AIFA scraper backend

Software Architectures and Methodologies

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Introduction

AIFA

Agenzia Italiana del Farmaco

- public institution
- responsible for the regulatory activity of pharmaceuticals in Italy

Medicines data

AIFA mantains the only official database of italian medicines, which contains information like names, companies, active ingredients, leaflets...

This project

How can we query AIFA database?
There is a service, though it is not well-documented

Objective of this project

- **extract** data from AIFA services
- **store** data in a relational database
- **provide** access to data through a REST API

Technologies

- JEE with Hibernate
- MariaDB
- Gradle and Docker

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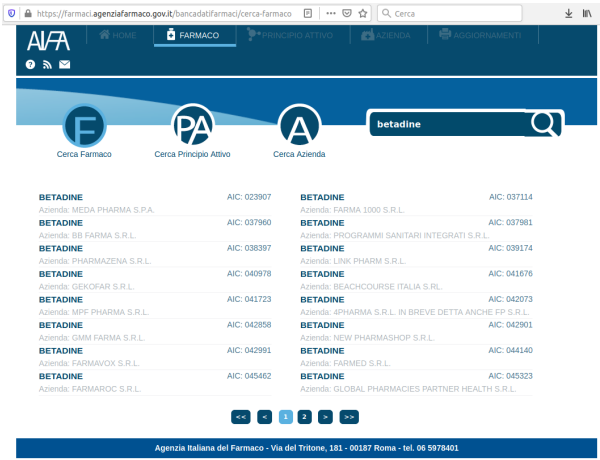
AIFA services

AIFA web interface



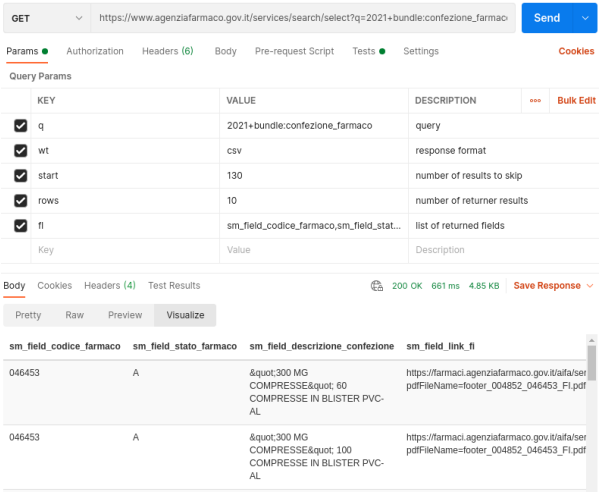
By inspection:

- one remote endpoint
- example queries
- response fields
- wildcard *

On parameters:

- many response formats
- can specify fields
- can limit the results

Understanding of AIFA services



GET https://www.agenziafarmaco.gov.it/services/search/select?q=2021+bundle:confezione_farmaco Send

Params Authorization Headers (6) Body Pre-request Script Tests Settings Cookies

Query Params

KEY	VALUE	DESCRIPTION	Bulk Edit
q	2021+bundle:confezione_farmaco	query	
wt	csv	response format	
start	130	number of results to skip	
rows	10	number of returner results	
fl	sm_field_codice_farmaco,sm_field_stat...	list of returned fields	
Key	Value	Description	

Body Cookies Headers (4) Test Results 200 OK 661 ms 4.85 KB Save Response

Pretty Raw Preview Visualize

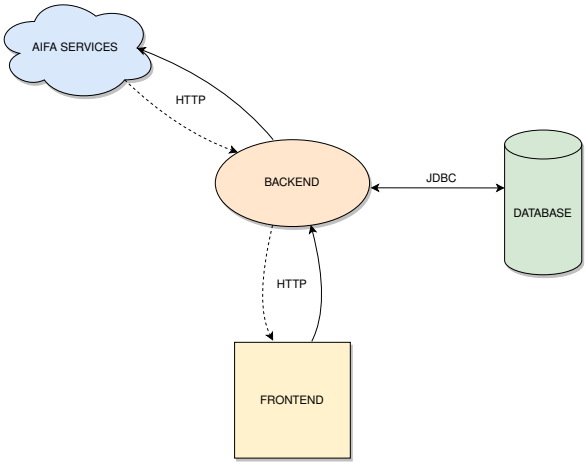
sm_field_codice_farmaco	sm_field_stato_farmaco	sm_field_descrizione_confezione	sm_field_link_fi
046453	A	"300 MG COMPRESSE" 60 COMPRESSE IN BLISTER PVC-AL	https://farmaci.agenziafarmaco.gov.it/aifa/ser pdfFileName=footer_004852_046453_FI.pdf
046453	A	"300 MG COMPRESSE" 100 COMPRESSE IN BLISTER PVC-AL	https://farmaci.agenziafarmaco.gov.it/aifa/ser pdfFileName=footer_004852_046453_FI.pdf

