Demand-driven Optimization of Public Transit

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HAFAS Request Data – A Unique Source

1

Origin/Destination Information:

Large number of requests allow to derive fine-grained origin/destination information

2

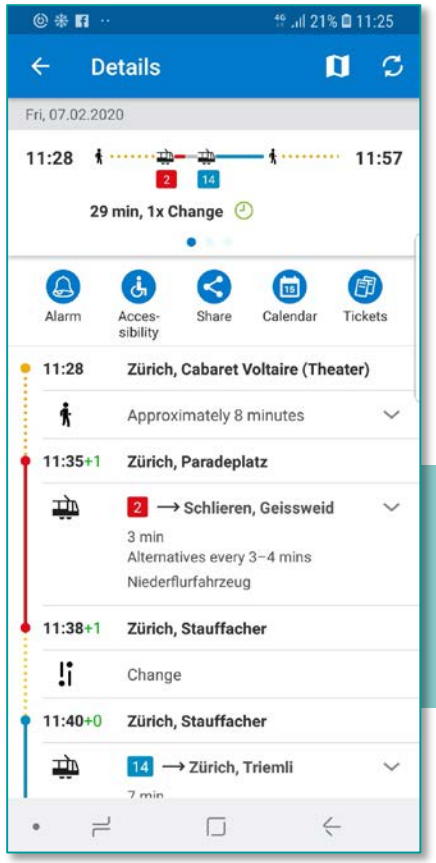
Anonymous Data:

No need to process person-specific data

3

Accurate:

Calibration and validation possible with samples from various sensors (e.g. counting, weight, Bluetooth, WiFi)



Huge number of trip requests, including:

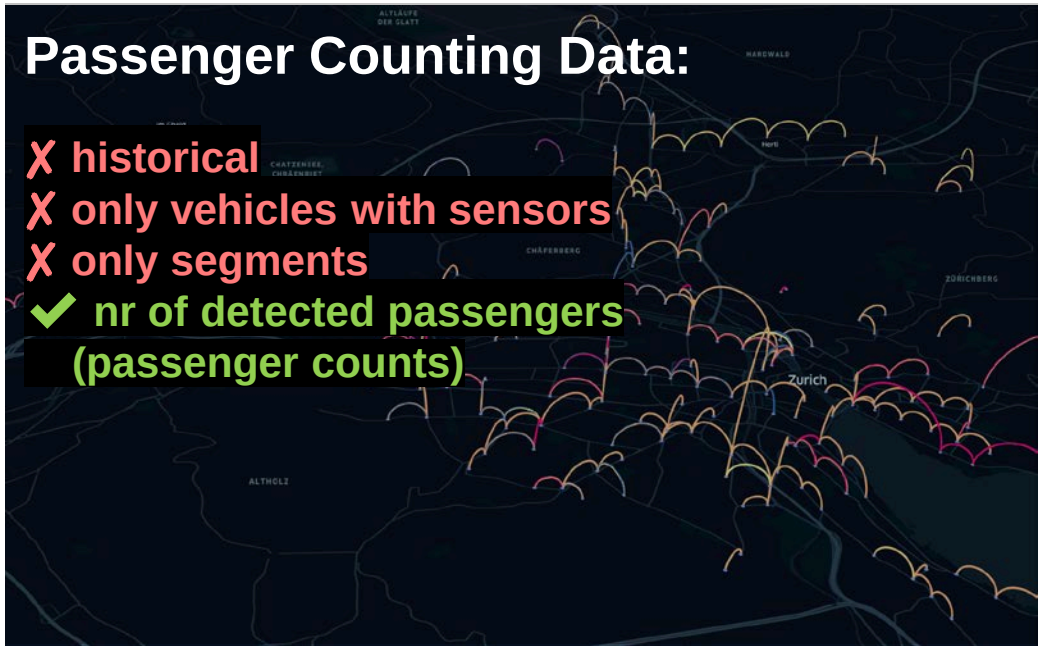
- ✓ Origins/Destinations
- ✓ First & Last Mile incl. walking distance
- ✓ Time of request & how much time before a trip
- ✓ Lines used, interconnections and waiting times

HAFAS Data and Passenger Counting Data
Used for calibration and validation

Request Data:

- ✔ predictive
- ✔ full network coverage
- ✔ door-to-door
- ○ nr of detected passengers (trip requests)

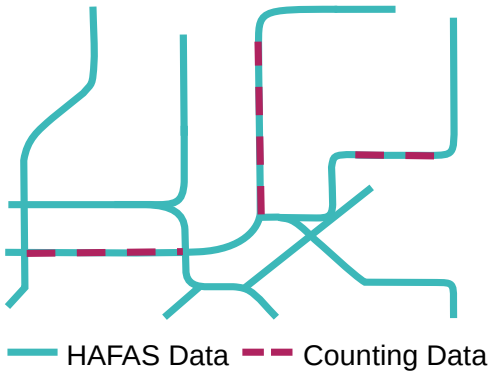
Passenger Counting Data:



- ✗ historical
- ✗ only vehicles with sensors
- ✗ only segments
- ✔ nr of detected passengers (passenger counts)

