GIS Implementation part 2

Implementation challenges
Key issues
Effect
Consequences

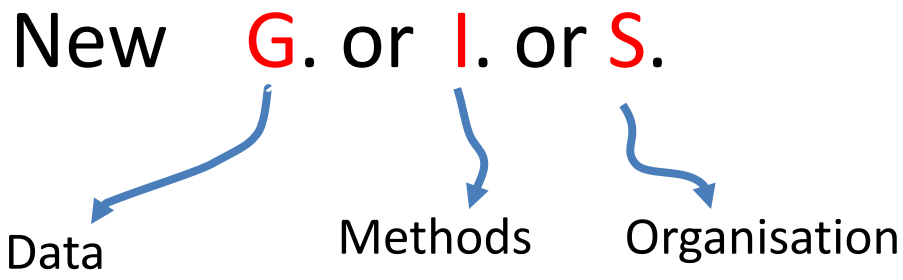
GIS management

The first aspect of understanding and successfully accomplishing GIS **implementation** and **management** is to fully understand the GIS implementation process *Somers 1993–2001*

technlogical

organisational

Developing GIS



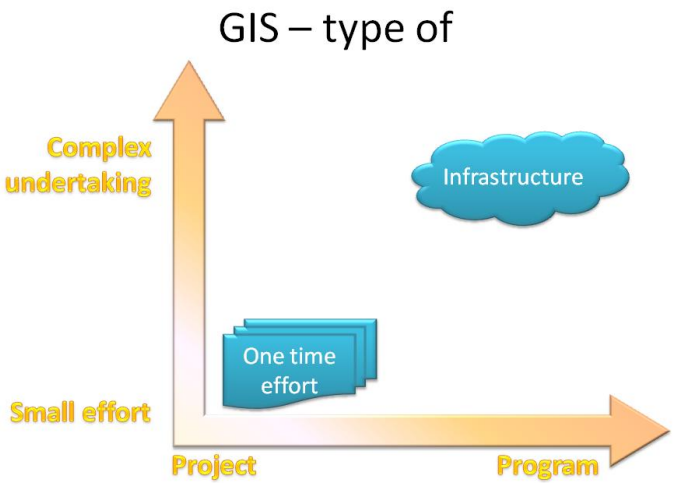
Developing GIS

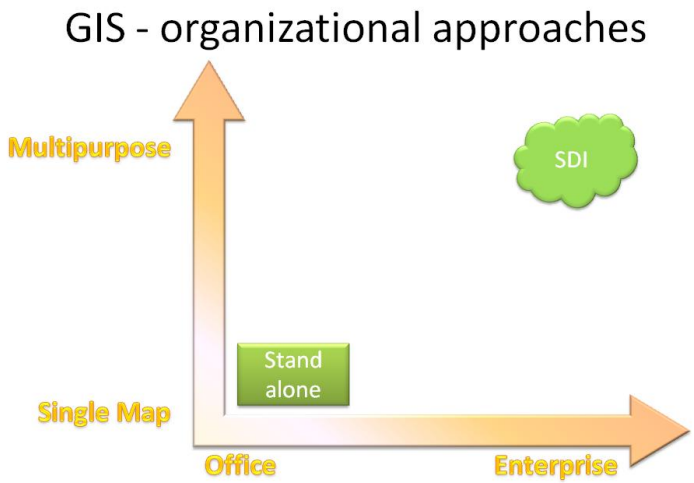
New G. or I. or S.

Data

Methods

Organisation





Developing GIS - New G. or I. or S.

Technological perspective of GIS

- Process/function-oriented: emphasises the information handling capabilities of GIS (eg. collection, storage, retrieval, manipulation, etc.);
- Application: divides information systems according to the problems they seek to address (eg. soil, land, and planning information system);
- Toolbox : emphasises the generic aspects of GIS as a toolbox to manipulate spatial data;
- Database: regards GIS as a database system, reflecting the influence of database theory and practice on GIS.

Chan & Williamson, 1997

Developing GIS - New G. or I. or S.

Organisational perspective of GIS

- Burrough (1990) describes 'organisational context' in terms of new business operations, new staff and new organisational units created to manage GIS, reliable funding and proper legal and political support

Burrough, P. A., 1990, Principles of Geographical Information Systems for Land Resources Assessment (New York, USA: Oxford University Press)

Developing GIS - New G. or I. or S.

