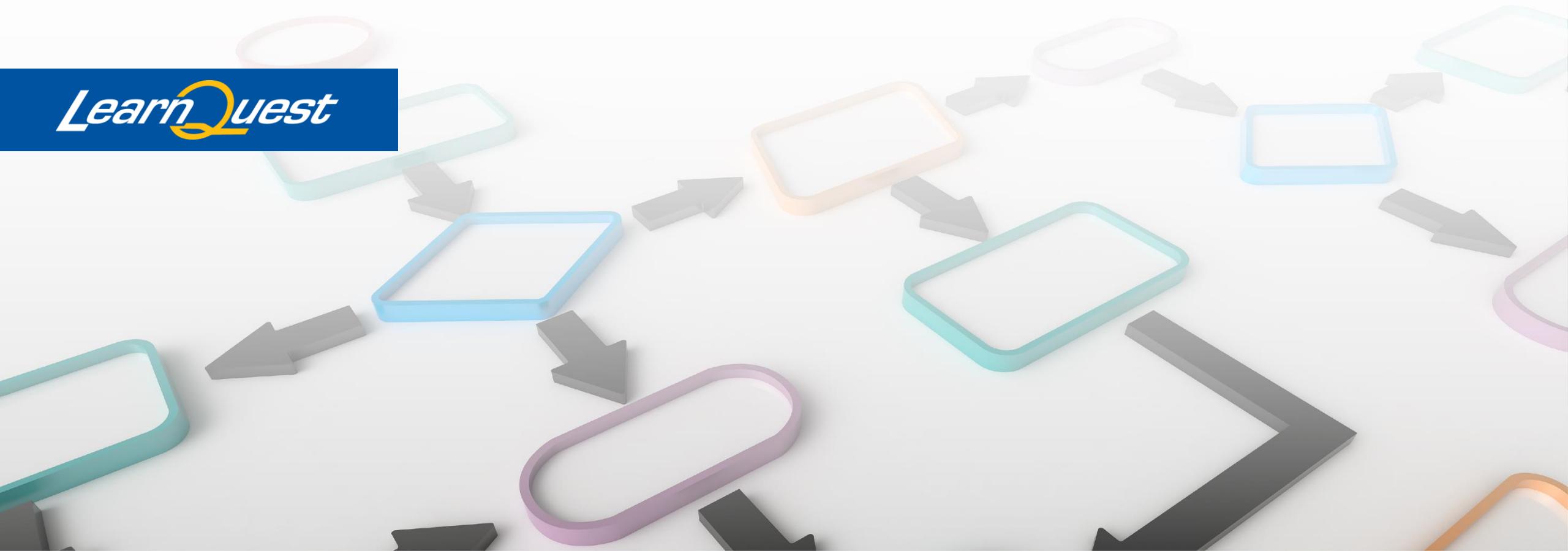


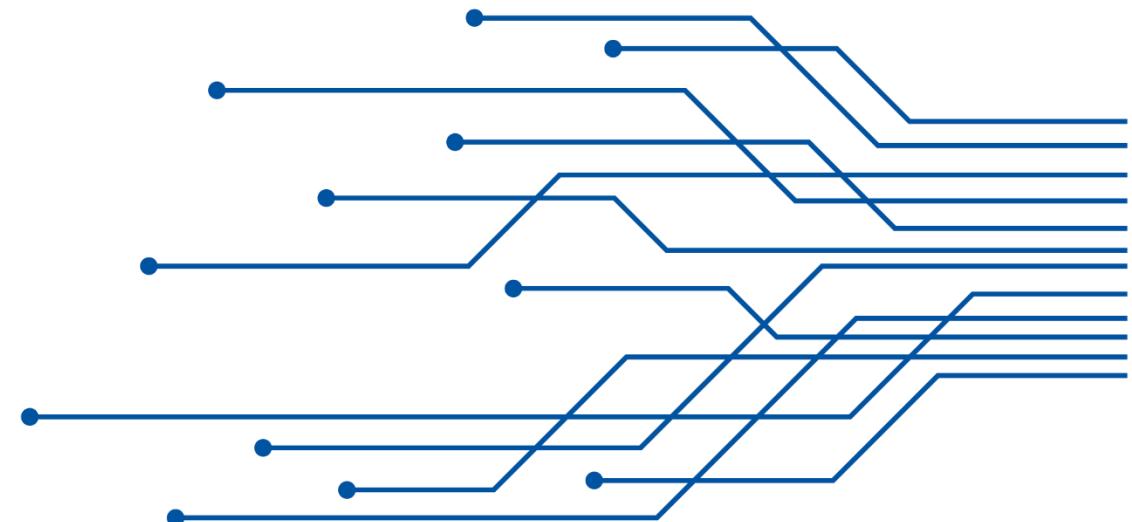
Managing Linux Systems

- 2nd Course in Linux Foundations Specialization



Configure Network Connections

In this module, we look at how we can connect Linux computers together.



Learning Objectives

Configure Network Connections

Upon completion of this module, learners will be able to:

- Describe Network Configuration Files
- Configure Networks with the Linux command line
- Perform Basic Network Troubleshooting
- Perform Advanced Network Troubleshooting

Lesson 1

Network Configuration Files

In this lesson we look at several Network Configuration Files used in Linux

Network Configuration Files

