The quality indicators of generated flows service in xDSL network's users group

The calculations are performed using the distributed structure of the devices. 29 blocks of separate DSLAM and BAS there are used. In this case, a lower throughput is required, than using cascade structure, where high throughput not always can be realized.

Three types of flows (voice, data and IPTV) come to the BAS block, which connects DSLAM with IP. With the number of admitted users, getting that:

- Intensity of voice packets - $\lambda_{DSLAM\_BAS\_voice}$ = 1300 pps;
- Intensity of data packets - $\lambda_{DSLAM\_BAS\_PC} = 27709$ pps;
- Intensity of IPTV packets - $\lambda_{DSLAM\_BAS\_IPTV}$ = 2850 pps.

Then the common flow of packets $\lambda_{\Sigma BAS}$

$$\lambda_{\Sigma BAS} = \lambda_{DSLAM\_BAS\_voice} + \lambda_{DSLAM\_BAS\_PC} + + \lambda_{DSLAM\_BAS\_IPTV} = 31859 \text{ pps}, \quad (4)$$

There is probability, that particular service packets will arrive in to the service system

$$P_{service} = \frac{\lambda_{service}}{\lambda_{\Sigma BAS}}. \quad (5)$$

Probabilities of voice, data and video services arrival to the system, presented in Table 1.

Table 1. Values of the services probabilities

Probability	P_v	P_{PC}	P_{IPTV}
Value	0,041	0,87	0,089

When headers of required protocols are calculated in Ethernet network, sizes of services packets are:

- Voice - $L_v = 238$ bytes;
- Data - $L_{PC} = 700$ bytes;
- IPTV - $L_{IPTV} = 1394$ bytes.

Average size of packet, arrived in to the service system $\bar{L}_{pak} = P_v * L_v + P_{PC} * L_{PC} + P_{IPTV} * L_{IPTV} = 743{,}2$ bytes.

Assuming that ρ = 0,5 then departure rate μ = 63718 pps. For this case, required packets transfer rate is B = 379 Mbps. In order to transfer this flow, Gigabit Ethernet technology is necessary, providing up to 1000 Mbps speed.

Recalculated departure rate μ = 168192 pps and system utilization ρ = 0,2.

As in the previous case, assuming, that the inter-arrival times and service times are exponentially distributed, M/M/1 model can be used. Then application's average being time in the system $\bar{T}_S$ equals 7,34 *10^{-6} s. $\bar{T}_S$ dependence on ρ presented in Fig. 3.

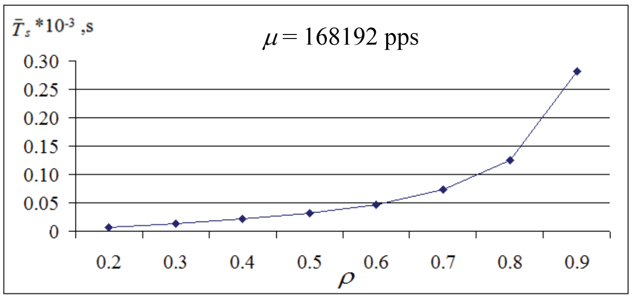

Fig. 3. $\bar{T}_S$ dependence on ρ in ADSL2+ user's group, when exponential distribution is used

Different types of flows, which service times are also different, arrive to the BAS block. Therefore it is appropriate to use M/G/1 model, where application's service time is general distributed. According this model, application's average being time in the system calculated by formula

$$\bar{T}_{sys} = \frac{1}{\mu} + \frac{\lambda * E[X^2]}{2*(1-\rho)}, \quad (6)$$

where $E[X^2]$ - common second moment; ρ - system utilization rate (traffic intensity); λ - arrival rate, μ - departure rate (service rate).

For the case, which is mentioned above, the application's service time is exponentially distributed, $E[X^2]$ equals:

$$E[X^2] = 2/\mu^2 = 7{,}07 * 10^{-11}. \quad (7)$$

Under this condition, application's average being time in the system $\bar{T}_{sys}$ = 7,34 * 10^{-6} s.

Due to different flows service time there can be more dispersal, therefore ascertained $\bar{T}_{sys}$ dependence on $E[X^2]$, which presented in Fig. 4.

