sensibility](#), [MORE](#)
Siblings: [Cassandra Austen](#), [Henry Thomas Austen](#), [MORE](#)

Quotes View 7+ more

There is no cham equal to tenderness of heart.

It is a truth universally acknowledged, that a single man in possession of a good fortune, must be in want of a wife.

Ah! There is nothing like staying at home, for real comfort.

Books View 45+ more

Pride and Prejudice 1813

Emma 1815

Persuasion 1817

Sense and Sensibility 1811

Northanger Abbey 1817

People also search for View 65+ more

Emma Thompson

Charlotte Brontë

Charles Dickens

Emily Brontë

Virginia Woolf

Is Jane Austen considered a romantic writer?

Library Standards Created for Linked Data Environment

- **IFLA Library Reference (LRM) Model**

(<https://www.ifla.org/publications/node/11412>)

- Consolidation of the separately developed IFLA conceptual models: FRBR, FRAD, FRSAD

- **Resource Description and Access (RDA)**

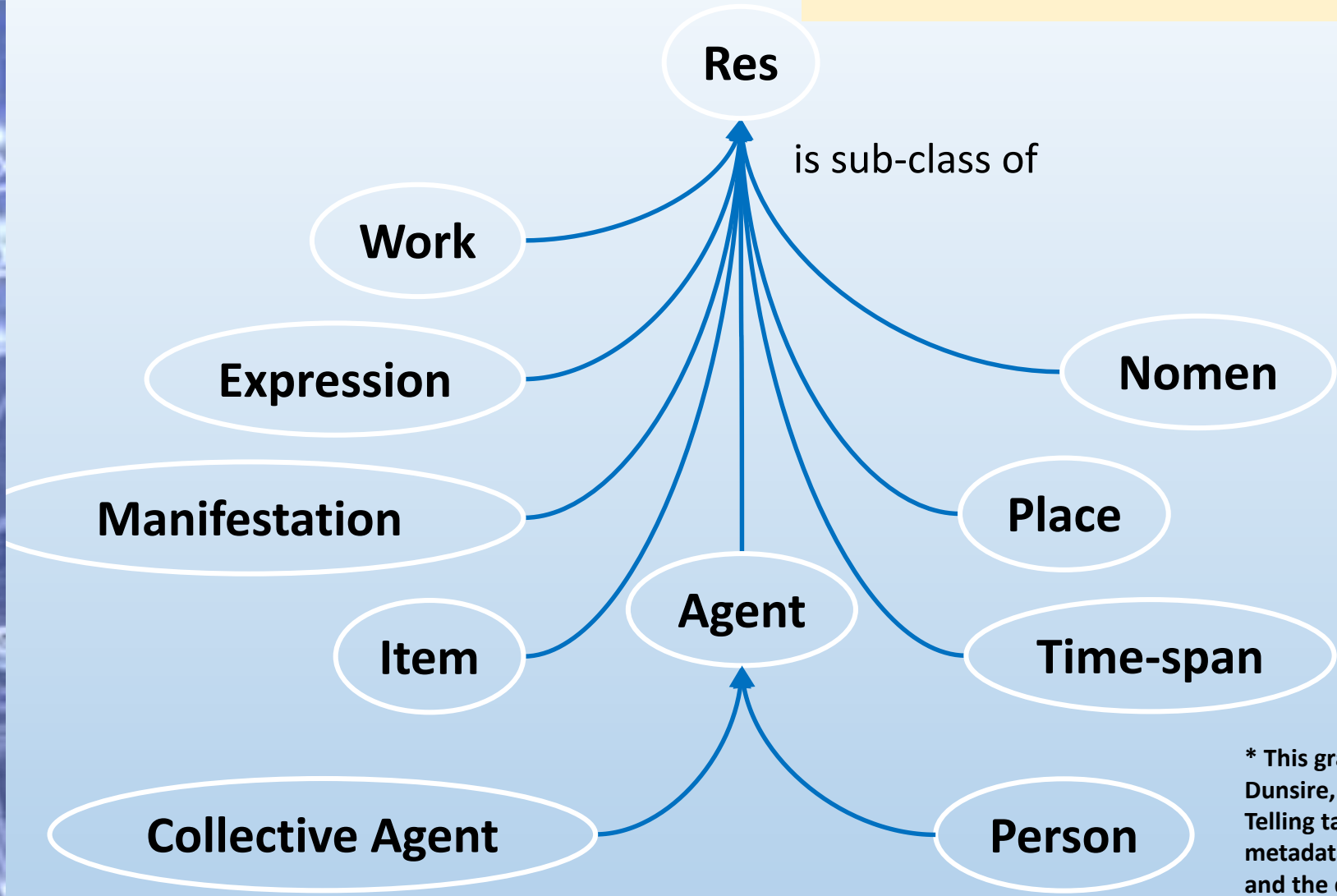
- “RDA is a package of **data elements, guidelines, and instructions** for creating library and cultural heritage resource metadata that are well-formed according to international models for user-focussed linked data applications.”
- **RDA Registry** (<http://www.rdaregistry.info/>)

- **Built upon the Standards**

- Make bibliographic information discoverable on the web
- Linked Open Data Bibliographic System: [BIBFRAME](#)
- Prototype: [SHARE-VDE \(Virtual Discovery Environment\)](#)

