Pilot Monitoring System Migration to Grafana
KEK SSP(Summer Student Program)

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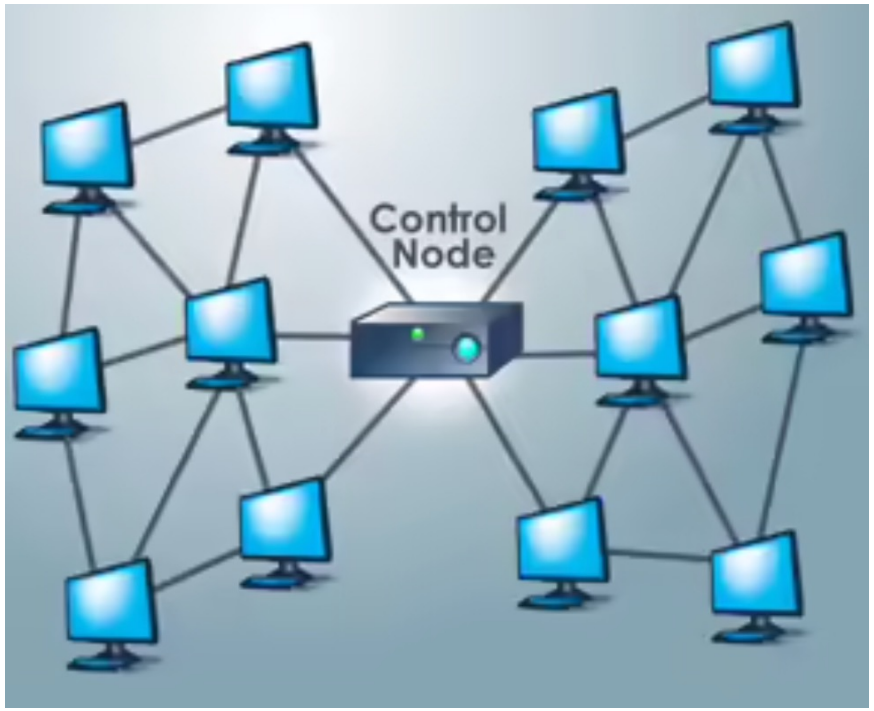
My Chinese characters : 炅珉 李

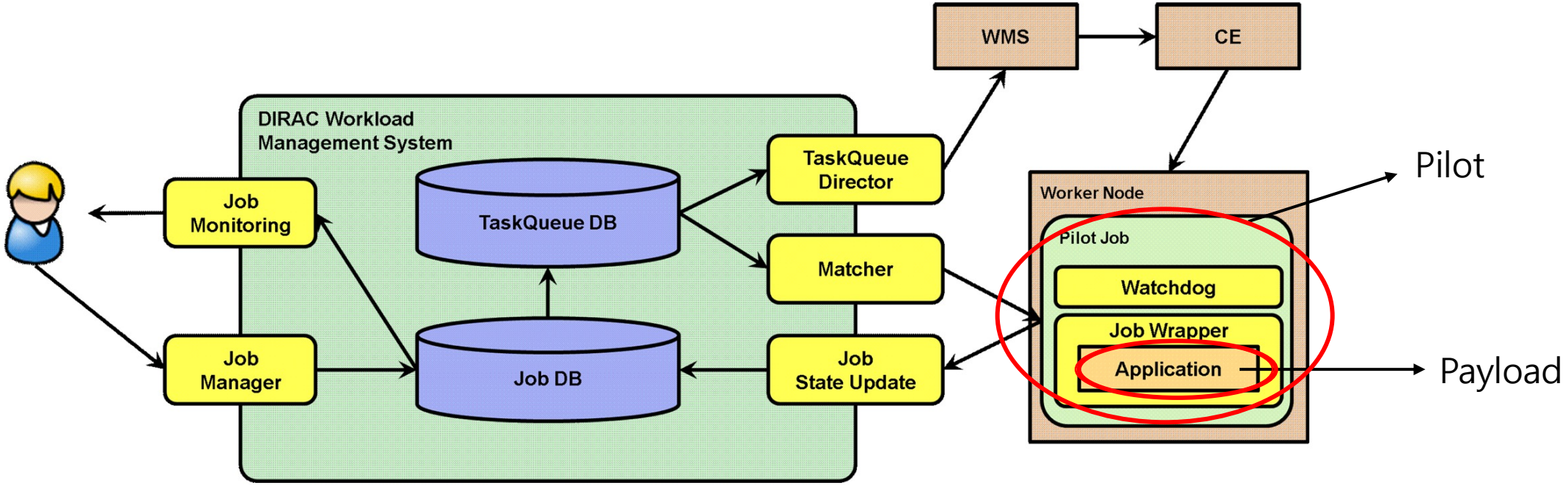
Grid system and Dirac

- In Belle2 experiment, we need to MC generation(Monte Carlo simulations), raw data processing, making skim, and user analysis.
- Nowadays all of those activities require huge amount of resources, thus we need a distributed computing system. (grid system)
- We use DIRAC (Distributed Infrastructure with Remote Agent Control) to manage the grid system.



