Installation of OpenStack (Liberty release) using PackStack

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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.

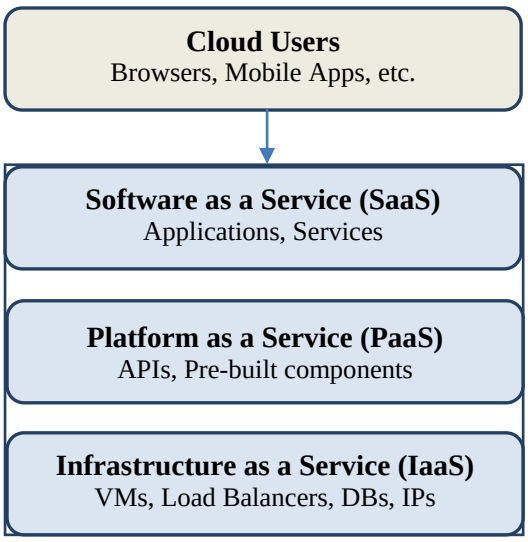

Fig. 1: Cloud layered model

Furthermore, it is a design concept which tries to separate the application from the operating system on which the hardware runs. Users are charged based on short-term basis. Cloud computing is scalable in nature. It provides various services like Data as a Service (DaaS), Software as a Service (SaaS), Platform as a Service (PaaS) or Infrastructure as a Service (IaaS). Therefore, one can say that Cloud Computing has evolved at an incredible pace.

In literature, Anshu [5] has compared various OpenStack installers. Rakesh [8] has described various solutions for deploying cloud environments with a special emphasis on OpenStack– installation and components. Rohit [4] has described various components of OpenStack.

The organization of the paper is as follows: In section 2 OpenStack is explained. Section 3 describes the prerequisites for installation and implementation steps of the Liberty release of OpenStack whereas in section 4 experimental results are discussed.

2. OPENSTACK
OpenStack [1] is a collection of software components that enable one to leverage the power of resources like computing power, memory, and other specialized storage structures like object storage and block storage distributed across datacentres. OpenStack consists of a set of continually advancing but mature components specializing in various aspects of cloud computing as mentioned in Table 1.

Table 1: Some of the OpenStack components/services

Service Name	Service Provided
Horizon	Dashboard
Ceilometer	Telemetry
Nova	Compute
Neutron	Networking
Swift	Object Storage
Cinder	Block Storage
Keystone	Identity
Glance	Image Service

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.

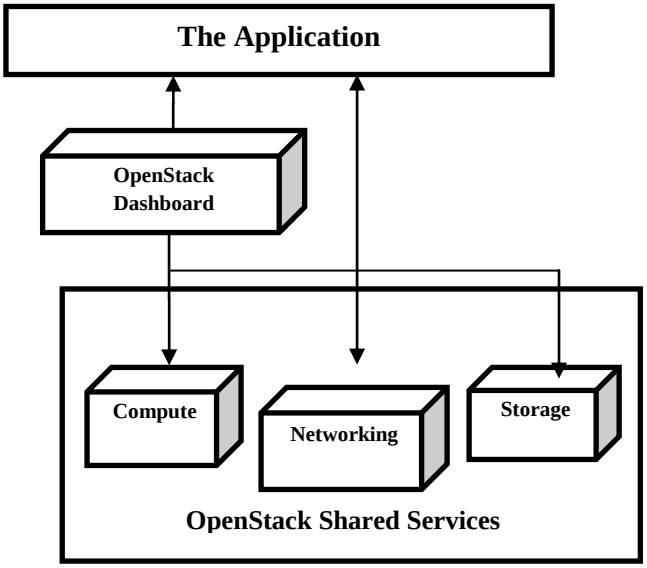

Fig. 2: OpenStack services

As shown in the figure2, 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)

