CHEP 2016
Declination

22nd International Conference on Computing in High Energy and Nuclear Physics, Hosted by SLAC and LBNL, Fall 2016
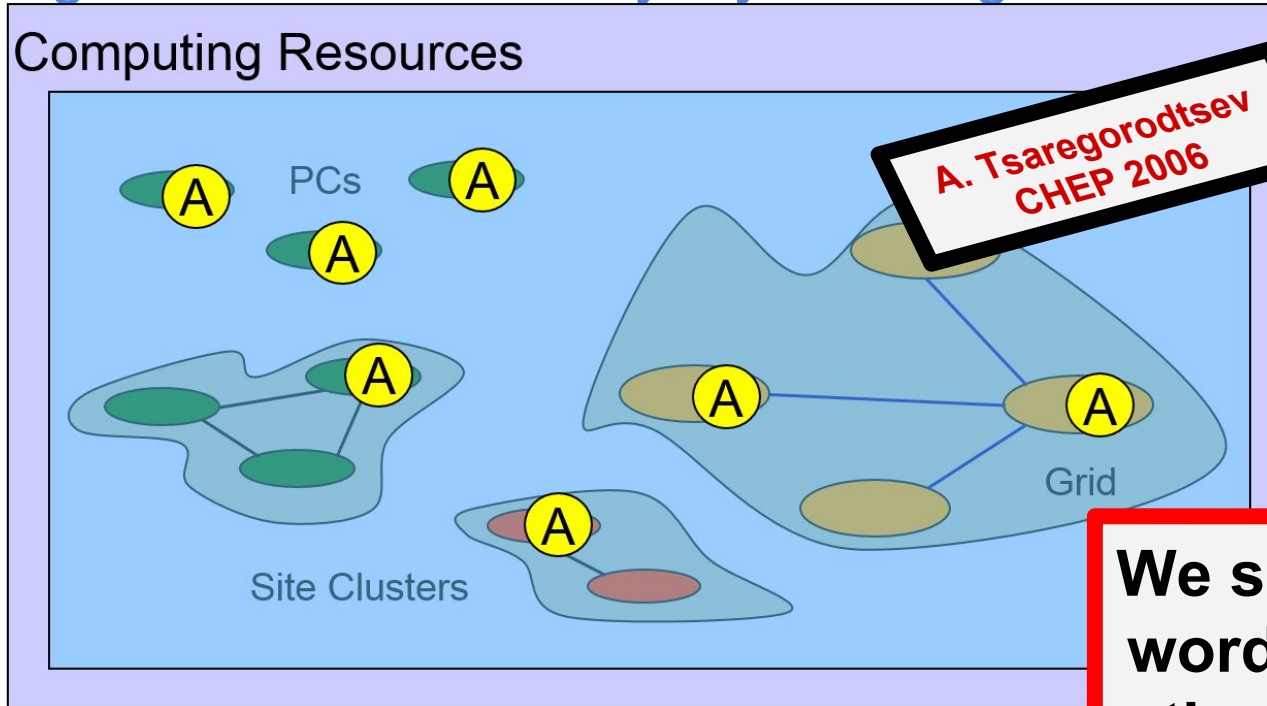
DIRAC Universal Pilots

DIRAC
THE INTERWARE

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On behalf of the DIRAC consortium

Pilots: not a new concept

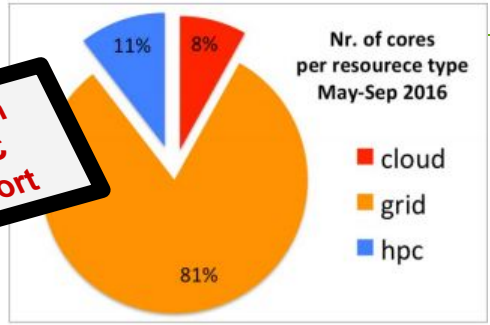Agents form an overlay layer hiding the underlying diversity

