Introduction

The present society is characterized with an intensive development of new technologies and materials. Those processes are followed by processing great amount of information worldwide. All those developments lead to a closer interconnection among particular activities and create new linkages among them. At the same time those developments create new hazards that make the human society more fragile (Waugh 2000). Besides the technical development, environmental changes and politically unstable environments may cause further types of new hazards. Emergency management has to be flexible enough to reflect those new hazards. Due to the complexity of current man-made systems and unexpected nature of present environmental disasters globally, large amounts of information have to be included in decisions related to emergency management. A possible way to reflect present requirements to emergency management is introducing GIS (Geographic Information Systems) to decisions related to emergency management. GIS may succeed in the process of searching new ways to improve emergency management as 85% of all problems contain some spatial aspect (Easa et al 2000). GIS allows linking various digital map layers and databases (Fig. 1) and performs various unique analyses of those data, which cannot be realized any other way. Those analyses start with simple overlay operations and end with advanced real-time mathematical models analyzing behavior of various phenomena. The GIS data can also be combined with other types of data (e.g. air photos, satellite pictures), which could be acquired and sent for the analysis in real-time. Therefore GIS could make emergency management more efficient and perform its procedures faster. This paper tries to look at GIS as a core IS (Information System) in emergency management as possible approach. This concept has also significant effect on emergency telecommunication as an important compliment of GIS in emergency management.

Fig. 1: GIS model consisting of topographic (e.g. roads, rivers, buildings), countour (e.g. terrain, meteorology), and choropleth (e.g. land use, population, soils) maps to represent real world (Ordnance Survey 2001)
GIS in emergency management

Present emergency management represents a complex set of operations including various pre- and post-disaster measures. Those measures are planned and realized by various organizations such as fire and rescue services, emergency medical services, police, or local authorities. Those organizations have different structures, routines, etc. It brings new problems to emergency management and also increases its complexity. To overcome such problems a new concept, which could be resistant to different types of organization structures and various diversities, seems to be necessary. This concept is based on GIS as a core IS independent on number of participants in emergency management, their structure, routines, and possible changes of those factors. GIS in emergency management as a core IS can be defined as a cycle (Fig. 2), consisting of eight elements: (1) assessment, (2) prevention, (3) mitigation, (4) preparedness, (5) disaster event, (6) response, (7) recovery, and (8) evaluation. Over the classic emergency management scheme, the scheme for GIS includes new element called ‘evaluation’. This element is added to the cycle to evaluate GIS and its performance in emergency management, and also emergency management itself. The outcomes of the element lead to changes in organizations, methodology, technology, or data involved in emergency management according to Bernhardsen’s GIS chain (Bernhardsen 1999). This concept creates a process, which link all the information geographically. Therefore a unique expertise of local specifics, problems, etc. could be recorded and shared by others. It has also a positive effect on the decentralization of decisions. So the concept of GIS as a core IS leads to more effective and flexible emergency management with decentralized decisions.

GIS and emergency telecommunication

Based on the introduced concept, GIS also plays a main role in emergency response. Thus there is also a close connection of GIS and emergency telecommunication. In this case, emergency telecommunication is meant as a network of high performance computers, wireless mobile data computers, remote sensing devices, measuring devices, etc. providing collection, computation, storage, and access of GIS data. Different fix and wireless telecommunication networks such digital radio networks (Tetra, Tetrapol), GSM networks (UMTS), Mobitex, Internet, etc. are involved in the processes of the data transfers to achieve the fastest, most secure, and most stable connection. Generally there are two types of data to transfer. The first type is formed by ‘historical’ data collected and created in previous phases of emergency management and stored at different locations. The second type of data represents data from the ‘scene’ in the form of ‘recently acquired’ data from devices such as various sensors, satellites, or meteorological stations. Thus there are different requirements to provided telecommunication services. The data services play a critical role compared to standard voice communication services in this case. The main requirements to
telecommunication services are focused on sufficient capacity, adequate security, and variability of the services to perform a broad range of tasks. So there is a number of questions and problems coming up as a result of combining GIS, telecommunication, navigation systems, remote sensing, etc., which need to be answered. Thus a new branch called ‘telegeomatics’ has been founded to deal with those questions and problems. Apparently this branch is very young.

Present questions and problems
As it has been mentioned, telegeomatics is very young branch, especially telegeomatics in relation to emergency response. Therefore there are a lot of fundamental questions and problems related to emergency telecommunication. One of the most fundamental questions is what role should have GIS in emergency response, or entire emergency management. The represented concept deals with GIS as a core IS. So far GIS is rather accepted as an advanced part of emergency management among the organizations involved in emergency management. So it is still unclear, which role GIS will be given and what tasks should perform. Therefore it is difficult to define basic concepts in related branches involved in telegeomatics. Nevertheless, present problems are rather organizational than technical because organizations have difficulties to find agreement about the role of GIS, data sharing, level of security, etc. When those fundamental questions will be answered, basic strategies can be developed and common technical and data standards searched. Unfortunately there is a lack of well-documented experience from development, implementation, and operation of GIS in emergency management. Therefore there is a lot of uncertainty in development of GIS as a core IS, particularly combining GIS and emergency telecommunication.

Perspective
Recently a discussion about the role of GIS in emergency management has been opened in Sweden. This discussion intends to find common agreement about the role of GIS; in particularly its possible role as a core IS among organizations involved in emergency management in Sweden (e. g. fire and rescue services, Swedish Rescue Service Agency, SOS Alarm, Police, municipalities, county authorities). Unfortunatelly not all the organizations have taken part in the discussion yet, as there are more than 280 municipalities, 250 fire and rescue services, 20 county authorities, and a number of interest groups. Linköping University decided to take an active role in this discussion because of its experience with GIS, telecommunication, sensors, command and control, etc. As a first outcome, a GIS center dealing with GIS in emergency management is planned to open. It shall help the organizations involved in emergency management with their GIS solutions. This center should also deal with the development of strategies and concepts, and search for common technology, data, and procedure standards. Critical part of the center’s work will be to collect experience and good and applicable examples from all over Europe and USA.

References

