2021 IEEE 29th International Conference on Network Protocols (ICNP 2021)

Virtual Conference
1-5 November 2021

IEEE Catalog Number: CFP21065-POD
ISBN: 978-1-6654-3096-8

Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP21065-POD
ISBN (Print-On-Demand):	978-1-6654-3096-8
ISBN (Online):	978-1-6654-4131-5
ISSN:	1092-1648

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

Main Conference

Session 1: Datacenter Transport

RPO: Receiver-driven Transport Protocol Using Opportunistic Transmission in Data Center...1
Jinbin Hu, Jiawei Huang, Zhaoyi Li, and Yijun Li (Central South University); Wenchao Jiang (Singapore University of Technology and Design); Kai Chen (Hong Kong University of Science and Technology); Jianxin Wang (Central South University); Tian He (University of Minnesota)

R-AQM: Reverse ACK Active Queue Management in Multi-tenant Data Centers...12
Xinle Du (Tsinghua University); Tong Li, Lei Xu, and Kai Zheng (Huawei); Meng Shen (Beijing Institute of Technology); Bo Wu (Tsinghua University); Ke Xu (Tsinghua University, BNRist, PCL)

FlashPass: Proactive Congestion Control for Shallow-buffered WAN...24
Gaoxiong Zeng and Jianxin Qiu (HKUST); Yifei Yuan and Hongqiang Liu (Alibaba); Kai Chen (HKUST)

Receiver-Driven RDMA Congestion Control by Differentiating Congestion Types in Datacenter Networks...36
Jiao Zhang, Jiaming Shi, Xiaolong Zhong, Zirui Wan, Yu Tian, Tian Pan, and Tao Huang (BUPT)

Session 2: ML for Networks I

Federated Traffic Engineering with Supervised Learning in Multi-region Networks...48
Minghao Ye (New York University); Junjie Zhang (Fortinet, Inc.); Zehua Guo (Beijing Institute of Technology); H. Jonathan Chao (New York University)

Is Machine Learning Ready for Traffic Engineering Optimization?...60
Guillermo Bernárdez, José Suárez-Varela, Albert López (Universitat Politècnica de Catalunya); Bo Wu, Shihan Xiao, Xiangle Cheng (Huawei Technologies); Pere Barlet-Ros, Albert Cabellos-Aparicio (Universitat Politècnica de Catalunya)

Generalizable and Interpretable Deep Learning for Network Congestion Prediction...71
Konstantinos Poularakis and Qiaofeng Qin (Yale University); Franck Le (IBM Research); Sastry Kompella (Naval Research Laboratory); Leandros Tassiulas (Yale University)

Session 3: LoRa and LEO

AlignTrack: Push the Limit of LoRa Collision Decoding...81
Qian Chen and Jiliang Wang (Tsinghua University)

Partial Symbol Recovery for Interference Resilience in Low-Power Wide Area Networks...92
Kai Sun (Southeast University); Zhimeng Yin (City University of Hong Kong); Weiwei Chen, Shuai Wang, Zeyu Zhang, and Tian He (Southeast University)

Cooperatively Constructing Cost-Effective Content Distribution Networks upon Emerging Low Earth Orbit Satellites and Clouds...103
Zeqi Lai, Hewu Li, Qi Zhang, Qian Wu, and Jianping Wu (Tsinghua University)

ORBITCAST: Exploiting Mega-Constellations for Low-Latency Earth Observation...115
Zeqi Lai, Qian Wu, Hewu Li, Mingyang Lv, and Jianping Wu (Tsinghua University)

Session 4: Security

ISP Self-Operated BGP Anomaly Detection Based on Weakly Supervised Learning...127
Yutao Dong (Tsinghua Shenzhen International Graduate School, Tsinghua University); Qing Li (Peng Cheng Laboratory (PCL)); Richard O. Sinnott (the School of Computing and Information Systems within The University of Melbourne); Yong Jiang and Shutao Xia (Tsinghua Shenzhen International Graduate School and also with Peng Cheng Laboratory (PCL))

DOVE: Diagnosis-driven SLO Violation Detection...138
Yiran Lei (Tsinghua University); Yu Zhou (Tsinghua University and Alibaba Inc); Yunsenxiao Lin, Mingwei Xu, and Yangyang Wang (Tsinghua University)

