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EGI-ACE

EGI Workload Manager service

DIRAC
THE INTERWARE

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Outline

- EGI Workload Manager setup
- Communities
- Resources
- Services
- Interfaces
- Conclusions

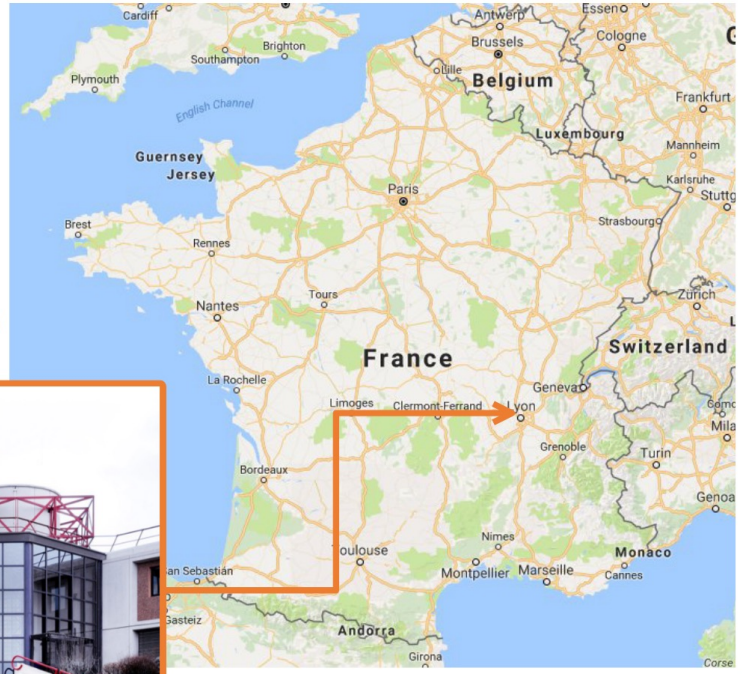
EGI Workload Manager

- EGI Workload Manager is one of the services in the EOSC Marketplace Catalog
  - https://marketplace.eosc-portal.eu/services/egi-workload-manager
  - Managing user jobs running on the EGI computing resources
  - Based on the DIRAC Interware distributed computing framework
  - Development team: CERN, CNRS
  - Hosting: CC/IN2P3, Lyon
  - Operations: CPPM, CC/IN2P3

Hosting at CC/IN2P3, Lyon

CC-IN2P3 at a glance

- Academic data center in Lyon, France
  - Compute (59kslots)
  - Storage (Disk 65 PB, MSS 100 PB)
  - IT services
- LHC Tier-1+ many other experiments (~70)
  - Mainly HEP but not only
- EOSC services hosting
  - Operations portals
  - EGI WMS



Service infrastructure

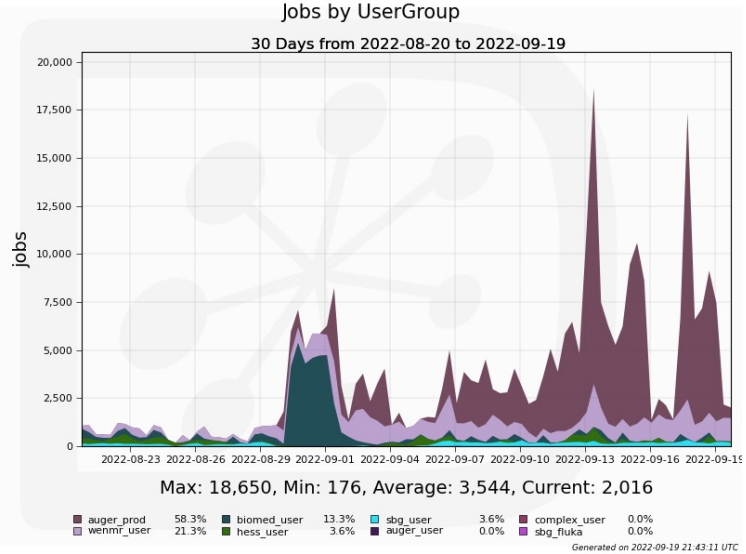
- 10 VM servers
  - Openstack, 8Cores/16GB
- CEPH storage, 20TB
  - Service logs
  - Sandboxes
  - Storage Element service:
    - Failover
    - Tutorials
- MariaDB and Elasticsearch DB services provided by the computing center
- Accessible via the endpoint
  - https://dirac.egi.eu

