Harmonisation and edge-matching in the OME2 project

Noémie Grémeaux (IGN France)

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The OME2 project

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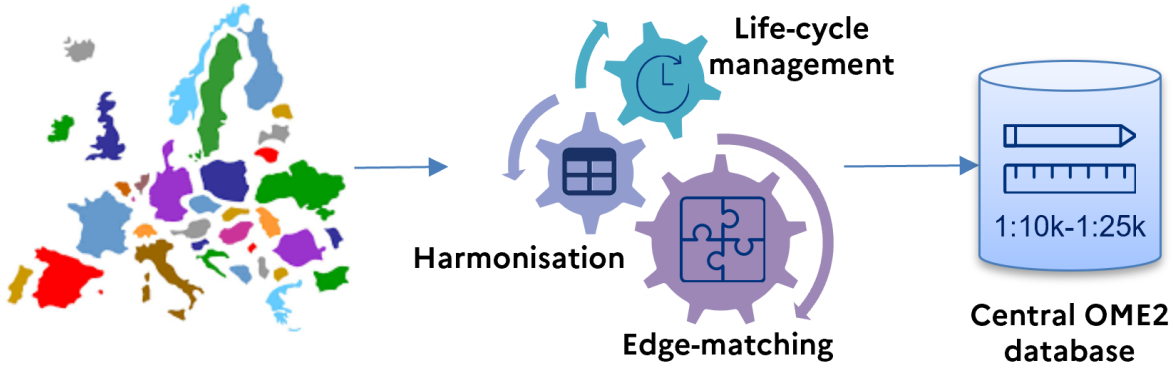
Open Maps for Europe 2 (OME2)

- Consortium led by EuroGeographics

- Co-funded by the European Commission

- To create a **production process** for:
  - An open “High-value large-scale prototype” (HVLSP)
  - Containing key themes: AU, TN, HY
  - With **harmonised** and **topologically edge-matched** data
  - Including life-cycle management



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The OME2 approach

- **Centralised process**: implementation, maintenance & production are handled by the project
- **Minimal additional workload** for national producers
- **Re-use results** from previous projects
- A **technical** and **practical** approach to harmonisation:
  - Iterative approach taking into account feedback from users
  - Technical (not political) solutions
  - Highly automated

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Harmonisation tool

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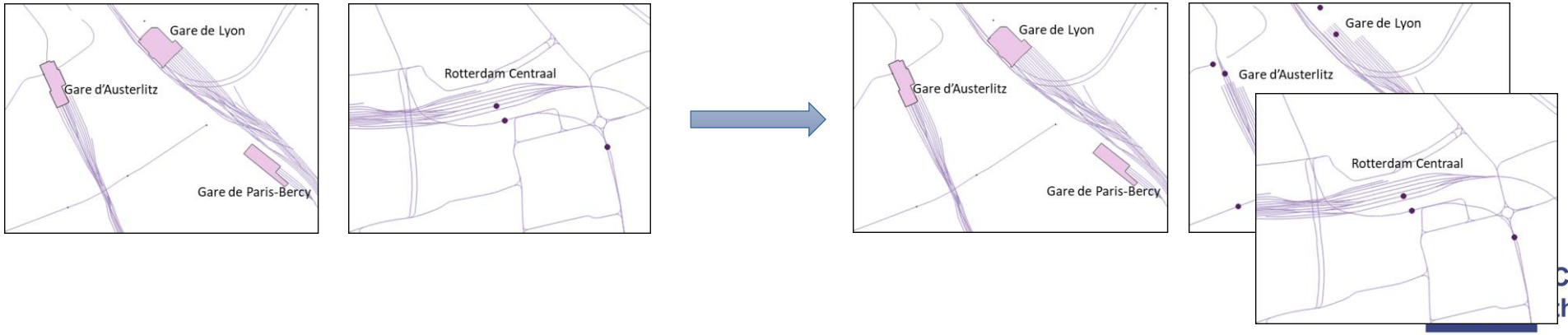
Harmonisation tool

Purpose: transform national/INSPIRE data into the OME2 data model

- Common table names, field names, attribute values
- Common geometry type (single vs multiple geometry, 3D)
- Common projection
- Common core representation



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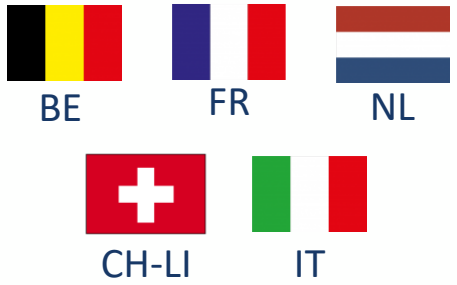
Configuration files