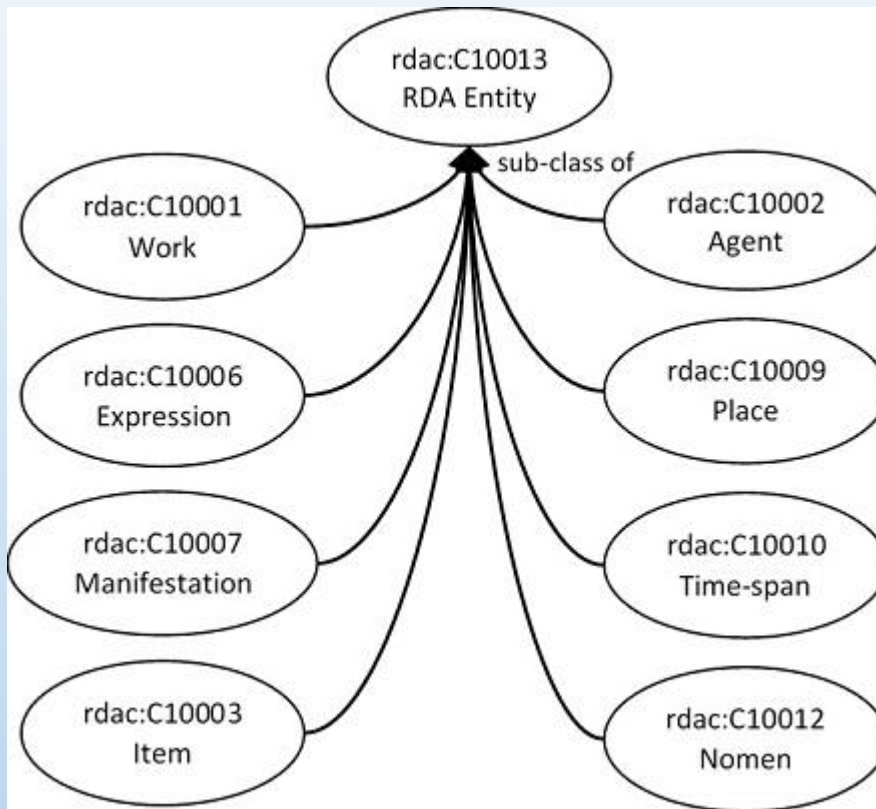
IFLA LRM entities

IFLA Library Reference (LRM) Model

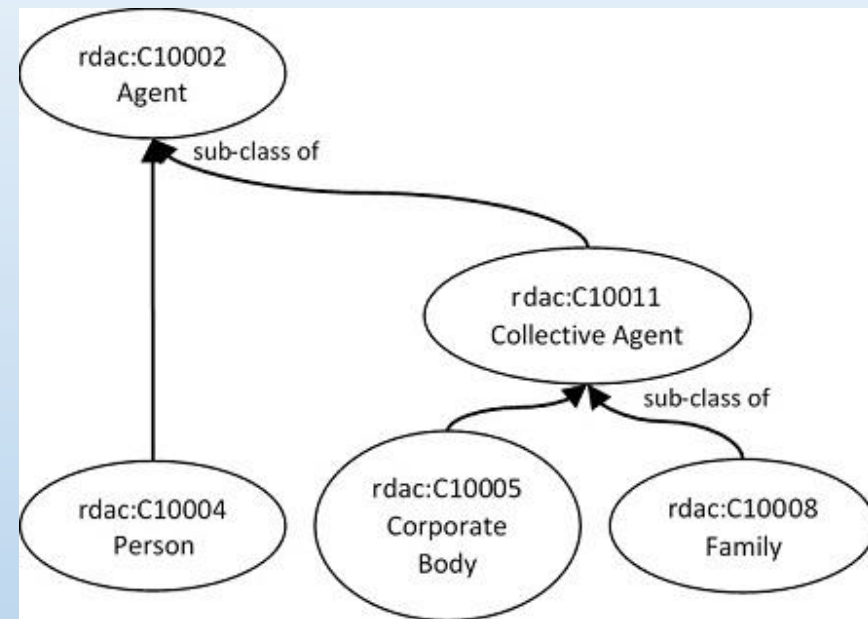


* This graph is from:
Dunsire, Gordon.
Telling tails:
metadata standards
and the digital
humanities.

RDF Graph for RDA Class Hierarchies



RDF graph of the class hierarchy of RDA Entity

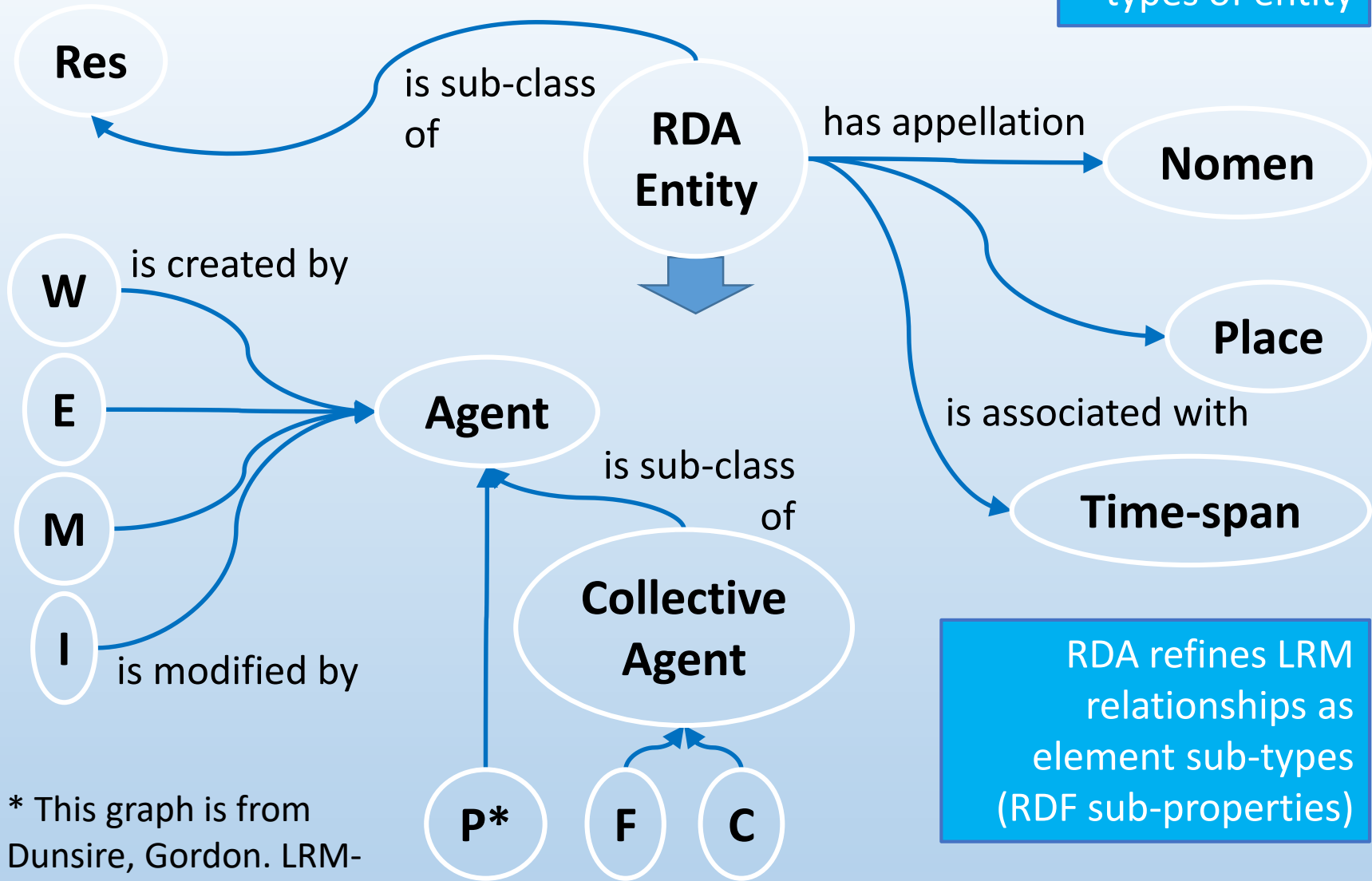


RDF graph of the class hierarchy of RDA Agent

Source: <http://www.rdaregistry.info/rgAbout/rdaont/ontHierarchies.html>

IFLA LRM and RDA entities

Any RDA Thing:
Covers all other
types of entity



RDA refines LRM
relationships as
element sub-types
(RDF sub-properties)

* This graph is from
Dunsire, Gordon. LRM-
RDA. 2017.

