

The MAPS Initiative: Gateway to Minerals-Related Spatial Data

**Eamonn Doyle, Liam Kidd, Wayne Cox and Piers Gardiner
Department of Communications, Marine & Natural Resources**

Abstract

In early 2001 the then Department of the Marine and Natural Resources established its Implementation Plan for the provision of ePublic Services to clients and citizens, in accordance with the Action Plan of the Information Society. The work of the Exploration and Mining Division (EMD) was selected as a key pilot project designed to develop an integrated system with GIS functionality for the management of its activities, which could then be generically applied across the Department. EMD was chosen because much of its work dealt with licencing and had major involvement with geographical data, a situation common to other sectors in the Department. Furthermore, and relatively unusual in Government Departments, the Division was heavily engaged in promoting inward investment in mineral exploration as part of its mandate. With the minerals industry being a largely international IT literate target client base, availability of all data digitally was seen as vital to stimulate exploration interest in Ireland.

This project, termed the MAPS (Mineral Administration Programme Support) Initiative, was designed to give the industry internet access for the first time to:

- Conduct their licencing business online, including payments
- Access a wide range of relevant spatial data (including exploration licence areas, base maps, environmentally restricted areas, geology maps, drill holes, historic mines, mineral deposits, airborne geophysics and forestry coverage)
- Download maps, reports and all other available exploration data to help assess ground for mineral potential

A number of key business requirements for the web-enabled MAPS solution were needed to provide maximum client benefit and put Ireland in the fore-front of competitor countries in delivering product. These included fast downloading of raster and spatial data, maximum screen size for maps, interlinked availability of a wide range of themes, and ease and simplicity of use.

Solutions to these requirements have been determined in the initial phase of the project, which is being delivered in collaboration with Fujitsu Consulting. The first phase is being currently evaluated by selected clients on extranet, with the intention that the site will go live in a limited form by November 2002.

The technical architecture and GIS solutions for the MAPS Initiative are the foundations for the progressive roll-out of similar projects for other sectors in what is now the Department of Communications, Marine and Natural Resources. This presentation will focus on the following issues:

- The Exploration and Mining Division's GIS requirements and solutions
- The technologies employed and the technical architecture underpinning the MAPS project

Table of Contents

1.	Introduction	3
1.1	Context	3
1.2	Exploration & Mining Division	3
1.3	The MAPS Initiative	4
1.4	MAPS Services	4
2.	EMD GIS Requirement	5
2.1	Prospecting Licence Areas	5
2.2	Reference Data	5
2.3	Constraints	6
2.4	Surrendered Data	6
2.5	Application of GIS	6
2.6	Proposed Solution	7
3.	Delivery Architecture	7
3.1	Technical Environment	7
3.2	Multi Tier Architecture	8
3.3	GIS Architecture	9
4.	Conclusions	10

Introduction

1.1 Context

In early 2001 the then Department of Marine and Natural Resources established its Implementation Plan for the provision of ePublic Services to clients and citizens, in accordance with the Action Plan of the Information Society. The Implementation Plan was backed up by an eServices Strategy document which catalogued the services provided by the Department and detailed the information requirements of each service. Amongst the 17 services provided by the Department some 10 services were identified as having a dependence on map based information. Other common requirements included database, document management and workflow requirements.

The Department's IS Division has put in place a programme to address the provision of services as described in the eServices Strategy document. This programme is ambitious, as it must satisfy the key business requirements across the Department's diverse range of services whilst at the same time establishing a solid architectural, infrastructural and technical base for the provision of these services to both internal and external customers.

Within the programme a number of projects are currently running:

- A Corporate Data Model project to define the key informational requirements of the Department in terms of both core Department and Divisional sectoral data models and also to define the stewardship of that data as services are rolled out.
- An Architecture project to define and document an Enterprise Architecture for the Department and to deliver common components of that Architecture which can then be reused across multiple initiatives.
- A Systems Analysis project to define requirements to Request for Tender (RFT) stage for services to prioritised business initiatives.
- The MAPS Initiative, a pilot project the primary objective of which is to satisfy the business (including online) and promotional requirements of the Exploration and Mining Division of the Department. A secondary objective was to validate key aspects of Enterprise Architecture for licencing and GIS requirements for the Department as a whole.

