

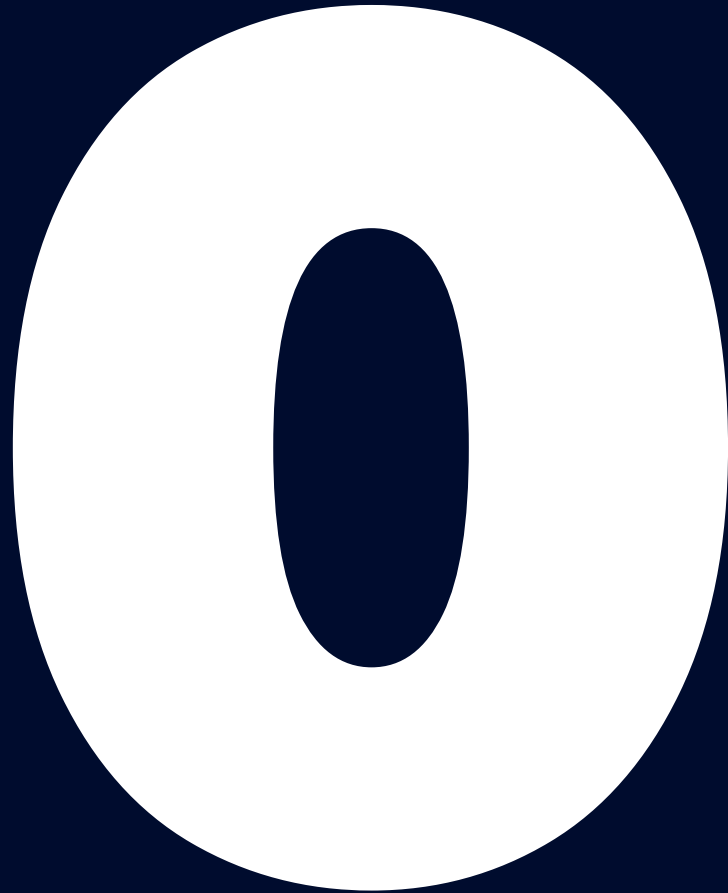
June 27th, 2019

Emil Tin, ITS Program
City of Copenhagen

Cycling Data for Active Traffic Management in CPH

**Innovative ways of collecting
cycling data in Copenhagen**





Copenhagen
Carbon Neutral
by 2025

CPH 2025 CLIMATE PLAN

A GREEN, SMART AND
CARBON NEUTRAL CITY



Service goals

- Reduce travel time for cyclists by 10% on specific corridors
- Reduce number of stops for cyclists by 10% on specific corridors
- .. as well as goals for busses, pedestrians and cars

10%

Active Traffic Management

- Ability to monitor and manage traffic as it happens
- Data within minutes, not days/weeks/months
- Many data sources are fine for analysis, but not fit for operational use
- Yes, data and active traffic management should also be for bicycle traffic



Key Metrics

- Volume
- Travel time
- Number of stops



Volume?

- Loops
 - often destroyed
- Radars
 - can't count groups
- Apps
 - no absolute counts



ViSense

- Camera sensors mounted in traffic light poles
- Images analysed on the device, only simple counts are transmitted
- Need to improve performance in some low-light situations

Hour	Detected	Truth	Missed
8:00	445	434	2.3%
16:00	359	352	2.0%
23:00	47	46	2.2%



ViSense installations

MobiMaestro Copenhagen 1.46.5.54 - Emil Tin

System Layout View Scenario Operator Maintenance Help

København

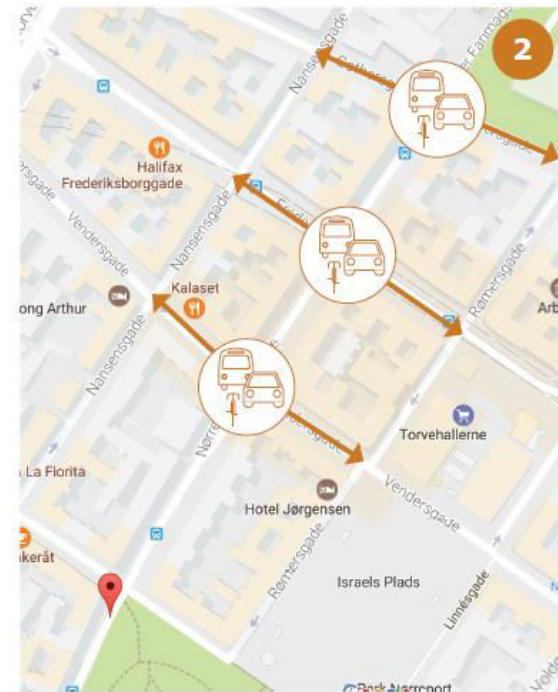
The map displays the city of Copenhagen with various districts labeled: Østerbro, Nørrebro, København, Frederiksberg, Vesterbro, Langebro, Christianshavn, and Kløvermarken. Several green icons representing ViSense cameras are placed across the city, primarily along major roads and near the harbor. A control panel on the right side of the map includes the following options:

- Road layers
- Copy of Roadwork (vejarbejde)
- Objects**
 - Counting station
 - Generic icons
 - Sign groups
 - Image display
 - Static text
 - Radar
 - RSMP traffic lights
 - RSU
 - Scenarios
 - ViSense cameras
- Segments**
 - Segments

