

# Running Scientific Applications with DIRAC in Federated Clouds

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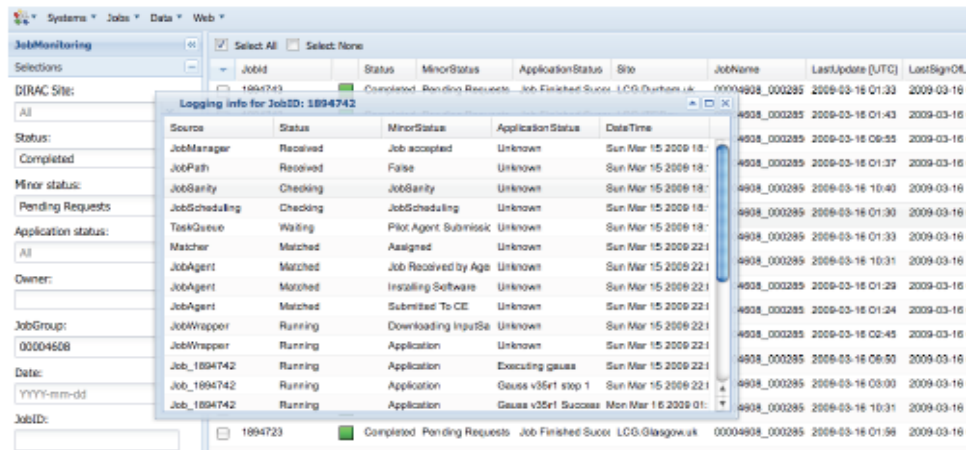
## DIRAC Web Portal

Job Launch Pad

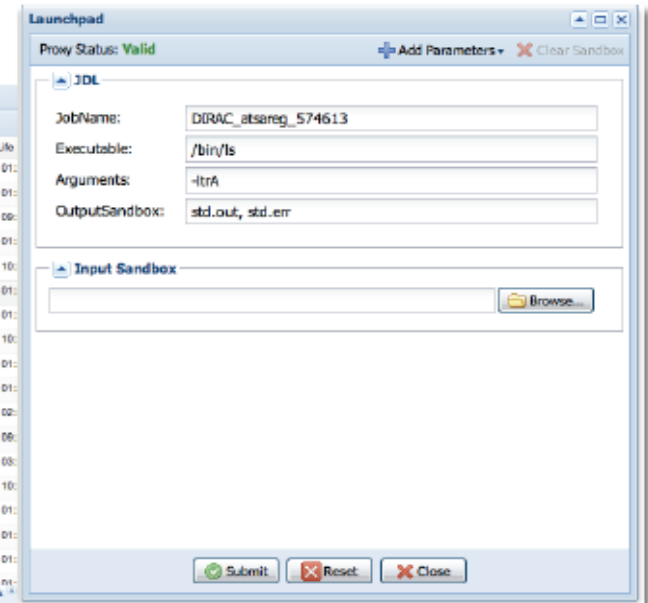
Pilot Management

Job Management

Data Management



Source	Status	MinorStatus	ApplicationStatus	DateTime
JobManager	Received	Job accepted	Unknown	Sun Mar 15 2009 18:...
JobPath	Received	False	Unknown	Sun Mar 15 2009 18:...
JobGarity	Checking	JobGarity	Unknown	Sun Mar 15 2009 18:...
JobScheduling	Checking	JobScheduling	Unknown	Sun Mar 15 2009 18:...
TaskQueue	Waiting	Pilot.Agent.Submitok	Unknown	Sun Mar 15 2009 18:...
Matcher	Matched	Assigned	Unknown	Sun Mar 15 2009 22:1...
JobAgent	Matched	Job Received by Age	Unknown	Sun Mar 15 2009 22:1...
JobAgent	Matched	Installing Software	Unknown	Sun Mar 15 2009 22:1...
JobAgent	Matched	Submitted To CE	Unknown	Sun Mar 15 2009 22:1...
JobWrapper	Running	Downloading InputSe	Unknown	Sun Mar 15 2009 22:1...
JobWrapper	Running	Application	Unknown	Sun Mar 15 2009 22:1...
Job_1894742	Running	Application	Executing gauss	Sun Mar 15 2009 22:1...
Job_1894742	Running	Application	Gauss v35r1 stop 1	Sun Mar 15 2009 22:1...
Job_1894742	Running	Application	Gauss v35r1 Success	Mon Mar 16 2009 01:0...



Proxy Status: Valid

JobName: DIRAC\_atcareg\_574613

Executable: /bin/lis

Arguments: -lra

OutputSandbox: std.out, std.err

Input Sandbox: [Browse...]

