



INSPIRE

Infrastructure for Spatial Information in Europe

INSPIRE Network Services Architecture

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1 Foreword

INSPIRE is a Directive proposed by the European Commission in July 2004 setting the legal framework for the establishment and operation of an Infrastructure for Spatial Information in Europe. The purpose of such infrastructure is to support the formulation, implementation, monitoring activities and evaluation of Community policies linked with the environment at all levels, European, national and local, and to provide public information.

INSPIRE should be based on the infrastructures for spatial information that are created by the Member States. The components of those infrastructures include: metadata, spatial data themes (as described in Annexes I, II, III of the Directive), spatial data services; network services and technologies; agreements on sharing, access and use; coordination and monitoring mechanisms, processes and procedures.

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

The text of the INSPIRE Directive is available from the INSPIRE web site (<http://www.ec-gis.org/inspire>). The Directive identifies what needs to be achieved, and Member States have two years from the date of adoption (15th May 2007) to bring into force national legislation, regulations, and administrative procedures that define how the agreed objectives will be met taking into account the specific situation of each Member State. To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas. Implementing Rules are adopted as Commission Decisions, and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed by representatives of the Member States and European Parliament. The committee is chaired by a representative of the Commission (this is known as the Comitology procedure). The committee was established within three months from the entry in force of the Directive.

This Network Services Architecture document is informative and is therefore not an Implementing Rule. Rather, it is a contribution from the Network Services Drafting Team to help the process of developing the Implementing Rules for each of the INSPIRE Network Services. The purpose of the document is to provide the architectural context to enable Member States to better understand the Implementing Rules for Network Services.

Preliminary versions of this document have already been revised in the light of comments from the INSPIRE Consolidation team, INSPIRE Drafting teams and the registered SDICs and LMOs.

The D3.5 v2.0 has passed a review by the SDICs and LMOs. The comment resolution process included a workshop with their representatives and an open workshop during the INSPIRE 2008 conference. Based on the discussions, the Drafting Team "Network Services" resolved the comments in this version. The table containing the comments and the resolution is available on the INSPIRE web-site http://www.ec-gis.org/inspire/reports/ImplementingRules/network/D3_5_INSPIRE_NS_Architecture_to_v3-0_comments.pdf.

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2 Background

The INSPIRE Directive requires that:

Inspire shall build upon infrastructures for spatial information established and operated by the Member States. (Article 1)

and;

Member States shall establish and operate a network of the following services for the spatial data sets and services for which metadata have been created in accordance with this Directive:

- (a) discovery services making it possible to search for spatial data sets and services on the basis of the content of the corresponding metadata and to display the content of the metadata;*
- (b) view services making it possible, as a minimum, to display, navigate, zoom in/out, pan, or overlay viewable spatial data sets and to display legend information and any relevant content of metadata;*
- (c) download services, enabling copies of spatial data sets, or parts of such sets, to be downloaded and, where practicable, accessed directly;*
- (d) transformation services, enabling spatial data sets to be transformed with a view to achieving interoperability;*
- (e) services allowing spatial data services to be invoked.*

Those services shall take into account relevant user requirements and shall be easy to use, available to the public and accessible via the Internet or any other appropriate means of telecommunication. (Article 11).

and;

Member States shall ensure that public authorities are given the technical possibility to link their spatial data sets and services to the network referred to in Article 11(1). This service shall also be made available upon request to third parties whose spatial data sets and services comply with implementing rules laying down obligations with regard, in particular, to metadata, network services and interoperability. (Article 12).

and;

Rules for implementation designed to amend non-essential elements of this Chapter by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 22(3), and shall in particular lay down the following:

- (a) technical specifications for the services referred to in Articles 11 and 12 and minimum performance criteria for those services, taking account of existing reporting requirements and recommendations adopted within the framework of Community environmental legislation, existing e-commerce services and technological progress;*

In addition, the Network Services Implementing Rules in particular address:

- General Architectural Model
- Security (access to the service and data transfer) when applicable
- Multilingualism as requested by INSPIRE.
- Compliance with services metadata and impact
- Technical architectures and protocols
- End-users' needs.

The Network Services Implementing Rule takes into account the Implementing Rules developed for Data Specification and Data Sharing. As the INSPIRE Geo-Portal is a Commission internal development, it does not form part of the Network Services Implementing Rule but will nevertheless play an important role.

For e-commerce services specifications the Network Services Implementing Rule refers to existing European/National legal frameworks and relative technical documents whenever applicable. For example, the Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, including e-commerce, and the Internal Market ('Directive on electronic commerce'). Particular attention has been focused on Digital Rights Management and how it relates to e-commerce services.

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3 Scope

This document is not normative but informative, it provides the architecture within which the INSPIRE Network Services will be implemented.

It defines the “INSPIRE Network Services Architecture” that includes the INSPIRE service types as mandated by the directive, and how those services connect to portals and applications through the INSPIRE Service Bus. In addition, the architecture specifies Rights Management Services (RM), which are needed to invoke e-commerce services.

The purpose of this document is to expand on the architecture as defined in the INSPIRE Technical Architecture Overview, and provide additional technical information to enable the implementation of INSPIRE Network Services by Member States.

The detailed definition for the implementation of each of the INSPIRE Network Services will be documented separately. Figure 3-1 illustrates the relationships of documents from the DT Network Services perspective.

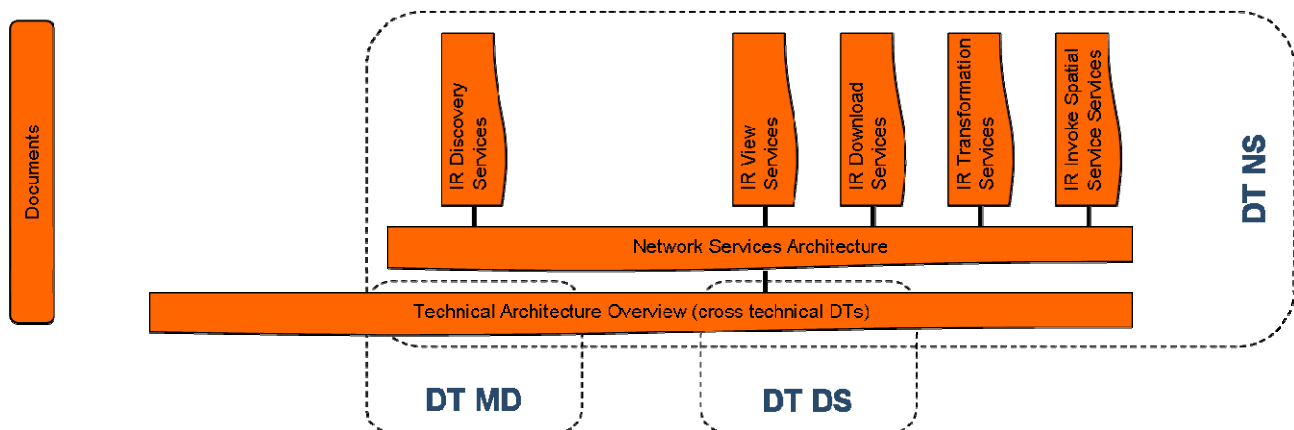


Figure 3-1: Relationships of (IR) Documents

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4 Terms and abbreviations

4.1 Terms

The terms in this sub-clause are taken from the “Glossary of Generic Geographic Information Terms in Europe” that specifies the terminology used in the INSPIRE Implementing Rule documents.

Access point: Portal, or similar, providing access to (INSPIRE) services.

Cascading: Integration of distributed services is a major functionality of a Spatial Data Infrastructure. Distributed services of the same type are integrated by a new middle tier between application and services. This middle tier offers the application a new service with the same type of interface, receives a request from the application, separates the request according to the known distributed services characteristics, requests the services serially, receives the responses, integrates them and delivers the integrated response back to the application.

Façade: A component for transport protocol transformation and manipulation. Used to support multiple web service specification versions, to filter or add specific data, e.g. data relevant for rights management. There might be known and unknown facades. Known facades, e.g. transformation between WMS 1.0 and WMS 1.3 might be shared within the SDI to enhance productivity and lower exceptions. Facades might be offered from propriety component vendor to include non-INSPIRE compatible services. Facades seem to have similar characteristics like drivers.

Geo-Portal: Internet site, or equivalent, providing access to the services referred to in Article 11(1)

INSPIRE Application: software using INSPIRE network services (without access to a portal)

INSPIRE Network Services: Services required by the Directive (discovery services, view services, download services, transformation services, services allowing spatial data services to be invoked) conforming to the INSPIRE network services implementing rules.

INSPIRE Service bus: This software bus allows the connection of Geo-portals and applications to the INSPIRE network services using the standardised interfaces.

MS Network Service: any Network Service operated by a MS, not necessarily conforming to the INSPIRE IRs

Portal: Internet site, or equivalent, providing access to services

RM (Rights Management) technology provides additional infrastructure functionalities to control access to service and means to provide access under operator-defined conditions, business models and policies.

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4.2 Abbreviations

DT	INSPIRE Drafting Team
DT DS	INSPIRE Drafting Team for Data Specification
DT MD	INSPIRE Drafting Team for Metadata
DT NS	INSPIRE Drafting Team for Network Services
EU	European Union
GeoRM	Rights Management for geo information
GI	Geographic Information
ICT	Information and Communication Technology
IDA	Interchange of Data between Administrations", concept belonging to the European eGovernment policies
INSPIRE	INfrastructure for SPatial InfoRmation in Europe
IR	Implementing Rule
ISO	International Standardisation Organisation
LMO	Legally Mandated Organisation
MS	Member State of the European Union
OGC	Open Geospatial Consortium
RM	Rights Management
SDI	Spatial Data Infrastructure
SDIC	Spatial Data Interest Community
SOAP	Web Service Messaging Framework (historically <i>Simple Object Access Protocol</i>)
UML	Unified Modelling Language
WSDL	Web Service Description Language
XML	eXtensible Markup Language

5 INSPIRE Network Services Architecture Overview

This section gives an overview of the INSPIRE Network Services Architecture. It is based on the description provided in the INSPIRE Technical Architecture Overview document. At the core of the architecture are the INSPIRE Service Types: Discovery, View, Download, Transform and Invoke – these are described in more detail in the following section.

