Generating Synthetic Populations Without Borders: A Geographically Independent Approach

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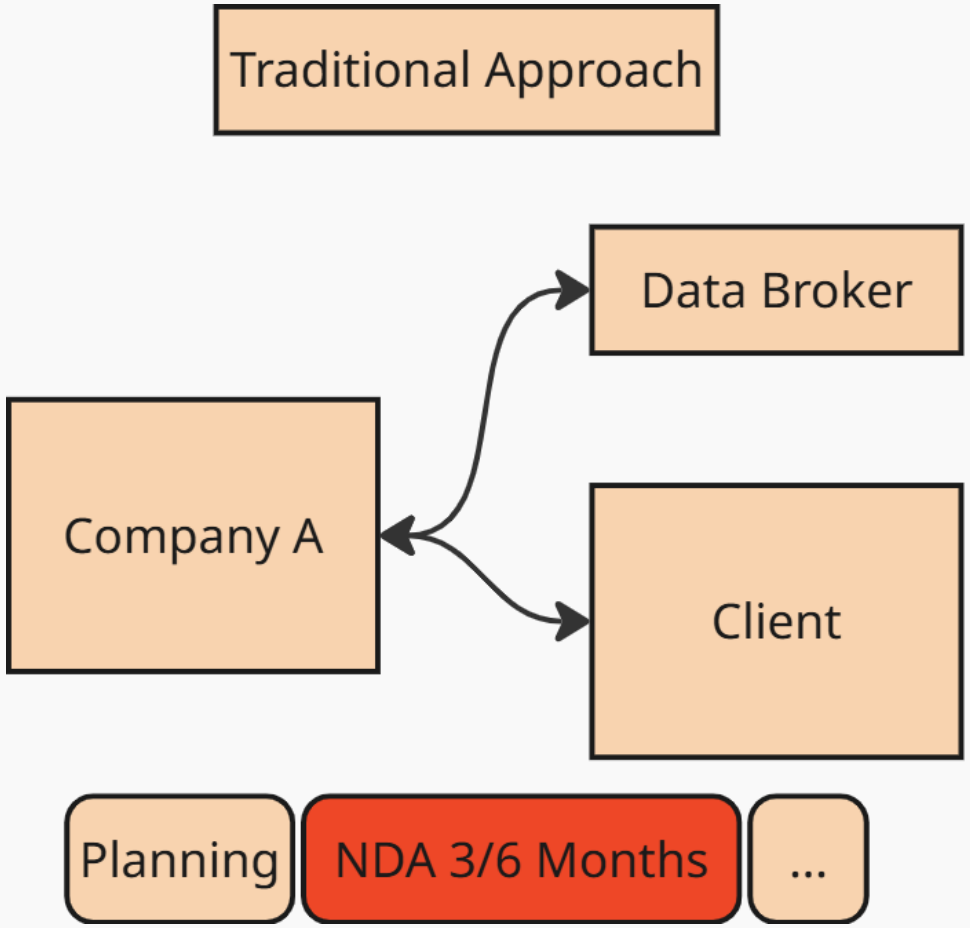
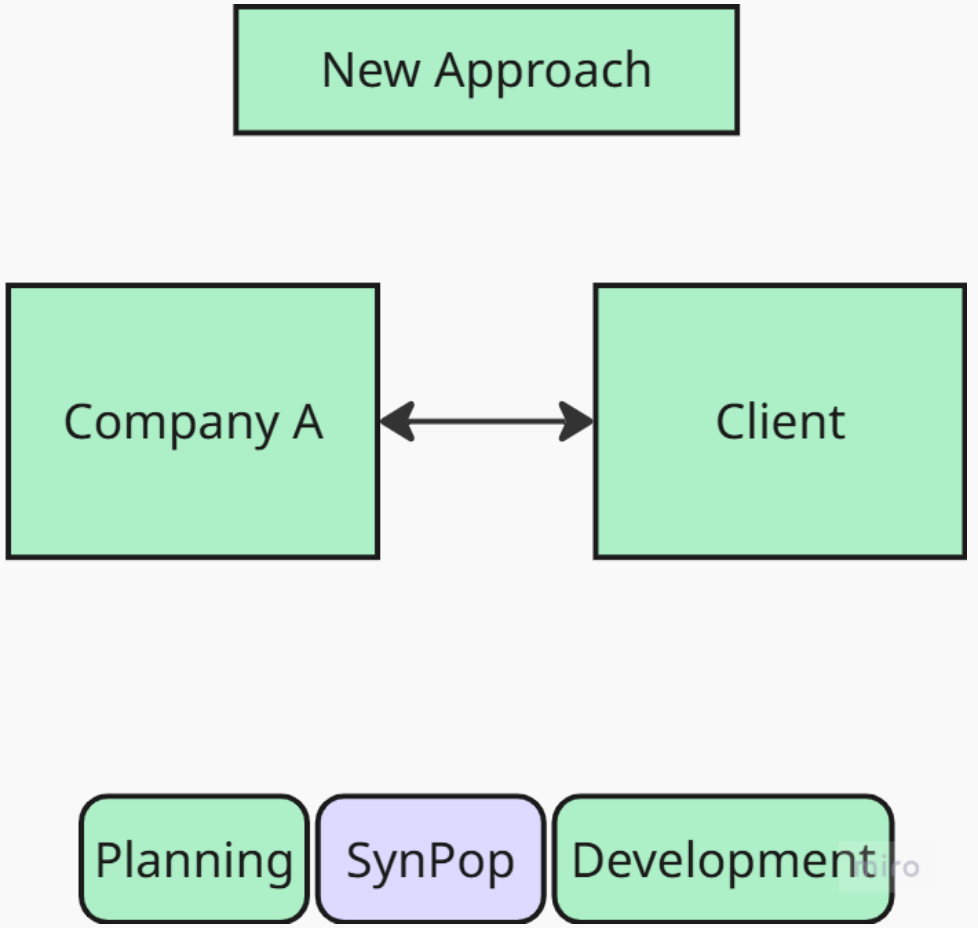
Introduction

