LAB2 – Fundamentals of router configuration

NETWORK CONNECTIONS USING CISCO ROUTERS

Running router

The purpose of runtime procedures for the Cisco IOS software is to start the router.
The runtime procedures are performed as follows:

- check whether the router hardware has been tested and working properly;
- finding and loading the Cisco IOS software;
- finding and using the initial configuration, or enter the setup mode.

After power on the Cisco internal test (power-on self test POST) is performed. During this test all hardware modules are performed diagnostic procedures contained in ROM. Checks the correct operation of the processor, memory and network interface ports. After checking the hardware functions shall initiate software.

After the POST on during initialization of the router, the following events occur:

Step 1: Take the basic procedure for loading the boot located in ROM. The boot is a simple set of instructions testing equipment and initiating the IOS to start work.

Step 2: IOS may be located in several places. Field runtime configuration register determines the location from which you will load the IOS. If the field indicates the runtime loading of flash memory or from the network, the command startup configuration file contains the exact name and location of the image.

Step 3: Loads the operating system image. Once the IOS is loaded and ready to work on the terminal console, you see a list of hardware and software.

Step 4: The configuration file stored in NVRAM is loaded into main memory and executed line by line. Configuration commands start routing processes, supply addresses for interfaces, and define other operational characteristics of the router.

Step 5: If the NVRAM has no valid configuration file, the operating system looks for an available TFTP server. If the TFTP server is not found, the configuration dialog begins.

Configuration mode setup is not intended to make complicated settings on the router protocols. It allows administrators to create a basic configuration of routers, you can not download it from another source.

Modifying the configuration

If the router configuration needs to be changed, go to the appropriate mode, and enter the appropriate command. If, for example, you must enable the interface, enter the global configuration mode, then the interface mode, and issue the command no shutdown.
To verify your changes, use the show running-config. This command will display the current

confi If the displayed variables are not correct, you can change the environment in one of the following ways (also illustrated graphically below):
• Issue the command configuration as well.
• Reload the system to restore the original configuration file from NVRAM.
Archive • Copy the configuration file from the TFTP server.
• Remove the boot configuration file using the command erase startup-config, then restart the router and enter the setup mode.

To save the configuration variables to the boot file in NVRAM, use the command line privileged EXEC command:

Router# copy running-config startup-config

Commands useful when working on the router console.

logging synchronous

```
R1(config)#interface fastethernet 0/0
R1(config-if)#ip address 172.16.3.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#descri
*Mar 1 01:16:08.212: %LINK-3-UPDOWN: Interface
   FastEthernet0/0, changed state to up
*Mar 1 01:16:09.214: %LINEPROTO-5-UPDOWN: Line protocol
   on Interface FastEthernet0/0, changed state to
   upption
R1(config-if)#
```

```
R1(config)#interface fastethernet 0/0
R1(config-if)#ip address 172.16.3.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#description
*Mar 1 01:16:08.212: %LINK-3-UPDOWN: Interface
   FastEthernet0/0, changed state to up
*Mar 1 01:16:09.214: %LINEPROTO-5-UPDOWN: Line protocol
   on Interface FastEthernet0/0, changed state to up
R1(config-if)# description
```

exec-timeout.

Router(config-line)# exec-timeout minutes [seconds]

no ip domain-lookup

```
Router#enablsd
Translating "enablsd"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find
   computer address
```

With the administration discussed the command to avoid unnecessary messages on the console.

Router(config)# no ip domain-lookup

Serial interface configuration

Router(config)# interface serial 0/0
Router(config-if)# ip address <adres_ip> <maska_podsieci>

Serial interfaces require a clock signal communications control. In most environments, the clock signal provides a DCE device such as CSU / DSU. By default, Cisco routers are DTE devices, but can be configured as a DCE device. In the case of directly interconnected serial lines, for example, in the laboratory, one of the parties must be treated as a DCE and provide the clock signal. Clock rate command to turn the clock and determine its speed. Available rate in bits per second is: 1200, 2400, 9600, 19 200, 38 400, 56 000, 64 000, 72 000, 125 000, 148 000, 500 000, 800 000,
1 000 000 1 300 000 2 000 000 and 4 000 000. In the case of some certain speed serial interfaces may not be available. It depends on the bandwidth of the interface.

