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**THESIS**

**EXPLORING THE PLAUSIBILITY OF A NATIONAL  
MULTI-AGENCY COMMUNICATIONS SYSTEM FOR  
THE HOMELAND SECURITY COMMUNITY: A  
SOUTHEAST OHIO HALF-DUPLEX VOICE OVER IP  
CASE STUDY**

by

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March 2009

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COMMUNICATIONS SYSTEM FOR THE HOMELAND SECURITY  
COMMUNITY: A SOUTHEAST OHIO HALF-DUPLEX VOICE OVER IP CASE  
STUDY**

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## **ABSTRACT**

Since 9-11, it has become apparent that the Homeland Security Community is comprised of more than first responders, and is in essence, a Megacommunity, composed of three components: government, business and non-profits. However, this has not translated into our communications strategies, which presently focus on radios for first responders in an emergency. Many reasons exist for not addressing this gap, including the myths that it is impossible or would be too expensive. Computer gamers, however, have been utilizing low-tech versions of half-duplex VoIP since the 1990s to connect millions worldwide. A Southeast Ohio VoIP system, consisting of health departments, hospitals, emergency management agencies, and their partners, has been testing a similar system since 2003. This thesis offers a definition of the Homeland Security Community, and provides criteria that were then used to evaluate six communications systems for use as integrated national systems, and to judge the plausibility of the Ohio system as a model. This thesis also proposes the concept of a “Universal Communicator” software system that would address the shortcomings of the Ohio system, and provide an inexpensive solution that would ideally address the nation’s need for a national Homeland Security Community Real-Time Voice Communications system.

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## I. INTRODUCTION

To best protect the American people, homeland security must be a responsibility shared across our entire Nation. As we further develop a national culture of preparedness, our Local, Tribal, State, and Federal governments, faith-based and community organizations, and businesses must be partners in securing the Homeland.<sup>1</sup>

--- President George W. Bush

We are here to do the work that ensures no other family members have to lose a loved one to a terrorist who turns a plane into a missile, a terrorist who straps a bomb around her waist and climbs aboard a bus, a terrorist who figures out how to set off a dirty bomb in one of our cities. This is why we are here: to make our country safer and make sure the nearly 3,000 who were taken from us did not die in vain; that their legacy will be a more safe and secure Nation.<sup>2</sup>

--- President Barack Obama

### A. PROBLEM STATEMENT

The issue of communications continues to represent a key challenge to our Homeland Security efforts. Communications in this thesis refers to the ability of the Homeland Security Community to speak to each other in real time, before, after and during an incident. There is little debate that events of national significance such as September 11, 2001 and Hurricane Katrina exposed the significant gaps and shortcomings in our current interoperable communications abilities to the public. For example during Katrina, “the American Bus Association spent an entire day trying to find a point of contact at FEMA to coordinate bus deployment without success.”<sup>3</sup> If private agencies had been linked into a real time communications system, the bus association

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<sup>1</sup> Homeland Security Council, *National Strategy for Homeland Security* (Washington, DC: The White House, 2007), [http://www.whitehouse.gov/homeland/book/nat\\_strat\\_hls.pdf](http://www.whitehouse.gov/homeland/book/nat_strat_hls.pdf) (accessed October 2, 2008).

<sup>2</sup> The White House, (Washington, DC: The White House, 2009), [http://www.whitehouse.gov/agenda/homeland\\_security/](http://www.whitehouse.gov/agenda/homeland_security/) (accessed March 5, 2009).

<sup>3</sup> The White House, *The Federal Response to Katrina Lessons Learned* (Washington, DC: The White House, 2006), <http://www.whitehouse.gov/reports/katrina-lessons-learned.pdf> (accessed October 2, 2008).

would have been able to contact FEMA directly, without the need to search for contact information. According to the National Emergency Communications Plan, “numerous after-action reports from major incidents throughout the history of emergency management in our Nation have cited communication difficulties among the many responding agencies as a major failing and challenge to policymakers.”<sup>4</sup>

The current interoperable communications strategies and governmental efforts provide an extremely unbalanced approach. The strategies are overly focused on providing first responders with radio communications, at ground zero, under worst-case scenario conditions. The Department of Homeland Security SafeCom program’s website defines communications interoperability as follows:

In general, interoperability refers to the ability of emergency responders to work seamlessly with other systems or products without any special effort. Wireless communications interoperability specifically refers to the ability of emergency response officials to share information via voice and data signals on demand, in real time, when needed, and as authorized. For example, when communications systems are interoperable, police and firefighters responding to a routine incident can talk to each other to coordinate efforts. Communications interoperability also makes it possible for emergency response agencies responding to catastrophic accidents or disasters to work effectively together. Finally, it allows emergency response personnel to maximize resources in planning for major predictable events such as the Super Bowl or an inauguration, or for disaster relief and recovery efforts.<sup>5</sup>

Notice that the focus is on emergency responders. While this is important, the problem is achieving balance among local, state, federal, and tribal governments, non-profit organizations, the private sector, faith-based organizations, volunteer groups and even citizens. The problem is simply a lack of national and state interoperable communication strategies that are inclusive of all the important partners. Another important concept is that this nation has adopted the National Incident Management

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<sup>4</sup> Department of Homeland Security, *National Emergency Communications Plan*, July 2008, [http://www.dhs.gov/xlibrary/assets/national\\_emergency\\_communications\\_plan.pdf](http://www.dhs.gov/xlibrary/assets/national_emergency_communications_plan.pdf) (accessed October 2, 2008).

<sup>5</sup> United States Federal Emergency Management Agency, “SafeCom,” Department of Homeland Security, <http://www.safecomprogram.gov/SAFECOM/interoperability/default.htm> (accessed October 2, 2008).

System, relying heavily on the Incident Command System, a key component of which is the difference between Command and Control compared to Coordination. The present interoperable strategies focus on the Command and Control component, ensuring that authorized personnel can communicate under a system of governance. For example, the National Emergency Communications Plan sets the following three strategic goals that only address response-level emergency communications:

**Goal 1**—By 2010, 90 percent of all high-risk urban areas designated within the Urban Areas Security Initiative (UASI)<sup>2</sup> are able to demonstrate response-level emergency communications<sup>3</sup> within one hour for routine events involving multiple jurisdictions and agencies.

**Goal 2**—By 2011, 75 percent of non-UASI jurisdictions are able to demonstrate response-level emergency communications within one hour for routine events involving multiple jurisdictions and agencies.

**Goal 3**—By 2013, 75 percent of all jurisdictions are able to demonstrate response-level emergency communications within three hours, in the event of a significant incident as outlined in national planning scenarios.<sup>6</sup>

Again, while this is very important, a whole range of support agencies are not receiving the strategic planning needed to ensure their communications needs are met, and these needs are very different from those of the first responders. There is also the strategic obsession with worst-case scenarios. Efforts are focused on communications systems that will function under any circumstance, such as an electrical outage, and disregard many less expensive alternatives that would provide superior communications under most scenarios. This would be like utilizing horses instead of vehicles so as to be prepared to function without gasoline. While it is very important for first responders in a command and control situation at ground zero to have systems that work under any circumstance, focusing on this high bar has led to less strategic effort being placed on providing effective communications to the support side of emergency response and certainly the communications needs before and after an incident in which worst case scenario communications may not be necessary. Finally, in the author's opinion, the grant centric system also causes problems in that it pushes agencies to purchase expensive communications solutions pushed by contractors and corporations often with cost

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<sup>6</sup> Department of Homeland Security, *National Emergency Communications Plan*, 1.

prohibitive user and maintenance fees. According to the National Emergency Communications Plan, “the largest investment category of DHS grant funds is interoperable communications.”<sup>7</sup> When national priorities change, and less homeland security funds are provided to the state and local agencies, it is doubtful that they will be able to maintain these yearly fees, as well as the costs of maintenance, equipment replacement and ongoing training. There is also much focus on security and on governance issues related to interoperable communications. While these issues are important, the author’s opinion is that failure to balance them with accessibility has resulted in communications systems that do not allow participation by individuals lacking clearance, volunteer groups, or even important citizens, such as subject matter experts. When information is being provided to the public in real time across CNN during an incident, it may not be necessary to sacrifice communications capacity for a highly secured and well-governed system that is not flexible enough to ensure the free flow of information.

The problem is simple; if national and state strategic interoperable communications plans do not comprehensively address the entire homeland security community, this nation will continue to suffer communications gaps, especially in incidents of national significance, thereby further eroding public confidence and tarnishing the substantial improvements in this nation’s prevention, preparedness and response efforts.

## **B. RESEARCH QUESTIONS**

This thesis will attempt to address the following four research questions.

### **1. How is the Homeland Security Community Defined?**

The Department of Homeland Security was only established in 2003 and still no clear agreement exists on the definition of homeland security, much less whom the

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<sup>7</sup> Department of Homeland Security, *National Emergency Communications Plan*, 1.

“community” consists of or their desired level of involvement. This thesis will define the homeland security community for the purposes of addressing the other research questions listed below, as it relates to communications issues.

**2. What Are the Communications Criteria for this Community?**

Just as it is unclear who is part of the homeland security community, settling on the communications system criteria for such a community can only be established after the community membership is defined. This thesis compiles a set of criteria based on its definition of the homeland security community utilizing the Megacommunity concept.

**3. How Does the Southeast Ohio Half-Duplex Voice over IP System Rate by These Criteria?**

The Southeast Ohio Regional Medical Response System has been testing a specific type of half-duplex Voice over IP for several years. This thesis will carefully evaluate the system based on the criteria established during the first phase of research.

**4. Does the Southeast Ohio System Have Any Characteristics that Would Provide Insight into the Plausibility of a National Communications System?**

This thesis will look at the characteristics of the Ohio system to determine if it has any value to the validation that a single comprehensive national communications system is plausible for the Homeland Security Community. The thesis will not directly address whether such a system is actually desirable or how well users would accept it.

**C. ARGUMENT**

Prevention, preparedness, response and recovery activities for a terrorist or natural disaster require a unified effort of more than just first responders; it requires a cohesive national Homeland Security Community. This community needs to be comprised of all levels of government including local, state, federal and tribal. In addition to government, the private sector, non-profit organizations and citizens must be included as well. If it is accepted that the Homeland Security Community should consist of this coalition, it is

reasonable to assert that a common interoperable communication system is needed. The problem is that present interoperable communications strategies are coordinated at a state level and overwhelmingly address first responder communications. Further, these strategies are overwhelming radio based. While radio interoperability is an important component of interoperability, it completely fails to address the larger issue of interoperable communications among the entire Homeland Security Community.

The next issue is the plausibility of a national Homeland Security Community real-time voice communications system. This thesis argues that such a system is possible and the Voice over IP systems presently being used by millions of computer gamers worldwide is such an example. It has been tested in the South East Ohio region with great success, and is presently being tested at the state level for over two years. The technology is available, it has been tested in real world situations, and the only thing remaining is for national leadership to implement a single comprehensive national real-time voice communications system. The National Emergency Communications Plan states, “there is no simple solution, or “silver bullet,” for solving emergency communications challenges....”<sup>8</sup> This thesis attempts to dispute this view and provide a look at the plausibility of a national communications system.

#### **D. SIGNIFICANCE OF RESEARCH**

This research has a direct bearing on the Homeland Security National Strategy. Communications has always been a key failure of this nation to respond to events of national significance in the past decades, and the current strategies do not appear to be addressing the problem. This research attempts to show that a unified National Homeland Security Community Real Time Voice Communications system is not only plausible, but has been thoroughly proven effective and would cost an insignificant amount of resources to implement.

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<sup>8</sup> Department of Homeland Security, *National Emergency Communications Plan*, 1.

## **E. RESEARCH METHODOLOGY**

Two research methods were utilized in this thesis, a 2 round Delphi type email survey consisting of 28 representatives of the Homeland Security Community and an informal observational case study of the Southeast Ohio Regional Medical Response System's Voice over IP system. This thesis attempts to answer one overarching question, is a National Homeland Security real time voice communications system plausible. The difficulty is in defining the community, establishing a set of communications criteria unique to that community, and determining possible systems that should be evaluated.

- National Homeland Security Community Definition and Makeup
  - A two round Delphi email survey was used to first ask 28 representatives of the Homeland Security Community who they thought were acceptable members of the community. They were then shown a compilation of their responses and asked to refine their answers. This information along with researching the literature resulted in the definition of the Homeland Security community to be utilized in the rest of the thesis.
- Communications Systems to be Evaluated
  - The Delphi email survey asked the same participants to list present communications systems being used by the Homeland Security Community. The participants were then provided a compilation of their responses and asked to choose the systems they felt are most valuable to the now defined Homeland Security community on a national basis. This resulted in eight communications systems that were then evaluated later.
- Communication Criteria
  - The Delphi email survey also asked participants to list what communication criteria were most important to them and their agency. Then the participants were provided a compilation of their responses and asked to rank the criteria with the now defined Homeland Security Community and in the context of a national communications system. These criteria were then weighted and used for two purposes, first to conduct the observational case study of the Southeast Ohio system and to evaluate the eight chosen communications systems referenced above.

- Southeast Ohio Regional Medical Response System VoIP Case Study
  - Utilizing the communications criteria collected in the Delphi survey, an observational case study of the Southeast VoIP system was conducted to evaluate the positive and negative characteristics of this unique form of VoIP.
- National Communications Systems Evaluation
  - The eight communications systems compiled from the survey participants were evaluated utilizing the weighted communications criteria also obtained from the Delphi study. The eight systems included the Southeast Ohio system, as well as a concept only “Universal Communicator” proposed by this thesis. The systems were given a numerical value from 0-100 based on the common grading system.

Due to the limited time available to conduct the survey and case study, the research is exploratory not comprehensive, and shows the need for in-depth research into utilizing half-duplex VoIP as a way to solve the Homeland Security interoperability problem.

## II. LITERATURE REVIEW

### A. SUMMARY OF RESEARCH

It has been well established that the emergency response community, pre and post 9-11, has suffered from poor communications. According to the National Communications Plan, “during the last three decades, the Nation has witnessed how inadequate emergency communications capabilities can adversely affect response and recovery efforts.”<sup>9</sup> Who comprises the Homeland Security Community is an area that still needs clarification. The National Communications Plan acknowledges the scope of the community stating that it “focuses on the emergency communications needs of response personnel in every discipline, at every level of government, and for the private sector and non-governmental organizations (NGO).”<sup>10</sup> However, in the next sentence of the plan, it defines emergency communications as “the ability of emergency responders to exchange information via data, voice, and video as authorized, to complete their missions.”<sup>11</sup> This shows that while acknowledging the larger community, the focus is still on responders.

Utilizing after-action reports, lessons learned and government reports, many sources show that more than just first responders respond to an incident. The research is rich in articles on current interoperability topics; however, little research has been conducted on comprehensive interoperability for the entire Homeland Security Community or a single national system.

All states are required to have an interoperability plan. Thus, about 50 documents exist to outline the current interoperable strategy of the states. From the 9-11 Commission Report<sup>12</sup> and the Katrina Lessons Learned,<sup>13</sup> plenty of past examples exist of both

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<sup>9</sup> Department of Homeland Security, *National Emergency Communications Plan*, 1.