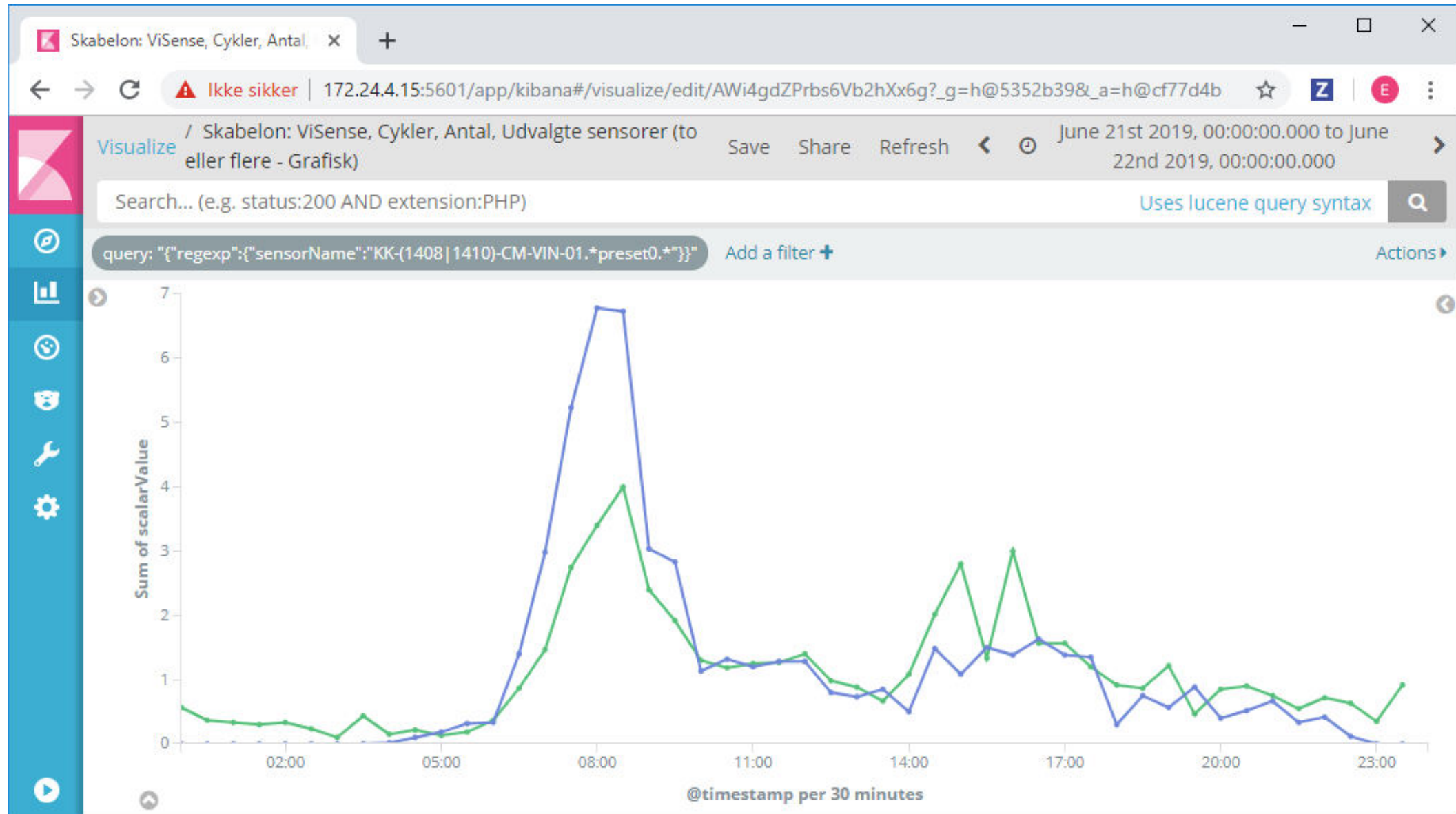
Notifications: 0 | New alarms: 6,345 | Seen alarms: 4

Automatic traffic optimization

- Scenarios are configured in *MobiMaestro*, and can use volumes, e.g:
 - IF service goals is met on the corridor
 - AND more than 300 cyclist / min for at least 15 minutes on side street
 - THEN change signal programs to prioritize side street
- Not just local traffic control – can consider the big picture



