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ESTIMATION OF PARAMETERS OF PRODUCTIVITY OF INFORMATION NETWORKS

In work the approach and software of simulation modelling of information networks, in particular, Intranet are described. Time of transfer of query and reception of the answer from a WEB-server are estimated at different algorithms of channels switching with the fixed and adaptive routing.

Keywords – information network, simulation modelling, fixed routing, adaptiv routing, time of transfer of query.

1. Introduction

Information networks as means of reception, preservation and transfer of the information become necessary compound of informational development of a modern society. Unlimited growth of users quantity results to the decision of the problems connected with increasment of liaison channels speed, distribution of information streams, creation of new ways and algorithms for information transfer, new ways of routing. In this connection the need for development of methods and means of modelling of such systems grows in order to analyse them, optimization and forecasting of their behaviour at change of the traffic for information transfer. The methodology and software tools for simulation modelling computer structures were described in [1], [2]. In the given work the problem is to create system of simulation modelling for research of different configurations of information networks, in particular, Intranet.

2. Statement of a problem

Functioning of similar networks is well enough described by circuits of the queueing theory. Basic elements of such networks are data channels, communications routers, WEB-servers and servers of databases, workstations which are sources of inquiries to servers. All these elements are represented by queueing system (QS) which are united in queueing network which represents finally, model of functioning of an information network.

Thus the problem of simulation modelling is reduced to the following:

Model M of a network are given

$M = < Q, R, A, L, S >$,

where Q - set of QS,

R - the operator of interface QS,

A - set of algorithms of functioning,

L - set of laws of distribution of parameters,

S - set of parameters which describe streams of queries.

To determine such characteristics of behaviour of a network as:

- parameters of distribution of time of transfer of queries,
- parameters of distribution of time of reception of answers,
- parameters of distribution of time of the response (time between the moment of submission of query and the moment of reception of the answer),
- average and maximal lengths of queue in QS,
- parameters of distribution of a waiting time in QS,
- distribution of loading of channels QS.

3. The description of model and program realization

Schematically topology of model of an information network submitted in figure1. Set of the local networks is displayed on it which include workstations and WEB-servers which are connected between itself routers and data channels. As it was specified in statement of a problem all these making models are interpreted QS.

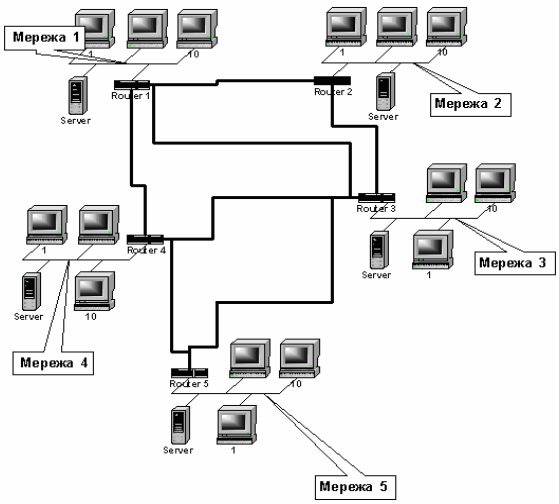

Fig. 1. Topology of an information network.

Each of workstations generates under the given law of distribution queries inquiries to WEB-servers. Popularity of WEB-servers which characterizes quantity of references to them, is set by the appropriate distribution. Data channels are characterized by speed and length of turn and routers - the appropriate algorithms of routing. On given time the circuit of data transmission with switching channels behind two algorithms is realized: with the fixed routing and adaptive which takes into account congestion routers.

The structure of model is open in that understanding that it provides an opportunity of addition of the model as other algorithms of routing and ways of data transmission and different laws of distribution of model parameters. The model is given in language Delphi in Windows environment.

4. The analysis of results

Modelling was carried out for network Intranet which included five local networks (figure 1). The summary routing information for all routers is given in Table 1.

