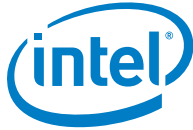


OpenStack* Networking with Intel® Architecture

Getting Started Guide

November 2014



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Revision History

Date	Revision	Description
July 2014	1.1	Second release.
Nov 2014	1.2	Third release.

§



1 Introduction

This document details the steps required to enable Intel® DPDK vSwitch and DPDK enabled OpenVswitch* with Openstack* (Juno release).

2 Requirements

2.1 Hardware

- 2x Intel® Grizzly Pass server boards:
 - CPU: 2x Intel® Xeon® CPU E5-2697 v2 @ 2.70 GHz
 - RAM: Minimum 16 GB; Recommended 64 GB.
- 1x Ethernet Controller on each board:
 - Intel® Ethernet Server Adapter X520-SR2
- 2x Physical Networks

2.2 Software

- Ubuntu* 12.04 64-bit Server Edition
<http://releases.ubuntu.com/12.04/ubuntu-12.04.4-server-amd64.iso>
- OR
- Fedora* 20 (minimal install)
http://ftp.upjs.sk/pub/fedora/linux/releases/20/Fedora/x86_64/iso/Fedora-20-x86_64-netinst.iso
- Devstack - <http://devstack.org/>
- OpenStack* - <http://openstack.org/>
- Devstack Patches from Intel
- Nova Patches from Intel

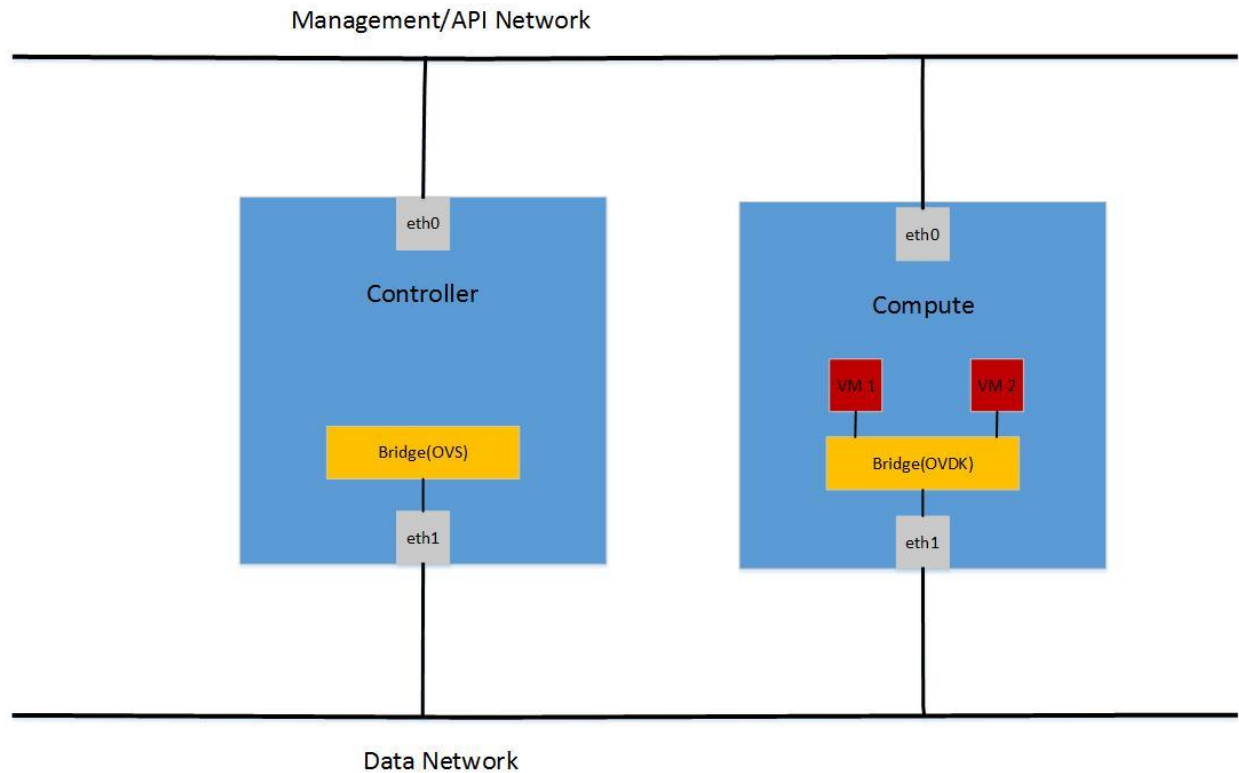
2.3 Pre-requisites

- Operating system is pre-installed*
- Hardware topology is configured as per [Chapter 3](#)
- Access to the Internet
- VT-x has been enabled in BIOS
- NTP is running on the boards
- VT-d is enabled in BIOS

