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<<http://www.remotesensing.org/proj/>>
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<<http://www.opengeospatial.org/specs/?page=specs>>
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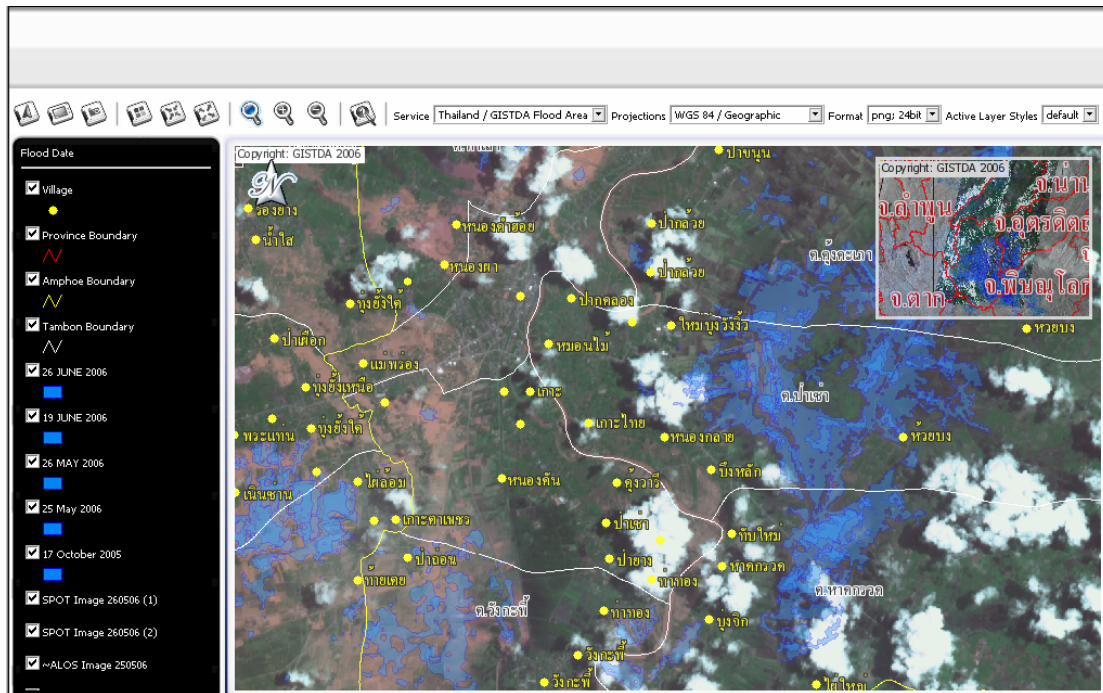


Figure 2 Thailand inundation map by GISTDA WMS AJAX Engine

## CONCLUSION

The system developed here integrates AJAX technology into the browser based dynamic WMS web client in order to establish the WMS scripts and class modules which can work with WMS from different providers. The results of this case can increase efficiency indifferent aspects as follows:

- Able to connect web map servers developed by various vendors, request self-capabilities of service by generating parameters, and create a map.
- Automatically request legend graphics of each layer, create table of content to manage visibility of layers.
- Support asynchronous preloading image map and other components for better visualization and performance.
- Support “on the fly” map projection for client side.
- Support a developer to simply integrate the system future with web applications as a set of separate objects that interact to each others.
- Able to change the user interface by skin set such as frame border, toolbar button, font format and etc.

## REFERENCES

- [1] Aaron Koning and the University of Northern British Columbia, “General Cartographic Transformation Package (GCTP) - JavaScript Edition 0.2.1 “,March 2006, <<http://datashare.gis.unbc.ca/gctp-js/index.php>>
- [2] David Martz , XML for <SCRIPT> , <<http://xmljs.sourceforge.net/index.html>>

map at incorrect location. This problem can be solved by re-projection bounding box before send through the map server.

Library function for re-projection BBOX value is General Cartographic Transformation Package - JavaScript Edition (GCTP-JS) version 0.2.1<sup>[1]</sup>. The GCTP-JS is an Open Source set of JavaScript code files which provide dynamic, client side coordinate transformations for internet applications. It also provides transformation capabilities for a number of projection types including Lambert, Albers, UTM, and others.

The “GCTP-JS” is modified for supporting different parameter values in map projection; especially in the coordinating system used in Thailand, i.e. geographic and UTM Zone 47-48 coordinating system with Indian Thai 1975 datum. The projection parameters are extracted from “PROJ.4 - Cartographic Projections Library”<sup>[3]</sup> which is the original source code obtain from GCTP-JS in C/C++ language.

## RESULT

GISTDA WMS AJAX Engine can support almost all services which web map servers can provide. However, to illustrate the advantages of this engine, the comparisons of system from different provider are explained in table 1.

