

## The Principles and Practices of Mobile GIS

Oliver Sangster,  
Andrew Hansford and Lex Chalmers



## Structure

- What is mobile GIS?
- Historical developments
- Principles of mobile GIS
- Applications of mobile GIS

### What is mobile GIS?

*"Mobile GIS is an integrated **technological framework** for the access of **geospatial data** and **location-based services [LBS]** through **mobile [handheld] devices**" (Tsou 2004: 153).*

Mobile systems allow GIS tools to be accessed wirelessly and utilised in field situations, away from the desktop, for a sustained period of time (Raper 2009: 4).

### Historical development

Mobile GIS emerged in the 1990s, with integration of GPS, mobile data connections and geographic information in a portable handheld device.

Mobile technologies were initially developed for military use: selective availability.

Economic driver: growing consumer demands for location-based services (LBS).

- Commercial users: e.g. companies
- Recreational users: e.g. shoppers, trampers

LBS technology developed to meet demand of users.

- Personal Digital Assistants (PDAs): e.g. Palm (1996); iPAQ (2000) can store geographic information
- Handheld GPS receivers provide accurate positioning
- Networks: e.g. General Packet Radio Service / 3G

New technology stimulated demands for **in-field applications**.

- ESRI released ArcPad in 2000

The technology of handheld devices has improved since 2000.

#### Portability:

- 'Ruggedness'
- All-day battery life

#### Capacity:

- RAM, flash memory and processing speed;
- Improved screen size, brightness and touch sensitivity;
- Wireless networking e.g. Wi-Fi, Bluetooth.



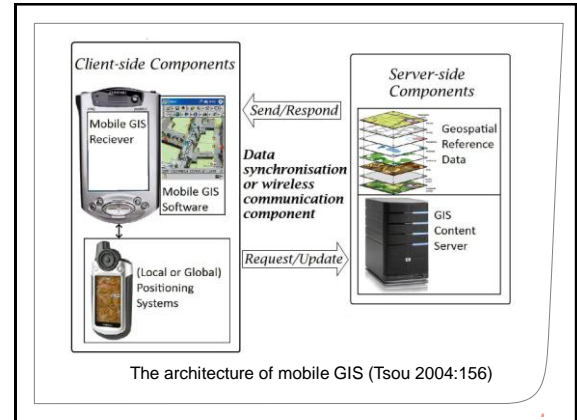
Using a Trimble GeoXT rugged handset for data acquisition and design at a Shanghai construction site.

<http://www.wbpps.com/Article/ShowArticle.asp?ArticleId=56>

## Principles

Mobile GIS consists of basic components:

- Positioning systems e.g. satellite-based GPS
- Handheld receivers (with integrated computing capacity)
- Software e.g. ArcPad
- Geospatial reference data and servers
- Data synchronisation/wireless communication



## Elements

**Scale:** mobile GIS can operate at a variety of scales.

**Accuracy:** Sub-metre (survey) accuracy can be provided by high-performance GPS receivers.

**User-oriented cartography:** mobile GIS software must be user-friendly (e.g. ArcPad).

## Applications

ESRI has identified application areas where mobile GIS can be used:

- field mapping
- asset management
- inspections/"ground truthing"
- incident reporting
- field-based GIS analysis

Mobile GIS is a useful tool for **managing infrastructure resources:**

- Improved efficiency of public works
- Mapping transportation networks
- Mapping and inspecting storm-water, waste-water and electricity infrastructure
- Maintenance of city parks

Mobile GIS has also been used for **responding to emergencies:**

- Mapping and reporting disease outbreaks, North Carolina
- Victoria bush fires, Australia, February 2009



[http://www.esri.com/news/arcnews/summer09/articles/031009\\_21\\_2.jsp#news-summer09.pdf](http://www.esri.com/news/arcnews/summer09/articles/031009_21_2.jsp#news-summer09.pdf)

Mobile GIS has been widely adopted as a tool for **environmental monitoring**:

- Tree survey for a residential development area (Trimble 2009)
- Mapping and inventorying plant/weed infestations
- Recording sightings of the endangered African Elephant in Amboseli National Park, Kenya

## Summary

Mobile GIS:

- Developed over time as a result of synergetic and coincidental technological advancements, driven by LBS
- Incorporates the principles of scale, accuracy and user-oriented cartography
- Enables users to access and utilise data in environmental monitoring, infrastructure maintenance and emergency response

## References

Raper, J., editor 2009: *ArcPad: a field user's guide*. Redlands, CA.: ESRI

Trimble 2009: *Mapping and GIS customer stories*. [http://www.trimble.com/mgis/customer\\_stories.aspx](http://www.trimble.com/mgis/customer_stories.aspx)

Tsou, M.-H. 2004: Integrated mobile GIS and wireless internet map servers for environmental monitoring and management. *Cartography and Geographic Information Science* 31(3), 153-165.

The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
0800 WAIKATO  
www.waikato.ac.nz



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*