

DKS

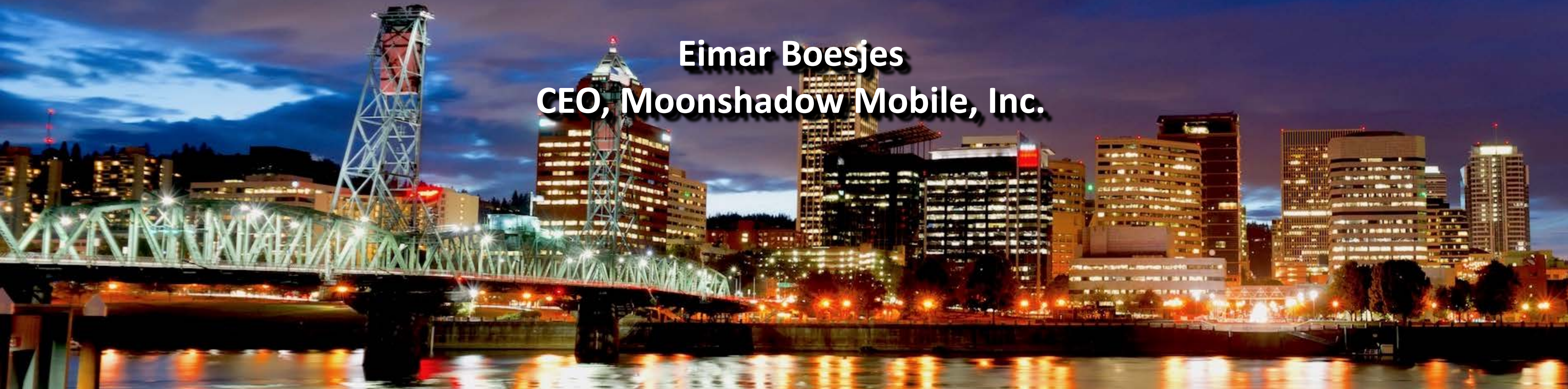
DB₄IoT

Moonshadow

Oregon Modeling Users Group July 18, 2018

Using Big Data for Traffic Modeling and Analytics

Eimar Boesjes
CEO, Moonshadow Mobile, Inc.



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Moonshadow Mobile, Inc.

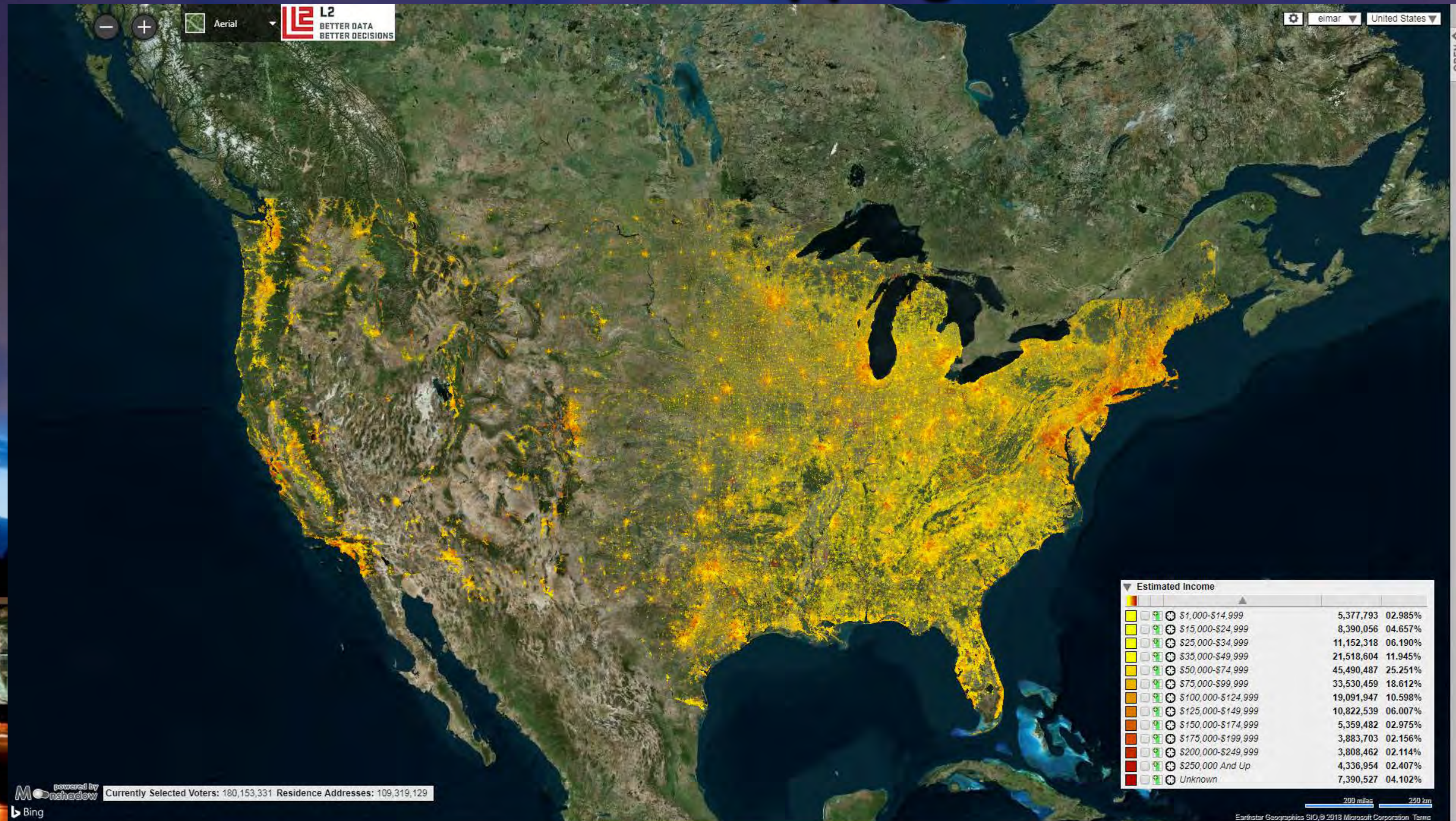
Founded in 2010 to

Develop Technology for Geospatial Big Data



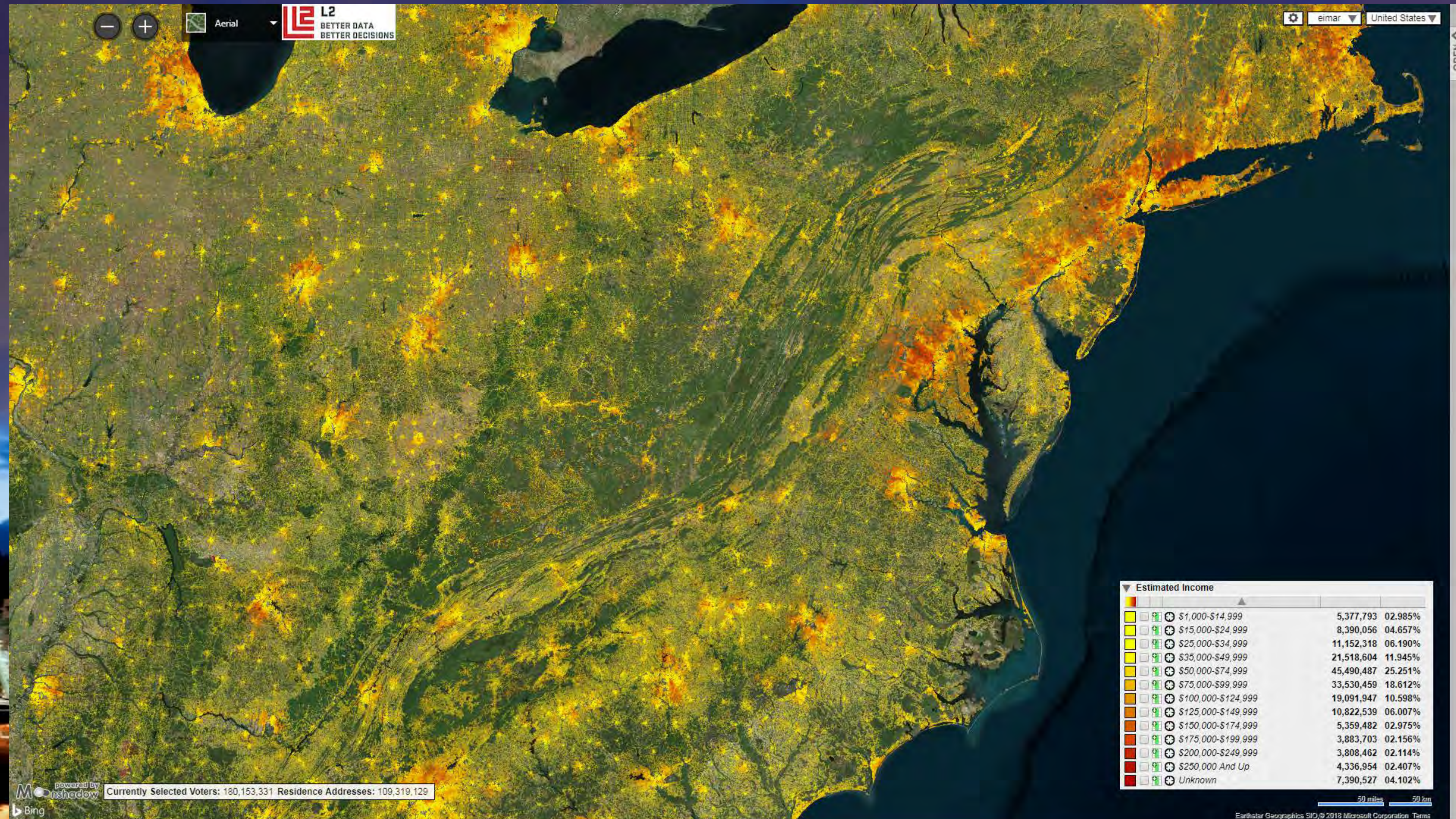
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2012: VoterMapping for L2



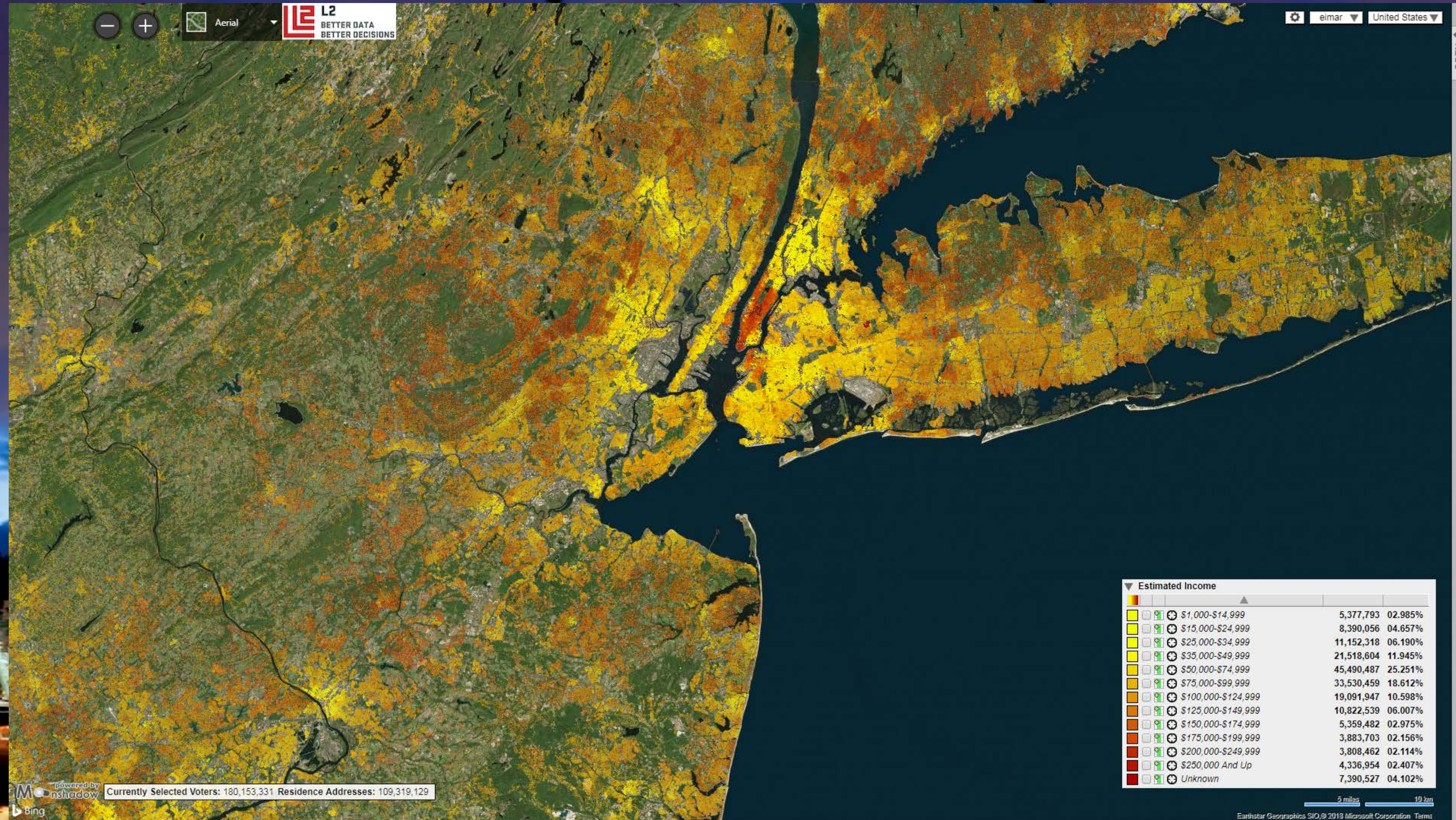
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180 Million US Voters on 110 Million Addresses



