Leveraging GIS analyst expertise in a Web application

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Abstract:

Management of data in multiple locations like user's personal geodatabase, File geodatabase, shared folders etc., becomes a tedious job when a common sharing framework is not present. This also leads to data redundancy. A centralized data management system like ArcSDE becomes need of the hour when data is in abundance and needs to be shared with multiple users post analysis and calculation. The current business case talks of one such scenario where both processing and data management have to be centralized. The absence of data management system like Portal for ArcGIS in the environment makes it more challenging.

Business Case:

Industry: Oil & Gas Exploration & Production

Business need:

To develop a solution which has the capability to expose analyst capability of Geoprocessing tools in a thin client and make the intermediate data available for users centrally.

Current scenario:

When oil spill happens third party tool captures the type of oil and direction in which it may travel based on wind and water flow as shapefiles. These shapefiles act as primary data for analysis.

- Users usually work with local data store and the output files were stored in multiple locations and shared drives
- ArcGIS Desktop is used to workout analysis.
- Business logic is not integrated with Geoprocessing tool

Our Solution:

To realize a unified web portal with GIS visualization dashboard and configurable Geoprocessing services for analytics. The proof of concept of the solution fits into existing ArcGIS environment without disturbing its actual functionality. The thin client is built using ArcGIS JavaScript API. ArcGIS rest API is used to build the analytics.

Benefits:

- Drastic reduction in time and cost.
- Eliminate multiple versions Data.
- Extensible due to configurable Geoprocessing services.

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Background

In the current scenario, ArcMap is being used for handling region based spatial data available in the form of shapefiles. Shapefiles are received from a third party tool and has data geometry discrepancy. The data does not have a projection system defined and also has geometrical errors. Running geometry correction tool on such huge data is time consuming and in current scenario each user pulls his own data and corrects the issue and stores it as feature classes in a personal geodatabase which adds to the owe.

The spatial analysis and calculations are done by different users using their respective workstations. There is no central storage location to share this data as there exists too many versions of the same case due to multiple region based analysis. For a particular region different skilled users (like Engineers, spatial analysts and data collectors) work on same data stored in their local machines (which is redundant). Integrating the analysis and calculation outcomes from different process result take more effort.

Challenges

The main challenge is data handling, no central system to store and analyze spatial data centrally. There is no Portal for ArcGIS available in the environment. Although the user base is small, the data being dealt with is huge.
For analyzing the data it requires users to have access to ArcMap (increased license demand) and understanding of its usage, which becomes a challenge for users from non GIS background.
Publishing data into SDE for centralized data handling would still require the use of ArcGIS desktop.

Infosys Solution

To achieve efficient data handling and perform QA/QC, existing enterprise geodatabase solution is employed. A thin client is preferred over the use of ArcGIS desktop to enhance performance and for ease of use by non-GIS users. Analytics is manifested by employing Geoprocessing services, this not only helps to handle data and server centrally but also provides an easier interface for user with limited GIS skills.

To avoid multiple data storing locations, SDE was proposed to use in place of file geodatabase. In order to avoid the need for user to use desktop clients a Geoprocessing service to create a temporary map service of the user selected data was created. The same can be utilized by multiple users for calculations.

User friendly UI was designed to address audience with different skill set (GIS and non-GIS). Business logic and data handling were integrated into different modular Geoprocessing services.

Each GP service is triggered from a particular tool on web application. Users need to upload shape files to application using one of the tool provided in application, this data will be uploaded to server for carrying out the below processes:

1. Tool first adds coordinate system to spatial data and checks for any geometry errors to correct it. Once the correction is done tool copies shape file to SDE under dataset created for that particular user with time stamp appended for identifying different versions of the run. Converted and corrected feature classes will be added to the application as a map service. (Admin decides to crawl the specific versions of the user store to default dataset for general use)
2. User can select his own area of interest to analyze and calculate using Area of Interest tool on the map.
3. Geoprocessing service on server will be triggered to carry out the calculations, which uses scratch workspace for easier and faster calculations. These calculated spatial data will be displayed on map.
4. User can see the output from Geoprocessing service as a map layer. This has helped to have a unified spatial query setup for all the layers.
5. If user is satisfied about the report and data generated from the analysis and calculation, he/she can save the results as feature classes. The save option will be available on the application.
6. To save Geoprocessing result, data from the scratch workspace is exported to that particular user session's dataset in SDE.

