

Phase 3: Linux Networking Lab

This phase focuses on essential networking concepts and commands used to inspect and troubleshoot network configurations on a Linux system. The commands were executed on a remote Fedora host accessed via hardened SSH from a MacBook terminal.

Objectives

- Display and interpret IP address configuration
- Inspect routing table entries
- Check device status with `nmcli`
- Explore network interfaces using `ip link`

Tools Used

- `ip a` – shows IP address assignment
- `ip route` – displays routing table
- `nmcli device status` – checks network manager status
- `ip link show` – inspects interface state and stats
- Fedora Linux (target node)
- macOS Terminal (control node)

Screenshots

1. IP Address Output

```
-----[devops@localhost:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    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 noprefixroute
        valid_lft forever preferred_lft forever
2: enp1s0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000
    link/ether 30:24:a9:7f:c0:1b brd ff:ff:ff:ff:ff:ff
    altname enx3024a97fc01b
3: wlp0s20f3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether 46:fa:86:32:6a:8e brd ff:ff:ff:ff:ff:ff permaddr 44:af:28:07:06:34
    altname wlx44af28070634
    inet 192.168.1.141/24 brd 192.168.1.255 scope global dynamic noprefixroute wlp0s20f3
        valid_lft 81789sec preferred_lft 81789sec
    inet6 fe80::40f7:9f02:f863:685e/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
4: tailscale0: <POINTOPOINT,MULTICAST,NOARP,UP,LOWER_UP> mtu 1280 qdisc fq_codel state UNKNOWN group default qlen 500
    link/none
    inet 100.73.223.55/32 scope global tailscale0
        valid_lft forever preferred_lft forever
    inet6 fd7a:115c:a1e0::2701:df40/128 scope global
        valid_lft forever preferred_lft forever
    inet6 fe80::10db:85df:99c2:a173/64 scope link stable-privacy proto kernel_ll
        valid_lft forever preferred_lft forever
devops@localhost:~$ ]
```

2. Routing Table

```
-----[devops@localhost:~$ ip r
default via 192.168.1.1 dev wlp0s20f3 proto dhcp src 192.168.1.141 metric 600
192.168.1.0/24 dev wlp0s20f3 proto kernel scope link src 192.168.1.141 metric 600
devops@localhost:~$ ]
```

3. NMCLI Device Status

```
[devops@localhost:~$ nmcli device
DEVICE           TYPE      STATE            CONNECTION
wlp0s20f3        wifi     connected        SHELL_5C4F_5G
tailscale0       tun      connected (externally) tailscale0
lo               loopback connected (externally) lo
p2p-dev-wlp0s20f3 wifi-p2p  disconnected   --
enp1s0          ethernet unavailable      --
devops@localhost:~$ ]
```

4. IP Link Summary

```
[devops@localhost:~$ ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN mode DEFAULT group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: enp1s0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN mode DEFAULT group default qlen 1000
    link/ether 30:24:a9:7f:c0:1b brd ff:ff:ff:ff:ff:ff
    altname enx3024a97fc01b
3: wlp0s20f3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP mode DORMANT group default qlen 1000
    link/ether 46:fa:86:32:6a:8e brd ff:ff:ff:ff:ff:ff permaddr 44:af:28:07:06:34
    altname wlx44af28070634
4: tailscale0: <POINTOPOINT,MULTICAST,NOARP,UP,LOWER_UP> mtu 1280 qdisc fq_codel state UNKNOWN mode DEFAULT group default qlen 500
    link/none
devops@localhost:~$ ]
```

All outputs were captured during real command-line sessions as part of the [linux-networking-lab](#). This project is part of a Linux+ certification training path and documents validated system behavior on a Fedora server.

Phase 3A – Interfaces & Static IP Setup

Manually assign a static IP to the Fedora laptop and map it to a custom hostname using [/etc/hosts](#). This setup improves SSH stability, scripting, and internal network recognition — all critical for sysadmin and DevOps tasks.