- A framework that consists of several processes that allow users to generate on-demand household level characteristics for any county/city/town across the USA, Japan, Europe and the UK.
- This method demonstrates how jurisdictional barriers to data acquisition, wrangling and implementation from various countries can be overcome.
- We demonstrate SynPop in a mobility use case showing how realistic trips can be generated for various insights such as, CO2 estimation, traffic demand and more.

Purpose





Synthetic Population Generator

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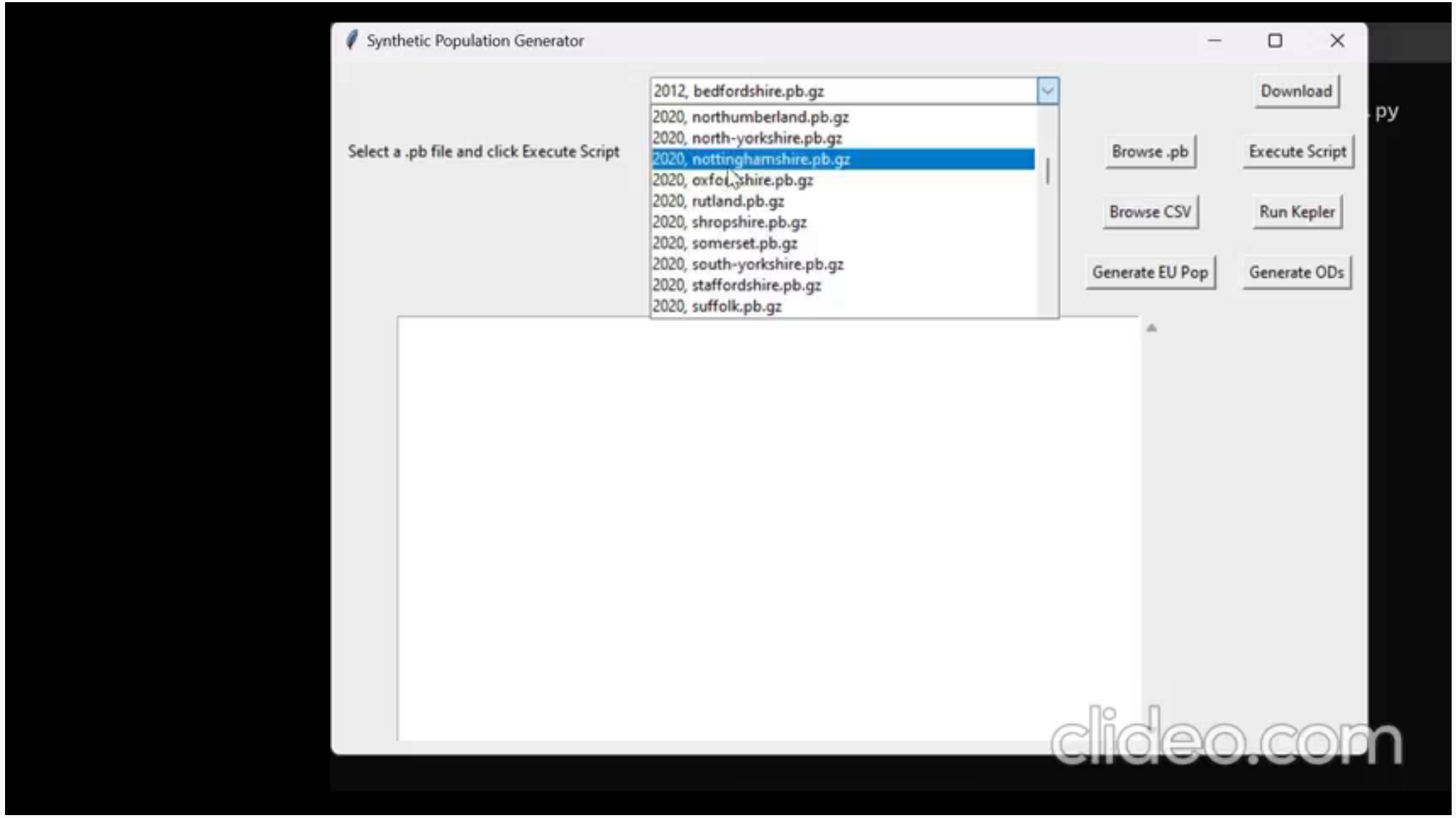
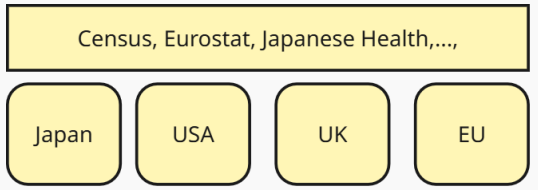
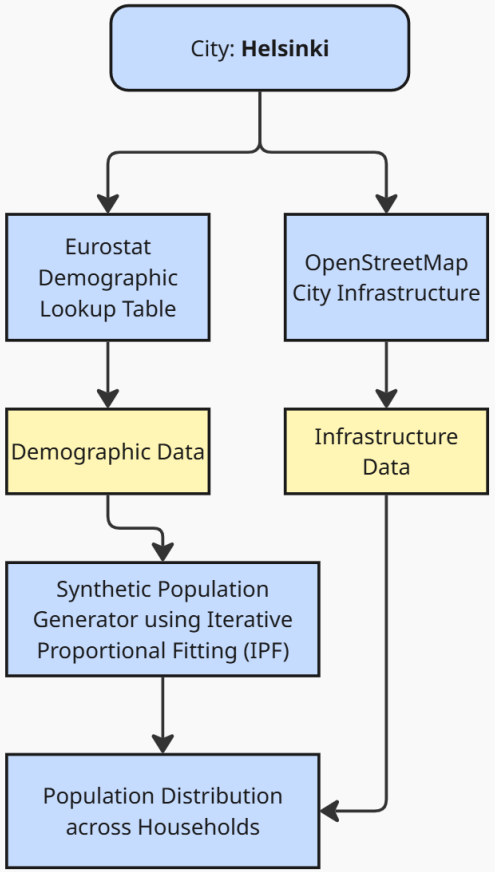
- The Synthetic Population Generator creates realistic synthetic populations for the UK, USA, Japan and Europe
- Utilises SPC (Synthetic Population Catalyst) backend for UK cities, builds populations based on US census for USA, Eurostat dataset for European cities and Japanese census for Japan.
- Generates and visualises synthetic populations and integrates with GPT locations to produce synthetic ODs and transport simulation.
- Creates agent-based simulations of synthetic ODs to produce trips reflective of real-world trips from households to places of interest (POI) and simulates these trips using a SUMO simulation.

