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Construction of Effective Model of Computer Network By Means of Systems of Simulation Modeling

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Abstract

Study of modern information systems and existence of modern systems of study helps to develop new models. These models will become the basis of effective organization of computer systems and networks. It's very important task at the current stage of development of computer networks. The article considers the issues regarding to development of models in the modern technological environment of simulation. These models will increase the efficiency of organization of internet-space. Besides, investigators will get ready-made automated environment of simulation, where they will be able to make independent simulation experiments to increase the efficiency of organization of information system.

Keywords: Computer Networks; Network Simulation; System Modeling

Introduction

The efficient design and organization of network imply the abundance of design scenarios and fulfillment of requirements related to specifications of efficient network. Simulation theory is used to improve the efficiency of design. One of the branches of simulation theory is simulation modeling. In the environment of simulation modeling alternative scenarios of design are studied and the best solutions are chosen. The modern technologies of simulation are rapidly developing. High-level macro-languages of simulation, based on the simulation technologies, significantly reduce time and effort spent on development of models in the cycle of simulation. The article considers the problem of development of studied models by means of Any Logic language of multi-agent simulation. Usage of Any Logic gives opportunity to estimate the effect of structural decisions in the complex systems of real life. Simulation experiments are conducted and recommendations, based on correct management of system, are given to efficiently design the computer network.

The Main Content

Efficient planning of computer networks is actual task. First of all, we must study the aim of design of network and criterions of evaluation of efficiency to design computer networks efficiently. Criterions may be cost reduction, improvement of network's efficiency, possibility of future development, possibility of introduction of new technologies, etc. Different techniques of simulation modeling are used to avoid unnecessary expenses and efficiently plan the computer networks. Simulation network must be similar to planned network as much as possible at the stage of simulation. Let's consider the computer network on the basis of which parameters of real network will be selected.

Methodology

In our case simulation network is the network of internet provider. It includes four nodes (Node 1 - Internet provider (ISP); Node 2; Node 3; Node 4) (Fig. 1). Each node is connected to main node (ISP). Nodes are connected with multi-mode optical cable. ISP is connected to Node 2 by means of circular topology. Node 2 is connected to Node 3 without protection to reduce financial expenses. Node 4 is directly connected to ISP without protection.[2]

Simulation experiments are conducted and recommendations, based on correct management of system, are given to efficiently design the computer network

ISP includes the following devices: router, two switches, servers WWW, MAIL, FTP, etc. Four switches are connected to Node 2 (Fig. 2). Consumers are connected to these switches.

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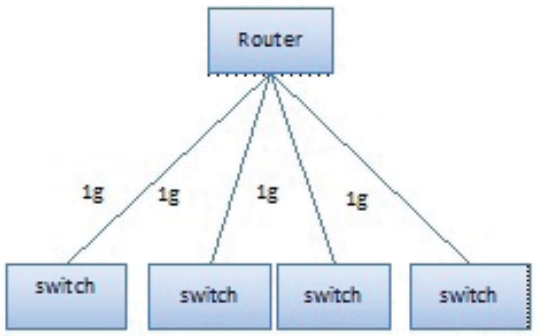

