Library Linked Data Webinar 14 September 2021

On the way to Library Linked Data: The view from OCLC Research

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Lead Software Engineer

OCLC Research

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Principal Software Engineer

OCLC Research

Discussion Topics

works in

OCLC

OCLC Linked Data Research Projects

has research focus

Linked Data

Data Model

follows design principles

facilitates

has project

has ontology

collaborated on

Project Partners

part of

OCLC Research

works in

uses platform

CONTENTdm Linked Data Pilot

Wikibase

Discovery Tool

created for

has findings

created for

Subject Matter Expert Tool

Lessons Learned

part of

OCLC CDM Product Team

collaborated on

ABOUT OCLC RESEARCH

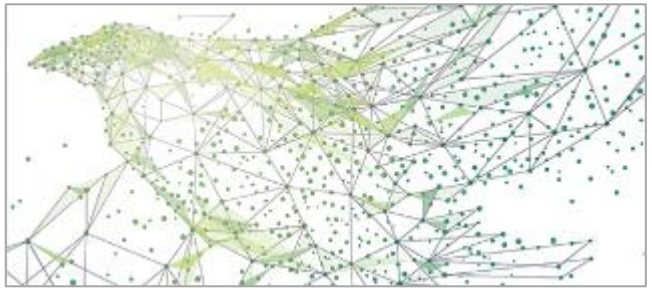
OCLC’s Research Division

- is a **community resource** for the research-driven advancement of libraries and archives,
- provides **advanced development and consultation** for the teams that create and maintain OCLC’s products, and
- enhances OCLC's **member and partner engagement** to mobilize the community around shared concerns.

OCLC Research Areas

The Collective Collection

Providing evidence and models that help libraries optimize access to collections.

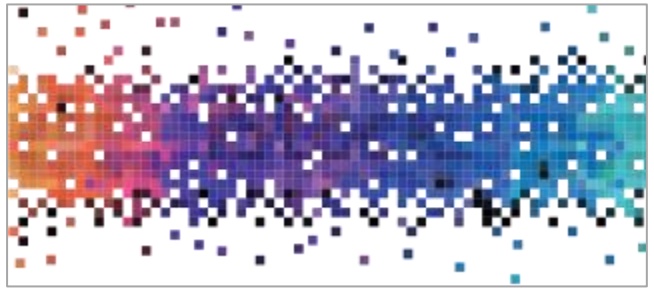


Data Science

Analyzing bibliographic data to derive new meaning, insights, and services.

Libraries as Community Catalysts

Equipping library staff to respond to ever-evolving community needs.

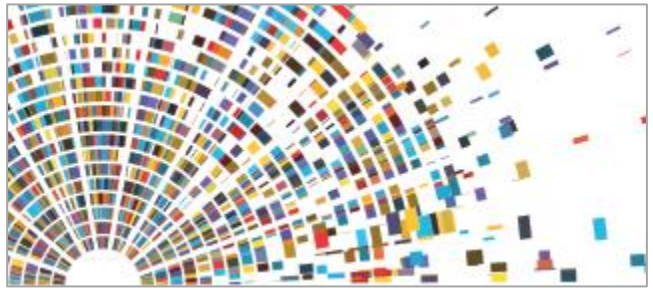


Research Collections & Support

Exploring new modes of researcher support and collection management.

User Research

Studying trends in consumer technology and learning environments and sharing evidence.



Library as Enterprise

Exploring how libraries organize internally, engage with their community, and act collectively.

For more information about the people and programs of OCLC Research:

www.oclc.org/research/

THE LINKED DATA VALUE PROPOSITION

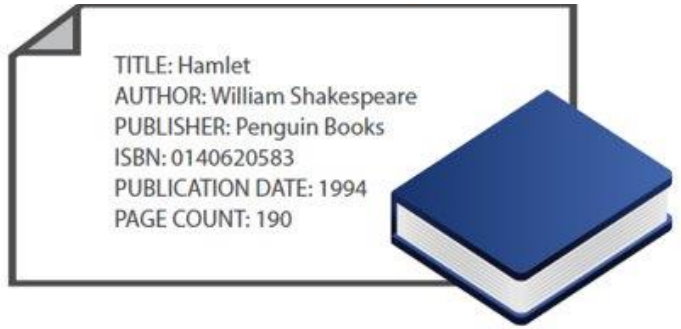
“Linked Data” refers to …

a set of best practices for publishing structured data on the Web.

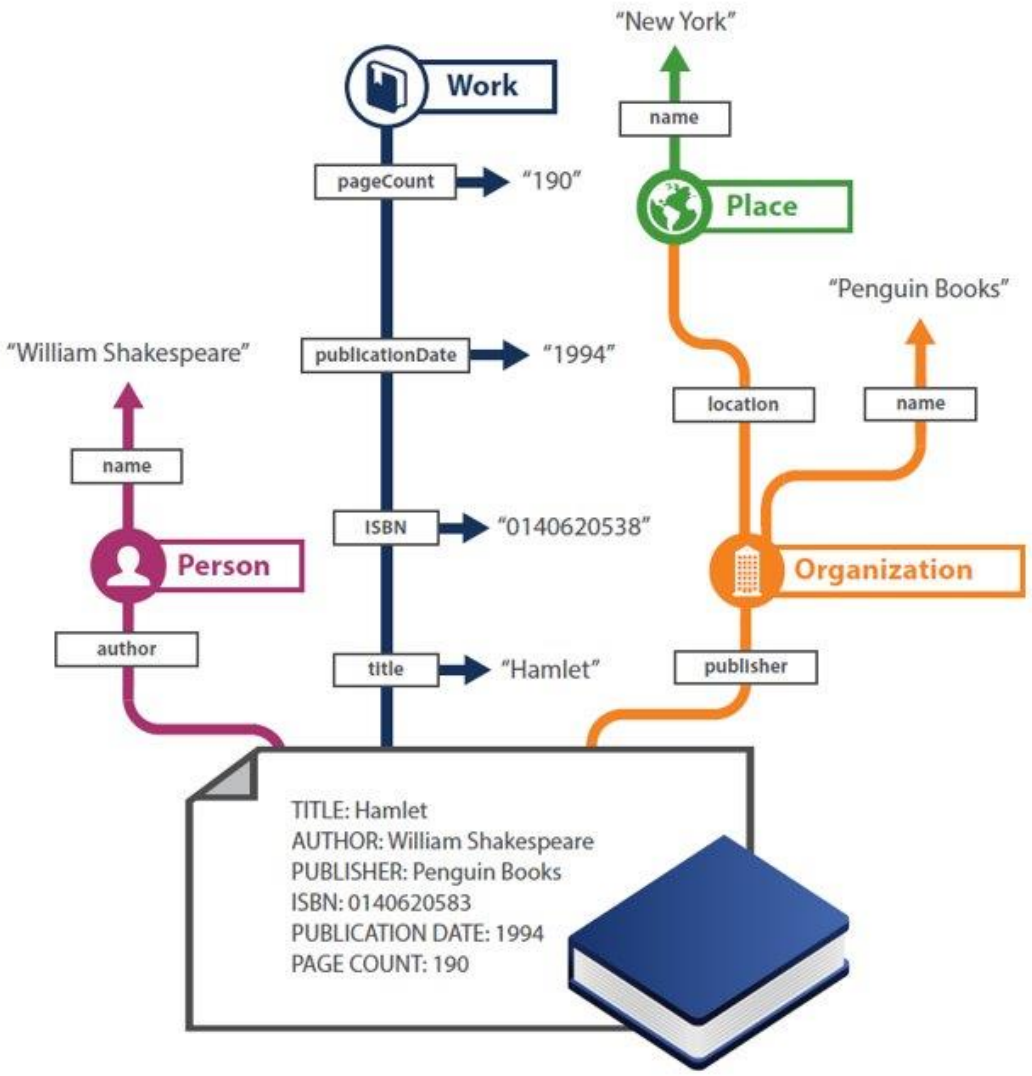
1. Use URIs as names for things
2. Use HTTP URIs so that people can look up those names.
3. When someone looks up a URI, provide useful information.
4. Include links to other URIs so that they can discover more things.

https://www.w3.org/wiki/LinkedData

Moving from records to entities



Moving from records to entities



Linked data models reflect common-sense and in the long-term can save money

- Describe real world relationships between things
- Evolve and improve the data model inexpensively
- Avoid complex and inefficient database processes
- Obtain new skill sets and software frameworks

Quality issues with legacy data can be found and fixed when viewed as linked data

- Reveal problematic data using identifiers and rules
- Set data constraints on the model's classes and properties
- A relational database problem can become a linked data problem unless completeness and quality is addressed
- Significant resources are needed for data modeling

Attainable, incremental Linked Data projects produce solid results and lead to long-term goals.