1.2 Exploration & Mining Division

The work of the Exploration and Mining Division (EMD) of the Department was selected as a pilot project to spearhead the Department's Implementation Plan for the provision of ePublic Services.

The Division regulates and promotes two related areas of the Minerals Industry: Exploration and Mining. While the exploration sector is small in a world-wide context with some €8-10 million a year being spent in Ireland at present, it is nevertheless of fundamental importance if new economic deposits are to be found. Ireland is facing intense competition both from other European countries and globally for inwards minerals investment.

There is also increasing pressure from conservation and environmental lobbies seeking ever more stringent controls on mining developments in the EU which are inevitably on green field sites. It is therefore vital that in promoting and regulating the sector through the Minerals Development Acts that the Department insists on and fosters sustainable environmentally responsible mining including the rehabilitation of sites.

EMD's key business objectives are:

- To maximise the level of minerals exploration by marketing Ireland's potential to attract national and international investment
- To collect fees for prospecting licences and negotiate equitable contracts with developers
- To foster and regulate the minerals sector so that it operates in accordance with the environmental, social and economic pillars of sustainable development

- To gather and analyse intelligence on the exploration and mining industry nationally and internationally, to inform policy / decision-making.
- To formulate national minerals policy proposals and influence policy at international level so as to promote the interests of the State
- To implement Departmental policy in relation to customer service to ensure that a top class service is provided to customers.

1.3 The MAPS Initiative

The objectives of the MAPS (Mineral Administration Programme Support) Initiative are to:

- e-Enable the EMD business process with respect to licensing both exploration and mining by the provision of a browser based, workflow enabled system. This system will be utilised by both EMD staff on the Department's Intranet, and external applicants via and the Internet.
- g-Enable the EMD business process for both internal and external users by the provision of a series of Map Services pertinent to the business process.
- Validate key aspects of the Department's Enterprise Architecture by the provision of components, which can then be reused in other Departmental IT initiatives.

EMD was chosen as the business area in which to conduct a pilot project because its services had a number of features, which are in common with other Departmental business areas catalogued in the eServices Strategy document, namely:

- EMD is involved in the issue of licences to external applicants
- The EMD licence application process is heavily dependant on map based data
- EMD has a requirement for the provision of online services including application, fee payment, spatial data visualization, access to and download of documents.

Furthermore the minerals industry is an IT literate target client on which to validate the provision of eServices. As a significant added benefit, the Initiative would be a major asset in promoting exploration investment in Ireland by providing online permitting facilities and access to all required data for assessing the potential of exploration ground. The Division is unusual in that a significant part of its work is promotional.

1.4 MAPS Services

The MAPS system is a fully eEnabled and gEnabled system which provides services to both internal and external clients via a browser based interface.

For the external user MAPS is designed to provide:

- An industry focused website
- Online application for exploration licences
- Online payment of application fees
- Map visualization of the location, status and geology of any licence areas as well as any environmental constraints that might inhibit exploration
- Serve a range of available geological, geophysical and exploration data.

For the internal user, MAPS provides:

- A browser based, workflow enabled system to process exploration licence applications from application to surrender

- Electronic access to all documentation submitted by current and previous holders for all licence areas, including exploration data.
- Map visualization of all spatial data pertinent to the submitted application

MAPS Services are currently available to internal users and are being piloted with a selected set of external clients in the industry.

2. EMD GIS Requirement

The rationale why EMD was chosen as the initial pilot project to prove aspects of the overall Departmental strategy was the heavy reliance on map based information by both EMD and its clients. For example, each exploration licence application is accompanied by one or more maps and requires evaluation with respect to a number of static spatial data sources.