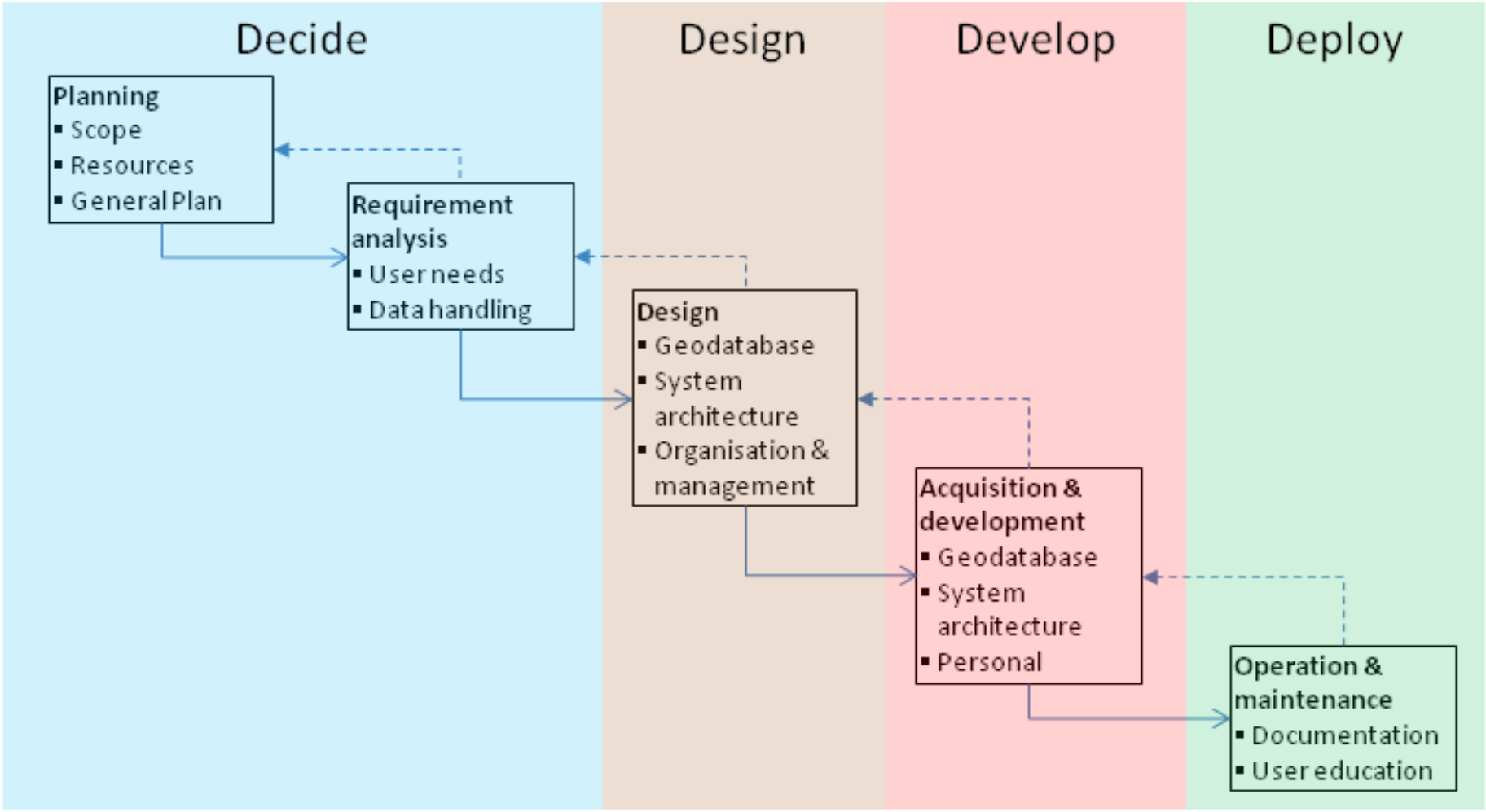
Organisational perspective of GIS

- Business process: serves as a integral part of business processes to improve their efficiency and effectiveness;
- Infrastructure: facilitates the development of business process GIS-tech;

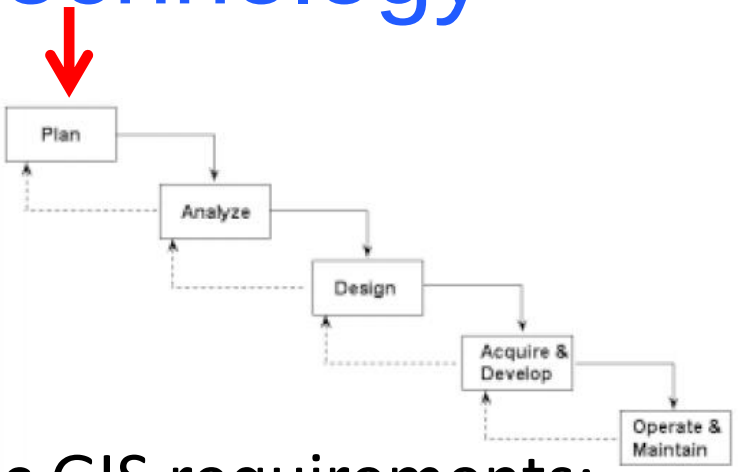
Warning!!
Distinguishing GIS from IT using the convenient concept of GIS paradigm (georeferencing, geocoding and topology)

Chan & Williamson, 1997

Developing GIS - Technology



Developing GIS - Technology



- **Planning**: defining the scope of the GIS and developing a general plan;
- **Analysis**: determining users' specific GIS requirements;
- **Design**: integrating all requirements and developing GIS specifications;
- **Acquisition and development**: acquiring software, hardware, and data, and putting them together in a system tailored to the organization
- **Operations and maintenance**: using the GIS and maintaining the system.

Developing GIS - Technology

..map the AI outbreaks..

Developing GIS - planning

- scope: defines the basic nature of the GIS and its role in the organisation,
- participants: determines who should be involved in its design and implementation,
- resources: provides an indicator of the amount and type of the resources required,

planning - scope

- Will it be a one-time project or an ongoing program?
- Will it be used for all the office's spatial data handling or for only a specific subset of task, such as for a given specie, disease, etc.?
- Will most people in the organization use it or will users be limited in number or job function?
- Will this GIS activity be part of a larger GIS effort such as data collection, webGIS, etc.?
- Will spatial data and technology be integrated with the organization's other data and systems?
- Will GIS change the way the organization does business or will its impacts be limited?

planning - participant

- users1: Are the end-users in charge for authoring the geographical information?
- users2: Can you recognise different types of users (viewer, checkers, analysts, etc.)
- manager and policy makers: Are the top management aware of the GIS activity?
- required skills: What skills will be needed to carry out GIS implementation (in-house vs outsourcing)?
- project management and leadership.. *for GIS efforts of even modest size, it is usually necessary to form a team and assign a leader*..

planning - resources

At this stage an idea of the amount and type of resources required is “possible”.

- Money (software, hardware, web connectivity, etc.)
- Time (ir
- Labor fo
- Type of required data (roughly identify if the data must be collected or are already available)
- A very rough preliminary ROI is also possible to calculate

Warning!!
expose the ROI and the estimation of the required resources at this stage can be very dangerous!!
The manager can use these estimation as a “promise” you made and compare these with the final results.

Developing GIS - planning

- scope: defines the basic nature of the GIS and its role in the organisation,
- participants: determine who should be involved in its design and implementation,
- resources: provides an indicator of the amount and type of the resources required,

Blueprint

Developing GIS - planning

Blueprint

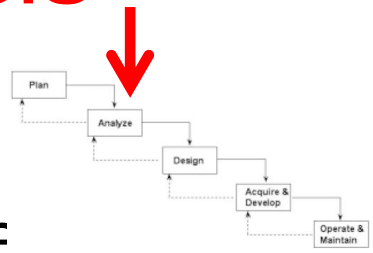
- Introduction
  - define the context
  - identify the “problems”
  - stress the G. I. components (missing, poor quality, etc.)
  - what is the focus of the initial drive?
- G. I. as solution
  - use the ROI list
- Express the goal and objectives
  - the goal must be clear, well outlined and comprehensible by the manager
  - the goal must be in line with the organisation mandate
  - for objectives refer to the “scope” question list
- Identify users and stakeholders

Developing GIS - planning

Blueprint

- Provide a rough timing schedule (Gantt + Pert ?)
- Technological Maturity
  - Describe the experience the staff of the organization have with G.I. technology
  - Describe past experience with G.I. technology
  - Describe the available resources (SW, HW, and presonnel)
  - Describe the GI and IT technology aspects
- Develop a rough SWAT
  - Financial feasibility
  - Technical feasibility
  - Institutional feasibility
- Develop a rough ROI (?)

Developing GIS - analysis



..specific requirements analysis is needed to provide the necessary detailed information for successful GIS implementation..

*..the goal is to identify the **functional** and **data** needs of the GIS participants and users, as well as the **organizational** environment*.

Tomlinson, 2007

Developing GIS - analysis

Use case modelling technique

[definition] *a use case is a description of the possible sequences of interactions between the system under discussion and its external actors, related to a particular goal.*

Cockburn, 2000

- The functionality of a system is provided as seen by an external actor.
- The functionality is seen from the actor's perspective, not from the technological perspective (what the system does, not how it does it).
- The use case approach is user-centric and seems easy and intuitive to work with. This leads to ease of analysis and simplicity of design.

