Bialystok University of Technology

Faculty of Electrical Engineering

Course name:
Computer Networks

Course code: IS-FEE-10082S

Laboratory classes manual guide

Laboratory exercise no: **5**

Subject of the laboratory exercise:

Configuring and testing dynamic routing protocols

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1. General characteristics of the exercise

The routing process in a TCP/IP network consists of forwarding IP packets and selecting a route through which these packets are sent. In the case of static routing, this route is permanently established in the process of configuring network devices (especially routers). This solution ensures high stability of network operation, simple configuration and a high level of security, but it is quite troublesome in the case of frequent changes to the network structure. Therefore, static routing is mainly used in the case of not very complex network architectures and in selected fragments of more extensive structures.

In wide IP network structures, dynamic routing is used, which ensures automatic updating of route tables in routers and optimal selection of a route based on specific criteria. Dynamic routing is implemented through dedicated dynamic routing protocols. They enable automatic transfer of information between routers about the routes available through these routers. Thanks to the use of a dynamic routing protocol, changes in the network topology do not require manual change of device configuration (especially routers).

Due to the area of operation, dynamic routing protocols can be divided into internal and external. Internal protocols are used within autonomous systems (AS – typically network systems managed by individual operators), and external protocols exchange information about available routes between autonomous systems.

The aim of the exercise is to familiarize yourself with the internal dynamic routing protocols RIP (Routing Information Protocol) and EIGRP (Enhanced Interior Gateway Routing Protocol), the principles of their configuration, and to study the behavior of a network using these protocols.

2. Preparation for classes

Before starting the exercise, you should read the following materials:

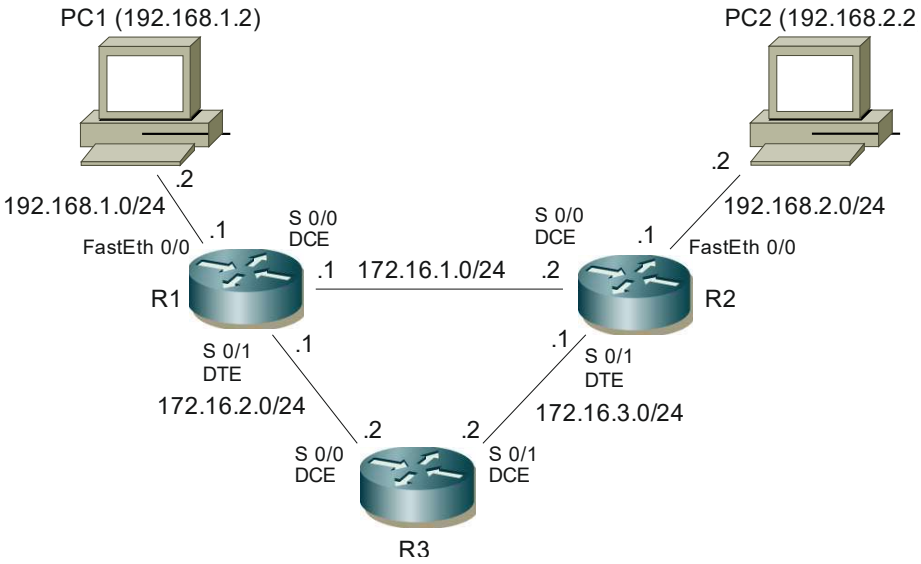
- This entire manual.
- Basic information about routing in IP networks, e.g. **Pages 448-466 from „CCENT-ICND1 Exam Certification Guide.pdf".**
- On the Internet find the formula for calculating the EIGRP metric.

The above-mentioned information is the **minimum** theoretical knowledge necessary to start and properly complete the exercise.

3. Laboratory exercise plan

Initial configuration of the network system

1. Connect the **R1**, **R2**, **R3** routers and the **PC1** and **PC2** stations according to the diagram below.



2. Set the appropriate names on each router (**R1**, **R2** and **R3**).
3. Configure the IP addresses on the individual router interfaces according to the data in the diagram.
4. Configure other parameters of the router interfaces (e.g. the speed of the DCE serial ports).
5. After configuring the router interfaces check whether each of the 5 links (2 Ethernet and 3 serial) work correctly (e.g. using the **ping** command).

RIP protocol configuration and testing

6. In the set up network configuration, configure the RIP protocol (**version 2**) in routers on all used interfaces. In the RIP protocol configuration, disable the option of automatic route connection at the border of the main networks (command **no auto summary**).
7. Check the correct operation of the structure (i.e. the availability of all connected networks from the selected router and host) by reading its routing table (**sh ip route** command) and using the *ping* and *traceroute* commands.
8. Record sent and received RIP messages using the router debug command (**debug ip rip**). Pay attention to whether the received messages contain route information not included in the routing table (e.g. with higher metric). Interpret the sent RIP network addresses in the context of the classless nature of RIP version 2.
9. Check the behavior of the RIP protocol (sent and received messages, and the contents of the routing table) after disconnection from the structure of one of the Ethernet networks. Carry out observations both in the case of complete shutdown of the interface (**shutdown** command) and in the case of switching the interface to passive mode for a given routing protocol.

10. Check the behavior of the RIP protocol (RIP messages sent and received and the contents of the routing table) after reconnecting the network disconnected in the previous step.
11. Check the behavior of the RIP protocol (sent and received RIP messages, and the contents of the routing table) after turning down (using **shutdown** command) S0/0 interface on the R2 router.
12. Record RIP messages sent via the Ethernet interface on router R1 using a protocol analyzer (Wireshark). Note to which addresses (MAC and IP) these messages are sent.

EIGRP protocol configuration and testing

13. In the set up network configuration, configure the EIGRP protocol in routers on all used interfaces.
14. Check the correct operation of the structure (i.e. the availability of all connected networks from the selected router and host) by reading its routing table (**sh ip route** command) and using the *ping* and *traceroute* commands.
15. Calculate the EIGRP metric for the 192.168.2.0 network on router R1 and compare it to the value determined by the router.
    You will need the bandwidth (BW) and delay (DLY) values on the particular interfaces. They can be read using the **sh int** command.
    The formula for calculating the EIGRP metric can be found on the Internet.

Exercise report

The report should include a diagram of the assembled network system, listings of the commands performed, a description of the activities performed at individual points, as well as your own conclusions and observations made during the exercise.

4. Health and safety requirements

According to the rules specified in the first class and confirmed by students held. Appropriate health and safety regulations are also posted in the laboratory room.

5. References

1. Wendell Odom: CCNA 200-301 Official Cert Guide, Volume 1 and 2. Cisco Press, 2019.
2. Dooley K., Brown I.: Cisco IOS Cookbook. O'Reilly Media, Second Edition, 2006.
3. Cisco technical documentation for 2600XM routers (available in the lab and at www.cisco.com).