Emergency Communications Using the Web: Matching Media Richness to the Situation

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Abstract

The Internet has become a method of mass communication during disasters and emergencies. Using Media Richness Theory, the design parameters of emergency communication techniques are examined and new methods of using the web are proposed. The objective is to better serve those in need at the time of need with targeted communications that provide value. The new methods proposed are starkly different than those in common use today, but after testing during hurricane Ike in 2008, they appear to offer functionality not currently available through existing methods of communication.

1. Introduction

The Internet has become ubiquitous for many across the globe. Used for shopping, information, communicating and sharing with friends, the Web 2.0 powered world has changed lives. Just as technology has advanced and changed, so have users as explored in Tapcott’s books on the digital generation [1, 2]. The growth of the Internet has touched people’s lives in many ways, online banking, online investing, social networks, news feeds, instant messaging, email, and more. The information age has arrived and somewhere over the past decade it went from “interesting and useful” to “essential and critical” as an infrastructure.

As Tapscott illustrated, the youth of today are not hooked on TV or radio, but rather online content. As time moves forward and the youth become the mainstream managers of our technological culture, expect the Internet to be the mainstream communication method for all media. As bandwidth has increased, the capacity needed for media rich channels such as video has expanded into even the cellular phone marketplace.

But higher bandwidth communications is not always the best answer to a communication problem. Media Richness Theory connected the level of ambiguity in a conversation to the appropriate level of media richness [3]. Further studies segmented communication channels into groups from informational flyers up through face to face conversations. The increasing richness of the media channel provides more information, compensating for levels of ambiguity of the part of the receiver [4]. An examination of the web today shows this concept still holds true, with sites adding more multimedia to assist users in making a selection among a myriad of choices.

Technology has provided several tools that are currently in widespread use that have direct applicability when responding to disasters. Short Message Service (SMS) and Twitter are both examples of technologies that can serve a specific emergency communications role.

This paper looks at a different use of the web, and related technologies, using them for emergency communications to mass populations during periods of disaster and large scale emergencies. During these periods the need to transmit directed information to affected groups is immense and the usual web environment of ‘surf and find’ becomes more ‘turn on and receive’. This paper examines how the Media Richness Theory proposed by Daft and Lengel applies to emergency communications and what lessons it provides to assist in more effective use of the Internet for mass communications during crises.

Using data collected in the aftermath of Hurricane Ike in the Galveston/Houston area in the fall of 2008, this paper presents how technology came to the rescue with respect to communicating when much of the telecommunication infrastructure is damaged or degraded. This paper presents the problem of emergency communications in today’s interconnected world, it examines the use of media richness theory, it then connects current communication technologies with the theory in the context of a disaster, hurricane Ike. The paper finishes with conclusions based on first hand observations from Ike and subsequent discussions.
with government officials concerning next steps for future disasters.

2. Emergencies & Communications

Emergencies occur in society every day. From simple car accidents to major natural disasters, the communications concepts associated with many types of emergencies are similar, just the scale with respect to the areas affected increases. As the scale of the emergency condition increases and more of the populace becomes involved, communication to the population in the affected area becomes a necessity. From automated road signs warning of congestion ahead to the emergency broadcast system for storms and other large scale conditions, government officials have been effectively communicating to large audiences for years.

For small personal emergencies, the scale of communication is also small – one call to 911, for instance. When the scale of the disaster or emergency increases, then the communication needs also increase accordingly. During major weather events, such as a metropolitan wide area ice storm, calls to 911 for minor accidents are discouraged, as the capacity of the system is consumed by more major events at that time.

Communications from government officials to the population are also directly connected to the scale of an emergency or disaster. Large events such as hurricanes require significant coordination of many elements of society. There are areas that need to be evacuated prior to the storm. There are services that need to be established immediately after the storm to provide necessary essentials to the community. There are a wide range of “what should I do” questions that need to be answered. Government officials have responded to this need for years, using the mass media of radio, TV and the emergency broadcast system, a string of radio stations.

