

# Recommender Metrics Framework

Measuring the success of a Recommender System

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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

## 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.

CAN BE USED

## 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**.

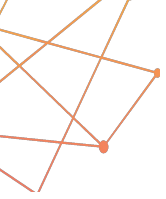


# What it offers?

## Statistics

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



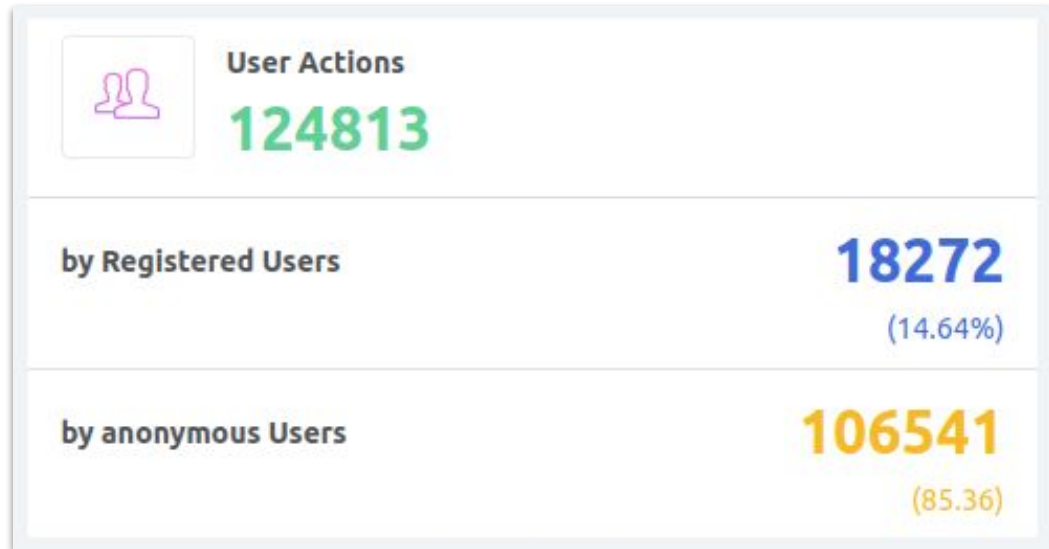


# What it offers?

## 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






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## Metrics

- Accuracy
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- 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

**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:

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

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

Output
Prerequisites

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**TYPE** FLOAT

**RANGE VALUES**

Min=0 to Max=1

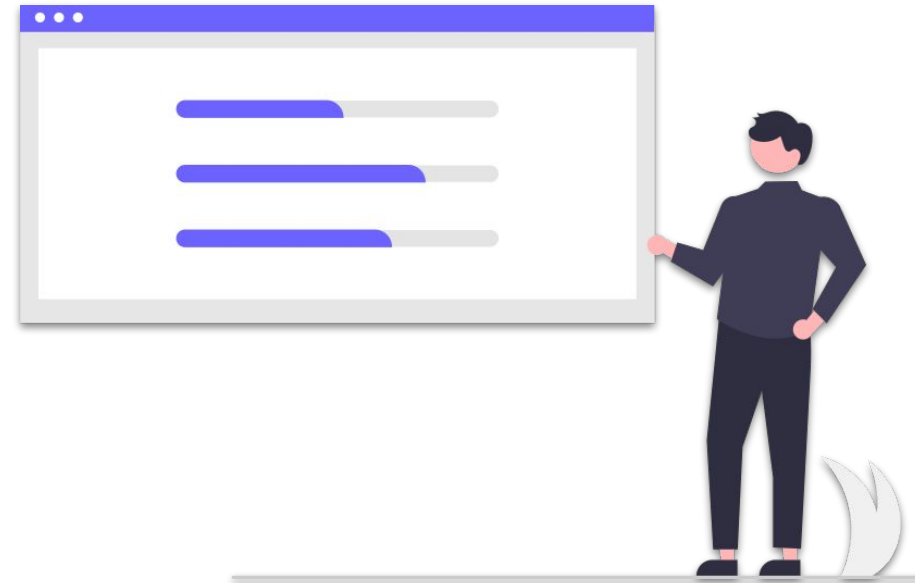
*A value of 1, indicates that the RS model got all the predictions right, and a value of 0 indicates that the RS model did not make a single correct prediction.*



# 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:

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

**Output**   Prerequisites

**TYPE** **FLOAT**

**RANGE VALUES**

Min=0 to Max=+inf



*A value of 0 indicates that no user hits occurred*

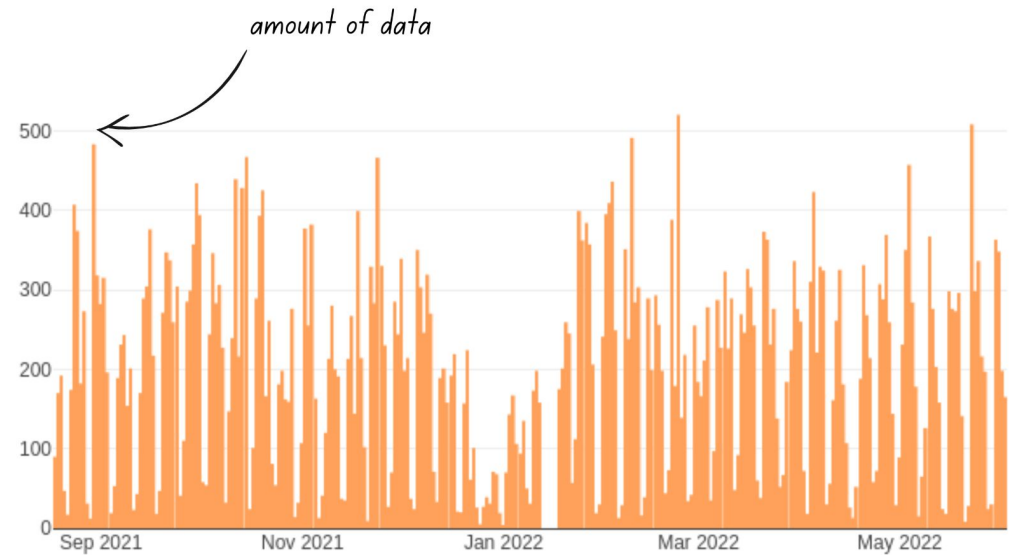
# What it offers?

## Graphs

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

USER ACTIONS PER DAY

*type of metric*



*amount of data*

*referenced date-time range*



# What it offers?

## Rest API

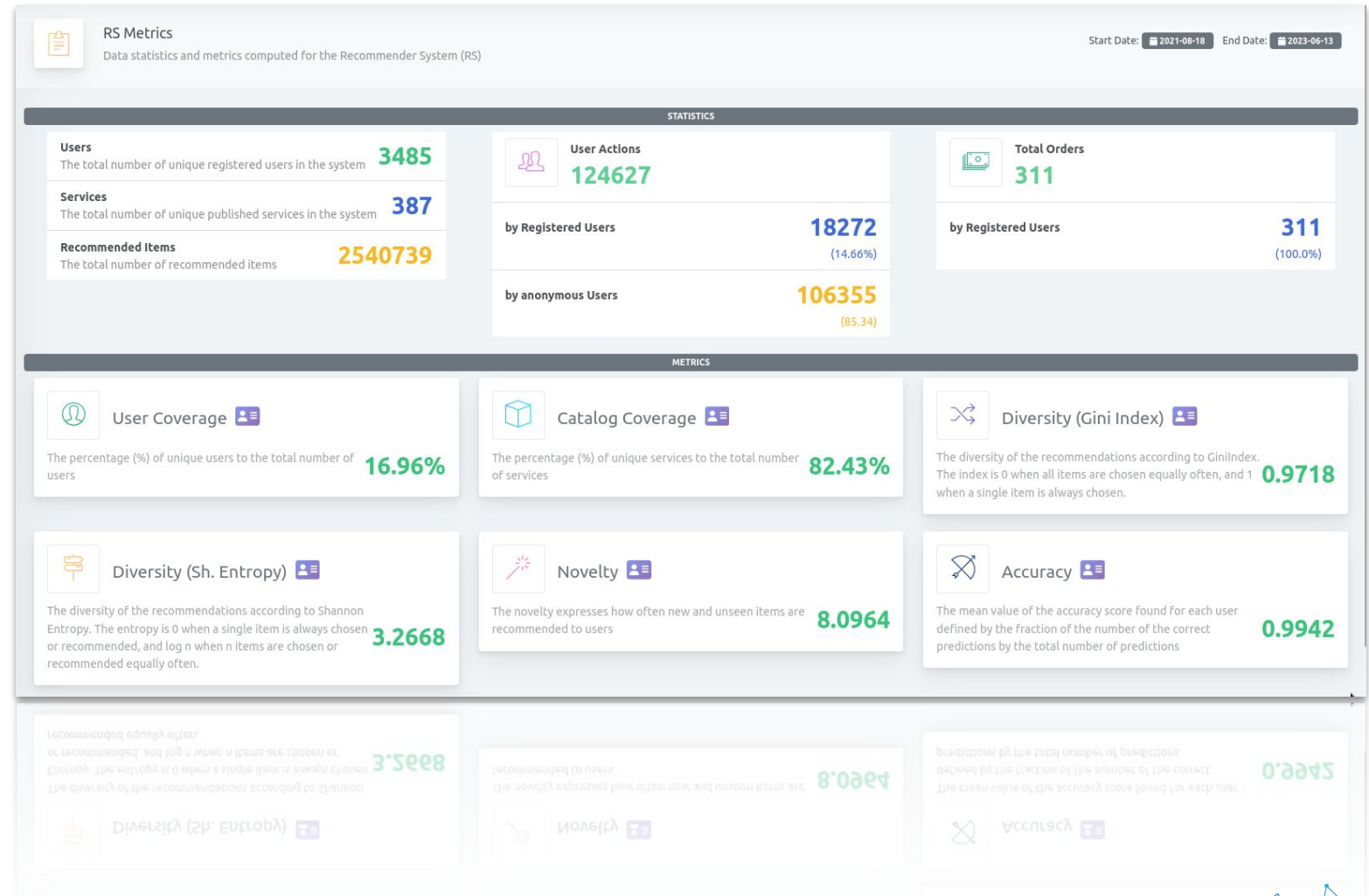
- Statistics
- Metrics
- KPIs
- Graphs' Data

```
▼ 0:
  name: "accuracy"
  value: 0.9942
  doc: "The mean value of the accuracy score found for each user defined by the fraction of"
▼ 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"
▼ 3:
  name: "diversity"
  value: 3.2668
  doc: "The diversity of the recommendations according to Shannon Entropy. The entropy is 0"
▼ 4:
  name: "diversity_gini"
  value: 0.9718
  doc: "The diversity of the recommendations according to GiniIndex. The index is 0 when al"
▼ 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"
▼ 6:
  name: "novelty"
  value: 8.0964
  doc: "The novelty expresses how often new and unseen items are recommended to users"
▼ 7:
```

