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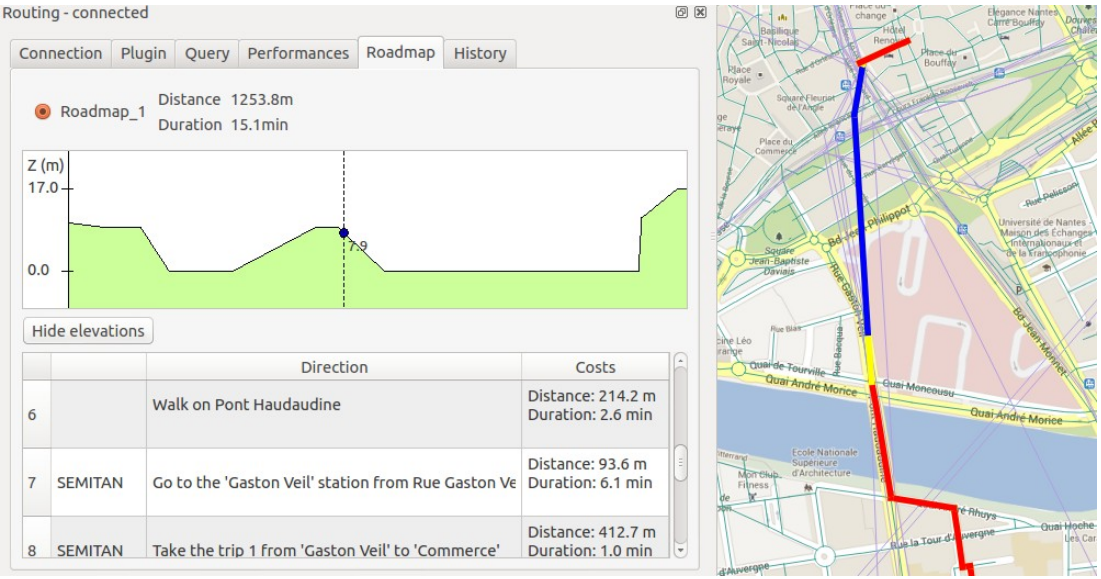
A new OpenSource platform for Multimodal routing



Vincent Picavet – Oslandia – www.oslandia.com

Multi / inter-modal

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Multimodal routing

An **Intermodal Journey Planner** is a computer system which can provide a traveller with an itinerary for an intermodal passenger transport journey.

The system can provide **timetable, routing** and other travel information.

A single journey may use a **sequence of several modes of transport**, meaning that the system must know about **public transport** services (bus, train, aeroplane, tram, metro) and about transportation networks (roads, footpaths, cycle routes) for **private transportation** (automobile, walking, bicycle).

« From A to B by all means ! »

Source : Wikipedia

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Multimodal graph

- *One* road graph
- *N* public transport graphs
- *M* POIs (parkings, shared bikes & cars...)
- Linked on road edges

