

# Chapter 12: Facilitating the National Infrastructure for Managing Land Information (NIMLI) through Spatial Metadata Automation

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## **Introduction**

As part of the National Infrastructure for Managing Land Information (NIMLI) research project, Tambuwala et al. (2012) proposed a national land information lifecycle model that includes five main stages: collect; store and maintain; share; use; and dispose or archive. Among these stages, 'share' refers to the entities and inter-governmental process and services that disseminate information. For instance, in the context of Australia, PSMA<sup>1</sup> is involved in the 'share' stage of the information lifecycle and currently shares the CadLite and G-NAF datasets with Commonwealth Departments.

In order to facilitate sharing the information within the national land information lifecycle there is a need to provide and maintain complete, up-to-date, and precise metadata for shareable land-related datasets. Metadata, commonly defined as 'data about data' (ANZLIC 1996, Zarazaga-Soria et al. 2003), plays a critical role in any spatial data sharing platform (Ezizbalike and Rajabifard 2009, Rajabifard 2007) of which the aims are to simplify data sharing, discovery, retrieval and access.

However, the current approaches cannot effectively manage metadata creation, updating, and improvement for an ever-

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<sup>1</sup> Public Sector Mapping Agencies Australia Limited

growing amount of data created and shared in the sharing platforms, particularly within the national infrastructures for land information, due to the huge amount of data involved and updated in short time frames. Metadata is commonly collected and created in a separate process from the spatial data lifecycle which requires the metadata author or responsible party to put extra effort into gathering necessary data for metadata creation (Olfat et al. 2012c).

Metadata and related spatial data are often stored and maintained separately using a detached data model (Kalantari et al. 2009). This issue results in avoiding the automatic and simultaneous metadata updating when a dataset is modified (Rajabifard et al. 2009). In addition, the end users are disconnected from the metadata creation and improvement process and there is a need for more interaction with the end users within the data catalogue systems (Kalantari et al. 2010).

With this in mind, investigation of the feasible automatic approaches for creating, updating and improving the content of spatial metadata applicable to any level of spatial information infrastructure (e.g. the national infrastructure for land information) is central to the 'Spatial Metadata Automation' ARC<sup>2</sup> - Linkage Project. This project is coordinated by the researchers from CSDILA, at the University of Melbourne in conjunction with industry partners including the Victorian Departments of Primary Industries (DPI) and Sustainability and Environment (DSE), the Land and Property Management Authority (LPMA) – NSW, Emerg, CubeWerx, and Logica Pty Ltd.

This chapter explores the framework and technical solutions designed, developed and evaluated within the spatial metadata automation research project for addressing the main challenges regarding the metadata management mentioned earlier in this section.

### **Spatial Metadata Management Framework**

The spatial metadata management framework developed in the research project includes three complementary approaches namely 'lifecycle-centric spatial metadata creation', 'automatic spatial metadata updating (synchronisation)', and 'automatic spatial metadata enrichment', and an

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<sup>2</sup> Australian Research Council

integrated data model for spatial data and metadata storage and delivery, as illustrated in Figure 1.

