RAW 2017 Keynote Speaker 1

Heterogeneous Technology Configurable Fabrics: Leveraging Reconfiguration as a Pathway Towards Emerging Devices

Ronald F. DeMara –University of Central Florida, Orlando, FL, USA

Abstract: Heterogeneous Technology Configurable Fabrics (HTCFs) are introduced as versatile and advantageous hybrid post-CMOS platforms for next-generation reconfigurable computing. HTCFs assimilate the complementary roles of emerging and CMOS devices within an integrated reconfigurable array to impart field-programmable accessibility supporting both synthesis-time and run-time co-design among device technologies. Heterogeneous fabrics are comprised by a triad of emerging device blocks, CMOS logic blocks, and signal conversion blocks. Emerging device blocks utilize the strengths of non-volatile devices for non-charged based resistive/nanomagnetic storage for realizing Look-Up Tables (LUTs), Configurable Logic Block (CLBs), and switching blocks. CMOS logic blocks, or other logic-optimized switching device technologies, realize functional elements such as adders and multipliers to facilitate complex functions. Whereas the inter-device signal conversion requirements determined by the state-holding and state-changing mechanisms of these device blocks differ, signal conversion blocks are also be encapsulated within the fabric. Thus, devices that utilize a voltage-level representation, or alternatively magnetic orientation, having distinct switching mechanisms involving voltage, current, or magnetic fields undergo the transformations required for field-programmable accessibility. By considering programmable interconnect points integrated within a structured block, devices can be interconnected while retaining their intrinsic signal representations to realize diverse benefits. These include architecture-level advancements ranging from innovative resilience strategies to improved static versus dynamic energy profiles enabled by runtime configurability of HTCFs. Their implications to enable fresh computing paradigms, facilitate new CAD tools for emerging devices, and realize low energy IoT platforms will be discussed. In summary, the opportunity for HTCFs to enable a new orthogonal dimension in reconfigurable and evolvable hardware will be emphasized.

About the Speaker: Ronald F. DeMara (S'87-M'93-SM'05) received the Ph.D. degree in Computer Engineering from the University of Southern California in 1992. Since 1993, he has been a full-time faculty member at the University of Central Florida where he is a Professor of Electrical and Computer Engineering, and joint faculty of Computer Science, and has served as Associate Chair, ECE Graduate Coordinator, and Computer Engineering Program Coordinator. His research interests are in computer architecture with emphasis on reconfigurable logic devices, evolvable hardware, and emerging devices, on which he has published approximately 200 articles and holds one patent. He is a Senior Member of IEEE and has served on the Editorial Boards of IEEE Transactions on VLSI Systems, Journal of Circuits, Systems, and Computers, the journal Microprocessors and Microsystems, and as Associate Guest Editor of ACM Transactions on Embedded Computing Systems, as well as a Keynote Speaker of the International Conference on Reconfigurable Computing and FPGAs (ReConFig). He is lead Guest Editor of IEEE Transactions on Computers joint with IEEE Transactions on Emerging Topics in Computing 2017 Special Section on “Innovation in Reconfigurable Computing Fabrics: from Devices to Architectures.” He is currently an Associate Editor of IEEE Transactions on Computers, and serves on various IEEE conference program committees, including ISVLSI and SSCI. He received IEEE’s Joseph M. Bidenbach Outstanding Engineering Educator Award in 2008.
Abstract: Public cloud computing has been taking the world by storm. A public cloud appeals to both senior management and to IT departments of many organizations from a wide range of domains. For senior management, a public cloud creates a second source for IT services, removing the lock-in with large internal IT teams and steadily growing infrastructure costs. For the new generation of IT professionals, the public cloud offers the power to manage a massive amount of resources with reduced effort and lower required expertise. Cloud providers are now becoming serious about high performance computing services: 2016 has seen the integration of Altera into Intel, on the back of a large deployment of Altera products at Microsoft; SuperVessel of OpenPower by IBM using Xilinx devices and more recently Amazon announcing their new AWS EC2 F1 instance as their top end performance offering. AWS F1 instances are fully compatible with Maxeler’s MAX5 Dataflow Engines (DFEs) generation and come in single and eight-way configurations similar to the MPC-C appliances (one DFE) and the 8-way MPC-X DFE appliance in 1U form factor. The above provides organizations with the ultimate elasticity to blur the boundaries between public and private clouds in case of hybrid, large-scale deployments. This is of special interest for large organizations in Finance and Data Business Analytics where confidentiality, service level guarantees, and critical business continuity services are of ultimate importance. The recently announced partnerships of Maxeler with Amazon Web Services and Hitachi Data Systems emphasize just two examples of the competitive edge our DFE technology brings on the cloud while providing solutions for extremely hard problems, e.g., computing minimal capital requirements using standard models (FRTB and Basel III) and high-frequency, transaction-related record keeping (Dodd-Frank and MiFID II). In this talk we will show how our Multiscale Dataflow Computing solutions leverage the Amazon AWS F1 instance and provide an elastic hybrid cloud solution to minimize both operational and financial, cost and risk.

About the Speaker: Georgi Gaydadjiev is VP of Dataflow Software Engineering of Maxeler Technologies. Georgi has been designing various computer systems in both Industry and Academia for more than 25 years. He is also a Visiting Professor at the Department of Computing at Imperial College. In the period between 2011 and 2015 he held a Chair in Computer Systems Engineering at Chalmers University of Technology in Sweden and was a faculty member at the Microelectronics and Computer Engineering Department at TU Delft starting from 2002. Georgi has three Best Paper Awards (ICS-10, USENIX/SAGE-06), one of his projects in industry won the CES Design & Engineering Showcase Award in 1999 and his academic research for the last 14 years was funded by the European Commission, National Agencies in the Netherlands, Sweden and UK, as well as Google Inc. in USA.