An intelligent Data Delivery Service for and beyond the ATLAS Experiment

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iDDS (a joint project with IRIS-HEP and ATLAS)

- **An intelligent service to transform and deliver needed data to consumers, to orchestrate WFMS and DDMS with generalized workflows**
  - **Experiment agnostic**
  - **Extraction and abstraction of functions for orchestration**
  - **Maintainability and extensibility with plugin architecture**
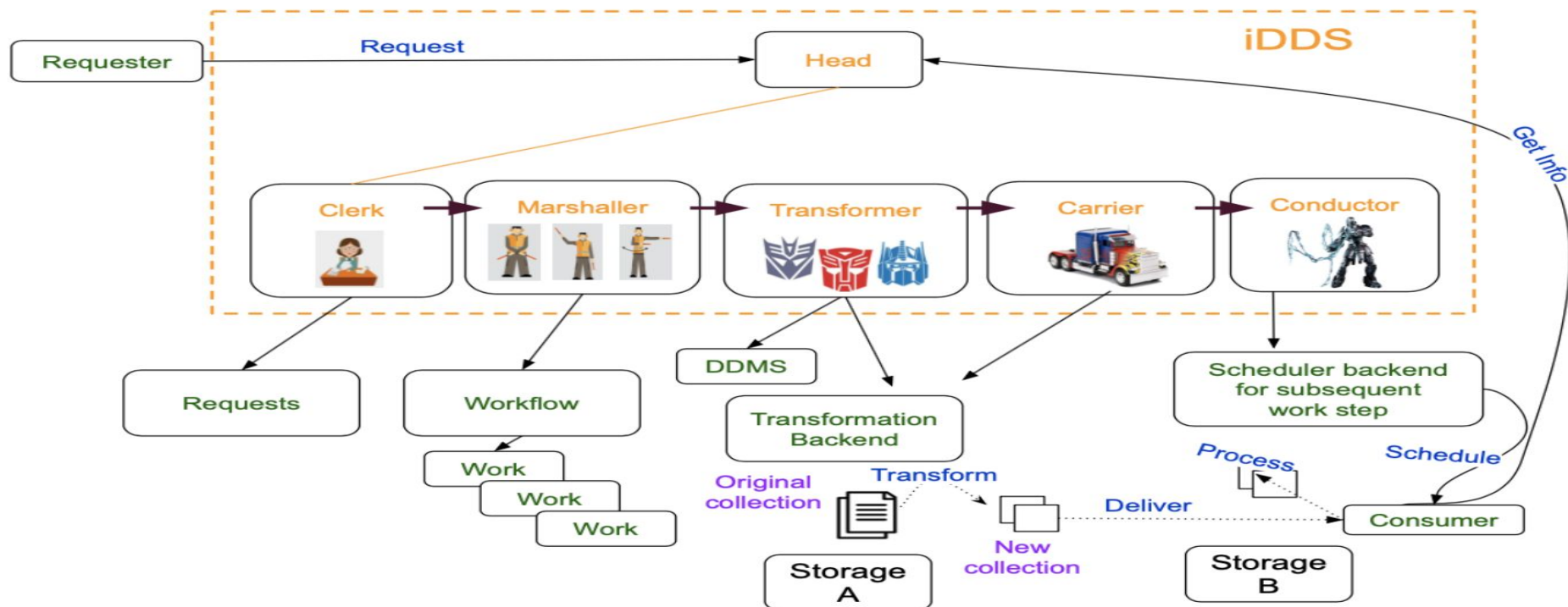
iDDS

