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DESIGNING A SMALL CORPORATE BUILDING WITH FOUR WORKING COMPUTER DEPARTMENTS USING DISTANCE VECTOR ROUTING PROTOCOL - RIP

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ABSTRACT:

In this paper a small corporate building with four working computer departments using dynamic routing protocol - RIP is designed and made. Dynamic routes are the most important step in the construction of any computer network. Subnetting is one of the best network tools with that each system and network administrator is able to divide one specific computer network into many subnetworks. Thereby, some network administrators, security professionals and network architects can use the free of charge software program Cisco Packet Tracer in order to design and administer different corporate computer networks.

KEY WORDS: *Cisco, Computer and network administrators, Dynamic routing, Hosts, IPv4, Network interface, LAN, Monitoring, Network, Protocols, RIP, Security, Subnetting.*

1. Introduction

Designing and maintaining a specific computer network in defined business corporate building is very important for each network administrator and security expert specialist. It is necessary physical and logic scheme for the whole computer network to be made in order to all of the network devices to be correctly and neatly placed. One of the ways doing this responsible work is connected with the use of specialized software program called “Cisco Packet Tracer” [1,3,6,7,8,9,11,12,18,19]. This program has a great set of tools that can simulate small and large computer networks. This program is designed primarily for students and people who prepare for the certification exams of Cisco Systems Corporation. Therefore, each person who wants to work with this program must possess in-depth knowledge and skills in the construction of small

and large networks using the dynamic routing protocol - RIP [2,5,13,17,22,23,24,30,31,32].

This paper is structured as follows. First, in section 2, a related work for designing and subnetting of computer networks is made. After that, in section 3, a sophisticated implementation of the software program - "Cisco Packet Tracer version 5.3.3.0019" into server operating system Windows Server 2008 R2 Enterprise is performed. The achieved results are presented in section 4. The conclusions and recommendations are made in section 5.

2. Related work

In [2] some methods and systems for exchanging routing information by Edward Barnes Boden, Paul Albert Gebler Jr and Franklin Alfred Gruber are made. In [5] constructing optimal IP routing tables by Richard P. Draves are shown. In [13] the routing information protocol version 2 is totally by Gary Malkin explained. In [17] different routing reconfigurations in IP networks by Paolo Narvaez are made. In [22] static and dynamic routing implementation for efficient transformations of store-and-forward protocols by Christian Scheideler and Berthold Vöcking are shown. In [32] some distance vector multicast routing protocols by David Waitzman S. E. Deering, and Craig Partridge are illustrated.

3. Experiment

The experiment in specialized university computer and network laboratory is made. The used free of charge software program is "Cisco Packet Tracer version 5.3.3.0019" which is owned by Cisco Systems, Inc. The host has used server operating system - Windows Server 2008 R2 Enterprise x64. Initially was necessary to be enumerated the network devices and hosts. The computer network has consisted of the following items [30,31,32,33]:

- Eight personal computers.
- Three Server machines.
- Two Laptops.
- Several Copper Straight-Through UTP cables cat.5e
- One Copper crossover UTP cables cat.5e.
- One Serial Smart DCE DB60 cable;
- One modular router - Cisco 1841 Modular Router.
- One modular router - Cisco 2811 Modular Router.
- One modular router - Cisco 2621XM Modular Router.
- Three Printer machines.
- Two switches - Cisco Switch WS-C2950-24.
- One switch - Cisco Switch WS-C2960-24TT.
- Five IP phones - Cisco IP Phone 7960.

- Three departments (office 1, office 2 and office 3).
- One Central Equipment Room (CER).
- Two racks for the CER.
- Six working table for the staff.
- One complete scheme of the entire network.
- One Packet Tracer Cloud Server for Internet.

The computer network in the program environment of Cisco Packet Tracer 5.3.3.0019 is simulated. On fig.1 the common logical scheme of the whole computer network is shown. The Routing Information Protocol (RIP) was activated in the routing table of the routers [30,31,32,33].

