INSTRUCTIONS TO PROVISION OPENSTACK MANILA AND CINDER (LIBERTY-BASED) USING NETAPP CLUSTERED DATA ONTAP (CDOT), PACKSTACK, AND RDO

Akshai Parthasarathy

Technical Marketing Engineer, Cloud Solutions
Data Fabric Group
NetApp
akshai@netapp.com

Table of Contents

Instructions to Provision OpenStack Manila (Liberty-based) Using NetApp Clustered Data ONTAP (cDOT), PackStack, and RDO

The following instructions setup OpenStack Manila and Cinder (Liberty-based) using PackStack and RDO. RDO is a community of people using and deploying OpenStack on CentOS, Fedora, and Red Hat Enterprise Linux. These instructions are for CentOS7.
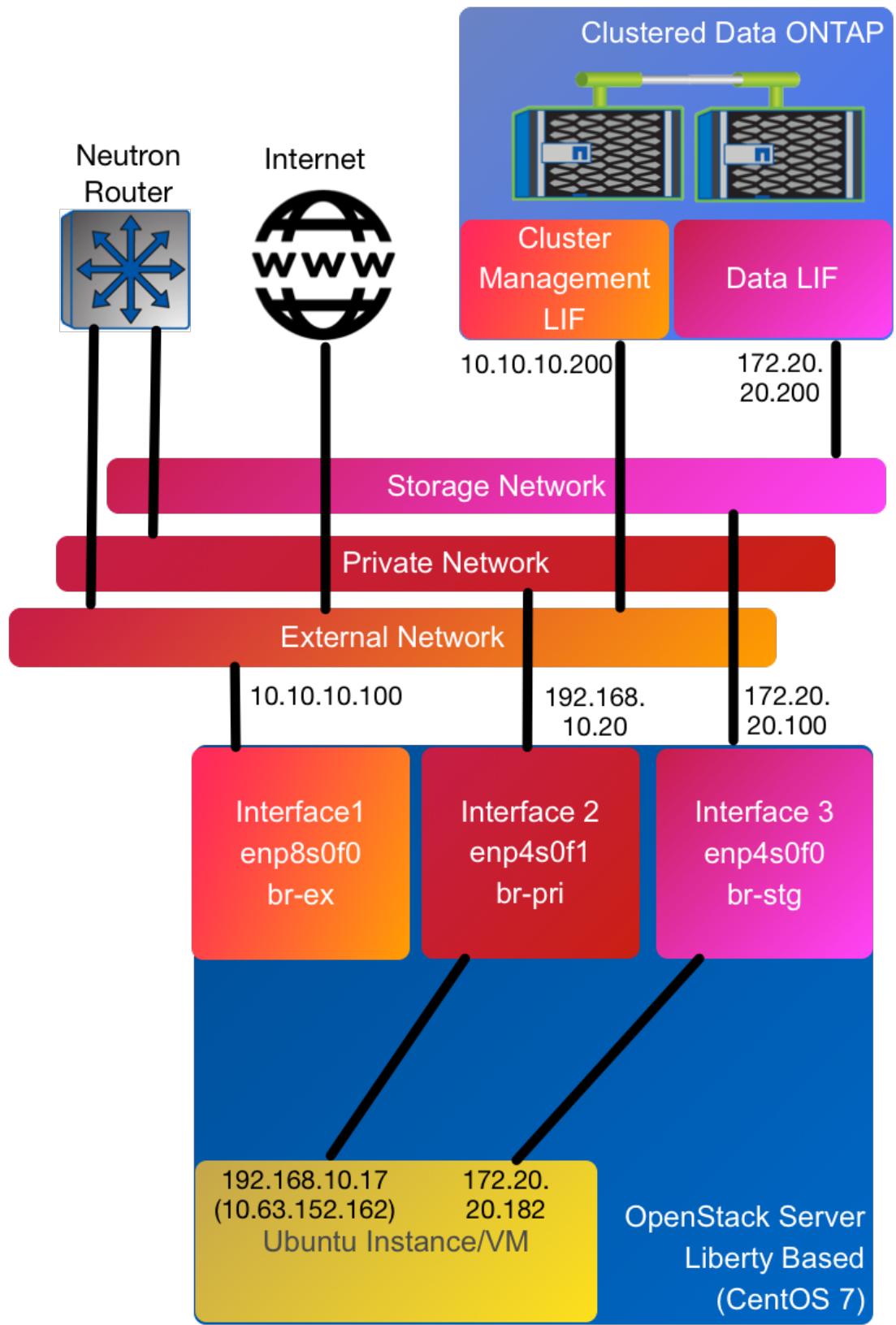
Architecture

This exercise will walk you through installing OpenStack on a single server with 3 network interface cards. Clustered Data ONTAP should be setup with a Cluster Management LIF prior to proceeding. Our recommendation is to provision sufficient disk space (100GB or more), memory (16GB or more), and networking (1Gbps or more) for the OpenStack server. The instructions assume the availability of:

- An external network that you can use to SSH to your server and Clustered Data ONTAP.
- A private network that is used for OpenStack instance-to-instance communication. It is not heavily used in this lab guide, but is needed for instance-to-instance communication.
- A storage network on which the Clustered Data ONTAP NFS Data LIFS are located. In our lab, the Clustered Data ONTAP Cluster Management LIF was located on the external network, but it should still be functional if you have it on the Storage Network along with the NFS Data LIF.