Writing Effective Use Cases, Alistair Cockburn, 2000

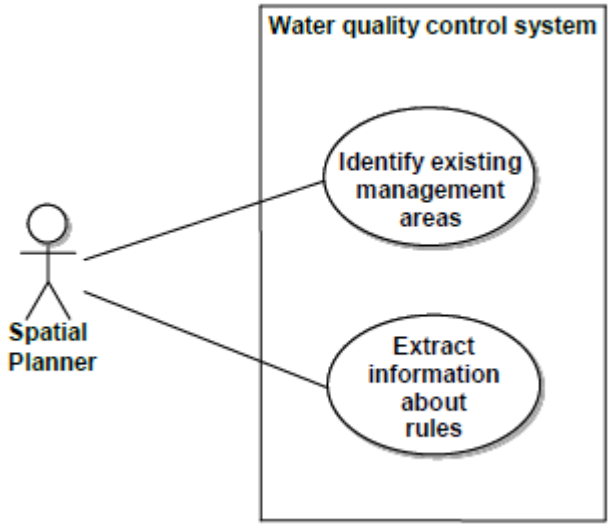
Developing GIS - analysis

Use case modelling technique

Use case is merely a form of writing.

- Textual descriptions using informal natural language
- UML use case diagrams

Use Case Description*	
Name	Planning new management rules for water quality control
Primary actor	Spatial Planner
Goal	To introduce new restrictions and rules for river systems to protect / improve water quality by determining that they will be in line with rules which are already active in the area of interest or that they will not conflict with any valid regulation.
System under consideration	Water Quality Control System (operated by a municipal authority of hydraulic works)
Importance	High
	The spatial planner performs a spatial overlay analysis using the planning area



Developing GIS - analysis

Use case modelling technique

1. Name: A short paragraph of textual description.
2. Frequency: How often does this use case occur?
3. Response Time: In what time frame must the business respond to the event triggering this use case?
4. Priority: Identify as high, medium, low, to prioritize your analysis work.
5. Triggering Event: Which business event causes this use case to occur?

Developing GIS - analysis

Use case modelling technique

7. Goal or Result: What is the anticipated result of the use case? What is its goal? How can it be measured?
8. Actors: List the actors participating in this use case.
9. Precondition(s): List the conditions that must be true before this use case can be invoked.
10. Postcondition(s): List the conditions that must be true before the use case can terminate.
11. Flow of Events: List the sequence of events that can occur when this use case is invoked.

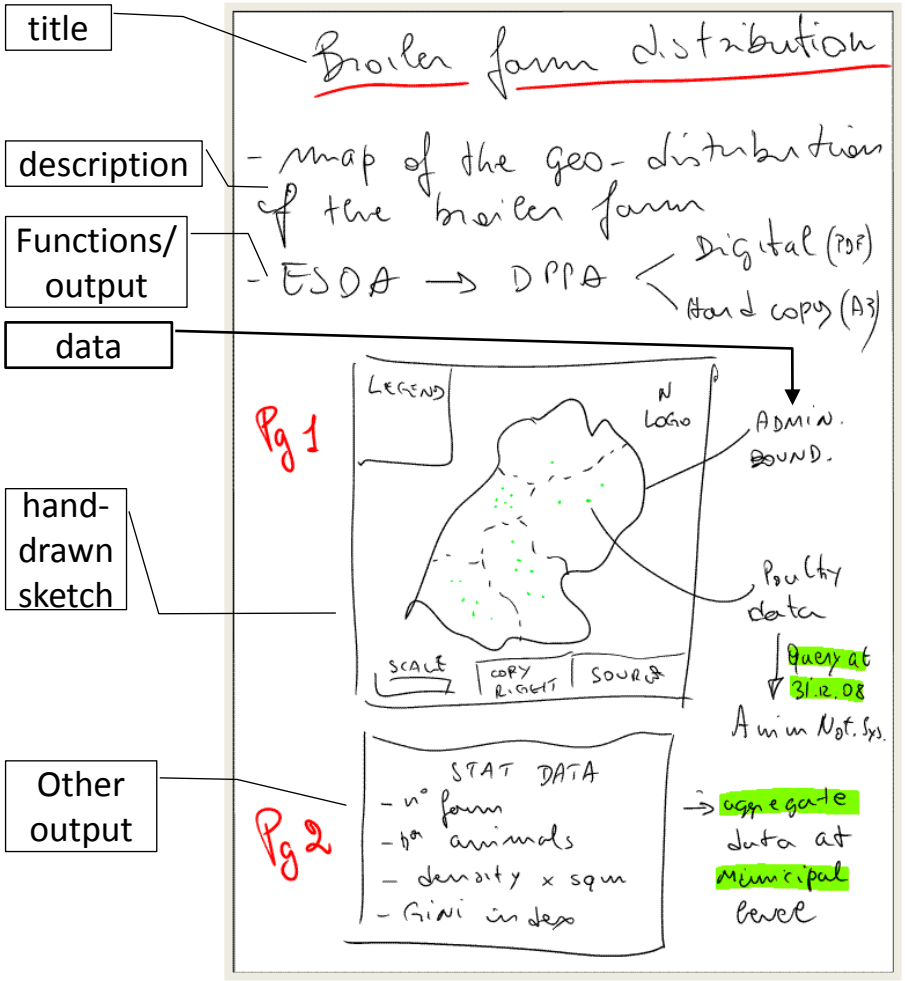
Developing GIS - analysis

Use case modelling technique

12. Data set: a description of the data set used by the use case.
13. Use Cases in Scope: List the other use cases that are "used" or that "extend" this use case.
14. Exceptions: List the actions to be taken when an exception occurs during the execution of a use case. Exceptions are a means of modeling alternative paths.
15. Other Associated Documentation: Attach any other documents needed to clarify the understanding of this use case.