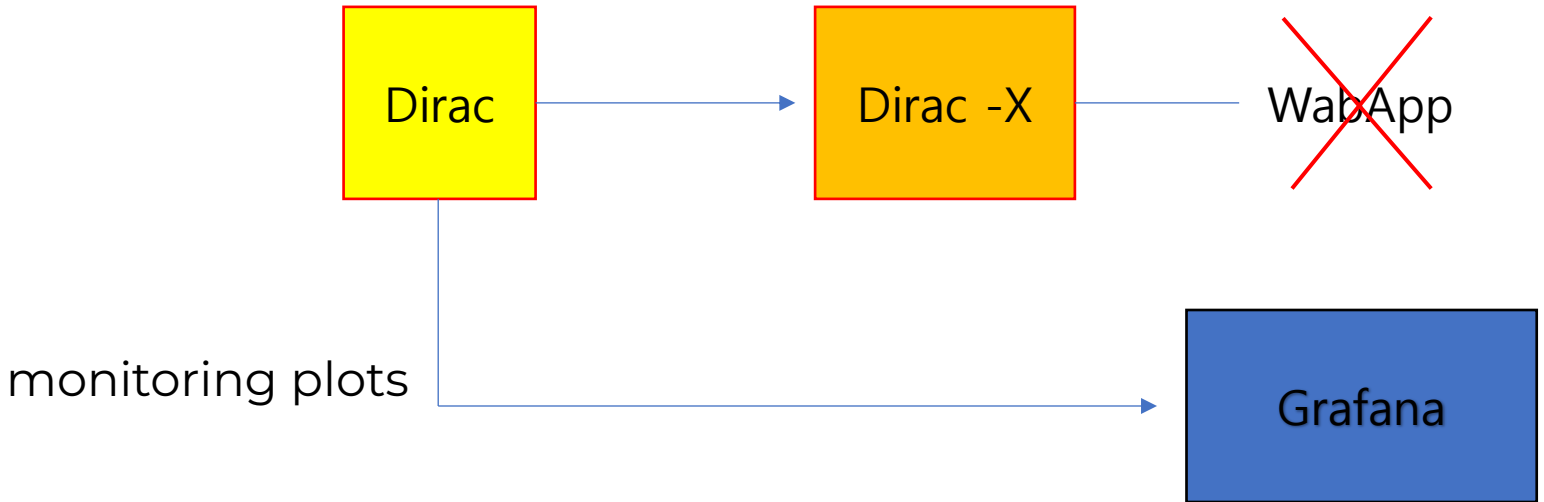
What is Pilot

In DIRAC, a Pilot is a lightweight job that runs on a worker node to check the environment before executing actual tasks. It ensures that the node meets all requirements and is ready to run user jobs.
After a successful check, it retrieves a real job from the central queue.
This mechanism improves reliability and optimizes resource usage.
periodical health check of them are essential for smooth data processing.



