Pilots 2.0: DIRAC pilots for all the skies

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On behalf of the DIRAC consortium and the LHCb collaboration
History class
(with possibly an LHCb bias)
We didn’t have a big variety of resources:
- WLCG sites - AKA the "Grid"
  - EDG, EGEE, EGEE-II, EGEE-III, EGI, EMI, EMI2, EMI3...

Submitting Jobs (from a central queue) to:
- The LCG resource broker (aka WMS): a queue for dispatching to
- CEs (LCG, then CREAM): a queue for dispatching to
- Batch queues in front of the WNs
- Finally, running on a WN

› Number of queues: 4

- LCG inefficiencies exposed to end users
- High load on LCG brokers

› So, pilot jobs came
Some time ago

Pilot jobs came also because **VOs** wanted their "own" machines for their Grid jobs

- Or, at least, to privatize them for some hours

Pilot jobs became the first way of privatizing grid **WNs**:

- set the environment
- install the middleware

- (LHCb)DIRAC: installed in every job via the pilot jobs (wget)
- Application software: installed with SAM jobs
Agents form an overlay layer hiding the underlying diversity.

Let’s (in 2015) substitute the word “agent” with the word “pilot”.

A. Tsaregorodtsev, CHEP 2006, DIRAC presentation
A DIRAC pilot has, at a minimum, to:
- install DIRAC
- configure DIRAC
- run and agent: the “JobAgent”
  - That fetches (matches, in fact) a job from the central jobs queue
    ➡ Or, more than one job only

In DIRAC, a pilot has to run on each and every computing resource type.

Agents Pilots form an overlay layer hiding the underlying diversity
- ...or not?
  ➔ Well, not completely… until Pilots 2.0
More recently

Many LHC and non-LHC communities started having quite some variety of resources

- **WLCG sites**
  - CREAM CE: direct pilot jobs submission
    - and no more central brokers are needed \( \Rightarrow \text{one less queue} \)
  - But also other CEs, e.g. ARC CEs are a popular choice among sites

- **WNs** are VMs that the experiment provides on VAC, Cloud
  - VAC: an IAAC
  - Cloud: an IAAS
  - Condor-based systems

- **Various forms of opportunistic computing**
  - HLT farms
    - Some experiments made a cloud, other (i.e. LHCb not)
  - (HPC) opportunistic sites
    - Usually, not used as real HPC, anyway...
  - BOINC
    - both IAAS and IAAC

It seems like the grid is not anymore “The Grid”

Heterogeneity is the norm
Exercise: monitoring of pilots as example of heterogeneity

- Exercise: get the Logging Info of the pilot
  - LCG: edg-job-logging-info -v 2 --noint <ref>
  - gLite: glite-wms-job-logging-info -v 3 --noint <ref>
  - CREAM: glite-ce-job-status -L 2 <ref>
  - ARC: a feature request
  - DIRAC CEs: ...nope
  - CLOUDs: depends from cloud to cloud and from what you expect
  - BOINC: NA
  - HLT: ...not?
  - Opportunistic: ...
  - ... resources of tomorrow: ??

So, we can keep adding support for each and every type of resources, or

⇒ we can just embed this functionality in the pilot

- 2nd exercise: get the log output file
  - Same story as above!
Pilots 2.0 as overlay layer
A pilot is what creates the possibility to run jobs on a worker node.

- A pilot 2.0 is a standalone script
- Can be sent, as a “pilot job”
  - To all “Grid” CEs
- Can be run as part of the contextualization of a VM
  - Or on an HPC machine
  - Or on a …whatever machine
- Can run on every computing resource, provided that:
  - Python 2.6+ on the WN
  - It is an OS onto which we can install DIRAC
Pilots running everywhere

- The same pilot used everywhere

Computing Resources

- Opportunistic
- (volunteer) PCs

Pilots

- Grid
- VAC
- CLOUD
- HLT
A toolbox of pilots capabilities (that we will call "commands") is available to the pilot script.

Each command implements a single, atomic, functions, e.g.:

- Run an environment test
- Install DIRAC (or its extension)
- Configure DIRAC
- Run the JobAgent
- Run monitoring thread
- Report usage
- ... and whatever it is needed

- Communities can easily extend the content of the toolbox, adding more commands
- If necessary, different computing resource types can run different commands
  - All configurable
LHCb pilots 2.0
Pilots 2.0 can be easily extended

- **LHCb requirement: CVMFS**
  - For the distribution of all LHCb software, including LHCbDIRAC
  - LHCb Pilots will try to “install” (set up) LHCbDIRAC from CVMFS
    - If it fails (e.g., it’s a just deployed version, and the cache is cold – or a test version), will fall back installing the old way
  - LHCb won’t download CAs: instead it uses what is on CVMFS
  - ...

LHCb experience with running jobs in VMs
A. McNab, Track 7, Tue, 17:30
“Pilots to fly in all the skies”
Pilots 2.0 are the “pilots to fly in all the skies”

Available to all DIRAC communities as of DIRAC v6r12
- Some may have not noticed the change...

Easy to extend
- Actively developed

Pilots 2.0 are the real federators
- WNs look the same everywhere
  - Make a pilot to run, and you will monitor all of them the same way

Extended by LHCb
- Mainly for fully using CVMFS

Prospects:
- Add more generic commands
- One will be for running SAM jobs
Question, comments