Accuracy and Validation

Model Training

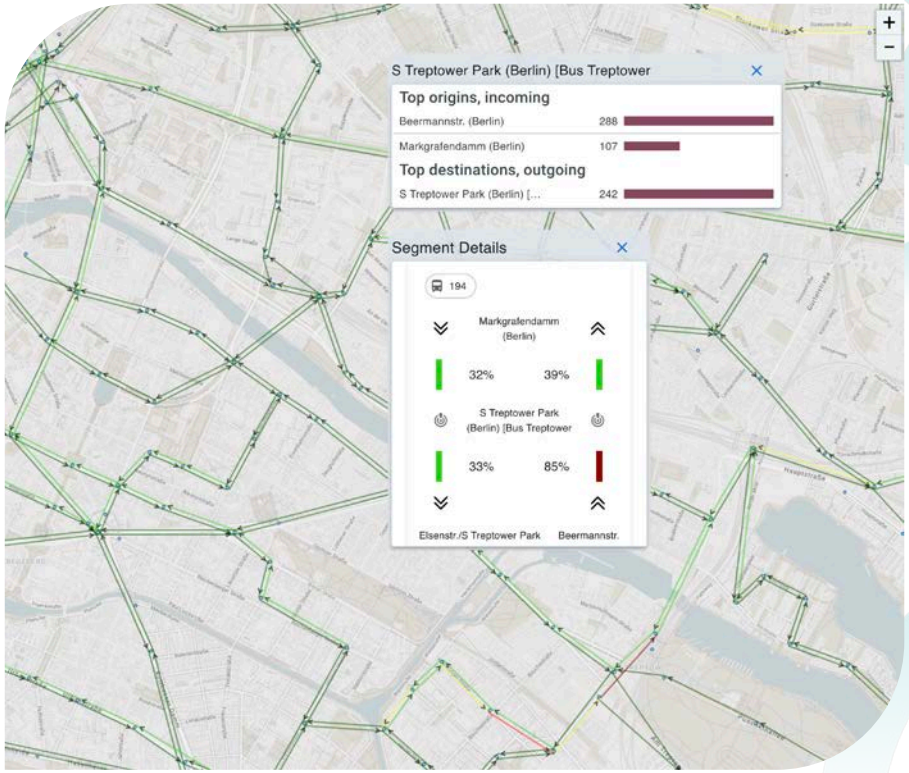


- HAFAS Data is calibrated with counting or similar data where it's available
- Continuous model improvement

Validation

80% of trip segments with an error of <10 passengers

- Test in network with 101 lines
- Large busses and trams (capacity: 150 & 240)
- Average error of 8 passengers
- In 96% of cases an error of less than 30 passengers

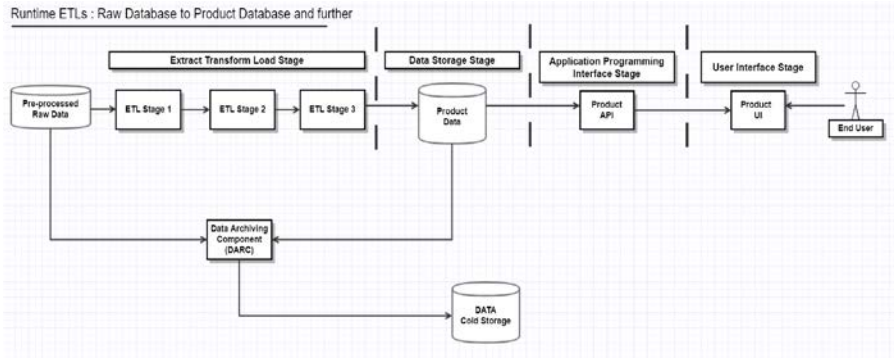


Data Processing in Real-Time

- HAFAS.analytics receives any new data instantly
- Full data collection, aggregations and reports accessible to our customers
- Data export & APIs to support 3rd party tools
- Build your own analyses with AWS QuickSight (BI Tool)
- Different storage types supported:

  from high-performance storage for interactive analysis

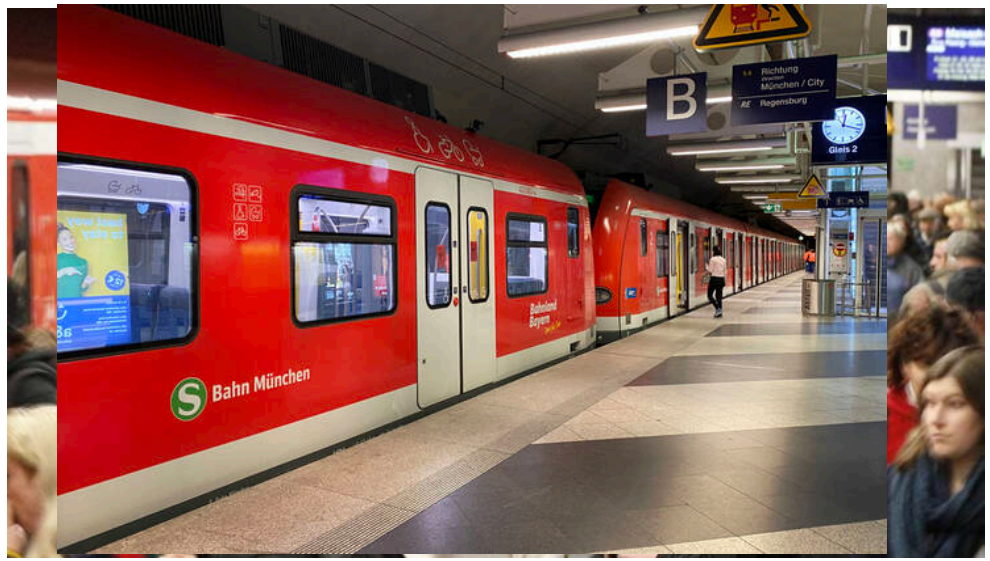
  to cost-efficient long-term archives



Data Archiving & Management

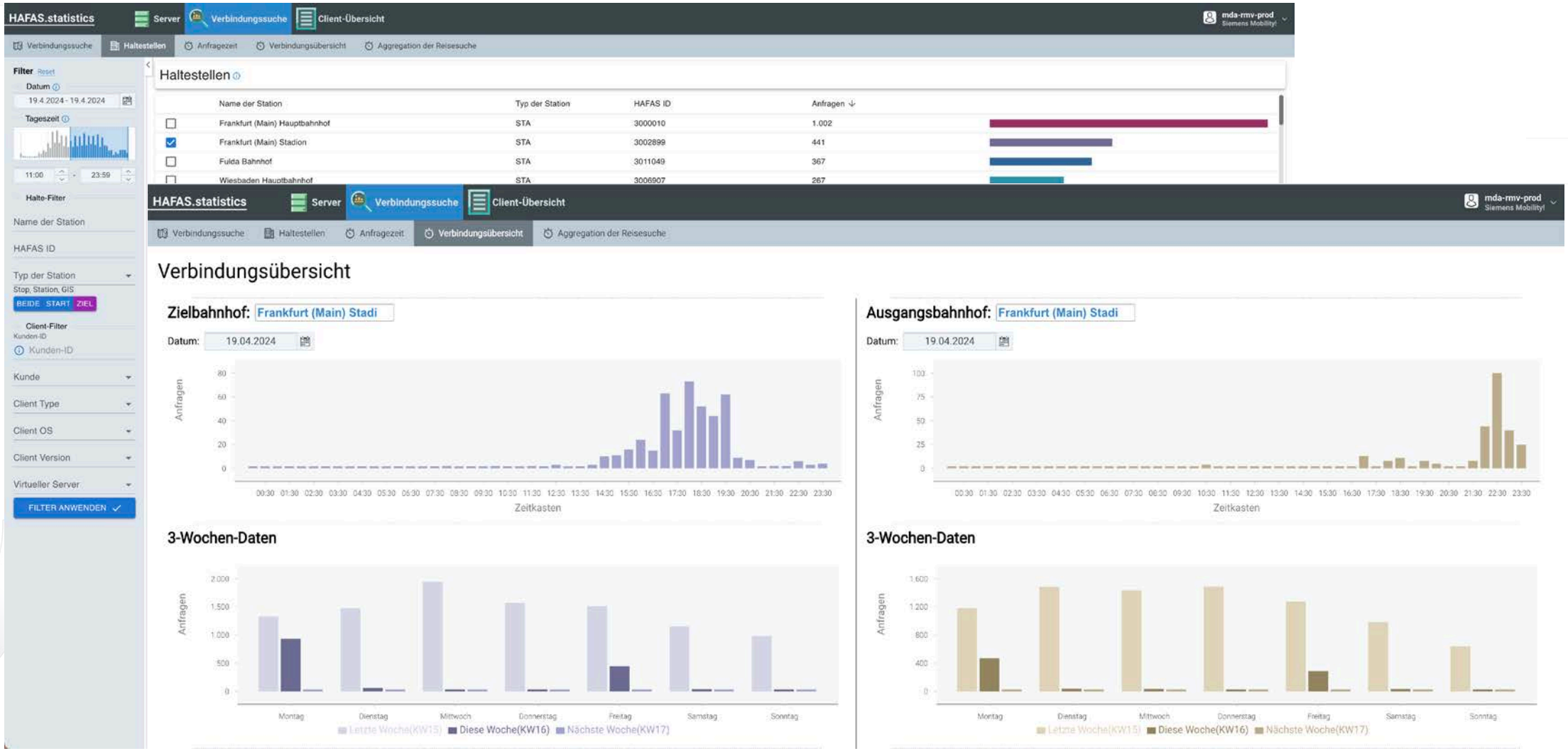
Effects of Delays & Incidents

09:05		Darmstadt Hauptbahnhof	3
09:09		Darmstadt-Arheilgen Bahnhof	1
09:09			1
09:11		Darmstadt-Wixhausen Bahnhof	1
09:11			1
09:13		Erzhausen Bahnhof	2
09:14			2
09:16		Egelsbach Bahnhof	1
09:16			1
09:18		Langen (Hessen) Bahnhof	3
09:19			3
09:20		Langen (Hessen) Flugsicherung	1
09:21			1
09:23		Dreieich-Buchschlag Bahnhof	2
09:23			2
09:26		Neu-Isenburg Bahnhof	2
09:26			2
09:29	9:49	Frankfurt (Main) Louisa Bahnhof	1
09:29	9:49		1
09:31	9:51	Frankfurt (Main) Stresemannallee Bahnhof	2
09:31	9:51		2
09:32	9:52	Frankfurt (Main) Südbahnhof	4
09:33	9:53		4
09:34		Frankfurt (Main) Lokalbahnhof	2
09:35			2
09:36		Frankfurt (Main) Ostendstraße	2
09:37			2
09:38		Frankfurt (Main) Konstablerwache	3
09:39			3
09:40		Frankfurt (Main) Hauptwache	3
09:40			3

