

# FOUNDATIONS IN LINKED DATA FOR SERIALISTS

**June 8, 2017**  
**NASIG**

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# AGENDA AND LEARNING OUTCOMES

- Linked Data 101 (Robert)
- Ontology Basics (Amber)
- Turtle Tutorial (Amber)
- Serials RDA Elements in BIBFRAME (Robert)
- Hands-on lab time!

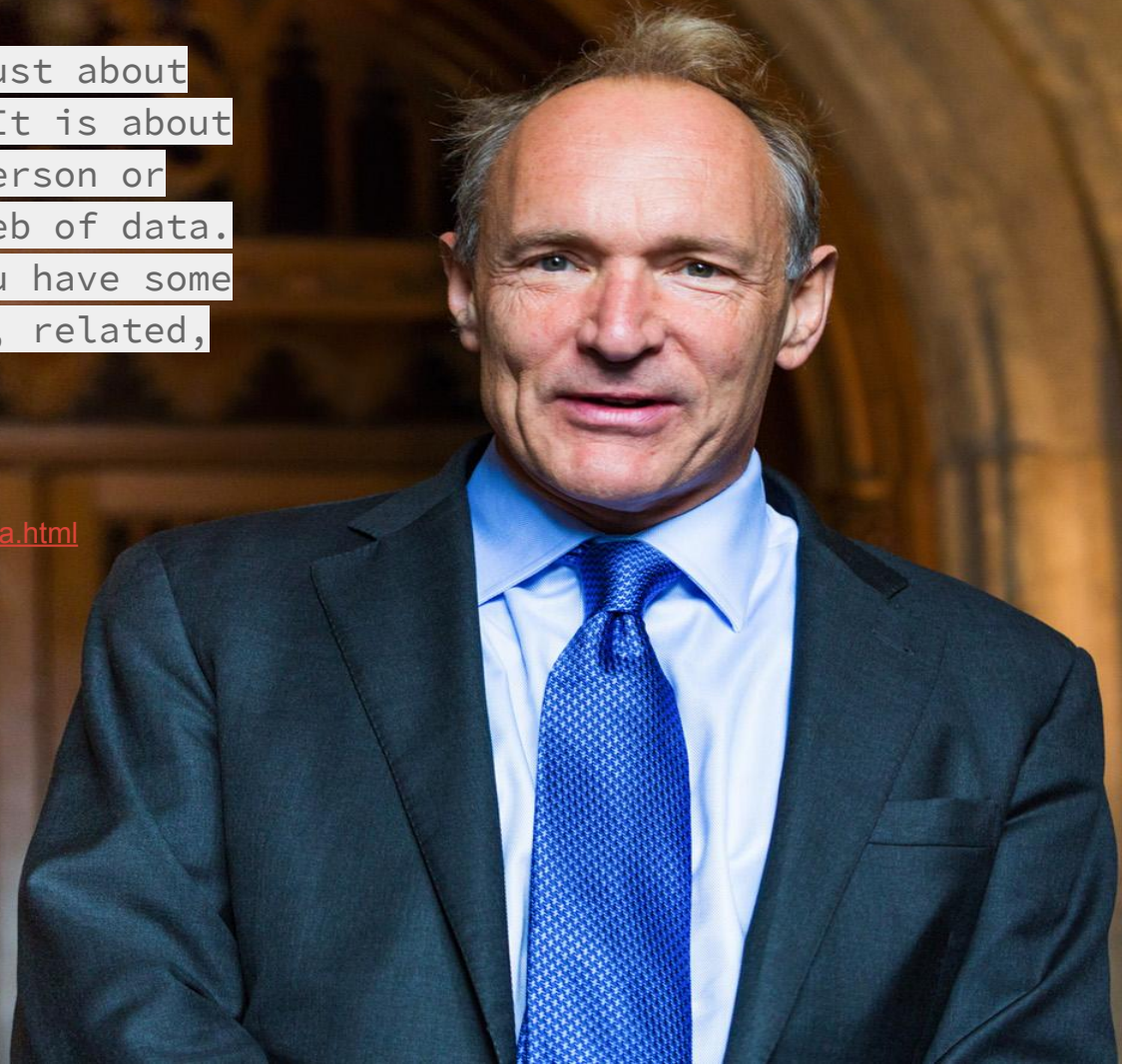
[https://github.com/amberbilley/NASIG17\\_LDworkshop](https://github.com/amberbilley/NASIG17_LDworkshop)

# LINKED DATA 101

“The Semantic Web isn't just about putting data on the web. It is about making links, so that a person or machine can explore the web of data. With linked data, when you have some of it, you can find other, related, data.”

<https://www.w3.org/DesignIssues/LinkedData.html>

Tim Berners-Lee, 2006



# RULES OF LINKED DATA

- Use URIs as names for things
- Use HTTP URIs so that people can look up those names.
- When someone looks up a URI, provide useful information.
- Include links to other URIs so that they can discover more things.

<https://www.w3.org/DesignIssues/LinkedData.html>

# 5-STAR LINKED OPEN DATA



Available on the web (whatever format) *but with an open licence, to be Open Data*



Available as machine-readable structured data (e.g. excel instead of image scan of a table)



as (2) plus non-proprietary format (e.g. CSV instead of excel)



All the above plus, Use open standards from W3C (RDF and SPARQL) to identify things, so that people can point at your stuff



All the above, plus: Link your data to other people's data to provide context

<https://www.w3.org/DesignIssues/LinkedData.html>

# THE LINKED DATA TECHNOLOGY STACK

URI (Uniform Resource Identifier)

HTTP (HyperText Transfer Protocol)

<http://id.loc.gov/vocabulary/issuance/serl>

# THE LINKED DATA TECHNOLOGY STACK

RDF (Resource Description Framework)

`<http://bibframe.example.org/instance/instanceY>`

`<http://bibframe.org/vocab/instanceOf>`

`<http://bibframe.example.org/work/workX> .`



# THE LINKED DATA TECHNOLOGY STACK

RDFS (RDF Vocabulary Definition Language)

OWL (Web Ontology Language)

```
<owl:DatatypeProperty rdf:about="http://id.loc.gov/ontologies/bibframe/firstIssue">
  <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
  <skos:definition>
    Beginning date of a resource and/or the sequential designations.
  </skos:definition>
  <rdfs:comment>Used with Work or Instance</rdfs:comment>
  <rdfs:label>Multipart first issue</rdfs:label>
  <dcterms:modified>2016-04-21 (New)
  </dcterms:modified>
</owl:DatatypeProperty>
```

# THE LINKED DATA TECHNOLOGY STACK

SPARQL (SPARQL Protocol and RDF Query Language)

```
PREFIX bf: <http://bibframe.org/vocab/>
SELECT ?title
FROM <http://loc.gov/catalog/dataset.rdf>
WHERE {
  ?x bf:title ?title .
}
ORDER BY ?title
```

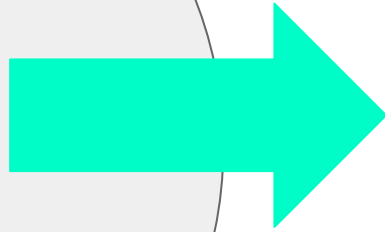
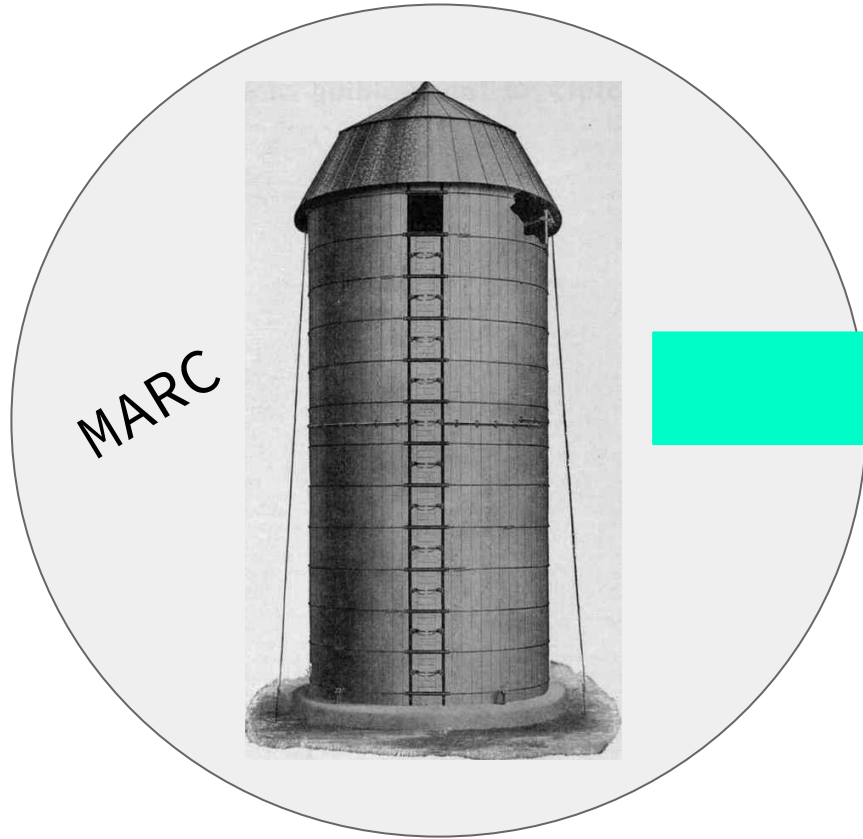
# WHO IS USING LINKED DATA?

