

Complex Navigation Systems – Some Challenges and Solutions

Vladislav Martínek and Michal Žemlička

Charles University, Faculty of Mathematics and Physics

martinek@ksi.mff.cuni.cz, zemlicka@ksi.mff.cuni.cz

Paper Content

- Challenges
 - Fixed and Free Sections of Path
 - Combinations of Different Search Networks
- Some Solutions
 - Linking the Network of Walk Paths and PTN
 - Network Reduction
 - Path Planning in Combined network
 - User Preferences

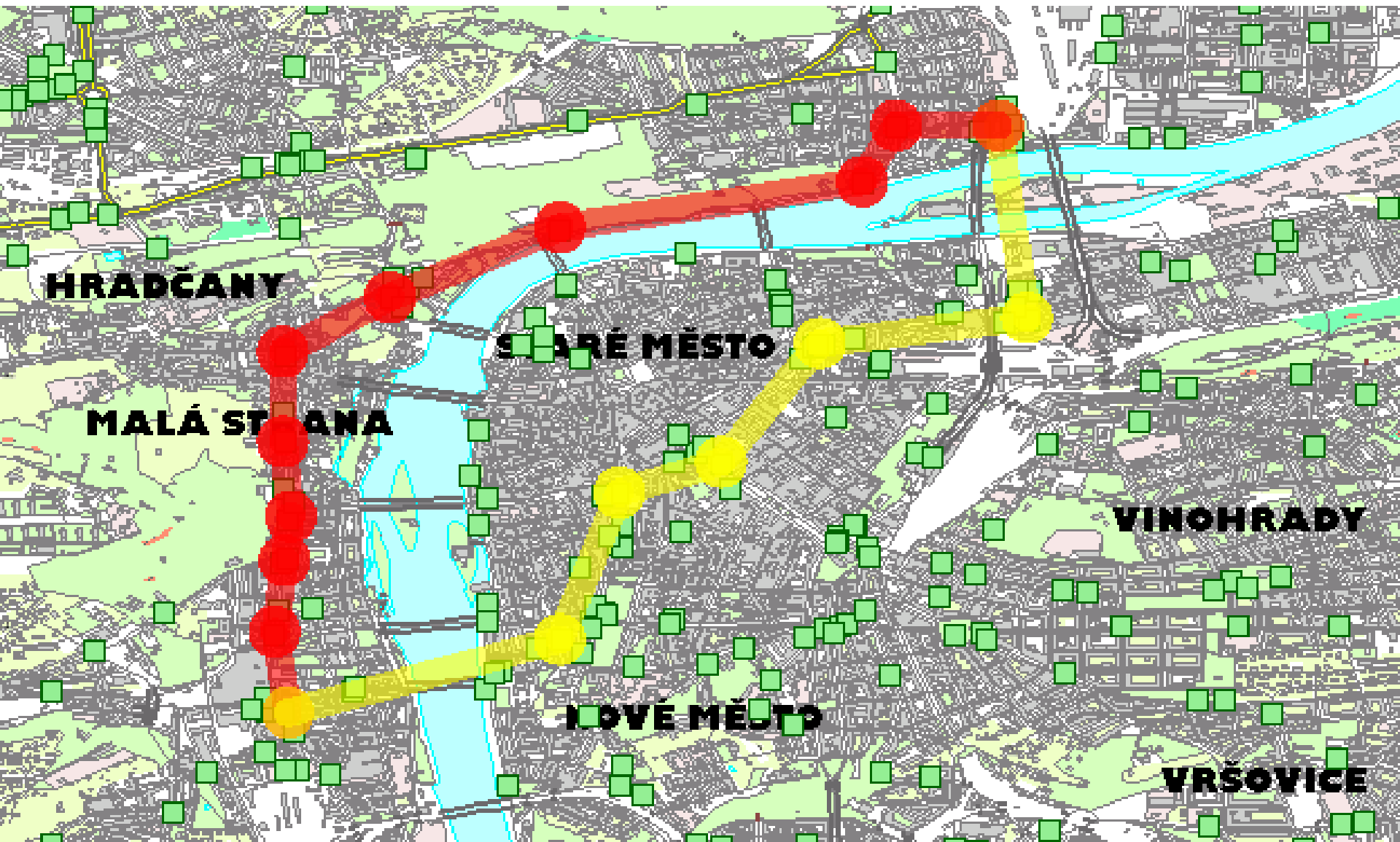
Challenge – Fixed and Free Sections of Path

- Time dependent path sections
 - Does not tolerate late coming passengers
- Time independent path sections
 - Can be moved in time to satisfy various conditions



