

DEVELOPMENT & IMPLEMENTING *LINKED DATA COMPETENCY INDEX (LDCI)* IN TEACHING AND TRAINING

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[Webinar] Knowledge Organization Competencies and Skills
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- December 1, 2014 - November 30, 2017

• **Led by:**

- University of Washington, Information School
- Kent State University, School Information
- Dublin Core Metadata Initiative (DCMI)

• **Content Partners:**

- OCLC
- Elsevier
- Access Innovations
- Synaptica
- Sungkyunkwan University (Korea)



Lead Project Personnel:

- Project P.I.: Michael Crandall
- Technical Infrastructure Team: Stuart Sutton
- Learning Resource Collection Team: Marcia Zeng
- Competency Index Editorial Board: Tom Baker
- Community Building and Outreach: Michael Lauruhn

<https://ld4pe.dublincore.org/about/project-participants/>



I. Introduction

“Competency Index”

A thematic set of competencies organized by

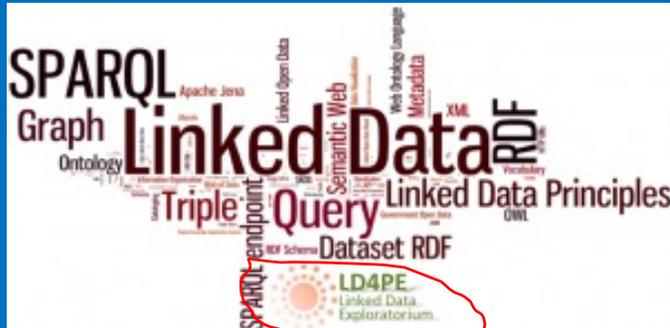
- **Topic**
 - **Competency**: a tweet-length phrase about knowledge or skills that can be learned
 - **Benchmark**: an action that demonstrates accomplishment in a given competency

EXAMPLE

Topic: Querying RDF Data

- **Competency**: Understands that a SPARQL query matches an RDF graph against a pattern of triples with fixed and variable values
- **Competency**: Understands the basic syntax of a SPARQL query
 - **Benchmark**: Uses angle brackets for delimiting URIs.
 - **Benchmark**: Uses question marks for indicating variables.
 - **Benchmark**: Uses PREFIX for base URIs.
- ...





Understanding linked data standards and practices has become a key requirement for information professionals

The challenge of acquiring new competencies

extends to

- educators &
- trainers

A competency index can be used for:



Descriptions for what a learner can learn



Descriptions of skills that demonstrate understanding



Basis for:

job descriptions

course syllabi

university degrees

micro-credentials

digital badges



Tags descriptions of learning resources



...





ASN Description Framework Schema

Last update:

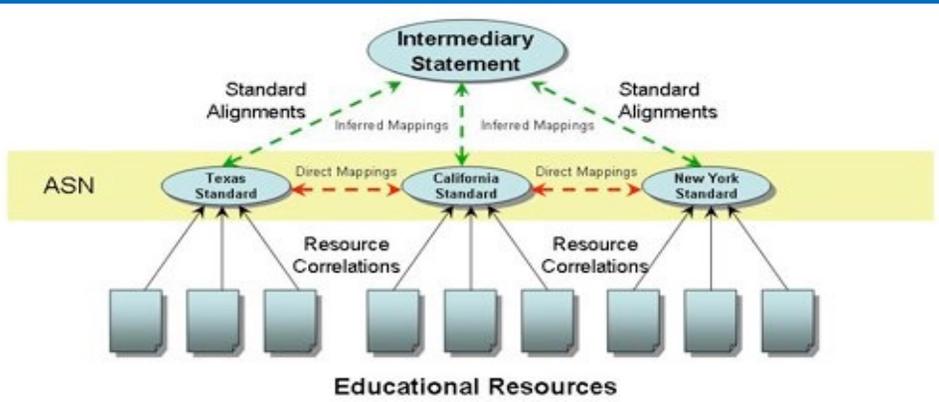
2019-11-17

Editors:

Joseph Chapman ([D2L](#))

Stuart A. Sutton ([Information School, University of Washington](#))

