Harnessing Web 2.0 and Cloud Computing in the Service of Disaster Response and Recovery

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Background and Introduction

The underlying theme of many disaster response case studies is effective human resource management under challenging conditions. Disaster response in libraries often centers on the reaction to events, bringing to mind images of triage and salvage. However, an important component of preservation involves laying the groundwork for the human response to disaster. Central to human resource management during disaster response and recovery is the maintenance of open and rapid sharing of information between disaster responders. Cloud computing, by distributing communication technology infrastructure to the Internet, can facilitate collaboration and improve the chances for a satisfactory human response to disaster.

Disaster preparedness for libraries can logically be divided into four distinct stages: prevention, planning, response, and recovery.[1] Wong and Green[2] recommend that libraries approach preparedness as an ongoing or circular process rather than a linear process beginning with prevention and then progressing through planning, response, and recovery. Preparedness and planning activities will inform response and recovery activities, and the outcome of the response and recovery activities in turn should inform future prevention and planning decisions. Each of these stages involves communication between a diverse set of disaster preparedness actors, both human and organizational, and internal and external to the organization. The foundation of successful disaster preparedness is built upon efficient communications between all actors, and is especially critical in the event of a catastrophic disaster which overwhelms intra-institutional response and recovery infrastructure.

The scope of a catastrophic disaster increases the need for communication between library responders while simultaneously limiting the number of communications channels available. The focus of this paper is to consider communications breakdowns during catastrophic disasters, then discuss measures Auburn University has taken to diversify post-disaster communication channels through the employment of cloud computing and Web 2.0 applications. The paper ends with a discussion of cloud computing utility for disaster communication and the expectations we have for future disaster response and recovery situations.

Disaster Response and Recovery at Libraries

Randy Silverman[3] expressed the time-sensitive nature of disaster response when he noted that "speed and effectiveness of the human response following a disaster are the most critical variables affecting the condition of an institution's collections in the aftermath of the recovery." Recognizing that rapid response is a critical component of library preservation, Auburn University Libraries has long incorporated disaster planning into preservation management. The major catastrophic disaster threats to the Auburn area are hurricanes and tornadoes. With the exception of a core group of administrative and preservation staff, participation in

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Auburn's disaster response team is voluntary. Our disaster plan, activated thus far only for a shelving collapse, a burst pipe and occasional roof leaks, remains untested against catastrophic disaster. Thus, Auburn planners have studied other institutions that have responded to major disasters in order to keep plans up-to-date.

The devastation caused by Hurricanes Katrina and Rita has highlighted the vulnerabilities of communication networks dependent upon non-resilient systems such as land-line phone networks, local internet servers, and cellular phone providers.[4,5] A particular weakness in response and recovery efforts following Hurricanes Katrina and Rita in 2005 was the breakdown in established communications channels between library staff, institutional leadership, emergency authorities, and recovery professionals. As a result of both physical damage to regional utility infrastructure and the evacuation of large numbers of the population, including many library staff trained in in-house recovery efforts, it was a common experience among library emergency response leaders to be unable to contact fellow responders and initiate response efforts.[6,7]

Muir and Shenton[8] argue that phone trees and emergency contact lists are the most useful part of the response plan. These brief documents facilitate communication and enable disaster responders to quickly enact disaster plans. Phone networks—landline and cellular—are prone to failure during disasters. To increase the likelihood of contact lists being useful, redundant voice communication channels are critical in times of disaster. Curzon[9] and Skinner[10] recommend that cellular phone networks, as practical alternatives to landlines, be included in planning documents. While cellular networks avoid to some degree the vulnerabilities of landline networks, they too are vulnerable to catastrophic disasters such as hurricanes. Most people on the Katrina-damaged coast were found to have lost cell phone from several days to up to 3 weeks because cell towers and their back-up, on-site generators were destroyed.[11] Cell phones still proved useful after Katrina in that they allowed evacuated staff to communicate from their locations in exile with each other and with vendors.[12,13]

The loss of internet infrastructure can be an equally challenging issue for libraries and library responders. Intranets provide tremendous capabilities for information exchange, but local servers are vulnerable to power outages and physical damage during disasters. In several disaster case studies where the loss of institutional email servers disrupted email communication, authors recommended the inclusion in planning documents of alternate email addresses independent of local infrastructure.[14–16] With the free availability of Web-based email accounts, adding alternate email accounts is a simple first step in diversifying communication channels. It also lays the groundwork for further incorporating cloud services into the recovery plan.

Equally problematic with local server failure is the loss of the library Web pages, and networked disaster planning documents. With the loss of the Web page, the primary avenue for publicly communicating disaster and business continuity information to library users and displaced staff vanishes. Servers knocked off line by disaster but not destroyed may be physically relocated by library staff, but this is a time-consuming and potentially hazardous solution. If emergency responders have restricted access to the institution, delays in bringing servers online can be even longer.

