

Assignment #2

HA and robust applications

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Assignment #2

In this assignment you will have to:

1. Use **Docker Compose** to create an application that is built from 4 services:
 - the meals service you did for assignment #1 and a *diet* service you will build,
 - a database service and a reverse-proxy service that you download from DockerHub
2. Make the meals and the diet services **persistent**
3. Use Docker Compose to **restart the assignment and diet services after a failure** (and process requests as if it never failed)
4. Use a **reverse-proxy** (NGINX) to route requests to the right server
5. **Extra-credit:** implement **load balancing** for the meal service

The diet microservice

The diet service supports:

- POST /diets
- GET /diets
- GET /diet/name

A **diet** is a JSON object of the form:

```
{  
  "name": <string>,  
  "cal" : <number>,  
  "sodium" : <number>,  
  "sugar" : <number>  
}
```

Example:

```
{  
  "name": "low sodium",  
  "cal": 5000,  
  "sodium": 5,  
  "sugar": 50  
}
```

NOTE: **No ID** is included
in the JSON object

Modify the GET /meals request of the meals service

Modify the meals service to support:

GET /meals
'http://0.0.0.0:port/meals?diet=<name>'

where <name> gives the name of a specific diet. The response are all those meals that conform to the diets.

If the diet specifies

cal=num1,sodium=num2,&
sugar=num3

then all the meals returned have calories \leq num1, sodium \leq num2, and sugar \leq num3

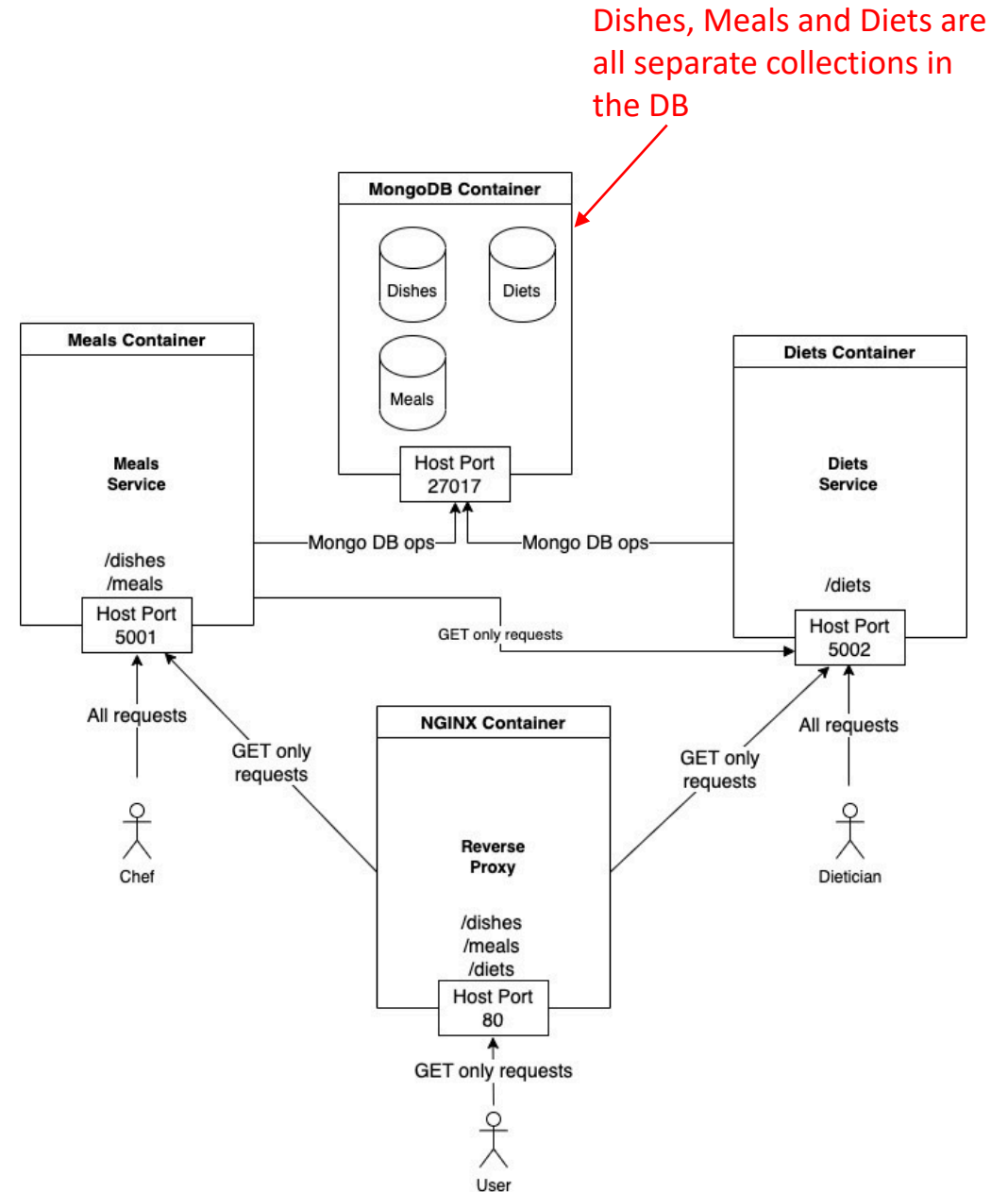
Note: GET /meals is still supported with no query string

