Spatial Data Infrastructure and GIS applications as support to activities of Public Administrations in Apulia

Abstract

The Geographical Information System of Apulia Region (SIT-Puglia) is conceived as a cooperative framework for Local Administrations, based on web functionalities and a geographic data infrastructure, devoted to territorial and landscape planning activities.

The specific purposes of the SIT-Puglia can be described by 4 main lines of development, i.e.: topographical database to 1:5.000 scale (1:2.000 for urban areas); functionalities for the government of the territory, with specific reference to territorial and landscape planning, emergency management, territorial marketing policy definition and historical-cultural property enjoyment; functionalities for precision positioning, with specific reference to a network of twelve permanent GPS stations; it includes a Thematic Centre for the management of the SIT-Puglia, to support Local Administrations in the adoption of Regional/National/European technical standards for geographic data and software applications development.

The technological stack includes Oracle database and ArcGIS Server. The purpose is to develop the application functionalities in a SOA architecture with elementary JAVA web services.

The project

Introduction

Apulia Region is doing a process of legislative renewal about territorial planning, focusing on five areas of intervention :

1. tutelage and valorization of landscape;
2. improvement of the quality of environment and population's life;
3. simplification of the process in which local choices about territorial government are formed and verified;
4. a more efficient and supportable infrastructural endowment, promoting relationships between territorial and infrastructural planning;
5. certainty of a prompt fulfilment of territorial government choices, through a more general construction of synergic relationships among territorial government's system and enterprises involved in environment tutelage and development planning.

In order to facilitate the application of regional politics, Apulia Region is realizing the SIT-Puglia that is conceived as a framework of application services and territorial information that can be used by all local corporations working at different territorial levels: above all, municipalities, provinces and region.

The main aims of SIT-Puglia can be summarized in:

1. the construction of a territorial data infrastructure representing the shared knowledge on which the politics of territorial government are based;
2. the realization of a services infrastructure for territorial management, with particular references to:
    *   territorial and landscape planning
    *   fulfilment of planning instruments
    *   management of civil protection plans;
    *   territorial marketing
    *   agriculture
    *   cultural goods
3. the realization of services of global positioning
4. the creation of a Thematic Centre for the management of the System, the definition of technical guide lines and the support of local administrations in the adoption of regional, national and European technical standard.

Below, you can find some synthetic elements about these aims.

**The infrastructure of territorial data of Apulia Region**

"Shared knowledge for the management of the territory": this is the purpose with which all realized stages in the project have been faced; this concept is summarized by the name "puglia.con", chosen to represent the whole process of the Regional Administration for which the SIT-Puglia is the main cross tool for every action.

One of the main activities was centred on the realization of an up-to-date and homogeneous knowledge base. So, it has been chosen to produce a technical cartography (CTR) on scale 1:5.000, from which a topographical database can be derived.

To this aim, a low height flight (about 2.000m) has been realized; a photogrammetric Z/Integraph camera has been used to obtain digital photograms with a high precision resolution on the ground (about 20cm). These shots have been used to produce:

- CTR
- topographical database (DB-Topo)
- Digital Terrain Model
- Orthophoto
- Land use (IV level of CORINE European standard)
- a derived topographical database on scale 1:25.000

