UK Location Programme

Conceptual Design

UK Location Information Infrastructure Blueprint

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File Reference:

DOCUMENT CONTROL

Change Summary

Version	Date	Author/Editor	Change Summary
1-0	21/05/2009	Tim Manning/Keith Murray	Initial version issued for internal Quality Review.
2-0	15/06/2009	Tim Manning	Version issued for External Quality Review. Incorporates the majority of comments from the Internal Quality Review. A number have been carried over to assess in the light of external comment.
2-3	12/08/2009	Tim Manning	Incorporates changes applied following external quality review by CD core stakeholder group (changes highlighted)
3-0	12/08/2009	Tim Manning	Version issued for public review. Incorporates the majority of comments from the external quality review by CD core stakeholder group.
3-1	03/11/2009	Tim Manning	Incorporates changes following public review.
3-2	19/11/2009	Tim Manning	Final draft against version 3. Changes highlighted.
4-0	27/11/2009	Tim Manning	Base-lined version.

References

Ref.	Title/Version/Publication Date/Author
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2	Official Journal of the European Union, Directive 2007/2/EC of the European Parliament and of the Council, "Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)", March 2007 http://inspire.jrc.ec.europa.eu/
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4	Freedom of Information Act 2000
5	Official Journal of the European Union, Directive 2003/98/EC of the European Parliament and of the Council, "on the Re-use of Public Sector Information", 17 November 2003: http://www.opsi.gov.uk/si/si2005/20051515.htm
6	Environmental Information Regulations 2005 http://www.opsi.gov.uk/si/si2004/20043391.htm
7	Data Protection Act 1998 http://www.opsi.gov.uk/Acts/Acts1998/ukpga_19980029_en_1
8	INSPIRE Network Services Architecture http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/network/D3_5_INSPIRE_NS_Architecture_v3-0.pdf
9	Geospatial Digital Rights Management Reference Model (GeoDRM RM) (06-004r3)

Ref.	Title/Version/Publication Date/Author
	http://www.opengeospatial.org/standards/as/geodrmrm
10	INSPIRE Data Theme Descriptions [2,3] http://inspire.jrc.ec.europa.eu/reports/
11	INSPIRE Generic Conceptual Model [2,5] http://inspire.jrc.ec.europa.eu/reports/
12	INSPIRE Annex I Data Specifications: v3.0 baseline versions http://inspire.jrc.ec.europa.eu/reports/ [from 1 September 2009]
13	INSPIRE Methodology [2,6] http://inspire.jrc.ec.europa.eu/reports/
14	INSPIRE Encoding [2,7] http://inspire.jrc.ec.europa.eu/reports/
15	BS 7666-0:2006 Spatial datasets for geographical referencing. General model for gazetteers and spatial referencing BSi code: BS 7666-0:2006; ISBN number: 0 580 48709 1; Product code: 30127201; Publication Date: 28th Jul 2006
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CONTENTS

1 EXECUTIVE SUMMARY

This Blueprint sets out the conceptual design of the UK Location Information Infrastructure (UKLII). This design is intended to provide a common framework of standards, policies, ways of working, products and services that will enable the strategic objectives of the UK Location Strategy [1] to be fulfilled. These are that location information is:

- "fit for purpose;

- collected once, to universally accepted standards;

- appropriately maintained and used many times by the public and private sector, referenced to a definitive information framework which supports its seamless combination;

- able to better enable effective cross-organisational business processes;

- easy to discover and with clear terms for its use;

- simple to access and easy to share and integrate;

- understood sufficiently to maximise its application; *and*

- aligned with Europe and the INSPIRE Directive."

The Blueprint defines this framework through the specification of a Conceptual, Business and Operating Model for the infrastructure.

The Conceptual Model is a 'rich picture' representation of the design, and a summary of the key characteristics. As part of this summary, reference should be made to the Conceptual Model in sec. 5.3.

The Business Model sets out what value will be created, who the customers of the infrastructure will be and what infrastructure will be required to deliver this value, in terms of products and services; capabilities and partnerships. It also sets out how the infrastructure will be funded and where the costs will reside.

The Operating Model defines the infrastructure in terms of a number of architectural design perspectives, or domains. These cover the Business Process, Organisation, Distribution, Learning and Skills, Data Sharing and IT System architectures that need to be built and operated.

The principal components that result from this design are:

- a technical infrastructure, in the form of a UK Geoportal, providing the means to publish location information, and then discover and use it. This portal will include:

  - publishing catalogue (Discovery Metadata);

  - master data registry services for recording and using common definitions for features and other common data elements;

  - search and evaluation services (the ability to discover location information and evaluate it for a given purpose);

  - community networking (w2.0) services to facilitate data re-use and quality improvement through discussion and feedback (both on data and associated services);

- supporting products in the form of policies, standards and guidance and training packages relating to publishing, interoperability and data sharing (rights management, security and charging)

- harvesting and distribution facilities for collecting publishing catalogue entries from data providers and distributing these to other information portals;

- theme coordination – the creation of core reference geographies and INSPIRE themes (dataset harmonisation); *and*

- coordination, facilitation and monitoring functions, centered around the creation and operation of the Location Council.

These components translate into a number of deliverables, to be defined in the UK Location Programme Roadmap. These consist of both physical products and services; and most importantly a range of activities associated with facilitation and coordination. In terms of effort, it is the latter that constitutes the greater part of the work that needs to be undertaken to deliver the considerable business change that is required.

2 INTRODUCTION

2.1 Background

In November 2008 the UK Government published "Place matters: the Location Strategy for the United Kingdom" [1]. This was produced by the Geographic Information Panel, formed in 2005, to give high level advice to Communities and Local Government Ministers on geographic information issues of national importance to the United Kingdom. The members of the panel represented key interest groups in government, the private sector and the wider geographic information industry across the UK.

The strategy addresses the lack of any overarching framework for the management of geographic information across the UK. Its objective is to maximise the value of location information to the public, government, UK business and industry, by providing a common framework that ensures ease of access and re-use.

In developing the strategy it was recognised that it also needed to take account of, and incorporate, the implementation of the EU INSPIRE Directive [2] in the UK.

As part of publishing the Strategy, the UK Government appointed the Department of Food and Rural Affairs (Defra) as the lead department. Amongst the initial steps taken by Defra, was the setting of the Location Council as recommended by the Strategy (replacing the GI Panel) and establishing an initial conceptual design phase, of which this document is a primary output.

2.2 Purpose and Scope

The purpose of the Conceptual Design Blueprint is to provide a clear description of the business and operating models for the UK Location Information Infrastructure, i.e. how it will create and deliver value to its customers. It will subsequently provide the foundation for detailed design and implementation. These two models are supplemented by a Conceptual Model, a visualisation of what the UK Location Information Infrastructure will look like.

The Blueprint will be used to engage key stakeholders[1] in the design process and cement their support and commitment to the initiative. It will be submitted for sign off by the Location Council - a prerequisite before more detailed work is undertaken.

The Blueprint is a target model. How much of the design is implemented, and over what timescales, will be subject to funding constraints and the degree of collaboration and shared purpose that is achieved across the many stakeholders.

The target itself will change over time, as better insight is gained into customer needs and as the market for location information matures. The Blueprint should therefore be considered a living document, retained as the target, irrespective of decisions made relating to implementation.

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[1] See Location Programme web site for list of key stakeholders: http://www.defra.gov.uk/location.

2.3 Constraints

This document attempts to describe what the UK Location Information Infrastructure could look like and how it might work. There are a number of factors the reader should bear in mind when reading the document:

- the Blueprint has been developed whilst the majority of the INSPIRE Implementing Rules are still under development. As the Implementing Rules are published it will be revised to incorporate any changes that are subsequently required;

- the level of funding and investment by stakeholder organisations will govern the extent of the operational implementation and some of the design stages in the next phase. Therefore it cannot be assumed that all that is described in this document will be implemented;

- the development of the document has been a significant piece of work covering a very large topic area which has been undertaken in a relatively short period of time in conjunction with stakeholder groups. It will never be complete or a perfect reflection of the goals – feedback will however help make it fit for purpose; *and*

- the document is important in the sense that the goal is to work towards an infrastructure which is a "means to an end". The "end" is a new environment where spatial information, combined with other information, creates greater business value in the future. This is an extensible process. This should avoid the situation in several countries where the portal is simply an end in itself and therefore real business advantage has rarely been secured.

2.4 Audience

This document is primarily intended for those who will be charged with delivering the UK Location Information Infrastructure, i.e. technical experts working within the UK Location Programme and data provider and user organisations, developing the products and services that will be delivered through the infrastructure, or supporting its operation. It should be treated as the primary point of reference, for a given design domain or area of interest.

Please note that the acronym "SDI" may be used in this document and is the equivalent to "Location Information Infrastructure" and "UKLII".

2.5 Design Approach

The design of the UK Location Information Infrastructure will be developed through the use of two design templates:

- Business Model template, used to model how the UK Location Information Infrastructure will <u>create value</u> for its stakeholders

- Operating Model template, used to model how the UK Location Information Infrastructure will <u>deliver value</u> for its stakeholders

The business and operating models contain a number of interrelated architectural 'model views', or 'design domains'; each of which will describe the business at three levels of detail:

- **Conceptual**, establishes a high level direction and architecture;

- **Logical**, presents a fully attributed and 'normalized' design – in the form of operational Frameworks and detailed design documentation;

- **Physical**, specifies the physical characteristics in sufficient detail to build and operate the UK Location Information Infrastructure; and integrate its various components, in the form of final deliverables and associated products.
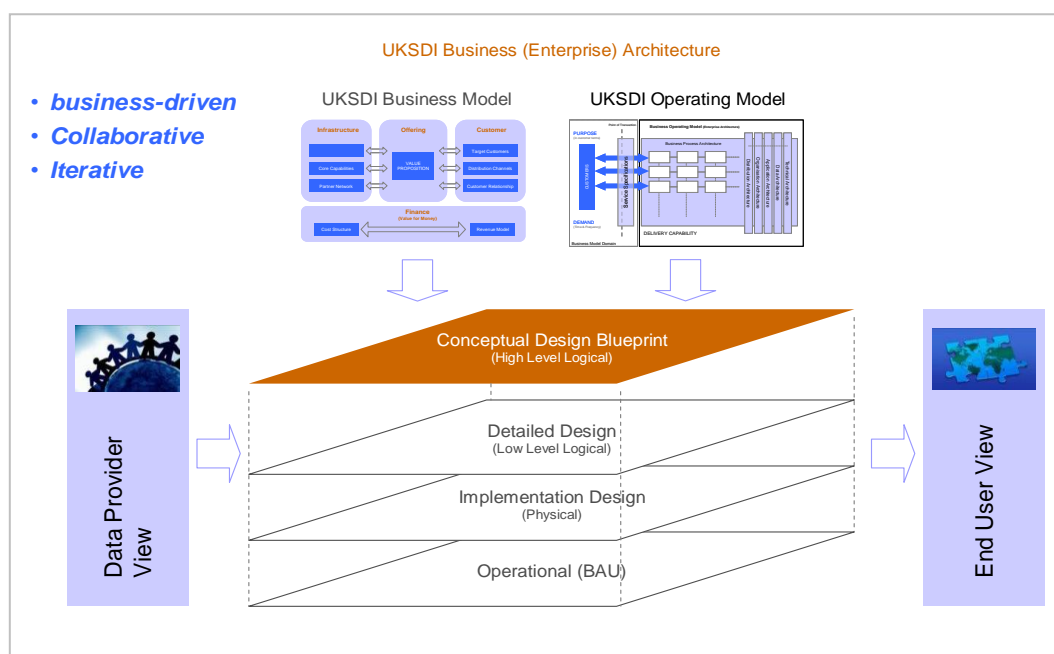
Figure 1 UK Location Information Infrastructure Design Approach

The model views are dynamic entities, which are intended to grow and change throughout the development of the UK Location Information Infrastructure. Once the initial business development programme is complete, this set of models will describe the current design of the UK Location Information Infrastructure and will form the basis for subsequent development and business change, i.e. they will represent the baseline business (or enterprise) architecture for the UK Location Information Infrastructure.

2.5.1 Blueprint Development

The Blueprint represents the conceptual definition of the UK Location Information Infrastructure. Based on the strategic direction, as set out in the UK Location Strategy [1], it provides the conceptual business and operating models for the infrastructure in terms of how the infrastructure will create value for its customers and how this value will be delivered operationally.

The Blueprint has been developed through a series of workshops with key stakeholders[2]. The final base-lined version will be the product of a formal stakeholder quality review, followed by a public review and subsequent approval by the Location Council. It will be a living document and maintained under change control.

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[2] List of key stakeholders can be found at http://www/defra/location.

3 STRATEGIC DIRECTION

This design blueprint sets out the conceptual design for the implementation of the UK Location Strategy [1] and EU INSPIRE Directive [2].

More specifically, it sets out the means for achieving the following operational changes, as set out in Appendix 3 of the UK Location Strategy [1] (Table 1):

Topic	From	To
Metadata Access	Inconsistent approach to the recording of important details about location data being captured (metadata).	Creation and enforcement of a consistent recording method for metadata and the storage of these artefacts in a readily accessible repository.
Core Reference Data	A lack of consistency and clarity over the geographic data that defines and underpins UK location-based information.	Development of an agreed set of core reference geographies forming a common framework within which INSPIRE deliverables may be met.
Data Exchange	Lack of interoperability standards for location based information and datasets within the e-GIF and/or adoption of those that exist.	Open standards for geographic information (ISO & OGC) adopted consistently into UK location datasets, creating a consistent framework within the INSPIRE Implementing rules.
Education & Practice	A lack of awareness of location information and insufficiency in skills to manage and exploit location based data within the public sector.	A consistent and widely used exploitation model for geographic information across sponsor, user and provider communities.
Governance	Lack of single point of independent ownership.	A revised and modified governance model overseeing the implementation of the strategy and ongoing monitoring.
Licensing	Inconsistencies in the licensing models, creating unnecessary complexity; and are difficult for the user to administer.	A significant increase in the use of location information through review and simplification of licensing of core location based datasets.

Table 1: Key UK Location Information Infrastructure Changes

This will be achieved through the creation of a web-enabled UK Location Information Infrastructure (UKLII), or "reference framework", based on common standards, coordinated ways of working and web services, such that it is easier to find, access and combine location information for multiple uses.

The UKLII will not be something that any one organisation will create. Rather, it will emerge from the collective efforts of the numerous participants, working together to define and develop the common reference framework; and then implementing this within their own organisations.

3.1 The Need for Change

The UK Location Strategy [1] sets out the current inefficiencies and short-comings related to the creation and use of public sector location information:

- "imposes costs and inefficiency on a wide range of public sector bodies, due to duplication of effort associated with collecting similar data, and the difficulties in sharing information;

- hampers the use and integration of accurate place-based information to inform policy development and the fair distribution of resources;

- impedes government strategies for improving services to the citizen; *and*

- makes it very difficult for citizens to know where data can be sourced for community applications, that encourage local contributions to the available information, e.g. community web applications, combining different data to help resolve local issues."

In response, it establishes a strategy for "joining up and integrating information from many public sector sources within a consistent reference framework". It sets out the following strategic outcomes for this framework:

Location information will be:

- "fit for purpose;

- collected once, to universally accepted standards;

- appropriately maintained and used many times by the public and private sector, referenced to a definitive information framework which supports its seamless combination;

- able to better enable effective cross-organisational business processes;

- easy to discover and with clear terms for its use;

- simple to access and easy to share and integrate;

- understood sufficiently to maximise its application; *and*

- aligned with Europe and the INSPIRE Directive."

3.2 INSPIRE

The EC INSPIRE Directive [2] seeks to achieve many of the same aims as the UK Location Strategy, but with a focus on the accessibility and interoperability of environmental information at the EC level, for the purposes of Community environmental policy making.

The guiding principles of INSPIRE are:

- that the infrastructures for spatial information in the Member States should be designed to ensure that spatial data are stored, made available and maintained at the most appropriate level;

- that it is possible to combine spatial data from different sources across the Community in a consistent way and share them between several users and applications;

- that it is possible for spatial data collected at one level of public authority to be shared between all the different levels of public authorities;

- that spatial data are made available under conditions that do not restrict their extensive use; *and*

- that it is easy to discover available spatial data, to evaluate their fitness for purpose and to know the conditions applicable to their use.

It seeks to achieve this by laying down general rules aimed at the establishment of an infrastructure for spatial information in the European Community. These 'Implementing rules' for data standards, interoperability and accessibility provide the 'backbone' for the UK Location Information Infrastructure.

3.3 Design Choices

The primary purpose of the programme is to meet the two overriding operational goals of the design - improving data coordination and data management; and promoting re-use and making users aware of what data exists and the quality of that data.

These goals in turn influence the design choices that have to be made. The choice is not in fact one of several options, as can be seen from Figure 2. Rather, the choices and policy decisions need to be made holistically and along several dimensions. The resultant position is the full aggregation of those selections.

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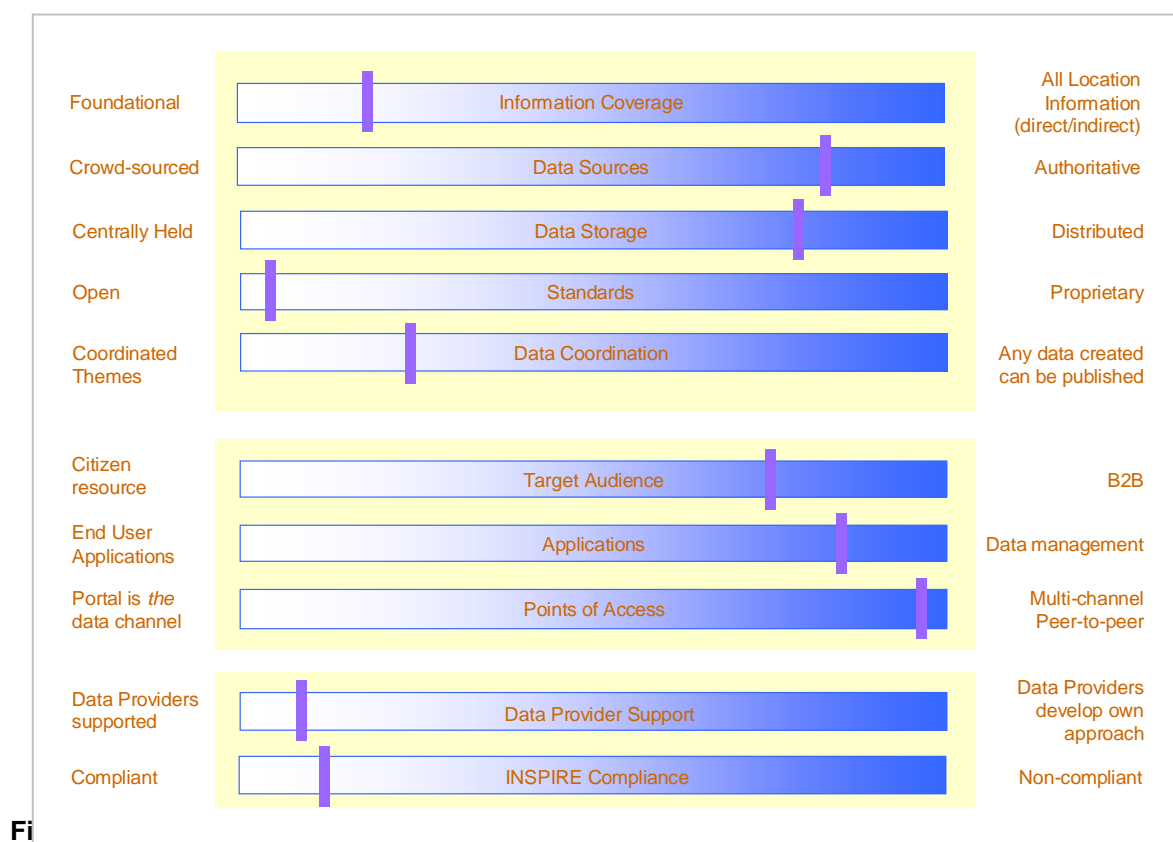
An explanation of the position taken around a number of these key design decisions is set out below.

Information Coverage

The intended scope of information covered by the UK Location Information Infrastructure is shown in Figure 3.
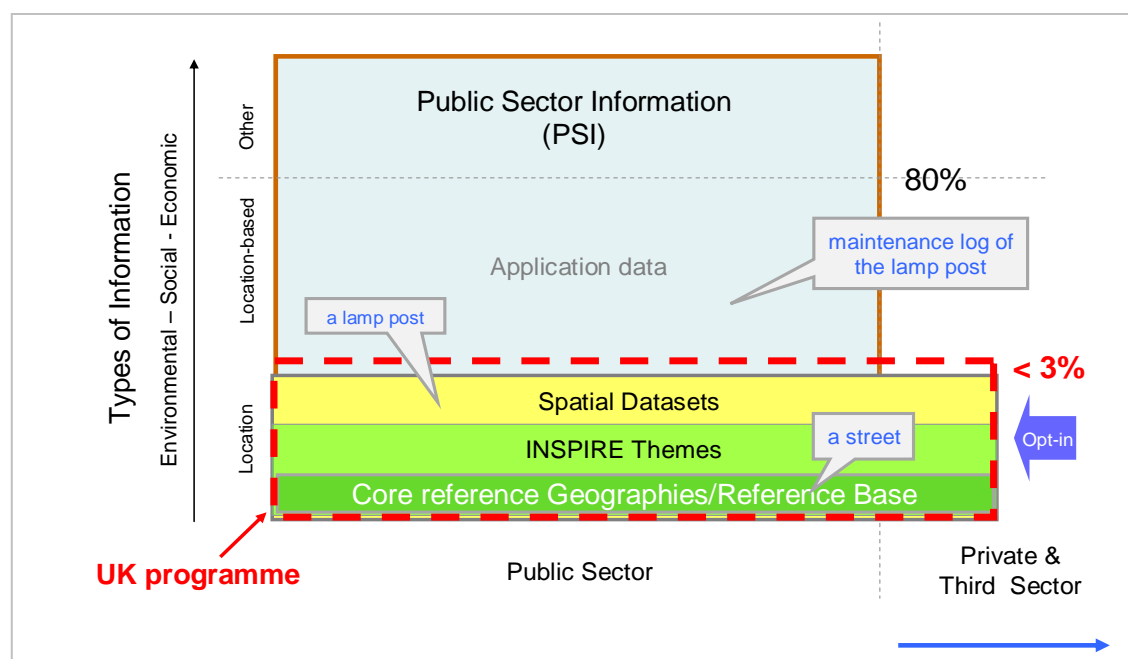

Figure 3 UK Location Information Infrastructure Information Scope

Although a significant proportion of public sector information is either directly or indirectly related to location, much of this is business application related. The purpose of the UK Location Information Infrastructure is not to provide an infrastructure capable of supporting all forms of location information, but to provide an infrastructure that supports the geospatial (layers, against which other location-based information can then be linked, specifically the "Core Reference Geographies" [1] and INSPIRE themes [2].

This coverage will extend across land, sea and air, covering spatial datasets relating to:

- Topographic surface objects;

- Terrain;

- Marine (topographic);

- Underground – natural;

- Underground – man-made;

- Atmosphere; *and*

- those objects associated with the features recorded in any of these domains, as covered by the INSPIRE Directive or additionally defined by the Location Council.

The extent will be the UK and the "UK marine area" as defined in the UK Marine Bill.

The infrastructure will primarily be for public sector information (PSI), but there will be provision to include private sector location information, where the private sector sees a benefit to publishing their data through the UK Location Information Infrastructure.

Data Sources

The focus of the UK Location Information Infrastructure will be on the publishing of authoritative data held by public bodies; with the provision for private and third sector bodies to also publish their data.

The primary public sector datasets within the information scope of the programme have been collected and maintained over several decades in different forms and are highly tuned to satisfy key public sector business processes, e.g. taxation, flooding, property ownership and traffic management.

The "capture once and use many times" model will be adopted, although it is acknowledged that this may not always be a practical solution. Nevertheless, the future state should be more coherent and definitive than today, with less duplication and greater inter-theme/object interoperability.

Within the scope of authoritative sourcing, there is scope for users of all kinds to contribute by pointing out corrections, beneficial changes or errors; either through the provision of intelligence, or location information that can be subsequently incorporated into the dataset.

Data Storage

Apart from the registered meta and master data (catalogues, coordinate reference systems etc), no data will be stored (cached) within a UK central data hub. Data will be supplied in line with the INSPIRE model – either directly from the data provider or through a 'publishing agent'. .The latter will see the creation of thematic, sector or regional data hubs, as deemed beneficial by the different data provider communities.

Unlike smaller communities (e.g. Northern Ireland where data is held centrally), there is no justification for this approach in a UK context, where the volumes and data synchronisation issues and hence costs would be prohibitive (in the order of £10+ million).

It is recognised that this distributed approach will make it harder to ensure compliance, data quality and ease of combined use. But by placing the 'point of control' at the data source, or within a specific data provider community, it will over time result in a much more sustainable and flexible infrastructure for data sharing and re-use.

Open Standards

The absence of a common data architecture and the limited adoption of standards, is widely recognised as a major root cause of many of the documented problems relating to data sharing and re-use. Data providers often find their data satisfactory for their own internal processes, but an external user would find many datasets unsuited for an application. The INSPIRE implementing rules are grounded on ISO and OGC standards and these, together with the necessary technical guidance, will provide the framework for the UK.