Submit Reset Close

Proxy Auth



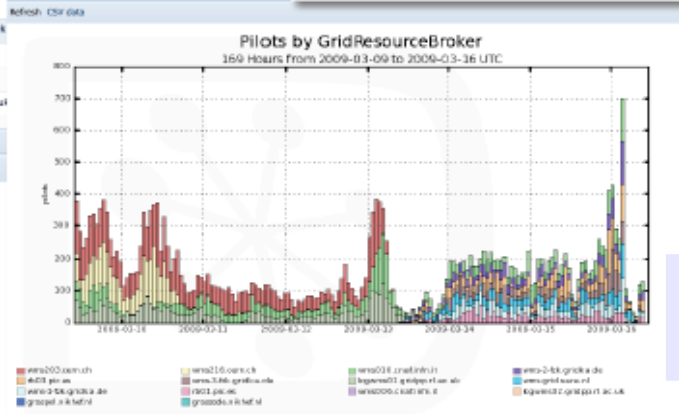
Certificate: [Browse...]

p12 password: [ ]

not keeping neither your private key nor password for p12 file on our server. While we try to make this process as secure as possible by using SSL to encrypt the p12 file with your credentials when it is sent to the server, for maximum security, we recommend that you manually convert and upload the proxy using DIRAC client commands:

```
dirac-cert-convert.sh YOUR_P12_FILE_NAME,p12
dirac-proxy-init -U -g GROUP_NAME
```

Submit Reset Close



Accounting Statistics

- Resilient High-level Layer to provide service delivery and management (VMs):
  - Persistent Configuration: An extension of DIRAC Configuration System
  - VM Manager: Taking statistics of VM status
  - VM Scheduler: Integrated with DIRAC TQ job brokering, or with third party job brokers
  - VM Interface: An extension of the DIRAC Web portal
- Multi-Cloud Low-level layer:
  - OpenNebula OCCI 0.8 and rOCCI 1.1, CloudStack 2, OpenStack nova 1.1 driver, EC2 Amazon
  - Image Context Manager

- Federated Hybrid Cloud Services Low-level layer:
  - V0r9: Federated static info managed by admins at DIRAC Configuration System
    - Image Metadata, IaaS Information
  - Third party VOMS authentication is integrated in DIRAC ( OpenNebula, OpenStack )
  - DIRAC VM monitoring is provided for VOs
  - Third party ganglia monitoring system has been tested for IaaS monitoring of the VMs
  - Next: Accounting

- X509 proxy authentication and authorization transparent for user by the DIRAC user/group system integrating third party VOMS
- DIRAC image setup to run VMs:
  - Ad-hoc image
  - Golden image and dynamic contextualization
    - HEPiX contextualization (OpenNebula, OpenStack)
    - SSH generic contextualization

- VM horizontal auto-scaling setup I:
  - VM allocation policy
    - Elastic: Depending in the work of the DIRAC TQ:
      - CPUPerInstance: VM Scheduler option to balance efficiency and wall time:
        - a) Zero to submit a new VM with no minimal CPU in the jobs of the tasks queue.
        - b) A longer value could be the average required CPU of the jobs as a compromise solution between VM efficiency and total wall time.
        - c) A very large value to maximize the efficiency in terms of VM creation overhead, for the cases where the production total wall time is not a constrain.
      - Static: A constant number of VMs defined by IaaS provider

- VM horizontal auto-scaling setup II:
  - VM stoppage policy:
    - Elastic: VM is automatically stopped by DIRAC if there are no more jobs running in the last VM halting margin time, which is an option to be setup.
    - Never: VMs is not automatically stopped by DIRAC
      - VM is requested to stop by the VO operator or by IaaS provider using DIRAC interface (Web or HEPiX machine features)
      - VM Monitor Agent manages to orderly shutdown

