ABSTRACT

OpenStack is an open source cloud platform created by Rackspace Hosting and NASA. It is primarily used for Infrastructure as a Service (IaaS) deployments. IaaS deployments deal with physical/infrastructural aspects of the virtualization provided by cloud which signifies – storage, computing power, Random Access Memory (RAM) for efficient utilization of resources. This paper presents the installation steps for the ’Liberty’ Release of OpenStack using the PackStack installer script. It also describes how to launch an instance using an image of the ‘CirrOS’ cloud OS, pinging and accessing it via Secure Shell (SSH).

Keywords

Cloud computing, OpenStack, IaaS, Liberty, CirrOS, PackStack, Open Source

1. INTRODUCTION

Over the last decade cloud computing [1, 2, 4] has grown from being a promising business concept to one of the fastest growing segments of the IT industry. Big companies like Amazon, Google, Microsoft etc., expand their market by adopting Cloud Computing systems which enhance their services provided to a large number of users. The term Cloud computing refers to the delivery of computing as a service rather than a product. Below figure 1 shows various cloud services.

Various OpenStack components/services can be combined to create various configurations which can include a general compute grid or Big Data storage and processing clusters. OpenStack is driven by community efforts and backed by RackSpace Cloud Computing. Community gatherings or summits tend to involve many other ideas fuelling the growth of the OpenStack cloud ecosystem.

<table>
<thead>
<tr>
<th>Service Name</th>
<th>Service Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizon</td>
<td>Dashboard</td>
</tr>
<tr>
<td>Ceilometer</td>
<td>Telemetry</td>
</tr>
<tr>
<td>Nova</td>
<td>Compute</td>
</tr>
<tr>
<td>Neutron</td>
<td>Networking</td>
</tr>
<tr>
<td>Swift</td>
<td>Object Storage</td>
</tr>
<tr>
<td>Cinder</td>
<td>Block Storage</td>
</tr>
<tr>
<td>Keystone</td>
<td>Identity</td>
</tr>
<tr>
<td>Glance</td>
<td>Image Service</td>
</tr>
</tbody>
</table>

Table 1: Some of the OpenStack components/services
The Application

OpenStack Dashboard

Compute Networking Storage

OpenStack Shared Services

Fig. 2: OpenStack services

As shown in the figure 2, OpenStack primarily consists of Compute (Nova), Networking (Neutron) and Storage (Swift, Cinder, Glance) components. The OpenStack Dashboard (Horizon) provides a graphical user interface to control the various services of OpenStack without having to resort to executing commands on a terminal/console. Thus, the UI provides a way to control and manage resources in a user friendly manner thereby eliminating the need for technical experts for doing simple tasks. At the same time, OpenStack gives a lot of power to developers by providing a rich API using which various services can be controlled and managed. This means scalability and extensibility become a lot easier.

OpenStack releases are named in a similar fashion as Android Operating Systems (i.e. in an alphabetical order).

Table 2: OpenStack Releases (Latest first)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name</th>
<th>Year</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Liberty</td>
<td>2015</td>
<td>Oct</td>
</tr>
<tr>
<td>2</td>
<td>Kilo</td>
<td>2015</td>
<td>Apr</td>
</tr>
<tr>
<td>3</td>
<td>Juno</td>
<td>2014</td>
<td>Oct</td>
</tr>
<tr>
<td>4</td>
<td>Icehouse</td>
<td>2014</td>
<td>Apr</td>
</tr>
<tr>
<td>5</td>
<td>Havana</td>
<td>2013</td>
<td>Oct</td>
</tr>
<tr>
<td>6</td>
<td>Grizzly</td>
<td>2013</td>
<td>Apr</td>
</tr>
<tr>
<td>7</td>
<td>Folsom</td>
<td>2012</td>
<td>Apr</td>
</tr>
<tr>
<td>8</td>
<td>Essex</td>
<td>2012</td>
<td>Apr</td>
</tr>
<tr>
<td>9</td>
<td>Diablo</td>
<td>2011</td>
<td>Sep</td>
</tr>
<tr>
<td>10</td>
<td>Cactus</td>
<td>2011</td>
<td>Apr</td>
</tr>
<tr>
<td>11</td>
<td>Bexar</td>
<td>2011</td>
<td>Feb</td>
</tr>
<tr>
<td>12</td>
<td>Austin</td>
<td>2010</td>
<td>Oct</td>
</tr>
</tbody>
</table>

PackStack is a script that installs various components of OpenStack in one go. Rather than installing and configuring each component separately, the PackStack script allows one to install and pre-configure a subset of the components by executing a single command.

3. PROPOSED METHOD

Proposed method section is divided into three sub-sections. Sub-section 3.1 gives pre-requisites for OpenStack installation using PackStack. Sub-section 3.2 shows a flowchart for installation steps of OpenStack. Sub-section 3.3 gives implementation steps of OpenStack’s ‘Liberty’ release.

3.1 Pre-requisites

Installation can be done on a virtual machine or on a bare minimum system. If VMware Workstation is being used, check the checkboxes labeled ‘Virtualize Intel VT-x/EPT or AMD-V/RVI’ and ‘Virtualize CPU performance counters’.