<sup>10</sup> Ibid.

<sup>11</sup> Ibid.

<sup>12</sup> National Commission on Terrorist Attacks Upon the United States, *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks upon the United States* (Washington, DC: U.S. Government Printing Office, 2004), <http://www.gpoaccess.gov/911/pdf/fullreport.pdf> (accessed October 2, 2008).

<sup>13</sup> The White House, *The Federal Response to Katrina Lessons Learned*, 1-217.

communications failures and examples to show the participation of more than first responders only in the prevention, preparedness, response and recovery to terrorism and natural disasters.

Southeast Ohio, sponsored by the Ohio Department of Health, has instituted a VoIP solution, modeled after the use by computer gamers in MMORPGs (massively multiuser online role-playing games). This is a good example of engaging the larger Homeland Security Community, as compared to just the first responder community. By utilizing an open system, Southeast Ohio is able to engage the private sector, volunteer agencies and even citizens in the process, and thereby, benefit from a truly collaborative effort. Eleven after action reports were conducted during a week long regional drill utilizing the system and information was collected on VoIP use by the Ohio Department of Health during grant evaluations. There are more and more peer reviewed journal articles being written on MMORPGs, but this work is mainly geared towards social networking and leadership issues. No research was found related to any best practices or suggestions for a radio like voice communications system to incorporate all homeland security partners. The system being used by Ohio may provide a substantial model for an expansion of the homeland security strategy as it relates to communications and interoperability. This literature review suggests a significant gap in the homeland security communications strategy as conveyed by Homeland Security's SAFECOM site.<sup>14</sup> This gap is simply the result of the homeland security community being expressed as consisting of local, tribal, state, and federal governments, non-profit organizations, volunteer groups, and the private industry; however, only first responders are reflected in the definition of interoperability and the bulk of the grant funding.

The research for this thesis covers multiple areas including communications needs, homeland security partners, current interoperability, past examples/future scenarios, the gamers' solution and the southeast Ohio project.

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<sup>14</sup> United States Federal Emergency Management Agency, *SafeCom*, 1.

## **B. COMMUNICATIONS NEEDS**

The need for good communications in homeland security is well defined in government strategies, reports, and after-action reports, including the 9-11 Commission Report,<sup>15</sup> state strategic plans such as the Ohio Homeland Security Strategic Plan,<sup>16</sup> the National Response Framework,<sup>17</sup> and the National Strategy for Homeland Security<sup>18</sup> and FEMA's National Incident Management System.<sup>19</sup>

## **C. HOMELAND SECURITY PARTNERS**

Homeland Security Partners include first responders, local, tribal, state, federal, volunteer, faith based, and the private sector and at its highest level citizens as well. The government strategies, reports and after-action reports listed in the need for communication's section also describe the homeland security community's composition. In addition, many research articles describe the importance of all homeland security partners. The articles cover topics such as interagency coordination between police and health departments,<sup>20</sup> community involvement in disasters,<sup>21</sup> and the role of faith based and non-governmental organizations in emergencies.<sup>22</sup>

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<sup>15</sup> National Commission on Terrorist Attacks Upon the United States, *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks upon the United States*.

<sup>16</sup> Ohio Department of Public Safety, *Ohio Homeland Security Strategic Plan: Version 3* (State of Ohio, 2007), [http://www.homelandsecurity.ohio.gov/Strategic\\_Plan.pdf](http://www.homelandsecurity.ohio.gov/Strategic_Plan.pdf) (accessed October 2, 2008).

<sup>17</sup> United States Department of Homeland Security, *National Response Framework* (Washington, DC: Department of Homeland Security, 2008), <http://www.fema.gov/pdf/emergency/nrf/nrf-core.pdf> (accessed October 2, 2008).

<sup>18</sup> Homeland Security Council, *National Strategy for Homeland Security*.

<sup>19</sup> United States Federal Emergency Management Agency, *National Incident Management System Draft* (Washington, DC: FEMA, 2007), <http://www.fema.gov/library/viewRecord.do?id=2961> (accessed October 2, 2008).

<sup>20</sup> Joe Eyerman and Kevin Strom, *A Cross-National Comparison of Interagency Coordination between Law Enforcement and Public Health* (Research Triangle Park, NC: RTI International, 2005), <http://www.ncjrs.gov/pdffiles1/nij/grants/212868.pdf> (accessed October 2, 2008).

<sup>21</sup> James Carafano, Jennifer Marshall and Lauren Hammond, *Grassroots Disaster Response: Harnessing the Capacities of Communities* (Washington, DC: The Heritage Foundation, December 28, 2007), <http://www.heritage.org/Research/NationalSecurity/bg2094.cfm> (accessed October 2, 2008).

<sup>22</sup> Homeland Security Institute, *Heralding Unheard Voices: The Role of Faith-Based Organizations and Nongovernmental Organizations during Disasters* (Arlington, VA: Homeland Security Institute, 2006), [http://www.homelandsecurity.org/hsireports/Herald\\_Unheard\\_Voices.pdf](http://www.homelandsecurity.org/hsireports/Herald_Unheard_Voices.pdf) (accessed October 2, 2008).

## D. CURRENT INTEROPERABILITY

The present strategy of interoperability is based on providing radio communications for incident command and control for first responders only. This is a very rich field of study. There are numerous media articles, journal articles, research papers, thesis, and books on the subject of interoperability issues among first responders on the scene. A thesis called “Radio Interoperability: Addressing the Real Reasons We Don’t Communicate Well during Emergencies”<sup>23</sup> written by a graduate of the Center for Homeland Defense and Security Postgraduate Program was written in 2006 and gives a very clear picture of the current situation, with many references to others’ work in the field. Each state also has an interoperability plan, required by the Department of Homeland Security that provides details of the direction the states are going, such as Washington State’s Statewide Communications Interoperability Plan.<sup>24</sup> Also, the government has put together many guides on proper implementation of a communications strategy<sup>25</sup> and the Department of Homeland Security’s SAFECOM<sup>26</sup> website provides a clearing house of reports, articles, best practices and other resources for interoperable communications. However, according to a GAO report from April 2007, “The SAFECOM program has made limited progress in improving communications interoperability at all levels of government; however, the program has not addressed interoperability with federal agencies, a critical element to interoperable communications required by the Reform and terrorism Prevention Act of 2004.”<sup>27</sup>

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<sup>23</sup> Ronald Timmons, “Radio Interoperability: Addressing the Real Reasons We Don't Communicate Well during Emergencies” (Master’s Thesis, Naval Postgraduate School, 2006), [https://www.hsdl.org/homesec/docs/theses/06Mar\\_Timmons.pdf](https://www.hsdl.org/homesec/docs/theses/06Mar_Timmons.pdf) (accessed October 2, 2008).

<sup>24</sup> State of Washington, *Washington Statewide Communications Interoperability Plan* (Olympia, WA: Washington State Interoperability Executive Committee (SIEC), 2008), <http://isb.wa.gov/committees/siec/WASCIPapproved.pdf> (accessed October 2, 2008).

<sup>25</sup> National Task Force on Interoperability, *Why Can't We Talk Interoperability: Working Together to Bridge the Communications Gap to Save Lives* (Washington, DC: National Task Force on Interoperability, 2003), [http://www.safecomprogram.gov/NR/rdonlyres/322B4367-265C-45FB-8EEA-BD0FEBDA95A8/0/Why\\_cant\\_we\\_talk\\_NTFI\\_Guide.pdf](http://www.safecomprogram.gov/NR/rdonlyres/322B4367-265C-45FB-8EEA-BD0FEBDA95A8/0/Why_cant_we_talk_NTFI_Guide.pdf) (accessed November 20, 2008).

<sup>26</sup> Department of Homeland Security, “Safecom,” <http://www.safecomprogram.gov/SAFECOM/> (accessed November 20, 2008).

<sup>27</sup> United States Government Accountability Office, *First Responders: Much Work Remains to Improve Communications Interoperability* (Washington, DC: Government Accountability Office, 2007), <http://www.gao.gov/new.items/d07301.pdf> (accessed November 20, 2008).

## E. PAST EXAMPLES/FUTURE SCENARIOS

Since past incidents have shown that all homeland security partners respond to an incident, and no clear communications strategy exists to link all partners nationwide or even at a local basis, the enormous communications gap will continue to cause catastrophic communications failures into the foreseeable future in any type 1 disaster, regardless of the billions of dollars spent on radio equipment and radio bridging technologies. Katrina and 9-11 are, of course, the two largest examples, but research into after action reports will provide plenty examples of communication challenges. The Lessons Learned from Katrina<sup>28</sup> produced by the Whitehouse and the 911 Commissions Report<sup>29</sup> regarding September 11, 2001 provides very detailed reports of communications failures.

The 9-11 example provides many case studies showing both the lack of interoperable communications between fire, law enforcement and other responding agencies. According to the 9-11 report, “Any attempt to establish a unified command on 9/11 would have been further frustrated by the lack of communication and coordination among responding agencies.”<sup>30</sup> The 9/11 Commission is very clear in its recommendation that interoperable communications must be a high priority and that planning and preparedness must include the private sector.<sup>31</sup>

Katrina also provides many examples of the need for interoperable communications to go beyond radios for first responders. Communications is listed by the Katrina Report as a critical challenge and a main lesson learned was that “the Department of Homeland Security should review our current laws, policies, plans, and strategies relevant to communications. Upon the conclusion of this review, the Homeland

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<sup>28</sup> The White House, *The Federal Response to Hurricane Katrina Lessons Learned* (Washington, DC: White House, 2006), <http://www.whitehouse.gov/reports/katrina-lessons-learned/> (accessed November 20, 2008).

<sup>29</sup> National Commission on Terrorist Attacks upon the United States, *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks upon the United States 1-567*.

<sup>30</sup> *Ibid.*, 321.

<sup>31</sup> *Ibid.*

Security Council, with support from the Office of Science and Technology Policy, should develop a National Emergency Communications Strategy that supports operability and interoperability.”<sup>32</sup>

## F. GAMERS’ SOLUTION

Computer gamers have been utilizing a specific type of voice over IP to provide continuous real time voice communications for years that meet the same criteria needed to fill the homeland security gap nationally. Very little research is being done on the communications aspect of the massively multiuser online role-playing games (MMORPGs). Most of the literature is about leadership and social networking. There is literature on VoIP systems, but not on the very specific server/client based VoIP system used by the computer gamers, an example of a specific technical article is Jem Berkes, “Design of a Voice over IP System that Circumvents NAT.”<sup>33</sup> Other information can be found from thesis work<sup>34,35</sup> and many online sources.<sup>36</sup>

MMORPGs are interactive computer games that can only be played over the internet. Thousands of people play a specific game in a persistent world, and spend years building up their characters, in game wealth and prestige. At the high levels in these games, upwards of 40 people work together as a highly organized group to execute online operations that can take hours or even a full day. These groups must work in a highly organized fashion, have a incident command like structure, follow orders, and do it all in real time. The slightest mistake in by one member of the group can waste hours of the other player’s time as they work to reach their common goal. Out of this extreme need for communications came the use of VoIP programs to give them an edge over other groups

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<sup>32</sup> The White House, *The Federal Response to Hurricane Katrina Lessons Learned*, 1-228.

<sup>33</sup> Jem Berkes and others, “Design of a Voice over IP System that Circumvents NAT,” (Bachelor of Science, University of Manitoba), 1-92.

<sup>34</sup> Thomas J. Richardson, “First Responder Weapons of Mass Destruction Training Using Massively Multiplayer on-Line Gaming,” (Master’s Thesis, Naval Postgraduate School, 2004), 1-136, <http://bosun.nps.edu/uhtbin/hyperion-image.exe/04Jun%5FRichardson.pdf> (accessed November 20, 2008).

<sup>35</sup> Nick Yee, “VoIP Usage,” <http://www.nickyee.com/daedalus/archives/001519.php?page=1> (accessed November 20, 2008).

<sup>36</sup> “Vonmag,” <http://www.vonmag-digital.com/vonmag/200603/> (accessed November 20, 2008).

and players that had to rely solely on text messaging. Their answer in VoIP is cheap, flexible, and works in real time across the entire globe. Utilizing separate voice channels, large groups are able to break into smaller units and complete tasks very efficiently. Their needs closely reflect those of the new homeland security community. The question is will their successful solution to communications work to bridge the communications gap that still exists between government, state, local and tribal governments, non-profits, and the private sector?

#### **G. SOUTHEAST OHIO PROJECT**

Southeast Ohio, public health, hospitals and EMAs, supported by the Ohio Department of Health have been testing this same system for a couple years with excellent results on a small scale, and it has proven very effective in a 21 county pandemic influenza week long functional exercise. After action reports are available. Research can also be conducted as a state wide rollout of the program is underway. In the summer of 2009, the Ohio Department of Health is expanding the system statewide and it has also been adopted by the Ohio Homeland Security Office, but has yet to be implemented.

#### **H. SUMMARY**

Overall, little research has been done to specifically address the research questions posed in this thesis. For example, defining the Homeland Security Community, the President sets the strategy, and therefore, the definition of the Homeland Security Community, but more research is needed to establish how this is translated to state and local levels. Therefore, this thesis starts with a survey to establish a conscience as to the content of the community. This leads to the second research question of what are the communications criteria for this community. Again, this thesis relies on the survey as opposed to past research and to obtain more data on an under researched topic, this thesis conducts a brief case study to obtain data on half-duplex VoIP systems and utilizes the

combined data to evaluate the plausibility of a national communications system. This thesis will hopefully be the start of filling in the gap in research into the plausibility of a national communications system.

### III. DEFINING THE HOMELAND SECURITY COMMUNITY

#### A. INTRODUCTION

This chapter attempts to answer the first research question of this thesis: How is the Homeland Security Community defined? Defining a National Homeland Security Community is difficult; there is even controversy over what Homeland Security is itself. This thesis chose to utilize the 2007 National Strategy for Homeland Security<sup>37</sup> as a starting point for defining who is involved in the Homeland Security Community. The strategy defines Homeland Security as “a concerted national effort to prevent terrorist attacks within the United States, reduce America’s vulnerability to terrorism, and minimize the damage and recover from attacks that do occur.”<sup>38</sup> The structure of the community is described throughout the strategy as including all levels of government, the private and non-profit sectors, and individual citizens. “Federal, State, local, and Tribal governments, the private and non-profit sectors, communities, and individual citizens all share common goals and responsibilities – as well as accountability – for protecting and defending the Homeland.”<sup>39</sup> The private sector especially must be included, as they are responsible for almost eighty-five percent of infrastructure.<sup>40</sup> While as a nation it can be stated that the community must be inclusive and that it shares a common task, the national strategies do not go much further than expressing the sentiment. The challenge is to find a way to discuss the Homeland Security Community in a broader sense. The next section discusses the Megacommunity concept and how it provides a framework for viewing the Homeland Security Community.

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<sup>37</sup> Homeland Security Council, *National Strategy for Homeland Security*, 1-53.

