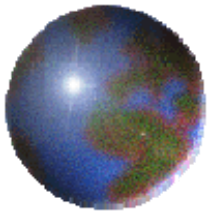

11. Distributed GIS

Geographic Information Systems and Science

SECOND EDITION

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Outline

- Introduction
- Distributing the data
- The mobile user
- Distributing the software: GIServices

Distributing a GIS

- The component parts can be at different locations
  - The user
  - The data
  - The software
- The network links all of the parts together

The Subject Location

- Also important to GIS is the area that is the subject of the GIS project
  - In principle a subject area can be studied by a GIS user located anywhere on the Earth's surface
  - The power of GIS is greatly enhanced when the user is located in the subject location
    - Information from the database can then be combined with information from the user's senses

The Role of Standards

- Distributed GIS relies on the adoption of common standards
  - To allow the various components to operate together
  - Such standards have been developed by various national and international bodies, aided by the Open Geospatial Consortium

Distributing the Data

- It must be possible to find remotely located data
  - Data documentation, or *metadata*, provides the key to successful search
  - The U.S. Federal Geographic Data Committee devised a much-emulated standard for geographic data description
    - The Content Standard for Digital Geospatial Metadata

Major Features of FGDC Metadata

1. Identification Information: basic information about the data set
2. Data Quality Information: a general assessment of the quality of the data set
3. Spatial Data Organization Information: the mechanism used to represent spatial information in the data set
4. Spatial Reference Information: the description of the reference frame for, and the means to encode, coordinates in the data set
5. Entity and Attribute Information: details about the information content of the data set, including the entity types, their attributes, and the domains from which attribute values may be assigned
6. Distribution Information: information about the distributor of and options for obtaining the data set
7. Metadata Reference Information: information on the currentness of the metadata information, and the responsible party
8. Citation Information: the recommended reference to be used for the data set
9. Time Period Information: information about the date and time of an event
10. Contact Information: identity of, and means to communicate with, person(s) and organization(s) associated with the data set

Metadata Light

- Metadata are expensive to assemble
  - Custodians of data are often reluctant to incur the expense
  - There is interest in less elaborate formats
  - Many users have adopted subsets of the FGDC standard
  - A more generic alternative is the Dublin Core, devised as a standard for describing all types of data

The Dublin Core Components

- 1.TITLE. The name given to the resource by the CREATOR or PUBLISHER.
- 2.AUTHOR or CREATOR. The person(s) or organization(s) primarily responsible for the intellectual content of the resource.
- 3.SUBJECT or KEYWORDS. The topic of the resource, or keywords, phrases, or classification descriptors that describe the subject or content of the resource.
- 4.DESCRIPTION. A textual description of the content of the resource, including abstracts in the case of document-like objects or content description in the case of visual resources.
- 5.PUBLISHER. The entity responsible for making the resource available in its present form, such as a publisher, a university department, or a corporate entity.
- 6.OTHER CONTRIBUTORS. Person(s) or organization(s) in addition to those specified in the CREATOR element who have made significant intellectual contributions to the resource, but whose contribution is secondary to the individuals or entities specified in the CREATOR element.
- 7.DATE. The date the resource was made available in its present form.
- 8.RESOURCE TYPE. The category of the resource, such as home page, novel, poem, working paper, technical report, essay, dictionary.
- 9.FORMAT. The data representation of the resource, such as text/html, ASCII, Postscript file, executable application, or JPEG image.
- 10.RESOURCE IDENTIFIER. String or number used to uniquely identify the resource.
- 11.SOURCE. The work, either print or electronic, from which this resource is delivered, if applicable.
- 12.LANGUAGE. Language(s) of the intellectual content of the resource.
- 13.RELATION. Relationship to other resources.
- 14.COVERAGE. The spatial locations and temporal durations characteristics of the resource.
- 15.RIGHTS MANAGEMENT. The content of this element is intended to be a link (a URL or other suitable URI as appropriate) to a copyright notice, a rights-management statement, or perhaps a server that would provide such information in a dynamic way.

Geolibraries and Geoportals

- A Geolibrary is a digital library containing georeferenced information
  - Its search mechanism uses geographic location as the primary key
- A Geoportal is a digital library of geographic data and GIServices
  - A one-stop shop for information relevant to GIS