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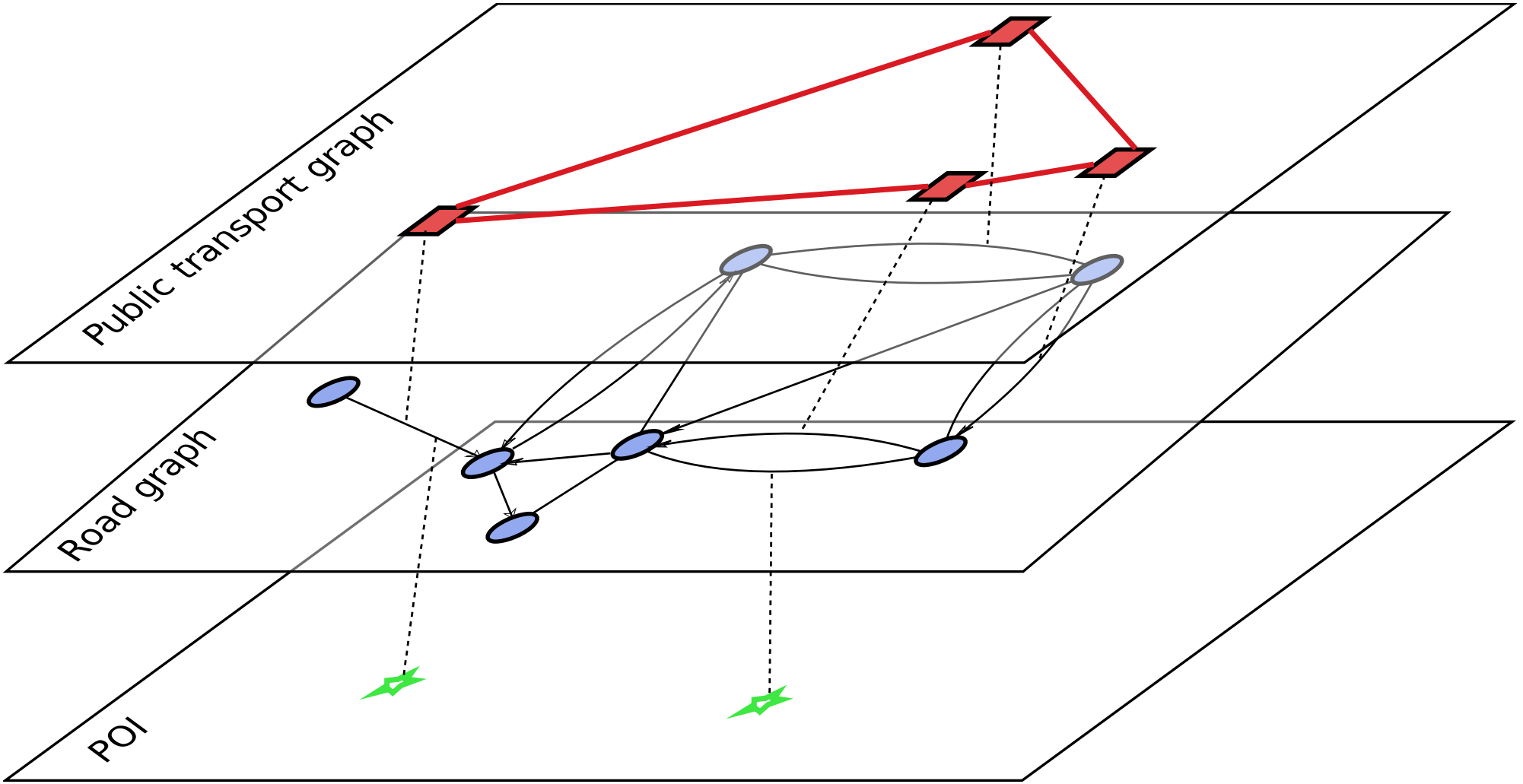
Multimodal graph



Multimodal adjacency

- Meta graph on top of other graphs (road, PT)
- Seen as Boost graph (duck typing)
  - Node : node of underlying graphs
  - Edge : needs special adjacency rules

