

RESTful Diner

A Restaurant orders management APIs system

Enrico Stefanel [SM3500554]

`enrico.stefanel@studenti.units.it`

Data Science and Scientific Computing Master's Course

Department of Mathematics and Geosciences

University of Trieste

A.Y. 2024–2025

Table of Contents

Introduction

- System requirements

Application

- System design

- System implementation

Open Data principles

- Linked Open Data

- Data Management

Conclusions

The Problem

In a far away land, there is a restaurant that is serving every day thousands of hungry customers. The restaurant owner needs a system to keep track of all the orders that are coming in, and that can also help him to analyze the data in order to improve the service that he is offering to his customers.

The restaurant owner understands that the data that he is collecting is very valuable, and **he wants to make it available to the public**, so that other willing Data Scientists can help him to understand any hidden insight on the data, and to suggest him how to improve his business.

Envisioned Solution

The solution of the problem is to design a system that can handle the restaurant orders data, and that can also provide an API to access the data in a simple and efficient way.

In a few words, an **Open Data API system** is exactly what the restaurant owner needs.

The whole code of the project is available on GitHub at <https://github.com/enstit/RESTfulDiner>.

Use Case Diagram

The first step of our development to identify the use cases of our system. We have identified four main use cases:

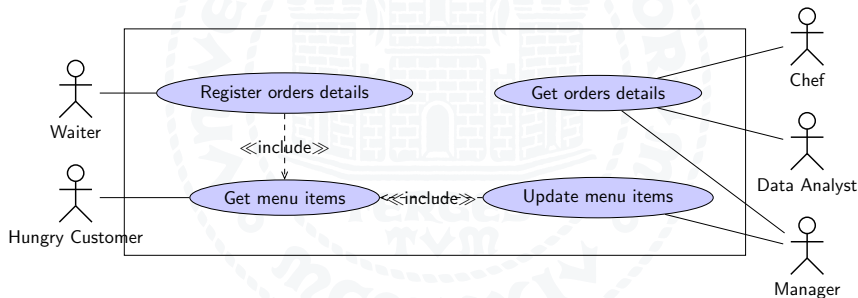


Figure: Use cases diagram

E/R Diagram

Next, the E/R diagram was designed to represent the data model of the system:

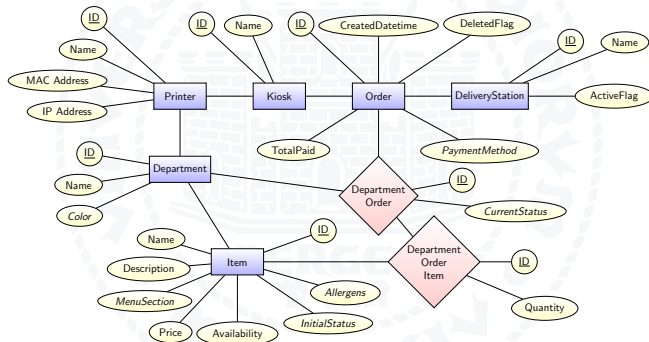


Figure: E/R diagram

Data model (logical) implementation I

The data model has been implemented using the SQLAlchemy ORM, which provides a high-level interface to the (PostgreSQL, in this case) database.

```
1 class BaseModel(DeclarativeBase):  
2     __abstract__ = True  
3     metadata = metadata  
  
4     @declared_attr  
5     def id(cls) -> Mapped[UUIDType]:  
6         return mapped_column(  
7             cd.ID,  
8             default=lambda: uuid8(domain=cls.__name__),  
9             primary_key=True,  
10            comment=f"Unique {cls.__name__} instance identifier",  
11            sort_order=-1, # Ensure the id is the first column in the table  
12        )
```

Any class inherits from the `BaseModel` class and is automatically mapped to a table in the database.

