Analysis of IP System Channel Efficiency Usage Reduction Via TCP Connection Procedures

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Abstract – **The criterion is suggested and the IP system channel efficiency usage reduction while TCP session is evaluated.**

Keywords - **TCP session, Encapsulation, The amount of information, Efficiency, Speed.**

I. Introduction

Protocol procedures for reliable data transfer load channels of interacting IP communication systems with additional service information. This reduces the efficiency of bandwidth usage of these systems. This problem is researched in many works. However, estimating the reduction of interaction IP systems channel efficiency when applying TCP procedures for reliable data transfer was not carried out.

Objective – evaluating the channel speed usage efficiency the between interacting systems via establishment/closing connection procedures, the reliable transfer of TCP protocol.

II. Model of Data Encapsulation

In TCP communication session the following procedures can be distinguished: connection establishment, reliable data transfer and connection closing [1]. These procedures due to packet encapsulation increase the amount of service data transmitted over the communication channel. Using the model [2], let's define the total amount of information, formed during the TCP session between the levels (sublevels) *m* and *n* of the system

$$I_{\Sigma}^{(n)} = I^{(m+1)} + \Delta I^{(m,n)} + I_d^{(r,n)}, \quad m \ge r \ge n \ge 1, \qquad (1)$$

where: $I^{(m+1)}$ – the amount of information on the $m+1$ protocol level (sublevel) output;

$$\Delta I^{(m,n)} = \sum_{k=0}^{m-n} \Delta I^{(n+k)} \qquad (2)$$

– amount of service information in the packet header between *m* and *n* sublevels;

$\Delta I^{(k)}$ – amount of the protocol system of *k*-th level (sublevel) service data;

$$I_d^{(r,n)} = \sum_{j=1}^{d} [I_j^{(r)} + \Delta I^{(r-1,n)}] \qquad (3)$$

– total amount of service information between the *r* and *n* sublevels of the system in *d* service segments that are generated by TCP protocol in communication session;

$I_j^{(r)}$ – amount of *r*-th sublevel protocol data in the *j*-th TCP service segment;

$\Delta I^{(r-1,n)}$ – amount of service information in the packet header between *r*-1 and *n* sublevels.

III. Criterion Evaluation of the Efficiency

To evaluate the system channel speed efficiency usage the criterion [3] is applied

$$\gamma^{(m,n)} = \frac{q I^{(m+1)}}{q(I^{(r+1)} + \Delta I^{(m,n)}) + I_d^{(r,n)}}, \quad m \ge r \ge n \ge 1. \qquad (4)$$

Factor (4) refers to the information proportion of *m* + 1 level in the total amount of information at the output of the *n*-th sublevel, formed in the TCP session connection in *q* informational and *d* service packages.

IV. Analysis of the Channel Efficiency

Assuming in (1)...(4) $n = 1$ let's calculate $\gamma_R = \gamma^{(m,n=1)}$ efficiency of the system channel speed usage while data transmission $I_{\text{app}} = I^{(m+1)}$ by protocols as TCP over IP over GbE (Gigabit Ethernet). The results of efficiency calculations depending on I_{app} information amount shown in Fig. 1, with $d = \{0;\ 5+q\}$.

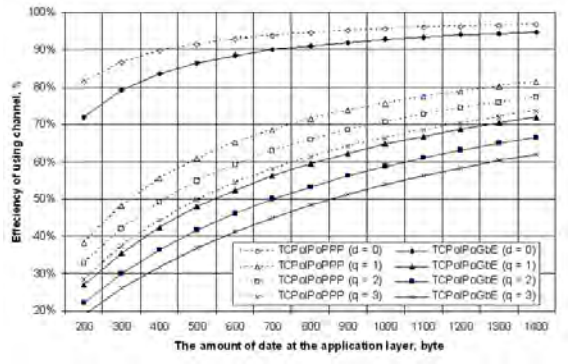

Fig.1 Efficiency of channel speed usage

The considered TCP protocol procedures significantly reduce the efficiency of system channel speed usage. For example, for the protocol stack TCPoIPv4oGbE at $q = 1$, and $I_{\text{app}} = 200\,(1400)$ byte γ_R efficiency is reduced by 45,1 (22,8) %.

V. Conclusion

The considered model of data encapsulation allows to research different protocol procedures impact on the system efficiency.

References

[1] J. Postel, "Transmission Control Protocol", *IETF*, RFC 793, Sept. 1981, http://www.ietf.org/rfc/rfc793.txt.

[2] С.М. Струкало, "Моделювання процесів обміну службовими даними N-рівневих керуючих об'єктів взаємодіючих систем комутації пакетів", *Цифрові технології*, № 6, 2009, pp. 33-39.

[3] М.І. Струкало, "Оцінка ефективності передавання трафіку реального часу в сучасних мережах з комутацією пакетів", *Інфокомунікації: проблеми та перспективи розвитку*, International scientific-practical conference, Odessa, 8-10 sept. 2010, pp 51-53.

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