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Conference on Networked Systems 2021 (NetSys 2021)

Preface and Table of Contents

Mathias Fischer, Winfried Lamersdorf

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Guest Editors: Mathias Fischer, Stefan Fischer, Horst Hellbrueck, Winfried Lamersdorf
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1 Preface

Since 2013, the bi-annual international conference series on *Networked Systems (NetSys)* has been organized as an international event jointly by the German Computer Society (Gesellschaft für Informatik, GI, FG KuVS) and the Information Technology Society (Informationstechnische Gesellschaft (ITG) in Verein Deutscher Ingenieure (VDE). In addition, Netsys 2021 is again supported by IFIP TC6 (Communication Systems). Netsys provides an international forum for engineers and scientists in academia, industry, and government to discuss recent innovations in the realm of networked and distributed systems. The Netsys conference series originated from the previous scientific conference series on networked systems in German-speaking countries *KiVS* (Kommunikation in Verteilten Systemen) that was initiated 41 years ago. In particular, NetSys 2021 is organized by the special interest group "Communication and Distributed Systems" (KuVS), which is anchored both in the German society for Computer Science (Gesellschaft für Informatik (GI)) and in the Information Technology society (Informationstechnische Gesellschaft im VDE (ITG)).

Furthermore, NetSys 2021 again includes the annual one-day ITG expert symposium *Future of Networking* (Zukunft der Netze, ZdN) as an integral part of its program on the last conference day. The ZdN program consists of invited presentations by major industry and academic experts. It is organized by the ITG expert group (Fachausschuss) on "Communication Networks".

The NetSys 2021 proceedings (please see the table of contents in Section 2) consist of 18 peer-reviewed **extended abstracts** on innovative aspects of networking and distributed systems, ten peer-reviewed **extended abstracts on practical demos**, seven peer-reviewed **extended abstracts featuring early work**, and 13 peer-reviewed papers of the following four co-located **workshops**:

- Cyber Forensics and Advanced Threat Investigations in Emerging Technologies (CC-FATI3)
- International Workshop on Communication Technologies for Vehicles (Nets4Cars)
- Machine Learning in Networking (MaLeNe)
- Workshop on Nanonetworks and Nanocomputation (WONAN)

In addition, the NetSys program features two sessions with **hot topic presentations** (i.e. presentations of papers already accepted at top-ranked conferences and journals in the last two years), **invited keynotes**, **panels**, a **PhD forum**, **tutorials**, and an **awards session**.

As a special motivation for high-quality extended abstracts, a small number of the such abstracts as submitted to the conference and carefully selected by the PC, have been invited for submission to a special issue of ACM Transactions on Internet Technology (TOIT) on *Recent Advances in Networks and Distributed Systems* which is to appear at the end of 2021 resp. beginning of 2022.

In parallel, the one-day ITG expert symposium on the *Future of Networking (ZdN-track)* includes sessions on 5G, 6G, as well as other advanced networking technologies with a major emphasis on recent developments in related industry.

Organizationally, as we still have to live with the Pandemic, Netsys 2021 was a specific adventure: First we aimed at a regular face-to-face conference in March 2021 in Lübeck in the very attractive Media Docks. We then had to postpone that to September – and already prepared a (nearly) full program for that by the end of June 2021. But finally, we had to face the fact that even in September 2021, a full face-to-face meetings (as we all would have liked it most) would still not be feasible. Therefore, we had to cancel all event venue(s) in Lübeck in July and to completely change to the program into a much more compact digital format. This new digital format includes the main NetSys conference days on Tuesday and Wednesday and additional events on Monday and Thursday.

We thank the Electronic Communications of the EASST (ECEASST) for making these electronic proceeding possible as a peer-reviewed, scientific, and open access journal in an efficient and timely manner. And we also thank our sponsors, especially, the Bio-Med-Tec Management GmbH, Lübeck, for their support.

Finally, we would like to thank all those who contributed to making NetSys 2021 a success, especially the

Workshop Chairs
Olaf Landsiedel, University of Kiel, Germany
Andreas Kassler, Karlstad University, Sweden
PhD Forum Chairs
Andreas Blenk, TU München, Germany
Oliver Hohlfeld, BTU Cottbus, Germany
Demo Chairs
Andreas Timm-Giel, TU Hamburg, Germany
Koojana Kuladinithi, TU Hamburg, Germany
Alexey Vinel, Halmstad University, Sweden
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Janick Edinger, Universität Hamburg, Germany
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Klaus Wehrle, RWTH Aachen University, Germany
Lars Wolf, TU Braunschweig, Germany
Martina Zitterbart, Karlsruhe Institute of Technology, Germany

Finally, we thank all reviewers and subreviewers in the Technical Program Committee, all speakers, workshop organizers, tutorial and PhD forum presenters, panelists, organization support etc. who helped to make Netsys 2021 a success despite the digital format and all other obstacles which occurred during this specific year.

