Case Study

Test of Metis Secure's emergency notification platform
at Mellon Institute on the campus of Carnegie Mellon University

Carnegie Mellon

METIS SECURE SOLUTIONS

Background

In January of 2006, the Metis Secure team met with Madelyn Miller, Director of Environmental Health and Safety (EH&S) at Carnegie Mellon University to demonstrate a new emergency warning platform that was in the initial prototype stage at that time. In that meeting, Miller first described the difficulty of delivering emergency warnings and information on campus.

> *"We began to talk to the Metis Secure team in 2006. I was concerned, at that time, about our ability to drill down to the student level. For example, I wanted to be able to tell a teacher in a classroom not to let students out if some emergency situation outside warrants a shelter-in-place directive. In some cases we don't have much time to notify. Therefore, I was interested in the message speed and targeting capabilities that the Metis team was claiming to achieve. We also have areas where cell phone reception isn't good, in Mellon Institute, for example. I needed to fill some holes where existing technologies did not provide solutions. Metis appeared to be a unique solution that we could use in any building on campus, but would also be particularly effective in our most challenging environments."*
>
> *– Madelyn Miller, Director, Environmental Health and Safety, Carnegie Mellon University*

Miller's concerns included the difficulty of quickly notifying the campus population to evacuate or to shelter in place during times of emergency. For example, due to the proximity of rail lines to campus, a derailment of hazardous materials in Panther Hollow would require immediate notification of the campus population. Mock drills had identified the difficulty in both alerting and providing information to students and staff for short notice emergencies.

At the time, the university employed a range of technologies currently available to alert and inform the campus population. While partially effective, many of these solutions had limitations.

Technology	**Limitations**
Alert Now cell calling	• Takes 30+ minutes to deliver messages. • Voluntary opt in yields only about 40% enrollment in warning program. • Poor reception limits success in some locations.
Email	• Only works when someone voluntarily reads email. • Not a "wake up and warn" technology.
Fire alarm	• Loud buzzer, little or no information. • Often thought to be a false alarm or drill and ignored by occupants • Cannot tell people to shelter in place
Blue Lights	• Outdoor locations only. • Not capable of mass notification.

None of the existing solutions employed by the university provided the ability to deliver warning information to specific buildings or rooms in a time-effective manner. According to Miller, when a water main break occurred several months earlier, security resorted to posting handwritten notices on doors in affected locations to communicate updates and information.

In exploring various communications solutions, CMU identified one building, Mellon Institute, as the single most difficult environment for communications. Also, as a research building, Mellon Institute has a higher potential for hazardous chemical events than other buildings on campus. The combination of a high risk and low communications effectiveness made Mellon Institute an ideal site for testing a new emergency warning platform.

High Priority Facility

Mellon Institute's location in the heart of the Oakland neighborhood connects it to the expansive network of scientific activity in Pittsburgh's biomedical, technological and industrial research community. Mellon Institute houses the Mellon College of Science's departments of biology and chemistry, supporting study and research in chemistry, biochemistry, biophysics and the biological sciences.

On a daily basis, research activity in the building includes:

- Scientists conduct experiments in over 150 laboratories.
- Irreplaceable research is being conducted that cannot be easily interrupted or terminated.

Not only does the scope of research activity present a continual safety concern, but the unique construction of the building itself poses a second critical issue in terms of emergency warning. Covering a city block, the building is densely constructed of stone and concrete. Sixty two monolithic limestone columns line the four sides of the building. The sidewalk, platform and steps are made of granite. Concrete between floors ranges from 18 to 30 inches thick. This kind of old world construction is a hostile environment that creates a serious challenge for today's communications technologies. There are extensive dead zones for cell phone reception on 4 underground floors creating problems for use of a cell phone based call/txt message system.

If it works here… it will work anywhere.

It was agreed that a successful proof-of-concept test, using the Metis Secure System at Mellon Institute, would serve as validation that the system could be successfully deployed in any building on any campus in any location.

Mellon Institute is a high priority research facility where communications dead zones pose a communications challenge to safety officials responsible for emergency warning.

Metis Secure Solution

Prior to discussions with CMU, the Metis Secure team had explored the use of sending emergency warning information to intelligent devices over a sub-carrier data path on commercial FM bandwidth. In May of 2005, Metis Secure technology was successfully demonstrated in an exercise conducted by the SOSSEC division of the U.S. Army Arsenal at Picatinny, NJ. At this point, the Metis Secure system was capable of sending specific warning messages to specific building location in less than 10 seconds.

Meeting the complex communications challenges faced at Carnegie Mellon University, however, required expansion of the platform. The team proposed adding a mesh network data path to allow the system to penetrate reception dead zones by passing warning messages from unit to unit within the building.

