

I. IDENTIFICATION DATA

Thesis name:	Offloading computing tasks to multi-access edge computing via multiple relaying nodes
Author's name:	Džubur Arman
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Telecommunication Engineering
Thesis supervisor:	Ing. Pavel Mach, Ph.D.
Supervisor's department:	Department of Telecommunication Engineering

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>Evaluation of thesis difficulty of assignment.</i>	
Considering the fact that student had been working on the thesis only approximately 12 weeks, I see the assignment quite challenging. More specifically, student had to manage to do the following tasks: i) thoroughly study the problem of computation offloading to multi-access edge computing (MEC) servers and general relaying concepts adopted in mobile networks, ii) implement direct offloading and offloading via (multi-hop) relaying in MATLAB, iii) propose a simple algorithm jointly selecting most beneficial relay(s) and relaying mode, iv) analyze and discuss the achieved results.	

Satisfaction of assignment	fulfilled
<i>Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.</i>	
In my opinion, all the goals of the thesis had been fulfilled satisfactorily. More specifically, a derivation of transmission power while considering maximum processing time of the offloaded tasks had been carried out for several relaying modes. Further, exploiting the derivation of transmission power for calculation of energy consumption, a simple algorithm had been proposed and implemented in the MATLAB. It had been demonstrated that offloading over multi-hop relaying is of benefit if distance between offloading device and base station increases.	

Activity and independence when creating final thesis	B - very good.
<i>Assess that student had positive approach, time limits were met, conception was regularly consulted and was well prepared for consultations. Assess student's ability to work independently.</i>	
Student regularly attended regular meeting every week. I would like to emphasize that he has been working very hard to achieve all the thesis's goals within limited amount of time (12 weeks). He was coming to regular meeting well prepared and had questions to the point. Sometimes, I would appreciate a little bit more independency though.	

Technical level	C - good.
<i>Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.</i>	
To the best of my knowledge, the thesis is technically sound. Student exploited gain knowledge regarding mobile networks and get quickly familiar with the MEC concept that is frequently exploited also in IoT domain, e.g., for offloading of computation of IoT devices in order to save their battery. Also, student exploited the knowledge of MATLAB tool in implementing of the proposed algorithm and analyzing its performance. The student contribution is stated in the Introduction chapter. Last, student also showed some math skills in deriving transmission power of the devices in both half- and full-duplex relaying mode in closed-form.	

Formal and language level, scope of thesis	B - very good.
<i>Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.</i>	
The thesis is organized in a logical way. First, Introduction explains why MEC concept has been introduced and what are its benefits and drawbacks. Then, the system model is introduced and problem is formulated. Next, transmission power is derived for several relaying modes, such as half and full duplex, in the closed-form. Even though the English level is	

generally well there are some typos and grammar errors due to insufficient time in the writing process. Despite of this, the English is more than satisfactory.

Selection of sources, citation correctness

C - good.

Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.

Thesis contains references mostly from papers published in highly renowned IEEE journals. However, I would appreciate more references to be included (now there are less than 20 references), especially those dealing with the relaying to better distinguish the contributions. The references seem to follow common citation standards in the field.

Additional commentary and evaluation

Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.

The main strengths and novelty I see with respect to the current state-of-the-art are as follows: i) the derivations of transmission power in closed form for full duplex mode while taking into account self-interference, interference from the offloading UE to the BS, and limited amount of time for tasks transmission has not been done so far and ii) analysis of multi-hop offloading with joint selection of relaying mode is novel.

There are also some weaknesses. In particular, the algorithm for selection of relays is describe only for two-hop relaying while multi-hop case is not explained in detail. This description should be worth to be added as it may not be that straightforward as implied in the thesis. Also, a short discussion on the complexity of proposed algorithm would be useful. Last, a relation between analytical derivations of transmission power in Chapter 4 and its use in proposed algorithm in Chapter 5 could be better explained.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation.

The goals of the thesis have been fulfilled satisfactorily. Since the relays are supposed to be users that may not be willing to relay tasks in the first place, I have the following question: How to motivate the users to relay data for others? Please overview briefly the existing incentive mechanisms and discuss if these can be adopted for offloading of computing tasks to MEC.

I evaluate handed thesis with classification grade **B - very good**.

Date: **19.6.2023**

Signature: Mach