Conceptual Framework for Hyperconnected Package Transport Logistics Infrastructure

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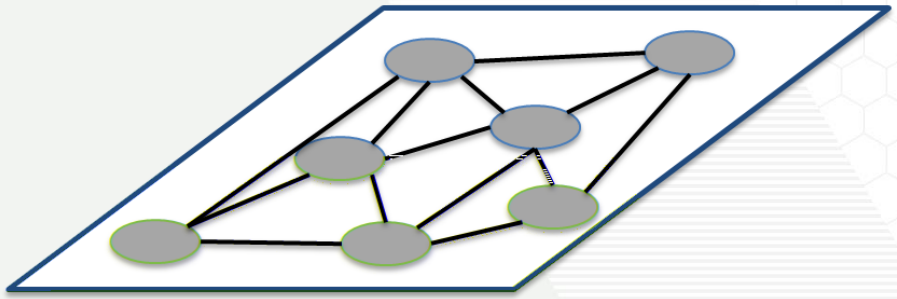
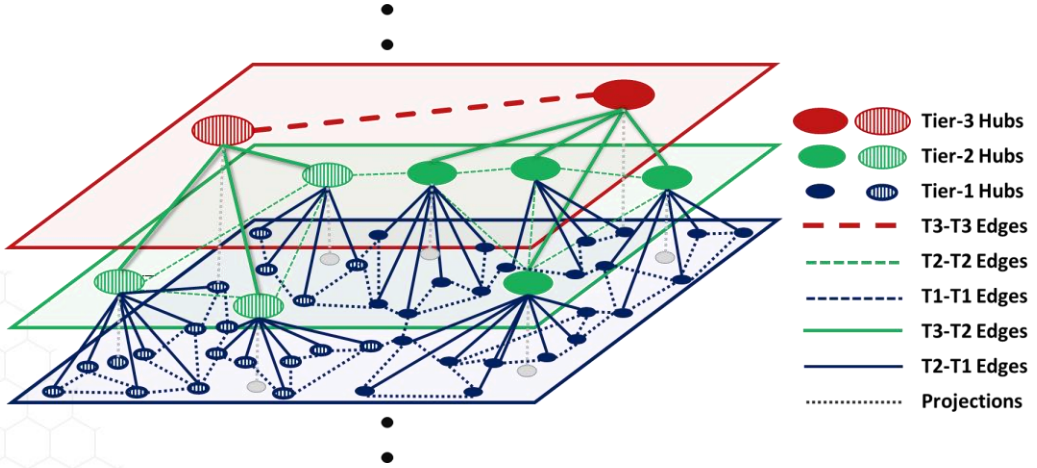
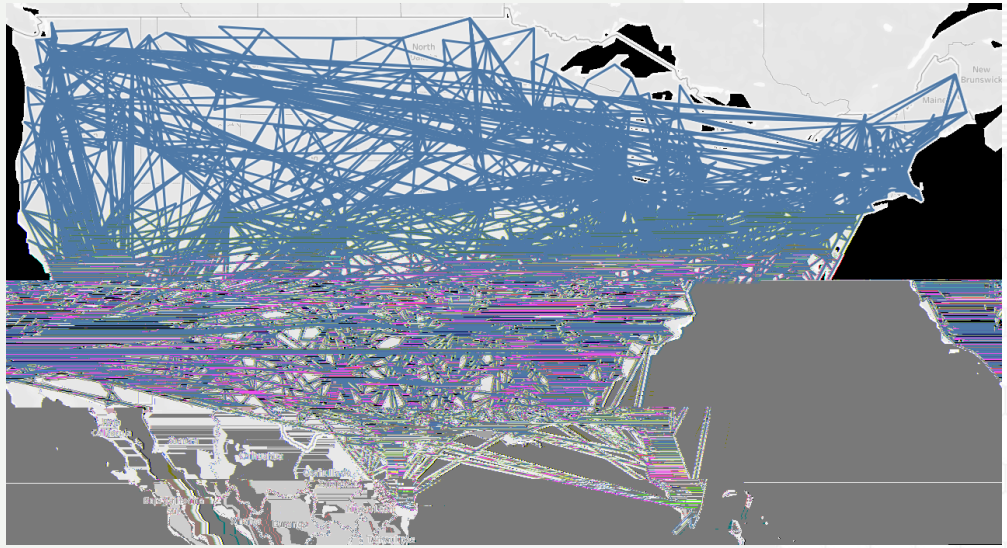
LOGISTICS WEB OF MULTI-TIER MESHED NETWORKS

