

# BYOI: Build you own index

*Build your own discovery index of scholarly e-resources*

5th German Vufind Meetup 2016, 2016-10-11, Freiburg, University  
Library Freiburg [is.gd/iQYDZB](https://is.gd/iQYDZB)

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# Welcome

During the next few hours, we will create an small aggregated index from scratch.

You can code along if you like. Code, data and slides are distributed in a VM (on a USB stick).

# Why

At Leipzig University Library we built a version that serves as a successor to a commercial product.

Index includes data from *Crossref*, *DOAJ*, JSTOR, Elsevier, Genios, Thieme, DeGruyter among others.

Various coverages per library, from 55% to 70%. Potentially growable in breadth and depth.

# Format

We will use a combination of

- ▶ slides to motivate concepts and
- ▶ live coding and experimentation

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We will not use a product, we will build it.

## Goals

- ▶ a running VuFind 3 with a small aggregated index
- ▶ learn about a batch processing framework

## First Steps

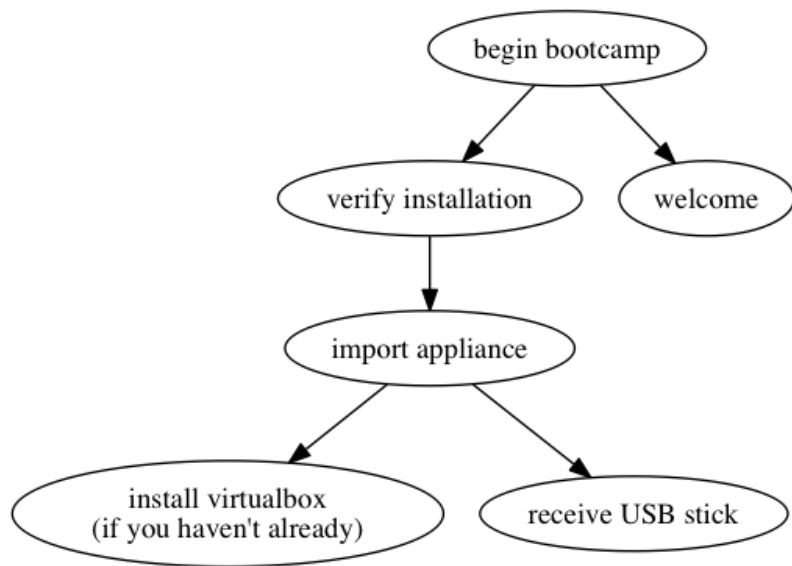


Figure 1: First steps

# Prerequisites

- ▶ Virtualbox: <https://www.virtualbox.org/wiki/Downloads>

# Import Appliance

On the USB-Stick you can find an OVA file that you can import into Virtualbox (or try to download it from <https://goo.gl/J7hcYC>). This VM contains:

- ▶ a VuFind 3 installation – `/usr/local/vufind`
- ▶ raw metadata (around 3M records) – `~/Bootcamp/input`
- ▶ scripts and stubs for processing – `~/Bootcamp/code`
- ▶ these slides – `~/Bootcamp/slides.pdf`

## Forwarded ports

Guest (VM)	>>	Host
80	>>	8085 (HTTP, VuFind)
8080	>>	8086 (SOLR)
8082	>>	8087 (luigi)
22	>>	2200 (SSH)
3306	>>	13306 (MySQL)

SSH tip:

```
$ curl -sL https://git.io/vrxoC > vm.sh
$ chmod +x vm.sh
$ ./vm.sh
```



# Outline

Bootcamp play book:

- ▶ intro: problem setting (heterogenous data, batch processing)
- ▶ VM setup - during intro

Then we will write some code:

- ▶ a basic pipeline with luigi python library
- ▶ combine various sources into a common format
- ▶ apply licensing information
- ▶ index into solr

