

KEA

Full design

Product description

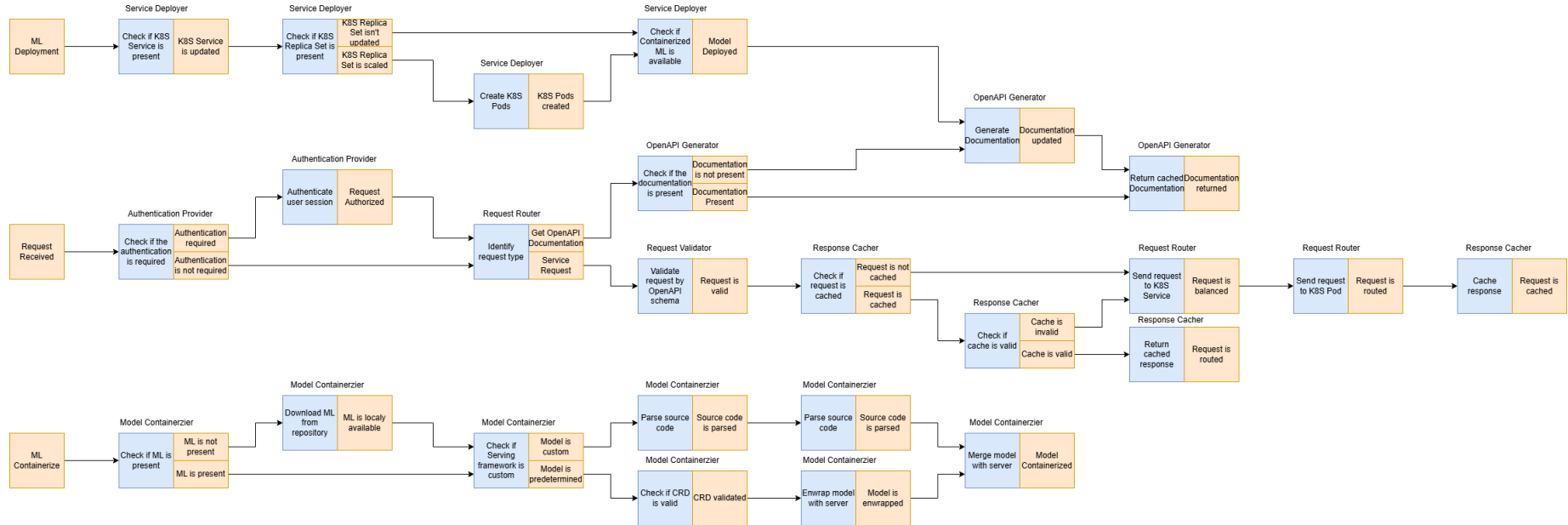
The product is a platform for deploying, managing, and scaling machine learning models in production. It offers a secure, flexible environment for automating ML tasks like model versioning, routing, and monitoring. With Kubernetes integration and containerization support, it's designed for developers, ML engineers, and enterprises needing scalable, reliable ML infrastructure.

