

# The Internet GIS Infrastructure for Interoperability: MAP(Mapping Assistant Protocol)

Seokchan Yun, Youngsup Kim

GIS Research Institute, Handong University

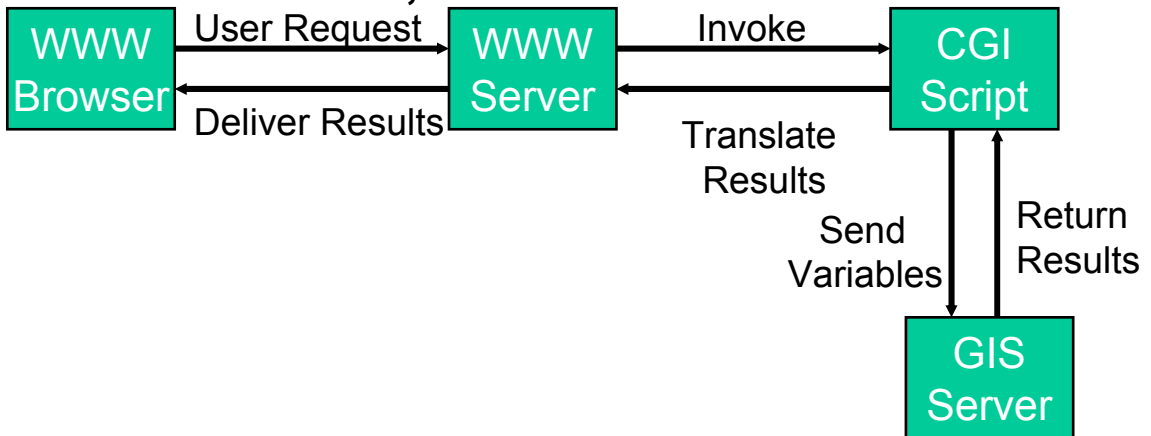
## Agenda

- What's Internet GIS
- Activities
- Requirements
- MAP Overview
- MAP Server
- MAP Client
- MapML
- Summary

# What's Internet GIS (1)

- Data processing and browsing technology of spatial data (GIS) via Internet

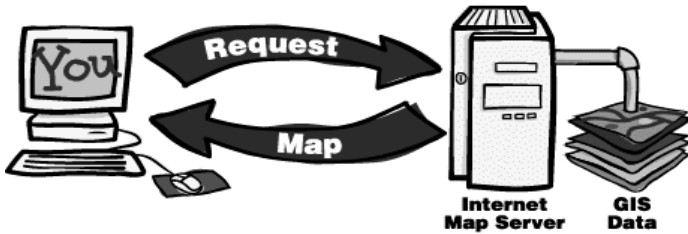
- **Sever-side : CGI, JDBC**



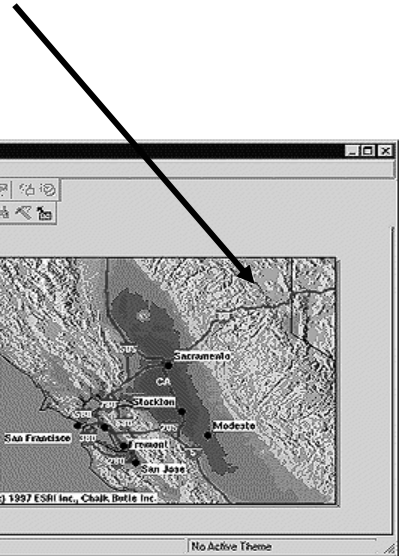
- **Client-side : Java, Plug-in, ActiveX**
- **Raster-based map**
  - XeroxPARC Map Server (<http://www.parc.xerox.com/map>)
  - ESRI Arc Explore (<http://www.esri.com>)
- **Vector-based map**
  - Active Map. (<http://www.internetgis.com>)
  - Internet Geo Star. (<http://www.rcgis.wtusm.edu.cn/wwwgis>)
  - Jshape (Open Vector-Java APIs)