Clarification

- When assigning unique IDs to dishes, meals, and diets, you **cannot reuse** an ID.
 - E.g., if a meal M was assigned the ID X, then M was deleted, you cannot reuse the ID X for another meal that gets added later.

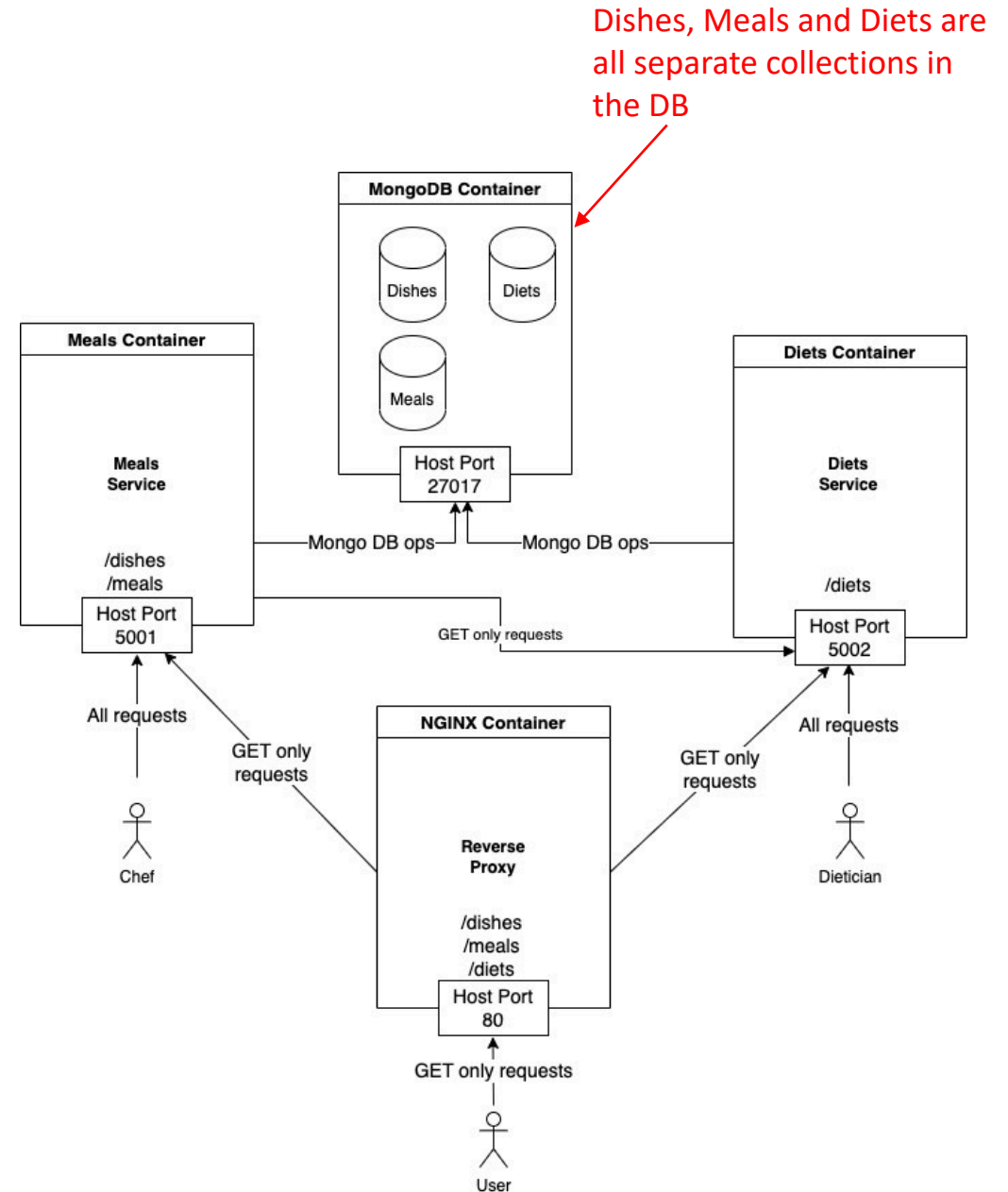
Architecture

- Create a docker-compose.yml that implements this architecture
 - It must include instructions for restarting services when they fail
 - It must have the services responding to requests on the host ports listed
 - It must start the services in the appropriate order
- Implement persistence for the meals and diet microservices



Architecture (cont)

- The meals and diets services must restart in the appropriate state after a failure:
 - Requests after a failure should be answered as if there was no failure
- Implement the reverse proxy as in the diagram
 - Requests on port 80 for meals or diets only support GET requests
 - Requests on port 5001 (5002) that do not go through the reverse-proxy support all requests (GET,POST,PUT...)



How to invoke a container API from another container

