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MANAGEMENT OF INFORMATION STREAM IN COMMUNICATION NETWORKS

Annotation. Various ways and restrictions from the point of view of management of data flows and computing resources of a network of data transmission are considered. Management of data flows is connected with optimization of the current parameters of quality of service of networks. Thus the technology of transfer of a stream is based on development of such model of management which includes the scientific principles of measurement of intensivnost, both receipts of packages, and their processings on switching knots, process of formation of a nodal and channel stream and directly management of these streams. Main goal of management of data flows in a network is achievement of effective and reliable network functioning. In article formulas for optimum control of streams in a network are removed and definition is presented.

Keywords: information streams, communication networks, optimum control, data transmission.

Тірек сөздер: ақпараттық ағындар, коммуникациялық желілер, тиімді басқару, деректерді жіберу.

Ключевые слова: информационные потоки, коммуникационные сети, оптимальное управление, передача данных.

Routing algorithm of packages in communication networks is understood as a rule according to which in knot the leaving main path for transfer of the package which has arrived in knot gets out. This rule can take into account the accessibility of individual network nodes, the frequency of errors when transferring data of turns of packages to incoming channels, estimations of packet delay on various routes. Corresponding decisions can be accepted irrespective of each separate package [1].

Routing methods allow a certain level of adaptation or find workarounds to bypass the damaged line or node. However separate methods differ, whether they allow to react quickly enough to damages and whether they provide possibility of struggle against overload and damages the equipment. The main methods for the network include the following:

1) dynamic routing;
2) routing on virtual channels;
3) routing on the fixed way.

Each of these methods can be implemented in different ways and may include some of the characteristics of other procedures of routing control [4]. The components of the physical structure of networks of information flow are the communication systems – switching nodes and backbone links, which are used to transfer information to ensure that the physical connection between a switching node, and their interaction with each other. Switching nodes perform process control transmission of the information flow between users, in particular, their routing in the network, and is usually implemented with high-performance multiprotocol routers. Backbone links are based on general-purpose communication systems, for example, on the base of isolated (unswitched) telephone channels, channels of digital communication networks, transmission systems or specialized data traffic. As lines of communication can be used cable, fiber optic, microwave or satellite links.

Let's contemplate the problem of managing the flow of information in the following formulation. Possible location of the place switching nodes (routers) are given, the number of essential characteristics of the user's computer systems (including local and corporate networks) are known , that are connected to each node switching, and the approximate intensity of traffic (expected or that which is desirable to provide) for transmission and Admission is defined affordable range of hardware (routers, modems, adapters, etc.) and their characteristics, as well as the available channels of communication between the possible locations for switching nodes and their characteristics [7]. It is required to construct a model of information-sharing process, which provides the optimum value of the criterion of quality of service network.

Let the topological structure of the network is an undirected graph, where V – a given set of locations of nodes switching network, with the number of nodes n, L – a lot of branches, corresponding to the set of

available channels of communication between nodes switching. *L*– *s*et of the branches corresponding to set of accessible communication channels between knots of switching. Ler (*ik*) designates the channel of transfer from *i* knot to *k* knot (*i*, *k* – the next knots) then $L = \{(ik)\}$. Knot (*ik*) and (*ki*) are considered various and all communications are assumed by the duplex. Each branch $(ik) \in L$ let's compare group c_{ik} serving devices (time channels of the main path) which are used for an information transfer [5].

Loads (bags) are received with a given intensity at each node, whose distribution plan, all paths are determined by traditional methods of adaptive routing. These methods allow you to allocate bandwidth network connection. Packets to enter the service network by accident and time of their service are not known in advance. The main stage of the traffic analysis consist in describing the process of admission packets and their time of service. After this, the efficiency of the network can be estimated volume of traffic and how often the traffic may exceed the capacity of the network.

