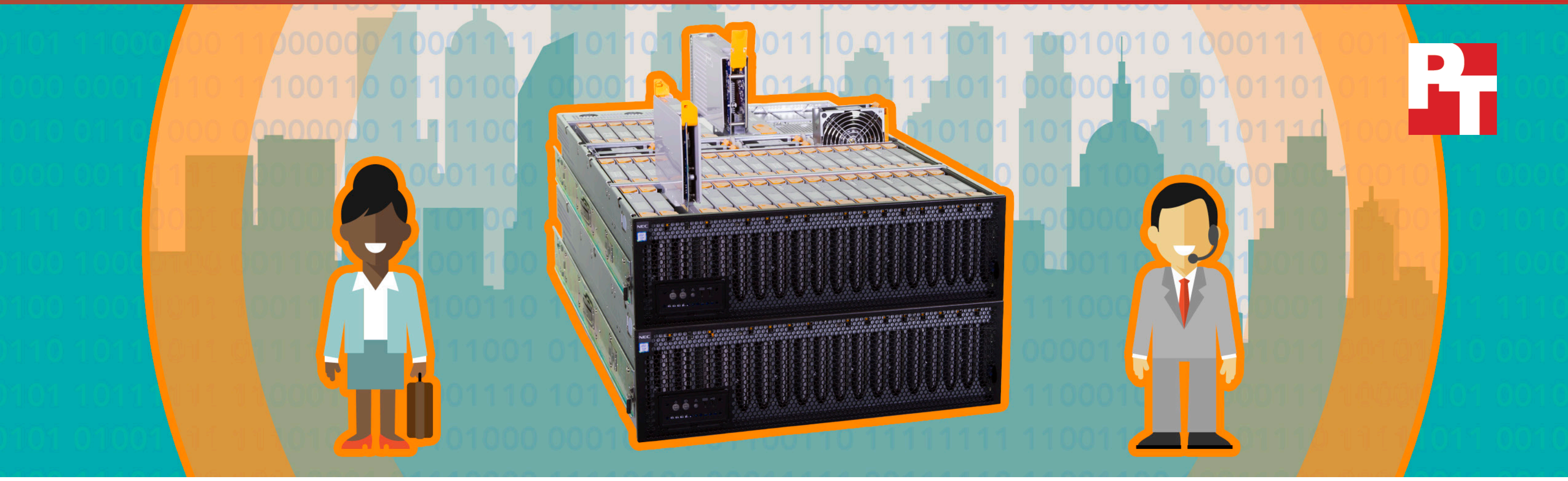
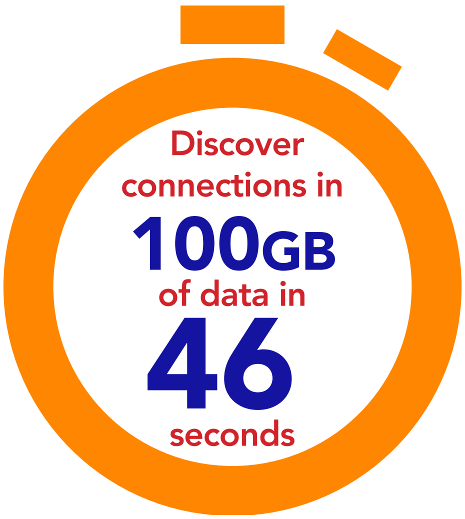


Unlock the value of big data with the DX2000 from NEC

With speedy analysis in a highly scalable solution, powered by Intel

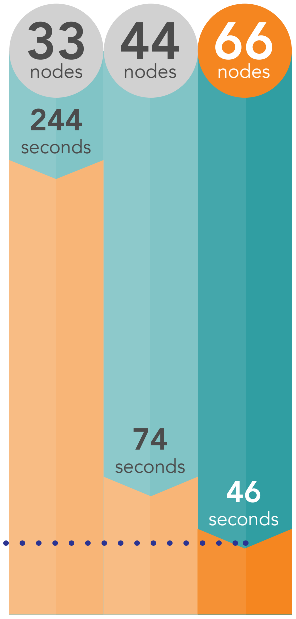


Effective, accurate data analysis is a must. The big data your business examines today is a building block for the sales and business initiatives of tomorrow. Finding connections in data, no matter what the form or size, leads to better insights into your business.

Starting with the right infrastructure means your analytical capabilities can expand easily to fulfill the growing needs of your company. The Scalable Modular Server DX2000 from NEC can deliver quick analytical insight, scaling as your analytics workloads evolve.

Building on our previous discoveries,[1] we evaluated how well the new Scalable Modular Server DX2000 from NEC, powered by the Intel® Xeon® processor D product family, could scale as your data analysis needs grow. We configured a Red Hat® Enterprise Linux® OpenStack® cloud environment with Apache Spark™, an industry-leading big-data analytics engine. We evaluated a single DX2000 enclosure with 33 four-core server nodes and then with 44 four-core server nodes. Finally, we scaled out to a second enclosure containing 22 eight-core server nodes. The eight-core nodes allowed us to run 85 executors of our Apache Spark™ workload on the 66 server nodes.

As we added server nodes, the solution analyzed a big data sample set quicker and more efficiently, and most importantly, in a predictable, scalable fashion.



Get answers even faster by adding server nodes

The Scalable Modular Server DX2000 from NEC has 44 customizable slots available to create a number of configurations. Each DX2000 could hold up to:

- 44 server nodes featuring Intel Xeon D processors for compute density, 2.75TB DDR4 memory (64 GB per server node), and 22TB of flash-based storage (512 GB per server node)
- 22 dual 10Gb Ethernet links for additional networking (up to 22 slots for server nodes)
- 8 PCIe card modules for expanding resources available to specific server nodes (up to 36 slots for server nodes)

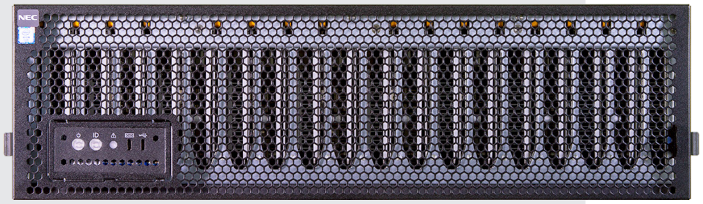
Clustering nodes of necessary resources in a small space makes sense for big data initiatives, particularly because big data requires so much processing power.

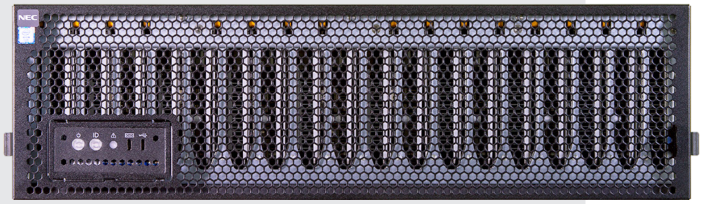
Each of the 44 server nodes in our first DX2000 enclosure featured the following:

- 4-core Intel Xeon processor D-1527
- 16GB memory
- 512GB flash-based storage
- Dual 10Gb Ethernet links

Each of the 22 server nodes in our second DX2000 enclosure featured the following:

- 8-core Intel Xeon processor D-1541
- 64GB memory
- 256GB flash-based storage
- Dual 10Gb Ethernet links





Build data analysis upon a solid foundation

A good foundation supports and stabilizes structures as they develop. This applies to your business, too. Existing big data initiatives in your business need dependable hardware resources to keep pace with often rapidly growing data. Your business can continue to gain valuable insights quickly when resource growth meets demand.

Processing large volumes of data in a timely manner requires significant compute power. The DX2000 brings that power by providing up to 44 multi-core server modules per 3U enclosure.

Apache Spark—the analytics tool we used in testing—uses in-memory processing, which helps shorten the time to analyze data. Combining Apache Spark with the memory resources of DX2000 server nodes allows you to get results more quickly than traditional disk-based approaches in many applications.

