
# Fair and Open Smart Cities: Growing the Local IoT Data Infrastructure Partnerships - Joint Workshop: Internet of Things for Smart Cities & Communities (IoT4SCC)

Themes: Smart Cities & Communities | Large Scale Pilots (LSP)

What: Panel

When: Thursday Jun 20 11:15 AM to 12:30 PM (1 hour 15 minutes)

Where: Musikhuset Aarhus - Lille Sal

Discussion: 0

EINDHOVEN

# 1 Fair

= based on common

Principles & Guidelines?

## What needs a city to become ‘fair open and smart’?

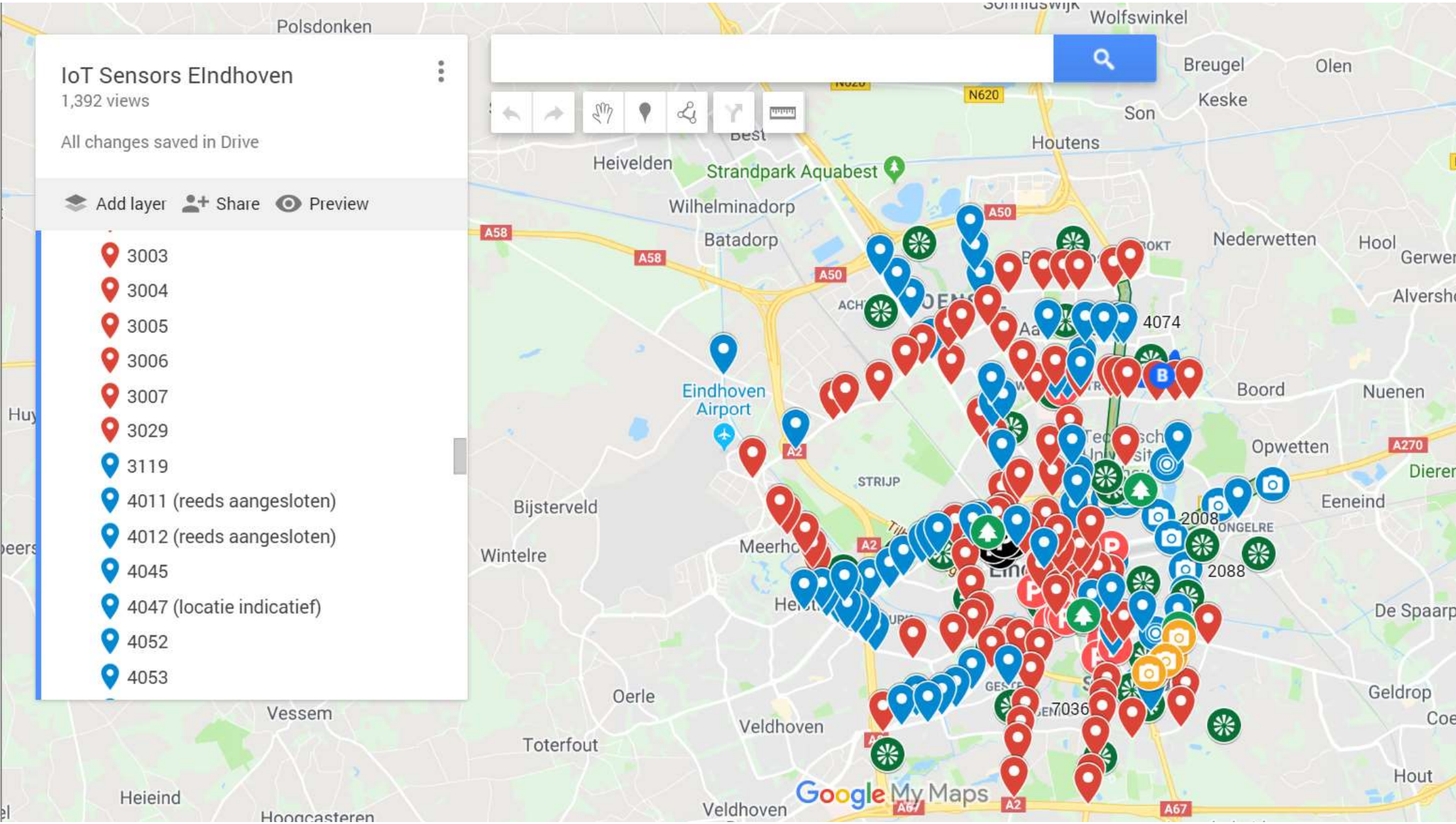
- some ‘rules of engagement’
- an open shared platform to capture and store ‘raw’ (IoT) data and events in context, using standard APIs and (meta) data models
- some data analysis/intelligence to transfer ‘raw’ data into added value information,
- a market place to exchange data, intelligence, applications and services for all interested parties, to create and share (also justified financial) benefits

# Key message

EINDHOVEN

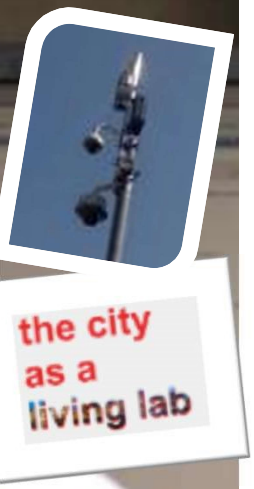

Eindhoven:
Smart Society


AiREAS
SCAPELER
Smart lighting
?
Citybeacons
Stratumseind 2.0
Santé
Santé


IoT Sensors Eindhoven
1,392 views
All changes saved in Drive
Add layer
Share
Preview
3003
3004
3005
3006
3007
3029
3119
4011 (reeds aangesloten)
4012 (reeds aangesloten)
4045
4047 (locatie indicatief)
4052
4053
Polsdonken
Wolfswinkel
Breugel
Olen
Keske
Son
Houtens
N620
Heivelden
Strandpark Aquabest
Wilhelminadorp
Batadorp
A58
A50
Nederwetten
Hool
4074
Eindhoven Airport
A2
Boord
Nuenen
Opwetten
A270
STRIJP
Bijsterveld
Eeneind
2008
TONGELRE
Wintelre
2088
De Spaarp
Oerle
Geldrop
7036
Vessem
Veldhoven
Toterfout
Hout
Heieind
Google My Maps
A67

# Rules to improve quality of life

- IoT sensors are everywhere => safeguard public interest
- Stimulate economic development & eco-systems
- Frame to support existing organic approach
- Futureproof: prepare to change




## Open data

### Eindhoven Open Data principles:

- Data residing in the public space belongs to everyone and should be set open
- Data may only be opened if there are no privacy or public safety threats
- Data may be used by all parties

## IoT Charter

### Smart Society IoT Charter


## Digital Cities Agenda

**Four principles for digital infrastructure of Smart Society**

1. Contributes to livable, healthy, safe and inclusive city development.
2. Is available for everyone in the city, future proof, reliable & safe
3. Builds on open interfaces, open protocols & open standards. Transparency & control by the residents is guaranteed.
4. Opens up data, with respect for privacy & safety.

# European+ Common Principles

- On top of ‘our’ Open Data principles, IoT Charter and 4 main Principles Digital Cities Agenda
- In SynchroniCity a' comparative principles research’ between the participating cities: Antwerp (ANT), Eindhoven (EIN), Helsinki (HEL), Manchester (MAN), Porto (POR), Santander (SAN), and Carouge (CAR) versus the ‘comprehensive list compiled by New York City (NYC)’.
- For IoT infrastructure principles is compared: Privacy, Data management, Openness of standards and interfaces, Infrastructure, Architecture, Security, Social responsibility as well as Operation and sustainability
- For Open Data is compared: public data ownership, release management of open data, Information about data formats, metadata and open data catalogues, Recommended data licenses, how exploitation of open data by third parties is encouraged as well as How users of open data can provide feedback on the data to the city authorities.
- See D1.3 Guidelines for SynchroniCity architecture

SYNCHRONICITY

NYC Guidelines for the Internet of Things

EINDHOVEN

# Data management example

| Concern | ANT | EIN | HEL | MAN | POR | SAN | NYC | CAR |
|---|---|---|---|---|---|---|---|---|
| Importance of standards | X | X | X | X | | X | X | X |
| Provide data in standard formats | | X | X | X | | X | X | X |
| Metadata harmonization | | | | | | | X | |
| Use of APIs | | X | X | X | | | X | X |
| Modularity | X | X | | | | X | | |
| Communication with devices based on open standards, | X | | | | | | | |
| Staying on track with new standards | | | X | X | | | | |
| Ability to adjust to new standards | X | | | | | | | |
| Documentation | | | X | | | | | |
| SDKs for API users | | | | | | | | |

**6.1.2 Data management**

**RI2.1:** IoT data should be accessible through open APIs. The access should be limited when restricted by existing laws or regulations and/or when it compromises privacy or public safety. When useful, relevant business and historical data should be made available.

**RI2.2:** IoT data should be categorized as efficiently as possible. Compliance with specific standard or catalogue is not enforced at this stage.

**RI2.3:** Security and privacy concerns should be addressed to protect data and restrict access to unauthorized users.

**RI2.4:** Each IoT device data set should be validated and verified. Accuracy and validity should be monitored continuously and automatically. Versioning of data can help to distinguish any updated data from the original and/or master copy.