The alignment with the current initiatives around "linked data" is good, supported by the INSPIRE data model and by the aims of the UK Location Strategy.

Data Coordination

All core reference geographies and INSPIRE themes will be managed collectively as themes (e.g. transport network) supported by sub-theme (rail) or object (railway station). For most themes there may often be several datasets. Sometimes there will be overlap and sometimes their contribution is complementary. The themes will be coordinated by a process driven by the Location Council to ensure that unnecessary duplication is driven out and where different views remain, these are linked

(normally by cross referencing) to support the sharing of business information across the different "views". Any new themes outside the scope of the Location Strategy and INSPIRE will be similarly treated to bring greater coherence than we have at present, where the absence of standards and coordination leads to significant duplication and rework by users.

Target Audience

The principal target audience for the UK Location Information Infrastructure are organisations, either in the public, third or private sectors. Its focus will be to provide a business-to-business interface for the exchange and use of location information, for improving public sector policy making, delivery and encouraging innovation.

But within this, there is the recognition that the nature of how information-based public sector services are delivered and by whom is changing, particularly with regard to the engagement and involvement of the citizen. Also, it is recognised that the citizen themselves have a need for primary location information, which should be made available to them, particularly as in most cases they have paid for its creation; and that citizens will become an increasingly important source of intelligence on the data sources themselves. To this end, the infrastructure will be designed to serve the needs of those citizens engaged in the use of public sector information, as well as those of organisations.

Applications

It will not be the role of the UKLII to create or provide end user business applications; rather to encourage their creation by others using the published data and services.

The inclusion of end user applications would distract from the primary purpose of the UKLII. .. Beyond the UK Geoportal, the market in terms of applications will be able to grow as required by data users, uninhibited. Users will adapt and adopt, embed as today in organisational websites and grow new user communities. The functionality of the UK Geoportal will be minimised and restricted to simple common tools required to support the key customer groups (e.g. pan/zoom/locate/measure and possibly save image) to publish, search, evaluate and re-use location information.

Points of Access

Member States are not obliged to develop a geoportal under INSPIRE – but there are several good reasons to establish a member state point of contact and coordination.

Any European service will be unable to provide an efficient and oriented service customised to UK needs. Each Member State context is unique and stakeholders will require support, resources and datasets beyond the European baseline. A UK Geoportal can fulfil a unique role as a point of contact and coordination, by providing central registration of data and services; and associated resources.

Beyond its infrastructure and publishing coordination role, the UK Geoportal will be just one of many points of access to discover and view published location information. These are likely to reflect the current landscape of thematic, sector and regional based information portals.

Data Provider Support

INSPIRE requires the implementation of a set of specifications and standards, as set out in the Implementing Rules, relating to data and services. In one extreme it would be possible to issue specifications and expect data providers to provide conformant data and services. This would not necessarily realise business benefit or return on investment. By working within a common framework

and providing self help tools, guidance and recommendations for training - a solution that is "collectively greater than the sum of the parts" is feasible.

In promoting data sharing and re-use, the intention is to develop only those aspects that do not exist today and are unique to the world of spatial information. In addition to reusing other government services, this also implies contracting third parties to adopt existing systems, rather than engineer these aspects from scratch.

INSPIRE Compliance

The comparative importance of the data and the INSPIRE Directive does not warrant heavy regulation. Indeed, it is desirable that users identify business benefits of adopting the standards and protocols. Compliance will largely be achieved through self regulation and by ensuring an effective dialogue between data providers and data users. This will be supplemented by assurance and auditing activities, conducted by the Coordination Unit.

4 PRESENT STATE VIEW

This section reviews the current conditions that exist in the UK for the creation and use of public sector location information. This is intended to inform the conceptual design, identify opportunities for re-use and enable us to establish a baseline against which progress can be monitored. The view focuses on:

- the current operating models used for data production and sharing;

- collaborative initiatives established to develop policies, standards and guidance to improve data quality, consistency and sharing; *and*

- the existing use of spatial data to deliver policy and business objectives.

4.1 UK Data Production Infrastructure

4.1.1 Existing Operational Framework

The current operational framework for the production of UK spatial datasets involves a highly diverse set of 'actors' - Public Authorities (national, devolved, regional and local government organisations), private and third sector organisations and research and academia.

Some spatial datasets are produced commercially; however, many are produced to meet the obligations of national, European or International legislation, and/or internal business objectives and service delivery.

Organisations have often transferred their operations from a paper world into a digital form. Datasets collected for internal use have also found their way into the hands of external users. This has resulted in considerable duplication.

A dataset that has been collected for one purpose is not necessarily suitable for another application. Market research conducted by the Atlantis initiative found that a third of users spend between 25-50% of their project costs getting hold of data and cleaning it up ready for use in an application. The 2011 census is reported to be incurring a £8-10m cost in spatial data integration.

The downside of this is that applications are more costly than they need to be and these cannot be developed quickly and easily.

In summary there is too much duplication, little connectivity and too little re-use. Today's spatial datasets do not lend themselves to an era of online data services.

Responsibility for the production of spatial datasets is either:

- **Centralised** - a single organisation is responsible for the production of the dataset.

- **Federated** - the production of the dataset involves a consortium of organisations that produce data for specific geographic areas, to an agreed specification. These datasets are then collated and integrated by a single lead organisation to produce a single consistent dataset.

- **Distributed** - multiple organisations are given the remit to produce data for a specific geographic area, resulting in a series of datasets. There is usually little governance or coordination from a lead organisation; no integration of these distributed datasets into a single, consistent dataset; and no commonly agreed harmonised data specification or production method.

Examples of each of these approaches are given in Table 2.

Dataset	Producer
CENTRALISED	
OS MasterMap Topography Layer	Ordnance Survey
Land Cover Map 2007	Centre for Ecology and Hydrology (CEH)
NextMap® Britain	Intermap Technologies
Digital Geological Map of Great Britain (DiGMapGB)	British Geological Survey
FEDERATED	
National Land and Property Gazetteer (NLPG)	Local authorities in England and Wales.
25 cm Aerial Photography (RGB)	NextPerspectives (Infoterra Ltd, Bluesky International Ltd and Getmapping plc.)
National Air Quality Archive	AEA Technology (on behalf Defra)
Special Protection Areas	Joint Nature Conservancy Council (JNCC), Natural England, Countryside Council for Wales (CCW), Scottish Natural Heritage (SNH), Northern Ireland Environment Agency
UK Butterfly Monitoring Scheme (UKBMS)	CEH, Butterfly Conservation (BC), JNCC
DISTRIBUTED	
Conservation Areas.	Local Authorities

Table 2: Responsibility for Dataset Production

Spatial datasets are produced to varying update schedules:

- **Regular, managed schedule** - the data producer updates their dataset according to a defined maintenance schedule. Update intervals may range from continuous update to daily, monthly, annually or 3-6 yearly update.

- **Ad hoc** - the data producer may not have a defined maintenance schedule, but updates the datasets in response to specific ad hoc requirements.

- **Never** - the dataset may be produced to meet a specific requirement (e.g. land cover/land use in 2007) and once complete the dataset will not require update.

This may not change, but indicates how essential metadata stating the temporal nature of the data is when attempting to combine data from several sources; and where errors may simply be explained by differences in epochs.

4.1.2 Policies, Standards and Core Reference Data

Improvements have been made over the last few years to improve the quality, consistency and interoperability of spatial data. However, further improvements are required to ensure that the needs of data users and legislative obligations can be meet.

To date, many data producers have developed spatial datasets and metadata based upon specifications developed in-house, without evaluating whether existing definitions of object types, attributes and domain values were in use within other datasets (including non-spatial datasets) held internally or externally to the organisation. This has caused a wide range of inconsistencies between datasets representing the same theme, which can introduce costs to end users who have to resolve such inconsistencies, e.g. matching and cleaning differences between conservation area and local nature reserve datasets.

A number of data providers have begun to develop data management policies in response to legislative drivers such as the Freedom of Information Act 2000 [4], Environmental Information Regulations 2005 [6], Data Protection Act 1998 [7] and the Re-use of Public Sector Information (RoPSI) [5]. Such legislations have highlighted the need for better, formalised data management procedures to ensure data quality, interoperability and data handling security. This legislation has also highlighted the need to modify licensing policies in order to supply data fairly, consistently, transparently, etc.

Data Management Policies

Larger public authorities responsible for spatial data production are encouraged to ensure that they have a documented data management policy (or policies), aligned to a corporate data strategy.

Many public authorities have begun this process, but very few have produced comprehensive policies. Two examples are:

NERC (http://www.nerc.ac.uk/research/sites/data/documents/datahandbook.pdf)

ONS (http://www.statistics.gov.uk/about_ns/cop/downloads/datamanagement.pdf)

Data Standards

The UK has been a slow adopter of spatial information standards, especially at the ISO level. BS7666 [14] and the creation of the National Land and Property Gazetteer (NLPG) is perhaps the most widely known, but even after two major revisions it has failed to obtain significant adoption outside the local government community, with some notable exceptions.

At the International level, GML has been adopted by some e.g. Ordnance Survey. Also the metadata standard ISO 19115, at least at the discovery level, through UK GEMINI.

In the last decade there has been a rise in "community standards" i.e. thematic or other communities which have identified the need to progress more formally within their own sphere of influence. Although some of these may not be considered formal standards, they have helped galvanise specific groups and demonstrated an appetite and need for some form of documented approach. Several examples are shown in Table 3.

Collaborative Initiatives	Description
e-Government Interoperability Framework (eGIF)	Standards framework to improve the interoperability of government IT systems. Where relevant, the specified standards must be implemented for any new IT development programmes.
Defra GI Strategy and SPIRE Programme Data Working Group (DWG)	Corporate shared spatial information services. Common SPIRE Data Standard (extension of UK GEMINI standard etc).
Digital National Framework (DNF)	Guidelines, technical Papers, registers and tools on developing feature catalogues. Provides information on what constitutes core reference geographies and how interoperability can be improved through the use of definitive referencing via master data layers/core reference geographies.
National Underground Assets Group (NUAG)	Responding to the need to better coordinate and record underground infrastructure – with potential for very significant cost savings.
Atlantis	Adopting the DNF principles where each organisation adjusts its own data to better 'fit' with others in the initiative so that users can increasingly use the data "out of the box".
Local Government	The development of street and address datasets to the BS7666 standard.
Marine Environmental Data and Information Network (MEDIN/MDIP)	Metadata standard and discovery portal – searches a few selected data centres.

Collaborative Initiatives	Description
UK Environmental Observation Forum (UK EOF)	Developing standards and services for environmental monitoring data. Have developed a metadata standard.
National Policing Improvement Authority (NPIA)	Development of information standards for police service information systems in England, Wales and Northern Ireland: • Information Systems Strategy for the Police Service (ISS4PS); • Corporate Data Model (CorDM) The CorDM, developed in UML (the Unified Modelling Language), provides structure, definitions and standards for the data. It also provides a link to the CLMS (Code List Management Service) web site and the CorDM XML (Extensible Markup Language) web site. The CorDM forms part of a business model of the Police Service. http://cordm.npia.police.uk/

Table 3: Adoption of 'Community' Standards

Not all these initiatives are joined up and whilst it reflects a better stage than a decade ago, more work is required to integrate these valuable initiatives.

Use of Core Reference Data to Underpin Data Production

Inconsistencies between spatial data have been inherited from the early days of digital mapping; where applications were simply designed to fulfil a need and data collection costs were high. Until recently it has not been unusual to see data collected from mapping at 1:25,000/10,000 resolution, being combined with that from 1:2500/1,250 sourced data. This is never likely to yield reliable results. Even when common source data is used thethe traditional approach to data collection often results in overlapping and underlapping polygons based on the use of the different core reference datasets. In some cases this is not critical but in others data integrity is key to a definitive answer.

Tightly coupled data within isolated applications also contributes to the problem.T he corporate need for an immediate standalone solution can over time result in several duplications of the same, or different representations, of the same geography. The UKLP research has revealed a number of cases today where organisational data and location is delivered within an application. Due to this 'tight-coupling', little if any of the information can be re-used and such a way of working us unsustainable.

An 'enterprise architecture' approach is now recognised as the solution to this problem (using 'loose-coupling'), which permits common referencing to one geography and also enables the sharing of business data across applications. In the LII – such coupling is not restricted to in-house links.

UK Data Publication Infrastructure

The UK spatial data publication infrastructure is extremely immature. It is comprised of an ad hoc and uncoordinated set of services and applications incorporating discovery, evaluation, access and use of spatial datasets.

Data providers publish spatial datasets through a wide variety of channels:

- Data Discovery Applications - GIGateway, Go-Geo!;

- Free to use mapping view services - Streetmap, Multimap, GetaMap;

- Thematic or Organisational Portals - MAGIC, OneGeology, WIYBY; *and*

- Dedicated Data Ordering Applications - Ordnance Survey, InfoTerra, eMapSite

However, this is at best fragmented and uncoordinated. There also exists a major barrier concerning restrictions on the use of derived data. It is not surprising therefore, that users find it easier to commission a new survey, or dataset, to solve their particular need.

4.1.3 Public Access Data Publication Infrastructure

Public access to spatial data can be provided through a variety of forms:

- public registers and/or environmental information regulations registers;

- interactive visualisation applications such as web mapping applications, graphs and tables;

- static maps published in PDF; *or*

- by downloading the data directly from a website, or placing a request to the data provider for offline delivery.

Overall, the present state of public sector data access is extremely immature and fragmented, with a few exceptions such as Defra's MAGIC service. This has been disturbed in more recent years by the arrival of web-based services offerings from Google, Microsoft and Yahoo – all motivated by commercial interests and backed up by very substantial budgets. Nevertheless, they have raised the expectation of most organisations and users.

4.1.4 Legislative Framework

There has been significant activity over the last 10 years to develop an extensive legislative framework to improve the access and re-use of information. This aims to improve access to information held across all levels of the public sector to support policy-making; provide public and commercial access and the re-use public sector information; facilitate and encourage a participatory approach to decision-making; and provide access to judicial and administrative proceedings in environmental matters. However, while the legislative framework has addressed issues around access and reuse, overall regulation on data sharing amongst public sector organisations to fulfil a public task is fragmented.

A summary of this legislative framework is provided in the Blueprint Supplement [3].

5 FUTURE STATE VIEW

5.1 Design Principles

A general set of design principles will apply to the UK Location Information Infrastructure; and more specific principles to each design domain within the UK Location Information Infrastructure operating model.

5.1.1 General Principles

The following design principles will apply:

- the UK Location Information Infrastructure will be a federated, collaborative partnership, involving public, third and private sectors;

- there will be a strong focus on facilitation, co-ordination and enablement, rather than on the direct supply of services;

- the infrastructure put in place will represent a minimum market intervention, to achieve the desired outcomes and benefits;

- built on open standards;

- built on what already exists where possible;

- harnesses the market to provide re-usable products and services:
  - public sector cross Government Enterprise Architecture (xGEA); *and*
  - commercial offerings (inc. open source).

- establishes the basics and achieve benefits early; *and*

- evolves as the environment evolves.

The following (adapted) principles of the Digital National Framework (DNF) will also be applied:

- the concepts and methods shall always be driven by the strategic needs of the wider geographic information (GI) community and the needs of the information industry;

- data should be collected only once and then re-used (subject to Re-use of PSI Regulations);

- reference data should be captured at the highest resolution whenever economically possible; *and*

- source reference data should be re-used to meet multi-resolution publishing requirements in a seamless and integrated way (from local to European resolution).

The infrastructure should allow location enabled information services to be created more effectively and to encourage innovation. The infrastructure should also integrate with the wider access to PSI.

5.1.2 Data Ownership & Responsibilities

Specific to the ownership of data and associated responsibilities, the following principles will apply:

- the data provider will be responsible for ensuring that they present their data to the UK Location Information Infrastructure (via the registration process) in an INSPIRE compliant form;

- the identified owner(s) for each theme/subtheme will work to the agreed thematic roadmap (see sec. 5.4.5) to ensure greater coherence at all levels of government; *and*

- data owners will collaborate with other data owners to ensure interoperability and a better joined up service to data users.

5.1.3 Standards

The UK Location Information Infrastructure will be built using open standards and protocols and will therefore be independent of any particular underlying technology.

In support of this, the UK Location Information Infrastructure will adopt the INSPIRE Implementing Rules: These cover:

- Discovery Metadata;

- Data Specifications and supporting data specification guidelines;

- Data sharing (access and rights of use); *and*

- Network Services.

For data specifications, the INSPIRE themes are based on the INSPIRE D2.5 Generic Conceptual Model (Figure 4) into which several years of cross-European effort has now been invested. This will be adopted as the basis for any spatial object that the UK Location Information Infrastructure needs to define, that is not already in the scope of the 34 INSPIRE themes. [3]

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[3] Some INSPIRE Data Specifications illustrate how the model can be extended using the Generic Conceptual Model.
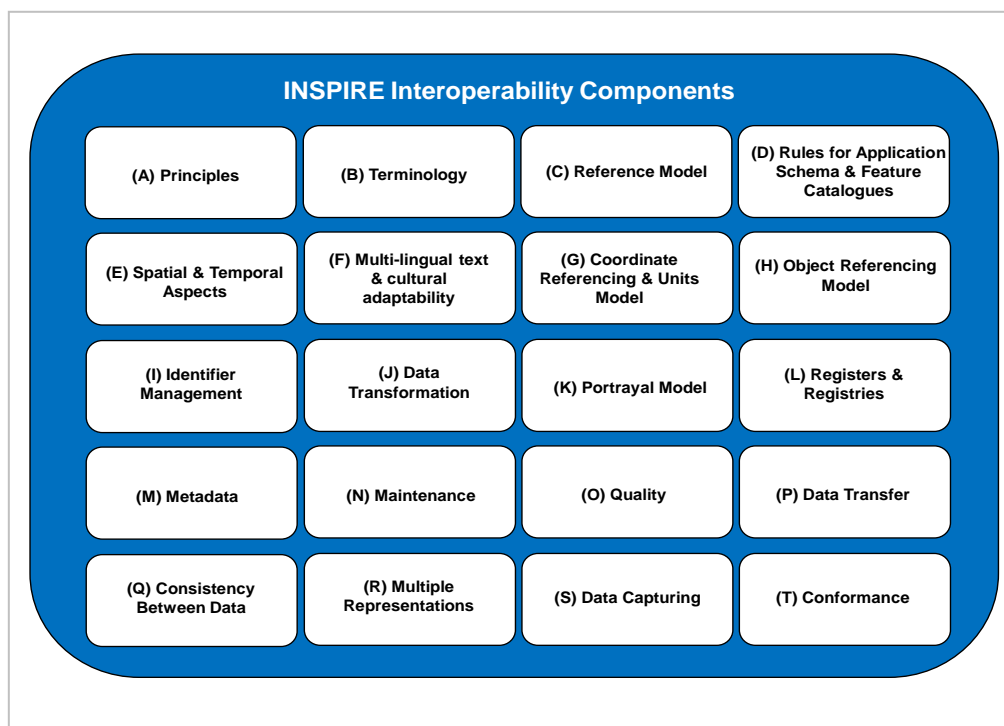
Figure 4: INSPIRE Data Interoperability Components (from D2.5 the INSPIRE Generic Conceptual Model)

The INSPIRE Implementing Rules will reference and utilise appropriate ISO and OpenGeospatial Consortium (OGC) standards. Within the INSPIRE GCM these 'de jure' standards also provide a common foundation in line with the rest of Europe. The UK Location Information Infrastructure will avoid any further standards development beyond the production of UK specific extensions and where applicable, profiles and technical guidance (e.g. GEMINI2). Pan European consistency and interoperability will be paramount at all times. Any proposed extensions will require a clear justification; and most likely coordination with the European Commission.

The Unified Modelling Language (UML) will be used as the conceptual schema language, in line with EC models and data specifications. This is dependent on the European Commission providing up to date access to these models. These will be supported via the Registry/Resource Centre.

5.2 UK Location Information Infrastructure Business Model

The success of the UK Location Information Infrastructure will be highly dependent on the establishment of a sustainable, long term business model[4]. This and the operating model for the UK Location Information Infrastructure, needs to also support a variety of data provider business models.

The business model for UK Location Information Infrastructure is structured around the template shown in Figure 5.

Source: A. Osterwalder
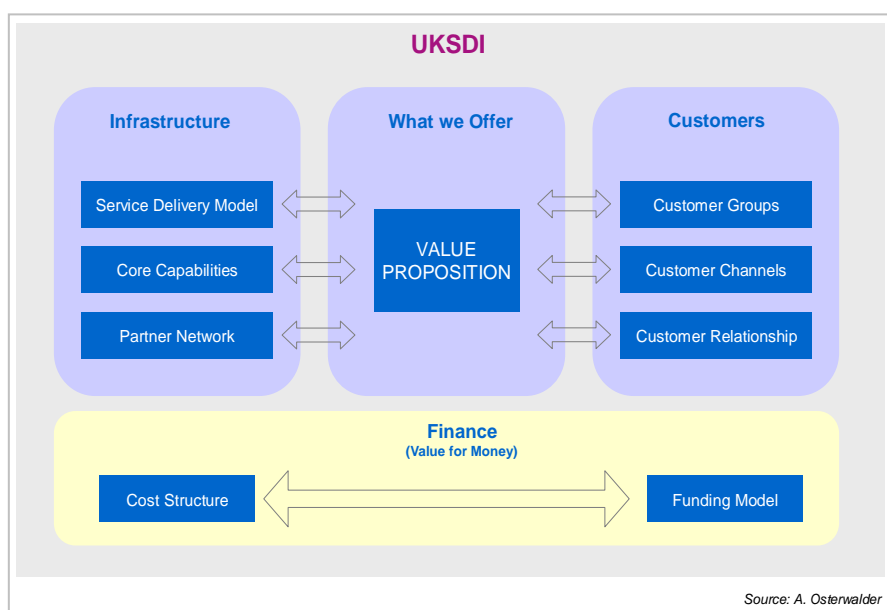
Figure 5 UK Location Information Infrastructure Business Model Template

The Business Model defines the UK Location Information Infrastructure in terms of the value it will deliver to its customers (referred to as the 'value proposition'), what products and services are required to deliver this value and how it will be funded. Each element of the UKLII Business Model will now be covered.

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[4] Note that the term 'business' is used in a more general sense here, i.e. relating to the activities of an organisation or organisations, rather than its more traditional commercial meaning.

5.2.1 Operational Goals and Value Proposition

The primary operational goals and 'value proposition' for the UK Location Information Infrastructure are represented in Figure 6:
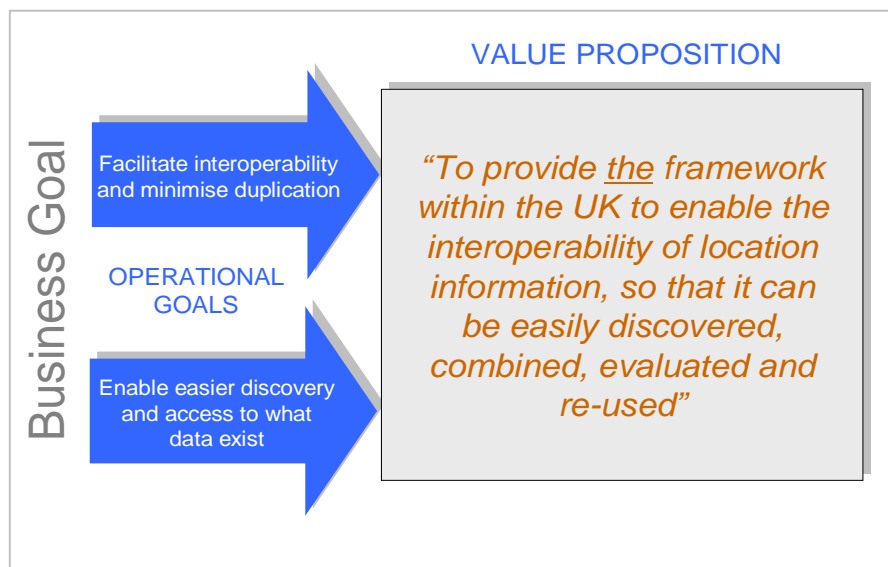

Figure 6 UK Location Information Infrastructure Operational Goals and Value Proposition

By delivering this value proposition, customers will be able to satisfy their needs for gaining access and using location information created by others.

5.2.2 Target Customer Groups

The target customers for the UK Location Information Infrastructure can be segmented into a number of key customer groups, with specific characteristics relating to the benefits they derive from the UKLII, the nature of their relationship to the UKLII and their channel preference – how they will receive the service (Table 4):

Customer Group	Derived Benefits	Nature of Relationship	Channel Preference
1. Data Providers & their Agents			
UK Government Departments Devolved government bodies and regional public sector bodies such as regional assemblies, development agencies, etc. UK National Delivery Bodies UK Local Authorities	Able to provide UK Location Information Infrastructure compliant data and services with the objective of encouraging the re-use of data held by the organisation, in the public interest; and/or to reduce operating costs through mutual benefit; and/or to benefit from wider market exploitation.	Data and services made available through the UK Location Information Infrastructure, within a collaborative partnership.	Online, with possibly some requirement for telephony and face-two-face contact; e.g. through the creation of a data provider group and events in partnership with AGI.