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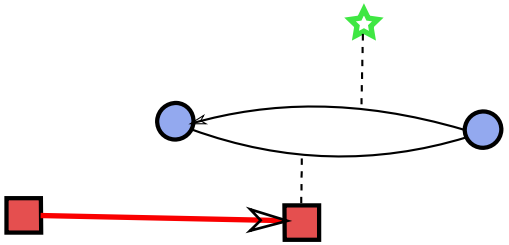
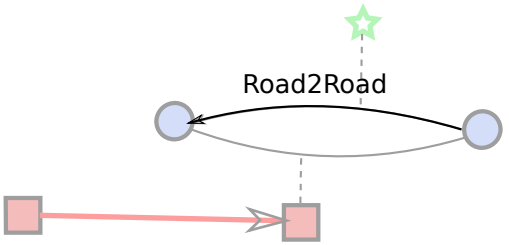
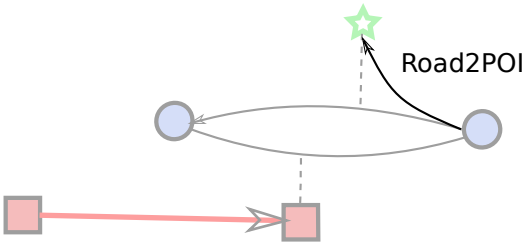
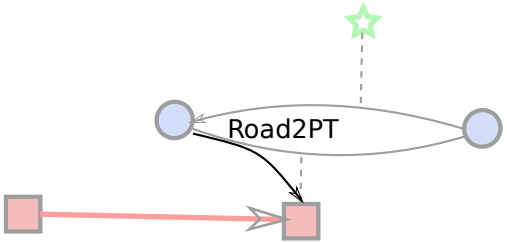
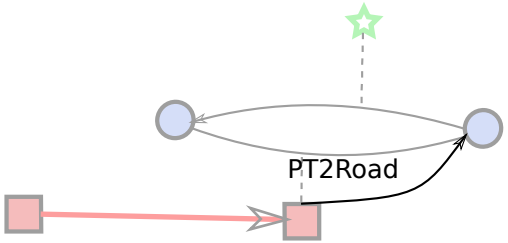
Multimodal adjacency

