

REVIEW

of a dissertation for the acquisition of the educational and scientific degree "Doctor"

in the field of higher education "Technical Sciences"

professional field: 5.3. Communication and Computer Engineering

Doctoral Program: Automated Information Processing and Control Systems

Author of the dissertation: M. Eng. Velin Sabinov Hadzhiev

Topic: Modelling of Data Structuring, Storage, and
Processing Operations on the Internet

Reviewer: Assoc. Prof. Dr. Eng. Galina Ivanova Ivanova

1. Topic and relevance of the problem developed in the dissertation

The problem addressed in the dissertation is relevant in connection with the growing need for effective structuring, processing and storage of large volumes of heterogeneous data on the Internet.

The objective of this dissertation is to generate and study modern models for structuring, storing and processing data, obtained through the application of various methods for modelling these operations on the Internet.

In the dissertation research, methods for structuring, storing and processing data have been modified and studied, and algorithms for structuring, storing and processing data have been developed and studied. Models of operations for structuring, storing and processing data on the Internet have been developed and a study and comparison of the proposed models has been made.

The proposed hybrid model combines different architectures of data warehouses and meets modern technical and business requirements, ensuring greater flexibility. This model enables the integration of data from different sources and includes three main levels: a decentralized level for local storage and processing, a distributed level for sharing and integrating data, and a global level for centralized data management and aggregation.

2. Review of the cited literature

In the present dissertation, a literature review of 118 references (books, articles, reports, dissertations, technical documentation) has been conducted, of which 4

references in Cyrillic, 111 – in Latin script and 3 – internet-based sources. The list of references covers scientific literature related to the topic of the dissertation research topic. The cited references are from recent years.

The review of the cited references demonstrates Eng. Velin Hadzhiev's strong awareness and understanding of the scientific field. Based on the literature review, the relevant conclusions and appropriate solutions have been formulated within the dissertation.

The conducted SWOT analysis of the existing Inmon and Kimball models and the SWOT analysis for evaluating architectures are valuable for identifying the strengths and weaknesses of popular solutions.

3. Research methodology

The dissertation consists of 156 pages and includes a table of contents, a list of terms and abbreviations, an introduction, four chapters, general conclusions and a conclusion, contributions, a list of publications of the dissertation, citations, implementations and references. The dissertation is properly structured and methodologically well-organized.

In the **First chapter**, in the line with engineering traditions, the scientific problem and its relevance are analysed. A review of the existing models, methods and architectures for structuring, storing and processing data is conducted, with a particular focus on key methods for structuring data. Five methods for structuring data, three models and five architectures for structuring, storing and processing data based on these methods are examined. An overview of the existing approaches to data storage and management is provided, including a description of evaluation measures and a comparative analysis of the models.

In the Second chapter, the methodology for implementing the task is presented, including the selection of an approach for implementing the operations of structuring, storage and processing data, the choice of an appropriate concept for implementing the tasks set and a description of the specific activities that will be carried out within the framework of the dissertation research.

A model defining a hybrid approach to structuring, storing and processing data is introduced, which combines different data warehouse architectures suitable for different technical and business needs. The data architecture and the organization of the data flow are described, which provide a step-by-step centralization of data structuring, storage and processing.

In the Third chapter, a SWOT analysis of the hybrid model for structuring, storing and processing distributed data is made. At the end of the chapter, the summarized results of the analysis are presented, based on which a conclusion is drawn.

The fourth chapter presents the implementation of a data and information management system based on the hybrid model for structuring, storing and processing distributed data on the Internet, as described in the second chapter. The

system requirements, the selection of tools and technologies for its implementation, and the system are presented. The software implementation of the system is described. An analysis of the solution is provided, highlighting its strengths and weaknesses, opportunities and threats.

The conclusion summarizes the key findings of the research. The achieved scientific results, contributions and their validations are indicated.

Each chapter of the dissertation ends with conclusions. Eng. Velin Hadzhiev has systematically and convincingly justified conclusions that support his thesis and has achieved the objective results of his dissertation work.

This confirms the doctoral candidate's ability to clearly define his goal, to scientifically argue his ideas, and independently solve engineering problems by conducting experimental research in a structured and persuasive manner.

4. Contributions of the dissertation

The key contributions can be summarized as follows:

Scientific-Applied Contributions.

1. A comprehensive analysis of architectures for data structuring, storage, and processing in cloud environments has been conducted. This analysis serves as the foundation for developing sustainable and scalable systems that meet the requirements for database accessibility for a wide range of users.

2. A methodology has been developed for selecting and evaluating models for data structuring, storage, and processing, offering a systematic approach to adapting these models to specific requirements for data structuring, storage and processing.

3. Models for data structuring, storage, and processing were evaluated and analysed, with a focus on applying the developed methodology for their assessment. Software tools were utilized to provide an objective evaluation of critical aspects such as efficiency, sustainability, and scalability of the models.

4. A hybrid model has been created that combines key functionalities of the selected models, addressing specific requirements for data structuring, storage, and processing, while ensuring database accessibility for a wide range of users. The developed data flow diagram demonstrates the model's effectiveness in various practical scenarios.

5. A SWOT analysis of the hybrid model has been conducted, confirming its potential for integration into real systems and highlighting its flexibility and resilience across various solutions.