Linked Data Implementations An Instance (in Share VDE)

The screenshot shows the Share VDE website interface. At the top, there is a navigation bar with the Share logo (a yellow circle with 'SHARE' text) and a diagram showing 'Discovery' (green circle) connected to 'Virtual' (red circle) and 'Environment' (orange circle). The page title is 'Publications (Instances)'. Below the navigation bar is a search bar and a filter menu showing 'Advanced search', 'Everywhere', 'show 10 results per page ordered by Score'. The main content area displays the book 'Pride and prejudice / Jane Austen'. On the left is a red book cover with the title and author 'Austen, Jane, 1775-1817, author'. Below the cover are several small icons representing different digital formats. The main content area is titled 'Resources' and contains a list of metadata fields and values. A yellow callout box on the right side of the page contains the text 'SHARE Virtual Discovery Environment (VDE)'. Another yellow callout box at the bottom left contains the text 'Book (Instance) in Share VDE' and a URL.

Book (Instance) in Share VDE
<http://share-vde.org/sharevde/resource?uri=LOC18799564&v=l&dcnr=5>

SHARE Virtual Discovery Environment (VDE)

Pride and prejudice / Jane Austen

Resources

(View Marc21 format) (View BIBFRAME 2.0 dataset)

Creator: Austen, Jane, 1775-1817, author

Title: Pride and prejudice / Jane Austen

Link to work: Pride and prejudice

Publication: New York, NY : Barnes & Noble, Inc., [2015]

Extent: 361 pages ; 22 cm

Media type: unmediated

Content type: text

Carrier type: volume

Dewey: 823/.7

Topical term: Sisters -- England -- Fiction
Young women -- England -- Fiction
Courtship -- Fiction
Social classes -- England -- Fiction

Geographic Subject: England -- Social life and customs -- 19th century -- F

Index term-Genre/form: Domestic fiction
Love stories

LOC Call Number: PR4034 .P7 2015

ISBN: 9781435159631 (hbk.)

Format: Language material

Bibliographic level: Monograph

Language: English

Record Nr.: 18799564

You will find it: Library of Congress
Item: [Permalink to OPAC](#)

Creator: Austen, Jane, 1775-1817, author

Title: Pride and prejudice / Jane Austen

Link to work: Pride and prejudice

Publication: New York, NY : Barnes & Noble, Inc., [2015]

Extent: 361 pages ; 22 cm

Media type: unmediated

Content type: text

Carrier type: volume

Person (Entity)

www.share-vde.org/sharevde/searchNames?n_cluster_id=2568128

Italiano Info Contacts

SHARE Virtual Environment Person/Work Go to Publications

Person Work Publishers Subject

Search Person/Family/Corporate body

EXPAND ALL CLOSE ALL

Jane Austen (Entity) in Share VDE

http://www.share-vde.org/sharevde/searchNames?n_cluster_id=2568128

- ISNI
- Wikidata
- LC Name Authority File
- WorldCat Identities
- Data.bnf.fr
- VIAF

This person in

- isni
- WIKIDATA
- LIBRARY OF CONGRESS
- WorldCat Identities
- data.bnf.fr
- VI AF

Other name forms

- Austen, Jane, 1775-1817
- Остин, Д. 1775-1817 Джейн
- 1775-1817, ڄاڻ, ڊاڪٽر
- 1817-1775, اوسٽن, جين
- Austen, Jane
- Austen, Jane (English writer, 1775-1817)
- ...(other forms)

Wikipedia

ography

ick title to search on Google)
Aşk mi ve gurur mu
Cambridge edition of the works of Jane
iten. 2005
Correspondence
Emma
... (other titles)

Works

- Complete illustrated novels of Jane Austen
- Persuasion
- Correspondence
- Pride & prejudice

Work (Entity)

share-vde.org/sharevde/searchTitles?t_cluster_id=1092450

Browse Italiano Info Contacts

SHARE Virtual Environment Person/Work Go to Publications


Person Work Publishers Subject

Search Work/Publications

EXPAND ALL CLOSE ALL

Publications

Pride and prejudice



Pride and prejudice
ID: 1092450

Creators:

Subject

- Domestic fiction
- Social classes -- Fiction
- Courtship -- Fiction
- Young women -- Fiction
- Sisters -- England -- Fiction
- Love stories
- England -- Fiction
- England -- Social life and customs -- 19th century -- Fiction
- Young women -- England -- Fiction
- Sisters -- Fiction
- Social classes -- England -- Fiction

All x +

- Select all
- Pride and prejudice / Jane Austen
Austen, Jane, 1775-1817, author
New York, NY : Barnes & Noble, Inc., [2015]
Language material
You will find it: Library of Congress
- Pride and prejudice / illustrated by Ian Beck
Austen, Jane, 1775-1817
London : Century Hutchinson, 1985
Language material
You will find it: Library of Congress

(2568128) Austen, Jane, 1775-1817

Linked Data Design Principles & Five Star-schema of Linked Open Data

- **The Four Design Principles of Linked Data** (Tim Berners-Lee. 2006)
 - Use Uniform Resource Identifiers (**URIs**) as names for things.
 - Use **HTTP URIs** so people can look up those names.
 - When someone looks up a URI, **provide** useful **information** using the standards (**RDF**, **SPARQL**).
 - Include **links to other URIs** so that they can discover more things.
 - Source: <https://www.w3.org/DesignIssues/LinkedData.html>
- URIs for naming things, RDF for describing things, SPARQL for querying data; link to other URIs to find more things.
- **Five star-schema of Linked Open Data** (Tim Berners-Lee)



Linked Data Building Blocks

- **The LOD Data Model:** RDF triples
- **Content Rules:** relies on external vocabularies and ontologies
- **Metadata schema**
 - RDF Schema
 - Vocabulary Building Blocks: SKOS, OWL
 - Open Archives Initiative Object Reuse and Exchange (OAI-ORE)
- **Serializations of LOD**
 - RDF Notation-3/N3, Turtle, N-Triples, JSON-LD, RDFa
- **Exchanging LOD**
 - SPARQL
- Mitchell, Erik T. Building Blocks of Linked Open Data in Libraries. *Library Technology Reports* (vol. 49, no. 5)

Linked Data Building Blocks

- **Take DBpedia as an example:**
 - **The LOD Data Model:** RDF triples
 - **Content Rules**
 - DBpediaOntology Classes (<http://mappings.DBpedia.org/server/ontology/classes/>)
 - **Metadata schema**
 - RDF Schema, XML Schema
 - Vocabulary Building Blocks: FOAF, DC, OWL, SKOS
 - **Serializations of LOD**
 - Turtle, N-Triples, Trix, RDF/JSON
 - **Exchanging LOD**
 - SPARQL
- **A Dbpeida page:** (rdf)About: (Person) Jane Austen (http://DBpedia.org/page/Jane_Austen)
 - [dbo:abstract](#), [dbo:birthDate](#) ([dbr:Hampshire](#)), [dbo:deathDate](#)...
 - [dct:subject](#) (e.g., [dbc:English_women_novelists](#))
 - [rdf:type](#) (e.g., [owl:Thing](#), [foaf:Person](#), [dbo:Agent](#), [dbo:Writer](#))
 - [rdfs:comment](#)
 - [owl:sameAs](#) [wikidata:Jane_Austen](#)
<http://viaf.org/viaf/102333412>
 - [foaf:gender](#) (female (en))
 - is [dbo:author](#) of (e.g., [dbr:Emma_novel](#))
 - is [dbo:influenced](#) of (e.g., [dbr:George_Crabbe](#))

Vocabularies
from:
DBpedia,
dcterms,
rdf,
owl,
foaf...