INSPIRE Services are accessed via the rights management layer and may be accessed by applications and geoportals via the INSPIRE services bus. Figure 5-1 shows the components and responsibilities of the Drafting Teams.

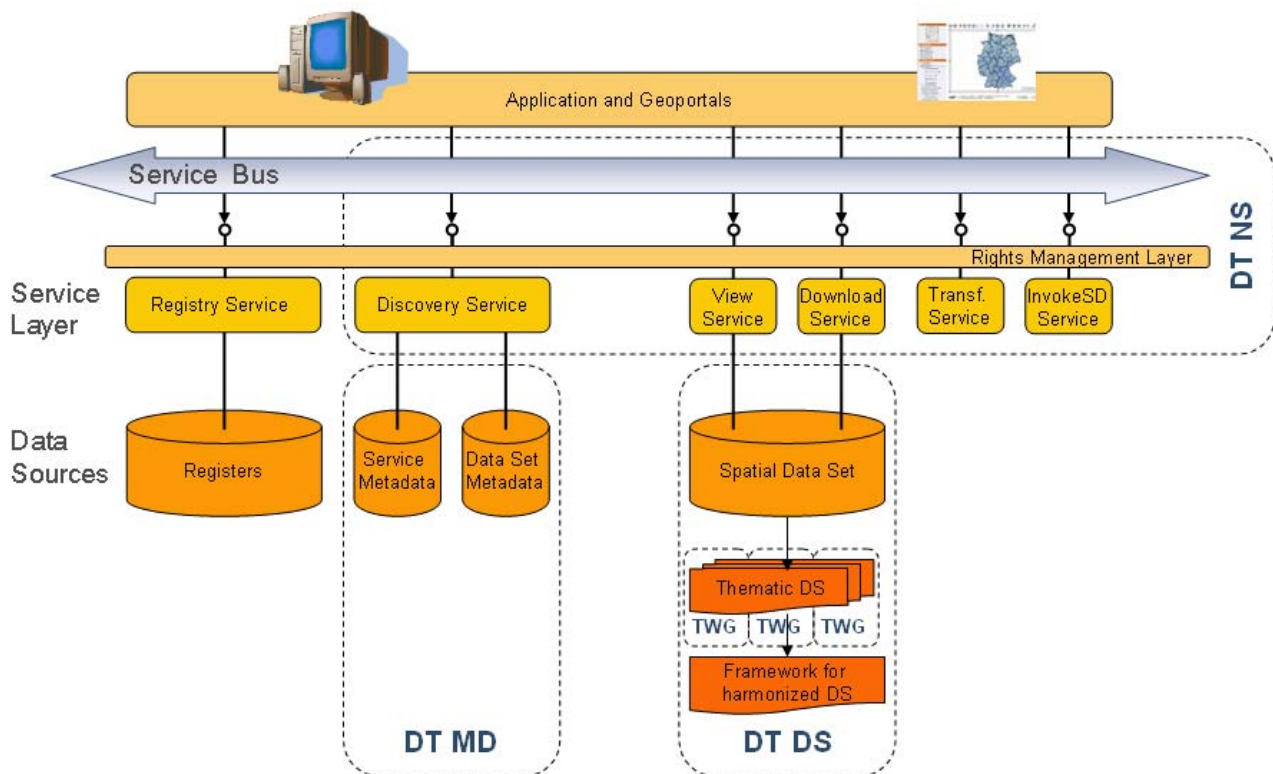


Figure 5-1: INSPIRE technical architecture overview

Further description is provided in the INSPIRE Technical Architecture Overview document. The following sections focus on the INSPIRE Service Types and how the INSPIRE Service Infrastructure is implemented.

6 INSPIRE Service Types

The key components and their relationships are described by a brief discussion about the different INSPIRE service types.

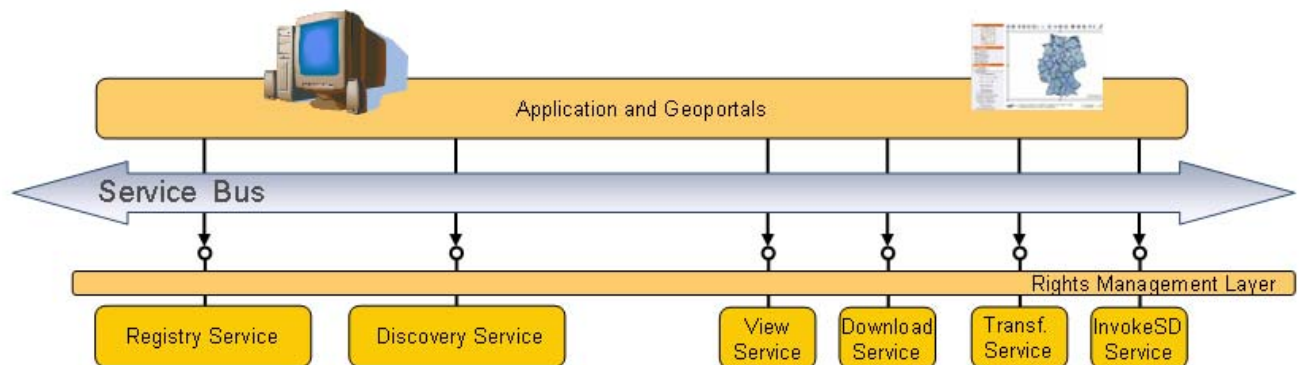


Figure 6-1: INSPIRE Service Types

6.1 Discovery Services

The INSPIRE Directive asks Member States in article 11(1) (a) to establish and operate a network of services for the discovery of spatial data sets and services “for which metadata have been created”. “Discovery services making it possible to search for spatial data sets and services on the basis of the content of the corresponding metadata and to display the content of the metadata.” Within the geographic community various names have been assigned to instruments for discovering spatial data and services through the metadata properties; examples are Catalogue Services, Spatial Data Directory, Clearinghouse, Geographic Catalogue and Geodata Discovery Service. In INSPIRE these services are referred to as Discovery Services.

The goal of discovery services is to support discovery of data, evaluation and use of spatial data and services through their metadata properties. Metadata is the information and documentation, which makes these resources understandable and sharable for users over time. Indexed and searchable metadata provide a controlled vocabulary against which discovery can be performed. INSPIRE Discovery Services shall provide the functionality for users both to manage and search catalogues for the purpose of discovery and evaluation within the context of the INSPIRE Directive. The network of services should also include the technical possibility to enable public authorities to make their spatial datasets and services available. The INSPIRE Directive specifies that Member States shall ensure that public authorities are given the technical possibility to link their spatial datasets and services to the network. This ‘linking’ service is also offered in the context of a discovery service as a capability of the discovery service.

6.2 View Services

The INSPIRE directive asks Member States in article 11(1) (b) to establish and operate “view services making it possible, as a minimum, to display, navigate, zoom in/out, pan or overlay viewable spatial data sets and to display legend information and any relevant content of metadata”. Where public authorities levy charges for view services, the Member States shall ensure that e-commerce services (including rights management services) are available (article 14(4)).

The process of laying down implementing rules for the directive highlights the following aspects of a view service:

- Nature of the Metadata
- Common coordinate reference system

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- Temporal data dimension
- View geometry selection
- Multiple datasets view output format
- Styling
- Rights Management
- Legend availability and handling
- Correspondence between layers and INSPIRE themes
- Multilingualism
- relationship with client applications

6.3 Download Services

The INSPIRE Directive asks Member States in article 11(1) (c) to establish and operate a network of “download services, enabling copies of spatial data sets, or parts of such sets, to be downloaded and, where practicable, accessed directly”. In addition, where public authorities levy charges for the download services, Member States shall ensure that e-commerce services (including rights management services) are available (article 14(4)).

A download service supports

- download of a complete dataset or datasets, or
- a part of a dataset or datasets, and
- where, practicable, provides direct access to complete datasets or parts of datasets.
- Gazetteer like services are also covered by a type of download service.

In the context of INSPIRE and the scope of the Implementing Rules, datasets are restricted to the categories defined by the Annexes I-III (see Article 4), and for which metadata exist and are updated according to Article 5, and that spatial datasets are interoperable and harmonised according to Article 7-10.

It is worth to note that the conceptual or application schema of the **local or national** spatial data set may and will often differ from the **INSPIRE** harmonised specification of the spatial object types in the data specification. In this case a download service may transform between the application schema of the spatial dataset and the harmonised schema on-the-fly, if possible, or a transformation service (see 6.4) may be invoked. Alternatively, a member state may provide a download service based on derived datasets converted in advance of receiving the query. Search criteria need to support a variety of criteria, including spatial and temporal extents, metadata elements, and feature properties.

INSPIRE services are restricted to INSPIRE IR and INSPIRE themes, but obviously the same type of services can be used much more general. The architecture and the IRs are focusing on INSPIRE requirements, but does not restrict MS to operate other services and services on other data - on the contrary, such data services may be registered in the metadata.

6.4 Transformation Services

The INSPIRE Directive requires, in Article 11(1)(d), Member States to “establish and operate a network of ... transformation services, enabling spatial data sets to be transformed with a view to achieving interoperability”.

Transformation Service is a special case among the recognized INSPIRE service types, as its function is to help other services in achieving compliance with the relevant INSPIRE specifications. It cannot thus be required at the MS level, if all the existing services already comply with the INSPIRE rules. In many cases the functionality envisaged for a Transformation Service is recommendable to be embedded inside another service type. This can be justified both for performance and service robustness reasons and might be realised, for instance, in the form of a transforming View service or a transforming Download service. When regarded as an individual service instance, the Transformation Service is currently interpreted as a real-time Coordinate Transformation Service, chained with a Download Service for input data. This kind of Transformation Service is seen as a spatial data processing service, capable of transforming the input dataset from a Coordinate Reference System (CRT) into another.

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6.5 Invoke Spatial Data Services

The INSPIRE Directive asks Member States in article 11(1) (e) to establish and operate a network of “services allowing spatial data services to be invoked”. In addition, where public authorities levy charges for invoke spatial data services, Member States shall ensure that e-commerce services (including rights management services) are available (article 14(4)).

The “Invoke Spatial Data Service” service allows defining both the data inputs and data outputs expected by the spatial service and define a workflow or service chain combining multiple services. It also allows the definition of a web service interface managing and accessing (executing) workflows or service chains.

