**Configure IPv4 addresses and perform basic IPv4 troubleshooting.**

**Presentation**

Although it is still possible to define the network configuration through the files in the **/etc/sysconfig/network-scripts** directory, it’s not the preferred way any more (don’t forget to execute **# nmcli con reload** if you manually modify the files!).

With **RHEL 7**, all the network configuration is now mainly done through **NetworkManager** (the **NetworkManager** changelog is available [here](https://cgit.freedesktop.org/NetworkManager/NetworkManager/tree/NEWS)).

You can use:

* the **nmtui** command and a **T**ext **U**ser **I**nterface,
* the **nmcli** command at the **C**ommand **L**ine **I**nterface,
* or the graphical interface.

For the rest of this tutorial, it is the **nmcli** option that has been chosen because it’s the quickest method and arguably the least prone to errors.

Changes made through the **nmcli** command are permanent.

**Caution:** To practice this tutorial in the best conditions, connect to the machine through its console (you could otherwise loose your connection!).

**Network Configuration**

To display the network configuration, type:

# **nmcli con show**

NAME UUID TYPE DEVICE

**ethernet-eth0** **8d83684f-cd22-42cc-9fff-7704945a5c36** 802-3-ethernet eth0

Note: **con** is a shortcut for **connection** (you can even type only **c**).

**Alternatively**, you can type:

# **nmcli dev status**

DEVICE  TYPE      STATE      CONNECTION

eth0    ethernet  connected  ethernet-eth0

lo      loopback  unmanaged  --

To remove a connection (here **ethernet-eth0**), type:

# **nmcli con del ethernet-eth0**

Note1: If a space appears in the interface name (like **System eth0**), put everything between quotes: **nmcli con del “System eth0”**.  
Note2: **del** is a shortcut for **delete**.

or

# **nmcli con del 8d83684f-cd22-42cc-9fff-7704945a5c36**

**Connection Management**

To create a connection with the name **ethernet-eth0**, the IPv4 address **192.168.1.10/24** and the default gateway **192.168.1.1**, type:

# **nmcli con add con-name net-eth0 ifname eth0 type ethernet ip4 192.168.1.10/24 gw4 192.168.1.1**

Connection 'net-eth0' (441085a4-4155-417b-ad8f-78a888d89988) successfully added.

Note1: If you don’t specify **con-name net-eth0**, the connection is called **ethernet-eth0**.  
Note2: If you don’t specify the **ip4 192.168.1.10/24 gw4 192.168.1.1** part, you end up with a connection automatically configured through **DHCP**.  
Note3: **nmcli con up net-eth0** is not necessary when initially configuring a connection.  
Note4: **ip4** and **gw4** are used for respectively the ip address and the default gateway. Below, you will see that the syntax when modifying a connection is different: it’s then using **ipv4.addresses** and a **space** between the ip address and the default gateway.

To check the configuration, type:

# **ip a**

1: lo: <LOOPBACK,UP,LOWER\_UP> mtu 65536 qdisc noqueue state UNKNOWN

link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00

inet 127.0.0.1/8 scope host lo

valid\_lft forever preferred\_lft forever

inet6 ::1/128 scope host

valid\_lft forever preferred\_lft forever

2: eth0: <BROADCAST,MULTICAST,UP,LOWER\_UP> mtu 1500 qdisc pfifo\_fast state UP qlen 1000

link/ether 00:00:00:00:00:00 brd ff:ff:ff:ff:ff:ff

inet **192.168.1.10/24** brd 192.168.1.255 scope global eth0

valid\_lft forever preferred\_lft forever

inet6 fe80::0000:00:0000:0000/64 scope link

valid\_lft forever preferred\_lft forever

# **ip r**

default via **192.168.1.1** dev eth0 proto static metric 1024

**192.168.1.0/24** dev eth0 proto kernel scope link src **192.168.1.10**

Note1: **ip a** is a shortcut for **ip address show**, **ip r** a shortcut for **ip route show**.  
Note2: Don’t use the **ifconfig** command any more. This command is deprecated and no longer displays the correct network configuration (secondary ip addresses, etc).

