

RECLAMATION

Managing Water in the West

Conceptual Model Report

Linking Documents and Information Stored in SharePoint Libraries to Geospatial Representations of Reclamation Features

**Project 2998
Science & Technology Program**



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INTRODUCTION

1.1 Project Description

Many Reclamation offices are discovering the utility of the collaborative features of Windows SharePoint Services, in particular, document libraries. SharePoint document libraries provide an efficient way to store and share digital information such as documents, spreadsheets, and reports, associated with Reclamation lands, facilities, or operations.

While SharePoint provides a great repository for digital documents, it lacks a framework for organizing them. Generally, Reclamation tends to organize information in the context of Congressionally-authorized Projects. Reclamation Projects are collections of lands, facilities, and associated features necessary to deliver water and/or power. These collections correlate to features in specific places (e.g., dams, reservoirs, canals, etc.). Although location is implicit in Reclamation projects, it provides a fundamental organizational framework to which otherwise unrelated data and information can be related.

The goal of this project is to develop an approach to allow Reclamation personnel to use an interactive web-based map to link documents to the associated feature (e.g., land parcel or facility). Once linked, the interactive web-based map provides a simple way to retrieve related documents. The link also provides a way to display the map location of the feature(s) associated with a document. A major focus of the project is researching the feasibility of developing interoperable web services between SharePoint and GIS to store and manage the sometime complex relationships between documents and features.

1.2 Definitions

| | |
|------------------|---|
| Web Part | A reusable component of Windows SharePoint Services that provides a specific set of functions in the SharePoint web application (e.g., document library, list, image, etc.). |
| Document Library | A SharePoint web part specifically designed to allow users to upload and access documents through a web application. Documents are stored in binary format in the database associated with the SharePoint instance. |
| List | A SharePoint web part specifically designed to allow users to create a spreadsheet like list with custom fields that can be accessed and updated by many users. |
| FLEX | A programming environment from Adobe used to build custom web applications that run in Adobe Flash Player, a common browser plug-in. |
| | |

CONCEPTUAL MODELS

1.3 Project Scoping

Lands Resources

Project scoping was conducted by members of the project team. Project team members located in the Mid-Pacific Region (MP Region) and Pacific Northwest Region (PN) met with Lands Resources personnel in their respective Regions to discuss the nature and type of documents that might be stored in a SharePoint document library, as well as the relationship with Reclamation features.

It was found that the documents typically managed by Lands Resources consist of forms, deeds, contracts, and agreements associated with lands transactions. The majority of documents were found to be in Adobe PDF format, largely the result of scanning signed documents.

MP Region was found to have an extensive compilation of scanned lands documents that are associated to plats. Plats are map representation of the location of transactions of Reclamation land interests.

PN Region was found to have several Project-level compilations of lands documents that are associated with individual land parcels, easements, other land interest types. Lands documents in a number of cases were associated with more than one land parcel or interest. In some cases, land parcels were found to be associated with more than one lands document.

Facilities Operations & Maintenance

Project Team members contacted the Facilities O&M groups and found that activities associated canal inspection work under ARRA would likely preclude sufficient personnel time to participate in this project. Requirements into the project are based on past experience of several project team members who have worked with Facilities O&M in the past. Generally, the document and location requirements of Facilities O&M were found to be very similar to those Land Resources, except there were no complex relationships. Consequently, a model that works for Lands Resources is expected to also work for Facilities O&M.

1.4 Conceptual Models

The project team developed two conceptual models. One model focuses on a loosely-coupled interoperation with a custom FLEX web application designed to handle the web mapping functionality (Figure 1). The other model focuses on a more integrated interface approach that involves a custom SharePoint web part (Figure 2).