Discoveries:

- other parameters
- AND/OR expressions
- paginated requests
- filter by year

Software architecture

System architecture



What already exists:

- AIFA services
- frontend

What we developed:

- backend (JEE server)
- database (MariaDB DBMS)

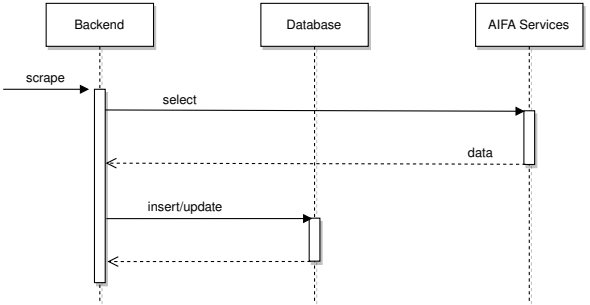
Interactions during scrape

Scrape procedure:

1. get data from aifa services
2. elaborate data
3. save data into the database

Suggested start automation:

- manual start: using cURL
- periodic start: using cron

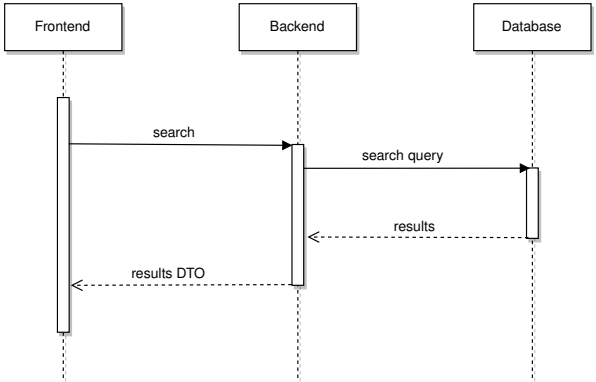


Scrape API

`PUT {server_url}/api/scrape`

Parameter	Type	Default	Description
url	String	null*	url of remote service
file	String	null	path to csv file
firstResult	Integer	0	index of first result in download
maxResults	Integer	10	max results in all downloads
downloadSize	Integer	*maxResults*	max results per download
transactionSize	Integer	1000	max insert per transaction
checkLastUpdate	boolean	false	if true, discard records not updated since last time
year	Integer	null	request records with *year* in one of the date fields

Interactions during search



Search steps

1. frontend send the request
2. backend queries the database
3. results are returned in JSON

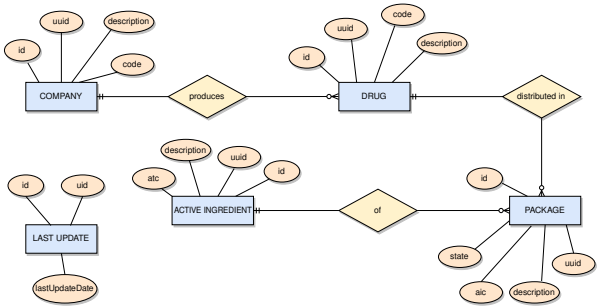
Search API

`GET {server_url}/api/search`

Parameter	Type	Default	Description
drug	String	null	value to search in drug description
name	String	null	alias for drug (compatibility reasons)
activeIngredient	String	null	value to search in active ingredient description
company	String	null	value to search in company description
text	String	null	value to search in all descriptions
firstResult	Integer	0	index of first result
maxResults	Integer	null	number of maximum results
retired	boolean	false	if true, return retired packagings too

Type of returned JSON: `List<DrugDto>`

Entity-Relationship diagram



Entities that store data:

- Active Ingredient
- Company
- Drug
- Package

Last Update entity to reduce load

Remark
Active Ingredient is linked to package

Note
Tables are auto-generated with JPA

Server load during scrape

Several techniques are available to reduce the load of the server

Reduce downloaded data
Download only useful fields from AIFA

Paginate downloads
Download chunk after the preceding was processed

Paginate transactions
Many insert in the same transaction

Select year
Download only records modified in the year

Discard old
Discard records not modified since last scrape

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Packages

→ `model`: domain model

→ `api`: exposes the endpoints

→ `controller`: business logic

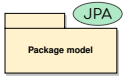
→ `dao`: provides data operations

→ `requester`: handle requests to AIFA services

→ `dto`: defines the format of JSON objects

→ `mapper`: converts domain objects to DTOs

→ `config`: enables CORS



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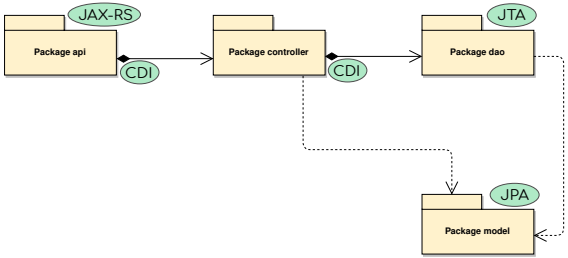

