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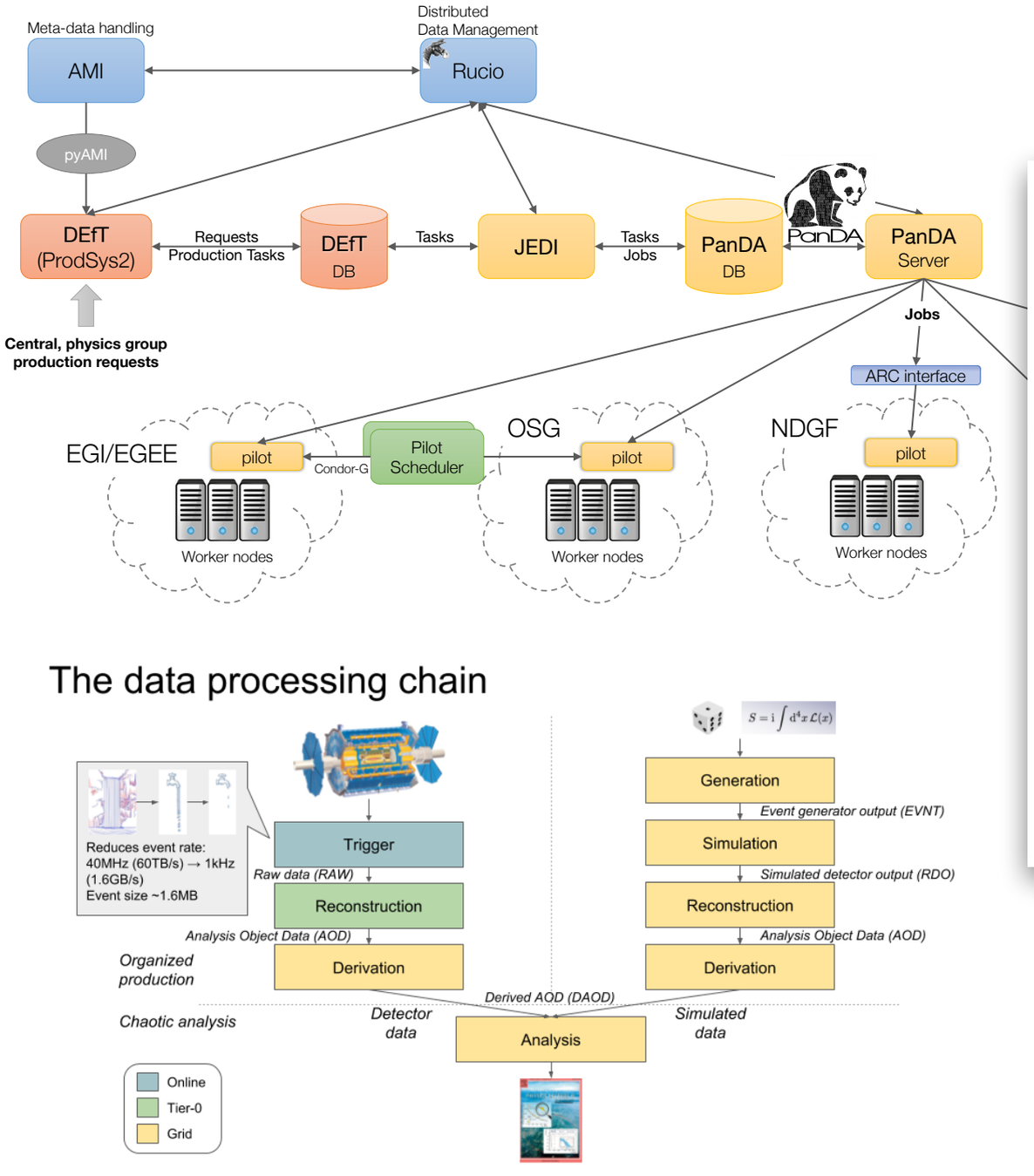
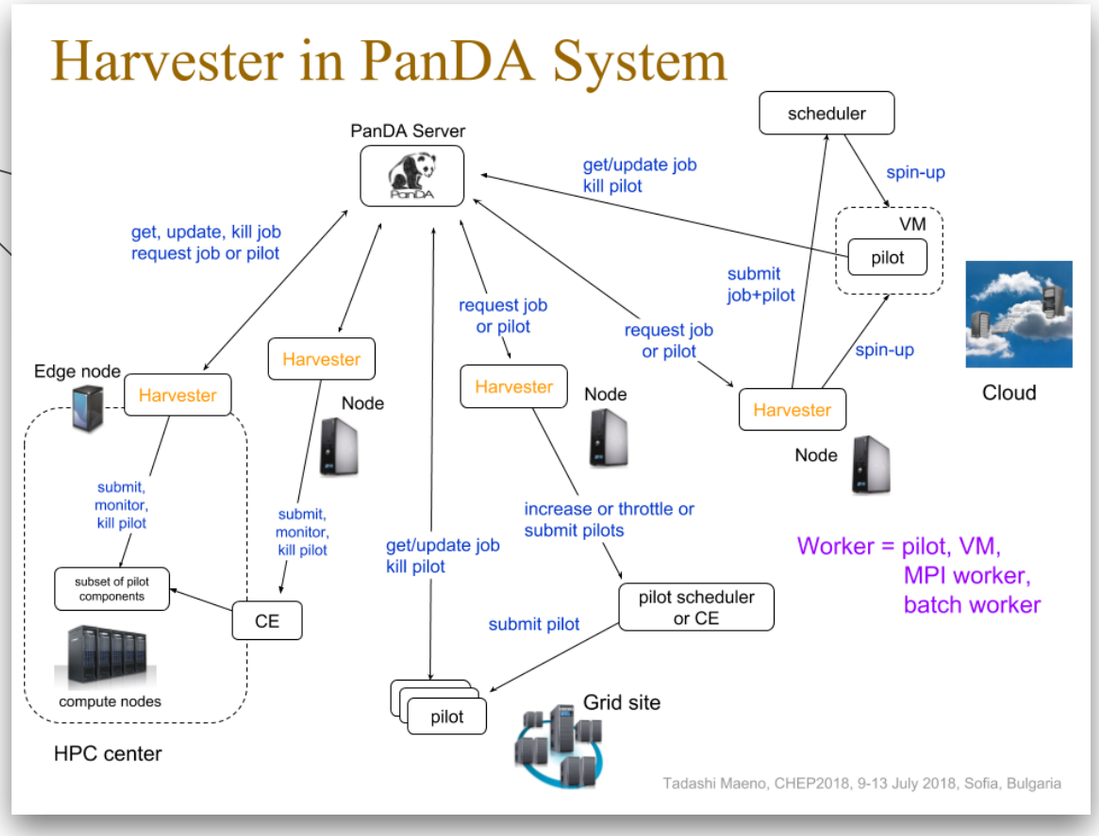
The ATLAS Production System
Predictive Analytics service:
an approach for intelligent task analysis

