



mtec

URBAN DIGITAL TWINS

TANGUY COENEN

IOT SENSEMAKERS AMSTERDAM

19 FEBRUARY 2020

PUBLIC

IMEC



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LEUVEN

THE NETHERLANDS
EINDHOVEN & WAGENINGEN

INDIA
BANGALORE

CHINA
SHANGHAI

JAPAN
OSAKA

TAIWAN
HSINCHU

JAPAN
TOKYO

APPLICATION DOMAINS

SMART HEALTH



SMART MOBILITY



SMART CITIES



SMART INDUSTRIES



SMART ENERGY



SMART EDUCATION

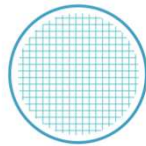


SEMICONDUCTOR & SYSTEM TECHNOLOGIES

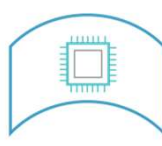
CORE
CMOS



SENSOR
TECHNOLOGY



FLEXIBLE
TECHNOLOGY



PATTERNING
TECHNOLOGY

LOGIC
TECHNOLOGY

MEMORY
TECHNOLOGY

INTERCONNECT
TECHNOLOGY

3D INTEGRATION
OPTICAL I/O

DIGITAL TECHNOLOGY PLATFORMS

NETWORKING



DIGITAL PRIVACY &
SECURITY



SOFTWARE & DATA
MANAGEMENT SKILLS



CITY OF THINGS - SMART CITY PROGRAM

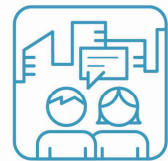
Let's design a smarter city together.



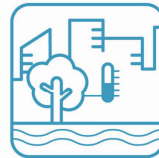
CITY
OF
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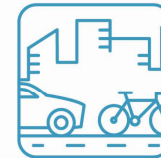
The keys to a smarter city



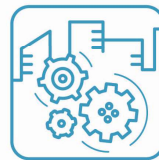
PEOPLE



ENVIRONMENT



MOBILITY



**SMART CITY
ARCHITECTURE**

A communal, shared architecture



PROJECT: OPEN CITY OF THINGS, VLOCA
LOCATION: ALL CITIES AND MUNICIPALITIES IN FLANDERS

Smoother and safer traffic in Flanders.

PROJECT: MOBILIDATA
LOCATION: ALL CITIES AND MUNICIPALITIES IN FLANDERS



You can't design a smart city alone.



You can't design a smart city alone.

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- Sensor technology
- Network technology
- Data technology
- Living labs
- Hardware prototyping
- Software prototyping
- Business modelling

structural academic collaboration

- University Of Antwerp (IDLab)
- University Of Ghent (IDLab)
- University Of Brussels (SMIT)
- University Of Leuven (CiTiP)

