PublicTransitSnapper:

Map Matching Mobile Phones to Public Transit Vehicles

Bachelor's Thesis by Gerrit Freiwald
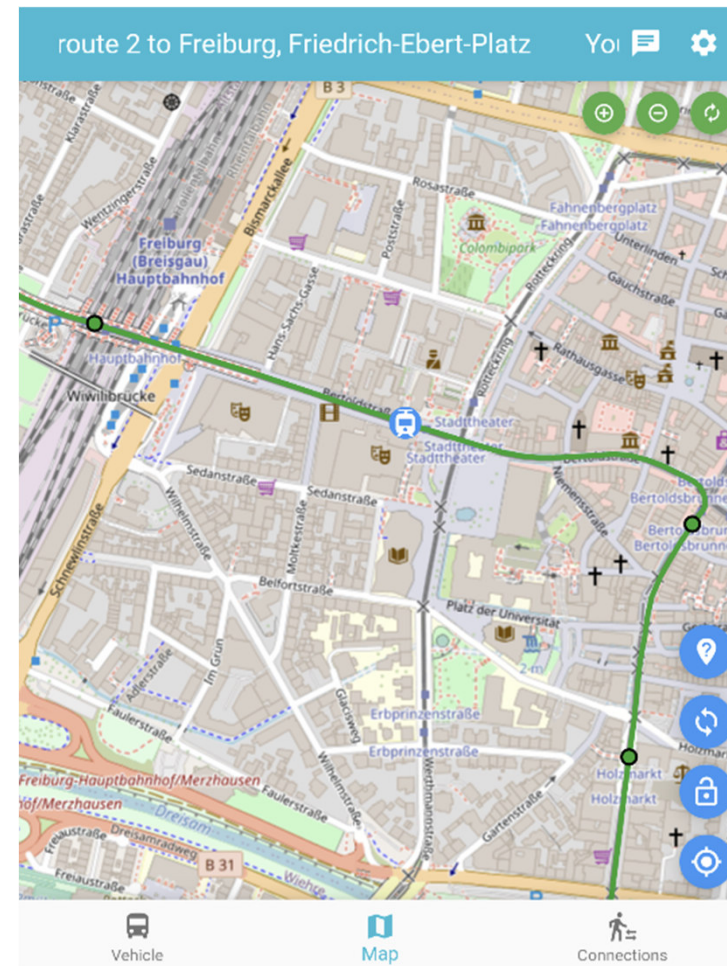
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Introduction: Live Demo

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General Transit Feed Specification (GTFS)

- Each trip is described by:
  - Shape
  - Route
  - Service
    - Active weekdays
    - Exception dates
  - Stops
    - Location
    - Stop times

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Public Transit Vehicle Matching