Mikhail TITOV, Mikhail BORODIN, Dmitry GOLUBKOV, Alexei KLIMENTOV
on behalf of the ATLAS Collaboration

Introduction

ATLAS Workflow Management





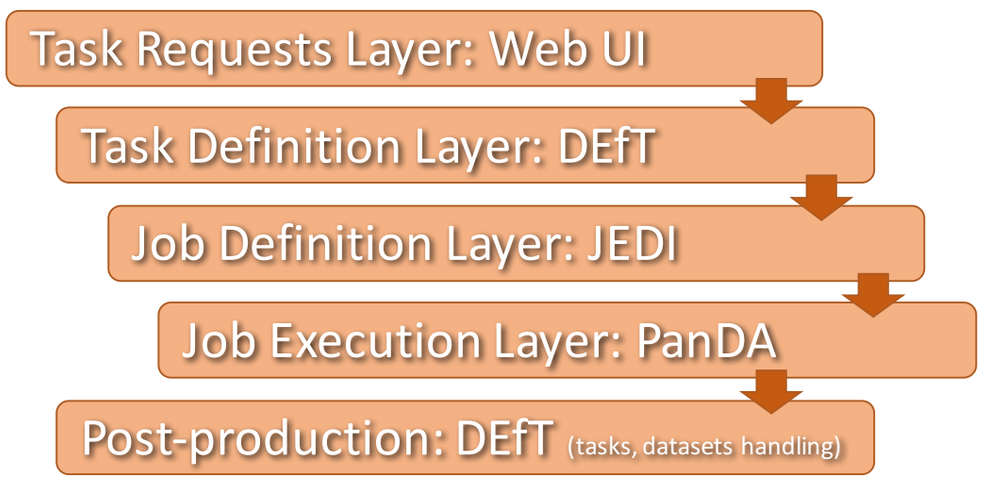
ATLAS Production System [ProdSys2]

