LINKED OPEN DATA FOR LIBRARIES, ARCHIVES, AND MUSEUMS

Linked Open Data (LOD) holds the promise of connecting people, objects, concepts, places and more across datasets and institutions. It has also been notoriously complicated to implement. We believe that LOD is reaching a place of integration into cultural heritage practices, in particular with the rollout of FAST from OCLC and BIBFRAME from the Library of Congress. Getting to a place where linked data is fully incorporated into our regular metadata practices, and/or automated by our software is the key to widespread adoption. Understanding the potential and technological possibilities, however, is the key to taking full advantage of LOD for our institutions. To that end, the UT Linked Data Learning Group meets monthly to discuss any and all aspects and implications of Linked Data in the cultural heritage space. Please make full use of the resources linked below, and get in touch if you have any questions! [contact email]

Fundamentals of Linked Data and the Semantic Web

- Berners-Lee, Tim, and Kieron O'Hara. 2013. "The Read—Write Linked Data Web." Philosophical Transactions: Mathematical, Physical and Engineering Sciences 371 (1987): 1–5.
- Berners-Lee, Tim. 2001. "The Semantic Web." Scientific American 284 (5): 34–43. Berners-Lee, Tim.
- Why Linked Data? Linked Data for Libraries (LD4L) Project Proposal
    - https://wiki.duraspace.org/pages/viewpage.action?pageId=43910411
- Berners-Lee, Tim. 2006. "Linked Data." Design Issues. July 27, 2006.
    - https://www.w3.org/DesignIssues/LinkedData.html.
- Heath, Tom, and Christian Bizer. 2011. Linked Data:Evolving the Web into a Global Data Space. 1st ed. Synthesis Lectures on the Semantic Web: Theory and Technology. Morgan & Claypool.
- W3C Working Group. 2014. "RDF 1.1 Primer." http://www.w3.org/TR/2014/NOTE-rdf11-primer-20140624/.
- W3C: RDF 1.1 Turtle
    - https://www.w3.org/TR/turtle/
- W3C: SPARQL 1.1 Query Language
    - https://www.w3.org/TR/sparql11-query

Tools for Creating and Exploring Linked Data

- OpenRefine with RDF Extension - Transforms tabular data into RDF triples with a graphical interface.
- CIDOC-CRM: Ontology for cultural heritage data.
    - https://cidoc-crm.org/
- Library of Congress Linked Data Service
    - https://id.loc.gov/
- Schema.org - A collaborative vocabulary that provides schemas for structured data used in many RDF implementations.
    - https://schema.org/docs/about.html
    - Schema.org behind the scenes of the web:
        - Visit any web page
        - In the menu bar, click: View > Developer > View Source
        - Search for 'schema.org'
- Wikidata - A free and collaborative knowledge base with millions of entities that provides data in RDF format. It has a query service that lets you search for entities and their relationships.
    - https://www.wikidata.org/wiki/Wikidata:Main_Page
- DBpedia - Contains structured data extracted from Wikipedia with billions of RDF triples. Browse entities at https://dbpedia.org/ or query their SPARQL endpoint.
- FAST – a vocabulary that is designed to work with Linked Data. It assigns URIs and is available in RDF format.
    - Quick Start: https://www.oclc.org/content/dam/oclc/fast/FAST-quick-start-guide-2022.pdf
    - Search FAST: https://fast.oclc.org/searchfast/
    - FAST Converter: https://fast.oclc.org/lcsh2fast/

Examples of Linked Data In Action

- Linked Open Data Cloud: A massive visualization of linked open datasets across domains including geography, government, life sciences, linguistics, etc.
    - https://lod-cloud.net/#about
- Europeana - Europe's digital library uses Linked Data to connect cultural heritage information across institutions.

    - https://www.europeana.eu/
- Linked Art
    - https://linked.art/
- Lux: Yale Collections Discovery
    - https://lux.collections.yale.edu/content/technology
- SNAC: uses Linked Data principles, URIs to connect people, families, and organizations mentioned in historical records.
    - https://snaccooperative.org/
- Bio2RDF - https://bio2rdf.org/ - Linked Data for the life sciences.
- Open Corporates - https://opencorporates.com/ - legal entities database
- The New York Times - Uses Linked Data for their articles archive and 'Times Tags'.
- BBC - Transformed their website architecture using Linked Data for content management. BBC Sports, News, and Music sites all leverage Linked Data.
    - https://www.bbc.co.uk/ontologies
- Google, Microsoft, and Yahoo collaboratively developed and use Schema.org to enhance search results and better categorize web pages.

