How to implement OGC API – Moving Features with pygeoapi and MobilityDB

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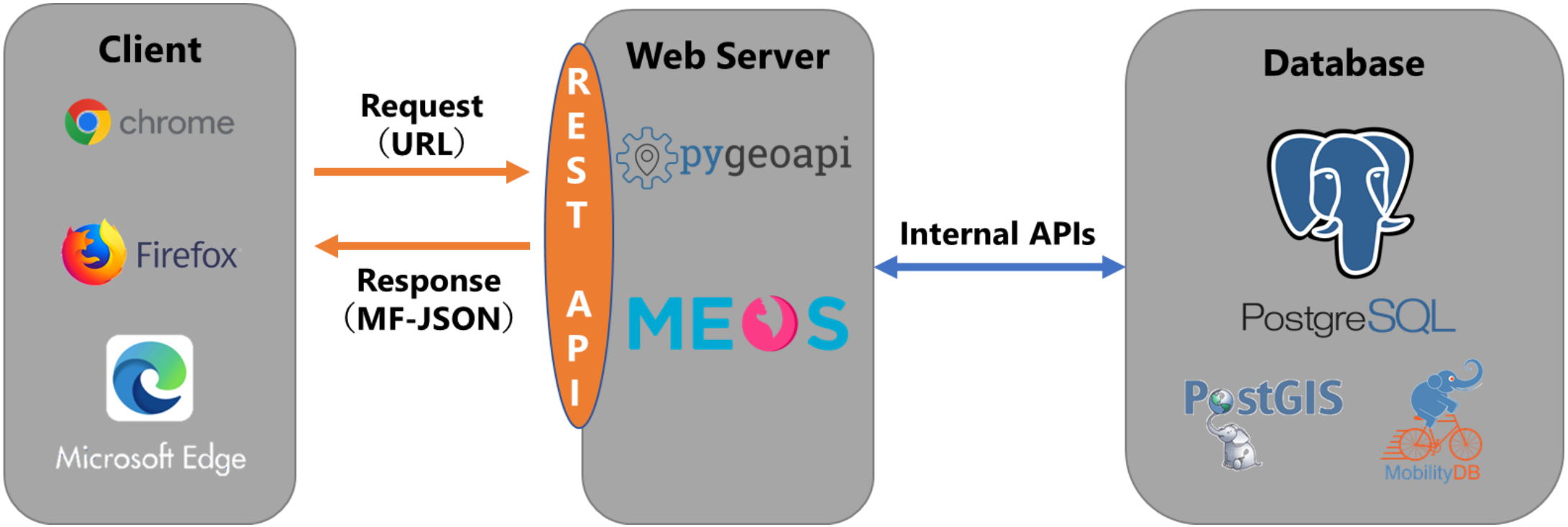
(AIST)

A brief explanation of pygeoapi and install it

1. Overall architecture
2. What is pygeoapi
3. How to install (using Docker)

Overall architecture



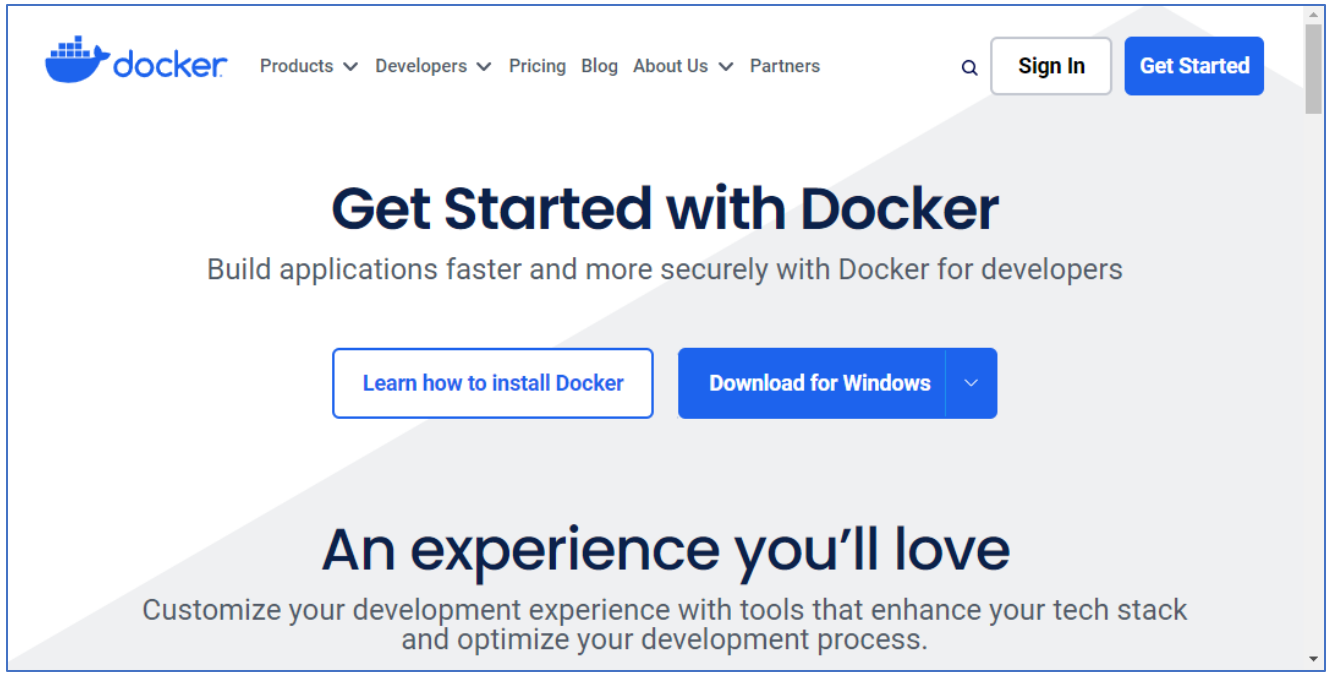
What is pygeoapi

- Python server implementation of the OGC API standard
  - Providing the ability to deploy RESTful OGC API endpoints using OpenAPI, GeoJSON, and HTML
- Features
  - Easy-to-install, ready-to-use, state-of-the-art OGC API server
  - Easy-to-use OpenAPI/Swagger for developers
  - Built on a robust plugin framework Custom data connections, formats, and processes can be built

[pygeoapi] https://pygeoapi.io/

How to install (using Docker)

- Install docker
  - https://www.docker.com/get_started/

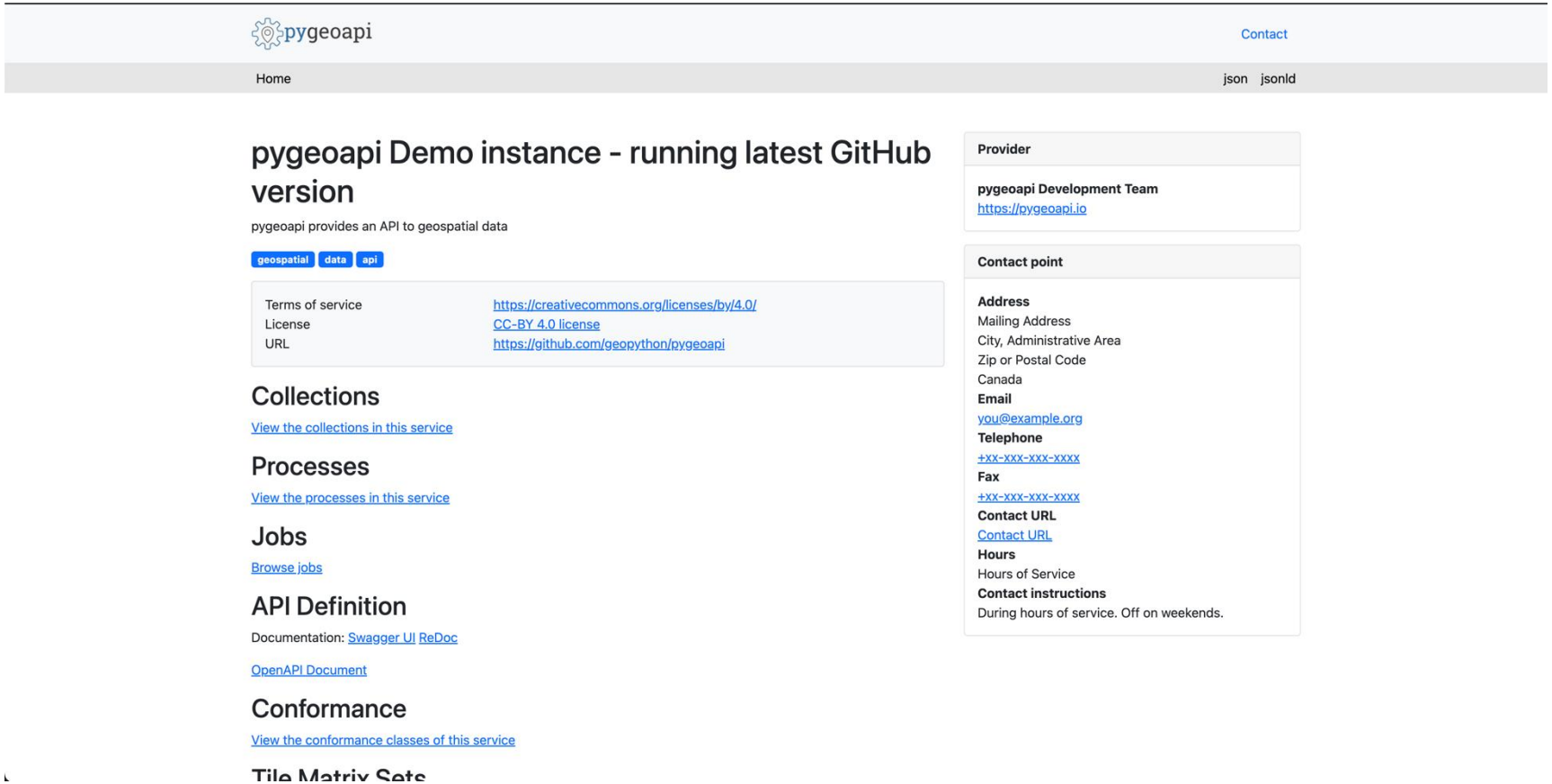


How to install (using Docker)

- Pull Docker image
  - docker pull ghcr.io/taehoonk/pygeoapi-mf-api:latest
  - docker pull ghcr.io/taehoonk/pygeoapi-mf-api-mobilitydb:latest
  - docker-compose up
    - **localhost:5050**
- Optional
  - Checking the status of docker application

How to install (using Docker)

- Checking the localhost
  - http://localhost:5050/



A brief explanation of MobilityDB

1. What is MobilityDB
2. Process flow from MovingFeature to MobilityDB
3. Process flow from TemporalGeometry to MobilityDB
4. Process flow from TemporalProperties to MobilityDB

What is MobilityDB

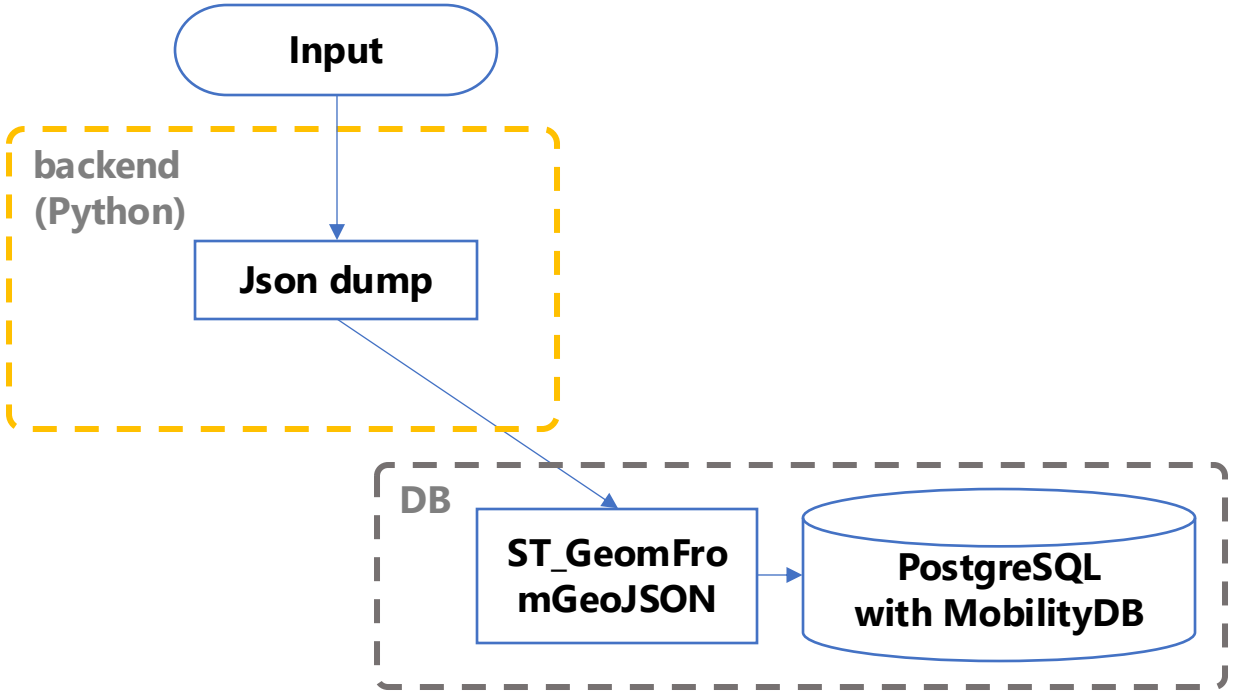
- Postgres extensions for geospatial traces of moving objects such as GPS traces
- To the PostgreSQL database and its spatial extension PostGIS, Spatiotemporal object support has been added
- Example of MobilityDB specific types:
  - **tgeogpoint, tfloat, ttext, etc…**