Every Linux distribution uses network configuration files to define the network settings required to communicate on the network.

Distribution Network Configuration

Debian based

Red Hat based

openSUSE

Location

/etc/network/interfaces file

/etc/sysconfig/network-scripts
directory

/etc/sysconfig/network file

Sample Debian network static configuration settings

```
auto eth0
```

```
iface eth0 inet static
```

```
    address 192.168.1.55
```

```
    netmask 255.255.255.0
```

```
    gateway 192.168.1.1
```

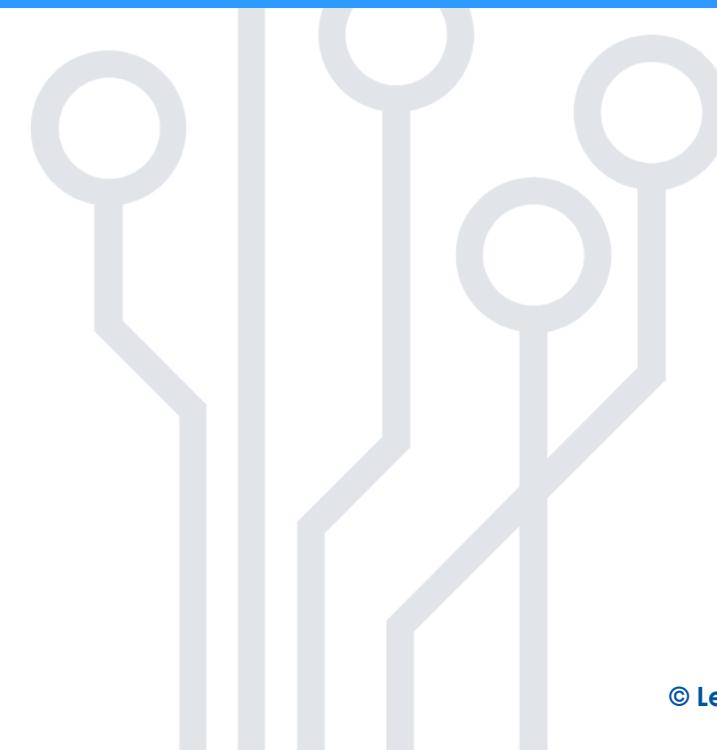
```
iface eth0 inet6 static
```

```
    address 3034:abf0::2bd1::0c10:00c1
```

```
    netmask 64
```

```
    gateway 3034:abf0::2bd1::0c10:0001
```

Assigns both IP and IPv6 addresses to the wired network interface eth0.