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

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

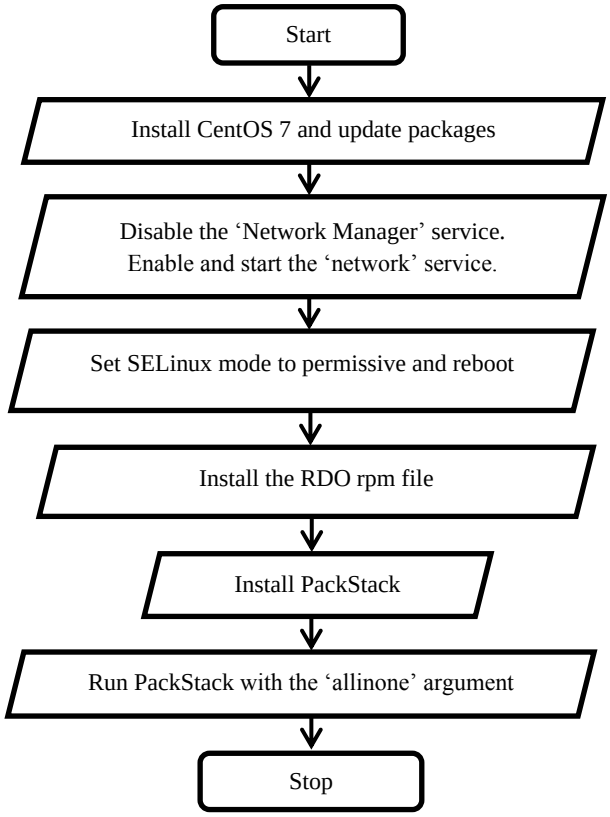

Fig. 3: Flowchart depicting installation steps of OpenStack

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 (figure4)
4. Reboot
5. Install the RDO rpm file:sudo yum install -y https://www.rdoproject.org/repos/rdo-release.rpm
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

```
[root@localhost ~]# cat /etc/selinux/config

# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#     enforcing - SELinux security policy is enforced.
#     permissive - SELinux prints warnings instead of enforcing.
#     disabled - No SELinux policy is loaded.
SELINUX=permissive
# SELINUXTYPE= can take one of three two values:
#     targeted - Targeted processes are protected,
#     minimum - Modification of targeted policy. Only selected p
#     mls - Multi Level Security protection.
SELINUXTYPE=targeted
```

Fig. 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.

```
[jamesjacob@james ~]$ sudo yum install -y https://www.rdoproj
[sudo] password for jamesjacob:
Loaded plugins: fastestmirror
rdo-release.rpm
Examining /var/tmp/yum-root-AL0b35/rdo-release.rpm: rdo-relea
Marking /var/tmp/yum-root-AL0b35/rdo-release.rpm to be instal
Resolving Dependencies
--> Running transaction check
---> Package rdo-release.noarch 0:liberty-2 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================
 Package                          Arch
================================================================
Installing:
 rdo-release                      noarch

Transaction Summary
```

Fig. 5: Installing the RDO rpm file

Figure 5 shows installation of the RDO (RPM Distribution of OpenStack) rpm file.

```
[root@localhost ~]# yum install openstack-packstack
Loaded plugins: fastestmirror
base
epel/x86_64/metalink
epel
extras
openstack-liberty
updates
```

Fig. 6: Installing the PackStack script

Figure 6 shows the beginning of the installation of the PackStack script.

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

```
[root@localhost ~]# packstack --allinone
Welcome to the Packstack setup utility

The installation log file is available at: /var/tmp/packstack/20160112
Packstack changed given value  to required value /root/.ssh/id_rsa.pub

Installing:
Clean Up                                             [ DONE ]
Discovering ip protocol version                      [ DONE ]
Setting up ssh keys                                  [ DONE ]
Preparing servers                                    [ DONE ]
```

Fig. 7: Running the PackStack script with the 'allinone' switch enabled

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.

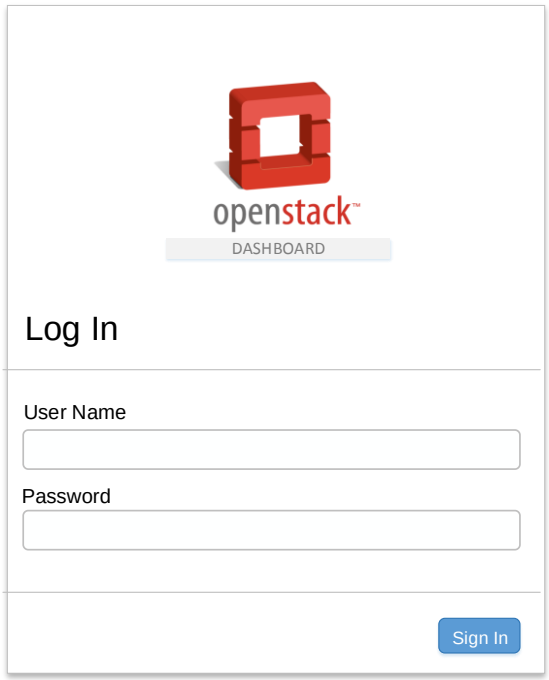

Fig. 8: OpenStack dashboard (Horizon)

Figure 8 shows a screenshot of the OpenStack dashboard (Horizon) as it appears in the Mozilla Firefox Browser.