3 Topology

3.1 Multi Node

Figure 1. Multi Node Topology Diagram



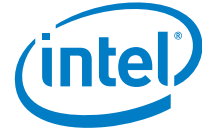
4 Linux* Configuration

4.1 Sudoers

Create user 'stack':

```
sudo adduser stack
```

Add 'stack' to the sudoers file:



```
sudo su -c 'echo "stack ALL=(ALL) NOPASSWD: ALL" >> /etc/sudoers'
```

For example:

```
sudo cat /etc/sudoers

#
# This file MUST be edited with the 'visudo' command as root.
#
# Please consider adding local content in /etc/sudoers.d/ instead of
# directly modifying this file.
#
# See the man page for details on how to write a sudoers file.
#
Defaults            env_reset
Defaults            mail_badpass
Defaults
secure_path="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin"

# Host alias specification

# User alias specification

# Cmnd alias specification

# User privilege specification
root    ALL=(ALL:ALL) ALL
# Members of the admin group may gain root privileges
%admin  ALL=(ALL) ALL

# Allow members of group sudo to execute any command
%sudo  ALL=(ALL:ALL) ALL

# See sudoers(5) for more information on "#include" directives:

#includedir /etc/sudoers.d
stack  ALL=(ALL) NOPASSWD: ALL
```

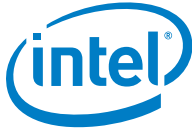
4.2 Configuring Proxies

4.2.1 Configure a Git Proxy Wrapper to Allow Access to Git Repos

```
sudo vi /home/stack/git-proxy-wrapper

#!/bin/sh
_proxy=<PROXY>
_proxyport=<PROXYPORT>
exec socat STDIO SOCKS4:$_proxy:$1:$2,socksport=$_proxyport

sudo chown stack:stack /home/stack/git-proxy-wrapper
```



```
sudo chmod +x /home/stack/git-proxy-wrapper
```

4.2.2 Configure External Proxy

```
sudo vi /home/stack/.bashrc
```

```
export GIT_PROXY_COMMAND=~/.git-proxy-wrapper
export http_proxy=<PROXY>
export https_proxy=<PROXY>
export NO_PROXY=127.0.0.1,127.0.1.1,<YOUR HOST IP ADDRESS>,<YOUR
CONTROLLER IP ADDRESS>*
export no_proxy=127.0.0.1,127.0.1.1,<YOUR HOST IP ADDRESS>,<YOUR
CONTROLLER IP ADDRESS>*
```

```
sudo chown stack:stack /home/stack/.bashrc
```

To enable bashrc defined variables:

```
source ~/.bashrc
```

4.3 Package Dependencies (for Ubuntu*)

Install the following dependencies:

```
sudo su stack
```

```
cd ~
sudo apt-get update
sudo apt-get upgrade -y
sudo apt-get install -y git
sudo apt-get install -y socat
sudo apt-get install -y zlib1g-dev
sudo apt-get install -y python-dev
sudo apt-get install -y libxslt-dev
sudo apt-get install -y zip screen
sudo apt-get install -y libvirt-bin
sudo apt-get install -y build-essential
sudo apt-get install -y python-passlib python-setuptools
sudo apt-get install -y ntp
```

```
date ; sudo service ntp stop ; sudo ntpdate -s <ntp-server-address>;
sudo service ntp start ; date
```

```
curl -o dnsmasq-2.72.tar.gz
http://www.thekelleys.org.uk/dnsmasq/dnsmasq-2.72.tar.gz
tar zxvf dnsmasq-2.72.tar.gz
cd dnsmasq-2.72/
sudo make install
dnsmasq --version
```




```
sudo apt-get purge -y apparmor
```