A. Tsaregorodtsev
CHEP 2006

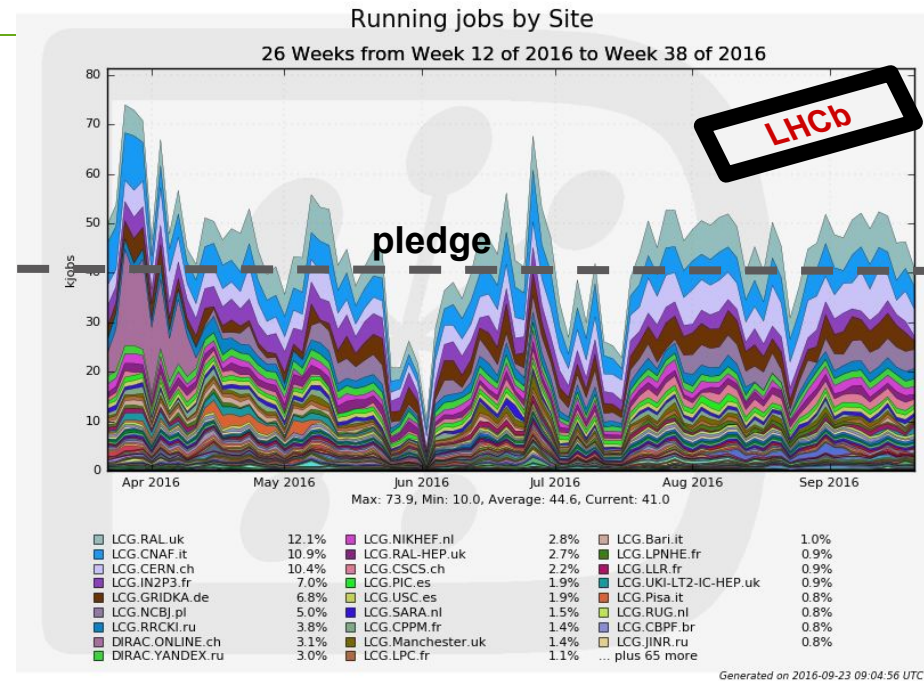We substituted the word "agent" with the word "pilot"

In the meantime...
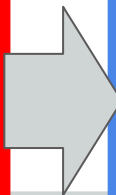
R. McPherson 127th LHCC ATLAS report

Nr. of cores per resourece type May-Sep 2016

- 11%
- 8%
- 81%

- cloud
- grid
- hpc

20% of data processing happens today on non grid resources

Integration of non Grid resources in ATLAS is a big investment with a big return

Automation is the key

Running jobs by Site
26 Weeks from Week 12 of 2016 to Week 38 of 2016

LHCb

pledge

Max: 73.9, Min: 10.0, Average: 44.6, Current: 41.0

LCG.RAL.uk	12.1%	LCG.NIKHEF.nl 2.8%	LCG.Bari.it 1.0%
LCG.CNAF.it	10.9%	LCG.RAL-HEP.uk 2.7%	LCG.LPNHE.fr 0.9%
LCG.CERN.ch	10.4%	LCG.CSCS.ch 2.2%	LCG.LLR.fr 0.9%
LCG.IN2P3.fr	7.0%	LCG.PIC.es 1.9%	LCG.UKI-LT2-IC-HEP.uk 0.9%
LCG.GRIDKA.de	6.8%	LCG.USC.es 1.9%	LCG.Pisa.it 0.8%
LCG.NCBJ.pl	5.0%	LCG.SARA.nl 1.5%	LCG.RUG.nl 0.8%
LCG.RRCKI.ru	3.8%	LCG.CPPM.fr 1.4%	LCG.CBPF.br 0.8%
DIRAC.ONLINE.ch	3.1%	LCG.Manchester.uk 1.4%	LCG.JINR.ru 0.8%
DIRAC.YANDEX.ru	3.0%	LCG.LPC.fr 1.1%	... plus 65 more