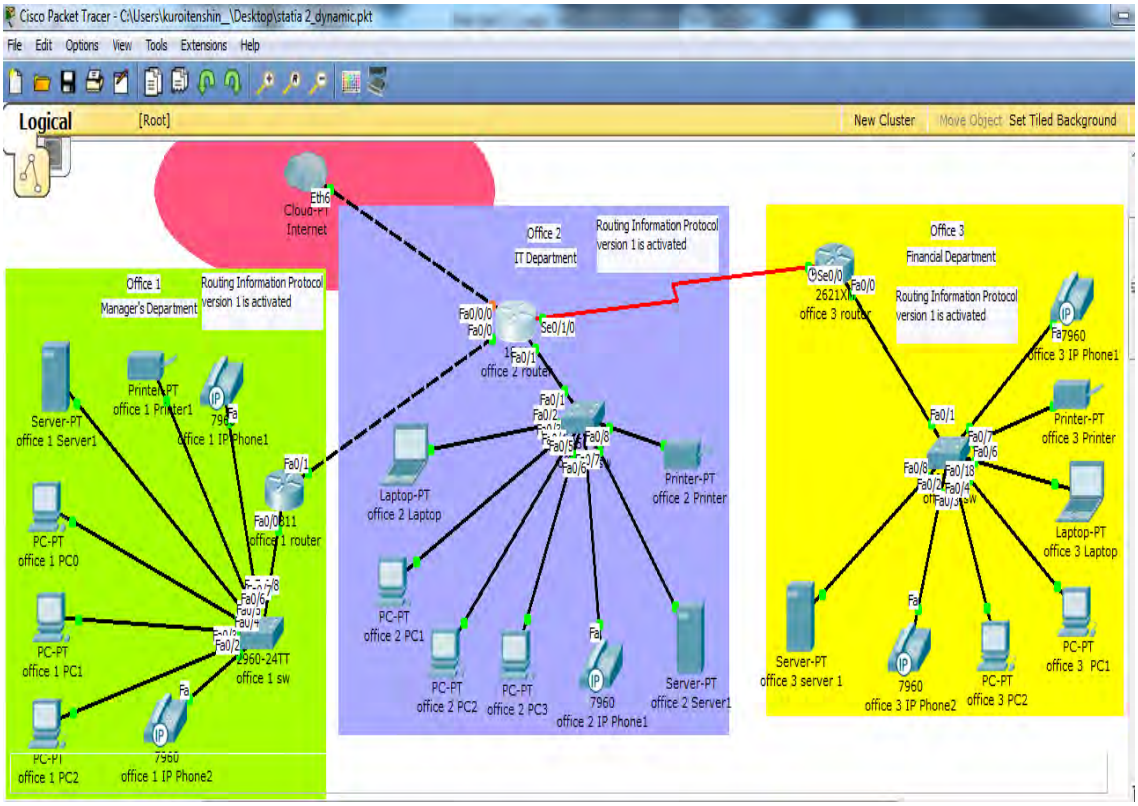

Fig.1. Common logical scheme of the whole computer network

As is known to all network administrators, each router consists of determinate numbers of network interfaces. In our communication scenario router “office 1” has got interface FastEthernet (Fa0/0) with number network ID (Net ID) - 10.10.1.0/27 and other FastEthernet (Fa0/1) with number network ID (Net ID) - 10.10.1.32/27 [30,31,32,33].

Router “office 2” has got interface FastEthernet (Fa0/0) with number network ID (Net ID) - 10.10.1.0/27, other interface FastEthernet (Fa0/1) with number network ID (Net ID) - 10.10.1.64/27, interface FastEthernet (Fa0/0/0)

for Cloud Internet and one interface Serial (Se0/1/0) with number network ID (Net ID) - 10.10.1.96/27 [2,4,6,8,9,10,11,16,17,18,19,20,21,22,23,24,25].

Router “office 3” has got interface FastEthernet (Fa0/1) with number network ID (Net ID) - 10.10.1.160/27 and one interface Serial (Se0/0/0) with number network ID (Net ID) - 10.10.1.96/27 [30,31,32,33].

The network 10.10.1.0/27 consists of one Cisco 2811 Modular Router and one Cisco Switch WS-C2960-24TT. In this switch are connected three personal computers, two Cisco IP Phones 7960, one printer machine and server machine. The network 10.10.1.32/27 is private local network and its IPv4 Default Gateway is 10.10.1.33/27 (This is the configured network address of interface FastEthernet (Fa0/1) in router “office 1”). The capacity of this network is 30 hosts. The connection between the Cisco switch and the hosts is made with Copper Straight-Through UTP cable cat.5e and the connection between the router „office 1” and the switch is made again with Copper Straight-Through UTP cable cat.5e [4,5,6,7,8,9,10,11,13,14,21,26,27,28,].

