

Communication Protocols 2021-2022

Lab Assignment 0 - Basic configuration of Cisco routers

Objectives and organisation

The objective of this lab assignment is to get acquainted with Cisco's Internetwork Operation System (IOS). Routers are network elements that, among other functions, perform switching and routing of IP packets and, thus, are essential to the operation of any network or set of networks and, consequently, to the operation of the Internet as a whole.

The assignment can be prepared using the GNS3 router emulator before executing it in the lab. There are guided exercises, for which the commands/actions to execute are presented and explained, and proposed exercises that should be done autonomously by the students.

The following topics are addressed in the lab assignment:

- Connecting a console to a Cisco router
- Introduction to the Cisco IOS
- Interface configuration
- Connection of a router to two local area networks

Throughout the execution of the lab assignment, commands output and configuration files should be kept for inspection by the teacher. Special attention should be given to their interpretation and explanation.

The current lab assignment may require cooperation between groups in order to setup the scenarios under study. More than the sheer configuration of individual routers, it is important to interpret, explain and understand the behaviour in the overall network scenario. This is a key element for evaluation.

The following aspects will be taken into account when evaluating the work:

- Preparation of the lab assignment – 10%
- Knowledge of the aspects under consideration – 30%
- Exercises execution – 50%
- Group autonomy – 10%

In the lab, the scenario presented in Figure 1 exists or should be set up. Before starting your work, ask the teacher in the classroom which networks and routers will be under your responsibility, in order to avoid address conflicts.

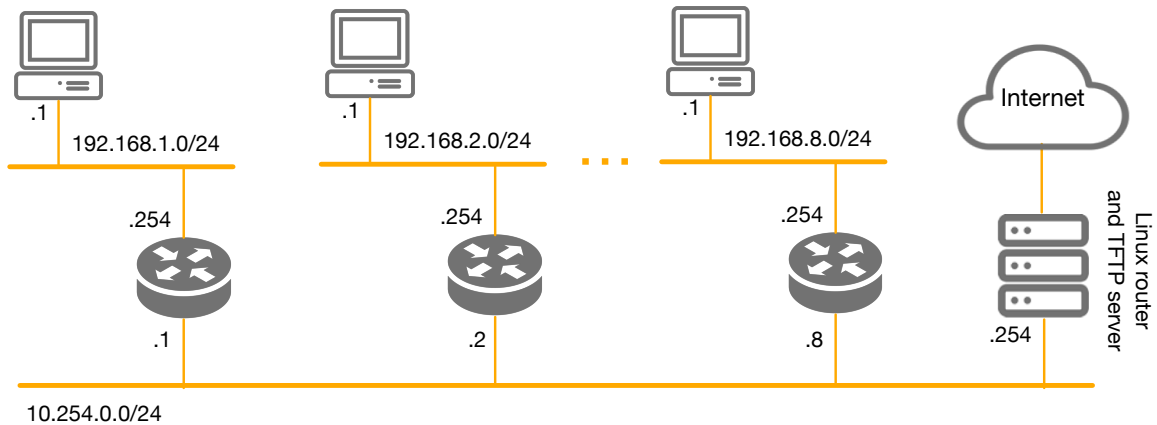


Figure 1 – Lab scenario

0. Router console configuration

Router configuration commands are issued through the equipment console. In the case of our labs, the available personal computers will be used as consoles, using a virtual terminal program (e.g., minicom in Linux, or hyperterminal in Windows) and a serial connection between the COM1 serial port of the computer and the console port in the router. As physical medium, a console cable (the supplied light blue cable) will be used, as shown in Figure 2.

