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# CONSTRUCTION AND SIMULATION OF OPTICAL LOCAL AREA COMPUTER NETWORKS FOR THE NEEDS OF THE ACADEMIC INSTITUTIONS

**Abstract:** In this paper a construction and simulation of optical local area computer networks for the needs of the academic institution is made.

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## 1. Introduction

This paper discusses a technical solution for cabling residential or administrative buildings to provide broadband access to any apartment or office. Particular attention is paid to optical fibers and cables, passive and active optical components, optical receivers, transmitters, optical regenerators and optical amplifiers, planning, design, construction and operation of optical cable lines, measurements in optical communication equipment, optical telecommunication systems generally [1], [2], [20], [21], [22], [23], [25], [26], [27],[28].

Over the last decade, the development of various types of information and communication networks is closely linked to the widespread use of fiber optic communications. Fiber optic communication systems or fiber optic cable lines and networks are a type of transmission system where information is transmitted, transmitted and distributed aided by optical dielectric waveguides, known under the popular name fiber optics. At present optical fibers are the most perfect and promising physical environment for transferring information telecommunication signals [29], [30], [31], [32]. The transmission of information by means of fiber optic and fiber-optic cable communication lines and networks provides enormous advantages over conventional communication transmission systems using copper wire communication cables [4], [7], [8], [10], [11], [13], [14], [15], [29], [30], [31], [32].

## 2. Simulation of optical local area computer networks

The all optical local area computer networks in the Cisco Packet Tracer version 6.2.0.0052 programming environment are simulated. On fig.1 the general scheme of the optical computer networks is shown.

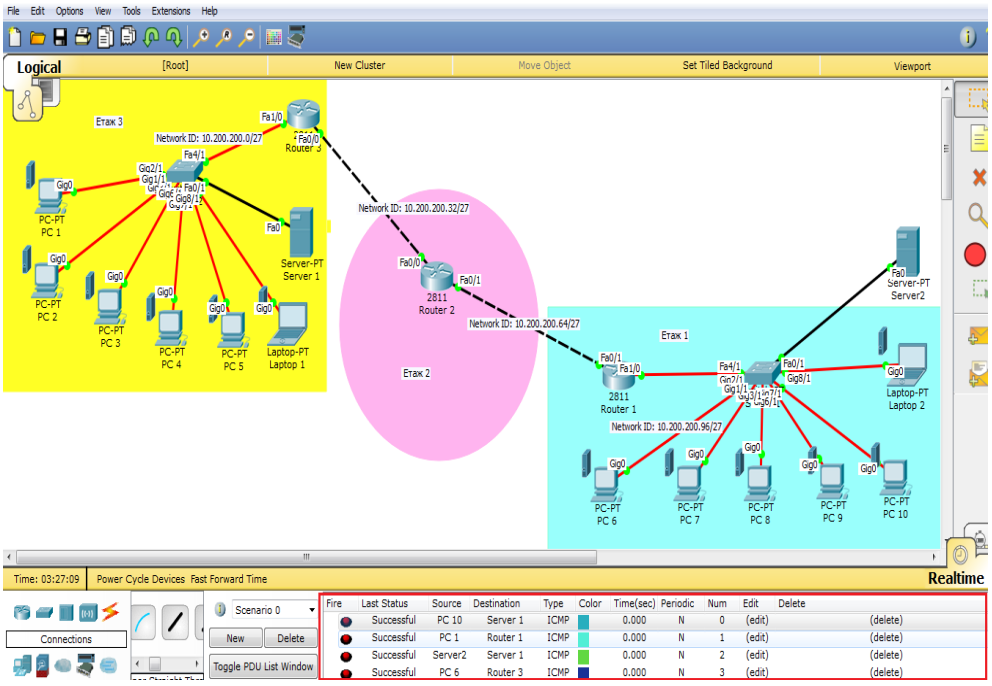


Fig.1. General scheme of the computer networks

**Communication links**

As is known, each router has a number of network interfaces. In our communication scenario, Router 1 has a FastEthernet (Fa1/0) interface with Net ID 10.200.200.96/27 and another FastEthernet (Fa0/1) with Net ID 10.200.200.64/27.

