

Delivery trailer for parcels

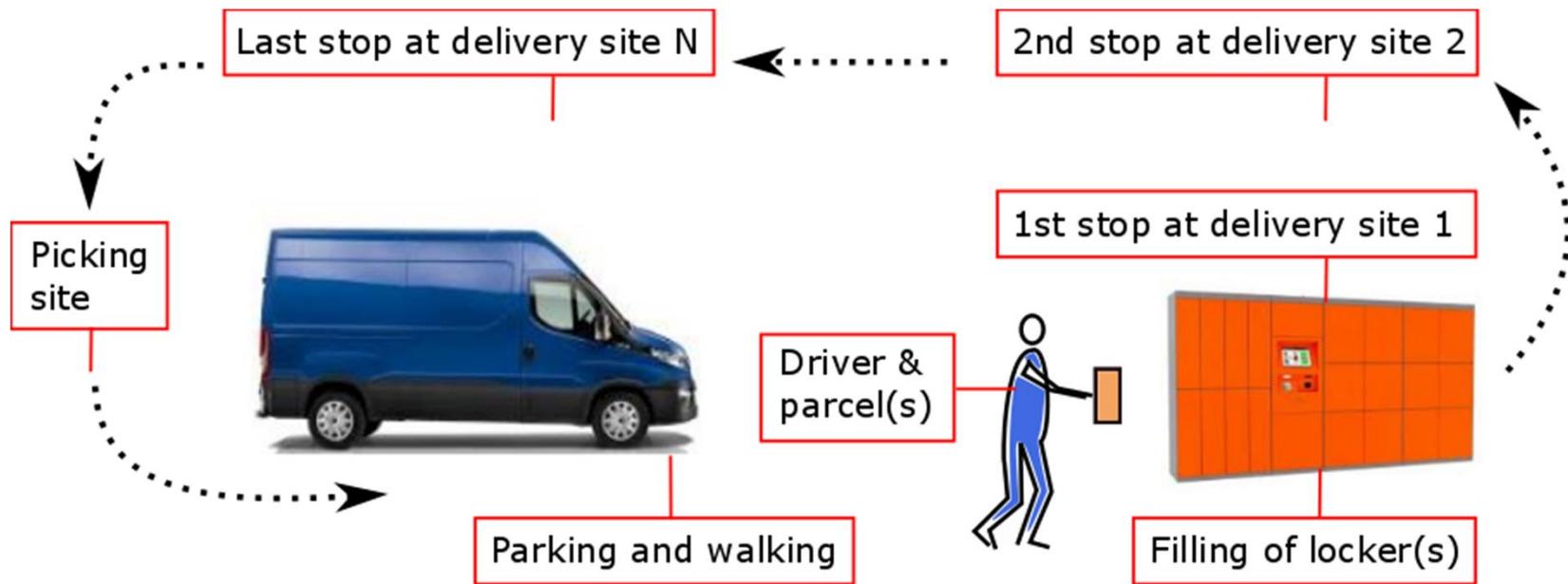
New solutions to last mile problem

www.pickdelso.com

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Known problem

- Each stop at a locker system consumes time
- Sometimes there is only one parcel to be delivered