The scale of communication requirements is tied to several issues. Immediately during the disaster, blanket messages, such as “take shelter” can be transmitted via common methods such as the Emergency Broadcast Network. In the aftermath, the scale shifts from broad sweeping announcements to those that are directed to geographically constrained elements. In major metropolitan urban areas, the population density and large geographic areas conspire to make broad announcements meaningless when trying to direct people. Consider aid distribution locations; when the number is in the tens, then reading a list works. When the number is in the hundreds, reading lists becomes too time consuming and confusing for many recipients to consume.

In recent times, as other communication channels have added the Internet as an alternative, so too have emergency services. During the period after hurricane Ike, dedicated web pages at the federal, state and local level were put up to provide information to the populace. The use of the Internet was undertaken for a variety of reasons, but the preparation and understanding of how to utilize the Internet during disasters and disrupted systems was less apparent. One of the first issues noticed was one of format – can this communication channel and Internet media work with small mobile devices? The answer is clearly yes, it does so every day in the commercial sector. However, unlike normal operations, in the aftermath of a disaster with degraded infrastructure and other issues that arise as part of emergency response, the situation was far from normal. Reduced bandwidth, connection issues and the wholesale shift from PC’s to small mobie devices created significant changes in how the web was used. Taking these changes into account, a retooling of the communications methodology is needed.

Additionally, a whole new set of communication methods have grown up around text messaging. Done between mobile phones, this ‘texting’ has become a strong movement in the under 25 crowd. Services, such as Twitter, have been established to provide a bit more control via home PC platforms. Texting, SMS and Twitter, all have outstanding potential to increase communication effectiveness during emergency situations. The challenge is in determining how to proceed.

3. Hurricane Ike 2008

In September 2008, Hurricane Ike hit the coast of Texas near Houston. The ensuing storm damage destroyed the communities on Galveston Island, as well as a significant percentage of the buildings in the surrounding 100’s of square miles. As the storm progressed inland, the cities and counties in the path of the storm were leaving cities and counties devastated. Millions were without electrical power. Many had limited access to working telephones, not because of the phone lines, but because most phones today rely on electrical power to operate. Finding a plain telephone that runs off the current provided by the phone jack was an issue that once it became apparent, was too late to address. The affected residents adapted to these issues, using car radios for radio and cell phones for Internet access. For some
lucky few, these degraded conditions lasted but a few days, but for many the outage was measured in weeks. As time wore on, there was greater and greater need for differing levels of information. The need for government supplied information, such as, was open, where it was open, etc. was tremendous and lists of open schools, businesses and services were being read on the radio every hour. The challenge became how to supply this information over serial communication channel (radio) when the listening base was large and had a varied requirement.

Coastal evacuations were ordered days in advance, but many of the area’s 6+ million residents were outside the evacuation area and chose to ride out the storm. Maps showing evacuation zones, and the routes to take were shown on TV, but were also available for download via the Internet.

For weeks following the storm, those who chose to stay behind had no electricity, dwindling food supplies, limited availability of simple commerce (no ATM, few gas pumps working). The government responded with hundreds of points of delivery stations (PODS) where residents could obtain ice, water and meals ready to eat (MREs).

The challenge was one of information overload. Not because of too much information in the type, but in the specifics. Hundreds of school closings were needed for the entire area, yet a particular recipient of the information was looking just a few entries on the long list. These long lists were perfectly suited for display via the Internet. There were hundreds of PODs, geographically distributed across almost 1000 square miles where residents could get free food, water and ice. These locations shifted every few days to temporally move materials closer to people who were in need. Keeping track of the locations was easy for the government, but communicating 200 locations today, and 200 different ones tomorrow, to a constituency that really only needed to know about the closest one became a challenge.

But as life slowly moved from total disaster, towards more normalcy, people needed additional information. Which schools were closed, how long? What stores were open, where could you bank, get gas, etc.? Now where is the nearest POD? A local radio station took the lead, providing 24/7 coverage, but when you have hundreds of square miles and the lists are hundreds of entries long – this was a challenge. Added to this challenge is that people did not have the transportation means to “go out and look for themselves” as gasoline was in short supply and lines were long.