DNSonChain: Delegating Privacy-Preserved DNS Resolution to Blockchain...149
Lin Jin (University of Delaware); Shuai Hao (Old Dominion University); Yan Huang (Indiana University); Haining Wang (Virginia Tech); Chase Cotton (University of Delaware)

Advertising DNS Protocol Use to Mitigate DDoS Attacks...160
Jacob Davis (Sandia National Laboratories); Casey Deccio (Brigham Young University)

Session 5: Wireless

Hopping on Spectrum: Measuring and Boosting a Large-scale Dual-band Wireless Network...171
Haibo Wang, Tao Gao, Weizhen Dang, JingAn Xue, Jiahao Cao, Fenghua Li, and Jilong Wang (Tsinghua University)

Exploiting WiFi AP for Simultaneous Data Dissemination among WiFi and ZigBee Devices...182
Wei Wang, Xin Liu, Yao Yao, and Ting Zhu (University of Maryland, Baltimore County)

ATRIA: Autonomous Traffic-Aware Scheduling for Industrial Wireless Sensor-Actuator Networks...193
Xia Cheng and Mo Sha (Florida International University)

Chimera: exploiting UAS flight path information to optimize heterogeneous data transmission...205
Russell Shirey, Sanjay Rao, and Shreyas Sundaram (Purdue University)

Session 6: ML for Networks II

Constraint-Aware Deep Reinforcement Learning for End-to-End Resource Orchestration in Mobile Networks...217
Qiang Liu (University of Nebraska-Lincoln); Nakjung Choi (Nokia Bell Labs); Tao Han (New Jersey Institute of Technology)

Learned FIB: Fast IP Forwarding without Longest Prefix Matching...228
Shunsuke Higuchi, Yuki Koizumi, and Junji Takemasa (Osaka University); Atsushi Tagami (KDDI Research, Inc.); Toru Hasegawa (Osaka University)

MPLibra: Complementing the Benefits of Classic and Learning-based Multipath Congestion Control...239
Hebin Yu, Jiaqi Zheng, Zhuoxuan Du, and Guihai Chen (Nanjing University)

Antelope: A Framework for Dynamic Selection of Congestion Control Algorithms...250
Jianer Zhou (Southern University of Science and Technology); Xinyi Qiu (Peng Cheng Laboratory, Shenzhen, China); Zhenyu Li (ICT, CAS); Gareth Tyson (Queen Mary University of London); Qing Li (Peng Cheng Laboratory, Shenzhen, China); Jingpu Duan (Southern University of Science and Technology); Yi Wang (Sothern University of Science and Technology, Shenzhen, China)

Session 7: Charging, Scheduling, and Reconfiguring

Recycling Wasted Energy for Mobile Charging...261
Yu Sun and Chi Lin (Dalian University of Technology); Haipeng Dai (Nanjing University); Pengfei Wang, Jiankang Ren, Lei Wang, and Guowei Wu (Dalian University of Technology)

pMACH : Power and Migration Aware Container scheduling...272
Sourav Panda, K. K. Ramakrishnan, and Laxmi N. Bhuyan (University of California, Riverside)

HLS: A Packet Scheduler for Hierarchical Fairness...284
Natchanon Luangsomboon and Jorg Liebeherr (University of Toronto)

Reconfiguring Cell Selection in 4G/5G Networks...295
Qianru Li (UCLA); Chunyi Peng (Purdue University)

Session 8: Network Architecture

Loom: Switch-based Cloud Load Balancer with Compressed States...306
Jiao Zhang, Yuxuan Gao, Shubo Wen, Tian Pan, and Tao Huang (BUPT)

StaR: Breaking the Scalability Limit for RDMA...317
Xizheng Wang, Guo Chen, and Xijin Yin (Hunan University); Huichen Dai, Bojie Li, Binzhang Fu, and Kun Tan (Huawei)

Loss-freedom, Order-preservation and No-buffering: Pick Any Two During Flow Migration in Network Functions...328
Radhika Sukapuram (Indian Institute of Information Technology Guwahati); Ranjan Patowary (Central Institute of Technology Kokrajhar); Gautam Barua (Indian Institute of Information Technology Guwahati)

