

Introduction to Linked Data

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Learning Outcomes

Learn why linked data is useful

Understand linked data terminology and best practices

Become familiar with Linked Data in Fedora

Linked Data Overview

“...is a method of publishing structured data so that it can be interlinked and become more useful through semantic queries ... This enables data from different sources to be connected and queried.”

- https://en.wikipedia.org/wiki/Linked_data

- Helps to dismantle silos
- Human and machine readable
- Graph based representation of data

Linked Data Ingredients

- Resource Description Framework (RDF)
- Uniform Resource Identifiers (URI) as Subjects/Objects
- HTTP

Resource Description Framework - RDF

A set of W3C specifications.

RDF adopted as a specification in 1999

RDF 1.0 published in 2004

RDF 1.1 published in 2014

*Abstract data model that expresses relationships
resources have with data or other resources.*

Resource Description Framework - RDF

- Structure of an RDF statement (a.k.a triple):

<subject> *<predicate>* *<object>*

- *<subject>* is an entity or thing
- *<predicate>* represents a relationship between subject and object
- *<object>* of a statement may be an entity or literal (string)

Ontologies

Ontologies are formal specifications of shared conceptualizations

Well-known ontologies:

- RDF, RDFS, Dublin Core, FOAF, ORE, schema.org, SKOS, EDM, OWL

Fedora4 community ontology:

- [PCDM](#) (Samvera + Islandora)

Less well-known ontologies:

- BIBFRAME, Fedora, W.I.P MODS/MADS, Darwincore-SW

Vocabularies

Controlled list of terms, each with a URI.

Building blocks that you can use to make an ontology or describe data with.

Examples: [LOC Name Authority File and Subject Headings](#)

Well-known vocabularies

- Library of Congress
 - Subject Headings
 - Names
 - MARC Relators
- Virtual International Authority File (VIAF)
- Getty vocabularies (AAT, ULAN, TGN)
- GeoNames
- DBpedia

Linked Data “Rules”

- 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, using the standards (RDF*, SPARQL)
- Include links to other URIs, so that they can discover more things.

Linked Data Platform

- Provides some terminology
 - RDFSource
 - NonRDFSources (binaries)
 - Container
- Defines a set of rules for HTTP operations on a web resource to provide structure for how to work with linked data on the web
- How servers and clients can expect to interact
- Fedora follows this specification

Data Modeling with PCDM

Modeling Examples

- **Books with multiple editions**
- **Books with internal structure**
- **Books with annotations at the page, character¹, or pixel level¹**
- Image collections³
- Images with annotations at the pixel level¹
- Serials
- Audio or video with transcriptions or other annotations on time slices^{1,2}

¹ <https://www.w3.org/TR/annotation-model/#fragment-selector>

² <https://www.w3.org/TR/media-frags/>

³ <http://iiif.io/api/presentation/2.1/>

Toolkits - Modeling & Interoperability

PCDM - <https://github.com/duraspace/pcdm/wiki> & <http://pcdm.org>

Rights Metadata recommendations - <https://wiki.duraspace.org/display/hydra/Rights+Metadata+Recommendation>

Technical Metadata recommendations - <https://wiki.duraspace.org/display/hydra/Technical+Metadata+Application+Profile>

File use recommendations - <https://wiki.duraspace.org/display/hydra/File+Use+Vocabulary>

