Models of the Traffic in Mobile Communication Network

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Abstract - **It was suggested to use wavelet transforms and the auto regression model in order to describe the network traffic fractal properties as a solution for emerging problems in modeling and traffic prediction as well as planning and service quality optimization in the mobile connection network.**

Keywords - **Mobile communication network, Real traffic, Fractal properties, Mathematical model.**

I. INTRODUCTION

In planning and optimization of third generation mobile connection network it is sometimes necessary to model the probable changes in network functioning due to the change in conditions or maintenance parameters. The existing modeling methods and prediction of network characteristics based on mathematical graphic model of Poisson streams are not able to give the full and exact picture of processes taking place in the network at present. This fact determines the relevance of development of adequate mathematical models of traffic in mobile communication network on the base of wavelet transforms and also auto regression models that take into account the self-similar (fractal) properties of real traffic.

II. THE FEATURES OF MATHEMATIC MODELS DEVELOPMENT FOR DESCRIBING AND FORECASTING OF NETWORK TRAFFIC

The self-similarity analysis of real traffic was carried out on the traffic data of the third generation mobile connection network. Voice traffic was processed in course of 2 months, 24 hours a day with interval of 30 minutes. Data transfer traffic was accumulated for 2 months, 24 hours a day with 5 minutes interval.

For self-similarity verification of real traffic absolute moments method was used [1]. The values of Hurst parameters H calculated with the help of this method were 0, 84 – for data transfer and 0, 96 – for voice transfer data.

The analysis of obtained wavelet transform coefficients also allows to analyze the fractal properties of the studied real traffics in the network.

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The studies have shown that voice and data transfer traffic in the mobile connection network can be described by self-similarity processes well enough.

The theoretical and practical features of network traffic description with the help of developed mathematical models based on the wavelet transforms and auto regression models – integrated moving average with taking
into account the self-similarity of real network traffic were considered.

Particularly, the modeling of random processes method based on the orthogonal expansion was used. Here the wavelet transform represents an equivalent of decorrelating orthogonal expansion of Karhunen – Loeve of the self-similar processes with long-term dependence. The network traffic modeling could be carried out on the base of reverse wavelet transform.

The features of modeling and prediction of the mobile connection network traffic based on the linear prediction model were considered, specifically the auto regression models that consider the non-stationarity of the real traffic that is determined by its trend and periodic seasonal component.

III. CONCLUSION

The practical features of short term and long term prediction were studied. It was shown that the reviewed mathematical models of the network traffic could be used for prediction purposes in planning and optimization of the service quality in the third generation of the mobile connection network.

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