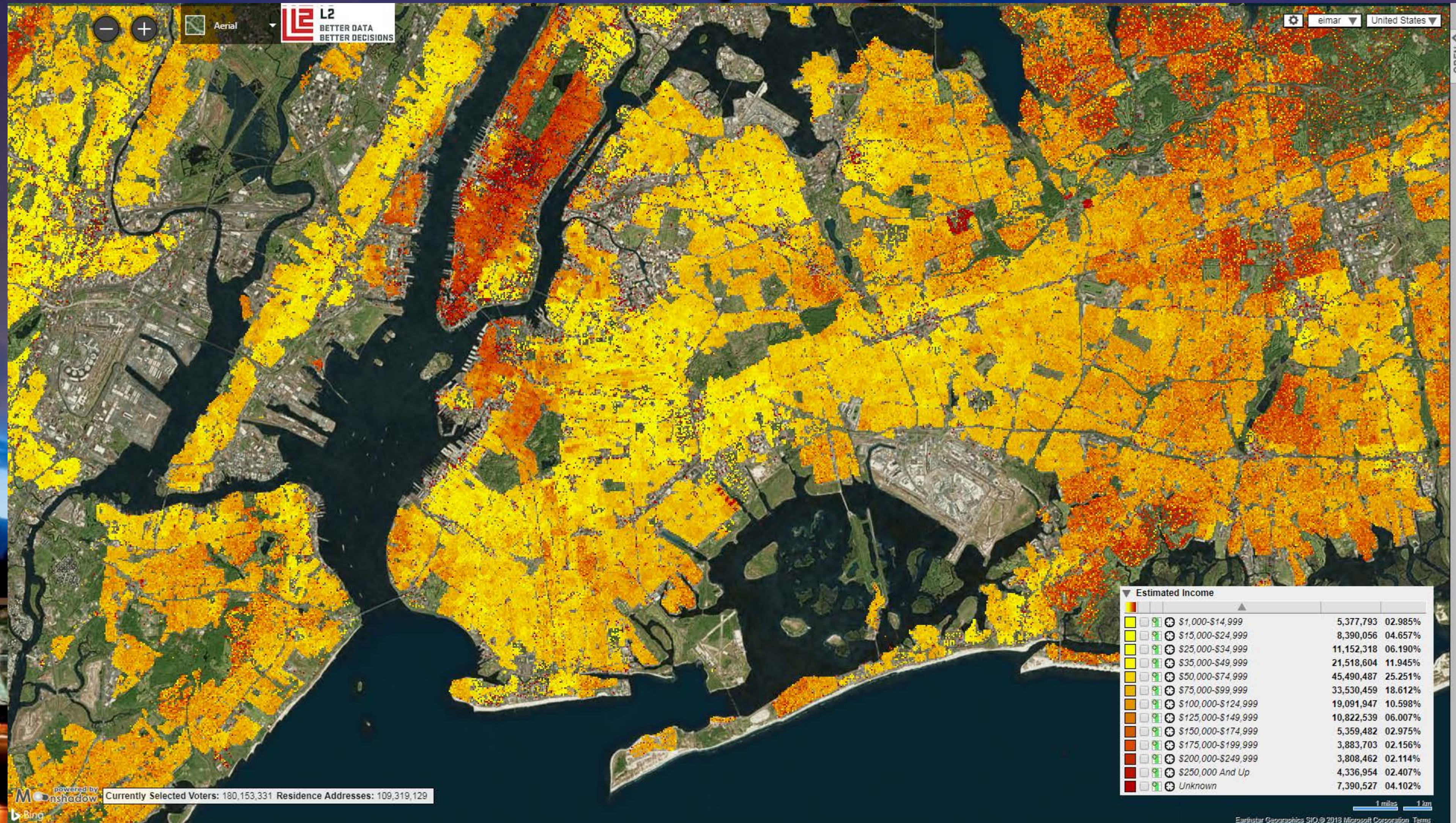
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Fully Interactive Map



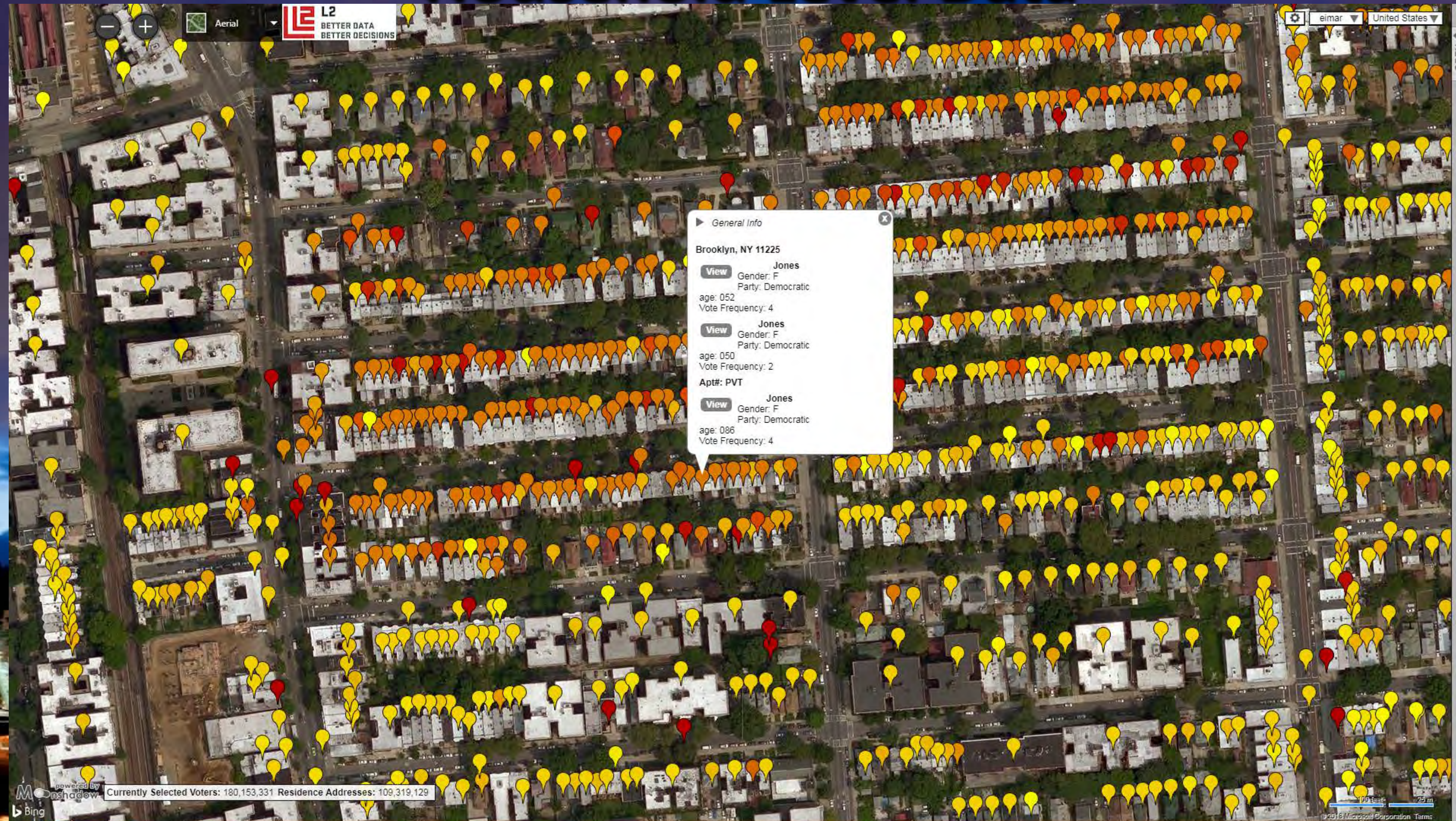
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Zoom in on any Neighborhood



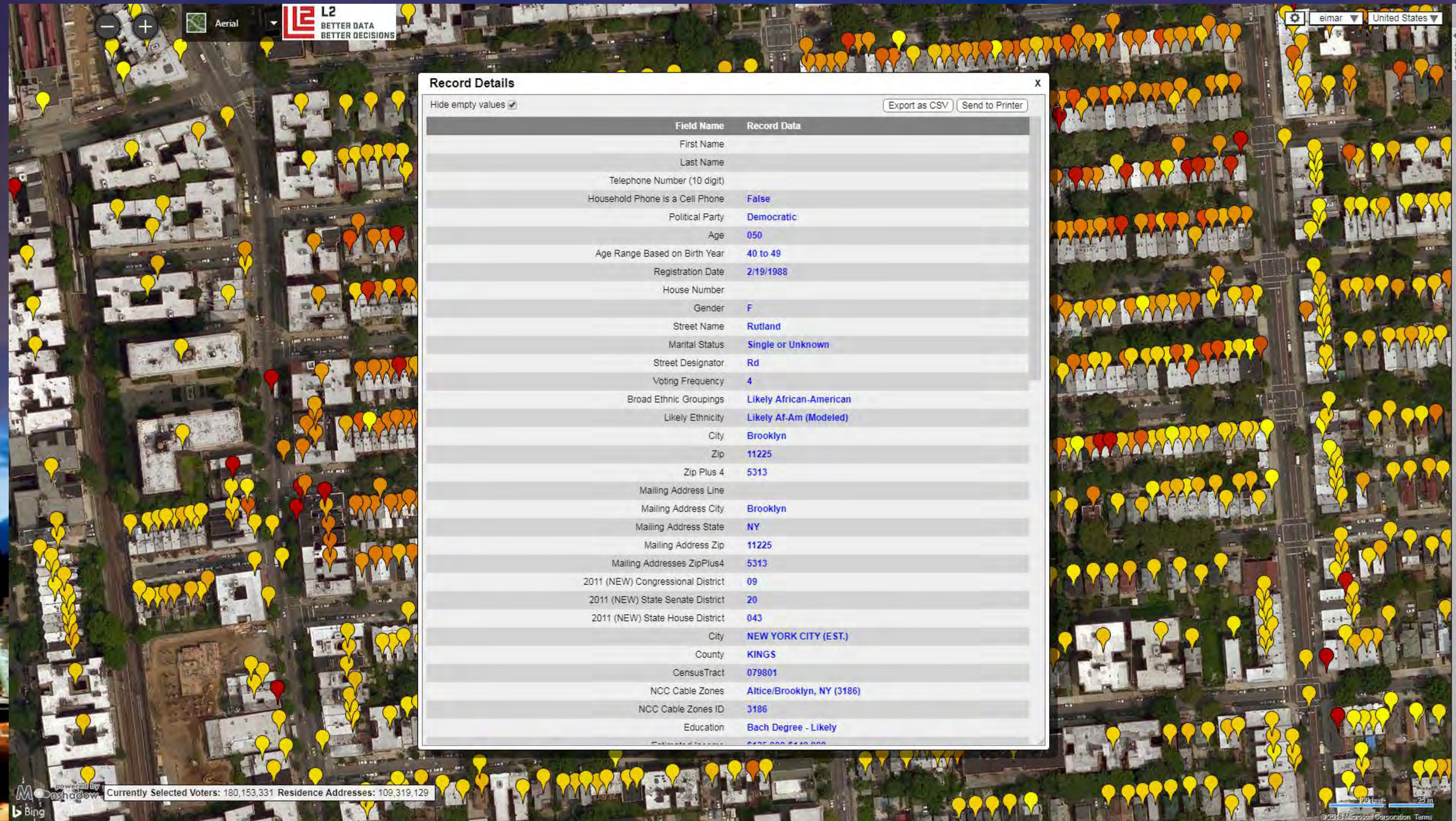
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Household Level Data

