

Irish Spatial Data Infrastructure

I

Bruce McCormack

Department of Environment, Heritage and Local Government, Irish Government

ABSTRACT

The establishment of an Irish Spatial Data Infrastructure (ISDI) is in the early stages in Ireland. However although no concrete products or services are available preliminary discussions and investigations have taken place. Currently a public consultation process is taking place on the basis of a Consultation Document. After dealing with various background matters the paper highlights issues which are raised in the Document, including such matters as a vision and principles for the ISDI, the spatial area of coverage of the ISDI, options for the overall structure of the system, standards, data matters, the establishment of a framework of 'small areas' across the country, legal and financial issues, consultation and publicity, education and training matters. Finally implementation of the ISDI is discussed with mention being made of some short term milestones.

KEYWORDS

Spatial Data Infrastructure, Ireland

1 BACKGROUND

Currently it would appear that over 120 countries are involved in establishing Spatial Data Infrastructures. Thus building this type of infrastructure is widely seen as a means of advancing national goals. Ireland takes the same view. In 2002 the Irish government resolved to establish a National Spatial Data Infrastructure. This paper provides a background context within which the Irish Spatial Data Infrastructure (ISDI) has developed and highlights some of the main issues which are being addressed.

A Consultation Document has been prepared and on the basis of this document the public and a wide variety of organisations in Ireland are being asked to provide their comments. This paper draws heavily on the Document (<http://www.irishspatialstrategy.ie>).

2 WHAT IS A SPATIAL DATA INFRASTRUCTURE

A formal definition of a SDI which has been used in the ISDI context is '**(an SDI is) the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data.**'¹ A key element of this definition is the scope of issues which are covered by an SDI. It is clearly not just about technology nor even the straightforward provision of certain datasets.

¹ US Federal Government circular issued on 19 August 2002, and available at http://www.whitehouse.gov/omb/circulars/a016/print/a016_rev.html

In more straightforward terms an SDI is seen as the ‘ground rules’ and arrangements which are put in place to enable spatial data from separate digital data bases to be combined seamlessly without undue difficulty and for such data to be widely available and used.

In practical terms, if an ISDI were operational, spatial data would be readily discoverable and available via the Internet using a browser based facility. For some users it would be available on their organisation’s Intranets. It is envisaged that in time any device (PDA, mobile phone, laptop, desktop computer, etc.) connected to the Internet could access a GIS client application on a geo-portal which would allow the user to create customised maps from diverse data drawn from distributed databases. This could be carried out without the user having to search for and explicitly link to the individual servers. A user could thus create maps consisting of base layers overlain with more specialist “thematic” data from a variety of fields (e.g., health, demography, transport, education, planning, etc.). Users would have a range of options available, from the relatively simple visualisation of data (map viewers) to more sophisticated analyses of spatial data. Spatial data could also be made available for download to local desktop GIS applications.

Accessing relevant data and using the various functionalities which can be performed on the data should ideally take place with a minimum of delay (seconds in some cases, depending on the type and size of the data files being downloaded into the system).

It is envisaged that the databases that would be involved in the ISDI would remain the property and responsibility of the host organisations (termed data custodians).

This is not a full description of a possible future situation but merely an outline that provides a glimpse of what could be involved.

3 WHY AN ISDI IS NECESSARY

In general terms some of the benefits of an ISDI could include:-

- Making ‘joined up government’ more of a reality
- Making government more transparent
- Facilitating more evidence based policy making
- Facilitating more targeted service provision
- Making more efficient and effective use of available government resources
- Facilitating more robust spatial analysis and modeling which would result in better understanding of development and other processes
- Creating a more informed general public
- Supporting a more competitive economy.

One of the realisations which underpins the ISDI initiative is the understanding that the whole is greater than the sum of the parts. By linking separate databases in an integrated network, there can be little doubt that new and innovative insights would become possible which could not be obtained through considering individual non-linked databases. In fact the greater the number of separate data bases which are linked the greater the extent of the benefits.

