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SIMULATION OF LOCAL AREA COMPUTER NETWORKS WITH DISTANCE-VECTOR ROUTING PROTOCOLS FOR THE NEEDS OF THE PRIVATE COMPANY

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ABSTRACT: *In this paper a simulation of local area computer networks for the needs of the private company is made.*

KEY WORDS: *Computer and network administrators, Computer resources, LAN, Optics, Protocols, Security, Simulation, WAN.*

1. Introduction

The computer application using a software product - Cisco Packet Tracer was developed. It presents an integrated development program that has become extremely popular over several years among engineers, researchers and specialists in almost all fields of modern science and technology. The software product of the American company Cisco Systems offers great opportunities for complex calculations, simulation and visualization of small and large local, urban and global networks, as well as high-quality graphical presentation of the results [1,3,4,6,8,10,12,15,18,19,27,30,31,32]. The program allows network architects to construct their own virtual network model to access important graphical images of network devices in order to combine the provision of communication networks, adding special data packets and creating many more useful network features. Thanks to the incorporation of a high-level programming language, the system can be subjected to the requirements of each user through self-developed rather than applied software tools [2,5,7,9,11,13,14,16,17,20,21,22,23,24,25,26].

2. Experiment

The all local area computer networks in the Cisco Packet Tracer version 6.2.0.0052 programming environment are simulated [26,27,28,29,30,31,32]. On fig.1 the general scheme of the computer networks is shown.

Communication links

As is known, each router has a number of network interfaces. In our communication scenario, office 1 router has a FastEthernet (Fa0/0) interface with Net ID 10.10.1.0/27 and another FastEthernet (Fa0/1) with Net ID 10.10.1.32/27.

The office 2 router has a FastEthernet interface (Fa0/0) with Network ID (Net ID) - 10.10.1.0/27 another FastEthernet (Fa0/1) interface with network ID 10.10.1.64/27, cloud service interface FastEthernet (Fa0/0/0) for Internet connection and one interface Serial (Se0/1/0) with network ID 10.10.1.96/27.

The office 3 router has a FastEthernet interface (Fa0/1) with network number 10.10.1.128/27 and one interface Serial (Se0/0/0) with network number 10.10.1.96/27.

