TOWARD e-LAND ADMINISTRATION: 
AUSTRALIAN ONLINE LAND INFORMATION SERVICES

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ABSTRACT

Sustainable development (SD) is accepted as a central driver in countries world wide with land administration playing an important role in delivering SD objectives. Within this context the emerging use of the Internet and other information and communication technologies (ICT) are increasingly being utilised by land administration organizations. These technologies provide opportunities for better service delivery and customer satisfaction and a reduction in operating costs. However establishment of these systems as part of e-land administration and in the context of e-government has to date not been fully realised and is often problematic.

E-land administration includes the coordination among various parts of land administration businesses including front office operations like online customer services and private partnership services, and also back office operations like internal work flow and central data base management. The first step in improving the current systems within a particular jurisdiction is assessing the current performance of online land information services as part of e-land administration.

There are various initiatives to deliver land related information over the Internet for the public in the different Australian states. Analysing these experiences and determining good practice will assist in proposing effective and innovative solutions to improve or re-engineer the existing services as a key infrastructure for implementing e-land administration services.

This paper first introduces and discusses various quality of service criteria for the assessment of an online land information system. The criteria include popularity, performance, functionality and user requirements of services. The paper then reviews and presents current land administration services in Australian states including a statistical analysis to better understand the advantages and deficiencies of current services. The results are assessed and suggestions are proposed for improving online land information services.

BIOGRAPHY OF PRESENTER

Mohsen Kalantari currently is a PhD student in the University of Melbourne. He was awarded a Bachelor of Surveying Engineering and Master of GIS by KNT University of Technology in Tehran, Iran. During his M.Sc. studies, he was involved in various research projects in the Geodesy and Geomatics Research Centre at KNT University of Technology. During his final year of M.Sc. Mohsen worked as a teaching assistant in the GIS department and was involved in tutoring GIS students. After finishing his Masters degree in Dec 2003, he became R&D director in GlobeArray (Geomatics Private Research and Development Company) in Tehran.
1. INTRODUCTION

The importance of spatial data can be summed up as, “everything and every one is someplace”. Crime management, emergency services, property taxes, public health, public works, urban planning, disaster management and almost all activities of government can be done efficiently with the help of land related information [Pichler 2004]. This makes the three main groups of governance - government, the private sector and civil society [Steudler 2004] heavily dependent on land administration for informed decision making.

Within this context, the Internet and other information and communication technologies (ICT) are increasingly being heavily utilised by land administration organizations. These technologies provide opportunities for better service delivery, customer satisfaction and reduction in operating costs. Although the Internet and web technologies have found their way into the business of the cadastre, with several initiatives taking place in many countries to improve the delivery of cadastre services over the Internet [Radwan et al. 2005], establishing these systems as part of e-land administration and in the context of e-government has not been fully realised and is often problematic.

While much of the activities in land administration are committed to serving a broad range of citizens and business, e-land administration requires electronic or online services delivery. e-land administration is defined as a capacity to transform land administration through the use of ICT.

To establish an e-land administration system five phases are suggested, with the first being Internet based land administration. This includes delivering organizational information to customers over the public Internet and through Intranets to their own staff on private internal networks; which is as far as most governments today have gone. The second phase is transacting with customers over the Internet; this requires the organization to offer products and services to their customers over the Internet. The third phase is integrating Internet applications with transactional e-land administration by connecting internal enterprise applications and transactional e-land administration systems. The fourth phase is external integration with partners and suppliers through connecting internally integrated applications to the enterprise applications of external partners. The final phase is undertaking real-time monitoring and understanding of the e-land administration service.

In order to identify possible models and guidelines for e-land administration services, analysis of country experiences and good practice as well as identifying key challenges and impacts is necessary. There are various initiatives to deliver land related information over the Internet to the public in different Australian states. Existence of more than ten online land information services in the various states proves that Australia is one of the leading countries in conducting e-land administration. Governments worldwide are recognising the importance of delivering citizen-centric services which put citizens at the centre and provide a single interface for citizens to access all (or a range of) government services [Commonwealth 2003]. However, the variety of approaches indicates a lack of harmonization and integration and eliminates the opportunity for a single portal e-government service for land administration. Analysing these experiences and determining good practice will assist in proposing effective and innovative ways to improve or re-engineer the existing services as key infrastructure in e-land administration. The first step in the improvement of current systems is assessing the current situation of online land information services as part of e-land administration.

