Chapter 15
A Grid–Aware Emergency Response Model (G–AERM) for Disaster Management

Eleana Asimakopoulou
University of Bedfordshire, UK

Chimay J Anumba
Loughborough University, UK

Dino Bouchlaghem
The Pennsylvania State University, USA

ABSTRACT
The emergency management community is working toward developments associated with the reduction of losses in lives, property and the environment caused by natural disasters. However, several limitations with the particular collaborative nature of current Information and Communication Technology (ICT) in use have been reported. In particular, how emergency management stakeholders within an ICT environment can bring together all their resources in a collaborative and timely manner so as to improve the effectiveness and efficiency of emergency response tasks. With this in mind, the authors describe the Grid-Aware Emergency Response Model (G-AERM) to make the best of functionality offered by emerging ICT to support intelligence in decision making toward a more effective and efficient emergency response management.

INTRODUCTION
Research studies over the last fifty years suggest that the number of losses caused by natural catastrophes is becoming increasingly significant. It is not only that the public is growing ever more aware of natural disasters due to increased general knowledge and the expansion of mass media, but also that the number of natural catastrophes is constantly increasing (Burton et al., 1978; Bryant, 1991; Lekkas, 2000). Some of the factors responsible for this development include the increase in the world’s population and the density of population within an area and the emergence of

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settlement in areas that were previously uninhabited. Apart from human losses, natural disasters cause damage to buildings, infrastructure, and everyday activities.

As natural disasters are considered a threat and of great risk to people, property and the environment, specific bodies have been funded at international, national, regional and local level, in order to prevent, organize, analyze, plan, make decisions, and finally assign available resources to mitigate, prepare for, respond to, and recover from all effects of disasters (Trim, 2003; Shaw et al., 2004). These bodies act under the relevant policies and in line with the principles of the emergency management discipline. In particular, several international bodies, such as the North Atlantic Treaty Organization, the United Nations and the European Union have recognized the great problem related to the losses to humanity caused by the occurrence of natural disasters. Therefore, they have funded relevant departments responsible for the application of emergency management operations, as well as for the improvement of the relevant processes through further research into natural disasters and investigation of the current and future needs of humanity (European Commission, 2000).

The authorities involved in emergency management use a range of information and communication technologies (ICT) in order to assess the disastrous situation caused by the occurrence of an extreme natural phenomenon and to respond to it. Science has improved the equipment used to detect, sense, measure and store the characteristics of natural phenomena. At the same time, people witness rapid progress in the telecommunications sector everyday. The following section discusses the limitations of the current ICT used by the emergency management authorities, with particular reference to those used during the emergency response operations. In particular, it is focused on the communication between relevant parties and on the technological support which the decision makers, operational units and victims have available during an emergency response operation.

**LIMITATIONS OF THE CURRENT ICT IN USE IN EMERGENCY RESPONSE MANAGEMENT**

The area of emergency response is characterized by distributed operations that are of a multidisciplinary and interdisciplinary nature. Emergency management authorities are required to cooperate in order to plan, control, coordinate, take appropriate decisions and provide with an effective and efficient response to an emergency situation caused by the occurrence of a natural disaster. On this basis, a number of processes – distributed in nature – take place during the response phase. To achieve the effective and efficient management of the response operations, a number of resources owned by each relevant authority are made available for disposition. Resources – like their owners – may be distributed and/or multidisciplinary in nature.

During such operations, information management becomes crucial. Emergency management stakeholders – as decision makers – require continuous access to various distributed resources in order to plan, make appropriate decisions, and allocate resources for particular tasks. Although supporting ICT and relevant available collaborative computer-based systems would be adequate to support the requirements, there is the ‘hazards and disaster research informatics problem’ (NRS, 2006). Various limitations of ICT were confirmed when various emergency management stakeholders from UK and Greece interviewed. They stressed the need for bringing together all their resources in a collaborative and timely manner. They state that there is not any particular concern with individual ICT; however they are clearly dissatisfied with the collaborative nature of these distinct ICT. It is important to note that a range of ICT is used throughout the response operations.
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