

Communicating Effectively When Disaster Strikes

A New Nationwide Commercial Wireless IP Network can be a Resilient, Durable and Dynamic Component of the Overall Solution!



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Building the Foundation for the Future of Emergency Communication

When disaster strikes, traditional emergency communications systems that focus solely on first responders and localized emergencies are of limited use because they are often overwhelmed by the magnitude of the events. Crisis communication begins long before the immediate emergency and continues long after the immediate crisis has passed. Emergency communications systems must not only incorporate the demands of first responders to the scale required by the circumstances, but also those of the general public facing the same situation as well. In doing so, the power of the general public's input can be channeled and utilized in a constructive manner instead of lingering in the pervasive fear and darkness that is commonplace during times of distress. These are the foremost lessons of Katrina, 9/11, the annual fires of the southwest, the catastrophic earthquakes in the west and the tsunami that swept across the Indian Ocean.

Thus, the public safety emergency response system we need TODAY is not a single monolithic system. It must be a diverse set of systems that delivers *INFORMATION to public safety personnel and the public*—when they need it and in a form they can use. The key attributes for providing a strong foundation for future emergency communications include:

- ❖ A focus on achieving INFORMATION INTEROPERABILITY across all subsystems, something that can be achieved today by mandating the use of IP-based applications across all subsystems and components.
- ❖ Extensive INTEGRATION of wireless systems across all user groups, including first responders and the general public because of the need for mobility and ease of access;
- ❖ Highly SURVIVABLE AND RESILIENT systems with low likelihood of failure across individual subsystems;
- ❖ The ability to DYNAMICALLY SHIFT NETWORK CAPACITY between user groups, network elements, geographies, and time (e.g., during the emergency and during recovery phase) based on demand and circumstances;
- ❖ The use of standardized, nonproprietary technologies and protocols such as WiMax and TCP/IP in order to generate LOW-COST, HIGHLY AVAILABLE NETWORK ELEMENTS (i.e. base stations) and end user equipment in order to create highly durable, replaceable communications infrastructure.

Delivering on these key elements is crucial for the future support of our dedicated emergency personnel as they strive to leverage available communications networks to provide critical services to the public.





About M2Z Networks

M2Z is a Silicon Valley company founded in 2005 by Milo Medin and John Muleta. Medin and Muleta are two successful Internet entrepreneurs who are committed to bring the benefits of the broadband age to the American people through the use of advanced wireless technologies and systems. In addition to their entrepreneurial activities, Medin and Muleta have distinguished themselves through dedicated service to the American people in previous federal government career positions.

Earlier in his career, Medin served as an engineer at NASA and helped construct NASA's data network. He left NASA in 1996 to become founder and Chief Technical Officer of @HOME, the first commercial broadband network in the United States that operated on cable network infrastructure. Muleta has served twice at the Federal Communications Commission. From 2003 to 2005, Muleta served as head of the FCC's Wireless Bureau. In the mid-1990's, Muleta also served at the FCC including becoming Deputy Bureau Chief in the Agency's Common Carrier Bureau during the implementation of the 1996 Telecommunications Act. Muleta's career includes serving as a senior officer of PSINet, Inc., a leading commercial Internet Services Provider. Muleta headed PSINet's infrastructure provisioning organization that operated in 28 countries. Muleta was also head PSINet's India, Middle East and Africa unit and of PSINet Ventures, the company's \$160 million corporate venture unit.

M2Z's current financial backers are three leading Silicon Valley venture firms: Kleiner, Perkins, Caufield and Byers, Charles River Ventures, and Redpoint Ventures. These three firms have played seminal roles in the transformation of the American economy and are determined to bring the ingenuity of the American entrepreneur to solve the vexing problems facing the American communications industry: universal access to broadband and increasing competition in the broadband market.

The goal of M2Z is to transform the current state of the broadband marketplace by providing a high speed wireless network throughout the United States that radically improves the economics of Internet access for consumers and public safety entities.

I. Challenges to Meaningful Emergency Communications

Effective communication at times of emergency is critical. Unfortunately, recent man-made and natural disasters have demonstrated the urgent need for improved communications when a tragedy occurs. **Currently, the United States does not have an interoperable broadband public safety network capable of providing relevant and timely information to first responders and the public during times of emergency.** As a result, there is usually poor coordination of relief efforts and available resources are often stretched beyond their limits at times of greatest need. Such flawed coordination is further exacerbated by the fervent and repeated attempts of survivors to communicate with family members and other individuals outside the disaster zone — leading to a complete breakdown of the affected area’s communications infrastructure.

As witnessed during Hurricane Katrina, the majority of communication lines can fail due to overwhelming conditions. The ability to build a more survivable infrastructure for communication that is both reliable and resilient is a major first step towards improving emergency communications to better address current and future needs.