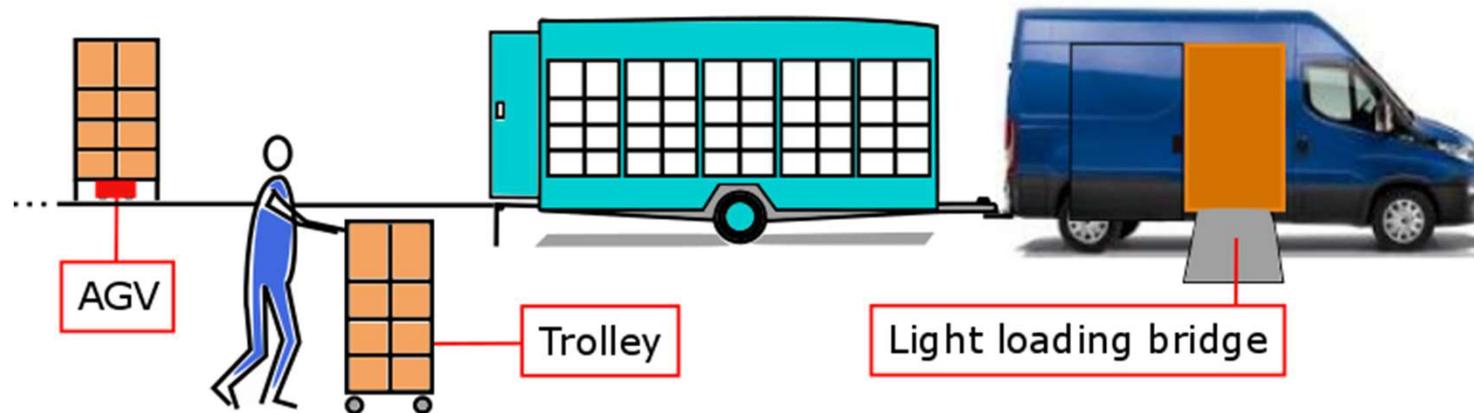
Solution to problem

- Capacity is increased with Delivery trailer
- Delivery trailer is parked at some delivery site
- In addition, at least one fixed locker system is visited within a delivery cycle



Loading and transportation

- The delivery cycle and transportation has a starting point (it is, for example, a sortation hub)
- Delivery trailer is loaded in this example by AGVs
- Trunk of the van is loaded by the driver



Types of parcel delivery

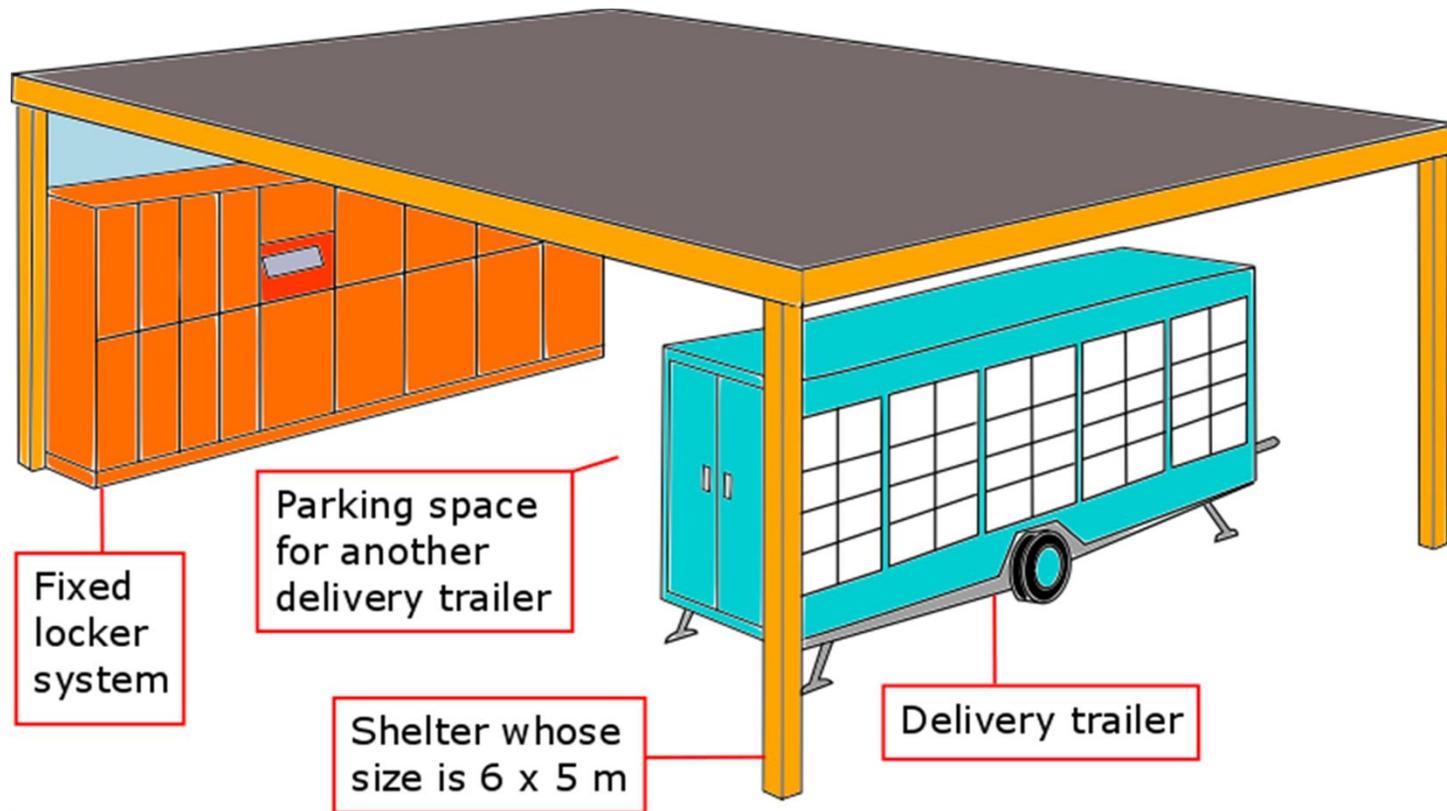
- **Type 1** : consumers order products online stores and the products ordered are delivered to the consumers
 - This means: lots of parcels are delivered from the sorting hub to delivery sites but much less vice versa
- **Type 2**: consumers send packets to each other
 - This means: approximately the same number of parcels are delivered from the sorting hub to delivery sites than from the delivery sites to the sorting hub
 - Sender of a parcel (usually) don't know the recipient's timetable (thus a long delivery time window is needed)