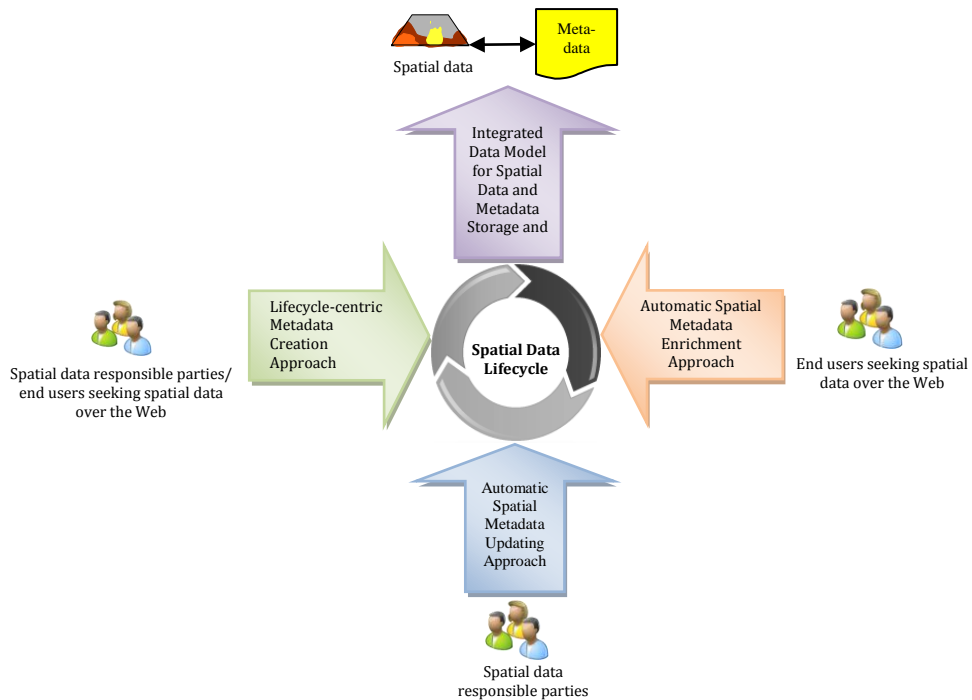


Figure 1: Spatial metadata management framework

The components of this framework are explored as follows:

### Lifecycle-centric Spatial Metadata Creation Approach

The ‘lifecycle-centric spatial metadata creation’ approach identified the ISO 19115: 2003 metadata elements that needed to be created within any step of the spatial data lifecycle. In this regard, a generic spatial data lifecycle was designed and employed by this approach. The generic lifecycle consisted of eight steps including: planning and policy making, data collection, spatial dataset creation, storage, publication, discovery and access, utilisation, and maintenance (Olfat et al. 2012c).

It was also realised that the highest number of ISO 19115: 2003 metadata elements should be created within the spatial dataset creation step. Planning and policy making, dataset maintenance, publication, data collection, dataset storage, utilisation, and discovery are respectively the next steps with the highest number of elements. The research showed that

using the lifecycle-centric spatial metadata creation approach the metadata could be completed over time in conjunction with the spatial data lifecycle and therefore, it would be more likely to be accurate and up-to-date.

Moreover, it was deduced that the proposed approach has the potential to reduce the burden of metadata creation for metadata authors by involving the spatial data responsible parties and interacting with the end users in creating and updating metadata values.

### Automatic Spatial Metadata Updating (Synchronisation) Approach

The 'automatic spatial metadata updating (synchronisation)' approach focused on automating the process of updating a subset of ISO 19115: 2003 metadata elements (including bounding box, lineage statement, date of revision, and metadata date stamp) whenever the vector dataset was modified, regardless of the dataset format (Olfat et al. 2010, Olfat et al. 2012a). The research identified a number of technical requirements to develop such a new approach.

The main requirement was an integrated data model built upon Geography Markup Language (GML) technology for storing and delivering the spatial metadata and dataset jointly. A mapping software application to generate the integrated data model and support dataset and metadata updating; a user-friendly interface to view the dataset and metadata from an integrated data model and then modify the dataset; and synchronisation scripts to update metadata based on dataset changes; were also the other technical requirements considered for implementing this approach.

In order to prove the metadata synchronisation concept, a prototype system based on the open source environments (GeoNetwork, deegree, PostGIS, PostgreSQL, OpenLayers, GeoExt, etc.) was implemented and evaluated in this research. Figure 2 illustrates the prototype system user interface.

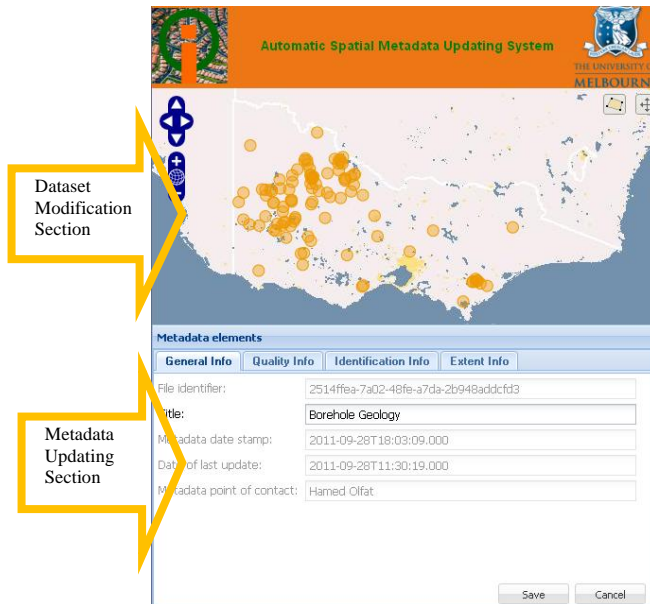


Figure 2: Automatic spatial metadata updating prototype system user interface (Olfat et al.2012a)

### Automatic Spatial Metadata Enrichment Approach

The 'automatic spatial metadata enrichment' approach concentrated on Web 2.0 features (folksonomy and tagging) to involve the end users seeking spatial data to improve the content of 'keyword' metadata element. The research designed two complementary models (Kalantari et al. 2010).