Assume we have two services, A-svc and B-svc.

- A-svc provides a REST API for a resource “/my_resource”.
- The A-svc declares the port mapping “4017:8090”.
- Using the docker-compose.yml given here, how would the B-svc invoke this REST API; e.g., with a GET request?

```
version: '3' # version of compose format

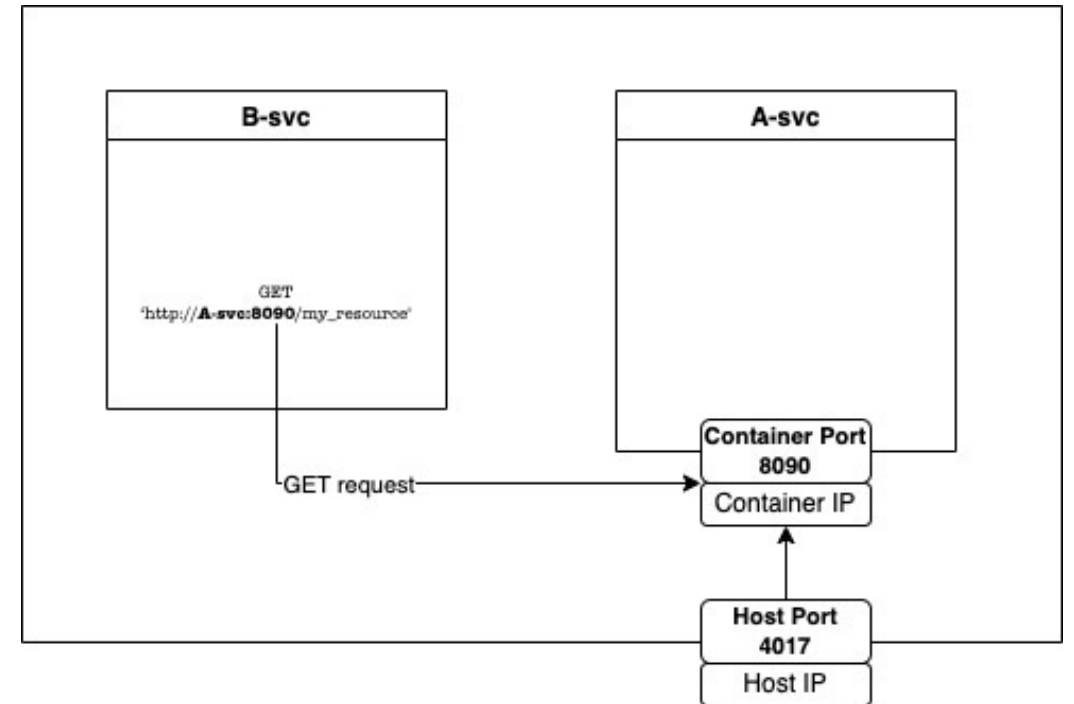
services:
  A-svc:
    build: ./app
    ...
    ports:
      - "4017:8090"
    expose:
      - 8090
  B-svc:
    build: ./dir
    ...
```


How to invoke a container API from another container (cont)

For the B-svc to invoke the API provided by the A-svc, it would issue the cmd:

GET 'http://**A-svc:8090**/my_resource'

- Since containers are isolated from the host, it needs to invoke the API from inside Docker, using the Docker network.
- “**A-svc**” is a symbolic name that refers to the Docker IP of the container running the A-svc service.
- Since this invocation is not going through the host, but directly to the container’s IP inside Docker, the port must be the container port 8090.



