ADMISSION TO DOCTORAL STUDIES Session September 2025

Field of doctoral studies: Electronic engineering, telecommunications and information technologies

Doctoral supervisor: Prof. Dr**. Titus Constantin BĂLAN**

TOPICS FOR THE ADMISSION TO DOCTORAL STUDIES

TOPIC 1: Optimized hardware/software architectures for packet processing
Contents / Main aspects to be considered - *Methods for implementing packet processing at the level of hybrid embedded systems including processor, SW elements and HW acceleration* - *FPGA-based systems for real-time packet analysis* - *Implementing and optimizing package processing for cybersecurity applications* - *Secure communication at the level of RISC-V architectures*
Recommended bibliography: - John L. Hennessy and David A. Patterson. 2017. Computer Architecture, Sixth Edition: A Quantitative Approach (6th. ed.). Morgan Kaufmann Publishers Inc., San Francisco, CA, USA. - Mohit Arora, The Art of Hardware Architecture: Design Methods and Techniques for Digital Circuits, 2012 - Philip Andrew Simpson, FPGA Design Best Practices for Team-based Reuse, 2015 - Computer Organization and Design RISC-V Edition: The Hardware Software Interface (1st. ed.). Morgan Kaufmann Publishers Inc., San Francisco, CA, USA. https://futurenetworks.upb.ro/sdpicaddos/
Prerequisites / Remarks: - *Bachelor's and/or Master's degree in the field of Electronic Engineering, Telecommunications and Information Technologies or in a very close field*
X Scientific Doctorate (full-time only) ☐ Professional Doctorate (full-time or part-time)
X without tuition fee (state budget funded) X with tuition fee or with funding from other sources than the state budget

TOPIC 2: AI solutions for cybersecurity and methods to secure AI-based deployments
Contents / Main aspects to be considered - *Improving digital fact investigations and incident response using AI* - *Streamlining penetration testing* - *Methods to optimize malware analysis with intelligent processes*
Recommended bibliography: - M. Sikorski and A. Honig, Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software. San Francisco, CA: No Starch Press, 2012. - B. Nikkel, Practical Linux Forensics: A Guide for Digital Investigators. San Francisco, CA: No Starch Press, 2021. - S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 4th ed. Upper Saddle River, NJ: Pearson, 2020. - G. Weidman, Penetration Testing: A Hands-On Introduction to Hacking. San Francisco, CA: No Starch Press, 2014.
Prerequisites / Remarks: - *Bachelor's and/or Master's degree in the field of Electronic Engineering, Telecommunications and Information Technologies or in a very close field* - *Cybersecurity Knowledge*
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TOPIC 3: Modelling and evaluating two-way interaction in VR and XR applications
Contents / Main aspects to be considered – - *System architectures for real-time interaction between users and content generators in VR/XR environments, with a focus on latency and synchronization.* - *Bidirectional feedback mechanisms (audio, visual, gestural) and their impact on user and performer experience.* - *Quality of Experience (QoE) assessment and analysis of objective and subjective metrics for interaction in low-latency networks*
Recommended bibliography: - *A. Janin, C. Choi, M. Rath, R. Tang, and T. Pederson, "Real-Virtual Objects: Exploring Bidirectional Embodied Tangible Interaction with a Virtual Human in World-Fixed Virtual Reality," in 2024 IEEE Conference on Virtual Reality and 3D User Interfaces (VR), Orlando, FL, USA, 2024.* - *A. A. Ababneh, M. M. Alkhateeb, and Y. Jararweh, "Virtual Reality and User Experience: Current Trends and Future Challenges," Sensors, vol. 25, no. 6, 2025. [Online].*

Available: https://www.researchgate.net/publication/390153559

- *M. Saba, P. Lin, S. Lee, and J. Park, "Understanding User Behaviors of XR Environments using LLM," arXiv preprint arXiv:2501.13778, Jan. 2025. [Online]. Available: https://arxiv.org/abs/2501.13778*
- *B. Petit, R. Paiva, F. D. V. Ramos, and M. Cordeiro, "Collaboration in Virtual Reality: Survey and Perspectives," arXiv preprint arXiv:2411.16124, Nov. 2024. [Online]. Available: https://arxiv.org/abs/2411.16124*

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TOPIC 4: Hardware-software methods for data acquisition and audio-video signal processing for real-time CVI applications

Contents / Main aspects to be considered

1. Hardware/software architecture for real-time data acquisition and processing in CVI applications, focusing on low latency and synchronization.
2. Data transmission for CVI applications with networking and cybersecurity considerations.
3. Integrating AI methods for data processing optimization and enforcing confidentiality.

Recommended bibliography:

1. H. Hadizadeh și I. V. Bajić, "Learned scalable video coding for humans and machines," EURASIP Journal on Image and Video Processing, vol. 2024, art. 41, Nov. 2024.
2. Z. Liu, F. Yang, D. Wang, L. Herranz et al., "A slimmable framework for practical neural video compression," Neurocomputing, vol. 610, art. 128525, Dec. 2024.
3. Y. Xu, F. Dang, R. Xu, X. Chen, Y. Liu, "LSync: A Universal Event-synchronizing Solution for Live Streaming," în Proceedings of IEEE INFOCOM 2022 (Workshop la INFOCOM 2022).
4. K. Jeziorek, P. Wzorek, K. Blachut, A. Pinna, T. Kryjak, "Embedded Graph Convolutional Networks for Real-Time Event Data Processing on SoC FPGAs," preprint arXiv, 11 June 2024

Prerequisites / Remarks: *to be adapted/ completed/ deleted*

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TOPIC 5: Cybersecurity solutions for secure data sharing in hydrid and distributed environment and critical infrastructures protection
Contents / Main aspects to be considered 1. Solutions for data protection in distributed and hybrid (cloud, on-prem) environments 2. Shared data spaces security: Identity federation, data protection & confidentiality, integrated application security in operational workflows 3. Cybersecurity solutions for critical infrastructures: network security and perimeter defense, incident response, security monitoring and audit. 4. AI based automated cybersecurity operations
Recommended bibliography: 1. Jarmul, Katharine. *Practical data privacy*. " O'Reilly Media, Inc.", 2023. 2. B. Nikkel, Practical Linux Forensics: A Guide for Digital Investigators. San Francisco, CA: No Starch Press, 2021. 3. G. Weidman, Penetration Testing: A Hands-On Introduction to Hacking. San Francisco, CA: No Starch Press, 2014.
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Doctoral supervisor,

Prof. Dr. Titus Constantin BĂLAN

Signature

Coordinator of the field of doctoral studies,

Prof. Dr. Mihai IVANOVICI

Signature