

Reference to original scientific contributions

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(according to a competition for the occupation of the academic position of "professor" in professional direction 5.3 "Communication and computer technology", provided for the needs of the "Telecommunications" department, FDENO of the New Bulgarian University, announced in SG No. 85 / 08.10.2024)

I. Scientific and applied scientific contributions in a monographic work

Monographic work with author Rosen Ivanov Pasarelski on the topic "New 5G mobile cellular systems. Exploring the Interaction between 4G-LTE and 5G Systems: Architecture, Network Functions, Interfaces and Protocols", ISBN: 978-619-233-282-2, is a detailed study and analysis of architecture, network functions, interfaces and protocols of the fifth (5G) generation of mobile cellular networks and their interaction with 4G LTE systems. An approach of consistent analysis and assessment of network architecture status in 4G-LTE mobile systems, backbone network and radio access network, interfaces and protocols in 4G networks, radio resource management and services, security, channels and multiple access methods in LTE is presented. The monograph covers a survey and analytical review of the network architecture in 5G mobile systems, looking at the backbone network, the radio access network and the new radio in 5G systems. The monograph analyzes the network functions and objects in 5G systems, management and quality of services, control, auditing and authentication, network protocols and methods for multiple access in the network architecture. Interaction approaches between 4G LTE and 5G systems are investigated, emphasizing the connection between the core 4G-EPC and the backbone 5G network, as well as the connection in the radio access networks E-UTRAN and 5G RAN. The monograph provides a thorough analysis of the exposure of services between different types of networks. The monographic work also presents extended mathematical analyzes and models with numerical results of the multiple access methods used in 4G and in 5G systems, as well as mathematical models with specific examples and calculations for optimizing radio signaling capabilities in 5G systems.

The following scientific and applied scientific contributions can be systematized in the monographic work:

- Extensive studies and analyzes have been made of the main interfaces for connection and communication between different network components in a 4G - LTE network, of the functions and protocols of the control and user planes in a 4G - LTE network, of the channels for effective and reliable communication between the base station and the user equipment in LTE networks, the radio resource management, the security architecture, the radio access network and the core network in LTE.
- Mathematical analysis and numerical results of Orthogonal Frequency Division Multiplexing - OFDM in LTE networks, Mathematical analysis and modeling for OFDM system in LTE, Mathematical analysis and modeling for OFDMA system in LTE are provided.
- The network functions and objects in 5G systems, management and quality of service, control, auditing and authentication, non-3GPP 5G interaction functions, the protocol stack in the

control and user planes, the reference points in the 5G network architecture, the radio access network and the core network in 5G, the next-generation architecture - NG RAN, the interaction between 4G and 5G networks - between EPC core and 5G RAN, between 5GS with non-3GPP access and EPC/E-UTRAN and between evolved gateway for packet data connected to EPC and 5G system are investigated and analyzed in detail.

- The architecture of 5G systems for time-sensitive communications and industrial automation is explored.
- Non-orthogonal multiple access - NOMA and transmission principles in 5G systems with non-orthogonal multiple access are researched and analyzed.
- Mathematical analyzes supported by numerical results and models for the optimization of radio signaling capabilities in 5G systems, mathematical analysis of forward and reverse channel transmission of 5G systems with non-orthogonal multiple access and comparative analysis between NOMA and OFDMA multiple access methods have been made. in order to have a clearer picture in the study of the two methods.

The work is also characterized by scientific application value, as the results presented in it can be used in the telecommunications sector in the design, implementation and management of 5G networks. Specific technical issues and opportunities for integration of 4G and 5G networks are explored and described, which has practical implications for existing operators.

The monograph also has educational value, as it would be a comprehensive resource for students and telecommunications professionals on topics related to mobile cellular networks and wireless communications.

II. Scientific and applied scientific contributions in the other attached publications

Regarding the competition for the academic position "professor" in the professional direction 5.3 "Communication and computer technology" in the NBU, a list of 29 scientific publications is presented. These works have been published in national and international editions, referenced and indexed in established global databases, as well as in peer-reviewed collections and journals.

Scientific and applied scientific contributions can be systematized in the attached publications as follows:

- 1. R. Pasarelski, G. Petrov, T. Pasarelska, K. Angelov, "Neural Network Architecture to Predict Radio Wave Attenuation in a 5G Network," 2023 National Conference (TELECOM)**

This publication presents the use of a neural network architecture to predict radio wave attenuation in 5G networks. The main contribution consists in the innovative application of artificial neural networks for modeling the radio environment in 5G networks. The proposed architecture improves prediction accuracy, which is key to radio resource optimization and network planning.