# 2 Open

**= Quadruple Helix**

**& other ecosystems?**


Municipality Eindhoven
Market parties
Citizens
Knowledge institutes
Together, we improve quality of life
EINDHOVEN

# Local Ecosystem


BRAINPORT EINDHOVEN

EINDHOVEN

METROPOOL REGIO EINDHOVEN

munisense

Atos

OpenRemote

Sorama

ViNotion

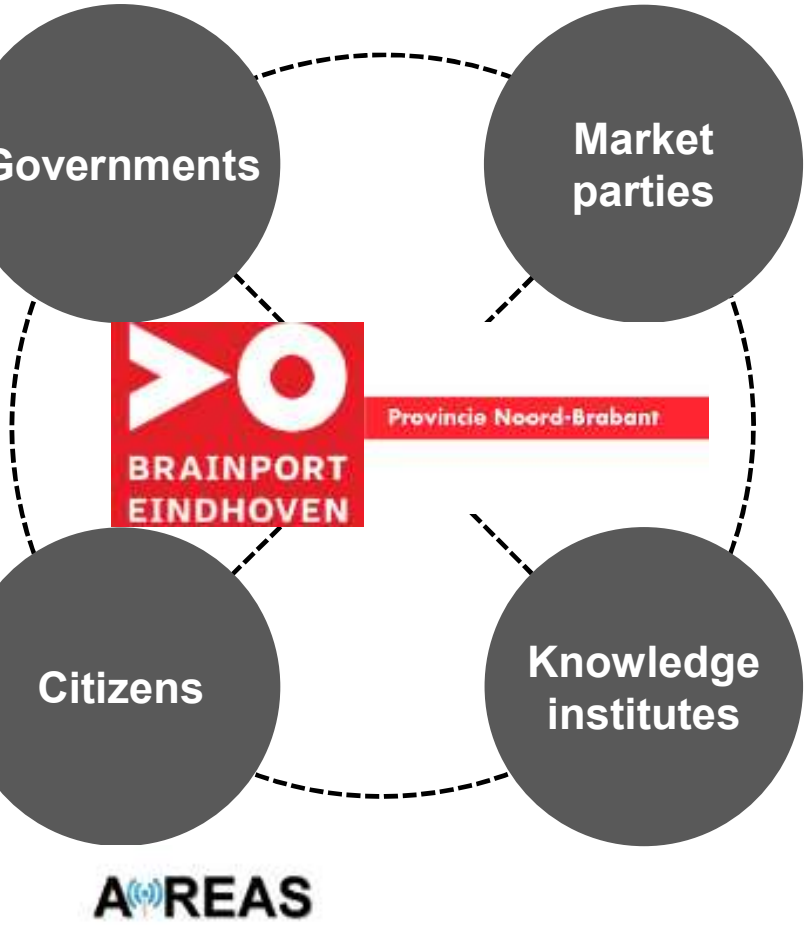
venturespring
start to grow

AREAS

Fontys

TU/e

# Regional Ecosystem

# National Ecosystem

Governments

Market parties

Citizens

Knowledge institutes

kadaster

NEN Smart Cities Standaardisatie adviesgroep

VNG Vereniging van Nederlandse Gemeenten

VNG Realisatie

Gemeente Amsterdam

Gemeente Almere

EINDHOVEN

Gemeente Rotterdam

Gemeente Enschede

Gemeente Utrecht

Zwolle

alliander

Atos

esri

kpn

Fraunhofer

imec

TNO innovation for life

SAXION

Windesheim

Universiteit Utrecht

# European Ecosystem


This project has received funding from the European Union's Horizon 2020 Research and Innovation Program under Grant Agreement

PRESTIGIOUS EUROPEAN ITS CONGRESS COMING TO THE NETHERLANDS IN 2019

# Knowledge Sharing

- OASC
- European network organizations
- EU H2020 projecten
- NL Digital City Agenda, VNG, Brainport region
- Living labs


triangulum
DEMONSTRATE · DISSEMINATE · REPLICATE

UNaLAB
URBAN NATURE LABS

SYNCHRONICITY

AUTOPILOT

European Network of Living Labs

EUROCITIES

EIP-SCC
European Innovation Partnership on Smart Cities and Communities

LUCI ASSOCIATION

Creative Ring

# 3 Open

## = MIM's SynchroniCity project Architecture framework and MIMs!

SYNCHRONICITY

# IoT Large Scale Pilot for Smart Cities


Martin Brynskov, Coordinator

—

Chair, Open & Agile Smart Cities (OASC)
Director, AU Smart Cities, Aarhus University
Coordinator, Danish Smart Cities Network
Expert, Danish Standards SSCC mirror committee


"Apologies for the mad scientist pose"

OPEN & AGILE SMART CITIES

SYNCHRONICITY

# 5 IoT Large Scale Pilots (104 m€)

- **Smart Cities = “SynchroniCity”***
- Automotive = “Autopilot”*
- Assisted living = “ActiveAge”*
- Wearables/safety = “Monica”*
- Agro = “Internet of Food & Farming”(*)

+ 2 CSAs (tech + co-creation)

* = smart cities-related

“

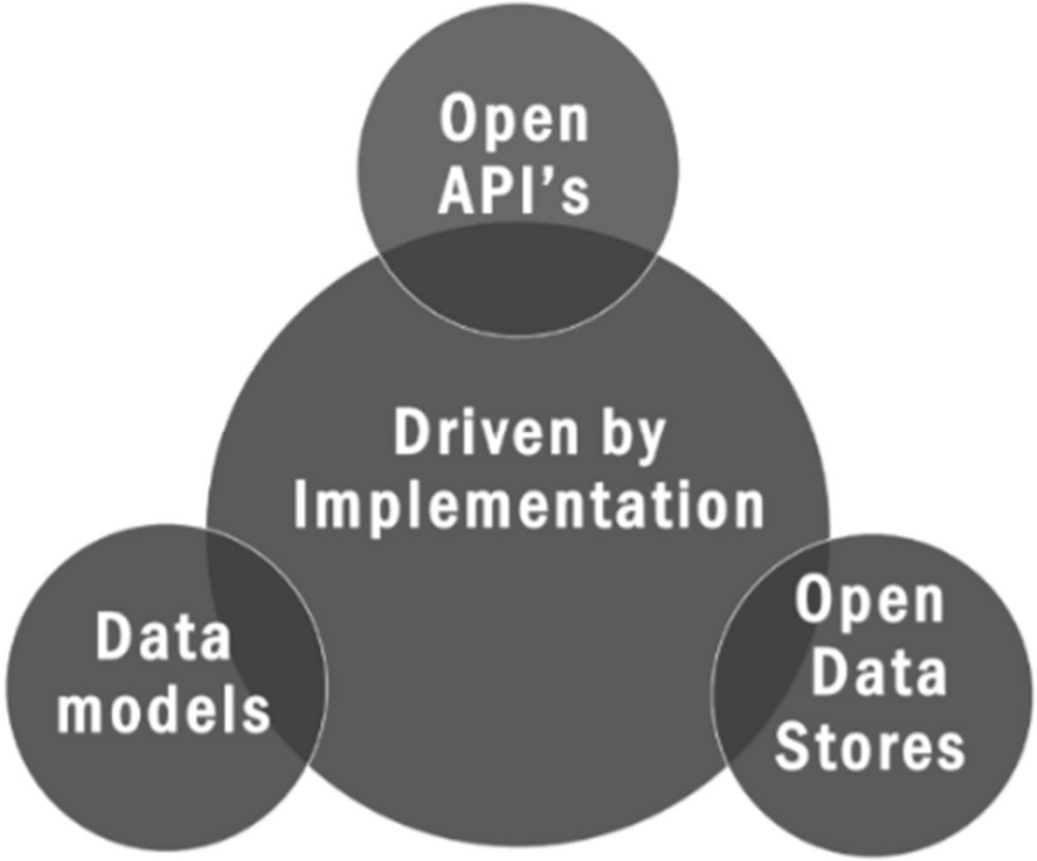
# Deliver a market for IoT-enabled urban services for Europe and beyond

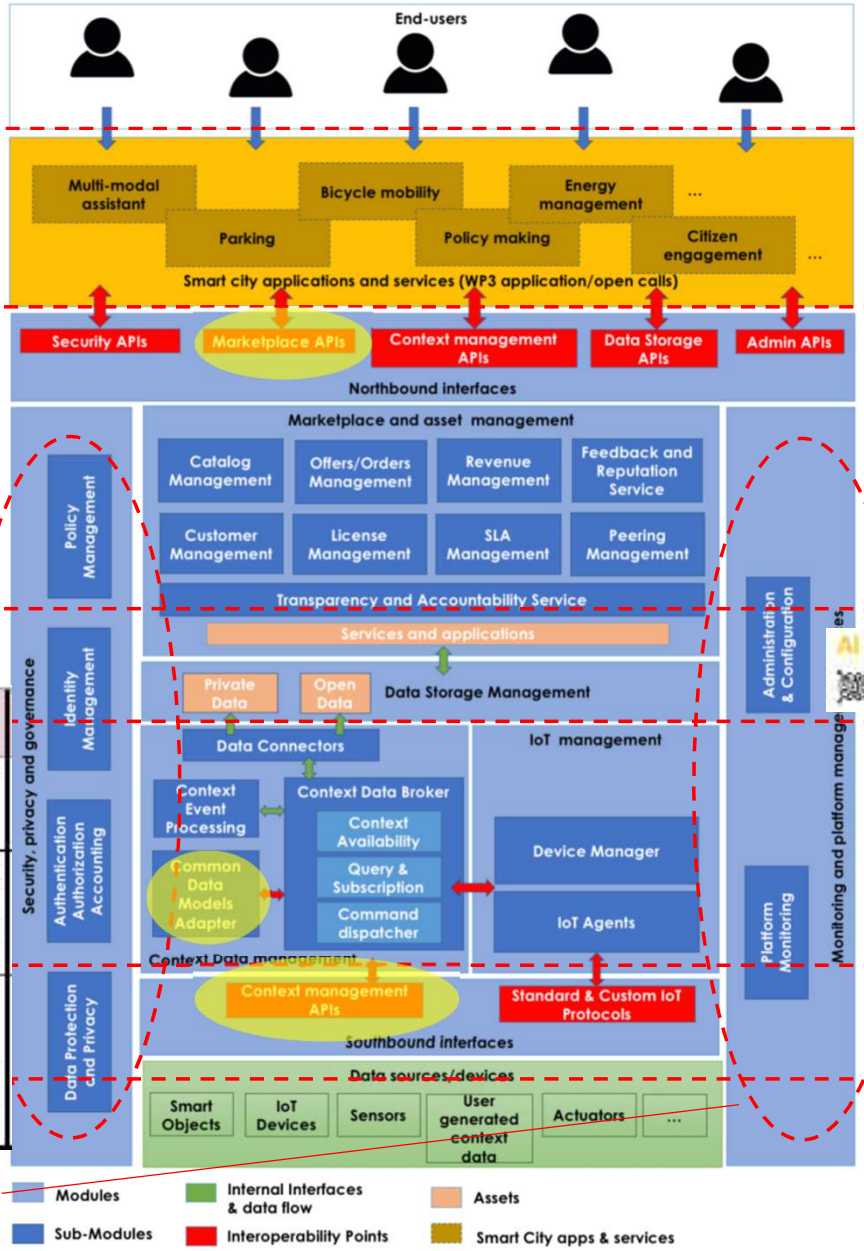
“A robust model for standards-based innovation and procurement of IoT-enabled services across domains

# Common Technical Ground

1. **OASC** neutral branding (based on standards and consensus specifications)
2. **OASC** Minimal Interoperability Mechanisms (MIMs)
   - Context Information Management
   - Common data models
   - Ecosystem Transaction Management (marketplaces)
3. **SynchroniCity** reference implementation (standards-based)
4. **SynchroniCity** cloud hosting (option)