- Build and test manageable subsets of the complete ontology in a graph-based data model
- While iterating, work towards a more comprehensive longer-term objective

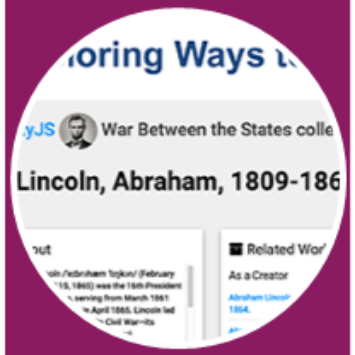
Recommended reading: “Overcoming Resistance to Technology Change: A Linked Data Perspective”, Tim Williams, UCB Biosciences Inc., PhUSE EU Connect 2018

LINKED DATA RESEARCH AT OCLC

A decade with Linked Data

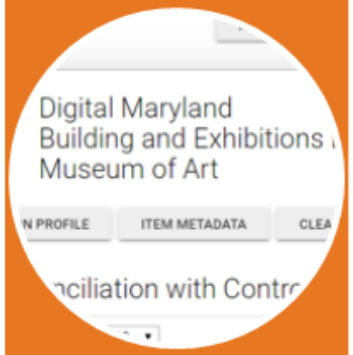
oc.lc/linkeddataresearch

Publish linked data - FAST, VIAF, WorldCat (2009 -)



EntityJS Research Project (2013)

Person Entity Lookup Pilot (2014)



CONTENTdm Metadata Refinery (2015-16)

Project Passage (2017-18)

CONTENTdm Linked Data Pilot (2019-20)

Shared Entity Management Infrastructure (2020-21)

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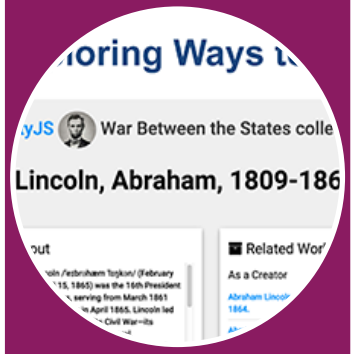
Shared Entity Management Infrastructure (2020-21)

VIAF, FAST, and WorldCat: Publish Linked Data on the web with a UI, API, and downloadable datasets

Publish linked data - FAST, VIAF, WorldCat (2009 -)



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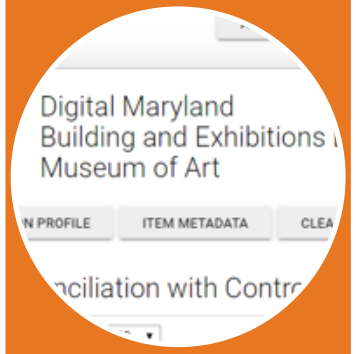


CONTENTdm Metadata Refinery (2015-16)

Project Passage (2017-18)

CONTENTdm Linked Data Pilot (2019-20)

Shared Entity Management Infrastructure (2020-21)

EntityJS: Explore how Linked Data improves discovery of related entities
Person Entity Lookup Pilot: Test use cases and interoperability for Linked Data as a web service
CONTENTdm Metadata Refinery: Evaluate shared tools to manage the Linked Data workflow

Publish linked data - FAST, VIAF, WorldCat (2009 -)

EntityJS Research Project (2013)

Person Entity Lookup Pilot (2014)

CONTENTdm Metadata Refinery (2015-16)

Project Passage (2017-18)

CONTENTdm Linked Data Pilot (2019-20)

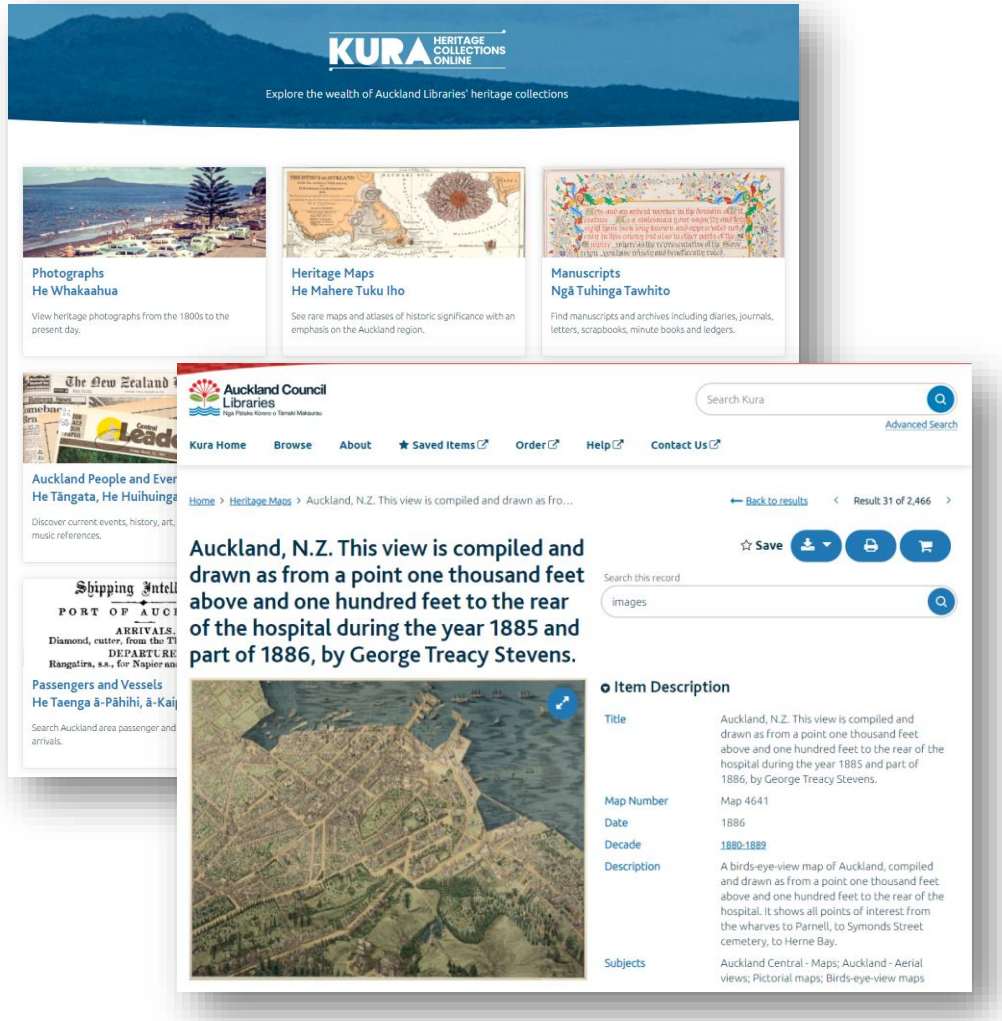
Shared Entity Management Infrastructure (2020-21)

Project Passage: Think big... Build a complete system based on Linked Data
CONTENTdm Linked Data Pilot: Think "long tail". Attend to the issues around the special and unique.
Entity Management: Build a full entity management infrastructure at global scale.

ABOUT THE CONTENTDM LINKED DATA PILOT PROJECT

What is CONTENTdm?

- OCLC's digital content management service.
- CONTENTdm builds and showcases digital collections.
- CONTENTdm securely manages digital materials in a cloud-based system.

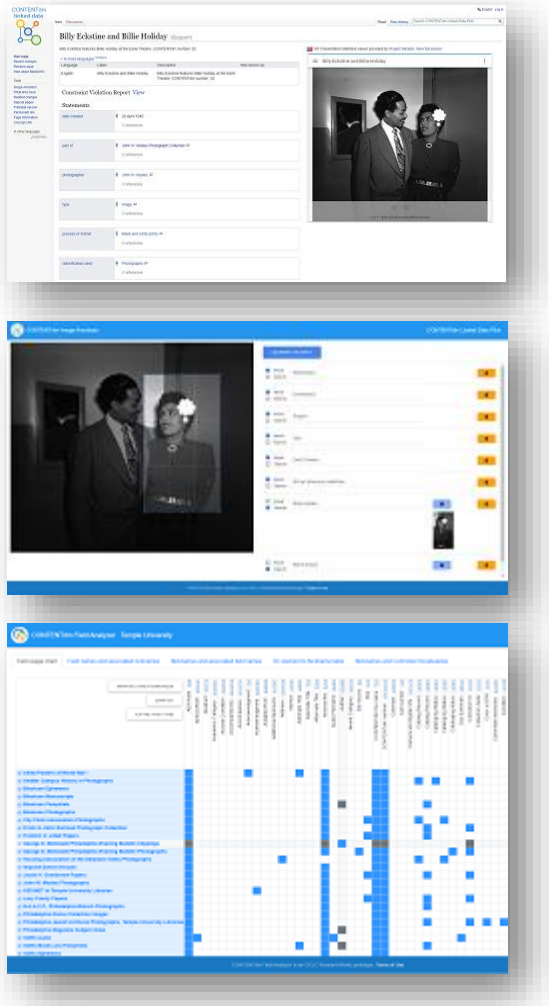


https://kura.aucklandlibraries.govt.nz/

Research Areas of Interest

oc.lc/cdmld

1. Divergent practice and collection assessment
2. Shared data models for diverse collections and institutions
3. Automated data processing and human attention
4. Tools for subject matter experts
5. Discovery tools to reveal hidden connections
6. The Linked Data paradigm shift



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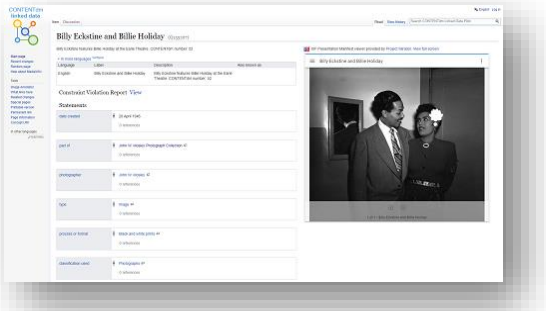


BUILDING A LINKED DATA MODEL

OCLC

Developing a Data Model

- CONTENTdm metadata is very heterogeneous, when comparing different institution's practices.
- There can be variability in vocabularies and data dictionaries even for different collections at the same institution.
- A single data model was needed for the Linked Data pilot project, as a single system would manage metadata for all institutions and collections.