2.1 Prospecting Licence Areas

The primary spatial structure within which EMD operates is Prospecting Licence Area (PLA). These are the areas over which exploration licences are issued, and over the past 50 years, some 1600 areas have been defined. Each PLA covers an area of approximately 35 Km² and generally they are based on townland boundaries, although approximately 15% deviate from townland boundaries to accommodate geological requirements. These maps are based on the OSi 1:10,560 map series.

Within each individual PLA, an applicant can request and be awarded exploration rights for a wide range of different minerals. In a single Prospecting Licence Application, applicants can apply for one or more PLAs and various minerals within each PLA.

When a Prospecting Licence is awarded for certain minerals within a PLA, that licensee holds exclusive rights to explore those minerals for the duration of the licence, however another applicant may apply for any remaining mineral exploration rights within the same PLA.

The above system results in a complex set of many to one and one to many relationships between PLAs, minerals, applicants and licensees.

Some areas of the country are as yet unexplored. These areas are referred to as Open Ground and do not have PLAs defined. An applicant can apply for a licence over Open Ground, in which case EMD defines a new PLA with respect to the applicants desired areas and the relevant townland boundaries.

2.2 Reference Data

Each application for a Prospecting Licence is evaluated in exactly the same way. There is a well defined process for checking the bona fides of the applicant and also for evaluating the application on technical grounds. The technical evaluation takes place with reference to a number of map sources:

- Initially the application is checked against the current PLA map to determine the availability of the PLA(s) applied for in respect of the relevant minerals.
- The location to which the application refers dictates to which geologist it is assigned for further evaluation.
- The location to which the application refers determines the townlands in which public notices of the proposed activities must be advertised.
- The application is then assessed against Geological Survey of Ireland (GSI) maps to determine its technical merits, including geological data available from earlier exploration over the ground.
- Should the application be on Open Ground, its extent also needs to be compared with the OSi 1:10,560 townland boundary maps to determine which townlands to use to delineate the new PLA.

NOTE: In the case of mining facilities, mineral ownership must be determined on application in order to advise owners of mineral rights of the intention to exploit. Owners may then be entitled to fees and compensation in respect of the minerals extracted. The area for which a mining facility is granted is extracted from a PLA.

2.3 Constraints

One of the key business objectives of EMD is to ensure that all activities carried out under its jurisdiction are operated in accordance with the environmental, social and economic pillars of sustainable development. In the case of Prospecting Licence Applications this involves checking all applications against the latest Duchas delineation of:

- Special Areas of Conservation (SACs)
- Special Protection Areas (SPAs)
- National Parks
- Natural Heritage Areas (NHAs)
- National Monuments Register

The outcome of this check determines whether a referral to Duchas is necessary and may also constrain the activities of an exploration company. Gas pipeline routes are also checked, since exploration is not permitted in the immediate vicinity of any pipeline.

2.4 Surrendered Data

Exploration licences are granted for a finite period of time (usually six years), but can be extended or surrendered. Under the terms of the licence, licensees are required to provide EMD with any data they have gathered during their exploration activities. Data relating to licences that are surrendered, or data on current licences that is older than 6 years, may be released into the public domain to assist other prospecting companies in exploration evaluation. Such data assumes many forms including maps, documents, borehole logs and digital data sets.

2.5 Application of GIS

The requirement of EMD was to provide a single, universally accessible data store which could render spatial and location based data via browser technology to both internal and external MAPS users. It was intended that this would:

- Reduce or eliminate the dependence on paper maps
- Automate the constraints checking
- Standardise the process with respect to each application

and in doing so improve customer service by reducing the turnaround time on applications.

It was also a requirement that the application of GIS internally should provide benefits to the customers of EMD. This was to be achieved by implementing a world class industry focused website on which exploration companies could:

- Research the availability of Prospecting Licences Areas
- Evaluate the geology and mineralisation of the selected area
- Evaluate any environmental constraints which may apply to the selected area
- Access metadata and data surrendered as a result of previous exploration activities
- Apply for a Prospecting Licence online
- Pay for a Prospecting Licence online.

- Apply for renewal of licences, surrender licences and submit all required reports on current exploration to EMD.

