I-911: Deploying Advanced Internet Based Emergency Services

Executive Summary

The Internet has led to a dramatic revolution in communications, converting other transport systems by the ubiquitous availability of Internet access. Corporations are rapidly adopting mobile technologies as a key productivity tool. Telephone service using the Internet, both mobile and fixed, is experiencing exponential growth. Residential internet phones, (commonly referred to as Voice over IP or VoIP) are expected to top 5 million in number in 2006. Growing popularity of wireless and integrated devices presents new, additional challenges. A key issue is maintaining critical system features, especially those related to safety. Cell phone deployment happened without sufficient consideration of emergency services. Given the projections of small office/ home office conversion to Internet communications and the growing dependence of a mobile workforce on Internet-based communications, research examining effective and efficient support for 911 will facilitate productivity and safety.

We propose to define and prototype technologies addressing the time-critical issue of location identification for Internet-based phones and other communication devices. Specifically we will develop cost-effective solutions for Internet-based emergency phone calls, I-911, consistent with today's 911 response standards. We will explore ways in which the expanded capabilities of Internet-based communications, in particular video, may be incorporated into emergency transmissions.

Our team combines extensive, practical experience in telecommunications, standards development and leading edge networking. Strengths of the team include participation from the following entities: Henning Schulzrinne, of Columbia University, the author of the draft standards for internet-based communications, and one of the Co-Principle Investigators; the recently created Internet2 Technology Evaluation Center at Texas A&M University; Internet2; and representatives of the National Emergency Numbering Association (NENA). Additionally, resources from the offices of Emergency Communications for the States of Texas and Virginia, industry leaders Cisco and Nortel, and a direct fiber optic cable to two PSAPs in Texas will be dedicated to the project. Our team will not only solve the challenge of identification location of callers from an internet platform but will supply a sound architecture for a technology that is both: (1) one of the fastest growing in our society and (2) one in which our population is increasingly dependent.

This project will help to realize the benefits to higher education by the enhancements to education, research and outreach that Voice over IP offers. This revolutionary means of communicating will add new collaboration applications, expand reach and reduce overall costs. While the advantages of converged network services (voice, data and video) all on one common infrastructure remain unquestioned, the reality is that less than 10% of the communications lines have made the transition at this point. The lack of reliable emergency call information is slowing down the transition and this project attempts to make significant progress in the resolution of the problem by enabling the processing emergency calls coming from an IP based network in a manner that allows flexibility and mobility.

Project Purpose

The purpose of this project is to demonstrate the capabilities of an Internet based emergency call architecture that, unlike all existing emergency call architectures, is standards based, works even in a very mobile environment and allows multimedia applications to be integrated into the emergency call process, allowing the conveyance of critical information to the ECC. The project would use telephones modified by Columbia University to access a location server. When this telephone wishes to make an emergency call it would initiate a call using a special "SOS" user resource identifier (URI) to an emergency call proxy. This proxy would then use a database lookup to complete the call to the appropriate ECC. Once the call is connected to the emergency operator, video images will be relayed to the ECC.

The protocols required to accomplish this demonstration already exist. The location identification, information, derived from both hardwire connected and wireless connected devices and routing of the call to the appropriate call center are projects currently under way at Columbia University. The SOS call handling document in the Attachment describes the steps involved.

This project would install an IP based Internet-911 (I-911) workstation at the Brazos County, and City of College Station PSAPs in Texas as well as a PSAP in Virginia. The Texas PSAPs were selected for their close proximity to Texas A&M University. Both PSAPs are currently directly connected to Texas A&M University with dark fiber that is provisioned at 155 million bits per second (OC-3). A separate 10 million bit per second link will be partitioned out of the OC-3 link ensuring that the production and research traffic are not in any way connected. The PSAP in Virginia will also receive a separate 10 Mbps link to be used for call rerouting. The Internet based 911 solution or I-911 workstations will be separate from any of the production equipment in the E-911 Call Center. This maintenance of separate facilities for the project will ensure that there is no detrimental impact on critical emergency services.

One area that this project will not be able to address directly but will be able to begin to define is in the area of routing the call to the appropriate call center. While location identification is fairly easy for DSL and cable modem broadband users, it becomes more complicated for Local Area Network (LAN) location id, for both wireless and hard-wired devices. This complication is further exasperated when the end user is a mobile user connected over a Virtual Private Network

(VPN). This project will develop, define, and demonstrate the call routing for LAN cases and will identify solutions for the most complex of users (VPNs).

The desired result of this project is for industry to embrace and work towards emergency call services standards that are non-proprietary and based upon intelligence in the User Agent (UA) rather than the network. This will increase capabilities, reduce cost and support mobility in a manner for which existing centralized systems are incapable.

