

European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

WGs and MC Meeting at ISTANBUL, 3-5 December 2014

SENSEable Cities



Massachusetts Institute of Technology

senseable city lab:...:



Singapore-MIT Alliance for Research and Technology

Dr. Marguerite Nyhan

Keynote speaker

Fulbright – EPA Scholar for Climate Change & Sustainable Environment

SENSEable City Laboratory,

Massachusetts Institute of Technology,
Cambridge, USA

Singapore-MIT Alliance for Research & Technology, Singapore

 **cost**
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY





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70% of the world's population will live in cities in the year 2050

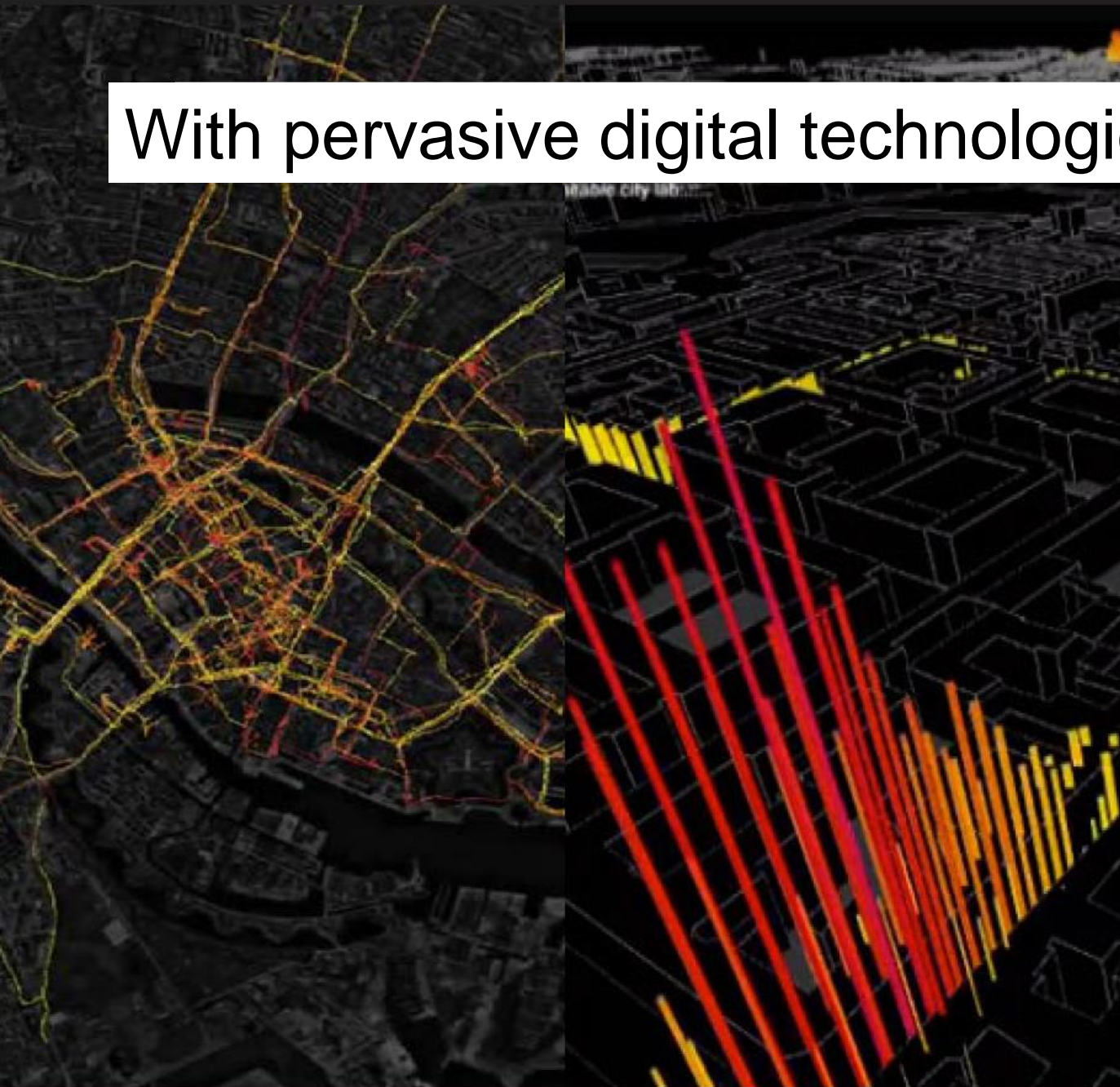
3.2 million premature deaths worldwide due to air pollution in 2010.



CURRENT AIR QUALITY MONITORING IN BOSTON



With pervasive digital technologies





AIR
QUALITY
+
PEOPLE
?

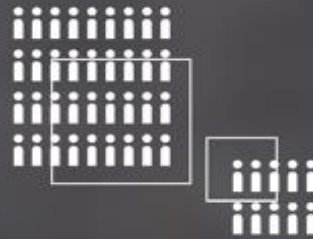


AIR QUALITY + PEOPLE

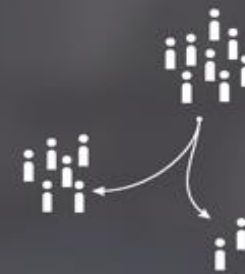
$PM_{2.5}$ O_3

SO_2 NO_2

air
quality



population
density



crowd
dynamics

AIR QUALITY MONITORING IN SMART CITIES

The background is a stylized map of a city grid. Overlaid on this are several large, semi-transparent red circles of varying sizes, representing monitoring zones. Within these circles and scattered across the map are small black icons that look like lowercase 'i's, representing individual monitoring stations. White arrows of varying lengths and directions connect some of these stations, suggesting a network or data flow between different parts of the city.