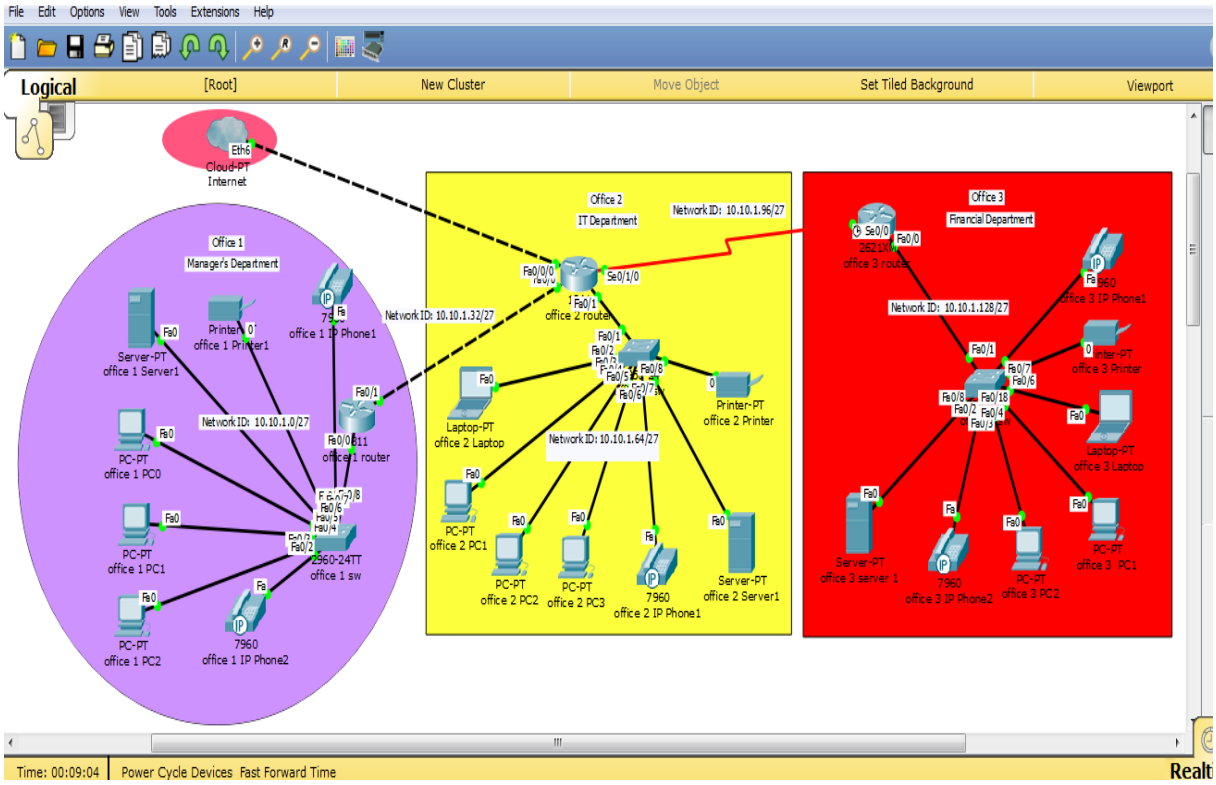

Fig. 1. General scheme of the computer networks

The network 10.10.1.0/27 consists of a Cisco 2811 Modular Router and a single Cisco Switch WS-C2960-24TT. Three PCs, two Cisco IP Phones 7960, one network printer and one server to this switch are connected. The network with the number 10.10.1.32/27 is a private local computer network and its default gateway (IPv4 Default Gateway) is 10.10.1.33/27. This is the configured network address of the FastEthernet interface (Fa0/1) in the office 1 router. The capacity of this network is 30 hosts. The connection between the switch and the hosts is made using Copper Straight-Through cables UTP cat.5e and the connection between the router office 3 router and the switch with Copper Straight-Through cables UTP cat.5e is made.

The network 10.10.1.64/27 consists of a Cisco 2811 Modular Router and a single Cisco Switch WS-C2950-24TT. Three PCs, one laptop, two Cisco IP Phones 7960, one network printer and one DHCP server to this switch are connected. The capacity of this network is 30 hosts. The connection between the switch and the hosts is made using Copper Straight-Through cables UTP cat.5e and the connection between the router office 2 router and the switch with Copper Straight-Through cables UTP cat.5e is made.

The network 10.10.1.96/27 consists of office 2 router и office 3 router. Their connections are point-to-point type and with serial cables are connected.

The connection between office 2 router and office 3 router is serial and the synchronizing router is office 3 router with synchronized clock rate of 64000 bit per second.

The network 10.10.1.128/27 consists of Cisco 2621XM Modular Router and Cisco Switch WS-C2950-24. Two PCs, one laptop, two Cisco IP Phones 7960, one network printer and one DHCP server to this switch are connected. The default Gateway is 10.10.1.129/27. This is the configured network address of the FastEthernet interface (Fa0/0) in the office 3 router. The capacity of this network is 30 hosts. The connection between the switch and the hosts using Copper Straight-Through cables UTP cat.5e is made. The connection between the router office 3 router and the switch with Copper Straight-Through cables UTP cat.5e is made.