<sup>38</sup> *Ibid.*, 3.

<sup>39</sup> *Ibid.*, 4.

<sup>40</sup> *Ibid.*

## **B. THE HOMELAND SECURITY MEGACOMMUNITY**

The Homeland Security Community described by the 2007 National Strategy for Homeland Security closely resembles a Megacommunity. According to the book, “Megacommunities,” the authors propose that beyond private-public partnerships there exist issues that are so large they require three main components to solve them: Government, Business and Non-Profit Organizations.<sup>41</sup> The Megacommunity as a concept is apparent in the Homeland Security strategies, and the issues are certainly complex enough. The government involvement in the community is obvious, but the private sector is also very important as it controls the critical infrastructure of this country, and non-profit agencies such as the American Red Cross and Salvation Army comprise key response agencies to disasters, whether natural or man made.

The federal system has made it difficult for anyone to take the lead in this Megacommunity. The first responders are certainly on the front lines of emergency response at a local level, but it is the Federal Government that needs to take the lead in nurturing the Megacommunity. The Federal Government, using grant deliverables, has the ability to shape state and local policy, much as it has done with the nationwide implementation on NIMS, the National Incident Management System. While the government can take a leadership and coordination role, the government certainly cannot manage all of the aspects of prevention, preparedness, response and recovery. History has shown that the private sector and non-profits will be involved in the response and recovery phase, but more effort needs to be made to bring them in on the preparedness phase. The private sector and non-profits should be heavily involved in planning, training, and exercising. The main research question of this thesis is whether or not a national communications system is plausible, but before addressing that question, it is necessary to define who constitutes the National Homeland Security Community. The Federal Government acknowledges in its 2007 National Homeland Security Strategy that a broad community is desired, stating:

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<sup>41</sup> Mark Gerencser, *Megacommunities: How Leaders of Government, Business and Non-Profits Can Tackle Today's Global Challenges Together* (New York, NY: Palgrave Macmillan, 2008), 51-62.

An effective, coordinated response begins with sound planning well before an incident occurs. The planning process will translate policy, strategy, doctrine, and capabilities into specific tasks and courses of action to be undertaken during a response. The resulting plans must represent collaborative efforts involving communities, States, and the Federal Government as well as private sector and non-profit partners to ensure we effectively bring to bear all instruments of national power in our response to an incident...Ultimately, a continuous cycle of joint training and exercises will ensure that all government, private sector, and non-profit stakeholders are capable of fulfilling their roles and responsibilities and can achieve unity of effort when responding to a real-world natural or man-made disaster.<sup>42</sup>

There is much that the government can do to encourage a Megacommunity type collaboration but the first step is to define it clearly and provide a method of communication. This thesis attempts to both define the National Homeland Security Community clearly and examine a possible communications system for it. The United States Citizen Corps program was designed to assist in providing a format for this Megacommunity, but went woefully underfunded, and did not receive the strong national support needed to make the program successful.<sup>43</sup> For example, according to the Department of Homeland Security, fiscal year 2009 grants will only consist of \$14.6 million dollars to be distributed to all states. This is out of a more than three billion dollars total, meaning that Citizen Corps amounts to less than 5% of the funding.<sup>44</sup> When considering that these are the funds to assist with the development of the citizen component of the Megacommunity as well as bridging the governmental, business and non-profit sector gap, it is apparent that the priorities are not what are expressed in these strategies.

Hurricane Katrina provides one of the best examples in recent history as to the reality on the ground that more than first responders are involved in Homeland Security. According to the White House's report *The Federal Response to Hurricane Katrina*:

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<sup>42</sup> Homeland Security Council, *National Strategy for Homeland Security*, 33-34.

<sup>43</sup> Federal Emergency Management Agency, "Citizen Corps," <http://www.citizencorps.gov/> (accessed November 21, 2008).

<sup>44</sup> Department of Homeland Security, "DHS Announces Fiscal Year 2009 Grant Guidance for Over \$3 Billion in Preparedness Grant Programs," [http://www.dhs.gov/xnews/releases/pr\\_1225900531284.shtm](http://www.dhs.gov/xnews/releases/pr_1225900531284.shtm) (accessed November 21, 2008).

*Lessons Learned*, “Hurricane Katrina prompted an extraordinary national response that included all levels of government—Federal, State, and local—the private sector, faith-based and charitable organizations, foreign countries, and individual citizens.”<sup>45</sup> A major study by the Homeland Security Institute found that FBOs (Faith Based Organizations) and NGOs (Non-Governmental Organizations) had a significant beneficial impact during and after Hurricanes Katrina and Rita.<sup>46</sup> The study also found that these agencies provided assistance in 10 specific areas: “shelter, food services, medical services, personal hygiene services, mental health and spiritual support, physical reconstruction, logistics management and services, transportation management and services, children’s services, and case management and related services.”<sup>47</sup> The hurricane Katrina response showed that these agencies and people do respond to disasters in greater numbers than first responders and government agencies. It is now imperative to decide as a nation if it would be beneficial for them to have an interoperable communications system.

### **C. RESEARCH METHODOLOGY**

The Delphi Survey Method was utilized to question 28 members of the Homeland Security Community to see who they think should comprise the Homeland Security Community, as well as solicit opinions on the Homeland Security Community concept. The 28 representatives participating in the survey were chosen from various states, disciplines and community sizes. See Table 1 for a complete list of the participants. The participation divided into 15 local agencies, seven state agencies and 6 federal agencies. Utilizing the Megacommunity concept, the participation represented 17 government agencies, four businesses and seven non-profits.

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<sup>45</sup> The White House, *The Federal Response to Hurricane Katrina Lessons Learned*, 3.

<sup>46</sup> Homeland Security Institute, *Heralding Unheard Voices: The Role of Faith-Based Organizations and Nongovernmental Organizations during Disasters*, 2.

<sup>47</sup> *Ibid.*

Table 1. List of Survey Participants

#	Agency	Position
1	Local American Red Cross, City Chapter	Director, Emergency Services
2	Local Bank Corporation	Life Safety Manager
3	Local Chemical Plant	Senior Health and Safety Specialist
4	Local City Council and Local Church	Council Member and Pastor
5	Local City Utility	Emergency Management Coordinator
6	Local Emergency Management Agency	Deputy Director, Homeland Security
7	Local Emergency Medical Services (EMS)	Chief of EMS Training
8	Local Fire Department	Chief
9	Local Health Department	Emergency Planner
10	Local Hospital	Emergency Services Coordinator
11	Local IT Company	Product Development and Support
12	Local Police Department	Sergeant
13	Local Retired Senior Volunteer Program	Director
14	Local State University	Assistant Director of Facilities
15	Local Tribal Health Corporation	Director of Safety and Security
16	State Baptist Disaster Relief	Director
17	State Department of Health	Director, Emergency Preparedness
18	State Department of Public Safety	Director, Policy and Legislative Affairs
19	State Emergency Management Agency	Response Section Manager
20	State House of Representatives	State Representative
21	State Police	Lieutenant
22	State Salvation Army	Director, Emergency Services
23	U.S. Coast Guard	Lieutenant Commander
24	U.S. Department of Defense, NORTHCOM	Liaison Officer, National Guard Bureau
25	U.S. Department of Defense, NORTHCOM	Officer, Medical Operations
26	U.S. Federal Bureau of Investigations	Field Agent
27	U.S. Federal Emergency Management Agency	Program Specialist
28	U.S. Medical Reserve Corps	Regional Coordinator

The survey was not broken up evenly between categories, so results did not provide strict analytical data, but did provide qualitative data into the views of Homeland Security practitioners. The survey was conducted in two parts, both by email. The first round of questions was given with almost no background information, so as not to bias the responses. The second round included information on who the other participants in the survey were and compiled results from the first round with a request to clarify their responses to the first round of questions.

**D. DELPHI SURVEY QUESTIONS AND RESULTS: ROUND 1**

The first email consisted of the following three questions, at this time the participants did not know who the other agencies were in the survey pool:

- The broad concept of a nationwide homeland security community has been defined many ways since September 11, 2001. Who do you consider to be members of the homeland security community? Feel free to provide any opinions you have on the concept of the homeland security community.
- Thinking about the homeland security community, what types of systems exist, if any, to support communications across the membership of the community? Please provide positives and negatives for any existing systems.
- Considering either an existing, possible or future communications system, what would be your top 5 criteria for the system? For each criterion please provide an explanation.

This chapter focuses on the first question only to reach a consensus of who should or should not be part of the Homeland Security Community. The intent of question 1 during the first round was to be as vague as possible, to elicit an unbiased response from Homeland Security practitioners. Since no categories were provided, people answered in many different ways, for instance some answered law enforcement and some were more specific and stated local law enforcement. Not surprisingly, local law enforcement was the most cited, with local fire departments being tied for second. This was to be expected, as the traditional concept of Homeland Security is first responders. The surprising aspect is that citizens were tied for the second most mentioned group, with caveats of course. See Table 2 for the raw data, be reminded that some participants list just a few agencies as being involved in the Homeland Security Community, and some provided a very comprehensive list.

Table 2. Homeland Security Community Raw Survey Data

#	<i>Response to who is part of the HLS Community</i>	<i>Responses</i>
1	Law Enforcement-Local	11
2	Citizens	10
3	Fire Departments-Local	10
4	Emergency Medical Services (EMS)	9
5	First Responders	9
6	Bureau of Investigations-Federal (FBI)	8
7	Emergency Management Agency-Local	8
8	Department of Homeland Security-U.S.	7
9	Law Enforcement	7
10	Law Enforcement- State	7

#	<i>Response to who is part of the HLS Community</i>	<i>Responses</i>
11	Emergency Management Agency-State	6
12	Health Care Providers (Hospitals)	6
13	Public Health	6
14	Department of Defense-U.S (DoD).	5
15	Emergency Management Agency-Federal (FEMA)	5
16	Law Enforcement-Federal	5
17	Department of Homeland Security-State	4
18	Emergency Management Agencies	4
19	Government-Local	4
20	Non Governmental Organizations-(NGOs)/(VOAD)	4
21	Central Intelligence Agency-U.S. (CIA)	3
22	Government-Federal	3
23	Intelligence Community-Federal	3
24	Private Sector	3
25	All Federal, State and Local Stakeholders	2
26	Border Patrol	2
27	Bureau of Citizenship and Immigration Services-U.S. (INS)	2
28	Churches/Faith-based Community	2
29	Citizen Corps Members	2
30	Customs-U.S.	2
31	Fusion Centers-State	2
32	Government-Federal Listed in National Response Network	2
33	Government-State	2
34	Law Enforcement-Sheriff's Office	2
35	Military Intelligence Agencies-U.S.	2
36	National Guard-State	2
37	Neighborhood Watch Coordinator	2
38	Public Safety Agencies-Federal, State, Tribal, Local	2
39	Secret Service-U.S.	2
40	Transportation Security Authority-U.S.	2
41	Airport Authority	1
42	Aviation Administration-Federal (FAA)	1
43	Bureau of Investigations-State	1
44	Businesses	1
45	Coast Guard	1
46	COBRA Teams	1
47	Communications Commission-Federal (FCC)	1
48	Community Emergency Response Teams (CERT)	1
49	Congress-U.S.	1
50	Daycares	1
51	Department of Defense-U.S Reserves	1
52	Department of State-U.S.	1
53	First Preventers	1
54	HAZMAT	1
55	Immigration and Customs Enforcement (ICE)	1
56	Infrastructure Partners	1
57	Law Enforcement-Municipal	1
58	Law Enforcement-Tribal	1

#	Response to who is part of the HLS Community	Responses
59	Medical Reserve Corps (MRC)	1
60	National Security Agency-U.S. (NSA)	1
61	Port Authority	1
62	Public Officials-Local	1
63	Public Works	1
64	Red Cross	1
65	Salvation Army	1
66	Schools	1
67	State Community Service Council	1
68	SWAT	1
69	Waterways Authority	1
70	Vendors	1
71	Contractors	1
72	Utility Companies	1
73	Financial Institutions	1
74	Sector-Transportation	1
75	Businesses-Building Supplies	1
76	Security-Ports of Entry	1
77	Security-Airport	1
78	Faith Based Response Agencies	1

The private sector was not routinely mentioned. Hospitals were only listed by 6 out of 28 participants, and only about 4 out of 28 mentioned other private sector entities. As the private sector controls over 80 percent of the infrastructure, this gap may be meaningful. Since 17 of the 28 participants were government employees, this further exposes the government's lack of embracing the private sector at a fundamental level. Figure 1 shows a broad category breakdown of the responses. This divided into 75% of the responses for a governmental agency while only 11% were for the private sector and 14% for the non-profit agencies. Notice the discrepancy in Figure 1 compared to Table 2 concerning citizens. Citizens were mentioned once by about a third of respondents, but as Figure 1 demonstrates, citizens only counted for 5% of the total groups mentioned collectively by the survey respondents.

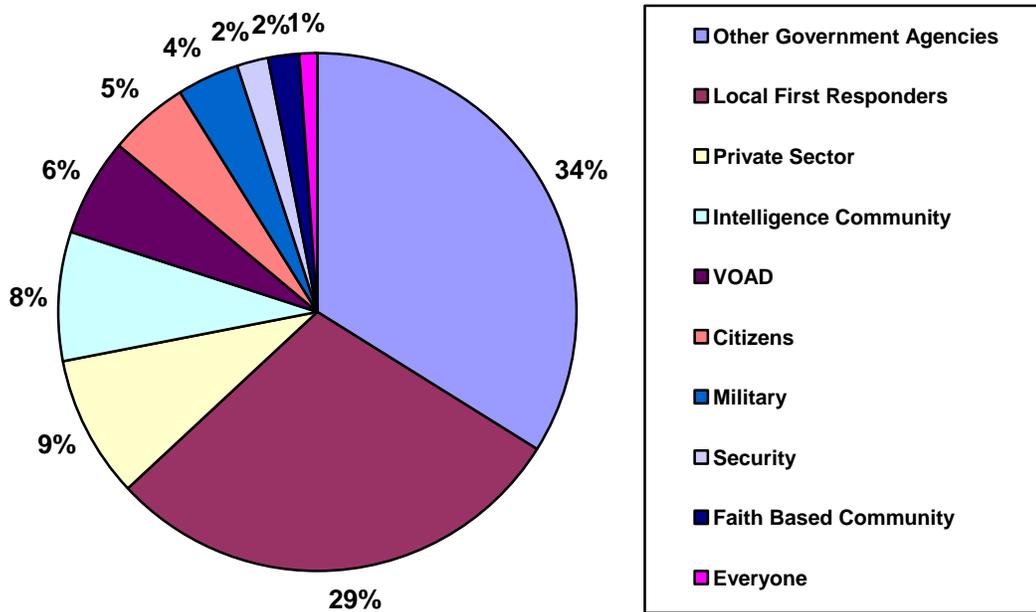


Figure 1. Homeland Security Community Responses

It is important to note that 61% of the participants in the survey were from governmental agencies, so the results are probably skewed towards the government. Governmental agencies are the ones needed to propel the 2007 National Homeland Security Strategy forward, and as such, governmental agencies should be even more cognizant of the need to include the private sector and the non-profit agencies. The other way to look at the data is by jurisdictional level, as seen in Figure 2. The phrase “all response is local” is often used in the emergency response community, and over 50% of the responses were for a local entity. This, however, could just be a reflection of the survey participants being composed of over half local agencies.

