



THE CMS MONITORING APPLICATIONS FOR LHC RUN 3

B. Jashal, V. Kuznetsov, F. Legger, C. Uzunoglu

On behalf of the CMS Collaboration

REQUIREMENTS





- QUASI-REAL TIME
 - MONITORING
- GENERAL AND DETAILED VIEWS
- SMART ALERT SYSTEM
- HISTORICAL INFORMATION

- USE **COMMON** TOOLS
- LEVERAGE OPEN-SOURCE SOLUTIONS AND IAAS/SAAS
- MINIMISE OPERATIONAL EFFORTS
- IF POSSIBLE, AVOID CUSTOM APPLICATIONS

CMS MONITORING IN A NUTSHELL

Storage metrics - long term

Dataset monitoring

CMS Total Disk Fractions - Countries

32.9%

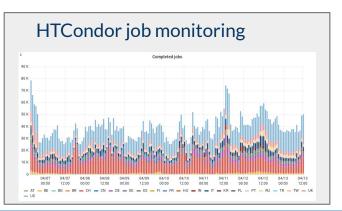
16.2%

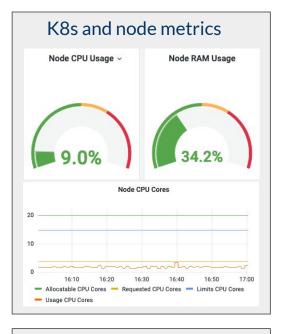






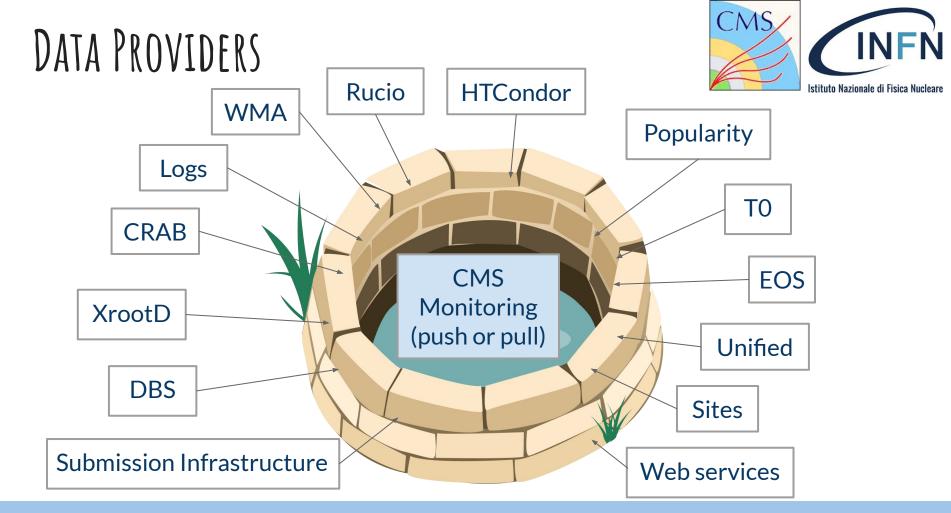






Support for big data analysis HPC, CPU efficiency, Datasets





DATA FLOW

Injection

















Transport

























LOG

















CMS Monitoring







CMS MONITORING INFRASTRUCTURE

Dashboards





CMS Monitoring

CMS Monitoring provides comprehensive information about CMS services and metrics.

We support Data Injection, Data Storage and Data Access into CERN MONIT infrastructure.

Prometheus



Alerts **AlertManager** (HA1)



(HA2) **Dashboard** (HA2)



SNOW Tickets



Documentation Contact Us



https://cms-monitoring.cern.ch/

CMS collaboration ©

We monitor:

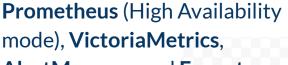
- 20+ k8s clusters
- services on VMs
- 100+ services on k8s
- 150+ alert rules

We manage:

- 8+1 k8s clusters
- **100+ Grafana** dashboards in production (>500 overall)
- **3x500** Billion data points
- 30+ TB of data on OpenSearch
- 45 TB of compressed data on HDFS
- 4-5 M msg/hour to AMQ brokers with 6.5 kHz

