



Volume 17, Issue 2
Spring '17

CECS eNEWS



Center for Embedded and Cyber-physical Systems, University of California, Irvine

Highlights

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UC Irvine will be the first university in the U.S. to offer a professional master's in embedded and cyber-physical systems (MECPS). Set to enroll its inaugural class of students in fall 2017, the one-year full-time master's program will train students in the foundation, skills and hands-on practices of embedded and cyber-physical systems design, optimization and evaluation. Cyber-physical systems (CPS) are a broad range of complex, multidisciplinary, engineered systems that integrate embedded computing technologies (sensors and actuators) and computational algorithms into the physical world.

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Information technology researchers forecast that by 2020, upwards of 20.8 billion connected things will be in use worldwide. Devices will connect our homes, buildings, factories, cars, transportation infrastructure and even our bodies to the internet. This Internet of Things will drive an economy expected to account for \$6-14 trillion into the next decade.“These numbers give us confidence that graduates who are trained in this domain will not have trouble finding jobs, and ones with high paying salaries,” said Fadi Kurdahi, founding director of the MECPS program, a professor of electrical engineering and computer science, and the Samueli School of Engineering associate dean of graduate and professional studies. Faculty in the schools of engineering and information and computer sciences will teach the courses.

The interdisciplinary program will prepare graduates for jobs in a variety of industries: electronics, aerospace, automotive/transportation, biomedical, manufacturing, robotics, security, defense, civil infrastructure and construction. Applications are now being accepted, and the university hopes to enroll 30 in its inaugural class. For more information, visit mecps.uci.edu.

Awards and Honors

Proof of Product (POP) Grant Awarded to Prof. Jeff Krichmar



Professor Jeffrey L. Krichmar of CECS was awarded the 2017 Proof of Product (POP) Grant for his interactive robotic device used as therapy for children with developmental disorders. The POP Grant provides funds of up to \$125,000 to campus entrepreneurs to move promising early technologies closer to commercialization. As part of The BIG Initiative, the grant bridges the gap between promising UCI research and commercialization and spurs regional economic development.

As one of the faculty leaders in the UCI Cognitive Anteater Robotics Laboratory (CARL), Professor Krichmar's research interests include neuro-robotics, embodied cognition, biologically plausible models of learning and memory, and the effect of neural architecture on neural function.

Associate Professor Zoran Nenadic named Hai-Tian Scholar



Associate Professor of Biomedical Engineering and Electrical Engineering and Computer Science Zoran Nenadic has been appointed a Hai-Tian Scholar in recognition of his research contributions.

The Hai-Tian Scholar Award is part of an ambitious program by the Dalian University of Technology (DUT), China, to improve the quality of research through collaboration with researchers around the world. With this award, Nenadic will work with international researchers for a three-year period in the general area of brain signal processing. With these collaborations, facilitated future exchange programs between DUT and UCI will be possible.

Visitor and Student Profile

Graduate Student Profile: Peizho Ou



Peizhao Ou, a fifth-year PhD Student in computer engineering in the department of Electrical Engineering and Computer Science at UC Irvine. His research focuses on designing and implementing practical techniques that check the correctness of concurrent data structures under the C/C++ memory model.

In his research, he shows evidence that writing efficient and correct concurrent data structures under the C/C++ memory model is exceedingly tricky and difficult, even for experts. He presented his paper titled

"AutoMO: Automatic Inference of Memory Order Parameters for C/C++11", at the 30th ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages, and Applications. His approach partially automates the process of finding the appropriate memory order parameters for atomic operations, thus alleviating the burden of (expert) concurrent data structure programmers and helping code quality improvement.

Recently, he presented another paper titled "Checking Concurrent Data Structures Under the C/C++11 Memory Model", at the 22nd ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming, in which he proposed a novel correctness criterion for efficient concurrent data structures under the C/C++11 memory model. He designed a simple and useful specification language to help programmers better understand, specify and check the correctness properties of their concurrent data structures. As a result, this helps catch hard-to-find bugs and make concurrent programs more robust. His PhD research is under the supervision of Professor Brian Demsky and is so far supported by the NSF under grants CCF-1217854, CNS-1228995, and CCF-1319786.

