Integrating OGC Catalog Search and Searched OGC Layers into ArcIMS HTML Viewer

By

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Abstract:

In the role of fulfilling its mission of bringing biological information to the Internet, USGS-NBII has developed dozens of ArcIMS HTML Viewer-based applications targeting various biological issues or concerns. The focus of NBII's interoperability framework is to provide users of each of these individual issues or concerns ArcIMS software-based applications with the capability to discover and visualize additional biological content from within that application. By extending the current and new ArcIMS applications to search and consume services from OGC Catalogs, NBII provides a richer user experience and exposure to its wide array of resources to users in the tools they currently use to perform their work. The NBII created enhanced HTML-Viewer templates allowing for new development or modifications to existing systems. These templates give the NBII nodes and partners a quick start in creating/modifying HTML Viewer site(s) for searching any OGC Catalog and consuming searched OGC Layers.

Introduction:

The USGS - National Biological Information Infrastructure (NBII) <http://www.nbii.gov> is a broad, collaborative program to provide increased access to data and information on the nation's biological resources. The NBII links diverse, high-quality biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry. NBII partners and collaborators also work on new standards, tools, and technologies that make it easier to find, integrate, and apply biological resources information. Resource managers, scientists, educators, and the general public use the NBII to answer a wide range of questions related to the management, use, or conservation of this nation's biological resources.

For serving scientific data over Web, several ArcIMS based applications were developed by NBII, its nodes and partners. These HTML viewer based ArcIMS applications served

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initial purpose of data dissemination over the web and were used and valued by resource managers, scientists, educators and the general public. These ArcIMS applications were doing an excellent job for the specific need or scientific concern they were developed to address, however these applications were not flexible enough to use data from other NBII data clearinghouses and had no support for interoperability.

This paper covers how NBII modified the basic ArcIMS HTML viewer based applications to be more flexible and interoperable by integrating an OGC Catalog search, OGC web-map services, OGC WFS gazetteer service and a bounding box service to HTML viewer based ArcIMS applications. This paper also talks about the architecture and various advantages of extended ArcIMS applications.

The Need:

NBII, NBII nodes, and NBII partners (all three will be referred as NBII in this paper) have made accessible a significant amount of biological data with plans on increasing the amount of data online in future years. These resources, mostly mapping applications and databases can be consumed by any Internet accessible application through an XML interface. However, there was no mechanism in place for discovering these web-services in the context of geography or place, and subsequently analyzing the discovered data and services. NBII needed a mechanism in place for its users to search for these valuable resources by geography.

Additionally, NBII had developed several ArcIMS HTML viewer-based applications. These applications address specific biological concerns or issues. Users of these applications did not have flexibility of mapping or analyzing the application data with other data or services of their interest, limiting users to the analysis of data provided by the application.

Proposed Solution:

For addressing above needs a toolkit with following 3 components was proposed:

   a. A pluggable client for OGC catalog servers for discovering published contents,
   b. A pluggable client for consuming, viewing and analyzing discovered OGC contents, and
   c. A template which could integrate these clients with the existing or new HTML viewer based applications.

The Challenges:

Implementing proposed toolkit was not an easy task due several factors: the legacy of the existing HTML Viewer applications, the limited expertise and availability of staff within the distributed network, and the nature of working with relatively new OGC specifications such as the CSW 2.0.

While NBII has resources and expertise for maintaining existing NBII HTML viewer applications, often these resources are not devoted full time to these tasks. Therefore, adding a small feature to an existing application competes with other priorities for work within the organizations. Given that modifying existing applications to allow for an OGC catalog search and consuming searched content was evaluated as a difficult task, it seemed unlikely that the nodes would be able to accomplish the task in a reasonable timeframe.

Additionally, NBII did not have an interoperability framework in place for re-using data produced by partners or nodes.

Then, to complicate the situation a bit more, a solution for a single application might not be portable to other applications. Given the limited resources within the NBII Nodes, would there be resources within each node to make modifications or future enhancements when OGC specifications advance?

The Solution:

NBII adopted the strategy of using OGC specifications for publishing, discovering and consuming of maps, data and services. NBII needs a solution which was easy to maintain, extend and deploy and which could be integrated with existing HTML viewer applications as well.

