The open source GIS, an ideal framework for the development of an integrated modelling platform devoted to sustainable urban planning

First steps with OrbisGIS and CartoPolis

Gérard HEGRON, IRSTV/Ifsttar
Erwan Bocher, IRSTV/CNRS
Gwendall Petit, IRSTV/CNRS

An interdisciplinary and systemic approach

Sustainability

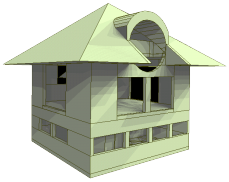
- Environmental, sociological, economic and cultural dimensions

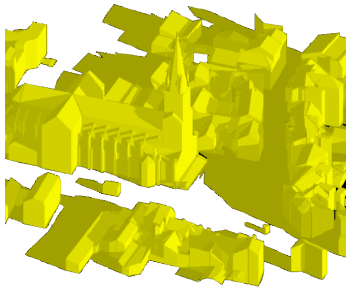
Timescales

- Differences in time scales for planning and design, practice and management
- From short to long term effects (trends, change, risks)

Spatial scales

- Local, regional and global
- Links between local action and global environmental change





Sustainable urban planning

Relationships

- between the environment, technical systems, social and economic practices, spatial planning
- between different sectors and stakeholders

Need of an integrated modelling platform for

- Evaluation of urban projects (multicriteria, multi-actor)
- Spatial analysis tools at ≠ spatial and time scales

Open source
Spatial Data Infrastructure (CartoPOLIS)
+ Geographic Information System (OrbisGIS)

an ideal framework to fulfill this objective !

The need of an open source SDI

Huge amount of **data**

- coming from **various origins** :
  - Surveys
  - Measurements (*in situ* sensors, remote sensing)
  - Modeling and simulations (evaluation, indicators)
- of various **nature** (quantitative, qualitative)
- at different spatial an temporal **scales**
- to perform **multi-criteria** analysis
- for **different actors** (urban planners, decision makers, inhabitants, …)

A Spatial Data Infrastructure

SDI

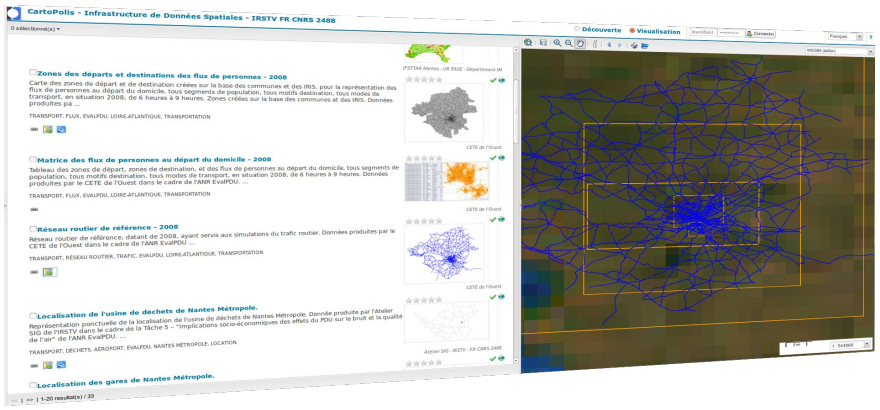
Used of ISO and OGC standards for the acquisition, processing, capitalization, sharing and preservation of spatial data and metadata

Issues to face systemic and interdisciplinary applications :

- Description and storage of multi-source and multi-scale data/metadata
- Querying of such data: what kind of language for users?
- Utilization of data by models or tools: how to enable the integration?
- Provision of data and tools:
  - Are data standards sufficient to manage the data flows?
  - How do we manage the data processing flows and the storage of the spatial analysis tools?
  - How to visualize the spatial data according to specific mapping rules?