Data model (logical) implementation II

```
1 class Department(BaseModel):
2     name: Mapped[str] = mapped_column(
3         cd.SHORT_NAME,
4         unique=True,
5         comment="Unique name of the department",
6     )
7     color: Mapped[Optional[str]] = mapped_column(
8         cd.SHORT_NAME,
9         comment=(
10             "A color between the Recognized color keyword names. "
11             "See also https://www.w3.org/TR/SVG11/types.html#ColorKeywords"
12         ),
13     )
14     printer_id: Mapped[Optional[UUIDType]] = mapped_column(
15         cd.ID,
16         ForeignKey("printer.id"),
17         nullable=True,
18         default=None,
19         comment="Identifier of the printer the department is equipped with",
20     )
```


Data model (physical) implementation

Since we are using an ORM, the physical implementation of the data model is automatically generated by the ORM itself. This is, for example, the code for the department table:

```
1 CREATE TABLE department (  
2   id UUID NOT NULL,  
3   name VARCHAR(63) NOT NULL,  
4   color VARCHAR(63),  
5   printer__id UUID,  
6   PRIMARY KEY (id),  
7   UNIQUE (name),  
8   FOREIGN KEY(printer__id) REFERENCES printer (id)  
9 );  
10 COMMENT ON COLUMN department.id IS 'Unique Department instance identifier';  
11 COMMENT ON COLUMN department.name IS 'Unique name of the department';  
12 COMMENT ON COLUMN department.color IS 'A color between the Recognized color keyword names. See  
    also https://www.w3.org/TR/SVG11/types.html#ColorKeywords';  
13 COMMENT ON COLUMN department.printer__id IS 'Identifier of the printer the department is  
    equipped with';
```

API resources I

The RESTful API has been implemented using the Flask web framework.

```
1 class DepartmentResource(ProtectedResource):  
2     def get(  
3         self, *, _id: str | None = None, name: str | None = None  
4     ) -> tuple[dict, int]:  
5         if _id or name:  
6             department = (  
7                 db.session.query(Department)  
8                 .where(Department.id == _id if _id else Department.name == name)  
9                 .one_or_none()  
10            )  
11            if department:  
12                return DepartmentDTO.from_model(department), 200  
13            return {"message": "Department was not found"}, 404  
  
14        departments = db.session.query(Department).all()  
15        return DepartmentDTO.from_model_list(departments), 200
```

API resources II

```
1 {  
2   "@context": {  
3     "schema": "https://schema.org/",  
4     "self": "@id",  
5     "type": "@type",  
6     "name": "schema:name",  
7     "printer": {  
8       "@id": "schema:isRelatedTo",  
9       "@type": "@id"  
10    },  
11    "license": {  
12      "@id": "schema:license",  
13      "@type": "@id"  
14    }  
15  },  
16  "license": "https://creativecommons.org/licenses/by/4.0/",  
17  "data": {  
18    "self": "http://127.0.0.1:5000/api/v1/departments/5b11618c-51f5-8000-8000-6496d5c5c0cf",  
19    "type": "schema:Organization",  
20    "name": "Kitchen",  
21    "printer": "http://127.0.0.1:5000/api/v1/printers/5b11618c-51f5-8000-8000-2a5553677712"  
22  }  
23 }
```

Demo

A live demo of the system is available at <https://diner.enricostefanel.it>.

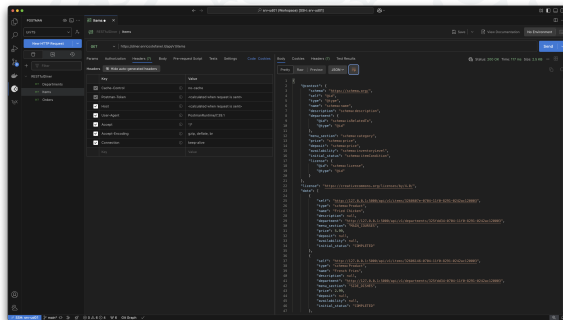


Figure: Demo of the system using Postman

Linked Open Data^[1] requirements I



Make your stuff available on the Web (whatever format) under an open license.