ViSense data



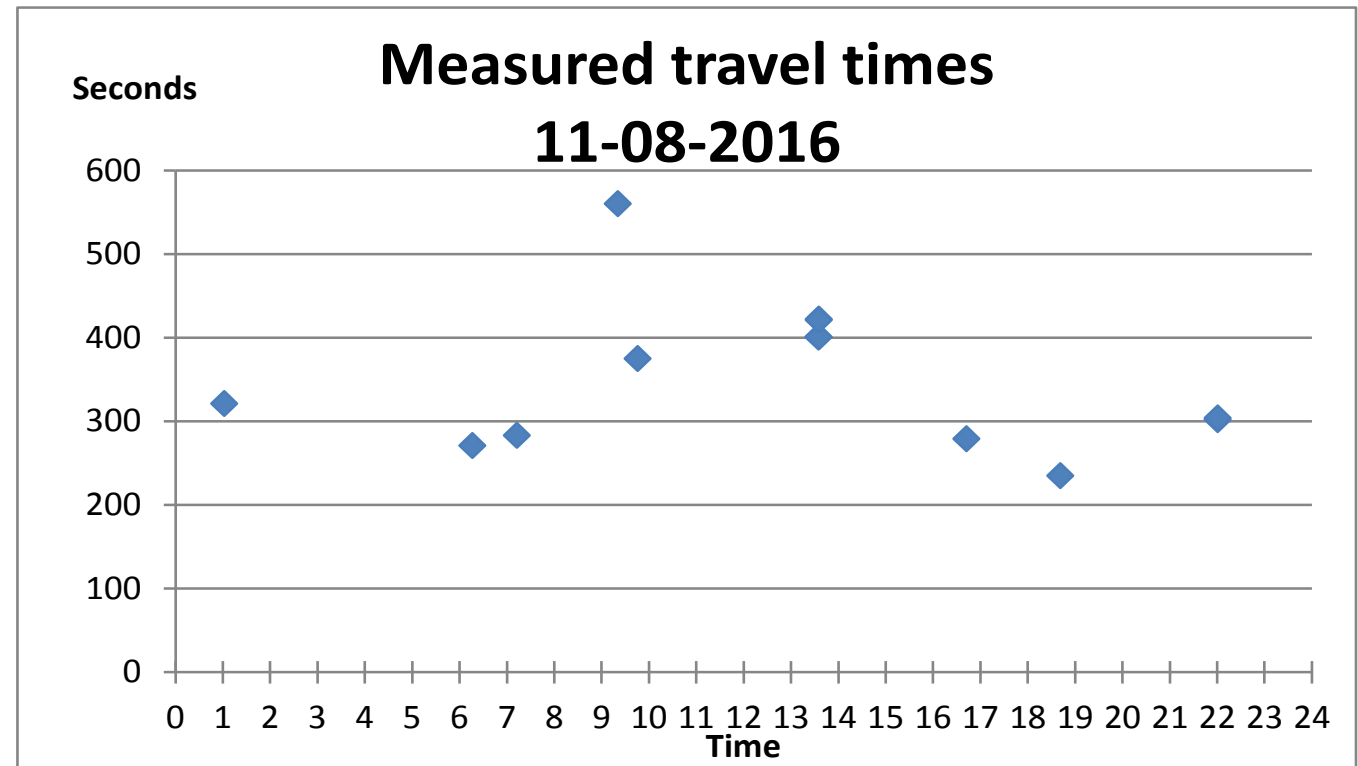
Travel time / number of stops?

- Hard to find existing solutions that deliver operational travel times or number of stops for cyclists
- Need to track individual cyclists?
- Need to install a lot of equipment?



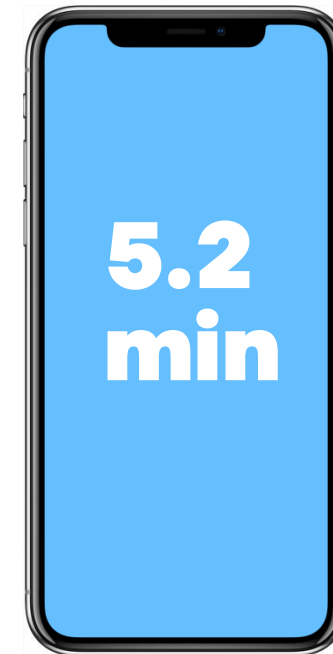
Shared City Bikes?

- All bikes have GPS
- 1.5 million trips per year
- But not operational data
- Ex: Bredgade/Grønningen
 - 440 trips / day
 - Only 15 travel times / day



Apps?

- Its' the future! But still hard because:
 - Single apps provide too little data
 - User group too narrow, leading to biased data
 - Uncertainty about quality of data
- A few big players probably have enough data, but don't (yet) have a business model for selling it