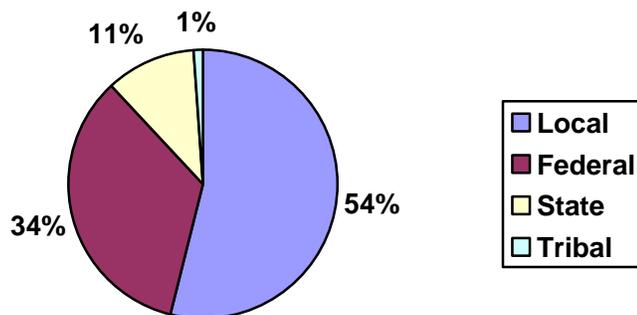


Figure 2. Governmental Breakdown of Responses

#### E. DELPHI SURVEY QUESTIONS AND RESULTS: ROUND 2

In between rounds 1 and 2 of the survey, a major hurricane struck Galveston, Texas. As the survey pool consisted of many first responders, six people dropped out of the survey, leaving the survey pool at 22. Since this study is qualitative more than quantitative, it should not interfere with the results. The author will, however, indicate any irregularities it may have caused.

The second email consisted of the following three questions. At this time, the participants were given a list of the other participants by agency and title, and the raw data listed above. This was to first let them know who the survey considered part of the Homeland Security Community, who the participants considered members of the Homeland Security Community, and to provide context:

- Defining the National Homeland Security Community: Utilizing the following data, are there any survey participants or survey responses that you do NOT consider to be part of the Homeland Security Community and why? BE HONEST. Keep in mind that we are going to be putting together a list of communication criteria for a bridging national communications system for the Homeland Security Community, so think about your answers in that context. Are there any large categories that we have forgotten? Please feel free to provide any comments or insight into the idea of a broad Homeland Security Community, in the context of a terrorism/all-hazards approach.

- Defining the Communications Systems: Utilizing the following data or other thoughts, pick your top five choices for a communications system that might be appropriate for the Homeland Security Community as defined above. As for citizens, do not think about public information or mass media, citizens would be part of this system if they had reason, such as part of a volunteer group, or a subject matter expert. Also, start thinking about more than just the hot zone and command/control, also consider coordination of resources and situational awareness of an incident. For example, how did the rest of the broad Homeland Security Community outside the gulf coast communicate during Hurricanes Katrina or Rita, or the county after 9-11 and the 2001 Anthrax Bioterrorism attacks? Besides picking your five top choices, please feel free to provide your comments or thoughts on the subject.
- Communications Criteria: Utilizing the following data or other thoughts, choose your top five criteria for a communications system for the broad Homeland Security Community, as is starting to be defined in Question Sets 1 and 2. Also, feel free to provide any comments or observations you have about the subject. **IMPORTANT:** Do not think about a replacement of systems in place, think about a bridging communications system, that we have, need to develop, or if you do not think one is needed please indicate.

This chapter will focus on the first question to reach a consensus of who should or should not be part of the Homeland Security Community. This set of questions provided context, to not only think about these people being in the Homeland Security Community in theory, but how would it be defined when they would actually be participating in the community through a communications system. The overwhelming majority of people agreed with the consensus of a broad Homeland Security Community, with only 4 out of 22 responding that some agencies did not belong. The U.S. Coast Guard Representative worried that including local companies such as banks and IT companies made the Homeland Security Community definition too broad. The U.S. Department of Defense, Medical Operations Representative questioned the usefulness of the local IT company. What was interesting is that the only two that had very strong opinions that many of the agencies were not part of the Homeland Security Community were the local fire and local police representatives. The Fire Chief questioned the trustworthiness of volunteers with intelligence information, did not see a role for legislative representatives, did not think clergy had a role in Homeland Security, considers the private sector to be profit driven, and the following to be response and recovery only: Hospitals, Universities, Banks, State

Baptist Disaster Relief, Red Cross, and the Salvation Army. The Police Sergeant cut out the following, but did not provide a reason: the local Retired Senior Volunteer Program, local city council, local city clergy, the state department of public safety, the state house of representatives, local tribal health corporations, local state universities, and local bank corporations. This study did not have enough participants to do a quantitative analysis, and two local first responders cannot be considered representative. However, the results of this survey do provide motivation to conduct further research into local first responders opinions into how willing they are to consider the private sector and non-profit organizations as partners in an inclusive Homeland Security Community.

## **F. CONCLUSIONS**

The Homeland Security Community clearly is defined as broader than first responders and government agencies. The 2007 National Homeland Security Strategy clearly and numerous states that the national strategy needs to be inclusive. The Strategies' vision states that "the United States, through a concerted national effort that galvanizes the strengths and capabilities of Federal, State, local, and Tribal governments; the private and non-profit sectors; and regions, communities, and individual citizens – along with our partners in the international community – will work to achieve a secure Homeland that sustains our way of life as a free, prosperous, and welcoming America."<sup>48</sup>

At the beginning of this survey, the author had expected to see a lot of resistance to this concept, but it appears that in the post 9-11 environment, most people and agencies are willing to acknowledge that a broad scope of governmental jurisdictions, agencies and people are needed to meet Homeland Security challenges. A large difference exists between acknowledgement and action. By acknowledging the concept of a Homeland Security Megacommunity, is the nation ready to embrace it in a system that requires trust such as a national real-time voice communications system. The next chapters will look at questions two and three of the Delphi Survey, to define a set of

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<sup>48</sup> Homeland Security Council, *National Strategy for Homeland Security*, 13.

communications criteria for a Homeland Security Megacommunity. The term Megacommunity will be used throughout the rest of this thesis to express a community comprised of government, business and non-profits.<sup>49</sup>

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<sup>49</sup> Gerencser, *Megacommunities: How Leaders of Government, Business and Non-Profits Can Tackle Today's Global Challenges Together*, 255.

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## IV. ESTABLISHMENT OF COMMUNICATIONS CRITERIA

### A. INTRODUCTION

Defining criteria for interoperable communications is difficult, as it is dependent on the organization in need of those communications. Chapter III defined the National Homeland Security Megacommunity as including federal, state, local, and tribal governments, the private sector, and non-profits, including volunteer groups, faith-based organizations, and citizen. The third question in each of the two rounds of the Delphi Survey worked to establish a set of criteria centered on what would be needed for an interoperable communications system for such a community. The need for proper communications is well documented in the literature, and after-action reports from incidents. According to the United States Department of Homeland Security, “\$2.15 billion in grant funding was awarded to states and localities from 2003 through 2005 for communications interoperability enhancements.”<sup>50</sup> Even with this amount of funding, the Government Accounting Office reported that much work was still left to be done. The problem is that this grant money is still focused on first responders. The rest of the Homeland Security Community needs attention as well. For example, according to the White House’s Lessons learned from Katrina, the private sector had problems reaching FEMA, “the American Bus Association spent an entire day trying to find a point of contact at FEMA to coordinate bus deployment without success. The report also discussed non-first responders, stating that “Faith-based, non-profit, and other non-government and volunteer organizations continued to provide essential support to Hurricane Katrina victims... However, faith-based and non-governmental groups were not adequately integrated into the response effort.”<sup>51</sup> This chapter looks into developing the criteria to evaluate an interoperable voice communications system for the entire National Homeland Security Megacommunity.

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<sup>50</sup> United States Government Accountability Office, *First Responders: Much Work Remains to Improve Communications Interoperability*, 5.

<sup>51</sup> The White House, *The Federal Response to Hurricane Katrina Lessons Learned*, 43.

## B. DELPHI SURVEY QUESTIONS AND RESULTS: ROUND 1

The first email consisted of the following three questions. At this time, the participants did not know who the other agencies were in the survey pool:

- The broad concept of a nationwide homeland security community has been defined many ways since September 11, 2001. Who do you consider to be members of the homeland security community? Feel free to provide any opinions you have on the concept of the homeland security community.
- Thinking about the homeland security community, what types of systems exist, if any, to support communications across the membership of the community? Please provide positives and negatives for any existing systems.
- Considering either an existing, possible or future communications system, what would be your top five criteria for the system? For each criterion, please provide an explanation.

This chapter will focus on the third question to reach a consensus of what the criteria for a National Homeland Security Megacommunity should be. As this survey was only conducted with 28 people, it is not meant to be comprehensive but to provide a qualitative framework for evaluating the Southeast Ohio Voice over IP system discussed in the next chapter. Table 3 lists the results.

Table 3. Raw Communications Criteria Data

#	<i>Communications Criteria</i>	<i>Number of Responses</i>
1	Ease of Use	16
2	Interoperability	11
3	Affordability/Well Funded	11
4	Relevance (Accurate/Efficiency/Timeliness)	10
5	Real Time/Interactive	9
6	Reliability/Redundancy/Fault Tolerance	9
7	Accessibility, Availability, Inclusiveness	9
8	High Bandwidth/Support Heavy Use/Quality of Service/Scalable	9
9	Single Common System/Single Point of Access	6
10	Secure/Users Vetted	6
11	Standardization/Training/Common Language	5
12	Public Transparency when Appropriate/Record Function	3
13	Physical Durability (Environmental)	3
14	Physical Flexibility (example use with PPE, Portable)	3
15	Electrical Independent	3
16	Multi-Channel/Room/Talk Group	2
17	Range/Coverage Area	2

#	<i>Communications Criteria</i>	<i>Number of Responses</i>
18	Secure versus Open Toggling	1
19	Monitoring-24/7	1

Ease of use was by far the most common criteria mentioned by the respondents, but by no means was universal with just more than a half of respondents mentioning it. None of the other criteria was mentioned by over half of the respondents, so over all, different agencies showed different priorities when considering the needed communication criteria. This showed a lack of consensus most likely due to the differing needs of each agency, and could have been overcome with a larger sampling pool within each discipline.

### **C. DELPHI SURVEY QUESTIONS AND RESULTS: ROUND 2**

In between rounds 1 and 2 of the survey, a major hurricane struck Galveston, Texas. As the survey pool consisted of many first responders, six people dropped out of the survey, leaving the survey pool at 22. Since this study is qualitative more than quantitative, it should not interfere with the results. The author will, however, indicate any irregularities it may have caused.

The second email consisted of the following three questions. At this time, the participants were given a list of the other participants by agency and title, and the raw data listed above. This was to first let them know who the survey considered part of the Homeland Security Community, who the participants considered members of the Homeland Security Community, and to provide context:

- Defining the National Homeland Security Community: Utilizing the following data, are there any survey participants or survey responses that you do NOT consider to be part of the Homeland Security Community and why? BE HONEST. Keep in mind that we are going to be putting together a list of communication criteria for a bridging national communications system for the Homeland Security Community, so think about your answers in that context. Are there any large categories that we have forgotten? Please feel free to provide any comments or insight into the idea of a broad Homeland Security Community, in the context of a terrorism/all-hazards approach.

- Defining the Communications Systems: Utilizing the following data or other thoughts, pick your top five choices for a communications system that might be appropriate for the Homeland Security Community as defined above. As for citizens, do not think about public information or mass media, citizens would be part of this system if they had reason, such as part of a volunteer group, or a subject matter expert. Also, start thinking about more than just the hot zone and command/control, also consider coordination of resources and situational awareness of an incident. For example, how did the rest of the broad Homeland Security Community outside the gulf coast communicate during Hurricanes Katrina or Rita, or the county after 9-11 and the 2001 Anthrax Bioterrorism attacks? Besides picking your five top choices, please feel free to provide your comments or thoughts on the subject. This method provides each discipline to contribute an equal contribution to the final criteria, thereby representing their agency.
- Communications Criteria: Utilizing the following data or other thoughts, choose your top five criteria for a communications system for the broad Homeland Security Community, as is starting to be defined in Question Sets 1 and 2. Also, feel free to provide any comments or observations you have about the subject. IMPORTANT: Do not think about a replacement of systems in place, think about a bridging communications system, that we have, need to develop, or if you do not think one is needed please indicate.

This chapter will focus on the third question to reach a consensus of what the communications criteria for a National Homeland Security Megacommunity should be. In this second survey, the participants were provided a list of how the other people in the survey responded to what the communications criteria should be. They were asked to pick their top five choices from the list in Table 3. Table 4 lists the results.

Table 4. Weighted Communications Criteria Data

#	<i>Communications Criteria</i>	<i># of Responses</i>	<i>Weight</i>
1	Interoperability	15	1
2	Reliability/Redundancy/Fault Tolerance	11	.73
3	Affordability/Well Funded	10	.67
4	Relevance (Accurate)/Efficiency/Being Used/Timeliness	9	.6
5	Ease of Use	8	.53
6	Secure/Users Vetted	8	.53
7	Real Time/Interactive	7	.47
8	Accessibility, Availability, Inclusiveness	7	.47
9	Standardization/Training/Common Language	5	.33
10	High Bandwidth/Support Heavy Use/Quality of Service/Scalable	4	.27
11	Secure versus Open Toggling	4	.27
12	Single Common System/Single Point of Access/Unified System)	3	.2

#	<i>Communications Criteria</i>	<i># of Responses</i>	<i>Weight</i>
13	Physical Durability (Environmental)	2	.13
14	Physical Flexibility (example use with PPE, Portable)	2	.13
15	Electrical Independent	2	.13
16	Range/Coverage Area	2	.13
17	Monitoring-24/7	2	.13
18	Public Transparency when Appropriate/Record Function	1	.06
19	Multi-Channel/Room/Talk Group	0	0

The above criteria were then weighted as to importance to the survey group. The method used to weight the criteria is as follows. The interoperability criteria, having had the most responses, was given a value of 1, then the other criteria received a percentage of 1, according to how many responses they received in proportion to the highest ranking criteria. The multichannel talk group criteria had no responses in the second survey, but it is being left in for evaluation purposes, but will have no weight. The 19 criteria will be used in the next chapter to evaluate the effectiveness of the Southeast Ohio Teamspeak Voice over IP program, and in the last chapter, to evaluate eight possible communications systems for the National Homeland Security Megacommunity.

