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## **DESIGNING A SMALL CORPORATE BUILDING WITH FOUR WORKING COMPUTER DEPARTMENTS USING STATIC ROUTING AND SUBNETTING**

**Petar Boyanov**

*DEPARTMENT OF COMMUNICATION AND COMPUTER TECHNOLOGY, FACULTY OF TECHNICAL SCIENCES, KONSTANTIN PRESLOVSKY UNIVERSITY OF SHUMEN, SHUMEN 9712, 115, UNIVERSITETSKA STR, E-MAIL: peshoaikido@abv.bg*

### **ABSTRACT:**

*In this paper a small corporate building with four working computer departments using static routing is designed and made. Static 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, Hosts, IPv4, Network interface, LAN, Monitoring, Network, Port, Security, Static routing, 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 [30,31,32]. One of the ways doing this responsible work is connected with the use of specialized software program called "Cisco Packet Tracer". This program has a great set of tools that can simulate small and large computer networks [5,6,7,9,12,13,14,16,18,23,26,28,29,30]. 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 method of data static routing [1,2,3,4,8,10,11,15,17,19,20,21,22,24,27,33].

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 [6] Techniques for prefix subnetting by Kirk Erichsen, Howard Lee and Ken Gould is presented. In [14] Internet standard subnetting procedure by Jeffrey Mogul is made. In [31] some different methods and systems for subnetting in a switched IP network by Deepak Vig is shown. In [33] IP addressing and subnetting including IPv6 protocol by J. D. Wegner, Robert Rockell and Cameron Brandon is 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 [1,2,3,4,5,6,7,30,32,33]:

- 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 static routes were manually entered in the routing table of the routers.