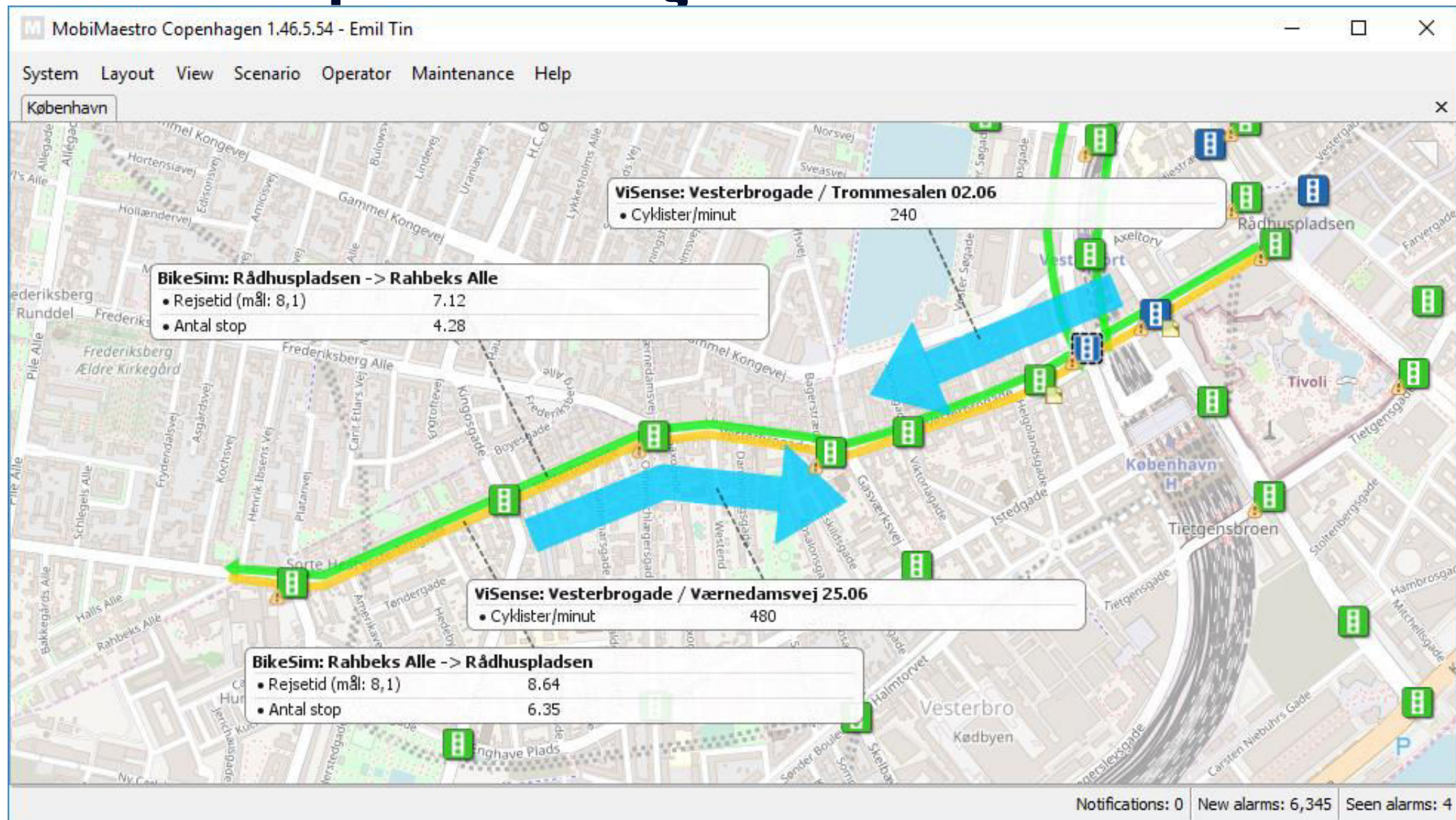
BikeSim

- Smart reuse of existing equipment and systems
- We can already fetch real-time data from all traffic lights!
- Part of our *MobiMaestro* traffic management system

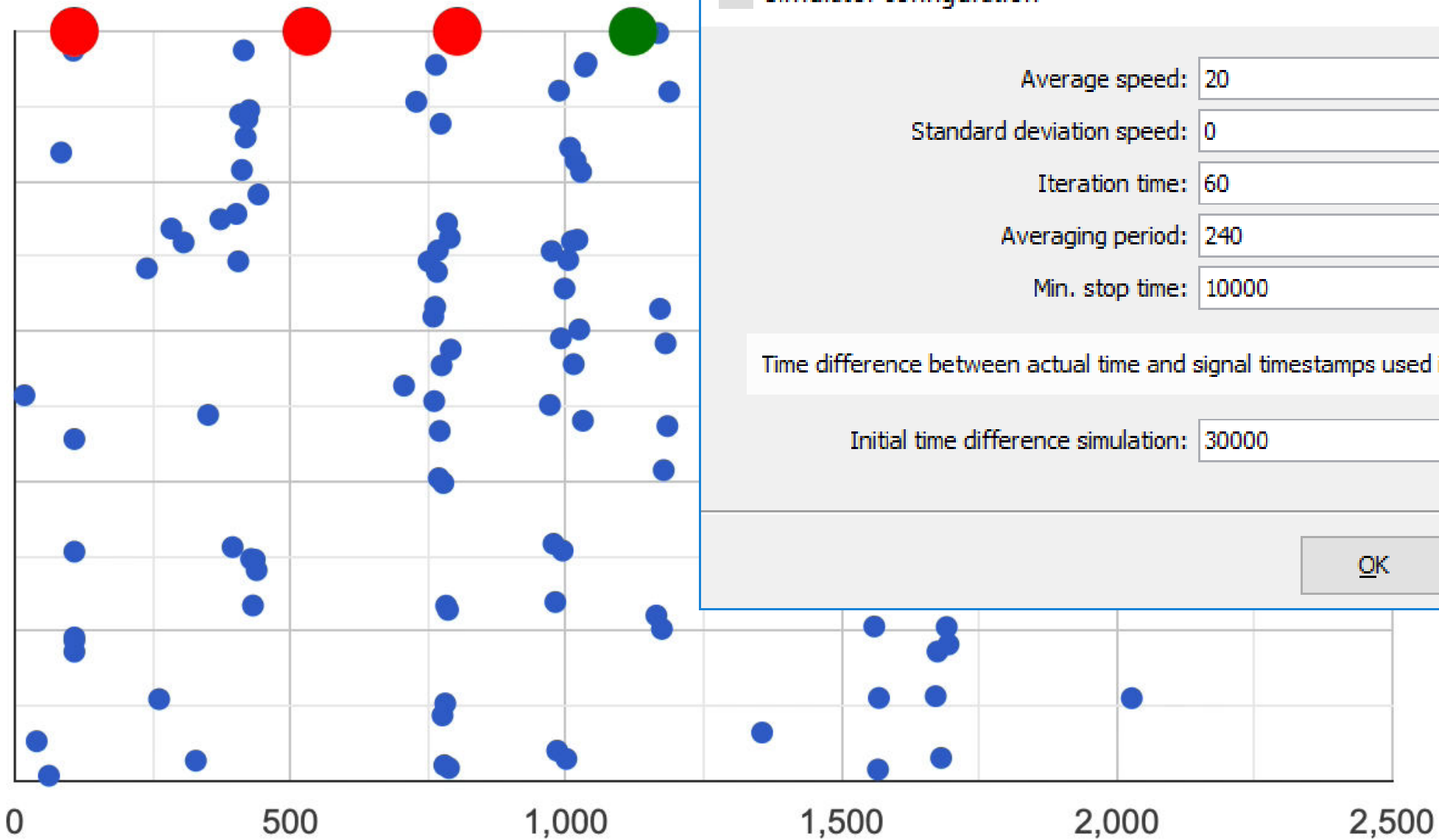
- BikeSim computes estimated travel times and number of stops based on:
 - Actual signal state of traffic lights
 - Distance between intersections

- Monte Carlo simulation of cyclist moving along a corridor
- Optionally use of volume sensors for estimating the effect of crowding
- Data fetched from traffic lights using the open RSMP protocol

