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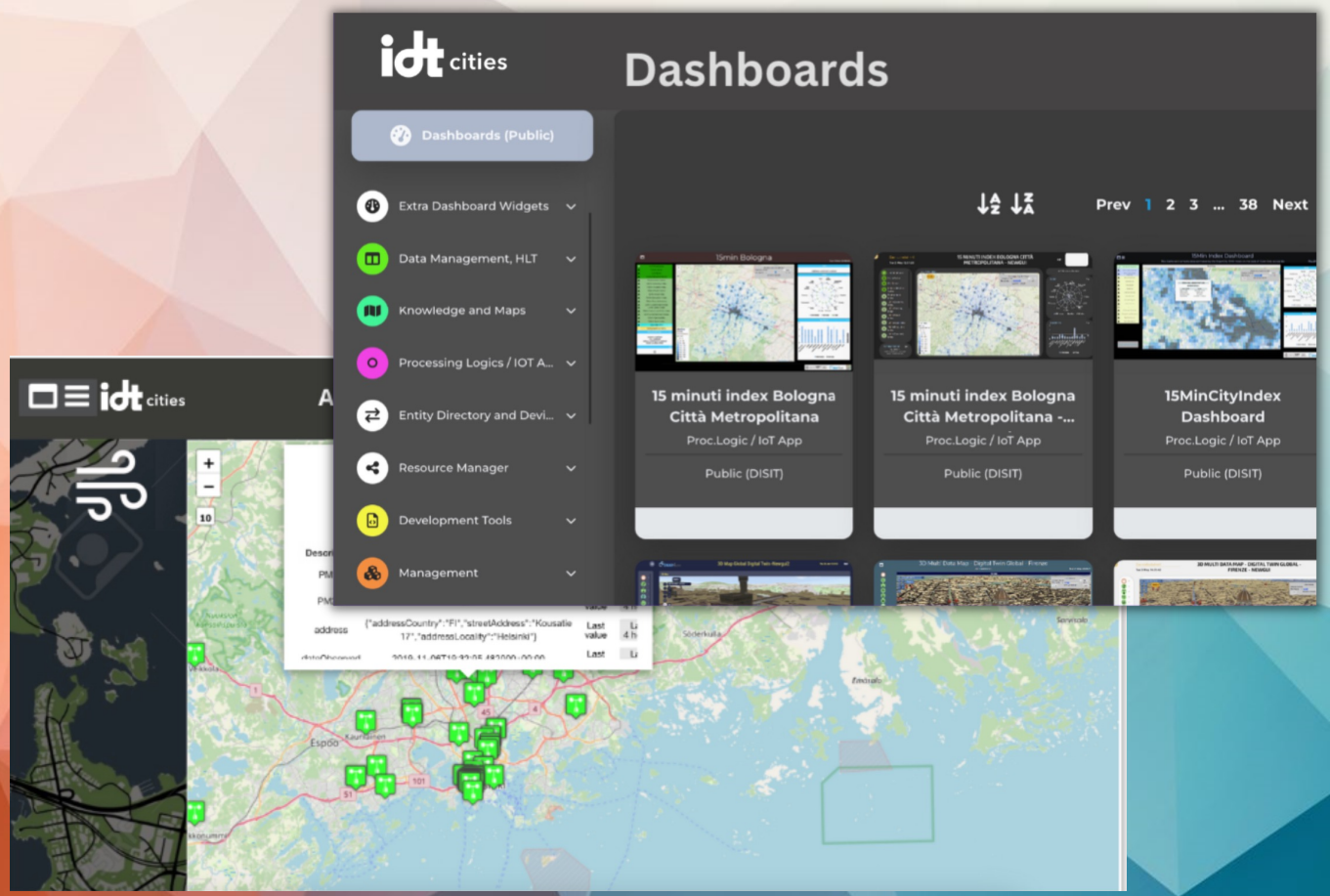
•Smart Cities Solutions • Digital Twins, Smart Cities • Control Rooms • CO2 Emissions, Internet of Things (IoT) • Information Sharing • Data Collection, Ingestion • Storage • Integration • Data Visualization • Virtualization • Transformation • Data Security • Analytics • Forecasting • Predictions



OVERVIEW

- System architecture
- Why use smart cities?
- IDTcities platform
- What does IDTcities offer?
- Who benefits from IDTcities?

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SYSTEM ARCHITECTURE

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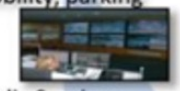
Smart City Functional Architecture

Transport systems
Mobility, parking



Public Services,
Govern, events, ...

Sensors, IOT Cameras,
Wi-Fi

Environment, Water,
energy

Shops, services,
operators

Social Media

Social Media Crawler and Manager

Data Sources, External Services
PULL Data

Data Sources, Brokers, External Services
Data Driven, Real Time

Data Ingestion, aggregation, regularization, reconcile:
IOT Directory, NIFI, special tools

Back-End

Front-End

Knowledge base
Semantic Reasoners

Indexing and aggregating
NiFi, OpenSearch

Federation

Search and Query, Smart City API, Web Socket Server, GIS, Facet, semantic

Data Analytics, Simulations, Special Tools
R Studio, Tensor Flow, Python, ...

IOT Applications, Business Logic
Node-RED + Snap4City MicroServices

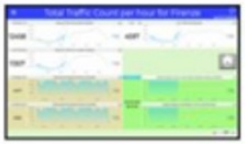
Rendering Acting, Widgets, Synoptics, MicroApps
User interface, Drill down, maps, heatmaps

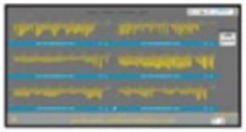
Inform, announce, Act!, warning, alarms, What-IF, ..

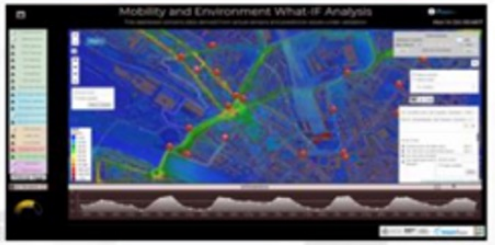
Authentication, Authorization, Platform & Processes Management, Data Inspector, Digital Twin, ...

Back office tool

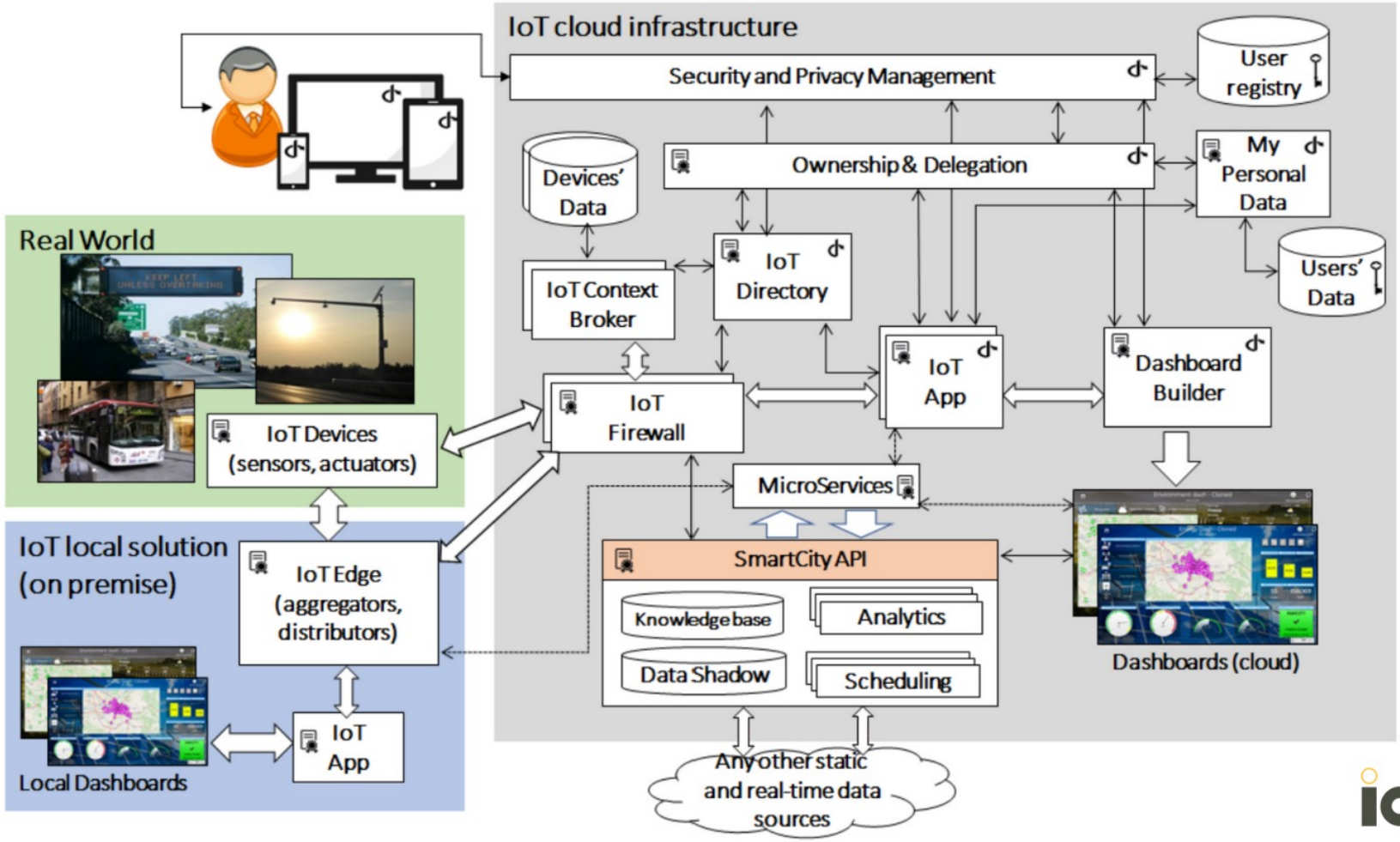
Dashboards, visual tools,
Web and Mobile Apps