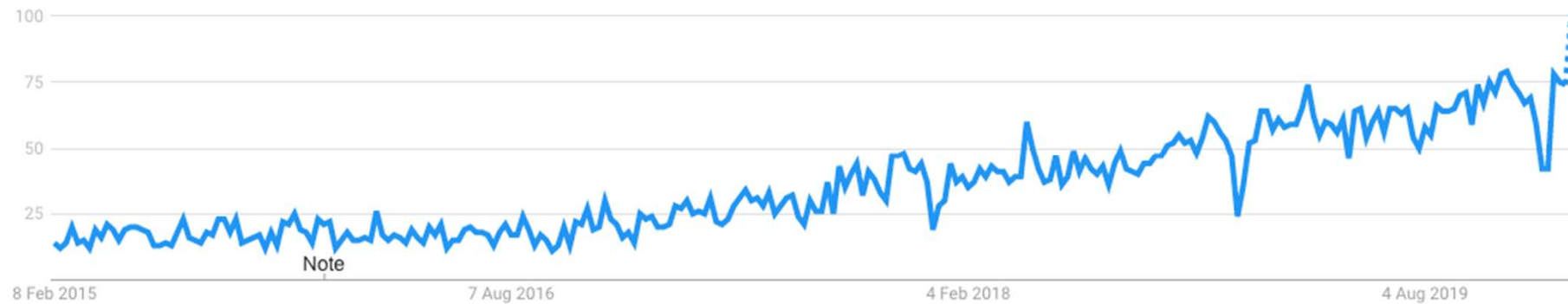
Antwerp, capital of things

- University Of Antwerp
- Port Of Antwerp
- City Of Antwerp



URBAN DIGITAL TWINS

DIGITAL TWIN SEARCH EVOLUTION ON GOOGLE TRENDS



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Urban digital twin =>
the entity is a city

Mission:

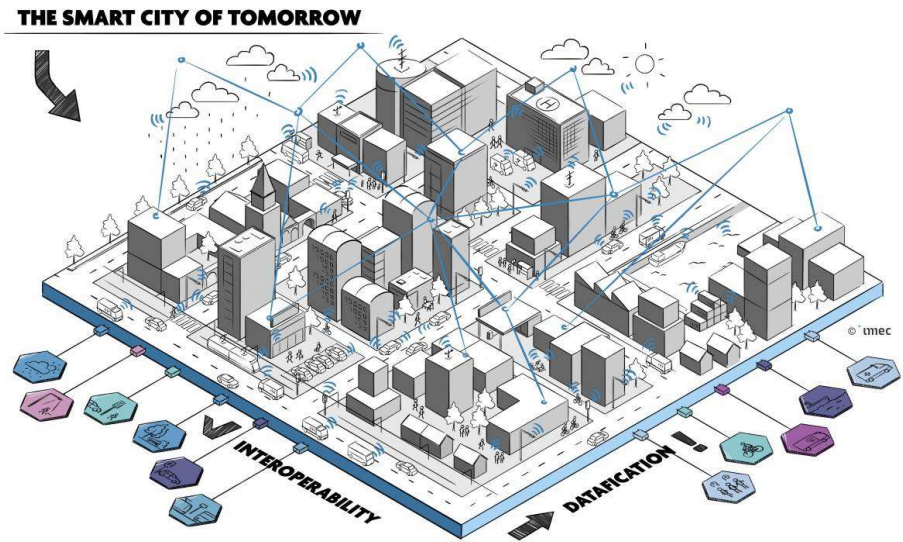
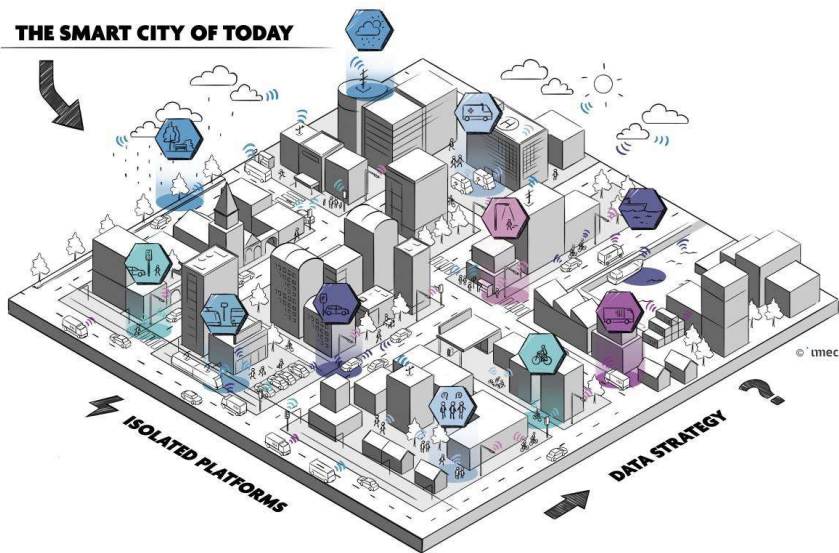
- to improve decision making for city administrations and emergency responders
- to allow citizens to understand the impact of decision in the city and provide feedback