The CLAIRITY network



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CLAIRITY

Home Data The Project The Team How It Works

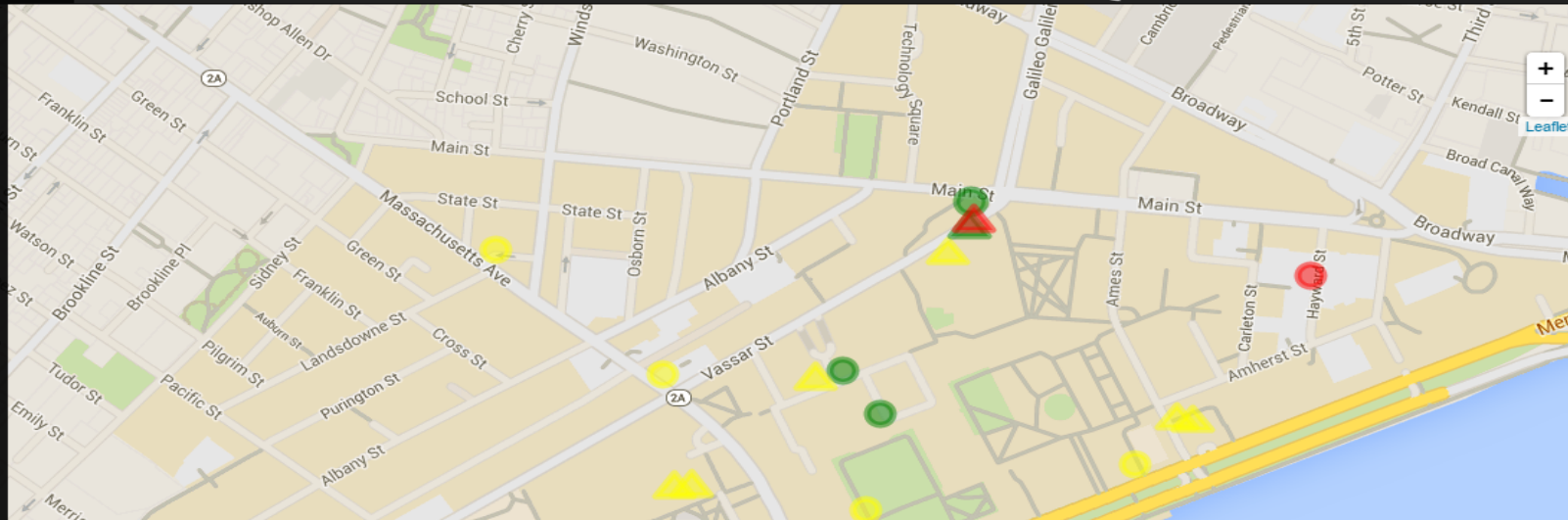


Department of Civil & Environmental Engineering
Massachusetts Institute of Technology

Mass Ave/ Memorial

Last Updated: 11/06/2014 21:43 UTC

CO	91
Carbon Monoxide	ppb
NO	3
Nitric Oxide	ppb
NO₂	26
Nitrogen Dioxide	ppb
O₃	20
Ozone (Uncalibrated)	ppb
Fine Particles	673
Particle Count	per 0.01 ft ³
Coarse Particles	12
Particle Count	per 0.01 ft ³



CLAIRITY Home Data The Project The Team How It Works

MIT Department of Civil & Environmental Engineering

Nodes

MIT Museum	Next House Dining	Stratton Student Center
Burton Conner	Media Lab	Briggs Field
Next House Courtyard	Green Building Roof	West Parking Garage
Parsons Laboratory	Cafe 4	Killian Court
Building 16	Mass Ave/ Vassar Parking	Building 1
Walker Memorial	Green Building	Stata Loading Dock
Sloan School	MIT Medical Parking	

Real time data unavailable for mobile platforms and the co-gen plant

Data

Coarse Particles
Fine Particles
NO
O ₃
NO ₂

Zoom 1h 1D 1W 1m All From Apr 18, 2014 To May 6, 2014

download raw data in a csv file

Disclaimer: While every effort has been made to ensure quantitative accuracy of measurements, these sensors were not calibrated against established regulatory standards and are not intended to be a replacement for regulatory-grade measurements. As of May 6, calibrations are not finalized and data are subject to change. For more information, please contact clairity@mit.edu



Legend

- Good
- Moderate
- Unhealthy
- Offline
- Indoor Nodes
- Outdoor Nodes

Air quality classification derived from EPA and Dylos thresholds for ozone, carbon monoxide, and particle counts

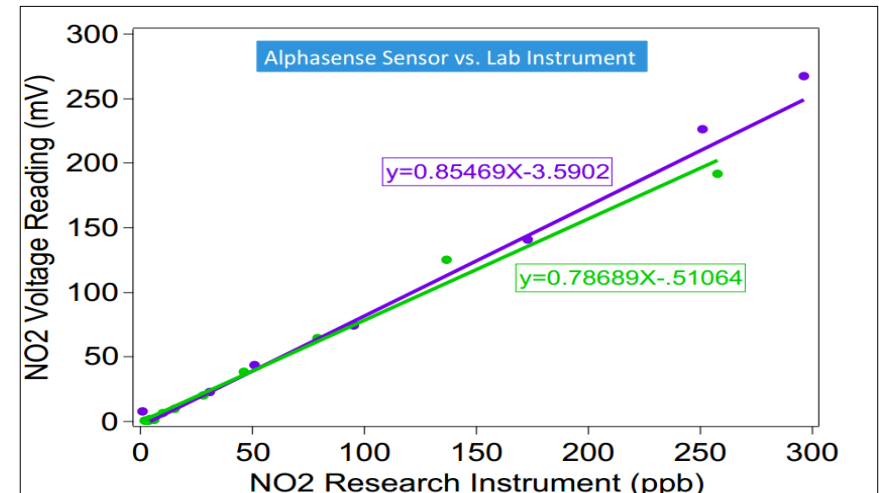
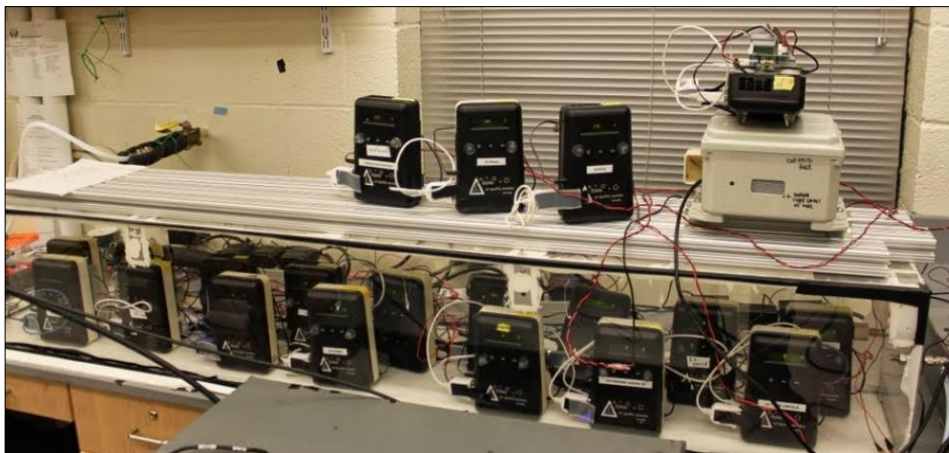
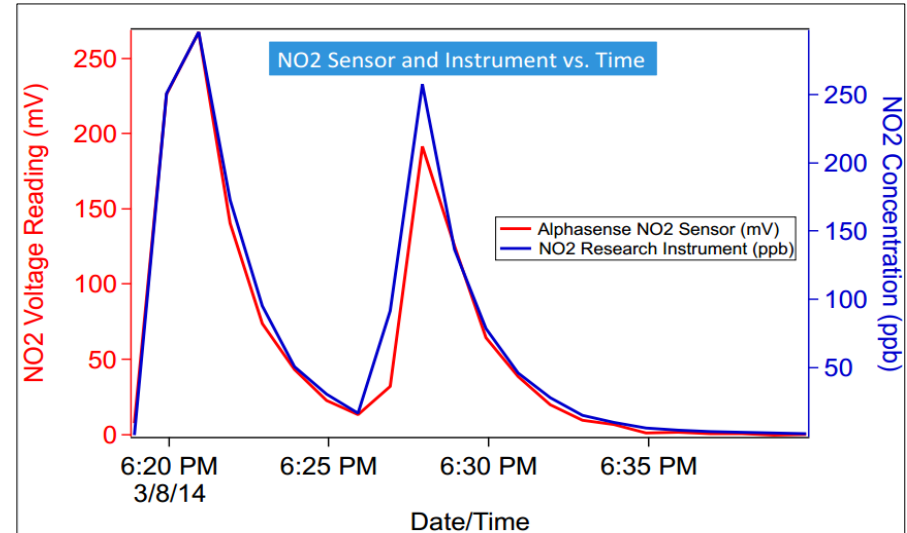
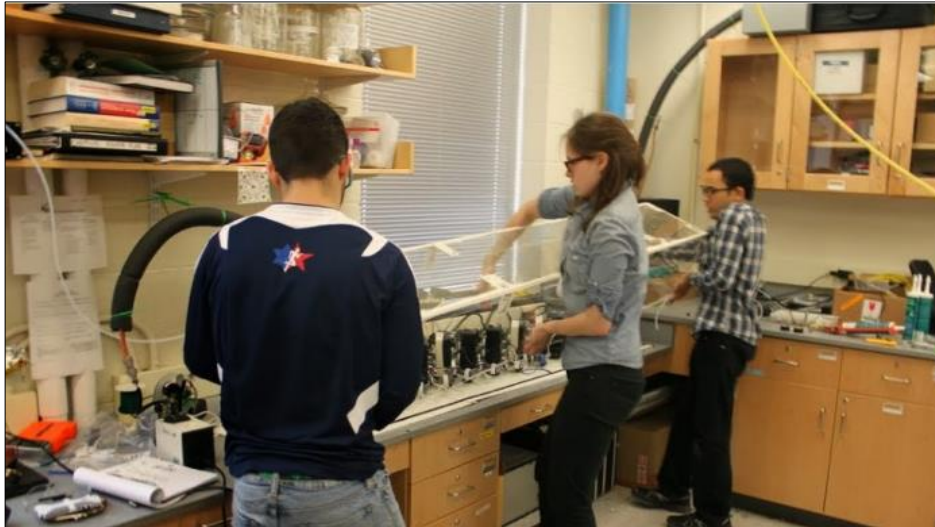
Content and images courtesy of the Civil & Environmental Engineering Department, MIT. See clairity.mit.edu