How to invoke a container API from another container (cont)

IMPORTANT: you must use the `expose` command on the container IP (8090) to allow other container services to reach this port.

```
version: '3' # version of compose format

services:
  A-svc:
    build: ./app
    ...
    ports:
      - "4017:8090"
    expose:
      - 8090
  B-svc:
    build: ./dir
    ...
```



The meals service

- The meals service supports all the same requests as in assignment #1. While it still supports GET /meals, without any query string, it also now supports
 - GET URI:port/meals?diet=<name>
This request returns those meals that conforms to the diet.

One other change to dishes and meals API

GET /dishes and GET /meals will return a **JSON array** of JSON objects

- **NOT** a JSON object (where each field was also a JSON object).
- Note that the ID of the dish (meal) is part of the JSON object.
- Note, to make it easier to use with Mongo, instead of “ID” field we have “_id:” field.

```
1  [
2    {
3      "_id": 1,
4      "name": "green salad",
5      "cal": 23.4,
6      "size": 100.0,
7      "sodium": 37,
8      "sugar": 2.2
9    },
10   {
11     "_id": 2,
12     "name": "scrambled eggs",
13     "cal": 150.2,
14     "size": 100.0,
15     "sodium": 146,
16     "sugar": 1.4
17   },
18   {
19     "_id": 3,
20     "name": "brisket",
21     "cal": 289.3,
22     "size": 100.0,
23     "sodium": 47,
24     "sugar": 0.0
25   }
26 ]
```

The diets service

The POST /diets request provides a diet JSON object. It returns the following:

- If request is successful, it returns “Diet <name> was created successfully” with a status code of 201
- If the <name> provided for the diet is already in use (was already added), it returns “Diet with <name> already exists” with a status code of 422.
- If the JSON object is ill-formed such as not containing a “cal”, “sodium” or “sugar” field, then it returns “Incorrect POST format” with a status code of 422.
- If the POST request did not supply JSON content, then it returns “POST expects content type to be application/json” with a status code of 415.

The diets service

The POST /diets request provides a diet JSON object. It returns the following:

- If request is successful, it returns “Diet <name> was created successfully” with a status code of 201
- If the <name> provided for the diet is already in use (was already added), it returns “Diet with <name> already exists” with a status code of 422.

You are only responsible for these two sorts of requests:

1. Where Diet is successfully created, and
2. Where the name of the diet is already in use.

Successful and unsuccessful POST /diets requests

POST ▼ http://0.0.0.0:5002/diets

Params Authorization Headers (8) Body ● Pre-request Script Tests Settings

☐ none ☐ form-data ☐ x-www-form-urlencoded ☒ raw ☐ binary ☐ GraphQL **JSON** ▼

```
1 {
2   ... "name": "recommended-sodium",
3   ... "cal": 5000,
4   ... "sodium": 200,
5   ... "sugar": 100
6 }
```

Body Cookies Headers (5) Test Results 🌐 Status: 201 CREATED

Pretty Raw Preview Visualize **JSON** ▼ 🔗

```
1 "Diet recommended sodium successfully created"
```

POST ▼ http://0.0.0.0:5002/diets

Params Authorization Headers (8) Body ● Pre-request Script Tests Settings

☐ none ☐ form-data ☐ x-www-form-urlencoded ☒ raw ☐ binary ☐ GraphQL **JSON** ▼

```
1 {
2   ... "name": "recommended-sodium",
3   ... "cal": 5000,
4   ... "sodium": 200,
5   ... "sugar": 100
6 }
```