Team K8C: Tsurkan Daniel; Dandamaev Gadji; Tsaturyan Konstantin; Smolkin Mikhail

Project repo: <https://github.com/fanglores/Advanced-Software-Design>

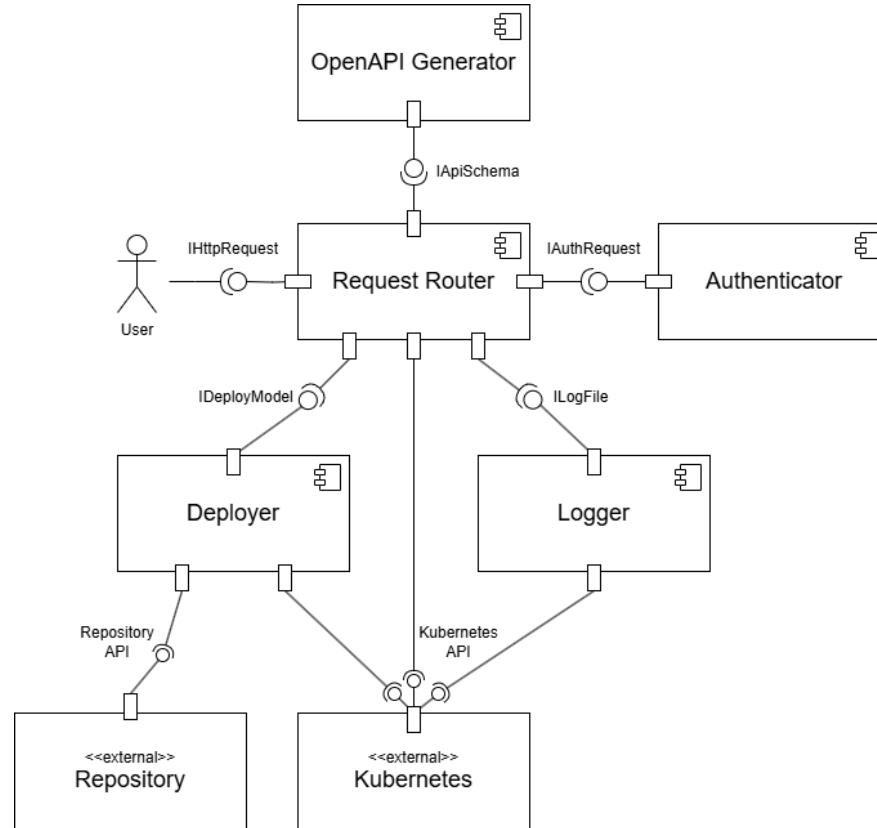
This report: [https://github.com/fanglores/Advanced-Software-Design
/blob/master/Practice%20Tasks/Module2/FinalTask_2/FinalTask_2.pdf](https://github.com/fanglores/Advanced