TROD: Evolving From Electrical Data Center to Optical Data Center...339
Peirui Cao and Shizhen Zhao (Shanghai Jiao Tong University); Min Yee Teh (Columbia University); Yunzhuo Liu and Xinbing wang (Shanghai Jiao Tong University)

Session 9: Programmable Networks

NetFC: Enabling Accurate Floating-point Arithmetic on Programmable Switches...350
Penglai Cui, Heng Pan, and Zhenyu Li (Institute of Computing Technology, Chinese Academy of Sciences); Jiaoren Wu, Shengzhuo Zhang, and Xingwu Yang (Kwai Inc.); Hongtao Guan (Institute of Computing Technology, Chinese Academy of Sciences); Gaogang Xie (Computer Network Information Center, Chinese Academy of Sciences)

MagicTCAM: A Multiple-TCAM Scheme for Fast TCAM Update...361
Ruyi Yao, Cong Luo, and Xuandong Liu (Fudan University); Ying Wan and Bin Liu (Tsinghua University); Wenjun Li (Peng Cheng Laboratory); Yang Xu (Fudan University)

PIPO: Efficient Programmable Scheduling for Time Sensitive Networking...372
Chuwen Zhang and Zhikang Chen (Tsinghua University); Haoyu Song (Futurewei Technologies); Ruyi Yao and Yang Xu (Fudan University); Yi Wang (Southern University of Science and Technology); Ji Miao and Bin Liu (Tsinghua University)

Session 10: Network Measurement

SketchINT: Empowering INT with TowerSketch for Per-flow Per-switch Measurement...383
Kaicheng Yang, Yuanpeng Li, Zirui Liu, and Tong Yang (Peking University); Yu Zhou (TsingHua University); Jintao He (Peking University); Jing'an Xue (Huawei Technologies); Tong Zhao (Peking University); Zhengyi Jia and Yongqiang Yang (Huawei Technologies)

DeltaINT: Toward General In-band Network Telemetry with Extremely Low Bandwidth Overhead...395
Siyuan Sheng (The Chinese University of Hong Kong); Qun Huang (Peking University); Patrick P. C. Lee (The Chinese University of Hong Kong)

CELL: Counter Estimation for Per-flow Traffic in Streams and Sliding Windows...406
Rana Shahout, Roy Friedman, and Dolev Adas (Technion)

Virtual Filter for Non-duplicate Sampling...418
Chaoyi Ma, Haibo Wang, Olufemi O Odegbile, and Shigang Chen (University of Florida)

Posters/Demos

Poster: Reverse-Path Congestion Notification: Accelerating the Congestion Control Feedback Loop...429
Ralf Kundel (Technical University of Darmstadt); Nehal Baganal Krishna (University of Duisburg-Essen); Christoph Gärtner, Tobias Meuser (Technical University of Darmstadt); Amr Rizk (University of Duisburg-Essen)

Poster: Private Internet: A Global End-to-End Service Model...431
Souvik Das, Kamil Sarac (The University of Texas at Dallas)

Poster: Loading Programmable Data Plane Programs to Virtual Plane...433
Yuxin Zhao (Tongji University)

Poster: Enabling Fast Forwarding in Hybrid Software-Defined Networks...435
Yijun Sun, Zehua Guo, Songshi Dou (Beijing Institute of Technology); Junjie Zhang (Fortinet); Changlin Li, Xiang Ouyang (Beijing Institute of Technology)

Poster: EasyTrans: Enable Fast Iteration of Transport Protocol...437
Jie Zhang, Chuan Ma (Tsinghua University); Wei Wang, Kai Zheng (Huawei Technologies); Yong Cui (Tsinghua University)

Poster: DSME-LoRa – A Flexible MAC for LoRa...439
José Álamos, Peter Kietzmann, Thomas C. Schmidt (HAW Hamburg); Matthias Wählisch (FU Berlin)

Poster: Data Collection for ML Classification of Encrypted Messaging Applications...441
Jason Hussey, Ethan Taylor (Colorado School of Mines); Kerri Stone (iCR, inc.); Tracy Camp (Colorado School of Mines)

