How to Manage Linux Network Connections from the Command Line

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The `nmcli` command lets you tap into the power of the Linux NetworkManager straight from the command line, making it perfect for servers with no desktop environment and remote SSH shell administration.

The nmcli Command

The `nmcli` command isn't new, it was released in 2010. Together with the ip command, it replaces the venerable—but deprecated— `ifconfig`. Old habits die hard, and many sysadmins still use

`ifconfig`. They already know how to use it, there's no learning curve, and they just need to get the job done. So why learn yet another tool?

Well, eventually, `ifconfig` will be dropped by the distributions so it's a change that is coming, like it or not. But `nmcli` has some neat tricks all of its own that make it worthwhile finding out what it can offer.

The ncmli Concepts and Syntax

Like all CLI commands, `nmcli` accepts command line parameters. The parameters are grouped into three categories.

- **Options**: These modify `nmcli`'s behavior
- **Sections**: These tell `nmcli` which set of actions you are invoking. Think of sections as collections of commands.
- **Actions**: These tell `nmcli` what you want it to do. Think of them as commands.

The general syntax format is:

```
nmcli <options> <sections> <action>
```

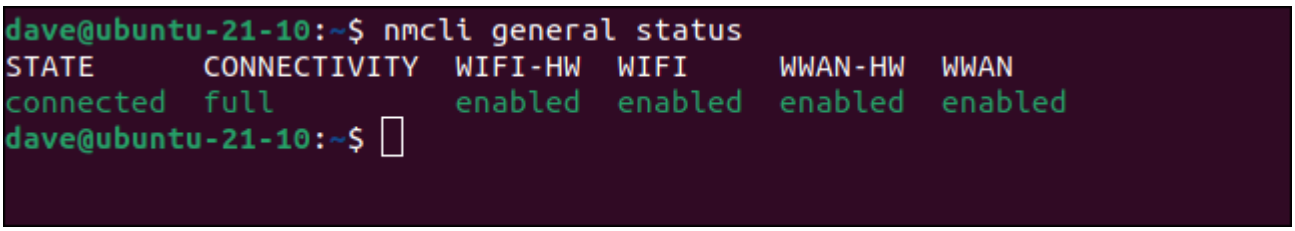
But note that you don't always need all three sets of parameters for every command. The `nmcli` sections are:

- **Help**: Provides short help texts on the `ncmcli` commands
- **General**: Retrieves the status and configuration of NetworkManager
- **Networking**: Queries, enables, or disables network connections
- **Radio**: Queries, enables, or disables Wi-Fi network connections
- **Monitor**: Monitors NetworkManager and status changes of network connections
- **Connection**: Directly manipulates network interfaces, including enabling and disabling them, adding new connections, and removing existing connections
- **Device**: Modifies network device parameters and connects or disconnects a device from an existing connection
- **Secret**: Registers `nmcli` as a NetworkManager secret agent. Because `nmcli` does this automatically, this is very rarely used.

First Steps with nmcli

Let's make sure NetworkManager is installed, running, and we can connect to it with `nmcli`. We'll use the `status` action from the `general` section.

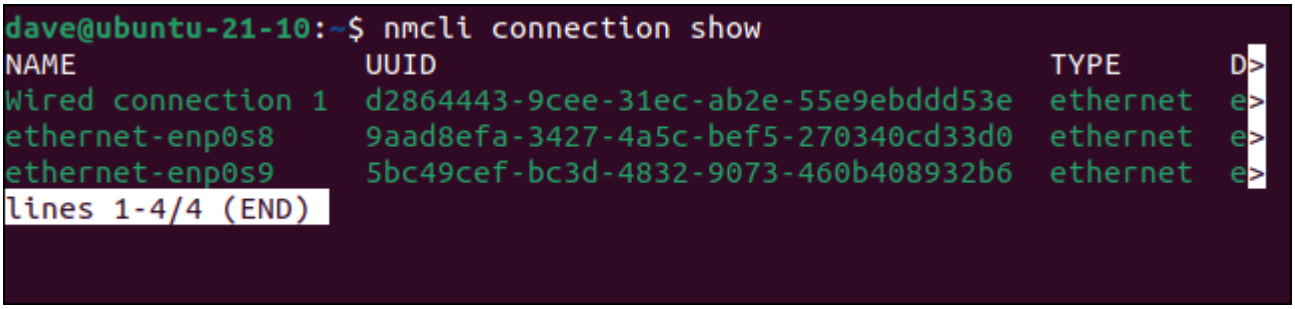
```
nmcli general status
```



Actually, status is the default action for general, so we could have left that word off the command. But we've verified that `nmcli` —and therefore NetworkManager—is installed and operational. Let's find out a bit more about this computer.