CLOUD INFRASTRUCTURE

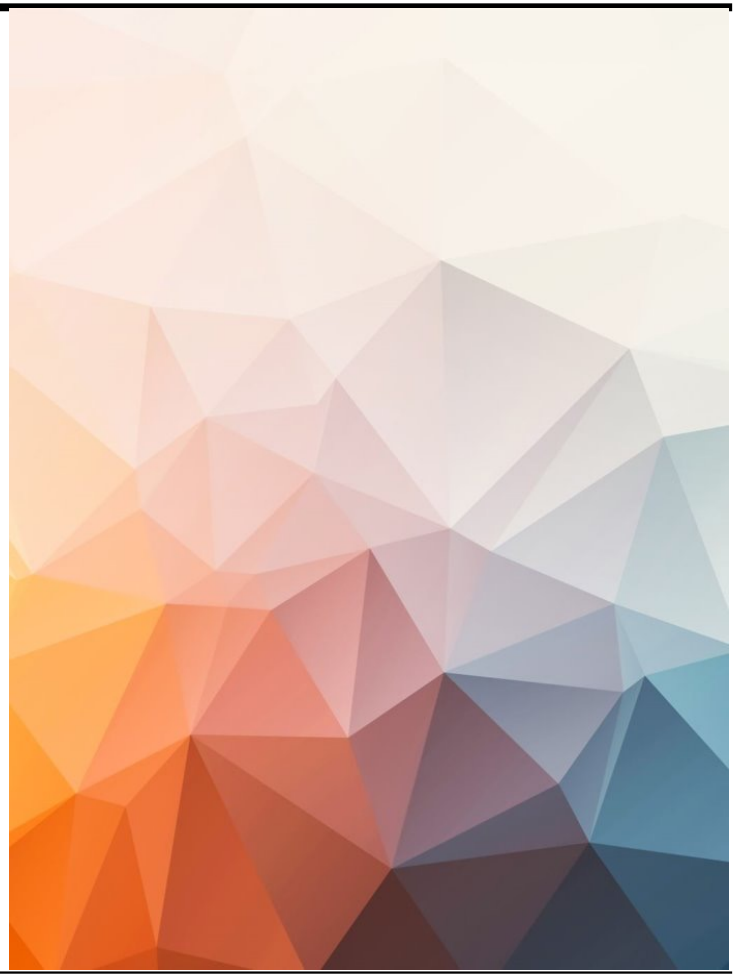


WHY SMART CITIES?

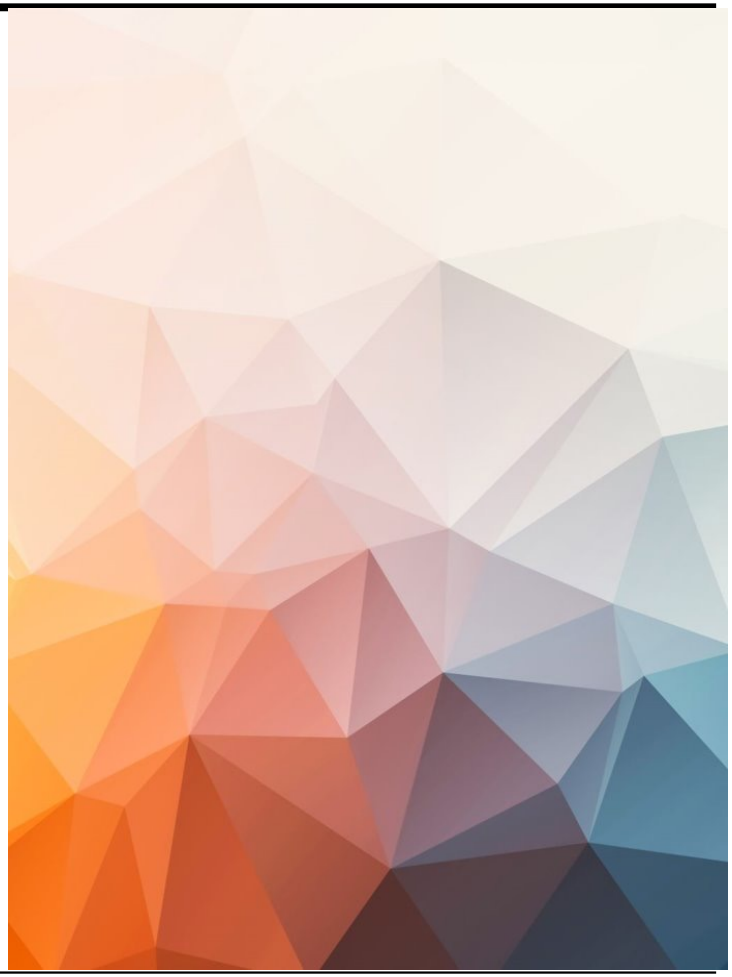
A smart city is a digital urban area that leverages technology and data-driven solutions to enhance the efficiency of city operations, improve residents' quality of life, and promote sustainable development.

Objectives:

- Enhanced urban living
- Infrastructure efficiency
- Sustainability
- Innovation and economic growth
- Data-driven decision-making
- Smart mobility
- Public safety and security
- Community engagement



- **Improved quality of life:** Enhancing transportation efficiency, public safety, and sustainability by optimizing energy usage, waste management, and citizen involvement in decision-making. It also improves public service efficiency, supports cultural and recreational spaces, and enhances public services through data-driven management.
- **Sustainability:** Monitoring air quality and environmental parameters, it helps address pollution concerns and creates healthier living conditions.
- **Economic growth:** Fostering innovation and economic growth by attracting businesses and entrepreneurs to the city, creating job opportunities, and driving economic development.