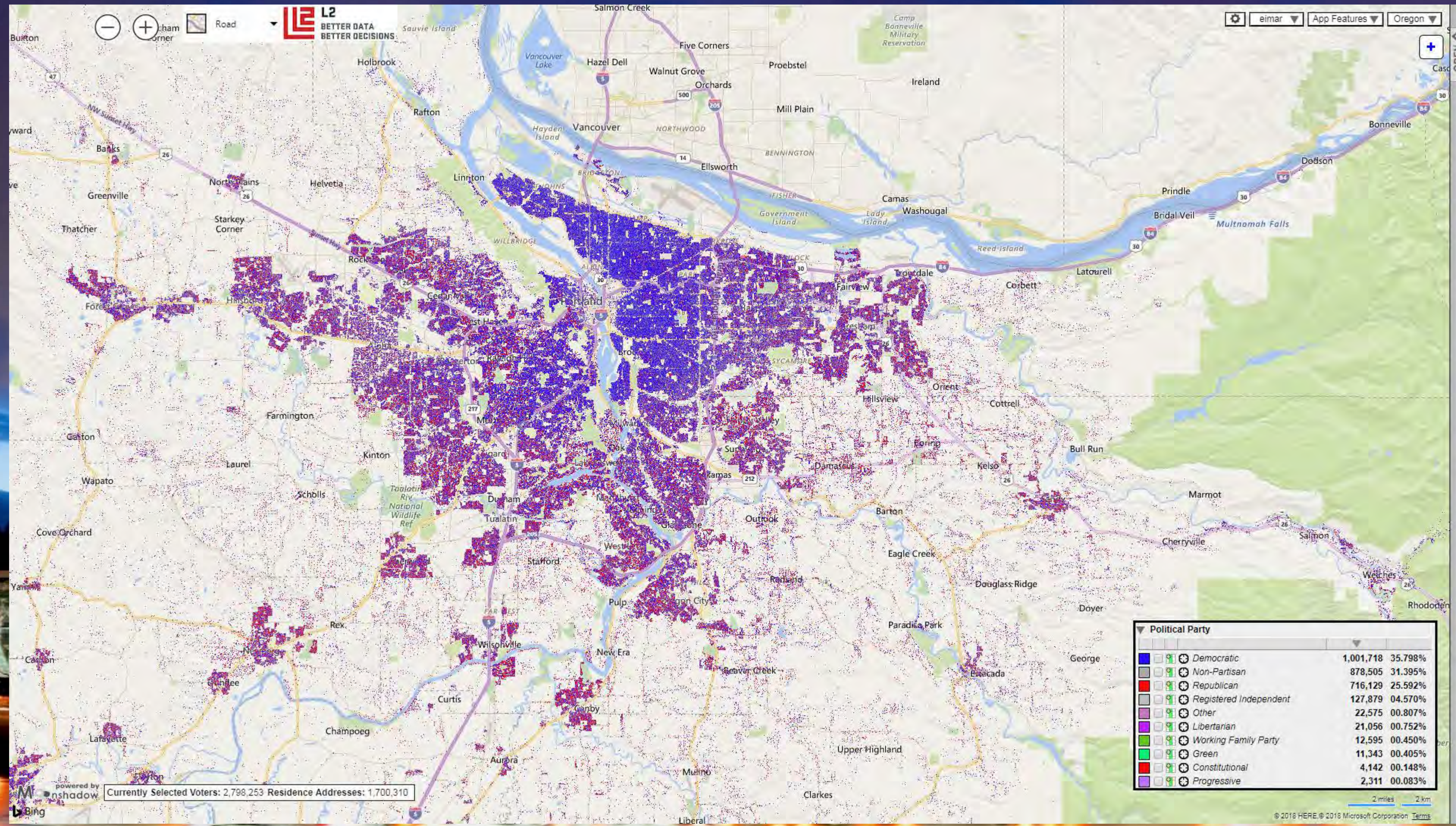


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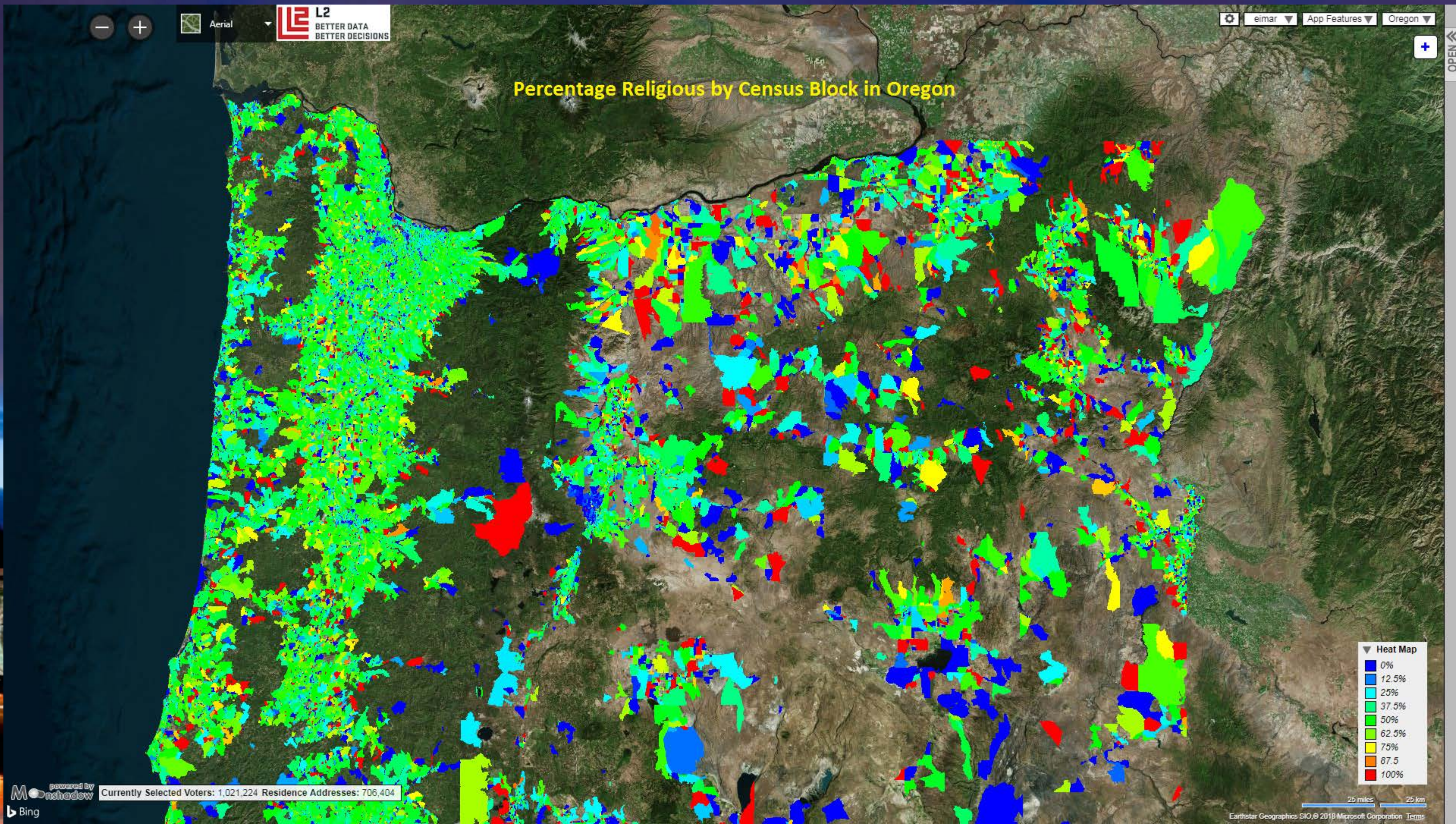
Hundreds of Data Fields



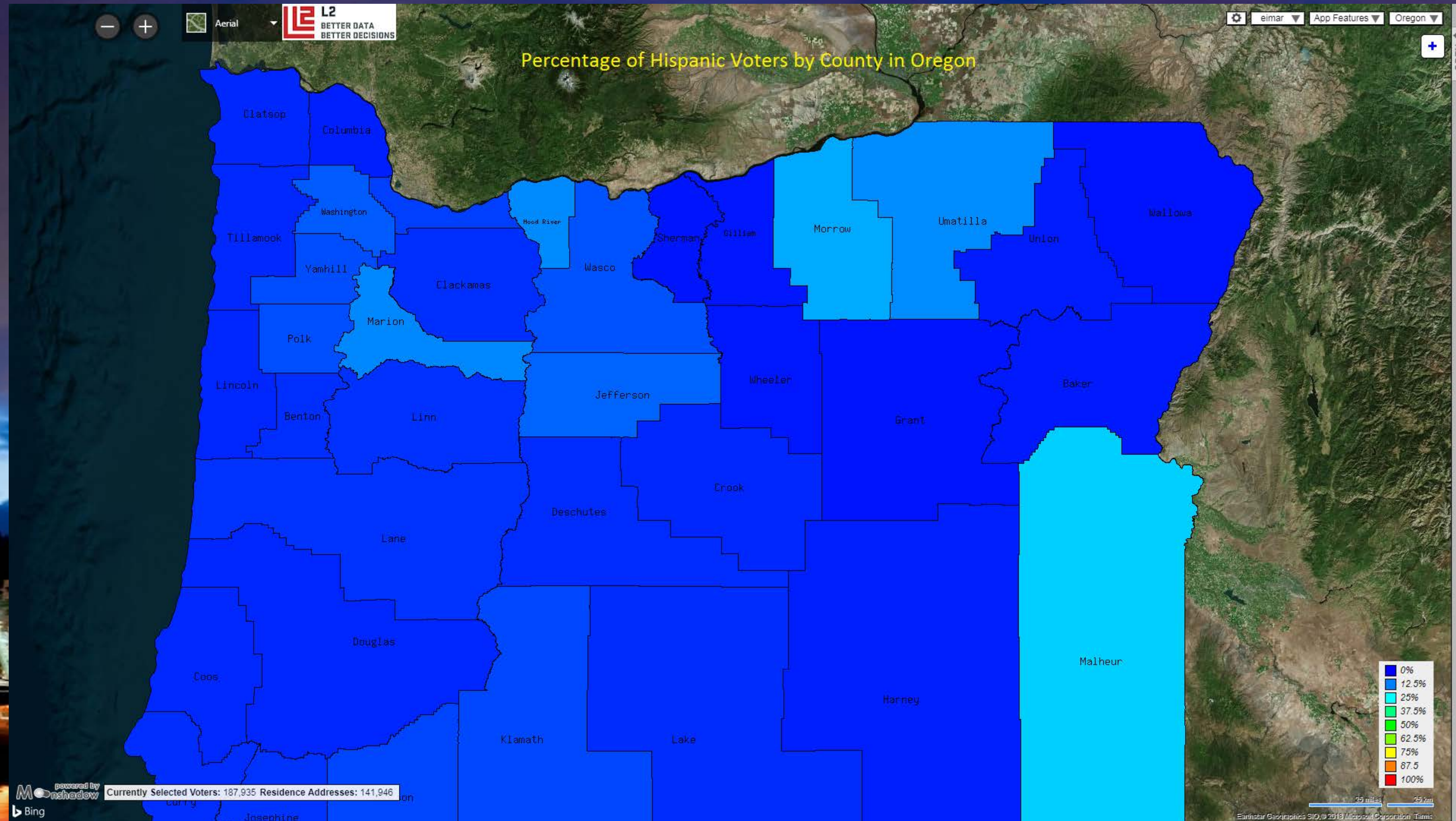
Visualize Data by Any Field: Voter Registration

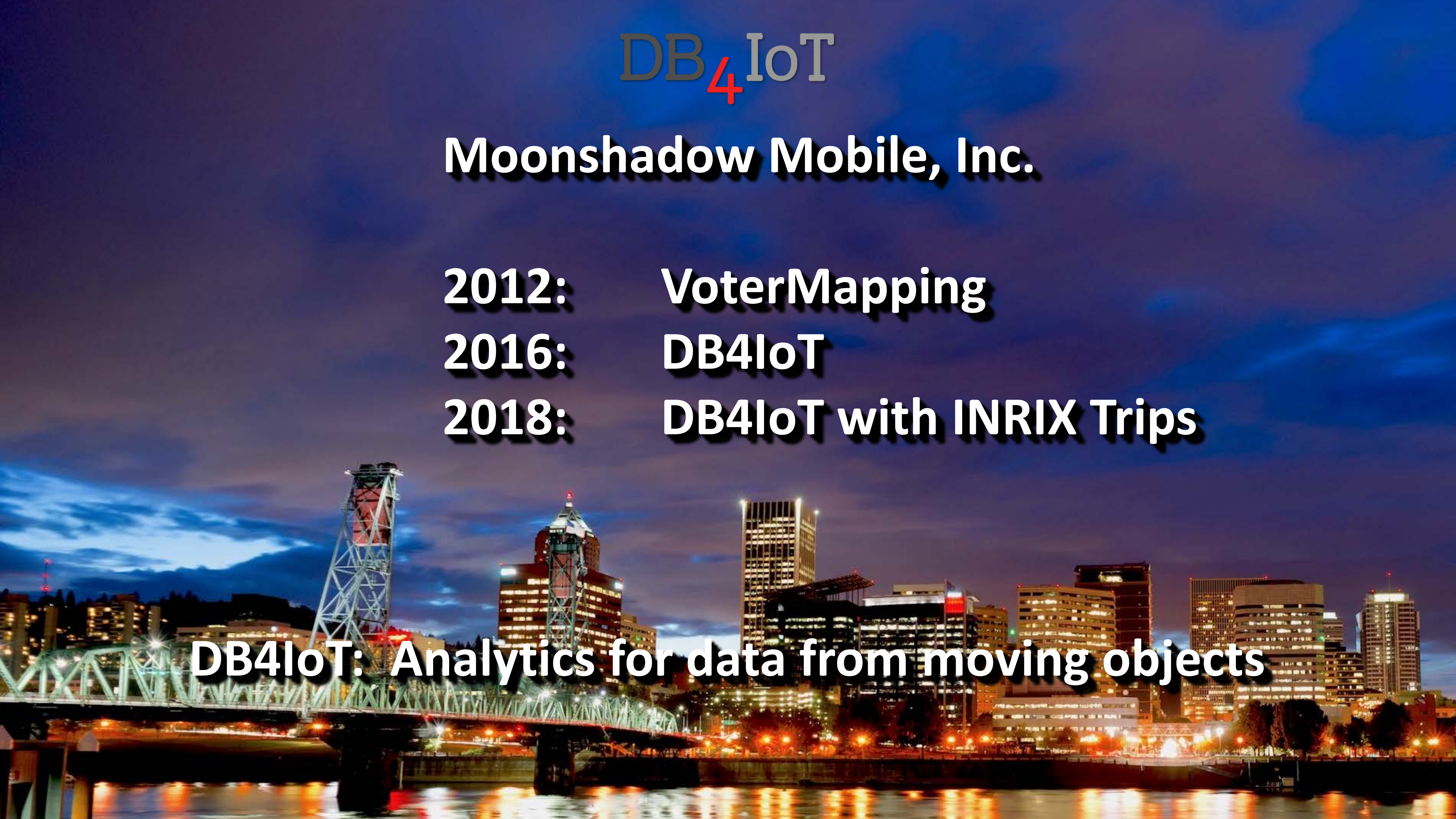


Visualize Data by Any Field: Percentage Religious



Visualize Data by Area: Percentage Hispanic





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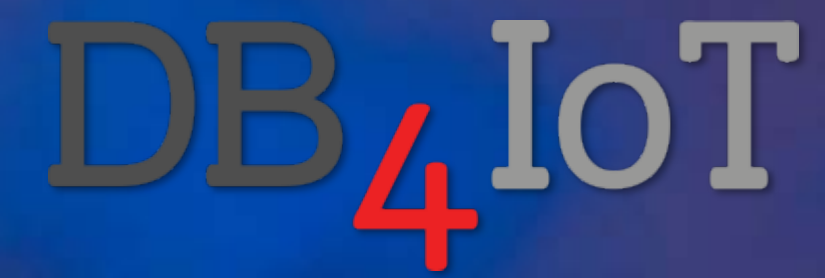
Moonshadow Mobile, Inc.

2012: VoterMapping

2016: DB4IoT

2018: DB4IoT with INRIX Trips

DB4IoT: Analytics for data from moving objects

The logo for DB4IoT, featuring the text "DB4IoT" in a sans-serif font. The "4" is red, while "DB" and "IoT" are grey. The background is a night-time photograph of a city skyline with a bridge in the foreground and lights reflecting on the water.