Body Cookies Headers (5) Test Results 🌐 Status: 422 UNPROCESSABLE ENTITY

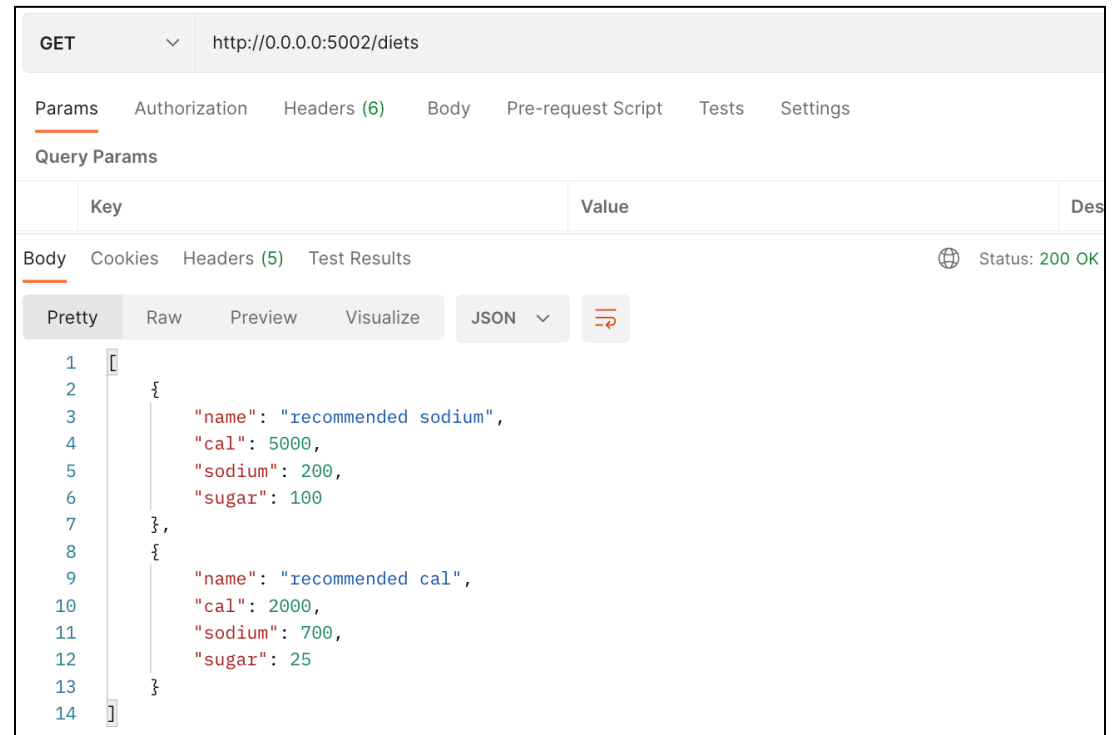
Pretty Raw Preview Visualize **JSON** ▼ 🔗

```
1 "Diet with name recommended sodium already exists"
```

The diets service (cont)

The GET /diets request returns the following:

- It returns a JSON array of all diets with a status code 200
- NOTE: no “_id” field is returned. Eventhough Mongo creates such a field, for the end-user, this is not relevant and is not included in the output. (See slide 3).



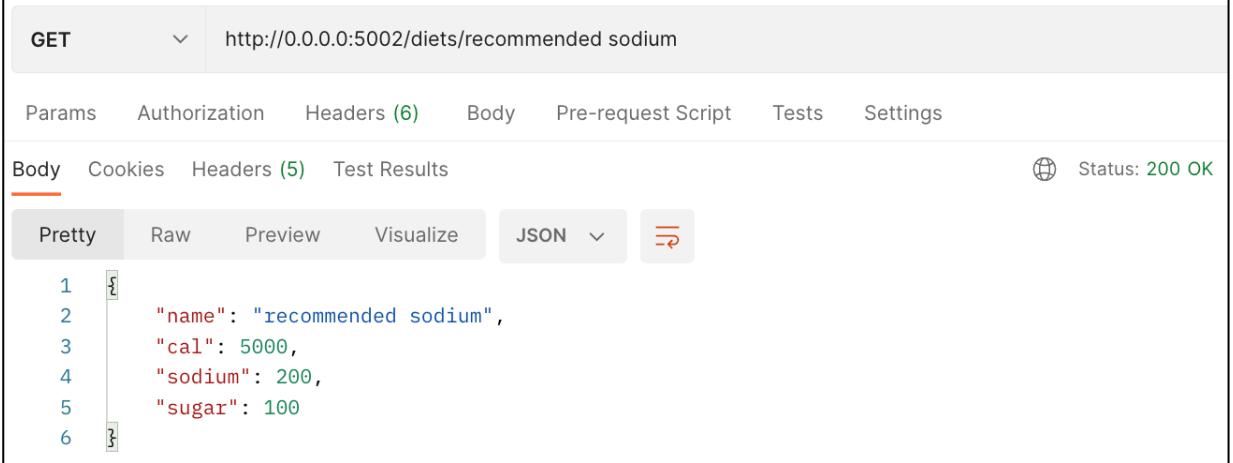
```
GET http://0.0.0.0:5002/diets

Params Authorization Headers (6) Body Pre-request Script Tests Settings
Query Params
Key Value Des
Body Cookies Headers (5) Test Results Status: 200 OK
Pretty Raw Preview Visualize JSON
1 [
2   {
3     "name": "recommended sodium",
4     "cal": 5000,
5     "sodium": 200,
6     "sugar": 100
7   },
8   {
9     "name": "recommended cal",
10    "cal": 2000,
11    "sodium": 700,
12    "sugar": 25
13  }
14 ]
```