Again, the Internet was the solution, with long lists being posted on line. And suddenly the availability of electricity became an issue. The local government officials had power, as did the hospital district, and the radio station – critical infrastructure elements were wired via underground sources. This enabled these sources to transmit messages, but with just battery powered TVs and radios, the value of the Internet was lessened. What came to the rescue of the Internet as a communication channel were smart phones, Internet enabled phones that provided a limited means of surfing the web and obtaining information.

But Internet enabled phones relied upon the cell networks to carry the traffic. And this became an issue as the networks were significantly degraded in capacity and signal strength. Besides the damage to the electrical wires above ground, cell towers were also damaged. This degraded the carrying capacity of the cell networks, limiting signal strength and channel availability.

This had significantly less effect on SMS traffic, as these short 160 character messages use the signaling band of the cell network, not the primary communication channel. But the lack of bandwidth had profound implications on normal web users, limiting their ability to connect and access content. As the infrastructure was being repaired, the bottom line answer was simple; short messages with little bandwidth requirements would work, downloading large content via the web did not.

Unfortunately the message being sent was not planned to use SMS, but rather was in the form of bandwidth consuming web pages with Java, Flash and other byte heavy technologies. Addressing this issue requires a re-examination of how messages will be structured. This leads us to examine media richness theory.

4. Media Richness Theory

Media richness theory is proposed to explain communication effectiveness under the conditions of uncertainty and ambiguity. Uncertainty is defined as "the difference between the amount of information required to perform the task and the amount of information already possessed by the organization" [5]. In cases of high uncertainty, the organization is forced to ask questions and obtain information prior to a decision. Ambiguity is defined as “the existence of multiple and conflicting interpretations about an organizational situation” [3]. High levels of ambiguity reflect the situation where simple questions and answers are not sufficient to provide participants with the necessary information to constructively utilize the contents of the
communication. The higher the level of uncertainty and the higher the level of ambiguity; the greater the need for a richer media to act as the communication channel. The richest media is face to face communications, with simple posted information flyers being on the other end of the scale.

Both of these constructs, uncertainty and ambiguity, play a role in emergency communications from government officials to populations. First, and foremost, in the case of emergency communications from the government to the populace, the message is considered to be directive and not subject to interpretation. This means that once the government has made the decision to communicate, that the level of uncertainty associated with the particular communication is low. There may be significant levels of uncertainty in the government agency at the time the decision is made, but with respect to the issue at hand that is being communicated to the masses, the level of uncertainty is constrained.

Because the communication channel is one way, as in the case of radio broadcasts, the primary mission is to deliver information to the populace. Because the agency that is formulating the communication is doing so to achieve some specific goal associated with the communication, the objective of the communication is well defined and understood. This allows the message to be crafted to convey the message without additional interpretation. This is about “evacuate north via IH-45” not explaining the intricacies of the tax code.

Because both of the antecedent values are kept in low state, the required level of media richness is reduced significantly. In most cases, the equivalent of a revolutionary war era handbill announcing a meeting of citizens is all that is needed. Unlike our country at the time of its founding, we now have the ability to instantly reach out and provide information to large segments of the population, separated by time and distance through the Internet. The primary problem faced with the Internet is the wide range of communication channels that comprise the Internet and the bandwidth issues associated with much of the content being passed today.

5. Web Information Ike 2008

During the aftermath of Hurricane IKE several web sites became common sites for people seeking assistance. In this study, we examined sites from The City of Houston, Harris County, FEMA and the radio station KTRH. Each of these sites was updated and maintained during the period after the hurricane moved through the city. Ike left a trail of destruction in its wake, including significant damage to overhead electrical lines and cell towers. Flying debris caused damage to components of infrastructure that would otherwise have survived. The loss of electrical distribution across most of the city resulted in people having to use cell phones to access the Internet and information being posted by the government and critical firms. An examination of the web browsing experience was performed using cell phone browsers, as that was the primary method available during the recovery period. Infrastructure routers for entities such as Comcast, and AT&T were working, but the cell towers were significantly overloaded between calls and web data transfers and the significantly disrupted.

The local cell phone infrastructure took significant hits during the storm. Although towers were designed to withstand high winds, flying debris caused large scale damage and outages. Repairs were done in a timely fashion, but for days there were limitations on bandwidth and signal strength. This resulted in service disruptions across the network and combined with the large number of people attempting to use the service, utility was significantly constrained.