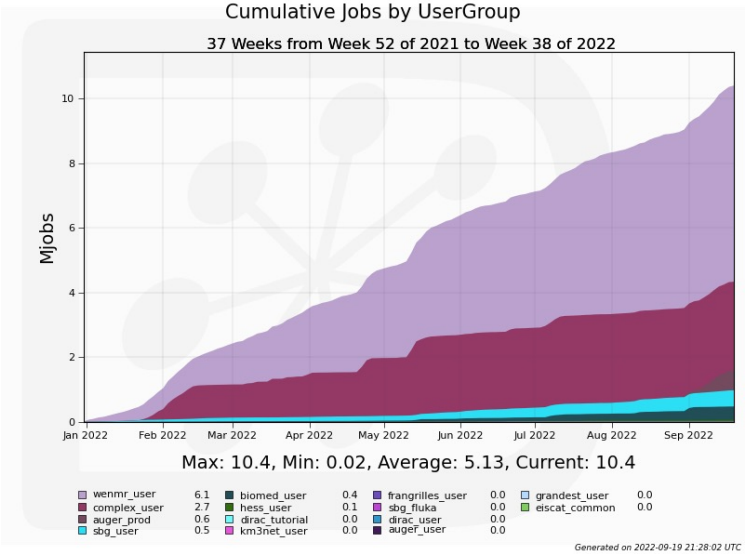
Communities

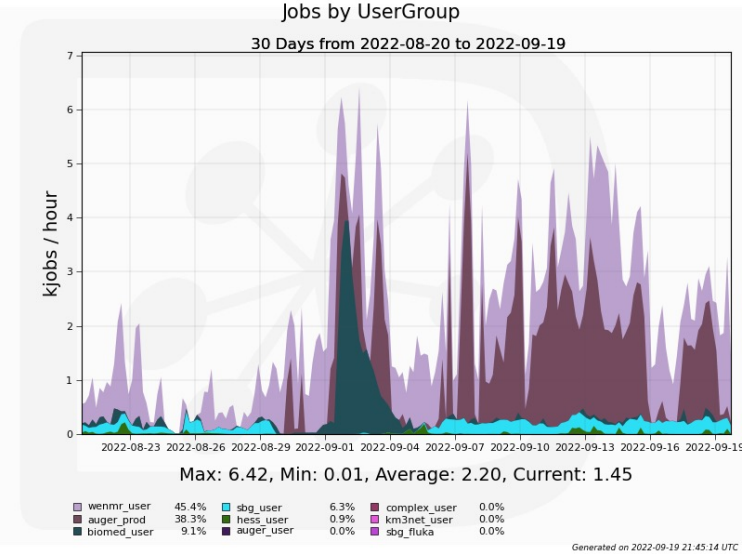
- >40 registered VO's
  - ~15 really active
  - Large collaborations
  - Regional/university communities
- About 700 registered users
  - Many users accessing the service via application web portals

EGI/FG services

- Service running smoothly
  - Since Jan 2022: >10M jobs
- Up to 18K simultaneously running jobs
- Up to 2 Hz job execution rate