4 THE CURRENT SITUATION IN IRELAND

No SDI as outlined above currently exists in Ireland. However, elements required to build a first rank spatial data infrastructure do exist. If these components can be adequately organised, combined and developed Ireland would have the ability to derive the substantial potential benefits arising from an SDI which are mentioned in section 3 above. Some of the important positive elements include:-

- An increasing realisation within government and business that spatial data can play a major role in improving policy making and service delivery. More specifically an increasing number of public bodies are integrating spatial data with document management systems and sometimes also with process tracking systems
- The commitment of government to building an ISDI and the appointment of a government department (Department of Environment, Heritage and Local Government) to take the lead role in creating such an infrastructure
- The fact that many organisations have a GIS capacity. For example virtually all County Councils have such a capacity and many government departments and an increasing number of public sector agencies are in a similar situation
- A number of tertiary education bodies provide education and training in GIS and related matters
- Research bodies are building increasing competency in spatial analysis. A University based national center for geocomputational analysis is to be established with secure funding for the next five years
- Large quantities of data are already spatially ‘tagged’ in a variety of ways. However, the method of tagging for many of these datasets does not always facilitate seamless integration with other databases
- The national mapping agency (Ordnance Survey Ireland – OSi) has a sound and expanding digital spatial database. For example the infrastructure exists through OSi to provide real-time GPS positioning
- An umbrella organisation (the Irish Organisation for Geographical Information – IRLOGI) exists. This organisation is concerned specifically with spatial data matters and draws together interested individuals and organisations from a variety of sectors.

Although the above strengths exist there are also a number of difficulties which exist, including:-

- lack of adequate current funding for the ISDI
- no coherent overall policy framework, a matter which is currently being addressed
- large numbers of fragmented databases containing data which can not be seamlessly combined
- lack of an integration mechanism such as an ISDI Internet portal
- institutional issues and unresolved questions, including the balance between public good and the rights of the individual to privacy and suitable frameworks for protecting intellectual property rights (including copyright) while at the same time ensuring appropriate levels of access to information.
- lack of a data sharing culture.

Given the strengths and in spite of the difficulties there is little doubt that Ireland is well placed to develop a first rate SDI in the years to come.

5 THE POLICY CONTEXT

The policy context within which the ISDI exists has aspects ranging from the international to the national and local levels. In this paper only brief mention will be made of the international and European level policy issues as somewhat more attention will be given to policy issues of national and local relevance.

At the **international level** it is recognized that a number of bodies set policies which need to be taken into consideration, namely, the International Organisation for Standardisation (ISO), the Open GIS Consortium (OGC) and the Global Spatial Data Association (GSDA).

At the **European level** there is the European Committee for Standardisation (CEN), and the INSPIRE initiative which is aimed at producing an EU Directive related to the establishment of a European SDI. There are also many other initiatives, Directives and Regulations which impact directly or indirectly on ISDI matters, including for example the Information Society initiative, the Use of Public Sector Information Directive, the Water Framework Directive and many others. The ongoing cooperation

between the Republic and Northern Ireland initiated by the Good Friday Agreement also provides a broad policy context.

Within the **Irish context** the main policy context for the ISDI is the Information Society initiative. This initiative is driven by the Information Society Commission and staff who are located in the Department of the Taoiseach (Prime Minister). Other important policies or initiatives include Better Local Government (an initiative aimed at transforming local government with the view to improving efficiency, effectiveness and social inclusion), government modernisation (an initiative which is aimed at introducing new technologies and achieving organisational reorientation), the Management Information Framework (an initiative within the broader government modernisation programme which aims specifically at managing information more effectively). Another information focused initiative is the decision by government that all government departments must have statistics / information policies in place by the end of 2004.

6 THE CONSULTATION PROCESS AND REPORTING ARRANGEMENTS

To date consultation has taken four main forms.

ISDI Work Group. A group was established by the Department comprising representatives from a number of key organisations and certain academics who have an interest and expertise in spatial data matters. The organisations are Ordnance Survey Ireland (the national mapping agency), Land Registry, the Central Statistics Office, the Department of the Taoiseach and the Local Government Computer Services Board (the central agency which supports ICT development in local authorities). This Group has met seven times and has been involved in all aspects of the ISDI.