<http://www.achievementstandards.org/content/technical-documentation>

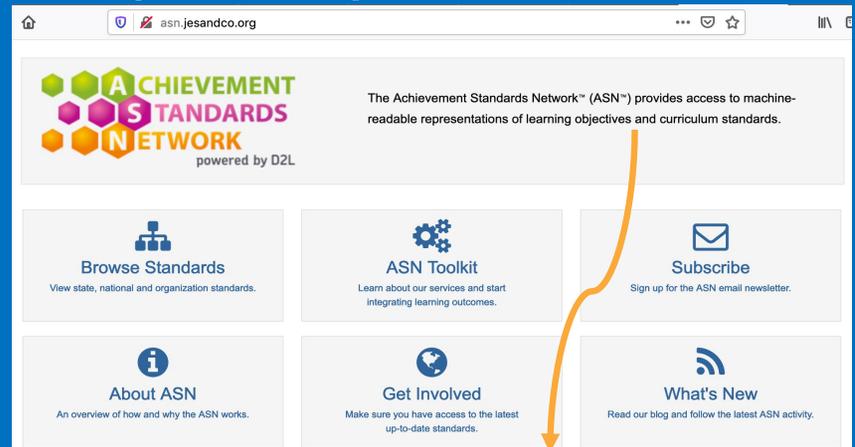


<https://ld4pe.dublincore.org/theory/briefing-papers/asn-briefing-1/>

MARCIA ZENG & LD4PE TEAM. IFLA SAA WEBINAR, 2022-08

Competency-based education and training

The *ASN Description Language (ASN-DL)* can be used for describing formally promulgated competencies and benchmarks.



The Achievement Standards Network™ (ASN™) provides access to machine-readable representations of learning objectives and curriculum standards.

ASN is now owned and operated by D2L.
The D2L family of companies includes D2L Corporation, D2L Ltd, D2L Australia Pty Ltd, D2L Europe Ltd, D2L Asia Pte. Ltd., and D2L Brasil Soluções de Tecnologia para Educação Ltda.
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<http://asn.jesandco.org/>

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A Linked Data competency index is built based on ASN model for competency index construction.

Competency Index for Linked Data

<http://asn.desire2learn.com/resources/D2695955>

View About these standards

Competency Index for Linked Data

Quick Find:

- Fundamentals of Resource Description Framework
 - Identity in RDF
 - RDF data model
 - Related data models
 - RDF serialization**
 - Understands RDF serializations as interchangeable encodings of a given set of triples
 - Uses tools to convert RDF data between different serializations
 - Distinguishes the RDF abstract data model and concrete serializations of RDF data
- Fundamentals of Linked Data
- RDF vocabularies and application profiles
- Creating and transforming Linked Data
- Interacting with RDF data
- Creating Linked Data applications

ASN Dashboard

A thematic set of competencies organized by

- Topic**
- Competency**: a tweet-length phrase about knowledge or skills that can be learned
- Benchmark**: an action that demonstrates accomplishment in a given competency



Another example



http://asn.desire2learn.com/resources/D2527589

Competency Index for the Library Field

View About these standards

About this resource:

Title en-US: Competency Index for the Library Field
Description en-US: Across industries, competencies provide a foundation on v
Ultimately to strengthen the organization as a whole. Libraries need such a found
productive paths for staff training, recruiting and other personnel directions. In a
competency statements that address a broad spectrum of library practice and s
Publication Status: Published
Subject: Career Education
Education Level: Professional Education & Further Development
Language: English
Source: http://www.webjunction.org/content/dam/WebJunction/Documents/we
Date Valid: 2009
Repository Date: 2013-12-05
Publisher en-US: WebJunction
Rights en-US: Copyright © 2009, OCLC Online Computer Library Center, Inc.
remixed (adapted) under the condition that WebJunction receives attribution as
Rights Holder en-US: OCLC
Date Copyrighted: 2009
Manifest: http://asn.jesandco.org/resources/D2527589_manifest.json

Download these standards as: RDF/XML, RDF/JSON, Turtle or N-Triples

About Browse Standards ASN Toolkit Community Get Involved What's New Documentation Contact Us

