Faculty Candidate Seminar

Building Reliable Distributed Cyber-Physical Systems

Kyungmin Bae, Carnegie Mellon University

Tuesday, February 24, 2015 11:00 to 12:00pm
Venue: CS 203

(Refreshments will be served at 10:45 a.m.)

Abstract – Distributed cyber-physical systems are emerging in many areas such as avionics, automotive, medical devices, robotics, etc. Developing reliable distributed cyber-physical systems is very hard due to the inherent complexity of distributed systems, including asynchronous communication, network delays, and skews of the local clocks. This talk presents effective methods to design and analyze reliable distributed cyber-physical systems, based on robust system designs, automatic formal analysis techniques, and model-based software engineering methods. First, the Multirate PALS architectural pattern reduces the system complexity of distributed cyber-physical systems. Instead of directly designing complex distributed systems, we create simple synchronous designs and then Multirate PALS produces correct-by-construction distributed system implementations. Second, rewriting-based model checking automatically analyzes synchronous models based on their formal semantics, and SMT-based methods precisely analyze both discrete and continuous behavior. Third, Synchronous AADL allows engineers to easily design and analyze distributed cyber-physical systems within the industrial modeling standard AADL. The tool automatically checks whether a given AADL design conforms to the Multirate PALS pattern, and provides a one-click interface to perform model checking of the system within the modeling tool. In this talk, I will illustrate such design and verification of Multirate Synchronous AADL models with avionics case studies.

Bio - Kyungmin Bae is a postdoctoral fellow in the School of Computer Science at Carnegie Mellon University. He received his Ph.D. in Computer Science at University of Illinois at Urbana-Champaign in 2014, and earned his bachelor's degrees in Computer Science and Mathematics from KAIST. His research interests are in formal methods and software engineering to improve the safety, security, and reliability of a wide range of real-world applications, including distributed, real-time, and cyber-physical systems.