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It seems like the grid is not anymore "The Grid"

Heterogeneity is the norm

(WLCG, CREAM, ARC, HTCondor, HLT, HPC, Opportunistic, Volunteer, Virtual Machines, clouds, vac, BOINC, containers, Docker…)

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Pilots are the "federators"
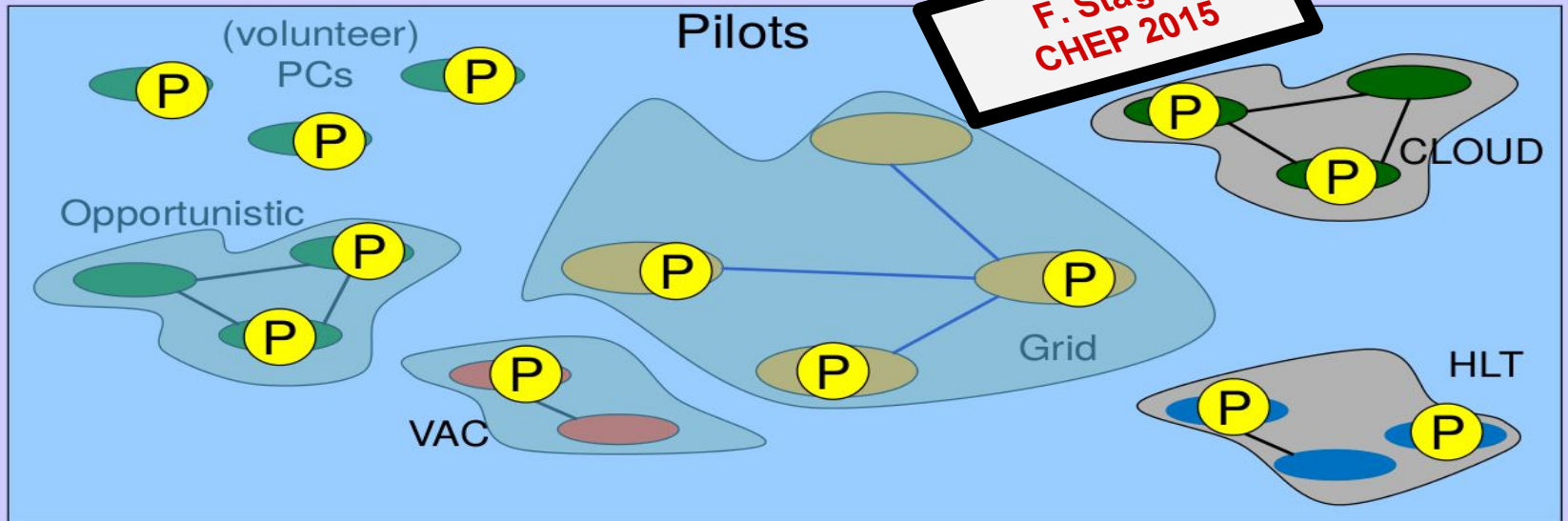
Send it

as a "pilot job"

Or just **Run it!**

e.g. as part of the contextualization of a (V)M

OR

"Make a machine a pilot machine, and you are done"

