

Advanced Networking

If you're still using NetworkManager then you should disable it as it interferes with many high level networking configurations. To stop NetworkManager and disable its persistency use:

```
# service NetworkManager stop  
# chkconfig NetworkManager off
```

IP aliasing

There may be a need for you to allocate multiple IP addresses to the same network interface. Doing so via the command line requires use of the ip command as follows:

```
# ip address add 1.1.1.1/24 brd + dev eth0
```

What this does is that it adds the IP address 1.1.1.1 with a 24 bit subnet mask to the interface eth0. The brd + part says that the broadcast address is to be automatically calculated based on the subnet mask.

!!! NOTE !!!

The above command is NOT persistent and will not survive a reboot nor the network service being restarted

To set the above persistently, create a file called /etc/sysconfig/network-scripts/ifcfg-eth0:0 with the following content:

```
IPADDR=1.1.1.1  
PREFIX=24  
ONPARENT=yes
```

Once you have done this, you may restart the network service to effect your changes:

```
# service network restart
```

Bonding

Multiple physical network cards may be combined to present a single interface, this is called bonding and offers numerous benefits ranging from fault tolerance to performance depending on the bonding mode configured.

The most popular modes of bonding are:

0 also known as balance-rr	round robin policy, all interfaces are used for balancing	load balancing
1 also known as active-backup	your system primarily uses 1 interface and uses other interfaces only on failure	fault tolerance
3 also known as broadcast all	all packets are broadcast from all devices	fault tolerance

To create a bonded interface, create a file called `/etc/sysconfig/network-scripts/ifcfg-bond0` with the following content:

```
1. DEVICE=bond0
2. IPADDR=192.168.122.100
3. PREFIX=24
4. ONBOOT=yes
5. BOOTPROTO=none
6. USERCTL=no
7. BONDING_OPTS="mode=1 miimon=100"
```

Explanation:

1. The interface name to which the configuration is applicable
2. The IP address allocated
3. The subnet mask
4. This specifies that the interface will be brought up automatically when the server boots
5. No particular IP configuration is set
6. Normal users cannot manage this interface
7. We're using bonding mode 1 and the monitoring interval is set to 100 milliseconds

Now adapt the configuration files for your slave interfaces as follows, this is `/etc/sysconfig/network-scripts/ifcfg-eth0`

```
1. DEVICE=eth0
2. BOOTPROTO=none
3. ONBOOT=yes
4. MASTER=bond0
```

5. SLAVE=yes
6. USERCTL=no

Explanation:

1. The configuration is applicable to the interface called eth0
2. No particular IP configuration is set
3. This specifies that the interface will be brought up automatically when the server boots
4. The interface cannot stand on its own and is attached to the master called bond0
5. The interface is a slave and has no direct IP configuration
6. Normal users cannot manage this interface

!!! TIP !!!

Install the kernel documentation using the command `yum install -y kernel-doc` and have a look at `/usr/share/doc/kernel-doc*/Documentation/bonding.txt` for more information.

Kernel network parameters

Your server's ability to provide other networking features can be further enabled/disabled or enhanced by tuning kernel parameters.

For example, to disable ping responses at a kernel level you could add the following to `/etc/sysctl.conf`:

```
net.ipv4.icmp_echo_ignore_all = 1
```

Your system has a number of tunable parameters below `/proc` and specifically the network parameters are stored below `/proc/sys/net`.

If you want to see all the ipv4 parameters, have a look at the files below the directory `/proc/sys/net/ipv4`

Some of these tunables are boolean value based and others have string values.

If a boolean has the value set to 0 then it means that it is not enabled.

So let's have a look at the content of `/proc/sys/net/ipv4/ip_forward`

```
# cat /proc/sys/net/ipv4/ip_forward
0
```

This means that IP forward is not enabled, which means that our server cannot act as a router. To change this behavior, we could do the following:

```
# echo 1 > # cat /proc/sys/net/ipv4/ip_forward
# cat /proc/sys/net/ipv4/ip_forward
1
```

But the changes will not be persistent, remember that persistency is defined via configuration files and in particular we deal now with `/etc/sysctl.conf`

The notation is simple: specify the path to the file relative to `/proc/sys/` replacing all `/` with `.` followed with a `=` and the value

Therefore we would add the following into `/etc/sysctl.conf` to persistently enable IP forwarding:

```
net.ipv4.ip_forward = 1
```

Lab activity

Shutdown your virtual machine and add an additional network adapter to it. Power it up and create a bonded interface called `bond0` which consists of the slave devices `eth0` and `eth1`. Make sure that packets are sent across both interfaces. The IP address of your bonded interface must be `192.168.122.254/24`.

Make sure that `tcp_window_scaling` is persistently disabled.