Automated short-term train planning in OSRD: from POC to production

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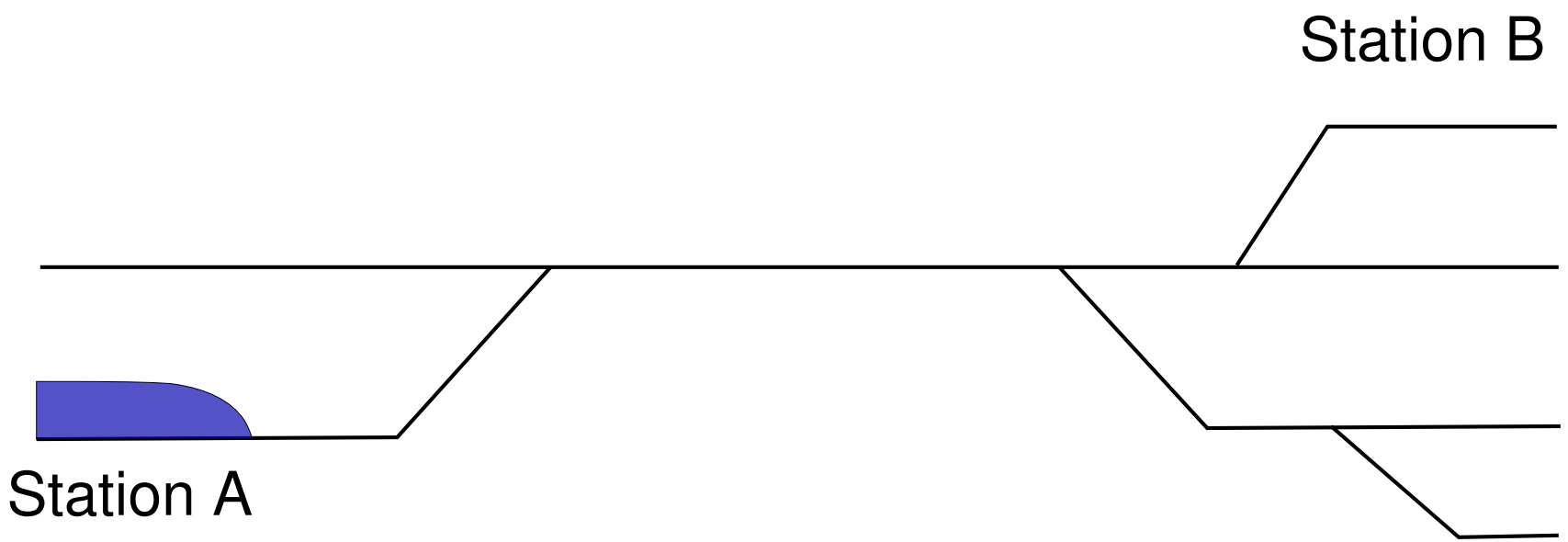
Railways and Open Transport

OSRD (Open-Source Railway Designer)

- OSRD is an open-source project that can be used to **edit railway infrastructures** and **run simulations**.
- We'll talk about one of its many features: **train planning**.