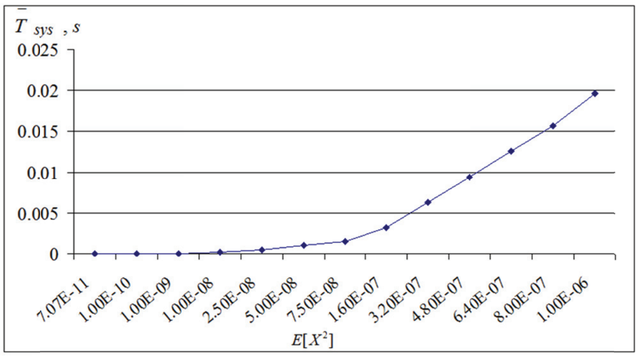

Fig. 4. $\bar{T}_{sys}$ dependence on $E[X^2]$ in ADSL2+ user's group

Assuming that $E[X^2]$ is fixed value, equals to 5*10^{-8}, then ascertained delay dependence on ρ (Fig. 5.).

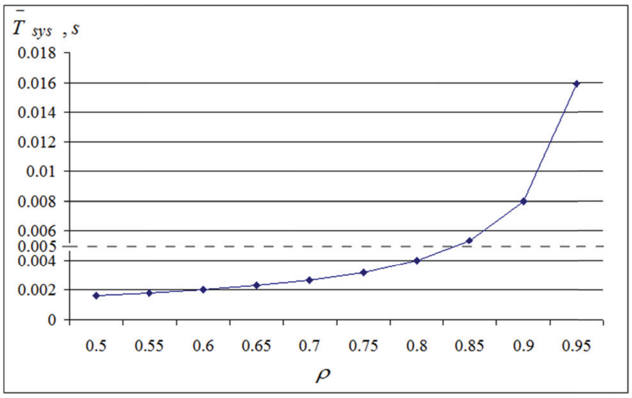

Fig. 5. $\bar{T}_{sys}$ dependence on ρ in ADSL2+ user's group, when common distribution is used

Dependence shows that increasing packet's service time dispersion in the system, delay increases too. When $\rho \leq 0{,}84$, delay do not exceed 5 ms in the access. For this case, M/G/1 model let accurately assess the characteristics of the flow service.

Conclusions

1. In the PSTN access with an IP network to ensure voice information delay up to 5 ms, system's load must not exceed 0,98.
2. When different services are used in access networks interaction with IP network, it is better to use common distribution for packet's quality characteristics evaluation. This distribution better evaluates service time dispersal.
3. In the case when different services are used in the access with IP network, information's delay is up to 5 ms, when system's load do not exceed 0,84.

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A. Jarutis, S. Simkute. QoS Analysis in IMS Network // Electronics and Electrical Engineering. – Kaunas: Technologija, 2011. – No. 6(112). – P. 43–46.

Fixed-mobile networks convergence and multimedia services supply at any device and any access are enabled in IMS technology. It is a network and layered architecture using packet transmission in the transport layer. For IMS interoperability with different technology networks, there are network gateways, which affects the quality of real-time services. Qualitative analysis of the service flows is carried out in this work. Also there is evaluating fixed access specification and packets service distributions. The delay dependence on utilization rate in the system also on service time dispersion there is assessing in this work. Ill. 5, bibl. 9, tabl. 1 (in English; abstracts in English and Lithuanian).

A. Jarutis, S. Šimkutė. IMS tinklo kokybinių charakteristikų tyrimas // Elektronika ir elektrotechnika. – Kaunas: Technologija, 2011. – Nr. 6(112). – P. 43–46.

Konverguoti įvairialypius tinklus ir bet kokiu įrenginiu per bet kokią prieigą IMS technologija įgalina teikti multimedijos paslaugas. Tai tinklinė daugelio lygmenų architektūra, transportiniame sluoksnyje naudojanti paketinį perdavimo principą. IMS sąveikai su skirtingų technologijų tinklais naudojami tinklų sietuvai, turintys įtakos realaus laiko paslaugų kokybei. Darbe atliekama kokybinė informacijos srautų aptarnavimo analizė, atsižvelgiant į fiksuotos prieigos specifiką bei paketų aptarnavimo skirstinius. Nustatoma vidutinės aptarnavimo trukmės sistemoje priklausomybė nuo sistemos išnaudojimo koeficiento bei aptarnavimo trukmės dispersijos. Il. 5, bibl. 9, lent. 1 (anglų kalba; santraukos anglų ir lietuvių k.).