Figure 1
Scheme of operation of Node 1

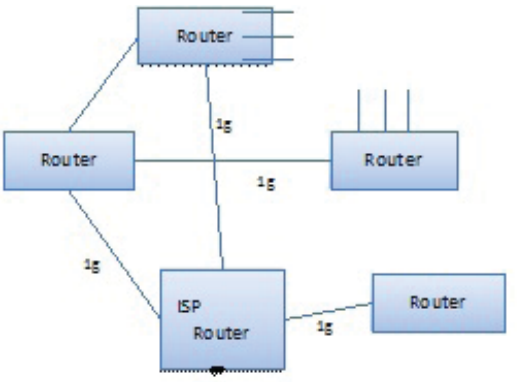

Figure 2
Scheme of connection of nodes to internet provider

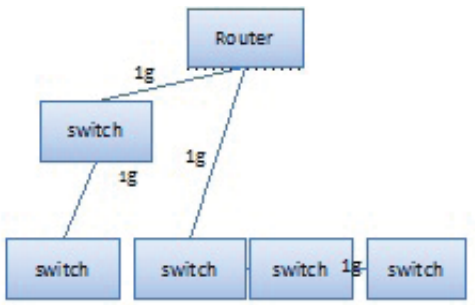

Figure 3
Scheme of operation of Node 3

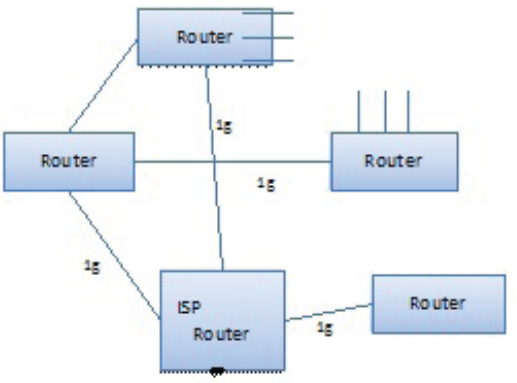

Figure 4
Scheme of operation of Node 4

Serially connected three switches are connected to Node 3 (Fig. 3).

Five switches are connected to Node 4. Three of these switches are serially connected. Other two switches make independent network (Fig. 4)

As a result of studies, reaction time, transfer time, load coefficient and quantity of lost packets were determined. It was determined that growth of internet traffic reduces system's reaction time. In this case large quantity of packets is lost in the network and internet becomes much slower. The results of observation of reaction and delay time are shown in Table 1 and corresponding diagram is shown on Fig. 5.

We simulated similar network by means of packet ANYLOGIC of simulation modeling to solve the above-

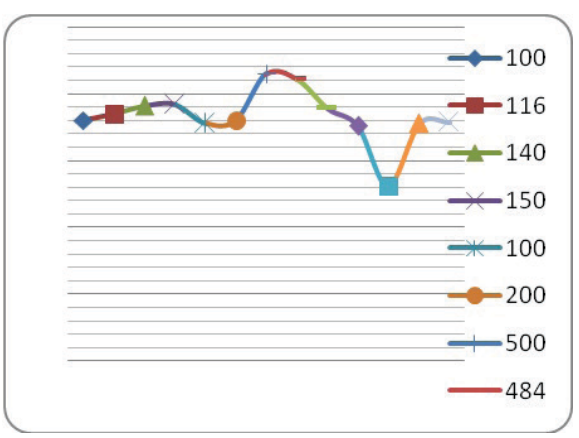

Figure 5
Dependence of reaction and delay time on loads

Time	g 0/1	g 0/2	g 0/3	g 0/4	TTL
10	100	96	104	101	180
12	116	107	120	108	185
14	140	125	136	129	191
16	150	140	148	155	192
18	100	109	96	85	178
20	200	195	209	218	180
22	500	516	517	503	215
24	484	502	500	505	211
2	350	420	384	340	189
4	246	261	205	240	176
6	114	106	97	140	131
8	64	54	41	64	178
10	102	105	117	100	179

Table 1:
Reaction dependence and delay time on loads in time interval.

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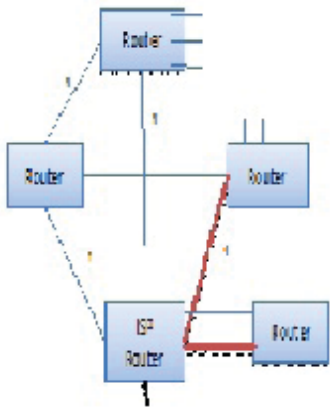

Figure 6
New network with circular topology

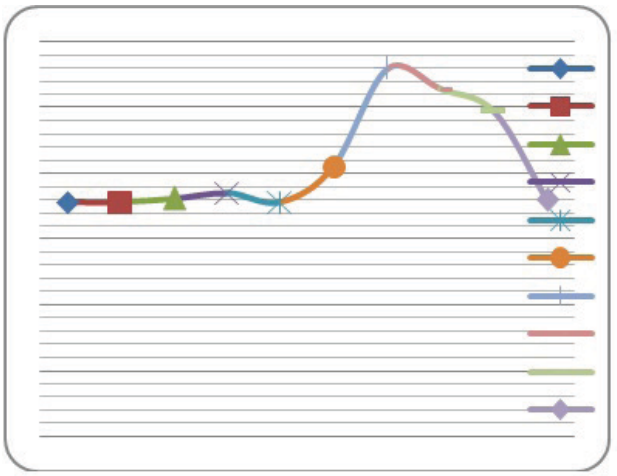

Figure 7
Dependence of reaction and transfer time on traffic

mentioned problems and made different experiments, particularly:

Network was developed by means of circular topology;

Additional channel was introduced in Node 4 in parallel with increasing the loads;

Node 3 and Node 4 were remade by means of star topology.

The results of study show that network should be similar to Fig. 6 to solve the present problems. The corresponding diagram will be similar to Fig. 7. Improvement is significant.

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