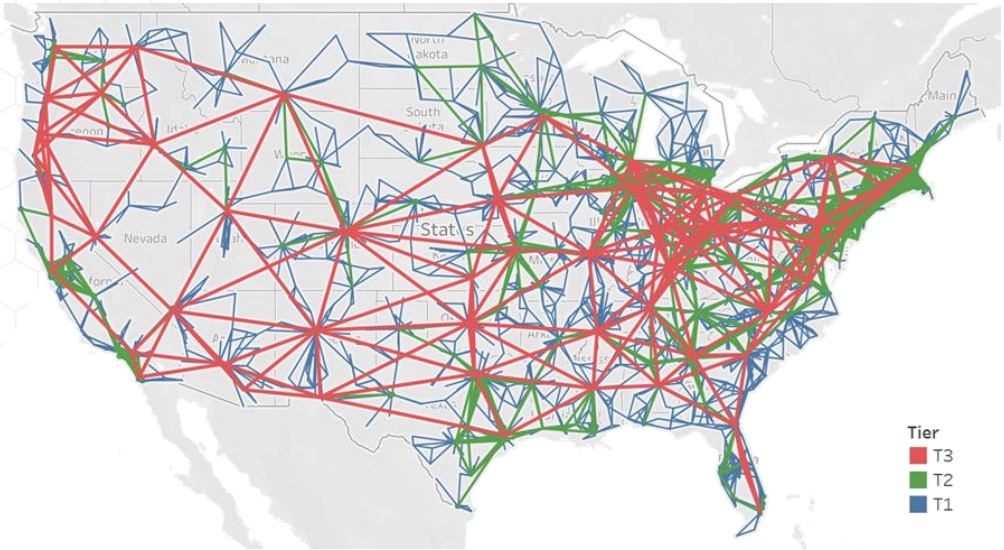
Consolidated shipping lanes providing same service







Typical logistics flow in a traditional logistic network (P2P and H&S)