Developing GIS - analysis

Alternative method: Information products



Other requirements:

1) Describe the GIS function you need and the sequence of the process
2) The frequency of use
3) Data quality both for attribute and geographical data:
   - completeness
   - missing values
   - temporal accuracy
   - positional accuracy (scale)
4) Type of GIS

Developing GIS - analysis

Use case modelling technique

a/c

id	description
Name	Download Species Distribution Data.
Frequency	On request
Priority	Medium
Goal or Result	The user downloads Species Distribution data and associated metadata in a selected area and with selected feature types included
Primary actor	Expert data user (further data processor).
Pre-condition	Species Distribution are available as a web Service and the metadata provides all necessary information for standardised access to data.
Post-condition	The user has a copy of the Species Distribution data according to his or her geographical and feature type selection

Developing GIS - analysis

Use case modelling technique

b/c

Flow of events	
Step 1	The user selects the area of interest graphically on a map (this can be part of a member state, a whole member state or more than one member state) of from a textual list of countries (selecting either one or more than one country).
Step 2	The user selects the feature types of interest from a list of all of the Species Distribution feature types (one or more).
Step 3	The user invokes the download.
Step 4	The system calls the relevant Web Feature Services to retrieve the information
Step 5	The response is provided to the user
Step 6	The user has a copy of the Species Distribution data according to his or her geographical and feature type selection

Developing GIS - analysis

Use case modelling technique

c/c

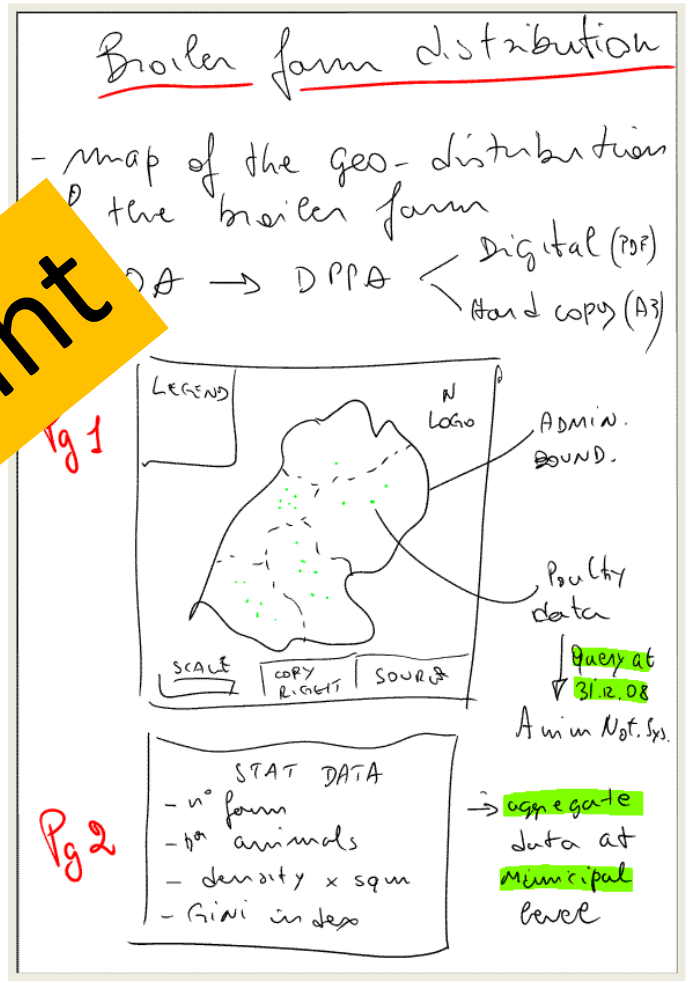
Data set	
Description	This use case uses web feature services from a catalogue managed by the IZSVe
Data provider	IZSVe
Scale, resolution	Data is provided at the most detailed scale and resolution available. The user may be given the option to select scale and resolution if required.
Documentation	Species Distribution Data Product Specification

id	description
Use Cases in Scope	Metadata authoring, Catalogue feeding

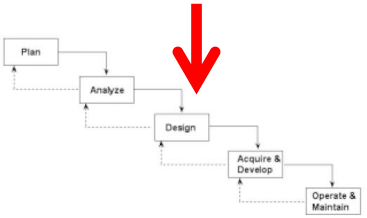
Developing GIS - analysis

id	description
Name	Download Species D
Frequency	On request
Priority	Medium
Goal or Result	The user dow… metadata in…
Primary actor	Expert data use…
Pre-condition	Species Distribution are… provides all necessa…
Post-condition	The user has a copy o… her geographica…

Blueprint



Developing GIS - design



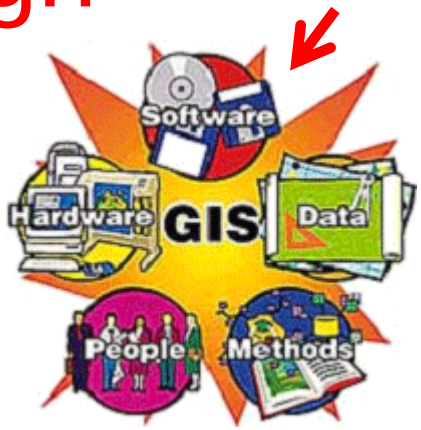
The design task involves putting the components together: determining the characteristics and combination of

- software,
- hardware,
- data,
- processes, and
- people

Source: ESRI

that will meet the organization's GIS needs.

Developing GIS - design



Function: what a department/office does
Process: how it is doing it, or how it will do it
Application: software capabilities required for the process

Example:

Function: review & prepare zoning changes

Process:

1. receive farm location editing request
2. edit a point location → potential software application
3. examine topological requirements → potential SW app

Developing GIS - design

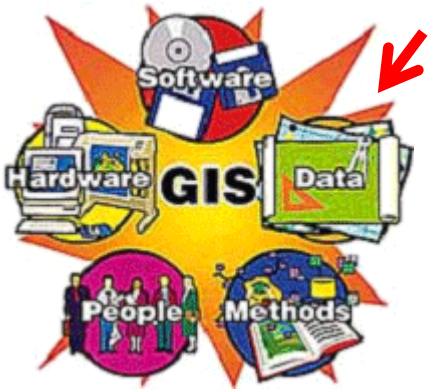
Warning!!
Data requirements are the heart of any GIS design

- Identifying data
  - internal and external sources
  - checking for completeness and quality
    - fixing problems in the data source
    - data conversion specifications (projection coordinate system, accuracy requirements, etc.)
- Logical data modeling

  define entities, attributes, the relationships between them (feature schema)
- Physical Data modeling

  how this data will be stored in a specific vendors database

Developing GIS - design



..but also

- consistency of standards
- accuracy requirements
- update frequency requirements
- magnitude and storage requirements
- layer organization
- report organization
- metadata

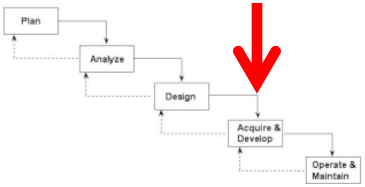
Developing GIS - design

Design results.