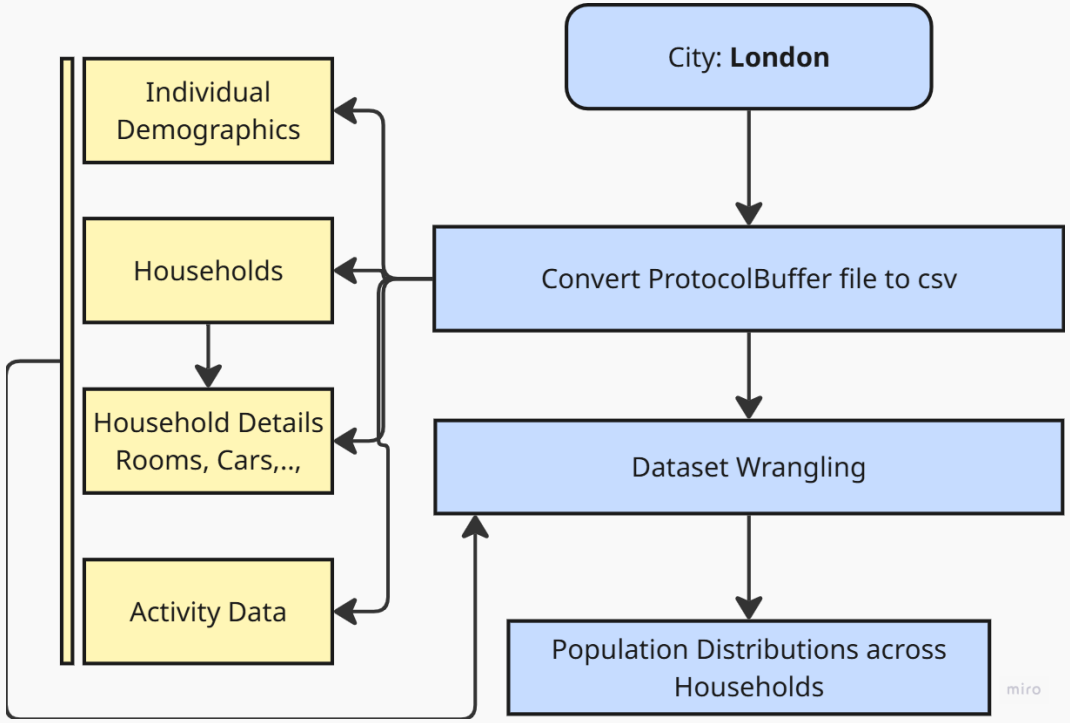
Demo



Methodology (I)



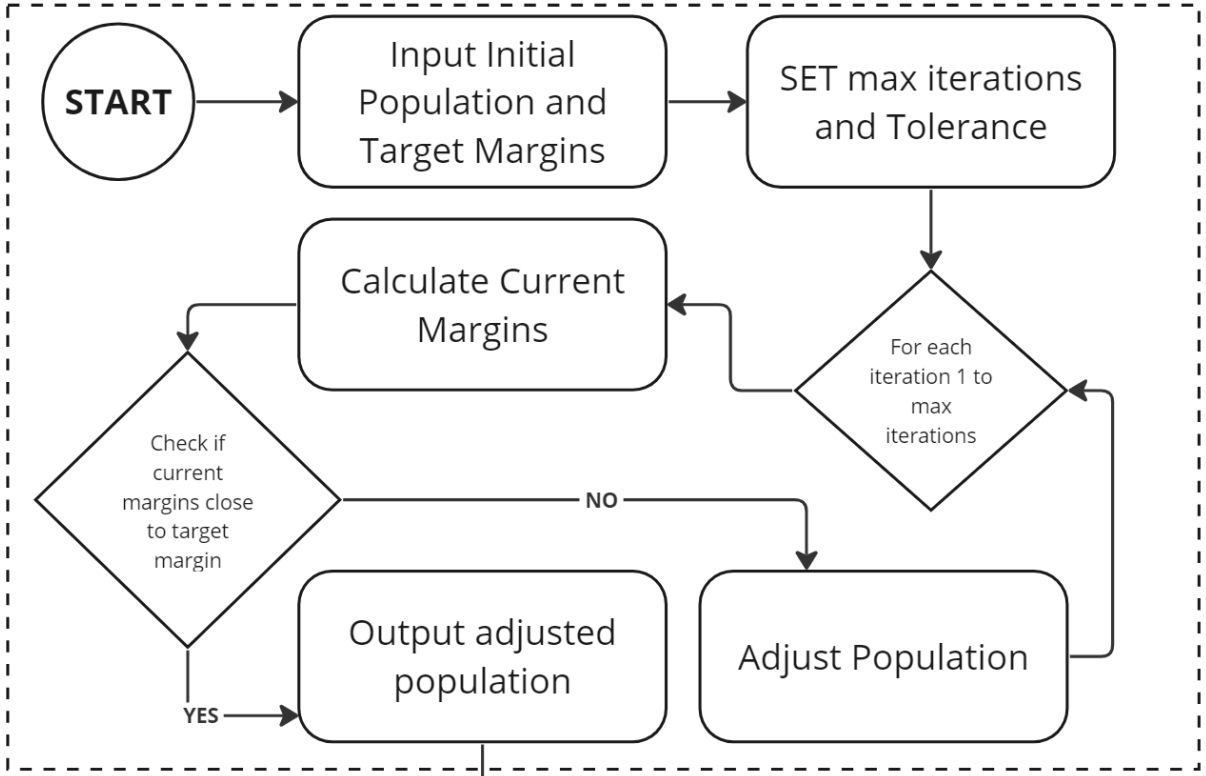




Simulating Mobility (Use Case)