Innovation – The innovation of this project can be found throughout the entire project. While most of the components of this project are either available as a product or have been developed as a part of a stand-alone research project, no one has yet put all of the components together to form an integrated system. For example the GEOPRIV research community has already accomplished significant work in the location space, Columbia University has already begun work on the DHCP location information as well as the modification to the SIP proxies to support I-911 or SOS call routing. Much of the Multi-media work has already been accomplished and would be integrated by Texas A&M University.

The process developed in the project will ultimately lead towards a model that will formulate an open systems approach to emergency call processing. This architecture will be a future requirement if the industry is ever to migrate from a centralized switched architecture to a distributed packet based peer-to-peer architecture.

Community Involvement

This project involves partnerships from higher education, State Government, local government and industry. The partners, along with some of the principle participants and their contribution to the project are listed below:

Partnerships

Columbia University will, through their Internet Real-Time (IRT) labs will complete the development of the User Agent modifications (for both the call center and the end user) and the location proxy. They will also draft any additional Request for Comment (RFC) documents that may evolve out of this project. The primary contact for Columbia is Dr. Henning Schulzrinne, Chairman of the Computer Science Department. Dr. Schulzrinne has drafted several of the existing Voice over IP standards, including the VoIP Emergency Services draft standard, and is well know in the Voice over IP world as one of the leading experts in the industry.

Texas A&M University will be under the direction of the TAMU Internet2 Technology Evaluation Center (ITEC) and coordinate the installation of the PSAP I-911 workstations in Texas; develop the multimedia interface for the PSAP I-911 and the end user's workstation; support the project evaluation portion of the project; and facilitate the workshops and project demonstrations at NENA, FCC

and Internet2 meetings. The primary contacts for Texas A&M University will be Dr. Walt Magnussen, ITEC Director, Co-Chair Internet2 VoIP Working Group and Director for Telecommunications; Dr. Wei Zhao, Associate Vice President for Research and President Elect for the IETF, Real-Time Working Group; Mr. Willis Marti, Director Network Testing Lab and Associate Director for Networking Services; Ms. Patti Urbina, Assistant Director for the Academy for Advanced Telecommunications and Learning Technologies; and, Dr. Lloyd Korhonen, Director for the Center for Distance Learning Research (CDLR). The CDLR has significant experience in the evaluation process and will provide independent, outside evaluation of the project.

The University of Virginia will facilitate the workstation installation at the Virginia PSAP, support the network links between the University and the PSAP and coordinate the testing of the remote PSAP routing capabilities. The Virginia PSAP that is a part of the project is connected to the University. The primary contact will be James Jokl.

The State of Texas Commission on State Emergency Communications (CSEC) – The Texas CSEC will coordinate the requirements portion of the I-911 PSAP workstation, help to develop the evaluation criteria, assist in the workshop agendas and provide funding in support of the project. The primary contact for the Texas CSEC is Paul Mallett, Executive Director.

The State of Virginia Division of Public Safety Communications of the Virgina Information Technologies Agency (VITA). VITA will work with the Texas CSEC to coordinate the requirements portion of the I-911 PSAP workstation, help to develop the evaluation criteria, assist in the workshop agendas and provide funding in support of the project. The primary contact for the Virginia CSEC is Steve Marzolf, Public Safety Communications Coordinator.

University Corporation for Advanced Internet Development (UCAID) – UCAID is the organization that has oversight of the Internet2 project and the Abilene network. UCAID is owned by over 200 United States Universities and its mission is to support the development of advanced Internet applications and services. The primary contact for UCAID will be Mr. Ben Teitelbaum, Program Mgr. Voice & Integrated Communications Initiative. UCAID will be responsible for coordinating the efforts of this project with other Internet2 projects and disseminating information to other Internet2 members. Since the project is facilitated by the TAMU ITEC, UCAID will also coordinate this project with the other three ITECs (see information in Appendix)

Brazos County Texas E911 District – The Brazos County E911 district is the Primary Service Answering Point (PSAP) for Texas A&M University. The primary contact will be Mr. Greg Petry, Director of the District. The District will

provide access to emergency services personnel, input into the requirements phase of the PSAP I-911 workstation and feedback necessary for the evaluation portion of the project.

City of College Station Texas– The City of College is the secondary Primary Service Answering Point (PSAP) for Texas A&M University. The primary contact will be Ms Olivia Burnside, Director of Information Technology for the City. The City will provide access to emergency services personnel, input into the requirements phase of the PSAP I-911 workstation and feedback necessary for the evaluation portion of the project.

National Emergency Number Association (NENA) – NENA is the organization that has primary responsibility for the coordination of emergency communications at the national level. The primary contact for NENA will be Mr. Rick Jones, Operations Issues Director. NENA will be responsible for coordinating user requirements in the development of the project and coordination information dissemination to the user community through white papers developed by the project and workshops and seminars provided by the three Universities involved.

