General information

The workshop will take place on June 19 and 20 at the Styles Hotel near Frankfurt (https://www.styles-hotel-frankfurt.de/de/hotel).

Location

The hotel is located near Frankfurt Airport, which also has a long-distance train station. The address is:

Styles Hotel Frankfurt Airport
Isarstraße 2
65451 Kelsterbach

Directions

To get to the hotel from the airport/the long-distance train station, the hotel offers a shuttle service. However, the shuttle only operates from 05.30 (departure hotel) to 11:30 (arrival hotel) every 60 minutes and from 16:00 (departure hotel) to 22:25 (end terminal 2) every 60 minutes.

Alternatively, you can use public transport (see https://www.rmv.de/c/en/homepage), which takes about 45 minutes (including 20 minutes of walking), or a taxi (about 15 minutes of driving) to reach the hotel.

If you arrive by car, you may park your car at the hotel's parking garage. The parking fee is 10 € per day and must be paid at the hotel's reception.

Please note that check-in at the hotel starts at 15.00. Earlier check-in is possible for a fee.

For additional information, you may also refer to the hotel's homepage: https://www.styles-hotel-frankfurt.de/de/service#anreise.

Participation fee

The participation fee per person is 198,95 € and must be paid by May 19. This fee includes a finger-food lunch on arrival, breakfast, a buffet in the hotel's craft brewery on Monday evening, and drinks during the workshop (except in the evening).

During the workshop

Introductions

We would like to start the workshop with a round of introductions where each of the PhD students and postdocs briefly introduces themselves for about 3 minutes.

Therefore, we ask each PhD student and postdoc to prepare one slide with information about their research topic, methods and tools used in their research, and other applications or methods they are interested in or would like to know more about. A corresponding template will be provided.

Presentations

All presentations will take place in the hotel's conference room "Donau".

Each speaker will be given a time slot of 25 minutes in total. The speakers are asked to prepare a talk in English of about 20 minutes, leaving 5 minutes for short questions.

The adjoining "corner discussion" at the end of each session provides an opportunity for in-depth discussions of the session's talks. The speakers are encouraged to bring a selection of their slides in printed form for the corner discussions.

Schedule

Monday, June 19

13:00 – 14:00	**Arrival and light lunch**
14:00 – 15:00	**Welcome and introductions**
15:00 – 15:15	**Coffee break**

Session 1

15:15 – 15:40	**Charlotte Ackva** *(Otto von Guericke University of Magdeburg)* Consistent Routing for Local Same-Day Delivery via Micro-Hubs
15:40 – 16:05	**Ehsan Aghamohammadzadeh** *(Rotterdam School of Management)* In what settings can a priori routes facilitate time slot management for attended service delivery?
16:05 – 16:30	**Lena Hörsting** *(Christian-Albrecht University of Kiel)* A Stakeholder-Based View of Business Cases for Integrated Urban Transport
16:30 – 17:00	Corner discussion

17:00 – 17:30	**Coffee break and group picture**

Session 2

17:30 – 17:55	**Steffen Elting** *(University of Vienna)* Machine-learning-based bundle generation for Collaborative Last-Mile Logistics
17:55 – 18:20	**Daniela Sailer** *(University of Augsburg)* Demand Management for Parcel Lockers
18:20 – 18:50	Corner discussion

From 19:30	**Dinner at the hotel's brewery "WasserCraftWerk"**

Tuesday, June 20

	Session 3
09:00 – 09:25	**Rico Kötschau** *(University of Vienna)* A Heuristic for Planning Mobile Parcel Locker Operations with Individual Customer Service
09:25 – 09:50	**Katrin Waßmuth** *(University of Mannheim)* On the impact of overlapping time windows in attended home delivery
9:50 – 10:15	**Liana van der Hagen** *(Rotterdam School of Management)* Effective Training of Machine Learning Models for Dynamic Time Slot Management
10:15 – 10:45	Corner discussion
10:45 – 11:00	**Coffee break**
	Session 4
11:00 – 11:25	**Felix Spühler** *(Technical University of Braunschweig)* Modeling Rider Preferences in a Bicycle Courier Service
11:25 – 11:50	**Jens Frische** *(WHU – Otto Beisheim School of Management)* Robust models for strategic first-mile capacity planning under uncertainty
11:50 – 12:20	Corner discussion
12:20 – 12:30	**Farewell**
From 12:30	**Lunch on an individual basis / departure**