You will also step through the deployment of a Neutron router, creation of a Nova instance, setup and use of a Manila share, and setup and use of a Cinder volume.

The architecture is shown below.

Clustered Data ONTAP

Cluster Management LIF	Data LIF

Neutron Router

Internet

10.10.10.200

172.20.
20.200

Storage Network

Private Network

External Network

10.10.10.100

192.168.
10.20

172.20.
20.100

Interface1 enp8s0f0 br-ex	Interface 2 enp4s0f1 br-pri	Interface 3 enp4s0f0 br-stg

192.168.10.17
(10.63.152.162)
Ubuntu Instance/VM

172.20.
20.182

OpenStack Server
Liberty Based
(CentOS 7)

Setup Clustered Data ONTAP (CDOT)

Please setup your CDOT with a Cluster Management LIF on the external network before proceeding.

#Login to CDOT using your username and password
```
[user@local-machine]$ ssh admin@<cluster-mgt-lif-ip-
address>
Password: <password>
```

Example:
```
$ ssh admin@10.10.10.200
```

#Create a new vserver (SVM). The name used was "netapp-vs" and aggregate (disk pool) used was "aggr1." Your aggregate may be different.
```
OPSK-02::> vserver create -vserver netapp-vs -rootvolume
root -aggregate aggr1 -rootvolume-security-style unix
```

#Ensure that the vserver was created
```
OPSK-02::> vserver show

                                      Admin      Operational Root
Vserver      Type    Subtype    State      State
Volume       Aggregate
----------- ------- ---------- ---------- ----------- -----
----- ----------
netapp-vs data    default    running    running     root
aggr1
<output-removed>
```

#Create a new NFS Data LIF with the appropriate port, address, and netmask
```
OPSK-02::> network interface create -vserver netapp-vs -lif
nfs_lif -role data -data-protocol nfs -home-node OPSK-02-n1
-home-port e0b -address 172.20.20.200 -netmask
255.255.255.0
```

#Note that NFS Data LIF was created
```
OPSK-02::> network interface show
            Logical      Status       Network
Current         Current Is
Vserver       Interface  Admin/Oper Address/Mask        Node
Port     Home
----------- ---------- ---------- ------------------ ------
------- ------- ----
Cluster
netapp-vs
```

```
                nfs_lif      up/up    172.20.20.200/24   OPSK-
02-n1    e0b        true
<output-removed>
```

#Create a default export policy
```
OPSK-02::> vserver export-policy rule create -vserver
netapp-vs -policyname default -clientmatch 0.0.0.0/0 -
rwrule any -rorule any  -allow-suid true -allow-dev true -
protocol any
```

#Note that the export policy was created
```
OPSK-02::> vserver export-policy rule show
              Policy           Rule     Access    Client
RO
Vserver       Name             Index    Protocol Match
Rule
netapp-vs   default           1        any      0.0.0.0/0
any
<output-removed>
```

#Add aggregates to the vserver. Your aggregate names may be different.
```
OPSK-02::>vserver add-aggregates -vserver netapp-vs -
aggregates aggr1 aggr2
```

#Add NFS protocols to the vserver (use tab-completion)
```
OPSK-02::> vserver nfs create -vserver netapp-vs -access
true -v3 enabled -tcp enabled -mount-rootonly enabled -nfs-
rootonly disabled -permitted-enc-types des,des3,aes-
128,aes-256 -showmount disabled -name-service-lookup-
protocol udp
```


The CDOT filer has now been configured for Manila.

OpenStack Server Configuration

Obtain an x86_64 server.
Setup 3 network interface cards on the box.
Ensure it has 16GB of memory, 100GB of disk space, and 1GbE networking.
Install Centos 7 on it. The version installed in the lab was:
CentOS Linux release 7.2.1511 (Core) with GUI

Networking Pre-Configuration

#Login to the server
```
[user@local-machine ~ ]$ ssh root@<external-network-
interface-ip-address>
Password: <password>
```

#Turn NetworkManager off
```
[root@stlrx300s7-102 ~ ]$ service NetworkManager stop
[root@stlrx300s7-102 ~ ]$ chkconfig NetworkManager off
```

#For name resolution, use the following in /etc/resolv.conf
```
nameserver 8.8.8.8
nameserver 8.8.4.4
nameserver 127.0.0.1
```

As mentioned previously, there should be 3 interfaces on the CentOS server.
1. Interface1 connects to your LAN is the external interface
2. Interface2 connects to your private network
3. Interface3 connects to your storage network

	Interface 1	Interface 2	Interface 3
ID	enp8s0f0	enp4s0f1	enp4s0f0
IP Address	10.10.10.100	192.168.10.20	172.20.20.100
Network	10.10.10.0/24	192.168.10.0/24	172.20.20.0/24
Description	External Interface	Internal Interface	Storage Network Interface

The initial configuration of each of these interfaces is shown below, please adapt these to suit your networking.