Web Annotations - <https://www.w3.org/annotation/>

IIIF - <http://iiif.io/>

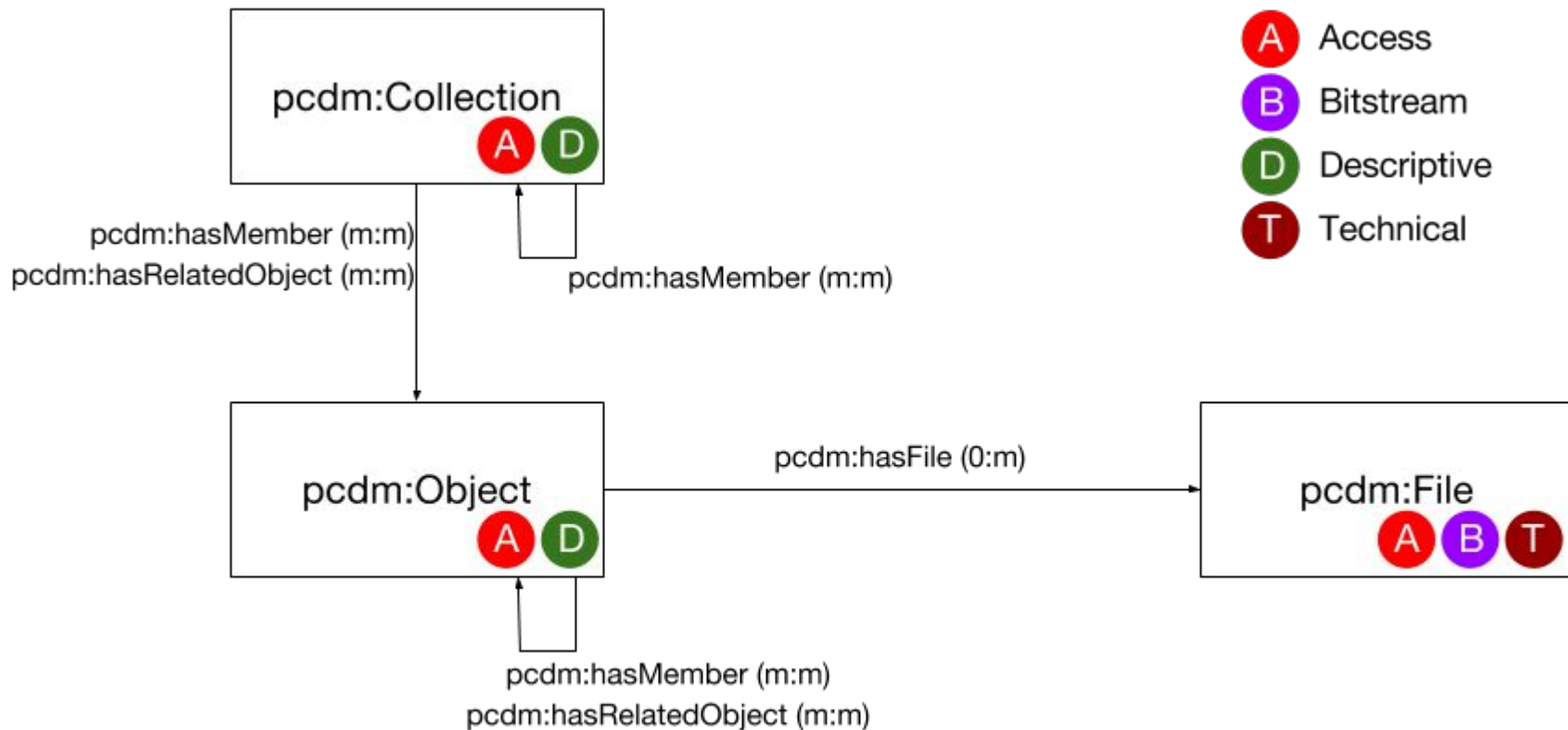
LDP - <https://github.com/projecthydra/hydra/wiki/LDP-Containers-for-the-perplexed>

History



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Portland Common Data Model



pcdm:fileSets

FileSets encapsulate groups of related Files, e.g. a master file and its derivatives.

A FileSet represents the Object it is a member of:

- A FileSet including a PDF would be attached directly to the book Object
- A FileSet including a TIFF of a page would be attached to the Object representing that page.

