DIRAC Computing Resources

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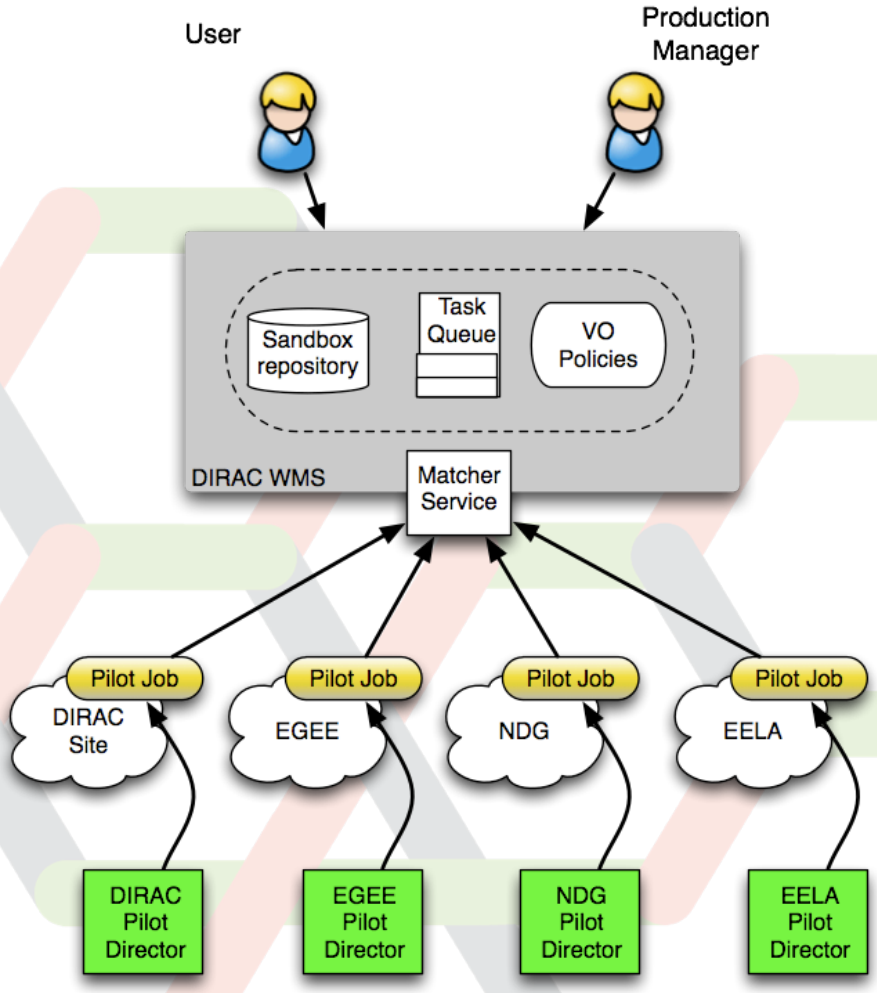
DIRAC
THE INTERWARE

