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PERFECTION OF STANDARD DOCUMENTS AND SYSTEM REQUIREMENTS IN THE FIELD QUALITY OF SERVICE NGN

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It is resulted results of researches by calculation of network characteristics and estimations of quality characteristics of service in networks of following generation, methodical recommendations about perfection of standard documents in the field of quality of service NGN are made, it is offered methods of calculation of probability of timely delivery of packets, variations of a time delay of packets and probability of readiness of a network.

Keywords: networks of following generation, quality of service, average delay of packets, probability of timely delivery of packets, a variation of a time delay of packets and probability of readiness of a network.

Приводятся результаты исследований по расчету сетевых характеристик и оценки показателей качества обслуживания в сетях следующего поколения, даны методические рекомендации по совершенствованию нормативных документов в области качества обслуживания NGN, предлагаются методы расчета вероятности своевременной доставки пакетов, вариации задержки пакетов и вероятности готовности сети.

Ключевые слова: сети следующего поколения, качество обслуживания, средняя задержка пакетов, вероятность своевременной доставки пакетов, вариация задержки пакетов и вероятность готовности сети.

Кейинги авлод тармоқларида хизмат кўрсатиш сифат кўрсаткичларини баҳолаш ва тармоқ тавсифларини хисоблаш бўйича тадқиқот натижалари хисоботи келтирилди, NGN хизмат кўрсатиш сифати бўйича норматив хужжатларни ривожлантириш бўйича методик тавсиялар берилди, пакетларни кечикиш вариациялари, пакетларни ўз вақтида етказиш ва тармоқни тайёргарлик эхтимолликларини хисоблаш усуллари тавсия этилди.

Таянч иборалар: кейинги авлод тармоқлари, хизмат кўрсатиш сифати, пакетларнинг ўртача кечикиш вақти, пакетларни ўз вақтида етказиш эҳтимоллиги, пакетларни ушланиш варияцияси ва тармоқнинг тайёргарлик эҳтимоллиги.

I. INTRODUCTION

Quality of a telecommunication service as essential property and concept of branch of telecommunications, is the important factor influencing competitiveness of telecommunications operators: for the purpose of improvement of quality of rendering of a telecommunication service in the conditions of a competition in the market of telecommunication services development of appropriate regulating documents in the field of quality of services and giving of the status of the is standard-legal document by it is necessary. Proceeding from market requirements, it is expedient to develop standard basis of quality of the services, including nomenclature of controllable quality characteristics, important from the point of view of users, admissible norms on these indexes and methods of their measurement, uniform for application as telecommunications operators, and supervising organs in the field of communication.

The given operation is logical generalization led in НИР researches [1] and is intend for reviewing as a methodical material on individual questions of support of quality of service in NGN (NextGenerationNetwork).

II. MAIN PATH

Methodical recommendations about estimations of quality characteristics of service. As practical experiment of telecommunications operators, a deviation or underestimation of certain norms on quality characteristics of functioning of a data communication network shows, can lead to inadequate quality of provision of some services; to such situations it is possible to carry stream-oriented transmission of a multimedia content to a format standard and high resolution (high requirements to loss factor and errors), transmission of the synchronous traffic (high requirements to a variation of a time delay and loss factor). In particular, as an example it is possible to address to the document «Methodical instructions according to quality of services of a data communication network» (application №4 to the order of UzASI №24 from 14.01.2010y.) Where in the descriptive form the list of key parameters characterizing QoS in networks IP (according to recommendation ITU-T Y.1541 [2]), without instructions of conditions of influence of a network is resulted. These indexes are the objective and measured characteristics QoS having boundary values with reference to different classes of service, valid for level UNI-UNI (end-to-end QoS) and which, leaning against results of the led researches [1], it is expedient to consider separately.

1. A sentence according to transfer lag of packets. Requirements of performance characteristics for transfer lag of packet IPis the upper restriction for basic value IPTD (Transfer lag of packet IP) for a flow. Measurement IPTD is carried out by means of exploring IP a packet described in recommendation ITU-T O.211 [3]. This test consists in transmission from one end of the channel in another

of a flow of packets with time marks. Packet receptive period is registered. Time expended on transmission of each packet in one direction, is defined as a difference of the moments of receptive period and transmission of packets. Because of results of measurement, the average of value of a time delay under the formula settles:

$$\overline{IPTD} = \frac{\sum_{i=1}^{N_{IP}} IPTD_i}{N_{TD}} \qquad (1)$$

Where: $IPTD_i$- Delay period *i*-a packet ($i=\overline{1,N_{IP}}$),
N_{IP}- Total of the packets transferred for an interval of measurement.

In recommendation Y.1541 it is specified that average value $IPTD$ should be less, than the normalized restriction $IPTD_H$.