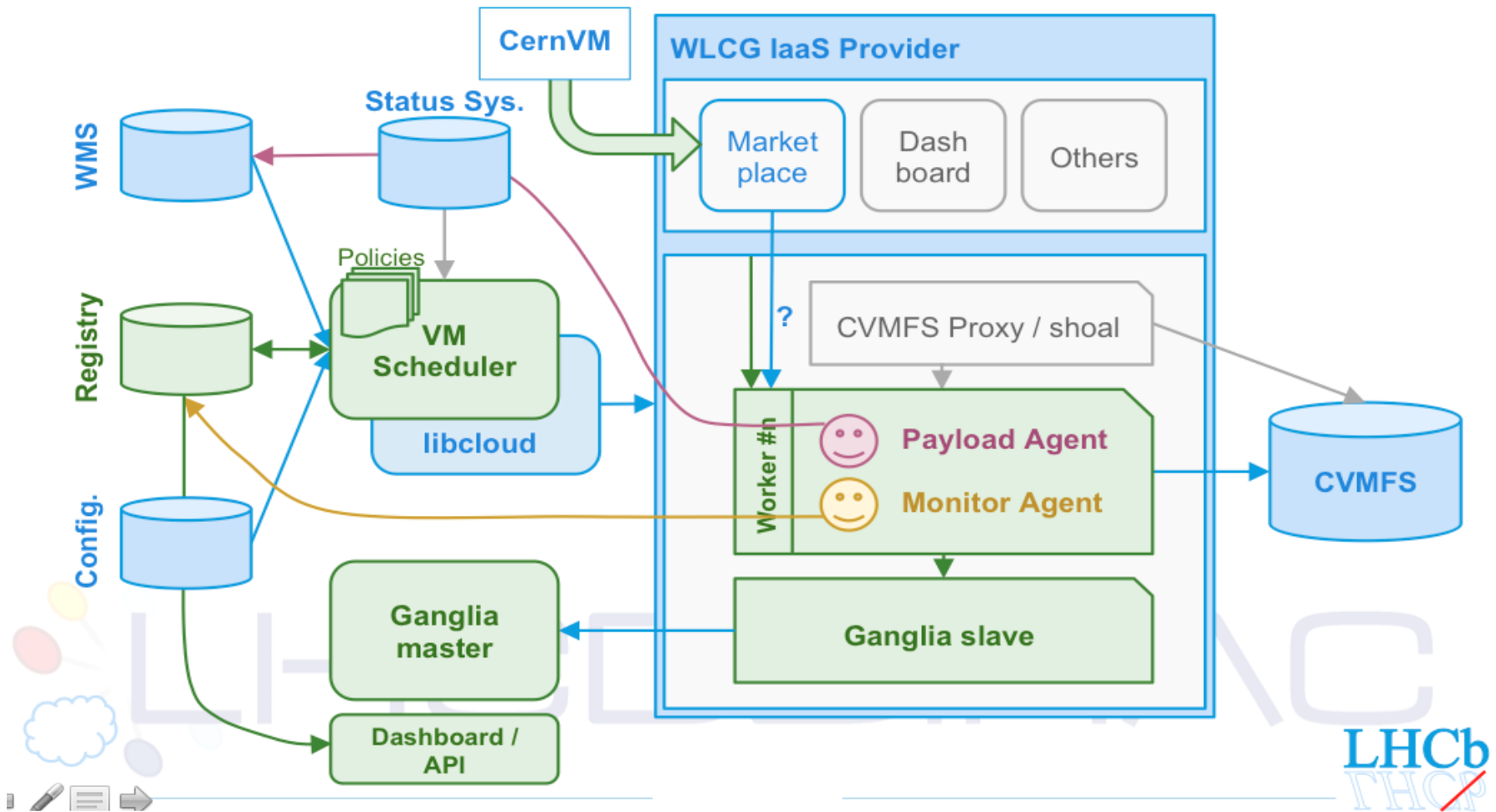
- v1r0: Cloud VM allocation by resource use accounting and top-down resource usage policy
- v1.r1: Integration of the Federated Cloud Accounting Service
- v1.rX: Integration of other Federated Cloud Services: Information System, Federated Market Place
- v1.rX: Cost/Price efficiency integration of commercial and community Clouds



## Cloud Resources in the LHCb computing

- Running on Production at:
  - CERN ( OpenStack )
  - PIC ( OpenNebula )
- Jobs Types:
  - LHCb Monte Carlo Simulations
  - Data processing (LHCb offline)