Linked Data: SPARQL

- **SPARQL Explorer** (<http://DBpedia.org/snorql/>)
- A very simple example: People who were born in Hampshire before 1900

PREFIX owl: <<http://www.w3.org/2002/07/owl#>>

PREFIX xsd: <<http://www.w3.org/2001/XMLSchema#>>

PREFIX rdfs: <<http://www.w3.org/2000/01/rdf-schema#>>

PREFIX rdf: <<http://www.w3.org/1999/02/22-rdf-syntax-ns#>>

PREFIX foaf: <<http://xmlns.com/foaf/0.1/>>

PREFIX dc: <<http://purl.org/dc/elements/1.1/>>

PREFIX: <<http://DBpedia.org/resource/>>

 PREFIX DBpedia2: <<http://DBpedia.org/property/>>

PREFIX DBpedia: <<http://DBpedia.org/>>

PREFIX skos: <<http://www.w3.org/2004/02/skos/core#>>

```
SELECT ?name ?birth ?death ?description
?person
WHERE { ?person dbo:birthPlace :Hampshire .
        ?person dbo:birthDate ?birth .
        ?person foaf:name ?name .
        ?person dbo:deathDate ?death .
        ?person rdfs:comment ?description .
        FILTER (?birth < "1900-01-01"^^xsd:date) . }
ORDER BY ?name
```

- Returned results, e.g.,

name	birth	death	description	Person
"Adolphus James Sparrow"@en	"1869-05-10"^^xsd:date	"1936-09-06"^^xsd:date	"Adolphus James Sparrow (10 May 1869 – 6 September 1936) was an English cricketer who represented Hampshire in one first-class match in 1904 against Leicestershire. In his only first-class innings Sparrow made 1 run before being dismissed by John King."@en	:Adolphus Sparrow
...				
"Jane Austen"@en	"1775-12-16"^^xsd:date	"1817-07-18"^^xsd:date	"Jane Austen (/ˈdʒeɪn ˈɒstɪn/; 16 December 1775 – 18 July 1817) was an English novelist known primarily for her six major novels which interpret, critique and comment upon the British landed gentry at the end of the 18th century..."@en	:Jane Austen

Linked Data Creation

- **Providing Linked Data: creating, interlinking, publishing**
- **Creating Linked Data**
 - **Extract data from spreadsheet, databases, text;**
 - **Tools:** [OpenRefine](#), [W3C R2RML](#), [DBpediaSpotlight](#)
 - **Using URIs to name entities;**
 - **Selecting vocabularies**
 - **Linked Open Vocabularies (LOV)**
(<https://lov.linkeddata.es/dataset/lov/>)...
 - **Expressing data using RDF data model;**
- **Interlinking Linked Data**
 - **Links at instance level** (rdfs:seeAlso, owl:sameAs) **or schema level** (SKOS:closeMatch, exactMatch, relatedMatch...)
 - **Tool: Linked Data Integration Framework - [Silk](#)**

Linked Data Creation

A Test: Annotate using [DBpediaSpotlight](#)

Log 0:28 Birthplace; 0:43 Parents; 1:14 Siblings; 1:31 Childhood; 2:52 Education; 3:52 Family Service; 4:18 Enlistment, Pearl Harbor; 5:12 ROTC, Army Reserves; 6:33 Family Reaction; 6:52 Examinations; 7:37 Marine Corps Commission; 8:13 Second Lieutenant Boot Camp; 9:06 Drill Instructors; 9:55 Date of Commission; 11:38 Advanced Training, Classified Radar Course; 15:19 Cherry Point, Miramar; 15:51 Convoy Transport to South Pacific, Guam; 18:28 Okinawa, Ulithi; 21:27 Atomic Bombs; 22:11 Unusual Days; 22:34 Friendship, Ulithi Air Crew, Kamikaze Attacks; 25:53 Mail Correspondence; 26:21 Guam Experiences; 28:31 Liberty; 28:48 Going Home, Flight Training, Company Commander; 32:02 Marine Corps Retirement...

Place of Birth Dadeville (Ala.)

Home State Alabama

War or Conflict World War II

Location of Service Guam; Palau; China; Okinawa Island (Japan); Korea; Quantico (Va.); Camp Pendleton (Calif.); Monterey (Calif.)

Highest Rank Lieutenant Colonel; LtCol

Note Went to Naval Post Graduate School and Headquarters Marine Corps.

City of Birth Dadeville

Country of Birth United States

Location of Interview Winter Park, Florida

Log 0:28 Birthplace; 0:43 Parents; 1:14 Siblings; 1:31 Childhood; 2:52 Education; 3:52 Family Service; 4:18 Enlistment, [Pearl Harbor](#); 5:12 ROTC, [Army](#) Reserves; 6:33 Family Reaction; 6:52 Examinations; 7:37 [Marine Corps](#) Commission; 8:13 [Second Lieutenant](#) Boot Camp; 9:06 Drill Instructors; 9:55 Date of Commission; 11:38 Advanced Training, Classified Radar Course; 15:19 Cherry Point, [Miramar](#); 15:51 Convoy Transport to [South Pacific](#), [Guam](#); 18:28 [Okinawa](#), [Ulithi](#); 21:27 Atomic Bombs; 22:11 Unusual Days; 22:34 Friendship, [Ulithi Air Crew](#), [Kamikaze](#) Attacks; 25:53 Mail Correspondence; 26:21 [Guam](#) Experiences; 28:31 [Liberty](#); 28:48 Going Home, Flight Training, Company Commander; 32:02 [Marine Corps](#) Retirement...

Place of Birth [Dadeville](#) (Ala.)

Home State [Alabama](#)

War or Conflict [World War II](#)

Location of Service [Guam](#); [Palau](#); [China](#); [Okinawa Island](#) ([Japan](#)); [Korea](#); [Quantico](#) (Va.); [Camp Pendleton](#) (Calif.); [Monterey](#) (Calif.)

Highest Rank [Lieutenant Colonel](#); LtCol

Note Went to Naval Post Graduate School and [Headquarters Marine Corps](#).

City of Birth [Dadeville](#)

Country of Birth [United States](#)

Location of Interview [Winter Park, Florida](#)

*Need review. Can use other LOD vocabularies.

Works with **Name-Entity Extraction** in OpenRefine.