We can list all of the in-memory and on-disk network connection profiles using the show action from the connection section:

```
nmcli connection show
```



The output is wider than the terminal window. Our results were:

```
NAME                UUID                                  TYPE     DEVICE
Wired connection 1 d2864443-9cee-31ec-ab2e-55e9ebddd53e ethernet enp0s3
```

```
ethernet-enp0s8    9aad8efa-3427-4a5c-bef5-270340cd33d0 ethernet enp0s8
ethernet-enp0s9    5bc49cef-bc3d-4832-9073-460b408932b6 ethernet enp0s9
```

The test machine used for this article is running a pre-launch version of Ubuntu 21.10. It has three network adaptors installed in it, named `enp0s3`, `enp0s8`, and `enp0s9`.

Understanding the Plumbing

A network connection allows your computer to communicate over a network to another device. Internally, `nmcli` holds all the information regarding a network connection in a data object it calls a connection.

An `nmcli` connection encapsulates all of the information related to that connection, including data link layer and IP addressing information. You can think of `nmcli`'s connections as the configuration details for real-world network connections.

To reach the outside world a connection must use a networking interface device, such as a network card. A connection is bound to a device. When a device is active and able to receive or transmit data, the connection is said to be `active` or `up`. The corresponding inactive state is called, unsurprisingly, `inactive` or `down`.

Adding Network Connections

With `nmcli` you can create a network connection and set some of its configuration options with a single command. On this test computer, there is no connection on `enp0s8` , the name for our wired connection (ethernet) number 2. We'll add a connection to `enp0s8`. Because we're making system changes, you'll need to use `sudo`:

```
sudo nmcli connection add type ethernet ifname enp0s8
```

```
dave@ubuntu-21-10:~$ sudo nmcli connection add type ethernet ifname en
p0s8
Connection 'ethernet-enp0s8-1' (b874aa09-3a25-4f52-b20b-1b95d9741be9)
successfully added.
dave@ubuntu-21-10:~$
```

This command uses the `add` action from the `connection` section. We used the `type` option to request an ethernet connection, and the `ifname` (interface name) option to specify the network interface device we want this connection to use.

Let's check what's happened:

```
nmcli connection show
```



```
NAME                UUID                                  TYPE      DEVICE
Wired connection 1  d2864443-9cee-31ec-ab2e-55e9ebddd53e  ethernet  enp0s3
ethernet-enp0s8     9aad8efa-3427-4a5c-bef5-270340cd33d0  ethernet  enp0s8
ethernet-enp0s9     5bc49cef-bc3d-4832-9073-460b408932b6  ethernet  enp0s9
ethernet-enp0s8-1   b874aa09-3a25-4f52-b20b-1b95d9741be9  ethernet  --
```

Our new connection, `ethernet-enp0s8-1` , has been created. Its universally unique identifier (UUID) has been assigned, and the connection type is ethernet. We can now make it active with the `up` command. The `up` command must be followed by the connection name or its UUID:

```
nmcli connection up ethernet-enp0s8-1
```

```
dave@ubuntu-21-10:~$ nmcli connection up ethernet-enp0s8-1
Connection successfully activated (D-Bus active path: /org/freedesktop
/NetworkManager/ActiveConnection/6)
dave@ubuntu-21-10:~$
```

Let's check our active connections once more:

```
nmcli connection show --active
```

```
dave@ubuntu-21-10:~$ nmcli connection show --active
NAME                UUID                                  TYPE      D>
Wired connection 1  d2864443-9cee-31ec-ab2e-55e9ebddd53e  ethernet  e>
ethernet-enp0s8-1   b874aa09-3a25-4f52-b20b-1b95d9741be9  ethernet  e>
ethernet-enp0s9     5bc49cef-bc3d-4832-9073-460b408932b6  ethernet  e>
lines 1-4/4 (END)
```

```
NAME                UUID                                  TYPE      DEVICE
Wired connection 1  d2864443-9cee-31ec-ab2e-55e9ebddd53e  ethernet  enp0s3
ethernet-enp0s8-1   b874aa09-3a25-4f52-b20b-1b95d9741be9  ethernet  enp0s8
ethernet-enp0s9     5bc49cef-bc3d-4832-9073-460b408932b6  ethernet  enp0s9
```

Our new connection, `ethernet-enp0s8-1`, is now active and bound to the `enp0s8` network interface device.

