# Service Quality Oriented Method of Multiservice Telecommunication Networks Design

Mykhailo Klymash, Orest Lavriv, Bohdan Buhyl, Yuriy Danik

*Abstract* – **This work proposes the analysis of service quality parameters for packet networks. The algorithm of packet processing is designed. It is made a research of delay and jitter for proposed processing method.**

*Keywords* – **self-similar traffic, traffic distribution system, simulation.**

## I. Introduction

In modern multimedia telecommunication networks there is an important challenge of quality of service (QoS) provision. The traffic for these networks is self-similar. That is why there are no adequate analytic models for this kind of stochastic process.

QoS provision for multimedia traffic using analytic methods leads to serious inaccuracy. Thus, the only appropriate method is statistic simulation.

It is important to use an appropriate traffic model to obtain accurate QoS parameters.

The main service quality parameters are as follows [1]:

- packet delay – time gap between the transmit and receive moments;
- variation of delay (jitter) – the difference between delay for a single packet and the normal delay of a packet for particular service.
- packet loss percentage – ratio of lost packets to the total packets number;
- capacity of network channel – total capacity of channel resources which is enough for particular service through the whole transmitted pass;
- throughput – the maximum speed of data transition through the network channel.

## II. Hierarchical Structure of IP Network

Hierarchical structure of multiservice IP networks caused by demands of high scalability and diversifying access, aggregation, and content distribution challenges. Its principal scheme is shown on fig. 1.

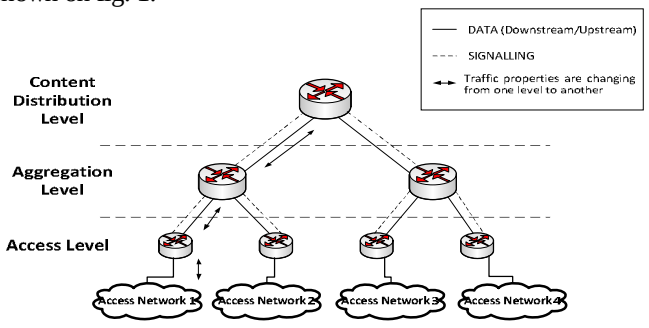


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Fig.1. Hierarchical structure of the designed method

The direct result of use this kind of structure causes the difference of traffic properties in each level of the network model. Because of this the parameters of the nodes might be different to provide appropriate QoS parameters. So, choosing node parameters is a very important task of quality servicing.

## III. Traffic Generation and Processing

It is very important to use adequate traffic models to calculate node parameters as have been considered earlier.

This work proposes the method of traffic generation with the packet duration is modeled by uniform distribution and the gap between packets is modeled by fractional Brownian motion. Due to the algorithm shown in [2], it was generated a traffic shown on fig. 2.

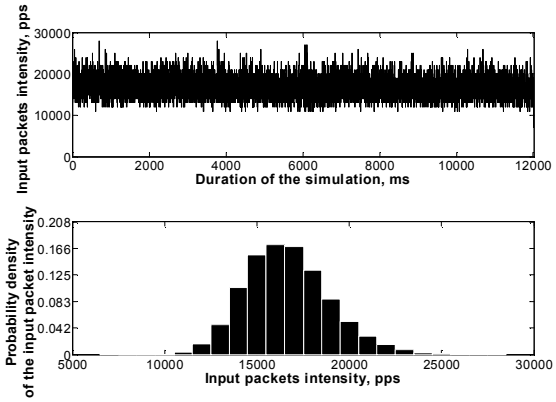



Fig.2. Input packets intensity

It was designed an algorithm to process the formed traffic for analyzing the QoS parameters [3]. The output traffic profile and its probability density are shown on fig. 3.

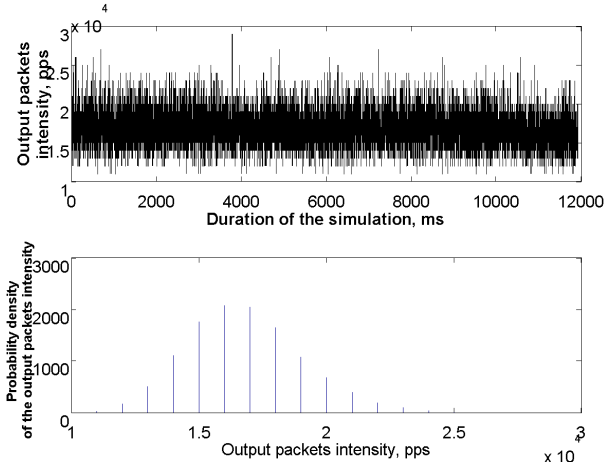



Fig.3. Output packets intensity

## IV. Service Quality Parameters Research

It is performed a research of service quality parameters considering formed traffic profile and the parameters of queuing system (queue state and speed of bus and internal servicing processor).

