Flexibility extension of the Event Picking service for ATLAS experiment

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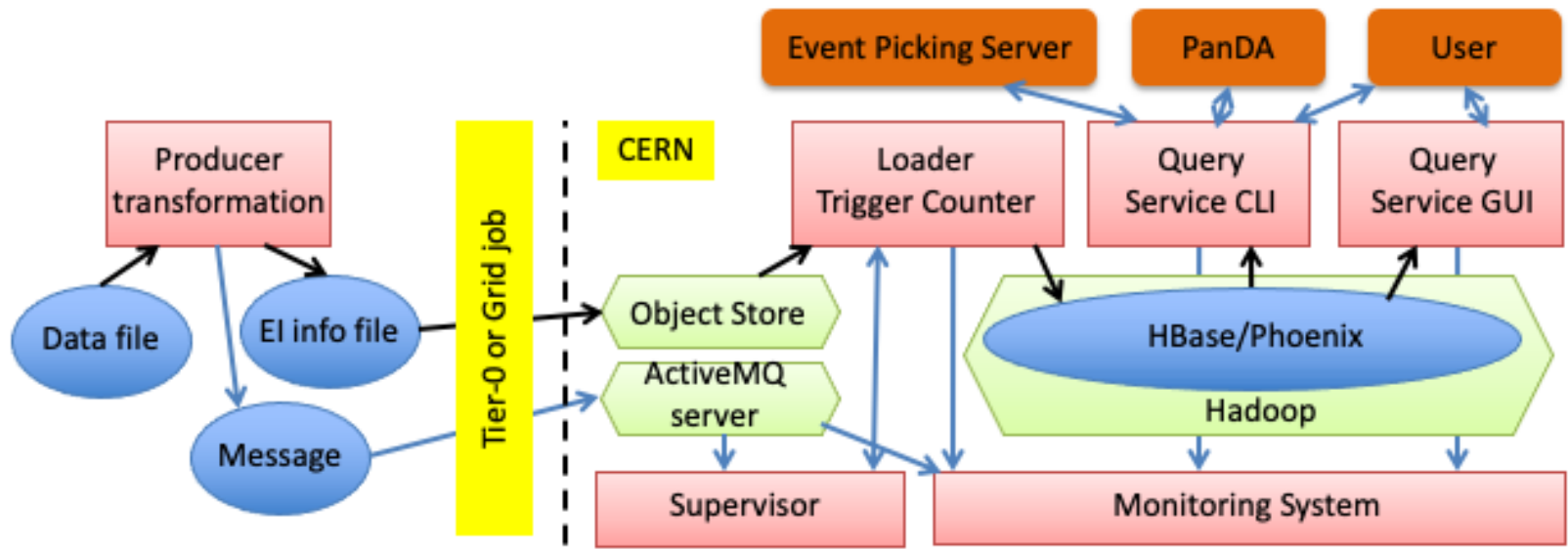
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The ATLAS EventIndex

- The EventIndex is the global catalogue of all ATLAS events

- For each event, each data format and each processing version, it contains:

  - Event identifiers (run and event number)

  - Location (GUID of the file containing it) and provenance

  - Trigger and other useful metadata

- Main use case is event picking for detailed analysis and/or displays

  - Also production checks and overlap counts

EventIndex for Run 3

- The core data storage system was reimplemented during 2021 and deployed in 2022 for the start of LHC Run 3
  - HBase for the dataset and event tables
  - Phoenix interface for SQL queries
  - New client query service CLI also implemented for optimal performance

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Event Picking Service

- Some physics analyses need to extract many events in order to process them with enhanced algorithms

  - γγ -> WW analysis:
    - The first round 50k events (2019)
    - The second round 136k events (2021)

  - B_c^* -> B_c gamma analysis:
    - 650K events (2023)

  - Z -> TauTau selections:
    - 11K events (2023)

- An automatic system to extract the requested events and deliver them to the requestors is therefore needed: the Event Picking Service