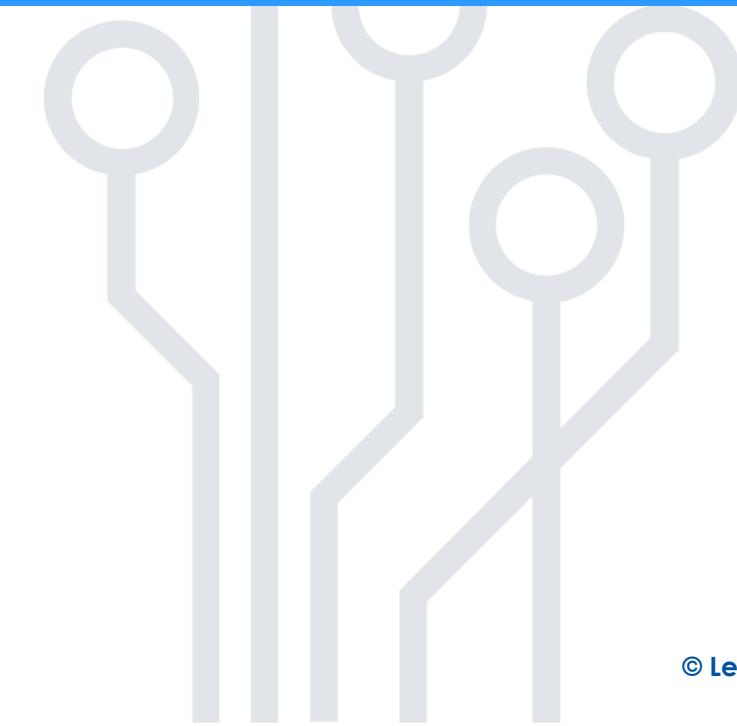
Sample Debian network dynamic configuration settings

```
auto eth0
```

```
iface eth0 inet dhcp
```

```
iface eth0 inet6 dhcp
```

Uses DHCP for both IP
and IPv6 addresses to
the wired network
interface eth0.



RedHat uses two separate files for network configuration settings

```
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=dhcp
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
IPV6_ADDR_GEN_MODE=stable-privacy
NAME=enp0s8
UUID=9b692d39-8354-4212-acf3-79e9c3748e8c
DEVICE=enp0s8
ONBOOT=yes
IPV6_PRIVACY=no
```

First file defines the network and netmask addresses in a file named after the network interface name (such as ifcfg-enp0s8)



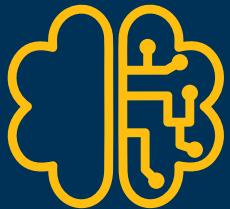
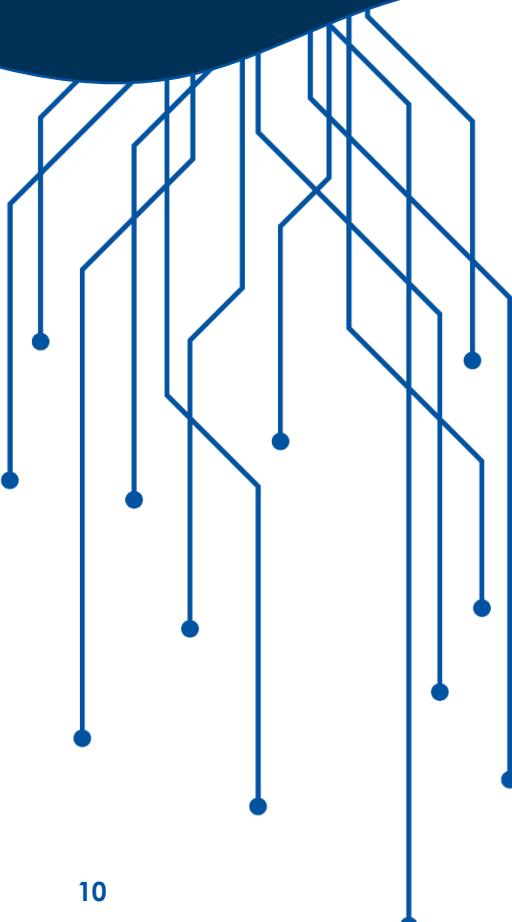
Second RedHat File - /etc/sysconfig/network

```
NETWORKING=yes  
HOSTNAME=centOSServer  
GATEWAY=192.168.1.1  
IPV6FORWARDING=yes  
IPV6_AUTOCONF=no  
IPV6_AUTOTUNNEL=no  
IPV6_DEFAULTGW=3034:abf0::2bd1::0c10:0001  
IPV6_DEFAULTDEV=eth0
```

Second file defines the gateway and host details shared among network interfaces



Lesson 1 Review



Debian and openSUSE use a single file per network interface



RedHat has a special directory for interface files



DHCP assigns an address to an interface

Lesson 2

Command Line Network Configuration

In this lesson we look at how we can configure networks with the Linux command line tools.