To get all the information about a connection (here **net-eth0**), type:

# **nmcli con show net-eth0**

connection.id: net-eth0

connection.uuid: 441085a4-4155-417b-ad8f-78a888d89988

connection.interface-name: eth0

connection.type: 802-3-ethernet

connection.autoconnect: yes

connection.timestamp: 1427832564

connection.read-only: no

connection.permissions:

connection.zone: --

connection.master: --

connection.slave-type: --

connection.secondaries:

connection.gateway-ping-timeout: 0

802-3-ethernet.port: --

802-3-ethernet.speed: 0

802-3-ethernet.duplex: --

802-3-ethernet.auto-negotiate: yes

802-3-ethernet.mac-address: --

802-3-ethernet.cloned-mac-address: --

802-3-ethernet.mac-address-blacklist:

802-3-ethernet.mtu: auto

802-3-ethernet.s390-subchannels:

802-3-ethernet.s390-nettype: --

802-3-ethernet.s390-options:

ipv4.method: manual

ipv4.dns:

ipv4.dns-search:

ipv4.addresses: { ip = 192.168.1.10/24, gw = 192.168.1.1 }

ipv4.routes:

ipv4.ignore-auto-routes: no

ipv4.ignore-auto-dns: no

ipv4.dhcp-client-id: --

ipv4.dhcp-send-hostname: yes

ipv4.dhcp-hostname: --

ipv4.never-default: no

ipv4.may-fail: yes

ipv6.method: auto

ipv6.dns:

ipv6.dns-search:

ipv6.addresses:

ipv6.routes:

ipv6.ignore-auto-routes: no

ipv6.ignore-auto-dns: no

ipv6.never-default: no

ipv6.may-fail: yes

ipv6.ip6-privacy: -1 (unknown)

ipv6.dhcp-hostname: --

GENERAL.NAME: net-eth0

GENERAL.UUID: 441085a4-4155-417b-ad8f-78a888d89988

GENERAL.DEVICES: eth0

GENERAL.STATE: activated

GENERAL.DEFAULT: yes

GENERAL.DEFAULT6: no

GENERAL.VPN: no

GENERAL.ZONE: --

GENERAL.DBUS-PATH: /org/freedesktop/NetworkManager/ActiveConnection/0

GENERAL.CON-PATH: /org/freedesktop/NetworkManager/Settings/0

GENERAL.SPEC-OBJECT: --

GENERAL.MASTER-PATH: --

IP4.ADDRESS[1]: ip = 192.168.1.10/24, gw = 192.168.1.1

IP6.ADDRESS[1]: ip = fe80::0000:00:0000:0000/64, gw = ::

**Alternatively**, you can type:

# **nmcli dev show eth0**

GENERAL.DEVICE:                         eth0

GENERAL.TYPE:                           ethernet

GENERAL.HWADDR:                         00:00:00:00:00:00

GENERAL.MTU:                            1500

GENERAL.STATE:                          100 (connected)

GENERAL.CONNECTION:                     net-eth0

GENERAL.CON-PATH:                       /org/freedesktop/NetworkManager/ActiveConnection/0

WIRED-PROPERTIES.CARRIER:               on

IP4.ADDRESS[1]:                         192.168.1.10/24

IP4.GATEWAY:                            192.168.4.10

IP4.DNS[1]:                             192.168.4.1

IP6.ADDRESS[1]:                         fe80::0000:00:0000:0000/64

IP6.GATEWAY:

To stop a network connection from working (here **net-eth0**), type:

# **nmcli con down net-eth0**

# **nmcli con show**

NAME UUID TYPE DEVICE

net-eth0 441085a4-4155-417b-ad8f-78a888d89988 802-3-ethernet **--**

Note1: The **—** shows that the connection isn’t active any more (add the **–active** option to only display active connections).  
Note2: You can specify the **UUID** (here **441085a4-4155-417b-ad8f-78a888d89988**) instead of the network connection name.  
Note3: After reboot, the connection still restarts automatically, the property **connection.autoconnect** being set to **yes**, equivalent to **ONBOOT=yes**.