The scientific and applied contribution lies in the ability of this approach to improve coverage and quality of service in real 5G networks. The research combines modern methods from the field of machine learning with telecommunication technologies, which makes it significant in both scientific and applied science aspects.

- 2. K. K. Angelov, P. G. Kogias, R. I. Pasarelski, "Application and Performance Analysis of LoRa End Devices for Monitoring of Indoor Lighting Systems," 2023 International Scientific Conference Electronics (ET)**

This publication examines the application of LoRa devices for monitoring indoor lighting systems. The main contribution is in the performance analysis of LoRa technology for specific IoT applications, such as lighting monitoring, which extends the capabilities of LoRa in smart buildings and control systems.

The scientific and applied contribution includes the ability to effectively use LoRa for energy-efficient solutions in lighting systems, offering a practical solution with low energy consumption and wide network connectivity. The research is relevant to the development of smart infrastructures and sustainable IoT networks.

3. R. Pasarelski, K. Angelov, K. Postagian, S. Sadinov, "Implementation and Analysis of a Customized Encryption Algorithm in 5G Networks for Educational Purposes," 2023 International Conference (CIEES)

The paper presents the development and analysis of a custom encryption algorithm implemented in 5G networks for educational purposes. The main scientific contribution consists in the proposal of cryptographic approach adapted for the 5G environment, which demonstrates how security can be improved in modern mobile networks.

The scientific and applied contribution includes the integration of this algorithm into the educational process, which assists students in understanding the fundamentals of cryptography and security in telecommunications.

4. Teresa Stefanova, R. Pasarelski, COMPARATIVE ASSESSMENT OF THE PERFORMANCE OF HIGH SCHOOL GRADUATES IN THE PROFESSIONAL FIELD OF COMMUNICATION AND COMPUTER TECHNOLOGY, ISSN 13126121, Academic Journal "Management and Education", Publishing Complex of University "Prof. Dr. Asen Zlatarov" - Burgas, 2023

The scientific contribution consists in providing an objective analysis of the professional realization of graduates in the field of telecommunications and computer technology, using empirical data to assess their success in the labor market.

Scientific applied contribution is considered in directly contributing to the improvement of educational programs by adapting them to the real needs of industry.

5. Teodora Pasarelska, Rosen Pasarelski, THE KEY MOMENT IN THE GENESIS OF MOBILE CELLULAR SYSTEMS. CONTROL OF RADIO LINKS IN UNIVERSAL MOBILE CELLULAR SYSTEMS, Yearbook Telecommunications 2022, vol. 9, p. 69-77 eISSN 2534-854X <https://telecommunications.nbu.bg/bg/godishnik-telekomunikacii> DOI: <https://doi.org/10.33919/YTelecomm.22.9.7>

As a scientific contribution, the study of the evolution of mobile cellular systems with an emphasis on radio links and their control, which is of key importance for mobile cellular networks, can be noted.

In a scientific applied aspect, it has a direct application in the optimization of mobile cellular networks, which supports the development of more efficient data transmission technologies.

6. Rosen Pasarelski, NETWORK CONCEPTS AND DATA STORAGE PROTOCOLS, Collection of articles from the annual university scientific conference June 27-28, 2019, pp. 1618-1625, ISSN 2367-7481, Vasil Levski National University Publishing Complex, Veliko Tarnovo, 2019

The scientific contribution consists in the analysis of modern network concepts and protocols that provide reliable and scalable data storage in distributed networks.

As a scientific applied contribution, the publication is considered to be relevant to the construction of new, more efficient solutions for network storage systems, which is beneficial for information technology and cloud services.

- 7. Rosen Pasarelski, Analysis of optical devices with wavelength compression, ISSN 2367-7473; Collection of articles from the scientific conference "Current security issues" October 17-18, 2019, pp. 604-611, Vasil Levski National University Publishing Complex - ISSN 2367-7473; Veliko Tarnovo, 2019**

In this publication, the scientific contribution is related to a detailed analysis of optical wavelength division multiplexing (WDM) devices that increase the capacity of optical networks.

Scientific applied contribution concerns the direct application in the construction of high-speed communication systems, to improve the efficiency of optical networks.

- 8. Rosen Pasarelski, Technologies for the security of communication channels in the public network, Collection of articles from the scientific conference "Current security issues" October 22-23, 2020, p. 867-874, ISSN 2367-7473, Veliko Tarnovo, 2020**

The publication explores modern technologies for securing communication channels in public networks.