- Search engines (schema.org)
- Wikipedia (DBPedia and Wikidata)
- Europe
- GeoNames

<http://lod-cloud.net/>

# ONTOLOGY BASICS

# MOVING FROM MARC SILOS TO THE WWW



W3C®

# DIFFERENCES BETWEEN MARC AND LD TECH STACKS

## MARC

- MARC (syntax)
- ILS (data storage and delivery)
  - SQL Database
- Z39.50 (query and transmission)
- Discovery Layer (data delivery)

## LINKED DATA

- RDF (data model)
- XML, JSONLD, N3, Turtle, ... (syntax)
- Triplestore (data storage)
- SPARQL (query)
- WWW (data delivery)

# WHAT *EXACTLY* IS BIBFRAME?

- BIBFRAME is a **LD *vocabulary***
- Being formally encoded for machine processing using W3C standards such as **OWL** or **RDFS** makes it an ***ontology***
- BIBFRAME is heavily inspired by MARC to prevent loss of legacy data
- BIBFRAME is intended to accommodate FRBR and RDA, but is structure and content standard agnostic for an evolving standards landscape

# PRIMARY DESCRIPTIVE CATALOGING MODEL AND THEIR STANDARDS

## **Structure Standard**

- ISBD, MARC, FRBR, Dublin Core, EAD, MODS, VRACore, CIDOC, **BIBFRAME**

## **Content Standard**

- AACR2, RDA, CCO, DACS, ...

## **Value Standard**

- LCSH, NAF, LCGFT, RDA Vocabularies, RBMS Thesauri, AAT, ...

## **Encoding Standard**

- 3x5 card, MARC (ISO 2709), CVS, XML, RDF-XML, JSON, Turtle ...



# CHERRY PICK VOCABULARIES. BUILD CUSTOM ONTOLOGIES.

- Build 5-star linked data
- Linked data allows for customization
- So BF can be one of several ontologies that we use for bibliographic descriptions
- Be careful!
- <https://lov.okfn.org/dataset/lov/>



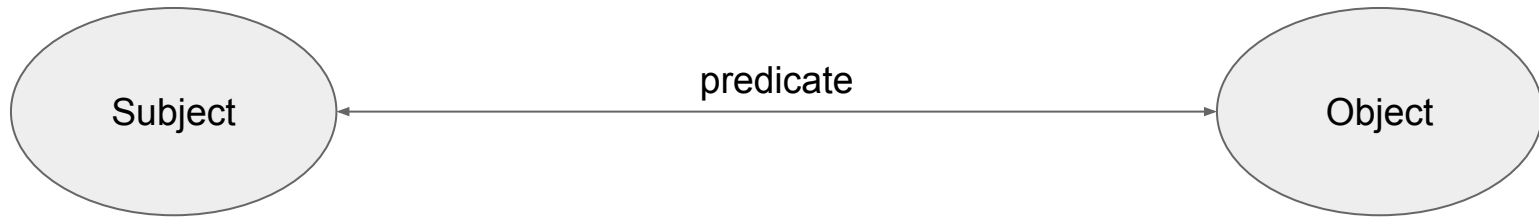


The Structure Standard for Linked Data

# RESOURCE DESCRIPTION FRAMEWORK

- Conceptual model for structuring data and relationships
- It is a W3C Standard framework for data interchange on the Web
- Enables the creation of relationships between things on the Web

# THE RDF TRIPLE

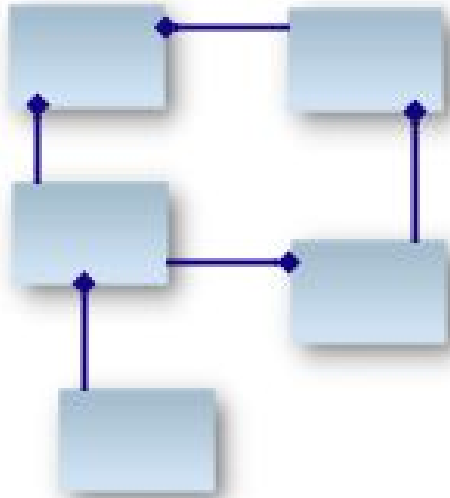


# RDF TRIPLE IN XML

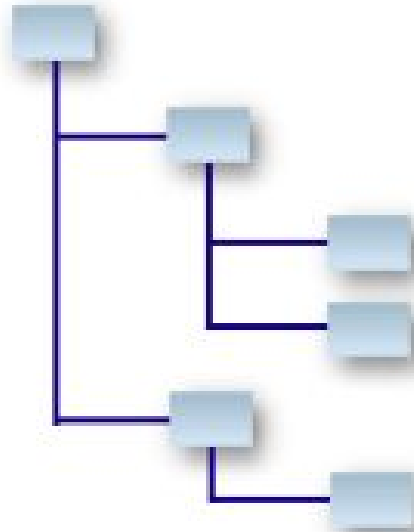
```
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF PUBLIC "-//DUBLIN CORE//DCMES DTD 2002/07/31//EN"
    "http://dublincore.org/documents/2002/07/31/dcmes-xml/dcmes-xml-dtd.dtd">

<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:dc="http://purl.org/dc/elements/1.1/">

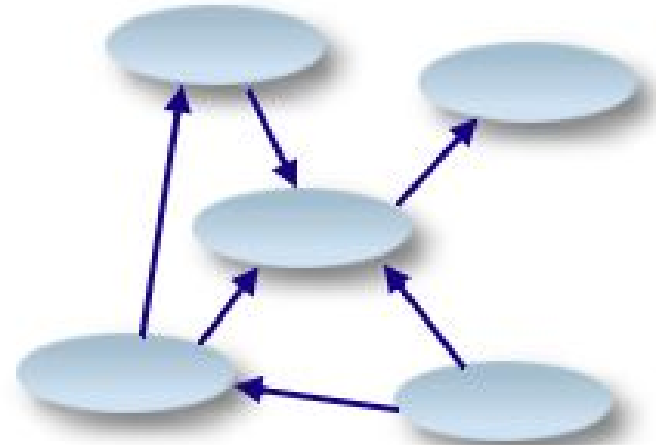
    <rdf:Description rdf:about="https://ejournals.lib.vt.edu/valib/index">
        <dc:title>Virginia Libraries</dc:title>
        <dc:publisher rdf:resource="http://id.loc.gov/authorities/names/n80023576">Virginia
Library Association</dc:publisher>
        <dc:identifier>ISSN 1086-9751</dc:identifier>
    </rdf:Description>
</rdf:RDF>
```