Building the CLAIRITY network



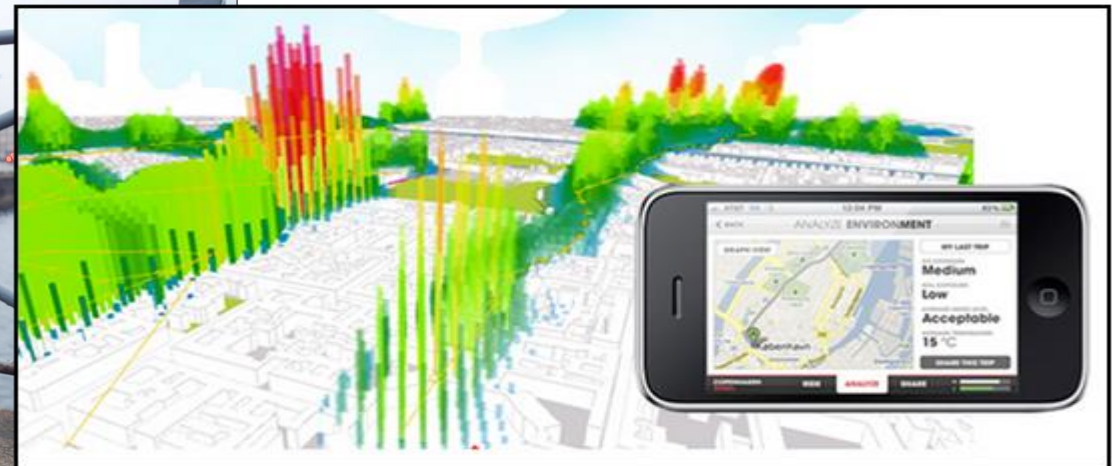
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Challenges + future considerations



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THE COPENHAGEN WHEEL

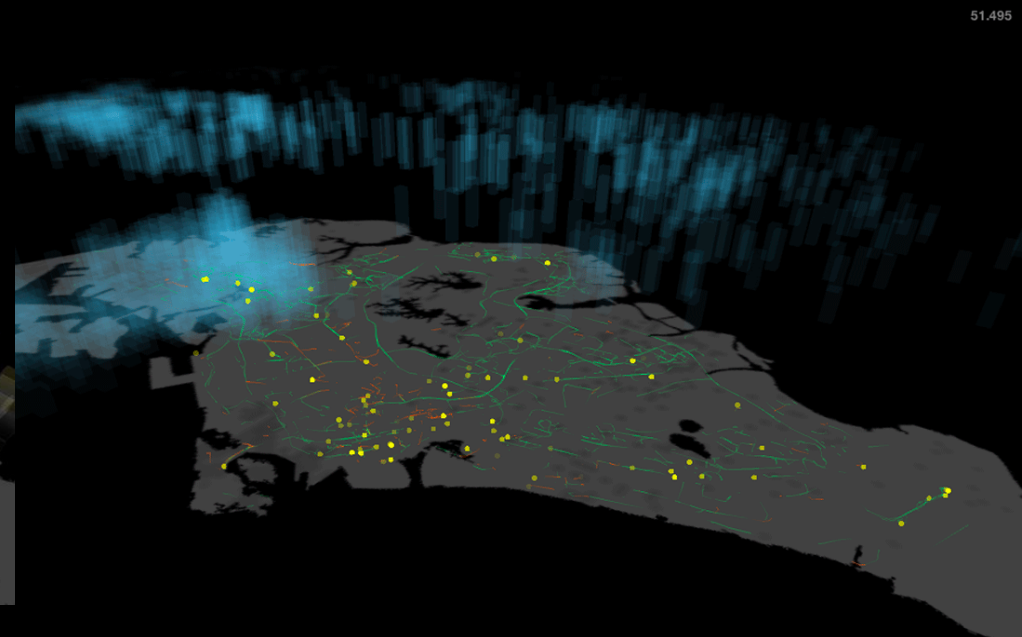
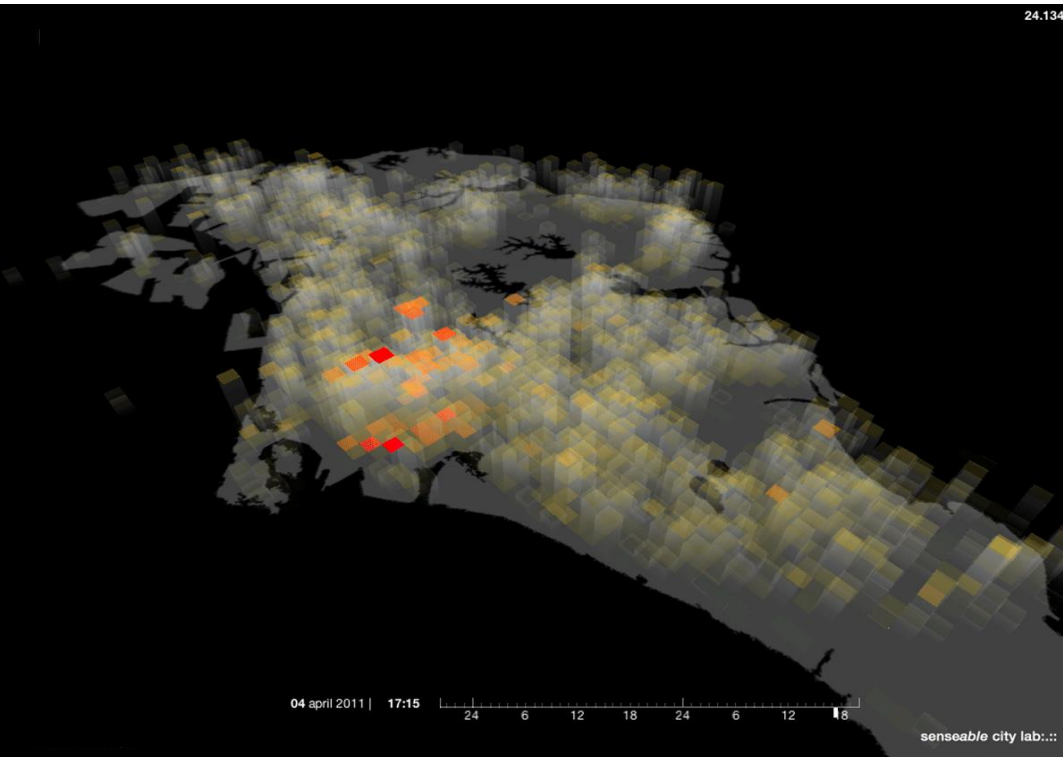