The “Invoke Spatial Data Services” service supports invoking individual (spatial) services as well as combinations of individual (spatial) services both synchronous and asynchronous, in service chains through a (web) service orchestration engine a.k.a. “workflow engine”. The service chains are expressed in a standard (e.g. XML-based) notation that can be consumed by commercial as well as open-source orchestration engines from multiple sources.

For spatial data services available on the Internet, the “Invoke Spatial Data Service” service will enable a user or client application to run them without requiring the availability of a GIS. This requires that a client application can discover the service, bind to it and invoke it. The orchestration/combination of Spatial Data Service with other services will require to precisely define the interactions between the services. Therefore, the interaction between the (spatial) services to be invoked is defined as a workflow or composite service in a standard notation (e.g. XML-based).

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7 INSPIRE Network Services Infrastructure

Network services are necessary for sharing spatial data between the various levels of public authority in the Community and the public.

For these services interoperability is requested by the directive, which means the possibility for services to interact, without repetitive manual intervention. To reach this goal the INSPIRE Network Services Definitions define the interfaces by which the different parties of the European Spatial Data Infrastructure will communicate. Thus, the INSPIRE Network Services can be seen as the interface being used to realise a pan-European geo spatial service bus (see fig. 7-1):

- Different *service providers* who contribute INSPIRE-conforming services (access only)
- INSPIRE Network Services expose services for machine-to-machine communication. At least a workflow that follows the “publish – find – bind” design pattern (see figure 7-4) should be possible. However, users do not necessarily have to follow this pattern; they can also invoke services directly.
- INSPIRE Applications solving specific tasks by involving INSPIRE services.
- INSPIRE geo-portal at Community level and further Member States access points offering INSPIRE functions to the different user groups (usage of INSPIRE services). A user can access services on an EU level via the INSPIRE geo-portal but also on a MS level – usage on the EU level offers the advantage to access data that integrates seamlessly data from different member states.

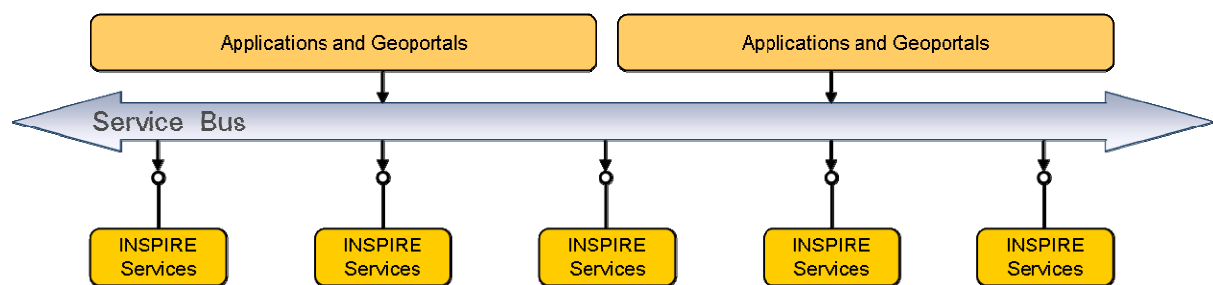


Figure 7-1: INSPIRE Network Service bus

It is important to note that for INSPIRE it is assumed that all kind of data and metadata access and processing is performed using web services. All services are described by service descriptions (service metadata, as part of the INSPIRE metadata), allowing humans and software applications to discover specific service instances in the infrastructure and invoke them automatically.

The INSPIRE Network Service Architecture is designed as Service-Oriented Architecture with service consuming and service providing components communicating via an INSPIRE (enterprise) service bus. The primary aim of the INSPIRE service infrastructure is to provide seamless and interoperable information exchange between European bodies, institutions, member states and public authorities. With respect to service provision and consumption, those are therefore the primary participants of an enterprise SDI.

In addition it is envisioned that the INSPIRE service bus provides additional management services like registries, authentication, and access control functionalities, eCommerce services, etc. The INSPIRE architecture needs to support not only point-to-point communication between clients and services, but as workflows utilizing services in a chained manner. To facilitate such a truly SOA styled INSPIRE Architecture, well-defined, type-safe and machine-readable interfaces are essential. In this context, the communication-protocol and interface binding technology for INSPIRE services have to be defined.

As the INSPIRE directive advises to utilize existing standards, OGC service bindings are taken as a guidance. Existing OGC Web Services (OWS) support a mix of protocols and technology bindings. These are Key-Value-Pairs send via HTTP/GET, XML send via HTTP/POST, SOAP via HTTP/POST and combinations. In addition the World Wide Web Consortium (W3C) suggests the usage of SOAP as a messaging protocol for web services. INSPIRE services should utilize one standard technology binding for all service types. In order to streamline integration and implementation as well as getting a maximum benefit

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from the offered services, a mix of technologies is to be avoided. Taking all requirements, opportunities and risks into account, the default communication-protocol and binding technology for INSPIRE services should be SOAP (document/literal).

A number of additional arguments can be listed in favour of a SOAP approach for the INSPIRE network services:

- SOAP web services are the standard information technology for Service-Oriented Architectures and thus support sustainable implementing rules.
- SOAP web services ensure smooth and complete integration in development environments (cross-platform and cross-technology).
- SOAP web services yield a direct and seamless integration with other system environments.
- SOAP web services have the possibility to be extended by management functionalities (such as supporting geo rights management services)
- SOAP web services provide the necessary means to chain services and perform automated business workflows.

Whilst consequently choosing SOAP as service binding technology, INSPIRE Network Service can still reuse OGC service specifications. This is because the service binding technologies used by OGC services are service oriented designed. SOAP service can follow the design exactly. Therefore, a SOAP service interface is nothing more than a simple technology bridge without influencing any semantics. In addition as by June 2006, all new and revised OGC service specifications have to provide SOAP bindings¹.

Usage of REST APIs and related technologies may help open up INSPIRE resources to mass market information infrastructures. The general applicability of Resource Oriented Architecture (ROA) and REST tendencies is examined in a JRC Scientific and Technical Report published by the European Commission.²

In order to identify and further elaborate on the SOAP approach the INSPIRE Network Service Drafting Team requested the European Commission to launch a project to study in detail whether a SOAP based approach is feasible for the INSPIRE network services.

Another view on the INSPIRE Network Services is to see them as a mediator between the services provided by the member states or offered by third parties and their EU-level usage for example via the INSPIRE geo-portal. Here "INSPIRE geo-portal" means an Internet site which provides access to the services referred to in Article 11(1): discover, transform, view and download spatial data, invoke spatial data and e-commerce services. Therefore services in the member states are not required to be changed because of INSPIRE. INSPIRE just requires that data and services in the member states are made available through INSPIRE-conformant network services. Technically, this can either be done by chaining an INSPIRE-conformant service to an existing service - or by establishing an INSPIRE-conformant service linked to the existing data source – assumed the data can be provided INSPIRE-conformant.

The figure 7-2 sketches the mediator view:

- Member State services (here a "Member State service" is any service provided by any public authority within a member state) – whether conforming to the INSPIRE Network Service Definitions or not – can be used as input for the Member States infrastructures and portals. Be aware, that Member State services do not have to conform to the INSPIRE Network Service Definitions but only the INSPIRE Network Services which are provided through the Member State access points.
- In addition to MS INSPIRE Services for the communication between EU and Member State level the Member State access points may provide a specific client (portal). However, it is not required that a member state provides a portal of its own (in which case MS services must conform to INSPIRE Network Service Definitions). In addition, organizations of the member states can provide MS INSPIRE Services which can be used directly within the INSPIRE geo-portal or by EU level users.

¹ OGC #06-135r1, http://portal.opengeospatial.org/files/?artifact_id=17566

² JRC Scientific and Technical Report "Resource Oriented Architecture and REST - Assessment of impact and advantages on INSPIRE" to be published June 2008.

- The INSPIRE services are used by the INSPIRE geo-portal as well as by applications / users which directly use the INSPIRE services on EU level. INSPIRE Services can be provided directly conforming to the INSPIRE Network Service specification or can be realized by a façade which cascades to the original MS services.

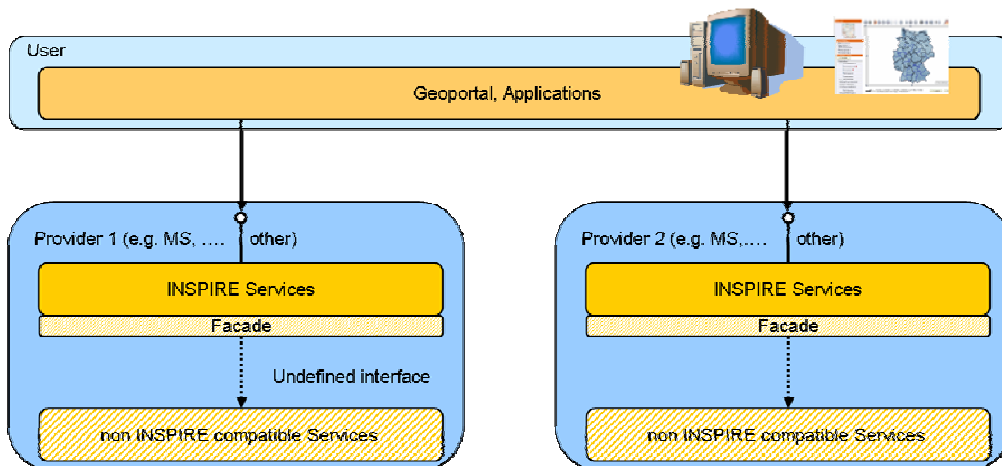


Figure 7-2: Network Service Definitions as a mediator between member states INSPIRE and non INSPIRE services and EU level users

The INSPIRE architecture can be structured with multiple tiers, which might be cascaded (see figure 7-3). The simple case is the classic client-service separation. A user or other general applications interact with an INSPIRE compatible application in a use case depending way. This interaction is not subject to any INSPIRE harmonization efforts. An example for an application is a geoportal. The INSPIRE compatible application can interact with INSPIRE services due to harmonized specifications. In the cascading access case also INSPIRE services can interact with other INSPIRE services, e.g. from other providers. An example is the usage of the INSPIRE geoportal, which access EC INSPIRE services and if requested also MS INSPIRE services via cascaded access. All providers remain logically on the same level to balance different interests. The architecture of INSPIRE as well as of the INSPIRE geo-portal can be seen as multi tier architecture (see figure 7-3) which separates between:

- the INSPIRE user layer (human as well as machine users),
- the INSPIRE service layer representing all the INSPIRE services which can be accessed on the EC level for example by the INSPIRE geo-portal and
- the different member state services which can be lifted to the EC level by service cascades but also accessed directly on EC level if the service interface is conforming to the INSPIRE Network Service definitions.