The realization of these products has been made according the standards established by National and European work teams.
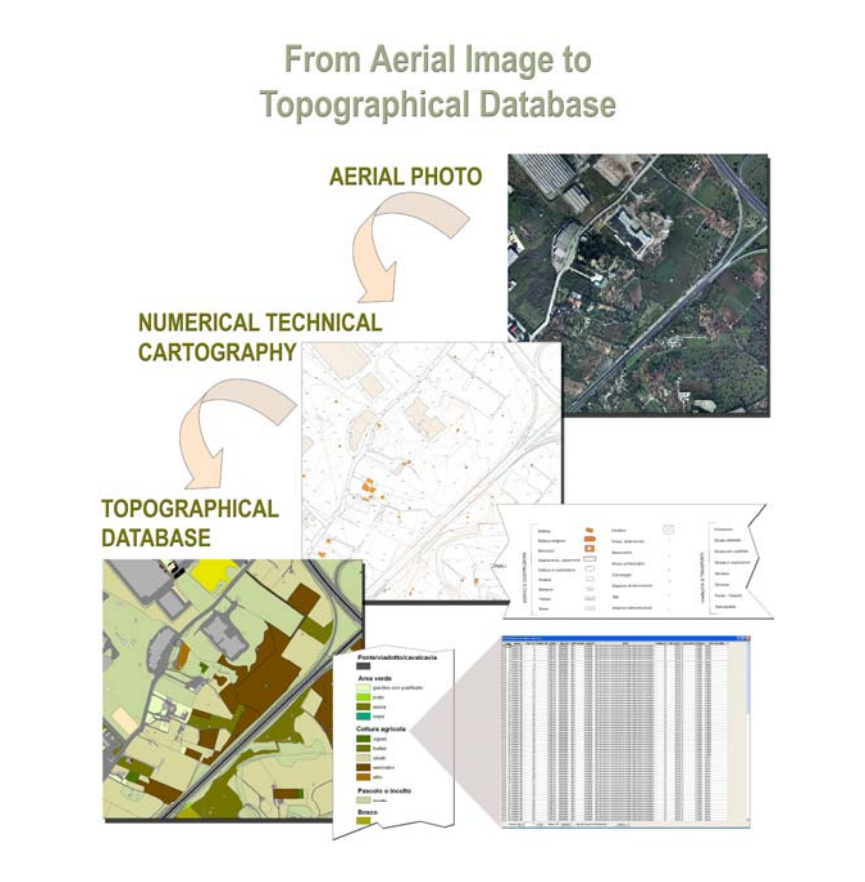
The fig. 1 summarizes the main differences between CTR and DB-Topo:

- while territorial objects in CTR are "linear", in DB-Topo they typically are given by "polygon" objects;
- each polygon in the DB-topo can have more and more information associated;
- polygons in the DB-topo can be characterized by the 3D-rings.

These products represent the basis for the construction of the essential elements for Local and Regional planning, but they must be integrated with some other information, particularly about the environment. This second aim is being achieved through a collaboration with:
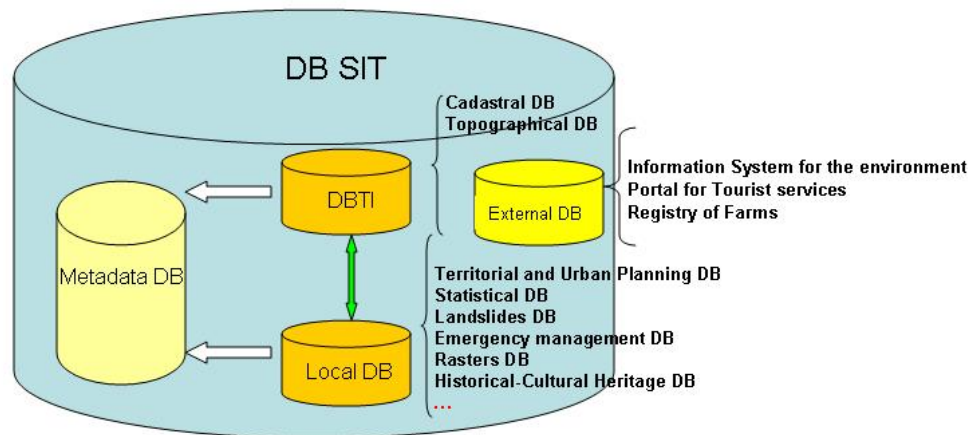
- The *Autorità di Bacino,* engaged with the construction of a hydrographical network from the CTR contents integrated with elaborated historical data. The resulting elements are to be shared with the Communal Administrations involved in the preservation of the territory;
- The *Acquedotto Pugliese*, engaged with some surveys on water pipes and water–meters in about 143 Apulia towns; surveying also involves streets names and civic numeration: data is available to Region which, at its turn, allows the use of all topographical layers being constructed;
- The *Regional Institute for statistics inquiries* (IPRES), which is supporting the definition of a socio-economic indicators set (population, industries, etc.);
- The *Regional Environment Assessorship*, which is realizing an information system for the environment (SIPA) to manage information related in wide lines to physical components such as air, water and soil quality;
- The *Regional transport assessorship*, which manages traffic flows information related to the main extra-urban Regional streets (survey organized from July to December 2007).