Only on the Controller, add archive repository to apt to install the latest version of **openvswitch**

```
sudo apt-get install python-software-properties
sudo add-apt-repository cloud-archive:icehouse
sudo apt-get update
sudo apt-get install -y openvswitch-switch
```

Reboot:

```
sudo reboot
```

4.4 Package Dependencies (for Fedora*)

Install the following dependencies. Note 'proxy=<PROXY>' in /etc/yum.conf may be required if using proxy:

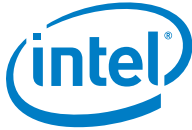
```
sudo su stack

cd ~
sudo yum update
sudo yum install -y git
sudo yum install -y socat
sudo yum install -y zlib-devel
sudo yum install -y python-devel
sudo yum install -y libxslt-devel
sudo yum install -y unzip screen tar
sudo yum install -y libvirt
sudo yum install -y automake gcc
sudo yum install -y python-passlib python-setuptools
sudo yum install -y patch
sudo yum install -y kernel-devel*
sudo yum install -y kernel-modules-extra*
sudo yum install -y net-tools
sudo yum install -y python-lxml
sudo yum install -y ntp

curl -o pip.tar.gz https://pypi.python.org/packages/source/p/pip/pip-1.4.1.tar.gz
tar xvfz pip.tar.gz
cd pip-1.4.1
sudo -E python setup.py install
sudo pip install dogpile.cache --proxy=`echo $http_proxy`

date ; sudo service ntpd stop ; sudo ntpdate -s <ntp-server-address>;
sudo service ntpd start ; date

sudo vi /etc/selinux/config
```



- `set SELINUX=permissive`

Reboot:

```
sudo reboot
```

4.5 Libvirt Config

Libvirt must be configured to allow use of Huge Pages and USVHost:

```
sudo vi /etc/libvirt/qemu.conf
```

- Uncomment the `cgroup_controllers` line
- Uncomment the `hugetlbfs_mount` line and modify as below

```
hugetlbfs_mount = "/mnt/huge"
```
- Uncomment the whole `cgroup_device_acl` array and add ensure the following entries are included

```
"/dev/null", "/dev/full", "/dev/zero", "/dev/random",  
"/dev/urandom", "/dev/ptmx", "/dev/kvm", "/dev/kqemu",  
"/dev/rtc", "/dev/hpet", "/dev/net/tun", "/mnt/huge",  
"/dev/vhost-net", "/dev/vfio/vfio",
```

Restart libvirt:

For Ubuntu*: `sudo restart libvirt-bin`

For Fedora*: `sudo service libvirtd restart`

5 Devstack Configuration

5.1 Pulling from Repo and Applying Patches

5.1.1 Devstack

```
cd /home/stack
```

```
git clone https://github.com/openstack-dev/devstack.git  
cd devstack
```



```
git checkout 7eac0c927ca95fe3f6457b52d701a010a7e65123
patch -p1 < <PATH TO PATCH>/devstack.patch
```

5.1.1.1 Gcc libtool fix (Ubuntu only)

```
sed -e "179i sed -e 's#\\(datapath_dpdk_ovs_dpdk_LDFLAGS\\) = \\(-Wl,-
-whole-archive\\)#\\1 = -Wl,--no-as-needed \\2#' -i
datapath/dpdk/automake.mk" -i lib/neutron_plugins/ovdk_base

sed -e "181i sed -e 's#\\(configure RTE_SDK=\\$(DPDK_DIR)\\)#\\1
LDFLAGS=-Wl,--no-as-needed#' -i Makefile" -i
lib/neutron_plugins/ovdk_base
```

5.1.2 Nova

Clone Nova into /opt/stack and apply patches in that directory:

```
sudo mkdir /opt/stack
sudo chown stack:stack /opt/stack
cd /opt/stack
git clone https://github.com/openstack/nova.git
cd nova
git checkout b7738bfb6c2f271d047e8f20c0b74ef647367111
patch -p1 < <PATH TO PATCH>/nova.patch
```

5.2 Local.conf Configuration

Create a local.conf file in the devstack directory.

For a sample local.conf, see [Section 6.1 Sample Configurations for Multi Node Topology](#).

See [PCI NUMA placement](#) Section for additional configuration.

5.2.1 Huge Pages

To be able to run OVDK, hugepages must be configured.

When stack.sh is run, devstack allocates the specified number of hugepages and mounts them.

