The goal of this project is to support the design of a public transportation system by mathematical optimization. In this way, we want to improve the efficiency and the attractiveness of public transport. There are two major challenges:

1. the simultaneous optimization of two competing objectives, namely, cost minimization versus quality of service, and
2. the consideration of passenger behavior.

We focus on the line planning problem, i.e., the definition of line routes and their associated frequencies of operation.

### Line Optimization – Potsdam 2010

We optimized the 2010 line plan of Potsdam’s public transport company ViP in the project Stadt+. The final optimized solution reduces the cost by around 4% and the perceived travel time by around 6%\(^a\). ViP implemented a slightly deviating plan: ViP did not want to reduce the tram network as much as the optimizer suggested for fear of demand reductions.

\(^a\)evaluated with VISUM (ptv AG)

### Transfers

- **exact treatment of transfers** \(\sim\) large scale models
- **direct connection approach** to maximize direct travelers
  - idea: penalize all paths that do not provide a direct connection
  - “first order” approximation on exact models
  - computationally tractable for medium-scale real-world instances
  - accurate estimates on the (real) number of direct travelers

### Passenger Behavior and Variable Demand

- include passenger preferences in terms of the transportation mode, e.g., bus or tram
- bound passenger volume in terms of travel time (consider individual traffic as travel alternative)
- investigate the use of a demand function in line planning models