- Geographical Component
- Time Component

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PTV Matching – The Geographical Component
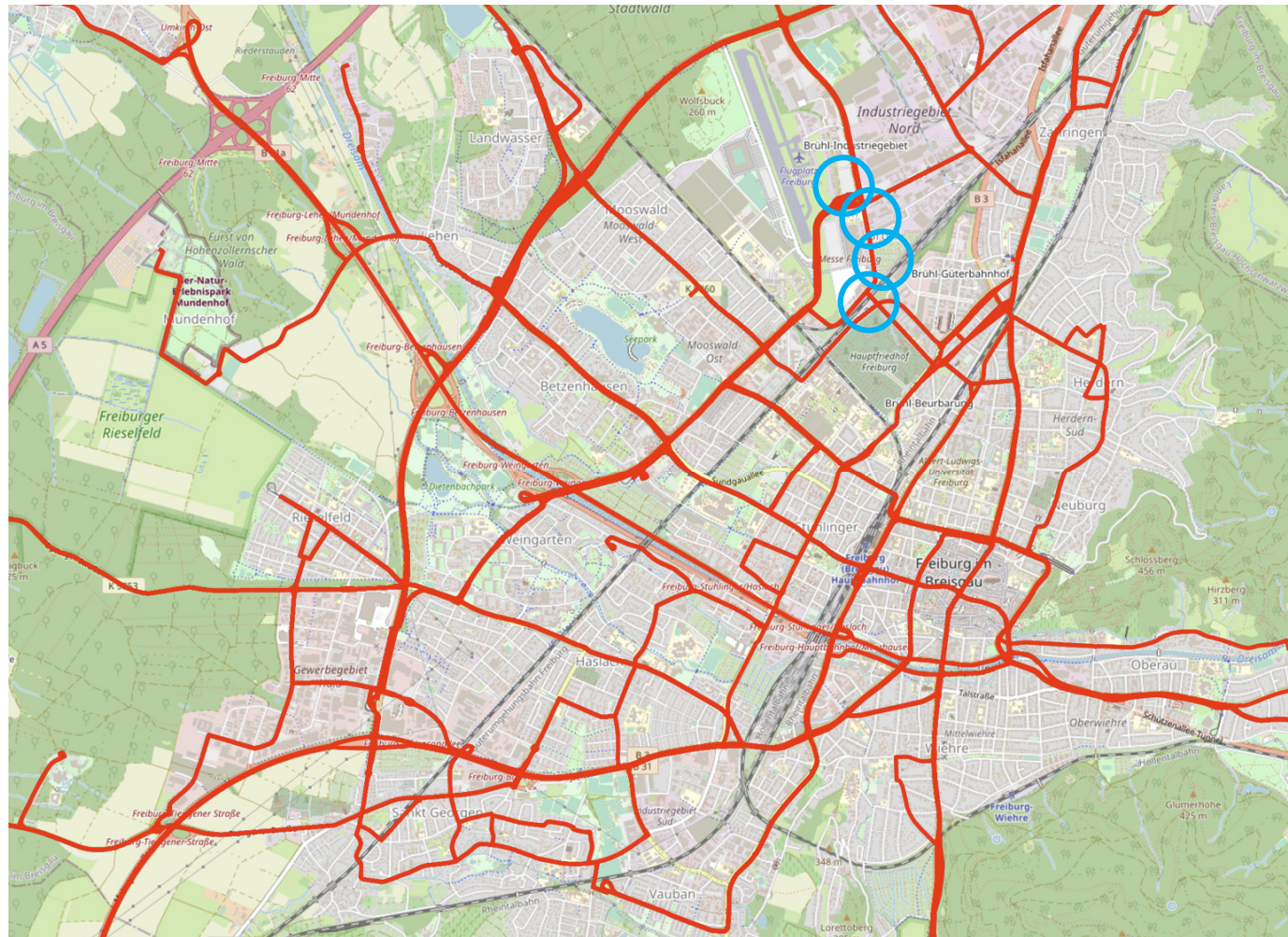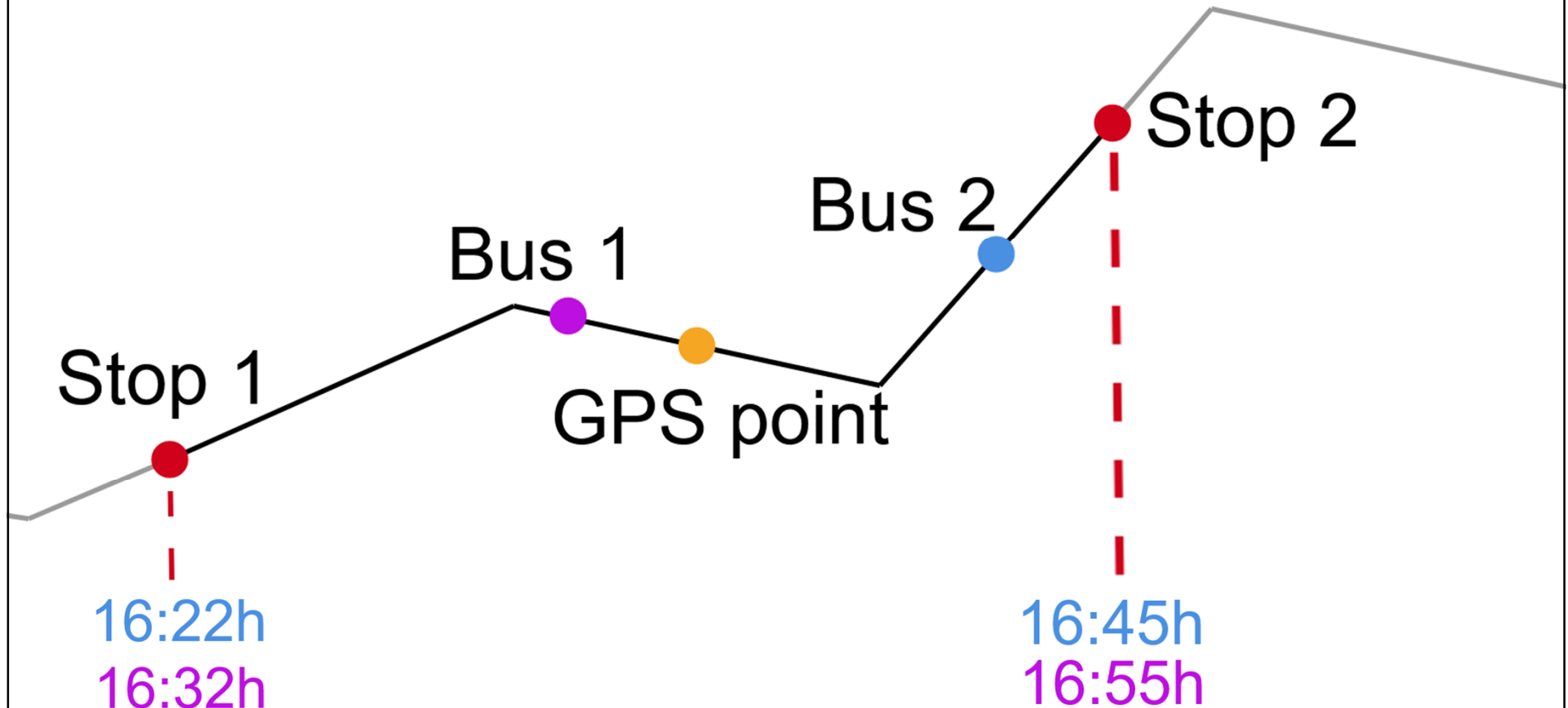