Cisco Inc. – Cisco will, as a corporate partner Provide Cisco hardware and software needed to accomplish the development and testing of the I-911 PSAP workstation. Cisco will also provide access to one of their E-911 gateway solutions to be used in the evaluation phase of the project. Finally Cisco will provide access to source code to Cisco equipment and applications along with engineering and development time to assist Columbia University in adding the location information to a Cisco DHCP server. They will also provide access to their primary Emergency services architecture engineer that currently serves on the NENA VoIP committee. The primary contact for Cisco will be Doug Foster.

Nortel Inc. will, as a corporate partner provide a SIP based switching platform that can be utilized on the call routing process as well as one of the wireless systems with the ability to provide location information about the Access Point being utilized for the connection. Nortel will also provide access to one of their E-911 gateway solutions to be used in the evaluation phase of the project. Finally Nortel will provide access to source code to Nortel equipment and applications along with engineering and development time to assist Columbia University in adding the location information to a DHCP server. They will also provide access to their primary Emergency services architecture engineer that currently serves on the NENA VoIP committee. The primary contact for Nortel is Scott Possell,

Support for End Users – There are three types of end users in this project. The end user that places the I-911 emergency call, the Emergency Call Center operator and the technical staff that currently support the E-911 PSAPs.

For the end user that places the call the interface needs to be totally transparent and intuitive. It was a lengthy and costly proposition to educate end users to simply call 911 to make an emergency call years ago. This process should be as simple to use. The PSAP directors, the VITA and CSEC staff and the NENA staff will assist in the definition of the ideal end user interface.

The call center operators are typically well trained and their interface can trade off simplicity for functionality. The PSAP directors, the CSEC staff and the NENA staff will assist in the definition of the ideal end user interface along with a definition of enhance multimedia capabilities.

While the industry as a whole is making a transition from circuit switched technology to packet based technology, the staff that technically support the PSAPs must be retrained as well. The two technologies require a completely different skill set as any institution that has undergone voice and data convergence can attest. Center for Distance Learning Research at TAMU will complete a knowledge based skills assessment that will define the required skills along with a proposed training plan or curricula that will provide these skills. This project is not intended to provide the actual training for the technical staff, just to define what is required.

Stakeholder Involvement – The stakeholder involvement will be ensured through a series of several meetings, one all day to be held in the Washington DC area and the rest facilitated by video conference systems. The initial one day meeting will include representatives from the three Universities, the two CSECs, NENA and both Corporate Partners. These meetings will create a detailed functional specification for the PSAP I-911 workstations. The follow-up meetings will refine the specifications as the project matures and will provide input into the evaluation team.

Sustained Commitment – This project is designed to be a demonstration of an architecture that will, solidify support for a proposed architecture and lead to the development of additional capabilities and maturity of the existing components. In this sense the project would not be required to be sustained upon completion of the project. It is important that information gathered, lessons learned and training material developed in the process of supporting the workshops be properly protected, indexed and archived so that it can be utilized in future developments.

Evaluation – – Program evaluations are partnerships that unite project managers, partners, members of the project taskforce, and other stakeholders in the pursuit of achieving higher levels of performance. The evaluation plan is a framework of activities that provide reliable information to inform program decisions that orient the organization along a path leading to particular goals and objectives. The evaluation plan created for this project will be designed with a unique set of activities calculated to highlight successes as well as areas for project improvement. The primary goal of this project is to develop a replicable prototype for 911 emergency service linkages between VOIP phone systems and the pubic switch system. A secondary goal is developing a model for the technical and organizational issues faced by this

gap in technologies. Formative and summative evaluation techniques will be used throughout the project.

In order to collect the data needed, the CDLR will create a personalized evaluation e-portal for the Internet-based communications emergency services project to give project managers secure access to evaluation processes that include information dissemination, data collection, threaded-discussions, knowledge base management, site content management and real-time status reports. This portal will enable all project managers to identify critical events and generate real-time reports to be used in the formative decision making process. Evaluation information / findings indicate the extent of goal attainment, suggest in-progress program improvements, and inform decisions regarding future activities. Evaluation reports address performance objectives and accomplishments to demonstrate emergent as well as overall progress toward program goals. Reports include support documentation and recommendations for future activities as well as in-progress feedback to inform immediate / ongoing program decisions.

The information logs from this portal will be analyzed to summarize the process and findings of the workgroup. Final reports will include such information as success and failure rates, overall strategies and design suggestions and compiling the documentation for a standard process of replicating emergency services to users of Internet based communications.

Project Feasibility – This project is made feasible in that it 1.) utilizes existing components of the architecture in the creation of the demonstration project and it 2.) assembles a powerful team made up of the developers of the standards that define the architecture, University leaders in VoIP, state and local leadership with years of experience in the delivery of emergency services and the support of two of the largest telecommunications vendors that have existing support for the existing architecture but are willing to expend valuable resources to assist in a demonstration project that shows the value of the new architecture.