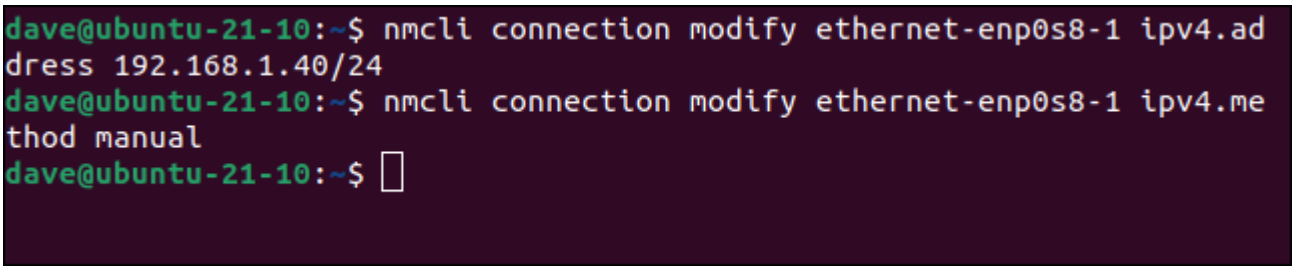
Adjusting Connections

Of course, `ncmli` lets you change the parameters of existing connections too. Suppose we want to switch a network interface from Dynamic Host Configuration Protocol (DHCP) to using a static IP address. To match our network, we need a fixed IP address of 192.168.1.40 for our new connection.

To achieve that, you need to issue two commands. One to set the IP address, and one to set the connection's method of obtaining an IP address to manual:

```
nmcli connection modify ethernet-enp0s8-1 ipv4.address 192.168.1.40/24
```

```
nmcli connection modify ethernet-enp0s8-1 ipv4.method manual
```

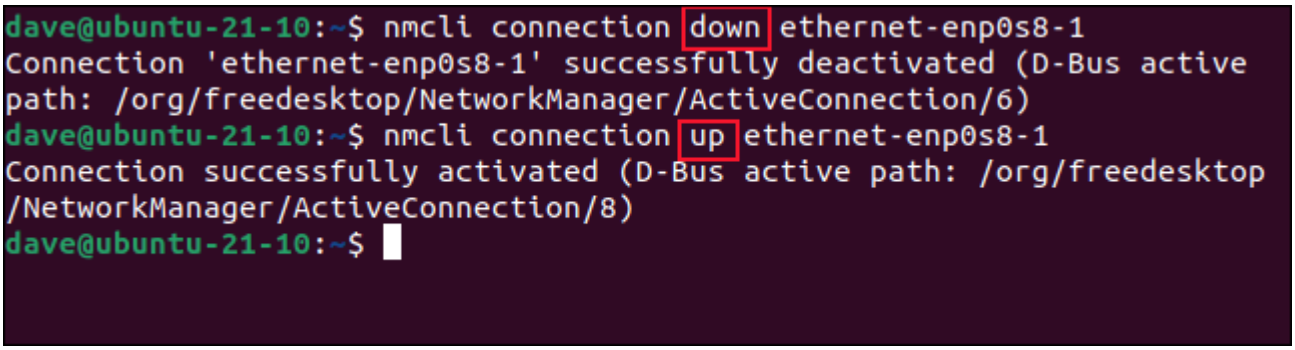


The “/24” we’re providing with the IP address is the subnet mask in Classless Inter-Domain Routing (CIDR). In this context “/24” means “255.255.255.0.”