Outline

- Pilot based WMS
- Grids
- Clusters
- PCs
- Desktop Grids
- Clouds

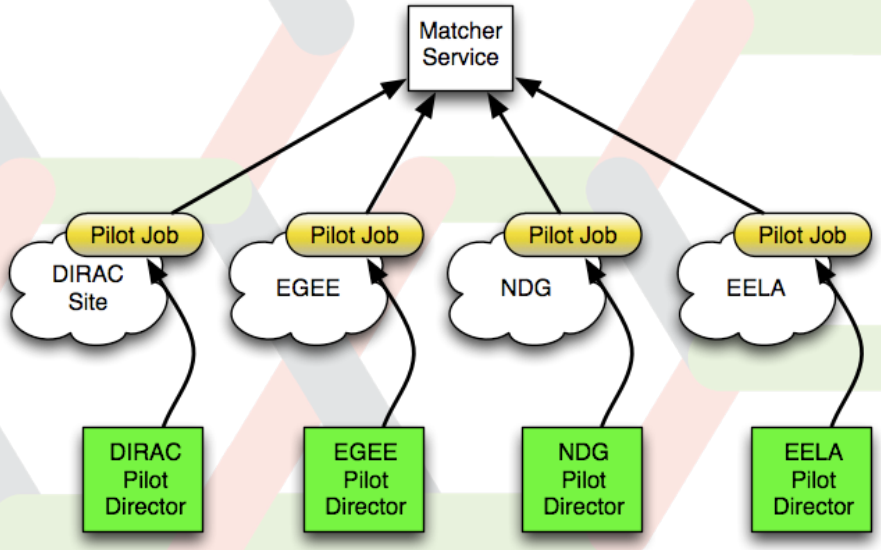
DIRAC WMS

- Jobs are submitted to the DIRAC Central Task Queue with credentials of their owner (VOMS proxy)
- Pilot Jobs are submitted by specific Directors to a Grid WMS with credentials of a user with a special Pilot role
- The Pilot Job fetches the user job and the job owner's proxy
- The User Job is executed with its owner's proxy used to access SE, catalogs, etc



WMS: using heterogeneous resources

- Including resources in different grids and standalone clusters is simple with Pilot Jobs
  - Needs a specialized Pilot Director per resource type
  - Users just see new sites appearing in the job monitoring

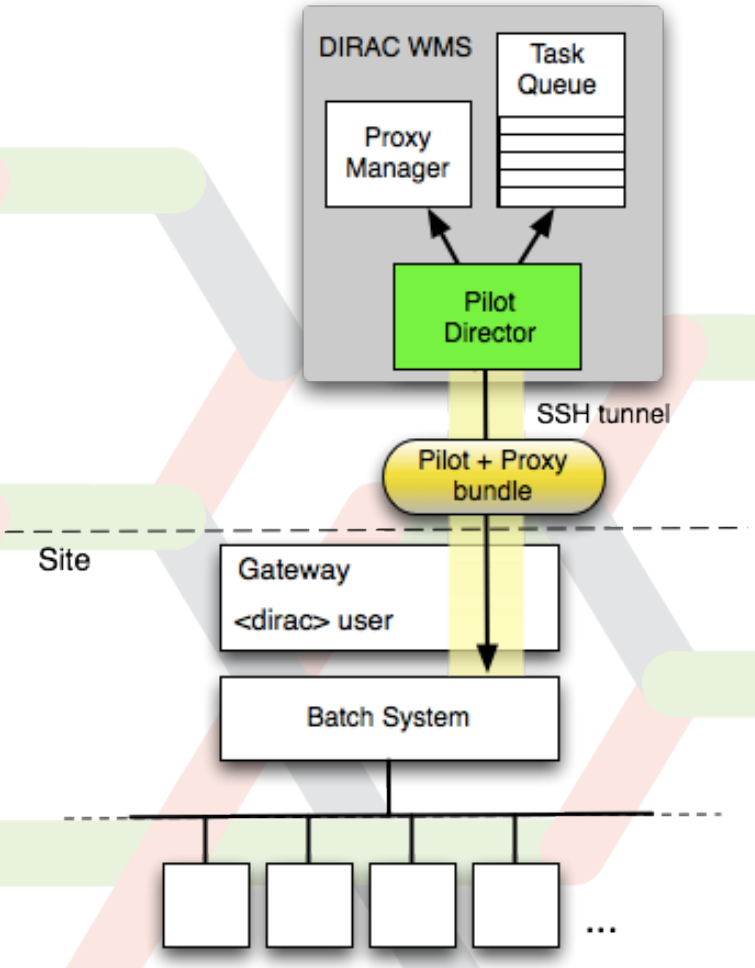


Computing Grids

- DIRAC was initially developed with the focus on accessing conventional Grid computing resources
  - WLCG grid resources for the LHCb Collaboration
- It fully supports gLite middleware based grids
  - EGI, GISELA, etc
    - Using gLite WMS or accessing CE's directly
  - OSG, e.g. ILC/CLIC has resources in OSG
- Negotiations are in progress to support ARC middleware based grids
  - NorduGrid
  - A successful demonstration was already done in the past
- Other types of grids can be supported
  - As long we have customers needing that
- DIRAC is providing alternative WMS for grid infrastructures
  - Architecture confirmed by the HEP experience
  - Now available for any grid user