Benefit for the citizen

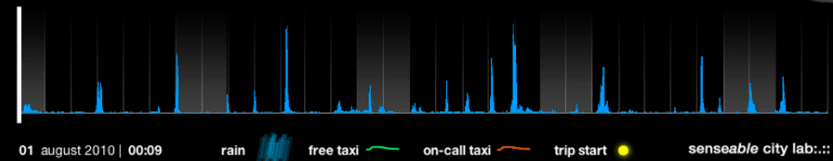
- Informed Citizens
- Environmental awareness
- Healthy route planning applications

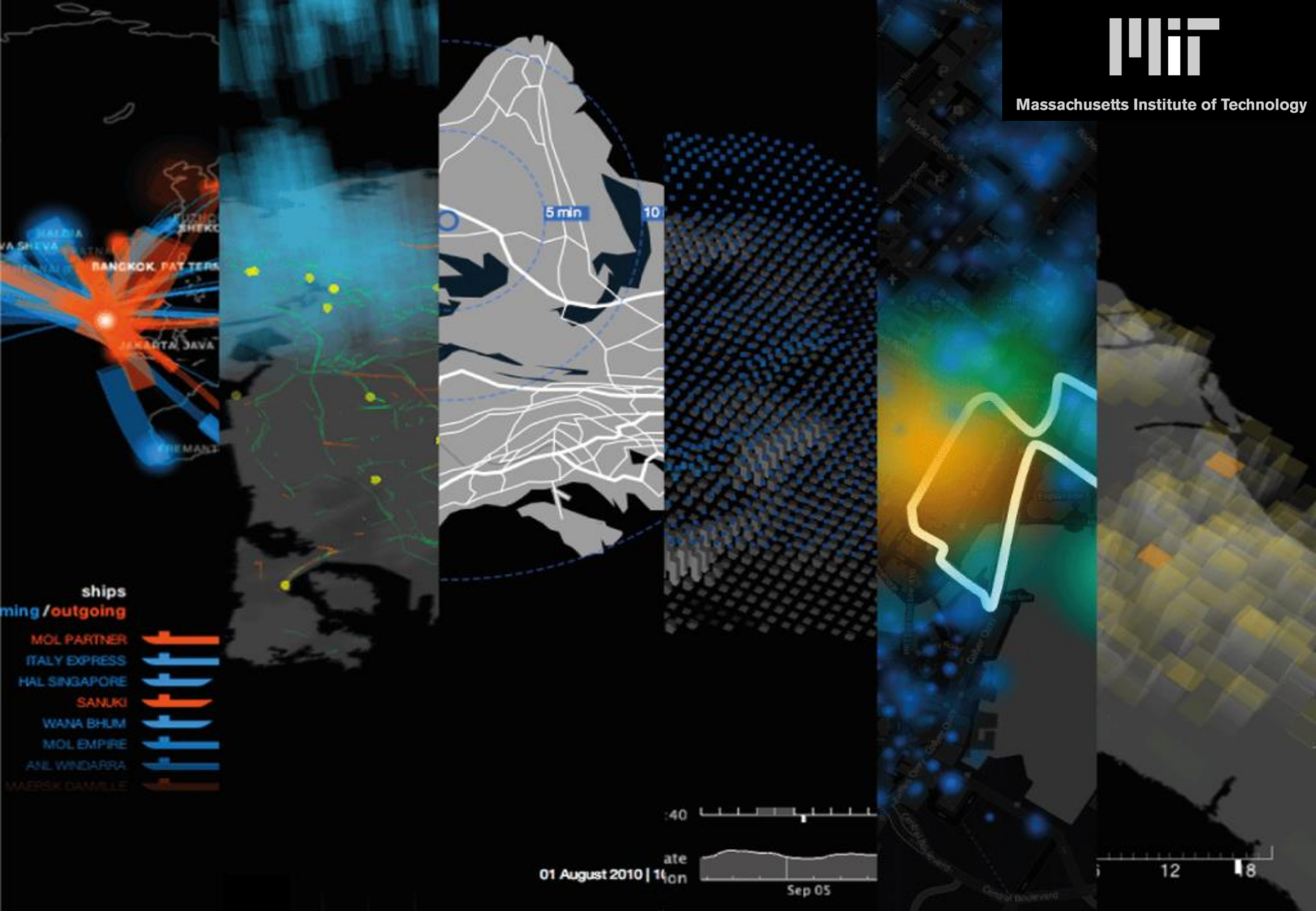


Communication of data - URBAN DASHBOARDS



Live Singapore!





