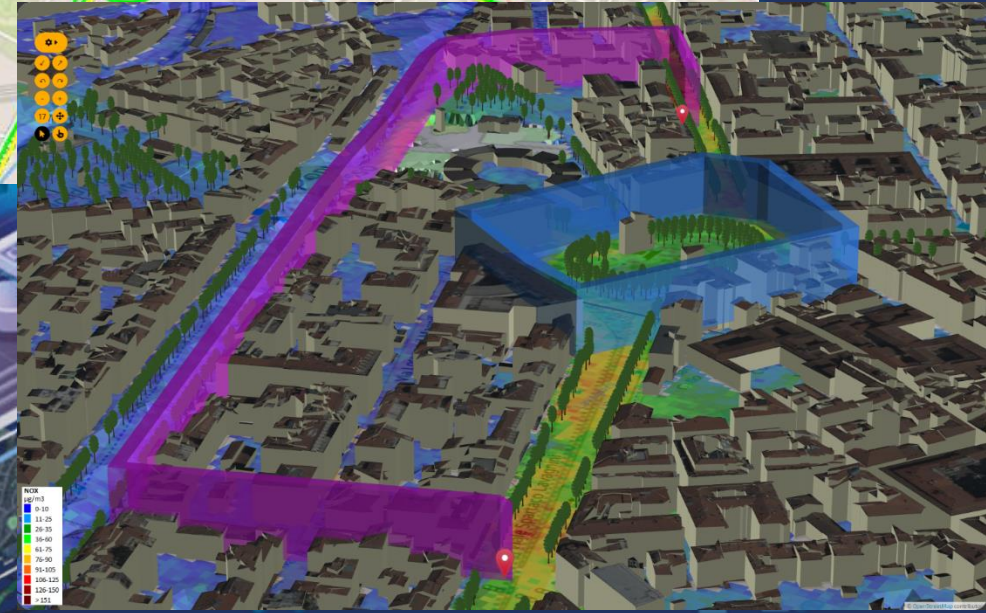
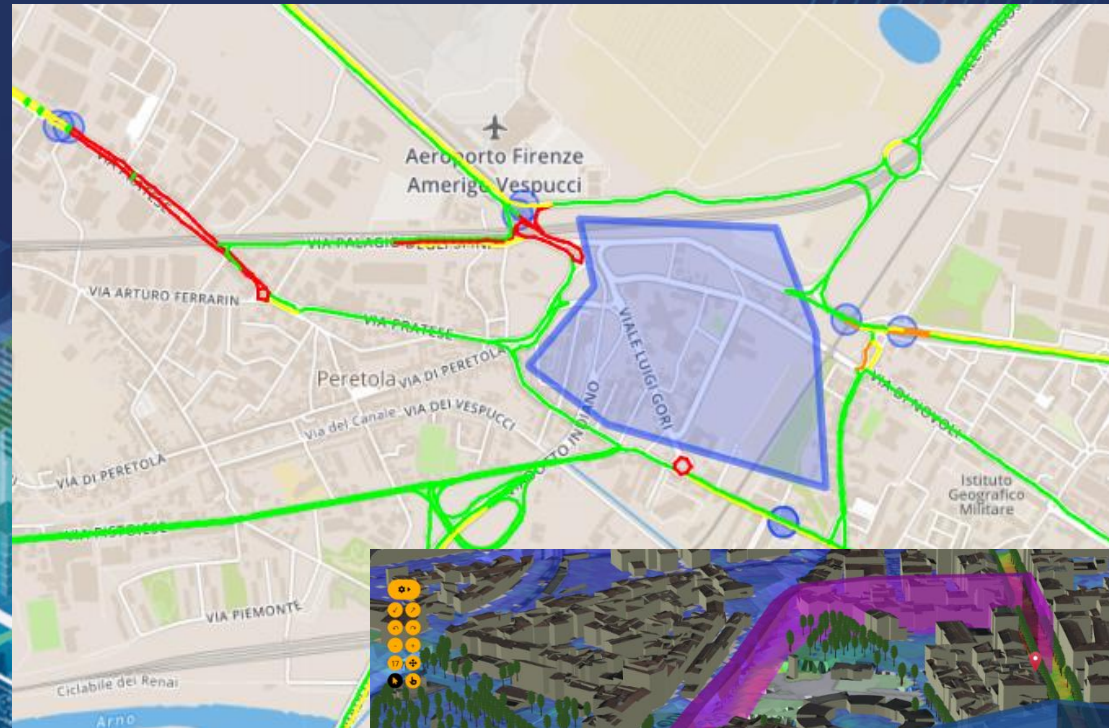




www.snap4city.org
www.snap4solutions.org



Mobility and Transport overview

DIGITAL TWIN SOLUTIONS TO SETUP SUSTAINABLE DECISION SUPPORT SYSTEMS AND BUSINESS INTELLIGENCE

Mobility and Transport

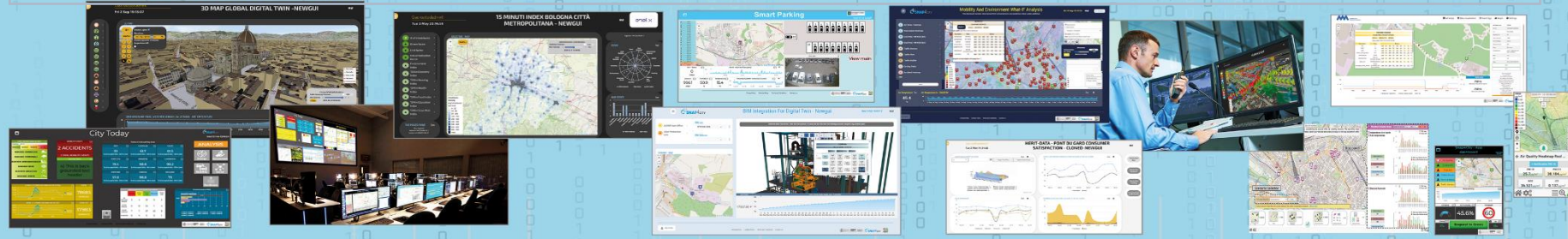
 **SNAP4CITY**



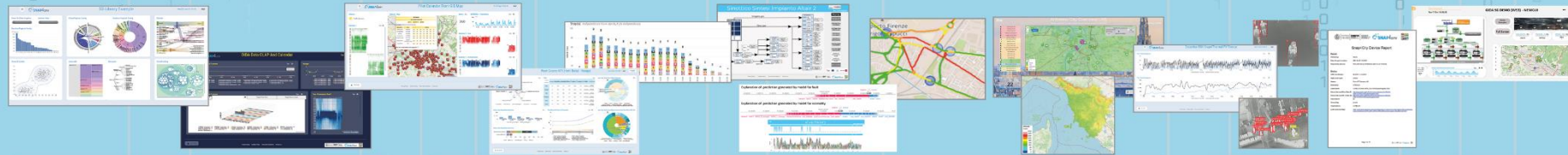


Smart Solutions and Decision Support Systems

CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - BUSINESS INTELLIGENCE - SIMULATIONS - SMART APPLICATIONS



DASHBOARDS - VISUAL ANALYTICS - SYNOPTICS - DIGITAL TWIN - GRAPHICAL WIDGETS - ANALYTICS - GUI CUSTOM STYLES - VISUAL PROGRAMMING



DASHBOARDS, WIDGETS
TEMPLATES

PREDICTION - ANOMALY DETECTION - CLUSTERING - ROUTING - SENTIMENT NLP - TRAFFIC FLOW
PEOPLE FLOWS - SDG - 15 MIN CITY INDEX - KPI - HEATMAPS - ORIGIN DESTINATION - ETC...

API - MICROSERVICES - GIS - BPM
VIDEO - REPORTS - MAPS - 3D ...

ANY: DATA, BROKER, NETWORK AND VERTICAL

EXPERT SYSTEM, KNOWLEDGE BASE
SEMANTIC REASONING
SMART DATA MODEL
IOT DEVICE MODELS, STORAGE

BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE
EXPLAINABLE AI, MACHINE LEARNING
OPERATIVE RESEARCH, STATISTICS

VISUAL PROGRAMMING, ADAPTERS
DATA FLOWS, WORKFLOWS
PARALLEL DISTRIBUTED PROCESSING
EVENT DRIVEN

Native and External
Smart Applications

Mobility & Transport

Light & Energy

Waste

Environment

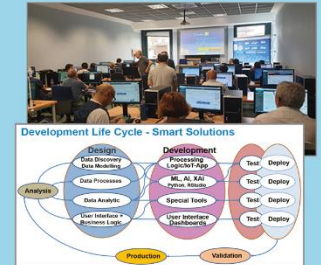
Building

Tourism

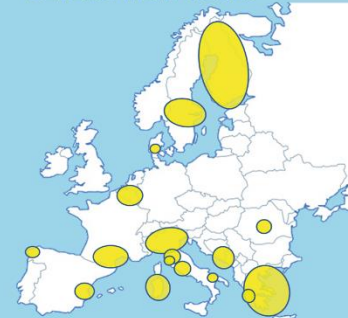
Asset Management

Security and Safety

Social Media



METHODOLOGIES
LIVING LABS
COURSES AND COMMUNITY
DEVELOPMENT TOOLS



Powered by
FIWARE

FREE
TRIAL

PEN Test
Passed

EU GDPR
COMPLIANT

SNAP4
Appliances and Dockers
Installations

EUROPEAN OPEN
SCIENCE CLOUD

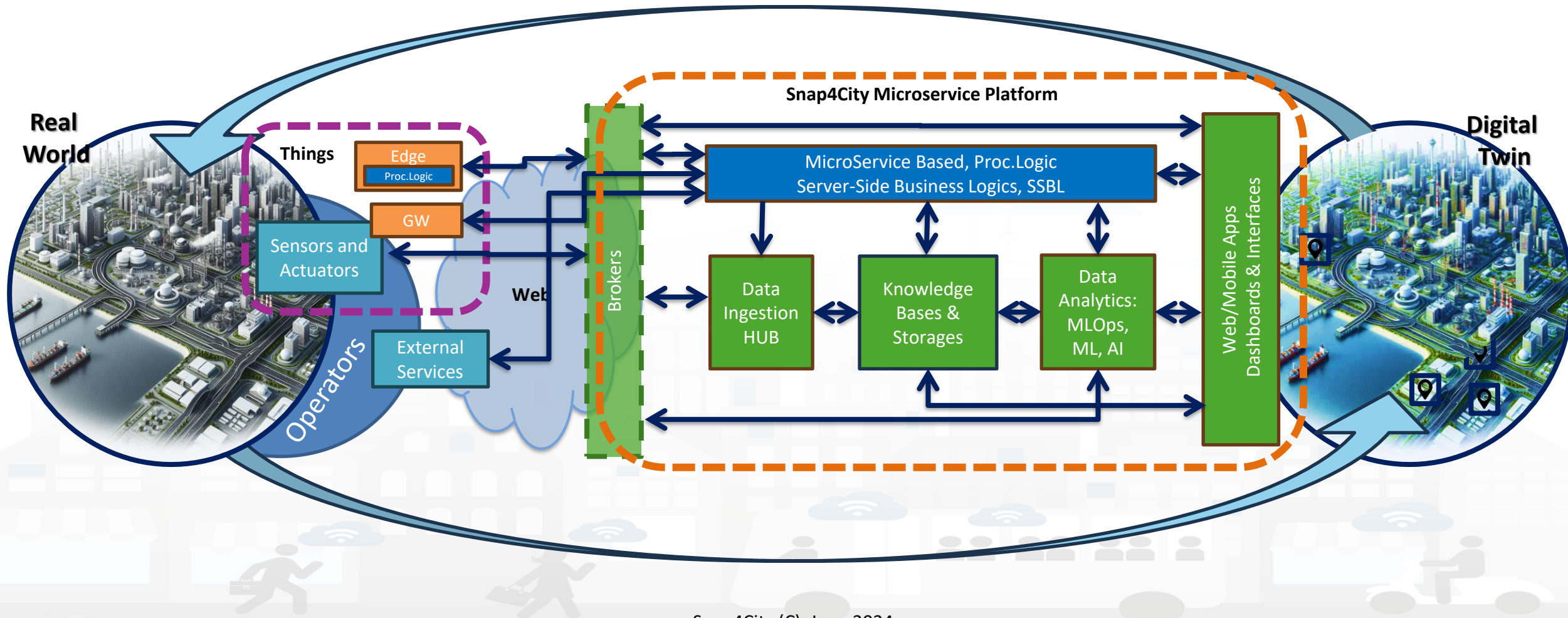
Node-RED

JS Foundation

E015
digital ecosystem

NVIDIA

Digital Twin Development Platform



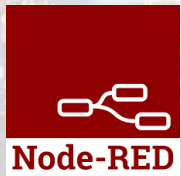
Standards and Interoperability (6/2023)



Compliant with:

- **IoT:** NGSI V2/LD, LoRa, LoRaWan, MQTT, AMQP, COAP, OneM2M, TheThingsNetwork, SigFOX, Libelium, IBIMET/IBE, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Protocol Buffer, KNX, OBD2, Proximus, ..
- **IoT model:** FIWARE Smart Data Model, Snap4City IoT Device Models
- **General:** HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, SOAP, WSDL, FTP, FTPS, WebSocket, WebSocket Secure, GML, WFS, WMS, RTSP, ONVIF, AXIS TVCam, CISCO Meraki, OSM, Copernicus, The Weather Channel, Open Weather, OLAP, VMS,
- **Formats:** JSON, GeoJSON, XML, CSV, GeoTIFF, OWL, WKT, KML, SHP, db, XLS, XLSX, TXT, HTML, CSS, SVG, IFC, XPDL, OSM, Enfuser FMI, Lidar, gITF, GLB, DTM, GDAL, Satellite, D3 JSON, ...
- **Database:** Open Search, MySQL, Mongo, HBASE, SOLR, SPARQL, ODBC, JDBC, Elastic Search, Phoenix, PostGres, MS Azure, ..
- **Industry:** OPC/OPC-UA, OLAP, ModBUS, RS485, RS232,..
- **Mobility:** DATEX, GTFS, Transmodel, ETSI, NeTEx, ..
- **Social:** Twitter, FaceBook, Telegram, ..
- **Events:** SMS, EMAIL, CAP, RSS Feed, ..
- **OS:** Linux, Windows, Android, Raspberry Pi, Local File System, AXIS, ESP32, etc.

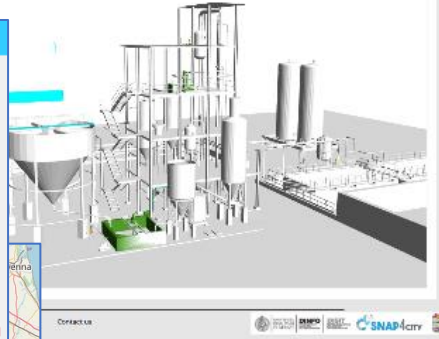
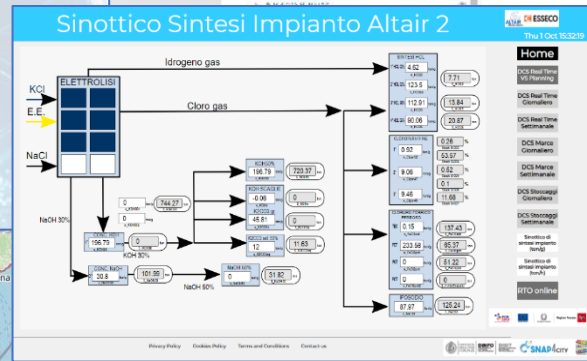
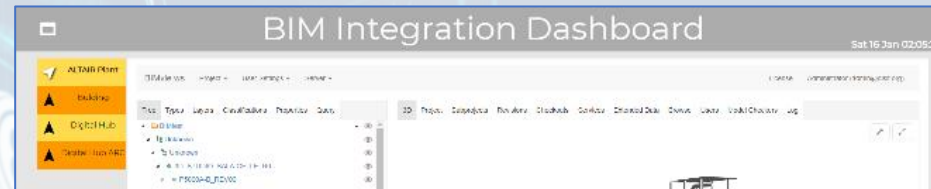
<https://www.snap4city.org/65>



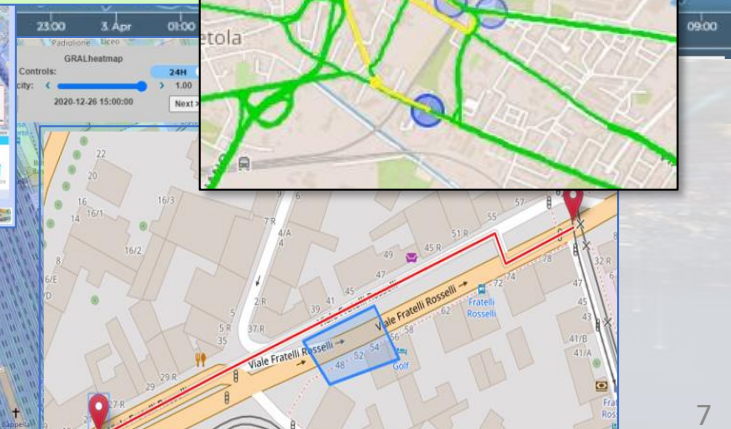
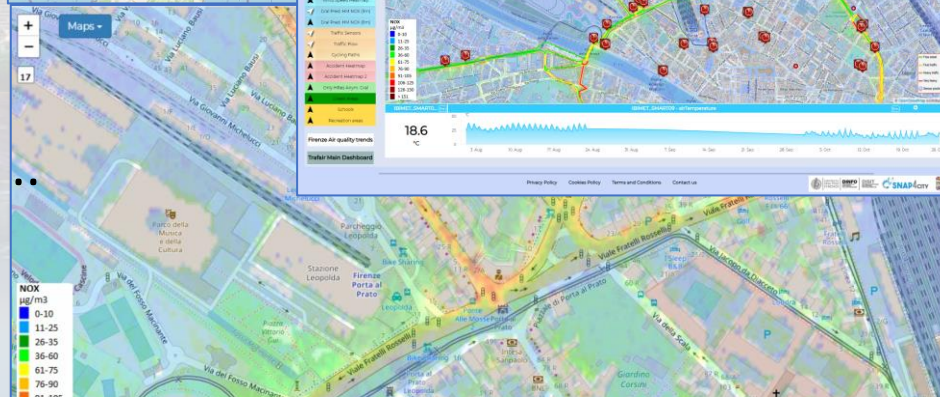
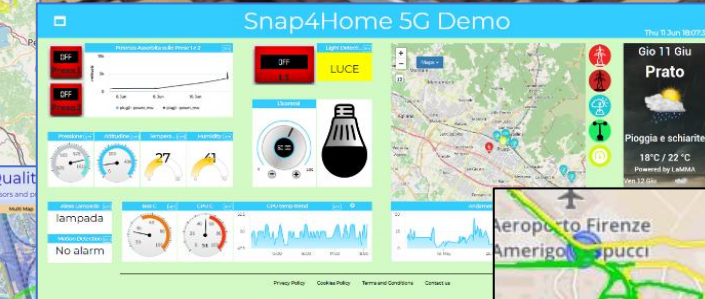
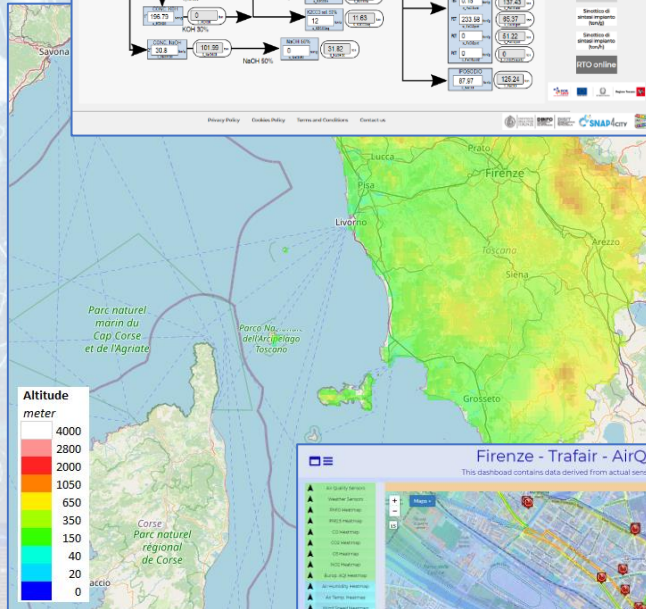
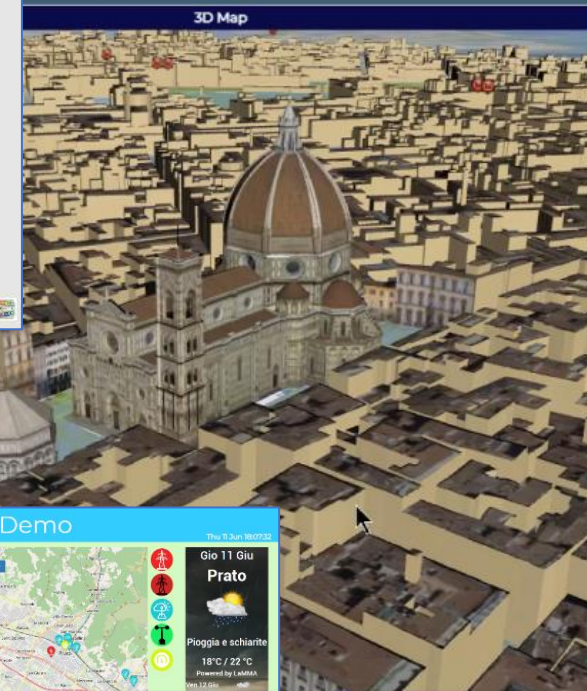
High Level Types

Snap4City (C), June 2024

- POI, IOT Devices, shapes, ...
 - FIWARE Smart Data Models,
 - IoT Device Models
- GIS, maps, orthomaps, WFS/WMS, GeoTiff, calibrated heatmaps, ...
- Satellite data, ...
- traffic flow, typical trends, ...
- trajectories, events, Workflow, ...
- 3D Models, BIM, Digital Twins, ...
- OD Matrices of several kinds, ...
- Dynamic icons/pins, ...
- Synoptics, animations, ...
- KPI, personal KPI, ...
- social media data, TV Stream, ...
- routing, multimodal, constraints, ...
- decision scenarios,
- etc.



SNAP4CITY
- Digital Twin Global - Fire
demonstrator

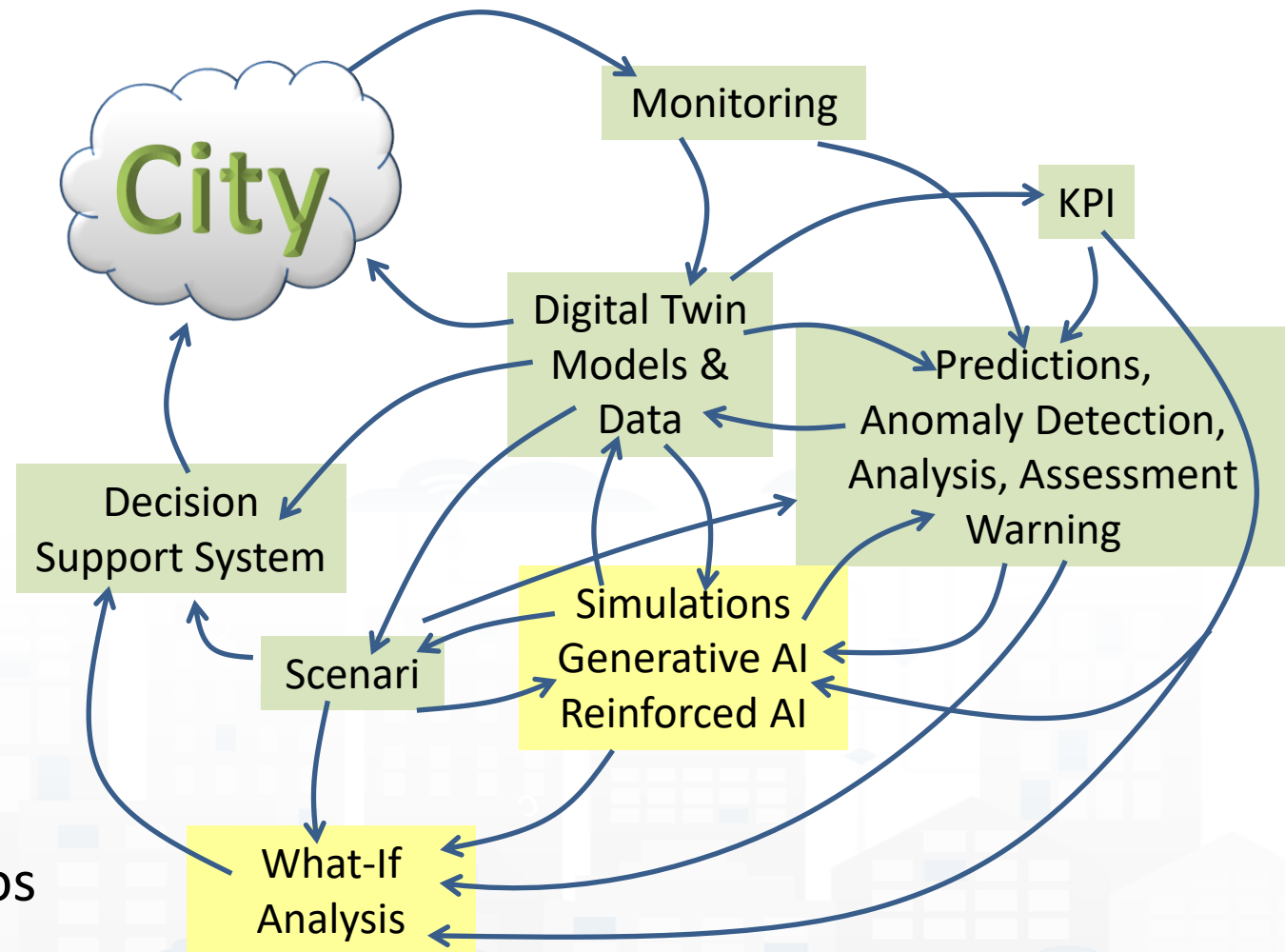


- **Controlling Status: management, and operational**

- Monitoring via KPI
- Computing predictions vs KPI
- Anomaly detection
- Neuro-Symbolic analysis
- Risk assessment
- Early warning on critical conditions

- **Making plan: tactic and strategic, medium and long range, micro/macro**

- Simulation & predictions
- Generative AI Prescriptions, scenarios
- Resilience to Unexpected unknowns
- What-if analysis wrt scenarios





UNIVERSITÀ
DEGLI STUDI
FIRENZE

DINFO
DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

DISIT
DISTRIBUTED SYSTEMS AND
INTERNET TECHNOLOGIES LAB
DISTRIBUTED DATA INTELLIGENCE
AND TECHNOLOGIES LAB

SNAP4CITY



Application: eSharing and Pooling



FROM CITY
DASHBOARD TO
APPLICATIONS

DATA AND
KNOWLEDGE
MANAGEMENT

SNAP4CITY
AND KM4CITY
PROJECTS

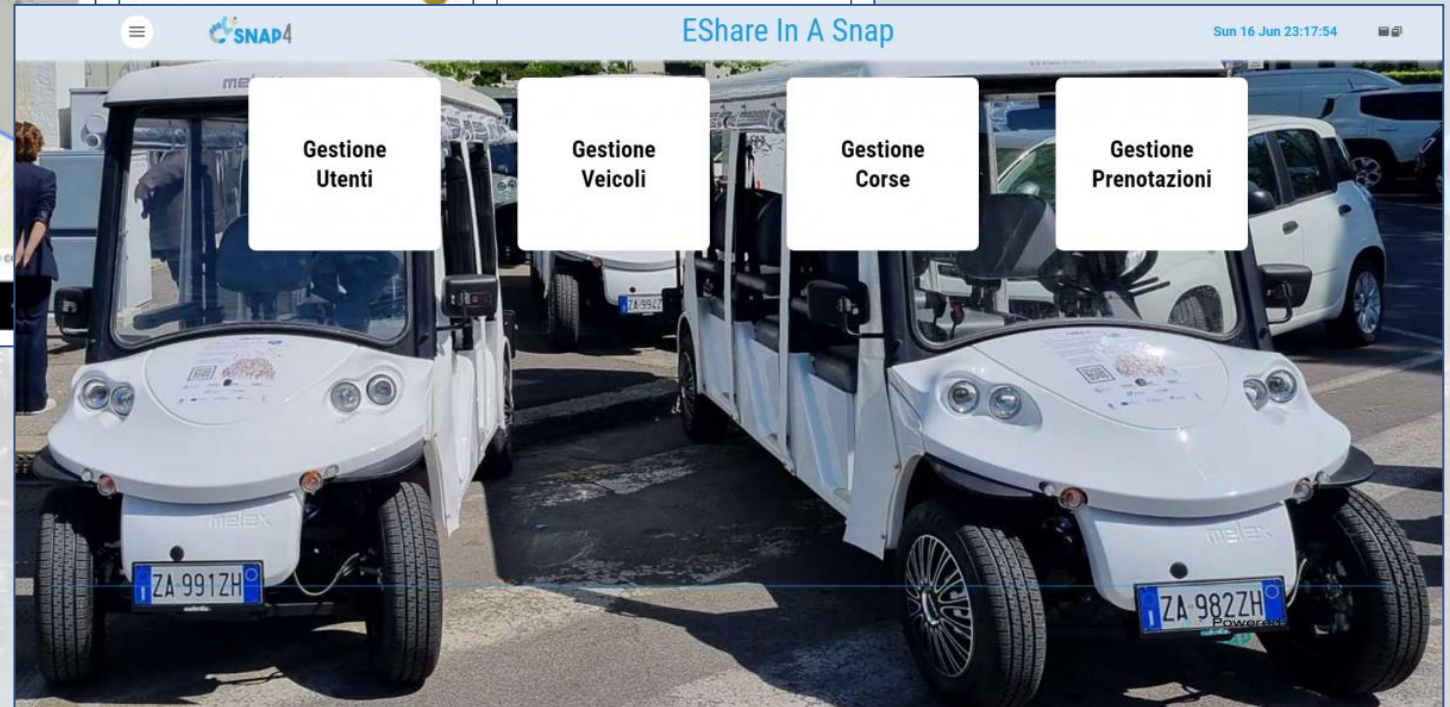
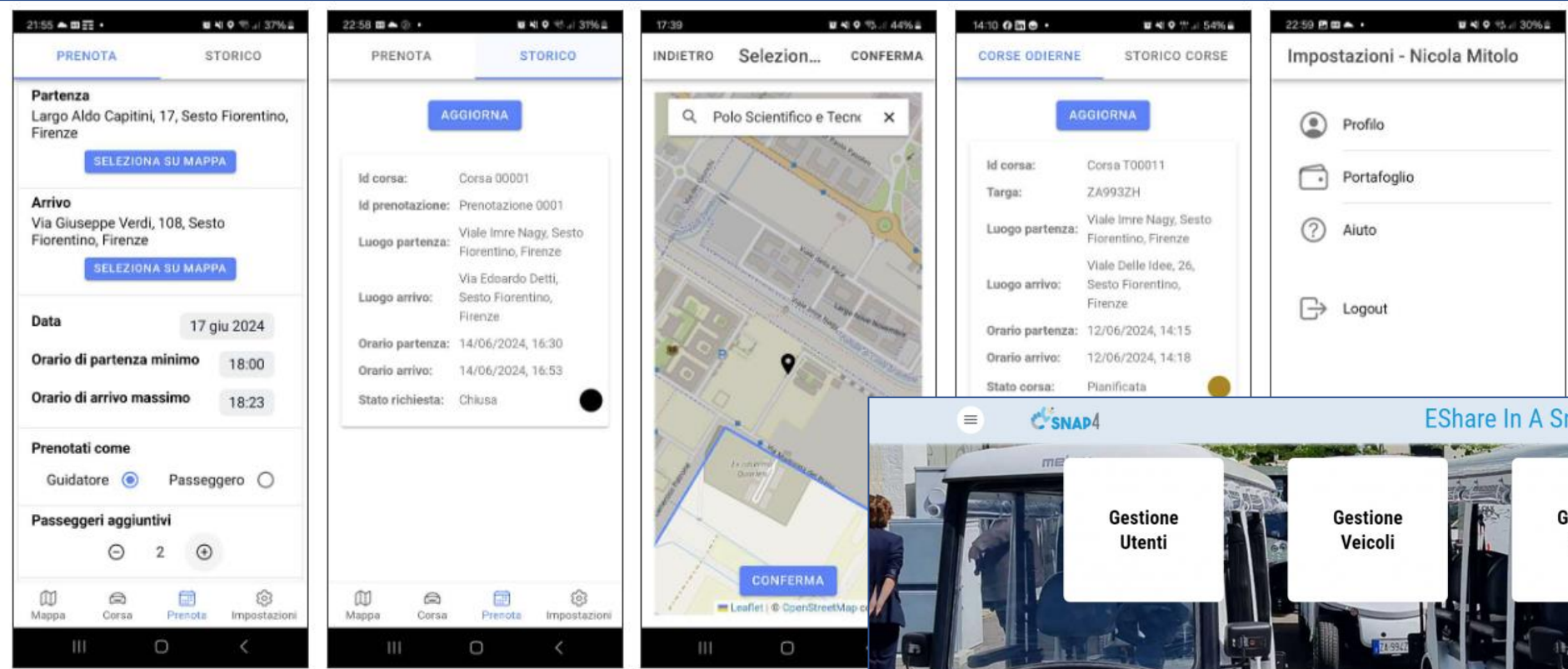
HOW TO ADOPT
SNAP4CITY, AND
THE ROADMAP

SNAP4CITY THE
VIEW OF THE
ADMINISTRATORS

eShare in a Snap, by Snap4 s.r.l.



eShare in a Snap, by Snap4



Integrated car sharing and pooling
Multiple drivers on the same means
Dyanamic pooling and e-sharing

eShare in a Snap, by Snap4



Gestione Veicoli

Sun 16 Jun 23:09:13

Ricarica tutti i veicoli

show area

Selector - Map

Vehicle	Batteria	condition	Data	Blocco	Targa	status	Km/h	Actions
vehicle_ZA994ZH	97.75	Ok	16/06/2024 04:36	On	ZA994ZH	closed	0	[P] [eye]
vehicle_ZA993ZH	98.67	Ok	16/06/2024 21:44	On	ZA993ZH	closed	0	[P] [eye]
vehicle_ZA991ZH	92.64	Ok	16/06/2024 21:13	On	ZA991ZH	closed	0	[P] [eye]
vehicle_ZA992ZH	88.76	Ok	16/06/2024 22:09	On	ZA992ZH	closed	0	[P] [eye]
vehicle_ZA983ZH	87.33	Ok	16/06/2024 23:06	On	ZA983ZH	closed	0	[P] [eye]

Time Trend Batteria

Time Trend Velocità

Gestione Prenotazioni Con Pool

Sun 16 Jun 23:14:32

Tutte le prenotazioni Domani

Dal 16/06/2024 Al 16/06/2024 Cerca

Svuota mappa Svuota pool Svuota mappa e pool
Simula percorso Assegna veicolo e crea pool

Elenco Prenotazioni

Reservation	Passenger	Data
mary_reservation_0003	2	14/06/2024 17:31
bostra3_reservation_0001	2	14/06/2024 17:35
michelangelosanto_reservation_0001	0	15/06/2024 18:19
michelangelosanto_reservation_0002	0	16/06/2024 19:58
simonemaga96_reservation_0003	0	16/06/2024 21:20

User	driver?	Inizio Pooling	Fine Pooling	Inizio Richiesto	Fine Richiesta	Distanza Pooling (m)	Distanza diretta (m)
bostra3	Si	17/06/2024 10:10	17/06/2024 10:32	17/06/2024 10:10	17/06/2024 10:33	6059	4313
mary	No	17/06/2024 10:12	17/06/2024 10:20	14/06/2024 07:10	14/06/2024 07:30	2249	1883
michelangelosanto	Si	17/06/2024 10:15	17/06/2024 10:33	17/06/2024 10:05	17/06/2024 10:20	4783	4292

Veicoli disponibili

Targa	Status	Distanza (metri)	Ha corse precedenti?	Posti totali	Data
vehicle_ZA981ZH	closed	49	No	8	16/06/2024 23:08 ✓
vehicle_ZA980ZH	closed	51	No	8	16/06/2024 23:12 ✓
vehicle_ZA982ZH	closed	220	No	8	16/06/2024 23:13 ✓

Pool Prenotazioni

Reservation	Passenger	Data	driver?	Inizio	Fine	status	userID	Actions
bostra3_reservation_0001	2	14/06/2024 17:35	yes	17/06/2024 10:10	17/06/2024 10:33	requested	bostra3	[map] [up] [down]
mary_reservation_0003	2	14/06/2024 17:31	yes	14/06/2024 07:10	14/06/2024 07:30	requested	mary	[map] [up] [down]

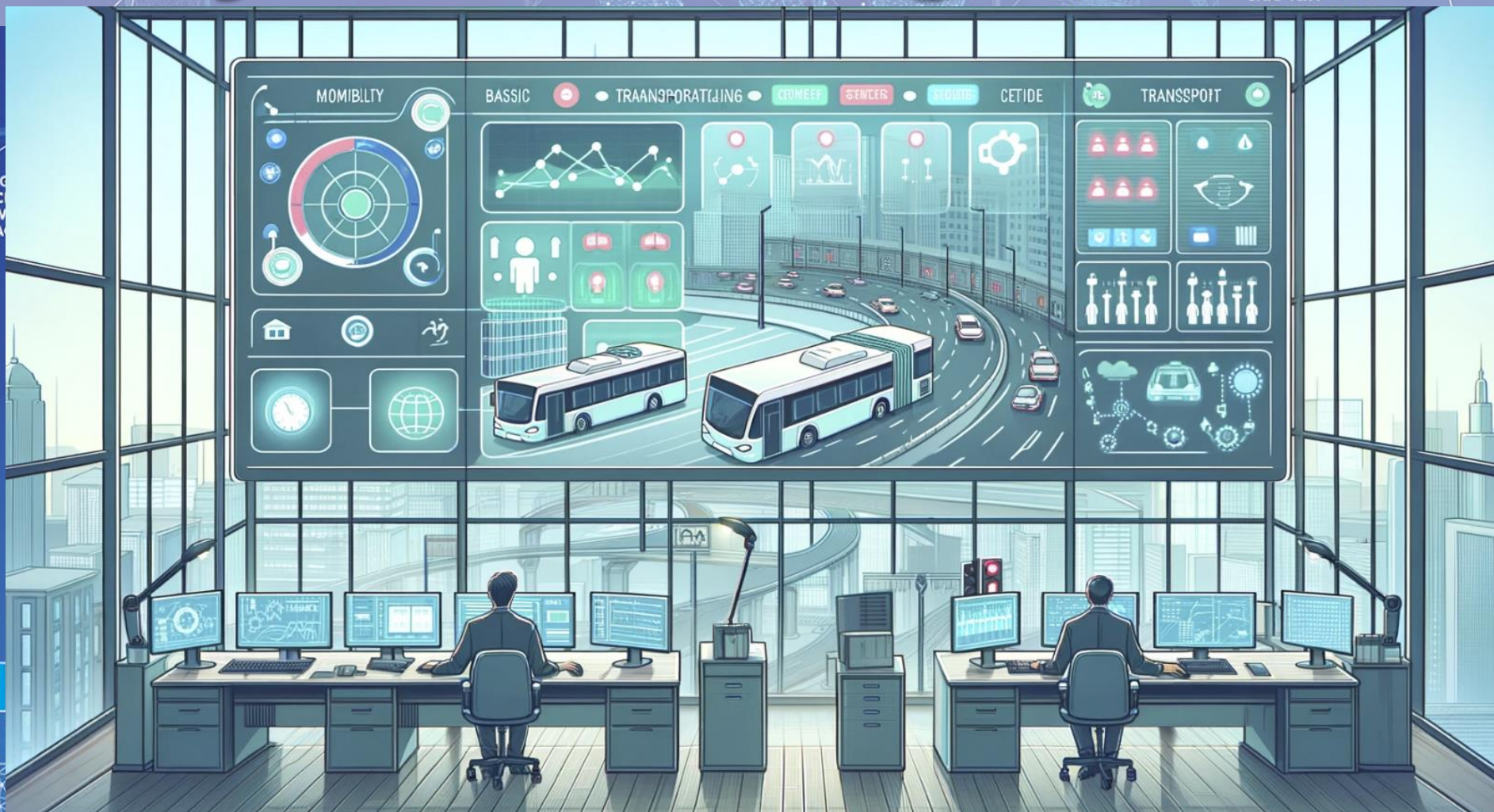
Integrated car sharing and pooling
Multiple drivers on the same means
Dyanamic pooling and e-sharing