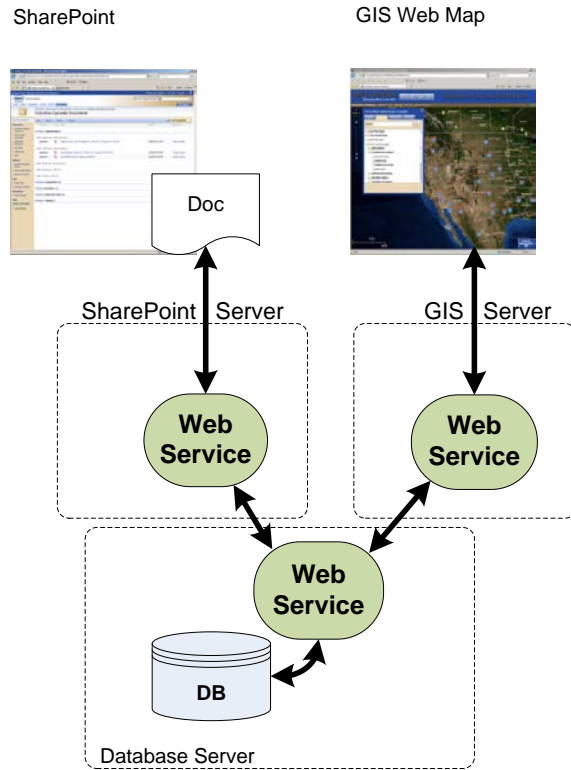


Figure 1

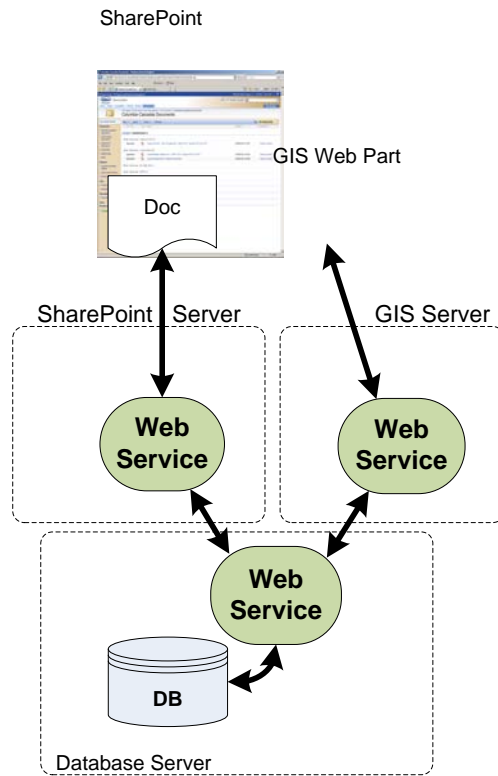


Figure 2

Both models share a common backend consisting of the database that hosts the SharePoint site (where documents are stored), the SharePoint web application, and a custom GIS web service. SharePoint has native web services available for interacting with document libraries. These web services support upload, retrieve, modify, and delete of documents. At its core, a SharePoint document library is a list that contains some basic information about a document, including: title, username, creation date, modified date, the document (binary), as well as custom fields that can be used to organize and display documents.

1.5 Document-to-Feature Relationships

During scoping, some document-to-feature relationships for Lands documents were discovered that substantially increase the complexity of handling documents in SharePoint. Specifically, some Lands documents in PN Region represent transactions that involve multiple parcels, and some parcels are involved in more than one transaction. This complex set of relationships requires the capability to support many-to-many relationships. Although SharePoint uses a database, which typically does support such complex data relationships, the web application does not support many-to-many relationships. The database component of SharePoint is used simply to keep track of paths and the contents of web parts hosted by the application. The handling of many-to-many relationships requires adding another component which will add complexity.

Complex relationships will require a matrix table to handle links between documents and features. This matrix table will require unique IDs for both documents and features. SharePoint list items (documents) have a GUID. Geospatial features can be implemented with a Global ID.

Although a matrix table could be added to the database used by a SharePoint web application, this would result in future problems as the SharePoint or the associate database is patched or upgraded. As a result, the project team will develop a separate database to be hosted on the same database instance as the SharePoint database to house the matrix table.