There are two variables that can be set in local.conf:

OVDK	Accelerated ovs	Description
OVDK_NUM_HUGEPAGES	OVS_NUM_HUGEPAGES	The number of hugepages to be allocated on each CPU node



OVDK_HUGEPAGE_MOUNT	OVS_HUGEPAGE_MOUNT	Where to mount the hugepages, by default it is: /mnt/huge

See [Section 6.1.1.2 Sample Compute local.conf – Openstack* Compute Node](#) for an example.

Note: At least 2 GB of memory in each node must be allocated to allow OVDK to run. Any VM’s instantiated on a compute node with OVDK will run in hugepage memory, so to run OVDK + 4 VM’s with 1 GB of memory, at least 4 GB of memory on each NUMA node needs to be reserved for hugepages. On a system with 2 MB hugepage size, that is 2048 pages per node. On a node with Accelerated ovs VM don’t use hugepage backed memory.

5.2.2 PCI NUMA placement (Optional)

Example configuration of PCI Numa placement on Fedora.

Ensure intel_iommu=on is set on the Kernel command line.

libvirt 1.2.8 or newer has to be installed.

```
cd ~

sudo service libvirtd stop
sudo yum install -y yaql-devel
sudo yum install -y device-mapper-devel
sudo yum install -y libpciaccess-devel
sudo yum install -y libnl-devel
sudo yum install -y numactl-libs numactl-devel
sudo yum install -y dbus-devel

curl -o libvirt-1.2.9.tar.gz http://libvirt.org/sources/libvirt-1.2.9.tar.gz
tar xzvf libvirt-1.2.9.tar.gz
cd libvirt-1.2.9/
./autogen.sh --system --with-dbus
make
sudo make install

sudo service libvirtd restart

libvirtd -V
expected output: libvirtd (libvirt) 1.2.9
```



Upgrade libvirt-python libraries:

```
cd ~
curl -o libvirt-python-1.2.9.tar.gz
https://pypi.python.org/packages/source/l/libvirt-python/libvirt-python-1.2.9.tar.gz
tar zxvf libvirt-python-1.2.9.tar.gz
cd libvirt-python-1.2.9
sudo -E python setup.py install
```

This section describes the steps required to validate the PCI NUMA placement feature added by the nova patch referenced in section 5.1.2.

The `local.conf` configuration files on controller and compute nodes will need modification in order to enable the use of PCI passthrough and PCI NUMA placement.

The following changes to the `local.conf` should be placed in the post nova configuration phase.

```
[[post-config|$NOVA_CONF]]
[DEFAULT]
```

Controller node

Specify alias for your PCI devices.

For example:

```
pci_alias={"name":"niantic","product_id":"10ed","vendor_id":"8086"}
```

Compute node

Specify which PCI devices you want added to your PCI whitelist, in this example we add two Niantic NIC's. Note: Each NIC is associated with a different NUMA node.

For example:

```
pci_passthrough_whitelist={"address":"0000:08:00.0","vendor_id":"8086","p
hysical_network":"default"}

pci_passthrough_whitelist={"address":"0000:82:00.1","vendor_id":"8086","p
hysical_network":"default"}
```

When you re-stack your nodes you should see the PCI devices you have added to the whitelist in the nova DB.

Create an image flavor that defines a PCI passthrough device and a host NUMA node for VM placement. This example uses the "niantic" PCI alias and requests the VM be placed on the host NUMA node 0.



```
nova flavor-create passtru-node0 auto 512 0 1
nova flavor-key passtru-node0 set "pci_passthrough:alias"="niantic:1"
hw:numa_nodes=1 hw:numa_cpus.0=0 hw:numa_mem.0=512
nova flavor-show passtru-node0
```

Boot the image with your new image flavor:

```
nova boot --flavor passtru-node0 --image Fedora-x86_64-20-20140618-sda
"VM name"
```

When the guest boots you will see:

The PCI device that is associated with node 0 will be allocated.

The VM will be placed on a pCPU that is associated with NUMA node 0.

5.3 Starting Openstack Services

Run:

```
./stack.sh
```

Note: Depending on your environment and configuration you may need to flush your iptables rules for some Openstack* services. Ensure your environment is secure before doing so.