It has a practical application to improve the security of telecom networks, which is critical for the protection of data and communications in the public sector, which represents the scientific and applied contribution of the publication.

- 9. Rosen Pasarelski, Vasil Kadrev, RESEARCH OF ANTENNAS IN THE AREAS OF ELECTROMAGNETIC RADIATION, Sbornik statii ot nauchna konferentsia „Aktualni problemi na sigurnostta” 25-26 oktombri 2018, str. 624-630, ISSN 2367-7473; Izdatelski kompleks na NVU "Vasil Levski" - Veliko Tarnovo, 2018**

A scientific contribution is related to conducting research on antennas and the influence of electromagnetic radiation on their functioning, which is key to the development of antennas.

- 10. Rosen Pasarelski, INFRASTRUCTURE BUILDING OF DATA CENTERS, Collection of articles from the annual university scientific conference June 27-28, 2019, pp. 1606-1617, ISSN 2367-7481; Publishing complex of Vasil Levski National University - Veliko Tarnovo, 2019**

The article explores the architecture and infrastructure construction of data centers, focusing on new technologies and standards. This publication has practical implications for the development of modern and sustainable data centers that are critical for large enterprises and cloud service providers, highlighting the scientific and applied contributions.

- 11. Rosen Pasarelski, A. Stancheva, NETWORK STORAGE SYSTEMS, Collection of articles from the annual university scientific conference June 27-28, 2019, pp. 1595-1605, ISSN 2367-7481; Publishing complex of Vasil Levski National University - Veliko Tarnovo, 2019**

The publication provides an analytical review of network storage technologies with an emphasis on security optimization and storage performance. As a scientific applied contribution, the direct contribution to the development of more efficient and secure solutions for data storage in modern network environments can be noted.

- 12. Verginia Todorova, Rosen Pasarelski, Analysis of the main components and processes for reception and processing of television content in IPTV, Telecommunications Yearbook 2019, volume 6, pp. 95-104, eISSN 2534-854X, <https://telecommunications.nbu.bg/bg/godishnik-telekomunikacii> DOI: <https://doi.org/10.33919/YTelecomm.19.6.10>**

The scientific contribution in the article is related to conducting a detailed analysis of the processes of reception and processing of television content in IPTV systems, providing knowledge for the improvement of these technologies.

As a scientific applied contribution, the application in the improvement of the IPTV infrastructure, which increases the quality of television services provided to the end user, is considered.

- 13. Rosen Pasarelski, Verginia Todorova, Analysis of protocols and techniques for voice transmission via Internet Protocol, Telecommunications Yearbook 2019, volume 6, pp. 105-113, eISSN 2534-854X, <https://telecommunications.nbu.bg/bg/godishnik-telekomunikacii> DOI: <https://doi.org/10.33919/YTelecomm.19.6.1>**

The publication provides a comprehensive survey of modern Voice over Internet Protocols (VoIP), such as SIP and RTP, and evaluates their characteristics and benefits for telecommunications systems.

The scientific-applied contribution is related to the study of the application of these protocols, which is important for improving the quality of services such as Internet telephony and VoIP, increasing the efficiency and security of communications.

- 14. Vasil Kudrev, Rosen Pasarelski, FEATURES OF RISK MODELING AND SIMULATION IN COMMUNICATION AND INSURANCE SYSTEMS - Yearbook Telecommunications 2020, volume 7, pp. 17-28, eISSN 2534-854X, <https://telecommunications.nbu.bg/bg/godishnik-telekomunikacii> DOI: <https://doi.org/10.33919/YTelecomm.20.7.3>**

The analysis of new methodologies for risk modeling and simulation in telecommunications and insurance systems is defined as a scientific contribution, exploring potential threats and opportunities for their prediction.

The publication offers solutions for security optimization in communication networks, which is useful for better risk management and incident prevention, which is the scientific and applied contribution.

- 15. Rosen Pasarelski, APPROACHES AND MECHANISMS FOR INCREASING CAPACITY AND INDOOR BUILDING RADIO COVERAGE OF MOBILE CELLULAR NETWORKS, Yearbook Telecommunications 2022, vol. 9, p 61-68 eISSN 2534-854X <https://telecommunications.nbu.bg/bg/godishnik-telekomunikacii> DOI: <https://doi.org/10.33919/YTelecomm.22.9.6>**

The scientific contribution in the publication is related to the analysis of methods to increase the capacity and improve the radio coverage inside buildings, considering the challenges of modern mobile networks.