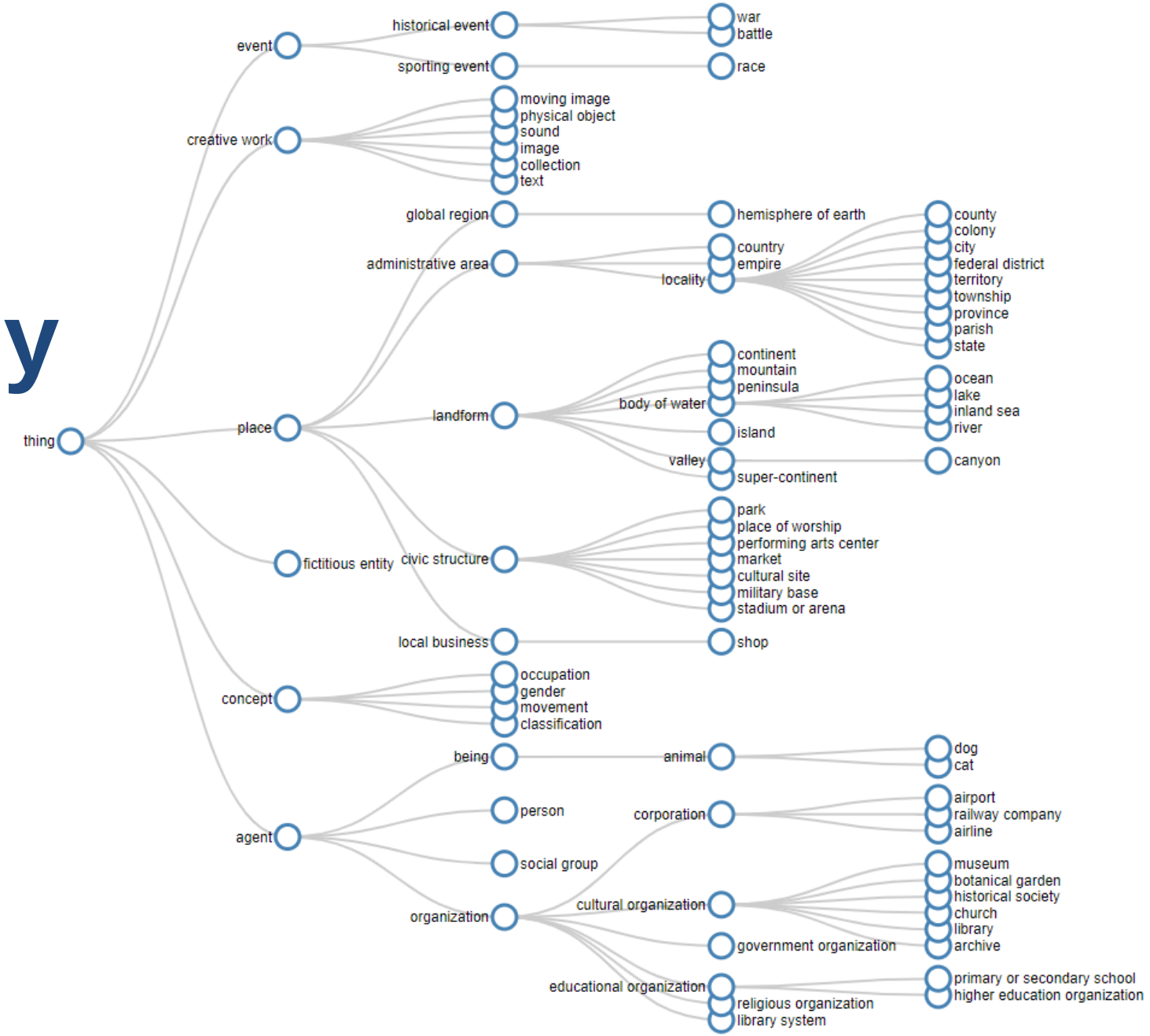
Developing a Data Model

- The pilot project tested a hypothesis:
  - through sampling current CONTENTdm metadata, and looking for patterns and convergence, a model could be driven by data and avoid speculation.
- Properties and Classes in the data model were associated with their counterparts in other ontologies and vocabularies, to support transformation, export, and linking.

Developing a Data Model

- Metadata analysis began with an inventory of CONTENTdm mapping of local data elements to Dublin Core.
- The most frequently encountered classes and relationships were identified.
- 13 million records were analyzed to find the most widely-used properties for creative works.
- The most frequently used terms were extracted to build an initial class taxonomy for creative works.
- Collaboration with project partners and colleagues revised this method.

CONTENTdm Data Model Class Hierarchy



WIKIBASE AS A LINKED DATA PLATFORM

OCLC

Why Wikibase?

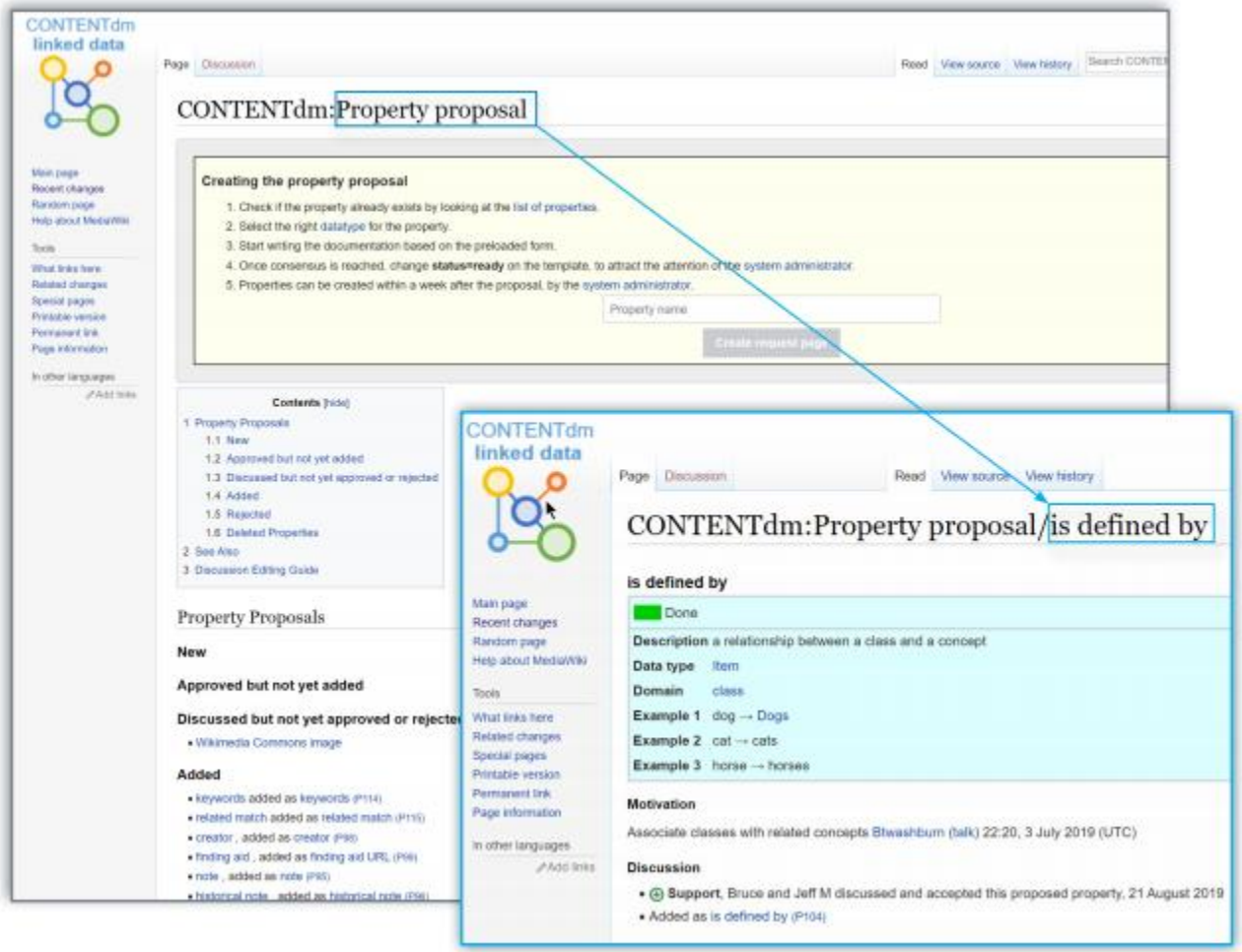
- OCLC Research is very familiar with the Wikibase ecosystem.
- Wikibase is well-suited for the Linked Data investigations for the CONTENTdm pilot project.
- Using Wikibase helped OCLC Research and the project participants dive right in.

Why not just use Wikidata?

- Testing new properties and classes, but the short time-frame of the pilot didn’t allow for the time needed to have these proposed, reviewed, and accepted in Wikidata.
- Participants would not have time to review and approve the metadata quality or be able to commit to maintaining it in Wikidata after the pilot project was over.

