A new digital approach to traffic management in stations

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What is DGEX SOLUTIONS ?

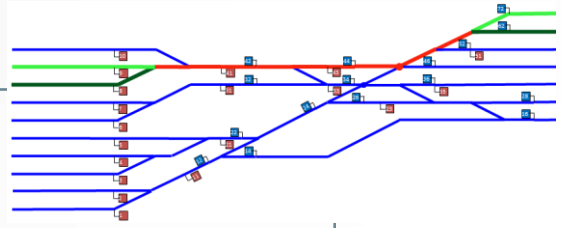
- **Customer based** approach
- Working hand in hand **with and for the field**
- Partnerships with schools and research labs
- Over a **100 collaborators**
- Teamed with the network operation studies department
- 1 **patent**
- 20 tools **dedicated both to planning and real time**

Planning phase

Case study : OpenGOV

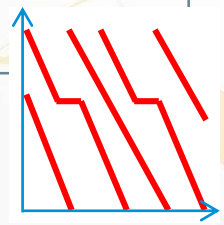
The train platforming problem

- Which is the best track allocation for a train in a station taking into consideration all of the constraints ?



Inputs

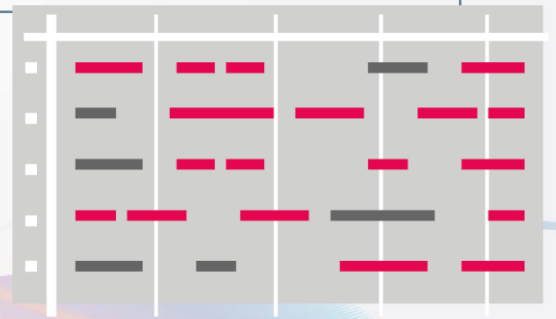
- Infrastructure topology (infrastructure constrains, paths, track length, etc.)
- Operations and customer service constraints
- Train schedule (train sets, train and personnel roster, direction, etc.)



Optimisation model

Output

- Track occupation diagram



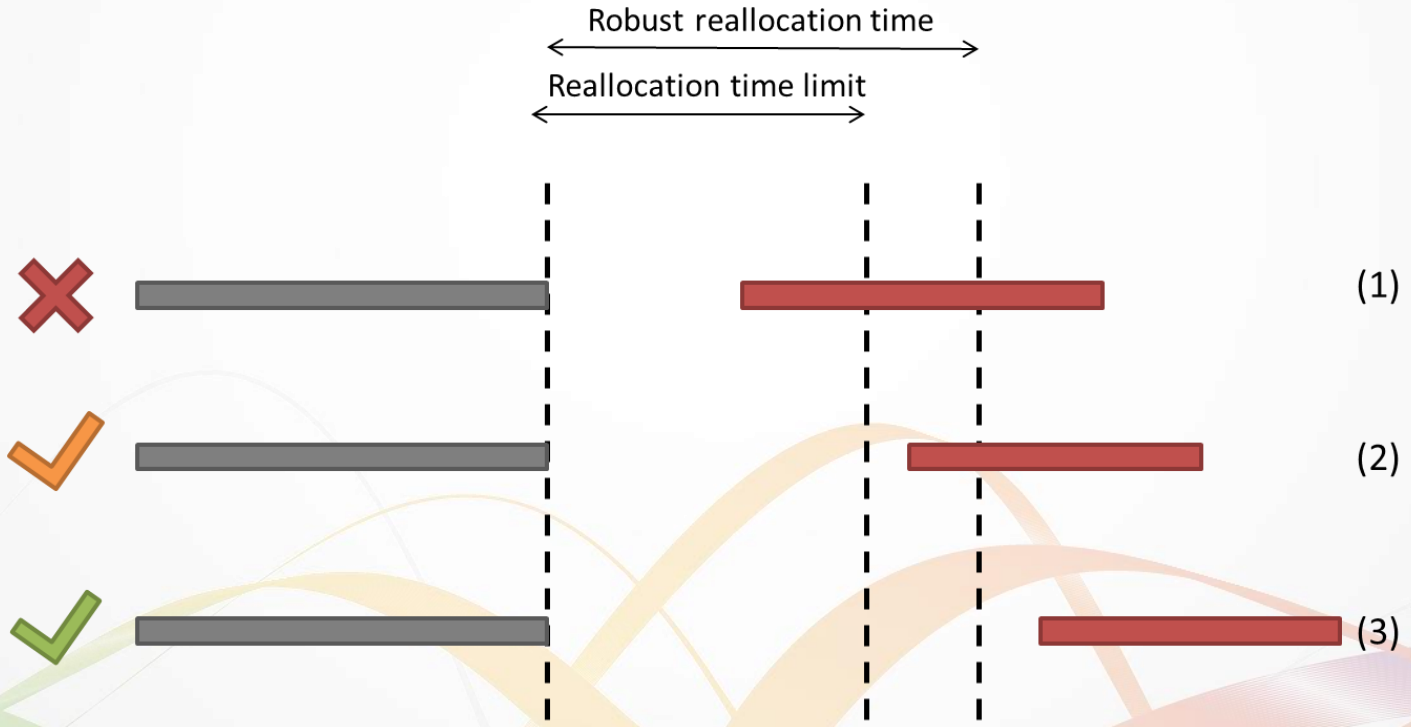
Addressing Railway operations with Operational Research