Logically SIT-Puglia databases are organized in the following way:
- **Local Archives** (or work-archives), representing sectorial archives (e.g. territorial planning);
- Integrated territorial database (DBTI), containing information built according to National/ European standards, as starting point to construct homogeneous databases at National and European level.

Figure 2 schematizes the access to databases.

LOGIC COMPONENTS OF DB SIT

DB SIT

Cadastral DB
Topographical DB

DBTI

External DB
> Information System for the environment
> Portal for Tourist services
> Registry of Farms

Metadata DB

Territorial and Urban Planning DB
Statistical DB
Landslides DB
Emergency management DB
Rasters DB
Historical-Cultural Heritage DB
...

Local DB

DBTI: Cartographic data based on national standard and managed by Apulia Region (Topographical DB, Cadastrale DB)

Local DB: Cartographic and alphanumeric data based on regional standard (Territorial and Urban Planning DB, Statistical DB, Landslides DB...) and managed by Local Public Administrations

DB Metadata

External DB: Cartographic and alphanumeric data not managed by SIT-Puglia

Fig. 2

It is important to point out that SIT-Puglia involves local Administrations in the management of specific information.

The infrastructure services for the management of the territory
The designed services are related to the fruition, management and improvement of data, they offer the possibility to make data based analysis. For this reason, two kinds of services have been realized, *infrastructural* and *application* services.
Infrastructural services are above all "Back Office" services, i.e. they are used to create and update the database. They include simple services for the front office too, in order to permit access and navigation on the database.

There are some infrastructural services devoted to management and synchronization of the different archives. In particular:

- Services for interfacing *local DB* and *DBTI*: they are used in applications each time the use of local data is required, even if they are not included; so, they are considered of general interest and, consequently, they are available to everyone with permission;
- Services to synchronize *local DB and DBTI:* they are activated each time a data inside DBTI is brought up to date by the "owner" in the "local DB" component; consequently, they need to be lined up in the DBTI component;
- Validation services: they are activated each time some controls are needed (not only topological) on the data, before their storage in the pertinent DB.