Linked Data in Alma/Primo

- Alma Refine Cloud App
    - https://developers.exlibrisgroup.com/blog/how-to-use-the-alma-refine-cloud-app-for-service-wikidata/

International Group of Ex Libris Users & Ex Libris Users of North America (IGeLU and ELUNA): Linked Open Data Community of Practice and Working Group

This working group focuses on linked data in ExLibris products (including Alma/Primo), hosts community meetings, and maintains a page of resources.

How to get involved:

- list-serv: https://exlibrisusers.org/postorius/lists/lod.exlibrisusers.org/
- presentation recordings of IGeLU and ELUNA Show&Tell: https://www.youtube.com/c/IGeLUandELUNAShowTell
- slack channel: igelu-eluna-siwg.slack.com#linked-data (email Xaoli Li if interested to join)
- user story collection form: Google doc

- URIs in Ex Libris Products: Report of current conditions and best practices, May 24, 2022

ELUNA 2023 Annual Meeting

- Linked Data Functionality in Alma by Yoel Kortick
- Slides 1 - why linked data, examples of custom author cards in Primo, extracting linked data from Alma via APIs, exporting linked data from Alma via publishing profile, viewing linked data in Alma
- Slides 2 - details on Linked Data Author Card feature tentatively scheduled for August 2023 release
- Alma Product Update, Linked Data plans for 2023/24 - Melanie's notes
- Linked Data Library Ecosystem Powered by AI - Melanie's notes
- Linked Open Data Community of Practice meeting - Melanie's notes
- Alma Roadmap Highlights 2023-2024 include linked data features

Presentations

- Jackie Shieh, A Triangular Connection Libraries' Wikidata projects on names, collections and users, 2022 Smithsonian Digitization Conference, 3/23/2022
    - https://www.youtube.com/watch?v=wqDgZJaVj20
- Jackie Shieh, "Morphing the authority control", 2020 LD4 Conference, 07/09/2020
    - https://www.youtube.com/watch?v=goTeN6jRZ9w
- Implementing Linked Library Data, a NISO (National Information Standards Organization) webinar, November 13, 2019
    - https://www.niso.org/events/2019/11/implementing-linked-library-data
- Jen Godby, What are "entities that matter?" And how much should we say about them?
    - https://www.slideshare.net/BaltimoreNISO/godby-what-are-the-entities-that-matter-and-how-much-should-we-say-about-them
- Jackie Shieh, Enabling Descriptive Data to be Linked at the Smithsonian Libraries
    - https://www.slideshare.net/BaltimoreNISO/shieh-enabling-descriptive-data-to-be-linked-at-the-smithsonian-libraries
- Abigail Sparling and Adam Cohen, BIBFRAME Implementation at the University of Alberta Library
    - https://www.slideshare.net/BaltimoreNISO/sparling-and-cohen-bibframe-implementation-at-the-university-of-alberta-library-193647440

- "A Sinopia, Marva and Alma Linked Data Implementation" webinar, hosted by the IGeLU/ELUNA Linked Open Data Community of Practice Working Group on January 12, 2023.
    - Meeting recording: https://youtu.be/Q0-ABLG4dyQ.
    - Presentation slides: https://docs.google.com/presentation/d/15MvExZfCLUFZmRJ1XzKQ5yD7SCXgzV9H/edit
    - List of resources mentioned during the presentation: https://docs.google.com/document/d/1qP04272tZpz_Q8P6yh0ssbPH7rXBXpYR/edit

Recommended Reading

Linked Data in Libraries

- Linked data for libraries
    - https://www.ifla.org/best-practice-for-national-bibliographic-agencies-in-a-digital-age/node/8549
- LD4: Community focused on linked data to enhance libraries and archives.
    - https://sites.google.com/stanford.edu/ld4-community-site/home

- Alemu, Getaneh, Brett Stevens, Penny Ross, and Jane Chandler. 2012. "Linked Data for Libraries: Benefits of a Conceptual Shift from Library-Specific Record Structures to RDF-Based Data Models." New Library World 113 (11/12): 549–70. https://doi.org/10.1108/03074801211282920.
- Byrne, Gillian, and Lisa Goddard. 2010. "The Strongest Link: Libraries and Linked Data." D-Lib Magazine 16 (11/12). https://doi.org/10.1045/november2010-byrne.
- Hallo, Maria, Sergio Lujan-Mora, Alejandro Mate, and Juan Trujillo. 2016. "Current State of Linked Data in Digital Libraries." Journal of Information Science 42 (2): 117–27. https://doi.org/10.1177/0165551515594729.
- Lampert, Cory K, and Silvia B. Southwick. 2013. "Leading to Linking: Introducing Linked Data To Academic Library Digital Collections." Journal of Library Metadata 13 (2–3): 230–53. http://www.tandfonline.com/action/showCitFormats?doi=10.1080/19386389.2013.826095
- Niu, Jinfang. 2016. "Linked Data for Archives." Archivaria 82: 83–110.

