REVIEW

on PhD thesis for the educational and scientific degree "doctor" (PhD)

Topic: „Blockchain and its Application"

Author: Biser Petrov Tzvetkov,
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Area of Higher Education: 4. Natural sciences, mathematics and informatics

Professional Field: 4.6. Informatics and computer sciences

By: assoc. prof. Yuri Lyubchov Borissov, PhD – IMI, BAS

I was appointed by the order № 202/02.05.2023 of IMI's director to be a chairman of this scientific jury and on the first session I was voted to write this review. I confirm that I have received all materials for this procedure according to LDASRB (the Law for the development of the academic staff in the Republic of Bulgaria). I do not have information for violation of the procedure, nor I'm aware of plagiarism in the presented PhD thesis.

1. **PhD student "curriculum vitae"**

The PhD candidate Biser Petrov Tzvetkov has received in 1999 his MS degree in computer science and mathematics from the Sofia University „St. Kl. Ohridski" as well as in 2004 his MS degree from the Veliko Turnovo University „St.St. Kiril and Metodii" in MS program „Finance". In the presented

very brief CV, unfortunately there is no information for his participation in scientific projects. The list of talks in scientific forums shows six items among them four at international conferences and two at the National Seminar of Coding Theory “Acad. Stefan Dodunekov”.

2. PhD data

The doctoral studies started on 05.07.2017 for a 4-year period and concluded with the right to defend thesis according to decision by IMI’s scientific board (Protocol № 616/30.06.2022). The preliminary discussion of the dissertation, which I attended, took place on 07.04.2023 at an extended meeting of the MFI in the IMI building. By order of the Director of IMI, a scientific jury and the date of the defense have been determined. I believe that the procedure is regular and there are no violations.

3. Thesis and abstract data

The PhD thesis written in Bulgarian has the following structure: introduction (32 pp.), main text (111 pp.) in 5 chapters divided in sections. There is a list of candidate’s contributions, a list of 58 references, as well as, lists for figures (70), one table and appendices with two dictionaries, i.e. of used abbreviations and used terminology. The thesis meets the requirements of LDASRB and RALDASRB (Rules on the application of the Law for the development of the academic staff in the Republic of Bulgaria), as well as of Regulations on the terms and conditions for acquiring scientific degrees and for holding academic positions in BAS. The abstract

(a total of 35 pp.) adequately reflects the main ideas and significant final results, which are described in the dissertation. Despite that citations are not requested by the LDASRB, 2 ones are noticed.

4. Review of the thesis

Chapter 1 provides an overview on DLT (Distributed Ledger Technology) technologies, their key features, as well as, types and classifications. Basic elements of DLT's functionality are described and analyzed, including how the communication security is provided and the quorum is reached. Main conclusions are made on the base of studied literature sources, and directions and functionalities of important value for designing the proposed new SDLC (Systems Development Life Cycle) blockchain system, are given.

In Chapter 2, the traditional SDLC systems with their key scenarios, participants in the processes, as well as, the challenges in deployment and update of the software, are presented. The requirements to SDLC system which in an innovative manner overcomes the difficulties connected with typical steps of renewing the software (with special focus on the system security and the responsibilities of every participant) are described.

Chapter 3 justifies the choice of blockchain platform and technological means to implement the new SDLC system. Characteristics of the various existing platforms are described and how their specificities could address challenges in the field of SDLC

systems are analyzed. After a choice of platform, i. e. EOSIO, is made, the specifics and functioning of this platform are described in more detail. The most essential part presented in this chapter is the definition of the innovative SDLC blockchain design and an analysis of how it overcomes the existing classic SDLC challenges.

Chapter 4 describes the prototype based on an innovative architecture, detailing the environment in which it works: interfaces, smart contracts, modules and agents, communication protocols, etc. Then, key scenarios with their step-by-step implementation addressing the SDLC challenges, are traced.

In last chapter, the results in development of the proposed SDLC system are summarized and different scenarios successfully addressed by the innovative architecture are analyzed. The advantages of the proposed SDLC blockchain system regarding traceability, security and definition of responsibilities are demonstrated. Also, the thesis contributions are summarized and future work directions are indicated.

5. Applied-scientific contributions of the thesis

The main scientific and applied contributions of the dissertation are the following:

• A detailed analysis of the existing solutions for managing the life cycle of business software systems and what are the difficulties, vulnerabilities and unsolved problems in this area has been done;

• Directions and functionalities that are important for the design of a proposed new SDLC blockchain system are formulated;

• Features of the various existing platforms and an analysis of how their specifics could

address challenges in the SDLC area are exposed;

• For the selected platform, a detailed analysis of the specifics and functioning of this platform has been made;

• An innovative SDLC blockchain design is established and it is shown how it overcomes existing classic challenges in the field;

• A prototype based on the innovative architecture and the environment in which it works is described in detail, including interfaces, smart contracts, modules and agents, and communication protocols;

• Key scenarios with their phased implementation addressing SDLC challenges are tracked;

• The advantages, especially in the area of traceability, security and definition of responsibilities have been demonstrated.

I acknowledge the scientific and applied contributions indicated in this dissertation.

6. Publications and participation in scientific forums

The list of publications consists of 4 articles that are published in reputable scientific publications referenced in Scopus. All four articles are co-authored with the scientific advisor assoc. prof. Hristo Kostadinov. One of these papers was published in the Springer issue Studies in Computational Intelligence with SJR 0.215, and another was also accepted for publication in the Springer issue: Communications in Computer

and Information Science, SJR: 0.160. The other two are included in the proceedings of following international scientific conferences:

• ACCT 2020, organized by the MFI section of IMI-BAS (IEEE Xplore);

• AIP Conference Proceedings, vol. 2164, art. n. 120015, 2019, SJR: 0.190.

I believe that the participation of the PhD candidate in all publications is equal to that of his co-author. The number of articles meets the requirements of RALDASRB.

7. Conclusion

In my opinion, the presented dissertation "Blockchain and its application" with author Biser Petrov Tsvetkov contains scientific and applied results that represent an original contribution to software engineering and informatics. Clearly, the PhD candidate has in-depth theoretical and practical knowledge in the field of blockchain technologies, as well as, the ability for independent scientific-applied and development work. This PhD thesis fully meets the requirements established by the LDASRB and the regulations of BAS and IMI, so I confidently suggest to the esteemed scientific jury to vote for the educational and scientific degree "Doctor" to BE ACQUIRED by Biser Petrov Tzvetkov in **Professional Field**: 4.6. Informatics and computer sciences.

23.05.2023 г. Reviewer: …….

Sofia /assoc. prof. Yuri Borissov/