For interface UNI-UNI containing *n* of network segments, average delay of packets $\overline{IPTD}_{UNI-UNI}$ is define under the formula:

$$\overline{IPTD}_{UNI-UNI} = \sum_{i=1}^{n} \overline{IPTD}_{NSi} \qquad (2)$$

Where: $\overline{IPTD}_{NSi}$- average delay of packets in a *i* network segment.

Comparing of average value of a time delay of packets with the normalized value is not enough for a correct estimation. Therefore, along with an estimation (2) it is offer to strengthen requirements to value IPTD by introduction of an estimation of probability of timely delivery of packets *Q(IPTD)*. At designing of a network, value *Q(IPTD)* is definebased on gamma allocation of delay period of packets in a network [1]. For an exploited network, value Q can be definebased on handling of results of measurement, under the formula:

$$Q(IPTD) = \frac{N(IPTD < IPTD_H)}{N_{IP}} \qquad (3)$$

Where: $N(IPTD < IPTD_H)$- An amount of packets at which value of transfer lag of packets (IPTD) is less, than the normalized value $IPTD_H$.

For interface UNI-UNI containing *n*of network segments, the probability of timely delivery of packets is define under the formula:

$$Q_{UNI-UNI}(IPTD) = \prod_{i=1}^{n} Q_{NSi}(IPTD) \qquad (4)$$

Where: Q_{NSi}- Probability of timely delivery of packets in i^{th}- network segment.

2. A sentence according to a variation of a time delay of packets. In the recommendation, MSE Y.1541 the variation of a time delay of packets is define under the formula:

$$IPDV = IPTD_{upper} - IPTD_{min} \qquad (5)$$

Where: $IPTD_{upper}$ - Equally $1 - 10^{-3}$ quantile of allocation $IPTD$ (the Variation of a time delay of packet IP), received in the range of an estimation; $IPTD_{min}$ - To equally minimum value $IPTD$, received in the range of an estimation.

It is offer to define value $IPTD_{upper}$ - based on gamma allocation $IPTD$ [1].

To define values of a variation of a time delay for interface UNI-UNI ($IPDV_{UNI-UNI}$) by addition of values $IPDV_{NS}$ of network segments it is impossible. For determination, $IPDV_{UNI-UNI}$ it is necessary to know allocations of time delays of packets in each network segment. If allocations of time delays in each network segment are known they (are measured) also are independent, allocation of time delays in interface UNI-UNI is defined by operation of convolution of allocations of time delays of network segments.

In recommendation Y.1541 it is marked that the information on allocation can $IPTV_{NS}$ be in rare instances share by operators of a network, and can be inaccessible at the continuous allocation. In recommendation, Y.1541 the method of an approximate estimation $IPTV_{UNI-UNI}$ according to formulas (5) is offer. Considering that researches in the field proceed, the method offered in recommendation Y.1541, is accept as temporary.

As values of a variation of time delays $IPDV_{NS}$ are not add, for the decision of this problem the following valuation method is offer $IPDV_{UNI-UNI}$. For each segment by measurement the probability of is definethat, the variation of time delays of packets is less, than the normalized value under the formula:

$$Q(IPDV) = \frac{N(IPDV < IPDV_H)}{N_{IP}} \qquad (6)$$

Where: $N(IPDV < IPDV_H)$- an amount of packets with condition observance $IPDV < IPDV_H$ for a measurement interval.

Theprobability of that a variation of time delays of packets in the interface $UNI - UNI$ is less, than the normalized value, is define under the formula:

$$Q_{UNI-UNI}(IPDV) = \prod_{i=1}^{n} Q_{NSi}(IPDV) \qquad (7)$$

Where: Q_{NSi} - Probability of that a variation of time delays of packets in i^{th} network segment it is less, than the normalized value $i = \overline{1,n}$.

3. A sentence on coefficient of unavailability of a network to operation. In the recommendation, MSE Y.1540 the criterion for the declaration of the periods of unavailability of a network to operation is define. IP service is consider not ready for open transmission channel if value IPLR (percent of the lost packets) is more or equally 75 % (probability of loss of packets 0.75) throughout an estimate interval 5 minutes. However, this criterion does not consider other quality characteristics of service, which also influence readiness of a network for operation.

Therefore, readiness of a network is necessary for estimating by complex criterion. It is offer to define probability of readiness of network IP to operation under the formula:

$$Q(IP)=Q(IPTD)*Q(IPDV)*[1-P(IPLR)]*[1-P(IPER)], \quad (8)$$

Where:*P(IPLR)*- Probability of loss of packets, *P(IPER)*- probability of an error of packets.

It is necessary to develop the supervising document on rating of values *Q(IP), Q(IPTD)*and *Q(IPDV)*.

III. CONCLUSION

Important result of the led researches is possibility of formation of necessary requirements and development of instructions on network indexes and characteristics for NGN. The methodology of the conducted research, a complexof models, methods and the instrumental software enveloping processes analytical and simulation modeling, are a basis of perfection or expediency of development of necessary standard basis for determination, calculation and an estimation of network characteristics at creation (designing) and maintenance NGN.

REFERENCES

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