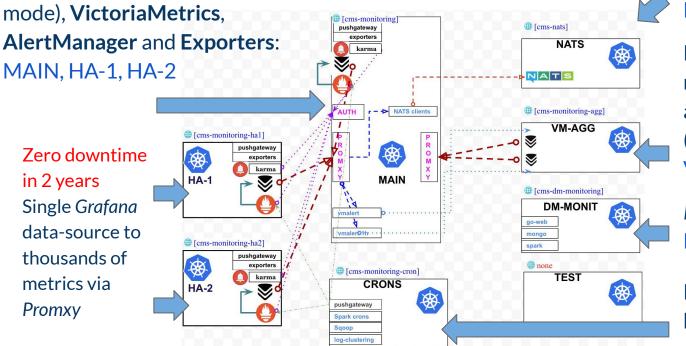
K8S INFRASTRUCTURE





MAIN, HA-1, HA-2

- Zero downtime in 2 years
- Single Grafana data-source to thousands of metrics via Promxy



In-house message broker: **NATS**

Long-term time-series metrics storage for aggregated data: (2xVictoriaMetrics) VM-AGG

Rucio dataset monitoring **DM-MONIT**

Data aggregation/ETL batch jobs (Spark, Sqoop, etc.): CRONS

RUCIO DATASET MONITORING

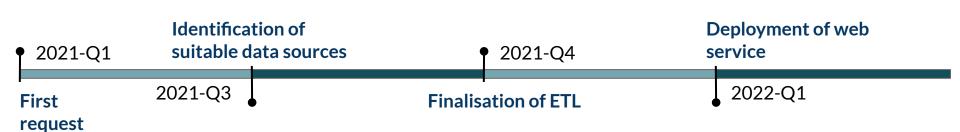




Views:

- Datasets not recently accessed (not read since n months)
- Time-series monitoring of dataset metrics
- Detailed view (tables) of all datasets

Name
Size
RSE
Creation date
Last access



NOT ACCESSED DATASETS







Optimized, sequential and parallel 10+ tables dumps. t<50m











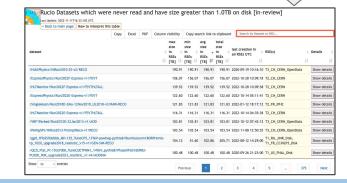






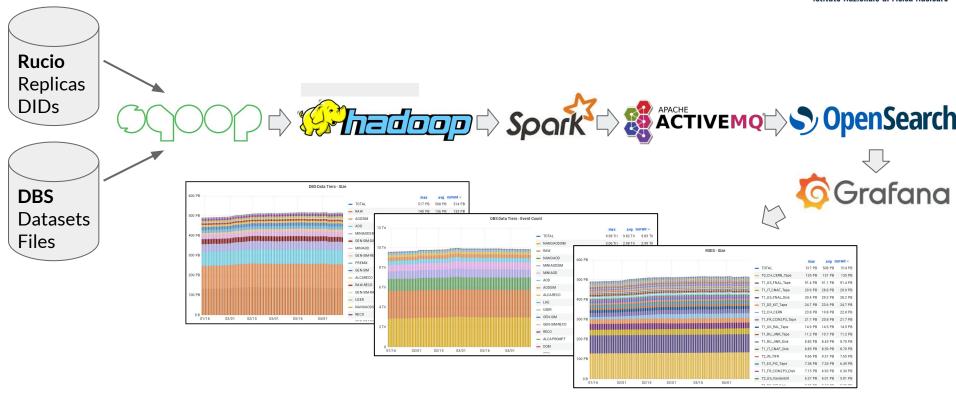






TIME SERIES DATASET MONITORING





TABULAR DATASET MONITORING









DataTables backed by Go web server and REST API for MongoDB

SUMMARY





- CMS Offline and Computing developed a comprehensive monitoring infrastructure
 - Use of common tools and technologies
 - DevOps approach
 - Minimise maintenance and operation tasks
 - Custom applications for specific use cases



WHAT GETS MONITORED GETS IMPROVED

[C UZUNOGLU]