Various input data

- **Data format**
  - Raw (only for real data)
  - AOD
  - Evnt (only for Monte Carlo)
- **Type**
  - Real data
  - Monte Carlo
- **Trigger stream** (only for Real data)
- **AMI tag** AMI tag (software version, not used for RAW data)
- **File containing run and event numbers**

Tasks and problems (1)

- The list and order of tasks may change over time
- Split by Run: required for correct work with minimal time
  - The number of input data can be large
  - Input data may not be in order
  - 1 run 1 file
- Get GUIDs: this information should be added to panda and is required to get the dataset name template
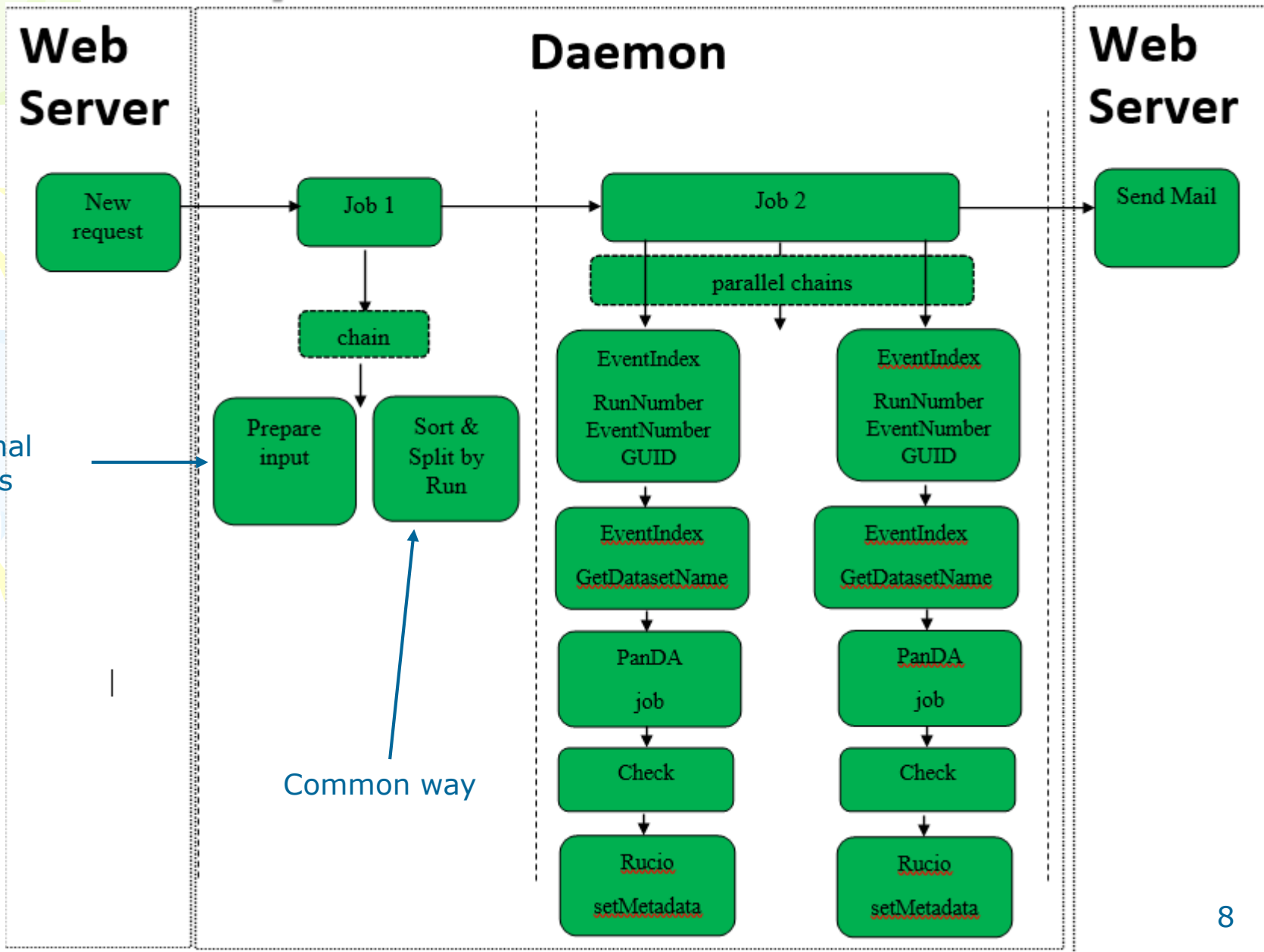 - Possible error answer from EI