Home > Jurisdictions > WebJunction

Competency Index for the Library Field

View About these standards

Competency Index for the Library Field

Quick Find: [search box]

- Library Management
- Personal/Interpersonal Competencies
- Public Service Competencies
- Technical Services Competencies
 - Accessing & Processing
 - Cataloging
 - Collection Management
 - E-Resource Management
 - Preservation
 - Establishes and implements appropriate techniques for the preservation and conservati
 - Identifies, selects and maintains special collections
 - Establishes and implements policies and procedures for digitization of library resource
- Technology Competencies: Core Skills
- Technology Competencies: Systems & IT

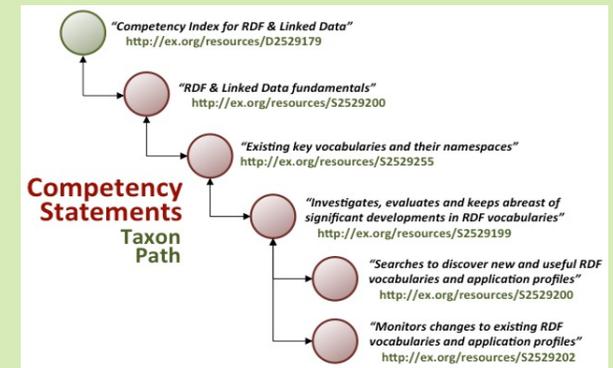
A thematic set of competencies organized by

- **Topic**
 - **Competency:** a tweet-length phrase about knowledge or skills that can be learned
 - **Benchmark:** an action that demonstrates accomplishment in a given competency



II. LINKED DATA COMPETENCY INDEX (LDCI)

- a set of topically arranged assertions of the knowledge, skills, and habits of mind required for professional practice in the area of Linked Data
- an overview, or map, of the Linked Data field both
 - for independent learners who want to learn Linked Data methods and technology, and
 - for professors or trainers who want to design and teach courses on the subject



Content

Competencies were proposed based on:

- Literary Warrant
- Resource Warrant
- Expert Warrant

6 topic clusters
30 topics

LD Competency Index (LDCI) Overview of topics

• **Fundamentals of Resource Description Framework**

- Identity in RDF
- RDF data model
- Related data models
- RDF serialization

• **Fundamentals of Linked Data**

- Web technology
- Linked data principles
- Linked Data policies and best practices
- Non-RDF Linked Data

• **RDF vocabularies and application profiles**

- Finding RDF-based vocabularies
- Designing RDF-based vocabularies
- Maintaining RDF vocabularies
- Versioning RDF vocabularies
- Publishing RDF vocabularies
- Mapping RDF vocabularies
- RDF application profiles

• **Creating and transforming RDF Data**

- Managing identifiers (URIs)
- Creating RDF data
- Versioning RDF data
- RDF data provenance
- Cleaning and reconciling RDF data
- Mapping and enriching RDF data

• **Interacting with RDF Data**

- Finding RDF Data
- Processing RDF data using programming languages
- Querying RDF Data
- Visualizing RDF Data
- Reasoning over RDF data
- Assessing RDF data quality
- RDF Data analytics
- Manipulating RDF Data