GPS Points

Choosing the closest
street parts

Map Matching

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PTV Matching – Shapes in Freiburg

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PTV Matching – The Time Component

Stop 2

Bus 2

Bus 1

Stop 1

GPS point

16:22h
16:32h

16:45h
16:55h

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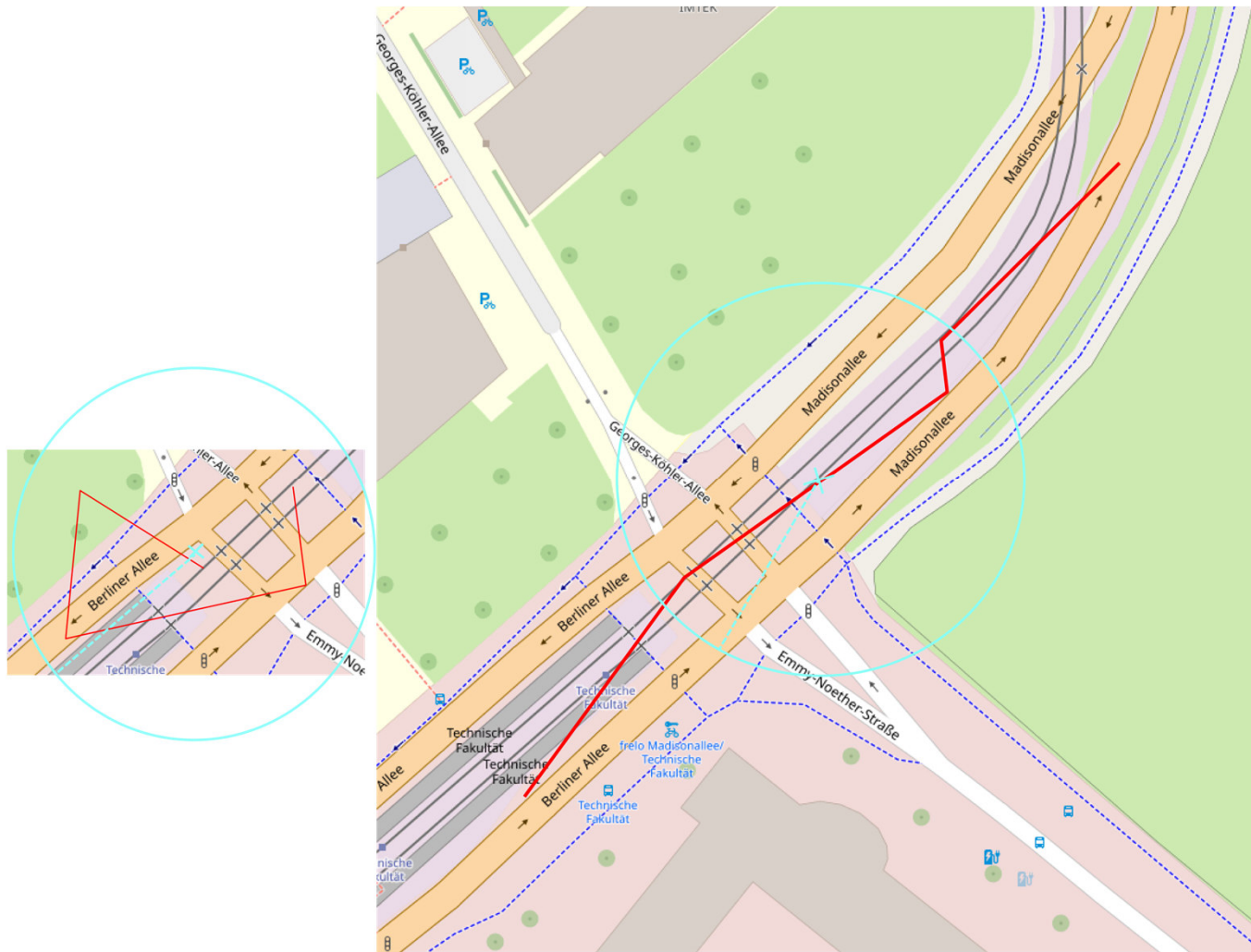
Anti Over-Matching