TABLE 1

THE TABLE OF ROUTES

FIXED			ADAPTIVE (the initial data)		
Network - source	Router of the appropriate networks	Final network	Network - source	Router of the appropriate networks	Final network
Network 1	1-2	Network 2	Network 1	1-2	Network 2
Network 1	1-3	Network 3	Network 1	1-3	Network 3
Network 1	1-4	Network 4	Network 1	1-4	Network 4
Network 1	1-33-44-5	Network 5	Network 1	1-44-5	Network 5
Network 2	2-1	Network 1	Network 2	2-1	Network 1
Network 2	2-3	Network 3	Network 2	2-3	Network 3
Network 2	2-33-4	Network 4	Network 2	2-11-4	Network 4
Network 2	2-33-44-5	Network 5	Network 2	2-33-5	Network 5
Network 3	3-1	Network 1	Network 3	3-1	Network 1
Network 3	3-2	Network 2	Network 3	3-2	Network 2
Network 3	3-4	Network 4	Network 3	3-4	Network 4
Network 3	3-5	Network 5	Network 3	3-5	Network 5
Network 4	4-1	Network 1	Network 4	4-1	Network 1
Network 4	4-33-2	Network 2	Network 4	4-11-2	Network 2
Network 4	4-3	Network 3	Network 4	4-3	Network 3
Network 4	4-5	Network 5	Network 4	4-5	Network 5
Network 5	5-33-22-1	Network 1	Network 5	5-44-1	Network 1
Network 5	5-33-2	Network 2	Network 5	5-33-2	Network 2
Network 5	5-3	Network 3	Network 5	5-3	Network 3
Network 5	5-4	Network 4	Network 5	5-4	Network 4

Parameters of streams of queries from workstations to WEB-servers were accepted identical and made: the average size of query - 1 кВ, and intensity - 0.1 query/c. Popularity of WEB-servers was determined under the uniform law of distribution. Intervals of time between the moments of generation of queries and intervals of a holding time of queries WEB-servers were distributed for exponential law with parameters $\lambda = 0.1c^{-1}$ and $\lambda = 0.5c^{-1}$ accordingly. Speed of data transmission by channels made 100 kB/c. Results of modelling are displayed on figure 2 and figure 3.

