Intelligent management of traffic in multi-layer Software-Defined Networks

Improving the quality of services offered by the Internet is a dream of a vast number of its users. The project aims at fulfilling this dream by merging three promising technologies, i.e., FAMTAR (Flow-Aware Multi-Topology Adaptive Routing), AHB (Automatic Hidden Bypasses) and SDN (Software-Defined Networks). The aim of research is to propose a new networking architecture which enables efficient and reliable transmission of traffic.

The main goal of the project is to propose a new multi-layer networking architecture based on the SDN approach. The proposed architecture will allow for intelligent traffic management of flows at IP (Internet Protocol) layer or optical layer. The main assumption of Software-Defined Networks is implementation of the central controller, which is responsible for traffic management in a network. Network nodes, by using dedicated signaling protocol, periodically inform the central controller about network state, and also about several parameters related to currently served traffic. The central controller, based on data received from the nodes, is able to control transmission in the network. Moreover, it can ensure proper quality of service for the transmitted data.

The SDN concept has been known for many years. However, recently research on SDN has intensified. This phenomenon is the effect of dynamic development of network hardware. Devices used today, including routers, are able to serve much more traffic in comparison to those used even a few years ago. In effect, many disadvantages of SDN were limited or completely eliminated. Transmission of huge packages of data or additional signaling traffic is no more a problem in SDN.

The FAMTAR mechanism was developed as a solution which allows for multipath transmission of traffic in IP networks without the implementation of a central controller. Consequently, the signaling traffic is limited. In networks with the FAMTAR mechanism, new flows are accepted on paths which do not contain congested links. If creation of such a path is impossible, new flows are discarded or accepted on path indicated by the routing protocol as a low cost path. Traffic of a particular flow is always transmitted through the same path, from the beginning of transmission to its end. Only in case of a link or device failure the path may change.

The AHB mechanism allows to create optical bypasses when a path at the IP layer is congested. In AHB, a part of resources is available only to the IP layer and a part only to the optical layer. As a result, it is possible to manage resources in an efficient way and to minimize operating costs.

The project will deal with the following aspects:
- cross-layer traffic management,
- quality of service assurances,
- resilience and service optimization.