CMS in the Cloud

GridPP Cloud Meeting
30 November 2012

Andrew Lahiff, Chris Brew

Science & Technology Facilities Council
Rutherford Appleton Laboratory

Why clouds?

- An interesting way to get additional resources when we need them

- An opportunity to develop components and services that we can float onto generic infrastructure

  - The images required for the cloud are the same as we could be developing for easy deployment of things

  - Being compliant with clouds may make our framework more modular/flexible/extendable...

- We may contribute to the development of cloud technologies so that they don't diverge too much from our needs

- A good way to stay relevant in high exposure development areas

What's the end result?

- The high level goal is to make use of additional resources from the cloud at a level that is noticeable to the experiment

    - Doesn't make sense to get 10% additional resources for a month. It's a lot of work, maybe some money, and in the end no one will notice

    - Goal should be an infrastructure that could double the simulation capacity of CMS for a month

        - This would be gaining 25-30k cores for a month

        - Enable high priority samples to be completed a month early

Requirements to run a CMS job

- CMS software framework (CMSSW)
  - CVMFS

- Frontier
  - Squid server in the cloud?

- Data (read access)
  - xrootd + sufficient WAN

- Data (write access)
  - SRM, or xrootd?

- Resource provisioning
  - glideinWMS starts VMs with pilots which register with central queue
  - Eliminates the need for a CE

Activities

- StratusLab

- LxCloud

- Amazon spot instances

- HLT cloud

StratusLab

- First tests carried out by CERN IT-ES
  - Dedicated Condor manager setup in the cloud; CRAB2 configured to submit to this
  - Software via CVMFS
  - Input data via xrootd
  - External Frontier squids
- Jobs ran successfully
  - MC
  - Analysis

Science & Technology Facilities Council
Rutherford Appleton Laboratory

Trial of Amazon spot instances

- Spot instances
  - EC2 opportunistic access
  - Low-cost (~10x less than on-demand instances)
  - Actual cost variable via spot market (bid x dollars per hour)
- Trial runs
  - Attached EC2 VMs to T2_US_Wisconsin
    - 3 cores for 1 month, 100 cores for 1 week
  - 55% of cost was for data transfer
- Ideal use case
  - Low output to CPU ratio
  - Short jobs (less work lost due to instance termination)
  - Distant deadline (more flexibility to use cheaper options)

HLT cloud

- The CMS High Level Trigger:

    - 13312 cores, 211280 HS06 → large resource

    - No storage, some computers have small disks

- Why not use these computers during the shutdown?

    - Actually, why not use them whenever they're not in use?

- Conceived as an Overlay Infrastructure

    - Try to minimize the impact on the existing production HLT cluster configuration (software & networking)

- Technology used:

    - Openvswitch

    - OpenStack (with as KVM underlying hypervisor)

HLT cloud: status

- Work is ongoing

- Will be first major production use of cloud infrastructure by CMS

- The exercise of deploying an overlay cloud on the CMS online cluster is fruitful for the future

  - Can share knowledge of how to deploy such an overlay layer to existing sites that may transition this way to a cloud infrastructure while keeping existing services running

  - Gaining experience on how to contextualize and deploy VMs on the cloud infrastructures that are becoming commonplace

Science & Technology Facilities Council
Rutherford Appleton Laboratory

Storage

- All tests have used storage outside the cloud

- Alternatives?
  - Setup a virtualized SE in the cloud
  - Cloud storage

Looking forward

- Cloud provided computing tends to be factors more expensive than providing the resources in house for resources that are heavily used

  - Costs for commercial facilities is coming down

    - Interesting to cover peak periods

- Need to prepare for a time when this could be the norm

- Even if we never use large scale commercial resources there could be a benefit to making the infrastructure work

  - Simplify the packing and deployment of infrastructure and services

  - May increase ability to share resources across disciplines