PCI NG : Strategy for migrating and mordernizing legacy cadastral map applications

French tax administration

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Legacy cadastral map applications

What is PCI project (digital cadastral map) ?

1 DGFiP software for management supported by the APIC GIS (1Spatial), allowing the handling and dissemination of the cadastral map.

2 This tool is used within topographic missions (updating parcel data and map elements like buildings) by cadastral agents. PCI is fed :
- with land-registry data from the MAJIC application (updates on parcels, addresses, and owners)
- with cartographic data from surveying documents produced mainly by professional surveyors and verified by cadastral services

3 As the reference repository for the cadastral map, PCI also incorporates topographic detections from Foncier Innovant and therefore includes "aerial-view" representations. With the help of the Foncier Innovant project, which uses orthophotos and AI, PCI is partially updated automatically.

What is SCPC project (cadastral map consultation service) ?

1 SCPC provides both consultation and dissemination of the cadastral map.

2 Cadastre.gouv.fr is the SCPC website dedicated to users for consulting the cadastral map. It allows searching by criteria, viewing and ordering map sheets.

3 It also serves as a tool for distributing the cadastral map to public administrations and businesses via cartographic data streams.

4 SCPC also aims to export cadastral-plan data as Open Data on the data.gouv.fr platform with different formats :
- EDIGEO
- DXF
- GeoJSON
- Shapefile
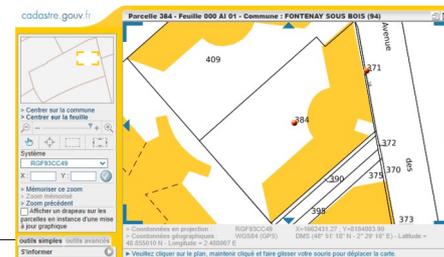
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Reasons, challenges and objectives for redesigning the cadastral plan applications

Functional challenges tied to underlying technical challenges
Technical obsolescence

1 **PCI,** the APIC GIS (1Spatial) is no longer maintained or evolving since 2018 :
- presents major risks in scalability, interoperability, security and service continuity
- Despite temporary extended support, the product will reach the end of its contract in 2028, making its replacement unavoidable.

2 **SCPC** : this application, built on obsolete Java frameworks such as Struts 1.3 and MyBATIS, now faces significant security, scalability and maintainability risks. In addition, the ICAD and Cadastre.gouv portals are not accessible, meaning full redesigns are required to meet accessibility standards.

Functional challenges tied to underlying technical challenges

Mains challenges :

- **Implement a simplified process** for producing, updating and distributing the cadastral map.

- **Adopt an integrated and scalable solution** that can easily adapt to new needs and provides straightforward maintenance.

- Facilitate data **interconnection and interoperability**, and streamline information exchanges both internally and externally.

- **Migrate the 350 PCI databases** into a single national cadastral map database.

- **Improve the continuity** of the cadastral map

Constraints related to cadastral map (1/2)

1 **Changes occurring over long periods of time :**
- A parcel subdivision process can take several months to several years (for example, in the case of an inheritance).
- The modification must exist in the system without being integrated into the cadastral map until it is legally validated.
- Concurrent modifications may occur on the same parcel during this time.

2 **Strong topological constraints :**

- Parcels are subject to topological constraints :
  - There must be no empty space between two parcels unless it corresponds to public land.
  - Two parcels must not overlap.
- Current cadastral data is not free of defects.
- It is necessary to preserve these existing defects during the migration phase from the old system to the new


Topographic issue

Common node

Topographic issue

Parcel limit
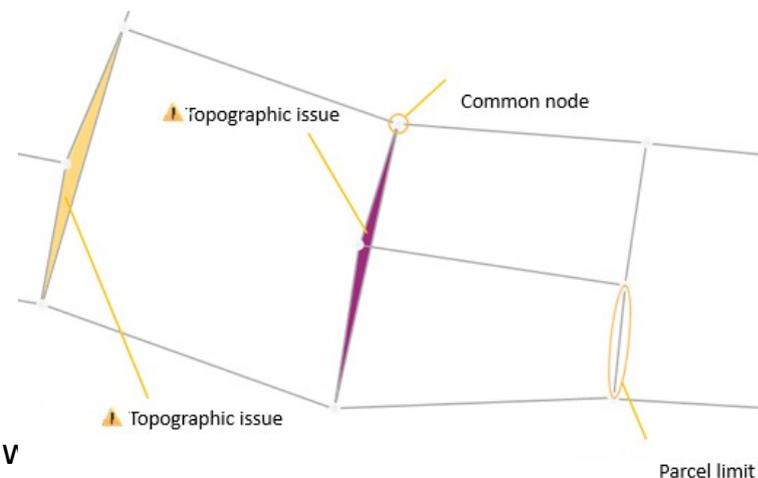
Constraints related to cadastral map (2/2)

3 **Concurrency risks in accessing the cadastral map :**

- The organisational procedures of the Cadastral Services generally help prevent concurrent access.
- Work on adjacent parcels or long-running modifications can increase the risk of concurrent access.