Customer Group	Derived Benefits	Nature of Relationship	Channel Preference
Other Public bodies.			
Academic and Research Organisations			
NGOs/Third Sector			
Private Sector Organisations			
2. Data Users			
Citizens (open government/Digital Engagement)	Specialist use. Able to easily access location information for local community use, and/or social web initiative; for personal use in support of location related fields of interest.	On-demand self service, using the services provided through UK Location Information Infrastructure and its various points of access.	On-line.
EU Body	Pan European monitoring and policy development.		
Devolved Administrations and National Government Departments	Evidence-based policy development, influencing EU policy development.		
UK Public Sector Delivery Bodies	Replace and/or supplement own data to improve service delivery.		
UK Local Government	Replace and/or supplement own data to improve service delivery. To provide easier access to external data sources in support of policy implementation.		
Academic and Research Organisations	Location-based research.		
NGOs/Third Sector	Replace and/or supplement own data to improve strategic and operational effectiveness.		
Private Sector (commercial) Organisations	To plan and enhance new products and services; and reach new markets.		
3. System Developers, Managers and Administrators			
Data Architects, Analysts and DBAs	Locate and evaluate potential sources of data for use in business application.	On-demand self service, using the services provided through the UK Location Information Infrastructure and its various points of access.	On-line.
Web Service Developers	Locate and evaluate potential sources of data for use in a business application.		
System Administrators	Access metadata and user community information relating to particular data sets in use within a business application, to resolve issues associated with this use.		

Customer Group	Derived Benefits	Nature of Relationship	Channel Preference
4. Client Application Developers, Managers and Administrators			
Application Architects, Analysts and programmers	Evaluate data and related services for use as part of a business application.	On-demand self service, using the services provided through the UK Location Information Infrastructure and its various points of access.	On-line.
Technical Architects and Analysts	Evaluate data and related services for use as part of a business application.		

Table 4 UK Location Information Infrastructure Target Customer Groups

The design and implementation of the UK Location Information Infrastructure will be focused on delivering the optimised value for each of these customer groups (, subject to any funding or technical constraints.

This will be achieved by gaining 'customer insight', i.e. through extensive market research and analysis; and under 'business as usual', by establishing customer feedback and demand-driven mechanisms to direct the future development of the UK Location Information Infrastructure.

Within the scope of the UK Location Programme, this model will also be used to: 'frame' the financial model discussed in sec. 5.2.5; identify implementation options within the UK Location Information Infrastructure implementation Roadmap; and prioritise design elements against available resources and technical capability.

5.2.3 Service Delivery Model

The delivery of value to the customer groups identified in sec. 5.2.2 will be through the implementation of the UK Location Information Infrastructure Service Delivery Model, or 'value system', shown in Figure 7. This will consist of a set of associated UK Location Information Infrastructure business products and services, delivered to its customers.
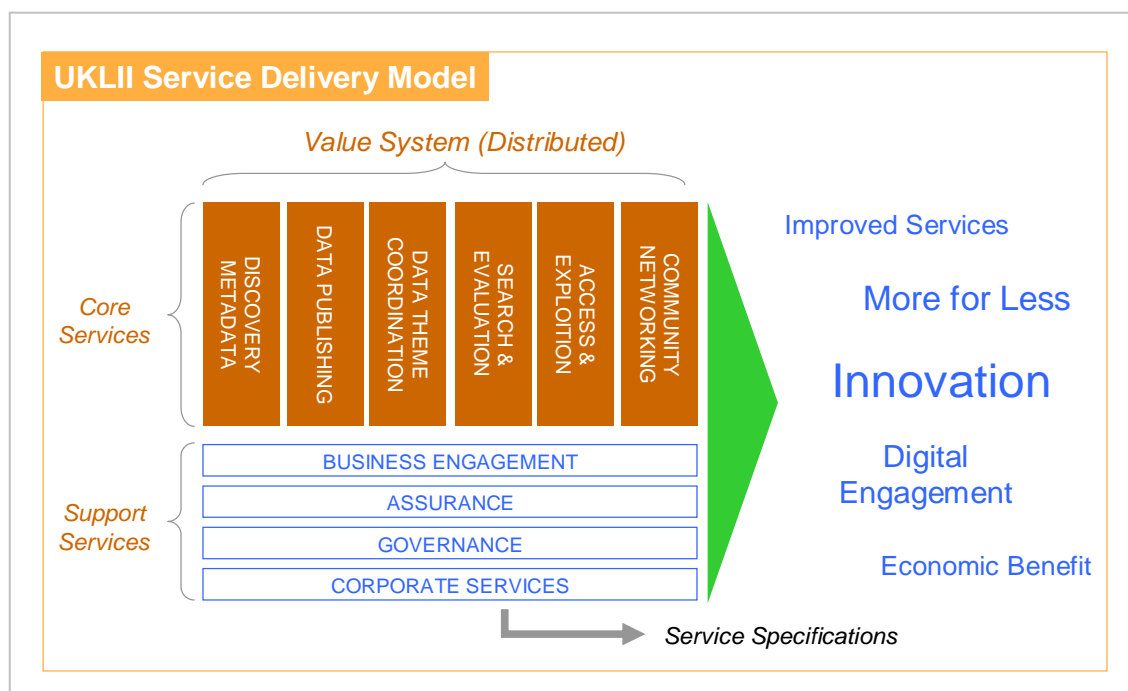

Figure 7 UK Location Information Infrastructure Service Delivery Model

The outline service specifications for each of these services are defined in Table 5.

Service	Customer Group/s	Short Description	Value Proposition	Method of Distribution	Key Features
CORE SERVICES					
Discovery Metadata	Data providers and their agents	Enables data providers to publish and maintain discovery metadata for datasets that they wish to make available through the UKLII. Main service components: • Policies, standards and operational framework for the publishing of discovery metadata • Discovery Metadata catalogue service • Associated business and technical resources • Metadata publishing toolkit • Resources, inc. training and education package; • Central coordination and marketing	Enables datasets to be discovered for data sharing and re-use; and evaluated for their suitability for a given purpose. Establishes a level of trust between the data provider and data user through the exchange of information about a given dataset. Ensures a coordinated approach towards the publishing of discovery metadata.	Public Internet client application, accessed through a standard web browser. Affiliated information portals.	• Set out in sufficient detail that ensures consistent implementation • Consistent with other Member States • Consistent and complementary to other wider standards setting • Supports all levels of organisational maturity re. data management and external publishing • Supports distributed cataloguing and use (publish & collect') • Makes available resources that simply and assist the publishing of Discovery Metadata • Data provider registration
Data Publishing	Data providers and their agents	Allows data providers or their agents to register their data and associated services; such that they can be discovered and used by data users. Service components:	Makes data available for data sharing and re-use. Ensures a coordinated approach towards the publishing of location information into the UKLII.	Central services and resources hosted on public internet client application, accessed through a standard web browser. Data publishing services – distributed web services from	As per Discovery Metadata Service +: • Data and services registration • Feature cataloguing

Service	Customer Group/s	Short Description	Value Proposition	Method of Distribution	Key Features
		• Policies, standards and operational framework for the publishing of data and associated services • Registry services • Associated business and technical resources • Training and education materials • Central coordination and marketing.		data provider or their publishing agent.	
Data Theme Coordination	Data providers and their agents	Coordinates the harmonisation of datasets around a given theme, e.g. INSPIRE theme and/or core geographic reference. Service components: • Policies and standards for data theme coordination • Operational framework for the coordination of data themes • Registry services • Transformation services • Theme coordination	Increases the interoperability of datasets created by different organisations related to a common theme.	Central services and resources hosted on public internet client application, accessed through a standard web browser. Data publishing services – distributed web services from data provider or their publishing agent.	• Ability to coordinate the harmonisation of datasets around a common data specification, either directly or through transformation.
Search & Evaluation	Data users	Able to search for data sets and services in combination; and obtain information on them.	Able to easily draw on a large range of geographic information and quickly evaluate it in the context of	Public Internet. Invoked indirectly through Discover Service (client application) and displayed using standard	• Ability to create composite maps from more than one data set, from more than one

Service	Customer Group/s	Short Description	Value Proposition	Method of Distribution	Key Features
		Enables data users to view combined geographic information as a digital image (not the data itself), to enable them to evaluate their use for a given purpose.	your intended application.	web browser.	distributed publisher (map server). • Ability to pan and zoom in/out. • Ability to obtain basic feature information associated with image.
Access & Exploitation	Data users	Provides access to the underlying geographic information datasets and their incorporation into a data user application. Provides resources for the exploitation of location information. Learning and Skill 'Exploitation Model' – incorporation of location information competencies into end user disciplines, e.g. social sciences and policy making.	Able to easily access geographic information data sets and integrate them into a data user application.	Peer-to-peer web service.	• Able to be routed from point of discovery , e.g. information portal. • Able to execute for multiple datasets, i.e. as a batch process.
Community Networking	Data providers and users	Enables both data providers and users to monitor who is using what data, their experiences, rate and leave feedback about any aspects of the service (data and service quality, fit for re-use).	Knowledge about datasets from the users of these datasets. Adds continuous improvement of the data through user feedback.	Public Internet client application, accessed through standard web browser.	• Web 2.0 type functionality – forums, ratings scheme, on-line customer feedback.
SUPPORTING SERVICES					
Business Engagement	Data Providers and Users	Outreach engagement with data providers and key data	Coordination; promotion of 'better practice' and re-use;	Direct relationships with key stakeholders.	• Collaboration

Service	Customer Group/s	Short Description	Value Proposition	Method of Distribution	Key Features
		users to facilitate the development of the UK Location Information Infrastructure. Benefit Realisation Management.	fostering 'collaborative advantage'; creation of exemplars.		• Bottom line benefit realization • Achievement of government goals, re. Open government, citizen engagement and improved service delivery.
Assurance	Data Providers	Assuring compliance with UK Location Information Infrastructure policies and standards.	Ensures interoperability across the UK Location Information Infrastructure.	Sample assessment of datasets and direct relationships with data providers and their service agents.	• Self regulation • Sample assessment
Governance	Data Providers and Users	To provide direction, coordination and cross government engagement for the establishment and onward development of the UK Location Information Infrastructure.	Ensures that a joined up, federated approach is adopted; and collective contribution to the delivery of the desired outcomes for the UK Location Information Infrastructure.	Delivered through the creation of the Location Council, supported by a coordination unit and Interoperability Board	• Representative • Provides strong leadership and clear direction • Collaborative approach
Corporate Services	Data Providers and users	Supports the overall operation of the UK Location Information Infrastructure.	Unpins the core and supporting services delivered by the UK Location Information Infrastructure, through the provision of technical services, e.g. IT, HR and administration.	Coordination unit functions.	• IT infrastructure support • Human resources provision and support • Facilities management

Table 5 UKLII Outline Service Specifications

To enable these services to be delivered, UK Location Information Infrastructure will need to develop capabilities and competencies in the following key areas:

- **Collaboration.** The creation of the UK Location Information Infrastructure will require the close collaboration of a large number of public, and private sector organizations. UK Location Information Infrastructure will need the capability to promote 'collaborative advantage' and facilitate the development of collaborative capability across these organizations, both formal and informal;

- **Geospatial Data Management.** The creation of core reference geographies and INSPIRE Themes will require the ability to coordinate data across a wide number of organizations; to facilitate the creation and ongoing management of these reference geographies. This will require a strong understanding of geo-spatial data, its creation, management and use across multiple business applications; and issues concerning sustainability and long term compliance;

- **Standards.** The infrastructure will be fundamentally based on the application of standards. A strong understanding of the use of standards and their successful promotion and deployment will be required;

- **Web Services.** The UK Location Information Infrastructure will be web-based. A strong understanding of web services architecture will be required; including its commercial provision; and engagement in ongoing technical developments;

- **Rights Management.** Rights management across diverse data providers will be a major challenge for the UK Location Information Infrastructure. A strong understanding and implementation capability will be required for all aspects of rights management, including digital rights management. Rights Management will also need to be managed in the context of PSI regulations;

- **Innovation and the management of change.** The UK Location Information Infrastructure is about the innovative re-use of location information; and changing the way people think about the creation of data, i.e. moving away from creating data for a single use, to creating it for multiple uses. This will require an understanding of how innovation is fostered and how behavioral change is achieved;

- **Learning and education.** Many of the interventions associated with the UK Location Information Infrastructure are about providing assistance to data providers and data users, in the form of resources and learning materials. This will require an understanding about how people (and organizations) learn and the best and most effective forms of learning products and services.

5.2.4 Strategic Partner Network

The delivery and operation of the UK Location Information Infrastructure will be dependent on a number of third party organisations working in collaboration. These key strategic partners and their roles are set out in Table 6.

UK Location Information Infrastructure Strategic Partner Organisation	Role
Devolved Administrations	To lead on the implementation of the UK Location Information Infrastructure at a national and regional level; and to development resources in support of their national priorities and activities concerning the use of location information.
Office of Public Sector Information (OPSI)	To define and administer the overarching operational framework for the re-use of public sector information, including schemes and licensing models; and conditions relating to charging. To ensure that the UK Location programme is aligned to wider policy aims on the re-use of public sector information.
European Commission	Ongoing development of specifications, models, and implementation and operation of the European Spatial Data Infrastructure in line with Member States.
Open Geographic Consortium (OGC) and the International Standards Organisation (ISO)	To develop and publish standards relating to the design and operation of spatial data infrastructures.
Digital National Framework	To continue to lead on industry wide efforts to improve the interoperability of location information through definitive referencing, i.e. the creation and use of common 'master data' in the form of feature dictionaries, catalogues and registries; and cross referencing between different datasets (both business data and spatial objects and collections of objects). To provide the foundation mechanisms for the related services provided through the UK Location Information Infrastructure.
Local Government Association (LGA)	To lead on the publishing of local government location information; including the promotion of local, regional and functional partnerships to publish and exploit location-based information; and the production of resources specifically related to the local government implementation of the UK Location Strategy and INSPIRE Directive.
Thematic, sector and organisational based Location Information Infrastructure initiatives, inc. National Underground Asset Group (NUAG), Marine Environmental Data and Information Network (MEDIN), the Defra Network,Atlantis and the academic sector Joint Information Systems Committee (JISC).	To coordinate the involvement and participation of group members in the establishment and operation of the UK Location Information Infrastructure; including the promotion of local, regional and functional partnerships to publish and exploit location-based information in their area of interest; and the production of tailored resources related to the implementation of the UK Location Strategy and INSPIRE Directive.
CIO and CTO Councils	To ensure that the UK Location Programme is aligned to the wider policy aims and activities relating to information management across government, e.g. cross government mandates such as the next generation of the eGovernment Interoperability Framework (eGIF).
Office of Government Commerce (OGC)	Through the OGC Gateway Review and IT portfolio management processes, to ensure that the investments being made by public

UK Location Information Infrastructure Strategic Partner Organisation	Role
	bodies are aligned to the UK Location Strategy, e.g. that all investments in geographic information systems are based on open standards, and that duplication and plans for accessibility and re-use have been fully taken into account.
Knowledge Council; Skills Framework for the Information Age (SFIA) User Council; National Policing Improvement Agency (NPIA), IDeA and others	To work with the Location Council to establish a "capability building programme to embed location information awareness and analytical skills as a business 'tool' across the public sector" [1].
Association for Geographic Information (AGI)	To assist in communication and stakeholder engagement. Also sponsors Geographic Information standards via BSI and IST/36
HM Treasury	To work with the Location Council, to "establish a strategic planning and business framework, that establishes an adequate period of sufficient certainty and predictability (inc. funding and pricing) for dataset owners and users to make the necessary sustainable investments" [1].

Table 6: Strategic Partner Network

Where appropriate, a Memorandum of Understanding will be established between the Location Council and each partner organisation, to set out the corresponding roles and responsibilities of both parties and to provide clear terms of reference for the partnership.

5.2.5 Financial Model

The prevailing conditions for financing the establishment of the UK Location Information Infrastructure will be testing. The Financial Model for UK Location Information Infrastructure will seek to deliver the 'nominal value' to UK Location Information Infrastructure customers through an approach based on cost minimisation and value maximisation (as per sec. 5.2.2).

Cost Model

The UK Location Information Infrastructure is by its very nature a distributed infrastructure, where the principal costs will lie within the data provider organisations. The individual costs to data providers will vary considerably, but will principally be associated with:

- data preparation and transformation;

- publishing (provision of web services and the creation and maintenance of metadata); *and*

- service delivery.

The design of the UK Location Information Infrastructure will seek to minimise these costs through the use of shared services and common reusable infrastructure components, e.g. metadata tools; and provision of common resources. As with INSPIRE timing - cost impacts will be minimised by linking change to internal investment windows such as strategic business developments in the provision of core services within an organisation. This may be as part of the drive to transform public sector services or the regular refresh of ICT capability.

At the centre, the principal cost components will be:

- technical infrastructure, in the form of centrally provided on-line services;

- content, in the form of published standards, guidance and other resources; *and*

- outreach, in the form of public events and business engagement activities.

Direct costs will be minimised through the re-use of existing infrastructure, by encouraging the commercial supply of products and services[5] and through the use of resources within Location Council members and other partner organisations.

Funding Model

The sources of funding for the 'core' UK Location Information Infrastructure programme, which include the initial set up and implementation scheduled over 4 years, will come from across government. This will include both direct funding and indirect or 'in kind' resources that can help the core programme with expertise and experience.

For the wider programme, the funding of changes, especially in areas covered by data management, including metadata changes, conversion to consistent data standards and data interoperability, will be the responsibility and funded by individual organisations within the wider community. The central programme will help in terms of the provision of tools and guidance, but the work itself will have to be completed locally. The size of this task will depend on the type of organisation, its use of location information, the maturity in terms of data management, and implications concerning the core reference geographies and INSPIRE Themes.

With regard to the ongoing maintenance and running costs, the detailed plans have yet to be agreed, however the options include: Treasury funding; Cross Government funding; some form of Public / Private partnership model; or some form of payment for use model.

The overall governance of the funding process, including key decisions with regard to the direction of funds, will be provided by the UK Location Council.

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[5] It is anticipated that with the establishment of European wide requirements associated with the implementation of INSPIRE, the commercial market will respond with a range of offerings to support the development and operation of the UKSDI.

The programme will be a phased delivery, with the central business case being updated for each phase. This will allow for a structured call-off of funding, approved by the Delivery Board.

5.3 Conceptual Model

The 'Conceptual Model' for the UK Location Information Infrastructure is shown in Figure 9. The design seeks to bring together data providers and users; and create a strong community for the reuse of location information.

The creation of this community will be coordinated and facilitated through the creation of a UK Geoportal. This will deliver a range of services to data providers to support data and service publication, including discovery metadata publishing and registry services.

Access to published data and services will be through a range of information portals, both public sector and commercial.

These information portals will provide the ability to discover and evaluate published location information and access associated services, including view, download, invoke and transformation.

Location information will be either published directly by the data provider, or through a 'Publishing Agent'. 'Publishing Agents' will act as a shared service provider for the publishing of data into the UKLII. It is anticipated that Publishing Agents will be one of three types: Corporate, Thematic/Sector or Commercial.

The ability to search and find relevant location information will be achieved through discovery metadata catalogue and registry services. Data providers or their publishing agents will submit catalogue and registry entries via the UK Geoportal, either directly or through a data 'harvesting' service. These entries will record key attributes relating to the location information, including any restrictions on use, licensing requirements and associated charges.

Data providers or their agents will also submit details about the data services available, including view, download, invoke and dataset transformation (coordinate reference grid system and data schema).

The publishing of location information will be subject to a set of data and interoperability standards. In the case of the UK Location Strategy, these will apply to the core geographic reference datasets and INSPIRE themes. Additional themes may be added, as agreed by the Location Council. These will also be subject to the same standards.

The UK Geoportal will provide a range of supporting services, focused on facilitating the exploitation of registered location information, by both professional and non-professional users. This will include a Learning and Resource Centre, forums, feedback and monitoring services. The portal will also provide a 'listings' service, to showcase the application of UK location information across the private and public sector and the availability of other information portals - sector, thematic and regional.

The rights management of location information will operate within an agreed framework, developed in conjunction with the Office of Public Sector Information (OPSI). This will be based on the existing Information Fair Trader Scheme to ensure transparency, fairness and simplicity.

The design will enable reuse in support of other Geoportals. It will support the exchange of catalogue data and offer the UK Geo-portal client application as a reusable component for other Geoportal sites, e.g. devolved administrations (both national and RDAs).

The development of the infrastructure will be based on the INSPIRE Implementing Rules, underpinned by open standards, services and technical guidance; with the objective of achieving the maximum re-use of IT services and components.

The UK Location Information Infrastructure will operate within the context of a collaborative network of organisations and individuals, linking data providers and their agents, application developers and major data end user groups, coordinated through the Location Council and the devolved administrations.
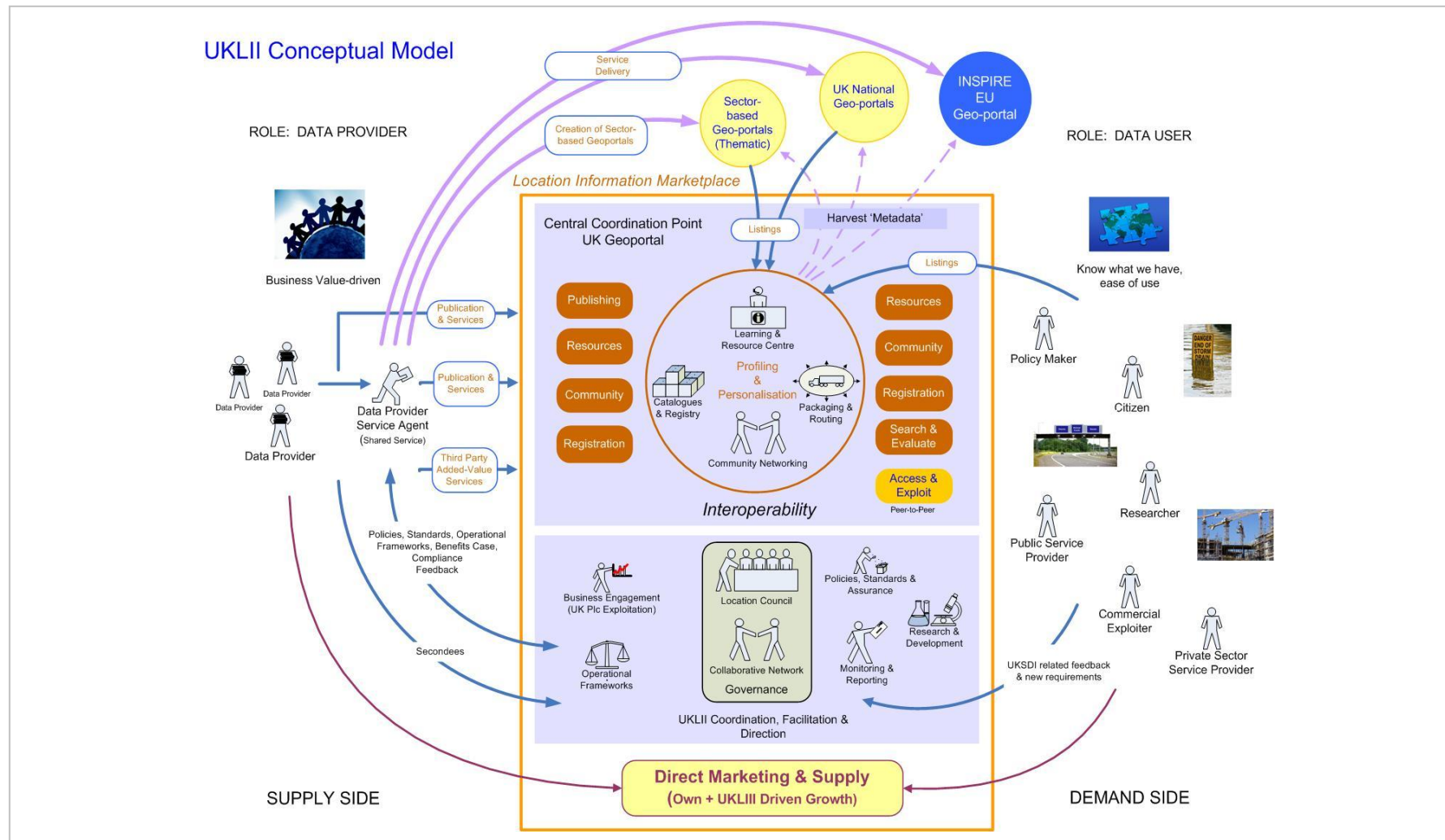
Figure 8: UK Location Information Infrastructure Conceptual Model

5.4 UK Location Information Infrastructure Operating Model

The operating model template shown in Figure 9 has been used to model the target operational architecture that will deliver the UK Location Information Infrastructure core and supporting business services, as defined by the UK Location Information Infrastructure Business Model (sec. 5.2).
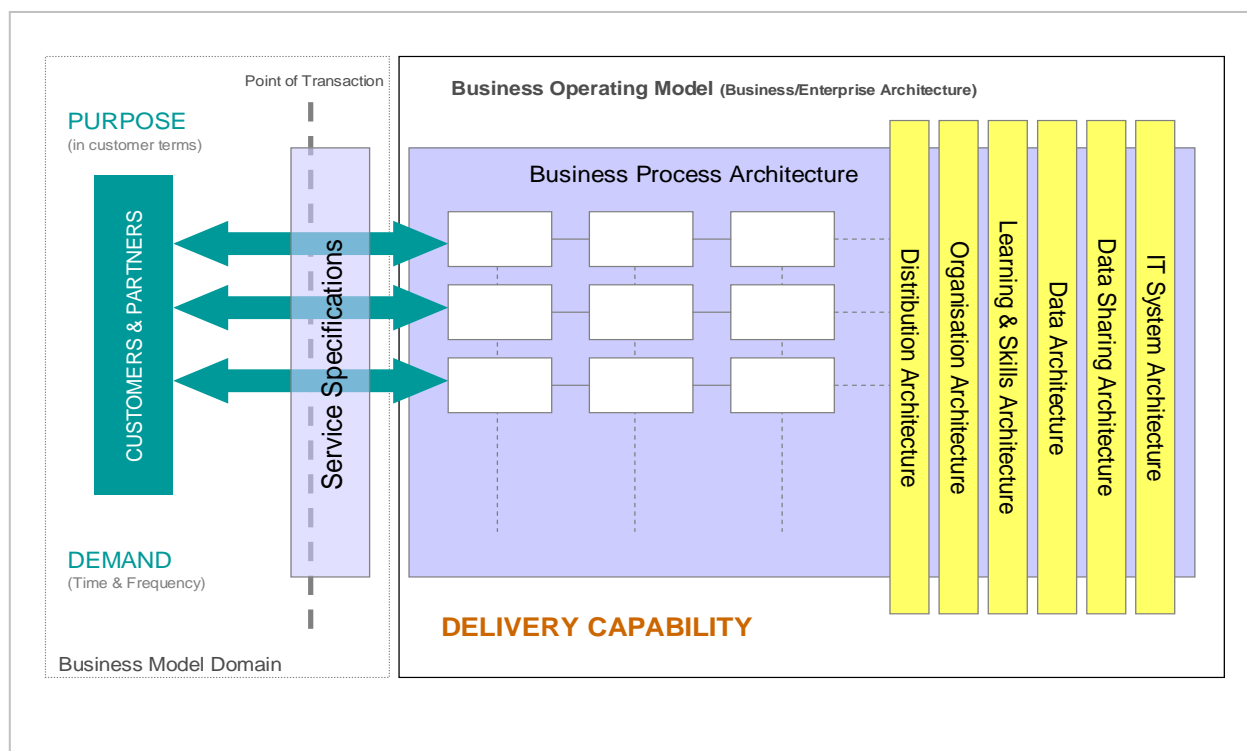

Figure 9   UK Location Information Infrastructure Operating Model Template

The conceptual design of each architectural domain is now described, starting with the underlying business process architecture for each of the core and supporting business services.