Linked Data Creation

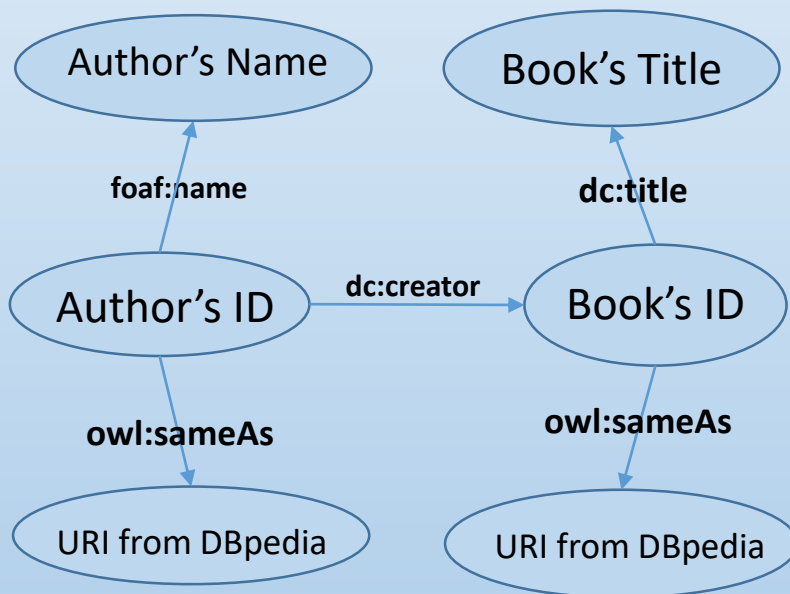
A Test: Create RDF from Spreadsheet with OpenRefine

id	author
1	Jane Austen
2	Ernest Hemingway

authorid	bookid
1	1
1	2
1	3
2	4
2	5

id2	title
1	Northanger_Abbey
2	Sense_and_Sensibility
3	Mansfield_Park
4	The_Old_Man_and_the_Sea
5	For_Whom_the_Bell_Tolls

OpenRefine RDF Extension:
 Edit RDF Skeleton.
Export: RDF as Turtle.



```

@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix dc: <http://purl.org/dc/elements/1.1/> .
  
```

```

<http://example.org/author/1> a foaf:Person ;
foaf:name "Jane Austen" ;
owl:sameAs <http://dbpedia.org/page/Jane_Austen> .
  
```

```

<http://example.org/book/1> a <http://example.org/Book> ;
dc:title "Northanger_Abbey" ;
owl:sameAs
<http://dbpedia.org/resource/Northanger_Abbey> .
  
```

```

<http://example.org/author/1> dc:creator
<http://example.org/book/1> .
  
```

```

...
<http://example.org/author/2> a foaf:Person ;
foaf:name "Ernest Hemingway" ;
owl:sameAs
<http://dbpedia.org/page/Ernest_Hemingway> .
  
```

```

...
<http://example.org/book/4> a <http://example.org/Book> ;
dc:title "The_Old_Man_and_the_Sea" ;
owl:sameAs
<http://dbpedia.org/resource/The_Old_Man_and_the_Sea
  
```


Linked Data Publishing

- **Publishing Linked Data**
 - **Dataset metadata creation;**
 - Describing LD with VoID Vocabulary <https://www.w3.org/TR/void/>
 - **Publish dataset via RDFa, SPARQL endpoints;**
 - Dereferencing HTTP URIs (e.g., DBpedia)
 - **RDFa:** embed RDF within HTML (e.g., <div class="artistheader" about=RDF link...>...</div>;
 - **SPARQL endpoints** (e.g., <https://www.w3.org/wiki/SparqlEndpoints>)...
 - **Upload the dataset to a Linked Data catalog or repository;**
 - The Linked Open Data Cloud <http://lod-cloud.net/>
 - Data Hub <https://datahub.io/search>
 - CKAN (open source) <https://ckan.org/>
 - **Validate datasets**
 - [Vapour, a Linked Data validator](#)
- **Source:** EUCLID. Chapter 3: Providing Linked Data. <http://euclid-project.eu/modules/chapter3.html>

Current Digital Repositories and Linked Data

- **CONTENTdm**
- **Not inside the system, but work on exported data;**
- **UIUC.** Challenges of Mapping Digital Collections Metadata to Schema.org (Lampron et. al. 2016)
- **OCLC& CONTENTdm** Metadata Refinery, transforms CONTENTdm metadata to Linked Data, 2016. Not yet scalable. (Washburn et al. 2016)

Linked Open Data Website

Home Browse All

Home » Motley Collection of Theatre and Costume Design [New] » Hamlet » Caesar

External Resources

- Julius Caesar (play)

The Tragedy of Julius Caesar is a tragedy by William Shakespeare, believed to have been written in 1599. It is one of several plays written by Shakespeare based on true events from Roman history, which also include Coriolanus and Antony and Cleopatra. [more from Wikipedia]
DBPedia
Theatricalia
Theatricalia
- William Shakespeare (Author)
 - Gender: male
 - William Shakespeare (/ˈʃelkspr/; 26 April 1564 (baptised) – 23 April 1616) was an English poet, playwright, and actor, widely regarded as the greatest writer in the English language and the world's pre-eminent dramatist. He is often called England's [more from Wikipedia]
DBPedia
VIAF Record
SNF Record
DNB Record
- Glen Byam Shaw (Director)
 - Gender: male
 - Glencairn Alexander "Glen" Byam Shaw, CBE (13 December 1904 – 29 April 1986) was an English actor and theatre director, known for his dramatic productions in the 1950s and his operatic productions in the 1960s and later. [more from Wikipedia]
DBPedia
VIAF Record
DNB Record
Theatricalia
- Luckham, Cyril (Actor)

Cyril Alexander Garland Luckham (25 July 1907 – 8 February 1989) was a British film, television and theatre actor. [more from Wikipedia]
DBPedia

Caesar



External Resources

- Julius Caesar (play)
- Glen Byam Shaw (Director)
 - Gender: male
 - Glencairn Alexander "Glen" Byam Shaw, CBE (13 December 1904 – 29 April 1986) was an English actor and theatre director, known for his dramatic productions in the 1950s and his operatic productions in the 1960s and later. [more from Wikipedia]
DBPedia
VIAF Record
DNB Record
Theatricalia

Description

Image Title	Ci
Performance Title	Ju
Theater	Ri
Author	Sj
Associated People (Director)	Sj

A UIUC Experiment <http://imagesearch-test1.library.illinois.edu/cdm/ref/collection/motley-new/id/599>
Project Site <http://publish.illinois.edu/linkedsppollections/>

Current Digital Repositories and Linked Data

- **Samvera** (previously “Hydra”)
 - LDP platform, publication of RDF data;
 - Extensions: GeoMash, ORCID integration
 - Case: [Oregon Digital](#)
 - Migrated from CONTENTdm to Hydra;
 - Created [opaquenamespace](#) (to accommodate terms without existing LOD links)
- **Islandora**
 - Effort in mapping MODS to RDF;
 - Fedora 4, LDP implementation; Islandora CLAW
 - Experiments and Cases:
 - [Islandora CLAW](#)
 - [TU Delft repository example: Colonial Architecture](#) (Delftdora module, Fedora 3)
 - [A Lightweight Structured Data Implementation Using JSON-LD and Schema.org for Digital Repository](#) (Mak et al.)

Current Digital Repositories and Linked Data

- **DSpace**

- **DSpace Linked Data support** spans all three Layers: “the storage layer with a **triple store**, the business logic with classes to **convert** stored contents into RDF, and the application layer with a module to **publish** RDF serializations.”

- Donohue. Linked (Open) Data.