# Outline DAG

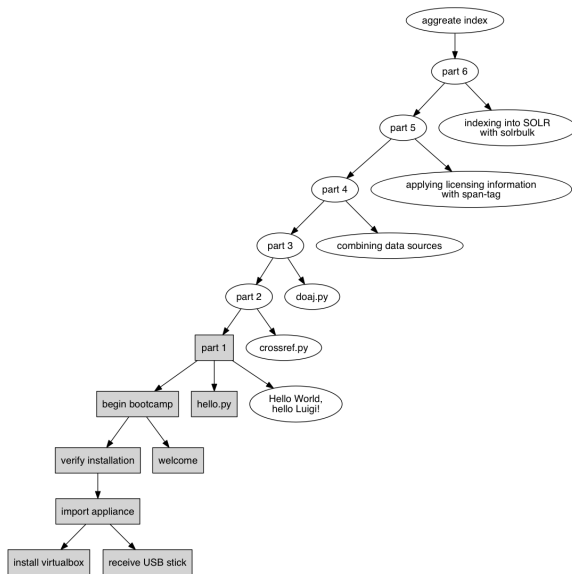


Figure 2: Tour

## Intro: Problem setting

- ▶ batch processing, not small data (but not too big, either)
- ▶ regular processing required
- ▶ varying requirements
- ▶ multiple small steps to apply on all data
- ▶ iterative development

# Intro: Rise of the DAG

- ▶ DAG = directed acyclic graph, partial ordering
- ▶ many things use DAGs, make, Excel, scheduling problems
- ▶ model tasks in a DAG, then run topological sort to determine order

## Examples:

- ▶ <http://goo.gl/FCpxiK> (history is a DAG)
- ▶ <http://i.stack.imgur.com/iVNcu.png> (airflow)
- ▶ <https://git.io/vw9rW> (luigi)
- ▶ <https://goo.gl/vMEezR> (Azkaban)

# Intro: Immutability

- ▶ immutability = data is not modified, after it is created
- ▶ immutable data has some advantages, e.g.
  - ▶ “human fault tolerance”
  - ▶ performance
- ▶ our use case: recompute everything from raw data
- ▶ tradeoff: more computation, but less to think about

# Intro: Frameworks

- ▶ many libraries and frameworks for batch processing and scheduling, e.g. Oozie, Askaban, Airflow, luigi, . . .
- ▶ even more tools, when working with stream, Kafka, various queues, . . .
- ▶ luigi is nice, because it has only a few prerequisites

## Intro: Luigi in one slide

```
import luigi

class MyTask(luigi.Task):
    param = luigi.Parameter(default='ABC')

    def requires(self):
        return SomeOtherTask()

    def run(self):
        with self.output().open('w') as output:
            output.write('%s business' % self.param)

    def output(self):
        return luigi.LocalTarget(path='output.txt')

if __name__ == '__main__':
    luigi.run()
```

## Intro: luigi

- ▶ many integrations, e.g. MySQL, Postgres, elasticsearch, ...
- ▶ support for Hadoop and HDFS, S3, Redshift, ...
- ▶ 200+ contributors, 350+ ML
- ▶ hackable, extendable – e.g.

<https://github.com/ubleipzig/gluish>



## Intro: Decomposing our goal

- ▶ clean and rearrange input data files
- ▶ convert data into a common (intermediate) format
- ▶ apply licensing information (from kbart)
- ▶ index into solr

# Intro: Incremental Development

- ▶ when we work with unknown data sources, we have to gradually move forward

## Intro: Wrap up

- ▶ many approaches to data processing
- ▶ we will focus on one library only here
- ▶ concepts like immutability, recomputation and incremental development are more general

—

- ▶ now back to the code

## Test VuFind installation

We can SSH into the VM and start VuFind:

```
$ ./vm.sh
```

```
(vm) $ cd /usr/local/vufind
```

```
(vm) $ ./solr.sh start
```

```
Starting VuFind ...
```

```
...
```

- ▶ <http://localhost:8085/vufind>
- ▶ <http://localhost:8085/vufind/Install/Home>

# Hello World

Test a Python script on guest. Go to the Bootcamp directory:

```
$ cd $HOME/Bootcamp  
$ python hello.py  
...
```

Note: Files follow PEP-8, so indent with space, here: 4.