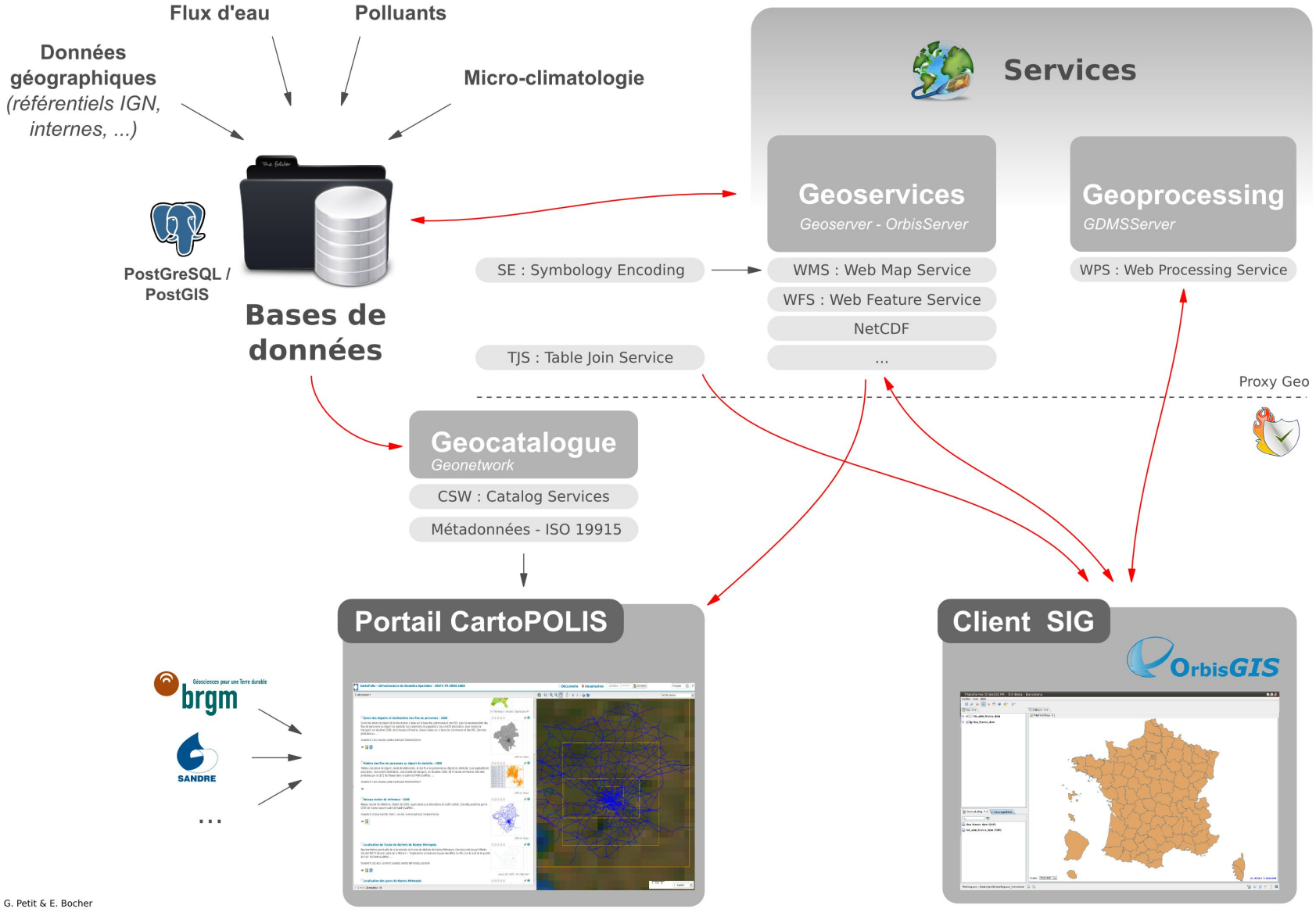
The open source SDI CartoPOLIS

- A **single database** aggregating all data collected or produced;
- **Geoservice**: a server of data flow providing geographic data via Internet using the standard Web Map Services.
- **Geocatalog**: a tool for cataloging data
  - set of metadata sheets structured according to ISO 19115
  - information: temporal extent of the dataset, spatial extent, origin, semantic features, etc.
- A mapping Internet gate with **graphical interfaces** for querying the Geocatalog



CartoPOLIS
IRSTV - FR CNRS 2488
www.cartopolis.org

The open source SDI CartoPOLIS



G. Petit & E. Bocher
Atelier SIG - IRSTV - 05/09/12

Diagnosis and evaluation of sustainable urban policies

- Modelling

  For understanding complex systems and for urban planning

- Decision making

  Complexity → different planning scenarii

  → comparison of scenarii (evaluation)

→ Platform integrating a lot of urban models, producing, exploiting, sharing spatial data: Open source SDI & GIS and standards

Why open source paradigm and standards ?