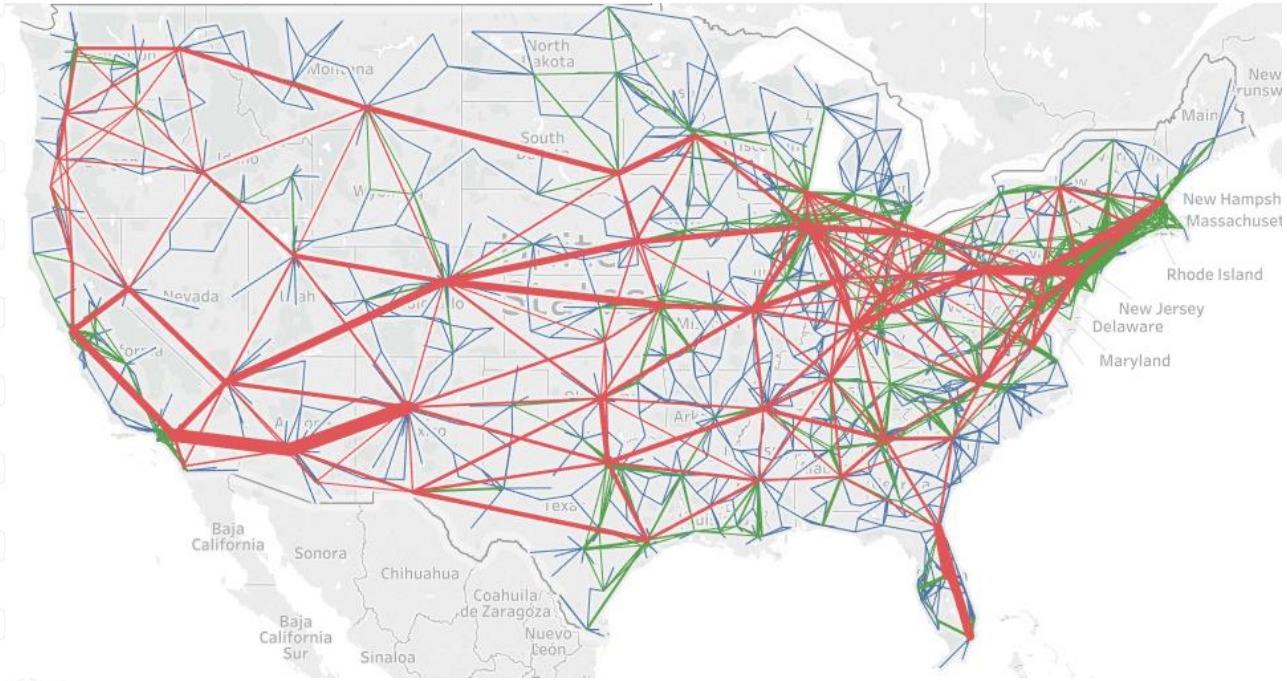


Hyperconnected Package Transport Logistics Infrastructure based on Multi-Tier Mesh Networks

HIERARCHICAL MESH ROUTING

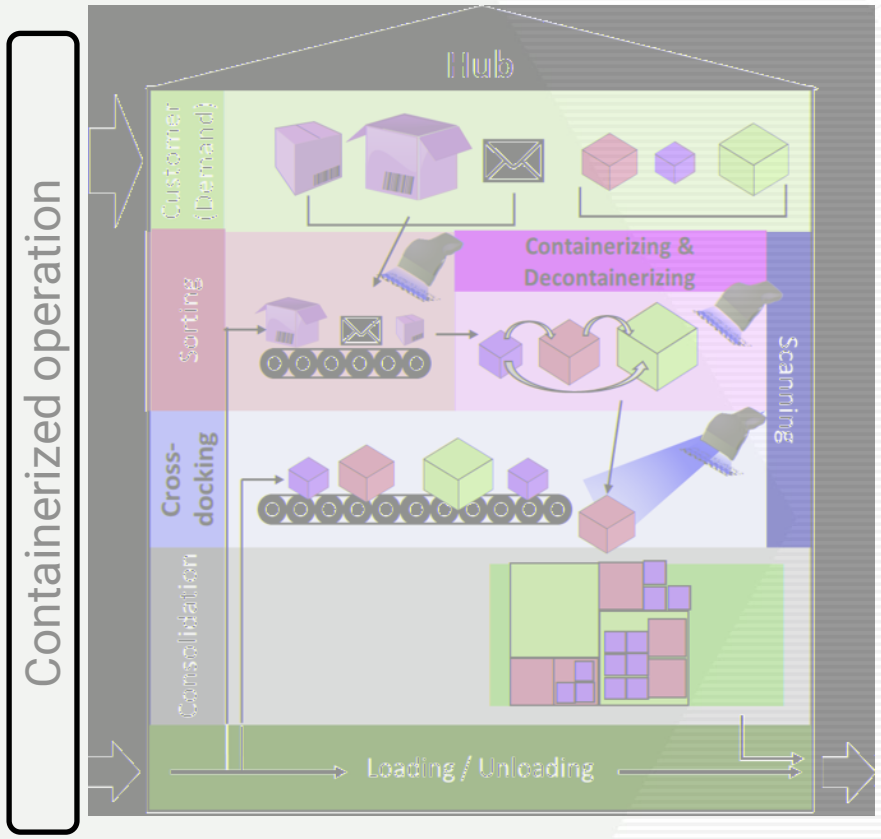
- Parcels are elevated to upper tier based on distance and consolidation
- More consolidation achieved in higher tier