In a scientific applied aspect, this research is essential for mobile operators who seek to provide better coverage and quality of service to their users, especially in urbanized areas.

- 16. Tsvetelina Simeonova, Rosen Pasarelski, Vasil Kudrev, Peculiarities of network performance related to the compatibility of IPv6 (SRv6) with the functionality of existing network devices, Collection of articles from the scientific conference "KNOWLEDGE, SCIENCE, INNOVATIONS, TECHNOLOGIES", p. 349- 360, ISSN 2815-3480, July 6-7, 2023, Veliko Tarnovo**

The article examines the network performance issues associated with the deployment of IPv6 and SRv6 protocols in existing network infrastructures.

The scientific and applied contribution is related to the definition of guidelines for improving network compatibility and optimizing network performance when migrating to new Internet protocols, which can benefit network service providers.

- 17. Rosen Pasarelski, Teresa Stefanova, Teodora Pasarelska, Analysis of mobility management in 5G mobile cellular networks, Collection of articles from the scientific conference "KNOWLEDGE, SCIENCE, INNOVATIONS, TECHNOLOGIES", April 28, 2023, pp. 586-601, ISSN 2815 -3480, Veliko Tarnovo**

As a scientific contribution, the publication notes the study of mobility management processes in 5G networks, which is key to maintaining continuous connections and high performance.

The scientific and applied contribution is contributing to the optimization of mobility in 5G networks, which enables better resource management and higher efficiency of network services.

- 18. Rosen Pasarelski, Teodora Pasarelska, Research of network functions and reference architecture of 5G mobile systems, Collection of articles from scientific conference "KNOWLEDGE, SCIENCE, INNOVATIONS, TECHNOLOGIES", pp. 388-400, ISSN 2815-3480, July 6-7 2023, Veliko Tarnovo**

Scientific contributions are reported in the analysis of 5G architecture and network functions, looking at key components such as network slicing, virtualization, and network function virtualization (NFV).

In a scientific applied aspect, it has a direct application in the development of modern mobile networks, improving the understanding of their architecture and facilitating the implementation of new services.

- 19. Rosen Pasarelski, Teodora Pasarelska - Study of phases for network planning of mobile cellular networks, Scientific journal "Industrial technologies" volume 9, page 122-130 Publishing complex of University "Prof. Dr. Asen Zlatarov", ISSN 1314-9911, Burgas, 2022**

The paper provides an analytical overview of the stages of the network planning process for mobile cellular networks, including equipment selection and network architecture.

The publication has a significant practical application for mobile operators in the planning and construction of mobile cellular networks with high efficiency and reliability, which consists of the scientific and applied contribution.

- 20. Rosen Pasarelski, Teodora Pasarelska, RESEARCH OF FEMTOCELL TECHNOLOGIES FOR MOBILE CELLULAR NETWORKS, Yearbook Telecommunications 2022, vol 9, p. 53-59 eISSN 2534-854X, <https://telecommunications.nbu.bg/bg/godishnik-telekomunikacii> DOI: <https://doi.org/10.33919/YTelecomm.22.9.5>**

The scientific contribution in the publication is related to the study of femtocell technologies and their role in improving network coverage and capacity, especially in hard-to-reach and closed spaces.

The scientific-applied contribution consists in the practical application in the implementation of femtocell solutions in mobile networks, which makes it possible to increase the quality of services in specific areas with insufficient coverage.

- 21. Vasil Kudrev, Rosen Pasarelski - APPLICATION OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING APPROACHES IN CYBERSECURITY, Yearbook Telecommunications 2021, volume 8, pp. 53 - 64 Yearbook Telecommunications 2021, vol. 8, p. 53 - 64 eISSN 2534-854X, <https://telecommunications.nbu.bg/bg/godishnik-telekomunikacii>, DOI: <https://doi.org/10.33919/YTelecomm.21.8.6>**

The scientific contribution is determined by the study of the applications of artificial intelligence and machine learning in the field of cyber security, analyzing different approaches for detecting threats and predicting attacks.

As a scientific applied contribution, the direct application in the development of new and more effective systems for protecting communication networks from cyber-attacks is considered, which is essential for the security of networks and data.

