

# Recommender Metrics Framework

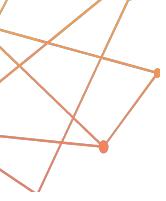
Measuring the success of a Recommender System

Kostas Kagkelidis, Nikolaos Triantafyllis, Themis Zamani, Kostas Koumantaros  
{kaggis, ntriantafyl, themis, kkoum}@admin.grnet.gr  
National Infrastructures for Research and Technology (GRNET)

Nikolaos Triantafyllis (GRNET)

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# What are we going to talk about?

A Recommender System's Metrics Framework used in EOSC, and how it can be easily integrated with external RS systems and evaluate them.

# Who may concern?

## Recommender Service

- Owners
- Developers
- Engineers



Statistics

KPIs

Graphs

Metrics

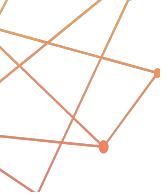
## Service using the RS Marketing Team





# What is a Recommender System? How to measure success?

- A **Recommender System (RS)** suggests relevant items based on user preferences and patterns.
- In the **EOSC Marketplace**, the RS is a novel component meant to improve user experience.
- **Measuring the success** of such a system is crucial to get valuable insights in many aspects that affect user experience.
- **Recommender Metrics Framework (RMF)** is being introduced to support the evaluation and adaptation of recommendation mechanisms.
- Diagnostic **statistics, metrics, and visualizations** offer deeper insights into a model's performance.



# Use Cases

IS CURRENTLY USED

CAN BE USED

## Monitoring the EOSC Marketplace RS

- Monitors and reports diagnostic metrics for the EOSC Marketplace RS.
- Analyses user actions and recommendations.
- Provides Statistics, Metrics, KPIs, Graphs in a REST API and dashboard UI.
- Delivers comprehensive documentation.

## Evaluate a third-party RS

- An analysis tool of the recommendation engine.
- Data preparation with the necessary input information.
- Tasks involve retrieving data from multiple sources, removing irrelevant data, correlating information, and generating **statistical insights**.

# What it offers?

## Statistics

- Number of Users
- Number of Resources
- Number of Recommended items
- Number of User Actions by
  - Registered or
  - Anonymous users
- Total Orders

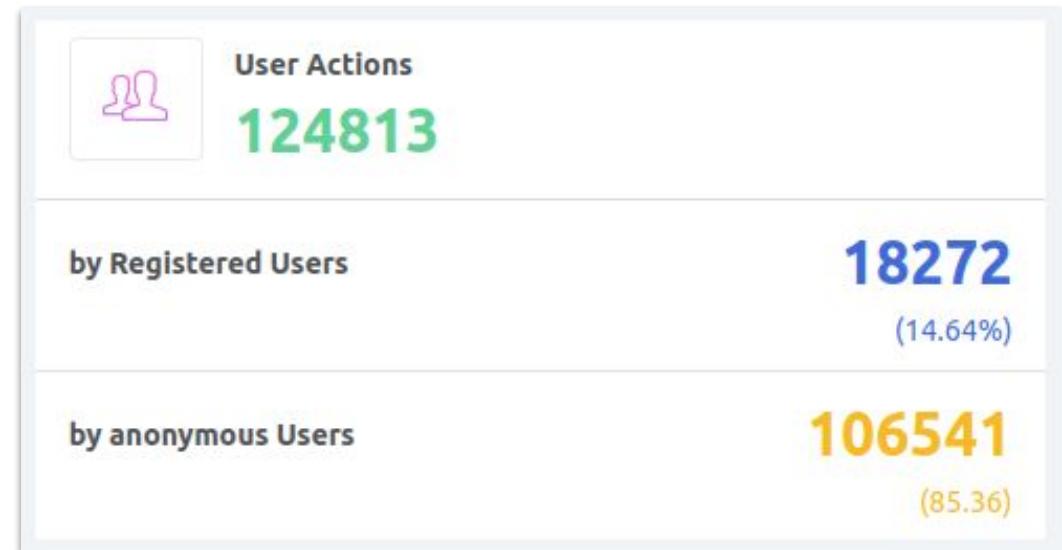


# What it offers?

User Actions

## Statistics

- Number of Users
- Number of Resources
- Number of Recommended items
- Number of User Actions by
  - Registered or
  - Anonymous users
- Total Orders



# What it offers?

## Metrics

- Accuracy
- Catalog Coverage
- Diversity Gini Index
- Diversity Shannon Entropy
- Novelty
- User Coverage



# What it offers?

## Metrics

- Accuracy
- Catalog Coverage
- Diversity Gini Index
- Diversity Shannon Entropy
- Novelty
- User Coverage

 Accuracy

Measures Recommendations' accuracy based on users' access to the services. A value of 1, indicates that the RS model got all the predictions right, and a value of 0 indicates that the RS model did not make a single correct prediction. Generally, the Accuracy mathematical expression is defined as:

$$A = \frac{\text{Number of correct predictions}}{\text{Total number of predictions}}$$

In RS Metrics the computation is determined by the following formula:

$$\text{Accuracy} = \frac{\text{Number of correctly recommended services}}{\text{Total number of services}}$$

where correctness is defined as if the service is both accessed by the user and also it is recommended by the RS

**METRIC**

**DESCRIPTION**

The accuracy ( $A$ ) of the recommendations is based on users' access to the services. A value of 1, indicates that the RS model got all the predictions right, and a value of 0 indicates that the RS model did not make a single correct prediction. Generally, the Accuracy mathematical expression is defined as:

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Output
Prerequisites

Type
Float

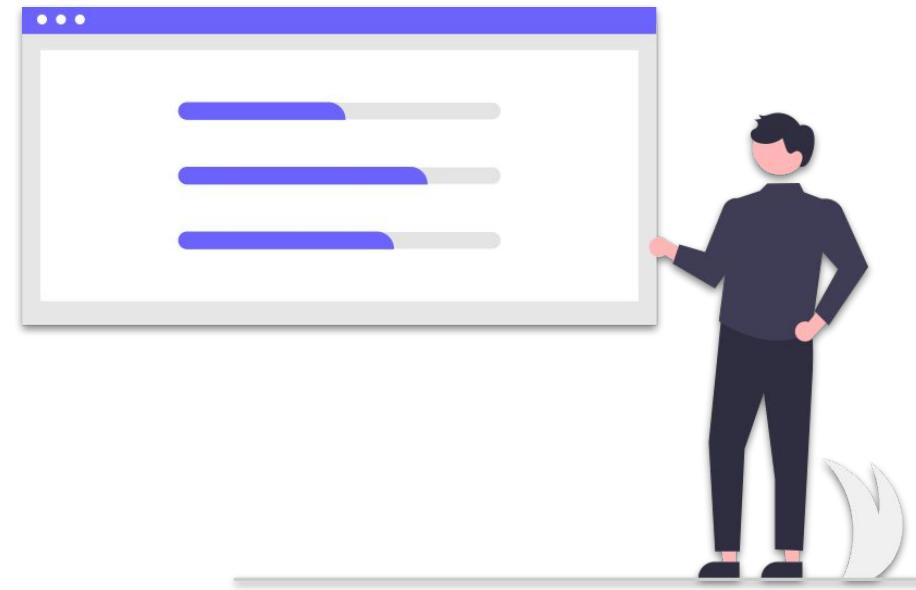
Range Values
Min=0 to Max=1

A value of 1, indicates that the RS model got all the predictions right, and a value of 0 indicates that the RS model did not make a single correct prediction.

# What it offers?

## KPIs

- Click-Through Rate
- Hit-Rate
- Top 5 ordered Services
- Top 5 recommended Services
- Top 5 recommended categories
- Top 5 ordered categories
- Top 5 recommended scientific domains
- Top 5 ordered scientific domains



# What it offers?

Hit Rate

## KPIs

- Click-Through Rate
- Hit-Rate
- Top 5 ordered Services
- Top 5 recommended Services
- Top 5 recommended categories
- Top 5 ordered categories
- Top 5 recommended scientific domains
- Top 5 ordered scientific domains

 Hit Rate  
The ratio of user hits divided by the total number of users

**METRIC**

**DESCRIPTION**  
The ratio of user hits divided by the total number of users (user hit: a user that has accessed at least one service that is also a personal recommendation). The metric is expressed by the formula:

$$HitRate = \frac{hits}{users}$$

**Output** **Prerequisites**

**TYPE** FLOAT

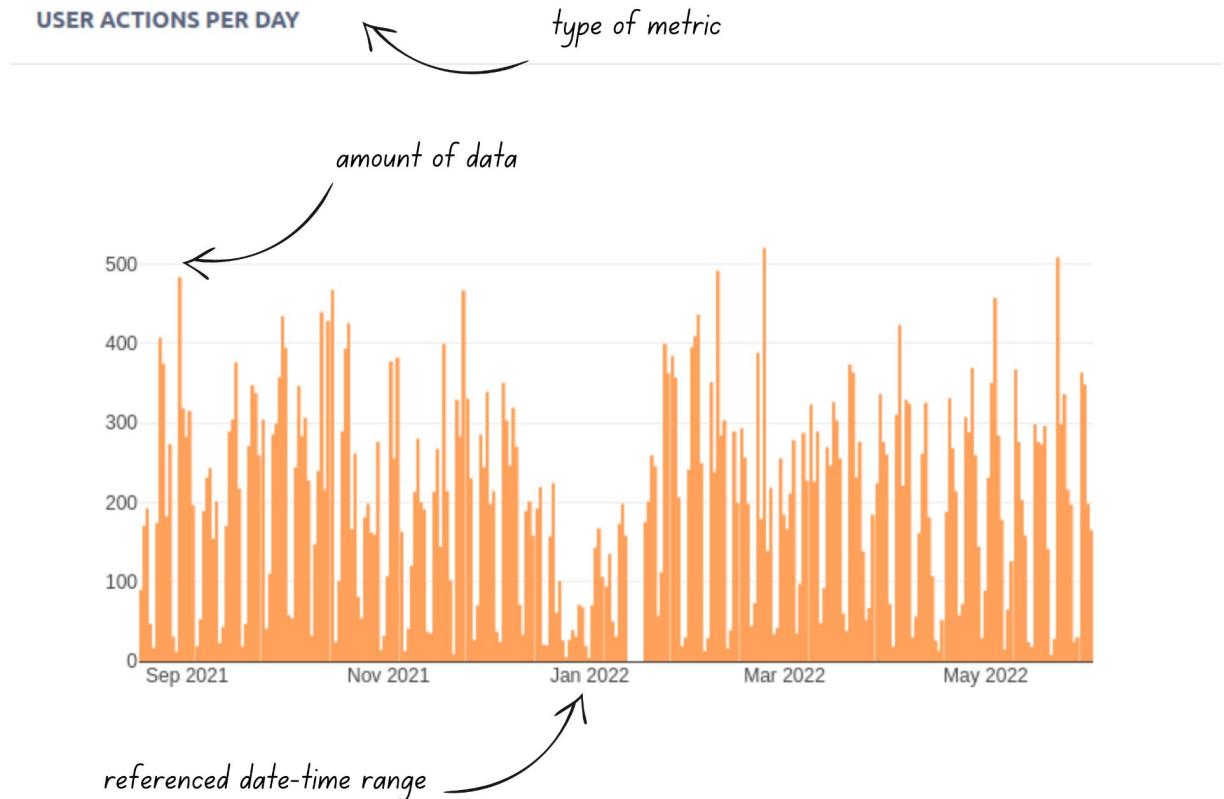
**RANGE VALUES**  
Min=0 to Max=+inf

A value of 0 indicates that no user hits occurred

# What it offers?

## Graphs

- User Actions per day
- Recommended Items per day
- User Actions per month
- Recommended Items per month



