Development of an “Enterprise Geographic Information System (E-GIS)” based on Open Standards

Dr. S.K. Ghosh
School of Information Technology
Indian Institute of Technology, Kharagpur
skg@iitkgp.ac.in
Introduction

- Sharing large volumes of spatial data is an important task
- GIS are no longer simple departmental tools
  - Corporate tools
  - Governmental tools
  - Society-oriented applications
Introduction

- Increasing demand for GIS in large computational environments, with a large number of users, spread over numerous locations, and high volumes of data

- Factors:
  - The fast development of networking technology and the Internet
  - The success of Web-based GIS
  - The wide applicability of mobile and ubiquitous computing
Introduction

GIS has always carried the promise of acting as a “common denominator” between various data sources

- Research on interoperability
- Research on semantics and ontologies

This makes much more sense in a widespread and heterogeneous computational environment
Data Sharing

- Data sharing and exchange among several organizations is hard to achieve
- It involves *at least*
  - A *lot* of political negotiation
  - Agreements on standards
  - Agreements on costs and cost sharing
  - Agreements on maintenance
  - ....
Data Sharing

- The impact of such data exchange and sharing efforts is very positive
- We need technology that can make such efforts pay off
  - Easier data access
    - Syntax
    - Semantics
  - Less maintenance and synchronization issues
    - Data usage directly from the source, without translation or replication
  - More applications
    - Free access to base maps
    - Public services
    - Value-added services
Approach for “GeoData Sharing”

- Spatial data transfer standards
- Spatial data clearinghouses
- Spatial data infrastructures
- Geoportals
“Early” GIS

- Dataset creation was *really* expensive and complex
- Redundant efforts were commonplace
- Potential data providers were late adopters of GIS technology
- Lack of data conversion services
“Spatial Data Clearinghouses” concept

- SD Clearinghouses have been described as sites through which a number of services related to spatial data can be accessed.

- The emphasis on services is recent: this concept has been initially implemented as a means to obtain “off-the-shelf” data.
Spatial Data Infrastructures

- Evolution from the clearinghouse perspective
- “Infrastructure” implies that there should be some sort of coordination for policy formulation and implementation
- US definition (NSDI):
  - “technologies, policies, and people necessary to promote sharing of geospatial data through all levels of government, the private and non-profit sectors, and the academic community”
Spatial Data Infrastructures – Expectations

- SDIs should
  - Provide standardized access to data
  - Have multiple participants, in the role of information services providers and/or users
  - Have a broad thematic scope
  - Facilitate data sharing
Spatial Data Infrastructures

- Widespread adoption of Internet-based tools allowed the creation of Web portals to multiple geographic information sources
  - Geoportals

SDI = Service-Driven Infrastructure!
SDI vs. Geoportal

- **SDI**
  - Confluence of several different geodata providers
  - Access through specific Web services
  - Requires a repository or catalog of available services
    - Metadata
  - Usage by applications

- **Geoportal**
  - An SDI encapsulated by a human-computer interface
  - Should be considered a component of an SDI
Service-oriented architecture (SOA)

- Involves service providers, service aggregators and service users
- Users may be human or software clients
- Available services are listed in directories by providers
- Aggregators design compositions of rules based on primary services
SDI vs GIS

- A SDI and a GIS are very different
  - SDI: widely-available, general-use data, accessible through services
  - GIS: organizational tool, built and operated around a definite set of goals
Users

Web Services

Services Registry

Metadata on data and services

Users

XML

XML / GML

Geographic Information Providers

University
NGO
Federal agency
State agency
Local Gov
Commercial provider
Major Motivation

- Includes
  - Develop a better understanding of the SDI approach – at multi-level
  - Develop a method for the design and implementation of Spatial Web Service (OGC compliant) for the SDI
  - **Enterprise-GIS**
    - *Study the architectural possibilities for chained Web services*
      - *Mobile GIS applications*
“The Big Picture View”

SDI’s Supporting User Needs

Regional/Multi-national
National
State, local

User Applications drawing on & supporting SDIs

E-Gov & E-Business
Homeland Security
Disaster Management
Land Tenure
Health Monitoring
Market Development
and
… many others

Source: NRDMS
http://nrdms.gov.in
Enterprise GIS?

- A GIS that integrates geographic data across multiple departments and serves the entire organization.
- A GIS that provides access to other information systems in the organization by using a map or application as the integrator of the organization’s information.
- A GIS that provides desktop access to all users.
- A GIS that supports applications that are easy to use and understand.
- A GIS that is well-organized and well-managed.
- A GIS that is supported by all departments and management.
Overall model

Data Provider End

Line Department
Data Transfer Interface

Line Department
Data Transfer Interface

Line Department
Data Transfer Interface

Secured Data Transfer

EGIS Core

OGC Web Services (WMS/WFS)

Oracle Spatial

Web Based Data Access/Query using OpenGIS Specification

Data Consumer End

Line Department

Line Department

Line Department
Broad Objectives

- Development of an E-GIS framework for integrating the geo-information bases developed by various organizations (line-departments)
- User department can access/query the system using OpenGIS-based web services over Internet
- Utilization/re-use of the huge data repositories (developed under different initiatives, like, NRDMS programme)
- Demonstrating the efficacy of the Enterprise GIS - Prototype
- Organizing workshops/training to the intended users/staffs
- Facilitating development of Indian NSDI
## Progress of the Work