# What it offers?

## UI Dashboard

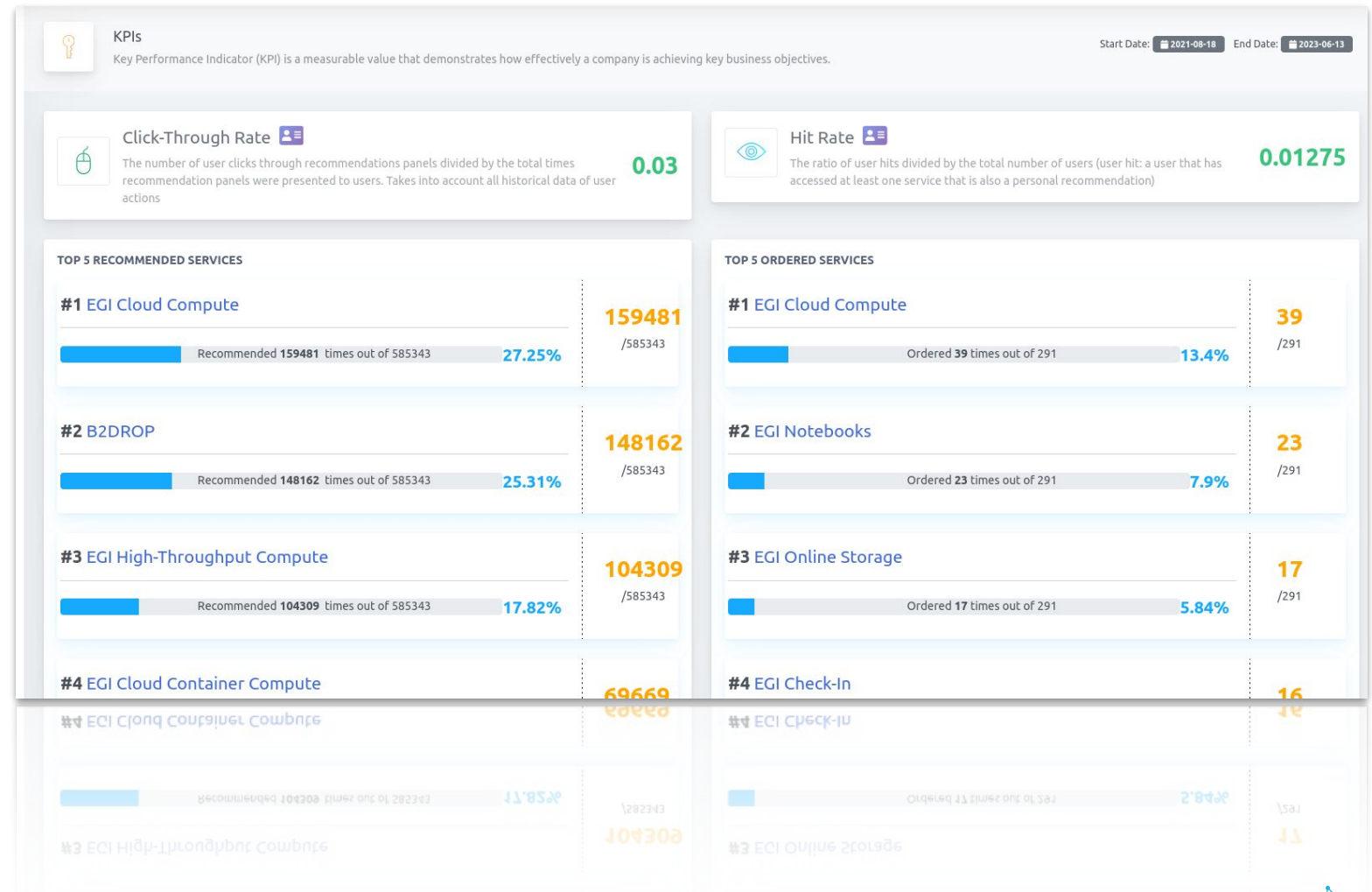
- Statistics
- Metrics
- KPIs
- Graphs



# What it offers?

## UI Dashboard

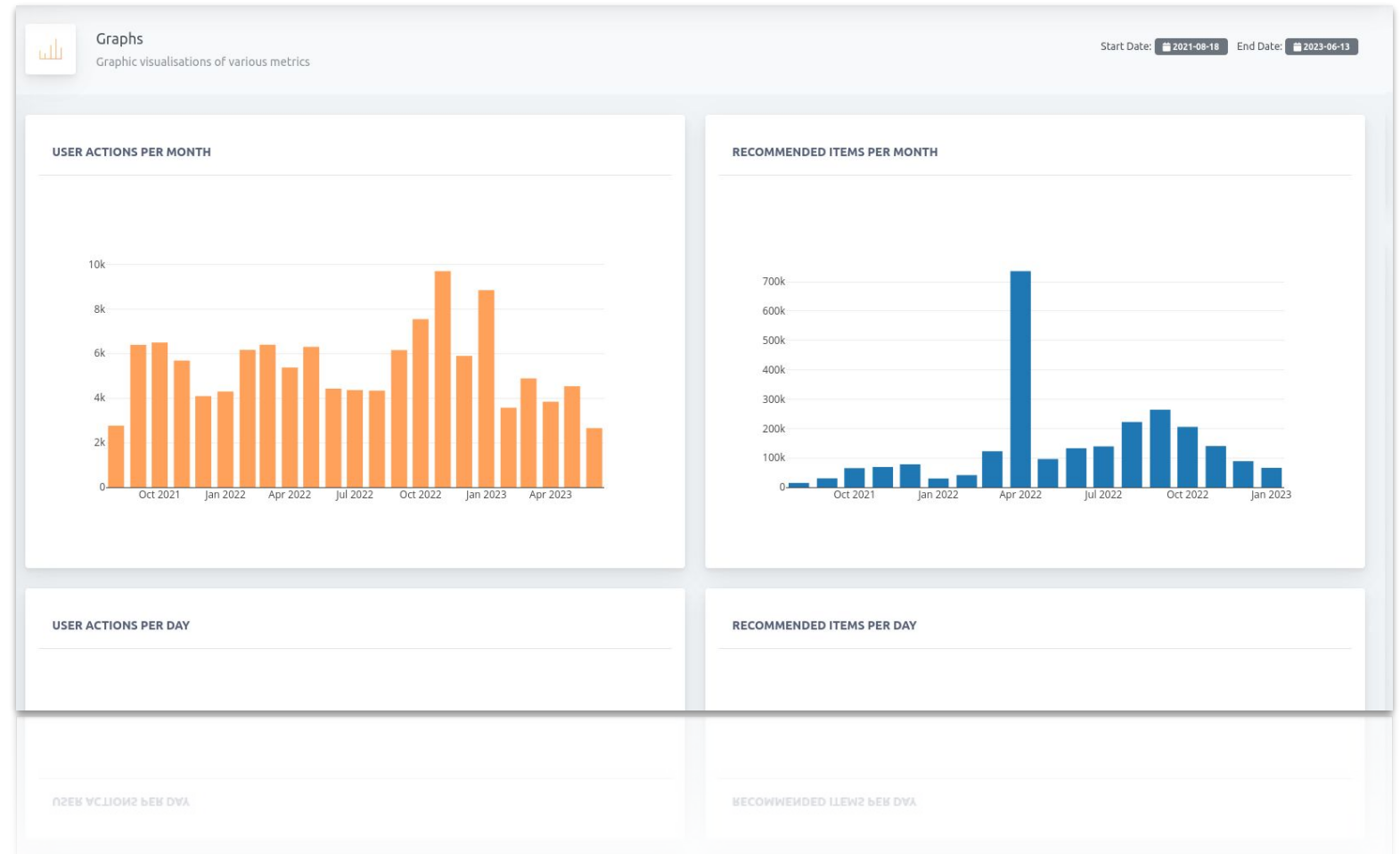
- Statistics
- Metrics
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# What it offers?