Abstracts

Session 1

Charlotte Ackva *(Otto von Guericke University of Magdeburg)*

Consistent Routing for Local Same-Day Delivery via Micro-Hubs

More and more local shops offer same-day delivery to compete with the online giants. However, low delivery volumes and the dispersed distribution of shop and customer locations reduce the rare consolidation opportunities in the last mile even further. Thus, shops start collaborating on urban same-day delivery by using shared vehicles and micro-depots for consolidated transportation of parcels. To coordinate all stakeholders involved (storekeepers, drivers, and customers), shared vehicles conduct consistent daily routes between micro-hubs. This simplifies the distribution process and increases reliability for the stakeholders. According to the consistent schedule, stores bring orders to the next micro-hub, where the parcel is picked up by a vehicle and delivered to the micro-hub closest to its destination. Creating effective schedules is thus very important to guarantee a high service level. The difficulty of finding an effective consistent route is amplified by the daily uncertainty in order placements.

We model the problem as a two-stage stochastic program which determines the vehicle schedules on the first, and the flow of realized orders on the second stage. The goal is to satisfy as many orders per day as possible with the shared vehicles. We assess our model against several benchmarks to evaluate the cost of consistency and the consolidation of goods. We observe that collaborative delivery via micro-hubs is worthwhile if the delivery time promise is larger than two hours. Noticeably, for these service promises, the costs of consistency are surprisingly low.

Ehsan Aghamohammadzadeh *(Rotterdam School of Management)*

In what settings can a priori routes facilitate time slot management for attended service delivery?

In delivery and service operations, the service provider and customer must agree on a day or time window for the service. These agreements directly impact the efficiency and effectiveness of the operations, as well as the attractiveness for the customer. In our specific problem, customers have a subscription for an at-home service with a service provider (e.g. for periodic maintenance). Each period the service provider must agree with its customers when to exactly carry out the service.

As we know the customers subscribed to the service, we want to investigate the use of fixed a-priori routes, to simplify planning both during and after the order intake. Based on these a-priori routes timeslot options can be offered to the customers, without any re-optimization being necessary. We specifically investigate under which circumstances this simpler “milk-man” route approaches perform well in comparison with the more complex dynamic approaches.

We investigate two conceptual models for designing a priori routes. In the first, customers select a day and the timeslot will be announced after the day is fully booked. In the second, customers are clustered in the a-priori routes in more detail such that they can chose from different day-timeslot combinations.

Lena Hörsting *(Christian-Albrecht University of Kiel)*

A Stakeholder-Based View of Business Cases for Integrated Urban Transport

Integrating urban parcel transport into a public passenger transport system is a promising concept to reduce traffic congestion and to use resources more efficiently. However, the last decade saw several promising pilot projects failing due to the lack of long-term support and profitability. Existing reviews show that financial viability is an important aspect for the long-term success of such projects. Integrated transport relies on a range of stakeholders, which differ in their incentives and want to profit from the system. For example, partially financing the public transit system with the revenue gained from parcel transportation may contribute to the success of a shared transport system from the point of view of public transit providers.

In this talk, we first describe the views of relevant stakeholders based on a review of the literature and case studies. Further, we propose performance indicators to evaluate a shared passenger and freight system from the perspective of the individual stakeholders. Secondly, we conceptualize an agent-based simulation model to evaluate business cases for a shared passenger and freight network.

Session 2

Steffen Elting *(University of Vienna)*

Machine-learning-based bundle generation for Collaborative Last-Mile Logistics

Steffen Elting, Jan Fabian Ehmke, Margaretha Gansterer

Service providers of Attended Home Deliveries (AHD) can reduce costs through collaboration. We investigate a combinatorial auction to determine a minimum cost reallocation of customer orders to the collaborating carriers. This Winner Determination Problem (WDP) requires as an input all carriers' bids (i.e., marginal routing costs) for all the possible bundles that can be created from the set of available orders. Computing these bids means that all m carriers must solve 2^{n-1} AHD problems, which is too expensive. Hence, previous research focused on reducing the number of necessary bid computations by concentrating on a limited set of bundles that are hopefully part of a good WDP solution (Gansterer & Hartl, 2018).

In this presentation, we explore the potential of machine learning (ML) methods to accurately predict a carrier's bid for a given bundle of orders using attributes that describe the bundle such as spatial density and size of the bundle. Sufficiently accurate predictions can then be used as a guideline for identifying the best bundles to be offered without having to query the carriers for exponentially many exact bids. We first evaluate a simple two-stage process in which the model is trained for prediction accuracy first and those predictions are used to solve the WDP afterward. Additionally, we adopt the Smart Predict-and-Optimize (SPO) framework by Elmachtoub & Grigas (2022) to let the downstream WDP steer the learning process directly to train for optimal WDP solutions instead.