Router 2 has a FastEthernet interface (Fa0/0) with Network ID (Net ID) - 10.200.200.32/27 another FastEthernet (Fa0/1) interface with network ID 10.200.200.64/27.

Router 3 has a FastEthernet interface (Fa1/0) with network number 10.200.200.0/27 and one FastEthernet interface (Fa0/0) with network number 10.200.200.32/27.

The 10.200.200.0/27 network consists of a Cisco 2811 Modular Router and a single Cisco Switch WS-CSwitch-PT. Five PCs, one laptop and one server are connected to this switch. The network with the number 10.200.200.32/27 is a private local computer network and its default gateway (IPv4 Default Gateway) is 10.200.200.33/27. This is the configured network address of the FastEthernet interface (Fa0/0) in the router "Router 3". The capacity of this network is 30 hosts. The connection between the switch and the hosts is made using cross-cables - Copper crossover cables UTP cat.5e and the connection between the router "Router 3" and the switch "Switch 2" is implemented through an **optical** cable [12], [16], [17], [18], [19].

The 10.200.200.96/27 network consists of a Cisco 2811 Modular Router and a single Cisco Switch WS-CSwitch-PT. Five PCs, one laptop and one DHCP server are connected to this switch. The capacity of this network is 30 real hosts. The connection between the switch and the hosts is accomplished by optical cables and separately the connection between the router "Router 1" and the switch is again performed via an **optical** cable [3], [5], [6], [7], [9], [10].

The web with the number 10.200.200.64/27 consists of two routers "Router 2" and "Router 1". They are connected to cross-cables Copper crossover cables UTP cat.5e.

On fig.2 shows the general physical circuit diagram of the optical computer network. The physical layout consists of the following floors of a building:

- 1st floor.
- Floor 2.
- Floor 3.
- Central Equipment Room (CER).
- Physical cable connection between each floor.

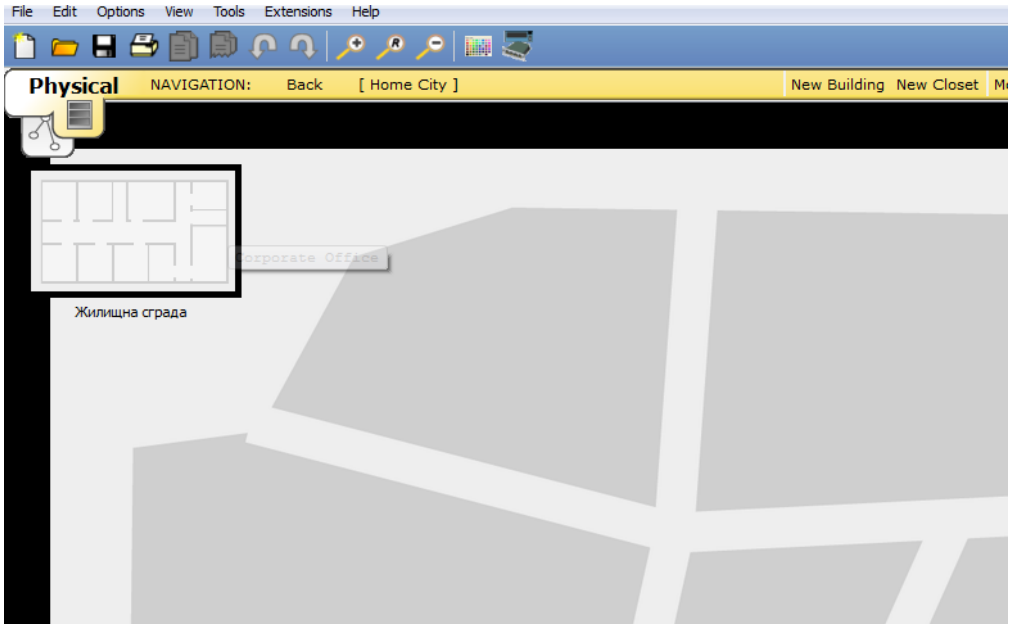


Fig.2. general physical circuit diagram of the optical computer network

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

• Router Cisco 1841 Modular Router and Router - Cisco 2811 Modular Router.