The network 10.10.1.64/27 consists of one Cisco 1841 Modular Router and one Cisco Switch WS-C2950-24TT. In this switch are connected three personal computers, one laptop, one laptop, two Cisco IP Phones 7960, one printer machine and one server machine. The capacity of this network is 30 hosts. The connection between the Cisco switch and the hosts is made with Copper Straight-Through UTP cable cat.5e and the connection between the router „office 2” and the switch is made again with Copper Straight-Through UTP cable cat.5e [4,5,6,7,8,9,11,14,15,16,19,18,20,30,31,32,33].

The network 10.10.1.96/27 consists of two routers - router „office 2” and router “office 3”. Their connection is of type Point-to-Point. In this case only two routers can establish a direct connection between them. Therefore, the subnet mask has a 30 bit prefix and it aims to save network address space in case additional hosts want to connect to this network. As is shown in Fig.1 the connection between routers „office 2” and “office 3” is serial and router “office 3” is a DCE device, that provides a clocking data signal used to synchronize data transmission between DCE and DTE devices. The clock data rate is configured to be 2000000 bit per second [1,4,6,7,8,12,13,14,18,19,22,23,24,25].

The network 10.10.1.160/27 consists of one modular router - Cisco 2621XM Modular Router and one Cisco Switch WS-C2950-24. In this switch are connected two personal computers, two Cisco IP Phones 7960, one printer machine and server machine. The IPv4 default gateway is 10.10.1.161/27 (This is the configured network address of interface FastEthernet (Fa0/0) in router “office 3”). The capacity of this network is 30 hosts. The connection between the Cisco switch and the hosts is made with Copper Straight-Through UTP cable cat.5e and the connection between the router „office 3” and the switch is made again with Copper Straight-Through UTP cable cat.5e [1,4,6,8,9,10,11,16,17].

On fig.2 the common physical scheme of the whole computer network is shown. The physical scheme of this computer network has consisted of the following items:

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

Central Equipment Room (CER) is consists of the following network devices:

- One modular router - Cisco 1841 Modular Router, one modular router - Cisco 2811 Modular Router, one modular router - Cisco 2621XM Modular Router.
- Two switches - Cisco Switch WS-C2950-24 and one switch - Cisco Switch WS-C2960-24TT.
- Three server machines.
- Two racks for the CER and one Packet Tracer Cloud Server for Internet. This is shown on fig.3.

Manager's Department - Office 1 is consists of the following network devices:

- Two IP phones - Cisco IP Phone 7960.
- Three personal computers.
- One printer machine.
- One server machine.