Poster: Connected Vehicles using Short-range (Wi-Fi & IEEE 802.11p) and Long-range Cellular Networks (LTE & 5G)...443
Muhammad Naeem Tahir (Faculty of Information Technology and Electrical Engineering University of Oulu, Finland); Marcos Katz (Centre for Wireless Communications- Networks and Systems University of Oulu, Finland); Zunera Javed (Centre for Wireless Communications-Radio Technology University of Oulu, Finland)

Poster: Accelerate Cross-Device Federated Learning With Semi-Reliable Model Multicast Over The Air...445
Yunzhi Lin, Shouxi Luo (Southwest Jiaotong University)

Demo: SkyRoute, a Fast and Realistic UAV Cellular Simulation Framework...447
Mingsheng Yin (New York University); Tuyen X. Tran, Abhigyan Sharma (AT&T Labs Research); Marco Mezzavilla, Sundeep Rangan (New York University)

Demo: Simple Deep Packet Inspection with P4...449
SAHIL GUPTA (Rochester Institute of Technology); Devashish Gosain (Max Planck Institute for Informatics); Garegin Grigoryan (Alfred University); Minseok Kwon, H. B. Acharya (Rochester Institute of Technology)

Demo: FLARE: Federated Active Learning Assisted by Naming for Responding to Emergencies...451
Viyom Mittal, Mohammad Jahanian, K. K. Ramakrishnan (University of California, Riverside)

Workshops

The Third IEEE International Workshop on Blockchain and Mobile Applications (BlockApp)

A Blockchain-based Trusted Testing System of Electric Power Materials...453
Bing Tian (Information & Telecommunications Company State Grid Shandong Electric Power Company); Xiaofeng Chen (PolyTechnic Institute，Zhejiang University);Jiawen Wang (Hangzhou Echaincity Technology Co., Ltd.); Dong Li (Information & Telecommunications Company State Grid Shandong Electric Power Company); Dong Wang, Liangliang Zhi (State Grid Blockchain Technology (Beijing) Co., Ltd.); Keting Yin (School of Software Technology Zhejiang University)

ISRaft Consensus Algorithm for Autonomous Units...458
Linir Zamir, Aman Shaan, Mehrdad Nojoumian (Florida Atlantic University)

Reducing Block Propagation Delay in Blockchain Networks via Guarantee Verification...464
Jiali Chen, Yang Qin (Harbin Institute of Technology (Shenzhen))

The 6th IEEE International Workshop on Cyber-Physical Systems Security Protocols (CPS-Sec)

Detecting Network Attacks using Federated Learning for IoT Devices...470
Osama Shahid (Department of Information Technology, Kennesaw State University, Marietta, GA, USA); Viraaji Mothukuri (Department of Software Engineering and Game Development, Kennesaw State University, Marietta, GA, USA); Seyedamin Pouriyeh (Department of Information Technology, Kennesaw State University, Marietta, GA, USA); Reza M. Parizi (Department of Software Engineering and Game Development, Kennesaw State University, Marietta, GA, USA); Hossain Shahriar (Department of Information Technology, Kennesaw State University, Marietta, GA, USA)

RIOT-AKA: cellular-like authentication over IoT devices...476
Giuseppe Bianchi (University of Roma "Tor Vergata" / CNIT); Alberto La Rosa (Univ. Roma Tor Vergata); Gabriele Restuccia (CNIT)

Generative Ensemble Learning for Mitigating Adversarial Malware Detection in IoT...482
Usman Ahmed, Jerry Chun-Wei Lin (Western Norway University of Applied Sciences); Gautam Srivastava (Brandon University)

Workshop on Intelligent Connected and Autonomous Vehicles (ICAV)

Cooperative Connected Smart Road Infrastructure and Autonomous Vehicles for Safe Driving...487
Zuoyin Tang (Aston University); Jianhua He (University of Essex); Steven Knowles Flanagan (Aston University); Phillip Procter (Highways England); Ling Cheng (University of the Witwatersrand)

Highway On-Ramp Merging for Mixed Traffic: Recent Advances and Future Trends...493
Stephanie Alvarez Fernandez, Marco A. M. Marinho (Halmstad University); Majid Vakilzadeh (Zenseact AB); Alexey Vinel (Halmstad University)