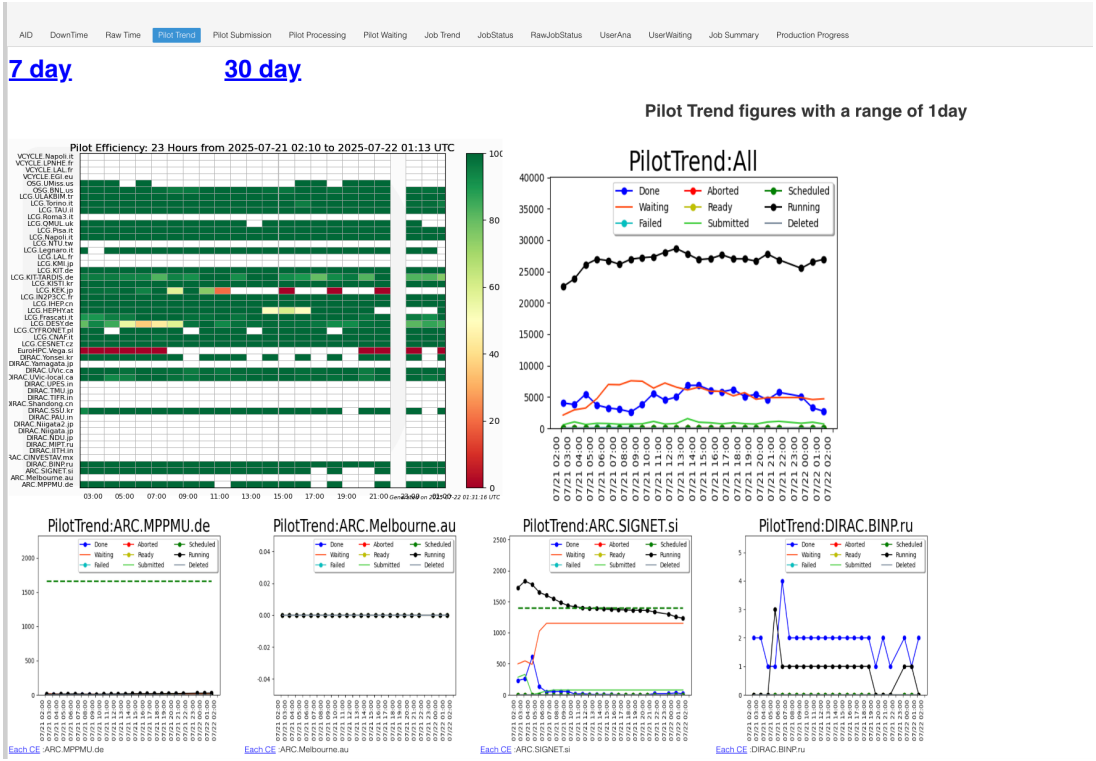
Why Migrate to Grafana

- In near future, DIRAC will be replaced by DiracX, next generation of DIRAC.
- At that time DiracX web portal does not support graph plotting widely use d for monitoring by current version of DIRAC web portal.
- Therefore, we need to migrate all monitoring plots to another tool, Grafana.
- The database is MySQL and OpenSearch, which are the same backends us ed by the DIRAC WebApp. Therefore, I need to study the relevant query lan guages, such as SQL for MySQL, and PPL (Piped Processing Language) and Lucene for OpenSearch.



Monitoring System Migration

- It is assumed that you do not have access to the DIRAC Wab App.
- Essentially, We should be able to view trend information for each site by time interval, overall trends across all site s, as well as heatmap graphs representing efficiency met rics.

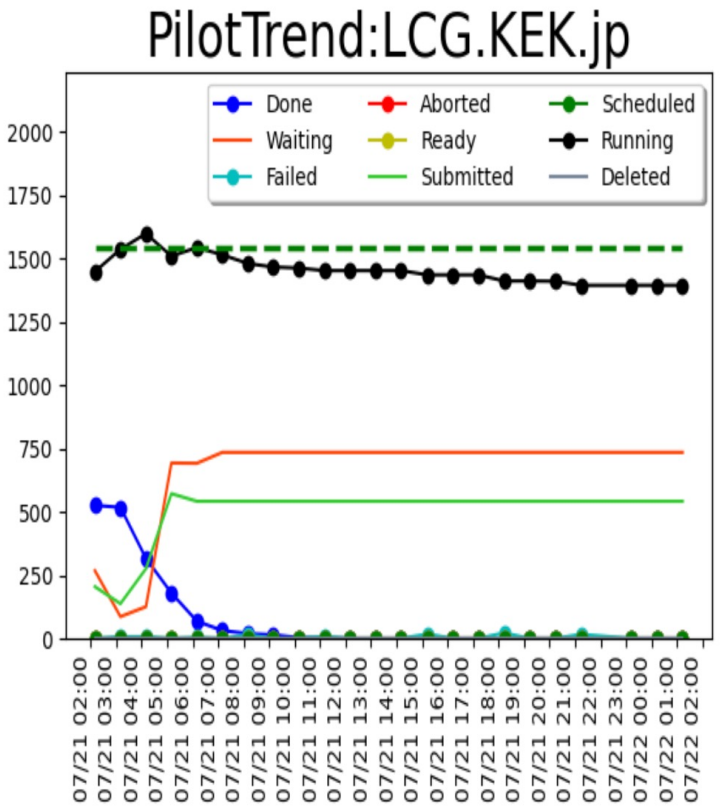


Monitoring System Migration

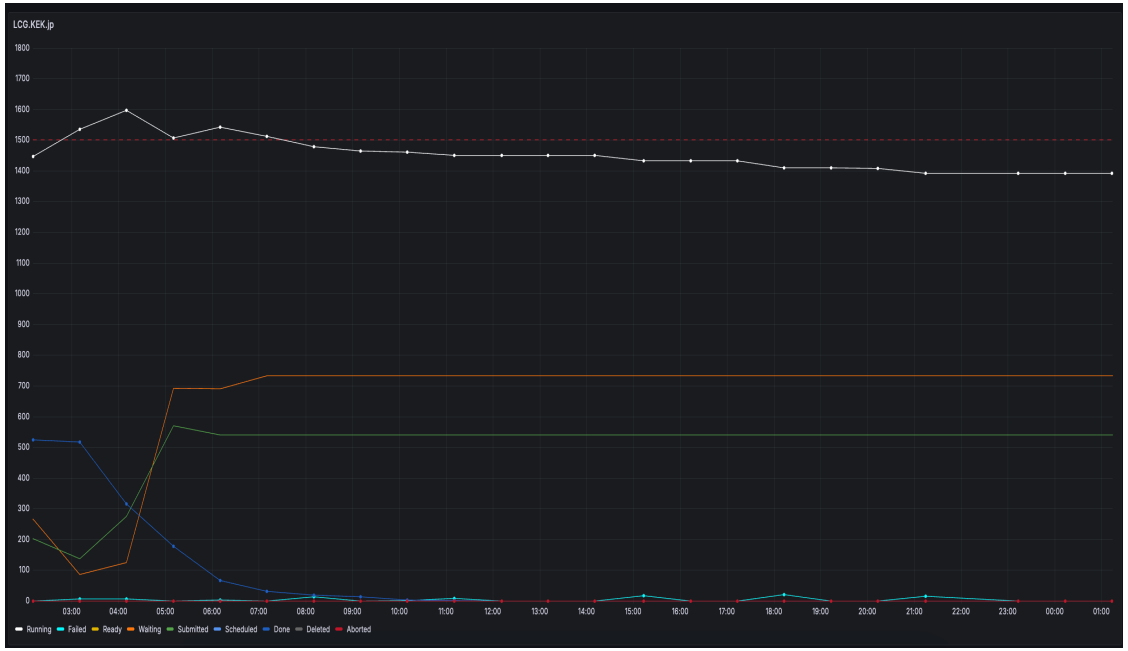
The Pilot Trend plot (mySQL) , a site

WebApp and Grafana plots are consistent.

