

Design and Implement a Map Library

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Abstract

The St. Johns River Water Management District (SJRWMD) generates thousands of maps each year for water resource management. Many of these maps are in digital format. It is in the district's best interest to maintain a centralized location to store and retrieve business critical digital maps, so we can reproduce paper maps upon public request. Map Library system is a way for the District's GIS users to create and archive digital maps in an enterprise environment. The SJRWMD's Map library consisted of a Map Library Publisher (ArcObjects application), a Map Library metadata service (ArcIMS) and a Map Library explorer (Internet Explore Browser). The Map Library uses ArcGIS 8.3, ArcIMS 4.1, Microsoft Internet Information Server, ArcSDE server, Oracle Database Server and Oracle 9iIFS software. Users can publish their maps through ArcMap. Digital maps are stored in the Oracle IFS while map metadata are sent to ESRI metadata services. The application is located at <http://arcimspub.sjrwmd.com/maplibrary/>.

Introduction

St. Johns River Water Management District implemented a Map Archive and Retrieve system based on the ESRI's ArcGIS and ArcIMS software. The main objective is to build a map archive and retrieve system using Image Management web services.

Background

The St. Johns River Water Management District generates thousands maps each year for water resource management. Many of these maps are in digital format. It is the best interest for the district to maintain a centralized location to store and retrieve business critical digital maps, so we can reproduce paper maps upon public request. Map Library system is a way for the District's GIS users to create and archive digital maps in an enterprise environment.

The initial version of the Map Library is a text file based system using ArcInfo 7 and ArcView 3.x technology. A common partition of shared hard drive is allocated to store PDS, GRA, JPG and Tiff files. An ASCII text description file is associated with each graphic data. The presentation system was built on Cold Fusion technology to search and retrieve map graphic and text file. This system was hard to maintain and use.

Image Management System

The District began the process of migrating their hard copy documents, stored in a central file vault, to an online system. Image Management System was built to capture, store and retrieve digital images and digital documents.

Image Management System (IMS) contains three components.

1. Client applications – front-end applications that have been customized for the type of document used by a business function, such as permits. These applications contain the rules for scanning, formatting, and editing the documents contained in the database and are enable the utilization of specific scanning equipment. Today there are 5 applications that have been customized to utilize Image Management System.
2. Interface application (Based on Oracle Internet File System) – customized, standalone software that allows each client application to interface to the Oracle database

3. Oracle database – the database that stores all digital documents. It is comprised of clustered servers and one instance of Oracle software.

Image Management System can be used to store two types of documents i.e. documents that are being worked on and documents that need to be put into a vault (finalized documents). The working database is available to only the staff of the District. Vault documents are defined as those documents that are to be put into safe keeping to be maintained as electronic records as per the relevant District, State and Federal Regulations for electronic storage of documents for long-term storage, which may include backup, recovery and safe-keeping procedures. Vault documents will be documents that are finalized and will not undergo any form of change. Vault documents will provide versioning, expiration, document integrity checks and a backup/restore plan.

Some applications make the final vault is available to the public, such as E-permitting. Security is provided by user group at the application level. It has not been developed at the document level.