5.4.1 Business Process Architecture View

This section defines the processes that will support the core and supporting business services defined in sec. 5.2.3.

The majority of these processes are not transactional in nature. They principally concern the production of written material of various forms, e.g. standard profiles, guidance and on-line training packages. The detailed definition of these processes will be in the form of process descriptions; supported where appropriate by process flows, use cases and business rule definitions. These will constitute business deliverables; for direct use by the Coordination Unit in the execution of the associated functions.

The main transactional processes are associated with the publishing and 'Search & Evaluation' services delivered through the UK Geoportal. The detailed definition of these processes will be through the creation of use cases and where appropriate, business process models to an appropriate level of abstraction. These in turn will be used to drive application development and user acceptance testing of the UK Geoportal.

Core Business Process Hierarchy

The core business process hierarchy for the UK Location Information Infrastructure is shown in Figure 10.
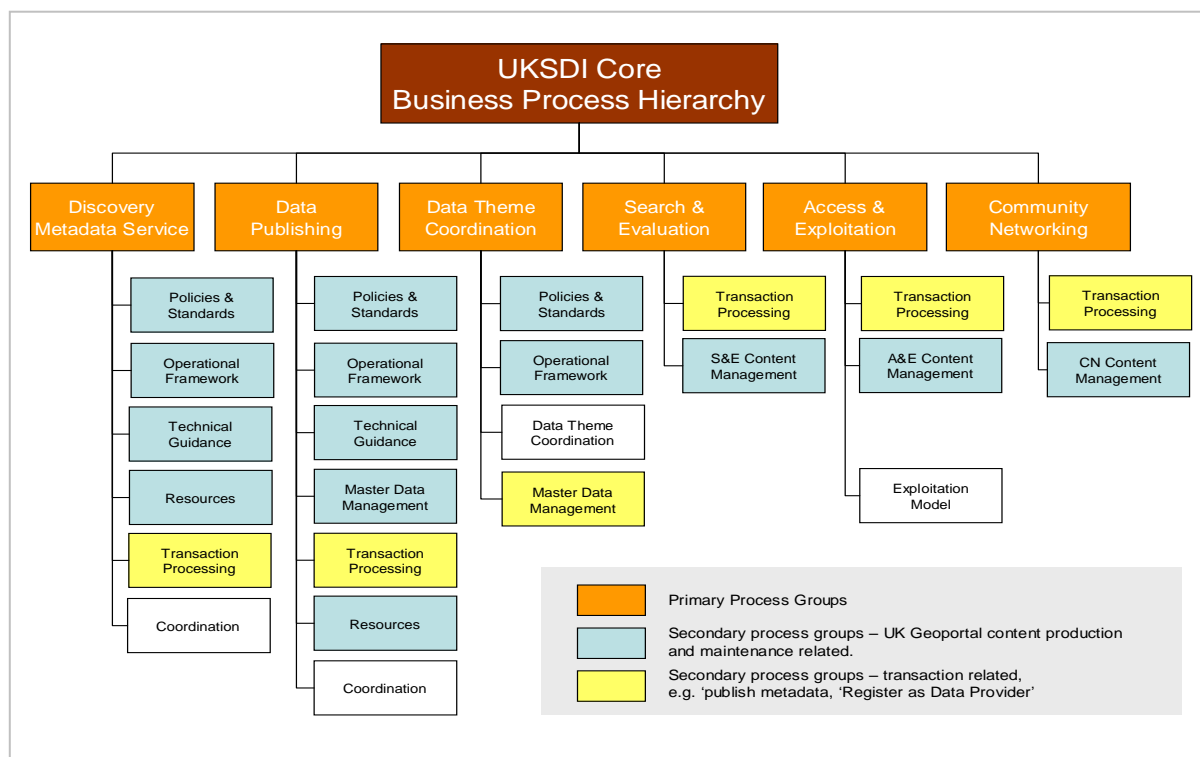
Figure 10: UK Location Information Infrastructure Core Business Process Hierarchy

This consists of a set of primary process groups associated with each of the core services outlined in sec. 5.2.3. Below these are a number of secondary process groups. These fall into a number of categories and general descriptions for each are provided here.

Policies and Standards

This will develop, publish and maintain UK Location Information Infrastructure policies and UK profiles for the data and service standards associated with the INSPIRE Implementing Rules; and develop on-line support products in the form of additional guidance and training.

Operational Frameworks

This will develop and maintain reference frameworks for a number of operational areas of the UK Location Information Infrastructure , including but not limited to:

- Discovery Metadata publishing;

- Data and services publishing;

- Data sharing (rights management, security, lifecycle management and ecommerce);

- Data Theme Coordination; *and*

- Master Data Management.

These operational frameworks will be developed in close cooperation with data providers; to ensure that they fully support their business needs and the variations that exist across the data provider community, e.g. relating to the nature, structure and use of location information, business models and operational service delivery.

Resources

This will create and maintain a range of business, technical and educational resources for use by data providers and users. Examples inc.: case studies, business case examples and contact points; technical guides and tools to support metadata capture and publication, schema translation and data and service validation; and educational guides on both business and technical topics.

Transaction Processing

This will support the physical publishing and use of data and services through the UKLII, in terms of registration, cataloguing, discovery, evaluation and access.

Specifically, it will support data provider registration and publishing; and provide automated processes for metadata and master data harvesting and distribution.

All data providers, publishers and service providers will be obliged to register with the UK Location Information Infrastructure before their components can be used. This will be a mandatory requirement.

All providers will be expected to pre-register to ensure that the correct standards and protocols are adopted and that re-use is maximised in dataset creation and when coupling services to the network.

Formal registration will include an approval stage and this will be part dependent on conformance testing.

For datasets, the registration of a namespace and dataset identifiers will be required at this stage.

Coordination

This will support the coordination of data publishing by data providers. Within this will be advise services and other services designed to assist and encourage the data publishing to the specified standards.

Content Management

This will support the creation and maintenance of content hosted on the UK Geoportal.

Supporting Business Process Hierarchy

The supporting business process hierarchy is shown in Figure 11.
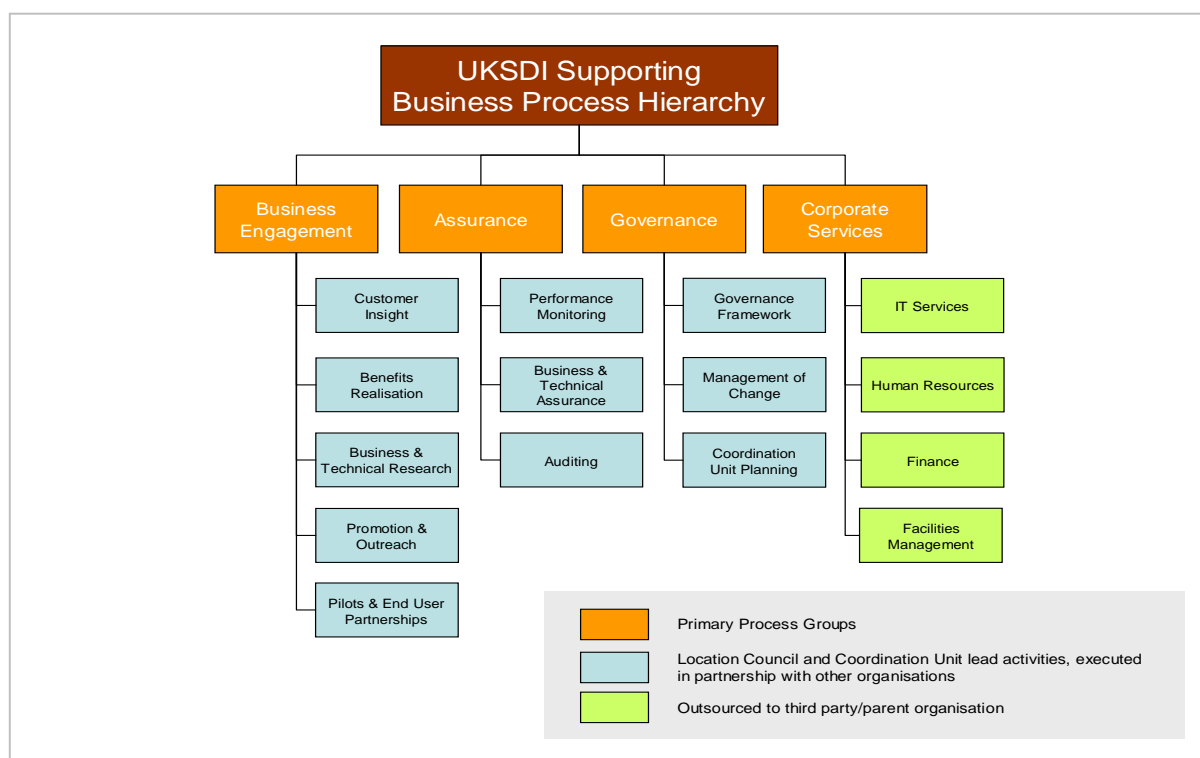
Figure 11: Supporting Business Process Hierarchy

This consists of a set of primary process groups associated with each of the supporting services outlined in sec. 5.2.3. Below these are a number of secondary process groups that are described in outline here:

Business Engagement

This will provide a range of business engagement activities, both relating to location information provision and its use within end user applications; and encompasses:

- 'customer insight' activities;

- benefits realisation planning, exploitation and monitoring activities;

- innovation;

- research relating to both business and technology development;

- promotion and outreach - stakeholder engagement planning; marketing; monitoring and external publication and events planning and execution, including oversight of all on-line content; *and*

- end user application pilots and partnerships to assist in the development of the infrastructure, demonstrate value at an early stage and develop business buy-in.

Assurance

This will provide business and technical assurance of the UK location infrastructure, incorporating:

- performance monitoring, including EC INSPIRE compliance reporting;

- business and technical assurance (design and programme delivery);

- information asset security; *and*

- auditing.

Publishers will be required to self certify their data or services on an ongoing basis to ensure continuous compliance. In addition, an external check will be applied to a percentage of datasets each year to ensure that Data Quality statements and INSPIRE standards as a minimum are being met. The test suites in the theme Data Specifications will be used as the basic framework, augmented by any UK needs agreed when theme coordination is undertaken.

Governance

This will provide the governance processes for the UK location infrastructure, relating to:

- the operation of the Location Council and its associated structures.

- the management of change (programme and project management); *and*

- business planning.

Corporate Services

This will provide the corporate services required to support the creation and operation of the UK location infrastructure, i.e. relating to IT, human resources, facilities and finance.

5.4.2 Distribution Architecture View

This section relates to the way the various parts of the UK Location Information Infrastructure will be physically distributed.

The UK Location Information Infrastructure will, by its very nature, be highly distributed, both in terms of supply and demand. It will involve the publishing of a large number of datasets from a large number of organisations. Equally, data users may want to work across thematic datasets, from a wide range of fields; or work within a specific area of interest, perhaps to a greater depth and degree of specialisation. The design of the UK location infrastructure needs to support this diversity, yet ensure that the UK Location Information Infrastructure can be easily navigated, both by data providers and users.

Supply-side Distribution

Data providers responsible for creating, managing and maintaining location data will be able to publish their data into the UK Location Information Infrastructure in one of two ways:

- **Directly -** by developing the publication services required to make their data accessible to users through the UK Location Information Infrastructure ; *or*

- **Indirectly -** by passing the responsibility for publishing the data to a publishing agent, who then provides the publication services required to make datasets available through the UK Location Information Infrastructure.
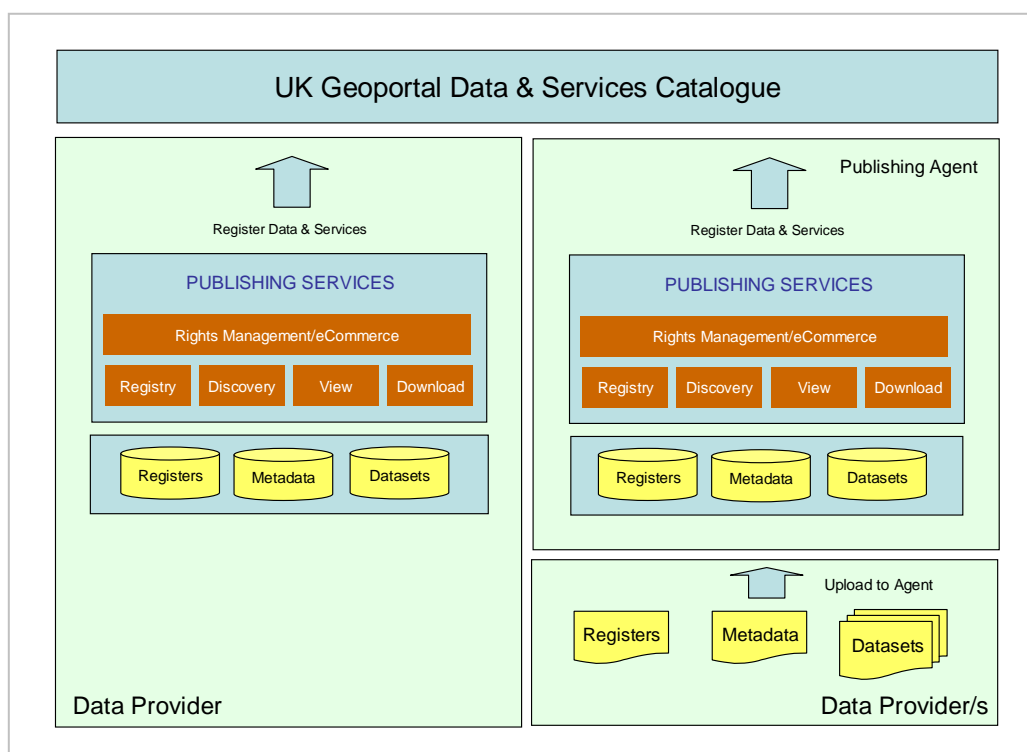
This is illustrated in (Figure 12):

Figure 12 Distribution Models for Publishing Data into the UK Location Information Infrastructure

There will be no centralised publication service provided by the UK Location Information Infrastructure for use by data providers. If data providers do not have sufficient resources to publish data directly, they must identify a suitable agent who can publish the data on their behalf.

It is anticipated that these agents will be one of three types:

    a. **Corporate Publishing Agent.** The data provider's parent organisation establishes one or more corporate data centres that provide publication services to make data accessible to both internal and external users. Existing examples include: NERC Data Centres/ DataGrid, Defra SPIRE, JISC Edina, Highways Agency LiDAR Framework;

    b. **Thematic/sector Publishing Agent.** A number of data providers form a partnership to establish a thematic/sector based data centre/repository. Existing examples include: National Air Quality Archive, National Biodiversity Network, DEAL, Data Archive for Seabed Species and Habitats (DASSH), Forth Valley GIS; *or*

    c. **Commercial Publishing Agent.** The data providers outsource the publication of their data to a commercial service provider.

The UK Location Information Infrastructure will seek to complement and build on existing sector-specific/thematic spatial data infrastructure efforts within the UK, e.g. JISC (EDINA); MEDIN, Atlantis, NUAG and the NERC Network. There are many advantages to this approach:

- assisting the coordination and transformation of data around core reference geographies and INSPIRE themes;

- efficiency and performance gains through the use of shared services (economies of scale);

- facilitating the re-use of infrastructure components; *and*

- reducing the operational demands on data providers, where in most cases the publishing of location information for re-use does not constitute their core business.

The formation of data provider partnerships and shared services, particularly around a given theme, will be encouraged.

Demand-side Distribution

It is anticipated that the demand for location information will be extremely varied in terms of end user application. The UK Geoportal will be just one point of access for location information published through the UK Location Information Infrastructure. It will be most suited to those users who are looking to combine data from a diverse range of sources, as opposed to a particular theme, specialisation or subject matter.

The UKLII will support this diverse range of users by encouraging a distributed approach to the access of location information..

This will be achieved by making available the metadata and master data catalogues for published data and services to third parties, who can then host this information on their own information portal. The UK Geoportal will also support thematic themed pages. These will provide links to dedicated, specialist thematic portals, where these exist. This structure is illustrated in Figure 13.
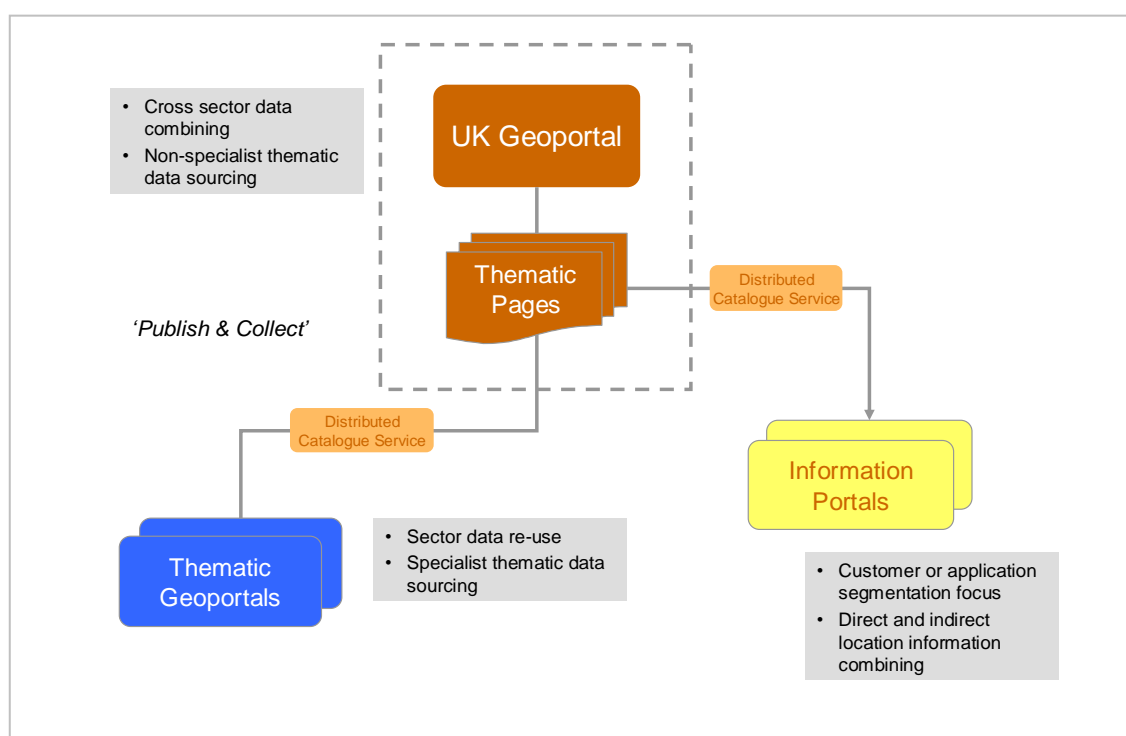

Figure 13: Demand-side Distribution Architecture

5.4.3 Organisation Architecture View

The organisation architecture surrounding the creation of the UK Location Information Infrastructure will consist of a large number of organisations, working together to achieve a set of shared goals and objectives. The organisation model will be that of a federation. In general terms it will consist of a small centre, connected to a wide range of networks, consisting of national, regional and sector-based thematic groupings, or partnerships. The way these individual networks are organised will vary. The architectural model presented in the Blueprint addresses the structure of the centre only; and how it will interface with this wide range of partner organisations and networks.

Design Principles

The fundamental design principle for the central organisation is to keep it small and informed by a UK view of what needs to be done at the centre to create and maintain an efficient and effective infrastructure.[6]

Further organisational design principles are:

- clear top management leadership, with a single Senior Responsible Officer (SRO) for the whole implementation programme, that has overall responsibility and is accountable to the responsible Ministers;

- non-executive capability of the Location Council will be provided through Ministerial Committees [DA (PED) and equivalents in Devolved Administrations] and independent assurance;

- the Interoperability Board will incorporate a mix of experts who represent their domain and other who link to wider standards bodies,

- although primarily a public sector strategy, the private, academic and 3rd sectors will have valuable roles within the governance structure to ensure that the implementation of the UK Location Strategy is user driven and meets the priorities of the wider sector; *and*

- as far as possible, the Coordination Unit will be staffed by resources drawn from Location Council members, either as part of their existing role, or through full or part time secondment.

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[6] The Coordination Unit will have specific statutory requirements to fulfil under the UK transposition of the EC INSPIRE Directive, for which it will be responsible to the Secretary of State.

Organisation Model

The organisation model for the central governance and administration of the UK Location Infrastructure is shown in Figure 14:
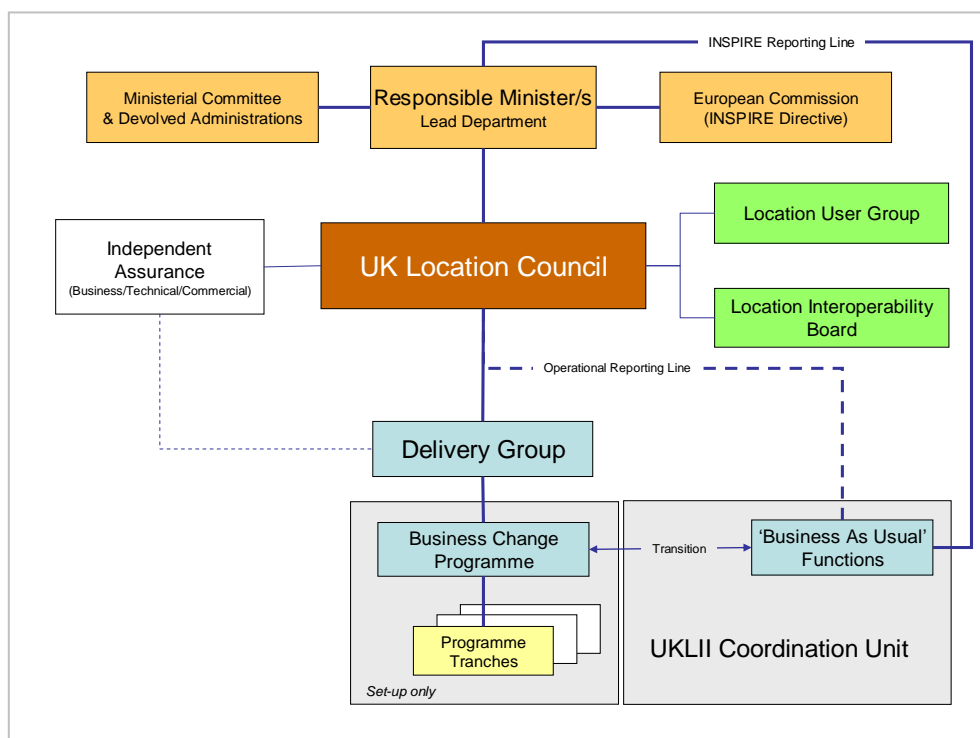
Figure 14: Governance and Administration Organisation Model

A brief terms of reference for each operational unit is provided below; and their inter-relationships.

Ministerial Committee

The minister responsible for delivering the UK Location Strategy and INSPIRE is charged with reporting progress to the Ministerial Committee [DA (PED) - Sub-Committee on Public Engagement and the Delivery of Services], equivalents in Devolved Administrations and the Secretary of State for Defence twice a year. These committees will have non-executive responsibility to provide strategic oversight of the programme to deliver the UK Location Strategy and INSPIRE. This will ensure wider government understanding and involvement in the UK Location Strategy implementation.