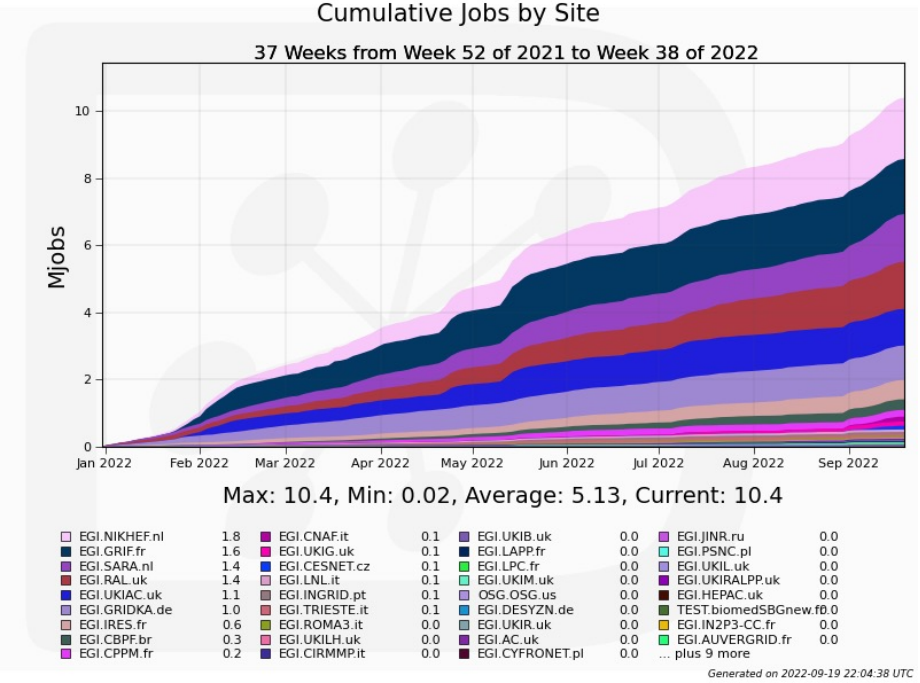






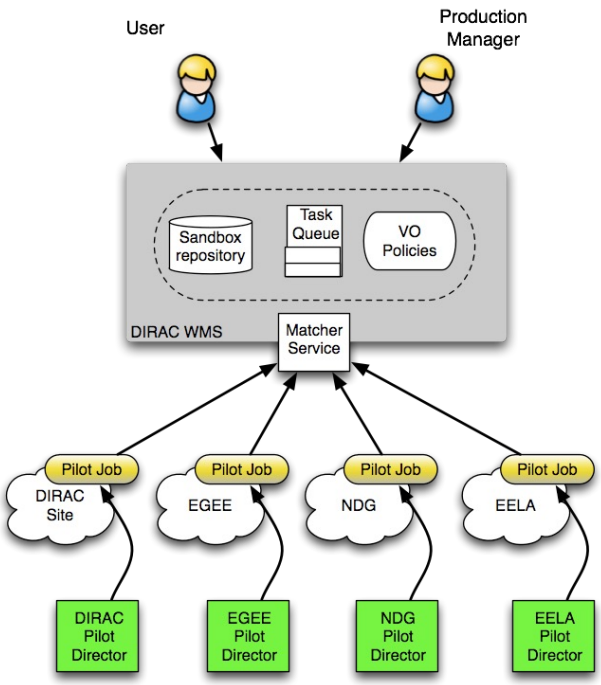
Resources

- ~40 distinct grid sites
- 5 EGI Fedcloud sites
  - Absorbing peaks
- Ongoing work to incorporate HPC resources
  - HPC access development for the LHCb Collaboration at CERN



Services: WMS

- Managing user jobs in a pilot based workload management infrastructure
  - Submission
  - Monitoring
  - Control
- Support for massive job operations
  - Transformation System is provided
    - Several pilot users



Services: DMS

- Support for user's data
- Access to Storage Elements
  - File replicas at ~50 SE's
    - dCache, DPM, iRods, DIRAC
- File Catalog service
  - General File Catalog service
  - Community File Catalogs:
    - Biomed
    - Pierre Auger ()
    - Eiscat 3D

```
Starting EiscatFileCatalog client
FC:/> size -l
directory: /
Logical Size: 88,211,270,880,740 Files: 118652994 Directories: 289197

   StorageElement Size                Replicas
=============================================
 1 EISCAT-disk    88,199,878,745,153 118643555
   Total          88,199,878,745,153 118643555
---------------------------------------------
```