Heighten insights in limited rack space

Once you've started capturing and analyzing valuable big data, you may want to expand your infrastructure to keep pace with the need for more in-depth analysis on existing data. However, limited datacenter space and hardware connectivity can limit scaling out and up. This is when resource density becomes even more important – adding compute, storage, and networking resources in as little space as possible is ideal.

A scalable modular server platform, such as the DX2000 by NEC, is a rack-mounted enclosure holding multiple server units, often called server nodes, which commonly work together as a cluster. These compact server nodes pack compute, storage, and networking resources into a small space. You can add nodes to your solution as needed to provide ample memory resources to existing clusters as well.

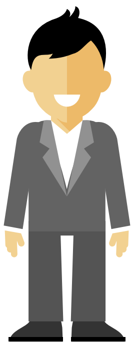
No need to unnecessarily expand your datacenter or shut down an existing cluster just to get more processing power – the DX2000 from NEC with Apache Spark is your opportunity to scale out effectively.

How can big data improve business?

When a business can analyze big data quickly, multiple departments have the ability to reap benefits. Consider the following scenarios:

Stay ahead of the competition

Dimitri is a retail fashion buyer for a major national chain of stores. He guarantees that his store has the merchandise his customer base wants, in their sizes, when they need it. He uses predictive analysis to determine his customer's preferences as well as financial forecasts to guide the advertising and marketing teams in their promotional endeavors. The faster the company's servers analyze the incoming data he relies on, the sooner Dimitri gets the reports he needs to predict sales patterns and plan his gross margin goals. The Scalable Modular Server DX2000 from NEC and Apache Spark provide a powerful platform for his analysis and forecast requirements, which helps him make informed purchase and marketing decisions.



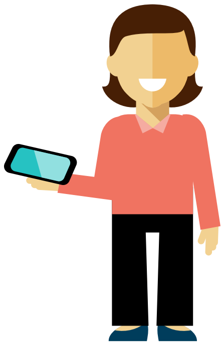
Tap into the power of big data with Apache Spark

Apache Spark is an industry-standard framework that processes big data in-memory. In-memory processing keeps data in RAM to shorten response times. Companies like Amazon, eBay, NASA Jet Propulsion Laboratories, TripAdvisor, and Yahoo use this tool to help them get real-time bid optimization, machine learning-based user data modeling, forecasting, and other predictive analytics.[2]

Your business can use robust hardware platforms like the DX2000 from NEC in conjunction with machine learning functionality – among other valuable kinds of data processing in Apache Spark – to make better use of your growing data and achieve fast analysis turnaround times.

Drive business strategy

Anna, a logistics and distribution manager for a regional superstore chain, supervises the movement of goods to and from warehouses across the country. Anna and her team save the company money by using data analytics to organize the warehouses in a way that streamlines the storage and retrieval of goods. Her team also works closely with the purchasing department and operations managers to facilitate smooth shipping and receiving strategies. Apache Spark and the Scalable Modular Server DX2000 from NEC can help Anna and her team predict and implement warehouse layout changes that keep the most popular items easily accessible.



Access meaningful analytics

In our datacenter, we used the clustering algorithm *k*-means. *k*-means takes large data sets and identifies patterns in them. Companies often use it in predictive analysis for cost modeling, market research, price forecasting, and customer-retention applications.

Boost your sales

Priyanka is a sales strategist for a national transportation services firm. Her CEO just authorized an increase in department funding to aggressively grow sales and marketing activity. She needs to create a cohesive prospecting strategy to figure out the best way to do that. Using the Scalable Modular Server DX2000 from NEC and Apache Spark for her data analysis means Priyanka can quickly gather the valuable information that identifies new revenue targets and directly affects the company's bottom line.

What we learned

Discover connections in your data

We put the one- and two-enclosure DX2000 solutions through their paces with a *k*-means data cluster analysis test from the HiBench benchmark suite. We used this tool because it measures algorithms that may be similar to those used by companies in their data analysis. When all 63 available compute nodes in our two-chasis configuration were running the *k*-means analysis, the NEC solution took 56 seconds to process approximately 100 GB of data. The eight-core server modules had additional resources to offer, so we created 22 more Spark executors to total 85. The 85-executor solution took 46 seconds to process the same data. Even though the data set we used is small by some big data standards, a hundred gigabytes is representative of some publicly available applications and use cases, and it could reflect scenarios that you can relate to. For example, 100 GB is large enough to store demographic data for the world's population in 2009 or three months of Wikipedia's page traffic statistics.[3,4]

Get answers even faster

We also compared throughput, a measure of how quickly a system can process data, as we increased the number of nodes first in a single enclosure and then scaled out to two enclosures. We did this to demonstrate how increasing the number of server nodes can increase the throughput capabilities of the DX2000, thus cutting down on processing time required for big data analysis. We began our scaling comparison with 33 server nodes in a single enclosure. We determined that due to the application design, data set footprint, and available memory resources, the fewest four-core nodes needed to run a data set this size was 33. Ultimately, a mix of 66 four-core and eight-core server nodes delivered more than double the throughput of 33, dropping analysis time of our 100 GB data set dramatically compared to our initial 33-server-node count. Our 44-server-node configuration showed more than three times the throughput of the 33-server-node configuration. In all three configurations, we used three server nodes for management services and the remaining nodes for data processing. Based on the results we got from 33 to 44 to 66 nodes, we expect your big data throughput could scale as your business grows.

We chose a sample data set big enough to store demographic data for 6.75 billion people.[3]

Big data analytics with private cloud flexibility

We deployed and tested a Red Hat OpenStack Platform environment in the Principled Technologies datacenter. In this OpenStack environment, we used three OpenStack controller servers for high availability, one server for management tasks, one server for Red Hat OpenStack Platform Director services, and up to two DX2000 enclosures from NEC with up to 66 server nodes. This deployment provided the flexible private cloud environment we needed for our Apache Spark VMs.

Red Hat Enterprise Linux OpenStack Platform 8

is an Infrastructure-as-a-Service (IaaS) private cloud solution. It allows you to build a cloud platform on your hardware and use resources efficiently.

When you use Red Hat Enterprise Linux OpenStack Platform 8 in conjunction with Apache Spark and the DX2000 environment, your team can dedicate as much or as little space to big data analysis as you need. The flexibility of this platform means you can spin up application instances to meet changing IT demands.

Cloud platforms such as Red Hat Enterprise Linux OpenStack Platform help increase your flexibility by adapting your hardware environment without having to rebuild your infrastructure from the ground up. For more information, please visit Red Hat's website.[5]

Conclusion

As data continues to pile up and departments find new ways to look at it, your datacenter needs a dense, powerful solution that can analyze this data quickly and scale resources as needed.

The Scalable Modular Server DX2000 from NEC processed big data quickly as we added server nodes and a second enclosure. In our *k*-means data cluster analysis test, a two-enclosure DX2000 solution running 85 Apache Spark executors and Red Hat Enterprise Linux OpenStack Platform processed 100 GB in just 46 seconds.

If you're looking to expand your business through data analysis, the Scalable Modular Server DX2000 from NEC powered by Intel and running Apache Spark can help you unlock key big data insights.

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1 http://facts.pt/p7bReD

2 https://cwiki.apache.org/confluence/display/SPARK/Powered+By+Spark

3 Basic demographic data refers to age, sex, income, ethnicity, language, religion, housing status, and location. Read a more detailed explanation and review at http://dl.acm.org/citation.cfm?id=1536632.

4 https://aws.amazon.com/datasets/wikipedia-page-traffic-statistic-v3/

5 https://access.redhat.com/documentation/en/red-hat-enterprise-linux-openstack-platform/version-7/red-hat-enterprise-linux-openstack-platform-7-architecture-guide/preface

On June 9, 2016, we finalized the hardware and software configurations we tested. Updates for current and recently released hardware and software appear often, so unavoidably these configurations may not represent the latest versions available when this report appears. We concluded hands-on testing on June 15, 2016.

Appendix A – Inside the server we tested

Figure 1 provides detailed configuration information for each of the 66 server nodes we tested.