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 (figure9).

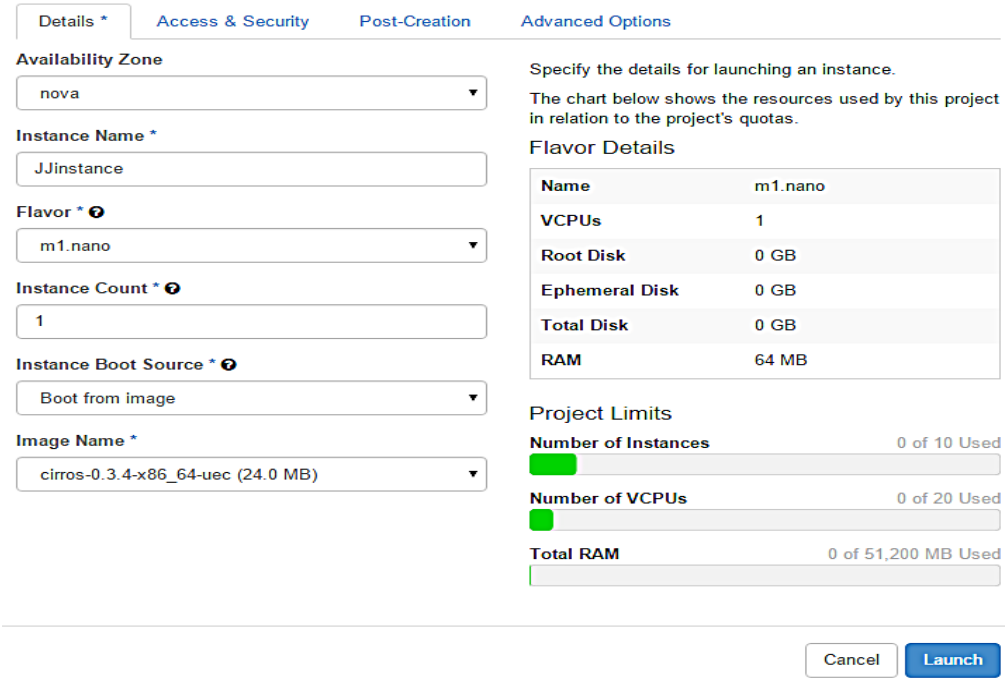

Fig. 9: Launching an instance – Details screen

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.

```
C:\Users\James\Desktop\Cloud1>ssh-keygen -t rsa -f cloud.key
Generating public/private rsa key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in cloud.key.
Your public key has been saved in cloud.key.pub.
The key fingerprint is:
SHA256:fBULmq40FyPO4w5w2CHadpba4p+KksMKx4tjInqvXYE
James@James-Laptop
The key's randomart image is:
+---[RSA 2048]----+
|          . .    |
|         o . o   |
|  . . . =   o    |
| o + * + o .     |
|. = E B S .      |
| o B o * .       |
|o.= o +          |
|OB.+ =           |
|%+=== .          |
+----[SHA256]-----+
```

Fig. 10: Generating an RSA key pair

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.

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

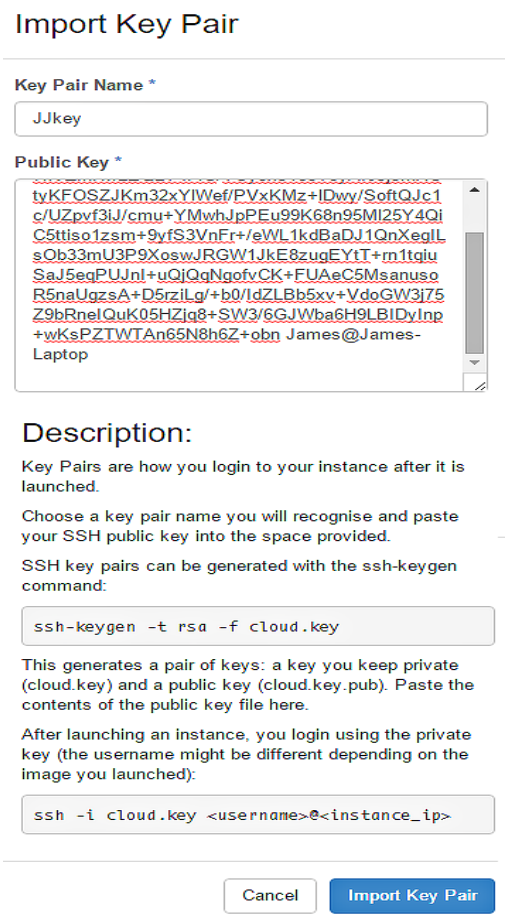

Fig. 11: Import key pair

Below figure 12 shows a screenshot of associating a key with the instance.