Conferences and Formal Interchanges. Issues associated with the ISDI have been presented at various conferences, seminars and workshops in Ireland. These has proven useful due to the feedback which has been received and also because they have assisted with the build up of an informal network of contacts. In January 2004 a seminar was held to which representatives from all government departments and selected public agencies were invited. Presentations were given regarding the ISDI and two officials from the UK's Department of the Deputy Prime Minister gave presentations on their Pan Government Agreement and Maps on Tap initiatives.

Informal Contacts. A network of contact has been built up and this network has given rise to a number of useful benefits, namely, sharing information about forthcoming events or new developments, debating various issues, sharing opinions etc.

Formal Public Consultation. On 8 May 2004 an ISDI Consultation Document was placed on a web site (www.irishspatialstrategy.ie). This Document is divided into three main parts.

Part 1 provides a short background to the ISDI and sets out information about the consultation process.

Part 2 deals with a number of background issues which help set the scene, namely, what is a Spatial Data Infrastructure, why is an ISDI needed, the policy context, the current situation in Ireland and the key challenge.

Part 3 deals with 14 key issues in relation to the ISDI (vision, finances, data, standards etc). Each issue is dealt with in the same manner, namely, a brief background or scene setting, followed by some key questions and finally a space is provided for the reader to fill in his/her comments. These comments can be sent back to the Department over the Internet.

In addition to placing the Consultation Document on the Internet, emails were sent to about 340 organisations in Ireland drawing attention to the Document on the Internet and encouraging them to provide comments. The organisations covered all sectors of Irish society (government departments, public sector agencies, academic institutions, professional bodies, etc).

Notices were also placed in the press drawing attention to the Document on the Internet.

In addition to the above consultation exercises a number of workshops have been held specifically to deal with the issues raised in the Document. The workshops have drawn together people from organisations within various thematic areas, eg enterprise. IRLOGI convened a workshop to discuss the Document and formulate a response. The workshop was attended by people from the private sector, local government, utilities and public agencies.

The closing date for comments is 2 July.

7 THE KEY CHALLENGE

The key challenge is to develop an ISDI that meets the key spatial data needs of policy makers and other users.

An important initial stage in the long process of meeting this challenge is to develop and gain government approval for an overall policy framework for the ISDI. It is envisaged that a draft framework will be produced later in autumn / winter 2004.

8 VISION AND PRINCIPLES

At the outset it is necessary to have an idea of what the ISDI should set out to achieve and to have a set of principles which underpin the infrastructure.

A **vision** for the ISDI which is currently being considered is set out below.

‘To have substantial amounts of harmonised, high quality spatial data readily available and widely used in ways which effectively meet social, economic, environmental and governance needs within the Republic and which fulfil Ireland’s international obligations.’

The **principles** which are under consideration have been derived from those set out in the INSPIRE project and are indicated below.

- Spatial data should be collected once and maintained at the level where this can be done most effectively.
- It should be possible to seamlessly combine spatial data from different sources, and share such data between many users.
- Spatial data needed for good governance at all levels should be abundant and available under conditions that place minimal or no restraints on its extensive use.
- It should be easy to discover which spatial data are available, fits the needs for a particular use and under which conditions it can be acquired and used.
- Spatial data should be easy to understand and interpret in a user-friendly way, within an appropriate context.

Spatial data in Ireland should be substantially compatible with Northern Ireland spatial data and with emerging European and world spatial data infrastructures.

9 SPATIAL AREA OF COVERAGE

The main focus of the ISDI will probably be the land area of the Republic. However Ireland has substantial territorial waters and thus the Consultation Document asks whether the ISDI should be concerned only with the land area or both the land and the territorial waters. Informal feedback suggests that both areas should be covered but that if resources are limited the land areas should be prioritised.

The island of Ireland comprises the Republic in the south and north west and Northern Ireland in the north east. There are many interconnections between these two jurisdictions (water catchments, roads, rail lines, trade flows, service provision, social linkages etc) and thus clearly it is necessary to ensure that there is a high degree of compatibility between the work undertaken in the North regarding spatial data and that which will take place in the ISDI in the South.