- <https://wiki.duraspace.org/display/DSDOC6x/Linked+%28Open%29+Data>

- Becker, Pascal-Nicolas. [Illuminating DSpace's Linked Data Support](#)

Current Digital Repositories and Linked Data

- **Omeka**

- Open source web publishing platform. Supports Dublin Core. Can export METS, dc-rdf, JSON etc.
- [Ozmeka \(plug-ins\)/ Omeka linked data](#)

- **Item Relations (Plug-in)**

- It defines item-item relationship using several vocabularies (e.g., [Dublin Core](#), [FRBR](#), [FOAF](#), and [BIBO](#)). For example,

Title: Linked data in the library

Is Part Of: CALA Southeast Chapter 2017 Spring Program "Sharing Your Professional Expertise and Your Library's Collections"

Item Relations

This Item **frbr:partOf** Item: [CALA Southeast Chapter 2017 Spring Program](#)

This Item **dcterms:isPartOf** Item: [CALA Southeast Chapter 2017 Spring Program](#)

Current Digital Repositories and Linked Data

- **Digital Commons**

- Allows adding extra fields for links (not RDF)

- **Preparing for Linked Data**

- Include links (e.g., id.loc.gov, viaf.org) in added additional fields for author, advisor, department names etc.;
- Data (in spreadsheet) cleanup and reconciliation using OpenRefine

Data Editing Tool: OpenRefine

- **OpenRefine**

- **Download and installation**

- <http://openrefine.org/download.html>

- **Documentation**

- <https://github.com/OpenRefine/OpenRefine/wiki/Documentation-For-Users>

- **Features**

- Import

- Facet

- Edit cells: Clustering...

- Edit columns: Add Column based on this column; Fetching URLs from Web Services (*Enrich existing data columns)...

- Expressions

- Export

- History...

- **Adding LOD Links to Fields in Digital Repositories**

- Authors/Creators

- Contributors, e.g., thesis advisors

- Corporate names, e.g., university, college and departmental names

- Subjects

- Person identifiers



Adding Linked Data Vocabularies to UCF Digital Repositories: Cases

- **Cases**

- **Adding LC and VIAF Links to Advisor Names**

- Faceting, clustering, LoC reconciliation, review; add column based on this column, VIAF reconciliation, review

- **Combining Multiple Links for Author Names**

- Expression: General Refine Expression Language (GREL)

- **Adding LC Subject Links to IR Records**

- Splitting, add column based on this column, expression

- **Adding FAST Headings by Fetching URLs**

- Add column by fetching URLs, expression, text transformation

- **For step by step instructions, please refer to**

[A Step Forward: Adding Linked Data Vocabularies to Digital Repositories](#)

Adding LC and VIAF Links to Advisor Names

968 rows

Show as: rows records Show: 5 10 25 50 rows Sort

All	identifier	advisor	advisor_lc
<input type="checkbox"/>	802.	DP0015862	Acierno, Louis J., 1920- Choose new match
<input type="checkbox"/>	890.	DP0017154	Acierno, Louis J., 1920- Choose new match

127.0.0.1:3333/project?project=2122028945939

LoC Reconciliation & Add LC Links

- Faceting, clustering;
- Click “Reconcile—Start reconciliation”;
- Add and choose Reconciliation Service;
- Reconciliation & review;
- **Add/Display LoC URLs:**
- Edit column—Add column based on this column
New column name: advisor_lc
Expression: cell.recon.match.id

advisors_RTDs.xlsx Permalink

Undo / Redo 5 968 rows Extensions: Named-entity re

Reset All Remove All Show as: rows records Show: 5 10 25 50 rows Sort

All identifier advisor

Reconcile column "advisor"

Services

- NamedEntity
- Wikidata Reconciliation for OpenRefine (en)
- VIAF
- LC (by way of VIAF)
- ORCID
- OpenLibrary
- LoC Reconciliation Service
- Virtual International Authority File
- Sindice
- LCSH
- VIAF - LC

Pick a Service or Ex

How to set up LoC Reconciliation Service

Click “Add Standard Service”;

Enter the service's URL:

<https://lc-reconcile.herokuapp.com/>

Add Service

Cancel

Add Standard Service...

Start Reconciling Cancel

Adding LC and VIAF Links to Advisor Names

VIAF Reconciliation

Show as: rows records Show: 5 10 25 50 rows Sort ▾ « first < previous 951 - 968 next > last »

All	identifier	advisor	advisor_c	advisor_lc
 	419. DP0013092	Yousef, Yousef A. <small>Choose new match</small>	Yousef, Yousef A. <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Yousef, Hoda A., 1979- Yūsuf, Hudā Ahmad, 1979-.... 1979 - يوسف، هدى أ. - Yūsuf, Hudā Ahmad (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Yousef, Tarek A. (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Alqudah, Mohammad Ali Yousef (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Yousef, Hassan A. (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Yousef, Ahmed Mohamed Fahmy (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Mousa, Wael A. Yousef (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Yousef, Eltohamy A. A. 1982- (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Yousef, Mohamed A. M. (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Yousef, Yousef A. (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Abu Hammad, Ahmad Hammad Yousef <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Hammad, Ahmad Hammad Yousef <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Abu (1) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Create new topic	<input type="button" value="edit"/> http://id.loc.gov/authorities/names/n8202792

VIAF-LC Reconciliation Service

<http://refine.codefork.com/reconcile/viaf/LC>

Virtual International Authority File service

http://iphylo.org/~rpage/phyloinformatics/services/reconciliation_viaf.php

Adding LC and VIAF Links to Advisor Names

Add VIAF Links

New column name:

advisor_viaf

Expression:

"https://viaf.org/viaf/" +
cell.recon.match.id

RTDs.xlsx Permalink

968 rows Extension

Remove All Show as: rows records Show: 5 10 25 50 rows Sort

change All identifier advisor advisor_c advisor_lc

419. DP0013092 Yousef, Yousef A. Yousef, Yousef A. http://id.loc.gov/au

Add column based on column advisor_c

New column name:

set to blank store error copy value from original column

Expression: Language: General Refine Expression Language (GREL) No syntax error.

Preview History Starred Help

row	value
419.	Yousef, Yousef A. https://viaf.org/viaf/272732530
429.	Yousef, Yousef A. https://viaf.org/viaf/272732530

968 rows Extensions: Named-entity recognition RDF

Show as: rows records Show: 5 10 25 50 rows Sort « first < previous 951 - 968 next > last »

identifier	advisor	advisor_c	advisor_viaf	advisor_lc
419. DP0013092	Yousef, Yousef A. <small>Choose new match</small>	Yousef, Yousef A. <small>Choose new match</small>	https://viaf.org/viaf/272732530	http://id.loc.gov/authorities/names/n82027924
429. DP0013117	Yousef, Yousef A. <small>Choose new match</small>	Yousef, Yousef A. <small>Choose new match</small>	https://viaf.org/viaf/272732530	http://id.loc.gov/authorities/names/n82027924
475. DP0013238	Yousef, Yousef A. <small>Choose new match</small>	Yousef, Yousef A. <small>Choose new match</small>	https://viaf.org/viaf/272732530	http://id.loc.gov/authorities/names/n82027924

OK

VIAF links
added

Adding LC and VIAF Links to Advisor Names

- Display in the IR

STARS Citation

Wanielista, Joseph R., "Removal of Color From Surface Water in Central Florida
Retrospective Theses and Dissertations. 80.