Transformation from national data models:

- Based on mapping tables provided by the national producers
- One configuration file per country and per theme
- Describe the transformations to be applied



Transformation from INSPIRE data model:

- One configuration file per theme (common to all countries)

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Configuration files

aerodrome_point	aerodrome
geom	centroid(geometrie)
<PointZ>	
country	gcms_territoire
<ISO code>	Correspondance entre gcms_territoire e
designator_iata	code_iata
<actual value>	
location_indicator_icao	code_icao
<actual value>	
un_locode	
<actual value>	
geographical_name	toponyme
spelling	toponyme
language	'fre'
script	'latn'
status	
historical	
official	official for all objects
other	
standardised	
nativeness	
endonym	endonym for all objects
exonym	
aerodrome_category	categorie
domestic_national	Nationale
domestic_regional	
international	Internationale
aerodrome_type	nature
aerodrome_heliport	
aerodrome_only	Aérodrome
heliport_only	Héliport
landing_site	Altiport, Hydrobase
restriction	usage
reserved_for_military	Militaire
temporal_restrictions	

```
"aerodrome_point":{                                   Target table
    "mock": true,
    "source_tables":{
        "aerodrome":{                                 Source table
            "mock": false,
            "where": "nature != 'Hydrobase' AND NOT gcms_detruit",   Selection query
            "mapping": {
                "country": { "function": "fr_country_code" },
                "designator_iata": { "eval": "data['code_iata'] if data['code_iata'] is not None else 'void_unk'" },
                "location_indicator_icao": { "eval": "data['code_icao'] if data['code_icao'] is not None else 'void_unk'" },
                "name":  { "function": "fr_xx_name" },
                "aerodrome_category": { "function": "fr_tn_aerodrome_category"},
                "aerodrome_type": { "function": "fr_tn_aerodrome_type"},
                "use_restriction": { "function": "fr_tn_aerodrome_restriction"},
                "w_national_identifier": "cleabs",
                "xy_source": { "eval": "'ome2'"},
                "z_source": { "eval": "'void_unk'"},
                "w_release": { "eval": "1"},
                "w_scale": { "eval": "'10000'"}
            },
            "geomapping":{
                "geom": {
                    "geometrie": {
                        "transform": "ST_Force3D(ST_PointOnSurface(${}), -1000)"
                    }
                }
            },
```

