A Step-by-Step Guide to Installing OpenStack on CentOS Using the KVM Hypervisor and GlusterFS Distributed File System

Anton Beloglazov Sareh Fotuhi Piraghaj
Mohammed Alrokayan Rajkumar Buyya

Contents

1 Introduction

- Cloud Computing [1], [2]
- Public / Private / Hybrid
- Why Open Source Cloud Platforms are Important
- OpenStack / Eucalyptus / CloudStack / OpenNebula
- Complexity of Installing OpenStack
- Our Step-by-Step Scripted Installation Approach
- The purpose is not just having an up and running OpenStack installation, but also learning the steps required to perform the installation from the ground up and understanding the responsibilities and interaction of the OpenStack components.

2 Comparison of Open Source Cloud Platforms

- OpenStack
- Eucalyptus
- CloudStack
- OpenNebula

3 Overview of the OpenStack Cloud Platform

- History
- Features
- Main Services
- Service Interaction

4 Existing OpenStack Installation Tools

- DevStack[1]
- Puppet / Chef[2]
- Difference From our Approach

[1] Http://devstack.org/.

[2] Http://docs.openstack.org/trunk/openstack-compute/admin/content/openstack-compute-deployment-tool-with-puppet.html.

5 Step-by-Step OpenStack Installation

5.1 Hardware Setup

The testbed used for testing the installation scripts consists of the following hardware:

- 1 x Dell Optiplex 745
  - Intel(R) Core(TM)2 CPU (2 cores, 2 threads) 6600 @ 2.40GHz
  - 2GB DDR2-667
  - Seagate Barracuda 80GB, 7200 RPM SATA II (ST3808110AS)
  - Broadcom 5751 NetXtreme Gigabit Controller
- 4 x IBM System x3200 M3
  - Intel(R) Xeon(R) CPU (4 cores, 8 threads), X3460 @ 2.80GHz
  - 4GB DDR3-1333
  - Western Digital 250 GB, 7200 RPM SATA II (WD2502ABYS-23B7A)
  - Dual Gigabit Ethernet (2 x Intel 82574L Ethernet Controller)
- 1 x Netgear ProSafe 16-Port 10/100 Desktop Switch FS116

The Dell Optiplex 745 machine has been chosen to serve as a management host running all the major OpenStack services. The management host is referred to as the *controller* further in the text. The 4 IBM System x3200 M3 servers are used as *compute hosts*, i.e. for hosting VM instances.

Due to specifics of our setup, the only one machine connected to public network and the Internet is one of the IBM System x3200 M3 servers. This server is refereed to as the *gateway*. The gateway is connected to the public network via the eth0 network interface.

All the machines form a local network connected through the Netgear FS116 network switch. The compute hosts are connected to the local network via their eth1 network interfaces. The controller is connected to the local network through its eth0 interface. To provide the access to the public network and the Internet, the gateway performs Network Address Translation (NAT) for the hosts from the local network.

5.2 Organization of the Installation Package

The project contains a number of directories, whose organization is explained in this section. The `config` directory includes configuration files, which are used by the installation scripts and should be modified prior to the installation. The `lib` directory contains utility scripts that are shared by the other installation scripts. The `doc` directory comprises the source and compiled versions of the documentation.

The remaining directories directly include the step-by-step installation scripts. The names of these directories have a specific format. The prefix (before the first dash) is the number denoting the order of execution. For example, the scripts from the directory with the prefix *01* must be executed first, followed by the scripts from the directory with the prefix *02*, etc. The middle part of a directory name denotes the purpose of the scripts in this directory. The suffix (after the last dash) specifies the host, on which the scripts from this directory should be executed on. There are 4 possible values of the target host prefix:

- *all* – execute the scripts on all the hosts;
- *compute* – execute the scripts on all the compute hosts;
- *controller* – execute the scripts on the controller;
- *gateway* – execute the scripts on the gateway.

For example, the first directory is named `01-network-gateway`, which means that (1) the scripts from this directory must be executed in the first place; (2) the scripts are supposed to do a network set up; and (3) the scripts must be executed only on the gateway. The name `02-glusterfs-all` means: (1) the scripts from this directory must be executed after the scripts from `01-network-gateway`; (2) the scripts set up GlusterFS; and (3) the scripts must be executed on all the hosts.

The names of the installation scripts themselves follow a similar convention. The prefix denotes the order, in which the scripts should be run, while the remaining part of the name describes the purpose of the script.

5.3 Configuration Files

The `lib` directory contains configuration files used by the installation scripts. These configuration files should be modified prior to running the installation scripts. The configuration files are described below.

`configrc`: This files contains a number of environmental variables defining various aspects of OpenStack's configuration, such as administration and

service account credentials, as well as access points. The file must be 'sourced' to export the variables into the current shell session. The file can be sourced directly by running: `. configrc`, or using the scripts described later. A simple test to check whether the variables have been correctly exported is to `echo` any of the variables. For example, `echo \$OS_USERNAME` must output `admin` for the default configuration.

`hosts`: This files contains a mapping between the IP addresses of the hosts in the local network and their host names. We apply the following host name convention: the compute hosts are named *computeX*, where *X* is replaced by the number of the host. According the described hardware setup, the default configuration defines 1 `controller` (192.168.0.1), and 4 compute hosts: `compute1` (192.168.0.1), `compute2` (192.168.0.2), `compute3` (192.168.0.3), `compute4` (192.168.0.4). As mentioned above, in our setup one of the compute hosts is connected to the public network and acts as a gateway. We assign to this host the host name `compute1`, and also alias it as `gateway`.

`ntp.conf`: This files contains a list of Network Time Protocol (NTP) servers to use by all the hosts. It is important to set accessible servers, since time synchronization is important for OpenStack services to interact correctly. By default, this file defines servers used within the University of Melbourne. It is advised to replace the default configuration with a list of preferred servers.

It is important to replaced the default configuration defined in the described configuration files, since the default configuration is tailored to the specific setup of our testbed.

5.4 Installation Procedure

5.4.1 CentOS Installation

5.4.2 Network Gateway

5.4.3 GlusterFS Distributed Replicated Storage

All nodes

Controller

All nodes

5.4.4 KVM

5.4.5 OpenStack

All nodes

Controller

Compute nodes

Network Gateway

Controller

5.4.6 Testing of the OpenStack Installation

5.5 OpenStack Troubleshooting

6 Conclusion

7 References

[1] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, and others, "A view of cloud computing," *Communications of the ACM*, vol. 53, pp. 50–58, 2010.

[2] R. Buyya, C. S. Yeo, S. Venugopal, J. Broberg, and I. Brandic, "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility," *Future Generation computer systems*, vol. 25, pp. 599–616, 2009.