Solr for newbies

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

Hector Correa
hector_correa@princeton.edu
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Princeton, NJ

Workshop Outline

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

Helping hands

- Bess Sadler
- Carolyn Cole
- Francis Kayiwa
- James Griffin

Thank you Bess, Carolyn, Francis, and James!

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https://2023.code4lib.org/conduct/

I. Introduction

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#part-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 is popular in libraries?

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

A few examples:

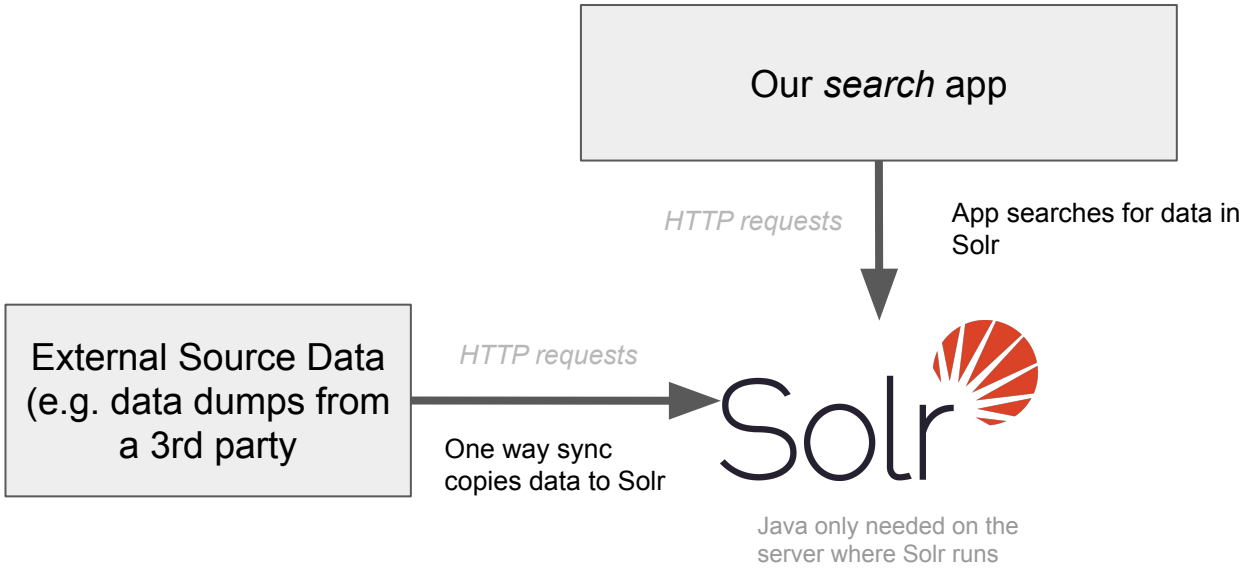
- Library Catalogs: Princeton and Stanford
- Institutional Repositories: Penn State and Brown
- Finding Aids: Princeton and NYU

Related tools and concepts

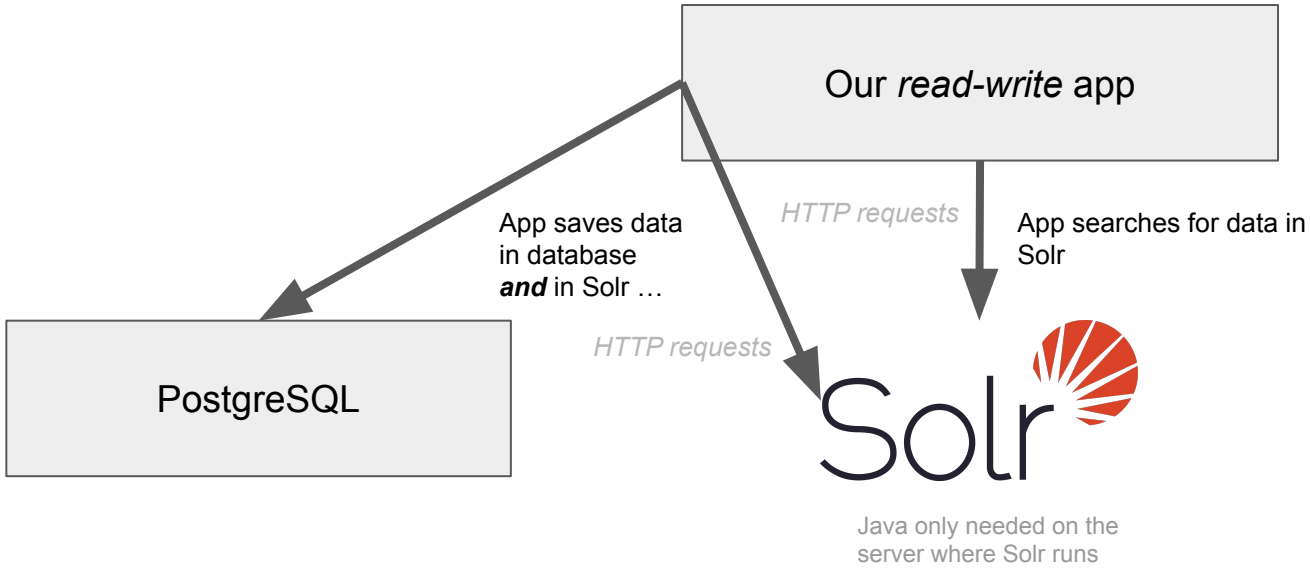
- Apache Solr
  - The Java app that we use, uses Lucene under the hood
  - Accessible via HTTP requests, no need to use Java to index or query
- Apache Lucene - brains behind Solr, used internally by Java applications
- Apache Software Foundation (ASF)*
- ElasticSearch
  - Another product like Solr that 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)