Mobility Monitoring and Control

FROM CITY
DASHBOARD TO
APPLICATIONS

DATA C
AND C
KNOW
MANA



HOW TO ADOPT
SNAP4CITY, AND
OUR ROADMAP

SNAP4CITY THE
VIEW OF THE
ADMINISTRATORS

SNAP4CITY
AND KM4CITY
PROJECTS

SNAP4CITY FOR
BEGINNERS

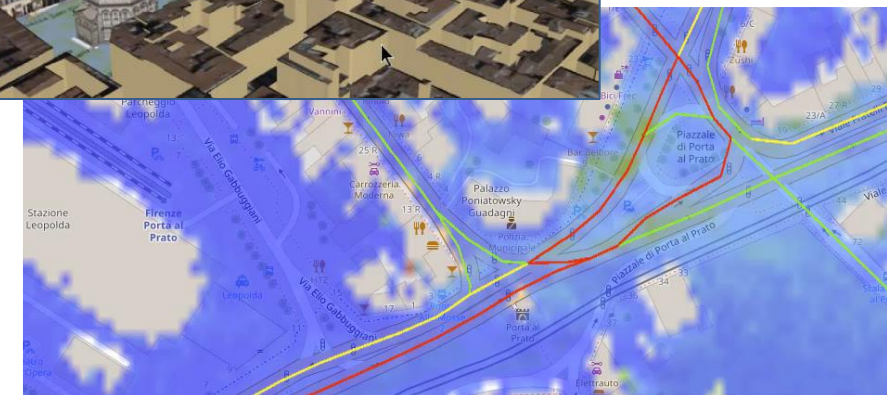
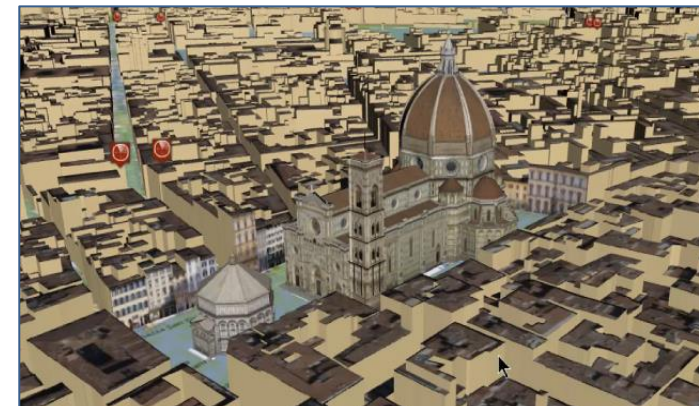
SNAP4CITY

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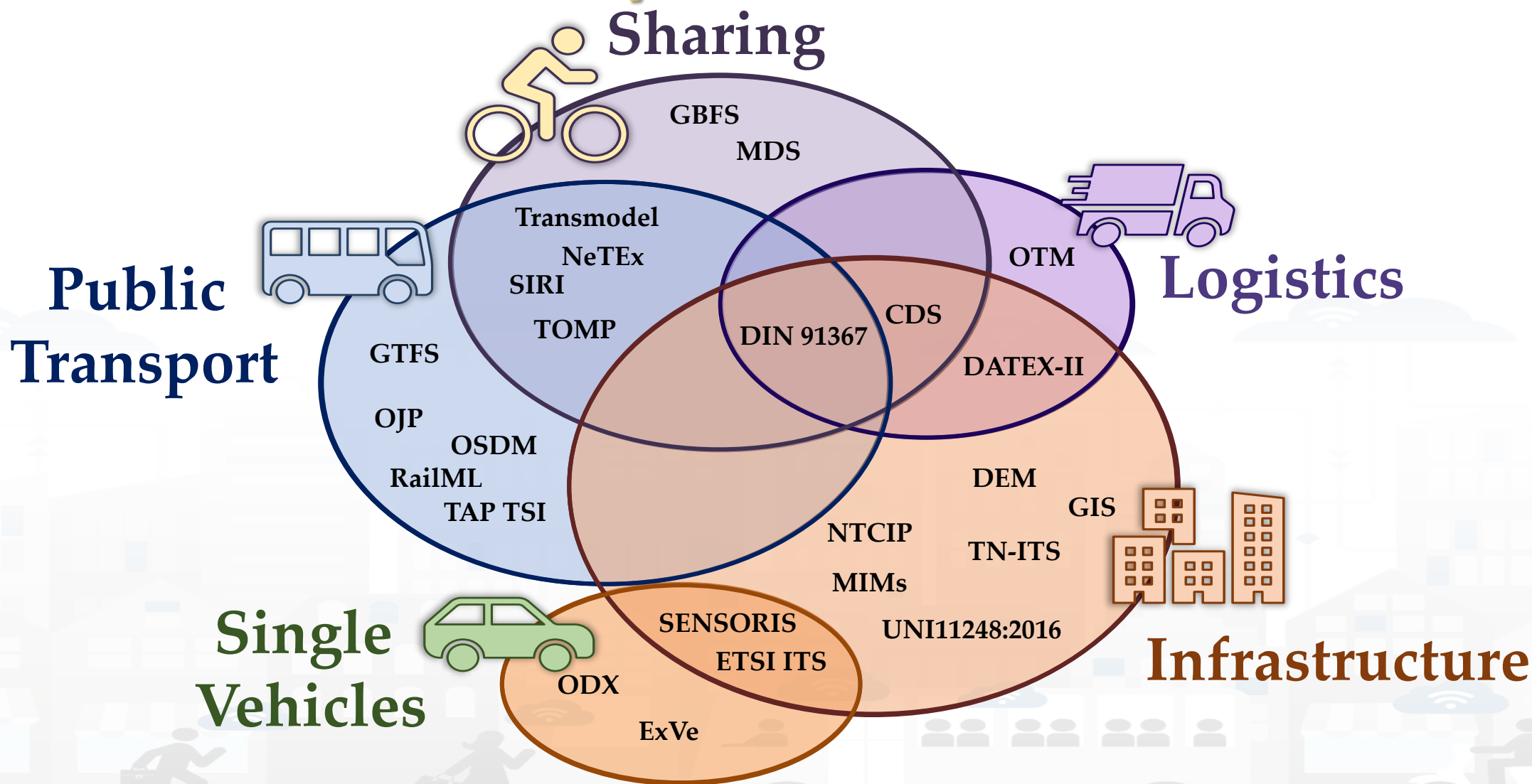
ORING &
MANAGING
AND FLEXIBLE
WEB
AND MOB
APPS



- **Controlling Status:** management, and operational
 - Monitoring via KPI
 - Computing predictions and KPI
 - Anomaly detection, Early warning
 - Control Rooms, situation rooms
- **Reacting: Computing in real time**
 - Changing semaphore maps
 - Changing Dynamic signage
 - Real time Info Mobility
 - User engagement via Mobile Apps
 - What-if analysis
 - etc.,



Mobility data formats



Data and standards	Temporal domain			Mobility Domain					Mobility Subdomain											Format																	
	Static	Historic	Real-time	Infrastructure	Logistic	Sharing	Public Transport (PT)	Single Vehicles	Census	Road network	Urban elements	Traffic Signals	POI	Buildings	Terrain	Weather	Pollution	PT Urban: Bus, Tram, ...	PT: Railways	Journey Planning User	notification Vehicle Status / Diagnosis	Excel	SDMX	XML	CSV	JSON	GeJSON	Protocol Buffers (PBF)	Esri Shapefiles	SVG	SQLite	RDF	PNG	GeoTIFF	Esri grid ASCII (ASC)	ASN.1	
Statistical data	X	X		X	X	X	X	X														X	X		X	X											
GIS data (governemnt)	X			X						X	X		X	X												X		X									
GIS data (OSM)	X			X						X	X	X		X	X											X	X	X	X	X			X				
TN-ITS	X		X							X														X													
DEM (DTM, DSM)	X													X	X																X	X	X				
CDS	X	X	X	X	X	X				X	X															X	X										
GTFS	X						X															X															
GTFS-RT			X				X															X															
NeTEx	X					X	X															X	X														
SIRI			X			X	X															X	X														
Transmodel	X		X			X	X															X	X	X													
OJP			X				X															X	X	X													
TAP TSI	X		X				X																														
RailML	X		X				X																														
OSDM	X						X																														
GBFS	X		X			X																															
MDS	X	X	X			X																															
DIN SPEC 91367			X	X	X	X	X			X	X		X									X	X	X											X		
OTM			X		X																																
IoT/loE Sensors - TV Cam			X	X						X			X			X	X																				
DATEX-II			X	X	X					X	X	X	X																								
NTCIP			X	X								X																									
UNI11248:2016			X	X							X																										
TOMP	X		X			X	X															X	X	X													
ETSI ITS			X	X			X			X																											X
SENSORIS		X	X	X			X			X																											
ExVe			X				X																														
ODX			X				X																														

Key Performance Indicators, KPI



- **United Nations Sustainable Development Goals, SDGs** (for which cities can do more to achieve some of the 17 SDGs, <https://sdgs.un.org/goals>);
- **15 minutes cities** (where primary services must be accessible within 15 minutes on foot);
- **objectives of the European Commission** in terms of pollutant emissions for: NO2, PM10, PM2.5 (https://environment.ec.europa.eu/topics/air_en);
- **SUMI: mobility and transport vs env**
 - <https://www.snap4city.org/951>
- **SUMP/PUMS: mobility and transport vs env.**
- **ISO indicators:** city smartness, digitization, tech level.
- **Low Level/Real Time:** global traffic, quality of service, betweenness, centrality, queue, time to travel, etc.

Global
&
Local

Periodic
&
Realtime

Air Quality Directive				WHO guidelines	
Pollutant	Averaging period	Objective and legal nature and concentration	Comments	Concentration	Comments
PM _{2.5}	One day			25 µg/m ³ (*)	99 th percentile (3 days/year)
PM _{2.5}	Calendar year	Target value, 25 µg/m ³	The target value has become a limit value since 1 January 2015	10 µg/m ³	
PM ₁₀	One day	Limit value, 50 µg/m ³	Not to be exceeded on more than 35 days per year.	50 µg/m ³ (*)	99 th percentile (3 days/year)
PM ₁₀	Calendar year	Limit value, 40 µg/m ³ (*)		20 µg/m ³	
O ₃	Maximum daily 8-hour mean	Target value, 120 µg/m ³	Not to be exceeded on more than 25 days per year, averaged over three years	100 µg/m ³	
NO ₂	One hour	Limit value, 200 µg/m ³ (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m ³ (*)	
NO ₂	Calendar year	Limit value, 40 µg/m ³		40 µg/m ³	



• **15 Minute City Index:**

- 13 subindexes: energy, slow mobility, fast mobility, housing, economy education, culture and cults, health, entertainment, gov, food, security...



- Monitoring and Prediction of energy consumption
- Stimulating: Bike sharing, e-bikes, car charge, etc.
- Community of Energy, planning energy plant



- Industry 4.0 integrated solutions
- Decisions Support Systems
- Process optimization, control
- Predictive maintenance



- Smart City infrastructure: monitoring and resilience, long terms predictions
- Effective and Low cost smart solutions
- What-if analysis, Simulations
- Origin Destination matrices computation



- business intelligence tools for decision makers
- Reduction production costs
- Monitoring resource consumption
- Optimization of Waste Collection



- Monitoring and Predicting: NO2, NOX, CO2, Traffic flow, pollutant, landslide, waste, etc.
- Traffic flow reconstruction
- Demand vs Offer of Mobility analysis



- Shortening justice time
- Anonymization and indexing legal docs.
- Prediction of mediation proneness
- Ethical Explainable Artificial Intelligence

15MinCityIndex

What would support my neighborhood to become a 15-Minute City?

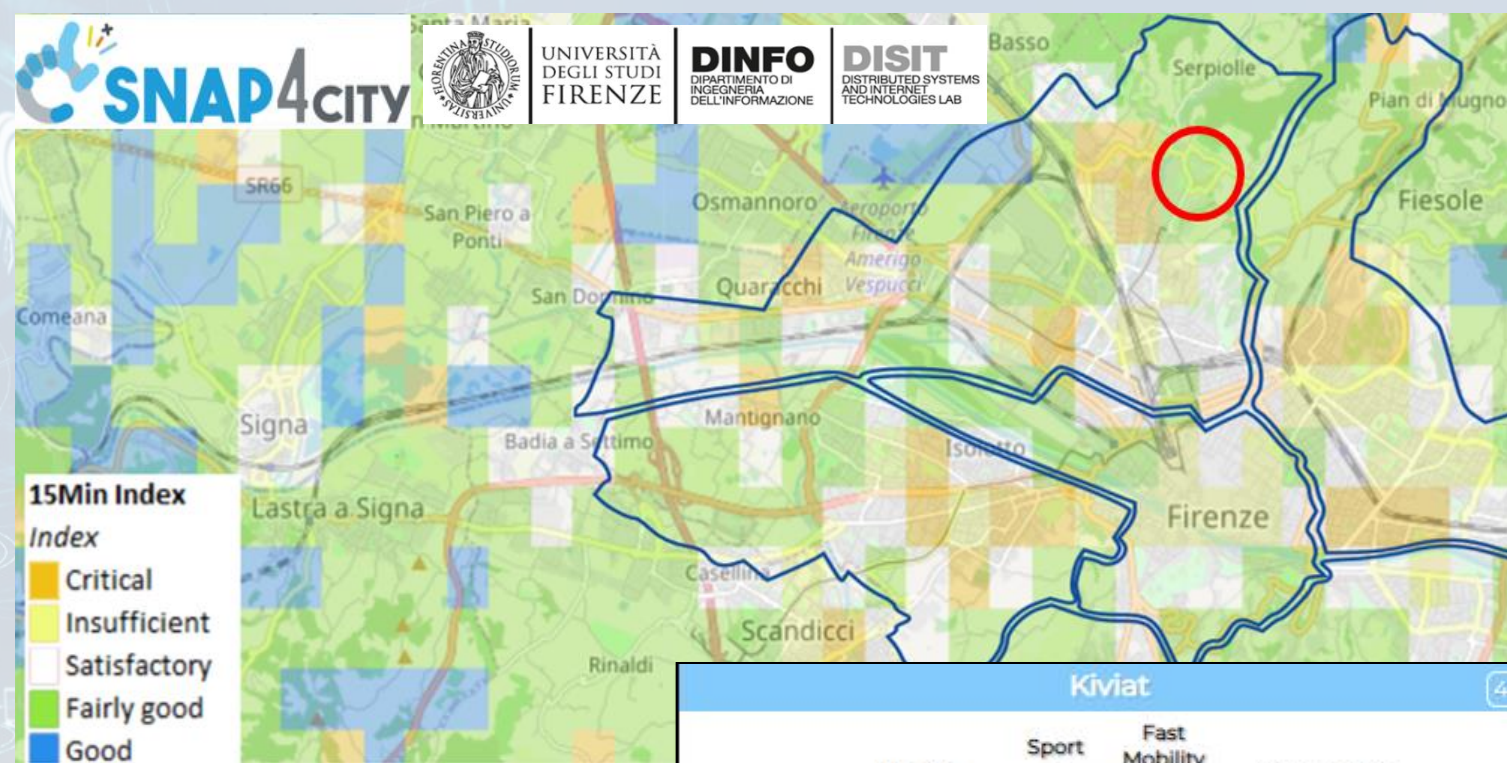
Using the Open Data:

We developed a data analytic tool based on municipal and national open data to assess services adequacy for people living in each 15 minutes areas of the city.

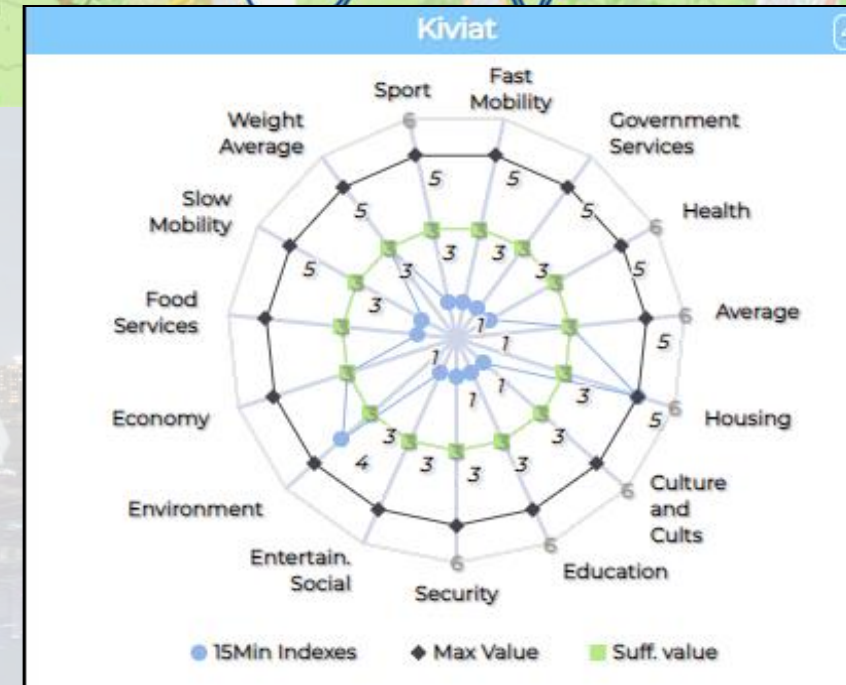
Good public transport services: bus, new tram line, train stations, cycle paths.



Careggi/Rifredi is a relevant district in Florence because of hosting the main Florence/Tuscany hospitals Careggi and Meyer, but also university headquarters and many other workplaces.



The tool supports the becoming of a 15-Minute city evaluating the service level in various domains.



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MjkzOA==>

15MinCityIndex on Bologna



Ciao roottooladmin!

Tue 3 May 20:14:59

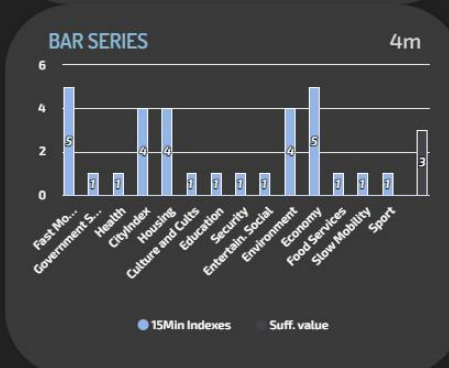
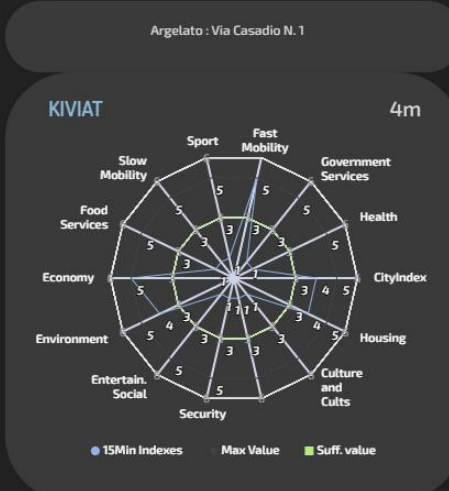
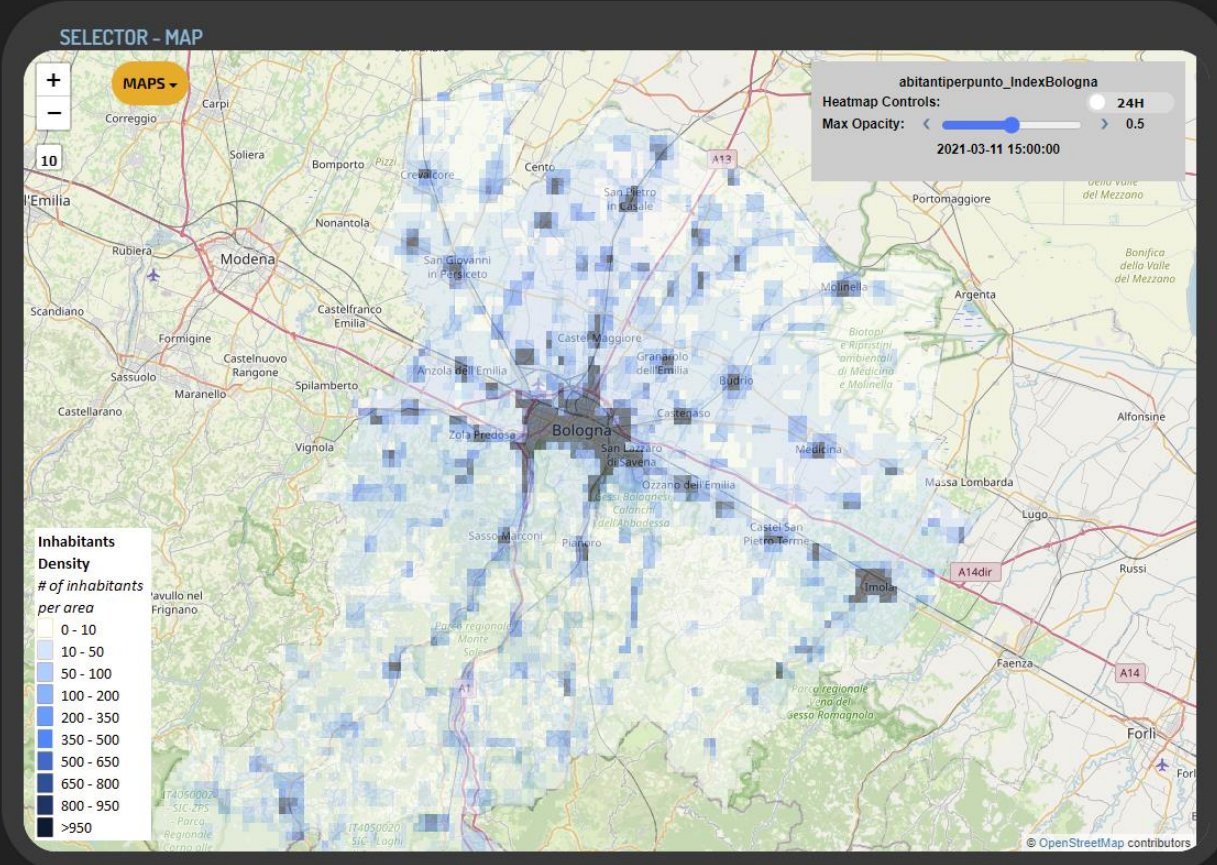
15 MINUTI INDEX BOLOGNA CITTÀ METROPOLITANA - NEWGUI



- # of Inhabitants >
- Green factor >
- Civil factor >
- Industrialization factor >
- Environment Index >
- 15Min Economy Index >
- 15Min Housing Index >
- 15Min Health Index >
- 15Min Food Index >
- 15Min Education Index >
- 15Min Slow Mob Index >

THE PICKED POINT 9m

City: Argelato
Address: Via Casadio N. 1
Lat,lon: 44.61882,11.35437



1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

7 AFFORDABLE AND CLEAN ENERGY

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

15 LIFE ON LAND

IoT App....

Snap4City

User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7
[Logout](#)

- My Snap4City.org
- Dashboards
- My Dashboards in All Org.
- Dashboards of My Organization
- My Dashboards in My Organization
- Extra Dashboard Widgets
- Notifier
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
 - IOT Applications
 - MicroServices for IOT Applications
 - MicroServices from DataAnalytic
 - IOT MicroServices for Final Users
 - IOT MicroServices for Developers
 - Doc: IOT Applications
 - How to Develop IOT Applications
 - Create A MicroService from RestCall
- IOT Directory and Devices
- Resource Manager
- Development Tools
- Management
- Decision Support Systems
- Settings
- User Management and Auditing
- Help and Contacts

15MinIndex

Node-RED

filter nodes

GPS to COMUNE | GPS to COUNT | GPS to HeatmapVal | GPS to Florence Qu | GPS to ZCS | GPS and Values to | GPS to Civic Numbe | GPS to Road Length | GPS to Cycl

subflows

- InjectedTimes

input

- inject
- catch
- status
- link
- mqtt
- http
- websocket
- tcp
- udp
- amqp2
- stomp

output

- debug
- link
- mqtt
- http response
- websocket
- tcp

Smart City Control Room

Florence Metropolitan City



reference



- **Multiple Domain Data**

- Thousands of Open/Private data, POI, IOT, etc.
- **mobility and transport:** accidents, public transport, parking, traffic flow, Traffic Reconstruction, KPI, ...
- **AND:** environment, civil protection, gov KPI, covid-19, social & social media, people flow, tourism, energy, culture, ...

- **Multiple dash/tool Levels & Decision Makers**

- Real Time monitoring, Alerting, quality assess.
- Predictions, KPI, DSS, what-if analysis

- **Historical and Real Time data**

- Billions of Data

- **Services Exploited on:**

- Multiple Levels, Mobile Apps, API

- **Since 2017**



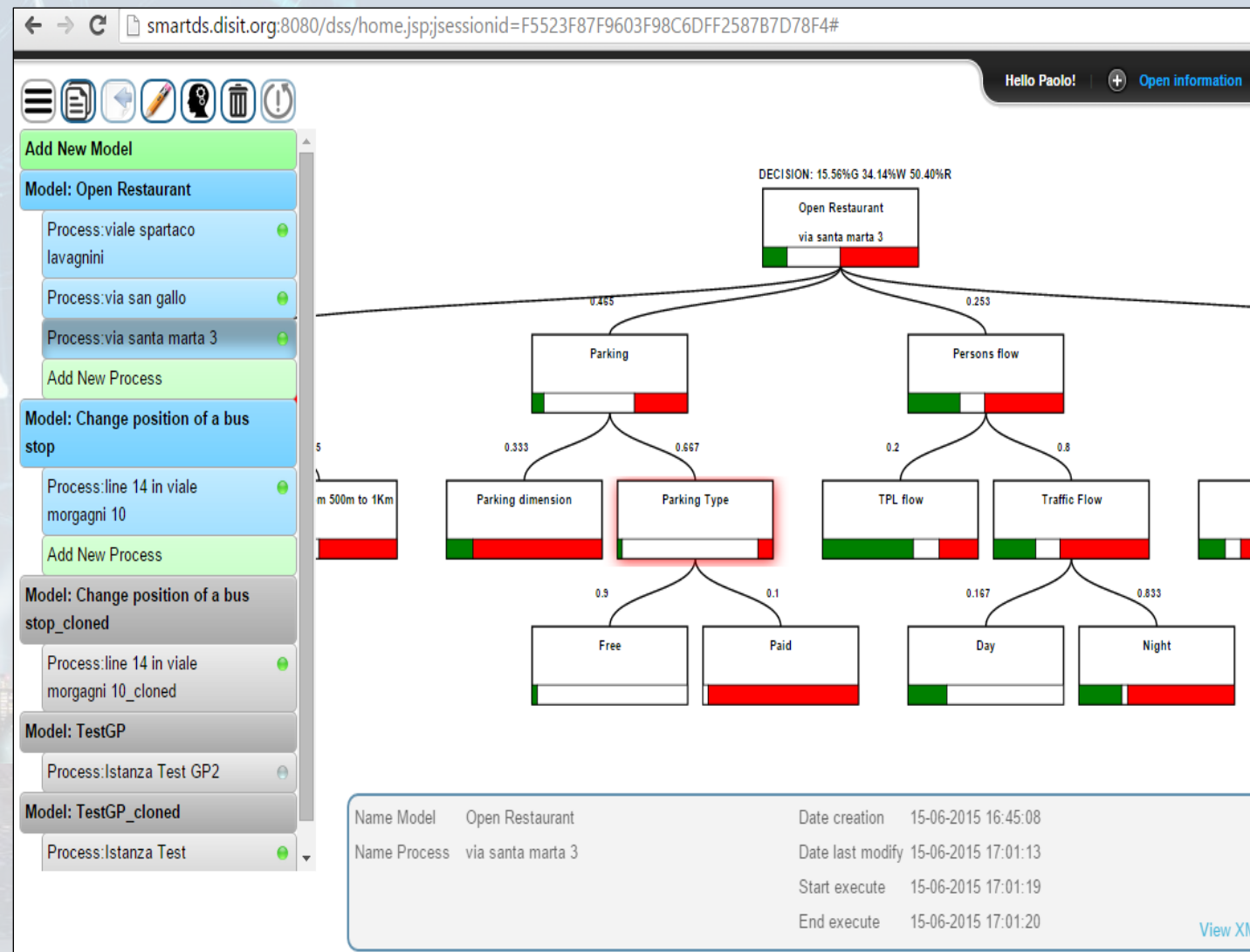
<https://www.snap4city.org/747>



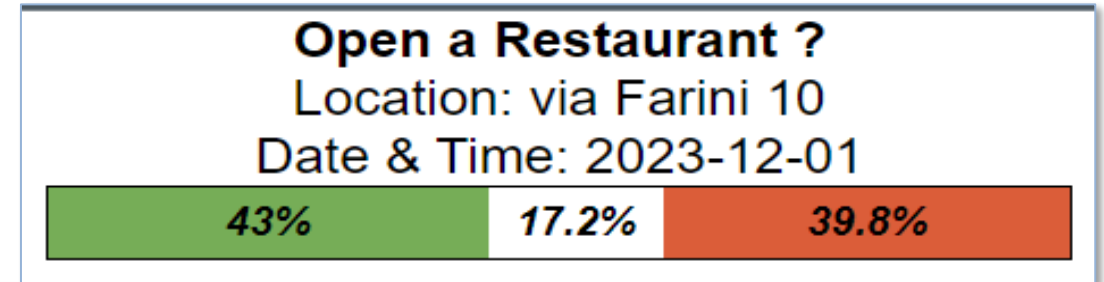


Smart Decision Support, system thinking

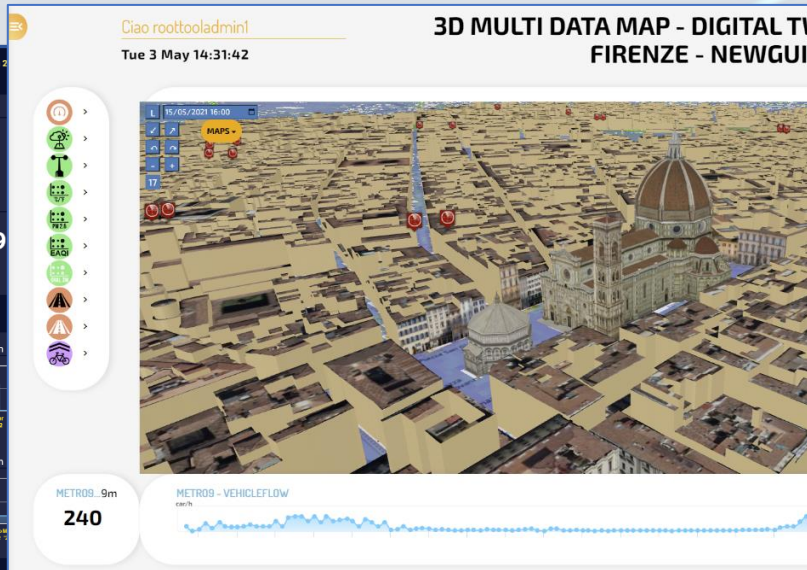
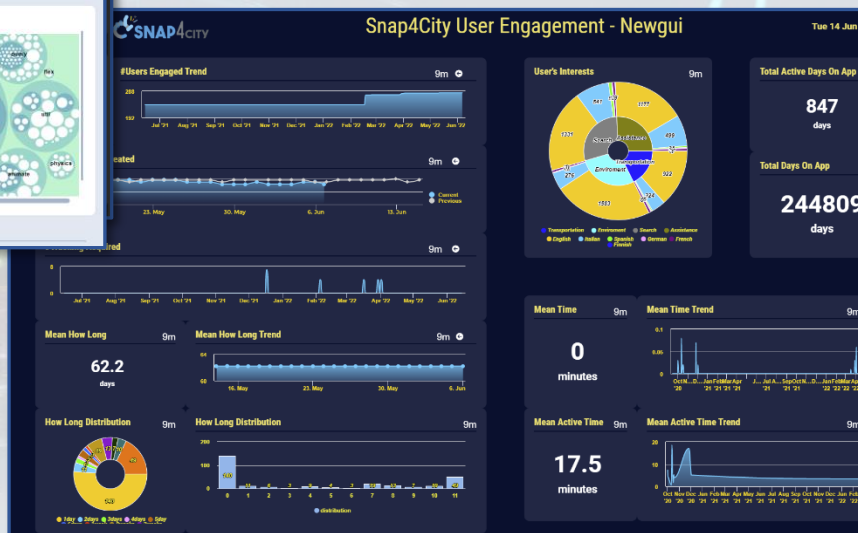
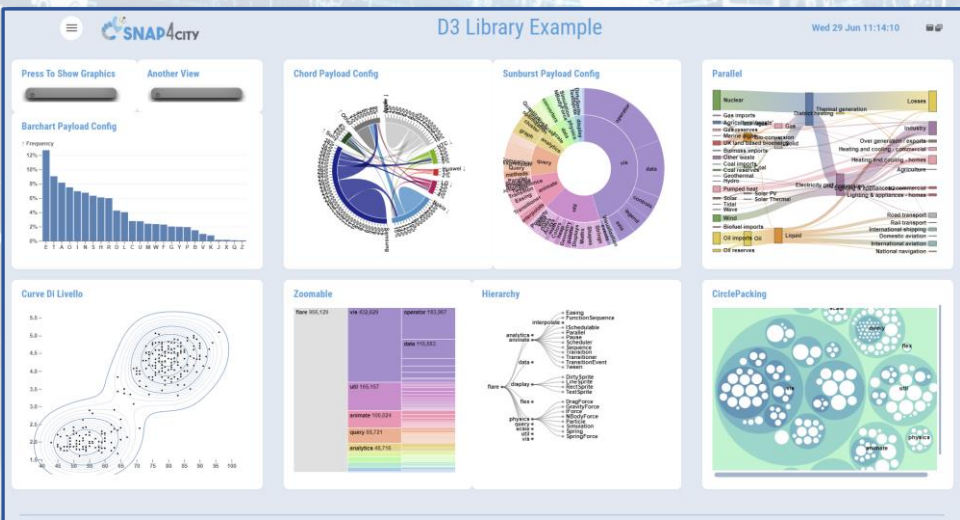
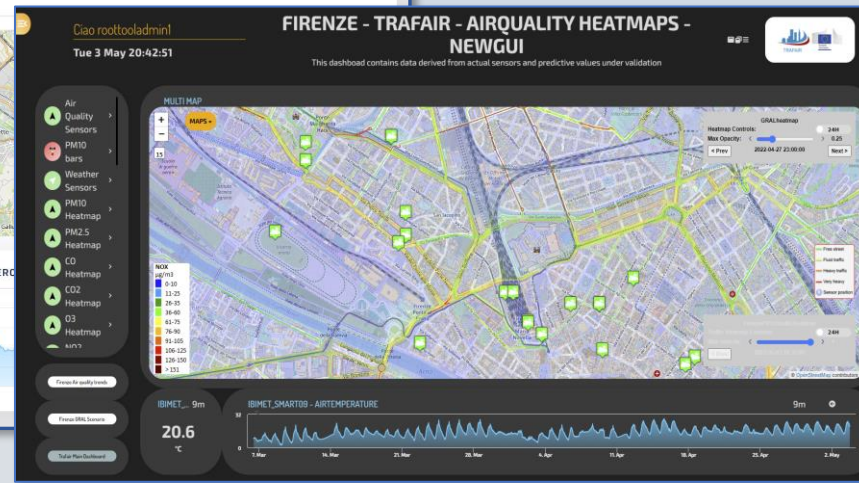
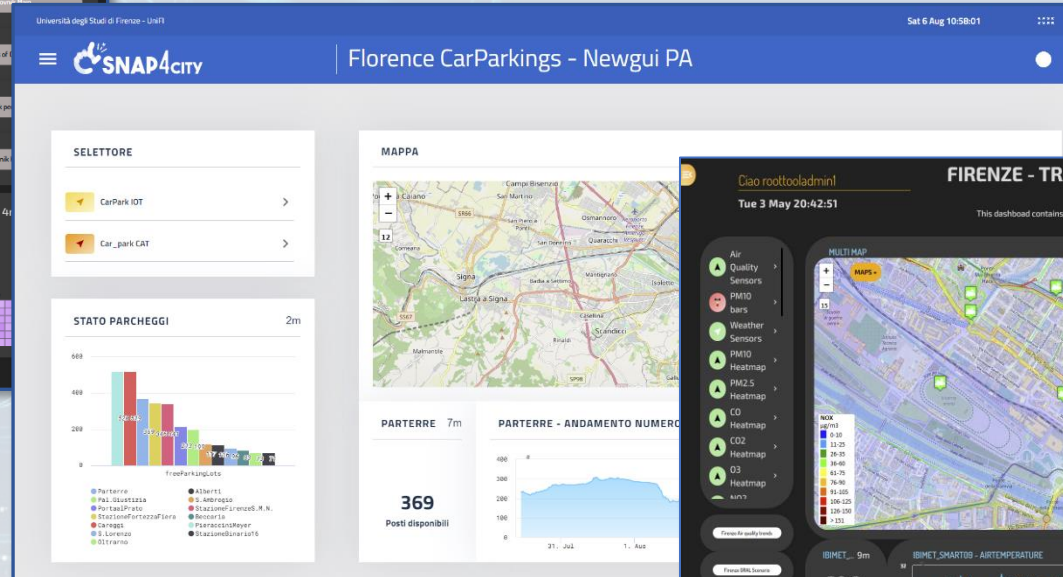
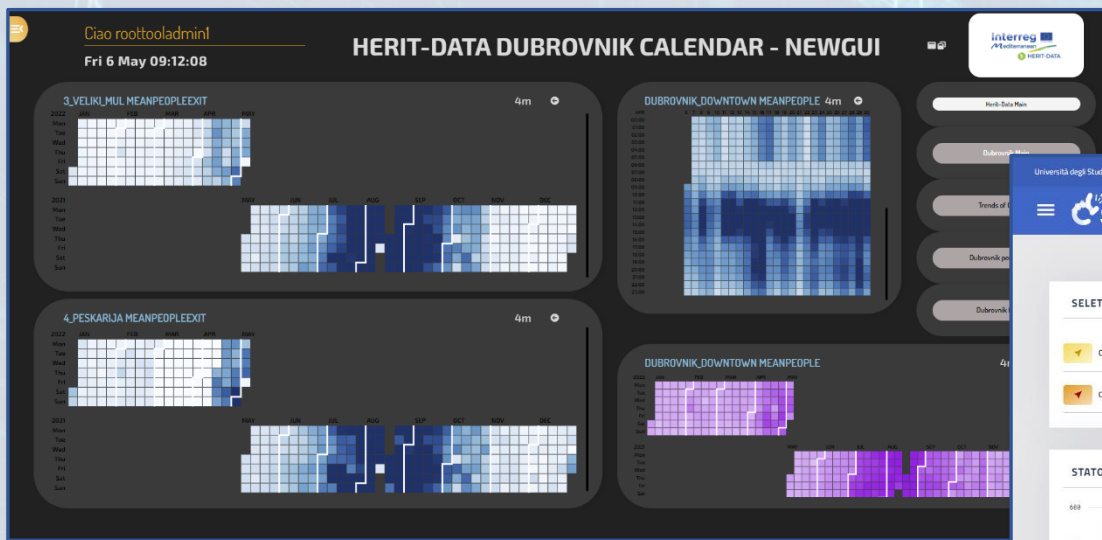
- **Smart Decision Support System** based on System Thinking plus
- Actions to city reaction, resilience, smartness, ...
- Enforcing Mathematical model for propagation of decision confidence..
- Collaborative work, ...
- Processes connected to city data: DB, RDF Store, Twitter, etc.
- Production of alerts/alarms
- Data analytics process
- Twitter Processes
- reuse, copy past, ...