#ifcfg- enp8s0f0
#Interface 1 initial configuration
TYPE=Ethernet
BOOTPROTO=static
IPADDR=10.10.10.100

```
NETMASK=255.255.255.0
GATEWAY=10.10.10.1
DNS1=10.60.60.100
DNS2=10.70.70.200
DEFROUTE=yes
PEERDNS=yes
PEERROUTES=yes
NAME=enp8s0f0
UUID=a82d2cc3-7e94-496f-9085-54c88ea6983b
DEVICE=enp8s0f0
ONBOOT=yes

#ifcfg- enp4s0f1
#Interface 2 initial configuration
TYPE=Ethernet
BOOTPROTO=static
IPADDR=192.168.10.20
NETMASK=255.255.255.0
DEFROUTE=no
NAME=enp4s0f1
UUID=6d6d7592-f005-4bc1-b5b3-377bdc4aa8b8
DEVICE=enp4s0f1
ONBOOT=yes

#ifcfg- enp4s0f0
#Interface 3 initial configuration
TYPE=Ethernet
BOOTPROTO=static
IPADDR=172.20.20.100
NETMASK=255.255.255.0
DEFROUTE=no
NAME=enp4s0f0
UUID=1844b13f-baaf-4708-96bc-a4e6bb6ecf60
DEVICE=enp4s0f0
ONBOOT=yes
```

Once the interfaces are configured according to your network infrastructure, please:
- ensure that you can ping other hosts in the external (LAN) and storage networks
- ensure that private network interface is up and configured with an IP address.
  Use the command `ifconfig`

[root@stlrx300s7-36 network-scripts]# service network restart
```
Restarting network (via systemctl):                    [  OK  ]
```

#ping the Clustered Data ONTAP Cluster Management LIF
```
[root@stlrx300s7-36 network-scripts]$ ping 10.10.10.200
PING 10.10.10.200 (10.10.10.200) 56(84) bytes of data.
64 bytes from 10.10.10.200: icmp_seq=1 ttl=64 time=1.09 ms
...
```

#ping the Clustered Data ONTAP Data LIF
```
[root@stlrx300s7-36 network-scripts]# ping 172.20.20.200
PING 172.20.20.200 (172.20.20.200) 56(84) bytes of data.
64 bytes from 172.20.20.200: icmp_seq=1 ttl=255 time=0.180
ms
...
```

#ensure that the private network interface is UP
```
[root@stlrx300s7-36 network-scripts]# ifconfig enp4s0f1
enp4s0f1: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 192.168.10.20  netmask 255.255.255.0
broadcast 192.168.10.255
        ether 00:19:99:e0:0b:75  txqueuelen 1000
(Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0
collisions 0
```

Create a new user for OpenStack RDO (optional-you may already have a user created, but it may be easier to follow future instructions if you create this user)

```
[root@stlrx300s7-102 ~ ]$ useradd rdouser
[root@stlrx300s7-102 ~ ]$ sudo visudo
```

#Make the following change (comment out the first line and uncomment the second line):
```
....
## Allows people in group wheel to run all commands
# %wheel        ALL=(ALL)       ALL

## Same thing without a password
%wheel ALL=(ALL)       NOPASSWD: ALL
....
```

#Add rdouser to wheel group
```
[rdouser@stlrx300s7-102 ~ ]$ usermod -aG wheel rdouser
```

```
[rdouser@stlrx300s7-102 ~ ]$ passwd rdouser
Password: <password>
Confirm: <password>
```

#Transfer the install script from your local machine
```
[user@local-machine ~ ] $ scp provision-packstack-
liberty.sh rdouser@<external-interface-ip-
address>:/home/rdouser
```

