Media Analysis Pipeline

Executive Summary

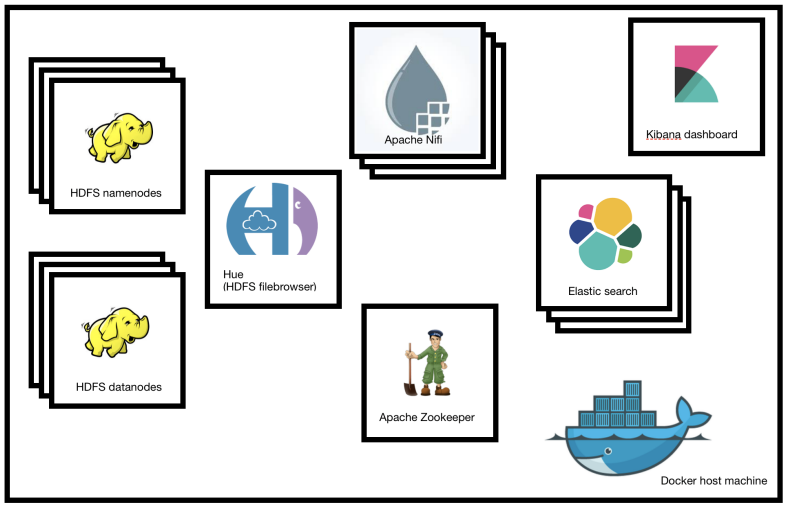
Our Capstone Project called "Media Analysis Pipeline" is used to collect various newspapers articles and store them for analysis.
The pipeline consists of various technologies, all of which run in containerized environments. The containers are managed by Docker and specified in `docker-compose.yml`.

Magazines scraped and saved as rawdata	Transformer available
Die Presse	✔
Kronen Zeitung	✔
Unzensuriert.at	✔
Kurier	

Deployment

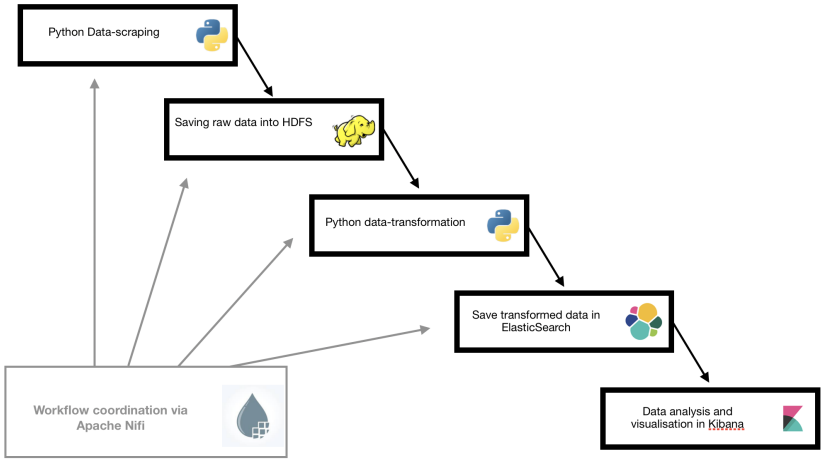
The minimum deployment consists of following containers:

- **One Apache Zookeeper**
- **One Apache NiFi**
- **One HDFS namenode**
- **One HDFS datanode**
- **One Hue**
- **Two ElasticSearch Nodes**
- **One Kibana**



Workflow

All of the workflow for getting the data, transforming it, saving raw data as well as transformed and finally storing it in ElasticSearch for analysis, is managed by Apache Nifi.