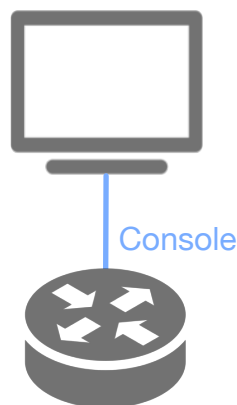


Figure 2 – Using a computer as router console

The settings for the serial connection are the following:

- 9600 bits per second
- 8 data bits
- No Parity
- 1 stop bit
- No flow control

Exercise 1 – Based on the information presented above, configure a virtual terminal session so that your computer can be used as router console, and startup the router so that it is ready for accepting configuration commands. For this, execute the following steps:

- Turn on your computer and start it up in Windows. The Administrator's password is the name on the top left corner of the screen, in lowercase.
 - Start up a Hyperterminal session. Choose a name for the session, select COM1, and set up the session using the parameters presented above.
 - Turn on the power of your router and wait for it to complete the startup process. When the router ask if you want to enter in configuration mode, choose 'No'.
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1. Introduction to Cisco IOS

1.1 IOS modes of operation

Cisco IOS has two modes of operation: *user mode* (or *user exec mode*), and *privileged mode* (or *privileged exec mode*).

The *user mode* gives access to information on the state of the router and can be easily identified by the following prompt:

```
Router>
```

User commands available in this mode can be displayed using the following command:

```
Router>?
```

Changing to privileged mode is achieved through the following command and the privileged mode password:

```
Router>enable
Password:
Router#
```

(NOTE: the routers in the lab are configured so that no password is needed for entering the privileged mode)

This mode of operation is identified by the # character that shows up in the last part of the prompt. This operation mode provides access to all of the router information, including the configuration commands and files.

In order to change the router configuration, it is necessary to enter the configuration sub-mode:

```
Router#configure terminal
Enter configuration commands, one per line. End with Ctrl-Z
Router(config)#
```

Exiting the configuration mode can be done using the 'exit' command or typing ctrl-z. Exiting the privileged mode is done using the 'disable' command:

```
Router(config)#exit
Router#disable
Router>
```

The configuration sub-mode has, in turn, other sub-modes, briefly described in the following:

- Configuration mode – entered by issuing the 'configure terminal' command, as previously mentioned. This mode allows to configure the router through the command line interface.
- Line configuration mode – it's a sub-mode of the configuration mode, and is entered by issuing the 'line' command. The corresponding prompt is `Router(config-line)#`. It enables the execution of commands for the configuration of the router's physical lines (vty, tty, console, aux).
- Interface configuration mode – it's a sub-mode of the configuration mode, and is entered by issuing the 'interface' command. The corresponding prompt is `Router(config-if)#`. It enables the execution of commands for the configuration of the router's interfaces (i.e., the protocol aspects of the router ports), such as, for instance, Ethernet or serial interfaces.
- Router configuration mode – it's a sub-mode of the configuration mode, and is entered by issuing the 'router' command. The corresponding prompt is `Router(config-router)#`. It enables the execution of commands for the configuration of routing functions. These commands depend on the type of used routing protocols.

Check the commands available in each configuration sub-mode by issuing a question mark command, '?'. Explore some of the commands.

1.2 Command abbreviation and help

Cisco's IOS allows the abbreviation of commands as a way to save work or aid the user in finding the correct command syntax. As a rule, there is no need to write the full command, just the characters that unambiguously identify it. For instance, instead of

```
Router#configure terminal
```

you can simply type

```
Router#conf t
```

Another example: instead of

```
Router#show running-config
```

you can simply type

```
Router#sh ru
```

Another important aspect that should be mentioned is the command help that the user can get by typing a question mark. This can be used for obtaining information on the available commands or sub-commands. For instance, if you want to know the sub-commands of the copy command, just type

```
Router#copy ?
```

Also, if you want to know which commands begin with the letters 'co', just type

```
Router#co?
```

2. Connecting the router to a local area network

The routers that exist in the lab have two network interfaces. Identify these interfaces, using the 'sh ru' command.