-Software-Design/blob/master/Practice%20Tasks/Module2/FinalTask_2/FinalTask_2.pdf)

Event flow



System architecture

BASE
Microservices
RESTful API



Solution stack

Implementation

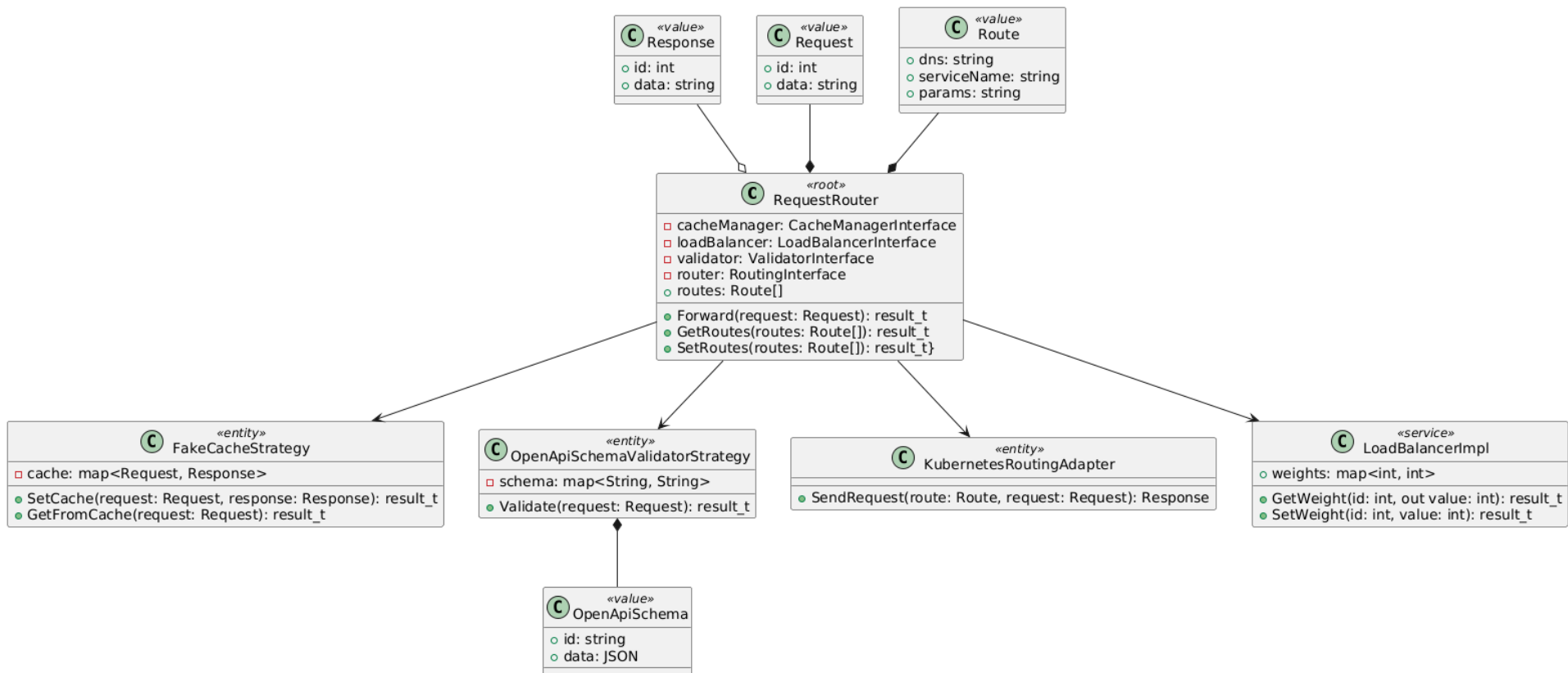
- API definition: OpenAPI
- Connection server for API: python gunicorn
- App framework: python FastAPI
- Serialization/state format: json