The incoming load - it's total load, which could be serviced network, if it had been able to serve all the packets as they arise. As usual economic factors do not allow you to design the network so as to provide immediate service received the maximum load, it is usually a small percentage of the incoming load is blocked or delayed. If the blocked packets are not serviced network, then this mode is called mode with obvious losses. In essence, it is assumed that blocked calls are not disappearing and are in the buffer storage node switching for further service. This assumption is most suitable for beams connecting lines with detours. In this case, the blocked packets are usually served by the other beam lines, and in fact is not refundable.

At the preliminary stage of the description of the model traffic control usually involves the following assumptions [2]:

- all knots of switching are absolutely reliable and processing time in them it is not a lot of;
- lengths of all messages (packages) are distributed on exponencial to the law with average value $1/\mu$ bit per second;
- system to be in a condition of statistical balance;
- system with unlimited expectation, that is the memory size in switching knot is not limited.

These assumptions are listed determines the degree of approximation of the model to a real network.

The initial data in determining the optimum parameters of quality of service in the network are:

- network structure (an arrangement of knots, capacity of branches);
- entrance loading for service between everyone steams of knots;
- the plan of distribution of streams of a network.

As an information flow network is considered the flow of packets entering the network node - sender node *i* and destined - destination *j*. In general, the address is coded designation of departure or destination of data. Address of an object is determined by the number, the code phrase. The list of objects includes registers, memory, peripherals, communication channels, processes, systems, networks. The receiving object data usually called the addressees. Often the address associated with the name of the object.

Let's designate through $r_i(j)$ – average intensity of the entrance traffic (in units in bit per second), arriving in a network in knot-sender *i* and intended to knot-addressee *j*. Size $r_i(j)$ let's name entrance loading of a network. At distribution of entrance loadings on branches on network knots central streams are formed. Let $t_i(j)$ – average intensity of the general stream of calls (bit per second), passing through transit knot *i* and intended to knot *j*. Size $t_i(j)$ – let's name central loading of a network.

Network management system is functioning in the process of establishing connections in a switched network. It is designed to load flow distribution through the channels of transmission to ensure the specified quality of service for different network status (congestion, damage, etc.). The system should provide an advantage for priority customers in establishing connections.

In branched switched networks between any two nodes in the network (source and destination), there are usually multiple independent paths that can be transferred to nodal loads. The main objective of routing is to choose a particular path from the specified set. The selection is made using matrices (tables) of the routes that are stored in each node switching. If set of routeing matrixes is set $\{M_i, i = \overline{1,n}\}$, that it means that for all network the plan of distribution of the information is set. In static terms of the distribution of information is a static (fixed) routing in the network. However, the most efficient use of network resources is achieved by adaptive routing, where the plan of distribution of information varies according to changing network conditions (congestion in certain areas or sections of the network of channels or damage their bundles, Criminal damage, etc.).

Adaptive routing provides the choice of optimal routes of transmission of information depending on the situation in the network. Optimization of routing can be performed both on network-wide and local criteria.

In general, the selection criterion of optimality in dynamic control algorithms for systems is not unique. Preference should be given the criteria related to the coefficients of the capacity of the network paths. This means that optimal solutions are those for routing or flow management that, when executed performance requirements for delivery of information allow maximum use of network bandwidth channels, or to obtain the maximum values of the coefficients of the network bandwidth channels [6].

Let's enter a following designation. Let $K_i(j)$ – the ordered set of such knots k, which for the addressee j form all starting with knot i transfer directions (ik). Further, for sizes designated by means of an index k it is considered $k \in K_i(j)$. Streamlining of elements of set $K_i(j)$ it is made according to a choice for knot j proceeding direction of priority sequence in a matrix of routes M_i.

Let's designate through $\varphi_{ik}(j) \in [0;1]$ share of a central stream $t_i(j)$ which is transferred on a branch (ik) and $\varphi_{ik}(j) = 0$ if a branch (ik) it is not used in one of ways connecting knots i j or if $i=j$ that is in knot-addressee the central stream leaves a network. If a communication channel (ik) unique, $\varphi_{ik}(j) = 1$.