Server configuration information	Server node type A	Server node type B
Number of server nodes	44	22
BIOS name and version	MM60-B30, BIOS 5.0.2011	MM60-B30, BIOS 5.0.0005
Non-default BIOS settings	Changed from UEFI to Legacy BIOS	Changed from UEFI to Legacy BIOS
Operating system name and version/build number	Red Hat Enterprise Linux 7.2 3.10.0-327.13.1.el7.x86_64	Red Hat Enterprise Linux 7.2 3.10.0-327.13.1.el7.x86_64
Date of last OS updates/patches applied	06/09/2016	06/09/2016
Power management policy	Default	Default
Processor		
Number of processors	1	1
Vendor and model	Intel Xeon CPU D-1527	Intel Xeon CPU D-1541
Core count (per processor)	4	8
Core frequency (GHz)	2.20	2.10
Stepping	V2	V2
Memory module(s)		
Total memory in system (GB)	16	64
Number of memory modules	1	4
Vendor and model	Hynix HMA82GS7MFR8N-TF	Hynix HMA82GS7MFR8N-TF
Size (GB)	16	16
Type	PC4-17000	PC4-17000
Speed (MHz)	2133	2133
Speed running in the server (MHz)	2133	2133
Storage controller		
Vendor and model	Intel 82801JI	Intel 82801JI
Cache size	N/A	N/A
Driver version	2.13	2.13

Server configuration information	Server node type A	Server node type B
Local storage		
Number of drives	1	1
Drive vendor and model	Toshiba THNSNJ256G8NU	Toshiba THNSNJ256G8NU
Drive size (GB)	512	256
Drive information (speed, interface, type)	6Gb/s, M.2, SSD	6Gb/s, M.2, SSD
Network adapter		
Vendor and model	Intel X552	Intel X552
Number and type of ports	2 x 10GbE	2 x 10GbE
Driver version	4.0.1-k-rh7.2	4.3.15

Figure 1: Detailed configuration information for each of the 66 server nodes we tested.

Figure 2 provides detailed configuration information for the two server enclosures we used in our tests.

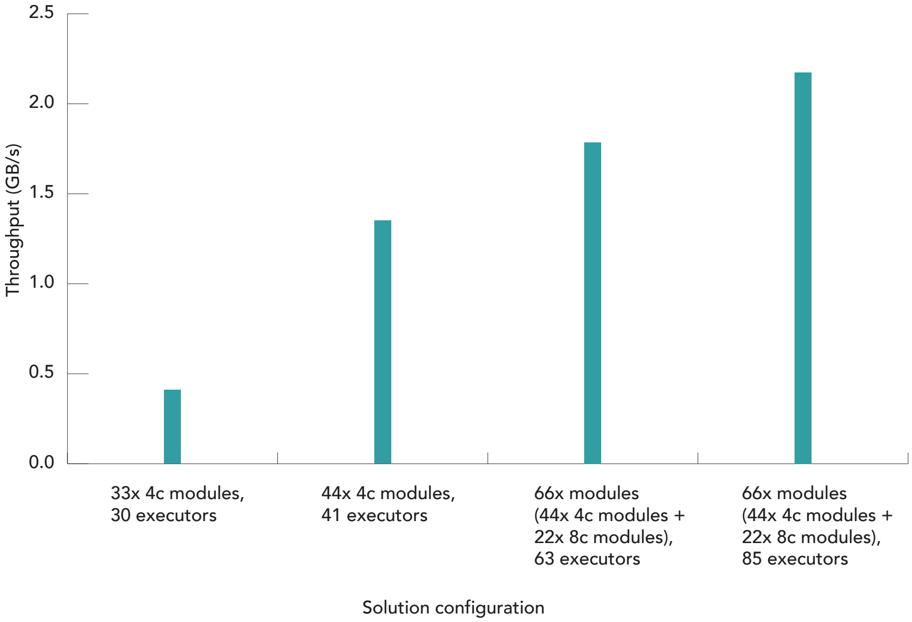
Server enclosure configuration information	NEC Scalable Modular Server DX2000
Number of management modules	2
Management module firmware revision	00.19
I/O module	
Vendor and model number	NEC Micro Modular Server DX2000 LAN Switch
I/O module firmware revision	ZebOS-XP version 1.2.0.5
Number of modules	2
Occupied bay(s)	1, 2
Power supplies	
Vendor and model number	Delta Electronics DPS-1600FB
Number of power supplies	3
Wattage of each (W)	1600
Cooling fans	
Dimensions in millimeters	80x80x30
Number of fans	8

Figure 2: Configuration information for the server enclosures.

Appendix B – Inside our testing

Detailed information on the results of our testing

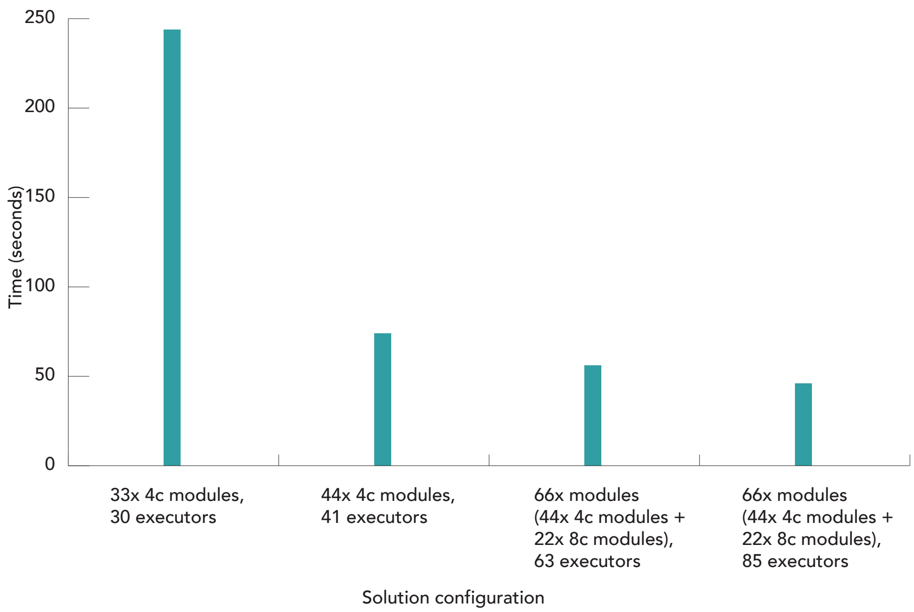
Figure 3 shows our median throughput results from 33 server nodes with 30 executors to 66 nodes with 85 executors.



Configuration	Throughput (GB/s)
33x 4c modules, 30 executors	0.41
44x 4c modules, 41 exectuors	1.35
66x modules (44x 4c modules + 22x 8c modules), 63 executors	1.79
66x modules (44x 4c modules + 22x 8c modules), 85 executors	2.18

Figure 3: *k*-means median throughput.

Figure 4 shows the median times to process the sample data set from 33 server nodes with 30 executors to 66 nodes with 85 executors.



Configuration	Seconds
33x 4c modules, 30 executors	244
44x 4c modules, 41 executors	74
66x modules (44x 4c modules + 22x 8c modules), 63 executors	56
66x modules (44x 4c modules + 22x 8c modules), 85 executors	46

Figure 4: *k*-means median time.