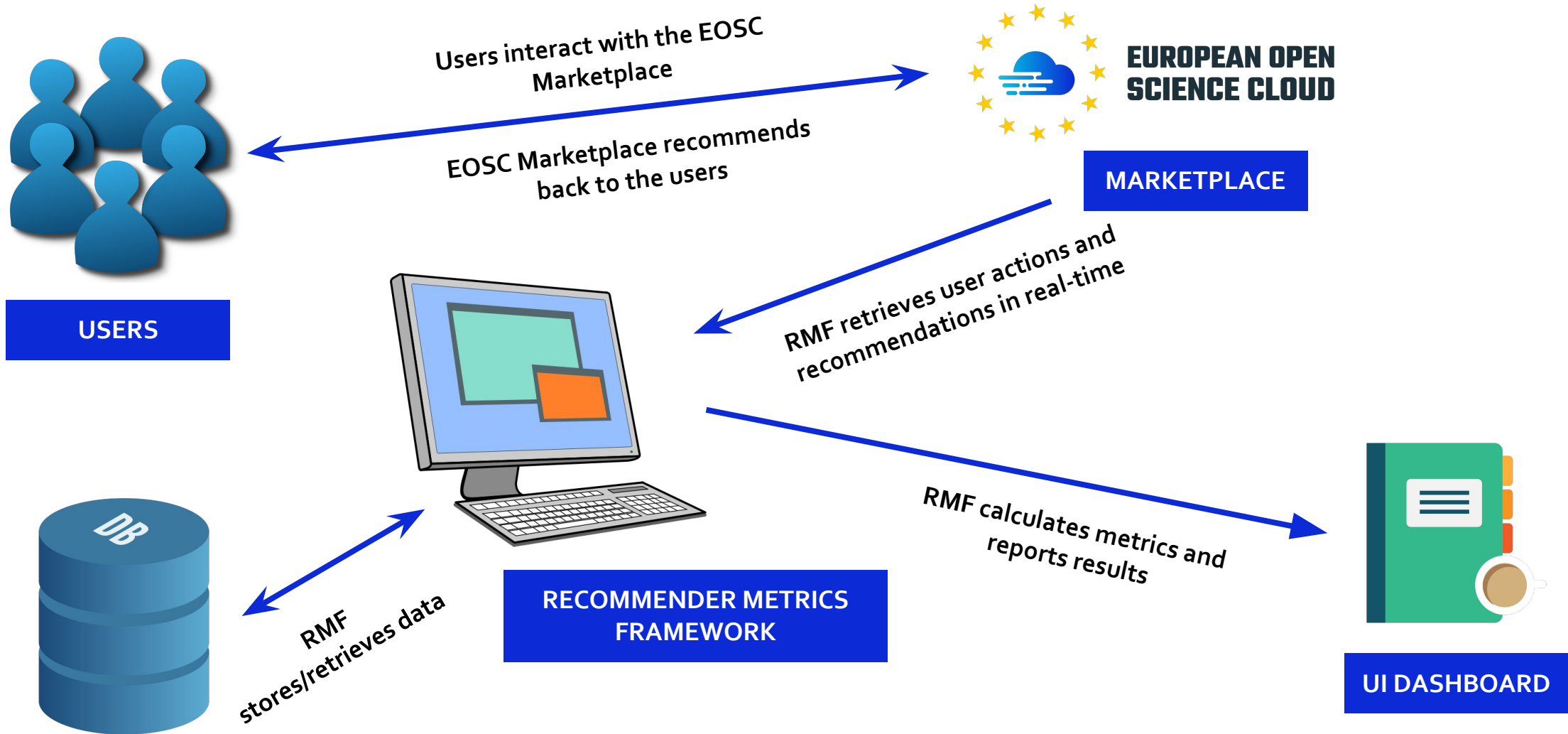
## UI Dashboard

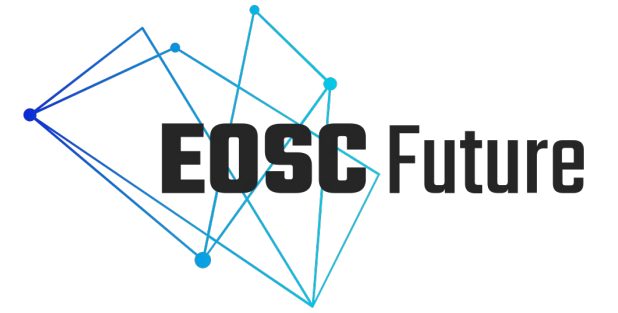
- Statistics
- Metrics
- KPIs
- Graphs





# Process Flow



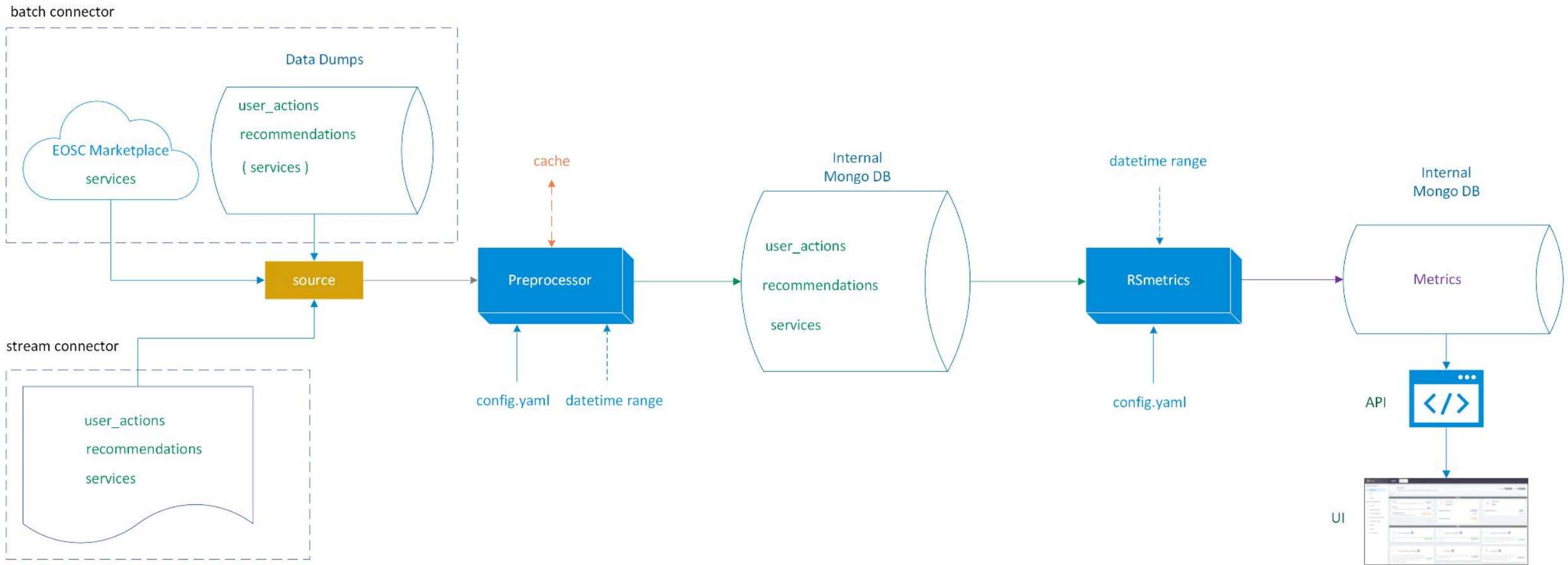