DB4IoT

Oregon has
Hundreds of thousands of moving vehicles and people
generating
Millions of movement measurements
per second

DB4IoT tracks movement data in real time,
keeps historic records and provides instant analytics

Movement Data Isn't Big Data, It's **Bigger** Data

TriMet Example

- 700 buses
- 145 light rail
- 300,000 weekday trips
- 100 million trips/year
- 400,000 daily stops

One Month of Data

- 200 values per bus
- Measured every five seconds
- Stored in 30,000 daily log files
- Comprising 250 million records
- Containing 50 billion values

Movement Data Isn't Big Data, It's **Bigger** Data

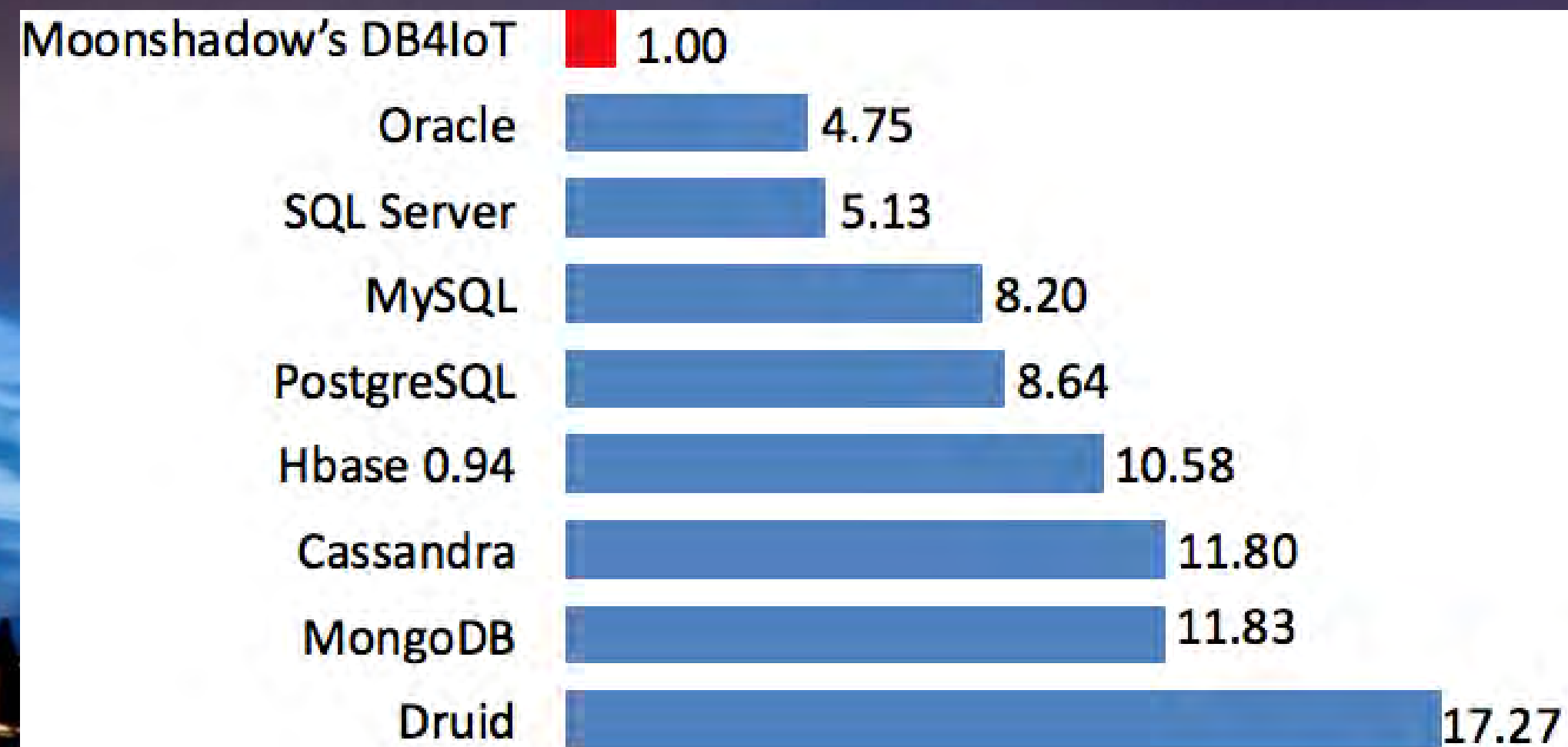
Vehicle Movement Data

- 60 MPH = 1 mile/minute = 27 meters/second
- For <1 meter movement resolution, you need 50 measurements/second
- Now TriMet's one-month bus movement database is 60 Billion Records
- 1 Month of TriMet Bus Data = 1TB in DB4IoT
- That is for only 845 vehicles

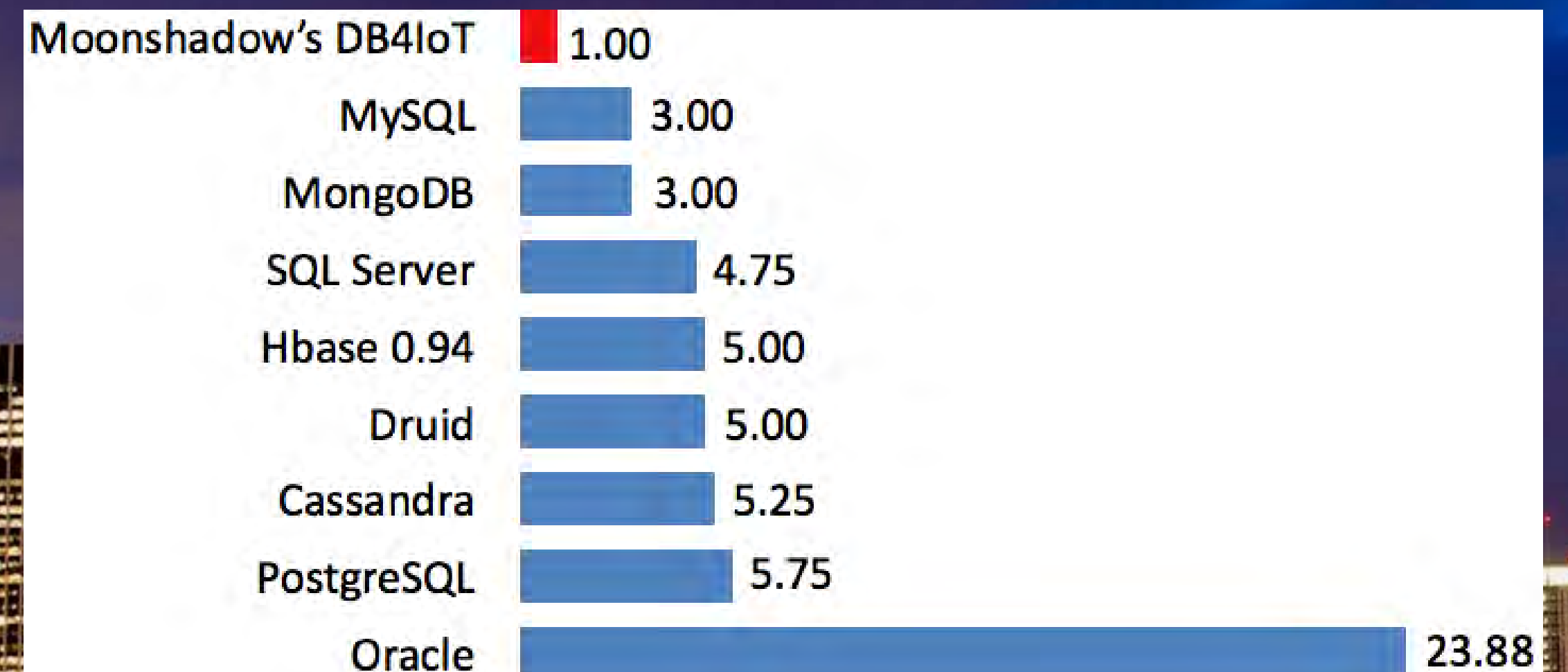
The Data is Too Large for Traditional Database Engines

DB4IoT Shrinks the Data Losslessly by 90%

Data Footprint Size



Data Row Overhead Size

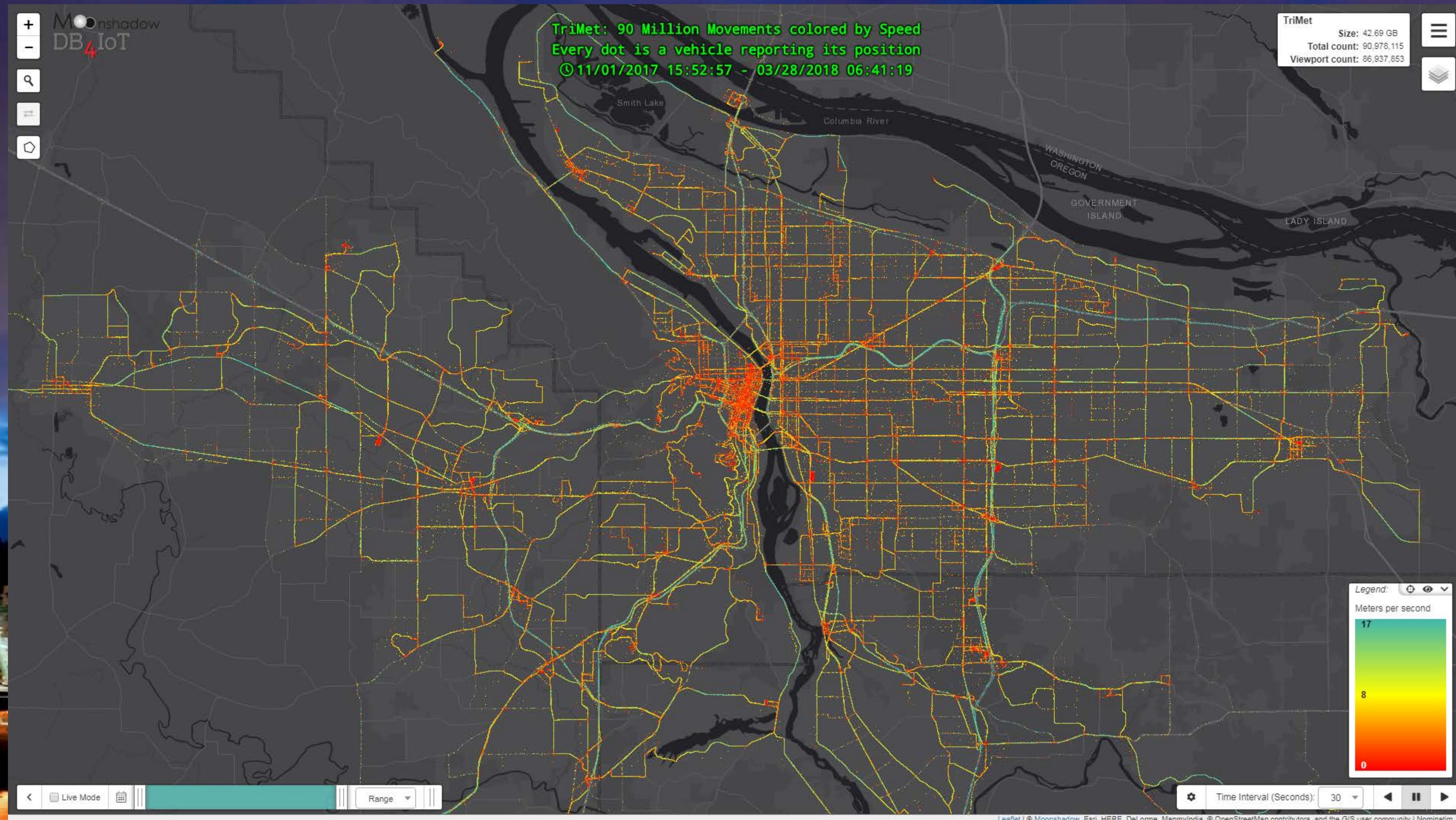


Traditional Database Engines Are Too Slow

DB4IoT Speed Advantages

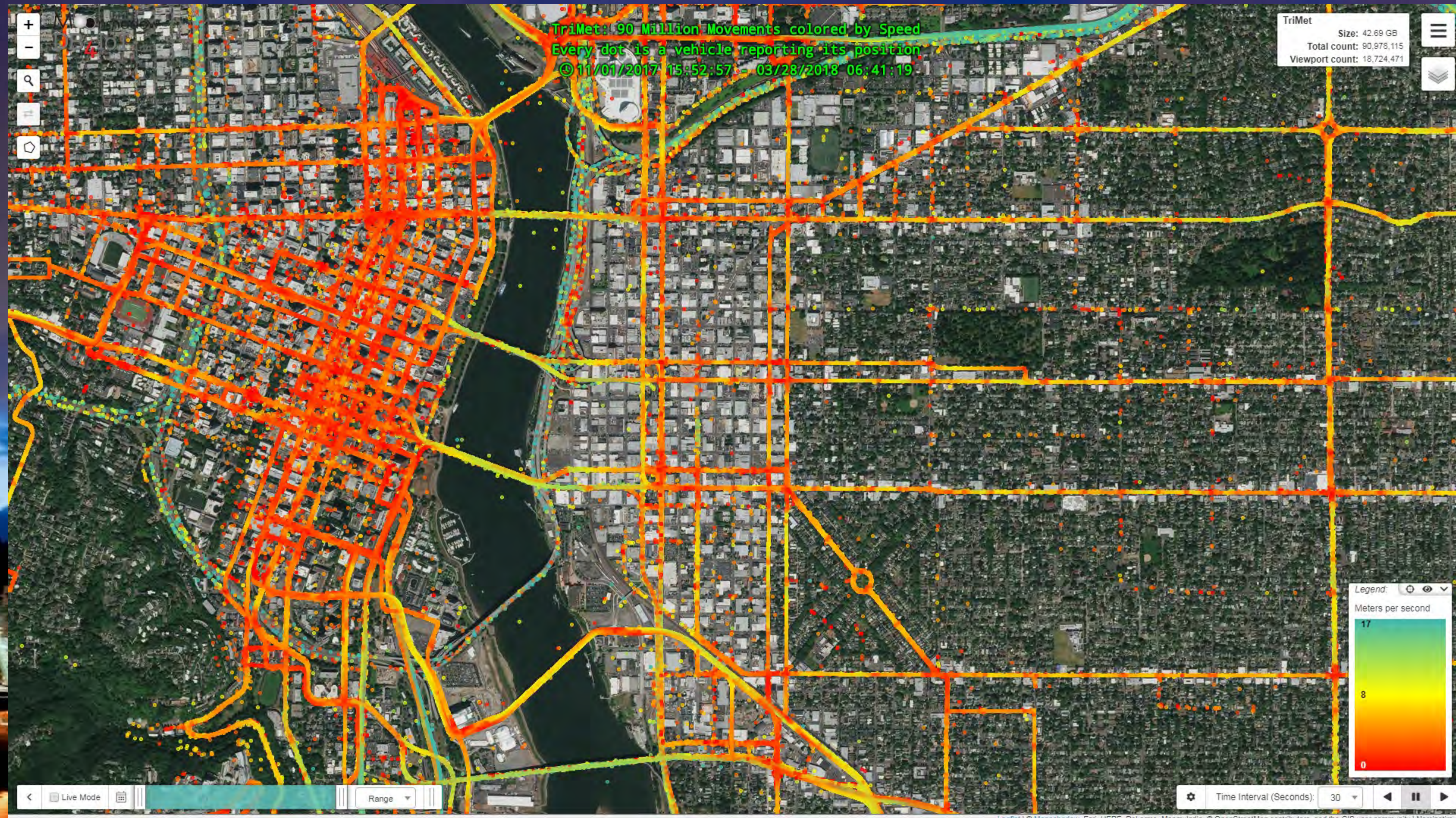
- | | |
|-------------------------|----------------------------|
| ■ Fast Ingestion Speed | 100k records/second/server |
| ■ Low Ingestion Latency | <150 ms |
| ■ Small Data Footprint | <1 byte/value, lossless |
| ■ Fast Analytics Speed | 200M records/second/cpu |
| ■ Instant Maps | 20+M records per sec |
| ■ Software Only | Runs on Intel X86 CPUs |
| ■ Deployment | In-Cloud |
| ■ Patents | Six issued, four pending |

What Does Vehicle Movement Data Look Like?



