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A Virtual Computing Lab for the Kenyan Research Community

Author: Martin Njau – Systems Administrator, KENET
Co-Authors:
1. Ronald Osure – Senior Applications Developer, KENET
2. Kennedy Aseda – Lead Network Operations, KENET
3. Meoli Kashorda, PhD, MIET, MIEEE – Executive Director, KENET
Agenda

- KENET Virtual Lab Background and History.
- Overview of the Architecture.
- Physical Hardware.
- Software/Application modules.
- Storage Architecture.
- Security Enforcement.
- Automation.
- Use cases.
- Metrics
- Conclusion.
Background

- The design and deployment commenced on November 2016.
- Need for a more powerful and robust virtual environment for KENET training boot camps and technical services test bed.
- KENET’s approach
  - Deploy a cluster model for seamless management and computing resources management.
Background cont..

- A cloud solution with a self provisioning feature for ease of use and user management.
- A secure solution to curb possible abuse scenarios.
- 24/7 access to the lab.
Overview of the architecture

Transforming education through ICT

Kenya Education Network

Astakos/cyclades
Authoritative NS
Pfsense
Pithos

User

Ganeti Cluster

Two(2) physical server

GlusterFS logical volumes

Ganeti External Storage (Archipelago)

GlusterFS Distributed Volume

Data

Data
Physical Hardware

- 2 physical Servers – Dell R530.
- RAM – 192GB (Combined Ram 384GB)
- Disk storage – 50TB each
- CPU – 40 CPU’s each (Intel(R) Xeon(R) CPU E5-2660 v3 @ 2.60GHz).
Software/Application modules

1) Ganeti
   - Ganeti is a virtual machine cluster management tool built on top KVM or Xen.
   - The cluster has two physical nodes running on KVM hypervisor.
   - KENET has an existing cloud setup running on Ganeti (Main reason we preferred building the virtual lab using a Ganeti cluster setup model).
Software/Application modules

cont..

1) Synnefo

- Synnefo is a complete open source IaaS cloud stack written in Python.
- Provides Compute, Network, Image, Volume and Object Storage services.
- Synnefo manages multiple Ganeti clusters at the backend (Currently managing one cluster).
Synnefo components

1) Astakos (Identity management)
   - Identity management component which provides a common user base to the rest of Synnefo. Astakos handles users, resource management and quotas enforcement.
   - Supports local, LDAP, shibboleth, Google and twitter authentication.
   - Provides a registration feature where users register using their valid email addresses.
2) Pithos (Object storage service)

- Pithos is the Object/File Storage component of Synnefo.
- Users upload files on Pithos using either the Web UI, the command-line client or native syncing clients e.g. agykyra.
- You can also share files with other users with specific read/write permissions.
3) Cyclades (Compute/Network/Image/Volume Service)

- Cyclades is the Synnefo component that implements the Compute, Network, Image and Volume services.
- Users have full control over their virtual machines: create, start, shutdown, reboot, and destroy the VMs.
- Provision custom virtual machines (VMs) resources using the defined templates (flavours).
- Dual IPv4/IPv6 connectivity for each VM, easy.
- Construct arbitrary L2 topologies
External Storage architecture (Glusterfs)

- GlusterFS is an open source, distributed file system.
- Can scale up to petabytes of storage.
- KENET virtual computing lab adopts glusterfs storage by combining two volumes of 25TB each from the two ganeti node and presents a total of 50TB.
- The storage is then presented to all the ganeti nodes, Cyclades, and pithos virtual machine as an NFS mount.
Authoritative Name servers

- Unique registered domain that has three (3) authoritative name servers running as virtual machines on the Ganeti cluster.
- Once a user deploys a virtual machine a domain name that follows a defined sequence is generated and real time updates to the authoritative name servers executed through custom script leveraging on dynamic dns functionality.
Pfsense Firewall gateway

- Opensource firewall.
- The firewall runs as a virtual machine in the Ganeti cluster.
- All the virtual machines are assigned public IP address that are routed through the pfsense firewall for filtering purposes.
- Choke point for all virtual machine traffic, filtering and shaping for both incoming and outgoing traffic.
- The pfsense also provides caching dns service to all the virtual machines.
Automation

- Customized python scripts interacting with the Cyclades snf-manage interface.
- Enforcing VM duration policies.
- All images registered with a time tag describing the associated VM life time e.g. (1 week, 1 month).
- Static time definitions in seconds that compares to the VM time delta.
- If the time since creation is greater than the image defined duration the VM is deleted.
Automation cont..

- Real time NS records update python script leveraging on dynamic dns functionality (Cron Job).
- DNS garbage collector python script which deletes obsolete A records.
Use cases

- Computing environment for Training boot camps and online courses e.g. ISOC Unix online course.
- Sandbox environment for testing services before migrating to production environment.
- Creation of custom images running specific tools and applications for learning purposes e.g. MATLAB.
Usage Metrics

- Twelve (12) different operating systems available.
- 300 Virtual machines spawned since deployment.
- Twenty (20) participants successfully completed the ISOC online Unix course using the platform.
- Seventy (70) concurrent running Virtual machines have been tested so far.
Rolling out the service to the community

- Awareness workshops (faculty workshop held on September 2017).
- Engage member’s through relevant mailing lists.
- Web conference webinar (frequent webinar for university technical staff undertaking ISOC NetOps course).
Conclusions

- Adoption of robust opensource Virtual computing lab model by other NRENs.
- Active community working around Ganeti and synnefo providing adequate support and improvement of these components.
- More automated functionalities to be implemented as need arises.
Questions
Thank You

www.kenet.or.ke
Jomo Kenyatta Memorial Library, University of Nairobi
P. O Box 30244-00100, Nairobi.
0732 150 500 / 0703 044 500