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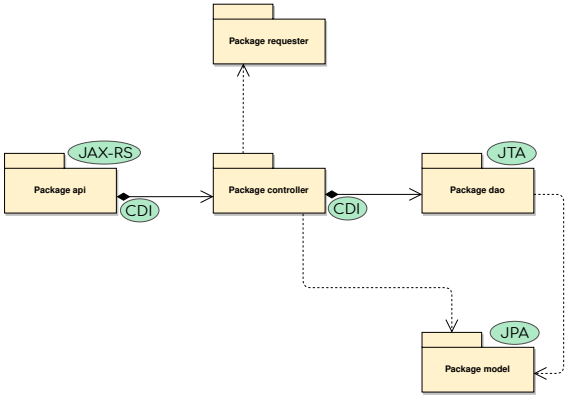

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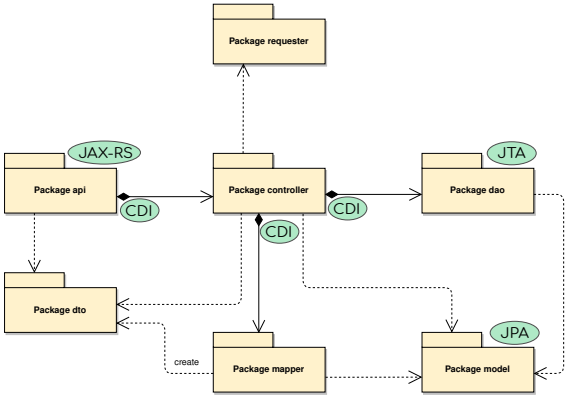

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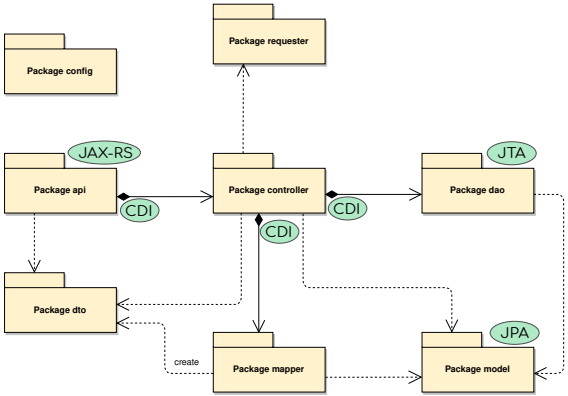

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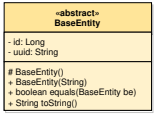
Domain model



- a common abstract base class

getters and setters omitted

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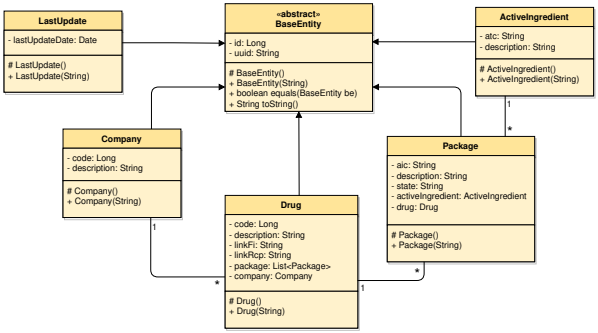

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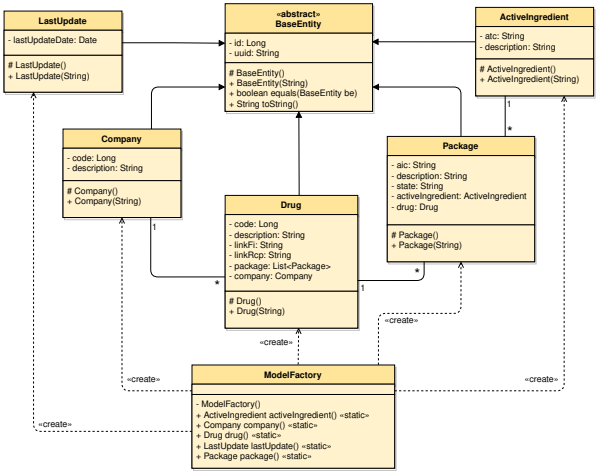