10 OVERALL STRUCTURE OF THE SYSTEM

Broadly two polar opposite types of systems have been identified. At the one extreme is a system based on distributed databases which are linked through the Internet. Each data custodian would be responsible for their own data which would be managed according to clearly defined protocols. At the other extreme is the situation where key spatial data is held on a single database and access is provided via the Internet to this single database.

Based on current discussions it would appear that the distributed model will be the one most likely to be adopted. However elements of the warehouse model may be used for specific sub-sets of data. For example a warehouse type model could apply where an organisation draws together data from a variety of sources on a regular basis and holds these data in a single database. This organisation's database would then be remotely linked with other databases through the ISDI network.

The final ISDI structure is likely to be a combination of both models.

11 STANDARDS

Without adequate standards it is recognised that the ISDI would not become a reality.

The key areas in which standards would be required are:-

- **Metadata.** In this case it is likely that ISO 19115 would be the standard that would be adopted.
- **Catalogue.**
- **Data transfer.** It is possible that GML would become the data transfer format.
- **Gazetteer.** In Ireland a comprehensive postal address system exists called GeoDirectory which links each postal address to geocodes. This system has been developed and maintained by a profit making company comprising OSi and An Post (the national postal agency). Although GeoDirectory has a major head start on other address systems the final selection for an address gazetteer would need to be based on the results of a competitive tendering process.
- **Georeferencing system.** A co-ordinate reference system is a fundamental basis of all spatial data. It is therefore vital that the systems in use are clearly defined and there are definitive means of moving between them. Relevant systems for an ISDI probably include the Irish Transverse Mercator (ITM) which has been adopted by OSi as the basis for its mapping, Universal Transverse Mercator (UTM) for international applications, and a sea level (height) reference system. To date the Irish National Grid has been the basis for mapping and thus a move to ITM would mean a significant change for many organisations.
- **Data quality.** In the case of all data incorporated into the ISDI it is essential that standards are set regarding the accuracy, up-to-dateness, coding, resolution etc of these data. Protocols will need to be prepared to deal with each of the data sets.
- **Software.** It will be vital to ensure that organisations using different software systems can share data between themselves. The OGC has undertaken a considerable amount of work in this area, including a programme of verification that various software systems meet interoperability requirements. Many organisations, however, are using systems which have been developed many years ago, or for their own particular purposes. Such systems many not meet the latest interoperability standards.

- **Semantic issues.** The need for standard definitions of relevant terms has been identified as an important issue within the ISDI and thus work would need to be undertaken to address this issue. Where possible definitions will be made on the basis of international or European standards (eg Corine's definitions of land cover).

12 DATA ISSUES

Data are at the heart of any spatial information system and thus data needs to be a specific and important focus of attention.

From a SDI perspective data may be viewed and categorised in various ways. However possibly one of the more important types of data that have been identified in the ISDI is Core Data. Core Data are the priority spatial data (reference and attribute) that in the ISDI should be maintained to the highest standard and be made widely and easily available. Some of the kinds of data which could be regarded as Core Data are:-

- Coordinate reference systems
- Base maps
- Remotely sensed rectified images (orthophotographs, satellite images)
- Geographical place names
- Geographical grid system
- Addresses
- Legal and administrative boundaries
- Transport networks (road, rail, airports, harbours)
- Hydrography including water catchment areas
- Terrestrial elevation
- Bathymetry and coastline
- Oceanic spatial features
- Protected natural and built heritage sites
- Land cover
- Cadastral parcels
- Development Plans
- Planning applications
- Selected basic demographic data
- Selected infrastructure (gas, telecommunications, electricity)
- Selected basic enterprise data
- Selected public facilities data (schools, hospitals, police stations etc)
- Geology.

When drawing up this provisional listing (it will only be finalised after the public consultation process has been completed) the data classifications identified in the INSPIRE initiative have been taken into account.

Decisions on what are the priority thematic areas will only be taken after the consultation process.

13 SMALL AREAS FRAMEWORK

The full power of GIS systems can be harnessed when point, line, plane or volume data are positioned in terms of xy (and z) co-ordinates. However two basic problems may exist if data were to be provided (outputted) at the accurate levels which this type of georeferencing permits.