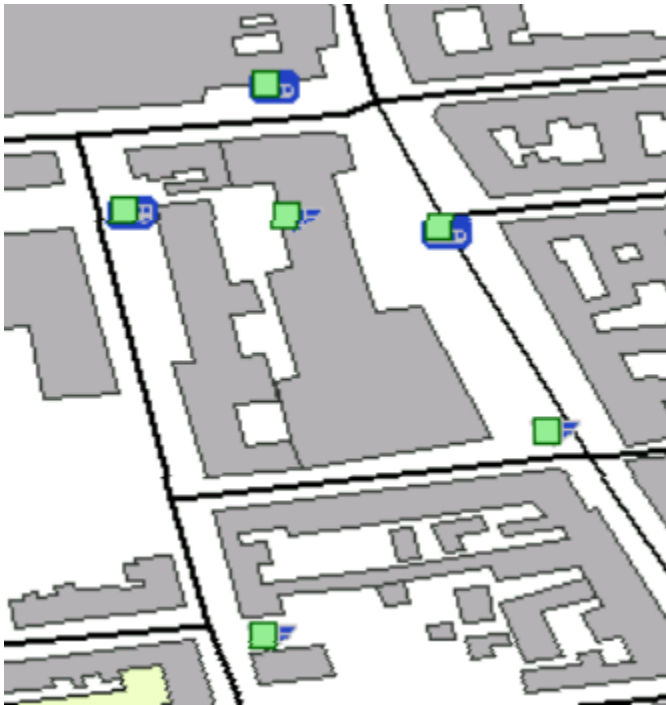
Challenge – Different Transportation Networks

- Public transportation network
 - The path typically starts at certain moments or periodical intervals given by a timetables
 - Path plan may be significantly different for two relatively close moments
- Pedestrian network
 - The path can typically start anytime
 - The duration of the path depends on preferences of a traveller



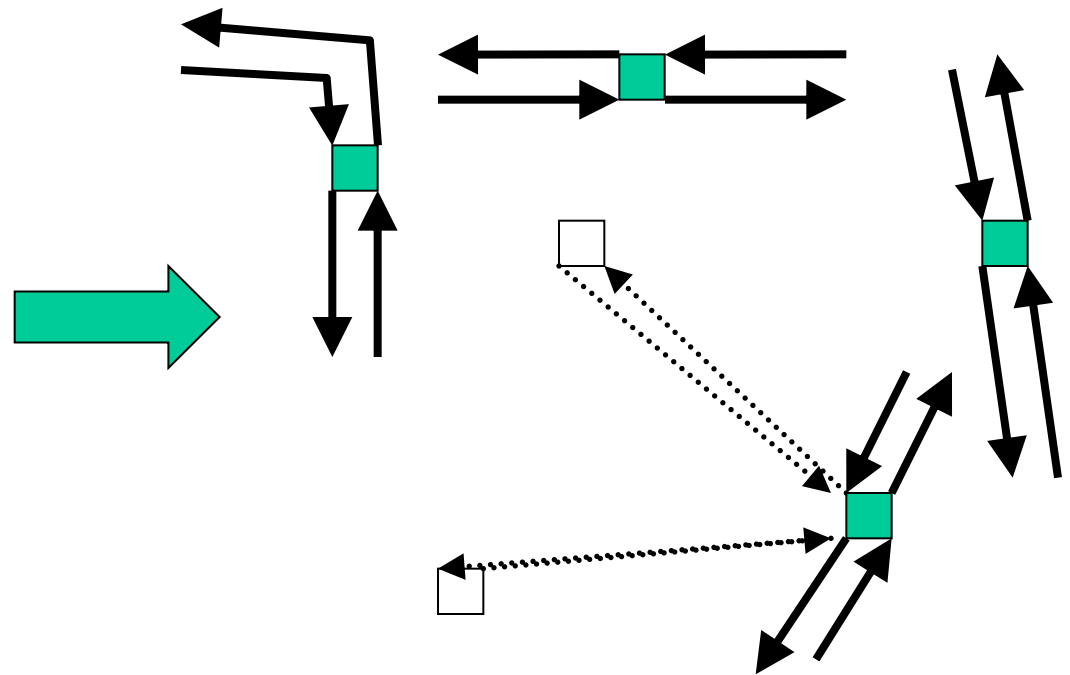
Solution – Connecting PTN into Pedestrian Network