Today's pilots

10 years later, pilots are still in use,
and keep being developed
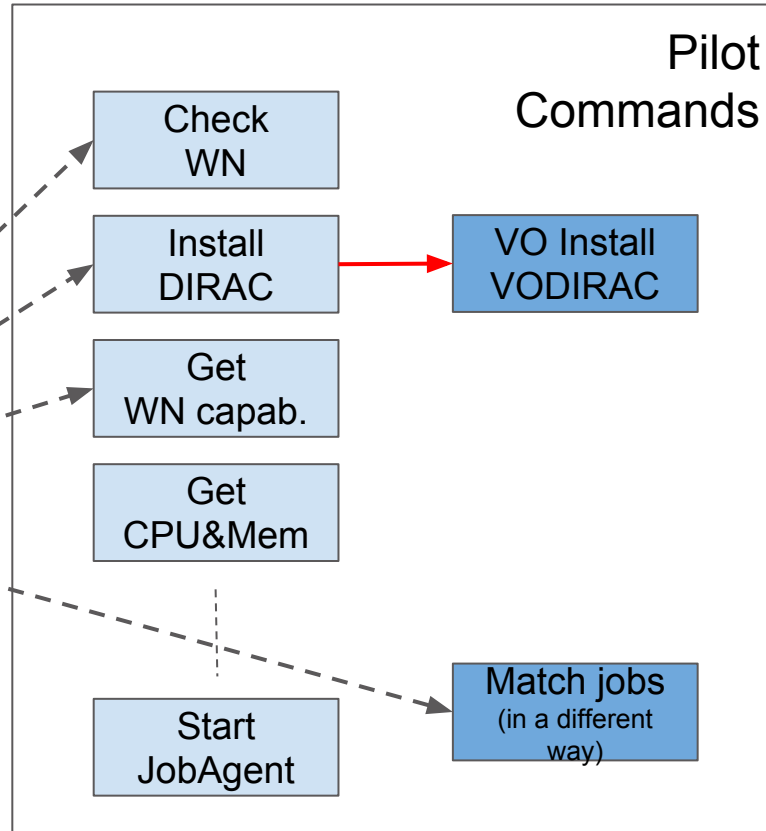
~2 years ago DIRAC introduced the so-called "**Pilots 2.0**"

- A pilot 2.0 is a standalone python script
- Common to all communities using DIRAC
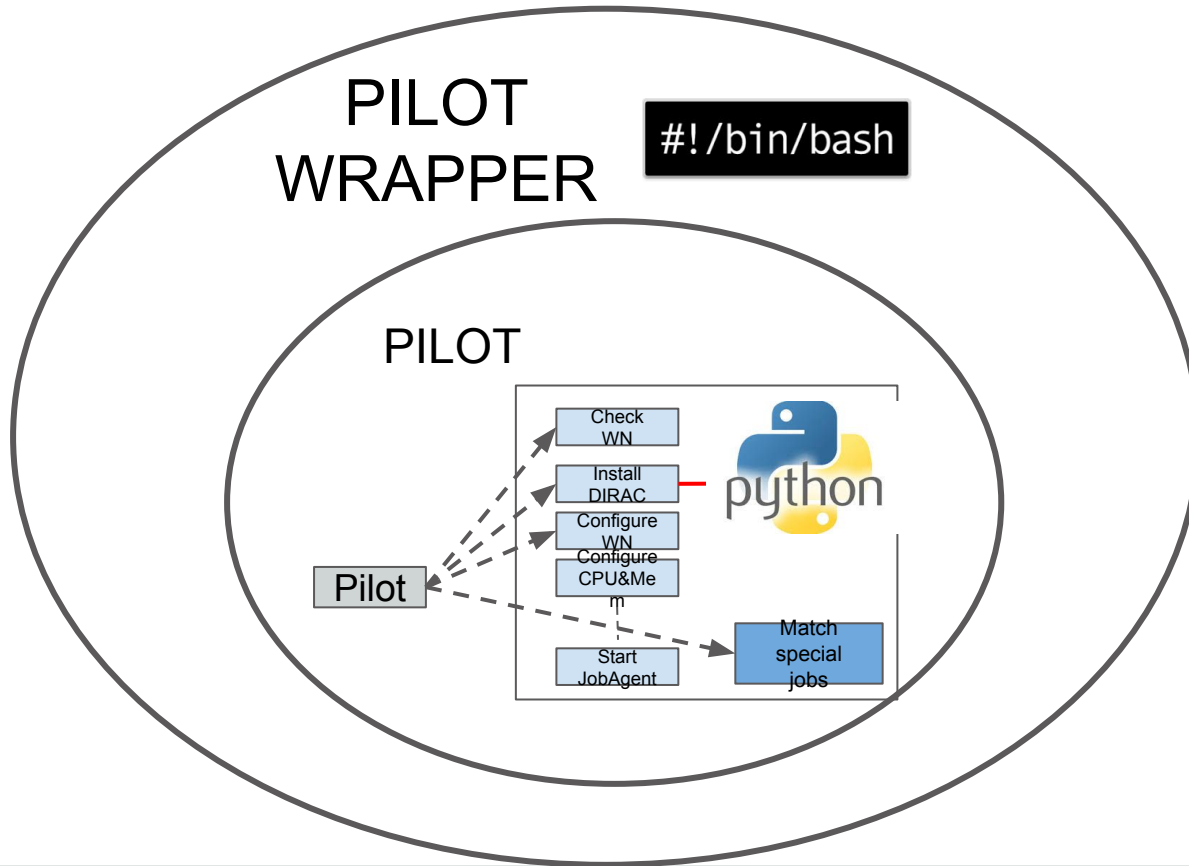- Can be run on every computing resource