BikeSim example: Vesterbrogade



BikeSim concept



M Simulator configuration ✕

Average speed: km/h

Standard deviation speed: km/h

Iteration time: sec

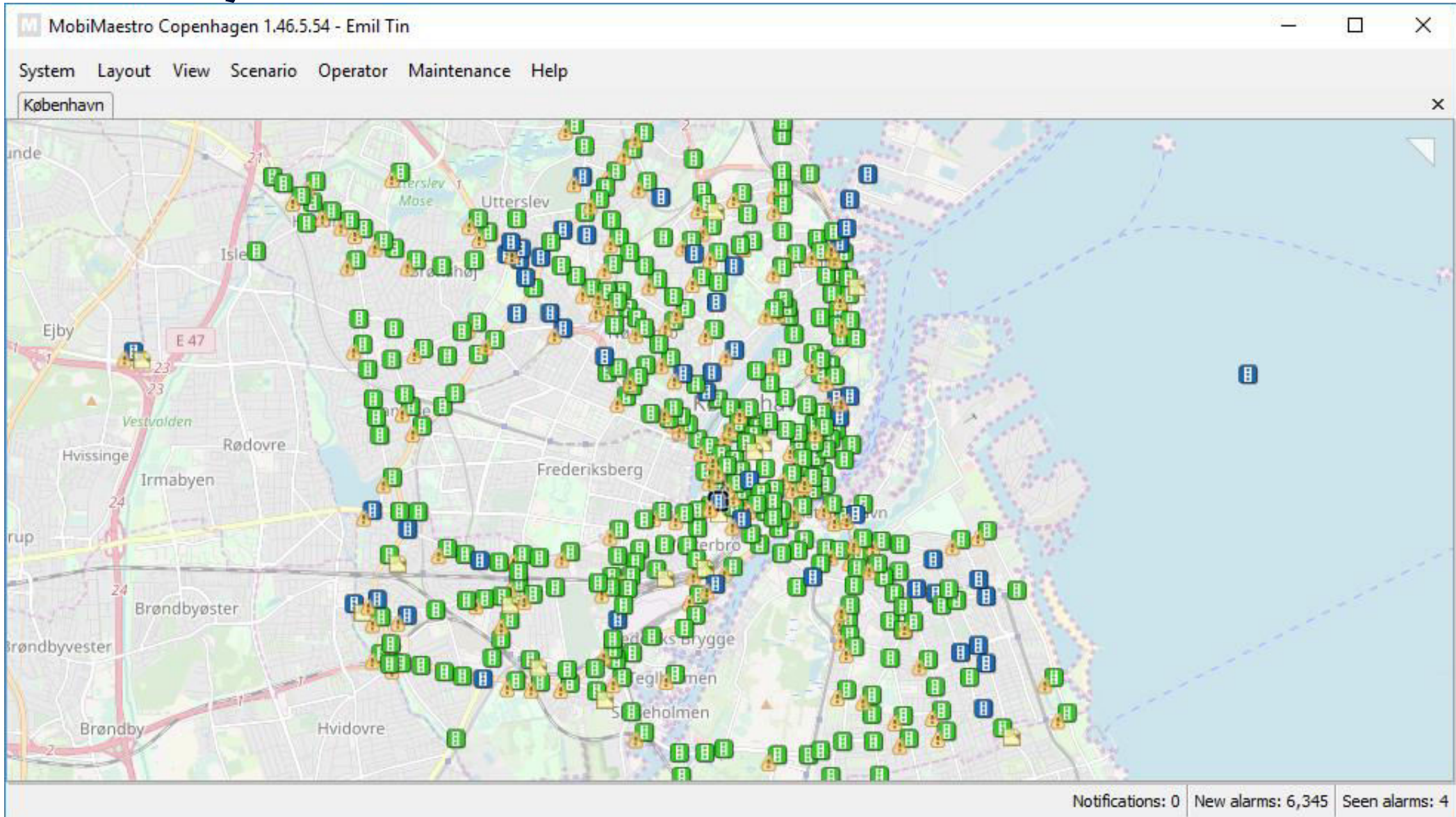
Averaging period: sec

Min. stop time: ms

Time difference between actual time and signal timestamps used in the simulation

Initial time difference simulation: ms

Traffic Lights: our travel time sensor network

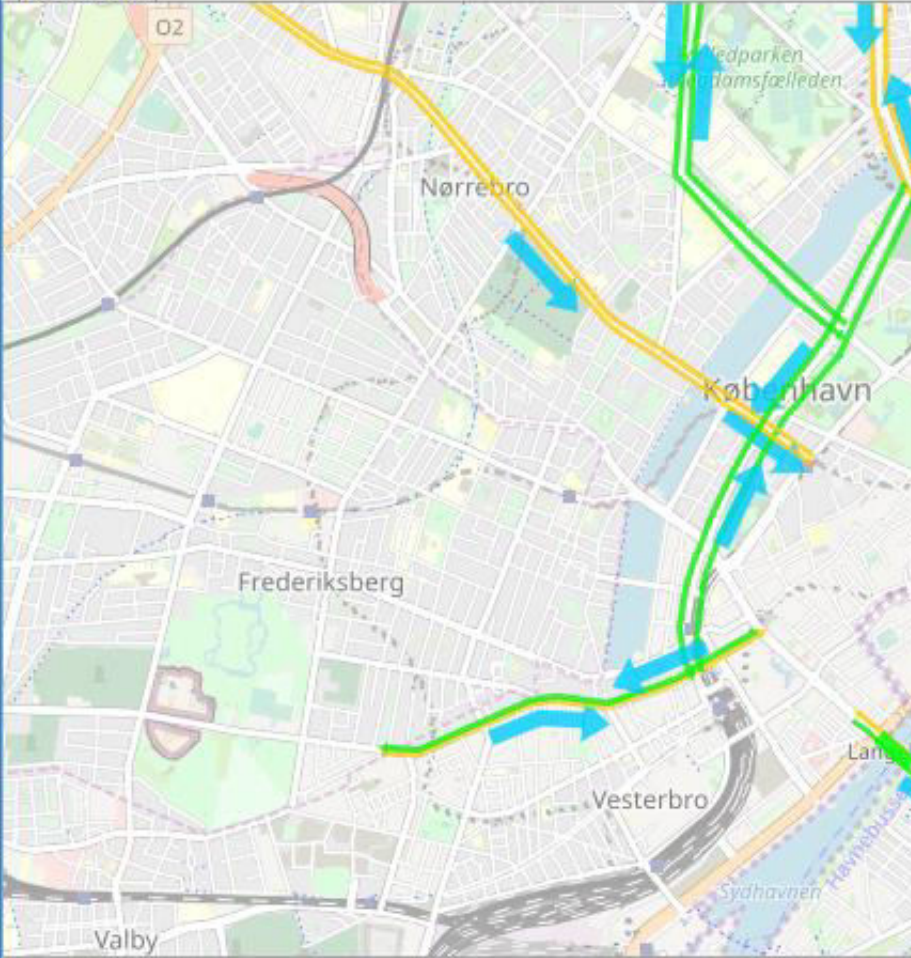


BikeSim operational views

MobiMaestro Copenhagen 1.46.5.54 - Emil Tin

System Layout View Scenario Operator Maintenance Help

København



M Sensor views

Sensor views

Q BikeSim

Description	Value	
Bikesim: Emdrup Sø -> Sølvtorvet	14 min	...
Bikesim: Hovedbanen -> Lille Triangel	11 min	...
BikeSim: Kgs. Nytorv -> Sundbyvester Pl	0 min +17	...
Bikesim: Kongens Nytorv -> Tuborgvej	18 min +1	...
Bikesim: Lille Triangel -> Hovedbanen	11 min	...
Bikesim: Nørreport -> Tomsgårdsvej	14 min +1	...
