WEB MAPPING WITH GEOGRAPHY MARKUP LANGUAGE

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ABSTRACT:
XML (eXtensible Markup Language) provides a powerful new way for data description and data exchange, and it is becoming widely used on the World Wide Web. Over 100 XML derived languages emerging in last year. In March of 2000, OpenGIS have proposed a format to represent geographical information with XML, which is called GML (Geography Markup Language). GML is a powerful new way for geographic information sharing, interoperability and Web Mapping. This paper represents a GML-based Web Mapping application that public spatial data via the web. The new web will be a semantic web. With GML, spatial data will be integrated within the semantic web totally.

1. INTRODUCTION

XML is the "eXtensible Markup Language" that was developed by the World Wide Web Consortium. XML is an idea data format for storing structured and semi-structured text intended for dissemination and ultimate publication on a variety of media (Robin Cover, W3C 1998). Over 100 XML derived languages emerging in last year. There are two subtle but keenly important differences between HTML and XML. SoftwareAG (makers of Tamino, an XML based database) explains the distinction this way: The motto of HTML is: "I know how it looks," whereas the motto of XML is: "I know what it means, and you tell me how it should look." Said another way, HTML is about making pretty presentations while XML is a semi-structured document that holds "content". Various techniques based on the XML are under an intensive development by the World Wide Web Consortium (W3C).

In the world of GIS we are still a ways off from extensive adoption of XML, as researchers and vendors explore and define how XML will be used (Adena Schutzberg, 2000). ESRI has chose XML to store metadata in Arcinfo 8. The data is in a raw format, and depending on your needs can be displayed in different ways. GI, Geographic Information, community's interest in this new technology is exemplified by the various initiatives to adopt XML syntax as a encoding language for spatial data. Examples include the ISO TC211's work on developing rules for expressing UML-modeled datasets in an XML vocabulary and the Open GIS Consortium's (OGC) recently introduced Geography Markup Language (GML). The W3C is also developing an XML-based Web vector graphics specification, called Scalable Vector Graphics (SVG). Since the number of XML-encoded spatial datasets available on the Web is evidently going to increase, a question must be raised about how these datasets might be used. Many client applications will not be able to process spatial information in it's original form. The W3C's recent Recommendation, eXtensible Stylesheet Language Transformations (XSLT), is a power tool to pre-process spatial XML-based datasets into a more easy-to-use form.

2. WHAT'S WEB MAPPING?

Web Mapping is the set of products, standards and technologies that enable access to location information, usually portrayed as maps, via the Web (OGC, 2000).

Unfortunately, today, most Web Mapping applications are inseparably tied to a specific server implementation. In other words, the client is hard coded to interact with a particular vendor's proprietary map server implementation. User must run different client applications in order to access the data and functionality provided by different server implementations. In this situation, there is very little interoperability or reuse of client and server implementations. Because data are often accessible only through a given server, there is also very limited ability for a user to transparently access data of interest from outside a fixed client/server.

The Open GIS Consortium's Web Mapping Testbed (WMT) is a process that brings together sponsors (customers) and
participants (vendors) to collaboratively research, develop and
demonstrate new Standards-based Commercial technologies
that enable your web browser to seamlessly access, view and
exploit the vast, diverse and widely distributed geospatial data
holdings on the Web. The first round of the WMT was started in
May of 1999 and completed in September 1999. The Web
Mapping Testbed Phase 2 (WMT 2) expands the range of
interoperable web mapping services to meet a broader
cross-section of community needs. In addition to creating new
specifications, WMT 2 will result in more federal data coming
on-line using WMT protocols. The WMT rapidly produces
interface specifications that enable interoperability and
innovation.

3. WHAT IS GML?

The Geography Markup Language (GML) is an XML
encoding for the transport and storage of geographic
information, including both the geometry and properties of
geographic features (OpenGIS Consortium, 2000). GML is
based on a common model of geography (OGC Abstract
Specification), which has been developed and agreed to by the
vast majority of all GIS vendors in the world.

GML version 1.0 is developed by OGC as a Recommendation
that was passed in May 2000, and OGC announces the release
of Geography Markup Language version 2.0 (GML) in April 4,
2001, a significant milestone in the development of
interoperable architectures for the use of spatial information
between commercial applications. The progress of GML 2.0 is
an example of the growing momentum for the acceptance and
use of GML specifications around the world. GML represents
one of the most visible steps taken by the geospatial community
towards the vision of widespread spatial interoperability. GML
was originally implemented and tested through a series of
demonstrations that formed part of the OGC’s Web Mapping
Testbed (WMT) conducted in the summer of 1999. These tests
involved GML mapping clients interacting with GML data
servers and service providers. Further exploration and
development of GML is now taking place within OGC’s Web
Mapping Testbed Phase II and Geospatial Fusion Services
Testbed Phase I.