Send it here

Just start it here

Vac - the first Vacuum system

Infrastructure-as-a-Client (IaaC)

Pilot VM. Runs Job Agent to fetch from TQ

Vacuum site

Since we have the pilot framework, we could do something really simple

Strip the system right down and have each physical host at the site create the VMs itself
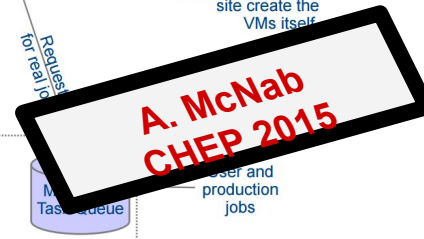
Instead of being created by the experiments, the virtual machines appear spontaneously "out of the vacuum" at sites.

Use same VMs as with IaaS clouds

Central agents & services

user and production jobs

- The bootstrap issue (pilot wrappers):
  - A pilot, on a VM, starts blind (in the vacuum). Need to supply info:
    - Where to get the pilot script(s)
    - Names: Site, CE, Queue
  - Solve the "difficult" case, generically
- **Simple pilot wrappers**

- ## Self-discovering WN capabilities
  - ### Including CPU power
    - Using DB12
    - And #processors
    - MJF supported

  > **→ more details**
  > **Benchmarking worker nodes using LHCb productions jobs and comparing with HEP-Spec06**

  - ### And memory

- ## Commands list configurable:

  With REST interface on top of DIRAC Configuration System

  - ### By type of "Grid"
    - i.e. some commands may be needed only for volunteer computing resources
  - ### By setup (e.g. production, test, …)

- A DIRAC client is installed
- By default a "JobAgent" is used to match the capabilities of the WN with the requirements of the waiting jobs.
- Support for MultiProcessor jobs:
  - Pilots advertise multi-processor payload slots
  - Multi-processor payloads matched
  - No mix/backfilling allowed yet

- Pilot logging:
  - A list of messages like
    - "I've booted up" …
    - "I found the DIRAC pilot ok" ...
    - "I'm about to shutdown"...
  - Uses MQ systems (stomp)
- Pilot self-upload their own logs before shutting down
  - Needs reliable/fast SE

Summary

- DIRAC Pilots are the real federator of "any" computing resource
- Used by all the DIRAC communities in every DIRAC installation
  - Single or multi-VO
- Already VERY flexible: highly configurable, easy to extend
  - E.g. LHCb uses extended the command to install LHCbDIRAC
- Actively developed

?

WMS overview

Pilot based Workload Management

- High user job efficiency
- Suitable for usage with heterogeneous resources
- Allowing application of community policies