Detailed information on how we tested the DX2000

Configuring Red Hat Enterprise Linux OpenStack Platform Director

1. Create a Director user:

```
useradd stack
passwd stack

echo "stack ALL=(root) NOPASSWD:ALL" | tee -a /etc/sudoers.d/stack
chmod 0440 /etc/sudoers.d/stack

su - stack
```

2. Create directories for templates and images:

```
mkdir ~/images
mkdir ~/templates
```

3. Set the hostname of the system:

```
sudo hostnamectl set-hostname director.test.lan
sudo hostnamectl set-hostname --transient director.test.lan

sudo vi /etc/hosts
```

An example of the content in the host file:

```
127.0.0.1   director.test.lan director localhost localhost.localdomain localhost4 localhost4.localdomain4
::1         director.test.lan director localhost localhost.localdomain localhost6 localhost6.localdomain6
```

4. Register the system:

```
sudo subscription-manager register

sudo subscription-manager list --available --all
```

5. Locate the OpenStack pool ID in output, and replace it with the following:

```
sudo subscription-manager attach --pool=<pool id>
sudo subscription-manager repos --disable=*
sudo subscription-manager repos --enable=rhel-7-server-rpms --enable=rhel-7-server-extras-rpms --en-
able=rhel-7-server-openstack-8-rpms --enable=rhel-7-server-openstack-8-director-rpms --enable=rhel-7-serv-
er-rh-common-rpms
sudo yum update -y
sudo reboot
```

6. Install the Director packages and additional widgets:

```
su - stack
sudo yum install -y python-tripleoclient
sudo reboot

yum install -y wget vim sysstat
```

7. Complete SSL certificate configuration:

```
su - stack
cp /etc/pki/tls/openssl.cnf .

vim ~/openssl.cnf
```

a. Modify the following lines in the SSL certificate:

```
[ req_distinguished_name ]
countryName_default             = US
stateOrProvinceName_default     = Default State
localityName_default            = Default City
organizationalUnitName_default  = TestOrg
commonName_default              = 192.0.2.2

[ v3_req ]
basicConstraints = CA:FALSE
keyUsage = nonRepudiation, digitalSignature, keyEncipherment
subjectAltName = IP:192.0.2.2

openssl genrsa -out privkey.pem 2048
openssl req -new -x509 -key privkey.pem -out cacert.pem -days 365 -config ~/openssl.cnf
cat cacert.pem privkey.pem > undercloud.pem

sudo mkdir /etc/pki/instack-certs
sudo cp ~/undercloud.pem /etc/pki/instack-certs/.
sudo semanage fcontext -a -t etc_t "/etc/pki/instack-certs(/.*)?"
sudo restorecon -R /etc/pki/instack-certs
```

8. To configure the Director file, modify the `dchp_end` and `discovery_iprange` as indicated below, and leave the remaining default options:

```
cp /usr/share/instack-undercloud/undercloud.conf.sample ~/undercloud.conf
vim ~/undercloud.conf
[DEFAULT]
image_path = .
local_ip = 192.0.2.1/24
undercloud_public_vip = 192.0.2.2
undercloud_admin_vip = 192.0.2.3
undercloud_service_certificate = /etc/pki/instack-certs/undercloud.pem
local_interface = ens2
masquerade_network = 192.0.2.0/24
dhcp_start = 192.0.2.5
dhcp_end = 192.0.2.99
network_cidr = 192.0.2.0/24
network_gateway = 192.0.2.1
inspection_interface = br-ctlplane
inspection_iprange = 192.0.2.100,192.0.2.249
inspection_extras = true
inspection_runbench = false
enable_tempest = false
ipxe_deploy = true
store_events = false
scheduler_max_attempts = 30
undercloud_debug = true

[auth]
```

9. Complete installation of the Undercloud:

```
openstack undercloud install

source ~/stackrc
```

10. Log into the Red Hat Network, and get the most recent URLs from the Red Hat OpenStack documentation for images of the Overcloud nodes:

```
sudo yum install -y rhosp-director-images rhosp-director-images-ipa
cp /usr/share/rhosp-director-images/overcloud-full-latest-8.0.tar ~/images/.
cp /usr/share/rhosp-director-images/ironic-python-agent-latest-8.0.tar ~/images/.
cd ~/images
for tarfile in *.tar*; do tar -xf $tarfile; done
openstack overcloud image upload --image-path /home/stack/images/
openstack image list
```

Sample output:

```
+--------------------------------------+------------------------+
| ID                                   | Name                   |
+--------------------------------------+------------------------+
| b10a15d7-d558-4d39-89a1-824e2e39c5f3 | bm-deploy-kernel       |
| 214f9cbf-a935-4d40-84fe-22e1d3764a51 | bm-deploy-ramdisk      |
| 7529fd44-84d4-4db2-8d82-36997d570a0e | overcloud-full         |
| b429415d-15d3-4911-a326-73c2cdf1c16d | overcloud-full-initrd  |
| dced3b92-fbae-4bd6-a0bb-795971b7ce77 | overcloud-full-vmlinuz |
+--------------------------------------+------------------------+
```

11. Enter a nameserver for the Overcloud:

```
neutron subnet-list
```

Sample output:

```
+--------------------------------------+------+--------------+--------------------------------------------+
| id                                   | name | cidr         | allocation_pools                           |
+--------------------------------------+------+--------------+--------------------------------------------+
| 58cb5657-53a6-45c9-aedc-5f04a6bd6793 |      | 192.0.2.0/24 | {“start”: “192.0.2.5”, “end”: “192.0.2.99”} |
+--------------------------------------+------+--------------+--------------------------------------------+
```

```
neutron subnet-update 58cb5657-53a6-45c9-aedc-5f04a6bd6793 --dns-nameserver 192.0.2.254
Updated subnet: 58cb5657-53a6-45c9-aedc-5f04a6bd6793

neutron subnet-show 58cb5657-53a6-45c9-aedc-5f04a6bd6793
+-------------------+-------------------------------------------------------------+
| Field             | Value                                                       |
+-------------------+-------------------------------------------------------------+
| allocation_pools  | {“start”: “192.0.2.5”, “end”: “192.0.2.99”}                 |
| cidr              | 192.0.2.0/24                                                |
| dns_nameservers   | 192.0.2.254                                                 |
| enable_dhcp       | True                                                        |
| gateway_ip        | 192.0.2.1                                                   |
| host_routes       | {“destination”: “169.254.169.254/32”, “nexthop”: “192.0.2.1”} |
| id                | 58cb5657-53a6-45c9-aedc-5f04a6bd6793                        |
| ip_version        | 4                                                           |
| ipv6_address_mode |                                                             |
| ipv6_ra_mode      |                                                             |
| name              |                                                             |
| network_id        | 660174c5-5300-4efd-a6ca-227effbd7b2b                        |
| subnetpool_id     |                                                             |
| tenant_id         | 9a658b9fea5641c38a5a052e4e0d5a3d                            |
+-------------------+-------------------------------------------------------------+
```

12. Install the Overcloud:

```
source ~/stackrc

openstack baremetal import --json ~/controllers.json
openstack baremetal import --json ~/chassis1.json
openstack baremetal import --json ~/chassis2.json
openstack baremetal configure boot


ironic node-list | awk ‘/None/{print $2}’ > nodes.txt
head -n `grep ‘”mac”’ controllers.json | wc -l` nodes.txt > controller_nodes.txt
tail -n `grep ‘”mac”’ chassis2.json | wc -l` nodes.txt > chassis2_nodes.txt
head -n-`cat chassis2_nodes.txt | wc -l` nodes.txt | tail -n `grep ‘”mac”’ chassis1.json | wc -l` > chassis1_
nodes.txt

openstack baremetal introspection bulk start

sudo journalctl -l -u openstack-ironic-discoverd -u openstack-ironic-discoverd-dnsmasq -u openstack-iron-
ic-conductor -f

watch -n 60 -d ‘openstack baremetal list | grep -v COMPLETE’
```

```
for node in `cat controller_nodes.txt`; do ironic node-update $node add properties/capabilities='profile:con-
trol,boot_option:local' ; done
for node in `cat chassis1_nodes.txt chassis2_nodes.txt `; do ironic node-update $node add properties/capabili-
ties='profile:compute,boot_option:local' ; done

cp -r /usr/share/openstack-tripleo-heat-templates/network/config/bond-with-vlans ~/templates/nic-configs
cp /usr/share/openstack-tripleo-heat-templates/environments/net-bond-with-vlans.yaml /home/stack/templates/
network-environment.yaml
cp /usr/share/openstack-tripleo-heat-templates/environments/storage-environment.yaml ~/templates/.

vim ~/templates/timezone.yaml
parameter_defaults:
  TimeZone: 'EST5EDT'

sudo openstack-config --set /etc/heat/heat.conf DEFAULT max_resources_per_stack -1
sudo openstack-config --set /etc/heat/heat.conf DEFAULT max_stacks_per_tenant 1000
sudo openstack-config --set /etc/heat/heat.conf DEFAULT stack_action_timeout 14400
sudo openstack-config --set /etc/heat/heat.conf DEFAULT rpc_response_timeout 14400
sudo openstack-config --set /etc/heat/heat.conf DEFAULT action_retry_limit 100
sudo openstack-config --set /etc/nova/nova.conf DEFAULT scheduler_max_attempts 30
sudo openstack-config --set /usr/lib/systemd/system/mariadb.service Service LimitNOFILE 16384


sudo vim /etc/security/limits.d/mysql-server.conf
mysql soft nofile 16384
mysql hard nofile 16384


sudo vim /etc/sysconfig/network-scripts/ifcfg-vlan1200
DEVICE=vlan1200
ONBOOT=yes
HOTPLUG=no
NM_CONTROLLED=no
PEERDNS=no
DEVICETYPE=ovs
TYPE=OVSIntPort
OVS_BRIDGE=br-ctlplane
OVS_OPTIONS="tag=1200"
IPADDR=10.1.1.5
PREFIX=24


sudo vim /etc/sysconfig/network-scripts/ifcfg-vlan1201
DEVICE=vlan1201
ONBOOT=yes
HOTPLUG=no
NM_CONTROLLED=no
PEERDNS=no
DEVICETYPE=ovs
TYPE=OVSIntPort
OVS_BRIDGE=br-ctlplane
OVS_OPTIONS="tag=1201"
IPADDR=172.16.0.201
PREFIX=24


sudo ifup vlan1200
sudo ifup vlan1201

sudo reboot
```