OUR SMART CITY PLATFORM

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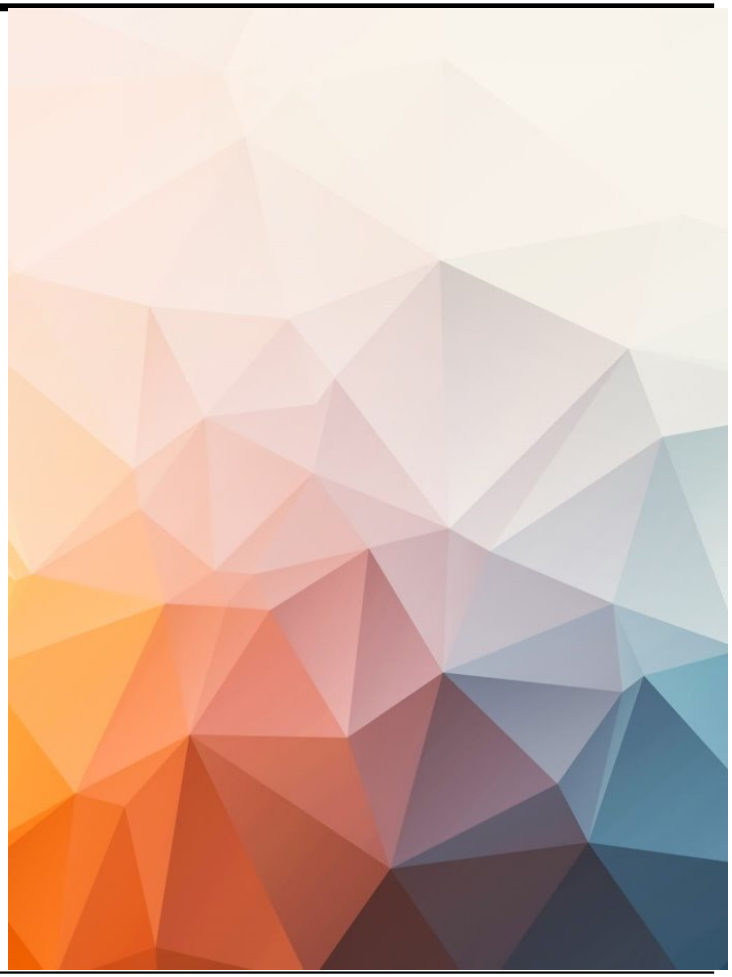
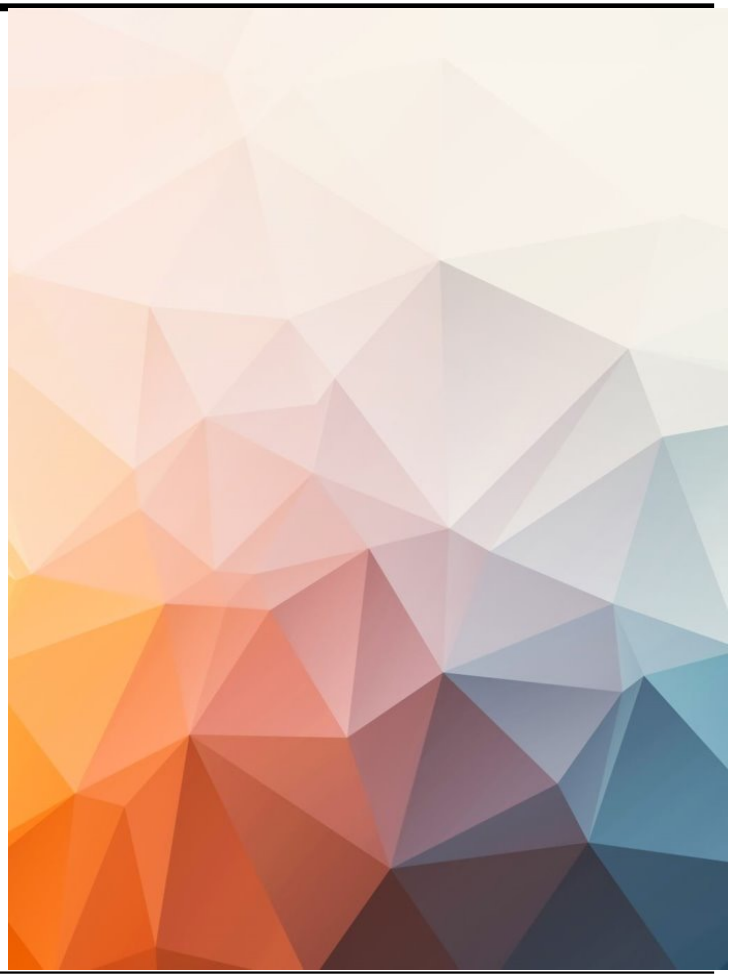
PERFORMANCE HIGHLIGHTS FROM DEMONSTRATION AND TEST RUNS

- **Overall Satisfaction:** 91% expressed satisfaction, with 53.40% being highly pleased.
- **IoT Solution and Data Analysis:** 85% rated it as very good, and among them, 42.17% ranked it as excellent.
- **Ease of Dashboard Production Tools:** 72.63% found them more than somewhat satisfying.
- **Functions for Creating IOT Apps (MicroServices):** 93% found them complete and satisfactory, with 31.25% considering them very comprehensive.
- **Solution Utility:** 100% acknowledged its usefulness for their work, with 78.13% declaring it would be very useful in their daily tasks."



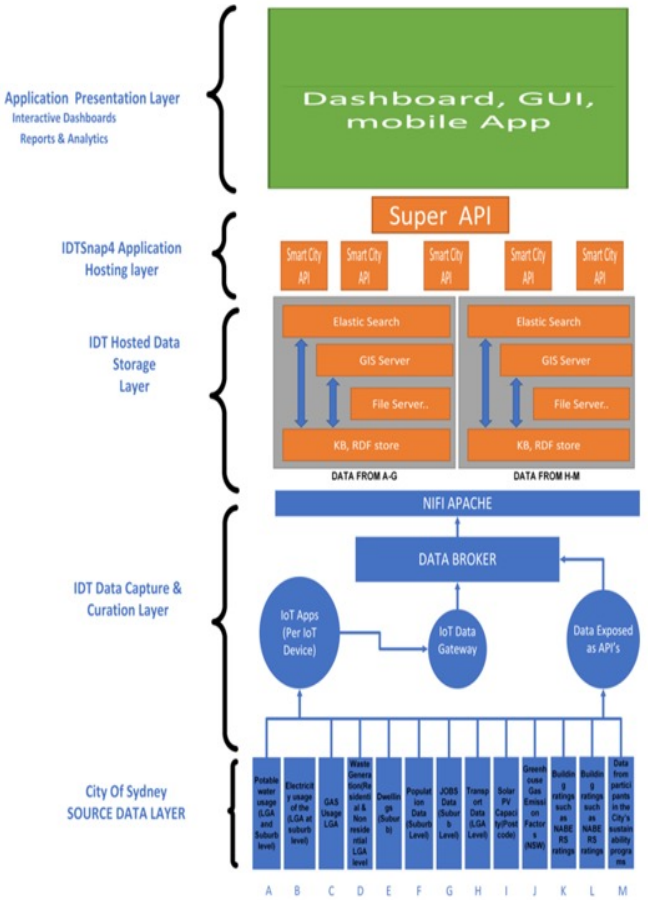
AS PAAS/SAAS

- IDTcities as a SaaS solution offers a subscription-based model, enabling users to pay for services without upfront infrastructure investment.
- It boasts user-friendly features, scalability, and provides automatic updates and maintenance.
- As a PaaS platform, it empowers users to develop and deploy smart city applications, integrate seamlessly with other systems, and customize functionalities.
- Functioning as a data management hub, IDTcities supports collaboration, innovation, and IoT devices, contributing to a more connected and intelligent urban environment.



COMPONENTS

- IOT Broker
- IOT App
- IOT Directory
- API Manager
- Federation Smart API
- Data Analytics
- Storage
- Dashboard Manager



IDTCITIES: FEATURES AND VALUE PROPOSITION

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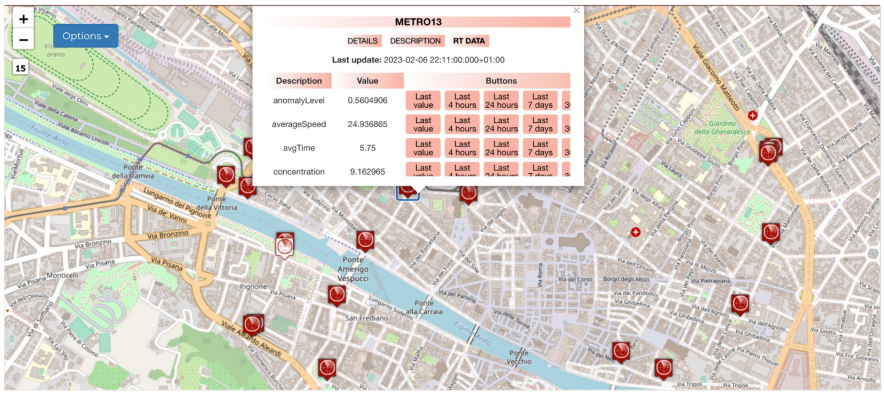
IDTCITIES OFFERINGS