User jobs

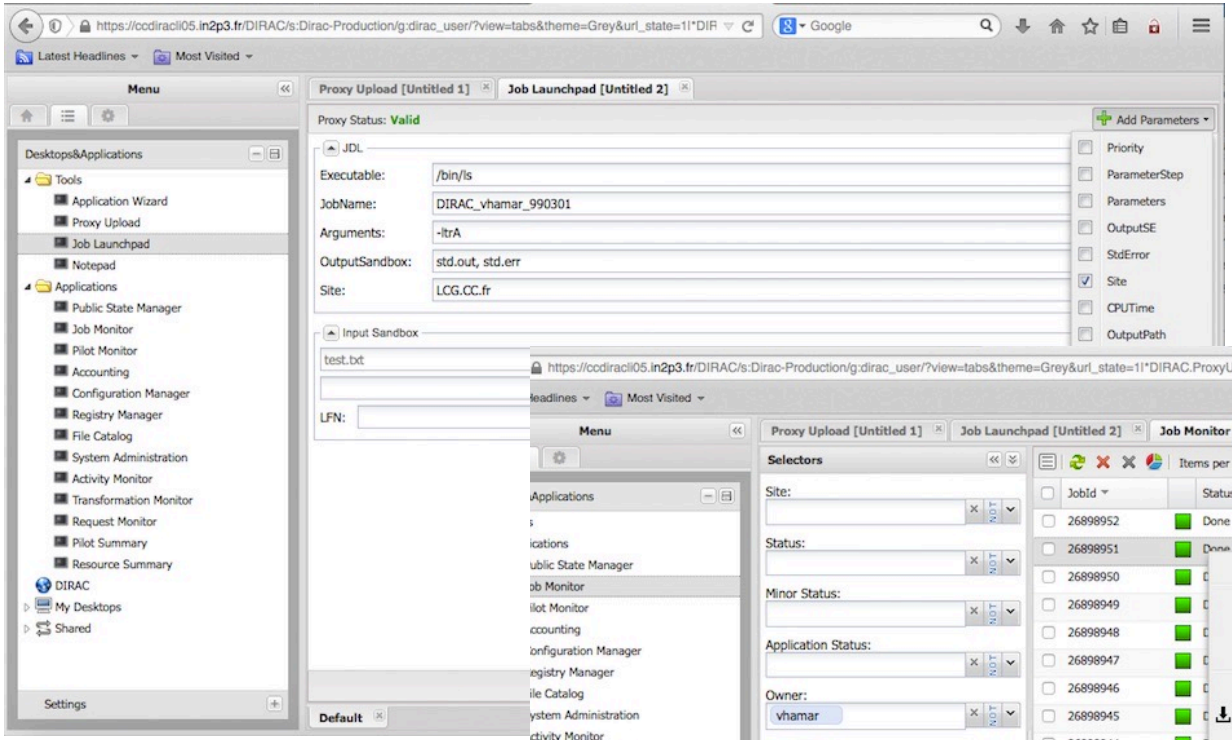
- Users are managing jobs using various tools
  - Command line (batch system like interface):

```
bash-4.2# dsub /bin/echo "Hello world"
53917277
bash-4.2# dstat
JobID     Owner    JobName  OwnerGroup  JobGroup  Site           Status   MinorStatus  SubmissionTime
=============================================================================================================
53917277  atsareg  Unknown  wenmr_user  NoGroup   EGI.NIKHEF.nl  Running  Application  2020-10-22 19:06:24

bash-4.2# doutput 53917277
bash-4.2# ls -l 53917277
total 4
-rw-r--r-- 1 71139 2062 12 Oct 22 19:06 std.out
```