# SynchroniCity Architecture

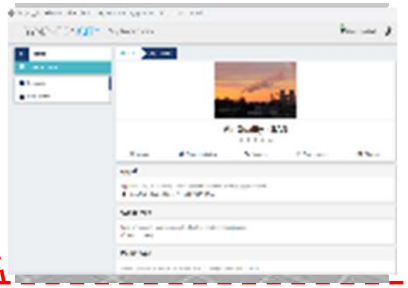





| MIM | Point | Description |
|---|---|---|
| OASC Context Information Management MIM | Context Info Management API | The API allow to access to real-time context information from the different cities |
| OASC Data Models MIM | Shared Data Models | Guidelines and catalogue of common data models in different verticals to enable interoperability for applications and systems among different cities |
| OASC Ecosystem Transactions Management MIM | Marketplace API | It exposes functionalities such as catalogue management, ordering management, revenue management, Service Level Agreements (SLA), license management Etc Complemented by marketplaces for hardware and services |

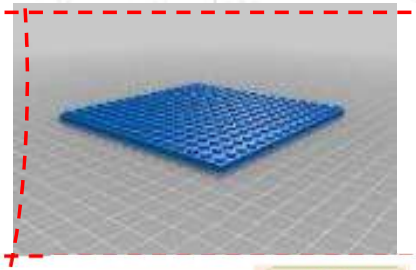
…to all interested Quadruple Helix parties

6. Services and applications that deliver the ‘real’ added value…



5. The EU Digital Single market: Market place where ‘raw’ data, (added value) information, applications and services are available for all parties

4. Urban Platform from ‘raw’ data to value added information



2. Platform from ‘raw’ IoT/sensor and/or user historical data to storage management
3. in standard formats and in context

1. Network connections + ‘translation office’

0. IoT/sensor/verticals ‘own/dedicated’ formats and protocols

7. Security, Privacy and Governance

8. Monitoring and Platform management

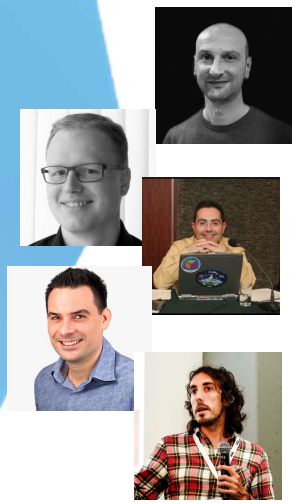
# Interoperability Mechanisms

| Interoperability Point | Description | Specification document | Related Standards [and Baselines] |
|---|---|---|---|
| **Context Management API** | This API allow to access to real-time context information from the different cities. | Reference Architecture for IoT Enabled Smart Cities (D2.1) | ETSI NGSI-LD prelim API, OMA NGSI, ITU-T SG20*/FG-DPM* |
| **Shared data models** | Guidelines and catalogue of common data models in different verticals to enable interoperability for applications and systems among different cities | Guidelines for the definition of OASC Shared Data Models (D2.2)<br><br>Catalogue of OASC Shared Data Models for Smart City domains (D2.3) | [SynchroniCity RZ + partner data models] |
| **Ecosystem Transaction Management ("Marketplace") API** | It exposes functionalities such as catalog management, ordering management, revenue management, SLA, license management etc. | Basic Data Marketplace Enablers (D2.4)<br><br>Guidelines for the integration of IoT devices in OASC compliant platforms (D2.6) | [TM Forum API] |
| **Security API** | API to register and authenticate user and applications in order to access to the SynchroniCity-enabled services. | Reference Architecture for IoT Enabled Smart Cities (D2.1) | OAUTH2 |
| **Data Storage API** | This API allows to access to historical data and open data of the reference zones. | Reference Architecture for IoT Enabled Smart Cities (D2.1) | ETSI NGSI-LD, DCAT-AP [CKAN] |

# 'Tech User Experience'

⇒ a holistic view of the SynchroniCity products as presented, in a more structured way

⇒ check that it actually does what it says it does, and as documented.. .



1. API documentation, Martino Maggio Ingegneria Informatica SPA, IT
2. Docker platform components, Thomas Gilbert, Alexandra Instituttet, DK
3. SynchroniCity/OASC (meta) data models, Jose Manuel Cantera Fonseca, FIWARE, D
4. SynchroniCity IoT Data Marketplace, Alex Gluhak, Digital Catapult, UK
5. SynchroniCity Baseline Services, Jose Gato Luis, Atos Research & Innovation, ES

# USPs

- A common technical ground in architecture framework model based on **minimal interoperability** and **city needs**
- **Choice**, flexibility, efficiency, value-for-money, independence, economic development
- Agile and scaled development/deployment; **open** sources, APIs and community with clear documentation and processes
- **Standards-based** innovation and procurement across domains
- Reduced risk, **increased** investments, **innovation path** from R&I to implementation (AI, 5G, edge, …)
- **Validation by SME/pilot** implementation vs. committee

# 4 Fair

## = What's in I(o)T for QoL?

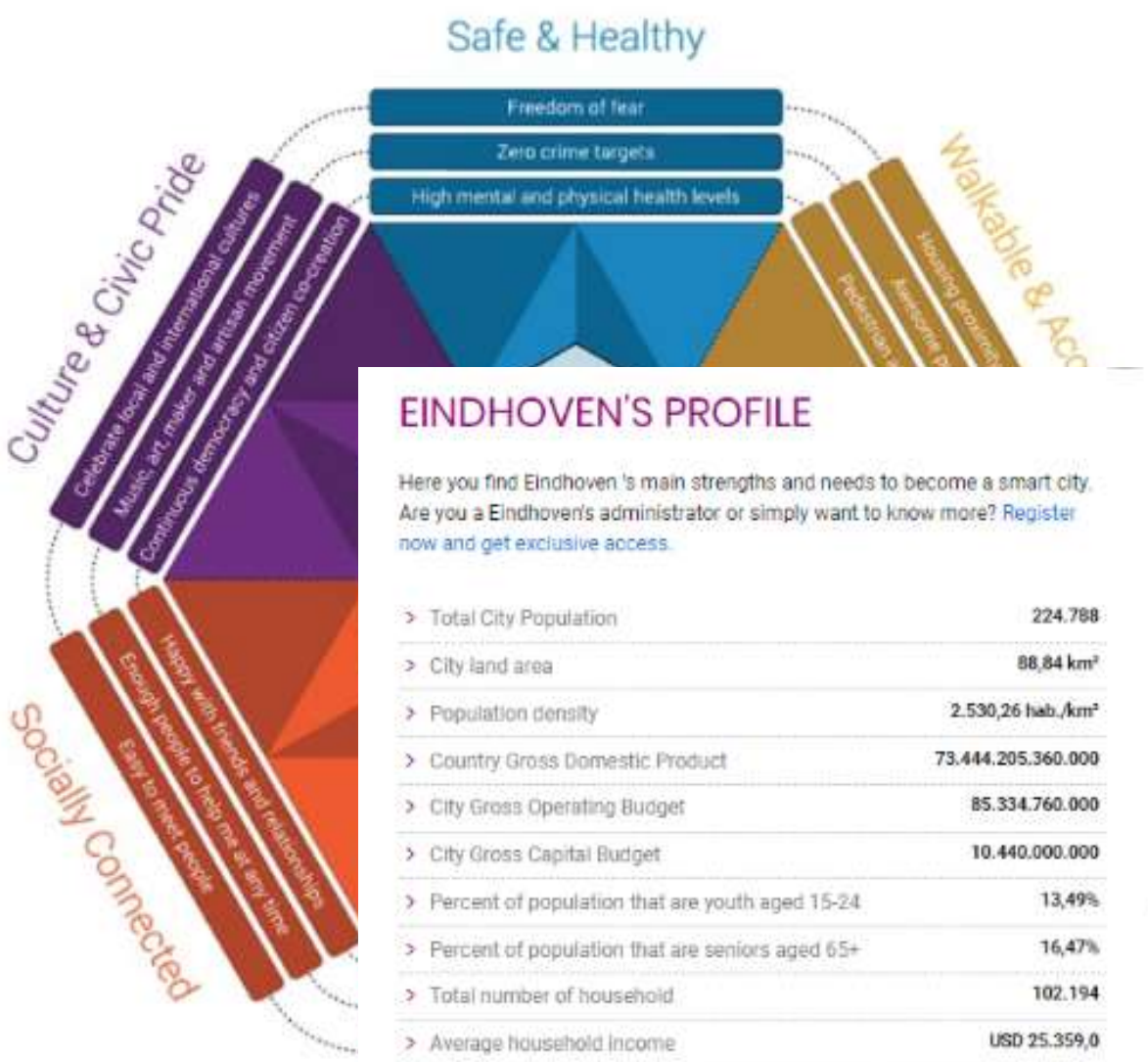
| Rank | City | Quality of Life Index | Purchasing Power Index | Safety Index | Health Care Index | Cost of Living Index | Property Price to Income Ratio | Traffic Commute Time Index | Pollution Index | Climate Index |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Zurich, Switzerland | 204.82 | 139.57 | 82.76 | 74.44 | 125.65 | 9.05 | 33.51 | 16.43 | 81.48 |
| 2 | Eindhoven, Netherlands | 203.53 | 120.06 | 73.53 | 72.56 | 74.19 | 4.70 | 23.71 | 22.16 | 85.38 |
| 3 | Copenhagen, Denmark | 191.54 | 103.93 | 76.33 | 76.16 | 87.18 | 9.49 | 29.41 | 20.50 | 83.74 |
| 4 | Reykjavik, Iceland | 191.04 | 95.48 | 78.42 | 67.82 | 98.93 | 6.28 | 20.48 | 15.03 | 68.81 |
| 5 | Vienna, Austria | 190.12 | 93.42 | 76.43 | 79.50 | 69.46 | 12.83 | 25.86 | 17.71 | 81.77 |
| 6 | Luxembourg, Luxembourg | 189.62 | 107.58 | 74.21 | 78.30 | 89.21 | 11.05 | 34.48 | 18.24 | 82.62 |
| 7 | Edinburgh, United Kingdom | 189.61 | 104.48 | 69.06 | 80.44 | 70.31 | 8.65 | 27.44 | 26.24 | 84.01 |
| 8 | Helsinki, Finland | 188.96 | 107.28 | 77.88 | 75.23 | 74.51 | 11.39 | 33.37 | 12.58 | 62.79 |
| 9 | Liverpool, United Kingdom | 186.10 | 113.64 | 56.27 | 85.06 | 63.08 | 10.28 | 35.06 | 26.54 | 90.87 |
| 10 | Gothenburg, Sweden | 185.91 | 107.43 | 59.96 | 69.95 | 67.67 | 10.63 | 23.06 | 17.89 | 77.49 |