Install OpenStack Liberty Using Script

```
$./provision-packstack-liberty.sh <answer-file-name>
<cluster-management-lif-ip-address> <vserver-name> <CDOT-
username> <CDOT-password> <external-ethernet-interface>
<private-ethernet-interface> <storage-ethernet-interface>
```
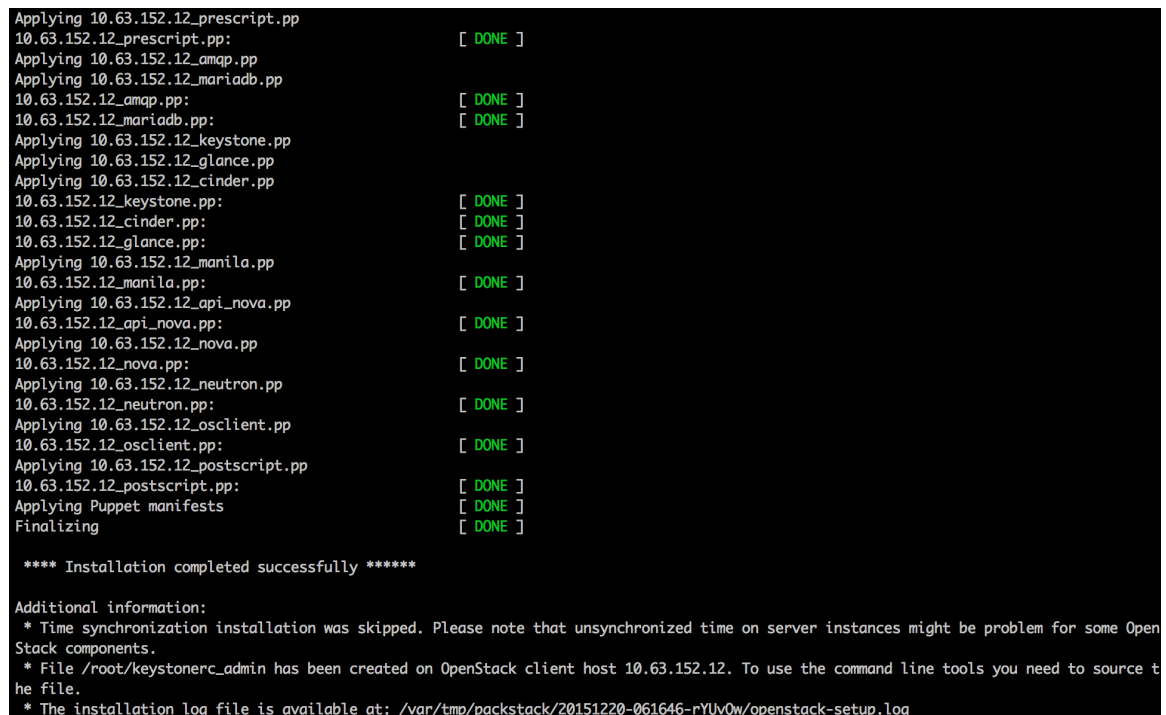
Example:
```
[rdouser@stlrx300s7-102 ~ ]$./provision-packstack-
liberty.sh ans.txt 10.10.10.200 netapp-vs admin Netapp123
enp8s0f0 enp4s0f1 enp4s0f0
```

Wait 30-45 mins for the install to complete. In order to assess your installation success,
please scroll up on the console until you see a message similar to the screenshot below.

Note: You will need to scroll up to check on the installation success.

Setup Neutron Networking

Continue working on the OpenStack server.

#Source the keystonerc_admin file
```
[rdouser@stlrx300s7-102 ~] $. keystonerc_admin
```

#Create an external network and subnet. Note that you need to change the subnet configuration ip addresses to suit your networking. We have allocated a pool of 5 addresses in this example for OpenStack instances/VMs (10.10.10.160-165).
#Note: These ip addresses are not arbitrary. They have to match your topology.

```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron net-
create external-net --router:external --
provider:physical_network exnet --provider:network_type
flat
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron subnet-
create external-net 10.10.10.0/24 --name external-subnet --
allocation-pool start=10.10.10.160,end=10.10.10.165 --
disable-dhcp --gateway 10.10.10.1
```

#Create a private network and subnet. You have to change the ip addresses to suit your networking.
#Note: These ip addresses are not arbitrary. They have to match your topology.

```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron net-
create private-net
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron subnet-
create private-net 192.168.10.0/24 --name private-subnet --
gateway 192.168.10.1
```

#Create a router between private and external networks

```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron router-
create pri-ext-router
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron router-
interface-add pri-ext-router private-subnet
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron router-
gateway-set pri-ext-router external-net
```

#Create a storage network and subnet. You have to change the ip addresses to suit your networking. We have again allocated a pool of 5 addresses for OpenStack VMs/instances. (172.20.20.180-185)
#Note: These ip addresses are not arbitrary. They have to match your topology.

```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron net-
create storage-net --provider:physical_network stgnet --
provider:network_type flat
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron subnet-
create storage-net 172.20.20.0/24 --name storage-subnet --
allocation-pool start=172.20.20.180,end=172.20.20.185
```

Setup Security Group, Glance, Key-Pair, and Ubuntu Instance/VM

#Allow Security Group Access for VMs/instances
```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova secgroup-
add-rule default tcp 1 65535 0.0.0.0/0
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova secgroup-
add-rule default udp 1 65535 0.0.0.0/0
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova secgroup-
add-rule default icmp -1 -1 0.0.0.0/0
```