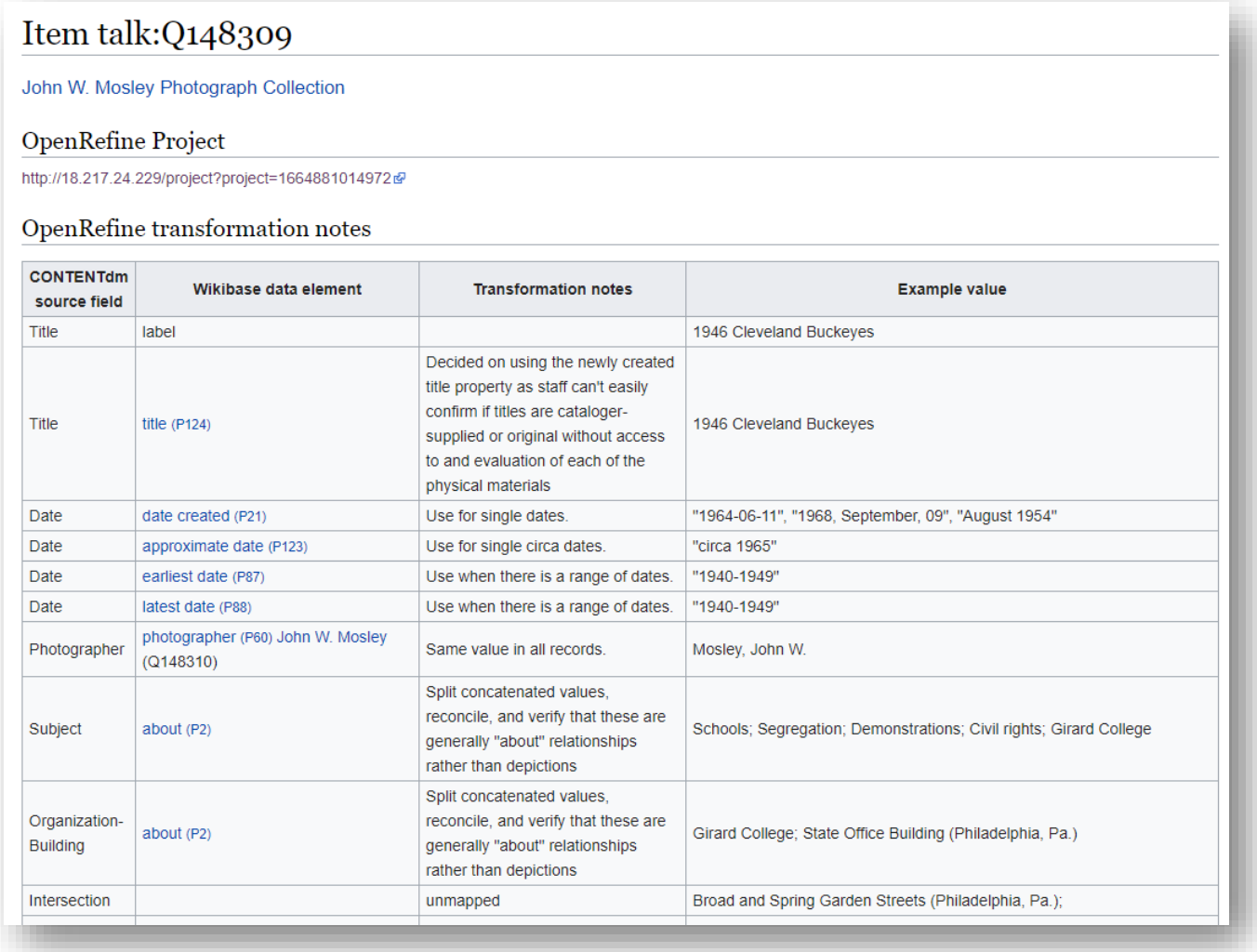
Managing the Data Model in Wikibase

- Applies a workflow used in Wikidata.
- We reused the Wikidata templates for new Class and Property proposals.
- Even with a very small team, it was beneficial to establish a review practice and to remind ourselves of prior decisions.



Talk Pages for Managing Collections

- Leveraged a built-in Wikibase feature.
- A useful tool for communication and collaboration with partners.
- Helped us track differences and similarities across collections.



Item talk:Q148309

John W. Mosley Photograph Collection

OpenRefine Project

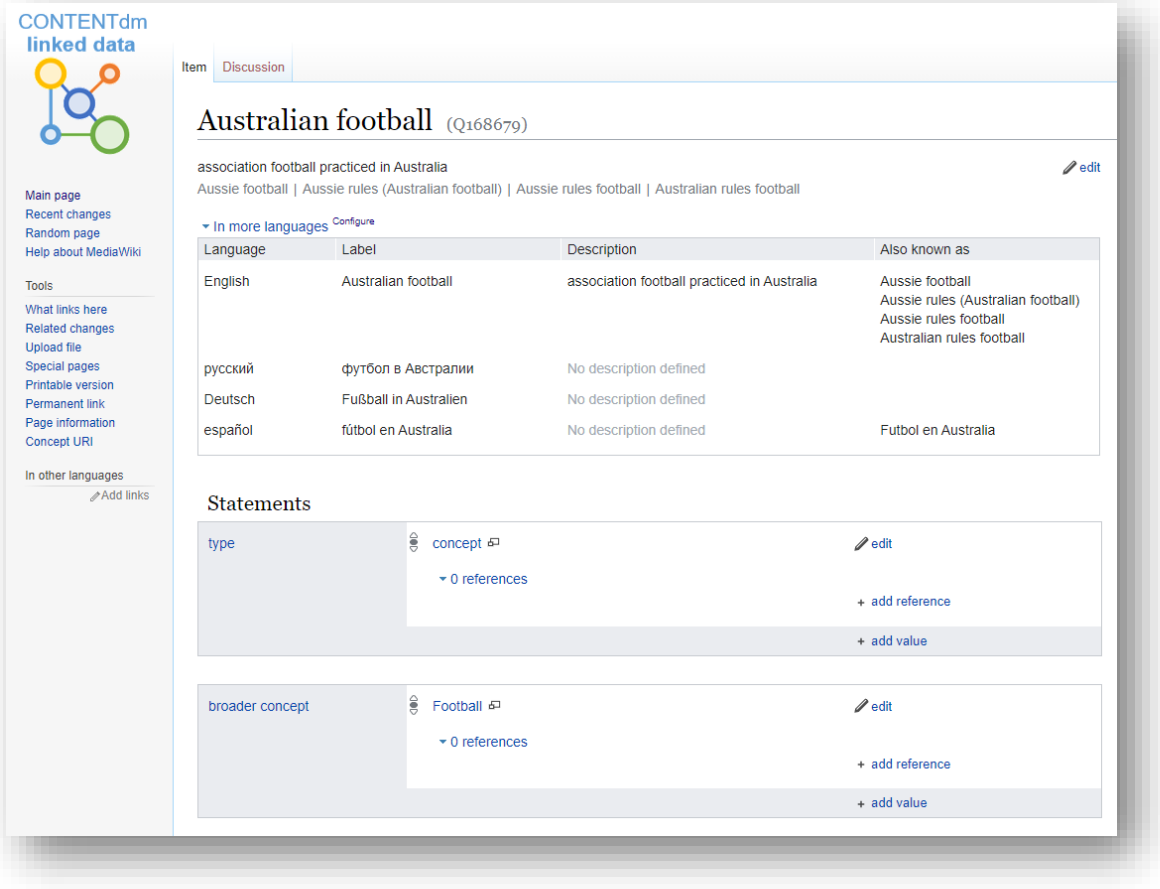
http://18.217.24.229/project?project=1664881014972

OpenRefine transformation notes

CONTENTdm source field	Wikibase data element	Transformation notes	Example value
Title	label		1946 Cleveland Buckeyes
Title	title (P124)	Decided on using the newly created title property as staff can't easily confirm if titles are cataloger-supplied or original without access to and evaluation of each of the physical materials	1946 Cleveland Buckeyes
Date	date created (P21)	Use for single dates.	"1964-06-11", "1968, September, 09", "August 1954"
Date	approximate date (P123)	Use for single circa dates.	"circa 1965"
Date	earliest date (P87)	Use when there is a range of dates.	"1940-1949"
Date	latest date (P88)	Use when there is a range of dates.	"1940-1949"
Photographer	photographer (P60) John W. Mosley (Q148310)	Same value in all records.	Mosley, John W.
Subject	about (P2)	Split concatenated values, reconcile, and verify that these are generally "about" relationships rather than depictions	Schools; Segregation; Demonstrations; Civil rights; Girard College
Organization-Building	about (P2)	Split concatenated values, reconcile, and verify that these are generally "about" relationships rather than depictions	Girard College; State Office Building (Philadelphia, Pa.)
Intersection		unmapped	Broad and Spring Garden Streets (Philadelphia, Pa.);

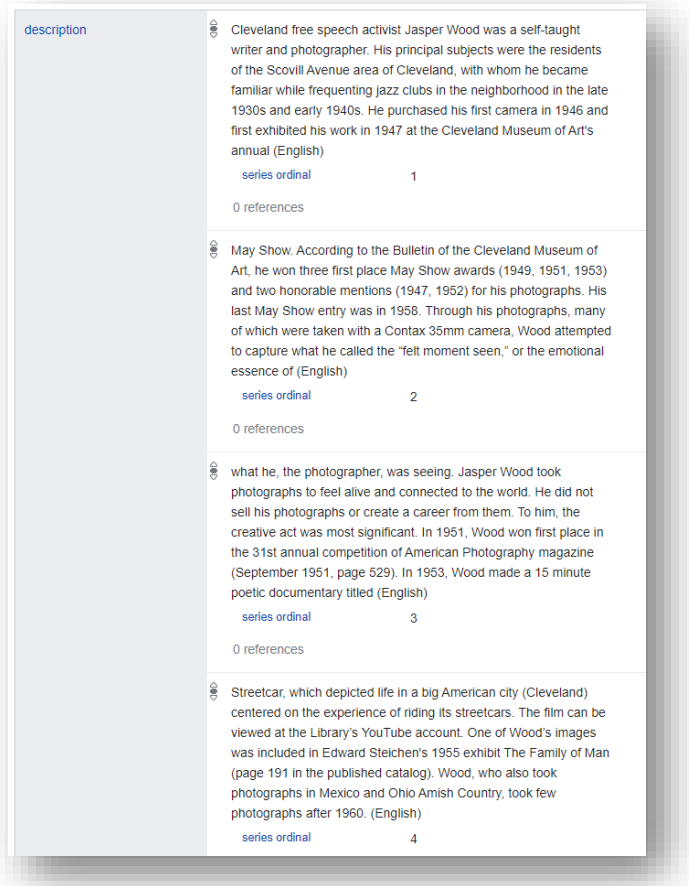
Implementing Authority Control

- CONTENTdm is a traditional, record-oriented system, with authority control based on the use of heading strings.
- Varying cataloging practices and sources can create discovery obstacles if searches do not use the preferred form of the heading.
- Wikibase takes multi-lingual data seriously and allows any number of variant forms to find matches, with an assigned unique identifier serving as the key.