Operational research	Train platforming
• Problem-solving techniques and methods • Methods that help to make better decisions • Solve complex decision-making problems	• Complex problem • Millions of potential solutions • Relying on the know-how specialists

Operational research methods are completely appropriate for train platforming

How does it work ?

- Minimize a weighted sum subject to constraints :
  - Hard constraint : cannot be violated
  - Soft constraint : can be violated but penalised in the objective function to ensure robustness



OpenGOV

Helps scheduling experts with their task, in order to guarantee an optimal capacity distribution

Reducing time consuming task

Highlighting conflicts

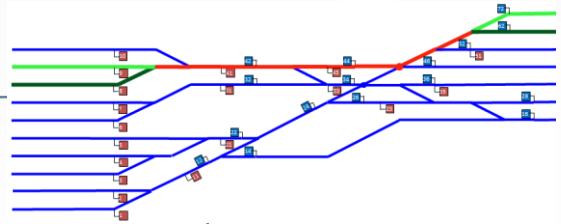
Improving robustness

Monitoring real time

Case study : OpenGOV Real Time

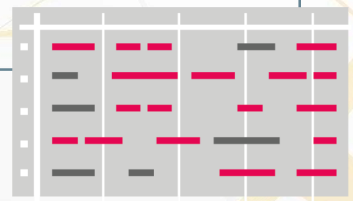
The operation train platforming problem

- How to help decision maker during operation in real time ?

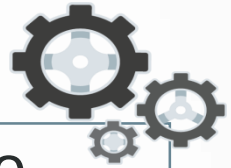


Inputs :

- Infrastructure topology (infrastructure constrains, routes, track length, etc.)
- Operation and custumer service constraints
- Transportation plan (set of moves, rolling stock set, direction, etc.)
- **Real time disruption (delays, rolling stock change, etc.)**
- **Pre operational train occupation graph**



Real time Optimization model



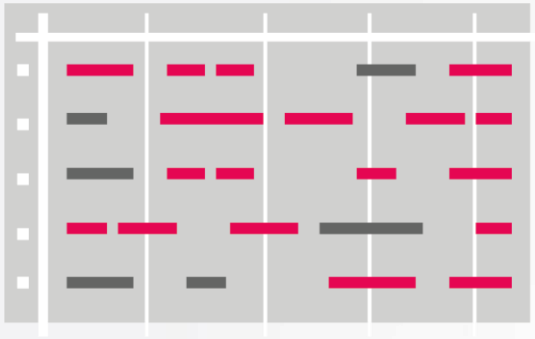
Output :

- Allocation change proposal

How does it work ?

- A lexicographic multi-objective approach
  - Multiple objectives are declared
  - Objectives are ranked in order of preference
    - Minimise the number of train not assigned to a platform
    - Minimise the number of soft constraints violated
    - Minimise the change compare to the nominal situation (delays, platform change, path change)
  - Local search : quick solution for operation

What is it for ?



