

# Challenges in Crowd Communication for Emergency Management

Jorge Pereira<sup>1</sup>, Renato Novais<sup>1,2</sup>, Vaninha Vieira<sup>1,3</sup>, Karina Villela<sup>4</sup>, Manoel Mendonça<sup>2</sup>

<sup>1</sup>Centro de Projeto Fraunhofer para Engenharia de Software e Sistemas  
Parque Tecnológico, Salvador – BA – Brasil

<sup>2</sup>Departamento de Ciência da Computação – Instituto Federal da Bahia (IFBA)  
Salvador – BA – Brasil

<sup>3</sup>Departamento de Ciência da Computação – Universidade Federal da Bahia (UFBA)  
Salvador – BA – Brasil

<sup>4</sup>Fraunhofer Institute for Experimental Software Engineering (IESE), Germany

{jorge.pereira,vaninha.vieira}@fpc.ufba.br,renato@ifba.edu.br,  
karina.villela@iese.fraunhofer.de, manoel.mendonca@ufba.br

***Abstract.** The public communication during an emergency is a key step on emergency management. The maintenance of a clear communication with the involved parties is essential for avoiding panic or misguidance. One challenge is to find out who are the targets such communication which are relevant information to them and which communication channels they can be achieved. Existing public communication solutions were not designed thinking in the variability of message according the interested, concerned only with the disclosure of a single message independent of relevance of your content for each stakeholder. However, variability in the message content is important for ensuring that each stakeholder receives relevant information for him, respecting the good principles of communication in crisis situations. This paper presents the challenges of dissemination of public communication to different targets on the crowd during an emergency on industrial areas.*

## 1. Introduction

**Emergencies** are critical situations caused by **incidents** (e.g. flooding, wildfire, earthquake) [United Nations Department of Humanitarian Affairs 1992]. The adverse and undesired consequences of an emergency give rise to a **crisis**. Crisis management [Quarantelli 1986] involves: a) *evaluating the severity* of the adverse consequences of an emergency; b) *coordinating required measures* to avoid, control, and/or mitigate those consequences; and c) *establishing a communication strategy* with and among the involved parties. The challenge is to filter contextual information regarding the incident and provide it with appropriate timing to the right people [Engelbrecht et al. 2011].

The public communication team must establish clear communication between the emergency managers and the general public, ensuring precise, reliable and real-time contextual information about the emergency. The absence of official information feeds the creation of false rumors that can may provoke panic or misguidance. To be effective, the public communication must consider some essential principles [Steven Venette 2006]: communicate repeatedly; be clear (use simple language and do not use technical terms,

statistics or probabilities); communicate by different tools, media and communication channels; transmit consistent information; and only provide relevant information. Existing public communication solutions were not designed thinking in the variability of message according the interested, concerned only with the disclosure of a single message independent of relevance of your content for each stakeholder. However, variability in the message content is important for ensuring that each stakeholder (e.g. press, public authorities and civilians) receives relevant information for him, respecting the good principles of communication in crisis situations

For example, consider a fire in an industrial park provoked by a chemical product leakage; *employees* from companies in the park may want to know in what company the fire occurred and the status of the emergency; while a *politician* may also demand information about the actions performed by the operational forces, and if there were casualties; additionally, *environmental departments* may also be interested in what chemical material was released during the incident. In addition, the employees can be informed by an emergency management *mobile app*, the politician may receive a release by *email*, and the *environmental department* may see the information in the industrial park *website*.

The challenge here is to establish a good strategy for communication with different parties that should be informed, providing **only** the information they require (*to be simple*), but **all** information they need (*to be precise*), and considering multiple communication channels (*to be safe*). This is a key step on crisis management. If well conducted, it can help involved people and organizations to handle the crisis situation.

This paper fits in the scope of a larger research project named **RESCUER**<sup>1</sup>, a joint Brazil-Europe initiative, involving nine research and industry organizations in four countries (Brazil, Austria, Germany and Spain). RESCUER aims at developing an interoperable solution to support command centers (both in Brazil and in Europe) in quickly managing emergencies and crisis, based on reliable and intelligent analysis of crowdsourcing information mashed up with open data. Two application scenarios are under investigation, considering emergencies in: a) *Industrial areas*, such as chemical parks; and b) *Large-scale events*, such as the Olympic Games. This contribution focuses on emergencies and crisis in the **industrial areas** scenario.

The goals of this research are: 1) to identify the best practices on public communication during an emergency; 2) to elicit existent users and contextual information needs in an emergency; 3) to define the relevant information adaptation according to different target audiences and phases of an emergency; and 4) to analyze the channels used to communicate with the public.