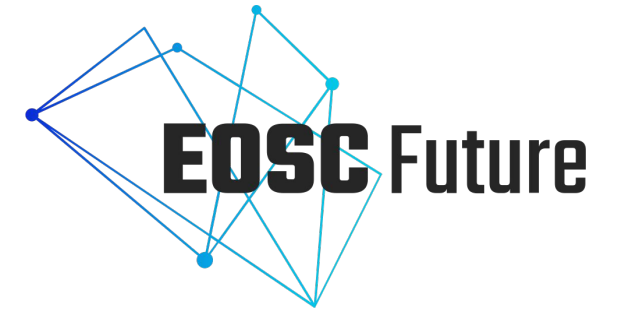
# RMF Components

All Units



# Framework's components

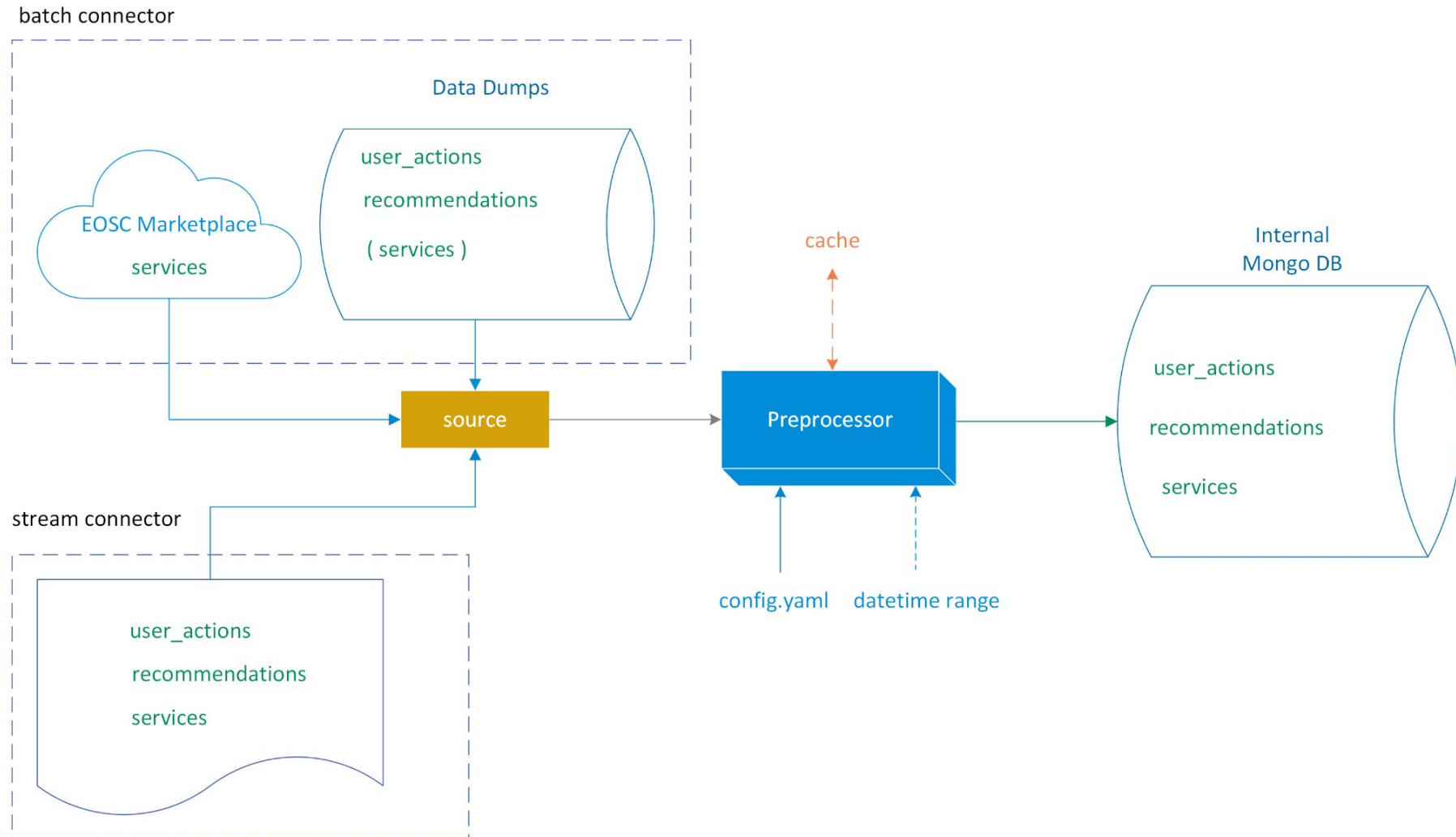




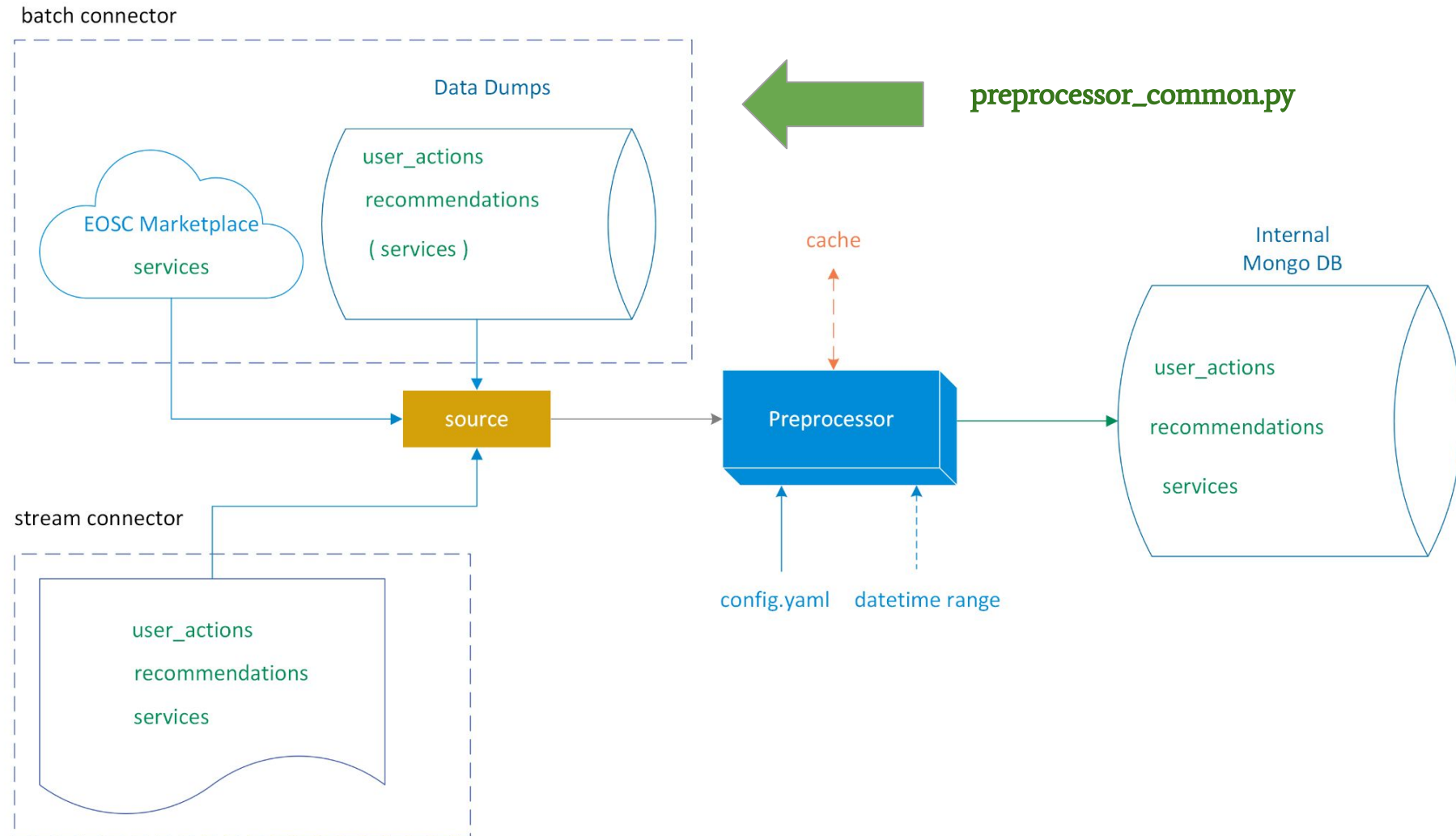
# RMF Components

Preprocessor Unit