Hamburg/Lübeck, September 2021

Mathias Fischer and Winfried Lamersdorf (**PC Chairs)**
Stefan Fischer and Horst Hellbrück (**General Chairs)**

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NetSys Extended Abstracts

1. A Novel Approach to Achieving End-to-End QoS for Avionic Applications
Yevhenii Shudrenko, Daniel Plöger, Koojana Kuladinithi and Andreas Timm-Giel

2. Count Me If You Can: Enumerating QUIC Servers Behind Load Balancers
Kashyap Thimmaraju and Björn Scheuermann

3. Data Serialization Formats for the Internet of Things
Daniel Friesel and Olaf Spinczyk

4. Discrete-time Analysis of Multicomponent GI/GI/1 Queueing Networks
Stefan Geissler, Stanislav Lange, Phuoc Tran-Gia and Tobias Hossfeld

5. Dynamic Monitoring Area Allocation for Aerial Post-Disaster Situation Monitoring
Julian Zobel, Niklas Stöhr, Ralf Kundel, Patrick Lieser and Ralf Steinmetz

6. Federated User Clustering for non-IID Federated Learning
Lucas Pacheco, Denis Rosário, Eduardo Cerqueira and Torsten Braun

7. Firewall-as-a-Service for Campus Networks Based on P4-SFC
Marco Häberle, Benjamin Steinert and Michael Menth

8. Implementing DNSSEC soft delegation for microservices
Andres Marin-Lopez, Patricia Arias-Cabarcos, Thorsten Strufe, Gabierl Barcelo-Soteras, Daniel Díaz-Sánchez and Florina Almenares-Mendoza

9. Large Scale Monitoring of Web Application Software Distribution to Measure Threat Response Behavior
Fabian Marquardt and Lennart Buhl

10. On the Resilience of Opportunistic Networks against Attacks
Sanaz Afzali, Asanga Udugama, Anna Förster and Mathias Fischer

11. Performance Evaluation of MANET Based Routing Protocols in Wireless Seismic Data Acquisition
Aliyu Makama, Koojana Kuladinithi, Musab Ahmed Eltayeb Ahmed and Andreas Timm-Giel

12. Ray-tracing based Inference Attacks on Physical Layer Security
Paul Walther, Markus Richter and Thorsten Strufe

13. Secure Construction of Redundant Greedy Embeddings in Friend-to-Friend Overlays
Martin Byrenheid, Stefanie Roos and Thorsten Strufe

14. Towards opportunistic UAV relaying for smart cities
Tobias Hardes, Clemens Boos and Christoph Sommer

15. Towards Optimization-Based Predictive Congestion Control for the Tor Network
Christoph Döpmann, Felix Fiedler, Sergio Lucia and Florian Tschorsch

16. Towards SCION-Enabled IXPs: The SCION Peering Coordinator
Lars-Christian Schulz and David Hausheer

17. User Space Packet Schedulers: Towards Rapid Prototyping of Queue-Management Algorithms
Ralf Kundel, Paul Stiegele, Dat Tran, Julian Zobel, Osama Abboud, Rhaban Hark and Ralf Steinmetz

18. Zero Trust Service Function Chaining
Leonard Bradatsch, Frank Kargl and Oleksandr Miroshkin

NetSys Demonstrations

Demo Chairs:

- Prof. Dr. Andreas Timm-Giel, Hamburg University of Technology, Germany
- Dr. Koojana Kuladinithi, Hamburg University of Technology, Germany
- Prof. Dr. Alexey Vinel, Halmstad University, Sweden

Demo Papers:

1. A cloud-control system equipped with intrusion detection and mitigation
Fatemeh Akbarian, William Tärneberg, Emma Fitzgerald and Maria Kihl

2. A cloud-native digital twin with adaptive cloud-based control and intrusion detection
William Tärneberg, Martin Gunnarsson, Maria Kihl and Christian Gehrmann

3. An Application Layer Protocol to Support Cooperative Navigation of Multiple UAVs Systems
Maik Basso, Alexey Vinel and Edison Pignaton de Freitas

4. FlowEmu: An Open-Source Flow-Based Network Emulator
Daniel Stolpmann and Andreas Timm-Giel

5. IDN-Laser-Tester: A Framework for Detecting and Testing ILDA Digital Network Consumers for Laser Projection
Matthias Frank

6. MoleNet: An Underground Sensor Network for Soil Monitoring
Jens Dede, Daniel Helms and Anna Förster

7. Simulation-as-a-Service to Benchmark Opportunistic Networks
Jens Dede, Asanga Udugama and Anna Förster

8. Smart Urban Data Space for Citizen Science
Heiko Bornholdt, David Jost, Philipp Kisters, Michel Rottleuthner, Winfried Lamersdorf, Thomas C. Schmidt and Mathias Fischer

9. Traffic Splitting for Tor – A Defense against Fingerprinting Attacks
Sebastian Reuter, Jens Hiller, Jan Pennekamp, Andriy Panchenko and Klaus Wehrle