Web App



Grafana

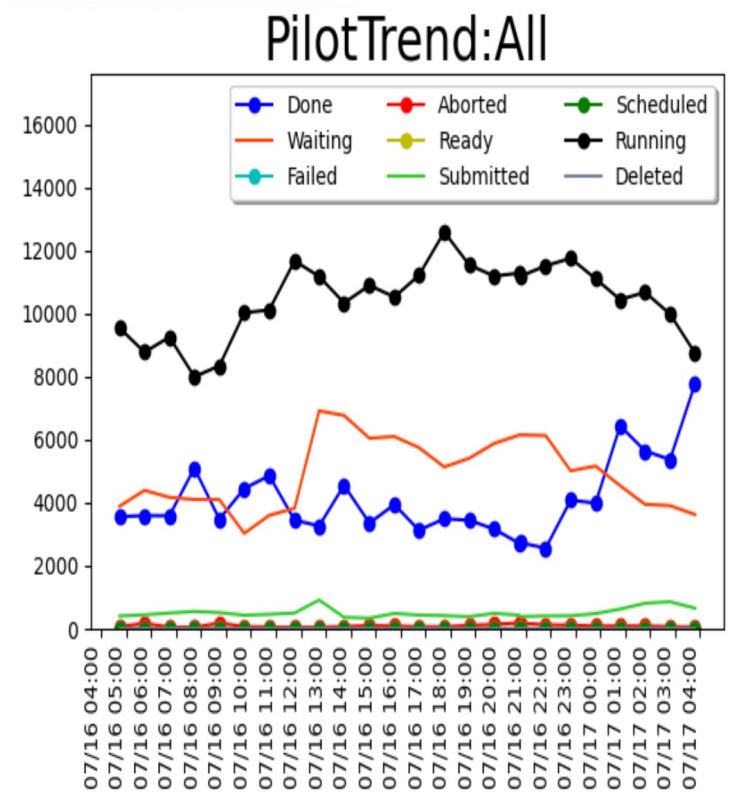


Monitoring System Migration

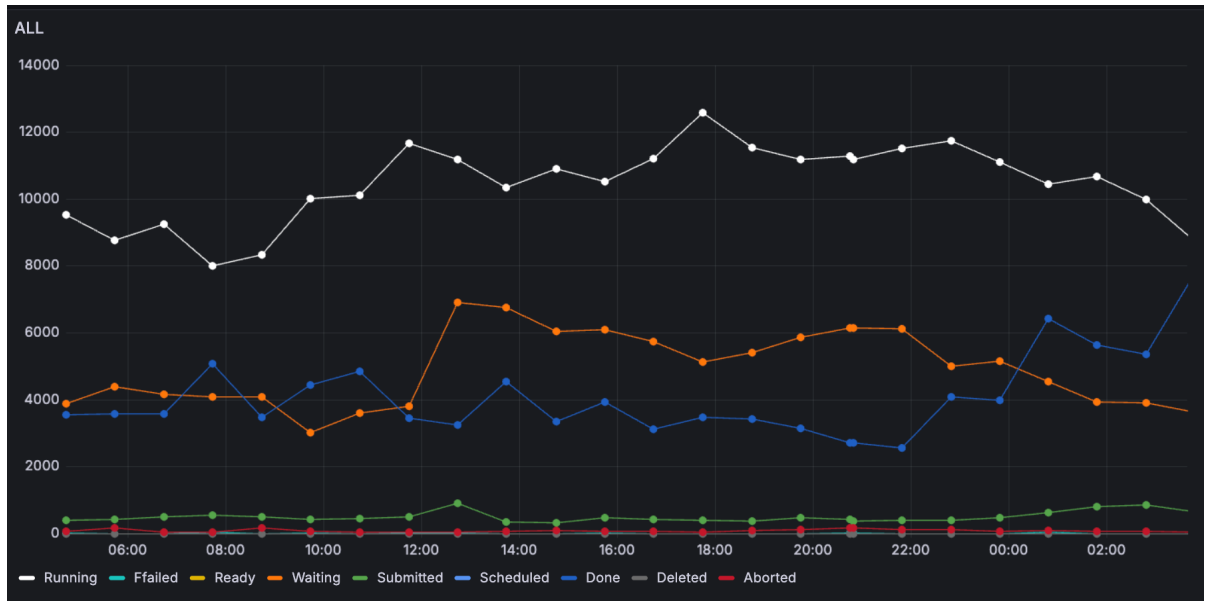
The Pilot Trend plot (mySQL) , for all sites

WebApp and Grafana plots are consistent.