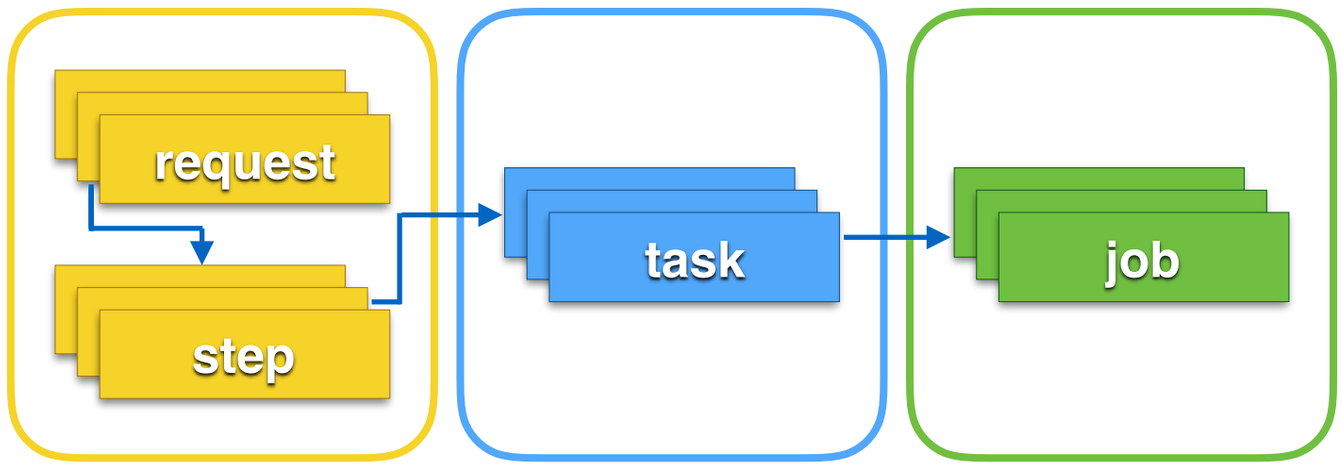
Database Engine for Tasks (DEfT)

- Formulate the tasks, chains of tasks and task groups (production request)
  - *Task represents a logical grouping of computing jobs, that are responsible of the execution of program/transformation on input files and generate output files*
- Complete with all necessary parameters

Job Execution and Definition Interface (JEDI)

- Task-level workload management (i.e., brokerage and execution)
- Dynamic job definition and execution (optimization of the resources usage)





Problem statement

Analytical service focused on tasks

- Analysis of task processing
    - Example: selection and regulation of key task features that affect its processing the most
- Modeling of processed data lifecycles for deep task analysis
    - Example: generate guidelines for particular stage of data processing
- Forecasting processes with focus on data and tasks states as well as on the management system itself
    - Example: detect the source of any potential malfunction