10. Using LoRa Communications and Epidemic Routing in Disaster Rescue Operations
Yamani Dalpathadu, Showry Thumma, Asanga Udugama and Anna Förster

NetSys Early Work

PhD-Forum and Early-Work Chairs:

- Andreas Blenk, TU München, Germany
- Oliver Hohlfeld, BTU Cottbus, Germany

Early Work Papers:

1. Path Selection in a Path-aware Network Architecture
Thorben Krüger and David Hausheer

2. Information Management for Multi-Agent Systems
Yasin Alhamwy

3. Discrete Event Simulation for the Purpose of Real-time Performance Evaluation of Distributed Hardware-in-the-loop Simulators for Autonomous Driving Vehicle Validation
Christoph Funda, Kai-Steffen Hielscher and Reinhard German

4. Polymorphic Protocols for Fighting Bots
August See

5. Privacy-Preserving and Scalable Authentication based on Network Connection Traces
David Monschein and Oliver Waldhorst

6. Property Inference-based Federated Learning Groups for Collaborative Network Anomaly Detection
Jens Wettlaufer

7. Towards Deterministic Reconfigurable Networks
Zikai George Zhou and Wolfgang Kellerer

NetSys Workshops

Cyber Forensics and Advanced Threat Investigations in Emerging Technologies (CCFATI3)

CCFATI3 Workshop Chairs:

- John William Walker, Nottingham Trent University, United Kingdom.
- Ahmed Elmesiry, University of South Wales, United Kingdom.

CCFATI3 Papers:

1. Wiretapping Pods and Nodes - Lawful Interception in Kubernetes
   Daniel Spiekermann and Jörg Keller
2. Hacking planned obsolescense in robotics, towards security-oriented robot teardown
   Víctor Mayoral-Vilches, Alfonso Glera-Picón, Unai Ayucar Carbajo, Stefan Rass, Martin Pinzger, Federico Maggi and Endika Gil-Uriarte
3. Modular Platform for Detecting and Classifying Phishing Websites Using Cyber Threat Intelligence
   Ahmed Elmisery and Mirela Sertovic
4. Early Warning Identity Threat and Mitigation System
   Aditya Tyagi, Razieh Nokhbeh Zaeem and K Suzanne Barber

International Workshop on Communication Technologies for Vehicles (Nets4Cars)

Net4Cars Workshop Chairs:

- Andreas Festag, Technische Hochschule Ingolstadt & CARISSMA, Germany
- Alexey Vinel, Halmstad University, Sweden

Net4Cars Papers:

1. Impact of radio channel characteristics on the longitudinal behaviour of truck platoons in critical car-following situations
   Salil Sharma, Ehab Al-Khannaq, Raphael Riebl, Wouter Schakel, Peter Knoppers, Alexander Verbraeck and Hans Van Lint
2. Congestion Aware Objects Filtering for Collective Perception
   Quentin Delooz, Andreas Festag and Alexey Vinel
3. ”Vehicular Steganography”?: Opportunities and Challenges
   Martin Cooney, Eric Järpe and Alexey Vinel

Machine Learning in Networking (MaLeNe)

MaLeNe Workshop Chairs:

- Michael Seufert, Julius-Maximilians-Universität Würzburg, Germany
- Andreas Blenk, TU München, Germany

MaLeNe Papers:

1. Navigating Communication Networks with Deep Reinforcement Learning
   Patrick Krämer and Andreas Blenk

2. Deep Reinforcement Learning for Smart Queue Management
   Hassan Fawaz, Djamal Zeghlache, Tran Anh Quang Pham, Jérémie Leguay and Paolo Medagliani

3. Time- and Frequency-Domain Dynamic Spectrum Access: Learning Cyclic Medium Access Patterns in Partially Observable Environments
   Sebastian Lindner, Daniel Stolpmann and Andreas Timm-Giel

4. Towards QoE-Driven Optimization of Multi-Dimensional Content Streaming
   Yassin Alkhalili, Jannis Weil, Anam Tahir, Tobias Meuser, Boris Koldehofe, Heinz Köppl, Ralf Steinmetz and Andreas Mauthe

5. Browser Fingerprinting: How to Protect Machine Learning Models and Data with Differential Privacy?
   Katharina Dietz, Michael Mühlhauser, Michael Seufert, Nicholas Gray, Tobias Hoßfeld and Dominik Herrmann

Workshop on Nanonetworks and Nanocomputation (WONAN)

WONAN Workshop Chairs:

- Jens Kirchner, Friedrich-Alexander-Universität, Germany
- Florian Lau, Universität zu Lübeck, Germany
- Lukas Stratmann, TU Berlin, Germany

WONAN Papers:

1. Molecular Communication Channel Modelling in FPGA Technology
   Daniil Romanchenko, Matis Tartie, Ba Que Le, Jorge Torres Gómez and Falko Dressler

In addition, WONAN issued a call for participation.