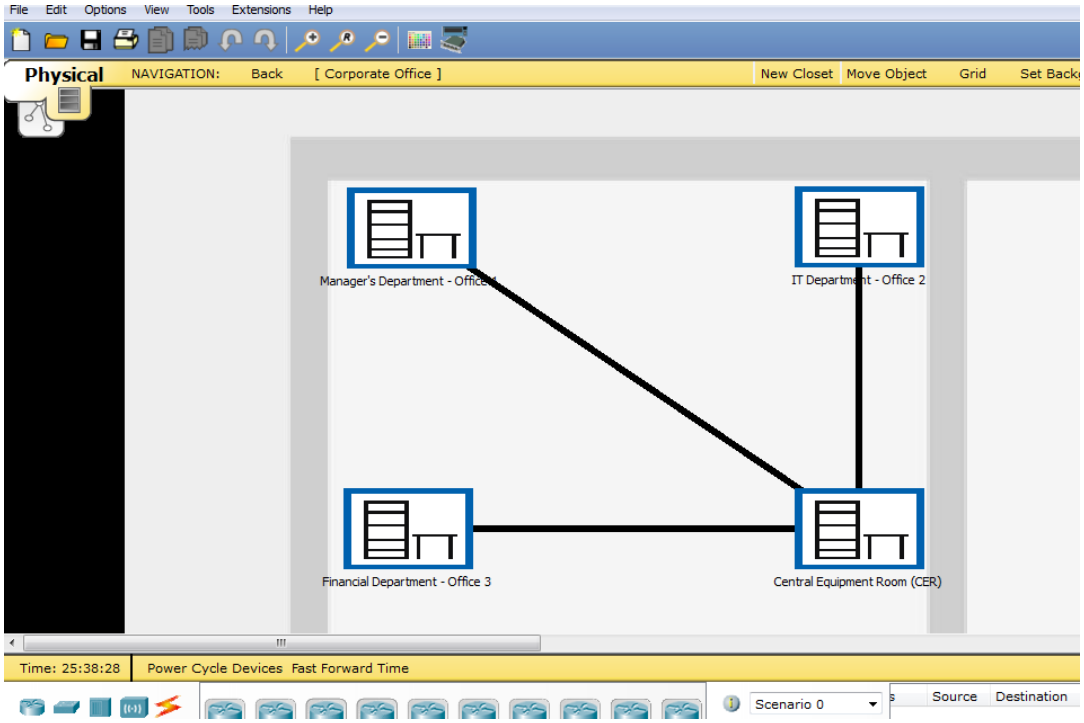

Fig. 2. General physical circuit diagram of the entire computer network

Fig.2 shows the general physical circuit diagram of the entire computer network. The physical layout consists of the following offices:

- Manager's Department - Office 1.
- IT Department - Office 2.
- Financial Department - Office 3.
- Central Equipment Room (CER).
- Physical cable connection between each floor.

The Central Equipment Room (CER) consists of following items:

- Router Cisco 1841 Modular Router, Router - Cisco 2811 Modular Router and Cisco 2621XM Modular Router.
- Two Cisco Switch WS-C2950-24 switches and Cisco Switch WS-C2960-24TT.
- 3 servers.
- 2 racks. This is shown on fig.3.