1.6 Implementation Plan

The project team devised the following implementation plan to guide the development of components based on the two conceptual models. This plan is somewhat conceptual because additional research is required to determine the native capabilities of components before customization work can be identified.

1.6.1 Review Existing Document Structures

The Lands Resource documents for MP Region are currently structured as one-to-many where the geospatial feature is the index item of a plat page. The documents are organized in a file hierarchy – Project, Plat page, Index. The group discussed the use of metadata fields in SharePoint rather than folders. Metadata fields allow content to be displayed using one or two levels of “group by”. The current folder names provide the metadata field reference. The group will need to devise a programmatic method to populate metadata fields to facilitate bulk loading of documents.

The PN Region Lands Resources documents are currently structured as many-to-many where the geospatial feature is a parcel rather than plat index item. In this case, each document can have one or more parcels linked to it. To keep the user experience simple, the approach to linking documents to parcels would start with one document. Users would invoke a custom function (e.g., button/icon on the document list item) that would open a web map application in which the user would navigate to and select one or more parcels. Once the parcels are selected, a function in the web map would extract the Global ID of the parcels and the GUID of the document, and passes them to a SOAP web service on the database (a SQL Server DB on the same server as SharePoint DB). The SOAP web service calls a SQL stored procedure which writes a record for each selected parcel. When complete, the stored procedure sends a message to the SOAP web service, which is presented to the user in dialog

1.6.2 Identify Components

Document Storage

A SharePoint document library (web part) is a type of SharePoint list. Each list item is assigned a GUID when it is created, which occurs when a document is uploaded. The list item consists of default fields, and the binary of the uploaded document. Custom field can be added to support display and query. The GUID provides the hook to retrieve items from the document library (list). SharePoint natively exposes a number of SOAP web services that provide programmatic access to stored content.

Geospatial Features

Geospatial features managed through ArcGIS Server, a web application server product. ArcGIS Server uses standard REST and SOAP web services to provide programmatic access to stored geospatial features. Global IDs can be implemented on geospatial features to provide an equivalent of the GUID associated with each document stored in SharePoint.

User Interface – SharePoint + Web Map

The user interface is somewhat unique to each conceptual model. In one case, the user interface will be a custom SharePoint web part. In the other case, the user interface will be standalone custom FLEX web application. For these components the research will focus on two programmatic environments.

The project team discussed FLEX and Silverlight as alternatives for developing the web map component that users would use to link a document to one or more geospatial features. The following summarizes the advantage and disadvantages of each:

FLEX

Advantages

- Team has extensive development experience
- User experience is similar to other existing BOR web mapping applications
- Flash Player is already installed on all BOR computers

Disadvantages

- Potential for problems interacting with Microsoft .NET objects
- Authentication may require impersonation of user credentials

Silverlight

Advantages

- Integrates seamlessly with SharePoint and shares common development environment (.NET Framework)
- User credentials can be accessed through Internet Explorer browser