Keeping above points and challenges in mind, the solution was divided into following four components.

a) OGC Catalog Client – A standalone, pluggable, service oriented, JSP based OGC catalog client was written. This client could search one or many OGC CSW based catalog servers. It could take care off new as well as existing versions of OGC CSW protocols. Client specifies guidelines for writing components for future versions of CSW protocols. Component, written using these guidelines, can easily be embedded into the client.

b) OGC Web Map Service Client – A pluggable, JavaScript based OGC web-map service client was written. This client can communicate with one or many OGC WMS based map services. It can take care off new as well as existing versions of OGC-WMS protocols. Client specifies guidelines for writing components for future versions of OGC-WMS protocols. Component, written using these guidelines, can easily be embedded into the client.

c) HTML viewer template for existing HTML viewer applications – This template was written for existing HTML viewer application. It served as integrator for integrating existing ArcIMS application, OGC catalog client and OGC web-map service client.

Changes in HTML viewer code were clearly marked and documented for easy integration.

d) HTML viewer template for 'new' HTML viewer applications – This template was written for new ArcIMS applications. It served as integrator for integrating new HTML viewer application, OGC catalog client and OGC web-map service client. This template had NBII look and feel, enhanced TOC (for e.g. folder display, layer/group up and down) and new tools like gazetteer services etc.

A toolkit for existing HTML viewer application was packaged containing components a, b, and c. Another toolkit for new HTML viewer application was packaged containing components a, b, and d. These toolkits addressed all challenges and needs as discussed.

Following image describes complete system of 'Enhanced HTML Viewer Application'.
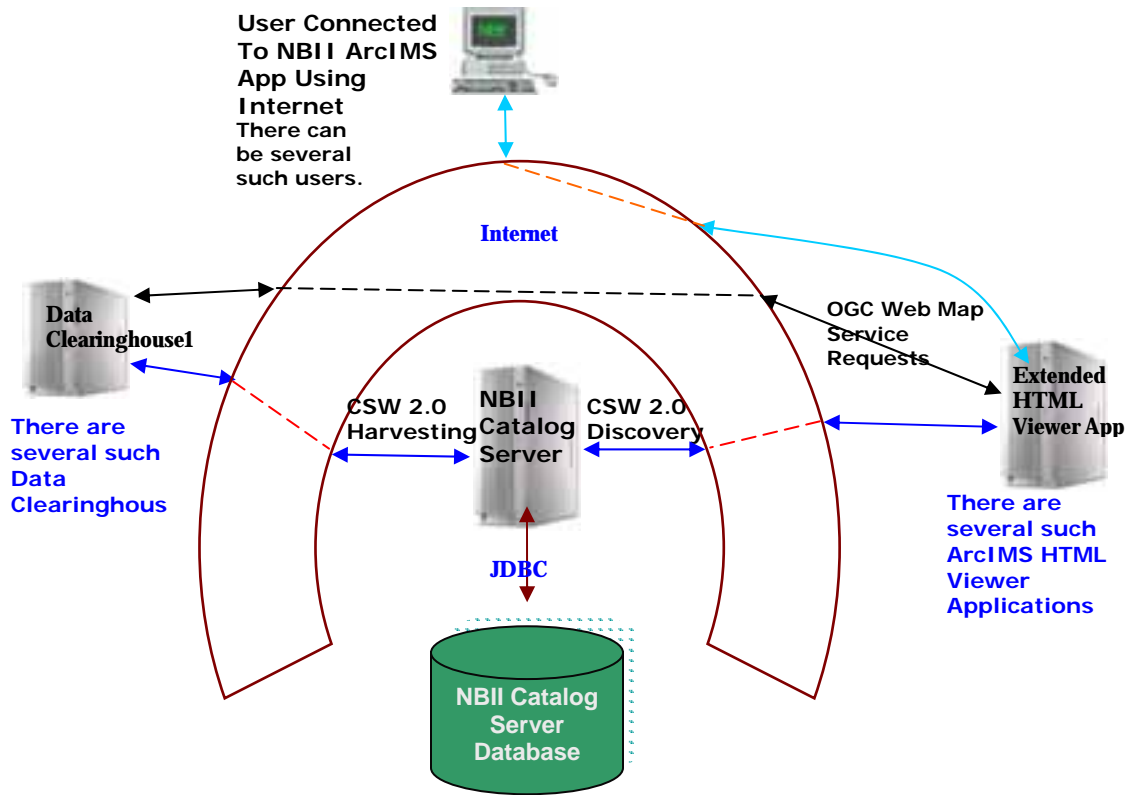