In the INSPIRE user layer we find the usage of the INSPIRE services by the INSPIRE geo-portal client for human users, as well as the INSPIRE applications which use different INSPIRE services to fulfil their specific tasks. The different INSPIRE applications can be understood as "INSPIRE machine users" - in this way machine-to-machine communication on the European and International level is supported by INSPIRE.

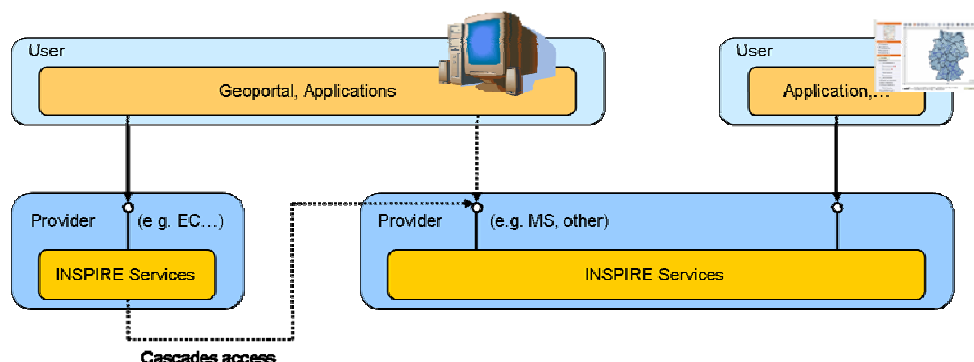


Figure 7-3: Conceptual multi tier architecture of the INSPIRE Geo-portal

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The next one is the service layer, which represent services and service cascades. Every service (see figure 7-3, 7-13) typically consists of:

- if needed: the **rights management layer** providing infrastructure functionalities to control and grant access.
- The **service**, which realizes one of the different INSPIRE service types.

All these Servers / Services use either cascaded services or data which is provided locally by different **data sources**.

Although INSPIRE services can be used in many variations, the regular underlying process model reflects the fundamental publish-find-bind pattern. Figure 7-4 depicts the process phases and the related services.

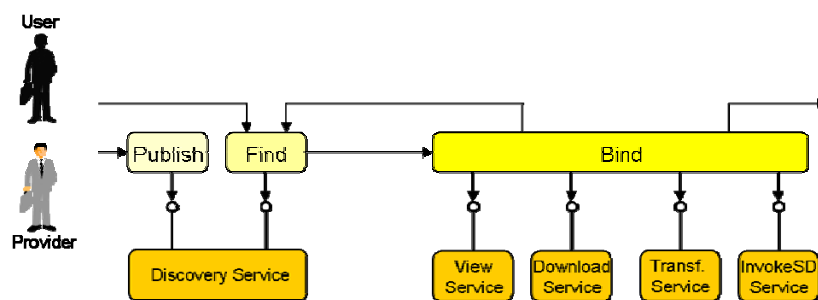


Figure 7-4: Publish-Find-Bind pattern

7.1 E-Government Integration

In June 2002, European heads of state adopted the eEurope Action Plan 2005 at the Seville summit. It calls on the European Commission “to issue an agreed interoperability framework to support the delivery of pan-European eGovernment services to citizens and enterprises”.

Although the INSPIRE Directive does not directly refer to eGovernment, it will potentially establish one of the most powerful set of pan-European government (in general, public) electronic services. It is therefore highly recommended that the INSPIRE architecture aligns with more general frameworks of eGovernment services.

An interoperability framework can be defined as a set of standards and guidelines that describes the way in which organisations have agreed, or should agree, to interact with each other. An interoperability framework is, therefore, not a static document and may have to be adapted over time as technologies, standards and administrative requirements change.

The European Interoperability Framework (EIF) defines a set of recommendations and guidelines for eGovernment³ services so that public administrations, enterprises and citizens can interact across borders, in a pan-European context.

³ In the Communication “The role of Government for Europe’s future”, COM (2003) 567 final of 26 September 2003, eGovernment is defined as the use of information and communication technologies in public administrations combined with organisational change and new skills in order to improve public services and democratic processes and strengthen support to public policies.

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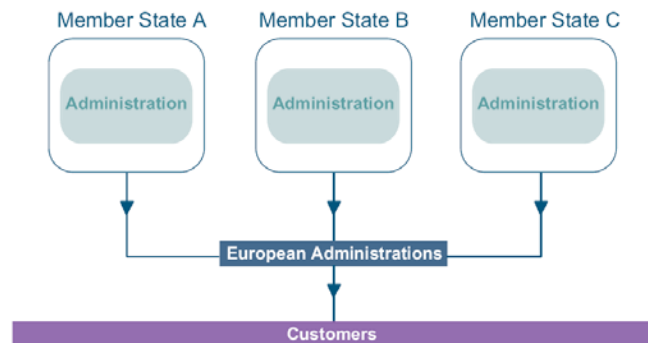


Figure 7-5: Interaction between national and European administrations

The current work on EIF is done under the programme initiated by the proposal from the Commission for a Decision on Interoperable Delivery of pan-European eGovernment Services to Public Administrations, Businesses and Citizens (IDABC) as adopted by the Council and by the European Parliament on 21 April 2004.

The following principles, of a general nature, should be considered for any eGovernment services to be set up at a pan-European level:

- Accessibility
- Multilingualism
- Security
- Privacy
- Subsidiarity
- Use of Open Standards
- Assess the benefits of Open Source Software
- Use of Multilateral Solutions

The current EIF version 1.0 (<http://ec.europa.eu/idabc/servlets/Doc?id=19529>) provides 17 recommendations concerning organisational, semantic and technical viewpoints. These recommendations are well worth noting also in the INSPIRE context. EIF is also accompanied by the IDA Architecture Guidelines (<http://ec.europa.eu/idabc/en/document/2317/5890>). The IDA AG is very focused on interconnectivity technology.

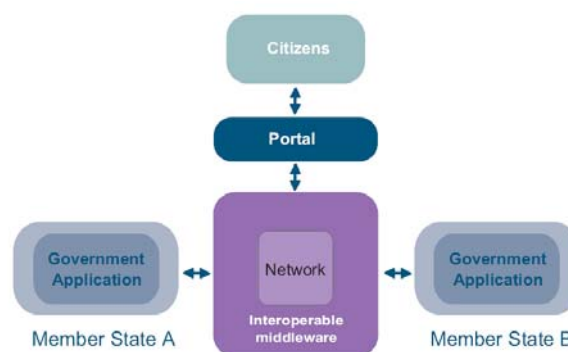


Figure 7-6: Interaction through a portal

EIF version 1.0 end up in the following general approach: When implementing a national interoperability framework the emphasis is obviously on “interoperability”. Standardisation in technology and harmonisation in legislation are just two ways to achieve this. Other recommendations are:

- Use open standards.
- Incorporate existing standards in a larger context.
- Stimulate re-use of proven standards.

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- Redesign administrative processes and make the best use of the available technology. This is also an opportunity to make services more user-centred.
- Keep administrative systems independent of proprietary technology.
- Coordinate and manage the eGovernment initiative.
- Centrally agreed XML schemas may be provided free of charge throughout the public sector. This form of re-use reduces cost and the need to develop separate mechanisms for interchanging data.
- Keep track of developments in the wider community. For instance, changes in privacy legislation may impose requirements to the provision of some eServices.
- Reduce the amount of data to be collected by using well-defined data dictionaries and data structures.
- Ensure information security by preventing unauthorised access to systems and, in the case of highly confidential information, securing each record (or even each component) individually.
- Enable wide access (user-friendly interfaces, access for the disabled, foreign language support, etc.).

The interoperability framework is now under revision. The Gartner Inc. has been contracted to make a report and recommendations for such a revision. The final report is on <http://ec.europa.eu/idabc/en/document/6227> and direct link to the report is <http://ec.europa.eu/idabc/servlets/Doc?id=29727>). The EIF version 2.0 is still under work. eGovernment activities are relevant for interoperability and horizontal services and harmonization of INSPIRE services with EIF should be a long term ambition.

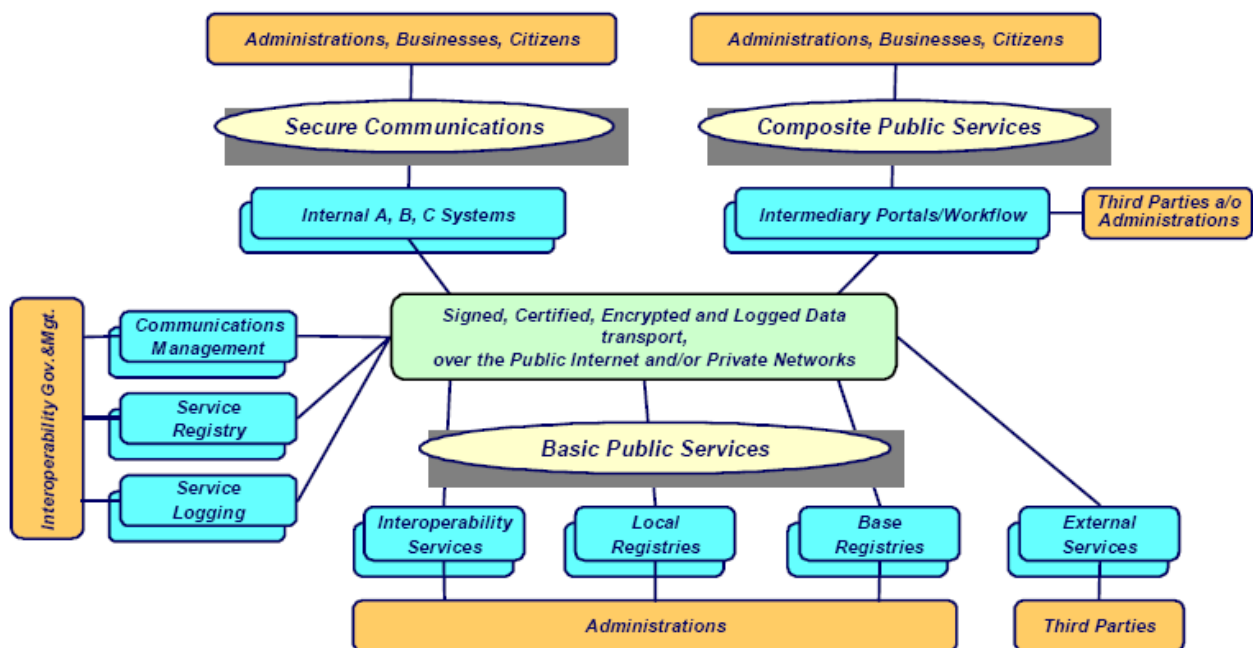


Figure 7.7 National eGovernment Services Framework according to Gartner report

The national eGovernment services framework corresponds to the MS infrastructure. We find the same elements as in the NS Architecture though possible with different names. The basic layer illustrated below, corresponds partly to our service bus with horizontal services, but includes the service registry. The service registry allows the Bind part of the Publish-Find-Bind pattern.

