Chapter LVII
Mobile GIS—Challenges and Solutions

Pramod Sharma
The University of Queensland, Australia

Devon Nugent
The University of Queensland, Australia

ABSTRACT

This chapter focuses on Mobile GIS (MGIS), which uses wireless networks and small screen mobile devices (such as PDAs and smartphones) to collect or deliver real time, location specific information and services. Such services can be divided into field and consumer (location based services) GIS applications. The use of wireless networks and small screen devices, introduce a series of challenges, not faced by desktop or wired internet GIS applications. This chapter discusses the challenges faced by mobile GIS (e.g. small screen, bandwidth, positioning accuracy, interoperability, etc.) and the various means of overcoming these problems, including the rapid advances in relevant technologies. Despite the challenges, many efficient and effective Mobile GIS applications have been developed, offering a glimpse of the potential market.

INTRODUCTION

A geographic information system (GIS) is a computer-based system designed for the collection, storage, analysis, and visualisation of geographic data. Geographic data includes geographic location as an important attribute. The technology of GIS has undergone rapid development over the past three decades and in the process has transformed itself from mainframe-based systems to Internet-based distributed systems operating on a variety of hardware platforms (see Table 1). During this period, GIS applications have also changed from "the static compilations of the specialist to applications supporting the everyday lives of everyone, everywhere, all the time" (Smyth, 2000). The GIS hardware, software, and services industry was valued at over US$7 billion in 1999 and growing at over 10% per annum—estimated to be over

US$11 billion in 2004 (Longley , Goodchild, Maguire, & Rhind, 2001, p. 13; Daratech, 2005).

Early GISs of the 1970s were static, stand-alone, proprietary systems, focusing on inventory applications (e.g., inventory of natural resources, transportation networks, or utilities infrastructure) and on the automation of existing tasks. The next phase in the evolution of GIS involved the use of the networked client-server model to access remote data servers, and more advanced analysis and modelling capabilities. These systems were still, however, closed, stand-alone systems. They were used to model soil erosion, predict flood risk, model power network outages, and so forth. The GISs of today, however, are open distributed systems utilising the wired and wireless Internet to access distributed GIS services, tools, and spatial information for real-time data management applications (e.g., emergency management systems, location-based services). Not so obvious over the period has been the change in emphasis from "GIS software" to an emphasis on "GIS functionality"—the latter not necessarily delivered via "GIS software".

Traditional GISs are large project, departmental, or enterprise-wide PC- or mainframe-based applications, with full GIS functionality (e.g., natural resource inventory, urban management systems, utilities management systems). Such "legacy" applications continue alongside the newer types of Internet-based GISs—indeed, they are often the core component of the newer applications. Also, while the evolution of technology deserves analysis in its own right, it is the change in the user base ("market") rather than the technology change that is influencing new developments—technology is merely the enabler. Thus Internet GISs tend to have more limited functionality, and can be accessed by clients without GIS software and with little GIS experience/knowledge. The needs of these users are easily met by simple mapping output to simple queries: Where is x? Where is nearest x? How do I get there? Internet GIS applications do, however, allow a much wider range of people to gain access to GIS tools and data via the wired Internet (e.g., the usage of MapQuest and WhereIs type services).

This "simplification" or "democratisation" of GIS technology finds a natural home in Mobile GIS (MGIS). In MGIS, current technology limitations—both in terms of the wireless communications infrastructure as well as those related to small-screen mobile devices—introduce additional constraints to GIS functionality. MGISs are, however, very well suited to a wide range of field and consumer applications, which do not require a full GIS toolset, processing power, and so on. MGISs complement traditional GISs, extending some GIS functionality into the field (e.g., to collect and update the databases of enterprise GISs).

This chapter focuses on MGIS—where the service coverage is wireless based and the client platforms are small-screen mobile and wireless devices, such as laptop computers, tablet PCs, PDAs, and cellular phones. We exclude laptop computers from any further analysis as, apart from the wireless connection, they essentially mimic the functionality of desktop computers. The chapter begins with a discussion of what MGIS is and the rationale for its introduction. It then examines some common applications, the challenges faced by MGIS, and some of the solutions employed to overcome these problems. It will conclude with a look at the future directions of MGIS services.

MOBILE GIS—THE INNOVATION

What is MGIS? MGIS refers to the access and use of GIS data and functionality through mobile and wireless devices such as mobile laptop