

DECENTRALIZED PUBLICATION AND CONSUMPTION OF TRANSFER FOOTPATHS

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OPEN DATA PUBLISHING

What data should be published?

How should data be published?

How do we enable data reuse?

MOBILITY AS A SERVICE

“ provide a traveler with the service needed for a door-to-door travel under a single payment whilst integrating disparate modes of mobility under one travel experience ”

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What about walking between public transit stops?

FOOTPATHS

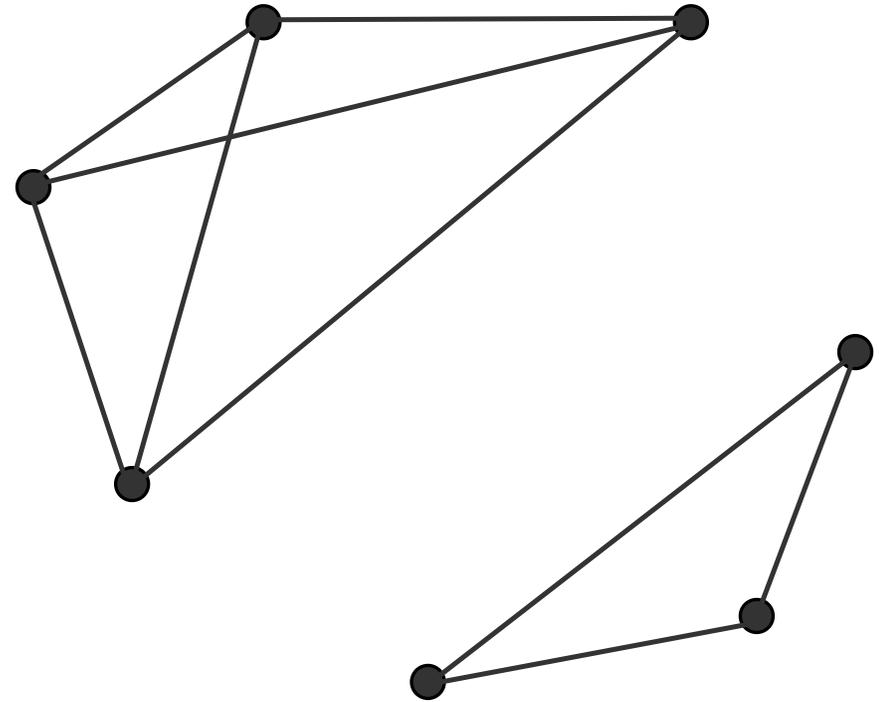
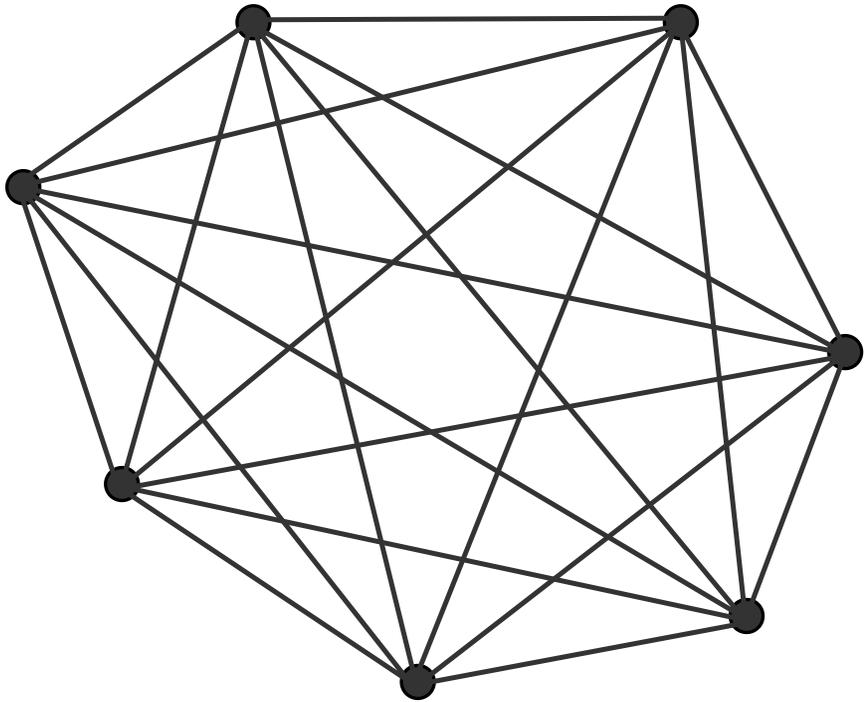
Terminology used in RAPTOR, CSA, ...