[MobilityDB] https://github.com/MobilityDB/MobilityDB

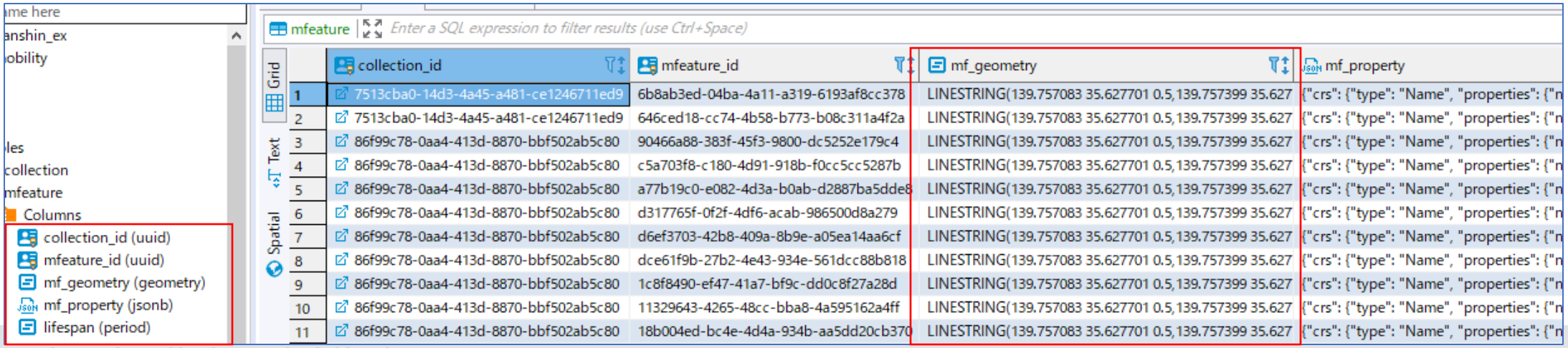
What is MobilityDB

- Functions used to handle
  - Postgres (PostGIS)
    - MovingFeature Geometry -> ST_GeomFromGeoJSON
    - GeoJSON response -> st_asgeojson()
  - Postgres (MobilityDB)
    - subTrajectory parameter -> tstzspan()
    - leaf parameter -> tstzset()
    - bbox parameter -> stboxx(), stboxz()
    - temporalGeometry, temporalProperty GET request -> extent()
  - PyMEOS
    - MFJSON interconversion -> from_mfjson(), as_mfjson()

Process flow from MovingFeature to MobilityDB

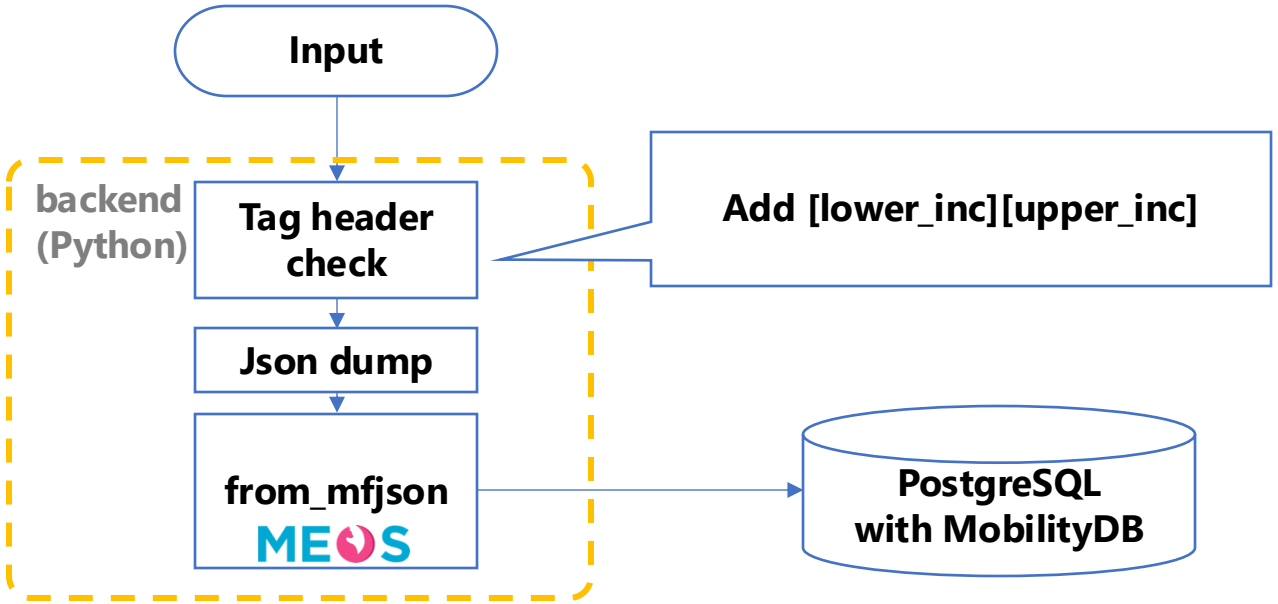


[mfeature]

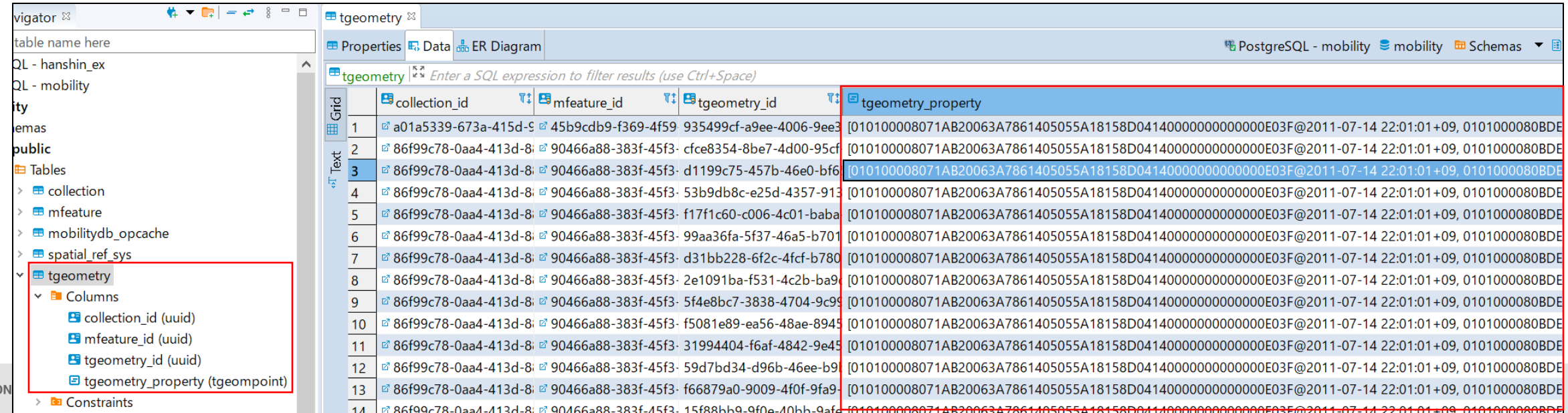


	collection_id	mfeature_id	mf_geometry	mf_property
1	7513cba0-14d3-4a45-a481-ce1246711ed9	6b8ab3ed-04ba-4a11-a319-6193af8cc378	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
2	7513cba0-14d3-4a45-a481-ce1246711ed9	646ced18-cc74-4b58-b773-b08c311a4f2a	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
3	86f99c78-0aa4-413d-8870-bbf502ab5c80	90466a88-383f-45f3-9800-dc5252e179c4	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
4	86f99c78-0aa4-413d-8870-bbf502ab5c80	c5a703f8-c180-4d91-918b-f0cc5cc5287b	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
5	86f99c78-0aa4-413d-8870-bbf502ab5c80	a77b19c0-e082-4d3a-b0ab-d2887ba5dde8	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
6	86f99c78-0aa4-413d-8870-bbf502ab5c80	d317765f-0f2f-4df6-acab-986500d8a279	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
7	86f99c78-0aa4-413d-8870-bbf502ab5c80	d6ef3703-42b8-409a-8b9e-a05ea14aa6cf	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
8	86f99c78-0aa4-413d-8870-bbf502ab5c80	dce61f9b-27b2-4e43-934e-561dcc88b818	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
9	86f99c78-0aa4-413d-8870-bbf502ab5c80	1c8f8490-ef47-41a7-bf9c-dd0c8f27a28d	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
10	86f99c78-0aa4-413d-8870-bbf502ab5c80	11329643-4265-48cc-bba8-4a595162a4ff	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n
11	86f99c78-0aa4-413d-8870-bbf502ab5c80	18b004ed-bc4e-4d4a-934b-aa5dd20cb370	LINESTRING(139.757083 35.627701 0.5,139.757399 35.627	{"crs": {"type": "Name", "properties": {"n

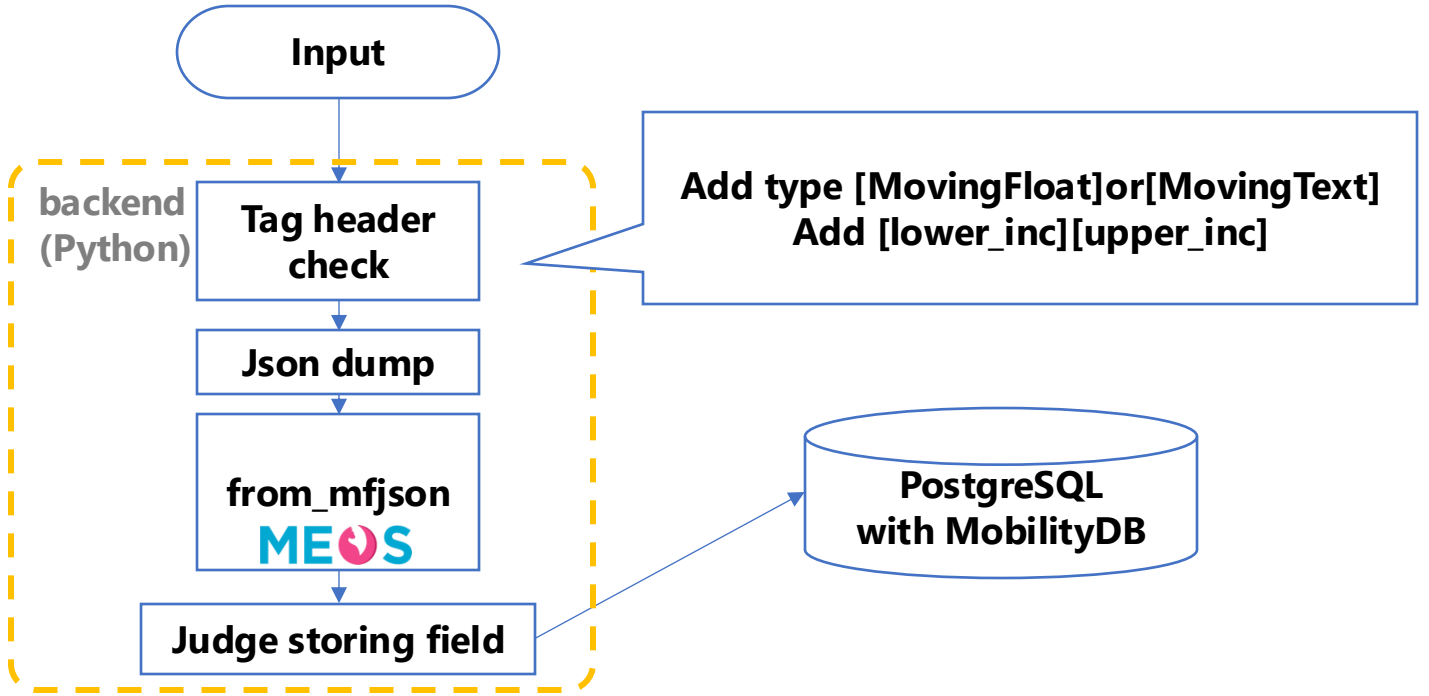
Process flow from TemporalGeometry to MobilityDB