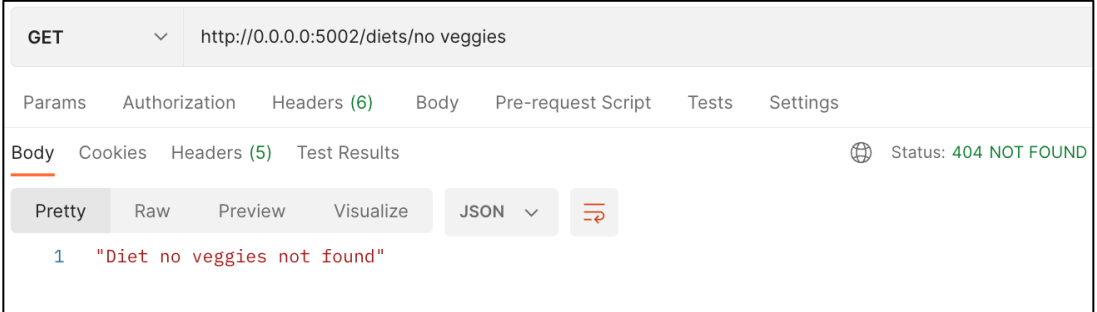

The diets service (cont)

The GET /diets/{diet_name} request returns the following:

- If the request is successful, it returns the requested JSON object
- If there does not exist a diet of the given name, it returns “Diet <diet_name> not found” with status code 404 (example shown on right).