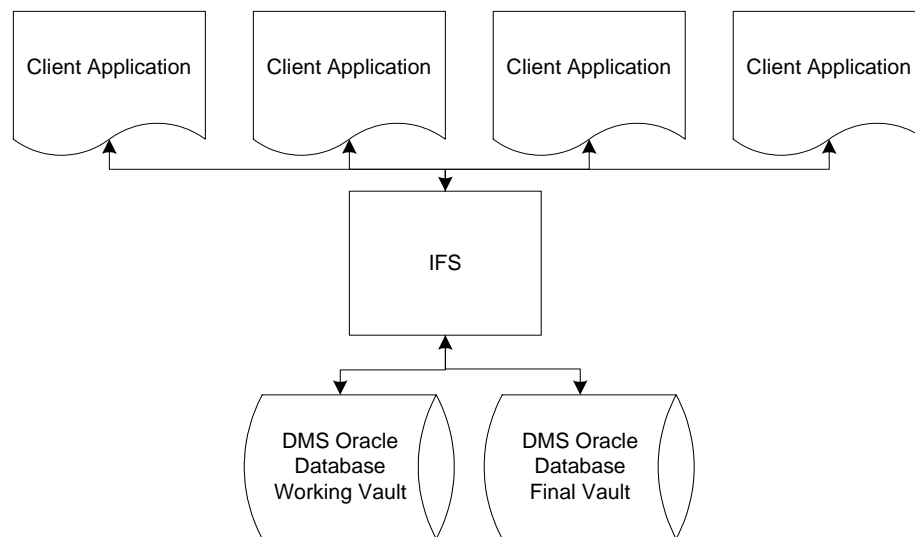


Image management System provides the following functions:

- Store documents
- Retrieve documents
- Query for documents
- Query on the state of documents
- Remove documents (working documents)
- Provide for expiration of documents i.e. documents expire on a specified date, after which date the document is no longer available (vault documents)
- Provide for versioning of documents (vault documents)
- Provide for security based on authentication/authorization
- Provide for the integrity of documents stored, using MD5 Message Digest for vault documents (not implemented in the current phase)

Map Library is one of the Image Management System components. Digital maps are treated as any other digital images that are maintained by the same system. Development efforts were saved for managing digital maps. It provides one platform for end users to get their digital maps and other digital documents.

Map Library System Design

The Map Library was designed to use combination of ESRI's ArcMap, ArcIMS, Metadata Services, Java Web Services and Oracle Internet File System. Much of customization was implemented to make system seamless to the end users.

The major features of the system includes:

- a) A FGDC standard metadata database for storing description of map
- b) ArcMap Map Library publisher
- c) ArcIMS Map Library metadata service
- e) Map Library explorer with the metadata keyword search facility

Tables, Models & Data Definitions

Map metadata data are stored in following tables by ArcMap metadata publisher.

IMSMETADATA
IMSMETADATARELATIONSHIPS
IMSMETADATATAGS
IMSMETADATATHUMBNAILS
IMSMETADATAUSERS
IMSMETADATAVALUES
IMSMETADATAWORDINDEX
IMSMETADATAWORDS