<table>
<thead>
<tr>
<th>Activities</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature survey, Study of OGC standards &amp; draft framework preparation</td>
<td>Completed</td>
</tr>
<tr>
<td>Procurement &amp; Installation of the equipments / software</td>
<td>Completed (First Phase)</td>
</tr>
<tr>
<td>Identification of model district (Bankura, W.B.)</td>
<td>Completed</td>
</tr>
<tr>
<td>Workshop-1 (at Bankura, W.B.)</td>
<td>Completed</td>
</tr>
<tr>
<td>Conceptual Design (UML)</td>
<td>Draft Design Completed</td>
</tr>
<tr>
<td>Physical Mapping of model to RDBMS for selected Blocks</td>
<td>In Progress</td>
</tr>
<tr>
<td>Populating the database</td>
<td>In Progress</td>
</tr>
<tr>
<td>Workshop-2</td>
<td>To be done</td>
</tr>
<tr>
<td>Development of the Core-System</td>
<td>In progress</td>
</tr>
<tr>
<td>Development of interface with data-provider</td>
<td>To be done</td>
</tr>
<tr>
<td>Development of interface with data-user</td>
<td>In progress</td>
</tr>
<tr>
<td>System level integration</td>
<td>In progress</td>
</tr>
<tr>
<td>Development of the prototype E-GIS framework</td>
<td>In progress</td>
</tr>
<tr>
<td>Testing of the functionalities of the E-GIS</td>
<td>In progress</td>
</tr>
<tr>
<td>Documentation (Design &amp; User)</td>
<td>In progress</td>
</tr>
</tbody>
</table>
Overview of IIT Kharagpur Geo-service
“Home”

IITKGP Geoservice is an implementation of Enterprise-GIS (EGIS) which can be accessed through web. It conforms to OGC standard and WMS, WFS are implemented to access data from oracle. The initial page has a user authentication to access the service.
After providing the user name and password, the control goes to next page, and the geospatial information of the available set of data are displayed. Geospatial information of Raipur and Ranibandh blocks of Bankura district.
The different sets of data can be viewed by selecting the themes accordingly. In the case study the available themes are

- **Bankura Intra** - Data of Raipur and Ranibandh block of Bankura district can be seen in this theme.
- **Bakura Purulia** – Data of Kashipur block and Chatna block can be seen in this theme.
- **Survey of India** - Data of Survey of India can be seen in this theme.
- **Trivandrum** - Data of some panchayat of Trivandrum can be seen in this theme.
Description of themes

Available themes in the drop down box
Description of themes

- Administrative boundary of Raipur and Ranibandh block of Bankura district along with its road feature.
Description for selecting the features

The administrative boundary, drainage, forest and water body of Ranibandh block is selected.

The user can view the feature of its own choice by clicking on the check box of the available features.
Description of style for the features

The style of available features can be seen by selecting "legend" type of view from the highlighted drop down box.
Description of style for the features

Style and color code for the feature displayed in the map
Data of “Survey of India”

“Survey of India” (SoI) map. Road, building and stream data are shown.
Data for “Survey of India”

- All Features “Survey of India” (SoI) is selected
Data of Kashipur Block

- Kashipur Road and Kashipur Village is selected from in the theme “Bankura Purulia”
Description for WFS

The Feature request can also be made by clicking on the button IITKGP-WFS
Description for WFS

After clicking on the button IITKGP-WFS, The following page is displayed.
Description for WFS

- Click on drop down named Request

```
<?xml version="1.0" encoding="UTF-8"?>
<ws:DescribeFeatureType version="1.1.0" xmlns:ws="http://www.opengis.net/wfs" xmlns:app="http://www.opengis.net/app"
xmlns:ogc="http://www.opengis.net/ogc"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/wfs http://schemas.opengis.net/wfs/1.1.0/wfs.xsd">
  <ws:FeatureType>
    <ws:Name>RaiP_Census.xml</ws:Name>
    <ws:App xlink:type="simple" xlink:href="http://www.opengis.net/app/"/>
    <ws:DefaultApp xlink:type="simple" xlink:href="http://www.opengis.net/app/"/>
  </ws:FeatureType>
</wfs:DescribeFeatureType>
```

“DescribedFeatureType” for XSD

“GetFeatureType” for GML
The user have to select the item from the list and then click GET SERVICE button.

Selected item Raipur roads “Raip_Roads.xml”
Description for WFS

The Web Feature Service

Web Feature Service
Of the selected Item.
Thank you!!

Dr. S.K. Ghosh
School of Information Technology
IIT Kaharagpur
skg@iitkgp.ac.in
Fund Position

- Total Fund allocated: Rs. 40.50 Lakhs
  - First Year: Rs. 29.20 Lakhs
  - Second Year: Rs. 11.30 Lakhs
- Fund received: Rs. 16.00 Lakhs

Request

- Release of the remaining Allotted Fund
- Increase of Project Period by One(1) year with existing Fund Allocation