# What it offers?

## Rest API

- Statistics
- Metrics
- KPIs
- Graphs' Data

```
▼ 0:
    name: "accuracy"
    value: 0.9942
    ▼ doc:
        "The mean value of the accuracy score found for each user defined by the fraction of correct recommendations given to the user"

▼ 1:
    name: "catalog_coverage"
    value: 82.43
    ▼ doc:
        "The percentage (%) of unique services to the total number of services"

▼ 2:
    name: "click_through_rate"
    value: 0.03
    ▼ doc:
        "The number of user clicks through recommendations panels divided by the total times the user has interacted with the recommendation system"

▼ 3:
    name: "diversity"
    value: 3.2668
    ▼ doc:
        "The diversity of the recommendations according to Shannon Entropy. The entropy is 0 when all recommendations are the same"

▼ 4:
    name: "diversity_gini"
    value: 0.9718
    ▼ doc:
        "The diversity of the recommendations according to GiniIndex. The index is 0 when all recommendations are the same"

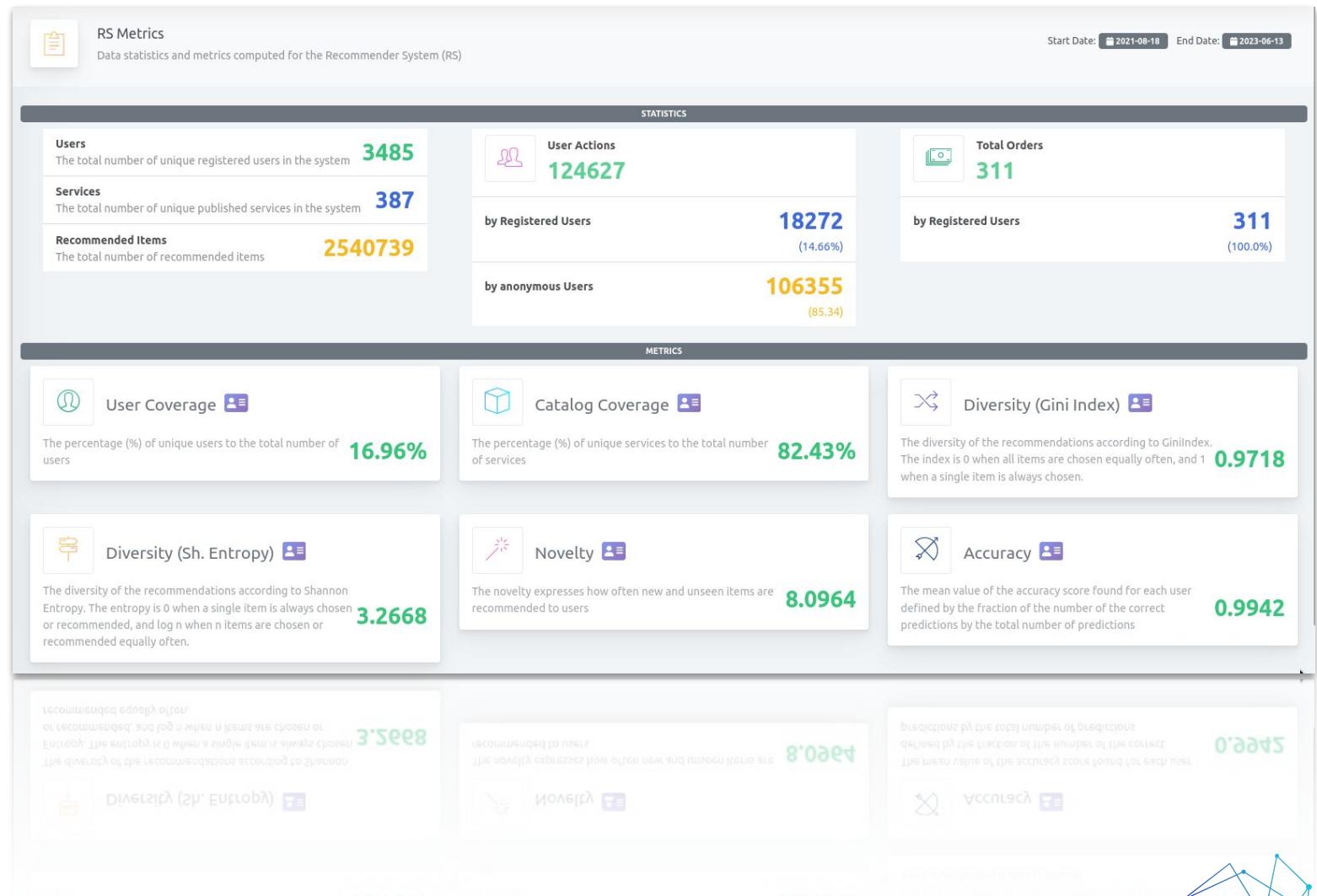
▼ 5:
    name: "hit_rate"
    value: 0.01275
    ▼ doc:
        "The ratio of user hits divided by the total number of users (user hit: a user that has interacted with at least one recommended item)"

▼ 6:
    name: "novelty"
    value: 8.0964
    ▼ doc:
        "The novelty expresses how often new and unseen items are recommended to users"
```