- **Client/Server**
  - REST server to handle requests from clients.
  - Employ different backends for transformation: PanDA, Rucio, Condor and so on.
- **Layered architecture of the server**
  - Every layer abstracts a group of functions, hiding the complexity of different logics on different layers.
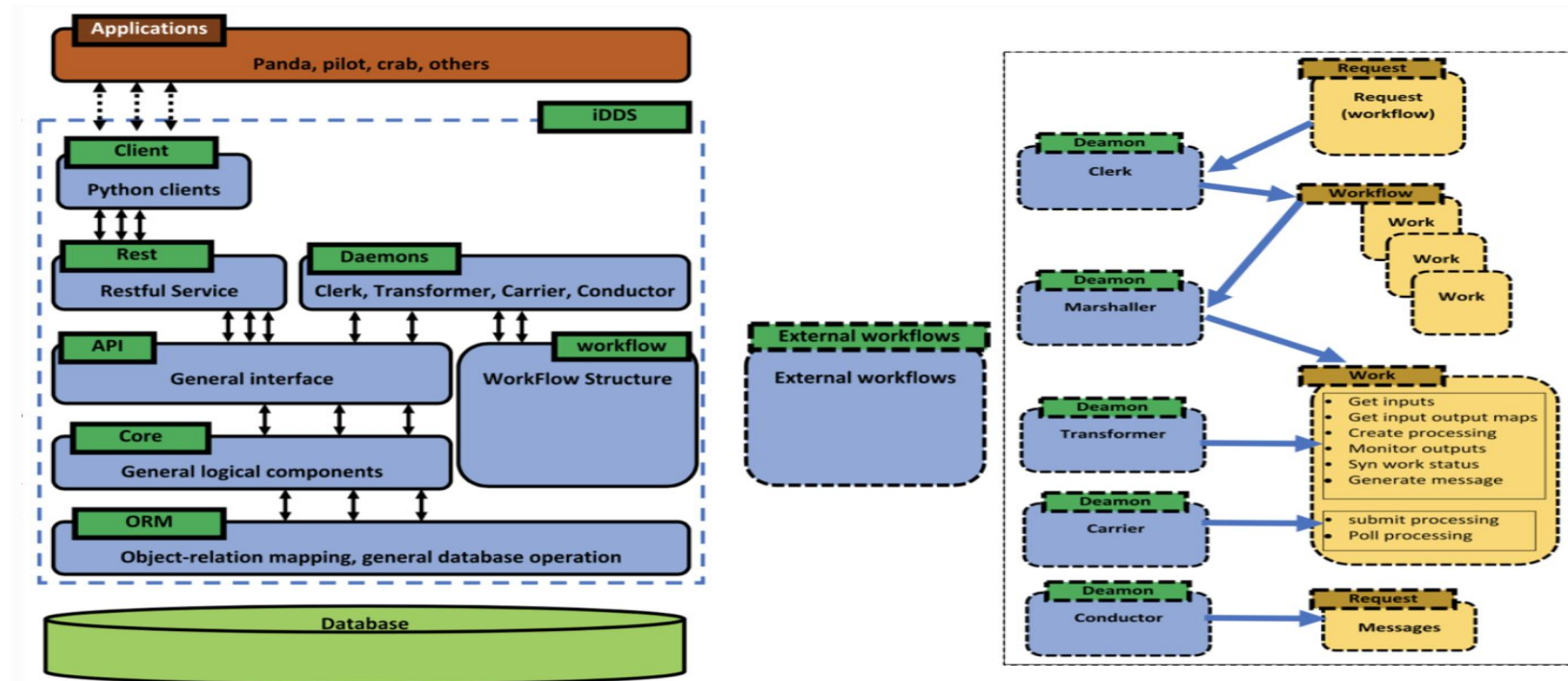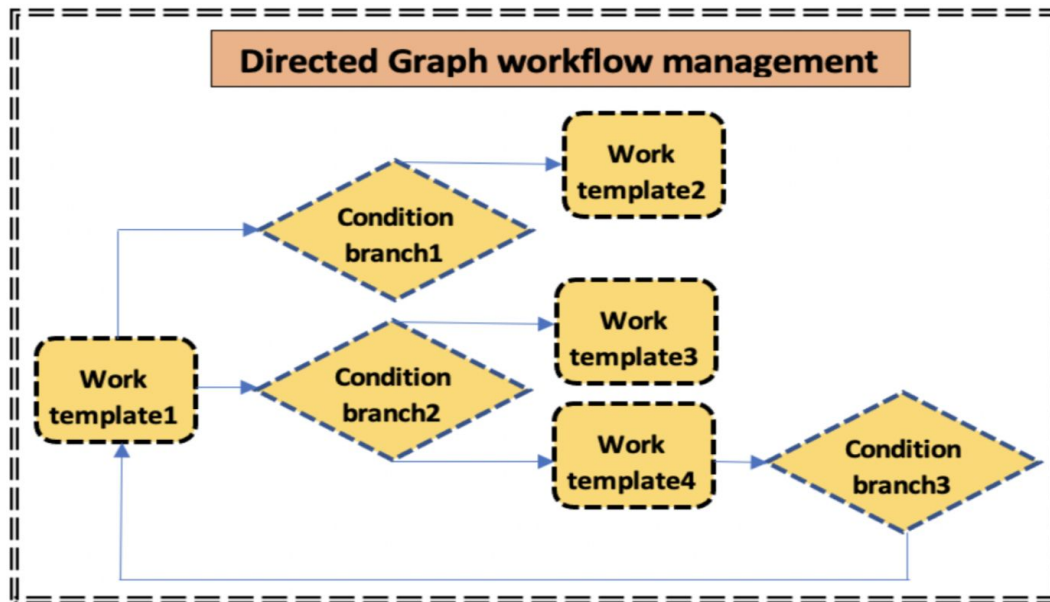
iDDS