- Supports the definition of the **Decision Tree Model, DTM**, in terms of System Thinking, with Italian Flag and combinations
- Allows the **statistic composition** of subDecisions probabilities
- **Generating a DTM as an IoT App,**
- **IoT Apps with DTM can**
 - be customized
 - **compute root values in real time in any context: location, parameters, etc.**
 - Single DTM root value can be produced on Dashboard
 - Several DRM root values can be represented on dashboard as heatmaps for Green/White/Red values



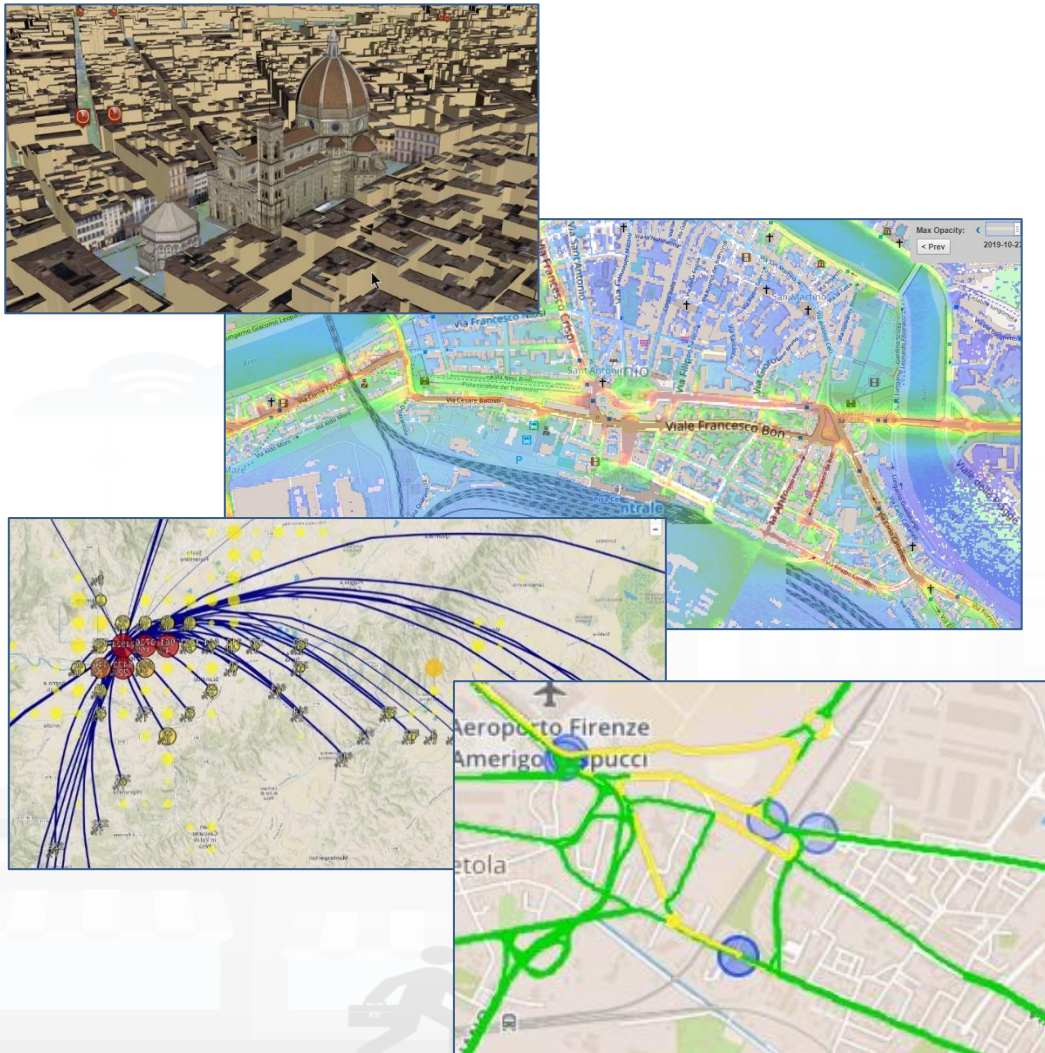
Different Themes



New styles/themes can be developed by specializing a few files from open source

<https://www.snap4city.org/793>

Smart City Digital Twin City Digital Model with...



- Intuitive platform
- Any Data TYPE, any data source, any protocol
- Data storage seamless
- Data analytics → artificial intelligence, AI/XAI
- Data Ethics, AI Ethics, GDPR
- Data Representation, any kind
- Key Performance Indicators, any kind
- What-IF analysis – Simulation, prediction, 2D/3D
- Micro, Meso e macro scales
- Operation, planning tactic and strategic
- Collaborative and shared representation
- Sustainable, shared, open source 100%

Complex and heterogeneous information, interoperability

- GIS, ITS, AVM, IoT, BIM, CKAN, etc.
- Satellite services
- MaaS, last-mile delivery HUBs
- etc.



Ciao roottooladmin!

Fri 2 Sep 19:13:07

3D MAP GLOBAL DIGITAL TWIN - NEWGUI



3D MAP

Enable Lights

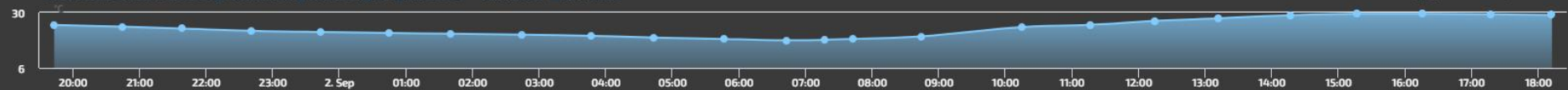
Datetime: 02/08/2022 10:11

Enable dynamic shadows (experimental)

Free street
Fluid traffic
Heavy traffic
Very heavy
Sensor position

FirenzeFIPILITrafficRealtime
Traffic Heatmap Controls: 24H
Max Opacity: 1
< Prev 2022-09-02 18:56:00

DISIT:ORIONUNIFI:TUSC_WEATHER_SENSOR_OW_3176959 - AIRTEMPERATURE



Ciao

Fri 13 Oct 18:29:18

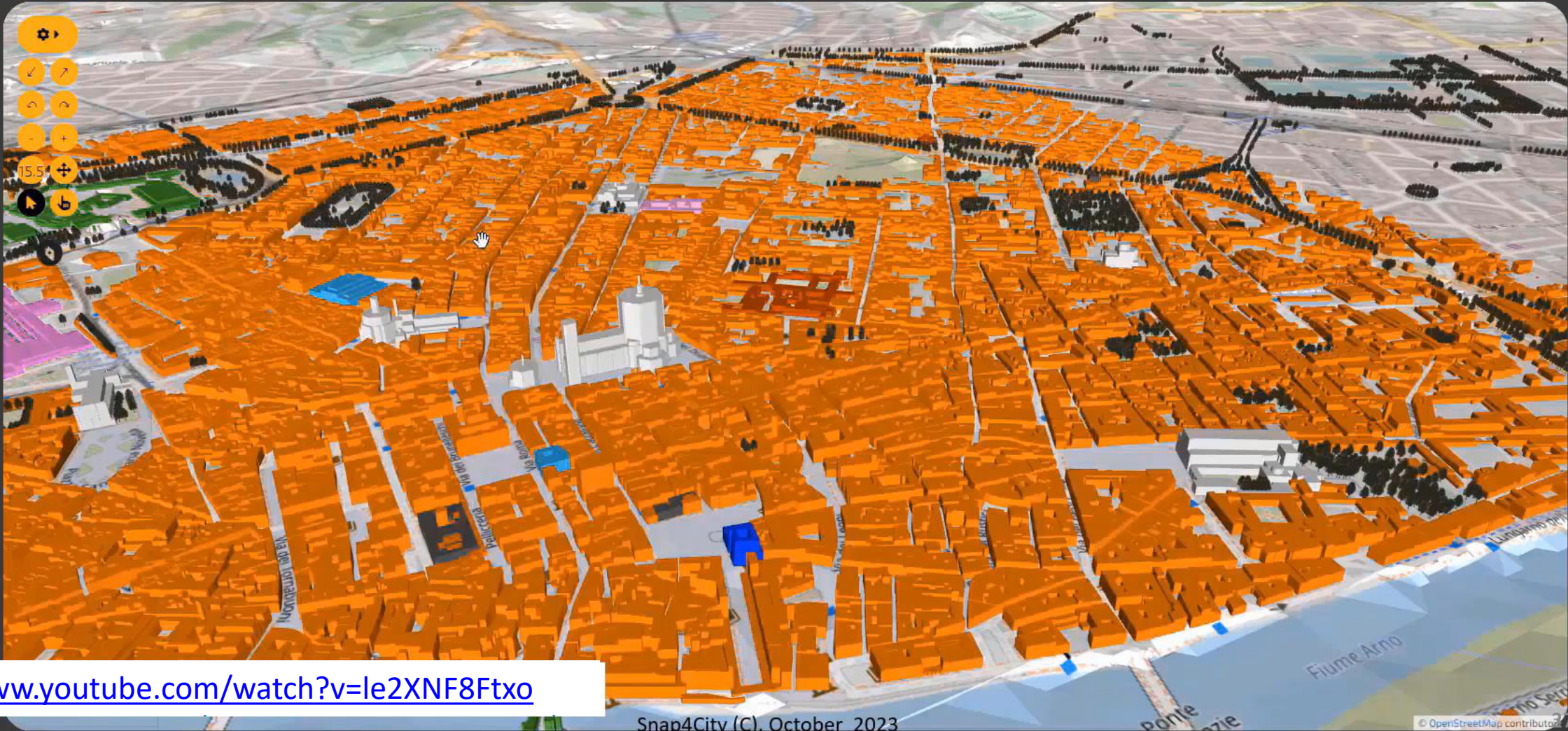
FLORENCE SCDT

SELECT...

- GRAL HD
- NO 2
-
-
-
-
-
-
- WHAT-IF
-
-

DOUBLE MAP

Map navigation controls including zoom in (+), zoom out (-), home, and a scale indicator showing 15.5.



<https://www.youtube.com/watch?v=le2XNF8Ftxo>



UNIVERSITÀ
DEGLI STUDI
FIRENZE

DINFO
DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

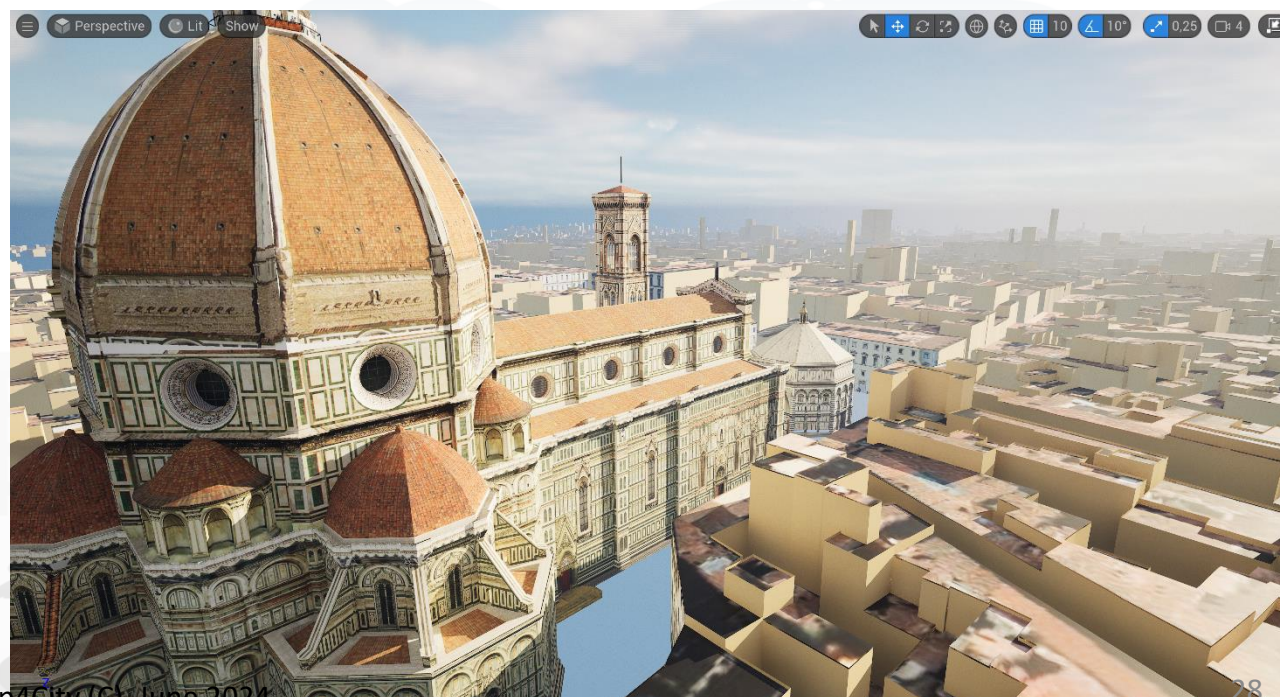
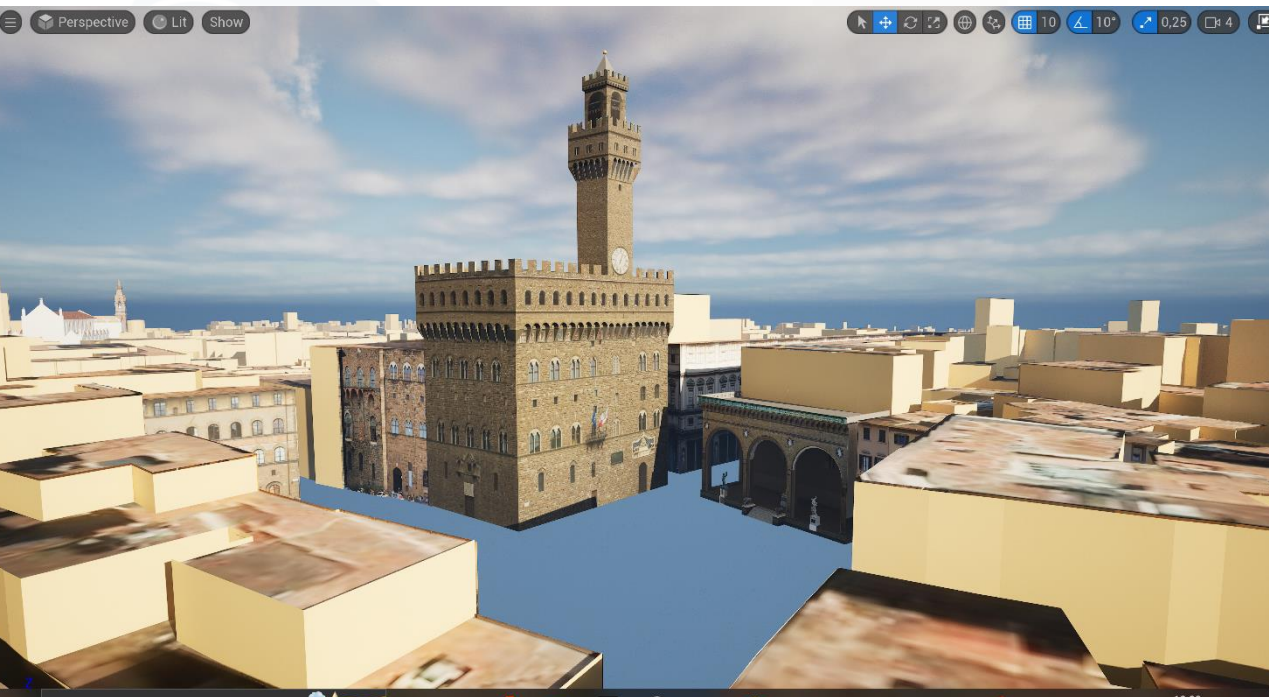
DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB



SNAP4CITY



OCULUS



SNAP4CITY (C), June 2024



Exploiting Google API with Snap4City engine

- Select any city/locality and see if 3D Representation of your city is Available
- Snap4City re-rendering and distribution engine allows to
 - Optimize distribution of data
 - Integrate any kind of data on Digital Twin with 3D tileds of Google
 - PIN, IoT Data
 - Traffic Flows
 - Cycling paths
 - 3D shapes superimposed
 - Etc.

Snap4City Digital Twin Engine and data + 3D Google Data





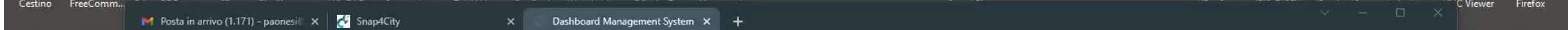
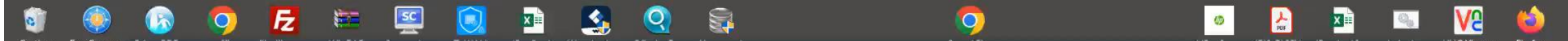
UNIVERSITÀ
DEGLI STUDI
FIRENZE

DINFO
DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

DISIT
DISTRIBUTED SYSTEMS AND
INTERNET TECHNOLOGIES LAB
DISTRIBUTED DATA INTELLIGENCE

Firenze

SNAP4CITY



☰
SNAP4CITY
Florence Testing
Mon 18 Sep 17:40:57

Selector

- ▶
- ▶
- ▶
- ▶
- ▶
- ▶
- ▶
- ▶
- ▶
- ▶
- ▶

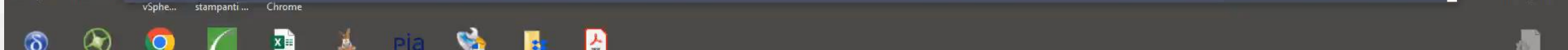
Double Map

OBS è già in esecuzione

?

OBS è già in esecuzione! A meno che non si intendeva effettuare questa operazione, chiudere tutte le istanze esistenti di OBS prima di provare a eseguirne una nuova. Se avete OBS impostato per minimizzarsi nell'area di notifica, si prega di controllare per vedere se è ancora in esecuzione.

Avvia comunque
Annulla



Paolo Nesi - Google Scholar | Snap4City | Snap4CityDocker | Dashboard Management System | St. Stephen's Cathedral - Google

Non sicuro | dashboard/dashboardSmartCity/view/Baloon-Dark.php?iddashboard=MTY=

App | Maps | Google | Gmail | Snap4City | Snap4 | Calendar | Translate | Google Scholar Cita... | DISIT | DISIT old | Facebook | DataCenter | Trello | Km4City major tools | Impostazioni | YouTube | Google Forms | News | Qnap15sek7gyfe

Ciao

Mon 18 Sep 18:25:55

GOOGLE TEST

SELECT...

- 100%
- NO ?
- Bar chart
- Line graph
- Bus
- WHAT-IF
- Car
- Bicycle

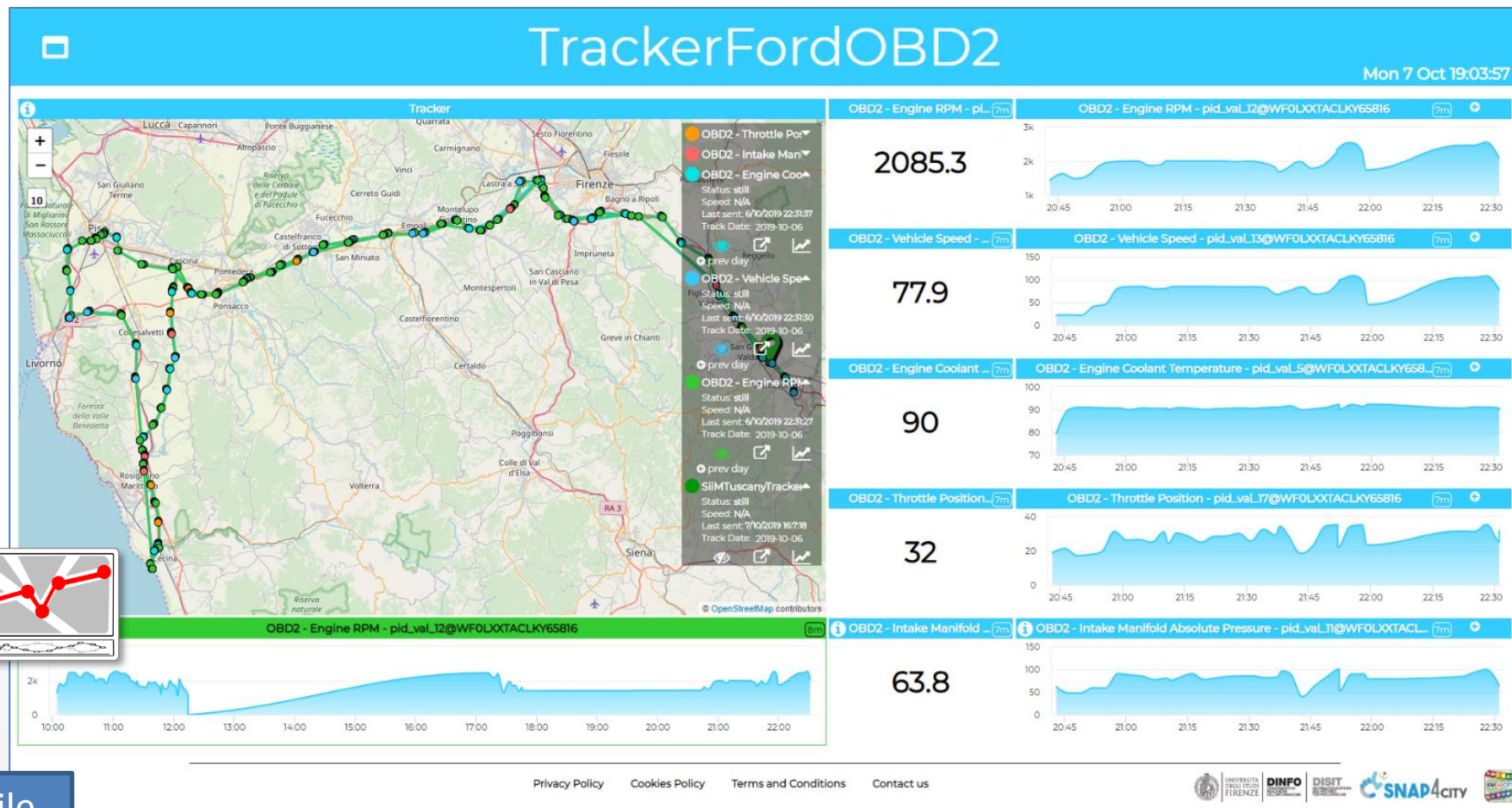
DOUBLE MAP

© OpenStreetMap contributors

Snap4City (C), June 2024

MyKPI: Tracking of Devices and Mobiles

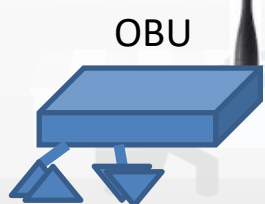
- Real Time Trajectories for
 - Mobile Phone
 - Moving IOT Devices
 - OBU, Vehicular Kits
 - Multiple tracks
 - Day by day
- Micro Application



Mobile
PAX Counter

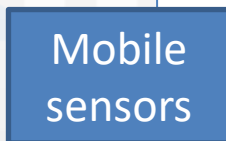


Apps



OBU

OBD2



Mobile
sensors

Custom Dynamic Pins



Custom Pins on Map - test GP

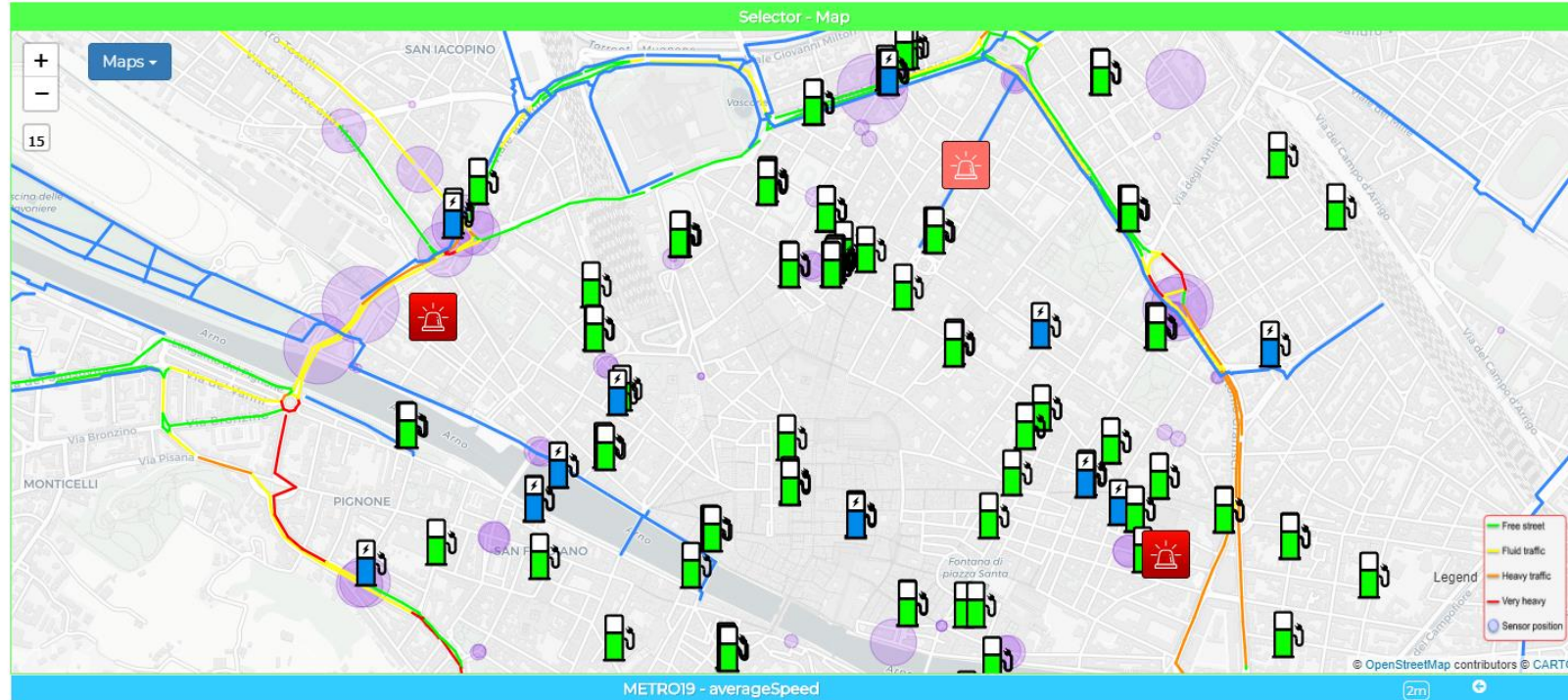
Sat 31 Oct 11:35:41



Selector



METRO19 - avera... (2m)

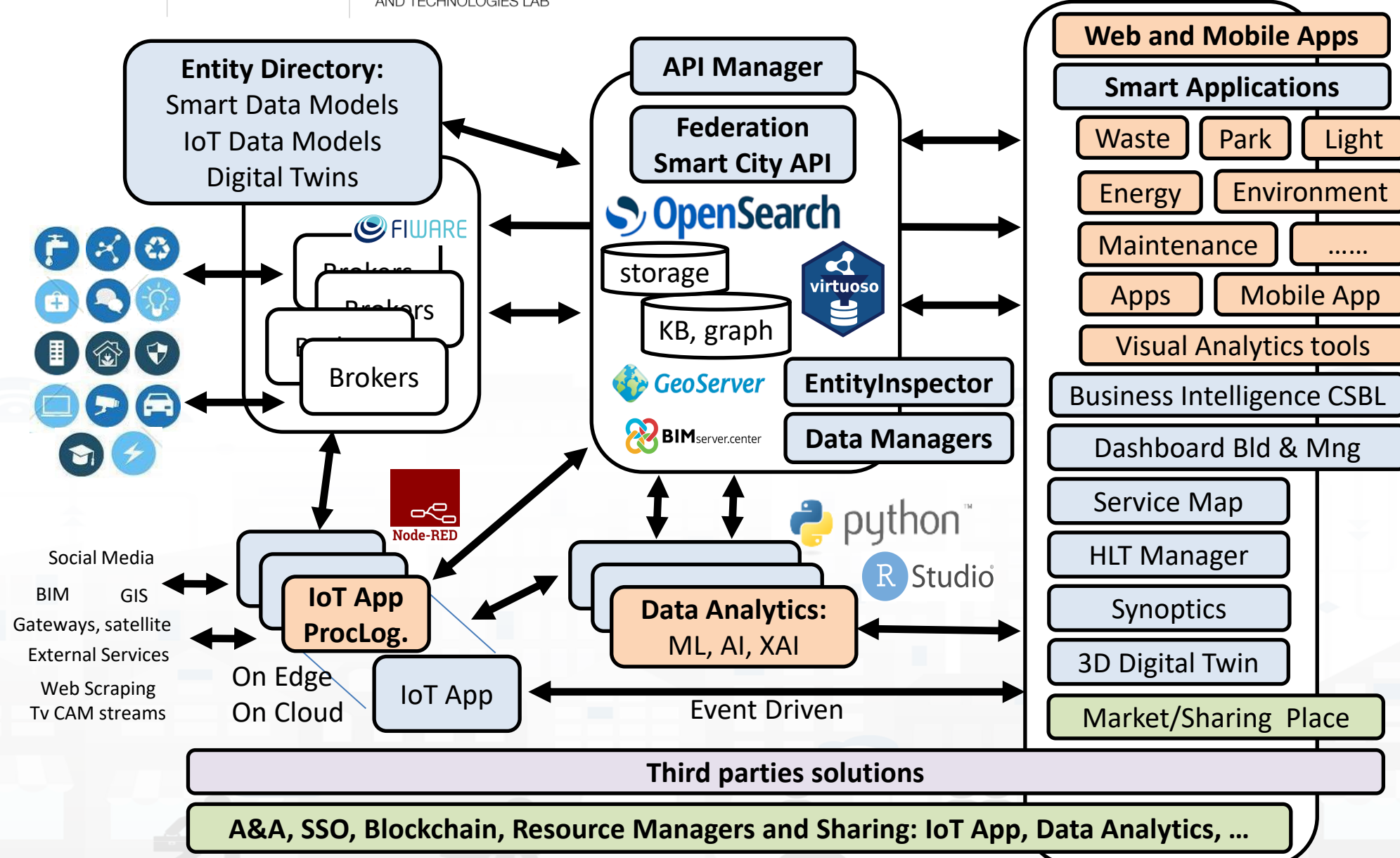


0.1

Km/h



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=Mjk5MA==>



Decision Support System:

Immediate response and Tactical and Strategic Plans, via What-if Analysis

FORGING & MANAGING OPEN AND CLOSED ECOSYSTEMS

IOT APPLICATIONS AND DEVICES

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM, OPENED TO DEVELOPERS AND STAKEHOLDERS

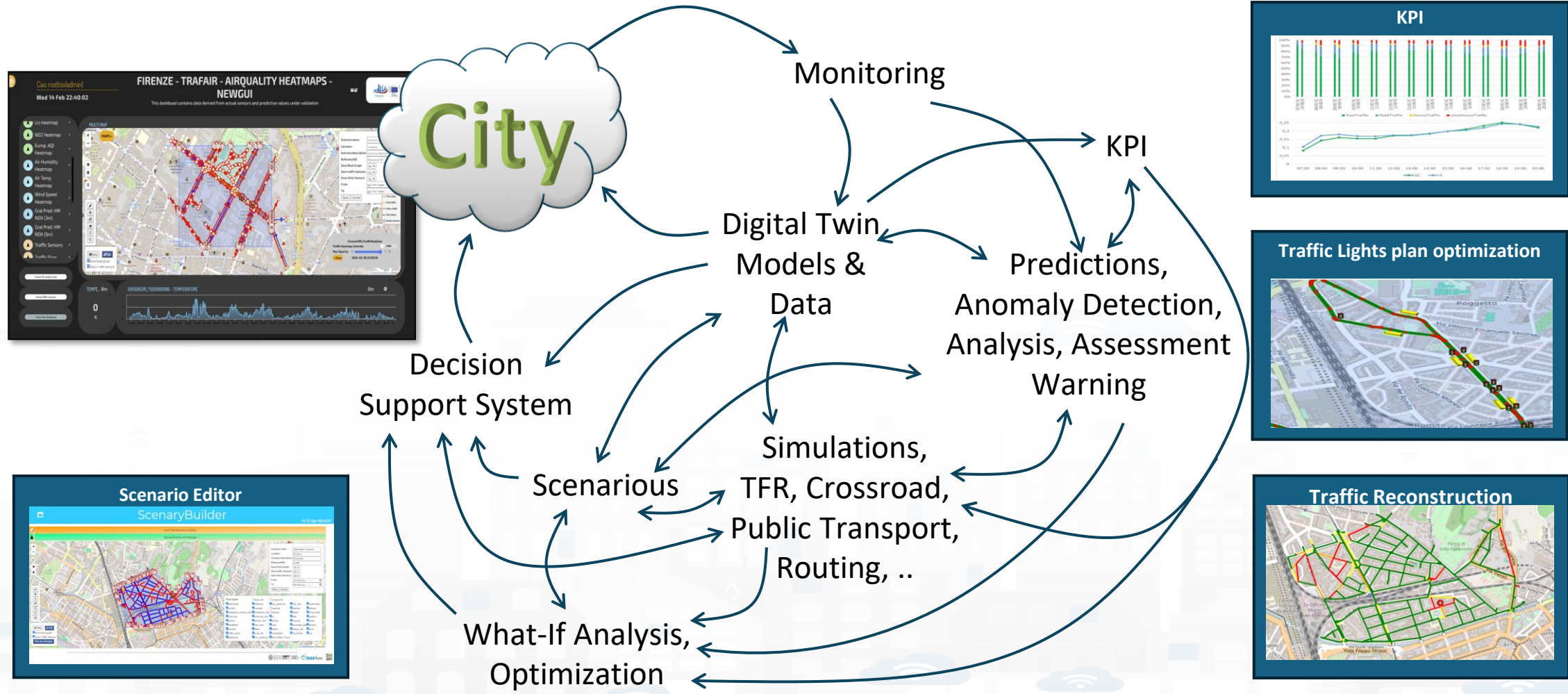
SNAP4CITY AND KM4CITY PROJECTS

FROM CITY DASHBOARD TO APPLICATIONS



NAP4CITY THE VIEW OF THE ADMINISTRATORS





For example:

Select map

Zoom

New Scenario

Editing

Drag & drop

Split & Join

Delete

Do and Undo

Scenario name:

Location:

Scenario description:

ReferenceKB:

Save Road Graph:

Save traffic Sensors:

Save other Sensors:

From:

To:

Save

Category Street:

Nr.Lanes:

Speed Limit (km/h):

Direction:

Restrictions:

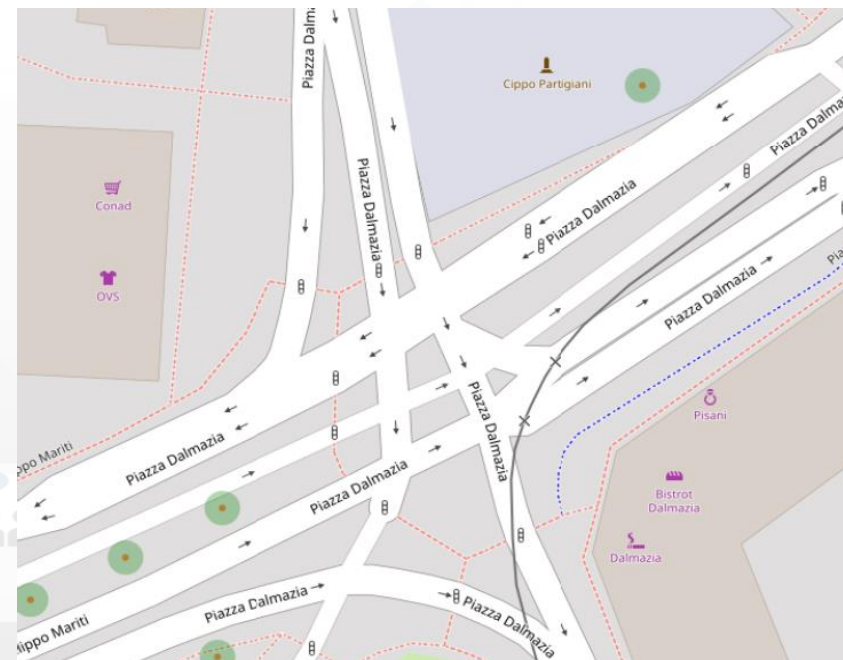
Edit Road Segment

identifier
composition
elemLocation
elementClass
elementType
length
operatingStatus
speedLimit
trafficDir
width
highwayType
route

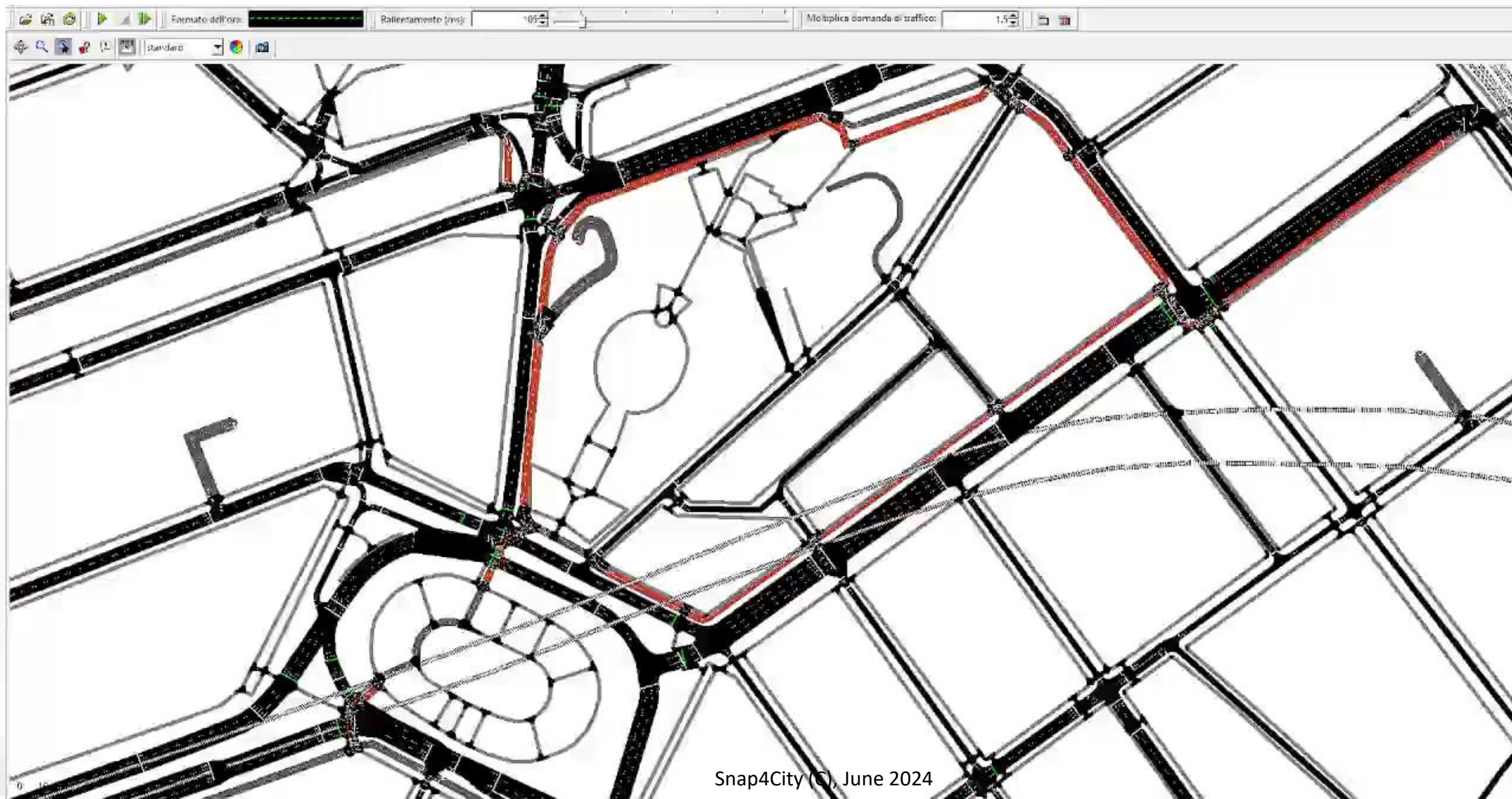
OSM data with non correct viability in Piazza Dalmazia, Firenze



After Correction of OSM data defining a correct viability of Piazza Dalmazia, Florence. Regeneration of the TILES for the maps

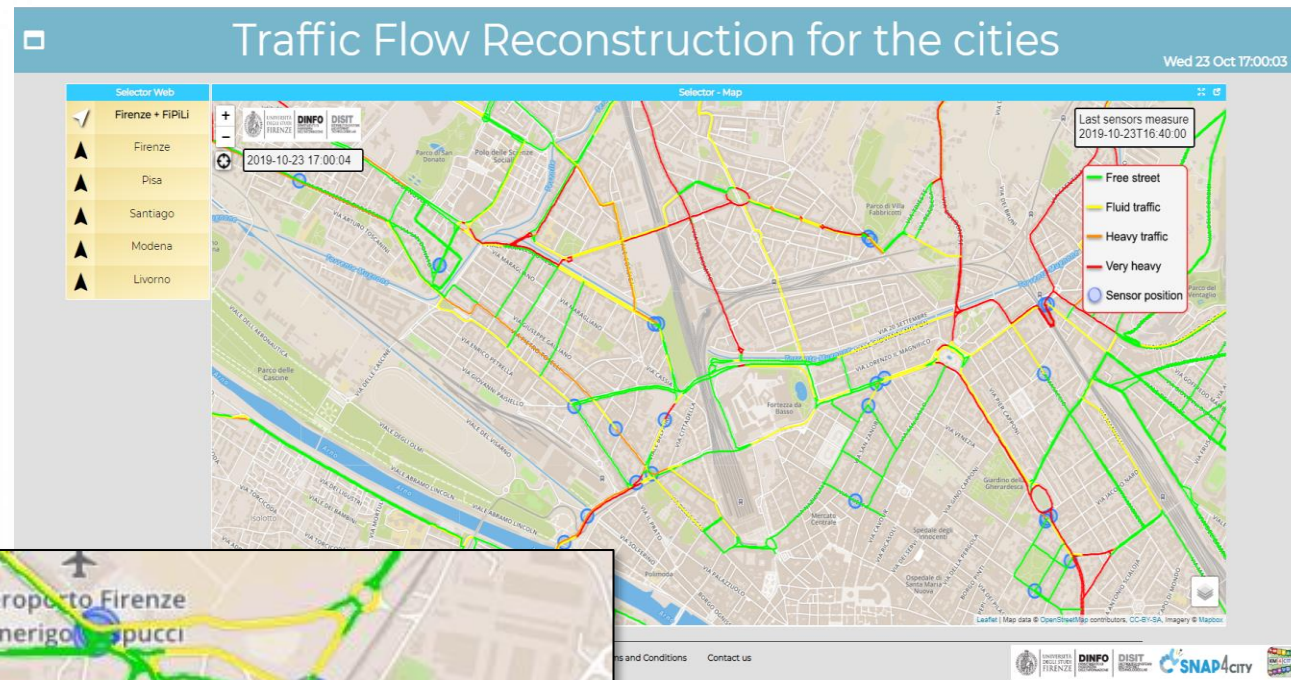


Micro Simulation



Why Dense Traffic Flow Reconstruction ?