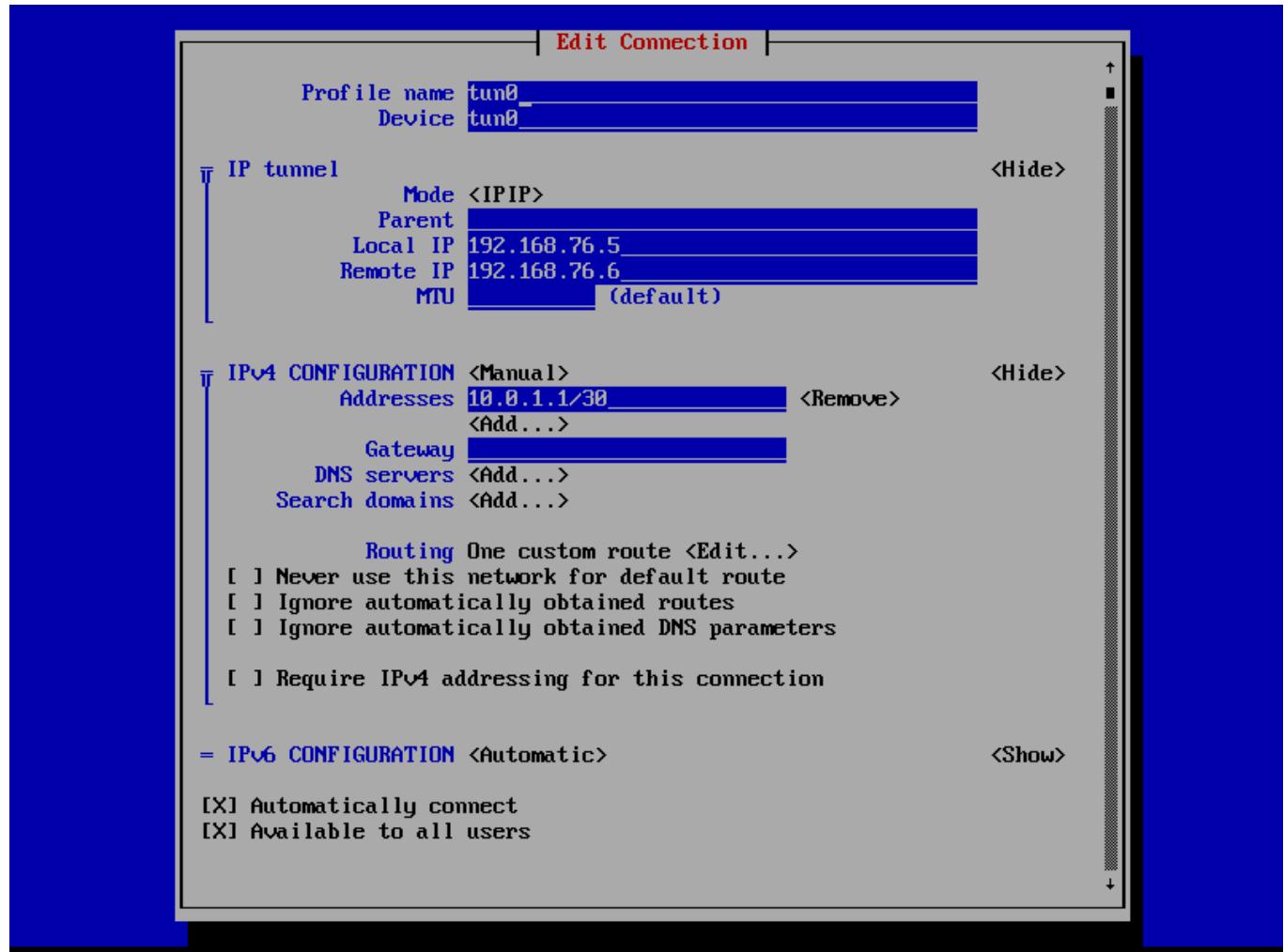
Network Manager

- Used by many Linux distributions to provide a graphical interface for defining network connections
- Starts automatically at boot time and appears in the system tray area of the desktop as an icon.
- The Network Manager tool also provides two different types of command-line tools:
 - nmtui provides a simple text-based menu tool.
 - nmcli provides a text-only command-line tool.



