Solr for newbies

https://hectorcorrea.com/solr-for-newbies

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Workshop Outline

- Introduction
    - Concepts, quick tour, installation
- Schema
    - Types, Fields, Tokenizers, Filters
- Searching
    - Search parameters, Facets, Highlighting
- Miscellaneous
    - Configuration, synonyms, spell checking

I. Introduction

What is Solr?

"Solr is the popular, blazing-fast, open source enterprise **search platform** built on Apache Lucene." - Solr's Home Page

"Solr is a scalable, ready-to-deploy enterprise **search engine** that's optimized to search large volumes of **text-centric data** and return **results sorted by relevance**." - Solr in Action [p. 4]

Why Solr at the Princeton University Library?

- We have lots of text centric searches
- Relevance in results is important to us
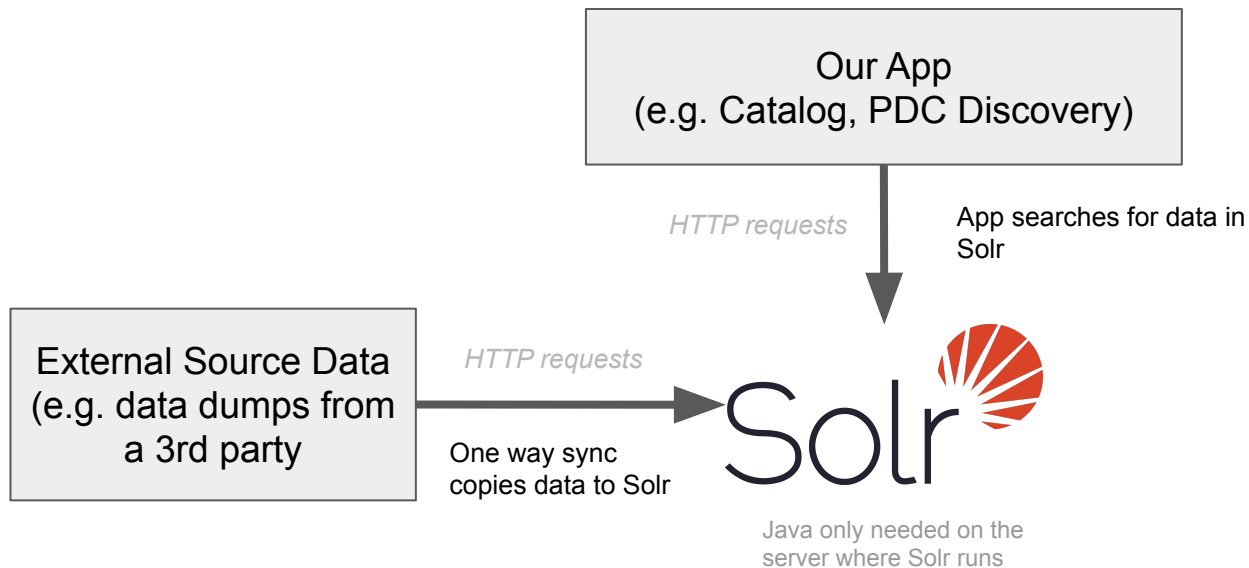- Solr is free and open-source
- Facets

Where do we use it?