By default, interfaces are disabled or inactive. To turn on or activate the interface, use the *no shutdown* command. If you need to disable the administrative interface to perform maintenance or solve the problem, use the *shutdown* command.

Router(config)# interface serial 0/0
Router(config-if)# clock rate 56000
Router(config-if)# no shutdown

Manual procedures, which must be repeated on the following laboratories:

Router> enable
Router#erase startup-config

Router# reload

*System configuration has been modified. Save? [yes/**no**]:*

Proceed with reload? [confirm]

Reload requested by console.

*Would you like to enter the initial configuration dialog? [yes/**no**]:*

Press RETURN to get started!

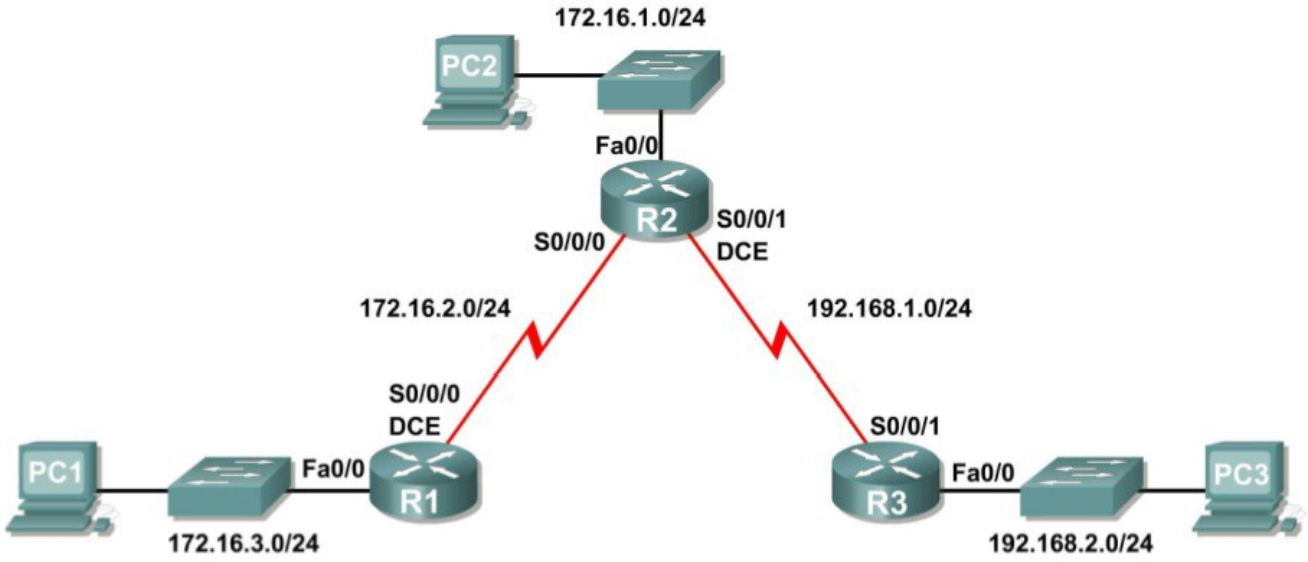
1. Router name configuration

The router should be given a unique name. This is usually one of the first tasks of the router configuration. This task is performed in the global configuration mode (global configuration mode). Command (name TESTER is an example):

Router(config)# hostname TESTER
TESTER(config)#

2. Sample network topology creation and configuration.

Note:
given in Figure interface names please as examples and during this exercise include the type of used routers and the names of their interfaces.



Exercise should start by creating a physical network as shown below. After clearing the configuration, go to global configuration mode and make a basic router configuration using the following steps:

Step 1. Setting up the work

a. Give the names of the routers as shown (R1, R2, R3)

b. For the console on all routers, add the command logging

synchronous. R1(config)# line console 0
R1(config-line)# logging synchronous

c. Add command exec-timeout 0 0 for all routers

. TESTER(config)# line console 0
TESTER(config-line)# exec-timeout 0 0

Step 2: Interpretation of results debugger

a. On the R1 router, go to the privileged EXEC mode and follow commands debug ip routing.

R1#debug ip routing
IP routing debugging is on

Note: The debug ip routing command shows the process of adding, modifying and deleting routes from the routing table. For example, if only properly configure and activate the interface, the IOS will add a route to the routing table. We can verify this by observing the messages generated by the router, use the command debug ip routing.

b. On the R1 router, go to LAN interface configuration

mode

R1# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.
R1(config)# interface fastethernet 0/0

c. Configure the IP address according to the table of addresses.