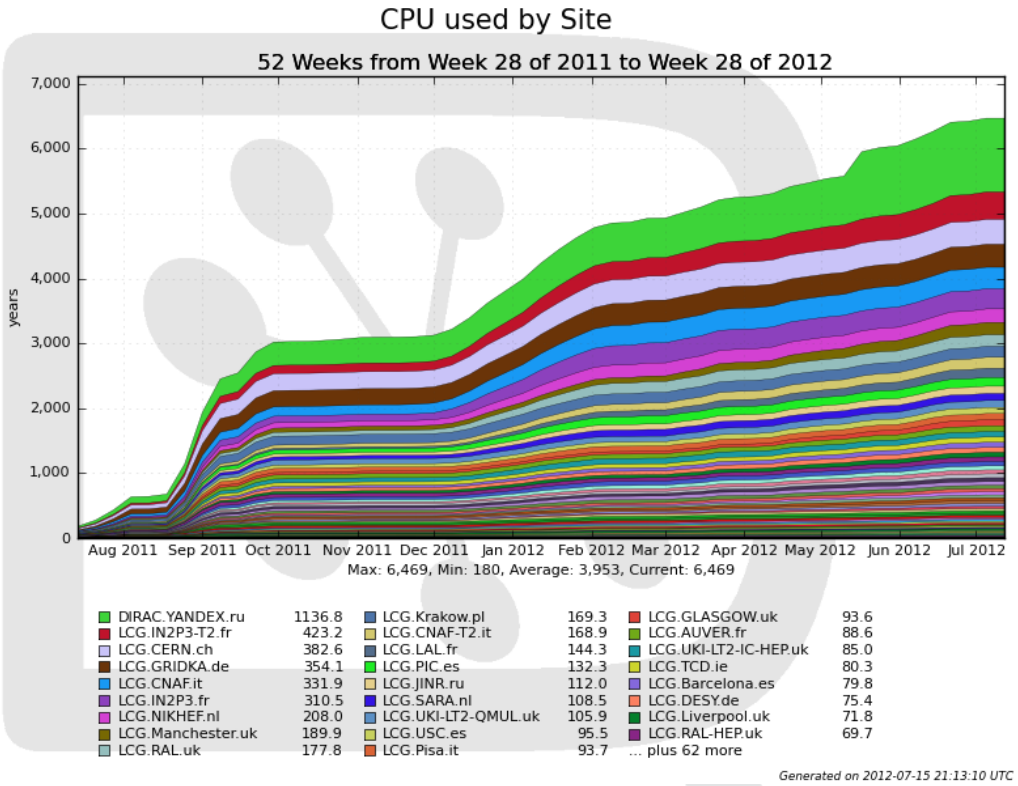
Standalone computing clusters

- Dedicated Pilot Director per group of sites
- Off-site Director
  - Site delegates control to the central service
  - Site must only define a dedicated local user account
  - The payload submission through the SSH tunnel
- The site can be a single computer or a cluster with a batch system
  - LSF, BQS, SGE, PBS/Torque, Condor
  - More to come:
    - OAR, SLURM, LoadLeveler. etc
- The user payload is executed with the owner credentials
  - No security compromises with respect to external services



Standalone computing clusters

- Example: DIRAC.Yandex.ru
  - 1800 cores
  - Torque batch system, no grid middleware
  - Second largest LHCb MC production site