Usage

Clone the github repository: `git clone git@github.com:AppField/media-analysis-pipeline.git`
Ensure ElasticSearch will work

ElasticSearch needs more memory to store its inidices. Therefore the mmap counts needs to be increased.
To do so simply run following shell command(s), depending on your OS:

Linux	OS X
`sudo sysctl -w vm.max_map_count=262144`	`screen ~/Library/Containers/com.docker.docker/Data/com.docker.driver.amd64-linux/tty` `sudo sysctl -w vm.max_map_count=262144`
Or execute `elsearch_setup.sh`	

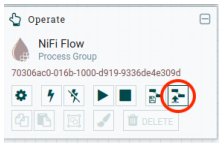
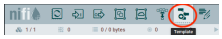
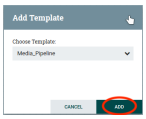
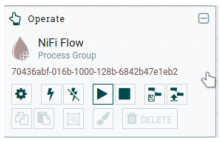
This has to be done after every reboot of the docker host machine.

Run

To start all docker containers simultaneously run this: `docker-compose up`
Then run `hdfs_conf_script.sh` to copy HDFS config files from the namenode to Nifi. This is only necessary the first time you start the containers.

Import Workflow

To edit or start the current workflow open Nifi in your browser.
Get NiFi port by running: `docker ps | grep nifi` and open `localhost:<NIFIPORT>/nifi` in your browser.

Step	Image	Step	Image
1. Select `upload template` on the left side of the screen.		2. Select the template, which is located in `./nifi/templates` and click `Upload` .	