# What it offers?

## UI Dashboard

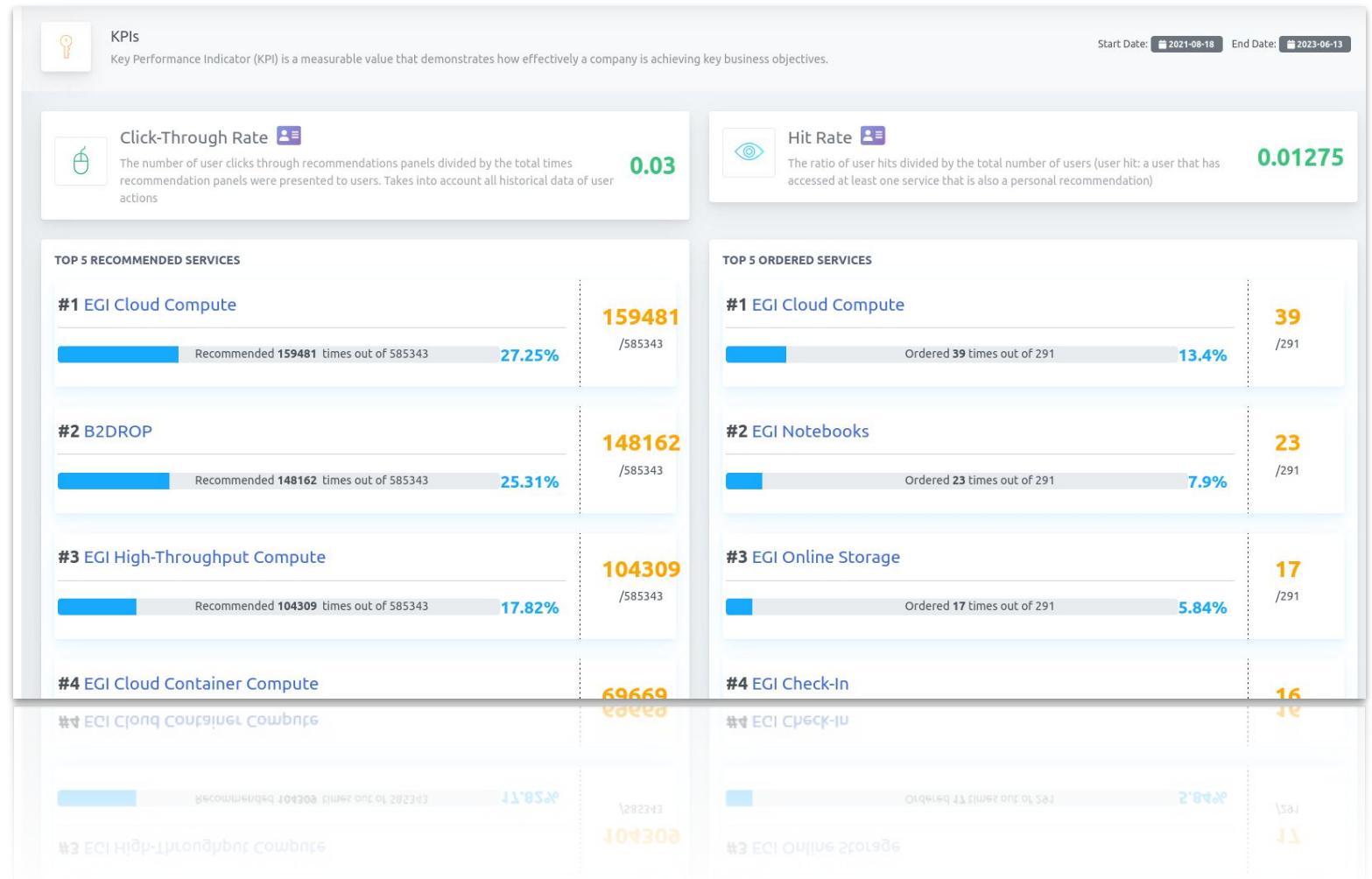
- Statistics
- Metrics
- KPIs
- Graphs



# What it offers?

## UI Dashboard

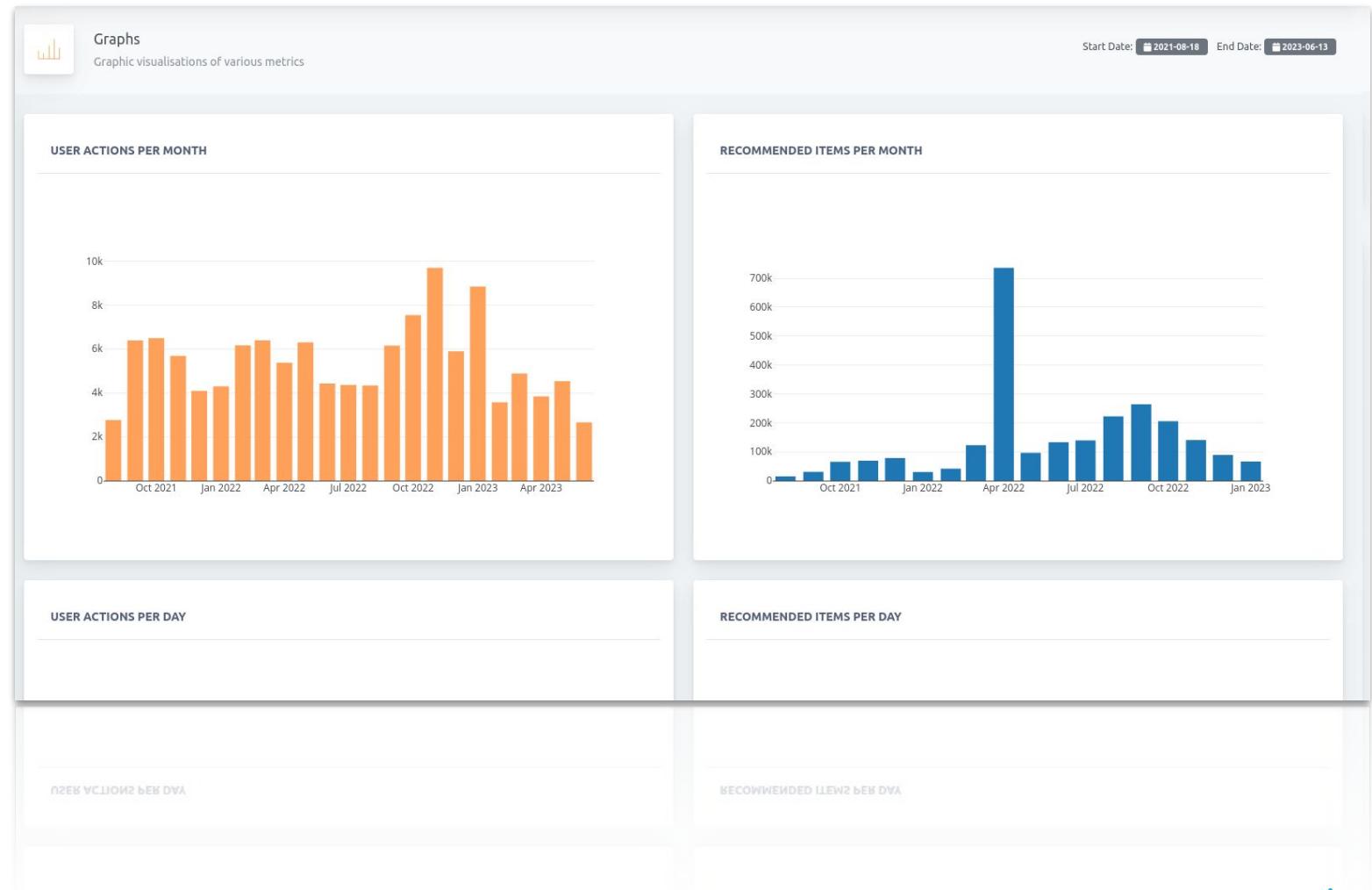
- Statistics
- Metrics
- KPIs
- Graphs



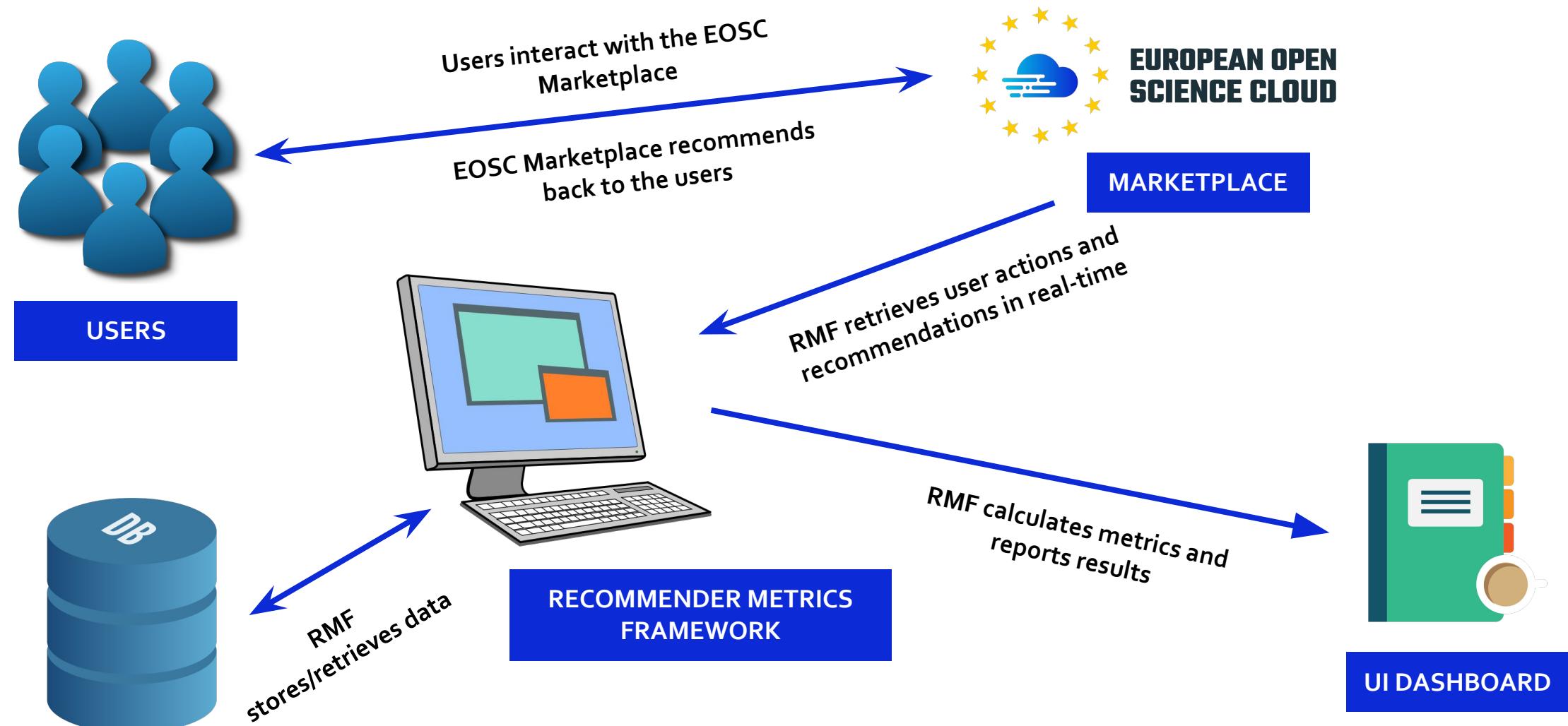
# What it offers?