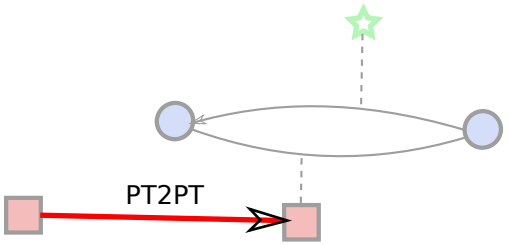












⇒ graph data model

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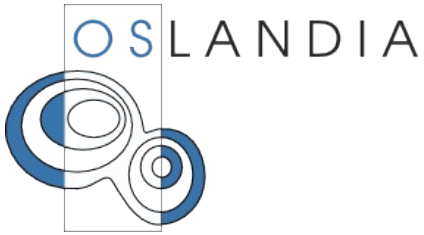
Why ?

- **Issues at IFSTTAR R&D lab**
  - **Industrialisation**
  - **R&D task follow-up**
  - **Collaboration between researchers**
  - **Common codebase**
  - **Knowledge dissemination**



- **Global refactoring**
  - **Architecture**
  - **Full rewrite ⇒ solid, industrial, durable**

- **Initially a standard contract**
  - **⇒ Now a partnership with FOSS**

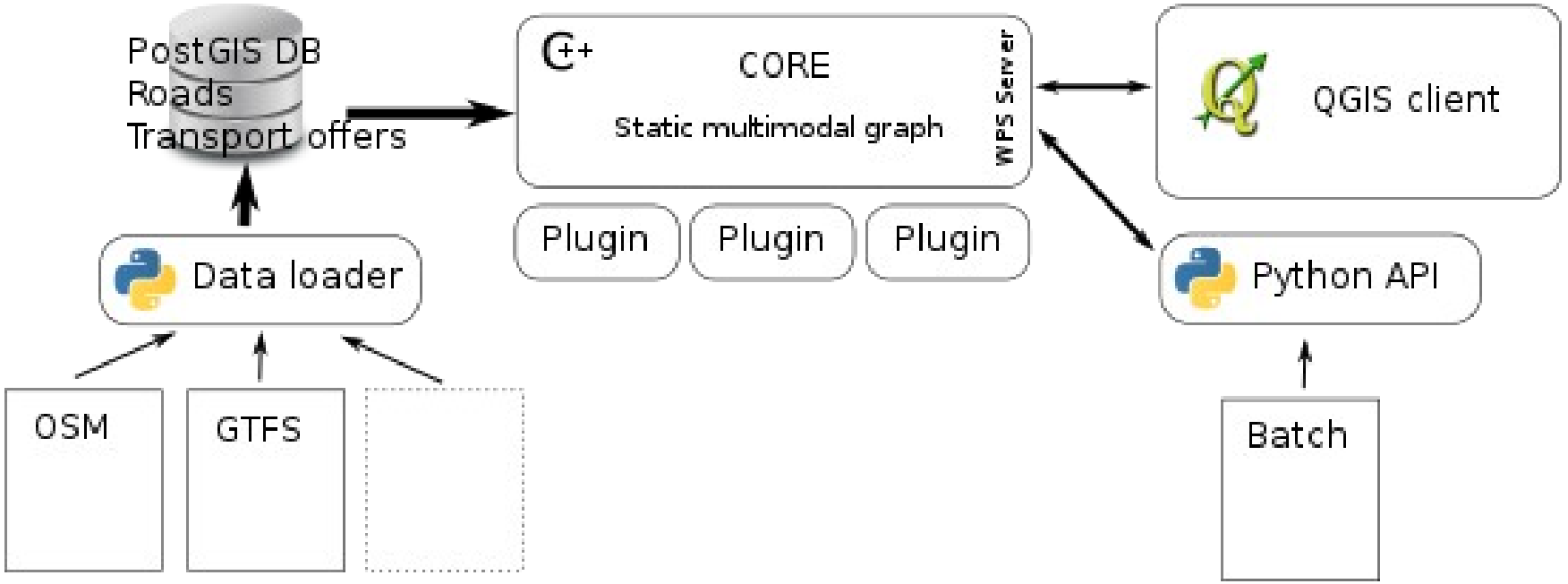
- A platform for multimodal route planning
- Collaboration with R&D lab IFSTTAR / CEREMA