Mapping with a simple expression

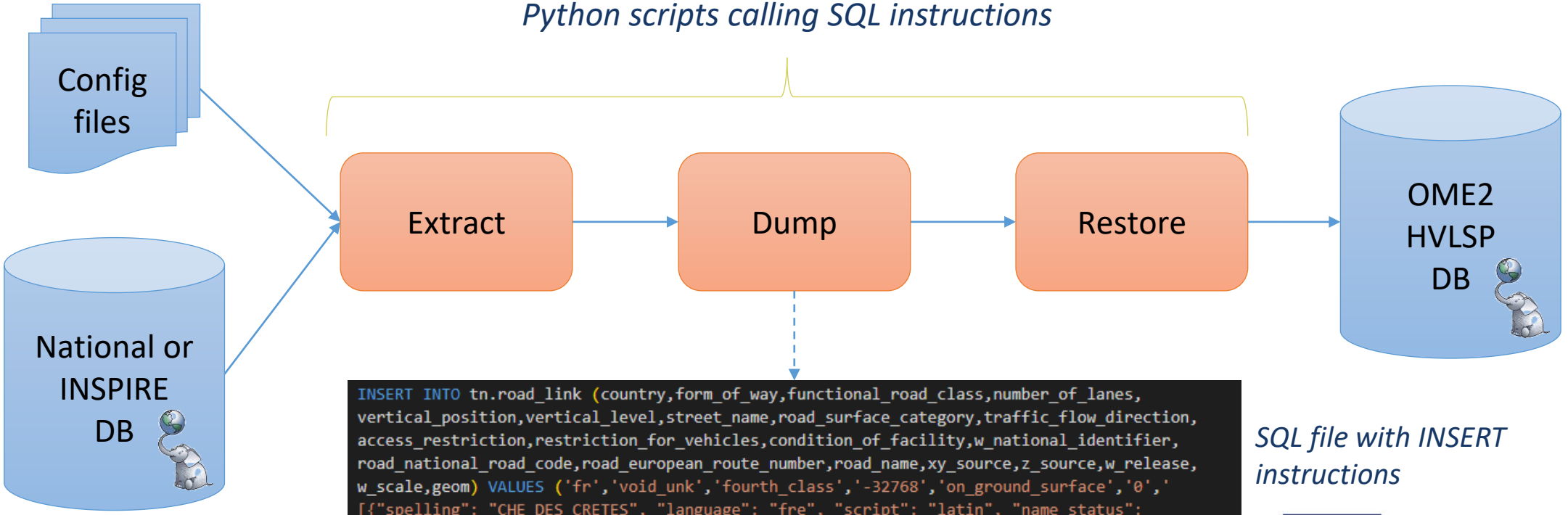
Function

Simple 1-1 mapping

Geometrical transformation

```
# def function_name(context):

    category = context['data']['categorie']

    if category == "Nationale":
        return "domestic_national"

    if category == "Internationale":
        return "international"

    return "void_unk"        You, 6 months ago
```

Harmonisation tool (data_model_transformer)




```
INSERT INTO tn.road_link (country,form_of_way,functional_road_class,number_of_lanes,
vertical_position,vertical_level,street_name,road_surface_category,traffic_flow_direction,
access_restriction,restriction_for_vehicles,condition_of_facility,w_national_identifier,
road_national_road_code,road_european_route_number,road_name,xy_source,z_source,w_release,
w_scale,geom) VALUES ('fr','void_unk','fourth_class','-32768','on_ground_surface','0','
[{"spelling": "CHE DES CRETES", "language": "fre", "script": "latin", "name_status":
"official", "nativeness": "endonym", "spelling_latn": "CHE DES CRETES", "display": 1}]',
'void_unk','both_directions','public_access','{}'::json,'functional',
'TRONROUT0000002327067770','void_unk','void_unk','{}'::json,'nmca','nmca',1,'10000',
'01020000a0db0b0000020000026dd85a7c2384d415a8b261d9b754741cdcccccccc4c4140fb8f30b8d1384d419d4
94231a0754741333333333734140');
```

SQL file with INSERT instructions

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Edge-matching tools

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OME2 edge-matching tools characteristics

- Several tools:
  - au_matching
  - au_merging
  - tn_matching…
- Implemented in C++ using IGNF's internal libraries and external libraries (e.g. CGAL) → part of the ERM/EGM generalization process is re-used.
- Based on graph theory

Ex 1: Administrative units

Ex 2: Road network

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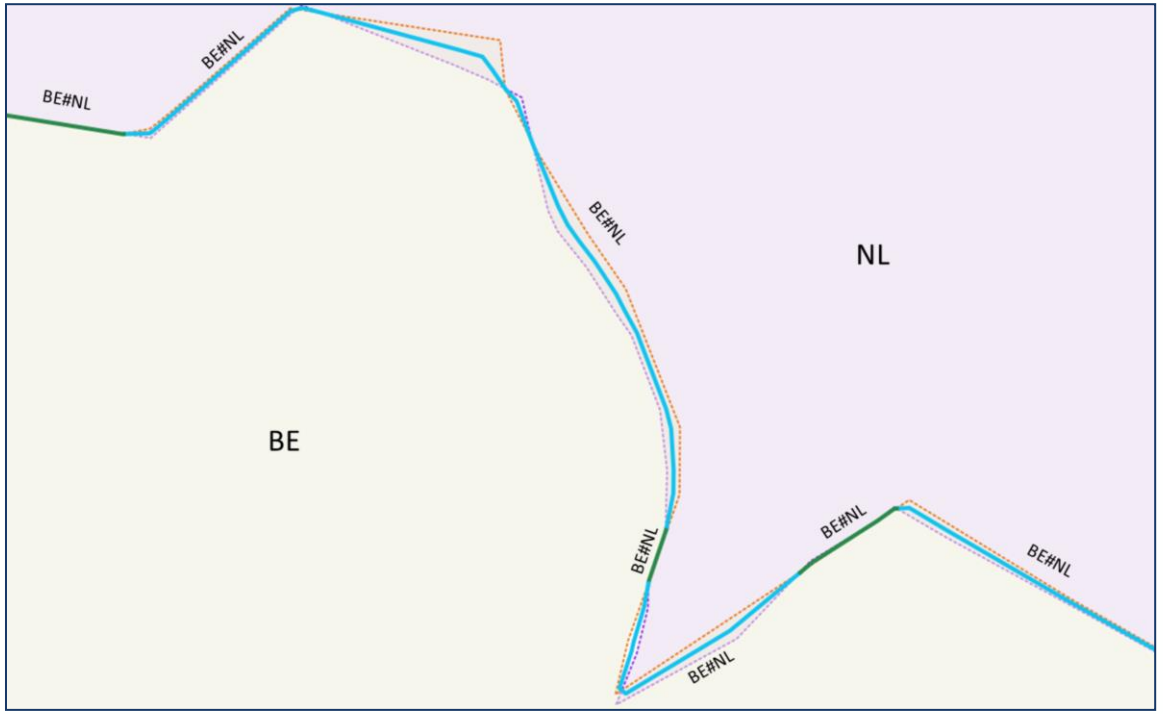
Context for AU: international boundaries in the OME2 dataset

