REVIEW

of the *member* of the dissertation council for the dissertation of *Nikolenko Sergey Igorevich* on the topic: "*Algorithms for Networking Problems and Their Theoretical Analysis*", submitted for the degree of *doctor of Physical and Mathematical Sciences* in a scientific speciality 1.2.3. *Theoretical Computer Science, Cybernetics*

The submitted Doctor of Science thesis deals with problems of information transmitting through network nodes supplied with buffers for temporary storing of packets of information. The objectives of the research are to develop several new algorithms for buffer management and packet classification and to investigate their performance.

In Chapter 1 the author provides formulations of main topics of interest. In conclusion, an extensive list of publications by Mr. Nikolenko is given, which is a source of proofs of his results that make up the Thesis.

Chapter 2 describes algorithms for services that change inter-packet properties. At the beginning the author gives a complete review of literature. Then new algorithms (for instance, Lazy-Push-Out, Lazy-Priority-Queue, and Minimal-Queue-First (MQF)) are introduced and their properties are investigated. In my personal opinion, the most beautiful results are tight upper and lower bounds on efficiency of No-Push-Out and matching bounds for MQF obtained by Mr. Nikolenko. The Chapter concludes with an application of Machine Learning technique to choose buffer management algorithms.

Chapter 3 deals with services that change properties of single packets via exploiting new structural properties of packet classifiers. In this Chapter, most of the results are negative, but it also contains several useful algorithms.

In Chapter 4 author introduced and investigated several different algorithms to better exploit network infrastructure: to simplify the network, to aggregate data for cloud computing, to balance a load for multi-grid computing, and to monitor an overloading of the network.

This Doctor of Science thesis is well structured, correctly presented and good documented. The text is written in a clear and conceivable manner. The practical significance of the work is great: it is impossible to imagine modern life without networks now, and results of this Thesis can significantly increase a cost efficiency for using existing networks to transmit information.

Some critical remarks:

a) In order to increase the benefit of the text for readers, it needs to establish a correspondence between theorem numbering of the Thesis and theorems from author's publications (in the list on pages 13-21).

b) On page 33 Picture 2.2 tears Theorem 2.2.6 apart.

c) On page 80 Picture 3.2 rips Theorem 3.2.1 apart.

d) On page 183 there are copies of same reference (i.e., [44] and [45]).

Overall evaluation:

To sum up, the Doctor of Science thesis represents high level scientific work. The introduction gives a clear idea why the research was carried out and its novelty and scientific significance. The candidate's research produced high-quality results which can be a stimulus for future investigations and corresponds to the international standards. The results are well presented and the author clearly explained their interpretations. Furthermore, it is complemented by an excellent publications list of Mr. Nikolenko. The work satisfies all requirement to Doctor of Science Degree Thesis.

Dissertation of *Nikolenko Sergey Igorevich* on the topic: "*Algorithms for Networking Problems and Their Theoretical Analysis*" *meets/does not meet* the basic requirements established by Order No.11181/1 dd. 19.11.2021 "On the procedure for awarding academic degrees at St. Petersburg State University". The applicant *Nikolenko Sergey Igorevich deserves/ does not deserve* to be awarded the academic degree of *doctor of Physical and Mathematical Sciences* in a scientific speciality 1.2.3. *Theoretical Computer Science, Cybernetics*. Paragraphs 9 and 11 of the specified Order have not been violated.

Member of the Dissertation Council
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Dmitry V. Vinogradov

Date: 2 August, 2022

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