3.2 Flowchart of installation steps of OpenStack using PackStack

Fig. 3: Flowchart depicting installation steps of OpenStack

3.3 Implementation Steps of Latest Release of OpenStack (Liberty)

1. Install CentOS and update packages: sudo yum update
2. Disable the ‘Network Manager’ service. Enable and start the ‘network’ service instead.
3. Set SELinux to permissive mode (figure 4)
4. Reboot
6. Install PackStack: sudo yum install openstack-packstack
7. Run PackStack with the ‘allinone’ argument: packstack –allinone

4. EXPERIMENTAL RESULTS

Experimental results section is divided into four sub-sections. Sub-section 4.1 shows various screenshots for OpenStack installation using PackStack. Sub-section 4.2 shows screenshots of launching a CirrOS instance. Sub-section 4.3 associates an IP address with an instance. Sub-section 4.4 shows screenshot of logging into an instance using SSH with a private key and getting root privileges.
4.1 Dashboard installation

```bash
$ sudo yum install -y https://www.rdoproject.org/rdo-release.rpm
```

Figure 4: Setting SELinux to permissive mode

Figure 4 shows SELinux set to permissive mode so that it doesn’t interfere with the installation of various OpenStack components as the PackStack script changes various settings which SELinux might not allow.

```bash
$ packstack --allinone
```

Below figure 7 shows the start of the execution of the PackStack script with the ‘allinone’ switch enabled.

![Figure 7: Running the PackStack script with the ‘allinone’ switch enabled](image)

On successful execution of the PackStack script, details regarding the Horizon and Keystone URIs and default users and login password are printed on the screen.

```bash
$ packstack --allinone
```

4.2 Launching a CirrOS instance

On successful login to the dashboard, one is presented with a screen that shows various components.

1. Click on ‘Project’.
2. Then click on ‘Instances’ under the ‘Compute’ menu.
3. Click on ‘Launch Instance’.
4. Enter the amount of computing resources along with the image name (figure 9).

![Figure 8: OpenStack dashboard (Horizon)](image)
5. Assign a new key pair by clicking on the plus (+) symbol.

To generate a key pair, type:

```
ssh-keygen -t rsa -f <name_of_key.key>
```

Two keys will be generated – one public key and one private key as shown in figure 10.

6. Copy the contents of the public key file and paste it into the “Public Key” field as shown in figure 11.

SSH uses the RSA (Rivest Shamir Adleman) method which generates public and private keys. The private key is to be kept safely by the user who wishes to log in to the instance.

Below figure 12 shows a screenshot of associating a key with the instance.
Fig. 12: Launching an instance - Associating a key with the instance

7. Additionally, one can specify CloudInit data (figure 13) to boot the instance with data that will automatically run when the instance is started.

Fig. 13: Launching an instance - CloudInit data input

8. Disk partitioning can also be done at this stage as shown in the figure 13.

Fig. 14: Launching an instance – Disk partitioning screen

9. Click on ‘Launch’ to launch the instance. The new instance will be listed in the ‘Instances’ section. The instance will start spawning. After some time, the instance will have launched successfully if the required resources are available.

Fig. 15: Launching and instance - Spawning

The above figure 15 shows the instance as it is spawning.

CirrOS is a cloud operating system and is downloaded and bundled by default when one runs the PackStack script. It doesn’t have all the capabilities of a full-fledged operating system like CentOS and Ubuntu. For example, installers like yum and sudo are not available on a fresh installation of CirrOS which are, by default, present in most of the distributions of Linux. As CirrOS is bundled, it will appear in the list of images automatically.

4.3 Pinging the IP address of the instance

Once the instance has been launched one can ping the instance to ensure that connectivity has been established. Assign a floating IP to the instance from the ‘actions’ menu so that it can be accessed from a public network.

Fig. 16: Associating a floating IP address to an instance

Figure 16 shows a dropdown menu which lists various options which can be used to control instance behavior.

ping <ip_address>

If the packets loss is zero or negligible then connectivity has been established.

4.4 Using SSH to login into the instance as root user

SSH access is also possible. Once it is determined whether the instance can be successfully pinged to, SSH can be used to log into the instance.

The preferred way of logging into an instance using SSH is using keys that were previously generated during the creation of the instance. This is because the user who wishes to log in needs the private key during the connection step. If the key fails, the user will be prompted for a password. But the key adds one layer of security.

Without a key:

ssh <username>@<ip_address>

With a key

ssh -i <keyname>.key <username>@<ip_address>

Once one has logged in to the instance successfully, one can get root privileges by using the sudo command:

sudo su –
On logging in, the command `sudo su -`, used to get root privileges.

5. APPENDIX
The paper recommends having more than 4 GB RAM, CPU with virtualization capability, hard drive with capacity greater than 100GB and an active Internet connection. Also, an ISO image of the operating system will be required. The paper assumes a 64-bit CentOS7 as the base operating system. If using a hypervisor ensure that Intel VT-x or AMD-V are enabled.

6. FUTURE WORK
Various OpenStack components can be worked on, say, the network components like Neutron, storage components like Swift and Cinder, identity components like Keystone, compute components like Nova, etc. Load balancing and security areas that can be explored. With each new release of OpenStack, various components and options could be added which would give more flexibility to deploy clouds.

7. CONCLUSION
The paper describes a method for installation of OpenStack using the PackStack script. The script fetches various components from the required repositories and sets them up automatically. PackStack simplifies installation of various OpenStack components by pre-configuring various sub-components required for running various OpenStack services. Instances launched can be accessed via SSH which was also described in the paper. The requirements and configuration setup described in this paper are cost effective and deployment can be done on inexpensive hardware at the time of this writing.

8. REFERENCES