Urządzenie	Interfejs	Adres IP	Maska podsieci	Brama domyślna
R1	Fa0/0	172.16.3.1	255.255.255.0	Nie dotyczy
	S0/0/0	172.16.2.1	255.255.255.0	Nie dotyczy
R2	Fa0/0	172.16.1.1	255.255.255.0	Nie dotyczy
	S0/0/0	172.16.2.2	255.255.255.0	Nie dotyczy
	S0/0/1	192.168.1.2	255.255.255.0	Nie dotyczy
R3	FA0/0	192.168.2.1	255.255.255.0	Nie dotyczy
	S0/0/1	192.168.1.1	255.255.255.0	Nie dotyczy
PC1	NIC	172.16.3.10	255.255.255.0	172.16.3.1
PC2	NIC	172.16.1.10	255.255.255.0	172.16.1.1
PC3	NIC	192.168.2.10	255.255.255.0	192.168.2.1

R1(config-if)# ip address 172.16.3.1 255.255.255.0
is_up: 0 state: 6 sub state: 1 line: 1 has_route: False

As soon as you press the Enter key, Cisco IOS debugger indicates that there is a new route, but her condition is False. In other words, the route has not been added yet to the routing table.
Why did this happen? What should I do to make the route has been added?

Its happened because we didn't get up the interface. You should execute 'no shutdown' command.

c. Execute the command necessary to install the route in the routing table. After the correct command, the router should generate appropriate messages. The messages on your device may vary slightly from the following.

```
is_up: 1 state: 4 sub state: 1 line: 1 has_route: False
RT: add 172.16.3.0/24 via 0.0.0.0, connected metric [0/0]
RT: NET-RED 172.16.3.0/24
RT: NET-RED queued, Queue size 1
RT: interface FastEthernet0/0 added to routing table
%LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
is_up: 1 state: 4 sub state: 1 line: 1 has_route: True
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, chan
ged state to up
is_up: 1 state: 4 sub state: 1 line: 1 has_route: True
is_up: 1 state: 4 sub state: 1 line: 1 has_route: True
```

d. Enter the command that allows you to verify that the new route is added to the routing table. Result command should be similar to the example shown below. Table Router R1 should now strewn suitable route. What command is used?

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     172.16.0.0/24 is subnetted, 1 subnets
C       172.16.3.0 jest bezpośrednio podłączona, FastEthernet0/0
```

a. On the R1 router configuration mode, go to the WAN interface connected to the router R2.

R1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)# interface Serial 0/0/0

Configure the IP address according to the topology

diagram.

R1(config-if)# ip address 172.16.2.1 255.255.255.0
is_up: 0 state: 0 sub state: 1 line: 0 has_route: False

As soon as you press the Enter key, Cisco IOS debugger indicates that there is a new route, but her condition is False. In this connection, the router R1 is the DCE side of the connection (note: this situation can be different depending on your hardware), we need to determine the rate of clock bits between routers R1 and R2.

a. On router R1, enter the command clock rate. You can select the clock speed. Use a question mark? To see the available values. Here we use 64000 b / s.
R1(config-if)#clock rate 64000
is_up: 0 state: 0 sub state: 1 line: 0 has_route: False

Note: Some versions of IOS messages shown above are displayed every 30 seconds.

Why the route is still able False? What you need to do to make sure, that the interface has been completely configured?

Because its needs to be get up with using 'no sh' command. We can check the configuration with using 'show running' command or by ping results.

c. Execute the command by which you can ensure that the interface is properly configured.
R1(config-if)# **'no shutdown'**

After entering the correct command, the debugger should display a message similar to one of this:
is_up: 0 state: 0 sub state: 1 line: 0 has_route: False
%LINK-3-UPDOWN: Interface Serial0/0/0, changed state to down

Note: In contrast to the LAN interface, the full configuration of the WAN interface does not guarantee add a route to the routing table (even if the wiring has been done correctly). The other side of the WAN link has been configured.

i. Establish a separate console session with the router R2 (on another workstation).

```
R2#debug ip routing
IP routing debugging is on
```

On the R2 router configuration mode, go to the WAN interface connected to router R1.

```
R2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#interface serial 0/0/0
```

Configure the IP address according to the diagram.