Applied Contributions

1. A method for optimizing data operations has been developed, integrating best practices and proven techniques for data structuring, storage, and processing. Its applicability has been demonstrated through simulations and tests in real conditions.

2. The effectiveness of the proposed hybrid model has been validated through

empirical testing, which includes assessments of performance, resilience, and scalability.

3. Based on the method for optimizing data operations, a web - based system for data structuring, storage, and processing has been developed, offering access to databases for a wide range of users. Tests conducted in real - world scenarios confirm its practical effectiveness.

5. Publications and Citations of Publications on the Dissertation Work

The main results of Velin Hadzhiev's dissertation have been published in 9 scientific publications, including 2 journal articles, 4 reports at international scientific conferences abroad, 3 reports at international scientific conferences in Bulgaria. Of these, 5 publications are in English and 4 in Bulgarian. 5 of the publications are in SJR publications indexed in Scopus. 8 publications are co-authored with the scientific supervisor, and in all of them the doctoral student is in first place.

The content of the publications presented research related to the individual chapters of the dissertation.

The results obtained have been reported at international conferences, including four abroad (ELECO 2019, ELECO 2021, ICCCNT 2022) and three in Bulgaria (Automation and Informatics '19 2019, ICAI 2021). Two articles have been accepted for publication in a national scientific journal (Automation and Informatics Journal, 2019, vol. 2 and vol. 3).

Eng. Velin Hadzhiev presented the following scientific production, correlated with the criteria for the minimum national requirements for the scientific activity of candidates for acquiring scientific degrees in 5. Technical Sciences, as follows by the relevant groups of indicators:

- Indicator A: Dissertation for educational and scientific degree "Doctor" - 50 points;

- Indicator D: with a minimum required score of 30, the candidate presents 160 points for 9 publications as follows:

- 5 scientific publications in publications that are referenced and indexed in world databases of scientific information - a total of 120 points;

- 4 scientific publications in non-refereed journals with scientific review or in edited collective volumes - a total of 40 points.

- Indicator E: Citations or reviews in scientific publications, referenced and indexed in world databases of scientific information or in monographs and collective volumes - a total of 30 points.

The scientific publications presented exceed the minimum requirements for obtaining a doctoral degree. The main results of the dissertation have been reported

and discussed at a number of scientific forums, including international ones.

Three citations of the scientific works presented by Eng. Velin Hadzhiev in his dissertation are provided.

Regarding the implementation of the scientific results, the dissertation states that the hybrid model for structuring, storing and processing distributed data on the Internet is implemented in an experimental web-based data and information management system. This system enables users to organize and manage data according to their own preferences, even if they have no experience in the field of databases.

6. Authorship of the Obtained Results

I do not personally know the candidate and have no direct impressions of his work. My conclusions are based on the provided documents. One of the scientific publications is independent, while the rest are co-authored with the scientific supervisor. In all joint scientific publications, Eng. Velin Hadzhiev is listed as the leading author in the first place, which shows his leading role in conducting the research. This attests to his active contribution and authorship of the obtained results.

I highly value the large number of joint publications with the academic supervisor as an indicator for strong collaboration within the scientific tandem supervisor-doctoral student.

Based on the conducted authorship verification, I found no evidence of plagiarism by the author in the submitted dissertation and the related published works.

7. Abstract and Author's Reference

The abstract of the dissertation is presented in 43 pages and includes a general description of the dissertation (relevance, objective, tasks, research methods, applicability and validation), as well as a brief content of the dissertation by chapters, general conclusions, conclusion, contributions and a list of publications, a list of citations, implementations and a summary in English. The abstract meets the requirements and accurately reflects the essence of the conducted scientific research and the achieved results.

The abstract is prepared in Bulgarian and English.

8. Opinions, recommendations and notes on the dissertation

By order of the Rector No. 3-01-504/28.11.2024 of the Technical University - Gabrovo, I was appointed as a preliminary reviewer of the dissertation. A significant portion of my recommendations and comments were incorporated in the final version of the dissertation. Here I will point out some remarks from a technical aspect.

In order to improve the overall perception, remarks can be made to some inconsistencies in style and formatting of the dissertation.

The dissertation contains occasional spelling, stylistic and typographical errors which however do not affect the value of the presented dissertation.

In the text of the dissertation, the formulations could be more precise, especially when defining concepts. Terminological inconsistency is noted when using certain terms.

The review of the existing literature is extensive, but there are inconsistencies in the citation style in certain parts of the referenced sources.

I recommend that Eng. Velin Hadzhiev maintain and update his profiles on Google Scholar and ResearchGate to further promote his scientific publications.

The recommendations do not change my positive evaluation of the dissertation, which sufficiently meets the formal requirements in terms of scope, quality, contributions and publications.

9. Conclusions

I believe that the presented dissertation meets the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria. The achieved results provide sufficient grounds for me to recommend that M.Eng. Velin Sabinov Hadzhiev be awarded the educational and scientific degree "Doctor" in the field of higher education 5. Technical Sciences, professional field 5.3. Communication and Computer Technology, doctoral program Automated Information Processing and Control Systems.

07.02.2025

Reviewer: /signature/

/Assoc. Prof. Dr. Eng. Galina Ivanova/