- Objectives
  - Extensibility
  - Performances

- Use cases
  - New route planning algorithms
  - Tests and benchmarks
  - Production-scale multimodal route planner

- Young project
  - First OSS release : may 2014

Tempus Architecture



Tempus Core

- In-memory graph representation
- Templated modern C++
- Uses Boost::graph
- Graph serialized in PostGIS DB
- WPS server
- Multi-threaded

Tempus plugins

- Modular architecture with C++ plugins
- Each declared plugin
  - Can be requested by the user
  - Receives the global graph as input
  - Produces roadmaps as output
- Allows to easily experiment new features

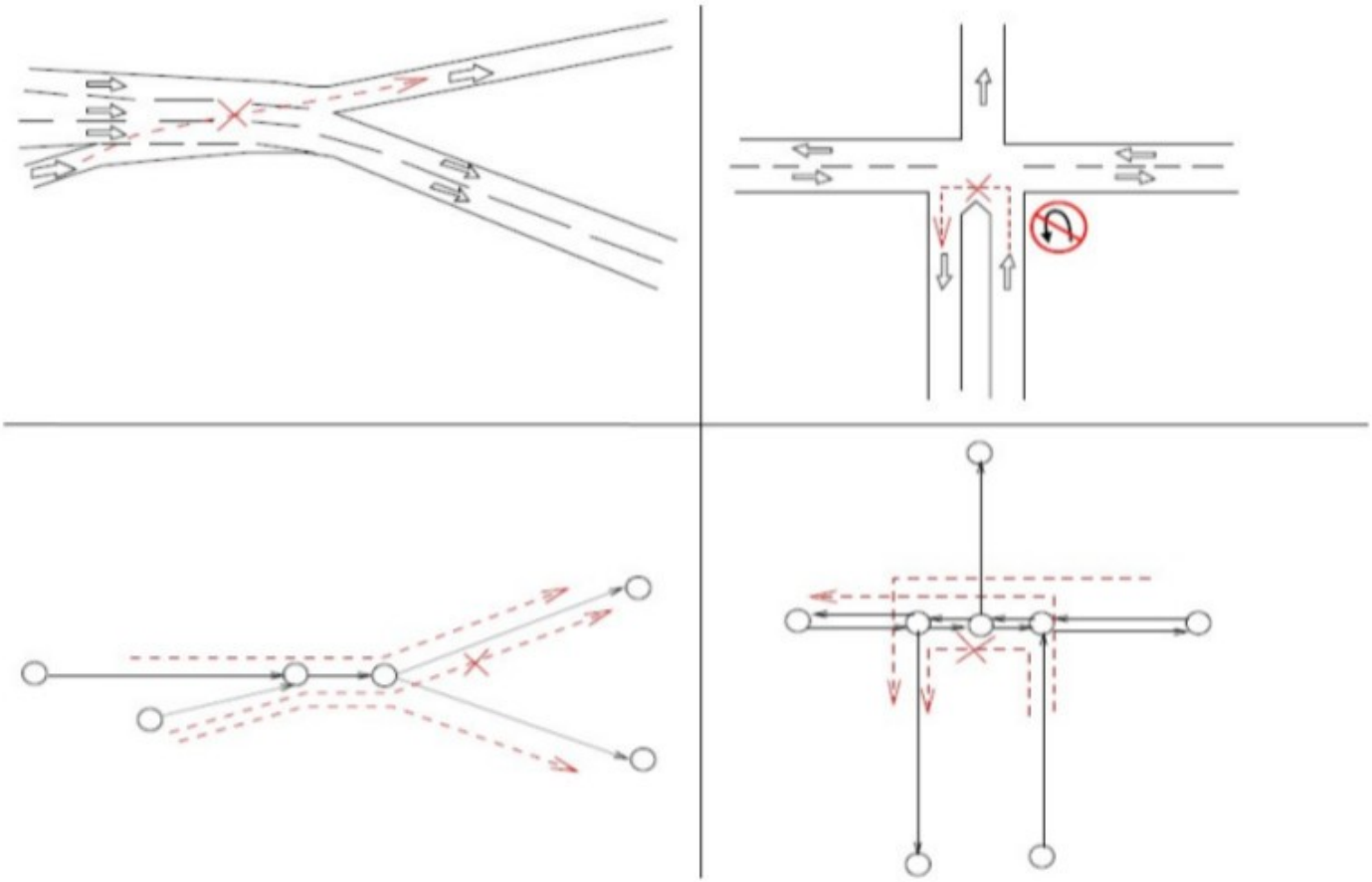
Tempus plugins

- **Current active plugin : A***
- **Focus on multimodal**
  - **Walking + PT + shared bike / cars**
  - **Parkings**
- **Turn restrictions**
- **Speed profiles**