Providers	GetCapabilities MIME Type	GetLegend Graphic	Layer Styles	Server Side Projection
UMN MapServer	application/vnd.ogc.wms_xml	Yes	Yes	Yes
NASA OnEarth JPL	application/vnd.ogc.wms_xml	Yes	Yes	-
CubeWerx Server	application/vnd.ogc.wms_xml	Yes	Yes	Yes
Demis World Map	application/vnd.ogc.wms_xml	Yes	Yes	-
ESRI Service (ArcIMS)	text/xml	-	-	-

Table 1 Comparison web map service potential from several providers

iii. Map Control is the map display class library derived from Map Object and basic JavaScript class to display map as a set of separate objects that interact to each other. The automatic interaction on demand can be pan, zoom in and zoom out map by using keyboard and mouse.

iv. Map TOC is the table of content class library which is implemented using map object and basic JavaScript class to display table of map content as a set of separate object that interact with each other. The table of map content is created from map object which describe the layer properties such as name, extent, legend graphics, title, abstract and relevant metadata.

v. Utility is the other class libraries which manage some specific functions and cooperate external class libraries.

vi. Style Set is the set of toolbar menu, image button, Cascading Style Sheet (CSS), event handling in JavaScript language, which has been developed for web page visualize in various styles.

### • XML Parser Module Set

AJAX technology supported in any newer web browsers can be parsing or translating the XML document responded from the web server, specifically in only “text/plain” or “text/xml” Multipurpose Internet Mail Extensions (MIME) Type or Content-Type. The security of XML parser on web browser can prevent translating other content types such as a harmful XML Document include “application/vnd.ogc.wms\_xml” MINE Type which is a standard format of WMS specification and implementation. From testing to request and response getcapabilities by UMN MapSerer version 4.4.2 on Windows operating system and many kinds of map server, XML parser represents an error security warning. This problem can be solved by using extra XML parser in JavaScript language.

JavaScript library module to parsing XML Document in this development is “XML for <Script>” version 3.1<sup>[2]</sup>, a cross platform XML parsing in JavaScript , standards-compliant JavaScript XML parser designed to help web application designers implement cross platform applications that take advantage of client-side manipulation of XML data. “XML for <SCRIPT>” provides a full suite of tools including: a standards-compliant W3C DOM Level 2 processor and an XPath processor.

- A standards-compliant SAX processor
- A simple (classic) DOM processor
- Proxies for XML retrieval from any domain
- Utilities for XML and application development

### • Map Projection Module Set

Generally, WMS web client can receive a projected image map by providing Spatial Reference System (SRS) parameter into the request. For example, the specific parameter “&SRS=EPSG:4326” is a parameter to request image map from server in geographic coordinating system using the WGS 1984 datum. When the map projection is changed, the display area or bounding box (BBOX) coordinating system still keeps the same value before being updated. This case will take effect to display

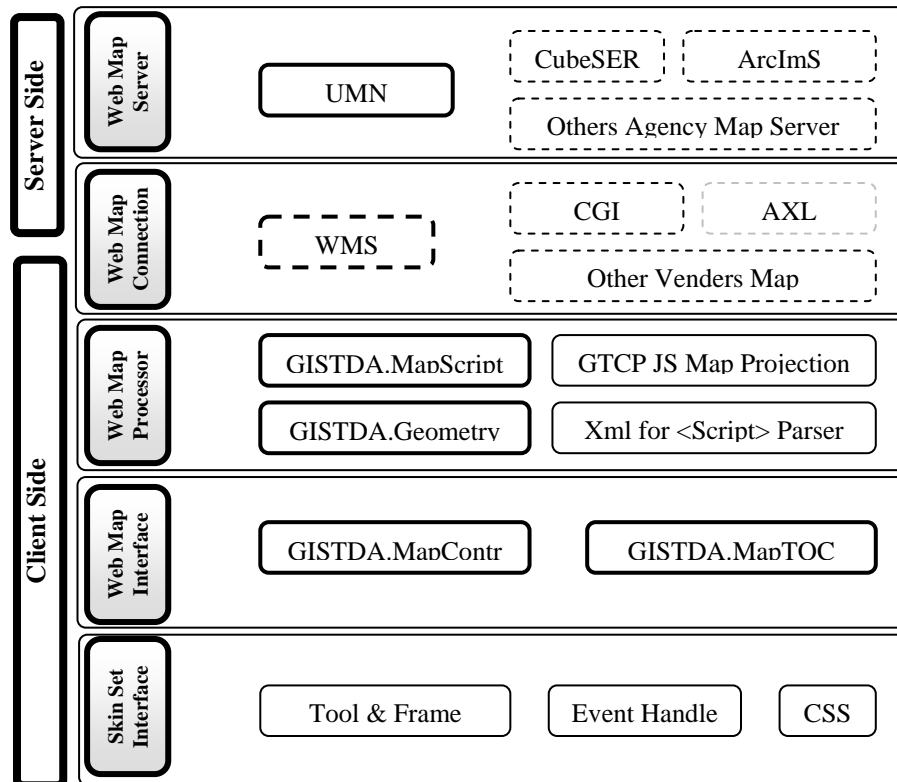


Figure 1 System Architecture

### Web Map Server Implementation

The first part of system architecture focus on server side. To ensure that WMS AJAX Engine can support other configurations, the open source web map server which developed by University of Minnesota (UMN MapServer) <sup>[5]</sup> has implied to test and validate system.