## Setup wrap-up

You can now edit Python files on your guest (or host) and run them inside the VM. You can start and stop VuFind inside the VM and access it through a browser on your host.

We are all set to start exploring the data and to write some code.

# Bootcamp outline

- ▶ parts 0 to 6: intro, crossref, doaj, combination, licensing, export
- ▶ each part is self contained, although we will reuse some artifacts

# Bootcamp outline

- ▶ you can use scaffoldP\_..., if you want to code along
- ▶ the partP\_... files contain the target code

code/part{0-6}\_....py

code/scaffold{0-6}\_....py



## Coding: Part 0

- ▶ Hello World from luigi

```
$ cd code
```

```
$ python part0_helloworld.py
```

# Coding: Part 0 Recap

- ▶ simple things should be simple
- ▶ basic notion of a task
- ▶ command line integration

# Coding: Part 1

- ▶ An input and a task

```
$ python part1_require.py
```

## Coding: Part 1 Recap

- ▶ it is easy to start with static data
- ▶ business logic in python, can reuse any existing python library

## Coding: Part 2

- ▶ a first look at Crossref data
- ▶ harvest via API, the files contain batch responses
- ▶ custom format

## Coding: Part 2

Three things to do:

- ▶ find all relevant files (we will use just one for now)
- ▶ extract the records from the batch
- ▶ convert to an intermediate format

## Coding: Part 2

- ▶ Now on to the code

```
$ python part2_crossref.py
```

## Coding: Part 2 Recap

- ▶ used command line tools (fast, simple interface)
- ▶ chained three tasks together



## Excursion: Normalization

- ▶ suggested and designed by system librarian
- ▶ internal name: intermediate schema –  
<https://github.com/ubleipzig/intermediateschema>
- ▶ enough fields to accomodate various inputs
- ▶ can be extended carefully, if necessary
- ▶ tooling (licensing, export, quality checks) only for a single format

## Excursion: Normalization

```
{  
  "finc.format": "ElectronicArticle",  
  "finc.mega_collection": "DOAJ",  
  "finc.record_id": "ai-28-00001...",  
  "finc.source_id": "28",  
  "rft.atitle": "Importância da vitamina B12 na ...",  
  "rft.epage": "78",  
  "rft.issn": [  
    "1806-5562",  
    "1980-6108"  
  ],  
  "rft.jtitle": "Scientia Medica",  
  ...  
}
```

## Coding: Part 3

- ▶ DOAJ index data
- ▶ a complete elasticsearch dump

## Coding: Part 3

This source is not batched and comes in a single file, so it is a bit simpler:

- ▶ locate file
- ▶ convert to intermediate schema

```
$ python part3_require.py
```

## Coding: Part 3 Recap

- ▶ it is easy to start with static data
- ▶ business logic in python, can reuse any existing python library

## Coding: Part 4

- ▶ after normalization, we can merge the two data sources

```
$ python part4_combine.py
```

## Coding: Part 4 Recap

- ▶ a list of dependencies
- ▶ python helps with modularization
- ▶ using the shell for performance and to reuse existing tools

## Coding: Part 5

- ▶ licensing turned out to be an important issue
- ▶ a complex topic
- ▶ we need to look at every record, so it is performance critical
- ▶ we use AMSL for ERM, and are on the way to a self-service interface
- ▶ AMSL has great APIs
- ▶ we convert collection information to an expression-tree-ish format – <https://is.gd/Fxx0IU>, <https://is.gd/ZTqLqB>



## Coding: Part 5

```
$ python part5_licensing.py
```

## Coding: Part 5

- ▶ boolean expression trees allow us to specify complex licensing rules
- ▶ the result is a file, where each record is annotated with an ISIL
- ▶ at Leipzig University Library we currently do this for about 20 ISILs