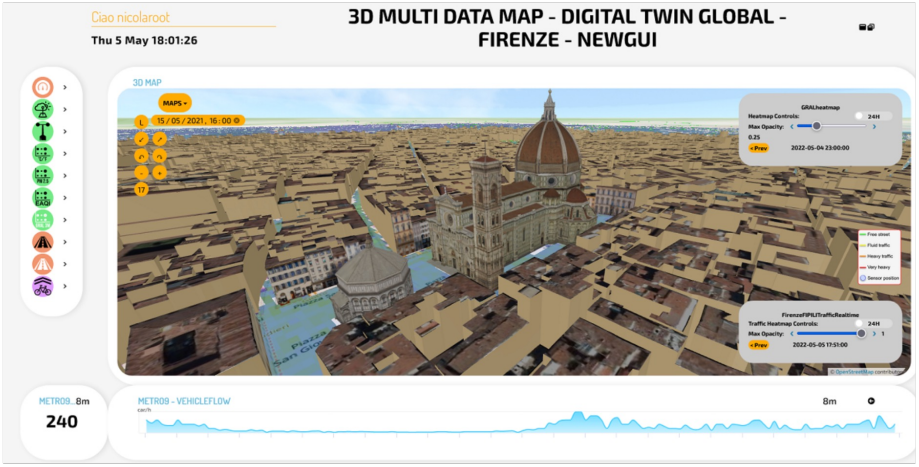
- Integrating and aggregating data from various sources.
- The system provides analytical tools and visualization dashboards for in-depth analysis of collected data.
- Comprehensive traffic management capabilities.
- Inclusive of a variety of smart city services: smart transportation, energy management, waste management, and public safety.
- Promotion of efficiency and sustainability.
- Integrated data management and real-time monitoring.

- Supports the integration of Internet of Things (IoT) devices
- Customizable to fit the specific needs of a city and scalable to accommodate growth.
- Includes a decision support system to assist city authorities in making informed decisions based on data analysis.
- Provides APIs for seamless integration with other systems and services
- Increased volume of data & transparency of information
- Ubiquitous access
- Carbon emission and air quality analysis
- Security and privacy measures for data collected

DIGITAL TWIN

- Connected with real systems
- Modelling aspects
  - Structural, visual, informative, real time data sensors (context), POI, functional, resources, etc.
- Integration
  - AI/XAI techniques, simulations, users' needs, etc.
- Experiment via simulations and analyse by case
  - Reduction of costs to experiments new solutions Share the possibilities with city users
- Virtual Representation: Easier to understand the context, review from multiple points of view

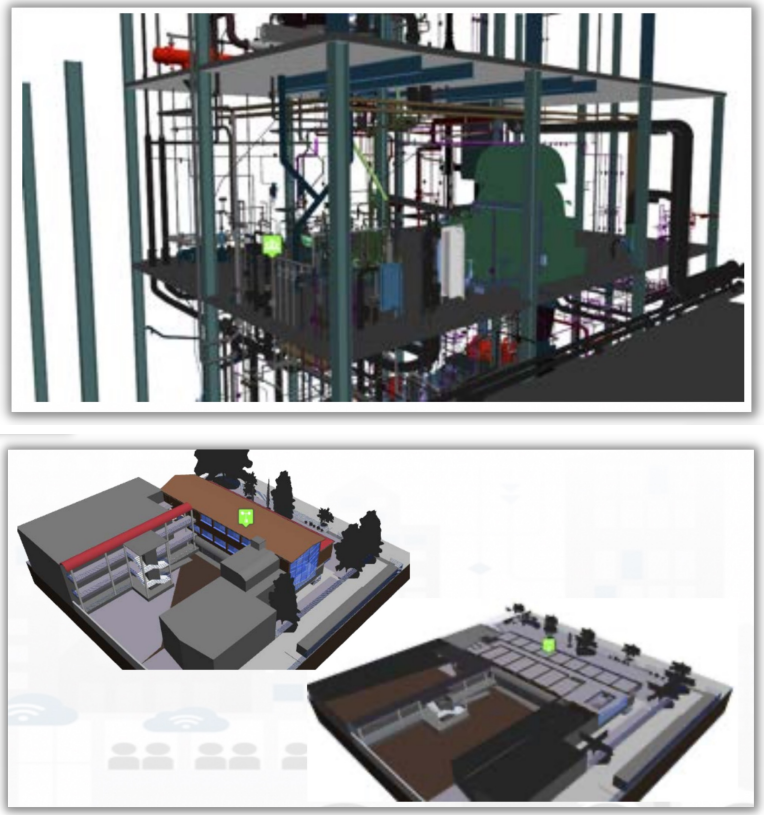




LOCAL DIGITAL TWIN

- Detailed aspects modeled digitally for a physical element, such as a chemical plant with machines, motors, silos, etc.

- Each element includes a 3D representation, detailed components, and real-time values of attached sensors, allowing understanding of its behavior in terms of real-time data

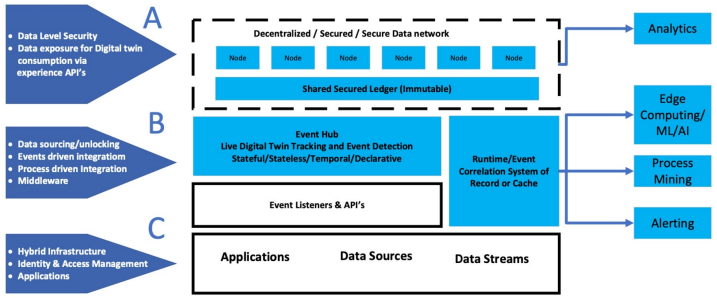


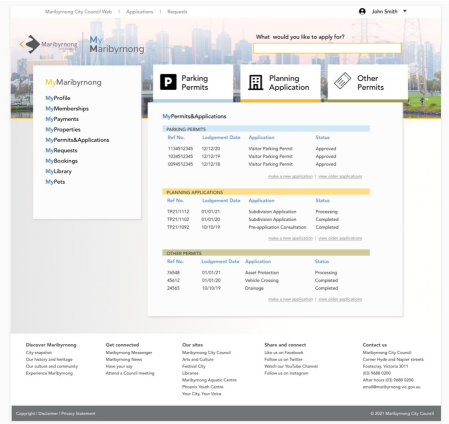
GLOBAL DIGITAL TWIN

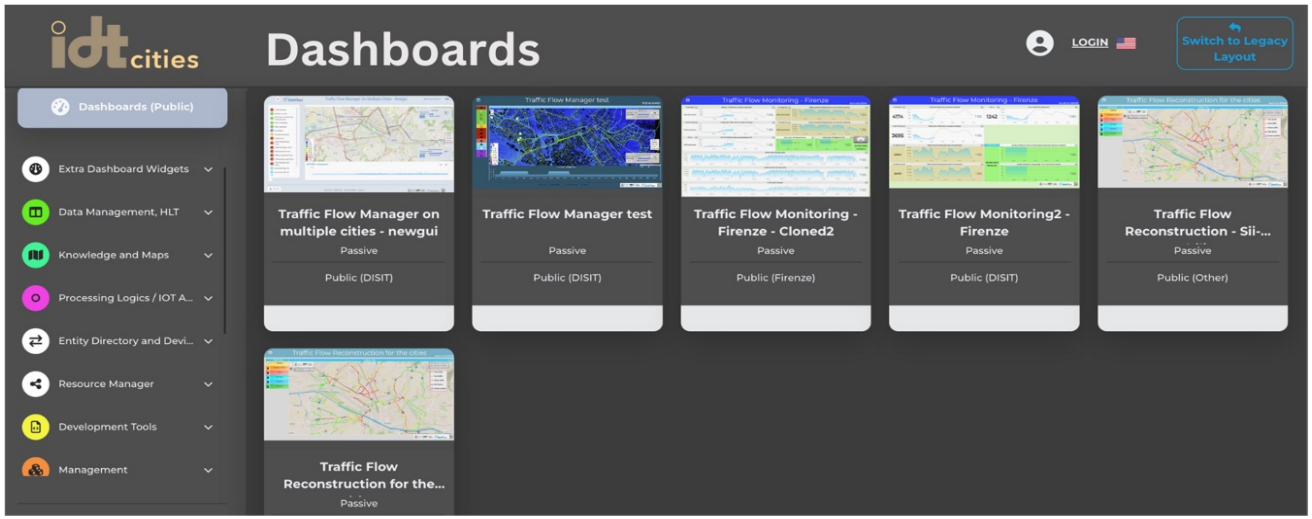
- Detailed aspects digitally modeled for a physical element, such as a chemical plant with machines, motors, silos, etc.
- Each element features a 3D representation, detailed components, and real-time values of attached sensors that can be used to understand its behavior in terms of real-time data.