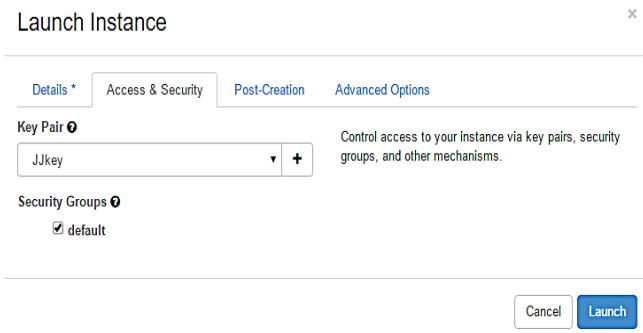

Fig. 12: Launching an instance - Associating a key with the instance

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

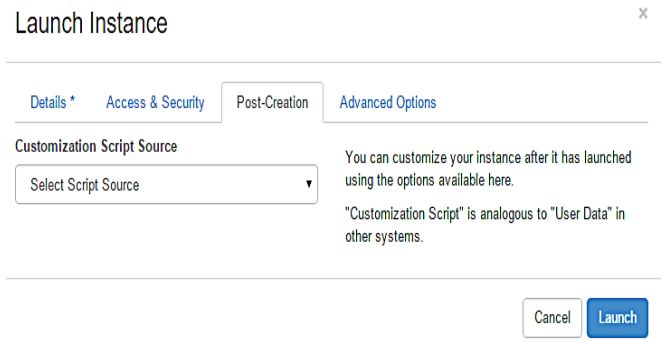

Fig. 13: Launching an instance - CloudInit data input

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

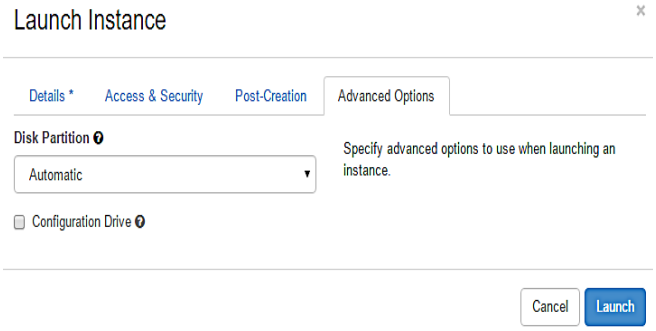

Fig. 14: Launching an instance –Disk partitioning screen

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.

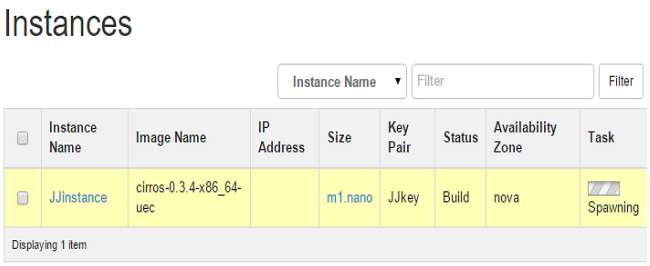

Fig. 15: Launching and instance - Spawning

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 –

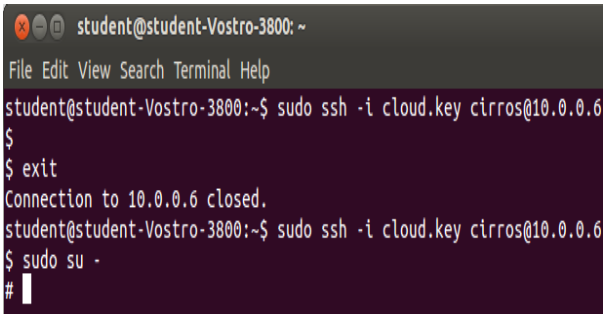

Fig. 17: Logging into an instance using SSH with a private key and getting root privileges

Figure 17 shows the use of SSH to log into an instance using the supplied private key. On logging in, the command 'sudo su – ', was 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 are 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.

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