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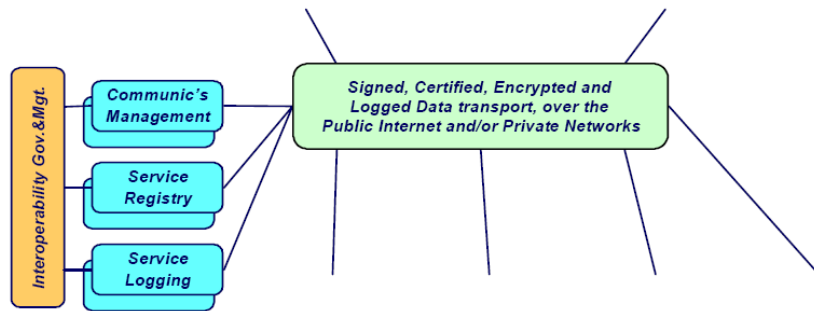


Figure 7.8 Network management and services

INSPIRE services like discovery, view, download and transformation correspond to the basic services illustrated below.

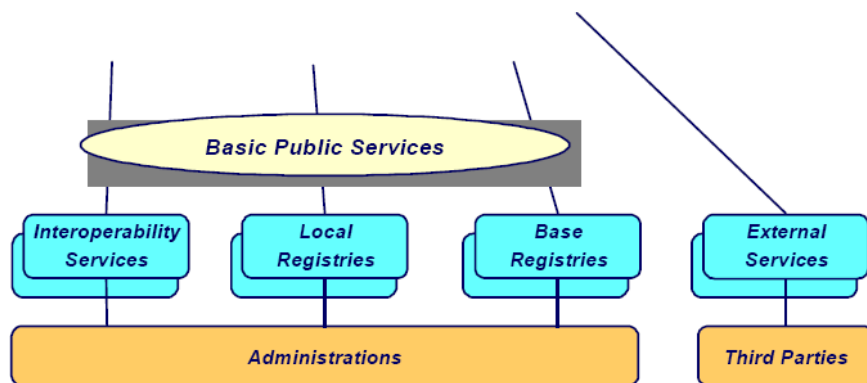


Figure 7.9 Basic services delivered by MS

The external services illustrated at the right hand side, can correspond to the INSPIRE requirement of allowing third parties to register their INSPIRE compliant data and services to the infrastructure. Finally, we can illustrate the invoke spatial services in the generic eGovernment diagram by the below element of the whole picture.

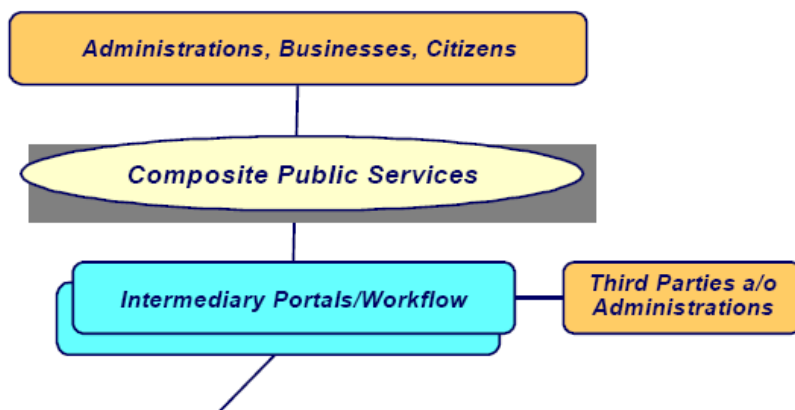


Figure 7.10 Composite services delivered by MS

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The importance of being able to relate the INSPIRE architecture to the generic eGovernment architecture is that this allows reuse of standards and solutions developed for the general ICT world. It is also a prerequisite if we want integration between the geospatial infrastructure and eGovernment architecture in general. The above description indicates that the proposed INSPIRE Network Services is well aligned with the ongoing work on the new European Interoperability Framework.

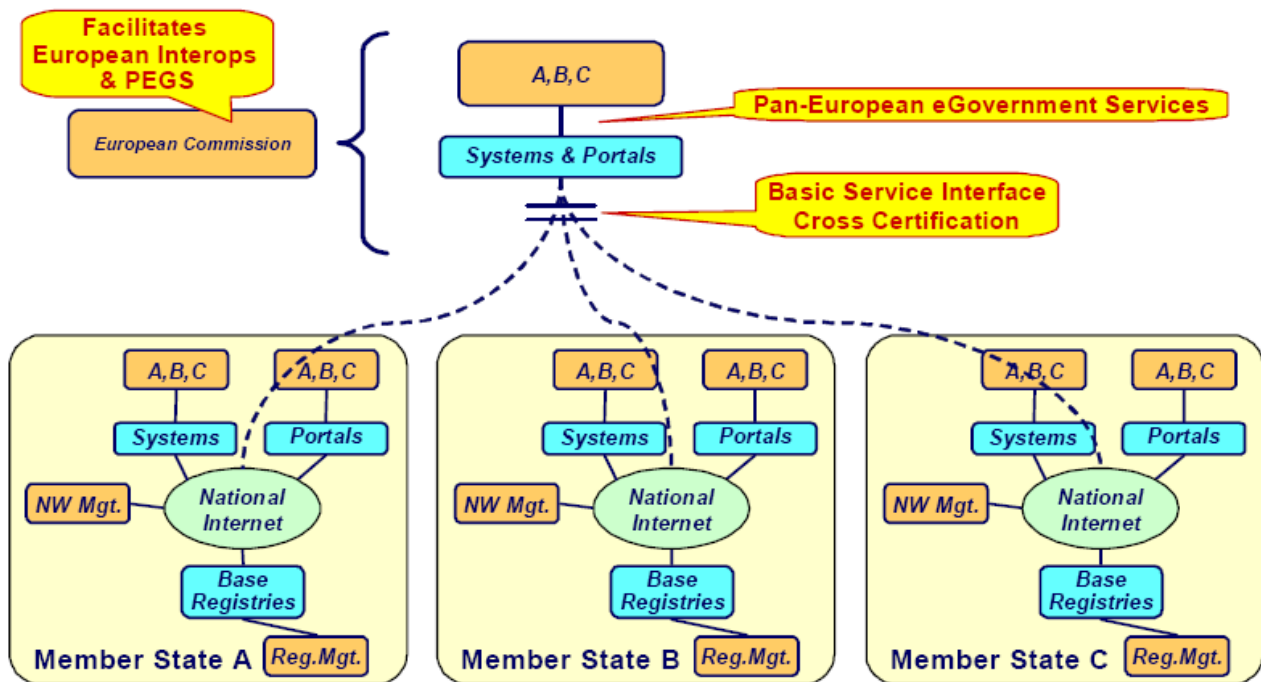


Figure 7.11 Pan-European eGovernment Services Framework as composed of national frameworks according to proposed EIF 2.0 (PEGS = Pan-EuropeanGovernment Services)

7.2 Right Management (RM)

INSPIRE rights management services are introduced to manage different kinds of rights (legal, business contracts, access keys) between an application (e.g. a Geoportal) and the INSPIRE infrastructure if needed. Electronic contracting is requested by the INSPIRE Directive to lower the interaction threshold (see article 14 and other). Rights management service functions allow controlling access to INSPIRE services and to define terms and condition under which access will be granted.

The negotiation of terms and conditions between consumer and provider of INSPIRE services needs to happen prior to the “bind” phase. Therefore the basic process pattern “publish-find-bind” is enhanced to with an “agree” phase, which refers to geo rights management (see figure 7-13) in the case if rights management is needed. If not yet contracted resources are tried to be accessed, the user and its application is transferred to the find or agree phase via an exception.

User/Customer

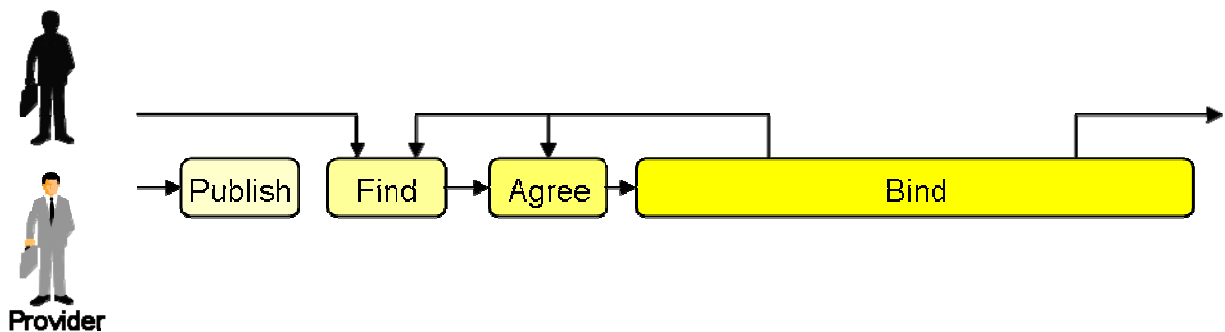


Figure 7-12: Publish-find-agree-bind process phases

The access control functions of the rights management layer are independent of a dedicated INSPIRE service type and therefore applicable to all. The rights management layer is conceptually passed for every INSPIRE service access where rights management is required. As an underlying concept it is assumed that an INSPIRE service request (possibly enhanced with further data like license or identity information coded in a rightsManagementKey) is passed through a series of rights management functionalities. Rights management functionalities may act according to the underlying policies using the rights management information to control the communication and/or trigger additional workflows.. In the non rights managed case, no specific rights management layer is needed at all.