<http://stars.library.ucf.edu/rtd/80>

Contributor (Linked data)

[Yousef, Yousef A.](#) [VIAF]

[Yousef, Yousef A.](#) [LC]

[University of Central Florida. College of Engineering](#) [VIAF]

[University of Central Florida. College of Engineering](#) [LC]

Collection (Linked data)

[Retrospective Theses and Dissertations](#)

LOD links
added for:
Advisor name
College name

[Home](#) | [About](#) | [FAQ](#) | [My Account](#)
[Privacy](#) [Copyright](#)

<http://stars.library.ucf.edu/rtd/80/>

*Adding LOD links for the
advisor names is a work in
progress.

STARS Citation

Dory, Ivan Ray, "Solid Waste Resource Recovery Plan for Dekalb County Georgia" (1976).
Retrospective Theses and Dissertations. 211.

<http://stars.library.ucf.edu/rtd/211>

Contributor (Linked data)

[Yousef, Yousef A.](#)

[University of Central Florida. College of Engineering](#)

Collection (Linked data)

[Retrospective Theses and Dissertations](#)

<http://stars.library.ucf.edu/rtd/211/>

*Add both links or
only one type of
link for advisors
(e.g., VIAF, or LC)

Combining Multiple Links for Author Names

- **Using Expression to Format Multiple Links**

- Expression Language: **General Refine Expression Language (GREL)**
- First, run reconciliations and get VIAF and LC links;
- Then add columns, e.g.,
 - Edit column – Add column based on this column
 - **New Column name** author1_viafurl
 - **Expression** "http://viaf.org/viaf/"+ cell.recon.match.id
 - Edit column – Add column based on this column
 - **New column name** author1_lcurl
 - **Expression** cell.recon.match.id

Refine UCFForum_batch2.xlsx Permalink

Open... Export Help

Extensions: RDF

Facet / Filter Undo / Redo 42

102 rows

Show as: rows records Show: 5 10 25 50 rows

« first < previous 41 - 50 next > last »

	All	title	author1	author1_copy	author1_lcurl	author1_viafurl	contribu
☆	41.	Where Are Your Papers?	McCloud, Rebekah Choose new match	McCloud, Rebekah Choose new match	http://id.loc.gov/authorities/names/n2008001755	http://viaf.org/viaf/70855412	

Combining Multiple Links for Author Names

- Using Expression to Format Multiple Links

- Add column based on this column

- New column name author1_viafurl_lcurl

- Expression

```
cells["author1_viafurl"].value + " " + cells["author1"].value +  
"[VIAF] " + cells["author1_lcurl"].value + " " +  
cells["author1_copy"].value + "[LC]"
```

rows				« first < previous 41 - 50 next > last »			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
author1_lcurl	author1_viafurl	author1_viafurl_lcurl					
http://id.loc.gov/authorities/names/n2008001755	http://viaf.org/viaf/70855412	http://viaf.org/viaf/70855412 McCloud, Rebekah [VIAF] http://id.loc.gov/authorities/names/n2008001755 McCloud, Rebekah [LC]					

Adding LC Subject Links to IR Records

<SX Permalink

Open... Export ▾ Help

102 rows

Show as: rows records Show: 5 10 25 50 rows

document_type	publication_date	season	keywords 1	keywords 2	keywords 3	keywords 4
opinion_column	2016-11-02T00:00:00Z		Election	Game day	Football	Voting

▼ subjects_linked

<http://id.loc.gov/authorities/childrensSubjects/sj96004925> | Blacks
<http://id.loc.gov/authorities/subjects/sh85001932> | African Americans
<http://id.loc.gov/authorities/childrensSubjects/sj96006075> | Safety
<http://id.loc.gov/authorities/demographicTerms/dg2015060072> | Police
<http://id.loc.gov/authorities/subjects/sh85105939> | Poverty
<http://id.loc.gov/authorities/subjects/sh85110266> | Racism

Main Steps:

- Splitting keywords into columns;
- **Edit column** – Add column based on this column:

New column name

keyword1_url

Expression

```
cell.recon.match.id + " | " +  
cell.recon.match.name
```

...

- **Put all subjects & links together in a column:**

New column name

subjects_linked

Expression

```
if(isBlank(cells["keyword1_url"].value),  
" ", cells["keyword1_url"].value) + " " +
```

...

```
if(isBlank(cells["keyword6_url"].value),  
" ", cells["keyword6_url"].value)...
```

Adding LOD Links to IR Records

Violence is Not a Virus, but it is Transmitted

Roberto Hugh Potter *University of Central Florida*

Description

The University of Central Florida (UCF) Forum is a weekly series of opinion columns presented by the UCF News & Information. The columns are the opinions of the writers, who serve on the UCF Forum panel of faculty members, staffers and students for a year. A new column is posted each Wednesday at UCF Today and then broadcast between 7:50 and 8 a.m. Sunday on WUCF-FM (89.9).

Publication Date

9-5-2012

Keywords

Violence; Mass shooting; Firearms; Gun violence; Assailant; Firearm; Criminal behavior; Criminal violence; Campus violence

Introduction

Recent mass shootings have again brought out the "violence is a disease" crowd. The thinking is that if we reduce the availability of firearms, we will decrease violence.

Subjects

Violence; Mass shootings; Firearms; Criminal behavior

Creator (Linked Data)

Potter, Roberto Hugh(VIAF); Potter, Roberto Hugh(LC)

Collection

UCF Forum

Publisher

University of Central Florida

Source

https://today.ucf.edu/violence-is-not-a-virus-but-it-is-transmitted/ (UCF Today: UCF Forum)

Type

article

STARS Citation

Potter, Roberto (2012). Violence is not a virus, but it is transmitted. UCF Today, 2012-09-05. Retrieved from https://today.ucf.edu/violence-is-not-a-virus-but-it-is-transmitted/

UCF Forum note

Information presented on this website is considered public information (unless otherwise noted) and may be distributed or copied. Use of appropriate byline/photo/image credit is

 Download

 INCLUDED IN

Communication Commons,
Criminology Commons

SHARE



An Example in the IR
<http://stars.library.ucf.edu/ucf-forum/186/>

Subjects

Violence; Mass shootings; Firearms; Criminal behavior

Creator (Linked Data)

Potter, Roberto Hugh(VIAF); Potter, Roberto Hugh(LC)