- database design (including data descriptions, data model, ETL process, etc.)
- data management specifications (update, back-up, etc.)
- map product specifications
- metadata specifications
- applications descriptions;
- correlations among data, application, and users;
- general architecture for the GIS system and its integration with other systems and databases;
- an implementation plan

Blueprint

Developing GIS – acquire & develop



- hardware & software procurement ar installation
- data conversion and data base construction
- application development
- training
- system installation/going operational

Implementation plan

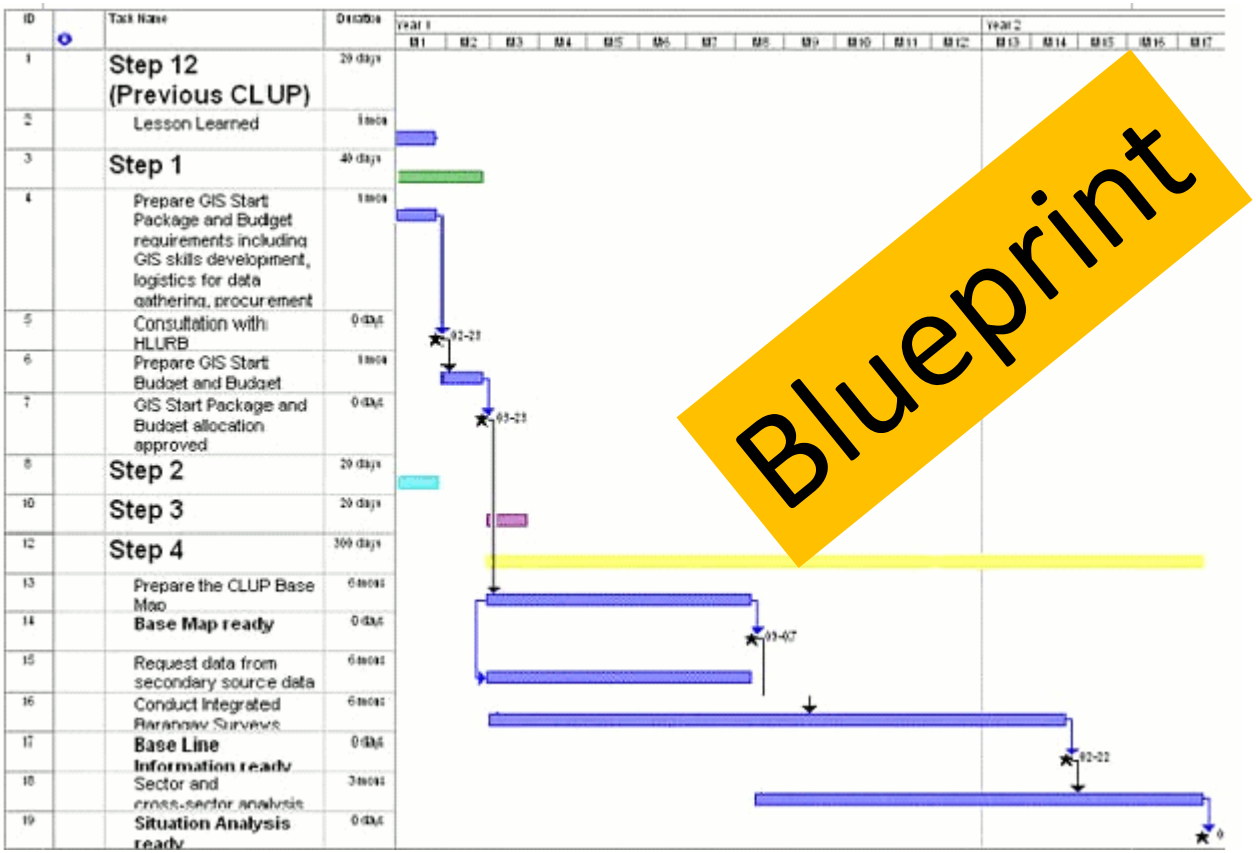
Developing GIS – acquire & develop

Implementation plan

- creates a commitment to agreed upon work and schedule (utilize project management software..)
- assures everybody knows their responsibilities (identify tasks and determine dependencies via network diagram)
- can provide early warning of potential problems as implementation proceeds (incorporate frequent review points with clear milestones)
- allows activities to proceed concurrently, when appropriate (thus speeding up implementation)

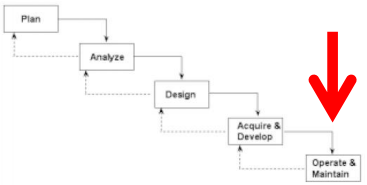
Developing GIS – acquire & develop

Implementation plan



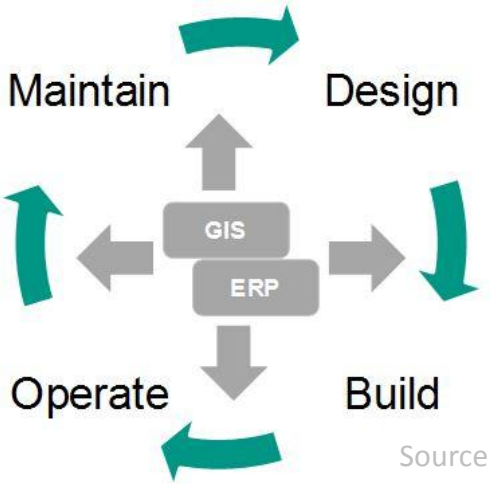
Source: GIS Cookbook

Developing GIS – operate & maintain



.. recognize that the GIS is not "finished" when it is put into operation. This is just the beginning of the next phase of the system life cycle.

Somers, 2001



Source: ESRI UK

GIS – Geographic Information System
ERP – Enterprise Resource Planning

Developing GIS – operate & maintain

a GIS must be maintained and kept current in terms of data and user support.

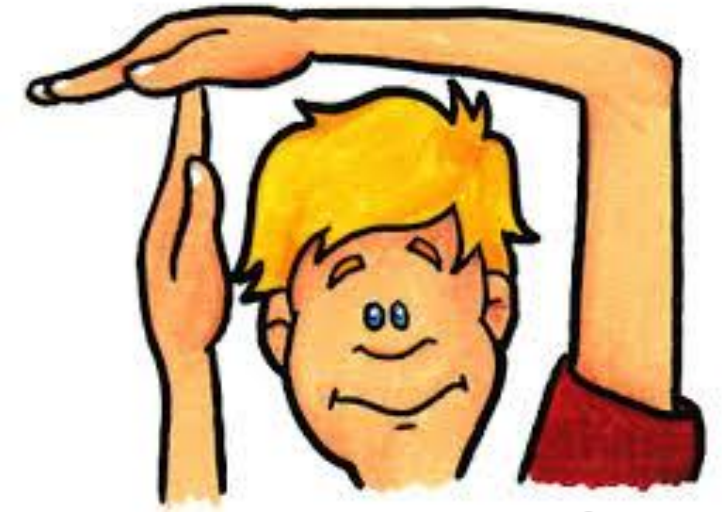
1. **specific/finite project** (however, even if the initial GIS application is no longer being utilized, the data generated for the initial project may be useful to other projects or users)
2. **on-going mission** (the system must be kept up-to-date in order to fulfill its design goals)

<u>Maintenance includes</u>:

- updating hardware and software
- adding new data
- updating existing data records
- keeping users current in terms of system functionality (call centre)

Developing GIS

Does it really happen this way?