Web App

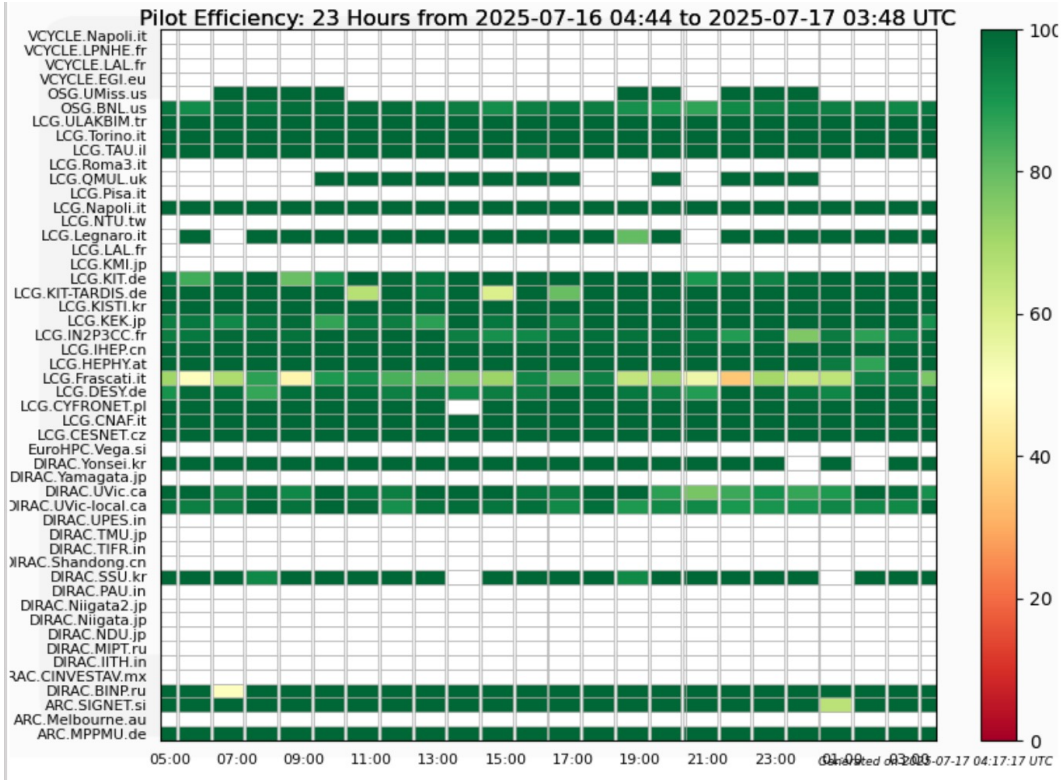


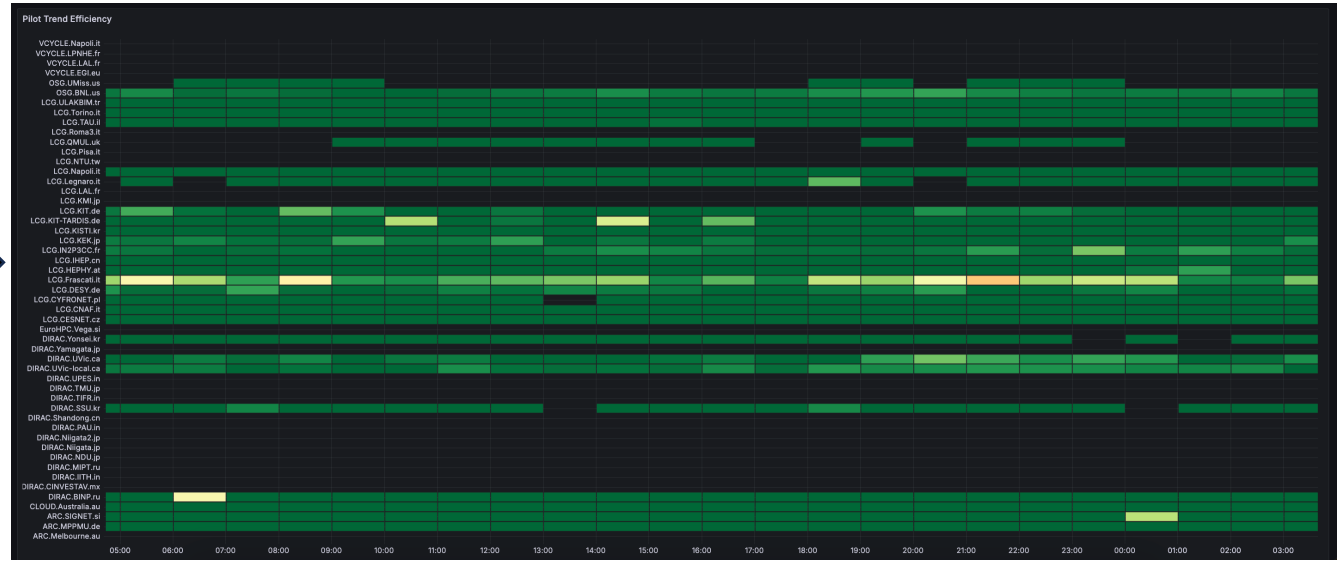
Grafana



Monitoring System Migration

The Pilot Trend plot (mySQL) , Efficiency Heatmap





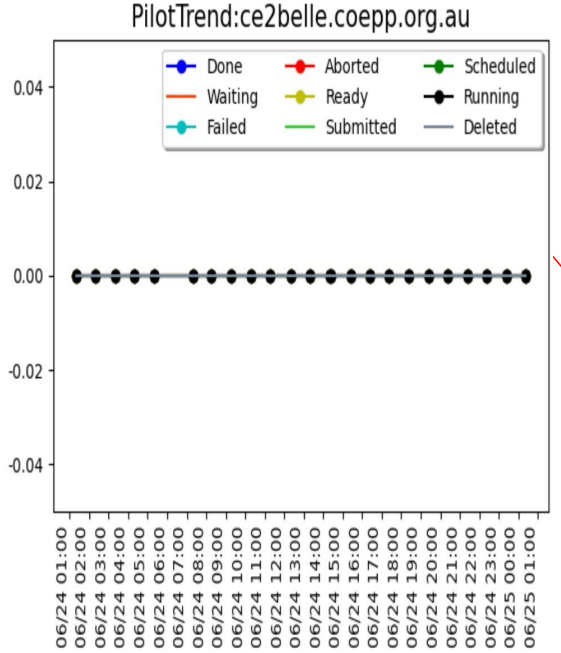
X- axis : Time, Y-axis: Each site
color: Efficiency(Done/(Done+failed+aborted))

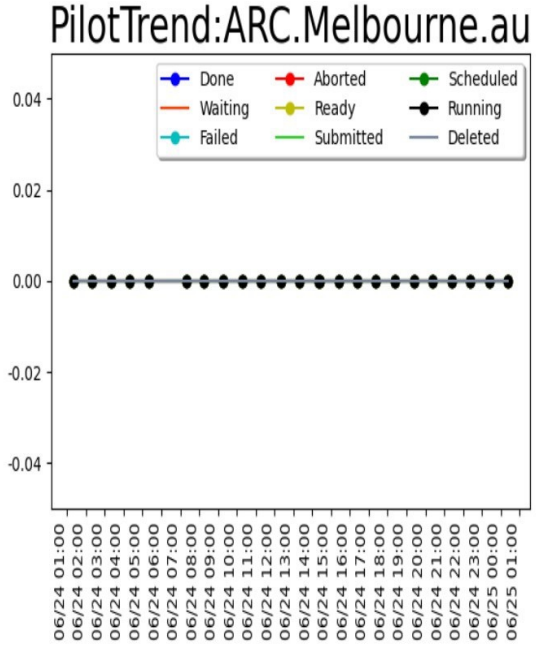
Monitoring System Migration