Collection

UCF Forum

Adding FAST by Fetching URLs

45 rows Extensions

Show as: rows records Show: 5 10 25 50 rows

▼ All		▼ Topical Subject	fast_url
☆	1.	African Americans <small>Choose new match</small>	http://experimental.worldcat.org/fast/799558
☆	2.	Collectibles <small>Choose new match</small>	http://experimental.worldcat.org/fast/867139
☆	3.	Blacks <small>Choose new match</small>	http://experimental.worldcat.org/fast/833880
☆	4.	United States <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> United States Courthouse (Austin, Tex.) (54) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> United States Capitol (Washington, D.C.) (53) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> United States Courthouse (Orlando, Fla.) (53) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Create new topic	<div style="border: 1px solid #ccc; padding: 5px;"> <p>▼ Topical Subject</p> <p>▼ fast_url</p> <p>1. African Americans <small>Choose new match</small> http://experimental.worldcat.org/fast/799558</p> <p>2. Collectibles <small>Choose new match</small> http://experimental.worldcat.org/fast/867139</p> <p>3. Blacks <small>Choose new match</small> http://experimental.worldcat.org/fast/833880</p> </div>
☆	5.	History <small>Choose new match</small>	http://experimental.worldcat.org/fast/958235
☆	6.	Civil War, 1861-1865 <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Create new topic	<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:coord="http://whatever/java/ORG.oclc.util.CoordToDecimal" xmlns:naco="http://whatever/java/ORG.oclc.util.NacoNormalize" xmlns:norm="http://whatever/java/ORG.oclc.util.NormalFormC" xmlns:schema="http://schema.org/" xmlns:madsrdf="http://www.loc.gov/mads/rdf/" xmlns:skosxl="http://www.w3.org/2008/05/skos-xl#" xmlns:dct="http://purl.org/dc/terms/" xmlns:foaf="http://xmlns.com/foaf/0.1/" xmlns:void="http://rdfs.org/ns/void#" xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:mx="http://www.loc.gov/MARC21/slim" xmlns:skos="http://www.w3.org/2004/02/skos/core#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#" xml:base="http://id.worldcat.org/fast/"><void:Dataset rdf:about="http://id.worldcat.org/fast/void/0.1"><dct:title>FAST (Faceted Application Subject Terminology) Data</dct:title><dct:license><rdf:Description rdf:about="http://www.oclc.org/research/activities/fast/odcby.html"><dct:title>Open Data Commons Attribution License (ODC-By) v1.0</dct:title><rdfs:comment>This OCLC's "local copy" of the ODC-By license</rdfs:comment><rdfs:seeAlso rdf:resource="http://opendatacommons.org/licenses/by/#toc-anchor-337-3"/><owl:sameAs rdf:resource="http://opendatacommons.org/licenses/by/1-0/"></rdf:Description></dct:license></void:Dataset></rdf:RDF>
☆	7.	African Americans in art <small>Choose new match</small>	http://experimental.worldcat.org/fast/799722
☆	8.	African American children <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Create new topic	http://experimental.worldcat.org/fast/799071
☆	9.	Children, Black, in art <small>Choose new match</small>	http://experimental.worldcat.org/fast/856910
☆	10.	Racism in art	http://experimental.worldcat.org/fast/1086652

FAST links added

Edit column—add column by fetching URLs (under “Topical_Subject”):

New column name
fast_url

Expression

"http://experimental.worldcat.org/fast/search?query=oclc.heading+exact+%22"+value.replace(/(\s)/, '%20')+"%22&httpAccept=application/rdf%2bxml"

Text transformation (extract FAST ID):

Expression

"http://experimental.worldcat.org/fast/"+value.parseHtml().select('dct|identifier')[0].htmlText()

Other Possibilities for Adding LOD Links to Digital Repositories and OpenRefine

- **Augment Data with Reconciliation Services**
 - Reconcile genre values to AAT terms
 - Reconcile places to GeoNames
 - Reconcile ORCID...
- **Add Columns by Fetching URLs**
 - [Geocode your data using a service like Google map](#)
 - [Gathering IR seed data with OpenRefine and SHERPA/RoMEO](#)
- **Reconcile Against Local Vocabularies**
 - **reconciliation-csv**
 - <http://okfnlabs.org/reconcile-csv/>
 - Possibilities: Reconcile various fields in OpenRefine against local controlled term lists, e.g., medals, ranks for Veterans Oral History
- **Next Steps**
 - Keep adding more LOD links to personal names, subjects and college/department names to digital collections;
 - Continue to explore OpenRefine and related services to enrich metadata and improve workflow;
 - Promote, explore and link authors/researchers to personal identifiers.

Reflections

- **Possible Ways to Get Involved with Linked Data**
 - **Be aware of what's going on, such as major LOD projects in the library community and the web;**
 - **Attend webinars and trainings to learn;**
 - **Be an advocate of open data;**
 - **Help faculty members and graduate students to understand linked data (such as linked data in general and in their disciplines), use open data and linked open data to support research;**
 - **Promote linked data and identity management (e.g., ORCID), make researchers aware of their presence in established linked data set (e.g., VIAF, LC LOD);**
 - **Collaborate and contribute to linked data projects when possible, e.g.,**
 - **Add LOD links to enrich record information and improve workflow using tools (e.g., OpenRefine);**
 - **Enrich project content by auto-annotating using tools (e.g., DBpediaSpotlight);**
 - **Support in applying and designing LOD thesauri and dataset;**
 - **Watch for LOD developments in state and national level initiatives;**
 - **Facilitate research in using linked open data...**

Resources

- Becker, Pascal-Nicolas. [Illuminating DSpace's Linked Data Support](#)
- Berners-Lee, Tim. Linked Data <https://www.w3.org/DesignIssues/LinkedData.html>
- BIBFRAME <http://BIBFRAME.org/>
- Creative Commons Rights Expression Language (CC REL) https://wiki.creativecommons.org/wiki/CC_REL
- Data Linkage Infrastructure - Census Bureau <https://www.census.gov/about/adrm/linkage/about.html>
- DATA.GOV <https://www.data.gov/>
- DBpedia <http://wiki.DBpedia.org/>
- DBpediaOntology Classes <http://mappings.DBpedia.org/server/ontology/classes/>
- DBpedia page: Jane Austen http://DBpedia.org/page/Jane_Austen
- Deng, Sai. A Step Forward: Adding Linked Data Vocabularies to Digital Repositories. <http://stars.library.ucf.edu/cgi/viewcontent.cgi?article=1652&context=ucfscholar>
- DPLA <http://dp.la>
- EUCLID. Chapter 3: Providing Linked Data. <http://euclid-project.eu/modules/chapter3.html>
- Europeana <http://europeana.eu>
- Facebook's Open Graph <https://developers.facebook.com/docs/sharing/opengraph/>
- FAST: Faceted Application of Subject Terminology. <http://id.worldcat.org/fast>
- FAST Linked Data API. <https://www.oclc.org/developer/develop/web-services/fast-api/linked-data.en.html>
- Free Your Metadata. Linked Data. <http://freeyourmetadata.org/>
- Friend-of-a-Friend <http://www.foaf-project.org/>
- GeoNames <http://www.geonames.org/ontology/documentation.html>
- Google Knowledge Graph https://en.wikipedia.org/wiki/Knowledge_Graph
- IFLA Library Reference (LRM) Model <https://www.ifla.org/publications/node/11412>
- International Standard Name Identifier (ISNI) <http://www.isni.org/>
- LC Linked Data Service: Authorities and Vocabularies <https://id.loc.gov/>
- Library.Link Network <http://library.link/>
- Library Linked Data Incubator Group: Datasets, Value Vocabularies, and Metadata Element Sets. <https://www.w3.org/2005/Incubator/ld/XGR-ld-vocabdataset-20111025/>
- LinkedGeoData <http://linkedgeo.org/>
- Mak, Lucas et al. [A Lightweight Structured Data Implementation Using JSON-LD and Schema.org for Digital Repository.](#)
- Metadata Authority Description Schema in RDF. <http://www.loc.gov/standards/mads/rdf/>
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Resources

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Thank you!

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