The paper is organized as follows: Section 2 introduces concepts and best practices for public communication in emergencies. Section 3 discusses related works. Section 4 presents the main contribution of this paper that is raising the challenges public communication in crisis situations, targeted to different audiences in the crowd. Finally, Section 5 presents our final considerations and further work.

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<sup>1</sup> [www.rescuer-project.org](http://www.rescuer-project.org)

## 2. Crisis and Emergency Risk Communication (CERC)

In this study, we adopt the concepts and best practices defined in the CERC Manual [Centers for Disease Control and Prevention 2014; Veil et al. 2008], created by the CDC (Centers for Disease Control and Prevention, USA). CERC means a set of principles that aim to guide emergency managers to know what to say, when to say, how to tell and thus preserve or win the public's confidence during a crisis [Centers for Disease Control and Prevention 2014]. Its basic principle of communication is: *be first, be right, and be credible*.

Two concepts are essential to understand the principles of CERC: a) Crisis communication, and b) Risk communication. The former refers to communication activities of an organization facing a crisis and is associated with the emergency management and the effort involved in alerting and keeping the public informed about an incident [Centers for Disease Control and Prevention 2014]. *Risk Communication* [Glik 2007] is the “information exchange about health risks caused by environmental, industrial, or agricultural, processes, policies, or products among individuals, groups, and institutions”. CERC arises from the application of risk communication principles in crisis communication [Reynolds and W Seeger 2005]. Despite a crisis is a random event and totally unexpected [Centers for Disease Control and Prevention 2014], it presents patterns that can help communicators to anticipate problems and give immediate response. A crisis is divided in five phases [Centers for Disease Control and Prevention 2014; Reynolds and W Seeger 2005], each demanding different actions for public communication, as follows:

- **Pre-crisis:** the goal is educational and seeks to prepare the public to know how to be positioned in an emergency, and to test the communication systems.
- **Initial:** the priority is to inform the general public and affected people about the occurrence of the incident [Reynolds and W Seeger 2005] in a quick, yet reliable, way. It aims to ensure that the public: a) has reassurance, reducing emotional turmoil; b) understands the roles of involved organizations; and c) knows where to get more information. The message should be simple, credible, accurate, consistent, and on time [Centers for Disease Control and Prevention 2014].
- **Maintenance:** seeks to ensure that the public: a) understands the risk involved in the incident and how to prevent it; b) is instructed about misunderstandings or rumors; c) receives guidance on protective actions to be followed; and d) be kept informed about actions taken to control the incident.
- **Resolution:** guarantees continuous information to the public about the incident, showing the measures taken to overdue the damages caused by the incident.
- **Evaluation:** starts after the crisis is over; includes the analysis of the performed communication, actions to improve it, and documentation of best practices.

Some principles are essential for effective communication with the public during emergencies [Centers for Disease Control and Prevention 2014; Glik 2007; Reynolds and W Seeger 2005]: Communicate repeatedly; Be clear (use simple language and do not use technical terms, statistics or probabilities); Communicate by different tools, media and communication channels (never trust on a single method of communication); Transmit consistent information; Provide only relevant information.

### 3. Related Works

In this section, we discuss existing solutions for public communication. The **Twitter Disaster Alerts**<sup>2</sup> provides, for authorities, a new way to disseminate information about an emergency. The crisis reports are disseminated via SMS and tweets, with a specific visual identity. To receive such notifications, the Twitter users must subscribe to this service. This solution is a means of message dissemination in large scale. However, it does not support generating or sending messages to specific people in specific areas.

The **Google Public Alerts**<sup>3</sup> is a platform to disseminate relevant emergency alerts to users when and where they are searching for. The users are warned by: a) automatic reports sent through Google Now, and b) customized search results when the user is looking for the situation of a specific emergency in the Google search engine.

The **Cell Broadcast Emergency Alerts** is a communication channel where messages can be issued to people in a specific area [One2Many 2012]. To receive reports, the user's mobile device must support the technology and the cell phone provider should make the cell broadcast infrastructure available. Unlike SMS, solutions based on cell broadcast are free of network congestion, since such messages use an exclusive channel. There are government applications being developed for emergency communication using cell broadcast. For example, in USA, the Commercial Mobile Alert System (CMAS) and the Wireless Emergency Alerts (WEA) [FCC 2014], and, in the Netherlands, the NL-Alert [Conict 2006].

Developed by the Israeli government, the **National Message** solution [Weiss 2011] aims to “establish a nationwide warning system that disseminates selective alerts and guidance messages to the population in real time, based on immediate control of all available and relevant channels in Israel”. It has a module for public communication called Personal Message that allows the notification of an emergency occurrence to the population in a specific area.

