GE0SPATIAL DATA INFRASTRUCTURE

Course outline:

- Introduction: Definition, components
- concepts of Geospatial Data Infrastructure (SDI)
- Data sources & Data quality
- Spatial data exchange standards
- SDI implementation: Legal and institutional issues
- Case studies on SDI implementation

Evaluation

- Assignments./Practicals /CATs.....30%
- Exams.....70%

Introduction

- We live in an age of information, and geographic information is one of the most critical elements underpinning decision making for many disciplines.
- In this regard, many of the things that different organizations want to achieve together can only be achieved if good, consistent spatial data is available and readily accessible. This is especially important when planning for the future.
- Geographic data are still expensive and time consuming to produce.
- In recent years nations have made unprecedented investments in both information and the means to assemble, store, process, analyze, and disseminate it.
- Thousands of organizations and agencies (all levels of government, the private and non-profit sectors, and academia) throughout the world spend billions of dollars each year producing and using geographic data

Introduction

- This has been particularly enhanced by the rapid advancement in spatial data capture technologies, which has made the capture of digital spatial data a relatively quick and easy process.
- But, they still do not have the information they need to solve critical problems. There are several aspects to this problem:
  i. Most organizations need more data than they can afford.
  ii. Organizations often need data outside their jurisdictions or operational areas. In addition, information needed to solve cross-jurisdictional problems is often unavailable
  iii. Data collected by different organizations are often incompatible.
  iv. a lot of data redundancies exist, and money and human resources were wasted in duplicated data collection and maintenance efforts
- Hence governments of different nations, and organisations within each nation should reach agreement on what fundamental datasets are required to meet their common interests, to what standards they should be collected and maintained, and what the priorities are for their collection.

Introduction

Introduction

- With this background, many countries believe they can benefit both ***economically and environmentally*** from better management of their spatial information by taking a perspective that starts at a local level and proceeds through state, national and regional levels to a global level. This has resulted in the development of the Spatial Data Infrastructure (SDI) concept at these levels.
- Using GIS solutions to create a spatial data infrastructure ***(SDI) ensures that data and resources are available to the organizations and stakeholders that need them.*** From large countries to small nations, everyone benefits from documented public works and utilities, protected environments and biodiversity, correctly assessed resources, and completed strategic planning.

Definition

SDI Definition;

- The term spatial data infrastructure was coined in 1993 by the U.S. National Research Council to denote ***a framework of technologies, policies, and institutional arrangements that together facilitate the creation, exchange, and use of geospatial data and relatedinformation resources across an information-sharing community.***
- Spatial data infrastructure (SDI) is the infrastructure that facilitates the discovery, access, management, distribution, reuse, and preservation of digital geospatial resources.
- Spatial Data Infrastructure (SDI) is an initiative intended to create an environment in which all stakeholders can co-operate with each other and interact with technology, to better achieve their objectives at different political/administrative levels.

Definition

Common terms;

I. ***Geoportal:*** A gateway website through which people can search, discover, access, and visualize the geospatial resources within a SDI.

II. ***Metadata:*** Documentation about who, when, how, what, why, and many other facets of the data and the data production process. Metadata can be used for describing not only data, but also tools, services, and other geospatial resources.

III. ***Data standard:*** A commonly agreed specification on how data should be recorded and described.

IV. ***Geospatial interoperability:*** The ability of different geographic information systems to share, exchange, and operate (heterogenous) geospatial data and functions.

V. ***Web service:*** A Web application that provides standardized application programming interfaces to allow remote access to data and functions over the Internet

Introduction

- SDI can be implemented ***narrowly*** to enable the sharing of geospatial information within an organization or more **broadly** for use at a national, regional, or global level.
- SDI resources may include maps, data, geospatial services, and tools.
- In all cases, an SDI will provide an institutionally sanctioned, automated means for posting, discovering, evaluating, and exchanging geospatial information by participating information producers and users.
- SDI extends a GIS by ensuring geospatial data and standards are used to create authoritative datasets and polices that support it.