The Features of GML includes:

- GML can readily integrate with Non-Spatial Data
- GML implements data transform between XML-to-XML
- GML can transport behavior

4. WEB MAPPING WITH GML

Geographic data is concerned with a representation of the
world in spatial terms that is independent of any particular
visualization of that data. When we talk about geographic data,
we are trying to capture information about the properties and
geometry of the objects that populate the world about us. How
we symbolize these on a map, the colors or line weights we
choose to use is something quite different. Just as XML now
helps to clearly separate content from presentation for web
pages, so GML will do the same in the world of geography and
mapping (Ron Lake, 2000).

GML is concerned with the representation of geographic data
content. As well, we shall see we can also use GML to make
maps. This might be accomplished by developing a rendering
tool to interpret GML data. However, this would conflict with the
GML approach to standardization, and to the separation of
content and presentation.

To make a map with GML data, we must style the GML
geographical content into a suitable graphical presentation. This
involves the interpretation of the GML content using graphical
symbols, and often some sort of transformation of the geometry
of the GML data into the geometry of the visual presentation.
We refer to this interpretation process as map styling (Ron Lake,
2001). Many of the same tools and technologies, such as XSLT
(XML Transformation Language), can be used to perform this
styling operation. Potential graphical display formats include
W3C Scalable Vector Graphics (SVG), Vector Markup
Language (VML), and the Web 3D Consortium’s X3D.

XSLT is well suited to XML-to-XML transformations. XSLT is
tablet, XSLT supports the concept of an extension function.
An extension function allows an XSLT engine to perform
operations that are beyond the capabilities of the XSLT
language such as geometric or coordinate transformations. In
the majority of cases we may use XSLT as a tool to style the
GML data into an XML graphical format such as SVG, VML or
X3D.

The process of transforming the graphical presentation into a
viewable image we shall refer to as graphical rendering. At the
present time there are a variety of graphical renders available
for each of the different XML graphical formats, some native to
the browser (e.g., Internet Explorer 5.0’s built in VML processor),
some distributed as plug-ins for many browsers (e.g., Adobe SVG Viewer) and some available as stand alone viewers or code libraries (SVG and X3D). The overall process of GML map making is illustrated in Figure 1.

![Figure 1. Process of GML Web Mapping](image)

5. APPLICATION OF GML-BASED WEB MAPPING

Several Web Mapping products are available since 1997, including Intergraph WebMap Server, ESRI Internet Map Server (IMS), Autodesk MapGuide and others with lesser impact. There are two primary data provision solutions in those products, one is Java applets, and the other is browser plug-ins.

Java applets nice in principle, but slow in practice (still optimistic), applets normally downloaded at beginning of each site visit, plug-ins allow fast visualization and interaction, but require initial download & installation.

Whether the client side of an Internet mapping solution is thin, like a web browser, or thick, like a web enabled desktop product, XML and its associated technologies can be used to transfer geographic data. The size of the client will determine the method used to display the map to the end-user, either via Windows graphic calls, Java graphic calls, or possibly a plug-in.

We developed an ActiveX Control, called GMLViewer for publishing GML data on the Web. Layers with map information are converted from a GIS Products GeoBeans into GML files. After it has download, GML data will be viewed by anyone on the Web! The architecture of the sample GML application shows in Figure 2.

![Figure 2. Sample Architecture for GML Web Mapping](image)

The Sample fragment of GML encoded file see as follows:

```xml
<FeatureCollection
  typeName="City">
  <boundedBy>
    <Box srcName="UTM">
      <coordinates>100,100 500,500</coordinates>
    </Box>
    <boundedBy>
      <featureMember
        typeName="Point">
        <Feature
          type="city" identifier="0">
          <property
            type="ID" type="long">0</property>
          <geometricProperty
            type="Location">
            <Point>
              <coordinates>152,763,335,172</coordinates>
            </Point>
          </geometricProperty>
        </Feature>
      </featureMember>
    </FeatureCollection>
```

6. CONCLUSIONS

The Web will be changed qualitatively, not only quantitatively during the next few years. The new web will provide better tools to manage not only page markup but also recognition and organization of page content. The key to the future of IT is communication, not PCs. The new web will be a semantic web,
and will be constructed on the back of XML. XML provides an effective way for open, vendor neutral data exchange, locally and especially over the Internet. The pieces for XML-based GIS have existed, especially for technologically open Web-GIS. GML provides an open data interface for data exchange between different GIS products from desktop to Internet.

GML is new and exciting technology that will drive the future of spatial information on the Internet. With GML, spatial data (e.g., points, polygons and lines) is encoded with XML, spatial objects encoded with unique IDs, attribute data (text) encoded in standard XML. Metadata can be integrated within the same files, spatial data can be distributed in the net via wired and wireless network. Spatial data will integrate within the semantic web totally.

5. REFERENCES