The changes won’t take effect until the connection is “bounced.” That is, disabled and brought back online. The first command takes the connection down and the second brings it back up.

```
nmcli connection down ethernet-enp0s8-1
```

```
nmcli connection up ethernet-enp0s8-1
```



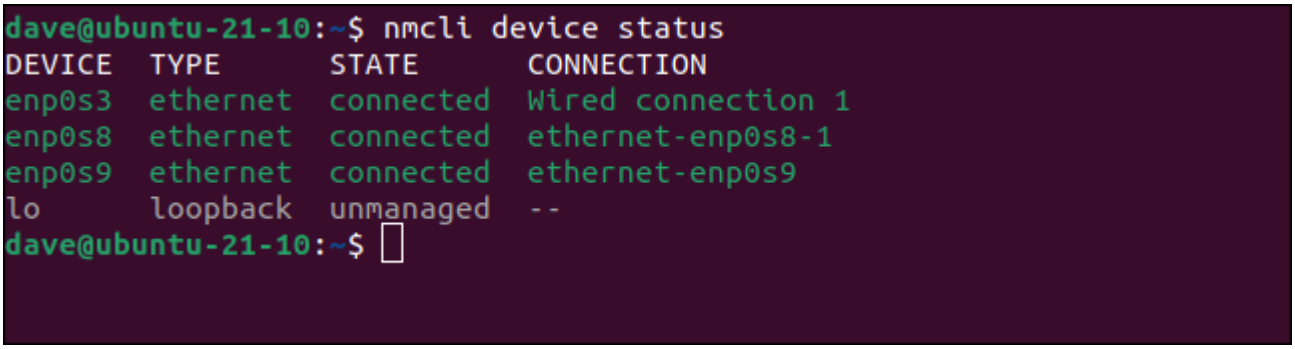
If you want to reverse the change and move from a static IP address to a DHCP IP Address, use the `auto` option instead of `manual`.

```
nmcli connection modify ethernet-enp0s8-1 ipv4.method auto
```

Device Management

The `nmcli device` section contains actions (commands) that let you manage the network interfaces installed on your computer. To see the status of all the network interfaces on your computer use:

```
nmcli device status
```

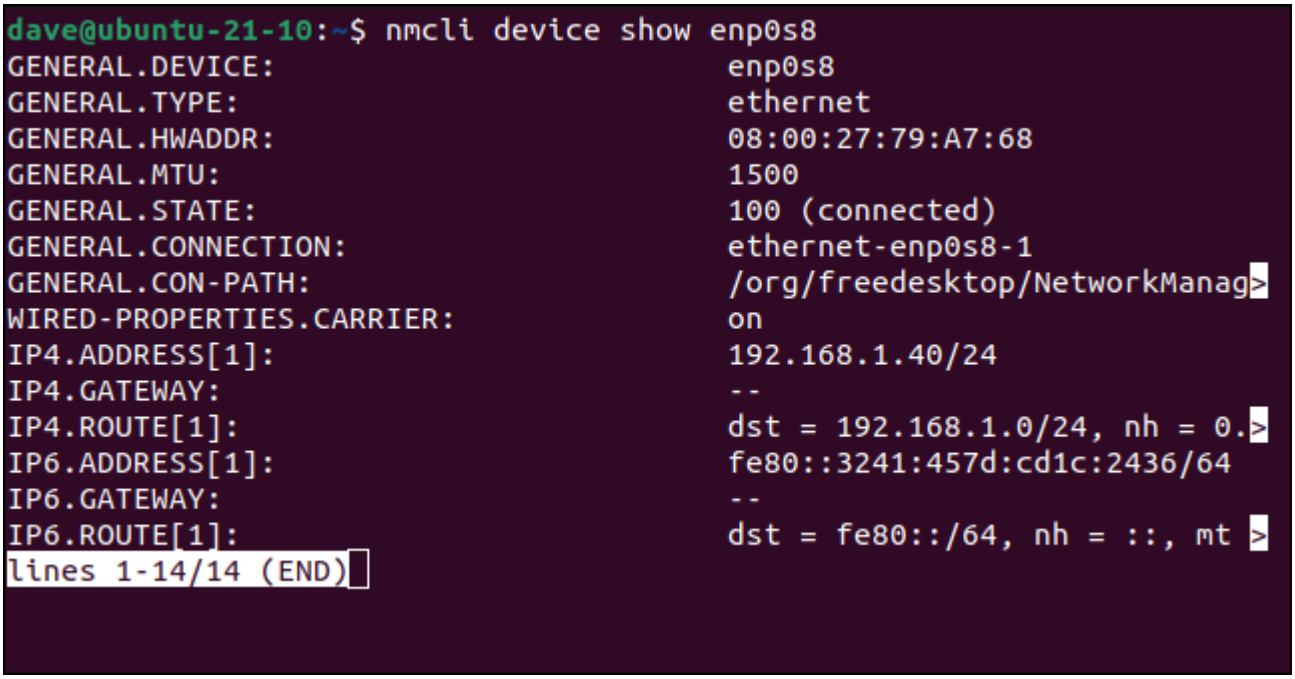


Showing Device Details

To examine the details of a network interface, we use the `show` action from the `device` section. If you do not provide a device name, the details of all devices are retrieved and displayed. You can scroll and page up and down to review them.

