

Demand-Responsive Collective Transportation including Door-to-Door Services for Mobility Impaired People

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1 Introduction

2 Research

3 Concepts

4 Software

5 Design Ideas

6 Next Steps

Overview

1 Introduction

2 Research

3 Concepts

4 Software

5 Design Ideas

6 Next Steps

- 1 Work in Progress
- 2 Main ideas and concepts
- 3 No implementation yet
- 4 In the context of SmartPT
 - Research partially funded by the IWT 135026 Smart-PT : Smart Adaptive Public Transport (ERA-NET Transport III Flagship Call 2013 “Future Travelling”)

Overview

1 Introduction

2 Research

- General
- Example

3 Concepts

4 Software

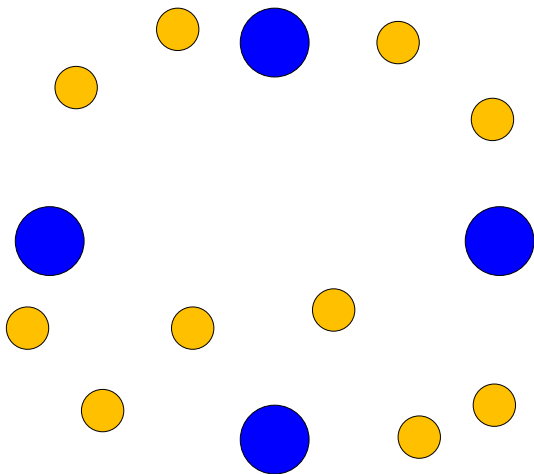
5 Design Ideas

6 Next Steps

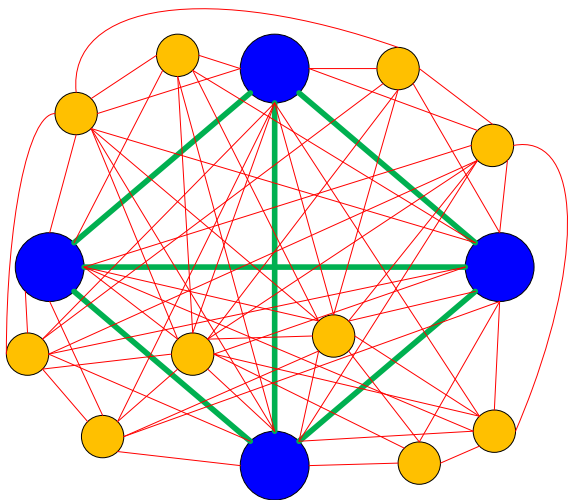
General:

- 1 Modelling *thin flows*
 - Low density regions
 - Elderly and mobility impaired people
- 2 Modelling feeder services
 - Low density → high density
- 3 Research Questions
 - Are these companies viable?
 - Do these companies need subsidizing?
 - What is the influence on the different prices?