Several factors were present that made cell based reception difficult if not impossible during the recovery period. The reduction in cell towers and tower capacity due to damage, the large number of people using cells to contact loved ones, and an increase in normal phone usage because of exigent circumstances all contributed to reduce available bandwidth to cell users.

Under normal situations, the design of a web site is done to take advantage of the visual nature of the web and the current state of widespread broadband connections. Web sites are graded based on look and feel, specifically from a PC monitor, typically at fairly high resolution. Java, Flash and ActiveX all provide a wonderful browsing experience, at the cost to this system in the form of direct resources.

Table 1 provides sizes of the first page of various sites, and estimates of actual content information.

<table>
<thead>
<tr>
<th>Site</th>
<th>Download size</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>KTRH radio</td>
<td>880KB</td>
<td>21KB</td>
</tr>
<tr>
<td>City Houston</td>
<td>128KB</td>
<td>24KB</td>
</tr>
<tr>
<td>Harris County</td>
<td>89KB</td>
<td>35KB</td>
</tr>
<tr>
<td>FEMA</td>
<td>74KB</td>
<td>3KB</td>
</tr>
</tbody>
</table>

Table 1 Content ratios

These figures are indicative of normal websites. The download size is the cumulative total of all resources associated with the site that are downloaded automatically when the site is visited.
The content approximation is the size of the text as displayed, which ignores the size of downloaded objects.

During the aftermath of Ike, with limited bandwidth availability, cell phone users were attempting to download sites like above, only to run into time-out issues. Another factor in obtaining data via the web was the use of Flash, Java applets, and PDFs. On cell phones, these are all subject to interpretation with the majority of phones not recognizing the advance of technology. So, even if the user was able to get to a page with resources, they were unable to display the resources. The FEMA locator site, set up to help people find the nearest supplies, including walking directions, was wiped out because they chose a Java applet to do the work, and this failed on the majority of phones. PDFs were used on both Harris County and the City sites, which made the crucial information embedded in them undeliverable to the typical cell browser.

On the FEMA site, navigation was an issue, as the phone based browser begins with the upper left corner of the site, and because of resolution significant scrolling is required to find what is on the site. Unless one had visited the site on a PC and knew where to go, this was an exercise in hide and seek. Additionally, FEMA posted a nice Java applet that would give someone directions to the nearest POD when given the recipient’s location. The problem with this approach was that it required the use of a PC, not a mobile phone based browser, and PC’s required electrical power, making this approach meaningless for millions in the affected area.

Because of sheer size of the rich media downloads from the websites, the majority of phones timed out before receiving the desired information from the appropriate site. A local radio station created pages with multitudes of emergency and recovery data, from closures to openings, from food to gas to POD, banks, schools, and government centers, everything you could want to find was posted. This site had some of the most current and relevant content, yet it was wrapped in nearly a megabyte of ads and flash type objects. Again, web based thinking centered around PC browsers and high bandwidth failed in this crucial time to get the message to the intended recipient.

6. A Better and Small Way

Mobile phone web browsing is not new. The mobile domain is designed specifically to denote this environment. Recognizing that mobile devices were being used differently than other web access methods, a series of design practices and rules have been promulgated by the .mobile community. These rules are particularly salient in light of what is being done with emergency communications [6].

1. The mobile web is mobile
2. Context is king
3. The devices are (very) different
4. Forget your dotcom thinking.

As already noted, the mobile devices were mobile and frequently people had to move to get a better signal to receive stored communications such as voicemails. People were not glued to their PC’s as power was an issue for many, and the penetration of web enabled phones has been increasing for years to the point of most devices had some capability. This led to a wide range of different devices, so unlike designing for a 1024x768 or 800x600 screen, the screens are small and vary across wide range of sizes and formats.

The most applicable rule is the one about content and context. Context is the most important concept in the .mobi world. A driver using his cell phone to get information on a business is probably not interested in browsing their catalog, but more interested in targeted information, such as how to get there or how to call them.