2. METHODOLOGY

Online monitoring of different land information services around Australia was undertaken to determine the capacity to deliver services to users and was conducted systematically and periodically (Oct 2004, December 2004, April 2005, and May 2005). The methodology used in this research consisted of the following two steps: making an inventory of all existing services on the Internet, then measuring several characteristics to describe each service.

The inventory (Step 1) was periodically compiled by visiting the services. There are 12 online land information services in Australia. NSW, NT, SA, TAS and VIC have one portal for their land information services, while ACT and WA have two services and the QLD government presents 3 portals in the context of GIS and land information systems managed by three different departments: the Office of Economic and Statistical Research and the Department of Natural Resources and Mines as well as the Office of Urban Management. The assessment identified only one online land information service from each State based on that service being most relevant to land administration. The assessment (Step 2) was based on the following criteria: performance, functionality, user requirements and popularity. The presentation of the results is grouped using these quality of services criteria.

A brief description of each service is presented, followed by the results related to each criterion. Due to the large amount of data gathered and the number of services, results are presented by figures. The diagrams and charts are
principally used to present the results of assessment at a glance; statistical presentation usually relies on averages and medians.

3. ONLINE SERVICES

a) Descriptions

Of the 12 existing services in Australian jurisdictions, 8 (one for each state) were identified as being comprehensive and most relevant to land administration and cadastre applications. This section presents a brief description of these preferred services.

ACT Locate: ACT Locate is an Internet mapping service created for the Australian Capital Territory (ACT) Government, which aims to promote the use of geographic information across the ACT [DUS 2005]. ACT Locate is built upon a mapping capability that enables visualisation of the information being sought by the user. It provides two ways to access the system. The first is via a text search and the second is to start with a map and select the area and scale of interest, along with the required layers of information [ACT 2005].

Land Geospatial Portal: The Lands GeoSpatial Portal (GSP) is a multi-functional interface, providing internal and external user access to spatial data of the Department of Lands, NSW. It aims to increase the services that it provides via the Internet and through secured online applications [DOL 2005] and it enables viewing and searching of integrated spatial data, including cadastral, topographic and some imagery data. The GSP also provides new integrated applications allowing the user to access topographic maps and aerial photographs, with secure credit card transactions ordered over the web. External data can also be viewed in the application, such as national mapping and mining lease data [NSW 2005].

Northern Territory Atlas: The Department of Infrastructure, Planning and Environment (DIPE) is responsible for the Northern Territory Atlas which is the lead agency for GIS and spatial data management in the Northern Territory, responsible for coordinating, monitoring and advising agencies on geographic information systems and associated spatial data management activities [NT 2005]. The Atlas was designed to provide easier access to Australia’s geographical information and improve the ability of Commonwealth, State, Territory and Local Governments and community groups to manage resources [NTA 2000]. The service provides viewing and searching of spatial data and attributes by building various kinds of queries based on available data and attributes as well as locating by coordinates or simple zooming and panning.

Interactive Map: The Interactive Map is owned by the Office of Urban Management of Queensland. The material presented on this site is provided by the Queensland Government to the public for information purposes [QLD 2005]. The service is based on searching. The search form provides several options for locating an area of interest. Searching can be done by entering the partial or full address, lot plan details or a specific suburb or locality. Users can also search visually by using the toolset provided above the map itself [QLD 2005].

Atlas of South Australia: The Atlas of South Australia is an initiative of the South Australian Government to provide a common access point to maps and geographic information in an interactive atlas format. The Atlas comprises two main parts – an interactive mapping system and a database of map (or spatial) products and services [SA 2005]. It is based on a conventional atlas format and builds on the previous paper edition of the Atlas of South Australia 1986, however it now takes advantage of new databases and technology and aims to deliver current information to the community in an interactive environment [SA 2005].