- Making decision on mobility and transport solutions → what if analysis
- Controlling pollution
- Dynamic Routing for Firebrigade, Ambulances, general public
- Planning Public Transportation routing



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc5NQ==>

Decision Support Systems, What-if

○ Event planning, via what-if analysis

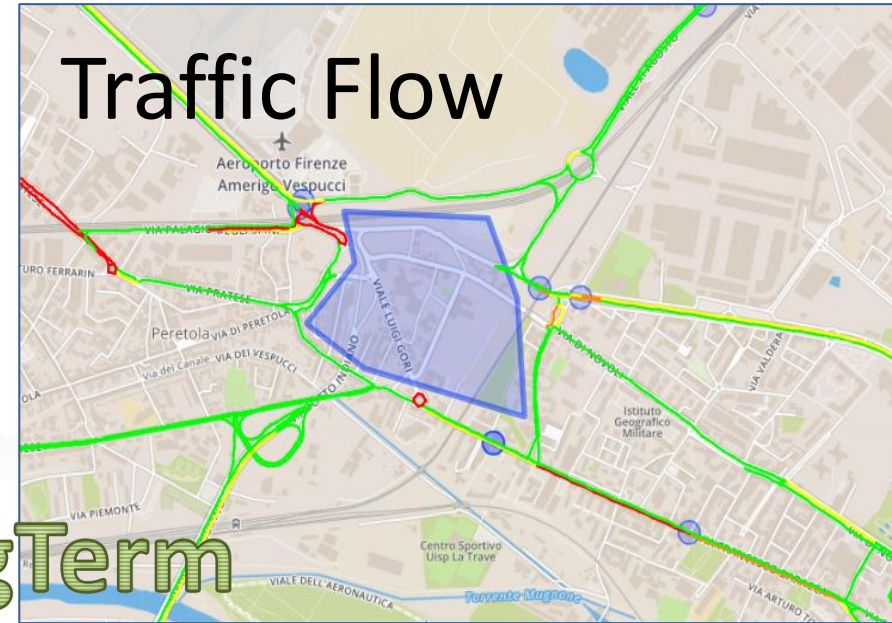
- Change in the graph structure of the city
- Impact on the flow of people and vehicles
- Adaptation: public transport, traffic, pedestrian management, etc.

○ Immediate reaction to natural events or not

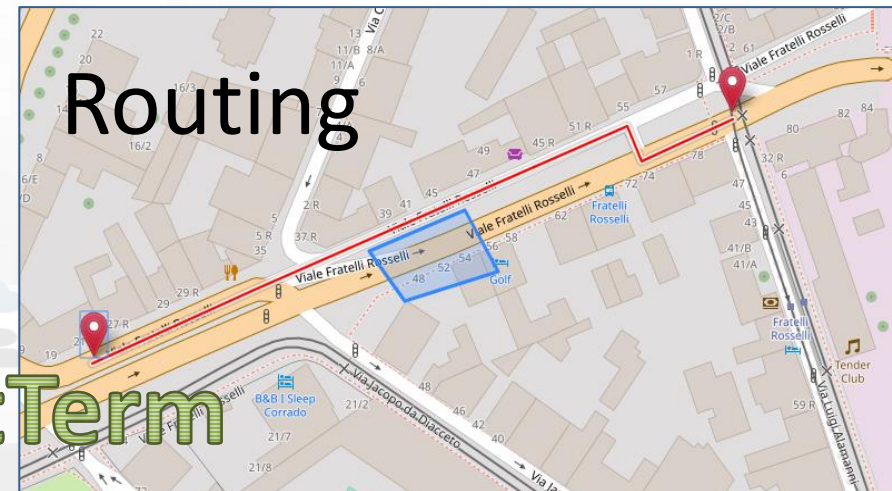
- Everything is ready and updated in real time
- Each view is contextualized in terms of data: descriptive and prescriptive

○ Digital Twin

- More detail in the context integrated data
- Greater realism in deductions and representations
- Less fragmentation and non-uniformity in the views to support decisions

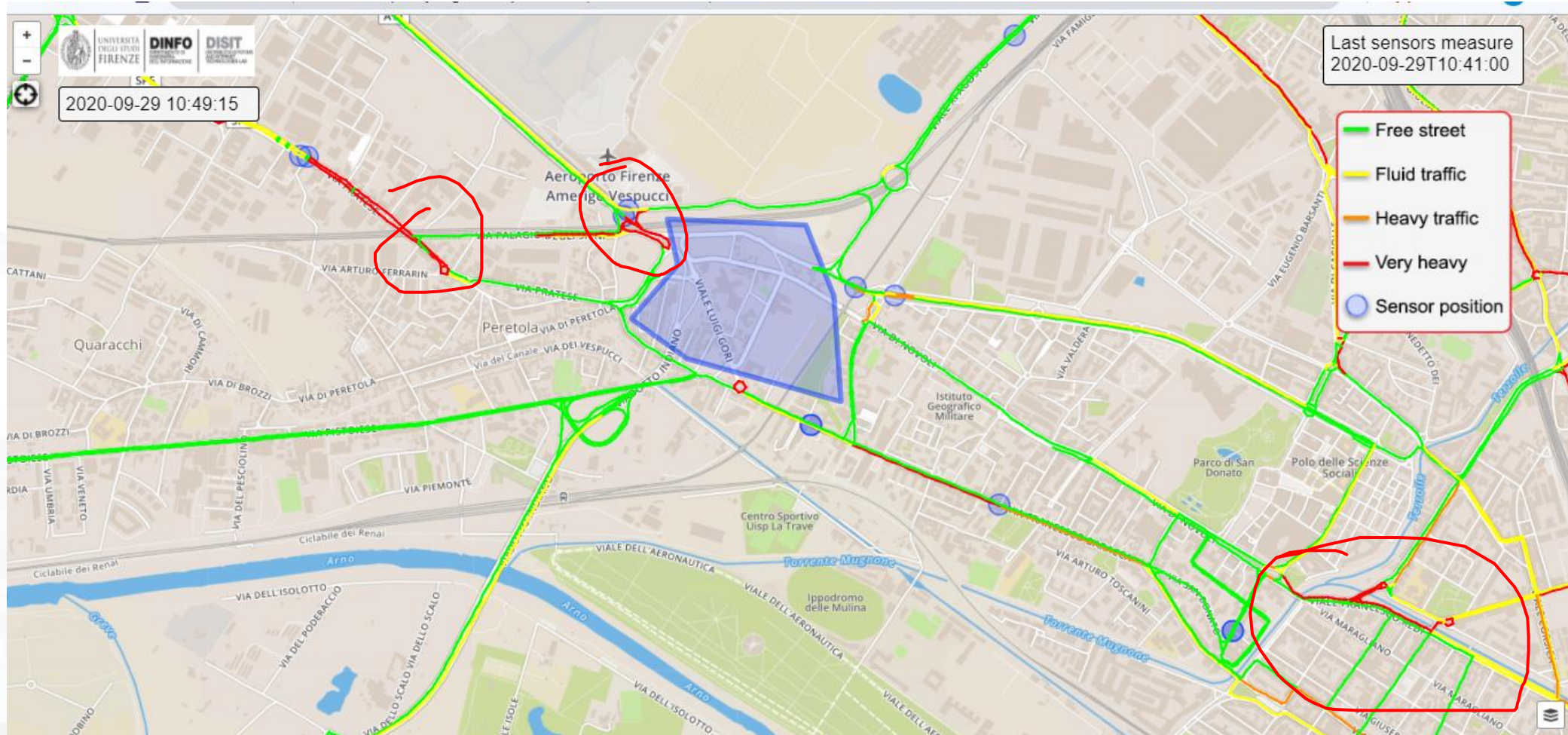


LongTerm



ShortTerm

Computation of Traffic Flow Evolution, cascade effects



Ciao roottooladmin!

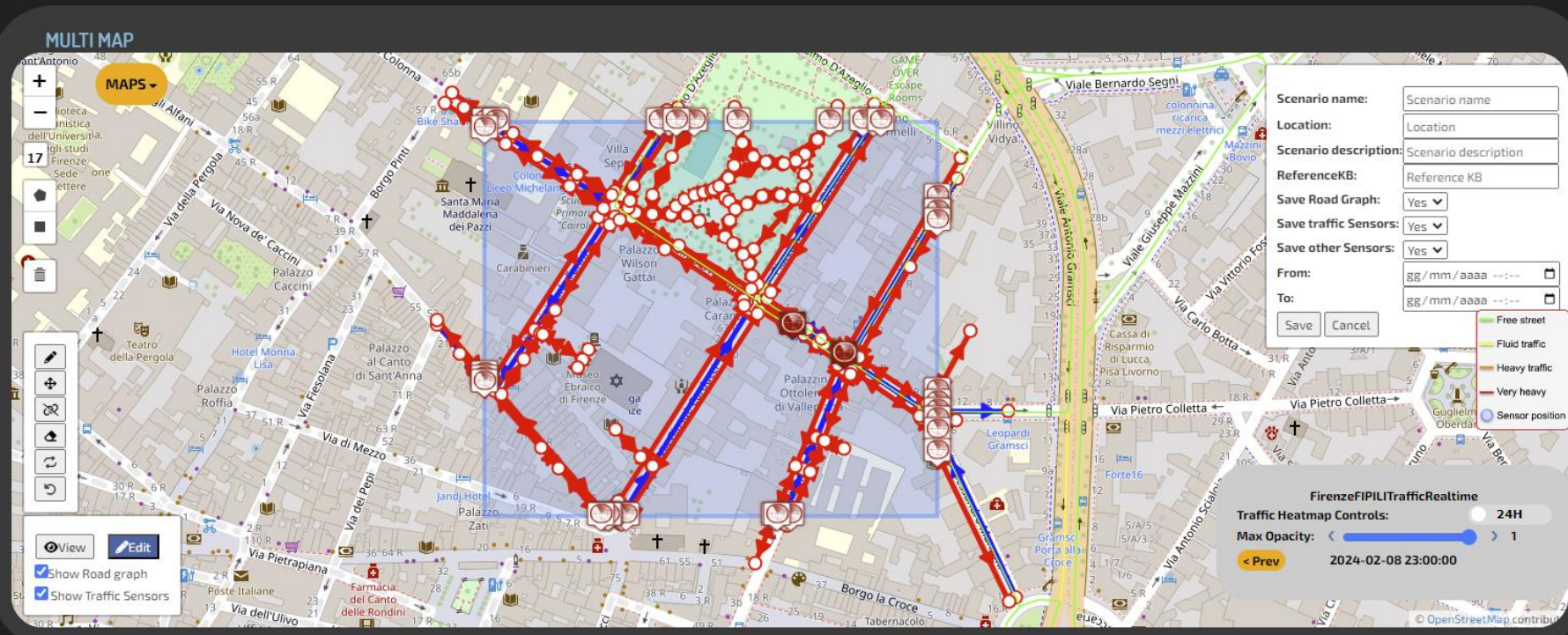
Wed 14 Feb 22:40:02

FIRENZE - TRAFAIR - AIRQUALITY HEATMAPS - NEWGUI

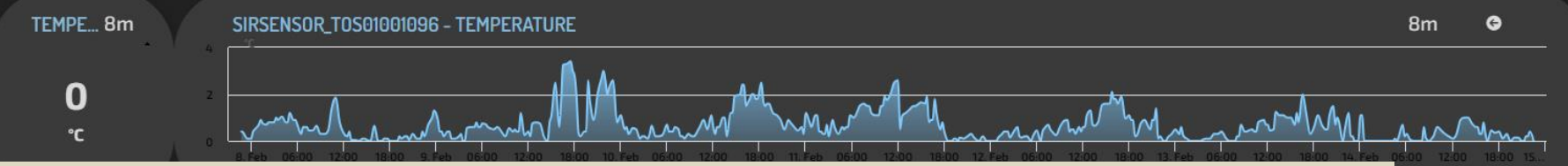
This dashboard contains data derived from actual sensors and predictive values under validation



- U3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow



- Firenze Air quality trends
- Firenze GRAL Scenario
- TraFair Main Dashboard



<https://www.snap4city.org/dashboardSmartCity/view/Baloon-Dark.php?iddashboard=MzQyMw==>

Scenario Builder

Tue 12 Mar 15:53:34

Call the Scenario Editor

Some Points of Interest

Load Scenario: Init Acc TDM

Scenarios waiting to be processed: FDSA Load Scenario

View Edit

- Show Road graph
- Show Traffic Sensors

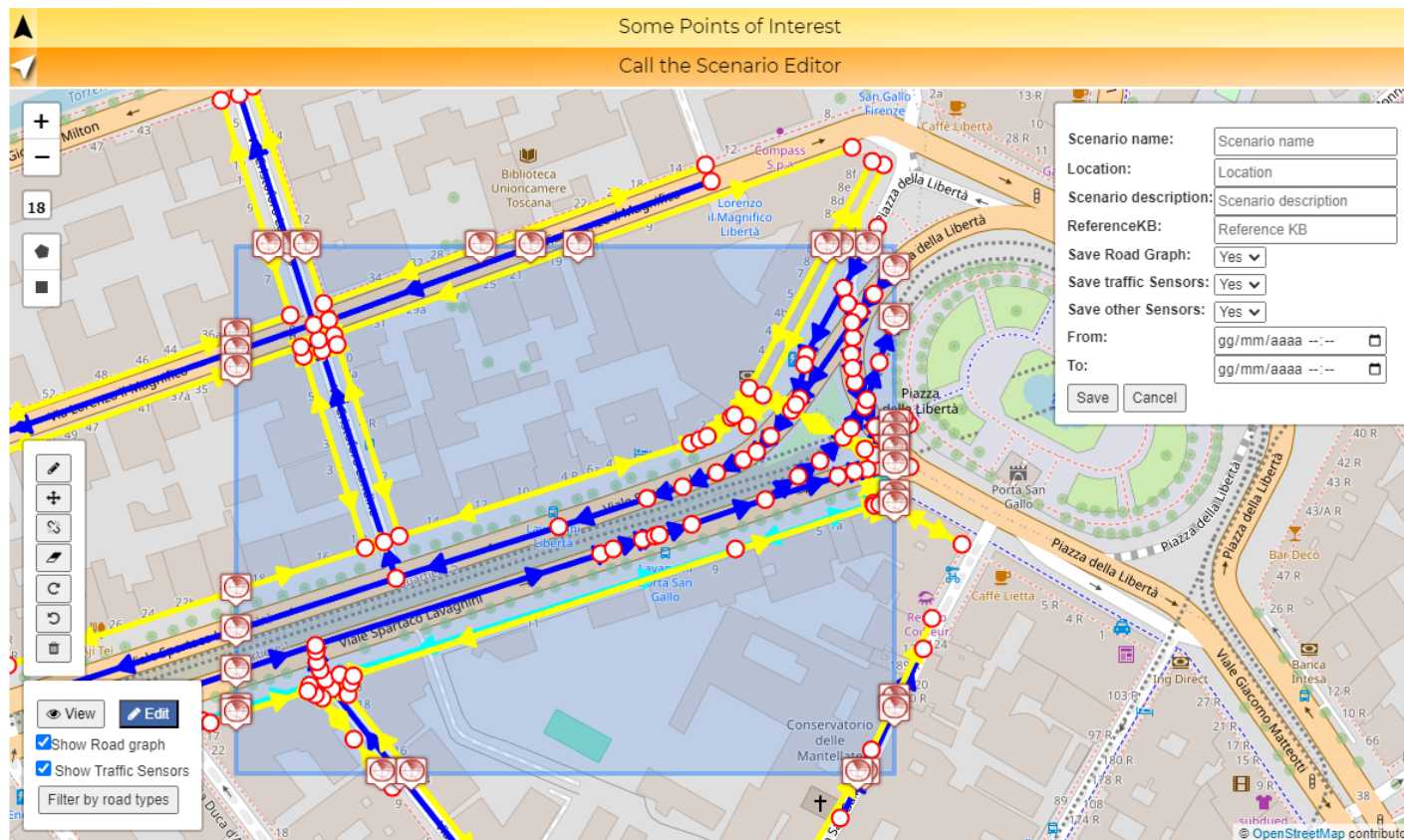
Filter by road types

© OpenStreetMap contributors

Usability Assessment

Usability Assessment for Scenario Editor

Tue 12 Mar 16:26:34



Usability Test for Scenario Editor

Your feedback is invaluable in helping us improve the user experience.

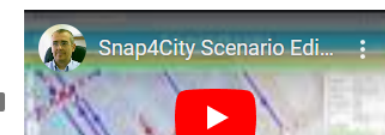
- The usability test will involve interacting with the Scenario Editor tool
- You will be asked to perform 3 tasks such as:
 - Drawing a polygon on the map to define a scenario area and see the scenarios graph
 - Modifying the scenario to exclude "primary roads" or add Point of Interest in the area.
 - Setting metadata such as name, description, fromTime, and toTime for the scenario.
- You will need to provide feedback on your experience, and suggestions for improvement.
- you will be asked to provide estimated time of completion

Thanks a lot for your participation!

paolo.nesi@unifi.it [Cambia account](#)

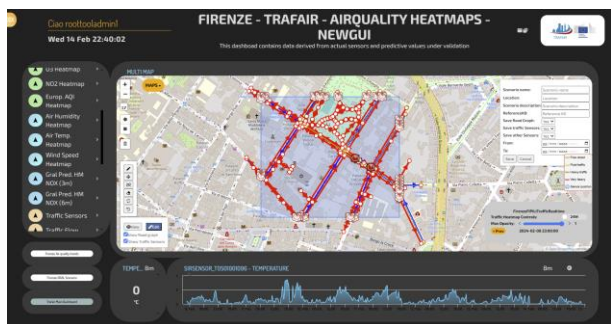
Non condiviso

Snap4City Scenario Editor, mini tutorial



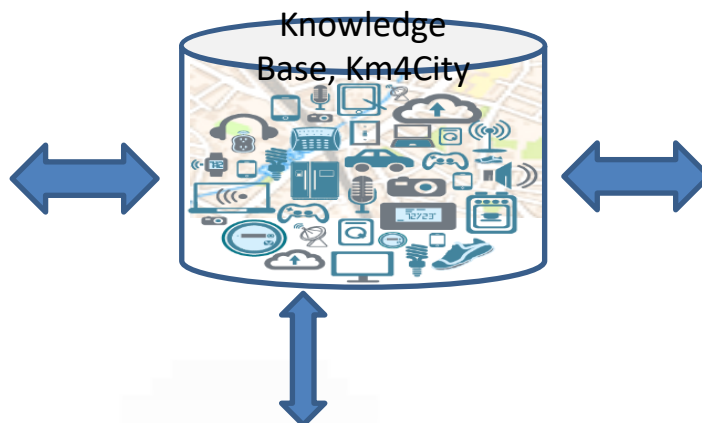
<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=NDE2MQ==>

The actual Scenario Exploitation



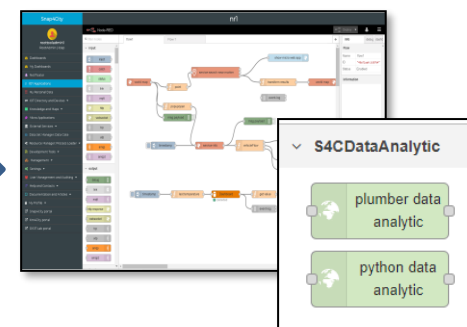
Defining Context via Editing Scenario:

- Select area and data
- Editing roads, POI, IoT entities, ..
- Save/load, share
- Change status



A Scenario includes:

- Metadata
- Status and versions, date time
- Period of validity
- Road graphs, cycling, pedestrian seg.
- List of data, sensors
- Etc.

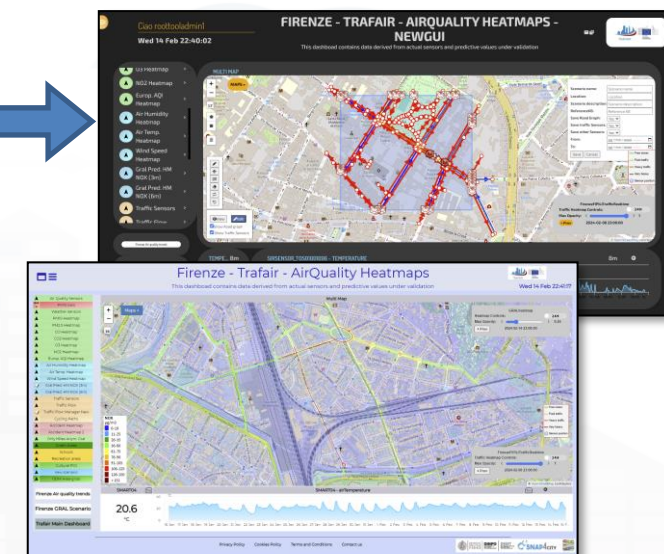


Computing in the Scenario Context as:

- KPI, Metrics, SUMI, SUMP, 15MinCity Index
- Heatmaps
- OD Matrices
- Traffic Flow reconstructions
- Predictions
- Routing, constrained routing
- Early Warnings
- Etc.

ReLoading Scenario in JavaScript

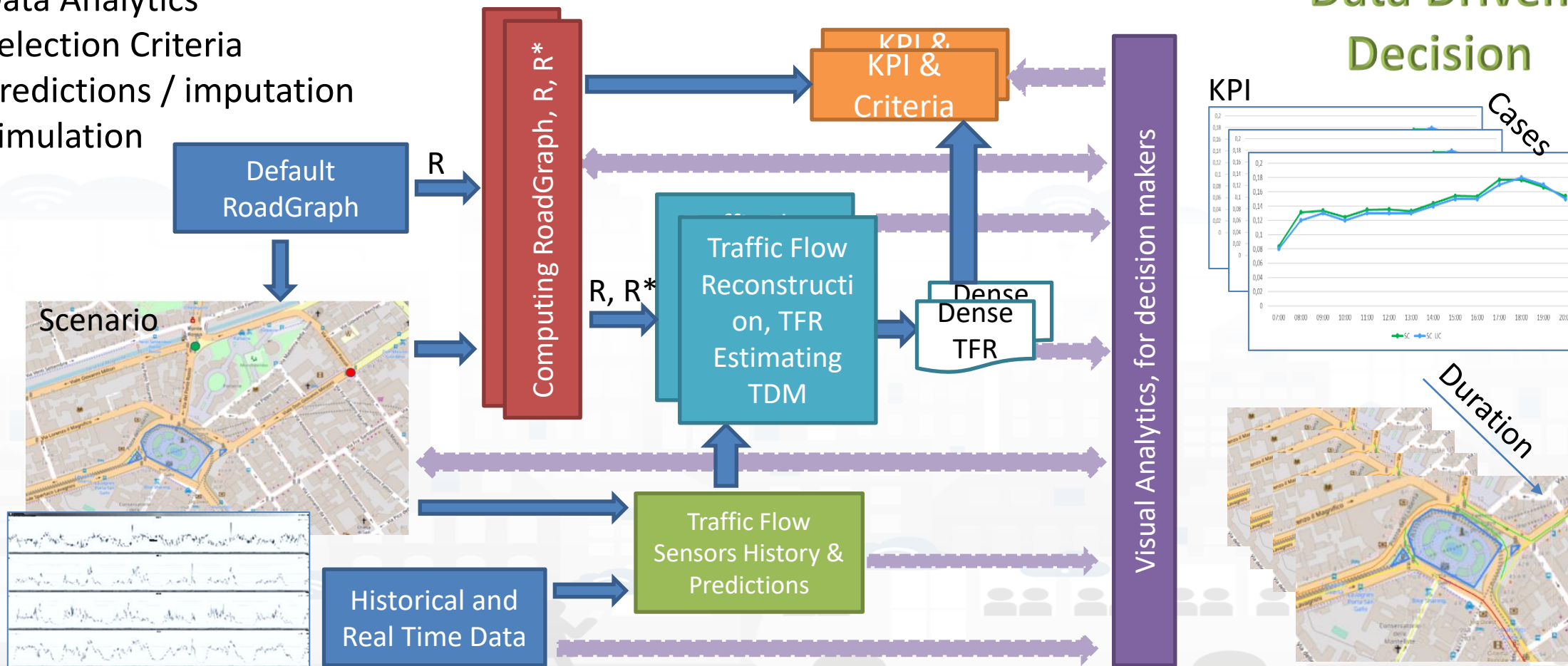
- Evolve Scenarios
- Use Scenario to context the Data Analytics: R Studio, Python for computing



What-if: Simulation for Traffic Flow

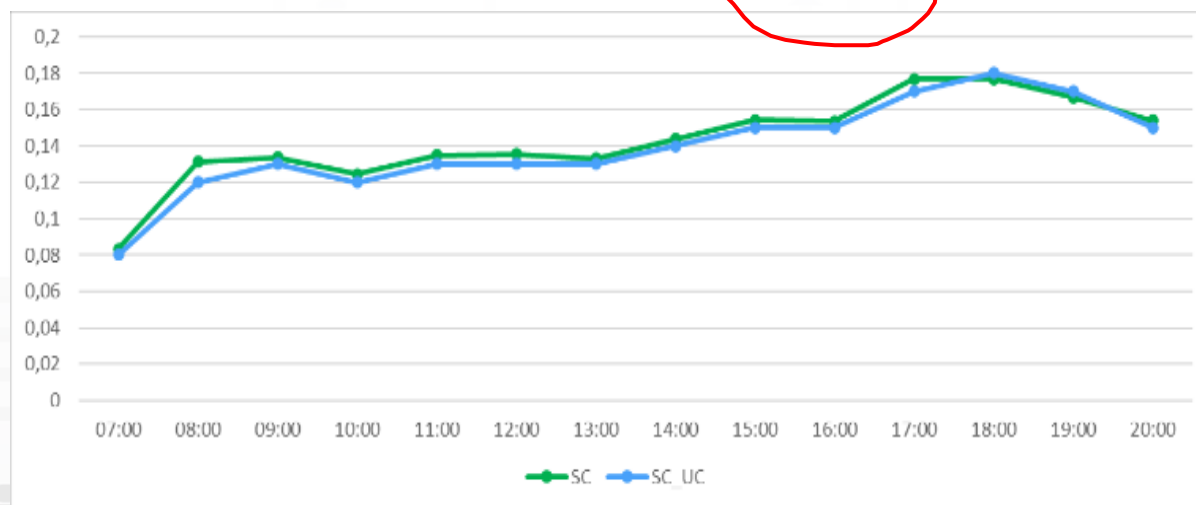
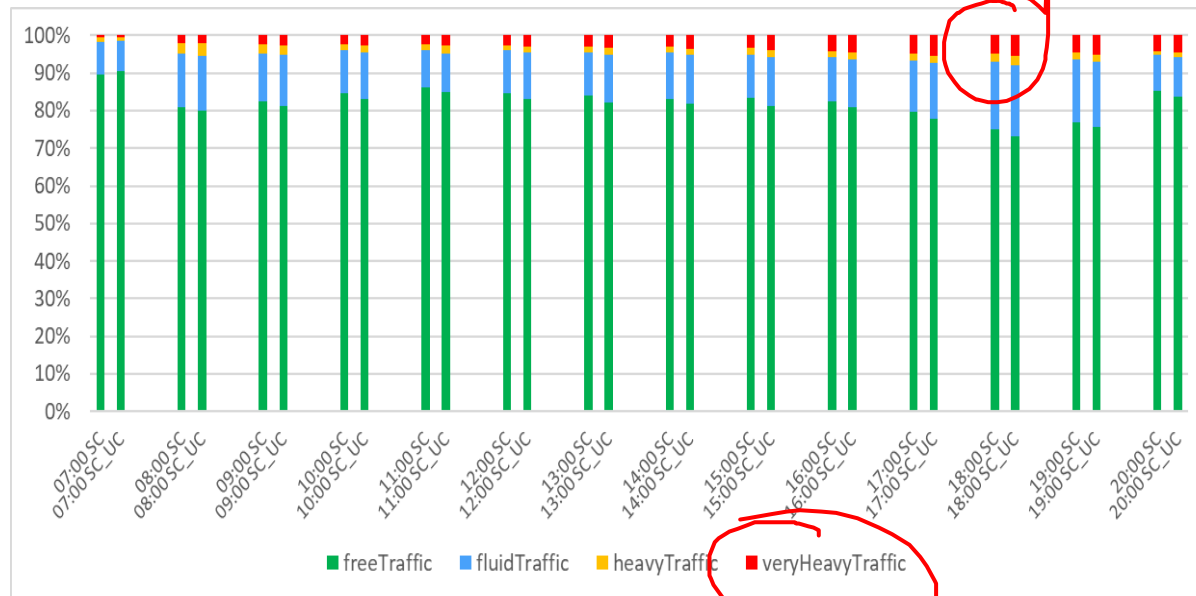
At the same color corresponds the same area:

- Data / information
- Data Analytics
- Selection Criteria
- Predictions / imputation
- Simulation



What-if

	analysis results of $SC_{i,T}$	Actual Traffic Flow results of R_{T1}
09:00		
15:00		

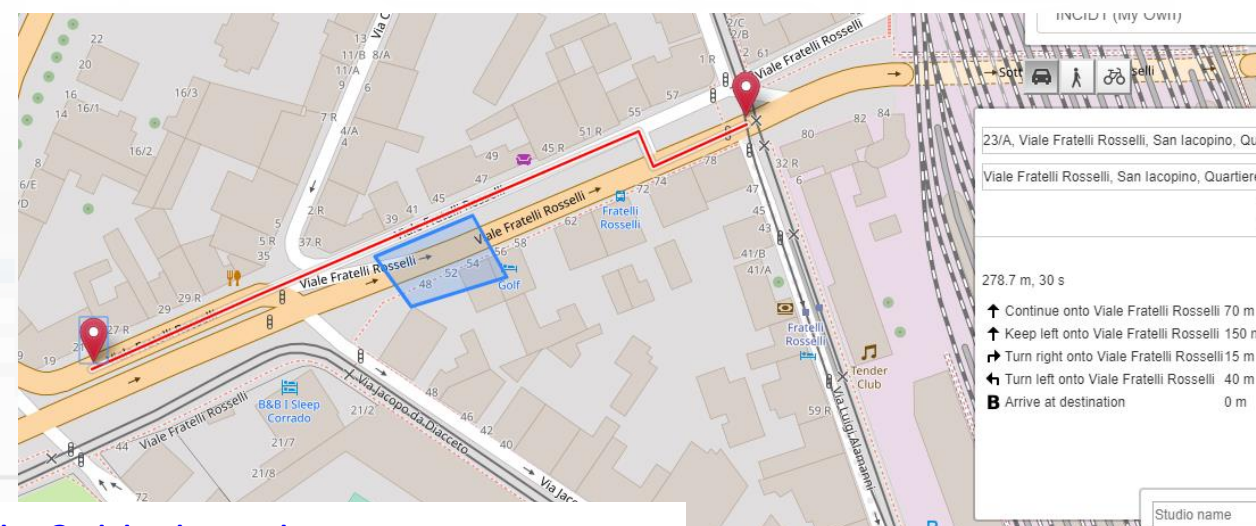
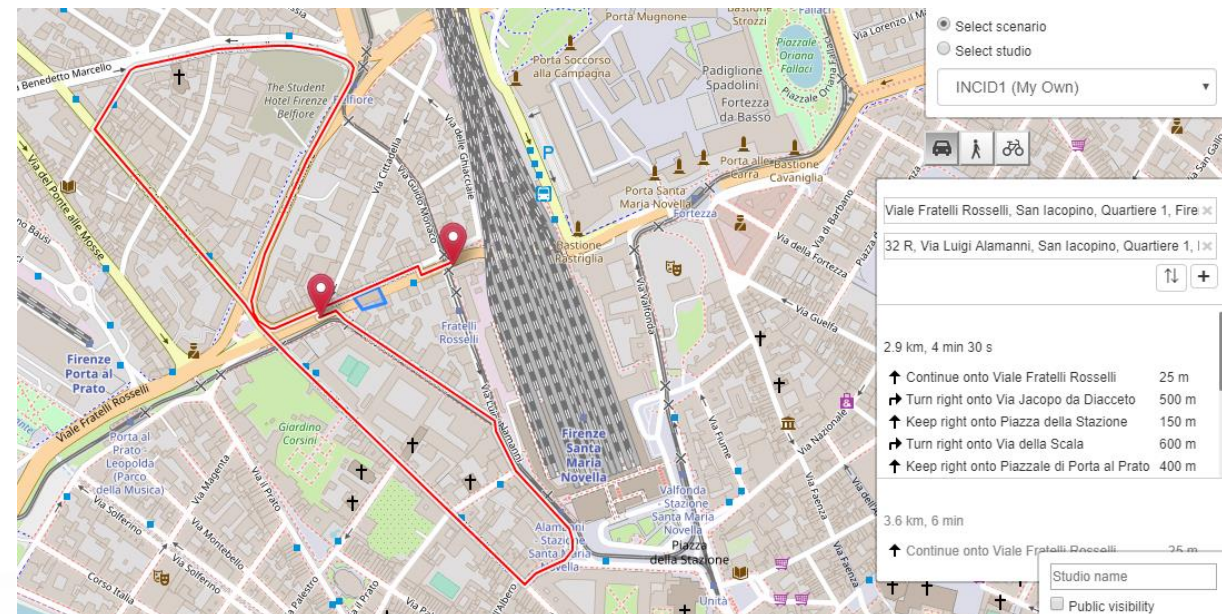


Accidents and elements blocking Points and Shapes taken into account for:

- Routing
- Traffic Flow reconstruction
- Evacuation paths
- Rescue team paths

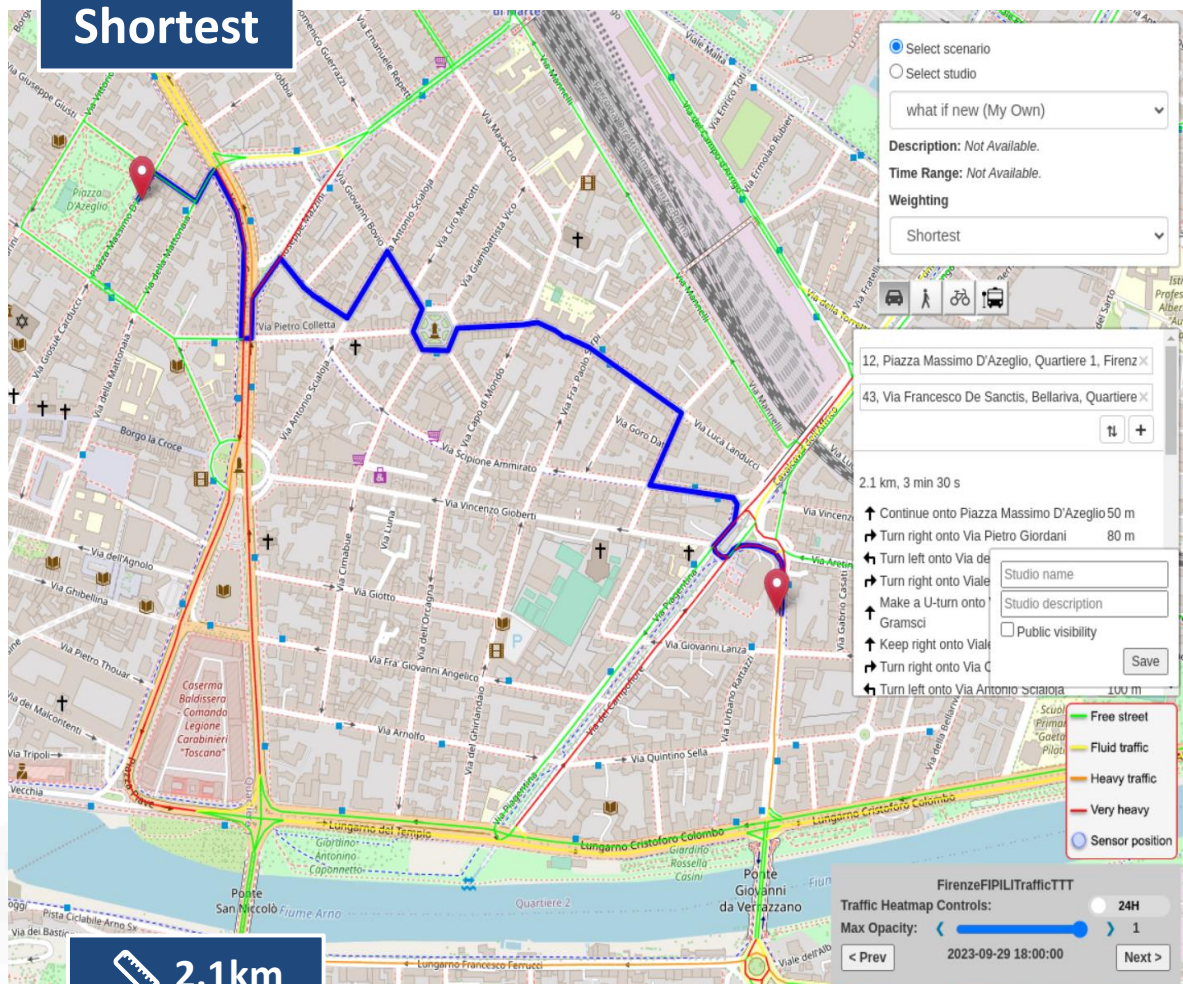
Assessment on the basis of changes:

- Mobility demand assessment
- Mobility Offer assessment

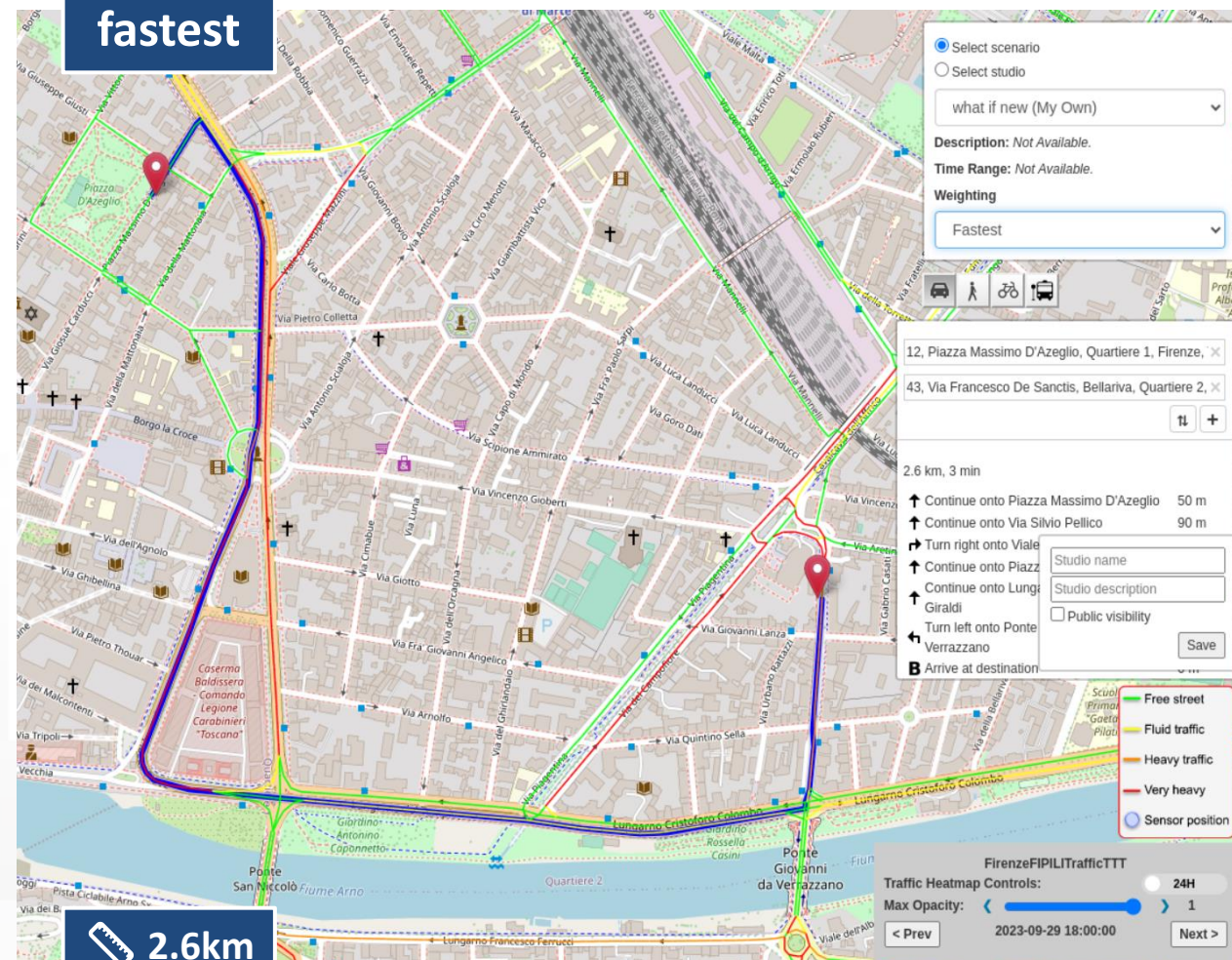


Constrained Dynamic Routing: Traffic Flow

Shortest

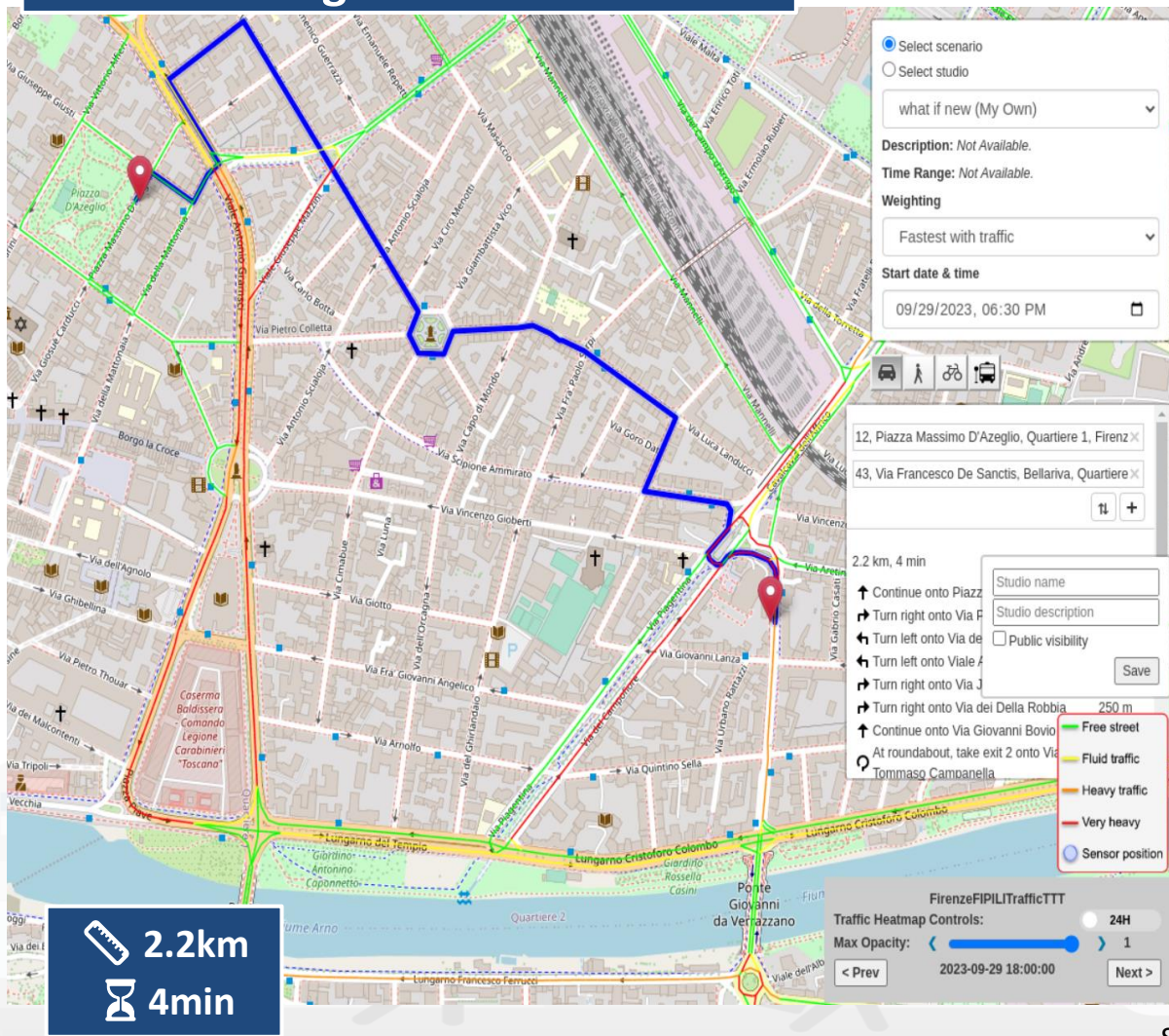


fastest

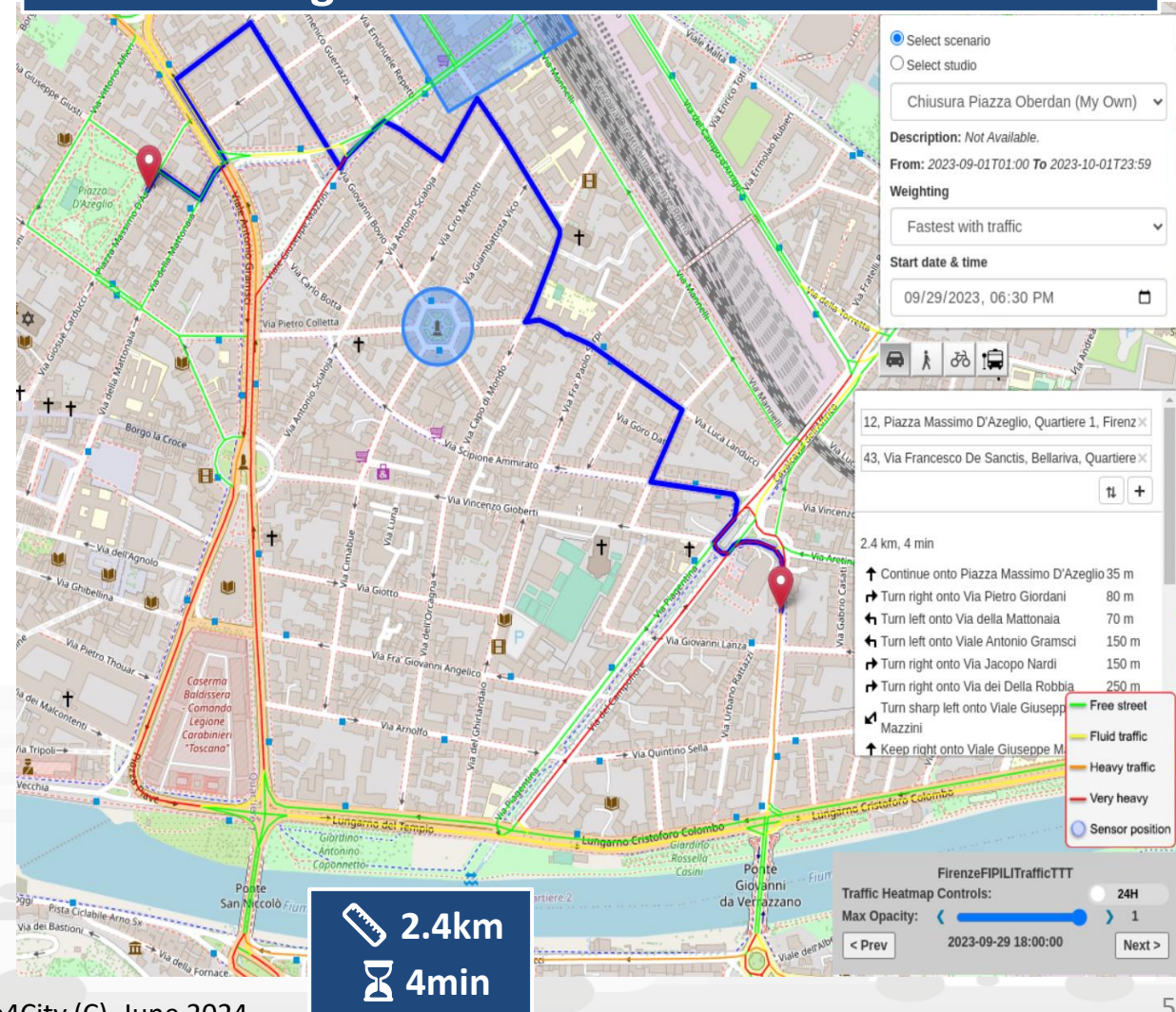


Constrained Dynamic Routing: Traffic Flow

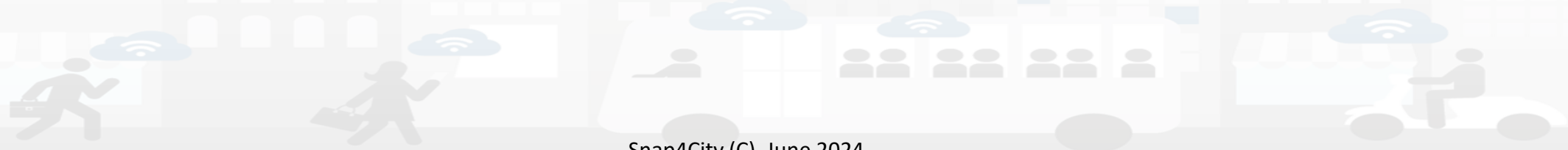
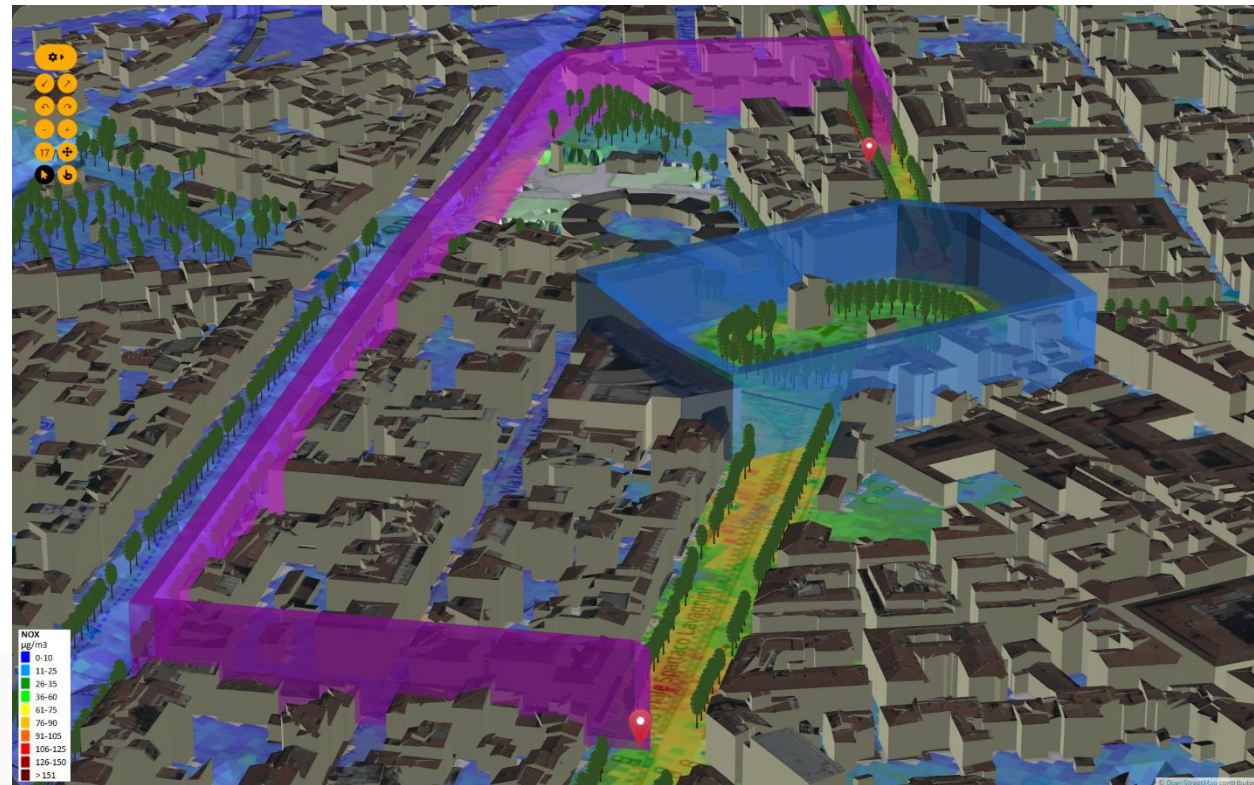
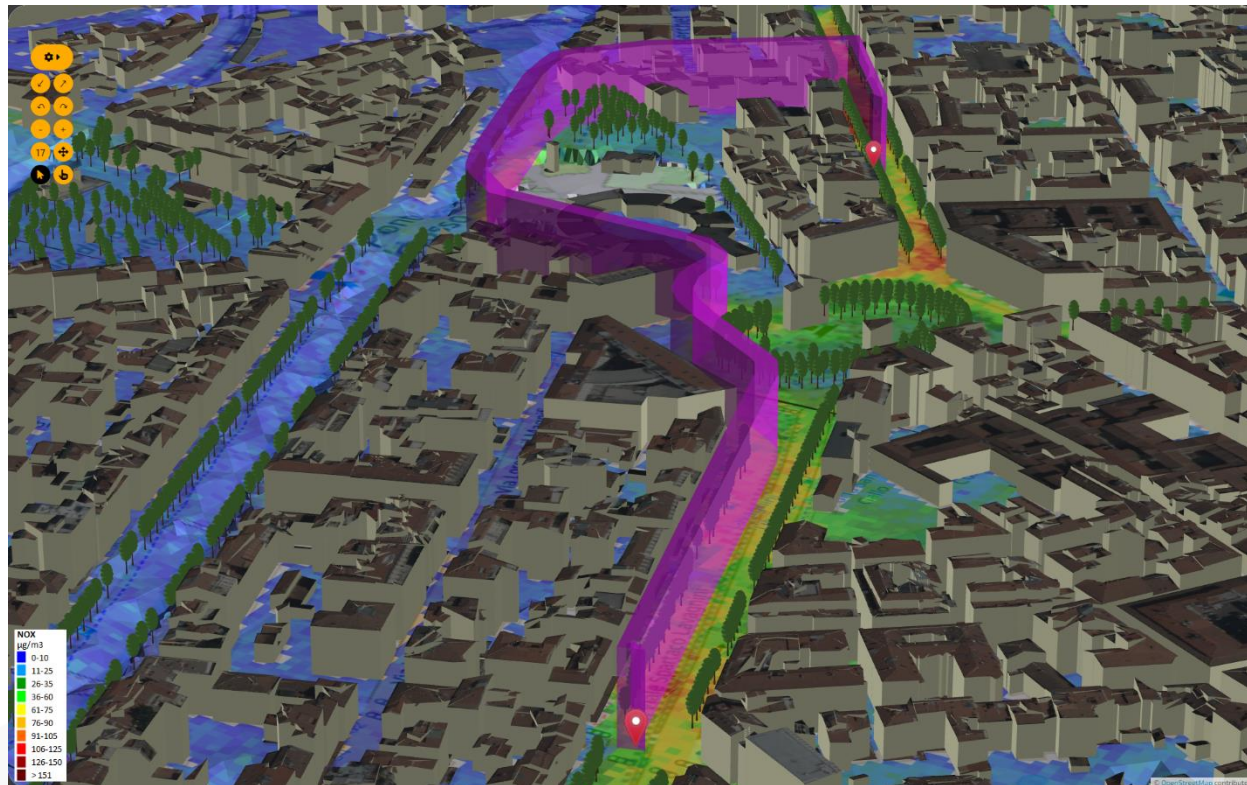
Fastest taking into account traffic



Fastest taking into account traffic and blocked areas



Dyamic Routing in 3D space



Data Analytic Artificial Intelligence, XAI, Machine and Deep Learning

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

FROM CITY DASHBOARD TO APPLICATIONS

SNAP4CITY FOR BEGINNERS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM, DESIGNED TO DEVELOP AND STAKEHOLDERS

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

SNAP4CITY AND KM4CITY PROJECTS

IOT/JOE DEVICES AND NETWORKS

DATA ANALYTICS, BUSINESS INTELLIGENCE, WHAT-IF, AND TO

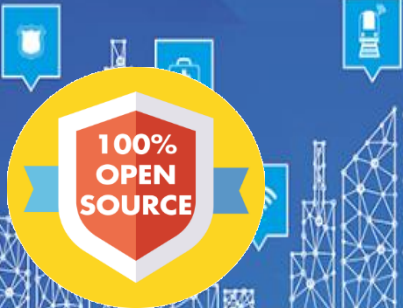
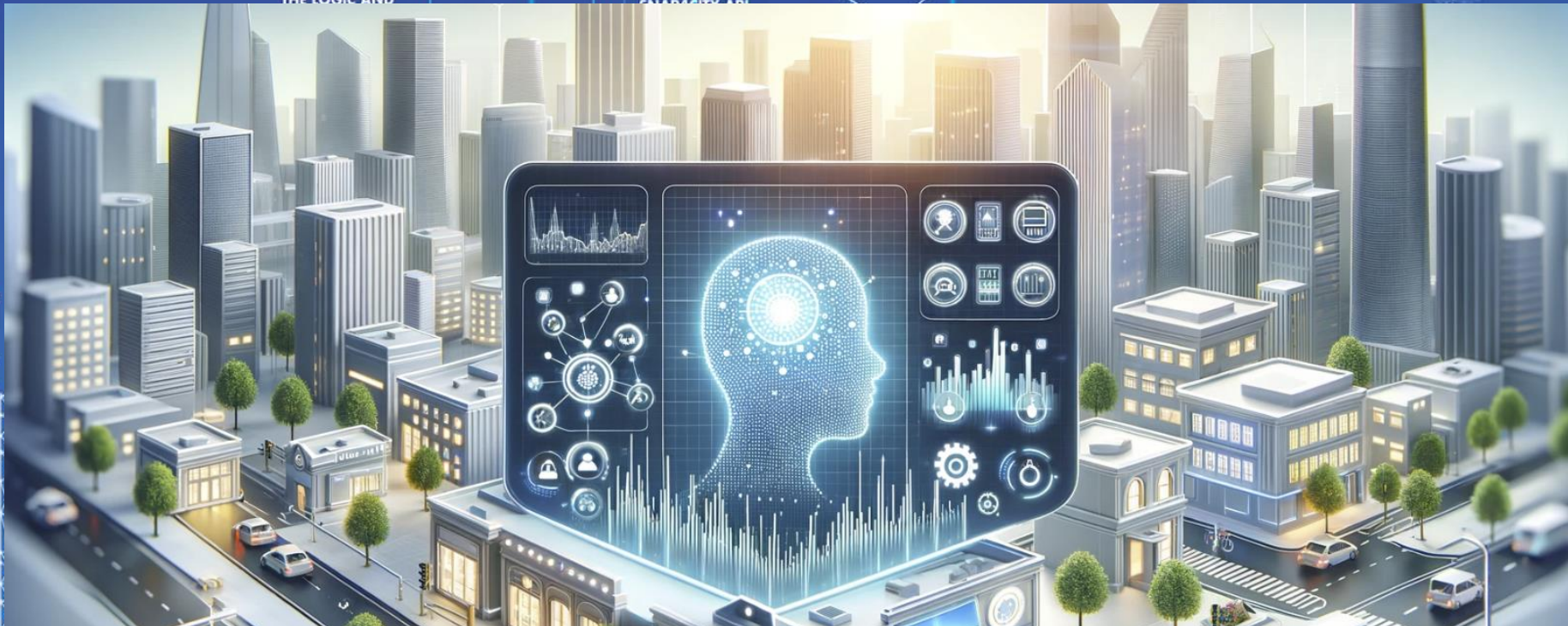
HOW TO ADOPT SNAP4CITY AND R ADIOP

DECISION SUPPORT SYSTEMS, CITY RESILIENCE

IOT APPLICATIONS, THE LOGIC AND

ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API

SNAP4CITY THE VIEW OF THE ADMINISTRATORS





Available AI Solutions on Snap4City

<https://www.snap4city.org/997>

More than 80 Available Solutions & 300 AI applic.

- **Mobility and Transport**
- **Environment, Weather, Waste, Water**
- **City Users Behaviour and Social analysis**
- **Energy and Control**
- **Tourism and People**
- **Security and Safety**
- **High Level Decision Support Solutions**
 - **Asset management**
 - **Resilience and Risks Analysis**
- **Low level Techniques**



https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf

<https://www.snap4city.org/download/video/course/p4/>

Mobility and Transport Domain (2024)

- **Goals:**
 - Decongestion
 - Decarbonization
 - Accessibility to services
 - Security/Safety of city users
- **Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)**
 - Monitoring traffic, parking, people flow, services, boats, ports, beaches, etc.
 - Early detection/warning of critical conditions: traffic, congestion, security/safety
 - Managing Smart Parking, transportation services, fines, etc.
 - Managing fleets: personal, sharing, waste collection, maintenance, etc.
 - Managing E-sharing, pooling services, MaaS, etc.
 - Managing entrances in city areas: restricted areas, touristic busses, etc.
 - Production of suggestions, recommendations, nudging
 - Computing predictions of any kind
- **Solutions for Planning (optimization and what-if analysis)**
 - Reduction of traffic congestion, via optimization: semaphore cycles, viability, routing
 - Reduction of Pollutant Emissions, via optimization: semaphore cycles, viability
 - Optimization of transportation offers wrt multimodal mobility demand
- **Algorithms and computational solutions, see next slide**

Tools for Mobility and Transport (2024)

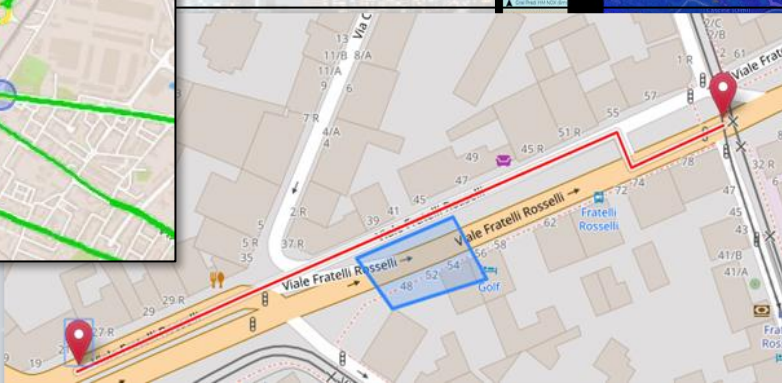
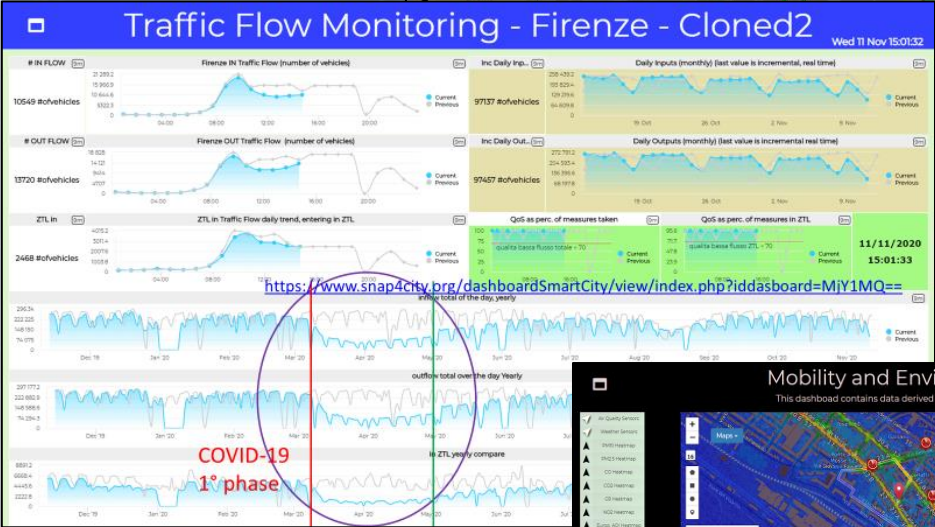
- Optimisation of viability of an area for reducing congestion, waiting time, stops
- Optimisation of semaphores time cycles, synchronization, in an area for reducing congestion, waiting time, stops
- **Predictions** for: traffic flow, smart parking, smart bike sharing, people flows, etc. (ML, DL)
- **What if analysis**: routing, traffic flow, demand vs offer, pollutant, etc. (Simulation + ML)
- **Traffic flow reconstruction** from sensors and other sources (simulation + ML)
- **Public Transportation**: Ingestion and modelling of GTFS, Transmodel, NeTEx, etc. (DP)
 - Analysis of the **demand mobility vs offer transport** of according to public transportation and multiple data sources (Simulation)
 - Assessing **quality of public transportation** (analysis)
- **Accidents** heatmaps, anomaly detection (analysis, ML)
- **Road light controlled by traffic conditions**
- **Tracking fleets**, people, via devices: OBU, OBD2, mobile apps, etc. (DP)
- **Routing** and multimodal routing (multistop travel planning), constrained routing, dynamic routing (DA)
- Computing **Origin Destination Matrices** from different kind of data (analysis, DP, DP)
- Computing **typical trajectories** on the basis of tracks (analysis, ML)
- Fleet management, monitoring, booking, allocation, maintenance
- Computing Messages for Connected drive (DP)
- Slow and Fast Mobility **15 Minute City Indexes** (analysis, DP, ...ML)
- Computing and comparing traffic flow on devices and at the city border (analysis)
- **Typical time trends** for traffic flow and IoT Time series. (analysis, ML)
- **Impact of COVID-19** on mobility and transport
- Computing **SUMI, PUMS**, etc. (mainly DP)
- **Definition of Scenarios**: traffic, road graph, conditions, etc.
- Etc.

Mobility and Transport Traffic Flow Analysis

Cities: Firenze, Pisa, Livorno, Modena, Santiago di Compostela



- **Multiple Domain Data**
 - Traffic Flow sensors, city structure, weather
- **Decision Makers Multiple Locations**
 - Real time Monitoring, predictions
 - Traffic Flow Predictions,
 - Traffic Reconstructions, routing
 - Dashboards, What-IF analysis
 - Mobile App, people flows
- **Historical and Real Time data**
- **Services Exploited on:**
 - Dashboards, Mobile App
- **Since 2017, 2019**



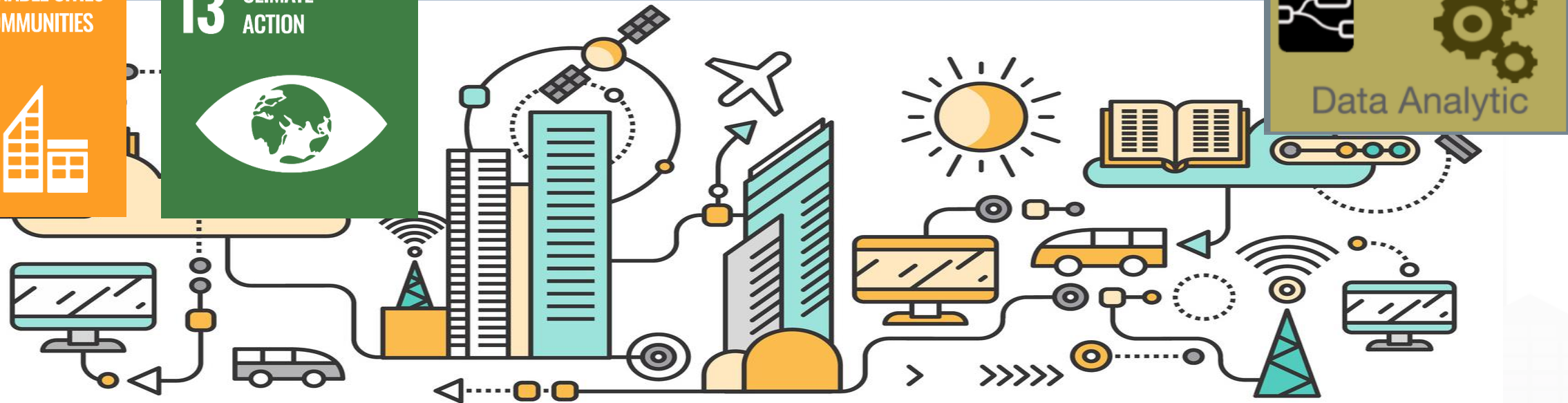
TOP

Traffic Flow

11 SUSTAINABLE CITIES
AND COMMUNITIES

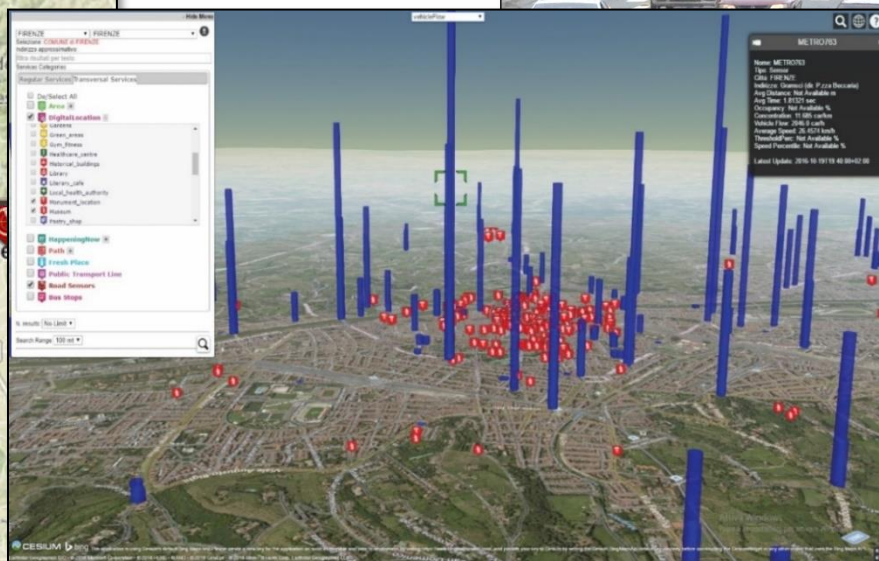
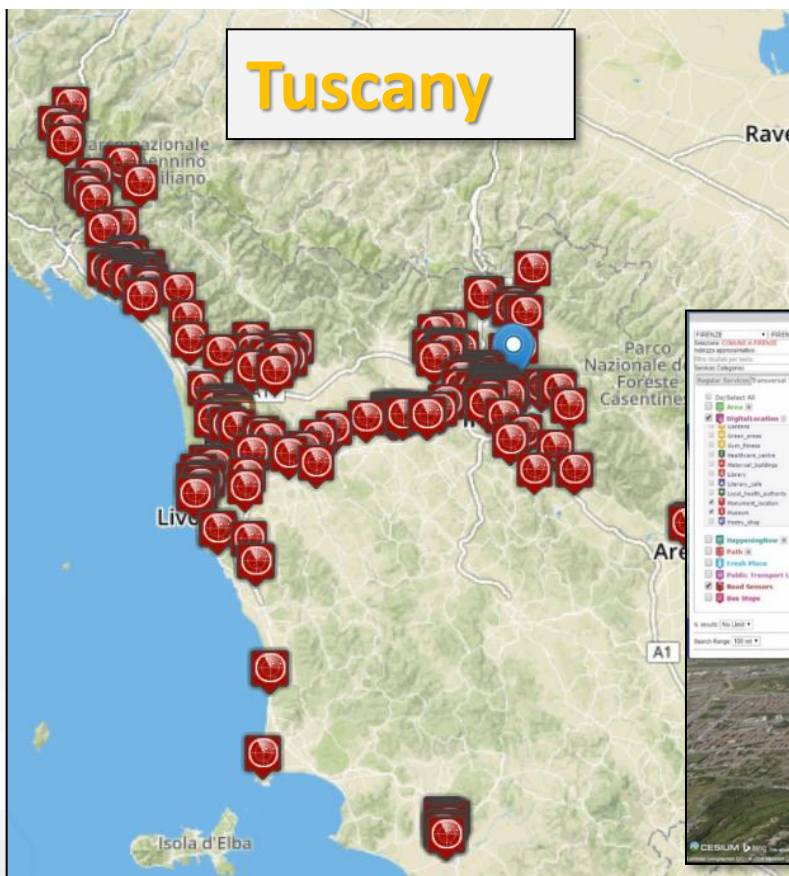


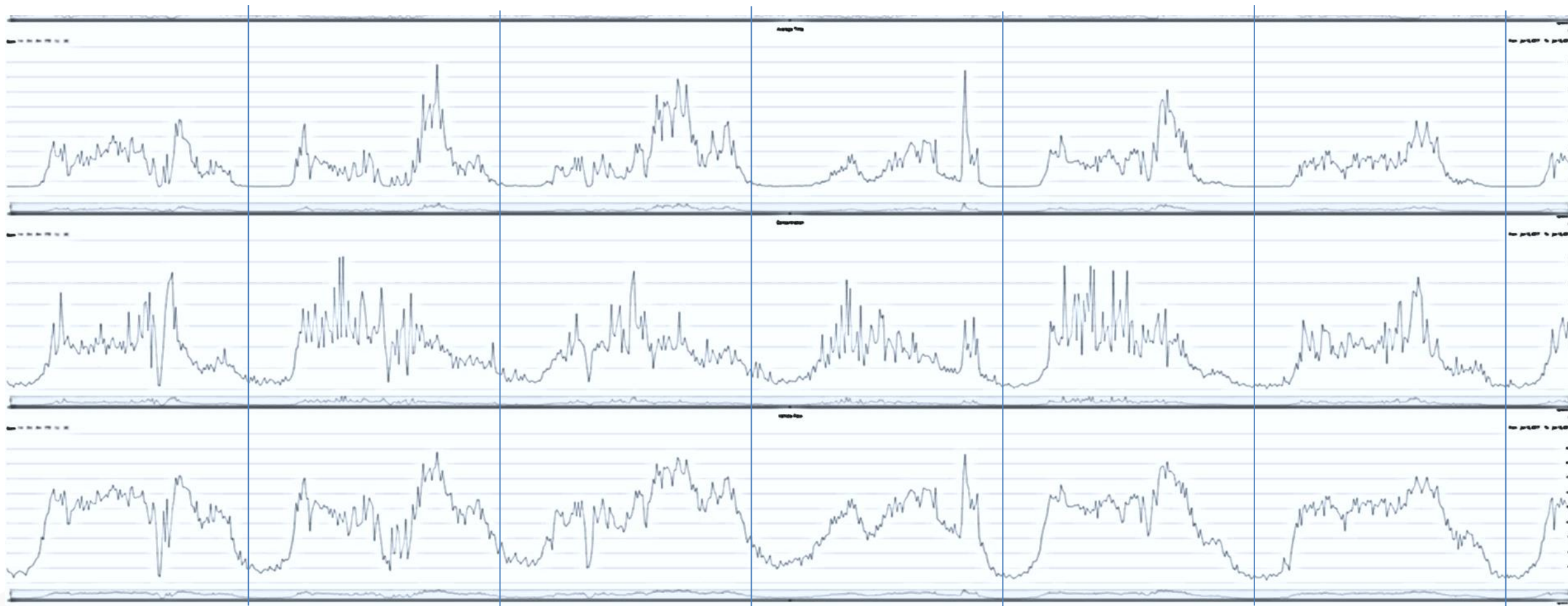
13 CLIMATE
ACTION



Traffic Flow Tools

Spire and Virtual Spires (cameras), Bluetooth, ...
Specifically located: along, around, on gates, on x...