SOME SEMANTIC ASSUMPTIONS

- **Built environment:** “the human-made environment that provides the setting for human activity , ranging in scale from buildings to cities and beyond.” (wikipedia)
- **Domain:** a view of reality through a certain data set, e.g. water quality, air quality, etc...
- **Use case:** a type of decision making, supported by BuDi, e.g. understanding the influence of traffic on air quality
- **Solution accelerator:** a combination of a data source + a modelling component that analyses the data, which can be YTT
 - Yesterday: historical
 - Today: realtime
 - Tomorrow:
 - Predictive
 - What-if

OVERCOMING DECISION MAKING SILO'S

- A city is an interconnected system where changes to one part very often have an impact on other parts
- People need decisions making tools that can foster and understanding across disciplines
- Datasets that are locked-into disciplinary silo's need to be opened up and interconnected



Internet of Things

Artificial intelligence

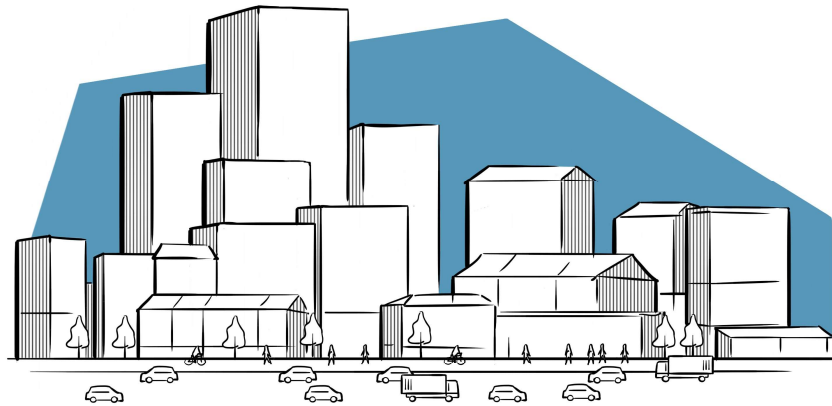
Open data, context data and data standards