He received his B.S. in Software Engineering in 2012 from the School of Software Engineering at Shanghai Jiao Tong University in China where he worked with Professor Jianjun Zhao in the STAP group. His research interests is focused on building reliable concurrent software and systems, including static/dynamic analysis and support tools. He is actively involved in the verification and testing of concurrent data structures under relaxed memory models.



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Visitor and Student Profile

Assistant Project Scientist Profile: Giordano Da Lozzo



Giordano Da Lozzo is an Assistant Project Scientist in the Center for Embedded & Cyber-Physical Systems at UC Irvine. Before joined UCI, he was a postdoctoral fellow in the Department of Informatics and Automation at the Roma Tre University. In the same institution he received the "Laurea" Bachelor's degree and the "Laurea Magistrale" Master's degree in Computer Science and Engineering, and defended his PhD thesis entitled "Planar Graphs with Vertices in Prescribed Regions: Models, Algorithms, and Complexity" on June 2015, advised by Prof. Giuseppe Di Battista and Prof. Maurizio Patrignani.

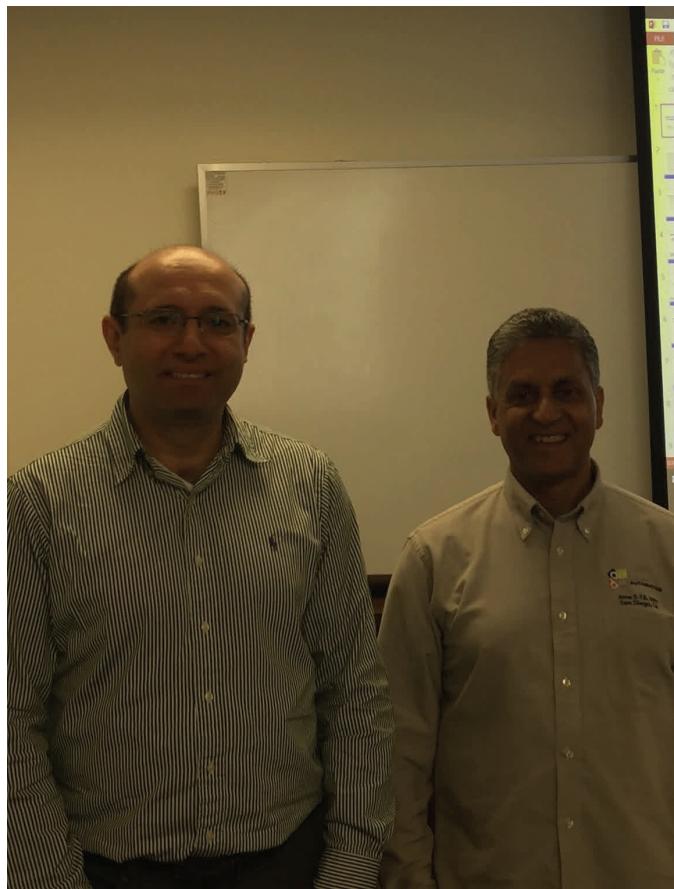
His main research interests are in the areas of Algorithm Design and Computational Complexity, with particular focus on problems related to the drawing and visualization of networks (Graph Drawing). Strongly related areas of interest are Computational Geometry, Graph Theory, Combinatorial Optimization, and Discrete Mathematics. Typical questions he uses to study are those concerned with Algorithmic Graph Drawing, that is, determining the computational complexity of testing whether graphs belonging to some particular graph class admit drawings with certain topological or geometric properties

and, in case they do, of constructing such drawings. In this context, his efforts have primarily been focused on the investigation of different notions of constrained planarity, such as Clustered Planarity, Partial Planarity, Simultaneous Embeddings with Fixed Edges, and Level Embeddings in high genus surfaces. Other questions he uses to study are those concerned with Combinatorial Graph Drawing, that is, determining worst-case asymptotic bounds for some measure among all possible representations of a graph from a certain graph class. In this context, milestones in his research so far are the works on the planar morphing problem, which has attracted a great research effort since Cairns' seminal 1944 paper.