Firstly, tagging data in this way means that in the case of some types of data (eg census information, household surveys), the privacy of data suppliers (individuals, households, businesses, organisations) can be compromised.

Secondly, many data users would not have access to software which can manipulate data which are in xy(z) format.

In order to get round the privacy difficulties it would be necessary before outputting data to aggregate the information. This would ensure that individual records can not be identified. It would also make it possible in some cases for standard widely used software programmes (eg Excel) to store and manipulate the output data.

From the ISDI perspective, the questions become:-

- is it possible and appropriate to identify a network of areas across the whole State which would be the smallest spatial units ('atomic' areas) for the supply of certain kinds of aggregated data?
- In the case of data which do not have potential privacy difficulties, what types of data should be made available (outputted) in terms of areas rather than in point based xy(z) terms?

From an analytical point of view the smaller the extent of the atomic output areas the better. Having established such a small area network other area data could be tagged using these atomic areas.

Having established such a network of smallest atomic areas, it is desirable that whenever larger areas are used to collect or display data these larger areas are whole multiples of the atomic areas (ie the larger areas do not involve splitting any of the atomic areas). For many purposes a basic hierarchy of areas along the lines set out below may be appropriate.

- Atomic areas at the bottom of the spatial hierarchy
- Election Divisions
- Local authority areas
- Regions
- The State
- The island of Ireland.

Obviously this basic hierarchy would not be suitable for all purposes (eg analysing water quality by water catchment) and data providers would need to shape their data output areas to suit their user needs. However where possible and appropriate data providers would be encouraged to issue data in terms of these areas or in a form which would enable the data to be aggregated or disaggregated into these basic types of areas without the necessity to split atomic areas.

14 ORGANISATIONAL ISSUES

The key organisational issue facing the ISDI is which body takes overall responsibility for the initiative. There is little doubt that in the Irish context it would be a government department. Currently the Department of Environment, Heritage and Local Government has this responsibility. However this department sees its role generally as having a policy rather than an executive brief and thus should it in future retain the overall responsibility it would no doubt place operational responsibilities for managing and running the ISDI on some other body. The ISDI policy framework would need to set out the way forward regarding this matter.

Other key organisational issues are what responsibilities are placed on such organisations as the national mapping agency (OSi) and the data custodians who have responsibility for Core Data. These matters would require finalisation in the policy framework after the formal public consultation process has taken place.

15 LEGAL ISSUES

One of the important legal issues which needs to be considered is whether or not new legislation should be introduced to facilitate the development of the ISDI. The alternative is to develop and maintain the ISDI through the adoption of government policies and by agreements between data custodians and other groupings. The main argument in favour of the legislative approach is that it provides greater certainty that organisations will play their necessary roles. It also clearly identifies legal responsibilities. The arguments against adopting legislation are that it could make for a more rigid and inflexible system, a particular problem in a rapidly changing technological and socio-economic context. The fact that an EU Directive derived from the INSPIRE initiative may come about is also a factor to take into consideration. At present no decisions have been taken regarding which approach to adopt and this remains an issue to be finalised in the policy framework.

Other important legal issues which have been identified relate to data privacy, protection of intellectual property rights, freedom of information and legal issues associated with data issues (eg inaccuracy etc).

16 FINANCE MATTERS

Some of the important financial costs which have been identified are set out below.

- The establishment of an ISDI Unit to manage and co-ordinate the roll-out and maintenance of the ISDI on a hands-on day-to-day basis.
- Harmonisation of attribute data by data custodians, particularly in priority thematic areas.
- The creation of the hardware, software and human resources necessary to ensure full and appropriate participation by data custodians in the creation and ongoing operation of the ISDI.
- Publicity and consultation.
- Research.
- Development of software tools to facilitate access, download etc of data.
- Development of pilot / demonstration projects.
- The purchase of copyright protected spatial data.
- Training for those most directly involved in various facets of the ISDI.
- Development of certain datasets, in particular some of the Core Data sets.