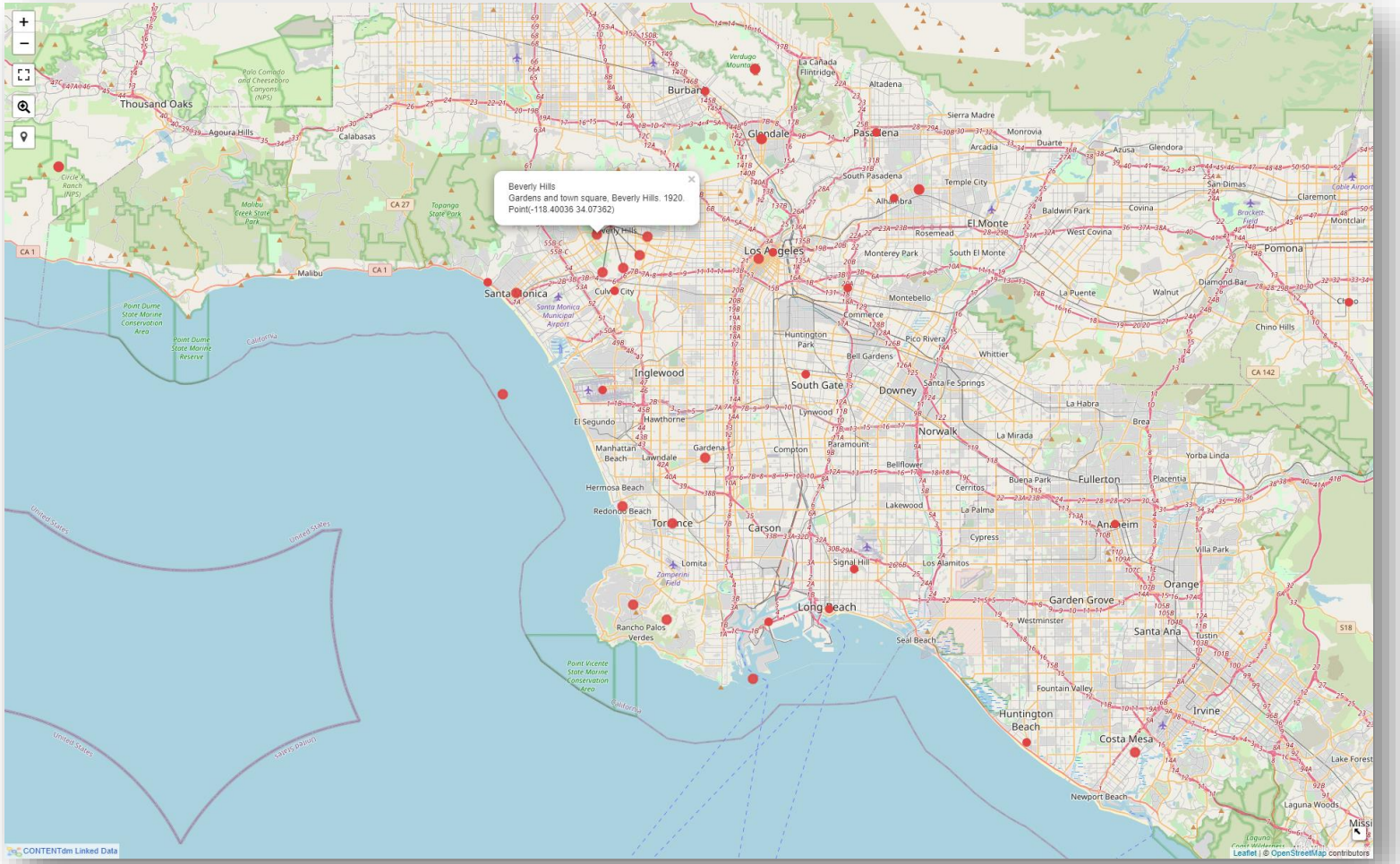
Decreasing cataloging inefficiencies, increasing descriptive quality

- In CONTENTdm, information about a person related to a work needs to be repeated in every record related to that person.
- If the description changes, all the records need to be updated.
- In Wikibase, entities for works and related things are maintained separately.
- The description of the person can be entered and maintained in one entity.
- This efficiency gain could encourage richer descriptions.



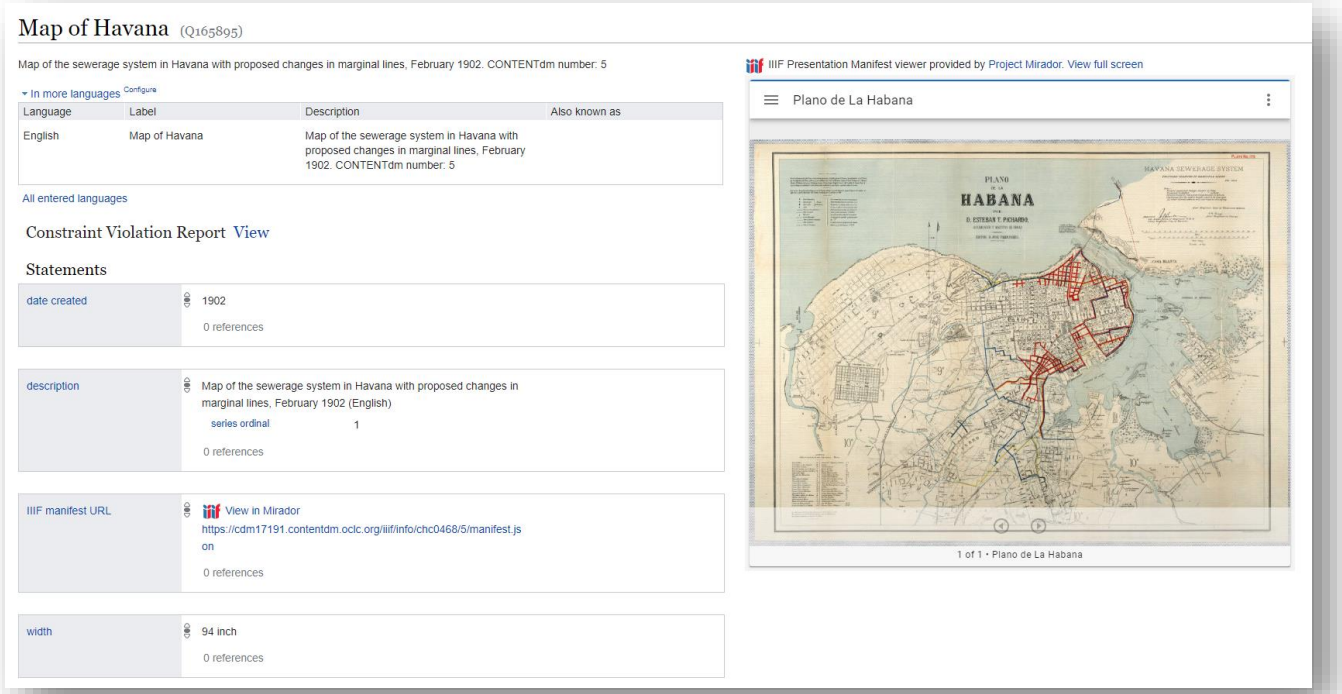
Generating Data Visualizations

- The triplestore that maintains a linked data representation of Wikibase can be queried using SPARQL.
- The SPARQL Query UI provided by the Wikibase ecosystem makes it easy to query and visualize connections that would have been difficult or infeasible in a traditional record-oriented system.