#Create a Glance Image
```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ curl
http://uec-images.ubuntu.com/trusty/current/trusty-server-
cloudimg-amd64-disk1.img  | glance image-create --
name=ubuntu --container-format=bare --disk-format=qcow2
```

#Create a key-pair
```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ mkdir
/home/rdouser/.ssh
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ ssh-keygen -t
rsa -N "" -f id_rsa
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ mv id_rsa
/home/rdouser/.ssh/
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ mv id_rsa.pub
/home/rdouser/.ssh/
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova keypair-
add openstack_key --pub-key /home/rdouser/.ssh/id_rsa.pub
```

#Get the network IDs for the private and storage networks
```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ neutron net-
list
+--------------------------------------+-------------+----
-------------------------------------------------------+
| id                                   | name        |
subnets                                               |
+--------------------------------------+-------------+----
-------------------------------------------------------+
| 22bdde43-f4ae-4254-adac-b9f33274f2b6 | private-net |
143d2345-8314-448b-bde4-921bfa39a0b4 192.168.10.0/24 |
```

```
| 7e79c010-a71b-4261-beaa-b2ea25eefcd2 | storage-net   |
14d911f6-6c9c-4664-a79c-f23b117c5189 172.20.20.0/24 |
| de1ddd64-b905-43de-bf3f-31b8f36f90c8 | external-net |
ee0f4aab-7bfa-4bb5-88c4-1796bc423f52 10.10.10.0/24  |
+----------------------------------------+-------------+----
--------------------------------------------------+
```

#Create an instance using the network UUIDs from the previous command
```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova boot --
flavor m1.medium --image ubuntu --key-name openstack_key --
nic net-id=<network-id-for-private> --nic net-id=<network-
id-for-storage> <instance-name>
```

#Example: Creating an instance called 'test'
```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova boot  --
flavor m1.medium --image ubuntu --nic net-id=22bdde43-f4ae-
4254-adac-b9f33274f2b6 --nic net-id=7e79c010-a71b-4261-
beaa-b2ea25eefcd2 test
```

#Create a floating IP address and associate it with the instance
```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova floating-
ip-create external-net
+----------------------------------------+--------------+---
--------+----------+-------------+
| Id                                     | IP           |
Server Id | Fixed IP | Pool        |
+----------------------------------------+--------------+---
--------+----------+-------------+
| f67ddc23-b6e3-4b6c-8a5c-9864c1153387 | 10.10.10.162 | -
| -        | external-net |
+----------------------------------------+--------------+---
--------+----------+-------------+
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova floating-
ip-associate test 10.10.10.162
```

#Wait until the instance is Running and has 3 ip addresses
```
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ nova list
+----------------------------------------+-------+--------+--
----------+-----------+------------------------------------
------------------------------------+
| ID                                     | Name  | Status |
Task State | Power State | Networks
|
+----------------------------------------+-------+--------+--
----------+-----------+------------------------------------
------------------------------------+
```

```
| 87b3c024-3e43-4f36-b85b-a23f4ba4a0f4 | test | ACTIVE | -
| Running      | private-net=192.168.10.17, 10.10.10.162;
storage-net=172.20.20.182 |
+-------------------------------------+------+-------+--
----------+------------+----------------------------------
------------------------------------+
```

You will connect to your Nova instance using its floating ip address.

Setup Manila and Create a Share

#Setup Manila to use Single Storage Virtual Machine Mode (Single SVM)
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ manila type-create ontap_share false

#Create and enable access to the share
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ manila create --share-type ontap_share nfs 1
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ manila list
```
+-------------------------------------+------+------+-----
--------+----------+----------+------------+------------
----------------------------------------------+----------
------------------+
| ID                                  | Name | Size |
Share Proto | Status    | Is Public | Share Type  | Export
location                                          | Host
|
+-------------------------------------+------+------+-----
--------+----------+----------+------------+------------
----------------------------------------------+----------
------------------+
| 02ff4bc6-5143-4d6d-b399-c47e377c601b | None | 1     | NFS
| creating | False     | ontap_share |
172.20.20.200:/share_02ff4bc6_5143_4d6d_b399_c47e377c601b |
stlrx300s7-102@netapp#aggr2 |
+-------------------------------------+------+------+-----
--------+----------+----------+------------+------------
----------------------------------------------+----------
------------------+
```

[rdouser@stlrx300s7-102 ~(keystone_admin)]$ manila access-allow 02ff4bc6-5143-4d6d-b399-c47e377c601b ip 0.0.0.0/0

#Ensure that the share is **available**
[rdouser@stlrx300s7-102 rdouser(keystone_admin)]# manila list

```
+-------------------------------------+------+------+-----
-------+----------+----------+------------+------------
-------------------------------------------------+----------
-----------------+
| ID                                  | Name | Size |
Share Proto | Status    | Is Public | Share Type  | Export
location                                           | Host
|
+-------------------------------------+------+------+-----
-------+----------+----------+------------+------------
-------------------------------------------------+----------
-----------------+
| 02ff4bc6-5143-4d6d-b399-c47e377c601b | None | 1     | NFS
| available | False     | ontap_share |
172.20.20.200:/share_02ff4bc6_5143_4d6d_b399_c47e377c601b |
stlrx300s7-102@netapp#aggr2 |
+-------------------------------------+------+------+-----
-------+----------+----------+------------+------------
-------------------------------------------------+----------
-----------------+
```

#If the share is still being created, please run the `manila list` command again and wait.