Bikesim: Rahbeks Allé -> Rådhuspladsen	9 min	...
BikeSim: Rysensteensgade -> Øresund St	14 min	...
Bikesim: Rådhuspladsen -> Rahbeks Allé	7 min	...
BikeSim: Sundbyvester Pl -> Kgs. Nytorv	16 min	...
BikeSim: Sølvtorvet -> Emdrup Sø	14 min	...
BikeSim: Tomsgårdsvej -> Nørreport	14 min	...
BikeSim: Tuborgvej -> Kongens Nytorv	18 min +1	...
BikeSim: Øresund st -> Rysensteensgade	0 min +15	...

14 results

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Automatic selection of VMS content based on travel times

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KK-0406-VM-ITT-01 VMS_2 AG 04.06 Gyldenløvesgade
Scenarios BikeVMS - Master scenario
Status Good (Wed, Jun 26, 2019 11:40)
VMS_2 AG 04.06
Gyldenløvesgade

KK-4103-VM-ITT-01 VMS_3 AG 41.03 Vermlandsgade
Scenarios BikeVMS - Master scenario
Status Good (Wed, Jun 26, 2019 11:46)
VMS_3 AG 41.03
Vermlandsgade

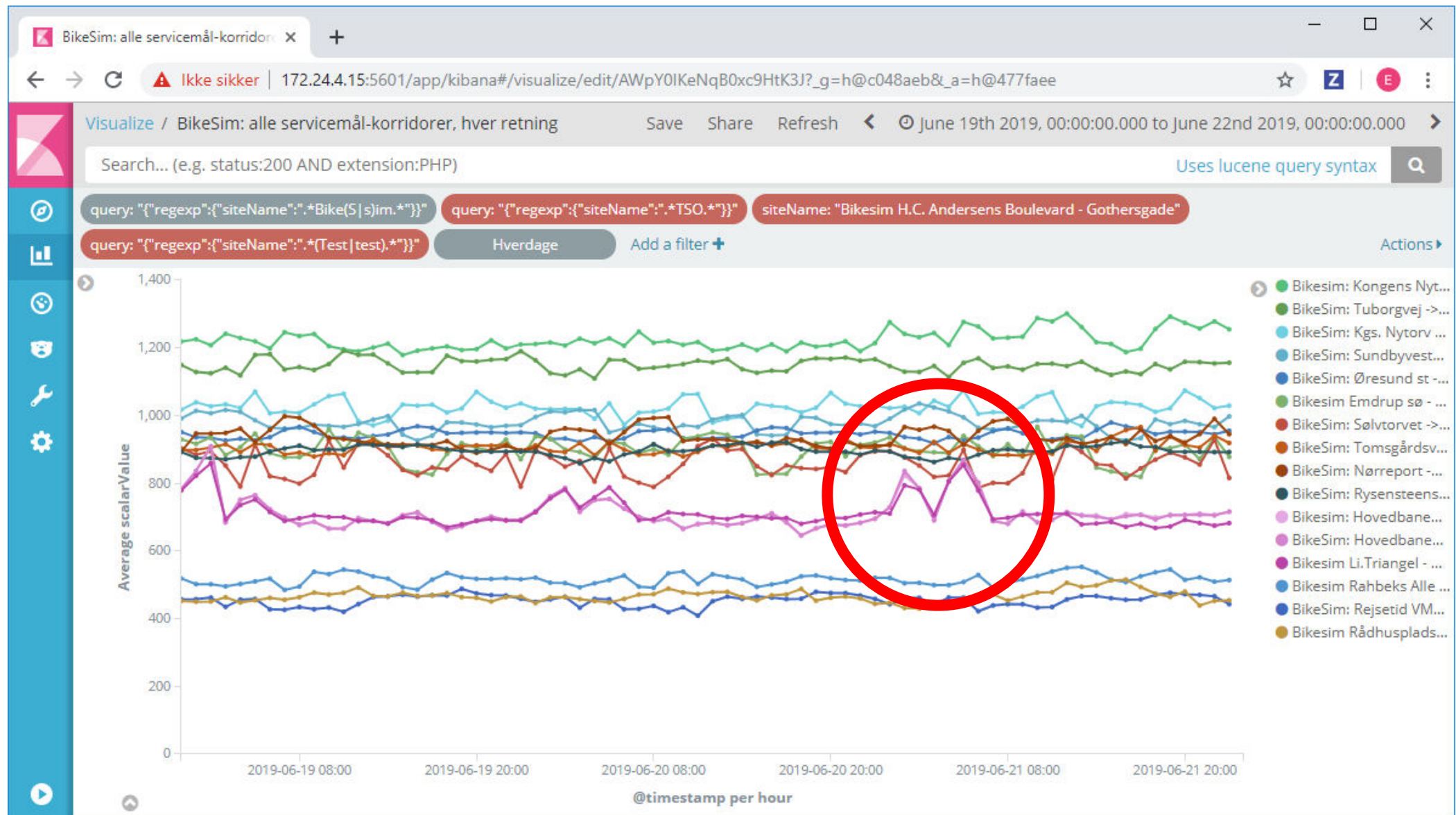
Nørreport
Langebro 3,3 km
Knippelsbro 3,0 km