Software

ArcIMS 4.0, ArcSDE 8.2, ArcMap 8.2, Oracle 8i, Oracle IFS

Customized metadata publisher, customized Map Library Explore

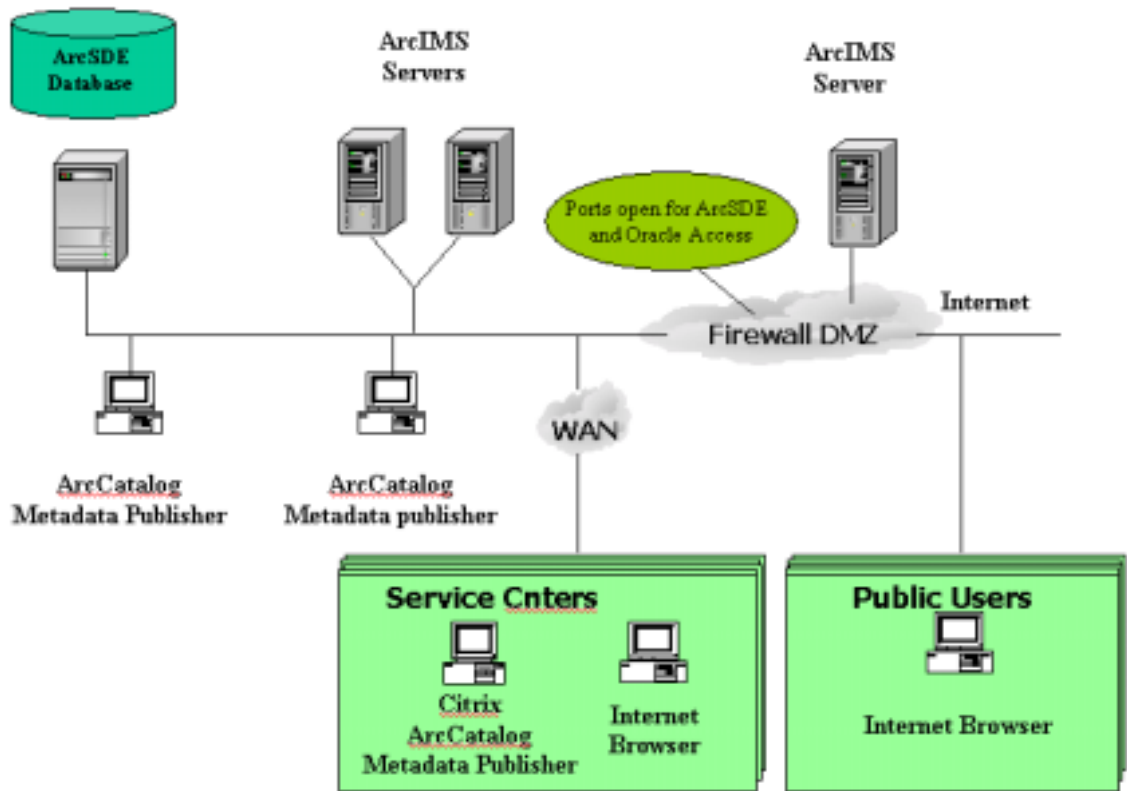
Infrastructure

The database will be located on a Sun E3500 server-running Solaris with a hard disk capacity of 85GB raid 5 disk array dedicated to the relational database tables. The I/O rate of the production server is 1Gb of cache. The CPU is a 2x 400 MHz UltraSPARC.

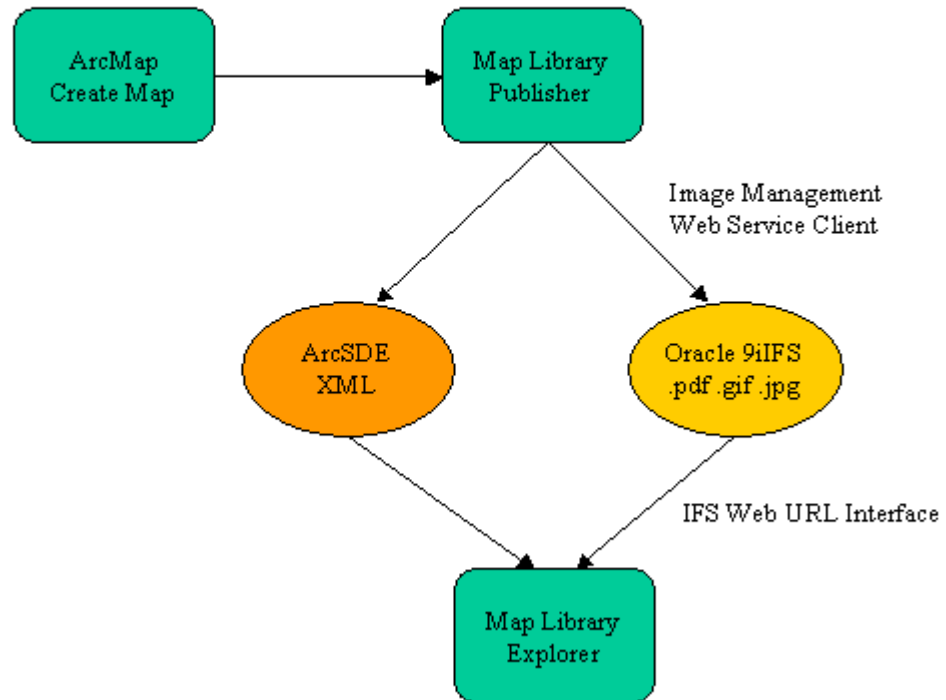
ArcIMS Server:

DELL PowerEdge 2550
Dual CPUs, Pentium III, 1.9 Ghz, 256K Cache
2 GB SDRAM, 133Mhz, 2X1GB DIMMs
180 GB Hard disk, 5x36 GB, 1 In, Ultra 3 SCSI 10000 RPM Hot Plug Drive
Windows 2000 Advance Server, 25 Client Access Licenses

SJRWMD Metadata Infrastructure



Map Library Diagram



As illustrated from the graph above, the system uses the following major software packages - ESRI's ArcGIS 8, ESRI's ArcIMS, Microsoft Internet Information Server, ArcSDE server, Oracle Database and Oracle 9iIFS.