2.6 Proposed Solution

The delivery of the MAPS Initiative was put out to commercial tender and ICL, (now Fujitsu Consulting), was awarded the contract to build the MAPS system. The Fujitsu Consulting proposal, in respect of GIS, was basically to build a series of Map Services which could be deployed internally on the Department Intranet, in fulfillment of EMD's internal requirements, but which also could be deployed on a website to support the requirements of incoming applicants.

The Map Services proposed were:

- Status: A service which published the current status of Prospecting Licences for every PLA
- Location: A service which published the OSi mapping from 1:600,000 to 1:10,560 scales for each PLA
- Geology: A service which provided the GSI 1:100,000 and EMD 1:500,000 maps of geology and mineralisation as well as providing access to borehole, geophysical and documentary data.
- Constraints: A service which published the Duchas Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Natural Heritage Areas (NHAs), National Monuments Register and National Parks.
- Gazetteer: A service which enabled rapid navigation of any other service by Townland, PLA Number, OS 6" index or County.
- Analysis: A service which reported any intersection between one or more selected PLAs and the Constraints Service.

3. Delivery Architecture

As mentioned in the introduction, an important aspect of the MAPS Initiative was to pilot the delivery of eServices for the Department. MAPS is just one of a series of initiatives which will be delivered by ISD over the coming years and it is considered fundamental that a robust Enterprise Architecture be implemented to support not just MAPS but also the ongoing delivery of services to the other Divisions.

3.1 Technical Environment

In conjunction with Fujitsu, the Department has standardized on a technical environment currently incorporating the following components:

- Oracle 9i Enterprise Edition
- Oracle 9i Application server
- Oracle Spatial
- ESRI ArcGIS 8.2
- ESRI ArcIMS 4.0
- Apache Web Server
- Windows 2000 Server

In addition a decision has been taken to develop all services within a Java II Enterprise Edition (J2EE) environment.

3.2 Multi Tier Architecture

The Technical Environment described above will be deployed in an Enterprise Architecture developed by the Department in conjunction with Fujitsu. This Enterprise Architecture is a multi-tier architecture which serves to separate the infrastructure, the data, the business logic and the delivery channel.