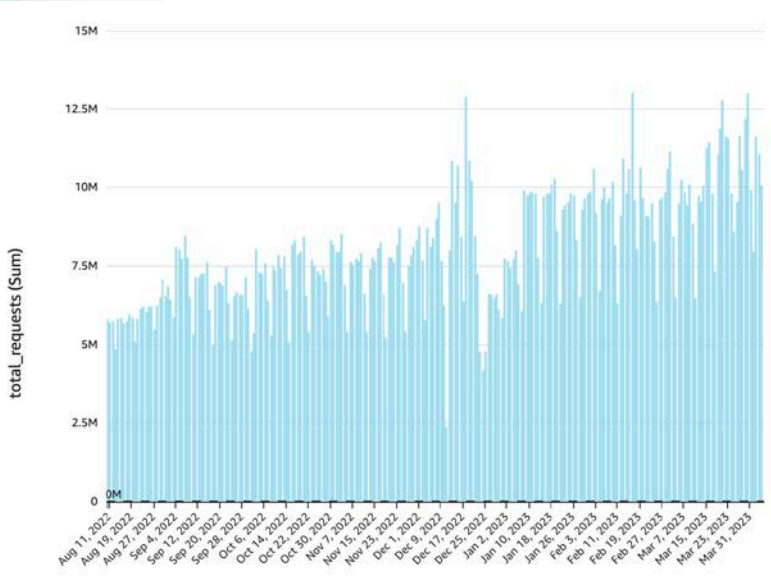


Real-time information is used for HAFAS occupancy prognosis

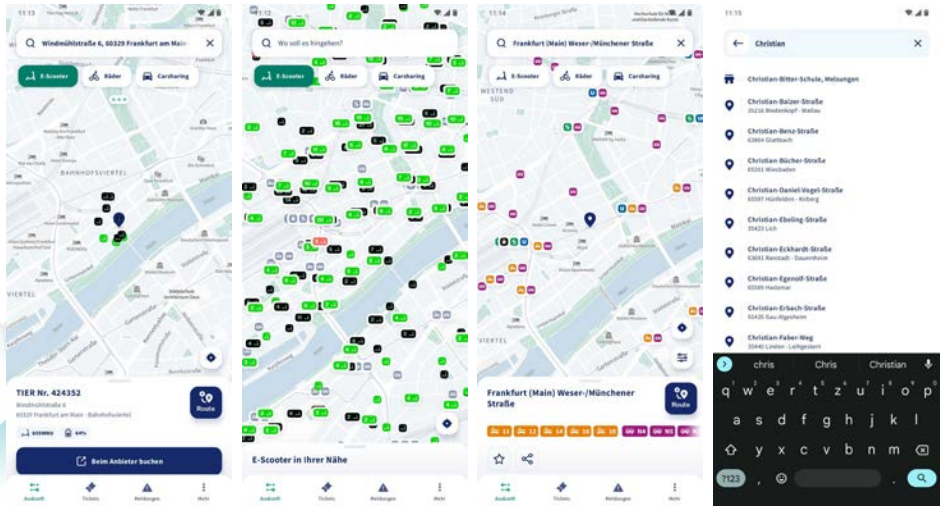
HAFAS.statistics – Predictive Nature of Request Data



Understand Trip Planner Utilization



+ 110 %



Customers produce a lot of data:

- Currently around 10 million HAFAS-requests per day
- Number of queries on a steep growth path

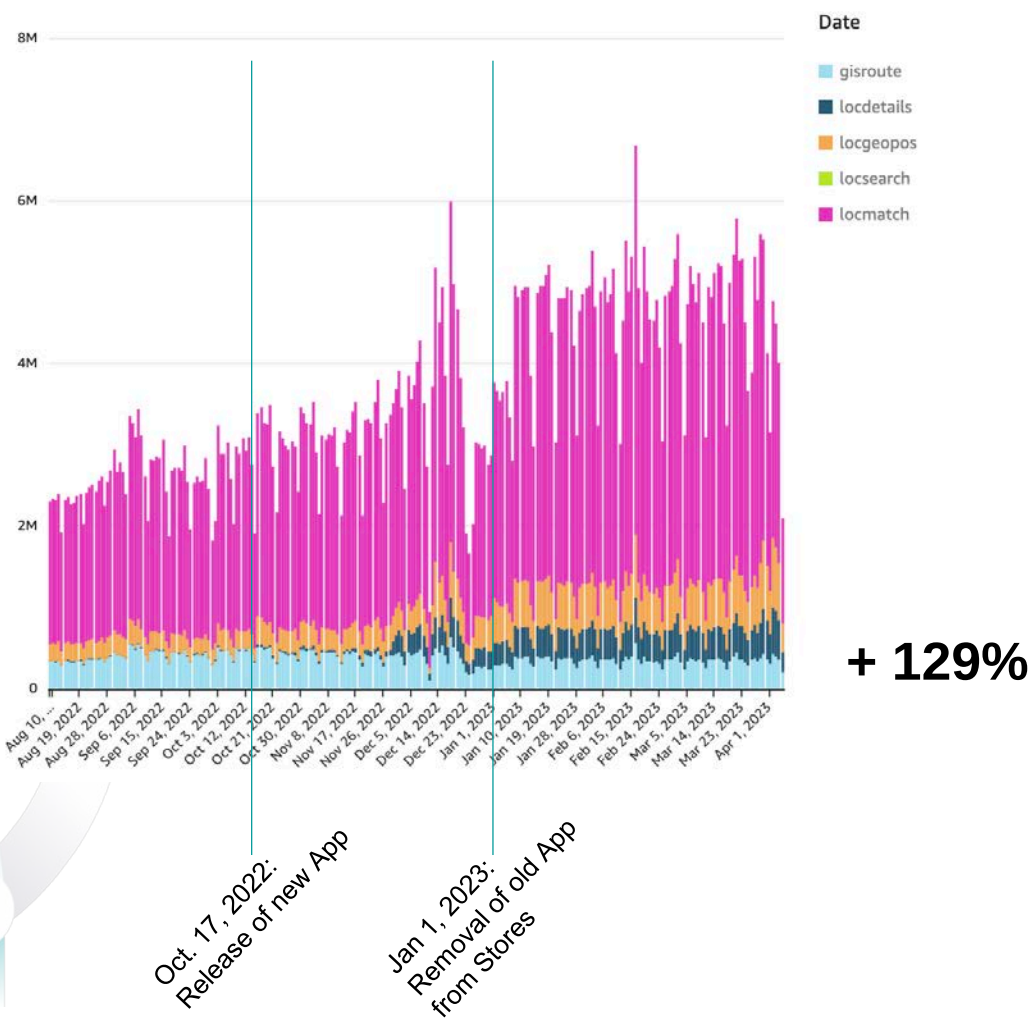
Rising numbers mean:

- Representative sample of data
- Improved data quality
- Increased confidence in findings

There is great potential to use the data to accomplish the following:

1. Get the whole picture
2. Improving the passenger experience
3. Learn about passenger behaviour

Utilization of Location Based Features



+ 129%

We recognize a trend in request types:

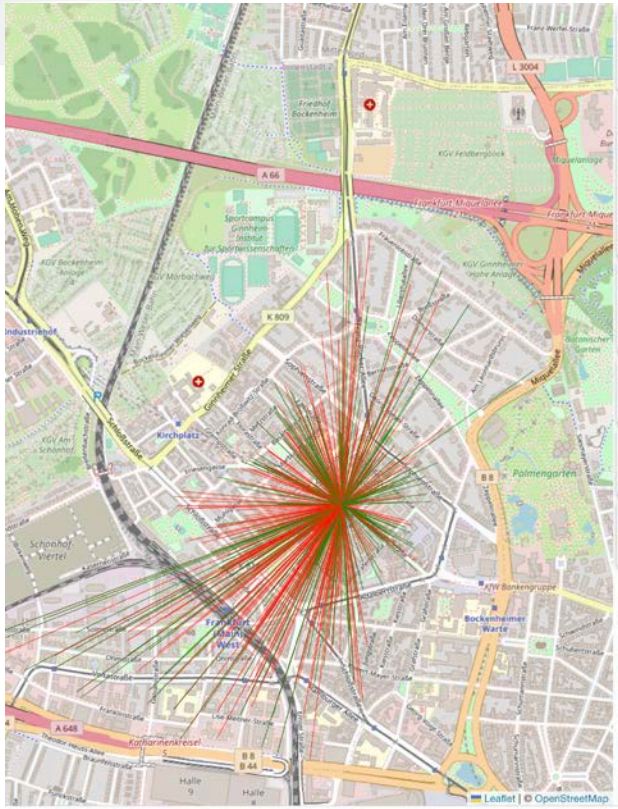
- Sharp increase in location-based queries (i.e., customers use addresses as search parameters).
- Geolocation usage shows a steep increase.

Passengers are beginning to use door-to-door routing!

From an analytical perspective, this shift in request types offers the potential:

1. To gain insights about the First&Last-Mile
2. Discover blind-spots in the PT-Network
3. Improve Accessibility to Stations and MSPs in key locations