Note: On the controller node and any compute node that uses vanilla OVS, after the stack.sh has completed, issue the command:

```
sudo ovs-vsctl add-port br-eth1 eth1
sudo ifconfig eth1 up
```

5.4 Availability Zones (Optional)

To configure Availability Zones, run on the controller:

```
cd /home/stack/devstack/
source openrc admin demo

nova aggregate-create <AZ NAME> <AZ NAME>
nova aggregate-add-host <AZ NAME> <HOSTNAME TO ADD TO AZ>
nova availability-zone-list
```

Note: Depending on your environment and configuration you may need to add your hosts to /etc/hosts.



6 Sample Configuration

6.1 Sample Configurations for Multi Node Topology

Refer to Figure 1.

6.1.1 Multi Node

For a multi node topology, a `local.conf` file must be configured on the controller and all compute nodes in the environment.

6.1.1.1 Sample Controller `local.conf`

```
#CONTROLLER CONFIG FILE

[[local|localrc]]

HOST_IP=<HOST IP ADDRESS>
HOST_NAME=$(hostname)
HOST_IP_IFACE=<eth0>

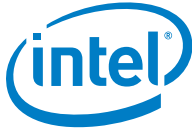
FORCE=yes

MYSQL_PASSWORD=password
DATABASE_PASSWORD=password
RABBIT_PASSWORD=password
ADMIN_PASSWORD=password
SERVICE_PASSWORD=password
HORIZON_PASSWORD=password
SERVICE_TOKEN=token

disable_service n-net
disable_service n-cpu
enable_service q-svc
enable_service q-agt
enable_service q-dhcp
enable_service q-l3
enable_service q-meta
enable_service neutron

Q_AGENT=openvswitch
Q_ML2_PLUGIN_MECHANISM_DRIVERS=openvswitch
Q_ML2_PLUGIN_TYPE_DRIVERS=vlan,flat,local
Q_ML2_TENANT_NETWORK_TYPE=vlan

DEST=/opt/stack
SCREEN_LOGDIR=$DEST/logs/screen
LOGFILE=${SCREEN_LOGDIR}/xstack.sh.log
LOGDAYS=1
```



```
ENABLE_TENANT_VLANS=True
ENABLE_TENANT_TUNNELS=False
ML2_VLAN_RANGES=default:1000:1010
PHYSICAL_NETWORK=default
OVS_PHYSICAL_BRIDGE=br-eth1
MULTI_HOST=1

[[post-config|$NOVA_CONF]]
[DEFAULT]
firewall_driver=nova.virt.firewall.NoopFirewallDriver
novncproxy_host=0.0.0.0
novncproxy_port=6080
scheduler_default_filters=RamFilter,ComputeFilter,AvailabilityZoneFilter
,ComputeCapabilitiesFilter,ImagePropertiesFilter,PciPassthroughFilter,NUMA
TopologyFilter
```

6.1.1.2 Sample Compute local.conf

```
#COMPUTE NODE CONFIG FILE

[[local|localrc]]

FORCE=yes

HOST_IP=<HOST IP ADDRESS>
HOST_NAME=$(hostname)
HOST_IP_IFACE=eth0
SERVICE_HOST_NAME=<CONTROLLER HOST NAME>
SERVICE_HOST=<CONTROLLER IP ADDRESS>

MYSQL_HOST=$SERVICE_HOST
RABBIT_HOST=$SERVICE_HOST
GLANCE_HOST=$SERVICE_HOST
GLANCE_HOSTPORT=$SERVICE_HOST:9292
KEYSTONE_AUTH_HOST=$SERVICE_HOST
KEYSTONE_SERVICE_HOST=$SERVICE_HOST

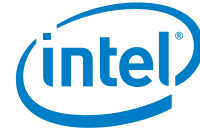
MYSQL_PASSWORD=password
RABBIT_PASSWORD=password
ADMIN_PASSWORD=password
SERVICE_PASSWORD=password
HORIZON_PASSWORD=password
SERVICE_TOKEN=token

disable_all_services
enable_service n-cpu
enable_service q-agt
enable_service rabbit

Q_AGENT=ovdk
Q_ML2_PLUGIN_MECHANISM_DRIVERS=openvswitch
Q_ML2_PLUGIN_TYPE_DRIVERS=vlan
Q_ML2_TENANT_NETWORK_TYPE=vlan

OVDK_NUM_HUGE_PAGES=8192
```