+ basic sample demo plugin

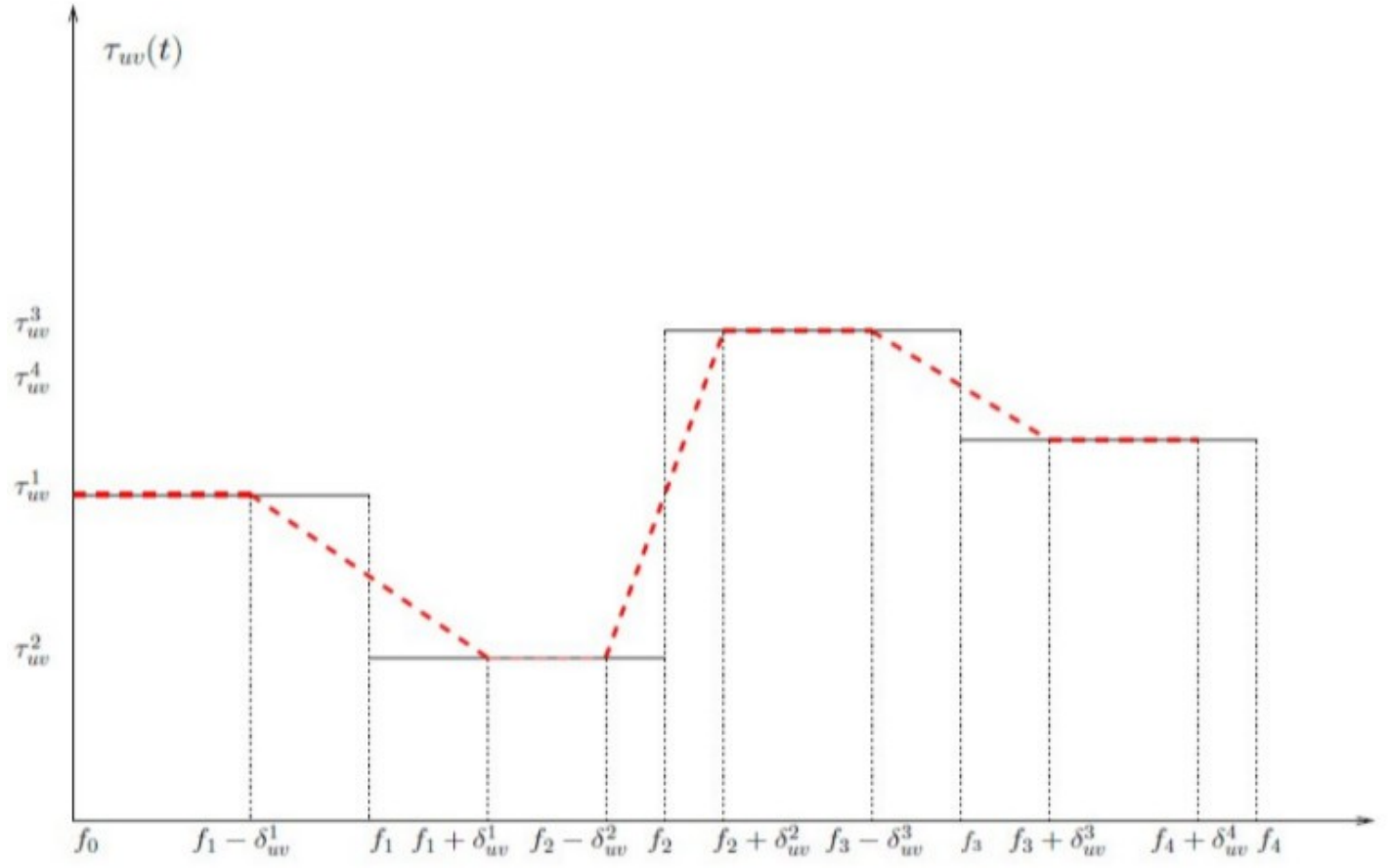
Turn restrictions

- Complex turn restrictions
- Graph + automaton



Speed profiles

- Average speed = f(day, time)
- For given transport mode and road edge



Data loader

- Import data to PostGIS DB
- Roads
  - OSM, Navteq, Multinet
  - Elevation (SRTM, BD Alti)
- Public Transportation
  - GTFS
- POIs
  - Shapefiles
- Coming soon
  - BDTopo, Route120, Route500 (IGN)
  - Chouette (PT)
  - ... your format ?

Tempus loader

OSM

```
./load_tempus -t osm -s myregion.shp -p nantes _ -d « dbname=tempus_test_db » -R
```

Imports turn restrictions

Handles topology processing

POIs

```
./load_tempus -t poi \ # type : POI
              -y 4   \ # POI type: shared bikes
              -v name:NOM_COMPLE \  # station names field
                 service_name:Bicloo \
                 filter:type=100301  \  # filter to apply
              -s /xxx/LOC_EQUIPUB_MOBILITE_NM.shp \
              -d "dbname=tempus_nantes" \
              -W LATIN1 \
              -S 2154
```

WPS

- WPS ~= XML RPC OGC standard
- Tempus uses FastCGI
- Multi-threaded : concurrent requests
- XML
  - Input : request
  - Output : roadmap