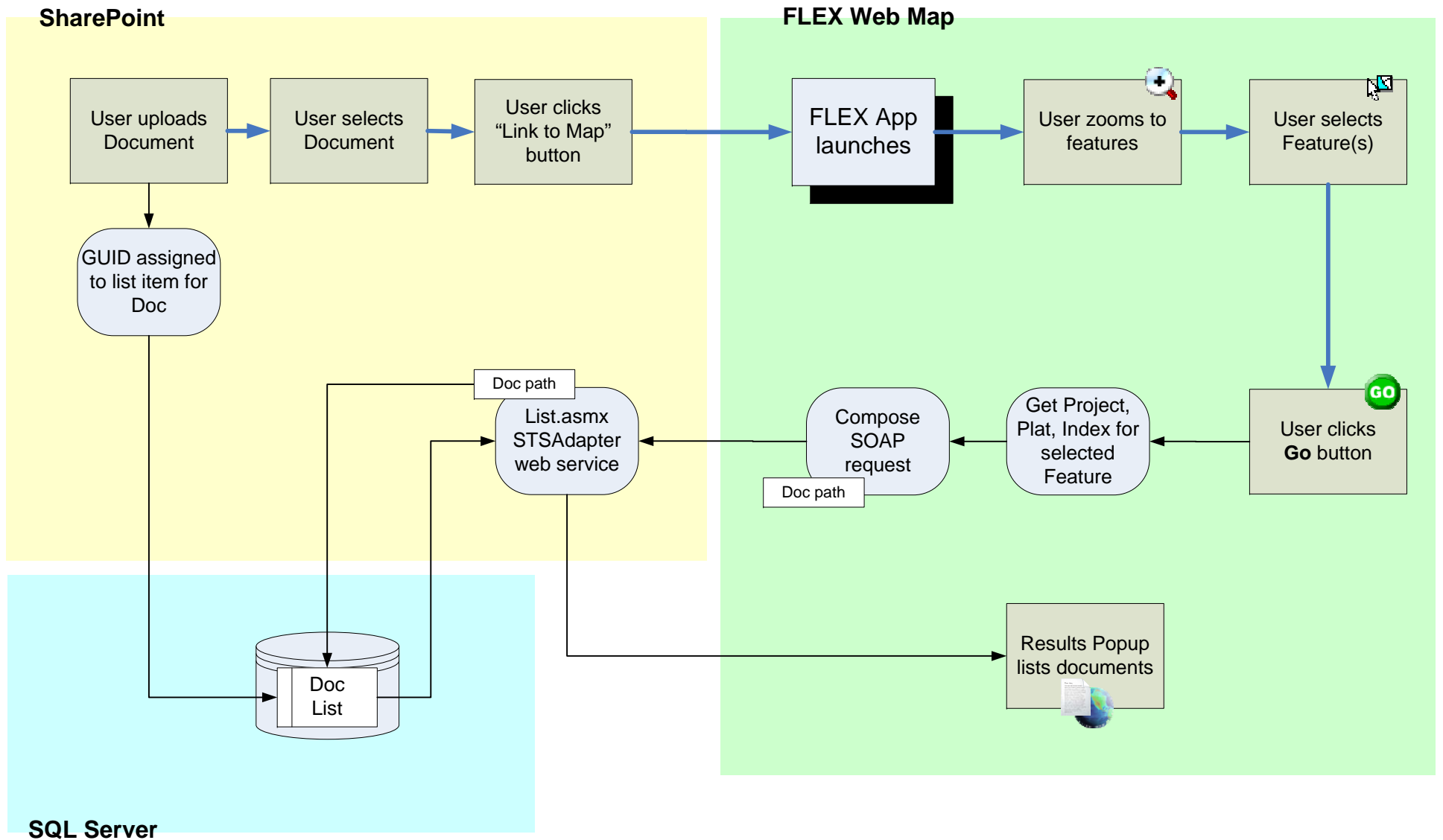
Disadvantages

- Team has limited experience
- Requires installation of Silverlight on client computers

1.6.3 Build/Develop Components

The project team developed diagrams (following this page) to illustrate the conceptual flow of documents between components. The following tasks are planned for the first of two project team meetings:

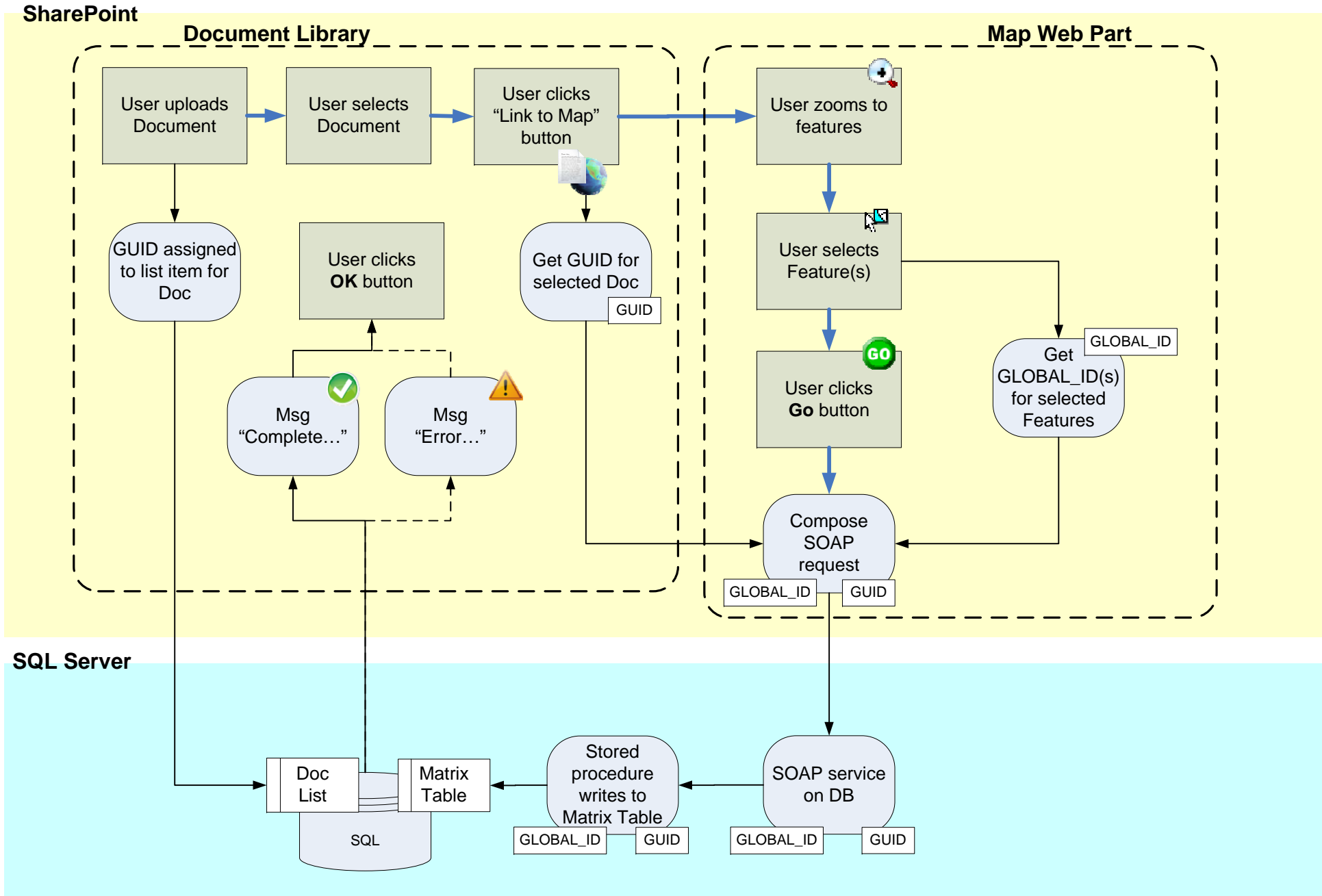
- Develop a simple FLEX web application to query a native SharePoint web service to retrieve a list of documents from a document library. Create hyperlinks in query result to open documents based on their MIME types.
- Install and configure an instance of Windows SharePoint Services 3.0 (sp2) on a test server. Configure a new database to store the matrix table.
- Create a matrix table in the new database to store records of IDs that link documents (GUID) to geospatial features (Global ID).
- Create the core code for a stored procedure that will write new records to the matrix table in the new database. Create a service account for the database to be used by the SOAP web service and stored procedure.
- Create a SOAP web service to interact with the database stored procedure and pass GUID and Global ID values selected by a user.



This scenario assumes a one-to-many relationship where the result returns the contents of a folder in SharePoint document library.

Link Documents to Map in SharePoint - FLEX

Last revised: 8/23/2010



This scenario assumes a many-to-many relationship where the result writes to a matrix table in SQL Server that can be used to return documents in SharePoint document library related to parcels and vice versa.

Link Documents to Map in SharePoint Web Part

Last revised: 8/23/2010