The Model of Prioritization of Services for Efficient Usage of Multiservice Network Resources

Mychailo Klymash, Mykola Beshley, Valeriy Koval

Abstract – **In this paper the method of prioritization of services of multiservice network has been created. The simulation statistical model of the priority service of multiservice traffic with classifier of priorities has been proposed .The parameters and structure of multiservice telecommunication network have been analized on the basis of the simulation model.**

Keywords– **parameters QoS, multiservice traffic, Differentiated Services Code Point, buffer, simulation model.**

I. INTRODUCTION

Nowadays the development of telecommunication sphere is one of the most intensive. The operators of communication introduce new services, that leads to the change of telecommunication network into multiservice. The main task of multiservice network is to ensure coexistence and interaction of different info communication subsystems into single transport environment and to give proper quality of service (Quality of Service, QoS). It is necessary to introduce new algorithms of traffic control for simultaneous provision of different demands of quality of service of multiservice traffic in the communication system and it is turn has to allow all peculiarities of different kinds of service and to give effective usage of network resources. The distribution of resources of commutation knots is defined by memory buffering algorithms, giving the services priorities and defining the formation of their processing.

II. THE METHOD OF PRIORITIZATION OF SERVICES FOR DIFFERENT USERS GROUPS

In this piece of work you find the method that is based on the formalized criteria of defining the comparative priority of traffic classer, which takes into account the demands of quality of services, probability of usage services and the coefficient importance of the parameters relative to others. In this case it is developed seven the main services, which is given by multiservice network (voice (A), video conference (B), IPTV (C), Internet data (D), interactive data (E), media on demand (F), traffic signaling (G)).

So, if the user uses different services in different extent, that's why for more wide coverage of attractiveness spectrum of exact services for user we have to inject such parameter as probability of usage services according to it we may divide the users into three groups:

• the group of home users (H);
• the group of office users (O);
• the group of data center (C).

The relative priority for every category of services is made by the formula:

$$Pvpr_i = \frac{(p_i \cdot Bp_i \cdot Pp + t_i \cdot Bt_i \cdot Pt + j_i \cdot Bj_i \cdot Pj + c_i \cdot Bc_i \cdot Pc)P_{usage_i}}{\sum_i (p_i \cdot Bp_i \cdot Pp + t_i \cdot Bt_i \cdot Pt + j_i \cdot Bj_i \cdot Pj + c_i \cdot Bc_i \cdot Pc)P_{usage_i}} \quad (1)$$

where: P_{usage} – probability of usage services;
Bp, Bt, Bj and Bc – coefficient importance of services;
Pp, Pt, Pj, Pc – coefficient importance of the parameters relative to others;
j, t, c, p - relative coefficients of generalized services.

Coefficients Bp, Bt, Bj та Bc that may accept numbers from 1 to 3 where the larger means the larger significance of certain parameter of Qos for this category of service.The method can be used as differentiation of sequence of classes processing of traffic multi-service network with different network protocols which are for designation of priority level in the packages headlines.

Table 1.

INPUT DATA OF METHOD OF PRIORITIZATION

P / S	Packet loss P,%	Delay T,ms	Jitter J, ms	Bandwidth C, kbit/c	P_{usage}		
					H	O	C
A	0.1	150	10	64	0.25	0.15	0.02
B	0.8	100	20	2048	0.1	0.12	0.01
C	1.5	1000	50	4096	0.04	0.03	0.05
D	0.1	1000	1000	2048	0.08	0.01	0.3
E	0.1	400	500	256	0.02	0.08	0.15
F	0.05	500	30	10240	0.01	0.02	0.005
G	0.01	100	1000	64	0.5	0.5	0.5

TABLE 2.

RESULTS OF METHODS OF PRIORITIZATION

P / S	Pvpr			Absolute priority		
	H	O	C	H	O	C
A	0.297	0.195	0.036	2(010)	2(010)	4(100)
B	0.103	0.135	0.015	3(011)	3(011)	5(101)
C	0.012	0.008	0.002	4(100)	7(111)	7(111)
D	0.008	0.016	0.043	5(101)	4(100)	2(010)
E	0.004	0.012	0.041	7(111)	5(101)	3(011)
F	0.007	0.01	0.005	6(110)	6(110)	6(110)
G	0.57	0.624	0.858	1(001)	1(001)	1(001)

Mykola Beshley, Mychailo Klymash – Lviv Polytechnic National University, S. Bandery Str.12 Lviv, 79013, UKRAINE, E-mail: beshlebmi@gmail.com , mklymash@polynet.ua

Defining of the predicted size of buffer is realized by the formula Polacheka-Hinchena.