A footpath connects two stops



You can walk between those stops

DISCONNECTED BUT COMPLETE GRAPHS



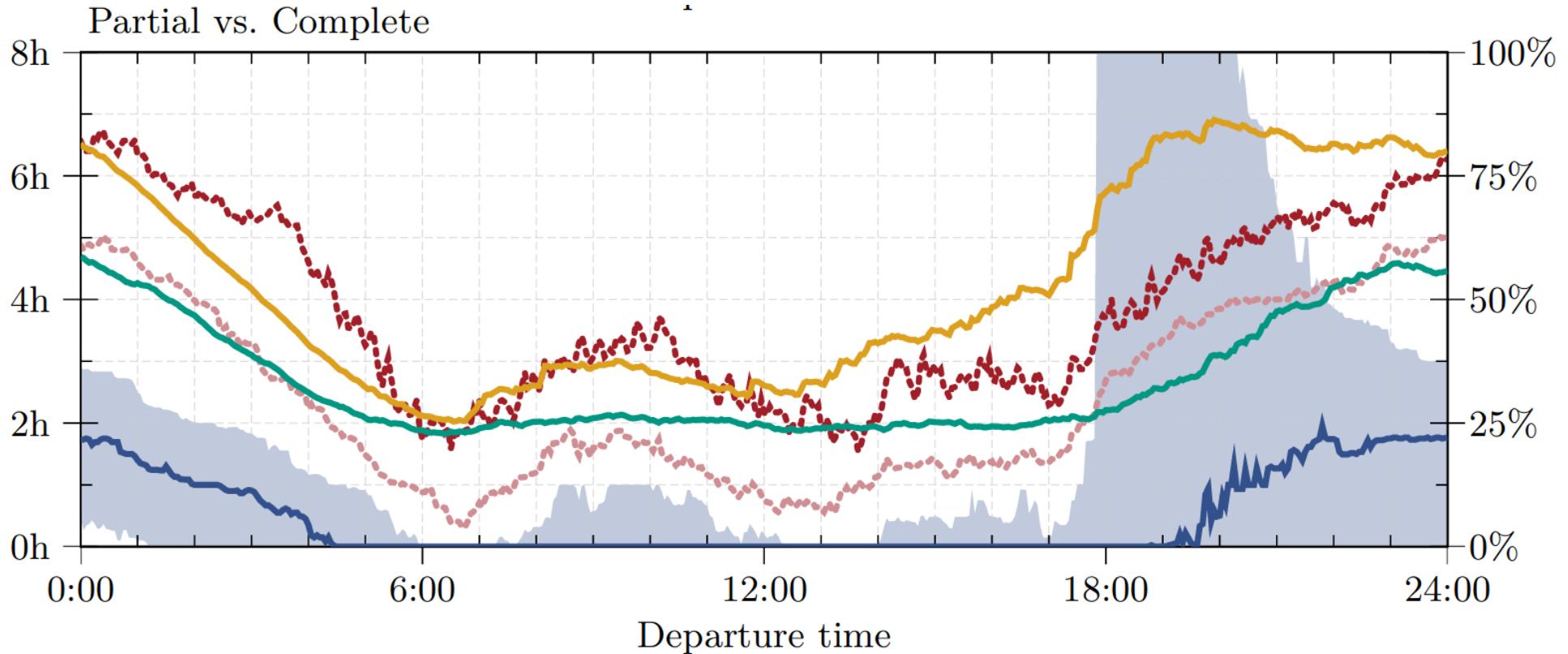
COMPUTING FOOTPATHS DYNAMICALLY

“ Even with all accelerations, the exact algorithms proposed are not fast enough for interactive applications. ”

“ It ... limits walking transfers between stops to x minutes; in this case we precompute these transfers.... Note that existing solutions often use such restrictions. ”

Delling, D., Dibbelt, J., Pajor, T., Wagner, D., & Werneck, R. F. (2013, June). Computing multimodal journeys in practice. In International Symposium on Experimental Algorithms (pp. 260-271). Springer, Berlin, Heidelberg.

UNRESTRICTED WALKING IS IMPORTANT



Wagner, D., & Zündorf, T. (2017). Public transit routing with unrestricted walking. In 17th Workshop on Algorithmic Approaches for Transportation Modelling, Optimization, and Systems (ATMOS 2017). Schloss Dagstuhl-Leibniz-Zentrum fuer Informatik.