3. Insert the template via the button in the top menu bar.		4. Click `Add`	
5. Click somewhere on the background of NiFi and Click the `Play` button to start the whole workflow.		6. Start all processes, except `Get Articles from HDFS` to start the Pipeine	

Hue

To see the data stored in the HDFS open your browser and navigagte to `localhost:8088/home` . The first time you open it you have to specify an username and a password. Click `File Browser` on the top right corner and go two level up in the folder hierchachy to view the different magazine folders.
From there you can browse the data.

Kibana

The project already contains a Kibana objects file, which contains the index patterns, visualizations and dashboard. To import it you have to do following steps:

- Open Kibana on `localhost:5601` in your browser
- On the left menu bar open settings (last one)
- Click `Saved Objects` on lower menu
- Click `Import` on top right corner
- Click `Import` again
- Open `./kibana/objects.json` and click the `Import button`

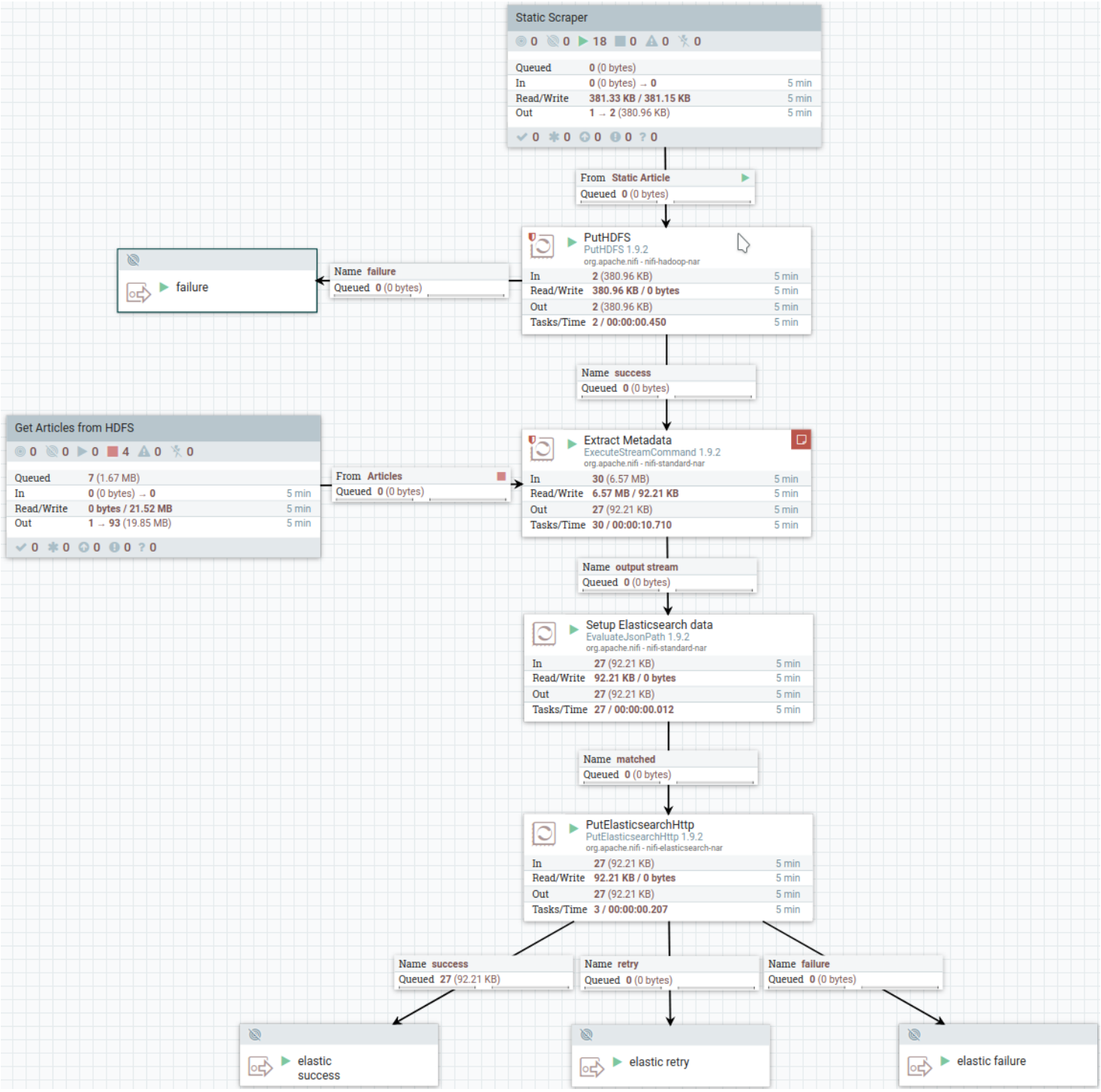
Now you can click `Dashboard` on the left menu bar and select the dashboard `Online Magazines` which you've just imported to view the data.