Anti Over-Matching

User Study

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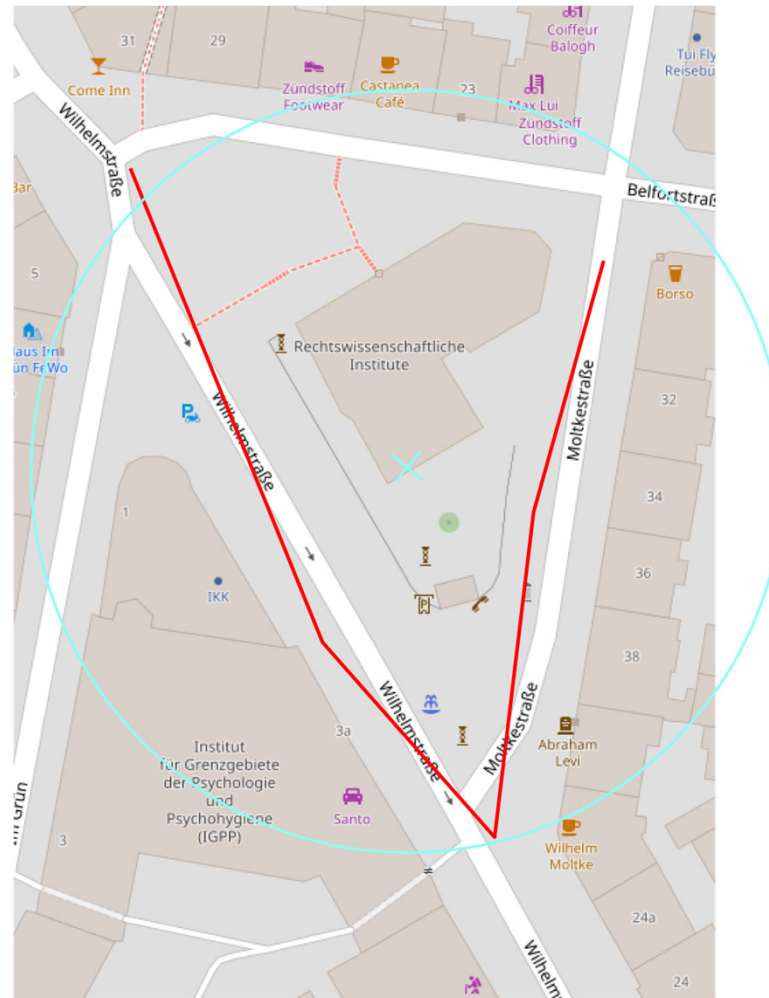
User Study – General Inquiry

- Were there any bugs?

- Were there unclear elements within the app?

- Were there matches when you were not in a Public Transport Vehicle?

- Usability rating from 1 to 5 stars

- Other remarks?