- Catalog
- PDC Discovery
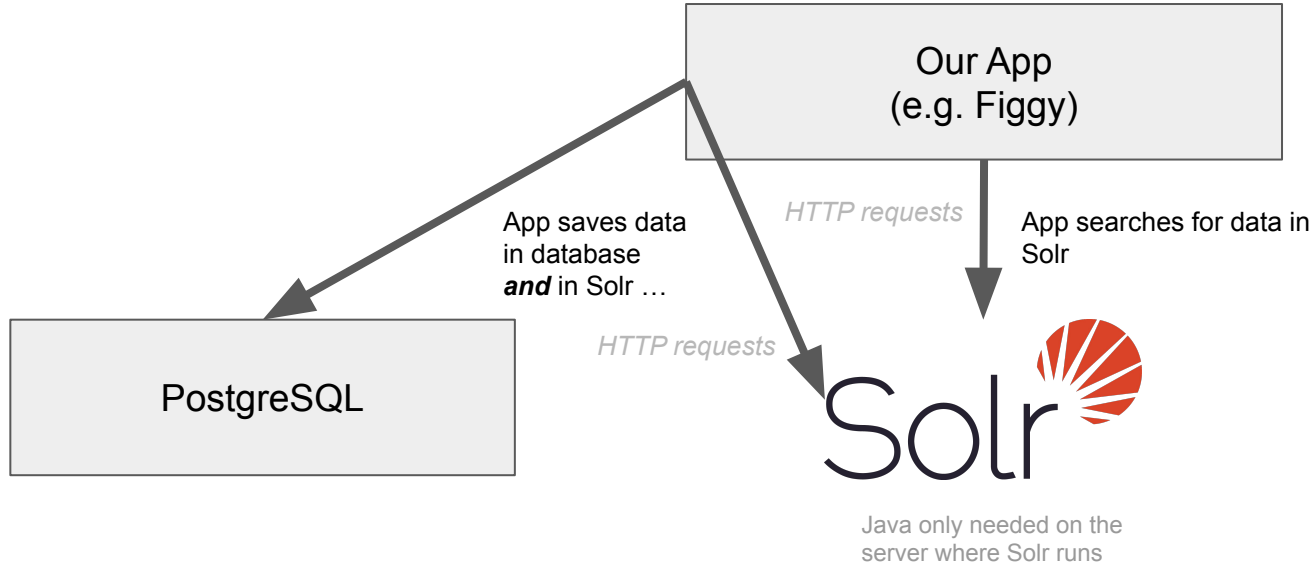- Figgy, Finding Aids, Digital PUL, and many more

Related tools and concepts

- [Apache Solr](#)
  - The Java app that we use, uses Lucene under the hood
  - Accessible via HTTP requests, no need to use Java to index or query
- [Apache Lucene](#) - brains behind Solr, used internally by Java applications
- [Apache Software Foundation](#) (ASF)
- [ElasticSearch](#)
  - Another product like Solr that also uses Lucene, increasingly popular
  - Not from ASF, weird license, not entirely open-source
- Indexing - when we ingest data into Solr
- Querying - when we search for data in Solr
- Tokenizing - a process of splitting a large text into smaller pieces (tokens)

Solr in our apps

Our App
(e.g. Catalog, PDC Discovery)

HTTP requests

App searches for data in Solr

External Source Data
(e.g. data dumps from a 3rd party

HTTP requests

One way sync copies data to Solr

Solr

Java only needed on the server where Solr runs

Solr in our apps (cont.)

Our App
(e.g. Figgy)

App saves data
in database
and in Solr …

HTTP requests

App searches for data in
Solr

HTTP requests

PostgreSQL

Solr

Java only needed on the
server where Solr runs

Is Solr a database?

- Technically yes
  - Solr is a document-oriented database (a NoSQL database)
  - Solr is not a relational database like PostgreSQL, MySQL, Oracle, MS Access

- In practice no
  - Although we use Solr to store data…
  - …we do this to **power the search feature** of our applications
  - …and the source data lives somewhere else, in a "real" database

Demo time

Your turn: Installing Solr

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#installing-solr-for-the-first-time
- Install Docker
- Create a Solr core named `bibdata`
- Load data to our `bibdata` Solr core
- Run basic queries

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#searching-for-documents
- If don't want to install Solr

II. Schema

Solr's Document Model

id	book_title	subjects
1	Princeton guide for dog owners	guides, animals
2	Princeton tour guide	guides
3	Cats and dogs	animals

Relational Model

books

subjects
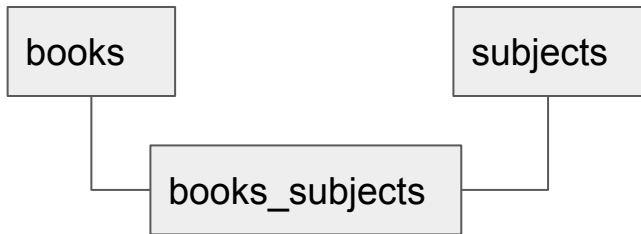
books_subjects

Solr Document Model

```
solr_doc {

  id: "1",

  book_title: "Princeton guide for dog owners",

  subjects: ["guides", "animals"]

}
```

Inverted Indexes - How Solr indexes our data

id	**book_title**	subjects
1	Princeton guide for dog owners	guides, animals
2	Princeton tour guide	guides
3	Cats and dogs	animals

Traditional Index

id	**book_title**
3	cats and dogs
1	princeton guide for dog owners
2	princeton tour guide