Documentation

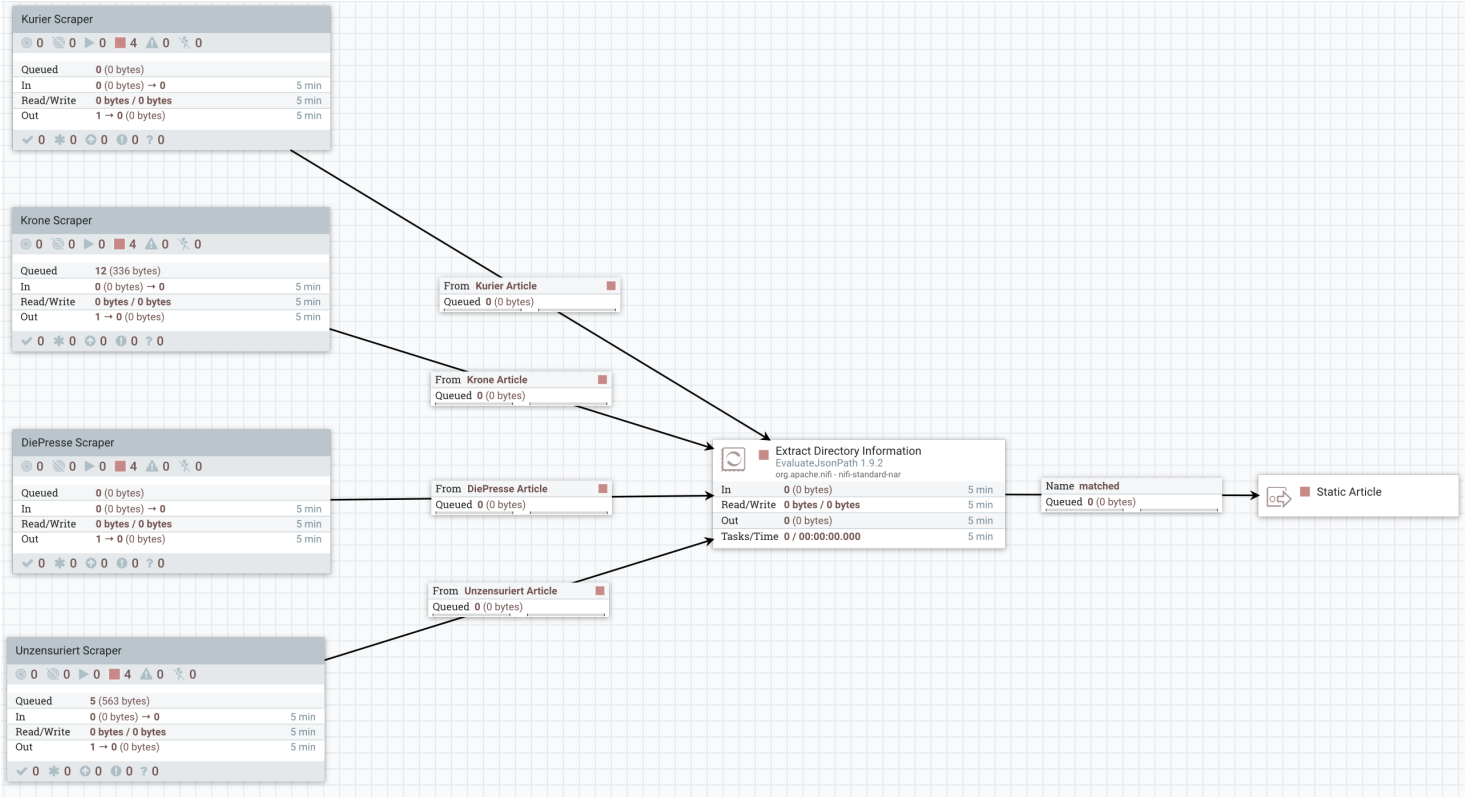
Nifi-Workflow

All of the computational work is manged by one Nifi workflow.

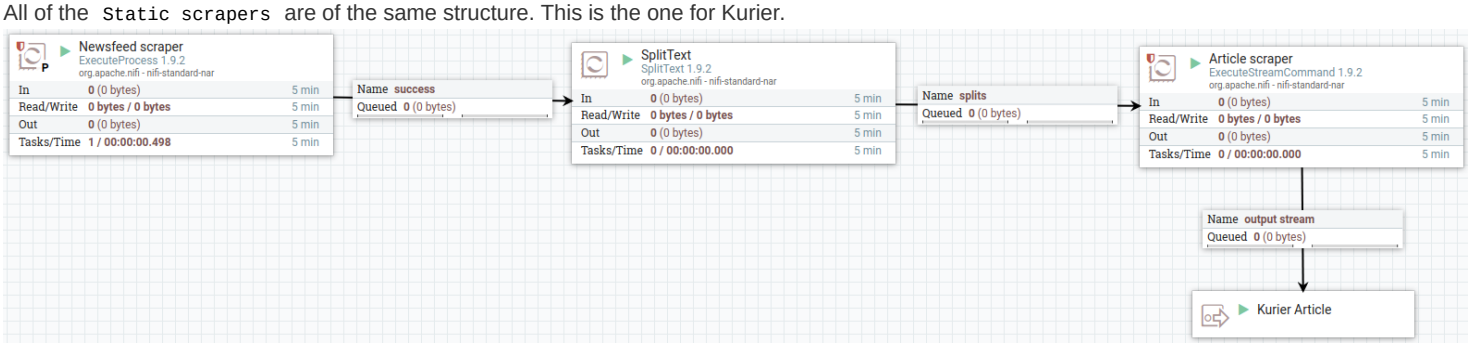
In the main workflow, one can see it starts with the processor group `Static Scraper` .
The scraped articles are then saved to HDFS via the processor `PutHDFS` . After that metadata is extracted (which is saved by python in JSON format, scripts are located in `./src/transformer`) into the flow file so the last processor `PutElasticSearchHTTP` has the necessary information to save the data into ElasticSearch.



`Static scraper` starts with processor goups for every outlett.
Then the processor `Extract Directory Information` extracts information used by the processor `PutHDFS` from the output of the scrapers into the flow file.