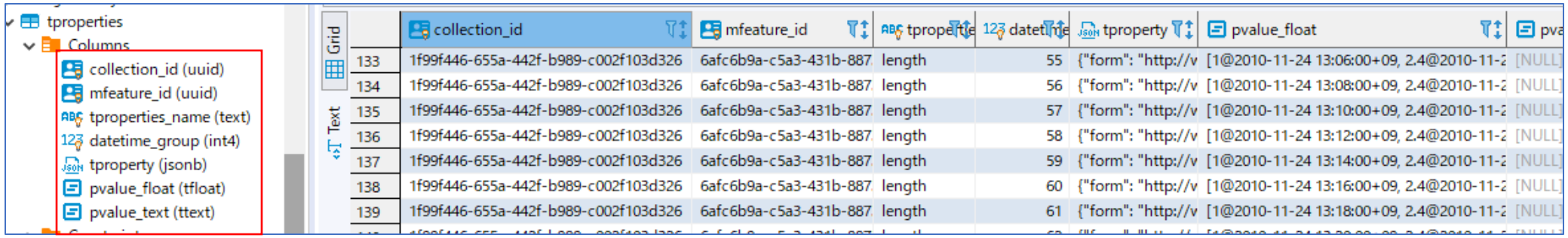
[tgeometry]



Process flow from TemporalProperties to MobilityDB



[tproperties]

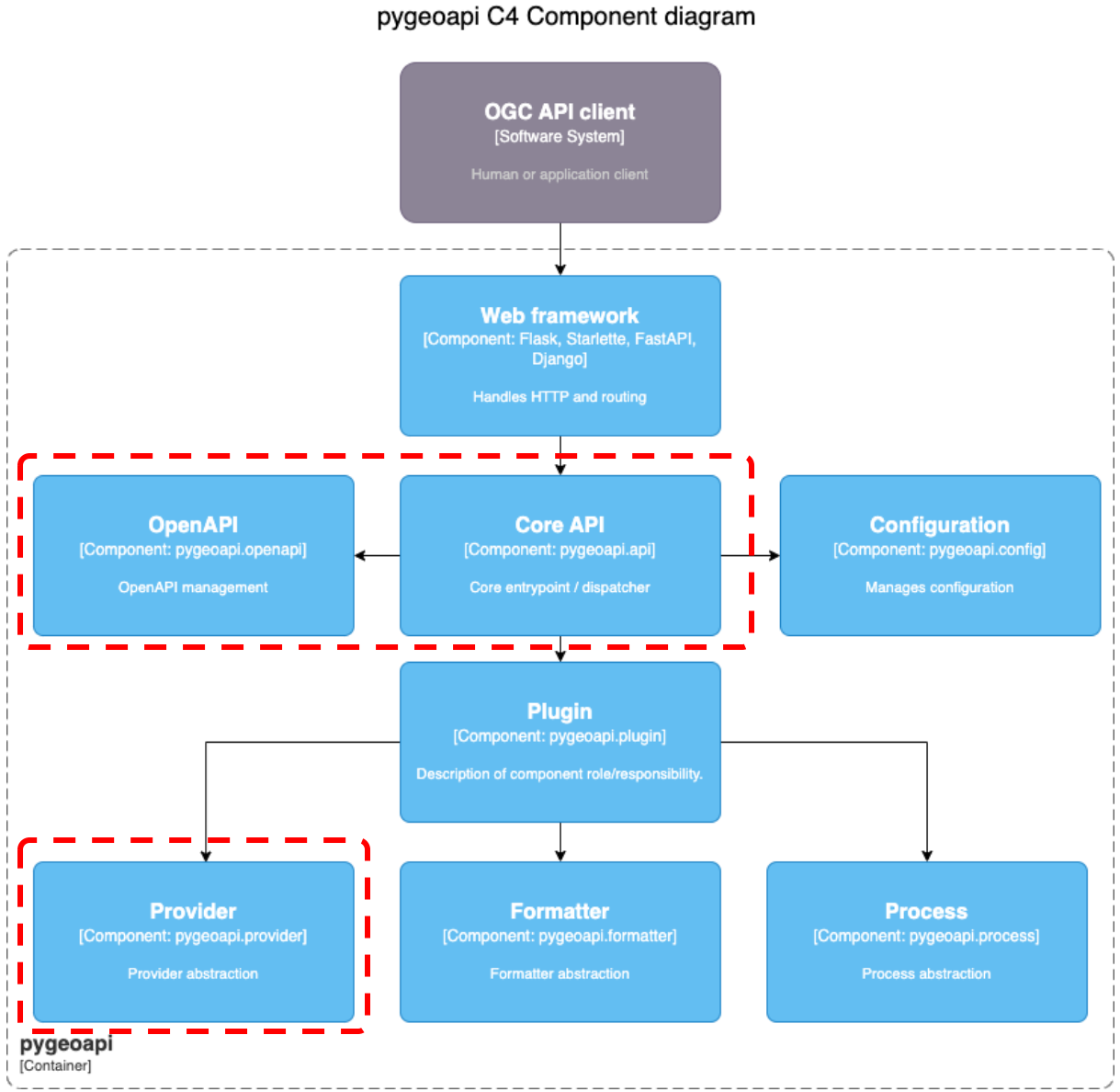


How to extend pygeoapi to support OGC API – Moving Features

1. Extension parts of pygeoapi
2. Process flow in pygeoapi
3. Used libraries for extension structure
4. PyMEOS in the process flow

Extension parts of pygeoapi

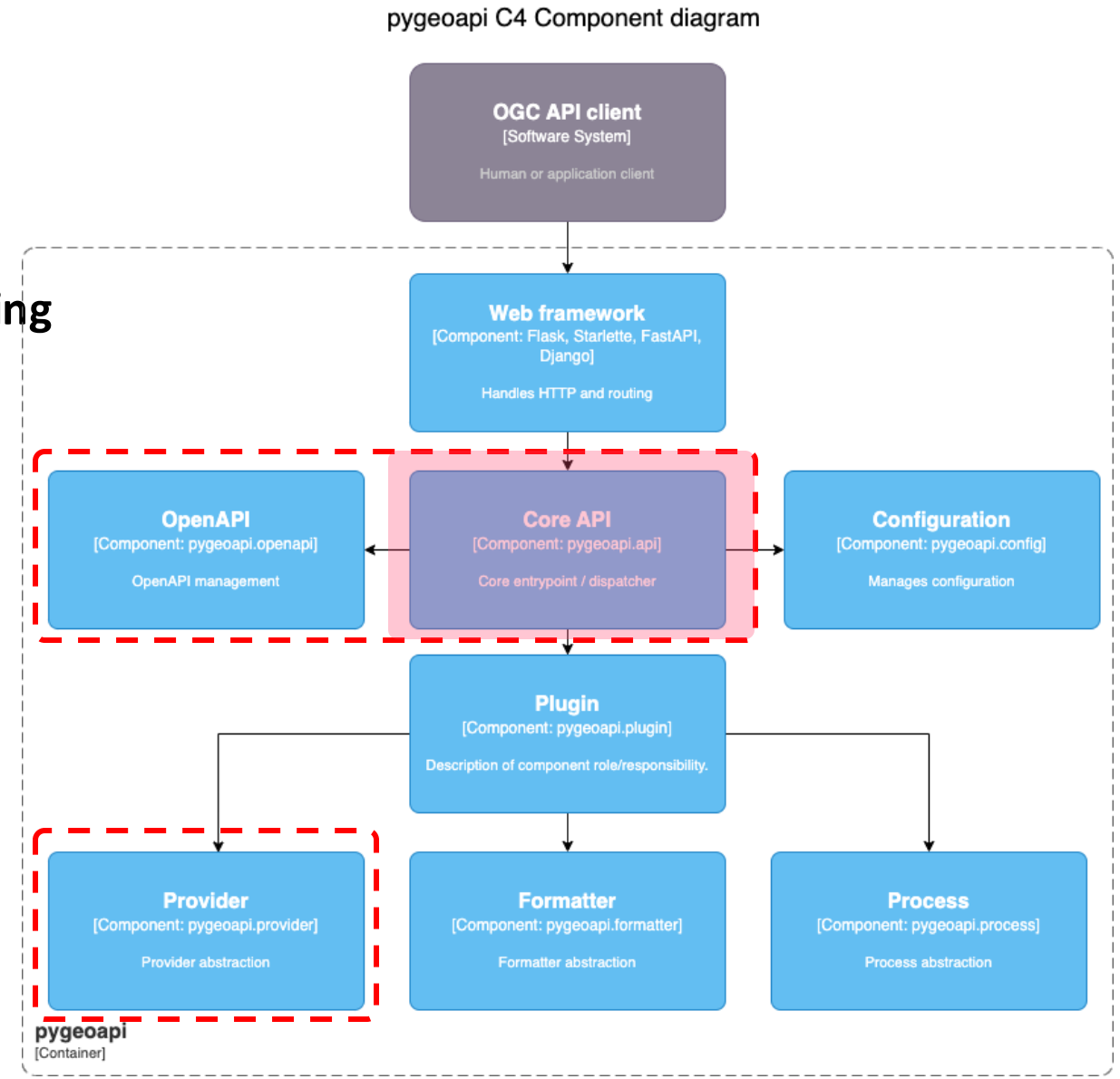
Extension



[pygeoapi] https://docs.pygeoapi.io/en/stable/how-pygeoapi-works.html

Extension parts of pygeoapi

- In Core API
  - pygeoapi/api/__init__py
  - pygeoapi/api/movingfeature.py
  - **Parameter identification and response formatting**

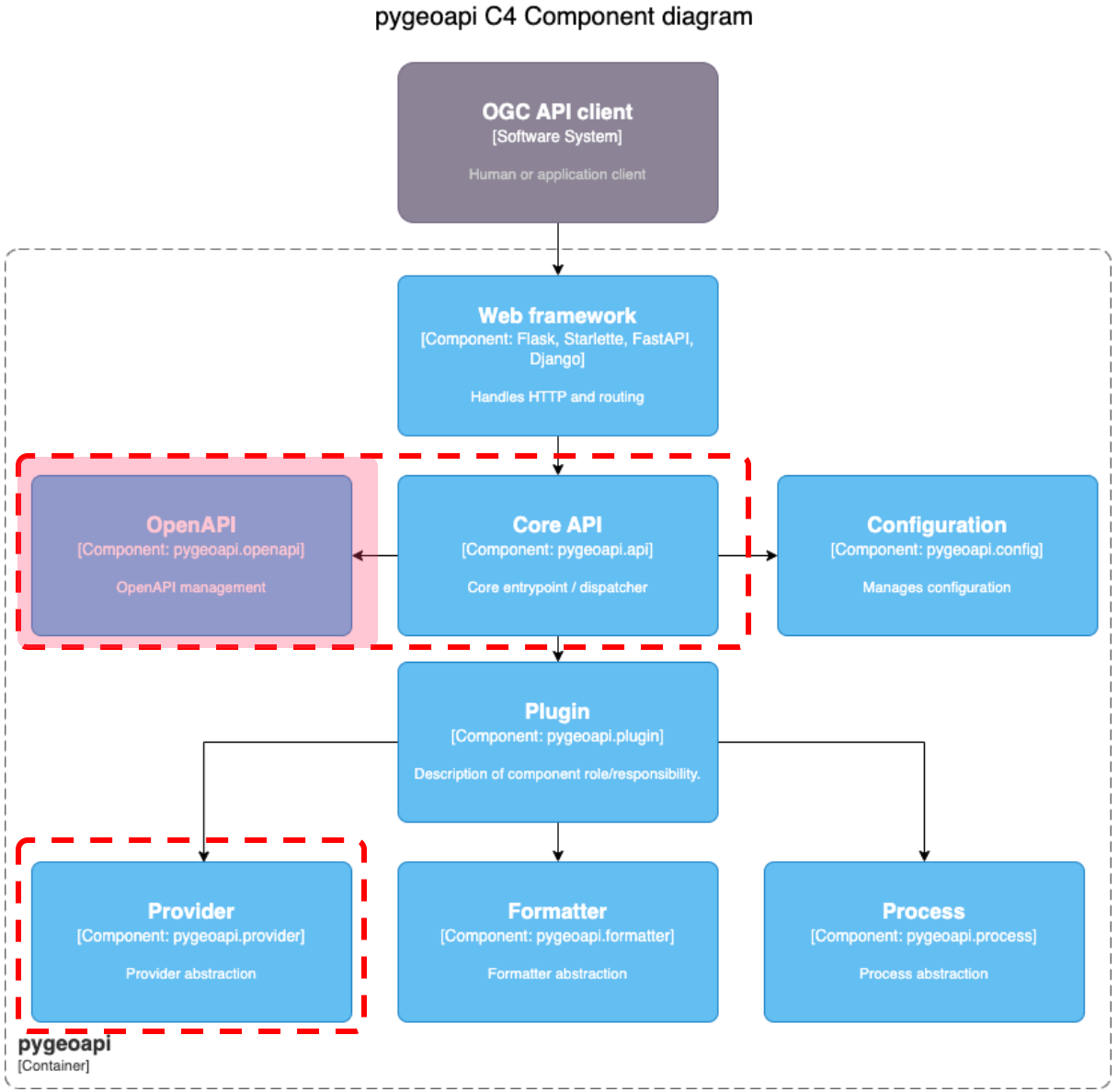


Extension

[pygeoapi] https://docs.pygeoapi.io/en/stable/how-pygeoapi-works.html

Extension parts of pygeoapi

- In OpenAPI
  - pygeoapi/flask_app.py
  - pygeoapi/openapi.py
  - **Determine processing from Swagger requests**