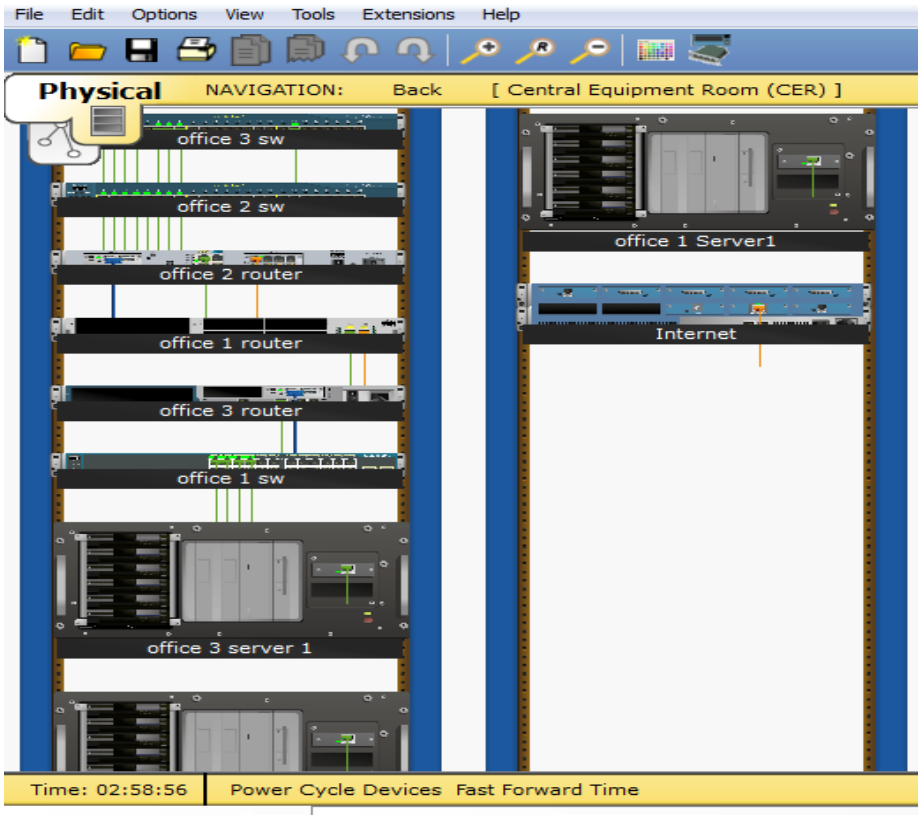

Fig. 3. The communication rack

On fig.4 the successfully DHCP request service for the network number 10.10.1.0/27 is illustrated.

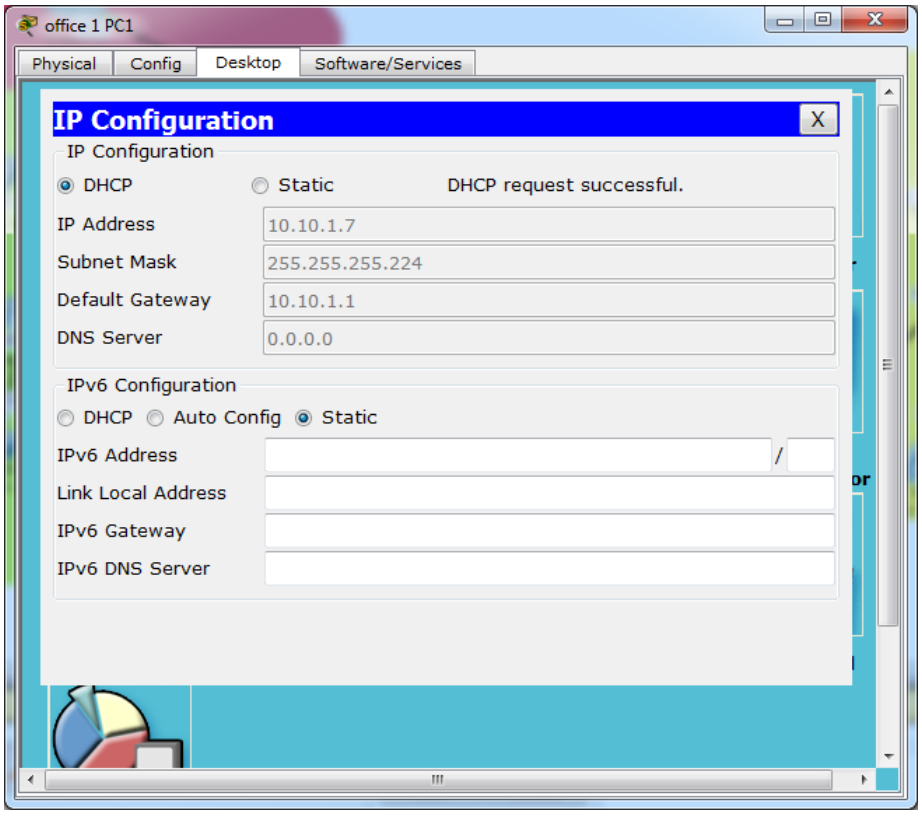

Fig. 4. The proper distribution of IPv4 configurations

In the command line interface of each router the network administrator must enter the command “router rip” and then the command “network 10.0.0.0”. Another way to enter these important commands is in the graphical configuration menu of each router. After applying these commands each router had automatically discovered his neighbor although there was subnetting in the whole network. This is illustrated on fig.5.