• Two Cisco Switch WS-CSwitch-PT Switches.

• 2 servers.

• One item of rack. This is shown on fig. 3.

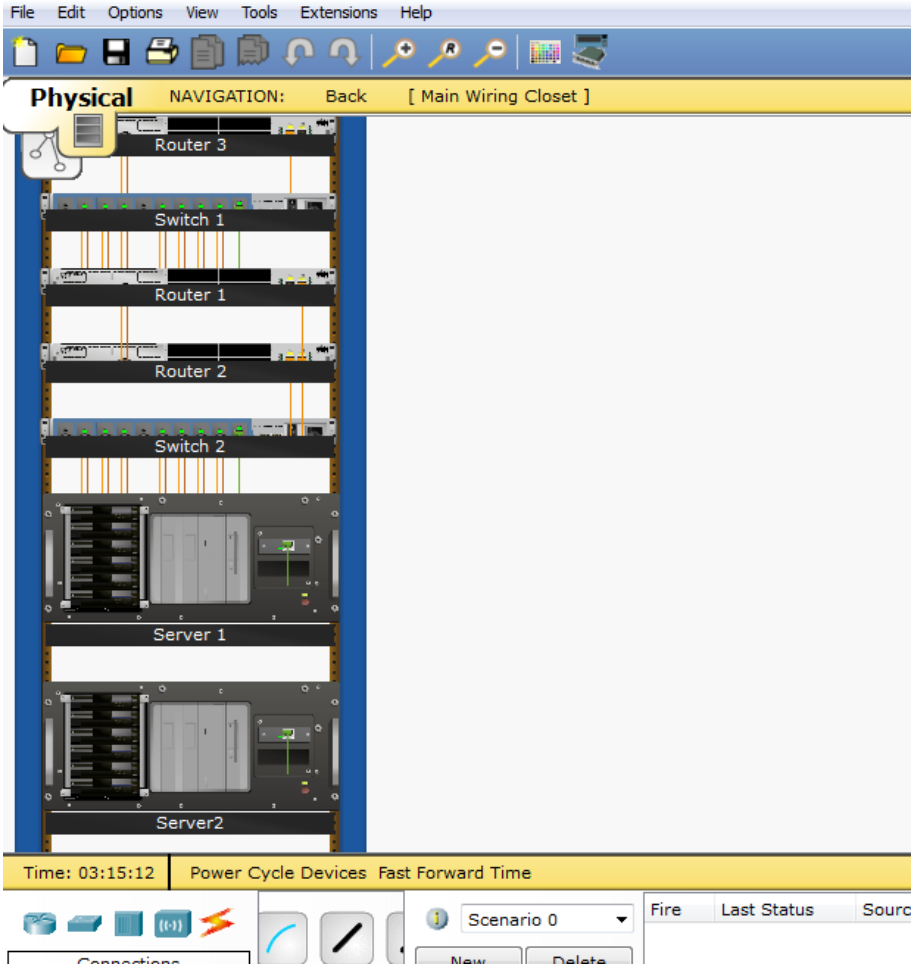


Fig.3. Communication rack

On fig.4 it has been shown that the DHCP service delivers the IPv4 network addresses correctly with the number 10.200.200.0/27.