** I also think they should change their name*
https://www.endasfmascotry.com/

Solr in our apps



Solr in our apps (cont.)

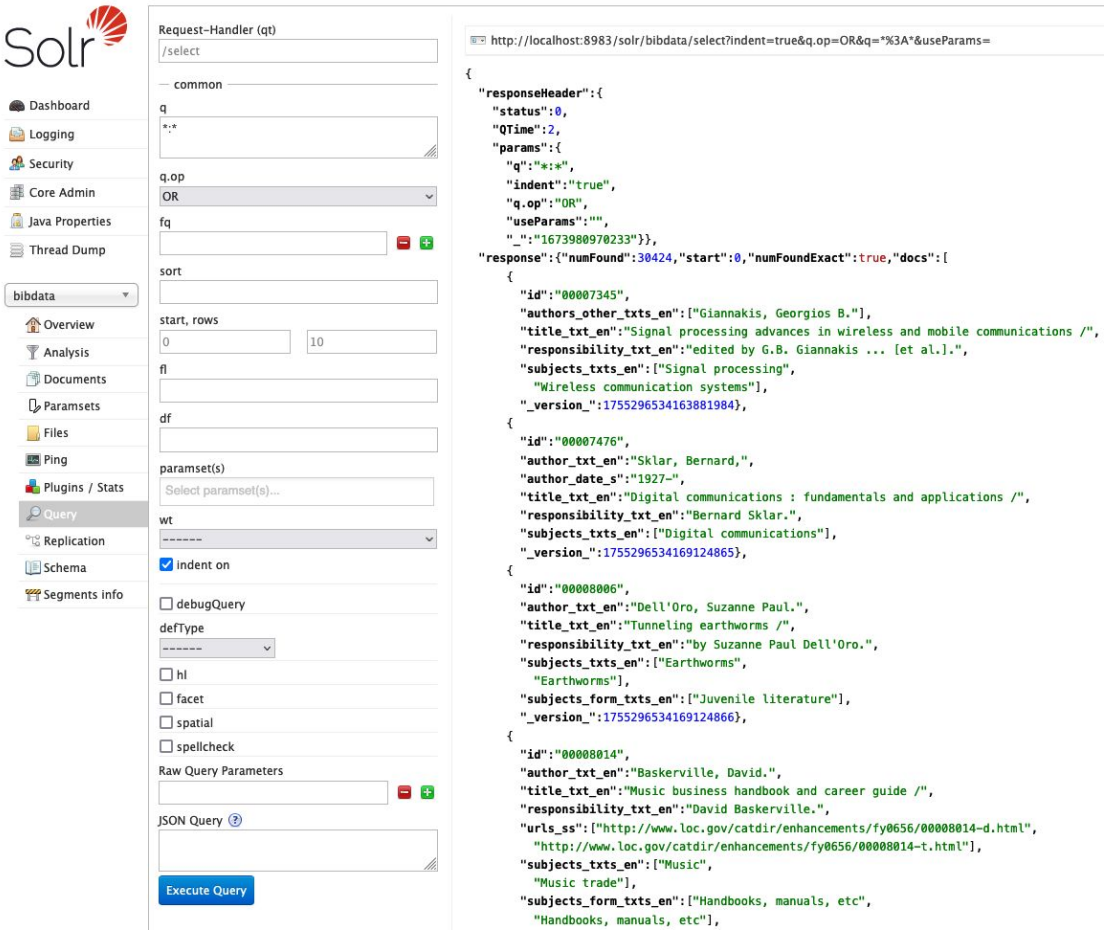


Is Solr a database?

