Nowadays, the communication networks are indispensable part of the society every-day life. They support a variety of human activities including entertainment, social life, finance, medical care and business. As a consequence of their ubiquity and relevance, a significant increase is observed regarding the requirements for networks and expectations of network users. The analysis of current network trends reveals two crucial issues that have to be addressed – **support increasing traffic volumes** (especially in transport optical networks) and **provision of network survivability** (ability to restore full connectivity after a failure/attack and minimize amount of lost data). The ever growing network requirements entail that currently deployed technologies and algorithms become not efficient enough. Thus, **it is crucial to improve existing solutions and implement new efficient techniques in the fields of design and optimization of communication networks** (especially in terms of routing, resource allocation and survivability provisioning).

What is more, we also observe **increasing popularity of machine learning algorithms and their numerous successful applications** for various complex problems. Here, the most representative examples of application domains are medicine, diagnosis, security systems, robotics, finance and social networks. What is more, the latest literature review proves that machine learning algorithms can be successfully applied for communication networks optimization as well.

The proposed project answers the observed trends and requirements of communication networks. It aims to **design and implement a packet of dedicated models and algorithms which ought to improve performance and survivability level of the transport optical network**. The main project principle is associated with the modeling and prediction of network traffic and its application for the purpose of efficient routing and resource allocation as well as survivability mechanisms (re-)optimization (i.e. proposal of traffic-aware methods for allocation and survivability provisioning). The main research hypothesis is stated as follows:

***"It is possible to improve the performance and increase the survivability level of transport optical network by applying dedicated models and algorithms based on the network traffic modeling and prediction."***

A number of research tasks and secondary goals were defined to achieve the main goal. The t whole project is divided into three stages depending on the main addressed issue: (*i*) **modeling and prediction of traffic in transport optical networks**, (*ii*) **traffic-aware routing and resource allocation in transport optical networks**, (*iii*) **traffic-aware (re-)optimization of survivability mechanisms in transport optical networks**.

The first stage aims to design realistic models of traffic in transport optical networks (taking into account real characteristics of the communicating nodes, network topology graph and location of data centers), compare machine learning algorithms for the problem of traffic prediction and select most suitable method for that task. Then, the second stage focuses on the proposal of efficient routing and resource allocation algorithms based on the continuous analysis of the network resource availability and traffic prediction. The numerical experiments will be performed to evaluate algorithms efficiency and verify project thesis – provided increase of the network performance. The third stage aims to design and/or (re-)optimize network survivability mechanisms based on the continuous analysis of network resource availability, routing and resource allocation rules as well as traffic prediction. The numerical experiments will be carried out to evaluate algorithms efficiency and verify project thesis – provided increase of the network survivability level.

Consequently, the project results will be undoubtedly relevant development of the knowledge from **modeling and optimization of communication networks** as well as practical **applications of machine learning algorithms**. The proposed models and algorithms will answer the most important trends and requirements of improving network performance and providing its survivability. Hence, the results will be new **knowledge from the fields of telecommunication and computer science.** This knowledge can be interesting and essential for many scientists all over the world, thus the project leader aims to publish it in reputable international journals and during international conferences. What is more, the project results can be relevant and inspirational in designing and implementing new networks standards and protocols.

Based on the above-discussed background, the project leader has identified the proposed project as novel, relevant and important to be considered.