The Digital National Framework of Great Britain

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Introduction

As our increasingly complex Information Society develops, it is well recognised that many of the decisions made by policy makers, planners, businesses and citizens, rely on spatial data, making its availability, quality and interoperability, increasingly important issues. How that data is produced, funded, and made available, varies widely from country to country, depending mainly on political, historical and cultural differences, but increasingly it is undertaken within the context of a spatial data infrastructure (SDI).

Spatial Data Infrastructures

Although various definitions exist, the term Spatial Data Infrastructure (SDI) generally describes a framework of components that collectively create an environment in which spatial data can be accessed and widely used; often it is the co-ordinating infrastructure underpinning the data assets of a country. The US National Spatial Data Infrastructure (NSDI) is defined (NSDI 2002) as:

"*the technology, policies, criteria, standards and people necessary to promote geospatial data sharing throughout all levels of government, the private and non-profit sectors, and academia*."

Placing slightly more emphasis on the role of the Internet, and alluding to support for private sector involvement, the Canadian view (Geoconnections Secretariat, 1999) is that an SDI is:

"An integrated on-line mechanism to deliver geo-spatial data, services and information for applications, better business and policy decision making and value-added commercial activities."

The Global Spatial Data Infrastructure (GSDI Cookbook, 2001) says that the term SDI is often used to denote:

"The relevant base collection of technologies, policies and institutional arrangements that facilitate the availability of, and access to, spatial data"

The word *infrastructure* is intended to denote the creation of a dependable, supporting environment in the same way that efficient road or telecommunications *infrastructures*, or networks, are pre-requisites for the efficient movement of road traffic, or internet content. One of the earliest and perhaps most prominent examples of SDIs is the NSDI in USA. Others, such as Sistema Nacional de Informacao (SNIG) in Portugal, and the Australia Spatial Data Infrastructure (ASDI), have also emerged. Given its size the US example might be considered to be a regional SDI. In many

respects these initiatives have differed from the outset due to inherently different geographical, political, economic and social roots. In recent months there has been growing momentum for the creation of a European SDI, initially to support the demands of the environment sector. This has legal justification, to support the Water Framework Directive for example, and political backing from EC Commissioners (European Commission 2002).

As spatial data can perform such a key role in informing decision making for government, business, and the citizen, one would expect that creating an SDI would be a high priority for national governments. Indeed, recognition of the benefits of SDI's appears to be growing, and is reflected in a recent survey (Crompvoets J. and Bregt A, 2002) that found that 120 out of the 192 nations of the world (in Dec 2001) were working on their national SDIs, albeit with a varying mixture of components and models. A similar list in 2000 only included 40 countries (Tom H, 2001). Within Europe, the development of the Information Society, a key EU policy area, has included steps to liberalise both the telecommunications sector and the availability of Public Sector Information (PSI). A report for the European Commission (EC) in 2000 (PIRA, 2000) maintained that Geographic Information (GI) represents more than 35% of the total economic value of Public Sector Information (PSI) in Europe.

The British Context

A paper describing the UK National Geospatial Data Framework (NGDF) (Hadley C, Elliot L, 2001) reported that the annual spending by UK government departments and other organisations on geo-spatial data collection was £400 million. As in the US however, the same paper reported serious inconsistencies between data collections. Some were difficult to discover in the first place while others were difficult to access when they were found. The NGDF no longer exists, but it did contribute the askGIraffe metadata service for the UK.

Ordnance Survey, the National Mapping Agency, has made Great Britain one of the few countries in the world to have a complete digital national topographic database, including complete large scale data for all urban areas. In the last year Ordnance Survey Northern Ireland has completed the UK picture with large scale digital data covering the entire province (Ordnance Survey Northern Ireland, 2001). Within Great Britain there is now widespread use of digital mapping across many user sectors, in one of the most developed GI markets in Europe, based on a robust data infrastructure which enables major contributions to national economic development. Emphasising this importance to economic activity, a study in 1999 (OXERA, 1999) indicated that over £100Bn of the GB GDP per annum is based on the use of Ordnance Survey's digital data. The inconsistencies between datasets held by different owners however, and the inability to easily cross-reference information, means that much of the potential value of data collected, for example by central government departments, local government, and private sector organisations, is not being fully realised.

Ordnance Survey has been able to provide data within a common reference system (the National Grid) since the 1930's thanks to the far-sighted recommendations of the 1938 Davidson Committee. Digitisation of the large scales mapping began in 1972 and the National Topographic Database was completed in 1995. A number of related thematic databases have since been created, for example administrative boundaries,

electoral districts, postal code points and polygons, road centrelines, and digital terrain models.