3 cases:

- Full agreement → the official line is used in OME2
- Disagreement → the two lines are kept
- Theoretical agreement → a **common technical line** is calculated via a FME process

  ⇨ National AU are no longer aligned with the OME2 international boundaries



Technical line in blue

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Administrative units

Input:

- International boundaries defined by OME2
- National administrative units at all levels (e.g. 6 levels for France)

→ National AU are not aligned with the OME2 boundaries

Expected output:

National AU aligned with the OME2 boundaries at all levels

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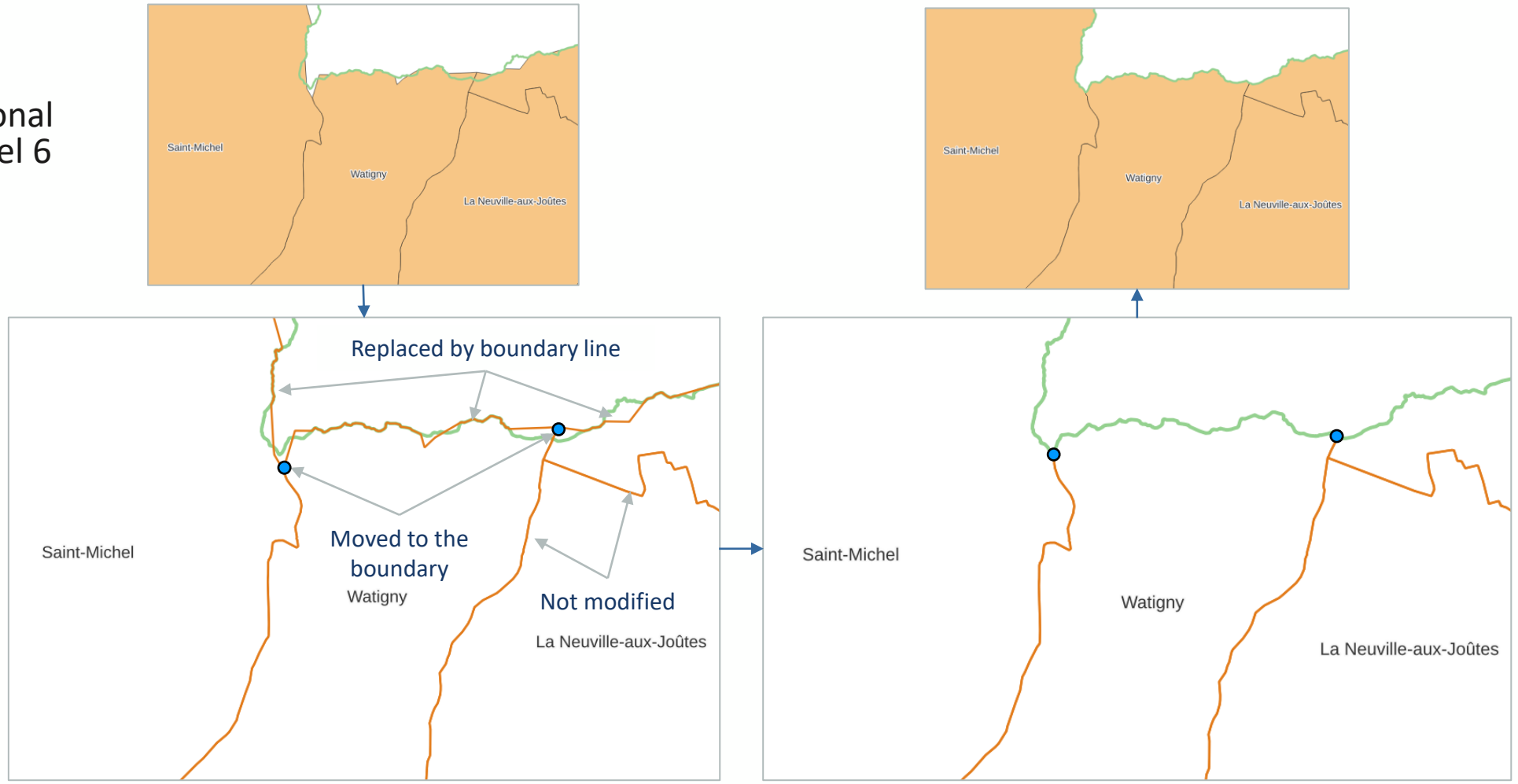
Administrative units – Tool #1 (au_matching)