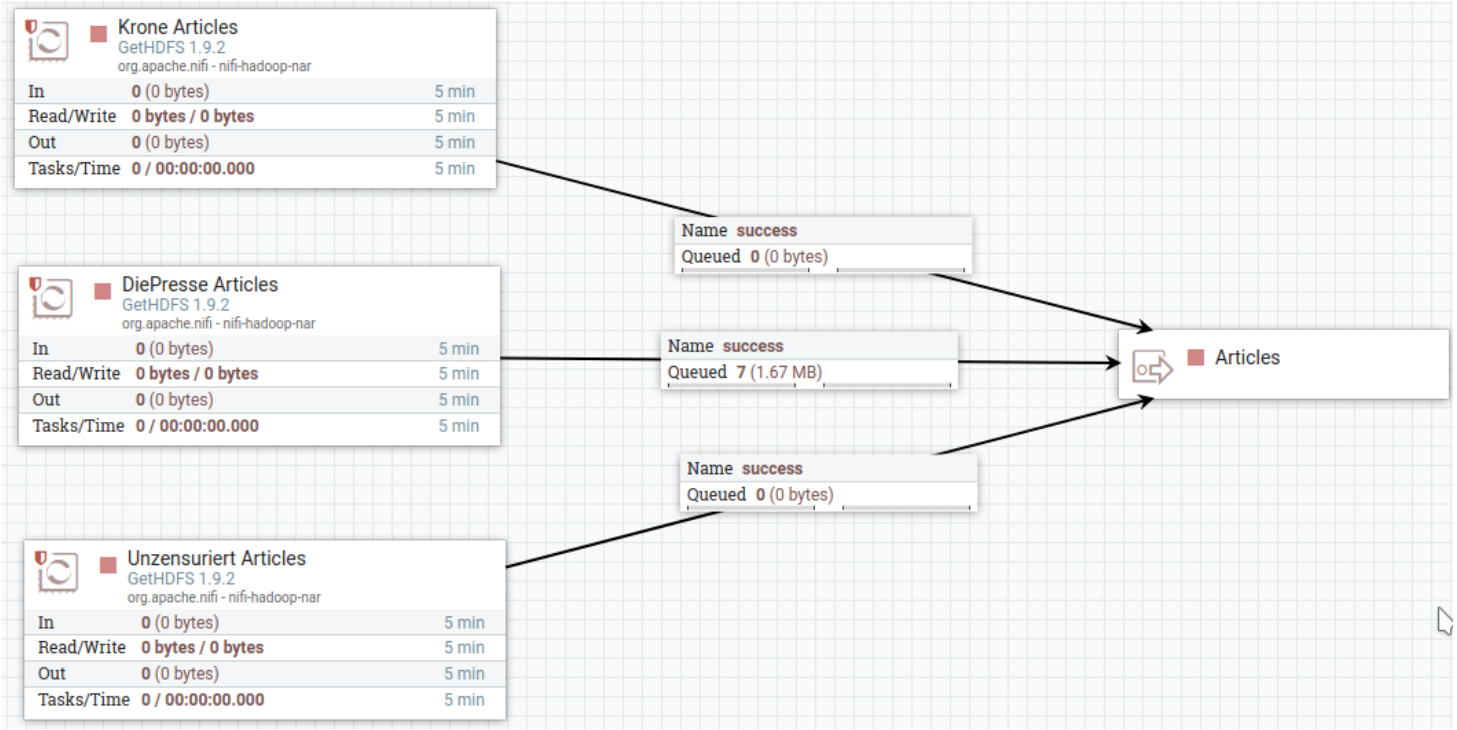
All of the `Static scrapers` are of the same structure. This is the one for Kurier.



First step in our pipline is the scraping of the article links. This is part of our `Newsfeed Scraper` processor. This one uses a python script to get links for articles. These are then split up by the processor `Split Text` . For each link the processor `Article Scraper` runs the actual python scraper to get the article.