Analyze Public Transit Coverage: Walking Distances for First & Last Mile



Summary

Average Distance	Number of Trips
472.963	12,702

Distance

501-750m	5,550
251-500m	3,879
<=250m	2,654
>1000m	345
751-1000m	274

Segmentation Type

First Mile	6,655
Last Mile	6,047

PT Mode

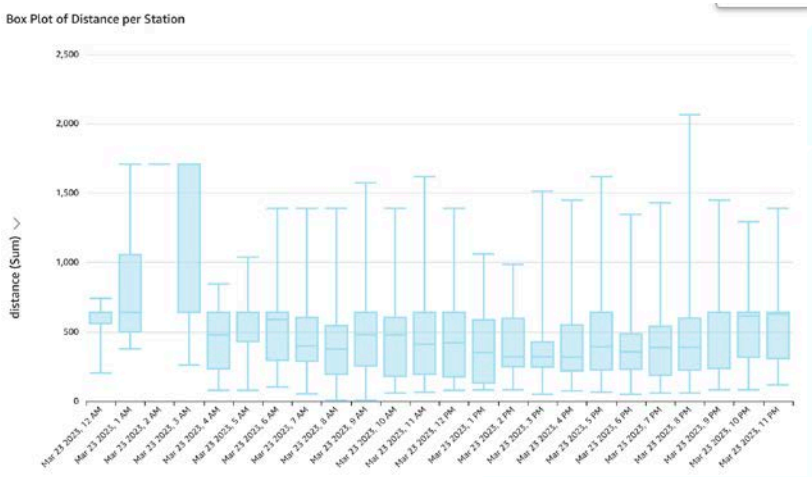
U-Bahn	12,702

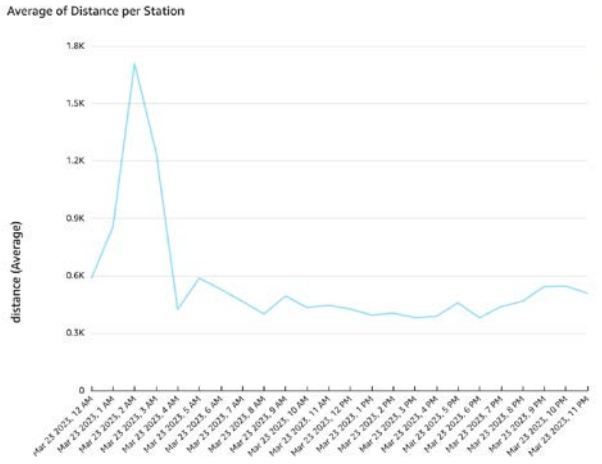
Day of the Week

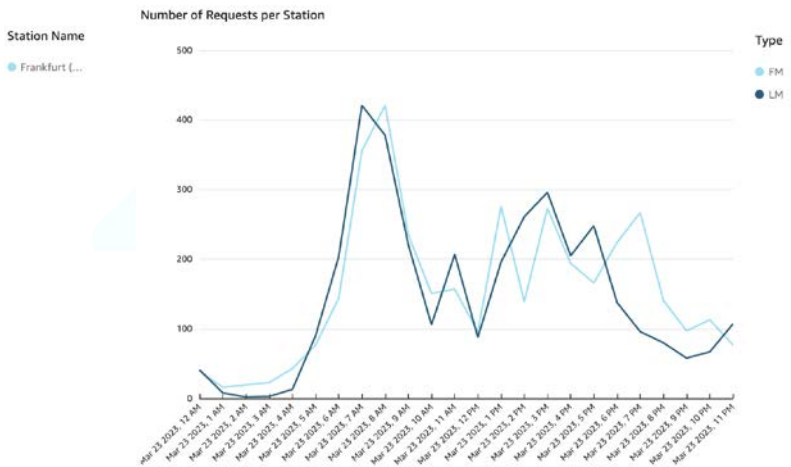
3	12,702

Stations Reset

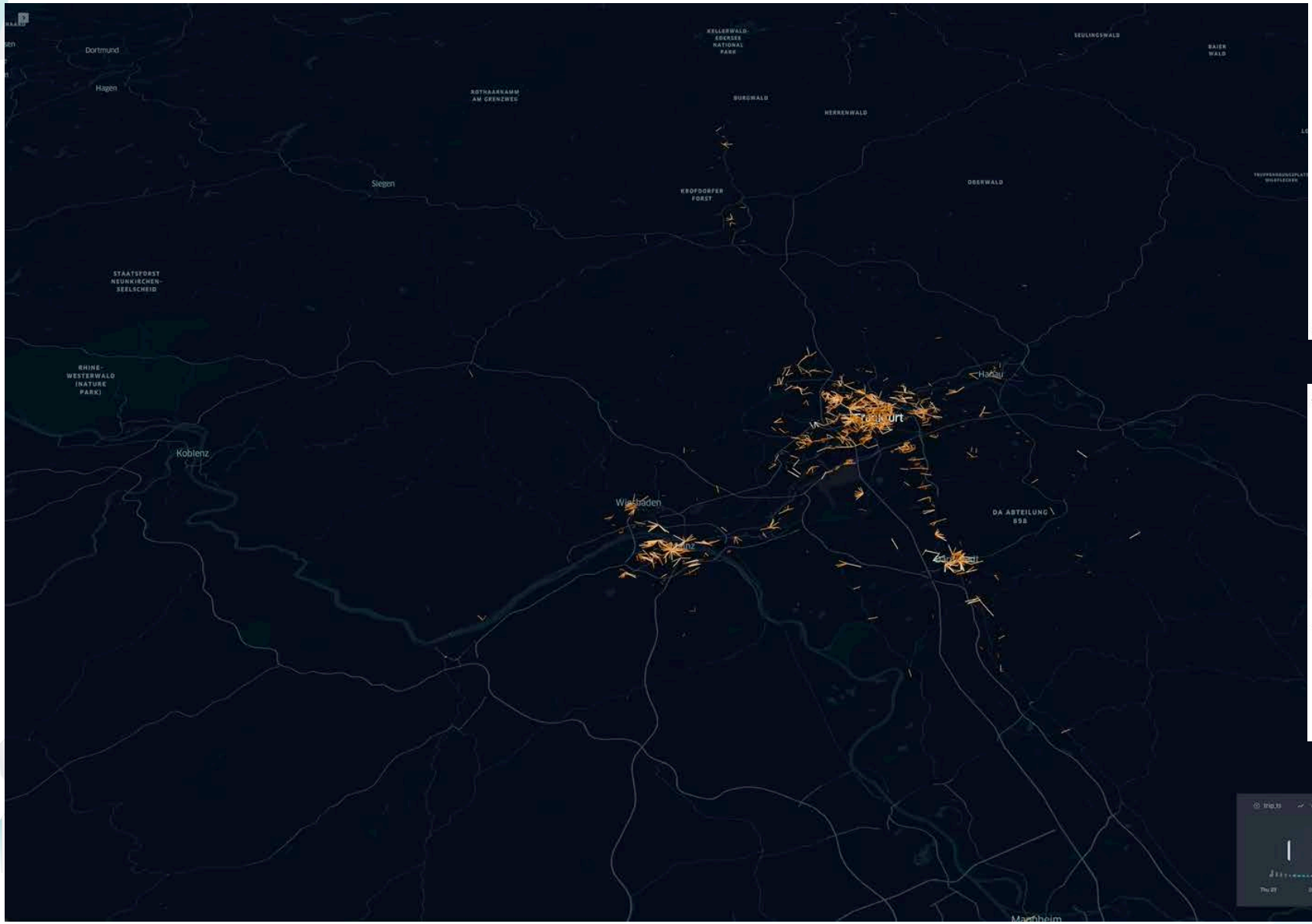
Frankfurt (Main) Leipziger Straße	12,702