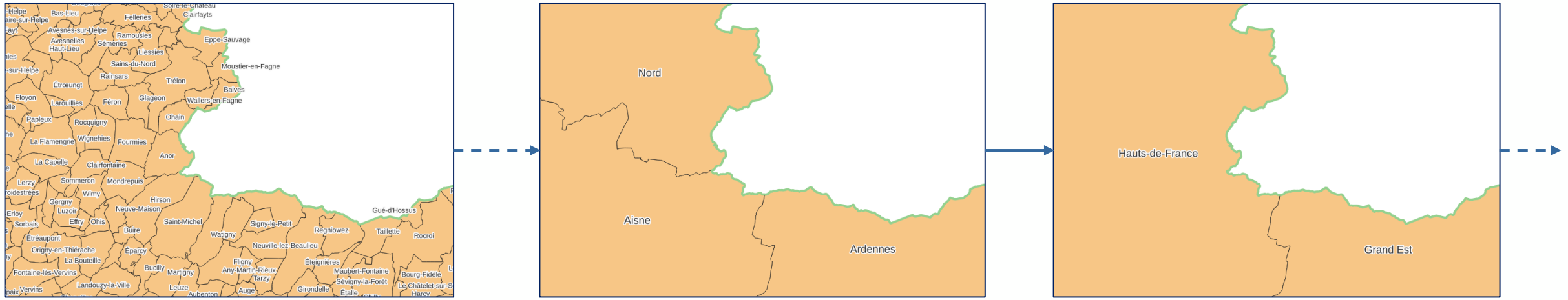
AU are geometrically edge-matched at the lowest national level (e.g. level 3 for NL, level 6 for FR).

1. Select AU polygons along international boundaries
2. Transform AU into lines and make them consistent with IB
3. Recreate AU polygons



Administrative units – Tool #1 (au_matching)

Recreate upper level geometries based on the edge-matched lowest level:



Level 6 … *Level 3* *Level 2* …

→ Consistency of all levels with international boundaries without relaunching the edge-matching process itself

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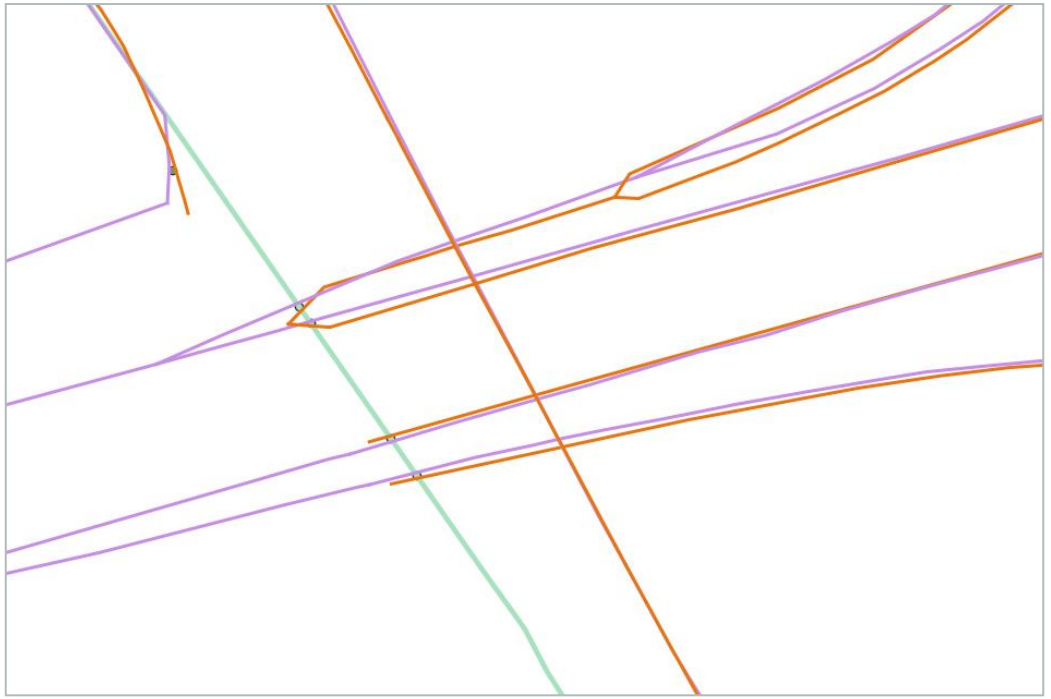
Edge-matching for the road network