Retransform articles

The processor group `Get Articles from HDFS` is used to get articles which are already stored in HDFS. Therefore we can retransform them and save them again into ElasticSearch.



Project Structure

Files

This project uses a simple filestructure.
The folder `etc` contains everything that is not directly associated with the deployment (e.g. pictures used in this README).
All files containing code are located in the folder `src`. In `src` files are devided in either `scrapper` or `transformer`.
The folder `nifi` contains all files necessary for the custom Nifi container to run.

Setup

Ensure ElasticSearch will work

ElasticSearch needs more memory to store its inidices. Therefore the mmap count needs to be increased.
To do so simply run following shell command(s), depending on your OS:

Linux	OS X
`sudo sysctl -w vm.max_map_count=262144`	`screen ~/Library/Containers/com.docker.docker/Data/com.docker.driver.amd64-linux/tty` `sudo sysctl -w vm.max_map_count=262144`
Or execute `elsearch_setup.sh`	

This has to be done after every reboot of the docker host machine.

Run

To start all docker containers simultaneously run this:

```
docker-compose up
```

You can also detach the command from the terminal: `docker-compose up -d`
Then run `hdfs_conf_script.sh` to copy HDFS config files from the namenode to Nifi. This is only necessary the first time you start the containers.

Import Workflow

To edit or start the current workflow open Nifi in your browser.
Get NiFis port by runnning `docker ps | grep nifi` and open `localhost:<NIFIPORT>/nifi` in your browser.

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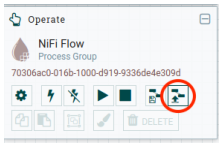
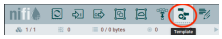
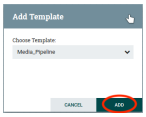
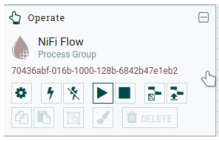
1. Select `upload template` on the left side of the screen.		2. Select the template, which is located in `./nifi/templates` and click `Upload`.	
3. Insert the template via the button in the top menu bar.		4. Click `Add`	
5. Click somewhere on the background of NiFi and Click the `Play` button to start the whole workflow.		6. See the workflow running!	

Stop

To stop all docker containers simultaneously run this:

```
docker-compose down
```

This will also delete the containers.

Python Scripts

To scrape and transform the articles, we use Python 3.7.
Libraries which are used:

- request
- beautifulsoup4

`Request` is used to download the articles from an url and `BeautifulSoup` for parsing the HTML.
For local development Pipenv is used. Execute this commands to get it up and running:

Install Pipenv

Linux:

```
# Debian/Ubuntu
sudo apt install pipenv
# fedora
sudo dnf install pipenv
```

OS X:

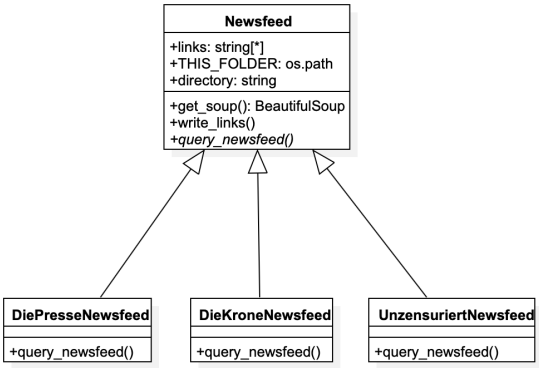
```
brew install pipenv
```

Install dependencies and get into the newly created virtual environment:

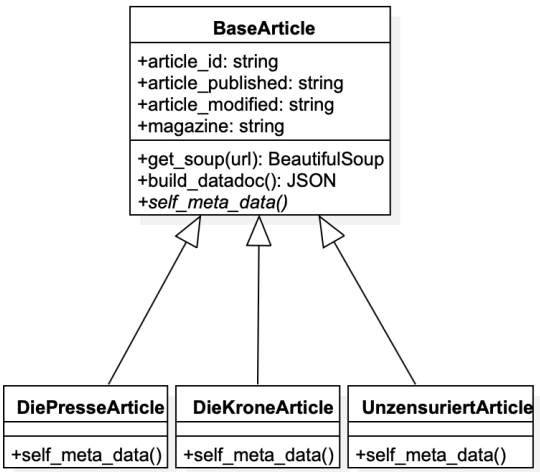
```
pipenv install
pipenv shell
```

Class diagrams

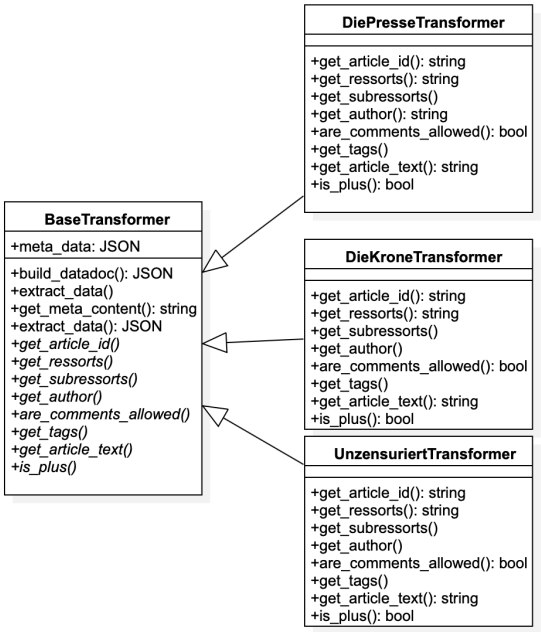
First to get the URLs which we want to scrape, we use a class called `Newsfeed`. This is the base class and every news outlet has it's specialised class which inheritates from it.



With the URLs at hand we can start scraping. For the scraper we use the same structure as for the Newsfeed scraper. In this case the base class is called `BaseArticle`.



Finally all of the data needs to be transformed, so that it can be easily analysed. For this, again, we have a base class called `BaseTransfomer` and subclasses for ever outlet.



HDFS

As mentioned earlier, all of the data gets saved in raw format (complete HTML of the website) to a hadoop filesystem in a json file (HDFS). This consists of:

- namenode(s)
  - responsible for orchestrating datanodes
- datanode(s):

- responsible for actually saving the data

All files are saved in a common directory hierachy: `magazineName/year/month/`
The articles itself are saved in JSON files with this name schema: `articleId-published_date.json`
The JSON files have this data forma:

```
{
    "id": "<Value>",
    "magazine": "<Value>",
    "directory": "<Value>",
    "filename": "<Value>",
    "content": "<Value>"
}
```

The content attribute is where the actual article HTML belong to.

Hue

To see the data stored in the HDFS open your browser and navigagte to `localhost:8088/home`. The first time you open it you have to specify an username and a password.
Click `File Browser` on the top right corner and go two level up in the folder hierchachy to view the different magazine folders.
From there you can browse the data.

ElasticSearch

ElasticSearch is available on `localhost:9200`. The ElasticSearch cluster consists of two nodes, which are specified in the `docker-compose.yml` file.

Data format

Indices schema: `magazineName-month-year`

```
{
    "id": "<Value>",
    "title": "<Value>",
    "ressorts": "<Value>",
    "published_time": "<Value>",
    "modified_time": "<Value>",
    "url": "<Value>",
    "author": "<Value>",
    "are_comments_allowed": "<Value>",
    "tags": "<Value>",
    "article_text": "<Value>",
    "is_plus": "<Value>"
}
```

Kibana

Kibana is used to visualize the data which is stored in ElasticSearch.
Open `localhost:5601` in your browser to view kibana.

The project already contains a Kibana objects file, which contains the index patterns, visualizations and dashboard. To import it you have to do following steps:

- Open Kibana on `localhost:5601` in your browser
- On the left menu bar open settings (last one)
- Click `Saved Objects` on lower menu
- Click `Import` on top right corner
- Click `Import` again
- Open `./kibana/objects.json`
- Click lower `Import` button

Now you can click `Dashboard` on the left menu bar and select the dashboard `Online Magazines` which you've just imported to view the data.