

# DIRAC project at IN2P3

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- ▶ DIRAC was developed 10-15 years ago by the LHCb collaboration for the workload management on the grid
- ▶ Later adopted by several communities
  - ▶ ILC, Belle II, T2K, Bes III, Juno, CTA, Fermi, Pierre Auger, biomed, Geant 4, EGI, France Grilles, GridPP
- ▶ In continuous evolution
  - ▶ New use-cases and infrastructures/technology evolutions
- ▶ DIRAC@IN2P3 project started in 2017 with the focus on the software generalization to accommodate the requirements of several users communities
  - ▶ Federating the effort of French institutes active in DIRAC development and service operation

- ▶ Partners

- ▶ CPPM, CC-IN2P3, LUPM, Creatis/CNRS, University of Bordeaux

- ▶ Monthly teleconferences and 3 F2F per year

- ▶ Project web page

- ▶ <https://forge.in2p3.fr/projects/dirac-in2p3/wiki>

- ▶ Focus on 3 main topics

1. Management of various types of computing resources: HTC, HPC, Cloud
2. Management of complex scientific workflows
3. Management of large datasets for “Big Data” applications

# 1. Computing Resource Management: HTC, HPC, Cloud

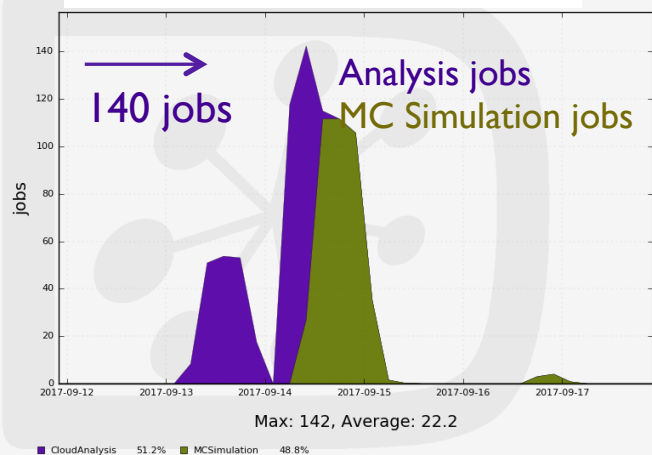
- ▶ HTC resources are routinely used by the DIRAC WMS
  - ▶ Grid resources
  - ▶ Standalone clusters
  - ▶ BOINC Volunteer resources
- ▶ **Main goals**
  - ▶ Improvements with respect to a flexible usage of multi-core queues and queues with special capabilities
  - ▶ Monitoring of the HTC resources availability

- ▶ Unlike grid resources HPC centers are not ‘uniform’
  - ▶ Different access protocols, batch systems, connectivity to outside world
- ▶ HPC resources allow a rich description with respect to traditional grid resources
- ▶ Work in progress
  - ▶ Develop a more elaborated model of their description with the corresponding payload matching mechanisms
  - ▶ Development of the HPC access protocols ( SSH, GSISSH, ARC, OAR, SLURM )
  - ▶ Methods for remote control of user payloads and data at the HPC centers
    - ▶ Site proxy/gateway services
    - ▶ User data import and export
- ▶ Extensive tests on GPU integration for biomedical applications

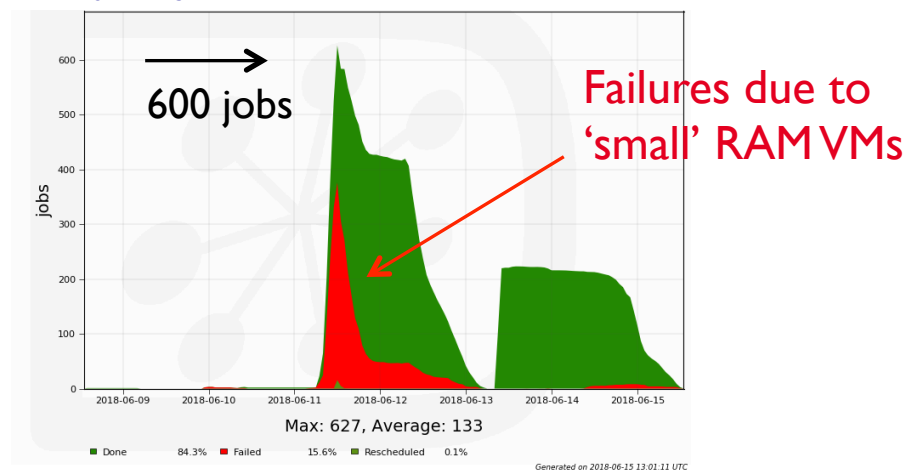
- ▶ VMDIRAC module allows cloud resources integration
- ▶ The goal is 'readiness' for large productions
  - ▶ Extensive tests of VMDIRAC functionalities done using CTA workflows (HNSciCloud and LUPM/CC resources)
  - ▶ Future work on multi-community scheduler enabling fair sharing and opportunistic usage