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Every dot is a vehicle reporting its position



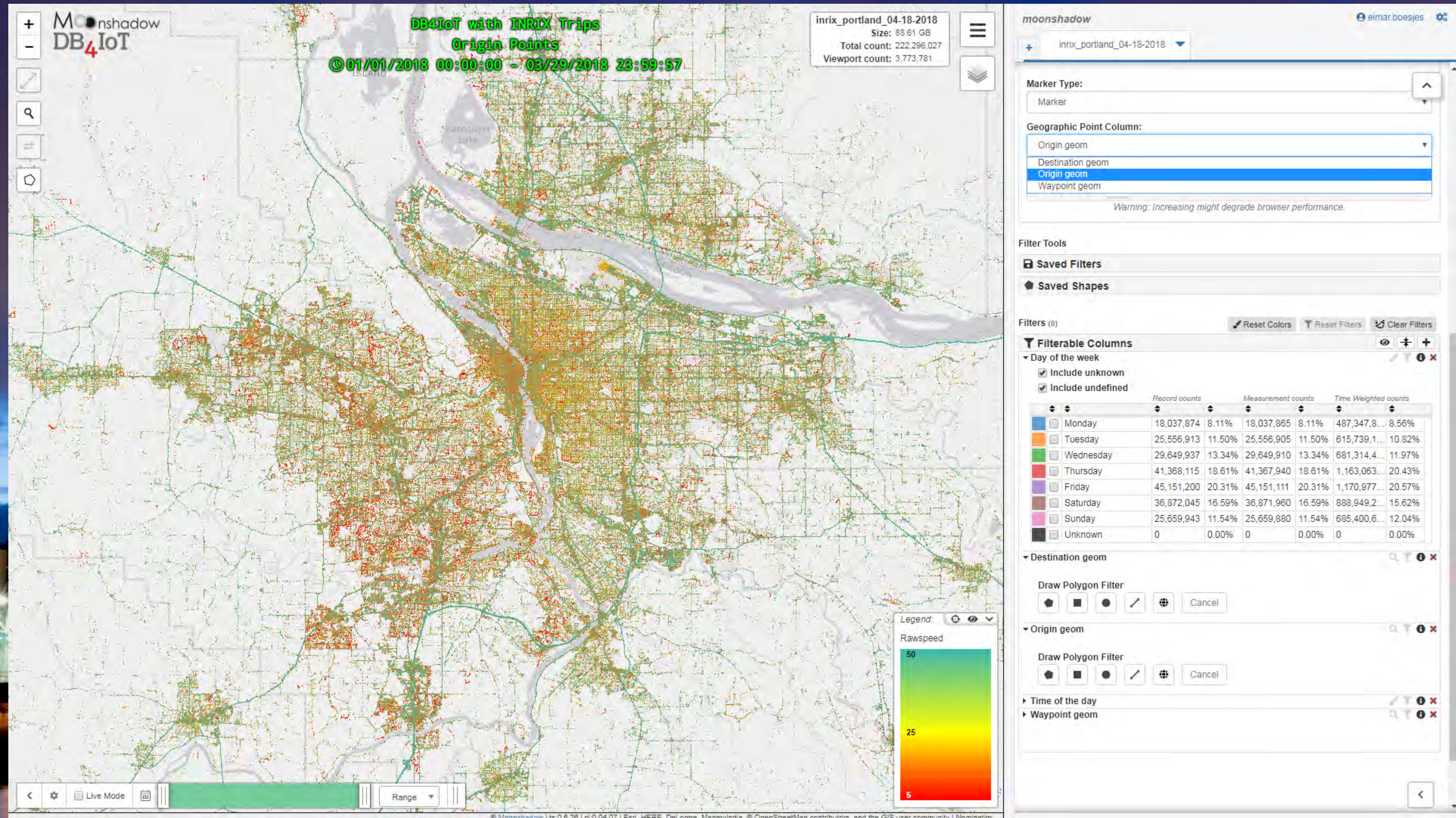
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Every dot is a vehicle reporting its position



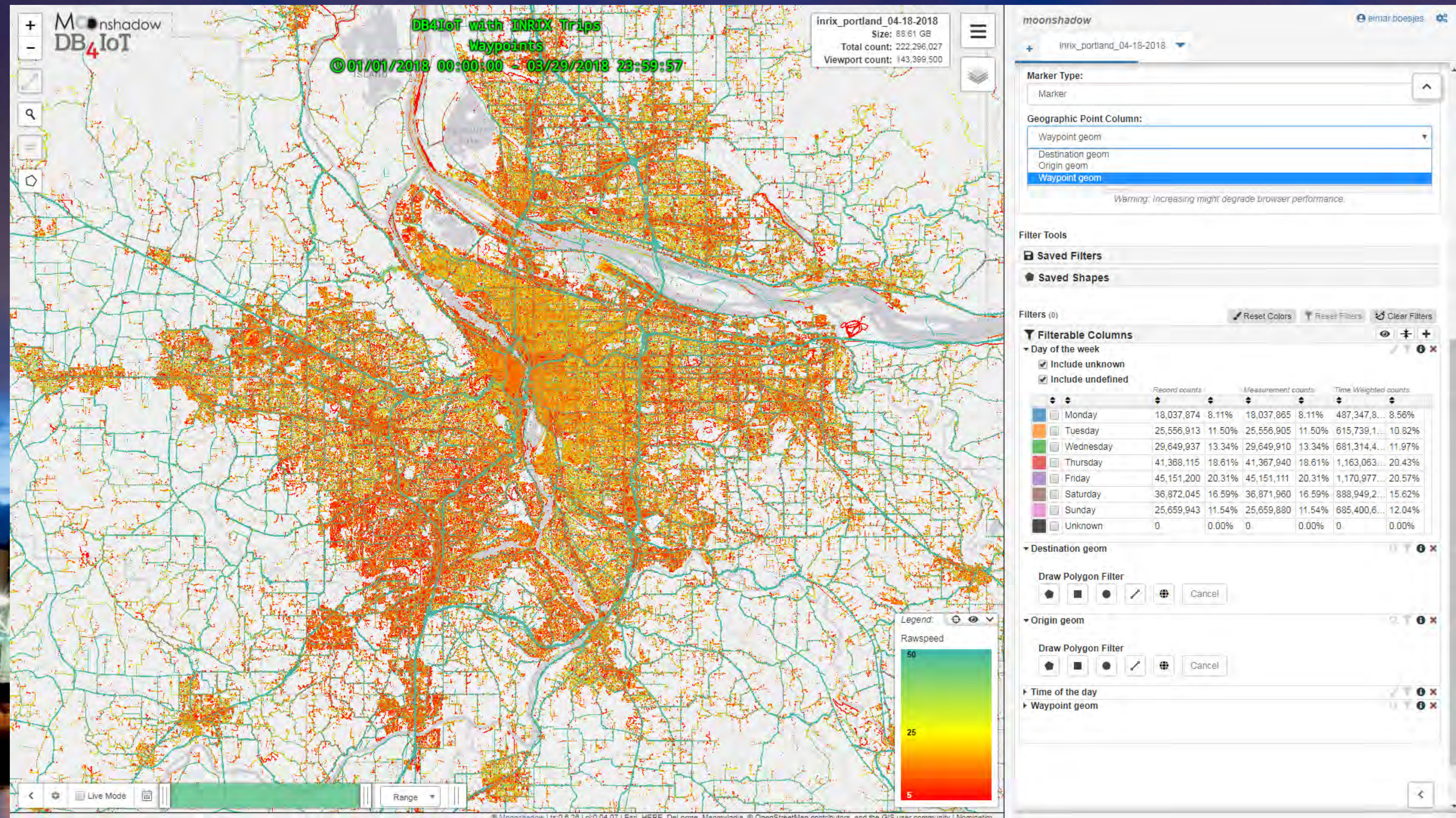
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DB4IoT with INRIX Trips: Origin Points



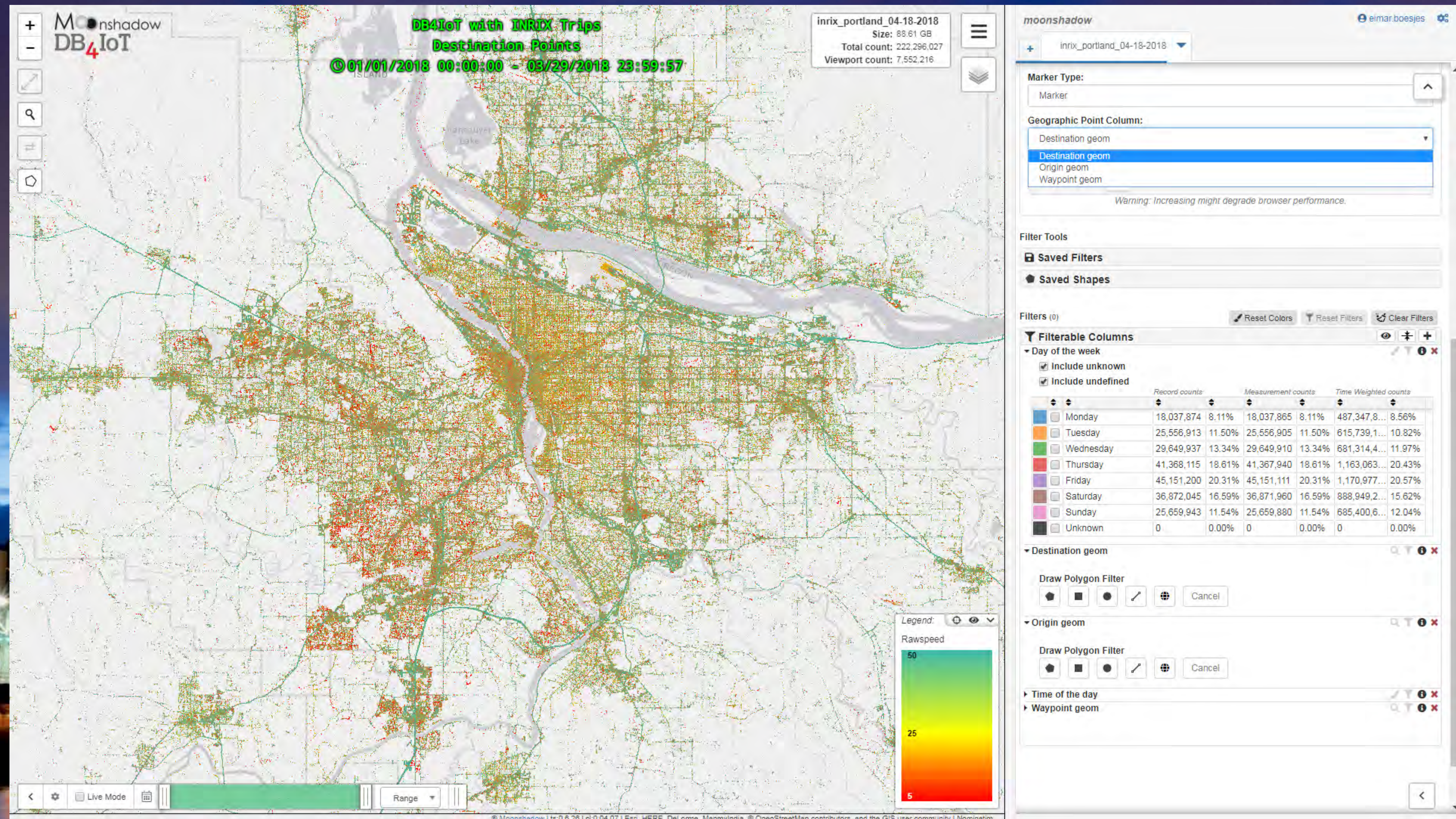
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DB4IoT with INRIX Trips: Waypoints