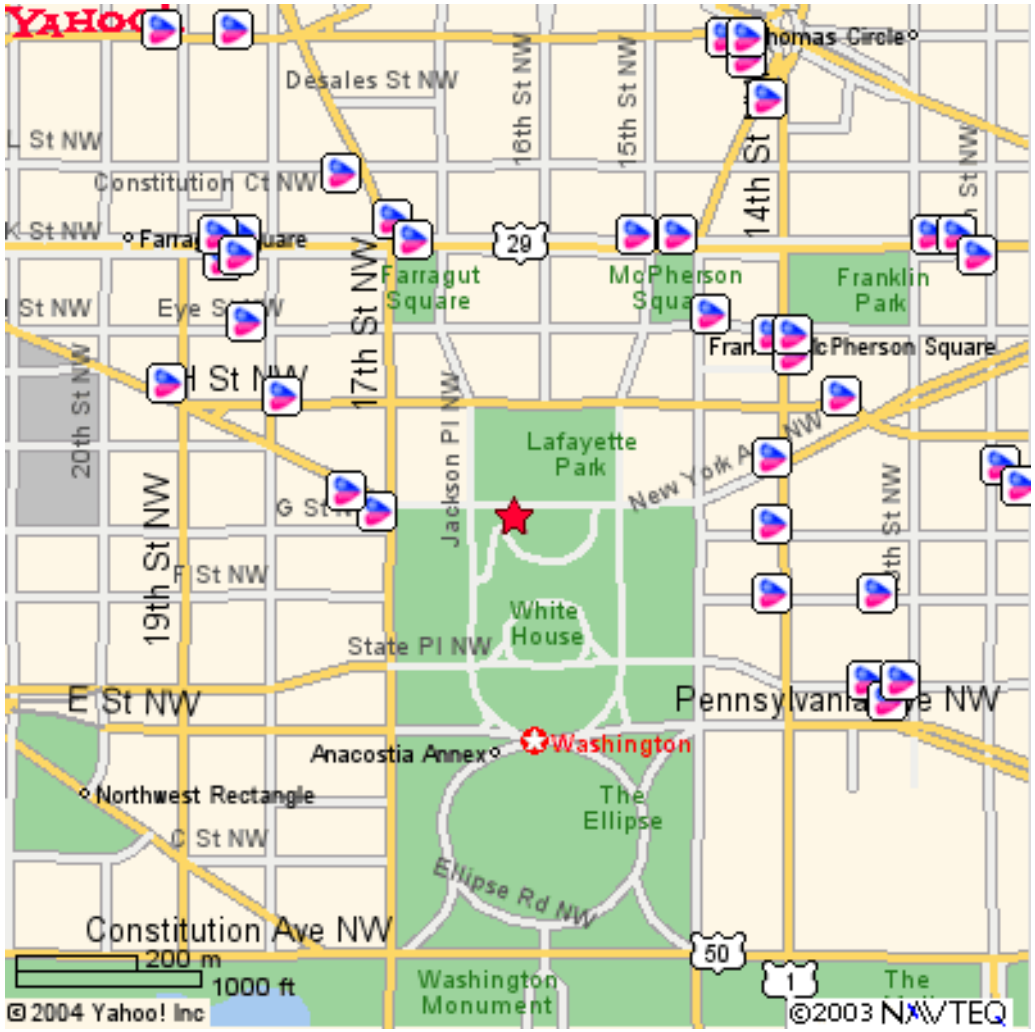
Collection-Level Metadata

- There are now many geolibraries and geoportals on the Internet
  - Each has its own search mechanism
  - But how does the user know which geolibrary to search for data about a specific area, on a specific topic?
  - Collection-level metadata describes the contents of entire collections, clearinghouses, archives, and digital libraries

The Mobile User

- It is increasingly possible to obtain the services of a GIS through hand-held and wearable devices
  - Some cellphones can now be used to generate maps
    - Such maps can be centered on the user's current location

Map showing WiFi hotspots in the area surrounding the user's current location (the White House, 1600 Pennsylvania Avenue NW, Washington DC)



A wearable computer in use. The outfit consists of a processor and storage unit hung on the user's waist belt; an output unit clipped to the eyeglasses with a screen approximately 1 cm across and VGA resolution; an input device in the hand; and a GPS antenna on the shoulder. The batteries are in a jacket pocket. (Courtesy: Keith Clarke)

Virtual Reality

- Use of digital technology to create an artifical visual and auditory environment that simulates the actual environment elsewhere
  - User and subject are in different locations
  - Technology allows the user to explore a remote location

Augmented Reality

- The user is in the subject location
  - Technology is used to augment the user's senses
  - Information from a database can be displayed directly in the user's field of view
    - Superimposed on what is actually seen

The system worn here by Reg Golledge (a leader of the development team) uses GIS and GPS to augment the senses of a visually impaired person navigating through a complex space such as a university campus. (Courtesy: Reginald Golledge)

Location-Based Services

- An LBS is an information service provided by a device that:
  - Knows where it is
  - Modifies the information that it provides accordingly

How Does a Device Know Where It Is?

- GPS on board
  - Many current cellphones
  - Increasing numbers of vehicles
- Fixed device, location established when device installed
  - Point-of-sale systems
- Location deduced from Internet address

InfoSplit's business is based on determining the locations of Internet users, allowing Web services to determine where their users are located

Distributing the Software

- A GIService is a GIS process provided remotely
  - A user can send a request and receive a result
    - A gazetteer service will accept a placename and return that location's coordinates
    - A geocoding service will accept a street address and return the house's coordinates

Advantages of GIServices

- Users do not need to obtain and install expensive software
- Only one version of the service software need exist
  - It is always the latest version
- Data used in the service can be kept constantly up to date