- **Exchange of data** between urban models, applications, visualization tools :

  Interoperability and standard data like OGC standards (WMS, WFS, …) and ISO standards (19115, …)

- Plugins and transfers of **new models :**

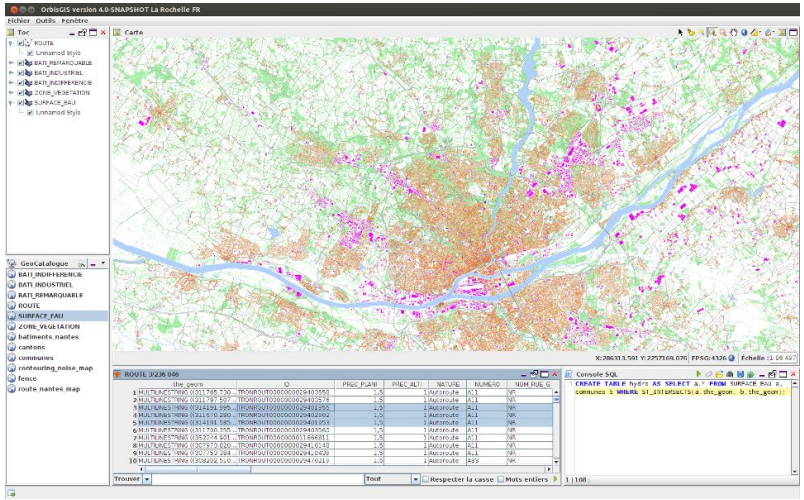
  A modular approach to development (model-view-controller software design pattern)

- Data query and data processing :

  The query language must be comprehensible to different users and easily completed when adding additional features like new evaluation tools or models

The open source GIS OrbisGIS

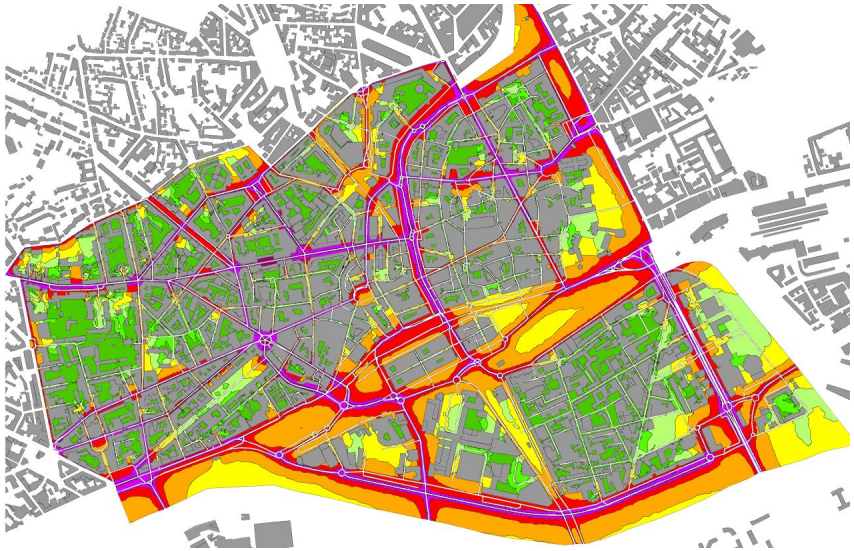
- Integration of an extended spatial language:
  management of both vector and raster data) based on the Simple Feature SQL (SFS) standard
- A unique way to describe spatial processing
- Coupling with the Web Processing Service:
  to share in a common plateform all geospatial processing available on-demand via internet.