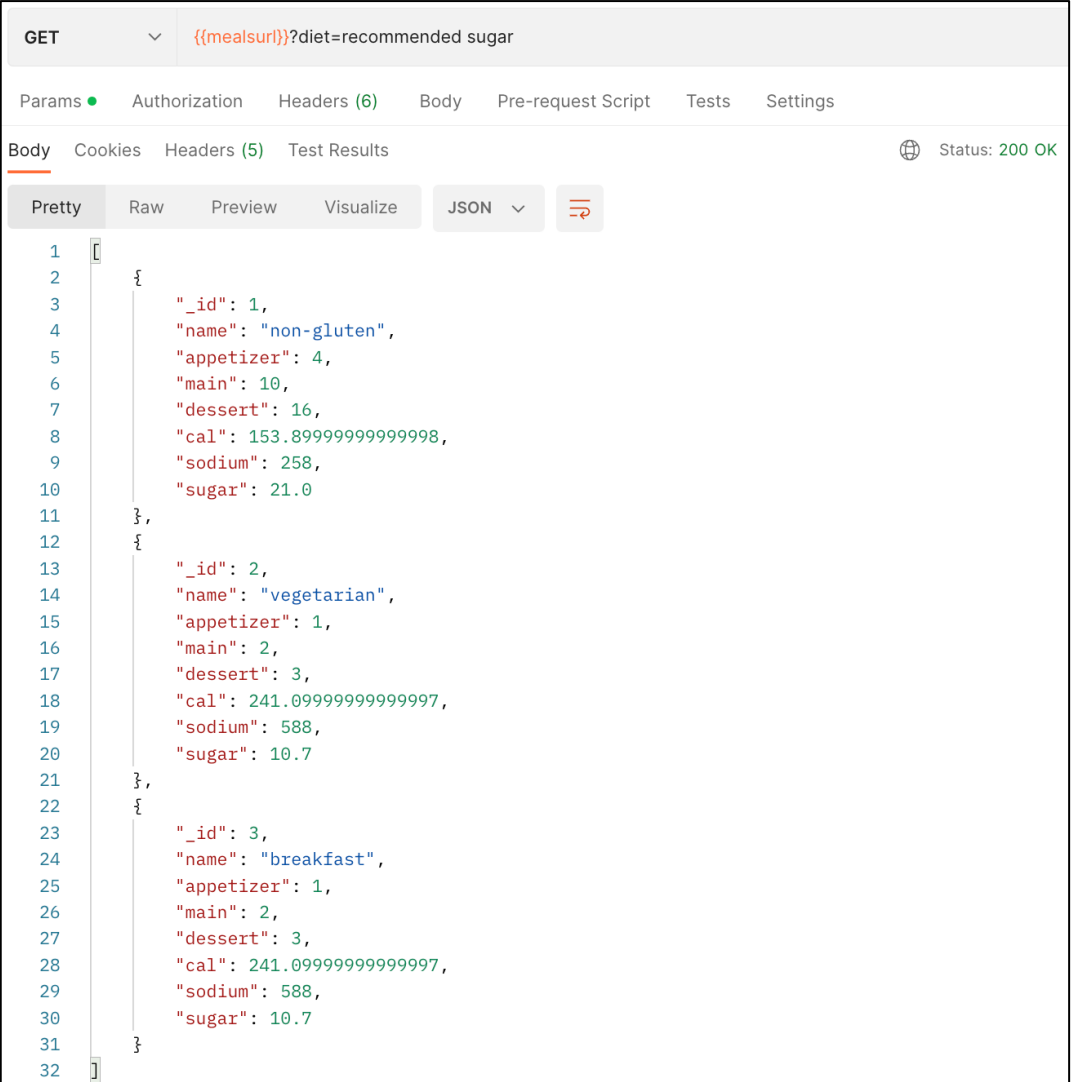
```
GET http://0.0.0.0:5002/diets/recommended sodium
Params Authorization Headers (6) Body Pre-request Script Tests Settings
Body Cookies Headers (5) Test Results Status: 200 OK
Pretty Raw Preview Visualize JSON
1 {
2   "name": "recommended sodium",
3   "cal": 5000,
4   "sodium": 200,
5   "sugar": 100
6 }
```



```
GET http://0.0.0.0:5002/diets/no veggies
Params Authorization Headers (6) Body Pre-request Script Tests Settings
Body Cookies Headers (5) Test Results Status: 404 NOT FOUND
Pretty Raw Preview Visualize JSON
1 "Diet no veggies not found"
```

Meals with query string

This example shows invoking the /meals API returning only those meals that satisfy the diet specified in the query string.



The screenshot shows a REST client interface with a GET request to the URL `{{mealsurl}}?diet=recommended sugar`. The response is a JSON array of three meal objects, each with fields for _id, name, appetizer, main, dessert, cal, sodium, and sugar. The status is 200 OK.

```
1  {
2    {
3      "_id": 1,
4      "name": "non-gluten",
5      "appetizer": 4,
6      "main": 10,
7      "dessert": 16,
8      "cal": 153.89999999999998,
9      "sodium": 258,
10     "sugar": 21.0
11   },
12   {
13     "_id": 2,
14     "name": "vegetarian",
15     "appetizer": 1,
16     "main": 2,
17     "dessert": 3,
18     "cal": 241.09999999999997,
19     "sodium": 588,
20     "sugar": 10.7
21   },
22   {
23     "_id": 3,
24     "name": "breakfast",
25     "appetizer": 1,
26     "main": 2,
27     "dessert": 3,
28     "cal": 241.09999999999997,
29     "sodium": 588,
30     "sugar": 10.7
31   }
32 }
```

Killing containers

- Make sure that in your container images for meals as well as diets, you have **/bin/sh** available. You probably do. To check, do the following:
 - Start up your container and issue the cmd **docker exec --it <container> /bin/sh** where <container> is the name or ID of the container
 - If after executing this command you are inside your container and can issue commands (try "ls" for example), then you are good.
- The **בודק** will use /bin/sh to kill your container and see if it restarts