In a disaster, time is of the essence. Having a communication system that can be easily reconstructed or repaired will allow first responders to address their overall needs for coordination efforts, disaster recovery and general information transmission. Survivors and concerned family members would likewise have access to the same network of communication.

“Hurricane Katrina knocked out more than 3 million customer phone lines in the Louisiana, Mississippi, and Alabama area. The wireline telecommunications network sustained enormous damage both to the switching centers that route calls and to the lines used to connect buildings and customers to the network. Local wireless networks also sustained considerable

damage – more than a thousand cell sites were knocked out of service by the hurricane. During this disaster, millions of telephone calls simply have not been able to get through. Of the 41 broadcast radio stations located in New Orleans and the surrounding area, only two AM and two FM stations remained on the air in the wake of the hurricane.”

Taken from the written statement of:
Kenneth P. Moran
Director, Office of Homeland Security
Enforcement Bureau Federal Communications Commission
Hearing on Hurricane Katrina and Communications Interoperability
Before the Committee on Commerce, Science and Transportation, United States Senate, September 29, 2005

Timely communications during a disaster can literally mean the difference between life and death. Nearly every aspect of an emergency response is strengthened when communications systems are readily available and useable. These activities include initial assessments, operational coordination, resource deployment and search and rescue efforts. Rapid turn up and deployment of a viable communication system would address immediate needs for information and decrease the negative compounding effects from miscommunication in the affected areas.

What stands in the way of the delivery of such information? We outline several challenges below. These include the ability to ensure that a communications network promotes durable information exchange, scalability for when there is a surge in usage, expands information exchange both within and outside the disaster area, and all the while achieving these goals without draining the public treasury.

Survivable and Resilient Systems

Under catastrophic circumstances, communication systems can be rendered useless with little or no warning. The need for a system that is genuinely more survivable and can be easily restored is a seemingly insurmountable challenge. However, meeting this challenge is paramount.

The new public safety paradigm should migrate away from a single homogenous system to a more heterogeneous “system of systems.” Supplementing today’s primarily voice centric public safety networks with secondary commercial networks focused on “information delivery” increases the heterogeneity of the public safety response network and leads to a more diverse and survivable communication system.

Regardless of the systems and networks deployed, a useful public safety response network must assure its users **“Information Interoperability.”** Policymakers have traditionally focused on network interoperability. Unfortunately, network interoperability, including spectrum addition does not guarantee information interoperability. In the past, the dominance of voice centric applications for public safety has masked the need for information interoperability. That is no longer the case.

The complexity of today’s society and the multi-jurisdictional nature of new emergencies and threats require a more coherent and organized response from first responders and others which can only be achieved by use of integrated information databases and applications. Therefore, in order for public safety communications to successfully evolve, there must be a mandate that newer systems use of Internet Protocol (IP)-based systems and applications that promote universal information interoperability.

Large Dynamic Capacity

When a catastrophe strikes, the communication link at that particular location is quickly pushed to its limits by the substantial increase in usage. The usage is ramped up quickly as first responders and survivors attempt to communicate with others. A multi-jurisdictional response from local, state and federal personnel as well as other interested persons adds to the volume of usage and most existing networks are quickly rendered ineffective. Capacity limits are even further taxed when disasters happen in highly populated areas.

Not only must an effective communications system meet the increase in usage, it must be able to dynamically assign “network capacity” to areas that require it the most. A bona fide disaster is hardly a static environment and should not be managed with an inflexible network that indiscriminately assigns capacity regardless of actual needs.

Communication Outside the Disaster Zone

Although most activity is staged within the disaster zone, another key challenge is communication with personnel and the public outside the stricken location. To get a troublesome situation under control, it is necessary to maintain organization-wide communications so, for instance, additional personnel, equipment and resources may be mobilized. This can only be accomplished with real-time information regarding the situation on the ground. During recent disasters, the ability to communicate rapidly changing conditions with others outside the actual crisis location was a major challenge for emergency personnel.

Practical and Economic Challenges

The United States has extremely dedicated and professional emergency responders but does not have unlimited resources at their disposal. The need to supplement their spirit must be met with practical and affordable solutions.

Based on current practice and system capabilities, crafting an “information” network that addresses the challenges outlined above would in most cases be cost prohibitive. The emergency system must be survivable and scalable as well as interoperable and ubiquitous. The creation of a system that can be accessed anywhere in the country when a disaster strikes requires new ways of using technology to harness needed resources to solve a crisis.

II. Innovative Solutions

Pre-existing communication infrastructure will undoubtedly be strained during a crisis. It is uneconomical and impractical to expect that such systems can be built with sufficient capacity and durability to handle each “100 year event” that randomly strikes each year. Nevertheless, at every incident site, first responders need reliable access to valuable information. Uninterrupted information flow during an emergency is achieved through additional capacity and infrastructure.

