

IMPLEMENTATION OF ENVIRONMENTAL DATA EXPLORER FOR
DEPARTMENT OF ENVIRONMENT (DOE)

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BORANG PENGESAHAN STATUS TESIS ♦

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FOR DEPARTMENT OF ENVIRONMENT

SESI PENGAJIAN: 2003/2004

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
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To my supportive family, zai, and fahim, with all my love.

To the Malaysian Government, UTM, and all CASE community, with million of
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ABSTRACT

Implementation of Environmental Data Explorer (EDE) for Department of Environment (DOE) involves the process of designing a spatial object model, configuring a Spatial Database Engine (SDE) as a gateway that facilitates managing spatial data in a database management system, create and publish metadata into Metadata Service, and use the customised Metadata Explorer to search and browse the contents of Metadata Service from a web browser. The metadata system to be developed is using an e-RAD (enhanced-Rapid Application Development) software development methodology, where it is an adaptation of the Spiral Methodology by which the software development process starts from gaining user requirements, customizing a new or a ready made available modules, and finally launching the prototype or a complete system. This project is using Java Server Pages (JSP) together with ColdFusion and Map Configuration File (AXL) to develop the Environmental Data Explorer (EDE). ESRI's ArcIMS technology was used to build a Web-based environmental data explorer to query, browse, and analyze the environmental metadata. Both ArcIMS, Cold Fusion and Java analysis tools were constructed and customised. The metadata explorer was evaluated with respect to accessibility, navigation, interactive geographic functionality, and spatial analysis functionality. There are four deliverables (some of them being customised) needed to support this project documentation, known as Software Development Plan (SDP), User Requirement and Functional Specification (URFS), and Database Design Description (DBDD); which all of them followed the software documentation standard set by the U.S. Department of Defense (DoD 2167-A) and Military (MIL-STD-498).

ABSTRAK

Implimentasi berkaitan Penjelajah Data Alam Sekitar (*Environmental Data Explorer*) untuk Jabatan Alam Sekitar (JAS) melibatkan proses merekabentuk model data spatial, menkonfigur Enjin Pangkalan Data Spatial (*Spatial Database Engine*) sebagai pelalu yang memudahkan pengurusan data spatial di dalam sistem pengurusan pangkalan data, mencipta dan menghantar metadata ke dalam Metadata Servis, dan menggunakan Penjelajah Metadata yang diubahsuai untuk mencari dan melayari kandungan Metadata Servis menggunakan pelajar web. Sistem Metadata yang ingin dibangunkan adalah menggunakan metodologi pembangunan perisian e-RAD (*enhanced-Rapid Application Development*), di mana ia adalah adaptasi daripada Metodologi *Spiral* iaitu proses pembangunan perisian bermula daripada mendapatkan keperluan pengguna, mengubahsuai modul-modul aplikasi yang sedia ada atau yang baru, dan akhirnya menghasilkan prototaip atau sistem yang lengkap. Projek ini menggunakan *Java Server Pages* (JSP) bersama dengan *Cold Fusion* dan Fail Konfigurasi Pemetaan (AXL) untuk menghasilkan Penjelajah Data Alam Sekitar (EDE). Teknologi ArcIMS daripada ESRI digunakan untuk membina Penjelajah Data Alam Sekitar berasaskan-web untuk mencari, melayari, dan menganalisa metadata alam sekitar. Kedua-dua ArcIMS, HTML dan alat analisa Java dibina dan diubahsuai. Penjelajah Metadata dinilai berdasarkan mudah-capai, navigasi, fungsi interaktiviti geografi, dan fungsi analisis spatial. Terdapat empat dokumen (beberapa daripadanya telah diadaptasi) yang diperlukan untuk projek ini iaitu Plan Pembangunan Perisian (SDP), Keperluan Pengguna dan Spesifikasi Fungsian (URFS), dan Deskripsi Rekabentuk Pangkalan Data (DBDD); yang mana semuanya berdasarkan piawaian dokumentasi perisian yang telah disetkan oleh Jabatan Ketenteraan Amerika (DoD 2167-A) dan Ketenteraan (MIL-STD-498).