The Digital National Framework

In developing its strategy Ordnance Survey has been led by changing customer requirements - particularly in the emerging internet and location based service sectors. It has recognised the need for a portfolio of definitive national GI data, and the integration problems identified above. Over the last twelve months Ordnance Survey has embarked on a number of projects under the umbrella of a new "e-Business strategy", the vision of which is:

"Ordnance Survey and its partners will be the content provider of choice for location based information in the new knowledge economy".

Included in the strategy adopted by Ordnance Survey are the three key issues identified in the 1994 strategic plan for developing the NSDI of the United States, namely:

- Creating **Standards**;
- Improving **Access** to, and sharing of data (by the creation of a National Geospatial Data Clearinghouse) and;
- Creation of framework, or reference data – a **Geospatial Data Framework**.

a) Standards

As well as participating in a number of national and international standards bodies, Ordnance Survey, as an active member of the Open GIS Consortium, has helped the development of Geography Markup Language (GML), the format in which the new OS MasterMap™ data is supplied. Working with other National Mapping Agencies, Ordnance Survey has developed the Digital National Framework (DNF) - an infrastructure that includes a co-ordinate reference system, information layers, electronic service delivery, and data association features. DNF is further described below.

b) Access

Ordnance Survey data products are described in the UK "askGIraffe" metadata service maintained by the Association for Geographic Information (AGI). In addition, the Ordnance Survey web site provides detailed product information including downloadable user guides and sample data. A number of users have dedicated extranet access to Ordnance Survey data allowing, for example, change only update if required, on a daily basis.

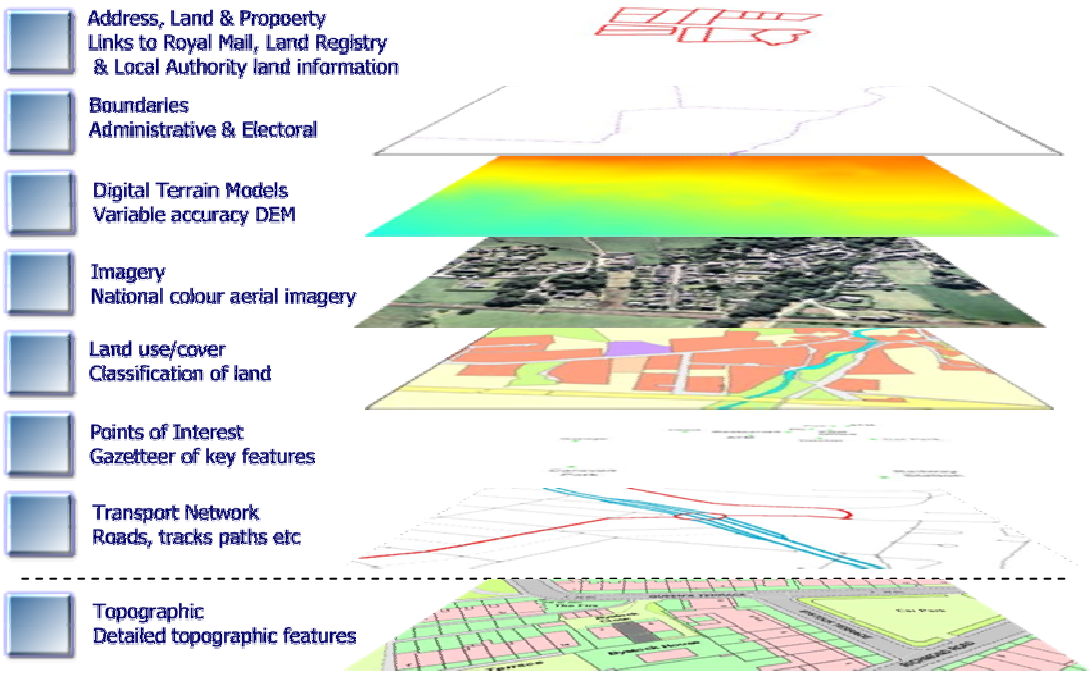
c) A Geospatial Data Framework

As part of its new e-Business strategy, Ordnance Survey is developing its digital mapping products and services within a coherent infrastructure known as the Digital National Framework. The DNF combines the British National Grid and GPS referencing system to create a new spatial reference standard that provides both location **and the link to topographic objects**. A unique 16 digit Topographic Identifier (TOID) is used for all points, lines, and areas, and provides a common link

that will allow different data to reference the same feature, allowing users to cross-reference data in a way that should help to release the potential and value of their data.