Let's take a look at `enp0s8`, the device our new connection is using. We can verify that the IP address in use is the address that we previously requested.

```
nmcli device show enp0s8
```




```
GENERAL.DEVICE:           enp0s8
GENERAL.TYPE:             ethernet
GENERAL.HWADDR:           08:00:27:79:A7:68
GENERAL.MTU:              1500
GENERAL.STATE:            100 (connected)
GENERAL.CONNECTION:       ethernet-enp0s8-1
GENERAL.CON-PATH:         /org/freedesktop/NetworkManager/ActiveConnection/
WIRED-PROPERTIES.CARRIER: on
IP4.ADDRESS[1]:           192.168.1.40/24
IP4.GATEWAY:              --
IP4.ROUTE[1]:             dst = 192.168.1.0/24, nh = 0.0.0.0, mt = 102
IP6.ADDRESS[1]:           fe80::3241:457d:cd1c:2436/64
IP6.GATEWAY:              --
IP6.ROUTE[1]:             dst = fe80::/64, nh = ::, mt = 102
```

A screenful of information is returned by `nmcli` . Some of the commonly useful items are:

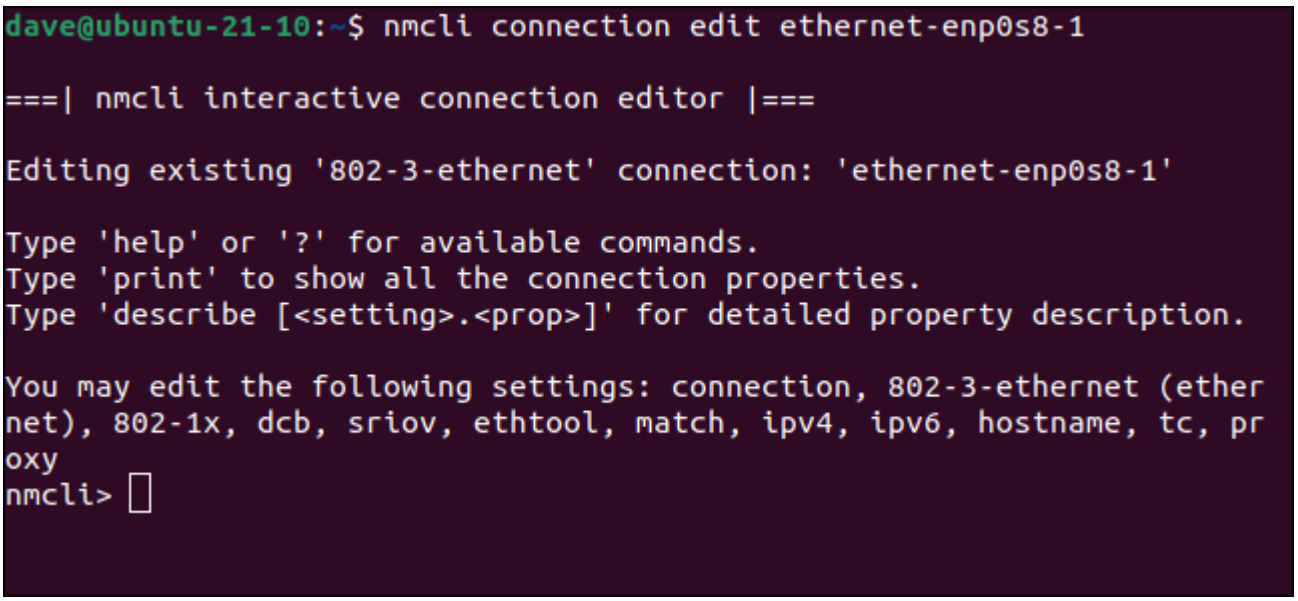
- **DEVICE**: The name of the device we're examining.
- **TYPE**: The type of connection using this device.
- **HWADDR**: The MAC address of the interface card.
- **STATE**: Whether this device has a live connection on it.
- **IP4.ADDRESS[1]**: The IP address and subnet mask for this device.