- **DAG workflow management**
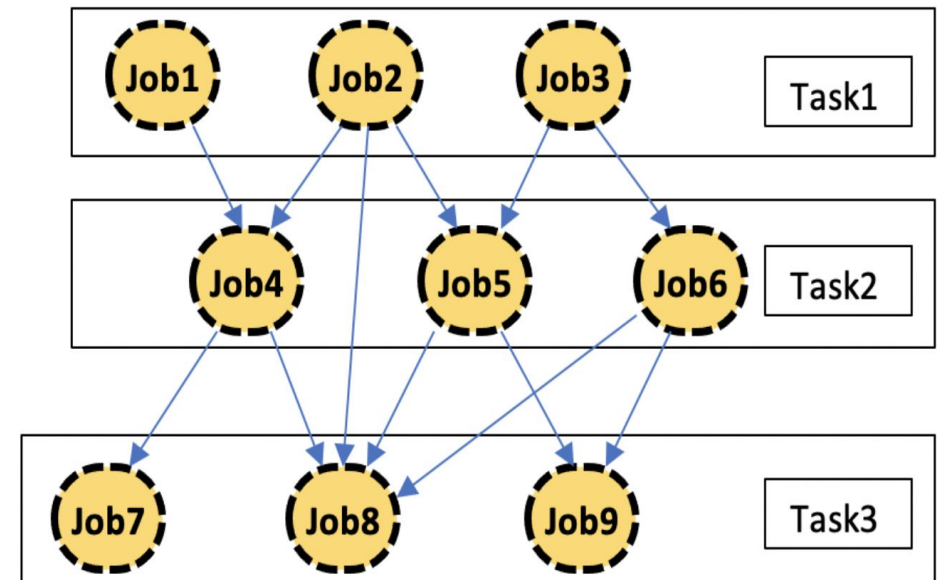 - ## Task Level DAG
    - Relation description is among tasks.
    - When there are new outputs in a task, new jobs are generated for the dependent tasks.
    - When a task is terminated, dependent tasks are triggered.
  - ## Job Level DAG
    - Relation description is among pre-defined jobs.
    - Job grouping based on WFMS.
   - When a job is terminated, dependent jobs are triggered.

Task Level DAG

Job Level DAG

iDDS Data Carousel

- **Orchestrates Rucio to collect and digest file information, and lets JEDI/PanDA process only prestaged files with proper granularities and grouping.**
- **In ATLAS production since May 2020**
- **Has processed in total about 21 PB data.**
- **Reduced a lot of redundant job attempts.**
  - **With iDDS, the tail of jobs with a lot of attempts becomes shorter.**
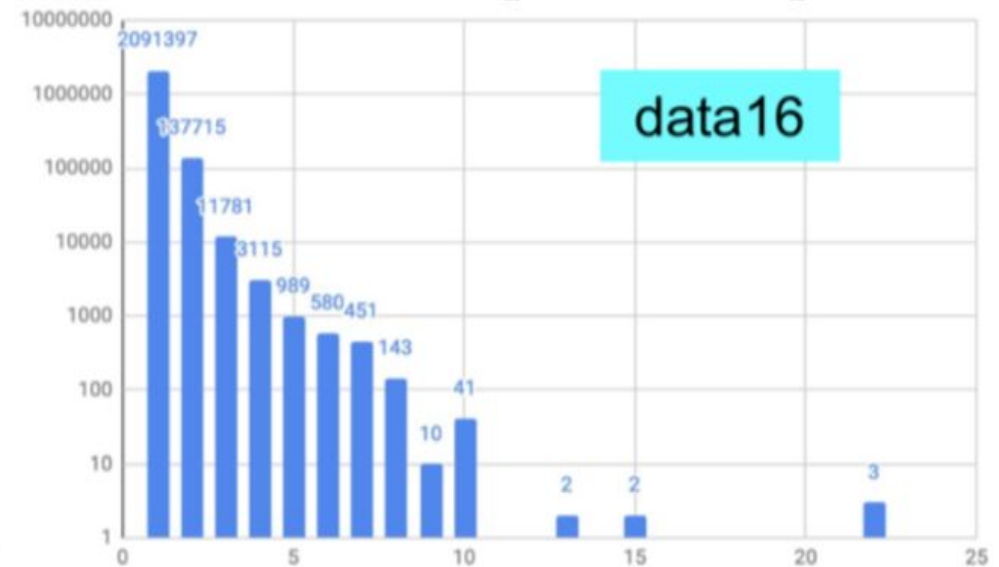
X: attempt times, Y: number of jobs

iDDS HPO(HyperParameterOptimization)

