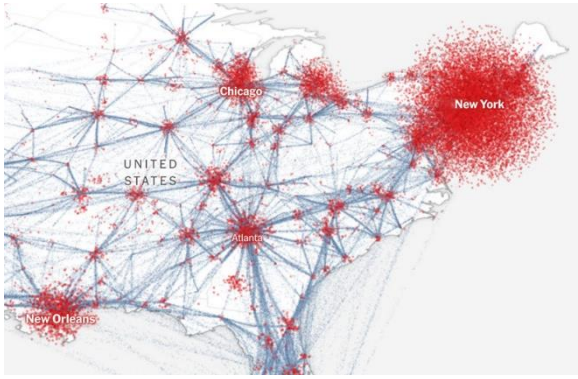
Modeling Virus Spread in Air Travel Networks

Comparing Hub & Spoke and Point to Point Network Structures



Problem description

Aviation networks are mostly organised in a hub & spoke (H&S) structure whereby passenger flows from smaller airports are consolidated in larger hubs. While a H&S structure is efficient and economic from an operational point of view, it is assumed that the mingling of multiple travel flows accelerates the spread of diseases throughout the world. A competing paradigm, point-to-point (P2P) aims to connect all hubs directly with a lesser reliant on hubs. While P2P might reduce overall travel times and offer benefits over H&S during public health disruptions it is less cost efficient.

Assignment

The aim of this graduation project is to gain an insight in how different network structure designs affect virus spreading with an application to aviation networks. The research primarily focuses on the comparison of the two competing network paradigms being H&S and P2P. The following activities will be part of the graduation project:

- Simulate virus spread throughout a fictive aviation network using alternative H&S and P2P network structures
- Apply the model for a (sub-)network of air travel based on actual connections and demand estimates
- Evaluate how the H&S and P2P model influence virus spread under various epidemiological circumstances and derive policy recommendations

Candidate

- Should have coding skills in Python, R or similar
- Have affinity and/or is intrigued by epidemiological (e.g. SIR) modelling
- Affinity with system design and/or design thinking is a nice to have

Research group

Smart Public Transport Lab at T&P, in collaboration with partners at IDE (specifically, is part of the "Designing Pandemic Antifragility for Multimodal Transport Hubs" project) and the data team at the Royal Schiphol Group.

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