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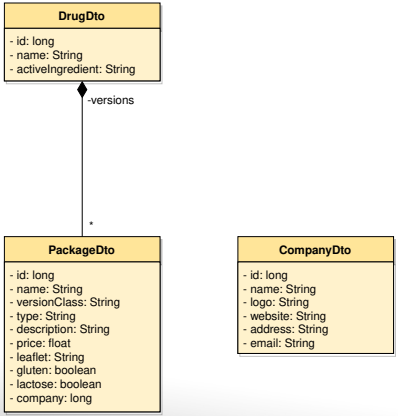
- a common abstract base class
- a factory creates all the entities

Data Transfer Objects



Compatibility
The client expect objects in different format

Solution
Use the Data Transfer Object pattern

1. a mapper convert an entity into a DTO
2. DTOs are transformed into JSON

Software usage

Persistence unit configuration: persistence.xml

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<persistence xmlns="http://xmlns.jcp.org/xml/ns/persistence"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/persistence
        http://xmlns.jcp.org/xml/ns/persistence/persistence_2_2.xsd" version="2.2">
    <persistence-unit name="aifaPU" transaction-type="JTA">
        <jta-data-source>java:jdbc/datasources/AifaDB</jta-data-source>
        <properties>
            <property name="hibernate.dialect" value="org.hibernate.dialect.MariaDBDialect" />
            <property name="hibernate.hbm2ddl.auto" value="update"/>
            <property name="hibernate.show_sql" value="true"/>
        </properties>
    </persistence-unit>
</persistence>
```

Remark

The persistence unit configuration is Hibernate-specific.

Datasource configuration: web.xml

```
<data-source>
    <name>java:jdbc/datasources/AifaDB</name>
    <class-name>org.mariadb.jdbc.MariaDbDataSource</class-name>
    <server-name>aifadb-service</server-name>
    <port-number>3306</port-number>
    <database-name>aifa_db</database-name>
    <user>root</user>
    <password></password>
</data-source>
```

Remark

The `name` property shouldn't be changed: it is linked to `persistence.xml`.
The other properties can be changed, according to the desired datasource.

Build

Gradle

- no installation needed (thanks to the gradle wrapper)
- fast and easy

Compile the application

- Linux/macOS: `./gradlew war`
- Windows: `gradlew.bat war`

Compilation output

`aifa-scraper.war` inside `build/libs/` subdirectory

Run: two different ways

Without docker

1. start the DBMS
2. create a database
3. modify datasource configuration in *web.xml*
4. compile the application with *Gradle*
5. run *WildFly* in standalone mode
6. move `aifa-scraper.war` into *standalone/deployments/* subdir of *WildFly*

With docker

1. compile the application with *Gradle*
2. launch with *Docker Compose*: `docker-compose up`

Docker 

Backend

In the *Dockerfile*:

1. start from a *WildFly* image
2. move the `aifa-scraper.war` file
3. run *WildFly* in standalone mode

All togheter

The *docker-compose.yml* defines:

1. a service based on the built backend
2. a service based on a MariaDB image
3. a network that allows the two services to communicate with each other

Conclusions

Recap

- → JEE server
- → scrape data from AIFA
- → control server load during scrape
- → serve data through a RESTful API
- → easy compilation and running with Gradle and Docker

Thanks for the attention!

Dockerfile

```
FROM jboss/wildfly:22.0.1.Final

ADD build/libs/aifa-scraper.war /opt/jboss/wildfly/standalone/deployments/

CMD ["/opt/jboss/wildfly/bin/standalone.sh", "-b", "0.0.0.0", "-bmanagement", "0.0.0.0"]

EXPOSE 8080 9990 5005
```

docker-compose.yml

```yaml
version: "3.7"
services:
    jeeserver-service:
        container_name: "aifa-scraper_jeeserver_container"
        build:
            context: .
        depends_on:
            - aifadb-service
        networks:
            - aifa-scraper-network
        ports:
            - "8080:8080" # application
            - "9990:9990" # admin console
            - "5005:5005" # debug port
    aifadb-service:
        container_name: "aifa-scraper_db_container"
        image: "mariadb:10.5.8"
        environment:
            - MYSQL_DATABASE=aifa_db
            - MYSQL_ALLOW_EMPTY_PASSWORD=true
        networks:
            - aifa-scraper-network
        ports:
            - "3306:3306"
networks:
    aifa-scraper-network:
        name: aifa-scraper-network
```