Tasks and problems (2)

- Get Dataset Name: require for panda job
  - Rucio has no information about some GUID
- Start Panda Job: make a real copy of events
  - Long working time
  - The result may be an error (even for valid inputs)
- Validate : should validate the output data
  - Possible duplicate/ skip events
- Set Metadata in RUCIO: panda does not set event count of events
  - Possible big number of output files
- Restart: events that were skipped or have errors
  - Possible big number such events in different runs
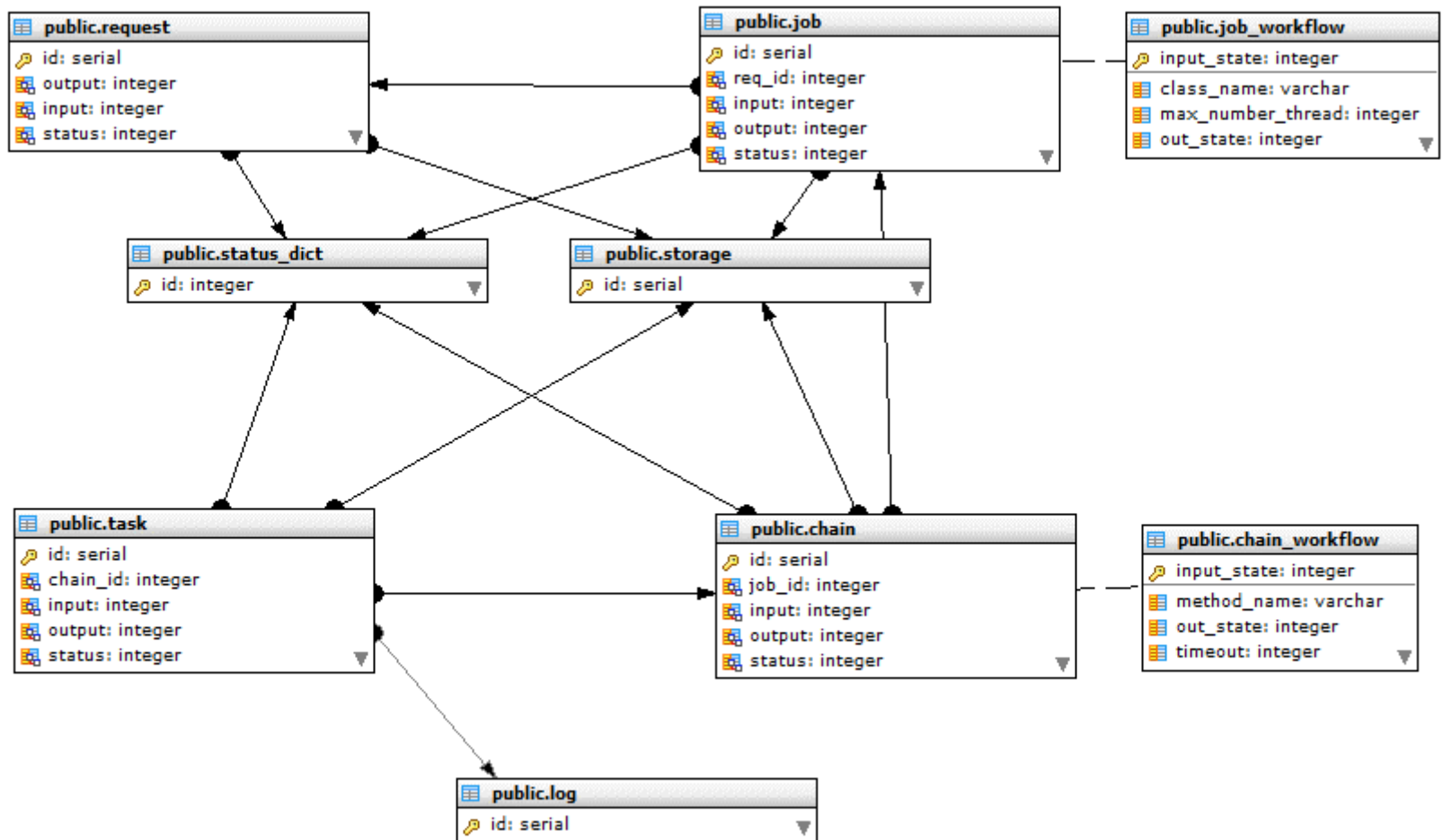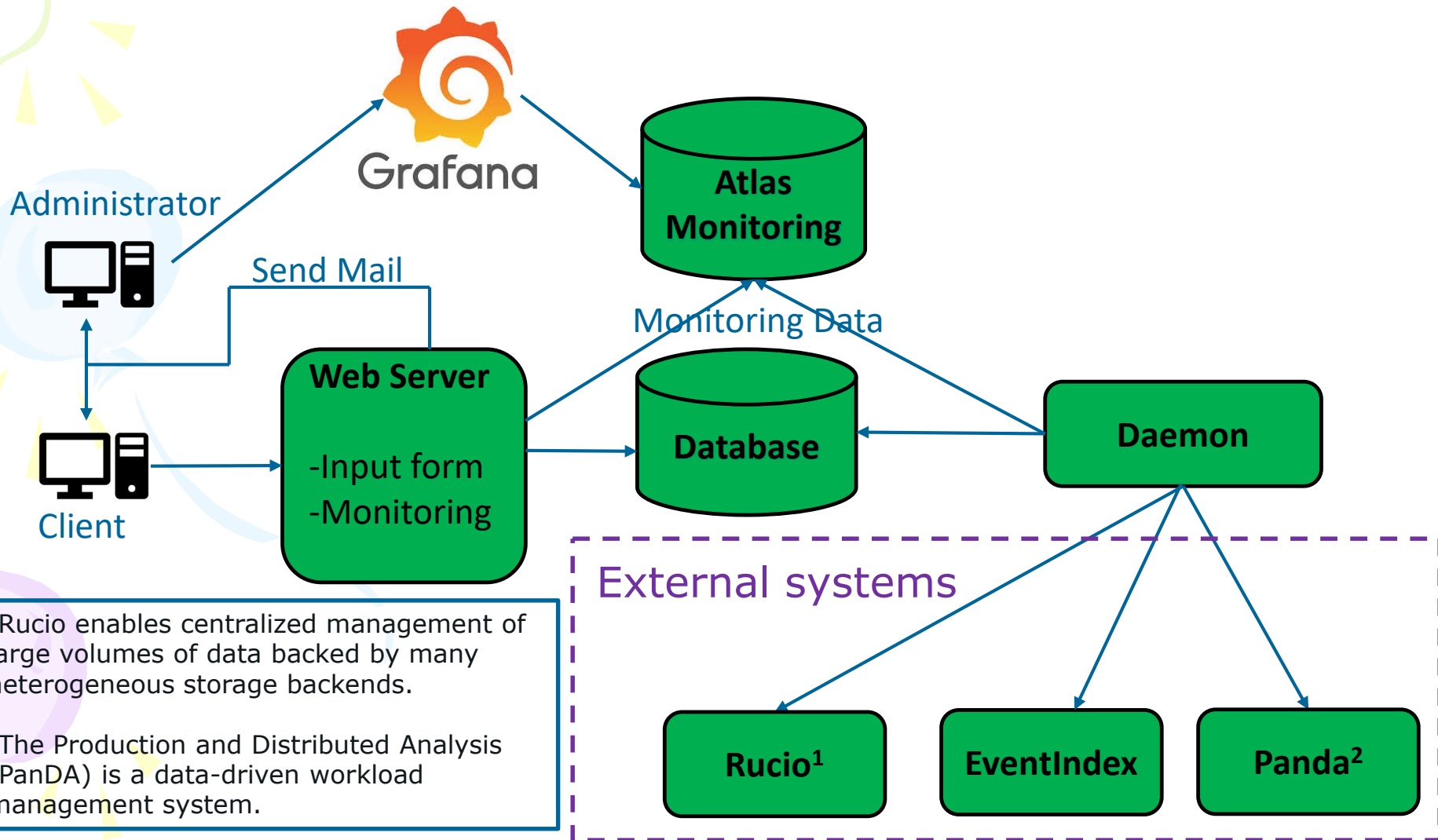
Request Workflow for Atlas