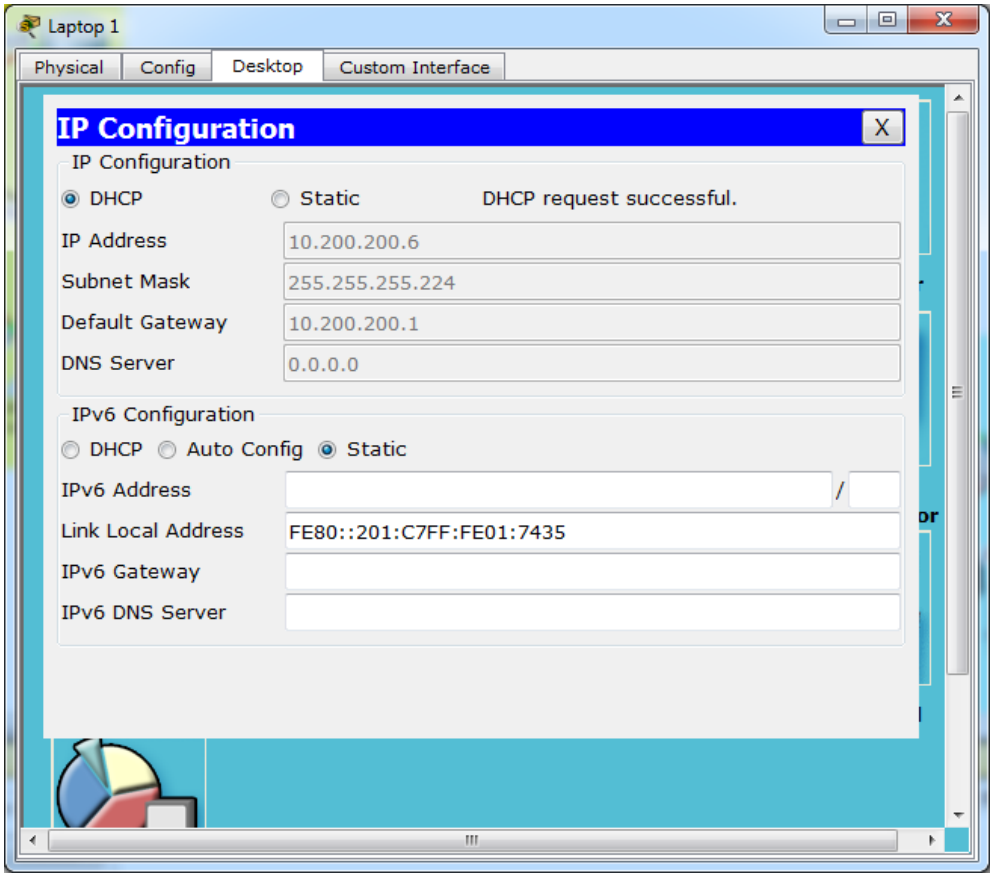


Fig.4. Proper distribution of IPv4 configurations

On fig.5 and fig.6 show that there is a complete network connection between the different subnets of the entire computer network. Host "PC 3" sends ICMP ECHO Request requests to host "PC 8". The application that implements this communication process is Ping. All-routine routing of network information between routers is applied. The following networking module for optical connectivity on PCs and laptops is used - "The Cisco Gigabit Ethernet Network Module (PT-HOST-NM-1FGE) provides Gigabit Ethernet optical connectivity for access routers." The dedicated network module of the „Single-port Cisco Gigabit Ethernet Network Module (PT-SWITCH-NM-1FGE)“ module provides Gigabit Ethernet optical connectivity for access routers [19], [20], [21], [22], [23], [24], [25], [26], [27], [28]. The module is supported by the Cisco 2691, Cisco 3660, Cisco 3725, and Cisco 3745 series routers. This network module has one gigabit interface converter (GBIC) slot to carry any standard copper or optical Cisco GBIC ".