- **CONNECTION**: The name of the connection using this device.

The nmcli Interactive Editor

Although `nmcli` is a command-line tool it does have an elementary interactive editor. The edit action in the connection section opens the interactive editor on the connection you pass on the command line:

```
nmcli connection edit ethernet-enp0s8-1
```



Some help text is printed to the screen, and you're presented with the "nmcli>" command prompt.

if you type `print` and hit "Enter", `nmcli` lists all the properties associated with the connection. There are lots of them. You can scroll through them to review them.

```
print
```

```
               Connection profile details (ethernet-enp0s8-1)
================================================================================
connection.id:                          ethernet-enp0s8-1
connection.uuid:                        b874aa09-3a25-4f52-b20b-1b95d9
741be9
connection.stable-id:                   --
connection.type:                        802-3-ethernet
connection.interface-name:              enp0s8
connection.autoconnect:                 yes
connection.autoconnect-priority:        0
connection.autoconnect-retries:         -1 (default)
connection.multi-connect:               0 (default)
connection.auth-retries:                -1
connection.timestamp:                   1626973622
connection.read-only:                   no
connection.permissions:                 --
connection.zone:                        --
connection.master:                      --
connection.slave-type:                  --
connection.autoconnect-slaves:          -1 (default)
```

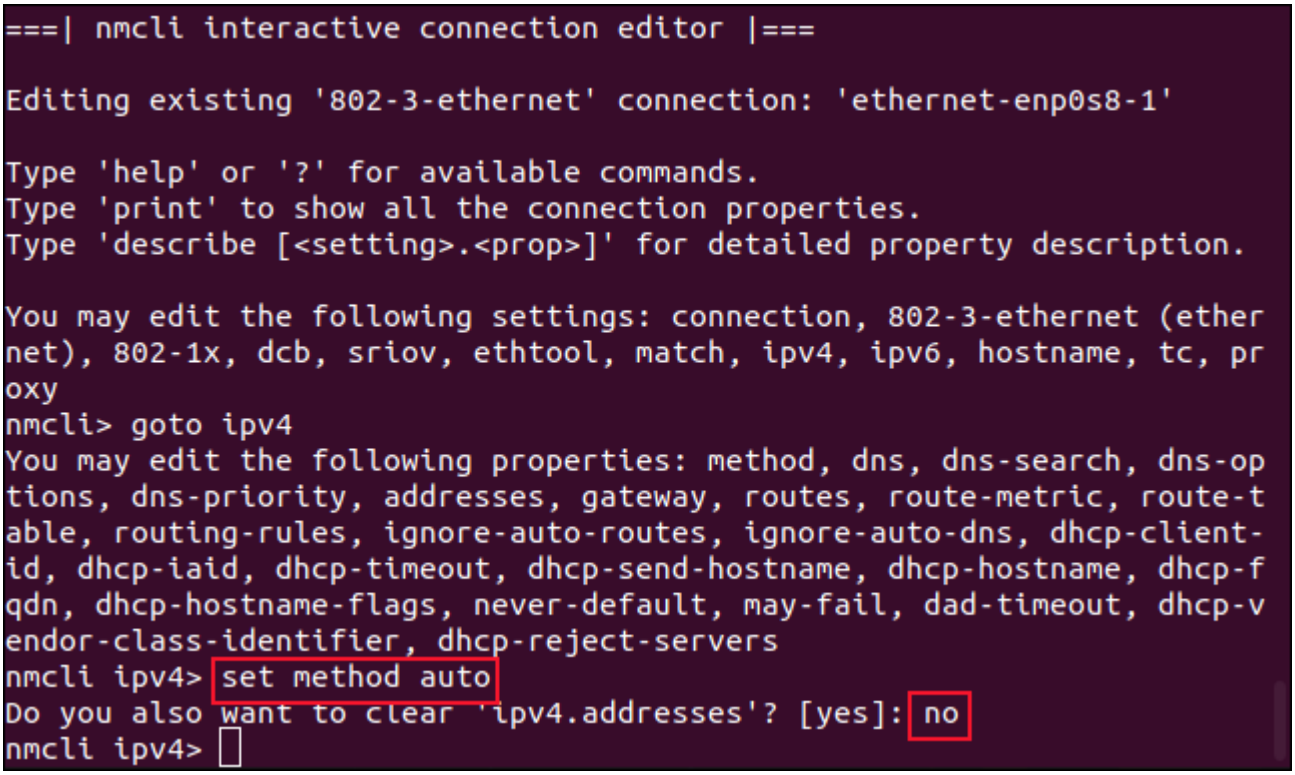
Let's change our connection back to using DHCP. We'll use the "ipv4" settings. To do that, we need to "go" to the IPv4 settings.

```
goto ipv4
```

```
dave@ubuntu-21-10:~$ nmcli connection edit ethernet-enp0s8-1

===| nmcli interactive connection editor |===

Editing existing '802-3-ethernet' connection: 'ethernet-enp0s8-1'

Type 'help' or '?' for available commands.
Type 'print' to show all the connection properties.
Type 'describe [<setting>.<prop>]' for detailed property description.

You may edit the following settings: connection, 802-3-ethernet (ether
net), 802-1x, dcb, sriov, ethtool, match, ipv4, ipv6, hostname, tc, pr
oxy
nmcli> goto ipv4
You may edit the following properties: method, dns, dns-search, dns-op
tions, dns-priority, addresses, gateway, routes, route-metric, route-t
able, routing-rules, ignore-auto-routes, ignore-auto-dns, dhcp-client-
id, dhcp-iaid, dhcp-timeout, dhcp-send-hostname, dhcp-hostname, dhcp-f
qdn, dhcp-hostname-flags, never-default, may-fail, dad-timeout, dhcp-v
endor-class-identifier, dhcp-reject-servers
nmcli ipv4>
```