Object model (briefly)

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Architecture of the Event Picking service

Administrator

Client

Send Mail

Web Server

-Input form
-Monitoring

Atlas Monitoring

Monitoring Data

Database

Daemon

External systems

Rucio[1]

EventIndex

Panda[2]

[1]Rucio enables centralized management of large volumes of data backed by many heterogeneous storage backends.

[2]The Production and Distributed Analysis (PanDA) is a data-driven workload management system.

Time results

Request	Number of events	Version	Time
$\gamma\gamma$ -> WW	50k	1.0.0	2 weeks
		manual	3 months
$\gamma\gamma$ -> WW	136k	Beta version	3 months
B_c^* -> B_c	16K	1.2.37	84h
Z -> TauTau	11K	1.2.37	40h

Production server

- Production version is available since middle of 2022.
- Web service is available outside of CERN (need CERN SSO authorization)
- Exploitation of the Event Picking Server revealed deficiencies that were solved by creating new Workflows

Critical error for most of chains

Critical error for a few of chains

root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/02/f7/group.proj-evind.41431871._000027.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/6f/7b/group.proj-evind.41431871._000028.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/1d/22/group.proj-evind.41431871._000029.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/e2/22/group.proj-evind.41431871._000030.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/a3/40/group.proj-evind.41431871._000031.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/1c/4d/group.proj-evind.41431871._000032.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/89/20/group.proj-evind.41431871._000033.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/2d/fd/group.proj-evind.41431871._000034.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/90/fd/group.proj-evind.41431871._000035.data.root
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root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/06/14/group.proj-evind.41431871._000037.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/48/9a/group.proj-evind.41431871._000038.data.root
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root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/f2/96/group.proj-evind.41431871._000040.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/b6/06/group.proj-evind.41431871._000041.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/34/71/group.proj-evind.41431871._000042.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/70/5b/group.proj-evind.41431871._000043.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/b0/c0/group.proj-evind.41431871._000044.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/a8/1c/group.proj-evind.41431871._000045.data.root

group.proj-evind.data16_13TeV.00303832.physics_BphysDelayed.evtpick.DRAW_EVTPICK.n347_11016t34958

root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/5e/0d/group.proj-evind.41431860._000001.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/59/ed/group.proj-evind.41431860._000002.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/df/0b/group.proj-evind.41431860._000003.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/78/af/group.proj-evind.41431860._000004.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/34/e3/group.proj-evind.41431860._000005.data.root
root://eosatlas.cern.ch:1094//eos/atlas/atlasgroupdisk/proj-evind/rucio/group/proj-evind/eb/bb/group.proj-evind.41431860._000006.data.root

Request progress

Jobs:	Job Name	Initial state	Current state	Created	Changed	Job Status
└	SplitJob	Sort and split (state: SORT_SPLIT)	Panda job (state: PANDA_PART)	26.09.2024 22:11	26.09.2024 22:11	Finalized. Total=1, errors=0, warnings=0 (Done without error and warning)
└	PandaJob	Panda job (state: PANDA_PART)	Request finished (state: DONE_REQ)	26.09.2024 22:11	29.09.2024 14:15	Finalized. Total=168, errors=2, warnings=0 (Finished with fatal error)

Only 2 errors. 166 done.