User Study – Freiburg

Freiburg	Route Name	Vehicle Type	Time & Date	Boarding Station	Exit Station
Trip 1	4	Tram	21:31h 10.10.2022	Messe	Stadttheather
Trip 2	5	Tram	21:53h 10.10.2022	Stadttheather	Europaplatz
Trip 3	4	Tram	21:57h 10.10.2022	Europaplatz	Messe

- Matching not precise on the highly frequented tracks
- No Matching at some stations
- Matching precise on lesser frequented tracks

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User Study – Hamburg
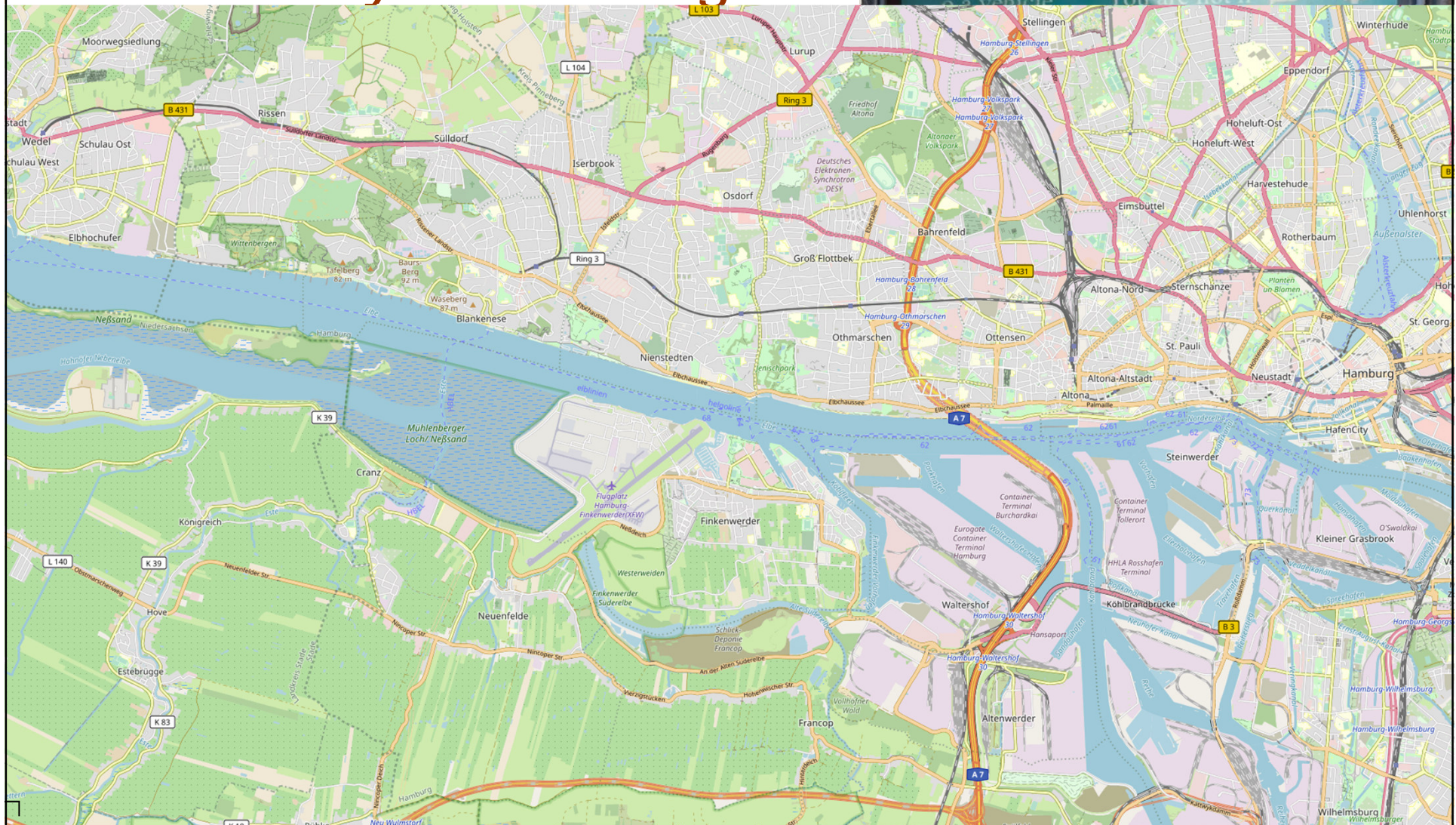
- Correct matching on most tracks

User Study – Munich

Munich	Route Name	Vehicle Type	Time & Date	Boarding Station	Exit Station
Trip 1	192	Bus	08:39h 18.10.2022	Am Hochacker	Quiddestrasse
Trip 2	U5	Subway	08:50h 18.10.2022	Quiddestrasse	Stachus
Trip 3	U6	Subway	08:01h 20.10.2022	Odeonsplatz	Universität
Trip 4	68	Bus	11:56h 20.10.2022	Universität	Königsplatz
Trip 5	58	Bus	13:32h 20.10.2022	Königsplatz	Siegestor
Trip 6	153	Bus	09:57h 21.10.2022	Universität	Odeonsplatz