Locker system types

- Delivery trailer is a moveable locker system
 - Delivery time window is, for example, one day
 - Suits for **Type 1** delivery
- Fixed locker system
 - Delivery time window is, for example, one week
 - Suits for **Type 2** delivery
- The same delivery site may have:
 - Delivery trailer for **Type 1** delivery
 - Fixed locker system for **Type 2** delivery

Delivery point

- Two various locker systems at the same site



Tasks at delivery point

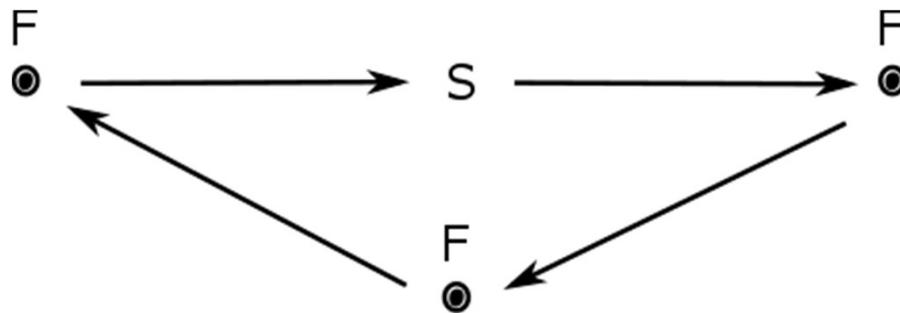
- Parking of Delivery trailer onto the parking space
- Taking a trolley out of the van trunk
- Filling the fixed locker system with parcels until the trolley is empty
- Collecting parcels from the fixed locker system into the trolley and moving the trolley into the trunk
- Detaching Delivery trailer from the van
- Attaching the van to Delivery trailer shown in the previous slide (its delivery time window is ended)