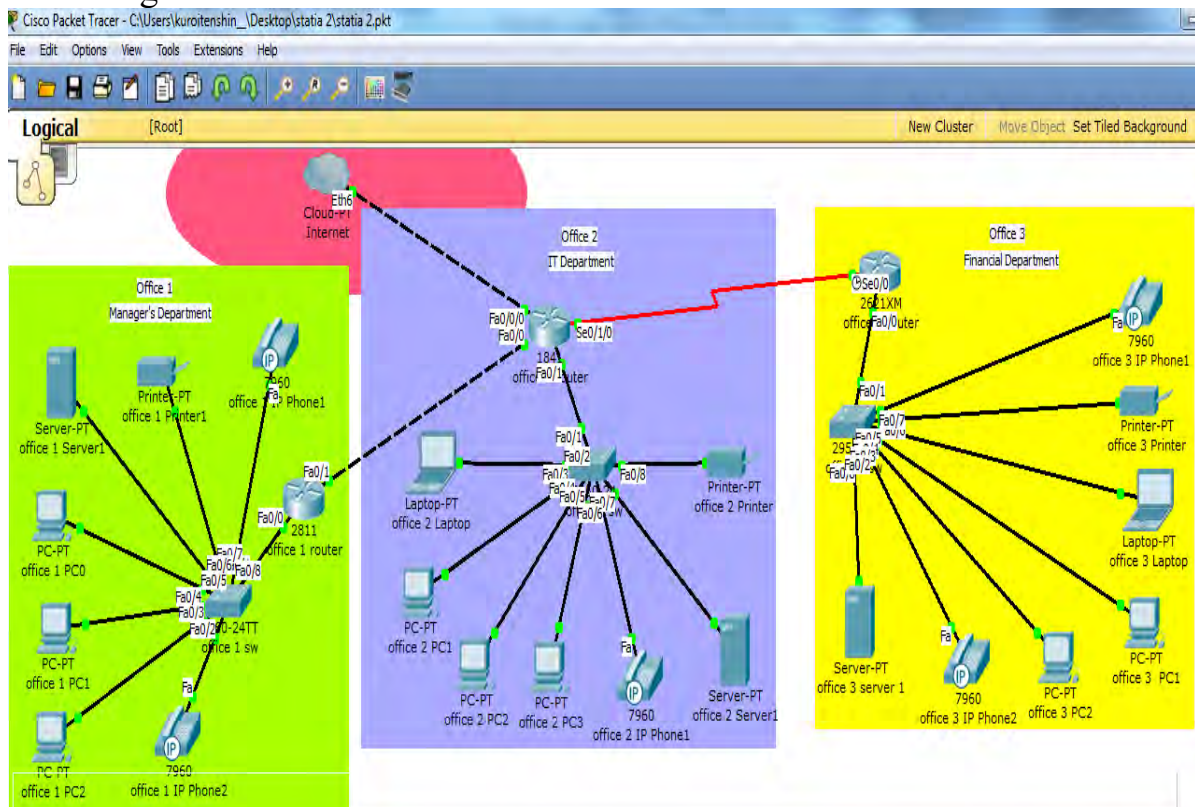


Fig.1. Common logical scheme of the whole computer network

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 [5,6,7,9,11,15,30,31,32,33].

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 [20,21,22,24,25,30,31,32,33].

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 [5,6,7,8,10,11,12,13,14,16,18].

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 [30,31,32,33].

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 [21,22,23,25,28,30,31,32,33].

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 [1,2,3,4,5,6,7,10,11,20,29,30].

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 [30,31,32,33].

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.

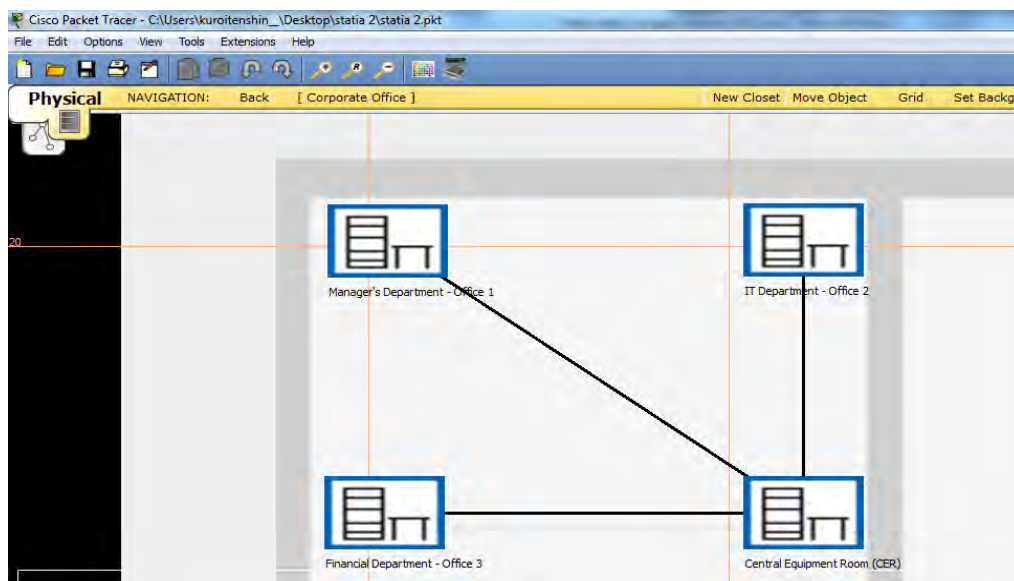


Fig.2. Common physical scheme of the whole computer network

#### 4. Results

In fig.3 successful ping between hosts office 1 PC1 and office 3 PC2 is illustrated.

