REFEREE

on the procedure for receiving educational and scientific degree "Doctor" (PhD) in field of higher education: 4. Natural Sciences, Mathematics and Informatics, professional field: 4.6 Informatics and computer sciences.

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Dissertation: Smart Contract Platforms.

The referee was prepared by Assoc. Prof. PhD, Zlatko Georgiev Varbanov, Faculty of Mathematics and Informatics, University of Veliko Tarnovo, field of higher education 4. Natural Sciences, Mathematics and Informatics, in my capacity as a member of the Scientific Jury according to Order No. 91/18.11.2025 of the Director of IMI-BAS and decision of the Scientific Jury (Protocol 1/28.11.2025).

1. General characteristics of the dissertation and the presented materials

The main goal of the presented dissertation is to develop approaches related to several well-known and widespread challenges: stimulating scientific research, implementing and ongoing support of business software systems in real environments, and generating random numbers. The solutions that are proposed are based on a distributed architecture based on blockchain, satisfying the requirements of modern software for delivery and implementation of software systems with business applications. In the architecture of the blockchain-based system, it is envisaged to automate steps related to specific responsibilities and key performance indicators through smart contracts. In recent years, various classic businesses have been studied, from finance to real estate to autonomous cars and insurance, all characterized by the participation of multiple participants in each process, where transactional information must be permanently stored and remain protected from misuse. In this regard, the topics covered by the dissertation work, i.e. the stimulation of scientific research, SDLC (systems development life cycle) and the generation of provably random numbers, are still poorly studied. Therefore, the contribution of this work is unique and contributes to the establishment of blockchain as a new standard in quality and reliable services for the mentioned areas.

An important part of the dissertation is the development of a prototype that demonstrates how the main modules, the connections between them and the communication protocols solve the goals set for the given architecture. The prototype in Chapter 4 is built on the EOSIO/Antelope blockchain platform, which is open source and is characterized by fast, scalable and secure transaction processing. A significant point is the storage of big data, for which a new generation of decentralized distributed storage network called the Interplanetary File System is used. The network in question uses content addressing to uniquely identify each file in a global namespace. Files uploaded to IPFS are distributed across multiple computers and assigned a hash value that allows users to easily locate them.

The presented dissertation consists of 135 pages in general. It contains an introduction, four chapters, conclusion, list of publications and author's contributions, bibliography, a list of figures and tables, and a glossary of abbreviations and terms.

2. Data of the candidate

Jivko Jeliazkov graduated with a master's degree in Probability and Statistics in 1998 from Sofia University. Since January 1997, he has been working in various software companies, and since June 2003, he has been in one of the most prestigious software companies internationally. In 2019, he started in a part-time doctoral program at the Institute of Mathematics and Informatics-BAS.

3. Content analysis of the candidate's scientific and scientific-applied achievements, contained in the presented dissertation and the publications to it, included in the procedure

The introduction contains a presentation of the problems that are solved in the dissertation, as well as a description of the content of the following chapters. Chapter 1 contains an overview and analysis of distributed ledger technology (DLT). This includes the definitions and notations used further in the work, along with a historical overview and description of the characteristics of DLT that allow its application in business. Based on an appropriate analysis of the main elements of the functioning of DLT, as well as how communication security is ensured and how consensus is achieved, basic conclusions are drawn based on researched literature sources and guidelines and functionalities that are relevant for the design of the proposed new blockchain systems are formulated. The choice of blockchain platform and technological means for implementing the system is justified. The characteristics of the various existing platforms are described and an analysis of how their specificities could respond to challenges in different areas is analyzed.

Chapter 2 describes and analyzes a distributed system based on a public blockchain that can be used to incentivize scientific discovery and collaboration. The proposed distributed system would allow for the public sharing of many computational problems. Rewards are determined for each potentially anonymous participant who manages to provide their correct solutions. Some of the advantages of using a distributed application are its flexibility and transparency, immutability by design, administrator-free operations, as well as the full traceability of both the problem definition and the reward structure and the proposed solution. The developed prototype of the EOSIO technology covers the key roles and interactions for the proposed systems. It is shown that even the simplest incentive scenarios must be carefully constructed to avoid many potential attacks specific to third-generation public blockchains.