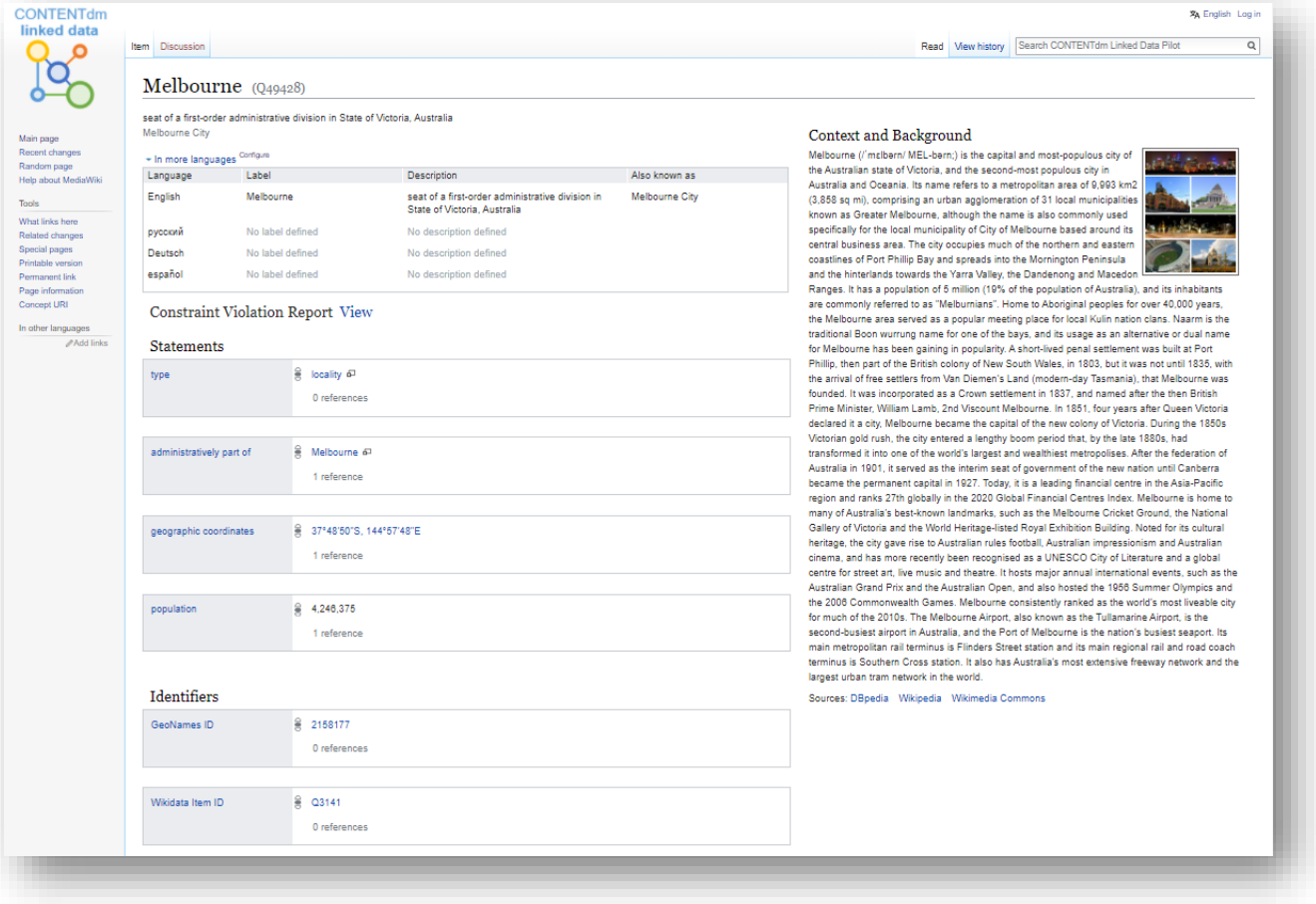
Adding the Mirador Viewer

- The Wikibase ecosystem has a “Gadget” extension to develop and add custom features to the user interface.
- CONTENTdm items all have IIIF Presentation Manifests.
- Mirador is an image viewer that uses IIIF Manifests to present images and metadata.
- The Gadget can embed the Mirador viewer, making the entity view more dynamic and connected to digital content.



Showing Contextual Information

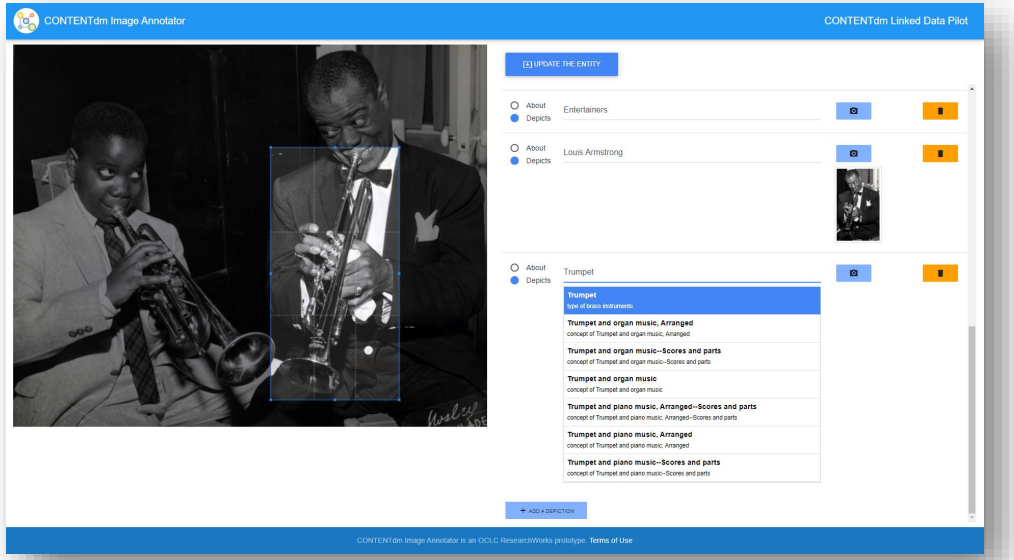
- A key Linked Data value proposition: link to related things in other systems.
- Pilot project entities sometimes have related identifiers for Wikidata entities.
- A Gadget, combined with a server-based application, uses Wikidata identifiers to find content in Wikipedia and supplements the entity display with contextual descriptions and images.



TOOLS FOR SUBJECT MATTER EXPERTS

Tools for Subject Matter Experts

- Differentiating between what a work is “about” and what it “depicts”.
- Testing Wikibase as a platform for tool development.
- Help subject matter experts correct and supplement transformed metadata.



Louis Armstrong and Jake Armstrong (Q155370)

Daniel Louis "Satchmo" Armstrong with his son, Jake Armstrong, at the Academy of Music. edit

In more languages Configure

Language	Label	Description	Also known as
English	Louis Armstrong and Jake Armstrong	Daniel Louis "Satchmo" Armstrong with his son, Jake Armstrong, at the Academy of Music.	

Statements

date created	22 March 1956 0 references + add reference	edit
	+ add value	
part of	John W. Mosley Photograph Collection 0 references + add reference	edit
	+ add value	
photographer	John W. Mosley 0 references + add reference	edit
	+ add value	
type	image 0 references + add reference	edit
	+ add value	
process or format	Black and white prints	edit

IIIF Presentation Manifest viewer provided by Project Mirador. View full screen

Main page
Recent changes
Random page
Help about MediaWiki

Tools
Image Annotator
What links here
Related changes
Upload file
Special pages
Printable version
Permanent link
Page information
Concept URI

In other languages
Add links

UPDATE THE ENTITY

About / Depicts	Philadelphia	
About / Depicts	Entertainers	
About / Depicts	Musicians	
About / Depicts	Singers	
About / Depicts	Jazz	
About / Depicts	African Americans	
About / Depicts	Composers	
About / Depicts	African American entertainers	
About / Depicts	Jazz musicians	
About / Depicts	African American men	

UPDATE THE ENTITY

About / Depicts	Philadelphia		
About / Depicts	Musicians		
About / Depicts	Singers		
About / Depicts	Jazz		
About / Depicts	African Americans		
About / Depicts	Composers		
About / Depicts	African American entertainers		
About / Depicts	Jazz musicians		
About / Depicts	African American men		
About / Depicts	African American pioneers		

UPDATE THE ENTITY

About / Depicts	Jazz musicians	✓	🗑
About / Depicts	African American men	✓	🗑
About / Depicts	African American pioneers		🗑
About / Depicts	African American icons		🗑
About / Depicts	Composers--United States		🗑
About / Depicts	Innovators		🗑
About / Depicts	Entertainers	✓	🗑
About / Depicts	Louis Armstrong	✓	🗑

+ ADD A DEPICTION

UPDATE THE ENTITY

About
Depicts
Entertainers

About
Depicts
Louis Armstrong

About
Depicts
Trumpet

Trumpet
type of brass instruments

Trumpet and organ music, Arranged
concept of Trumpet and organ music, Arranged

Trumpet and organ music--Scores and parts
concept of Trumpet and organ music--Scores and parts

Trumpet and organ music
concept of Trumpet and organ music

Trumpet and piano music, Arranged--Scores and parts
concept of Trumpet and piano music, Arranged--Scores and parts

Trumpet and piano music, Arranged
concept of Trumpet and piano music, Arranged

Trumpet and piano music--Scores and parts
concept of Trumpet and piano music--Scores and parts

+ ADD A DEPICTION

UPDATE THE ENTITY

concept of Trumpet and piano music--Scores and parts

ADD A DEPICTION

UPDATE THE ENTITY

About / Depicts	African American entertainers		
About / Depicts	Jazz musicians		
About / Depicts	African American men		
About / Depicts	Entertainers		
About / Depicts	Louis Armstrong		

About / Depicts	Selmer		

Henri Selmer Paris K-Modified B-flat trumpet
trumpet manufactured by Henri Selmer, Paris, in 1954

Henri Selmer Paris
musical instrument company, a predecessor of Conn-Selmer

+ ADD A DEPICTION

depicts

Louis Armstrong

digital representation URL

https://cdm16002.contentdm.oclc.org/digital/iiif/p15037coll17/55/1489,16,1330,2255/full/0/default.jpg

0 references

Henri Selmer Paris K-Modified B-flat trumpet

digital representation URL

https://cdm16002.contentdm.oclc.org/digital/iiif/p15037coll17/55/1560,630,731,1492/full/0/default.jpg

0 references

+ add reference

+ add value

CONTENTdm linked data

Main page
Recent changes
Random page
Help about MediaWiki

Tools
What links here
Related changes
Upload file
Special pages
Printable version
Permanent link
Page information
Concept URI

In other languages
Add links

English | Btwashburn | Talk | Preferences | Watchlist | Contributions | Log out

Item | Discussion | Read | View history | Search CONTENTdm Linked Dat

Henri Selmer Paris K-Modified B-flat trumpet (Q221428)

trumpet manufactured by Henri Selmer, Paris, in 1954 edit

Selmer B♭ trumpet | Selmer trumpet | Selmer K-Modified B♭ trumpet | K-Modified B♭ trumpet | K-Modified trumpet | Selmer B-flat trumpet | Selmer B flat trumpet

In more languages Configure

Language	Label	Description	Also known as
English	Henri Selmer Paris K-Modified B-flat trumpet	trumpet manufactured by Henri Selmer, Paris, in 1954	Selmer B♭ trumpet Selmer trumpet Selmer K-Modified B♭ trum… K-Modified B♭ trumpet K-Modified trumpet Selmer B-flat trumpet Selmer B flat trumpet

Statements

type — physical object — edit
0 references
+ add reference
+ add value

is defined by — Trumpet — edit
0 references
+ add reference
+ add value

material used — Brass — edit
0 references

Image Annotator Findings

"Think Aloud" user study results were mostly positive.