13. Edit control-scale and compute-scale to match the environment:

```
openstack overcloud deploy --templates -e /usr/share/openstack-tripleo-heat-templates/environments/net-
work-isolation.yaml -e ~/templates/network-environment.yaml -e ~/templates/storage-environment.yaml --con-
trol-scale 3 --compute-scale 66 --control-flavor control --compute-flavor compute --ntp-server 192.0.2.254
--neutron-network-type vxlan --neutron-tunnel-types vxlan

heat stack-list --show-nested | grep -v COMPLETE
watch -n 60 -d 'heat stack-list --show-nested | grep -v COMPLETE'
```

14. Reboot the controller nodes one at a time:

```
nova list
nova reboot NODE_INSTANCE_ID
```

15. Use the command line interface (CLI) to set up cluster fencing using STONITH (Shoot-The-Other-Node-In-The-Head) on the controller nodes:

```
ssh heat-admin@192.0.2.XX
```

Replace XX with the IP address of a controller node. Note: `ipaddr` is the IP address of your controller servers' IPMI interface.

```
sudo pcs stonith create my-ipmilan-for-controller01 fence_ipmilan pcmk_host_list=overcloud-controller-0 ipad-
dr=192.168.0.251 login=Administrator passwd=Administrator lanplus=1 cipher=1 op monitor interval=60s
sudo pcs constraint location my-ipmilan-for-controller01 avoids overcloud-controller-0

sudo pcs stonith create my-ipmilan-for-controller02 fence_ipmilan pcmk_host_list=overcloud-controller-1 ipad-
dr=192.168.0.252 login=Administrator passwd=Administrator lanplus=1 cipher=1 op monitor interval=60s
sudo pcs constraint location my-ipmilan-for-controller02 avoids overcloud-controller-1

sudo pcs stonith create my-ipmilan-for-controller03 fence_ipmilan pcmk_host_list=overcloud-controller-2 ipad-
dr=192.168.0.253 login=Administrator passwd=Administrator lanplus=1 cipher=1 op monitor interval=60s
sudo pcs constraint location my-ipmilan-for-controller03 avoids overcloud-controller-2

sudo pcs stonith show
sudo pcs property set stonith-enabled=true
sudo pcs property show
sudo pcs status
```

16. Create the Overcloud tenant network:

```
source ~/overcloudrc
neutron net-create default
neutron subnet-create --name default --gateway 172.20.1.1 default 172.20.0.0/16
neutron net-list
```

17. Create the Overcloud external network (using a non-native VLAN):

```
source ~/overcloudrc
neutron net-create nova --router:external --provider:network_type vlan --provider:physical_network datacentre
--provider:segmentation_id 1200
neutron subnet-create --name nova --enable_dhcp=False --allocation-pool=start=10.1.1.51,end=10.1.1.250
--gateway=10.1.1.1 nova 10.1.1.0/24
```

18. Configure the router:

```
neutron router-create default-router
neutron router-interface-add default-router default
neutron router-gateway-set default-router nova
```

19. Run the following commands on both controller nodes to complete the DHCP/DNSMASQ fix for DSN forwarding:

```
sudo openstack-config --set /etc/neutron/dhcp_agent.ini DEFAULT dnsmasq_dns_servers 10.1.1.1
sudo systemctl restart neutron-dhcp-agent
```

Configuring Red Hat Enterprise Linux OpenStack Platform Manager

1. Install Red Hat Enterprise Linux 7.2 Server with GUI, DNS Server, and all virtualization groups:

```
setenforce 0
sed -i 's/SELINUX=enforcing/SELINUX=disabled/' /etc/selinux/config
firewall-cmd --permanent --direct --add-rule ipv4 nat POSTROUTING 0 -o enp3s0f0 -j MASQUERADE
firewall-cmd --permanent --direct --add-rule ipv4 filter FORWARD 0 -i br1 -o enp3s0f0 -j ACCEPT
firewall-cmd --permanent --direct --add-rule ipv4 filter FORWARD 0 -i enp3s0f0 -o br1 -m state --state RELAT-
ED,ESTABLISHED -j ACCEPT
firewall-cmd --permanent --direct --add-rule ipv4 filter FORWARD 0 -i br2 -o enp3s0f0 -j ACCEPT
firewall-cmd --permanent --direct --add-rule ipv4 filter FORWARD 0 -i enp3s0f0 -o br2 -m state --state RELAT-
ED,ESTABLISHED -j ACCEPT
firewall-cmd --permanent --direct --add-rule ipv4 filter FORWARD 0 -i br3 -o enp3s0f0 -j ACCEPT
firewall-cmd --permanent --direct --add-rule ipv4 filter FORWARD 0 -i enp3s0f0 -o br3 -m state --state RELAT-
ED,ESTABLISHED -j ACCEPT
firewall-cmd --reload
hostnamectl set-hostname manager.test.lan
hostnamectl set-hostname --transient manager.test.lan

sudo subscription-manager register
sudo subscription-manager list --available –all
```

2. Locate the OpenStack `pool_id` in output, and replace it with the following ID in the next command:

```
sudo subscription-manager attach --pool=<pool_id>
sudo subscription-manager repos --disable=*
sudo subscription-manager repos --enable=rhel-7-server-rpms --enable=rhel-7-server-optional-rpms --en-
able=rhel-7-server-extras-rpms

yum update -y
reboot
```

3. Install Tiger VNC server:

```
yum install -y tigervnc-server

cp /usr/lib/systemd/system/vncserver@.service /etc/systemd/system/vncserver@.service
vim /etc/systemd/system/vncserver@.service
```

4. Modify the following lines from USER to root:

```
ExecStart=/usr/sbin/runuser -l root -c "/usr/bin/vncserver %i"
PIDFile=/root/.vnc/%H%i.pid

systemctl daemon-reload
su - root
vncpasswd

firewall-cmd --permanent --add-port=5901/tcp
firewall-cmd --reload

systemctl start vncserver@:1.service
systemctl enable vncserver@:1.service
```

5. Use Virtual Machine Manager to create two bridge interfaces:

```
br1: enp3s0f1: 192.168.0.1/24
br2: ens1: 192.0.2.254/24
```