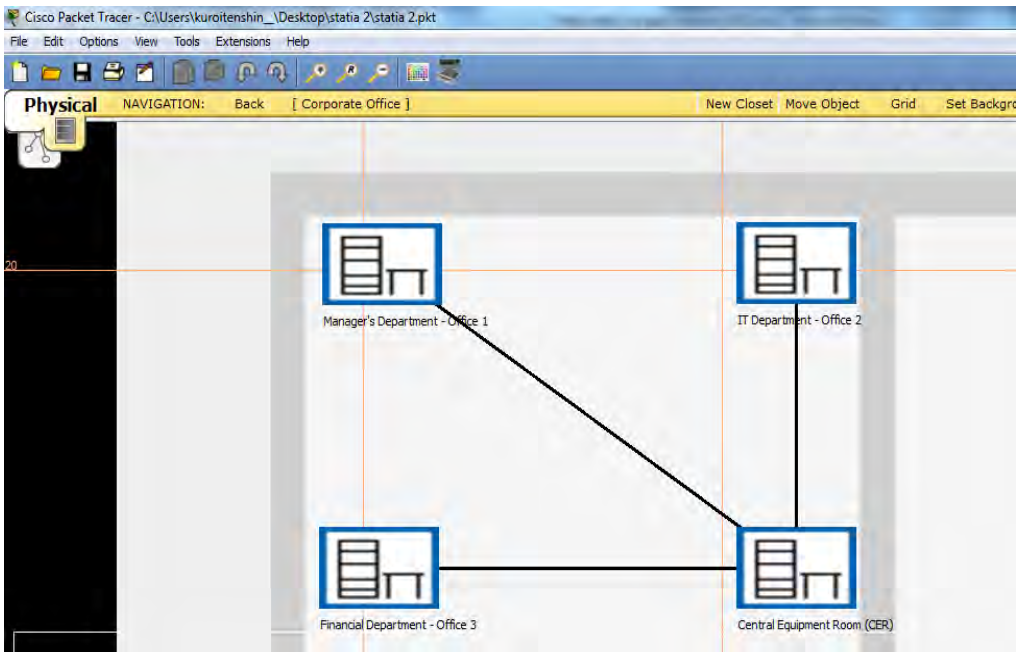

Fig.2. Common physical scheme of the whole computer network

4. Results

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 [1,2,3,4,5,6,7,8,9,10,11,15,19,20,21,22,23,24]. This is illustrated on fig.3.

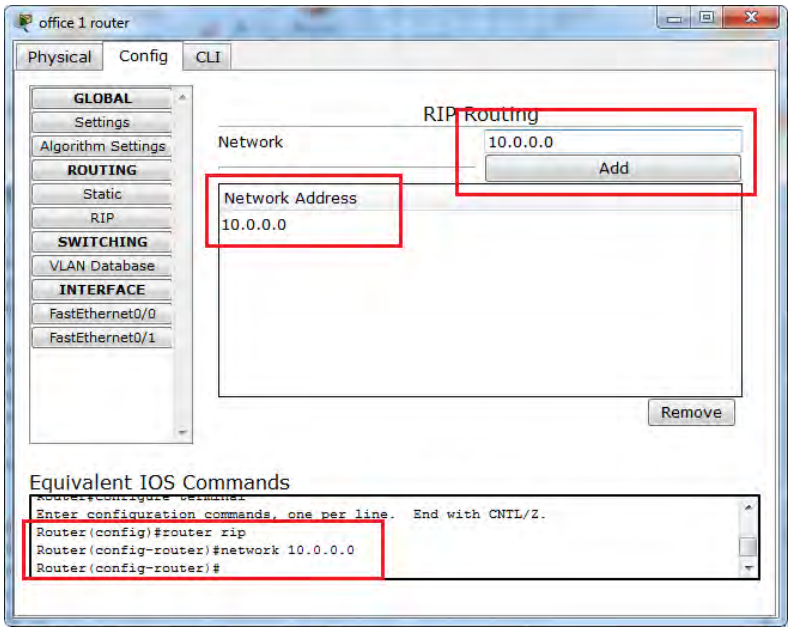

Fig.3. Activation of Routing Information Protocol in router “office 1”

On fig.4 successful ping between hosts office 1 PC1 and office 2 PC3 is illustrated.

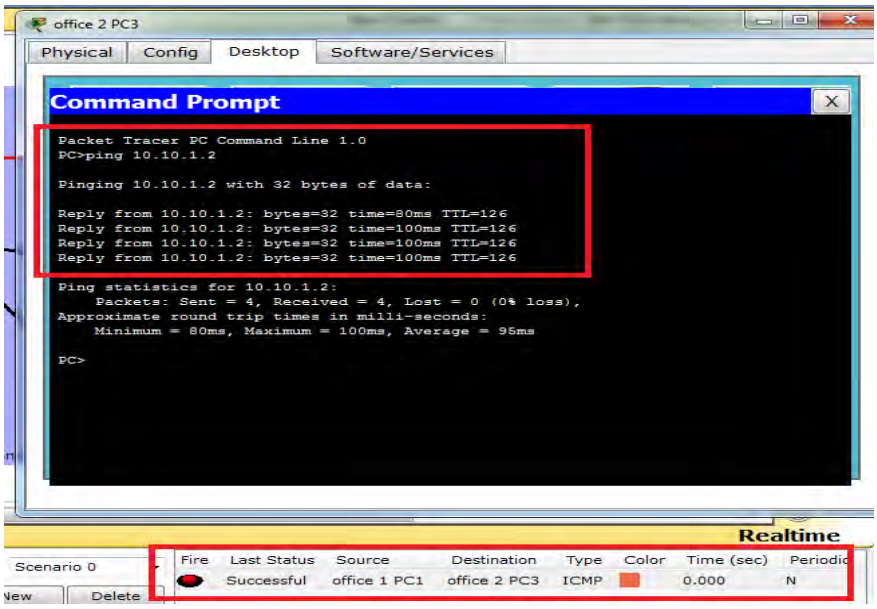

Fig.4. Successful ping between hosts office 1 PC1 and office 2 PC3

On fig.5 the common physical scheme of the Manager's Department - Office 1 is shown.