OUR GOALS

- Time and space efficient
- No walking restrictions
- Open-world assumption

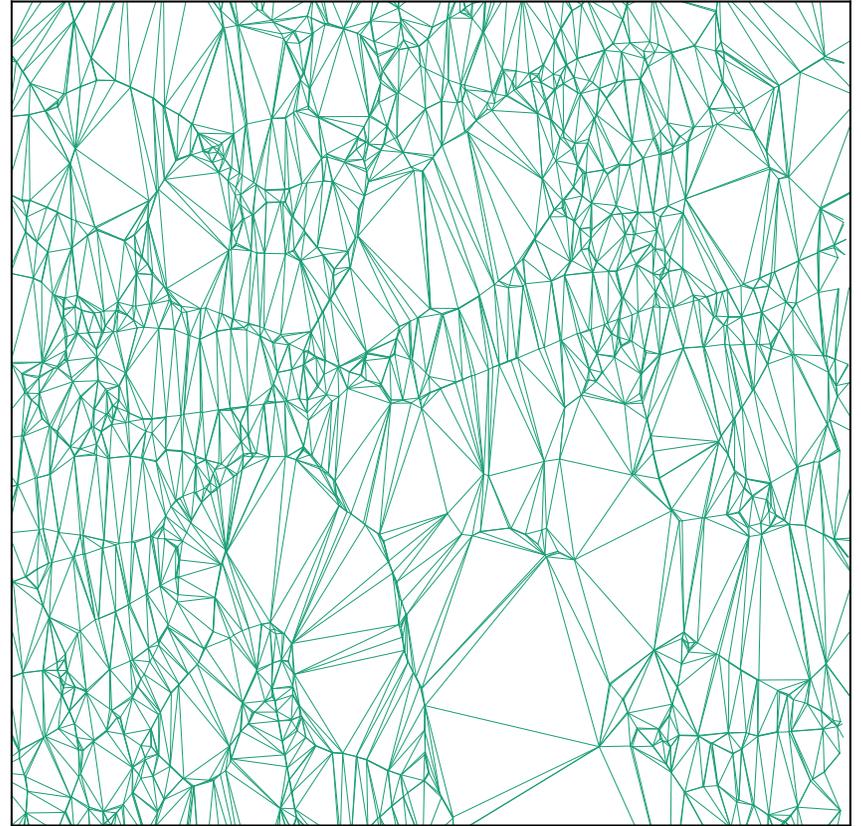
DELAUNAY TRIANGULATION

$\mathcal{O}(n)$ edges

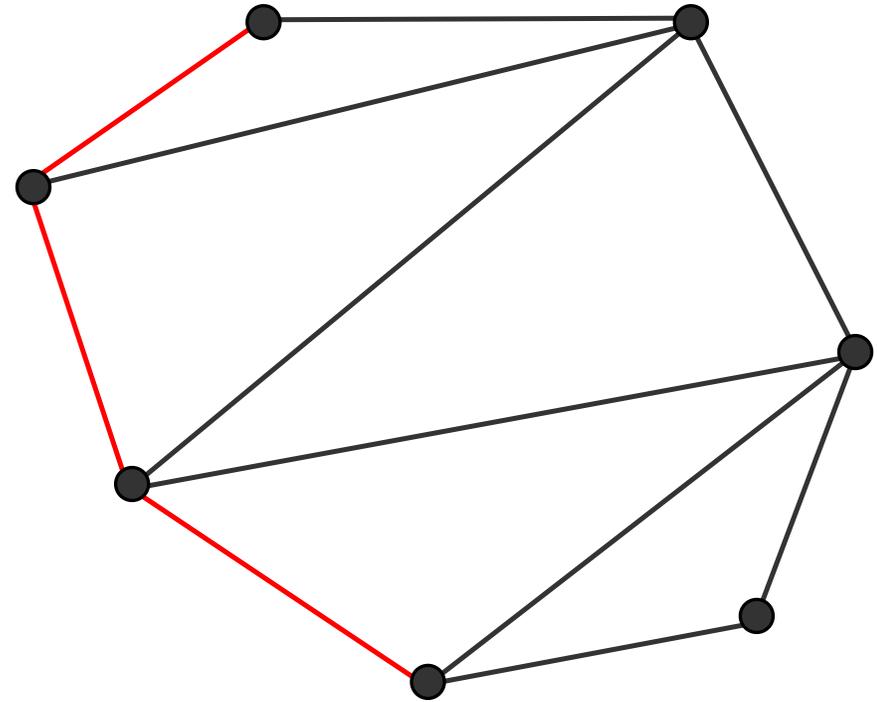
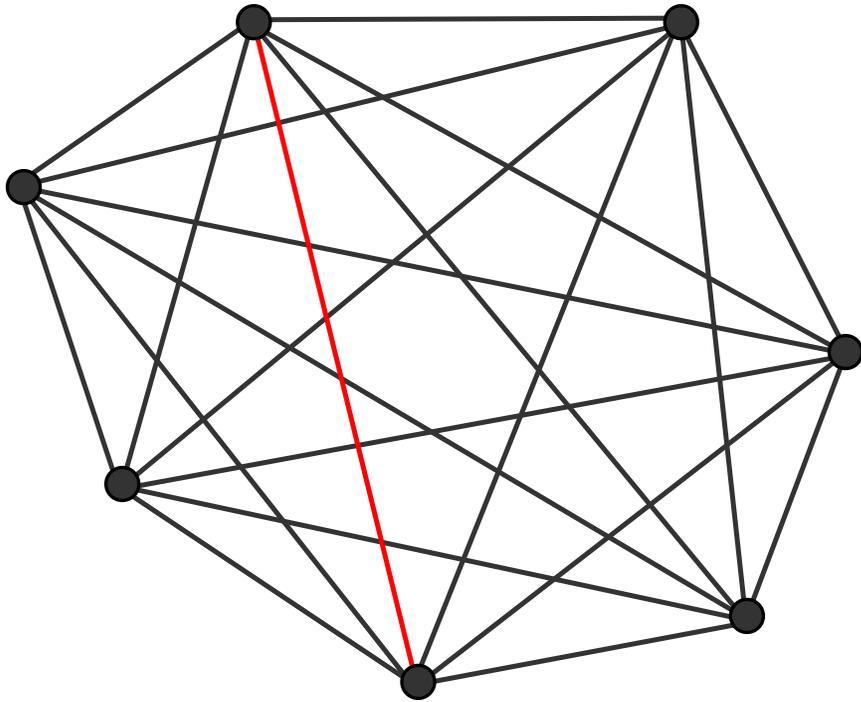
Easy to compute