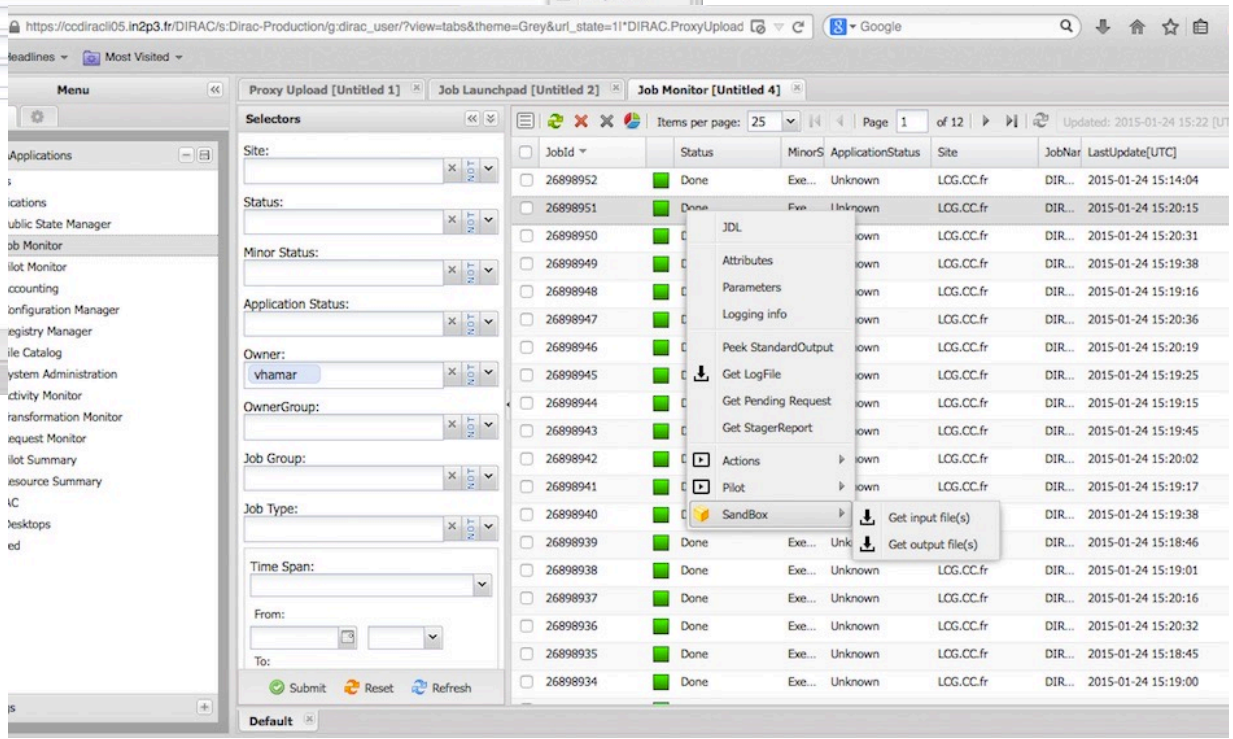
  - Python API
    - Pyhton3 client API is supported
      - Only Python3 starting from DIRAC 8.0

```
from DIRAC.Interfaces.API.Job import Job
from DIRAC.Interfaces.API.Dirac import Dirac

dirac = Dirac()
j = Job()

j.setCPUTime(500)
j.setExecutable('/bin/echo hello')
j.setExecutable('/bin/hostname')
j.setExecutable('/bin/echo hello again')
j.setName('API')

dirac.submitJob(j)
```

Web Interface



Job Launchpad



Job Monitoring

API interfaces

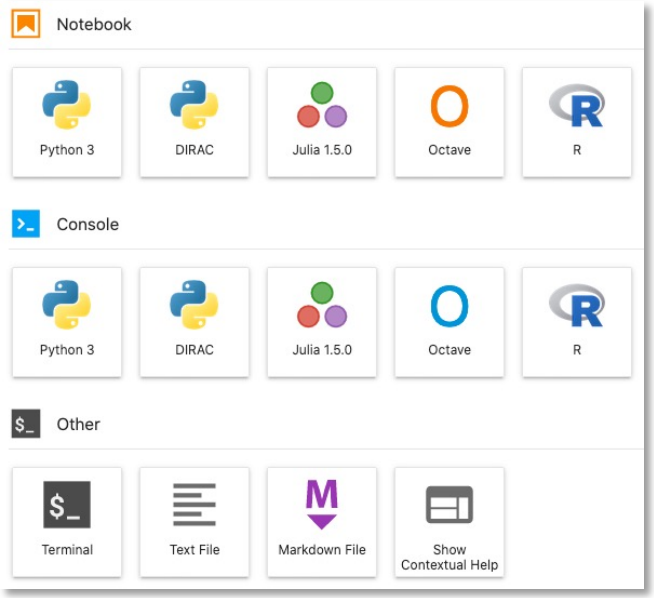
- REST API
  - A language neutral interface for job manipulation
- DIRAC services can be accessed with generic HTTPS requests

```
In [31]: import requests

In [32]: url='https://server:8443/DataManagement/TornadoFileCatalog'
    ...: cert='/tmp/x509up_u1000'
    ...: kwargs={'method':'whoami'}
    ...: caPath='/home/dirac/ClientInstallDIR/etc/grid-security/certificates/'
    ...: with requests.post(url,data=kwargs,cert=cert, verify=caPath) as r:
    ...:     print r.json()
    ...:
{u'OK': True, u'Value': {u'DN': u'/C=ch/O=DIRAC/OU=DIRAC CI/CN=ciuser/emailAddr
Proxy': True, u'validGroup': False, u'validDN': False, u'issuer': u'/C=ch/O=DIR
lUser'], u'identity': u'/C=ch/O=DIRAC/OU=DIRAC CI/CN=ciuser/emailAddress=lhcb-d
38813'}}
```