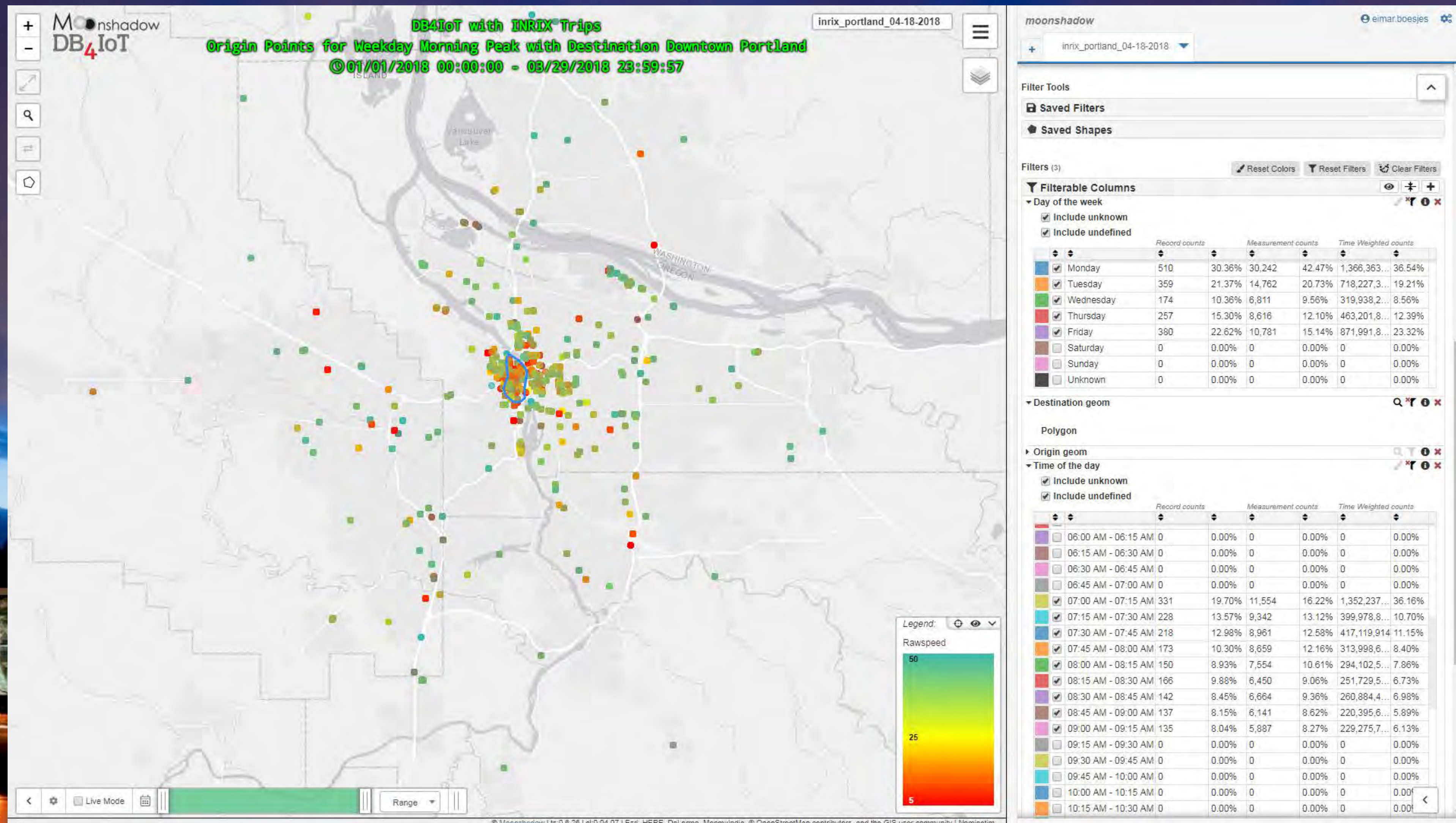


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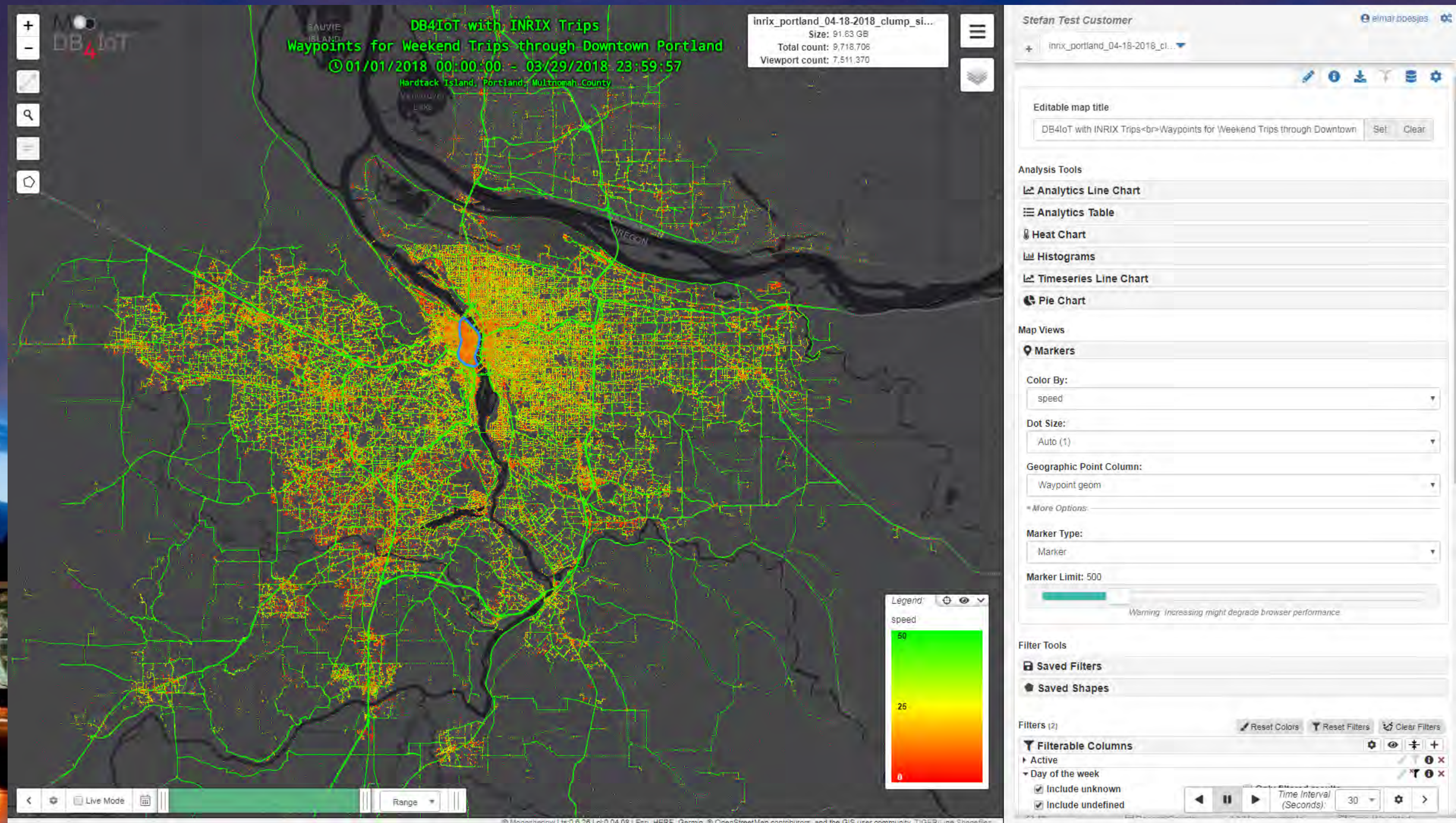
DB4IoT with INRIX Trips: Destination Points



Origins for Weekday Morning Downtown Destinations

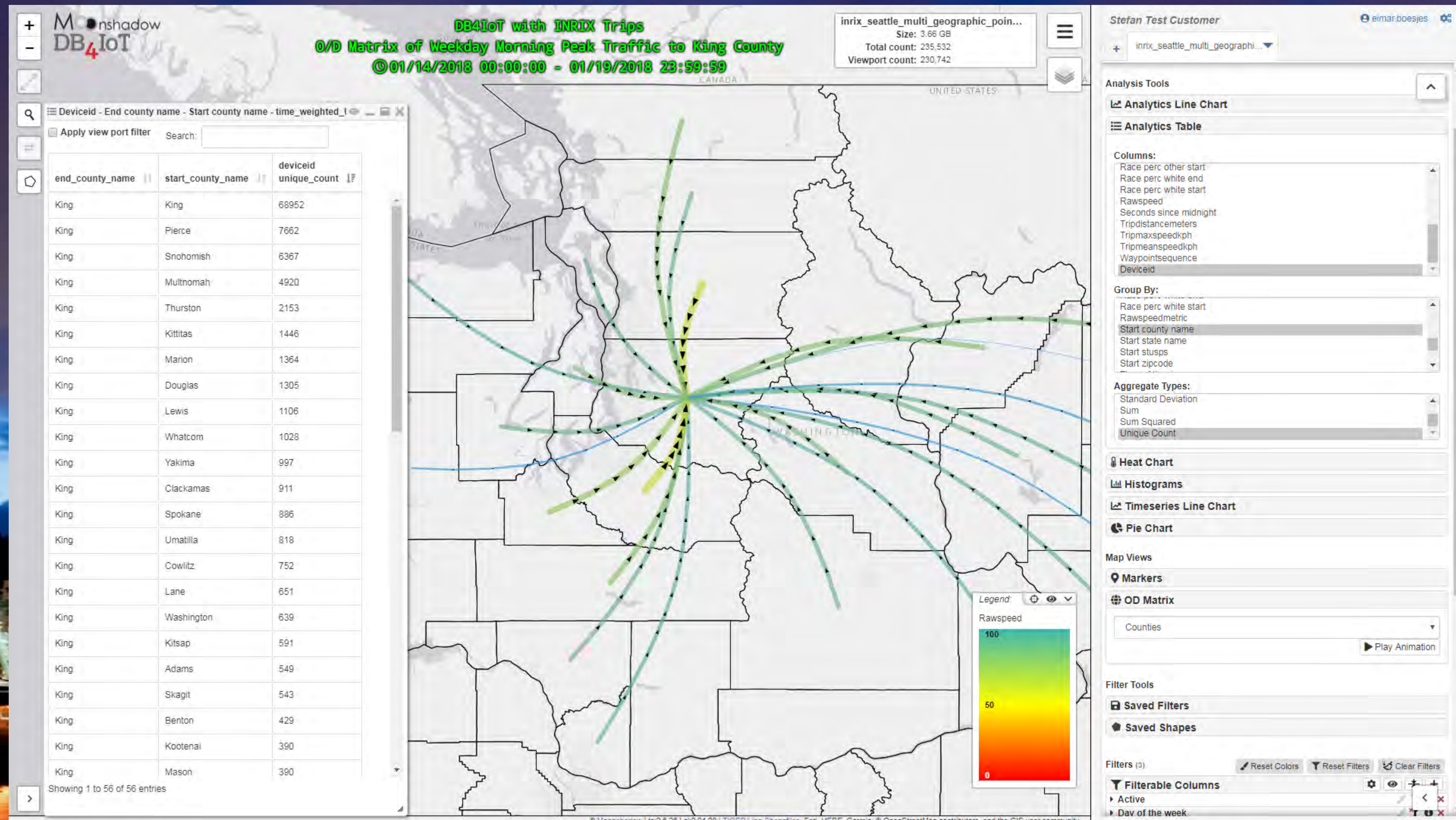


Waypoints for Weekend Trips through Downtown

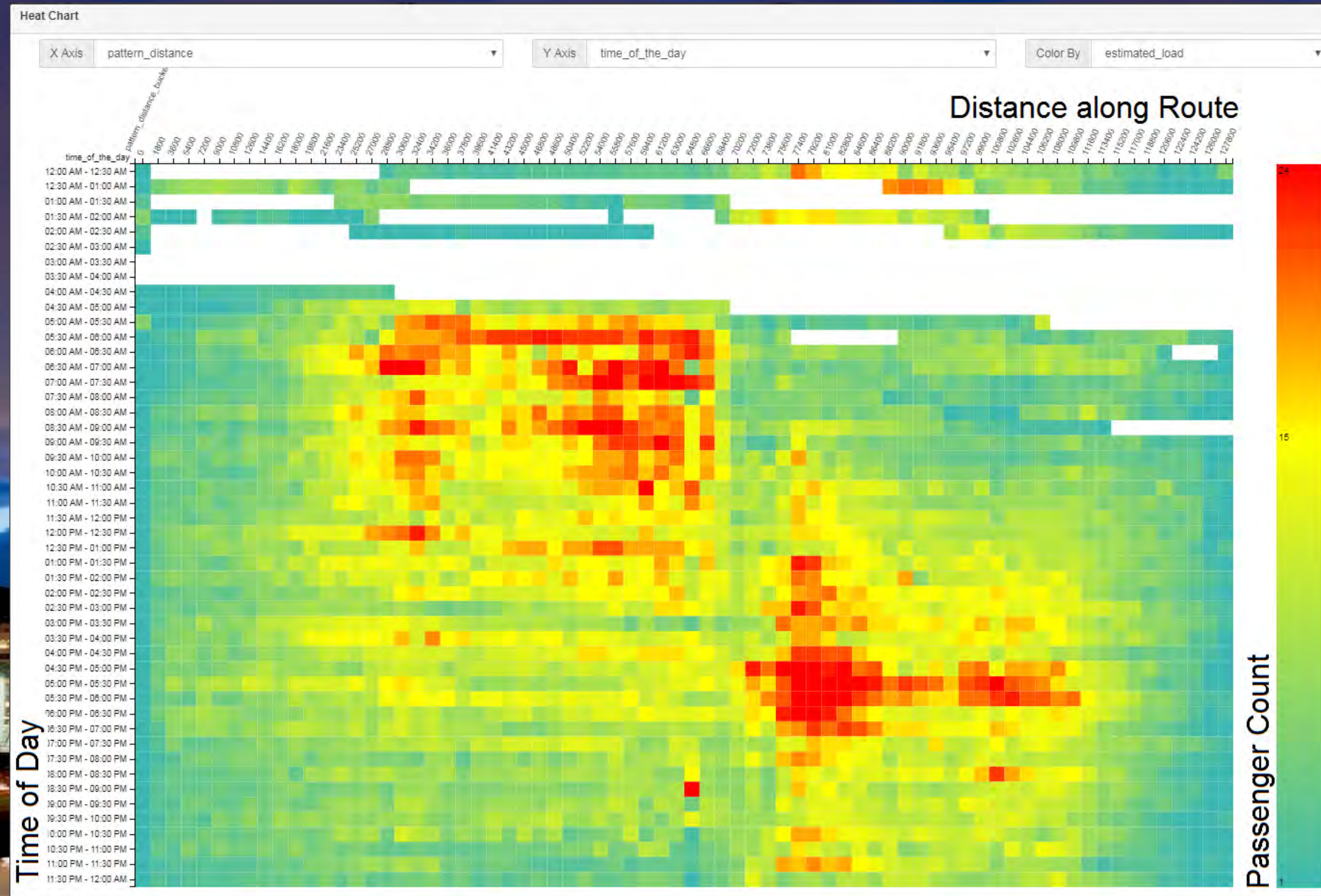


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O/D Matrix by County



Transit Analytics: Ridership



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Transit Analytics: Delays



Corridor Studies: Model Calibration

NoBuild Vissim Model
Travel Times (Graph)
Speeds (Map)

Actual Measurements
Travel Times (Graph)
Speeds (Map)