PARALLEL DEPLOYMENT

- Digital-twin running in parallel deployment mode requires live data processing. Applications/Systems within different orgs are classified into two main categories
  - Business Support Systems (BSS) – Single Customer View Portal
  - Operations Support Systems(OSS)







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CO2 ESTIMATION & ANALYTICAL MODEL

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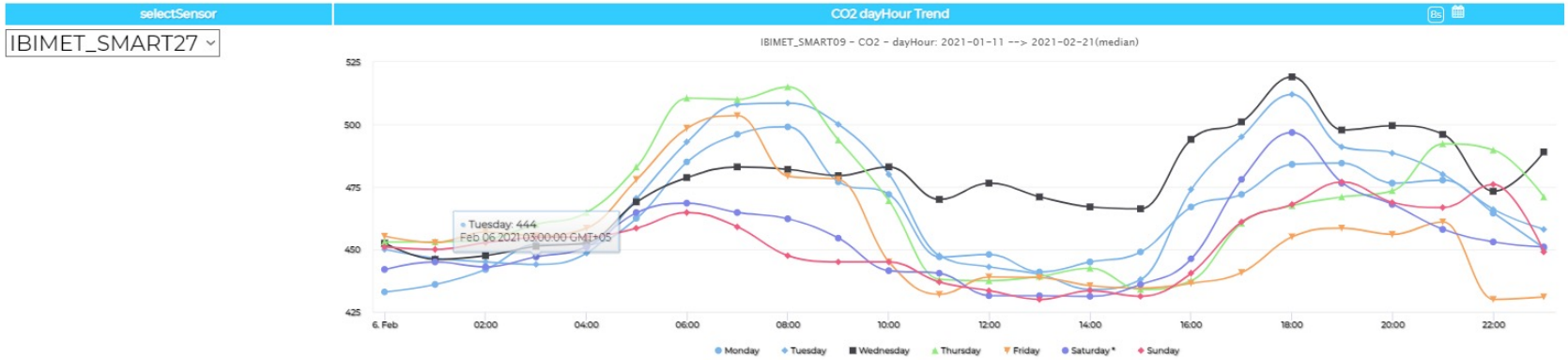
CO2 ESTIMATION

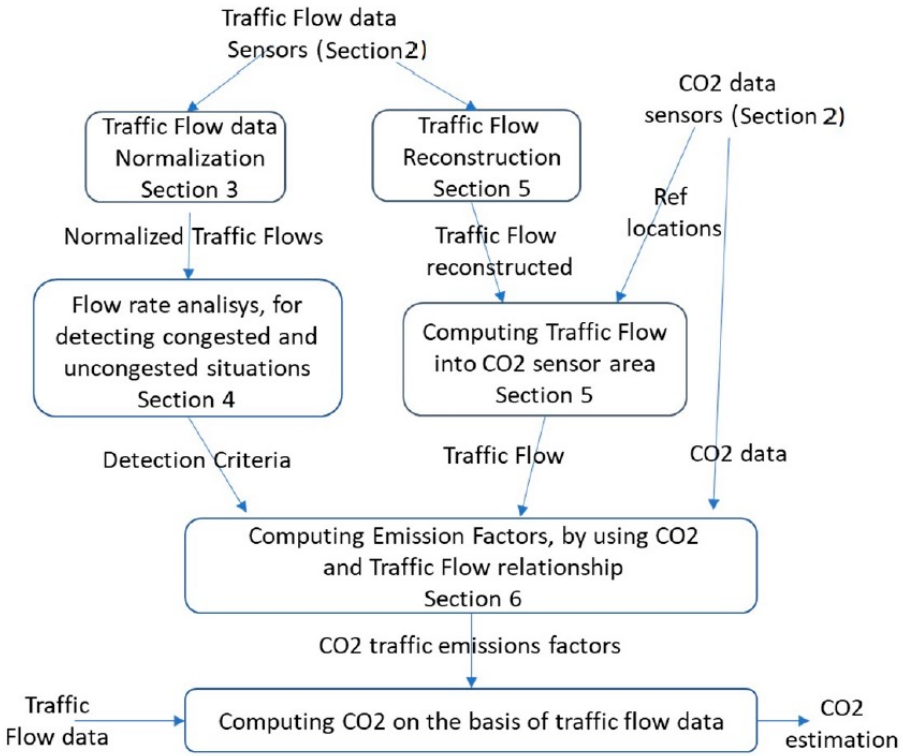
BASED ON VEHICULAR TRAFFIC

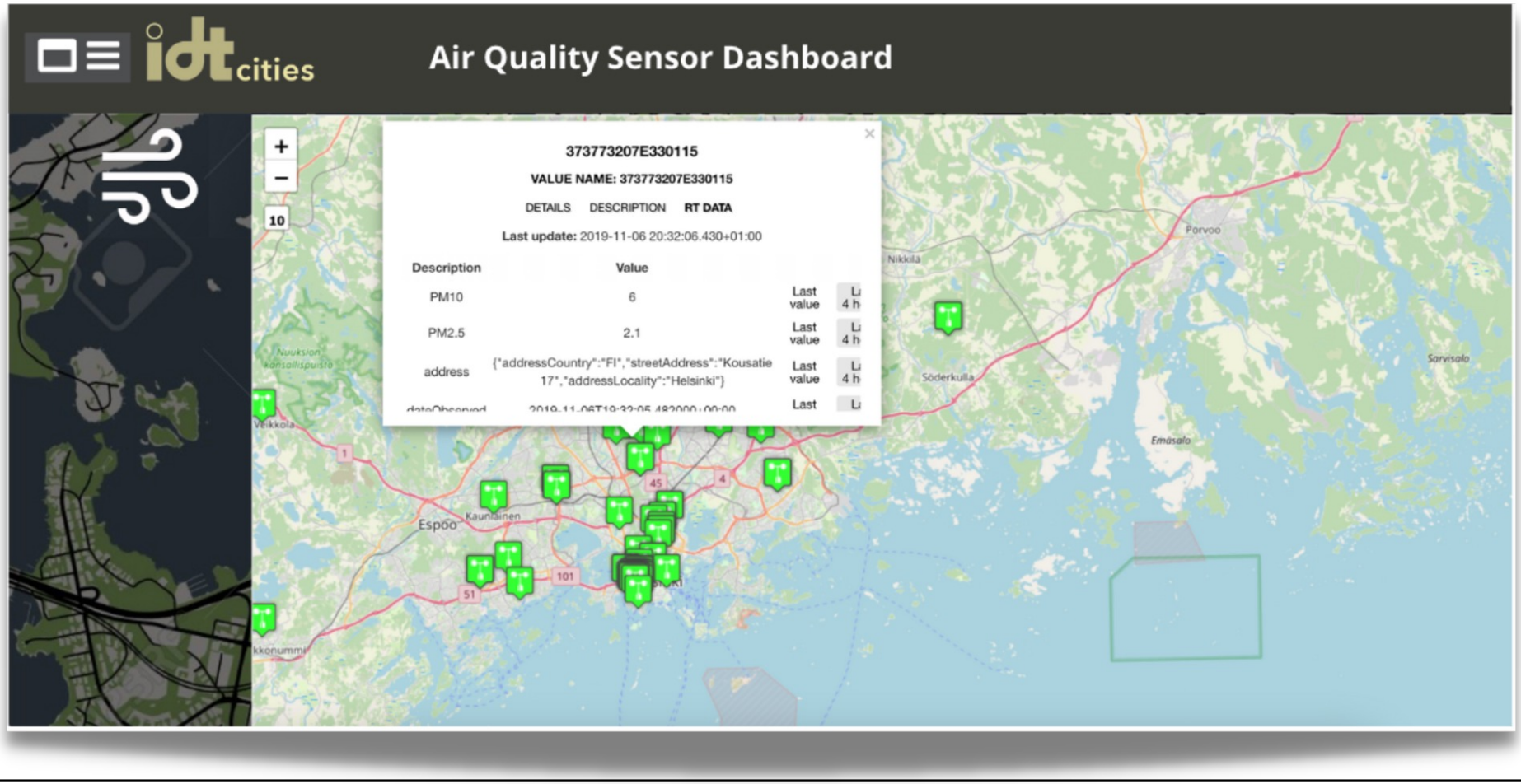
- CO2 emissions at major activity hubs within the city are estimated by leveraging:
  - Reconstructed Traffic Flow, and
  - Air Quality Sensor data.
- The analytical model for this utilizes the model created for traffic reconstruction and air quality station data to generate current and predictive heat maps for CO2.