URBAN DIGITAL TWIN PROTOTYPE

- https://www.dropbox.com/s/fst7lur7ckkdn4b/DigtalTwin_2Min_Promo.mov?dl=0

BUDI - BUILT ENVIRONMENT DIGITAL TWIN

APPLICATION AREAS

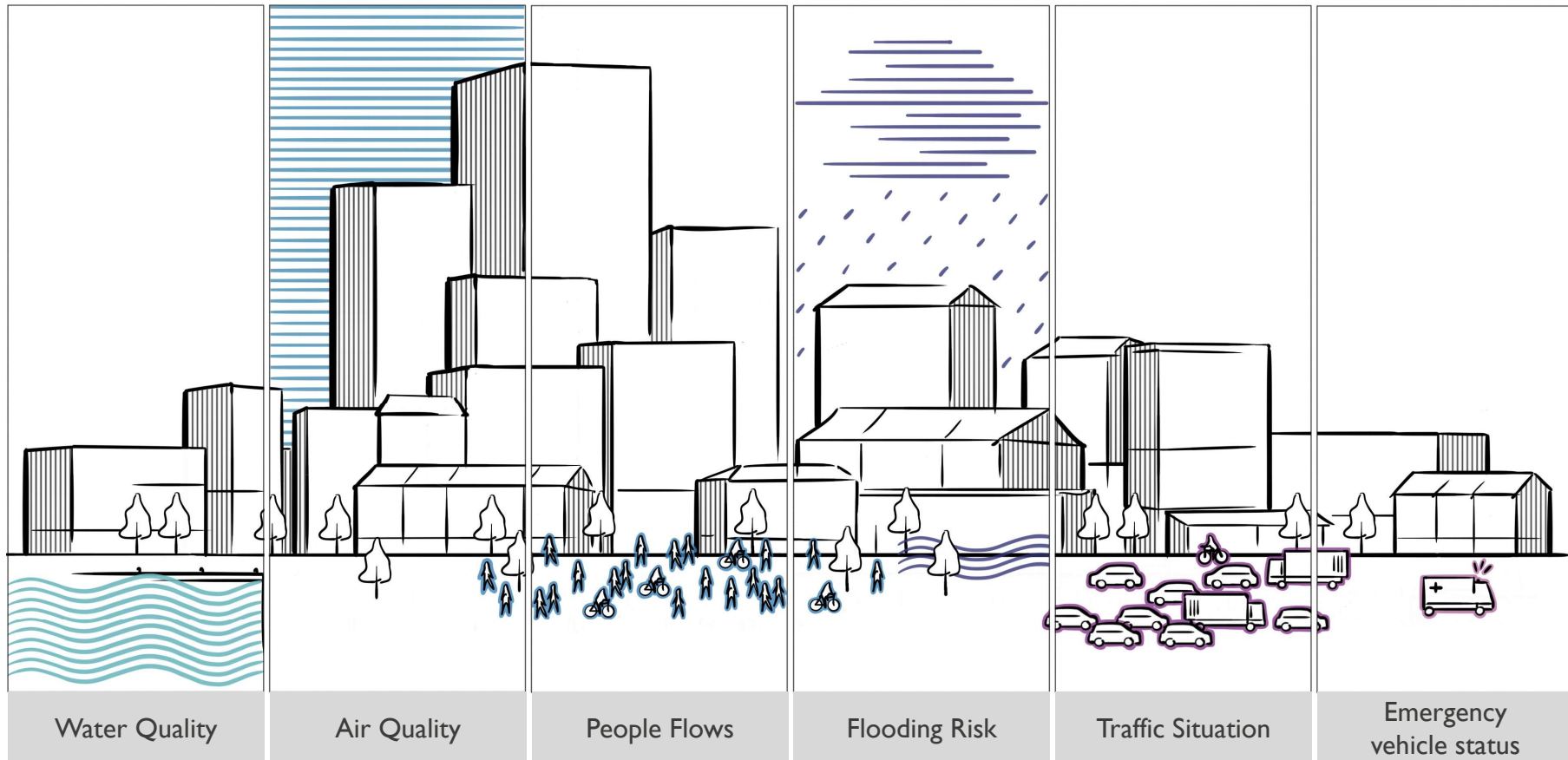