Jupyter notebooks

- Jupyter Notebook interface
  - EGI notebooks
- DIRAC client available via a mounted CVMFS in a Jupyter console:

  source /cvmfs/dirac.egi.eu/dirac/bashrc_egi
- User credentials obtained with EGI Check-In tokens



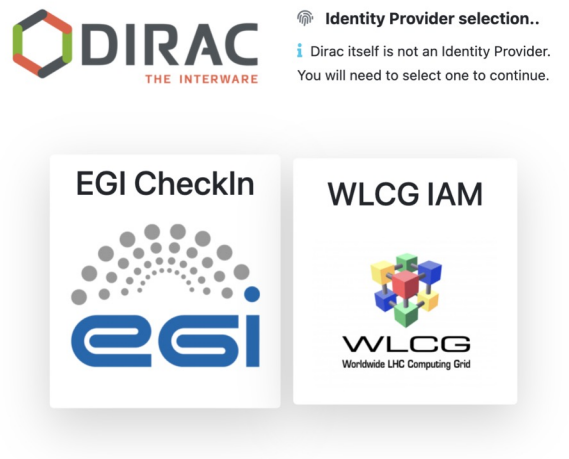
CLI login with tokens

The login with **DIRAC CLI** is as follows:

1 **Initialize authorization flow**

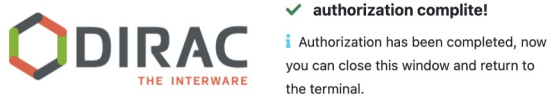
```
$ dirac-login --issuer https://dirac.egi.eu/auth
Use the following link to continue
https://dirac.egi.eu/auth/device?user_code=TRJF-CDQR
```

2 **Authenticate via EGI Check-in in a browser**



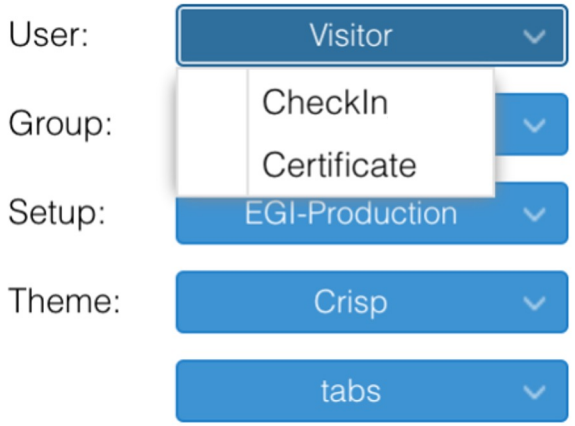
3 **Save the received token (or proxy)**

```
New token is saved to /tmp/bt_u504.
subject       : 22bca818-acea-46bd-b290-c7536c56f962
issuer        : https://wlcg.cloud.cnaf.infn.it/
timeleft      : 01:59:56
username      : atsareg
DIRAC group   : wlcg_user
properties    : NormalUser
```



Web Portal login

- WebApp portal users will be given a choice of authorization method by selecting a certificate or identity provider



AAI developments

- Pilot Job submission with tokens
  - Demonstrated for both HTCondorCE and ARC7 using the DIRAC Pilot Factory
  - Should be integrated with the TokenManager
- Developing a solution compatible with various IdPs
  - Check-In, WLCG IAM, DIRAC Registry
  - Define rules for mapping the AS scopes/capabilities onto DIRAC groups
- Integration with the RCAuth service
  - Provisioning of certificate proxies on the fly based on the OIDC tokens authentication
  - Users will not need X.509 certificates any more (is it a dream ?)
    - Certificates are still needed currently
- Services to support tokens usage for different purposes (TokenManager, Registry)
  - Pilot framework
  - Asynchronous operations