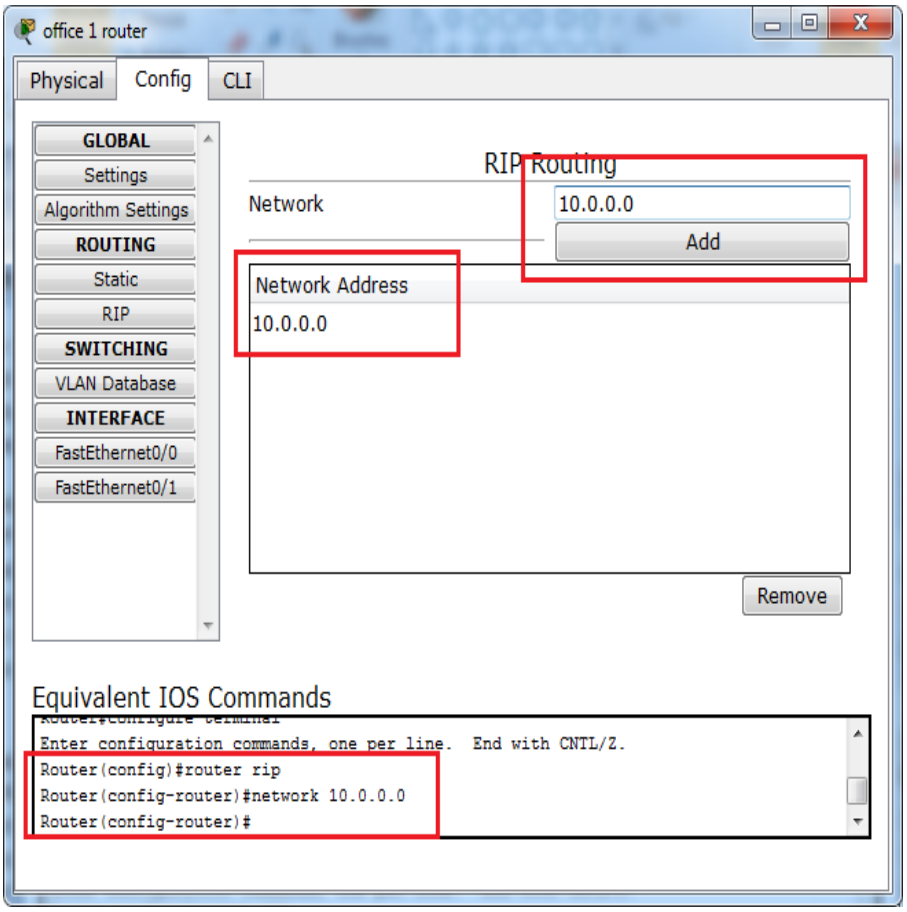

Fig. 5. Activation of Routing Information Protocol in the office 1 router

On fig.6 successfully sent ping between hosts office 1 PC1 and office 3 PC2 is illustrated.