CITIES / PUBLIC BUILT
ENVIRONMENT

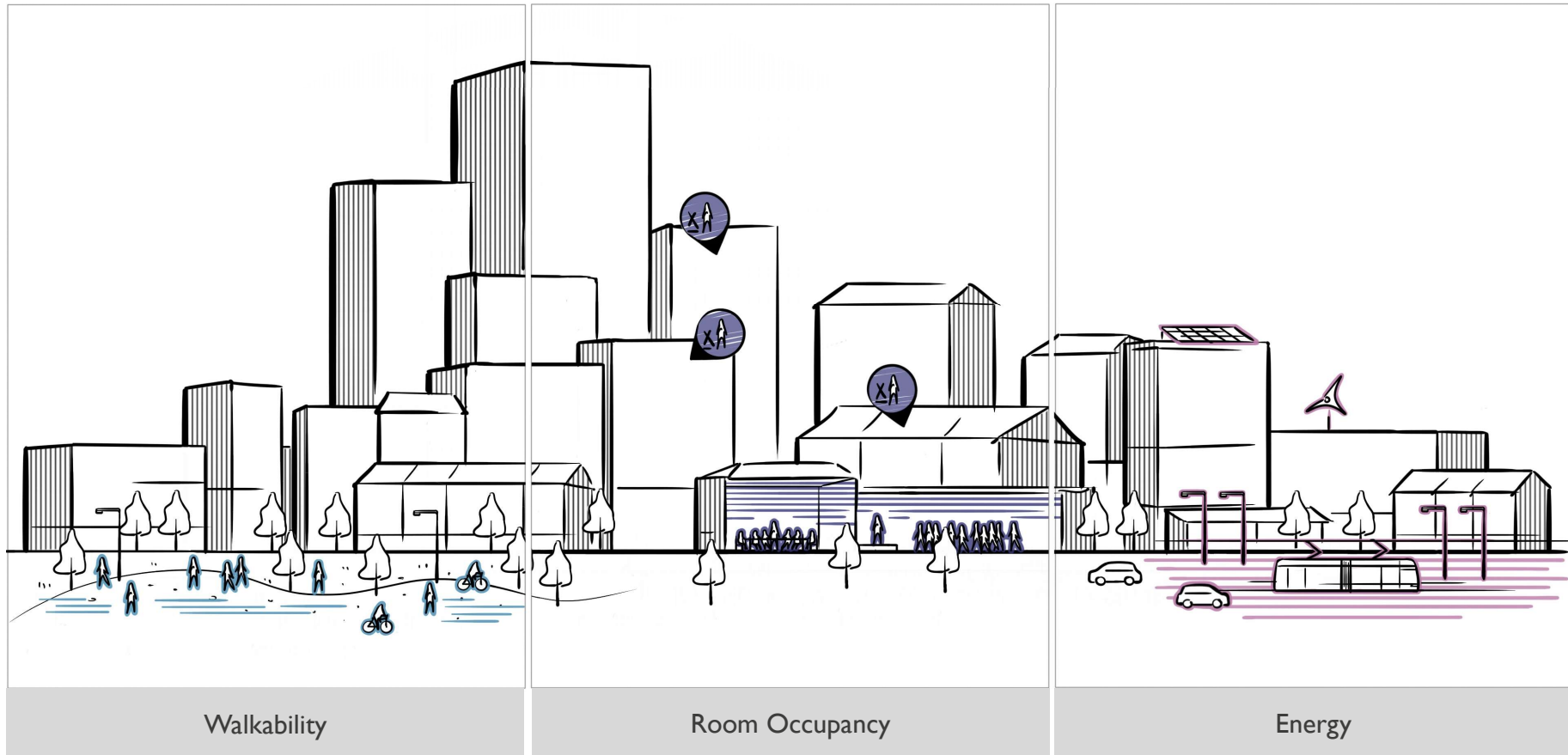


PRIVATE BUILT
ENVIRONMENT

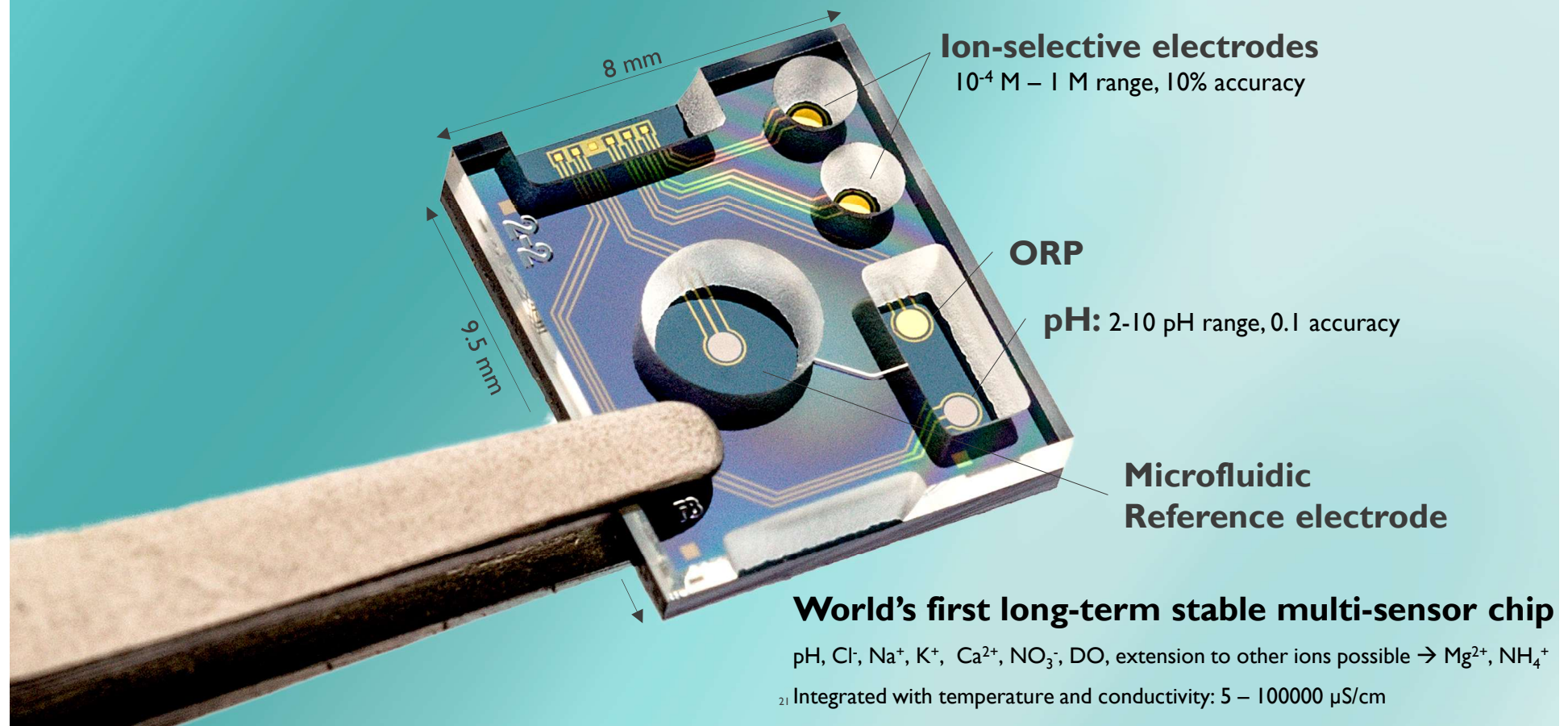
BUDI - BUILT ENVIRONMENT DIGITAL TWIN – EXAMPLE DOMAINS



BUDI - BUILT ENVIRONMENT DIGITAL TWIN - USE CASES



MINIATURIZED COST-EFFECTIVE LIQUID SENSORS





One view on multimodal flows in the city.

PROJECT: CITYFLOWS
LOCATION: ANTWERP

High-resolution environmental data.