Figure 1 – **System Architecture**

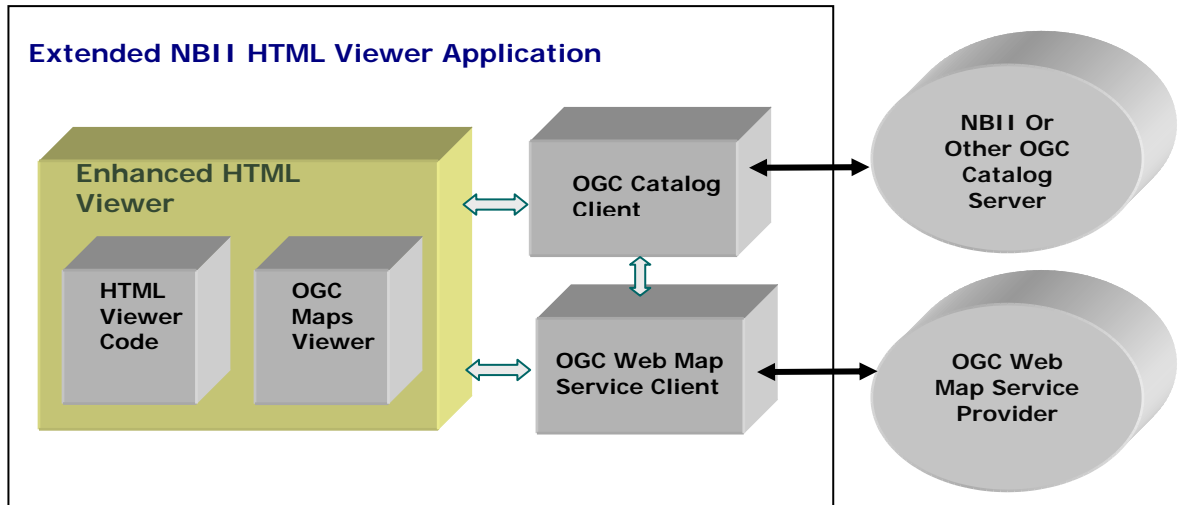Following image describes overview of 'Software Architecture' of the 'Extended HTML Viewer Application'.

Figure 2 – **Software Architecture**

Advantages of 'Extended HTML Viewer' Toolkit:

Streamlined development and maintenance:

- enhanced productivity during application development,
- reduction in time for maintaining and growing these applications,
- reduced time for supporting new OGC specifications,
- helped reduce duplication of effort in using and maintenance existing data such as the National Map

Enriched the end-user experience:

- increases discovery and availability of data by allowing re-usability of Internet accessible data,
- increases data currency within HTML Viewer applications by using up-to-date data directly from the data producer, and
- Allows the users of the HTML Viewer applications to analyze and use data in ways not anticipated by the developers.

Sites, Using 'Extended HTML Viewer' Toolkit:

Following sites have used the 'Extended HTML Viewer' toolkit:

- http://wildlifedisease.nbii.gov/mass3 - This site is using 'Extended HTML Viewer' Toolkit for existing sites. This site also uses Gazetteer service for zoom-in to a place. This site has been developed by Wild Life Disease Node of NBII.
- http://wildlifedisease.nbii.gov/epizoo2 - This site is using 'Extended HTML Viewer' Toolkit for new sites. This site also uses Gazetteer service for zoom-in to a place. This site has been developed by Wild Life Disease Node of NBII.

- http://128.173.240.47/MainNodeOGC/ - This site is using 'Extended HTML Viewer' Toolkit for existing sites. This site has been developed by Virginia Tech.
- http://hoosier.cr.usgs.gov/NBIIOGCNewAppTemplate/ - This site is using 'Extended HTML Viewer' Toolkit for new sites.

Conclusion:

This toolkit has reduced development time of any ArcIMS application from a minimum of two months to just a few days.   It helps to integrate an OGC Search into an existing application within few hours of time.   NBII is saving on an average of two months of labor per application development for each template implementation. Additionally, since the templates use common components, maintenance of these components has been reduced across all users.

Additionally, the NBII ArcIMS applications are becoming richer, allowing a better user experience.   Users can now find and use data that is available on the Internet and registered in an OGC catalog.

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