Steps Performed

```
# 1. Set static IP, gateway, and DNS via nmcli
sudo nmcli con mod SHELL_5C4F_5G ipv4.addresses 192.168.1.50/24
sudo nmcli con mod SHELL_5C4F_5G ipv4.gateway 192.168.1.1
sudo nmcli con mod SHELL_5C4F_5G ipv4.dns "1.1.1.1 8.8.8.8"
sudo nmcli con mod SHELL_5C4F_5G ipv4.method manual
sudo nmcli con down SHELL_5C4F_5G && sudo nmcli con up SHELL_5C4F_5G

# 2. Confirm IP works with ping
ping -c 3 8.8.8.8

# 3. Set custom hostname
sudo hostname fedora-lab
# (hostnamectl set-hostname failed due to PolicyKit auth timeout)

# 4. Update /etc/hosts
sudo nano /etc/hosts
# → Add line: 192.168.1.50      fedora-lab
```

```
# 5. Validate hostname resolution
ping -c 3 fedora-lab
```

💡 Output Validation

| ✓ Checkpoint | Result |
|------------------------------------------|---------------------------------------------------|
| Static IP applied via <code>nmcli</code> | 192.168.1.50/24 assigned to Wi-Fi |
| Internet test with ping | Successful: packets returned from 8.8.8.8 |
| <code>hostname</code> command output | Transient hostname set to <code>fedora-lab</code> |
| <code>/etc/hosts</code> manually updated | Maps 192.168.1.50 to <code>fedora-lab</code> |
| <code>ping fedora-lab</code> | <1 ms latency — local resolution working |

📸 Screenshots

| Step | Description | Screenshot |
|------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <code>nmcli</code> static IP config + ping test | <pre>[devops@localhost:~\$ ping -c 3 8.8.8.8 PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data. 64 bytes from 8.8.8.8: icmp_seq=1 ttl=117 time=10.0 ms 64 bytes from 8.8.8.8: icmp_seq=2 ttl=117 time=12.1 ms 64 bytes from 8.8.8.8: icmp_seq=3 ttl=117 time=12.2 ms --- 8.8.8.8 ping statistics --- 3 packets transmitted, 3 received, 0% packet loss, time 2003ms rtt min/avg/max/mdev = 10.047/11.476/12.244/1.011 ms devops@localhost:~\$]</pre> |
| 2 | Hostname set via <code>hostnamectl</code> attempt | <pre>[devops@localhost:~\$ sudo hostnamectl Static hostname: localhost Transient hostname: fedora-lab Icon name: computer-laptop Chassis: laptop 🖥 Machine ID: 92536b377e194d62abc4b685ccba9f65 Boot ID: 9e63fd67c9de4c3ab68160d8c785b7df Product UUID: 88a41f92-fded-8d5d-5e72-798a2541cc79 Operating System: Fedora Linux 42 (Workstation Edition) CPE OS Name: cpe:/o:fedoraproject:fedora:42 OS Support End: Wed 2026-05-13 OS Support Remaining: 11month 5d Kernel: Linux 6.14.8-300.fc42.x86_64 Architecture: x86-64 Hardware Vendor: HP Hardware Model: HP ProBook 430 G7 Hardware Serial: 5CD0481FCM Firmware Version: S71 Ver. 01.22.01 Firmware Date: Fri 2024-08-23 Firmware Age: 9month 1w 6d devops@localhost:~\$]</pre> |

| Step | Description | Screenshot |
|------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | ping fedora-lab successful | [devops@localhost:~\$ ping -c 3 fedora-lab PING fedora-lab (192.168.1.50) 56(84) bytes of data. 64 bytes from fedora-lab (192.168.1.50): icmp_seq=1 ttl=64 time=0.093 ms 64 bytes from fedora-lab (192.168.1.50): icmp_seq=2 ttl=64 time=0.072 ms 64 bytes from fedora-lab (192.168.1.50): icmp_seq=3 ttl=64 time=0.054 ms --- fedora-lab ping statistics --- 3 packets transmitted, 3 received, 0% packet loss, time 2068ms rtt min/avg/max/mdev = 0.054/0.073/0.093/0.015 ms devops@localhost:~\$] |

📡 Phase 3B – DNS Configuration & Testing

In this section, we configure DNS resolvers manually and validate DNS resolution using diagnostic tools.