Initial situation:

- International boundaries defined by OME2
- National road networks overlapping in neighbouring countries
- No real-world consistency between the road network and the international boundaries

Expected output:

A « clean » network with correct topology



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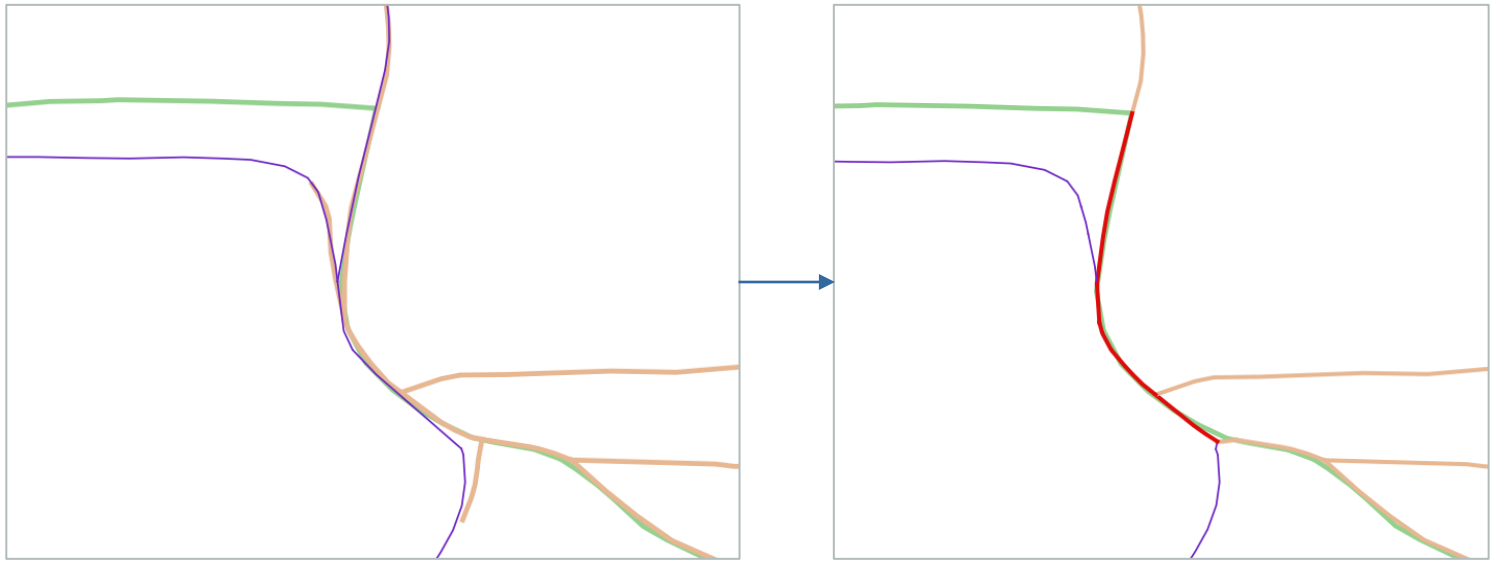
Edge-matching for the road network

Step 1: identify and merge objects provided by 2 countries and “aligned” with the boundary (~ERM connecting lines concept)



objectid	fa8cca3a-1594-40cd-b8f2-30273b2274cd
country	be#fr
begin_lifespan_version	01/12/2023 10:07:21 (Paris, Madrid)
end_lifespan_version	NULL
form_of_way	single_carriage_way#tractor_road
functional_road_class	fourth_class
number_of_lanes	1
vertical_position	on_ground_surface
vertical_level	0

