ARRIVAL

Algorithms for Robust and online Railway optimisation: Improving the Validity and reliAbility of Large scale systems

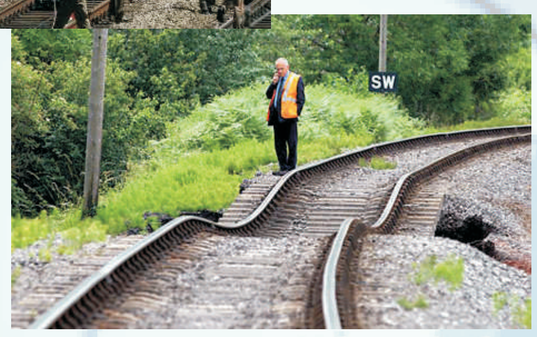
Objectives: to investigate the fundamental principles that underlie the planning optimisation of large-scale complex systems, as those in railways, from a proactive (robustness) and a reactive (online) perspective, and develop the necessary foundational algorithmic research to provide ingenious and sound answers to the encapsulated efficiency and quality issues.

Robust planning: How can the different planning stages be optimized, before operations, so that they can absorb disruptions?

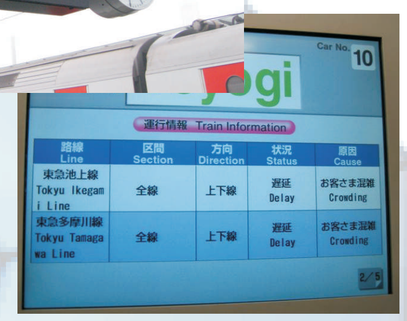
Online planning: How can one react and re-plan within strict time limits and typically before the entire sequence of disruptions is known?