6. Configure the DHCP server:

```
yum install -y dhcp
vim /etc/dhcp/dhcpd.conf
subnet 192.168.0.0 netmask 255.255.255.0 {
        option routers                  192.168.0.1;
        option subnet-mask              255.255.255.0;
        option domain-search              "test.lan";
        option domain-name-servers       192.168.0.1;

        option time-offset              -18000;     # Eastern Standard Time
        range 192.168.0.51 192.168.0.99;

        include "/etc/dhcp/mms-static.conf";
}

echo > /etc/dhcp/mms-static.conf
systemctl enable dhcpd
systemctl start dhcpd
```

7. Configure DNS:

```
yum install -y bind
firewall-cmd --permanent --add-service=dns
firewall-cmd --reload
vim /etc/named.conf
```

a. Modify the following entries:

```
listen-on port 53 { 127.0.0.1; };
          allow-query           { localhost; };
        dnssec-validation yes;


          listen-on port 53 { any; };
          allow-query           { any; };
        dnssec-validation no;
```

b. Append these lines to the end of the file:

```
zone "test.lan" {
   type master;
   file "test.lan.zone";
   allow-update { none; };
};

zone "0.168.192.in-addr.arpa" {
   type master;
   file "external.zone";
   allow-update { none; };
};

zone "2.0.192.in-addr.arpa" {
   type master;
   file "deployment.zone";
   allow-update { none; };
};
```

8. Configure the NTP time server:

```
yum install -y ntp
sed -i '/^server [^ ]* iburst/d' /etc/ntp.conf
echo "server 10.41.0.5 iburst" >> /etc/ntp.conf
systemctl start ntpd
systemctl enable ntpd
```

9. Configure the DX2000 Management tool:

```
yum install -y ipmitool OpenIPMI
systemctl enable ipmi
systemctl enable ipmievd
systemctl start ipmi
systemctl start ipmievd

cd /opt/mng/
./mng_util
```

Sample output:

```
mng_util version 01.03

 > search 192.168.0.51-192.168.0.99
```

Sample output:

```
Chassis serial : GFH9PA312A0006
Board        ManagementLAN MAC IP              DataLAN1 MAC      DataLAN2 MAC
-----------  ----------------- --------------- ----------------- -----------------
CSC          40:8d:5c:17:3c:71 192.168.0.51
LAN-SW1      40:8d:5c:57:94:a0 192.168.0.53
LAN-SW2      40:8d:5c:57:a2:10 192.168.0.52
CPU Board1   40:8d:5c:5e:ad:9a 192.168.0.69    40:8d:5c:5e:ad:98 40:8d:5c:5e:ad:99
CPU Board3   40:8d:5c:5e:ae:0c 192.168.0.63    40:8d:5c:5e:ae:0a 40:8d:5c:5e:ae:0b
CPU Board5   40:8d:5c:5e:ae:cc 192.168.0.72    40:8d:5c:5e:ae:ca 40:8d:5c:5e:ae:cb
CPU Board7   40:8d:5c:5e:af:4a 192.168.0.66    40:8d:5c:5e:af:48 40:8d:5c:5e:af:49
CPU Board9   40:8d:5c:5e:ac:ce 192.168.0.73    40:8d:5c:5e:ac:cc 40:8d:5c:5e:ac:cd
CPU Board11  40:8d:5c:5e:ab:e1 192.168.0.64    40:8d:5c:5e:ab:df 40:8d:5c:5e:ab:e0
CPU Board13  40:8d:5c:5e:ae:77 192.168.0.68    40:8d:5c:5e:ae:75 40:8d:5c:5e:ae:76
CPU Board15  40:8d:5c:5e:ad:b5 192.168.0.61    40:8d:5c:5e:ad:b3 40:8d:5c:5e:ad:b4
CPU Board17  40:8d:5c:5e:ab:b4 192.168.0.55    40:8d:5c:5e:ab:b2 40:8d:5c:5e:ab:b3
CPU Board19  40:8d:5c:5e:af:4d 192.168.0.74    40:8d:5c:5e:af:4b 40:8d:5c:5e:af:4c
CPU Board20  40:8d:5c:5e:ac:c5 192.168.0.62    40:8d:5c:5e:ac:c3 40:8d:5c:5e:ac:c4
CPU Board21  40:8d:5c:5e:ac:26 192.168.0.57    40:8d:5c:5e:ac:24 40:8d:5c:5e:ac:25
CPU Board22  40:8d:5c:5e:ab:78 192.168.0.59    40:8d:5c:5e:ab:76 40:8d:5c:5e:ab:77
CPU Board23  40:8d:5c:5e:ad:c1 192.168.0.75    40:8d:5c:5e:ad:bf 40:8d:5c:5e:ad:c0
CPU Board24  40:8d:5c:5e:ab:fc 192.168.0.60    40:8d:5c:5e:ab:fa 40:8d:5c:5e:ab:fb
CPU Board25  40:8d:5c:5e:ad:a0 192.168.0.56    40:8d:5c:5e:ad:9e 40:8d:5c:5e:ad:9f
CPU Board26  40:8d:5c:5e:ae:3f 192.168.0.67    40:8d:5c:5e:ae:3d 40:8d:5c:5e:ae:3e
CPU Board27  40:8d:5c:5e:ac:a4 192.168.0.58    40:8d:5c:5e:ac:a2 40:8d:5c:5e:ac:a3
CPU Board29  40:8d:5c:5e:ac:7a 192.168.0.71    40:8d:5c:5e:ac:78 40:8d:5c:5e:ac:79
CPU Board31  40:8d:5c:5e:af:41 192.168.0.70    40:8d:5c:5e:af:3f 40:8d:5c:5e:af:40
CPU Board33  40:8d:5c:5e:ab:d8 192.168.0.65    40:8d:5c:5e:ab:d6 40:8d:5c:5e:ab:d7
CPU Board35  40:8d:5c:5e:ae:3c 192.168.0.54    40:8d:5c:5e:ae:3a 40:8d:5c:5e:ae:3b

 > savelist -I all -f /root/maclist.csv
 > quit

cat /root/maclist.csv | awk -F',' '/CSC|LAN-|CPU/{print $2","$3","$5","$6}' | sed -e 's/CPU Board/srv/' -e
's/LAN-SW/switch/' -e 's/CSC/csc/' > /root/mms1.csv
MMS=1; cat /root/mms${MMS}.csv | awk -F',' '{printf "host mms-%s { hardware ethernet %s; fixed-address
192.168.0.%d; }\n",$1,$2,$1}' | sed -e "s/mms-/mms${MMS}-/" -e "s/\.csc/.${MMS}0/" -e "s/\.switch/.${MMS}/"
-e "s/\.srv/.${MMS}/" > /etc/dhcp/mms-static.conf
```