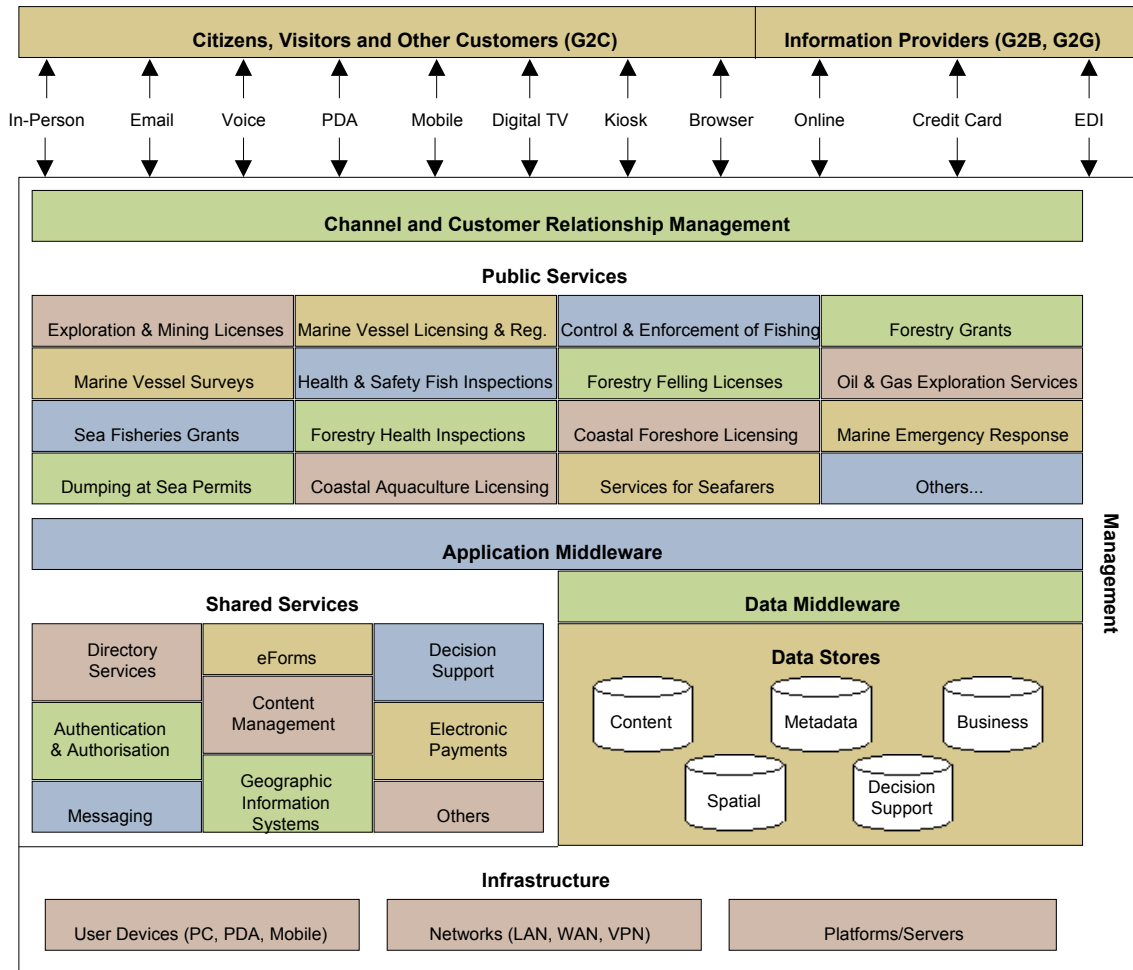


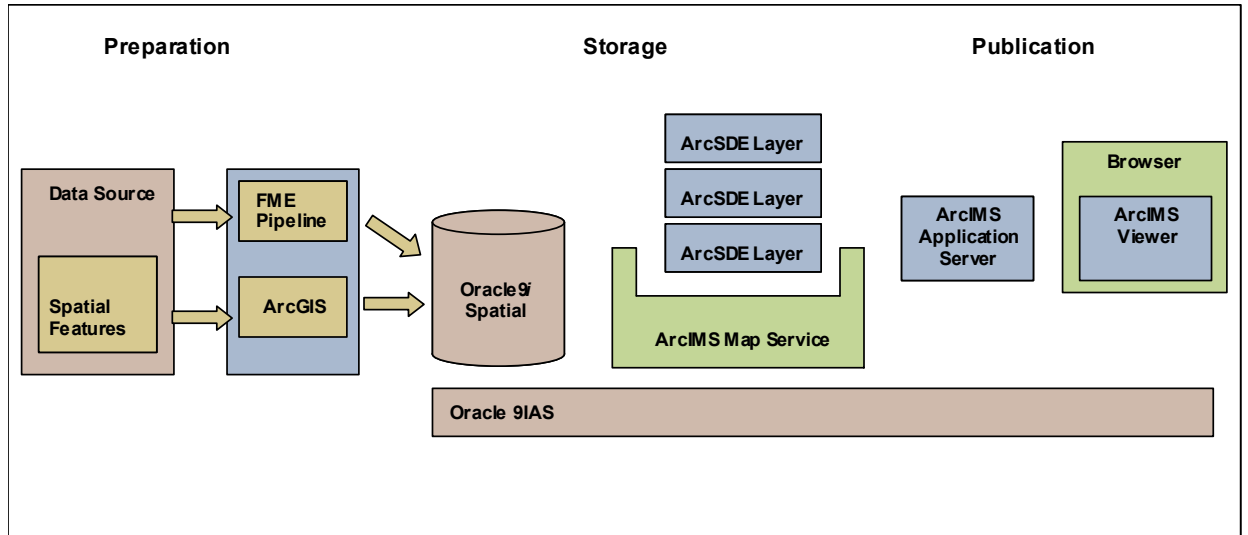
Figure 2 - Detail View of ePublic Services Conceptual Architecture

This class of architecture offers a number of important benefits to the Department:

- Services developed in conformance with J2EE design patterns can be deployed on this Enterprise Architecture and with few constraints, delivered to customers over multiple channels with appropriate security and personalisation.
- The shared services depicted in the Architecture are common to all initiatives envisaged in the delivery of eServices by the department. These shared services can be developed once as common components and deployed many times, thus reducing the development effort associated with any individual initiative.

