« Sentier de la Méridienne »
Web-GIS

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Paris prime meridian?

A long story...

- Defined in 1667, June 21th
- Has been a reference in France for three and a half centuries
- A lot of geographical sciences have emerged thanks to it (astronomy, geodesy, cartography...)

A lot of advances....

Earth radius length  
Earth’s form  
longitude determinations  
gometric maps  
meter length

An universal heritage to promote!
« Méridienne project » chronology

- **1999 - 2000**: « Méridienne Verte »
  - About 30 000 trees planted along the meridian
  - July, 14th 2000: organization of an « incredible picnic »

- **2004-2010**: Méridienne footpath survey
  - Landscape description, land surveying...

- **After 2010**: Awareness campaign
  - General public has to know what the meridian hides thanks to a ludic and lively foothpath
Why a web-GIS?

For internet users

- Territories discovering (geographically and historically)
- Walking planning (different course difficulties)

For administrators

- Footpath management (mapping, maintenance)
What technologies to adopt?

How to integrate old maps consultation?

How to allow a decentralized management of databases?

The choice of Open-Source!
**Web-GIS architecture**

**DATA**
- JPEG2000 files
- Raster data
- Old maps

**SOFTWARES**
- MapServer
- GeoServer
- MapFish framework
  (OpenLayers, GeoExt...)

**EXTERNAL DATA**
- OGC protocols
- INSEE
- IGN
- BRGM

**CLIENT**
- MapFish framework
  (OpenLayers, GeoExt...)

**DATA**
- PostGIS database
- Vector data
  (Footpath section, POI)
Old maps: integration chain

- Paper map
- Digitizing (human intervention)
- Numeric file (pixels matrix)
- Amer points definition (human intervention)
- Pixel coordinates = projected coordinates
- Clipping (Map extent)
- Georeferenced picture
- Georeferencing (Projection description)
- Rectified picture
- Sampling
- Assembling
- Usable picture
- Index file
- Assembled pictures
- Distribution (MapServer software)
- WMS visualization
GDAL use

- Proj.4 definition of « projection de Bonne »
  ```
  +title=Projection_Bonne_Etat_Major +proj=bonne +lat_1=45 +towgs84=1127,22,57 +a=6376523 +rf=308.64 +pm=2.33694136 +units=m +no_defs
  ```

- Georeferencing: gdal_translate
  ```
  gdal_translate -gcp 399 132 "-0.5" 46.5 -gcp 3399 113 "-0.25" 46.5 -gcp 6402 99 0 46.5 -gcp 2399 1369 "-0.3333" 46.4166 -gcp 4409 3018 "-0.1666" 46.3333 -gcp 397 4485 "-0.5" 46.25 -gcp 3409 4474 "-0.25" 46.25 -gcp 6424 4461 0 46.25 XVI_23R.tif XVI_23i.tif
  ```

- Sampling & clipping: gdalwrap
  ```
  gdalwrap -t_srs "+title=ATIG +proj=longlat +towgs84=1127,22,57 +a=6376523 +rf=308.64 +pm=2.33694136 +units=m +no_defs" -te "-0.5" 46.25 0 46.5 XVI_23i.tif XVI_23.JP2
  ```
Old maps: results

- **FILE CREATION → GDAL**
  
  More than a simple georeferencing: sampling

- **DISTRIBUTION → MapServer**
  
  Flexibility of Proj.4 library
  
  WMS flow

- **VISUALIZATION → OpenLayers**
  
  Fluidity of display:
  
  tiling + client side caching
Part of the footpath database
WFS-T: a web-service for decentralized management

WFS_T_Layer = new OpenLayers.Layer.Vector('coucheWFST {
    strategies: [new OpenLayers.Strategy.BBOX(), saveStrategy],
    projection: new OpenLayers.Projection("EPSG:4326"),
    protocol: new OpenLayers.Protocol.WFS({
        version: "1.1.0",
        srsName: "EPSG:4326",
        url: "/geoserver/wfs?",
        featureNS: "http://www.openplans.org/topp",
        typename: topp:T_SENTIER,
        featureType: T_SENTIER,
        geometryName: "the_geom",
    })
});
Examples of geometry digitalization

Footpath section

Temporary closed area

OpenLayers 2.8 > snap control > good for topology!
And now some demonstrations!
Conclusion and some outlooks

- Open-source based architecture defined in broad outlines
- Integration process successfully applied to five old maps
- Remote management of footpath database allowed thanks to WFS-T protocol
- A first implementation for walking search

At short term:
- Capture of object properties during digitizing
- Improvement of walking search capabilities

At long term:
- 3D integration
- Location based services

This project will involved a lot of competencies (local authorities, « Sentier de la Méridienne » organization, free software companies)