He was a visiting scholar at Charles University in Prague, working in the Department of Applied Mathematics (KAM), under the supervision of Prof. RN, Dr. Jan Kratochvíl and Dr. Ignaz Rutter; at the Karlsruhe Institute of Technology, working in the Institute of Theoretical Informatics, under the supervision of Dr. Dorothea Wagner and Dr. Ignaz Rutter; and at the RIPE Network Coordination Centre in Amsterdam, working in the Research and Development Department, supported by the EU-Commission Leonardo da Vinci Programme.

During his PhD he contributed to research projects in the fields of algorithmics for massive and networked data, Graph Drawing and Network Representation, and algorithms for data-intensive processing on emerging computing platforms, funded by the European Science Foundation (ESF) and the Italian Ministry of Education, Universities and Research (MIUR). From 2013 until 2016, he was a teaching assistant in the courses of "Theoretical Computer Science" and "Information Visualization" at the Roma Tre University.

CECS Seminar—Dr. Raid Ayoub



On June 23, 2017, Dr. Raid Ayoub, a research scientist at the Strategic CAD Labs of Intel Corporation held a seminar titled, “Mobile and Emerging Computing Systems: challenges and research opportunities”. In his seminar, he discusses that computing systems have been evolving at an incredibly fast pace and they are increasingly ubiquitous. This trend is driven by advancements in mobile technologies and emerging of Internet-of-Things (IoT) as well as new applications. However, the complexity and diversity of these systems continue to rise, which require transformative design automation solutions to meet stringent design metrics, e.g. time-to-market. This talk addressed research problems in mobile computing at the system level with some emphasis on energy efficiency and power budgeting of the CPU-GPU subsystem as well as user-experience related problems (e.g. skin temperature estimation and control). In addition, the seminar approached emerging challenges and future research problems in the domain of IoT systems with a focus on End-to-End system design.

Raid Ayoub received his Ph.D. degree in computer engineering from the department of computer science and engineering, University of California at San Diego in 2011. Currently he is a research scientist at the Strategic CAD Labs of Intel Corporation in Portland, Oregon. He has published more than 30 journal and conference papers. His research interests include run-time optimizations, dynamic control, system modeling, human cyber-physical systems/IoT, dynamic power and thermal management, machine learning, and design automation.



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CECS Lectures and Seminars

CECS Seminar-Professor Axel Jantsch



On June 16, 2017, Professor Axel Jantsch from TU Wien held a seminar titled, “Self-Awareness in Remote Health Monitoring Systems using Wearable Electronics”. In this talk, he highlights the importance of effective monitoring to detect health deterioration and abnormalities early and efficiently. Many signs of deterioration exist as early as 24 hours prior having a serious impact on the health of a person. As hospitalization times have to be minimized, in-home or remote early warning systems can fill the gap by allowing in-home care while having the potentially problematic conditions and their signs under

surveillance and control. This talk presents a remote monitoring and diagnostic system that provides a holistic perspective of patients and their health conditions. It discusses how the concept of self-awareness can be used in various parts of the system such as information collection through wearable sensors, confidence assessment of the sensory data, the knowledge base of the patient's health situation, and automation of reasoning about the health situation.

Axel Jantsch received the Dipl.Ing. and Dr. Tech. degrees from TU Wien, Vienna, Austria, in 1988 and 1992, respectively. He was with Siemens Austria, Vienna, Austria, as a system validation engineer from 1995 to 1997. From 1997 to 2002 he was an associate professor and from 2002 to 2014. He was full professor of Electronic Systems Design at the Royal Institute of Technology (KTH), Stockholm, Sweden. Since 2014, he has been professor of Systems on Chip at TU Wien and he has published about 300 papers in international conferences and journals including one book in the areas of Systems on chip, networks on chip and embedded systems. He has served on a large number of technical program committees of international conferences, such as FDL, DATE, CODES ISSS, SOC, NOCS, and others. He has been the TPC Chair of SSDL/ FDL 2000, the TPC Co-Chair of CODES ISSS 2004, the General Chair of CODES ISSS 2005, and the TPC Co-Chair of NOCS 2009. From 2002 to 2007, he was a subject area editor for the Journal of System Architecture. He is on the editorial board for IEEE Design and Test and for the Leibniz Transactions on Embedded Systems. He is a member of the IEEE. His main research interest is on networks on chip and self-awareness in systems on chip and embedded systems.

