Experience using Oracle OCI Cloud at CERN

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CERN openlab

A public-private partnership between the research community and industry

- **Mission:**
  - **Evaluate** state-of-the-art technologies in a challenging environment and improve them.
  - **Test** in a research environment today technologies that will be used in many business sectors tomorrow.
  - **Train** the next generation of engineers/researchers.
  - **Promote** education and cultural exchanges.
  - **Communicate** results and reach new audiences.
  - **Collaborate** and exchange ideas to create knowledge and innovation.
Goals

Exercise integration of opportunistic resources
   Into CERN cloud
   Into experiment’s Workload Management frameworks

Be prepared for new resources
Cloud challenges

Integration as a resource in general computing/batch pool

Challenges

To manage external resources seamlessly
  Provisioning
  Tools
  Presentation to customers

OCI specific challenge
  Use Bare Metal machines
  Previous cloud tests done on VMs
What we need in the cloud

**WLCG provides**

Abstraction for a variety of services:
- Job management, data management, security, information systems
- A centric monitoring, accounting, security model
- Management of communities via Virtual Organizations (VO)
- Hiding complexity from users
Job submission
Simplified

Submit machine → Compute Element → Worker Nodes

XRootD

CASTOR

EOS

EOS
Job submission in detail

CE provisioning and job submission process

Worker nodes
- 132 X5 High IO Bare Metal machines
- ~10,000 cores
- 10 GB RAM/core

CERN Storage
- EOS
- CASTOR

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Provisioning

Terraform

Terraform selected as industry standard tool to abstract APIs
Support out of the box for OpenStack
Issues if used to expand / shrink regularly, but ideal for our purposes
Personalization

Cloud-init

Cloud-init personalizes machine

Install and configure puppet client

Use one-shot time limited secret, unique to each machine, to sign off x509 certificate needed for puppet & condor
As with internal machines, foreman used for classification & inventory, puppet used for configuration
Some differences with internal machines, but re-use components & configuration where possible
**Application**

*HTCondor startd / Docker Universe*

HTCondor with Docker "universe" to abstract cloud machine from wlcg worker node environment

Host provides CVMFS and HTCondor but can use Cloud-provided CentOS images

HTCondor can be configured to work across firewalls & NATs
Oracle OCI resources

Oracle provided us
  132 X5 High IO Bare Metal machines
  Almost ~10’000 cores
  10GB RAM/core

Missing
  Dedicated network connection
    Due to limited time of the tests
Results
Database in the cloud

Short summary

Test focus
- Feasibility study
- Potential disaster recovery solution
  Exadata performance

Tested solutions
- Database on Bare Metal (including RAC)
- Exadata
- Database on VMs
Questions?

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Backup slides
Results

ALICE

Active jobs in Phoenix

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Results

ATLAS

Completed jobs Pie (Sum: 199,405)
Group Production - 51.20%

- Group Production - 51.20% (102,091)
- Others - 12.32% (24,573)
- MC Simulation - 18.91% (37,704)
- MC Reconstruction - 14.94% (29,161)
- Data Processing - 2.73% (5,452)

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Results

LHCb
Database in the cloud

Completes tests

Functional tests
  - Database setup (including Oracle RAC)
  - Data Guard Setup with failover/switchover
  - Automatic patching
  - Backup and recovery

Performance tests
  - Comparison of Oracle Exadata performance with Oracle In-Memory Database
  - Compression tests using Exadata storage capabilities
Database in the cloud

Planned/ongoing tests

Full disaster recovery plan
- Data guard setup between CERN and cloud
  - Switchover/failover between CERN DC and the cloud
- Application workload offloading
- Integration of Oracle Backup Cloud
- Assessment for instantiation of CERN Weblogic Applications
- Monitoring setup
- Security and GDPR assessment
Job submission in detail

Version for projector

CE provisioning and job submission process

- Submit machine
- CERN GPN
- Worker nodes
- Cloud Infrastructure
- CERN Storage

- 132 X5 High IO Bare Metal machines
- ~10,000 cores
- 10 GB RAM/core

XRootD

- Computing Element (CE)
- Terraform Provisioning
- puppet Configuration
- cloud-init Personalization
- HiCondor Scheduler
- docker Orchestration
- kibana Monitoring

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