- Python client library (unit tests, batch)
- QGIS plugin

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Numbers

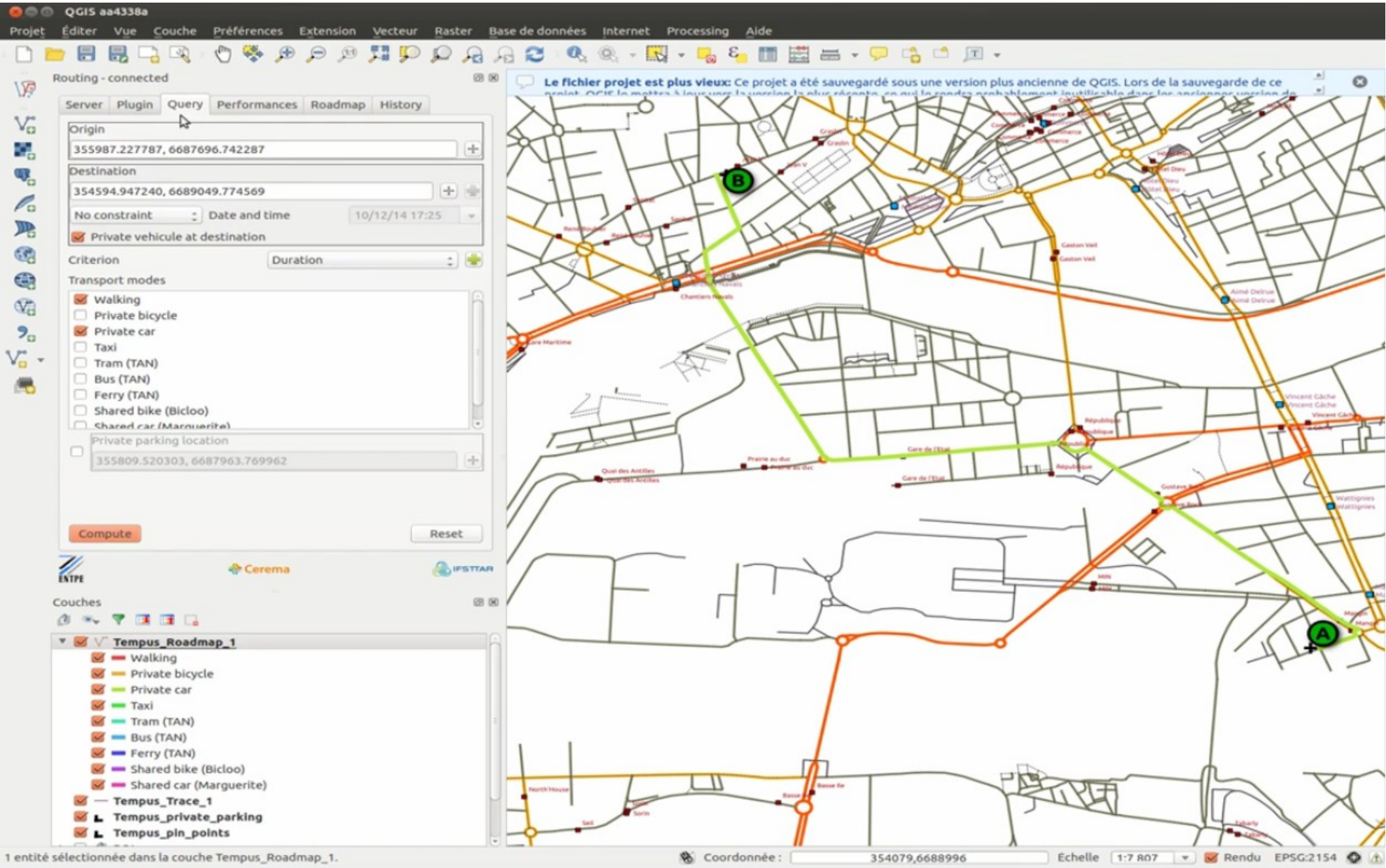
- France : 1GB graph
- Europe : 10GB graph

- Requests perf depend on mode

- Indicative times for mid-size town journey :
  - Pedestrian only : 10ms
  - Private car + parking : 280ms
  - Walking + PT : 225ms

USE IT !

