Chapter 17
Using Geospatial Web Services Holistically in Emergency Management

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ABSTRACT

To confront the ever-growing volume and complexity of disasters, development should begin on a highly interoperable, loosely coupled, dynamic, geospatially-enabled information platform with comprehensive situational awareness. This chapter argues that geospatial Web services are a crucial building component for the emergency management community to develop this desired information platform because geospatial Web services, along with other non-spatial Web services, can provide interoperability. In addition to discussing how geospatial Web services, especially the ones standardized by the Open Geospatial Consortium, have been used in different phases of emergency management, the chapter contends that a holistic approach with geospatial Web services will create more value for emergency management. It concludes by pointing out some future work that is worth exploring in order to cope with the ever-changing nature of emergency management.

INTRODUCTION

Natural disasters, including earthquakes, tsunamis, floods and droughts, have always posed tremendous obstacles to the survival and development of society. With rapid population growth and expanding urbanization, these disasters have become an even bigger threat to humanity. Around the world, many governmental, public and private organizations have steadily invested in emergency management to minimize the social and economic damage, especially the loss of life,

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caused by natural disasters. The United Nations General Assembly even designated the 1990s as the International Decade for Natural Disaster Reduction (United Nations General Assembly, 1989).

The terrorist attack on the World Trade Center on September 11, 2001 and subsequent high profile terrorist attacks in other countries highlighted the devastating impacts of another kind of disasters, i.e., human-caused disasters. This type of disaster is caused by human negligence, error, malicious action or the failure of a man-made system. The 1986 Chernobyl nuclear disaster in Ukraine is another high profile example of human-caused disaster.

The increased complexity and growing frequency of recent natural and human-caused disasters clearly indicate that society as a whole is heading toward what Beck referred to as a "Risk Society" (1992). Managing emergency to minimize the loss in a "Risk Society" is a daunting task, and requires collaboration from various constituencies within the whole society, especially government agencies, international humanitarian organizations and at times governments of multiple countries.

Over the years, the emergency management community has used different information technologies to improve its effectiveness, capacity and ability to collaborate. Since location information is an inherent attribute of disasters and emergencies, people have used spatial information technologies in different phases of emergency management. However, this critical information has been used separately in various organizations, and a cohesive and collaborative usage is rare (if there is any at all).

The popularity of Google Map, Google Earth, Microsoft Virtual Earth and other related applications has drawn significant attention to the underlying geospatial Web services. Researchers and practitioners in various domains, and, more importantly, ordinary Web users have enthusiastically embraced these geospatial Web services because of their strong interoperability and flexibility. This rapid adoption in turn pushes organizations in the public and private sectors to leverage these technologies to enable and enhance the interoperability in their business applications, and emergency management is one such application. The collaborative nature of emergency management fits well with the strength of geospatial Web services that emphasize the interoperability of loosely coupled systems and integration of information from different sources.

By reviewing the historical and recent advances in this area, we hope to convey the potential for using existing and emerging geospatial Web services, especially the standardized ones established by the Open Geospatial Consortium (OGC), in emergency management. After discussing in detail how to use OGC geospatial Web services in different phases of the classic four-phase model of emergency management – mitigation, preparedness, response and recovery (Waugh, 1994) – we argue that the strength of geospatial Web services can only be fully utilized in a holistic approach. We further discuss the direction of future work that is needed to improve the usage of geospatial Web services in emergency management. While most of the discussion in this chapter is geared toward the United States, the basic concepts and ideas are also applicable globally.

BACKGROUND

In this section, we first discuss the key concept: interoperability. We will then study why interoperability is important in emergency management system. Service-Oriented Architecture (SOA) is the state-of-the-art technical approach to provide interoperability; and the use of Web services, including geospatial Web services, is the most standard way to implement SOA.

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