# What's Internet GIS (2)

## Map Objects Internet Map Server



Raster Image



### Arc Explorer

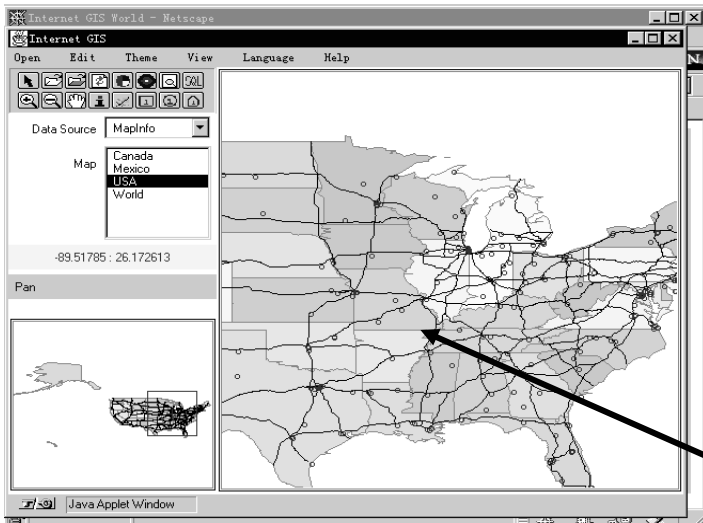
Zoom in/out, Pan, Layering,  
Query & Search

Plot Shape file, GIF/JPEG

Thematic mapping

**ESRI (<http://map.esri.com>)**

## Internet GeoStar of WTUSM



### **GEOSTAR VIEWER**

GIS+JDBC and Applet

Zoom in/out, Pan, Layer

Mapinfo, Arc/Info, DXF

**WTUSM of China**

c.f Jshape with .shp file

Vector Image

# Activities : OpenGIS, W3C

- Open GIS

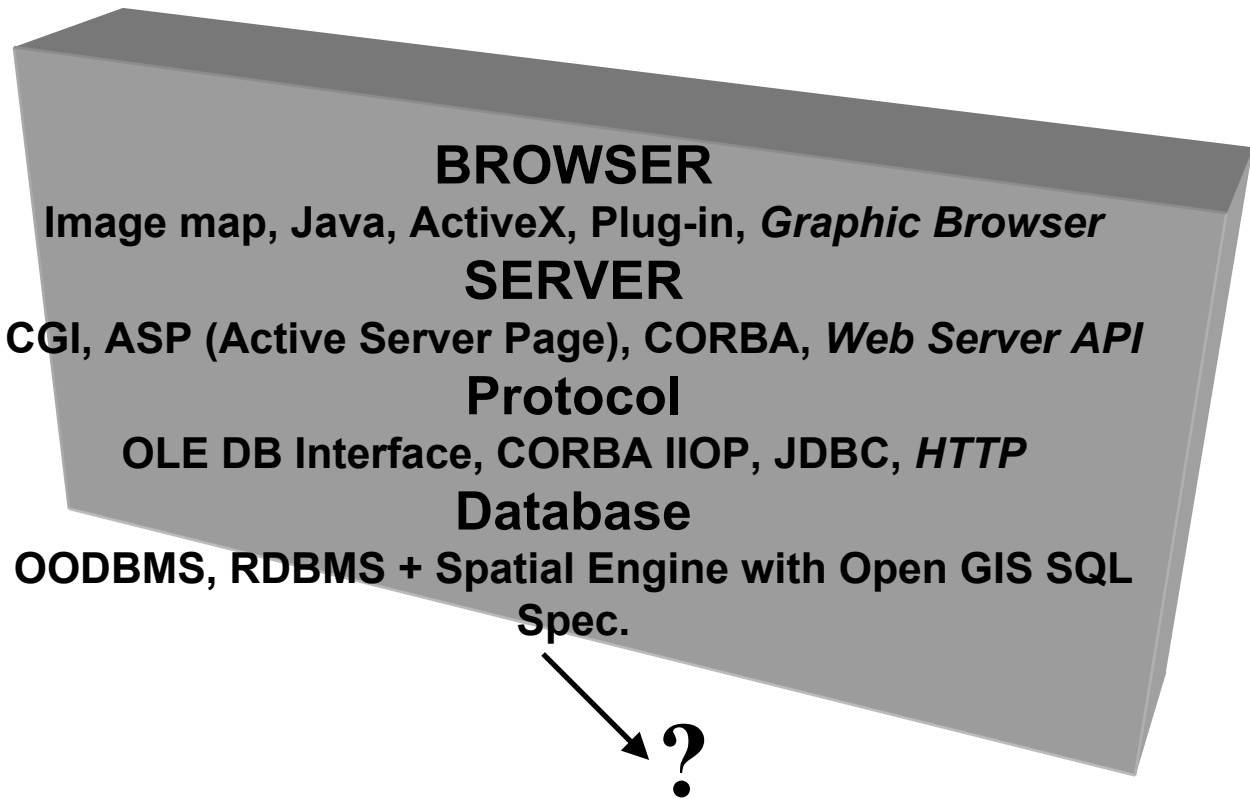
- Open interfaces and protocols defined by OpenGIS® Specifications support interoperable solutions that "geo-enable" the Web, wireless and location-based services, and mainstream IT, and empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications.
- Abstracts Spec. :
  - Open Geodata Model, OpenGIS Services Model, Information Communities Model
- Implement Spec.: **OLE/COM, CORBA, SQL**
- GIS Vendors
- <http://www.opengis.org>