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LIST OF ACRONYMS

| | | |
|--------|---|---|
| ArcXML | - | Arc Extensible Markup Language |
| ASP | - | Active Server Page |
| CGI | - | Common Gateway Interface |
| DBKL | - | Dewan Bandaraya Kuala Lumpur |
| ESRI | - | Environmental Systems Research Institute, Inc |
| ESSO | - | Eastern States Standard Oil |
| FGDC | - | Federal Geographic Data Committee |
| GIS | - | Geographical Information System |
| GUI | - | Graphical User Interface |
| GSDI | - | Global Spatial Data Infrastructure |
| HTML | - | Hyper-Text Markup Language |
| IMS | - | Internet Map Server |
| JSP | - | Java Server Page |
| NALIS | - | National Land Information System |
| NSDI | - | National Spatial Data Infrastructure |
| PAMIS | - | Pahang Management Information System |
| PLUS | - | Projek Lebuhraya Utara Selatan |
| FRIM | - | Forest Research Institute Malaysia |
| PORIM | - | Palm Oil Research Institute of Malaysia |
| PLUS | - | Projek Lebuhraya Utara Selatan |

LIST OF ACRONYMS (CONTINUE)

| | | |
|-------|---|-----------------------------|
| SDI | - | Spatial Data Infrastructure |
| URL | - | Uniform Resource Locator |
| Wi-Fi | - | Wireless Fidelity |
| XML | - | eXtensible Markup Language |

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CHAPTER I

INTRODUCTION

1.1 Introduction to Environmental Data Explorer (EDE)

By definition, metadata in context of geographic data can be described as data about data. In other words, metadata tells about something without having that something. Metadata for geographic data is often described as the content, quality, type, collection date, source of the data, and spatial location of the actual data. In fact, it is often easier to judge the suitability of the data from its metadata than by examining the actual data itself. This is because metadata is generally much smaller and easier to share than the actual data. For example of metadata, a map legend is a pure metadata. The legend contains information about the publisher of the map, publication date, the type of map, a description of the map, spatial references, the map's scale and its accuracy, among many other things. Metadata are simply that type of descriptive information applied to a digital geospatial file. They are a common set of terms and definitions to use when documenting geospatial data. In a nutshell, metadata answer who, what, when, where, and how about every aspect of the spatial data.

On the other hand, Internet Map Server (IMS) is a technology provides the framework to create Web mapping applications ranging from routing to mapping biodiversity. Therefore, ArcIMS is an ESRI's solution for distributing mapping and GIS data and GIS Web services over the Intranet or the Internet.

GIS Web services are Internet applications that use data and related functionality to perform basic geoprocessing tasks such as:

- Address matching
- Proximity searches
- Routing
- Mapping

GIS Web services enable application developers to integrate GIS functionality into their Web applications without having to build or host the functionality locally. GIS Web services deliver some of the most popular GIS capabilities, such as address matching, mapping, routing, and proximity, for easy integration into a wide variety of developer applications.

Back to ArcIMS, it can be used to distribute geographic data to many concurrent users and allow them to do location-based analysis. ArcIMS software enables users to integrate local data sources with Internet data sources for display, query, and analysis in an easy-to-use Web browser.

Relate to ArcIMS, Metadata Explorer which is shipped together with ArcIMS, is a Java Server Pages (JSP) application that can be used to build a customized, browser-based means of searching for metadata. Searching for metadata is quick and efficient because users can perform searches based on any combination of geographic extent, content type, data format, or keyword.

From here, Metadata Explorer can be understood as a Web-based application that can be used to find data based on geographic extent, content type, content theme, or keyword or to browse through the contents of a Metadata Service. Metadata Service, however, is a forum for sharing metadata. Metadata Service acts as a geographic data search engine that is use to find data. A Metadata Service works

over the Internet, allowing anyone who has access to the Web to use it. With Metadata Service, the process of searching for data can be done by geographic location, theme (such as environmental data, business data, and base map data), scale, data collected, and so forth.

Metadata Explorer utilizes JavaServer Pages (JSP) and HTML pages with Java functionality within them. This enables the major work of the application to run server-side, taking the load off the client machine. In addition to this core set of JSP files, a number of JavaScript files provide much of the interactive functionality present in Metadata Explorer.

Metadata Explorer is an open source application that can be easily customized to the specific needs in organization. With Metadata Explorer, user can choose to alter any or all of the following:

- Logos, color scheme, and other associated application graphics.
- Application name displayed.
- Map display.
- Search criteria interface.
- Result views (summary and detail).
- Help documentation.