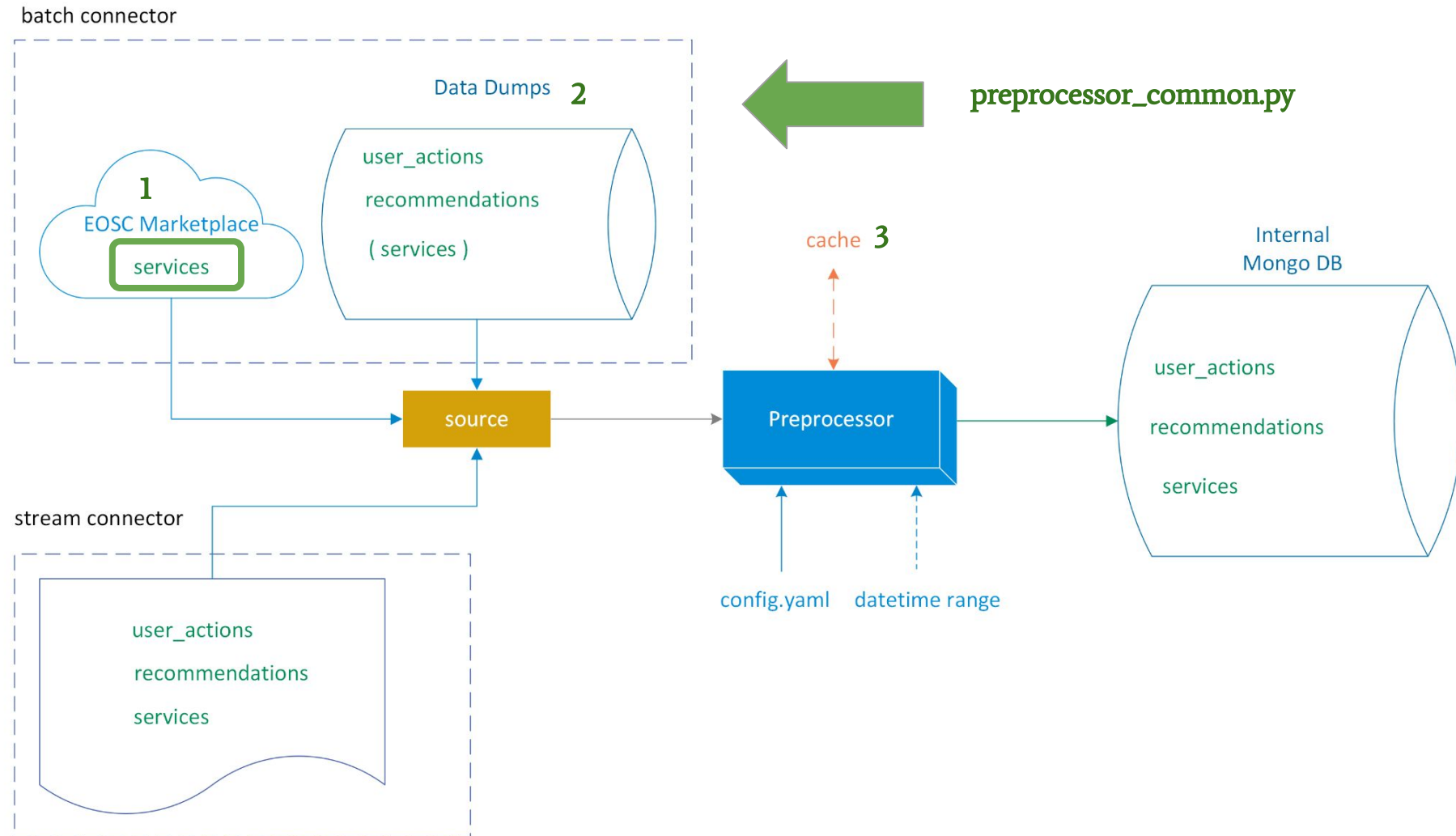
# Preprocessor Unit



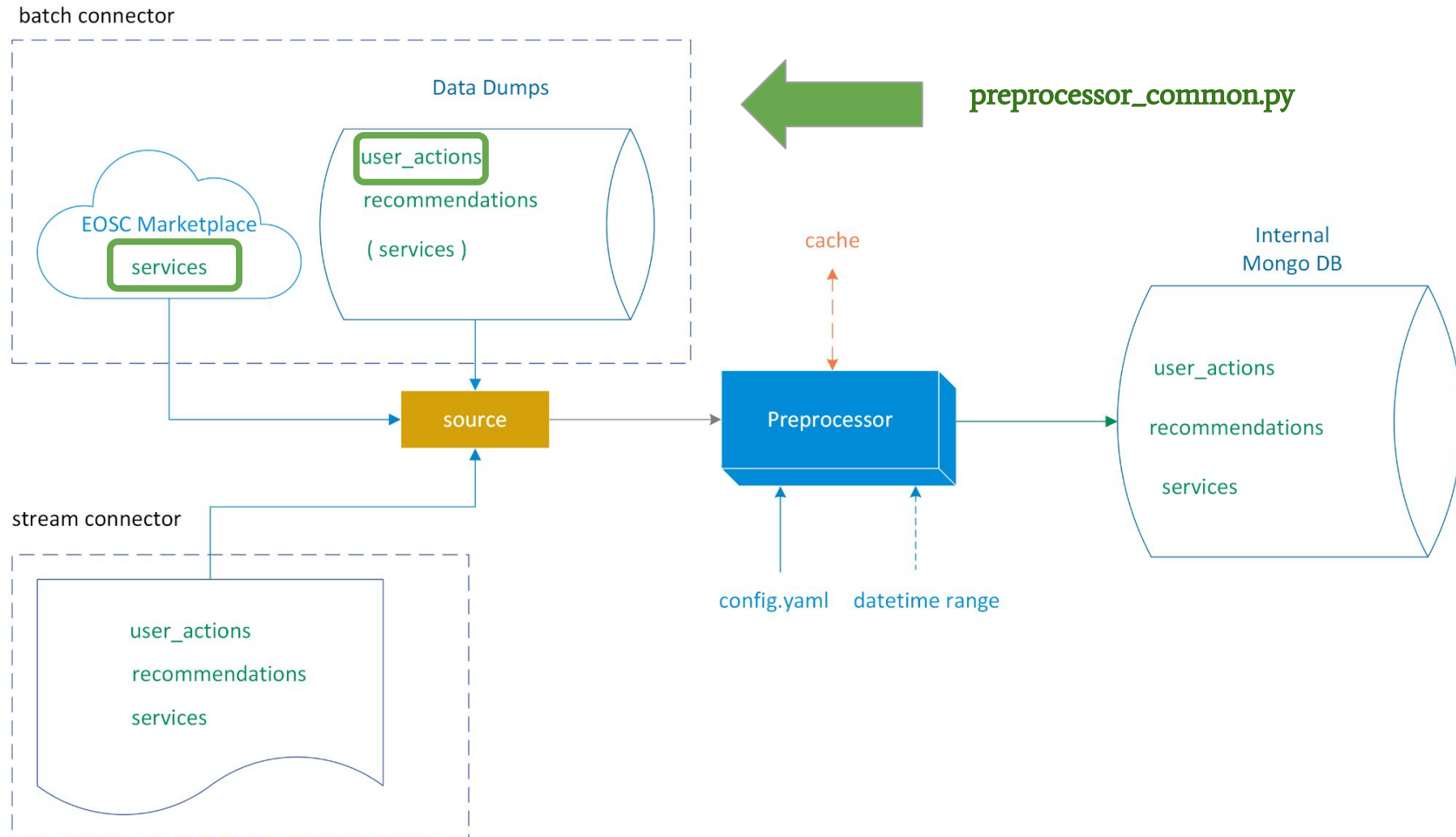
# Preprocessor Unit



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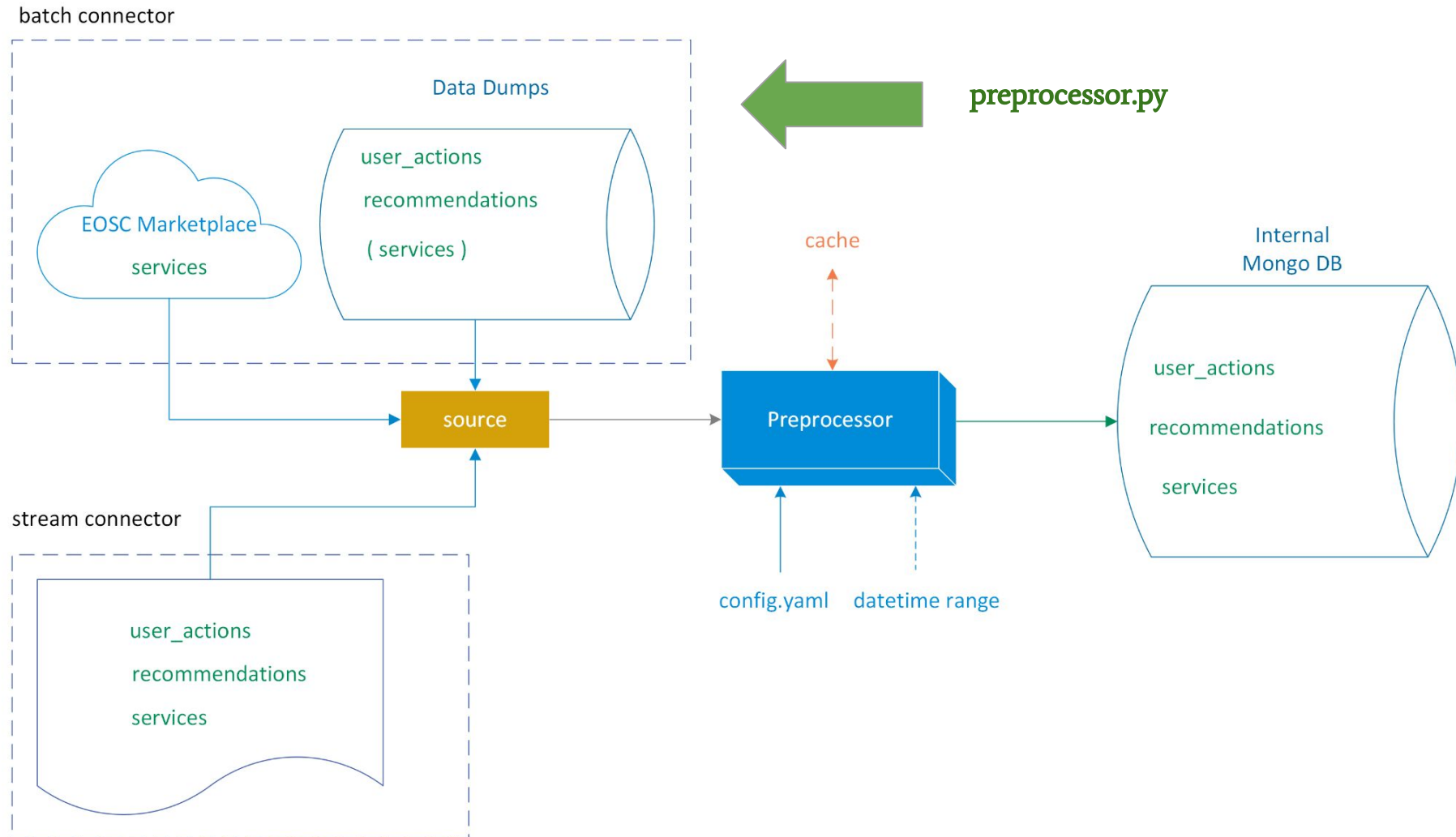