Corridor Studies: Model Calibration

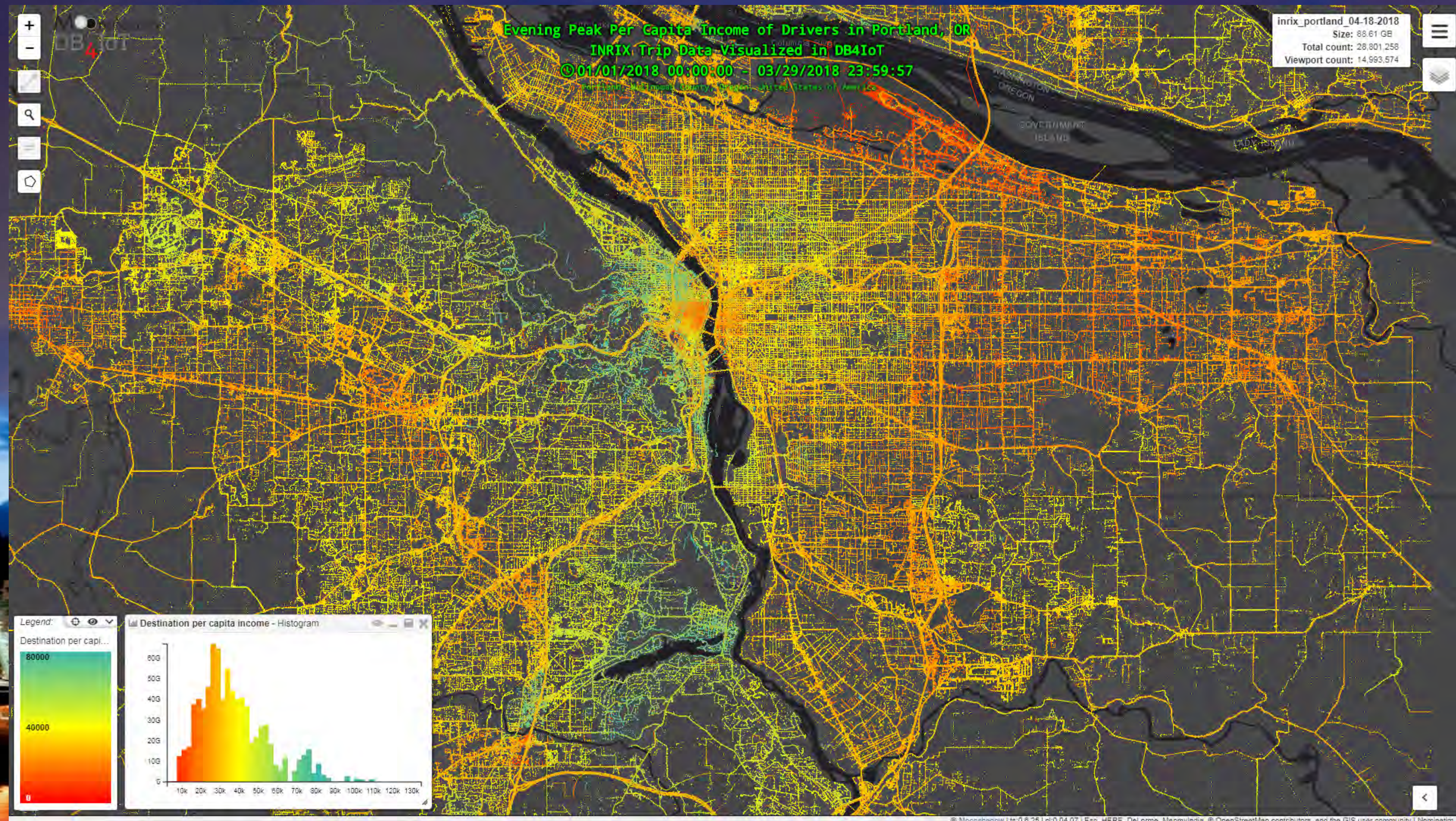
NoBuild Vissim Model
Speed Map & Graph



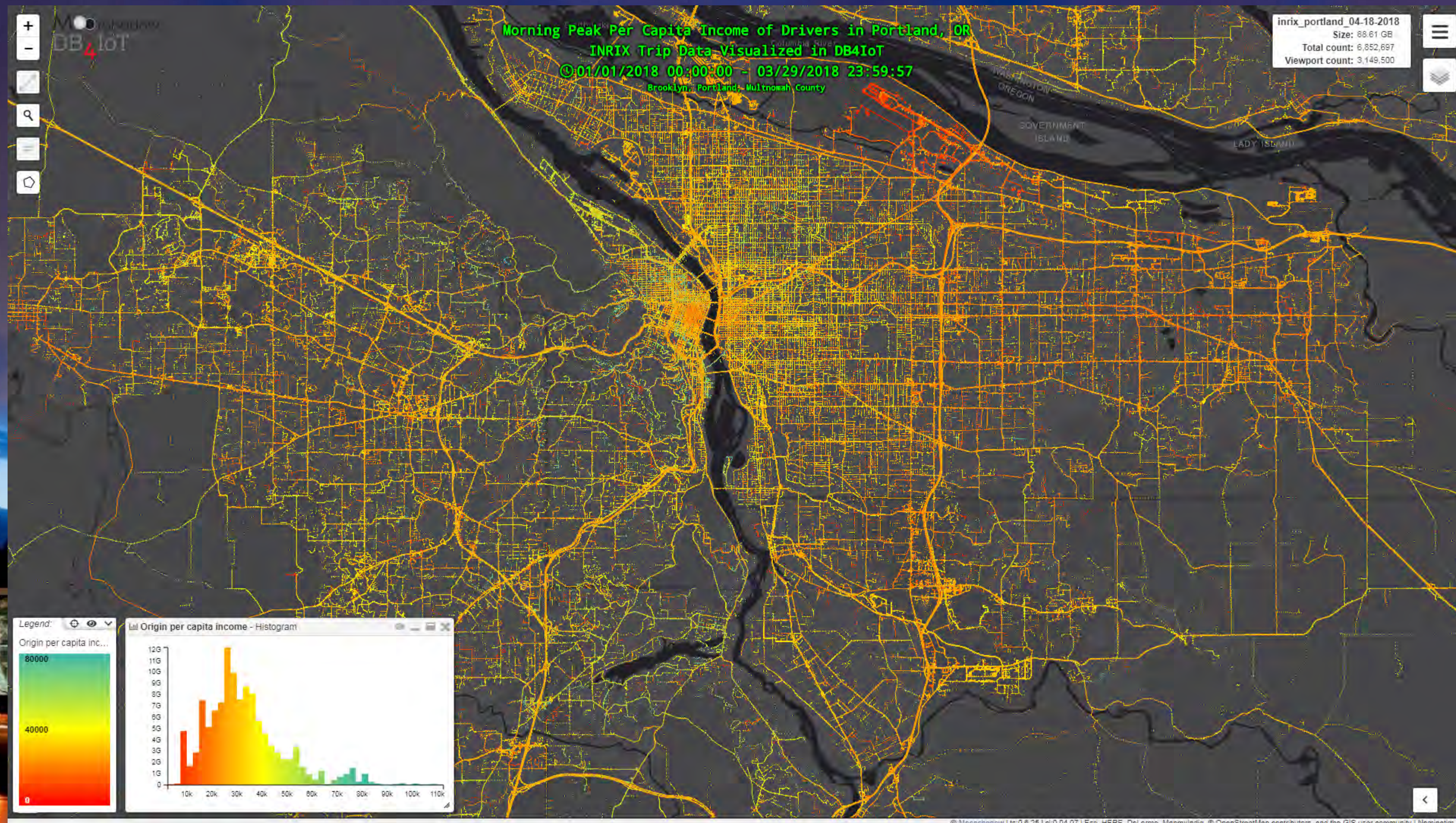
Actual Measurements
Speed Map & Graph



Combine INRIX & Census Data: Income of Evening Drivers



Combine INRIX & Census Data: Income of Morning Drivers

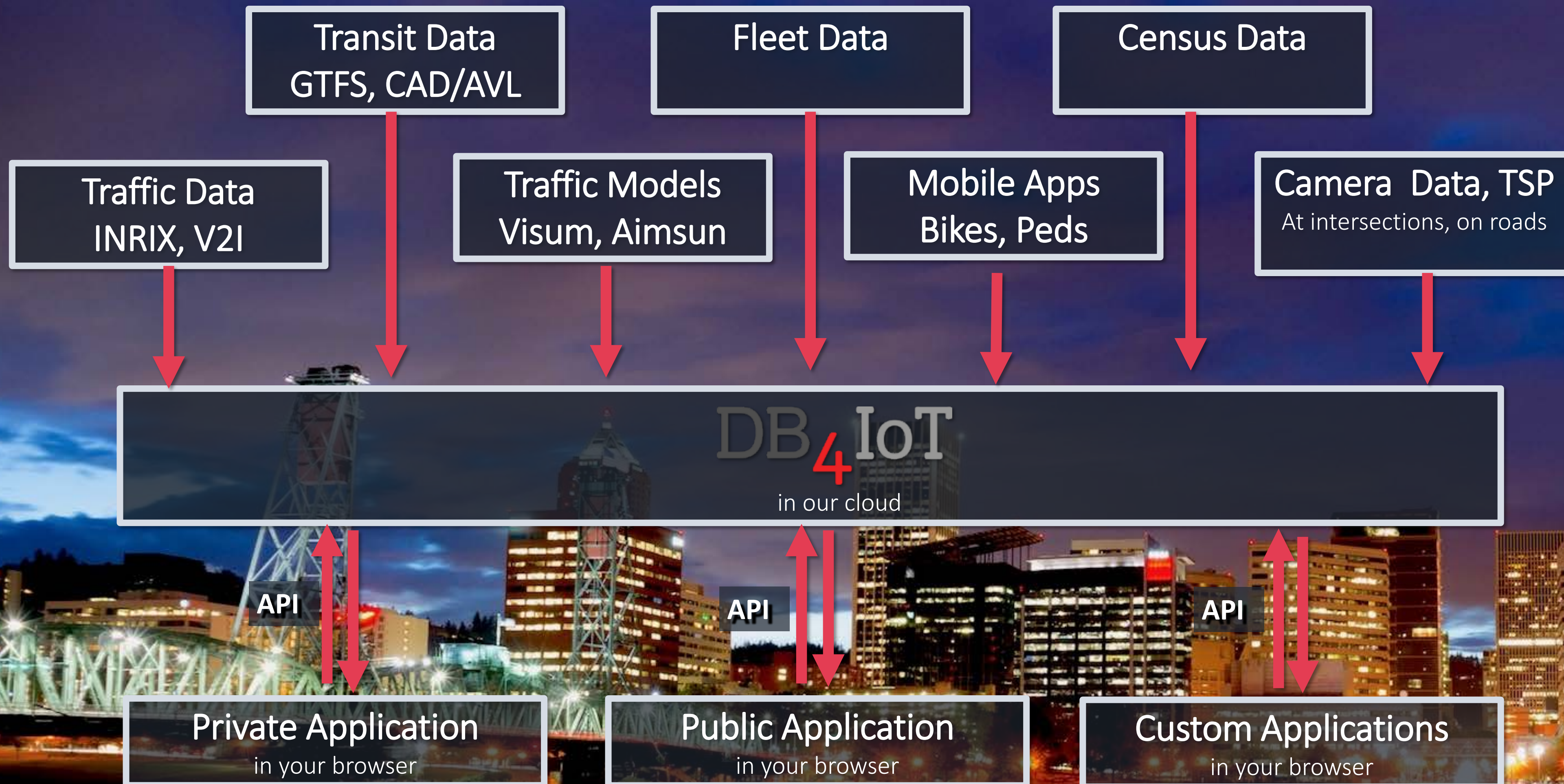


Per Capita Income of Evening Peak Drivers

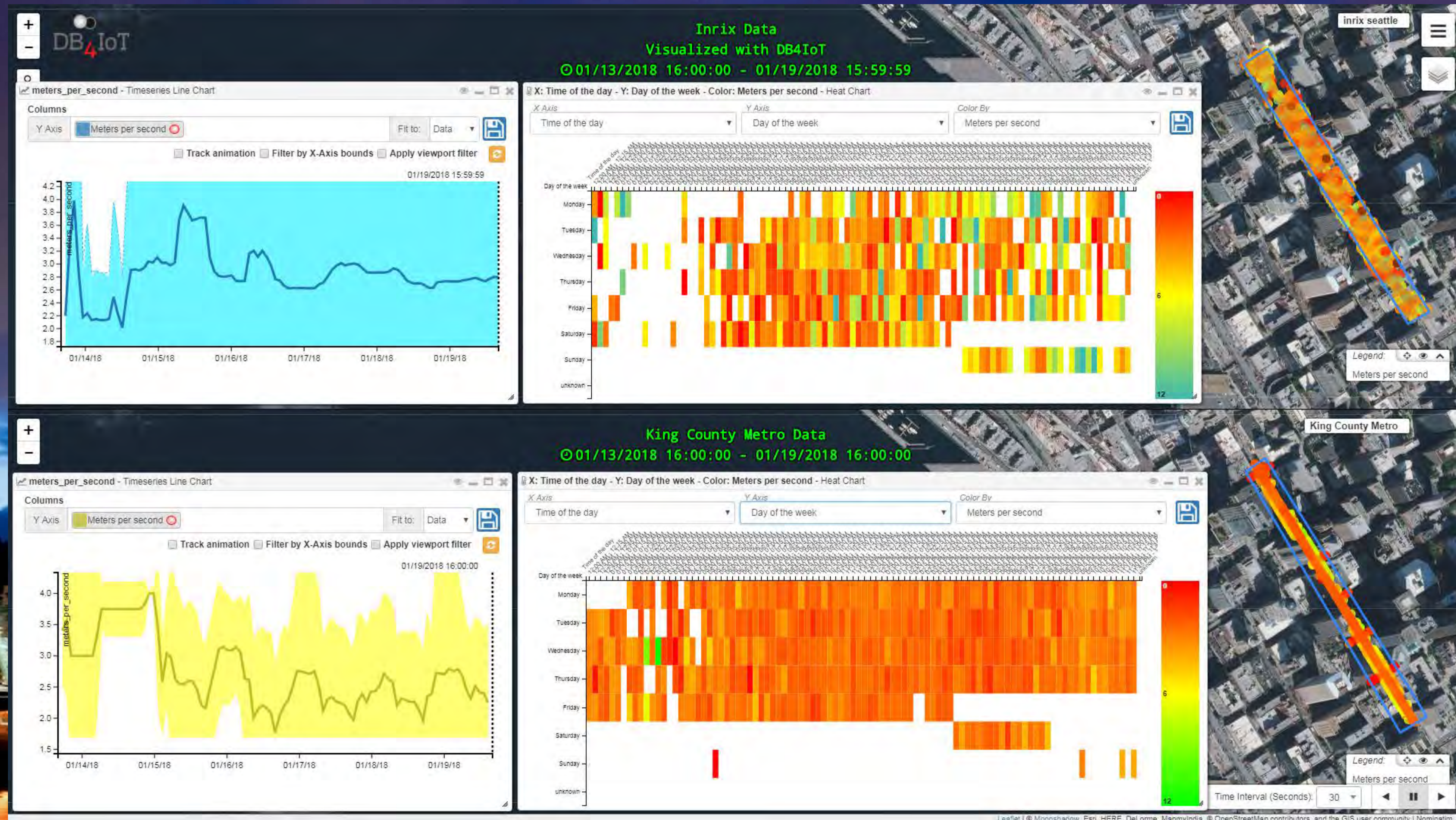


DB₄IoT

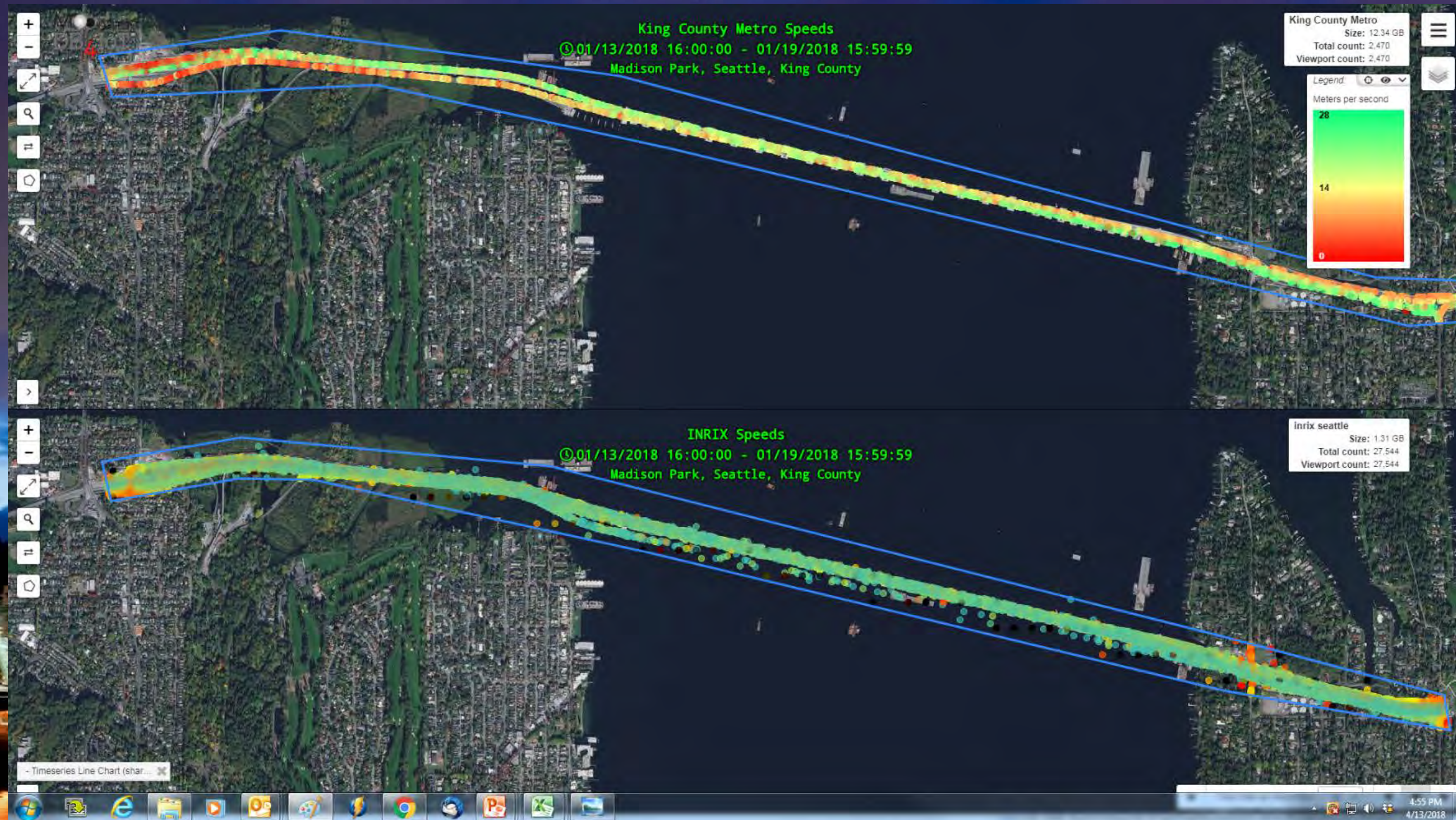
Combine Multiple Data Sources



