

# Communication Channels among various roles during Crisis Response

**Danilo P. Freitas**

PPGI/UFRJ, Brazil  
danilo.freitas@facc.ufrj.br

**Marcos R.S. Borges**

PPGI/UFRJ, Brazil  
mborges@ppgi.ufrj.br

**Adriana S. Vivacqua**

PPGI/UFRJ, Brazil  
avivacqua@ppgi.ufrj.br

**Paulo Victor R. Carvalho**

Instituto de Energia Nuclear, Brazil  
paulov@ien.gov.br

## ABSTRACT

During a disaster event there are many actors, some officially, others unofficially involved in the event. This paper explores the relationships between these individuals and between them and the activities performed during the response time. We claim that understand the roles and these relationships is an important starting point for developing information systems for response management. Many systems focus on the supporting activities played by these roles and not on the communication channels that enable a better understanding of the system requirements. This article describes a preliminary study towards this goal.

## Keywords

Roles in emergency response, communication channels, interaction support

## INTRODUCTION

A critical part of the response efforts lies with the individuals affected by the emergency (Palen et al., 2007). In most cases, the very first response actions are performed by in-place victims or passers-by. They are at the emergency site, and they can generate fresh information from the location of an incident. This type of contribution has been shown to play a key role in large natural disasters such as the Katrina hurricane (Palen et al., 2007) or wildfires in the USA (Sutton et al., 2008).

There are several articles that report the importance of information provided by the crowd. Most of them claim that information may represent an important factor to make rescue operations more successful. This is particularly true when responders try to improve their understanding of the situation and information from the public is mostly welcome. Most of these studies focus on how to create communication channels between the crowd and the emergency response teams (Ruiz-Zafra et al., 2014) and how to make sense of information sources.

In this article we address these issues. We claim there is a need for a framework to categorize and to support the communication between the many actors involved in a disaster response. The framework can be used as a guide to generate a more integrated view for the information flow avoiding the redundancy efforts in developing support tools. We introduce our proposal for this framework and use it to classify some of existent applications. Our intention however, is the development of a comprehensive environment that will support the availability of information to the people involved in an emergency.

The framework focuses on the information exchanged during the emergency response phase where context awareness is the most critical goal for emergency teams. The framework is based on two main assumptions. First, the public participation goes beyond a volunteer attitude. They can serve as human sensors assign to information provider agents. Second, even being an essential resource, information is just part of the requirements for an effective response. Requirements such as capacity to respond, infrastructure and logistics are as important as information to achieve a successful response.

In creating this framework, we first introduce a view about the information demands in the form of a conceptual map. This view was the result of several contacts with emergency teams and of course, in assessing the literature. In order to adjust the framework to reality we also position some relevant supporting tool within the framework.

### CROWD PARTICIPATION IN SITUATION AWARENESS

Rescue operations in most disasters are heavily dependent on accurate situational awareness. The environment can change dramatically and may be very difficult to plan an effective rescue operation without a situational awareness that indicates what and where to look for victims. Technology, such as satellite images, can help, but they can take time to retrieve and they lack important contextual data. An example of images that illustrate this difference and the difficulty to relate before and after images can be found in reference number 5. That is where crowdsourcing can play an important role. We claim that “human sensors” with adequate support can be an invaluable source of contextual information to achieve a more accurate representation of the situation.

Especially during the Response and Recovery phases, where communication, actions and time, need to be well managed, obtain good situation awareness may be the difference in saving more lives and assets. Use the combined crowd knowledge with other available resources, greatly increases the probability of success in an emergency situation.

Often, crowdsourcing is too broadly or narrowly defined to refer to a wide range of collective behavior particularly with the help of social media, resulting in nebulous interpretations of this term. To put it in a simple way, crowdsourcing is a dynamic form of cooperative work involving a large and often indeterminate number of civic participants conducting semi-autonomous tasks to address information management issues. This type of mass collaboration typically occurs in a distributed way often leveraging social networking technologies to facilitate coordination among different crowds (Ruiz-Zafra et al., 2014).