The Ministerial Committee key objectives will be:

- to ensure that the Location Council is driven by the needs and priorities from a senior public sector perspective and is being appropriately inclusive;

- to provide oversight of the programme plan for the implementation of the UK Location Strategy and INSPIRE;

- to ensure that the UK is meeting its statutory requirements under the EU INSPIRE Directive; *and*

- to promote the UK Location Strategy across government.

Lead Department

As a cross-cutting initiative, the implementation of the UK Location Strategy and INSPIRE will be driven by a 'lead department', agreed by the Ministerial Committee and appointed by the Head of the Civil Service's Civil Service Steering Board (CSSB), to fulfil the cross-government role with its full authority. The lead department will be the Department of Environment, Food and Rural Affairs (Defra). Defra will chair the Location Council and provide the Senior Responsible Officer (SRO) for the delivery programme.

Location Council

The Location Council will oversee the design, development and operation of the UK location information infrastructure. Location Council membership will be based on the following criteria:

- Organisations that have part funded the programme activities;

- Organisations that are undertaking significant work packages on behalf of the programme;

- Representatives of communities of practice directly involved in the programme, e.g. through pilots and testing; *and*

- Devolved administrations.

The Location Council will report to the responsible Minister (and equivalents in Devolved Administrations) and provide strategic oversight through to representative home departments.

The objectives of the Location Council will be:

- to be an inclusive Council with an overview of all public sector location initiatives at local, devolved and central government levels;

- to develop and oversee an Implementation Plan for the UK Location Strategy and the INSPIRE Directive;

- to act as the Programme Board, coordinating the UK's delivery of the implementation of the UK Location Strategy and INSPIRE Directive;;

- to take the lead on continuing strategic issues about location information and its use; *and*

- to advise the responsible Minister accordingly (and through that Minister, as appropriate, the devolved administrations) and, under the authority of the Minister, set standards, policies and implementation requirements for those involved in geographic information and its use.

A key responsibility for the Location Council will be the overseeing of all data themes, whether these exist or are created in the future. The scope will be INSPIRE Annex I-III and any supplementary themes that the Location Council decide to incorporate.

As the INSPIRE Implementing Rule for each theme is introduced, the Location Council will determine policy for each theme/subtheme. This will include:

- a strategy to move each theme towards the published specifications with short, medium and long term objectives in a coordinated way and at a pace appropriate to national needs of that theme/subtheme. This will include:

  - an assessment of the current situation (current state, how many datasets, level of duplication, interlinking etc);

  - options and selection of the preferred plan for the future (continue with the as is situation, impose better linking or take action to rationalise the holdings and link up remaining components);

  - temporal issues: Archiving & retention of the theme and subtheme, lifecycle policy – future, as is & past;

  - Metadata – work towards more comprehensive metadata provision from discovery to object level; *and*

  - an agreed and published interoperable license model for each theme/subtheme.

The resulting plan and roadmap for each theme will be agreed by the Location Council and the responsible data owners. Work towards coordinated data management across all organisations during the execution of the roadmap will be critical and is aligned with UKLS Recommendation number 4.

Delivery Group

The Delivery Group will report to the Location Council... It will be responsible for coordinating the delivery of the business change programme across the various strategic partners and core programme team.

The Delivery Group will comprise Of core programme team members and representatives of the key strategic partners. Its membership will change over time, as the focus of the UK Location Programme progresses.

The key objectives of the Programme Delivery Working Group will be:

- to act as a group to co-ordinate, review and ensure timely delivery of the federated work strands as agreed by the Location Council;

- to provide advice on key papers prior to their presentation to the Location Council;

- to collectively commit resources and funding to deliver their elements of the programme plan, where appropriate;

- to monitor the delivery of benefits by each of the projects and for ensuring delivery of cross-programme benefits, in line with those captured in the programme's business case and Benefits Realisation Plan;

- to manage risks, issues and dependencies that are escalated from the various elements of the programme; *and*

- to escalate significant risks and issues to the Location Council as necessary.

Location User Group

This advisory group will monitor the UK Location Strategy implementation programme, ensuring that it meets end user needs and priorities, and is on track to deliver value to users of location information across the UK.

Membership of this group will be limited to 25 and will be inclusive, representing a wide set of stakeholders groups. Each member must represent as large a location information community as possible and be influential in ensuring that the UK Location Strategy is adopted effectively in their communities.

The key objectives of this group will be:

- to ensure that the implementation of the UK Location Strategy is driven by user needs and priorities;

- to spread knowledge and understanding about the objectives of the UK Location Strategy and INSPIRE Directive;

- to facilitate the adoption of location standards and technology development across the sectors. This will largely be achieved through the INSPIRE Implementing Rules;

- to encourage partnerships and shared services where appropriate;

- to support the capacity building programme across the sector by introducing appropriate education, CPD and training; *and*

- to promote, share and encourage the adoption of best practice across the sector.

Location Information Interoperability Board

This technically oriented board will oversee and drive the implementation of the location data & interoperability standards, in conjunction with the INSPIRE Implementing Rules.   It will both provide input t the Location Council and support the production of specific products and services as part of the business change programme.

Membership will be limited to a maximum of 25 and be drawn from experts across government, the private and academic sectors. The board may co-opt short term working groups to progress and resolve topics.

Its key objectives will be[7]:

- to agree an initial portfolio of location data and interoperability standards to underpin the implementation of the UK Location Strategy. This will largely be achieved through the INSPIRE Regulations and prevailing policies within the UK public sector;

- to monitor International location data and interoperability standards and to recommend on-going changes to the adopted portfolio of standards;

- to drive the programme of location data and interoperability standards, technology developments and business change across the wider information community, e.g. through the creation of guidance;

- to provide a mechanism for checking and certifying conformance with the adopted standards;

- to spread knowledge and understanding about the location data and interoperability standards through a capacity building programme across the sector; *and*

- to share and encourage the adoption of best practice in the use of location data and interoperability standards across the sector.

The key activities of the Location Information Interoperability Board (LIIB) will be:

- agree the portfolio of location-related system and interoperability standards to be adopted to support the sharing of location-related information and resolve/agree operational/implementation issues;

- drive the adoption of location interoperability standards across government.

- support the business application pilots that will be delivered through the Location Council;

- interface with prevailing bodies leading on UK Information and Services strategy and ensure interoperability with those programmes; *and*

- monitor the development and use of location interoperability worldwide and provide guidance on trends and priorities for adopting new standards and approaches to interoperability in the UK.

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[7] Note: The LIIB Terms of Reference will be updated after the first meeting of the LIIB and subsequent Location Council meeting.

Independent Assurance

At least two non-executive member of the Location Council, reporting to the Chair, will provide independent assurance of the activities and outputs of the Location Council – business, technical and commercial.

The non-executive member can be drawn from the public and non-public sectors, but must provide a high degree of independence from any particular body.

The key objectives of the assurance group will be:

- to ensure that the Location Council is delivering against the requirements of the UK Location Strategy and INSPIRE;

- to ensure that the Location Council is driven by user needs and priorities;

- to provide oversight of the programme plan for the implementation of the UK Location Strategy and INSPIRE and to ensure that it represents value for money;

- to identify issues and risks to the chair of the Location Council when appropriate; *and*

- to provide quarterly assurance reports on the Location Council activities to the chair.

Co-ordination Unit

The day-to-day operation of the UK Location Infrastructure under business-as-usual will be managed through the creation of a Co-ordination Unit.

The unit will be responsible (with the Devolved Administrations) for ensuring compliance with the INSPIRE Directive, reporting to the Minister of State. Operational reporting will be to the Location Council.

It will perform the following 'business as usual' (BAU) activities:

- engagement with the EU;

- responding to parliamentary questions and ministers;

- maintaining all the products and services created in support of the Service Delivery Model (ref. sec. 5.2.3);

- ongoing operational coordination, including metadata and data publishing and theme coordination;

- wider business engagement,;;

- customer insight and market research;

- assurance services – conformance to data and network services standards; *and*

- monitoring and reporting, inc. UK and EC report creation on behalf of the Location Council.

Many if not all of these functions and activities will be initially established under the business change programme and then transitioned into 'business as usual'.

Business Change Programme

The purpose of the business change programme will be to deliver outputs and capability into the operational environment. Its structure and management will conform to "Managing Successful Programmes' (MSP) and PRINCE2 best practice. It will be staffed by a small core team, supplemented by additional team members drawn from Location Council members.

The core capabilities that will be delivered by the core programme team will be:

- programme and project management;

- business, information and technical architecture;

- benefits realisation management; *and*

- stakeholder engagement, partnership management and communications.

The Key objectives of the Business Change Programme will be:

- to successfully deliver outputs and capability into the operational environment; within the required timescales;

- to ensure effective and efficient stakeholder collaboration and participation, drawing on and engaging with acknowledged key experts within a given field;

- to work successfully with the Coordination Unit on ensuring an effective and efficient transition to business-as-usual;

- to maximise value for money, by drawing on the resources from stakeholders and reusing existing infrastructure components;

- to maximise the engagement of the public and private sector in the supply of reusable infrastructure components; *and*

- to minimise the publishing and in service costs to data providers.

This organisational unit is transitional. Once the core location infrastructure has been delivered and the Coordination Unit has been established, the management of ongoing business change will become an integral function within the Coordination Unit.

The Business Change Programme will be subject to independent assurance, including external 'Gateway Reviews' at appropriate intervals.

5.4.4 Learning & Skills Architecture

The delivery of the outcomes and benefits derived from the establishment of the UK Location Information Infrastructure requires a step change in the capability to understand and use location information. Currently the skills and knowledge surrounding location information and its use is limited to a specialist community. To achieve the exploitation of location information in key areas of policy making and service delivery, these skills and knowledge need to be embedded within a much wider community, covering a range of disciplines.

Therefore, a key architectural component of the UK Location Infrastructure is learning and skills development related to the application of location information to mainstream policy development and service delivery.

The architecture will consist of a capability building programme, lead by the Location Council, to embed location information awareness and skills as a business enabler across public services and professions.

The development of this capability will be informed by an initial audit of existing skills and supporting professional development programmes, the barriers that exist and the nature of future requirements. This will lead to the development of a 'Location Information Exploitation Model' – an operational framework for taking forward the development of a range of interventions and initiatives. Key components of this model will be:

- a range of resources, published on the UK Geoportal, promoting the sharing of knowledge, e.g. in the form of case studies and examples of good practice, particularly those that have a general application across other organisations;

- the working in partner with other organizations, e.g. the Knowledge Council and sector-specific innovation and improvement groups (IDeA and the National Policing and Improvement Agency, etc) and establishing a community of interest to facilitate the participation, engagement and the sharing of knowledge across these groups;

- building strong links with the National School of Government and other educational institutions, with the view to embedding location information skills and knowledge training within existing educational programmes, e.g. Professional Skills for Government (PSG) framework and Continuous Professional Development (CPD) programmes.

5.4.5 Data Architecture View

Data forms the core of the UK Location Information Infrastructure. It is referred to here as data, but includes all kinds or data and spatial information. There are three types of data that need to be created, managed, maintained and published by data providers into the UK Location Information Infrastructure . These are:

- **Location Information:** these are spatial datasets or spatial dataset series formed by collections of spatial objects (roads, buildings, gas pipes, geology, rainfall, marine wrecks, etc) usually common objects are managed and used within a theme, e.g. "transport networks";

- **Metadata:** information describing spatial datasets and services making it possible to discover and use them (metadata is present at the dataset level and at the discrete object level);

- **Registers[8]:** descriptions and definitions of items required to describe the content of spatial datasets and services. Not to be confused with Core Reference Geographies. The Register provides a way of ensuring interoperability is maintained across diverse organisational datasets.

Users have created 'business data', e.g. water quality records, crime records, land registration records, taxation records, etc for as long as they have been in operation. This can be geo-referenced by linking it to a spatial object(s) to which it is relevant. Apart from geo-referencing (i.e. the relationship of business data with location), this expansive landscape of data is not within the scope of the UK Location Information Infrastructure .

Location Information

Location information forms the core of the UK Location Information Infrastructure. The Location Strategy and INSPIRE Directive have identified a set of key thematic data themes that fall within the scope of the UK Location Information Infrastructure. These are shown in Table 7 as a combined Summary of the UK Location Strategy Core Reference Geographies (in red) and INSPIRE themes.

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[8] Also referred to as Master or Reference Data, in a wider information management context.

Annex 1	Annex 2	Annex 3	
Geographical names	Elevation	**Statistical units**	Buildings
Administrative units	Land cover	Mineral resources	Sea regions
Addresses	Ortho-imagery	Natural risk zones	Land use
Cadastral parcels	Geology	Soils	Energy Resources
Transport networks **(streets)**		Species distribution	Habitats & biotopes
Hydrography		Environmental monitoring facilities	Human health & safety
Protected sites		Population dist. & demography	Utility & govt. services
		Meteorological features	Atmospheric conditions
Coordinate reference Systems		Agricultural and aquaculture facilities	Bio-geographical regions
Geographical grid systems		Oceanographic features	Production & industrial facilities
		Area management restriction/regulation zones & reporting units	

Table 7: INSPIRE Themes and UKLS Core Reference Geographies (shown highlighted)

Over time the scope of location information may not be limited to these themes. The UK Location Information Infrastructure shall provide a flexible, open marketplace through which any data provider (public authority, commercial, research or third sector organisation) can provide access to their data and services; subject to some constraints to promote re-use and drive out duplication, as well as adherence to standards.

The Re-use of Location Information

Within the adopted framework for location information, a key principle is re-use. Currently many organisational applications are bespoke, i.e. they have been built to address an issue at a moment in time. Subsequently, the next issue demands another (point) solution. Over time, there can be several systems within an organisation where business and spatial data are used, but because there is no overriding data architecture, very little of this data can be re-used.

Often different representations of geography are incorporated in each application. In addition, both the generic location and the business application data is tightly bound together (tight coupling) and a regime of re-use cannot be easily adopted. Worse still, it is not possible to share business data easily across applications, e.g. between an application associated with road surface condition with one associated with traffic accidents.

The INSPIRE model, and within it components such as Unique Identifiers and Object Referencing, provides mechanisms similar to mainstream ICT database linkages to support a model that enables re-use and data sharing (through the cross referencing of unique identifiers).

The basic categories of spatial information

The scope of location information that needs to be considered can be divided into three broad categories (illustrated in Figure 15):

- **Core Reference Geographies:** commonly used geographic datasets that provide the base framework (reference objects) for linking and integrating other geo-referenced information, as well as providing key contextual information. A small subset of this group can be defined as core reference objects, as they provide the definitive set of objects that can ensure all spatial objects can be consistently integrated and reused (with some limitations, e.g. topographic objects v some environment objects);

- **Application Reference:** geographic datasets created to meet the needs of a specific business requirement, which are commonly used to link and integrate business information within an application. These will more often be associated (cross referenced) with one of the Core Reference Geographies; and to ensure spatial consistency they should reference those objects. Note that Application Reference objects may be built from (re-use) other application reference objects;

- **Business Data/Information (in the user domain):** are data objects that can be related to a location (i.e. a condition report, statistics, a mortgage, a maintenance log, details of an event (such as a traffic accident). As shown above, any of these can be linked to core reference or application reference datasets by cross referencing.

Core Reference Geographies

In Figure 15 spatial objects represent the location of some feature in the real world (this can be physical such as a building or defined by an organisation like an electoral boundary. They are modelled in the data and are used by at least one organisation. Some of these objects are widely used since they are employed in many applications and these are known in the UK Location Strategy as "Core Reference Geographies".

Figure 15: The relationship of common organizational business information and use spatial information

Within INSPIRE, this is implied by the inclusion of some objects within a theme and the omission of others (which are more application specific). Table 8 illustrates this with two sets of examples.

Theme	Core Reference Example	Application Reference Example
Cadastral Parcels	Cadastral parcel	Easement, Right of way
Transport Network	Centreline (of road or railway)	Signal Light, Gantry, Drain cover

Table 8: Examples of Core and Application Reference Objects implied from INSPIRE

All spatial objects will have at least one user who references something to it for a particular need. Some objects can have thousands of users – all using it for different purposes. The problem here lies in the fact that *"a geography collected for one purpose is not necessarily suitable for another"*. Unless the data provider takes the new user's needs into account – this then puts greater responsibility on the data provider.

From this it becomes clear that the boundary is not a black (core) or white (non-core) world – the boundary will vary not only for a given theme, but within a theme and over time. In practice this should not really be a key issue - if the same data standards are adopted for all spatial objects. However there will be much greater responsibility on Core Reference Geography providers.

Two misunderstandings have arisen and need to be clarified. INSPIRE does NOT require:

- that a single organisation is responsible for any given theme; *and*

- that there should only be one source of a theme or sub theme.

Hence, there will need to be greater collaboration across data providers in future to support the goals of interoperability and consistency between datasets.

Obligations for providers based on characteristics of Core Reference Geography

The main characteristics of what might be deemed a Core Reference Geography are:

- widely used and widely referenced by many different communities;

- generally, the highest resolution available data over a national area to promote consistency and standardisation;

- support/satisfies many different applications (and is designed to do so);

- complex objects are disaggregated into simpler more management components and allow assembly by the user to satisfy their own requirements and support re-use;

- is reusable (though an application may require some supplementary information);

- interoperable with other core reference geographies;

- has a defined lifecycle so that users know how it will change;

- has a defined maintenance plan – so that users will understand when it will be updated;

- has defined quality criteria so that users can determine whether it meets their needs;

- there is coverage of the entire extent of the domain of interest;

- the data is accessible; *and*

- there is documentation and support for users.

In practice - given the conditions outlined above – the number of core reference geographies will be balanced against actual need and the requirements of data users.

Interoperability & Harmonisation of Location reference Information

One of the main objectives of the UK Location Information Infrastructure is to enable interoperability, and where practicable, the harmonisation of spatial datasets and services within UK (and Europe via INSPIRE). Interoperability can be defined as:

> *"the possibility for spatial datasets to be combined, and for services to interact, without repetitive manual intervention, in such a way that the result is coherent and the added value of the dataset and service is enhanced (2007/2/EC Article 3(7))."*

Interoperability can be achieved at various levels:

- by providing access to spatial datasets through publication services in a representation that allows them to be combined with other datasets in a coherent way;

- development of harmonised data specifications based on a framework, that identifies the components relevant for interoperability and harmonization; *and*

- encoding of location reference information and metadata for exchange using open data formats standards (XML/GML) for publication via spatial datasets services.

Ensuring that location reference information and services are interoperable will require changes to the way data providers create and publish information. This will in turn introduce changes to the way users store and use information in the short term and how users build applications around online data services in the medium to longer term. These changes are summarised in Table 9 below.

Current Situation	Issue	Future Situation
Data providers do not publish their data to an agreed, published specification.	This mean that the reference information is either not accessible or is unsuited for re-use in other applications. This prevents easy data sharing across applications.	Data providers shall publish their data to an agreed published data specification using common standards.
Data providers commonly publish their data using proprietary data formats.	End users may need to transform the data format into another format before they are able to use the dataset. Users are required to have access to extract, transform and load (ETL) software. If they do not have access to such software they may not be able to use the data.	Data providers shall publish their data using agreed open data formats.
Data providers do not use a standardised schema for their data.	It is not possible for a third party to adapt the dataset for an application without a lot of preparation (it is also obstacle to schema translation to the INSPIRE model.	Data providers shall publish their data using an agreed methodology for application schema.
Harmonised data specifications are not created for datasets that are captured by multiple data providers.	Significant duplication and too little re-use.	Data providers shall develop and agree a formal data specification (including capture methodology and data quality constraints) to ensure that dataset and services can be combined in a coherent way.

Current Situation	Issue	Future Situation
Data providers capture data against different reference datasets.	Inconsistencies between datasets.	Business information will be loosely coupled with the reference information so that it can be re-used and data shared across the applications.

Table 9: Summary of Data Provider Interoperability Changes

The new environment will be based on open standards. This will present a challenge to many, especially data providers who will need to take greater ownership of their data and how they manage it.

This is going to require careful preparation at the start to ensure that key individuals in the stakeholder organisations (business and technical) are aligned with the same direction of travel. There is an opportunity, before the first data specifications are published in the official journal of the European Union (OJEU) to provide background training and workshops to ensure a better understanding of what needs to be done so that we can take advantage of what is a one off opportunity.

To this end, the UK Location Programme shall provide a range of supporting tools and guidelines (business and technical) via the Resource and Learning Centre to support self help and community help.

Creating Location reference Information and Developing Harmonised Data Specifications

The UK Location Information Infrastructure will not be responsible for the creation or update of *any* spatial [object] data. The creation of such information will remain the responsibility of data providers and their agents. The data provider will be responsible for ensuring that they meet INSPIRE compliance needs.

The INSPIRE Directive [2] will mandate harmonised data specifications for each of the INSPIRE Annex I-III themes as Regulations, to a given timetable. The UK Location Strategy [1] advocates several Core Reference Geographies for the UK. These overlap with INSPIRE themes apart from Topographic data - these two groups will be integrated and progressed collectively.

The Location Council will determine which additional themes or sub-themes will be brought in scope.

The INSPIRE Generic Model [11] will be used for all themes/objects adopted by the Location Council, that are not defined by the INSPIRE theme data specifications. Where applicable the development of additional themes should be addressed at the European level, to avoid potential rework at a later date.

The development of any UK based harmonised data specifications will be the responsibility of the designated community working to the UK Location Information Infrastructure Interoperability Board, using the same process as used by the INSPIRE Thematic Working Groups [12].

Publishing Datasets and Services that correspond to INSPIRE Annex themes and UK Location Strategy Core Reference Geographies

The INSPIRE Directive [2] requires that datasets provided by Public Authorities that correspond with the Annex themes are published in conformity with the Implementing Rules, either through adaptation of the dataset or through transformation services.

The timescales for publishing data conformant to the INSPIRE implementing rules are set out in Table 10.

2007/2/EC Annex Theme	Requirement	Annex I	Annex II & III
New & extensively restructured datasets and corresponding services	Not later than 2 years of adoption of the Data Specification Implementing Rule for the respective theme	2010	2014
Other spatial datasets and services still in use	Not later than 7 years of adoption of the Data Specification Implementing Rule for the respective theme	2017	2019

Table 10: Timetable for INSPIRE Data Specification Adoption [note that dates are dependent on Commission processes and are liable to change]

While the INSPIRE Directive [2] only applies to data owned by Public Authorities, where datasets that correspond to INSPIRE Annex themes are owned by the private sector, research or third sector organisations, these organisations will be encouraged to publish their datasets and services in conformity with the Implementing Rules.

The creation and publication of harmonised datasets and services is not straightforward for many annex themes. For example:

- **Addresses:** several national datasets exist that are close to operational business processes such as taxation (e.g. valuation lists for taxation purposes) or mail delivery (Royal Mail). These could be used to generate a harmonised dataset, but there will be many entries that are in one list that will not appear in another. Equally, the lifecycles for change in entries will be driven by the business process, which will also be different;

- **Protected Areas:** responsibility for collection of protected areas datasets has been devolved to relevant Public Authorities, established within each of the Devolved Administrations. Each of these Public Authorities may collect the data using a slightly different specification, resulting in inconsistencies between the datasets that must be resolved to ensure they can be seamlessly combined (e.g. overlapping objects at boundary edges, inconsistent data capture scales, inconsistent attributes and values). An adopted common data collection standard would improve consistency;

- **Transport Networks:** this is a broad theme which can be sub-divided into air, road, rail and water and cableway transport networks. Within each of these sub-themes, multiple organisations may be responsible for collecting the information required for the INSPIRE Annex theme. For example, Ordnance Survey could provide the road network (OS MasterMap ITN), the Local Authority the naming and other features while the Department for Transport/Highways Agency/Highway Authorities could provide operational information about the road surface type and authority responsible for maintenance and ownership;

- **Environmental Monitoring Facilities:** this is also a very broad theme extending across a wide range of domain communities (e.g. air, water, waste, biodiversity, marine, emergency & risk, meteorology), with data being provided by Public Authorities, private and third sector organisations, and research and academia.

While harmonisation may not always be possible across corresponding datasets, some form of cross referencing can be used to support the sharing of business data across organizations that may employ different reference datasets.

The Blueprint Supplement [3] contains an indicative summary of public authorities, private sector, research and third sector organisations that currently provide datasets that correspond with the INSPIRE Annex themes. This is NOT intended as a definitive list, since the exact nature of dataset custodianship and the nature of the data changes frequently.

To ensure that the UK publishes datasets and services conformant to the INSPIRE Implementing Rules within the stated timescales, the UK Location programme will establish a framework to provide the national coordination of the publication of datasets that correspond with INSPIRE Annex themes.

National Coordination of Harmonised Datasets and Services

To ensure successful implementation of the UK Location Strategy and INSPIRE Directive, the Location Council has been established. The Location Council is comprised of a wide range of Government stakeholders that provide datasets that correspond to the INSPIRE Annex themes.

The Location Council will establish a process (outlined below) which takes advantage of the release of the INSPIRE specifications to establish a regime of better coordination, minimise duplication, drive out costs and improve data quality to at least a fitness for universal purpose level.