Login to the Ubuntu Instance and Mount the Share

#Open new shell and ssh to the OpenStack Server
[user@local-machine]$ ssh root@10.10.10.100

#Login to the Ubuntu instance. The **external network ip address** (floating ip) indicated here can be obtained from the output of the `nova list` command from your other shell on OpenStack. (Highlighted)

[root@stlrx300s7-102 ~]$ su - rdouser
[rdouser@stlrx300s7-102 ~]$. keystonerc_admin
**[rdouser@stlrx300s7-102 ~(keystone_admin)]$ ssh
ubuntu@10.10.10.162**

#make the following change in /etc/hosts. "test" is the name of this instance (the value that was specified in the `nova boot` command)
root@test:~$ sudo vim /etc/hosts
#replace the following lines
#127.0.0.1 localhost
127.0.0.1 test

#make the following change to dns
root@test:~$ sudo vim /etc/resolv.conf

nameserver 8.8.8.8

#Setup Networking for eth1 – the storage network interface
ubuntu@test:~$ sudo su –
root@test:~$ apt-get install nfs-common -y

#update the eth1 interface
root@test:~$ vim /etc/network/interfaces.d/eth1.cfg
#insert the following lines for the secondary network interface
auto eth1
iface eth1 inet dhcp
#restart eth1
root@test:~$ ifdown eth1 && ifup eth1

#Ensure that eth1 has an **ip address in the storage network**

root@test:~$ ifconfig eth1

```
eth1      Link encap:Ethernet  HWaddr fa:16:3e:c5:cb:5a
          inet addr:172.20.20.182  Bcast:172.20.20.255
Mask:255.255.255.0
          inet6 addr: fe80::f816:3eff:fec5:cb5a/64
Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1400
Metric:1
          RX packets:1193 errors:0 dropped:0 overruns:0
frame:0
          TX packets:30 errors:0 dropped:0 overruns:0
carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:110852 (110.8 KB)  TX bytes:2846 (2.8
KB)
```

#Get the mount point of the share. Switch to the OpenStack shell and run `manila list`
[rdouser@stlrx300s7-102 rdouser(keystone_admin)]# manila list

```
+-------------------------------------+------+------+-----
--------+----------+----------+------------+------------
-------------------------------------------+----------
------------------+
| ID                                  | Name | Size |
Share Proto | Status    | Is Public | Share Type  | Export
location                                           | Host
|
```

```
+-------------------------------------+------+------+-----
--------+----------+---------+-----------+-----------
-------------------------------------------------+----------
------------------+
| 02ff4bc6-5143-4d6d-b399-c47e377c601b | None | 1    | NFS
| available | False     | ontap_share |
172.20.20.200:/share_02ff4bc6_5143_4d6d_b399_c47e377c601b |
stlrx300s7-102@netapp#aggr2 |
+-------------------------------------+------+------+-----
--------+----------+---------+-----------+-----------
-------------------------------------------------+----------
------------------+
```

#On the Ubuntu instance, mount the share using its export path
root@test:~$ exit
ubuntu@test:~$ sudo mkdir /mnt/nfs_share
ubuntu@test:~$ sudo mount -t nfs
172.20.20.200:/share_02ff4bc6_5143_4d6d_b399_c47e377c601b
/mnt/nfs_share

#Confirm that the share is mounted
root@test~# df -kh
```
Filesystem
Size  Used Avail Use% Mounted on
udev
2.0G   12K  2.0G   1% /dev
tmpfs
396M  344K  396M   1% /run
/dev/disk/by-label/cloudimg-rootfs
40G   872M   37G   3% /
none
4.0K     0  4.0K   0% /sys/fs/cgroup
none
5.0M     0  5.0M   0% /run/lock
none
2.0G     0  2.0G   0% /run/shm
none
100M     0  100M   0% /run/user
```
172.20.20.200:/share_02ff4bc6_5143_4d6d_b399_c47e377c601b
973M 128K 973M   1% /mnt/nfs_share

#Ensure that the share is writable
ubuntu@test:~$ sudo ls /mnt/nfs_share
ubuntu@test:~$ sudo touch /mnt/nfs_share/file.txt
ubuntu@test:~$ sudo ls /mnt/nfs_share
```
file.txt
```

You have now setup Manila, created a share and accessed from an OpenStack instance. If your networking is setup to provide access to the storage network (with or without routing), you should also be able to create shares using Manila for clients outside the OpenStack cloud.