Crisis crowdsourcing is a type of cooperative work emerging from improvised ICT uses to leverage and manage the crowds convergence, information, and resources to address emergency management needs. What is lacking in the field of crisis informatics is a conceptual framework for understanding the complex coordination and interaction mechanisms to integrate and operationalize crisis crowdsourcing into the official emergency management environment (Ruiz-Zafra et al., 2014).

In an Emergency Response, the community affected by a disaster or occurrence can work together beyond first aid and first actions of unprofessional rescue. It may offer information about the place, victims and other when operational teams reached the place. It is indeed very important to harness the potential contained in this crowd who knows more details of the environment than any map, plan or preparation that may have been done earlier.

### CLASSIFICATION OF ROLES AND INTERCHANGEABLE INFORMATION

In the conceptual map present in Figure 1, we have identified the following roles inherent to the crowd in an emergency situation:

**Event Follower** – A person who upon learning of the emergency situation and decides following the evolution of the event.

**Helper** – A person who upon learning of the emergency situation and decides become a helper, ready to support the rescue work and combat emergency. This profile was divided into two sublevels, **voluntary** and **non voluntary**. The volunteer is the citizen who previously registered in a volunteer program for emergencies and already have some knowledge on how to act, how to communicate, with whom to communicate and probably went through training. Usually, these groups are set up through a non-governmental organization and are triggered by these organizations due to the proximity to the event, the characteristics and skills associated with the event type. They have a coordination group and usually have previously functions and tasks specified.

Non volunteers are individuals that once are involved with the event seek to help, bringing information about the environment, obscure locations and victims, in order to contribute to the success of emergency management.

**Person in need** – It is the person who is directly affected by the event and need some attention. They need help to take care of their own rescue, to care of injury or to get some supplies (water, food, clothing, etc.). Another frequent need is to know about relatives or friends. When they are in center of the event, they also need information about escape routes safe.

All these actors use and update information in real time, with a tacit understanding of ways, people, imminent danger, among much other information and can feed and consume information from the command and control that is acting during the accident. However, it is not easy to keep this updated and accessible information in an appropriate way without the support of technology and efficient processes.