Connecting one of these interfaces to a network requires the configuration of that interface with an IP address, and the subsequent activation of the interface. For example, assuming that we intend to use the FastEthernet0 interface and that the IP address is 10.254.0.13 (for the sole purpose of this example), this configuration can be done with the following commands:

```
Router>enable
Router#config terminal
Router(config)#interface fastethernet0
Router(config-if)#ip address 10.254.0.13 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#exit
```

Exercise 2 – Based on the provided examples and explanation, connect your router and your computer to the same local area network, as illustrated in Figure 3. For this, execute the following steps:

- 'N' is the number of your group. Ask the teacher the value of variable 'X'.
- As the network will be composed of two machines only, it can be implemented using a point-to-point connection. For this, connect a cable from the Ethernet0 interface of your router to the Ethernet interface of your computer.
- Configure and activate the Ethernet0 interface of your router with the IP address shown in Figure 3.
- Configure your computer with the IP address shown in Figure 3. Do not forget to configure the default gateway as well.
- Test the connectivity between the two machines. For this, in the computer's command line, execute 'ping 192.168.(X+N).254'.

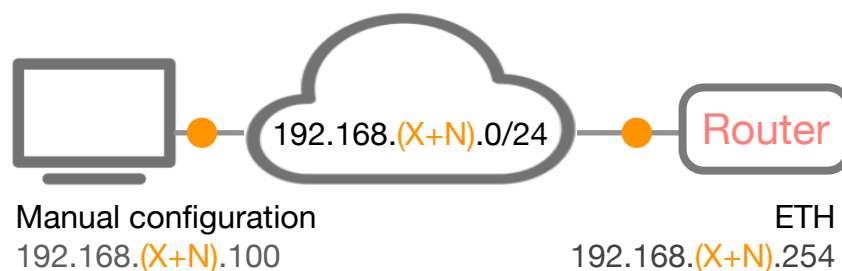


Figure 3 – Scenario for connecting the router and the computer to a local area network

2. Connecting the router to the lab network

As previously mentioned, a structured cabling network exists in the lab. At this point, we are going to connect the scenario construct in the previous exercise to the lab network, as illustrated in Figure 4.

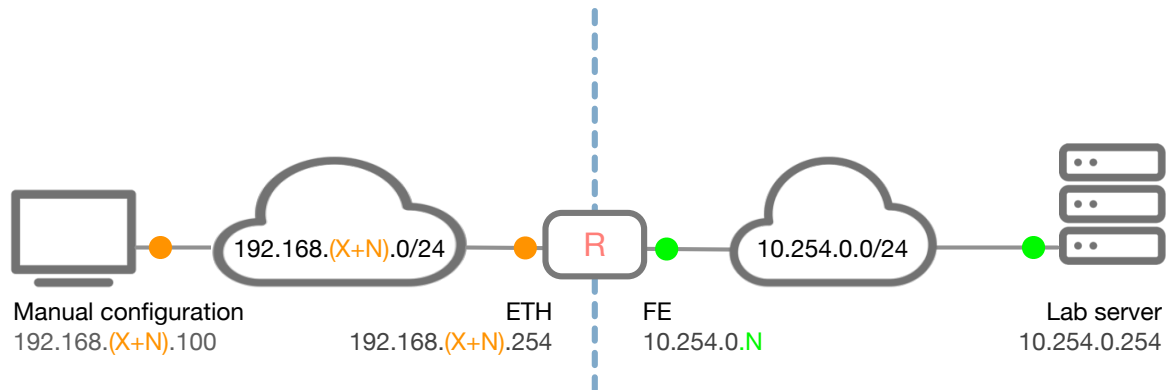


Figure 4 – Scenario for connecting the router to the lab network

Exercise 3 – Connect your router to the structured cabling lab network, as illustrated in Figure 4. For this, execute the following steps:

- 'N' is the number of your group.
- Connect the FastEthernet0 interface of your router to one of the network sockets that exist in the lab. Check that this socket is activate in the secondary network wiring closet. There should be a patch chord connecting the chosen socket to a socket in the main wiring closet.
- Configure and activate the FastEthernet0 interface of your router with the IP address shown in Figure 4.
- Test the connectivity between your router and the lab server. For this, in your router, execute 'ping 10.254.0.254'.