

2024 IEEE 30th Real-Time and Embedded Technology and Applications Symposium (RTAS 2024)

**13-16 May 2024
Hong Kong**



**IEEE Catalog Number: CFP24044-POD
ISBN: 979-8-3503-5842-1**

**Copyright © 2024 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:	CFP24044-POD
ISBN (Print-On-Demand):	979-8-3503-5842-1
ISBN (Online):	979-8-3503-5841-4
ISSN:	1545-3421

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

CURRAN ASSOCIATES INC.
proceedings
.com

2024 IEEE 30th Real-Time and Embedded Technology and Applications Symposium (RTAS) **RTAS 2024**

Table of Contents

Message from the RTAS 2024 Chairs	x
RTAS 2024 Organizing Committee	xii
RTAS 2024 Program Committee	xiii
Reviewers	xv

Papers

Trusted Timing Services with TimeGuard	1
<i>Adeel Nasrullah (University of Massachusetts Amherst, USA) and Fatima M. Anwar (University of Massachusetts Amherst, USA)</i>	
Integrating Sporadic Events in Time-Triggered Systems via Affine Envelope Approximations	15
<i>Anais Finzi (TTTech Computertechnik AG, Austria), Silviu S. Craciunas (TTTech Computertechnik AG, Austria), and Marc Boyer (ONERA / DTIS, Université de Toulouse, France)</i>	
Optimal Synthesis of Fault-Tolerant IDK Cascades for Real-Time Classification	29
<i>Sanjoy Baruah (Washington University in St. Louis), Iain Bate (University of York), Alan Burns (University of York), and Robert Davis (University of York)</i>	
USB Interrupt Differentiated Service for Bandwidth and Delay-Constrained Input/Output	42
<i>Zhiyuan Ruan (Boston University, USA), Anton Njavro (Boston University, USA), and Richard West (Boston University, USA)</i>	
A Predictable SIMD Library for GEMM Routines	55
<i>Iryna De Albuquerque Silva (ONERA, France), Thomas Carle (IRIT - Univ. Toulouse 3, France), Adrien Gauffriau (Airbus, France), Victor Jegu (Airbus, France), and Claire Pagetti (ONERA, France)</i>	
Safe and Secure? On the Timing Analysability of Cryptographic Implementations	68
<i>Alexander Stegmeier (University of Augsburg, Germany), Peter Knauer (Augsburg Technical University of Applied Sciences, Germany), Philipp Schubaur (Augsburg Technical University of Applied Sciences, Germany), Christian Piatka (University of Augsburg, Germany), Dominik Merli (Augsburg Technical University of Applied Sciences, Germany), and Sebastian Altmeyer (University of Augsburg, Germany)</i>	

PAAM: A Framework for Coordinated and Priority-Driven Accelerator Management in ROS 2	81
<i>Daniel Enright (University of California, Riverside), Yecheng Xiang (University of California, Riverside), Hyunjong Choi (San Diego State University), and Hyoseung Kim (University of California, Riverside)</i>	
Extending Network Calculus to Deal with Min-Plus Service Curves in Multiple Flow Scenarios.....	95
<i>Anja Hamscher (RPTU Kaiserslautern-Landau, Germany), Vlad-Cristian Constantin (RPTU Kaiserslautern-Landau, Germany), and Jens B. Schmitt (RPTU Kaiserslautern-Landau, Germany)</i>	
Real-Time Scheduling for 802.1Qbv Time-Sensitive Networking (TSN): A Systematic Review and Experimental Study	108
<i>Chuanyu Xue (University of Connecticut), Tianyu Zhang (University of Connecticut), Yuanbin Zhou (Singapore University of Technology and Design), Mark Nixon (Emerson Automation Solutions), Andrew Loveless (NASA Johnson Space Center), and Song Han (University of Connecticut)</i>	
Sync or Sink? The Robustness of Sensor Fusion Against Temporal Misalignment	122
<i>Daniel Kuhse (TU Dortmund University), Nils Hölscher (TU Dortmund University), Mario Günzel (TU Dortmund University), Harun Teper (TU Dortmund University), Georg von der Brüggen (TU Dortmund University), Jian-Jia Chen (TU Dortmund University; Lamarr Institute for Machine Learning and Artificial Intelligence), and Ching-Chi Lin (TU Dortmund University)</i>	
Optimizing Logical Execution Time Model for Both Determinism and Low Latency	135
<i>Sen Wang (Virginia Tech, USA), Dong Li (Virginia Tech, USA), Ashrarul H. Sifat (Virginia Tech, USA), Shao-Yu Huang (Purdue University, USA), Xuanliang Deng (Virginia Tech, USA), Changhee Jung (Purdue University, USA), Ryan Williams (Virginia Tech, USA), and Haibo Zeng (Virginia Tech, USA)</i>	
DAG Scheduling with Execution Groups	149
<i>Junjie Shi (TU Dortmund University, Germany), Mario Günzel (TU Dortmund University, Germany), Niklas Ueter (TU Dortmund University, Germany), Georg von der Brüggen (TU Dortmund University, Germany), and Jian-Jia Chen (TU Dortmund University, Germany; Lamarr Institute for Machine Learning and Artificial Intelligence, Germany)</i>	
A Hybrid Approach to WCTT Analysis in a Real-Time Switched Ethernet Network	161
<i>Aakash Soni (LyRIDS, ECE Research Center, France), Jean-Luc Scharbag (IRIT-ENSEEIH, France), and Jérôme Ermont (IRIT-ENSEEIH, France)</i>	
RT-Mimalloc: A New Look at Dynamic Memory Allocation for Real-Time Systems	173
<i>Raffaele Giannessi (Scuola Superiore Sant'Anna, Italy; Evidence S.R.L., Italy), Alessandro Biondi (Scuola Superiore Sant'Anna, Italy), and Alessandro Biasci (Huawei Pisa Research Center, Italy; Evidence S.R.L., Italy)</i>	
Exclusive Hierarchies for Predictable Sharing in Last-Level Cache	186
<i>Xinzhe Wang (University of Waterloo, Canada), Zhuanhao Wu (University of Waterloo, Canada), Rodolfo Pellizzoni (University of Waterloo, Canada), and Hiren Patel (University of Waterloo, Canada)</i>	