🔧 DNS Configuration

| Step | Command | Purpose |
|------|------------------------------------------------------------------------------------------------|--------------------------------------------|
| 1 | <code>sudo nano /etc/resolv.conf</code> | Edit DNS configuration file manually |
| 2 | Add the following lines: <code>nameserver 1.1.1.1</code> <code>nameserver 8.8.8.8</code> | Set Cloudflare and Google as DNS resolvers |
| 3 | Save and exit (<code>CTRL + O</code> , <code>Enter</code> , <code>CTRL + X</code>) | Apply the DNS changes |
| 4 | <code>cat /etc/resolv.conf</code> | Confirm resolvers are correctly set |

📸 Screenshot:

```
GNU nano 8.3
# This is /run/systemd/resolve/stub-resolv.conf managed by man:systemd-resolved(8).
# Do not edit.
#
# This file might be symlinked as /etc/resolv.conf. If you're looking at
# /etc/resolv.conf and seeing this text, you have followed the symlink.
#
# This is a dynamic resolv.conf file for connecting local clients to the
# internal DNS stub resolver of systemd-resolved. This file lists all
# configured search domains.
#
# Run "resolvectl status" to see details about the uplink DNS servers
# currently in use.
#
# Third party programs should typically not access this file directly, but only
# through the symlink at /etc/resolv.conf. To manage man:resolv.conf(5) in a
# different way, replace this symlink by a static file or a different symlink.
#
# See man:systemd-resolved.service(8) for details about the supported modes of
# operation for /etc/resolv.conf.

nameserver 1.1.1.1
nameserver 8.8.8.8]
```

DNS Lookup Test (dig)

| Step | Command | Description |
|-----------------------------------------------------------------------------------|-----------------------------|------------------------------------------|
|  | <code>dig github.com</code> | Query DNS to resolve GitHub's IP address |

Expected Output:

- You should see an **ANSWER SECTION** with GitHub's IP addresses.
- `Query time`, `SERVER`, and `WHEN` values validate DNS resolution is working.

Screenshot:

```
[devops@fedora-lab:~$ dig github.com

; <>> DiG 9.18.36 <>> github.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 14221
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;github.com.           IN      A

;; ANSWER SECTION:
github.com.        32      IN      A      20.26.156.215

;; Query time: 11 msec
;; SERVER: 1.1.1.1#53(1.1.1.1) (UDP)
;; WHEN: Fri Jun 06 20:23:39 BST 2025
;; MSG SIZE  rcvd: 55

devops@fedora-lab:~$ ]
```

DNS Test (ping)

| Step | Command | Description |
|-------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------------|
|  | <code>ping -c 3 github.com</code> | Validate name resolution + connectivity |

Expected Output:

- 3 replies from GitHub's IP (usually a `20.x.x.x` address).
- **0% packet loss**, and time in milliseconds.

Screenshot:

```
[devops@fedora-lab:~$ ping -c 3 github.com
PING github.com (20.26.156.215) 56(84) bytes of data.
64 bytes from 20.26.156.215: icmp_seq=1 ttl=114 time=11.3 ms
64 bytes from 20.26.156.215: icmp_seq=2 ttl=114 time=11.1 ms
64 bytes from 20.26.156.215: icmp_seq=3 ttl=114 time=13.0 ms

--- github.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 11.069/11.768/12.971/0.854 ms
devops@fedora-lab:~$ ]
```

Phase 3C – Network Diagnostics Tools

In this phase, we tested and validated network configurations, DNS functionality, service routes, and port availability using key diagnostic tools.

Tools Used

| Command | Purpose |
|-------------------------------------------|-----------------------------------------|
| <code>ping</code> | Test basic IP connectivity |
| <code>dig</code> | Perform DNS lookup |
| <code>ss -tuln</code> | Show listening ports (TCP/UDP) |
| <code>netstat -tuln</code> | Legacy alternative to <code>ss</code> |
| <code>nmcli dev show</code> | Display detailed device connection info |
| <code>journalctl -u NetworkManager</code> | View network-related logs |
| <code>ip route</code> | View current routing table |
| <code>traceroute</code> | Show packet path to destination |

Screenshots

| Step | Description | Screenshot |
|------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <code>ping google.com</code> successful | <pre>[devops@fedora-lab:~\$ ping -c 3 google.com PING google.com (142.250.187.238) 56(84) bytes of data. 64 bytes from lhr25s34-in-f14.1e100.net (142.250.187.238): icmp_seq=1 ttl=117 time=8.25 ms 64 bytes from lhr25s34-in-f14.1e100.net (142.250.187.238): icmp_seq=2 ttl=117 time=9.87 ms 64 bytes from lhr25s34-in-f14.1e100.net (142.250.187.238): icmp_seq=3 ttl=117 time=57.4 ms --- google.com ping statistics --- 3 packets transmitted, 3 received, 0% packet loss, time 2003ms rtt min/avg/max/mdev = 8.253/25.164/57.369/22.781 ms devops@fedora-lab:~\$]</pre> |