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## V. SOUTH EAST OHIO VOIP CASE STUDY

### A. INTRODUCTION

Since 2003, the Southeast Ohio Regional Medical Response System planning region consisting of 21 rural counties has been utilizing a form of Voice over IP, specifically a program called “Teamspeak.”<sup>52</sup> The program was started in Scioto County, Ohio by the Portsmouth City Health Department and the Scioto County Health Department coordinated by the thesis author, the Scioto County Emergency Management Agency coordinated by Kim Carver, the Southern Ohio Medical Center coordinated by Angela Hodge, and the Scioto County Retired Senior Volunteer Program coordinated by Vicki Daily. After a devastating ice storm hit Scioto County in 2003, these agencies started working very closely together on forming a collaborative group to address the post 9-11 requirements affecting all agencies. The author had utilized the voice over IP program called Teamspeak since 1999, and it turned out that the Emergency Management Agency Director, Kim Carver, had utilized the same program, also in online computer gaming. The author then established a Teamspeak server through the Portsmouth and Scioto County Health Departments under a public health infrastructure grant. This server was then opened up to our 21 county Regional Medical Response System region in December 2005. The RMRS Regional Coordinators, Doug Fisher and Betty King, and the author initially worked to add all the health departments, emergency management agencies, and hospitals within the region. In August 2006, the Ohio Department of Health agreed to host a statewide Teamspeak server. The server has functioned very well, only going down two times for just a few hours. A statewide formal rollout is planned for the summer of 2009. During this time, the Southeast Region was able to test the Teamspeak program in a weeklong Pandemic Influenza functional exercise and it preformed well. This chapter will discuss the history of this unique type of VoIP system, its use in Southeast Ohio, and evaluate the program utilizing the criteria developed through the Delphi Study discussed in the previous chapters.

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<sup>52</sup> Triton CI & Associates, “Teamspeak,” <http://www.teamspeak.com> (accessed November 20, 2008).

## B. DEFINING VOICE OVER IP TECHNOLOGY

Voice over Internet Protocol or VoIP, is a broad term used to refer to a number of technologies and software programs that relay voice over the internet. They can be hardware based such as Cisco VoIP phones,<sup>53</sup> Vonage type companies where you plug your existing phone into the internet,<sup>54</sup> or software programs such as Skype.<sup>55</sup> These types of VoIP systems are designed to simulate a telephone call, either one person to one person, or a conference call of a few people up to 100. The type of VoIP program discussed in this thesis is different in that it simulates a radio or intercom system. It still is passing data over the internet for voice communications but is substantially different from the phone types of VoIP. As the few commercial products such as Teamspeak<sup>56</sup> and Ventrilo<sup>57</sup> arose from the online computer gaming community, not much research has been conducted in this type of communication. One recent paper characterizes it as “Multiparty Voice Communications.”<sup>58</sup> By being only half-duplex, or push to talk, the computer program allows up to a thousand people to talk on one server utilizing their computer, microphone, speakers and internet connection as a radio system or virtual intercom. With scalable servers, the system does not have a restriction on the number of users allowing millions. This thesis will be focused solely on Teamspeak, as it is the program being utilized in Southeast Ohio. The most important concept to understand is the difference between full duplex and half duplex. Full duplex is like a telephone call in that it is possible to both hear and speak at the same time. Half duplex is push to talk like a radio system such that it is only possible to be heard when pushing the button, and if two people push the button at the same time, they will “talk over” each other. This is the reason for radio etiquette such as saying over when done speaking. This concept is of

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<sup>53</sup> Cisco, “Voice and Unified Communications,” <http://www.cisco.com/en/US/products/hw/phones/ps379/index.html> (accessed January 29, 2009).

<sup>54</sup> Vonage, “Vonage,” <http://www.vonage.com/> (accessed January 29, 2009).

<sup>55</sup> Skype, “Skype,” <http://www.skype.com> (accessed January 29, 2009).

<sup>56</sup> Triton CI & Associates, *Teamspeak*.

<sup>57</sup> Ventrilo, “Ventrilo,” <http://www.ventrilo.com> (accessed January 29, 2009).

<sup>58</sup> Gabor Papp and Chris Gauthier Dickey, “Characterizing Multiparty Voice Communication for Multiplayer Games,” *ACM SIGMETRICS Performance Evaluation Review* 36, no. 1 (2008): 465.

greatest importance, because half duplex VoIP is not in common use, and is considered inferior; however, it is this low tech concept that allows for thousands of people to utilize the same voice server without overwhelming the bandwidth of the internet connection, as would happen with a full-duplex, or phone call like systems. In other words, a thousand people could be in a conference call, but only when someone speaks is bandwidth utilized, compared to maintaining a thousand fully open channels.

### **C. HOW TEAMSPEAK WORKS**

Teamspeak is a commercially available VoIP program developed for online computer gaming. The MMORGs (Massively Multiplayer Online Roleplaying Games) consists of millions of players worldwide; these players interact within these virtual worlds and require a high level of communication. In other words, they needed very low cost, low bandwidth using, effective, easy, voice communications in real time. Teamspeak was one of the commercial products that filled this need. Utilizing the players' existing computer, microphone, speakers and internet connection, the software allows for multiplayer voice communications. The software consists of two parts, a server based software program and a client based software program. The server software is hosted by a server, much like a server hosting a website. In the case of the Ohio VoIP system, the Ohio Department of Health is hosting the voice server software on one of its servers for the rest of the state. The users then download free client software, which allows them to log onto the voice server. The interface is very simple as shown in Figure 3.

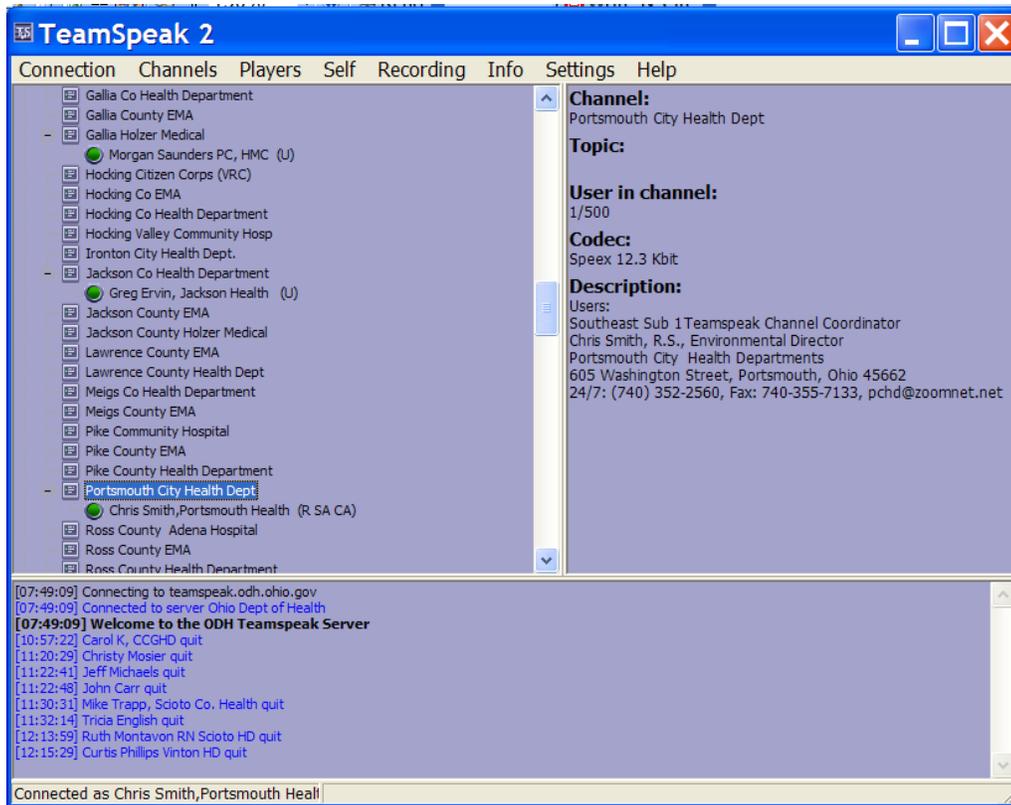


Figure 3. Teamspeak User Interface (Client Software)

Notice the different rooms listed. Each one functions as a channel. The green dots with a name next to them represent someone logged onto the voice server. When multiple people are in the same room, they will only be heard by the people in that room. This allows for multiple conversations to occur simultaneously, and for people to switch easily between rooms. The system is push to talk, meaning just like a traditional handheld radio, it is necessary to push a button to say something, and then release it for others to talk. This may seem like a negative of the system, but actually, this is the key to the whole system working. By only transmitting when someone talks, this system allows for up to a 1000 people per voice server, and with multiple servers, the system is unlimited in capacity. The system has many unique advantages to other types of communications systems, and these will be discussed in the following sections using the communications criteria developed in the Delphi study.

#### **D. EASE OF USE**

Ease of use was the top priority of the people surveyed for this thesis. The Ohio Teamspeak system was begun by less than five people. With simple one page instructions, most agencies and individuals are able to log onto and utilize the system. Appendix A contains a copy of the latest Teamspeak instructions. The system is, however, much easier to use than to install. The main problem encountered by individuals was getting their microphone to work, as many people had not utilized them in the past. These problems have all been troubleshooted over the phone by a couple of untrained individuals. The biggest problem with the installations has occurred with hospitals and other institutions that have strict firewall protocols, but these issues were able to be resolved with opening the proper firewall ports. The Regional Coordinators did find it easiest to do a site visit with each agency, give them a \$10 microphone, install the program and show them the system. Once installed, the system is very stable and easy to use. Since the client software is downloaded free from a commercial site, in an emergency; individuals and agencies can be added to the system by simply emailing them the instructions. Ohio has not experienced a major emergency since the system was implemented so no real data is available on how quickly others can be brought onto the system, but installation can take as little as ten minutes if there are no troubleshooting issues. If more voice server space is needed, it is relatively simple for IT staff to install additional voice server software on any server or even a home computer functioning as a server. Overall, the fact that a few people at a grassroots level were able to set up a functioning statewide voice communications system speaks to the ease of use of the system.

#### **E. INTEROPERABILITY**

Interoperability is the key term for discussing communications within the realm of Homeland Security. The Department of Homeland Security's SafeCom program defines interoperability as:

The ability of emergency responders to work seamlessly with other systems or products without any special effort. Wireless communications interoperability specifically refers to the ability of emergency response officials to share information via voice and data signals on demand, in real time, when needed, and as authorized. For example, when communications systems are interoperable, police and firefighters responding to a routine incident can talk to each other to coordinate efforts. Communications interoperability also makes it possible for emergency response agencies responding to catastrophic accidents or disasters to work effectively together. Finally, it allows emergency response personnel to maximize resources in planning for major predictable events such as the Super Bowl or an inauguration, or for disaster relief and recovery efforts.<sup>59</sup>

While much effort has been done to hook existing systems together, interoperability continues to plague Homeland Security efforts. An alternative is to provide a bridging technology based on a common technology platform utilizing legacy systems already in place. Teamspeak at present works across all major computer systems including Microsoft Windows, Apple Macintosh, and Linux. At present, the system requires a traditional computer system with an Internet connection, making it of limited value in the field, especially during an emergency. There has been much work conducted to provide ad-hoc Wi-Fi clouds during an emergency, and Teamspeak would provide the bridging common VoIP platform. Another possibility is the development of an emergency preparedness version of Teamspeak that works with cell phones. This technology is already commercially available for VoIP programs such as Skype and Google Talk, in the form of a small program called Fring.<sup>60</sup> During an emergency, COWs, or Cellular on Wheels, are units that can be deployed to provide first responders with cell phone service. The GETS, or Government Emergency Telecommunications Service also provides first responders with priority access to cell phone service during an emergency when lines are tied up due to overuse.<sup>61</sup> The issue of how interoperable the Teamspeak system is in Southeast Ohio is hard to define. At this time, Teamspeak does

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<sup>59</sup> United States Federal Emergency Management Agency, *SafeCom*, 1.

<sup>60</sup> Ltd Fringland, "Fring," <http://www.fring.com/> (accessed November 25, 2008).

<sup>61</sup> National Communications System, "National Communications System," <http://wps.ncs.gov/> (accessed November 25, 2008).

not have the ability for people to dial into it with a landline, as can be done with hardwired VoIP phone conferencing systems. This would never be a compatible option with the current program, since Teamspeak relies on visual interface and is purposely half-duplex or push to talk. The Teamspeak system falls short on interoperability with existing systems; however, simply providing the system to each dispatcher provides a bridging communications technology to allow information to be passed over the existing communications infrastructure of each local jurisdiction. Additionally, in the following chapters, a proposed “Universal Communicator” software program is described that would correct many of the interoperability shortcomings of Teamspeak.

## **F. COST**

Cost is probably one of Teamspeak’s greatest advantages. The commercial product was designed to cater to online computer gamers who could not afford high user fees and yearly maintenance charges. The present pricing structure according to the Teamspeak’s commercial website is based on purchasing a license for the server part of the software.<sup>62</sup> A nonprofit organization or individual can download and utilize the server software as long as no more than 100 users are logged into the voice server at a time. The client software is always free to download. Commercial or non-profit agencies wanting more than 100 users must pay a one time server software licensing fee. There is no yearly maintenance fee, but also no product support. The site does, however, have an active help forum and the software is simple enough to not require much technical support. The licensing fee for 250 user server is \$200. This is the amount that the Ohio Department of Health paid for the system they are using. A bonus is that Ohio can have thousands of people access the system, but no more than 250 at a time. This is a much more cost effective user fee structure than the current standard of charging per user account and yearly maintenance fees based on the number of users licensed. A voice server can handle a maximum of a thousand users, so the maximum cost paid would only be a one time fee of \$800 dollars. The system is completely scalable, so additional voice servers can be added. Ohio has 88 counties. If Ohio decided to provide voice server capacity to

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<sup>62</sup> Triton CI & Associates, *Teamspeak*.

even as many as a 1,000 users per county, the cost for an 88,000-user license would be a one-time fee of \$70,400 dollars. This is more than enough users to link an emerging Ohio Homeland Security Megacommunity together in a real time voice communications system. To provide some prospective, look at the Ohio MARCS, Multiagency Radio Communications System. This is a 900 MHz Motorola radio system consisting of handheld radios and desktop units. There are currently 24,700 MARCS radios in use.<sup>63</sup> The State of Ohio has spent about \$248 million to install the system, costs about \$11 million per year to maintain and just the user fees per year are over \$6 million dollars. The MARCS radio system provides field based radio communications statewide, under almost any conditions, so this is not a fair comparison. A program like Teamspeak could not replace the high tech security and redundancy of the MARCS radios for first responders and government agencies, but the staggering difference in costs, shows that a one time cost of \$70,000 dollars to provide virtual radio communications for the Homeland Security Megacommunity, is so inexpensive when speaking about interoperable communications as to score Teamspeak very high on the cost criteria. The proposed “Universal Communicator” software deliberated on in further chapters, could utilize the existing MARCS backbone, but cut user costs and equipment to a negligible amount, as well as allow for the unlimited expansion of users, that is currently impossible with a 900 MHz system.

## **G. RELEVANCE**

This criterion was described by the survey participants as the ability for the system to provide accurate information in a timely fashion. As Teamspeak is a real time voice communications tool, at face value, it would meet these criteria; however, it would be highly dependent on whom and how many people utilized the system. An underutilized system would obviously not provide relevant information. This thesis did not do any user adoptability studies, but this would be a good research topic for the future.

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<sup>63</sup> Ohio Office of Information Technology, “MARCS Facts,” <http://www.oit.ohio.gov/SDD/Marcs/default.aspx> (accessed November 25, 2008).