Chapter 3 presents the SDLC area with its development scenarios, process participants, and emerging challenges in software implementation and updating. The challenges are also described regarding the requirements for the developed SDLC system, which in an improved way overcomes the difficulties associated with typical software update steps with a special focus on system security, as well as the responsibilities of each participant. The most essential part presented in Chapter 3 is the definition of the innovative blockchain design of SDLC and an analysis of how it overcomes the existing classic SDLC challenges.

Chapter 4 describes the architecture of a practical system for generating provably random numbers and the results of building a simple but robust prototype based on the innovative architecture, describing in detail the environment in which it works: interfaces, smart contracts, modules and agents, communication protocols, etc. As a result of testing the prototype, it was concluded that it works and correctly generates provably random numbers using the blockchain as the source code for the random number generator. Thus, it is confirmed that the use of the prototype shows that the EOSIO blockchain technology is suitable for creating distributed applications that use the advantages provided by using the blockchain as a platform for smart contracts. Such an application can be very small and efficient, while using the advantages provided by the EOSIO/Antelope technology.

Chapter 5 is actually a list of publications on the dissertation, as well as a list of conferences at which the results were reported. Usually these parts of the dissertation should not be numbered as a separate chapter.

The last part is the conclusion and is marked as Chapter 6, although it is also customary not to number the conclusion as a separate chapter. It contains a brief description of the contributions of the dissertation, as well as a comprehensive

summary of the results obtained. At the end of the dissertation there is a list of literature, a list of figures and tables, as well as a list of abbreviations and terms used. A small number of spelling and stylistic errors are noticed, which do not reduce the value of the achieved results.

4. Approbation of the results

The dissertation is based on 2 papers. They were published in the proceedings of an international conference with an SJR of 0.190.

These two publications are fully sufficient to fulfill the minimum national requirements (they give the candidate 2x30 = 60 points). In general, the presented scientific works definitely cover and exceed the minimum national requirements and, accordingly, the additional requirements of the IMI - BAS for the acquisition of an educational and scientific degree "doctor" in the scientific field and professional direction of the procedure.

5. Citations of the candidate's papers

No list of citations of the candidate's works is presented.

6. Evaluation of the candidate's contribution to joint publications

The presented publications are co-authored with the PhD student's supervisor. It is clear from the attached documents that the applicant's contribution to the joint publications is indisputable and can be considered to be equal to that of the other co-authors.

7. Quality of the abstract and list of contributions

The abstract is written in sufficient detail and provides a clear and adequate idea of the content and main results of the dissertation. Having familiarized myself with the content of the publications and the dissertation, I acknowledge the following contributions:

• An analysis of existing solutions for Smart Contract Platforms based on blockchain technology and distributed storage technologies has been made (scientific-applied contribution);

• A distributed system for encouraging development activity through awards, which are determined for finding the only or best solution to a given problem, has been described (applied contribution);

• A system for managing the life cycle of corporate software has been described (applied contribution);

• A system for using a number of algorithms for generating provably random numbers, based on a smart contract platform, has been described (scientific-applied contribution).

• A prototype based on the innovative architecture has been presented, and the environment in which it operates has been described in detail: interfaces, smart contracts, modules and agents, communication protocols (applied contribution);

• The results of the development of new systems based on smart contract platforms are summarized and the different scenarios successfully addressed by the innovative architecture are analyzed. Their advantages are demonstrated, especially in the areas of traceability, security and definition of responsibilities (scientific-applied contribution).

8. Conclusion

Having become acquainted with the dissertation thesis presented in the procedure and the accompanying scientific papers and based on the analysis of their significance and the scientific and scientific-applied contributions contained in them, I confirm that the presented dissertation and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them meet the requirements of the Low for the Development of the Academic Staff in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules at the IMI - BAS for the acquisition by the candidate of the educational and scientific degree “Doctor” in field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6 Informatics and computer sciences. In particular, the candidate satisfies the minimum national requirements in the professional field and no plagiarism has been found in the presented dissertation and scientific papers. Based on the above, I recommend the scientific jury to award Jivko Stefchev Jeliazkov an educational and scientific degree "doctor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional field 4.6. Informatics and Computer Science.

19.12.2025 г. Signature:

/Assoc. Prof. PhD Z. Varbanov/