- Mapping stops from timetables to street refuges



Solution – Connecting PTN into Pedestrian Network

- Mapping stops from timetables to street refuges

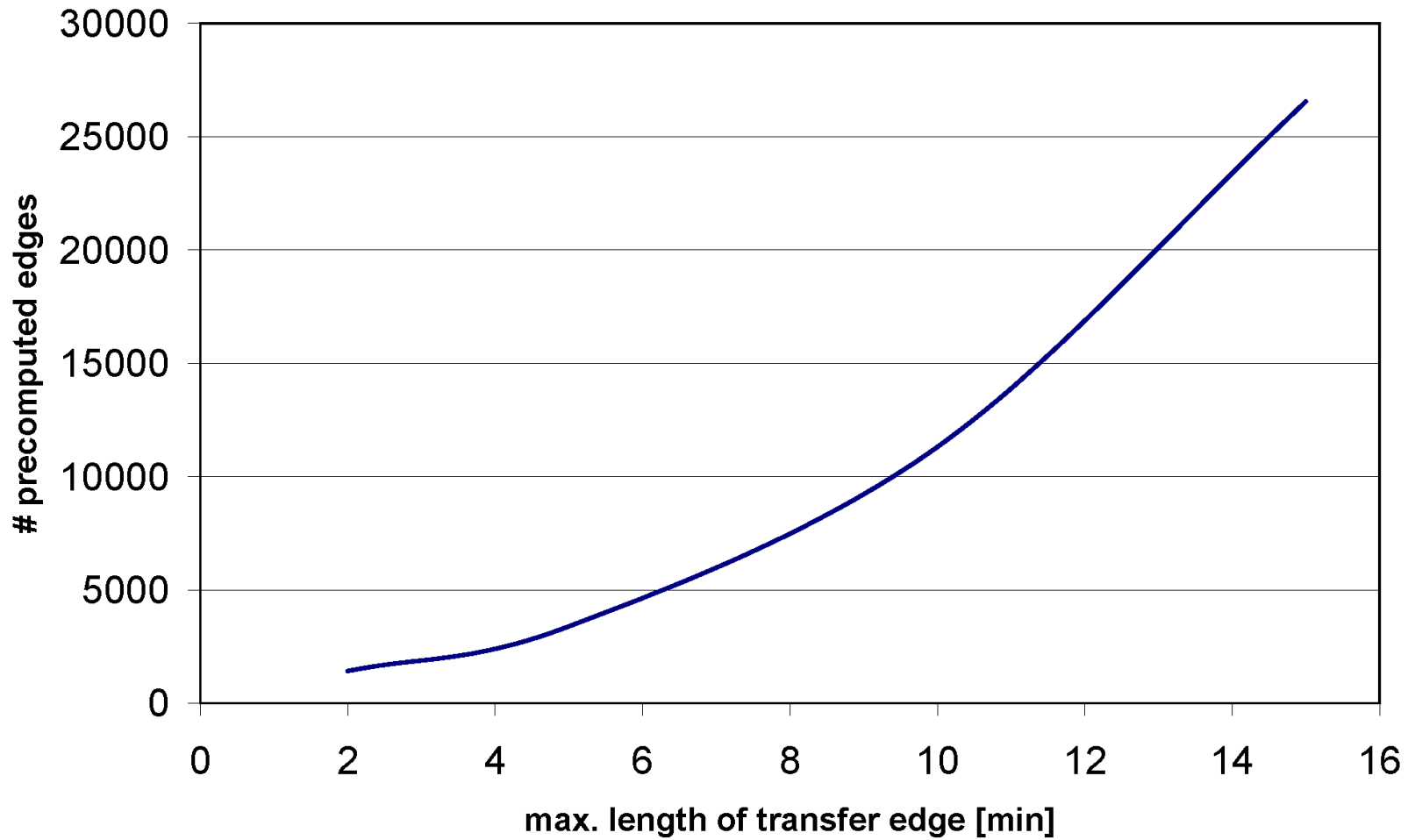


Solution – Network Reduction

- The character of the walk path **is** important
 - superelevation, barriers, accessibility of the path
- The shape of street is not important
- The non-branching nodes of PTN can be reduced
- The network reduction is orthogonal to the search algorithm optimizations

Some Solutions – Walk transfers inside PTN

- Searching walk transfer between stops of public transportation
 - Precomputed values saves computation time
 - The number of precomputed transfer edges grows strongly with the length of transfer
- The limit of length of precomputed transfer edges
 - High enough to make the connection search relevant
 - Low enough not to slow down the computation



Conclusion

- + Path efficiency and variability
- + Environmental aspect
- Different planning in the search networks
- Different sources of data

When the challenges are solved sufficiently, the complex navigation systems have a strong potential thanks to various possibilities of path planning.

Future Plans

- Multi-criteria path search
 - Time, cost, reliability, safety, ...
 - Points of interest
- More types of transportation
 - Hierarchy of transportation networks

Thank you for your attention.