## Coding: Part 5 Recap

- ▶ dependencies as dictionary
- ▶ flexibility in modeling workflows
- ▶ again: use command line tools for performance critical parts

## Coding: Part 6

- ▶ a final conversion to a SOLR-importable format

## Coding: Part 6

```
$ python part6_export.py
```

## Coding: Part 6

- ▶ slightly different from SOLRMARC style processing
- ▶ keep things (conversion, indexing) a bit separate
- ▶ standalone tool: solrbulk

## Coding: Part 6 Recap

- ▶ flexibility in modeling workflows
- ▶ again: use command line tools for performance critical parts

# Indexing

- ▶ finally, we can index the data into SOLR
- ▶ make sure SOLR is running on your VM



# Indexing

```
$ solrbulk -host localhost -port 8080 \  
          -w 2 -z -verbose -commit 100000 \  
          -collection biblio \  
          output/6/Export/output.ldj.gz
```

- ▶ might want to increase SOLR\_HEAP (defaults to 512M)

# Indexing

- ▶ go to `http://localhost:8085`
- ▶ index should be slowly growing

## Code recap

```
\_ Export()  
  \_ ApplyLicensing()  
    \_ CombinedIntermediateSchema()  
      \_ DOAJIntermediateSchema()  
        \_ DOAJInput()  
      \_ CrossrefIntermediateSchema()  
        \_ CrossrefItems()  
          \_ CrossrefInput()  
    \_ CreateConfiguration()  
      \_ HoldingFile()
```

## Code recap

```
$ python deps.py
\_ Export()
  \_ ApplyLicensing()
    \_ CombinedIntermediateSchema()
      \_ DOAJIntermediateSchema()
        \_ DOAJInput()
      \_ CrossrefIntermediateSchema()
        \_ CrossrefItems()
          \_ CrossrefInput()
    \_ CreateConfiguration()
      \_ HoldingFile()
```

## Code recap

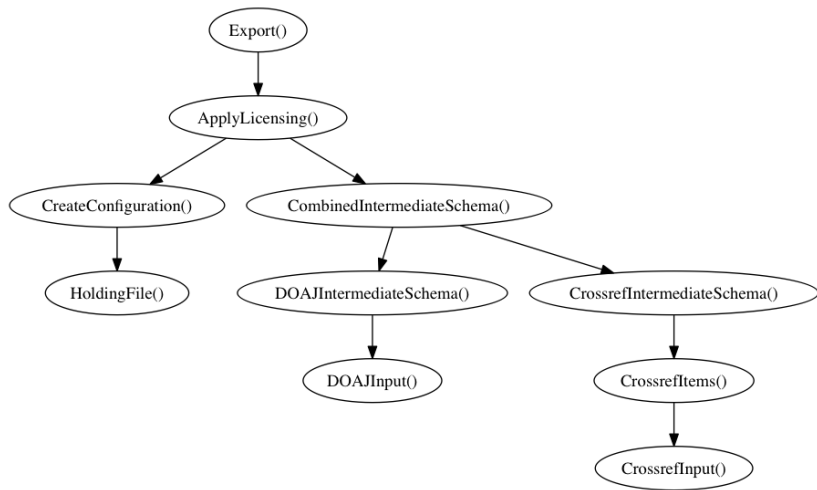


Figure 3: Deps

## Follow up with workflow changes

- ▶ `https://git.io/v0ZFQ`

# Indexing

Production data points:

- ▶ sustained indexing rates between 2000-4000 docs/s
- ▶ a full reindex of about 100M docs currently takes about 10h with SOLR

# Discussion

what we left out:

- ▶ more data sets
- ▶ larger data sets
- ▶ XML
- ▶ errors
- ▶ parameters
- ▶ collaboration and deployment



# Discussion

- ▶ what are your experiences with batch systems?
- ▶ how do you manage large heterogeneous data?
- ▶ what could we add to the pipeline?

## Q & A

Thanks for your attention.

For any questions, please get in touch during the conference or via e-mail:

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