**Relational DB**  
Tables Related By  
Primary Key

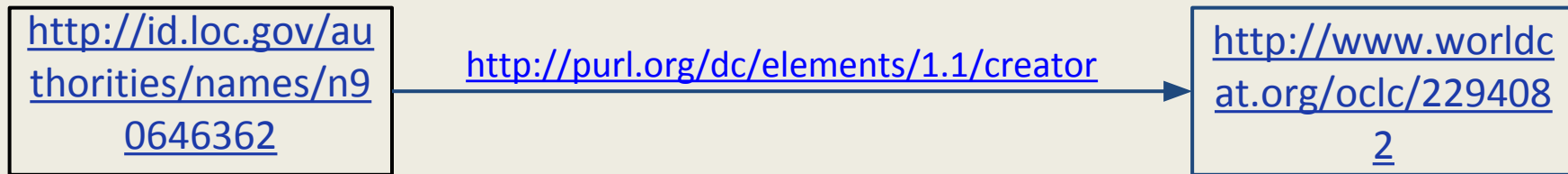
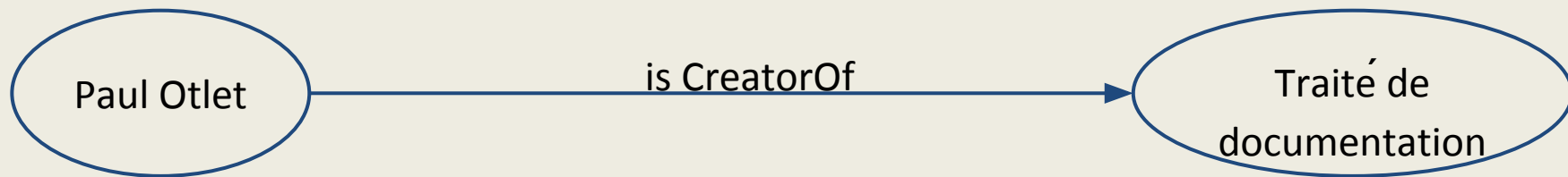
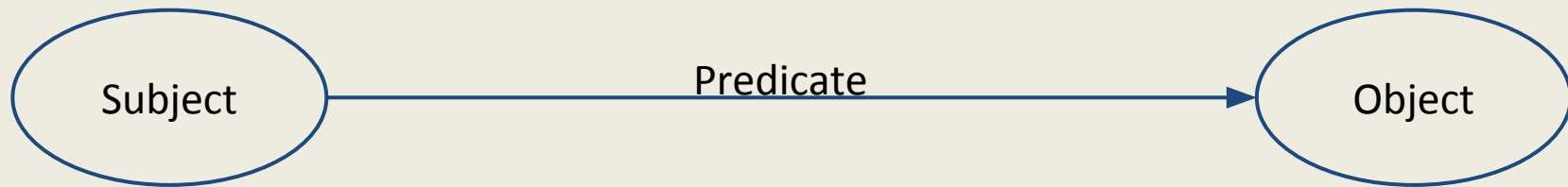


