Abstract: Critical infrastructure is undergoing a fundamental change worldwide in areas such as power, water, transport, defence, etc. Control systems that were previously physically-isolated and constructed from purpose-built components are increasingly being standardised and interconnected, exposing them to corporate networks and even the Internet. Consequently, well-established ways of engineering systems for safety and reliability are now being forced to address the additional demands of information security.

Having conducted research into a variety of safety-critical, mission-critical and security-critical systems, we reflect here on the different emphases they place on basic system requirements. For example, some properties, such as availability, have much higher importance for safety-critical systems than security-critical ones. By contrast, where data confidentiality is the primary concern of a security-critical system, it may be of lower priority in a safety-critical context, and so on.

We also review and contrast some widely-cited design principles for critical systems to identify their commonalities and differences. For instance, where a mission-critical system may emphasise ease-of-access for system maintenance, this directly contradicts the security principle of minimising the exposed attack surface. Similarly, while duplicating components can improve reliability it simultaneously creates more opportunities for security violations.

Ultimately we conclude not that the worlds of safety, mission and security-critical system engineering are on a disastrous collision course, but rather that the growing complexity of our critical infrastructure means that system developers are now obliged to consider carefully all three perspectives.

Biography: Dr. Colin Fidge is a full professor in the Science and Engineering Faculty of the Queensland University of Technology where he teaches software development and scientific research principles. His research interests include high-integrity systems engineering for safety, mission and security-critical applications. His research spans a broad range of systems development tasks including requirements specification, software analysis, and system modelling and simulation. He has conducted research on critical systems for the Defence Science and Technology Organisation, Telstra, Powerlink Queensland, Delta Electricity, NICTA, and the Australian Signals Directorate.
ICECCS 2015 Keynote 2

Title: Exhaustive Search and Resolution of OT Puzzles in Real-Time Collaborative Editing Systems
Speaker: Chengzheng Sun

Abstract: Operational Transformation (OT) is a cornerstone technology underlying modern real-time collaborative editing systems, which enable multiple geographically dispersed people to edit shared documents and see each other's updates instantly and consistently. Due to its unique combination of lock-free, non-blocking, fine-grained concurrency, and unconstrained interaction properties, OT is particularly suitable for supporting real-time collaborative work over long-latency communication networks like the Internet, and has been increasingly adopted in industrial applications, including Google Docs, and Microsoft Office Online, etc. One main driving force behind OT research is the curiosity to detect and resolve intellectually challenging puzzles – characteristic collaborative editing scenarios or transformation cases in which an OT system may fail to produce correct results. OT puzzles were notoriously difficult to detect since they were often hidden in intricate scenarios and caused by complex factors with infinite possibilities. As OT is increasingly applied to a wider range of real-world and complex systems, ensuring and verifying correctness of core OT algorithms become more and more important. In this talk, I present a brief history of OT, experiences and lessons in detecting and resolving major OT puzzles, and recent work on exhaustive search and resolution of OT puzzles under well-defined conditions and common data and operation models in collaborative editing systems.

Biography: Dr. Chengzheng Sun is a full professor in computer science at Nanyang Technological University, Singapore (www.ntu.edu.sg/home/czsun). Since 1994, Dr Sun has led and acted as the chief designer of a number of collaborative editing system projects, including CoWord, CoPowerPoint, CoMaya, etc., which contributed to the advancement of the theory and practical implementation of collaborative editing systems in general and the Operational Transformation (OT) technology in particular. Prof Sun obtained a PhD in computer engineering from National University of Defense Technology, China in 1987, and a PhD in computer science from the University of Amsterdam, Netherlands in 1992. His current research lies at the intersections of Computer-Supported Cooperative Work and distributed/cloud computing systems. Dr Sun has published and delivered seminars and tutorials on collaborative editing techniques and systems widely at major international conferences, universities, and industrial research labs.
ICECCS 2015 Keynote 3

Title: Facilitating Program Analysis through Active Learning
Speaker: Jun Sun

Abstract: It is true that many of the program analysis problems are undecidable. Yet, experienced programmers solve instances of those problems everyday. One of reasons is perhaps that programmers are good at learning and constructing abstract models of the programs which then facilitate their problem solving. Recently, we have started a line of research which aims to solve program analysis problems by taking advantage of active learning techniques from the machine learning community, in a way inspired by what experienced programs would work. In this talk, I will present some preliminary research that we conducted on using active learning to automatically construct abstract models of Java programs, for program comprehension, verification and debugging.

Biography: Sun, Jun received Bachelor and PhD degrees in computing science from National University of Singapore (NUS) in 2002 and 2006. In 2007, he received the prestigious LEE KUAN YEW postdoctoral fellowship in School of Computing of NUS. Since 2010, he joined Singapore University of Technology and Design (SUTD) as an Assistant Professor. He was a visiting scholar at MIT from 2011-2012. Jun's research interests include software engineering, formal methods, software engineering, program analysis and cyber-security. He is the co-founder of the PAT model checker. To this date, he has more than 130 publications. Jun was the general co-chair of ICECCS'13 and PRDC'14 and program co-chair of FM'14. He is a member of a number of conference program committee including FM'15 and ICSE'16.