Pas på hinanden

Notifications: 0 New alarms: 6,345 Seen alarms: 4



BikeSim data



BikeSim data

Dashboard / BikeSim servicemål

Share Clone Edit June 6th 2019, 23:59:59.994 to June 8th 2019, 23:59:59.994

Search... (e.g. status:200 AND extension:PHP) Uses lucene query syntax

Add a filter +

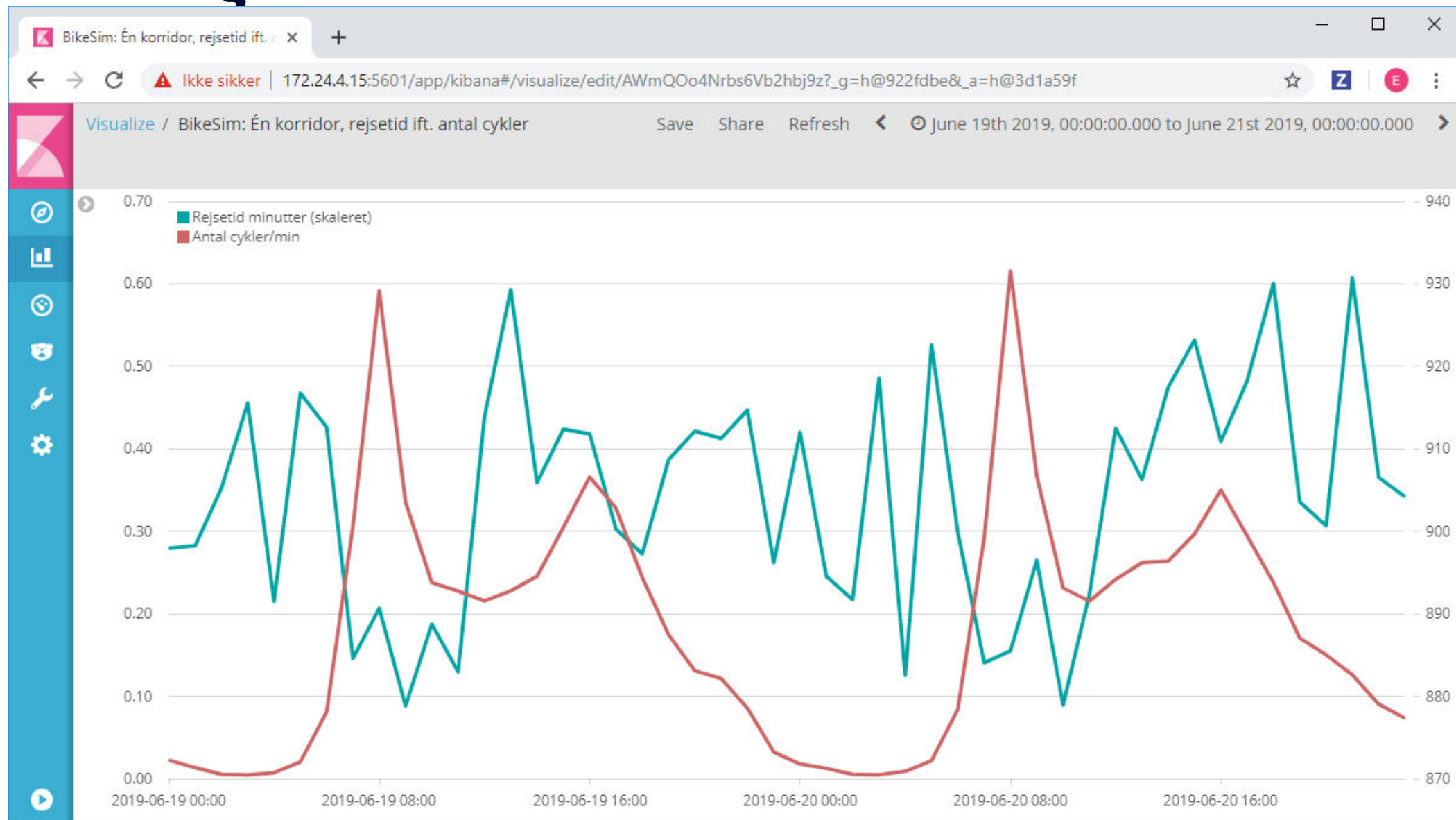
BikeSim: Rejsetid, alle korridorer, som tabel

filters	Rejsetid (minutter)
1 Tuborgvej - Kongens Nytorv	19.92
2 Emdrup Sø - Sølvtorvet	14.612
3 Tomsgårdsvej - Nørreport	15.571
4 Rahbeks Allé - Rådhuspladsen	8.307
5 Øresund Station - Rysenstengade	15.528
6 Sundbyvester Plads - Kongens Nytorv	16.865
7 Lille Triangel - Hovedbanegården	12.371