Network Manager (NM) Text User Interface (TUI)

- stripped-down version of the graphical
- select a network interface and assign network properties to it



Network Manager (NM) Command Line Interface (CLI)

- stripped-down version of the graphical
- select a network interface and assign network properties to it

```
emp0s8: connected to emp0s8
    "Intel 82540EM"
    ethernet (e1000), 08:00:27:84:5B:AC, hw, mtu 1500
    inet4 192.168.76.5/24
    route4 192.168.76.0/24
    inet6 fe80::93e3:f05a:a50f:4bf3/64
    route6 fe80::/64
    route6 ff00::/8

tun0: connected to tun0
    "tun0"
    iptunnel (ipip), C0:A8:4C:05, sw, mtu 1480
    inet4 10.0.1.1/30
    route4 10.0.1.0/30
    route4 192.168.56.0/24
    inet6 fe80::3676:de71:c9ed:f802/64
    route6 fe80::/64
    route6 ff00::/8

emp0s3: disconnected
    "Intel 82540EM"
    1 connection available
    ethernet (e1000), 08:00:27:34:75:68, hw, mtu 1500

tun10: unmanaged
    "tun10"
    iptunnel (ipip), 00:00:00:00:00:00, sw

lo: unmanaged
    "lo"
    loopback (unknown), 00:00:00:00:00:00, sw, mtu 65536

Use "nmcli device show" to get complete information about known devices and
"nmcli connection show" to get an overview on active connection profiles.

Consult nmcli(1) and nmcli-examples(?) manual pages for complete usage details.
[root@localhost ~]# _
```

NMCLI Connection Commands

nmcli con show – Show current connections

nmcli con add – Add a new connection

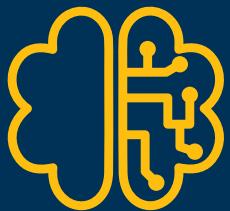
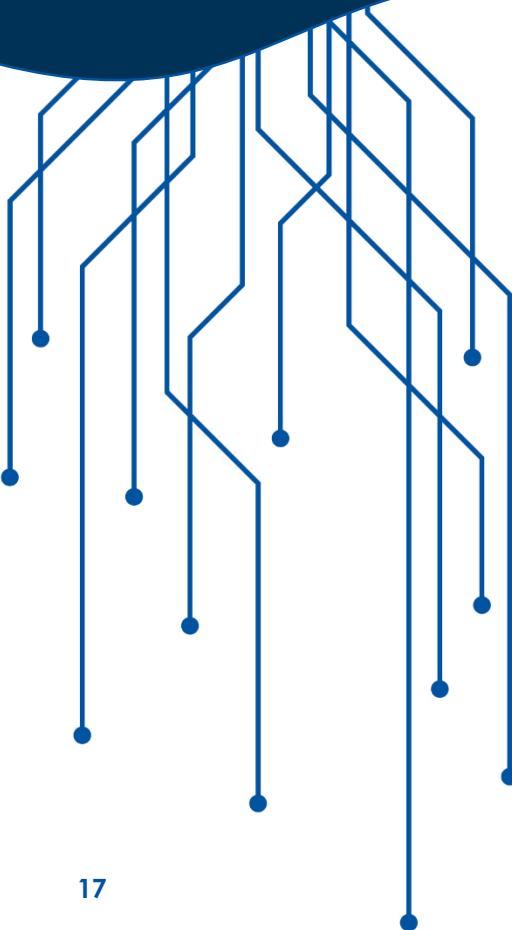
nmcli con mod – Modify a current connection