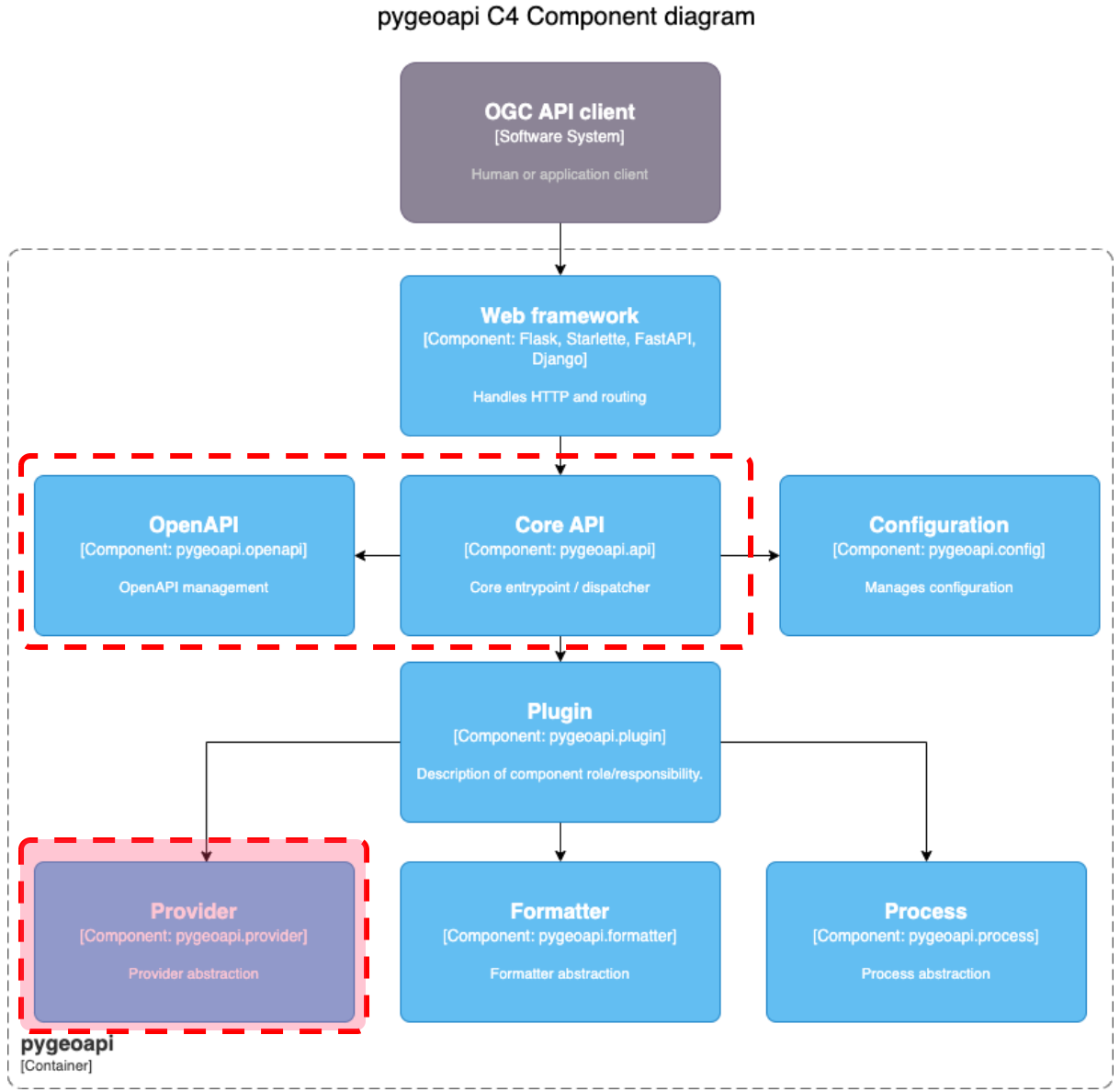


Extension

[pygeoapi] https://docs.pygeoapi.io/en/stable/how-pygeoapi-works.html

Extension parts of pygeoapi

- In Provider
  - pygeoapi/provider/postgresql_mobilitydb.py
  - **Query Execution**
  - **SQL query generation from parameters**



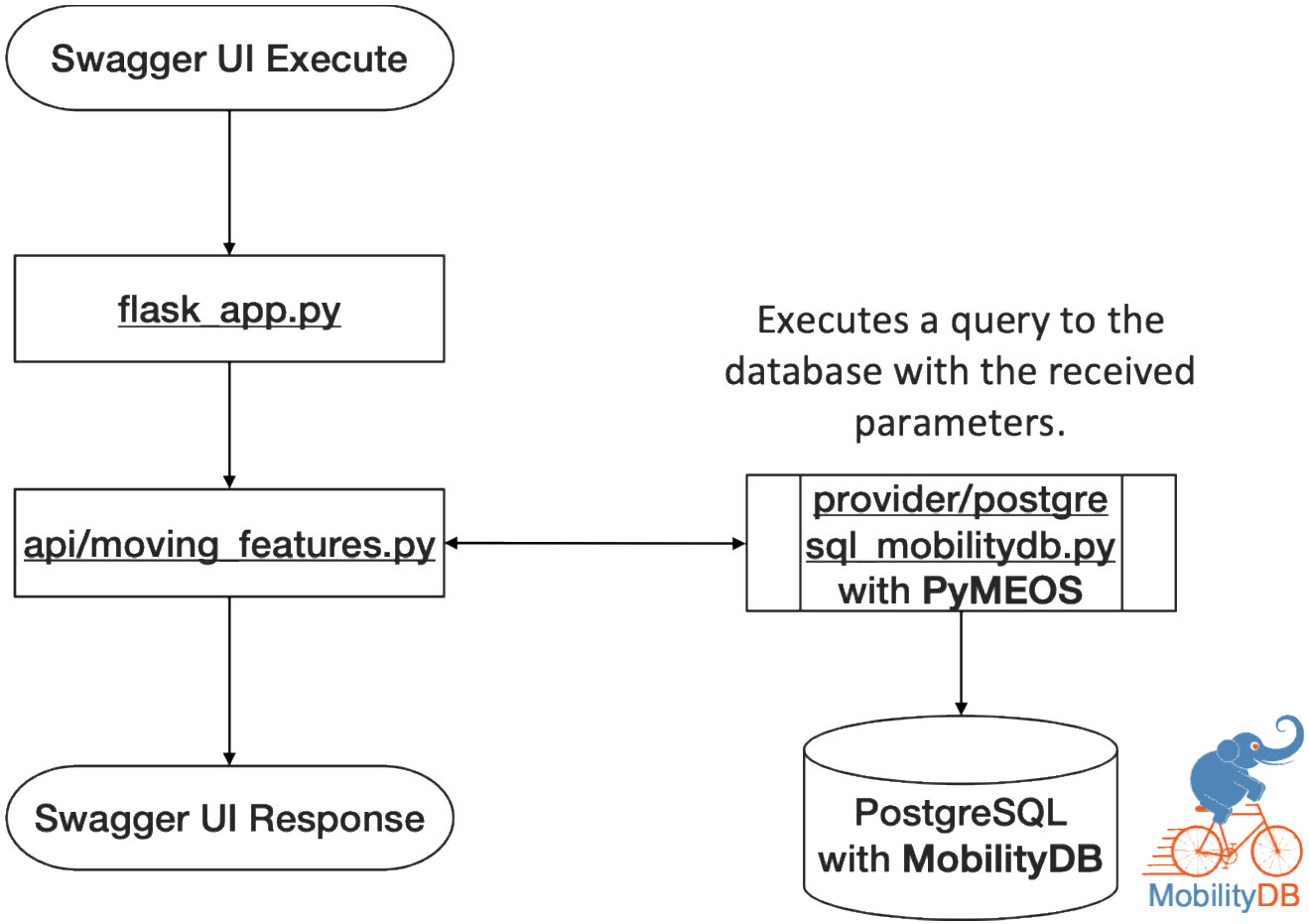
Extension

[pygeoapi] https://docs.pygeoapi.io/en/stable/how-pygeoapi-works.html

Process flow in pygeoapi

Process requests such as URI and GET, PUT, POST, DELETE operation with parameters

It handles parameters and receives the result of the query from the database.



Executes a query to the database with the received parameters.

[MF-API] https://github.com/aistairc/mf-api

Used libraries for extension structure

- GeoAlchemy2
  - To convert query paramerters
    - **ST_MakeEnvelope, ST_3DMakeBox, ST_MakePoint**
- psycopg2
  - Postgres database adapter for python
- SQLAlchemy
  - Python SQL toolkit
- Postgres extension
  - uuid-ossp: generating universally unique identifies (UUID)

[GeoAlchemy] https://geoalchemy-2.readthedocs.io/en/latest/
[psycopg2] https://pypi.org/project/psycopg2
[SQLAlchemy] https://www.sqlalchemy.org/
[uuid-ossp] https://www.postgresql.org/docs/current/uuid-ossp.html

Used libraries for extension structure

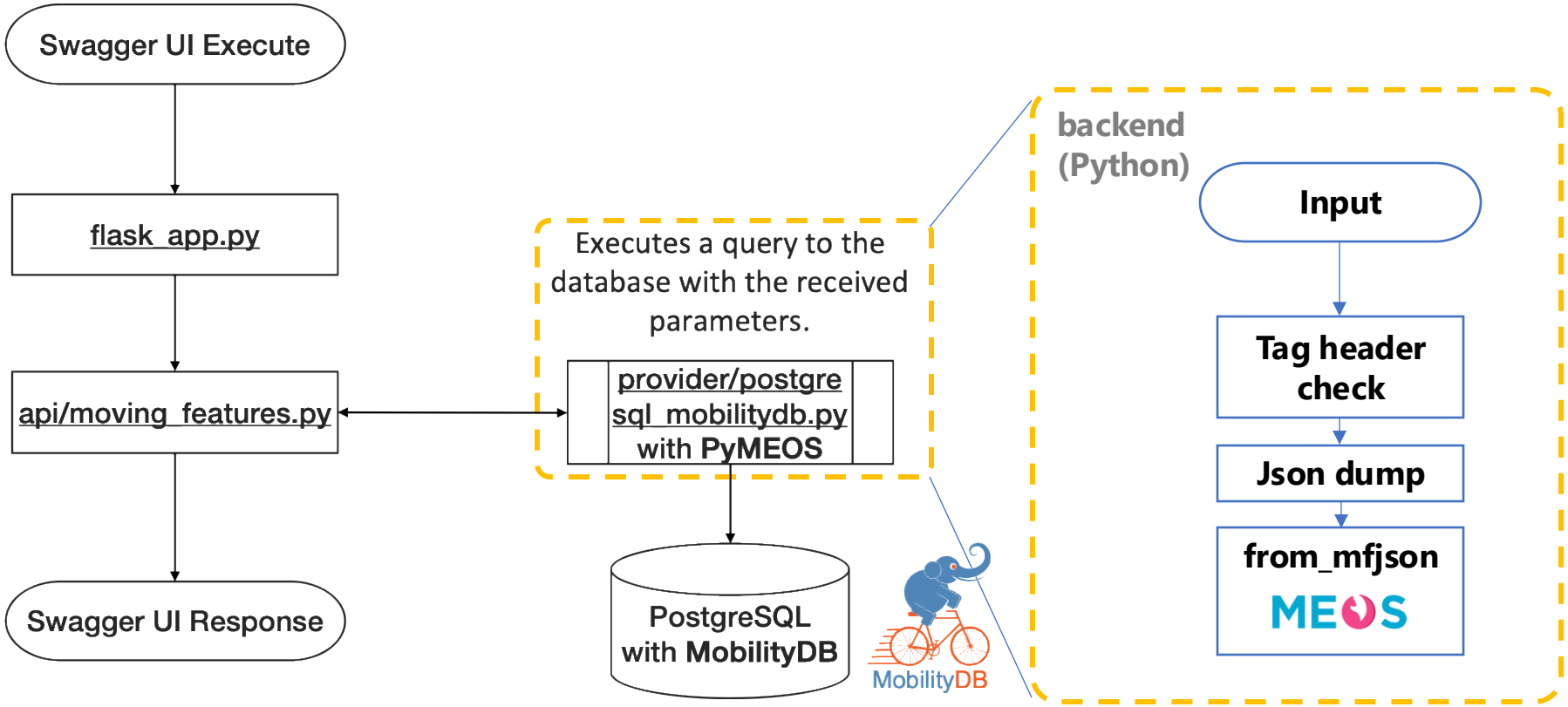
- PyMEOS (Mobility Engine, Open Source)
  - PyMEOS is a library built to top of MEOS that provides all its functionality wrapped in a set of Python class
  - MEOS
    - C library which enables the manipulation of temporal and spatio-temporal data based on MobilityDB's data types and functions

[pymeos] https://github.com/MobilityDB/PyMEOS

PyMEOS in the process flow

Process requests such as URI and GET, PUT, POST, DELETE operation with parameters

It handles parameters and receives the result of the query from the database.