Methodology (II)

https://www.sciencedirect.com/science/article/pii/S2352146516306925



- **Target Margins = Input Proportions for each age-group**
- **Tolerance: If the difference between the current margins and the target margins is less than the tolerance for all categories, the algorithm stops.**

Synthetic Population Generated

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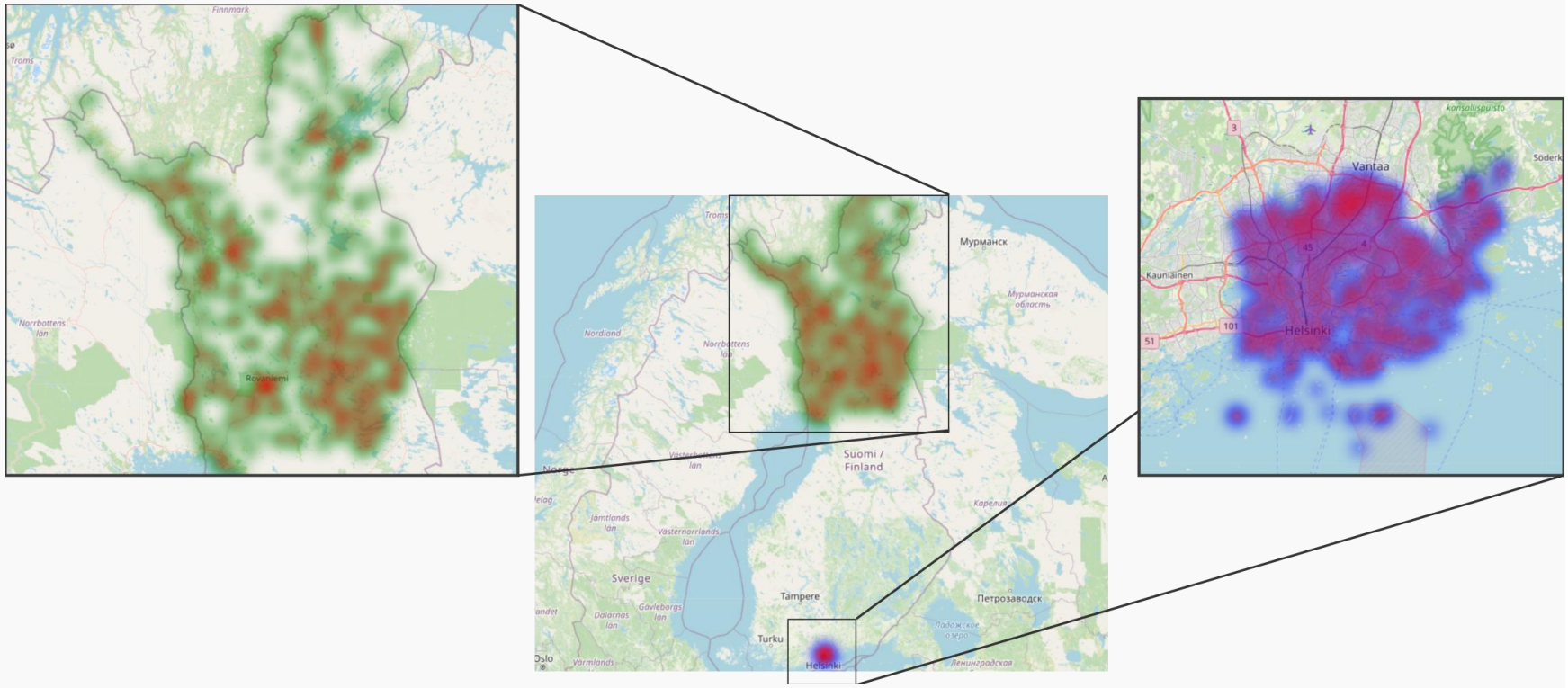
* Example population generated for two cities in Finland.