One site could accept pilots by multiple service endpoints (Computing Element, CE)
DIRAC submits pilot to sites (CEs), but sometimes pilot submission could fail by various reasons.

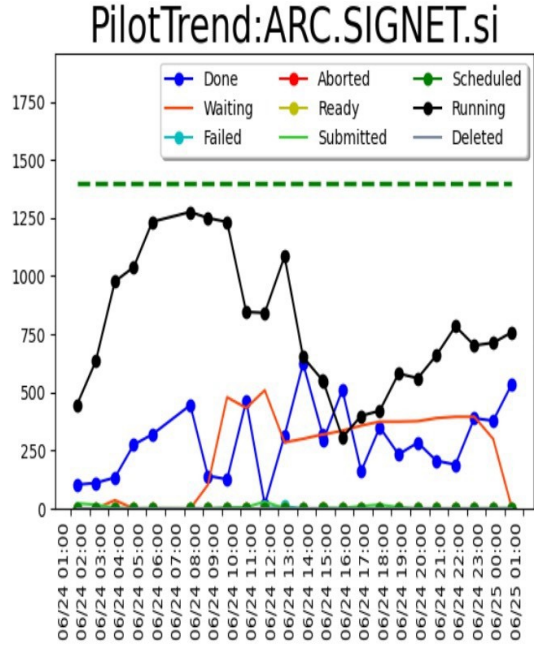
CE Graphs: Implementation for Each Site

We can view each CE by clicking the corresponding CE in Dirac. For now, each CE can be v iewed on a separate dashboard.