LARGE SCALE NETWORKS

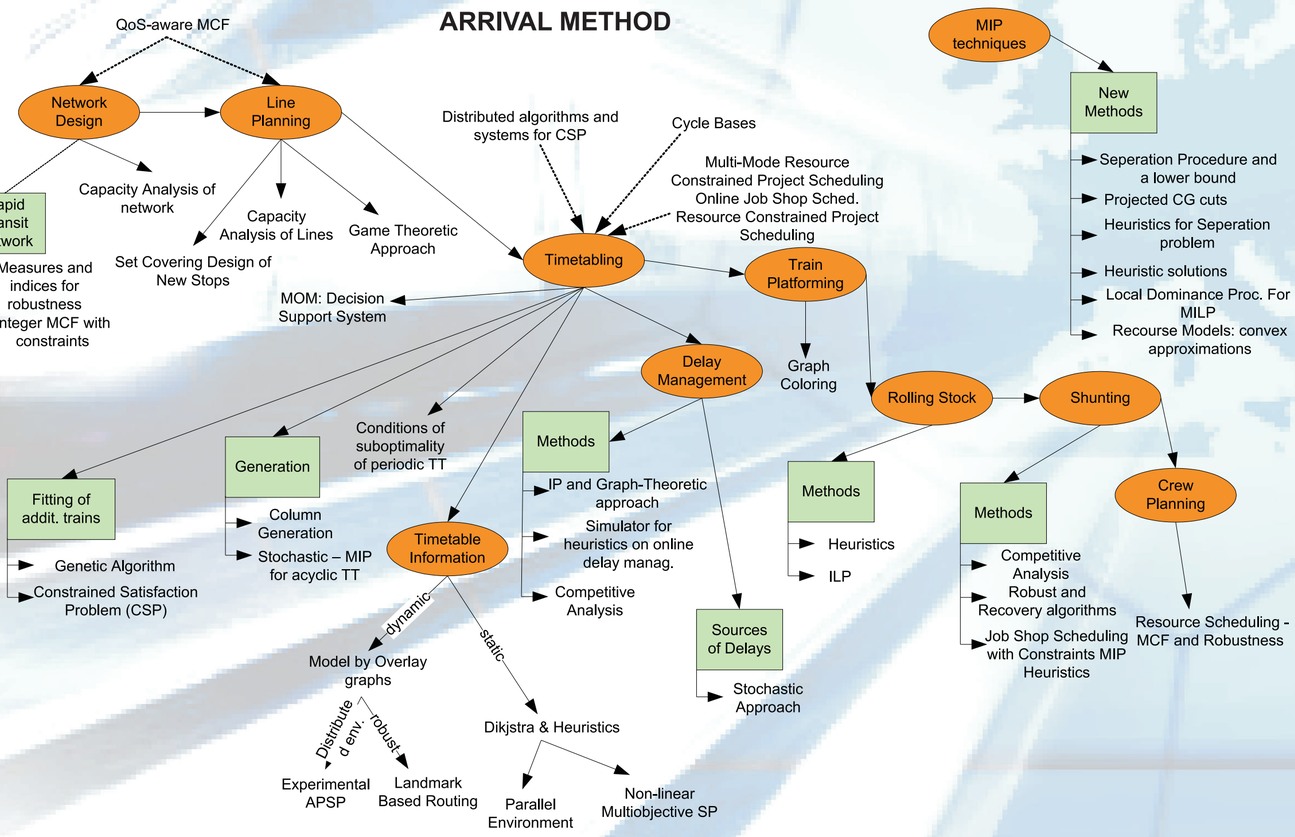
FAILURES/DISRUPTIONS



PROBLEMS/DELAYS



ARRIVAL METHOD



KEY RESULTS

- New concepts for measuring robustness and recoverability of plans
- Integration of planning stages to gain further optimization potential
- Algorithmic game-theoretic approaches for robust network and line planning
- New multidisciplinary models and methods for
  - robust & online timetabling
  - resource re-scheduling
  - dynamic timetable information updating
  - delay management
- Central repository of synthetic and real-world data sets
- Benchmarks for the experimental evaluation of our methods

ROBUST OPTIMIZATION

ONLINE OPTIMIZATION

WP1
New models for robust and online planning.
- Initiate and explore entirely new modelling and algorithmic perspectives
- Distil and generalize the inherent mathematical and algorithmic ideas arising in the overall project
- Provide the theoretical framework on robust and online railway optimization

WP2
Robust Network and Line Planning
- Relation of strategic planning to real-time disruptions to the normal operation
- Maintain feasibility and quality of an optimal solution in the case of disruptions.
- Robust network and line planning under Game Theoretic approaches
- Development of a generic methodological framework

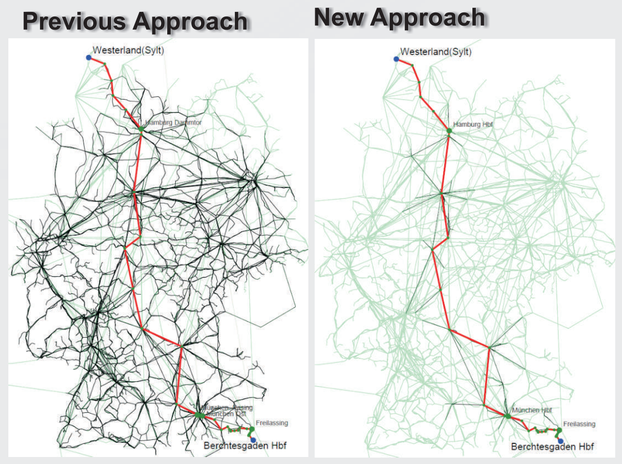
WP3
Robust and Online Timetabling and Timetable Information Updating
- Robust and Online Timetable planning in a sound mathematical and CS context
- Design of robust timetables that absorb disruptions and prevent their propagation.
- Online redesign and update of the timetable in case of disruptions
- Dynamic updating of timetable information systems

WP4
Robust and Online Resource Scheduling
- Robust and online scheduling and rescheduling of resources:
  - Rolling stock
  - Crew
- Robust and Online Shunting

WP5
Delay Management
- Robust delay management with respect to a multitude of operational constraints
- Online stochastic strategies for delay management decisions
- Effects of delay management to timetabling, line planning and resource scheduling

WP6
Experimental Evaluation and Verification
- Prototype implementations of mature theoretical methods
- Test data repository, including real world and synthetic data
- Evaluation and validation of new approaches

Previous Approach **New Approach**



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- University of Patras
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