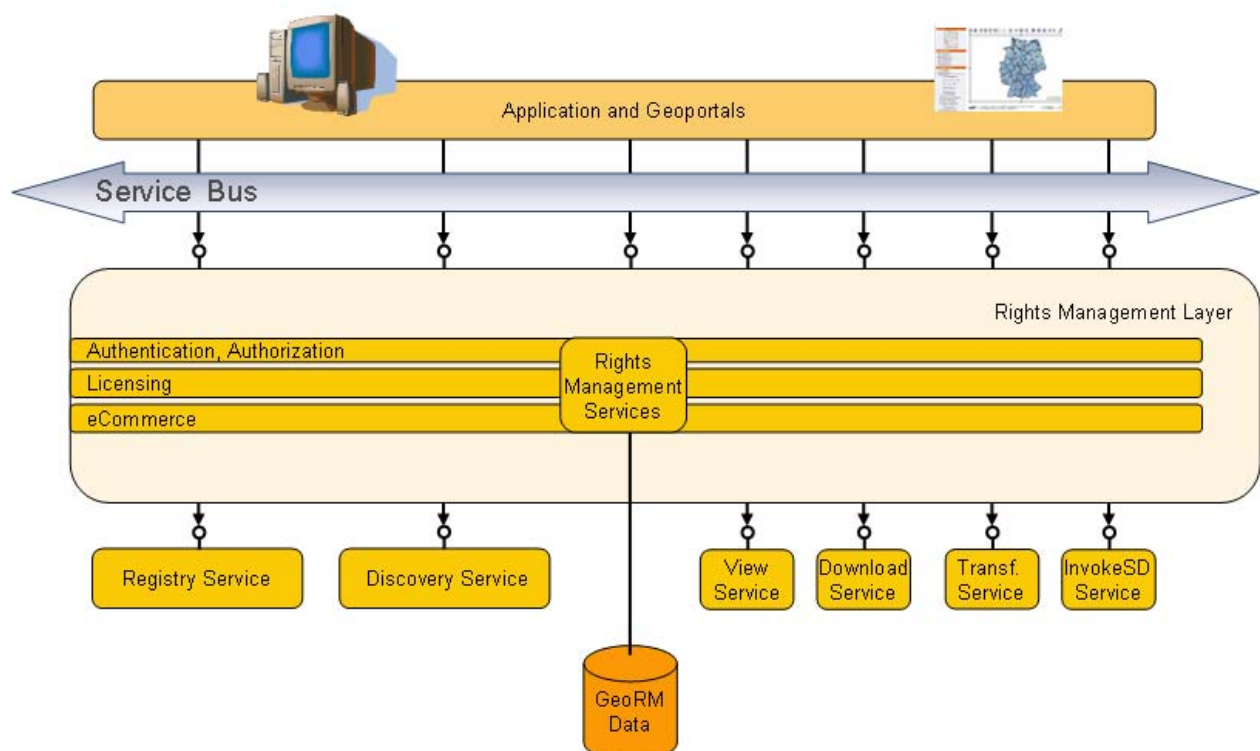


Figure 7-13: Embedding architecture for INSPIRE Services

The rights management services support INSPIRE services in the infrastructure, just only a rightsManagementKey has to be provided. Such a rightsManagementKey is attached to the SOAP header of the communication if required as shown in the following example:

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```

<soapenv:Envelope xmlns:soapenv=...>
  <soapenv:Header>
    <inspire:rightsManagement xmlns:inspire="http://..."
      soapenv:mustUnderstand="1">
      <rightsManagementKey>...</rightsManagementKey>
    </inspire:rightsManagement>
  </soapenv:Header>
  <soapenv:Body>
    // service call
  </soapenv:Body>
</soapenv:Envelope>

```

In an enhanced case all establishment and maintenance functions can be supported. Figure 7-13 illustrates the relationships between Application layer, Service Bus, rights management layer with rights management services supporting e.g. authentication, authorization, license management and possibly eCommerce. It is important to note that in the INSPIRE infrastructure every service provider is responsible for the rights management integration on its own. No communication between rights management services is needed and therefore there is no need for a specific Network Service Specification for these services. The rightsManagementKey however can be populated to transport additional information that will allow rights management enablement in an interoperable manner.

7.3 Multilingual aspects

The treatment of multilingualism is an issue for a number of aspects of the network services e.g. for metadata, legends, layer names, results of information requests that offer textual results, map content and service exceptions.

Having multilingual documents is mainly helpful to implement the client applications (the back-end); it is not required for the programming interfaces. Clearly, end users generally prefer to read documents and use applications in their native language. For the programming interface point of view most of the multilingual fields are not relevant. The way multilingualism is treated and realised is hidden from the client, for example the backend can handle multilingual documents but also other implementations are possible.

For all INSPIRE network services the operation providing the service metadata should return a list of the supported languages for the requested service. For every INSPIRE network service a mandatory parameter LANGUAGE is introduced which defines the client's preferred language. The response documents are returned in this preferred language if it is supported. If there is no support for the requested language, the documents are returned in the service default language (generally the Member State language being one of the official 23 European languages). However in following the European Interoperability Framework (EIF, see chapter 7.1) services should at least support parts of the service responses to be provided in English. To identify the different languages a language code list is provided.

For all INSPIRE network services the error messages (exceptions) are either expressed in the service's default language (suppose that the request is wrong and the LANGUAGE parameter has not been interpreted before issuing the error/exception text) or in the preferred (requested) language in other cases.

7.4 Quality of Service Requirements

The INSPIRE Directive asks Member States in article 16 (a) that "the services of the network should work in accordance with commonly agreed specifications and minimum performance criteria in order to ensure the interoperability of the infrastructures established by the Member States." To define these minimum performance criteria Quality of Service (QoS) requirements are introduced for network services. The number of defined criteria is minimal as well as the measures associated to the criteria are minimal.

The following table provides the proposed Quality of Service requirements for the INSPIRE Network Services:

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Quality of Service Requirement	Definition
Performance criteria	
<i>Performance</i>	The performance of an INSPIRE service represents the service response time, which must be kept for the given capacity. A service request is understood as a single call to a single operation of an INSPIRE service. Response time is the time measured on the server, in which the service operation returned the first byte of the result.
<i>Capacity</i>	The capacity of an INSPIRE service is given by a number of service request which are sent in a also given time frame. Then the performance indicator has to be met for every individual service response.
Service maintenance criteria	
<i>Availability</i>	The availability of an INSPIRE service is the probability that the system is up and running.
<i>Reliability</i>	The reliability of an INSPIRE service represents the ability of a web service to perform its required functions under stated conditions for a specified time interval.
Other QoS criteria	
<i>Security</i>	The security of an INSPIRE service is the quality aspect of the web service of providing confidentiality and non-repudiation by authenticating the parties involved, encrypting messages and providing access control
<i>Compliance</i>	the compliance of an INSPIRE service is the quality aspect of the Web service in conformance with the rules, the law, compliance with standards, and the established service level agreement.

Both performance and capacity indicators should be treated together. The network stress tools should be used to measure these indicators for a service. Performance indicator's values are defined by the Implementing Rules documents for every INSPIRE service. For monitoring reasons 90% of the availability is taken into account to leave out peak loads.

The availability requirement is the percentage of the year time when the service is up and running according to the capacity requirement. As an example, 99% represents 3.7 days of "out of service" per year, 99.9% represents less than 9 hours, 99.99% represents 52 minutes.

The reliability criterion is the effectiveness of an INSPIRE service response with regard to both INSPIRE IRs and Quality of Service. As an example, receiving a map for a given EU region with the right portrayal and the right response time is not sufficient. The map has also to be the real, updated and relevant map.

The security criterion is a more general IT requirement. Any e-commerce service has to comply with a minimum set of requirements making the transaction sure enough for both vendors and clients. As such, it is highly recommended to make external audits of the service.

The compliance criterion defines whether the service is compliant with INSPIRE Implementing Rules. The compliance is checked based on the following sub-criteria:

- the service version,
- existence of the mandatory operations,
- correct handling of the mandatory parameters of operations,
- correct format and versions (when applicable) of the results returned by the mandatory operations,
- compliance with INSPIRE data models for themes defined by the directive annexes.

Performance and Capacity indicators should be measured by the network stress tools at MS servers' level.

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Availability of the service (and its operations) can be monitored either by the network tools or by the service itself (in a form of log), which must be accessible by the INSPIRE monitoring measures. These measurements will be useful for monitoring levels of service, and may be useful for indicating potential problems.

Further definition of the monitoring features is out of scope of this document. It is defined by the “INSPIRE Monitoring and Reporting Implementing Rule”.

The reliability and compliance indicators are checked by the reference test suite.

The definition of what is the tests suite is out of the scope of this document.

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Annex A: INSPIRE Services using the GeoRM Framework

The INSPIRE Architecture specifies a rights management layer which provides the overall workflow control, consisting of authentication, authorisation, pricing and billing etc. This capability is needed by the INSPIRE directive to allow the INSPIRE network services to invoke e-commerce services [Ref: INSPIRE Directive Recital (17), Article 14(2), 14(4)].

In this section, we will reference the OGC Abstract Specification - [Topic 18 - Geospatial Digital Rights Management Reference Model \(GeoDRM RM\)](#) and understand how the INSPIRE Services could make use of the GeoRM Framework to implement key functionality of the rights management layer. The term GeoDRM was used in the OGC prior the renaming to GeoRM in April 2007. The renaming expresses that GeoRM has a broader scope than DRM.

Managing and Protecting Intellectual Property

The INSPIRE Directive does not affect the existence or ownership of public authorities' intellectual property rights. One of the key challenges for the successful implementation of INSPIRE will be simultaneously encouraging the wider sharing of spatial data and services while recognising the intellectual property rights of those public authorities.

Currently the main instrument used to protect intellectual property is a paper-based licence agreement which normally needs to be manually negotiated and agreed between the public authorities. The INSPIRE Directive [Ref: Recital (22)] notes that *"access can be hindered if it depends on individual ad hoc negotiations between public authorities every time access is required"*.

Geo Rights Management is a complementary instrument which will allow public authorities to electronically specify licence terms and conditions in such a way which supports the automated transfer of legal rights to use the spatial data or service.

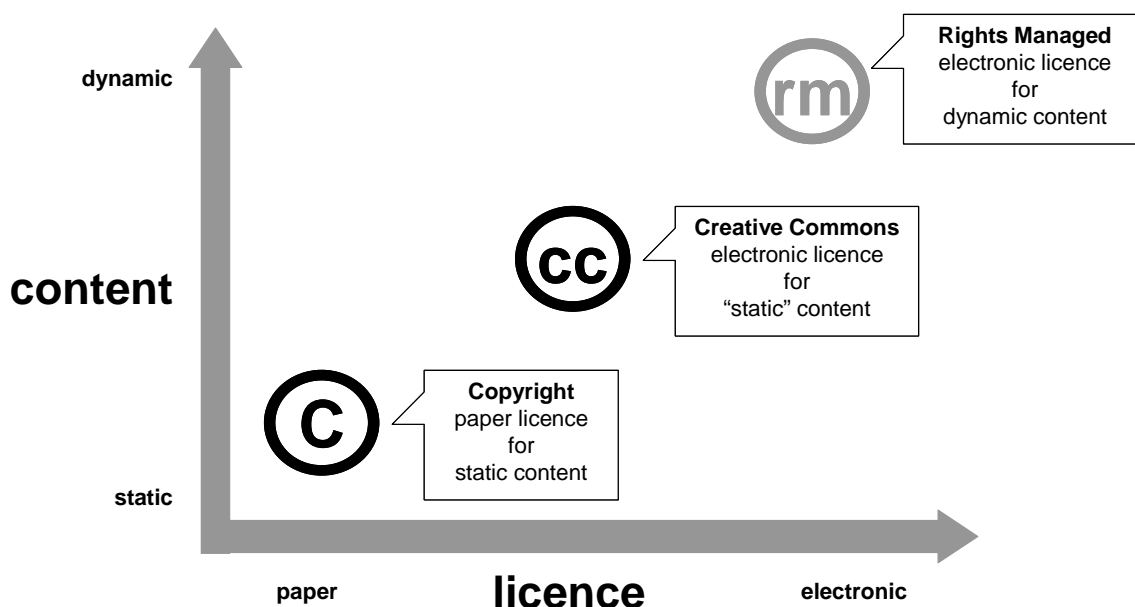


Figure A-1: Frontiers of Right Management

Figure A-1 above shows different techniques for managing and protecting intellectual property rights drawn against two axes: content, where content ranges from static to dynamic; and licence, where the licence is either paper based or electronically implemented.

Copyright © is the traditional method of protecting relatively static content often backed up with some form of paper licence. Creative Commons (cc) (<http://creativecommons.org>) is an initiative on the Internet which allows content owners to selectively release rights for the reuse of their intellectual property in a more

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standardised way.

What is currently beyond the state-of-the-art is a mechanism to automate the electronic licensing of dynamic content. On the figure above this is represented as the “rm” – rights managed symbol within the grey circle.

GeoRM Vision - Automating Rights Management