With the definition of Metadata Explorer, this is where Environmental Data Explorer comes in. Basically, Environmental Data Explorer is a java search engine used to find, view, and analyse an environmental spatial data and maps. It involves creating a Metadata Services, and making it available for Intranet data searching through the usage of Metadata Explorer, a component that is shipped together with ArcIMS Internet Mapping Server. Its main purpose is to deliver a full data display, analysis, updating of all spatial data in the Department of Environment.

1.2 Problem Statement

The introduction and widespread utilization of the Internet in today's world leads one to believe that there are many areas where web science and technology will meet with environmental data exploring and data searching to provide a new exploration to both fields. The objective of this project is to provide metadata and map searching by using ESRI web-based mapping tool and the usage of java technology, as applied to the Department of Environment regions. The necessary development tools to build a web-based application have to be identified. The understanding, advantages, and limitations of web based Java programming and Java Server Pages functionality is required. Internet GIS applications need to be explored along with spatial data availability for the study region. Environmental spatial data need to be gathered and analysed before it can be uploaded into the Internet Mapping Server.

1.3 Project Background

This project is a part of the Geodatabase Management Application and Mobile GIS System prepared by SEPAKAT Computer Consultant Sdn. Bhd., as to fulfil part of the requirements contained in "Tender AS (T) 008/2002: Membekal, Membangun, Memasang, Menguji dan Mentauliah Sistem Aplikasi GIS, Perkakasan dan Perisian Sokongan GIS di Jabatan Alam Sekitar, Malaysia". However, the commitment to complete this task is handled by SEPAKAT GIS I-Net Sdn. Bhd., a subsidiary of SEPAKAT Computer Consultant Sdn. Bhd. As an expert and established company in GIS development and consultancy, SEPAKAT GIS I-Net comes out with an idea and a proposal to develop a metadata and spatial data-searching engine for the Department of Environmental (DOE). This portal is known as Environmental Metadata Explorer and it acts as an additional feature to the Geodatabase Management Application System of DOE. With the help of this

functionality, the DOE officers are able to view, download, upload, analyse, and update every spatial data of interest available in map services.

1.4 Organizational Background

Established in July 1998, SEPAKAT GIS I-Net Sdn. Bhd. (which is a subsidiary of SEPAKAT Computer Consultant Sdn. Bhd.) focuses on key strategic technologies in the Internet, GIS, services, communications arena, consulting, IT planning, Web strategies, training and outsourcing. The Company focuses on research, development and marketing of these hi-tech products. Beyond R&D, SGISB also focuses on providing quality services for future and existing clients.

With its wide range of technologies services, it has been accepted as partner of major solution providers such as ESRI, Allaire Cold Fusion, Hewlett Packard, Compaq, Sun, etcetera.

To date, SEPAKAT GIS I-Net Sdn. Bhd. has been involved in various project such as National Land Information System (NALIS), Pahang Management Information System (PAMIS), Electronic Co-operative (E-Co-Op) for Koperasi KOSWIP Malaysia Bhd., ESSO, Projek Lebuhraya Utara Selatan Berhad (PLUS), FRIM, PORIM, and DBKL.

1.5 Project Mission

To develop an application of metadata searching engine that is available through the Internet twenty-four hours per day, seven days per week.

1.6 Project Objectives

While the whole project of Geodatabase Management Application and Mobile GIS System involves with the designing and modelling an environmental geodatabase and collecting spatial data using handheld mobile devices, this application definitely contributes to fulfil several additional objectives:

- To provide capability for Intranet users to access to central GIS data sources (GIS data files or ArcSDE database server) using ArcIMS tool through Local Area Network.
- To provide capability for Intranet users (States / Branches) to use ArcIMS map services and interact with data in a fast and efficient way.
- To allow officers to centrally build and deliver maps, data, and tools over the Intranet, thus provides a tremendous delivery of geographic data, maps, and applications over the Internet.
- To provide the organization to author maps and publish them to a Web site of their own creation, complete with map navigation and query tools.
- To allow administrator to regulate access to the services they deliver over the Intranet, by using the ArcIMS security features.

1.7 Project Scope

The project scope of the Implementation of Environmental Metadata Explorer for DOE application falls into the following category of technology:

- Metadata search engine development – using Java Server Pages
- Integration with web server – using New Atlanta Servlet Exec with Microsoft Internet Information Server

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