- W3C

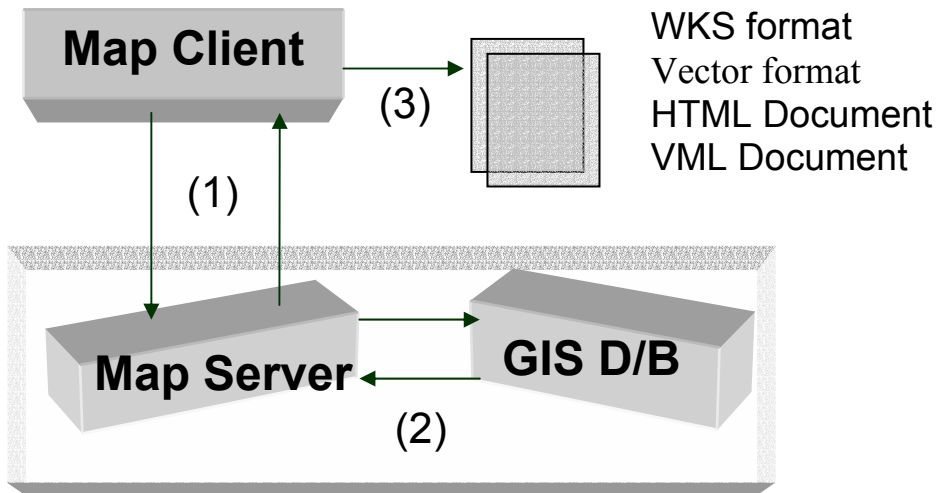
- The World Wide Web Consortium (W3C) develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential. W3C is a forum for information, commerce, communication, and collective understanding
- HTTP1.1 and Certificate Technology
- XML (Extensible Markup Language)
- **Scalable Vector Graphic Activities**
  - PGML : Precision Graphics Markup Language
  - VML : Vector Markup Language (98.5)
  - SVG Draft Requirements (98.10)
- Web and Graphics Vendors

# Requirements

- **Problems**
  - not based on internet environment
  - OS, Vendor dependent
- **Requirements**
  - Standard protocol
  - Web environment
  - Speed and Security
  - Open client with Open APIs
- **Implementation**



# MAP Overview



- MAP client requests specific document to MAP server. It's possible to use either HTTP or MAP.
- for example, `map:// + server : port number / + document`
- MAP server checks mime-type of a request. If it is HTML, server sends HTML document and if it's MAP, it does the GIS dataset written by MapML.
- MAP client lays out windows to display vector data by given Document Type Definition(DTD)
- MAP client requests vector data blocked by given data-set, server gets these data formatted by Open GIS or documents converted by MapML from GIS D/B and sends to client.
- MAP client displays graphic data such as vector format or WKS format and XML or HTML document.

# MAP Server

Client Request

Client Response

Server Core Routine

Standard Module

Database Module

Other Module . .

Database Access  
 Encoding Data  
 WKT Analysis  
 WKB Analysis  
 SVG Converting  
 HTML Converting  
 Attribute Data Access

HTTP1.1

+

SSL

CA

+

DB API

+

Converter

```
MIME type Extension text/xml      map mapml
application/x-mapd-wkb           wkb
```

**Request Example case**

```
GET /index.map MAP/1.1
From: scyun@www-kr.org
Referer: map://my.gisdata.com/index.map
User-Agent: Mozilla-Map 1.2
. . .
```

**Response Example**

```
MAP/1.1 200 OK
Server: MDMA/0.1
Content-type: text/xml
Last-Modified: Thu Jul 7 00:25:33 1994
Content-Length: 2003
```