Step Description

Screenshot

2

dig google.com
DNS resolution

```
[devops@fedora-lab:~$ dig google.com

; <>> DiG 9.18.36 <>> google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 15978
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;google.com.           IN      A

;; ANSWER SECTION:
google.com.        40      IN      A      142.250.179.238

;; Query time: 12 msec
;; SERVER: 1.1.1.1#53(1.1.1.1) (UDP)
;; WHEN: Fri Jun 06 20:45:25 BST 2025
;; MSG SIZE rcvd: 55

devops@fedora-lab:~$ ]
```

3

ss -tuln
showing listening ports

```
[devops@fedora-lab:~$ ss -tuln
NetId   State      Recv-Q      Send-Q      Local Address:Port          Peer Address:Port
ude     UNKNOWN    0            0          127.0.0.1:323
ude     UNKNOWN    0            0          0.0.0.0:41641
ude     UNKNOWN    0            0          0.0.0.0:5353
ude     UNKNOWN    0            0          127.0.0.1:53
ude     UNKNOWN    0            0          127.0.0.0:53
ude     UNKNOWN    0            0          [::]:323
ude     UNKNOWN    0            0          [::]:43641
ude     UNKNOWN    0            0          [::]:5353
ude     UNKNOWN    0            0          [::]:537762
tcp    LISTEN     0            4896       0.0.0.0:5353
tcp    LISTEN     0            4896       100.96.1.100:5353
tcp    LISTEN     0            4896       127.0.0.1:53
tcp    LISTEN     0            4896       127.0.0.0:54:53
tcp    LISTEN     0            4896       0.0.0.0:2222
tcp    LISTEN     0            4896       0.0.0.0:1:631
tcp6   0 ::5355    ::*        ::*
tcp6   0 fd7a:115c:a1e0::2:43877 ::*        ::*
tcp6   0 ::1:631    ::*        ::*
tcp6   0 ::2222    ::*        ::*
udp    0 127.0.0.1:323  0.0.0.0:*
udp    0 1280 0.0.0.0:41641 0.0.0.0:*
udp    0 0.0.0.0:5353  0.0.0.0:*
udp    0 0.0.0.0:54:53  0.0.0.0:*
udp    0 0.0.0.0:53:53  0.0.0.0:*
udp6   0 ::1:323    ::*        ::*
udp6   0 fe80::40f7:9f02:f86:546 ::*        ::*
udp6   0 ::41641    ::*        ::*
udp6   0 ::5355    ::*        ::*
```

4

netstat -tuln
legacy output

```
[devops@fedora-lab:~$ netstat -tuln
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address          Foreign Address        State
tcp     0      0 0.0.0.0:5355            0.0.0.0:*
tcp     0      0 100.73.223.55:37762      0.0.0.0:*
tcp     0      0 0.0.0.0.53:53          0.0.0.0:*
tcp     0      0 0.0.0.0.54:53          0.0.0.0:*
tcp     0      0 0.0.0.0:2222          0.0.0.0:*
tcp     0      0 0.0.0.0:1:631          0.0.0.0:*
tcp6   0      0 ::5355    ::*        ::*
tcp6   0      0 fd7a:115c:a1e0::2:43877 ::*        ::*
tcp6   0      0 ::1:631    ::*        ::*
tcp6   0      0 ::2222    ::*        ::*
udp    0      0 127.0.0.1:323          0.0.0.0:*
udp    0      1280 0.0.0.0:41641        0.0.0.0:*
udp    0      0 0.0.0.0:5353          0.0.0.0:*
udp    0      0 0.0.0.0:54:53          0.0.0.0:*
udp    0      0 0.0.0.0:53:53          0.0.0.0:*
udp6   0      0 ::1:323    ::*        ::*
udp6   0      0 fe80::40f7:9f02:f86:546 ::*        ::*
udp6   0      0 ::41641    ::*        ::*
udp6   0      0 ::5355    ::*        ::*
```