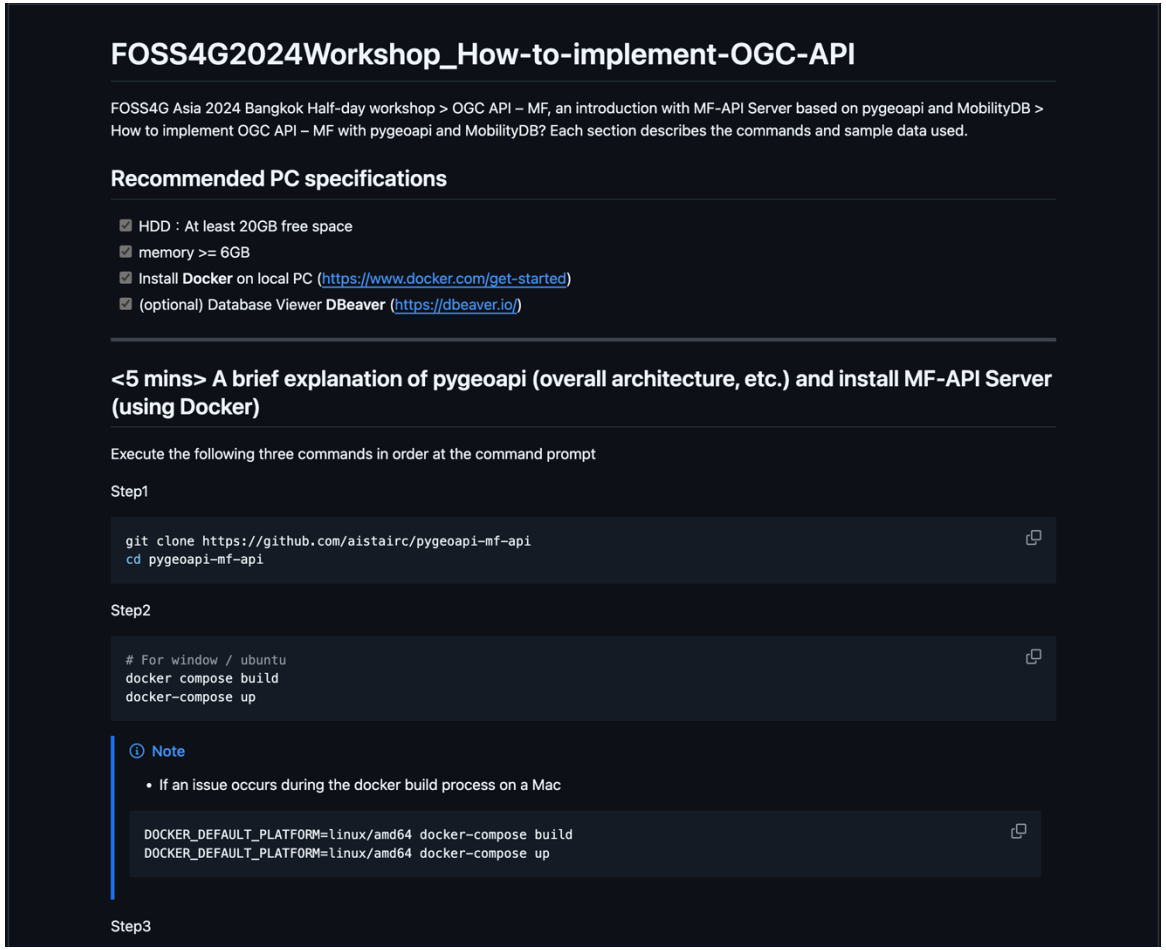
[pymeos] https://github.com/MobilityDB/PyMEOS

Verify that each API works properly using Swagger

1. Workshop materials
2. APIs about MovingFeatureCollection
3. APIs about MovingFeatures
4. APIs about TemproalGeometry
5. APIs about TemporalProperties
6. APIs about TemporalProperty
7. APIs about TemporalGeometryQuery

Workshop materials

- URL: https://github.com/opengeospatial/mf-swg/tree/foss4g_asia_2024
  - Sharing sample data with command for practicing



FOSS4G2024Workshop_How-to-implement-OGC-API

FOSS4G Asia 2024 Bangkok Half-day workshop > OGC API – MF, an introduction with MF-API Server based on pygeoapi and MobilityDB > How to implement OGC API – MF with pygeoapi and MobilityDB? Each section describes the commands and sample data used.

Recommended PC specifications

- ☑ HDD：At least 20GB free space
- ☑ memory >= 6GB
- ☑ Install **Docker** on local PC (https://www.docker.com/get-started)
- ☑ (optional) Database Viewer **DBeaver** (https://dbeaver.io/)

<5 mins> A brief explanation of pygeoapi (overall architecture, etc.) and install MF-API Server (using Docker)

Execute the following three commands in order at the command prompt

Step1

```
git clone https://github.com/aistairc/pygeoapi-mf-api
cd pygeoapi-mf-api
```

Step2

```
# For window / ubuntu
docker compose build
docker-compose up
```

Note

- If an issue occurs during the docker build process on a Mac

```
DOCKER_DEFAULT_PLATFORM=linux/amd64 docker-compose build
DOCKER_DEFAULT_PLATFORM=linux/amd64 docker-compose up
```

Step3

APIs about MovingFeatureCollection

POST /collections

No1

Parameters

Request body (application/json)

Reference GitHub Page

```
{
  "title": "moving_feature_collection_sample1",
  "updateFrequency": 1000,
  "description": "FOSS4G2024 Asia Workshop”,
  "itemType": "movingfeature"
}
```

Execute

APIs about MovingFeatureCollection

AIST
Create the Future, Collaborate Together

POST /collections

No1

Result

Server response

Code | Details

201

Response headers

```
access-control-allow-origin: http://localhost:8085
connection: close
content-language: en-US
content-length: 0
content-type: application/json
date: Thu,16 Nov 2023 07:02:19 GMT
location: http://localhost:8085/collections/9fc1986e-1258-49e3-b130-c2d211326319
server: Werkzeug/2.3.6 Python/3.9.2
vary: Origin
x-powered-by: pygeoapi 0.14.dev0
```