Delivery plans

- The following slides present four delivery plans
- The volume of the van trunk is one *unit*
- Also the volume of Delivery trailer is one *unit*
- Capacities of the plans are estimated in *units*
- Transportations are performed within a day
- The plans concern the same delivery area and the transportations have the same starting point (S)
- Symbols: F = fixed locker system, M = movable locker system (i.e. Delivery trailer), FM = the both systems

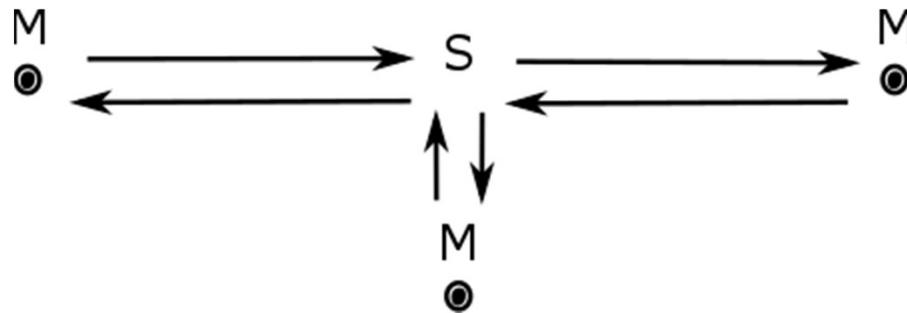
Plan 1

- Only fixed locker systems in use
- One transportation for the all three delivery sites
- Capacity of the van trunk is divided among the three fixed locker systems
- Capacity per delivery site is $1/3$ *unit* and the total capacity is one *unit*



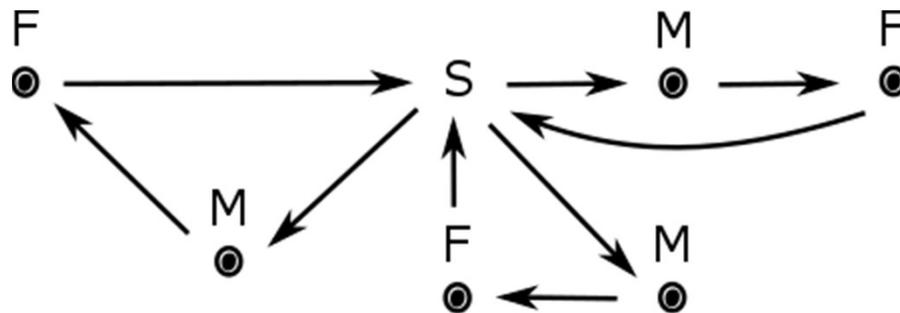
Plan 2

- Only movable locker systems in use
- One transportation per delivery site
- Capacity per delivery site is one *unit* and the total capacity is three *units*
- Problem: this plan does not serve customers who want to have one week delivery time window



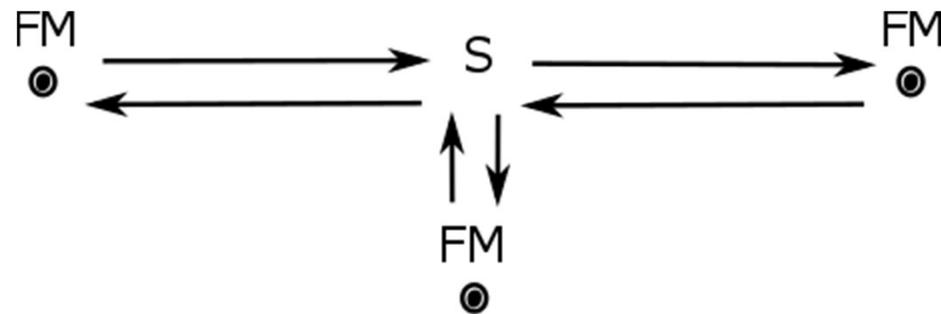
Plan 3

- The both locker systems are in use
- One transportation per delivery site
- Solves the problem of Plan 2
- The total capacity is four *units* assuming that it is the sum of the total capacities of Plan 1 and Plan 2
- Problem: the number of stops is high (six stops)