Contains nearest-
neighbors subgraph

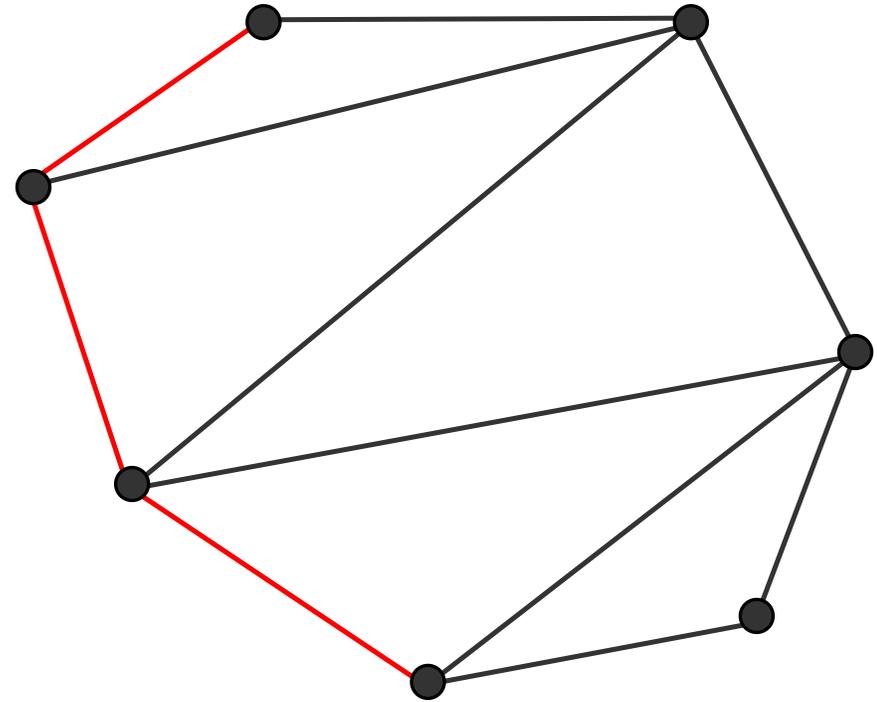
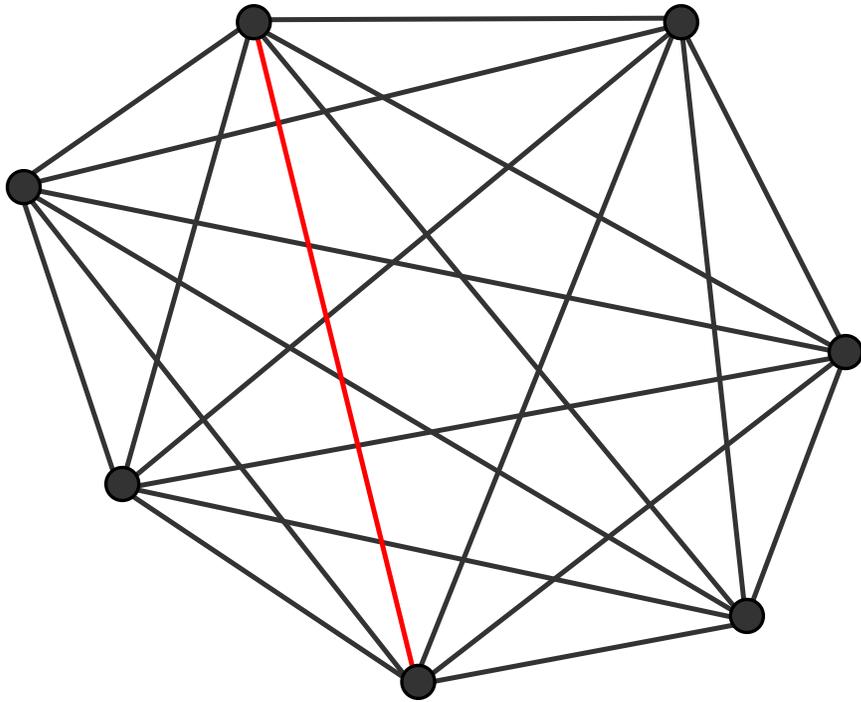
Good approximation of
complete graph



