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Mobility and the First

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How can information and communications technologies be better used to support the more then eight million first responders in U.S. homeland security? First responders are members of organizations and agencies such as emergency communications centers; emergency medical services; fire, rescue, and hazardous material response teams; law enforcement agencies; the Red Cross, and other disaster relief organizations [1]. In most cases first responders are those people who, during an event or incident, are the prime evaluators of threat and risk to homeland security. These people become the primary link in a chain of information exchanges that lead to making critical, perhaps lifesaving, decisions.

A typical first responder's work is characterized by routine occurrences punctuated by periodic emergencies. First responders' work is often structured around responding to incidents and events, the cause, severity, and consequences of which are not readily discernable. These incidents rarely occur at predetermined places or times. Thus, the routine patrol of a police officer can shift to emergency mode as a result of a single call from the police dispatcher. Many first responders are mobile as part of their routine work and must relocate to an incident site in an emergency, which means they must bring what they need with them or function with what they have to contain the situation [6]. However, some assessments of U.S. homeland security lament that first responders' needs for information access and sharing are not well supported, and are often disconnected from both the information systems and databases central to effective homeland security [5, 8].

Our interests in first responders, homeland security, and uses of computing motivated us to conduct a field trial of mobile access to the Commonwealth of Pennsylvania's Justice Network (JNET). For the purposes of this trial, mobile access meant using third-generation (3G) public wireless networks. A 3G network provides enough bandwidth to transmit photos and other large files securely to mobile and remote users. Several commercial wireless service providers (such as Horizon PCS, a Sprint subsidiary used for our trials) have built out their 3G networks and one goal of the field trial was to assess whether first responders could effectively use this public telecommunications

Responder

Supporting secure wireless access to databases via public telecommunications infrastructure.

infrastructure for their routine and emergency needs.

We partnered with JNET because this application provides a secure means to search more than 20 public-safety-related databases[1] [2]. A key aspect of the JNET architecture is the access it provides to residents' driver's license photos. Secure (and authorized) access to this range of available criminal justice data has been considered both critical and not possible for most public safety and police officers to date. The JNET approach—federated databases connected through a Web-based application/portal—reflects the new range of systems being developed to support criminal justice and homeland security work [2]. JNET's fixed-site desktop access currently experiences 45,000 hits and 2,000 interagency notifications per month and has been a significant asset to Pennsylvania's criminal justice efforts [7]. Thus, a second goal of the field trial was to better understand the technical needs, operational uses, and strategic opportunities of first responders' mobile access to JNET (and to the Web more generally) via laptop computers and PDAs using public 3G networks—see the sidebar, "The Field Study Method."

Observations from the Field Trials

The four observations we discuss are drawn from interviews, time diaries, observations, and ride-alongs, call logs, and unobtrusive traffic records.

Mobile access to JNET is a 'killer application' for first responders. Driver's license photos were the most requested information, just as they are for fixed-site JNET users. Driver's license photos provide a means of identifying and linking people (and their pictures) to vehicle registration, addresses, and other activities such as warrants, tickets, and other criminal justice incidents. JNET's

[1]The JNET program is operated by the Pennsylvania Office of IT and 15 Pennsylvania criminal justice agencies. For more on JNET and its role in both public safety and U.S. homeland security, see www.pajnet.state.pa.us.

value to trial participants is evident even though they had to grapple with the constraints of limited coverage on, and unstable access to, the 3G wireless network. For example, trial participants are highly conscious of security of information and they valued the steps taken by JNET to keep information secure during the field trial even though it added several steps to the log-in process.

We learned that connection reliability is more important to officers than is data download speed. When officers need identity or criminal justice data during an incident, they radio the police dispatcher. The dispatcher's proxy query takes place in parallel with the officer's incident management at the scene. Thus, there is no time penalty during a situation in which officers at the scene typically cannot divert their attention to deal with a query/response. Therefore, officers depend on the dispatcher to return information. More generally, we realize that the dispatch model is so central to current first-responder processes that it should be considered an integral aspect of new applications and not seen as an organizational work structure to be changed.

This observation suggests two things. First, that the value of high-speed access to data for trial participants is not tied to how much or how often, it is a matter of connectivity when it is needed. The common conceptualizations of value being measured by volume or use time are incorrect. Second, that future developments of JNET (and applications to support first responders) should be designed to work with existing dispatcher schemes. For example, if a JNET request was initiated by an officer (perhaps as a voice-driven query) and this request was completed and sent through dispatch, the officer would continue to have hands-free (and eyes-free) operations, the current working dispatch-centric model would be supported, and the query's results could be easily sent on to other units as needed.