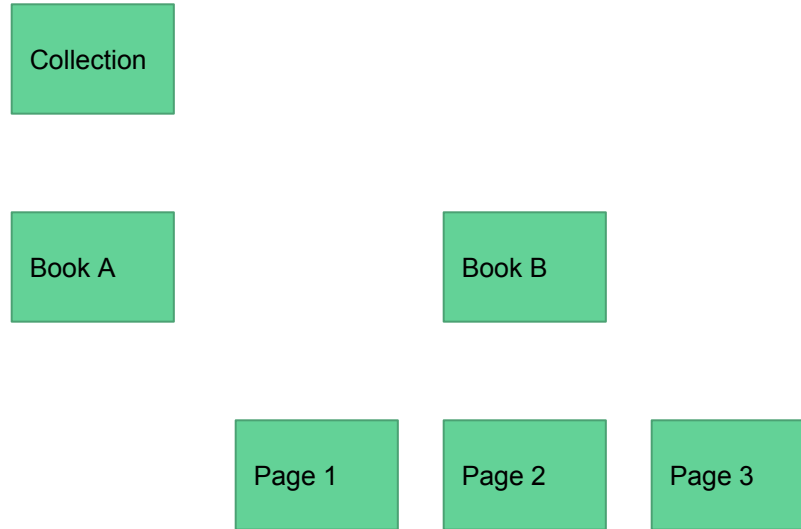
Book Modeling Example

Collection

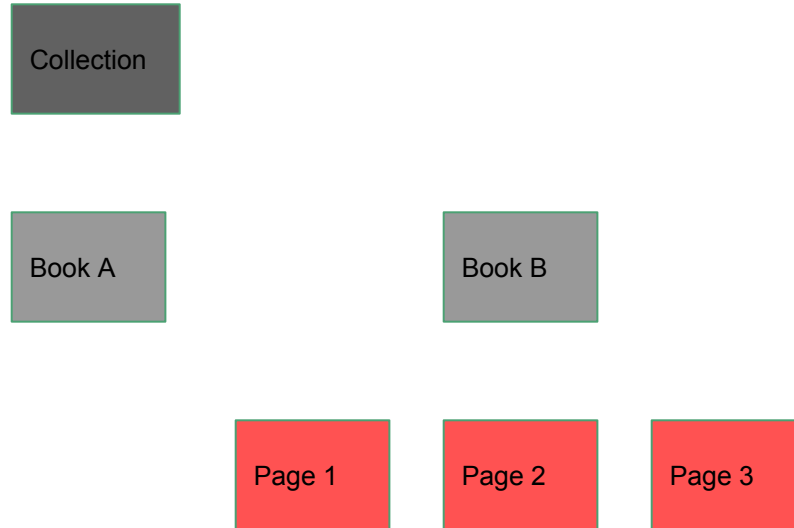
Book A

Book B

Book Modeling Example



Book Modeling Example

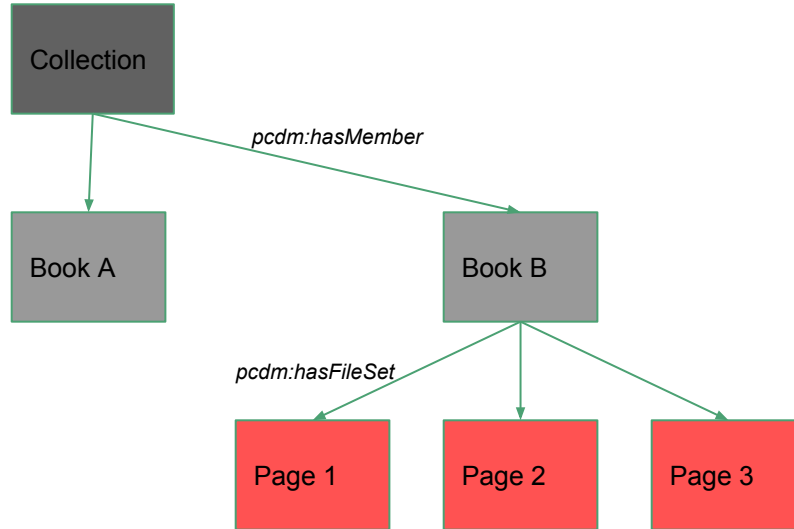


pcdm:Collection

pcdm:Object

pcdm:FileSet

Book Modeling Example

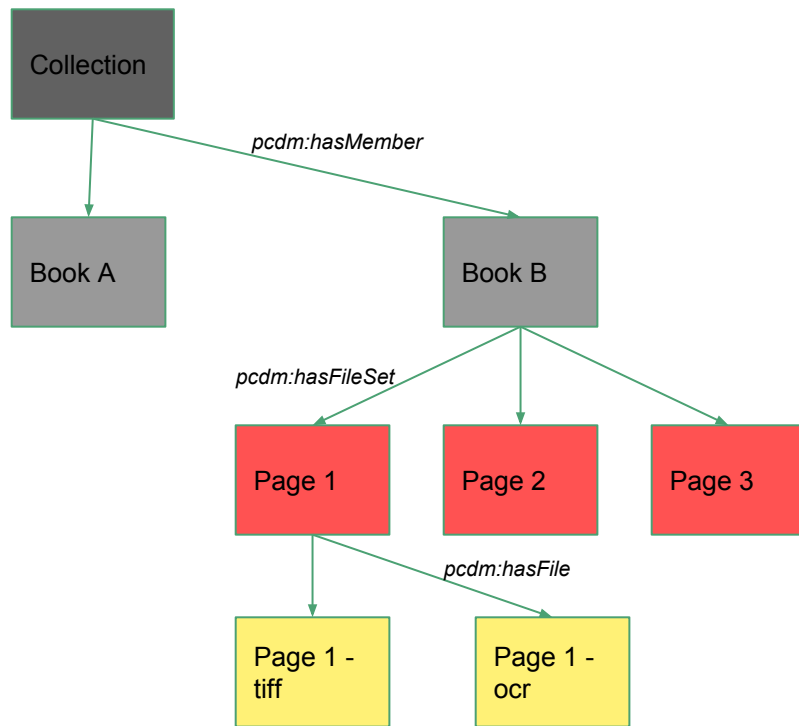


pcdm:Collection

pcdm:Object

pcdm:FileSet

Book Modeling Example



pcdm:Collection

pcdm:Object

pcdm:FileSet

pcdm:File

Hands-On!

Book Modeling Example - Structure

At top-level, create following Containers:

- BookB: <http://localhost:8080/fcrepo/rest/BookB>
- Page1: <http://localhost:8080/fcrepo/rest/Page1>

..and Binaries:

- Page1.tif: <http://localhost:8080/fcrepo/rest/Page1.tif>
- Page1.txt: <http://localhost:8080/fcrepo/rest/Page1.txt>

“BookB” - Types & Relationships

<http://localhost:8080/fcrepo/rest/BookB>

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

PREFIX pcdm: <http://pcdm.org/models#>

INSERT {

 </fcrepo/rest/BookB> rdf:type pcdm:Object .

 </fcrepo/rest/BookB> pcdm:hasFileSet </fcrepo/rest/Page1> .

} WHERE { }

“BookB” - Types & Relationships - Tarser 1