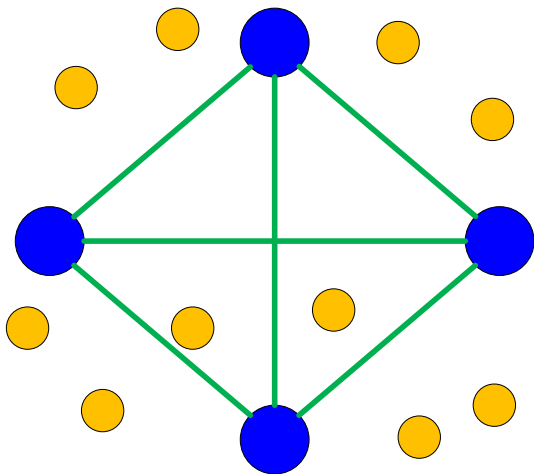
Example: Thin Flows



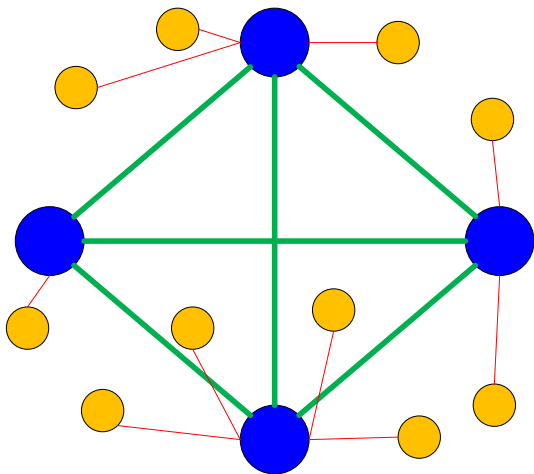
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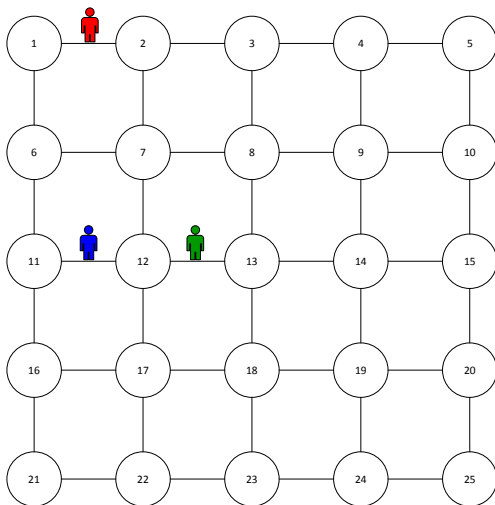
Example: Thin Flows



Example: Thin Flows



Example: Bringing/Getting Customers



User 1

Origin: link 1-2
 Destination : 14-19
 Departure: 09:00
 Arrival: 09:35



User 2

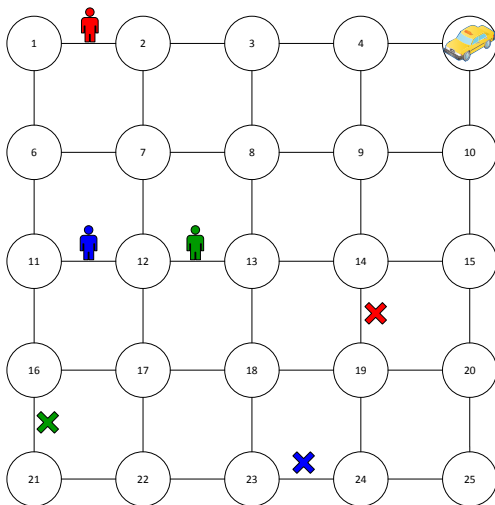
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 Departure: 09:25
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User 3

Origin: link 11-12
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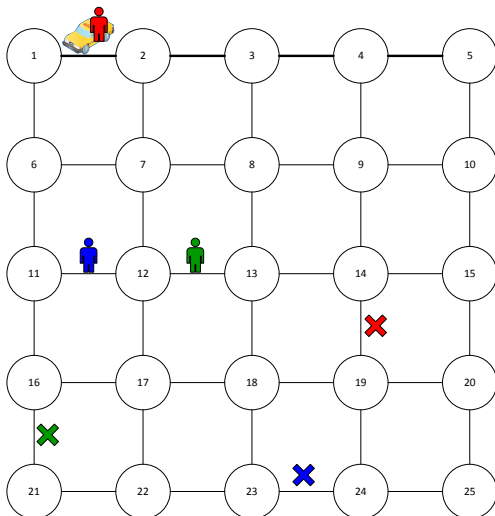
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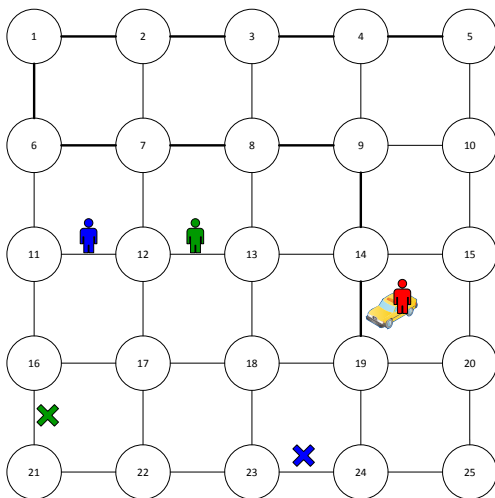