Setup Cinder and Create a Volume

On your CDOT, please create a FlexVol volume container, ensuring that your **"unix-permissions"** and **"junction-path"** are as shown below. You will use the junction path as the ==Cinder back end== later.

```
OPSK-02::> volume create -vserver netapp-vs -volume
cinderbe -aggregate aggr1 -size 25G -state online -type RW
-policy default -unix-permissions ---rwxrwxrwx  -security-
style unix –junction-path /cinderbe
```

The CDOT filer has now been configured for Cinder. We will perform the remaining steps on the OpenStack.

#change to the root user
```
[rdouser@stlrx300s7-102 rdouser(keystone_admin)]# sudo su
```

#"cd" to /etc/cinder and modify cinder.conf as shown below
```
[root@stlrx300s7-102 rdouser(keystone_admin)]#
cd /etc/cinder/
```

#edit cinder.conf as shown below. Pay particular attention to **netapp_server_hostname** (the CDOT IP Address), **netapp_password** (the CDOT password), and **netapp_vserver** (should be "netapp-vs")
```
[root@stlrx300s7-35 cinder]# vim cinder.conf
```

```
…
…
…
enabled_backends=netapp
…
…
…
[netapp]
volume_backend_name=netapp
volume_driver=cinder.volume.drivers.netapp.common.NetAppDri
ver
netapp_server_hostname=10.10.10.200
```

```
netapp_storage_protocol=nfs
netapp_storage_family=ontap_cluster
netapp_login=admin
```
netapp_password=\<replace-with-CDOT-password\>
netapp_vserver=netapp-vs
```
nfs_shares_config=/etc/cinder/shares.conf
nas_secure_file_permissions = false
nas_secure_file_operations = false
…

…
```

#edit the shares.conf file. The portion after the ":" is the Cinder backend and must match the junction path for the CDOT FlexVol exactly.
vim shares.conf
```
172.20.20.73:/cinderbe
```

#restart the Cinder scheduler and volume services
[root@stlrx300s7-35 cinder]# service openstack-cinder-scheduler restart
```
Redirecting to /bin/systemctl restart  openstack-cinder-scheduler.service
```
[root@stlrx300s7-35 cinder]# service openstack-cinder-volume restart
```
Redirecting to /bin/systemctl restart  openstack-cinder-volume.service
[root@stlrx300s7-35 cinder]#
```

#create a volume-type and point it to the netapp backend. This will inform Cinder to create volumes on the netapp filer
[root@stlrx300s7-35 cinder(keystone_admin)]# cinder type-create ontap
```
<output removed>
```
[root@stlrx300s7-35 cinder(keystone_admin)]# cinder type-key ontap set volume_backend_name=netapp

#confirm that the extra specs were set correctly
[root@stlrx300s7-35 cinder(keystone_admin)]# cinder extra-specs-list
```
+------------------------------------+-------+----------
----------------------------+
|                 ID                 |  Name |
extra_specs             |
+------------------------------------+-------+----------
----------------------------+
```

```
| 83514593-ceff-4331-a5f7-e6add0f08d25 | ontap   |
{u'volume_backed_name': u'netapp'}    |
+----------------------------------+-------+---------
---------------------------+
```

#create a Cinder volume
```
[root@stlrx300s7-35 cinder(keystone_admin)]# cinder create
--volume-type ontap 1
<output-removed>
 [root@stlrx300s7-35 cinder(keystone_admin)]# cinder list
+----------------------------------+----------+------
----------+------+------+-------------+---------+-------
-----+------------+
|                ID                | Status  |
Migration Status | Name | Size | Volume Type | Bootable |
Multiattach | Attached to |
+----------------------------------+----------+------
----------+------+------+-------------+---------+-------
-----+------------+
| 7ad7e231-292a-45ac-ac7a-37149dcfc436 | available |
-          | -  | 1  |   ontap   | false  |   False
|         |
+----------------------------------+----------+------
----------+------+------+-------------+---------+-------
-----+------------+
```

#attach the cinder volume the "test" nova instance
```
[root@stlrx300s7-35 manila(keystone_admin)]# nova volume-
attach test 7ad7e231-292a-45ac-ac7a-37149dcfc436
+----------+--------------------------------------+
| Property | Value                                |
+----------+--------------------------------------+
| device   | /dev/vdb                             |
| id       | 7ad7e231-292a-45ac-ac7a-37149dcfc436 |
| serverId | 87b3c024-3e43-4f36-b85b-a23f4ba4a0f4 |
| volumeId | 7ad7e231-292a-45ac-ac7a-37149dcfc436 |
+----------+--------------------------------------+
```