Jobs on the LUPM Cloud



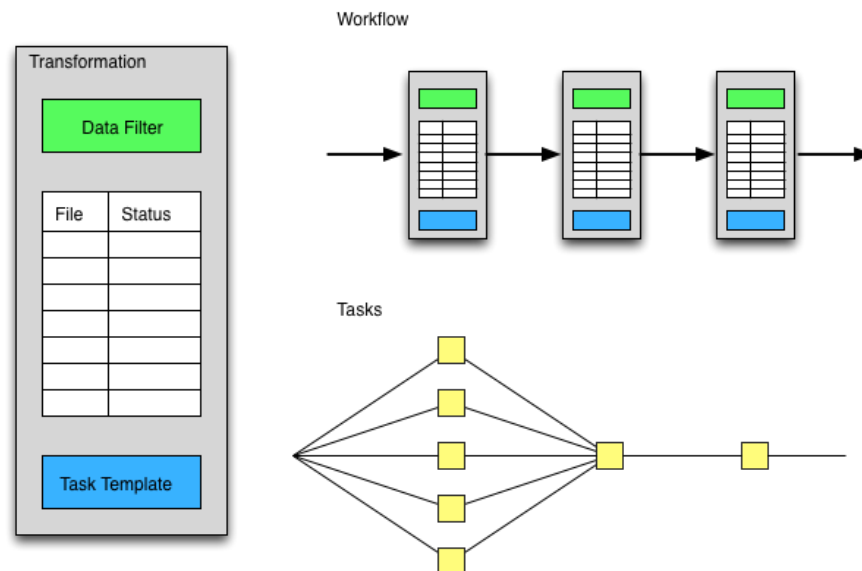
Analysis jobs on a commercial cloud



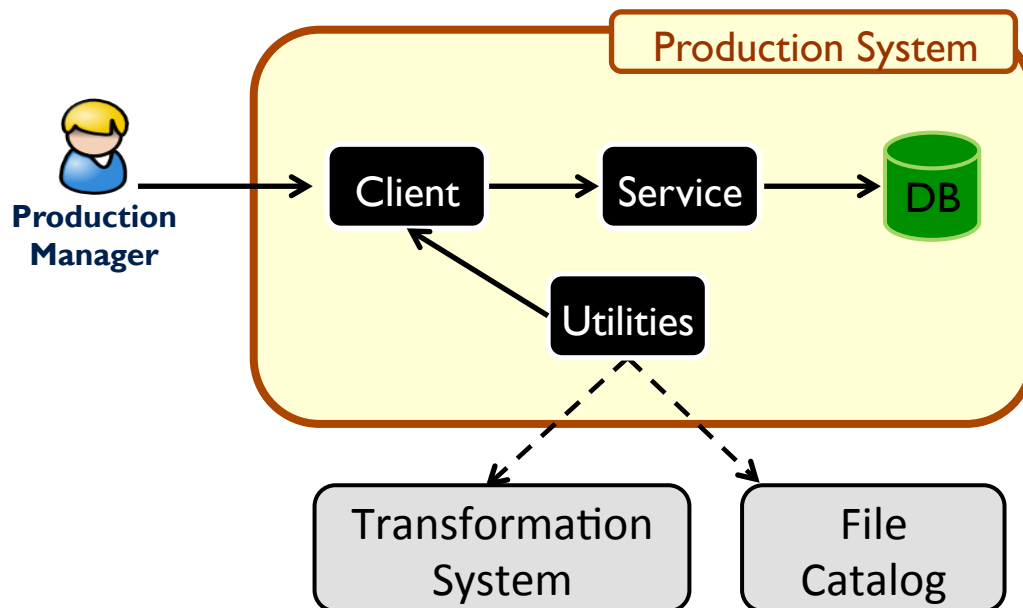
## 2. Data driven Workflow Management



- ▶ Workflow management currently based on the DIRAC Transformation System
  - ▶ A **Transformation** is an input *data filter* + a *recipe* to create jobs
  - ▶ Fully data-driven: jobs are created as soon as data with required properties are registered into the file catalog



- ▶ Managing complex workflow needs further automatization
  - ▶ Chaining several transformations in a data driven manner
- ▶ In 2018: development of a new high-level system ('Production System')
  - ▶ Ready to go in the next DIRAC major release