As each INSPIRE Data Specification Regulation is released, or an additional theme/set of spatial objects is proposed, the Location Council will follow the steps outlined in Figure 16.
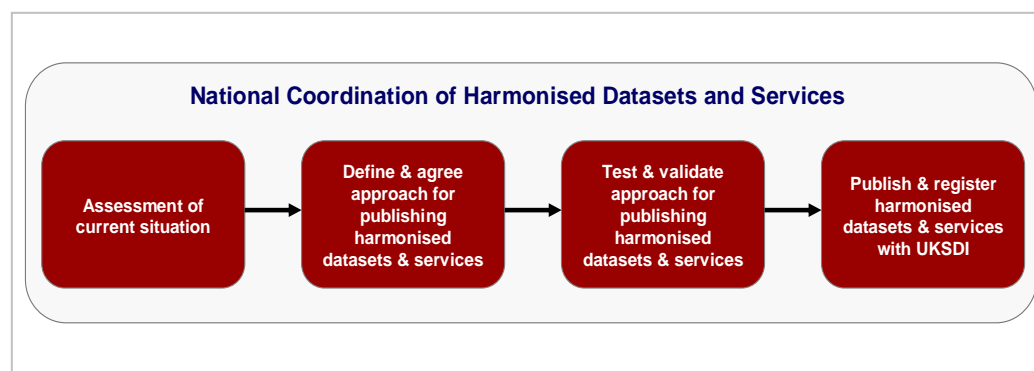
Figure 16: Summary of coordination of harmonised datasets and services

This process will operate at UK level, since several datasets are supplied at Great Britain or even UK level. However, the devolved administrations may wish to execute this process within their own domains, within the wider UK framework outlined in the Table above.

Crowd sourced data

The ability to collect data, at least the coordinates, is easier today that it has ever been and this will become more integrated in future. This has led to "crowd sourced" data, where citizens collect data using mobile devices. Collecting geometry is one thing, but the data management required to satisfy users needs, levels of attribution and update can be quite challenging.

However, crowd sourced data does have a role; ideally not to duplicate what we already have but to complement it. This could take one of two forms:

- Unique datasets, collected by communities but sufficiently well managed that 3rd parties can use and integrate them without effort, for example bird population surveys over a given weekend by RSPB volunteers; *and*

- Errors and notification of updates. These could be posted through the geoportal and routed to the data providers concerned.

Location and Classification of Objects and Ontologies

When providing any kind of reference object, most users need to know what the object is. "Everything happens somewhere" and the real power of location information is the ability to relate different (business) information to a common location, e.g., traffic accidents with road surface conditions,at a given location; health condition and the prevalence of pollutants,at a given location; to more simple referencing of maintenance logs with organisational assets. This only works if we have a clear view and ideally a single view of the location object. This is why the creation of core reference geographies is so important.

How do we know we are talking about the same thing? This has been a perennial problem and was raised in the PAT-18 Report on Social Exclusion in 2000 [15]. Only some datasets contain some form of classification system - the British Geological Survey, Ordnance Survey, Valuation Office and UK Hydrographic Office being some examples. Too many organisations have either primitive or no form of classification system. There are also cases where different systems have been adopted by several related organisations who then find they cannot easily exchange information. The INSPIRE specifications will introduce codelists that will provide a mechanism for different communities to talk the same language when referring to any spatial object (i.e. using a common ontology/taxonomy).

INSPIRE addresses this by supporting a bottom up process as well as a top down mechanism. Each INSPIRE data specification is supported by a feature catalogue (spatial object definitons). The FCD is a master list of all catalogues, but it also attempts to reconcile common object types within an overarching definition (e.g. building an overview of different definitions). The object types are supported by enumerations and codelists mentioned above to promote wide consistency.

By adopting a similar approach in the UK Location Programme, via the Registry and Resource Centre, it will be possible to extend the codelists in a managed way since any extensions are likely to require coordination with the European Commission at regular intervals.

Linked Data

Viewing datasets as a set of defined objects; leads us to the concept of 'linked data'. Here, the process of discovery is centred on the objects, rather than on the datasets in which they are embedded. All data about a given object can be discovered through a process of linked data. Linked data is based on the following principles:

- Use Unique Reference Identifiers (URIs) as names for things;

- Use HTTP URIs so that people can look up those names;

- When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL); *and*

- Include links to other URIs, so that they can discover more things.

Linked data is in its infancy, particularly in a geographic context. But the design and implementation of the UK Location Information Infrastructure will seek to incorporate the linked data approach; as the standards, technologies and approaches mature. The INSPIRE model is well aligned with the linked

data concepts, as is the DNF approach. It is likely to assist in the take up of "on-demand" usage of data as well as integrating spatial data much closer within the wider mainstream world of information. This will not happen overnight and will need to operate alongside the more established dataset centric approach, gradually providing the improved linking of associated data, though this needs to be designed in at the start,

Translation & Transformation Services

In the immediate future there are two forms of service required to support compliance and effective interoperability. Where there is repeated common requirement such services will be available as "stakeholder services" that data providers/publishers may call on to configure their data and so ensure compliance.

Transformation of Coordinates (Operations)

Several coordinate reference systems and grids, as well vertical reference systems are in everyday day use in the United Kingdom and data is best stored in the system closest to regular operational use to avoid unnecessary processing overheads. However, it will be necessary to transform some themes/sub themes to make it possible for people to use that data (e.g. coastal zone will require marine and land information – which are based on different systems). Likewise INSPIRE will require delivery in a pan European coordinate grid. Completion and implementation of the Vertical Offshore Reference Frame (VORF) will be important here,

Since it is likely that all data providers will need to transform their data it makes sense to establish a shared service to support this. A definitive register of UK systems will be maintained and made available as a registry service. This will be initially populated from the DNF Registry and restructured as required.

Schema Translation

Data providers will be wholly responsible in making their data compliant. This can be achieved in one of two ways (:

- a data conversion programme to adopt the new standard; this may be executed as a one off process or as a programme of upgrades in line with business benefits; *or*

- using a translator that receives the current model, maps the changes required and outputs the data in a compliant form. This may be a temporary solution or longer term, dependent on the local economic and technical environment.

There are short, medium and longer term advantages and disadvantages in each approach, but the key issues will be:

- whether the existing data is formally defined in a schema (if this is not the case – the second option is more challenging); *and*

- data processing overheads on publication which may adversely impact on display times.

It should be stressed that INSPIRE does not require the collection of new data to achieve compliance. Therefore there is no obligation to complete gaps in the source data as part of the output compliant dataset. The UK Location Programme may however oblige some aspects – such as the definition of features and feature catalogues.

A schema translation service would therefore be much more dataset-dependent than the coordinate transformation service would be. It may however be possible to establish a generic stakeholder service for some theme/objects. How this will work will only become clearer when the data specifications are finalised and the status of the source data is better understood.

The UK Location Information Infrastructure Registry

The UK Location Information Infrastructure Registry will document the essential parameters (master data) required to make the system work and promote re-use. All aspects of the infrastructure shall be predefined so that users can easily locate, access and use the resources they require to operate a service with minimum costs and maximum efficiency and effectiveness.

The UK Location Information Infrastructure Registry will include the components defined in Table 11 [Note the majority of these items will require close working with the European Commission and work was still ongoing in this area at the time of publication].

Items	Description	Purpose
Application Schema	A formal model of the data defining the INSPIRE Data Specifications and in turn the INSPIRE Generic Conceptual Model which incorporates ISO 191xx series standards	To provide a compliant starting point for any new datasets in future.
Coordinate Referencing Systems and Grids	The definitive coordinate reference systems adopted at the national level supporting land, marine and air communities and transformations between these systems.	To enable users compliance and facilitate transformation from one system to another as required.
Codelists	Master lists of object types and other elements e.g. national thematic identifiers etc that are commonly used across many communities.	A standard set of codes that provide users with a shared classification scheme or other kind of coding scheme
Feature Concept Dictionary (FCD	Master data register, establishing a set of feature-related concepts that may be used to describe geographic information.	Attempts to reconcile common object types within and overarching definition and will be inline with the INSPIRE FCD [IFCD].
Feature Catalogues	A catalogue of objects within a given dataset and a description of why they are included and how they are described. Incorporated in the Application Schema and Codelists above, but UK data providers may wish to provide more information about their data.	Provides users with information about the objects regarding their value in a proposed application.
Identifier namespace registration	In line the INSPIRE model local identifiers must be prefixed by "uk:<namespace>:"	Provides a mechanism to all existing and new identifiers to be globally unique. The mechanics for this were under review in mid 2009 with the European Commission. The connection to the linked data model also requires further resolution.
Portrayal	Any default or reusable stylesheets and symbology that can be used by any community for different applications, where	Provides a readymade visual/graphics styling to aid presentation that can be used freely and consistently across all

Items	Description	Purpose
	the default INSPIRE portrayal is considered inappropriate.	communities.
Units of Measure	The commonly used form of measure will be defined (distance, time etc)	To avoid ambiguity
Other	Other items that are of value to the wider community and support re-use can be added.	To enable flexibility

Table 11: UK Location Information Infrastructure Registry Components

Internally, the Registry will also hold information required for operations and data management purposes - Data owners, publishers, available services, metadata catalogues and a registry management system.

It is expected that the European Registry will be fed directly by the UK definitions from the UK Register. The UK Registry will hold more information than that required by Europe. The devolved administrations may also wish to establish registries. This will require:

- a single defined point of entry for the Registry items above, to avoid duplication and ensure uniqueness. For example an entry in Northern Ireland Register would need to verify no entry exists in the UK Register to complete a process; *and*

- synchronisation with other Registries - upstream from devolved administrations and those thematic groups responsible for defining certain features, e.g. International Hydrographic Office for marine features; and downstream with the EU registry and potentially laterally to share master data with other UK government systems.

Future users should be able to download schemas from the registry in a way that enables them to adopt and re-use data template specifications, that will help them conform in meeting INSPIRE and UK Location Information Infrastructure implementation needs and establish new datasets quickly and effectively. This has the potential too save several months work and ensure alignment with the published standards.

Gazetteer Services

In an electronic world a "gazetteer" assists the human in finding information about the location of geographic feature, in the same way as a gazetteer in an atlas provides a list of objects from which the user is able to immediately select a discrete item from many pages of detailed information.

Any geographic feature can be indexed in this way (rivers, woodland, buildings, properties, protected sites, streets, national parks and so on). The gazetteer would of course normally be derived from the information held about the object (e.g. via the river name, or thematic identifier such as a postcode). Addresses are a special case of a gazetteer. However, care is required regarding the object they represent (e.g. delivery point for mail, or taxable object).

As the level of electronic information grows it is likely that the demand for a comprehensive service will also grow where there is a human interface with the data. Such a service could significantly improve efficiency, not only in locating discrete objects but also where only that object is of interest (i.e. it avoids the 'bounding box' problem of accessing a lot of data which the user is not interested in).

However this wider gazetteer service remains immature. This is largely because the requirement, in the absence of many online datasets, has yet to surface fully. However there are two relevant developments:

- The INSPIRE Gazetteer service outlined in D2.5 the Generic Conceptual Model ; *and*

- Work within the OpenGeospatialConsortium on developing relevant standards;

In this case it is necessary that the UK Location Programme adopts a two stage approach.

Short-Medium Term

The short to medium term approach will be to use the established method that places the user in the correct location, where they can then manually locate the object of interest. Normally this uses: Placename, Postcode or Coordinate as user entry. It is quick and easy to adopt. Users may also use pan and zoom, but this does impose greater impact on data traffic and is therefore less efficient.

Medium-Longer Term

When the INSPIRE position and standards have been resolved and there is sufficient user demand (possibly theme or object type) a more comprehensive approach as outlined above will be considered. This will be taken forward in conjunction with the European Commission via the Drafting Teams, who will continue to monitor and seek a solution of this nature.

Metadata

Metadata means information describing spatial datasets and services making it possible to discover, inventory and use them (2007/2/EC Article 3(6)).

For the proper functioning of the UK Location Information Infrastructure , it is necessary for a user to be able to:

- discover the existence of datasets and services;

- establish whether the dataset may be used, for what purpose and determine any constraints that may apply;

- identify how to gain access to the dataset or service; *and*

- understand the dataset sufficiently to determine its fitness for purpose.

Data providers will need to create and publish two key types of metadata (at the dataset level):

- **Discovery Metadata:** providing a high level description of the resource that enables it to be found and inventoried; *and*

- **Exchange Metadata:** providing a more detailed description of the resource to ensure it is sufficiently understandable to enable use.

Discovery Metadata

Discovery metadata is published into a discovery catalogue which can be accessed by discovery clients to enable users to find, evaluate and gain access to the dataset or service.

All dataset and service providers should create discovery metadata for spatial datasets and services published within the UK Location Information Infrastructure and ensure that they are kept up to date.

To ensure that metadata is compatible and can be usable within the UK Location Information Infrastructure and INSPIRE, a common discovery metadata profile will be developed - UK GEMINI 2.

All discovery metadata published within the UK Location Information Infrastructure will conform to the UK GEMINI 2 metadata profile.

UK GEMINI 2 will define a minimum common set of metadata (information) elements necessary to support discovery, evaluation and access to spatial datasets and services.

UK GEMINI 2 is conformant with Commission Regulation (EC) No 1205/2008 - implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata.

Additional metadata elements for discovery, evaluation, access and use will be defined within the INSPIRE Data Specification Implementing Rule and supporting implementation technical guidelines. Where common metadata elements are identified across several INSPIRE Annex themes, these elements should be incorporated into UK GEMINI 2, where appropriate.

Data providers can add an extension toUK GEMINI 2, where additional elements are required to describe their datasets and services more comprehensively, to enable better discovery and evaluation. These additional elements should be derived from existing international standards or community specifications.

Exchange Metadata

Exchange (or evaluation) metadata is the metadata required to be disseminated/transferred with the encoded data that describes the dataset sufficiently to ensure that it is understandable.

All datasets published within the UK Location Information Infrastructure should be transferred with accompanying exchange metadata.

Discovery metadata may be derived from these more comprehensive exchange metadata records.

Datasets that correspond with 2007/2/EC Annex themes shall be disseminated with metadata that complies with the Commission Regulation (EC) No 1205/2008 metadata elements and additional metadata elements expressed for the relevant theme within the INSPIRE Data Specification Implementing Rule and supporting implementation technical guidelines.

The encoding of exchange metadata for datasets that correspond with the 2007/2/EC Annex themes should adopt the rules defined in the INSPIRE Data Specifications Guidelines for the Encoding of Spatial Data:

- for the download of a complete spatial dataset, the dataset should include the exchange metadata to enable evaluation and use;

- for the download of a user-selected part of a spatial data set (download of spatial objects based on queries), the response of the download service should not include the exchange metadata, but should provide a reference to the dataset or dataset series metadata in a discovery or registry service.

Datasets that do not correspond with 2007/2/EC Annex themes should be disseminated with exchange metadata that complies with UK GEMINI 2, extended to include additional metadata

elements required to sufficiently describe the dataset. Additional metadata elements should be derived from existing international standards or community specifications.

The UK Location Programme shall not define the additional metadata elements that are required for use, due to the wide variation in the metadata elements required to describe different types of spatial data. This makes it difficult to create a single comprehensive metadata profile for use for all spatial data. These shall be defined by data providers.

Rules for the encoding of exchange metadata for all spatial datasets shall be defined by the UK Location Information Infrastructure Location Council Interoperability Board.

Metadata Publication and Tools

UK Location Information Infrastructure shall provide access to tools to enable data providers to create and publish discovery metadata.

Commercial software vendors may also develop tools to create and publish discovery metadata compliant with UK GEMINI 2.

Data providers will be able to publish metadata into the UK Location Information Infrastructure in two ways:

* Upload discovery metadata records into a central discovery catalogue via the UK Geoportal;

* Publish metadata discovery (and exchange) records into a local discovery service, which is then registered with the central discovery broker service via the UK Geoportal for subsequent harvesting.

Conformance/Timescales

All data providers publishing datasets and services into UK Location Information Infrastructure shall create and publish discovery metadata that conforms to UK GEMINI 2.

For datasets and services that correspond to the 2007/2/EC Annex themes, data providers shall publish discovery metadata into the UK Location Information Infrastructure in accordance with Table 12.

2007/2/EC Annex Theme	Requirement
Annex I and II	Not later than 24th December 2010
Annex III	Not later than 24th December 2013

Table 12: Comformance Timescales

For all other datasets and services, no timescales shall exist. However, data providers should publish conformant metadata into the UK Location Information Infrastructure whenever they make their data available to users via download services.

Governance and Assurance

The UK Location Information Infrastructure Coordination Unit will take the necessary measures to ensure that metadata created for datasets corresponding the 2007/2/EC Annex themes are complete and of a quality sufficient to fulfil the purpose set out in Article 3(6) of 2007/2/EC.

Data Quality

The UK Location Information Infrastructure is about improving the interoperability of location information, for data sharing and re-use. Data may be interoperable both technically and in business terms, but a further factor influencing its usefulness is the quality of the data itself, e.g. digitisation quality, accuracy, currency, etc.

The influence of the infrastructure on data quality will be an indirect one. The act of publishing, sharing and re-using data can only have a positive impact on data quality. A third party user of data will be able to provide data providers with valuable information about their data. The infrastructure will provide feedback mechanisms in the form of UK Geoportal W2.0 functionality to facilitate this process, but it will be down to the data provider to make use of the feedback provided.

If functioning effectively, the sharing and re-use of data within the environment created will result in the continuous improvement of data quality (and interoperability), which in turn will lead to greater sharing and re-use and the creation of a virtuous circle.

INSPIRE will require some mandatory metadata in some cases (e.g. logical consistency in networks) but it is the responsibility of data providers to ensure that their data is not only immediately fit for purpose, but it remains *immediately fit for purpose when it is combined with data from several other organisations.*

5.4.6 Data Sharing Architecture

The interoperability barriers to the sharing and re-use of location information are not just technical. There are also a number of business interoperability issues that need to be addressed within the UK Location Information Infrastructure design, principally related to rights management, security, charging and change management. This is the focus of this design domain.

Rights Management Architecture View

The UK Location Information Infrastructure Rights Management Architecture will support the operational change for licensing as identified by the UK Location Strategy [1]. Specifically, it will help to facilitate the change from "Inconsistencies in the licensing models…." to a significant increase in the use of geographic information through review and simplification of licensing of core location based datasets.

The purpose of the Rights Management Architecture will be to offer an operational framework that enables geographic data and services to be licensed. The framework will be flexible and will enable providers to license data and services under specific licensing models.

The architecture will help facilitate a coherent approach to Rights Management, licensing and revenue generation from public data assets by focusing upon the design drivers outlined below in Table 13.

Topic	Design Driver	Expected Outcome
Ease of Use	Enable data users to understand what rights they have been granted in as efficient and automated a way as possible. Keep it simple and understandable.	Greater use of data – by simplifying and unifying rights management.
Ease of Implementation	Enable data users to readily combine data from multiple sources	Improved value extracted from the data – by enabling more applications that combine data in different ways.
Licensing Models	Support multiple licensing models which allow data providers to license content under specific terms where necessary.	Enable providers to share data under specific licensing models – but encourage the evolution to a common licence model.
Licence Creation and Enforcement	Support the process of creating and enforcing licences. Enable licences to be created on behalf of owners where the authority has been delegated.	Move towards electronic licensing of data and where possible, automating the creation and enforcement of licensing terms
Culture	We must facilitate what we are trying to achieve 'what' and 'how to'	Develop a culture of sharing digital content - by encouraging the licensing of data under more harmonised terms.
Education	We must provide education on rights management to our community	Wider understanding of licensing from both data provider and user perspective.
Maintaining Privacy	Ensure that privacy is maintained by providing access in line with data protection obligations	Enables compliance with Legislative Framework – see Section 4.2.5

Topic	Design Driver	Expected Outcome
Standards and Technology	We must have a common infrastructure that will support multiple players with different roles and responsibilities.	Make use of existing standards to facilitate the interoperability with other spatial data infrastructures – for example the INSPIRE

Table 13: Design Drivers for Rights Management

Rights Management encompasses both access and usage control of data. Many data providers currently control access to data by user authentication and authorisation and then control usage of data through legal instruments. The Rights Management Architecture will be designed to enable providers to continue to manage and protect their Intellectual Property Rights (IPR) through these existing mechanisms under specific licensing terms, while encouraging and supporting a simplified, harmonised and automated way of managing those rights.

The Rights Management Architecture will, by necessity, use an evolutionary approach to Rights Management which incorporates and supports, where feasible, elements of existing licensing frameworks and the joint further development of these frameworks to meet the requirements of the UK Location Strategy.

Current licensing models and initiatives that will be supported by the Rights Management Architecture include:

- the Office of Public Sector Information's (OPSI) Click-Use licensing framework (including Information Fair Trader Scheme accreditation);

- INSPIRE implementing rules for governing access and rights of use of spatial data sets and services [18]; *and*

- the Atlantis Initiative's Pricing & Licensing Task Force's work developing standardised Public Body Licensing Principles; *and*

The Rights Management Architecture will build on key aspects of the above licensing models and initiatives in order to work towards the harmonised sharing of data among public sector bodies (and preferably all data providers).

The Rights Management Architecture will seek to address derivative or residual rights in products produced from original source data.

Where necessary, data providers may continue to use a licensing model based on their specific terms of access and use.

A streamlined licence framework will be designed to protect copyright and/or database rights, but to facilitate re-use under the Re-use of Public Sector Information Regulations. The licencing model wil utilise existing licence models developed by OPSI. The approach to licensing will be underpinned by principles set out in the Information Fair Trader Scheme (IFTS). These are:

- 'Core' (or 'non-special') public sector information will be free to access and re-use (marginal costs may be charged, i.e. where there is a cost to supply the information or convert it from one format to another) under a default, non-transactional and un-editable licence;

- 'Value-added' (special) public sector information will be licensed under flexible arrangements (a default licence is available) in order to incorporate the continuing diverse range of business models established across government.

  Public sector data providers that require a delegated authority to trade shall be obligated (other data providers will be encouraged through demonstrable benefit) to pass each dataset that they wish licensed as 'Value-added' through stringent tests. These tests will be based upon updated IFTS principles:

  - **Maximisation:** an obligation to allow others to re-use information. The default position should be that information can be re-used unless there are strong reasons (for example personal information) not to allow re-use;

  - **Simplicity:** simple processes, policies and licences;

  - **Innovation:** public sector information holders actively remove obstacles to re-use, and facilitate the development of new and innovative forms of re-use;

  - **Transparency:** of the terms of re-use, including licence terms, where used. There should also be transparency about charges and the details of what information is available for re-use;

  - **Fairness:** all re-users must be treated in a non-discriminatory way for the same type of re-use. Public sector information holders should not use their market power to compete unfairly by virtue of having produced the information; *and*

  - **Challenge:** a robust complaints process in place to reconsider licensing decisions, with appropriate references to OPSI, that will investigate any complaints that the public sector information holder cannot resolve to the customer's satisfaction.

The Standards Division of OPSI provides oversight and governance of the information trading activities of government trading funds. The key elements of the IFTS verification process are:

- Governance and culture;

- Risk Management;

- Access, Data Sharing and Re-use policies;

- Licensing;

- Pricing;

- Customer experience and feedback; *and*

- Complaints.

The key purpose of the harmonised licensing model is to maximise access to, and re-use of, public sector information through simplification of the licensing terms. As such it will be based on OPSI's

licensing framework, make use of the ITFS as a core component to drive the harmonisation of principles, with extensions to handle those aspects that are specific to location information.

The harmonised licensing model will further develop location information specific standardisation by building upon the work undertaken by the Atlantis Initiative, specifically with regards to:

- Common licensing principles/definitions for 'Copy Derived' and 'Non-Copy Derived' location information;

- Common licensing principles for future use of Copy and Non-Copy Derived location information; *and*

- Standardised user number bands for location information.

The Rights Management Architecture will comply with the technical guidance in the INSPIRE Network Services Architecture [8]. Member state organisations are encouraged to follow the Geospatial Digital Rights Management Reference Model (GeoDRM RM) [9] standard for the implementation of a rights management capability.

Data providers have the option of implementing rights managed services. If they choose to implement a rights managed service, they will be required to follow the technical guidance provided by INSPIRE; and in addition will be required to license that service through a registered licensing model. A licence model register will be centrally managed by the UK Location Information Infrastructure.

Data providers will be encouraged to license their data based on the harmonised licensing model where feasible. In those cases where this is not feasible, data providers will be required to register a specific licensing model which makes reference to specific licensing terms and license data based on those specific licensing terms.

Many data providers control access to services by enforcing a security policy at the point of access. The Rights Management Architecture will allow these existing mechanisms to continue operation uninterrupted, whilst encouraging data providers to make use of the harmonised licensing model to enable wider data sharing within the UK Location Information Infrastructure . The UK Location Information Infrastructure will maintain a central registry where the harmonised licensing model and other licensing models may be registered.

License models shall be based on licencing terms which shall be expressed in the following ways:

- **Simple Expression**: A simple expression of the licensing term which may be easily understood by data users expressed in terms which are simple and understandable;

- **Legal Expression**: The same licensing terms expressed in such a way that it is legally binding and enforceable by law; *and*

- **Technical Expression**: Where practical, the same licensing term expressed using a technical encoding format.

Licences shall be created based on the terms as expressed in the licensing model, together with any additional constraints as agreed during licence negotiation. Licences may be created as a result of a manual or automated business process. Data providers may delegate authority for licence creation to an intermediary. Data users shall access data and services under the terms granted by the licence.