**Hierarchical DB**  
Parent Nodes Have More  
Intrinsic Importance

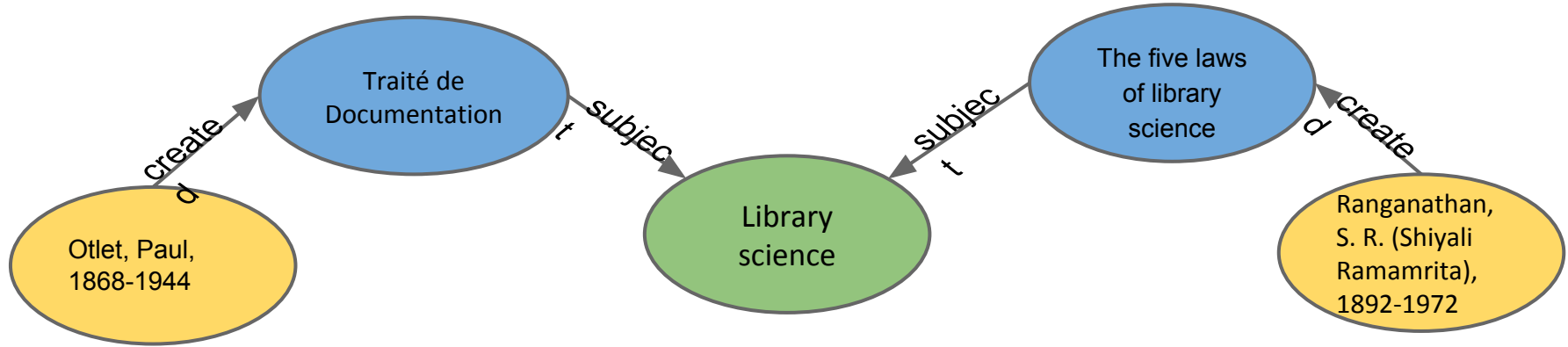


**Graph DB**  
Arbitrary Object Relations  
No Intrinsic Importance

# RDF Triple - another example



# Linked Data expresses relationships!

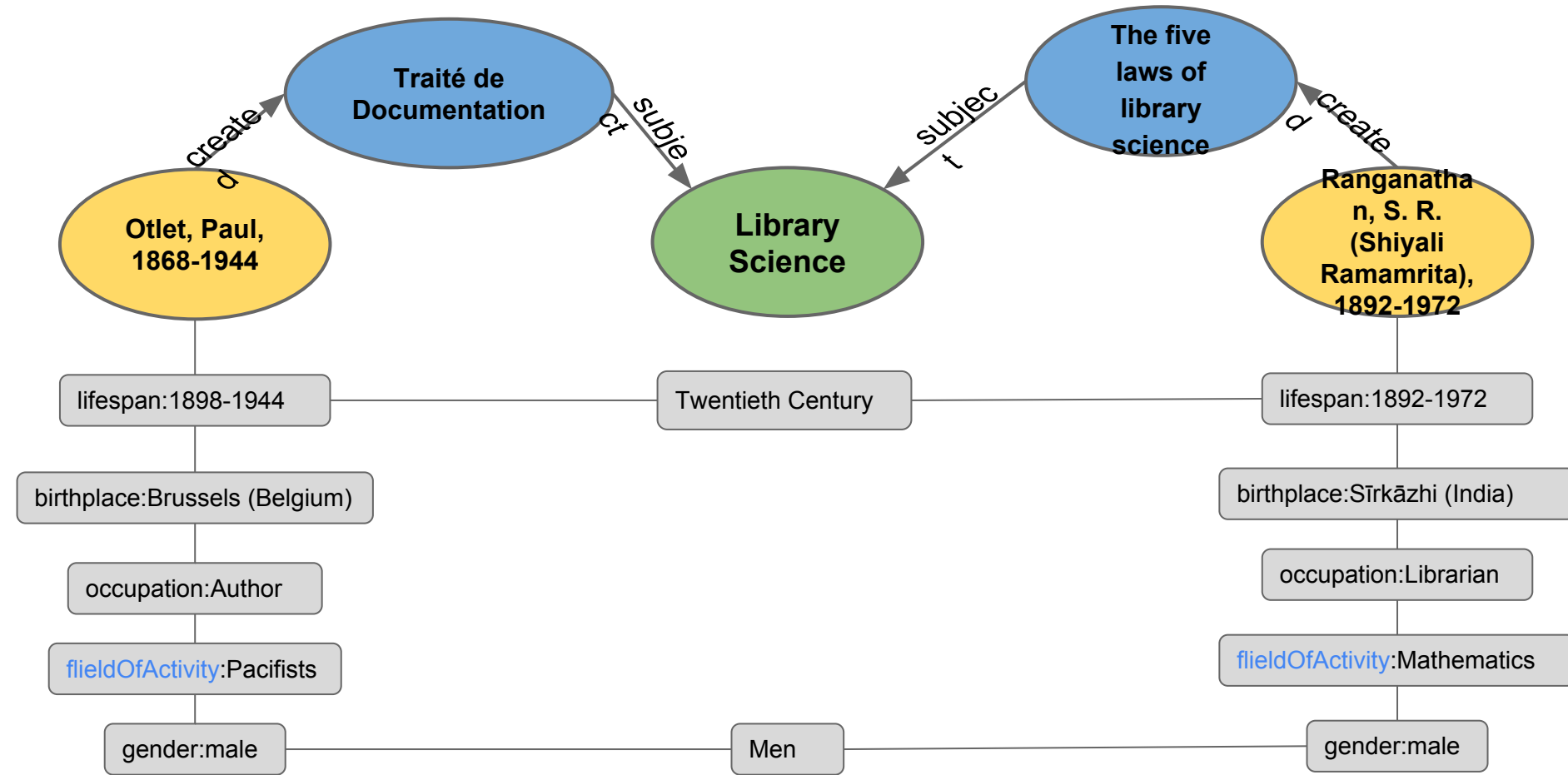




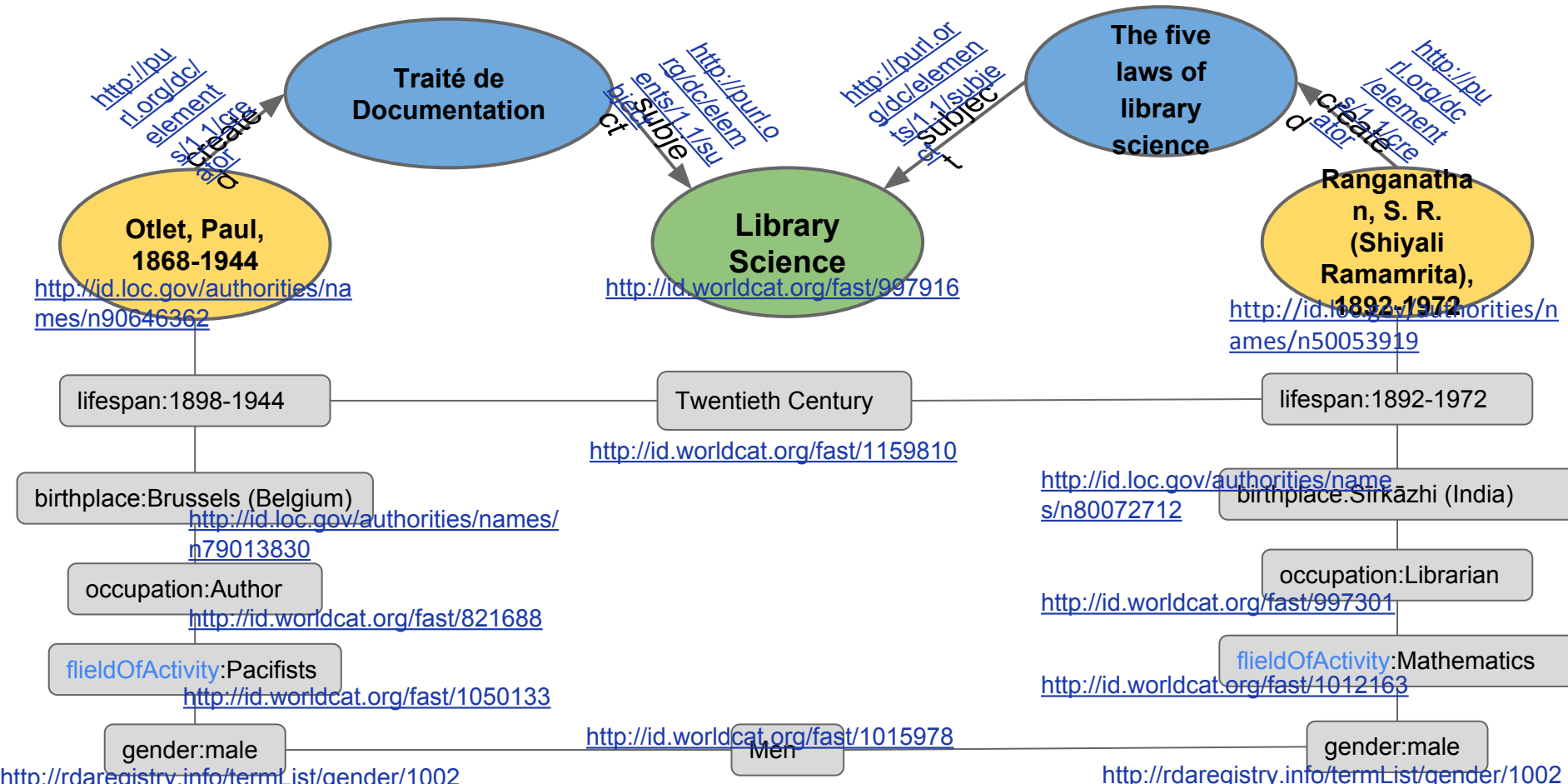
# Linked Data expresses relationships for machine processing.



# Linked Data is all about more relationships!



# Linked Data links all the relationships!



# RDF TRIPLE IN XML

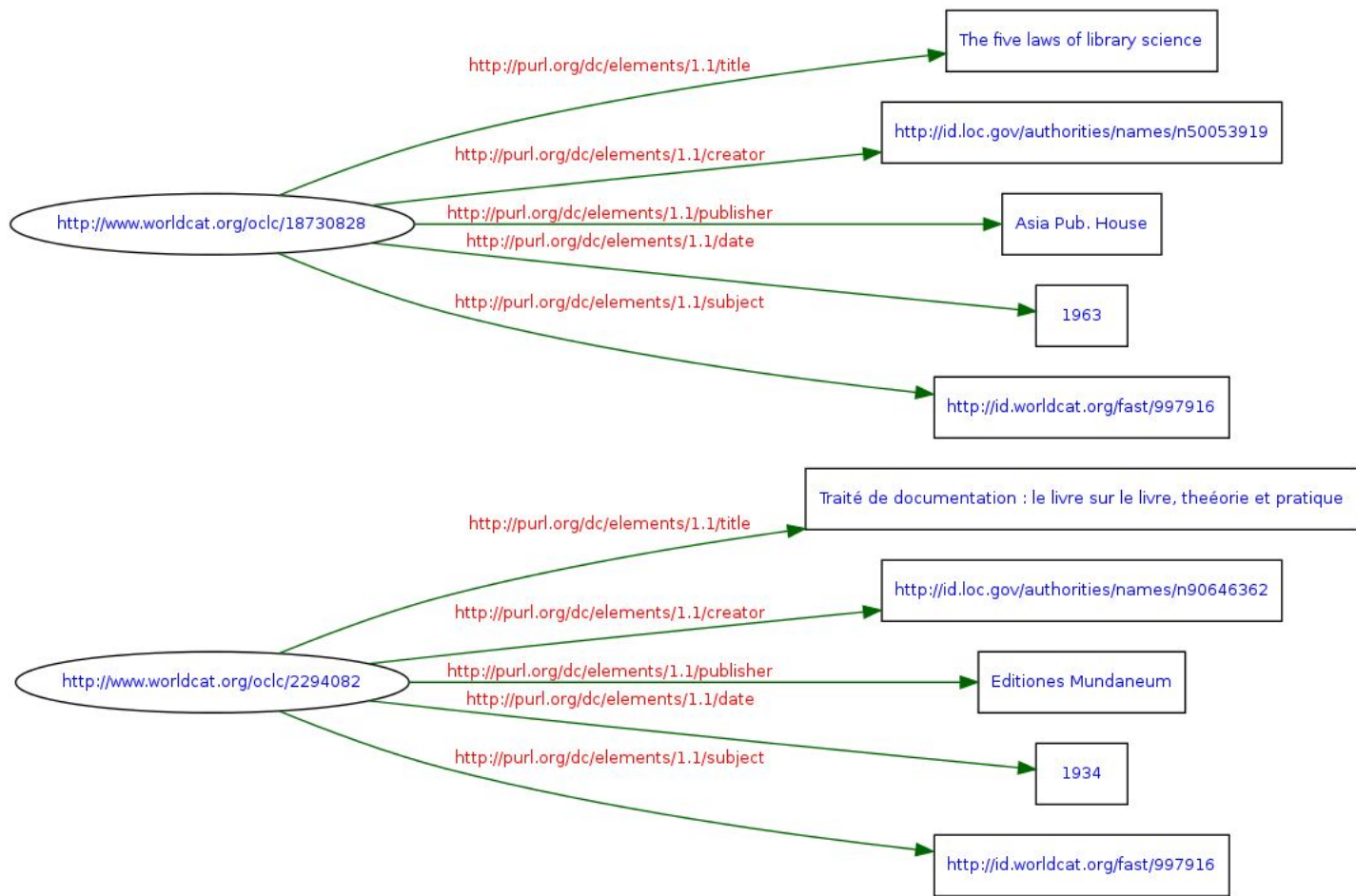
```
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF PUBLIC "-//DUBLIN CORE//DCMES DTD 2002/07/31//EN"
  "http://dublincore.org/documents/2002/07/31/dcmes-xml/dcmes-xml-dtd.dtd">
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dc="http://purl.org/dc/elements/1.1/">

  <rdf:Description rdf:about="http://www.worldcat.org/oclc/2294082">
    <dc:title>Traite' de documentation : le livre sur le livre, thee'orie et pratique</dc:title>
    <dc:creator>http://id.loc.gov/authorities/names/n90646362</dc:creator>
    <dc:publisher>Editiones Mundaneum</dc:publisher>
    <dc:date>1934</dc:date>
    <dc:subject>http://id.worldcat.org/fast/997916</dc:subject>
  </rdf:Description>

  <rdf:Description rdf:about="http://www.worldcat.org/oclc/18730828">
    <dc:title>The five laws of library science</dc:title>
    <dc:creator>http://id.loc.gov/authorities/names/n50053919</dc:creator>
    <dc:publisher>Asia Pub. House</dc:publisher>
    <dc:date>1963</dc:date>
    <dc:subject>http://id.worldcat.org/fast/997916</dc:subject>
  </rdf:Description>

</rdf:RDF>
```