Correct results

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Error for a check tasks

343 warning (error but result file exists)

Result files (+)

Request progress

Jobs:	Job Name	Initial state	Current state	Created	Changed	Job Status
└ SplitJob	Sort and split (state: SORT_SPLIT)	Panda job (state: PANDA_PART)	03.05.2024 15:34 ⬇	03.05.2024 15:34 ⬇	Finalized. Total=1, errors=0, warnings=0 (Done without error and warning)
└ PandaJob	Panda job (state: PANDA_PART)	Request finished (state: DONE_REQ)	03.05.2024 15:34 ⬇	20.05.2024 23:57 ⬇	Finalized. Total=343, errors=0, warnings=343 (Done with check errors)

Chains:	Chain number / Run number	Current state	Created	Changed	Chain status
└	1 363664	Chain finished (state: DONE_CHAIN)	03.05.2024 15:34:17 ⬇	05.05.2024 11:51:18 ⬇	Finalized (Done with check errors)

Tasks:	Task Name	Initial state	Current state	Created	Changed	Task status
└	getIndex	Panda job (state: PANDA_PART)	Get dataset name for first guid (state: GET_DATASET_NAME)	03.05.2024 15:34:17 ⬇	03.05.2024 15:34:47 ⬇	Finalized (Done without error and warning)
└	getDatasetName	Get dataset name for first guid (state: GET_DATASET_NAME)	Chain workflow. Get GUIDs from EventIndex (state: INDEXED_TASK)	03.05.2024 15:34:47 ⬇	03.05.2024 15:35:06 ⬇	Finalized (Done without error and warning)
└	panda	Chain workflow. Get GUIDs from EventIndex (state: INDEXED_TASK)	Chain workflow. Start panda task (state: START_PANDA_TASK) PanDA job	03.05.2024 15:35:06 ⬇	05.05.2024 11:17:07 ⬇	Finalized (Done without error and warning)
└	check	Chain workflow. Start panda task (state: START_PANDA_TASK)	Chain workflow. Start panda task (state: START_PANDA_TASK)	05.05.2024 11:17:07 ⬇	05.05.2024 11:21:53	Wait restart (Error state of task)
└	check	Chain workflow. Start panda task (state: START_PANDA_TASK)	Chain workflow. Start panda task (state: START_PANDA_TASK)	05.05.2024 11:26:53 ⬇	05.05.2024 11:39:04	Wait restart (Error state of task)
└	check	Chain workflow. Start panda task (state: START_PANDA_TASK)	Chain workflow. Start panda task (state: START_PANDA_TASK)	05.05.2024 11:44:05 ⬇	05.05.2024 11:51:18	Max number of restart (Error state of task)

The Panda task ran for about 2 days.
Other tasks usually ran for minutes.

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Available workflows

Main

- Common workflow for get selected events.

Full restart

- Restart request with the same parameters.

Restart errors and warnings job

- Restart only error and warning job.

Restart check task

- Restart job with check error. Start job since check task.

Finalize request (special system type)

- Use in case of critical error of request. Set error for all not finished job.

Conclusion

- The new implementation of the Event Index is working without problems.

- The Event Picking Service is running on the production server.

- Error handling and automatic fixes have been improved, which is why the speed of the new version has been increased.

- The number of users of the service is growing.

- The Event Picking Service is flexible and can be used in other experiments once the required workflow is implemented.