# Preprocessor Unit

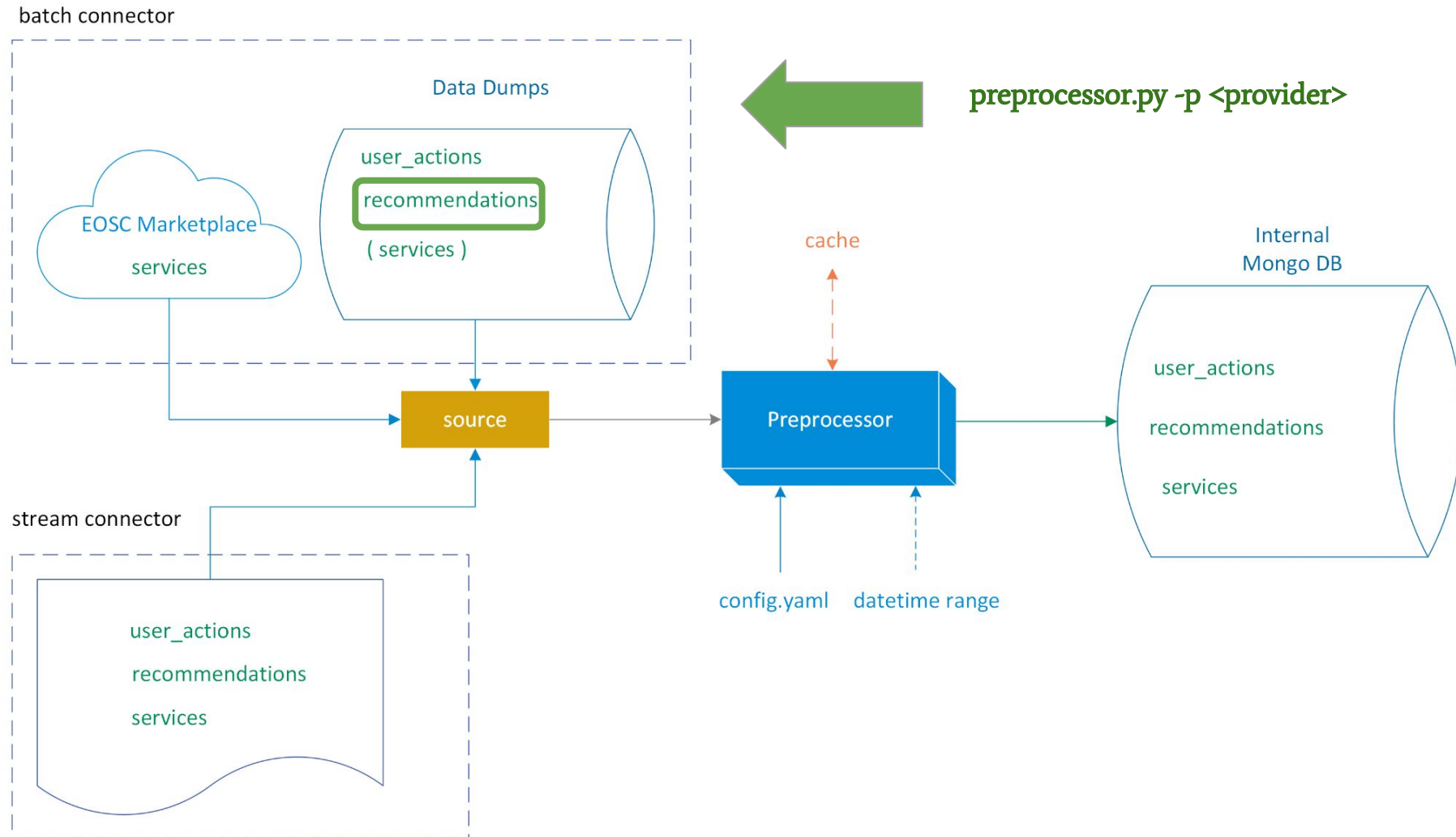




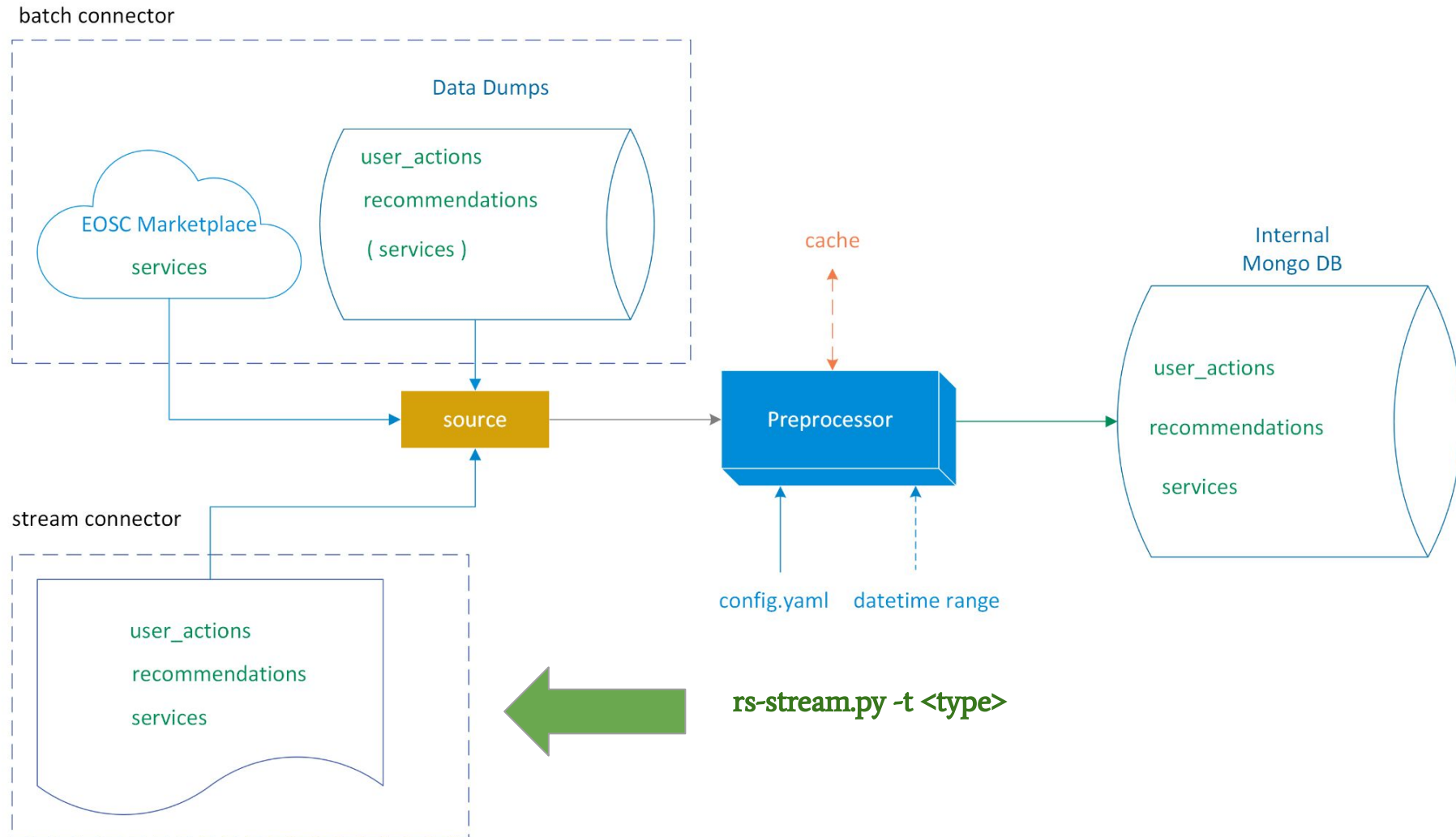
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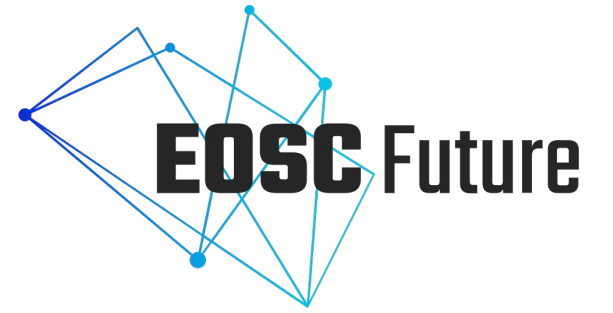