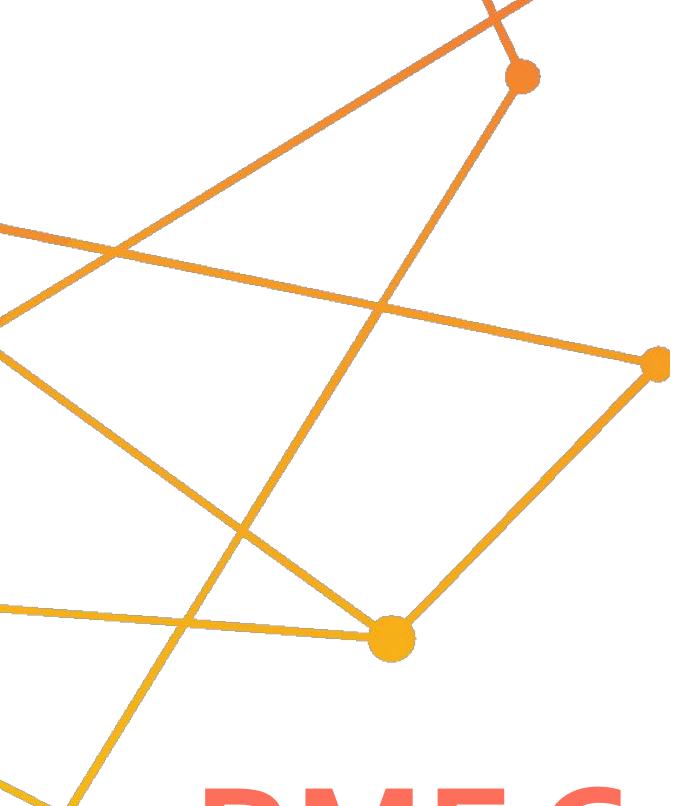
## UI Dashboard

- Statistics
- Metrics
- KPIs
- Graphs



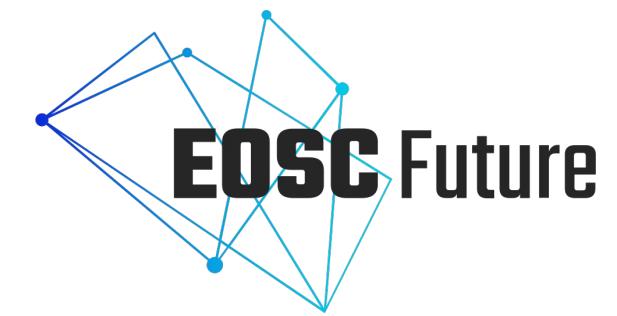
# Process Flow



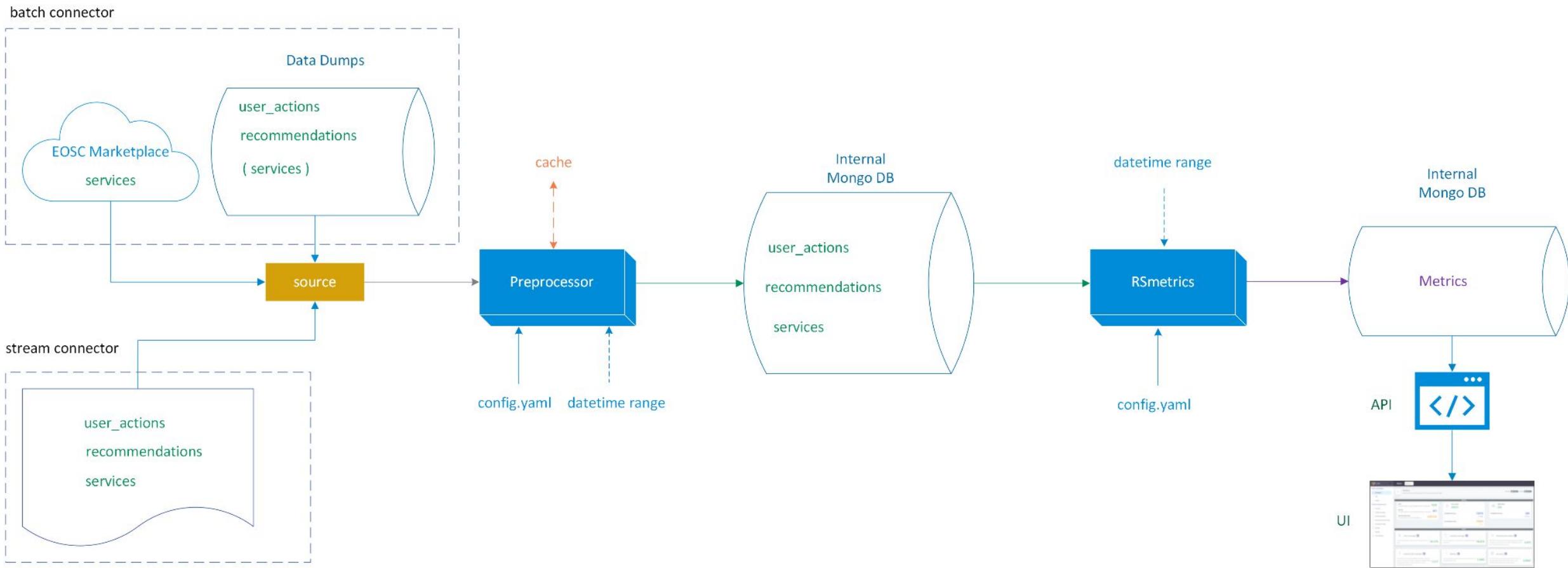


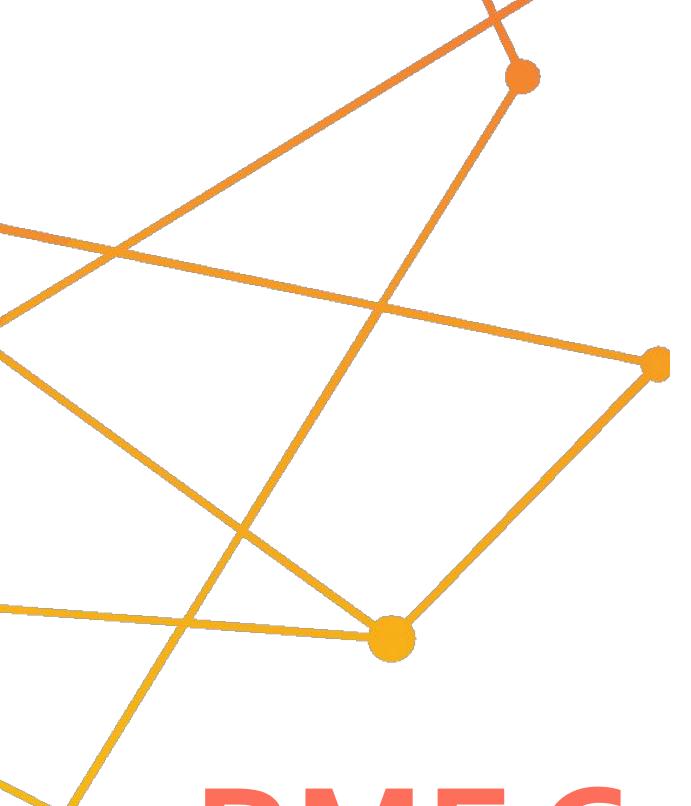
# RMF Components

All Units



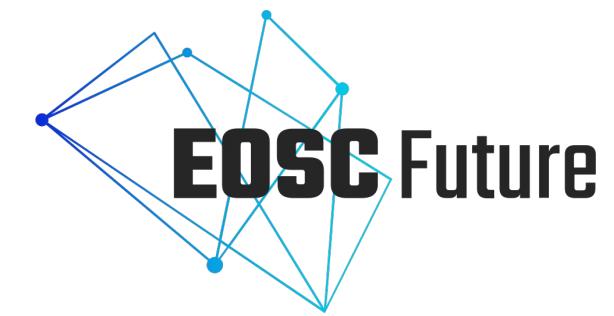