Step Description

Screenshot

| | |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 nmcli dev show detailed info | <pre>[devops@fedora-lab:~\$ nmcli dev show GENERAL.DEVICE: GENERAL.TYPE: wifi GENERAL.HWADDR: C6:A7:50:DB:CE:4A GENERAL.MTU: 1500 GENERAL.STATE: 100 (connected) GENERAL.CONNECTION: SHELL_5C4F_5G GENERAL.CON-PATH: /org/freedesktop/NetworkManager/ActiveConnection/6 IP4.ADDRESS[1]: IP4.GATEWAY: 192.168.1.1 IP4.ROUTE[1]: dst = 192.168.1.0/24, nh = 0.0.0.0, mt = 600 IP4.ROUTE[2]: dst = 0.0.0.0/0, nh = 192.168.1.1, mt = 600 IP4.DNS[1]: 1.1.1.1 IP4.DNS[2]: 8.8.8.8 IP6.ADDRESS[1]: fe80::40ff:9f02:f8e3:685e/64 IP6.GATEWAY: -- IP6.ROUTE[1]: dst = fe80::/64, nh = ::, mt = 1024 IP6.DNS[1]: fe80::bad5:26ff:fe18:7b65 GENERAL.DEVICE: GENERAL.TYPE: tun GENERAL.HWADDR: (unknown) GENERAL.MTU: 1280 GENERAL.STATE: 100 (connected (externally)) GENERAL.CONNECTION: tailscale0 GENERAL.CON-PATH: /org/freedesktop/NetworkManager/ActiveConnection/3 IP4.ADDRESS[1]: IP4.GATEWAY: 100.73.223.55/32 IP4.ROUTE[1]: dst = 100.110.43.32/32, nh = 0.0.0.0, mt = 0, table=52 IP4.ROUTE[2]: dst = 100.113.180.3/32, nh = 0.0.0.0, mt = 0, table=52 IP4.ROUTE[3]: dst = 100.100.100.100/32, nh = 0.0.0.0, mt = 0, table=52 IP6.ADDRESS[1]: fd7a:115c:a1e0::2701:df40/128 IP6.ADDRESS[2]: fe80::10db:85df:99c2:a173/64 IP6.GATEWAY: -- IP6.ROUTE[1]: dst = fe80::/64, nh = ::, mt = 256 IP6.ROUTE[2]: dst = fd7a:115c:a1e0::48, nh = ::, mt = 1024, table=52 IP6.ROUTE[3]: dst = fd7a:115c:a1e0::53/128, nh = ::, mt = 1024, table=52 IP6.ROUTE[4]: dst = fd7a:115c:a1e0::2701:df40/128, nh = ::, mt = 256 GENERAL.DEVICE: GENERAL.TYPE: loopback GENERAL.HWADDR: 00:00:00:00:00:00 GENERAL.MTU: 65536 GENERAL.STATE: 100 (connected (externally)) GENERAL.CONNECTION: lo GENERAL.CON-PATH: /org/freedesktop/NetworkManager/ActiveConnection/1 IP4.ADDRESS[1]: IP4.GATEWAY: 127.0.0.1/8 IP6.GATEWAY: -- IP6.ROUTE[1]: ::1/128 IP6.ROUTE[2]: -- GENERAL.DEVICE: GENERAL.TYPE: p2p-dev-wlp0s20f3 GENERAL.HWADDR: (unknown) GENERAL.MTU: 0 GENERAL.STATE: 30 (disconnected) GENERAL.CONNECTION: -- GENERAL.CON-PATH: GENERAL.DEVICE: GENERAL.TYPE: enp1s0 GENERAL.HWADDR: 30:24:A9:7F:C0:1B GENERAL.MTU: 1500 GENERAL.STATE: 20 (unavailable) GENERAL.CONNECTION: -- GENERAL.CON-PATH: WIRED-PROPERTIES.CARRIER: off IP4.GATEWAY: -- IP6.GATEWAY: -- devops@fedora-lab:~\$]</pre> |
| 6 journalctl -u NetworkManager log check | <pre>[devops@fedora-lab:~\$ journalctl -u NetworkManager --since "10 minutes ago" -- No entries --</pre> <p>The output shows the journalctl command running, indicating no entries found.</p> |
| 7 ip route routing summary | <pre>[devops@fedora-lab:~\$ ip route default via 192.168.1.1 dev wlp0s20f3 proto static metric 600 192.168.1.0/24 dev wlp0s20f3 proto kernel scope link src 192.168.1.50 metric 600 devops@fedora-lab:~\$]</pre> |