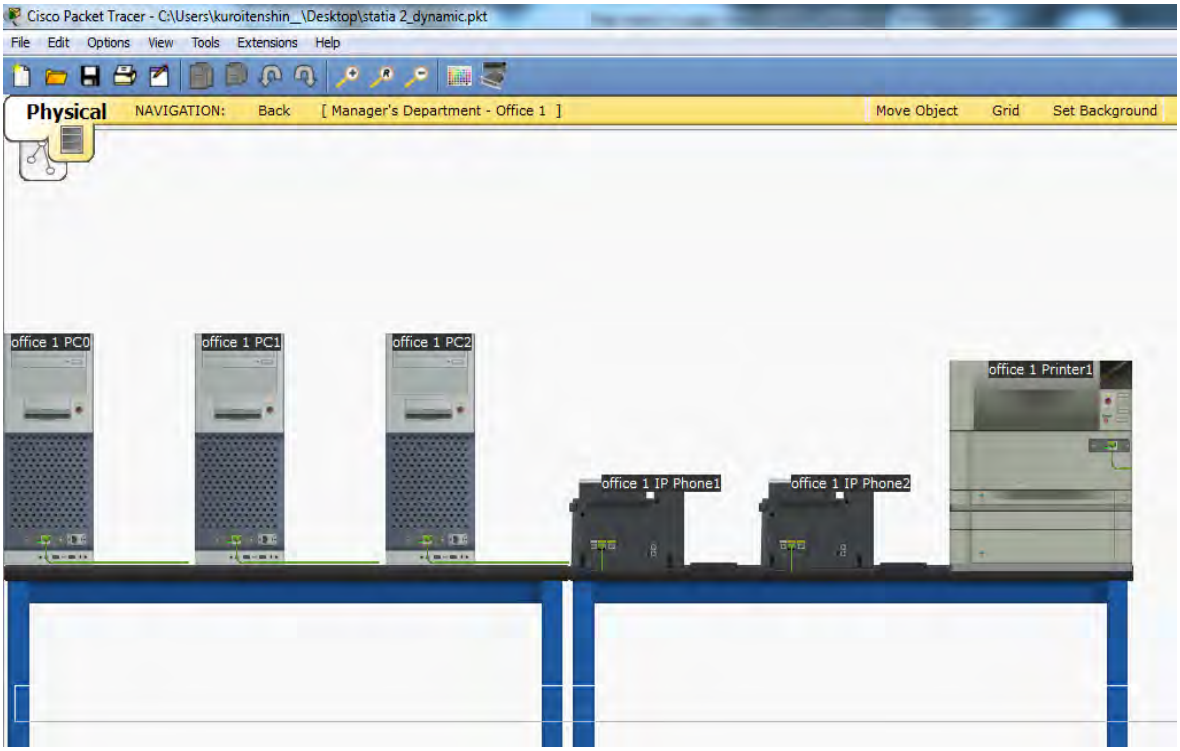

Fig.5. Common physical scheme of the Manager's Department - Office 1

Thanks to this program each plain user, system and network administrator and cyber professionals could obtain detailed graphical information about the server and network devices in the whole business corporate building [1,4,9,15,13,14,15,17,20,22,25,26,27,32,].

5. Conclusion

Some of the network administrators, security professionals and network architects can use the free of charge software program Cisco Packet Tracer in order to design and administer different corporate computer networks. Thanks to this program each IT expert is able to design physical and logical scheme of his local area network or wide area network. Subnetting allows system and network architects to save network address space in case you need to add more additional hosts to the network. Subnetting is an important method with that each security professional can provide access security level for each subnetwork in defined business corporate building. In this paper the routers had automatically discovered his neighbors' routers although there was subnetting (10.10.1.0/27) in the whole network.

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