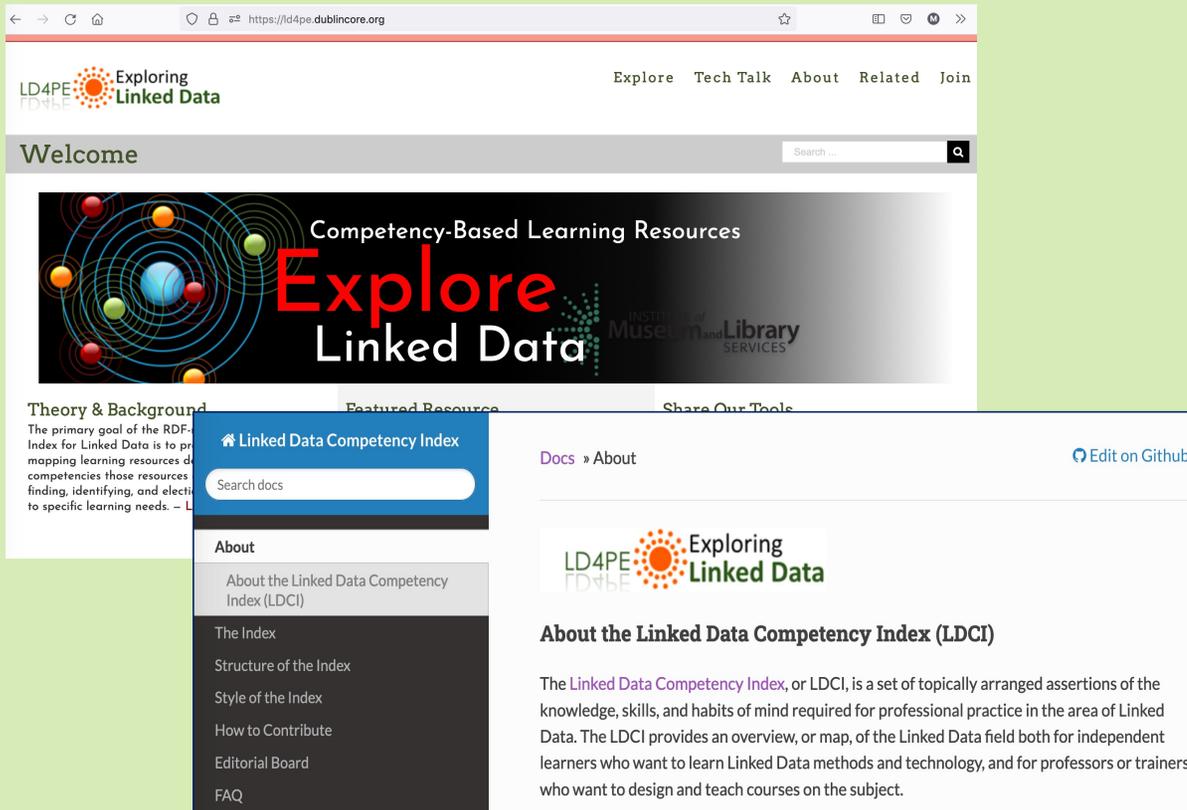
• **Creating Linked Data applications**

- Storing RDF data



Linked Data Competency Index (LDCI)

The LD4PE project created an RDF repository containing both the **Competency Index** and metadata for the cataloged **Learning Resources**.



The screenshot shows the LD4PE website interface. At the top, there's a navigation bar with 'Explore', 'Tech Talk', 'About', 'Related', and 'Join'. Below that is a 'Welcome' section with a search bar. The main content area features a large graphic with the text 'Competency-Based Learning Resources' and 'Explore Linked Data'. Below this, there's a sidebar with a search bar and a list of links: 'About', 'About the Linked Data Competency Index (LDCI)', 'The Index', 'Structure of the Index', 'Style of the Index', 'How to Contribute', 'Editorial Board', and 'FAQ'. The main content area displays the title 'About the Linked Data Competency Index (LDCI)' and a paragraph of text: 'The **Linked Data Competency Index**, or LDCI, is a set of topically arranged assertions of the knowledge, skills, and habits of mind required for professional practice in the area of Linked Data. The LDCI provides an overview, or map, of the Linked Data field both for independent learners who want to learn Linked Data methods and technology, and for professors or trainers who want to design and teach courses on the subject.'

1. Website LD4PE Explore

<https://ld4pe.dublincore.org/>

- The full Competency Index
- aligned with 600+ [open] learning resource descriptions [webinars, podcasts, lectures, web pages, readings ...]