CECS Lectures and Seminars

CECS Seminar-Christian Pilato



On June 14, 2017 Christian Pilato, a Postdoctoral Researcher at the ALaRi institute of Università della Svizzera italiana (USI), Lugano, Switzerland held a seminar at UCI. In his talk, he presented a system-level methodology for the generation of multi-bank memories in heterogeneous architectures. The methodology is supported by Mnemosyne, an open-source prototype CAD tool that can be easily integrated into commercial design flows. Mnemosyne includes various technology-aware optimizations to reduce the memory cost (area and power) by efficiently reusing the physical banks for storing different data. With Mnemosyne, Pilato suggests that it can reduce the memory cost of single accelerators by up to 45%. In addition, when reusing memory IPs across accelerators, Pilato says it he can achieve area savings that range between 17% and 55% compared to the case where the memory elements are designed separately.

Christian Pilato is a Postdoctoral Researcher at the ALaRi institute of Università della Svizzera italiana

(USI), Lugano, Switzerland. He received the Laurea degree in computer engineering and the Ph.D. degree in information technology from Politecnico di Milano, Italy, in 2007 and 2011, respectively. From 2013 to 2016, he was a Postdoctoral Research Scientist with the Department of Computer Science, Columbia University, USA. He has been visiting researcher at NanGate, Chalmers University of Technology, and Delft University of Technology. His current research interests include high-level synthesis, reconfigurable systems and system-on-chip architectures, with emphasis on memory aspects. He has actively participated in several projects sponsored by the European Union and DARPA, as well as a research center supported by SRC. Dr. Pilato served as the Program Chair of the Embedded and Ubiquitous Conference (EUC) in 2014. He is currently involved in the program committees of many conferences on embedded systems, CAD, and reconfigurable architectures, such as FPL, DATE, and CASES. He is a Member of IEEE and ACM.



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Publications

Publications

The following papers were published by CECS affiliates from Jan 2017 through Mar 2017 (and unreported papers from previous eNews).

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Prachi Joshi, Haibo Zeng, Unmesh D. Bordoloi, Soheil Samii, S.S. Ravi, Sandeep K. Shukla, " The Multi-Domain Frame Packing Problem for CAN-FD ," 29th Euromicro Conference on Real-Time Systems (ECRTS'17): 12:1-12:22, Dubrovnik, Croatia, June 27-30, 2017	
Tuan Nguyen Gia, Mingzhe Jiang, Victor Kathan Sarker, Amir M. Rahmani, Tomi Westerlund, Pasi Liljeberg, Hannu Tenhunen, " Low-Cost Fog-Assisted Health-Care IoT System with Energy-Efficient Sensor Nodes ," 13th International Wireless Communications and Mobile Computing Conference (IWCMC'17): 1765-1770, Valencia, Spain, June 26-30, 2017	
Nicoló Michelusi, Marco Levorato, " Energy-based Adaptive Multiple Access in LPWAN IoT Systems with Energy Harvesting ," 2017 IEEE International Symposium on Information Theory (ISIT'17): 1112-1116, Aachen, Germany, June 25-30, 2017	
Nikil Dutt, Amir M. Rahmani, Axel Jantsch, " Empowering Autonomy through Self-Awareness in MPSoCs ," 15th IEEE International New Circuits and Systems Conference (NEWCAS'17): 73-76, Strasbourg, France, June 25-28, 2017	
Ardalan Amiri Sani, " Schrodin Text: Strong Protection of Sensitive Textual Content of Mobile Applications ," 15th Annual International Conference on Mobile Systems, Applications, and Services (MobiSys'17): 197-210, Niagara Falls, NY, USA, June 19-23, 2017	
David Eppstein, Michael T. Goodrich, Nil Mamano, " Algorithms for Stable Matching and Clustering in a Grid ," Combinatorial Image Analysis - 18th International Workshop (IWCIA'17): 117-131, Plovdiv, Bulgaria, June 19-21, 2017	
Tim Schmidt, Guantao Liu, Rainer Dömer, " Exploiting Thread and Data Level Parallelism for Ultimate Parallel SystemC Simulation ," 54th Annual Design Automation Conference (DAC'17):79:1-79:6, Austin, TX, USA, June 18-22, 2017	
Mohsen Imani, Daneiel Peroni, Tajana Rosing, " CFPU: Configurable Floating Point Multiplier for Energy-Efficient Computing ," 54th Annual Design Automation Conference (DAC'17):76:1-76:6, Austin, TX, USA, June 18-22, 2017	
Haeseung Lee, Muhammad Shafique, Mohammad Abdullah Al Faruque, " Low-overhead Aging-aware Resource Management on Embedded GUPs ," 54th Annual Design Automation Conference (DAC'17):67:1-67:6, Austin, TX, USA, June 18-22, 2017	