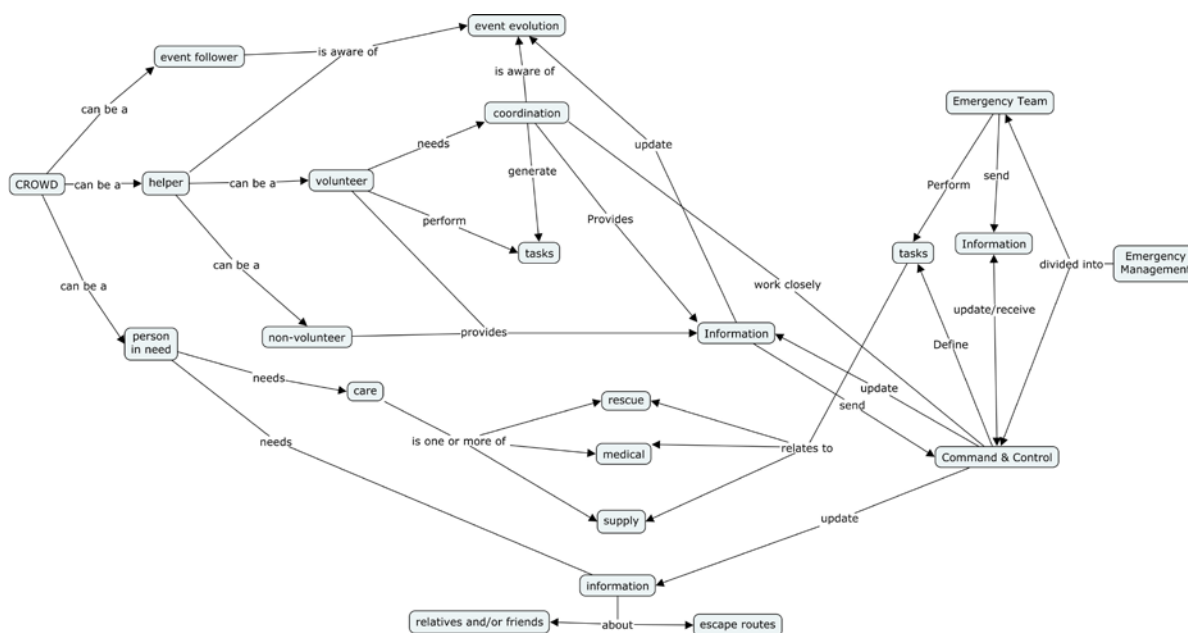


Figure 1. A Conceptual Map of Roles, Tasks and Information in a Disaster Response

**INTERACTION AND TOOLS**

Today, with the evolution of Information and Communications Technology (ICT), the majority of our interactions occur through technological means. Although in emergency management some face to face interactions also occur, we believe that is necessary a support by technology in order to provide a better communication, where is possible to answer quickly, keep the traceability and the flow of interactions. In the table below, we discuss what types of interactions occur in Emergency Management.

SOURCE	TARGET	TYPE OF INTERACTION					SUPPORT TECHNOLOGY		
		Task and Task Results	Rescue information (victims, localization, escape routes)	Events Evolution	Information update	Tacit knowledge about the environment	Needs, Information about relatives or friends	Technology in use by the team (radio, PDA, mobile, information system, etc.)	Social media (Twitter, Facebook, etc.)

Command & Control	Emergency Team	✓	✓					✓			
Command & Control	Event Follower			✓					✓		✓
Command & Control	Volunteers Coordination	✓	✓					✓	✓	✓	
Command & Control	Person in need		✓						✓	✓	
Command & Control	Self and Media			✓	✓				✓	✓	✓
Emergency Team	Command & Control	✓	✓					✓			
Emergency Team	Person in need		✓				✓		✓	✓	
Volunteers Coordination	Volunteer	✓		✓	✓			✓	✓	✓	
Volunteers Coordination	Command & Control	✓	✓		✓			✓			
Volunteer	Volunteers Coordination	✓	✓		✓			✓	✓	✓	
Volunteer	Command & Control				✓	✓			✓	✓	
Non Volunteer	Command & Control					✓			✓	✓	
Person in need	Command & Control		✓				✓		✓	✓	
Person in need	Emergency Team		✓				✓		✓	✓	

TABLE 1. INTERACTION AND SUPPORTING TOOLS IN A DISASTER RESPONSE

## CONCLUSION

The work presented explores various types of interactions that take place in a disaster response, and shows how the use of crowdsourcing from a active population may help in the success of a Emergency Management. Using the knowledge and experience of people who live and know the place and, included the possible victims of a disaster, represent a significant reduction in loss of life and property. The work is still preliminary but it can be used as a guide to orient the development of information systems to support interaction.

## REFERENCES

1. Palen, L., Hiltz, S. R. and Liu, S. B. (2007) Online forums supporting grassroots participation in emergency preparedness and response. *Communications of the ACM*, 50, 3, 54-58.
2. Ruiz-Zafra, A. , Nunez, A. G., Penadés, M. C., Canós, J. H. and Borges, M. R. S. (2014) SUCRE: Supporting Users, Controllers and Responders in Emergencies. *Proceedings of the 11th International Conference on Information Systems for Crisis Response and Management*, State College, PE. 260-264.
3. Sutton, J., Palen, L. and Shklovski, I. (2008) Backchannels on the Front Lines: Emergent Uses of Social Media in the 2007 Southern California Wildfires. *Proceedings of the 5th International ISCRAM Conference – Washington, DC, USA, May 2008*
4. Liu, S. B. (2014). Crisis Crowdsourcing Framework: Designing Strategic Configurations of Crowdsourcing for the Emergency Management Domain. *Computer Supported Cooperative Work (CSCW)*, 23(4-6), 389-443.
5. Before and after: high resolution images of the Brazil landslides  
<http://blogs.agu.org/landslideblog/2011/01/26/before-and-after-high-resolution-images-of-the-brazil-landslides/>