Age + Gender Distribution

(B) Household Density (green and blue) (A)



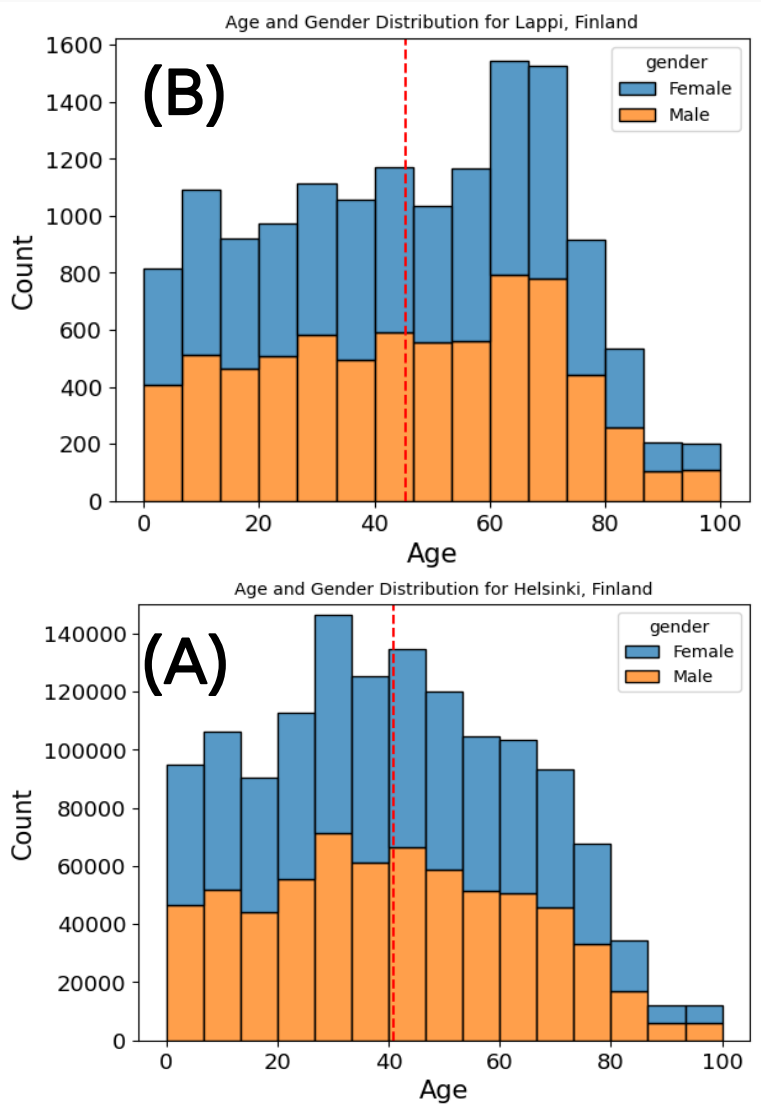


Fig 3. Comparing Synthetic Populations for two different cities in Finland, Helsinki (A) and Lappi (B).

Simulation feature (if time permits)