The LIST Map: LISTmap is an Internet based map viewer for the Land Information System Tasmania (LIST). The aim of the service is to encourage public access to government information and provides on-line access to some government services [Tasmania 2005]. It enables users to view and create maps from over 100 spatial datasets stored in LIST. Users can create maps and interrogate features within the datasets to find out information about the features. LISTmap replaces the two map viewers originally developed for LIST and is fully integrated with the title and property searching modules [TAS 2005].

Land Channel Map: The Land Channel is a Government web site owned by Department of Sustainability and Environment (DSE), providing integrated access to land, resource and property information and services for Victoria [VIC 2005]. The service provides various opportunities for the users to access information using searches by address, lot on plan, community facility as well as access to information using coordinates. It also allows users to add and switch
various map layers on and off to give a different look to the interactive map. The service seeks to deliver government information and services in terms of subjects, themes and life events (eg. buying or selling property), not government structures [VIC 2005].

**Landgate:** Landgate provides a range of online products and services and is Western Australia’s gateway to land and property information. Landgate map viewer is a tool to view land and property information online. Property, survey, native title, and planning data are available as map layers which can be turned on and off and can be displayed over aerial photography. One can search by street address, local government area, the land description or certificate of title number [WA 2005]. The service provides Western Australians with integrated online access to the most up-to-date land and property information.

**b) Performance**

The two major criteria for measuring performance are throughput and response time. Throughput is a server oriented measurement that measures the amount of work done in a unit of time. Response time is the amount of user-perceived time between sending a request and receiving the response [Peng & Tsou 2003]. An interaction for retrieving a web page is needed in order to measure performance. Any interaction can be broken into 4 stages and the time of each stage together represents the total time of the transaction. “D” or DNS (domain name services) is the resolution time, which is the time of the Internet's system for allowing users to utilize normal English descriptions for communicating with servers that must be addressed by an IP address. “T” or TCP is the connection time, which is the time of the connection process to the server. The FirstByte Time of “F” represents the time the browser waits between the request and receipt of the first byte of data from the web server responding to that request. The content time is directly related to the size of the downloaded file or “H”.

Recognising the times of the stages assists finding the hold-ups and problems within the stages. Any of the stages are related to one of the components of services including network, server and client machine. Figure 1 shows the various stage times used to calculate the response time for measuring the performance. The figure demonstrates the DNS time for access is close to zero while sometimes the connection time rises because of network traffic. The time of first byte also rises when the web pages carry too many objects and the content time represents the ability of browsers to parse the received data. Almost all of the services had this behaviour which is related to network, server and client performance together.

![Figure 1: Various stages for calculating the response time](image)

The process of performance monitoring was done in the full connection rate for Integrated Services Digital Network (ISDN) and T1 connections. Furthermore the results were corrected for modem connections (56Kbps or less) by a packet loss factor. Figure 2 shows the response time of the service relating to the size of the requested file in services. The figure clearly shows that by raising the size of a file the response time will be increased, but some times improper network setting causes latency in the clients’ requests. It is also important to note that the complexity of functionality in the service influences the time of response. For example the processing time for finding parcel information in a database is different from the time it takes for zooming or panning on a similar data set.
Nevertheless in some of the services, the sizes of the files are quite big but the response time is short, meaning they comprise proper network settings. For that reason the overall performance of the service is dependent on the combination of service, network and client machine, not the individual component alone. More specifically, the overall system performance depends on bottlenecks caused by the slowest component. Therefore the first step to enhance system performance is to identify the weakest component.

c) User interactivity and functionality support

The amount of functionality of a service is a usability issue. The functionality of online land information services can be divided into three categories including technical, general and cadastral factors.

Technical factors of online applications can be underlined as light weight download, JavaScript for a more dynamic system, and metadata or data catalogue support for the usage of data in the services.