The web is ruled by a mentality of deploying lots of information with links that lets the users explore and decide what they want. The .mobi world is much more constrained. Because of cognitive limitations and communication bandwidth, the key is to provide the desired information quickly, without a lot of linking or searching. In the .mobi world, the design is aimed to produce limited sets of information, targeted to user’s needs.

When designing for the .mobi world, designers take a totally different direction in their webpage design strategy. Rather than begin with the company logo in the upper left corner, which in some cases is all that is visible on initial phone download, they begin with the essential content that the user is looking for. The small screen size limits many of the elements of traditional web design, including navigation. This coupled with the fact that the mobile user is typically looking for a limited information set, forces a change in design.

In the case of emergency communications in the aftermath of a disaster, such as Ike, web users were using the web for a specific information need, not surfing for entertainment. If the user is using the Internet to get an answer to a specific question, why do they need 800K of ads? This is an example of how the normal web clashes with the needs of the
user during certain circumstances, such as to obtain information in the aftermath of a disaster.

7. Short Communication Technology

Examining the types of communications and the limitations of technology following a major disaster where infrastructure is impacted leads us to a simple conclusion. Messages need to be declarative and short. Although this is strange for the web, web pages can be designed to take this into account as shown in the .mobi examples.

There is another technology centered around short messages. Short Message Service (SMS) is an alternate communication channel associated with cell phones. This channel has taken off with the younger generation using it for sending short, less than 160 character, text messages between friends. Teenagers have become adept at texting to the point that many send in excess of 1000 texts every month. A series of short abbreviations have been developed to embrace the brevity of the channel and the personality of the communications.

An Internet based web service designed to interact with SMS is Twitter. Twitter users communicate through 140 character tweets, short messages that are timely declarative statements that are broadcast to groups of users that choose to follow a user’s activity.

Although seemingly novel and trivial, SMS and Twitter are both finding commercial success. Companies like Dell and others are beginning to communicate to large customer groups through these channels. A company, PIER Systems, has developed an emergency communications program that allows enterprises to communicate with their employees or other groups through a series of short informative messages to cell phones, text devices and land lines.

These technologies can be readily adopted for use during emergency situations. Take the case of family communications during a disaster. Are your family members safe, are they missing, what is their status? A lot of communication bandwidth as well as people’s time and effort is consumed answering these simple direct questions. And with the stroke of technology, Twitter can resolve this quickly and easily. Before the disaster strikes, families can register Twitter names, and let their remote relatives and loved ones monitor their presence. Then, after the event, the people inside the disaster zone, by updating their Twitter status, can inform everyone of their condition.

Employers can use SMS to contact key employees and communicate in simple declarative statements. By collecting cell numbers in advance, they can send messages targeting each employee, providing specific information as needed. Using simple codes, individual users can also reply – indicating a yes, a no, or providing some simple explanation.

Both of these examples require some minimal amount of familiarization and awareness training prior to the event. If we examine the use of SMS by teenagers, this limited use of Twitter and SMS is well within reasonable expectations.

To achieve abbreviated communications requires some planning in advance. Setting up Twitter schemes and SMS schemes requires that management and users spend some time and develop a common vocabulary and set expectations in advance. Families need to test Twitter before they need to rely upon it, and set the expectation that when they post information updates that they will be one-way, length limited statements. They also need to caution family members that in the event of “no update” that the primary cause will most likely be communications logjam, not something dreadful.

In the case of workers, SMS can be used to change staffing assignments, and to notify groups of timelines for staff changes. A hospital can change from A crew to B crew at a defined time after the disaster, or it could use SMS to update the shift, either pushing it back or pulling it forward.

Although Twitter was designed to follow activities of people, it first exploded onto the social scene at SXSW music festival in Austin TX in 2007. Twitter became the way to tack different events at the music festival. In the same way, professional groups with meetings can establish a Twitter presence and provide updates to members via this simple communication channel.

8. Conclusions

Much was learned in the aftermath of hurricane Ike. But one of the new lessons was in how the web can be used to communicate to the masses. Media richness theory provides guidance towards the lower end of the richness scale as being appropriate for emergency communications. The authorities had well thought out communication plans with well structured messages. The challenge was in delivering the targeted message to the targeted recipient. The nature of the communication requirement becomes one where personalized content is desired, and in very small form to conserve bandwidth. This was difficult because of the large area and the millions of people affected by the event.