<http://localhost:8080/fcrepo/rest/BookB>

PREFIX pcdm: <http://pcdm.org/models#>

INSERT {

</fcrepo/rest/BookB> a pcdm:Object .

</fcrepo/rest/BookB> pcdm:hasFileSet </fcrepo/rest/Page1> .

} WHERE { }

“BookB” - Types & Relationships - Tarser 2

<http://localhost:8080/fcrepo/rest/BookB>

PREFIX pcdm: <http://pcdm.org/models#>

INSERT {

 <> a pcdm:Object .

 <> pcdm:hasFileSet </fcrepo/rest/Page1> .

} WHERE {}

“BookB” - Types & Relationships - Tarser 3

<http://localhost:8080/fcrepo/rest/BookB>

```
PREFIX pcdm: <http://pcdm.org/models#>
```

```
INSERT {
```

```
    <> a pcdm:Object ;
```

```
    pcdm:hasFileSet </fcrepo/rest/Page1> .
```

```
} WHERE { }
```

“Page1” - Types & Relationships

<http://localhost:8080/fcrepo/rest/Page1>

PREFIX pcdm: <http://pcdm.org/models#>

INSERT {

 <> a pcdm:FileSet ;

 pcdm:hasFile </fcrepo/rest/Page1.tif>, </fcrepo/rest/Page1.txt> .

} WHERE { }

“Page1.tif” - Types & Relationships

<http://localhost:8080/fcrepo/rest/Page1.tif>

PREFIX pcdm: <http://pcdm.org/models#>

```
INSERT {  
    <> a pcdm:File .  
} WHERE { }
```

Success!