Figure 3 sums up the functional architecture of the infrastructural component in the SIT-Puglia project.
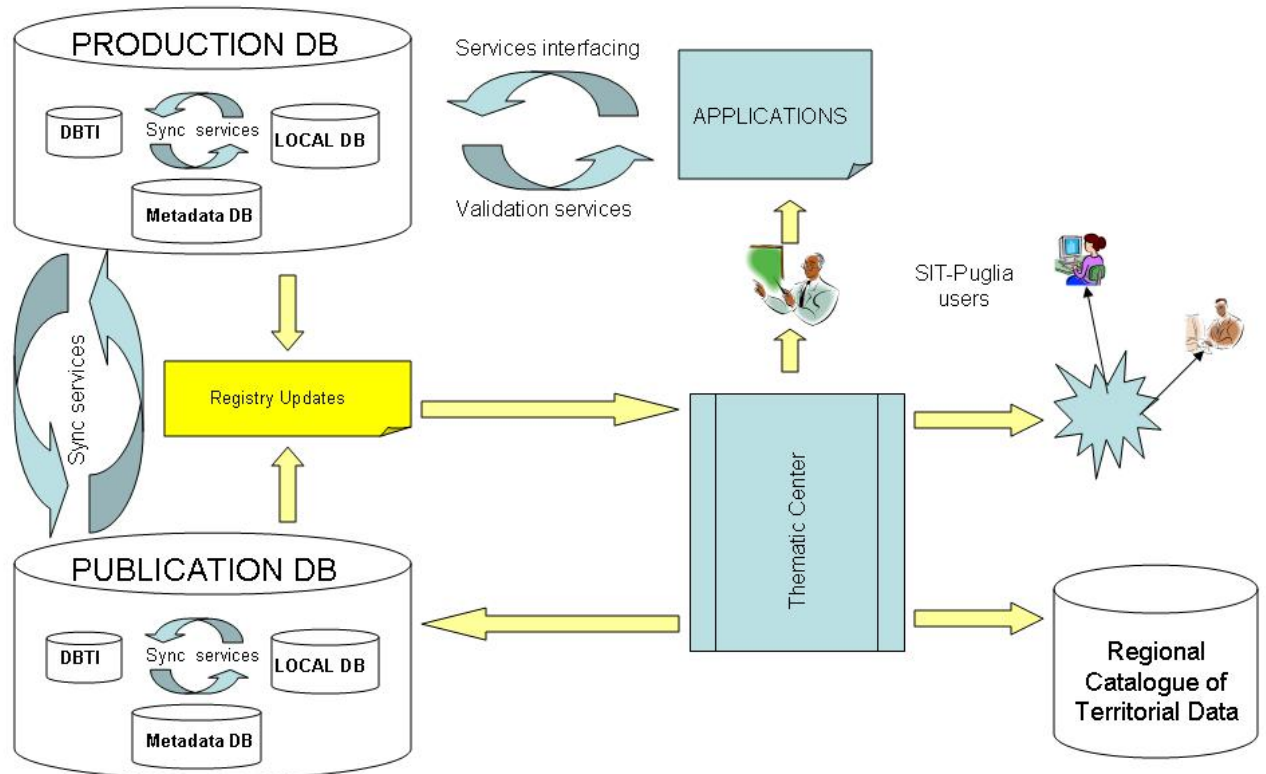
FUNCTIONAL ARCHITECTURE

Fig. 3

Application services offer products and functionalities for the cooperation of Regional administration with local administrations. Application services in the SIT-Puglia are essentially centred on urbanistic themes and territory and landscape planning, with the following specificities:

- **Urban activities:**

Building concession: it gives at municipal administrations the opportunity for releasing building permission based not only on alphanumeric, but also on topographical data and GIS analysis.

Certificate of urbanistic destination and repertoire of the disciplines on the territory: it automates the procedure of releasing the certificate, taking the forecasts of the current city plans as basis, and it allows to identify all current prescriptions on a territory.

- **Landscape and territorial planning:**

It supports the technical elaboration of the plans and the definition of territorial policies.
It provides an environment for the editing of Urban Plans and it is oriented towards the production of municipal plans. It gives the possibility to read the characteristics of the territory, monitor the state of actual plan, execute analysis; furthermore it put at disposal an environment for producing informative levels with the indications and prescriptions for municipal plans, to send the Municipal Urban Plans (PUG) directly in Region for compatibility controls and for the mosaic of all the plans at Regional levels. The service allows:

1. Analysis on Informative Layers published inside the map service in order to make:
   - Spatial or Alphanumerical Research and then save the result;
   - simple statistics on a particular field (Sum, Avg, Max, Min,..)

- relation between two fields and save the result
- Join between two informative layers, filter the result and save it
- aggregated statistics on one or more Informative layers.