Sample Configuration



```
OVDK_GIT_TAG=bd8e8ee7565ca7e843a43204ee24a7e1e2bf9c6f
#OVDK_PRE_10_VERSION=False

#OVDK_REPO=/opt/stack/ovdk
#OVDK_DPKD_DIR=/opt/stack/dpdk
#OVDK_BUILD_FROM_PACKAGE=True
#OVDK_PACKAGE_URL=<path-to-ovdk>

#OVDK_DPKD_BUILD_FROM_PACKAGE=False
#OVDK_DPKD_GIT_REPO=http://dpdk.org/git/dpdk
#OVDK_DPKD_GIT_TAG=<git-commit>
#DPDK_PCI_BIND=dpdk_nic_bind.py

DEST=/opt/stack
SCREEN_LOGDIR=$DEST/logs/screen
LOGFILE=${SCREEN_LOGDIR}/xstack.sh.log
LOGDAYS=1

ENABLE_TENANT_VLANS=True
ENABLE_TENANT_TUNNELS=False
ML2_VLAN_RANGES=default:1000:1010
PHYSICAL_NETWORK=default
OVS_PHYSICAL_BRIDGE=br-eth1
MULTI_HOST=1

[[post-config|$NOVA_CONF]]
[DEFAULT]
firewall_driver=nova.virt.firewall.NoopFirewallDriver
vnc_enabled=True
vncserver_listen=0.0.0.0
vncserver_proxyclient_address=<HOST IP ADDRESS>
```

6.1.1.3 Sample local.conf – Openstack* Accelerated OVS Compute Node

```
#COMPUTE NODE CONFIG FILE

[[local|localrc]]

FORCE=yes

HOST_IP=<HOST IP ADDRESS>
HOST_NAME=$(hostname)
HOST_IP_IFACE=eth0
SERVICE_HOST_NAME=<CONTROLLER HOST NAME>
SERVICE_HOST=<CONTROLLER IP ADDRESS>

MYSQL_HOST=$SERVICE_HOST
RABBIT_HOST=$SERVICE_HOST
GLANCE_HOST=$SERVICE_HOST
GLANCE_HOSTPORT=$SERVICE_HOST:9292
KEYSTONE_AUTH_HOST=$SERVICE_HOST
KEYSTONE_SERVICE_HOST=$SERVICE_HOST
```



```
MYSQL_PASSWORD=password
RABBIT_PASSWORD=password
ADMIN_PASSWORD=password
SERVICE_PASSWORD=password
HORIZON_PASSWORD=password
SERVICE_TOKEN=token

disable_all_services
enable_service n-cpu
enable_service q-agt
enable_service rabbit

Q_AGENT=openvswitch
Q_ML2_PLUGIN_MECHANISM_DRIVERS=openvswitch
Q_ML2_PLUGIN_TYPE_DRIVERS=vlan
Q_ML2_TENANT_NETWORK_TYPE=vlan

OVS_NUM_HUGEPAGES=8192
OVS_DATAPATH_TYPE=netdev
OVS_GIT_TAG=b35839f3855e3b812709c6ad1c9278f498aa9935

DEST=/opt/stack
SCREEN_LOGDIR=$DEST/logs/screen
LOGFILE=${SCREEN_LOGDIR}/xstack.sh.log
LOGDAYS=1

ENABLE_TENANT_VLANS=True
ENABLE_TENANT_TUNNELS=False
ML2_VLAN_RANGES=default:1000:1010
PHYSICAL_NETWORK=default
OVS_PHYSICAL_BRIDGE=br-eth1
MULTI_HOST=1

[[post-config|$NOVA_CONF]]
[DEFAULT]
firewall_driver=nova.virt.firewall.NoopFirewallDriver
vnc_enabled=True
vncserver_listen=0.0.0.0
vncserver_proxyclient_address=<HOST IP ADDRESS>
```

6.2 Issues

- Ensure the eth1 is down before running stack.sh on the Compute node.
- Setup in this guide was tested on kernel 3.15.6. Note kernel-devel and kernel-modules-extra packages have to match version of kernel booted. 'exclude=kernel' line may be needed in /etc/yum.conf to avoid kernel updates.
- no_proxy/NO_PROXY should contain IPs of all nodes and the controller.

Sample Configuration



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