ProdSys2 Predictive Analytics (PA) service

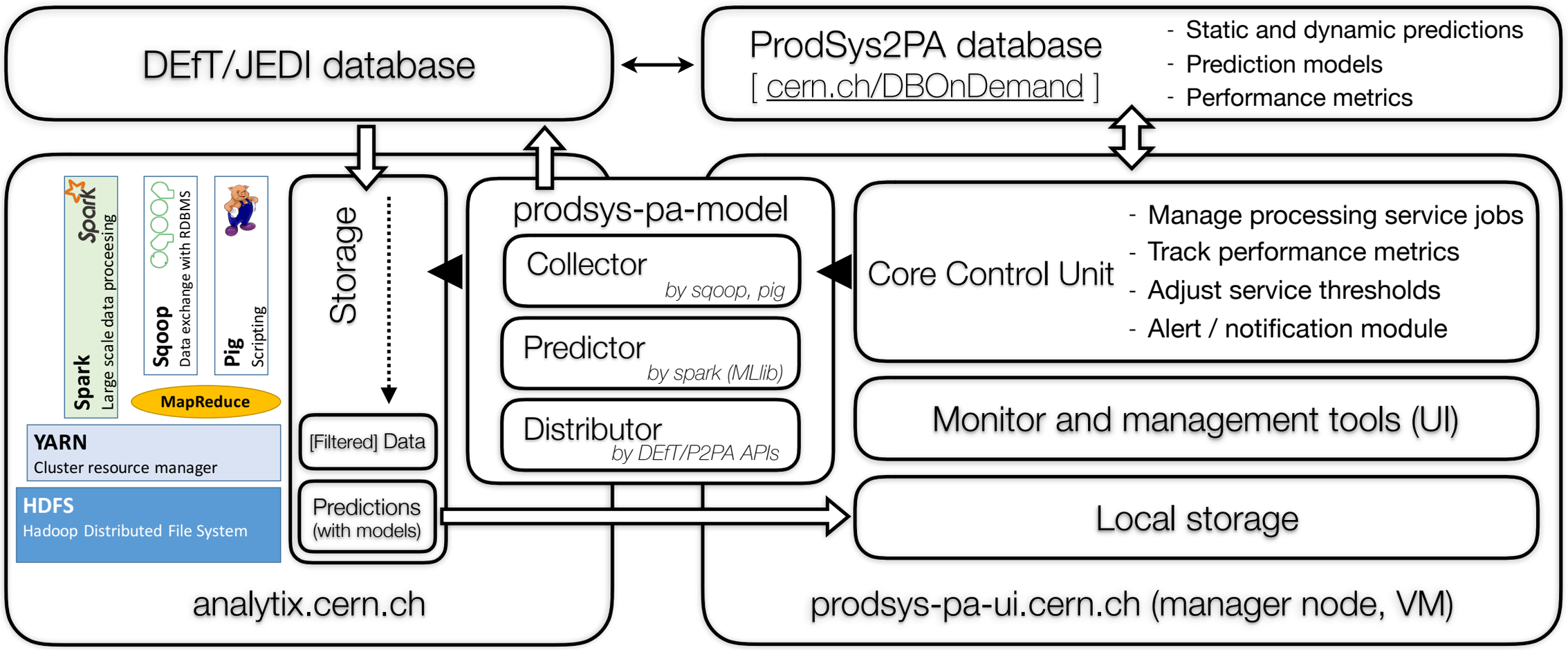
ProdSys2 PA service

Key components:

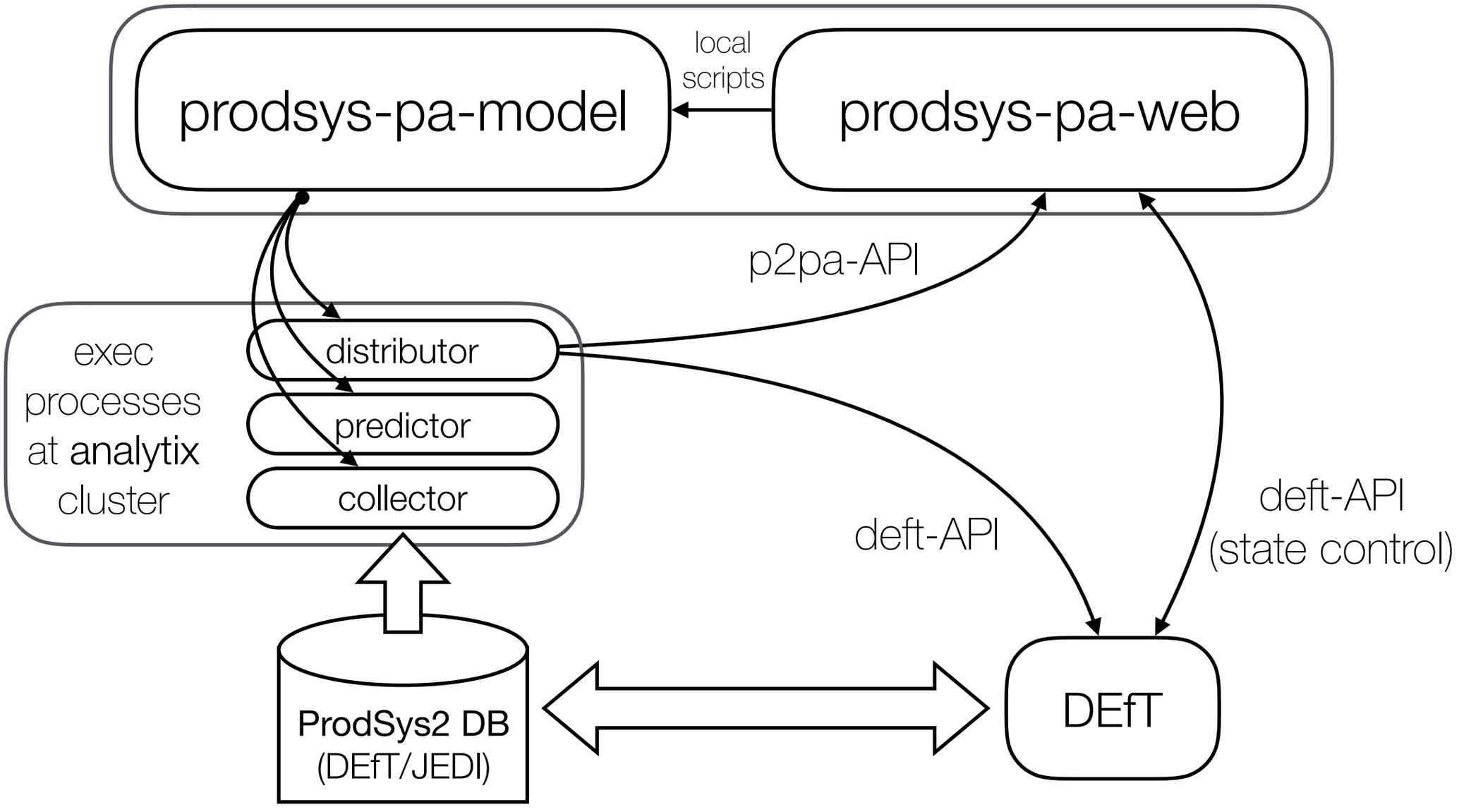
- **Predictive model handling** (*prodsys-pa-model*) - an independent package that is adjusted and integrated into P2PA
    - Data Collection
        - Source - data/mc-tasks from DEfT/JEDI
    - Data Analysis
        - Predictive model creation and usage for the process of TTC (Time-To-Complete) predictions generation