ANALYTICAL MODEL

- Traffic flow reconstruction algorithm applied to estimate traffic volume in segments closest to the identified air-quality sensors for validation.
- CO2 production is computed by considering several factors and efficiency aspects of the population of vehicle engines, heating, industries, etc.
- The matured model will consider weather conditions and the influence of the propagation of emissions based on wind and humidity.

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Air Quality Sensor Dashboard
373773207E330115
VALUE NAME: 373773207E330115
DETAILS
DESCRIPTION
RT DATA
Last update: 2019-11-06 20:32:06.430+01:00
Description
Value
PM10
6
PM2.5
2.1
address
{"addressCountry":"FI","streetAddress":"Kousatie 17","addressLocality":"Helsinki"}
Last value
Espoo
Kaunlainen
Porvoo
Nikkilä
Söderkulla
Sarvisalo
Emäsalo

CO2 AND AIR QUALITY ANALYSIS

Multiple Domain Data

Traffic Flow data, Pollutant: NOX, CO2, PM10, PM2.5

3D city structure, weather

Multiple Decision Makers

Pollutant Predictions: NOX, NO2

City officers, energy industries

Dashboards, What-If analysis

Traffic Flow Reconstruction

Historical and Real Time data

Billions of data

Services Exploited on:

Dashboards, Mobile App

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TRAFFIC FLOW HEATMAP

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TRAFFIC FLOW DASHBOARD

Multiple Domain Data

Traffic Flow data, 3D City structure, weather

Multiple Decision Makers

Pollutant Predictions: NOX, NO2

City officers, energy industries

Dashboards, What-IF analysis

Traffic Flow Reconstruction

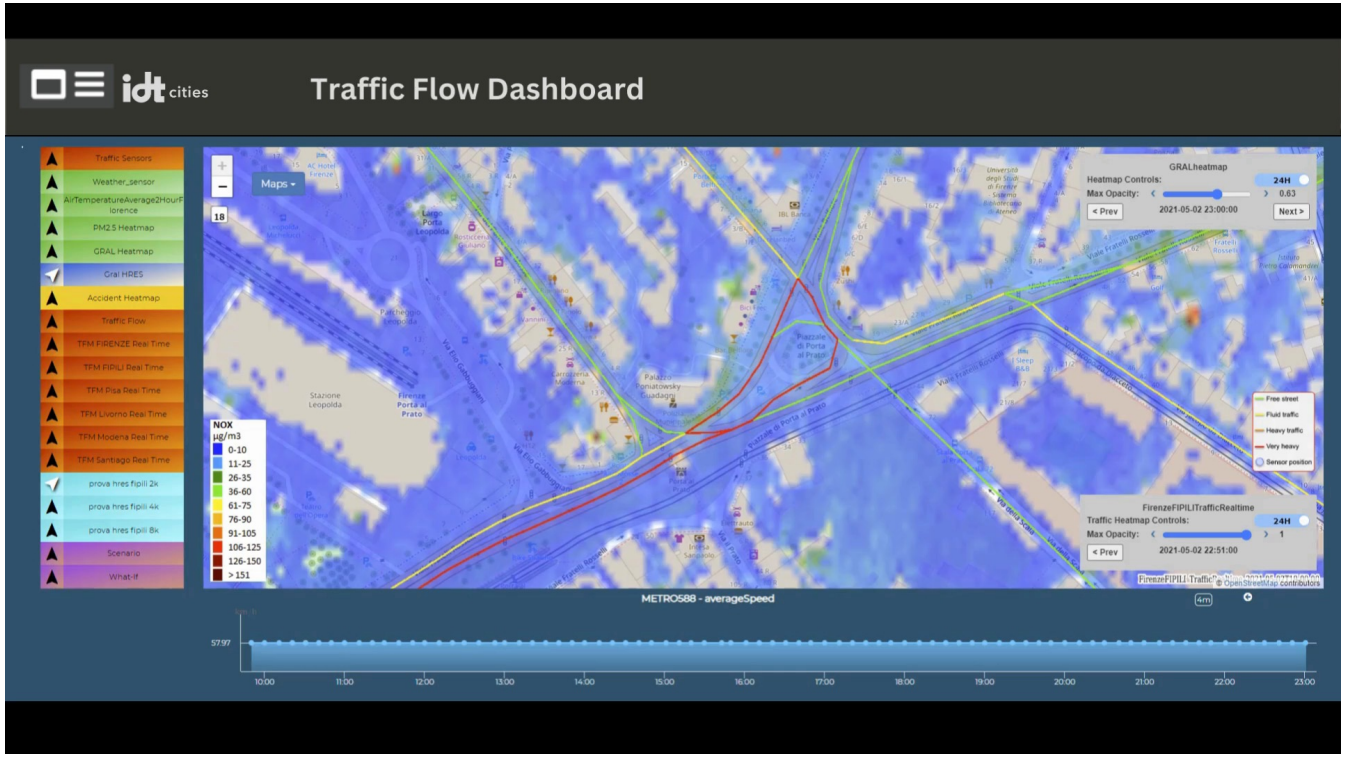
Predictive analysis based on real-time data

