

Stochastic passenger assignment in iterative timetabling (topic presentation)

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Työn saa tallentaa ja julkistaa Aalto-yliopiston avoimilla verkkosivuilla. Muilta osin kaikki oikeudet pidätetään.

Motivation

- Timetabling and passenger routing form a coupled system.
- Solving the integrated problem (timetabling + routing simultaneously) is computationally too expensive for larger datasets.
- An iterative approach offers a computationally manageable alternative and can give good heuristic solutions.
- Little prior research exists on how different stochastic passenger assignments affect the iterative process.

Objectives

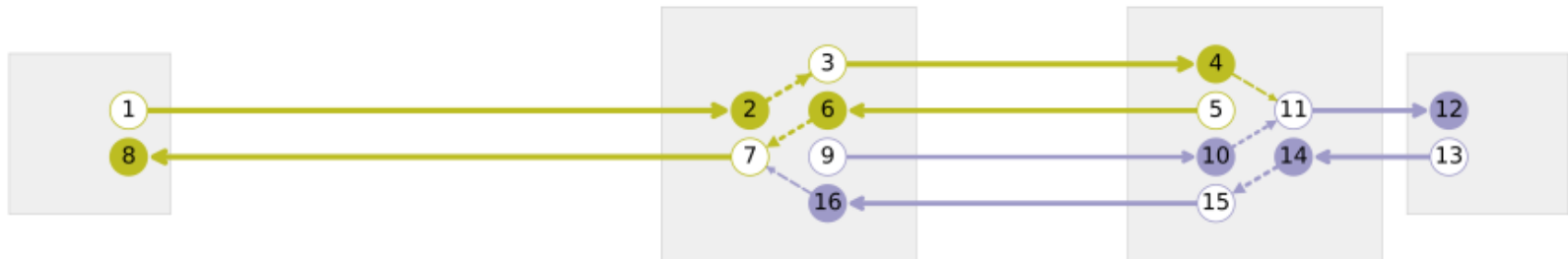
- Apply the iterative timetabling–passenger routing procedure to five example datasets.
- Compare the shortest path assignment against stochastic passenger assignments (Logit, Kirchhoff).
- Assess whether a stable result is reached.
- Examine the impact of the chosen timetabling algorithm on the results.
- Compare runtimes across datasets, parameters, and algorithms.

Scope

- Unimodal datasets only
- Vehicle capacity constraints are not considered
- Demand (OD matrix) held fixed throughout the process

Methods

- Foundation: PESP (Periodic Event Scheduling Problem) and EAN (Event-Activity Network)
- Timetabling via LinTim: the MATCH algorithm (heuristic) and cb_ip (optimal, cycle-based integer program)



Visualization of the EAN for small-path dataset.

Methods

- Route choice based on a generalized cost function: travel time + change penalty
 - Shortest path assignment
 - Stochastic passenger assignments, Logit and Kirchhoff: passengers distributed among the k shortest paths
- Iterative algorithm:
 - 1) compute timetable with fixed activity weights → 2) reroute passengers → 3) update activity weights → repeat until weights stabilize or the iteration limit is reached

Literature and references

- Philine Schiewe and Anita Schöbel. 2020. Periodic Timetabling with Integrated Routing: Toward Applicable Approaches.
- Yulin Liu, Jonathan Bunker, and Luis Ferreira. 2010. Transit Users' Route-Choice Modelling in Transit Assignment: A Review.
- Philine Schiewe, Anita Schöbel, Olli Herrala, Michael Rihlmann, Sarah Roth, Sebastian Albert, Christine Biedinger, Thorsten Dahlheimer, Lena Dittrich, Klara Hoffmann, Sven Jäger, Piyalee Pattanaik, Alexander Schiewe, Moritz Stinzendörfer, and Reena Urban. 2025. Documentation for LinTim 2025.11.
- Mathias Kinder. 2008. Models for periodic timetabling.

Tools

- LinTim: open-source software for applying optimization tools and algorithms in public transport
 - Utilization of the already-existing methods: timetabling, EAN, shortest path rerouting, visualizations
 - Implementing the stochastic passenger assignment functionality
- Gurobi as the solver
- Python script for calling the LinTim commands iteratively
- Excel for plotting data

Schedule

- Started in July 2026 by reading articles and related materials
- Modelling in July and August 2026
- Running the experiments in August and September 2026
- Analyzing the results in September 2026
- Topic presentation 13.9.2026
- Final presentation 25.9.2026