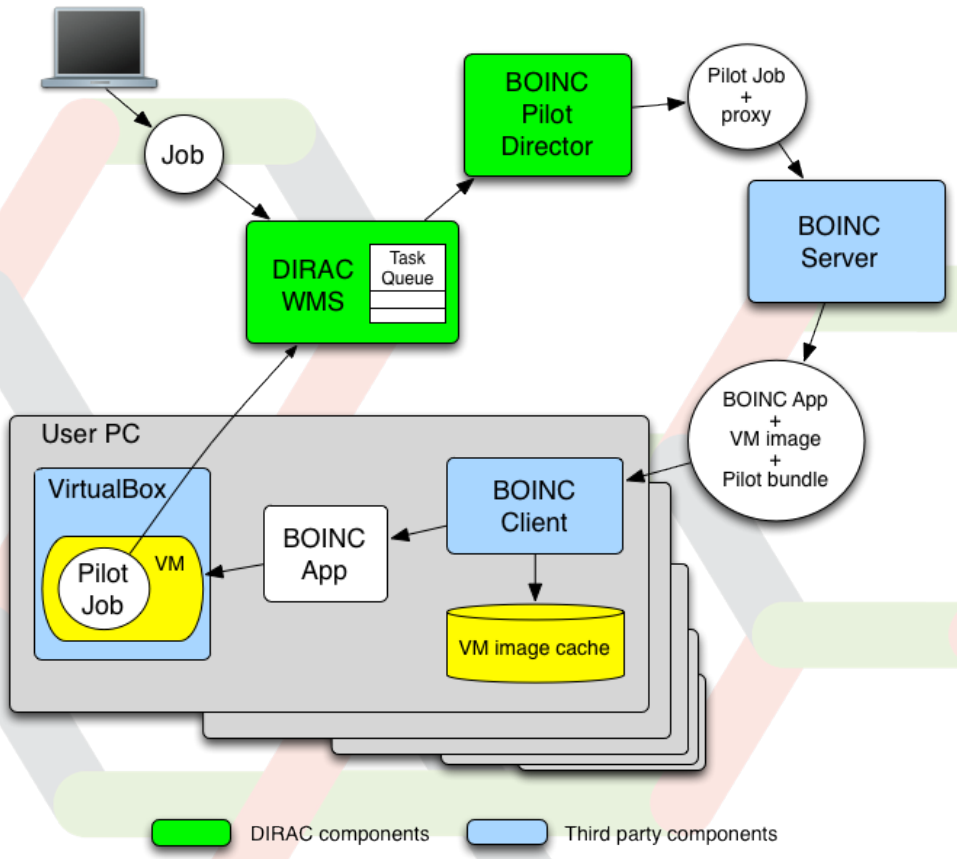


SSH sites

- SSHComputingElement (*L.Dimitriu*)
  - Multiple IP addresses can be specified
  - Number of slots per IP can be specified
  - Share the same access credentials
    - Public key
- Allows to create a computing cluster even without a batch system
- Can be useful together with Cloud resources:
  - VMs are often accessible with public ssl keys

BOINC Desktop Grids

- Campus desktop grid (J. Wu)
- On the client PC the third party components are installed:
  - VirtualBox hypervisor
  - Standard BOINC client
- A special BOINC application
  - Starts a requested VM within the VirtualBox
  - Passes the Pilot Job to the VM and starts it
- Once the Pilot Job starts in the VM, the user PC becomes a normal DIRAC Worker Node