The first model, namely 'indirect', monitors the end users' behaviour against the retrieved metadata during the data discovery process and records the search words that were relevant to the datasets (based on a weighting system), and finally assigns the popular search words to the metadata 'keyword' element.

The second model, namely 'direct', allows the end users to tag a dataset with words they feel best describe what it is about, and agree/disagree with the relevance of their used search words or formerly tagged search words (by previous users) to the retrieved metadata.

In order to prove the metadata enrichment concept, a prototype system was implemented and evaluated within two different environments: GeoNetwork as an open source spatial data catalogue application and

Model Information Knowledge Environment (MIKE) by DPI – Victoria as an example of data product – data modelling environment (Olfat et al. 2012b).

## **Conclusion and Recommendations**

The spatial metadata automation research project designed, developed and evaluated a framework that facilitates and automates the creation, updating and enrichment of the content of metadata for shareable datasets. This framework has the potential to be applied to the national infrastructure for managing land information (NIMLI) to assist the stakeholders in sharing, discovery, and access of land-related datasets.

The research highly recommends that the process of metadata creation needs to be integrated with the land information flow lifecycle to provide complete, up-to-date and accurate metadata. It also suggests that the land-related dataset and its associated metadata should be stored together using a GML-based integrated data model, so that managing and maintaining both metadata and datasets can be undertaken in real time. Finally, the research recommends that involving the end users of a national land infrastructure in the process of metadata creation and improvement would facilitate the data discovery and improve the usability of discovery services.

## **References**

ANZLIC, 1996. ANZLIC Guidelines: Core Metadata Elements Version 1.

Ezigbalike, C. and Rajabifard, A., Indicators for Assessing Spatially Enabled Government Services. *GSDI 11 World Conference*, 15- 19 June 2009 Rotterdam, The Netherlands.

Kalantari, M., Olfat, H. and Rajabifard, A., 2010. Automatic Metadata Enrichment: Reducing Spatial Metadata Creation Burden through Spatial Folksonomies. In: Rajabifard, A., et al. eds. *Spatially Enabling Society*. Luven University Press, 119-129.

Kalantari, M., Rajabifard, A. and Olfat, H. 2009. Spatial metadata automation: a new approach. In: Ostendorf B., Baldock, P., Bruce, D., Burdett, M. and P. Corcoran (eds.), *Proceedings of the Surveying & Spatial Sciences Institute Biennial International Conference*, Adelaide 2009, Surveying & Spatial Sciences Institute, 629-635.

Olfat, H., Kalantari, M., Rajabifard, A., Senot, H. and Williamson, I. 2012a. A GML-based Approach to Automate Spatial Metadata Updating. *International Journal of Geographical Information Science*, DOI:10.1080/13658816.2012.678853.

- Olfat, H., Kalantari, M., Rajabifard, A., Senot, H. and Williamson, I. P. 2012b. Spatial Metadata Automation: A Key to Spatially Enabling Platform. *International Journal of Spatial Data Infrastructures Research*, 7, 173-195.
- Olfat, H., Kalantari, M., Rajabifard, A. and Williamson, I. 2012c. Towards a Foundation for Spatial Metadata Automation. *Journal of Spatial Science*, 57(1); 65-81.
- Olfat, H., Rajabifard, A. and Kalantari, M. 2010. A synchronisation approach to automate spatial metadata updating process. *Coordinates Magazine*, VI(3), 27-32.
- Rajabifard, A., ed., 2007. *Towards a Spatially Enabled Society*. Melbourne: The University of Melbourne.
- Rajabifard, A., Kalantari, M. and Binns, A., 2009. SDI and Metadata Entry and Updating Tools. In: Loenen, B. v., Besemer, J. W. J. and Zevenbergen, J. A. eds. *SDI Convergence. Research, Emerging Trends, and Critical Assessment*. Delft, 121-136.
- Tambuwalla, N., Rajabifard, A., Bennett, R., Williamson, I. and Wallace, J. 2012. Inter-governmental land information asymmetries in Australia. *Journal of Spatial Science*, 57(1); 83-100.
- Zarazaga-Soria, F. J., Lacasta, J., Nogueras-Iso, J., Torres, M. P. and Muro-Medrano, P. R. 2003. *A Java Tool for Creating ISO/FGDC Geographic Metadata. Geodaten- und Geodienste-Infrastrukturen - von der Forschung zur praktischen Anwendung*, 18, 17-30.



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