- **Web application** (*prodsys-pa-web*) - a central operation hub
    - Monitor (e.g., exec processes that are historic data of runs, evaluation of estimated durations of task executions)
    - Control (e.g., selection parameters for training and input data collections, method / technology and set of features for prediction process)

ProdSys2 PA architecture



ProdSys2 PA packages



P2PA | Model handling | Analysis processes

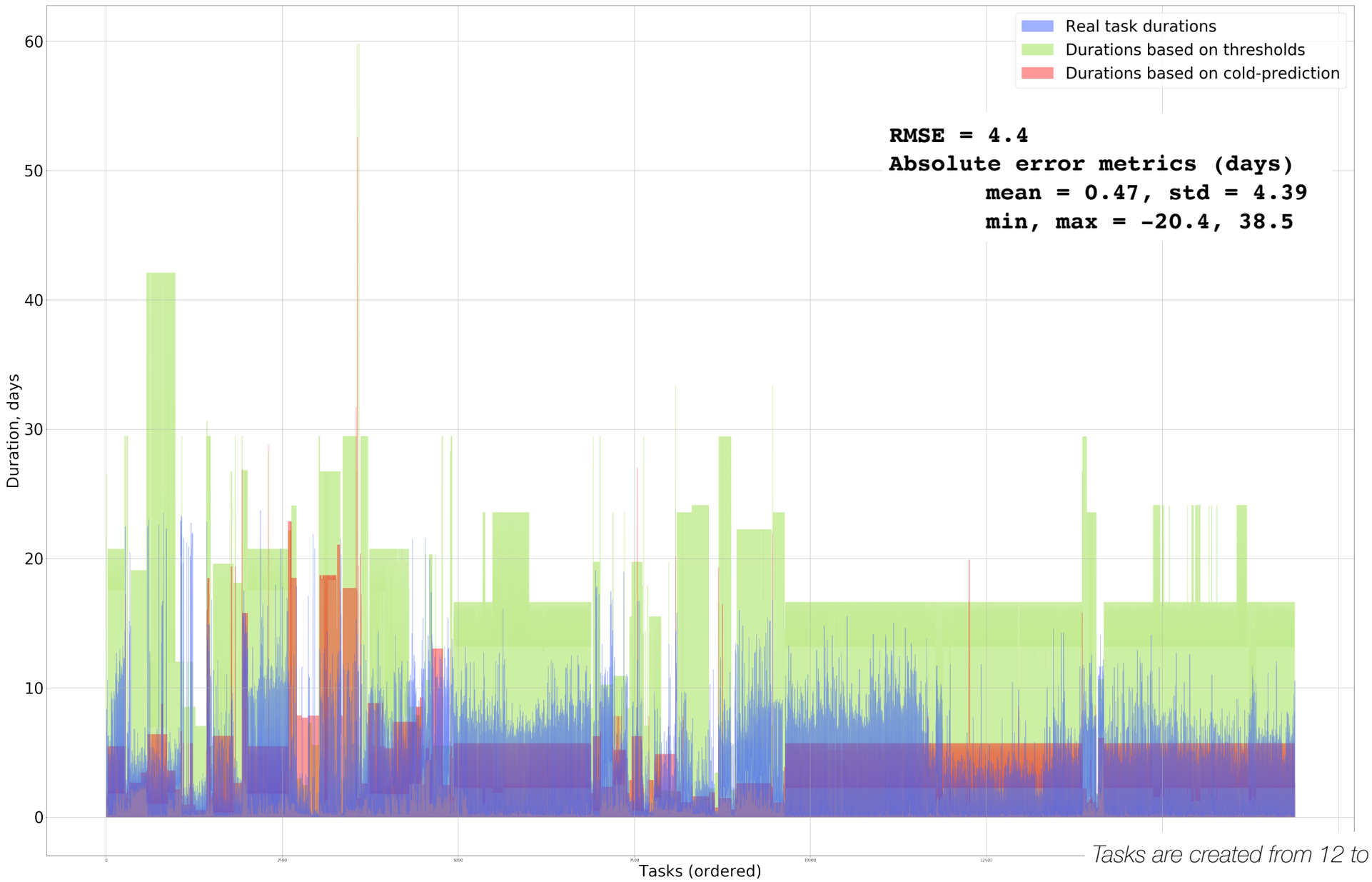
Threshold definition

- Calculates the upper limit of the duration of tasks execution process in such a way that 95% of all tasks of the corresponding type and for the defined time period (the last 180 days) are executed not longer than the calculated value.
    - Tasks are grouped by <project.productionStep.workingGroup>

Cold-prediction generation

- Estimates task duration during the task formation process (uses descriptive data and created earlier a predictive model).
    - Apache Spark.MLlib - Random Forests regression method