```
R2(config-if)# ip address 172.16.2.2 255.255.255.0
is_up: 0 state: 6 sub state: 1 line: 0
```

j. Execute the command by which you can ensure that the interface is properly configured.

R2(config-if)# **no shutdown**

If you enter the correct command, you should see output similar to that shown below.

```
is_up: 0 state: 4 sub state: 1 line: 0
%LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up
is_up: 1 state: 4 sub state: 1 line: 0
RT: add 172.16.2.0/24 via 0.0.0.0, connected metric [0/0]
RT: interface Serial0/0/0 added to routing table
is_up: 1 state: 4 sub state: 1 line: 0
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to
up
is_up: 1 state: 4 sub state: 1 line: 0
```

k. Enter the command that will help verify that the new route is added to the routing tables of routers R1 and R2. The result of the command should be similar to the example below. The routing table of the router R1 should be placed two routes while the routing table of the router R2 - one. What command is used?

R1# **show ip route**

```
R1#________ _____________________________
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     172.16.0.0/24 is subnetted, 2 subnets
C       172.16.2.0 is directly connected, Serial0/0/0
C       172.16.3.0 is directly connected, FastEthernet0/0


R2#_____________________________________
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     172.16.0.0/24 is subnetted, 1 subnets
C       172.16.2.0 is directly connected, Serial0/0/0
```

j. On both routers disable the debugging process. Use the command: no debug ip routing or undebug all.

R1(config-if)#end
R1#no debug ip routing IP
routing debugging is off

Step 3: The final configuration of the router interfaces

a. Configure other interfaces, R2
b. Configure the router interfaces R3

Step 4. Configure the addresses of PCs.

a. For the host PC1, configure the IP address: 172.16.3.10/24, and default gateway: 172.16.3.1.
b. For the host PC2, configure the IP address: 172.16.1.10/24, and default gateway: 172.16.1.1.
c. On the host PC3 configure the IP address: 192.168.2.10/24 and default gateway: 192.168.2.1.

Step 5: Testing and verification of configuration

a. Check the connectivity using the ping command from each host to the default gateway configured on it.
b. To verified connectivity between routers directly connected, use the ping command.
c. The use of the ping command to check the communication between devices which are not directly connected.
Was ping test from PC3 to PC1 successful? **no**

Was ping test from PC3 to PC2 successful? **no**
Was ping test from PC2 to PC1 successful? **no**
Was ping test from R1 to R3 successful? **no**

Step 6: Collection of information

a. Using command show ip interface brief check the status of interfaces on all routers. Router R2 produces the following result:

R2# show ip interface brief

```
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        172.16.1.1      YES manual up                    up
FastEthernet0/1        unassigned      YES unset  administratively down down
Serial0/0/0      172.16.2.2      YES manual up                    up
Serial1/0/0      192.168.1.2      YES manual up                    up
Vlan1                  unassigned      YES manual administratively down down
```

How many are active interfaces on routers R1 and R3? **2**

Why on router R2 are active three interfaces
Because of its position on topology.

b. b. Display the routing table of each router. Enter the appropriate command.

R1# **show ip route**

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     172.16.0.0/24 is subnetted, 2 subnets
C       172.16.2.0 is directly connected, Serial0/0/0
C       172.16.3.0 is directly connected, FastEthernet0/0
```

Which network topology diagram are not displayed in the routing table of the router R1?
R3

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR

Gateway of last resort is not set

     172.16.0.0/24 is subnetted, 2 subnets
C       172.16.1.0 is directly connected, FastEthernet0/0
C       172.16.2.0 is directly connected, Serial0/0/0
C    192.168.1.0/24 is directly connected, Serial0/0/1
```

Which network topology diagram are not displayed in the routing table of the router R2?

All of them are displayed

R3# **show ip route**

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR

Gateway of last resort is not set

C    192.168.1.0/24 is directly connected, Serial0/0/1
C    192.168.2.0/24 is directly connected, FastEthernet0/0
```

Which network topology diagram are not displayed in the routing table of the router R3?

R1

Why are not all networks are displayed in the table each router?

Because of the chosen topology.

Conclusion

- Learned how to configure a router
- Learned the interfaces defaultly came down and if you want to use them you have to get up with ‘no shutdown’ command
- Learned how to analyse routing table and relation between topology
- Learned ‘logging synchronous’ command. Its prevents the debug messages interrupt your command in terminal

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