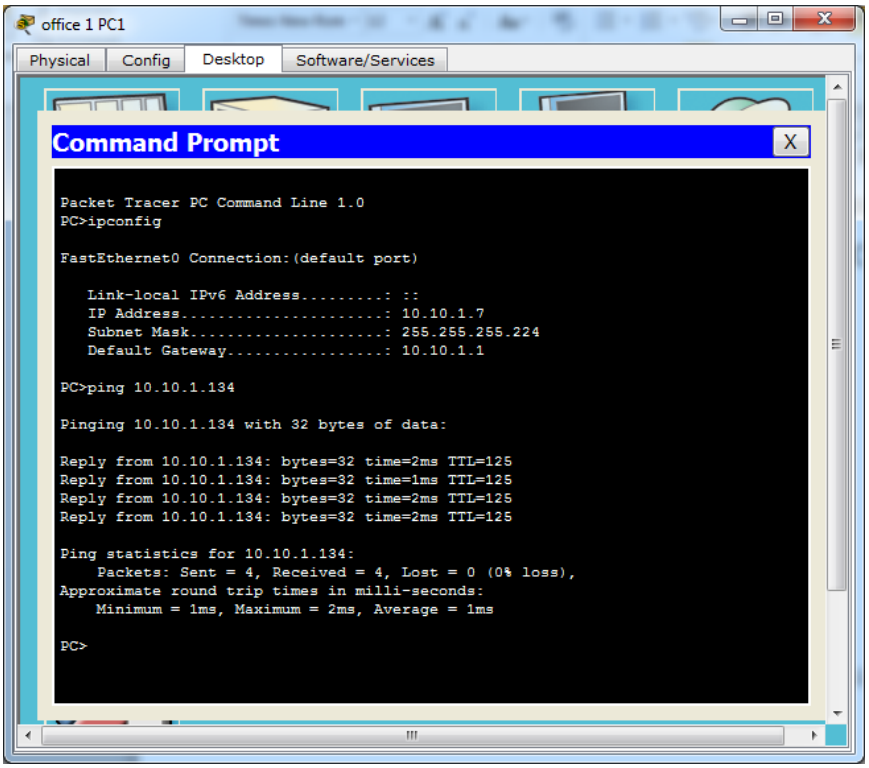

Fig. 6. Successful ping between the hosts office 1 PC1 and office 3 PC2

On fig.7 the RIP updates between the routers are shown.

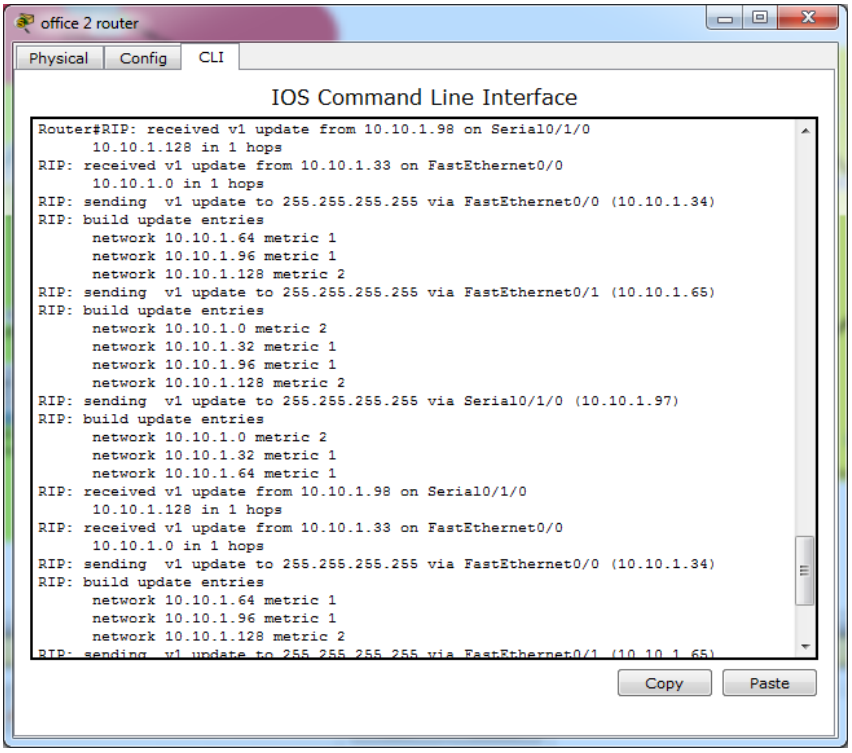

Fig. 7. The process of sending updates between the routers

ATTENTION: All the experiments and research in this paper are made in a specialized computer laboratory at the Faculty of Technical Sciences of the Konstantin Preslavsky University of Shumen. Everything illustrated and explained in this paper is for research purposes and the authors are not responsible in cases of abuse.