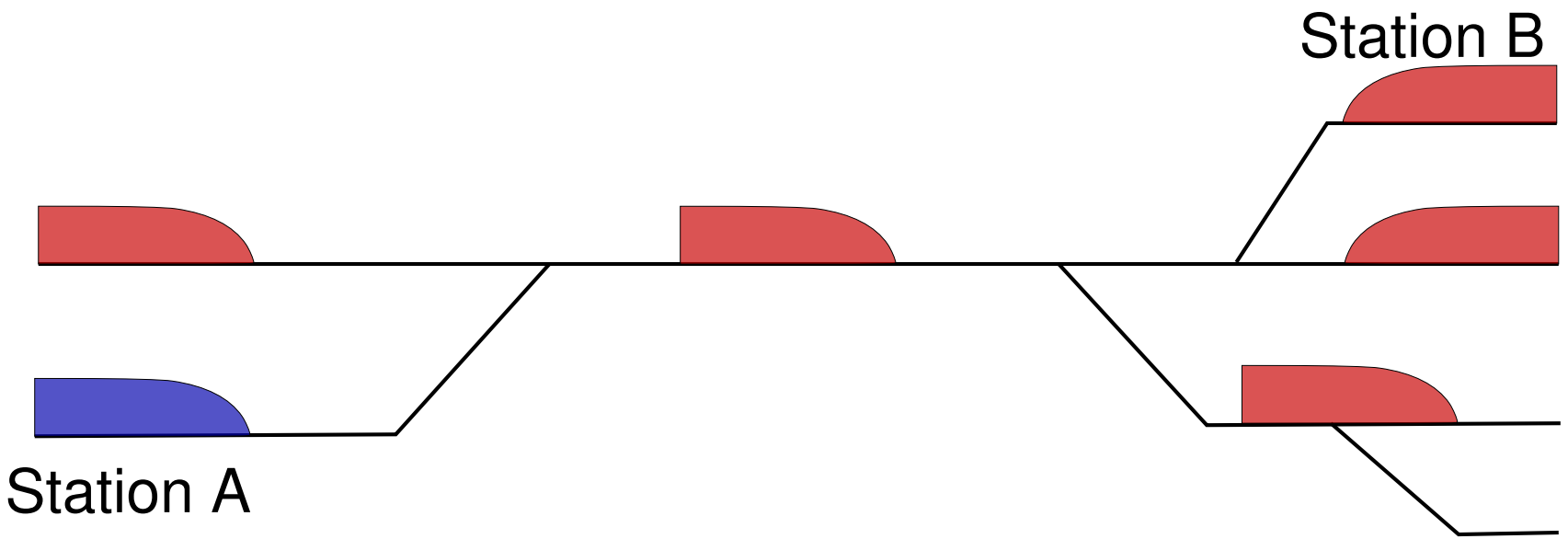
Problem presentation

A train wants to go from Station A to Station B, leaving tomorrow. We're the railway infrastructure manager and need to find a way.



Problem presentation

But many trains have already been scheduled!
(10k to 15k per day)



The rules

We cannot:

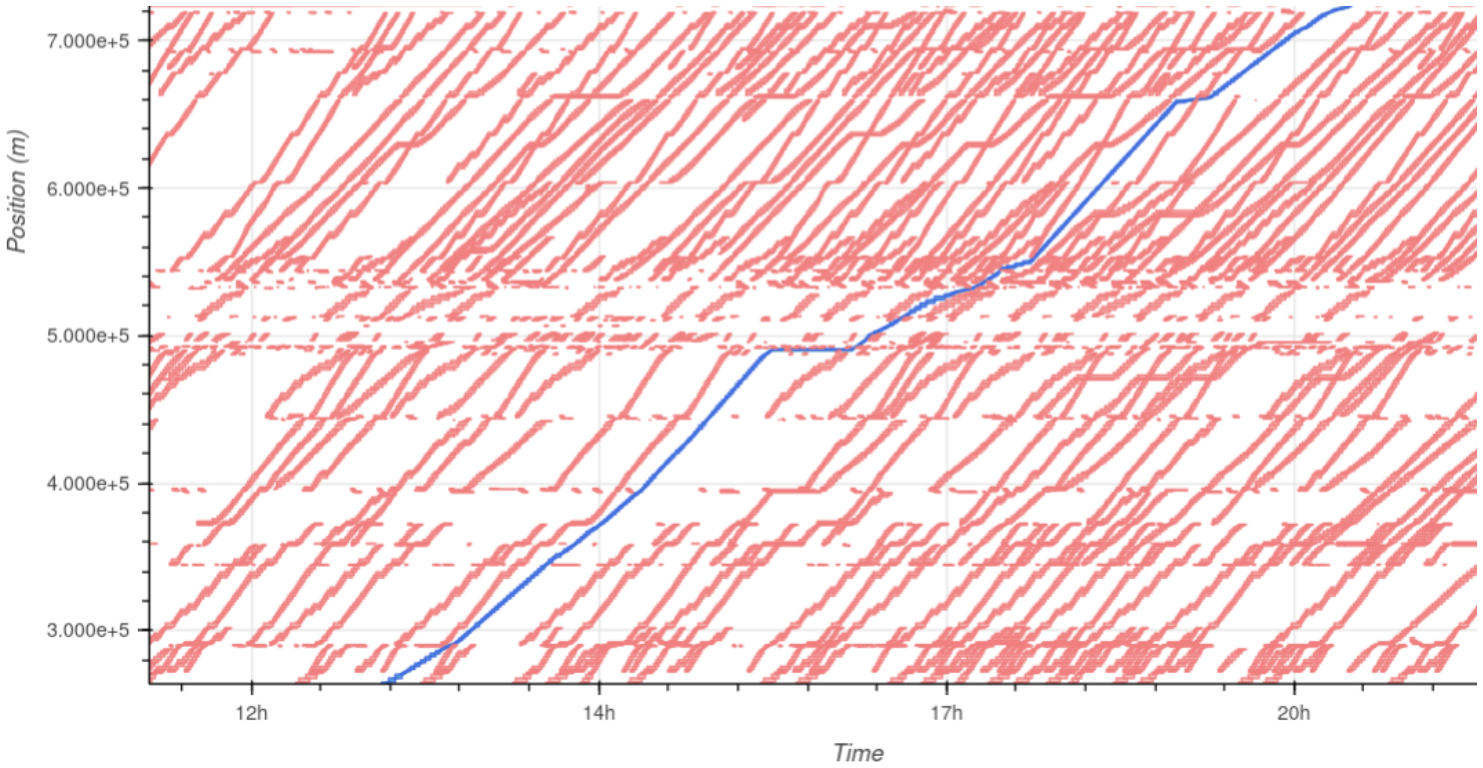
- Delay scheduled trains
- Provide an unrealistic path

We can:

- Add **detours**
- Slow down the new train
- Change the departure time
- Add or lengthen stops