References

Elmachtoub, A. N., & Grigas, P. (2022). Smart "predict, then optimize". Management Science, 68 (1), 9–26. https://doi.org/10.1287/mnsc.2020.3922

Gansterer, M., & Hartl, R. F. (2018). Centralized bundle generation in auction-based collaborative transportation. OR spectrum: quantitative approaches in management, 40 (3),613–635. https://doi.org/10.1007/s00291-018-0516-4

Daniela Sailer *(University of Augsburg)*

Demand Management for Parcel Lockers

Daniela Sailer, Robert Klein, Claudius Steinhardt

Parcel lockers are emerging as a viable alternative to traditional home delivery: When ordering goods online, customers can specify a locker instead of their home as their desired delivery address. Because the lockers are fully automated, they enable customers to pick up their parcels at any time within a given number of days. Therefore, customers benefit from increased flexibility in receiving their parcels. From the logistics service provider's point of view, parcel lockers offer a huge cost reduction potential resulting from consolidation and fewer failed delivery attempts.

To fully exploit this potential and simultaneously ensure customer satisfaction, however, successful management of the locker's capacity is crucial. Basically, this requires that an appropriately sized compartment must be available for each customer's parcel from the time of delivery up until the customer collects their parcel from the locker. This is challenging because future delivery requests, the associated parcel sizes, and pickup times are stochastic from the provider's perspective.

In this talk, we show that demand management may act as a valuable tool to maximize the number of served customers and effectively utilize scarce locker capacity. Firstly, we present the resulting sequential decision problem and highlight its main properties. Secondly, we outline an anticipatory solution approach. Thirdly, we conclude our talk with results from our computational tests that demonstrate the value of anticipation for this problem.

Session 3

Rico Kötschau *(University of Vienna)*

A Heuristic for Planning Mobile Parcel Locker Operations with Individual Customer Service

Rico Kötschau, Ninja Soeffker, Jan Fabian Ehmke

The ongoing growth of e-commerce deliveries has led to a significant increase in last-mile delivery volumes. New technologies are being investigated to provide these deliveries efficiently and in a customer-friendly manner. In this paper, we investigate mobile parcel lockers which can be parked for temporary collection of items at different locations, keeping the pickup distance to the customer short and avoiding high infrastructure costs. Mobile parcel lockers combine the possibilities of serving multiple customers with a longer stop if they indicate a willingness to walk and the delivery to conservative or remote customers with shorter stops at their doorstep. The objective is to maximize the number of served customers with a given fleet of mobile parcel lockers, considering which customers should be served individually at their doorstep (attended home delivery service) and which customers are served collectively through pickup points (mobile parcel locker service). We present heuristic approaches to solve this problem efficiently and analyze the characteristics of attended home delivery and mobile parcel locker customers.

Katrin Waßmuth *(University of Mannheim)*

On the impact of overlapping time windows in attended home delivery

Katrin Waßmuth, Niels Agatz, Moritz Fleischmann

The online grocery business continues to be rapidly growing. We are seeing highly dynamic developments with new business models entering the market and established players rethinking their delivery service offering. At the same time, research into demand management for such attended home delivery services is maturing. Contributions focus mainly on real-time operational and on tactical demand management. Those approaches commonly assume a given template of delivery time windows which serves as the basis for the retailer's offering and pricing decisions. What is much less well understood is the design of the time window template itself on the strategic level. In this paper, we contribute to filling this gap by investigating one of the dimensions of common time window templates, namely time window overlaps. Based on our analysis, we derive conditions under which it is, or it is not beneficial to offer such options. While an additional overlapping time window increases the demand volume it may result in an unfavorable distribution of demand, thereby harming delivery efficiency. We investigate this trade-off. To this end, we develop a stylized model that captures demand effects and evaluates expected fulfillment costs, using continuous approximation. We then use nonlinear optimization to identify how to best use the flexibility resulting from overlapping delivery time windows.

Liana van der Hagen *(Rotterdam School of Management)*

Effective Training of Machine Learning Models for Dynamic Time Slot Management

In grocery home delivery, retailers usually let customers select a delivery time slot for receiving their groceries. The delivery capacity - the number of vehicles and drivers - is often fixed and inflexible in the short term. To effectively use their delivery capacity, e-grocers may dynamically close time slots for certain new customers given the already accepted customer orders. We use Machine Learning (ML) to predict the feasibility of serving a customer in a certain time slot in this context. This ML model can be applied in real time during the booking process as it is extremely fast. However, training the model is computationally expensive as it requires finding feasible solutions for the Vehicle Routing Problem with Time Windows (VRPTW) to label the training instances. In this work, we focus on an active learning approach to carefully select the most informative training instances to reduce the amount of required training data and time.