Core-Local Reasoning and Predictable Cross-Core Communication with M ³	199
<i>Nils Asmussen (Barkhausen Institut), Sebastian Haas (Barkhausen Institut), Adam Lackorzynski (TU Dresden), and Michael Roitzsch (Barkhausen Institut)</i>	
End-To-End Timing Analysis and Optimization of Multi-Executor ROS 2 Systems	212
<i>Harun Teper (TU Dortmund University, Germany), Tobias Betz (Technical University of Munich, Germany), Mario Günzel (TU Dortmund University, Germany), Dominic Ebner (Technical University of Munich, Germany), Georg von der Brüggen (TU Dortmund University, Germany), Johannes Betz (Technical University of Munich, Germany), and Jian-Jia Chen (TU Dortmund University, Germany; Lamarr Institute, Germany)</i>	
TinyBFT: Byzantine Fault-Tolerant Replication for Highly Resource-Constrained Embedded Systems	225
<i>Harald Böhm (Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)), Tobias Distler (Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)), and Peter Wägemann (Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU))</i>	
OmniWasm: Efficient, Granular Fault Isolation and Control-Flow Integrity for Arm Microcontrollers	239
<i>Maorui Bai (The George Washington University), Runyu Pan (Shandong University), and Gabriel Parmer (The George Washington University)</i>	
Strict Partitioning for Sporadic Rigid Gang Tasks	252
<i>Binqi Sun (Technical University of Munich, Germany), Tomasz Kloda (LAAS-CNRS, Universite de Toulouse, INSA, France), and Marco Caccamo (Technical University of Munich, Germany)</i>	
HAEST: Harvesting Ambient Events to Synchronize Time Across Heterogeneous IoT Devices	265
<i>Adeel Nasrullah (University of Massachusetts Amherst) and Fatima M. Anwar (University of Massachusetts Amherst)</i>	
Fast Attack Recovery for Stochastic Cyber-Physical Systems	280
<i>Lin Zhang (University of Pennsylvania), Luis Burbano (University of California, Santa Cruz), Xin Chen (University of New Mexico), Alvaro A. Cardenas (University of California, Santa Cruz), Steven Drager (Air Force Research Laboratory), Matthew Anderson (Air Force Research Laboratory), and Fanxin Kong (University of Notre Dame)</i>	
Demystifying NVIDIA GPU Internals to Enable Reliable GPU Management	294
<i>Joshua Bakita (University of North Carolina at Chapel Hill) and James H. Anderson (University of North Carolina at Chapel Hill)</i>	
DECNTR: Optimizing Safety and Schedulability with Multi-Mode Control and Resource Allocation Co-Design	306
<i>Robert Gifford (University of Pennsylvania), Felipe Galarza-Jimenez (University of Colorado, Boulder), Linh Thi Xuan Phan (University of Pennsylvania; Roblox), and Majid Zamani (University of Colorado, Boulder)</i>	
An Empirical Study of Performance Interference: Timing Violation Patterns and Impacts	320
<i>Ao Li (Washington University in St. Louis), Jinwen Wang (Washington University in St. Louis), Sanjoy Baruah (Washington University in St. Louis), Bruno Sinopoli (Washington University in St. Louis), and Ning Zhang (Washington University in St. Louis)</i>	