## **H. INTERACTIVE**

The survey participants expressed a desire for a real time interactive communications system. Teamspeak meets these criteria in that it is a real time interactive communications tool, but it actually exceeds the interactivity of other mediums. Conference calls are one channel with everyone on the call; Teamspeak allows for multiple conference calls to occur simultaneously and for participants to move quickly between them. Furthermore, the system provides the visual aspect so that users can quickly see the names of who is in what channel. For instance, a group of health commissioners from all over Ohio can be discussing a statewide disease outbreak, while regional epidemiologists are discussing specifics in another room, in yet another room Public Information Officers can be discussing coordinating messages to the public and so on. If the health commissioners wanted an epidemiological update, they can switch to the epidemiologist's room, or go in and request an epidemiological representative, come and update all the health commissioners. If two people need to have a private conversation they can move off to another room for privacy. If they find they need a subject matter expert, that person can log onto the system, update everyone at once or move from room to room assisting each group with their unique needs. As the room structure is associated to the server, logging onto the system provides instant access to all the needed conference calls without the need to know the phone number and password. The system is highly interactive in a way very few people outside the online computer gaming community and possibly the military have experienced.

## **I. RELIABILITY**

Reliability is a criterion not scientifically studied in this thesis and would make for a good future research topic. The only observation of the Ohio system is that it has been running for four years now as a side project with almost no IT attention, and has only gone down twice because someone reset the server without restarting the program; both times the server was immediately brought back up. The program could be considered to be highly reliable and has incredible potential for redundancy, backup

voice servers are cheap and easy to set up. The Southeast Ohio Region still rents a backup voice server off a commercial company for a cost of \$120 dollars per year, in case the Ohio Department of Health system goes off line.

The weak point of the systems reliability lies with its dependency on electricity and the internet. This system is geared towards collaboration of the support functions of an emergency, as well as for planning, training, prevention, and preparedness activities, not towards field communications. The internet is becoming more and more redundant, and is also becoming an essential part of emergency response. However, at this time, the Teamspeak program in Ohio is only as reliable as the internet. The system can be used with a laptop with wireless internet, but again it is completely dependant on some form of internet. The proposed “Universal Communicator” software addresses many of these problems.

## **J. ACCESSIBILITY**

This criterion was described by the survey respondents as the ability of a system to be easily accessible, be inclusive and available. This criterion is in opposition to security. The higher the security protocols, the lower the accessibility. Nine out of 22 participants rated accessibility as important compared to 6 out of 22 participants listing security. The Ohio Teamspeak server is very accessible with the corresponding loss of security. Since the system was implemented at a grassroots level, it was intentionally left as an open system so all members of the Ohio Homeland Security Community including hospitals, volunteer group leaders, church officials, first responders, and government agencies could utilize it. Security will be talked about in a following section, but as the Ohio system stands now, it is highly accessible, to the point of weak security and governance. Knowledge of the server address and simple password makes it possible for anyone to log onto the system, and as it was viewed as a test server, the Ohio Department of Health has made no restrictions on who can utilize it. Participation has grown mostly by word of mouth and selective recruiting. Maintaining the system based on trust has provided the opportunity to keep the system very accessible, but it is probably luck that there have been no issues in these four years regarding unauthorized users.

## **K. CAPACITY**

The survey participants expressed a desired criterion as a system with a high capacity, not dependant on high bandwidth and that would support heavy use, have a high Quality of Service and be scalable. It is important to understand that Teamspeak is half-duplex. This means push to talk, just like a radio. It also means it is possible to talk over someone. Thus, if two people push their buttons at the same time, both will be heard as being garbled over each other. The advantage is that by being half duplex, bandwidth is only being utilized when someone is speaking. Therefore, if 100 people are in a traditional hardware VoIP conference call, 100 simultaneous connections are being kept open and using a tremendous amount of bandwidth. Since Teamspeak is push to talk, it is possible to have a thousand people utilizing the server, but they only utilize bandwidth when they push the button. It is difficult to compare the multiple types of communications because they are so different. Some people may consider that needing to push to talk and possibly talking over someone is a big downgrade in quality, but others would argue that dealing with conference calls that spend half the time trying to get people to mute their telephones is also a negative. Consequently, to look just at Quality of Service as a measure of how good someone sounds on the system, bandwidth requirements become the limiting factor. Teamspeak was developed for online computer gamers who need bandwidth for their computer games, so Teamspeak has good Quality of Service utilizing broadband but voice quality degrades when utilizing dial-up modems or satellite modems. In desperate situations, Teamspeak could function on dial-up but broadband is recommended. However, since it is half duplex, it has a tremendous advantage over hardware VoIP that cannot handle more than 50 people before starting to degrade in service. Another future research opportunity would be to study the Quality of Service of Teamspeak and compare it to other mediums. For this paper, Teamspeak is being given high marks on its ability to accommodate large amounts of users, but low marks on Quality of Service.

## **L. UNIFIED SYSTEM**

The survey participants described this criteria as a single common system, single point of access, a common system used by the whole community. This is certainly the use Teamspeak has served in Southeast Ohio. No compatibility issues occur by having everyone on a single system. In the case of Southeast Ohio, the system is utilized as a communications bridge. In other words, if there is a conference call, users utilize Teamspeak to look for people missing from the call, and give them the number and password information. They also use it to inform others that an important email was sent, or to tell someone they sent them a fax. This unified system has assisted Southeast Ohio in meeting its communications capabilities for pandemic influenza planning, for instance. The results of their week long functional exercise will be discussed in a later chapter.

## **M. SECURITY**

Surprisingly, only 6 out of 22 survey participants chose security as one of their top five criteria. Security versus accessibility continues to be an issue, especially when discussing it in the context of a National Homeland Security Megacommunity. Bringing on volunteer groups, church leaders, governments of all levels, and private businesses obviously raises issues of how these people interact with Homeland Security. This will be discussed further in the last chapter. Therefore, the current focus will only be on the following three aspects of security: system security, easedropping and clearance of users.

Evaluating Teamspeak's system security is difficult. It is easiest to think of it like a website. The website or voice server can be hacked, but this will not affect the individual users looking at the site or talking on the voice server. The Ohio Department of Health located the voice server software in a DMZ, a partition of the server outside the firewall. This is done to provide a layer of protection against hacking. The Teamspeak software is mostly utilized for gaming so at this time there is not much reward in hacking a Teamspeak server other than vandalism. If this happens to the Ohio Teamspeak server, a back up is available, and a copy of the server can be restored after the hacked site is

down. The next version of Teamspeak due out anytime, is supposed to offer a more secure system. In four years, Ohio has not experienced an incident, but is probably not a target. In system security, Teamspeak is rated the same as a website on security.

The next aspect of security is eavesdropping or will someone overhear conversations. The version presently being used by Ohio is not encrypted. This means that just like unencrypted email or visiting an unsecure website, voice data can be intercepted over the Internet. The Ohio Teamspeak community knows this and switches to another means of communication like a landline if discussing secure issues. Teamspeak is not a secure means of communication. However, the company that produces Teamspeak is releasing an encrypted version of Teamspeak that will solve this issue. It must be said though that any information that travels on the Internet can be intercepted.

The last issue of security is who is allowed on the system. Teamspeak allows for user accounts to be set up, so different people can have different levels of access. For instance, some people may only be able to enter the lobby channel, others would have more access. Different rooms can also be password protected to prevent unwanted people entering. For instance, the police chiefs could have a password protected room so they could ensure only they would be in the room. Ohio has chosen for now to permit everyone access to all rooms. If a private conversation is desired, then it is always possible to pull the screen up and watch to make sure others do not enter the room. In a book called “the Speed of Trust” the author discusses the dividends if a trust environment is possible over a policy environment.<sup>64</sup> The Ohio Teamspeak model has thrived on a trusted community that follows simple etiquette rules such as announcing when entering a room where other people are having a conversation. By not needing to assign individual user accounts to each user, and deal with the endless resetting of forgotten passwords, or deciding who gets what privileges, a self regulating environment has contributed to the

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<sup>64</sup> Stephen M. R. Covey, *The Speed of Trust* (New York, NY: Free Press, 2006), 354.

ease of the program. Eventually, Ohio will probably set up a parallel secure voice server for use when security is needed. Keeping an open system has been very important to Southeast Ohio in forming a collaborative system across many disciplines.

#### **N. STANDARDIZATION**

The survey participants described these criteria as ensuring proper training and using common language. In Ohio, no standardized training has been conducted. The system is easy enough to use for anyone with basic computer skills. As for language, radio etiquette is not utilized as users rely on common etiquette such as if two people talk at once, one person backs off, or tells the other to “go ahead.” A basic tenant of Incident Command is to use common language to prevent problems with individuals using agency specific codes that are not universal. This is more a function of protocol and governance as compared to anything intrinsic in the program.

#### **O. PUBLIC TRANSPARENCY**

The Teamspeak program does have a record feature, but must be activated by someone within the room, and stored to their local computer. These tend to be large wav files, so Southeast Ohio sometimes uses it to record a conference call, but then burns the file to a CD-ROM so it does not take up space on their hard drive. Teamspeak does not have any transparency feature equal to the recording abilities of advanced 9-11 call centers.

#### **P. PHYSICAL DURABILITY**

The survey participants noted this criteria as the ability of the system to withstand environmental conditions, such as a handheld radio that is waterproof. As Teamspeak is a computer system, it is not at all physically durable, although there are ruggedized laptops, but these are not commonly utilized. Teamspeak is not meant to function as a field communication device at this time. The proposed “Universal Communicator” software on a ruggedized cell phone would help this issue.

## **Q. PHYSICAL FLEXIBILITY**

The survey participants noted these criteria as the ability of a system to be utilized with Personal Protective Equipment, or how portable it is, such as handheld radios. Teamspeak is not physically flexible. At this time, a laptop with microphones and speakers is needed, not making it very flexible. Utilizing a laptop with a cell phone modem does allow for use in a vehicle or command post for instance, but this would still not be a highly flexible tool. Future versions of Teamspeak that run off a cell phone would provide for more flexibility, but not to a great extent in a Personal Protective Equipment environment.

## **R. ELECTRICAL DEPENDENCY**

Teamspeak is completely dependent on electricity or batteries. Laptops are becoming more widely used and can be recharged in a car, but like radios and other communications devices, are dependent on the electrical grid. This can also be addressed with the proposed “Universal Communicator” program.

## **S. MULTI-CHANNEL CAPACITY**

Teamspeak has a very flexible a channel or room system. Up to 500 channels can be provided, and adding new channels as-hoc is extremely easy for anyone given permission to edit them. This provides unique capabilities within the Teamspeak system. For instance, if a disaster needs a food distribution channel, it can simply be added, or if a special noon all hands meeting is called, a room can be titled for that purpose. This is unlike radio channels that may have a large capacity to add talk groups, but must be preprogrammed into the radios. Another advantage the rooms in Teamspeak have is that it is possible to see who is in what channel. Multi-channel radio systems have the disadvantage that everyone must be informed where people are gathering, and if the need to spread out to different channels occurs on the fly, it is difficult for latecomers to find their needed contacts.

## **T. COVERAGE AREA**

This criterion is more pertinent to radio systems, but as long as the Teamspeak user has access to the Internet, the coverage is worldwide. It is common for online computer gamers to interact with players from countries all over the world, with very little loss of sound quality.

## **U. SECURE VERSUS OPEN TOGGLE**

This is more of a feature than a criterion, but is thought to be worth examining. Security is always a balance. The Intelligence community may want to communicate, for instance, with other agencies but if they do not have the clearance and equipment, it is not possible, and switching from communications medium to communications medium can be tedious. At this time, the Ohio Teamspeak system does not incorporate this feature, and since the encrypted version of Teamspeak has not been released yet, there is no reason to add it. An encrypted version of Teamspeak with user accounts and secure rooms would allow users to utilize a common system, but at differing levels of security.

## **V. MONITORING 24/7**

At this time, the Ohio Teamspeak system is not monitored 24/7. If an alert goes out by other means, people gather on the system ad-hoc, or a message is set out for people to meet at a certain time. The technology, however, does allow for easy 24/7 monitoring. Southeast Ohio is hoping to incorporate the Teamspeak system into the 9-11 dispatch centers and the Ohio's fusion center is bringing the system online this year.

## **W. SOUTHEAST OHIO PANDEMIC INFLUENZA FUNCTIONAL EXERCISE**

The Southeast Ohio Regional Medical Response System Region conducted an eight-day pandemic influenza functional exercise from January 4-11, 2007. This Southeast region consists of 21 rural counties, without a major metropolitan area. This region had to improve communications across this vast geographical area between its hospitals, emergency management agencies and health departments after a failed

functional exercise in 2006. The region implemented and tested Teamspeak during this exercise to see if it could improve communications. The 2007 exercise consisted of the southern 10 counties playing with the northern 11 counties evaluating. The interoperable communications objectives were met this time, with the change being attributed to the Teamspeak program. Teamspeak was utilized for daily briefing, ongoing daily collaboration, and a bridging technology between conference calls, faxes and email. Over all, a key point of the exercise was listed as being that “regional crisis communications have improved and were interoperable i.e., Ohio Public Health Communications System (OPHCS), Teamspeak, and ECOMM Talk-groups for MARCS,” according to the after action report.<sup>65</sup> MARCS is the Ohio Multi-Agency Radio Communications System, a 900 MHz system. It was also noted in the report that “Teamspeak was pointed out on several occasions to be very helpful with this year’s exercise communications. Public health departments and several other partners like Ohio University and hospitals could communicate with good interoperability. Hospitals especially need targeted for installation and use of Teamspeak in the next year.”<sup>66</sup> In the communications evaluations summary section, the after action report stated that, “the evaluations and comments overall were in agreement that the crisis and risk communications improved significantly over the past year. Much of the improvement was credited to the use of Teamspeak (computer voice-over-IP) capability.”<sup>67</sup> Further research into the program needs to be conducted, but preliminarily, Teamspeak type VoIP appears promising.

## **X. CONCLUSION**

The Southeast Ohio RMRS Region has utilized the Teamspeak program for four years with great success. The Ohio Department of Health has maintained a stable system for two years. This case study of the Southeast Ohio use of Teamspeak showed that the

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<sup>65</sup> Southeast Ohio Regional Steering Committee, “Southeast Ohio Regional Pandemic Influenza Functional Exercise: After Action Report and Corrective Action Plan” (After Action Report, Ohio, 2007), 4.

<sup>66</sup> Ibid., 22-23.

<sup>67</sup> Ibid., 24.

system rated high in 13 of 18 criteria chosen by the Delphi Survey participants, and did very well in a regional eight-day pandemic influenza functional exercise. Much more research is needed into this type of VoIP system.

## **VI. NATIONAL COMMUNICATIONS SYSTEM**

### **A. INTRODUCTION**

The purpose of this thesis is to examine the plausibility of a national real time voice communications system. At this time, state interoperability communications plans are focused on first responders and worst-case scenarios, and as such, this can be attributed to a lack of vision. A nationwide system seems impossible. However, online computer gamers have shown that a worldwide system is possible at very little cost, and the Southeast Ohio Region has shown that such a system is beneficial to the Homeland Security environment. This chapter will examine and compare Teamspeak with other possible communications systems that may be appropriate to a national Homeland Security Megacommunity.