To start a network connection (here **net-eth0**), type:

# **nmcli con up net-eth0**

Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/1)

Note: As before, you can specify the **UUID** (here **441085a4-4155-417b-ad8f-78a888d89988**) instead of the network connection name.

To prevent the connection (here **net-eth0**) to restart after reboot, type:

# **nmcli con mod net-eth0 connection.autoconnect no**

Note: **mod** is a shortcut for **modify**.

To change the ip address and default gateway of the **net-eth0** connection to respectively **192.168.2.10/24** and **192.168.2.1**, type:  
In **RHEL 7.0**:

# **nmcli con mod net-eth0 ipv4.addresses "192.168.2.10/24 192.168.2.1**"

# **nmcli con mod net-eth0 ipv4.method manual**

# **nmcli con up net-eth0**

Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/2)

From **RHEL 7.1** on:

# **nmcli con mod net-eth0 ipv4.addresses 192.168.2.10/24**

# **nmcli con mod net-eth0 ipv4.gateway 192.168.2.1**

# **nmcli con mod net-eth0 ipv4.method manual**

# **nmcli con up net-eth0**

Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/2)

**Caution**: The command **nmcli con mod net-eth0 ipv4.addresses “192.168.2.10/24 192.168.2.1”** with a **space** between the ip address and the default gateway, **all between quotes**, was working in **RHEL 7.0**/**CentOS 7.0** but doesn’t in **RHEL 7.1**/**CentOS 7.1** and later due to **NetworkManager** changes (**v0.9.9.1** -> **v1.0.0**).  
Note1: You can use the syntax **+ipv4.addresses** or **-ipv4.addresses** to respectively add other ip addresses or remove some previously set (the initial one included).  
Note2: The syntax is different from the one you used to initially set up the connection with **ip4** and **gw4**.  
Note3: According to the [nmcli RedHat documentation](https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/7/html/Networking_Guide/sec-Using_the_NetworkManager_Command_Line_Tool_nmcli.html), the **ipv4.method** property can have different values: **auto** means an appropriate automatic method (DHCP, PPP, etc) will be used for the interface, **link-local** refers to a link-local address in the 169.254/16 range that will be assigned to the interface, **manual** means static IP addressing is used and at least one IP address must be given in the **addresses** property, **shared** indicates that the connection will provide network access to other computers and the interface will be assigned an address in the 10.42.x.1/24 range with a DHCP and forwarding DNS server being started and the interface is NAT-ed to the current default network connection, **disabled** means IPv4 will not be used on this connection.

With the **RHEL 7.3** release, **NetworkManager** now performs a check to detect duplicate IPv4 addresses when activating a new connection. If the address in LAN is already assigned, the connection activation fails. This feature is disabled by default, but you can enable it by the **ipv4.dad-timeout** property or the **ARPING\_WAIT** variable in the **ifcfg** files.

To assign the **net-eth0** connection to the **work** zone, type:

# **firewall-cmd --permanent --zone=work --change-interface=eth0**

success

# **nmcli con mod net-eth0 connection.zone work**

# **nmcli con up net-eth0**

Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/3)

Note1: Instead of using the **nmcli con mod** command, you can also edit the **/etc/sysconfig/network-scripts/ifcfg-eth0** file (here for the **eth0** network interface), add a **ZONE=work** statement and restart the network interface with **nmcli con up net-eth0**.  
Note2: For more details about the **firewall-cmd** command and the concept of **zone**, see the [Firewalld Getting Started page](https://www.certdepot.net/rhel7-get-started-firewalld/).

**Hostname Configuration**

In **RHEL 7**, there are three kinds of hostnames: **static**, **pretty**, and **transient**.  
“The **static** host name is the traditional hostname, which can be chosen by the user, and is stored in the **/etc/hostname** file. The **transient** hostname is a dynamic host name maintained by the kernel. It is initialized to the static host name by default, whose value defaults to **localhost**. It can be changed by **DHCP** or **mDNS** at runtime. The **pretty** hostname is a free-form UTF8 host name for presentation to the user.” Source: [RHEL 7 Networking Guide](https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/7/html/Networking_Guide/).