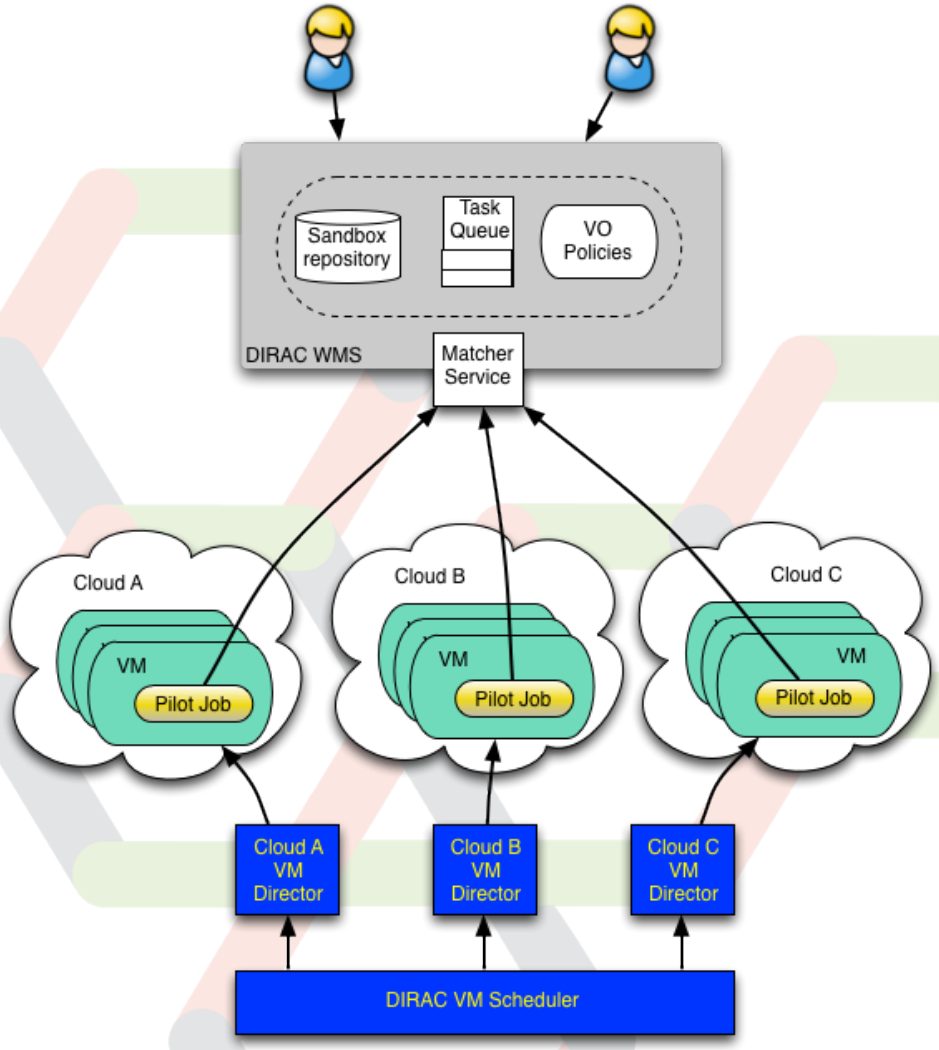


EDGI

- EDGI since recently provides volunteer grid resources with virtualization of the client machines
  - Similar to the BOINC+VirutalBox schema above
  - Up to 3000 cores available for the biomed applications
- In a move to ensure interoperability with EGI, EDGI is providing a special Computing Element with CREAM interface
  - This makes possible to interface to DIRAC WMS with direct submission using standard CREAM ComputingElement component
  - This is in the test now

Clouds

- VM scheduler developed for Belle MC production system
  - Dynamic VM spawning taking Amazon EC2 spot prices and Task Queue state into account
  - Discarding VMs automatically when no more needed
- The DIRAC VM scheduler by means of dedicated VM Directors is interfaced to
  - OCCI compliant clouds:
    - OpenStack, OpenNebula
  - CloudStack
  - Amazon EC2



Conclusions

- WMS with Pilot Jobs offers a simple and efficient mechanism to provide heterogeneous resources transparently to users
- New resource types beyond conventional grids are becoming available
- The inclusion of new resources is driven by the needs of the DIRAC users