

Doctoral thesis (hereinafter referred to as "thesis"), title of the thesis:

Hash-Based Pattern Matching for High-Speed Networks

Name of the doctoral student (hereinafter referred to as "student"), name and surname:

Ing. Tomáš Fukač

Name and institution of the reviewer (full name of the reviewer, full name and country of the institution):

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I. Thesis

Appropriateness and relevance

The focus of this Ph.D. thesis addresses a highly relevant issue. As the volume of data transmitted over network interfaces reaches hundreds of gigabits per second, real-time packet analysis has become essential for maintaining traffic security. This thesis explores algorithms and the implementation of such methods in FPGAs. The significance of this work is further underscored by its commercial applications.

A summary of the contributions of the thesis

The objective of this work was to design a pre-filter architecture optimized for high-throughput pattern searching using regular expressions. The proposed solution effectively reduces both memory access and collisions while minimizing hardware resource usage, thereby enabling an increase in the number of search patterns. This approach offers significant advantages, particularly in terms of scalability and efficiency.

A notable strength of the project lies in the implementation of the solution as a ready-to-use IP core for FPGAs, facilitating its practical application in the probes.

Overall, the thesis fulfills the objectives set by the author, demonstrating the student's ability to independently tackle complex problems.

Novelty and significance:

The results obtained are highly significant in addressing current challenges in computer network security. From my perspective, this work is particularly valuable for enhancing cybersecurity in communication nodes. Its practical applicability is further underscored by its adoption for commercial use by a private company.

Review of a Doctoral Thesis at FIT BUT

Evaluation of the formal aspects of the thesis:

The thesis is written in a clear. The formal aspect of the thesis is at a very good level. The illustrations used are clear and easy to interpret, contributing to the overall readability of the work. In summary, the thesis leaves a very positive impression on me.

Quality of publications

The core of the thesis is grounded in four conference publications indexed in the Web of Science database. Although these publications have multiple authors, the student's individual contribution is clearly delineated. Two publications are in CORE A and B rated conferences. Some papers already have several citations in the Web of Science database. Overall, this is a satisfactory result in my view for a Ph.D. student.

II. Student's overall achievements

Overall R&D activities evaluation:

From the submitted work and the attached papers, it can be concluded that the applicant is scientifically qualified. He has demonstrated the ability to conduct his own research and publish the results and is thus fully eligible for the Ph.D. degree.

Assessment of other characteristics:

The student has participated in many research projects. It is very positive that with the implementation of the solution in a real facility, the student received the award of the Minister of the Interior of the Czech Republic.

III. Conclusion

The student's work and results meet the generally accepted requirements for the award of the academic degree of Ph.D. (in accordance with Section 47 of Act No. 111/1998 Coll., on Higher Education). I therefore recommend the submitted thesis for presentation and defence.

Brno, 3. 11. 2024

Signature of the reviewer:

Zdeněk Matěj