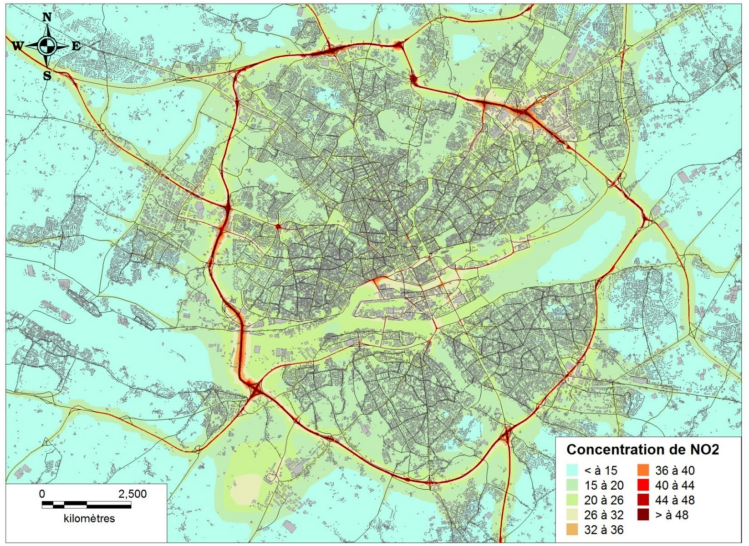
OrbisGIS

www.orbisgis.org

→ Enhancement of SDI uses by pooling all the processes built by IRSTV researchers (noise mapping, flooding modeling, atmospheric pollutant dispersion, etc.) and by creating a geospatial knowledge repository to study cities



Noise map in Nantes – Fortin N.



NO2 concentration in Nantes Metropole – Schmidt T.

The **visualization** of spatial data must

- cope with static, dynamic and multi-scale data,
- be comprehensible by all stakeholders (good representation of the semantic and use of standards),
- be easily edited and disseminated on different supports.

→ Symbology encoding standards have to be consistent with the purposes of research and new applications.

OGC®
Making location count.

irstv + iict

Illustrations ?

IRSTV + IICT: OGC SE proposal

cartographic publications with the Geospatial PDF

Collaborative development of the open source platform

At IRSTV, creation of a common platform

- where each member of IRSTV is an active contributor,
- a common tool adopted by all the different users,
- a single platform able to integrate and capitalize all the methods and tools necessary to describe, model, planify and manage the city.

→ Needs of a specific collaborative methodology :

to manage the understanding and the interaction between the various stakeholders (developers, users) to preserve the quality of code.

Cooperative software engineering

Project management for the integration of new packages and the preservation of the quality of the delivered code (validation process) controlled by :

- the open source tool Jenkins to ensure a continuous integration without regression.

- the platform GitHub and the GIT tool for the sharing and the distributed control of codes.

Pedagogy and training

… from software engineering to participating in coding

- MSc on Sciences and techniques for urban planning,
- Professional training providing full courses to learn how to use and develop these tools,
- Training project dedicated to the engineering of geographic information in cooperation with other existing communities like GvSIG and OpenStreetMap.

Contents : Theory and practice on open source software (GIS, SDI, relational database …) and on open data.

A research platform for proof and benchmarking

- A means to prove to the quality of the concepts, their implementation and usage, their computation performances according to the amount of data, and its ability to adapt to other datasets.

- A tool to compare their performances to other approaches on the same datasets.

- A way to demonstrate their relevance for the professional community.

To conclude ...

The open source paradigm:

a response for an integrated modelling platform dedicated to sustainable urban planning.

The open data and open source SDI:

a response for collaboration between all the stakeholders

Interoperability and common languages:

a response to interdisciplinarity, cooperation (data exchange and crossing, new functionalities), communication (symbology encoding)

To conclude ...

Research on sustainable urban planning is really a great opportunity and source of innovation and progress for the open source community.

Thanks for your attention !

gerard.hegron@ifsttar.fr