City Crowd Logistics

Can commuters solve the Last-Mile Delivery Problem?

### Motivation

- **Urbanization**: Growing population in cities, expected to reach 80% by 2100
- **E-commerce growth**: Mean annual growth of 10%, projections to increase up to 20% in 2018
- **Customers’ needs**: Customers are more demanding in terms of level of service and flexibility
  - Demand for speed (1-hour, 2-hour deliveries)
  - Delivery alternatives, like trunk deliveries, pickup points, etc
  - Customers have small willingness to pay

### Concept:

- **Classic Internet**
- **Physical Internet (x)**
- **City Crowd Logistics Net**

### Methodology

- **Strategic-Tactic Network Design**: 2-stage stochastic program for expected cost minimization
  - First stage decisions: physical locations for redistribution operations. Flow pre-allocation to the crowd
  - Recourse decisions: Flow allocation for professional courier services (backup process)
  - Stochastic capacity: Random time-dependent crowd flows

### System Representation

- Operational Matching of Parcels & Commuters
  - Reduce number of routing options (rules, recommender, push-notification)
  - Match parcels to commuters by setting prices for each arc of each routing option (clock auction, surge price)

### Impacts and Support Technology

- **Direct Impacts**:
  - Optimized network design
  - Online algorithms for resource allocation, routing and scheduling optimization
  - Reduction of last-mile delivery costs
  - Reduction of freight vehicle travels

- **Indirect Impacts**:
  - Reduction of emissions, congestion, and public space use

- **Support technology for Off-line pickups**:
  - Specialized parcel lockers (Boxes)

- **Mobile app for the Marketplace**:
  - Integrate shippers, carriers
  - Manage the crowd
  - Resource management
  - Decision support system
  - Tracking technology

- **Our Partners**:
  - 10 Parcels 12:00
  - 5 Parcels 12:20
  - 10 Parcels 12:30

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Clock auction price over time

- **Auctioning**:
  - Pricing mechanism for competitive price discovery and allocation of parcels to commuters

Space-Time Network	Time-dependent profile of arc (t, l)

Routing Options for a Parcel

- Source:
- Receiver
- Sender
- Min-Depot
- Reverse
- Mini-Depot / Pick-up
- Sort / Depot

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Clock auction price over time

- Latest delivery: 18h
- Earliest pickup: 0h
- Delivery time: 20 min
- Buffer: 10 min

- Case A: Price paid to sender
- Case B: Price paid to receiver
- Case C: No contact, order taken before

- Case D: Price paid to sender
- Case E: Price paid to receiver
- Case F: No contact, order taken before

- Case G: Price paid to sender
- Case H: Price paid to receiver
- Case I: No contact, order taken before

- Case J: Price paid to sender
- Case K: Price paid to receiver
- Case L: No contact, order taken before