

SEI Research Team Drives Edge-Enabled App Programming to Tactical Handheld Devices



July 19, 2011—A team of first responders searches a metropolitan area hours after a devastating earthquake. The responders carry mobile phones loaded with an app to collect, share, and catalogue information related to their mission. They use the app to record the area affected on a map, the extent of damage, and the address of each residence they clear. They also note GPS coordinates, obtained directly from a sensor in the phone, to record areas searched. The areas searched can then be shared with other responders allowing the whole team to get a better picture of the situation. The responders soon realize, however, they need to capture more information. So, using an intuitive programming interface, they add a “casualties” field to the app. They also configure the app to acquire the number of known residents for each address they search from a database in the command center. Having made these changes in the field, the responders proceed with greater accuracy and efficiency.

This is the vision of Ed Morris and his colleagues in the [Research, Technology, and System Solutions \(RTSS\) Program](#) at the SEI working on [edge-enabled tactical systems](#). He sees great potential in providing user-controlled system adaptation to first responders, warfighters, and others working with handheld devices in tactical environments at the edge, or periphery, of the network. “The idea is to bring a lot of flexibility to first responders and warfighters and others operating in the field,” said Morris. “We’re seeking to do this by giving people working at the edge the ability to tailor their handheld interfaces to tie information from various systems together and to customize this information to meet the needs of their missions.”

This effort is part of a larger body of RTSS research to enhance the capability of users operating in tactical network environments. Last year, RTSS conducted successful proof-of-concept and prototype exercises at the Naval Post-Graduate School’s Center for Network Innovation and Experimentation. The exercises previewed the great potential of service-oriented architectures (SOA) in edge environments. Service orientation enables communication among the various software components (services) in a system, which in turn enables rapid combination of the information and functionality of these services in new and useful ways. For instance, in one successful prototype, researchers used a web service to stream video from an unmanned aerial vehicle (UAV) to a handheld Android device, and to transfer images captured by a camera on that device to a computer in a Tactical Operations Center (TOC).

“Today, we’re focused on trying to understand what types of information and flexibility would be useful to edge users,” said Morris. “Rather than arbitrarily developing applications, we’re consulting a warfighter working group to understand the kinds of real-world missions they’re

engaged in. This includes missions such as clearing a weapons cache, clearing a route, or conducting a ‘meet and greet’ with the local population.” Morris and his colleagues will use this information to develop an initial end-user programming capability for handheld devices. Subsequent work will incorporate additional sensors and data formats, more layouts, and allow for more complex end-user programming.

“Our goal is to give ‘boots-on-the-ground’ first responders and others the ability to customize mission-specific views on their handheld devices,” said Morris. The ultimate vision of this work is to make customized, real-time situational awareness available to the smallest tactical unit in the field. The RTSS team believes this will improve decision making by increasing the relevance of data collected by and presented to users working at the edge. This improvement will be accomplished by reducing the volume of data that users (and their equipment) must process. It will also reduce distractions and wasted time by making the user interfaces useful, usable, effective, and efficient.

Morris stressed that the idea of first responders, warfighters, and others programming in the field is not at all farfetched. “Never sell short the ability of young soldiers and first responders. You have to understand they grew up with this technology. They’re sophisticated users of smartphones who are already figuring out how to replace pencil-and-paper processes with handheld apps. We’re working to help them use their know-how to get even more out of the impressive computing and networking power of today’s handheld devices.”

Nevertheless, the researchers in RTSS understand the nature of the environments in which first responders and warfighters operate. “The user interface for any edge programming capability we create is a big concern,” said Morris. “The last thing we want is for the smartphone user interface to be a distraction.” To address these concerns, RTSS is collaborating with Brad Myers of the [Human-Computer Interaction Institute \(HCII\)](#) in the School of Computer Science at Carnegie Mellon University (CMU). A leader in the field of human-computer interaction, Myers is a principal investigator for the Natural Programming Project, the Pebbles Handheld Computer Project, and worked on the Command Post of the Future (CPoF). He is collaborating with the RTSS team to help research the human-computer interaction issues and shaping strategies for edge-programming suited to front-line users.

Myers’ work is also informed by the input from experienced user groups, again demonstrating the collaborative nature of this research initiative. Drawing on the SEI’s existing relationships with DoD organizations, the RTSS team gained valuable insight into the challenges of working in tactical environments and the real-world problems that edge programming can address. Armed with this understanding, the RTSS team has tapped relevant expertise both within the SEI and at CMU to research appropriate and practical solutions.

For more information about the work of the RTSS Program in the area of edge-enabled tactical systems, please visit <http://www.sei.cmu.edu/sos/research/mobilecomputing/Edge-Enabled-Tactical-Systems.cfm>.