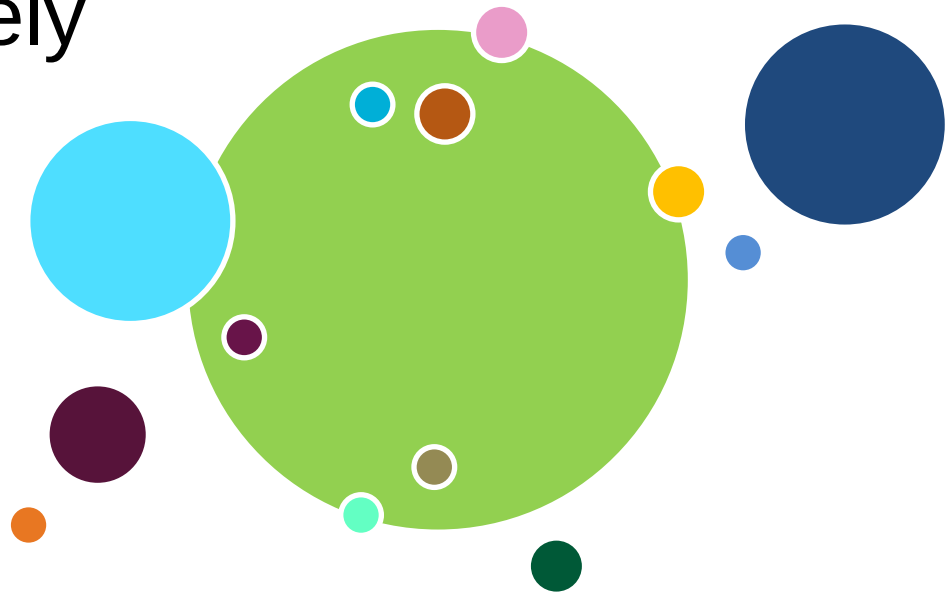
Subject matter expertise adds new access points and enriched relationships.

"About" vs. "Depicts" remains a puzzle.

TOOLS FOR DISCOVERY

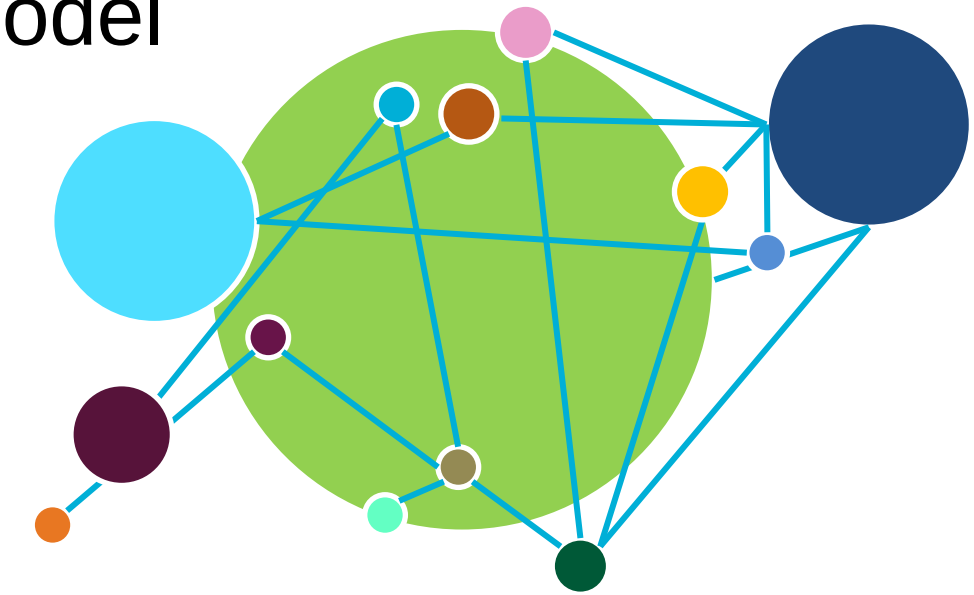
Discovery Tools

- CONTENTdm sites are individuals
- Searched separately, not collectively
- Faceted searching has challenges
- Content overlaps separate sites



Discovery Tools

- Opportunity to test cross-site discovery
- Descriptions use a shared data model
- Browse a graph of linked entities
- Reveal related content from decentralized sources



The CONTENTdm Explorer

- Focus on the most frequently occurring connections.
- See relationships described by different institutions, for different items, in different collections.
- Look for thematically related content.
- Follow links to related entities.

CONTENTdm Linked Data Pilot Explorer

Search for images of people, places, events, and more.

about

classification used

contributor

creator

depicts

part of

- CONTENTdm Transportation Hub 19,050
- George D. McDowell Philadelphia Evening Bulletin Photographs 4,008
- Frank G. Zahn Railroad Photograph Collection 3,906
- Minnesota Streetcar Museum collection 2,353
- A Gallery of Cleveland Photographs 2,015
- Southern California Edison Photographs and Negatives 1,347
- Photographs - Huntington Digital Library 967
- Cleveland Picture Collection 650
- University of Minnesota Duluth, Kathryn A. Martin Library, NEMHC Collections 306
- Floyd and Marion Rinhart Photograph Collection 250
- Jay T. Last Collection of Graphic Arts and Social History 236

< PREVIOUS 4061 to 4080 of 10,000 results for *part_of:Q202314*. NEXT >

East 6th Street 1930 CP06024

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Public Square 1896 CP04167

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Public Square 1905 CP04189

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Carnegie Avenue 1940 CPO5932

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Superior Avenue 1896, CP06853 Centennial Celebration

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Euclid Avenue 1912 CP06258

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CONTENTdm Linked Data Pilot Explorer

Search for images of people, places, events, and more.

strike

about

classification used

depicts

part of

- CONTENTdm Transportation Hub 218
- George D. McDowell Philadelphia Evening Bulletin Photographs 203
- Cleveland Picture Collection 7
- John W. Mosley Photograph Collection 5
- Temple History in Photographs 5
- A Gallery of Cleveland Photographs 2
- Jay T. Last Collection of Graphic Arts and Social History 1
- University of Minnesota Duluth, Kathryn A. Martin Library, NEMHC Collections 1
- Lake County Historical Society 1
- Guillermo "Willy" González Collection 1

photographer

process or format

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Truck brings employees home during P.T.C. walkout

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"Strike Pickets"

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"Trolley strike"

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Crowded train station during the PTC strike

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Crowded train station during the PTC strike

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PTC employees photographed with strike signs

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Attempted strike break

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Workers end strike

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Truck brings employees home during P.T.C. walkout

1 of 1 · Truck brings employees home during P.T.C. walkout

View in CONTENTdm | View in the Pilot Wikibase
IIIF Presentation Manifest viewer provided by Project Mirador

Truck brings employees home during P.T.C. walkout

A man helps several women into the back of a truck at 25th and Hunting Park Avenue. The truck is picking up employees from Budd Manufacturing Company in order to get them home during the P.T.C. walkout. With clipping

part of
CONTENTdm Transportation Hub | George D. McDowell Philadelphia Evening Bulletin Photographs

classification used
Photographs

about
Philadelphia transit strike of 1944 | Philadelphia

depicts
Trucks | Persons

More Like This

Protest against Philadelphia Transportation Company

1 of 1 • Protest against Philadelphia Transportation Company

View in CONTENTdm | View in the Pilot Wikibase
IIIF Presentation Manifest viewer provided by Project Mirador
http://rightsstatements.org/vocab/InC/1.0/

Protest against Philadelphia Transportation Company

A Philadelphia Transit Company (it would eventually become SEPTA) protest in support of African American trolley drivers on November 8, 1943. After the PTC chose eight Black men to drive trolleys in 1944, White transit workers went on strike, stopping the production of weapons and war material and leaving millions of riders stranded. The crisis ended after President Franklin D. Roosevelt sent in 5,000 armed troops to force the strikers back to work, the first time since Reconstruction that the federal government intervened to protect the rights of Black workers.

date created
1943-11-08

height
8 inch

width
10 inch

part of
John W. Mosley Photograph Collection | CONTENTdm Transportation Hub

classification used
Photographs

process or format
Black and white prints

about
Philadelphia | African Americans | African Americans--Civil rights | Civil rights | Transportation | Trolley cars | Civil rights demonstrations | Segregation in transportation | Philadelphia Transportation Company | African Americans--Pennsylvania--Philadelphia | Protests and Social movements

More Like This

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Search for images of people, places, events, and more.

Public Square 1899 CP04179

View in CONTENTdm | View in the Pilot Wikibase
IIIF Presentation Manifest viewer provided by Project Mirador
http://rightsstatements.org/vocab/NoC-US/1.0/

Public Square 1899 CP04179

Showing the crowds surrounding the first cars to reach the downtown section during a street car strike. These cars were on the Euclid Line. The clock at the extreme right housed the store of Wm. Taylor, Son and Co.

date created
1899

height
6.125 inch

width
8.125 inch

part of
Cleveland Picture Collection | CONTENTdm Transportation Hub

classification used
Photographs

depicts
Cleveland

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CONTENTdm Linked Data Pilot Explorer

Search for images of people, places, events, and more.