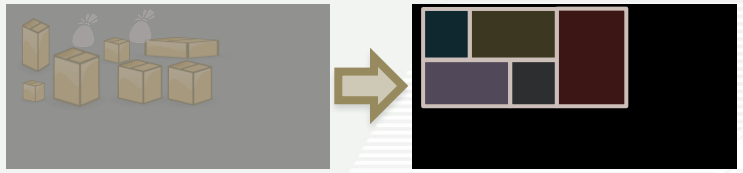
Expected Flows in a Tiered Mesh Network



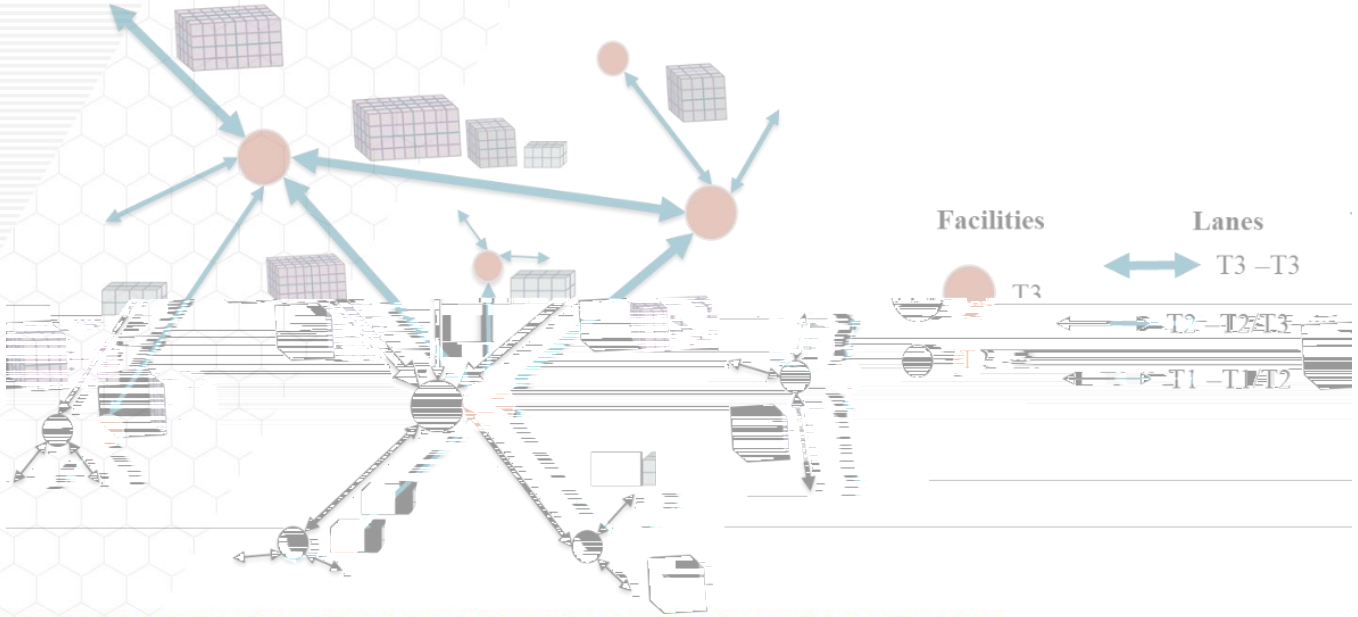
Tier 3 Hub Tier 2 Hub Tier 1 Hub

MODULAR CONTAINERIZATION

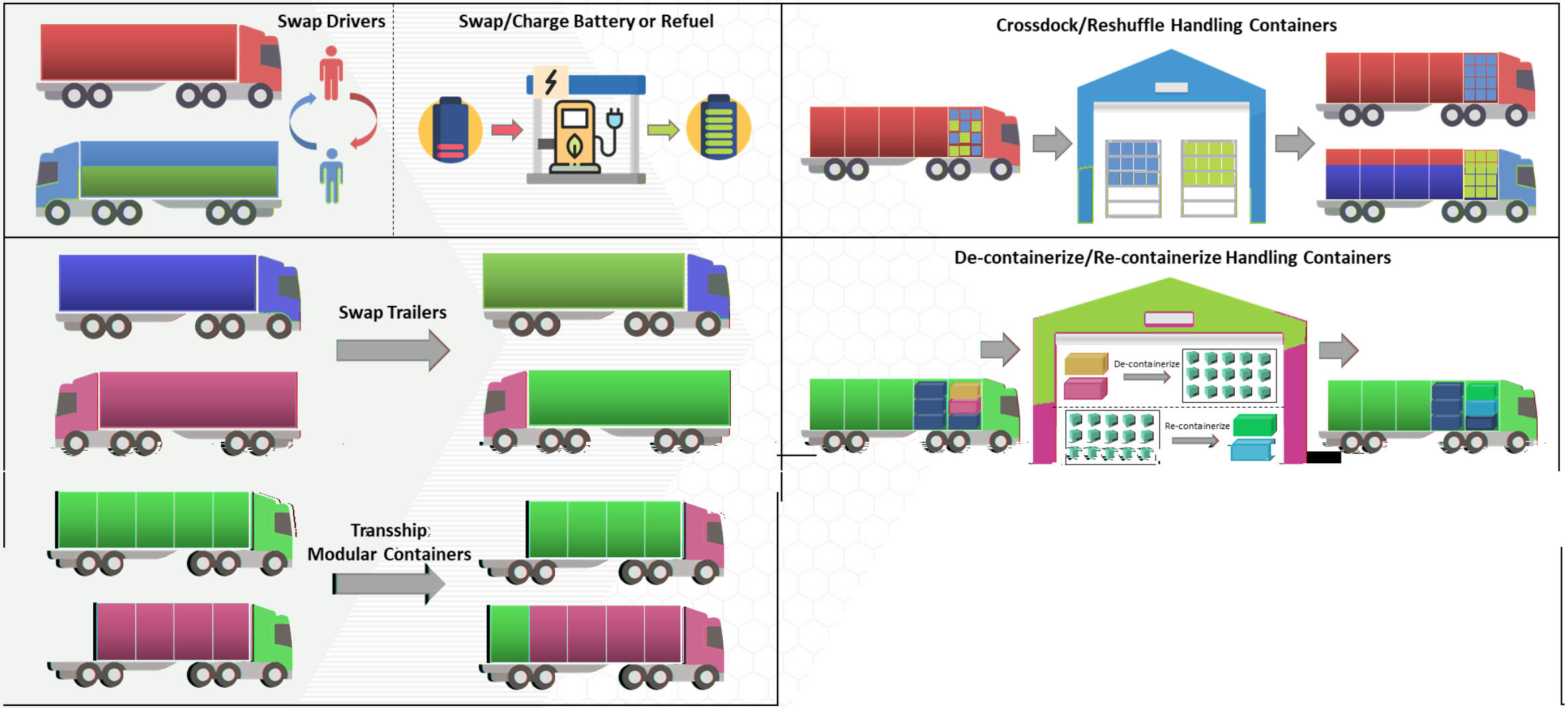




- **Easy to handle, store and transport**
  Potential to reduce handling effort with standard dimensions and consolidation
- **Robust & reliable**
  Potential to increase truck fill rate by reducing stacking constraints
- **Automation potential**
  (un)Loading, container crossdocking
- **Facilitates dynamic consolidation & deconsolidation across the network**
- **Smart, more reliable and efficient tracking** (e.g., RFID on containers)