3.3 GIS Architecture

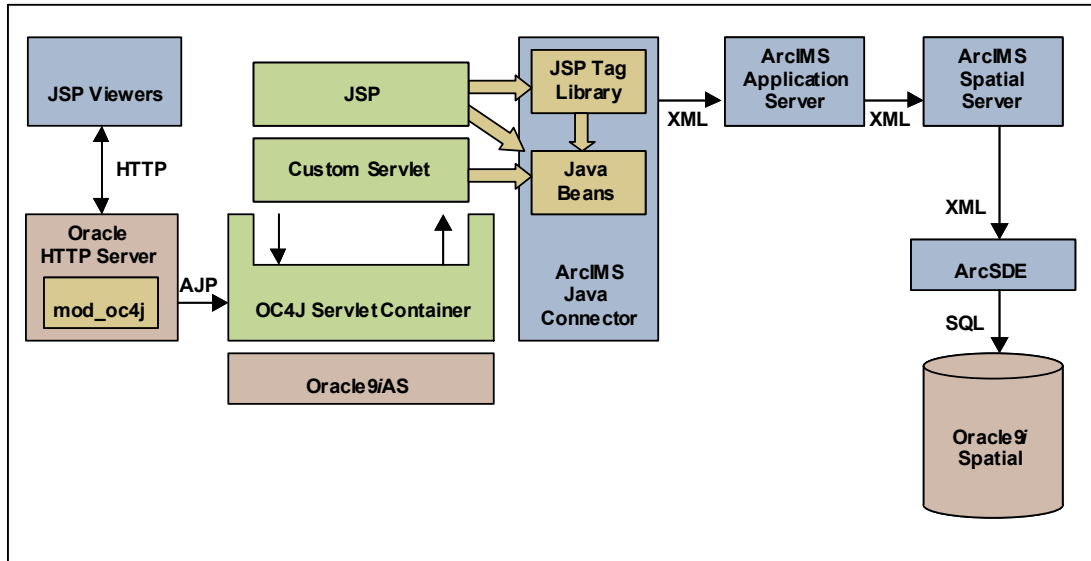
The GIS services to be deployed in support of the objectives of EMD must, of course, be delivered within this environment. The ESRI product set selected for the Department supports the J2EE environment and the diagram below illustrates the way in which the ESRI technology has been deployed.



In the previous phase of MAPS, the ESRI supplied HTML viewer was used to quickly deploy services and a custom JSP viewer was developed for Intranet deployment. The advent of ArcIMS 4.0 with a comprehensive set of Java Beans means that in the current and future phases of development, more extensive use of Java can be made. In fact Fujitsu have commenced development of a number of J2EE common components to implement the Shared Services of the Enterprise Architecture. These include a Content Management component and a GIS component. These common components can be reused by other developers in the deployment of subsequent initiatives.

The four GIS services mentioned above essentially encapsulate multiple spatial data sources into a single deployable object for publication via a web server. The development of web services is really the interface between traditional GIS skills and the development skills required to deploy J2EE or Java applications.

The definition of map services involves the preparation of the source data, combination of source data into a service and definition of how the data will be visualised.



4. Conclusions

The MAPS Initiative is at the half way stage and a number of important objectives have been realized.

- EMD have benefited from the deployment of a set of Map Services on the Departmental Intranet which obviate the need for constant referral to paper map sources.
- It has been shown that the same set of Map Services can be used to satisfy the needs of prospective applicants for Prospecting Licences using the web channel to interact with EMD.
- An online application and payment facility which is g-Enabled has been put in place.
- The Department has established a GIS architecture and set of services which can be reused across forthcoming initiatives.
- The Enterprise Architecture as a model for deployment of J2EE services has been validated.