3. Conclusion

The built simulation computer network shows precisely how the processes of communication between the nodes of the network are carried out. It examines and applies the characteristics of routing through the RIP routing protocol. The use of ICMP Echo messages is something extremely important in the modern construction and maintenance of computer networks. The ICMP protocol provides control and error messages and the main used applications are ping and traceroute. The purpose of these messages is to provide feedback to the other device to find out if communication has taken place between the hosts. The ICMP messages are optional and often most of the IT professionals do not use them because they hide a major breach in the network security. The static routing continues to be used in the construction and maintenance of small and medium-sized computer networks. In case large computer networks are being built, then the use of routing protocols is mandatory. Thanks to them, a lot of time for configuring different devices is saved and separately through them it is possible to monitor the communication processes between the devices. In this paper the RIP routing protocol for educational and application purposes is shown and implemented. It can be used to configure the process of routing information in the computer network of an entire university, company and other institution. The contemporary of RIP - RIPng is characterized by the fact that IPv6 addresses can be used for the purpose of information routing.

References:

[1] Ahmedova D., Konstantinova E., Tsankov Ts. The use of packet sniffing tools in computer networks security. International Scientific Conference "Defense Technologies" DefTech 2020, Faculty of Artillery, Air Defense and Communication and Information Systems, Shumen, 2020, ISSN 2367-7902, pp. 401-406.

[2] Boyanov, P., Designing a small corporate building with four working computer departments using distance vector routing protocol - RIP, a refereed Journal Scientific and Applied Research (Licensed in EBSCO,

USA), Konstantin Preslavsky University Press, ISSN 1314-6289, vol. 7, 2015, pp. 52-61.

[3] Boyanov, P., Implementation of the network vulnerability scanner Armitage for security weaknesses detection in the computer network and systems. A refereed Journal Scientific and Applied Research, Konstantin Preslavsky University Press, 2019, 15, 47-54, ISSN 1314-6289, EBSCO, Google Schloar and Web of Science.

[4] Boyanov, P., Educational exploiting the information resources and invading the security mechanisms of the operating system Windows 7 with the exploit Eternalblue and backdoor Doublepulsar, a refereed Journal Scientific and Applied Research (Licensed in EBSCO, USA), Konstantin Preslavsky University Press, ISSN 1314-6289, vol. 14, 2018, pp.34-41.

[5] Boyanov, P., Stoyanov St., Hristov, Hr., Fetfov, O., Trifonov, T., Security routing simulation the local area network of academic departments using a link-state routing protocol – OSPF, a refereed Journal Scientific and Applied Research (Licensed in EBSCO, USA), Konstantin Preslavsky University Press, ISSN 1314-6289, vol. 11, 2017, pp. 47-58.

[6] Boyanov, P., Stoyanov St., Hristov, Hr., Fetfov, O., Trifonov, T., Routing information security in the local area network of academic departments using an enhanced distance vector routing protocol - EIGRP, a refereed Journal Scientific and Applied Research (Licensed in EBSCO, USA), Konstantin Preslavsky University Press, ISSN 1314-6289, vol. 11, 2017, pp. 35-46.

[7] Getzov, P., Stoyanov, St., Boyanov, P., Research of the transparency characteristics of the atmosphere which influence the flight control of flying machines, a refereed Journal Scientific and Applied Research (Licensed in EBSCO, USA), Konstantin Preslavsky University Press, ISSN 1314-6289, vol. 11, 2017, pp. 5-9.

[8] Hinds, Alex, Anthony Atojoko, and Shao Ying Zhu. “Evaluation of OSPF and EIGRP routing protocols for ipv6.” International Journal of Future Computer and Communication 2.4 (2013): 287.

[9] Islam, Mohammad Nazrul. Simulation based EIGRP over OSPF performance analysis. Diss. Blekinge Institute of Technology, 2010.

[10] Knight, Steven, D. Weaver, D. Whipple, R. Hinden, D. Mitzel, P. Hunt, P. Higginson, M. Shand, and A. Lindem. “Virtual router redundancy protocol.” RFC2338, April (1998).