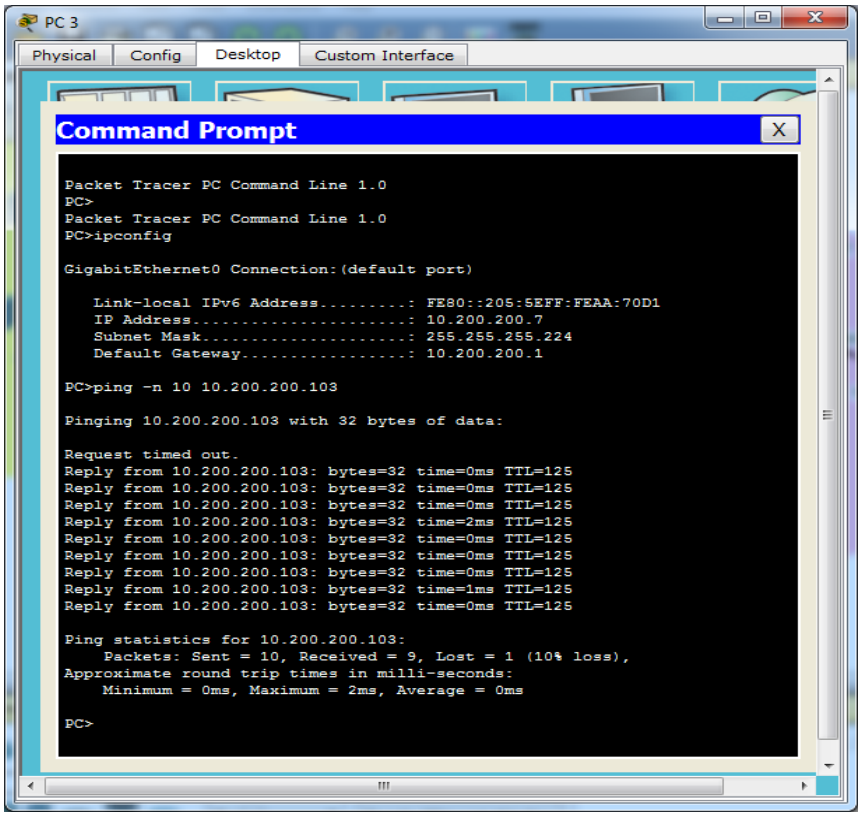


Fig.5. Successfully established connection between two hosts (10.200.200.7 and 10.200.200.103)

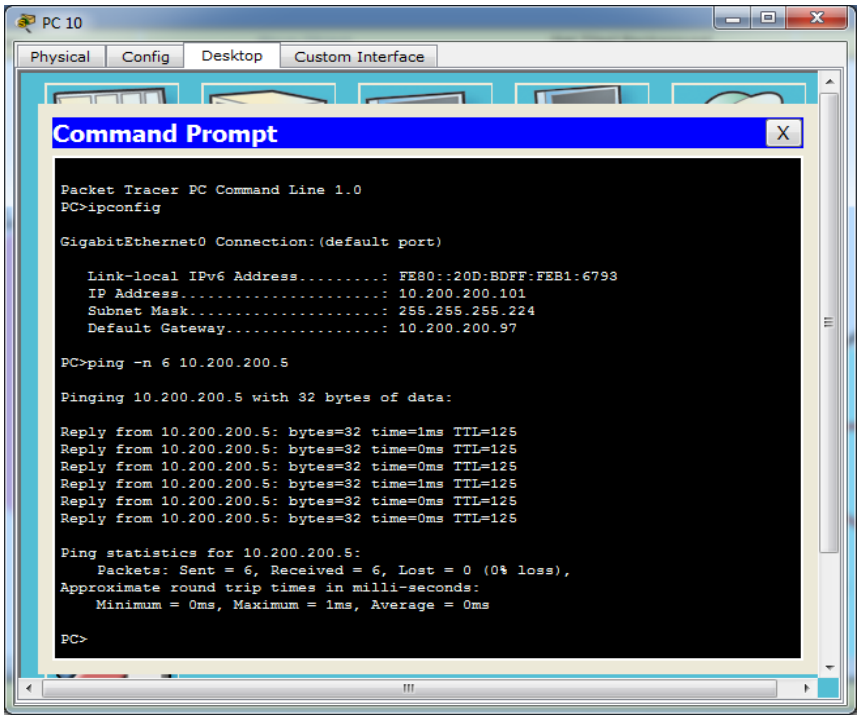


Fig.6. Successfully established connection between two hosts (10.200.200.101 and 10.200.200.6)

On fig.7 detailed information about the transmitting of network packets across the individual network devices into the optical computer network is shown.