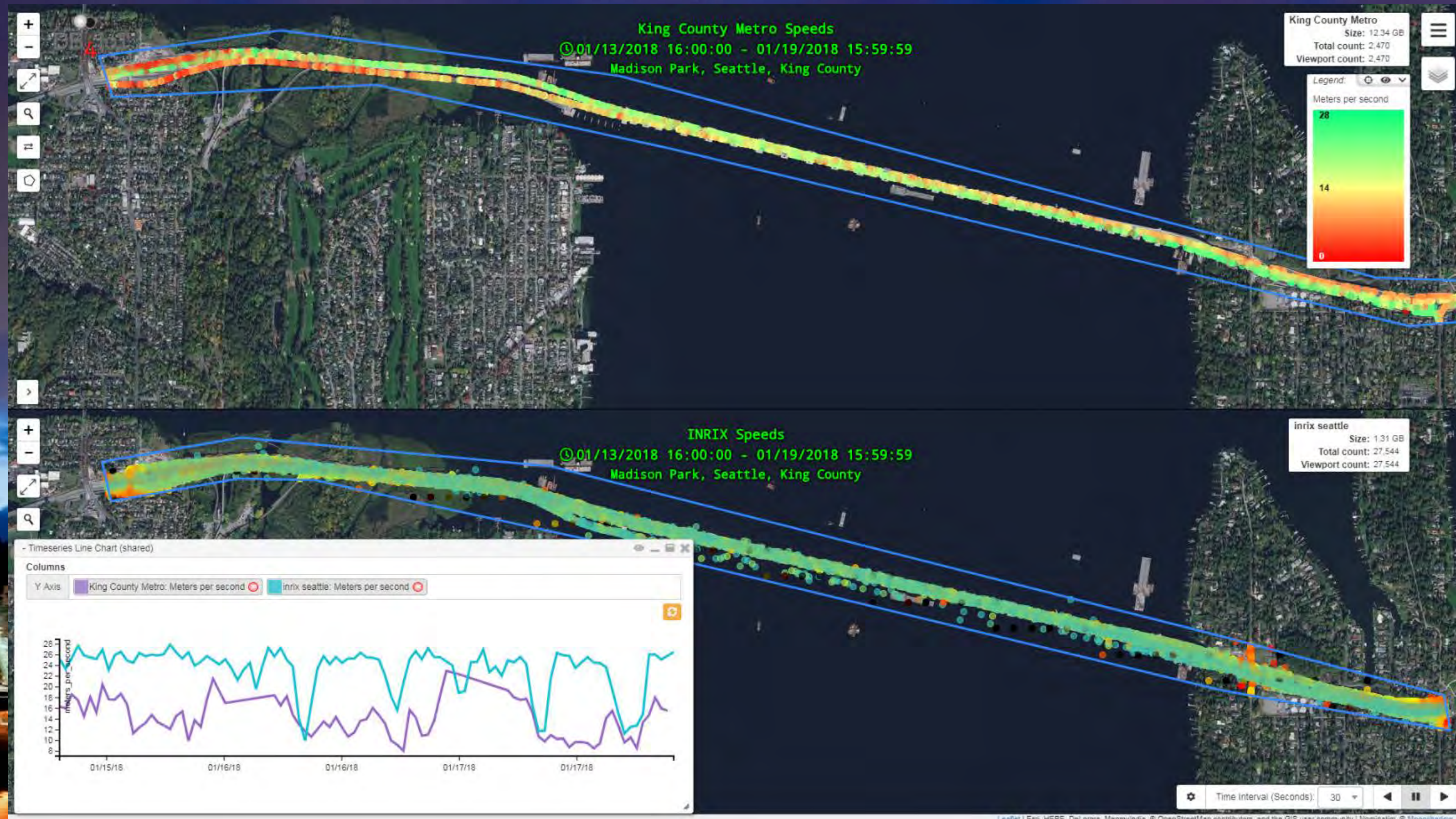
Compare Transit Data with INRIX Data



Compare Transit & INRIX Data: Evergreen Bridge

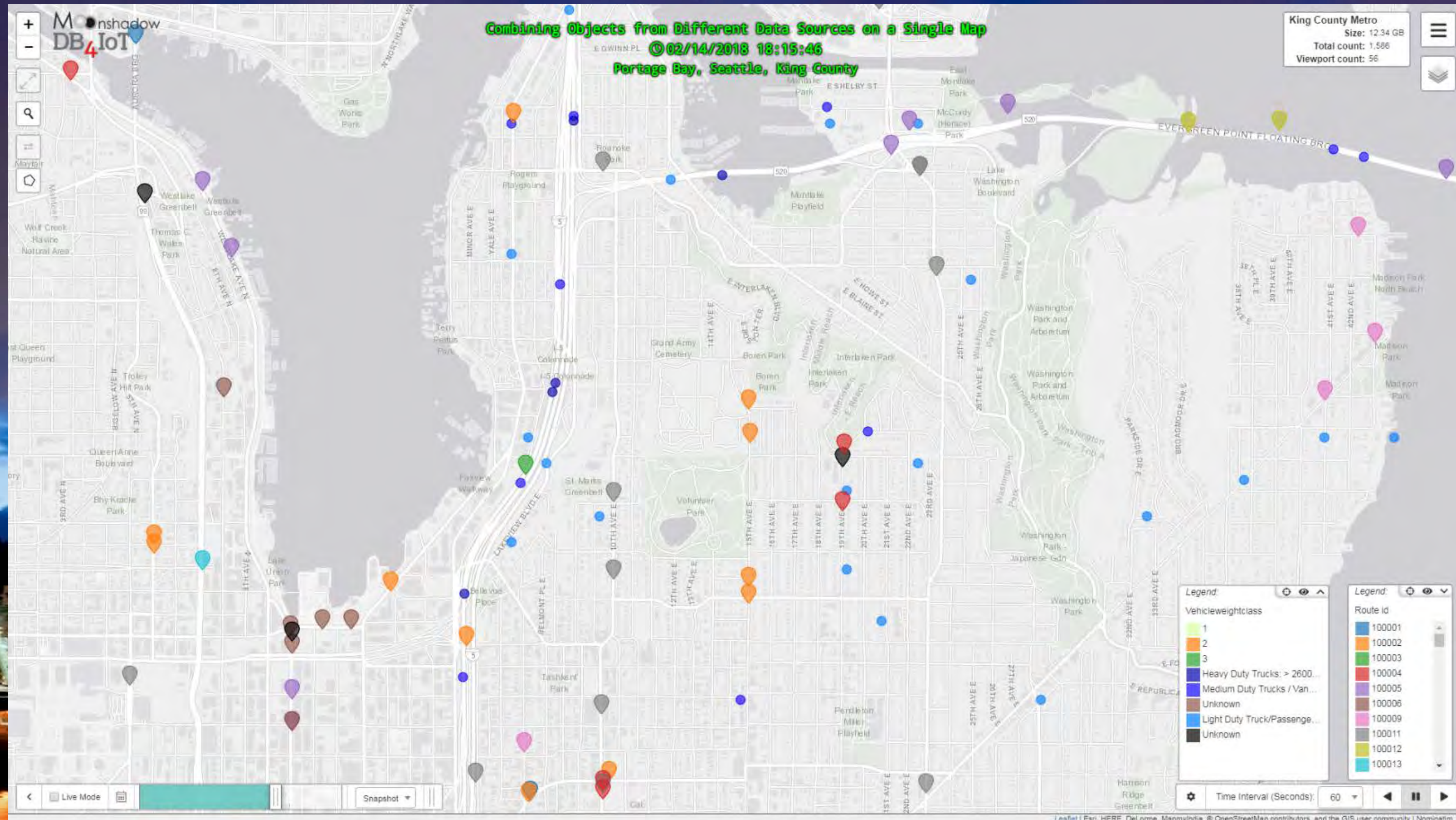


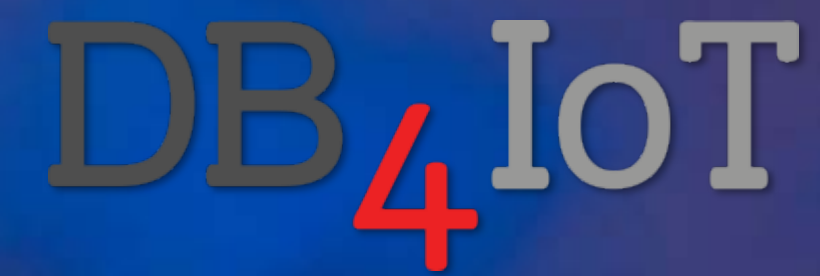
Compare Transit & INRIX Data in a Single Chart



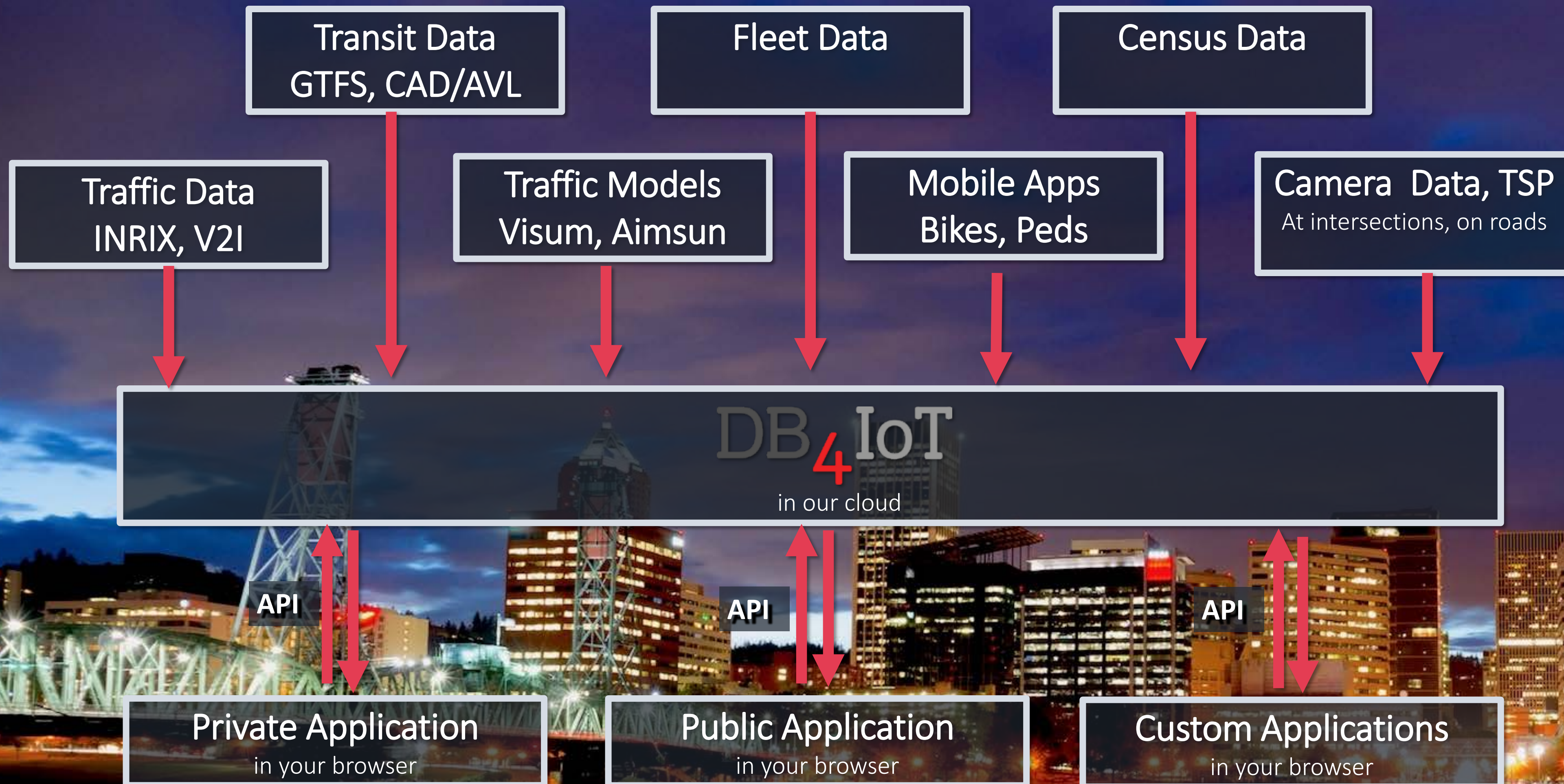
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View Transit & INRIX Data on a Single Map





Compare Data from Any Combination of Data Sources





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