

Research and Development of Improved Routing Mechanism with Load Balancing in Communication Network

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ABSTRACT

A study of an improved mathematical model of routing with load balancing in a communication network based on Traffic Engineering is presented. The mathematical model allows formalizing the case of network construction, when each access network to increase fault-tolerance is switched simultaneously not to one but several gateways. The advantage of the solution is improving the load balancing level according to the criterion of Traffic Engineering by ensuring the distribution of traffic at the access level between several gateways that create one virtual default gateways.

CCS CONCEPTS

• Applied Computing • Networks

KEYWORDS

Routing, Load Balancing, Virtual Gateway, Network, Optimization

1 Introduction

Among the directions of implementing the Traffic Engineering (TE) principles in networks is the improvement of routing protocols, which concerns the support of a multipath routing strategy [1-5]. Most of the existing routing protocols have been extended by Traffic Engineering, updated to OSPF-TE, IS-IS-TE, and more. However, they are still based on rather primitive algorithms to find the shortest path on the graph, which is not focused on managing load balancing over the multipath [6-8]. For example, the RIP and OSPF protocols support uniform load

balancing only on paths with the same metric (equal-cost). In comparison, the EIGRP protocol allows load balancing on paths with different metrics with mandatory additional settings during network administration. A highly efficient network load balancing by routing means can be ensured only by improving the relevant mathematical models and methods that would serve as a theoretical basis for promising solutions in the field [9-11].

2 Research of Improved Flow-Based Routing Mathematical Model with Load Balancing

Therefore, it is proposed to study the improved approach described in [10, 11] and related to the organization of fault-tolerant routing with default gateway protection, when with the aim of increasing the reliability access networks are switched to not only one but several gateways. In particular, the known default gateway protection protocols, such as VRRP, GLBP, and CARP, support load balancing between the interfaces of several gateways, which create a so-called default virtual gateway. Therefore, if you provide load balancing at the access level, it should improve the network load balancing in general.

The improved mathematical model is based on the conditions of implementation of single or multipath routing, load balancing conditions at the access level, flow conservation conditions at the access level and the network itself, as well as conditions for preventing network links overload, which in fact act as conditions for load balancing in the network. Within the proposed model, the task of load balancing in the network is formulated as an optimization problem of mixed-integer linear programming with the corresponding optimality criterion and the mentioned above constraints imposed on the control variables, namely routing and access variables.