- Oramas, Sergio, and Mohamed Sordo. 2016. “Knowledge Is Out There: A New Step in the Evolution of Music Digital Libraries.” Fontes Artis Musicae 63 (4): 285–98.
- W3C Incubator Group. 2011. “Library Linked Data Incubator Group: Use Cases.” October 25, 2011. https://www.w3.org/2005/Incubator/lld/XGR-lld-usecase-20111025/.

Linked Data in Archives

- "Archival description and linked data: a preliminary study of opportunities and implementation challenges" By Karen F. Gracy (DOI:10.1007/s10502-014-9216-2)
- Boer, Victor de, Johan Oomen, Oana Inel, Lora Aroyo, Elco van Staveren, Werner Helmich, and Dennis de Beurs. 2015. “DIVE into the Event-Based Browsing of Linked Historical Media.” Journal of Web Semantics, Semantic Web Challenge 2014, 35 (December): 152–58. https://doi.org/10.1016/j.websem.2015.06.003.
- Escolano Rodriguez, Elena, and Daniel Vila Suero. 2011. “Linked Data at the BNE.” presented at the World Library and Information Congress: 77th IFLA General Conference and Assembly Semantic Web Special Interest Group, Puerto Rico, August 17.
    - https://www.slideshare.net/bne/linked-data-al-the-bne.
- Gracy, Karen F. 2018. “Enriching and Enhancing Moving Images with Linked Data.” Journal of Documentation 74 (2): 354–71. https://doi.org/10.1108/JD-07-2017-0106.
- Haslhofer, Bernhard, Elaheh Momeni, Manuel Gay, and Rainer Simon. 2010. “Augmenting Europeana Content with Linked Data Resources - Google Search.” In Proceedings of the 6th International Conference on Semantic Systems. Graz, Austria: ACM. https://doi.org/10.1145/1839707.1839757.
- Szekely, Pedro, Craig A. Knoblock, Fengyu Yang, Eleanor E. Fink, Shubham Gupta, Rachel Allen, and Georgina Goodlander. 2014. “Publishing the Data of the Smithsonian American Art Museum to the Linked Data Cloud.” International Journal of Humanities and Arts Computing 8 (supplement): 152–66. https://doi.org/10.3366/ijhac.2014.0104.

Technical Implementation Research

- Drupal Introduction to RDF - https://www.drupal.org/docs/8/core/modules/rdf/rdf-introduction
- Bellini, Pierfrancesco, Paolo Nesi, and Alessandro Venturi. 2014. “Linked Open Graph: Browsing Multiple SPARQL Entry Points to Build Your Own LOD Views.” Journal of Visual Languages & Computing, Distributed Multimedia Systems DMS2014 Part I, 25 (6): 703–16. https://doi.org/10.1016/j.jvlc.2014.10.003.
- Guha, R.V., Dan Brickley, and Steve Macbeth. 2015. “Schema.Org Evolution of Structured Data on the Web.” ACm Queue 13 (9).
    - https://queue.acm.org/detail.cfm?id=2857276.
- “JSON-LD Articles and Presentations.” n.d. Accessed August 15, 2019. https://json-ld.org/learn.html.
- Ric. n.d. “Understanding RDF Serialisation Formats.” Swirrl Blog |. Accessed August 15, 2019. http://blog.swirrl.com/articles/rdf-serialisation-formats/.
- Rapoza, Jim. 2006. “SPARQL Will Make Web Shine; New W3c Standard May Be the Polish the Semantic Web Needs.” EWeek; New York 23 (18): 50.
- Tebbutt, David. 2008. “The Time Has Come for the Semantic Web to SPARQL.” Information World Review; Oxford, no. 242 (January): 13. W3C. 2013. “SPARQL 1.1 Query Language.” March 21, 2013. https://www.w3.org/TR/sparql11-query/.

Case Studies and Guides

- UCLA Semantic Web and Linked Data Research Guide - http://guides.library.ucla.edu/semantic-web
- Myntti, Jeremy, and Nate Cothran. 2013. “Authority Control in a Digital Repository: Preparing for Linked Data.” Journal of Library Metadata 13 (2–3): 95–113. http://www.tandfonline.com/action/showCitFormats?doi=10.1080/19386389.2013.826061
- Stanford University Libraries and Academic Information Resources, and Council on Library and Information Resources. 2011. “Report of the Stanford Linked Data Workshop.” https://www.clir.org/pubs/reports/pub152/stanford-linked-data-workshop/.
- Wenige, Lisa, and Johannes Ruhland. 2018. “Retrieval by Recommendation: Using LOD Technologies to Improve Digital Library Search.” International Journal on Digital Libraries 19 (2–3): 253–69. https://doi.org/10.1007/s00799-017-0224-8