Displacement occurring in the aftermath of a large-scale disaster can be the most problematic aspect of disaster response communications and the one for which cloud applications hold the most promise. The combination of disabled communications channels, an increased need for collaboration between disaster responders, and an inability for responders to meet face-to-face curtails collaboration. Because the specific effects of every disaster are unpredictable and the appropriate response must be adapted to the context of the disaster, a disaster plan functions as a starting document to be interpreted and revised on-the-fly as response and recovery proceeds. Disaster responders can overcome communication barriers resulting from the loss of utilities, phone, and internet connectivity by face-to-face meetings. With human displacement, this most fundamental strategy is lost. Following a large-scale disaster, finding and keeping track of staff members' "locations in exile" has been an important but time-consuming component of human resource management.[17,18]

In addition to limiting the ability of disaster response coordinators to contact and inform staff, mandatory evacuations also limit the ability of displaced staff to send information about their status and receive information regarding returning to work. Ellis[19]

and Corrigan,[20] in describing the aftermath of Hurricane Katrina, noted that evacuated staff experienced frustration when attempting to use phones or Web resources based on local servers to learn more about the fate of their places of work. The question planners must ask when planning for catastrophic disaster is "How do we communicate effectively when staff are scattered, local servers are down, and voice circuits are unreliable?" Communication channel redundancy is critical in a disaster, and Web 2.0 technologies, while also vulnerable to disaster, may assist in putting disaster preparedness on a more secure footing. The most catastrophic disasters are likely to render any plan, even one with numerous communication channel redundancies, inoperable for some time. Redundancies may, however, shorten the blackout period and hasten the return from chaos.

Cloud Computing Implementation for Disaster Preparedness

Cloud Computing is a term associated with the provision of computing resources (a combination of infrastructure, platform, and software) through external servers. While the term is relatively new and subject to conflicting definitions, Vaquero et al synthesized a definition of clouds as "a large pool of easily usable and accessible virtualized resources such as hardware, development platforms and/or services.[21]" There appears to be a large overlap between the definition of the cloud and Tim O'Reilly's notion of "Web 2.0-ness" as operability independent of a single device.[22] In Web 2.0, as with cloud computing, "the technology itself—in terms of both applications and operating software moves from the desktop the WebTop.[23]"

Auburn's use of synchronous and asynchronous, internal and public Web 2.0 applications provided a suitable foundation of familiarity upon which to develop tools useful for employing the cloud to improve disaster response readiness. With catastrophic disasters in mind, the primary challenge to improve preparedness at Auburn was to decrease reliance on local communications infrastructure. Disaster response, especially in the hectic days before local infrastructure begins to recover, requires a great degree of coordination and collaboration. Unfortunately, the Web 2.0 applications at Auburn most useful to internal collaboration and coordination, including email, blogs, document sharing drives, and wikis all remained tied to local servers and infrastructure.

Web 2.0 for Disaster at Auburn University Libraries

Auburn's primary focus on the cloud for disaster response has been to strengthen post-disaster communication and collaboration capabilities. Cloud applications serve to strengthen disaster preparedness for four interrelated reasons. First, remotely hosted communications platforms would be useful as standby communication systems between responders in cases where terrestrial and cellular systems are disabled or overwhelmed. Second, by enabling remote updating and sharing of critical disaster documents, cloud-based word processors and data storage services would function as a virtual collaborative space in cases where local servers are disabled. Third, device independence would allow evacuated staff to contribute to disaster response and recovery planning from any wired location. Fourth, cloud-based Web 2.0 applications would allow Auburn to maintain a nominal level of dialog between the library and the public in a time when operational continuity questions are most pressing. Ideally, cloud applications for disaster response would be free, easy to use, remotely hosted, and persistent.

After considering ease of use, persistence, security, and cost, Auburn chose to employ the Google suite of cloud applications for response and recovery internal collaboration. By placing all of these internal collaborative spaces under one login, Auburn has simplified the system and hopefully increased "buy in" from disaster responders and volunteer staff. While there is some risk to relying on one provider, Google is a stable presence on the Web with multiple sources of revenue. It is much less likely to suffer the same degree of financial instability as newly formed internet companies. The applications in the Google suite suitable for internal collaboration include Gmail, Google Documents, Google Talk, and Google Sites. Each of these applications not only has the potential to work as a substitute for failed primary communication channels, but also provide collaborative spaces for disaster response and recovery. Google Documents is the most important Web 2.0 component of Auburn's disaster preparedness plan. Free, with a large amount of file space available for use, Google Documents functions well as a secure, collaborative forum for disaster response. Because only invited participants have access to documents, spreadsheets, and presentations, Google Documents can perform as a virtual network drive when university servers are incapacitated. Au-

burn's disaster coordinator, the owner of the forum, can assign each invited participant the ability to either view or edit documents, thereby enabling the virtual drive to function as both a collaborative space and as a unidirectional information clearinghouse. Auburn's disaster coordinator updates the library responder list and comprehensive disaster plan quarterly to reflect changes in personnel and physical reorganizations within the Libraries. These documents are available in print, on Auburn network drives, and on Google Documents. While document maintenance is usually a one-person activity, during times when multiple updates are necessary the disaster coordinator can use Google Documents to draw upon the collective intelligence of the responder group. All people listed on Auburn's two-page responder list document have full editing privileges through Google Documents. This document contains the essential information necessary to contact key personnel and volunteers from the library and university. It also contains a list of supplies critical for initial disaster mitigation efforts. In the event of a catastrophic disaster involving displacement, evacuees can edit the document as necessary to update their contact information. On-site responders can update the simple document to track the movement of critical supplies.