nmcli con del – Delete a current connection

NMCLI Connection Modification Options

Modification Option	Setting	Effect
ipv4.method manual	BOOTPROTO=none	IPv4 address configured statically
ipv4.method auto	BOOTPROTO=dhcp	Will look for configuration settings from a DHCPv4 server
ipv4.address "192.168.0.1/24"	IPADDR=192.168.0.1 PREFIX=24	Set static IPv4 address, network prefix
ipv4.gateway 192.168.0.1	GATEWAY=192.168.0.1	Set IPv4 Gateway
ipv4.dns 8.8.4.4	DNS1=8.8.4.5	Modify /etc/resolv.conf to use this nameserver
ipv4.dns-search example.com	DOMAIN=example.com	Modify /etc/resolv.conf to use this domain in the search directive
ipv4.ignore-auto-dns true	PEERDNS=no	Ignore DNS Server information from the DHCP Server
connection.autoconnect yes	ONBOOT=yes	Automatically activate this connection on boot
connection.id eth0	NAME=eth0	The name of this connection
connection.interface-name eth0	DEVICE=eth0	The connection is bound to the network interface with this name
802-3-ethernt.mac-address 08:00:27:4b:7a:80	HWADDR=08:00:27:4b:7a:80	The connection is bound to the network interface with this MAC Address
ipv4.never-default no	DEFROUTE=yes	Never use provided interface's gateway as default gateway

Lesson 2 Review



Network Manager is the standard service to manage network configuration



NMTUI is a text-based user interface to Network Manager



NMCLI is a command line interface to Network Manager

Lesson 3

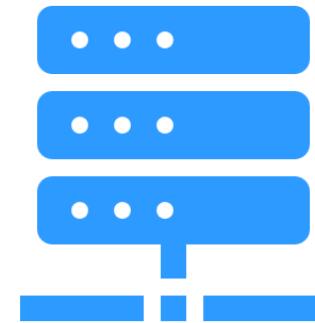
Basic Network Troubleshooting

In this lesson we look at some tools to perform basic network troubleshooting

Basic Network Troubleshooting Tools



Ping – See if you can reach
another IP address



Host, Dig, NsLookup - DNS
(Domain Name System) lookup

Ping Command



Ping works by sending one or more ICMP (Internet Control Message Protocol) Echo Request packages to a specified destination IP on the network and waits for a reply. When the destination receives the package, it responds with an ICMP echo reply



Example Usage:

```
ping 192.168.1.102
```



Options:

- c: specify the number of request packages.
- l: specify the network interface to use.
- 4: use IPv4
- 6: use IPv6

Host Command

Query DNS (Domain Name System) Information

Example Usage:

- host google.com
- host 52.25.109.230
- host -t ns google.com

Options:

- -v: verbose output
- -t: type of query

Dig Command

Query DNS (Domain Name System) Information

Example Usage:

- dig google.com
- dig @8.8.8.8 google.com

Options:

- @: specify DNS server
- -v: show version of the software

Nslookup Command

Query DNS (Domain Name System) Information

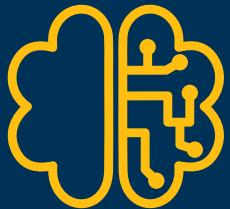
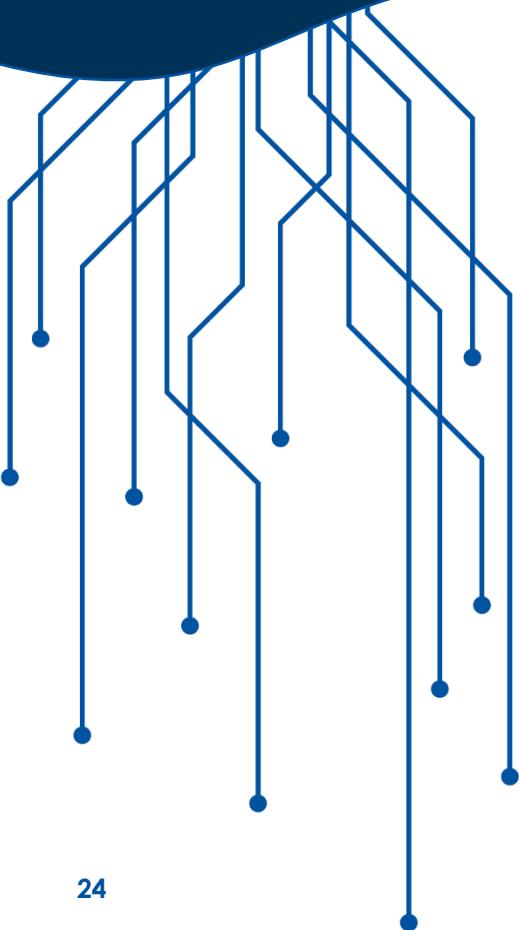
Example Usage:

- nslookup google.com
- nslookup 52.25.109.230
- nslookup -type=ns google.com

Options:

- -type: specify the type of record to query

Lesson 3 Review



Ping allows you to see if you can send packets to another IP address



NS records in DNS are the name server location for the domain



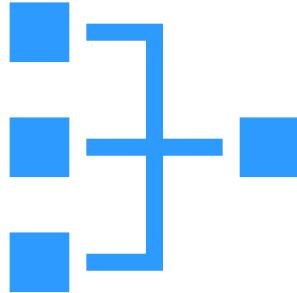
Host, Dig and NsLookup all allow you to query DNS information

Lesson 4

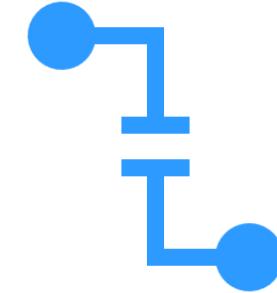
Advanced Network Troubleshooting

In this lesson we look at some tools to perform advanced network troubleshooting

Advanced Network Troubleshooting Tools



Netstat - displays network connections for Transmission Control Protocol, routing tables, and several network interface and network protocol statistics.



SS - tool that is used for displaying network socket related information (Simpler than netstats)

Netstat Command Options

Name	Description
-a	Displays all active connections and the TCP and UDP ports on which the computer is listening.
-g	Displays multicast group membership information for both IPv4 and IPv6 (may only be available on newer operating systems)
-i	Displays network interfaces and their statistics
-n	Displays active TCP connections, however, addresses and port numbers are expressed numerically and no attempt is made to determine names.
-p	Show which processes are using which sockets (similar to -b under Windows) (you must be root to do this)
-r	Displays the contents of the IP routing table. (This is equivalent to the route print command under Windows.)
-s	Displays statistics by protocol. By default, statistics are shown for the TCP, UDP, ICMP, and IP protocols. If the IPv6 protocol for Windows XP is installed, statistics are shown for the TCP over IPv6, UDP over IPv6, ICMPv6, and IPv6 protocols. The -p parameter can be used to specify a set of protocols.
-t	Display only TCP connections.
-u	Display only UDP connections.
-h	Displays help at the command prompt.

SS Command

01

Displays network socket related information

02

Example Usage:

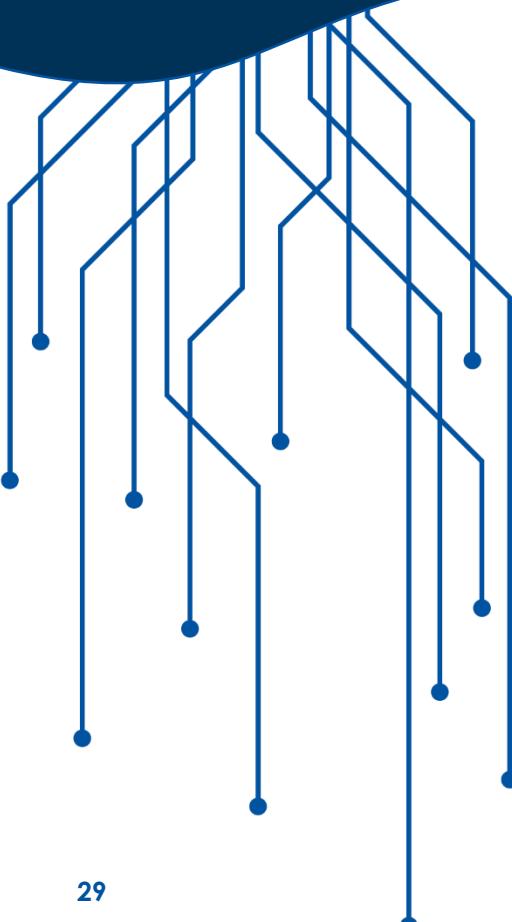
- ss
- ss -l
- ss -l -t

03

Options:

- -l: show listening sockets.
- -t: show tcp type sockets.
- -u: show udp type sockets

Lesson 4 Review



Netstat has many options for advanced network troubleshooting



The SS command is simpler than Netstats



The SS command is mainly for socket information