- To provide a fully-automated platform for hyper parameter optimization on top of geographically distributed GPU resources on the grid, HPC, and clouds.
- Used by ATLAS ML users, not specific to ATLAS.
- The usage is increasing.
  - FastCaloGAN
  - ToyMC
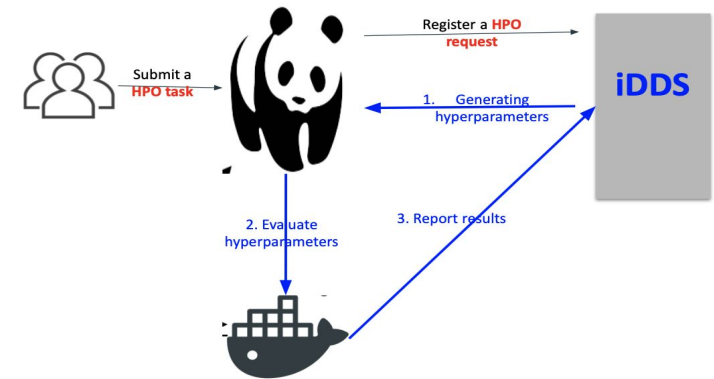
Requests:										
request_id	scope	name	status	transform_status	in_status	in_total_files	in_processed_files	out_status	out_total_files	
37223	hpo	hpo.24509485.2021_03_10_19_04_57_473740655	Transforming	Transforming	Open	2	2	Open	2	
37225	hpo	hpo.24509487.2021_03_10_19_04_57_829887699	Transforming	Transforming	Open	2	2	Open	2	
37227	hpo	hpo.24509488.2021_03_10_19_05_11_831247870	Transforming	Transforming	Open	2	2	Open	2	
37229	hpo	hpo.24509491.2021_03_10_19_05_44_755961431	Transforming	Transforming	Open	2	2	Open	2	
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37233	hpo	hpo.24509493.2021_03_10_19_05_48_072992706	Transforming	Transforming	Open	2	2	Open	2	
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37237	hpo	hpo.24509495.2021_03_10_19_06_18_859385180	Transforming	Transforming	Open	2	2	Open	2	
37239	hpo	hpo.24509500.2021_03_10_19_06_39_335869695	Transforming	Transforming	Open	2	2	Open	2	
37241	hpo	hpo.24509509.2021_03_10_19_06_47_514355545	Transforming	Transforming	Open	2	2	Open	2	

Showing 911 to 920 of 922 entries (filtered from 25,895 total entries)

For last 6 months
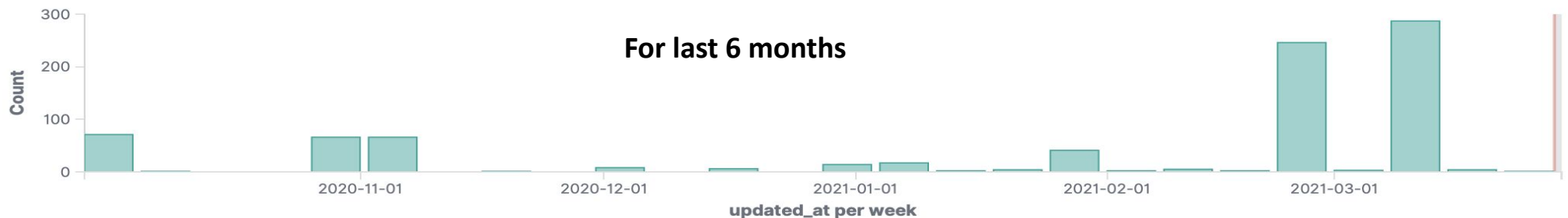
iDDS Rubin Observatory (LSST)

- **LSST exercise**
  - Use the experiment-agnostic DOMA PanDA instance.
  - Job Level DAG: cascade of chains for multiple-step processing.
  - iDDS manages the dependencies and triggers to release jobs incrementally when all dependencies are ready, instead of blocking tasks until all previous tasks finish, to avoid long waiting.
  - Scaling tested with 50K DAG jobs, will test with 150K jobs.