## Graph of the data model



# LINKED DATA LEXICON

# DE-REFERENCING URIS

“Dereferencing means you can get a lookup on the Web for the description of the reference concept resource.”\*

<http://id.loc.gov/ontologies/bibframe/Work.rdf>

NOT [http://id.loc.gov/ontologies/bibframe.html#c\\_Work](http://id.loc.gov/ontologies/bibframe.html#c_Work)

Utilizes the http protocol and RDF data to provide meaningful information when a URI is looked up by a machine.  
Puts the link in linked data!

\*<http://umbel.org/web-services/uri-dereferencing/>

# CLASS

A kind of thing.

Subjects and Objects belong to Classes.

You will usually see classes with the first letter in Uppercase.

**bf:Work**

**bf:Instance**

**bf:Item**

**bf:Identifier**

**BIBFRAME CLASSES!**



# SUB-CLASS

A kind of thing that is a “sub-type” of a kind of thing.

Chihuahua is a kind of Dog.

ISBN is a kind of Identifier.

**bf:Isbn**

[http://id.loc.gov/ontologies/bibframe.html#c\\_Identifier](http://id.loc.gov/ontologies/bibframe.html#c_Identifier)

# PROPERTY

The relationships between Classes (or things/objects).

The “predicate.”

Usually listed with lower-case.

**bf:title**

**bf:identifiedBy**

**bf:date**

# SUB-PROPERTY

A sub-type of a property.

**bf:date**

**bf:originDate**

**bf:copyrightDate**

**bf:creationDate**

[http://id.loc.gov/ontologies/bibframe.html#p\\_date](http://id.loc.gov/ontologies/bibframe.html#p_date)

# DOMAIN

The **domain** tells us what **individuals** (of a given class) this property is allowed to be applied to. AKA “Used with”

Concerns the Subjects of a predicate.

**bf:Work**

**bf:Instance**

**bf:Item**

# RANGE

**Range** indicates the range of valid values this property can hold. AKA “Expected value”

Concerns the Objects of a predicate.

Literals

Objects/Individuals/URIs

# DATATYPE PROPERTY

A property that can only relate to data and literals.

`rdfs:label`            “The Organization of Information” .

`rdfs:label`            “The Joy of Cataloging” .

`rdf:label`            “123 pages.” .

`bf:date` "2007/2010"^^<<http://id.loc.gov/datatypes/edtf>> ;

# OBJECT TYPE PROPERTY

A property that can only relate to objects (URI things).

`<http://example.com/Work_1> bf:contributor`

`<http://id.loc.gov/authorities/names/n80107118>`

# INDIVIDUAL

Something with a URI or an IRI. A thing. A resource. A subject or an object.

AKA: Named Individual

<[http://example.com/Work\\_1](http://example.com/Work_1)> bf:contributor

<<http://id.loc.gov/authorities/names/n80107118>>



# BLANK NODES

Ugh. blank nodes.

“a **blank node** (also called *bnode*) is a node in an RDF graph representing a resource for which a [URI](#) or literal is not given.<sup>[1]</sup> The resource represented by a blank node is also called an **anonymous resource**. According to the RDF standard a blank node can only be used as subject or object of an RDF triple.”

Think of it as an alternative to link out to a URI as the object of a property.

[https://en.wikipedia.org/wiki/Blank\\_node](https://en.wikipedia.org/wiki/Blank_node)

# OPEN WORLD ASSUMPTION

“In a formal system of logic used for knowledge representation, the **open-world assumption** is the assumption that the truth value of a statement may be true irrespective of whether or not it is *known* to be true. It is the opposite of the **closed-world assumption**, which holds that any statement that is true is also known to be true.”

([wikipedia](#))

# ASSERTION

Saying something about a thing and expecting it to be true.

“In computer programming, an **assertion** is a statement that a predicate ... is expected to always be true at that point in the code.” ([wikipedia](#))

# INFERENCE

“Inference is the process of deriving logical conclusions from a set of starting assumptions. Using Linked Data, existing relationships are modeled as a set of (named) relationships between resources. Linked Data helps humans and machines to find new relationships through automatic procedures that generate new relationships based on the data and based on some additional information in the form of a vocabulary.”

<https://www.w3.org/TR/ld-glossary/#inference>

# ENTAILMENT

“In **pragmatics** (**linguistics**), **entailment** is the relationship between two sentences where the truth of one (A) requires the truth of the other (B).”

([wikipedia](#))

SKOS:Concept and LCNAF example.

ARE THERE OTHER  
TERMS THAT ARE NEW  
TO YOU?

PROTEGE DEMO

# PROTEGE

Software for ontology modeling and development.

<http://protege.stanford.edu/>

<https://webprotege.stanford.edu/>





# EXPLORE BIBFRAME ONTOLOGY

- Open Protege
- Click File > Open from URL
- Enter the BIBFRAME ontology URL
  - <http://id.loc.gov/ontologies/bibframe.rdf>

ProtegeFileEditViewReasonerToolsRefactorWindowHelp

bibframe (http://id.loc.gov/ontologies/bibframe/) : [http://id.loc.gov/ontologies/bibframe.rdf]

←→

bibframe (http://id.loc.gov/ontologies/bibframe/)

Q Search for entity

Active Ontology × Entities × Individuals by class × DL Query ×

Ontology header:

Ontology IRIhttp://id.loc.gov/ontologies/bibframe/

Ontology Version IRIe.g. http://id.loc.gov/ontologies/bibframe/1.0.0

Annotations +

modified

2017-03-15T16:23:59.852-04:00

versionInfo [type: string]

2017-03-15T16:23:59.852-04:00

label

BIBFRAME vocabulary

Ontology metrics:

Metrics

Axiom	2198
Logical axiom count	459
Class count	189
Object property count	132
Data property count	63
Individual count	0
DL expressivity	ALHI(D)

Class axioms

SubClassOf axioms count	113
EquivalentClasses axioms count	0
DisjointClasses axioms count	0
GCI count	0
Hidden GCI Count	0

Object property axioms

Ontology imports

Ontology Prefixes

General class axioms

Imported ontologies:

Direct Imports +

Indirect Imports

No Reasoner set. Select a reasoner from the Reasoner menu ☒ Show Inferences

# RDF SYNTAX

# RDF-XML

```
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF PUBLIC "-//DUBLIN CORE//DCMES DTD 2002/07/31//EN"
    "http://dublincore.org/documents/2002/07/31/dcmes-xml/dcmes-xml-dtd.dtd">

<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:dc="http://purl.org/dc/elements/1.1/">

  <rdf:Description rdf:about="https://ejournals.lib.vt.edu/valib/index">
    <dc:title>Virginia Libraries</dc:title>
    <dc:publisher rdf:resource="http://id.loc.gov/authorities/names/n80023576">Virginia Library Association</dc:publisher>
    <dc:identifier>ISSN 1086-9751</dc:identifier>
    <dc:subject rdf:resource="http://id.loc.gov/authorities/subjects/sh85076502">Libraries</dc:subject>
    <dc:subject rdf:resource="http://id.loc.gov/authorities/names/n79022909">Virginia</dc:subject>
    <dc:format rdf:resource="http://id.loc.gov/vocabulary/marcgt/per">Periodical</dc:format>
    <dc:type rdf:resource="http://purl.org/dc/dcmitype/Text">Text</dc:type>
  </rdf:Description>

  <rdf:Description rdf:about="http://www.vermontlibraries.org/vlanews/">
    <dc:title>VLA News</dc:title>
    <dc:publisher rdf:resource="http://id.loc.gov/authorities/names/n85375613">Vermont Library Association</dc:publisher>
    <dc:subject rdf:resource="http://id.loc.gov/authorities/subjects/sh85076502">Libraries</dc:subject>
    <dc:subject rdf:resource="http://id.loc.gov/authorities/names/n79007067">Virginia</dc:subject>
    <dc:format rdf:resource="http://id.loc.gov/vocabulary/marcgt/per">Periodical</dc:format>
    <dc:type rdf:resource="http://purl.org/dc/dcmitype/Text">Text</dc:type>
  </rdf:Description>

</rdf:RDF>
```