ArcMap Map Library Publisher

The system includes a publisher for capturing metadata and sending graphic files in PDF format to Oracle 9iIFS. The publisher has been developed using Visual Basic with the type for creating an ActiveX DLL. It references the ESRI Object Library and contains a class that implements `esriCore.Imetadata editor`. Once registering the DLL on a machine, it becomes integrated within the ArcMap environment. It has an easy-to-use interface for the District general GIS users.

The image shows a software dialog box titled "Form1". It contains the following fields and controls:

- Map Title:** An empty text input field.
- Map Author:** An empty text input field.
- Division:** A dropdown menu with "Engineering" selected.
- Map Category:** A dropdown menu with "Administration and Political Boundaries" selected.
- Map Description:** A list box containing the following items:
 - Business and Economics
 - Cadastral and Land Use
 - Cultural and Demographic
 - Elevation
 - Environmental** (highlighted)
 - Facility and Structures
 - Geology and Geography
 - Water Resources
- Buttons:** "OK" and "Cancel" buttons at the bottom.

Map Metadata created with the publisher is stored as XML data in ArcSDE database.

Image Management System

The District recently elected to begin the process of migrating their hard copy documents, stored in a central file vault, to an online system. Image Management System is built to capture, store and retrieve digital images.

Image Management System contains three components.

1. Client applications – front-end applications that have been customized for the type of document used by a business function, such as permits. These applications contain the rules for scanning, formatting, and editing the documents contained in the DMS database and are enable the utilization of specific scanning equipment. Today there are 5 applications that have been customized to utilize DMS.
2. Interface application (IFS) – customized, standalone software that allows each client application to interface to the Oracle database. It has been structured as a standalone system so that the backend DMS database application may be enhanced or completely replaced as document management technology matures.
3. Oracle database – the DMS database software that contains all documents. It is comprised of clustered servers and one instance of Oracle software.

Image Management System can be used to store two types of documents i.e. documents that are being worked on and documents that need to be put into a vault (finalized documents). The working database is available to only the staff of the District. Vault documents are defined as those documents that are to be put into safe keeping to be maintained as electronic records as

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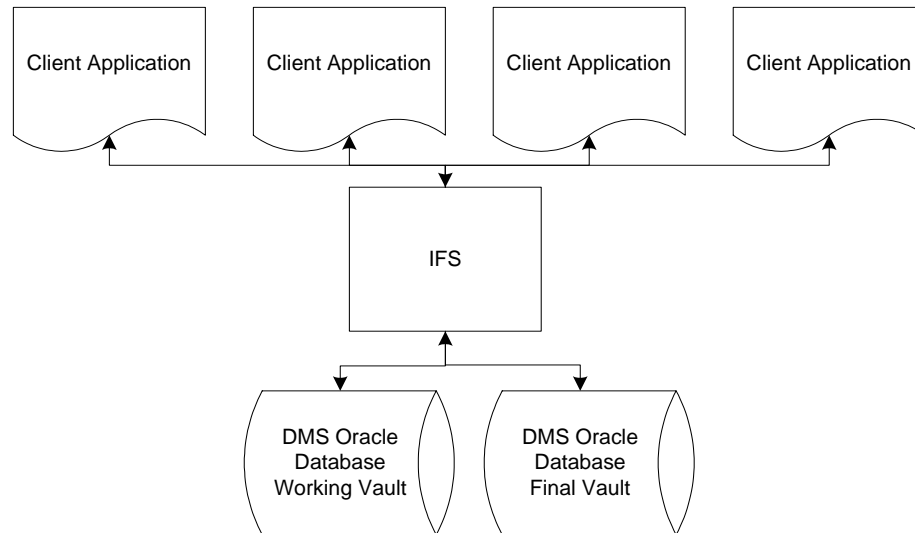


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Digital map is one component in this Image Management System. Digital maps are treated as any other digital images and they are maintained by the same system. It saved duplicate effort on the software development on managing digital maps. It provides a one platform for end users to get their digital maps and other digital documents.