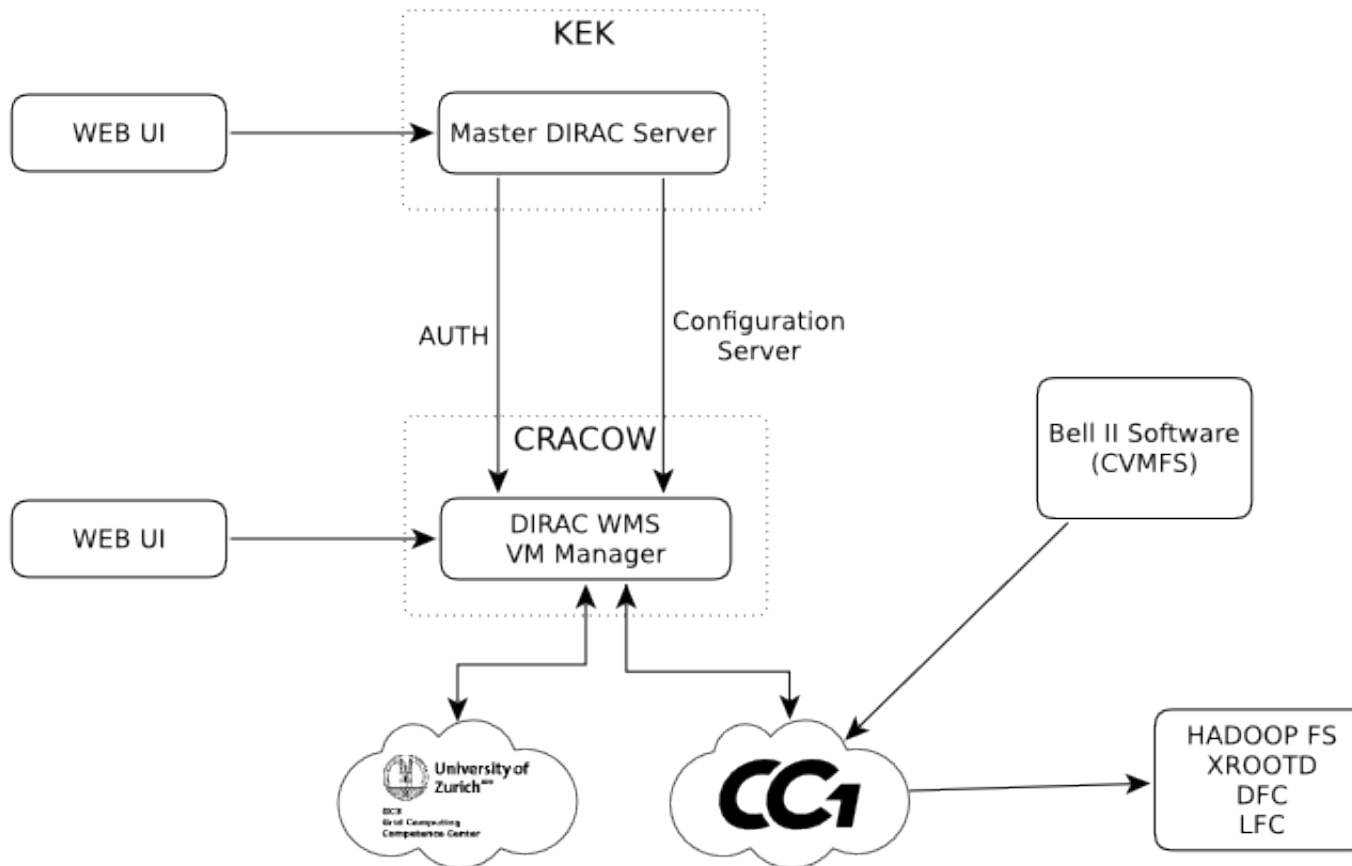
## Cloud Resources in the LHCb computing



## Cloud Resources in the Belle II computing

- Output ROOT files are stored straightly on grid SEs and registered in LFC and Amga metadata catalog (in KEK)
- VMDIRAC is connected to CC1 cloud now by EC2 interface and soon to OpenStack cloud in Zurich
- Testbed successful, going to production in October 2013