The integration of UAVs to the C-ITS Stack...499
Felipe Valle, Martin Cooney (Halmstad University); Konstantin Mikhaylov (University of Oulu); Alexey Vinel (Halmstad University)

Digital Twin Based Trajectory Prediction for Platoons of Connected Intelligent Vehicles...505
Hao Du, Supeng Leng (University of Electronic Science and Technology of China); Jianhua He (University of Essex); Longyu Zhou (University of Electronic Science and Technology of China)

Multi-tier Collaborative Deep Reinforcement Learning for Non-terrestrial Network Empowered Vehicular Connections...511
Yang Cao (University of Electronic Science and Technology of China, Chengdu, P. R. China); Shao-Yu Lien (National Chung Cheng University, Chiayi, Taiwan); Ying-Chang Liang (University of Electronic Science and Technology of China, Chengdu, P. R. China)

Workshop on Networking for Edge Computing and Distributed Cloud Applications (NetCloud)

Achieving Deterministic Service in Mobile Edge Computing (MEC) Networks...517
Binwei Wu, Jiasen Wang, Yanyan Wang (Purple Mountain Laboratories); Weiqian Tan (Southeast University); Yudong Huang (Beijing University of Posts and Telecommunications)

Deadline-Aware Transmission Control for Real-Time Video Streaming...523
Lei Zhang, Yong Cui, Junchen Pan, Yong Jiang (Tsinghua University)

Long-distance Deterministic Transmission among TSN Networks: Converging CQF and DIP...529
Weiqian Tan (Southeast University); Binwei Wu (Purple Mountain Laboratories)

Real-time Video Transmission Optimization Based on Edge Computing in IIoT...535
Lei Du (Information Department, Beijing University of Technology, Beijing, China); Ru Huo (Information Department, Beijing University of Technology, Beijing, China; Purple Mountain Laboratories, Nanjing, China)

A Fast-adaptive Edge Resource Allocation Strategy for Dynamic Vehicular Networks...541
Ying He, Yuhang Wang, Qiuzhen Lin, Jianqiang Li, Victor C. Leung (Shenzhen University)

Resource Allocation in Vehicular Networks with Multi-UAV Served Edge Computing...547
Yuhang Wang, Ying He, Minhui Dong (Shenzhen University)

The 2nd Workshop on New Internetworking Protocols, Architecture and Algorithms (NIPAA)

MRPGA: A Genetic-Algorithm-Based In-Network Caching for Information-Centric Networking...553
Fan Yang, Zerui Tian (Beijing University of Posts and Telecommunications)

OBF: A Guaranteed IP Lookup Performance Scheme for Flexible IP Using One Bloom Filter...559
Shihao Liu (Computer Network Information Center, Chinese Academy of Sciences; University of Chinese Academy of Sciences); Wanming Luo, Xu Zhou (Computer Network Information Center, Chinese Academy of Sciences); Bin Yang (Zhejiang Lab, Zhejiang Province, China); Yihao Jia, Zhe Chen, Sheng Jiang (Network Technology Laboratory, Huawei Technologies Co., Ltd.)

End-to-End Privacy for Identity & Location with IP...565
Saleem Bhatti, Gregor Haywood, Ryo Yanagida (University of St Andrews)

Speeding Up TCP with Selective Loss Prevention...571
Zhenyu Zhou, Xiaowei Yang (Duke University)

PEP-DNA: A Performance Enhancing Proxy for Deploying Network Architectures...577
Kristjon Ciko, Michael Welzl, Peyman Teymoori (University of Oslo)

STIP: A new model of trusted network...583
Adi Molkho, Sara Bitan (Huawei)

The Trapezoidal Sketch for Frequency Estimation in Network Flow...589
Ning LI, Xin Yuan (Harbin Institute of Technology); Jose Fernan Martinez, Vicente Hernadez Diaz (UPM)

Network Verification Workshop 2021 (NetVerify)

NetVerify 2021 - Network Verification Workshop...595
Karthick Jayaraman (Microsoft Azure Networking); Hongkun Yang (Google Cloud Platform)