Methods and algorithms for estimation of statistical characteristics of the MPLS network

Nikolay Medvedev and Philipp Panfilov

Bauman Moscow State Technical University, Russia,
email: medved@bmstu.ru, ponf@bmstu.ru

Keywords: Chvatal-Sankoff conjecture, longest common subsequence, optimal alignment, variance bound.

Proposed algorithms of MPLS [1] networks performance estimation allows to calculate with given accuracy following network characteristics:

- the number of routers in the current network work cycle;
- network topology (the number of senders, routers, connectivity, etc.);
- load (in) for each channel;
- performance for each of the routers;
- size of the queues at routers in a given network;
- total number of packets passing through the router in a session;
- the total number of lost packets on each router for a session;
- percentage of packet loss for each router in a session;
- average packet delay at each router for a session;
- total number of packets of each stream in the past for each of the switched paths for a session;
- percentage of packet loss for each thread in the past for each of the switched paths for a session.

To find the shortest path from sender to receiver, an algorithm is proposed based on use of elements of Dijkstra algorithm for finding the minimum distance in a weighted graph. As a result of the algorithm, we obtain the path length (length, the sum of all weights on this way). The path length is equal to 0 if the initial vertex is finite and equal to -1 if the path does not exist. For service organization streams of packets from certain users in the MPLS network can be allocated separate resources [2]. MPLS network operator, to analyze the capabilities of its network, to serve the above-mentioned flow parameters to provide guaranteed service. An example of application of the developed methods and algorithms to calculate the network routing and traffic optimization is given. As an example, we calculate now the best way for dynamic routing for a different set of restrictions on routing. In the case where there are no requirements flow network bandwidth, length is unlimited, that is the only requirement for routing is the absence of cycles, then we use the function

$$a^{sd,l} = \begin{cases} 1, & \text{when } (s,d) \text{ routers are connected by the edge } l, \\ 0, & \text{otherwise.} \end{cases}$$

To determine the parameters of quality of service it is necessary to classify application traffic by the following characteristics: the relative predictability of the data transmission speed, the sensitivity of traffic to the packet delay, traffic sensitivity to losses and distortions of the package [3]. Three criteria for classification applications correspond to three groups of parameters used in defining and specifying the required quality of service: the parameters of bandwidth, delay settings and parameters of transmission reliability.

References

[1] Lahoud, S., Texier, G., Toutain, L. (2001). *Classification and Evaluation of Constraint-Based Routing Algorithms for MPLS Traffic Engineering.*

[2] Ma, Q., Steenkiste, P. (1997). On path selection for traffic with bandwidth guarantees. In: *Proceedings of IEEE International Conference on Network Protocols.*

[3] Elwalid, A., Jin, C., Low, S. H., Widjaja, I. (2001). MPLS adaptive traffic engineering. In: *Proceedings IEEE INFOCOM 2001.*