# JSON-LD

```
{
  "@id": "http://www.vermontlibraries.org/vlanews/",
  "http://purl.org/dc/elements/1.1/title": [
    {
      "@value": "VLA News"
    }
  ],
  "http://purl.org/dc/elements/1.1/publisher": [
    {
      "@id": "http://id.loc.gov/authorities/names/n85375613"
    }
  ],
  "http://purl.org/dc/elements/1.1/subject": [
    {
      "@id": "http://id.loc.gov/authorities/subjects/sh85076502"
    },
    {
      "@id": "http://id.loc.gov/authorities/names/n79007067"
    }
  ],
  "http://purl.org/dc/elements/1.1/format": [
    {
      "@id": "http://id.loc.gov/vocabulary/marcgt/per"
    }
  ],
  "http://purl.org/dc/elements/1.1/type": [
    {
      "@id": "http://purl.org/dc/dcmitype/Text"
    }
  ]
}
```

# N-TRIPLES

<https://ejournals.lib.vt.edu/valib/index> <http://purl.org/dc/elements/1.1/title> "Virginia Libraries" .

<https://ejournals.lib.vt.edu/valib/index> <http://purl.org/dc/elements/1.1/publisher>  
<http://id.loc.gov/authorities/names/n80023576> .

<https://ejournals.lib.vt.edu/valib/index> <http://purl.org/dc/elements/1.1/identifier> "ISSN 1086-9751" .

<https://ejournals.lib.vt.edu/valib/index> <http://purl.org/dc/elements/1.1/subject>  
<http://id.loc.gov/authorities/subjects/sh85076502> .

<https://ejournals.lib.vt.edu/valib/index> <http://purl.org/dc/elements/1.1/subject>  
<http://id.loc.gov/authorities/names/n79022909> .

<https://ejournals.lib.vt.edu/valib/index> <http://purl.org/dc/elements/1.1/format>  
<http://id.loc.gov/vocabulary/marcgt/per> .

<https://ejournals.lib.vt.edu/valib/index> <http://purl.org/dc/elements/1.1/type>  
<http://purl.org/dc/dcmitype/Text> .

# N3

@prefix dc11: <http://purl.org/dc/elements/1.1/> .

```
<https://ejournals.lib.vt.edu/valib/index>
  dc11:title "Virginia Libraries" ;
  dc11:publisher <http://id.loc.gov/authorities/names/n80023576> ;
  dc11:identifier "ISSN 1086-9751" ;
  dc11:subject <http://id.loc.gov/authorities/subjects/sh85076502>,
<http://id.loc.gov/authorities/names/n79022909> ;
  dc11:format <http://id.loc.gov/vocabulary/marcgt/per> ;
  dc11:type <http://purl.org/dc/dcmitype/Text> .
```

```
<http://www.vermontlibraries.org/vlanews/>
  dc11:title "VLA News" ;
  dc11:publisher <http://id.loc.gov/authorities/names/n85375613> ;
  dc11:subject <http://id.loc.gov/authorities/subjects/sh85076502>,
<http://id.loc.gov/authorities/names/n79007067> ;
  dc11:format <http://id.loc.gov/vocabulary/marcgt/per> ;
  dc11:type <http://purl.org/dc/dcmitype/Text> .
```

# TURTLE

@prefix dc11: <http://purl.org/dc/elements/1.1/> .

```
<https://ejournals.lib.vt.edu/valib/index>
  dc11:title "Virginia Libraries" ;
  dc11:publisher <http://id.loc.gov/authorities/names/n80023576> ;
  dc11:identifier "ISSN 1086-9751" ;
  dc11:subject <http://id.loc.gov/authorities/subjects/sh85076502>,
<http://id.loc.gov/authorities/names/n79022909> ;
  dc11:format <http://id.loc.gov/vocabulary/marcgt/per> ;
  dc11:type <http://purl.org/dc/dcmitype/Text> .
```

```
<http://www.vermontlibraries.org/vlanews/>
  dc11:title "VLA News" ;
  dc11:publisher <http://id.loc.gov/authorities/names/n85375613> ;
  dc11:subject <http://id.loc.gov/authorities/subjects/sh85076502>,
<http://id.loc.gov/authorities/names/n79007067> ;
  dc11:format <http://id.loc.gov/vocabulary/marcgt/per> ;
  dc11:type <http://purl.org/dc/dcmitype/Text> .
```



TURTLE!!!



# TURTLE LANGUAGE



©2011 Warner Bros. Entertainment Inc. All Rights Reserved. TMNT/TEEN TURTLES and all related names, logos and characters are trademarks of Warner Bros. Entertainment Inc.

# SIMPLE TRIPLES

<subject> <predicate> <object> .

<Class> <property> <Class> .

<<http://www.worldcat.org/oclc/6626957>>

<<http://id.loc.gov/ontologies/bibframe.html#subject>>

<<http://id.loc.gov/authorities/subjects/sh85020816>> .

# PREDICATE LISTS

When you have to say more than one things about a subject.

<subject>      <predicate> <object> ;

                 <predicate> <object> ;

                 <predicate> <object> .

<<http://www.worldcat.org/oclc/6626957>>

<<http://id.loc.gov/ontologies/bibframe.html#subject>>

<<http://id.loc.gov/authorities/subjects/sh85020816>> ;

<<http://id.loc.gov/ontologies/bibframe.html#subject>>

<<http://id.loc.gov/authorities/subjects/sh85129425>> ;

<<http://id.loc.gov/ontologies/bibframe.html#classification>>

<<http://id.loc.gov/authorities/classification/Z693.A3-Z693.Z>> .

# OBJECT LISTS

When you have more than one object for a subject on the same predicate -- separate them with a comma

```
<subject>          <predicate>  <object>, <object> .
```

```
<some_book>        bf:heldBy    "DLC", "NNC" .
```

```
bf:title           [ a bf>Title, bf:VariantTitle ] ;
```

# URIS (AKA IRIS)

- URIs can be relative or absolute, or prefixed names.
- Relative and absolute URIs are enclosed in angled brackets <URI>
- Relative URIs like <#example> are resolved to the base URI that is declared as the @base or BASE

@base <<http://library.edu/>>

<#book\_0912700513> = http://library.edu/#book\_0912700513

# PREFIXES

Prefixes allow for shorthand references to ontology domains.

```
@base <http://library.edu/> .
```

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

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

```
@prefix bf: <http://id.loc.gov/ontologies/bibframe/> .
```

# PREFIXES CONTINUED

<Berman\_work1>

```
@base <http://library.edu/> .  
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .  
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .  
@prefix bf: <http://id.loc.gov/ontologies/bibframe/> .
```

a bf:Work ;

bf:hasInstance <Berman\_inst1> ;

bf:adminMetadata <Berman\_admin1> ;

bf:title [

a bf>Title, bf:WorkTitle ;

bf:mainTitle "Joy of cataloging" ;

bf:subTitle "essays, letters, and other explosions" ;

] ;



# PREFIXES CONTINUED

<Berman\_work1>

```
@base <http://library.edu/> .  
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .  
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .  
@prefix bf: <http://id.loc.gov/ontologies/bibframe.rdf> .
```

a bf:Work ;

bf:hasInstance <Berman\_inst1> ;

bf:adminMetadata <Berman\_admin1> ;

bf:title [



a bf>Title, bf:WorkTitle ;

bf:mainTitle "Joy of cataloging" ;

bf:subTitle "essays, letters, and other explosions" ;

] ;