71

# Quality of Life?

EINDHOVEN

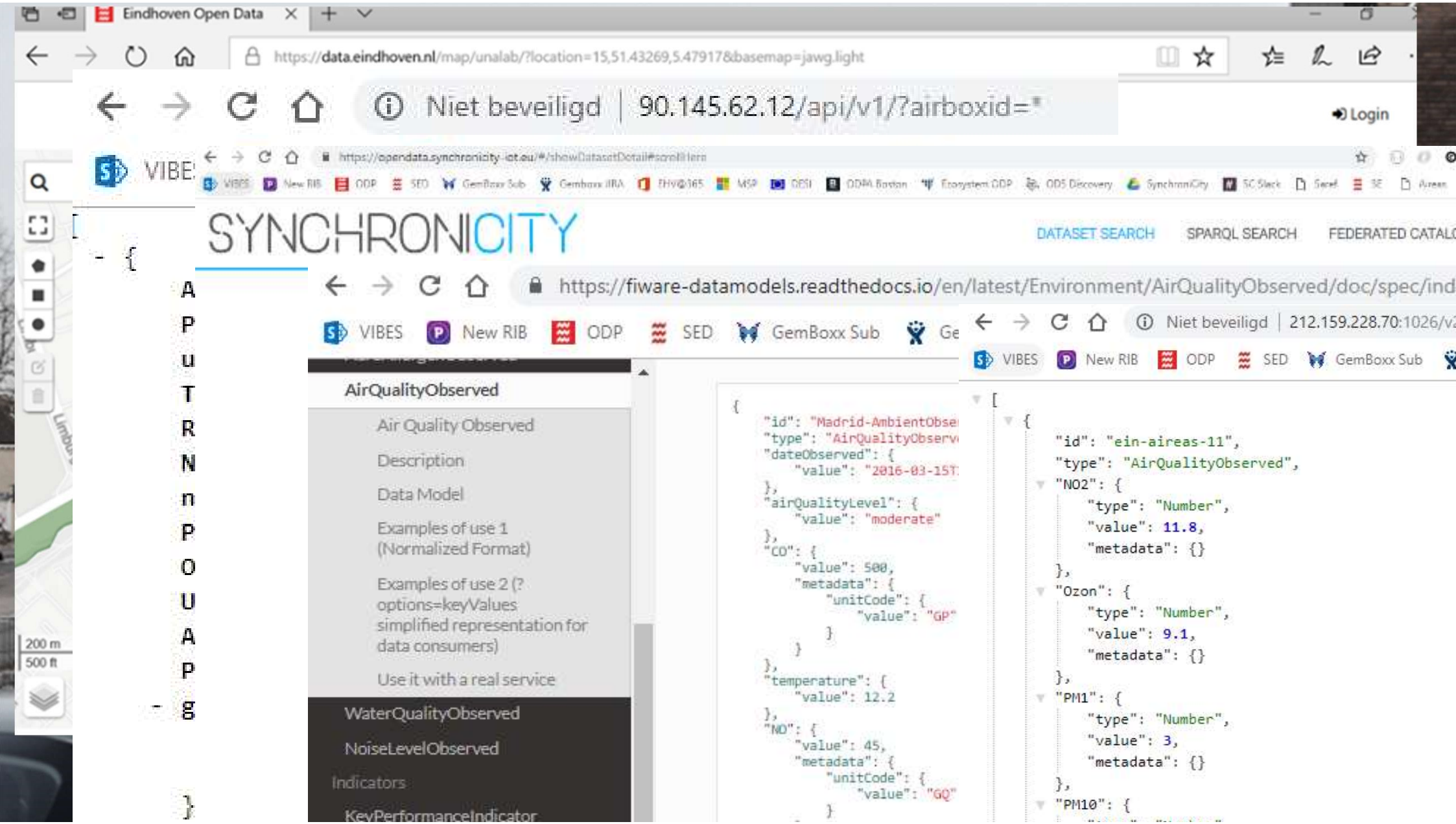
Ide em together:

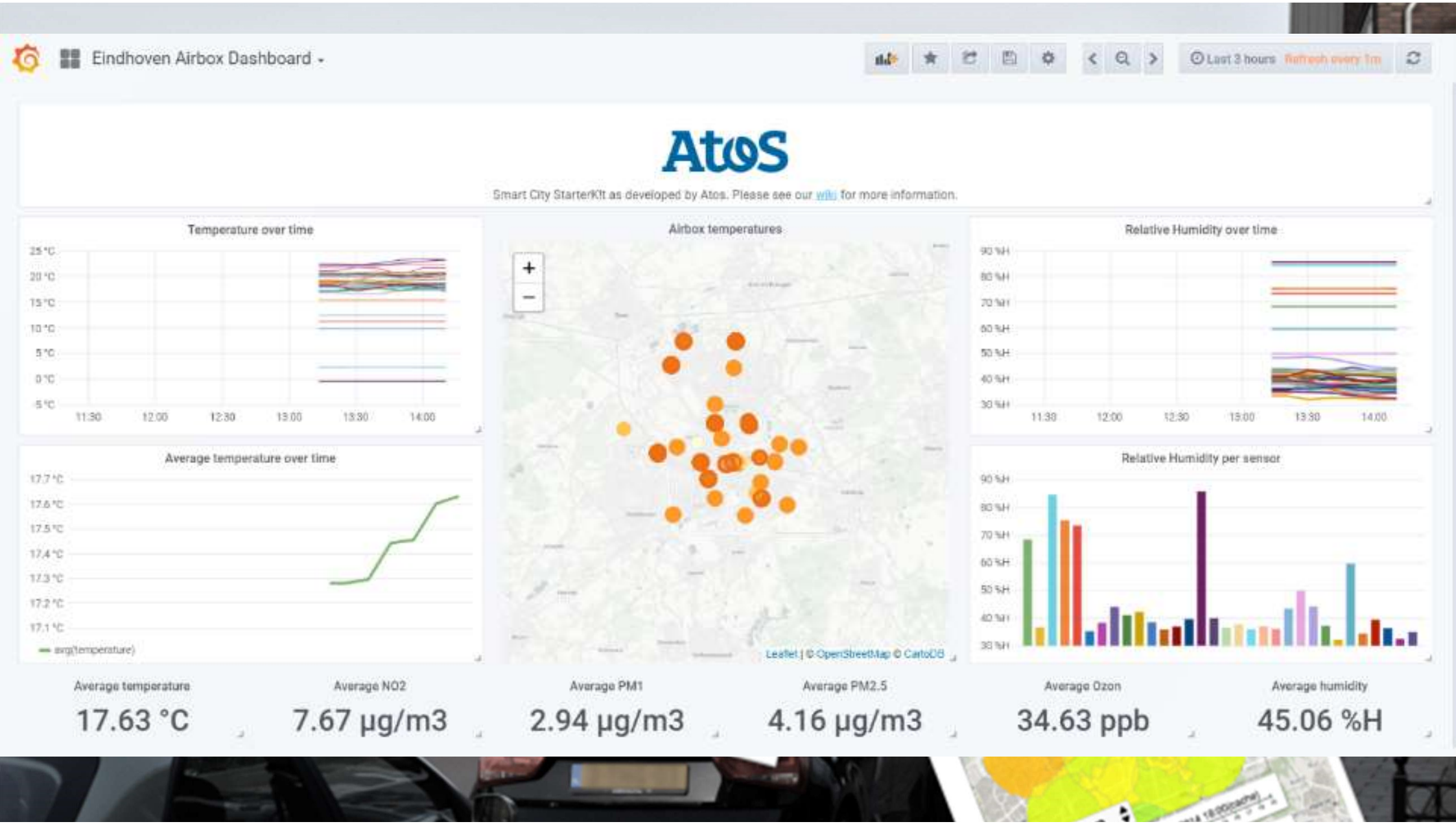



## EINDHOVEN'S PROFILE

Here you find Eindhoven 's main strengths and needs to become a smart city. Are you a Eindhoven's administrator or simply want to know more? Register now and get exclusive access.

| | |
|---|---|
| Total City Population | 224.788 |
| City land area | 88,84 km² |
| Population density | 2.530,26 hab./km² |
| Country Gross Domestic Product | 73.444.205.360.000 |
| City Gross Operating Budget | 85.334.760.000 |
| City Gross Capital Budget | 10.440.000.000 |
| Percent of population that are youth aged 15-24 | 13,49% |
| Percent of population that are seniors aged 65+ | 16,47% |
| Total number of household | 102.194 |
| Average household income | USD 25.359,0 |
| City product per capita | USD 39.753,98 |
| Annual inflation rate (average last 5 years) | 1,78% |


Eindhoven Open Data
https://data.eindhoven.nl/map/unalab/?location=15,51.43269,5.47917&basemap=jawg.light
Niet beveiligd | 90.145.62.12/api/v1/?airboxid=*
Login
SYNCHRONICITY
DATASET SEARCH
SPARQL SEARCH
https://fiware-datamodels.readthedocs.io/en/latest/Environment/AirQualityObserved/doc/spec/ind
VIBES
New RIB
ODP
SED
GemBoxx Sub
AirQualityObserved
Air Quality Observed
Description
Data Model
Examples of use 1 (Normalized Format)
Examples of use 2 (?options=keyValues simplified representation for data consumers)
Use it with a real service
WaterQualityObserved
NoiseLevelObserved
Indicators
KeyPerformanceIndicator
Niet beveiligd | 212.159.228.70:1026/v2
"id": "ein-aireas-11",
"type": "AirQualityObserved",
"NO2": {
"type": "Number",
"value": 11.8,
"metadata": {}
"Ozon": {
"type": "Number",
"value": 9.1,
"metadata": {}
"PM1": {
"type": "Number",
"value": 3,
"metadata": {}
"PM10": {
"airQualityLevel": {
"value": "moderate"
"CO": {
"value": 500,
"temperature": {
"value": 12.2
"NO": {
"value": 45,
200 m
500 ft

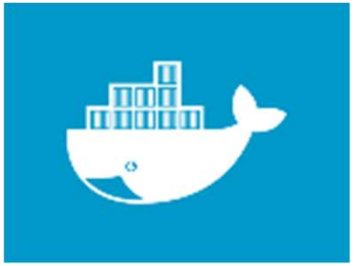

Eindhoven Airbox Dashboard
Last 3 hours
Atos
Smart City StarterKit as developed by Atos. Please see our wiki for more information.
Temperature over time
Airbox temperatures
Relative Humidity over time
Average temperature over time
Relative Humidity per sensor
Leaflet | © OpenStreetMap © CartoDB
Average temperature
17.63 °C
Average NO2
7.67 µg/m3
Average PM1
2.94 µg/m3
Average PM2.5
4.16 µg/m3
Average Ozon
34.63 ppb
Average humidity
45.06 %H

**The Atomic Service** is a good opportunity to test the SynchroniCity framework and OASC principles. It could be easily replicated, accelerating new developments, in many cities which provides and implement these principles.