III. MODELING AND DETERMINING OF BUFFER SIZE FOR PRIORITY SERVICE OF MULTISERVICE TRAFFIC

In the paper it is proposed to use the method of imitation statistical modeling for multiservice traffic generation. The multiservice mixture of packs goes to the entrance of router with middle speed (λ). The main reason of the influence level on appearance of turns is the coefficient of device usage (ρ)- relation of the middle intensity of entrance traffic (λ) device to the middle intensity of packs transmission to the exit interface (μ). Accordingly that came with intensity λ1 i λ1 > μ will be recorded into the buffer but before it they will go to the classifier that works on the basis of analysis of IP headline and depending on the contents of field DSCP will read DSCP code that will point an appropriate priority of pack on the basis of previous calculation of criteria for each of the traffic classes of different users group. After it the classifier will direct them into special buffers of fixed different length. In this case the router will contain 7 queues for every service separately to give high quality of service to priority service. The essence of the proposed approach is shown at (Fig. 1).

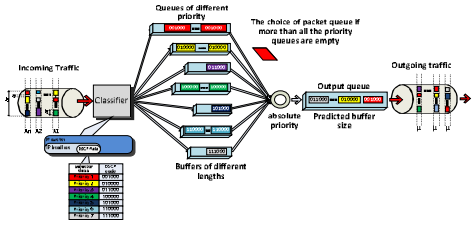

Fig.1. The model of priority service system of multi-service traffic

TABLE 3.

THE SIMULATION RESULTS

Group	(λ) pack/s	(μ) pack/s	(N) pak.	Precision of buffer, %	Size of buffer kbyte	(ρ) -
H	8314	9000	105	39	34,86	0,92
	8290	10000	27	35,8	8,9	0,82
	8496	11000	6	37,8	2	0,77
	8263	1200	5	36	1,6	0,67
O	7716	8000	466	36,8	172,5	0,96
	7516	9000	26	36	9,6	0,83
	7484	10000	8	36,8	2,9	0,74
	7257	12000	3	35	1,2	0,6
C	5830	6000	510	39	245	0,97
	6060	7000	25	38	7,3	0,88
	6132	8000	7	40	3,3	0,76
	5962	9000	4	39	1,9	0,66

Duration of packets determined with the recommended their size (from 64 to 1500 bytes). Traffic is the voice, signaling, interactive data is transmitted mainly by small-size packets, and services such as IPTV, video on demand, Internet data, video conference - large packages. Accordingly it is proposed to transfer the packs with such sizes where the frequency of appearance will be described in the random way distributed by the steady act considering the parameter of probability usage of service and with simultaneous appropriation DSCP code. The capacity of the channel was chosen as the result of the sum of all capacities necessary for every kind of service is C=20 Mbit/s. The amount of packs that are in the process of modeling is defined as 40 000. The intervals between packs were generated by the random process distributed by the law of Brownian with the parameters of Hersta H=0,7.

$$N = \frac{l}{m} \cdot \frac{\left(\frac{l}{m}\right)^{\frac{H-0,5}{1-H}}}{\left(1-\frac{l}{m}\right)^{\frac{H}{1-H}}} \qquad (2)$$

TABLE 4.

DETERMINATION OF TIME DELAY KNOTS FOR THREE GROUPS OF USERS

Group	L_{ser} bit	N pac.	C mbit/s	$T_{d.k}$ ms	$T_{(min)}$ ms	$K_{knot.}$ pieces
H	332*8	105	20	13.9	100	7
O	371*8	26	20	3.85	100	33
C	482*8	25	20	4.82	100	20

In conclusion, the modeling of multiservice traffic was conducted for 3 groups of users at different coefficients usage of device and is shown how the size of buffer is changing depending on ρ (coefficient of network usage). At the table 4 is shown the calculation of amount of network knots which provide QoS for 3 groups of users. According to the recommendations ITU-T the minimal time of packs delay for qualitative granting multi-service services is identical to the allowable time of delay of real time traffic which is 100 ms. Based on this the general time of delay while the packs buffering by network devices cannot be more than allowable delay time of real time traffic.

$$T_{delay} = \frac{N \times L_{ser}}{C} \qquad (3)$$

$$K_{knot} = \frac{T_{\min.}}{T_{d.k.}} \qquad (4)$$

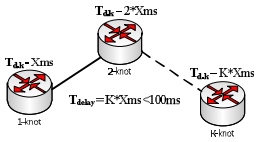

Fig.2. The maximum amount of knots that can be established for qualitative granting of multiservice

IV. CONCLUSION

The method of prioritization of services of multiservice traffic has been elaborated. The simulation statistical model of priority service system of multiservice traffic with the usage of elaborated priority method has been proposed. The analyses of coefficient influence of usage the network and parameter Hersta on the terminal result of the buffer size for 3 groups of users have been conducted. The time of packs delays in node and calculated the maximum amount of knots that can be established for qualitative granting of multiservice have been determined and calculated.

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