- One correctly matched trip in a tunnel
- No wrong matching on busses
- No non-matching at stops

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User Study – Zurich

Zurich	Route Name	Vehicle Type	Time & Date	Boarding Station	Exit Station
Trip 1	80	Bus	14:33h 14.10.2022	ETH Hönggerberg	Bhf. Oerlikon Nord
Trip 2	31	Bus	16:14h 14.10.2022	Neumarkt	Letzipark
Trip 3	80	Bus	19:12h 14.10.2022	Max-Bill-Platz	ETH Hönggerberg
Trip 4	89	Bus	20:52h 14.10.2022	Kappeli	Bahnhof Altstetten

- Some stops and curves lead to a non-matching
- Always matched correctly
- Tester walked next to a road and got matched

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User Study – Conclusion

- 18 recorded trips
  - 8x bus
  - 3x tram
  - 6x subway
  - 1x ferry
- Bus matchings very accurate
- Subway matchings rather inconsistent

- Anti Over-Matching too strict
- Next stop always shown correctly
- Transfer options page risky without real time data

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GTFS in Germany

Or: Prospects of publicly available GTFS data sets in Germany

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GTFS in Germany - The Current State

Verkehrs- und Tarifverbünde in Deutschland (1)
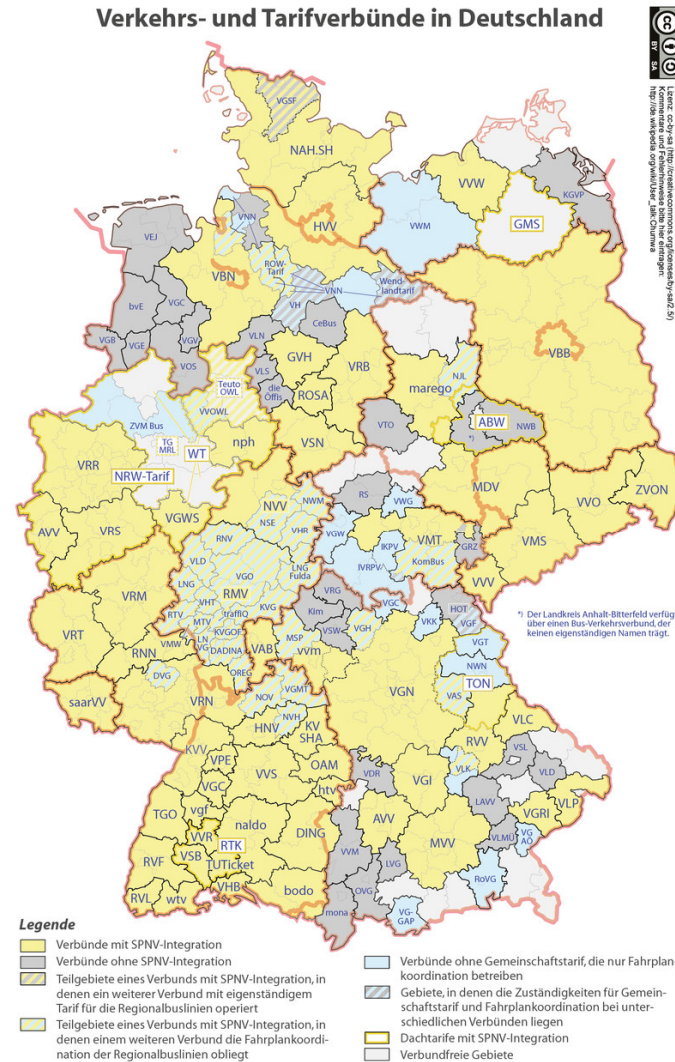
GTFS in Germany - Prospects

- DELFI: Verein zur Förderung einer Durchgängigen Elektronischen Fahrgastinformation e.V. (Association for `continuous electronic schedule information support´)

 (2)

- DEEZ: `Deutschlandweite Echtzeitdaten´ (real time data throughout Germany)

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Thank You for Listening

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Image Sources

(1) M. Dörrbecker (Chumwa), "Verkehrs- und Tarifverbünde in Deutsch-land." url: de.wikipedia.org/wiki/Liste_deutscher_Tarif-_und_Verkehrsverbünde, January 2021.

(2) DELFI, "Logo", url: https://www.delfi.de/, visited: November 2022.

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