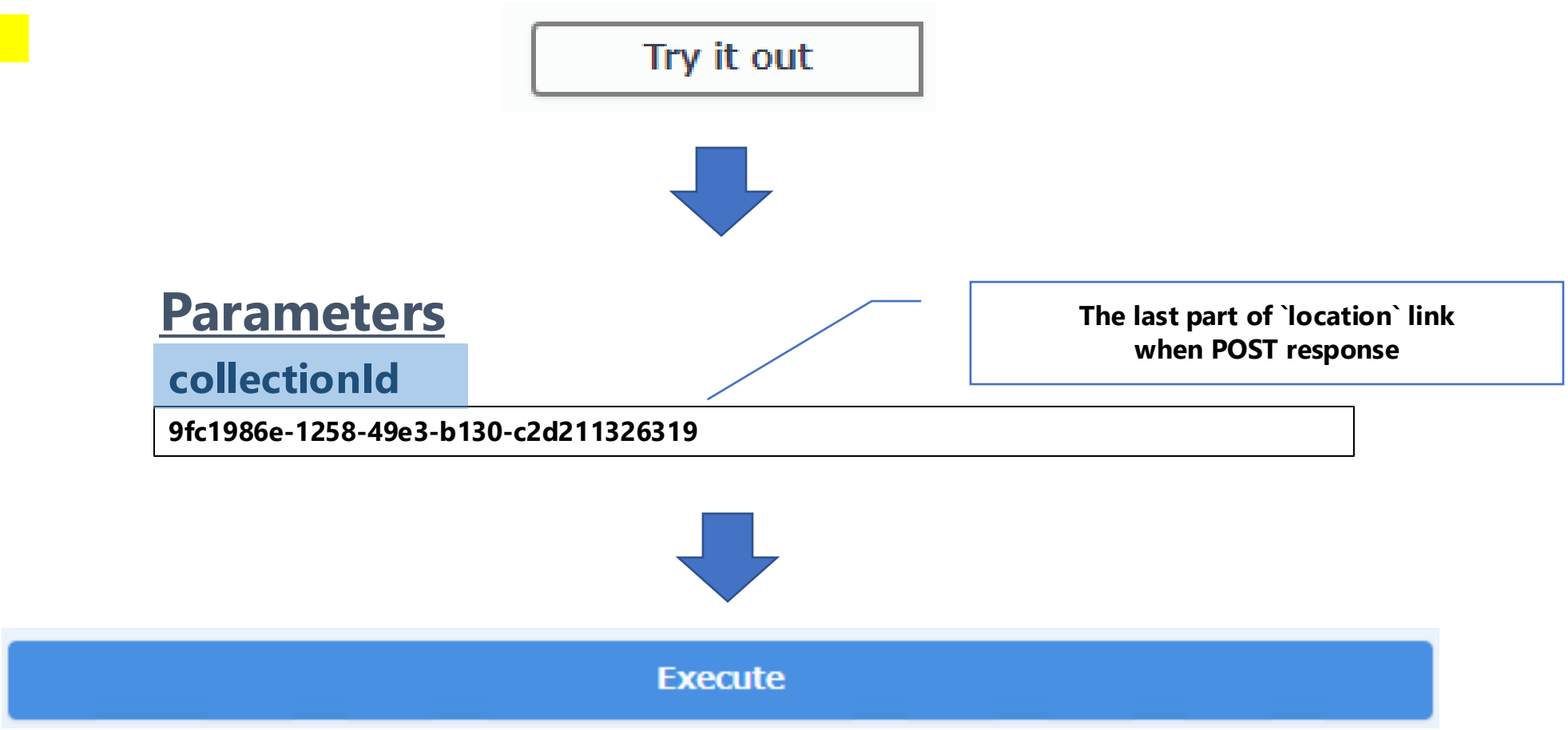
collectionId

collectionId : 9fc1986e-1258-49e3-b130-c2d211326319

APIs about MovingFeatureCollection

GET /collections/{collectionId}

No2



APIs about MovingFeatureCollection

GET /collections/{collectionId}

No2

Result

Server response

Code | Details

200

Response body

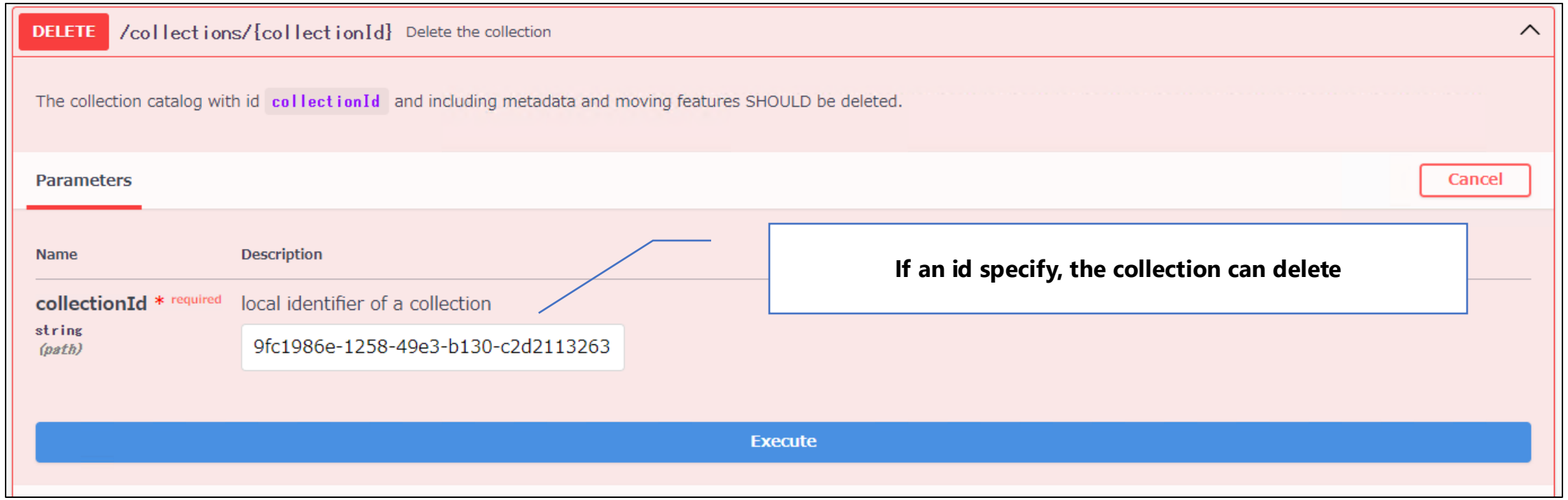
Input parameters when POST


```
{
  "collections": [
    {
      "title": "moving_feature_collection_sample1",
      "description": "FOSS4G2023 Seoul Workshop",
      "updateFrequency": 1000,
      "itemType": "movingfeature",
      "id": "9fc1986e-1258-49e3-b130-c2d211326319",
      "extent": {
        "spatial": {
          "bbox": [],
          "crs": "http://www.opengis.net/def/crs/OGC/1.3/CRS84"
        }
      },
      "temporal": {
        "interval": [],
        "trs": "http://www.opengis.net/def/uom/ISO-8601/0/Gregorian"
      },
      "links": [
        {
          "href": "http://localhost:8085/collections/9fc1986e-1258-49e3-b130-c2d211326319",
          "rel": "self",
          "type": "application/json"
        }
      ]
    }
  ],
  "links": [
```

APIs about MovingFeatureCollection

DELETE /collections/{collectionId}

Skip the DELETE request for the next demonstration



APIs about MovingFeatures

POST /collections/{collectionId}/items

No5

Parameters

collectionId

9fc1986e-1258-49e3-b130-c2d211326319

Reference GitHub Page

Request body(application/json)

```
{
  "type": "Feature",
  "properties": {
    "name": "car1", ...
```

Execute

APIs about MovingFeatures

POST /collections/{collectionId}/items

No5

Result

Server response

Code	Details
201	Response headers

```
access-control-allow-origin: http://localhost:8085
connection: close
content-language: en-US
content-length: 0
content-type: application/json
date: Fri,17 Nov 2023 01:17:43 GMT
location: http://localhost:8085/collections/9fc1986e-1258-49e3-b130-c2d211326319/items/f7a5b599-389e-4fdf-8849-bae0221dbe0c
server: Werkzeug/2.3.6 Python/3.9.2
vary: Origin
x-powered-by: pygeoapi 0.14.dev0
```

mFeatureId

Responses

Code	Description
201	Successful create a set of moving features or a moving feature into a specific collection.

mFeatureId : f7a5b599-389e-4fdf-8849-bae0221dbe0c

APIs about MovingFeatures

POST /collections/{collectionId}/items

No5-2

APIs about MovingFeatures

POST /collections/{collectionId}/items

No5-2

Result

Server response

Code	Details
201	Response headers

```
access-control-allow-origin: http://localhost:8085
connection: close
content-language: en-US
content-length: 0
content-type: application/json
date: Fri,24 Nov 2023 04:21:25 GMT
location: http://localhost:8085/collections/f71c3c59-becd-4cb7-bd98-a93505e769c8/items/015b3091-2a77-4390-b473-2966b64a8cb8
server: Werkzeug/2.3.7 Python/3.9.2
vary: Origin
x-powered-by: pygeoapi 0.14.dev0
```

mFeatureId

Responses

Code	Description
201	Successful create a set of moving features or a moving feature into a specific collection.

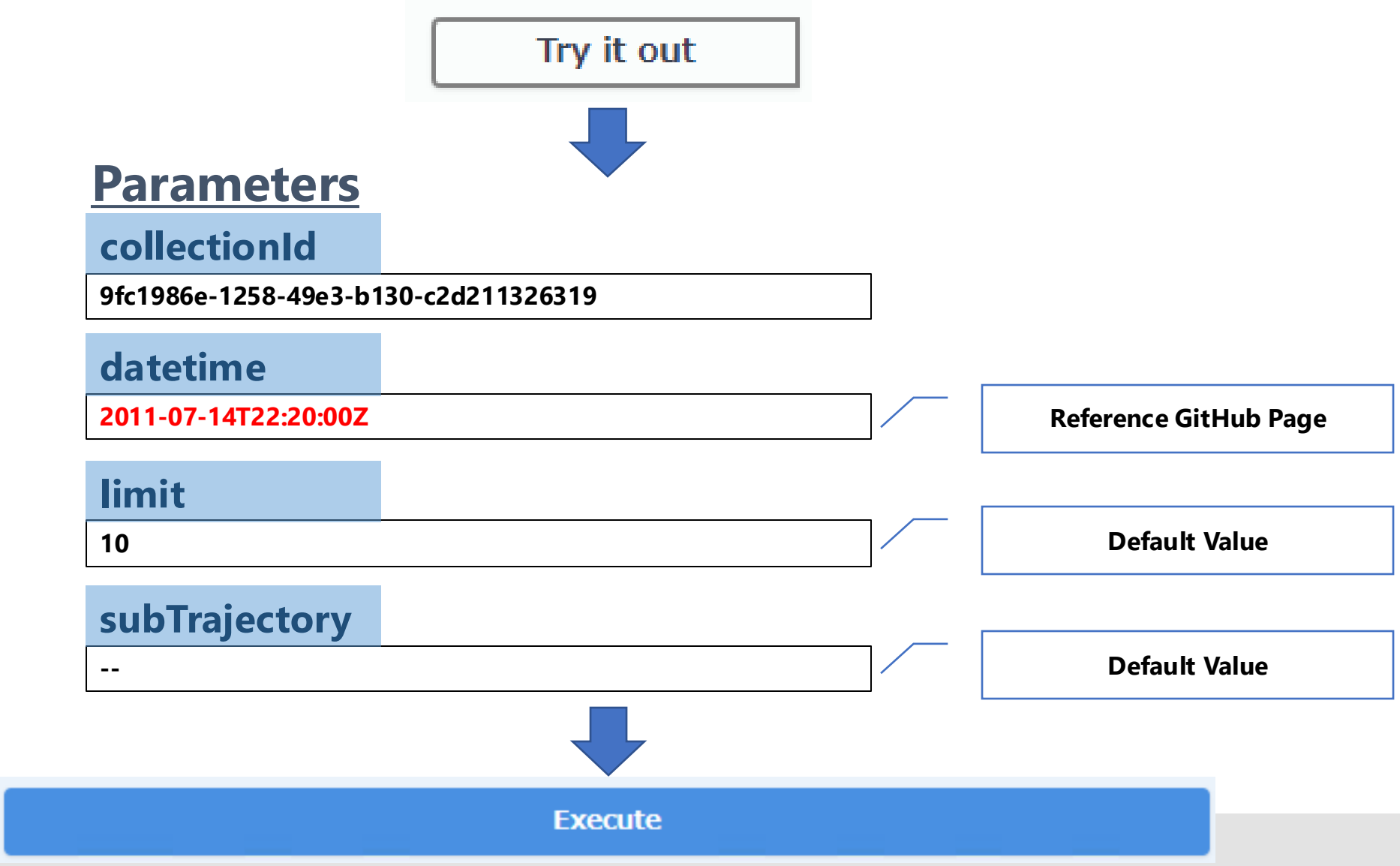
mFeatureId :015b3091-2a77-4390-b473-2966b64a8cb8

APIs about MovingFeatures

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items

No6



APIs about MovingFeatures

GET /collections/{collectionId}/items

No6

Result

Server response

Code | Details

200

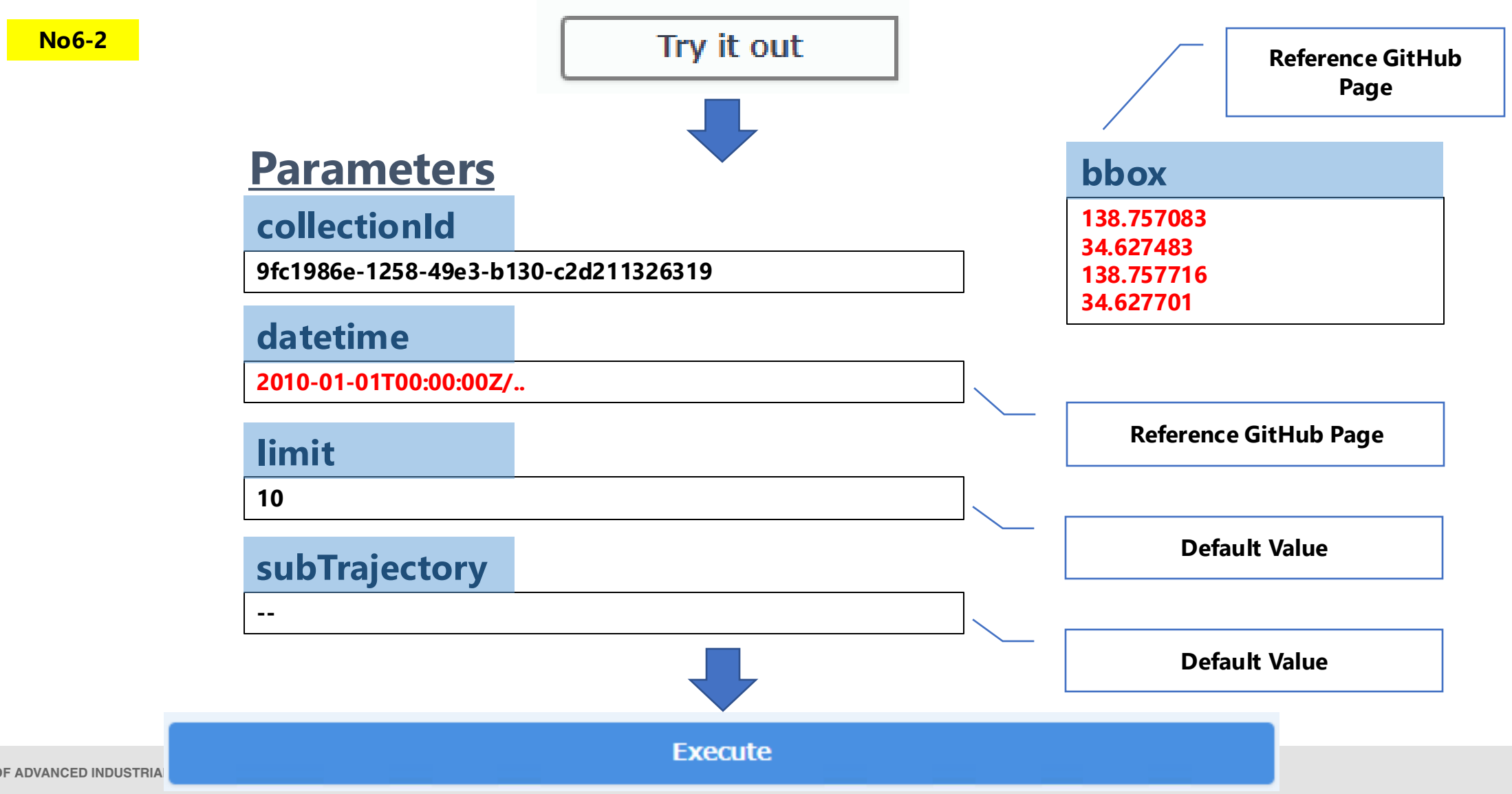
Response body


```
{
  "type": "FeatureCollection",
  "features": [
    {
      "id": "f7a5b599-389e-4fdf-8849-bae0221dbe0c",
      "crs": {
        "type": "Name",
        "properties": {
          "name": "urn:ogc:def:crs:OGC:1.3:CRS84"
        }
      },
      "trs": {
        "type": "Link",
        "properties": {
          "href": "http://www.opengis.net/def/uom/ISO-8601/0/Gregorian",
          "type": "ogcdef"
        }
      },
      "type": "Feature",
      "properties": {
        "name": "car1",
        "state": "test1",
        "video": "http://.../example/video.mpeg"
      },
      "geometry": {
        "type": "LineString",
        "coordinates": [
          [
```