# Atomic Services Basics

**City Agnostic**

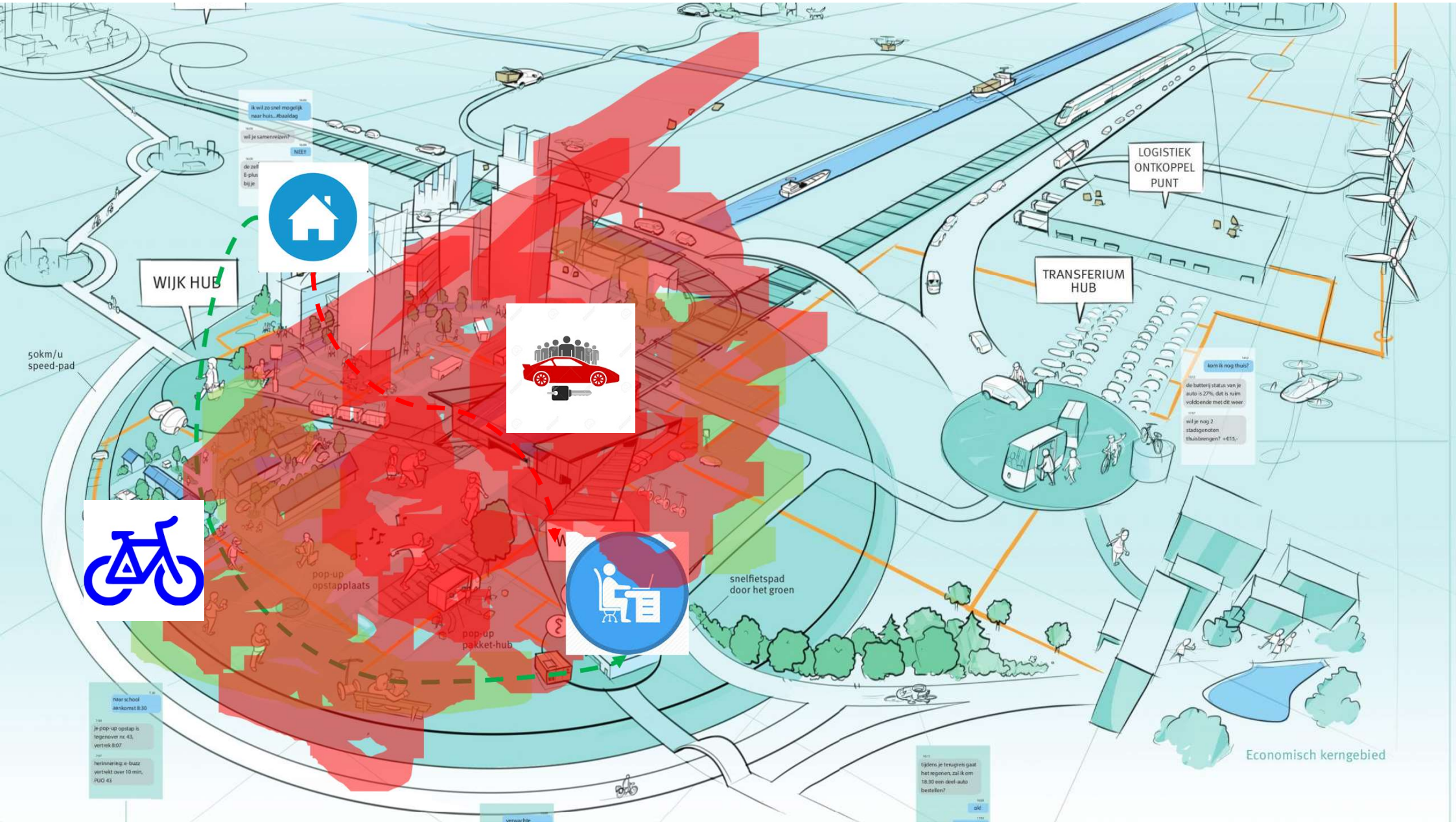
**Replicable**



**Easy Deployment**

Some described and incubated Atomic Services:

- Traffic Flow Estimator, Smart City Dashboard and Time series visualizations and Route Calculation
- OpenTripPlanner (based on Siri2gtfsrt and Ngsi2gtfsrt), Pelias (Geocoding and Reverse Geocoding Service), Mobility and Route Visualization plus Date/time filter function


WIJK HUB
50km/u
speed-pad
pop-up
opstapplaats
pop-up
pakket-hub
snelfietspad
door het groen
LOGISTIEK
ONTKOPPEL
PUNT
TRANSFERIUM
HUB
Economisch kerngebied

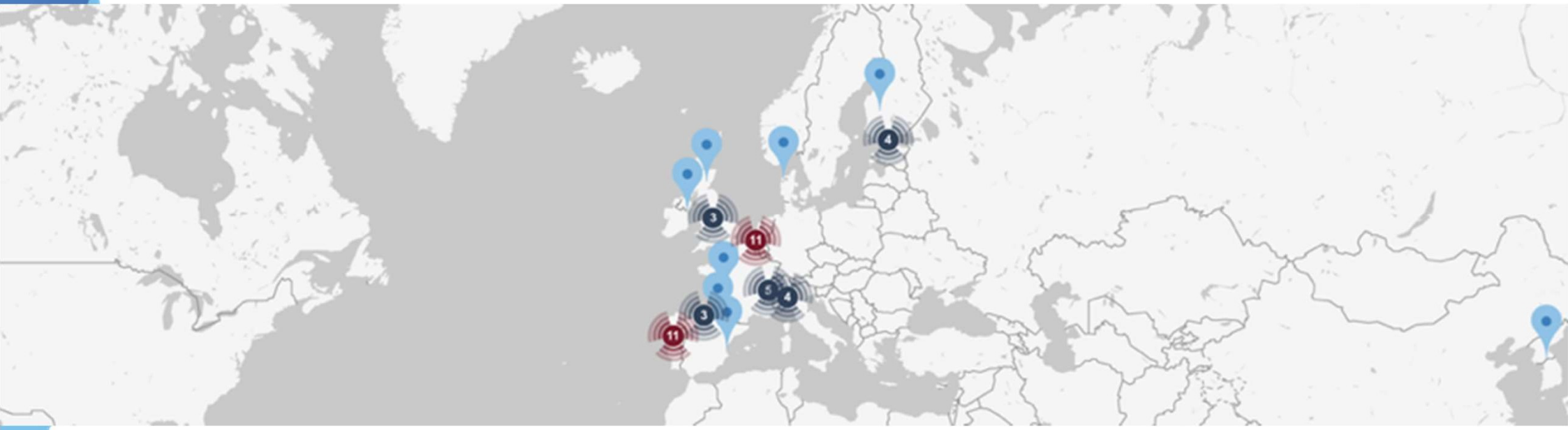

3 GOOD HEALTH AND WELL-BEING
5 YRS
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
7 AFFORDABLE AND CLEAN ENERGY
X2
11 SUSTAINABLE CITIES AND COMMUNITIES

# 5 Open & Fair

**= Everyone can join to scale out!**

# Scaling up 51 IoT Solutions for 130 Smart Cities & Communities

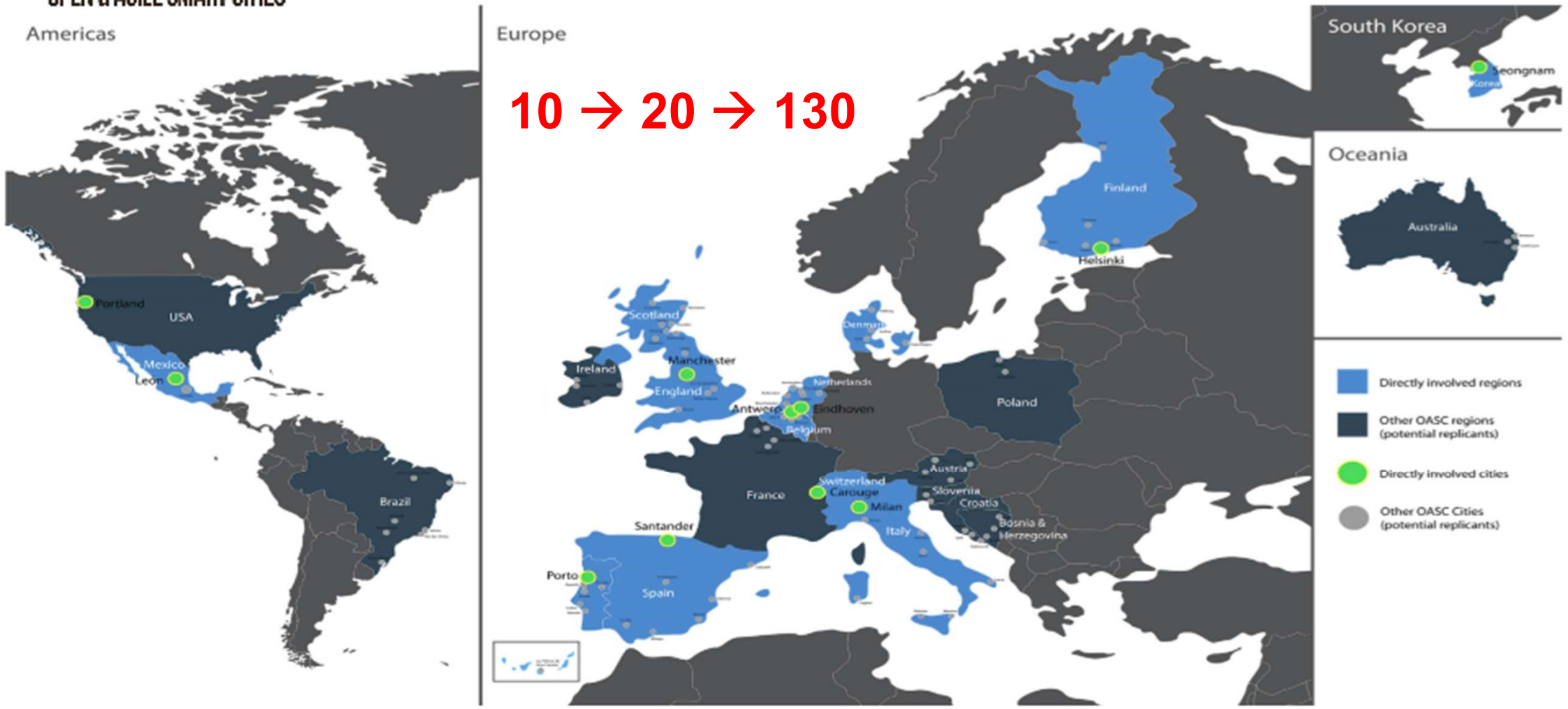
# 20 cities piloting innovative services