ships
 incoming / outgoing

- MOL PARTNER 
- ITALY EXPRESS 
- HAL SINGAPORE 
- SANUKI 
- WANA BHUM 
- MOL EMPIRE 
- ANL WINDARRA 
- MAERSK DAMVILLE 

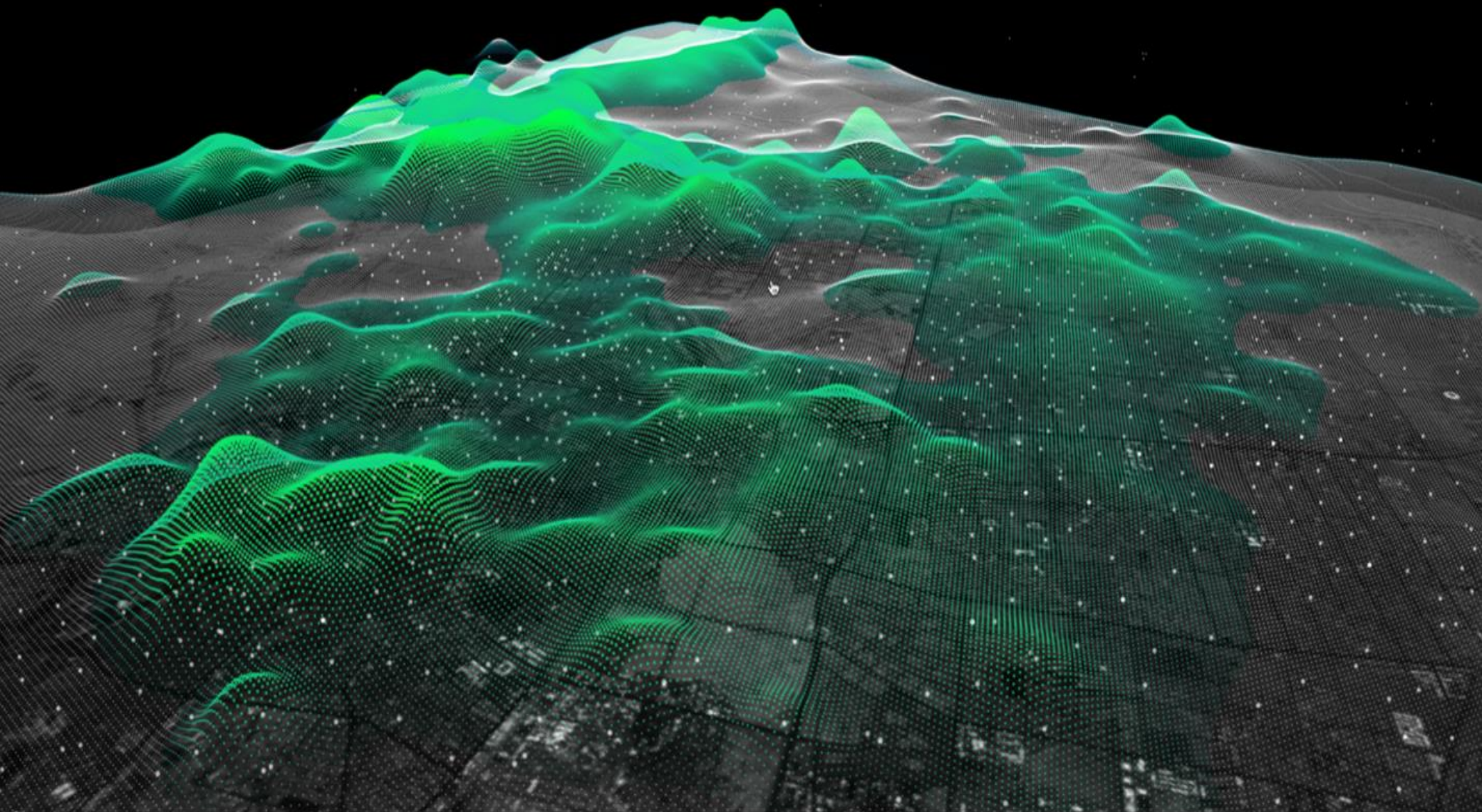
01 August 2010 | 11:00



Communicating urban data—web graphics



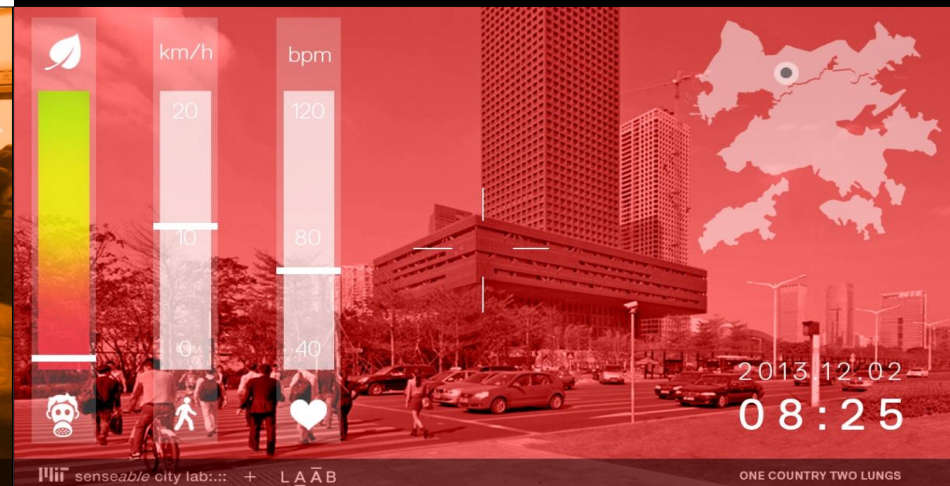