road_link_be_fr
- be
- be#fr
- fr

international_boudary_line

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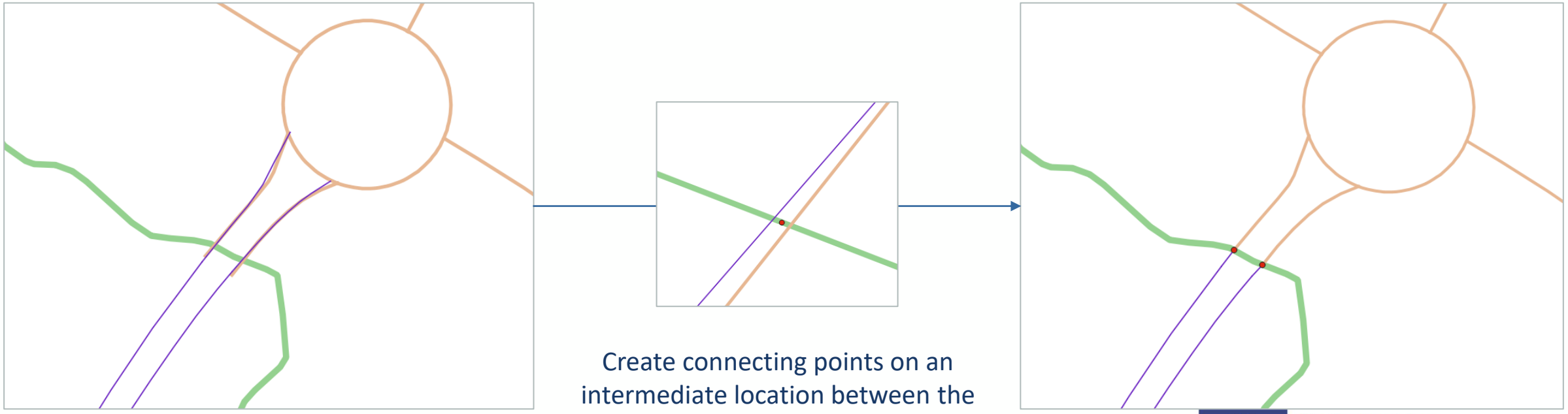
Edge-matching for the road network

Step 2: connect objects on the boundary (~ERM connecting points concept)



Create connecting points on an intermediate location between the two original objects

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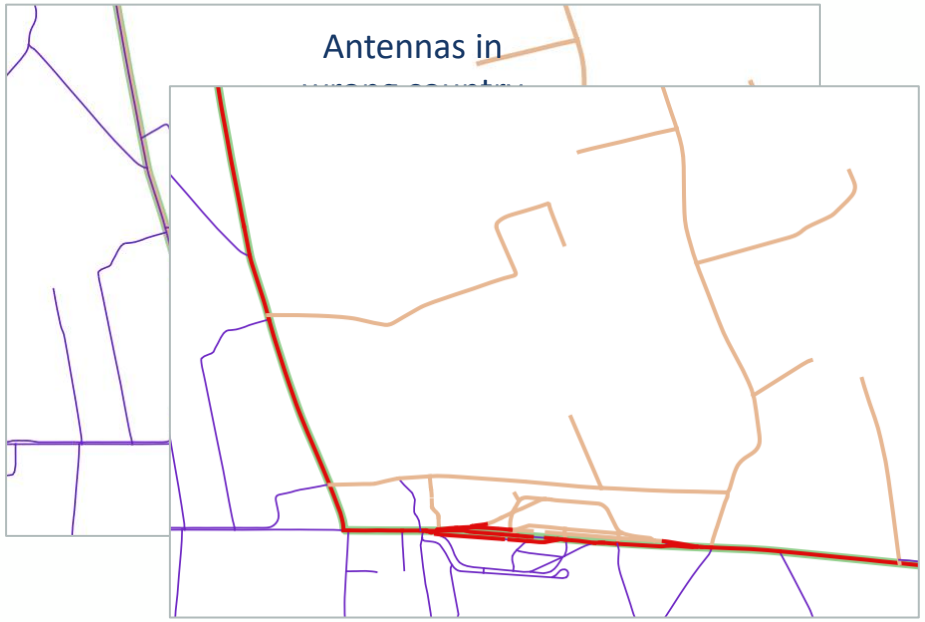
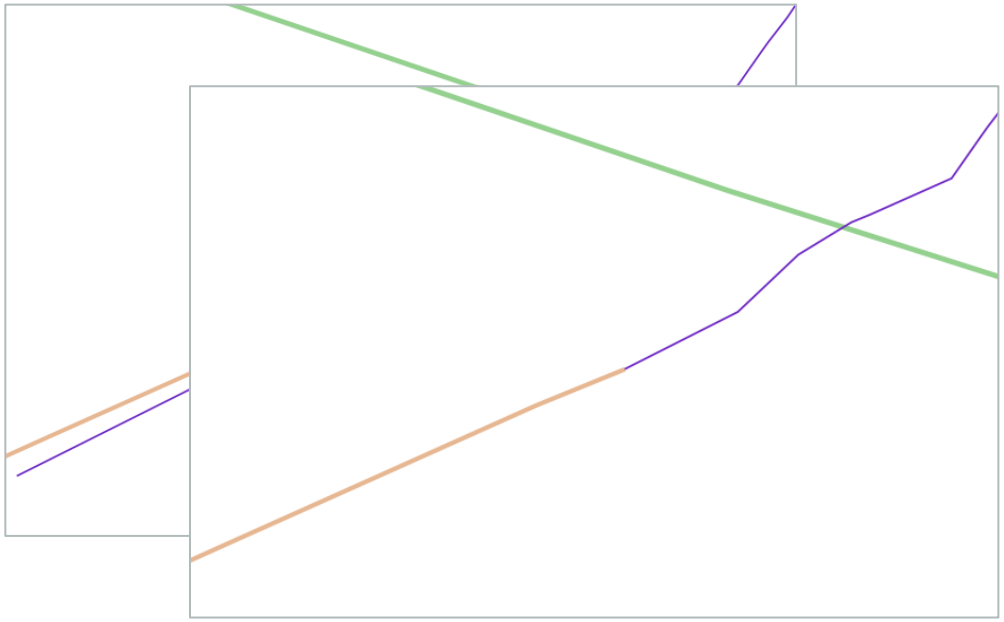
Edge-matching for the road network