Elastic Scheduling for Harmonic Task Systems	334
<i>Marion Sudvarg (Washington University in St. Louis), Ao Li (Washington University in St. Louis), Daisy Wang (Washington University in St. Louis), Sanjoy Baruah (Washington University in St. Louis), Jeremy Buhler (Washington University in St. Louis), Chris Gill (Washington University in St. Louis), Ning Zhang (Washington University in St. Louis), and Pontus Ekberg (Uppsala University)</i>	
Algorithms for Canvas-Based Attention Scheduling with Resizing	348
<i>Yigong Hu (University of Illinois at Urbana-Champaign), Ila Gokarn (Singapore Management University), Shengzhong Liu (Shanghai Jiao Tong University), Archan Misra (Singapore Management University), and Tarek Abdelzaher (University of Illinois at Urbana-Champaign)</i>	
InsectACIDE: Debugger-Based Holistic Asynchronous CFI for Embedded System	360
<i>Yujie Wang (Washington University in St. Louis), Cailani Lemieux Mack (Vanderbilt University), Xi Tan (University at Buffalo), Ning Zhang (Washington University in St. Louis), Ziming Zhao (University at Buffalo), Sanjoy Baruah (Washington University in St. Louis), and Bryan C. Ward (Vanderbilt University)</i>	
RT-Swap: Addressing GPU Memory Bottlenecks for Real-Time Multi-DNN Inference	373
<i>Woosung Kang (DGIST, Republic of Korea), Jinkyu Lee (Sungkyunkwan University, Republic of Korea), Youngmoon Lee (Hanyang University, Republic of Korea), Sangeun Oh (Ajou University, Republic of Korea), Kilho Lee (Soongsil University, Republic of Korea), and Hoon Sung Chwa (DGIST, Republic of Korea)</i>	

Brief Presentations

Work in Progress: Predictable Execution of Isolated Real-Time Tasks on Multicore Systems using the LET Paradigm	386
<i>Konstantin Dudzik (FZI Research Center for Information Technology, Germany), Maximilian Kirschner (FZI Research Center for Information Technology, Germany), Victor Pazmino Betancourt (FZI Research Center for Information Technology, Germany), and Jürgen Becker (FZI Research Center for Information Technology, Germany)</i>	
Work in Progress: Early Timing Prediction of Real-Time Tasks in Continuous Integration Environments	390
<i>Pengcheng Huang (ABB Corporate Research, Switzerland), Balz Maag (ABB Corporate Research, Switzerland), Thanikesavan Sivanthi (ABB Corporate Research, Switzerland), and Chunwei Xing (ABB Corporate Research, Switzerland)</i>	
DEMO: Developing a Virtual Remote Operating IoT Lab for Higher Education Research	394
<i>Michael Winokur (Faculty of Industrial Engineering and Technology Management, Holon Institute of Technology, Israel), Sofia Amador Nelke (Faculty of Industrial Engineering and Technology Management, Holon Institute of Technology, Israel), Arriel Benis (Holon Institute of Technology, Israel), and Michael Khomiakov (Faculty of Industrial Engineering and Technology Management, Holon Institute of Technology, Israel)</i>	

Brief Industry Paper: Delay-Aware Control in Networked Systems using Smart Actuators	396
<i>Paolo Pazzaglia (Robert Bosch GmbH, Corporate Research), Christoph Mark (Robert Bosch GmbH, Corporate Research), Behnaz Pourmohseni (Robert Bosch GmbH, Corporate Research), Fedor Smirnov (Robert Bosch GmbH, Corporate Research), Kevin Schmidt (Robert Bosch GmbH, Corporate Research), and Laura Beermann (Robert Bosch GmbH, Corporate Research)</i>	
Demo: Vulnerability Analysis for STL-Guided Safe Reinforcement Learning in Cyber-Physical Systems	400
<i>Shixiong Jiang (University of Notre Dame), Mengyu Liu (University of Notre Dame), and Fanxin Kong (University of Notre Dame)</i>	
Work in Progress: Guaranteeing Weakly-Hard Timing Constraints in Server-Based Real-Time Systems	402
<i>Nasim Samimi (Eindhoven University of Technology, The Netherlands), Mitra Nasri (Eindhoven University of Technology, The Netherlands), Twan Basten (Eindhoven University of Technology, The Netherlands), and Marc Geilen (Eindhoven University of Technology, The Netherlands)</i>	
Work in Progress: Emerging From Shadows: Optimal Hidden Actuator Attack to Cyber-Physical Systems	406
<i>Kausar Hamid Miji (The South Dakota School of Mines & Technology), Mengyu Liu (University of Notre Dame), Francis E. Akowuah (The South Dakota School of Mines & Technology), and Fanxin Kong (University of Notre Dame)</i>	
Author Index	411