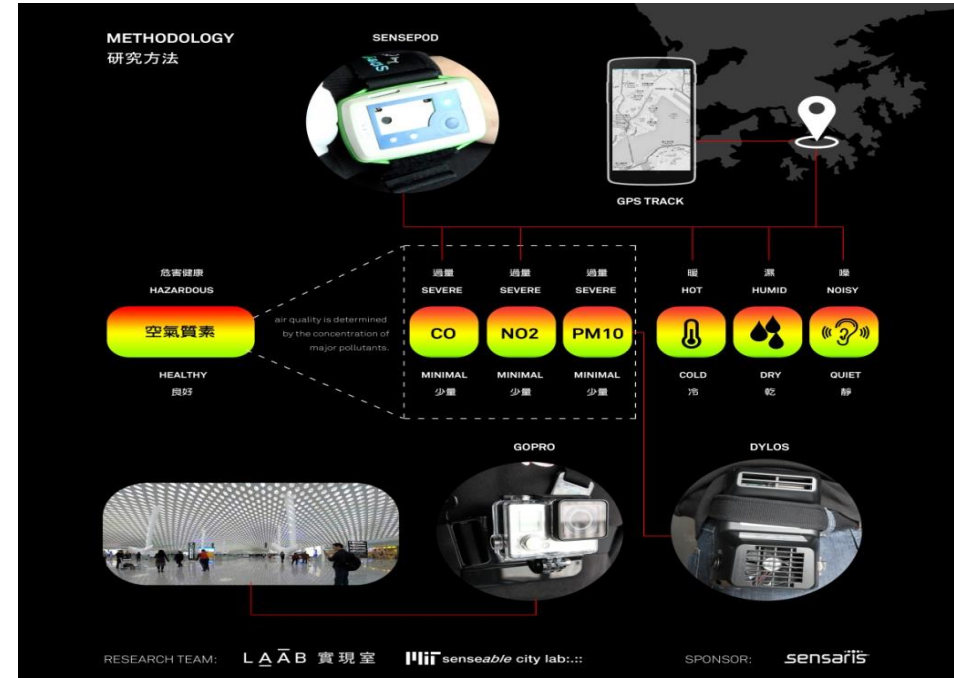
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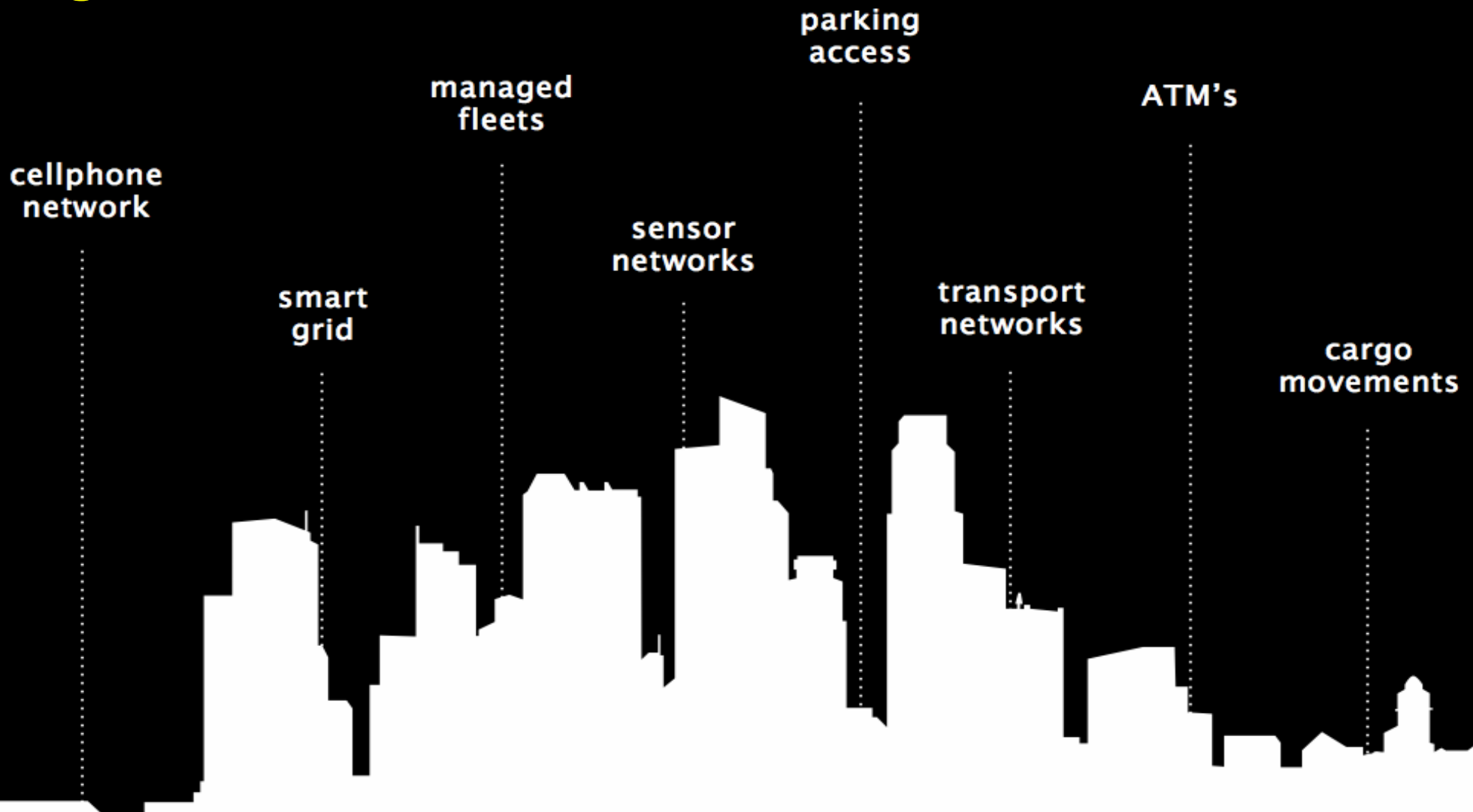
ONE COUNTRY TWO LUNGS



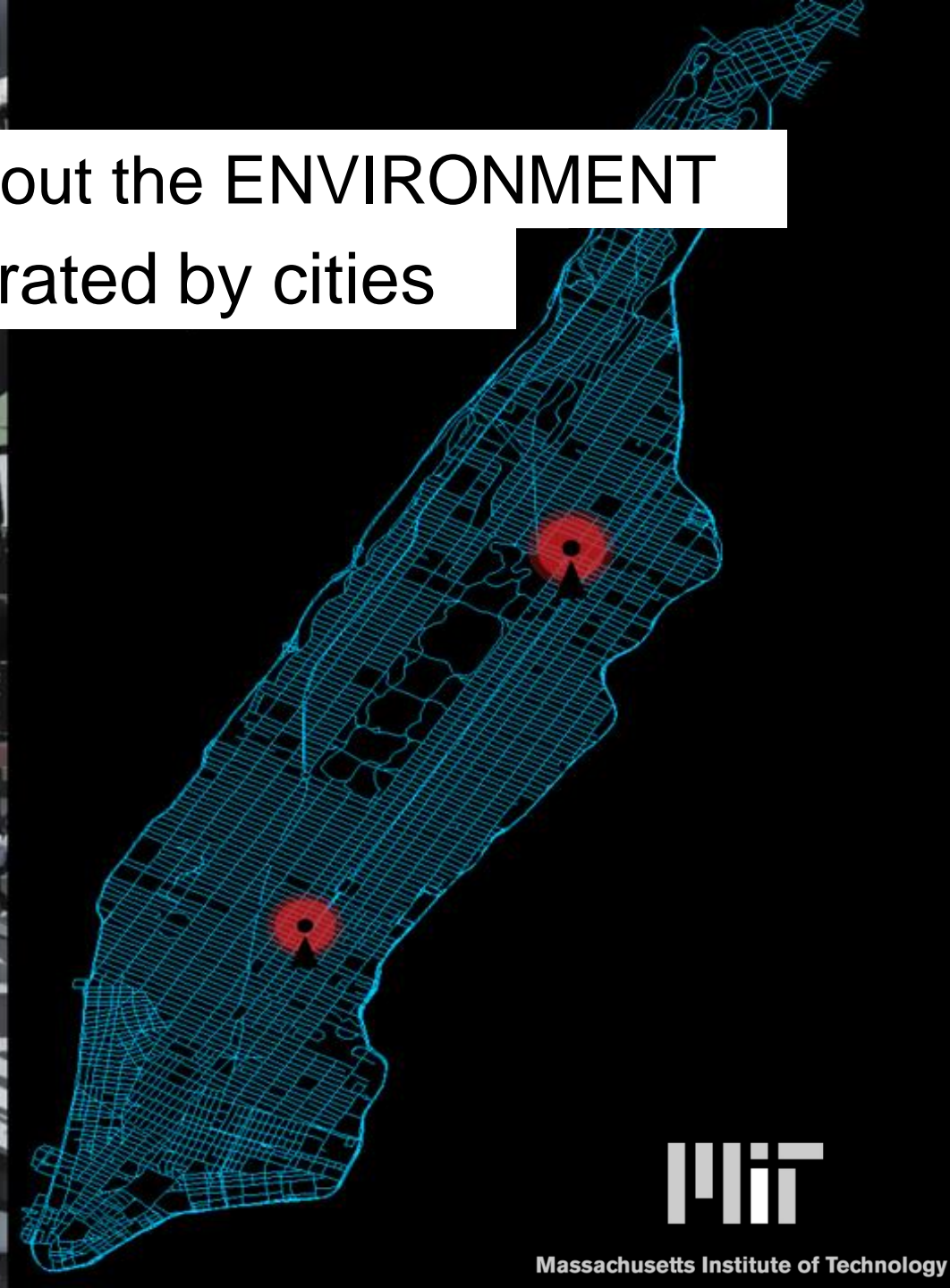
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enormous amounts of data generated in our cities