O_3

NO_2

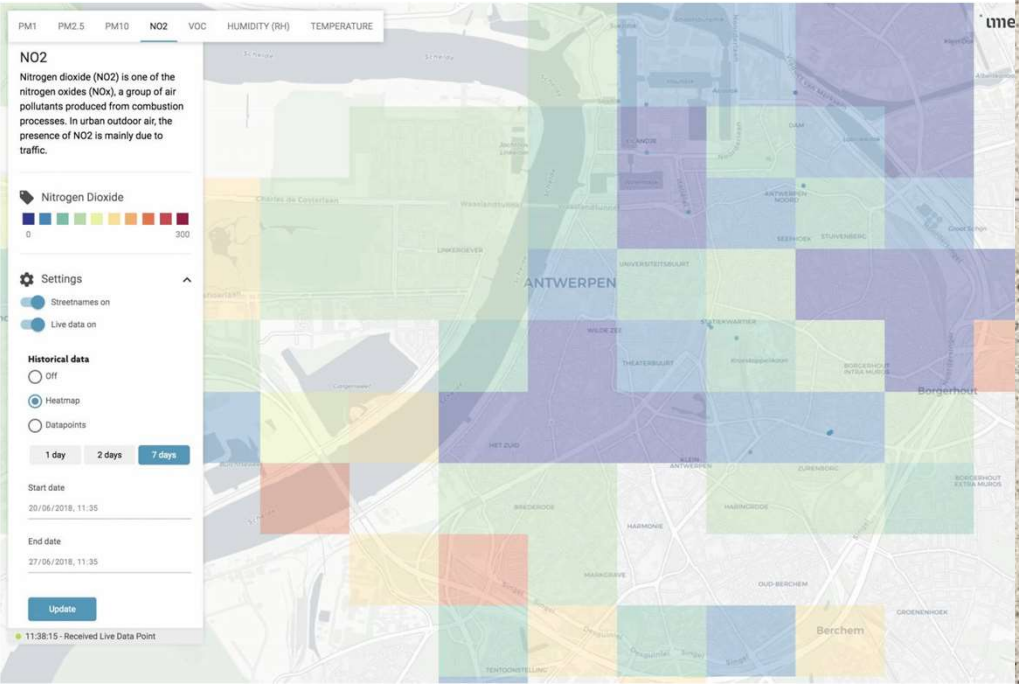
PROJECT: DENSITY
LOCATION: ANTWERP



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AIR QUALITY



Intervene proactively in case of urban flash floods.

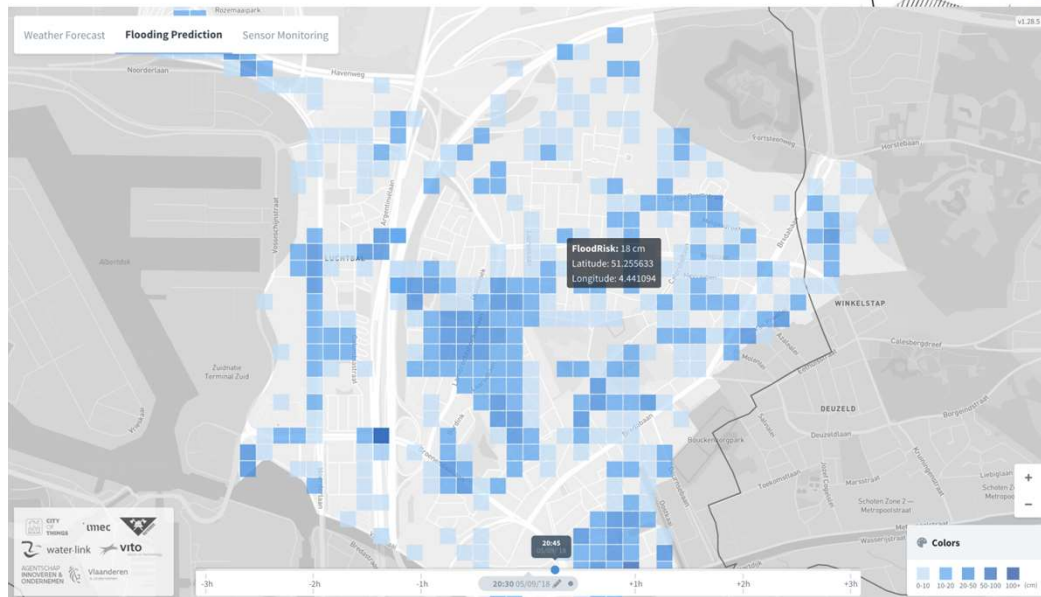
PROJECT: FLOODING
LOCATION: EKEREN, ANTWERP