The comprehensive library disaster plan at Auburn expands on the responder list to include recovery procedures, collections priorities, locations of disaster response supplies, and contact information for disaster mitigation vendors. This large document, an important resource for guiding post-response recovery activities, is an ideal candidate for inclusion on Google Documents. Core library responders have the ability to collaboratively edit the disaster plan in response to disaster specifics. Library disaster volunteers, disaster mitigation company representatives, and institutional emergency management personnel have only viewing access to Auburn's comprehensive plan.

Google Documents will improve disaster response in two ways. First, by enabling synchronous and asynchronous collaborative editing of key response and recovery documents, Google Documents frees the disaster coordinator from sole responsibility for the time-consuming effort of updating changes in responder contact information. In the case of a catastrophic disaster with significant human displacement, collaborative editing will likely save significant effort in keeping the list current. Second, by functioning as both a collaborative and unidirectional communication tool, Google Documents simplifies the task of disseminating information beyond the core responder group. In the immediate aftermath of a catastrophic disaster, unexpected actors may emerge as important players in library response and recovery. Google Documents will enable the disaster coordinator to quickly provide new actors with access to critical recovery documents.

Google Documents is the core application for Auburn's collaborative approach to maintaining and updating critical disaster response and recovery documentation. However, it does not perform well as a forum for synchronous communication. Synchronous communication, either through voice or text, is critical to coordinating response and recovery actions. All library responders with a Google account have the capability to communicate via instant messaging through Google Talk. Google Talk also has the capability to operate on some mobile devices and to leave messages for offline users. These characteristics make Google Talk a suitable forum for brief synchronous and asynchronous communication between responders when other avenues are unavailable. The inclusion of Google Talk as an alternative to existing voice and text protocols introduces another level of redundancy to Auburn's communication channels and increases the capabilities of responders to exchange information in the critical first few days after a catastrophic disaster.

Conclusion

Collaborative cloud applications have great potential to address weaknesses in disaster response communications. Auburn's disaster coordinators can harness Web 2.0 both behind the scenes and publicly for improving the likelihood of a better outcome to a library disaster. The critical property for a robust cloud-supported solution for disaster response is remote hosting. Auburn expects that during disasters where our primary communication and collaborative forums are unavailable, our adopted Google applications will function well enough to enable our staff to initiate response and recovery planning. These applications will also increase our ability to collaborate across distances with a wider network of disaster responders, including institutional leadership and disaster professionals.

We do not expect that the use of cloud resources will ever be a "silver bullet" to all problems associated with post-disaster communication, especially in the most catastrophic situations. Truly catastrophic disasters have shown to be so devastating that, despite careful preparation, library materials and structures can be severely compromised long before any response can be executed. Instead, we view the cloud as merely a hedge against the risk of extended communications breakdowns and associated delays in the response effort. At the very least, library disaster coordinators will hopefully be able to initiate a dialog with institutional leadership and disaster response companies such as BELFOR and Munters. The Gulf Coast Hurricane experience shows that the role of disaster response professionals cannot be understated. Getting people swiftly to the scene of the disaster is critical to recovery, and though social media and cloud computing cannot in themselves salvage a single wet document, they have the potential to hasten the presence of people who can.

Libraries with more developed social networking communities should consider Facebook and Twitter as a potential disaster utility for public communication. Flickr, as an image-oriented social application, may be useful in delivering tagged images not only to library staff and users, but also to disaster mitigation companies and emergency management authorities. The number and complexity of cloud applications continues to grow. As new applications are developed, we expect to evaluate them for their utility in facilitating communication and collaboration. Any adoption decision will involve a consideration of costs, direct and indirect. Maintaining a standby system of Web 2.0 applications and generating enough buy-in from library responders at Auburn has required a significant investment of time and personal persuasion. Given the infrequency of disaster, the perceived need among volunteers for Web 2.0 disaster response applications is low. In addition to conducting annual disaster response drills, Auburn's disaster coordinator must now send out periodic reminders to volunteers to keep their Web 2.0 skills sharp and their Google accounts active. The extra effort in maintaining Auburn's disaster Web 2.0 is an investment that we hope will never need to pay dividends. Still, the small investment we have made in improving our preparedness promises to be a worthwhile effort. In a large-scale disaster, having redundant channels of communications in place may make the difference between chaos and effective management of the human response.

Notes

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