**Alerts4All** [Alert4All 2014] is a project developed in cooperation by 12 European partners. Its goal is to create a complete communication framework for public alerts. It supports authorities during the preparation of emergency messages and provides a specific communication protocol to transmit such messages. Therefore, it is necessary that TV, cell voice message, SMS, radio, GPS Navigator and sirens manufacturers implement the communication protocol created in the project.

**Table 1. Analysis of Public Communication Solutions**

Solution	Communication Technology	Semi-Automatic Messages?	Reports for Specific Areas?	Group-Target Personalization?
Twitter Alerts	Mobile Application, Website and SMS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Google Alerts	Mobile Application and Website	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cell Broadcast	Cell Broadcast	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Israel National Message	Cell Broadcast, Pager, TV, Radio, Email, Website, ETWS and Sirens.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Alerts4All	Cell voice message, SMS, TV, Radio, GPS Navigator and Sirens.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

<sup>2</sup> <https://about.twitter.com/products/alerts>

<sup>3</sup> <https://support.google.com/publicalerts/>

Table 1 presents characteristics of those solutions, comparing communication technologies, if they support semi-automatic messages, if reports (messages) can be sent to specific areas (location), and if they support customized messages to different target groups. Existent solutions are not designed to create personalized messages for different target groups.

#### 4. Challenges in crowd communication for emergency management

The goals of this work (presented in Section 1) are aligned to the challenges in crowd communication. The first one was discussed in Section 2, aiming to identify public communication challenges coming up in an emergency. To pursue the other goals: 2) to *elicit existent users and contextual information needs in an emergency*; 3) to *define the relevant information adaptation according to different target audiences, and different phases of an emergency*; and 4) to *analyze the channels used to communicate with the public*; we conducted a **workshop with real end users** to learn from their experience how public communication occurs, in practice, during an emergency. Representatives from two partner organizations in the RESCUER project participated in this workshop: **COFIC**<sup>4</sup> (Brazil) and **FIRESEV**<sup>5</sup> (Austria), both with large experience in dealing with emergency situations in industrial parks. We wanted to guarantee that our solution was valid both for emergencies in Brazil and in Europe.

The workshop was guided by the brainstorm technique with the goal to answering the following questions: i) What are the types of users presented in an emergency situation, and what users should be considered for public communication? ii) What is the relevant information to be presented for each type of user in a public communication? and iii) How the information presentation should be adapted, considering the different phases in an emergency? Section 4.1 presents our findings for Question i), while Section 4.2 presents results for Questions ii) and iii). Section 4.3 analyzes differences in communication with the crowd.

##### 4.1. Types of Users in an Emergency

As illustrated in Figure 1, an emergency situation involves different people that are located in different places. We classify the locations between two main types: **On-site** (where the incident took place) and **Off-site**. The on-site is further divided into two regions: *on-spot area* and the *area nearby*. In the *on-spot area*, we can find various types of users, such as *Civilians* (e.g. Eyewitnesses, Affected People, Employees, Visitors), and *Operational Forces* (e.g. Medical, Fire and Police Services). In the *nearby area* we have Commanders and Staff of the *Command and Control Center*, responsible for managing the emergency. The off-site region is divided into two groups based on user type: *Operational Forces* and *Others* (e.g. Politicians, Media, General Public, Organizations). Operational Forces communicate directly to the Command and Control Center. The Command and Control Center must guarantee that public communication is sent to the users represented on green rectangles shown on Figure 1. Regarding **Question i)**, the end-users in our workshop agreed with the following types of users for public communication of emergencies in industrial parks: *Employee*; *Visitor*; *Neighbor Community*; *Environmental Department*; *Politician*; and *Press*.

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<sup>4</sup> <http://www.coficpolo.com.br>