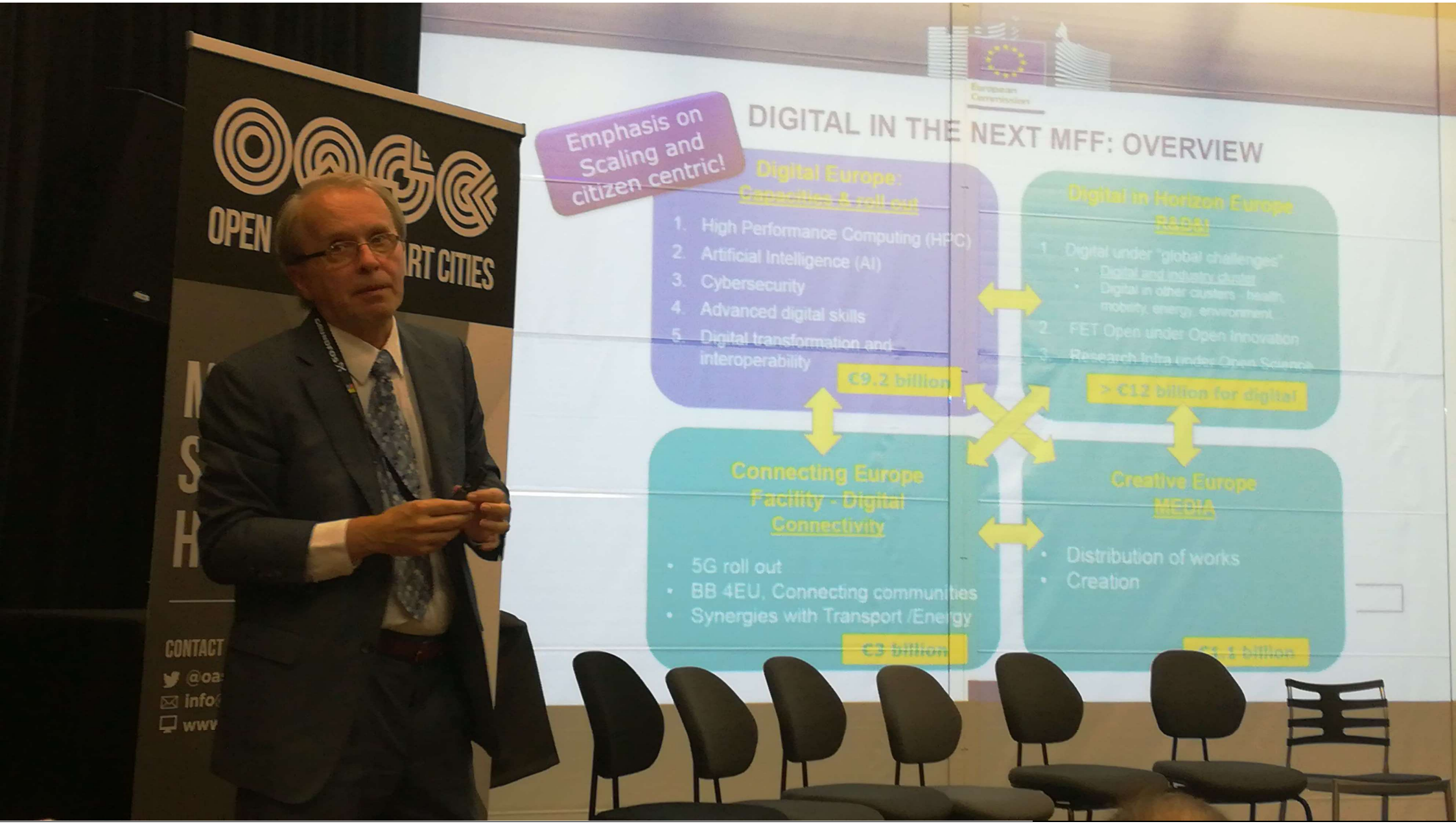


SYNCHRONICITY

OPEN & AGILE SMART CITIES

# A Global Market for IoT-enabled Urban Services




OPEN
RT CITIES
CONTACT
Emphasis on Scaling and citizen centric!
DIGITAL IN THE NEXT MFF: OVERVIEW
Digital Europe:
Capacities & roll-out
1. High Performance Computing (HPC)
2. Artificial Intelligence (AI)
3. Cybersecurity
4. Advanced digital skills
5. Digital transformation and interoperability
€9.2 billion
Digital in Horizon Europe
R&D&I
1. Digital under "global challenges"
• Digital and industry cluster
• Digital in other clusters - health, mobility, energy, environment
2. FET Open under Open Innovation
3. Research Infra under Open Science
> €12 billion for digital
Connecting Europe Facility - Digital Connectivity
• 5G roll out
• BB 4EU, Connecting communities
• Synergies with Transport /Energy
€3 billion
Creative Europe
MEDIA
• Distribution of works
• Creation
€1.1 billion


Share knowledge, co-create, collaborate and with open APIs, micro services and applications. And an real self-managed data and market place will arise and stay!

Not become just yet another smart dick. Do not re-invent the wheel, adhere to our motto:
**Digital Innovation =**
**City Knowledge Sharing!**


Thanks for
your attention
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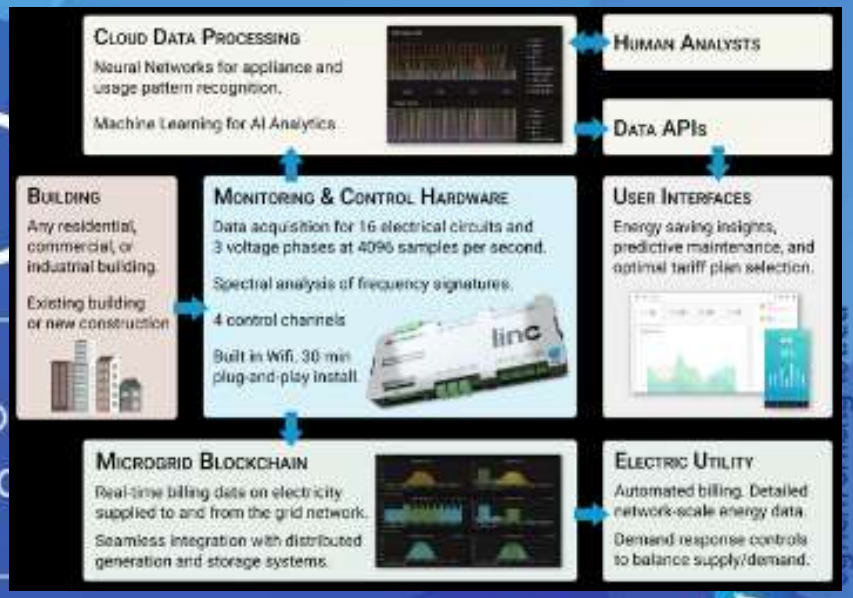
+31 (6) 3715 6986 Mobile 2
Rick Schager UK.vcf
EINDHOVEN

X

# BACK-UP SLIDES

## Can one do it agile?


16 Pilots

18 Cities


3 Million

6 Challenges

# NoiseAbility: what's it about?

NoiseAbility
Making sense of sound in the city

- NoiseAbility: AI driven, predictive city noise management tool
- Augments real noise data with the application of citizen 'noise personas' to determine the acceptability of noise in the city.
- The Noise data service will demonstrate how real noise can be modelled and augmented and will be able to be applied to other parts of the city where noise monitoring is limited.

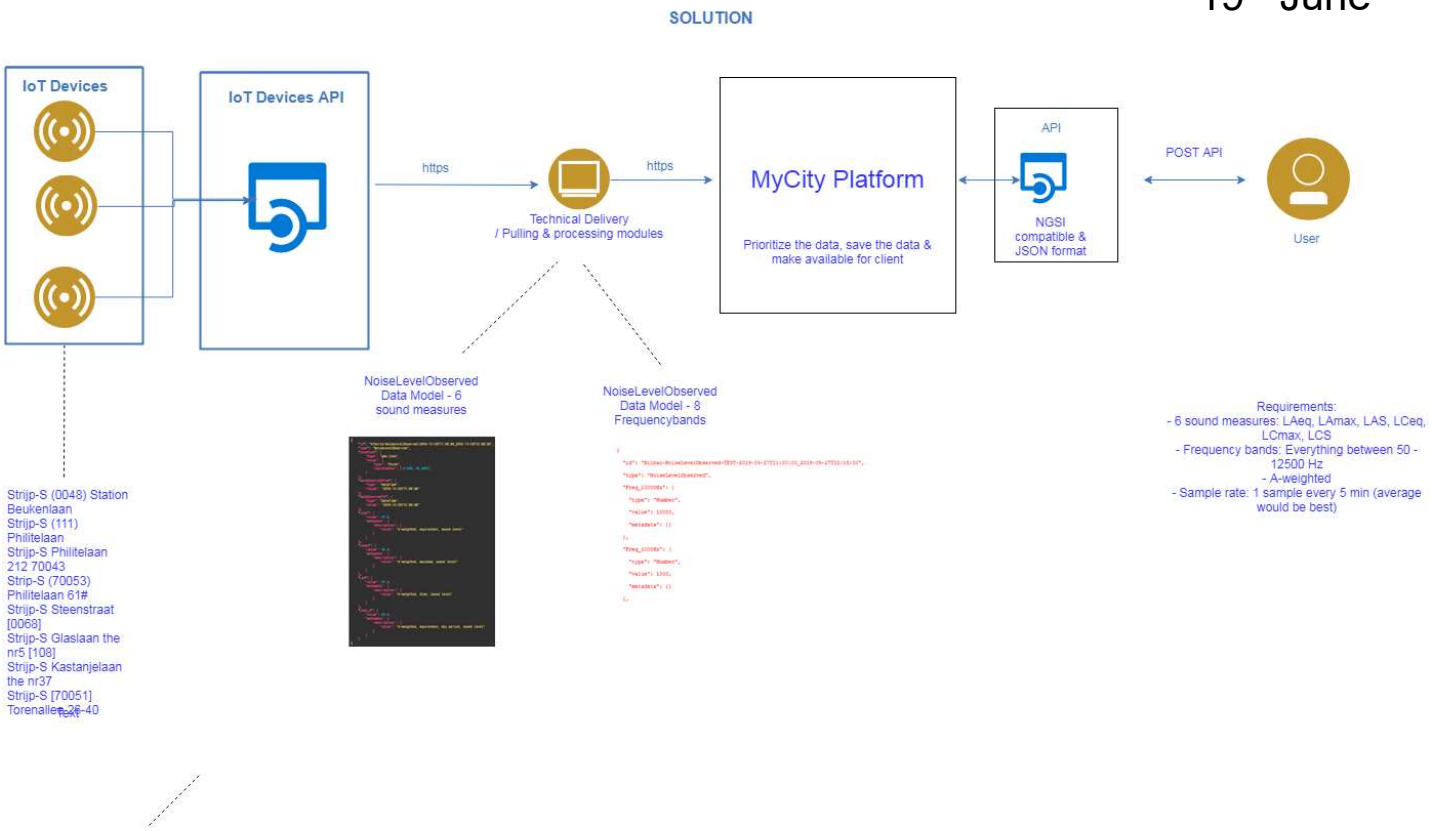
***'To demonstrate that cities can holistically incorporate noise measurement into cities' management of urban spaces for improving liveability, using IoT at the heart of citizen-centric engagement with noise; and with intelligent data at the core of city-based multilayered responses.'***