Testing tools pytest

Operations

- App initializer: cookiecutter
- Code build: makefile
- CI/CD pipeline: github ci/cd
- Delivery method: docker
- Logging & monitoring: ELK

Logical data model RequestRouter



API usage RequestRouter

Use Case: Forward Request

Scenario:

User sends request to a service

Request is being validated by OpenAPI schema

Request is being forwarded to a specific K8s service

RequestRouter Routes and validates API requests, with caching support. ^

POST

/router/loadbalancer Configure load balancer for a deployed ML service



GET

/router/loadbalancer List all load balancer configurations



GET

/router/loadbalancer/{serviceId}

Get load balancer configuration for a specific ML service



DELETE

/router/loadbalancer/{serviceId} Remove load balancer configuration



POST

/router/validate Validate an API request against OpenAPI schema

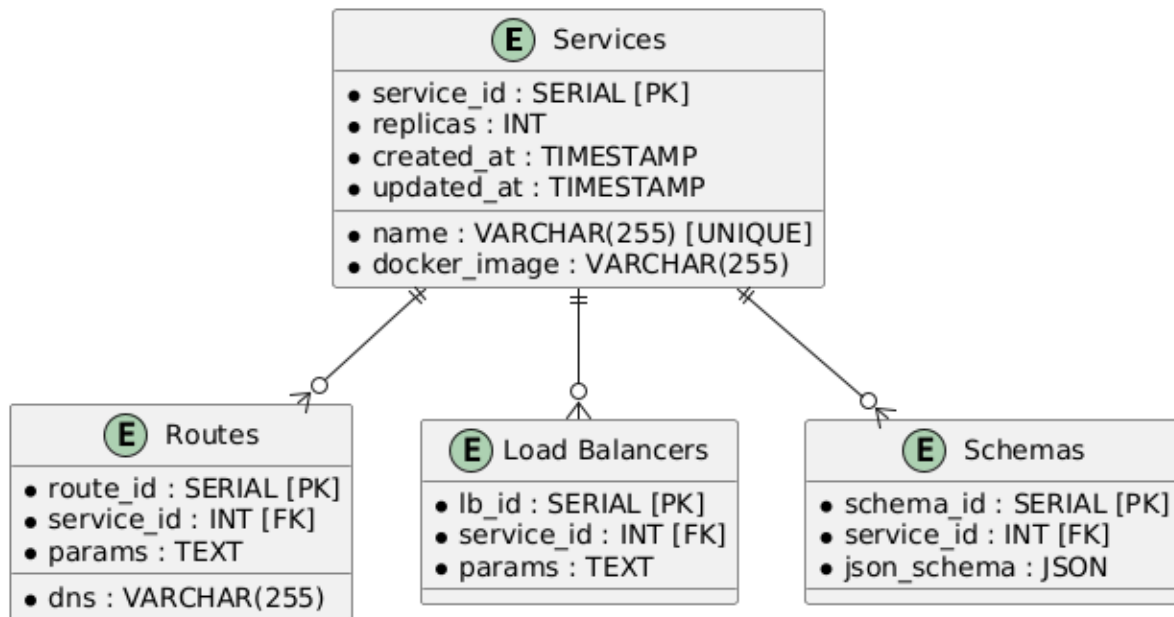


GET

/router/cache Fetch cached API response



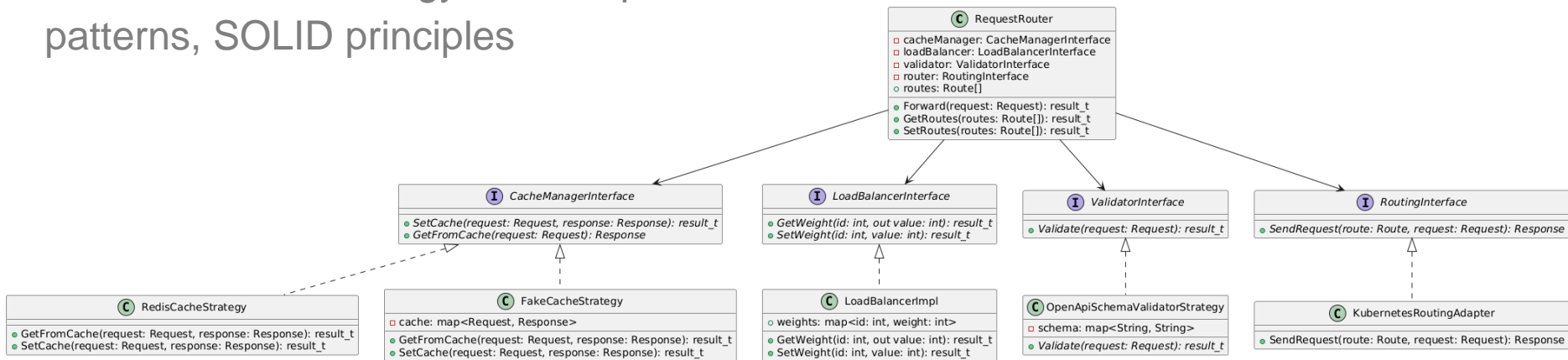
Physical schema RequestRouter



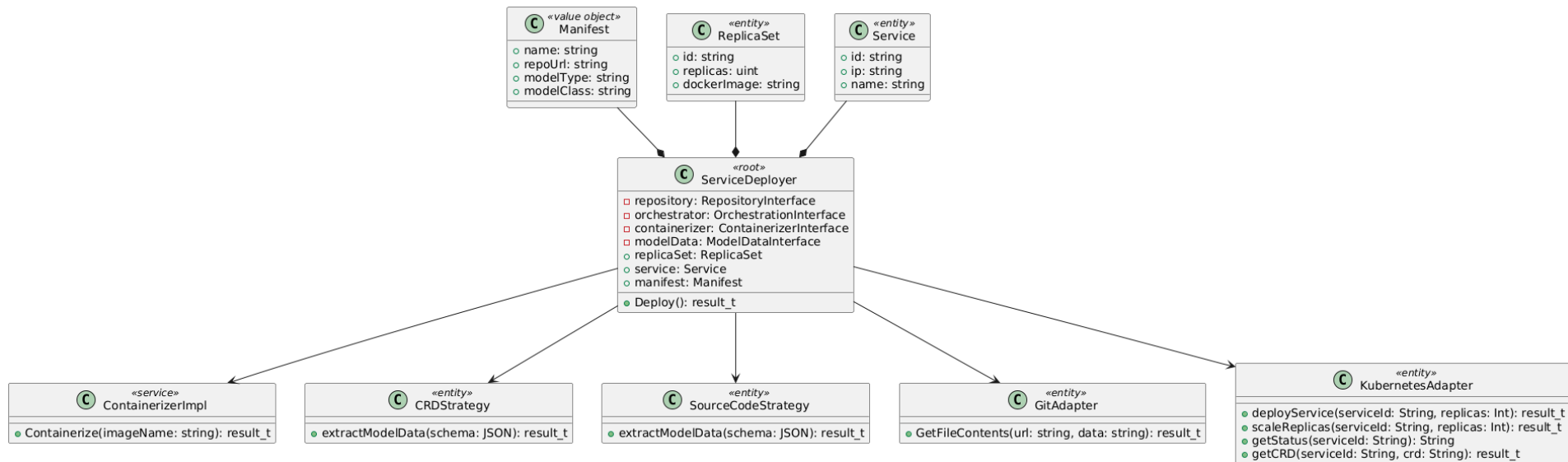
Design case for RequestRouter

Problems: strong dependency on
OpenAPI schemas, cache storage,
many functions

Solutions: use Strategy and Adapter
patterns, SOLID principles



Logical data model ServiceDeployer



API usage **ServiceDeployer**

Use Case: Deploy Service

Scenario:

User sends request to
deploy ML Model

ML Wrappers creates
docker container

Docker container is
deployed via service into
K8s

ServiceDeployer Deploys and manages ML services. ^

POST

/services Deploy an ML service



GET

/services List all deployed services



GET

/services/{serviceId} Get service details



PUT

/services/{serviceId} Update an ML service



DELETE

/services/{serviceId} Delete an ML service

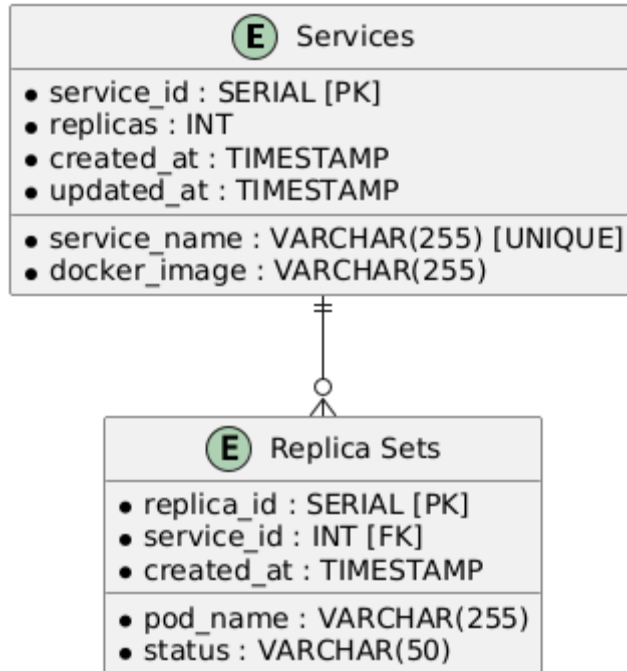


POST

/services/{serviceId}/predict Make a prediction



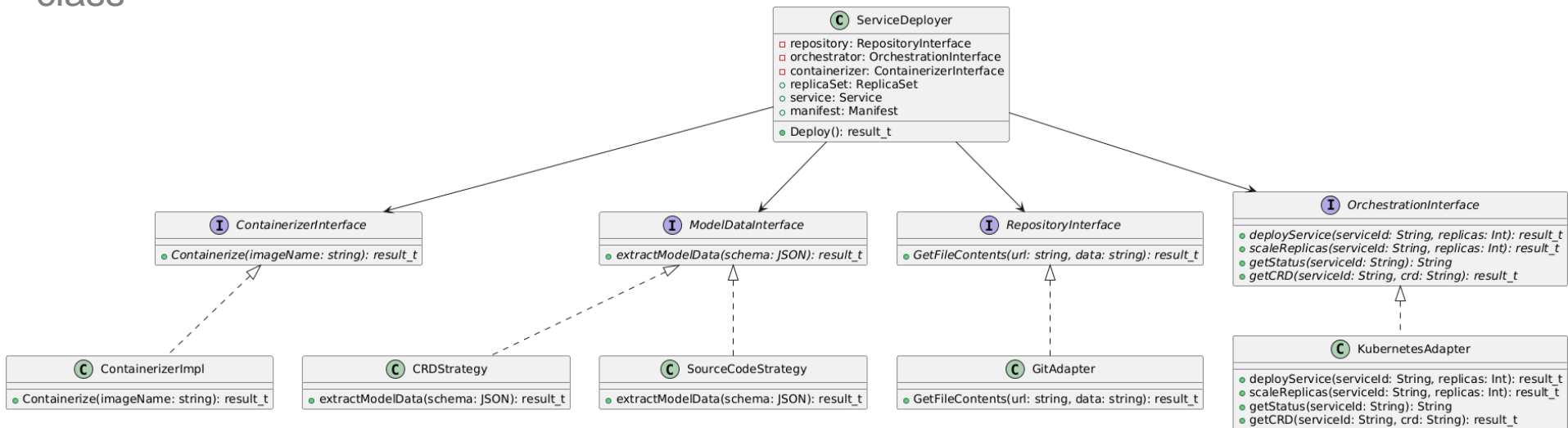
Physical schema **ServiceDeployer**



Design case of Service Deployer

Problems: new deploy strategies
require changes in ServiceDeployer;
ServiceDeployer can work with
different data, many functions in one
class

Solutions: use SOLID principles, Adapter
and Strategy patterns



Design complexity: Service Deployer

Class/Metrics	WMC	CBO	NOC	DIT
ServiceDeployer	1	8	0	1
ContainerizerImpl	1	1	0	2
CRDStrategy	1	1	0	2
SourceCodeStrategy	1	1	0	2
GitAdapter	1	1	0	2
KubernetesAdapter	4	1	0	2

Design complexity

Service	SIY	ADS	AIS
Request Router	0	4	0
Authenticator	0	0	1
OpenAPI Generator	0	0	1
Deployer	0	0	1
Logger	0	0	1
AVG	-	0,8	0,8

System demo

Service ping generates static answer «Ping!»
While service pong addresses Ping and returns the
answer from it to the user

<http://84.201.148.234.nip.io/kea-project/pong>

<http://84.201.148.234.nip.io/kea-project/ping>

Repository structure

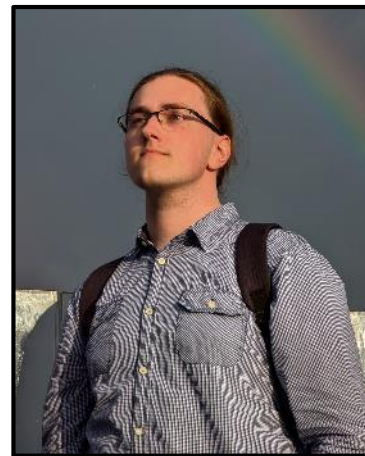
Repository structure

```
.
├── product_img.jpg
├── README.md
├── General/
│   ├── Domain_description_en.md
│   ├── Task_description_en.md
│   ├── DFD0/
│   ├── StoryMap/
│   └── UseCases/
└── Practice Tasks/module2
    ├── FinalTask_2/
    ├── Task_8/
    ├── Task_9/
    ├── Task_9.1/
    ├── Task_10/
    ├── Task_11/
    └── Task_12/
```

Tools Used:

- Github
- Drawio
- Planttext
- Swagger

Team and roles



Class diagrams,
design complexity

Use cases, design cases

Design cases/patterns,
logical and physical
schemas, components
diagram

Event flow, API
definition, K8s
deployment,
components diagram

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