### **B. DELPHI SURVEY QUESTIONS AND RESULTS: ROUND 1**

The first email consisted of the following three questions. At this time, the participants did not know who the other agencies were in the survey pool:

- The broad concept of a nationwide homeland security community has been defined many ways since September 11, 2001. Who do you consider to be members of the homeland security community? Feel free to provide any opinions you have on the concept of the homeland security community.
- Thinking about the homeland security community, what types of systems exist, if any, to support communications across the membership of the community? Please provide positives and negatives for any existing systems.
- Considering either an existing, possible or future communications system, what would be your top five criteria for the system? For each criterion, please provide an explanation.

This section will focus on the second question to reach a consensus of what communications systems are available to the Homeland Security Community. As this survey was only conducted with 28 people, it is not meant to be comprehensive but to provide a qualitative framework for evaluating the Southeast Ohio Voice over IP system. Table 5 lists the results.

Table 5. Raw Communications Systems Data

<i>Communications Systems</i>	<i># of Respondents</i>	<i>Broad Categories</i>
Radios (800, 900 MHz, VHF)	12	Radios
Telephones (Conference Calls)	9	Telephones
Meetings/Committees/Emergency Operations Center	7	Physical
Homeland Security Information Network (HSIN)	7	Internet
Internet/Web/Computer Networks	7	Internet
Cell phones	5	Cell phone
Conferences/Seminars	4	Physical
Email	4	Internet
Law Enforcement On-Line (LEO)	4	Internet
State Web Information Portals/Xebec	4	Internet
HAM Radio Systems	3	Radios
Mass Media	3	Media
Voice Over IP	3	Internet
Interagency Training/Exercises	2	Physical
ICS/NIMS	2	Physical
Chat Rooms (Text Based)	2	Internet
Fax	1	Telephones
Reverse 911	1	Telephones
Fusion Centers	1	Physical
Loudspeakers/Sirens	1	Physical
Personal Relationship	1	Physical
Publications (Weekly Bulletins, Journals)	1	Media
Intelligence Information Reports	1	Media
MS Office Groove (Collaborative Software)	1	Internet
HSDN (Homeland Secure Data Network)	1	Internet
Regional Sharing Systems-(RISS)	1	Internet
SIPRENET (Secret Internet Protocol Router Net)	1	Internet
Homeport (Web Community)	1	Internet
Defense Connect Online(Video Conf, Text Chat)	1	Internet
Video Conferencing	1	Internet
Text Messaging	1	Cell phone
Emergency Mobile Communications Systems	1	All

These responses were provided without the participants knowing the community context. This presents an opportunity to create an unbiased list of communication media.

### **C. DELPHI SURVEY QUESTIONS AND RESULTS: ROUND 2**

In between rounds 1 and 2 of the survey, a major hurricane struck Galveston, Texas. As the survey pool consisted of many first responders, 6 people dropped out of the survey, leaving the survey pool at 22. Since this study is qualitative more than quantitative, it should not interfere with the results. The author will, however, indicate any irregularities it may have caused.

The second email consisted of the following three questions, at this time, the participants were given a list of the other participants by agency and title, and the raw data listed above. This was to first let them know who the survey considered part of the Homeland Security Community, who the participants considered members of the Homeland Security Community, and to provide context:

- Defining the National Homeland Security Community: Utilizing the following data, are there any survey participants or survey responses that you do NOT consider to be part of the Homeland Security Community and why? BE HONEST. Keep in mind that we are going to be putting together a list of communication criteria for a bridging national communications system for the Homeland Security Community, so think about your answers in that context. Are there any large categories that we have forgotten? Please feel free to provide any comments or insight into the idea of a broad Homeland Security Community, in the context of a terrorism/all-hazards approach.
- Defining the Communications Systems: Utilizing the following data or other thoughts, pick your top five choices for a communications system that might be appropriate for the Homeland Security Community as defined above. As for citizens, do not think about public information or mass media, citizens would be part of this system if they had reason, such as part of a volunteer group, or a subject matter expert. Also, start thinking about more than just the hot zone and command/control, also consider coordination of resources and situational awareness of an incident. For example, how did the rest of the broad Homeland Security Community outside the gulf coast communicate during Hurricanes Katrina or Rita, or the country after 9-11 and the 2001 Anthrax Bioterrorism attacks? Besides picking your five top choices, please feel free to provide your comments

or thoughts on the subject. This method provides each discipline to contribute an equal contribution to the final criteria, thereby representing their agency.

- **Communications Criteria:** Utilizing the following data or other thoughts, choose your top five criteria for a communications system for the broad Homeland Security Community, as is starting to be defined in Question Sets 1 and 2. Also, feel free to provide any comments or observations you have about the subject. **IMPORTANT:** Do not think about a replacement of systems in place, think about a bridging communications system, that we have, need to develop, or if you do not think one is needed please indicate.

This section will focus on the third question to reach a consensus of what communications media are utilized or would be good to utilize for a National Homeland Security Megacommunity. In this second survey, the participants were provided a list of how the other people in the survey responded to what communications media are available and to provided context as to their uses. They were asked to pick their top five choices from the list in Table 5. Table 6 lists the results. The table also notes the compatibility of use as a national system.

Table 6. National Communications System’s Compatibility Data

#	<i>Communications Systems</i>	<i># of Responses</i>	<i>National System Compatibility</i>
1	Radios (800, 900 MHz, VHF...)	15	Not possible for national system
2	Internet/Web/Computer Networks	11	Deleting as it is redundant
3	<b>Homeland Security Information Network (HSIN)</b>	10	Yes
4	<b>Cell phones</b>	10	Yes
5	<b>Telephones (Conference Calls)</b>	9	Yes
6	Emergency Mobile Communications Systems	5	Not possible for national system
7	Mass Media	4	Not interactive
8	<b>Voice Over IP</b>	4	Yes
9	<b>Video Conferencing</b>	4	Yes
10	<b>Email</b>	3	Yes
11	State Web Information Portals/Web EOC	3	Deleting redundant with HSIN
12	HAM Radio Systems	3	Requires too much licensing
13	ICS/NIMS	3	Not a communications system
14	Chat Rooms (Text Based)	3	Adding to HSIN Capabilities
15	Fusion Centers	3	Not a communication system
16	Meetings/Committees/Agency Hub/EOC	2	Not really possible for national
17	Interagency Training/Exercises	2	No a communications system
18	Reverse 911	2	Not interactive
19	Loudspeakers/Sirens	2	Not interactive
20	Personal Relationship	2	Not really a com system
21	Intelligence Information Reports	2	Can not be shared
22	Conferences/Seminars	1	Deleting as it is redundant

#	<i>Communications Systems</i>	<i># of Responses</i>	<i>National System Compatibility</i>
23	Law Enforcement On-Line (LEO)	1	Law only
24	Publications (Weekly Bulletins, Journals)	1	Not interactive
25	Text Messaging	1	Adding in with cell phones
26	<b>Fax</b>	0	Yes
27	Groove	0	Deleting as it is redundant
28	HSDN	0	Deleting as it is redundant
29	Regional Sharing Systems-(RISS)	0	Deleting as it is redundant
30	SIPRENET	0	Deleting as it is redundant
31	Homeport	0	Deleting as it is redundant
32	Defense Connect Online	0	Deleting as it is redundant

After combining systems that were redundant, were not interactive or not possible for use as a national system, there are seven systems, plus one proposed by this thesis, left for analysis. These systems are:

- Homeland Security Information Network (HSIN)
- Cell phones with text messaging
- Telephones (Conference Calling)
- Voice Over IP (Teamspeak Type)
- Video Conferencing
- Email
- Fax Machine
- Universal Communicator (Proposed)

These systems will be graded according to the previously established weighted communications criteria.

#### **D. UNIVERSAL COMMUNICATOR (PROPOSED)**

During the writing of this thesis and after discussing the possibilities with a graduate student, Steven Lieberman, at the Naval Postgraduate School,<sup>68</sup> a new software program is being proposed that would take the Teamspeak concept designed for computer gamers, and design a program to meet the needs of the national Homeland Security Megacommunity in the areas of prevention, preparedness, response and recovery. The first hurdle is preventing the host voice server from becoming bottlenecked from too

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<sup>68</sup> Steven Lieberman and Chris Smith, Universal Communicator Discussion, December 13, 2009.

much bandwidth traffic. Mr. Lieberman proposed using peer-to-peer networking along with torrent protocols to bypass the need for a central voice server. The author was concerned about losing the aspect of centralization and the ability to exert control over the system. A main advantage of Teamspeak is that it is a persistent environment that does not require the user to know all the other users' contact information. The compromise developed was to have the voice server maintain the template for the voice chat rooms and who is in what room. The actual voice communication, however, would function peer to peer. This solution has many advantages. The template information and user placement requires very little data transfer, so would be unlikely to cause a bandwidth bottlenecking problem. This method also allows the users locally to function off the last template received if cut off from the central voice server. In this way, first responders isolated in a certain region could still communicate with each other.

Mr. Lieberman also indicated that every cell phone has a port for attaching a small, very inexpensive radio antenna to allow cell phones VoIP program to operate still under the worst of conditions in a 1-2 mile radius. The electrical problem for the cell phones is easily solved with car chargers in blackout situations, and worst case scenarios where gasoline is in short supply, inexpensive solar chargers now commonly available for cell phone recharging. Other problems that can be solved for first responders are the use of ruggedized cell phones, as well as hands free devices for use with suits such as personal protective equipment used for HazMat.

The system would function best through a computer or laptop, but would be very effective on a cell phone, and as a last resort, telephones could call into the voice server as well. The telephone aspect is slightly more problematic as one of the key features of the program would be the ability to see the voice chat room list, and what person is in what room. The issues are that the telephone caller would not see the rooms, but would have to be given voice prompts for which rooms are available and could alternatively push for a list of who is in that room. The issue would be when there were 100 or so people in a room, but not wanting to listen to them all, but there are numerous fixes for that issue. The other issue is that the telephone would have to work off voice activation, as compared to the computers and cell phones that would be push to talk.

Overall, the proposed Universal Communicator is completely plausible and could be produced either free through a volunteer community of programmers, or could be commissioned by an agency like the Department of Homeland Security at very little cost since the technology needed is already available open sourced. The key factor is to have the program available as a free download. A major obstacle of many communications solutions is the high cost of user fees and maintenance agreements. The control would be maintained by the entity hosting a voice server template. Through this template, an agency like the Department of Homeland Security, could provide a national radio like system to the entire national Homeland Security Community, and maintain aspects that were open for people like volunteers and such and other areas that had user controls for security and privacy, as well as for setting up strict governance. Encryption would be a basic function of the program providing security and privacy, as well as allowing the host agency to record as much as would be required to meet public transparency. The technology is available, and this could be a possible solution to the need for a national Communications System. However, the system would have to remain simple and free to the users. This is not much different from the Department of Homeland Security hosting a website, the public can enter one area, other areas are controlled, and the only difference is that instead of exchanging text information, it would exchange voice data.

## **E. METHODOLOGY AND RESULTS**

Utilizing the weighted communications criteria from Table 4, each of the eight communications systems was assigned a 0 or a 1 for each of the 19 communications criteria. A system that scores a 0 is considered to rank poorly for that criteria and a system that scores a 1 is considered to rank excellent for that criteria. This is based solely on the author's experience and collected research. While this is opinion, utilizing a poor versus excellent rating reduces the error as compared to trying to assign a 10-point scale to the system. The reasoning for each assumption is provided in Appendix B. The purpose of this thesis is to provide a preliminary evaluation of the plausibility of a national communications system; further research is warranted to evaluate these systems utilizing a comprehensive research method such as surveys or case studies. An additional

reason at this time to base the rankings on the author’s assumptions, research and observations is that some of the communications systems being evaluated are not widely used or understood, and would result in a biased ranking of systems favoring systems familiar to the survey participant.

After assigning the 1s and 0s to all the criteria for each communication system, the raw score was multiplied by the weight of the criteria. The now weighted score for each of the 19 communication criteria were then added together to provide a raw score for each of the eight communications systems. The scores were then compared utilizing standard grading criteria with a perfect score being 100%. Table 7 lists the results.

Table 7. Final Communications System Scores

#	<i>Communications Systems</i>	<i>Score (100% Possible)</i>
1	<b>Universal Communicator (proposed)</b>	99.1%
2	<b>Voice Over IP (Teamspeak)</b>	81.6%
3	<b>Homeland Security Information Network (HSIN)</b>	69.9%
4	<b>Email</b>	68.7%
5	<b>Cell phones</b>	58.8%
6	<b>Telephones (Conference Calls)</b>	51.8%
7	<b>Fax</b>	42.2%
8	<b>Video Conferencing</b>	26.4%

The results show that that Teamspeak, the system being used now in Ohio, scored 81.6%, which is considerably higher than the leading competitors. The proposed “Universal Communicator” that consists of the software program working across cell phones and telephones is thought to be an almost ideal system, and is completely plausible with today’s technology. This thesis, however, has not addressed many additional issues such as user acceptance, which requires further research and testing.

## F. CONCLUSION

The purpose of this thesis was to answer the question of whether a national Homeland Security Megacommunity real-time voice communications system is possible. Through the use of surveys, a wide variety of representatives of the national Homeland Security Community were asked to help define the Homeland Security Community, what communications systems are now available, and what criteria are important to them for a national Homeland Security communications system. The results were used to develop a

set of weighted criteria utilized to evaluate eight communications systems. These eight consisted of six systems chosen by the survey participants, the Voice over IP system, Teamspeak, utilized by Southeast Ohio, and a proposed Universal Communicator. The results showed that Teamspeak scored 11.7% higher than its leading competitor, the Department of Homeland Security's Homeland Security Information Network (HSIN). Please note that the HSIN system's main function is to provide an information sharing network. The HSIN system, in this thesis, was only evaluated for its real-time communications contributions. This thesis in no way evaluates the HSIN system based on information sharing. The proposed Universal Communicator, however, scored a 99.1% out of 100%, showing that the concept at the very least shows that a national radio like system is plausible and affordable.

The evidence that Southeast Ohio and millions of computer gamers worldwide have been able to utilize Teamspeak successfully and the technological plausibility of a "Universal Communicator" shows that a national Homeland Security Communications system is entirely plausible and cost efficient.

This thesis will hopefully be a starting point for more research into areas such as user acceptability and a questioning of this nation's present interoperable communications strategy based heavily on radios for first responders in worst case scenarios. While much research has been conducted to show that communications issues are based on interagency cultural issues as opposed to technological issues, the author proposes that more research is needed into the emerging VoIP technological innovations that would help bridge these cultural gaps, much as email has fundamentally changed the hierarchical communications culture of the past. Without exploring the possibilities of a national system, it seems shortsighted to dismiss it as being an unrealistic goal. September 11, 2001 and Hurricanes Katrina and Rita are just the obvious examples of the continuing inability to communicate within the expanded Homeland Security Megacommunity, despite the billions of dollars spent nationwide to improve interoperable communications. To meet the spirit of the 2007 National Homeland Security Strategy, it is vital to embrace all members of the homeland security community, including federal, state, tribal, and local government, first responders, the private sector,

faith-based organizations, non-profit agencies, volunteer groups and our citizens. This requires the involvement of all partners in the attempt to provide a communications system. The author hopes this thesis will be a first step towards exploring the possibilities.