# Agile SoW for IoT week

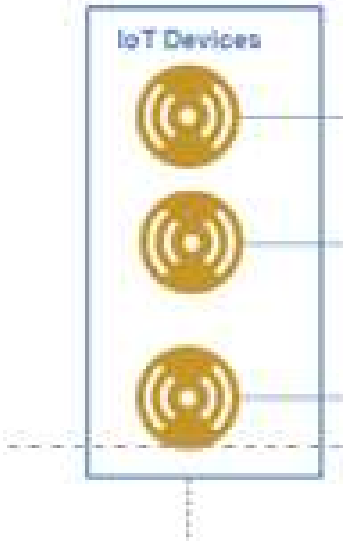
3rd June

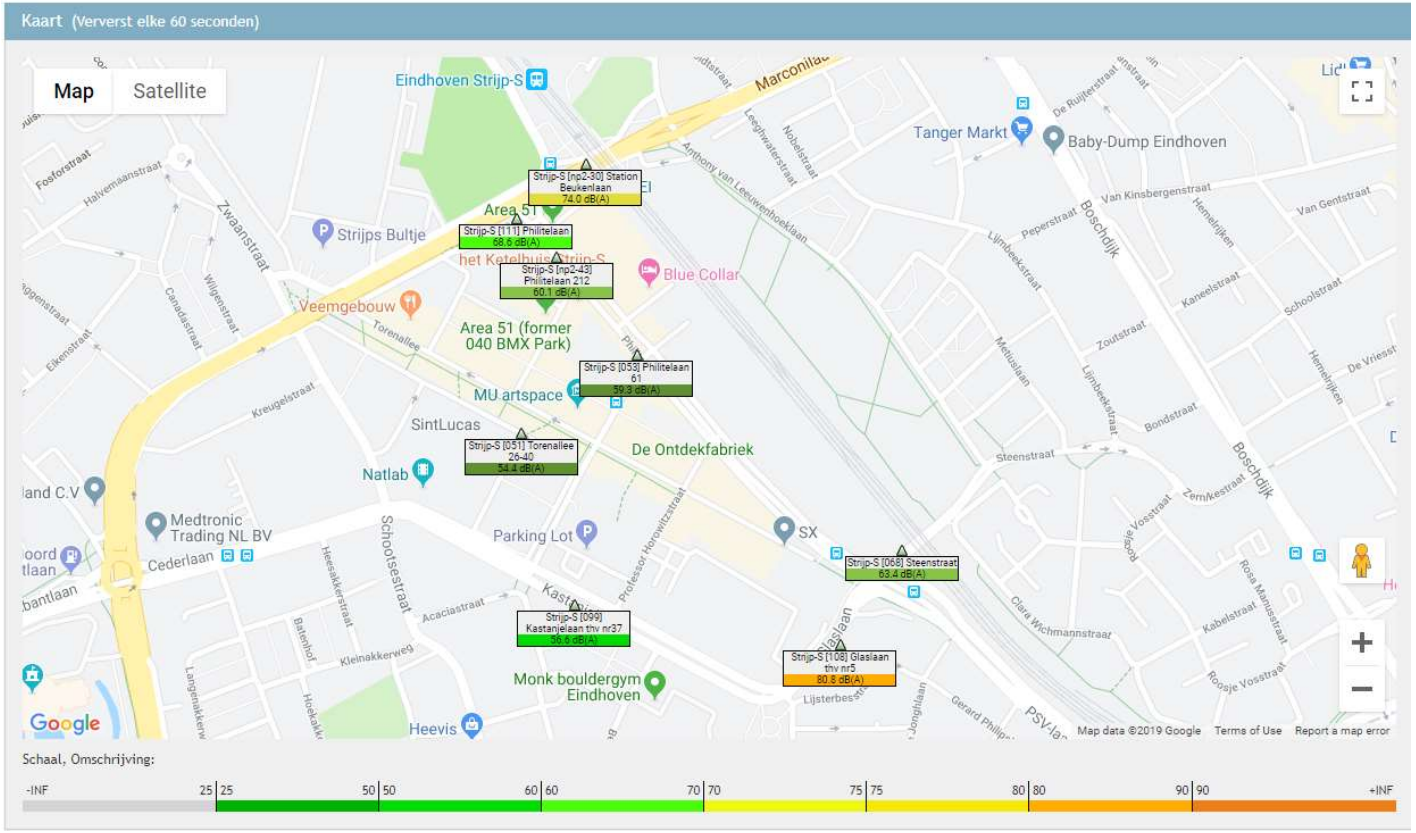
“some problems regarding the technical progress of the pilot”

19th June



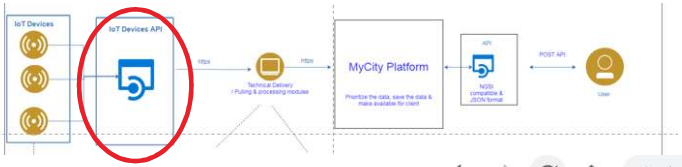

# EIN Munisense IoT devices



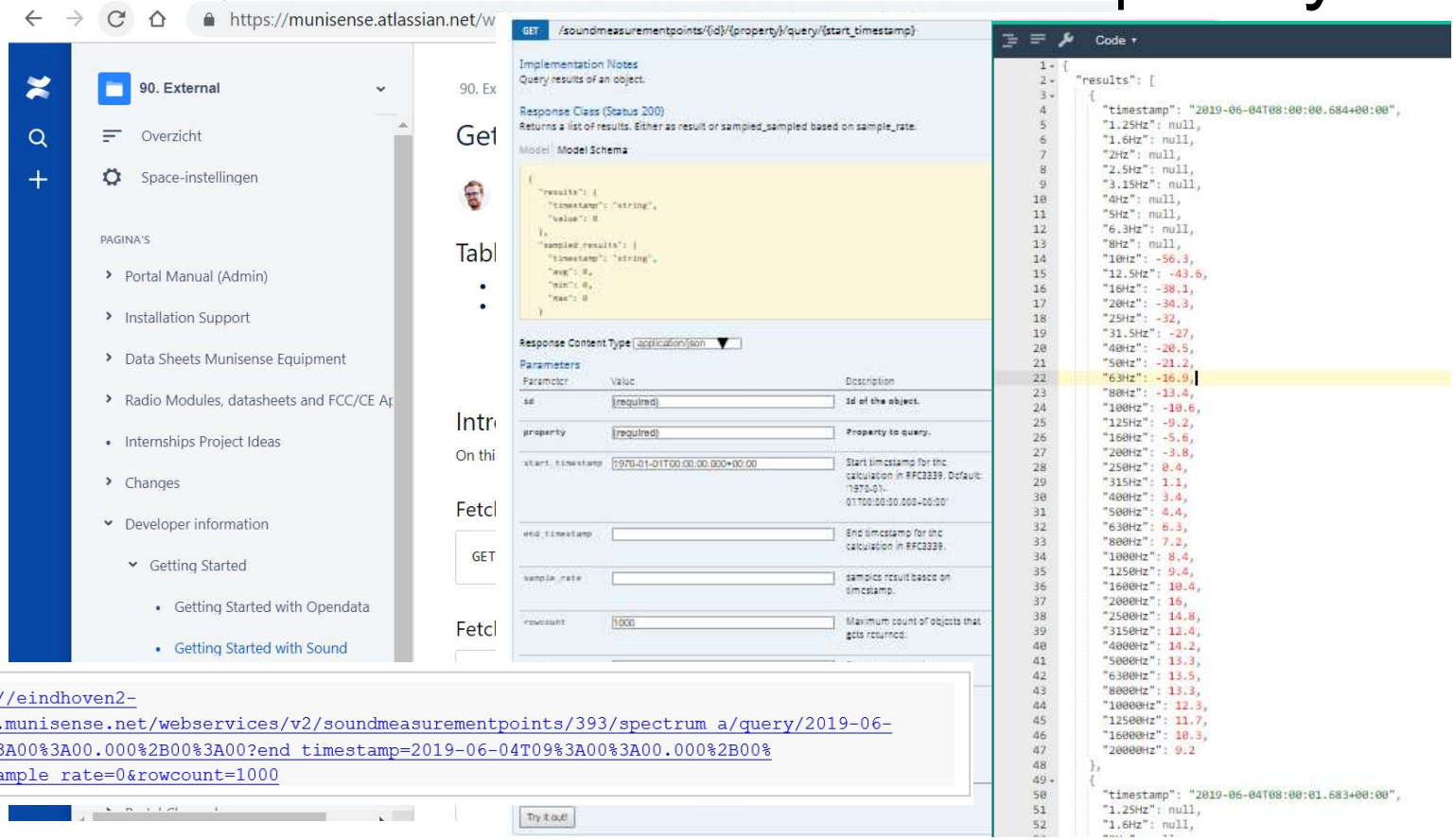




Source: [EIN Munisense dashboard]

# EIN Munisense API, swagger & example tertiary frequency bands








https://eindhoven2-geluid.munisense.net/webservices/v2/soundmeasurementpoints/393/spectrum_a/query/2019-06-04T08%3A00%3A00.000%2B00%3A00?end_timestamp=2019-06-04T09%3A00%3A00.000%2B00%3A00&sample_rate=0&rowcount=1000

# Noise level observed + (meta) data models

https://github.com/Fiware/dataModels/blob/master/specs/Envi

- Optional

### Representing acoustic parameters

The number of acoustic parameters measured can vary. *For each* acoustic name *MUST* be exactly equal to the acoustic measurand name, as follows