Historical and Real Time data

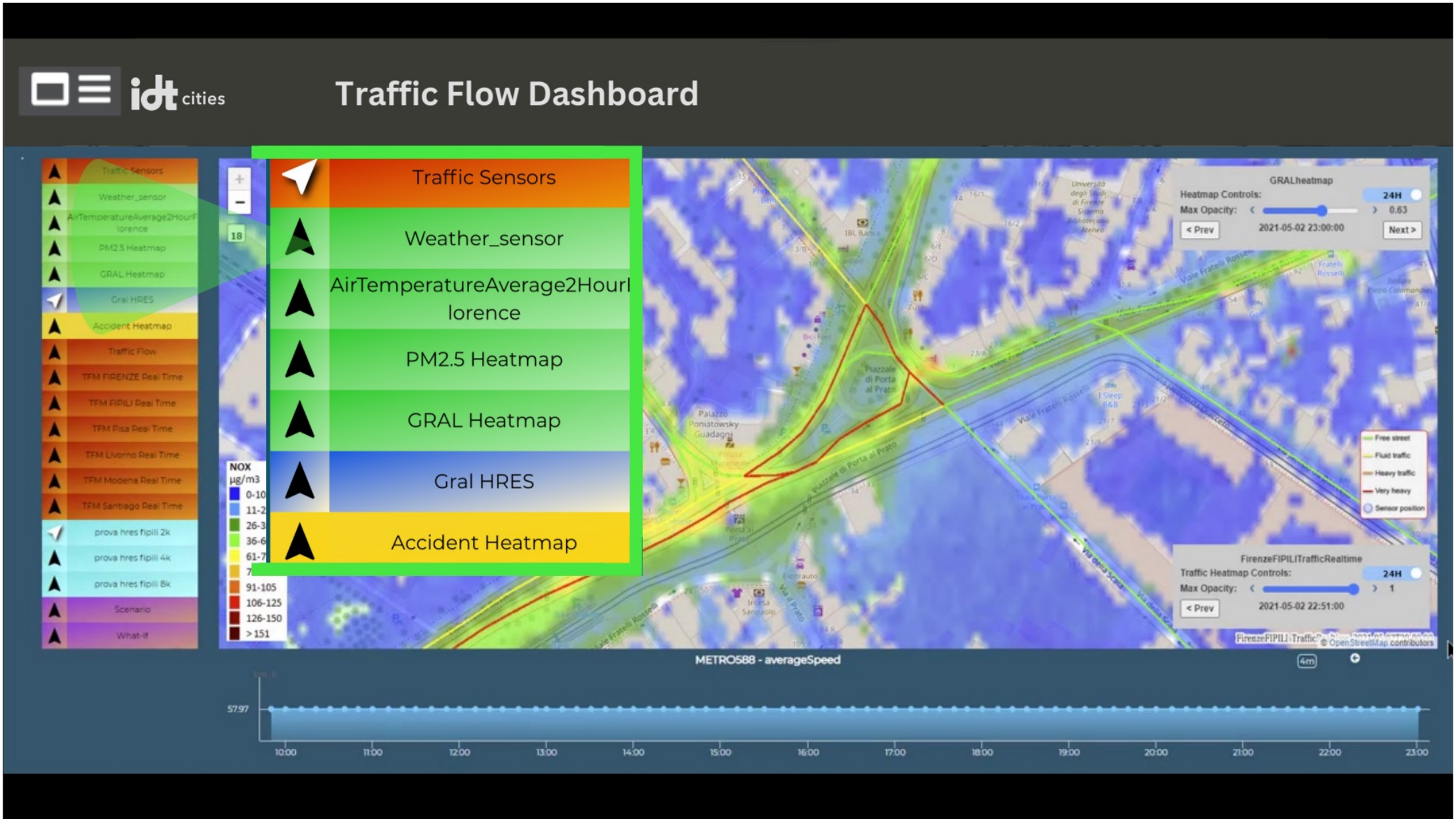
Billions of Data

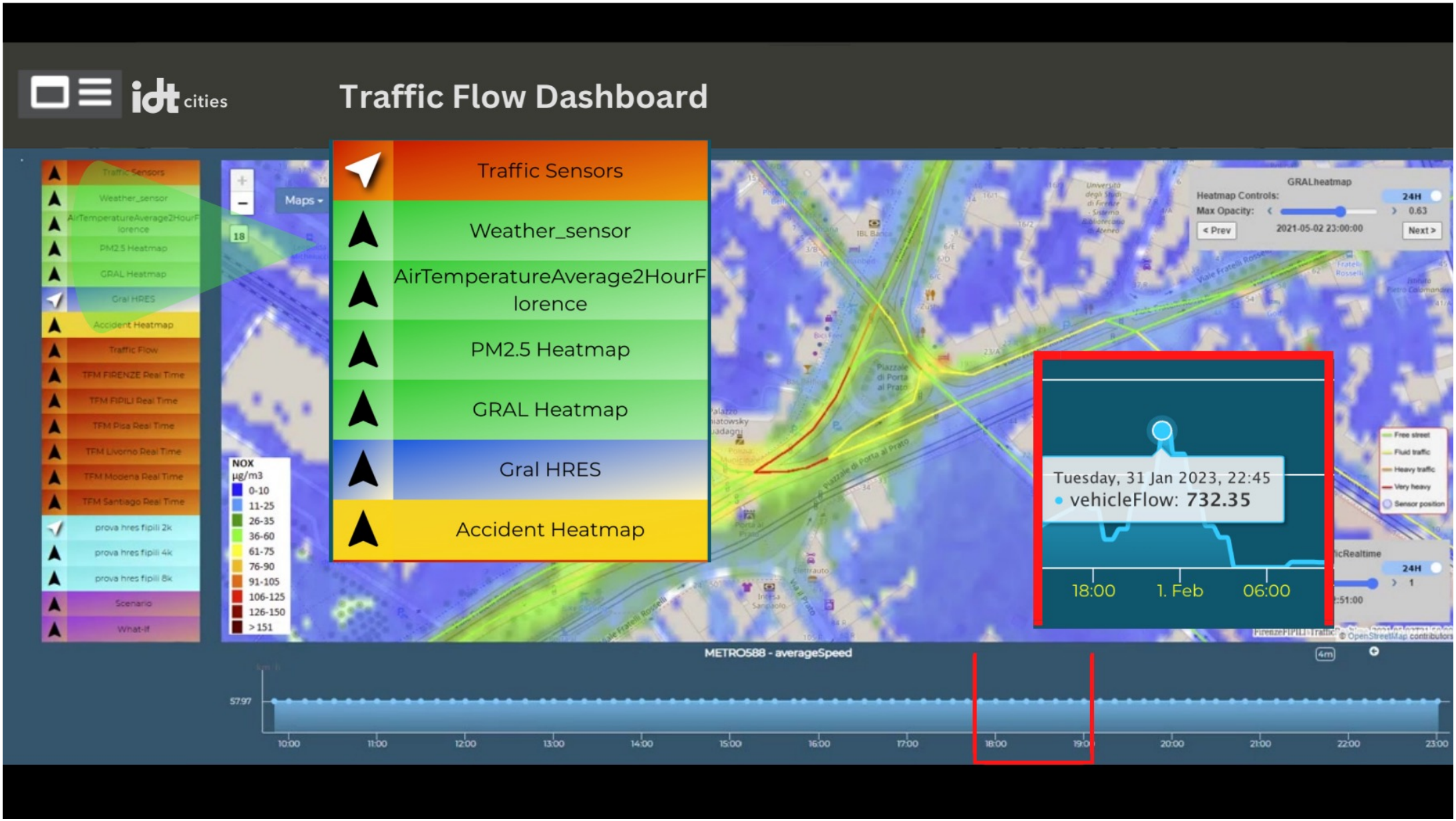
Services can be experienced on:

Dashboards, Mobile App



Traffic Flow Dashboard

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Traffic Flow Dashboard
Traffic Sensors
Weather_sensor
AirTemperatureAverage2HourFlorence
PM2.5 Heatmap
GRAL Heatmap
Gral HRES
Accident Heatmap
Traffic Flow
TFM FIRENZE Real Time
TFM FIPILI Real Time
TFM Pisa Real Time
TFM Livorno Real Time
TFM Modena Real Time
TFM Santiago Real Time
prova hres fipili 2k
prova hres fipili 4k
prova hres fipili 8k
Scenario
What-If
Maps
NOX
µg/m3
0-10
11-25
26-35
36-60
61-75
76-90
91-105
106-125
126-150
>151
GRALheatmap
Heatmap Controls:
24H
Max Opacity:
0.63
< Prev
2021-05-02 23:00:00
Next >
Tuesday, 31 Jan 2023, 22:45
vehicleFlow: 732.35
18:00
1. Feb
06:00
Free street
Fluid traffic
Heavy traffic
Very heavy
Sensor position
METRO588 - averageSpeed
57.97
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00

IDTCITIES IN THE REAL WORLD: PRACTICAL USE CASES

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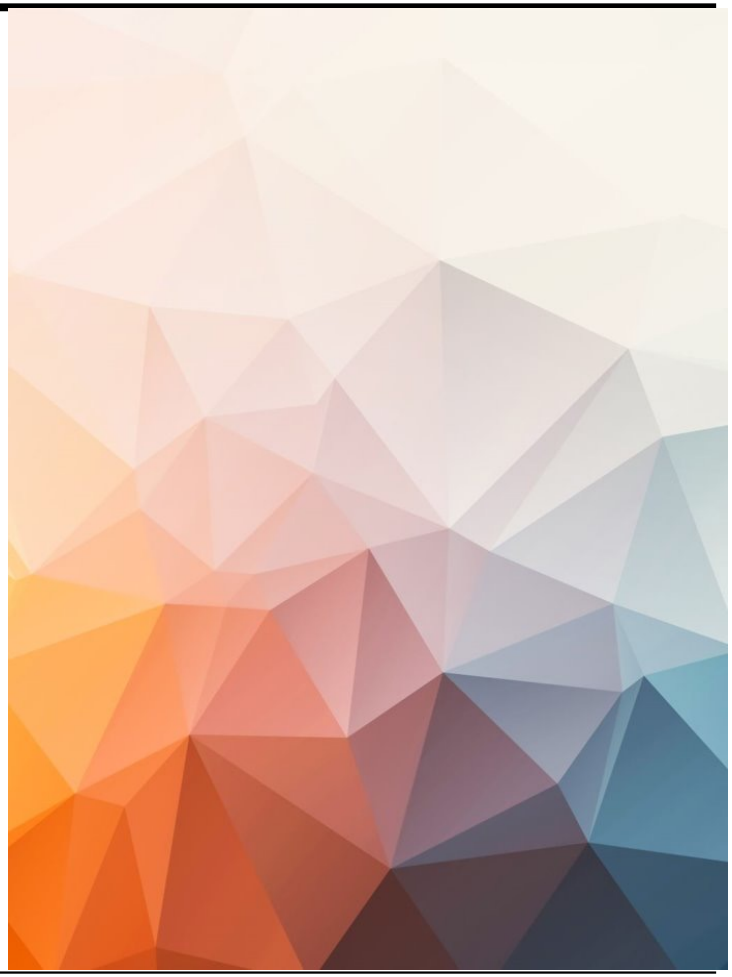
IDTCITIES APPLICATIONS SNAPSHOT:

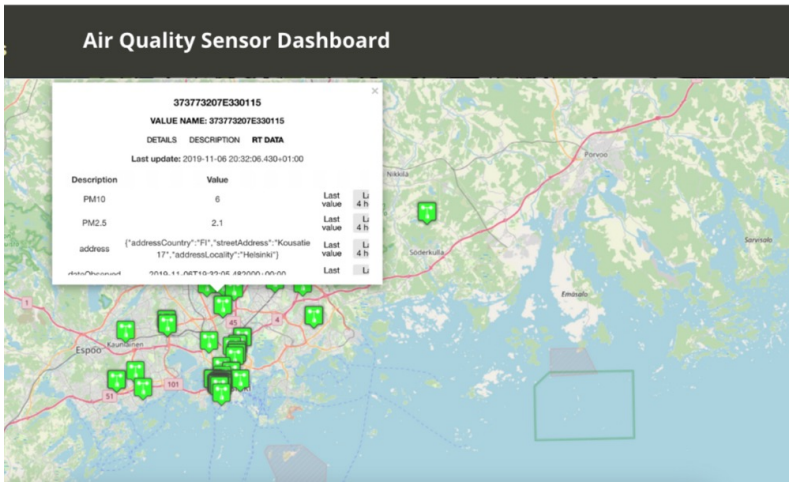
Smart City Infrastructure and Management:

- Traffic Flow Prediction and Improvement
- Historical Analysis for Traffic Flow Reconstruction
- What-If Analysis for Construction Redirects
- Visualization of City Traffic Flow
- Decision-Making for Public Services, Resource Allocation, and Policy
- Vehicle Location Tracking
- Integrated Alerting System with IoT Applications



Environmental Insights:

- Predictions for NOX and Air Quality
- Monitoring Energy Consumption
- Cost-Saving Efficiency Measures
- Advanced Waste Management
- Decision-Making for Environmental Conditions
- Innovation Opportunities for Businesses and Entrepreneurs
- Environmental Conservation Efforts through Data Monitoring and Analysis



Economic and Educational Development :

- Innovation Opportunities for Businesses and Entrepreneurs
- IDTcities as a Learning and Research Tool for Educational Institutions

OUR APPROACH

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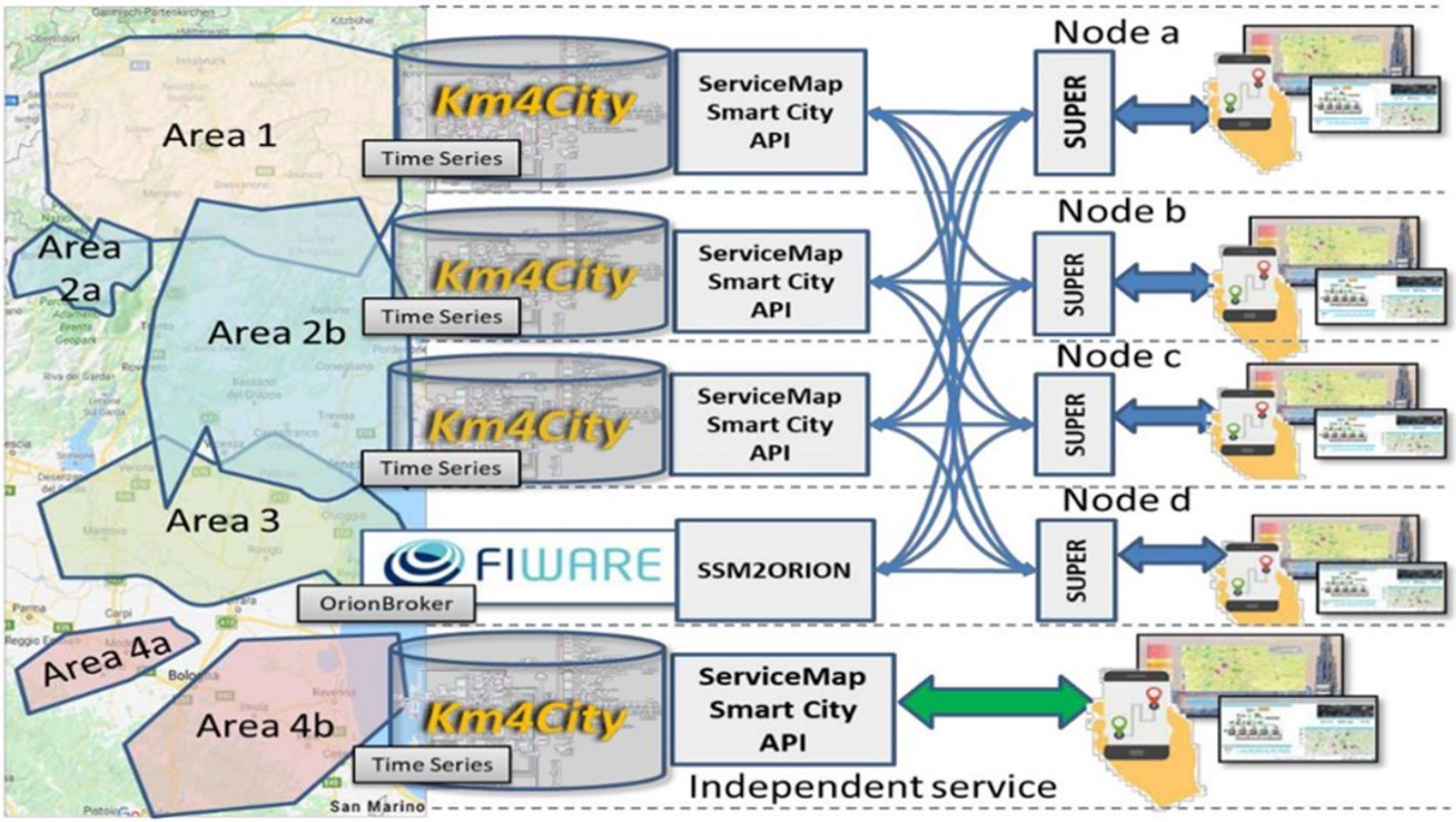
THE APPROACH

- First, the captured data through IoT Broker connectivity and IoT App logic will be validated (via CKAN) and ingested into Azure.
- Ingested data is immediately indexed, searchable, and usable for IDTcities tools such as the Data Inspector, Big Data Analytics, Dashboards builder, Smart City APIs, and Mobile Apps, via MicroServices for IoT Applications (IoT Apps, Node-RED).
    - These are used for integrations, data transformation, and business intelligence, among others.
- Data will be consumed by data processing/data analytics, IoT App/integrations, mobile App, Dashboards, and Synoptics, in real-time streaming, known as data-driven processes, ensuring end-to-end security (from devices to dashboards, in both directions).

REPORTS & BUSINESS INTELLIGENCE

Reports & BI can be built by users with no-code and generated on demand.

- We recommend using static data ingestion to save time. Configuring the IoT broker for the first time may take longer due to dependencies on the participants' end.
- Static data can be directly uploaded into the 'Data Storage and Application Hosting' layer.
- Once the data is uploaded, it becomes readily available for processing by Data Analytics, Data Inspector, Smart City APIs, and Dashboard Builder.
- The provisioning of an IDTCITIES.AU PaaS/SaaS instance for a customer typically takes **5 business days.**


Area 1
Area 2a
Area 2b
Area 3
Area 4a
Area 4b
Km4City
Time Series
Km4City
Time Series
Km4City
Time Series
FIWARE
OrionBroker
Km4City
Time Series
ServiceMap Smart City API
ServiceMap Smart City API
ServiceMap Smart City API
SSM2ORION
ServiceMap Smart City API
Independent service
Node a
SUPER
Node b
SUPER
Node c
SUPER
Node d
SUPER

CONTACT US AND BOOK A DEMO

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