Introduction

Reasons for SDI

- cyberinfrastructures, SDIs are similar to other infrastructures, such as water supplies and transportation networks, since they play fundamental roles in many aspects of the society.
- It is closely associated with the efforts of collecting and producing geospatial data, as well as the advancement of surveying and computer technologies
- Large amount of Geospatial data: These roles have become even more significant in today's big data age, when a large volume of geospatial data e.g RS Images, location based services through smart mobile devices and social media platforms.
- Web services: the componentization of GIS brings geospatial services that provide data processing and spatial analysis functions in the general Web environment.

Introduction

- However the large number of geospatial data, services, maps, and others, however, do not ease the use of these geospatial resources. On one hand, it is challenging to find and access these digital resources which are widely distributed at different government agencies and websites
- These roles have become even more significant in today's big data age, when a large volume of geospatial data and Web services are available. From a technological perspective, SDIs mainly consist of data, hardware, and software.
- A lot of data redundancies exist, and money and human resources were wasted in duplicated data collection and maintenance efforts

Introduction

SDI goals

- Fulfill the basic rights regarding ***access*** to information generated by public institutions, for governmental and private entities as well as the general public.
- Provide better visibility and ***transparency*** to the actions and projects of the public and private institutions, offering the public useful information and participation tools.
- ***Integrate*** geographical information on a common cartographic base, complete and updated.
- ***Coordinate*** information production, access and use, to improve efficiency and interoperability, both horizontally and vertically.
- Support the coordination of ***multi-disciplinary activities*** like strategic planning, land planning, risk management, resource management…
- Support the economic and social ***development***, reducing costs for companies and professionals to access information and therefore allow them to create added-value products and services

Introduction

SDI advantages

- Presents a solution to the problems of resource discovery and data redundancy. As multiple government agencies are sharing their data on one platform, SDI reduces data redundancy and the extra efforts in collecting duplicated geospatial data.
- SDI allows geospatial data to be collected once and reused multiple times in different applications.
- It increases the transparency of governmental activities and to enhance public participation.
- Better access to geospatial data also stimulates the growth of new businesses which may not be possible otherwise

Introduction

Factors to consider to ensure a successful SDI

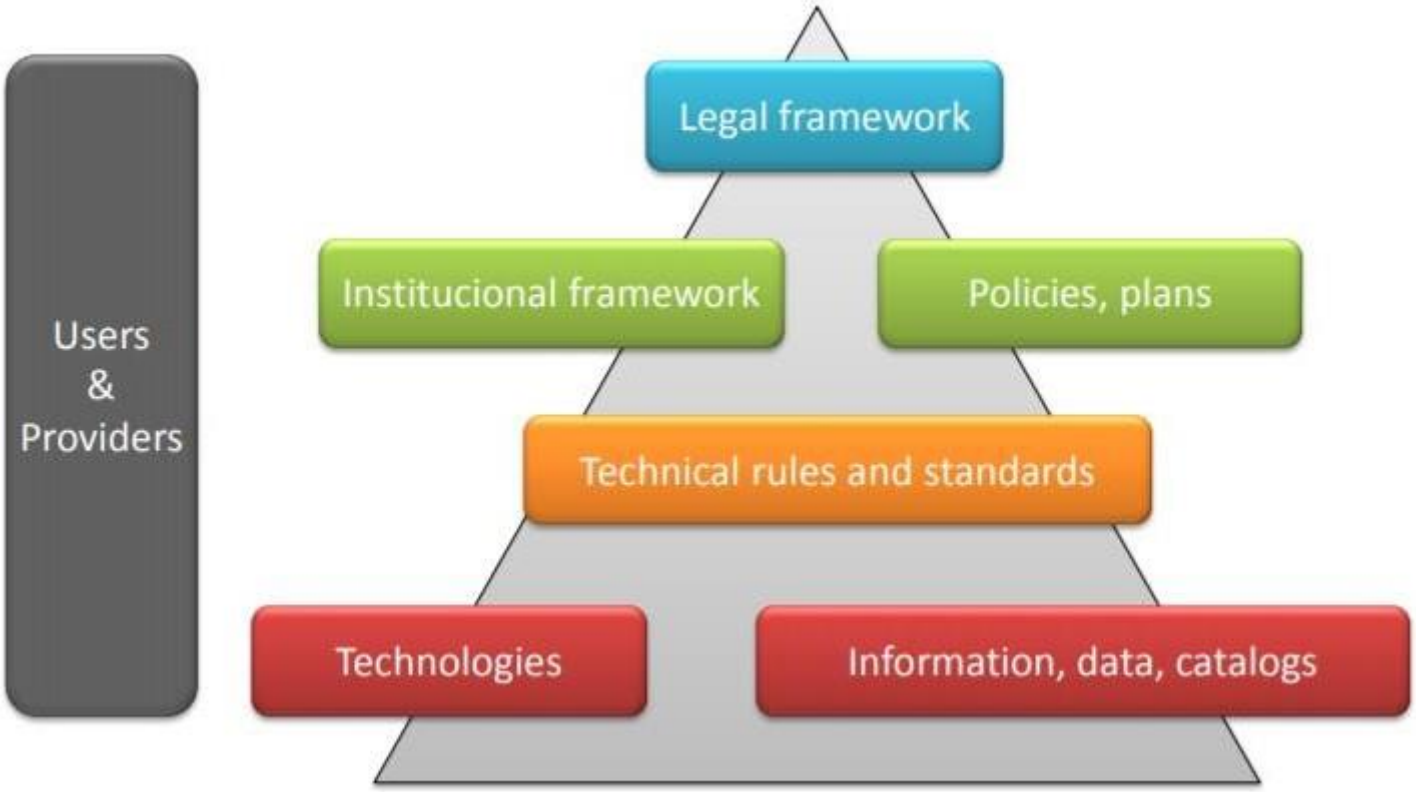
To realize the advantages of an SDI and to speed up its development, at least six key factors should be considered. These factors are:

- awareness of use of Geographic Information (GI) and SDIs;
- cooperation between the various stakeholders;
- involvement of the politicians concerned;
- knowledge about the type, location, quality and ownership of datasets;
- accessibility of datasets; and
- the successful widespread use of the datasets.

Introduction

Components of SDI

- core components of SDI :



Introduction

Components of SDI

- core components of SDI :
  1. Policies & Institutional framework (governance, data privacy & security, data sharing, cost recovery):
  2. Technology (hardware, software, networks, databases, technical implementation plans)
  3. People (training, professional development, cooperation, outreach)
  4. Data (digital base map, thematic, statistical, place names

Introduction

Components of SDI

- Data:
  - Data sets, which may be used for many different purposes and in many different applications, are often referred to as *base data*, core data, *fundamental data or reference data.*
  - These datasets are widely needed for a variety of purposes and by many agencies.
  - The other types of datasets are known as *thematic datasets* which are derived from the fundamental dataset.

Introduction

Components of SDI

- Metadata:
  - Data about data -- describes existing data
  - Metadata is a summary document about the dataset, including the geographic area that the dataset covers, the custodian, who to contact to obtain a copy of the dataset and other useful information that helps people decide whether or not the dataset is useful for their particular purpose.
  - A geospatial metadata record includes core library catalog elements such as Title, Abstract, and Publication Data; geographic elements such as Geographic Extent and Projection Information; and database elements such as Attribute Label Definitions and Attribute Domain Values.

Introduction

Components of SDI

- Benefits of Metadata
  - Organize and maintain an institution's internal investment in geospatial data.

  (Do you know what you've got?)
  - Provide information about an organization's data to catalogues and clearinghouses.

  (Can you describe to someone else what you've got?) (Is it useful to advertise or promote what you have?)

  •Provide information during a data transfer. (Can potential users figure out what you've done?)