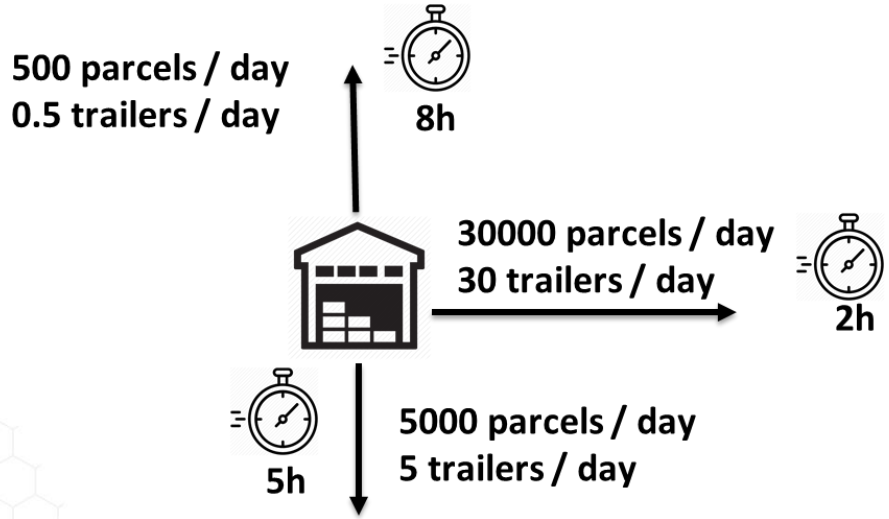


HUB-BASED OPERATIONS



SERVICE-DRIVEN SHUTTLING & ON-DEMAND TRANSPORTATION MODELS

- Transportation planning for meshed network
- Find total flow in trailers on all lanes
- Higher frequency but reduced trailer size for low flow lanes
- Lower frequency but larger trailer size for high flow lanes



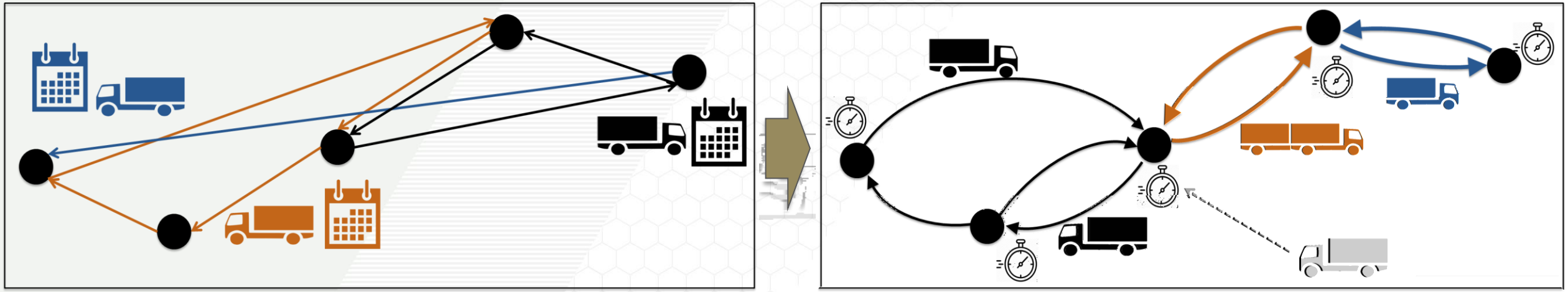


Illustration of traditional planned transportation (left) and service-driven shuttling with on-demand transportation (right) over network of 5 logistic hubs

CONCLUSION AND FURTHER RESEARCH

- Introduced a functional design for a Hyperconnected Package Transportation Logistics Infrastructure that facilitates flexible operation with potentially lower cost and higher resilience and sustainability, while providing better work environment for drivers

- Foundation of a logistics framework that enables the interactions between the tiers of the logistics network, such as the synchronization and coordination of the fleet and hub operations

- Involves optimization and modeling challenges that are related not only to the operations of vehicles and facilities in each layer, but also to the interactions between the tiers of the logistics network, such as the synchronization and coordination of the fleet and hub operations

Thanks

Questions and comments are welcome

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