2. Updated version and translations on Github (2017--)

<https://dcmi.github.io/ldci/D2695955/>

3. Registered (2016 version) In the Achievement Standard Network (ASN)

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LD4PE Explore Website <https://ld4pe.dublincore.org/>

- The full Competency Index --> **Explore**
- aligned with 600+ [open] learning resource descriptions (by 2017)

The screenshot shows the LD4PE Explore website interface. At the top, there is a navigation bar with links for 'Explore', 'Tech Talk', 'About', 'Related', and 'Join'. The main heading is 'Explore Learning Resources by Competency'. Below this, there is a section titled 'Browse Competency Index' with a sub-section 'Browse by Competency'. A red octagon with the number '1' is placed next to the 'Browse by Competency' heading. A red arrow points from this heading to a list of competency clusters. A red octagon with the number '2' is placed next to the first cluster: 'Fundamentals of Resource Description Framework (218)'. A red arrow points from this cluster to a specific resource description: 'BIBFRAME Training At The Library Of Congress: Introduction To The Semantic Web And Linked Data'. A red octagon with the number '3' is placed next to this resource title. A green oval highlights the resource description. A purple callout box on the right side of the page contains the text: '-- related resources are displayed on right side of the page.' At the bottom of the page, there is a brown box with three bullet points: 'Start at the top of the hierarchy and drill down.', 'Select a topic cluster, expand the menu, and', and 'look through the child options.'

Browse Competency Index

Browse by Competency

How does this work?

- New Comp Index (621)
- Fundamentals of Resource Description Framework (218)
- Identity in RDF (38)
- Knows that Uniform Resource Identifiers, or URIs (1994), include Uniform Resource Locators (URLs, which locate web pages) as well as location-independent identifiers for physical, conceptual, or web resources (18)
- Knows that anything can be named with Uniform Resource Identifiers (URIs), such as agents, places, events, artifacts, and concepts. (17)
- Understands that a "real-world" thing may need to be named with a URI distinct from the URI for information about that thing. (8)
- Recognizes that URIs are owned by their respective owners of their respective domains (3)
- + RDF data model (148)

Competency: Knows That Uniform Resource Identifiers (URIs) Include Uniform Resource Locators (URLs, Which Locate Web Pages) As Well As Location-independent Identifiers For Physical, Conceptual, Or Web Resources.

BIBFRAME Training At The Library Of Congress: Introduction To The Semantic Web And Linked Data

This resource was developed by the Library of Congress as one part of a pilot training project which tested the use of BIBFRAME for bibliographic [...]

The Semantic Web And Linked Data Concepts: The RDF Data Model And Linked Open Data (LOD) Quiz

This quiz covers material presented in the first module of the BIBFRAME pilot training project at the Library of Congress. The quiz consists of five [...]

The Semantic Web And Linked Data Concepts: The RDF Data Model And Linked Open Data (LOD)

This PowerPoint presentation was used during the "Introduction to the Semantic Web and

What's A URI And Why Does It Matter?

This brief article introduces the terminology and issues surrounding URIs and their role on the Web. This includes some historical context of what URI originally [...]

Between URIs And URIs

author succinctly explains

1

2

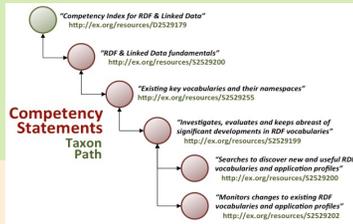
3

-- related resources are displayed on right side of the page.

- Start at the top of the hierarchy and drill down.
- Select a topic cluster, expand the menu, and
- look through the child options.



Structure



Topic cluster

Topic

Competency: Tweet-length assertion of knowledge, skill, or habit of mind

Benchmark: Action demonstrating accomplishment in related competencies

6 Topic Clusters

Explore Learning Resources by Competency

Search ...



Browse by Competency

How does this work?

+ New Comp Index (621)

+ Fundamentals of Resource Description Framework (218)

+ Fundamentals of Linked Data (135)

+ RDF vocabularies and application profiles (181)

+ Creating and transforming Linked Data (82)

+ Interacting with RDF data (368)

+ Creating Linked Data applications (0)



TOPICAL CLUSTER » TOPIC » COMPETENCY » BENCHMARK

Structure

6 clusters

30 topic groups

95 competencies

75 benchmarks

Topic Cluster

Topic

Competency

Benchmark

Benchmark

Competency

- RDF vocabularies and application profiles (181)
 - + Finding RDF-based vocabularies (16)
 - + Maintaining RDF vocabularies (0)
 - + Versioning RDF vocabularies (1)
 - + Publishing RDF vocabularies (33)
 - + Mapping RDF vocabularies (21)
 - + RDF application profiles (19)