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Nisarg Patel, Avesta Sasan, Houman Homayoun, " Analyzing Hardware Based Malware Detectors, " 54th Annual Design Automation Conference (DAC'17):25:1-25:6, Austin, TX, USA, June 18-22, 2017	
Sandip Ray, Wen Chen, Jayanta Bhadra, Mohammad Abdullah Al Faruque, " Extensibility in Automotive Security: Current Practice and Challenges: invited " 54th Annual Design Automation Conference (DAC'17):14:1-14:6, Austin, TX, USA, June 18-22, 2017	
Mehmet Kayaalp, Khaled N. Khasawneh, Hodjat Asghari Esfeden, Jesse Elwell, Nael B. Abu-Ghazaleh, Dmitry V. Ponomarev, Aamer Jaelle, " RIC: Relaxed Inclusion Caches for Mitigating LLC Side-Channel Attacks, " 54th Annual Design Automation Conference (DAC'17):7:1-7:6, Austin, TX, USA, June 18-22, 2017	
Mohsen Imani, Saransh Gupta, Tajana Rosing, " Ultra-Efficient Processing In-Memory for Data Intensive Applications, " 54th Annual Design Automation Conference (DAC'17): 6:1-6:6, Austin, TX, USA, June 18-22, 2017	
Pietro Mercati, Raid Ayoub, Michael Kishinevsky, Eric Samson, Marc Beuchat, Francesco Paterna, Tajana Simunic Rosing, " Multi-Variable Dynamic Power Management for the GPU Subsystem, " 54th Annual Design Automation Conference (DAC'17):2:1-2:6, Austin, TX, USA, June 18-22, 2017	
Sai Vineel Reddy Chittamuru, Ishan G. Thakkar, Sudeep Pasrich, " Analyzing Voltage Bias and Temperature Induced Aging Effects in Photonic Interconnects for Manycore Computing, " ACM/IEEE 2017 International Workshop on System Level Interconnect Prediction (SLIP'17): 1-8, Austin, TX, USA, June 17, 2017	
Igor Burago, Marco Levorato, Aakanksha Chowdhery " Bandwidth-Aware Data Filtering in Edge-Assisted Wireless Sensor Systems, " 14th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON'17): 1-9, San Diego, CA, USA, June 12-14, 2017	

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Mauro Conti, Giulio Lovisotto, Ivan Martinovic, Gene Tsudi, " FADEWICH: Fast Deauthentication Over the Wireless Channel ," 37th IEEE International Conference on Distributed Computing Systems (ICDCS'17): 2294-2301, Atlanta, GA, USA, June 5-8, 2017	
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Shouq Alsubaihi, Jean-Luc Gaudiot, " A Runtime Workload Distribution with Resource Allocation for CPU-GPU Heterogeneous Systems ," 2017 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPS Workshops'17): 994-1003, Orlando/Buena Vista, FL, USA, May 29-June 2, 2017	
Daniel Dauwe, Sudeep Pasricha, Anthony A. Maciejewski, Howard Jay Siegel, " An Analysis of Resilience Techniques for Exascale Computing Platforms ," 2017 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPS Workshops'17): 914-923, Orlando/Buena Vista, FL, USA, May 29-June 2, 2017	
Dylan Machovec, Sudeep Pasricha, Anthony A. Maciejewski, Howard Jay Siegel, Gregory A. Koenig, Michael Wright, Marcia Hilton, Rajendra Rambharos, Thomas Naughton, Neena Iman, " Preemptive Resource Management for Dynamically Arriving Tasks in an Oversubscribed Heterogeneous Computing System ," 2017 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPS Workshops'17): 54-64, Orlando/Buena Vista, FL, USA, May 29-June 2, 2017	
Shafiu Rahman, Nael B. AbuGhazaleh, Walid A. Najjar, " PDES-A: a Parallel Discrete Event Simulation Accelerator for FPGAs ," 2017 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation (SIGSIM-PADS'17): 133-144, Singapore, May 24-26, 2017	