Note: If the scrips fail to execute correctly, edit the /etc/dhcp/mms-static.conf file to match the following:

```
vim /etc/dhcp/mms-static.conf
host controller-ipmi { hardware ethernet 78:e7:d1:91:30:4e; fixed-address 192.168.0.252; }
host mms1-csc { hardware ethernet 40:8d:5c:17:3c:71; fixed-address 192.168.0.10; }
host mms1-switch1 { hardware ethernet 40:8d:5c:57:94:a0; fixed-address 192.168.0.11; }
host mms1-switch2 { hardware ethernet 40:8d:5c:57:a2:10; fixed-address 192.168.0.12; }
host mms1-srv1 { hardware ethernet 40:8d:5c:5e:ad:9a; fixed-address 192.168.0.101; }
host mms1-srv3 { hardware ethernet 40:8d:5c:5e:ae:0c; fixed-address 192.168.0.103; }
host mms1-srv5 { hardware ethernet 40:8d:5c:5e:ae:cc; fixed-address 192.168.0.105; }
host mms1-srv7 { hardware ethernet 40:8d:5c:5e:af:4a; fixed-address 192.168.0.107; }
host mms1-srv9 { hardware ethernet 40:8d:5c:5e:ac:ce; fixed-address 192.168.0.109; }
host mms1-srv11 { hardware ethernet 40:8d:5c:5e:ab:e1; fixed-address 192.168.0.111; }
host mms1-srv13 { hardware ethernet 40:8d:5c:5e:ae:77; fixed-address 192.168.0.113; }
host mms1-srv15 { hardware ethernet 40:8d:5c:5e:ad:b5; fixed-address 192.168.0.115; }
host mms1-srv17 { hardware ethernet 40:8d:5c:5e:ab:b4; fixed-address 192.168.0.117; }
host mms1-srv19 { hardware ethernet 40:8d:5c:5e:af:4d; fixed-address 192.168.0.119; }
host mms1-srv20 { hardware ethernet 40:8d:5c:5e:ac:c5; fixed-address 192.168.0.120; }
host mms1-srv21 { hardware ethernet 40:8d:5c:5e:ac:26; fixed-address 192.168.0.121; }
host mms1-srv22 { hardware ethernet 40:8d:5c:5e:ab:78; fixed-address 192.168.0.122; }
host mms1-srv23 { hardware ethernet 40:8d:5c:5e:ad:c1; fixed-address 192.168.0.123; }
host mms1-srv24 { hardware ethernet 40:8d:5c:5e:ab:fc; fixed-address 192.168.0.124; }
host mms1-srv25 { hardware ethernet 40:8d:5c:5e:ad:a0; fixed-address 192.168.0.125; }
host mms1-srv26 { hardware ethernet 40:8d:5c:5e:ae:3f; fixed-address 192.168.0.126; }
host mms1-srv27 { hardware ethernet 40:8d:5c:5e:ac:a4; fixed-address 192.168.0.127; }
host mms1-srv29 { hardware ethernet 40:8d:5c:5e:ac:7a; fixed-address 192.168.0.129; }
host mms1-srv31 { hardware ethernet 40:8d:5c:5e:af:41; fixed-address 192.168.0.131; }
host mms1-srv33 { hardware ethernet 40:8d:5c:5e:ab:d8; fixed-address 192.168.0.133; }
host mms1-srv35 { hardware ethernet 40:8d:5c:5e:ae:3c; fixed-address 192.168.0.135; }
```

10. Enable the NFS server:

```
mkdir -p /export/cinder
mkdir -p /export/glance
chmod 777 /export/*
vim /etc/exports
```

a. Append the following to the file:

```
/export/cinder 172.18.0.0/24(rw,no_root_squash)
/export/glance 172.18.0.0/24(rw,no_root_squash)

firewall-cmd --permanent --zone public --add-service mountd
firewall-cmd --permanent --zone public --add-service rpc-bind
firewall-cmd --permanent --zone public --add-service nfs
firewall-cmd --permanent --zone public --add-service ntp
firewall-cmd --reload

systemctl enable rpcbind
systemctl enable nfs-server
systemctl enable nfs-lock
systemctl enable nfs-idmap
systemctl restart rpcbind
systemctl restart nfs-server
systemctl restart nfs-lock
systemctl restart nfs-idmap
```

11. Configure Red Hat Enterprise Linux 7 and the HDP 2.4 mirror:

```
yum install -y yum-utils createrepo httpd
systemctl enable httpd
systemctl restart httpd
firewall-cmd --permanent --zone public --add-service http
firewall-cmd --reload

sudo pcs stonith create my-ipmilan-for-controller01 fence_ipmilan pcmk_host_list=overcloud-controller-0 ip-
addr=192.168.0.251 login=Administrator passwd=Administrator lanplus=1 cipher=1 op monitor interval=60s
sudo pcs constraint location my-ipmilan-for-controller01 avoids overcloud-controller-0
```

```
sudo pcs stonith create my-ipmilan-for-controller02 fence_ipmilan pcmk_host_list=overcloud-controller-1 ip-addr=192.168.0.252 login=Administrator passwd=Administrator lanplus=1 cipher=1 op monitor interval=60s
sudo pcs constraint location my-ipmilan-for-controller02 avoids overcloud-controller-1

sudo pcs stonith create my-ipmilan-for-controller03 fence_ipmilan pcmk_host_list=overcloud-controller-2 ip-addr=192.168.0.253 login=Administrator passwd=Administrator lanplus=1 cipher=1 op monitor interval=60s
sudo pcs constraint location my-ipmilan-for-controller03 avoids overcloud-controller-2


mkdir -p /var/www/html/repos
cd /var/www/html/repos
reposync -l
for repo in `ls`; do createrepo $repo ; done
wget http://public-repo-1.hortonworks.com/ambari/centos7/RPM-GPG-KEY/RPM-GPG-KEY-Jenkins
```

12. Edit the Red Hat Enterprise Linux guest KVM image:

```
cd /var/lib/libvirt/images
mkdir /mnt/guest
guestmount --rw -i -a rhel-guest-image-7.2-20160302.0.x86_64_hdp.img /mnt/guest
cd /mnt/guest
```

a. Disable SELinux in the guest KVM image:

```
sed -i ‘s/SELINUX=enforcing/SELINUX=disabled/’ /mnt/guest/etc/selinux/config
```

b. Update the repository in guest image to point to the local repository:

```
vi /mnt/guest/etc/yum.repos.d/rh.repo

[rhel-7-server-rpms]
baseurl = http://10.1.1.1/repos/rhel-7-server-rpms
ui_repoid_vars = releasever basearch
name = Red Hat Enterprise Linux 7 Server (RPMs)
gpgkey = file:///etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release
enabled = 1
gpgcheck = 1

[rhel-7-server-extras-rpms]
baseurl = http://10.1.1.1/repos/rhel-7-server-extras-rpms
ui_repoid_vars = basearch
name = Red Hat Enterprise Linux 7 Server - Extras (RPMs)
gpgkey = file:///etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release
enabled = 1
gpgcheck = 1

[rhel-7-server-optional-rpms]
baseurl = http://10.1.1.1/repos/rhel-7-server-optional-rpms
ui_repoid_vars = releasever basearch
name = Red Hat Enterprise Linux 7 Server - Optional (RPMs)
gpgkey = file:///etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release
enabled = 1
gpgcheck = 1

[rhel-7-server-rh-common-rpms]
baseurl = http://10.1.1.1/repos/rhel-7-server-rh-common-rpms
ui_repoid_vars = releasever basearch
name = Red Hat Enterprise Linux 7 Server - RH Common (RPMs)
gpgkey = file:///etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release
enabled = 1
gpgcheck = 1
```

13. Install the priorities plugin on the image, and enable it:

```
yum --installroot=/mnt/guest install -y yum-plugin-priorities
vi /mnt/guest/etc/yum/pluginconf.d/priorities.conf
[main]
enabled = 1
gpgcheck = 0
```

```
vi /etc/yum/pluginconf.d/priorities.conf
[main]
enabled = 1
gpgcheck = 0
```

14. Install updates:

```
yum --installroot=/mnt/guest update -y
```

15. Install Ambari required packages, and remove `chrony`:

```
yum --installroot=/mnt/guest remove -y chrony
yum --installroot=/mnt/guest install -y openssh-clients curl unzip tar wget openssl python ntp sysstat
numpy blas64 lapack64
```

16. Clean up installers in the guest image:

```
yum --installroot=/mnt/guest clean all
```

17. Enable NTP in guest:

```
ln -s /usr/lib/systemd/system/ntpd.service /mnt/guest/etc/systemd/system/multi-user.target.wants/ntpd.ser-
vice
sed -i '/^server [^ ]* iburst/d' /mnt/guest/etc/ntp.conf
echo "server 10.1.1.1 iburst" >> /mnt/guest/etc/ntp.conf
```

18. Zero fill the guest image, convert the file, and compress it:

```
dd if=/dev/zero of=/mnt/guest/tmp.bin bs=1M ; sync ; sleep 1 ; sync ; rm -f /mnt/guest/tmp.bin ; sync
cd /var/lib/libvirt/images
umount /mnt/guest
qemu-img convert -c -O qcow2 rhel-guest-image-7.2-20160302.0.x86_64_hdp.img rhel-guest-image-7.2-
20160302.0.x86_64_hdp.qcow
```

