Urban Parcel Logistics Hub and Network Design: The Impact of Modularity and Hyperconnectivity

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Research Overview

Challenge: The parcel logistics industry is under pressure to meet the worldwide challenges to efficiently and sustainably offer faster and more precise pickups and deliveries across the world’s urban megacities.

Goal: Conceptual enabling of a new generation of highly meshed urban parcel logistic networks of interconnected open hubs, breaking away from the currently dominating hub-and-spoke network topology, supporting live consolidation and routing for fast, precise, and cost efficient service.

Methodology: Applying modularity & hyperconnectivity concepts underpinning the Physical Internet in designing urban parcel logistic hub networks & operations.

Multi-tier Urban Pixelization

Smart Dynamic Hub-based Parcel Routing and Consolidation

Principles:
• Implement hub-based sorting and consolidation so as to be easy, cheap, fast, reliable and safe.
• Consider options for relay-based consolidation of parcels up to hub along their planned route from source to destination.
• Smartly decide upon consolidation actions at each hub at each arrival of parcels, exploiting all current information on parcel status, consolidation options, and expected parcel demand.

Modular Containerization

• Ultimately: Physical Internet Packs, Boxes and Pods.
• Short term:
  • As-is: packaged parcels as packs
  • Boxes: Tote & Pallet/cage-size modular containers
  • Adapted handling carts, racks, devices, robots, and vehicles.

Hyperconnected Gateway Hub

The meshed networks of adjacent planes are connected by inter-hub links.

Future Work

• Design and operation of modular-container & consolidation hubs.
• Assess, instrument and pilot testing the proposed concepts.
• Extend conceptual framework beyond urban and parcel contexts.

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