Optimizing Infrastructure Improvements in Bus Rapid Transit Systems (topic-presentation)

Veikko Hokkanen

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Instructor: Philine Schiewe
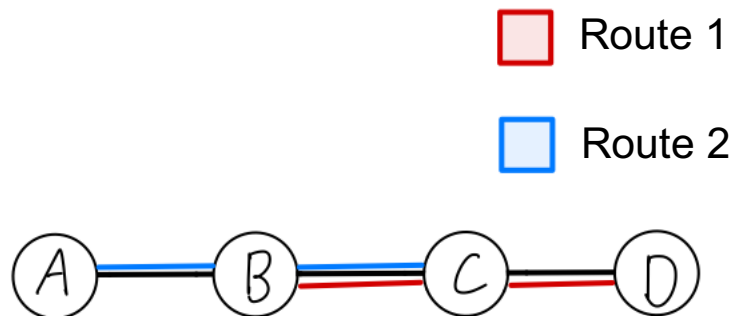
Supervisor: Philine Schiewe

Backround

- Bus lines can be upgraded to Bus Rapid Transit (BRT) line which attracts more passengers
- Bus line network can be modeled as a graph with weighted edges and vertices
- Optimizising methods can be used for the graph to solve which segments to upgrade
- Studied in a path graph setting in article by Schiewe et al. [2023]

Graph representing bus network with two lines

Goals

- Goal of my thesis is to formulate the same problem on an arbitrary graph and solve it.
- Which segments to upgrade to attract maximum amount of new passengers?
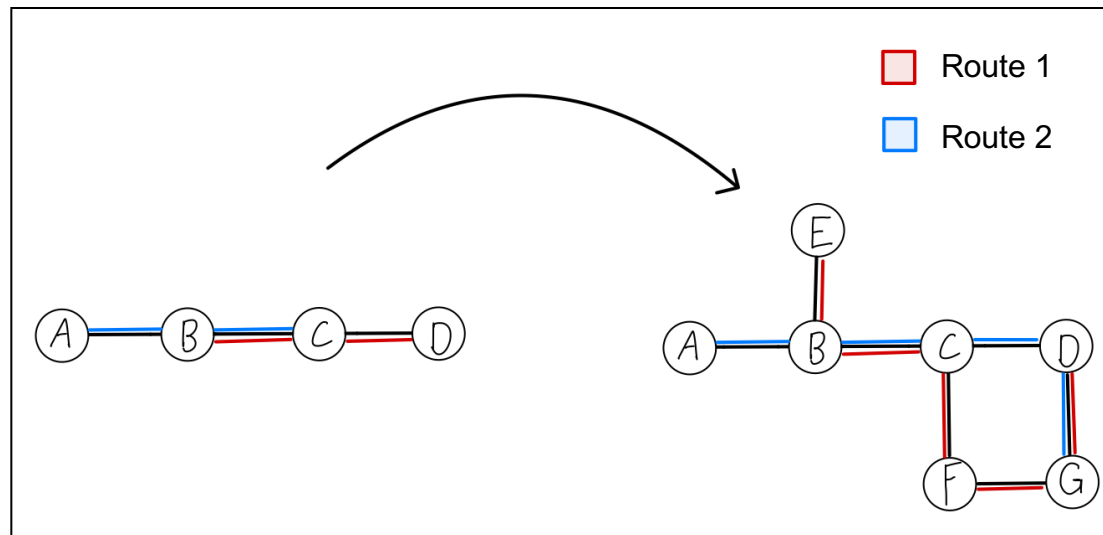
Path graph setting to regular graph setting

Scope and constraints

Original problem in the article

- Schiewe et al. [2023] includes limit for the amount of upgraded connected BRT components

- Budget is minimized and divided for segments.

My thesis

- The amount of BRT components is limitless. Limiting would be too complex in arbitrary graph

- Budget is not minimized but rather set to a constant. Minimizing budget would lead to bi-objective optimization problem

Methods and tools for solving

Simplified pseudocode

Find initial shortest paths
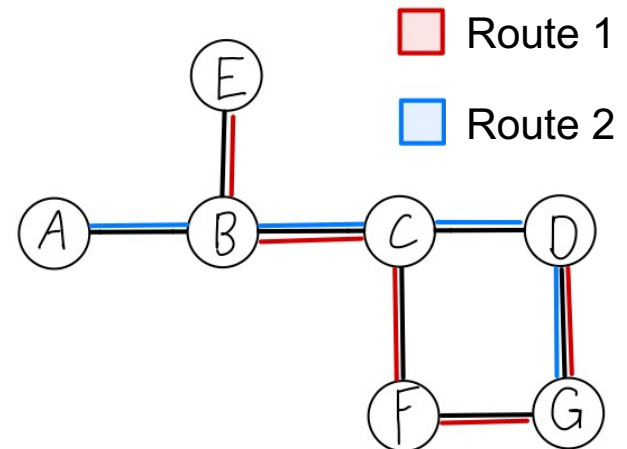
While upgrades possible:

    Find optimum edges to upgrade with current shortest paths

    Upgrade shortest paths to match with upgraded lengths

Return edges to upgrade

Software to be used

* Python with Networkx and NumPy
  to be used with Gurobi solver API

Route 1

Route 2

Schedule

- **February:** Start

- **March:** Model and implementation ready, start writing

- **April:** Finish the thesis

References

- Rowan Hoogervorst, Evelien van der Hurk, Philine Schiewe, Anita Schöbel, and Reena Urban, "The Bus Rapid Transit Investment Problem", 2023, arXiv preprint arXiv:2308.16104