19. Install Ambari server:

```
ssh -i hdpkey cloud-user@10.1.1.185
sudo su
vi /etc/yum.repos.d/ambari.repo

#VERSION_NUMBER=2.2.2.0-460
[Updates-ambari-2.2.2.0]
name=ambari-2.2.2.0 - Updates
baseurl=http://10.1.1.1/repos/Updates-ambari-2.2.2.0
gpgcheck=1
gpgkey=http://10.1.1.1/repos/RPM-GPG-KEY-Jenkins
enabled=1
priority=1


vi /etc/yum.repos.d/hdp.repo

#VERSION_NUMBER=2.4.2.0-258
[HDP-2.4.2.0]
name=HDP Version - HDP-2.4.2.0
baseurl=http://10.1.1.1/repos/HDP-2.4.2.0
gpgcheck=1
gpgkey=http://10.1.1.1/repos/RPM-GPG-KEY-Jenkins
enabled=1
priority=1

[HDP-UTILS-1.1.0.20]
name=HDP Utils Version - HDP-UTILS-1.1.0.20
baseurl=http://10.1.1.1/repos/HDP-UTILS-1.1.0.20
gpgcheck=1
gpgkey=http://10.1.1.1/repos/RPM-GPG-KEY-Jenkins
enabled=1
priority=1
```

```
yum install -y ambari-server

ambari-server setup
```

Sample output:

```
Using python  /usr/bin/python
Setup ambari-server
Checking SELinux...
SELinux status is 'disabled'
Customize user account for ambari-server daemon [y/n] (n)?
Adjusting ambari-server permissions and ownership...
Checking firewall status...
Redirecting to /bin/systemctl status  iptables.service

Checking JDK...
[1] Oracle JDK 1.8 + Java Cryptography Extension (JCE) Policy Files 8
[2] Oracle JDK 1.7 + Java Cryptography Extension (JCE) Policy Files 7
[3] Custom JDK
==============================================================================
Enter choice (1):
JDK already exists, using /var/lib/ambari-server/resources/jdk-8u60-linux-x64.tar.gz
Installing JDK to /usr/jdk64/
Successfully installed JDK to /usr/jdk64/
JCE Policy archive already exists, using /var/lib/ambari-server/resources/jce_policy-8.zip
Installing JCE policy...
Completing setup...
Configuring database...
Enter advanced database configuration [y/n] (n)?
Configuring database...
Default properties detected. Using built-in database.
Configuring ambari database...
Checking PostgreSQL...
Running initdb: This may take upto a minute.
Initializing database ... OK


About to start PostgreSQL
Configuring local database...
Connecting to local database...done.
Configuring PostgreSQL...
Restarting PostgreSQL
Extracting system views...
ambari-admin-2.2.2.0.460.jar
......
Adjusting ambari-server permissions and ownership...
Ambari Server 'setup' completed successfully.


ambari-server start
```

Sample output:

```
Using python  /usr/bin/python
Starting ambari-server
Ambari Server running with administrator privileges.
Organizing resource files at /var/lib/ambari-server/resources...
Server PID at: /var/run/ambari-server/ambari-server.pid
Server out at: /var/log/ambari-server/ambari-server.out
Server log at: /var/log/ambari-server/ambari-server.log
Waiting for server start....................
Ambari Server 'start' completed successfully.


ambari-server status
```

Sample output:

```
http://10.1.1.185:8080
admin/admin
```

20. To complete Ambari web setup, open the URL from the server setup in step 19, log in with the appropriate credentials, and create a cluster:

    a. Type `cluster1` for the cluster name.

    b. Type `host-172-21-0-[11-78].openstacklocal` for the target host information. Browse to hdpkey SSH key, and type `cloud-user` for the SSH User Account.

    c. Uncheck the following options:

    Sqoop
    Oozie
    Falcon
    Flume
    Accumulo
    Atlas
    Knox
    Slider
    SmartSense

    d. Distribute all services across the first three nodes or your three master instances with the exception of Metric Collector, which should be assigned to a client.

    e. Type `Password1` for the Hive database password.

    f. Set a password on the Hive database: Password1

    g. Accept defaults and continue.

    h. Accept defaults and continue.

    i. Complete web setup.

Configuring the HiBench client instance

From the Ambari GUI, add another client instance, add the Apache Kafka broker role, and complete the following steps:

1. Set the maximum number of client connections to 60:

```
maxClientCnxns=60
```

2. Install HiBench.

    a. Add a floating IP to the client instance:

```
ssh -i hdpkey cloud-user@10.1.1.186
sudo su - hdfs
hdfs dfs -mkdir /HiBench
hdfs dfs -chown -R cloud-user:hadoop /HiBench
hdfs dfs -mkdir /home/cloud-user
hdfs dfs -chown cloud-user /user/cloud-user
exit
yum install -y maven git vim numpy blas64 lapack64
git clone https://github.com/intel-hadoop/HiBench.git
cd HiBench/src
```

b. Open the datagen pom XML file. Replace the following:

```
vim streambench/datagen/pom.xml

<dependency>
     <groupId>org.apache.kafka</groupId>
     <artifactId>kafka-clients</artifactId>
     <version>0.8.1</version>
     <scope>system</scope>
     <systemPath>${basedir}/lib/kafka-clients-0.8.1.jar</systemPath>
   </dependency>

<dependency>
     <groupId>org.apache.kafka</groupId>
     <artifactId>kafka-clients</artifactId>
     <version>0.8.1</version>
   </dependency>
```

c. Open the following XML file, and replace the following:

```
vim streambench/sparkbench/pom.xml

     <exclusion>
          <groupId>org.sonatype.sisu.inject</groupId>
          <artifactId>*</artifactId>
        </exclusion>
        <exclusion>
          <groupId>org.xerial.snappy</groupId>
          <artifactId>*</artifactId>
        </exclusion>

        <exclusion>
          <groupId>org.sonatype.sisu</groupId>
          <artifactId>inject</artifactId>
        </exclusion>
        <exclusion>
          <groupId>org.xerial</groupId>
          <artifactId>snappy</artifactId>
        </exclusion>
```

d. Complete the HiBench installation:

```
mvn install:install-file -Dfile=streambench/datagen/lib/kafka-clients-0.8.1.jar -DgroupId=org.apache.kafka
-DartifactId=kafka-clients -Dversion=0.8.1 -Dpackaging=jar
mvn clean package -D spark1.6 -D MR2
cd ..

cp conf/99-user_defined_properties.conf.template conf/99-user_defined_properties.conf

grep -v "^#" conf/99-user_defined_properties.conf | grep -v "^$"
```

Sample output:

```
hibench.hadoop.home              /usr/hdp/current/hadoop-client
hibench.spark.home               /usr/hdp/current/spark-client
hibench.hadoop.mapreduce.home    /usr/hdp/current/hadoop-mapreduce-client
hibench.hdfs.master              hdfs://host-172-21-0-66.openstacklocal:8020
hibench.spark.master             yarn-client
hibench.hadoop.release           hdp
hibench.hadoop.version            hadoop2
hibench.spark.version           spark1.6
hibench.default.map.parallelism         252
hibench.default.shuffle.parallelism      252
hibench.yarn.executor.num 85
hibench.yarn.executor.cores      4
spark.executor.memory    9G
spark.driver.memory      2G
spark.rdd.compress            false
spark.shuffle.compress           false
```

```
spark.broadcast.compress  false
spark.io.compression.codec    org.apache.spark.io.SnappyCompressionCodec
spark.akka.frameSize          1000
spark.akka.timeout            600
spark.kryoserializer.buffer       2000mb
hibench.scale.profile                    census
hibench.compress.profile          disable
hibench.compress.codec.profile           snappy
hibench.streamingbench.benchname identity
hibench.streamingbench.scale.profile    ${hibench.scale.profile}
hibench.streamingbench.zookeeper.host   host-172-21-0-11.openstacklocal:2181
hibench.streamingbench.brokerList       host-172-21-0-78.openstacklocal:9021
hibench.streamingbench.storm.home       /usr/hdp/current/storm-client
hibench.streamingbench.kafka.home       /usr/hdp/current/kafka-broker
hibench.streamingbench.storm.nimbus     host-172-21-0-66.openstacklocal
hibench.streamingbench.partitions        1
```

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