Licences may comprise licensing terms which are enforced by the legal framework and licensing terms which are enforced by the technical framework. Where feasible, the harmonised licensing model will be defined to enable licensing terms to be enforceable by both legal and technical measures. The Rights Management Architecture will implement the technical measures for the enforcement of the licensing terms as specified by the harmonised licensing model.

Should data providers choose to make use of a specific licensing model they will be responsible for the enforcement of those licensing terms. Specifically, the UK Location Information Infrastructure Rights Management Architecture will not implement technical measures for the enforcement of licensing terms for specific licensing models.

Security

INSPIRE includes provision for the inclusion of specific security measures by data providers for data users to follow. These details must be included in a schedule to the licence. The options for security are limited to the following:

Level 1: Only for use by staff of the user;

Level 2: Only for use by authorised staff of the user;

Level 3: Only for use by authorised staff of the user in a closed network;

Level 4: Only for use by authorised staff of the User on standalone computers;

Other Level of security. The schedule will include details of the security required.

The specification of such conditions is associated with either the enforcement of rights, or the sensitivity of the published material.

The UK Location Information Infrastructure will include user identification, authentication and authorisation to support user access to published information, where such conditions apply, inc. the implementation of technical limitations on view services, or to prevent unauthorised re-use.

Protectively Marked Material

The specification of security conditions relating to the sensitivity of the material by public sector bodies must correspond to the data provider's overarching information security policy and Protective Marking System, under the HMG Security Policy Framework (SPF).

Under the Protective Marking System, material is classed as either Top Secret, Secret, Confidential, Restricted or Protect, assessed against a set of defined criteria. Unmarked material is considered 'unclassified'. The term "Unclassified or "Non" or "Not Protectively Marked" may be used to indicate positively that a protective marking is not needed.

The INSPIRE Directive makes provision for protectively marked material to be withheld from publication.

Given that the UK Location Information Infrastructure is based on the use of the public Internet, it will only provide a limited capability for the handling of Protectively Marked data. Primary responsibility for any security provision will rest with the data provider and as a minimum, the required security will need to form part of their published web services.

Where a secure Location Information Infrastructure is established for the sharing of protectively marked location information, the UK Location Programme will seek to ensure that this adopts the same interoperability standards for both data and services, to ensure that data providers can publish protectively marked and non-protectively marked information under a common set of standards; and that the two can be easily combined within a secure application environment.

eCommerce

A public body or private sector data provider may impose a charge for providing the data, subject to the conditions of the EC INSPIRE Directive and those defined by the Office of Public Sector Information (OPSI). Where there is a charge, this will need to be described in a separate schedule to the licence. In this instance, the standard licensing model/s for UK Location Information Infrastructure (inc. the INSPIRE Licence) will not be used, as they will only relate to free of charge use.

Any automated charging mechanism must be incorporated into the web service provided by the data provider. The development of a eCommerce brokerage service that can handle the payments of subscribed data providers will be investigated as an extension to the UK Location Information Infrastructure , once such a need (if it exists) is better understood.

Change Management

The publishing of location information for sharing and re-use places a major responsibility on the data provider relating to change management. The lifecycle of the data needs to be well defined and controlled; and transparent to data users; so that all uses of the data can incorporate this lifecycle into their own data management plans and practices.

The UK Location Information Infrastructure will specify best practices for data change management (including any associated services) within the operational frameworks to be developed as part of the infrastructure.

Before publishing, it will be the responsibility of the data provider, or their publishing agent, to ensure adequate change management measures are in place.

5.5 System Architecture View

Design Principles

The general principles for the IT System Architecture for the UK Location Information Infrastructure will be:

1. The central services provided by the UK Location Information Infrastructure will not include the hosting of location information;

2. All data services, i.e. the ability to discover[9], view, download and invoke the use of location information will be provided by the data providers or their publishing agents;

3. The IT System Architecture will be based on four inter-related sets of technical standards:

   - The INSPIRE Directive and Implementing Rules, which define the Web Services Architecture to be deployed in the form of a number of 'network' (or infrastructure) services;

   - OGC standards for spatial data specification, either as specified within the INSPIRE Implementing Rules, or where required to extend these into the member State context, for example in the application of Digital Rights Management (DRM);

   - SOAP[10] is promoted currently by INSPIRE (but is not mandated) for web service standards withinthe underlying technical architecture but there has always been a case for RESTful services as well;

   - E-GIF[11] standards for non-GI specific facilities, such as data interchange policies, web service standards and access policies.

4. A central set of application and technical services will be developed to support the set of core (centrally delivered) business services as defined in the UK Location Information Infrastructure Business Model. The overall technical framework will however be designed for the distributed delivery of the greater part of the UK Location Information Infrastructure , through services provided by data providers or their publishing agents;

5. UK Location Information Infrastructure will only provide the applications and services required to meet the requirements of the INSPIRE Directive; and its own operating model. Thematic, application specific, or other value-added services will not be provided. For example, the UK Location Information Infrastructure will provide a direct dataset search and evaluation service, but it will not provide direct download services.

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[9] Metadata services, i.e. catalogue and the ability to discover location information will be partly hosted centrally.

[10] SOAP: See INSPIRE paper on this topic on the INSPIRE website. It is possible that any "linked data" development would follow a RESTful path – therefore careful design is required in this topic area.

[11] e-GIF is currently being rewritten and most likely rebranded. It is expected that it will acknowledge this Blueprint and the INSPIRE Directive as the basis for UK spatial information.

System Architecture Model

The UK Location Information Infrastructure will be based on a Web Services Architecture; using the public Internet as a distributed web services platform for the discovery, evaluation and utilisation of location information. The conceptual IT System Architecture model view for UK Location Information Infrastructure is shown in Figure 17:
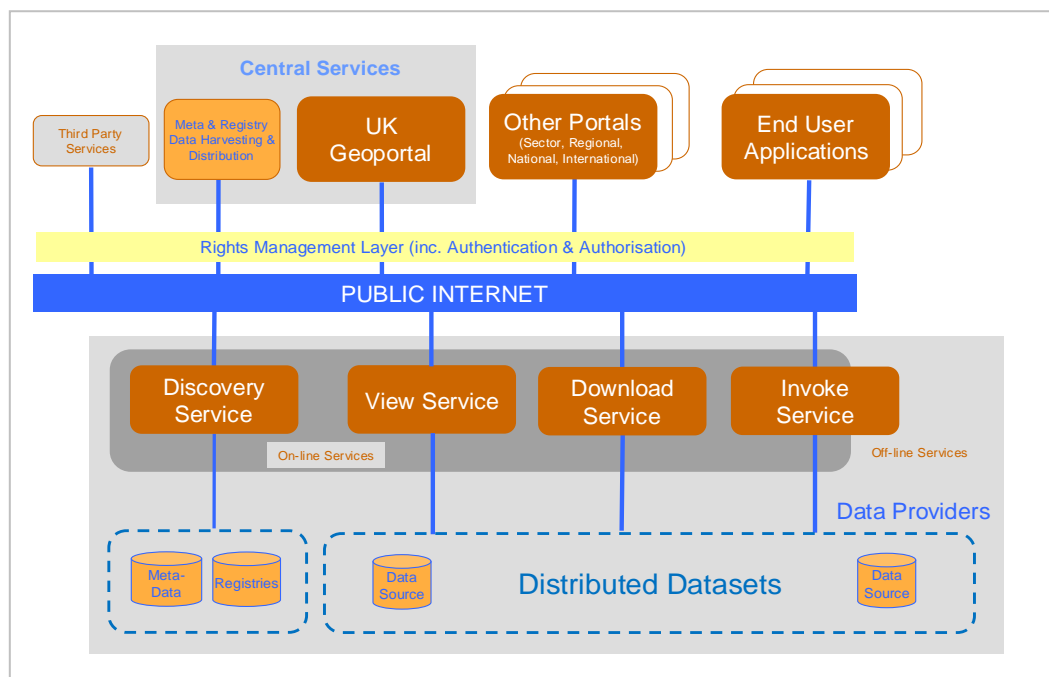

Figure 17: UK Location Information Infrastructure System Architecture Model

Central Services Application Architecture

The UK Location Information Infrastructure will be based around a number of core services, or functions, accessed via a UK Geoportal.

The application architecture for these core services is shown in Figure 18. This shows the functional components of each tier of the application architecture, classified according to the core services identified in the UK Location Information Infrastructure Service Delivery Model (ref. sec. 5.2.3).
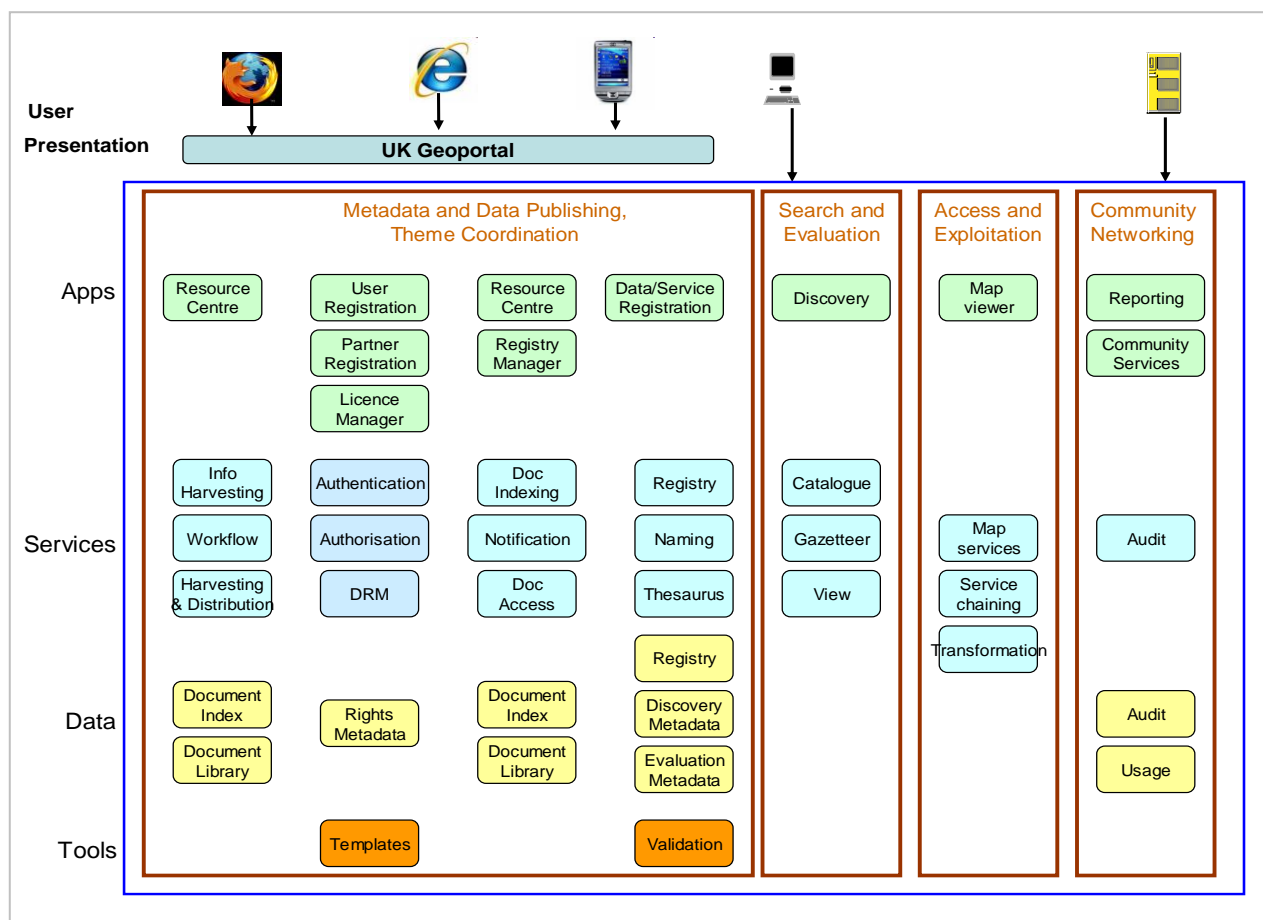
Figure 18: UK Location Information Infrastructure Central Services Application Architecture View

This architecture supports 5 application tiers:

1. **Presentation.** The UK Geoportal will provide a single presentation layer for the UK Location Information Infrastructure . The intent is that the UK Geoportal becomes the first point of contact for UK Location Information Infrastructure related matters, such as general information provision, registration, governance and core discovery services, but that thematic and partner portals provide the added value and theme oriented extensions to the UK Location Information Infrastructure , i.e. the UK Geoportal will be but one of many access points for discovering and using UK location information.

2. **Applications.** This tier includes all applications required to support the business operating model. These may be specific UK Location Information Infrastructure applications, i.e. COTS or custom developed applications designed to meet a specific need of the UK Location Information Infrastructure , or they may be domain specific thematic applications compiled from the underlying UK Location Information Infrastructure services.

3. **Services.** This tier includes all of the underlying IT services the UK Location Information Infrastructure needs to provide, both for its own internal operation, and to meet the broader objectives of the UK Location Information Infrastructure .

4. **Data** (i.e. master data). The UK Location Information Infrastructure will hold central data and service catalogues. Some source material for the UK registry is likely to be distributed

between the main reference data providers, but will be centrally maintained within the UK Location Information Infrastructure .

5. **Tools.** This tier includes all online and offline tools provided by the UK Location Information Infrastructure to support the publication of data and services; and the effective operation of the UK Location Information Infrastructure. Examples of tools include online and offline metadata editing and validation tools, spatial validation tools and feature class creation templates. These tools may be created or commissioned centrally; of provided commercially by third parties.

UK Geoportal

The conceptual design for the UK Geoportal has been developed through the creation of a number of initial personas and user journeys [16]; supported by a survey of key stakeholders [17]; and drawing on existing best practice elsewhere.

This has resulted in the production of a number of design mock-ups that illustrate the intended functionality, and the look and feel of the UK Geoportal [16]. Figure 19 shows the mock-up screens for data user landing page, data search and returned results.

The key features of the UK Geoportal will be:

- Data Provider:
    - Registration services;
    - Discovery Metadata publishing;
    - Registry services;
    - Resource centre (business and technical support; and tools) *and*
    - W2.0 type on-line community networking services (forums, newsfeeds, listings etc).
- Data User:
    - Registration services;
    - Search and Evaluation services (discover and view);
    - Download and Invoke services (through peer-to-peer routing);
    - Thematic pages;
    - Resource centre; *and*
    - W2.0 type on-line community networking services (forums, ratings, feedback, newsfeeds, listings etc)

Figure 19: UK Geoportal Mockups
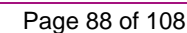
Technical Services

The UK Location Information Infrastructure will provide some or all of the technical services listed in Table 14, dependent on the evolving UK Location Information Infrastructure and INSPIRE specifications, available funding and agreed business need.

Service	Is provided for	In order to support (applications)	Implementation
Naming Service	UK Location Information Infrastructure service naming	Registration and identification of services offered by UK Location Information Infrastructure	RM-OA Infrastructure service
Registry service	Creating and maintaining registry entries	Registry maintenance application	
Thesaurus access service	Metadata and registry data creation and maintenance	Catalogue service; data and service preparation and validation tools	RM-OA Support service
Authentication service	User authentication	All user interactive applications	WS-Federation WS-Trust RM-OA Infrastructure service
Authorisation service	User Authorisation	All user interactive applications	WS-Security WS-Authorisation RM-OA Infrastructure service
Workflow service	Registration and publishing workflow support	Approval and governance processes	
Document indexing service	Creating search indexes of documentation published by UK Location Information Infrastructure	Find Information application	RM-OA Support service.
Notification	Workflow and subscription support	Approval and governance processes	Email and/or RSS
Document access service	Document retrieval	Resource centre	RM-OA Infrastructure service
Information Harvesting & Distribution service	Gathering information links etc on relevant document and data. Distributing this to others.	Resource centre Monitoring Reporting	
Audit service	Reporting and governance	Reporting Assurance and governance	
Catalogue service	Catalogue creation and maintenance	Discovery Metadata Harvester	RM-OA Infrastructure service OGC CS-W
Gazetteer service	Location search	Discovery	RM-OA Support service;

Service	Is provided for	In order to support (applications)	Implementation
		Map viewer	
View service	Data and service metadata viewing and evaluation	Discovery Map viewer	OGC WMS and application profile
Map service	General purpose map viewing	Map viewer application	OGC WMS and application profile Map only variant of RM-OA map and diagram service
Service chaining service	Linking services to create internal applications	All applications requiring multiple service input	RM-OA Support service; not for external use
User management service	Creating users and groups	Authentication, authorisation services, register user, register data	RM-OA Infrastructure service.
Coordinate transform service	Coordinate transformation	Map viewer External consumption	RM-OA Support service

Table 14: UK Location Information Infrastructure Technical Services –

As with the data specifications and the Registry, close collaboration will be required on all these topic items to ensure that the UK infrastructure and network remains fully interoperable with all others.

Data Storage

The central data storage for the UK Location Information Infrastructure will be limited to the support of a centralised data and service catalogue, business operations-related data (for example audit and management reporting data), and all or part of the registry (Table 15).

Data Store	Holds	To support
Document index	An index to all documentation accessible via the UK Location Information Infrastructure Resource centre., whether locally published, or simply referenced by the UK Location Information Infrastructure	Standards and policies Learning network
Document library	All documentation published by the UK Location Information Infrastructure itself	Standards and policies Learning network
Registry	All or some of the master data which constitutes the UK Location Information Infrastructure registry	Operational Frameworks Publishing
Discovery metadata	All metadata required to support discovery of data and services	Publishing Search and evaluation
Evaluation metadata	All metadata required to support the evaluation of data and services for use by users and applications	Publishing Search and evaluation
Audit	All management data required to support the effective operation and governance of the UK Location Information Infrastructure	Assurance Governance
Usage	All management data required to support reporting	Monitoring

Data Store	Holds	To support
	requirements for EU, UK Location Information Infrastructure management and service agents	

Table 15: UK Location Information Infrastructure Data Storage Requirements

Shared Application Components and Services

The UK Geoportal and its core services will exist alongside sector/thematic, EC, national and regionally based portals. The application architecture will be based on the joint development of functional components to maximise re-use and create an overall UK Location Information Infrastructure that has a common look and feel.

Discussions will take place with key partners against a list of required IT components and services to determine the current status, availability and suitability of packaged-based solutions, developed in-house or commercially, that could be utilised within the UK Location Information Infrastructure. Particular preference will be given to open source products and services.

Within this common architectural approach, it is anticipated that the various portals will provide replicated or and/or complementary applications and services.

5.5.1 Technical Architecture View

Design Principles

The UK Location Information Infrastructure will be based on open standards and a Service Orientated Architecture (SOA).

The UK Location Information Infrastructure will be implemented as a technical framework, and not as a single system, except in so far as it needs to provide the core functionality required for effective support of the business model.

The UK Location Information Infrastructure will be designed to be technology agnostic where possible. Support for the agreed standards will be the defining criteria for inclusion in the technical architecture. For example, spatial data may be stored in any format provided it can be accessed by UK Location Information Infrastructure network services, and transformed where appropriate for access purposes.

The UK Location Information Infrastructure will be designed to be extensible and flexible, so that functionality can be added and removed as the Location Information Infrastructure community and partner service providers evolve. The central UK Location Information Infrastructure service will only support the minimum functionality required for the effective operation of the Location Information Infrastructure; and the achievement of its business goals.

Open standards based technologies will be deployed where possible. Data providers or their agents will be required to conform to agreed interoperability standards for all services delivered into the UK Location Information Infrastructure.

It is anticipated that application profiles will be adopted where they exist (for example from Drafting Team specification), or will be agreed during the detailed design phase of the UK Location Information Infrastructure implementation.

The overall intention will be to allow data providers or their publishing agents some level of flexibility in implementing their own systems, consistent with maintaining effective interoperability. For example, we would expect to implement a metadata harvesting service which could interact with an agreed range of metadata stores and profiles, rather than constraining data providers to a single profile. On the other hand, for true interoperability it will be important that data providers agree to use specific profiles, where necessary.

Where data providers or their publishing agents offer services which form a core part of the UK Location Information Infrastructure , e.g. distributed registry services, these will be subject to the same service levels as those defined for the UK Location Information Infrastructure as a whole.

Registry Services

The UK Location Information Infrastructure registry is a 'master data' repository designed to support all data and processes provided by the UK Location Information Infrastructure. The contents of the Registry are described in sec. 5.4.5.

The UK Location Information Infrastructure technical architecture will be based on a distributed registry, with relevant master data components being maintained and hosted by the data owners or other responsible parties. To enable early implementation, in the short to medium term the registry may be managed through a simple file system (similar to the current DNF approach – which will be migrated to the UK Registry).

Discovery and View Services

There are a number of options for the way distributed discovery and view services may be implemented. Data providers may offer INSPIRE-compliant view services directly, or may offer non-compliant services requiring transformation for INSPIRE compliance.

The UK Location Information Infrastructure will encourage the development of compliant view services, but will provide a capability to bridge between non-compliant and compliant services, as recommended in the INSPIRE Network Services Technical Architecture [8].

Download and Invoke Services

UK Location Information Infrastructure Download Services will be based upon the INSPIRE specification for Download services, and will implement at least the minimum INSPIRE specifications. These are based on 2 principles:

1. The extent of the spatial data available for download may be predefined, or user selected. The full extent of a spatial dataset may be 'predefined', and/or parts of it may be. For user selected extents, the download service must provide a query capability. INSPIRE defines query based download as a direct access download service.

2. INSPIRE mandates provision of a predefined data download services, but direct access services only 'where practicable'. The service metadata is required to state what level of service is available. The implementing rule for download services states no criteria for when direct access is practicable.

The current draft INSPIRE Implementing rule for download services makes no reference or recommendation as to the standards and technologies to be deployed to support download services, although the draft technical guidance recommends WFS services for direct access, and simple HTTP for predefined spatial data download. UK Location Information Infrastructure will support a number of patterns for spatial data download, these may include:

- Direct access by means of an OGC Web Feature and/or Coverage Services. These would typically be accessed via a discovery/evaluation map viewer providing query facilities to support both spatial and attribute based filtering of the spatial data;

- Online, browser based (standard HTTP) file download, for full or partial predefined spatial data. This pattern is suitable for smaller pre-defined datasets;

- Online File Transfer Protocol (FTP) download, for full or partial predefined spatial data. This pattern supports the download of larger volumes of data than is practical using an online browser based service;

- Offline fulfillment. In this case the UK Location Information Infrastructure could provide an ordering process designed to place an order with a service agent able to fulfill it for example by the creation and dispatch of physical media. Offline fulfilment could be a delivery channel for both predefined and direct access spatial data downloads. In the latter case, the 'order' for the data would include the extent required; *and*

- Hybrid. Publishing agents may wish to offer hybrid download services wherein the extent of the data is determined as part of a view service transaction (a form of direct access, but not as defined in the INSPIRE rules), and the data is then offered via a file download or offline fulfillment service.

Primary responsibility for download will rest with the publishing agent hosting the spatial data to be downloaded, or in the case of offline fulfilment, with those publishing agents able to offer this service to other publishing agents.

Publishing agents will be required to offer at least a download service for predefined datasets, and encouraged to provide direct access download services.

Where data download results in a licensing or DRM obligation, the download service will be required to ensure compliance with these obligations.

Linking to UK Location Information Infrastructure download services (the Invoke Service) capability will be implemented by uploading into the UK Location Information Infrastructure metadata cache the relevant service metadata for each download service offered.

Transformation Services

The purpose of Transformation Services, in the INSPIRE context, is to promote and support interoperability. Their role is to help other services operate in conformance with the Implementing rules; and they perform the same function in the UK Location Information Infrastructure.

In this sense transformation services are seen as complementary to other services, and invocation of them is typically envisaged as part of a wider location information access process. For example, a download service might include a format transformation service in order to deliver a spatial dataset in the required format, and a view service might (will, if deployed as an OGC based and INSPIRE compliant WMS) include a coordinate transformation service in order to present a spatial dataset in a map viewer application in the correct coordinates for the then current content of the viewer.

INSPIRE defines 4 general classes of transformation service:

1. Schema transformation;
2. Language translation;
3. Format transformation; *and*
4. Geometric transformation.

The 'close coupled' pattern describe in paragraph 0 particularly suits the implementation of format and geometric transformation services, linked to online view and download services. For schema and language translation, a separate batch or offline based service may be more appropriate.

The UK Location Information Infrastructure provided map viewer tools will include coordinate transformation as a minimum capability. UK Location Information Infrastructure may provide other transformation services, in particular to support spatial data harmonisation initiatives, but the general principle for the UK Location Information Infrastructure will be that transformation services are published by the data providers or their publishing agents, either closely coupled to core discovery and view services, or for wider consumption by other publishers and application providers.

The UK Location Information Infrastructure will maintain a services catalogue enabling discovery of transformation services, and invocation or linking by means of the appropriate invocation metadata included in the service metadata.

Workflow (Service Chain) Services

The distributed, peer to peer, architecture of both INSPIRE and the UK Location Information Infrastructure leads to a requirement for services to be invoked or chained independently of the data upon which the services will work. INSPIRE specifications include the concept of service invocation, although this is not yet developed beyond the basic identification of the need.