# "A" TYPE OF THING

The token 'a' in the predicate position of a Turtle triple represents the URI <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>.

```
<Berman_work1>
```

```
  a bf:Work ;
```

```
  bf:title [ a bf>Title, bf:VariantTitle ] .
```

# LITERALLY LITERALS

Datatype properties require a literal value for their object. Enclose all literals with quotes -- “literal.” Literals are used to identify values such as strings, numbers, dates.

```
bf:supplementaryContent      "Includes index." ;  
bf:responsibilityStatement  "by Sanford Berman" ;  
bf:shelfmark                 "Z693 .B47 1981" .  
bf:mainTitle                 “Joie du catalogage”@fr
```

# DATATYPE IRI

You can specify a datatype for a literal using an IRI with a ^^ notation.

```
<http://bibframe.example.org/XXX#Instance
```

```
bf:provisionActivity
```

```
[ a bf:ProvisionActivity, bf:Publication ;
```

```
bf:date
```

```
"2007/2010"^^<http://id.loc.gov/datatypes/edtf> ;
```

```
bf:place <http://id.loc.gov/vocabulary/countries/ko> ]
```

```
.
```

# NESTING BLANK NODES

Super common in BIBFRAME when you need to provide legacy literal information.

```
<Berman_inst1>
  bf:provisionActivity
    [
      a bf:ProvisionActivity, bf:Publication ;
      bf:agent
        [
          a bf:Agent ;
          rdfs:label "Oryx Press"
        ] ;

      bf:place
        [
          a bf:Place ;
          rdfs:label "Phoenix, AZ"
        ] ;
      bf:date "1981"
    ] .
```

# TURTLE (POWER!) GRAMMAR



# WHITE SPACE

White space is largely ignored in Turtle, except for literals.

```
bf:summary      "A collection of essays and letters on  
cataloging, classification, and indexing." ;
```

Use `"` to escape quotes within a literal.

```
bf:summary '""A fantastic read!" says Maurice Freedman.''' ;
```

# COMMENTS

Add comments to your code by using the hash # sign.

```
@base <http://library.edu/> .
```

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

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

```
@prefix bf: <http://id.loc.gov/ontologies/bibframe.rdf> .
```

```
#This is a test record for the PCC BIBFRAME TG
```

```
<Berman_work1>
```



# PUTTING IT ALL TOGETHER

[https://github.com/amberbille/PCC\\_BIBFRAME/blob/master/BF\\_Berman\\_Example.ttl](https://github.com/amberbille/PCC_BIBFRAME/blob/master/BF_Berman_Example.ttl)



[http://vignette4.wikia.nocookie.net/tmnt/images/3/31/T\\_U\\_R\\_T\\_L\\_E\\_POWER!.jpg/revision/latest?cb=20130825150401](http://vignette4.wikia.nocookie.net/tmnt/images/3/31/T_U_R_T_L_E_POWER!.jpg/revision/latest?cb=20130825150401)

# LINKED DATA TOOLS

# TEXT EDITOR (YOUR BEST FRIEND)

- MACS
  - Text Wrangler (Free and open source)
- PCs
  - Notepad++ (Free and open source)
- Either
  - Sublime Text (Open source, free trial, paid license)
  - Atom (Open source, free)

# DATA VALIDATORS AND CONVERTERS

- W3C RDF Validator (parses and builds graphs)
  - <https://www.w3.org/RDF/Validator/>
- EasyRDF Converter
  - <http://www.easyrdf.org/converter>
- JSON-LD
  - <http://json-ld.org/playground/>
- Turtle
  - <http://ttl.summerofcode.be/>

Or seriously...just Google it.

# CUSTOM EDITOR

- BIBFRAME Editor
  - VitroLib Editor
  - BIBFLOW Editor
- 
- Local development

# PROTEGE

Software for ontology modeling and development.

<http://protege.stanford.edu/>

We already  
talked about this :-)



# KARMA

An ontology modeling and visualization tool.

“A data integration tool.”

<http://usc-isi-i2.github.io/karma/>

# VITROLIB

The linked data editor being developed for the LD4P Project.

<http://vitrolib.ld4p.library.cornell.edu/>



# OPEN REFINE

A data munging, modeling,  
reconciling, power tool.

<http://openrefine.org/>



# TEXT EDITOR DEMO

SERIALS IN  
BIBFRAME!

# Serials RDA Elements in BIBFRAME

## Mappings:

- LC: MARC 21 to BIBFRAME 2.0 Conversion Specifications  
<https://www.loc.gov/bibframe/mtbf/>
- CONSER: BIBFRAME 2.0 CSR Mapping (coming soon; watch this space:  
<http://www.loc.gov/aba/pcc/conser/index.html>)

# BIBFRAME 2.0 ontology

<http://id.loc.gov/ontologies/bibframe.html>

<b>Property:</b>	<b>title</b>
Label:	Title resource
Definition:	Name given to a resource.
Used with:	Work, Instance or Item
Expected Value:	<a href="#">Title</a>
Change Notes:	2016-04-21 (New)

<b>Class:</b>	<b>Title</b>
Label:	Title entity
Definition:	Title information relating to a resource: work title, preferred title, instance title, transcribed title, translated title, variant form of title, etc.
Used with:	<a href="#">title</a>
SubClassed As:	<a href="#">VariantTitle</a>
Change Notes:	2016-04-21 (New) 2017-02-03 (Definition changed)

[\[back to class list\]](#) [\[back to top\]](#)

# Instances

<http://bibframe.example.org/15297773#Instance>

**a** bf:Instance

# Title (for display)

<http://bibframe.example.org/15297773#Instance>

bf:title

[ a bf>Title ;

  rdfs:label "The international journal of Korean art and archaeology." ]

# Title (for sorting)

<http://bibframe.example.org/15297773#Instance>

**bf:title**

[ a bf>Title ;

    rdfs:label "The international journal of Korean art and archaeology."

;

**bflc:titleSortKey** "international journal of Korean art and  
archaeology." ]



# Title proper

<http://bibframe.example.org/15297773#Instance>

**bf:title**

[ a bf>Title ;

    rdfs:label "The international journal of Korean art and archaeology."

;

    bflc:titleSortKey "international journal of Korean art and  
archaeology." ;

**bf:mainTitle** "The international journal of Korean art and  
archaeology" ]

# Title proper (part number, name)

<http://bibframe.example.org/11315714#Instance>

**bf:title**

[ a bf>Title ;

    rdfs:label "Philosophical transactions of the Royal Society of London.  
Series A, Containing papers of a mathematical or physical character." ;

**bf:mainTitle** "Philosophical transactions of the Royal Society of  
London" ;

**bf:partName** "Containing papers of a mathematical or physical  
character" ;

**bf:partNumber** "Series A" ]

# Title proper and subtitle

<http://bibframe.example.org/12382624#Instance>

**bf:title**

[ a bf>Title ;

    rdfs:label "Gastronomica : the journal of food and culture." ;

    bflc:titleSortKey "Gastronomica : the journal of food and culture." ;

**bf:mainTitle** "Gastronomica" ;

**bf:subtitle** "the journal of food and culture" ]

# Variant title

<http://bibframe.example.org/15297773#Instance>

bf:title

[ a bf>Title, bf:VariantTitle ;  
 rdfs:label "Korean art and archaeology" ;  
 bflc:titleSortKey "Korean art and archaeology" ;  
 bf:mainTitle "Korean art and archaeology" ]

# Parallel title

<http://bibframe.example.org/11273268#Instance>

bf:title

[ a bf:ParallelTitle, bf>Title, bf:VariantTitle ;  
 rdfs:label "Korea today" ;  
 bf:lc:titleSortKey "Korea today" ;  
 bf:mainTitle "Korea today" ]

# Abbreviated title

<http://bibframe.example.org/18270882#Instance>

bf:title

```
[ a bf:AbbreviatedTitle, bf>Title, bf:VariantTitle ;  
  rdfs:label "Physician leadersh. j." ;  
  bflc:titleSortKey "Physician leadersh. j." ;  
  bf:mainTitle "Physician leadersh. j." ;  
  bf:source [ a bf:Source ;  
    rdf:value "issnkey" ] ]
```

# Key title

<http://bibframe.example.org/18270882#Instance>

bf:title

[ a bf:KeyTitle, bf:Title, bf:VariantTitle ;  
 rdfs:label "Physician leadership journal" ;  
 bflc:titleSortKey "Physician leadership journal" ;  
 bf:mainTitle "Physician leadership journal" ]

