Using Software Engineering Technology to Reduce Medical Errors

Lori A. Clarke
Department of Computer Science
University of Massachusetts, Amherst

It has been estimated that there are approximately 98,000 deaths per year in the United States caused by medical errors. In the University of Massachusetts Medical Safety Project, we are investigating the use of software engineering technologies to model, evaluate, and improve medical processes. Specifically, we are modeling medical processes with a process definition language, analyzing these processes using finite-state verification, fault-tree analysis, and other analysis techniques, and, if subsequently modified, reevaluating the changed processes to assure that discovered problems have been addressed without introducing other concerns. Working with the UMASS School of Nursing and the Baystate Medical Center, we are undertaking in-depth case studies on error-prone and life-critical medical processes. In many ways, these processes are similar to complex, distributed systems in that they have many interacting, concurrent threads and exceptional conditions frequently arise that must be carefully handled before normal execution can continue.

We have been able to develop detailed process models, to specify important safety properties, and to detect vulnerabilities in actual processes. This talk describes the technologies we are using, discusses the case studies, and presents our observations and findings to date. Although presented in terms of the medical domain, the described approach could be applied to other human-centric processes to provide a technology-driven approach to process improvement.

Lori A. Clarke is a professor in the Department of Computer Science at the University of Massachusetts, Amherst. She is a Fellow of the ACM, vice chair of the Computing Research Association (CRA), and co-chair of the CRA’s Committee on the Status of Women in Computing Research (CRA-W). She is a former IEEE Publication Board member, associate editor of ACM TOPLAS and IEEE TSE, member of the CCR NSF advisory board, ACM SIGSOFT chair, IEEE Distinguished Visitor, and ACM National Lecturer. She received a 2004 Distinguished Engineering Alumni Award from the University of Colorado, Boulder, the 2002 SIGSOFT Distinguished Service Award, a 1993 University Faculty Fellowship, and a 1991 University of Massachusetts Distinguished Faculty Chancellor's Medal. She was program co-chair of the 14th and general chair of the 25th International Conference on Software Engineering.

Dr. Clarke research is in the area of software engineering, primarily focusing on the finite-state verification of concurrent systems and requirements engineering. Recently she has been investigating applying software engineering technologies to detect vulnerabilities in complex processes in domains such as medicine, scientific workflow, and digital government. She is also involved in several programs to increase participation of underrepresented groups in computing research.