There were several lessons learned from this crisis and how the web can be used for communication.
Most important is the need to consider the audience, their technology and their communication needs. Mobile phones will continue to advance as web enabled devices, but one must remember that at times the infrastructure will be the limiting factor. During hurricane Ike, even advanced 3G phones were limited to SMS texting in many cases as that is all that the infrastructure could handle.

To utilize the information from .mobi and to understand how to apply the Media Richness Theory implications requires significant advanced planning on the part of several groups. Beginning with the Media Richness constructs, as these shape the remainder of the items, two thoughts are relevant. Know what you want to say in simple form and know to whom you wish to communicate, their technologies and their needs. These factors are important if one is to reduce the uncertainty and ambiguity associated with the communication. Having the contact numbers for utility services in advance is essential. Having a list of schools that will be issuing open and closing instructions, a list of critical businesses, gas, banks, hardware stores, etc.; these are all items that the government knows about in advance and can prepare for distribution when appropriate, once specific details are known.

Formatting these into a usable web format for mobile devices requires that the web designers stop thinking in terms of desktop display and begin thinking with respect to what mobile devices are used for and how they are actually employed by users. Text will be short, unformatted, directed text messages. In the case of web pages, less than 5K, in the case of SMS messages, 160 characters. The College of Technology at the University of Houston experimented with this concept, reducing the Dean’s communication to students during the recovery period from the standard 200KB webpage to less than 2KB of HTML.

This brings up the technological planning. The objective is to enhance communications by offering a new channel that is designed to bring essential information to mobile users in times of disaster and crisis. Templates need to be designed and tested, with quick index links to get a lot of information on the screen, and assist the user in getting what they need in minimal bandwidth and user interaction. This means removing all extraneous information – three column navigation schemes, graphics, ads, anything that is not the specific information needed is excess and during emergencies there is no time for ads or other distractions. A list of schools may take a couple of special pages. Perhaps one with just the letters of the alphabet and “pick the first letter of school name”. Then comes the information on that school – not everything about it, like size, etc., but just what the user wants to know; for instance, something to make the user comfortable that they chose the correct school and not a similarly named one. Lastly, the information they are looking for is it open or closed, what is the projected status. And when was this information last updated.

This all requires significant preparation to develop and stand up the templates. This needs to be done prior to the event, as during the event everyone will be busy vetting and posting new current content. This is not the development of normal web material. Gone are the specialized formats, such as Flash, PDF, and scripts. Java applets, web forms requiring any client side validation or scripts – these are not .mobi concepts and need to be designed out of the solution. The devices are smaller and are geared towards a specific task.

Information on items such as “where is the nearest water located” can be predesigned into the emergency system, so that when users are interested in specifics, the equivalent updating their stock watch list can be executed. This means that parties will need to examine what types of information are needed and the specifics associated with the information in advance of the need. But as organizations have been through disasters and disaster drills before, most if not all of these questions are known and have been asked before, all that is needed is an update to the current status.

8.1. Government Responsibilities

Using the Internet as a direct communication platform to communicate with cell phones and other mobile devices requires some preparatory steps. Getting the information to the hands of the end-user will occur in several ways. First and foremost, a subdomain under the main domain can be used. This would permit a separation between normal desktop content and emergency content. The new subdomain needs to be easy to remember and type in and can be communicated via radio broadcasts. For example text.radiostation.com can carry the .mobi based emergency content, while www.radiostation.com maintains standard PC content and www.radiostation.mobi contains regular content designed for mobile devices. As each of these domains is designed to fulfill a specific need, the designers need to understand the types of information end users will be seeking and make it easy find.

The role of standardization cannot be oversold. The web works because people learn that www means something. For an alternate channel to get the same critical mass, everyone needs to standardize.
The form needs to be simple, as typing on phones is more difficult. It also needs to be non-misleading. Using something like 911.sitename.com or help.sitename.com would confuse this with other essential services. As the sites would be mostly text based text.sitename.com has been suggested, but this is an item that needs further thinking.