7. Admin users can edit the Geoprocessing service calculation parameters by changing the simple configurations defined in XML file.
8. As the application can be run from thin clients like browsers and mobile devices, ArcGIS desktop usage can be minimized.
9. Due to configurable Geoprocessing services, the solution can be extend to configure web app builder with minor configuration. (Extensible)

Data flow and architecture of the proposed application is shown in figure 1.
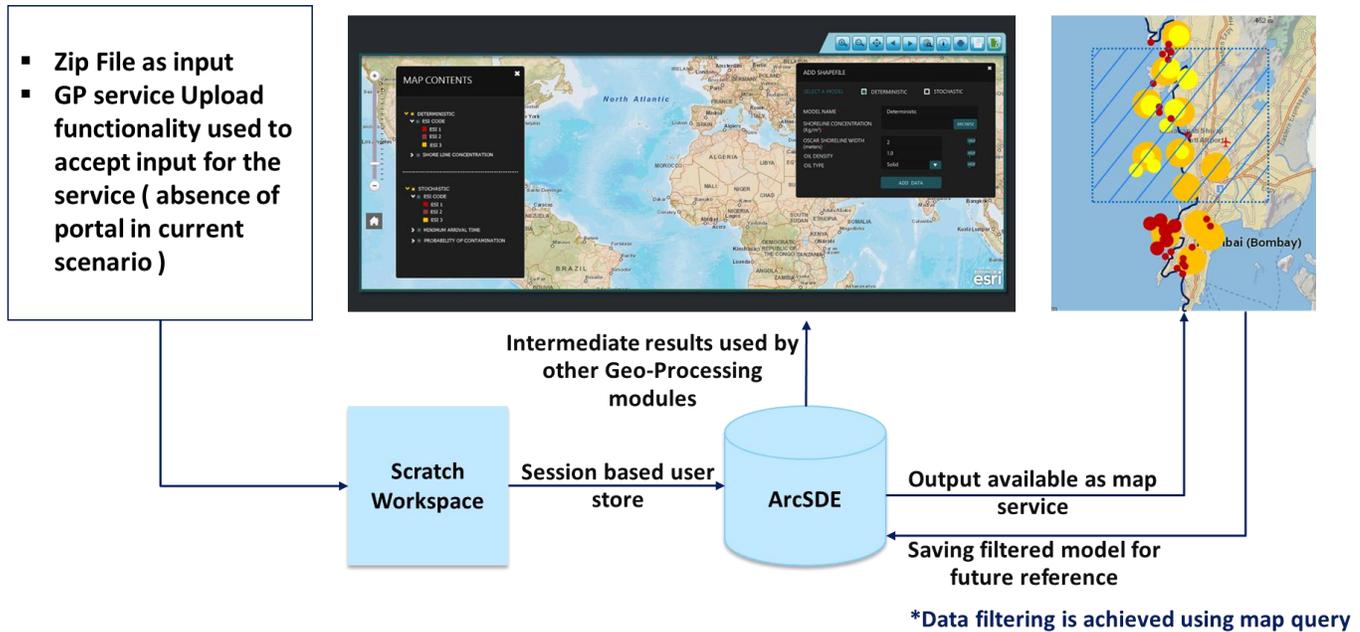

Figure 1: Data and proposed system architecture

Conclusion

With the use of application redundant data storage and handling can be overcome with reduction in time and cost, as the ArcGIS Server installation and setup is one time. Manual work involved in correcting data will be minimized with help of Geoprocessing services.

As storing the calculation and analyzed data can be stored on SDE, users can access it from anywhere using any applications like ArcGIS desktop tools or even with this web based application. Spatial data belonging to multiple users can be integrated with the application for sharing.

Admin users can modify XML to change the business logic of the Geoprocessing services. Since asynchronous approach is used in the application most of the Geoprocessing services can be used in parallel.

As future enhancements Geoprocessing services can be consumed from Webapp builders and will be easy to integrate in Portal for ArcGIS for providing better the data sharing environment.