2. Starting and managing of the whole administrative workflow for approval of the Urban Plan through the creation of:

- a repository
- some folders
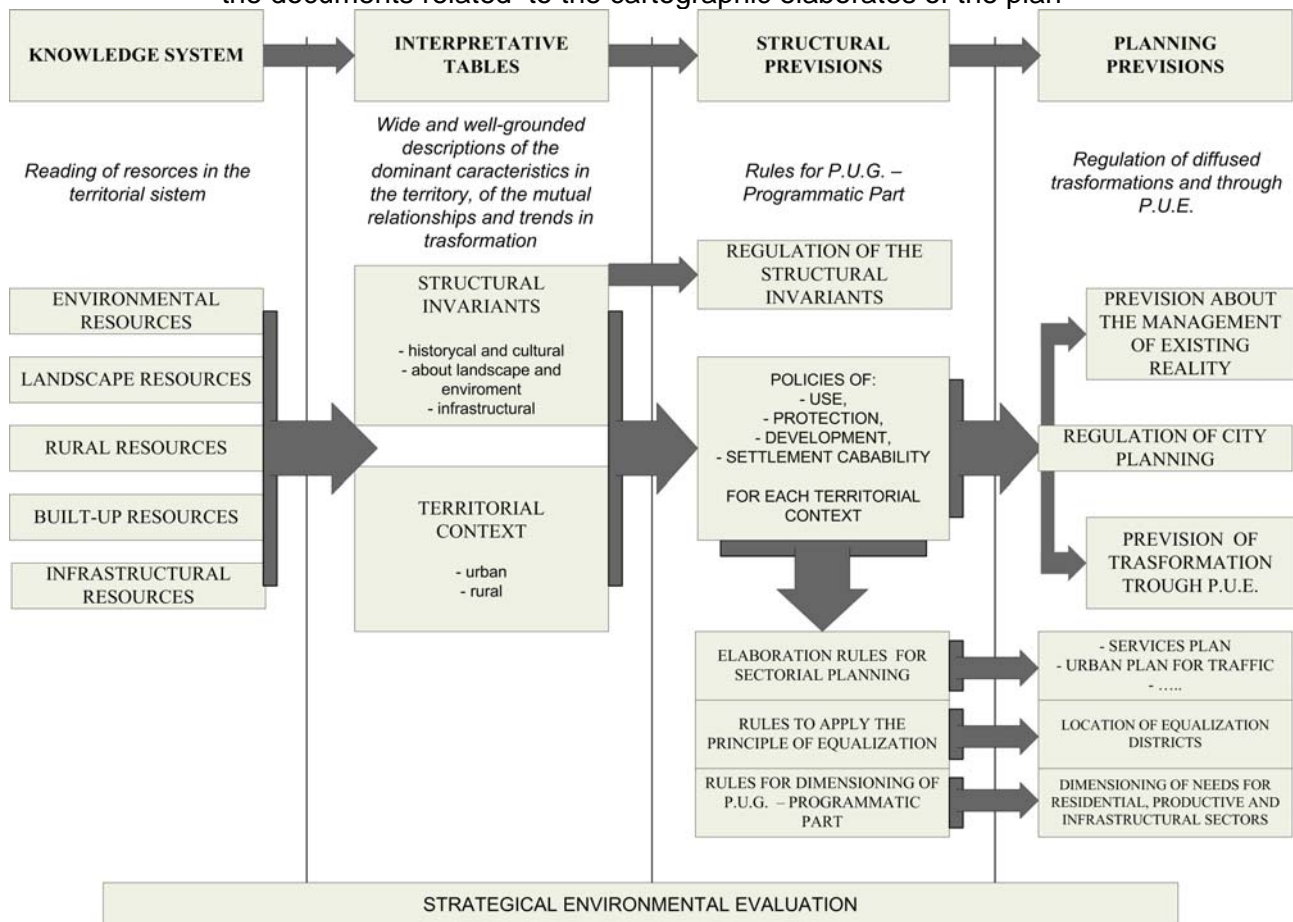- the documents related to the cartographic elaborates of the plan

Fig. 4: main phases of the process for the production of a Urban Municipal Plan

Support to the compatibility verification process of Urban Plans: it realizes an environment to control the municipal and provincial Urban Plans with respect to Regional ones, according to the actual law, and it accelerates some phases of the process, because it allows automatic control on possible incongruity elements.

It gives the possibility to:
- make analysis of the territory;
- Cross more informative layers. It allows to verify topological overlapping;
- Verify distances;
- manage signals; it allows to insert remarks in relation to the examining plan;
- calculate relationships among geometric entitties and/or numerical entitties;
- Manage relationships;
- Display in two different windows some informative layers referring to the same area in order to make analysis and visual control
- Visualize 3D.