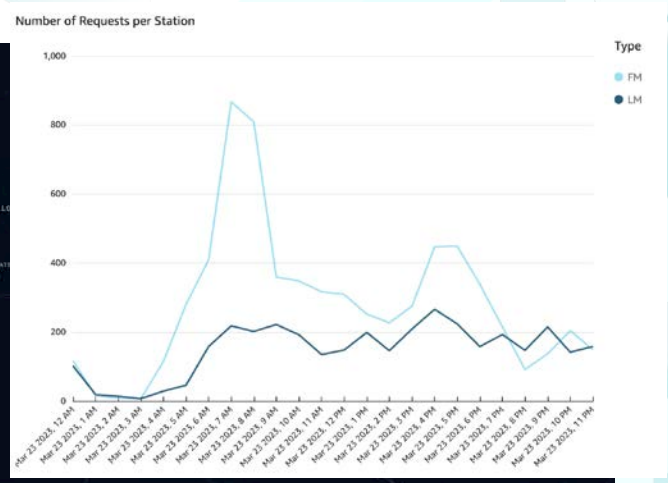


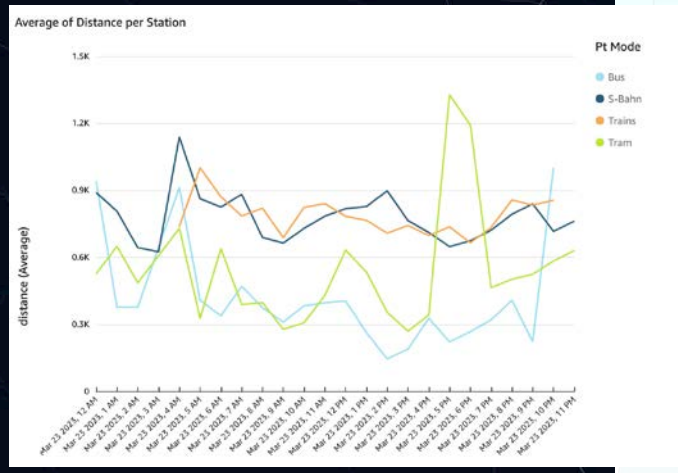


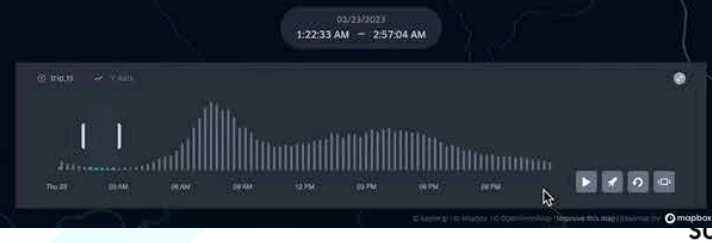


Visual analytics to identify areas of interest

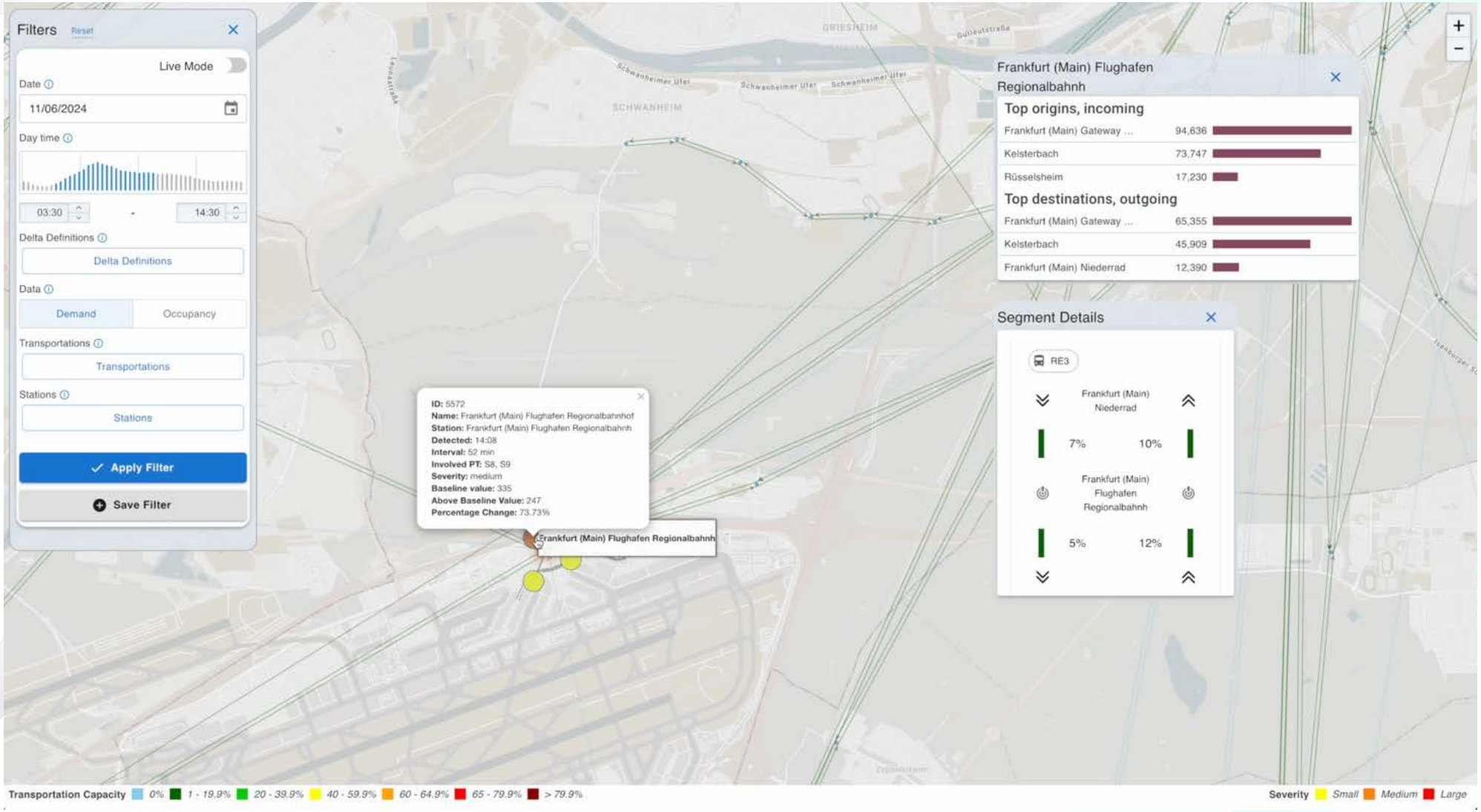




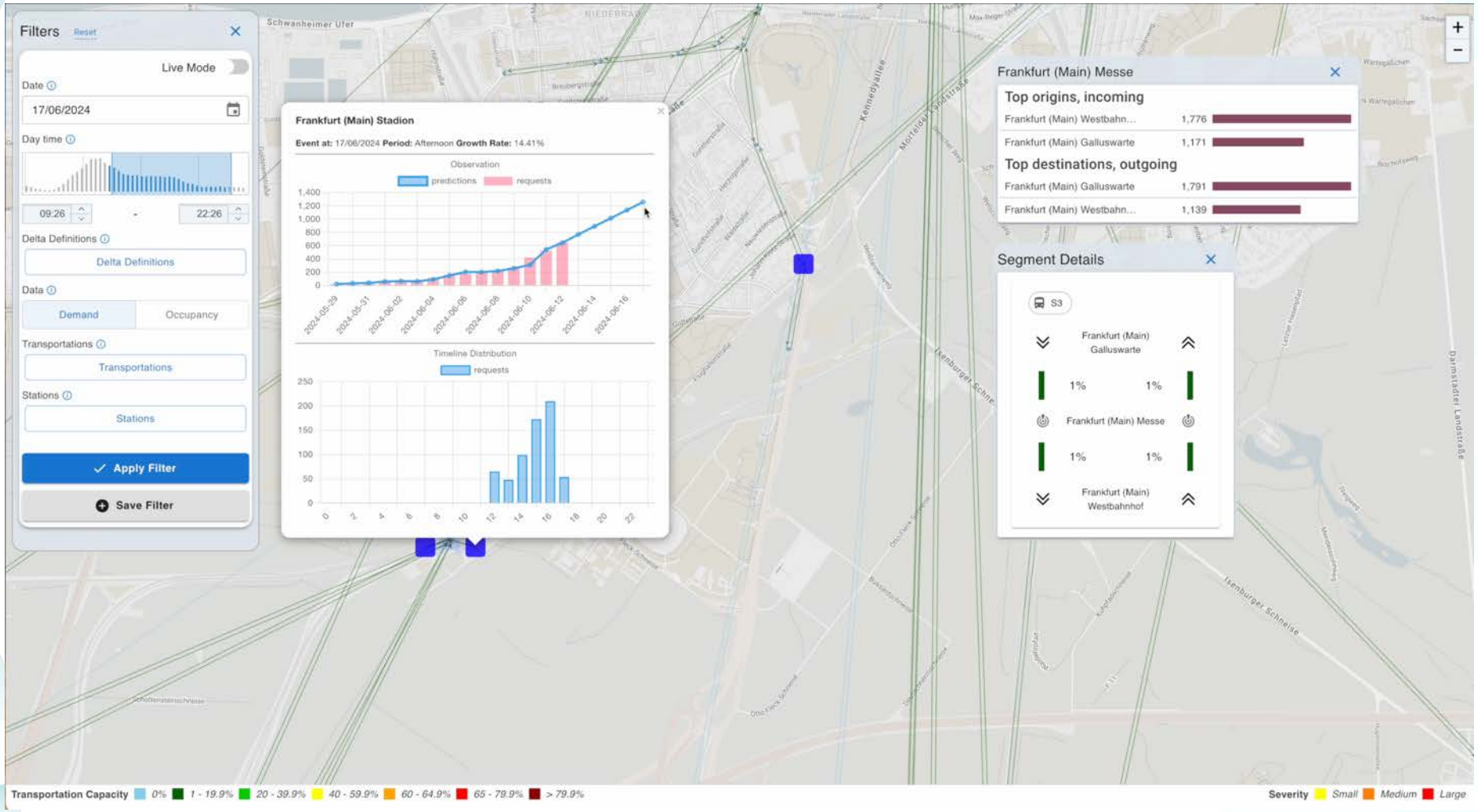