P2PA | Model handling | Task TTC estimation

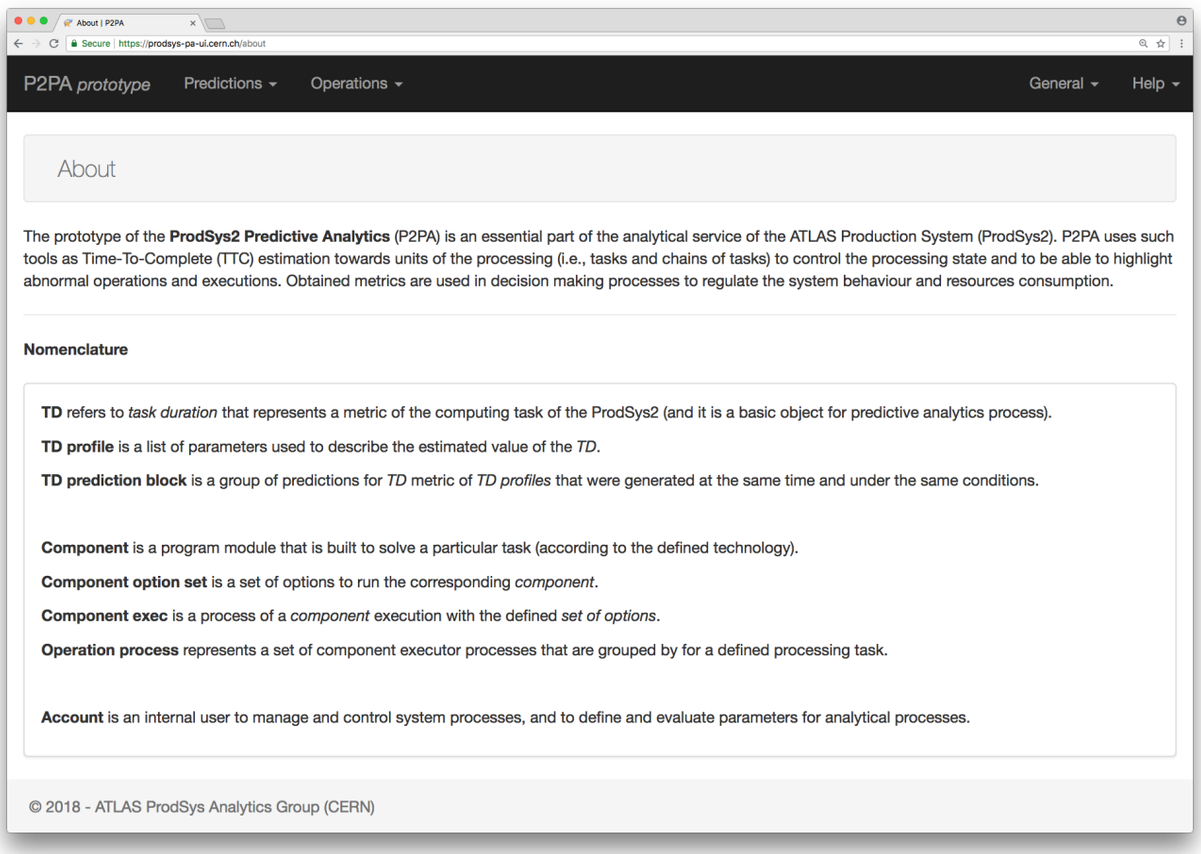


Tasks are created from 12 to 26 August, 2018

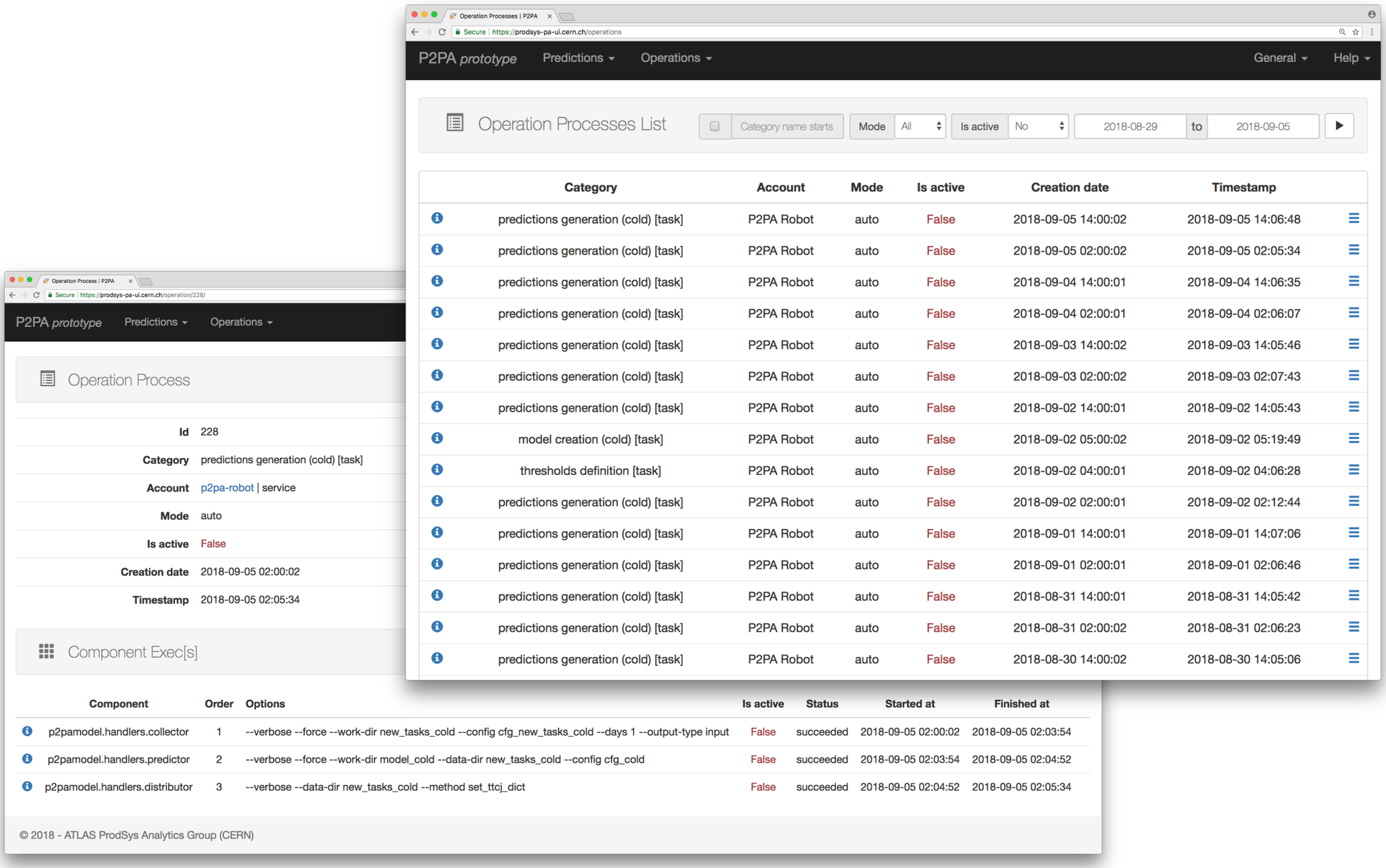
P2PA | Web UI | Infrastructure

Web application (web UI) setup

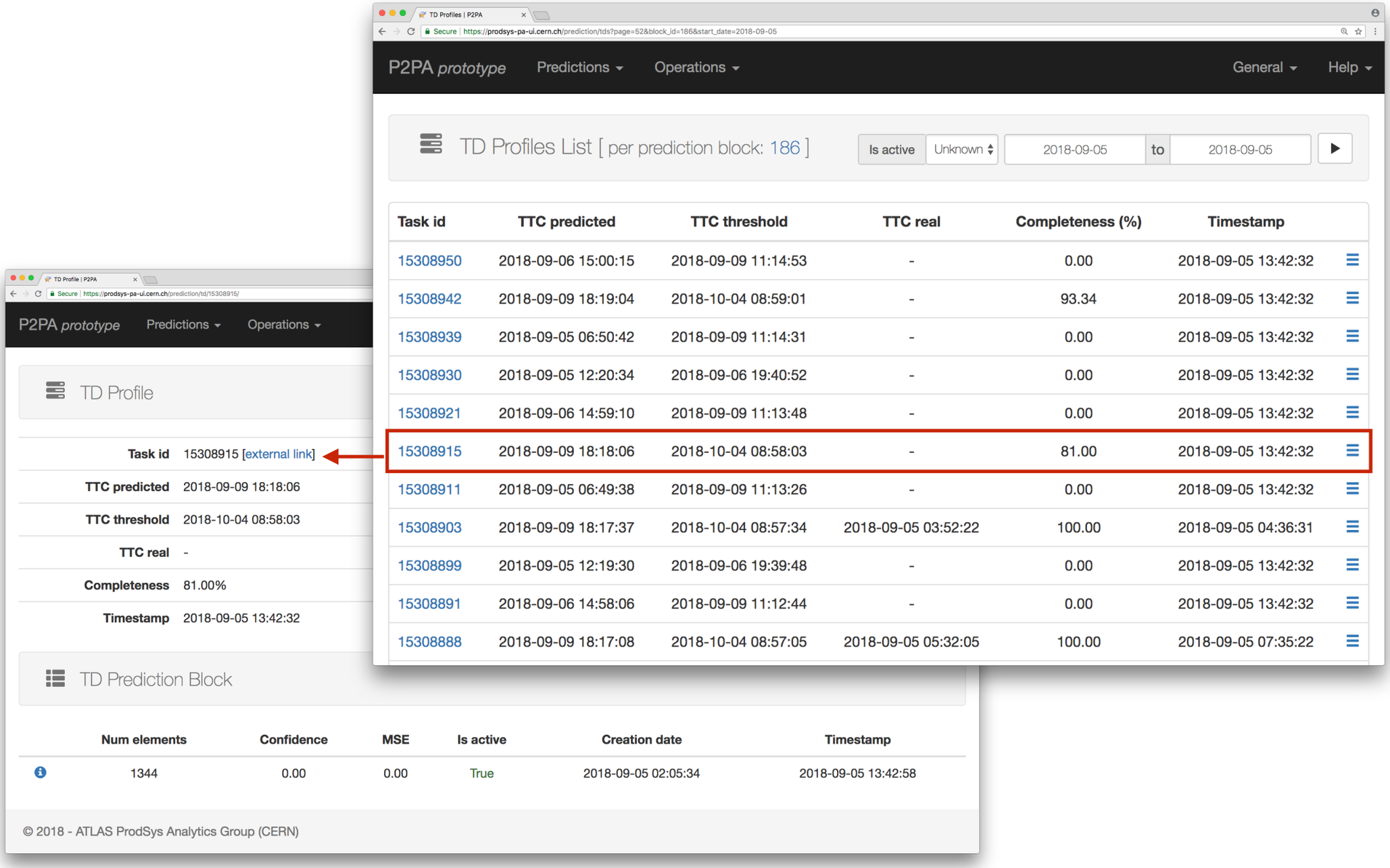
- https://prodsys-pa-ui.cern.ch [accessible inside the CERN network]
- VM by CERN OpenStack IaaS (CC7 – x86_64)
- Database On Demand (MySQL)
- Web server
  - nginx
  - gunicorn
- Web framework:
  - django
  - django REST framework
  - celery (using RabbitMQ)



P2PA | Web UI | Operation processes



P2PA | Web UI | Predictions generation



Conclusion

Summary

- ProdSys2 Predictive Analytics service is designed to enhance workflow control at the ATLAS Production System and to be able to detect and highlight abnormal operations and executions.

- It is planned to use obtained metrics in decision making processes to regulate the system behaviour and resources consumption.

- The quality of obtained metrics (estimated values of controlled parameters) is constantly improving and new evaluation parameters and metrics will be introduced.

* If you have any questions/comments/suggestions regarding P2PA, please email: atlas-adc-prodsys2-analytics@cern.ch

Acknowledgements

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