Streetcars parked on street during a strike

View in CONTENTdm | View in the Pilot Wikibase
IIIF Presentation Manifest viewer provided by Project Mirador
http://rightsstatements.org/vocab/InC/1.0/

Streetcars parked on street during a strike

Written on slide frame: "Tranvías, calle Reina, huelga

part of
CONTENTdm Transportation Hub | Guillermo "Willy" González Collection

classification used
Photographs

process or format
slides (photographs)

about
cable car | Cuba | Havana | General strikes | Pedestrians

depicts
Havana

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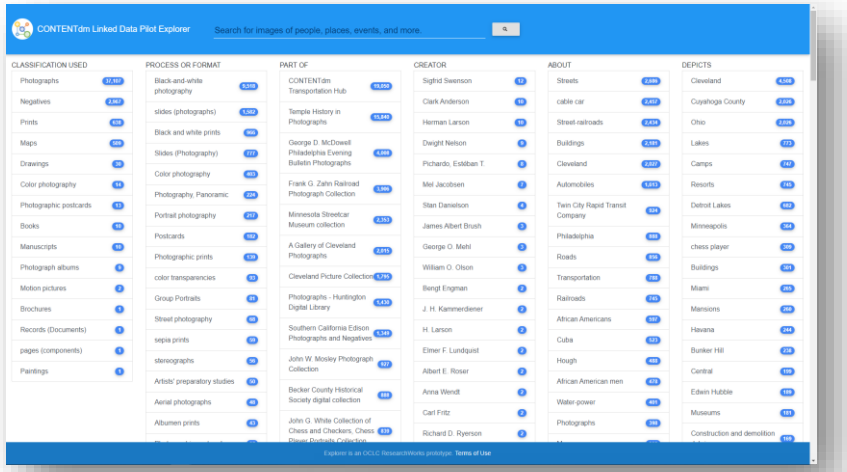
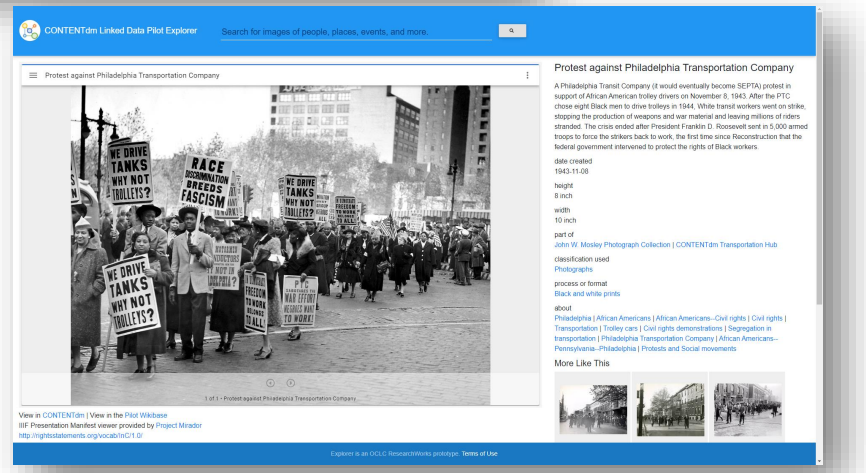
CONTENTdm Explorer Findings

Aggregation adds value.

The 80/20 rule was about right for automated reconciliation.

Completing the 20% will be challenging.





CONTENTdm Linked Data pilot findings

Testing the Linked Data value proposition

A Linked Data strategy can succeed when descriptions use a shared data model, headings are replaced with identifiers for entities, and entities and their relationships are presented in a single discovery system.

Evaluating a shared data model

A solid set of initial classes and properties can be generated from existing standards, and then responsively extended as more data needs arise.

Selecting and transforming metadata

Tools should be shared, and workflows decentralized.

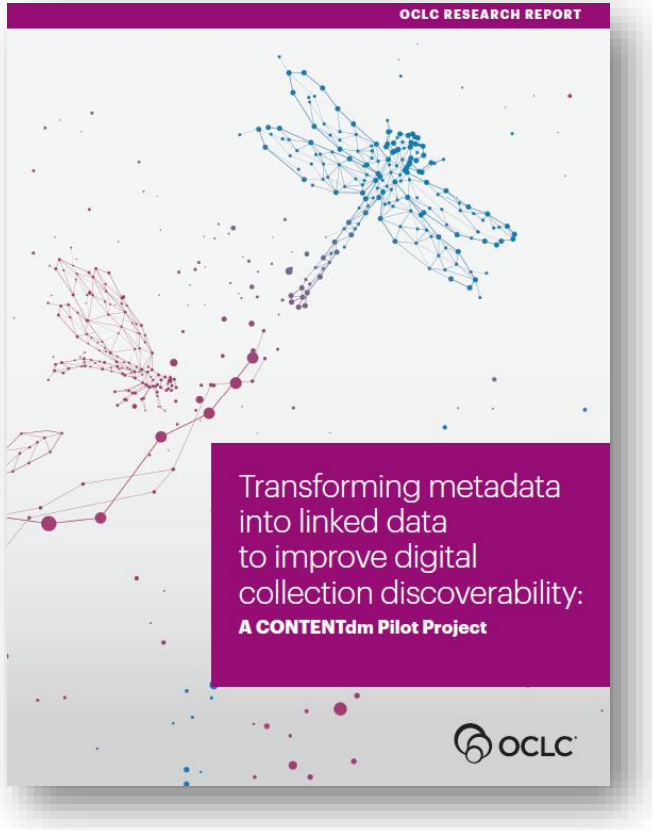
Domain expertise is needed for accurate data transformations.

Continuing the journey to Linked Data

Substantial resource commitments are required.

Benefits accrue long before the journey is completed.

It's a paradigm shift; takes time and long-term strategies.

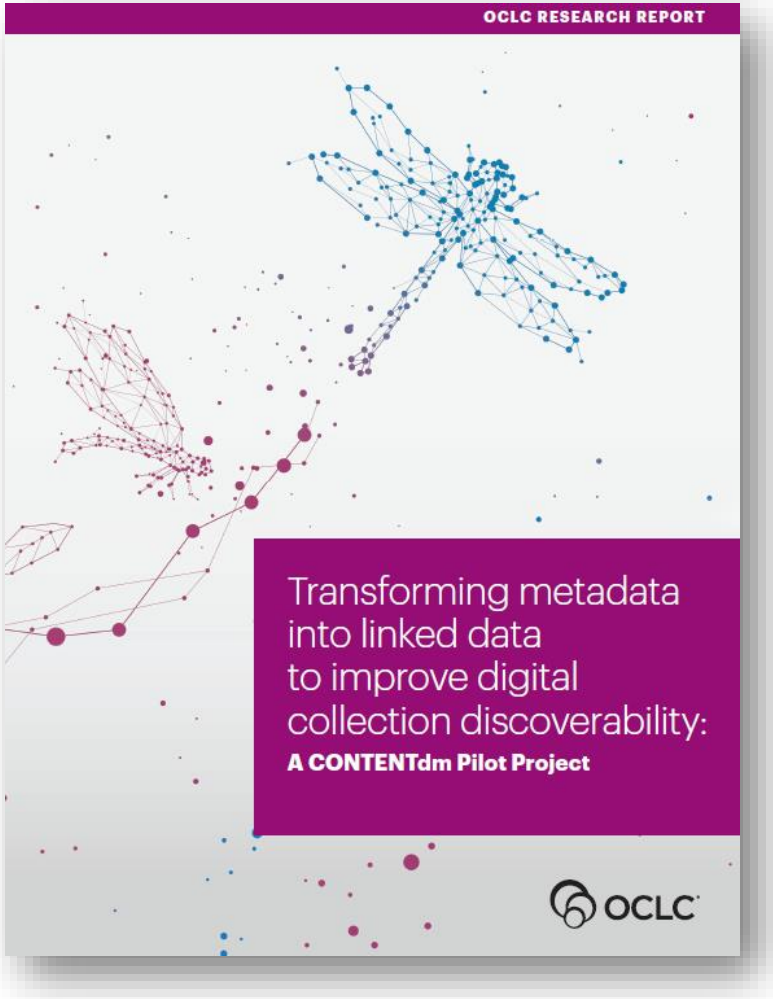


oc.lc/transform-linked-data

Working partnerships represent strength in numbers

Resources and Contacts

- The Pilot Project report
  - oc.lc/transform-linked-data
- Jeff Mixter, OCLC Research
  - jeff_mixter@oclc.org
- Bruce Washburn, OCLC Research
  - bruce_washburn@oclc.org



Shared entity management infrastructure

- Address infrastructure needs identified by libraries
  - Start with Persons and Works…
  - Expand on “native” metadata management
  - Link library data to non-library data… and shared data to local data
  - Provide ID creation services to help “at the point of need”
  - Persistent and maintained entity URIs
- Operate at a large scale – and be sustainable
- Complement other efforts—LD4, PCC, DCMI, etc.

oc.lc/sharedentitymgmt

OCLC awarded Mellon Foundation grant to develop infrastructure to support linked data management initiatives

'Entity Management Infrastructure' will advance use of linked data and ultimately improve discoverability of scholarly materials on the web

DUBLIN, Ohio, 9 January 2020—OCLC has been awarded a grant from The Andrew W. Mellon Foundation to develop a shared "Entity Management Infrastructure" that will support linked data management initiatives underway in the library and scholarly communications community. When complete, this infrastructure will be jointly curated by the community and OCLC, and will ultimately make scholarly materials more connected and discoverable on the web.

The two-year grant, for $2.436 million, will support work on the project that will run from January 2020 to December 2021. The Mellon grant funding represents approximately half of the total cost of the Entity Management Infrastructure project. OCLC is contributing the remaining half of the required investment.

"OCLC has been a leader in library linked data research for years, and we have developed prototypes, innovative pilot programs and partnerships that continue to inform our work," said Skip Prichard, OCLC President and CEO. "OCLC enables libraries to work together to achieve economies, efficiencies, and consistency in metadata creation. We're grateful to The

Convene, Understand, Share

BnF Bibliothèque nationale de France
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TEMPLE UNIVERSITY
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abes agence bibliographique de l'enseignement supérieur
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