Cross-Stratum Optimization for Provisioning of Cloud Data Center Services

Telecommunication networks are changing our lives for over several decades. Their **very rapid development** enables us to create a society based on access to information. Thanks to modern technology, we may freely communicate with families living hundreds of kilometers away from us, watch live major sports and cultural events, as well as conduct specialized training using video transmission. These changes impose on operators to improve the quality of services, and thus, create new, extremely challenging optimization problems and the need to seek effective methods to solve them.

One of the goals of this project is to consider an extremely important **optimization problem of data transmission in cloud services**. Services such as Amazon Web Services or even the cloud storages as Dropbox, use above-mentioned technology. The main objective of the research is the analysis and optimization of the three types of network flows (unicast, anycast, and multicast) in optical environment. We plan to use two **very innovative technologies**, which are elastic optical networks (EONs), and software-defined network (SDN). It opens a new perspective to **improve the efficiency of data transmission**. Analysis of current trends in telecommunications networks and expectations of end users confirms the importance of the optimization problem. Moreover, according to the current knowledge of the applicants, this problem was not fully addressed in the literature.

The **main objective of the research project** is to propose and implement the machine learning algorithms, in order to simultaneously optimize resource usage in data centers (ie. RAM, disk space, and CPU) and the resources in the current optical networks (such as spectrum, optical devices, etc.). The **effectiveness of machine learning techniques** has been confirmed in many studies in the field of optimization of complex problems. By using these advanced methods, we will be able to compare the performance of existing solutions to newly proposed in this project. On this basis, project applicants hypothesize that the aforementioned approach may be used to implement an effective tool for solving the optimization problem, which may surpass existing methods in terms of the effectiveness to solving the same task.

The project will be consist of a series of tasks. The outcome will be the **creation of a network simulator, which may be widely used**. The simulation results will be tested for efficiency of proposed method based on the comparison of its results with optimal results and the reference methods (previously proposed in the literature and adapted to solve the same problem).

The motivation is to create and implement innovative solutions for the optimization of telecommunications networks that will be able to be used by network operators.