Source: Alex's Tech Thoughts

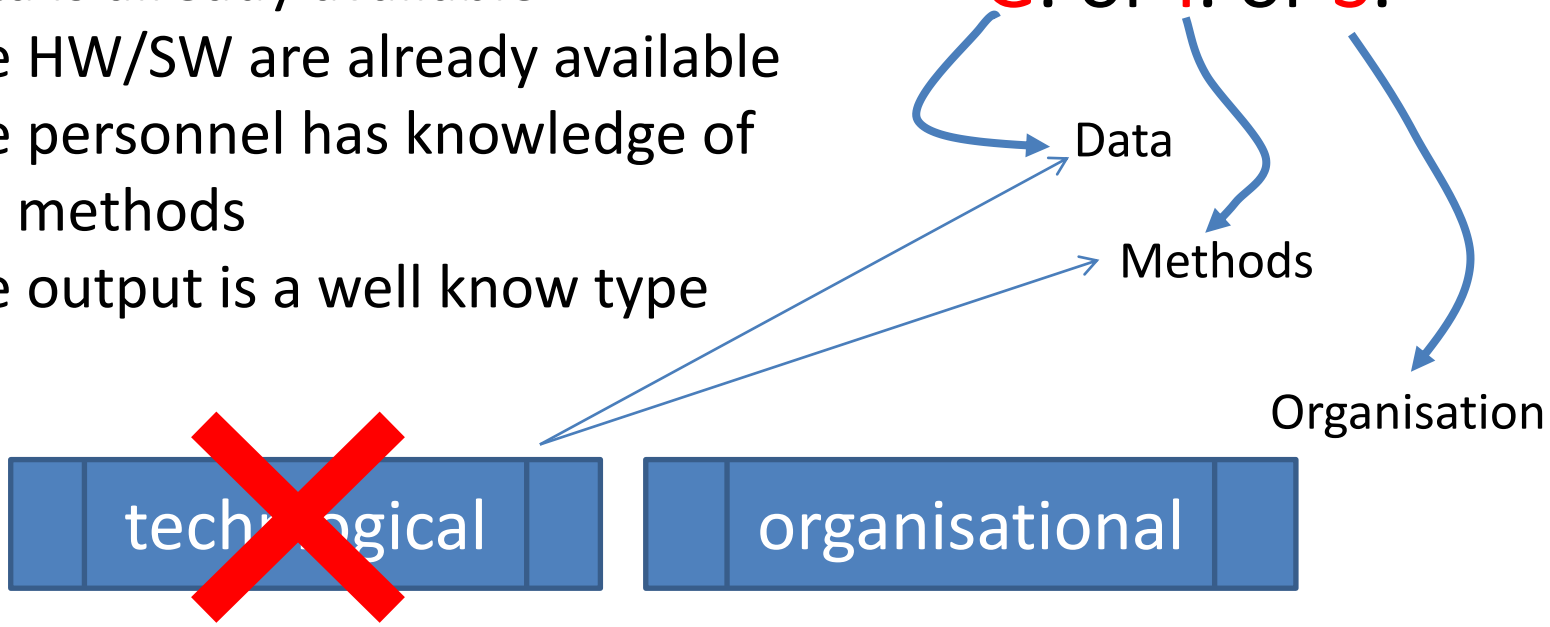
Developing GIS

One time effort

- Data is already available
- The HW/SW are already available
- The personnel has knowledge of the methods
- The output is a well know type

New

G. or I. or S.



Developing GIS – organisation

The development of an effective SDI often occurs in a fragmented organizational environment requiring a high level of inter-organizational collaboration..

Thellufsen, 2006

from a single-purpose perspective

to a multi-purpose perspective

minimization of data duplication

increasing technological possibilities

demand for an increased sharing of spatial information

qualified personnel

Developing GIS – organisation

Staffing for a GIS is a critical issue [..] in general, it is not easily feasible to directly expand the local government staff positions to fill the GIS need. Beker, 1995

The decision to develop a GIS is made incrementally

..the information needed to determine the feasibility and desirability of developing a GIS is not available until several of the planning steps have been completed..

Developing GIS – organisation

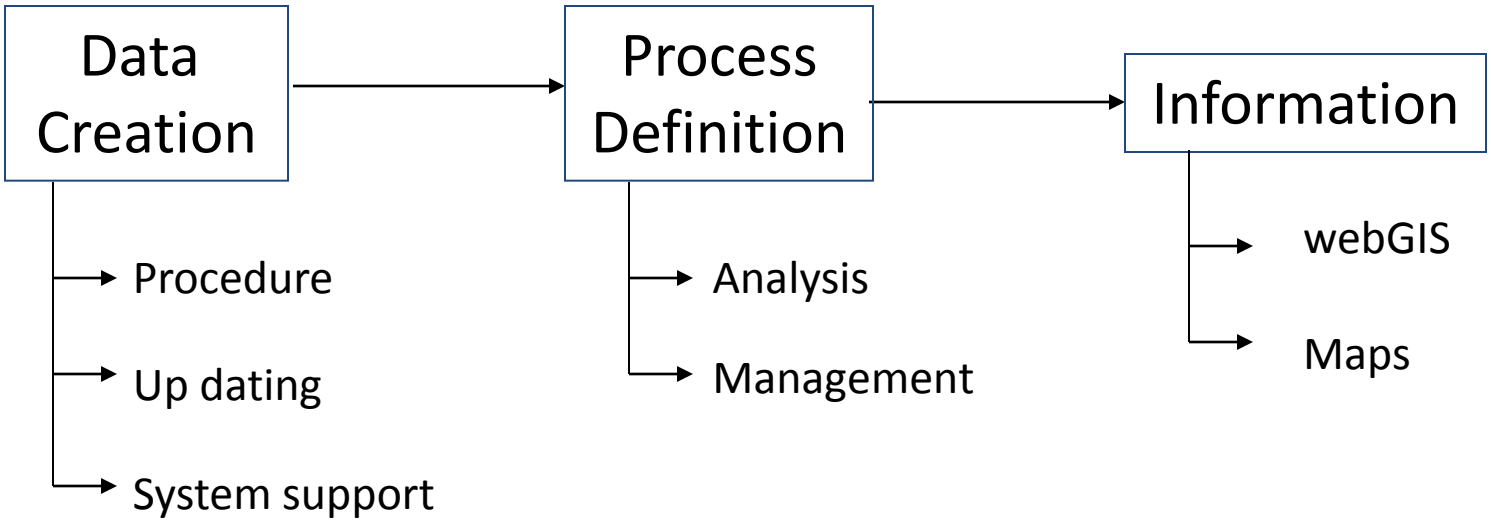
Descriptions for GIS Professionals

- GIS Director
- GIS Manager
- GIS Coordinator
- GIS Analyst
- GIS Specialist
- GIS Systems Analyst/Programmer
- GIS Technician
- GIS User (Heavy and Light)

