# Adaptation time-series analysis to number of calls on the modern telecommunication network

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*Abstract* - **This article describes a study the structure of calls on a modern telecommunication networks; such parameter as number of calls is described in detail.**

*Keywords* – **Stream of calls, Time-series analysis, Telecommunication network, Distribution function.**

## I. INTRODUCTION

The Cabinet of Ministers of Ukraine paying increasing attention to development of telecommunications and expanding access to the Internet. They provide the government support for development of the Internet and for encouraging the provision of using Internet services such as audio and video conferences, electronic education, electronic music, a distributed research networks, e-governance, e-commerce, etc. All this requires studying the structure of streams of calls on the modern telecommunication network (TN) in Ukraine.

## II. INVESTIGATION THE NUMBER OF CALLS

Methods of calculating the number of network resources depends on three parameters: the service discipline, service system and the steam of incoming calls. In the design of telecommunications networks the capacity of loading data is unknown, and the design is based on its predicted values.

For building and calculating the network we must have the most accurate information about the incoming load and the nature of the stream of calls. This is important because the quantity of equipment depends not only on the flow intensity and the probability of loss of calls, but on the probabilistic and temporal structure of the stream of calls. Call flow can be described by distribution functions of the intervals between the date of the call and the number of calls received in a given period of time.

In most mathematical models assume that the length of intervals between the calls described by an exponential distribution law, and therefore the stream is a Poisson stream of the first kind. A number of studies proved that on the existing real telecommunication networks the incoming stream of calls cannot be described by the Poisson model. In some researches the method of steps is used for describing the received incoming calls. This method is based on the composition and mixing exponents. To describe the real flow of calls have been proposed various models, but none of it is working for today.

The study of probabilistic and temporal structure of incoming calls was held at international switching centers of the southern region of Ukraine, which is also an important transit center on large region of Ukraine and international communications. On this center the actual measurements for the period from 2003 to 2009 years were received. The volume of statistical data contains over 1.8 million records, which is stored in the Oracle database.

Unlike most studies that describe the incoming stream of calls, this study examines the served stream of calls which differs by conditions its probability-temporal structure.

One of the obtained parameters is the number of calls, which was studied with specific time intervals. This parameter was checked for goodness of fit the distribution of probability that this value is distributed according to the normal, exponential, lognormal, exponential distribution and Poisson distribution, Pareto, Rayleigh, Weibull. In various studies carried out previously by other researchers, it was assumed that this value may be allocated to one of these distributions. Hypothesis checking was conducted by the author on the criteria of Kolmogorov-Smirnov test, Pearson and Shapiro-Wilk tests.

Generally accepted, that when we study large volumes of sample data the parameters of this data are normally distributed. This study proved that the hypothesis of normal distribution of considered values was not confirmed. In connection with this hypothesis the data have been tested on other distributions, which were not confirmed also.

## III. CONCLUSION

Further processing is possible using 2 approaches. The first approach involves the use of function approximation for the distribution function. The second approach involves consideration of the selected data using the theory of time series. Analysis of the first approach showed that only piece-wise linear approximation can be used, but this kind of approximation cannot be used to adjust the methods of calculating the number of connecting devices and communication channels. The second approach provides for consideration of the issue using the statistical theory of chaos. Further research is aimed in this direction.

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