PATH ALONG TRIANGLE EDGES

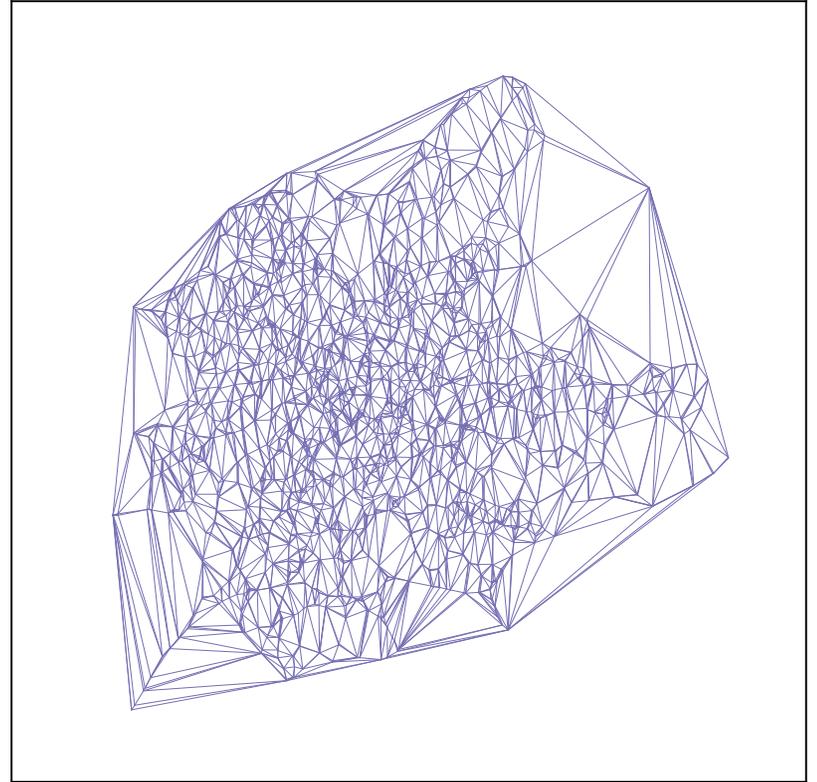
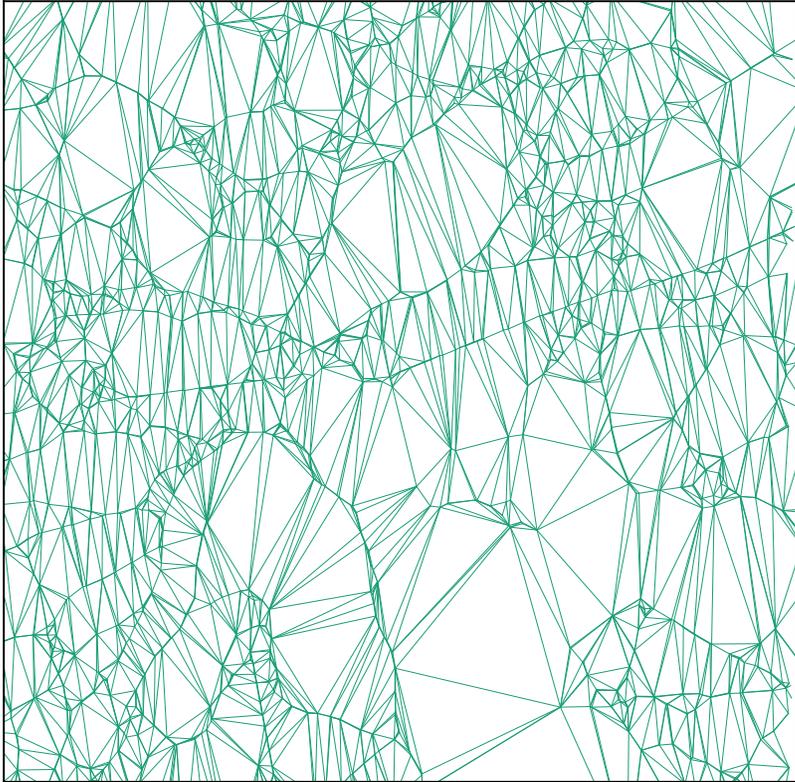