Step 3: clean the resulting network



Ex 1: Remove antennas in wrong country



Ex 2: Correct missing connections

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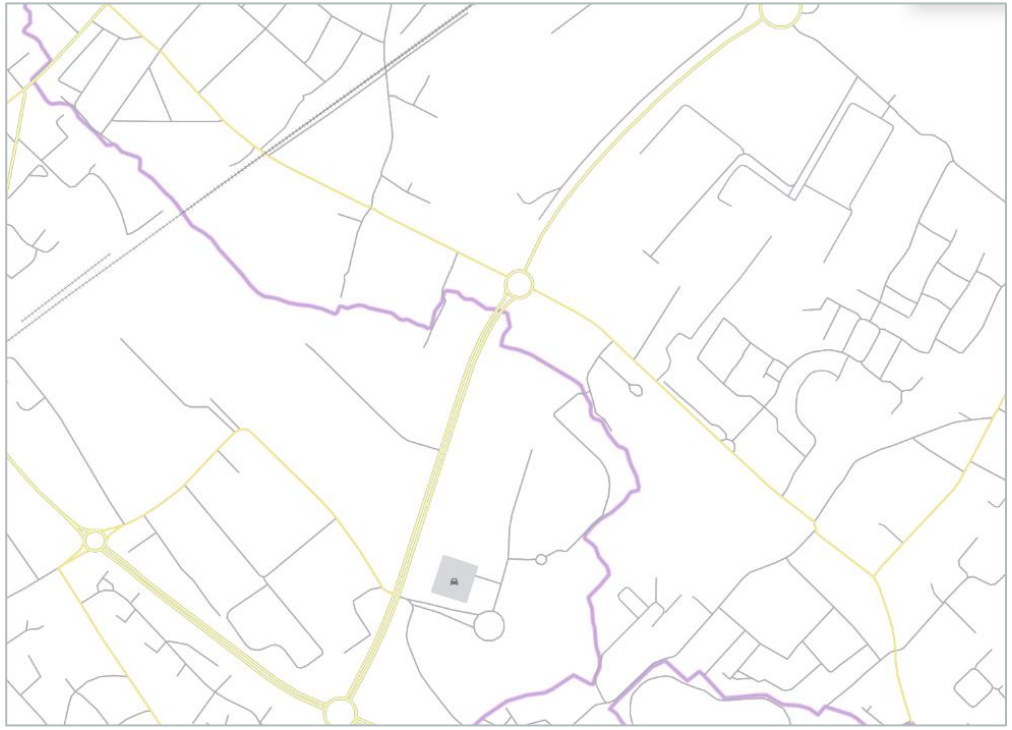
Current status

- Tools successfully used to produce the first version of the HVLSP
  - → Automatic edge-matching error rate (before manual corrections):
    - ✓ Roads: 3,52%
    - ✓ AU and railways: 0%
- To be progressively extended to new countries + Hydrography
- Source code available on github in June 2024.



https://www.mapsforeurope.org/explore-map/hvlsp

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Thank you for your attention!

Contact: ome2_project@ign.fr
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