# Preprocessor Unit



# Preprocessor Unit

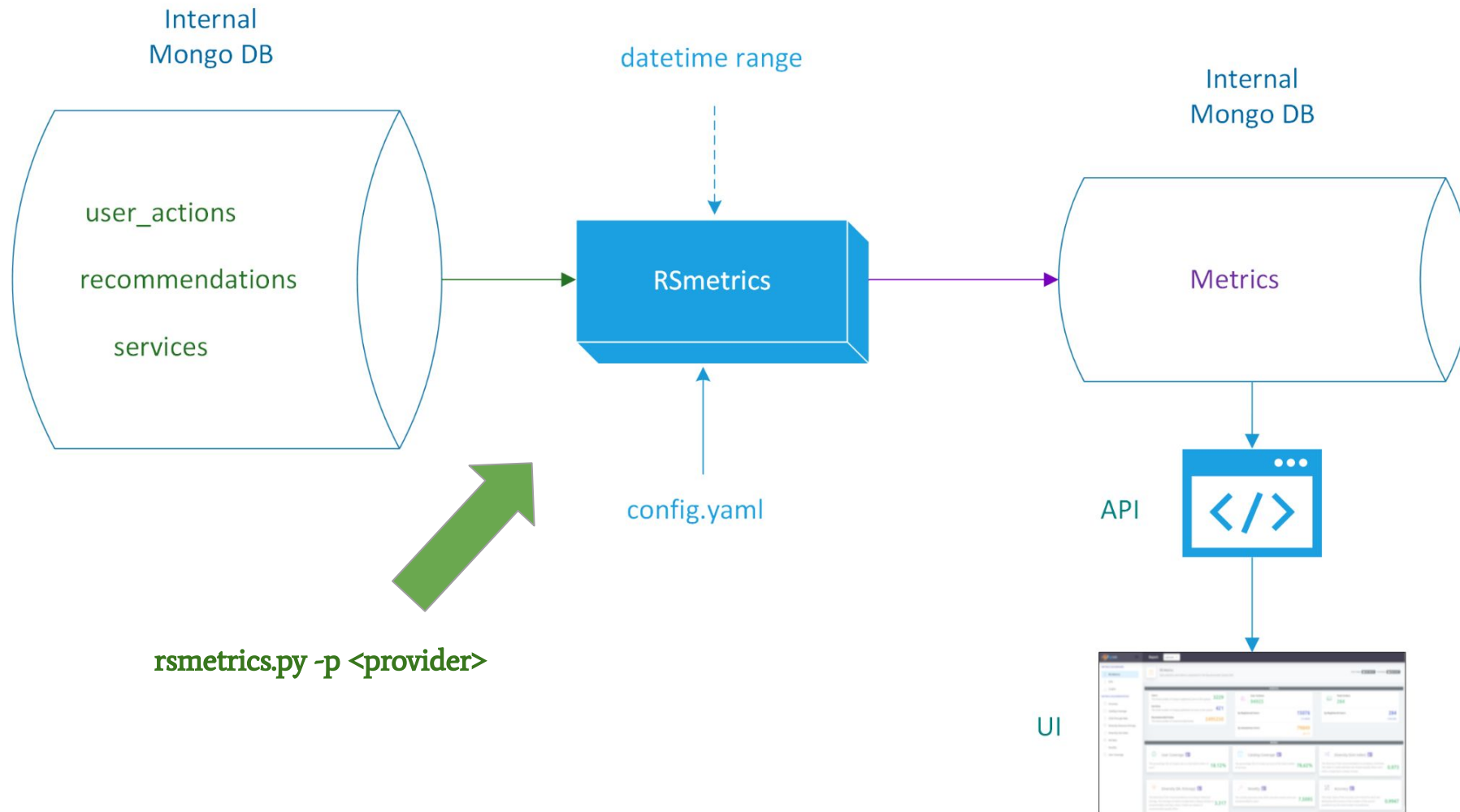




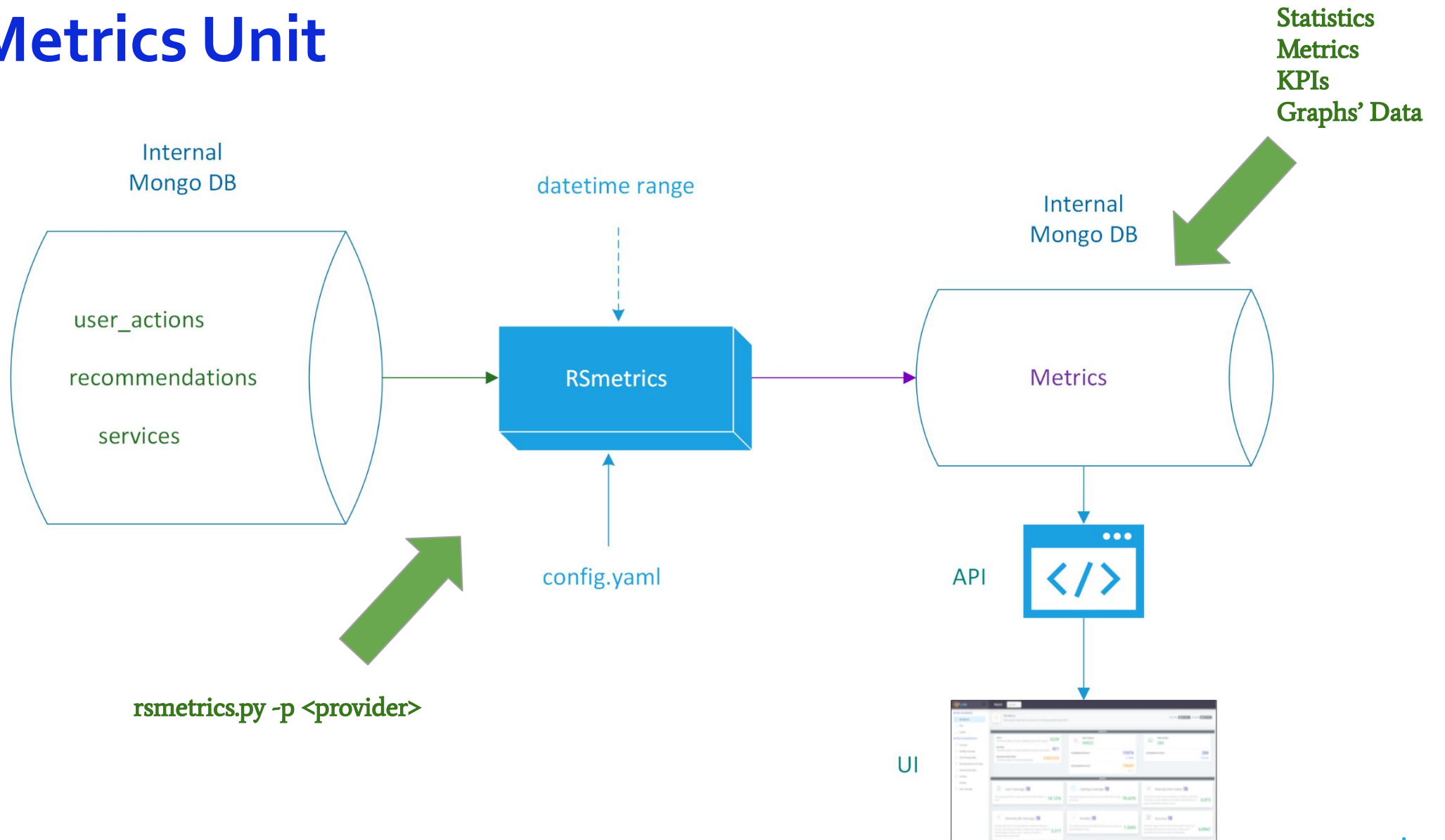
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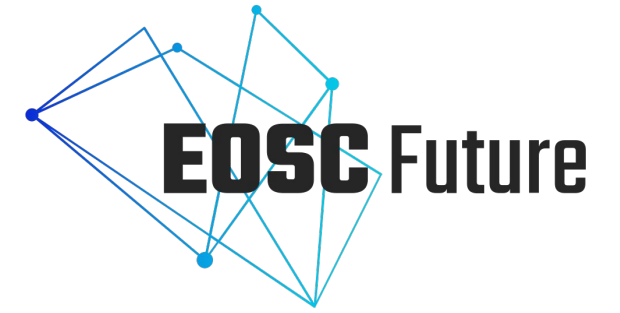
RS Metrics Unit