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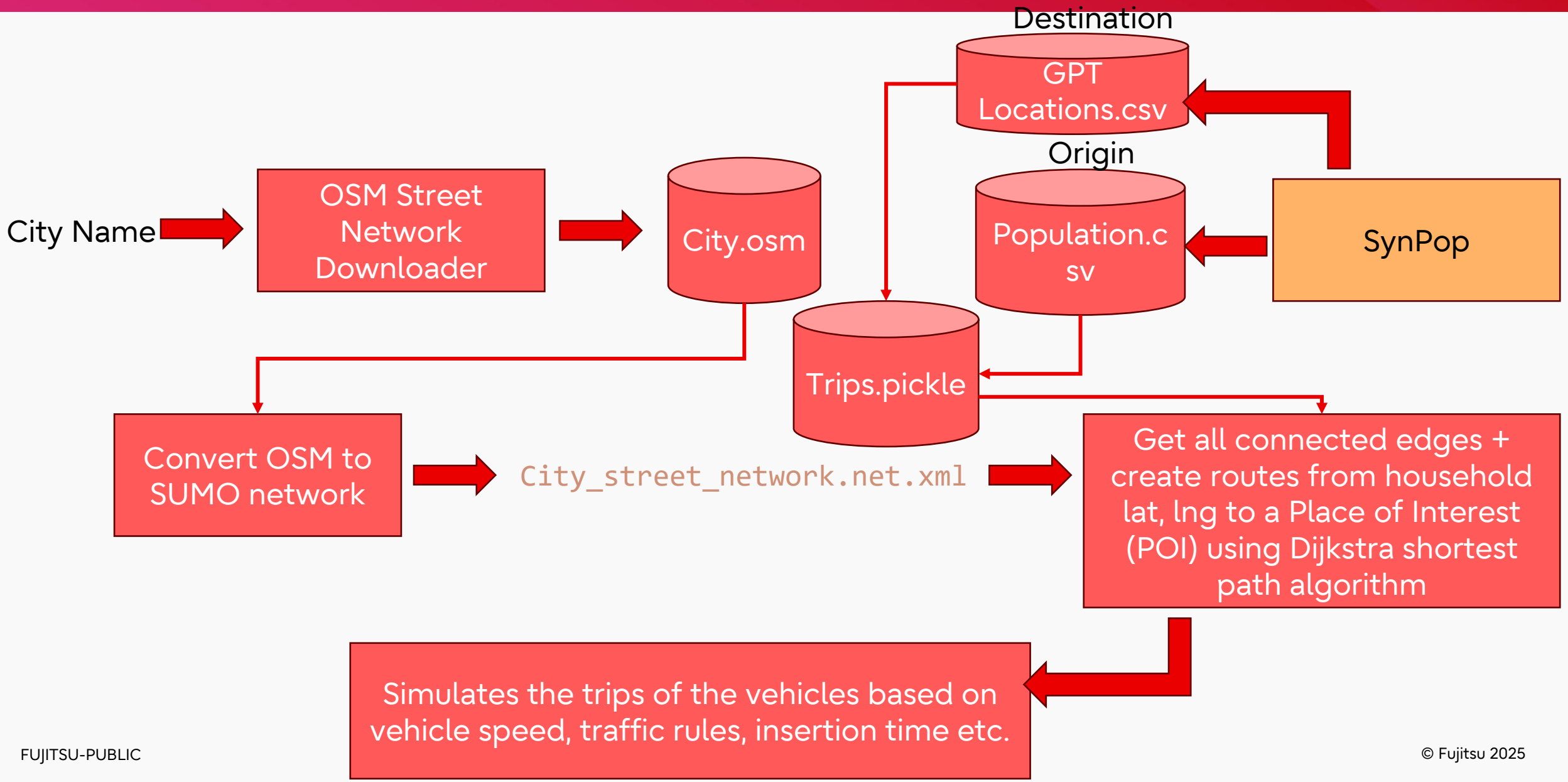