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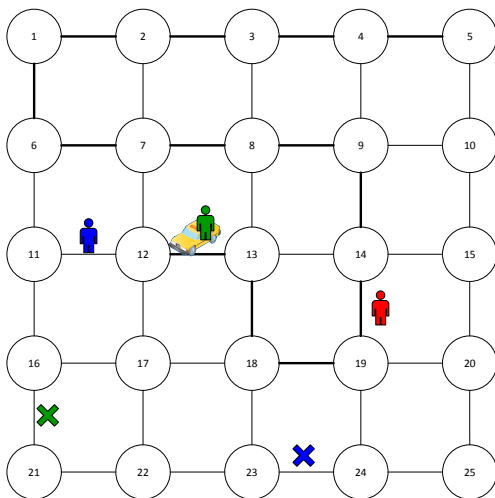
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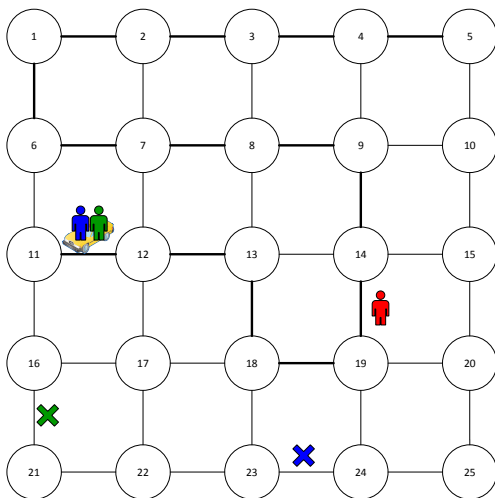
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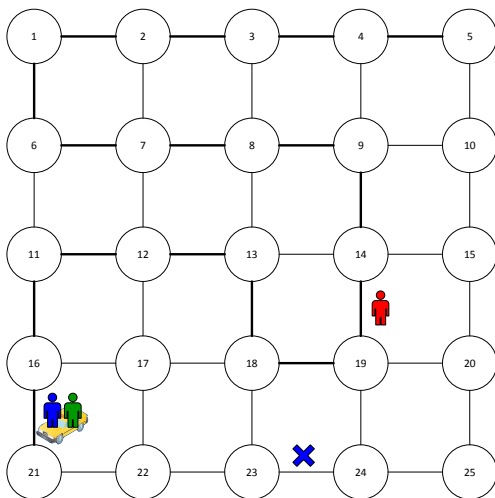


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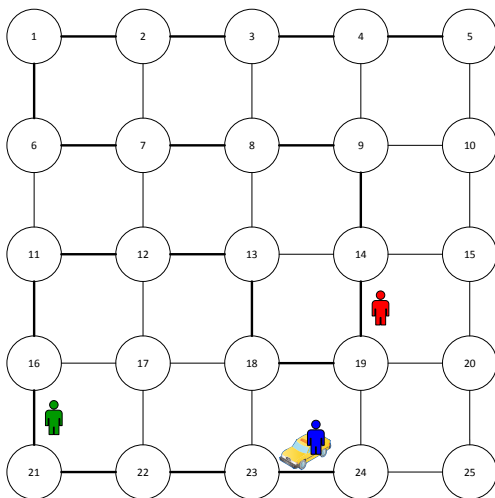