To get the server hostnames, type:

# **hostnamectl**

Static hostname: centos7.example.com

Icon name: computer

Chassis: n/a

Machine ID: 8f56e45764474b668b0db97b4127a01b

Boot ID: 2ae7e6c78331414b82aa89a0ffcfa9fa

Virtualization: kvm

Operating System: CentOS Linux 7 (Core)

CPE OS Name: cpe:/o:centos:centos:7

Kernel: Linux 3.10.0-123.el7.x86\_64

Architecture: x86\_64

**Alternatively**, you can use the **hostname** command to only get the host name (this reads the **/etc/hostname** file):

# **hostname**

centos7.example.com

Note: You can even get the same result with the command **nmcli gen host**.

To permanently assign the **rhel7** hostname  to the server, type:

# **hostnamectl set-hostname rhel7**

Note1: With this syntax all three hostnames (**static**, **pretty**, and **transient**) take the **rhel7** value at the same time. However, it is possible to set the three hostnames separately by using the **–pretty**, **–static**, and **–transient** options.  
Note2: The **nmcli gen host rhel7** command will give you the same result.

**Caution:** With the **RHEL 7.3** release, **NetworkManager** now uses the **systemd-hostnamed** service to read and write the static host name, which is stored in the **/etc/hostname** file. Due to this change, manual modifications done to the **/etc/hostname** file are no longer picked up automatically by **NetworkManager**. Users should change the system host name through the **hostnamectl** utility. Also, the use of the **HOSTNAME** variable in the **/etc/sysconfig/network** file is now deprecated.

**Hostname Resolution**

Hostname resolution relies on the **/etc/nsswitch.conf** file where you can find the following line by default:

**hosts: files dns**

This means that hostname resolution is at first done through **files** (**static** resolution) then **dns** (**dynamic** resolution).

The **static** hostname resolution comes through the **/etc/hosts** file:

**192.168.1.10 centos7.example.com centos7**

Note: Always write the IP address, the **F**ull **Q**ualified **D**omain **N**ame and optionally some aliases in this order, otherwise some services like **Kerberos** will not work!

The **dynamic** hostname resolution is based on the **/etc/resolv.conf** file:

**# Generated by NetworkManager**

**search example.com**

**nameserver 192.168.1.1**

Note: You can have up to 3 nameservers configured. As nameservers are called in the mentioned order (the second is called if the first doesn’t reply and so on), always put the main nameserver first in the list.

To add a **DNS** server (here **8.8.8.8**) to the configuration of the connection (here **net-eth0**), type:

# **nmcli con mod net-eth0 +ipv4.dns 8.8.8.8**

# **nmcli con up net-eth0**

Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/4)

# **more /etc/resolv.conf**

# Generated by NetworkManager

search example.com

nameserver 192.168.1.1

**nameserver 8.8.8.8**

Note1: Use **+ipv4.dns** to add a new **DNS** server, **-ipv4.dns** to remove a **DNS** server and **ipv4.dns** to replace the current **DNS** server.  
Note2: The change **only** occurs **after** the connection is restarted.  
Note3: Use the **ipv4.dns-search** option to change the domain name if necessary. Be careful to set the correct full qualified domain name before with the **hostnamectl set-hostname** command.

To add a domain name in the search list (here **example2.com**), type:

# **nmcli con mod net-eth0 +ipv4.dns-search example2.com**

# **nmcli con up net-eth0**

Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/5)

# **more /etc/resolv.conf**

# Generated by NetworkManager

search **example2.com** example.com

nameserver 192.168.1.1

nameserver 8.8.8.8

You can’t remove a **DNS** server provided through **DHCP** with the previous command (with the **-ipv4.dns** option for example), you will get this error message: **“Error: failed to remove a value from ipv4.dns: the property doesn’t contain DNS server ‘192.168.1.1’.”**.  
If you want to set your own **DNS** configuration in this context, type:

# **nmcli con mod net-eth0 ipv4.ignore-auto-dns yes**

Note: You get the same result by specifying **PEERDNS=no** in the network configuration files.

With **RHEL 7.3** comes the **ipv4.dhcp-timeout** property or the **IPV4\_DHCP\_TIMEOUT** option in the **ifcfg** files. As a result, **NetworkManager** now waits for a response from the DHCP server only for a given time.