The follow results are shown on fig. 4 (the queue state in dependence from system utilization).

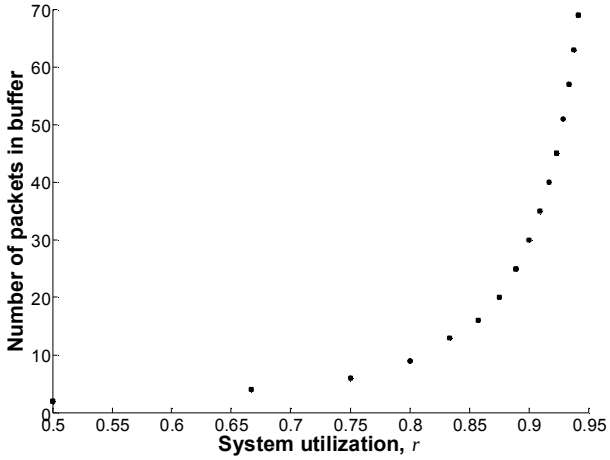
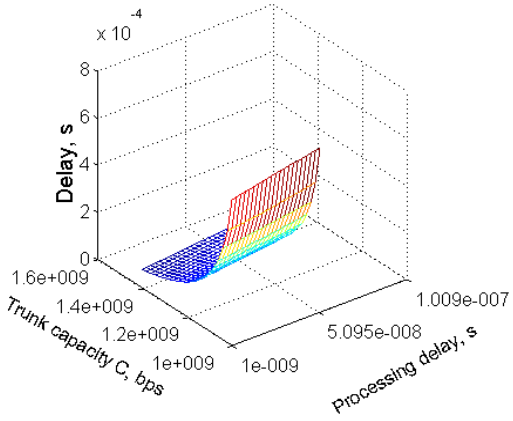



Fig.4. Dependence between the number of packets in buffer and the system utilization

Fig. 5 shows the packet delay and jitter in dependence from structural and functional parameters of servicing node.



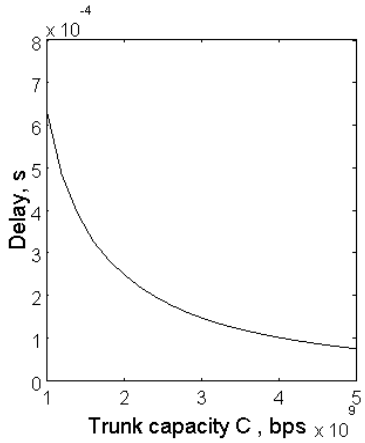




Fig.5a. Delay research

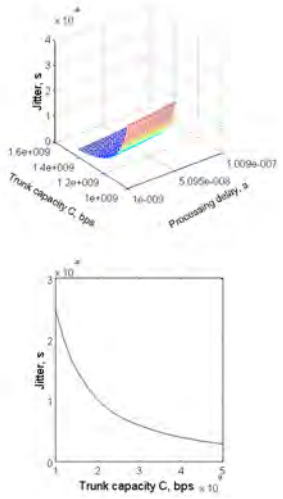



Fig.5b. Jitter research

## V. Conclusion

This work offers a method of QoS parameters provision on the basis of self-similar traffic statistic simulation and its single-channel servicing by the queue order.

Servicing algorithm takes into consideration packets durations, queue state, and speed of bus and internal servicing processor.

Total packet delay consists of partial delay of packet processing and buffer-waiting delay. Jitter is calculated as deviation between average delay and delay of each packet.

This work demonstrates that self-similarity of traffic is reached when the gap between packets is modeled by fractional Brownian motion with the Hurst parameter equal to 0,7.

The model gives a possibility to change the structural and functional parameters of the servicing node in order to have influence on QoS in the proposed algorithm [3].

## References

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