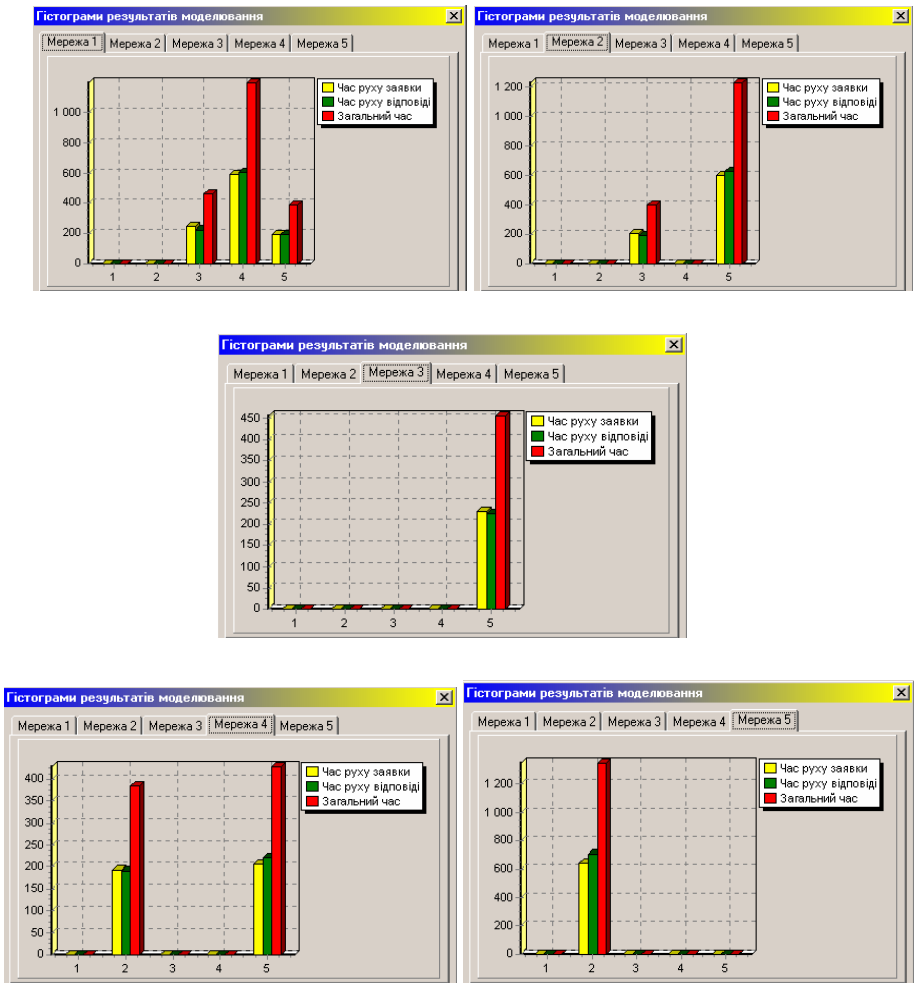

Fig. 2 Time of movement at the fixed routing.

Time of the response for local networks was compared at different algorithms of routing: fixed and adaptive. For adaptive routing congestion routers was taken into account and streams of queries inquiries were redirected in view of this congestion. Apparently from figure 2 and figure 3 for all local networks without exception time of the response at the fixed routing is much more than time of the response at adaptive routing, considering identical parameters in both cases of WEB-servers, workstations, data channels and routers.

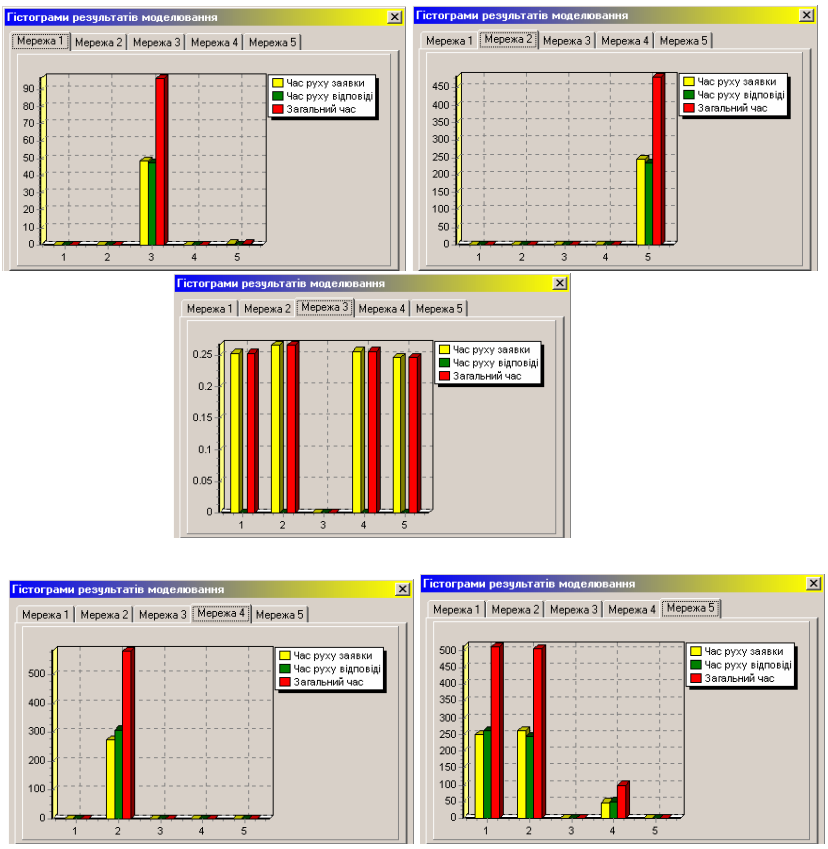

Fig. 3. Time of movement at adaptive routing.

It speaks that at the first way of switching the table of routing had a constant kind which not always is optimum. In the second case the routing table changed according to congestion routers that has increased productivity of work of a network, has reduced time of movement of queries and answers, has made the traffic more uniform.

5. Conclusion

The offered model allows to investigate information networks with the purpose of definition of parameters of productivity. It enables to estimate quality of service by a network at increase of quantity of queries in unit of time and to determine bottlenecks which reduce productivity of a network. The model and the appropriate tool means of simulation modelling can be used by system administrators for forecasting productivity at rearranging networks or increasement of the queries traffic.

References

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