- 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


Solr
Dashboard
Logging
Security
Core Admin
Java Properties
Thread Dump
bibdata
Overview
Analysis
Documents
Paramsets
Files
Ping
Plugins / Stats
Query
Replication
Schema
Segments info
Request-Handler (qt)
/select
common
q
:
q.op
OR
fq
sort
start, rows
0
10
fl
df
paramset(s)
Select paramset(s)...
wt
indent on
debugQuery
defType
hl
facet
spatial
spellcheck
Raw Query Parameters
JSON Query
Execute Query
http://localhost:8983/solr/bibdata/select?indent=true&q.op=OR&q=*%3A*&useParams=
{
"responseHeader":{
"status":0,
"QTime":2,
"params":{
"q":"*:*",
"indent":"true",
"q.op":"OR",
"useParams":"",
"_":"1673980970233"}},
"response":{"numFound":30424,"start":0,"numFoundExact":true,"docs":[
{
"id":"00007345",
"authors_other_txts_en":["Giannakis, Georgios B."],
"title_txt_en":"Signal processing advances in wireless and mobile communications /",
"responsibility_txt_en":"edited by G.B. Giannakis ... [et al.].",
"subjects_txts_en":["Signal processing",
"Wireless communication systems"],
"_version_":1755296534163881984},
{
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"author_txt_en":"Sklar, Bernard,",
"author_date_s":"1927-",
"title_txt_en":"Digital communications : fundamentals and applications /",
"responsibility_txt_en":"Bernard Sklar.",
"subjects_txts_en":["Digital communications"],
"_version_":1755296534169124865},
{
"id":"00008006",
"author_txt_en":"Dell'Oro, Suzanne Paul.",
"title_txt_en":"Tunneling earthworms /",
"responsibility_txt_en":"by Suzanne Paul Dell'Oro.",
"subjects_txts_en":["Earthworms",
"Earthworms"],
"subjects_form_txts_en":["Juvenile literature"],
"_version_":1755296534169124866},
{
"id":"00008014",
"author_txt_en":"Baskerville, David.",
"title_txt_en":"Music business handbook and career guide /",
"responsibility_txt_en":"David Baskerville.",
"urls_ss":["http://www.loc.gov/catdir/enhancements/fy0656/00008014-d.html",
"http://www.loc.gov/catdir/enhancements/fy0656/00008014-t.html"],
"subjects_txts_en":["Music",
"Music trade"],
"subjects_form_txts_en":["Handbooks, manuals, etc",
"Handbooks, manuals, etc"],

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

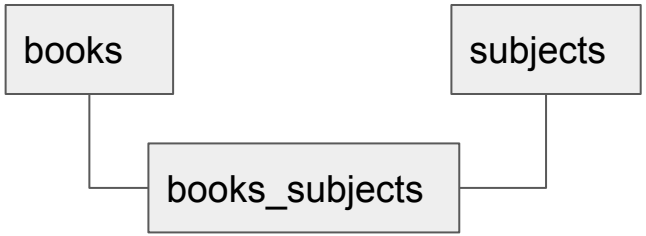
II. Schema

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#part-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



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

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#part-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

Your turn: Searching

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#part-iii-searching

- Searching
  - Basic parameters (`deftype`, `q`, `sort`, `rows`, `start`, `fl`, `fq`)
  - `qf`
  - `debug`
  - Ranking
  - Ranges
- Faceting
- Hit highlighting

IV. Miscellaneous

https://github.com/hectorcorrea/solr-for-newbies/blob/main/tutorial.md#part-iv-miscellaneous-optional

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

Recommended resources

- Book: Solr in Action by Trey Grainger and Timothy Potter
  - Old but still relevant
  - Great for general overview and in-depth analysis of some features
- Solr's official reference guide
- Relevant search with applications for Solr and Elasticsearch by Doug Turnbull and John Berryman
- Let's build a Full-Text Search engine by Artem Krylysov
- The technology behind GitHub's new code search by Timothy Clem

Thank you for attending!

Stay in touch

hector_correa@princeton.edu

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