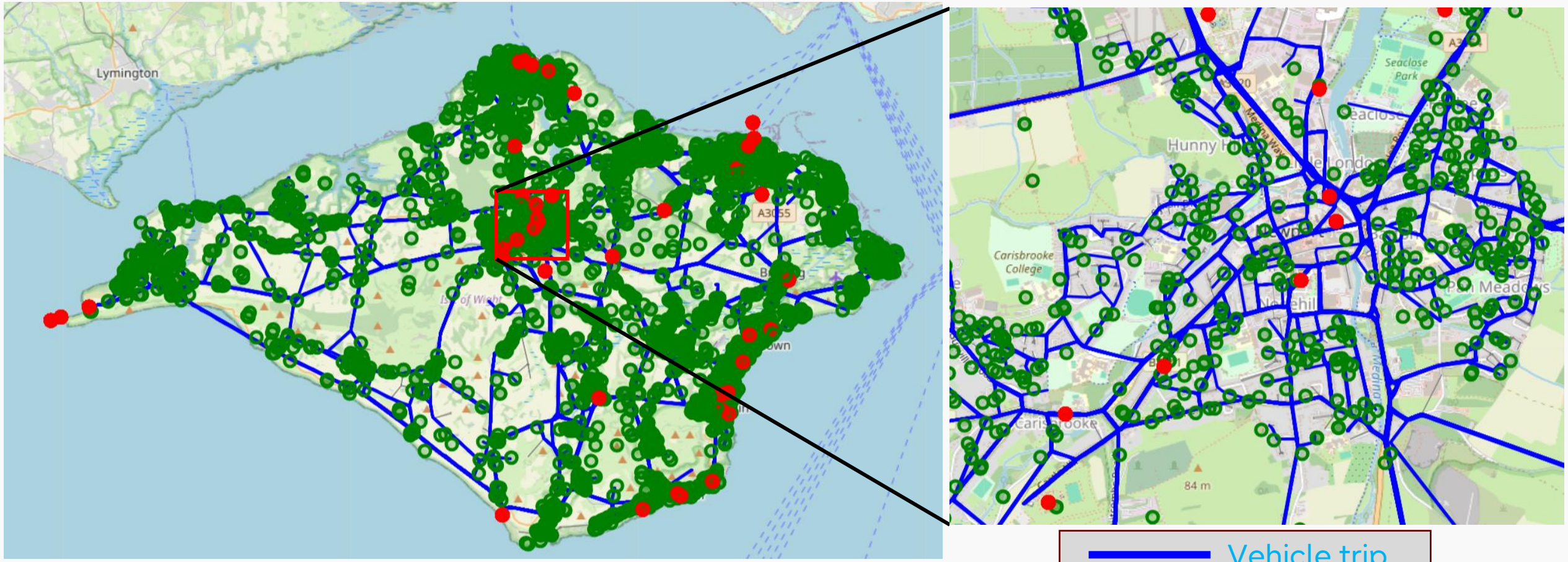
Simulation pipeline

