CS 6480: Lab Assignment 2
Phase 1 - A simple Eucalyptus cloud environment setup

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1 Introduction

The elasticity of cloud computing has changed the way resources are managed and allocated. Cloud computing provides a management interface for a large pool of resources and brings different services to users (IaaS, PaaS, SaaS). With its promising success in industry, cloud computing has become a hot research topic. Despite its popularity in research communities, cloud computing infrastructures are either proprietary or depend on softwares that are closed and impossible to instrument. This prevents researchers from having the power to innovate and develop new ideas in cloud computing.
Eucalyptus [1] is an open and modular cloud computing platform that allows researchers to instrument, modify, and realizes different research ideas in cloud computing. Eucalyptus provides a well-define API that are compatible with industry (Amazon EC2 and S3) and allow researchers to try new components. Eucalyptus is also easy to deploy on existing resources.
The goal of this lab assignment is to install a simple working set of Eucalyptus on commodity hardware (Emulab [2] testbed machines). The installed Eucalyptus should include a cloud controller (CLC), a cluster controller (CC), and a node controller (NC). The system administrator is able to manage resources: create instances using different OS images or remove an instances. Users are able to log in and use the instances. The system operates in a static network mode in which the administrator has to specify the network configuration that each instance will receive from the DHCP server that runs on the cluster controller of the instance.

2 Installation and screen shoots

1. Hardware and topology: the installation hardware consists of 3 physical machines in Emulab testbed. The 3 machines are able to run VMs and connect to each other in a VLAN. Each machine (node) hosts one of the 3 components separately: CLC, CC, and NC. They are accessible via public IP addresses.

2. Install Eucalyptus: This experiment installs Eucalyptus from release packages. Eucalyptus, Euca2ools, and EPEL are installed on every node while software is installed corresponding to the functionality of a node: cloud controller software runs on CLC, cluster controller software runs on CC, and node controller software runs on NC. Walrus is hosted by CLC (although it could be hosted separately).

3. Network Configuration:
Since the interfaces of the image used in the experiment (CENTOS64-64) is not configured by Emulab, network-scripts are created and added to /etc/sysconfig/network-scripts/ manually.

The 3 nodes then connected via the defined interfaces and are able to ping each other.
CC runs a DHCP server that assigns IP for any instance that run on NC nodes underneath. In static network mode, the MAC-IP mapping inside DHCP server is explicitly specified. DHCP configuration is done by specifying parameters in /etc/eucalyptus/eucalyptus.conf file (this file also determines the storage/network/virtualization options on each node). For example, if the MAC-IP in this setup is specified as *"AA:BB:CC:DD:EE:FF=10.1.1.11"*, the new instance will get the IP *10.1.1.11* when it boots up.
Eucalyptus uses the eucalyptus.conf file to create the real configuration file that is actually used by the dhcp server (the file locates in /var/run/eucalyptus/net). A log of network configuration when CC starts is shown in screen shoot 1. screen shoot 2 shows the dhcp server daemon running on CC node.

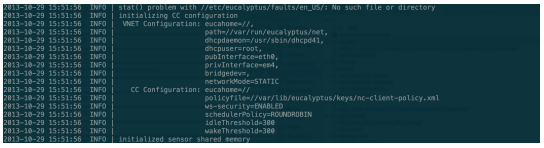

Figure 1: Configuration log on CC node.

Figure 2: DHCP daemon is running on CC node

4. Register and start Walrus, CC, and NC: Walrus and CC are registered on the CLC node that controls them while NC is registered on the CC node of the same control domain. After registering these components, the NC is able to start. The CC is able to see the status of all NCs underneath by using *"euca-describe-nodes"* command (as in screen shoot 3).

5. Download image from Eustore and launch instance:

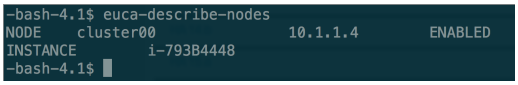

Figure 3: CC node shows all enabled nodes

To access to Eustore, a admin credential is used. The credential is created by running *"/usr/sbin/euca_conf –get-credentials"*. After creating the admin credential, the operator loads credential information by running *"source eucarc"*. After that, the operator is able to download images from Eustore using image ID. Operator also have to create keypairs that are used for accessing instances.
After having an image downloaded, operator can launch an instance on the NC and specify the keypair that is used to access that instance. The keypair consists of a public and a private key. While the public key is uploaded to CLC and associated with the target instance, cloud user uses private key to access the instance that has the corresponding public key. A successfully launched instance is described as in screen shoot 4. Routing information for the instance could

Figure 4: The instance running on NC. The key associated with the instance named *binh*, the IP address of the instance is *10.1.1.11*, instance ID is *i-793B4448*.

be found in the console output of a running instance (obtained by *euca-get-console-output ¡instance ID¿*). The log shows the network configuration during booting (as in 5).

6. Log into the instance using the keypair: a cloud user can login and use the instance that is running. The screen shoot 6 shows the login command. Cloud user successfully logged into the instance using the private key and gained the root privilege.

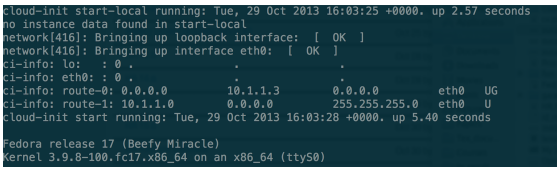

Figure 5: Interface starting up in the instance.

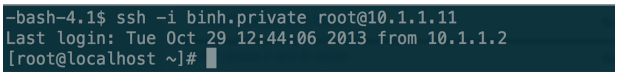

Figure 6: Cloud user accesses the instance using the associated private key

3 Conclusion

In this lab assignment, a simple but complete set of Eucalyptus was successfully installed on three physical machines. Operators can manage images/instances and provide the resources to cloud users. Although the installation process is specified in Eucalyptus documents, different system modes require different installation steps/requirements. The entire installation process is automated and repeatable using bash scripts. The detailed scripts could be found here.

References

[1] Nurmi, D., Wolski, R., Grzegorczyk, C., Obertelli, G., Soman, S., Youseff, L., and Zagorodnov, D. The eucalyptus open-source cloud-computing system. In *Cluster Computing and the Grid, 2009. CCGRID'09. 9th IEEE/ACM International Symposium on* (2009), IEEE, pp. 124–131.

[2] White, B., Lepreau, J., Stoller, L., Ricci, R., Guruprasad, S., Newbold, M., Hibler, M., Barb, C., and Joglekar, A. An integrated experimental environment for distributed systems and networks. *ACM SIGOPS Operating Systems Review 36*, SI (2002), 255–270.