Plan 4

- The both locker systems are arranged in the three delivery points
- One transportation per delivery site
- Solves the problem of Plan 3 (now only three stops)
- The total capacity is four *units* assuming that it is the sum of the total capacities of Plan 1 and Plan 2

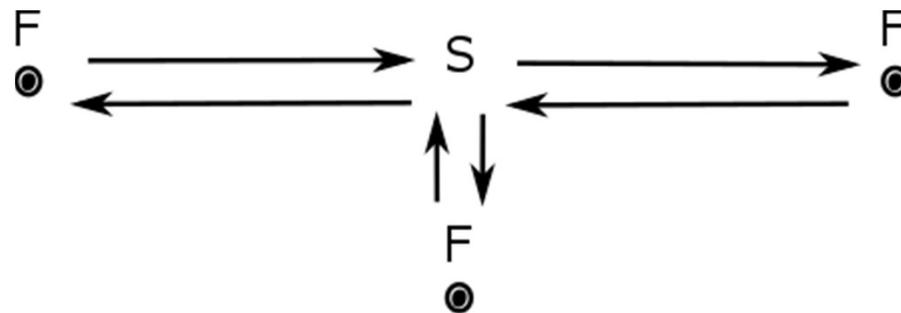


Other delivery plans

- The following slides present delivery plans 5, 6, and 7
- Assumptions are the same as in the previous plans
- Plan 5 explains a problem when using only *fixed* locker systems and *one week* delivery time window
- Plan 6 explains another problem when using only *movable* locker systems and *one day* delivery time window
- Plan 7 concerns use of the both locker systems

Plan 5

- Only fixed locker systems in use
- One transportation per delivery site
- Because of the one week delivery time window many of the lockers are occupied for days
- Problem: the total capacity cannot be much more than one *unit* (there is not enough empty lockers)



Plan 6

- Only movable locker systems in use
- One transportation per delivery site
- Each delivery site has seven Delivery trailers,
- Problems: an investment cost for 21 trailers is high and the trailers need at least 21 parking spots

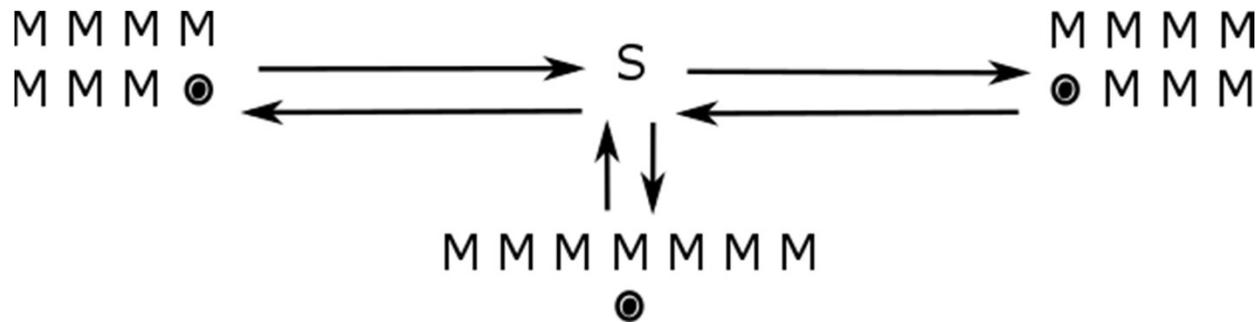
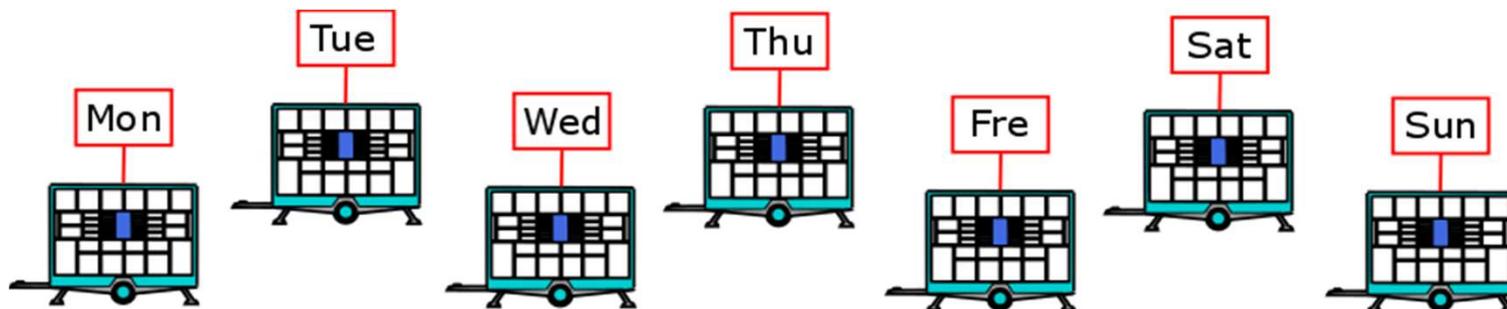


