Routing Basics - Lab Guide

V1.0.1 - Reviewed on 14/08/2021

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) ?

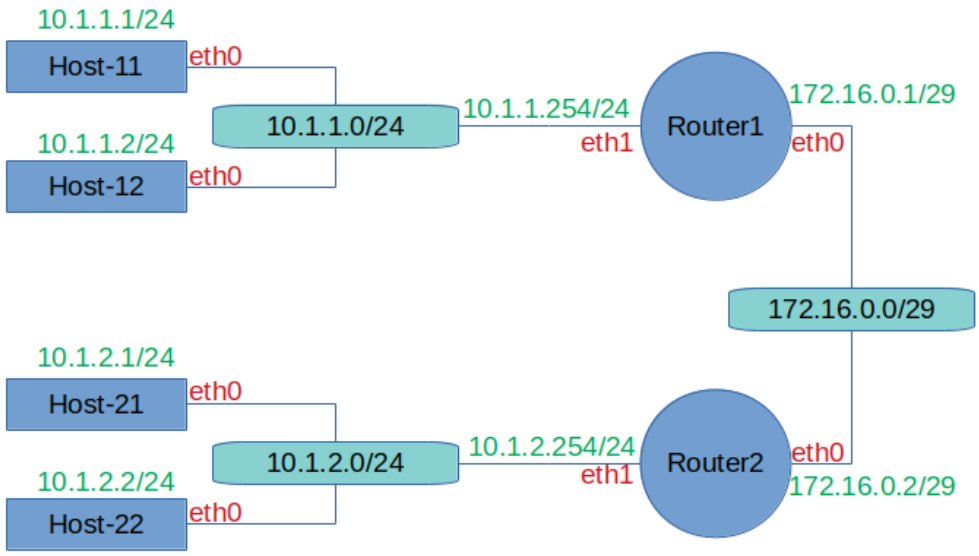

Figure 1: Network topology for routing-basics lab

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 172.16.0.2/29 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.