[11] Konstantinova E., Tsankov Ts. Analyzing security threats in smart homes technology. International Scientific Conference “Defense Technologies” DefTech 2020, Faculty of Artillery, Air Defense and Communication and Information Systems, Shumen, 2020, ISSN 2367-7902, pp. 373-378.
[12] Konstantinova E., Tsankov Ts. Capabilities for high-speed data transmission through the use of visible light. International Scientific Conference “Defense Technologies” DefTech 2020, Faculty of Artillery, Air Defense and Communication and Information Systems, Shumen, 2020, ISSN 2367-7902, pp. 379-385.
[13] Krishnan, Y. Navaneeth; SHOBHA, G. Performance analysis of OSPF and EIGRP routing protocols for greener internetworking. In: Green High Performance Computing (ICGHPC), 2013 IEEE International Conference on. IEEE, 2013. p. 1-4.
[14] Lemma, Esuendale Shewandagn. Performance Comparison of EIGRP/IS-IS and OSPF/IS-IS. Diss. Blekinge Institute of Technology, 2009.
[15] Lin-Zhu, Wang, Fang Ya-qin, and Shan Min. “Performance comparison of two routing protocols for ad hoc networks.” In Information Engineering, 2009. ICIE’09. WASE International Conference on, vol. 1. IEEE, 2009.
[16] Mogul, Jeffrey. “Internet standard subnetting procedure.” (1985).
[17] Munetomo, Masaharu, Yoshiaki Takai, and Yoshiharu Sato. “A migration scheme for the genetic adaptive routing algorithm.” In Systems, Man, and Cybernetics, 1998. 1998 IEEE International Conference on, vol. 3, pp. 2774-2779. IEEE, 1998.
[18] Narvaez, Paolo. “Routing reconfiguration in IP networks.” (2000).
[19] Ogletree, Terry William, ed. Upgrading and repairing networks. Que Publishing, 2004.
[20] Pepelnjak, Iv., EIGRP network design solutions. Cisco Press, 1999.
[21] Piscitello D., Chapin L, “Open Systems Networking TCP/IP and OSI”, Addison-Wesley, Reading, MA, 1993 г.
[22] Rakheja, Pankaj, Prabhjot kaur, Anjali gupta, Aditi Sharma,“Performance Analysis of RIP, OSPF, IGRP and EIGRP Routing Protocols in a Network”. International Journal of Computer Applications (IJCA) ISSN: 0975-8887.
[23] Scheideler, Christian, and Berthold Vöcking. “From static to dynamic routing: Efficient transformations of store-and-forward protocols.” SIAM journal on Computing 30, no. 4 (2000): 1126-1155.

[24] Simian, Corina, and VladislavGeorgiev. “Practical aspects regarding network monitoring.” In Proceedings of the 8th conference on Simulation, odeling and optimization, pp. 204-207. World Scientific and Engineering Academy and Society (WSEAS), 2008.
[25] SO-IN, Chakchai. A Survey of Network Traffic Monitoring and Analysis Tools. Cse 576m computer system analysis project, Washington University in St. Louis, 2009.
[26] Song, Yuqian, et al. Towards a framework to support novice users in understanding and monitoring of Home Area Networks. In: Pervasive Computing and Communications Workshops (PERCOM Workshops), 2012 IEEE International Conference on. IEEE, 2012. p. 82-87.
[27] Vetriselvan, V., Pravin R. Patil, and M. Mahendran. “Survey on the RIP, OSPF, EIGRP Routing Protocols.” IJCSIT) International Journal of Computer Science and Information Technologies 5.2 (2014): 1058-1065.
[28] Waitzman, David, S. E. Deering, and Craig Partridge. “Distance vector multicast routing protocol.” (1988).
[29] Wegner, J. D., Robert Rockell, and Cameron Brandon. IP addressing and subnetting including Ipv6. Syngress Media, 2000.
[30] WIJAYA, Chandra. Performance analysis of dynamic routing protocol EIGRP and OSPF in Ipv4 and Ipv6 network. In: Informatics and Computational Intelligence (ICI), 2011 First International Conference on. IEEE, 2011. p. 355-360.
[31] Wu, Bing. “Simulation based performance analyses on RIPv2, EIGRP, and OSPF Using OPNET” (2011).
[32] Xu, Don, and Ljiljana Trajkovic. “Performance analysis of RIP, EIGRP, and OSPF using OPNET.” (2011).