A workflow with cascade of jobs:
Jobs are grouped to tasks

iDDS ActiveLearning

- **ActiveLearning**
  - A simple DAG use case to chain processing and learning tasks.
  - To define the subsequent processing task based on the decision making in the learning task which analyze the results of the previous processing task.
  - Task templates to generate concrete tasks, and condition branches to control the workflow.
  - Under integration with PanDA.
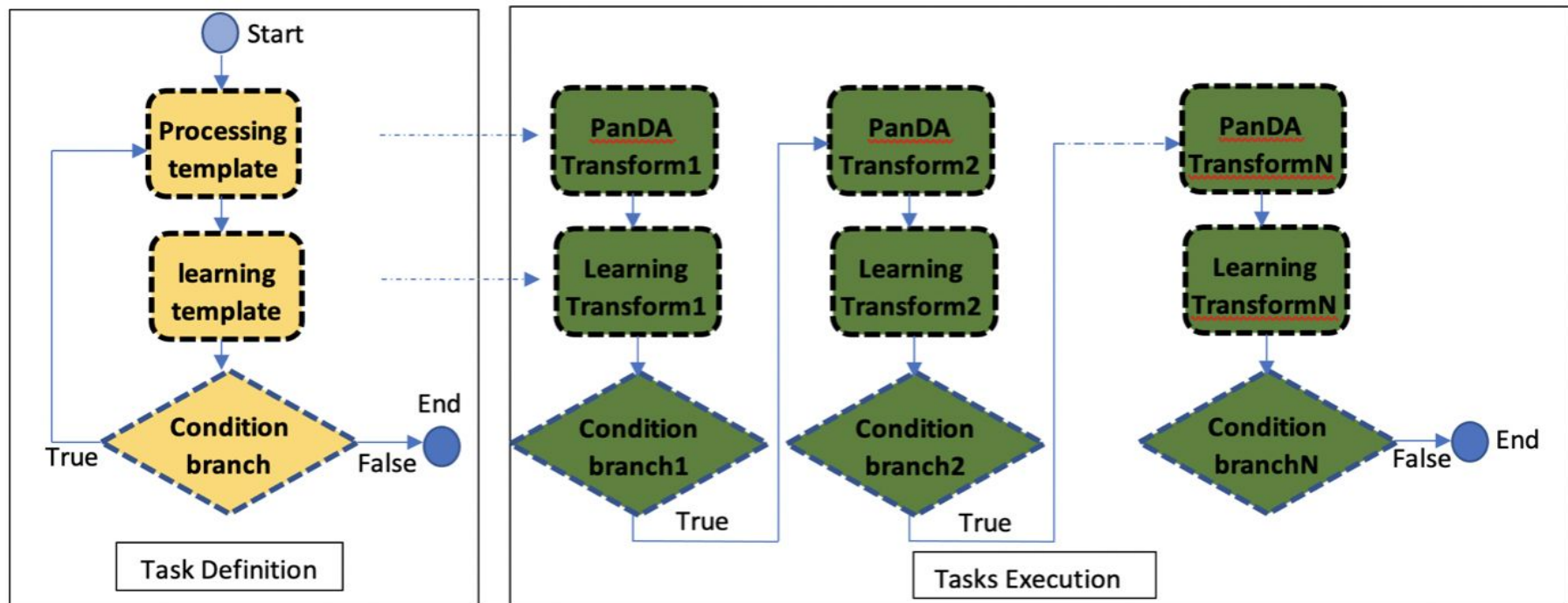
Summary: iDDS Current Status

❖ **Main architecture**
  ➢ iDDS database, core, REST API
  ➢ Plugins
  ➢ Agents
  ➢ Watchdogs

❖ **Documents & monitors**
  ➢ Home page: https://idds.cern.ch
  ➢ Codes: https://github.com/HSF/iDDS
  ➢ Documents: https://idds.readthedocs.io
  ➢ ATLAS monitor: https://bigpanda.cern.ch/idds/
  ➢ Different monitors are being enriched.

❖ **Instances in production**
  ➢ ATLAS, DOMA

❖ **Future developments**
  ➢ Main Structure improvements
  ➢ Monitor improvements
  ➢ New use cases
    ■ Dynamic transformation and placement on demand, for example Derivation on Demand
    ■ Fine-grained data transformation and delivery, such as Event Streaming Service