BikeSim: Antal stop, alle korridorer, som tabel

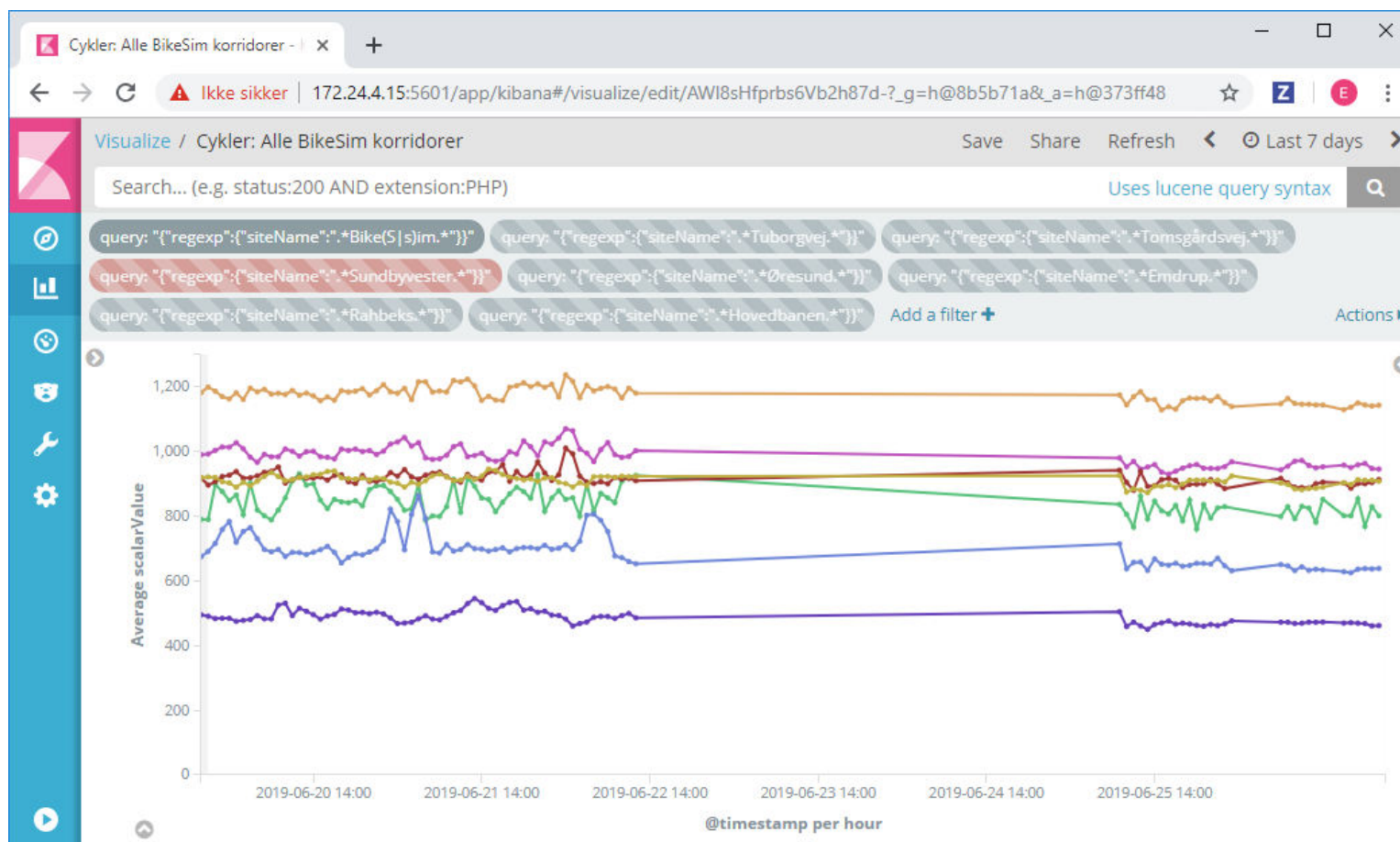
filters	Antal stop
1 Tuborgvej - Kongens Nytorv	8.491
2 Emdrup Sø - Sølvtorvet	7.454
3 Tomsgårdsvej - Nørreport	8.831
4 Rahbeks Allé - Rådhuspladsen	5.132
5 Øresund Station - Rysenstengade	3.596
6 Sundbyvester Plads - Kongens Nytorv	8.113
7 Lille Triangel - Hovedbanegården	6.29

Combining data



Challenges

- Maintaining a stable system involving multiple suppliers
- Validating data quality and establishing ground truth
- Privacy and GDPR
- Cost of equipment and maintenance



Why can't we just buy this bicycle data?

- We would rather just buy the data
- Most people already bike around with a powerful computer packed with sensors
- For cars, we can buy operational data from e.g. INRIX or TomTom – they collect from multiple sources and merge into a single uniform data set
- When will somebody grab this business opportunity?



City of Copenhagen

Thank you

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ITS Program

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