# 5G framework based on multi-level edge computing with D2D enabled communication

Abdelhamied A. Ateya*[1], Ammar Muthanna*, Andrey Koucheryavy*

*State University of Telecommunication, 22 Prospekt Bolshevikov, St. Petersburg, Russia

[1]Electronics and Communications Engineering, Zagazig University, Zagazig, Egypt,

***a_ashraf@zu.edu.eg*, *ammarexpress@gmail.com*, *akouch@mail.ru***

*Abstract*— **There is no doubt that the release of the fifth generation of the mobile cellular system (5G) becomes a great demand year by year, especially with the massive increase of heterogeneous Wireless devices. The 5G network will be a platform for wide variety of industries. Designing of 5G cellular system faces various challenges related to the capacity and traffic. One way to solve these challenges is to employ device –to-device (D2D) communication and mobile edge computing (MEC). Employing these technologies offload the core network and increase the capacity of the system. In this work, we propose a frame work for the 5G cellular system based on D2D communication and multi-level cloud units employed at the edge of the cellular network. The system employs four levels of cloud units with various hardware capabilities. The D2D communication is used as the communication technology in the first level of clouds. Employing D2D together with multi-level edge cloud units achieves varies benefits to the system as the system level simulation provides.**

Keywords— 5G, D2D, Offloading, Mobile edge computing, Latency, Traffic.

**Abdelhamied A. Ateya** received the BSc. and MSc. in Electrical Engineering from Zagazig University, Egypt, in 2010 and 2014, respectively. He is working as an Assistant Lecturer at the Faculty of Engineering, Zagazig University. He is currently a PhD student at St. Petersburg State University of Telecommunication, in St. Petersburg, Russia. Mr. Ateya's main area of research is wireless communication and currently, he is working on future Tactile Internet and its applications.

**Ammar Muthanna** is an Associate Professor at the Department of Telecommunication networks and Head of SDN Laboratory (sdnlab.ru), Saint - Petersburg State University of Telecommunications, Russia. He received his B.Sc. (2009), M.Sc. (2011) and as well as Ph.D. (2016) degrees from Saint - Petersburg State University of Telecommunications. In 2012/2013 he took part in Erasmus student program in the University of Ljubljana in Faculty of Electrical engineering. Area of research: wireless communications, 4G/5G cellular systems, IoT applications, and software defined networking.

**Andrey Koucheryavy** was born in Leningrad 02.02.1952. After graduated from Leningrad University of Telecommunication in 1974 he going to Telecommunication Research Institute named LONIIS, where A.Koucheryavy working up to October 2003 (from 1986 up to 2003 as the First Deputy Director). He became the Ph.D. and Dr.Sc. in 1982 and 1994 respectively. A.Koucheryavy is the St. Petersburg State University of Telecommunication (SUT) professor from 1998. He is Chaired professor of the department "Telecommunication Networks and Data Transmission" from 2011. He is honorary member of A.S.Popov's society. Prof. A.Koucheryavy was the Chairman Study Group 11 ITU-T (Study periods 2017-2020). His scientific areas of interest are the network planning, teletraffic theory, IoT and its enablers.