ISO/TR 19122:2004 - Qualification and Certification of Personnel

Source: Summaries of duties typically associated with different kinds of GIS-related jobs
Reference: Huxhold, W. (ed), 2000. (http://www.urisa.org/)

Developing GIS – organisation



Developing GIS – organisation

complexity

stand-alone → Enterprise

GIS Technician
or
GIS User (Heavy and Light)

Personal GDB
GIS desktop
Output: file/paper

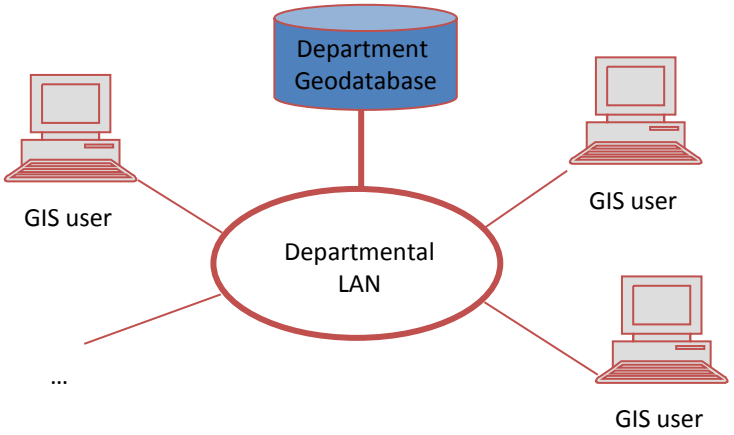
- Capture GIS data in different formats using GPS, electronic data recorders, digitisers, and other means.
- Download, convert and upload GIS data available from internal and external sources to make them usable.
- Perform GIS data quality control, including reviewing data for completeness and accuracy; identifying and correcting errors or omissions in the data.
- Catalog and inventory GIS data, including metadata creation.
- Input, update and maintain GIS databases, including backups and also maintaining linkages to other databases.
- Perform GIS spatial analyses.
- Create map layouts and views, and generate maps and reports.
- Develop new applications and train others in the use of these applications.

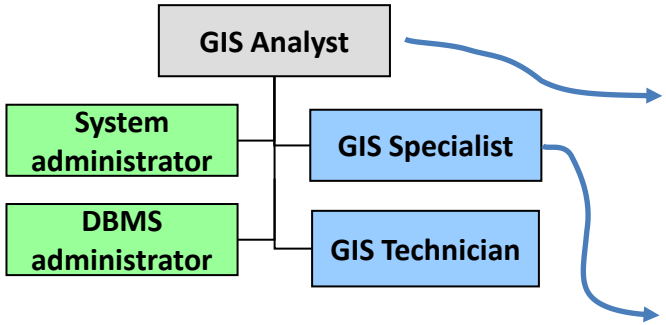
Developing GIS – organisation

complexity

stand-alone → Enterprise

Enterprise GDB
GIS desktop
Output: file/paper





- Coordinating the acquisition of new spatial data and supervising the integration of these data into the organisation's GIS.
- Preparing project plans

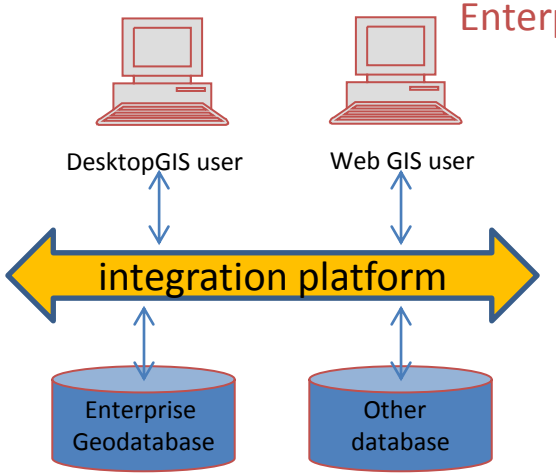
- Developing, maintaining and updating discipline specific GIS databases.
- Manipulating GIS data to create information products to meet discipline specific needs.
- Developing and applying GIS analysis solutions to meet other discipline specific needs.
- Serving as the GIS technical lead and point of contact on discipline specific GIS and related matters.