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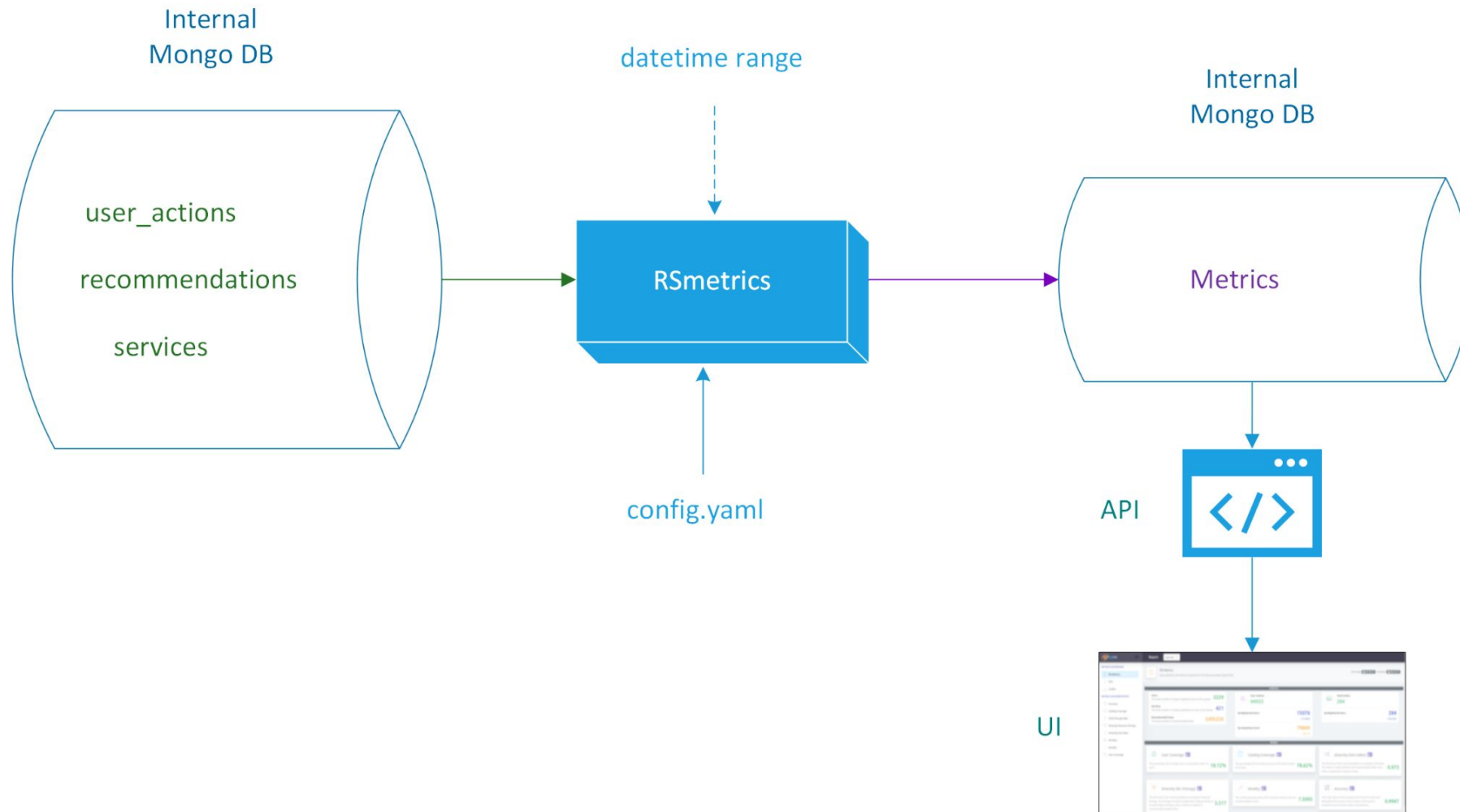




# RMF Components

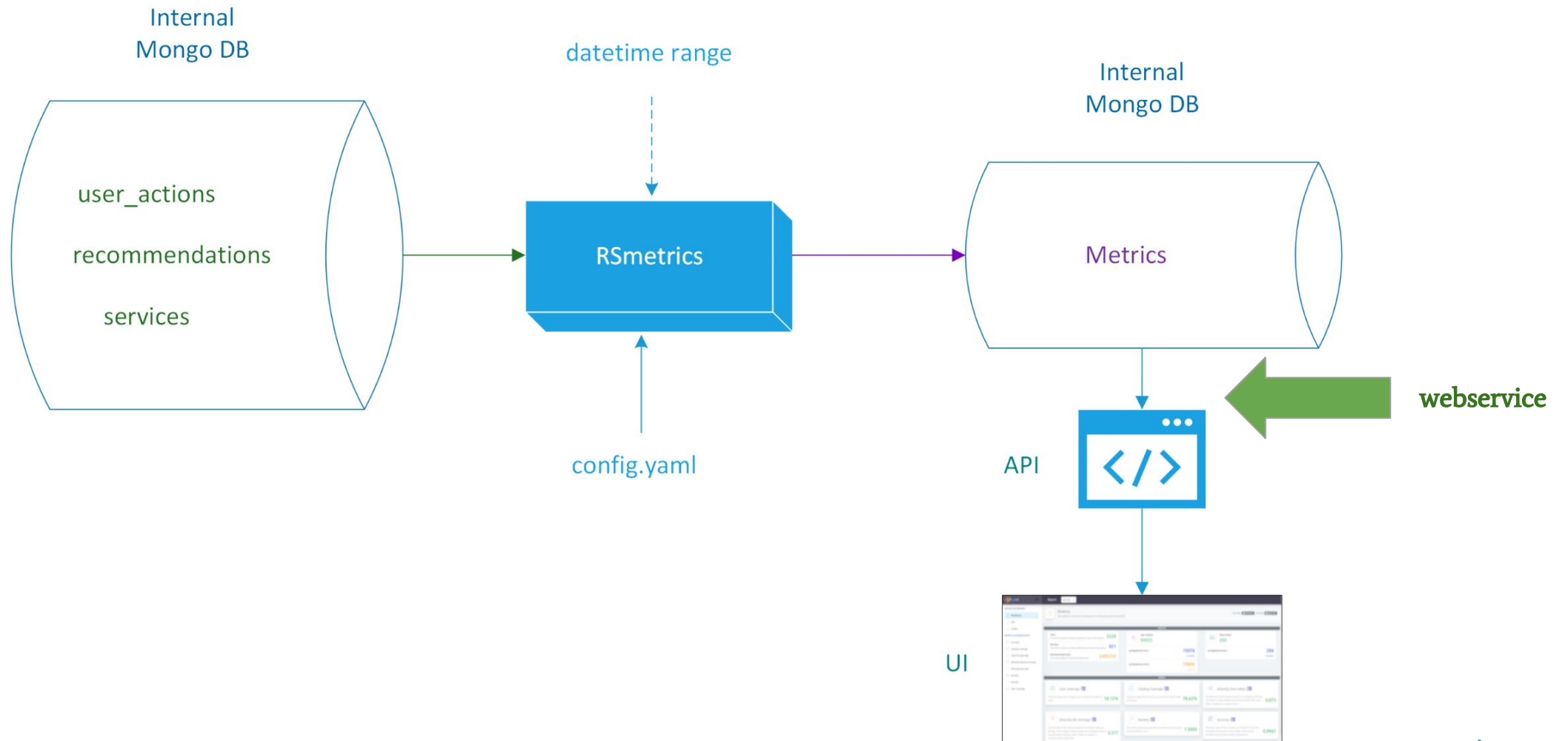
Rest API/ UI Dashboard Unit

# REST API/UI Dashboard Unit





# REST API/UI Dashboard Unit





## More to see ...



[overview](#)

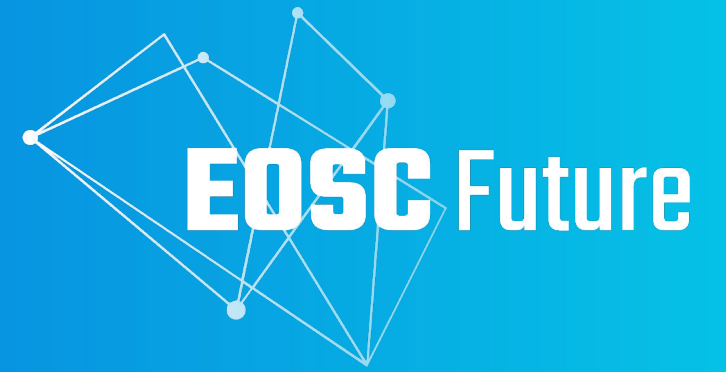


<https://github.com/ARGOeu/eosc-recommender-metrics>



# Ready to answer your questions !





# Thank you for your attention

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