Going Native - Relying on Pidgins and Creoles to Construct High Confidence Software

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Abstract:
Engineers developing high confidence systems must obtain a sound understanding of the domain phenomena, assumptions, and relevant invariants that underpin the space of acceptable solutions. As domain outsiders, these engineers must "go native" by engaging with domain experts to identify and discover the essential domain elements needed to properly exercise control over the environment in a predictable and reliable manner. Engineers and domain experts together rely on a variety of notations, methods, and tools to test their assumptions and to converge on a set of behaviors and properties that the system should embody, such as safety, security and privacy. This process is frequently riddled with ambiguity, inconsistency and conflict, which requires multiple design iterations, compromise and eventually commitment. In this keynote talk, we highlight the technical challenges to translating the informal, unstructured world into formal and semi-formal specifications needed to build and evaluate reliable, high confidence systems. These challenges include finding a domain-relevant semantics that is sufficiently expressive, supporting effective reasoning at the domain level, enabling a traceable connection between domain abstractions and implementation abstractions, developing mathematical metatheory to give confidence in this reasoning, and, in addition, assuring engineering realism and effective usability by engineers and evaluators.

Bio:
Travis D. Breaux is an Assistant Professor of Computer Science, appointed in the Institute for Software Research of the School of Computer Science at Carnegie Mellon University. Dr. Breaux's research program searches for new methods and tools for developing correct software specifications and ensuring that software systems conform to those specifications in a transparent, reliable and trustworthy manner. This includes demonstrating compliance with U.S. and international accessibility, privacy and security laws, policies and standards. Dr. Breaux is the Director of the Requirements Engineering Laboratory at Carnegie Mellon University. Dr. Breaux has several publications in ACM and IEEE-sponsored journals and conference proceedings. Dr. Breaux is a member of the ACM SIGSOFT, IEEE Computer Society and USACM Public Policy Committee.

Prior to coming to the Carnegie Mellon University, Dr. Breaux received the Doctorate of Philosophy in Computer Science from North Carolina State University (NCSU) in 2009. Dr. Breaux also holds Baccalaureate degrees in Computer and Information Science from the University of Oregon and in Anthropology from the University of Houston. He has conducted research at the Institute for Defense Analyses, the IBM Thomas J. Watson Research Laboratory, the Oak Ridge National Laboratory and the Center for Education and Research in Information Assurance and Security (CERIAS) at Purdue University. In 2000, Dr. Breaux served as a volunteer in the United States Peace Corps in Mongolia, before transitioning from anthropology to computer science.

Dr. Breaux traces his passion for exploring socio-technical systems back to teachings he received in culture cosmology and philosophy by Dr. Susan Rasmussen and Dr. Quetzil Casteneda at the University of Houston. Dr. Breaux was first introduced to the field of Requirements Engineering by his undergraduate adviser, Dr. Stephen Fickas, at the University of Oregon whose influence includes requirements monitoring, requirements negotiation and ephemeral requirements. Under the guidance of Dr. Annie Anton, Dr. Breaux has extended his interests to include the societal impact of system requirements on privacy and security in their "ground-breaking" work to acquire software requirements from policies and U.S. federal and state regulations.