Modular Framework for IMS Applications

As IMS software and applications mature there is a move towards using IMS as the core GIS component. This means using IMS not only to publish map data but using IMS to distribute GIS functionality and applications. Using IMS for distributing GIS functionality requires an a more robust software platform than previously needed for just publishing map data sets in a view only application. This paper introduces and discusses the concept of using a modular design solution (MSD) and for creating a Web based GIS application.

Current Trends

Today GIS departments are faced with reduced budgets and staff, and increasing GIS application and data requests. These GIS shops are responding to these market factors with the following objectives:

- Reduce desktop cost and maintenance
- Centralize database file serving
- Expand user base
- Utilize network and bandwidth

To meet these objectives organizations are implementing these programs:

- Bring GIS Functions to Client/Server
- Migrate GIS Desktop to Web
- Make Client Side Platform Independent
- Use Open System Applications and Software

Common Design Solution -- CDS

The common design solution for IMS applications is portrayed by the standard templates delivered with ArcIMS. HTML and JAVA based, these templates have the advantage of quick to set up, with little additional expense. In however, we see some disadvantages with implementing CDS applications. These include limited functionality by the capabilities and of the templates, the IMS server placed outside the organization's firewall, and no built-in capability to access and external databases.

Figure 1 shows the CDS architecture where client requests go to ArcIMS which performs required functions and delivering results back to the client. As more GIS functionality and data integration to the CDS is required, components are added in a serial fashion, stacked onto the structure of the IMS platform.
Figure 2 shows stacking effect as components are built upon the IMS platform. As more components and functionality are added to the CDS, more demands are put on the client application and base IMS application to communicate and make requests for processing. This architecture causes a high latency during operations.

Figure 2
Figure 3 diagrams this architecture where the client and ArcIMS applications are making multiple requests to complete a transaction. In this CDS serialized operation the database stacked upon the ArcIMS cannot be queried until the arc IMS data has been returned.

Figure 3
Drawbacks to the CDS solution include limits to systems security because typically the site will be located outside organizations firewall which exposes the arc IMS and as the database servers. Multiple applications to maintain; IMS, external databases, HTML client, and database query CGI applications. The CDS solution also becomes cumbersome when an organization has several different Web mapping applications. A public Works Web application, a public safety application, a land records application, all typically have stand-alone CDS applications and when major components change such as the IMS application a complete recoding of each individual CDS Web application needs to be undertaken.

Alternative Solution

When looking for an alternative solution to create a Web based GIS application some objectives come to the forefront after reviewing the CDS architecture. Reducing latency, eliminating the need for multipal client requests to ArcIMS and database servers, and simplifying the client/server data flow. These objectives will increased speed of the applications and reduce multiple Web based requests that can cause system breakage.

Introducing the modular design solution(MSD)

The alternative solution from the CDS would be to design a single server application that communicates with the ArcIMS and other major software components in a modular architecture. In this MSD the client communicates with a new server middleware which then communicates with major components for completing the GIS function. This server side application is a framework for integrating GIS and database components.

Figure 4 illustrates this new middleware where application layers communicate with the client browser and major components with XML based requests portals.
The advantages of the MSD framework is the following. Additional functionality can be added to the GIS application that is not included in the IMS software. Standard component interfaces in the framework software allow mapping or database components to be replaced without altering the client software. Back-end software become components to the new middleware framework.

Figure 5 illustrates MSD architecture. Notice that the client browser application only makes one requests to complete a complicated transaction. The middleware application coordinates required processing requests to the component software. Sending the final results to the browser application.
The MDS allows additional modules to be added to the framework without affecting the existing system. Existing modules can be upgraded without breaking existing clients. An example of this would be that a new version of ArcIMS would only require reconnecting the XML application layer to the middleware as opposed to the CDS architecture that would require a major rewrites for switching to the new ArcIMS software.

Figure 6. The addition of new or replacement clients can be added to the MSD, but must communicate using the same protocols as the server.
Figure 7. Illustrates not only the ability to add components to the server side middleware but also due to the fact that we have a standard server interface application layer it is easy for us to create different client platform applications.