## APPENDIX A. OHIO TEAMSPEAK INSTRUCTIONS

### 1. Software Installation

- a. Go to [www.teamspeak.com](http://www.teamspeak.com), download “TS2 Client,” and install.
- b. Add to the Start Menu by pushing “start” at the bottom of your desktop, then “all programs,” then highlight “startup,” then double click “startup,” place a copy of the Teamspeak shortcut in the startup folder.
- c. Start TS program, Hit “connection,” Then hit “connect”

### 2. Add both servers by right clicking over the word server and choose “add server”

- a. ODH Server
  - i. Label: ODH
  - ii. Server Address: teamspeak.xxx.xxxx.xxx or xx.xxx.x.xxx:8767
  - iii. Nickname: First Last County Discipline
  - iv. Anonymous/Password: xxxx, Check Auto Reconnect
  - v. Default Channel: Southeast Region Sub 1, Default Sub Channel: Personal Choice
- b. Backup Server
  - i. Label: Backup
  - ii. Server Address: xxx.xxxxxx.com:8774 or xxx.xxx.xx.xxx:8774
  - iii. Nickname: First Last County Discipline
  - iv. Anonymous/Password: xxxx, Check Auto Reconnect

### 3. Hit Connect and then Configure

- a. Choose “settings” at top, then “sound input/output settings,” Choose “push to talk” then “set,” Then select a button you will use to push to talk. (Choose f9 if you can’t decide)
- b. Choose “settings” then “options” then “sound notifications” then check “disable all sounds” (Talented individuals can add in the ones they want)
- c. Use your microphone and speakers, and push your button to talk.
- d. Troubleshooting microphone:
  - i. If your microphone worked in the past, but for no reason quit, try closing completely out of Teamspeak and logging back in.
  - ii. Double click the speaker icon on your start bar, to bring up the volume sliders.
  - iii. Click “options” and make sure Advanced Controls is checked
  - iv. Click “options” then “properties” then make sure microphone is marked.
  - v. Back on sliders, make sure microphone sliders are all the way up, the mute button under microphone should be checked, and push advanced & check boost.
- e. Trouble shooting a firewall on a network: Unblock port 8767 on your firewall, TCP and UDP.

### 4. Teamspeak Usage

- a. Install at home, on laptop, on as many computers as needed.
- b. During initial rollout, leave Teamspeak on in the background, use quiet room if needed.
- c. Hints:
  - i. You can move to a room by double clicking it, or you can drag someone else
  - ii. Broadcasting large meetings: Switch from “push to talk” to Voice Activation.
  - iii. You can send text messages, Right click over their name.
- d. Teamspeak Etiquette:
  - i. Ask permission before dragging someone to another room.
  - ii. When you enter a room with people talking, make your presence is known.
  - iii. If two people start to speak at once, one person keeps talking; the other backs off, or if what you are saying is not important say “go ahead.”
  - iv. If using recording feature, it shows an “r” next to your name but still announce.
- e. Invite as many people to Teamspeak as you want, but use discretion for trustworthiness.

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## APPENDIX B. COMMUNICATIONS CRITERIA EXPLANATIONS

<b>Homeland Security Information Network</b>		
<i>Communications Criteria</i>	<i>Reasoning</i>	<i>Score</i>
Interoperability	High-Uses existing computer and internet system	1
Reliability	High-Websites tend to be very stable	1
Affordability	High-Websites are not expensive to develop or operate	1
Relevance	Low-The general consensus is that HSIN does not have the information that people need. This is traditionally a problem with secure user based websites.	0
Ease of Use	High-Basic Computer skills are all that is needed	1
Security	High-Secure website with user permissions	1
Interactive	Low-there is little real-time interaction for communication, but information exchange is high	0
Accessibility	Low-Since Security is high, the system is not as accessible	0
Standardization	High-Uses common language	1
Capacity	High-Websites can handle a lot of traffic and can be spread across servers if needed	1
Secure versus open Toggle	High-a public section of the website with a secure section after login.	1
Unified System	High-This is one nationwide system	1
Physical Durability	Low-Computer/Laptop Based	0
Physical Flexibility	Low-Computer/Laptop Based	0
Electrical Dependency	Low-It is dependant on electricity and batteries, as well as internet	0
Coverage Area	High-Worldwide coverage with the internet	1
Monitoring 24/7	Low-This is not an always on system	0
Public transparency	High-Backups of all website content can be maintained	1
Multi-Channel Capacity	High-forums and such have unlimited channel capacity	1
<b>Cell phones with text messaging</b>		
<i>Communications Criteria</i>	<i>Reasoning</i>	<i>Score</i>
Interoperability	High-Cell Phones are standardized	1
Reliability	High-Cell Phone systems are traditionally reliable, even though they are not during an emergency	1
Affordability	High-Most people have cell phones now, and texting is not expensive	1
Relevance	Low-The number of the person being contacted needs to be known, this makes it less desirable for a national communications system, but is good for mass alerting	0

Ease of Use	High-Cell phones are very easy to use, but it is difficult to communicate with large amounts of people if you don't have large lists of contact numbers	1
Security	Low-Most cell phones can be listened to with the right equipment, and there is no user vetting	0
Interactive	Low-While two people can talk easily, large groups of people trying to interact is difficult	0
Accessibility	High-This is high because security is low, no vetting	1
Standardization	High-Common language is used	1
Capacity	Low-Really only best for two people talking, adding a lot more on conference call can be difficult on cell phones	0
Secure versus open Toggle	Low-Cell phone conversations can be overheard with the right equipment	0
Unified System	Low-This is really one to one talking, and possibly mass alerting, not much potential for a national communications system	0
Physical Durability	Low-Cell phones are traditionally susceptible to environmental factors	0
Physical Flexibility	High-With Bluetooth and only talking to another person, cell phones can be used under many constraints	1
Electrical Dependency	Low-Cell phone batteries die, and are dependant on electricity for recharging	0
Coverage Area	High-Worldwide cell phone coverage	1
Monitoring 24/7	Low-Cell phones are not an always on system	0
Public transparency	Low-Other than the Federal Government, Cell phone conversations are not public record	0
Multi-Channel Capacity	Low-you can not switch between channels on a cell phone	0
<b>Telephones (Conference Calls)</b>		
<i>Communications Criteria</i>	<i>Reasoning</i>	<i>Score</i>
Interoperability	High-Phones are standardized	1
Reliability	High-Phone systems are traditionally reliable	1
Affordability	Low-Conference calls are paid for by call or through a contract and can be very expensive	0
Relevance	High-Conference calls are used to provide important information	1
Ease of Use	Low-The phone number and password are needed. People also traditionally have trouble muting their phones	0
Security	High-Landlines are traditionally considered more secure than cell phones. Also, a password is needed to access the call	1
Interactive	Low-This system is not always on, so when group gets together, time is limited	0
Accessibility	Low-This is due to the high security, since the password is needed, the system is not as accessible as others	0
Standardization	High-Uses common language	1

Capacity	Low-Traditionally conference calls are limited to 100 people, and it gets difficult to hold conversations	0
Secure versus open Toggle	Low-Due to cost and limited capacity an open system is not feasible	0
Unified System	Low-There are lots of conference call companies, also billing would prohibit a nationwide system	0
Physical Durability	Low-Phones are usually in controlled environments and cell phones if used are not very durable	0
Physical Flexibility	Low-Cell phones are normally problematic when using conference calling especially if doing other tasks	0
Electrical Dependency	High-Phones tend to work when power is out	1
Coverage Area	High-Worldwide coverage with the phone system	1
Monitoring 24/7	Low-This is not an always on system	0
Public transparency	High-Conference calls can all be taped	1
Multi-Channel Capacity	Low-A different conference call room and password is needed, and must be set up and paid for	0
<b>Voice over IP (Teamspeak) Communications Criteria</b>	<b>Reasoning</b>	<b>Score</b>
Interoperability	High-Uses existing computer and internet system	1
Reliability	High-Very simple program, low tech, and redundant servers are easy to set up	1
Affordability	High-Cost is only a one time fee of \$250 for 200 connection server	1
Relevance	High-Information is real time, and is as relevant as present radio systems	1
Ease of Use	High-Only requires basic computer skills	1
Security	Low-It would be time consuming to vet users, and present system is not encrypted	0
Interactive	High, This is talk in real-time	1
Accessibility	High-This is high because security is low, no need to vet	1
Standardization	High-Uses common language	1
Capacity	High-System is completely scalable with computer servers. A 1000 people per servers with unlimited number of servers possible.	1
Secure versus open Toggle	Low-System has the ability to toggle user permissions, but the system is still not encrypted	0
Unified System	High-This is a system meant to be used by the entire Megacommunity	1
Physical Durability	Low-Computer/Laptop based	0
Physical Flexibility	Low-Computer/Laptop based	0
Electrical Dependency	Low-It is dependant on electricity and batteries, as well as internet	0
Coverage Area	High-Worldwide coverage with the internet	1
Monitoring 24/7	High-Program can be run in dispatches	1

Public transparency	Low-single channels can be recorded, but not all channels at once	0
Multi-Channel Capacity	High-Up to 200 rooms per voice server	1
<b>Video Conferencing Communications Criteria</b>	<b>Reasoning</b>	<b>Score</b>
Interoperability	Low-Proper equipment and a common software program are needed	0
Reliability	Low-Video Conferencing is very dependant on having a high bandwidth, especially with more than a few people	0
Affordability	Low-If bandwidth is available, basic video conferencing is free across programs like Skype	0
Relevance	High-Video Conference calls are used to provide important information	1
Ease of Use	Low-Video Conferencing software can be difficult to set up for the basic user	0
Security	High-Encryption is possible and user must have contact information and passwords to access	1
Interactive	Low-This system is not always on, so when group gets together, time is limited	0
Accessibility	Low-Participants must have access to the call information and passwords	0
Standardization	High-Uses common langue	1
Capacity	Low-Video Conferencing is very bandwidth dependant, the more users the more the system degrades	0
Secure versus open Toggle	Low-Due to limited capacity, an open system is not feasible	0
Unified System	High-It would be possible for a nationwide conference calling program to be designed, but the bandwidth requirements would be severely limiting	1
Physical Durability	Low-Computer/Laptop based	0
Physical Flexibility	Low-Computer/Laptop based	0
Electrical Dependency	Low-It is dependant on electricity and batteries, as well as internet	0
Coverage Area	High-Worldwide coverage with the internet	1
Monitoring 24/7	Low-This is not an always on system	0
Public transparency	Low-It would require a lot of data storage to record all conference calls	0
Multi-Channel Capacity	High-Multiple channel software is available	1
<b>Email Communications Criteria</b>	<b>Reasoning</b>	<b>Score</b>
Interoperability	High-Email is extremely common	1
Reliability	High-Except during emergencies, email has become very reliable	1
Affordability	High-Email is essentially free other than the cost of internet	1
Relevance	Low-When used for too much interactive mass communications, emails get buried and a lot of info that isn't needed by the whole group is sent to everyone	0

Ease of Use	High-Basic Computer Skills are all that is needed	1
Security	Low-Encrypted email is not in common use	0
Interactive	Low-This is not a real-time communication device	0
Accessibility	High-With low security, anyone can use if they have the address	1
Standardization	High-Common language is used	1
Capacity	High-More or less unlimited capacity	1
Secure versus open Toggle	High-Email can be sent encrypted	1
Unified System	High-A nationwide database of email distribution lists could be maintained	1
Physical Durability	Low-Cell phones are the most environmentally susceptible of email methods and they are not considered durable	0
Physical Flexibility	Low-Checking email in difficult situations, is not easy	0
Electrical Dependency	Low-It is dependant on electricity and batteries, as well as internet	0
Coverage Area	High-Worldwide coverage with the internet	1
Monitoring 24/7	Low-This is not an always on system	0
Public transparency	High-Most government emails are subject to open record laws	1
Multi-Channel Capacity	Low-Not an always on system	0
<b>Fax machines</b>		
<b><i>Communications Criteria</i></b>	<b><i>Reasoning</i></b>	<b><i>Score</i></b>
Interoperability	High-Faxes are standardized	1
Reliability	Low-Faxes are notoriously unreliable, the machine can be out of paper, or no one on the other end checks the machine	0
Affordability	High-Faxing is inexpensive	1
Relevance	Low-Faxes are not used much as in the past with the higher use of email, especially of no value for interactive communications	0
Ease of Use	High-Relatively easy to use	1
Security	Low-There are secure fax systems, but not in common use, and faxes are usually in public places of offices	0
Interactive	Low-This is not a real-time communications system	0
Accessibility	Low-Not everyone has access to a fax machine, especially in the field	0
Standardization	High-Common Language is used	1
Capacity	Low-Faxing to a lot of people takes time with out the proper software. Also the more information sent the more paper utilized.	0
Secure versus open Toggle	Low-Secure faxes are not in common use	0
Unified System	High-A nationwide database of fax distribution lists could be maintained	1
Physical Durability	Low-Not a device for the field, other than expensive communications vehicles	0
Physical Flexibility	Low-Can not be carried by first responders	0

Electrical Dependency	Low-Dependant on electric and Phone Lines	0
Coverage Area	High-World Wide with phone System	1
Monitoring 24/7	Low-This is not an always on system	0
Public transparency	Low-Fax machines do not traditionally keep a record of items faxed	0
Multi-Channel Capacity	Low-Not an always on system	0
<b>Universal Communicator Communications Criteria</b>	<b>Reasoning</b>	<b>Score</b>
Interoperability	High-Proposed system would work across phones, cell phones, and computers	1
Reliability	High-Proposed system would be very low tech and universal, thereby more reliable	1
Affordability	High-The software can be cheaply developed, and works off the existing hardware	1
Relevance	High-Universal System would allow access to whoever is relevant	1
Ease of Use	High-The proposed system is intentionally low-tech, universal and easy to use	1
Security	High-All voice traffic would be encrypted and password protocols available	1
Interactive	High-System would be very interactive in real-time	1
Accessibility	High-Universal system much like email would be accessible to everyone	1
Standardization	High-Common language is used	1
Capacity	High-Utilizing peer to peer networking, the system is completely scalable	1
Secure versus open Toggle	High-Public Areas available along with secure rooms	1
Unified System	High- This would be a completely Unified System	1
Physical Durability	High-Since the relevance would be so high for the system, investment in ruggedized cell phones would be acceptable	1
Physical Flexibility	High-Voice activation would be added to the program so that it can be used hands free with a ruggedized cell phone	1
Electrical Dependency	High-Since the relevance would be so high for the system, investment in ruggedized cell phones with solar chargers would be acceptable	1
Coverage Area	High-World Wide with phone system and Internet	1
Monitoring 24/7	High-Program can be run in dispatches	1
Public transparency	Low-There would be little reason to try to record all conversations on the system	0
Multi-Channel Capacity	High-Multiple channels is an integral part of the system	1

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