- Day by day traffic flow, on the week data from 3 sensors

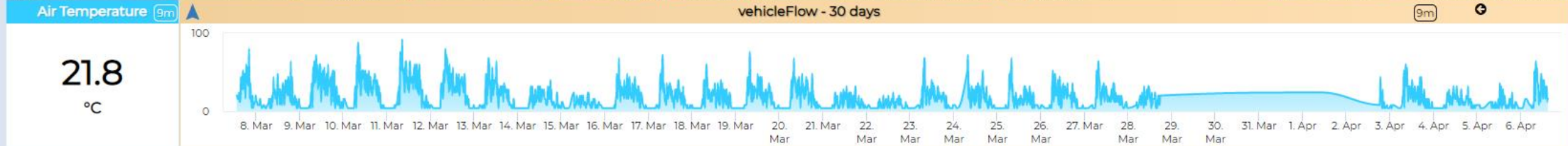
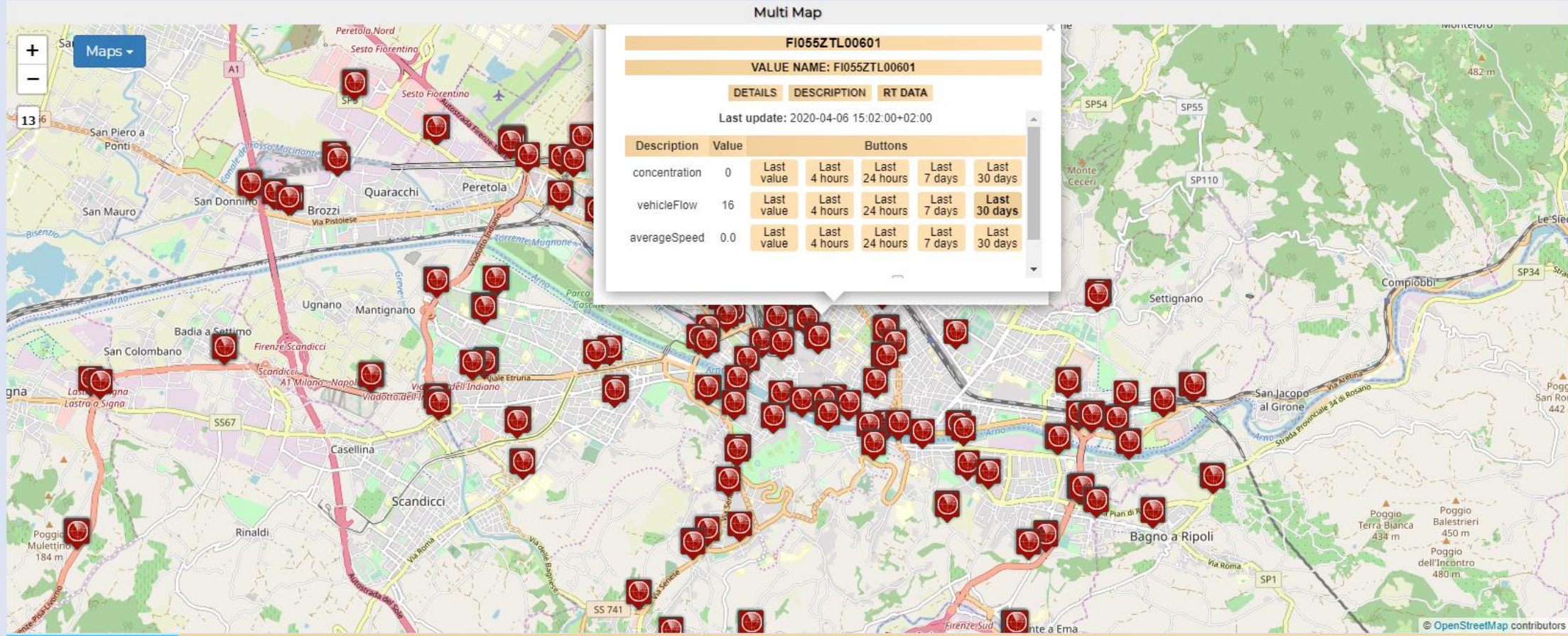
Firenze - Trafair - AirQuality Heatmaps



This dashboard contains data derived from actual sensors and predictive values under validation

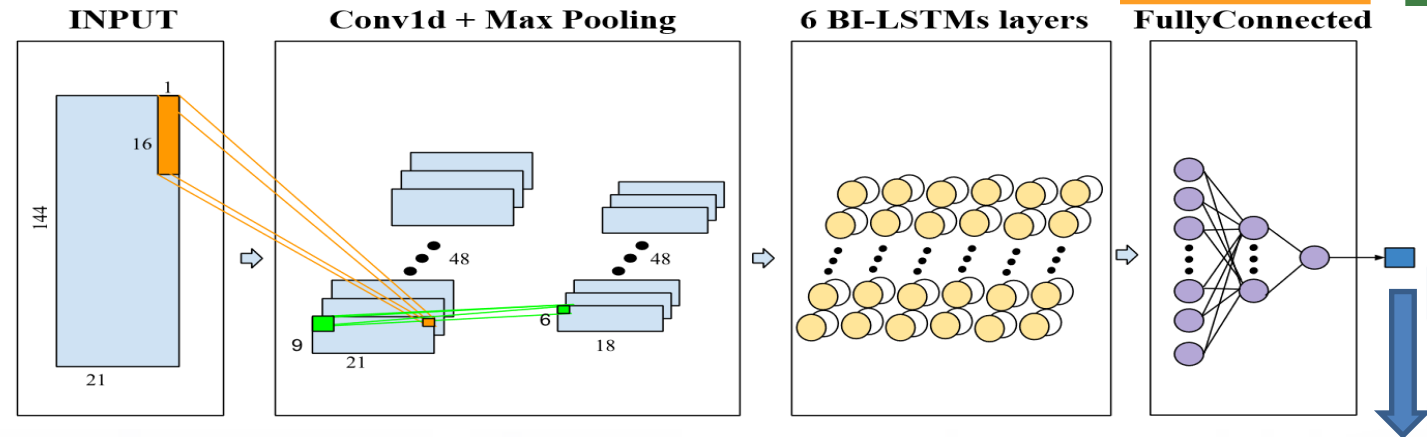
Mon 6 Apr 15:12:27

- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling Paths
- Accident Heatmap
- Accident Heatmap 2
- Only HRes Anym. Gral
- Green Areas
- Schools



Air quality trends

Short-Term Prediction of City Traffic Flow via Convolutional Deep Learning



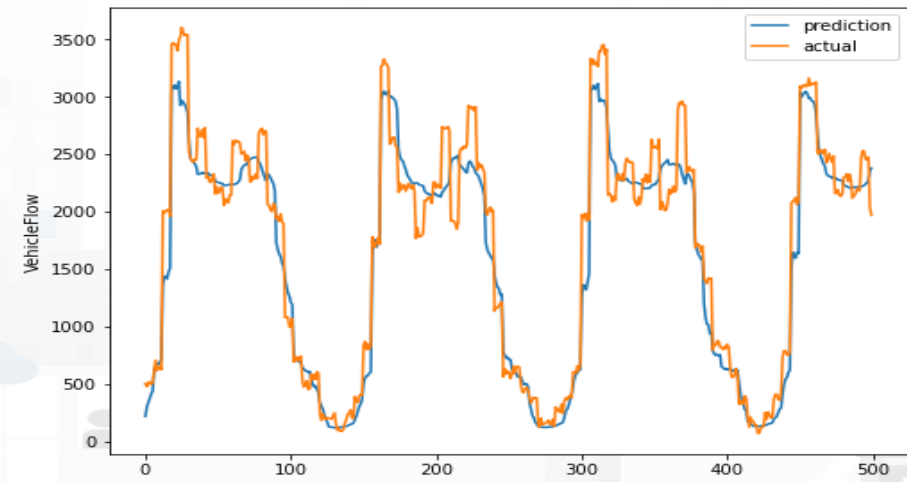
Urban data:

- Date-time
- Traffic
- Temporal
- Seasonality
- Pollution
- Weather



- RF
- XGBOOST
- DNN
- LSTM
- BI-LSTM
- Autoencoder BI-LSTM
- Attention CONV-LSTM
- CONV-BI-LSTM

CONV-BI-LSTM





Traffic Flow Monitoring - Firenze - Cloned2

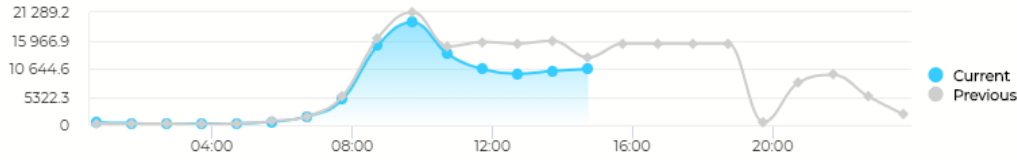
Wed 11 Nov 15:01:32

IN FLOW 9m

Firenze IN Traffic Flow (number of vehicles)

9m

10549 #ofvehicles

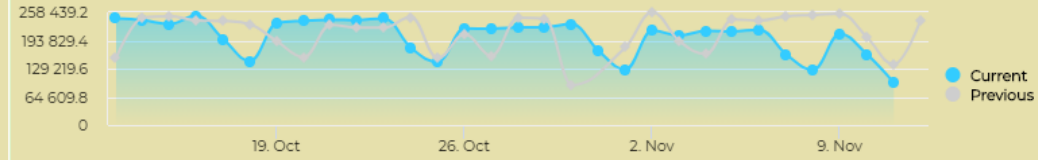


Inc Daily Inp... 9m

Daily Inputs (monthly) (last value is incremental, real time)

9m

97137 #ofvehicles

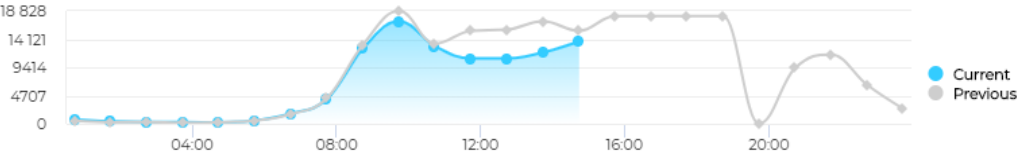


OUT FLOW 9m

Firenze OUT Traffic Flow (number of vehicles)

9m

13720 #ofvehicles

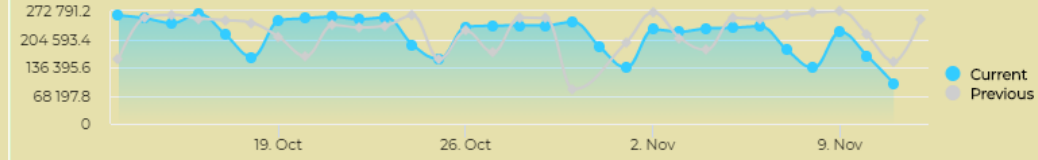


Inc Daily Out... 9m

Daily Outputs (monthly) (last value is incremental real time)

9m

97457 #ofvehicles

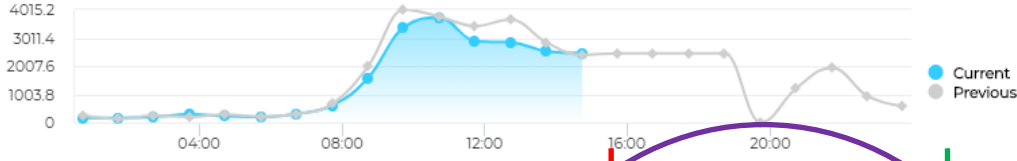


ZTL in 9m

ZTL in Traffic Flow daily trend, entering in ZTL

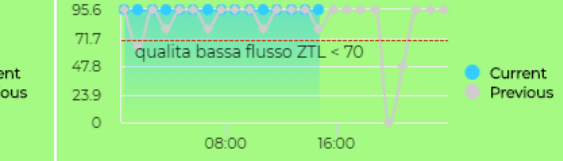
9m

2468 #ofvehicles



QoS as perc. of measures taken

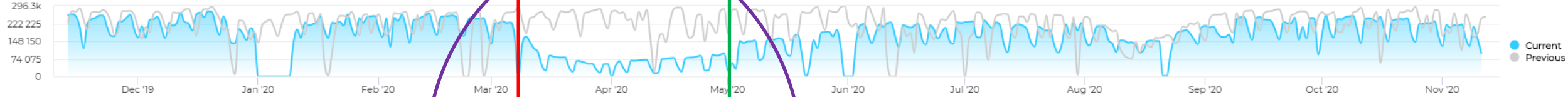
QoS as perc. of measures in ZTL



11/11/2020
15:01:33

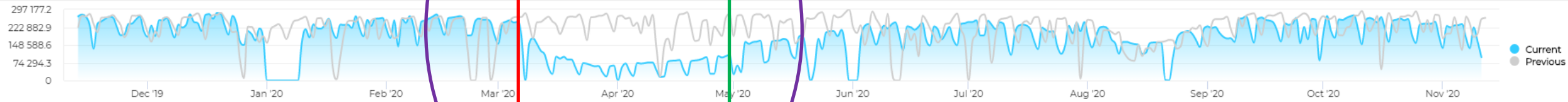
inflow total of the day, yearly

9m



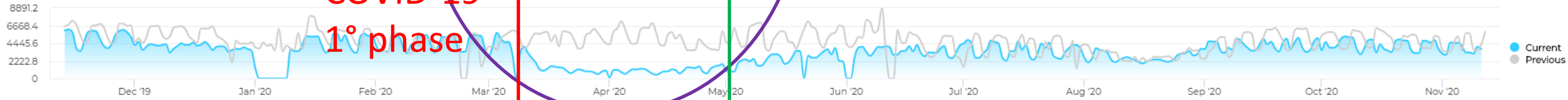
outflow total over the day Yearly

9m

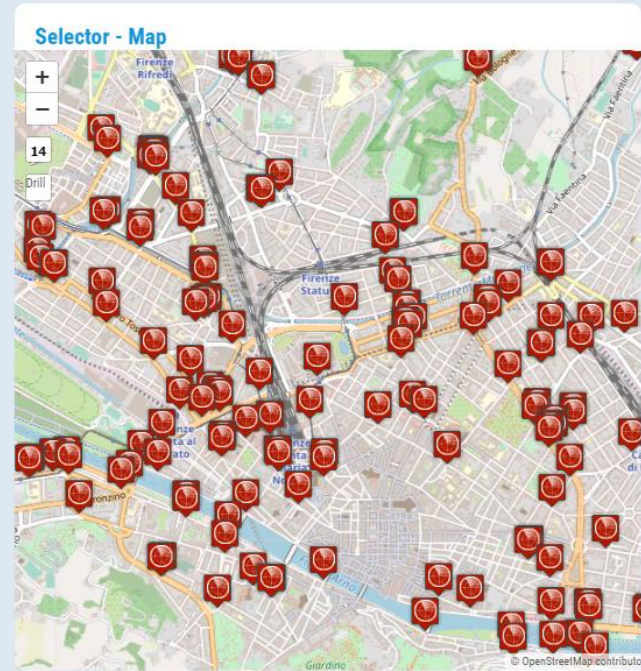


in ZTL yearly compare

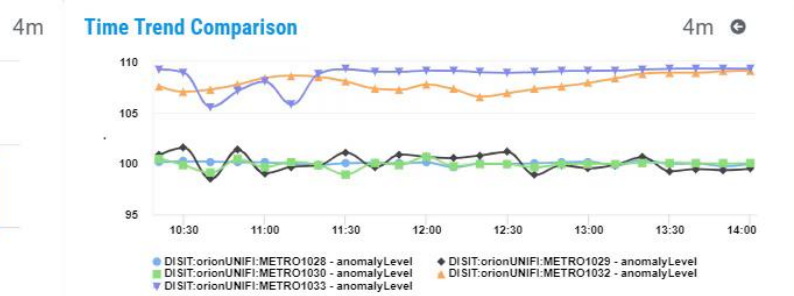
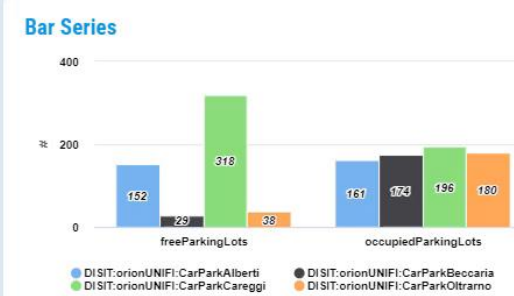
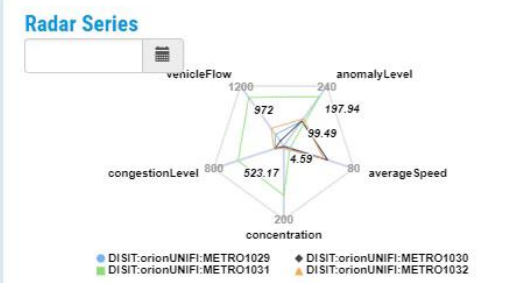
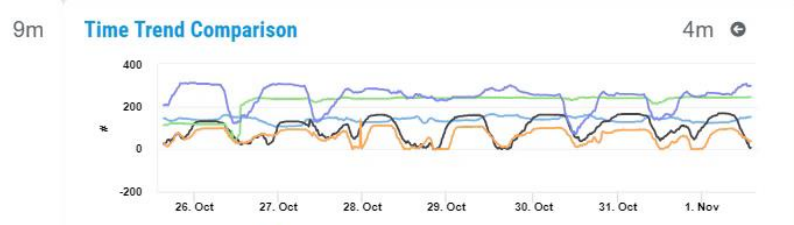
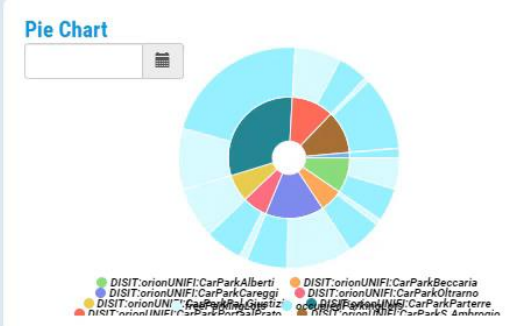
9m



COVID-19
1° phase

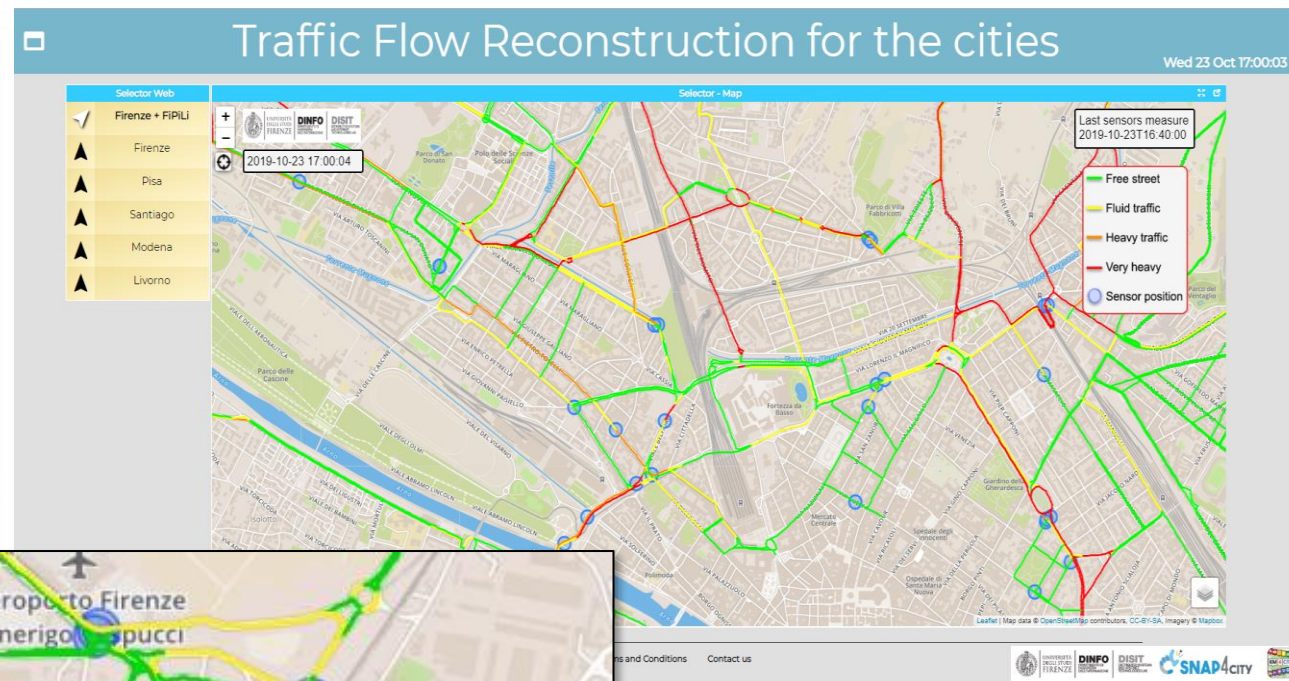


- ### Selector
- ▲ Car_park
 - ▶ metrotrafficsensor
 - ▲ Air_quality_monitoring_station
 - ▲ Weather_sensor



Why Dense Traffic Flow Reconstruction ?

- Making decision on mobility and transport solutions → what if analysis
- Controlling pollution
- Dynamic Routing for Firebrigade, Ambulances, general public
- Planning Public Transportation routing



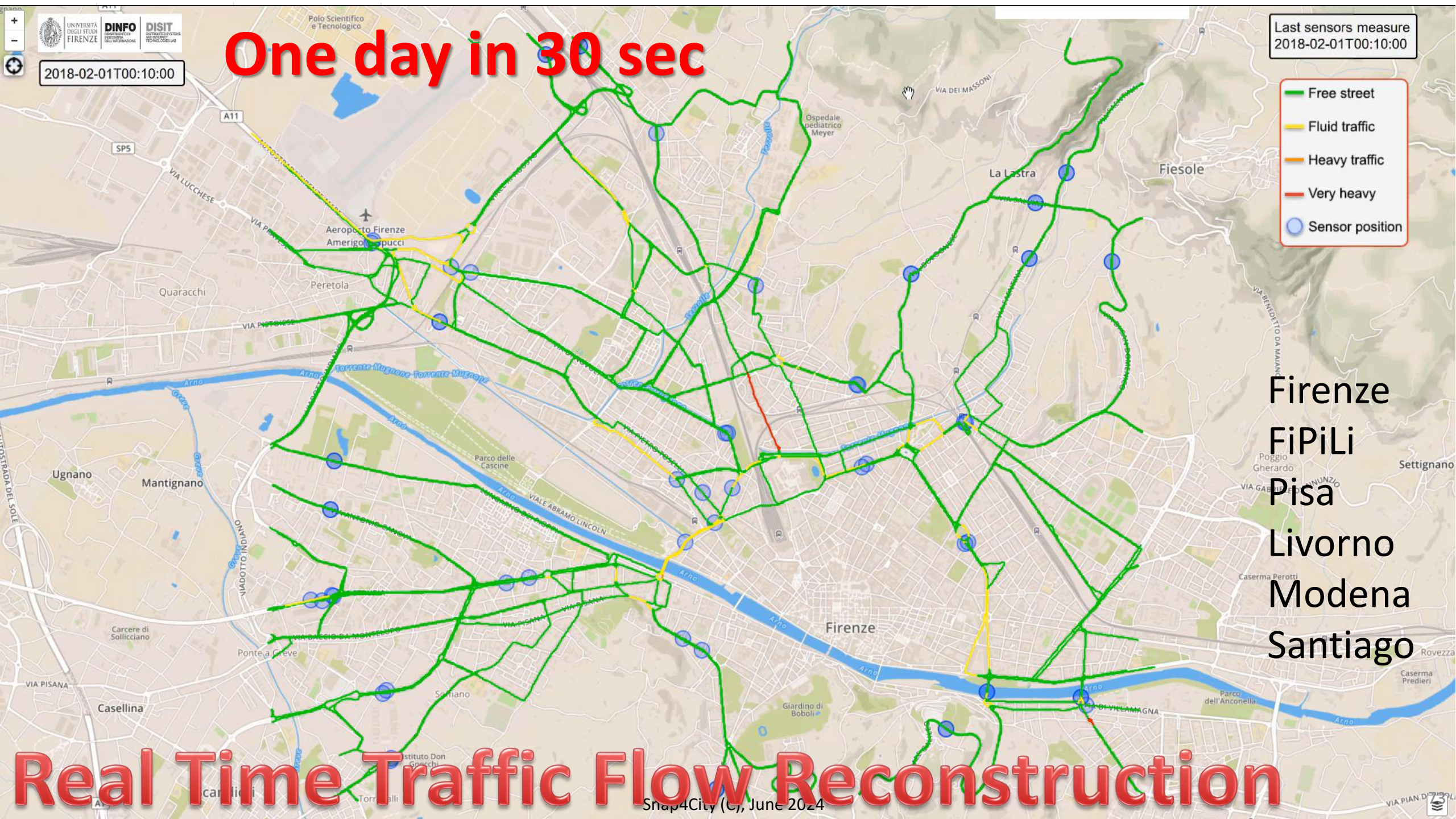
<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc5NQ==>

2018-02-01T00:10:00

One day in 30 sec

Last sensors measure
2018-02-01T00:10:00

- Free street
- Fluid traffic
- Heavy traffic
- Very heavy
- Sensor position



Firenze
FiPiLi
Pisa
Livorno
Modena
Santiago

Real Time Traffic Flow Reconstruction

Traffic Flow Reconstruction for the cities

Sun 3 Nov 20:37:43

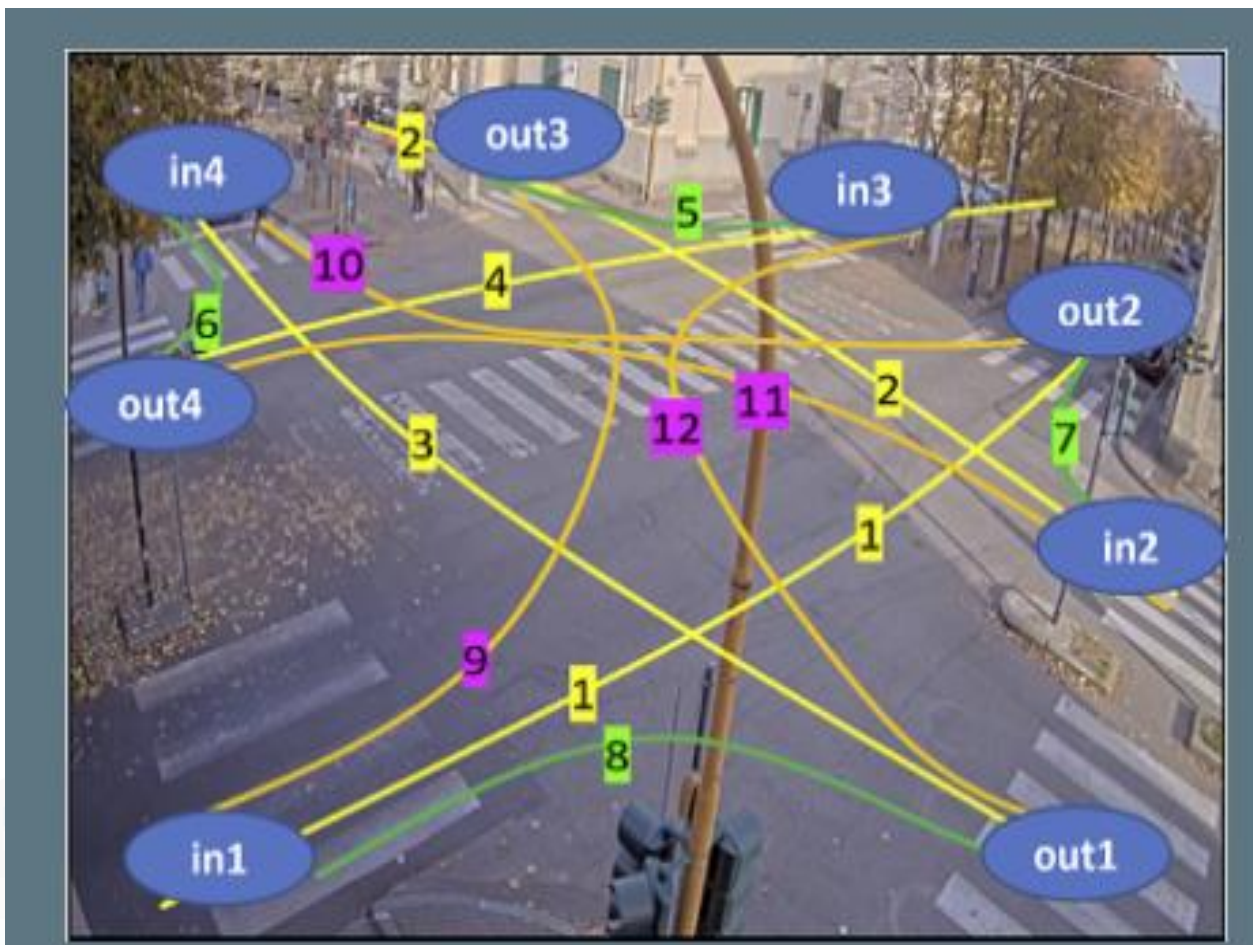


11 SUSTAINABLE CITIES
AND COMMUNITIES

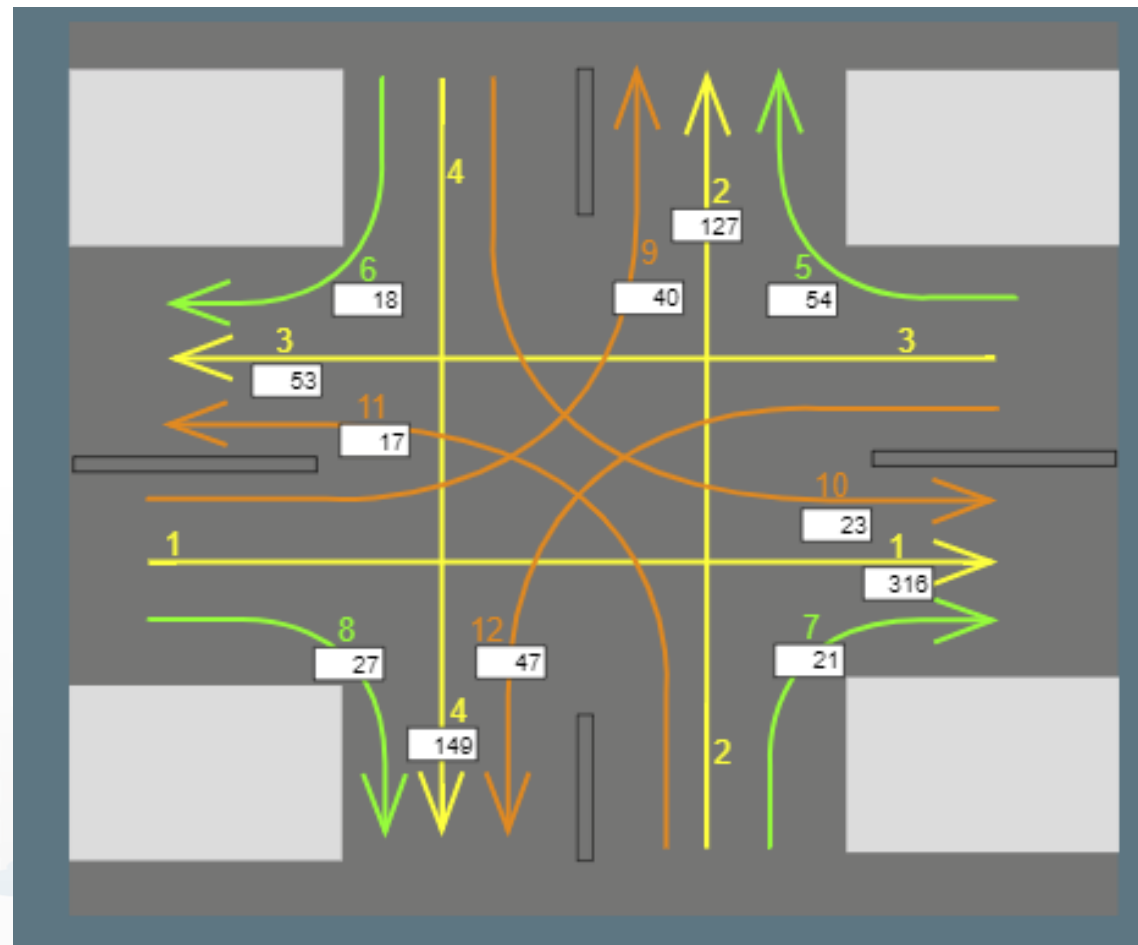


snap4City (C), June 2024

Real time Clustering: legenda and synoptic



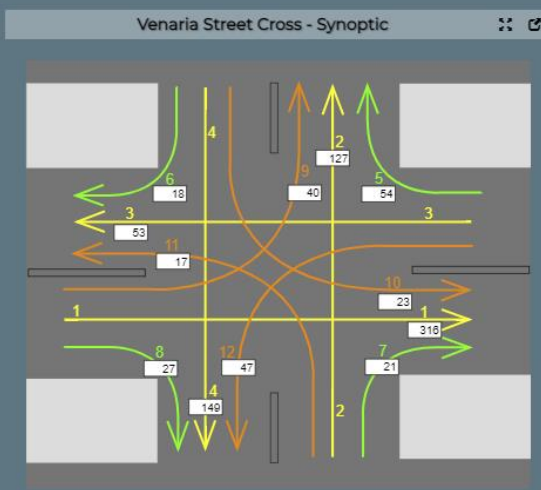
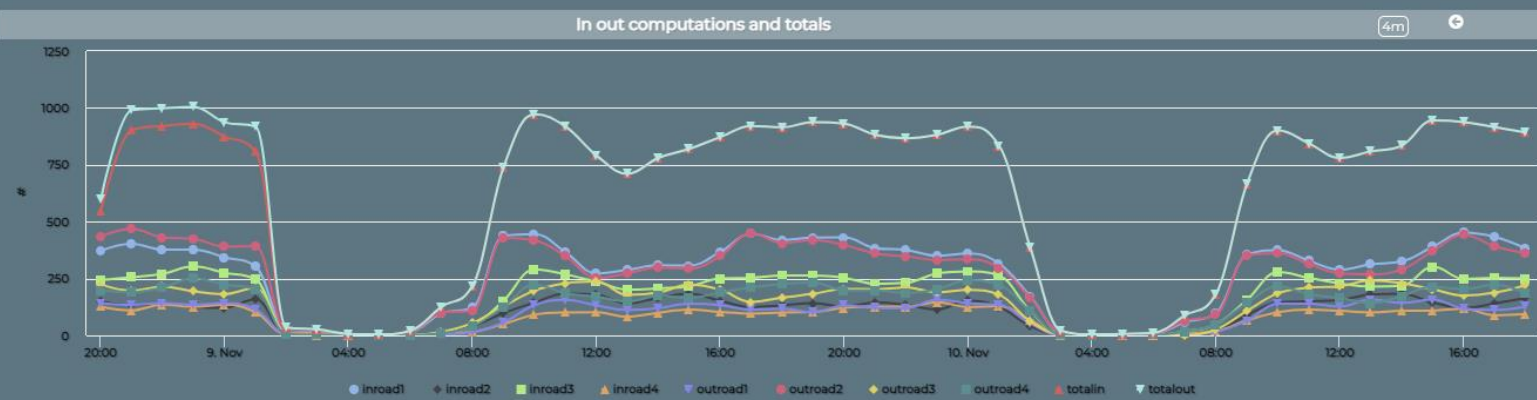
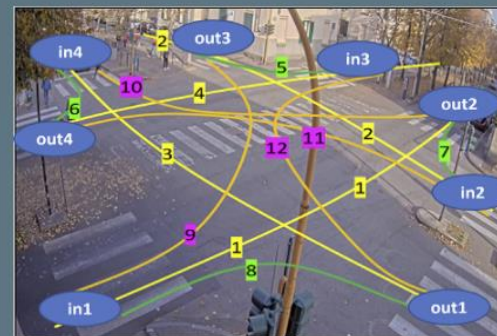
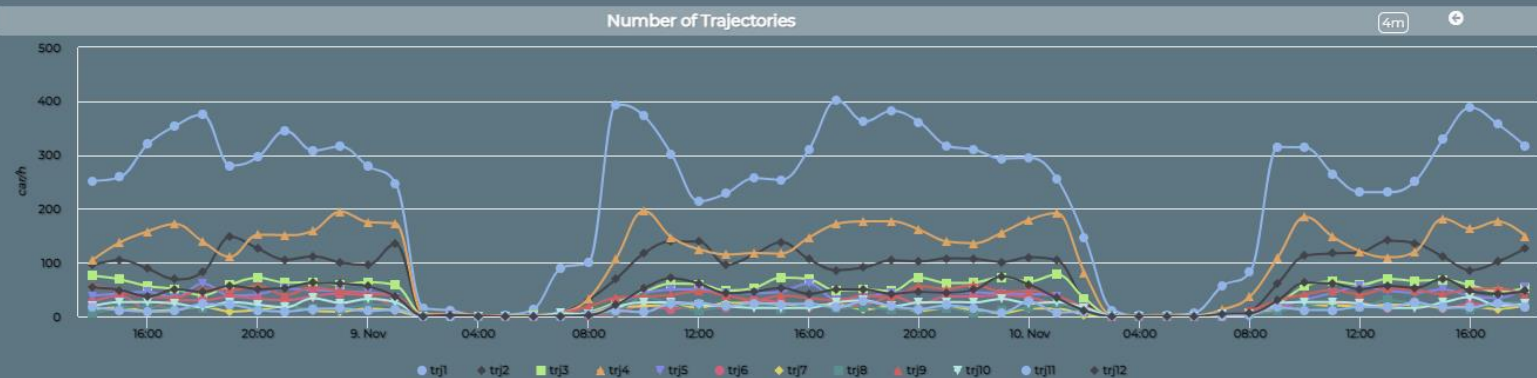
Legenda



Synoptic with real time data

Monitoring Cross Road Venaria - (AXIS Camera)

Wed 10 Nov 18:50:53



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MzI5Ng==>

Origin Destination Matrices

11 SUSTAINABLE CITIES
AND COMMUNITIES



13 CLIMATE
ACTION



Data Analytic



ODM, Traffic Flow

ODM Origin Destination Matrices

The screenshot displays the SNAP4CITY dashboard interface. On the left, a sidebar menu titled "Selectornew" includes options for Admin Areas, Areas or grids, Traffic Sensors, Traffic Flow, and Traffic Flow Manager New. The main area features a map of the Florence region with traffic flow heatmaps overlaid. A legend on the left of the map indicates flow levels from 0-2% (light yellow) to 10-100% (dark red). On the right, a "Controls" panel for the "Origin-Destination Map" includes settings for "Show all polygons" (ON), "Time period" (week), "Precision" (municipality), "Flow" (outflow), and "Max Opacity" (0.6). A date selector shows "2022-07-07 00:00:00". Below this, a "Traffic Heatmap Controls" panel shows "24H" and "Max Opacity" (1) with a date of "2023-11-01 03:00:00". A "Hover over a zone" tooltip is visible over the Florence area. The bottom of the dashboard includes a "My Profile" button and footer links for Privacy Policy, Cookies Policy, Terms and Conditions, and Contact us.