Utilizing current technology such as IP-based systems and streamlining infrastructure can provide an effective cost-efficient solution to augment existing public safety infrastructure. The Department of Homeland Security has already made this notion of a system of systems a priority as demonstrated in one of the key long-term goals of the Department’s SAFECOM program:

- ***Achieve a systems-of-systems environment supported by communications standards, tools, and best practices***

Source: *Statement of Requirements for Public Safety Wireless Communications & Interoperability*, The SAFECOM Program Department of Homeland Security p. 3

Below we discuss solutions that parallel the challenges listed outlined in the prior section of this paper.

Durable Infrastructure

A system that is both reliable and resilient should be flexible enough to meet unforeseen circumstances. A crucial component of this flexibility is the use of advanced wireless technology into public safety operations.

Wireless communication should be the cornerstone for increasing the survivability of any system. Wireless communication is effective during disasters because it can bypass damaged areas and provides the widest coverage with the least amount of “reconstruction.” The additional benefits that

come along with broadband wireless systems include:

- Greater mobility for the user;
- Greater ability to assign capacity to users based on demand and circumstances; and
- Greater collaboration among emergency personnel within and outside the disaster zone.

WiMax is a new wireless standard that incorporates IP-based communications as the primary information transport layer. WiMax was designed to provide for global scale and mass consumer adoption across a number of spectrum bands. Additionally, WiMax incorporates key elements such as built-in security protocols and Quality-of-Service (QoS) features allowing for multi-user types to interface to the same radio frequency (RF) network. Finally, the global design and scale of WiMax enables the deployment of cost reduced CPE into the network among all types of users including public safety and the general public

Using a global wireless standard such as WiMax as the primary RF transport layer will provide for a highly resilient, durable and flexible network.

Speedy Recovery

Public safety groups can increase communication capacity by promptly deploying standardized equipment on commercial networks. A public safety system must be instituted that interoperates with other commercial infrastructure and can be used by all levels of personnel.

IP-based systems and applications can deliver of this type of rapid deployment and capacity expansion. This universal approach can easily provide the necessary elements of communication throughout all levels of the disaster site. IP-based systems provide the necessary link for creating a communications network that has effective and reliable operability and delivers information across a wide variety of existing devices and technologies.

Significant Throughput

During a full-scale response to a stricken area, the demand on communication lines is quickly increased, in many cases far beyond the design capacity.

Due to cost considerations a primary system generally cannot be designed to accommodate such a surge in usage. Thus, a commonsense solution would be to provide first responders access to a secondary network that can be preempted as a way of increasing system capacity seamlessly and without interrupting information delivery to the first responders.

Beyond verbal communication, the ability to communicate through other methods is also important. Real-time multicast video of the area, as well as the posting of maps, blueprints and other layouts, can be vital in any disaster relief effort. The ability of responders to send pictures and other useful video can help others within and outside the incident area to understand the actual situation on the ground. This will also allow all levels of the rescue effort to better coordinate and deploy personnel to areas that need help the most.

The need to deliver this type of network was underscored in the December 2005 Federal Communication Commission Report to Congress:

“Emergency response providers would benefit from the development of an integrated, interoperable nationwide network capable of delivering broadband services throughout the country. A network that delivers real-time, high speed, highly secure broadband data to emergency response providers in the field would improve their ability to respond to emergencies. The benefits associated with a nationwide interoperable broadband mobile communications network include:

- *Delivery of rapid warnings and messages pertaining to criminal activity, including AMBER Alerts;*
- *Video surveillance during emergency incidents;*

- *Real-time text messaging and e-mail;*
- *Delivery of high resolution digital images; and*
- *The ability to obtain location and status information of personnel and equipment in the field.”*

Source: Report To Congress On The Study To Assess Short-Term And Long-Term Needs For Allocations Of Additional Portions Of The Electromagnetic Spectrum For Federal, State and Local Emergency Response Providers

Sharing Information Outside of the Incident Site

A forward-looking system must distribute valuable data to all responders inside and outside the incident site. Again, through the use of existing IP-based communications, a system can easily adapt to any user's device inside and outside the impacted area. This allows for easy transfer of information to help coordinate relief efforts in a timely manner. It also allows for the securing of additional resources needed for the immediate future as the incident unfolds.

In addition, during the post-disaster phase, an IP-based system would enable displaced persons to communicate with public safety personnel, relief agencies and loved ones.

Cost-Effective Solution

The harsh reality is that an effective public safety network does not exist independent of funding and cost considerations. Building a whole new system that is more survivable yet permits ease of recovery — while still providing the same effectiveness and scalability for the surge in usage — will prove to be extremely cost effective in the long run.