Session 4

Felix Spühler *(Technical University of Braunschweig)*

Modeling Rider Preferences in a Bicycle Courier Service

Courier services have a long tradition in city logistics, primarily in the delivery of valuable documents. For short trips, bicycle couriers are a suitable delivery option to bypass traffic, congestion, and parking problems in inner-cities. To avoid turnover of employees, companies are slowly changing the focus towards their satisfaction. Thus, the main goal of an operator is not only to minimize delivery costs, but also to consider preferences of the riders.

In our problem, we assume the fleet of riders divided into two groups with different preferences. The riders in the first group prefer income and want to take the most direct paths between the customers in their tour. The riders in the second group prefer safety and therefore accept detours and less income. Altogether, we want to serve all customers while following the preferences of the riders as much as possible. To a certain extent, safety-oriented riders can be forced to take direct paths between the customers, which is penalized in the objective function.

We formulate a pickup and delivery vehicle routing problem with time windows based on a multigraph representation. Between each pair of locations, we use two arcs, one representing the most direct path and one the detour paths incorporating the safety preferences. We implemented a mixed integer formulation to solve smaller instances to optimality. Additionally, we implemented an adaptive large neighborhood search that takes the multigraph structure into account. Preliminary results suggest, for example, good-quality solutions seek the switch from detour arcs to the directs arcs earlier in the tour to gain buffer for time window restriction later in the tour.

Jens Frische *(WHU – Otto Beisheim School of Management)*

Robust models for strategic first-mile capacity planning under uncertainty

Jens Frische, Arne Strauss

We consider a strategic first-mile logistics challenge of planning transport capacities in collaboration with a carrier collecting parcels from businesses on a fixed schedule with time windows. Our research project examines a key question for strategic first-mile routing decisions under uncertainty.

The decision maker must select the appropriate capacity (the supply side of the equilibrium), which is fixed before all demand and network information is available. Deciding the capacity levels bears the risk of inefficiency from high capacity costs (if the level is set too pessimistic) or failure to serve customers (if the capacity is set too optimistic). We explore the suitability of robust vehicle routing models for real-world scenarios, considering the uncertainties inherent (e.g., demand fluctuation) or exogenous (e.g., longer travel times due to congestion) to such operations.

Our main contribution is the empirical validation of a recent robust vehicle routing problem in real-world applications to obtain more efficient routing plans while being resilient against unfavorable materializations of uncertain factors.

University of Augsburg

Robert Klein

David Fleckenstein

Vienna Klein

Daniela Sailer

Jim Schoppa

Technical University of Braunschweig

Dirk Mattfeld

Felix Spühler

Christian-Albrecht University of Kiel

Catherine Cleophas

Lena Hörsting

European University Viadrina Frankfurt (Oder)

Charlotte Köhler

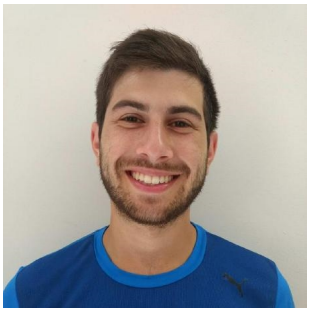
Erasmus University Rotterdam

Niels Agatz

Remy Spliet

Luuk Veelenturf

Ehsan Aghamohammadzadeh



Gustavo Hurovich

Liana van der Hagen

Lancaster University

Alp Arslan

University of Mannheim

Moritz Fleischmann

Katrin Waßmuth

Bundeswehr University Munich

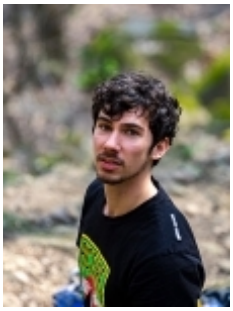
Claudius Steinhardt

Matthias Soppert

Otto von Guericke University of Magdeburg

Marlin Ulmer

Charlotte Ackva



Florentin Hildebrandt

WHU – Otto Beisheim School of Management

Arne Strauss

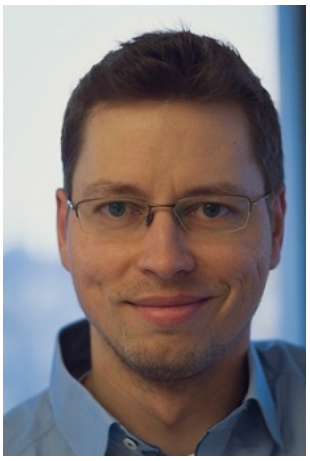
Jens Frische

University of Vienna

Jan Fabian Ehmke

Steffen Elting

Peiman Ghasemi



Rico Kötschau