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Fakir Sharif Hossain, Tomokazu Yoneda, Michiko Inoue, Alex Oraloglu, " Detecting Hardware Trojans without a Golden IC Through Clock-Tree Defined Circuit Partitions ," 22nd IEEE European Test Symposium (ETS'17): 1-6, Limassol, Cyprus, May 22-26, 2017	
Shihao Yan, Xianghun Zhou, Nan (Jonas) Yang, Thushara D. Abhayapala, A. Lee Swindlehurst, " Channel Training Design in Full-Duplex Wiretap Channels to Enhance Physical Layer Security ," IEEE International Conference on Communications (ICC'17): 1-6, Paris, France, May 21-25, 2017	
Byron Hawkins, Brian Demsky, " ZenIDS: Introspective Intrusion Detection for PHP Applications ," 39th International Conference on Software Engineering (ICSE'17): 232-243, Buenos Aires, Argentina, May 20-28, 2017	
David Eppstein, Michael T. Goodrich, Michael Mitzenmacher, Manuel R. Torres, " 2-3 Cuckoo Filters for Faster Triangle Listing and Set Intersection ," 36th ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (PODS'17): 247-260, Chicago, IL, USA, May 14-19, 2017	
Tiffany Hwu, Jacob Isbell, Nicolas Oros, Jeffrey L. Krichmar, " A Self-Driving Robot Using Deep Convolutional Neural Networks on Neuromorphic Hardware ," 2017 International Joint Conference on Neural Networks (IJCNN'17): 635-641, Anchorage, AK, USA, May 14-19, 2017	
Divya Pathak, Houman Homayoun, Ioannis Savidis, " Work Load Scheduling for Multi Core Systems with Under-Provisioned Power Delivery ," ACM Great Lakes Symposium on VLSI 2017: 387-392, Banff, AB, Canada, May 10-12, 2017	
Shoumik Maiti, Sudeep Pasrich, " DELCA: DVFS Efficient Low Cost Multicore Architecture ," ACM Great Lakes Symposium on VLSI 2017: 107-112, Banff, AB, Canada, May 10-12, 2017	
Michael T. Goodrich, Evgenios M. Kornaropoulos, Michael Mitzenmacher, Roberto Tamassia, " Auditable Data Structures ," 2017 IEEE European Symposium on Security and Privacy (EuroS&P '17): 285-300, Paris, France, April 26-28, 2017	

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Hsinchung Chen, Yi Lin Chen, Chia Hsun Wu, Mohammad Abdullah Al Faruque, Pai H. Chou, "EcoLoc: Encounter-Based Collaborative Indoor Localization: Poster Abstract," 2nd International Conference on Internet-of-Things Design and Implementation (IoTDI'17): 337-338, Pittsburgh, PA, USA, April 18-21, 2017	
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Xavier Carpent, Karim El Defrawy, Norrathep Rattanavipanon, Gene Tsudik, "Lightweight Swarm Attestation: A Tale of Two LISA-s," 2017 ACM on Asia Conference on Computer and Communications Security (AsiaCCS'17): 86-100, Abu Dhabi, United Arab Emirates, April 2-6, 2017	
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Nathan Burow, Scott A. Carr, Joseph Nash, Per Larsen, Michael Franz, Stefan Brunthaler, Mathias Payer, "Control-Flow Integrity: Precision, Security, and Performance," ACM Computing Surveys 50(1): 16:1-16:33, April 2017	
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Hela Jedda, Amine Mezghani, Josef A Nossek, A. Lee Swindlehurst, "Massive MIMO Downlink 1-Bit Precoding with Linear Programming for PSK Signaling," The Computing Research Repository (CoRR)abs/1704.06426, April 2017	
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Mohammad Hashem Haghbayan, Amir M. Rahmani, Pasi Liljeberg, Axel Jantsch, Antonio Miele, Cristiana BOlchini, Hannu Tenhunen, "Can Dark Silicon Be Exploited to Prolong System Lifetime," IEEE Design & Test 34(4): 51-59, April 2017	

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Publications

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