

Routing Basics - Lab Guide

This lab was developed by Sparta Global for Cybersecurity courses. It was built based on the original lab that was developed for the Labtainer framework by the Naval Postgraduate School, Center for Cybersecurity and Cyber Operations under National Science Foundation Award No. 1438893. This work is in the public domain, and cannot be copyrighted.

1 Overview

This lab covers IP configuration and basic routing functionality used in Linux OS.

These include use of:

- Add/Remove IP address using `ip address` command
- Add/Remove routes using `ip route` command
- Testing the connectivity using `ping` command

2 Lab Environment

This lab runs in the Labtainer framework, available at <http://my.nps.edu/web/c3o/labtainers>. That site includes links to a pre-built virtual machine that has Labtainers installed, however Labtainers can be run on any Linux host that supports Docker containers.

From your labtainer-student (/labtainer/labtainer-student) directory start the lab using:

```
labtainer sparta-routing-basics
```

A link to this lab guide will be displayed.

3 Network Configuration

This lab includes several IP networks as in Figure 1. When the lab starts, you will get four virtual terminals, one connected to each component (Host/Router).

IP addresses and routing are not configured

Question 1: How many IP networks in the shown topology ?

Question 2: Can you make enumerate these IP networks (Network IDs, Subnet Masks) ?

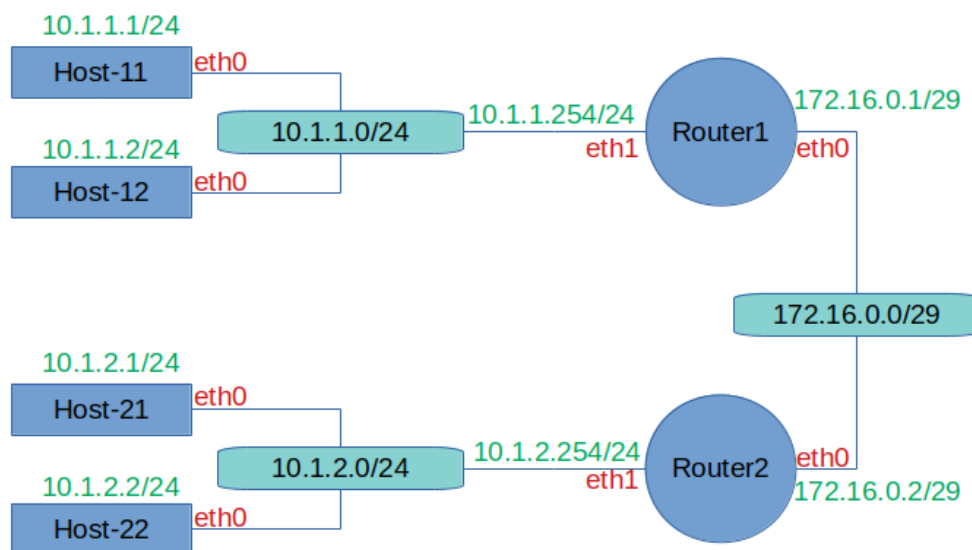


Figure 1: Network topology for routing-basics lab

4 Credentials

- **Host-11:**

- **Username:** user-11
- **Password:** user-11

- **Host-12:**

- **Username:** user-12
- **Password:** user-12

o

- **Host-21:**

- **Username:** user-21
- **Password:** user-21

- **Host-22:**

- **Username:** user-22
- **Password:** user-22

o

- **Router1:**

- **Username:** admin
- **Password:** admin

5 Lab Tasks

5.1 Configuring Network 10.1.1.0/24

5.1.1 Host-11 Configuration

Lets start by configuring the IP address and verify it **IP address:** 10.1.1.1/24

```
sudo ip address add 10.1.1.1/24 dev eth0
ip address
```

Configuring the Default Gateway: 10.1.1.254/24

```
sudo ip route add default via 10.1.1.254
ip route
```

5.1.2 Host-12 Configuration

Lets start by configuring the IP address and verify it

IP address: 10.1.1.2/24

```
sudo ip address add 10.1.1.2/24 dev eth0
ip address
```

Configuring the Default Gateway: 10.1.1.254/24

```
sudo ip route add default via 10.1.1.254
ip route
```

5.1.3 Testing the connectivity

Lets make sure that the two hosts can exchange traffic.

- On Host-11 (Ping Host-11 -> Host-12)

```
ping 10.1.1.2
```

What is the result ?

- On Host-12 (Ping Host-12 -> Host-11)

```
ping 10.1.1.1
```

What is the result ?

- On Host-11 (Ping Host-11 -> Router1)

```
ping 10.1.1.254
```

What is the result ?

- On Host-12 (Ping Host-12 -> Router1)

```
ping 10.1.1.254
```

What is the result ?

5.1.4 Router1 Configuration

Lets configure the IP address on eth1 **IP address:** 10.1.1.254/24

```
sudo ip address add 10.1.1.254/24 dev eth1
ip address
```

5.1.5 Testing the connectivity

Lets make sure that the two hosts can exchange traffic.

- On Host-12 (Ping Router1 -> Host-11)

```
ping 10.1.1.1
```

What is the result ?

