Cloud access with DIRAC

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LCG-France, 28 March, LLR
Outline

- VMDIRAC
- Federated cloud tests
- Prospects for the French cloud federation
- Conclusions
Acknowledgments

This is the work mostly done by Victor Mendez (PIC), Victor Fernandez (USC), Mathieu Puel (CC/IN2P3)
- VM scheduler initially developed for the Belle MC production system (VMDIRAC)
- Dynamic VM spawning taking the Task Queue state into account
- Discarding VMs automatically when no more needed
- The VM at boot time starts the “Pilot Job”
  - This makes the instantiated VMs behave as any other WN with respect to the DIRAC WMS
  - JobAgent and VMMonitorAgent are started inside the “Pilot Job”
Contextualization

- Standard (golden) VM image, e.g. CERNVM, is complemented by a context image
  - Containing the DIRAC software
  - Security token, e.g. VM host certificate
- The contextualization mechanism allows to configure the VM to start the Pilot script at boot time
  - Provides also the necessary configuration parameters to the pilot
- The contextualization mechanism is rather complicated
  - Different for different cloud managers
    - cernvm
    - amiconfig
- Ad hoc images
  - No contextualization, everything is put in the image for a particular endpoint (software, certificates)
Simple SSH contextualization

- VMs are instantiated with golden images
  - Plus user account with a public key for ssh login
- The IPs of the VMs are should be available to the VMDIRAC scheduler
  - Polling the VMs to establish connection
- Use SSH access to contextualize the image
  - Copy the software + certificate bundle via scp to the VM
  - Start the JobAgent and VM Monitor Agent
Federated cloud test
Test setup

- DIRAC + VMDIRAC installation at PIC (dirac.pic.es)
  - Configuration
    - VM metadata from MarketPlace (copy by hand)
    - VM images uploaded to endpoints manually
    - Cloud manager configuration static in the DIRAC CS
  - VM scheduler:
    - Decisions to schedule VMs based on the status of the DIRAC Task Queue, VMs already launched, prices, etc.
  - VM Launcher instantiates VMs using specific cloud plugins
  - VM Manager follows the VM status, stops idle VMs
Test setup (2)

- Total 250 VM slots at 3 sites
  - USC, PIC, CC/IN2P3 with 3 different cloud managers
  - 1 virtual CPU, 2GB RAM
- LHCb standard MC production application
  - Software distribution by CVMFS
  - 2000 jobs each producing 50 events
Test installation (2)

- PIC
  - 90 VM slots
  - OpenNebula, OCCI-0.8 driver
  - VM image: cernvm-batch-node 2.6
- Contextualization
  - OpenNebula .ISO context (software and tools)
  - context section on the OpenNebula VM creation (endpoint)
Test installation (3)

USC

- 10 VM slots
- CloudStack, CloudStack 2 driver, libcloud
- ad hoc VM image: CentOS 5.5 + preinstalled DIRAC + CVMFS
- Contextualization: none
Test installation (4)

CC/IN2P3

- 150 VM slots
- OpenStack, libcloud + nova 1.1 python client
- VM image: cernvm-batch-node 2.6
- Contextualization:
  - Amiconfig: *userdata* (software and tools), *metadata* (endpoint))
  - Golden image with DIRAC public key + ssh contextualization
VM scheduling compromise

- Each VM launching has a price
- The more VMs scheduled the faster user job turnaround but less efficiency

VM scheduler:

- 1 VM instantiated per minute, per cloud
- \textit{CPUPerInstance} parameter to limit the number of VMs to instantiate
- VM stopped after 5 minutes of “no job” waiting time

With more experience more sophisticated VM scheduling policies will be elaborated
219 VM at plateau

- No failed jobs
- Several failed VMs in OpenStack – timeout while setting up network interfaces (floating IPs)
Next steps

- French Federated cloud setup
  - VMDIRAC is installed as part of FG-DIRAC
    - Configuration is to be done following the PIC example
    - Update to v0r7 (includes fixes from the tests)
  - StratusLab resources incorporation
    - Based on libcloud driver
    - Straightforward to implement
  - OpenNebula sites
    - OCCI 0.8 (1.1) driver
    - Contextualization?
  - Tests with other applications
    - Biomed?
  - Manpower is a problem
Next steps (2)

- MarketPlace incorporation
  - VM image metadata catalog dynamic look up
  - VM image provisioning service
- Cloud access authorization
  - X509, VOMS in addition to login/password
- Cloud status information monitoring
  - EGI Federated Cloud TF standard (?), Helix Nebula (?)
- Cloud usage accounting
  - Incorporate into the DIRAC Accounting service
Conclusions

- VMDIRAC tests accessing 3 different clouds are successful including OpenStack/CC
- This is a good basis to incorporate other clouds in France: StratusLab, OpenNebula clouds
- Demonstrations with other applications than the ones of LHCb are to be done
- Manpower is an issue