- Attribute name: Equal to the name of the measurand, for instance `L` at http://www.acoustic-glossary.co.uk/definitions-l.htm, with the only contains a `,` char, such char shall be substituted by the `_` char. For represented by an Attribute which name shall be `LAeq_d`.
- Attribute type: Number
- Attribute value: corresponds to the value for the measurand as a nur
- Attribute Metadata:
  - `description`: short description of the measurand. (optional)
  - Normative References: https://schema.org/description

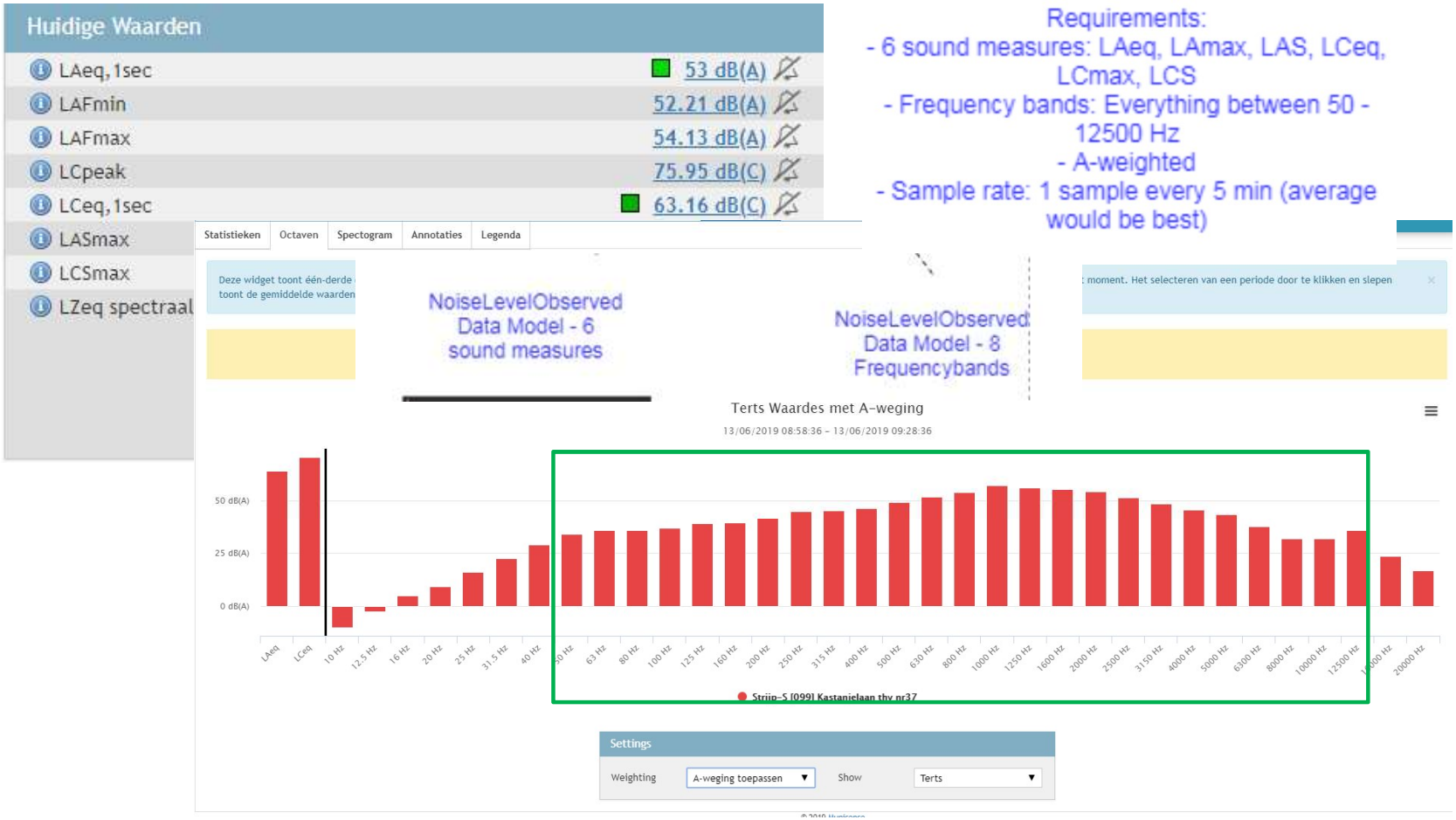

```
{
  "id": "Bilbao-NoiseLevelObserved-TEST-2019-05-27T11:00:00_2019-05-27T11:15:00",
  "type": "NoiseLevelObserved",
  "Freq_10000Hz": {
    "type": "Number",
    "value": 10000,
    "metadata": {}
  },
  "Freq_1000Hz": {
    "type": "Number",
    "value": 1000,
    "metadata": {}
  },
  "Freq_100Hz": {
    "type": "Number",
    "value": 100,
    "metadata": {}
  },
  "Freq_12500Hz": {
    "type": "Number",
    "value": 12500,
    "metadata": {}
  },
  "Freq_1250Hz": {
```


Source: Bilbao-NoiseLevelObsered-TEST-based data model:

NoiseLevelObserved Data Model - 6 sound measures

NoiseLevelObserved Data Model - 8 Frequencybands

# Noise levels available +




# MyCity (EIN) Platform

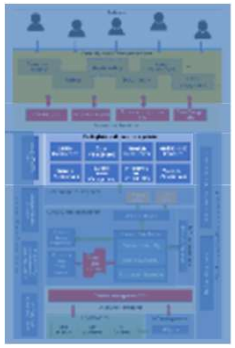
- Something magic to get (= pull) the agreed data set(s) from Munisence devices with the Munisense API
- Translate Munisense data sample to Bilbao Noise Level Observed enhanced data model
- Create an endpoint for consumers to get (pull) this standard data sets, similar to other data sets in the SynchroniCity market place.

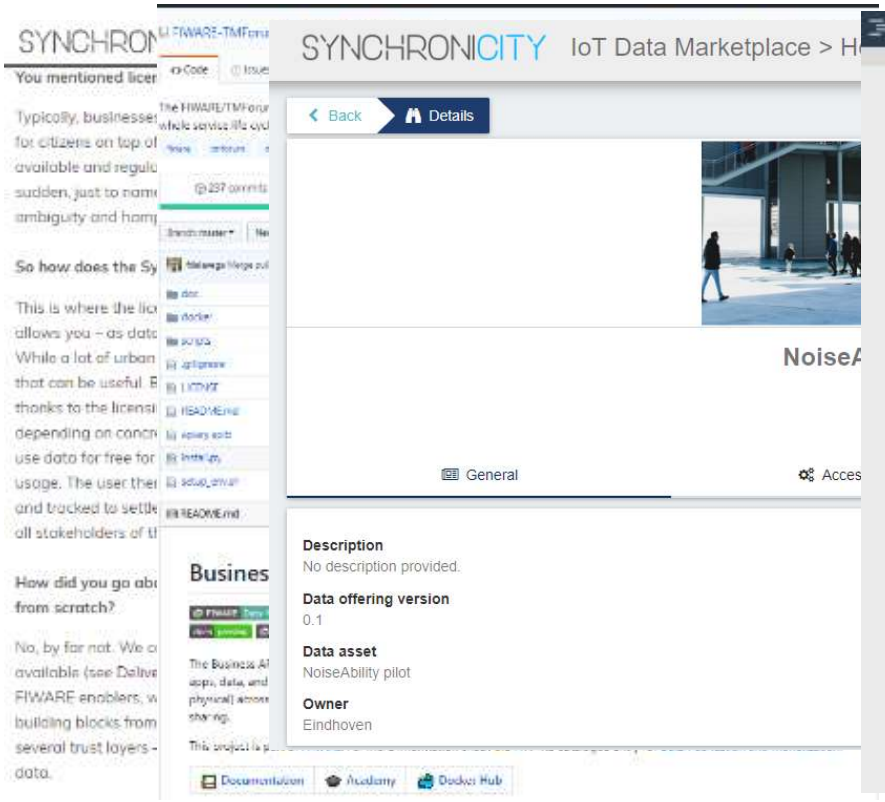
# MyCity (EIN) API ENLO


| ID | Description/location |
|---|---|
| 506 | Strijp-S [051] Torenallee 26-40 |
| 504 | Strijp-S [053] Philitelaan 61 |
| 396 | Strijp-S [068] Steenstraat |
| 344 | Strijp-S [099] Kastanjelaan thv nr37 |
| 343 | Strijp-S [108] Glaslaan thv nr5 |
| 345 | Strijp-S [111] Philitelaan |
| 393 | Strijp-S [np2-30] Station Beukenlaan |
| 499 | Strijp-S [np2-43] Philitelaan 212 |


```
"dateObservedFrom": {
  "metadata": {},
  "type": "Text",
  "value": "2019-06-14 16:25:43.582540"
},
"dateObservedTo": {
  "metadata": {},
  "type": "Text",
  "value": "2019-06-14T16:26:43.582540"
},
"id": "499-NoiseLevelObserved-2019-06-14T16:26:43.582540",
"laeq": {
  "metadata": {},
  "type": "Number",
  "value": 55.17
},
"lamax": {
  "metadata": {},
  "type": "Number",
  "value": 55.58
},
"lasmax": {
  "metadata": {},
  "type": "Number",
  "value": 55.08
},
"lceq": {
  "metadata": {},
  "type": "Number",
  "value": 66.04
},
"lcsmax": {
  "metadata": {},
  "type": "Number",
  "value": 65.76
},
"type": "NoiseLevelObserved"
},
{
"Freq_1.25Hz": {
  "metadata": {},
  "type": "Number",
  "value": null
},
"Freq_1.6Hz": {
  "metadata": {},
  "type": "Number",
  "value": null
},
"Freq_10000Hz": {
  "metadata": {},
  "type": "Number",
  "value": 32.5
},
"Freq_1000Hz": {
```

# 4. SynchroniCity IoT Data Marketplace






# NoiseAbility: what's it about?

NoiseAbility
Making sense of sound in the city

- NoiseAbility: AI driven, predictive city noise management tool
- Augments real noise data with the application of citizen 'noise personas' to determine the acceptability of noise in the city.
- The Noise data service will demonstrate how real noise can be modelled and augmented and will be able to be applied to other parts of the city where noise monitoring is limited.

***'To demonstrate that cities can holistically incorporate noise measurement into cities' management of urban spaces for improving liveability, using IoT at the heart of citizen-centric engagement with noise; and with intelligent data at the core of city-based multilayered responses.'***