The benchmarks for the download weight of the website can be derived using the number of objects, number of requests as well as number of scripts in the page. Using fewer images on the site or reusing the same image can promote the performance of systems, as an image should easily fit into one TCP-IP packet. Most of the services have additional external HTML files, which load another page or object and slow the total display time of the entire page. However most of the browsers can multithread several HTML files on the page. Nearly every websites’ page had a moderate amount of images. But in some cases they take the advantage of caching, using fewer images on the service or reusing the same image in multiple pages.

Minimising requests is a key for increasing performance of online land information services and this relies heavily on transactions with clients. Using JavaScript, requests over the server can be sorted and arranged before they are submitted to the online service, effectively reducing the number of interactions between the user and the online land information service [Green & Bosomair 2001]. Almost all of the online services have numbers of external script files on their webpages, which shows the service is well-equipped with JavaScript to assist the clients. Although multiple scripts on the page will increase the time of download, they assist the interactions and decrease network load during the process of interaction.

Metadata helps users understand data, provides consistency in terminology, focuses on key elements of data, helps users determine the data's fitness for use, and facilitates data transfer and interpretation by new users [Williamson et al. 2003]. Metadata accessibility describes the presentation of the data content within services. In most cases, services do not provide access to metadata in the same website. However, in a few cases the metadata is available in related websites. In other cases, the user has the ability to access the data directly by means of its metadata.
Important general functionality issues in the online land information services include: displaying wide regions on a small screen; supporting various methods of zooming and panning (11% of time is spent on these tasks); producing different views with the scale change; producing different cartographic displays for a special object in different scales; and allowing the users to express ad hoc queries and other orders and to receive information from the system [TheEuropeanCommission 2002]. Figure 3 shows the availability of general functions of the services. The results were derived from the functionalities which can be classified in 7 major groups including visualization, zoom, identification, selection, legend, scale and output preparation.

Accessibility to property rights, responsibilities, restrictions, descriptions of their extent, support for land transfers, provision of evidence of ownership, information for property taxation, monitoring of land markets, and support for land market and land use planning are important cadastral functionalities in the context of land administration which could be supported by online services.

Some services are specialised for cadastral and land administration applications. These services generally offer search by address as well as search by location name. In most of the services, the user can also access the attributes of various available layers by building queries. Access to information about the cadastral map, lot on plan and information about the properties are available in few of the services. Also services present various kinds of functionalities like search by suburb, search by unique ID, and search by administrative area. This variety comes from a state’s uniqueness, institutional, economic, legal, technical and cultural settings. Also most of the jurisdictions have initiated projects for electronic conveyancing and electronic lodgement which are internet-based systems that will enable online processing for the settlement and lodgement of land dealings. The number of specialized land related applications in the states is summarized in the Figure 4.

The development of the cadastre is dynamic and more institutionally and technologically driven rather than user driven. However the development of the models for services, especially in the user side of the business (owner, buyer and lender), should be more user-driven rather than based on the historical development of cadastral systems.
d) Analysing of user requirements

Understanding the users’ abilities and goals can positively influence the entire service design, development and customisation process [The European Commission 2002]. For the purposes of this research, users of land information services have been categorized into three major groups, including decision makers, information specialists and interested citizens, each requiring special facilities in the service.

The information specialist usually needs raw data and various kinds of functions and analysis to produce information from data. The service for this group should be large and flexible and linked to other packages and services. Good accessibility and interfaces for other service could be keys for this group. The assessment of services in Australia shows most provide the raw data which various users can download through the web. None of the services offer proper functionalities for data manipulation and they are not able to present any plug-in facilities for users. The result shows the services are designed to support the information specialist by making data available so that the services operate as spatial data clearinghouses rather than online interactive information services.

For decision makers, the service should provide proper and optimistic decision making models. Another key component of services for this group is the availability of strategic data, although services should be compact, small and manageable and provide interfaces to other similar services that assist the policy decision makers. The majority of the services analysed offer strategic information for the use of decision makers. The user interfaces are simple and friendly although not equipped with proper and optimistic models for decision makers. Likewise from the information specialist point of view services are needed to promote and develop their functionalities.