Introduction

Components of SDI

- Standards:
  - Effective use and sharing of spatial information requires that it adheres to known and accepted standards.
  - Standards facilitate the use of a wider range of data.
  - Development of formal standards is a consultative process through national standard bodies through international standard organizations. Spatial data are standardized in terms of geographic referencing, the data content, the resolution, and metadata.
  - Some international standard organization for geographic information are:
    i. ISO TC211 (de-jure) standards, and de facto specifications from organizations
    ii. OGC (Open Geospatial Consortium)
    iii. Organization for the Advancement of Structured Information Standards (OASIS)

Introduction

Components of SDI

- Types of geospatial Standards:
  - Data Classification e.g., Land Cover Classification
  - Data Content e.g., Digital Geospatial Metadata, Data Schemas
  - Data Symbology or Presentation e.g., Digital Geologic Map Symbolization
  - Data Transfer e.g., ftp
  - Data Services e.g. web mapping
  - Data Usability e.g., Geospatial Positioning Accuracy

Introduction

Components of SDI

- Access Network:
  - Although SDI are primarily institutional collaboration frameworks, they also define and guide implementation of heterogeneous distributed information systems, consisting of four main software components linked via Internet. These components are:
    i. metadata editors and associated catalogue services.
    ii. spatial data content repositories.
    iii. client applications for user search and access to spatial data.
    iv. middleware or intermediate geoprocessing services which assist the user in finding and in transforming spatial data for use at the client side application.

Introduction

Components of SDI

- Access Network:

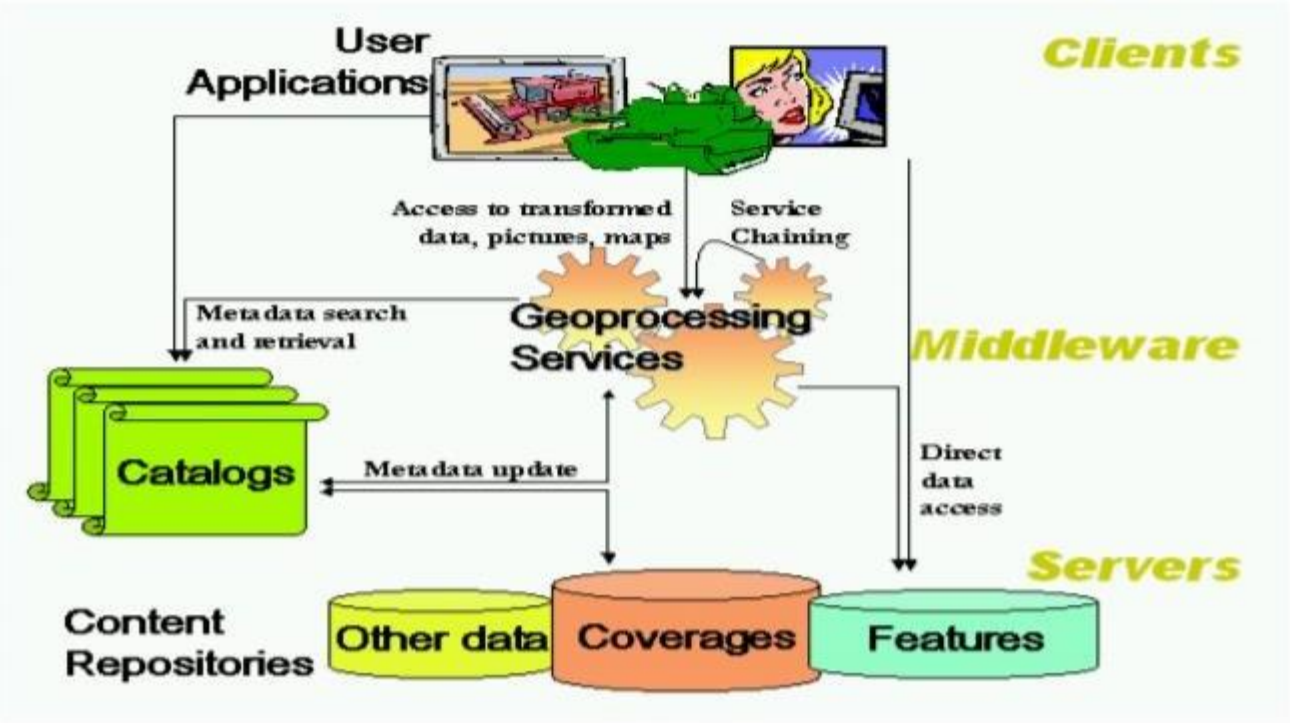


***Figure 2**: High-level SDI architecture, taken from the FGDC-NASA Geospatial Interoperability Reference Model (GIRM), (FGDC, 2003).*