# Framework's components



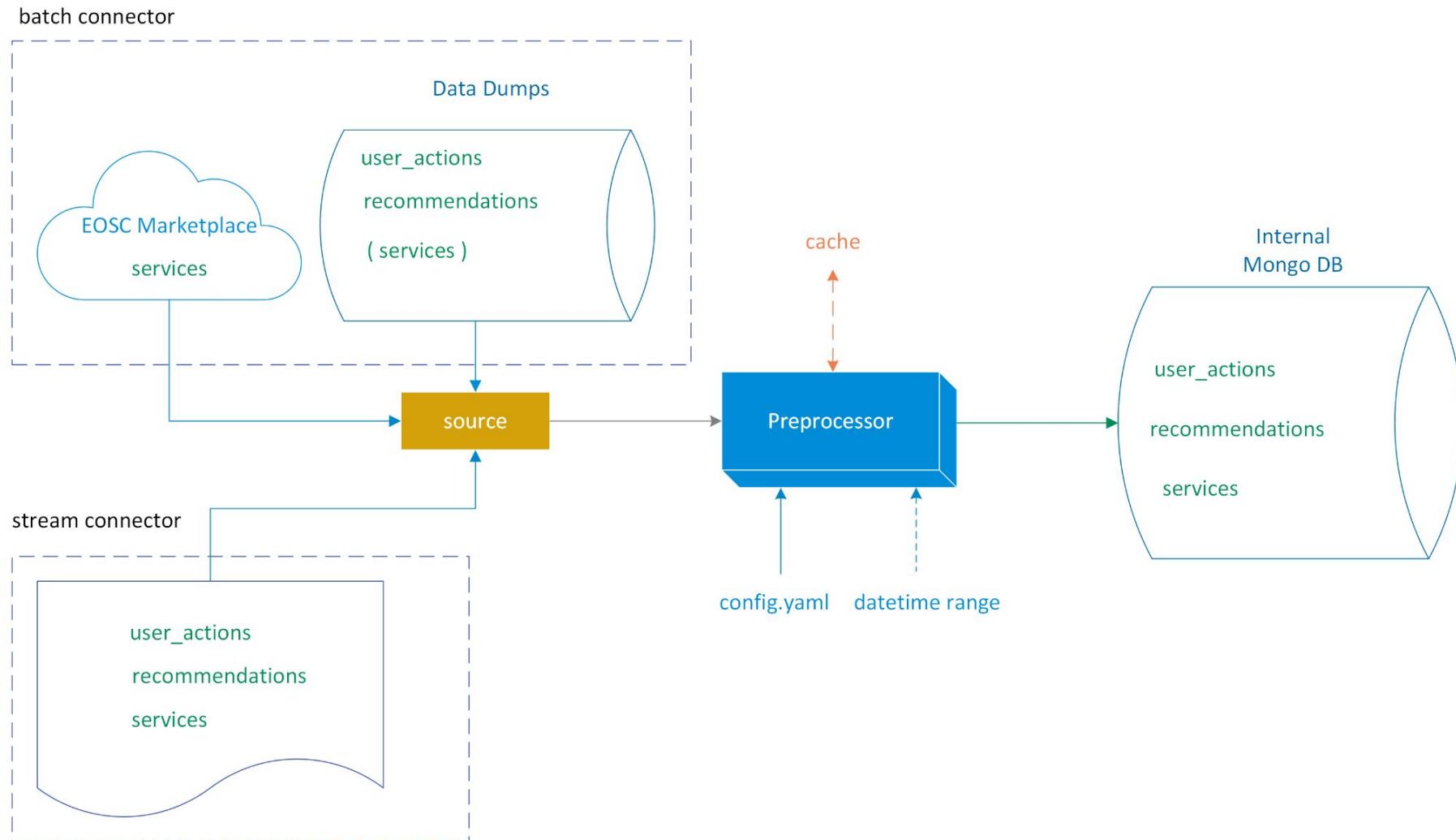


# RMF Components

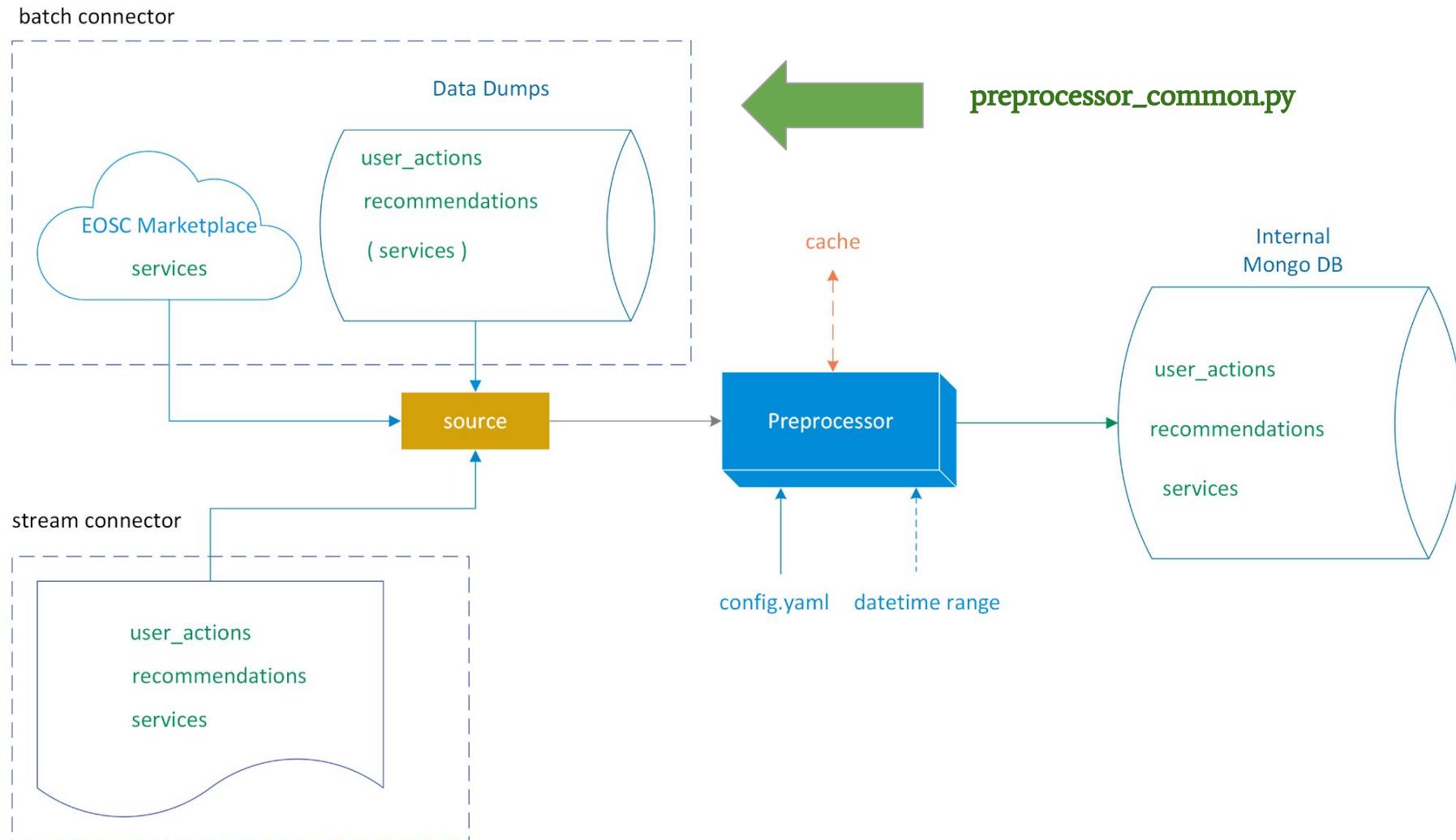
Preprocessor Unit



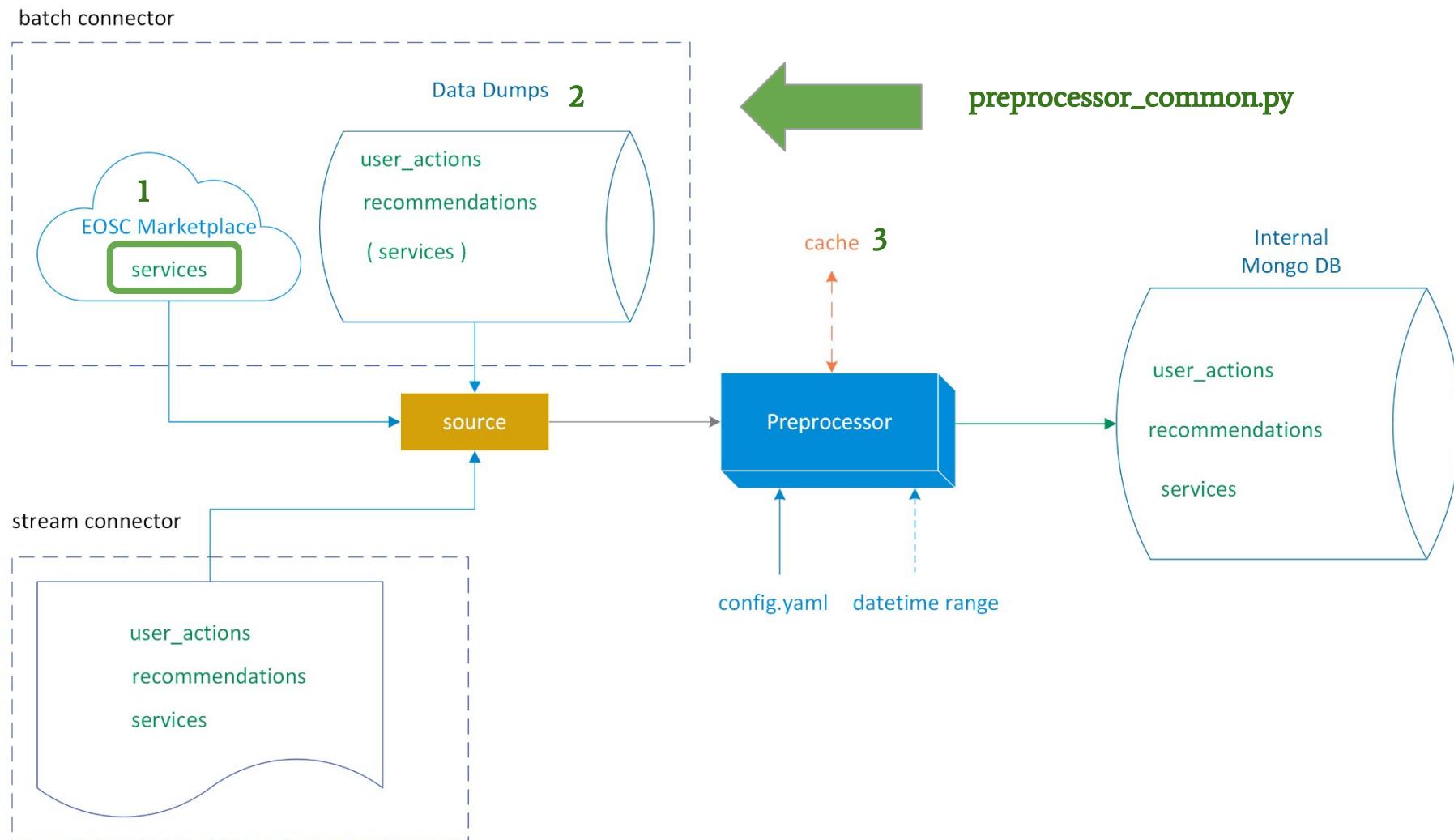
# Preprocessor Unit



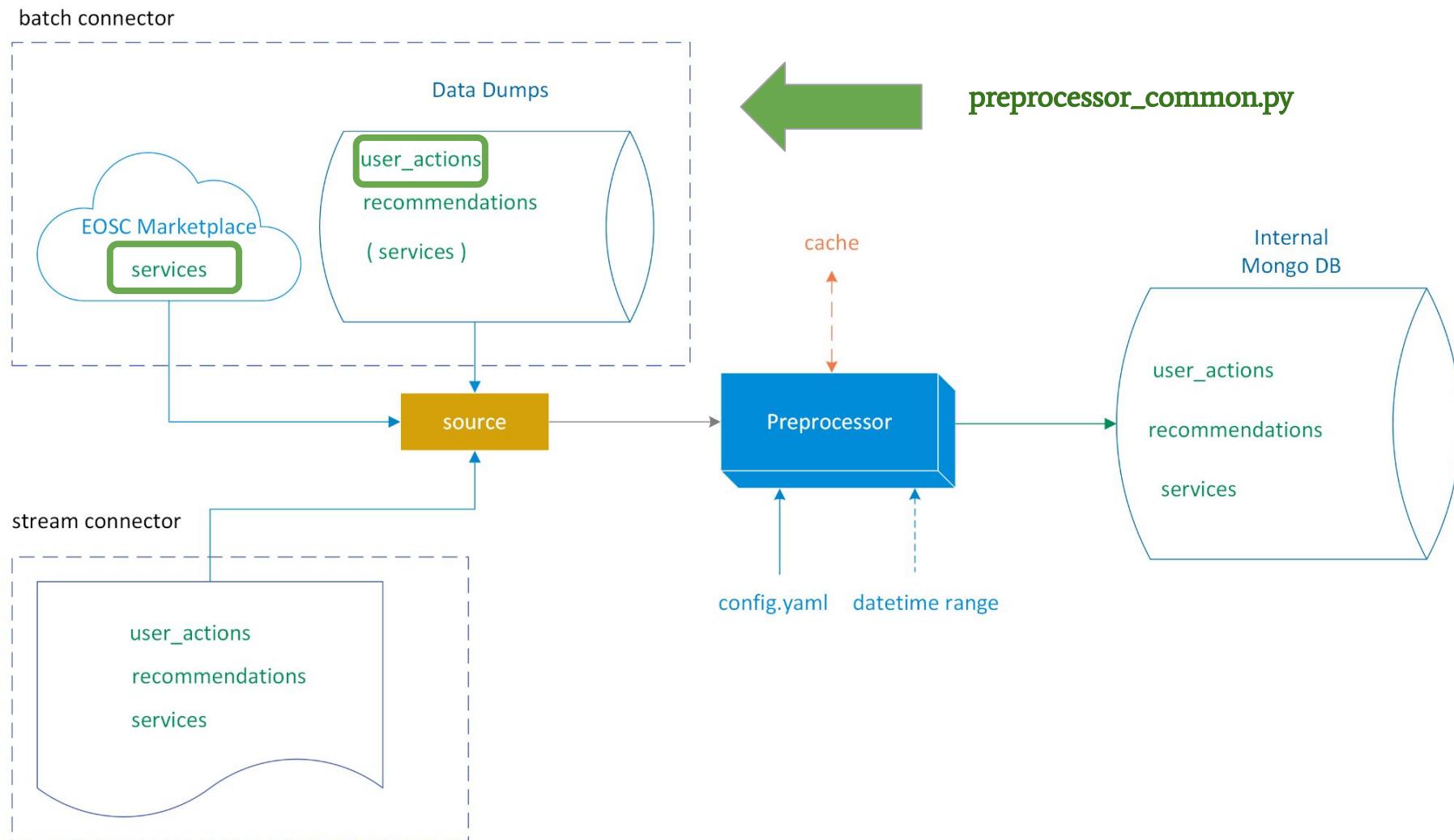
# Preprocessor Unit



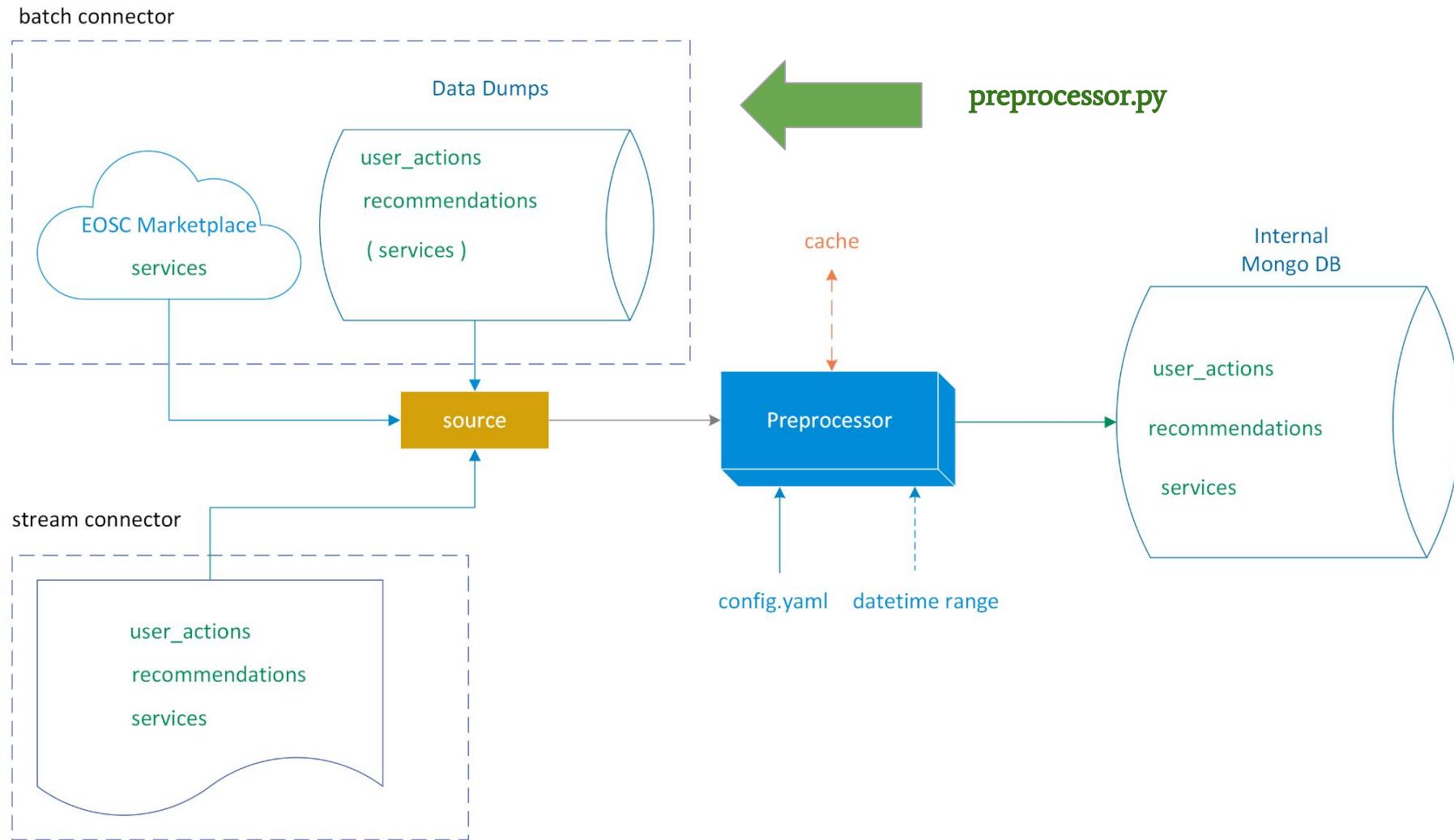