Trial participants have welcomed the mobile devices and advanced information and communications technologies in general. Participants are hopeful about the roles that mobile devices and wireless access can play in making their work life safer and also better enable them to perform their duties. They see the devices as part of a larger ensemble that could include local printers, digital cameras, driver's license scanners, and the ability to file reports via wireless connectivity: they want more. The officers in our trial are patient and willing to wait until something is proven to work before incorporating it as part of their daily routine. Based on the positive results of the laptop trial both the participants and study team expected significant usage of the PDA. However, the PDA battery life was not sufficient to maintain connectivity with the 3G network over long periods and this led trial participants to stop using their PDAs for mobile access. Instead, officers used PDAs for scheduling, contacts, note-taking and many other tasks. Our experience indicates first responders are willing to take on new tools, but will not compromise their (or anyone else's) safety if the device or application does not work. The JNET applications that are very useful for deskbound workers are neither fast enough nor focused on the needs of mobile workers, making use difficult during incident response.

We also note that the value of mobile access seems to be tied to particular aspects of their work. Mobile access and JNET use seems important to only certain tasks and events in the work of our participants. For example, in the eight-hour shifts we observed during ride-alongs, officers typically were engaged in information-seeking tasks for less then 15% of the total shift time. Self-reported time-diaries corroborate that information-seeking activities are a small but very critical aspect of police officer's work.

Use of mobile JNET does not alter existing organizational links. We imagined at the trial's outset that increased access to information might lead to changed interactions among personnel; there is no evidence of this in our experience. One possible artifact of the field

The Field Study Method

The trial was designed in two phases. The first was limited to five participants and focused on laptop usage. The second involved 13 participants and focused on PDA usage. Both phases lasted three months. Participants were police and other public-safety officers from within one Pennsylvania county. We used a four-pronged mixed-method approach to gather data: interviews and focus groups; ride-alongs and direct observation; pre- and post-trial survey data; and unobtrusively collected data on actual Web use, JNET use, and wireless connection use. This combination of methods allowed us to answer questions about where, when, and why this technology was used and why not. These methods also allowed us to answer important questions about first responders' and criminal justice organizations' unique use of mobile technology. The field trial arises from an ongoing partnership among: Pennsylvania state government (Office of Information Technology and Justice Network Project); Lucent Technologies; Boston University's Institute for Leading in a Digital Economy; Pennsylvania State University's School of Information Sciences and Technology; Horizon PCS; and Novatel. C

trial is that it created a reason for a number of local and county units to work together, and this has had an unintended but welcome positive effect of collaboration. These newly exercised links have led to demonstration efforts for other county public safety offices and local police units and interest in developing community policing grant proposals. But, in the short span of our six-month, two-phase trial, involving the day-to-day work of policing and public safety, JNET and mobile access has not changed communication patterns.

First-responder organizations have limited IT support and diverse IT infrastructures. The officers in our trial relied chiefly on themselves and on each other to learn to use and troubleshoot the laptops and PDAs. Each of the three units participating in the trial had different IT infrastructures and often these were supported through a variety of contracts to different third-party vendors. This is common in public-sector IT: limited IT support and piecemeal IT infrastructures [4]. During the trial we dedicated 20 hours per week of technical support for the participants and we were always over-tasked. It could be that production deployment may be easier to support if the systems are extremely reliable and devices/applications are designed for specific use by first responders. However, increased local IT support is crucial.

Implications and Issues

Wireless communication devices may have a role in facilitating communications between criminal justice personnel, but in this case they do not reduce the number of people involved in the process of completing any task, change the roles that any person currently plays, or reduce the number of steps in any process. The real implication for wireless computing is using the current people and processes—but allowing information to flow more quickly from repositories to people, and from person to person, at very important critical moments.

Successful systems in support of first responders will be driven by their users [3]. Our trial experience indicates laptop computers are too big and too tethered to the officer's car while PDAs are too small and have a limited amount of battery life. We learned that these officers must have adequate power and screen size to use the graphic data they require and cannot always be tethered to their cars to acquire this data. Thus, future trials should test pen-based tablets that are ruggedized to meet first responders' work conditions. In addition, all future devices should be designed to load photos and maps quickly since they are in the highest demand.

In order for wireless access to find a place on the officers' tool belts, it needs to be reliable, as it could be necessary to save their lives or the lives of those they protect. The data these officers require is time- and task-specific—just as always-on Internet connections are replacing dialup modem connectivity, first responders need an always-on network. In addition, they must know this access will be there whether they need it once a week or once a year. To achieve this, IT security measures must be made more streamlined, seamless, and immediate to provide officers with the information they require on demand.

Beyond the technical constraints and opportunities identified by our trial, we have four findings reflecting the role of this trial in strategic experimentation involving mobility. First, applications like JNET will be key elements in any information system to support first responders. Second, the use of public 3G networks to support U.S. homeland security is possible only if coverage and reliability goals are met. Third, such systems will require a federated view of the entire enterprise, demanding a focus on interoperability. There are too many critical and unique information systems supporting so many disparate organizations to imagine one large system. Instead, our experience suggests that portal and broker models such as JNET are the proper architecture to support first responders. Finally, we have learned that future trials should rely more on current dispatch and local control models with a focus on coordination. These are some of the issues to be tested in the next strategic experiment. C

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