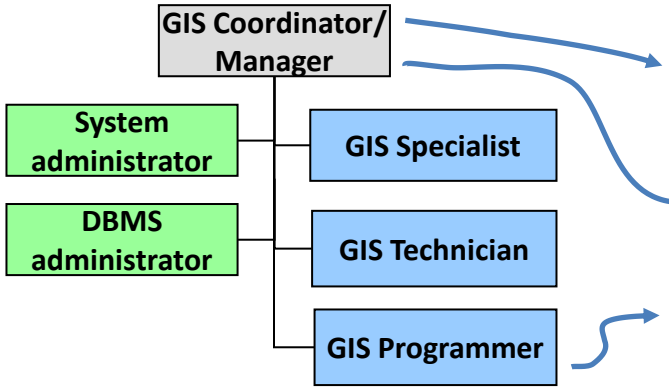
Developing GIS – organisation

complexity

stand-alone → Enterprise

Enterprise GDB
GIS desktop
webGIS
Output: file/paper/services



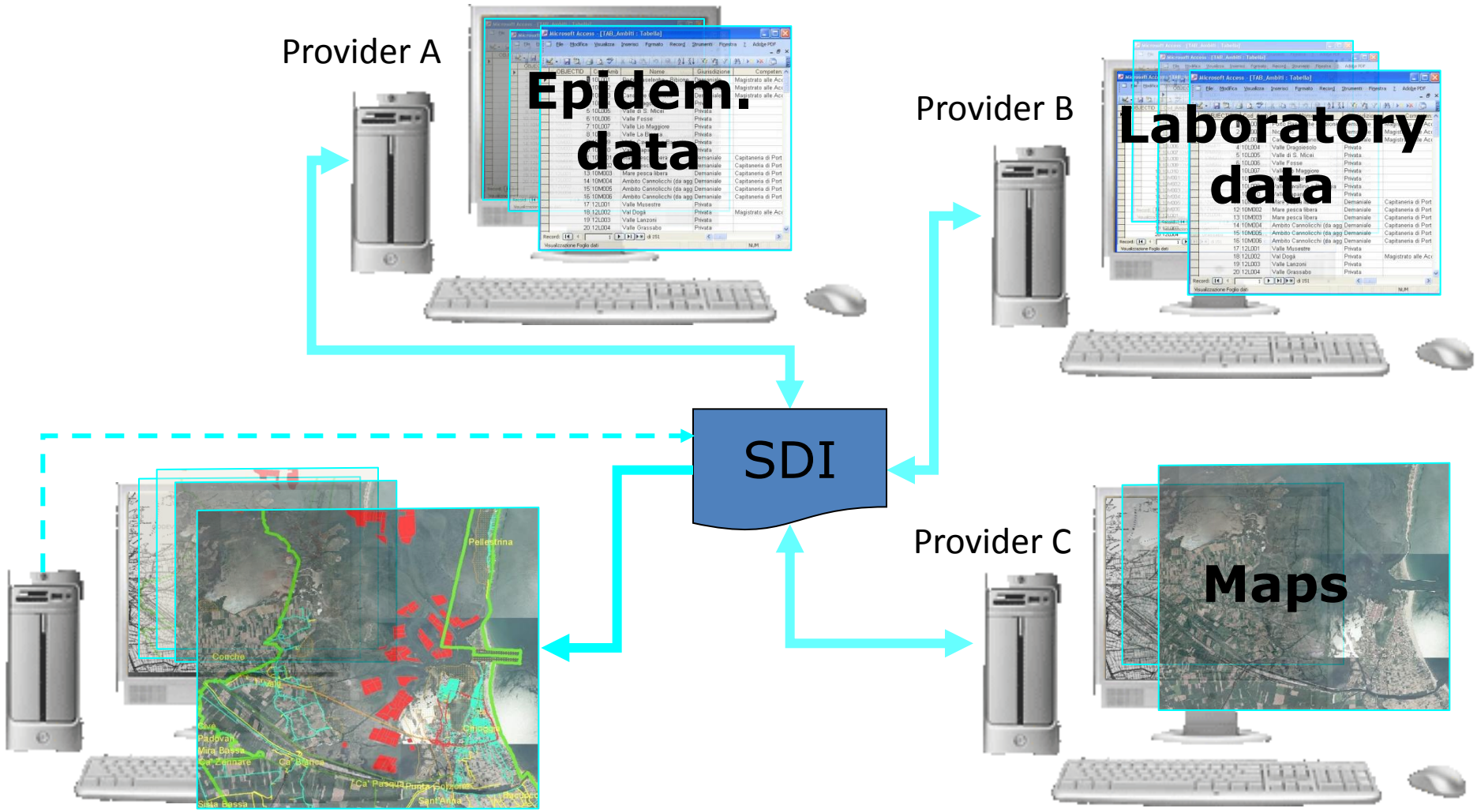


- Guiding policy making regarding GIS matters.
- Supervising the activities of GIS staff.
- Overseeing GIS applications development

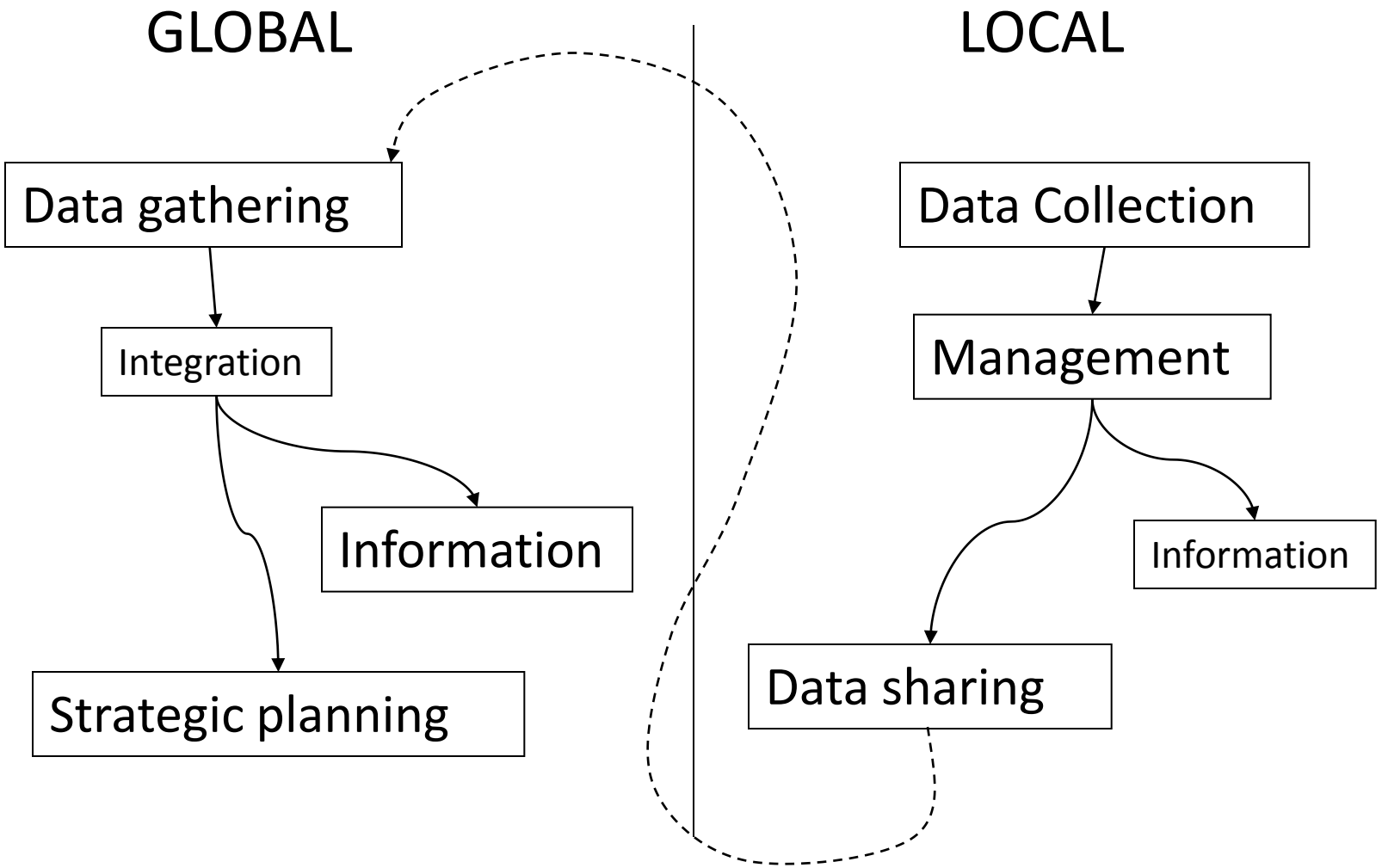
- Setting project goals and objectives.
- Developing GIS policies and procedures
- Acting as liaison with related external organizations.

- Creating and maintaining (updating and enhancing) the programmes that run the applications to satisfy specific user needs in the organization, taking full advantage of GIS platform functions and applications.

Developing GIS – organisation



Developing GIS – organisation



This is the end of the presentation