Each CE :ARC.Melbourne.au



Each CE :ARC.SIGNET.si

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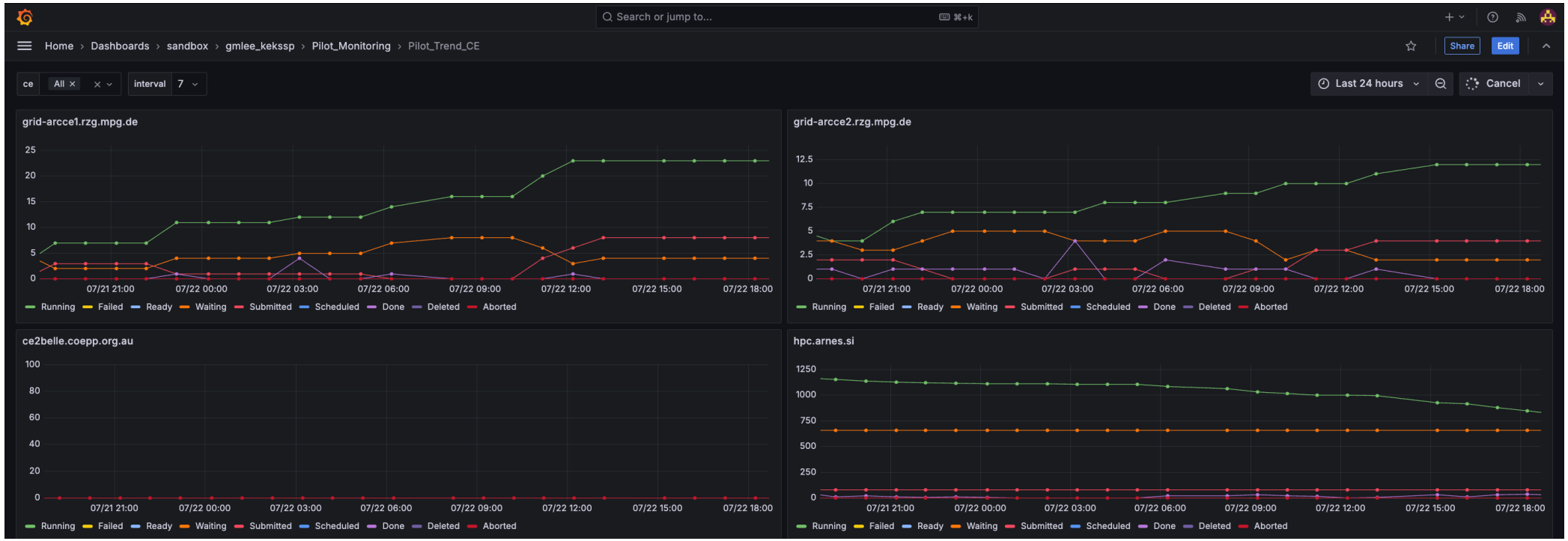
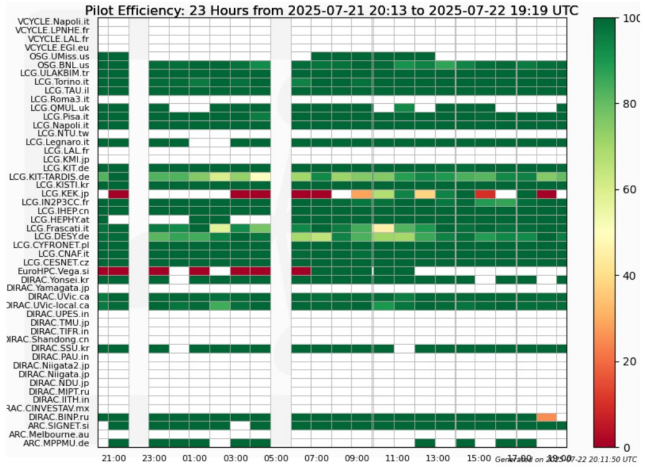
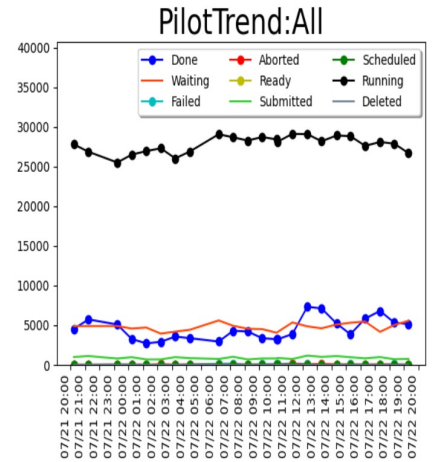


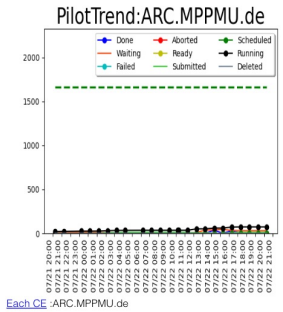
Monitoring System Migration

This is what it looks like after the DIRAC WebApp has been migrated to Grafana, as shown in the image below.