## 3. Dataset Management

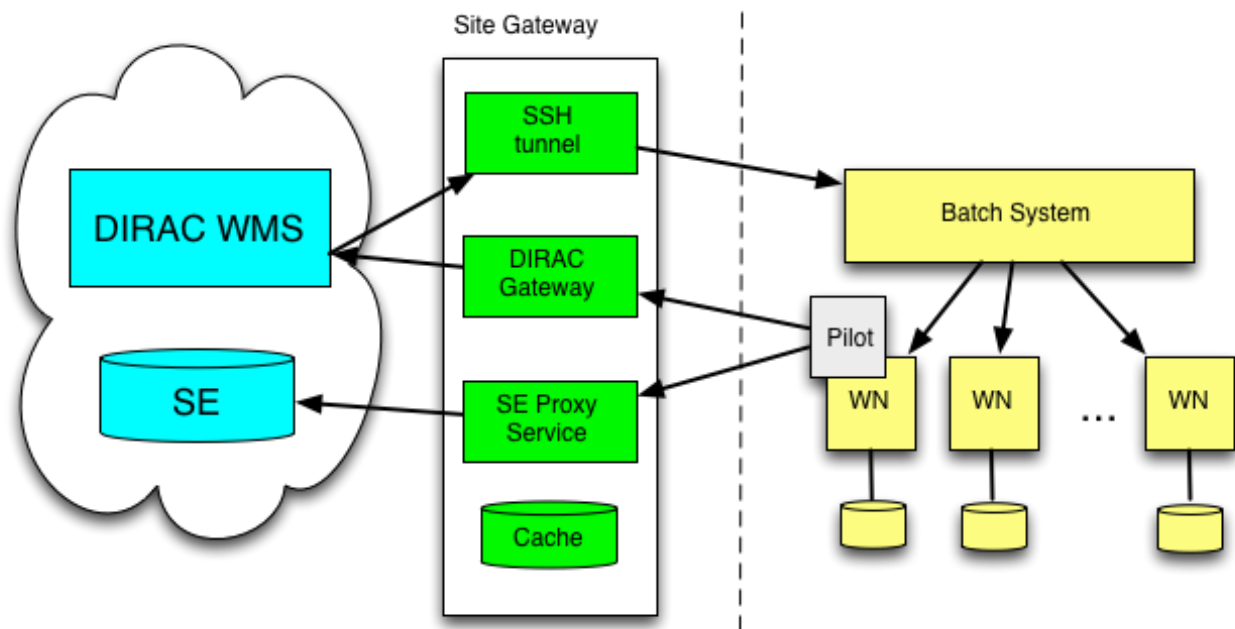
- ▶ Working on the development of the dataset concept
  - ▶ Based on the metadata characterization of user data
  - ▶ Dataset operations
  - ▶ Dataset validation
  - ▶ Dataset integrity verification
- ▶ It will enhance the Data driven Workflow Management

- ▶ DIRAC@IN2P3 allowed very fruitful exchanges of ideas among partners
  - ▶ Accelerated prototyping and development
  - ▶ More solid position of France with respect to the DIRAC Consortium
- ▶ A lot of progress in 2 project main topics
  - ▶ Resource and workflow management
- ▶ Future work will focus on the 3<sup>rd</sup> topic, the “Dataset Management”
- ▶ Proceedings and publications in preparation

# Backup

- ▶ CHEP'2018, ISGC'2018, Grid'2018 Proceedings
  
- ▶ Publications in preparation
  - ▶ DIRAC Transformation System ( state of the art of scientific workflows, DIRAC solution )
  - ▶ DIRAC Metadata system and datasets
  
- ▶ Presentations
  - ▶ Using virtualized computing resources with the DIRAC Interware, A.Tsaregorodtsev, International Symposium on Grids and Clouds, Taipei, Taiwan, 5-10 March 2017
  - ▶ DIRAC Distributed Computing Framework, A.Tsaregorodtsev, International Conference Nordugrid, Tromsø, Norway, 27-30 June 2017
  - ▶ DIRAC services for Grid and Cloud infrastructures, NEC'2017, Budva, Montenegro, 25-29 Sep
  - ▶ Journées Success, L.Arrabito, Grenoble, October 2017

- ▶ Pilot submitted to the batch system through an (GSI)SSH tunnel
- ▶ Pilot communicates with the DIRAC service through the Gateway proxy service
- ▶ Output upload to the target SE through the SE proxy





- ▶ Multi-core job scheduling
- ▶ Pilots with partitionable internal slots
  - ▶ M-core Pilots pull N-core jobs ( $N \leq M$ ) until internal slots used up
  - ▶ Pilot is standard-size, can be whole-node, 4-node, 8-node....
  - ▶ Optimizing CPU efficiency