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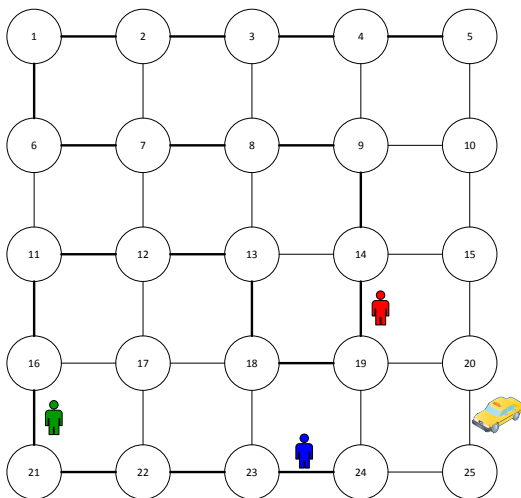
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Overview

1 Introduction

2 Research

3 **Concepts**

- Entities
- Company
- Customer

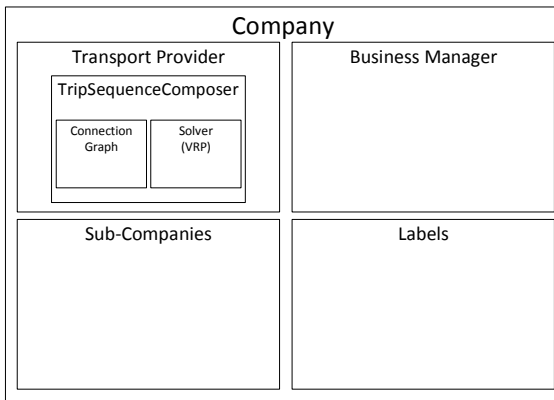
4 Software

5 Design Ideas

Entities: Overview

- 1 Company
- 2 Customer
- 3 Interactions, e.g.:
 - Customer books a trip at a company
 - A Company commits a trip to a customer
 - A Company books a trip at another company
 - ...

Company: Overview



Company: Responsibilities

- 1 Represents a real-life business
- 2 Always provides some kind of transportation
 - Providing own transportation
 - Acting like a broker (make use of other companies to provide trips)
- 3 Tries to survive
 - With subsidizing
 - Without subsidizing

Company: Transport Provider

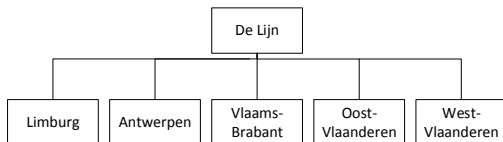
- 1 Entity in the company → providing transport
 - Routing of vehicles
 - Optimizing schedules
 - ...
- 2 Knows the area that can be served
- 3 TripSequenceComposer
 - Connection graph
 - Representing the sub contractors of a company
 - e.g. $A \rightarrow B$: Company A can ask company B for help
 - Comes in handy when request of customer falls out of the served region
 - Solver
 - VRP with labels, capacity and time windows

Company: Business Manager

- 1 Entity in the company → financial situation
 - Cost of a trip
 - Subsidizing
 - Profits
 - ...

Company: Sub-Companies

- 1 For practical reasons (every company/sub-company can be handled in the same way)
- 2 Easier to calculate the totals of a company
- 3 e.g. $I_{DeLijn} = I_{Limburg} + I_{Antwerpen} + I_{VlaamsBrabant} + I_{OostVlaanderen} + I_{WestVlaanderen}$



Company: Labels

- 1 Terms of services
 - Income category of customer
 - Able/willing to take mobility impaired people
 - ...

Customer: Overview

- 1 Represents a real-life Person
- 2 Labels
 - Wheelchair
 - Blindness
 - ...
- 3 Plans
 - What will I do today/tomorrow?
- 4 Memory
 - About travel times
 - About experience with different companies
 - ...