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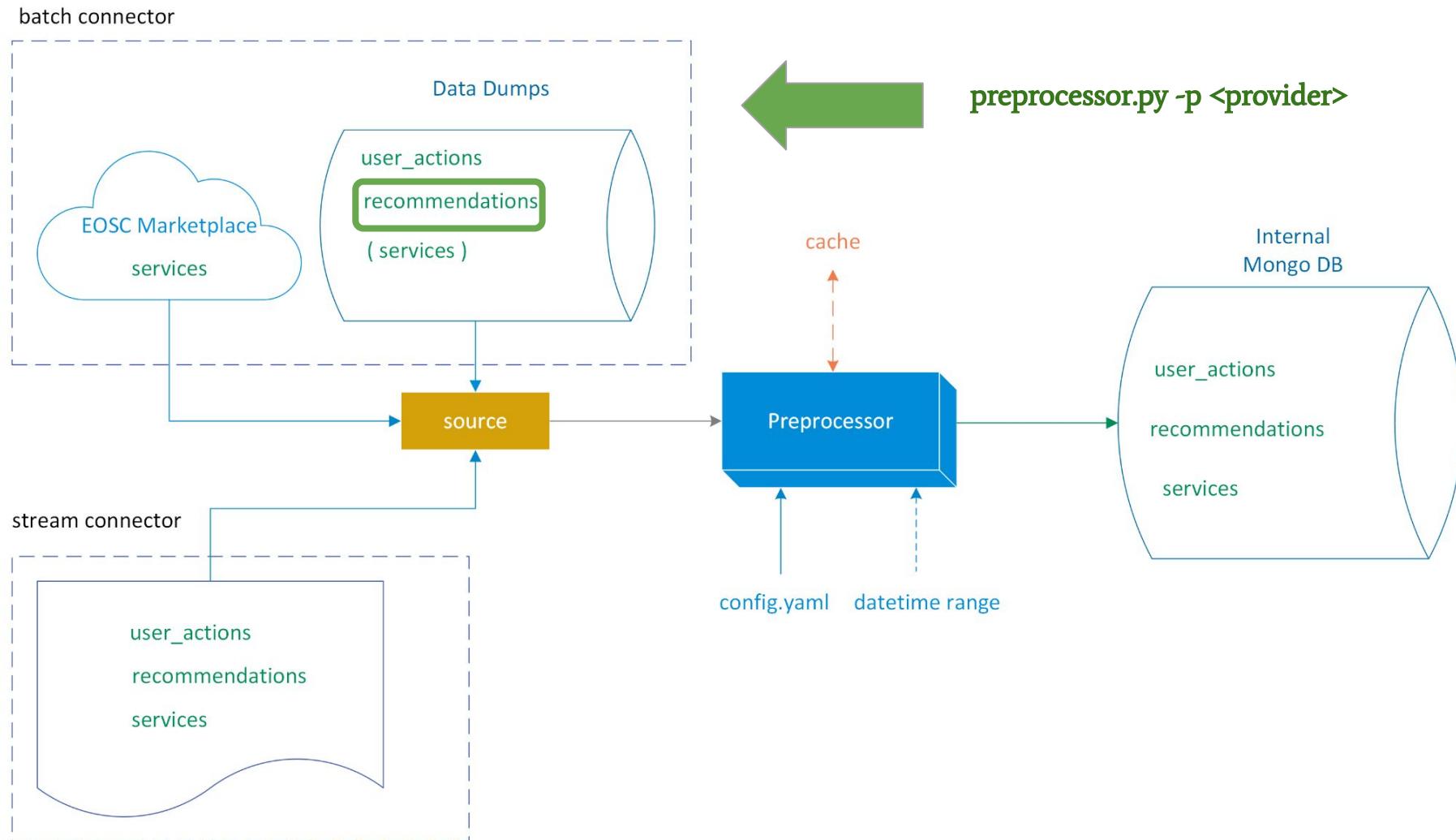
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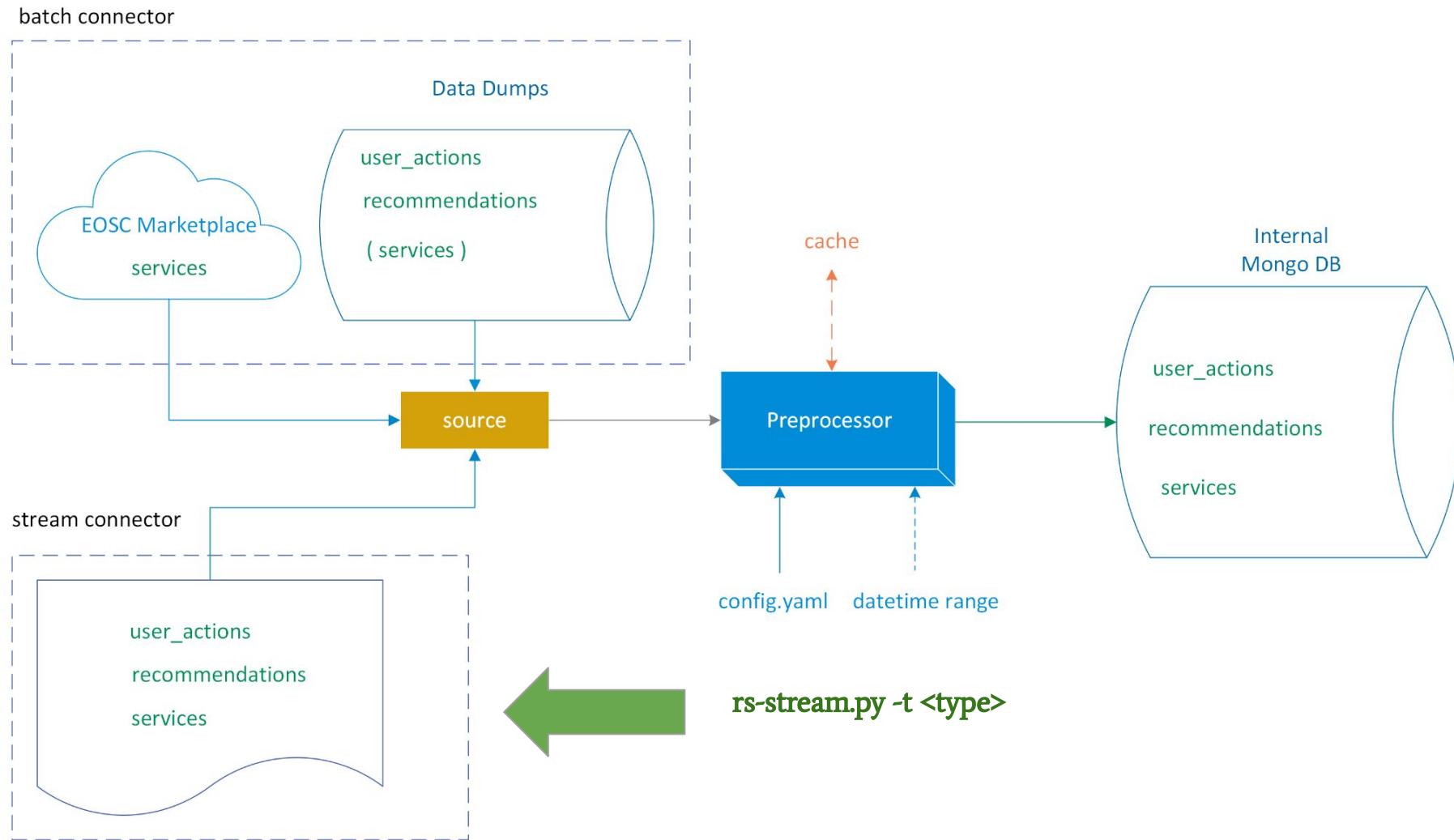
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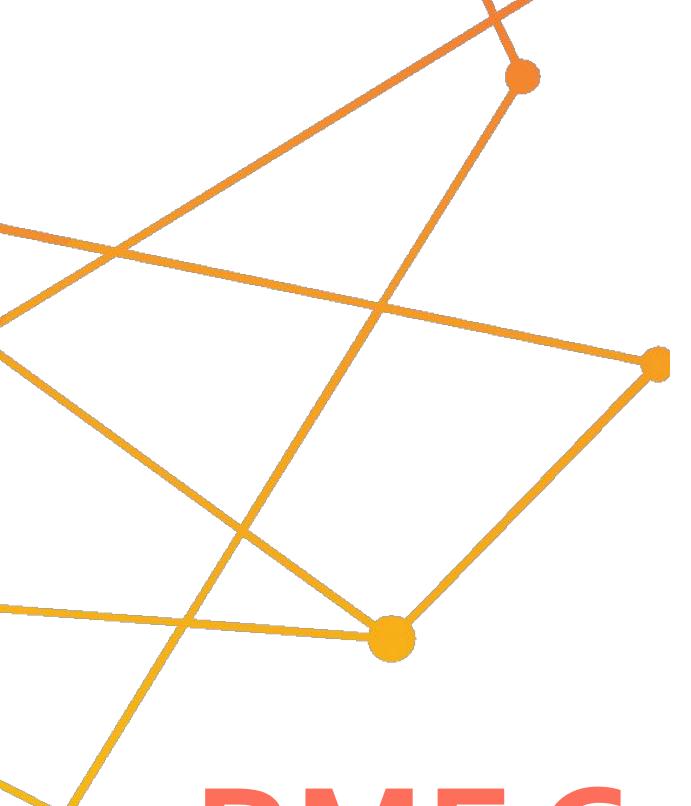