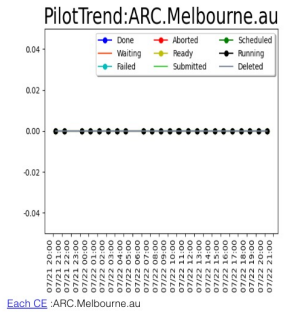
Web App







Each CE :ARC.MPPMU.de



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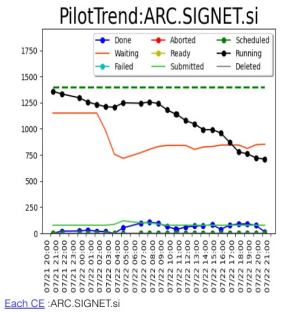
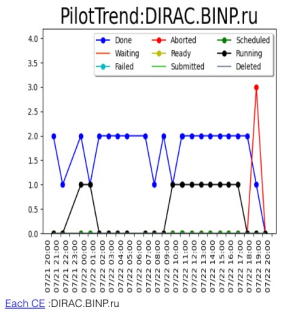


Each CE :ARC.SIGNET.si

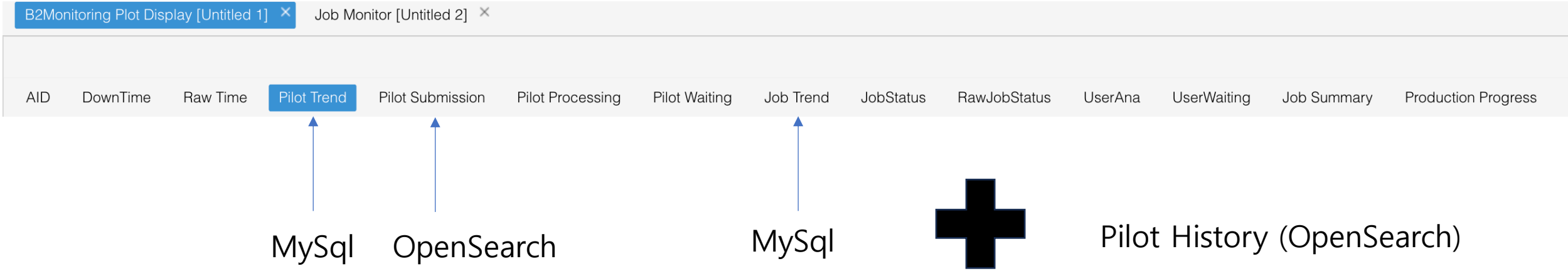


Each CE :DIRAC.BINP.ru

Grafana

Monitoring System Migration

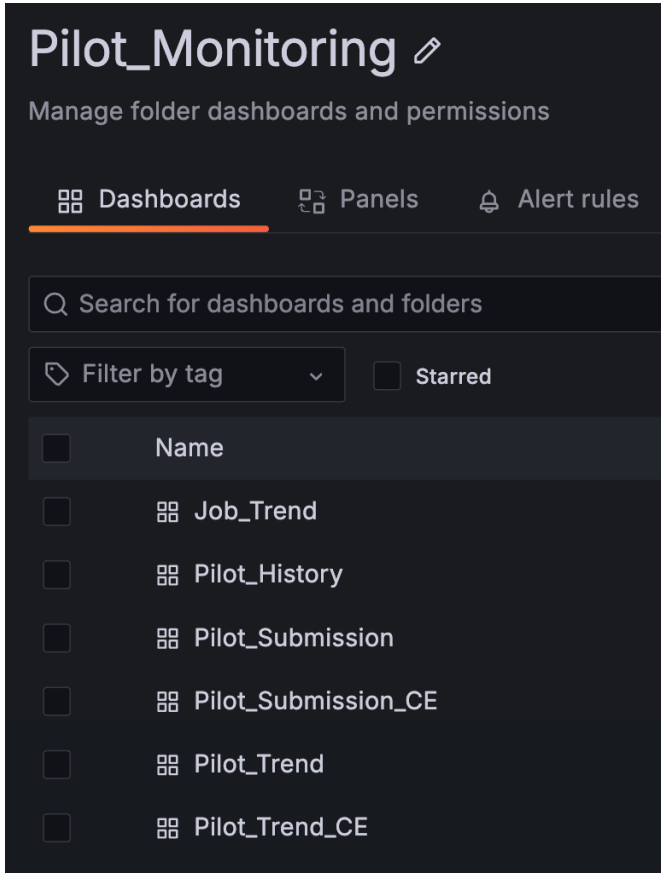
To give you a rough overview of the data migrated so far, we have transferred the pages listed below along with one additional Pilot History page to Grafana.



Monitoring System Migration

This is my Grafana Dashbards.
And my Grafana Link:
https://b2comp-mon.cc.kek.jp/grafana/dashboards/f/aes6n2c6r0v0ga/pilot-monitoring

It is likely that none of the people here have access to the linked page.
You need
1. Grid Certification
2. VOMS membership
3. Grafana Admin Account User's Permission



Summary

My development will be used by Belle II distributed computi ng in production, even for now, and in future, DiracX era.

1. To migrate pilot-related monitoring graphs from DIRAC to Grafana, I studied query languages, PPL, and Lucene.

2. I have successfully transferred the Pilot Trend, Pilot Submis sion, Pilot History, and Job Trend graph pages to Grafana.

Next Step

1. Try to visualize additional tables

Grafana

Grafana is an open-source tool for visualizing and monitoring data.

It creates dashboards with charts, graphs, and alerts from various sources.

Widely used for real-time system and application monitoring.