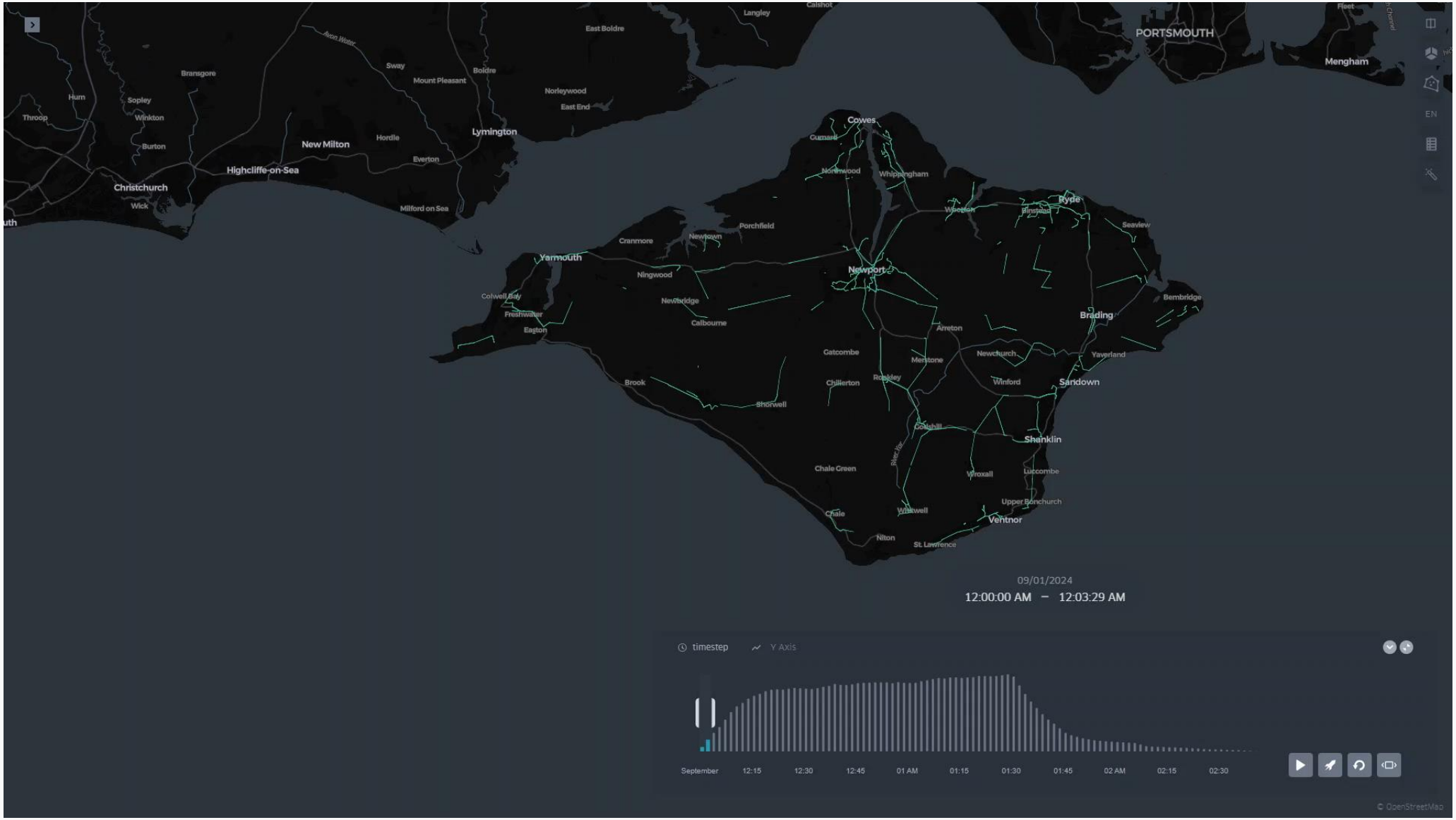


Simulation results (I)



* ODs plotted showing where trips start and end in IoW.

Simulation results (II)



Conclusion

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- SynPop utilises Iterative Proportional Fitting to adjust aggregated empirical statistics on populations from various sources such as the UK, US census, Japanese health and Eurostat.
- SynPop allows users to generate mobility simulations for any location in the aforementioned geographies.
- The method prioritises privacy through the use of aggregate data and probabilistic modelling techniques while being based on empirical ground-truths.
- This method is only an approximation given laws such as the General Data Protection Regulation (GDPR).

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