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Evaluation Report of the Doctoral Thesis

Online and Distributed Algorithms for

Packet Dissemination in Wireless Networks

submitted by

Paweł Garncarek

to obtain the doctoral degree at the Institute of Computer Science of the University of Wrocław

It is a great pleasure to provide a review of the dissertation submitted by Paweł Garncarek.

The thesis presents an impressive collection of results in the general context of online packet scheduling in networks subject to jamming, crashes or collisions. The general assumption over the whole set of models considered is that packets arrive continuously into the network. Hence, in general, the objective is to explore the stability of the network, or the competitiveness of the scheduling algorithms. The injection is assumed to be controlled by an adversary in most cases, but some results can be applied also to stochastic arrivals.

In Chapter 2 a communication link model with parallel channels is considered. The arrival of packets and errors in the channels are controlled by an adversary. The objective is to find algorithms that are competitive with respect to an optimal algorithm that knows the future actions of the adversary. In this set up multiple variants are explored, including jamming of channels independently, in parallel, and introducing errors (crashes with loss of state). For all of them the thesis presents algorithms with optimal competitiveness, providing matching upper and lower bounds.

In Chapter 3 the model assumes a multiaccess channel prone to collisions over which multiple stations communicate. The packet arrival to the stations is controlled by a bounded adversary that cannot saturate the channel. The thesis presents local algorithm that require only limited information for a station to decide whether to transmit a packet or not in a given slot. It shows a tradeoff on the rate for stability with the amount of memory used, proposing a local algorithm that achieves universal stability (stability for any injection rate) using a certain amount of memory, and showing that without memory stability can only be achieved with rate $O(1/\log n)$. Then, using a newly proposed combinatorial structure (universally strong selectors) it shows that it is possible to achieve stability without memory at rates $\Omega(1/\log^2 n)$.

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Madrid Institute for Advanced Studies in Networks
Avenida del Mar Mediterraneo, 22 – 28918 – Leganes (Madrid) – SPAIN
Tel: +34 91 481 6210 • Fax: +34 91 481 6965 • E-mail: info.networks@imdea.org •
www.networks.imdea.org

Finally, in Chapter 4 the single shared channel is generalized to a collision graph that determines which stations collide when they transmit. In this model the arrival is also adversarial, and it is shown that stability cannot be achieved if the injection rate is 1. Then, an algorithm that achieved universal stability (i.e., for any rate below 1) with limited assumptions about the information used is proposed. The algorithms proposed also achieve stability under stochastic arrivals.

The thesis has resulted in an impressive number of publications in well-known Distributed Computing conferences (DISC, SPAA, IPDPS).

Regarding the presentation, the thesis is well organized and written. The proofs of the results presented are hard to follow, but that is reasonable, since they are rather involved. An effort has been made in some of them to provide the intuition before getting into the details. However, the algorithms proposed are usually simple an elegant. The review of the literature is comprehensive, without important references obviously missing (although some references are duplicated, e.g. 44-45 and 58-59).

In summary, I consider the dissertation a solid piece of research work, and can hence be accepted for awarding a **doktorat degree** to Paweł Garncarek**.** Moreover, I think the **dissertation is outstanding.**

Digitally signed by FERNANDEZ ANTA ANTONIO - 04166960G
Date: 2021.09.07 19:42:39 +02'00'

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Antonio Fernández Anta, PhD
Research Professor
IMDEA Networks Institute (http://www.networks.imdea.org)
Av. del Mar Mediterraneo, 22, 28918 Leganés, Madrid, Spain
Tel: +34 608844802 Fax: +34 91 481 6965
http://people.networks.imdea.org/~antonio_fernandez/