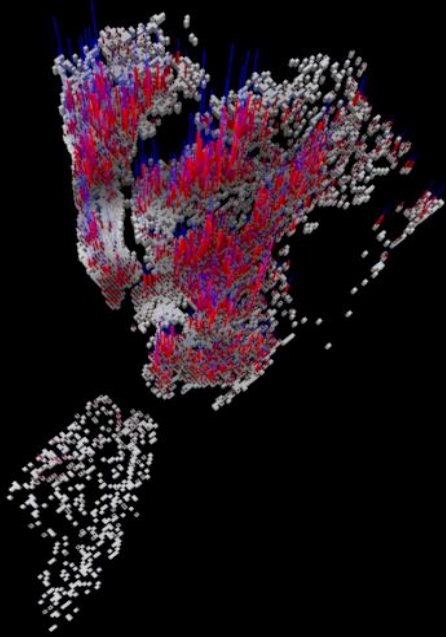
MAKING INFERENCES about the ENVIRONMENT using data generated by cities



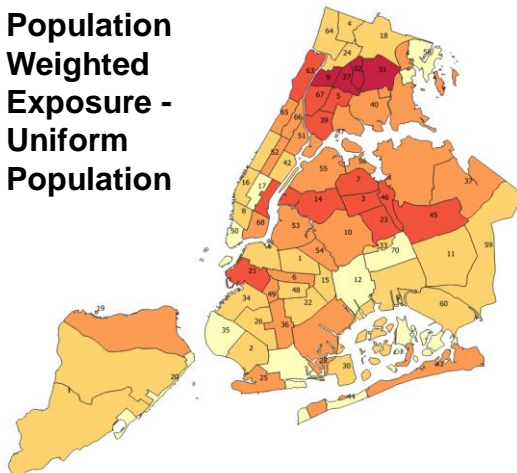
Urban data and air pollution



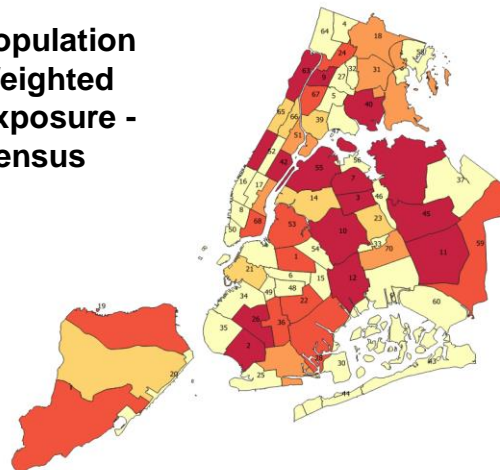
Population exposure to air pollution -NYC



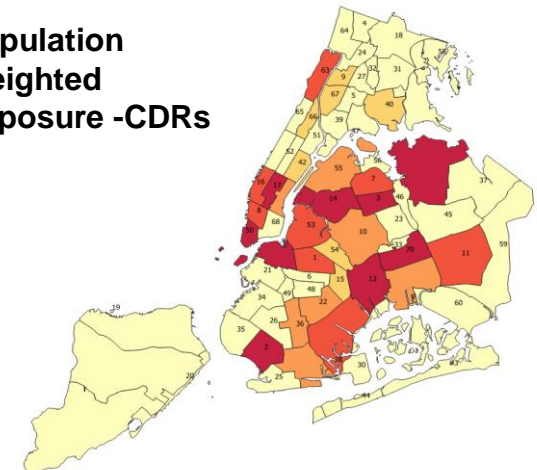
Population Weighted Exposure - Uniform Population