In order to install a test system in Mellon Institute that would solve the communications dilemma, the team modified the technology and began development of a new prototype. The new Metis Secure solution addressed key concerns such as message speed, targeting locations, penetrating reception dead zones, providing information and independence from phone, internet and power failure.

The new Metis Secure solution proposed to :

- Deliver data to all of the SMART devices in less than 10 seconds.
- Penetrate communications dead zones by passing information within a local wireless mesh network.
- Allow for selection of specific messages.
- Allow for selection of Metis Secure devices according to rooms, floors or other location-based criteria.
- Provide Call-for-help capability from any Metis Secure device
- Use 4 stimuli including – text – voice - lights - siren - to maximize effectiveness of message.
- Provide battery back-up in each unit to overcome power failures.
- Provide central monitoring of the system to identify points of failure, maintenance needs and system performance.

The development of the Metis Secure emergency notification platform continued with a focus on meeting the communications challenges on a university campus. Following a systematic and rigorous testing process, a set of 24 prototype units were installed at Mellon Institute in 2008.

Prototypes and Testing

Following successful hardware and software development, testing at Mellon institute began July 2008.

Timeline May – Dec 2008

* Preparation for the Metis Secure beta system begins with testing of FM and mesh signal strength in the building. Testing is done on the 2nd, 3rd, 4th and 5th floors. FM signal strength ranged from excellent to poor depending on the receiver location.

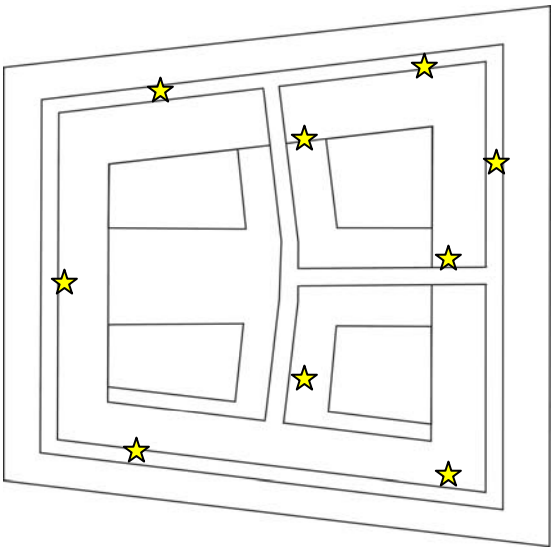
* A total of 12 units were installed on the 2nd 3rd and 4th floors. The mesh network is successfully configured on the initial attempt. Daily logging of mesh communications provides a reliable resource to analyze the performance of the system.

* Testing continues while new features and functionality were added to the system. Additional functionality includes:
    - received time of day from FM broadcast, distributed to all units via mesh network,
    - selecting and alerting individual units and unit groups
    - adding call for help button
    - receiving email from outside source and re-sending through the Metis Secure mesh
    - record and download new "live" messages into Metis Secure units

* Additional units were installed on the 2nd, 1st and basement floors. These units are critical to demonstrating the system's ability to penetrate reception dead zones.

* Continuous testing has revealed the ability of the mesh network to heal around failed units, to operate seamlessly within an active WiFi environment and to distribute data throughout the mesh network accurately.

* January 2009 – Live drill is successfully performed on 2nd and 3rd floors using prototype units.



Live Evacuation Drill

After logging hundreds of thousands of successful communications, the Metis Secure system was ready for testing in a real world environment. A live evacuation drill was conducted on Thursday, January 8th at Mellon Institute. This drill was the first exposure to the system for the building occupants. When the system was activated occupants of the 2nd and 3rd floors were notified that a drill was taking place and they were instructed to evacuate to a specific location. Metis Secure and CMU staff members were posted at various locations on the 2nd and 3rd floors to observe and ask questions of the evacuees as the drill proceeded.

Outcomes

- Drill message was delivered to selected Metis Secure units in 7 seconds.
- All units on 2nd and 3rd floors alerted with the correct message, lights, sirens and voice stimuli.
- A very high percentage of occupants participated in the drill. particularly when compared with traditional fire drills
- Many preferred the voice message to the fire alarm due to clarity of message and the directions provided by the Metis Secure system.
- Met all the requirements of the EH&S department

Conclusion:

The Metis Secure solution has successfully met the many challenges presented by Mellon Institute**.** Key concerns such as message speed, targeting locations and penetrating reception dead zones were successfully addressed.

In addition, the system offers a powerful array of optional features such as: Power over Ethernet, Call for Help capability, central system maintenance, dual data paths, custom messaging, integration with other ENS systems, ADA compliancy and multi-stimulus response behavior which are unrivaled in the market.

As a result, Carnegie Mellon has approved the purchase and installation of a working Metis Secure system at Mellon Institute in 2009.

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