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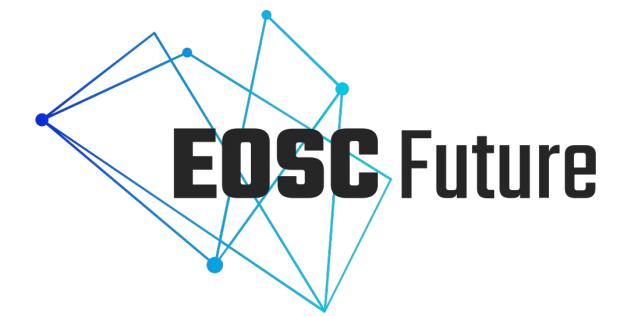
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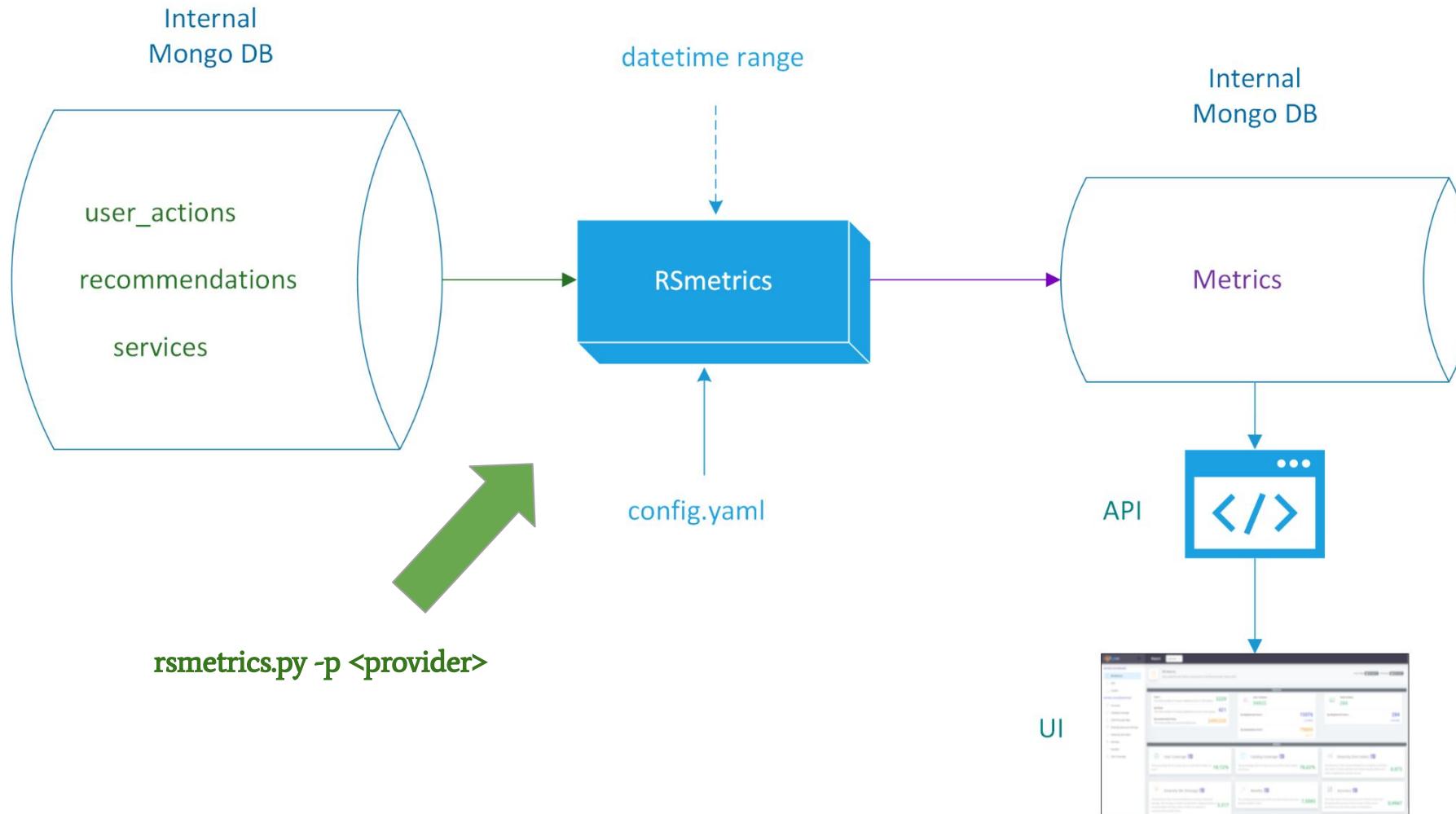


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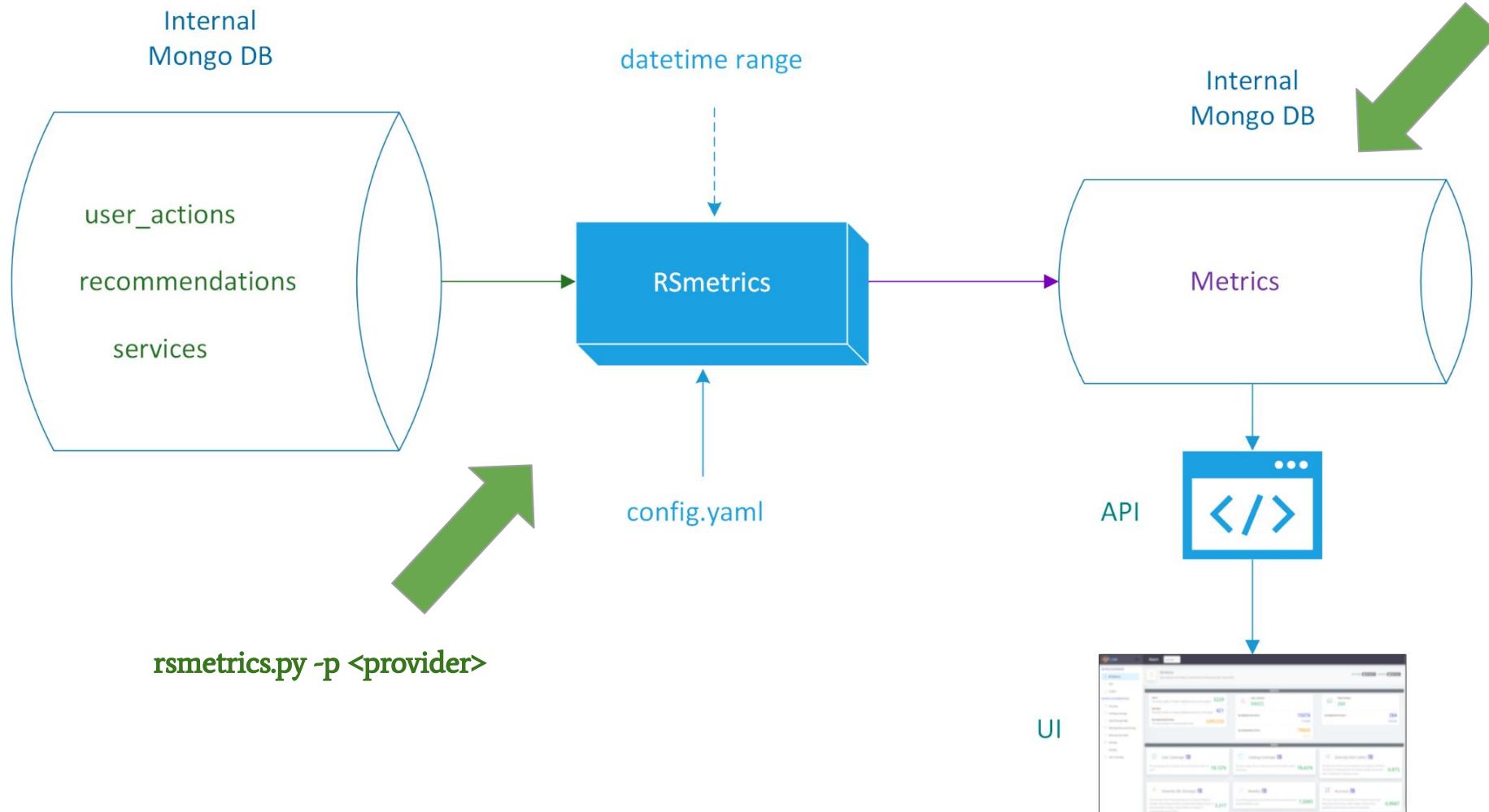
RS Metrics Unit