The most important task for the government is in recognizing the need to make communications simple and unambiguous. The recipient party will not have an opportunity to ask for additional data, so the first transmission must be complete. This will take significant advance planning to model different scenarios and create predetermined formats of responses. A strong comprehensive set of communications will also assist in the moment of battle if one is needed that has not been prepared, for plenty of examples will be available for comparison.

Designing sites for emergency, low-bandwidth use, will require significant design efforts. If a list of 250 items is presented and the user will be interested in one of them, a simple single digit index page to call the list to a more manageable size may be in order. Another option would be to build subscription type models, where users in advance register their preferences for information on specific items and then at any future time, updates can be had by reloading the web content. This is not unlike the current stock trading pages, where users can store their current portfolios and track watch lists with the click of a reload button.

8.2. Third Party Responsibilities

Building emergency use templates is not just a government task, but others need to assist in their creation well. In the case of the school example, there are several ways in which this could be employed. The government can put the information on their website, the radio station on theirs and the school could put it on theirs. All of these sites should be in the simplified text only method.

Much of the emergency service delivery is actually done with third party help. Radio stations act as communications channels. Critical infrastructure owners and operators (85% of the nation’s critical infrastructure is owned and operated by private firms) have critical roles to play in informing the public concerning status and progress issues during recovery from an emergency. Just as government needs to prepare communications in advance, both in tone and completeness, so do numerous third parties.

Commercial entities can make good use of these new technologies during emergency situations. Infrastructure operators can take advantage of the short text message format to get initial reports of problems. If we can text to a number to record a vote for our favorite dancer on a TV show, then surely we can set up a text based input system to report loss of critical service to the infrastructure operators.

8.3. Participant Responsibilities

The public is not just a passive receiver element during emergencies. They have preparation responsibilities as well. The public at large needs to heed advance warnings and do the necessary preparatory steps. But to the issue of emergency communications and the use of the web, the public can be a transmitter as well. Numerous family members across the country will call, attempting to learn the status of their loved ones. People in the affected areas can do things that will lessen this load on the communication system. Text messaging or SMS is a service that is highly efficient for sending short text messages. This can be used to provide updates to family members outside the affected areas.

Families need to have a communication plan, prepared in advance, so that if an evacuation is called, or a disaster occurs, people can pass the essential information to loved ones. This starts by developing a series of phone trees. In a large family, each person partners with one other family member residing outside the area. When disaster strike, only one phone call out of the area is needed to convey status to the entire family. The remote family member can then relay news to everyone else without burdening the stressed local telecomm channels. SMS can be used to provide status updates at regular intervals, again, not stressing the local communication channels. Setting up and using Twitter to keep remote family and friends advised of your status is yet another method of communicating you status to loved ones. In fact, the best choice may be a combination of all three methods.

For the general public to use the Internet during emergencies requires some advanced planning on the part of the end-user. Storing bookmarks to essential pages on your home PC will not facilitate their use when the power is turned off. Making certain that crucial pieces of information are transferred to the handheld device in advance is essential.

To achieve this type of coordination, the populace needs to be informed and this would require an awareness campaign. This would be a good project for government to undertake, as it can be targeted to both the populace and third parties at the same time. Rather than try to instantly change the understanding of everyone, this awareness can be tied to common
disaster seasons – hurricane season for coastal areas, spring flood season for the Midwest, etc.

9. Future Work

The next steps in this research involve further development of communication examples, templates and better examples. Determining how this communication methodology is situated into the normal emergency communication channels is needed. Many of the issues have only been examined in a shallow sense, deeper analysis is needed before significant resources are committed to attempt a regional trial.

New technologies, such as Twitter, and SMS make sense when certain types of communications are needed. The long understood theory of Media Richness provides insight into when different communication styles are effective, and what can be expected from them.

Combining the ability to reach larger population bases with new technology such as cell phones and SMS based services, with a better understanding of how to coordinate and structure messages from media richness theory, in the aftermath of future disasters, government officials can create small groups of recipients and get them geographically relevant information in a timely, bandwidth friendly manner. This will require significant additional planning and testing to develop the systems and then public awareness campaigns to educate the masses. These all represent areas where additional research and exploration can contribute to improving responses using technology.

10. References