PATH ALONG TRIANGLE EDGES

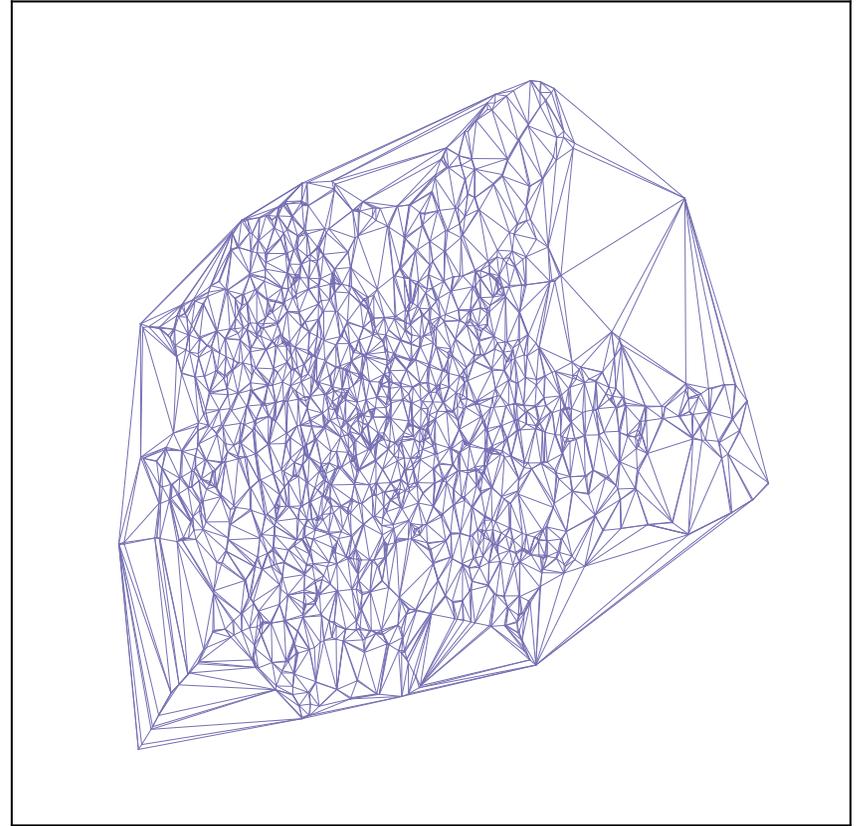
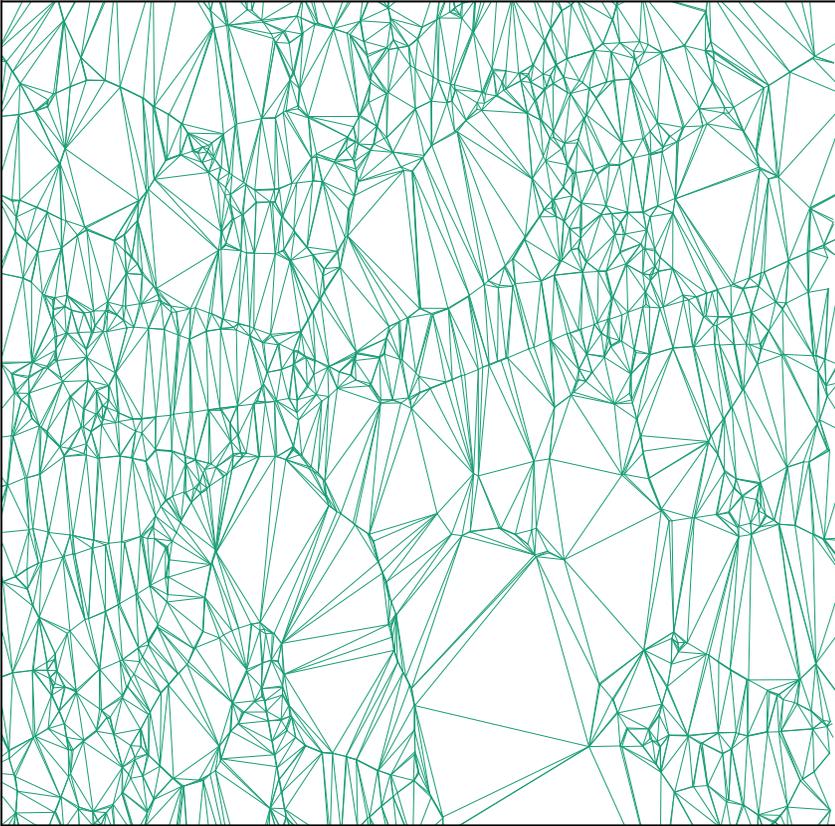