Population Weighted Exposure - Census

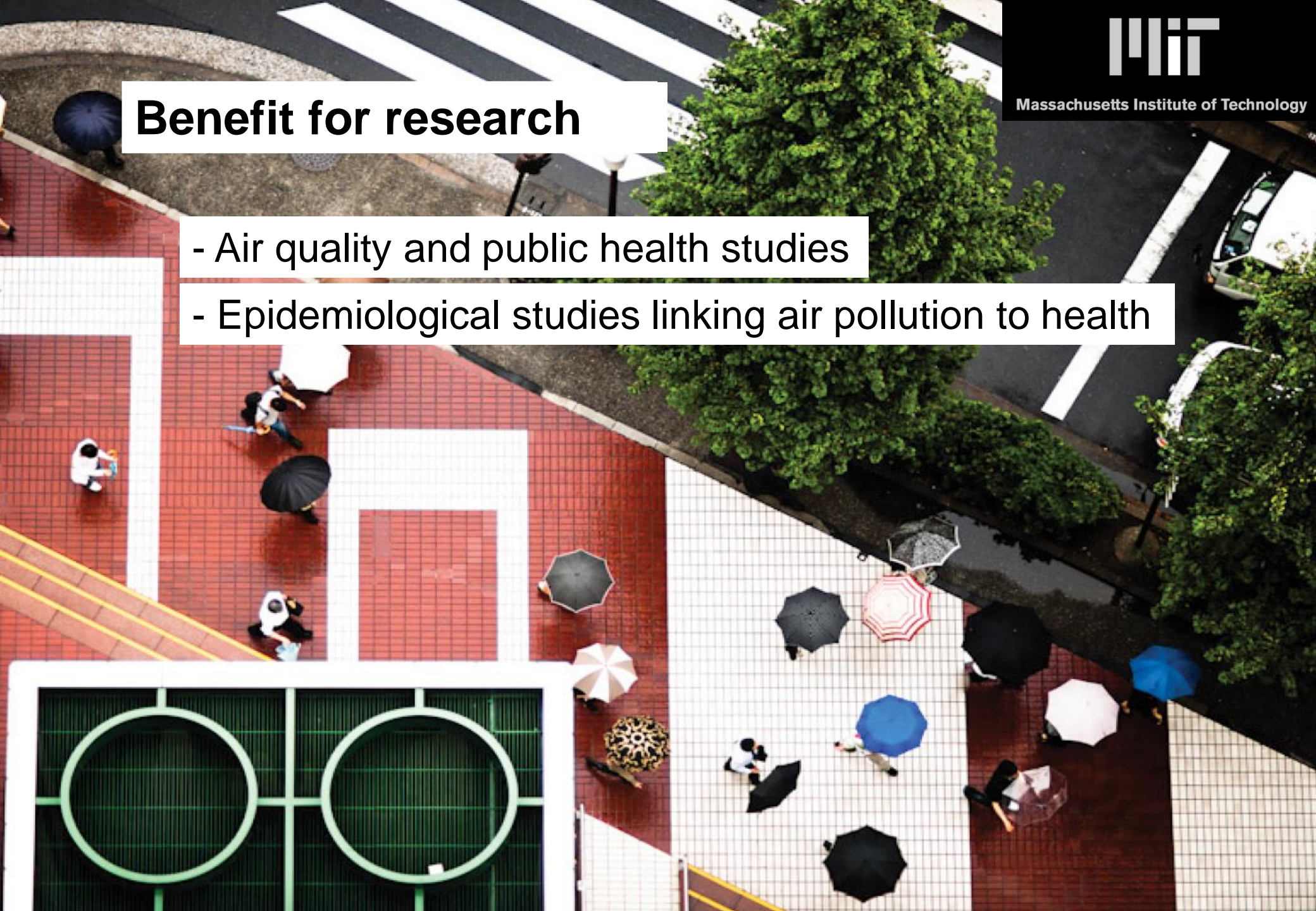


Population Weighted Exposure -CDRs



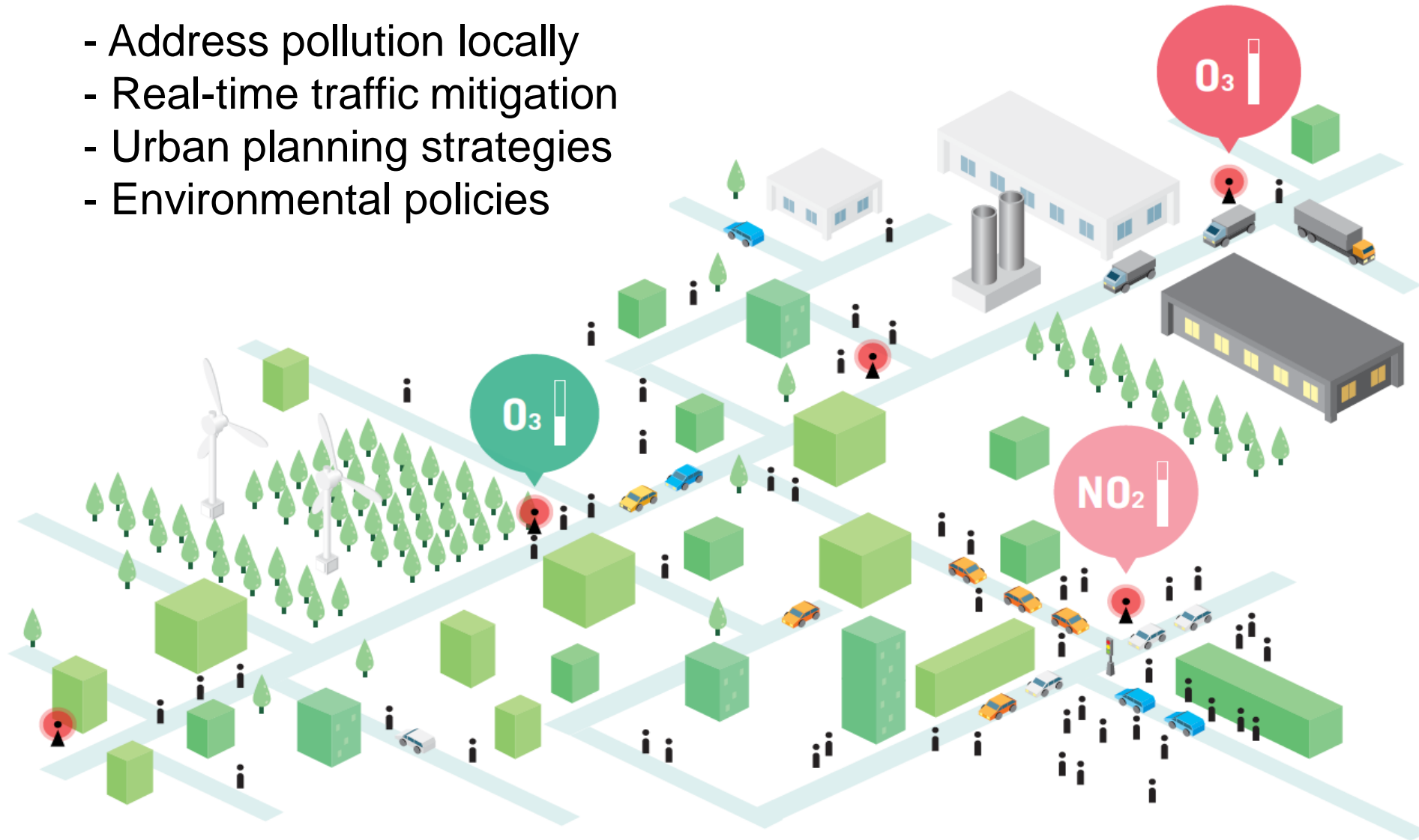
Benefit for research

- Air quality and public health studies
- Epidemiological studies linking air pollution to health



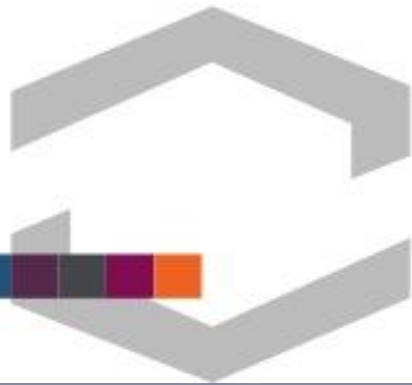
Benefit for the city

- Address pollution locally
- Real-time traffic mitigation
- Urban planning strategies
- Environmental policies



To summarise

- Urbanisation - increased population exposure to air pollution - global health concern.
- Real need for air quality information in high spatial and temporal resolution, and networks of air quality sensors are the solution here.
- More research - sensor accuracy over time, and network resilience.
- Urban dashboards offer opportunities for engaging graphical displays of city data including from air quality sensors.
- Air quality data from networks of sensors need to be understood in the context of other types of urban data.
- This will help to ascertain the main local drivers of air pollution.
- Where people and pollution overlap – prioritisation.
- Optimal implementation of air pollution intervention strategies for the protection of human health.
- New metrics for environmental regulation!
- More research needs to be conducted which emphasises how population exposure to air pollution can be reduced in cities using fine-grained air quality data from networks of sensors.



COST

Acknowledgements:

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