<https://www.snap4city.org/dashboardSmartCity/view/Gea-Night.php?iddashboard=Mzk3Nw==>



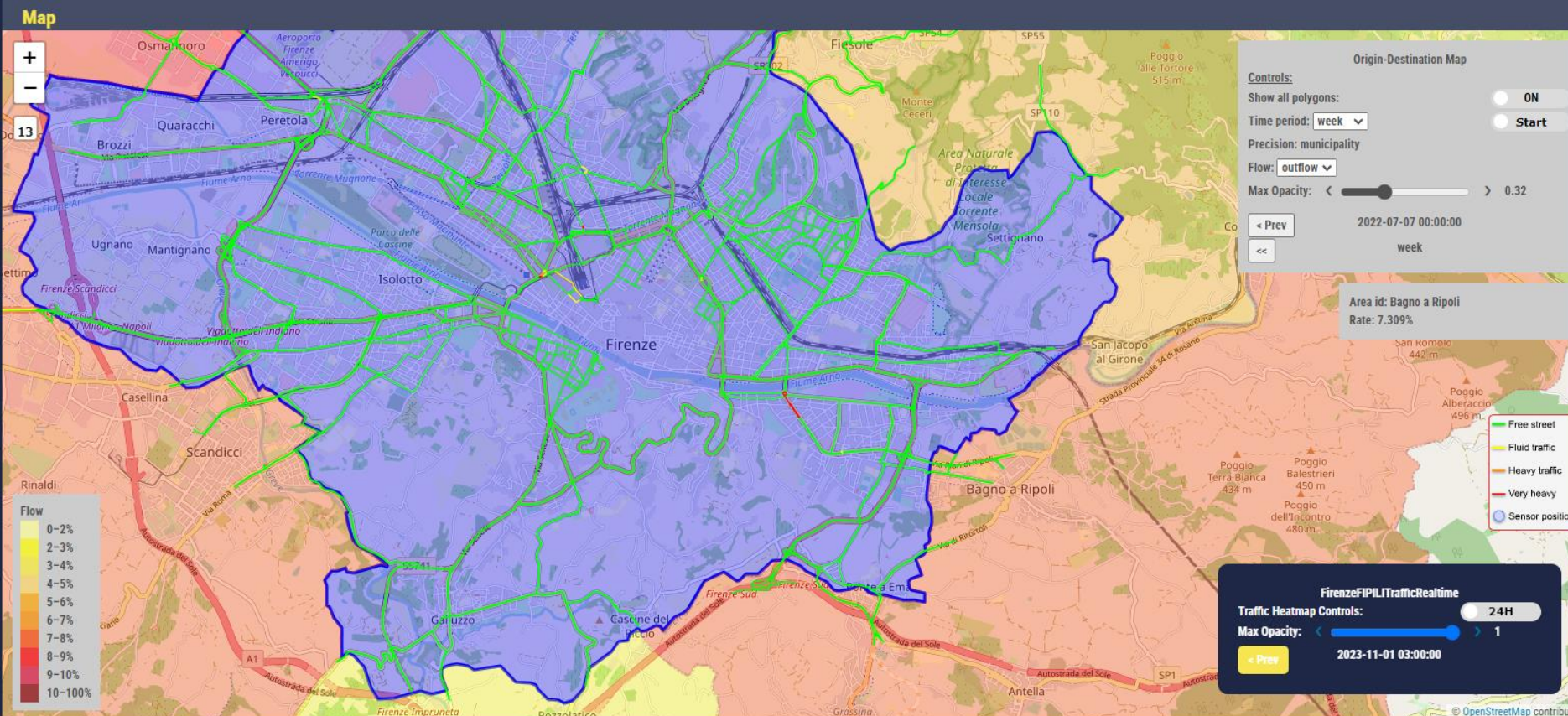
ODM Origin Destination Matrices

Wed 1 Nov 10:50:01



Select or new

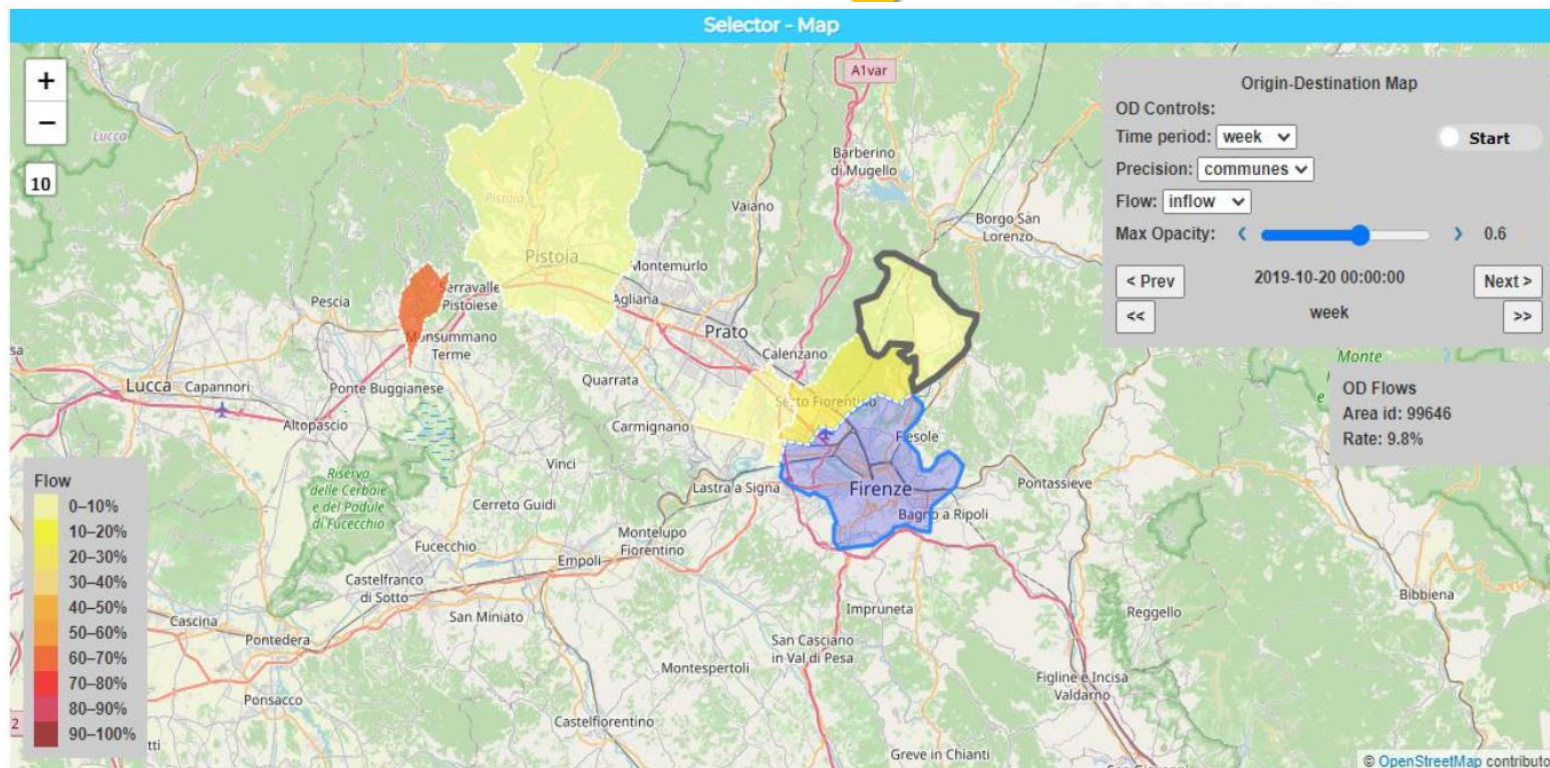
- Admin Areas >
- Areas or grids >
- Traffic Sensors >
- Traffic Flow >
- Traffic Flow Manager New >



My Profile

[Privacy Policy](#) [Cookies Policy](#) [Terms and Conditions](#) [Contact us](#)

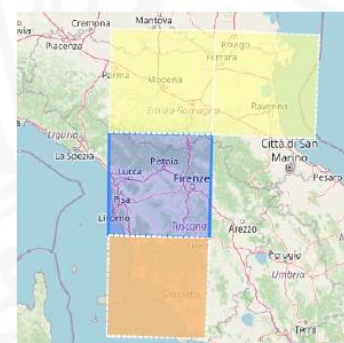
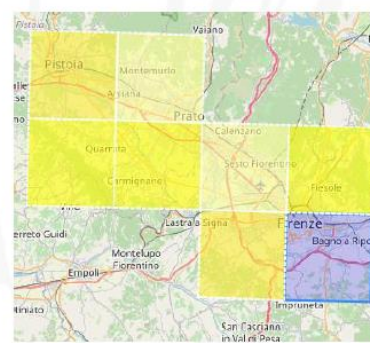
Different Origin Destination Matrices



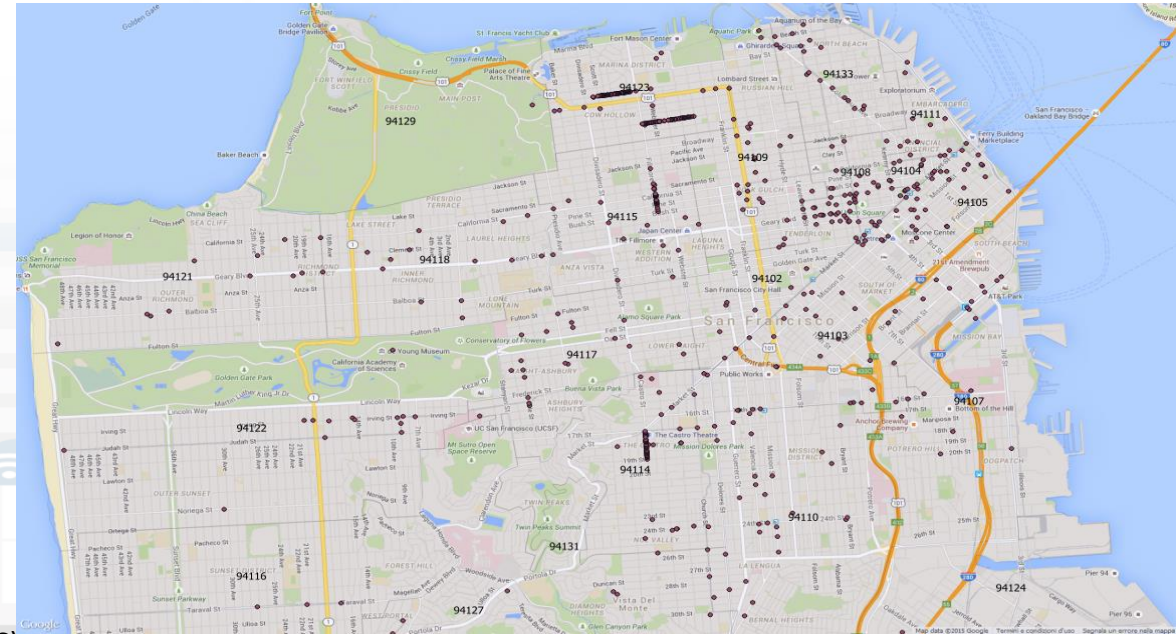
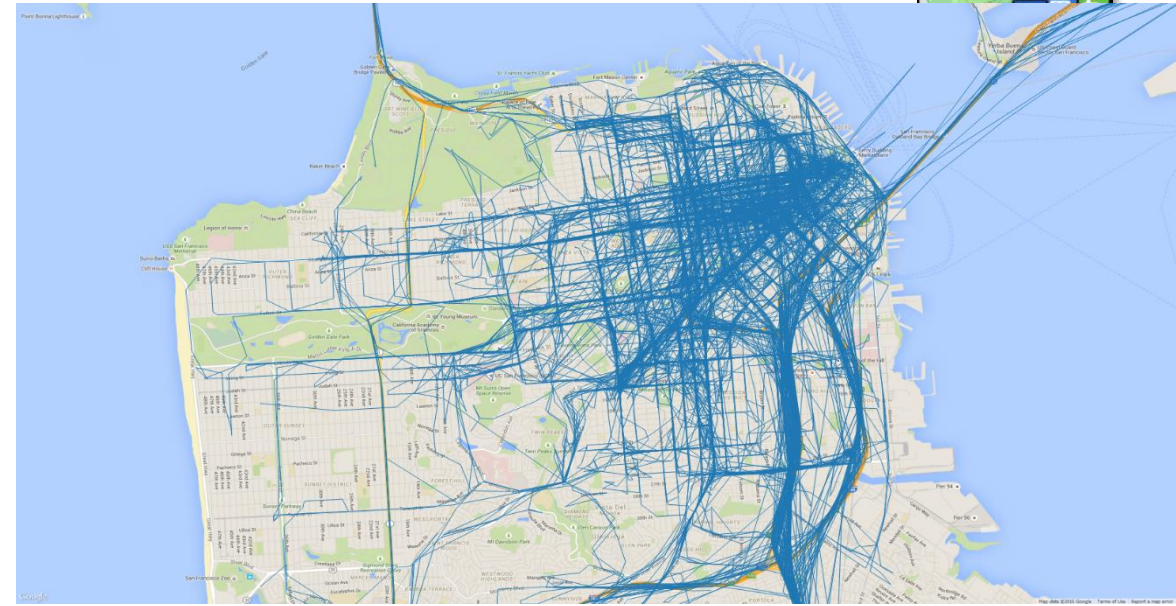
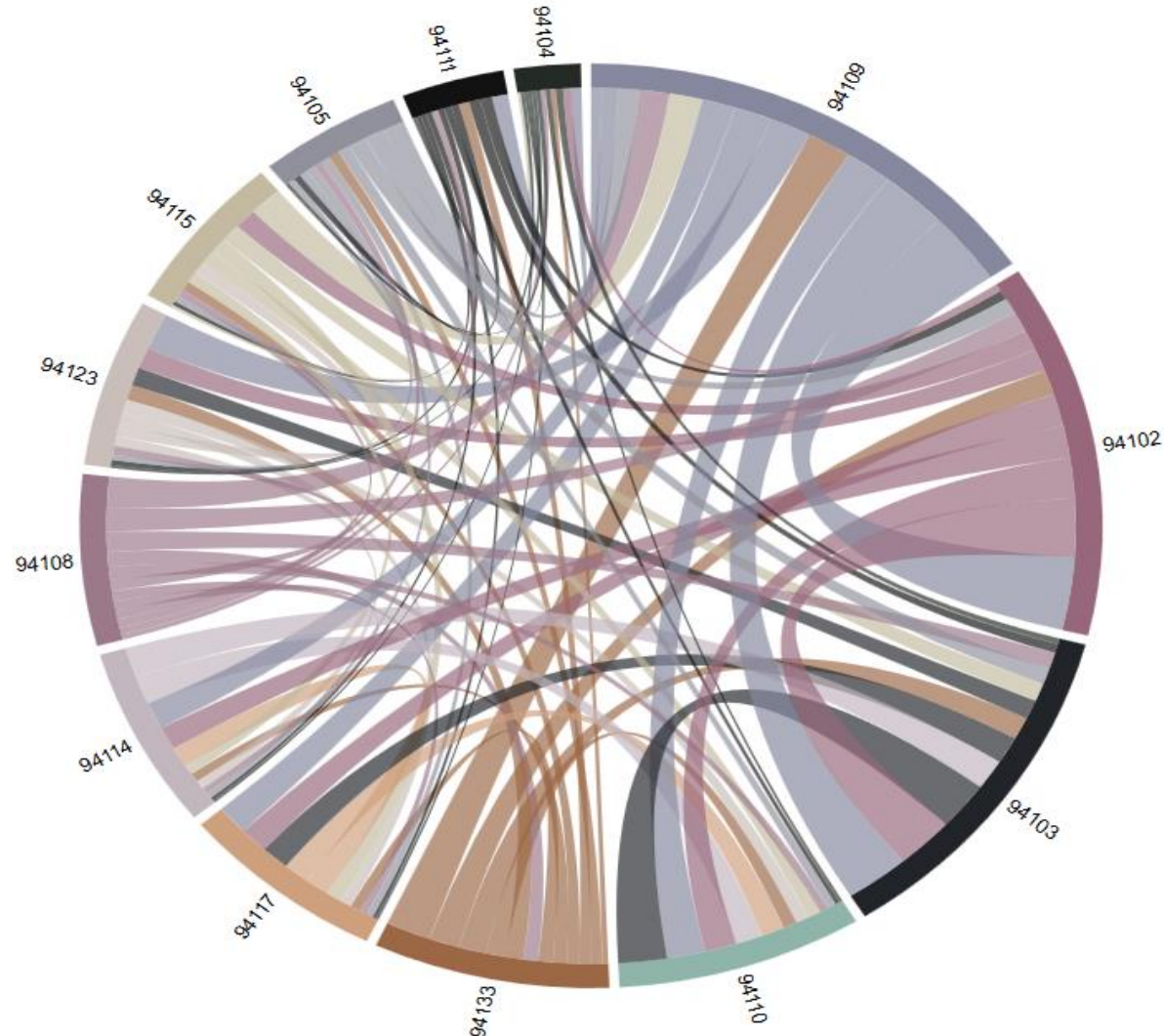
- Get specific value
- Time window
- Opacity
- Animation
- Inflow/outflow
- Sequence of OD matrices: next/prev

shapes

- Shapes: city, region, territories, etc.
 - GADM <https://gadm.org/>, and ACE
- Squared MGRS:
 - 1m, 10m, 100m, 1Km, 10Km, 100Km



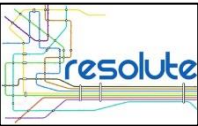
San Francisco



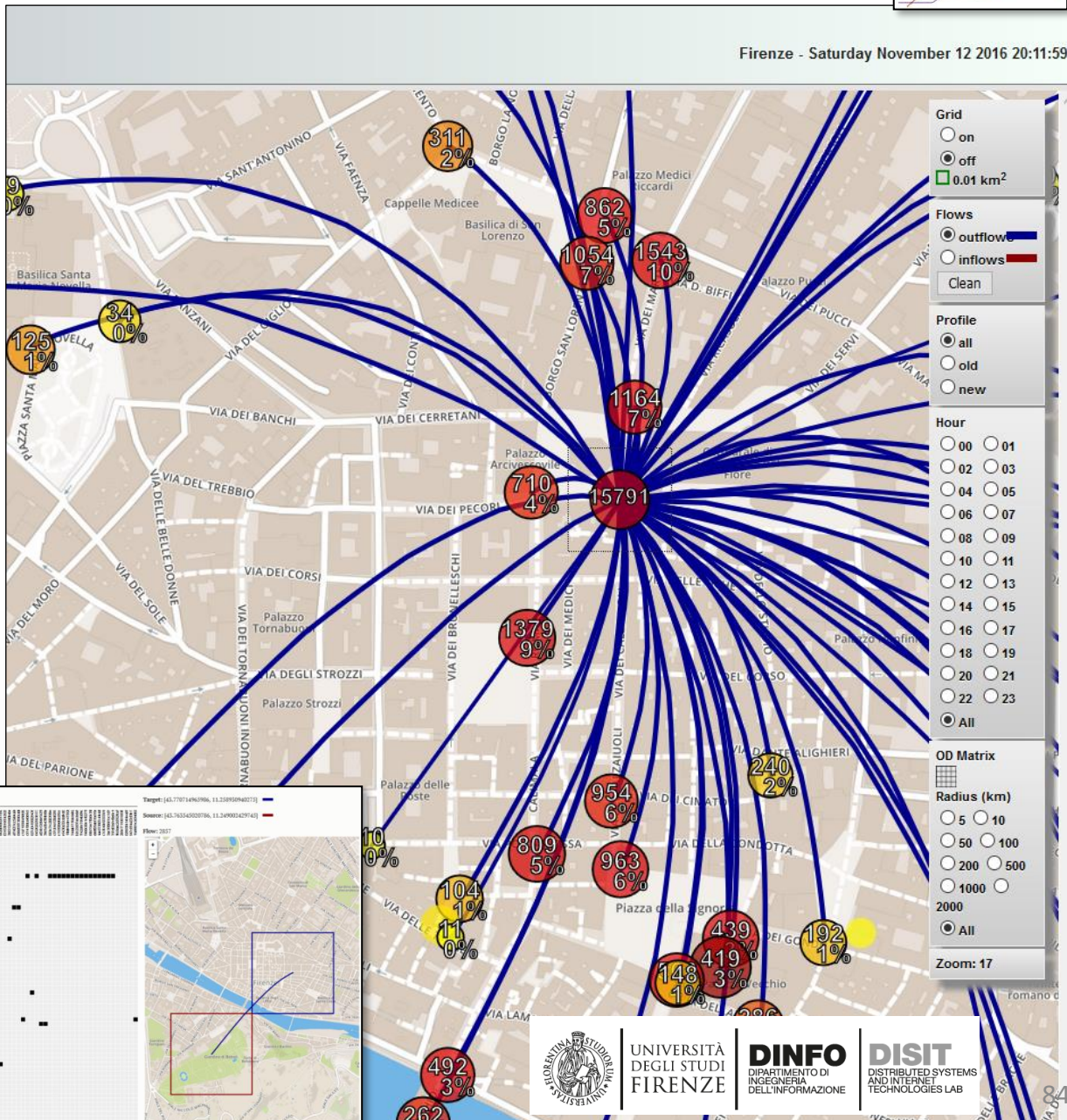
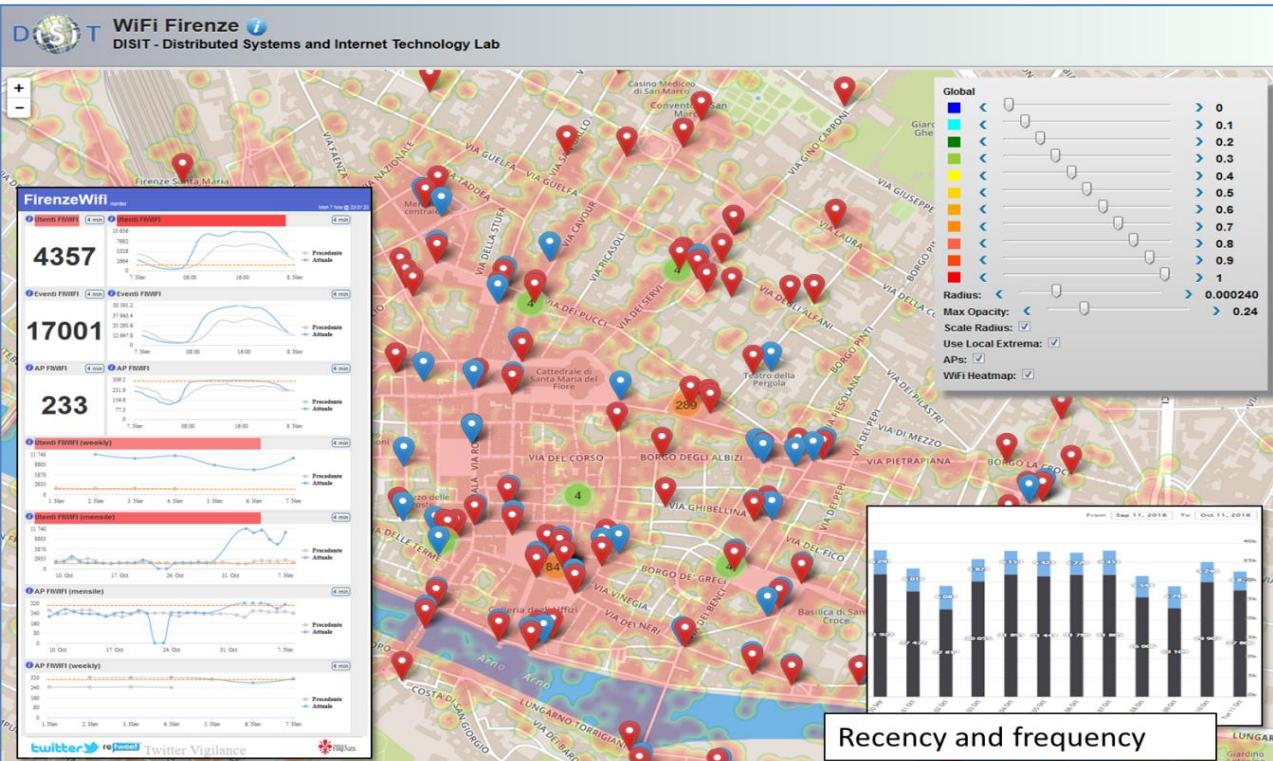
San Francisco OD matrix as a chord diagram, from TAXI OBU data

- 13 central ZIP areas of the city (real cab flows),
- ONLY on FLOW: from to

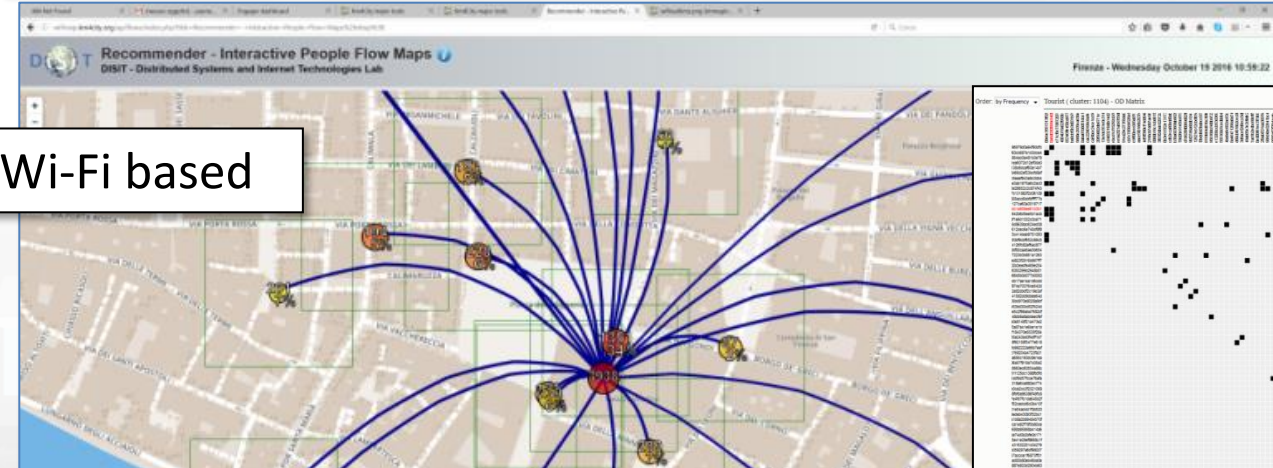
Origin Destination Matrix Estimation



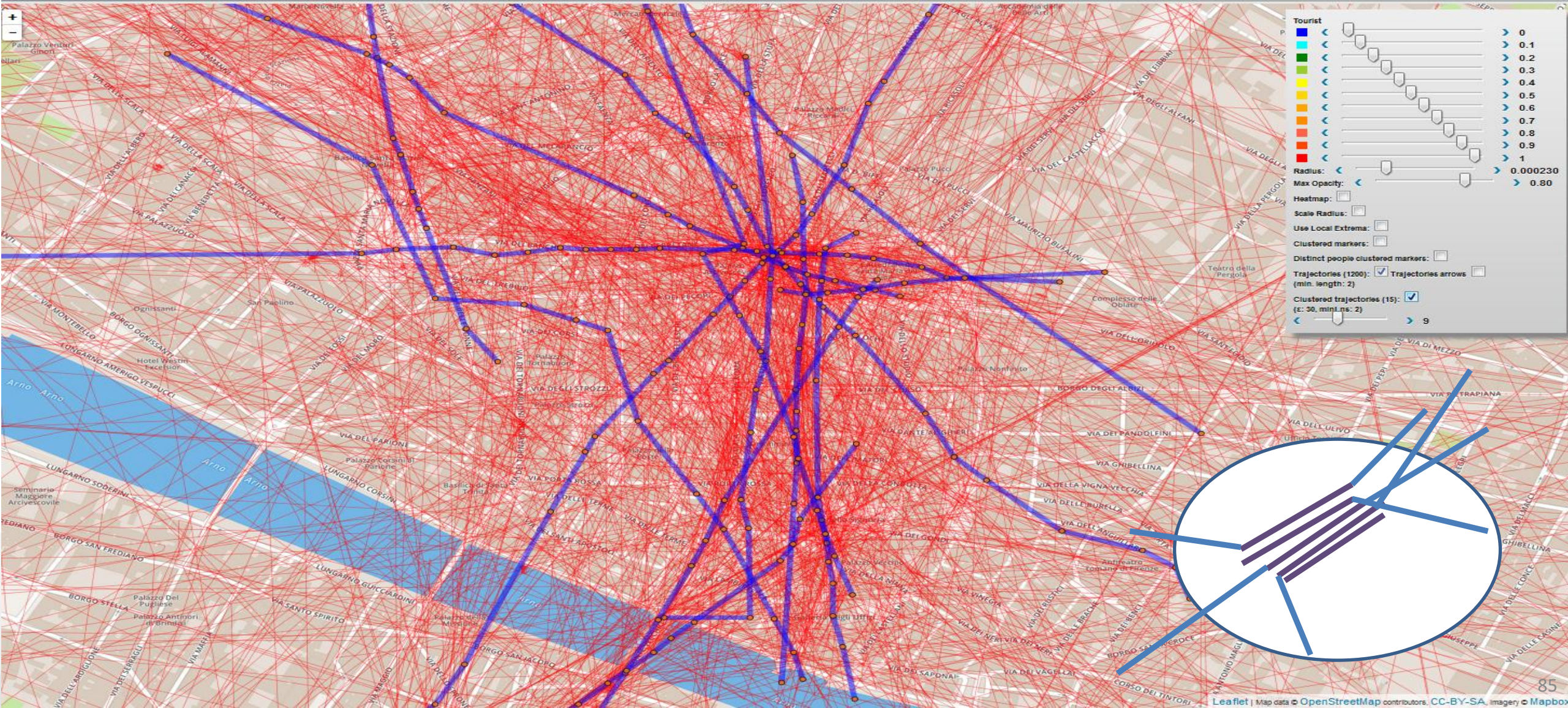
Firenze - Saturday November 12 2016 20:11:59



Wi-Fi based



Cluster di Trajectories



Smart Parking

11 SUSTAINABLE CITIES
AND COMMUNITIES



13 CLIMATE
ACTION



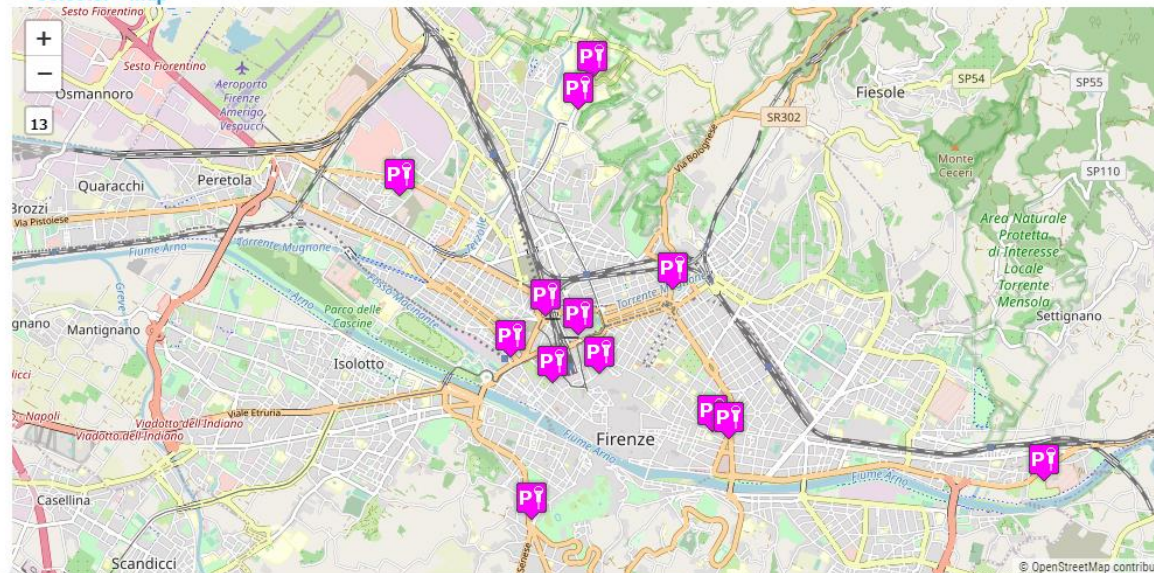
Data Analytic



Selector

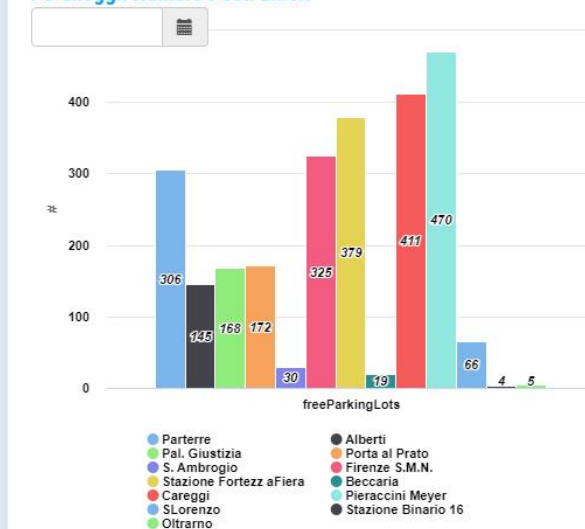
- Parterre
- Piazza Alberti
- Palazzo di Giustizia
- Porta al Prato
- S. Ambrogio
- Stazione Firenze S.M.N.
- Stazione Fortezza Fiera
- Piazza Beccaria

Selector - Map



Parcheggi: Numero Posti Liberi

4m



Stazione Firenze S.M.N. - Free Parking Lots

9m

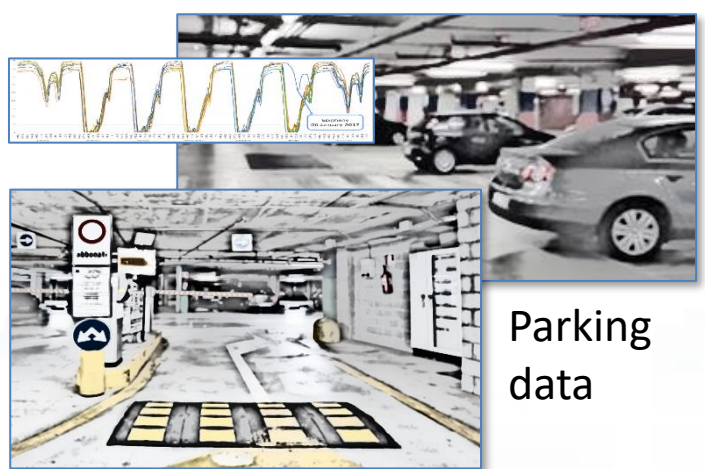


Andamento Posti Occupati

4m



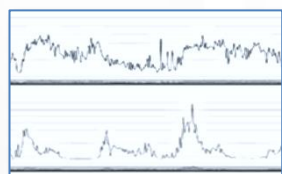
Deep Learning AI to surely Park!



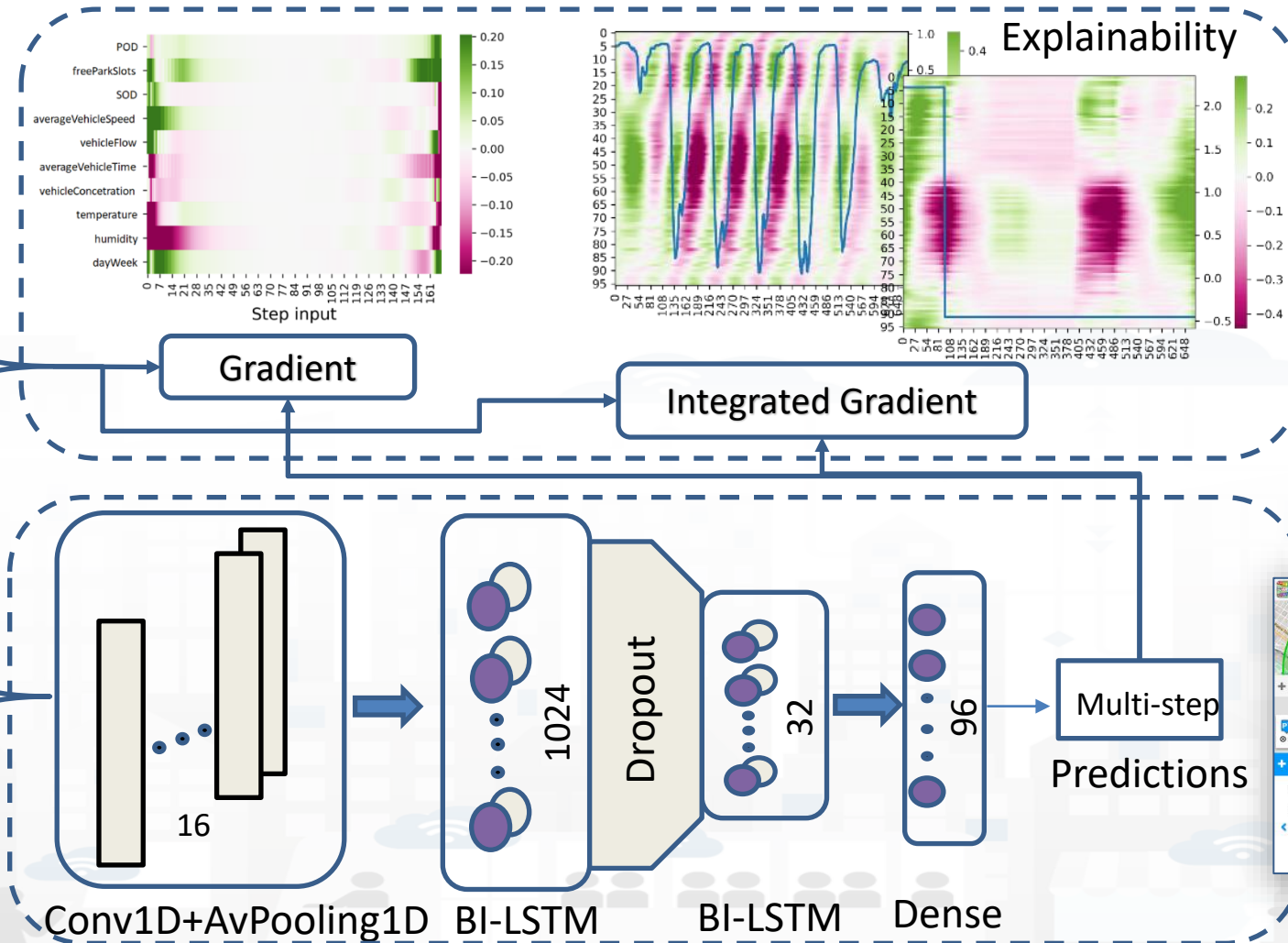
Parking data



Traffic sensors data



Weather Features



Smart City / Smart Parking + Environment

Reverberi, Lonato del Garda



reference

- **Multiple Domain Data**

- Smart Parking, Environment, Wi-Fi

- **Multiple Decision Makers**

- City Officer, operators
- Data monitoring, alerting
- analytics

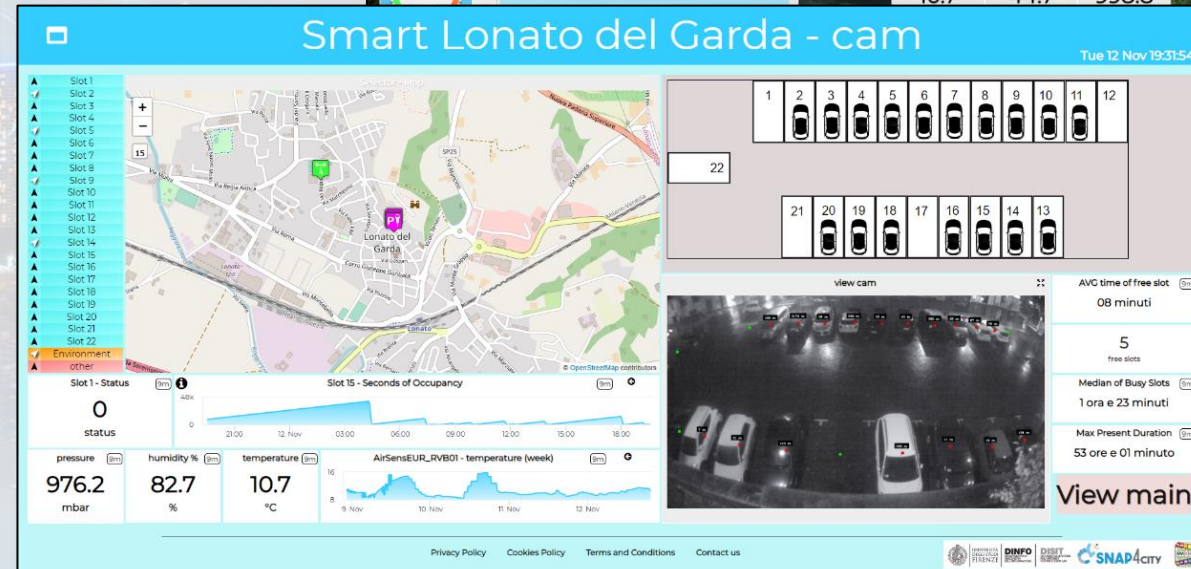
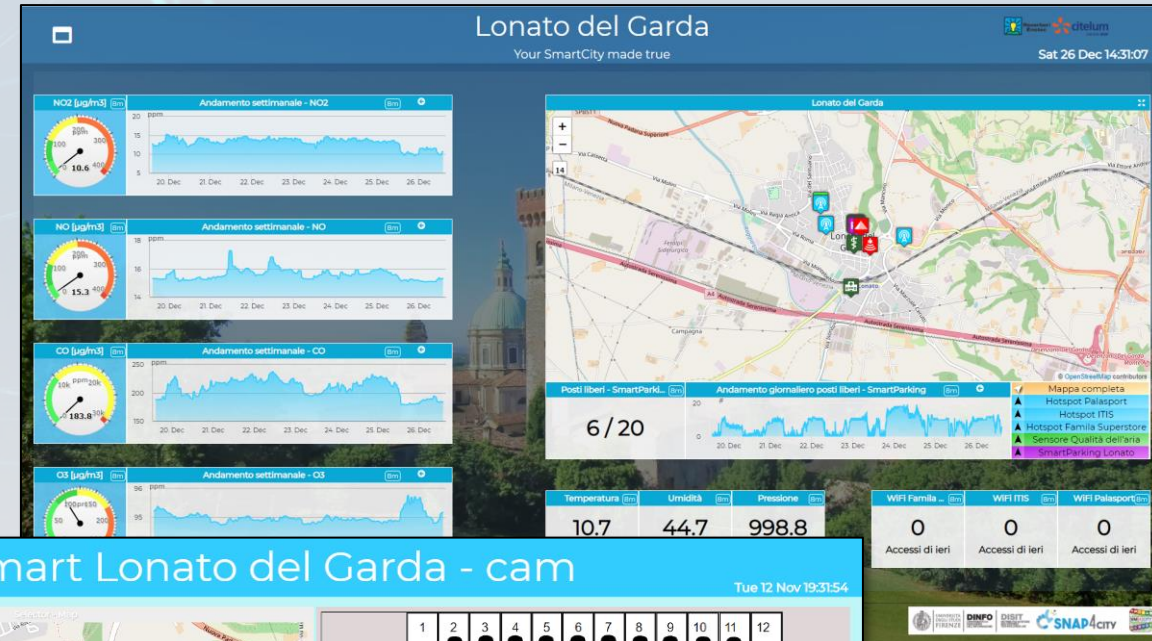
- **Historical and Real Time data**

- Dashboards

- **Services Exploited on:**

- Dashboards, API

- **Since 2019**



Snap4ISPRRA Parking

Parking 58C

Fri 6 Oct 18:33:41

A1_1	A1_2	A1_3	A1_4	A1_5	A1_6	A1_7	A1_8	A1_9	A1_10	A1_11	A1_12	A1_13	A1_14	A1_15	A1_16	A1_17	A1_18	A1_19	A1_20	A1_21	A1_22	A1_76	A1_77	A1_78	A1_79	A1_80	A1_81	A1_82	A1_83	A1_84	A1_85		
				🚗											🚗								🚗		🚗		🚗		🚗		🚗		
A1_23	A1_24	A1_25	A1_26	A1_27	A1_28	A1_29	A1_30	A1_31	A1_32	A1_33	A1_34	A1_35	A1_36	A1_37	A1_38	A1_39	A1_40	A1_41	A1_42	A1_43	A1_44	A1_71	A1_72	A1_73	A1_74	A1_75							
							🚗		🚗																								
A1_45	A1_46	A1_47	A1_48	A1_49	A1_50	A1_51	A1_52	A1_53	A1_54	A1_55	A1_56	A1_57	A1_58	A1_59	A1_60	A1_61	A1_62	A1_63	A1_64	A1_65	A1_66												
										🚗			🚗	🚗					🚗														

Time Trend Comparison

4m ↕

Legend: ● Free Slots, ● Overparking, ■ Unknown

Capacity

9m

85#

Free Slots

9m

74#

Occupancy

9m

12.9%

Overparking Slots

0#

Unknown State Slots

9m

3#

Free Slots Weekly Time Trend Compare

9m ↕

Legend: ● Current, ● Previous

Percentage Of Occupancy Daily Time Trend Com...