OS MasterMap™ the first realisation of DNF

In November 2001 Ordnance Survey released the first layer of its OS MasterMap, the first data product based on the DNF. The re-engineering of over 430 million point, line, and area features, each referenced by a unique TOID, has created a seamless, object-based, large scales topographic layer that initially includes nine themes. Additional layers will be added later in 2002 and into the future, driven by customer requirements. Some of the planned layers, in addition to the existing topographic layer, are shown in the following diagram:



By developing the DNF and OS MasterMap Ordnance Survey is providing the third of the key SDI features listed previously in this paper i.e. **providing the framework**. The data is intended to provide a definitive reference that acts as a common template onto which users can link their own data, by using the TOID. TOIDs support explicit linkages and therefore enable data sharing. The object based approach provides a more intelligent database including, where necessary, inferred links to close polygons. Service features such as on-line ordering and theme selection, user defined area selection, change only update, and on-line delivery make OS MasterMap data extremely accessible. Delivery is in industry standard GML which is supported by all major systems providers.

Funding and Investment

While the overall components of an SDI are generally accepted, the way in which the infrastructure is funded varies considerably. Analysis of funding options shows that the majority of SDI's have evolved from National Mapping Agencies (NMAs)

(Rhind, D, 2000) and have therefore largely followed NMA funding models. These are generally based on one, or a combination, of the following:

- public funds (from taxation)
- license charges directly from users or indirectly via public/private sector partnerships
- indirect funds such as advertising or sponsorship

While public funding is the most widely used model, the sale (or charged licensing) of spatial data is on the increase (Giff G and Coleman D, 2002). Giff and Coleman cite Ordnance Survey GB and the Dutch Kadaster as being success stories by having balanced expenditure and revenue models in which revenue surpluses can be re-invested back into the business. As well as decreasing the burden on state funding, there is also an argument that suggests that resources are best utilised when they *belong* to the spender; that if "the customer is king" then users will influence the development of products and services. Ordnance Survey has generated revenue from licensing for many years and has used this to fund investments which enhance database quality and service levels. Prior to it becoming a Trading Fund in April 1999, Ordnance Survey had to surrender revenues in excess of targets, and could not meet all of its investment needs as quickly as it wished. Since 1999 however, Ordnance Survey has been able to retain all of its revenue and has increased its level of investment to meet increasing customer expectations for quality, price and delivery of up-to-date geographic information. The principle is now a cornerstone of Ordnance Survey's business model. This re-investment has to take place within the realities of the market place however, making the data charging and investment equation a delicate one to balance. While the prices of Ordnance Survey data came down in the year 2000-1, in some cases substantially (Craglia M and Masser I, 2002), £8 million was re-invested out of a turnover of just less than £100 million (Ordnance Survey 2001). This re-investment is seen by Ordnance Survey as crucial to deliver the high quality location based content required by users in the new information economy, and in order to stimulate new markets. The experience of the US model has shown that although it allows easy access to some types of GI, by not being able to generate income to update and improve these data, the public GI are of poor quality and out of date compared to what is available from NMA's in Europe (EuroGeographics 2002). The necessity to allow the Public Sector the scope to re-invest in this way has been recognised in the latest proposal for a PSI Directive (European Commission 3, 2002) which states that:

> *"access to or re-use of these documents should not exceed the cost of producing, reproducing and disseminating them**, together with a reasonable profit margin**."*

Another cornerstone of Ordnance Survey's business model is the use of partners. It is widely recognised that the modern information products required to meet the needs of all users in a modern information based economy cannot be designed or provided by one supplier (Roper C, 2002). Ordnance Survey works in partnership with over 400 organisations that license data to provide specialist applications and content for specific market sectors. There is a wide range of organisations involved; some are major global corporations, such as Microsoft, while others are relatively small SMEs serving niche markets. Income from partnership agreements is seen as a key revenue growth area for Ordnance Survey in the coming years.

Conclusion

Ordnance Survey's strategy of developing a national infrastructure by **providing the national framework**, creating a template of object-based reference topographic data, and then gradually increasing the number of layers of compatible data is a pragmatic "step by step" approach given the dynamism of the new information economy. It is affordable because of the financial freedoms Ordnance Survey has in its current status. This allows Ordnance Survey to re-invest to provide increasingly higher quality data content, and new products and services to serve new markets. The formulation of the DNF and OS MasterMap provide a sound foundation upon which the rest of the nation can develop a co-ordinated spatial data infrastructure. Further development will be very much user led, influenced by changing market conditions and technologies, and enabled by working closely with public / private sector data users, business partners and other NMAs. By sharing its experiences of this practical approach at national level Ordnance Survey intends to play an active role in the development of the European SDI.

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