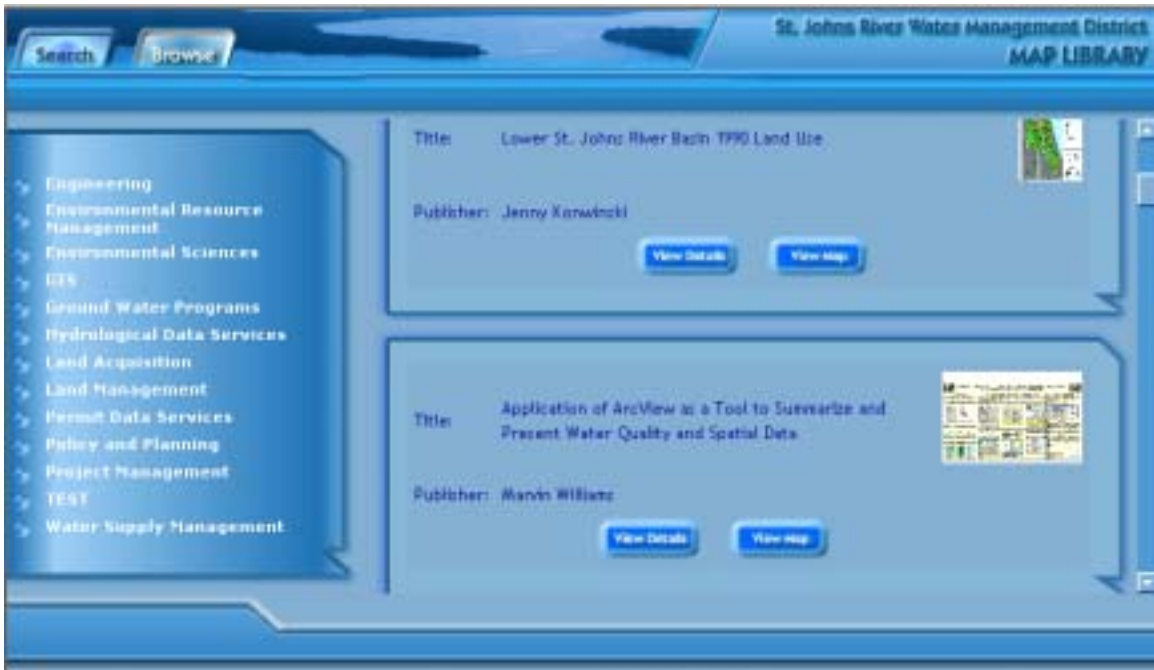
Map Library Explorer

Map Library explorer is a customized ESRI Metadata Explorer. Key word search include followings:

- Search by Division
- Search by key word
- Search by Category
- Search by user name
- Search by created date (start date, end date)
- Search by paper size



Browse to map category:



Display detail Map metadata information:



CONCLUSION

Development of Map Library serves as the basic and important component in accomplishing the Districts GIS Infrastructure. SJRWMD has put into place a comprehensive image management

web structure and GIS Metadata system. The development of Map Library provides ways to share GIS information among GIS users, resources managers and general public.

This system outlines creation of a common place on the Intranet/Internet offering a new one-stop experience for all digital graphic maps in the District. It is a centralized map repository to distribute digital maps to the public. Its potential will be realized when all the District's GIS users join together to publish and use their maps through the system.

Benefits of the new Map Library system are that technology serves the District GIS users better, the system provides single integrated Map Archive environment to the users and the system is integrated into IR Internet infrastructures.

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