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POSSIBLE TEMPORARY PARAMETERS IN THE CENTRALIZED STRUCTURE OF THE TWO LEVELS

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Abstract: *In this paper an algorithm for communication of communication nodes in LAN with star topology. Probability expressions for the correct sending of messages among the subscribers in the network and the mathematics expectation of the time for the finishing of one cycle from the structure are brought out.*

Key words: *computer network, data, errors, frame, hub, switch, traffic, структура, топология, вероятност за грешка, математическо очакване, средно време.*

The messages sending in LAN through a data interchange between the nodes in the network is made. This LAN with the help of communication nodes is realized and these nodes as hubs, multiple repeaters, switches and bridges are known. It is well known that in this network the nodes like computers in a common communication channel are connected and at this stage only one of them has the ability to send official and information messages. In each network exists a probability for arising some conflicts between the computers by the simultaneously appeal to the communication channel and because of this reason the network must be divided into several large networks with separated connected segments. Similar networks with switches structured into levels are being built. It is recommended that the number of levels to be limited in order to the data traffic between the computers of remote segments to satisfy the network speed of the subscribers.

On Fig.1 a communication network with levels is shown. At the first level has a one communication node that is head and at the second level there are q in number communication nodes. All these nodes from second level with the head node from first node in star topology are connected. The computers are connected to the second level.

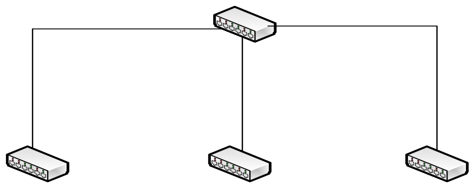

Fig. 1. Communication network in two levels

The communication algorithm in the accepted topology is as follows. The head node (C) scans consecutively the nodes from second level and receive responses from them. By this type of communication each node from some processing time and switch over rules for sending and receiving is in need. The nodes possess huge processing resource and these times for the research can be ignored. This fact gives us the reason to accept the independent character of each data sending between the nodes.

The temporary graph for communication between the nodes in fig.2 is shown.

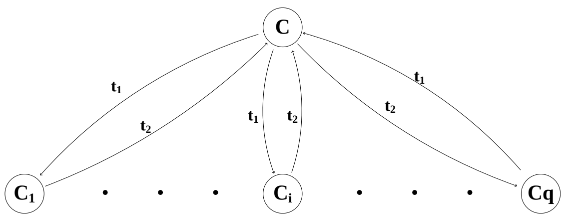

Fig. 2 A significative graph for scanning the head communication node in the network

The interchange time of data between the head node **t** and one of the nodes from second level from expression (1) is determinated.

$$t=t_1+t_2 \qquad (1)$$

Where:

$\mathbf{t_1}$ is the sending data time between the central station **C** and one of the stations $\mathbf{C_i}$;

$\mathbf{t_2}$ is the sending data time between the stations $\mathbf{C_i}$ and the central station **C**;

Because of the need of time for data processing from the stations **C** and $\mathbf{C_i}$ and between the sending and receiving processes there can be accepted that the arising probability of error $\mathbf{P_{гр}}$ and the probability for the correct sending $\mathbf{P_{п}}$ are independent events.

The dependence between the probability of the correct data sending among the nodes $\mathbf{(P_{п})}$ and the error probability $\mathbf{(P_{гр})}$ is:

$$P_{п} + P_{гп} = 1 \qquad (2)$$

From where for the probability of correct data sending is given

$$P_{п} = 1 - P_{гр} \qquad (3)$$

In order to be reduced the error probability by communication between the subscribers in the network there is allowed limited number of repetitions by error arising in the communication channels. It is accepted that the numbers of repetitions is $\boldsymbol{\kappa}$ times.

The error probability in data sending channel between the subscribers is dependent on the length of the protocol data unit $\boldsymbol{n}$, the grouping error coefficient α and the received error probability in the communication channel p.

The error probability by data sending between the central station **C** and one of the stations from second level $\mathbf{C_i}$ is determinated of the expression

$$P_{гр} = (n^{1-\alpha}. P_c)^k \qquad (4)$$

Where

P_c is the factory error probability in the channel that in the modern computer communication in the interval from 1.10^{-16} до 1.10^{-24} is being modified and thereby it is dependent on the material property from that the communication channel is built.

The correct probability of data sending between the central station **C** and one of the stations from second level is determinated of the expression

$$P_{\text{п}} = 1 - (n^{1-\alpha}.P_c)^k \quad (5)$$

The arising error probability by data sending for the accepted topology for a full cycle is:

$$P_{\text{гц}} = ((n^{1-\alpha}.P_c)^k)^q \quad (6)$$

The correct probability of data sending for the accepted topology for a full cycle is:

$$P_{\text{ппц}} = 1 - P_{\text{гц}} = 1 - ((n^{1-\alpha}.P_c)^k)^q \quad (7)$$

On fig. 3 the probably temporary graph with κ repetitions is shown.

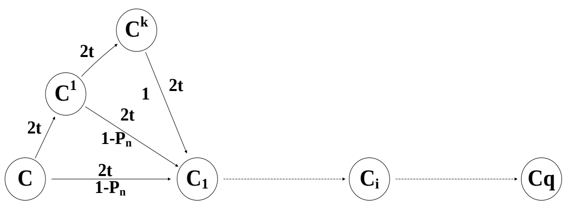

Fig. 3 The probably temporary graph with k repetitions.

Because of the independent character times for sending between node C and C_i ($i = 1 \div q$) it is assumed limited repetition (k) of information messages because of errors.

The mathematics expectation of the average cycle time for sending by k repetitions in case of error is determinated by the function:

$$\bar{T} = N.t_c \quad (8)$$

By correct data sending and positive receipt in the network the average time finding as follows is calculated:

$$\bar{t}_{\text{ц}} = t(1-P_{\text{п}}) + 2t(1-P_{\text{п}})P_{\text{п}} + 3t(1-P_{\text{п}})P_{\text{п}}^2 + \dots + k.t(1-P_{\text{п}})P_{\text{п}}^{k-1} \quad (9)$$

$$\bar{t}_{\text{ц}} = t[(1-P_{\text{п}})(1+2P_{\text{п}}+3P_{\text{п}}^2+4P_{\text{п}}^3+\dots+(k-1)P_{\text{п}}^{k-2}) + k.P_{\text{п}}^{k-1}] \quad (10)$$

The expression 1 + 2P is the geometric progression derivative of the expression $p + p^2 + \dots\dots\dots + p^{\kappa}$

By applying the theorem defining the derivative members sum of the geometric progression is received

$$1+2P_{\text{п}}+3P_{\text{п}}^2+4P_{\text{п}}^3+\dots+(k-1)P_{\text{п}}^{k-2} = \left(\frac{1-P_{\text{п}}^k}{1-P_{\text{п}}}\right)' = \frac{1-k.P_{\text{п}}^{k-1}+(k-1)P_{\text{п}}^k}{(1-P_{\text{п}})^2} \quad (11)$$

By replacing (11) in (10) it is received:

$$\bar{t}_c = t.\frac{1-P_n^k}{1-P_n} \quad (12)$$

By replacing (12) in (8) the expression of mathematics expectation for one cycle time is received:

$$\bar{T}_c = N.\bar{t}_c = N.t.\frac{1-P_n^k}{1-P_n} \quad (13)$$

Conclusion

The average time of mathematics expectation for leading one cycle for the researched structure is dependent on the data length in data protocol units and the algorithm in which the exchange data cycle is being executed.

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