## Cloud Resources in the Belle II computing

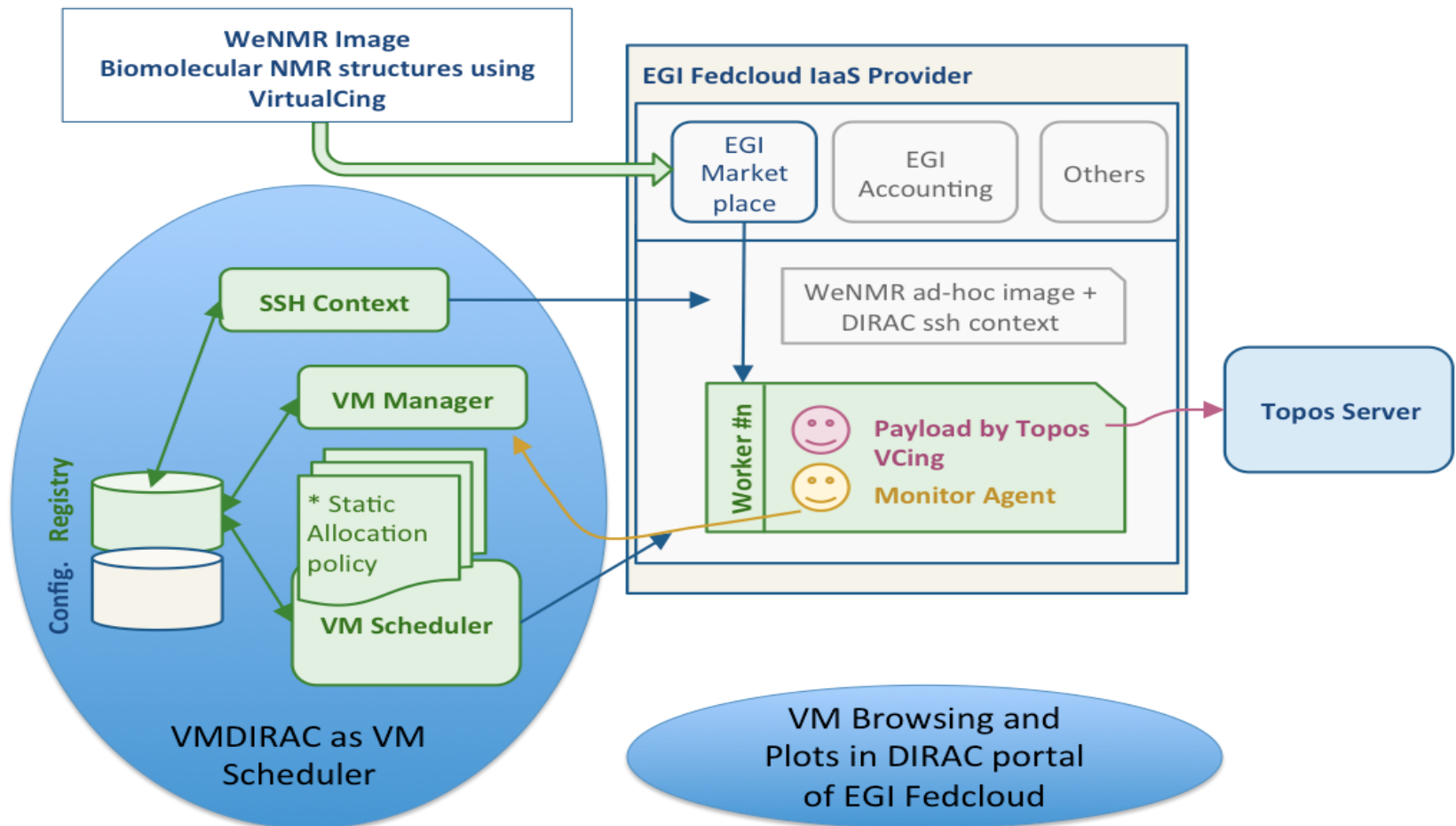


Belle II Cloud scheme courtesy of Rafał Grzymkowski in [CHEP2013](#)

## WeNMR-VMDIRAC EGI Fedcloud Use Case

- Validating and improving **biomolecular NMR** structures using VCing, a suite of ~25 programs
- Demonstrated using **EGI Fedcloud infrastructure**
- **EGI Fedcloud computing model** is moving beyond the frontier, integrating multiple IaaS providers, and deploying necessary services for eScience communities

## WeNMR-VMDIRAC EGI Fedcloud Use Case



## France Grilles Cloud and FG-DIRAC portal

- FG DIRAC portal is supporting different communities, mainly of life sciences
- FG Cloud aggregates multiple IaaS providers, using the FG-DIRAC portal with VMDIRAC server, successful in testbed and now is going to production
- Contextualization is ssh for generic image management, HEPiX with Cernvm can also be used

- VMDIRAC is a proved tool to aggregate IaaS providers in the level of NGIs supporting multiple VOs, and also in medium and big scientific communities
- VMDIRAC provides solutions to SaaS deployment and management in a wide range of scientific communities
- Small communities can be federated to face the DIRAC portal operations (EGI Fedcloud, FG Cloud)



- Medium and big communities may exploit their own DIRAC portal with Cloud resources (LHCb WLCG Clouds, Bell II private Cloud)
- VMDIRAC strategy is addressing sustainability through *industrial concentration* of SaaS management in Federated Hybrid Clouds, at the same time allowing *local development* by the aggregation of distributed IaaS resources



News in  
<https://github.com/DIRACGrid/VMDIRAC/wiki>

Thanks