Interested users’ services should be close to real life, possibly to solve their daily location related problems, and data on the service must be meaningful. For example topographic data for interested citizens does not make sense, while street information as well as addresses are very useful and provide proper and related information. Small and efficient services will attract and satisfy these users who need an intuitive interface for their requests. The services need to address the non expert user and interested citizens’ needs, through simple user interfaces, relevant information and user friendly interfaces.

As it is illustrated in Figure 5, 51 percent of the functions are related to common users and interested citizens, with a further 32 percent of functionalities related to the policy decision maker and 17 percent of functionalities are useful for information specialists; which are more related to data access.

![](image)

**Figure 5: User requirement analyse of the services**

In regards to the above results and discussions, detailed requirement analysis is needed to compile the user needs for developing a list of user requirements. The list contains details on the existing setup of the users and their requirements. This is used to specify design and re-engineer the online land information services.

e) Popularity

There are several criteria for measuring the popularity of online land administration services including findability, number of return visits, length of time on web site etc; however research within this paper used the number of web references and number of visitors to measure the popularity of the web site within the Internet network.

The assessment used *LinkPopularity.com, Free Link Popularity Service (http:// www.linkpopularity.com)* (The PC Edge, Inc.), which measures the number of links to the homepage of the land information service that can be checked by the following search engines: AltaVista and Google. A well-linked popular web site can dramatically increase traffic to
the specific web site. Assessment results show the popularity depends on the number of citations over the web (see Figure 6). If the popularity of services is high, then the number of references to them by other organizations is high.

![Figure 6: Number of links to the services based on search by Google and AltaVista](image)

The number of visitors in the period of assessment is a qualitative indication of the use of online services by end-users. This number relates to the number of visitors who visited the homepage of the service. It does not really present the usability of the service for doing land related tasks, because it does not identify the behaviour of the users within the service and the number of different visitors.

![Figure 7: Service’s traffic based on number of visitors](image)

Figure 7 illustrates the averages and median of the number of visitors in the period of three month for each of the services. Based on the gathered data, it seems that choosing a proper and relevant name for a service can dramatically improve the popularity of the service. Appropriate titles within the services environment increase the number of visitors. The average and median of the services with names like Atlas or titles including Map are much higher than those that have titles like Land, GeoSpatial, and Channel.

4. DISCUSSION AND FUTURE DIRECTIONS

The main objective of this paper is to assess the current situation of online land information services in Australia. The result is based on ongoing research by the authors, for defining a framework for better assessment and improvement of land information system in order to achieve e-land administration. With this in mind, the results of the assessment could be complimented by an in-depth investigation utilising case studies to determine the requirements for online land information.

Because each service is unique in its aims and objectives, there are also differences in institutional and technical settings, with no single best practice currently identified. However, the following are some indications of success factors:

- With regard to user requirements, be specific about the purpose of the land information service and identify the range of users including information specialist, decision makers or interested citizens and target them with proper functionality and data.
In order to achieve better service performance, provide good communication channels for the community for sharing and using datasets as well as interaction with map servers.

Offer proper services, presenting different architecture based on the client connection rates as well as levels of service interactivity to deliver reliable and popular services.

With respect to popularity and functionality, create more user-friendly interfaces with less discipline-specific terminology especially for decision makers and interested users. As mentioned above, a focus on the needs of the users is becoming a crucial aspect for implementation. At this moment, users have the right to expect more from facilities. A point of concern is that services are not always user friendly. It seems that some concepts are too complicated and the terminology used is too discipline specific.

5. CONCLUSION

The paper presented a methodology for assessment of online land information services. The methodology accessed the capacities of 8 online land information services in Australia. The monitoring and assessment tested the ease, speed and independence to assess the functionality and data on the web.

The success factors that have a positive impact on the development of online land information services are the inclusion of efficient and new technologies within services, the clarity of purpose of the services for various types of users, the provision of good communication channels, and the creation of user-friendly interfaces with clear terminology. Addressing these factors will go a long way towards meeting the needs of current users.

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