

Scientific Clouds

Introduction

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May 9, 2016



- ▶ Basic terminology
 - ▶ IaaS, PaaS, SaaS, XaaS, ...
 - ▶ opaque internal structure
 - ▶ resources on demand, *pay-as-you-go*
 - ▶ multi-tenant, multi-purpose
- ▶ Virtualization
 - ▶ compute (KVM, XEN, VMWare, HyperV, ...)
 - ▶ storage (block, object, fs, ...)
 - ▶ network (VLAN, VXLAN, ... *SDN*)
- ▶ Application deployment
 - ▶ designed for application-level horizontal scaling
 - ▶ replication, distributed consensus, self-healing
 - ▶ automated life-cycle processes, continuous integration and deployment

- ▶ Computing intensive tasks → *HPC*
- ▶ Data intensive tasks → *Big Data*
- ▶ Often requiring assistance as well as resources
- ▶ National providers targeting academic/research communities

– HPC Clouds –

- ▶ Require flexibility (OS, HW, network, ...)
- ▶ Make use of scalability, even on demand if supported
- ▶ User in control of the execution environment
 - additional responsibilities
 - higher skill requirements
- ▶ Wide variety of types (GPGPU, legacy, bleeding edge, ...)

- ▶ HPC vs. AWS-like end-user services
→ scientific grants from Amazon/Microsoft
- ▶ No “paying” customers (fairness in resource allocation)
- ▶ Expectation of assistance (looking for a research partner)
- ▶ Often working with open data, wanting to share the results

- ▶ No overcommitment of resources
- ▶ I/O performance often critical (disks, network)
- ▶ Tools for sharing data/results or restricting access
- ▶ Heterogeneous infrastructure and user requirements

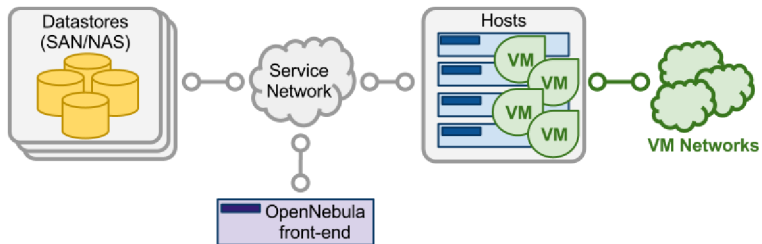
– MetaCloud –

Infrastructure Example

- ▶ OpenNebula cloud management framework (open source)
- ▶ *KVM* with *libvirt* on a mixed fleet of Debian/CentOS nodes
- ▶ *Kerberos* and *X.509* authentication for users (GUI and API)

Sandbox and Reference architecture:

- ▶ <http://opennebula.org/tryout/sandboxvirtualbox/>
- ▶ <https://goo.gl/470wce>



- ▶ Open to everyone in the Czech academic community
 - ▶ Resources from MetaCentrum (CESNET) and CERIT-SC (MU)
 - ▶ User payment → publications
-
- ▶ Registration – <https://goo.gl/3gGGjW>
 - ▶ GUI – <https://cloud.metacentrum.cz/>

1. Get a personal certificate at <http://goo.gl/CDsdIj>
2. Register your personal certificate at <https://goo.gl/NL2zB8>
3. Export your certificate from the browser
→ see a step-by-step conversion guide at <http://goo.gl/GzKjJX>

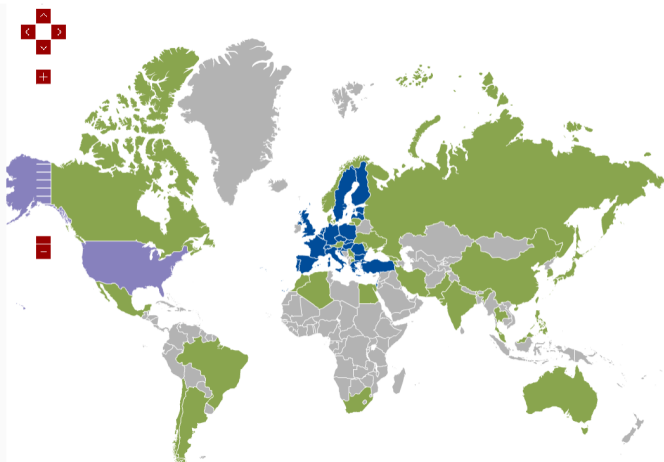
For more information, see <https://goo.gl/fDosgK>

```
$ oneuser login $USERNAME --x509 --force \  
    --cert usercert.pem --key userkey.pem  
  
$ onetemplate list  
...  
3397 oneadmin metacloud METACLOUD-Ubuntu-Docker-14.04  
...  
  
$ onetemplate instantiate 3397 --name MyPA200Instance  
ID: ...  
  
$ onevm show $INSTANCE_ID  
...  
VM NICS  
## IP address(es) HERE  
...  
  
$ onevm shutdown $INSTANCE_ID --hard
```

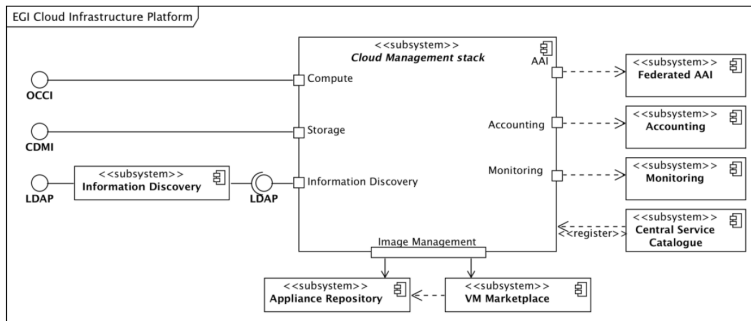
Adding "--xml" to commands gives machine-readable output!

– EGI Federated Cloud –

Infrastructure Example



Caption (as of July 2015)
 blue: EGI council members
 green: integrated resource infrastructure providers
 purple: peer resource infrastructure providers



– How To Use Cloud? –

- ▶ Automated and repeatable installation (and configuration)
- ▶ Possible approaches:
 - ▶ custom scripting (bash, powershell)
 - ▶ Ansible – <https://www.ansible.com/>
 - ▶ SaltStack – <https://saltstack.com/>
 - ▶ Chef – https://docs.chef.io/chef_solo.html
 - ▶ Puppet – <https://puppet.com/>
- ▶ Often used in combination with containers

– That's All Folks! –

...

Do you have any questions?

- ▶ ask **NOW!**
- ▶ ask us directly at parak@cesnet.cz or sustr4@cesnet.cz
- ▶ send your questions to cloud@metacentrum.cz