Pre-operational data

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Real time disruptions (delays, rolling stock changes, infrastructure availability etc.)

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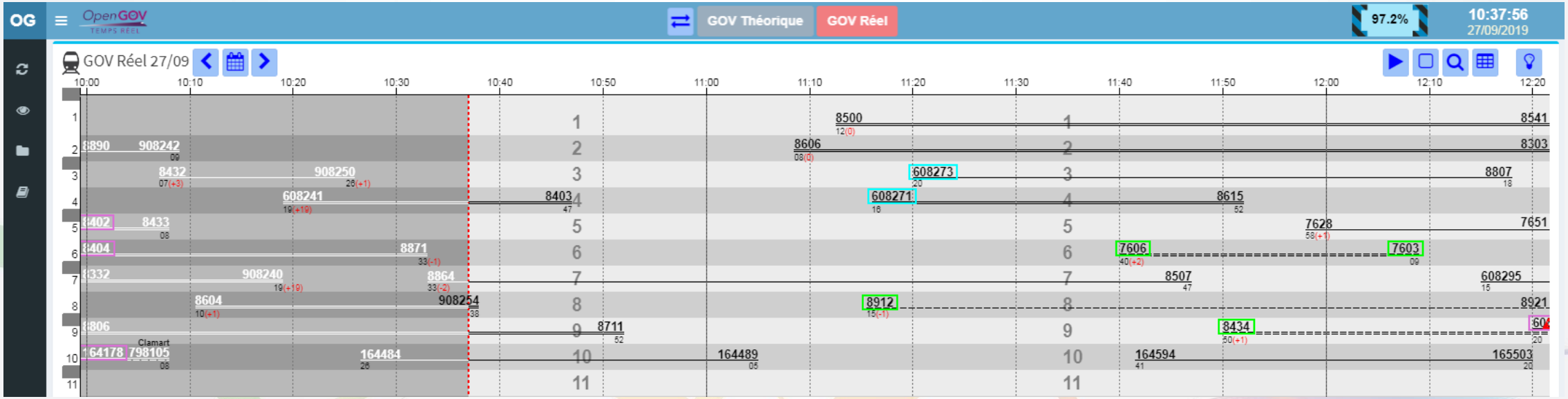
- Pre-operational data is often outdated
- Real time changes must be done
- Quick decisions must be taken
- Big pressure on operators

How can we help operators to make good decisions quickly ?

OpenGOV Real Time

- Based on operational research
- Synchronized with real time data
- Helps supervise the smooth running of operation
- Quick provider of feasible solutions



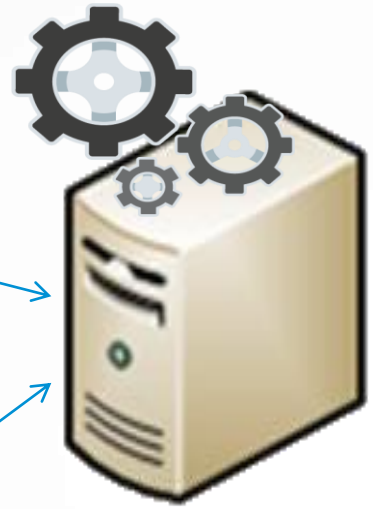
NEXT STEPS

What's next ?

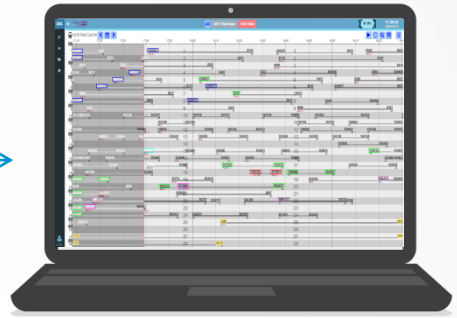
OpenGOV TEMPS RÉEL

Historical data

Real time data



Machine learning and improvement of the operational research model



Help our teams in operation

Coutinuous improvment

Thank you!

for your kind attention