Collection-and-Delivery Points in Last Mile Distribution

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Motivation

- Increasing adoption of internet and smartphones

- Consumer preferences changing to online shopping

- Consumers want flexibility in delivery schedule

- eCommerce growth creates challenges for last-mile delivery

- CDPs enable reductions in travel time, travel distance, delivery cost, and emissions

Key Question

- Create an optimal distribution network design which:

  - Integrates CDPs in network flow

  - Consolidates return flow and re-delivery attempts at CDPs
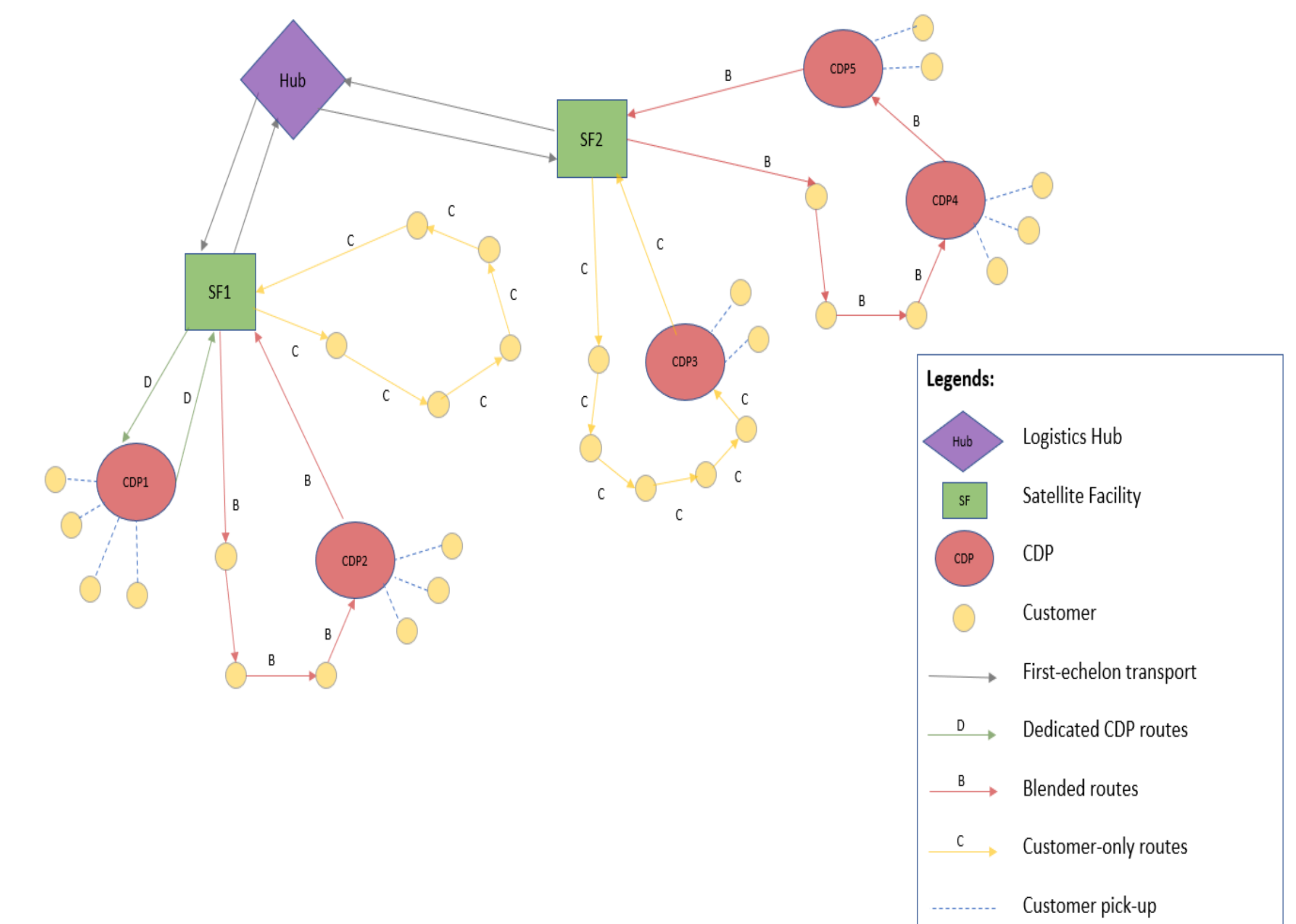
Relevant Literature

- Nagy G, Salhi S (2007) Location-routing: Issues, models and methods

- Winkenbach M, Kleindorfer PR, Spinler S (2016) Enabling Urban Logistics Services at La Poste through Multi-Echelon Location-Routing

- Merchan D, Winkenbach M (2018) High-Resolution Last-Mile Network Deisgn. City Logistics 3

Warehousing operations

Outdoor logistics operations

Line haul transportation

Last-mile delivery

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The Problem

- CDPs aggregate part of the customer demand

- CDPs can also be used as nodes to streamline return flow and redelivery attempts

- Location routing problem - Combines location and routing optimization

- Large scale / NP-hard problem

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Methodology

- Continuum approximation based route length and routing cost estimation

- Multi-stage non-linear optimization model

python

GUROBI OPTIMIZATION

Design

Legends:
- Hub — Logistics Hub
- SF — Satellite Facility
- CDP — CDP
- Customer
- First-echelon transport
- D — Dedicated CDP routes
- B — Blended routes
- C — Customer-only routes
- Customer pick-up

Expected Contribution

- Optimal network design to deliver sustainable cost savings

- Hub
- SF
- CDP

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