# Statement of responsibility

<<http://bibframe.example.org/17610810#Instance>>

**bf:responsibilityStatement** "edited by Nigel G. Foster, FRSA"



# Edition statement

<<http://bibframe.example.org/8330771#Instance>>

**bf:editionStatement** "Indiana ed."

# Numbering of serials (formatted)

<http://bibframe.example.org/11315714#Instance>

bf:firstIssue "Vol. 187 (1896)" ;

bf:lastIssue "v. 233"

# Numbering of serials (note)

<http://bibframe.example.org/15297773#Instance>

bf:note

[ a bf:Note ;

    rdfs:label "Began with v. 01 (2007); ceased with v. 04 (2010).";

    bf:noteType "Numbering" ]

# Publication statement (transcribed)

<<http://bibframe.example.org/15297773#Instance>>

**bf:provisionActivityStatement** "Seoul : National Museum of Korea, 2007-  
©2010."

# Publication statement (segmented)

<http://bibframe.example.org/15297773#Instance>

bf:provisionActivity

[ a bf:ProvisionActivity, bf:Publication ;

bf:agent [ a bf:Agent ;  
rdfs:label "National Museum of Korea" ] ;

bf:date "2007-©2010" ;

bf:place [ a bf:Place ;  
rdfs:label "Seoul" ] ]

# Publication information (using URIs)

<<http://bibframe.example.org/15297773#Instance>

**bf:provisionActivity**

[ a bf:ProvisionActivity, **bf:Publication** ;

**bf:date** "2007/2010"^^<<http://id.loc.gov/datatypes/edtf>> ;

**bf:place** <<http://id.loc.gov/vocabulary/countries/ko>> ]

# Copyright date

<<http://bibframe.example.org/19276940#Instance>>  
**bf:copyrightDate** "©2015"

# Series statement

<<http://bibframe.example.org/17610810#Instance>>  
**bf:seriesStatement** "Blackstone's statutes series"



# Series statement and enumeration

<<http://bibframe.example.org/317269#Instance>>

**bf:seriesEnumeration** "65, v. 5", "v. 5" ;

**bf:seriesStatement** "Archetypal images in Greek religion", "Bollingen series"

# Mode of issuance

<<http://bibframe.example.org/15297773#Instance>>

**bf:issuance** <<http://id.loc.gov/vocabulary/issuance/serl>>

# Frequency

<http://bibframe.example.org/15297773#Instance>

bf:frequency

[ a bf:Frequency ;  
 rdfs:label "Annual" ]

# Frequency

<<http://bibframe.example.org/15297773#Instance>>

bf:frequency

[ a bf:Frequency ;  
 rdfs:label "Annual" ],

<<http://id.loc.gov/vocabulary/frequencies/ann>>

# ISSN

<http://bibframe.example.org/15297773#Instance>

bf:identifiedBy

[ a *bf:Identifier*, bf:Issn ;  
 rdf:value "2005-1115" ]

# LCCN

<http://bibframe.example.org/15297773#Instance>

bf:identifiedBy

[ a *bf:Identifier*, bf:Lccn ;  
 rdf:value " 2008200843" ]

# DBO/LIC notes

<http://bibframe.example.org/15297773#Instance>

**bf:note**

```
[ a bf:Note ;  
  rdfs:label "Description based on: Vol. 01 (2007); title from t.p." ;  
  bf:noteType "description source" ],  
[ a bf:Note ;  
  rdfs:label "Latest issue consulted: Vol. 04 (2010).";  
  bf:noteType "description source" ]
```

# More notes

<http://bibframe.example.org/11315714#Instance>

bf:note

[ a bf:Note ;

    rdfs:label "Vols. for 1901-1930. 1 v.; 1931-1940. 1 v. (includes issues  
published under later title)." ;

    bf:noteType "index" ]



# Media

<<http://bibframe.example.org/15297773#Instance>>

**bf:media** <<http://id.loc.gov/vocabulary/mediaTypes/n>>

# Carrier

<<http://bibframe.example.org/15297773#Instance>>

**bf:carrier** <<http://id.loc.gov/vocabulary/carriers/nc>>

# Extent

<http://bibframe.example.org/15297773#Instance>

bf:extent

[ a bf:Extent ;

    rdfs:label "4 volumes" ]

# Illustrations?

<<http://bibframe.example.org/15297773#Instance>>

bf:note

[ a bf:Note ;  
 rdfs:label "illustrations" ;  
 bf:noteType "Physical details" ]

[but see [http://id.loc.gov/ontologies/bibframe.html#p\\_illustrativeContent](http://id.loc.gov/ontologies/bibframe.html#p_illustrativeContent)]

# Dimensions

<<http://bibframe.example.org/15297773#Instance>>

**bf:dimensions** "30 cm"

# URL

<<http://bibframe.example.org/item/item5>>

**bf:electronicLocator** "<http://hdl.loc.gov/loc.pnp/cph.3g11323>"

# Relationships (Instances)

<http://bibframe.example.org/15297773#Instance>

**bf:otherPhysicalFormat**

<http://bibframe.example.org/15297773#Instance776-41> .

<http://bibframe.example.org/15297773#Instance>

**bf:instanceOf** <http://bibframe.example.org/15297773#Work> .

<http://bibframe.example.org/15297773#Instance>

**bf:hasItem** <http://bibframe.example.org/15297773#Item050-13>

# Works

<<http://bibframe.example.org/15297773#Work>>

a bf:Text, bf:Work



# Work title

<<http://bibframe.example.org/15297773#Work>>

**bf:title**

[ a bf>Title ;

    rdfs:label "The international journal of Korean art and archaeology." ;

    bflc:titleSortKey "international journal of Korean art and  
archaeology." ;

**bf:mainTitle** "The international journal of Korean art and  
archaeology" ]

# ISSN-L

```
<http://bibframe.example.org/11273268#Work>  
  bf:identifiedBy  
    [ a bf:Identifier, bf:IssnL ;  
      rdf:value "1227-1632" ]
```

# Content

<<http://bibframe.example.org/15297773#Work>>

bf:content

<<http://id.loc.gov/vocabulary/contentTypes/txt>>

# Language of expression

<<http://bibframe.example.org/15297773#Work>>

bf:language

<<http://id.loc.gov/vocabulary/languages/eng>>

# Contributor

<<http://bibframe.example.org/15297773#Work>>

bf:contribution

[ a bf:Contribution ;

bf:agent <<http://id.loc.gov/authorities/names/n81039362>> ;

bf:role <<http://id.loc.gov/vocabulary/relators/ctb>> ]

# Subject

<<http://bibframe.example.org/15297773#Work>>

**bf:subject**      <<http://bibframe.example.org/15297773#Topic650-28>>,  
<<http://bibframe.example.org/15297773#Topic650-30>>,  
<<http://bibframe.example.org/15297773#Topic650-31>>

# Genre/Form

<http://bibframe.example.org/15297773#Work>

bf:genreForm

<http://bibframe.example.org/15297773#GenreForm655-38>

# Relationships (Works)

<http://bibframe.example.org/15297773#Work>

**bf:hasInstance** <http://bibframe.example.org/15297773#Instance>,  
<http://bibframe.example.org/15297773#Instance530-25> .

<http://bibframe.example.org/17610810#Work>

**bf:continues** <http://bibframe.example.org/17610810#Work780-31> .

<http://bibframe.example.org/15297773#Work>

**bf:continuedBy** <http://bibframe.example.org/15297773#Work785-42> .

<http://bibframe.example.org/17610810#Work

**bf:hasSeries** <http://bibframe.example.org/17610810#Work830-32>



# Non-Roman script

<http://bibframe.example.org/19583382#Instance>

bf:provisionActivityStatement

"Beijing Shi : Jie fang jun wen yi chu ban she",

"北京市：解放军文艺出版社"@zh-hani ;

bf:title

[ a bf>Title ;

rdfs:label "中国军事文学年选."@zh-hani ;

bf:mainTitle "中国军事文学年选"@zh-hani ],

[ a bf>Title ;

rdfs:label "Zhongguo jun shi wen xue nian xuan." ;

bf:mainTitle "Zhongguo jun shi wen xue nian xuan" ]

# QUESTIONS?

You've got to have some.