- 22. Rosen Pasarelski, Vasil Kudrev, Concept and reference model of a storage system architecture, Collection of articles from the Annual University Scientific Conference of NSU "Vasil Levski", May 27-28, 2021, pp. 2224 - 2230, ISSN 2367-7481, Publishing complex of Vasil Levski National University, Veliko Tarnovo**

The publication presents an analysis of the concept of creating an architectural model of a storage system, which outlines its scientific value in the field of telecommunication technologies and computer systems. The scientific-applied contribution consists in illustrating a reference model that can be applied in various organizations to optimize storage solutions. This is of particular importance for managing large volumes of data and improving the efficiency of IT infrastructure.

- 23. Rosen Pasarelski, Risk analysis of VOIP systems, Collection of articles from the Annual University Scientific Conference of Vasil Levski National University, May 27-28, 2021, pp. 2231 - 2240, ISSN 2367-7481, Vasil Levski National University Publishing Complex ", Veliko Tarnovo**

This publication analyzes the risks associated with VoIP systems, which has a high scientific application value for ensuring the safety and stability of modern telecommunication networks. It examines the potential vulnerabilities of VoIP infrastructure and proposes methods for their

management and minimization, which can be applied in practice in companies and organizations using such systems.

- 24. Rosen Pasarelski, Optical transmitters and receivers, Collection of articles from the Annual University Scientific Conference of Vasil Levski National University, May 27-28, 2021, pp. 2241 - 2248, ISSN 2367-7481, Vasil Levski National University Publishing Complex , Veliko Tarnovo**

The publication examines the technologies associated with optical transmitters and receivers, which are key components in modern communication networks. The scientific and scientific-applied contribution consists in the in-depth study of these technologies and the possibility of using the presented solutions in the construction and optimization of high-speed optical networks.

- 25. Rosen Pasarelski, Vasil Kudrev, Software threats and information vulnerability in the public network, Collection of articles from the Scientific Conference "Current Security Issues", October 22-23, 2020, pp. 875 - 882, ISSN 2367-7473, Publishing complex of Vasil Levski National University, Veliko Tarnovo**

This article focuses on software threats and vulnerabilities related to information security in public networks. It has high scientific application value, as the developed security strategies can be used to protect data in various public networks and organizations, especially in the context of growing cyber threats.

- 26. Verginia Todorova, Pocen Pacapelcki, Networks for data storage. interfaces and technologies, Collection of articles from the Annual University Scientific Conference, May 28-29, 2020, pp. 1817-1828, ISSN 2367-7481, Vasil Levski National University Publishing Complex, Veliko Tarnovo**

The publication explores data storage networks, emphasizing the interfaces and technologies that support them. The scientific-applied contribution consists in the study of new solutions for the optimization of network data storage, which can find application in modern IT infrastructures and improve the performance of data centers.

- 27. Rosen Pasarelski, Verginia Todorova, Implementations of a network-added storage system, Collection of articles from the Annual University Scientific Conference, May 28-29, 2020, pp. 1829-1838, ISSN 2367-7481, Vasil Levski National University Publishing Complex, Veliko Tarnovo**

The publication examines the practical aspects of implementing network-attached storage systems, which are critical for modern enterprise environments. The scientific-applied contribution is in the development of strategies for the successful implementation and management of these systems, which can lead to an increase in the efficiency and security of corporate networks.

- 28. Rosen Pasarelski, Methods and techniques for measuring and evaluating the quality of voice transmission over the Internet, Collection of articles from the scientific conference "Current Security Issues", October 17-18, 2019, p. 5 95-603, ISSN 2367- 7473, Vasil Levski National University Publishing Complex, Veliko Tarnovo**

This paper presents methods for measuring and evaluating Voice over Internet Protocol (VoIP) transmission quality by investigating various aspects of Quality of Service (QoS). The scientific-applied contribution is in the preparation of specific methods for improving the quality of VoIP communications, which can be applied by telecommunications operators and companies using these technologies.

29. Rosen Pasarelski, Verginia Todorova, Mechanisms for protection of signaling in VoIP networks, Collection of articles from the scientific conference "Current Security Issues", October 17-18, 2019, pp. 584-594, ISSN 2367-7473, Publishing complex of Vasil Levski National University, Veliko Tarnovo

The publication addresses the security issues of VoIP networks, specifically signaling protection. The scientific-applied contribution consists in the proposals for mechanisms to protect VoIP communications, which is especially important in the modern conditions of increased cyber threats. This makes the article valuable for companies and organizations providing communication services over the Internet.

The monographic work and the attached publications outline the scientific and applied scientific contributions of the author in a professional direction 5.3. "Communication and Computer Engineering".

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