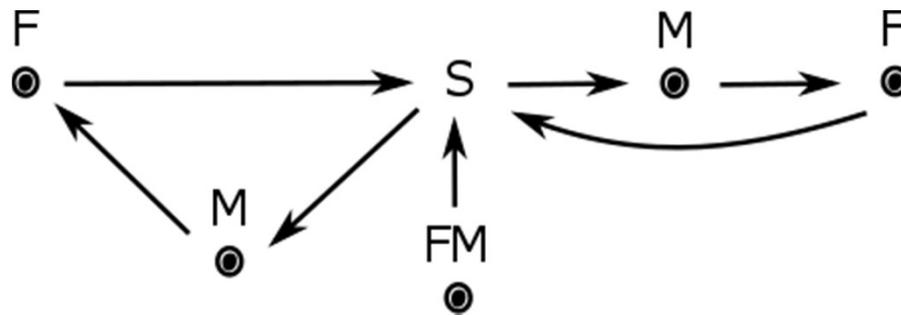
Illustration of Plan 6

- One Delivery trailer for each week day (Mon – Sun)
- Each trailer is small-sized and can be transported by a car, for example, by a taxi
- Each day a trailer, which has located at the delivery site the longest time, is replaced with another trailer



Plan 7

- The both locker systems and one delivery point
- Delivery point requires at least one parking spot (size 5 m × 2.5 m) and a road to the parking spot
- It is reasonable to use delivery points when possible
- It is reasonable to utilize existing fixed locker systems to minimize investment costs



Enhancing logistics

- Many customers prefer one week delivery time window
- One week delivery time window and fixed locker systems are a combination which may make logistics inefficient (as illustrated in slide 2 and plan 1)
- Logistics can be enhanced by Delivery trailers
- In plan 3 and in plan 4 the total capacity is four times greater than in plan 1

Adjusting time windows

- The delivery time windows are adjusted in the following manner to guide customers to prefer Delivery trailers:
 - a customer can collect a parcel from a fixed locker system only if the customer selects a delivery time window that is longer than day
 - if the customer selects one day delivery time window, the parcel is available in Delivery trailer
 - the customer gets a small discount by selecting one day delivery time window

Options

- A starting point of transportation is in the parcel delivery, for example, a (private) sortation hub or a postal sorting hub (owned by a state)
- Alternatively, the starting point can be a warehouse or an operations centre
- A customer may get more than one parcel
- Delivery trailers provide significant cost savings, especially when a goods-to-man method and/or AGVs are in use in the starting point