#confirm that the volume is attached
```
[root@stlrx300s7-35 manila(keystone_admin)]# cinder list
+----------------------------------+-------+---------
--------+------+------+-------------+---------+----------
--+----------------------------------+
|                ID                | Status | Migration
Status | Name | Size | Volume Type | Bootable | Multiattach
|              Attached to         |
```

```
+------------------------------------+--------+---------
--------+------+------+------------+---------+----------
--+------------------------------------+
| 1cae0e72-b8ae-4d42-9430-74380e4400ce | in-use |        -
|   -   |  1   |  packstack |  false  |   False    |
87b3c024-3e43-4f36-b85b-a23f4ba4a0f4 |
+------------------------------------+--------+---------
--------+------+------+------------+---------+----------
--+------------------------------------+
```

Login to the Ubuntu Instance and Use the Cinder Volume

#Open new shell and ssh to the OpenStack Server
[user@local-machine]$ ssh root@10.10.10.100

#Login to the Ubuntu instance. The **external network ip address** (floating ip) indicated here can be obtained from the output of the `nova list` command.

[root@stlrx300s7-102 ~]$ su - rdouser
[rdouser@stlrx300s7-102 ~]$. keystonerc_admin
[rdouser@stlrx300s7-102 ~(keystone_admin)]$ ssh
ubuntu@10.10.10.162

#confirm that the 1GB volume is present and available for use
ubuntu@test:~$ lsblk
ubuntu@test4-ubuntu-updated:~$ lsblk
```
NAME    MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
vda     253:0    0  40G  0 disk
 └─vda1 253:1    0  40G  0 part /
vdb     253:16   0   1G  0 disk
```

--end of instructions –

Troubleshooting

PackStack Install: RabbitMQ
PackStack install fails because rabbitmq-server cannot be started.

Ensure that that `/etc/hosts` and `/etc/hostname` are similar.
Example:
```
/etc/hosts
::1      localhost
127.0.0.1   centos7.corp.com   centos7
```

```
/etc/hostname
centos7
```

PackStack Install: NetworkManager
PackStack installs fail with NetworkManager errors.

Ensure that NetworkManager is stopped and turned off prior to PackStack install
```
$ service NetworkManager stop
$ chkconfig NetworkManager off
```

Commands on Nova, Cinder and Manila fail with "You must provide a user…" ERROR

Please source the keystonerc_admin file if you see the following error when running commands:

```
ERROR: You must provide a user name through --os-username
or env[OS_USERNAME].
$ source ~/keystonerc_admin
$ cinder list
+-------------------------------------+----------+-------
----------+------+------+------------+---------+-------
-----+------------+
|                 ID                  |  Status  |
Migration Status | Name | Size | Volume Type | Bootable |
Multiattach | Attached to |
+-------------------------------------+----------+-------
----------+------+------+------------+---------+-------
-----+------------+
+-------------------------------------+----------+-------
----------+------+------+------------+---------+-------
-----+------------+
```

Creating a Nova Instance Error
Nova instances don't boot and show an ERROR status almost immediately.

The Glance image you're using may be fetched from an outdated URL. For the latest URLs, please check http://docs.openstack.org/image-guide/obtain-images.html#official-ubuntu-images. In order to try with the new URL, please run the following command with the updated URL:

```
$ curl <replace-with-updated-image-url>  | glance image-
create --name=ubuntu-updated --container-format=bare --
disk-format=qcow2
```

Use the `ubuntu-updated` image in your nova boot command.

```
$ nova boot --flavor m1.medium --image ubuntu-updated --
key-name openstack_key test2
```

What were the changes made to manila.conf through the install script?

Manila.conf will have a new stanza called 'netapp' and this stanza will be enabled using the enabled_share_backends parameter.

```
####################
# manila.conf      #
###################…
…
enabled_share_backends=netapp
…
…
[netapp]
netapp_volume_name_template=share_%(share_id)s
netapp_vserver_name_template=os_%s
netapp_vserver=netapp-vs
netapp_password=Netapp123
driver_handles_share_servers=False
netapp_server_port=80
netapp_server_hostname=10.10.10.200
netapp_transport_type=http
netapp_login=admin
netapp_storage_family=ontap_cluster
netapp_aggregate_name_search_pattern=(.*)
netapp_lif_name_template=os_%(net_allocation_id)s
netapp_port_name_search_pattern=(.*)
share_driver=manila.share.drivers.netapp.common.NetAppDrive
r
share_backend_name=netapp
…
….
```

Do I need to setup Manila first if I only want Cinder?
No, you don't need to setup Manila for Cinder. However, in order to setup Cinder, you should setup CDOT first and install OpenStack. To setup only Cinder, your sequence of steps will be:

1. Architecture
2. Setup Clustered Data ONTAP (CDOT)
3. OpenStack Server Configuration
4. Networking Pre-Configuration

5. Install OpenStack Liberty Using Script
6. Setup Neutron Networking
7. Setup Security Group, Glance, Key-Pair, And Ubuntu Instance/VM
8. Setup Cinder and Create a Volume
9. Login to the Ubuntu Instance and Use the Cinder Volume

Acknowledgments