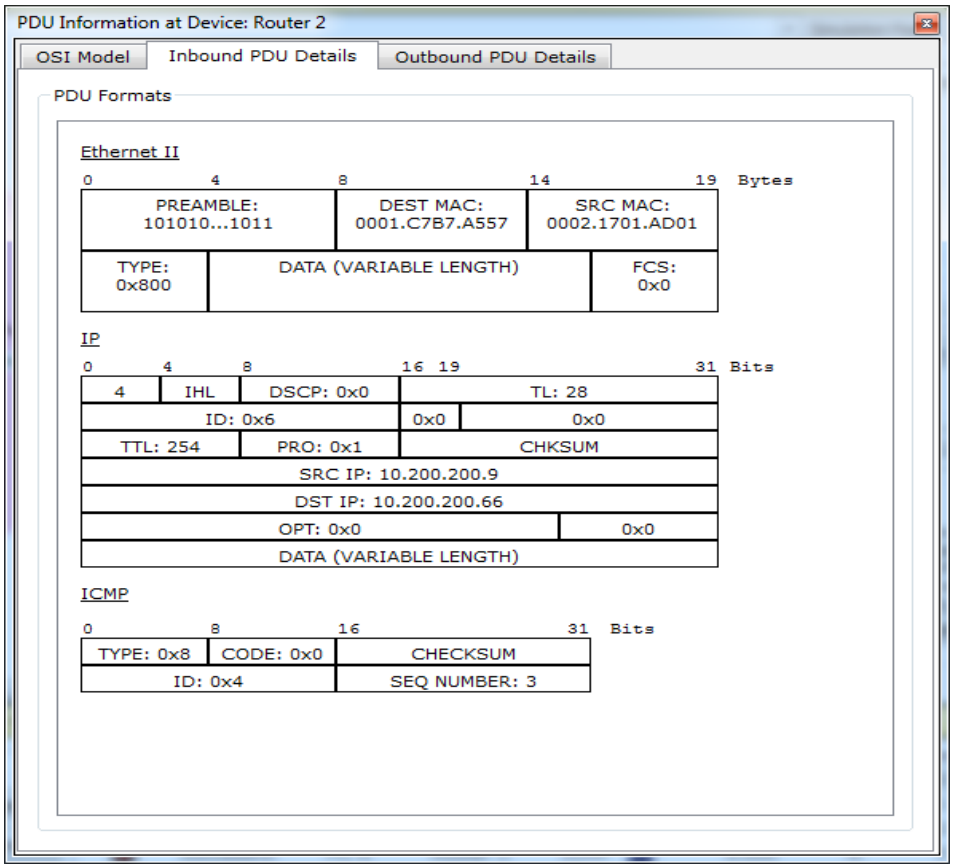


Fig.7. Transmitting of network packets across the individual network devices into the optical computer network

**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, consisting of several hosts and a home-based local computer network consisting of four hosts. Everything illustrated and explained in this paper is for research purposes and the authors are not responsible in cases of abuse.

### 3. Conclusion

The massive use of broadband services over recent years has shown the need for technology such as PON. The amount of information that daily exchanges even an average home user is already calculated in tens of gigabytes. With an avalanche increase in the number of subscribers to a typical Internet service delivery network, classic methods of access and data transfer are becoming more and more pungent. At the same time, optical fiber offers practically unlimited capacity in terms of bandwidth. This, in simple terms, means that delivery through PON would provide security and guarantees that all future needs and needs of "traffic" will be covered. Somewhat weakness of this system is the fact that it does not provide for a back-up mechanism. In case of failure of one end device of the supplier or mains cable, all connected subscribers are virtually extinguished, and the time for troubleshooting can vary from several hours to several days. PON networks have some undeniable advantages like security and speed.

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