All calculations of the total load carried missed a branch in two stages. In the first stage we determine all the admissible input load transmission between two nodes. They are formed by the given matrices for each node routes. Thus, the formation of admissible paths is based on the selection of the desired destination node – columns of primary routes and transit nodes. The set of admissible paths consists of the following ways:

- not contain cycles;
- not exceed any maximum number of node outgoing directions;
- not exceed, for any pair of nodes the maximum number of hops.

In the process of exchange of information flow between the nodes, the first condition of any ways exclude unacceptable circular routes, whose presence in the network gives rise to circulating loads. The second condition for each node limits the number of all possible outgoing directions, the network management system usually provides one main occupation of the (straight path) and four flanking the [3]. Finally, the third condition restricts the choice of the path by the number of hops between pairs of nodes. Later, under the tracks will be understood only valid way of transfer of loads.

The task for each node – recipient of a directed graph path determines an order of participation of each node in the transfer of loads. In this connection we give the following definition.

Definition. We will say that in a direction of movement of a stream of a network knot s is underlaying in relation to knot l if there is a route from knot l through s in knot j where $s\ l \in Vi(j)$. Let's say accordingly that in a direction of movement of a stream of a network knot l is overlying in relation to knot s.

Process of formation of total central loading which includes as entrance loading $r_i(j)$ and loadings $t_i(j)$ arriving in knot i from all adjacent knots with it l.

At distribution of entrance streams on branches of ways of transfer on knots central loadings, proceeding from the definition, all sizes are formed $t_i(j)$ satisfy to the following system of the equations:

$$t_i(j) = r_i(j) + \sum_l t_l(j)\varphi_{li}(j), \qquad \forall\, i, j, l \in V(j), \tag{1}$$

According to definition $\varphi_{ik}(j)$ following equality is carried out

$$\sum_k \varphi_{ik}(j) = 1, \qquad \forall\, \mathrm{k} \in \mathrm{K}(j). \tag{2}$$

Proceeding from these formulas an information stream on a communication channel (ik), intended for knot-addressee j

$$f_{ik}(j) = \sum_{i,k} t_i(j)\varphi_{ik}(j),$$

and total intensity the passed branch (ik) network loadings it is defined under the formula:

$$f_{ik} = \sum_j f_{ik}(j). \tag{3}$$

The development of automatic switching equipment, the mutual penetration of computer technology in communication technology have led to the development of highly adaptive management of communication networks, information flows and processes, service calls, subscribers to share the information. Such adaptive control systems ensure the elimination or weakening of the influence of the faults of individual network elements and the time variation of the flow of information between users and network nodes on the quality of service applications and users quality of information transfer. And therefore, considered the network appears to the system with the expectation of quality and customer service for her will be assessed an average delay of packets on the network.

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Резюме

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КОММУНИКАЦИЯЛЫҚ ЖЕЛІЛЕРДЕ АҚПАРАТТЫҚ АҒЫНДЫ БАСҚАРУ

Деректерді жіберу желілердің есептеу ресурстарын және деректердің ағындарын басқару көзқарасынан әртүрлі тәсілдер мен шектеулер қарастырылған. Деректердің ағындарын басқару жәлілерге қызмет көрсету сапасының ағымдағы параметрлерін оптимизациялаумен байланысты. Желіде деректердің ағындарын басқарудың басты мақсаты болып желінің тиімді және сенімді жұмысы табылады. Мақалада желіде ағындарды тиімді басқару үшін өрнектер шығарылған және анықтама берілген.

Тірек сөздер: ақпараттық ағындар, коммуникациялық желілер, тиімді басқару, деректерді жіберу.

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УПРАВЛЕНИЕ ИНФОРМАЦИОННЫМ ПОТОКОМ В КОММУНИКАЦИОННЫХ СЕТЯХ

Рассмотрены различные способы и ограничения с точки зрения управления потоками данных и вычислительными ресурсами сети передачи данных. Управление потоками данных связано с оптимизацией текущих параметров качества обслуживания сетей. Главной целью управления потоками данных в сети является достижение эффективной и надежной работы сети. В статье выведены формулы для оптимального управления потоками в сети и представлено определение.

Ключевые слова: информационные потоки, коммуникационные сети, оптимальное управление, передача данных.

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