The responsibility to provide effective emergency communication systems is increasingly being placed on local governments and agencies. These localities often find that providing such an extensive interoperable system is cost prohibitive. Governments have the unenviable task of attempting to build an effective public safety network to respond to increasingly complex and multi-jurisdictional threats occurring

randomly, while operating on a limited budget.

Resolving the current challenges to public safety need not involve such a difficult balancing act. Rather, the goals of safety-focused organizations can be achieved by augmenting the existing public safety network with commercial networks that are durable, effective, and resilient and capable of information interoperability. This is a more practical approach for achieving the goals of public safety. This alternative is better than building a whole new network just for public safety or keeping the same patchwork approach to building public safety networks. In December of 2005, the FCC itself identified the use of commercial networks for delivering communications services to the public and to the safety community an effective and affordable solution to the daunting problem of establishing a robust and interoperable public safety network.

What remains to be determined is who can meet this “public interest” challenge: existing commercial networks or newer networks that incorporate the latest technologies?



III. How the M2Z Initiative Helps Answer the Emergency Communication Challenge

The solution to communications concerns in times of emergency must be multi-pronged. M2Z believes that its network will provide many of elements necessary to make it a valuable adjunct to the current and future systems implemented by public safety entities throughout the United States.

The opportunity the M2Z network offers was introduced to the Commission on May 5, 2006, when M2Z submitted a license application to construct and operate a nationwide broadband wireless network in the 2155-2175 MHz spectrum band. As outlined in the Application, the benefits of a free commercial network are many and varied. Notably, consistent with the notion that spectrum is a resource of the American people, M2Z would permit any and all Americans to access its network in order to receive and send broadband data free of any recurring charges. To this end, public safety entities will enjoy a free secondary data network without limit to the number of devices on the network.

As the communications needs of public safety entities continue to evolve, these organizations will naturally diverge on the precise dimensions of their needs both in terms of scale and costs. The parameters are difficult to achieve because a low cost system requires economies of scale which cannot be achieved in isolation. In contrast, M2Z's system will have commercial scale and will permit public safety entities to gain access to critical data using off-the-shelf CPE without compromising security and interoperability. M2Z plans to provide public safety groups broadband IP access link free of charge at data rates of 384 kbps downstream and 128 kbps upstream. The single nationwide broadband network proposed by M2Z assures always-on interoperability across most of the United States. M2Z's network will also provide greater capacity and higher speeds than the systems that most public safety organizations are likely to be able to afford to construct themselves, and use of the M2Z's network does not require federal, state or local government users to pay any recurring charges.

Because M2Z's network will be a greenfield build, it will specifically incorporate many of the elements discussed herein that will serve the needs of public safety. M2Z has proposed a network that provides public safety a secondary network option that promotes information interoperability both inside and outside of the affected areas. M2Z's system is extendable and can work with other service providers to provide value-added services to public safety groups. For example, M2Z will partner with PacketHop, Inc. to expand the types of information that can be delivered to first responders. See www.packethop.com. PacketHop's technology will enable users, among other things, to obtain real-time multicast video, to perform resource tracking functions, and use multimedia instant messaging. Further, PacketHop will provide autonomous mesh networking that will extend the reach, utility and functions of the gateway device and will allow communication between devices even if network infrastructure is unavailable or compromised. The features and benefits of the PacketHop technology are explained more fully in Appendix 4 of M2Z's Application.

IV. Conclusion

Over the last several years, major events have illustrated the need to improve communication networks in order to assist public safety responders during relief and recovery efforts. From the events of September 11th, 2001 to the disaster of Hurricane Katrina, this need has been highlighted over and over. ***There continues to be a pressing need to provide local, state and national agencies as well as the public with reliable, resilient and durable means of communications and information sharing in times of crisis.***

When a disaster strikes, first responders initiate a wide variety of information and communications tasks. Emergency personnel need to first assess the damage and then react to the situation as it unfolds while bringing relief and aid to those that need it the most. Providing first responders with durable means of communications and information exchange are imperative to the first responders' ability to deliver an effective and efficient response to disasters. To date efforts to build robust communication networks during times of crisis has fallen short. The solutions that have been tried have been narrow with a focus on solving network interoperability instead of information interoperability. Other solutions throw more capacity in the form of additional spectrum although the capacity is so narrowly circumscribed to public safety that it does not achieve the scale of economies needed for meeting the new threat matrices faced by public safety groups. It has become clear that a homogenous approach towards meeting public safety's needs have failed and will continue to fail. In light of the need to make a change, M2Z espouses a new public safety network model comprised of heterogeneous systems that work together to meet the diverse needs of public safety in times of crisis.

In an emergency, it is understood that "all hands are on deck." Personnel from far and wide are needed to help bring about an effective and timely response. In like manner, multiple networks must be available at difficult times to supplement and reinforce each other.



Want to Know More?

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