One of the most important costs will be the purchase of copyright protected spatial data. In this regard consideration is being given to the establishment of what is termed a Pan Government Agreement. Such an agreement would entail the purchase by government of spatial data (eg OSi mapping and an address gazetteer) once (or at least on an annual basis) for subsequent use by all public sector bodies at no direct data purchase cost to these bodies.

Another big cost item will be the data custodian's data harmonisation costs, particularly if legacy data will be included to any large extent. This cost would vary substantially between custodians, with some incurring little or no extra cost and others finding that substantial sums will be needed.

Various possible sources of income have been identified to operate the ISDI but probably the basic funding would need to come directly or indirectly from the government exchequer.

A very preliminary cost / benefit analysis for the ISDI over the period up to 2010 has been conducted but at this stage the number and level of unknowns are too high to provide results which can be relied on. However, one of the insights which emerges when looking into the cost issues is the realisation that

compared with the costs incurred by government regarding other forms of infrastructure (transport, health, education etc), the costs associated with the ISDI are very small indeed.

17 CONSULTATION AND COMMUNICATION

It is suggested in the Consultation Document that consultation, publicity and communication should be aimed at achieving the following main results:-

- Obtaining input regarding needs
 - Developing a culture of data sharing
 - Informing stakeholders and the general public about progress and available means of accessing data once appropriate datasets have been developed
 - Obtaining feedback regarding the products and services which would become available
- Gaining and maintaining support for the ISDI.

It is fully recognised that involvement with users and the public at large will be an ongoing process. This has significant implications for budgets and for staffing in the proposed ISDI Unit.

Developing a system which makes useful information available does not necessarily mean that potential users will be aware of the system or that they will be aware of the possible benefits for themselves. Thus there will need to be regular publicity exercises that will highlight the existence of the ISDI and the potential benefits which it would entail.

Some of the means of communicating with the various stakeholders and the general public include:-

- The ISDI web site
- Hyperlinks from other government web sites to the ISDI site
- A regular newsletter which could be sent to organisations or individuals
- Presentations at conferences, workshops etc
- Occasional press releases
- Through IRLOGI, the umbrella geographical information / GIS body in Ireland.

18 EDUCATION AND TRAINING

The ISDI will generate a need for people with specific skills or types of knowledge. The Consultation Document identifies skills / knowledge in the following areas:-

- GIS
- Web services and systems
- Standards
- Data base management
- Legal issues
- Policy and strategy formulation
- Integration of spatial data bases with document management systems
- Network development and management
- Production of manuals and protocols
- Data collection and coding
- Communication and liaison.

Without an adequate skills / knowledge base the development and roll-out of the ISDI would be slowed.

19 IMPLEMENTATION

It is fully recognised that the ISDI is an ongoing project into the foreseeable future. However at this early stage it is necessary to outline certain broad developmental targets.

Some short term (say the next two to three years) milestones could include:-

- The adoption by the government of a comprehensive ISDI policy framework
- Ensuring that ISDI principles and requirements are embedded in the information strategies, statements of strategy and business plans of all government departments and most public sector agencies
- Establishing an adequately resourced ISDI Unit which would drive the initiative on an ongoing day-to-day basis
- Establishing an ISDI portal
- Establishing a mechanism for making reference data widely and quickly available using funding and pricing mechanisms which maximise the widespread use of such data (a Pan Government Agreement)
- Establishing the infrastructure (or linking to infrastructure currently under development) that would enable linkage of distributed databases, particularly those involving Core Data.

Milestones in the medium term (say 4 – 7 years) would essentially include consolidation and expansion on the base that would be created in the short term.

20 CONCLUDING COMMENT

The ISDI poses significant challenges and there is little doubt that the possible benefits will outweigh the costs. It is somewhat trite to state that all activities and all objects occur somewhere in space. This fact and the fact that proximity (distance) invariably plays a substantial and deciding role in determining the nature and change of these activities and objects. In fact space may be seen as one of the three basic elements, the others being time and matter. Given the fundamental nature and impact of space one can only wonder why it has taken so long for society at large and governments and business in particular to fully adopt technologies which introduce space into many of their policy making and operational business processes.

It is hoped that in Ireland at least, the ISDI will play a crucial role in redressing this situation, to the benefit of all who live and work in the country.