APIs about MovingFeatures

GET /collections/{collectionId}/items

No6-2



APIs about MovingFeatures

GET /collections/{collectionId}/items

No6-2

Result

Server response

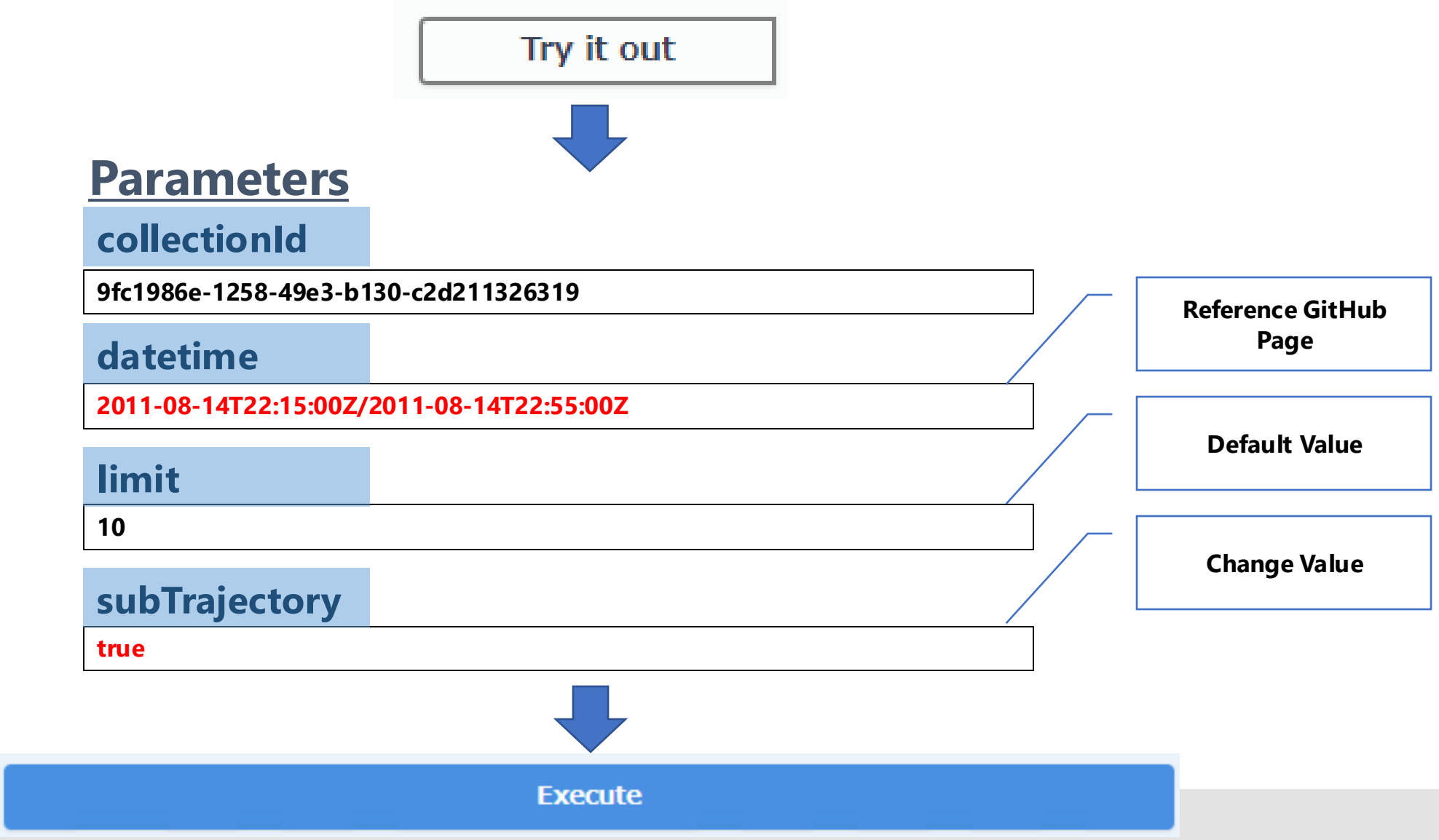
Code	Details
200	Response body


```
{
  "type": "FeatureCollection",
  "features": [
    {
      "id": "f7a5b599-389e-4fdf-8849-bae0221dbe0c",
      "crs": {
        "type": "Name",
        "properties": {
          "name": "urn:ogc:def:crs:OGC:1.3:CRS84"
        }
      },
      "trs": {
        "type": "Link",
        "properties": {
          "href": "http://www.opengis.net/def/uom/ISO-8601/0/Gregorian",
          "type": "ogcdef"
        }
      },
      "type": "Feature",
      "properties": {
        "name": "car1",
        "state": "test1",
        "video": "http://.../example/video.mpeg"
      },
      "geometry": {
        "type": "LineString",
        "coordinates": [
          [
```

APIs about MovingFeatures

GET /collections/{collectionId}/items

No6-3



APIs about MovingFeatures

GET /collections/{collectionId}/items

No6-3

Result

Server response

Code	Details
200	Response body

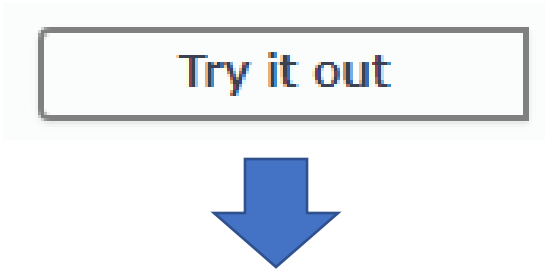

```
{
  "type": "FeatureCollection",
  "features": [
    {
      "id": "f7a5b599-389e-4fdf-8849-bae0221dbe0c",
      "crs": {
        "type": "Name",
        "properties": {
          "name": "urn:ogc:def:crs:OGC:1.3:CRS84"
        }
      },
      "trs": {
        "type": "Link",
        "properties": {
          "href": "http://www.opengis.net/def/uom/ISO-8601/0/Gregorian",
          "type": "ogcdef"
        }
      },
      "type": "Feature",
      "properties": {
        "name": "car1",
        "state": "test1",
        "video": "http://.../example/video.mpeg"
      },
      "geometry": {
        "type": "LineString",
        "coordinates": [
          [
```

APIs about MovingFeatures

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}

No7



APIs about MovingFeatures

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}

No7

Result

Server response

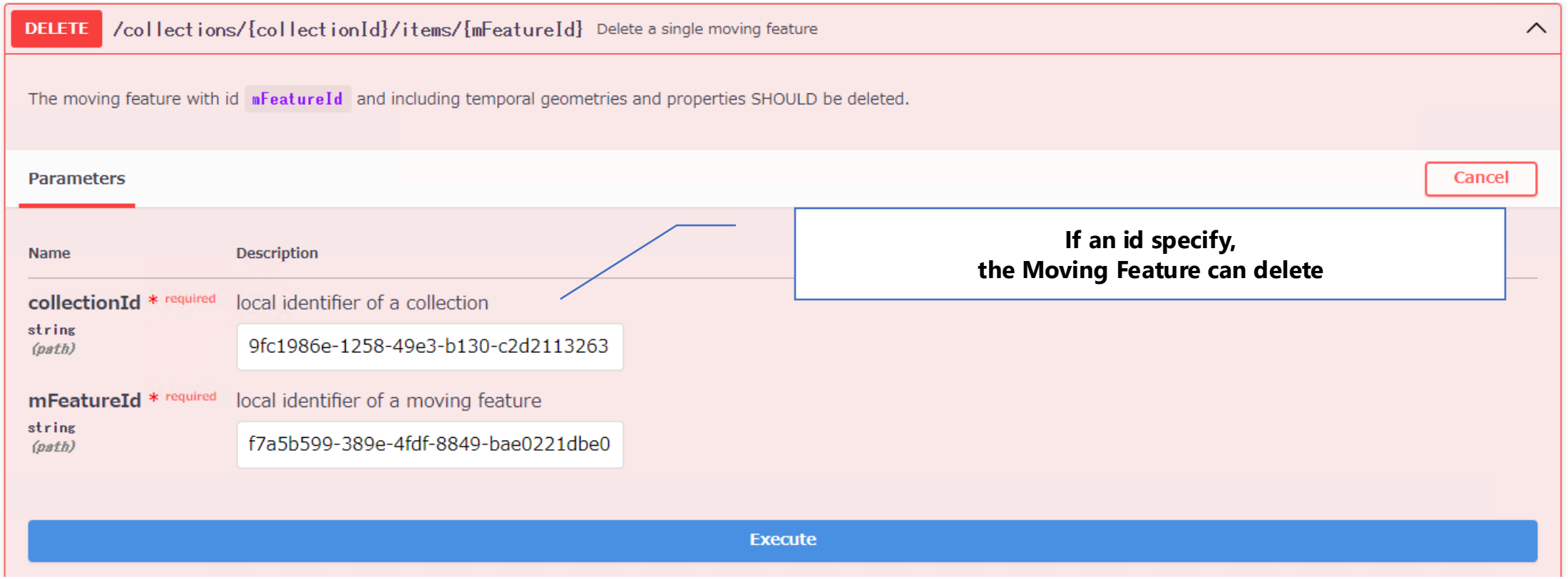
Code	Details
200	Response body


```
{
  "id": "f7a5b599-389e-4fdf-8849-bae0221dbe0c",
  "crs": {
    "type": "Name",
    "properties": {
      "name": "urn:ogc:def:crs:OGC:1.3:CRS84"
    }
  },
  "trs": {
    "type": "Link",
    "properties": {
      "href": "http://www.opengis.net/def/uom/ISO-8601/0/Gregorian",
      "type": "ogcdef"
    }
  },
  "type": "Feature",
  "properties": {
    "name": "car1",
    "state": "test1",
    "video": "http://.../example/video.mpeg"
  },
  "geometry": {
    "type": "LineString",
    "coordinates": [
      [
        139.757083,
        35.627701,
        0.5
```

APIs about MovingFeatures

DELETE /collections/{collectionId}/items/{mFeatureId}

Skip the DELETE request for the next demonstration



APIs about TemporalGeometry

POST /collections/{collectionId}/items/{mFeatureId}/tgsequence

No9

APIs about TemporalGeometry

POST /collections/{collectionId}/items/{mFeatureId}/tgsequence

No9

Result

Server response

Code	Details
201	Response headers

```
access-control-allow-origin: http://localhost:8085
connection: close
content-language: en-US
content-length: 0
content-type: application/json
date: Fri,17 Nov 2023 01:47:16 GMT
location: http://localhost:8085/collections/9fc1986e-1258-49e3-b130-c2d211326319/items/f7a5b599-389e-4fdf-8849-bae0221dbe0c/tGeometries/8602827f-6927-4c3c-9057-12c386889774
server: Werkzeug/2.3.6 Python/3.9.2
vary: Origin
x-powered-by: pygeoapi 0.14.dev0
```

tGeometryId

Responses

Code	Description	Links
201	Successful add more movement data into a specified moving feature.	*No links*

tGeometryId : 8602827f-6927-4c3c-9057-12c386889774

APIs about TemporalGeometry

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence

No10

Try it out

Parameters

collectionId

9fc1986e-1258-49e3-b130-c2d211326319

mFeatureId

f7a5b599-389e-4fdf-8849-bae0221dbe0c

leaf

2011-08-14T22:30:00Z

subTrajectory

--

limit

10

datetime

2010-01-01T00:00:00Z/..