Introduction

Components of SDI

- People and Partnership :
  - This component includes the spatial data users and suppliers and any value-adding agents in between, who interact to drive the development of the SDI.
  - For this reason the formation of cross jurisdictional partnerships has been the foundation of SDI initiatives supported to date.
  - People are the key to transaction processing and decision-making. All decisions require data and as data becomes more volatile human issues of data sharing, security, accuracy and access forge the need for more defined relationships between people and data.
  - Facilitating the role of people and data in governance that appropriately supports decision-making and sustainable development objectives is central to the concept of SDI.

Introduction

Components of SDI

- Policies and Institutional Framework. :
  - The institutional framework defines the policy and administrative arrangements for building, maintaining, accessing and applying the standards and datasets.
  - Policies and Institutional Arrangements define other components of SDI such as governance, data privacy and security, data sharing, and cost recovery.
  - It is the policies and organizational components that make it possible for the realization of aims and objective of SDI.
  - Even when data and other components are in place, without enabling policies, and institutional arrangements, coordination, cooperation and sharing will not be achieved.

Introduction

Components of SDI

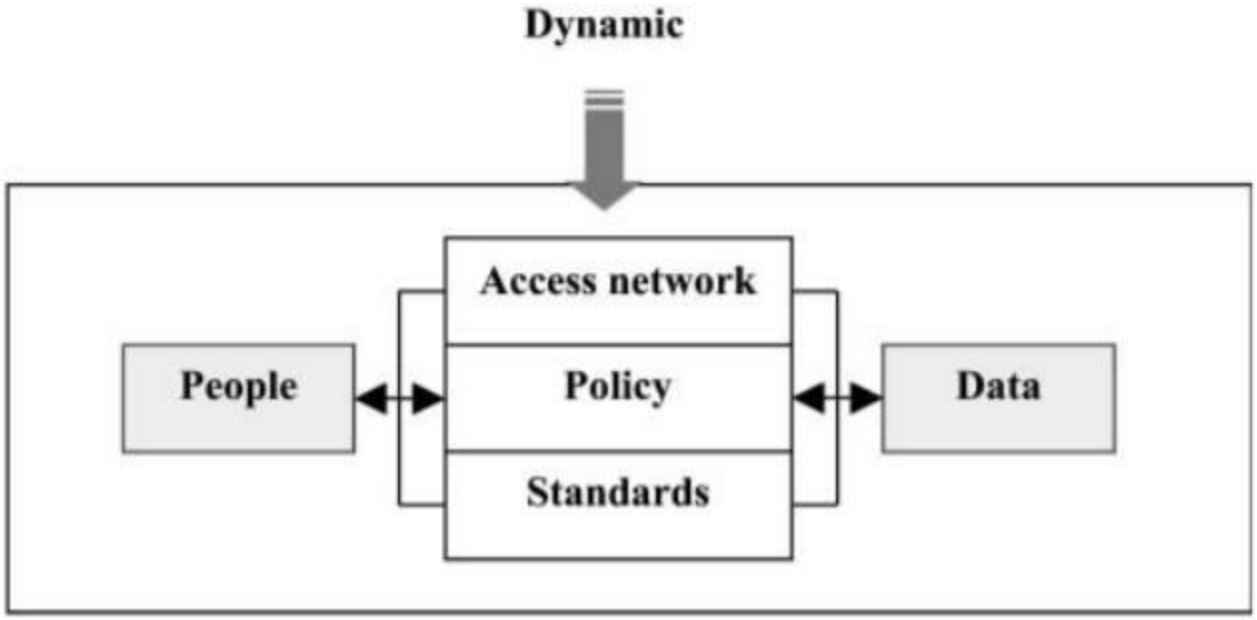


***Figure 3**: Nature and Relations between SDI Components.*

Introduction

Assignment 1:Discuss the History of SDI