Keynote 1
Real-Time Internet of Things

Speaker: Chenyang Lu, Fullgraf Professor, Department of Computer Science and Engineering, Washington University in St. Louis, USA

Abstract:

Internet of Things (IoT) are large-scale distributed systems spanning wireless sensor networks and cloud computing backend. Emerging applications from Industry 4.0 to smart cities demand end-to-end real-time services across IoT systems. However, existing IoT technologies are ill-suited for time-critical applications due to the lack of real-time performance guarantees in both wireless sensor networks and the cloud backend. This talk will discuss recent advances in real-time IoT in two key fronts. On the wireless front, we introduce real-time scheduling and protocols for industrial wireless sensor-actuator networks. On the cloud front, we will describe a real-time software stack for cloud computing: (1) RT-Xen, a real-time virtual machine scheduler incorporated in the Xen hypervisor; (2) VATC, a real-time network I/O system for virtualized hosts; and (3) RT-OpenStack, a cloud CPU resource manager for real-time virtual machines. The talk will further highlight the challenges and research opportunities toward an end-to-end infrastructure for real-time Internet of Things.

Biography:

Chenyang Lu is the Fullgraf Professor in the Department of Computer Science and Engineering at Washington University in St. Louis. His research interests include real-time systems, wireless sensor networks, cyber-physical systems and Internet of Things. He is Editor-in-Chief of ACM Transactions on Sensor Networks, Area Editor of IEEE Internet of Things Journal and Associate Editor of ACM Transactions on Cyber-Physical Systems and Real-Time Systems Journal. He also chaired premier conferences such as IEEE Real-Time Systems Symposium (RTSS), ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS) and ACM Conference on Embedded Networked Sensor Systems (SenSys). He is the author and co-author of over 150 research papers with over 16,000 citations and an h-index of 56. He received the Ph.D. degree from University of Virginia in 2001, the M.S. degree from Chinese Academy of Sciences in 1997, and the B.S. degree from University of Science and Technology of China in 1995. He is a Fellow of IEEE.
Keynote 2
Challenges in Safety-Critical Software

Speaker: Chris Hobbs, Software Safety Specialist, QNX Software Systems, Canada

Abstract:
The “safety-critical” label is expanding to cover more and more software. Clearly the software in (semi-)autonomous cars has safety-critical implications, but what about the software in soft drink vending machines? Modern drinks machines now mix the chemicals in situ, rather than dispensing pre-loaded cans; therefore a software failure could result in a dangerous caffeine overdose. Actors in a theatre work in an environment where software controls swinging scenery and workplace safety would normally require safety helmets and boots.

This presentation identifies some of the major technical challenges developers are facing in this growth industry of safety-critical software. Can we measure “safety” in terms of “system dependability”? How does one build a safe embedded system from memory chips that are subject to cosmic ray bit-flips and row-hammering, from processors that are subject to 20 pages of errata, from multi-threaded software subject to race hazards particularly when running on multi-core processors, from commercial off-the-shelf operating systems and from mathematical algorithms subject to the vagaries of floating point arithmetic? How can the dynamically-changing balances between reliability and availability and between safety and security be handled as a car leaves the highway and enters a congested town centre? Building on examples, both good and bad, from real industrial projects, this presentation discusses some of the recent advances in safety-critical software development and throws out challenges to academia on problems still unsolved.

Biography:
Chris Hobbs works for QNX Software Systems, specialising in the design and implementation of embedded, real-time systems for use in safety-critical applications (particularly medical, railway, industrial and automotive). He works on both the safety certification of QNX products against standards such as IEC61508, IEC62304 and ISO26262, and also on providing consultancy to QNX’s customers building safety-critical devices. His book *Embedded Software Development for Safety-Critical Systems* was published in 2015.

When not working with embedded systems, he provides flight instruction, sings Schubert Lieder and is author of various books including *Flying Beyond: The Canadian Commercial Pilot Textbook*. 