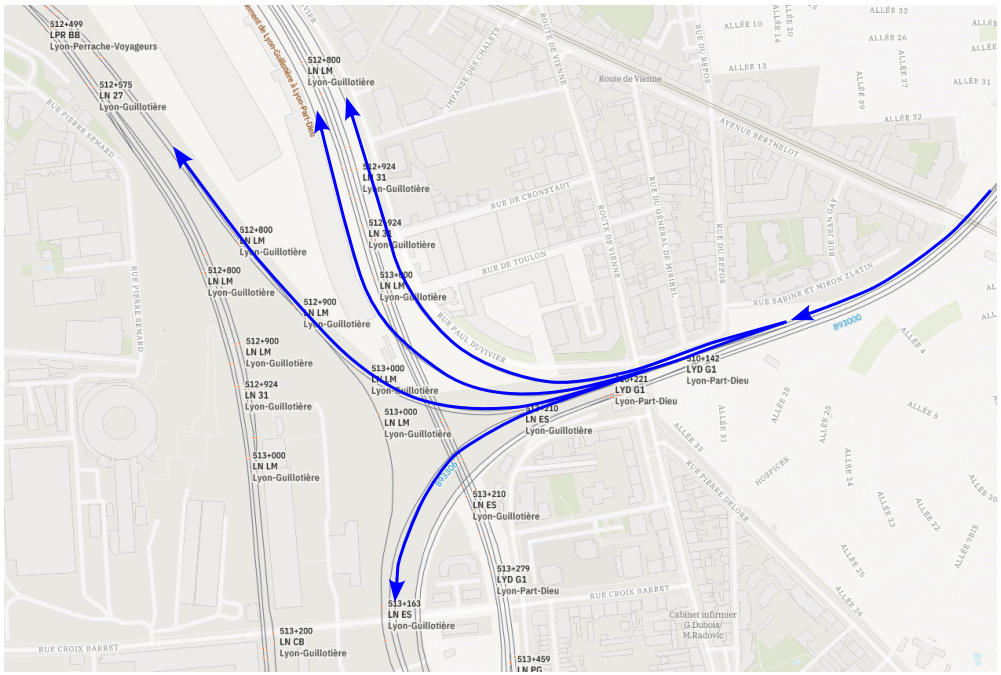
Search space

We now have a complex search problem in space and time. On one given path:



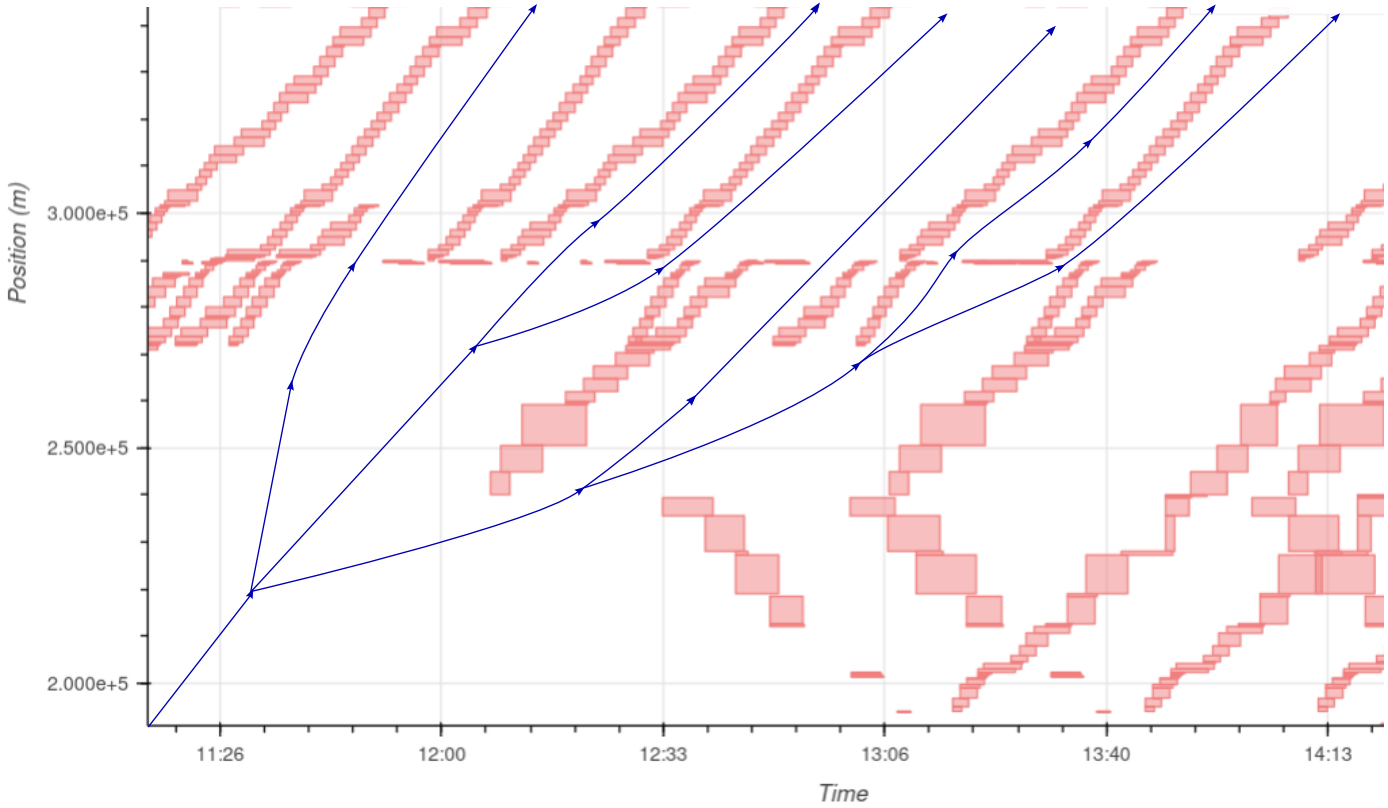
Our solution: general principles

We evaluate one big **decision tree**:
we enumerate all possible solutions and run a pathfinding algorithm on that tree (A*).
First on space:



Our solution: general principles

Then on top of each path, we evaluate another decision tree along the time axis:



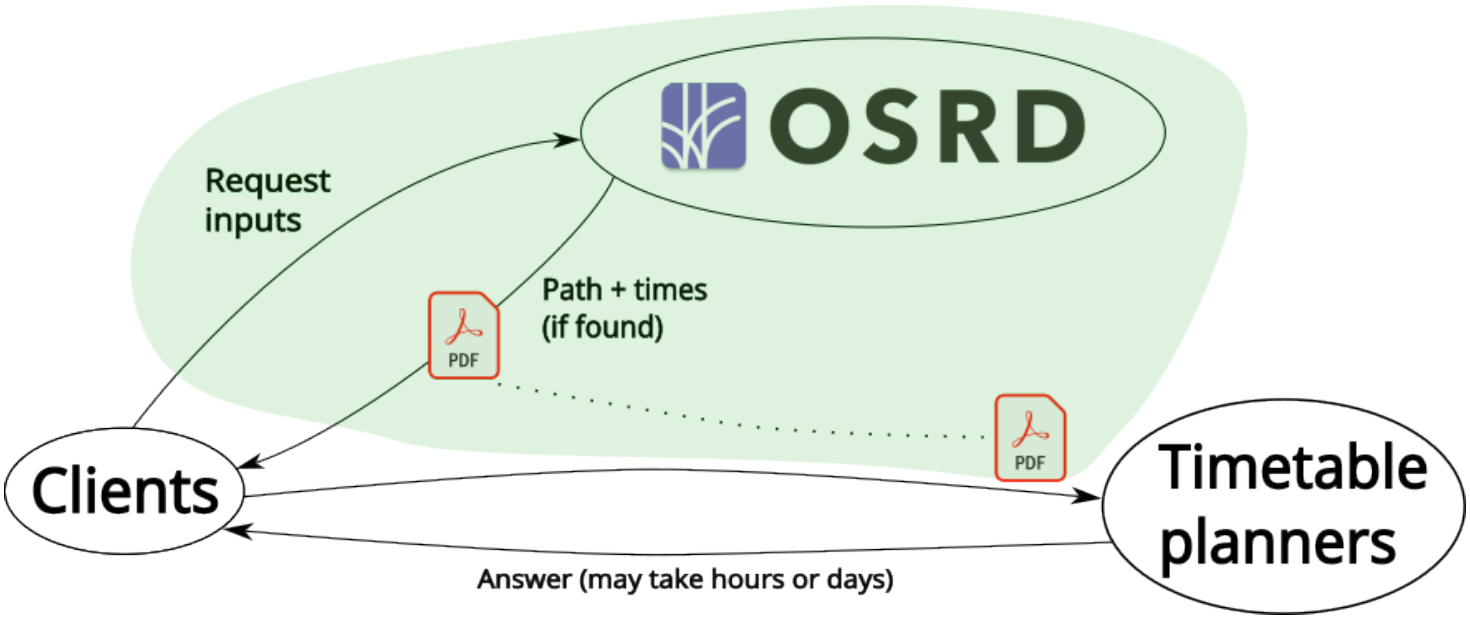
Short demo

Video available in the GitHub repo

`https://github.com/eckter/fosdem_2026/blob/master/short_demo.mkv`

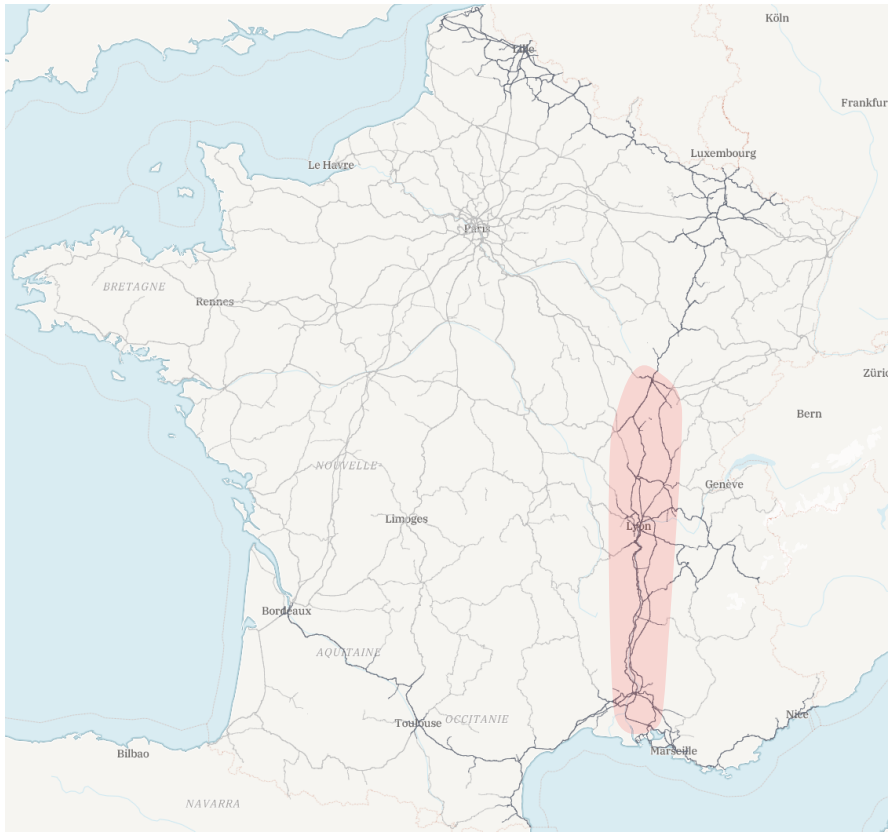
How the new tool fits in the existing processes

People are already in charge of answering such requests: timetable planners



Early 2025 : real data and first users

- First requirement: data
- We first focused on a specific axis



Early 2025 : first users and feedback

- First feedback from the new users!
- They want to use it as an optimistic **pre-filtering** check: "is there a chance my request could be accepted?"
- ...But we were on the pessimistic side.
- We then rushed some new features to fix that (e.g. adding extra stops).

2025 : feedback from timetable planners

- Timetable planners noticed data issue with *specific* examples.
- We had to work on our logging and context saving.
- They don’t focus on the same kind of data!
- Sometimes explaining **why** our solution was wrong could be difficult.

Some numbers

- We receive 10 to 20 requests per day
- Only a few are actually forwarded to timetable planners with the PDF file (1-2 per week)
- Out of those:
  - **13%** false positives
  - **6%** false negatives
  - All of the identified errors come from data issues
- Computation time per request: from 200ms to 3 minutes, 16s average

What we've learned

- The technical approach is sound
- The hard part is the data quality, not just the algorithm
- There's a lot of people we need to convince

It can work on any infrastructure as long as there's data.
We're always looking for collaborators, feedback, or other infrastructure managers interested in trying this

Questions

Any question?

For more information: `https://osrd.fr`
Github: `https://github.com/OpenRailAssociation/osrd`
Chat with us: `https://matrix.osrd.fr`
Email: `contact@osrd.fr`