OGC formed a GeoRM Working Group with the mission “*coordinate and mature the development and validation of work being done on digital rights management for the geospatial community*”. The key output from the group is the OGC Abstract Specification - [Topic 18 - Geospatial Digital Rights Management Reference Model \(GeoDRM RM\)](#)

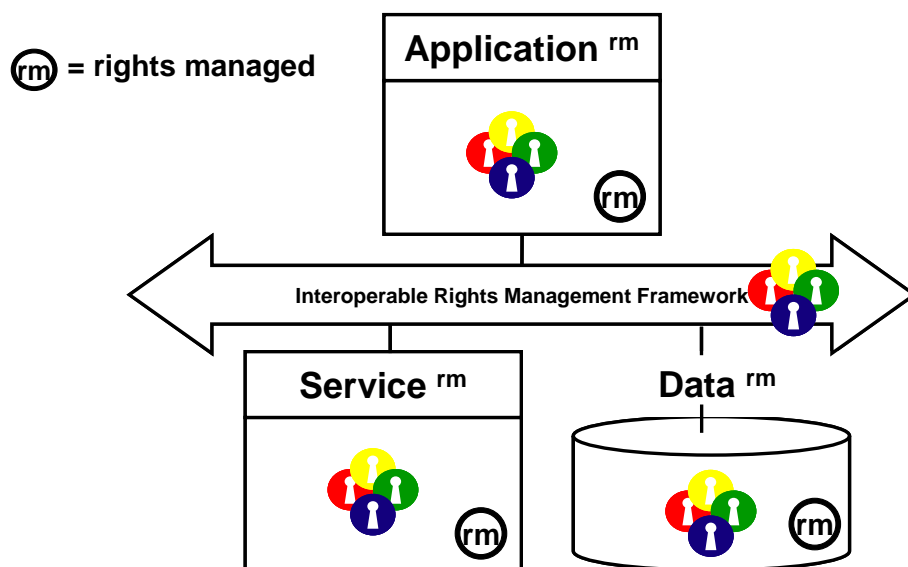


Figure A-2: Interoperable Rights Managed Framework

The vision of the GeoRM Working Group is to create an “Interoperable Right Managed Framework”. Owners of rights managed spatial data^{rm} and rights managed services^{rm} may publish content using an electronic licence, which may then be consumed by rights managed applications^{rm}. Automating rights management will reduced the practical time and costs associated with managing rights only using traditional paper-based methods.

Cultural Conventions for Data Sharing

One aspect which makes automated rights management so challenging is that the social and cultural conventions for sharing digital property have not yet been fully established.

To illustrate this point consider the social conventions we have established to access physical property. If you want go into a private home or office, social convention and the law require you to have permission. Similarly, when you go into a public building such as a public library or art gallery you know you are subject to an implicit set of terms and conditions. Finally, if you enter a commercial cinema or theatre you know that the terms and conditions will require you to pay to go in.

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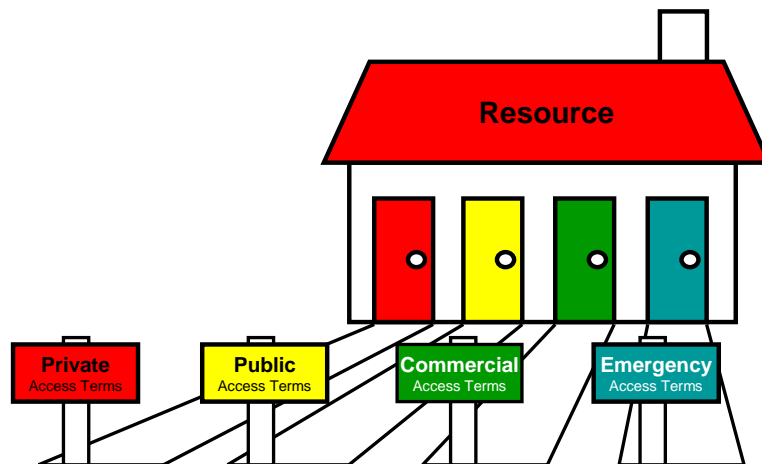


Figure A-3: Access Terms – in the digital world

One challenge we face in implementing INSPIRE is to allow public authorities to provide access to a given resource under different terms depending on what the content is going to be used for. For example, a member state could provide public access to a view service for free – provided it is for non-commercial purposes. However, if the content will be used for a commercial purpose – then the content will need to be accessed under commercial access terms.

Geospatial Digital Rights Management Reference Model

The key output from the GeoRM (former GeoDRM) Working Group is the OGC Abstract Specification - [Topic 18 - Geospatial Digital Rights Management Reference Model \(GeoDRM RM\)](#).

It is a standard that specifies a *policy* and *technology* neutral framework for the electronic licensing of spatial data and services. It defines:

- “A conceptual model for digital rights management of geospatial resources, providing a framework and reference for more detailed specification in this area.
- A metadata model for the expression of rights that associate users to the acts that they can perform against a particular geospatial resource, and associated information used in the enforcement and granting of those rights, such as owner metadata, available rights and issuer of those rights.
- Requirements that are placed on rights management systems for the enforcement of those rights. A rights management system must be necessary and sufficient: it must implement only those restrictions necessary to enforce the rights defined therein, and it must be sufficient to enforce those rights.
- How this is to work conceptually in the larger DRM context to assure the ubiquity of geospatial resources in the general services market. “

The standard is specifically designed to enable the electronic licensing of spatial data and services and is a natural candidate to enable the managed sharing of data within a network of INSPIRE services. It defines the concept of a GeoLicensing Community – “characterized as a domain of participants (licensor, licensee, licence broker, service provider, etc.) that communicate to each other for the purpose of exchanging licensed geospatial data”. We can consider the whole community of Member State public authorities and the European Commission as a kind of GeoLicensing Community.

Mapping INSPIRE Services to GeoRM Usage Scenarios

This section references the GeoRM Usage Scenarios as documented in Annex C of the standard. It defines a set of generalised usage scenarios for access to content from a single provider, overlaying or joining content from multiple providers and creating derived products. In this section, we will envisage potential usage scenarios in INSPIRE, expressed using INSPIRE terms. These may then be mapped to the more generalised scenarios as defined in the GeoRM standard.

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First, in order to make scenarios more concrete they have been mapped to INSPIRE service types and INSPIRE themes. Second, for the purposes of the example scenario we will assume that there are agreed, standardised set of INSPIRE access terms and conditions which can be encoded as an electronic licence:

- Private Access Terms: INSPIRE service can be accessed but the spatial data can not be redistributed.
- Public Access Terms: INSPIRE service can be accessed and spatial data redistributed for non-commercial purposes.
- Commercial Access Terms: INSPIRE service can be accessed under specific commercial terms.
- Emergency Access Terms: INSPIRE service can be accessed in an emergency situation – subject to access logging.

Scenario 1: INSPIRE Application accesses Public Authority discovery service

A public authority maintains a spatial dataset of Geographic Names for its administrative area. It provides public access to the discovery service, but requires that the geographic names are provided on the view service under private access terms and on the download service under commercial access terms. In the case of an emergency situation the Public Authority will provide access under emergency access terms to the Transform Service.

A publicly accessible INSPIRE Application has been implemented to discover Geographic Name services over a specified geographical area.

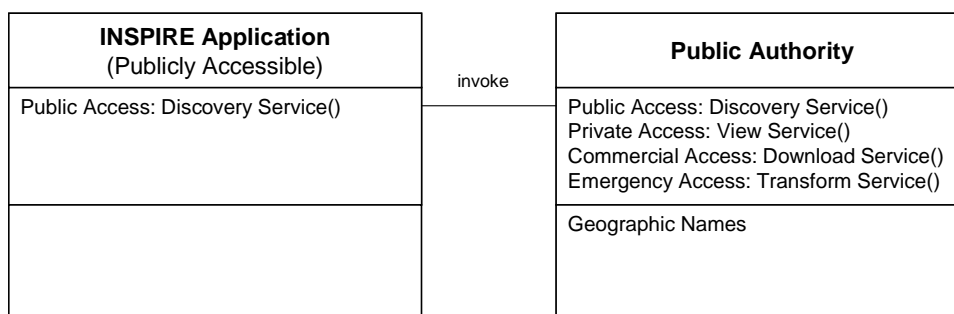


Figure A-4: INSPIRE Application accesses Public Authority Services

The Public Authority manages access to its services using electronic licenses based on the standardised INSPIRE terms. The GeoRM framework manages the creation and enforcement of the licensing terms which ensures that the INSPIRE application is able to invoke the publicly accessible discovery service. However, access would not be allowed to the private view service, commercial download service or emergency transform service.

Scenario 2: Member State Portal provides public view service for protected sites

A Member State Portal needs to provide a public view service for protected sites at a national level. Separate protected sites datasets are maintained by Public Authority A and Public Authority B.

Public Authority A provides a public and a privately accessible view service to its protected sites dataset. The privately accessible view service provides additional information that Public Authority A does not want to be publicly available. Public Authority B provides only a publicly accessible view service to its protected site dataset.

The Member State portal chooses to implement its view service as a publicly accessible service at a national level, based on the public view services to the protected site data provided by Public Authority A and Public

Authority B.

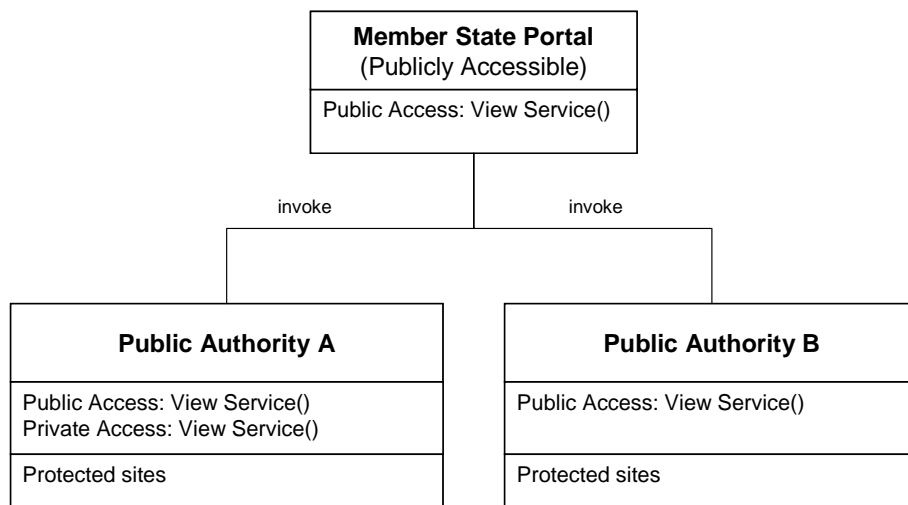


Figure A-5: Member State Portal provides public view service for protected sites

Each Public Authority manages access to its view services using electronic licenses based on standard INSPIRE access terms. The GeoRM framework manages the creation and enforcement of licensing terms which ensures that only the publicly accessible view services may be invoked by the Member State portal. However, similarly the GeoRM framework ensures that the privately accessible view service provided by Public Authority A may not be invoked.

Scenario 3: INSPIRE Geoportal provides private download service for cadastral parcels

The INSPIRE Geoportal needs to implement a private download service which can only be invoked by registered users of the INSPIRE Geoportal.

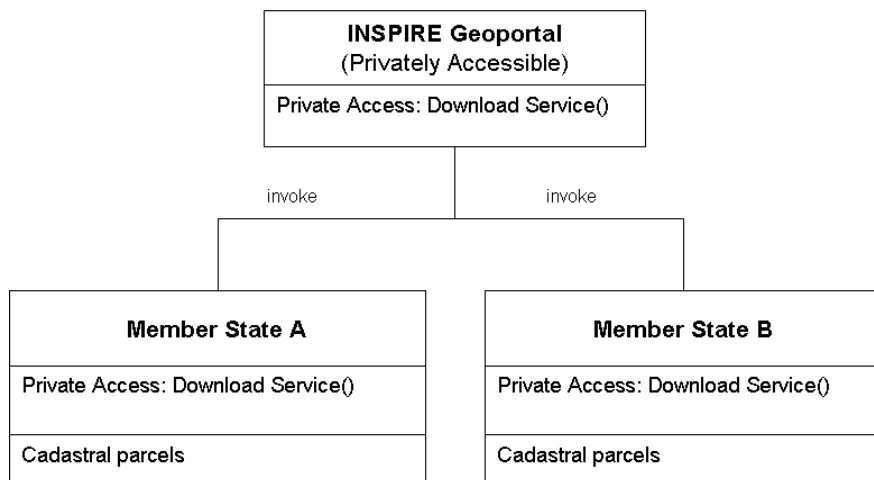


Figure A-6: INSPIRE Geoportal provides private download service for cadastral parcels

Cadastral parcel datasets are maintained by Member State A and Member State B. Each Member State provides a privately accessible download service to the Cadastral dataset. The GeoRM framework manages the creation and enforcement of the licensing terms to ensure that the Member State download services are accessed under private terms and conditions.

Scenario 4: INSPIRE Geoportal implements download service for private and commercial address data

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In this scenario the INSPIRE Geoportal implements a private access download service for addresses. Member State A provides access to its address data via a private download service. Member State B provides access under commercial terms to its address download service.

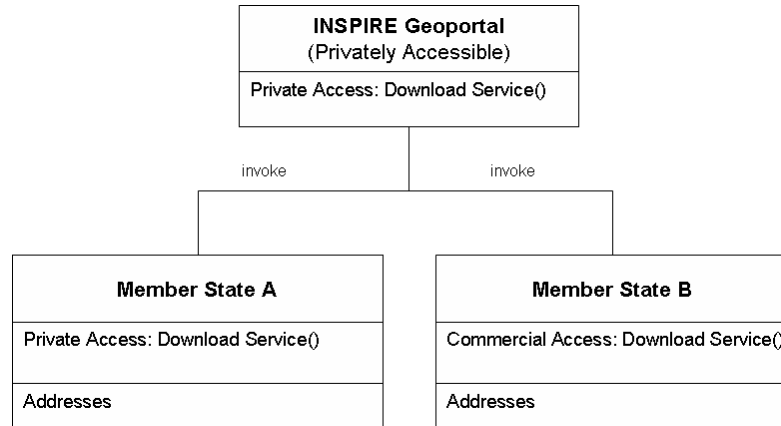


Figure A-7: INSPIRE Geoportal implements download service for private and commercial address data

The GeoRM framework ensures that addresses provided by Member State A can be combined with the addresses for from Member State B and that the commercial terms allow the private download via the INSPIRE Geoportal.

Scenario 5: Emergency Management application accesses Member State transport network

This is a special case scenario to handle the situation where there is not an existing private, public or commercial electronic licence in place and a genuine emergency situation occurs. Member State A and Member State B maintain a national level transport network. In order to cope with a genuine emergency situation where this information could be life-critical, both member states have made provision for the transport network to be access under emergency access terms.

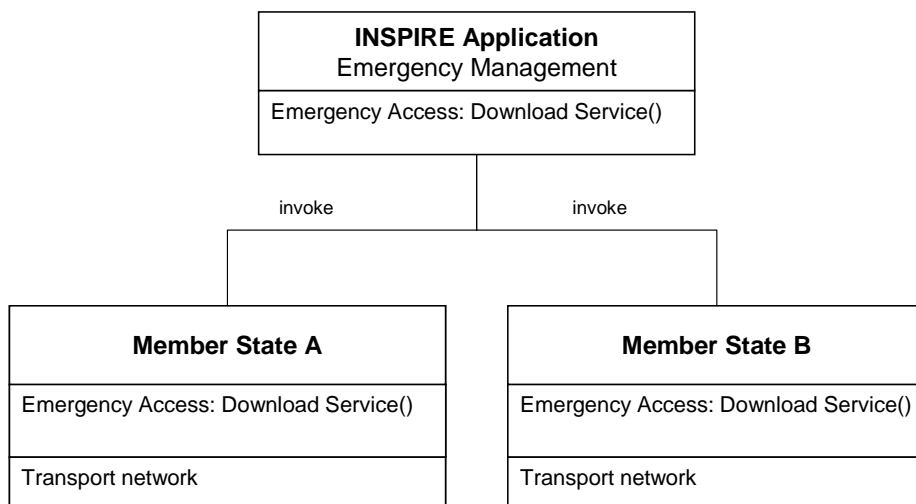


Figure A-8: Emergency Management application accesses Member State transport network

An INSPIRE conformant Emergency Management application requires emergency access to a cross-border Transport network. The application has discovered that there is a transport network download service available from Member State A and Member State B.

However, there is no pre-existing electronic licence granting access to these services. As it is a genuine emergency situation, the operator “breaks-the-glass” and is allowed access by both Member State A and

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Member State B Transport network. The terms of the emergency licence provide for access to the service – with all accesses logged and audited and later verified by the Member State to ensure it was a genuine emergency situation.