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● Tools

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Tools:

- 1 Programming language JAVA
- 2 MATSim
 - Multi-Agent Transport Simulation
 - TUBerlin
 - Used for the simulation of the agents in the network
- 3 JANUS
 - UTBM
 - Used for the communication/negotiation between customer(s)/company(ies)

Overview

- 1 Introduction
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- 4 Software
- 5 Design Ideas
 - Connection Graph
 - Transport Request
 - Score Function

Connection Graph: Example

currentCompany = { *Company 1*, *Company 4*, *Company 5* }

Company 1 = { *Company 2*, *Company 3* }

Company 2 = { }

Company 3 = { }

Company 4 = { *Company 1* }

Company 5 = { }

Connection Graph: Example

$currentCompany = \{Company\ 1, Company\ 4, Company\ 5\}$

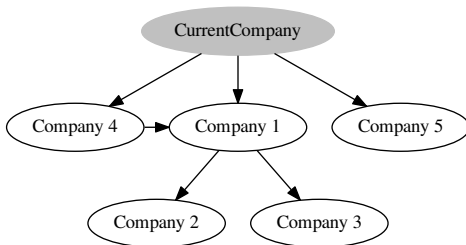
$Company\ 1 = \{Company\ 2, Company\ 3\}$

$Company\ 2 = \{\}$

$Company\ 3 = \{\}$

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$Company\ 5 = \{\}$



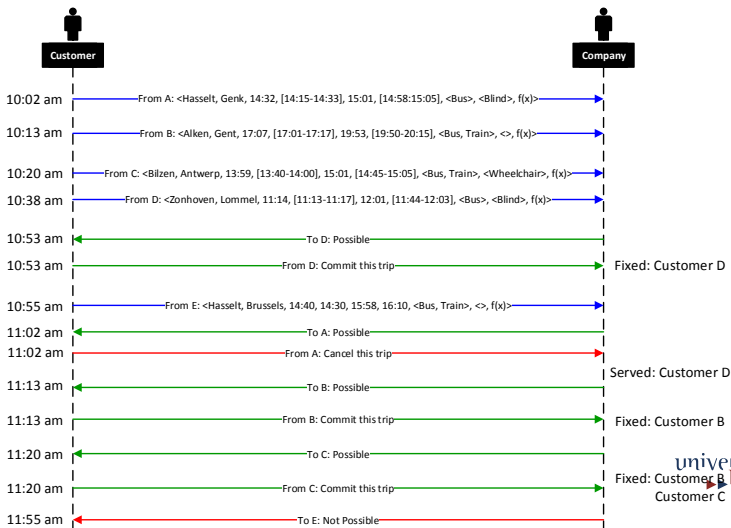
Transport Request: Overview

1 Conceptual view of a Request

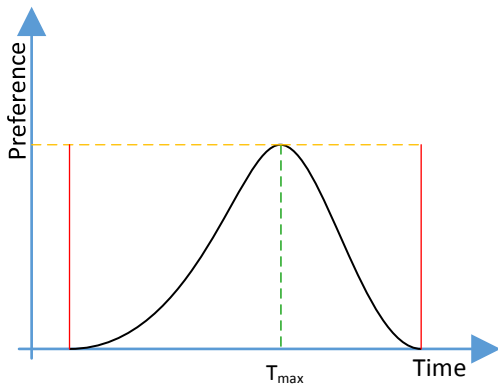
2 $\langle orig, dest, t_{orig}^P, w_{orig}, t_{dest}^P, w_{dest}, mSet, lSet, scoreFunc \rangle$

- $orig$ identifies the origin
- $dest$ identifies the destination
- $t_{orig}^P \in w_{orig}$ is the preferred departure time
- w_{orig} identifies the departure time window
- $t_{dest}^P \in w_{dest}$ is the preferred arrival time
- w_{dest} identifies the arrival time window
- $mSet$ is the set of transportation modes that can be used
- $lSet$ is the set of labels identifying special requirements (e.g. facilities of support) in order to enable travel
- $scoreFunc$ is a function to quantify the quality of proposed solutions in order to allow the responder to return the most appropriate (according to the requester's requirements) solutions

Transport Request: Example



Score Function: Conceptual View



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- 1 Finish this software specification
- 2 Start the implementation



Questions?