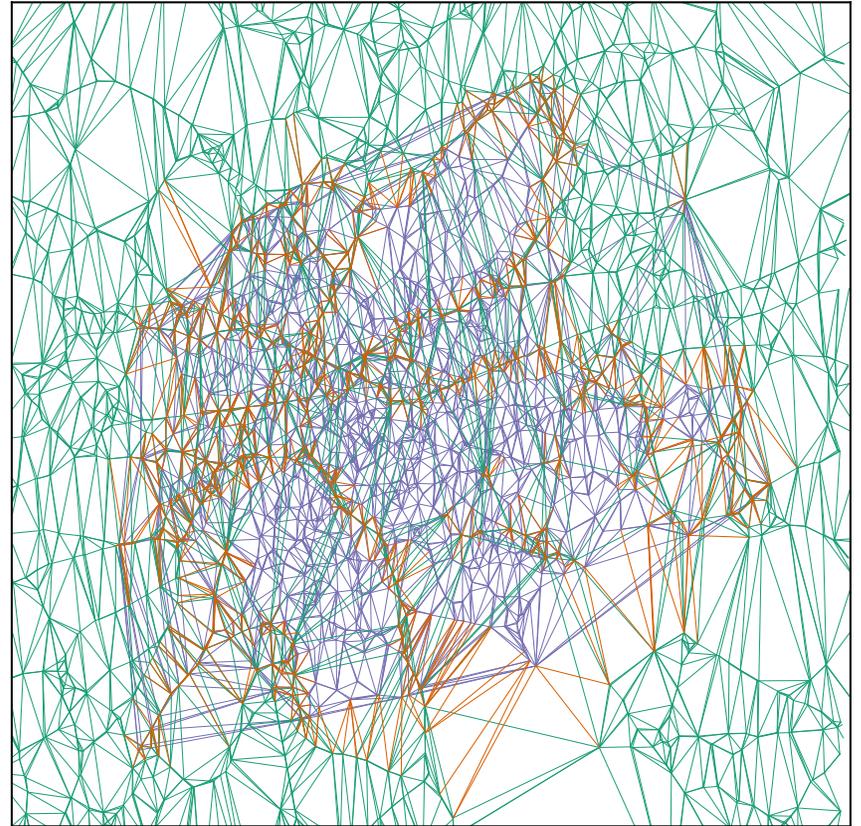
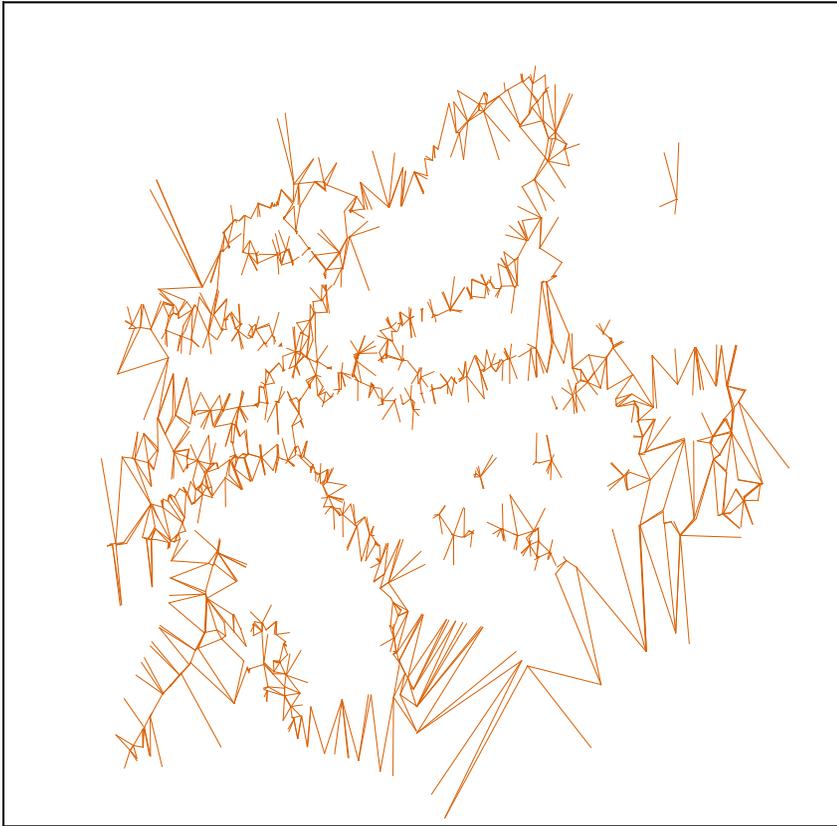
Everything is still reachable