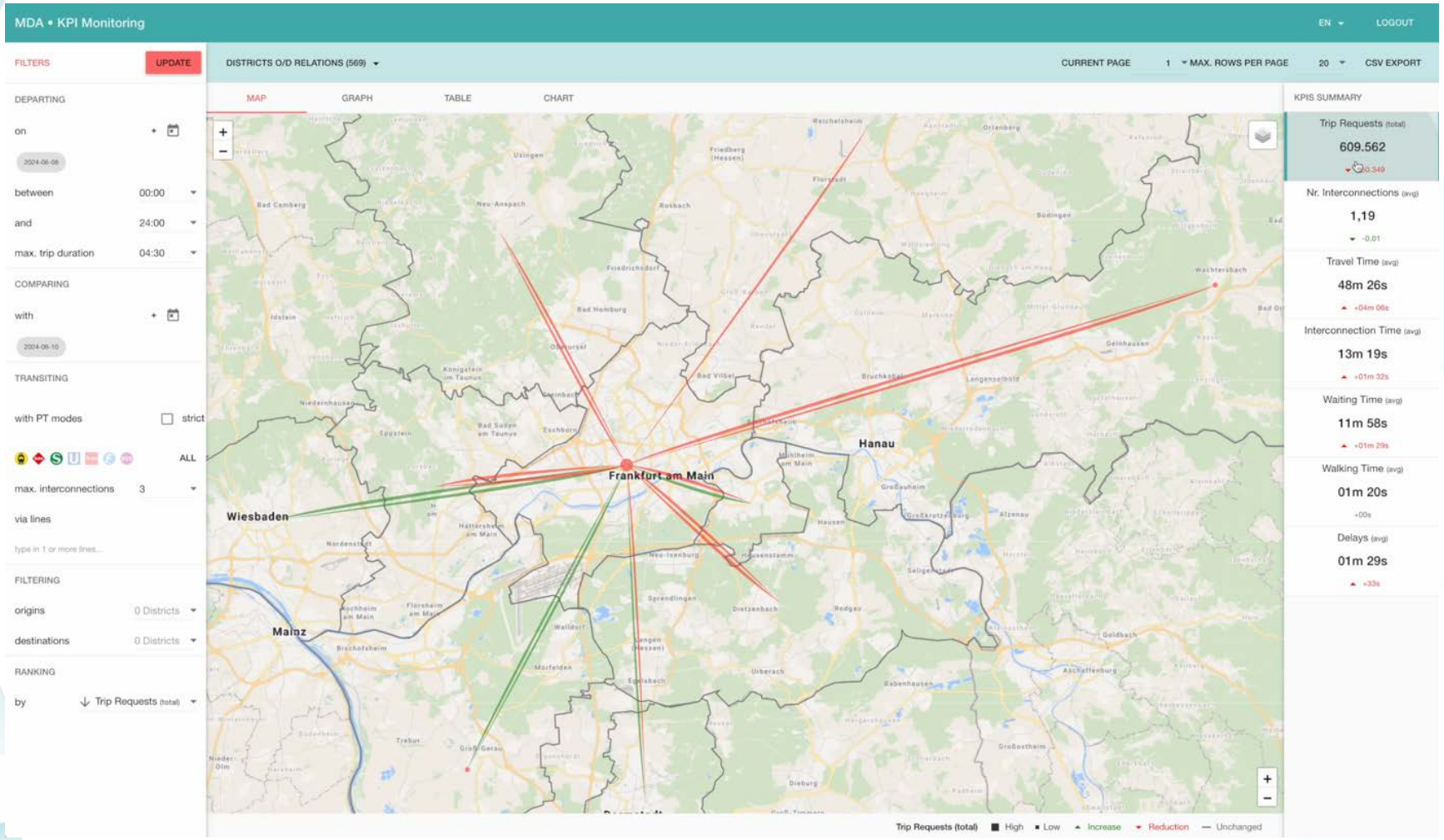
Detection of Incidents in Real Time



Prediction of Events, Days in Advance



Understand Transportation Demand – Adapt Schedules and Operation



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