4 **Complex data model :**

- The PCI cadastral data model is not just a simple set of maps. It includes numerous relationships involving :
  - Parcels
  - Update documents (used during the processing of update requests)
  - Some objects are non-geographic (for example : owners of parcels)
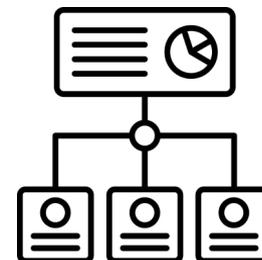
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PCI-NG : application architecture

PCI-NG : open source orientation

1 The technical scoping phase of PCI-NG, which was completed in August 2024, defined and selected the following technical components:

- **Free and maintained solutions**, to ensure the longevity of the system and the level of support. Off-the-shelf products, when applicable, to minimize development costs as much as possible.

- The proprietary solutions was ruled out : license fees are very high, and custom development would not be reduced.

2 **The core of PCI-NG** will rely on the main components of the **OpenStreetMap (OSM)** community, which allow :

- Leveraging the largest free community in the geospatial domain.

- Reusing stable, proven components that have been tested for many years.

- Implementing a workflow that covers everything from data updates to the dissemination of the map.

PCI-NG : the choice of OpenStreetMap components

1 **OSM model based on nodes, ways and relations** : naturally suited to handling topology, allows data to be imported included data containing defects, and enable defects to be corrected later.

2 **OSM versioning :** the version numbers of OSM elements make it possible to detect conflicts (what should be kept vs. what should be modified).

3 **OSM data modelling** (node–way–relation): highly suited to modelling relationships, grouping geographic objects to form new ones, and modelling relationships between geographic objects.

4 **Changes occurring over long periods of time :**
  - OSM editing workflow : it is carried out through the preparation of changesets. This fits the use case, but requires adaptation to store these changesets over the long term.

PCI-NG : the choice of OpenStreetMap components

1 **Reused OSM components :**

- **OSM Data model** (Node, ways, relations) with a new implementation that divides the data volume by four (Postgresql JSONB array)
- **OSM API 0.6** with a new implementation offering collaborative editing capabilities
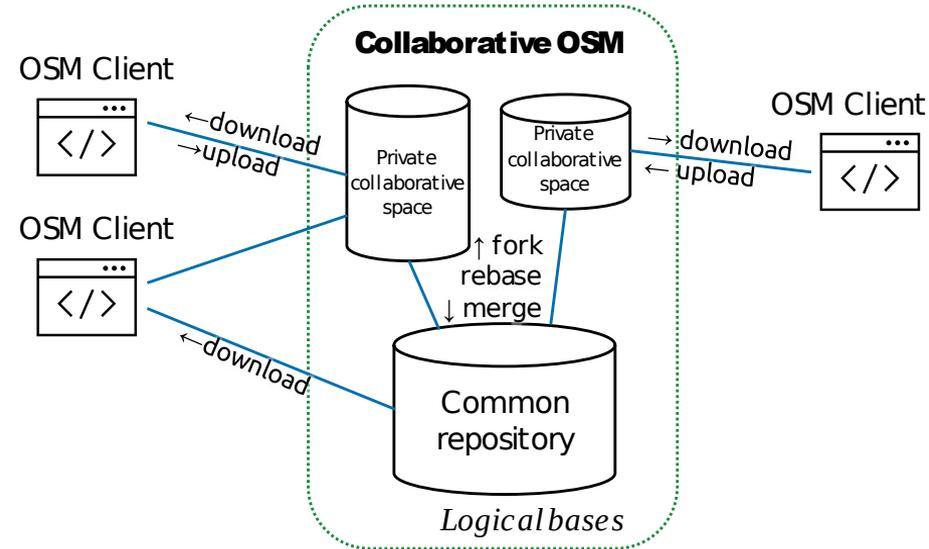- **OSM Tools** : Overpass, Osmium and osm2pgsql

2 **Current OSM workflow and limitations :**

- OSM operates in a wiki-style mode : changes are shared with everyone as early as possible.
- No mechanism to easily share modifications that are still being prepared
- Changes must be shared with everyone on the OSM repository
- This is unsuitable for the Cadastral Service and generally for public administration