The property we want to change is `method`. We want to set it to automatic.

```
set method auto
```



You'll see the following prompt:

```
Do you also want to clear 'ipv4.addresses'? [yes]:
```


If you don't clear the IP address, the next time you set this connection to use a static IP address it'll use the one that was previously set. If you do clear it, you'll need to set a new IP address if you ever change this connection back to using a static IP address. Type "yes" or just hit "Enter" to clear it. Type "no" and hit "Enter" to keep it.

We need to save our changes:

```
save
```

```
Type 'help' or '?' for available commands.
Type 'print' to show all the connection properties.
Type 'describe [<setting>.<prop>]' for detailed property description.

You may edit the following settings: connection, 802-3-ethernet (ether
net), 802-1x, dcb, sriov, ethtool, match, ipv4, ipv6, hostname, tc, pr
oxy
nmcli> goto ipv4
You may edit the following properties: method, dns, dns-search, dns-op
tions, dns-priority, addresses, gateway, routes, route-metric, route-t
able, routing-rules, ignore-auto-routes, ignore-auto-dns, dhcp-client-
id, dhcp-iaid, dhcp-timeout, dhcp-send-hostname, dhcp-hostname, dhcp-f
qdn, dhcp-hostname-flags, never-default, may-fail, dad-timeout, dhcp-v
endor-class-identifier, dhcp-reject-servers
nmcli ipv4> set method auto
Do you also want to clear 'ipv4.addresses'? [yes]: no
nmcli ipv4> save
Connection 'ethernet-enp0s8-1' (b874aa09-3a25-4f52-b20b-1b95d9741be9)
successfully updated.
nmcli ipv4>
```

Type “quit” to exit the interactive editor. If you don’t want to quit, type “back” to go back to the main level, and carry on using the editor.

There’s Much More in man

The `nmcli` command can do much more. It has a great many command-line parameters and options. So many in fact, that its man page runs to over 1200 lines. Review them to see what else `nmcli` can do for you.

And of course, if you’re remotely administering network connections, don’t disable the connection you’ve connected in on. That’s never fun.

DAVE MCKAY

Dave McKay first used computers in the industry when punched paper tape was in vogue and he has been programming ever since. His use of computers pre-dates the birth of the PC and the public release of Unix. He has programmed in

everything from 6502 assembly to Lisp, and from Forth to C#. He is now a technology journalist and independent Data Protection and Compliance consultant. **READ FULL BIO »**