**DB API Example**

```
int wkb_handler (request_rec *);

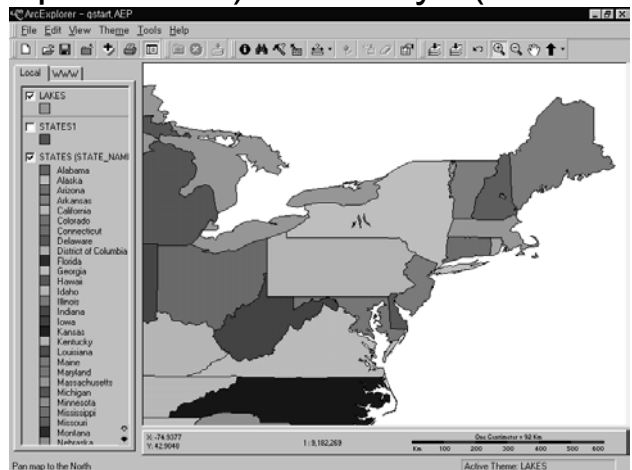
handler_rec wkb_handlers[] = {
{ "application/x-mapd-wkb", wkb_handler },
{ NULL }
};
```

# MAP Client

- Functions

- Program components and library for dynamic mapping and vector graphics
- Linkage between vector and attributing data
- Function of zoom in/out, panning, query, layering and thematic mapping
- Cryptographic communication using SSL.
- Supporting MapML and SVG(XML/VML) to show web documents and display vector data together
- Add vector graphic library to open browsers such as Mozilla (Open Net-scape Source) and Amiya (W3C Open Browser)

## Client Layout and MapML



```

<mapml>
<map name="EAST, U.S.A" coord="38 127, 43 134" scale="2"
bgcolor="blue">
<layer name="coastline" color="Red"
src="map://a.com/coast.wkb">
<layer name="state" color="Blue"
src="map://a.com/state.mapml">
<basemap name="tophology" alt="Basemap"
src="map://a.com/krbase.tif"></map>
</mapml>

```

# MapML (MapML/VML/SVG)

- The MapML is an application of XML which defines a format for the encoding of vector information.
- **Vector graphics:** line segments, closed filled shapes, Curved elements, Text, CSS/XSL, Layering, etc.
- **Interaction and Dynamic Behaviors :**Zoom and pan, Pick single elements, Switching layers
- **Metadata:** Author, title, copyright (Dublin core), Aspect ratio, physical size for stand-alone print, mapping scale, geographic coordinates, scale factor and GIS format etc.
- **Authoring tools:** wide cross-platform support in existing content creation tools

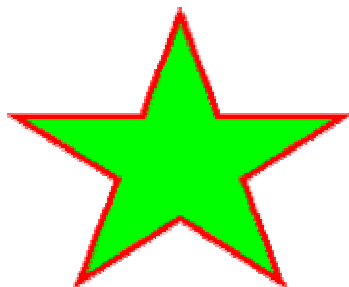
## DTD Example

```

<!ELEMENT polyline EMPTY>
<!ATTLIST polyline
    points          CDATA          #REQUIRED
    with            CDATA          #IMPLIED
    gname           CDATA          ""
    arrowhead      (none|start|end|both)  "none"
    align          (left|center|right)    #IMPLIED
    curve-type     (dotted|dashed|solid) #IMPLIED
    linewidth      CDATA          #IMPLIED
    curve-colour   CDATA          #IMPLIED
    height         CDATA          #IMPLIED
    style          CDATA          #IMPLIED
>

```

## VML Example



```

<v:shape style='top: 0; left: 0; width: 250;
height: 250' stroke="true"
strokecolor="red" strokeweight="2" fill="true"
fillcolor="green" coordorigin="0 0"
coordsize="175 175">
    <v:path v="m 8,65
172,65,92,11,112,65,174,65,122,100,142,155,92,
121,42,155,60,100 x e"/>
</v:shape>

```

# Summary

- The MAP model optimizes a performance of client and server and includes recent trends of web, also systems are composed of open API followed implement specifications of OGC and W3C.
- Because this is compatible with HTTP, it is possible to display web page and attributing data converted from GIS database and to pass secure data through authentication and cryptography.
- The basic protocol of this model is HTTP1.1. The server includes database access modules and analysis modules converting various vector formats to MapML format.
- The client is possible to implement XML with the vector graphic library. This infrastructure is programmed in Apache web server, Amiya browser and Grass D/B based on MapML which is expressed by Open GIS elements through the scalable vector graphic draft of W3C.
- The suggested web-based Internet GIS model by this paper will be good example for effective sharing of spatial data between offers and users, because this is focused on the Internet technologies and environment.