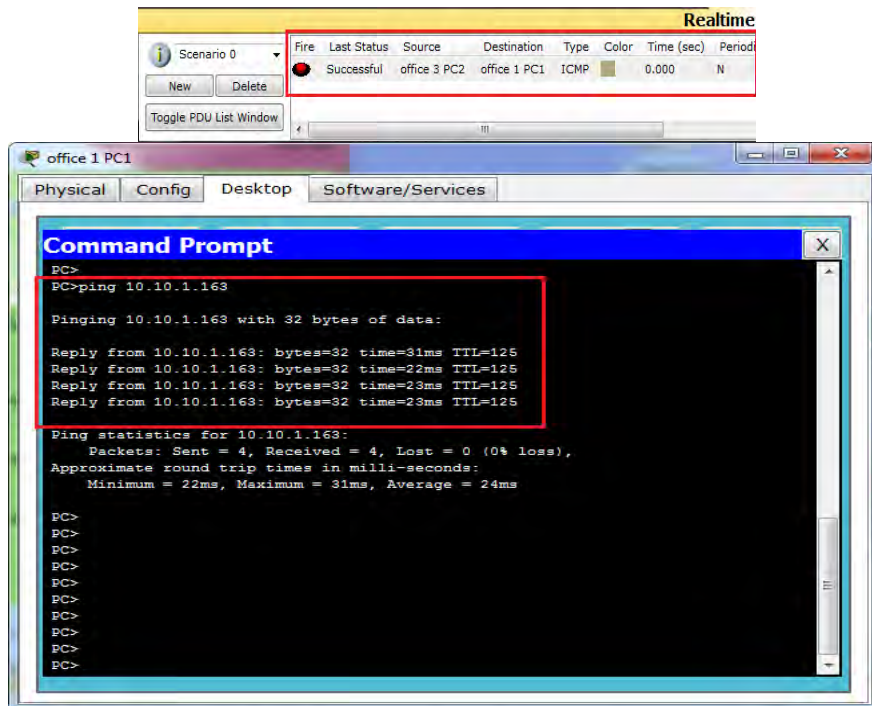


Fig.3. Successful ping between hosts office 1 PC1 and office 3 PC2  
On fig.4 the common physical scheme of the Central Equipment Room (CER) is shown.

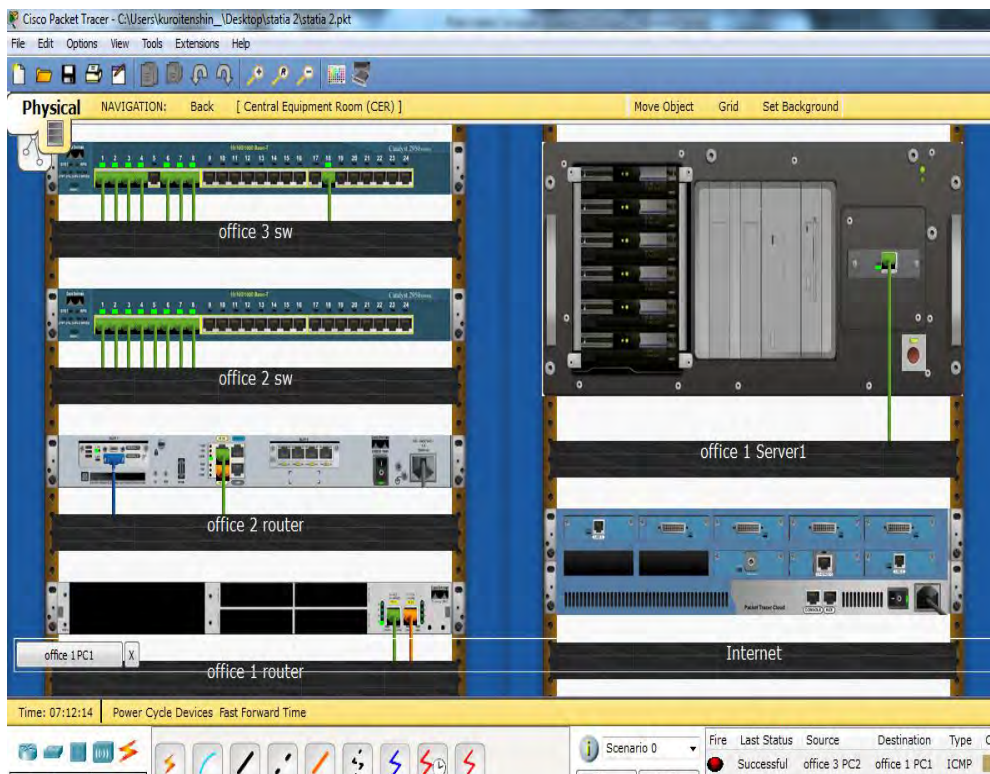


Fig.4. Common physical scheme of the Central Equipment Room (CER)

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. [4,13,14,15,17,24,26,30,31,33].

## **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 learnt all of the remote subnetworks using static routes in their routing table.

## **Acknowledgements**

This paper is supported by the Project BG051PO001-3.3.06-0003 “Building and steady development of PhD students, post-PhD and young scientists in the areas of the natural, technical and mathematical sciences”. The Project is realized by the financial support of the Operative Program “Development of the human resources” of the European social fund of the European Union.

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