https://vimeo.com/114875069



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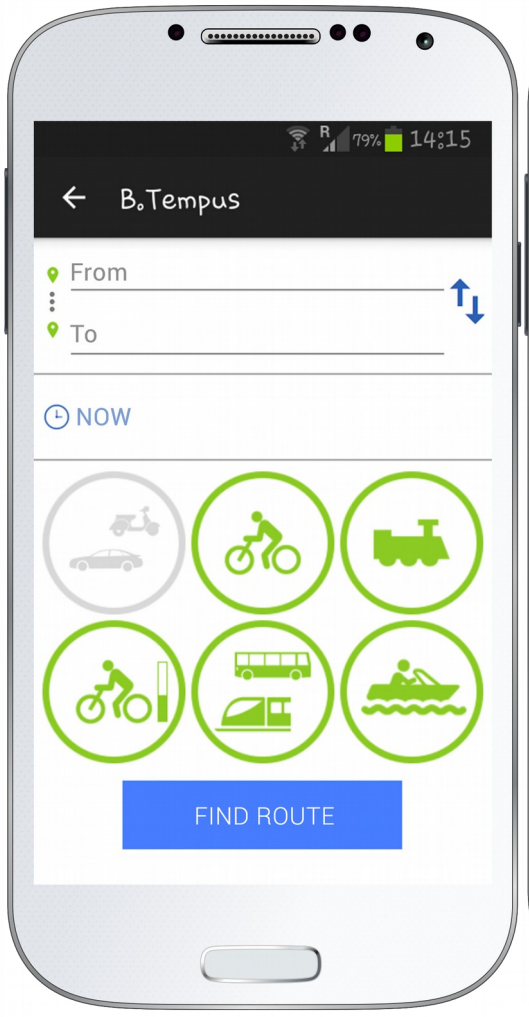
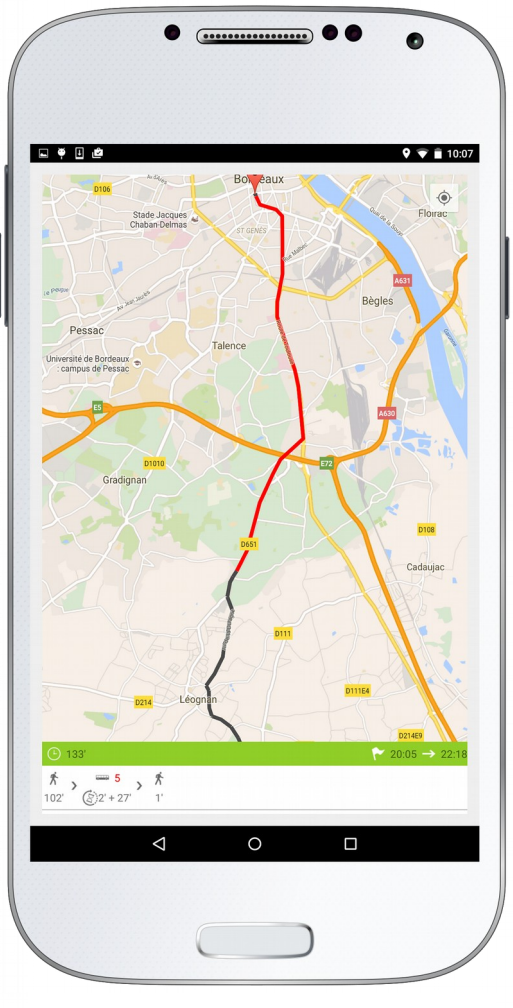
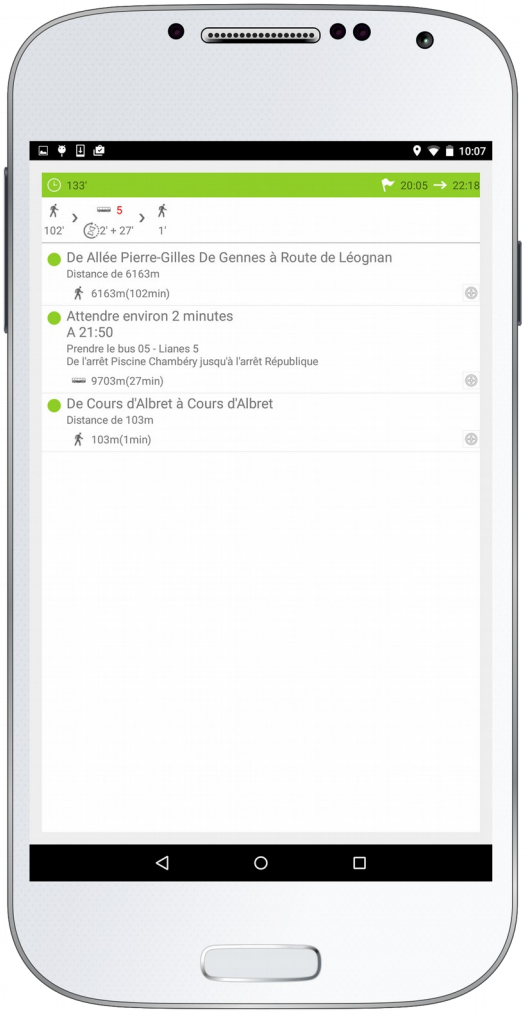
Tempus Users

Tram et Bus de la Cub







Tempus Users

- Among 25 largest FR websites
- LBS for B2B & B2C
- Multimodal prototype w/ TEMPUS
- Funders & contributors

Future

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Under development

- **New algorithms**
  - **Contraction Hierarchies**
  - **Time-dependant CH (previsionnal traffic)**
- **New modes**
  - **Electric cars (charge/discharge/stations)**
- **Optimization criteria**
  - **« simplest » path**
  - **Most conformtable**
- **Multi-objective optimization**

감사합니다
Merci
Thank you

Questions ?

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Tempus :

https://github.com/ifsttar/tempus

https://vimeo.com/114875069