Inverted Index

key	**ids**
princeton	1, 2
owners	1
dogs	1, 3
guide	1, 2
tour	2
cats	3

Storing information in Solr

- It's **very** different from what we do in other databases
    - Remember that we use Solr to power our searches
    - i.e. we store data for *search* and display purposes *not* for preservation
- It's common to store the same field more than once
    - e.g. display value vs searchable value vs value for facets

A field in Solr…

- Can be `String, Text, Number, Date, ...`
- Can be single-value or multi-value
- `String` values are stored as-is
  - No transformations at all, including extra spaces, `"hello "` `!=` `"hello"`
- `Text` supports many transformations
  - `Text General` indexes `"Mechanism"` as `"mechanism"`
  - `Text English` indexes `"Mechanism"` as `"mechan"`
- A field can be stored and/or indexed
  - Stored if we need to display it to the user
  - Indexed if we need to search for values by this field
  - It is possible to index a field but not store it. In this case you can search values on it, get docs that match, but never retrieve the actual value *head-explodes*

A *text field* in Solr…

- Can have index and query *analyzers*
- These analyzers alter the data as it's indexed or queried
- Two type of analyzers: tokenizer and filters
- Tokenizer
  - Breaks down text in tokens (e.g. `"hello world"` becomes `"hello"` and `"world"`)
- Filters
  - Lower case (`"HELLO"` becomes `"hello"`)
  - Strip punctuation (`"hello!"` becomes `"hello"`)
  - Handle diacritics (`"México"` becomes `"Mexico"`)
  - Extract stems of words (e.g. `mechanism` => `mechan`)
  - Drop stop words (e.g. `the`, `and`, `or`)
  - Handle Chinese-Japanese-Korean bigrams ([examples])
  - [Tons more]

Example of text processed with tokenizer + filters

Transformation	Result	
Original text	"Princeton guide for dog owners"	
Tokenizer	"Princeton", "guide", "for", "dog", "owners"	
Lowercase filter	"princeton", "guide", "for", "dog", "owners"	
Stop word filter	"princeton", "guide", "dog", "owners"	
Stem filter	"princeton", "guid", "dog", "owner"	

Fields in our `bibdata` Solr core

- Where did the fields in our `bibdata` Solr core come from?
- Fields, dynamic fields, and copy fields
- **Fields** define a type (string, text, date) and other properties like multi-value, stored, indexed, and so on.
- **Dynamic fields** are patterns to create fields on the fly.
- **Copy fields** are directives to copy the value of one field to another.

Fields in our `bibdata` Solr core (cont)

```
{

  "id":"00000018",

  "author_txt_en":"Tarbell, H. S.",

  "authors_other_txts_en":["Tarbell, Martha,"],

  "title_txt_en":"The complete geography.",

  "publisher_s":"New York,",

  "subjects_ss":["Geography", "Fluid mechanics"]

}
```

Fields in our `bibdata` Solr core (cont)

Field in data	Schema	Action	Resulting field
`id`	Matches `id` field defined as string	Saves value	`string`
`author_txt_en`	Matches `*_txt_en` dynamic field	Creates field `author_txt_en` and saves value	`text_en`
`authors_other_txts_en`	Does *not* match any dynamic field	Creates `authors_other_txts_en` field (guesses the type), and saves value	`text_general`
`publisher_s`	Matches `*_s` dynamic field	Creates field `publisher_s`	`string`
`subjects_ss`	Matches `*_ss` dynamic field	Creates field `subjects_ss`	`String (multi-value)`

Your turn: Customizing our schema

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#customizing-our-schema
- Recreating our Solr core
- Handling `_txts_en` fields
- Customizing the title field
- Customizing the author field
- Customizing the subject field (optional)
- Populating the `_text_` field
- Testing our changes

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#putting-it-all-together
- Use the Analysis Screen to visualize the differences

III. Searching

- Query Parsers
  - Standard, DisMax, and eDisMax
- Searching
  - Basic parameters (`deftype, q, sort, rows, start, fl, fq`)
  - `qf`
  - `debug`
  - Ranking
  - Ranges
- Faceting
- Hit highlighting

IV. Miscellaneous

- Solr's directories and configuration files
- Synonyms
- Request Handlers
- Search Components
- Spell checking

Other recommended resources

- Book: [Solr in Action](#)
  - Old but still relevant
  - Great for general overview and in-depth analysis of some features
- Solr's official [reference guide](#)
- We have several [Solr books in the catalog](#) (some of them online)

Thank you for attending!