ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 12 , December 2019

Evaluation of the Cost-Effectiveness of Telecommunications Network Parameters

S.S. Parsiev, U.M.Abdullaev

Ph.D. Associate Professor, Head of the Department of Hardware and Software of Management Systems in Telecommunication, The Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Tashkent, Uzbekistan

Senior lecturer, Department of Hardware and Software of Management Systems in Telecommunication, The Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Tashkent, Uzbekistan

ABSTRACT:In this paper, the prospects of the development of info-communication networks are considered, the basic directions of their development are given, mathematical model for calculation of info-communication networks probability-time characteristics is offered, info-communication networks optimal design technique based on well-known mathematical models is introduced.

KEY WORDS: info-communication networks, Next Generation Networks, telecommunications networks, optimization methods, probabilistic-time characteristics, network-wide discounted costs.

I.INTRODUCTION

The modern stage of social development is continuously connected with the movement towards building a global information society. This trend is largely achieved through the development and improvement of info-communication networks, a significant improvement in their performance, which primarily include the characteristics of the quality of service of all classes transmitted in these networks of traffic.

If quite recently the main mass of services provided by a wide range of data network subscribers was access to Internet resources, at the present time, this popular service is often supplemented by the services of sound and television broadcasting, IP-telephony of high-speed data exchange between users and others.

The introduction of these services, provided through modern multifunctional multimedia terminals, is accompanied by transition to a multiservice network infrastructure of a new type based on principles of next generation networks NGN (Next Generation Networks).

Optimization questions of the technical and economic indicators play an important role in the problem of creation and development of telecommunications networks. Correct solution of these problems allows projecting and developing telecommunications networks to achieve minimum network costs and the given technical effect. Known optimization methods [2, 5] of communication networks are reduced to the determination of the structure and other network settings of minimal cost, however, they do not result a mathematical and algorithmic support for the design of such networks and optimization of their parameters, make recommendations for the construction of telecommunications networks in a not full volume.

II. SIGNIFICANCE OF THE TASK

Practice of the design and planning telecommunications networks dire need of effective methods to optimize the structure of network, not limited to its scale, easily adaptable to various design and management situations taking into account the strong tendency of communication networks to integrate.

In this context, this paper deals with the optimization questions of the structure of telecommunications networks based on the criterion of network-wide discounted costs taking into account the multidimensionality (priority) of the incoming flows of information, multicriteriality of optimized parameters of telecommunication networks, etc. [1, 3, 4].

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 12 , December 2019

Solution of the optimization problem for the structure of telecommunications communication networks is sought in the class of hierarchical, homogeneous in levels structures, for which: interlevel subnets have a radial structure; connection of endpoints is also managed by the radial principle; the intra-subnets have the same type both by the structure, and the technical equipment and are described by one of the basic topologies [3,4].

III. EXPERIMENTAL RESULTS

Technique for optimization of the structure of telecommunications networks is a complex optimization procedure that focuses on the use of communication networks in problems of automated design and prediction of their technical and economic indicators.

Application of this technique allows to calculate the probability-time characteristics of telecommunications networks, to carry out the distribution of flows, to select the bandwidth of communication channels and the performance of switching centers, to calculate network-wide expect given the costs and determine the optimal structure of the networks. The choice of technique is dictated by the structure of network models, as well as the need to provide the ability to calculate the probabilistic-time characteristics (PTC) of telecommunications networks, taking into account the heterogeneity of traffic and the priority of incoming information flows.

The problem of optimizing the structure of hierarchical telecommunications networks is reduced to finding the components of the vector X delivering the minimum of the function of network-wide stated costs

$$P(X) \to \min , \qquad (1)$$

at realization of norms by the quality of service to users of the telecommunications network. For circuit-switched telecommunication networks, norms are formed on the average delivery time T_k of the packet delivery of data of the k-th priority and the probability $P_k\{T \le t\}$ to deliver a packet of speech for a random time T, not exceeding a given t.

To estimate the probabilistic-time characteristics of a circuit-switched telecommunications network, models of priority networks are used taking into account multidimensionality of incoming packets (load) [3,4].

For the telecommunications circuit-switched network, the probability P_{st} of loss of calls for any pair of nodes in the network is an important characteristic, which should not exceed a predetermined value P_s. The optimization problem of the network structure is solved using the method of penalty functions (PF), allowing us to reduce the optimization of the n-step process to “simultaneous” optimization of structures and it allows to evaluate the cost parameters and PTC of the without preliminary decomposition of the network topology (NT) on a single subnets in the unified optimization cycle.

Multivariate numerical calculations for the characteristics of the telecommunications network are carried out during the solution of the optimization problem. A series of network-wide dependencies of reduced expenditures on various input parameters: the size of the territory of the network, the number of endpoints, the number of levels of hierarchy is obtained. Numerical results have shown that increase of the number of hierarchical levels has little effect on the value of $P(X)$, which suggests finding the optimal number of levels of the network hierarchy. In addition, for various values R of the number of stages of the hierarchy R, network discounted costs increase with increasing values of network-wide area, which is the directly proportional ratio [3].

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 12 , December 2019

IV. CONCLUSION

As a result of carried out studies, method of optimizing the structure of hierarchical telecommunication networks has been developed by the criterion of network-wide discounted costs, which is the theoretical basis of a general approach to the solution of applied structural network problems and the development of existing mathematical apparatus of optimizing the structure of communication networks [4].

The obtained results of optimizing the structure of telecommunications networks can be used in preliminary stages of research for preliminary preparation of the main projects network.

REFERENCES

[1]. Design and Technical Operation of Transmission Networks of Discrete Messages: A manual for institution of higher education / Aripov M.N. et al. Eds. Zakharov G.P. “Radio isvyaz”, Moscow, 1988.
[2]. Zakharov G.P., Research Methods of Data Transmission Networks. “Radio isvyaz”, Moscow, 1982.
[3]. Zakharov G.P., Simonov M.V., Yanovskiy G.G., Service and Architecture of Broadband Digital Networks of Integral Maintenance // Electronic Switching Technology. Volume 41.”Ekotrendz”, Moscow, 1993.
[4]. Klimov G.G. Stochastic Service Systems. “Nauka”, Moscow, 1966.
[5]. Lokhmotko V.V., Pirogov K.I., Parsiev S.S., Probabilities of delivery of multi-packet messages in integrated service digital network. // Technique of communication means. Series of TPS, issue No. 1, 1989.