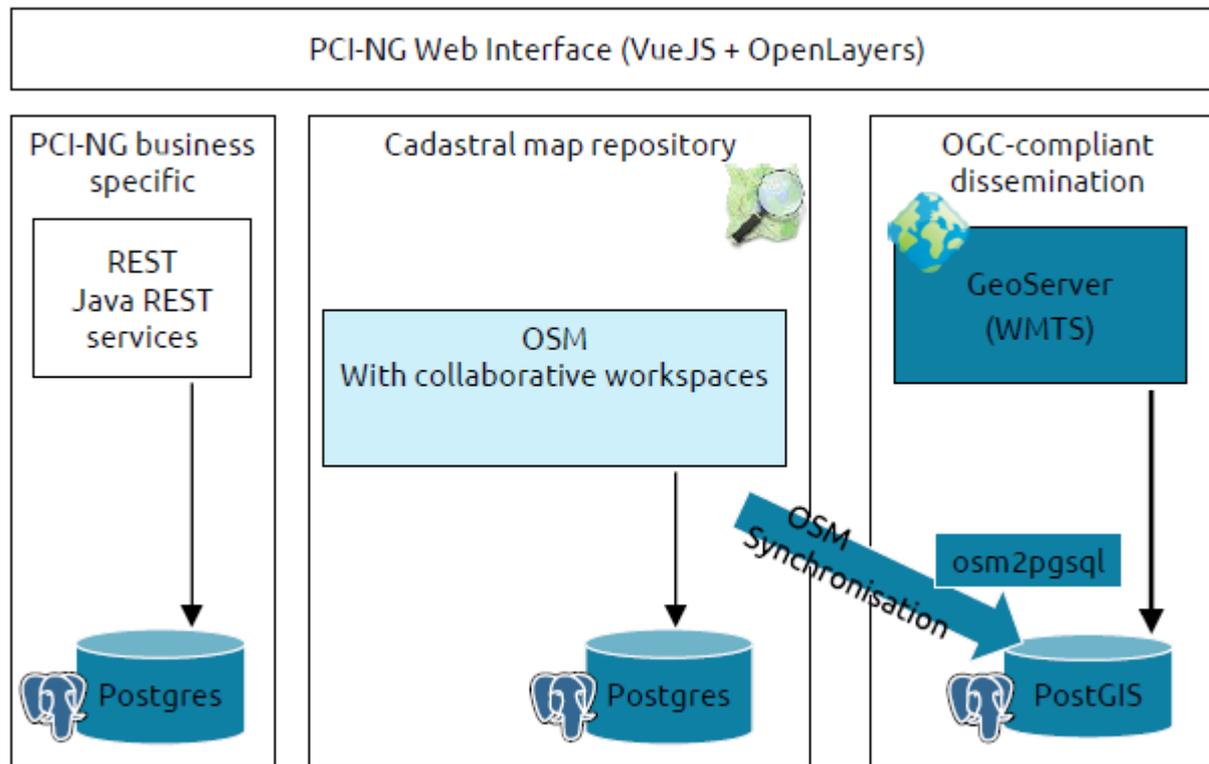# PCI-NG : OSM collaborative workspaces in OpenStreetMap

1 Like a Git approach, private collaborative workspaces offers :

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- Publishing modifications to a restricted group for internal validation.

- **Improved conflict detection :**
  - according to OSM rules (OSM element version numbers)
  - according to entity consistency rules

The development of these new features is in progress, and they will be released as open-source contributions to the OSM community in 2026.

Collaborative OSM

OSM Client — ←download →upload — Private collaborative space — Private collaborative space — →download ←upload — OSM Client

OSM Client — ←download — ↑ fork rebase ↓ merge — Common repository

Logical bases

PCI-NG : the overall application architecture

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PCI-NG : The 3-step migration strategy

PCI-NG : 1st step, build a new cadastral map repository

Target calendar : end of 2026

1 The legacy PCI application remains the management tool used by cadastral surveyors.

2 The new PCI-NG cadastral map repository is built and is read-only.

3 PCI exports its data in ASCODE format to PCI-NG. PCI-NG transforms these ASCODE exports in Geoparquet format to optimize its integration.

4 PCI-NG integrates this data into the OSM-based repository, which remains read-only at this stage.

=> OSM repository data can be viewed using OSM tools such as iD or JOSM.

PCI-NG : 2nd step, build a new cadastral map repository

Target calendar : end of 2027

1 Implementation of collaborative editing in the OSM repository.

2 Deploying data export modules to supply the existing SCPC cadastral map dissemination system, using specific formats such as GML, EDIGÉO and DXF.

3 Implementation of a simplified cadastral map viewer based on OGC services (PostGIS & Geoserver), only to internal staff.

4 Provide an interface offering advanced editing and drawing tools for updating the cadastral map.

End of 2027 : the legacy PCI application can be shut down, with PCI-NG taking over as the new cadastral map repository.

PCI-NG : 3rd step, build a new service for consulting and disseminating the cadastral map

Target calendar : 2029 / In accordance with the INSPIRE Directive and the needs of the French cadastre

1 Deploy cadastral map consultation functionalities via the Cadastre.gouv.fr portal.

2 Provide the functionalities required to generate a cadastral map extract (PDF document).

3 Make the full set of dissemination OGC services available : WMS, WFS and WMTS.

4 The cadastral map consultation service will be made available to partners (other public authorities, notaries, etc.) and to the general public.

5 Introduce new export formats (beyond EDIGÉO) and feed the Data.gouv.fr Open Data platform
=> End of 2029 : SCPC legacy application can then be shut down.

Thank you very much