TRIANGULATING PUBLIC TRANSIT STOPS

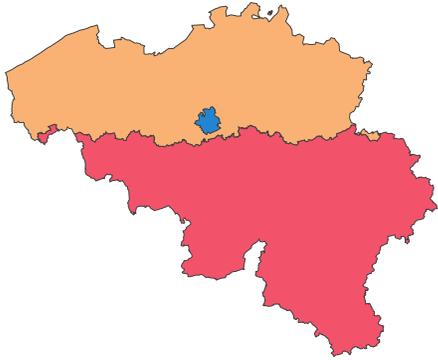


MERGING NETWORKS





OVERLAPPING SERVICE AREAS



	Paths in ♣	Paths in ♦	Missing paths
♣ ← Flanders	107,171	7,969	2,508
♦ ← Brussels			
♣ ← Flanders	107,171	94,730	4,020
♦ ← Wallonia			

PUBLISHING THE RESULTS

<https://hdelva.be/stops/distances/12/2090/1370>

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{
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    ...
  },
  "@graph":[
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      "planner:destination":"https://data.delijn.be/stops/204556",
      "planner:distance":775,
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```

BACK TO THE BASICS

Delaunay triangulations require a metric space

$$d(x, y) = d(y, x)$$

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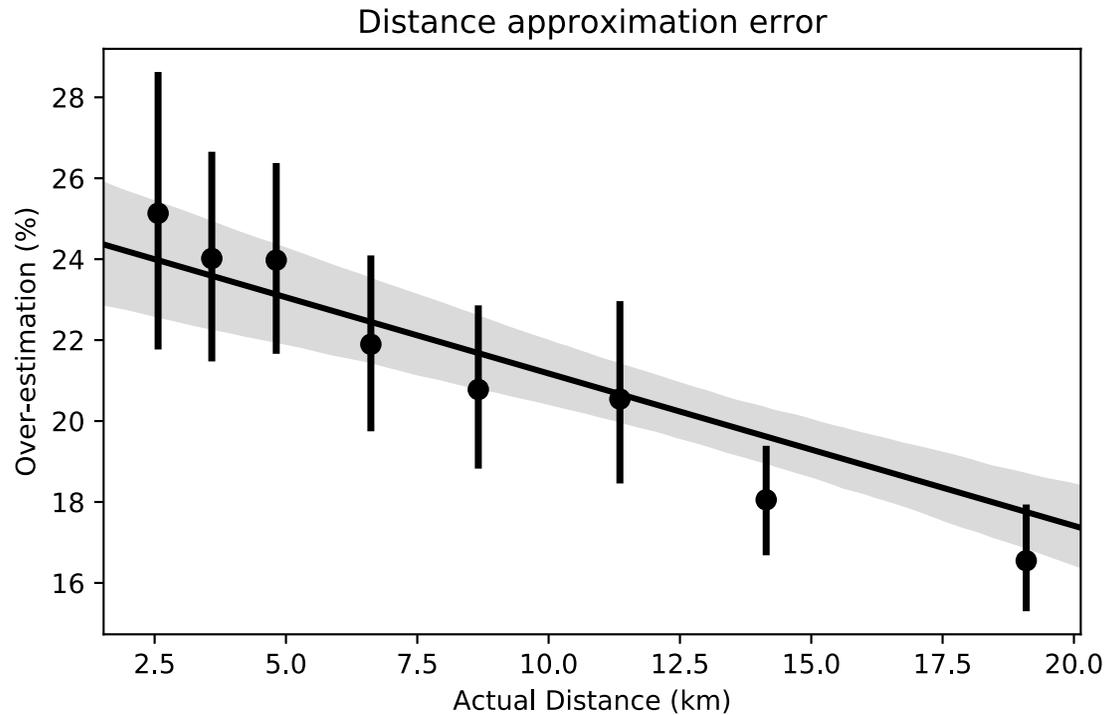
Delaunay triangulations require a metric space

$$d(x, y) = d(y, x)$$

Euclidean distance is by far the most convenient

APPROXIMATING WALKING DISTANCE

Can a bus network be used to approximate the distance between train stations?





NEXT STEPS

How reasonable are our overestimations?

Do you trust data that says two train stations are 200m apart?

CONCLUSION

Practical solutions use heuristics

Delaunay graphs seem promising

hdelva.be/slides/sem4tra2019/
hdelva.be/articles/decentralized-footpaths/