<sup>5</sup> <http://www.fireserv.at>

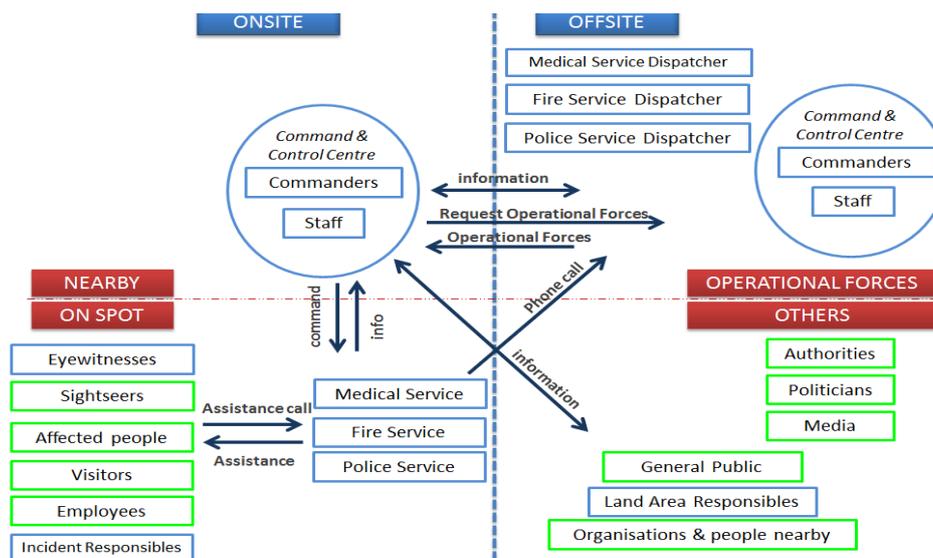


Figure 1 – Locations and Users Involved in an Emergency

#### 4.2. Contextual Information Adaptation for Public Communication

Public communication implies transmitting information from the on-site location to people located both on-site and off-site the incident place. In our workshop with end-users, on answering **Question ii)**, they agreed that the following set of information is relevant in industrial parks: *Incident Location, Incident Type, Occurrence Time, Consequences (physical, material, financial, etc.), Providences taken to control the Emergency, Status of Emergency, Injured People, Fatalities (or not), Schedule of press conferences and Type of chemical released*. Yet for **Question ii)** and also for **Question iii)**, we asked them to indicate how we should consider **information adaptation**, both to **different users** (which information is relevant for each type of user) and to **different phases** of an emergency. The end-users agreed that *Press and Politician* have the same set of relevant information. Similarly, *Visitor, Neighbor Community and Employee* share the information needs. The Table 2 is divided according to different users' groups and the information they need. For example, the Incident Location, Incident Type and Occurrence Time are relevant for all users while the *Environmental Department* is also worried about the Type of chemical released.

Table 2 - Stakeholder x Emergency Contextual Information

Emergency Contextual Information	Stakeholder		
	Visitor, Employee and Neighbor Community	Environmental Department	Press and Politician
<b>Visitor/ Neighbor Community and Employee</b>			
Incident Location	☑	☑	☑
Incident Type	☑	☑	☑
Occurrence Time	☑	☑	☑
Consequences (physical, material, financial etc..)	☑	☑	☑
Providences taken to control the Emergency	☑	☑	☑
Status of Emergency	☑	☑	☑
Injured People	☑		☑
Fatalities (or not)	☑		☑
Type of chemical released		☑	
Schedule of press conferences			☑

We can see that the communication of an emergency to the public varies according to the type of user. In addition, sending public information for unauthorized people is prohibited. Therefore, determining which information will be sent for each specific user is essential.

### **4.3. Communication Channels with the Crowd**

One of the basic principles of CERC is to never trust in a single channel for disseminating communications. This is because in case of failure, crisis managers would be unable to send news to the crowd. In order to avoid this situation, there is a need to ensure that multiple communication channels are available to the crisis managers can issuing communication during an emergency.

Another point to be considered in communication with the crowd is the need to disseminate to specific areas. For example, in the case of an emergency in the industrial park, you may need to send a warning statement for a specific neighboring community but not for other communities. In this case, you need to use communication channels that allow receiving messages filtered by geographic location (e.g. Mobile App, Cell Broadcast, Google Alerts) or channels that can use knowledge about the community to send information (e.g. Voice Messages, SMS or Email)

However, in many cases it is necessary for the news disseminated to be as wide and public as possible. This is important to prevent any misunderstandings, preserve the organization's image and sustain public confidence. For these cases, the news must be published in mass media, i.e., on social networks, website of organization responsible for crisis management or sent by email to the editorial offices of the main communication media.

## **5. Conclusions and Future Work**

Public communication is a key step on crisis management and helps involved people and organizations in handling crisis situations. A key point is to guarantee that the right people will receive the relevant information they need at the right time. This paper identified possible variabilities in the content of messages according to different users and emergency phases. We also analyze communication needs with the crowd giving examples of possible media that can meet such demands.

The result of this paper it is being used for develop a context-sensitive solution for dissemination of public communication to the crowd during an emergency. This solution was called RESCUER News and it is being developed inside of Rescuer Project. The main objective of Rescuer News is help the coordinator of public communication in the task of creation and dissemination of public statements adapted for each stakeholder. Besides, we will improve our approach to include support for crowd steering communication, when the Command Center not only notifies people but also gives them precise instructions to follow during the emergency.

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