- On Host-11 (Ping Router1 -> Host-12)

```
ping 10.1.1.2
```

What is the result ?

- On Host-11 (Ping Host-11 -> Router1)

```
ping 10.1.1.254
```

What is the result ?

- On Host-12 (Ping Host-12 -> Router1)

```
ping 10.1.1.254
```

What is the result ?

5.2 Configuring Network 10.1.2.0/24

5.2.1 Host-21 Configuration

Lets start by configuring the IP address and verify it

IP address: 10.1.2.1/24

```
sudo ip address add 10.1.2.1/24 dev eth0
ip address
```

Configuring the Default Gateway: 10.1.2.254/24

```
sudo ip route add default via 10.1.2.254
ip route
```

5.2.2 Host-22 Configuration

Lets start by configuring the IP address and verify it **IP address:** 10.1.2.2/24

```
sudo ip address add 10.1.2.2/24 dev eth0
ip address
```

Configuring the Default Gateway: 10.1.2.254/24

```
sudo ip route add default via 10.1.2.254
ip route
```

5.2.3 Testing the connectivity

Lets make sure that the two hosts can exchange traffic.

- On Host-21 (Ping Host-21 -> Host-22)

```
ping 10.1.2.2
```

What is the result ?

- On Host-22 (Ping Host-22 -> Host-21)

```
ping 10.1.2.1
```

What is the result ?

- On Host-21 (Ping Host-21 -> Router2)

```
ping 10.1.2.254
```

What is the result ?

- On Host-22 (Ping Host-22 -> Router2)

```
ping 10.1.2.254
```

What is the result ?

5.2.4 Router2 Configuration

Lets configure the IP address on eth1 **IP address:** 10.1.2.254/24

```
sudo ip address add 10.1.2.254/24 dev eth1
ip address
```

5.2.5 Testing the connectivity

Lets make sure that the two hosts can exchange traffic.

- On Host-22 (Ping Router2 -> Host-21)

```
ping 10.1.2.1
```

What is the result ?

- On Host-21 (Ping Router2 -> Host-22)

```
ping 10.1.2.2
```

What is the result ?

- On Host-21 (Ping Host-21 -> Router2)

```
ping 10.1.2.254
```

What is the result ?

- On Host-22 (Ping Host-22 -> Router2)

```
ping 10.1.2.254
```

What is the result ?

5.3 Configuring Network 172.16.0.0/29

5.3.1 Router1 Configuration

Lets start by configuring the IP address and verify it **IP address:** 172.16.0.1/29

```
sudo ip address add 172.16.0.1/29 dev eth0
ip address
```

5.3.2 Router2 Configuration

Lets start by configuring the IP address and verify it **IP address:** 172.16.0.2/29

```
sudo ip address add 172.16.0.1/29 dev eth0
ip address
```

5.3.3 Testing the connectivity

Lets make sure that the two routers can exchange traffic. Then lets try to check if the hosts on different networks can exchange any traffic

- On Router1 (Ping Router1 -> Router2:172.16.0.2)

```
ping 172.16.0.2
```

What is the result ?

- On Router2 (Ping Router2 -> Router1:172.16.0.1)

```
ping 172.16.0.1
```

What is the result ?

- On Host-11 (Ping Host-11 -> Host-21)

```
ping 10.1.2.1
traceroute 10.1.2.1
```

- On Host-11 (Ping Host-11 -> Host-22)

```
ping 10.1.2.2
traceroute 10.1.2.2
```

- On Host-12 (Ping Host-12 -> Host-21)

```
ping 10.1.2.1
traceroute 10.1.2.1
```

- On Host-12 (Ping Host-12 -> Host-22)

```
ping 10.1.2.2
traceroute 10.1.2.2
```

What is the result ?

5.3.4 Routing Configuration: Router1

Lets configure the routing on Router1 **Routing to 10.1.2.0/24: via 172.16.0.2**

```
sudo ip route add 10.1.2.0/24 via 172.16.0.2
ip route
```

5.3.5 Routing Configuration: Router2

Lets configure the routing on Router2

Routing to 10.1.1.0/24: via 172.16.0.1

```
sudo ip route add 10.1.1.0/24 via 172.16.0.1
ip route
```

5.3.6 Testing the connectivity

Lets make sure that all hosts can exchange traffic.

- On Host-11 (Ping Host-11 -> Host-21)

```
ping 10.1.2.1
traceroute 10.1.2.1
```

- On Host-11 (Ping Host-11 -> Host-22)

```
ping 10.1.2.2
traceroute 10.1.2.2
```

- On Host-12 (Ping Host-12 -> Host-21)

```
ping 10.1.2.1
traceroute 10.1.2.1
```

- On Host-12 (Ping Host-12 -> Host-22)

```
ping 10.1.2.2
traceroute 10.1.2.2
```

What is the result ?

6 Submission

After finishing the lab, go to the terminal on your Linux system that was used to start the lab and type:

```
stoplab sparta-routing-basics
```

When you stop the lab, the system will display a path to the zipped lab results on your Linux system. Provide that file to your instructor, e.g., via the Sakai site.