- Designing RDF-based vocabularies (142)

- Uses RDF Schema to express semantic relationships within a vocabulary. (53)

Correctly uses sub-class relationships in support of inference. (22)

Correctly uses sub-property relationships in support of inference. (25)

Knows the naming conventions for RDF properties and classes. (9)

**Linked Data
Competency Index
(LDCI)**

TOPICAL CLUSTER » TOPIC » COMPETENCY » BENCHMARK



Style

Topic Cluster

Topic

- RDF vocabularies and application profiles (181)
 - + Finding RDF-based vocabularies (16)
 - + Maintaining RDF vocabularies (0)
 - + Versioning RDF vocabularies (1)
 - + Publishing RDF vocabularies (33)
 - + Mapping RDF vocabularies (21)
 - + RDF application profiles (19)

Linked Data Competency Index (LDCI)

Writing effective competencies and benchmarks

Competencies (understanding)	Benchmarks (doing)
Understands	Uses
Knows	Expresses
Recognizes	Demonstrates
Differentiates ...	Converts ...

Competency

Benchmark

Benchmark

Competency

- Designing RDF-based vocabularies (142)

- Uses RDF Schema to express semantic relationships within a vocabulary. (53)

Correctly uses sub-class relationships in support of inference. (22)

Correctly uses sub-property relationships in support of inference. (25)

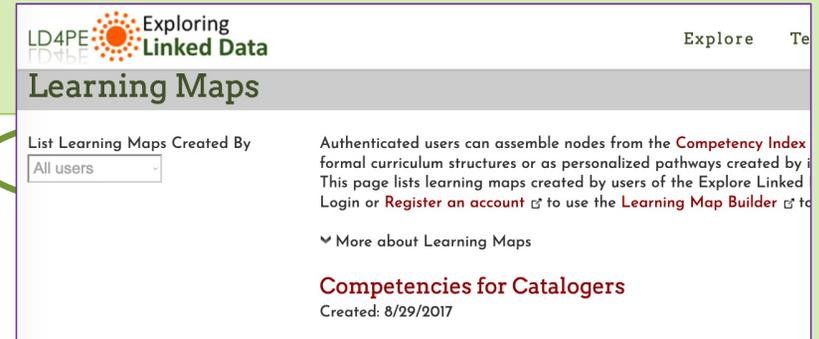
Knows the naming conventions for RDF properties and classes. (9)

TOPICAL CLUSTER » TOPIC » COMPETENCY » BENCHMARK



III. LEARNING RESOURCES CONNECTED WITH THE COMPETENCIES

- 600+ [open] resources' descriptions
 - webinars, podcasts, lectures, web pages, readings
 - aligned with competencies
- a dataset from OCLC (free for several years)
- a tutorial with some examples
- suggested learning maps



Example: How to get a real dataset for teaching

resource: WorldCat Linked Data (Library Science Subset)

Extracted from the original MARC records based on:

- FAST headings
- DDC classes
- LCC subclasses

Why provide a dataset?

- You have static data to test skills on or to use in creating new learning resources
- Ensures that consistent results can be obtained from queries and that access will not suddenly disappear



Explore Tech Talk Updates About Related Join

Share Our Tools

OCCL Dataset

The [Online Computer Library Center](#) (OCLC) has published a dataset, WorldCat Linked Data (Library Science Subset), so that those who visit the LD4PE site will have static data to test their skills on or to use in creating their own learning resources. Using the WorldCat dataset for these pursuits ensures that consistent results can be obtained from queries and that access to the dataset will not suddenly disappear.

Access the static dataset at: <http://purl.org/dataset/WorldCat/LibraryScienceSubset>

A tutorial and some example queries are available for those interested in getting started in using this resource.