DIRAC client installation

- Several methods to install the DIRAC client software on user workstations/laptops (Linux flavors)
  - No **dirac-install** custom installer any more
  - **Docker** container (Linux, MacOS)
    - docker run -it -v $HOME:$HOME -e HOME=$HOME diracgrid/client:egi
  - **CVMFS** client installation (Linux) - prefered
    - source /cvmfs/dirac.egi.eu/dirac/bashrc_egi
    - bashrc_egi_py2 for Python2 environment (legacy)
  - **DIRACOS2** for Python 3 installations (Linux, MacOS)
    - Setting up conda environment with all the required packages (conda-forge)
      - Single self-extracted archive executable
    - Install DIRAC with ***pip install***
    - *https://dirac.readthedocs.io/en/latest/UserGuide/GettingStarted/InstallingClient/index.html*

Documentation

The main DIRAC documentation:

https://dirac.readthedocs.io/en/latest

User, Administrator and Developer guides

Tutorials:

https://github.com/DIRACGrid/DIRAC/wiki/DIRAC-Tutorials

https://github.com/DIRACGrid/COMDIRAC/wiki

Conclusions

- The EGI Workload Manager service is providing reliable access to EGI computing and storage resources
- It is used by multiple communities and individual users with very different scenarios
- The DIRAC software used by the EGI WM is constantly evolving to cope with the new emerging computing technologies and provide users with a most efficient and comfortable environment

http://diracgrid.org

Acknowledgements

- This work is co-funded by the EOSC-hub project (Horizon 2020) under Grant number 777536
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- France-Grilles community, FG-DIRAC service admins,
- FG animation team.
- Experiences cited in use cases

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Backup slides

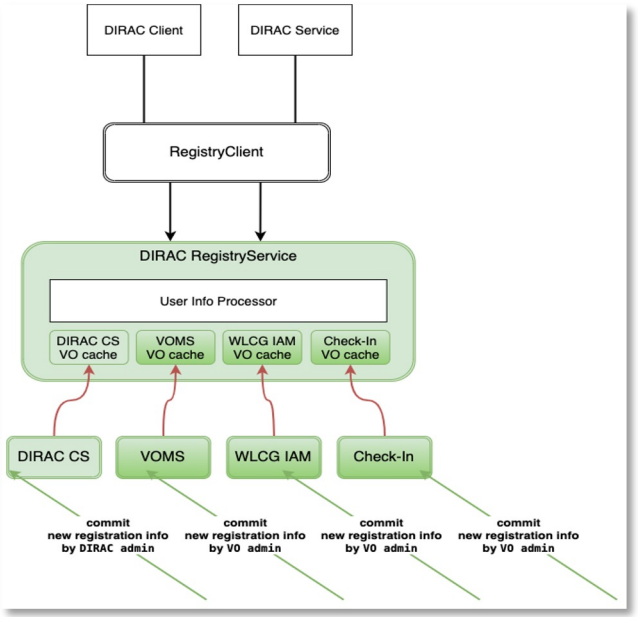
SSO solutions

- There are multiple examples of SSO solutions

- AAI service are based on OAuth2/OIDC technologies
  - Handling user identities
  - Managing user communities
  - Managing delegations of users rights in a distributed environment

DIRAC AAI solution

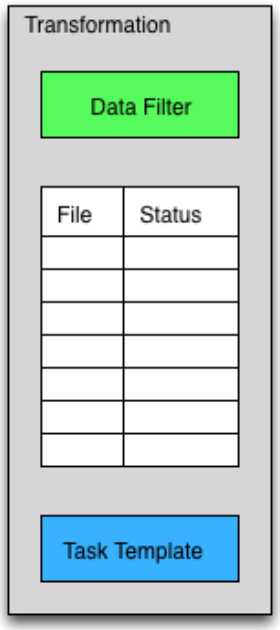
- Single solution for various Identity Providers (IdP)
  - EGI Check-In, (WLCG) Indigo AIM, etc
- Community management is fully done on the side of Identity Provider
  - Similar to VOMS
  - Defining user groups/roles/scopes
- DIRAC keeps a cache of user data dynamically updated from the IdP information
  - Including mapping of user roles onto the DIRAC groups
- Access control to DIRAC services is defined by the user DIRAC group
- TokenManager service to provide tokens to asynchronous operations
- The solution is now (partially) in certification for the next DIRAC release 8.0