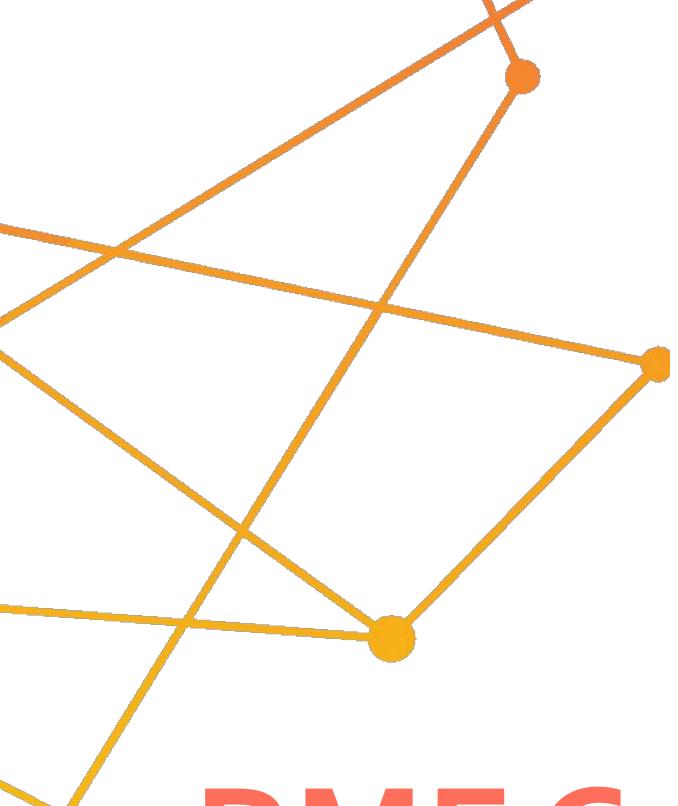


# RS Metrics Unit



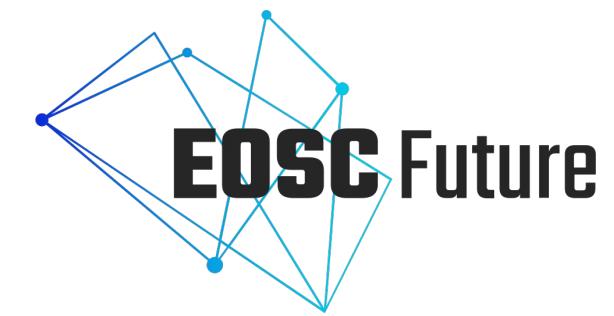
# RS Metrics Unit



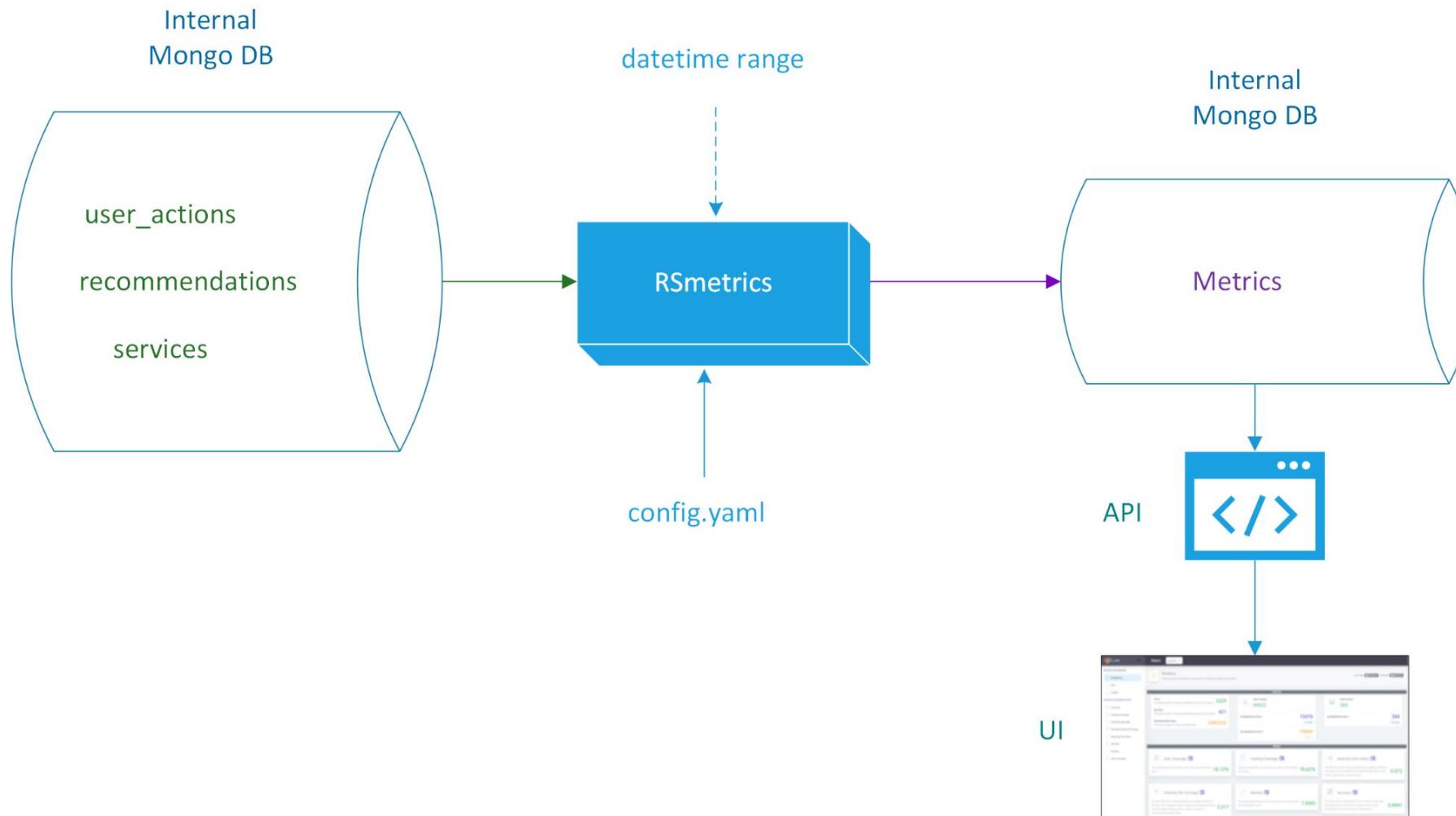


# RMF Components

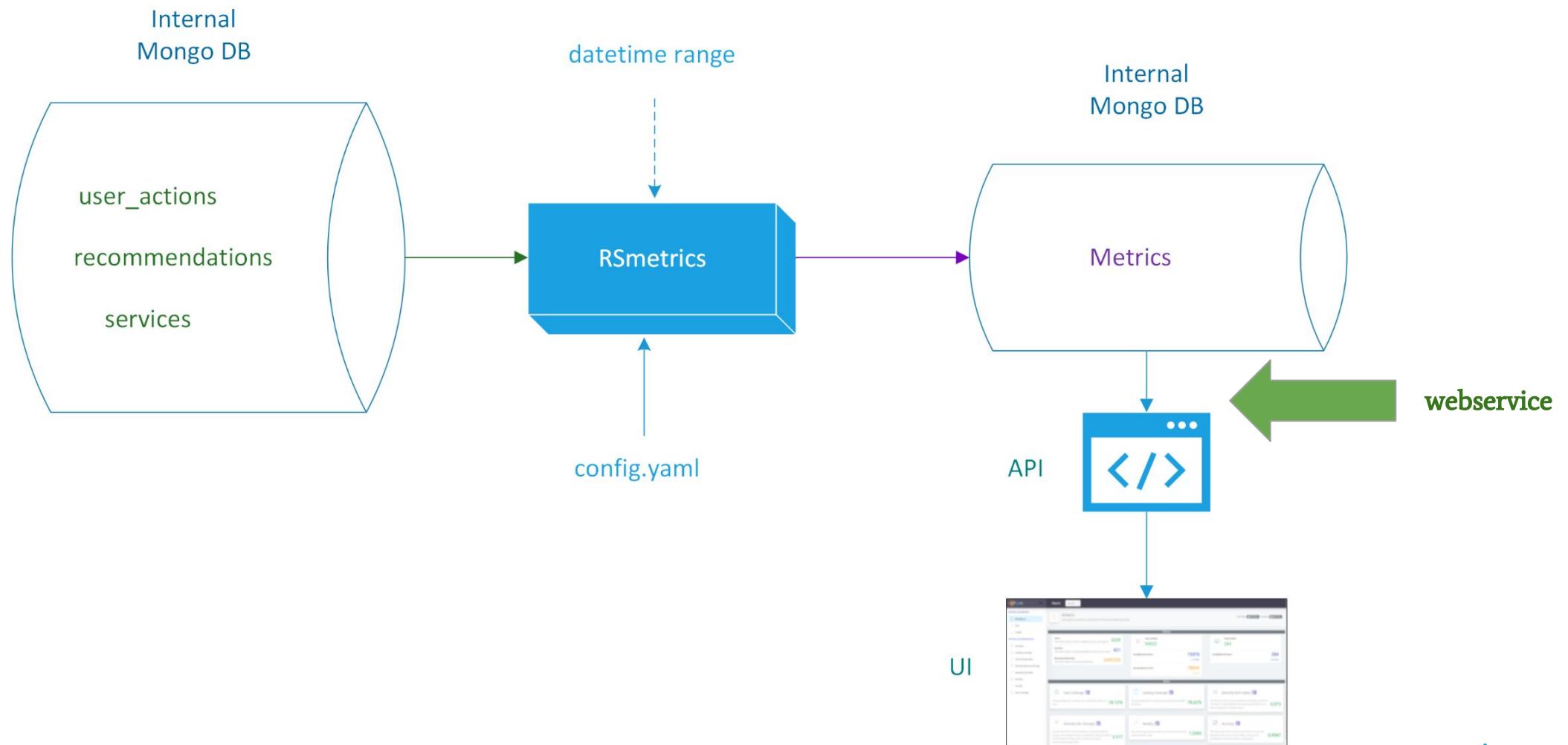
Rest API/ UI Dashboard Unit



# REST API/UI Dashboard Unit



# REST API/UI Dashboard Unit

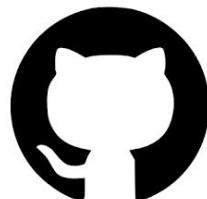




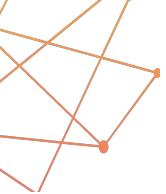
# More to see ...



[overview](#)

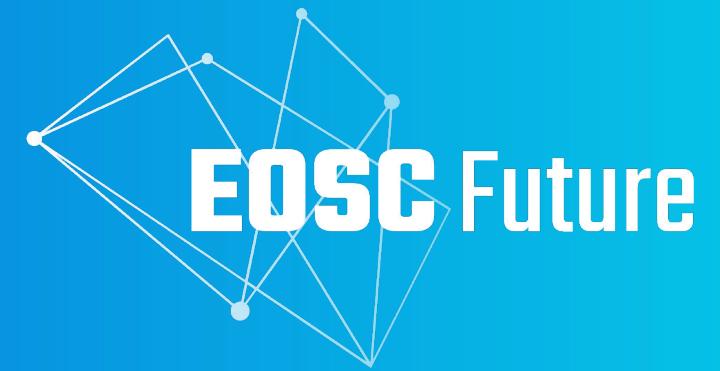


<https://github.com/ARGOeu/eosc-recommender-metrics>



# Ready to answer your questions !





# Thank you for your attention

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