| Step | Description | Screenshot |
|------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 | traceroute google.com multi-hop test | <pre>traceroute to google.com (142.250.180.14), 30 hops max, 60 byte packets 1 _gateway (192.168.1.1) 8.591 ms 8.539 ms 8.526 ms 2 * 81.1.113.43 (81.1.113.43) 9.742 ms 12.775 ms 3 ae51-ner002.mlk.as13285.net (78.144.1.27) 12.757 ms 14.322 ms 14.311 ms 4 ae67-scr002.slh.as13285.net (78.144.1.54) 15.487 ms ae51-scr102.loh.as13285.net (78.144.1.26) 16.830 ms 16.818 ms 5 * host-78-144-5-11.as13285.net (78.144.5.11) 17.584 ms 17.573 ms 6 * * 7 172.253.66.98 (172.253.66.98) 12.019 ms 216.239.41.240 (216.239.41.240) 12.999 ms lhr25s32-in-f14.1e100.net (142.250.180.14) 9.146 ms devops@fedora-lab:~\$</pre> |

🔒 Phase 3D – SSH & Remote Connectivity

This section validates that SSH is securely configured and running on the Fedora lab machine, using diagnostics and a successful remote login from the MacBook.

🛡 SSH Port Listening

Checked whether the SSH daemon is listening on the correct custom port (2222):

```
sudo ss -tuln | grep 2222
```

✓ Validation: Port 2222 is actively listening for incoming SSH connections.

📸 Screenshot:

```
[devops@fedora-lab:~$ sudo ss -tulnp | grep ssh
tcp  LISTEN 0      128          0.0.0.0:2222      0.0.0.0:*      users:(("sshd",pid=1182,fd=7))
tcp  LISTEN 0      128          0.0.0.0:2222      [::]:*       users:(("sshd",pid=1182,fd=8))
```

🧠 SSH Daemon Configuration

Inspected `/etc/ssh/sshd_config` to confirm secure options:

- Port 2222
- PasswordAuthentication no
- PermitRootLogin no
- AllowUsers sysops
- Protocol 2

```
sudo nano /etc/ssh/sshd_config
```

📸 Screenshots:

-
-

桯 SSH Service Logs (journalctl)

Used `journalctl` to view logs for `sshd` and confirm service restart and activity:

```
sudo journalctl -u sshd --since "15 minutes ago"
```

- ✓ Validation: SSH service restarted and bound to the correct port.

📸 Screenshot:

```
[devops@fedora-lab:~$ sudo journalctl -u sshd --since "10 minutes ago"
Jun 08 22:21:11 fedora-lab systemd[1]: Stopping sshd.service - OpenSSH server daemon...
Jun 08 22:21:11 fedora-lab sshd[1182]: Received signal 15; terminating.
Jun 08 22:21:11 fedora-lab systemd[1]: sshd.service: Deactivated successfully.
Jun 08 22:21:11 fedora-lab systemd[1]: Stopped sshd.service - OpenSSH server daemon.
Jun 08 22:21:11 fedora-lab systemd[1]: Starting sshd.service - OpenSSH server daemon...
Jun 08 22:21:11 fedora-lab sshd[626315]: Server listening on 0.0.0.0 port 2222.
Jun 08 22:21:11 fedora-lab sshd[626315]: Server listening on :: port 2222.
Jun 08 22:21:11 fedora-lab systemd[1]: Started sshd.service - OpenSSH server daemon.
devops@fedora-lab:~$
```

💻 Remote Login Test from MacBook

Used the MacBook Terminal to connect to the Fedora machine via:

```
ssh sysops@192.168.1.50 -p 2222
```

- ✓ Login successful using SSH key-based authentication.

📸 Screenshot:

```
[carlossemeao@localhost linux-networking-lab % ssh -p 2222 devops@100.73.223.55
Last login: Sun Jun  8 22:01:40 2025 from 100.113.180.3
devops@fedora-lab:~$
```

-
- ✓ **Result:** SSH is securely configured, actively running on port 2222, and accessible only via key-based login from trusted devices.
-

✓ **Summary:**

We configured DNS resolvers by editing [/etc/resolv.conf](#), validated them with [dig](#), and confirmed hostname resolution via [ping](#). These are core diagnostics for sysadmins and network troubleshooting.