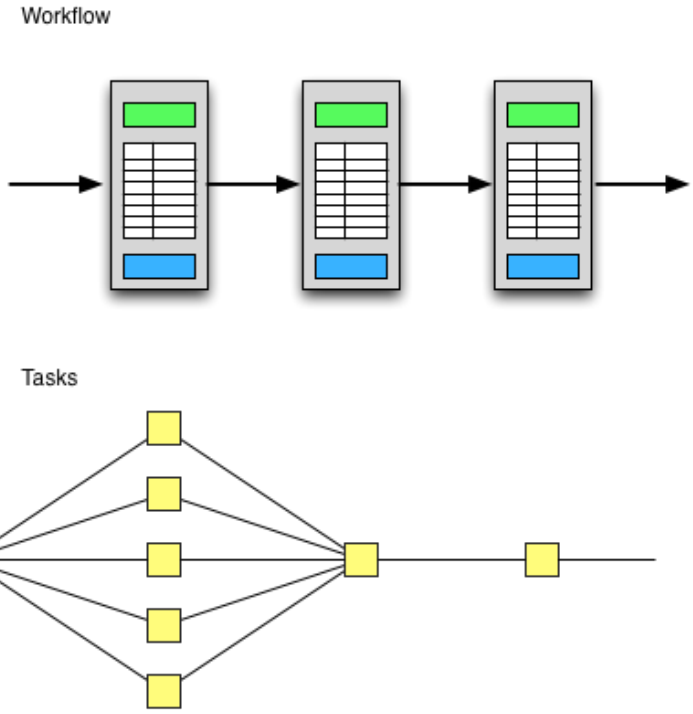



```
training_pilot
    Users = alitov, atsareg, vmendez
    Properties = GenericPilot, LimitedDelegation,
    VO = training.egi.eu
    VOMSRole = /training.egi.eu
training_user
    Users = alitov, atsareg
    Properties = NormalUser
    JobShare = None
    AutoUploadProxy = True
    VO = training.egi.eu
    VOMSRole = /training.egi.eu
```

Transformation System for data driven workflows

- Data driven workflows as chains of data transformations
  - Transformation: input data filter + recipe to create tasks
  - Tasks are created as soon as data with required properties is registered into the system
  - Tasks:
    - Jobs submission
    - Data replication, removal
    - *etc*

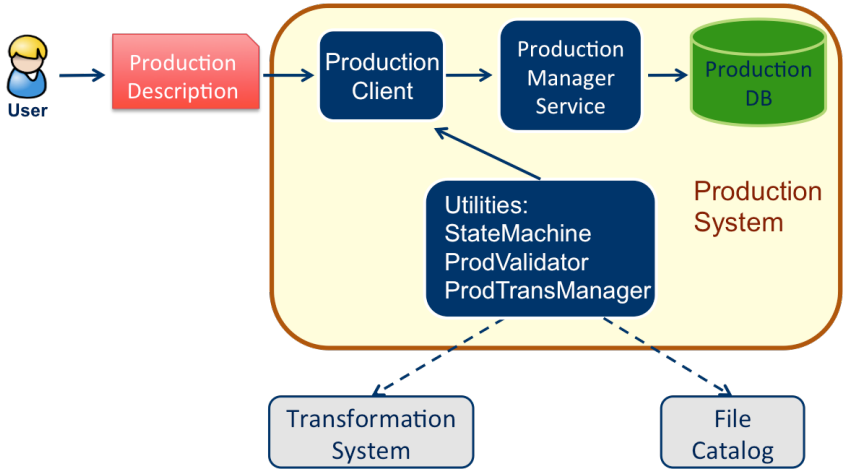




- Transformations can be used for automatic data driven bulk data operations
  - Scheduling RMS tasks
  - Often as part of a more general workflow

Production System

- TS automatizes a single step of workflow execution
  - Need to monitor dozens of transformations at once
  - Manual transformation definition is error prone
- LHCb, ILC, Belle II developed specific Production Systems on top of the TS
  - Found many commonalities



- Production System to help transformations management
  - Automatic transformation instantiation based on the production definition
  - Fully data-driven
  - Transformation are connected via "links" – metadata queries
- Part of the DIRAC distribution
  - In use by the CTA Collaboration