Execute

APIs about TemporalGeometry

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence

No10

Result

Server response

Code | Details

200

Response body

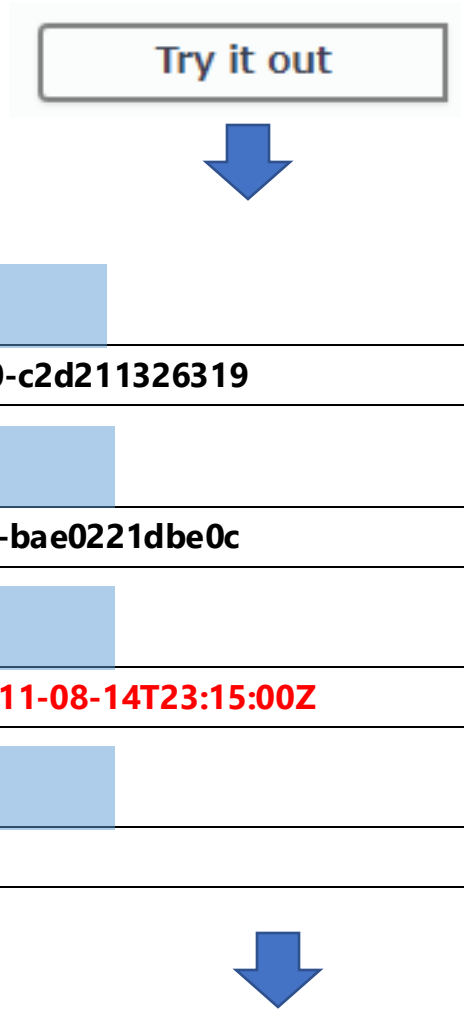

```
            35.627483,
            4
          ]
        ],
        "datetimes": [
          "2011-07-14T22:01:06-09Z",
          "2011-07-14T22:01:07-09Z",
          "2011-07-14T22:01:08-09Z",
          "2011-07-14T22:01:09-09Z",
          "2011-07-14T22:01:10-09Z"
        ],
        "interpolation": "Linear",
        "id": "8602827f-6927-4c3c-9057-12c386889774"
      }
    ],
    "crs": {
      "type": "Name",
      "properties": "urn:ogc:def:crs:OGC:1.3:CRS84"
    },
    "trs": {
      "type": "Name",
      "properties": "urn:ogc:data:time:iso8601"
    },
    "links": [
      {
        "href": "http://localhost:8085/collections/9fc1986e-1258-49e3-b130-c2d211326319/ite
        "rel": "self",
        "type": "application/json"
```

APIs about TemporalGeometry

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence

No10-2



APIs about TemporalGeometry

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence

No10-2

Result

Server response

Code | Details

200

Response body


```
            139.757716,
            35.627483,
            4
          ]
        ],
        "datetimes": [
          "2011-07-14T22:01:06-09Z",
          "2011-07-14T22:01:07-09Z",
          "2011-07-14T22:01:08-09Z",
          "2011-07-14T22:01:09-09Z",
          "2011-07-14T22:01:10-09Z"
        ],
        "interpolation": "Linear",
        "id": "8602827f-6927-4c3c-9057-12c386889774"
      }
    ],
    "crs": {
      "type": "Name",
      "properties": "urn:ogc:def:crs:OGC:1.3:CRS84"
    },
    "trs": {
      "type": "Name",
      "properties": "urn:ogc:data:time:iso8601"
    },
    "links": [
      {
        "href": "http://localhost:8085/collections/9fc1986e-1258-49e3-b130-c2d211326319/ite
        "rel": "self",
        "type": "application/json"
```

APIs about TemporalGeometry

POST /collections/{collectionId}/items/{mFeatureId}/tproperties

No12

Try it out

Parameters

collectionId

9fc1986e-1258-49e3-b130-c2d211326319

mFeatureId

f7a5b599-389e-4fdf-8849-bae0221dbe0c

Request body(application/json)

```
{
  "temporalProperties": [
    {  ...
```

Reference GitHub Page

Execute

APIs about TemporalGeometry

AIST
Create the Future, Collaborate Together

POST /collections/{collectionId}/items/{mFeatureId}/tproperties

No12

Result

Server response

Code	Details
201	Response headers

```
access-control-allow-origin: http://localhost:8085
connection: close
content-language: en-US
content-length: 0
content-type: application/json
date: Mon,20 Nov 2023 04:16:19 GMT
location: http://localhost:8085/collections/8f7c2c94-82db-4cad-b3f2-27c13ca1e5c5/items/1be529cd-fb42-416f-ab2e-3ed1f8e26c6d/tProperties/labels
server: Werkzeug/2.3.7 Python/3.9.2
vary: Origin
x-powered-by: pygeoapi 0.14.dev0
```

Responses

Code	Description

APIs about TemporalProperties

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tproperties

No13

Try it out

Parameters

collectionId

9fc1986e-1258-49e3-b130-c2d211326319

mFeatureId

f7a5b599-389e-4fdf-8849-bae0221dbe0c

datetime

2011-08-14T22:15:00Z/2011-08-14T22:55:00Z

limit

10

subTemporalValue

true

Execute

APIs about TemporalProperty

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tproperties

No13

Result

Server response

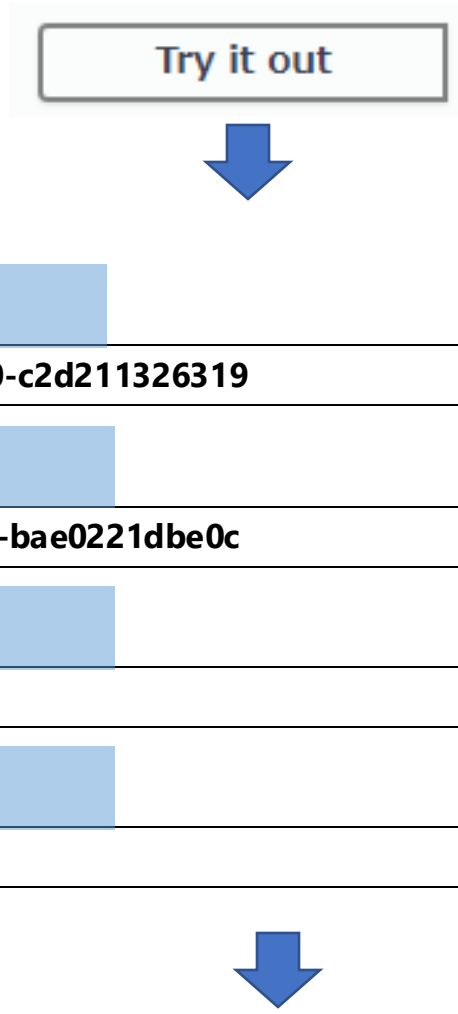
Code	Details
200	Response body


```
{
  "temporalProperties": [
    {
      "type": "Image",
      "name": "camera"
    },
    {
      "form": "MQS",
      "type": "Measure",
      "name": "discharge"
    },
    {
      "type": "Text",
      "name": "labels"
    },
    {
      "form": "http://www.qudt.org/qudt/owl/1.0.0/quantity/Length",
      "type": "Measure",
      "description": "description1",
      "name": "length"
    }
  ],
  "links": [
    {
      "href": "http://localhost:8085/collections/9fc1986e-1258-49e3-b130-c2c
      "rel": "self",
```

APIs about TemporalProperty

GET /collections/{collectionId}/items/{mFeatureId}/tproperties/{tPropertyName}

No14



APIs about TemporalProperty

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tproperties/{tPropertyName}

No14

Result

Server response

Code	Details

200

Response body


```
{
  "temporalProperties": [
    {
      "values": [
        1,
        2.4,
        1
      ],
      "datetimes": [
        "2011-07-14T22:01:01.45-09Z",
        "2011-07-14T23:01:01.45-09Z",
        "2011-07-15T00:01:01.45-09Z"
      ],
      "interpolation": "Linear"
    }
  ],
  "links": [
    {
      "href": "http://localhost:8085/collections/8f7c2c94-82db-4cad-b3f2-27c13ca1e5c5/items/1be529cd-fb42-416f-ab2e-3ed1f8e26c6d/tProperties/length?offset=0&limit=10",
      "rel": "self",
      "type": "application/json"
    }
  ],
  "timeStamp": "2023-11-20T04:17:45.377817Z",
  "numberMatched": 1,
  "numberReturned": 1
}
```

APIs about TemporalProperty

POST /collections/{collectionId}/items/{mFeatureId}/tproperties/{tPropertyName}

No15

Reference GitHub Page

APIs about TemporalProperty

AIST
Create the Future, Collaborate Together

POST /collections/{collectionId}/items/{mFeatureId}/tproperties/{tPropertyName}

No15

Result

Server response

Code | Details

201

Response headers

```
access-control-allow-origin: http://localhost:8085
connection: close
content-language: en-US
content-length: 0
content-type: application/json
date: Mon,20 Nov 2023 04:19:15 GMT
location: http://localhost:8085/collections/8f7c2c94-82db-4cad-b3f2-27c13ca1e5c5/items/1be529cd-fb42-416f-ab2e-3ed1f8e26c6d/tProperties/length/pvalue/0a59f0f1-2281-4133-811b-339b4863ce5c
server: Werkzeug/2.3.7 Python/3.9.2
vary: Origin
x-powered-by: pygeoapi 0.14.dev0
```

Responses

GET /collections/{collectionId}/items/{mFeatureId}/tproperties/{tPropertyName}

Server response

Code | Details

200

Response body


```
{
  "temporalProperties": [
    {
      "values": [
        0,
        20,
        50
      ],
      "datetimes": [
        "2011-07-15T08:00:00-09Z",
        "2011-07-15T08:00:01-09Z",
        "2011-07-15T08:00:02-09Z"
      ],
      "interpolation": "Linear"
    },
    {
      "values": [
        1,
        2.4,
        1
      ],
      "datetimes": [
        "2011-07-14T22:01:01.45-09Z",
        "2011-07-14T23:01:01.45-09Z",
        "2011-07-15T00:01:01.45-09Z"
      ],
      "interpolation": "Linear"
    }
```


confirm additions

APIs about TemporalProperty

AIST
Create the Future, Collaborate Together

DELETE /collections/{collectionId}/items/{mFeatureId}/tproperties/{tPropertyName}/{tValueId}

No16

Parameters | Cancel

Name	Description
collectionId * required `string` *(path)*	local identifier of a collection cb76b757-9c83-439b-baa9-e67c1cf12d74
mFeatureId * required `string` *(path)*	local identifier of a moving feature 71426252-f252-44cc-9d13-25eb1b93c31b
tPropertyName * required `string` *(path)*	local identifier of a temporal property label
tValueId * required `string` *(path)*	local identifier of a temporal primitive value d3b5b6a4-2415-4681-b5c1-dbdb397e6bc9

APIs about TemporalGeometryQuery

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence/{tGeometryId}/acceleration

No17

Try it out

Parameters

collectionId

cb76b757-9c83-439b-baa9-e67c1cf12d74

mFeatureId

71426252-f252-44cc-9d13-25eb1b93c31b

mFeatureId

0a7ac9ae-bed8-4c8b-9290-251e6ce21db9

datetime

2011-08-14T22:15:00Z/2011-08-14T23:55:00Z

leaf

subTemporalValue

--

Execute

APIs about TemporalGeometryQuery

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence/{tGeometryId}/acceleration

No17

Result

Code	Details
200	Response body


```
{
  "form": "MTS",
  "name": "acceleration",
  "type": "TReal",
  "valueSequence": [
    {
      "datetimes": [
        "2011-08-14T22:20:00.000000Z",
        "2011-08-14T22:30:00.000000Z",
        "2011-08-14T22:40:00.000000Z",
        "2011-08-14T23:00:00.000000Z"
      ],
      "interpolation": "Step",
      "values": [
        0,
        0,
        0,
        0
      ]
    }
  ]
}
```

APIs about TemporalGeometryQuery

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence/{tGeometryId}/distance

No18

Try it out

Parameters

collectionId

cb76b757-9c83-439b-baa9-e67c1cf12d74

mFeatureId

71426252-f252-44cc-9d13-25eb1b93c31b

mFeatureId

0a7ac9ae-bed8-4c8b-9290-251e6ce21db9

datetime

2010-01-01T00:00:00Z/..

leaf

2011-08-14T22:30:00Z

subTemporalValue

--

Execute

APIs about TemporalGeometryQuery

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence/{tGeometryId}/distance

No18

Result

Code	Details
200	Response body


```
{
  "form": "MTR",
  "name": "distance",
  "type": "TReal",
  "valueSequence": [
    {
      "datetimes": [
        "2011-08-14T22:10:00.000000Z",
        "2011-08-14T22:20:00.000000Z",
        "2011-08-14T22:30:00.000000Z",
        "2011-08-14T22:40:00.000000Z",
        "2011-08-14T23:00:00.000000Z"
      ],
      "interpolation": "Linear",
      "values": [
        0,
        1.500000033285333,
        3.500000039411582,
        3.500133005572702,
        3.500263366609814
      ]
    }
  ]
}
```

APIs about TemporalGeometryQuery

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence/{tGeometryId}/velocity

No19

Try it out

Parameters

collectionId

cb76b757-9c83-439b-baa9-e67c1cf12d74

mFeatureId

71426252-f252-44cc-9d13-25eb1b93c31b

mFeatureId

0a7ac9ae-bed8-4c8b-9290-251e6ce21db9

datetime

2011-08-14T22:15:00Z/2011-08-14T23:55:00Z

leaf

subTemporalValue

true

Execute

APIs about TemporalGeometryQuery

AIST
Create the Future, Collaborate Together

GET /collections/{collectionId}/items/{mFeatureId}/tgsequence/{tGeometryId}/velocity

No19

Result

Code	Details
200	Response body


```
{
  "form": "MTS",
  "name": "velocity",
  "type": "TReal",
  "valueSequence": [
    {
      "datetimes": [
        "2011-08-14T22:10:00.000000Z",
        "2011-08-14T22:20:00.000000Z",
        "2011-08-14T22:30:00.000000Z",
        "2011-08-14T22:40:00.000000Z",
        "2011-08-14T23:00:00.000000Z"
      ],
      "interpolation": "Step",
      "values": [
        0.002500000055476,
        0.003333333343544,
        2.21610269e-7,
        1.08634198e-7,
        1.08634198e-7
      ]
    }
  ]
}
```

Thank you