This dataset identifies and describes bibliographic resources gleaned from library, archives, and museum data from around the world. This subset is focused on bibliographic resources broadly related to the theme of library science. Specifically, resource descriptions were extracted from the original MARC records if they met at least one of the following criteria:

- FAST headings "library", "libraries", "librarian", or "librarianship" in field 650
- DDC classes "Library & information sciences" (O20 through O28) in field 082
- LCC subclasses for "Libraries" (Z662 through Z1000.6)
- "Information resources (General)" (ZA 3038 through ZA 5190) in field 050.

Records with "N@F" in the 040 field (name of the organization that created the original record) were excluded. [Download more detailed information](#) (PDF 439KB)



Example: How to get a real dataset for teaching

RESOURCE: TUTORIAL :



OCLC Dataset Tutorial

- DOWNLOAD DATASET
 - N-Triples
- STORE PERSISTENTLY
 - Apache Jena's TDB (Triple Store)
- QUERY USING SPARQL
 - Command Line using TDBQUERY (similar to ARQ)
 - Interpreting and storing results

```
get_french.rq - Notepad
File Edit Format View Help
PREFIX schema:<http://schema.org/>
SELECT DISTINCT ?s ?name
WHERE {
  ?s a schema:Book;
  schema:inLanguage "fr";
  schema:name ?name.
}
```

Figure 12: SPARQL query to retrieve all books written in French

Introduction

This tutorial was created both to highlight the potential of the Competency Index. Early sections address topics related to SPARQL queries introduce the broad topic of "Querying RDF sets. Finally, a series of exercises prompt the user to write more advanced uses of SPARQL functions and operators that make

There are a great number of SPARQL tutorials on the Web, but which do not always hold true in real-life cases:

1. That the dataset the user wants to query is relatively small
2. That if the user is querying a massive database (e.g., DBpedia)

What does the user do when he or she discovers that their dataset contains over twenty million triples? The WorldCat Dataset is

There are many different tools available for storing and querying, ultimately be used. This tutorial represents only one possible Dataset and start exploring it as quickly as possible and, hopefully

Accessing the Dataset

Let's say that a colleague has given you a link to a dataset: [http://www.worldcat.org/](#)

[Download detailed introductory information](#) (PDF, 274KB)

Storing the Data

Before you can start querying the data, we need to load it into Apache Jena's TDB.

[Download instructions for storing the dataset](#) (PDF, 115KB)

Querying the Data

When faced with a new and unfamiliar dataset, it is helpful to describe the data. Without this knowledge, writing queries is difficult. I can quickly give you an idea what a dataset is all about.

[Download exercises for exploratory queries](#) (PDF, 174KB)

PDFs AVAILABLE:

Simple Queries

The following sections contain walkthroughs of some simple queries for users new to the SPARQL query language.

Simple Query 1: Union and Shared Subjects

Start with this query: *What languages are represented in the dataset?*

To write this query, you need to determine one vital piece of information: what languages are represented in the dataset? Fortunately, you already know all the classes and properties in the dataset, so you can skim through the result set you saved, you see that the `http://schema.org/inLanguage`.

To determine which property you should use in future queries, you give you an idea how the dataset's creators used these properties.

[Download exercises for Simple Query 1](#) (PDF, 149KB)

Simple Query 2: Optional and Turning an Object into a Variable
Now that we know which properties are used to describe books, let's limit the type of Creative Works we are looking for to books. Let's string together a few triple statements.

[Download exercises for Simple Query 2](#) (PDF, 203KB)

Simple Query 3: Negation Using Not Exists and Minus
What if, on the hand, we had wanted to write a query specifying books in other languages (i.e., works originally written in French) using the topic of NEGATION.

[Download exercises for Simple Query 3](#) (PDF, 118KB)

Additional SPARQL Exercises

You are now ready to try writing some queries on your own. We will provide you with each task (answers).

[Download SPARQL exercises](#) (PDF, 128KB)

[Download exercise answer walkthrough](#) (PDF, 169KB)



Who can benefit from it?

- **Students:** help choose courses that cover what you want to learn
- **Instructors:** design a course, syllabus, homework, quizzes, exams
- **Employers:** write a job description
- **Self-learners:** explore technologies and methods related to Linked Data



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