<u>Support to the monitoring and the management of the plans</u>: It allows to localize on the territory the intervention foreseen in the many development projects (eventually putting them in relation with the engaged resources), to compile   some forms of descriptive character of the interventions themselves, annotating:

- Private data: Title of the program, number of Municipalities participating, total population, total area, date of presentation, date of approval;
- Reference to Municipalities involved: list of municipalities, distribution of financial resources between them, description of the interventions, indication of the municipality leader;
- Reference to associated Finances: source and   amount of Finance, kind of value of Finance:
- Attachments.

<u>Information about the state of the planning:</u> It creates a management system (workflow management) of the procedure of plans, supporting the application and allows the monitoring of all phases and foreseen passages by the regional law, included the phase of collection and analysis of the whole observations and against-deduction to the plan, the results and the statements of conferences of co-planning. The service allows the access to the instruments of the plan, at every foreseen layer.

<u>Information about mosaic of layers:</u> it builds and manages the mosaic of the knowledge and of the Plans at regional level, so it allows the knowledge and the analysis of adjacent plans.

The user can define the area where he can work trough the following controls:

- checkbox "Regione": this selection extends the content to the whole Region and disable the three controls

- listbox "Provincia/e", whose selection brings an up to date the listbox "Comune/i"
- Listbox "Comune/i", whose selection can be spread out with the checkbox "Tutti i comuni limitrofi a";
- Chosen the area of interest, the system sets the link to visualize on the map the mosaic of Informative Layers of the Urban Plans and of the useful instruments to the Analysis of the Area.

<u>Information on the supply and demand of the mobility:</u> It gives a vision, widen to the whole Regional territory, the demand of mobility about the main communication artery and the supply of the public local transport on over-local step. These information , if they are put in relation with some other archives, allow to realize functional analysis to the territorial and landscaping planning .

Precision positioning services
Precision positioning services represent an integration of application services described to the previous point. A network of 12 permanent GPS stations distributed on the Regional territory has been realized and it is working from September '07.

The network of permanent GPS stations allows to correct in real time (modality RTK) or in post-proceedings the position traced with a rover GPS during campaign surveys, reaching high precisions.

For the realisation of   the Net, 50 Municipal Administrations have been involved; careful investigations on about thirty city halls potentially suitable to lodge a Permanent Station have been made and up twelve of them the stations have been really realized. The GPS permanent stations dialogue with the control system through the regional IntraNet.

The precision positioning services are accessible from the geoportal of Apulia Region. The services are accessible, free of charge, at public and private operators. Today it counts about 470 users.

The Thematic Centre

All the actions before described are defined and supported by the Thematic Centre, that manages both the technological infrastructure and the services themselves. The Tematic Centre is devoted to:

- Maintenance of the databases of the system, guaranteeing in time the information's quality;
- Manage the hw and sw infrastructure;
- Promote and coordinate the development of new GIS services for the territory government;
- product, through the GIS laboratory, new added value products/ services;
- represent the reference point for Local Administrations in adopting GIS technology.

Furthermore a fundamental aim of the Centre is to define guide lines and best practises for the elaboration of data to insert in SIT-Puglia. With a specific reference to the elaboration of Municipal Urban Plans, the Centre has focused technical instruction to:

- establish a technical structure for information assembled during the phase of production,
- give a scheme (personal Geodb) to organize the layers of Urban Plans in coherence with the politics guide lines,
- promote the opportunity to realize the   plans directly in GIS environment,
- support the need to share geographical information through the net, in coherence with INSPIRE directive,
- support Local Administrations in the adoptions of   technical guide lines.

The technical instructions for Municipal Urban Plans will be tested through an experimentation phase, that is starting and involves about 45 Municipal Administrations. As a result of this activities, it will be possible to construct a planning homogeneous database on Regional Territory.

Final considerations

The SIT-Puglia can be considered   quite a complex and ambitious project and for this reason it is fundamental the collaboration among the Administrations at different level, both in the phase of the realisation and in that of management.
What is more, for the implementation and the update of databases is fundamental   the support of Local Administrations, that will be involved in specific formation courses.