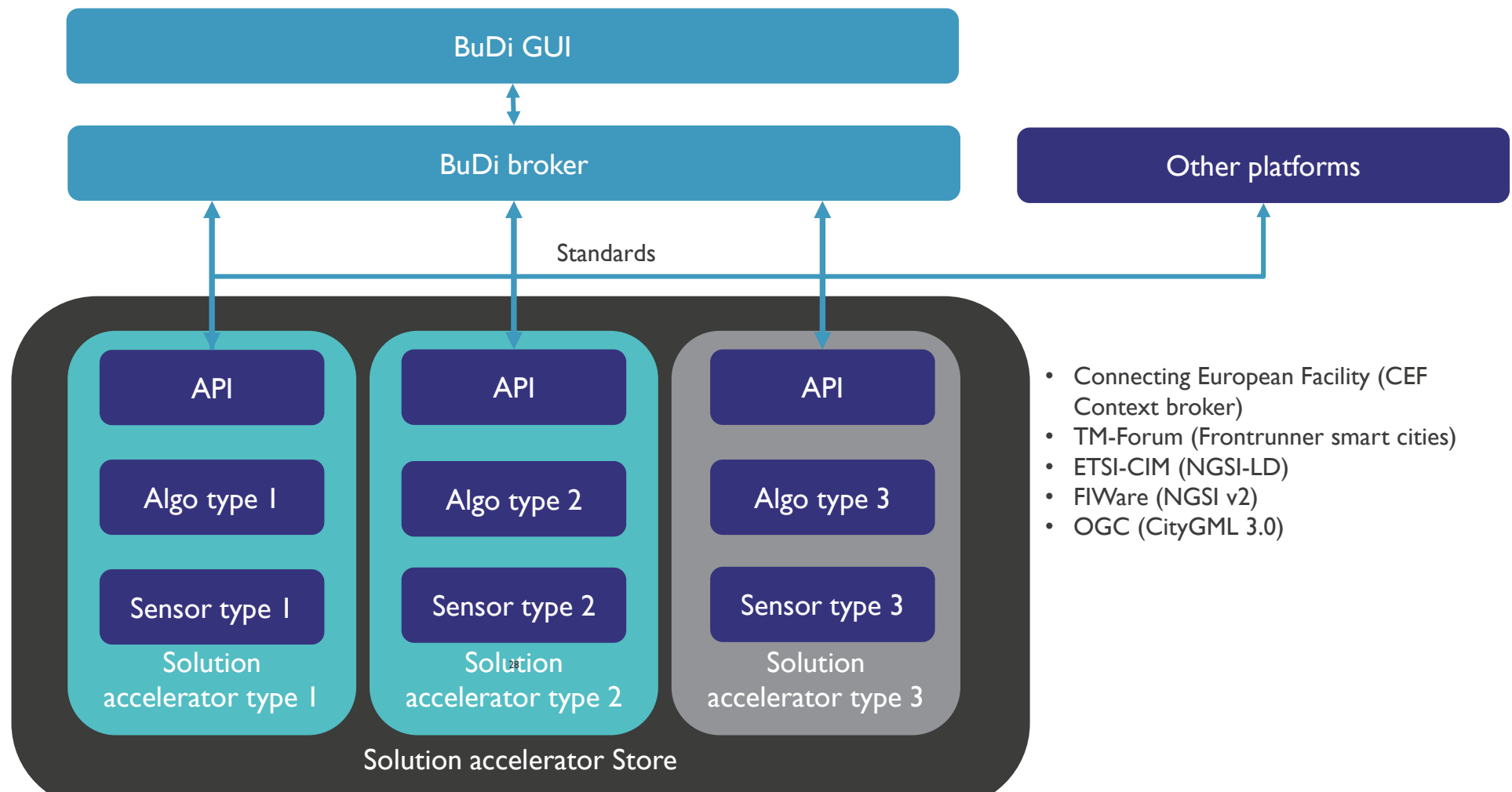


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FLASH FLOOD RISK





WHAT MAKES A GREAT BUDI?

- Extensible
 - In terms of domains
 - In terms of solution accelerators
- Interoperable
 - Can interact with IoT systems of multiple vendors
 - => Standards-based
- Machine learning at its core
 - For predictive modelling in solution accelerators
 - For model validation & learning in solution accelerators
 - For cross-solution accelerator use cases
- Great UX
 - For the end-user who wants to engage in decision making
 - For the administrator of data sources

SOME R&D QUESTIONS WE'RE CURRENTLY WORKING ON

- What would an ontological representation that allows the combination of various solution accelerators into cross-domain use cases look like?
- What is the best data economy business model that would support the integration of solution accelerators from various partners in BuDi?

...to bring entrepreneurial thinking, agile processes
and open innovation to Government decision making



MORE INFO

- Imec's City of Things program: www.imeccityofthings.be/en
- Duet H2020 project: www.digitalurbantwins.com
- tanguy.coenen@imec.be