In this context, service invocation means calling a service to perform some form of transformation or other manipulation on one or more spatial datasets. An example of service invocation is the conversion of a spatial dataset from one format to another before, during or after a file download operation. The service to transform the data could be invoked:

- before the data is downloaded. The hosting service agent may offer a transformation service that creates a download file in the required format. The user would then use a file download service to copy the file;

- as part of the download service, if that includes a transformation capability. If built upon a typical COTS extract/transform/load (ETL) tool, it is likely that this would provide the necessary capability with little or no custom development required. In this scenario, the user requests the transform as part of the download service; *or*

- following download, at which time the requester might perform the transformation himself, or could call a published ETL service to carry out the task. In this scenario the user downloads the data as a predefined dataset, and uses local resources to then transform it as required, or calls an independent published transformation service.

The UK Location Information Infrastructure should be able to support all of these patterns. It will at least publish appropriate metadata for such services, and may offer them itself.

Service chaining means linking a series of services to accomplish a more complex outcome than might be accomplished by a single service. An example of service chaining might be:

- view the data in a different coordinate reference system from that in which it is stored;

- select part of the data for download, and then download it into a different data format from that in which it is published; *and finally*

- transform the data schema into an INSPIRE compliant one for combination with other data similarly transformed.

For most discovery and use operations such as this there is little need for complex service chaining. Each of the operations described here can be carried out as discrete steps in a largely user driven workflow. More complex service chaining may be required to support advanced applications These requirements are in their infancy and further development of the UK Location Information Infrastructure design for service chaining will be required as the concept becomes better understood, real world business examples emerge and the INSPIRE implementing rules and technical guidance evolve.

Security Model

The UK Location Information Infrastructure security model will be based on the following architectural principles:

1. The overall security architecture will be based on and will implement the WS-Security family of web service standards, as shown in Figure 20. Some of these standards, in particular the top level ones (WS-Secure conversation, WS-Federation, WS-Authorisation) may not yet be fully developed, but shall be used as the basis for the security architecture for the UK Location Information Infrastructure .

2. Any future Digital Rights Management (DRM) architecture shall be separate from the security model, but shall integrate with it.

3. The security architecture shall be designed to support both secure user interaction across 'federated' systems (distributed identity management) and secure system interaction across distributed systems (web services security management), using a common trust infrastructure.

4. The security architecture will allow full federation. All functionality supported by the architecture may be provided by a data provider or their publishing agent, but they will not be required to provide all functionality. Data providers will be expected to provide a minimum level of security capability, but may subcontract other functionality to a service provider. For example, agents would typically choose to share WAYF and Trust services, or may implement their own if agreed with the UK Location Information Infrastructure design authority.

5. The UK Location Information Infrastructure will allow anonymous use of public services where no authentication or rights management is required.

6. The Government Gateway will be used as the principle authentication service for user identification and for data provider identification and authentication.

   Data providers may provide local authentication and access controls in addition to federal services, if appropriate or where no federal services have yet been developed. For example, a thematic portal service agent must support Government gateway authentication, but could also provide local identity management for public users for whom local services are provided. The security model would not preclude such capabilities, but would require any access other than localised use of local facilities to be authenticated through the government gateway.

   The UK Location Information Infrastructure will provide guidance and tools to help data providers and their agents to implement Government Gateway (GG) based security, including wrapper designs to GG-enable existing applications if required.
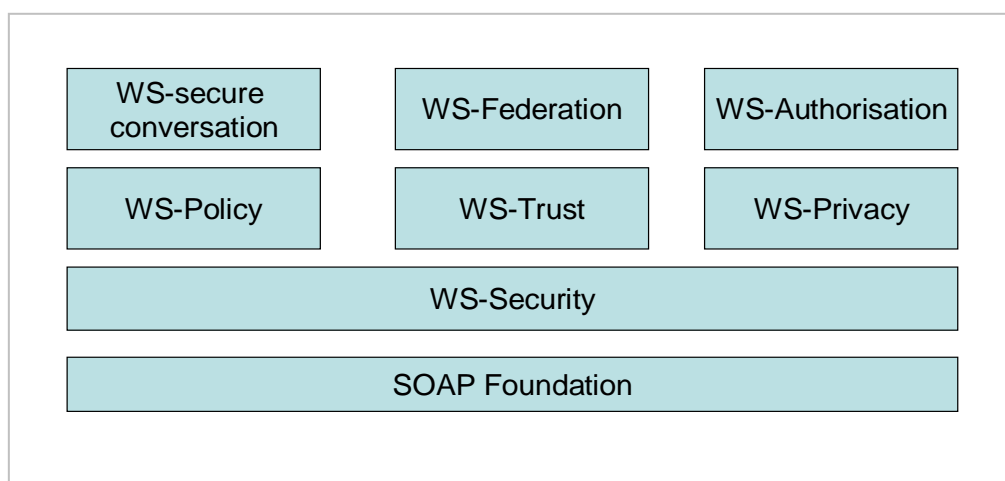
Figure 20: Web Services Security Standards

Security Architecture

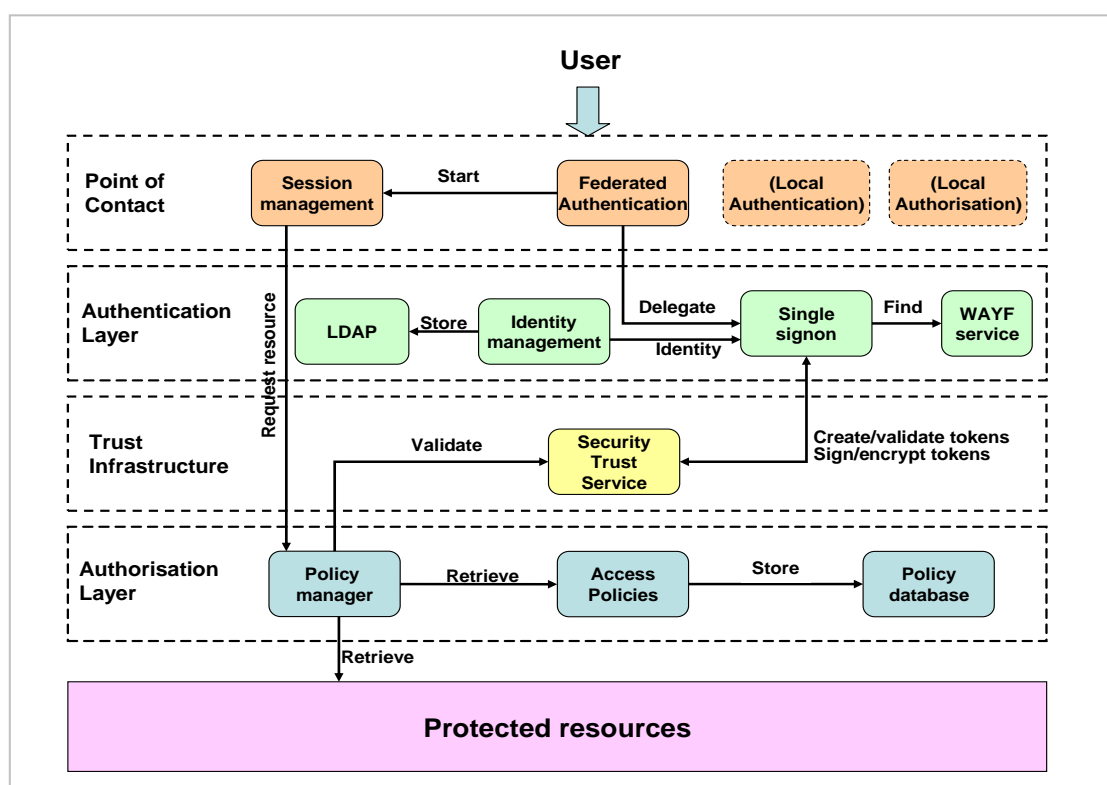The security architecture is shown in Figure 21:

Figure 21. UK Location Information Infrastructure Security Architecture

The architecture is depicted as a layered model. This reflects the cumulative application of security controls from the initial point of contact – typically a web server or reverse proxy providing managed access from the untrusted network – down to the resources which the system is designed to protect.

This hierarchy will typically need to be more or less wholly replicated in each service provider, although it is possible for some services to be shared.

The Point of Contact layer normally provides authentication and session management in a non-federated environment, and may be expected to provide such facilities in the UK Location Information Infrastructure for local domain users.

It would normally be implemented as a reverse proxy or similar buffer between the untrusted network and the trusted application domain. In the federated model it will hand off authentication to the single sign-on component in the federated authentication layer.

The Authentication layer provides local identity management (for those users for whom this is the 'home' domain'), plus federated facilities if required for user provisioning (i.e. providing user identities to federated partners, so that identity management can be subcontracted by a service provider to an Identity Provider).

The authentication layer also provides a single sign-on (and sign-off) capability, and will be implemented using the WS-Federation passive client specification. Lastly, the authentication layer implements a 'Where Are You From?' (WAYF) component to enable federated partners to establish a user's 'home' domain, and thus to request authentication.

The Trust Infrastructure layer embodies the WS-Federation specification by providing a Trust service which can be exploited by both authentication and authorisation services. The Trust service provides tools and services to create, validate and manage the tokens and keys which can be exchanges with federal partners to maintain trusted requests and responses. Trusted artefacts – keys, tokens and so on – can be created, transformed or mapped between requesters and responders in both authentication and authorisation steps in a transaction or web service request, and the core component providing this capability is a Security Trust Service.

The Authorisation layer in the UK Location Information Infrastructure security model will implement access controls to data and services, where this is not managed by any future Digital Rights Management (DRM) architecture. It will protect system and business (i.e. non-spatial) data, and UK Location Information Infrastructure applications, from unauthorised access, based on a role based access control mechanism. It will not implement Digital Rights Management, which in the UK Location Information Infrastructure will be designed as a separate capability, intended to separate rights management form the traditional identity/access control ICT security model.

Non-Functional Requirements

Performance

INSPIRE mandates certain performance requirements. Data providers and their publishing agents offering services to the UK Location Information Infrastructure will be expected to meet agreed and reasonable (from a user's perspective) performance levels for core services such as WMS and online download; and to provide the necessary hardware capacity and network bandwidth to meet the demand for these services.

Availability

The UK Location Information Infrastructure will be designed where possible to replicate capability across a number of thematic publishing agents so that the number of single points of failure is minimized. However, this is dependent on the willingness of publishing agents to host specific functionality; and it is not intended that all data and services be replicated – only the core applications and services required to support a basic set of UK Location Information Infrastructure functionality. The basic set of functionality will consist of:

1. The central metadata catalogue. Availability of the catalogue does not imply availability of data discovered via the catalogue; data will not be replicated, whilst the central catalogue will be. The catalogue should be available whenever the portal is available;

2. UK Geoportal. The UK Location Information Infrastructure will support high availability for limited portal functionality, designed to ensure that a user will always receive a meaningful response to a call to the UK Geoportal, but will not necessarily be able to perform a great deal of activity. It is not intended that the full portal be continuously available, but it will be available as specified in the INSPIRE implementing rules.

Other UK Location Information Infrastructure functionality must be available according to agreed and published service levels.

Accessibility

The design of publishing agent provided user interactive applications and services will be expected to conform to normal government accessibility and usability guidelines.

Scalability

The UK Location Information Infrastructure will be designed to allow appropriate scaling as demand and the increasing coverage of spatial themes require.

Data provider and publishing agent systems will be expected to scale to meet demand from the UK Location Information Infrastructure

5.6 Stakeholder Views

This section provides a number of summary views, from the perspective of the different stakeholder groups involved in the establishment and operation of the UK Location Information Infrastructure.

5.6.1 Data Provider View

Figure 22 presents a summary illustration of the distribution architecture for data and service publishing and network services delivery; and the business processes that a data provider will need to establish.
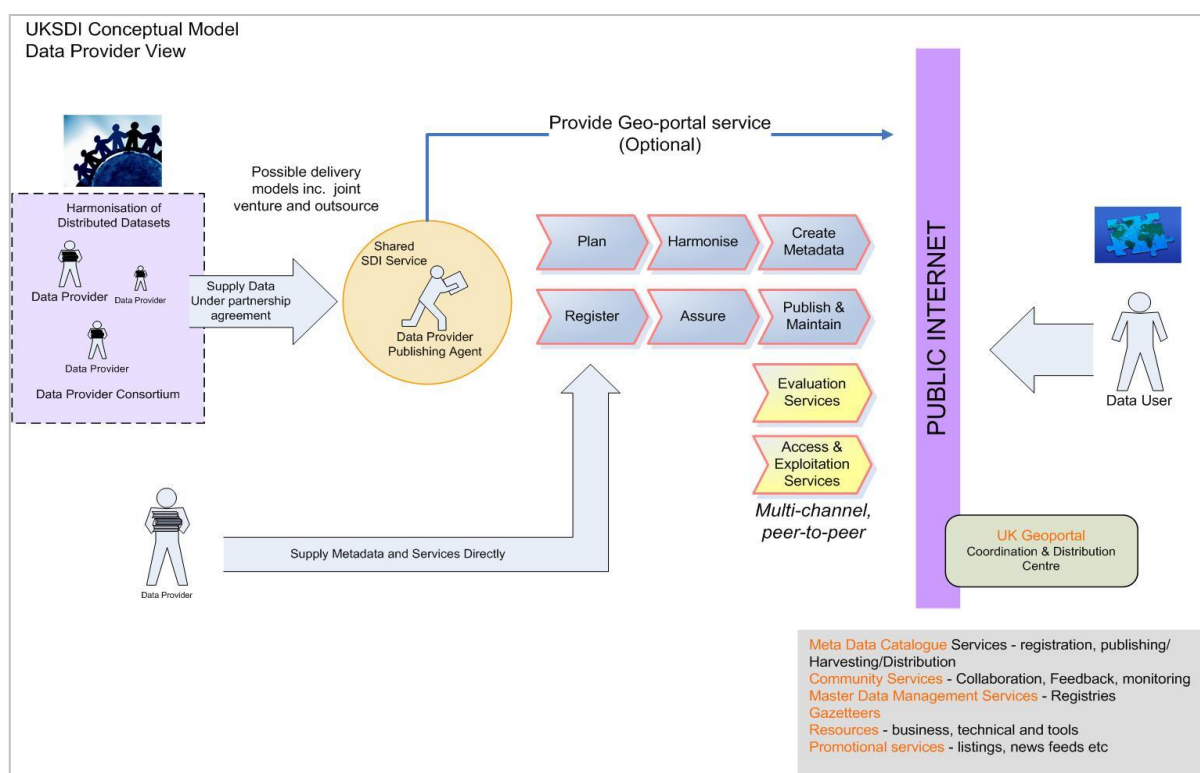

Figure 22: Data Provider View

To Publish data and services and deliver them as part of the UK Location Information Infrastructure , a data provider or their agent will need to:

- register as a data provider;

- prepare datasets for publication, including data transformation, where this is required to meet UK Location Information Infrastructure data specification and format requirements;

- establish Network (Web) Services in-line with UK Location Information Infrastructure requirements;

- create compliant Discovery Metadata about the datasets and services that they wish to publish;

- register 'master data' or access master data for own use, e.g. Features Catalogue;

- upload Discovery Metadata either directly or indirectly (through available Harvesting Service);

- service demand for published data and associated services; *and*

- optionally request distributed Discovery Catalogue service (for embedding all or part of the UK Location Information Infrastructure Discovery Metadata Catalogue into local geoportal services.

Through the UK Geoportal, data providers or their agents will be able to:

- Publish their datasets and services;

- obtain resources;

- monitor who is using their datasets;

- network with other data providers and with data users; *and*

- utilise the published datasets and services internally, for in-house end user applications.

5.6.2 Data User View

A data user will be able to:

- via multiple points of access, including the UK Geoportal:

    - search and find datasets of interest;

    - evaluate datasets individually or as a combined view;

    - perform simple analysis to determine suitability;

    - save and print images;

    - download datasets (through peer-to-peer web service chaining); *and*

    - network with data providers and other data users.

The ease in which data users are able to discover and use location information (both direct and indirect) will grow over time, as data becomes increasingly harmonised and cross referenced; and a broader range of data is published on the Web.

5.6.3 Private and Third Sector View

The private and third sectors will have a significant role to play in the development, operation and exploitation of the UK Location Information Infrastructure .

Location Data

The private and third sectors are a significant holder of location information, including datasets that fall within the INSPIRE themes. They can therefore make a significant contribution towards the development of these coordinated and harmonised themes, particularly in the areas of transportation and utilities - gas, water/sewage, power and telecommunications.

Products and Services

The UK Location Information Infrastructure will need to be supported by a range of infrastructure components and services. All offer a commercial opportunity for the private sector. These include:

- the provision of shared publishing agent services to data providers; and within this:
    - data hosting services;
    - dataset transformation services;
    - data publishing services;
    -
    - discovery metadata catalogue services;
    - access control (authentication and authorisation);
    - license management; *and*
    - web services delivery
- web services and tools;
- access and rights management solutions;
- data transformation solutions; *and*
- third party distributed services.

Commercial Exploitation of location information:

With the publication and harmonisation of location information, there will be significant opportunities for the development of innovative applications.

APPENDIX A: GLOSSARY OF TERMS

As a general principle the UK Location Programme will adopt the INSPIRE Glossary and the associated sourcing heirarchy:

http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY

The INSPIRE Glossary follows a sourcing hierarchy:

1. INSPIRE Directive definitions;

2. ISO TC211 standard definitions;

3. definitions from other international communities *and then*

4. definitions sourced from the Drafting team and Thematic Working Groups.

A definition of business and technical terms used within the Blueprint is provided below. Where terms and their usage are strongly linked, these are provided under a single definition aid understanding.

Term	Definition
Assurance	Part of corporate governance, in which an organisation provides accurate and current information to stakeholders about the efficiency and effectiveness of its policies and operations, and the status of its compliance with statutory obligations.
Business Model	A Business Model is a framework for creating economic, social, and/or other forms of value; providing a description of the core aspects of the enterprise.
Business (Target) Operating Model	An operating model describes how an organisation operates across both business and technology domains. It describes what is important for the organisation. This can cover many perspectives, inc. processes, people and technology. The Target Operating Model represents the high level requirements, that drives the future Business and IT development.
Conceptual Modelling and Conceptual Models	Conceptual modelling is the process of developing a graphical representation (or model) from the real world, or some proposed future world. The conceptual modeller has to determine what aspects of the real world to include, and exclude, from the model, and at what level of detail to model each aspect. In this wider sense those making conceptual models are facilitators helping groups of stakeholders better understand the real, or future world, they are seeking to create.
Business Processes, Core Processes and Supporting Processes.	A business process is a collection of related, structured activities or tasks that produce a specific service or product (serve a particular goal) for a particular customer or customers. There are three types of business process: (1) Operational or Core processes, processes that constitute the core business and create the primary value stream. Typical operational processes are Purchasing, Manufacturing, Marketing, and Sales. (2) Supporting processes, which support the core processes. Examples include Accounting, Recruitment, Technical support. (3) Management processes, those that govern the operation of a system. Typical management processes include "Corporate Governance" and "Strategic Management".

Term	Definition
	For simplicity within the UK Location Information Infrastructure conceptual design, we have grouped (2) and (3) under a common heading of "Support Processes".
Core Reference Geographies	Foundational geospatial (map) data against which more specific information can be consistently overlaid, including business application information.
Data Provider	An organisation that creates location information (directly or via a third party) who then publishes this data through the UK Location Information Infrastructure.
Data User	Anyone who uses the location information published through the UK Location Information Infrastructure.
E-GIF	The e-Government Interoperability Framework (e-GIF) is a component of the UK e-Government Strategy and sets out the policy and standards for interoperability across the public sector. It sets the architecture for joined-up and web-enabled government, for the UK online portal and Gateway, and for Electronic Service Delivery (ESD).
Exploitation Model	The learning and skills model by which location information will be exploited through an improved understanding and knowledge about how to utilise location information in a real world situation, e.g. for policy development, project delivery, or service delivery.
FTP	File Transfer Protocol.
Gazetteer	A gazetteer is a geographical dictionary or directory, used in conjunction with a map; a reference for information about places, or locations. It typically contains information concerning the geographical makeup of a country, region, or continent as well as the social statistics and physical features, such as mountains, waterways, or roads. Examples of information include the location of places, dimensions of physical features, population, GDP, literacy rate, etc.
Geo-portal	A web site to find (discover) geospatial information and access to associated services (view, evaluate, report and download). From http://www.geoportal.rlp/de: a geoportal is a central platform for sharing information about all geodata which covers a special region, with a focus on the data which is online available through standardised web services.
Governance	In the context of the UK Location Information Infrastructure, governance relates to consistent leadership and management; and cohesive policies, processes and decisions relating to the UK Location Information Infrastructure. The governing body is the Location Council.
Government Gateway	The website you use to register for online government services in the UK. It is an important part of the government's strategy of delivering 'joined up' government, enabling people to communicate and make transactions with government from a single point of entry: http://www.gateway.gov.uk/
HTTP	See Web Services definition.
IFTS	Information Fair Trading Scheme http://www.opsi.gov.uk/ifts/index
Interoperability	A property referring to the ability of diverse systems and organizations to work together (inter-operate). The term is often used in a technical systems engineering sense, or alternatively in a broad sense, taking

Term	Definition
	into account social, political, and organizational factors that impact system to system performance.
Location Information	Any information that is directly or indirectly related to a place. More commonly referred to as geographic information.
Master Data, Reference Data, MDM	Master Data (also called reference data but in an non geographic sense) relates to the non-transactional or subject matter data entities of an organisation. In a location information context, this is the registry data (e.g. features and symbols) relating to a specific dataset, or commonly shared across datasets.
	Master data management (MDM) comprises a set of processes and tools that consistently defines and manages these data entities.
OGC	Open Geospatial Consortium: http://www.opengeospatial.org/
Operational Framework	A set of generic definitions relating to how something should be achieved and/or implemented, that can be commonly agreed and then applied across a range of institutions, organisations or businesses. It can include a wide range of topics, relevant to the subject matter, e.g. covering policies and standards, best practice, business processes, systems and performance management. Examples can be found in many sectors and fields, e.g. the NHS, Eurosystem and Microsoft.
OPSI	Office of Public Sector Information: http://www.opsi.gov.uk/
Publishing Agent	A third party who provides publishing services to a data provider, e.g. data hosting, metadata management, master data management, data transformation and web services.
Registry	A database of master data, either generic (relating to all datasets, e.g. held within a Feature Concept Dictionary) or local (relating to a specific dataset, e.g. held within a Feature Catalogue).
Rights Management, Digital Rights Management	Rights Management is the imposition of limitations on the usage of a product or service.
	Digital rights management (DRM) refers to access control technologies that can be used by hardware manufacturers, publishers, copyright holders and individuals to try to impose limitations on the usage of digital content and devices.
Location Information Infrastructure	A Location Information Infrastructure (LII), more commonly referred to as a Spatial Data Infrastructure (SDI), is the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data.
	Some of the main principles are that data and metadata should not be managed centrally, but by the data originator and/or owner, and that tools and services connect via computer networks to the various sources.
	Due to its nature, a Location Information Infrastructure is usually government-related. An example of an existing Location Information Infrastructure is the National Spatial Data Infrastructure (NSDI) in the United States.
Service Delivery Model	A model of the services provided by an organisation to meet its business goals, objectives and value proposition. Frequently represented using Michael Porter's Value Chain model.

Term	Definition
SOA	Service Orientated Architecture.
SOAP	See Web Services definition.
UK Location Information Infrastructure	UK Location Programme name for the UK's Spatial Data Infrastructure.
UK Spatial Information Infrastructure (UK SDI).	Traditional name for UK Location Information Infrastructure used by the GI community.
Value Chain, Value System	The value chain is a concept first described and popularized by Michael Porter in his 1985 best-seller, Competitive Advantage: Creating and Sustaining Superior Performance. A value chain is a chain of activities. As part of each activity the 'product' gains some value. The chain of activities gives the products more added value than the sum of added values of all the activities. The value chain categorizes the generic value-adding activities of an organization. The "primary activities" include: The "support activities" include: administrative infrastructure management, human resource management, technology (R&D), and procurement. The value-chain concept has been extended beyond individual organisations. It can apply to whole supply chains and distribution networks, as in the case of the UK Location Information Infrastructure . The industry wide synchronised interactions of local value chains (the data providers) create an extended value chain (the UK Location Information Infrastructure). Porter terms this larger interconnected system of value chains the "value system."
Value Proposition	A simple, concise statement of the customer value or benefit to be created by the enterprise, organisation or business.
Web Services, SOAP, REST, WSDL, HTTP	A Web Service is defined by the W3C as "a software system designed to support interoperable machine-to-machine interaction over a network". Web services are frequently just Internet application programming interfaces (API) that can be accessed over a network, such as the Internet, and executed on a remote system hosting the requested services. The W3C Web service definition encompasses many different systems, but in common usage the term refers to clients and servers that communicate over the HTTP protocol used on the Web. Such services tend to fall under to forms: Those based on Extensible Markup Language (XML) messages that follow the Simple Object Access Protocol (SOAP) standard, popular with traditional enterprise architectures. In such systems, there is often a machine-readable description of the operations offered by the service written in the Web Services Description Language (WSDL). The latter is not a requirement of a SOAP endpoint, but it is a prerequisite for automated client-side code generation in many Java and .NET SOAP frameworks. Some industry organisations, such as the WS-I, mandate both SOAP and WSDL in their definition of a Web service. More recently, REpresentational State Transfer (REST) Web services have been gaining popularity, particularly with Internet companies such as Google. These also meet the W3C definition, and are often better integrated with Hypertext Transfer Protocol (HTTP) than SOAP-based services. They do not require XML messages or WSDL service-API definitions.

Term	Definition
xGEA	Cross Government Enterprise Architecture.