### Web Map Client Implementation

The other part of system architecture emphasize on client side. Base on the Object-Oriented Programming (OOP) concept, the computer program may be seen as comprising a collection of individual units, or objects, that act on each other, as opposed to a traditional view. The program may be seen as a collection of functions, or simply as a list of instructions to the computer. Each object is capable of receiving messages, processing data, and sending messages to other objects. Each object can be viewed as an independent machine or actor with a distinct role or responsibility.

- **GISTDA Module Set**

- Geometry is the class library of basic geometry interface; such as point, rectangular, line, polyline and polygon. The method and properties of its subclass will inherit to superclass. For example, a bounding box of map object and zoom box of map control are implement using a rectangular class.
- Map Script is a map object class library which is implemented using varies base class and external class library. The useful functional geographic information system will allow any map components to inherit the methods and properties of subclass, manage request and response through map server.

## IMPLEMENTATION

In order to fulfill the above mentioned objective, the architecture of WMS web map client was designed. Both Web Map Server and Web Map Client were then implemented with a set of library modules. This set includes MapScript modules, MapControl modules, MapTOC modules and Utility modules. This section will discuss in detail on system design and system implementation of WMS AJAX Engine.

### System Design

Currently, there are several map servers available in the GIS community. Although provided by different organizations, they are very well compliant with WMS standard<sup>[4]</sup>. However, some AJAX WMS web client is required to facilitate further development such that this new system can be applied to any web map client regardless of its source. The development can be divided into five parts, which are web map server, web map service, web map processor, web map interface, and skin set interface. Each part is under different environment as follows:

- i. Web Map Server: Several map server from various sources. They are all, however, compliant with WMS standard.
- ii. Web Map Service: The different providers design its own system. Each system needs set of unique parameters. However, this system design has been developed based on the WMS standard which can support other complicate systems as well.
- iii. Web Map Processor: This part operates on two different functions, i.e. process request parameter and response.
- iv. Web Map Interface: Providing flexible structure which other developers can change interface practically.
- v. Skin Set Interface: The design of skin set allow web designer to remake, enhance even design their favorite style. Thus, set of interface has divided from main web map interface for frame style, button, color, font, and further event handle design.

# **The Dynamic WMS Web Client Development with AJAX**

Pisut Narkmaunwai and Amornchai Prakobya  
Geo-Informatics and Space Technology Development Agency  
196 Phahonyothin Road, Chatuchak, Bangkok 10900, THAILAND  
Tel.: +66-0-2940-6420-9, Fax: +66-0-2561-3035  
<http://www.gistda.or.th>  
Email: [pisut@gistda.or.th](mailto:pisut@gistda.or.th) and [amornchai@gistda.or.th](mailto:amornchai@gistda.or.th)

**KEYWORDS:** Dynamic, WMS, AJAX,

## **ABSTRACT**

In the era of the globalization, the GIS technology together with Internet Technology seems to be indispensable in many aspects, for example, disaster management and decision support systems. To integrate with other powerful technologies, however, high performance and user friendly tools are required. Realizing this need, Geo-Informatics and Space Technology Development, has been developing a Web Map Engine based necessity on the Asynchronous JavaScript and XML (AJAX), so-called GISTDA WMS AJAX Engine. This paper has described techniques of the utilization of AJAX technology and its architecture. The connection of web map server and web map client has been established using the library module sets including MapScript, MapControl, MapTOC, and Utility class library. Based on these modules, GISTDA WMS AJAX Engine can generate self legends, support “on the fly” projection, show layer zoom by preloading, and display layer styles. Result showed that the AJAX technology played an important role when requesting and responding to satellite imageries and other related spatial data. It can be summarized that, this engine can significantly improve the performance of WMS web client.

## **INTRODUCTION**

The Asynchronous JavaScript and XML (AJAX), has played an important role in development module especially in the web browser applications. It uses several existing technologies. Those technologies include JavaScript and XML which come together and incorporate to create a new powerful technique. Nowadays, web map services can generate several required characteristics of GIS systems, such as standards for providing general purpose specifications for publishing, locating, and involving services across the web services. Since AJAX and web map services are able to leverage each other’s strength.

## **OBJECTIVE**

1. To develop JavaScript class libraries for a WMS web client such that it can be provided by most agencies.
2. To improve the capability of existing GISTDA WMS Web Client Engine using AJAX technology.