Make it available as structured data (e.g., Excel instead of image scan of a table).



Make it available in a non-proprietary open format (e.g., CSV instead of Excel).

These requirements are satisfied by our RESTful API that allows publicly access to data in JSON-LD^[2] format and provide them under Creative Commons license.

Linked Open Data^[1] requirements II



Use URIs to denote things, so that people can point at your stuff.



Link your data to other data to provide context.

Every resource in the system is identified by a URI, and can be accessed by a simple HTTP GET request to that URI. A relation between resources is established by linking them in the JSON response.

FAIR^[3] principles requirements I

Findable

- **F1.** (Meta)data are assigned a globally unique and persistent identifier
- **F2.** Data are described with rich metadata (defined by R1 below)
- **F3.** Metadata clearly and explicitly include the identifier of the data they describe
- **F4.** (Meta)data are registered or indexed in a searchable resource

The JSON-LD data representation includes the URI of the resource itself and the related resources. Since the metadata is provided together with the data, there is no need to include the identifier of the data in the metadata.

FAIR^[3] principles requirements II

Accessible

- **A1.** (Meta)data are retrievable by their identifier using a standardized communications protocol
 - **A1.1** The protocol is open, free, and universally implementable
 - **A1.2** The protocol allows for an authentication and authorization procedure, where necessary
- **A2.** Metadata are accessible, even when the data are no longer available

The HTTP protocol ensured that (meta)data is freely accessible, allowing for an authorization procedure where necessary (e.g., POST operations).

FAIR^[3] principles requirements III

Interoperable

- **I1.** (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation
- **I2.** (Meta)data use vocabularies that follow FAIR principles
- **I3.** (Meta)data include qualified references to other (meta)data

FAIR^[3] principles requirements IV

Reusable

- **R1.** Meta(data) are richly described with a plurality of accurate and relevant attributes
- **R1.1** (Meta)data are released with a clear and accessible data usage license
- **R1.2** (Meta)data are associated with detailed provenance
- **R1.3** (Meta)data meet domain-relevant community standards

Data Management Plan I

- 1 **How will the data be created?** The data will be created by the restaurant staff, who will use the system to manage the restaurant's departments, tables, and printers.
- 2 **How will the data be documented?** The data will be documented in the system's database, and the API will provide a JSON-LD representation of the data.
- 3 **Who will access the data?** The data will be publicly accessible through the RESTful API.
- 4 **How will the data be stored?** The data will be stored by the system's database, which is a PostgreSQL database. In case, the database can also be installed on a cloud service.

Data Management Plan II

- ⑤ **How will the data be shared?** The data will be shared through the RESTful API, which will provide a JSON-LD representation of the data for basic HTTP requests (GET, POST, PUT, DELETE).
- ⑥ **How will the data be preserved?** The data will be preserved by the system's database, which will be backed up regularly to ensure data integrity.
- ⑦ **Who will back up the data?** The data will be backed up by the system administrator, who will ensure that the database is backed up regularly.

The real world scenario



The system we presented today is not a requirements from a very *far away land*, after all...

More information on
<https://www.sagrevolution.it>

Q&A

Questions?



References

- [1] Tim Berners-Lee. *Linked Data*. W3.org. 2006. URL: <https://www.w3.org/DesignIssues/LinkedData.html> (visited on 2025-03-19).
- [2] Manu Sporny, Gregg Kellogg, and Marcus Langhaler. *JSON-LD 1.0*. W3.org. 2014. URL: <https://www.w3.org/TR/2014/REC-json-ld-20140116/> (visited on 2025-03-19).
- [3] Wilkinson Mark D., Dumontier Michel, Aalbersberg IJsbrand Jan, et al. “The FAIR Guiding Principles for scientific data management and stewardship”. In: *Scientific Data* 3.160018 (2016). DOI: 10.1038/sdata.2016.18.