9m ↕

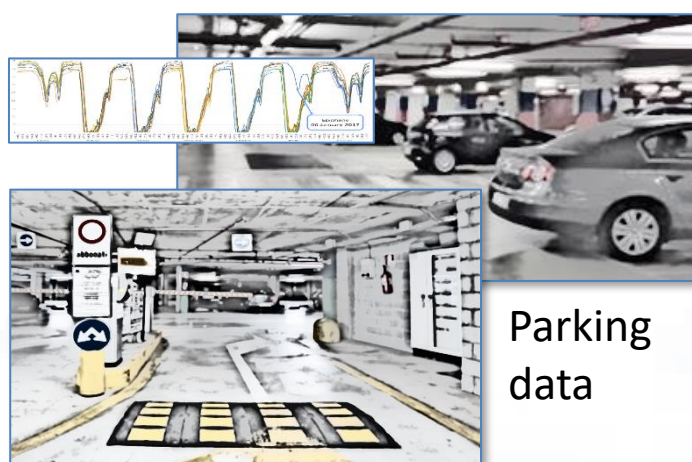
Legend: ● Current, ● Previous

Overparking Weekly Time Trend Compare

9m ↕

Thursday, Oct 05 2023, 04:20
Previous: 4.7

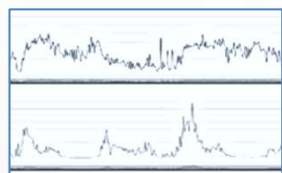
Deep Learning AI to surely Park!



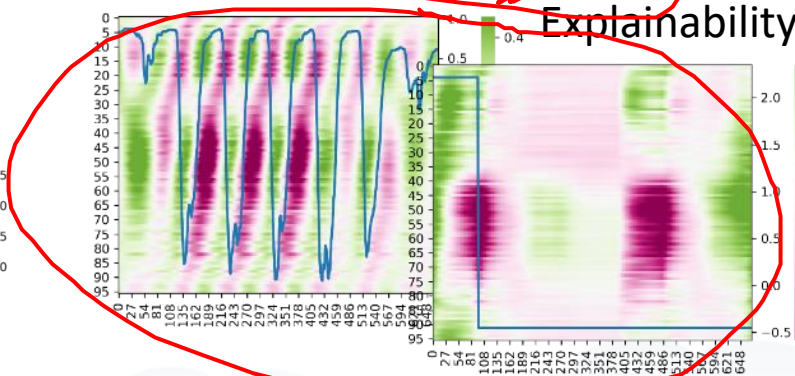
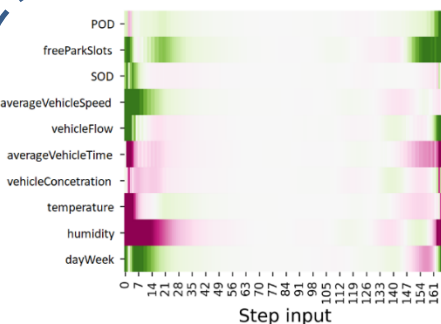
Parking data



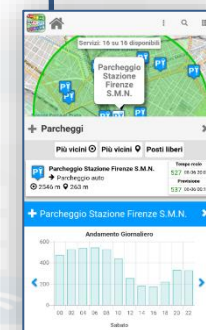
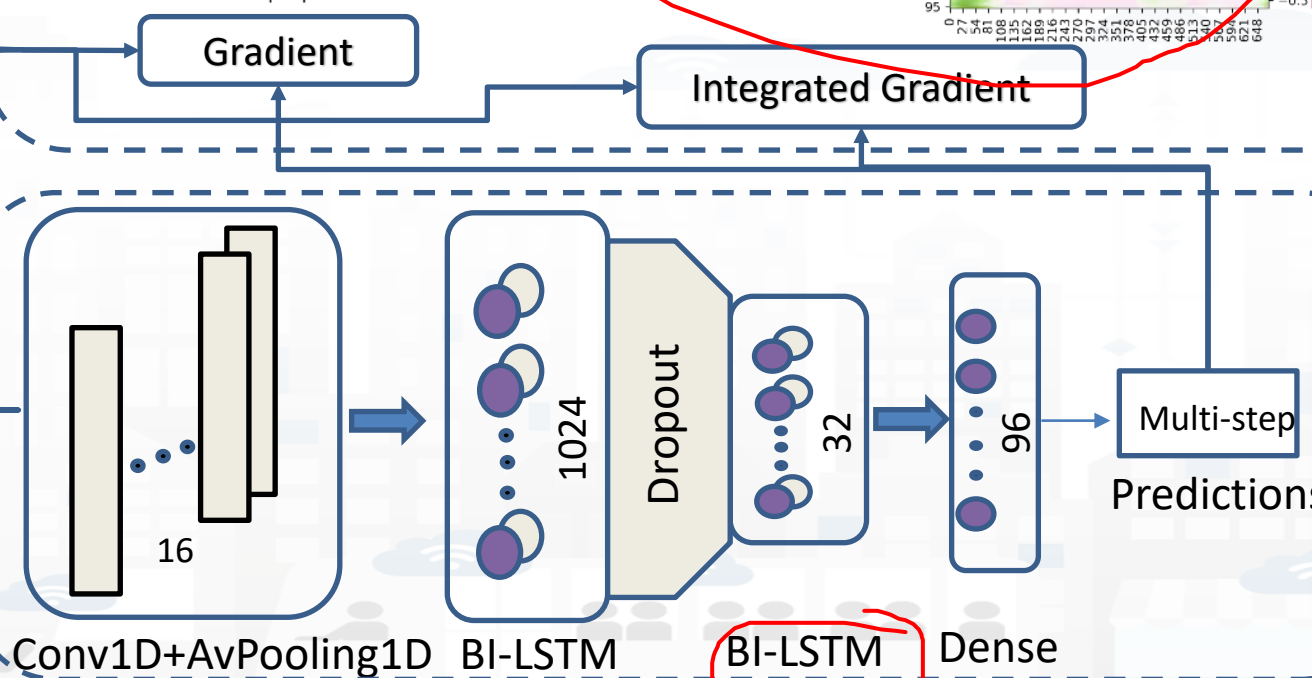
Traffic sensors data



Weather Features



Explainability



Smart Bike

Free Bike predictions

11 SUSTAINABLE CITIES
AND COMMUNITIES

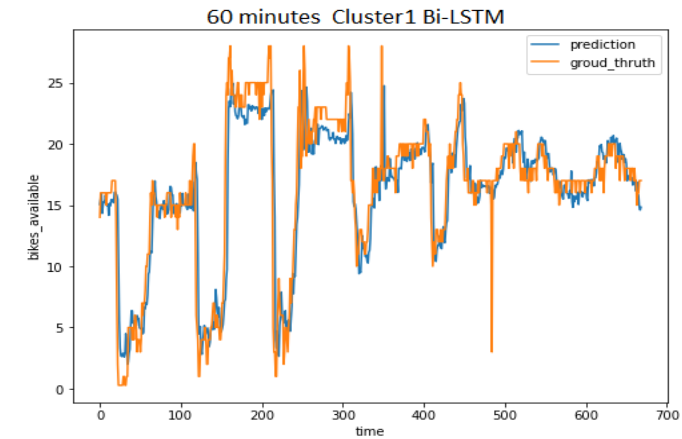
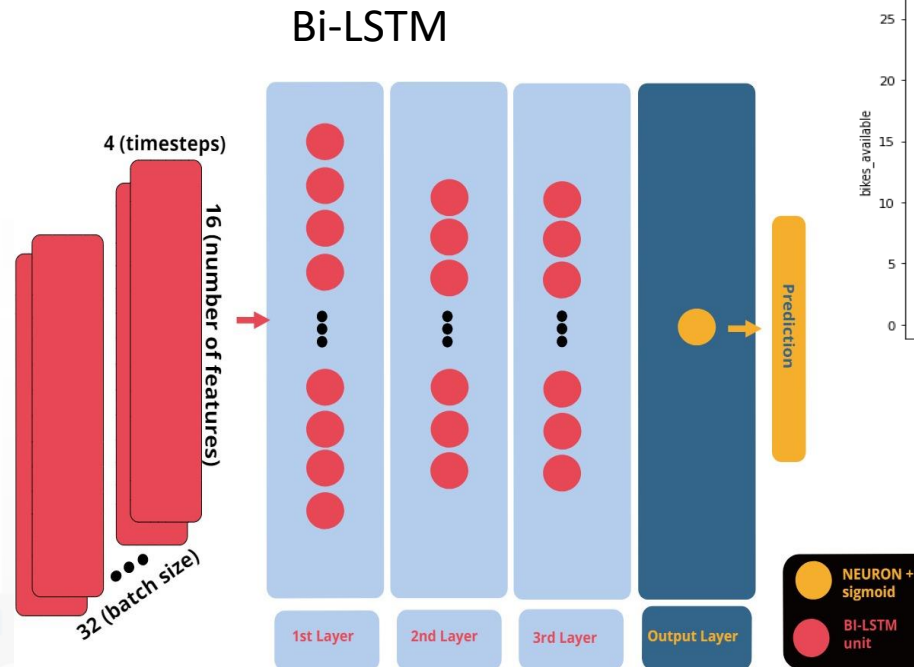


13 CLIMATE
ACTION



Data Analytic

Deep Learning for Short-Term Prediction of Available Bikes on Bike-Sharing Stations



Public Transport Analysis

11 SUSTAINABLE CITIES
AND COMMUNITIES



13 CLIMATE
ACTION



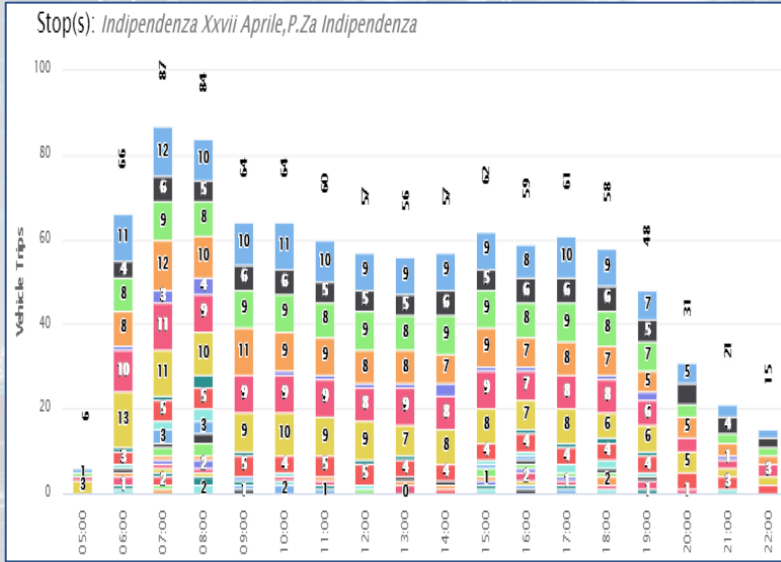
Data Analytic



What-if Analysis on Pub Transport

- Definition of scenarious impact on
 - Traffic, Pollutant, parking, public transport, private flows, etc.
 - KPI analysis

Public Services



Welcome to DORAM powered by SNAP4CITY

Services: 36 on 36 available

The public transportation system has been analyzed in the City, considering the service offer vs. mobility demand. The top-thirty most crowded stops are presented on the right panel and on the map. Please, select your desired scenarios or a stop on the map to perform other analysis.

Type the stop name ... Search

Stop panel

Scenario Selector

Choose a scenario: Actual scenario Load

Actual scenario: Describes the current status of the public transportation network. (More Info)

Daily Individual Trips > 52000
 Stops > 1900
 Residential Buildings > 31000
 Service Providers > 32000
 Mobility Operators > 10
 Transport Modes = 3

The Most Crowded Stops

Select a time slot: 05:00 to 01:59 Search

Indipendenza Xxvii Aprile
P.Za Indipendenza

Daily Pick-ups: 377
 Daily Drop-offs: 407
 Daily Vehicle Trips: 979

Stazione Nazionale

Daily Pick-ups: 321
 Daily Drop-offs: 358
 Daily Vehicle Trips: [unlabeled]

Welcome to DORAM powered by SNAP4CITY

Services: 36 on 36 available

The public transportation system has been analyzed in the City, considering the service offer vs. mobility demand. The top-thirty most crowded stops are presented on the right panel and on the map. Please, select your desired scenarios or a stop on the map to perform other analysis.

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> 52000
 > 1900
 > 31000
 > 32000
 > 10
 = 3

The Most Crowded Stops

Select a time slot: 05:00 to 01:59 Search

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Daily Pick-ups: 321
 Daily Drop-offs: 358
 Daily Vehicle Trips:

People
 People/Vehicle Arrival

Pick-ups
 Drop-offs

Pick-ups/Vehicle Arrival
 Drop-offs/Vehicle Arrival

Pick-ups
 Drop-offs

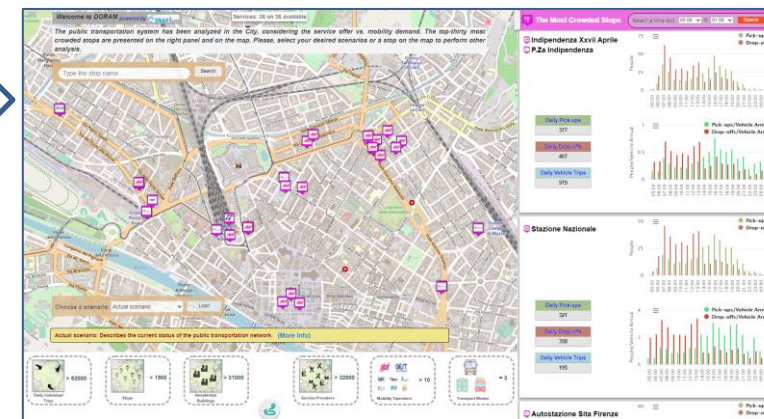
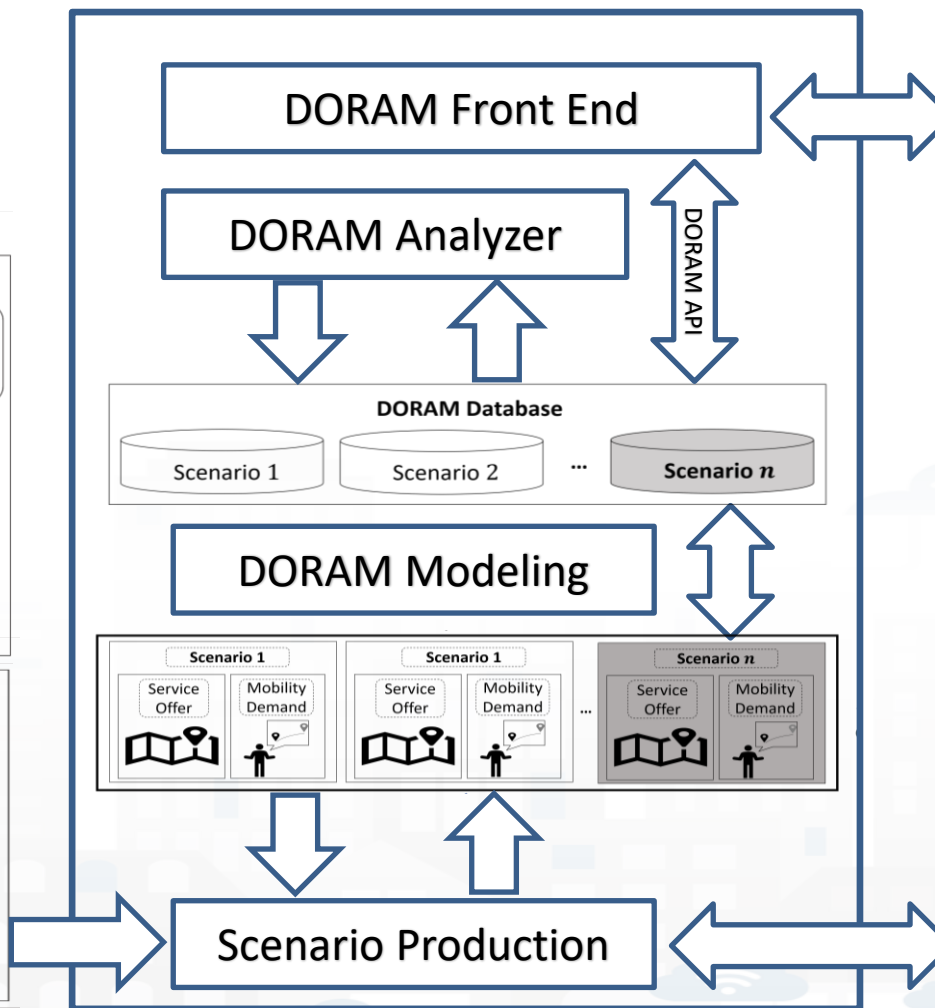
Pick-ups/Vehicle Arrival
 Drop-offs/Vehicle Arrival

People
 People/Vehicle Arrival

Pick-ups
 Drop-offs

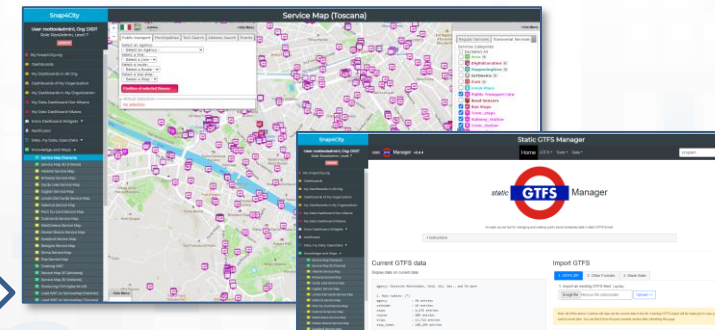
Pick-ups/Vehicle Arrival
 Drop-offs/Vehicle Arrival

DORAM



DORAM tool

Snap4City tools for City data

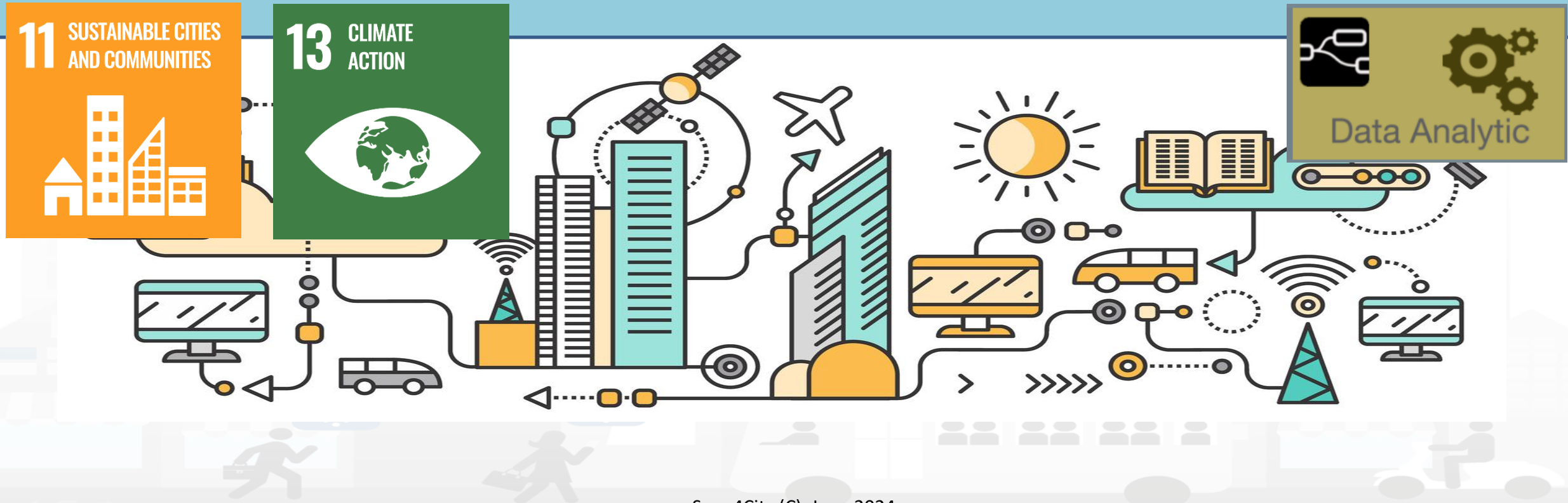


GTFIS Editor and browser

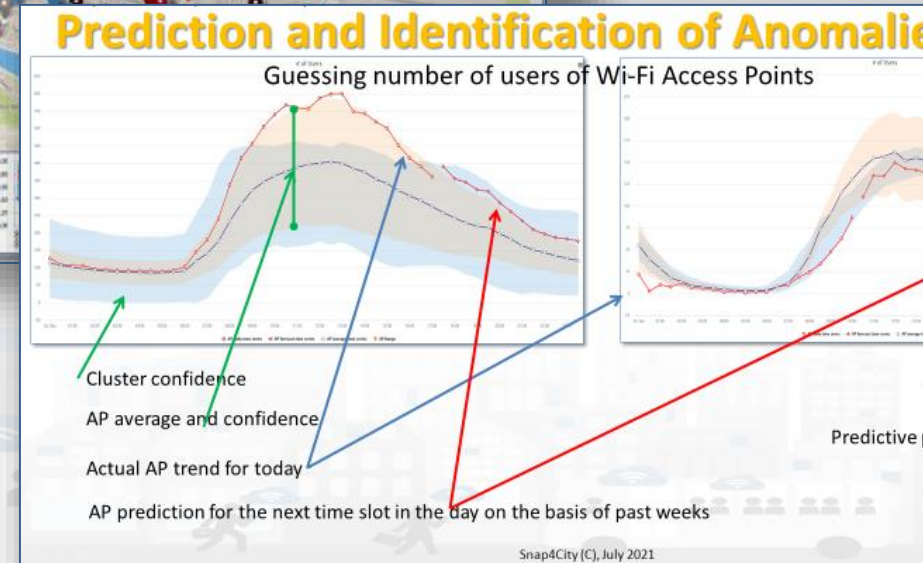
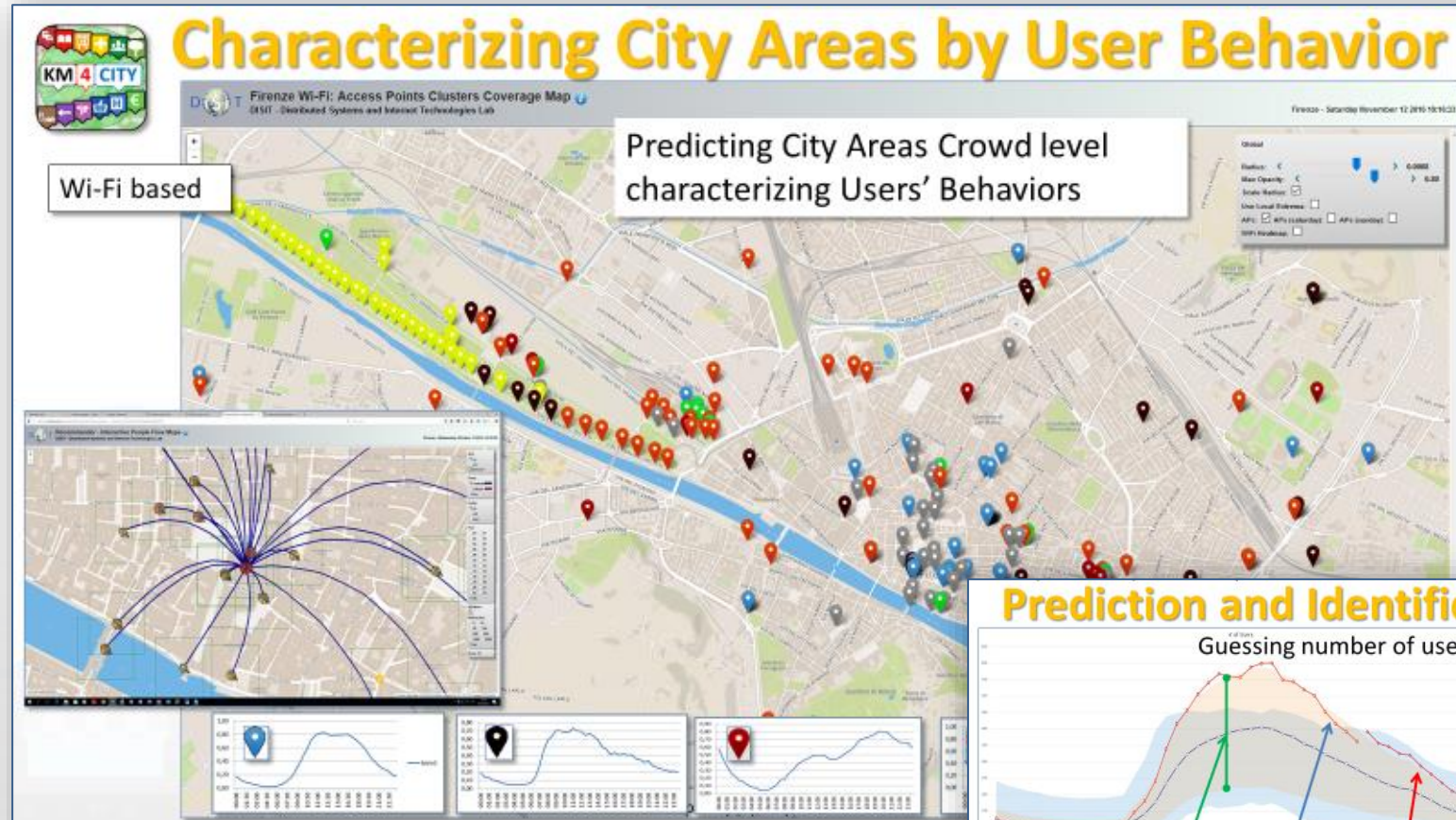
<https://www.snap4city.org/odanalyzer/#b>

TOP

User Behavior

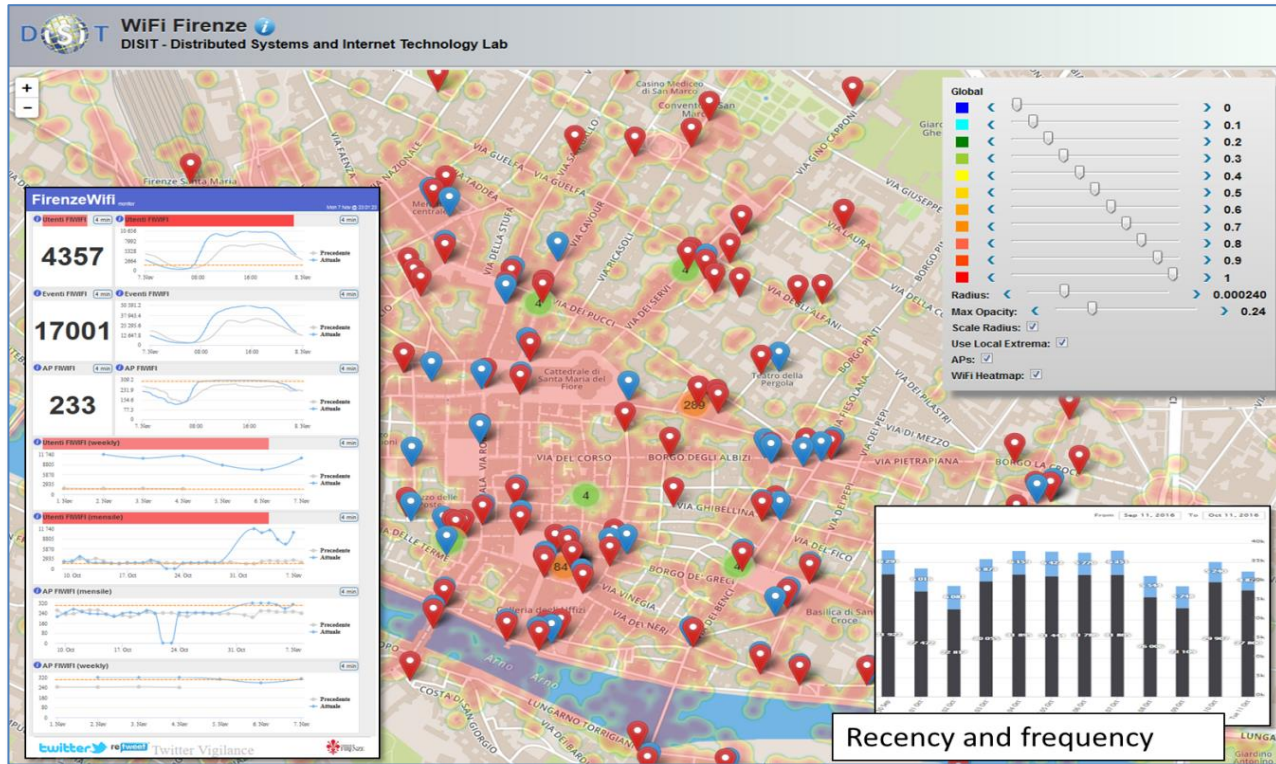


- **Prediction of people flows** on the basis of Wi-Fi data
- **Anomaly detection**
- **Resolute H2020**
- **Classification of city areas**

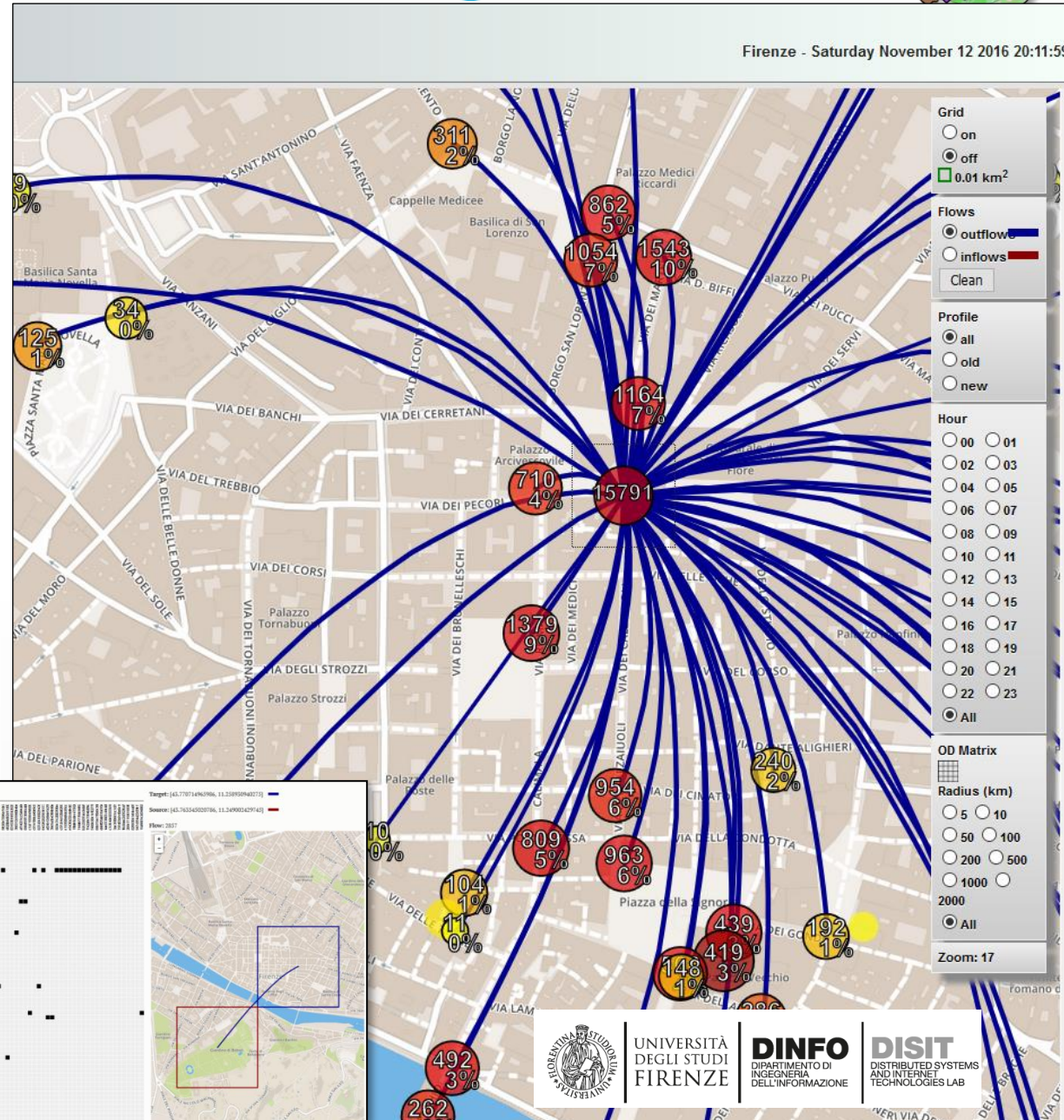


Origin Destination Matrix Estimation

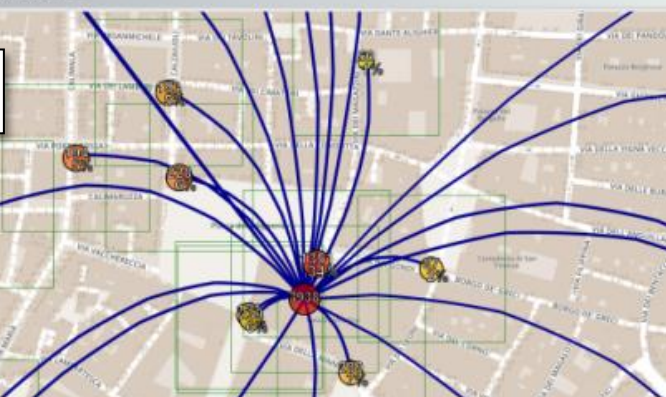
Firenze - Saturday November 12 2016 20:11:59



Recency and frequency



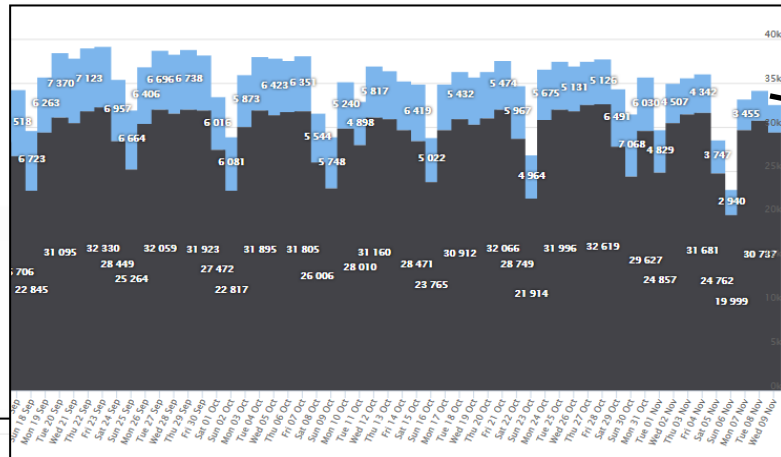
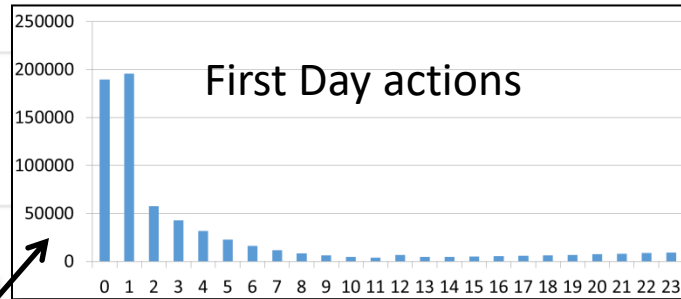
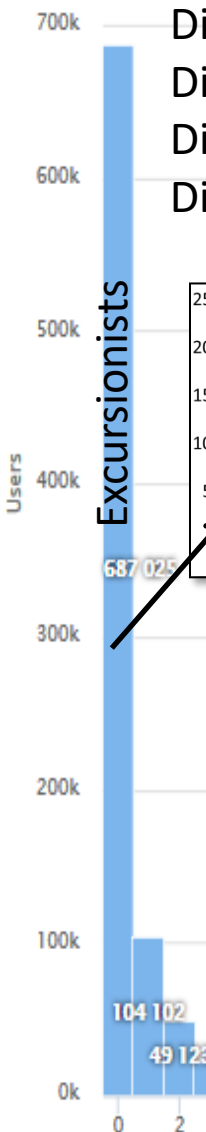
Wi-Fi based



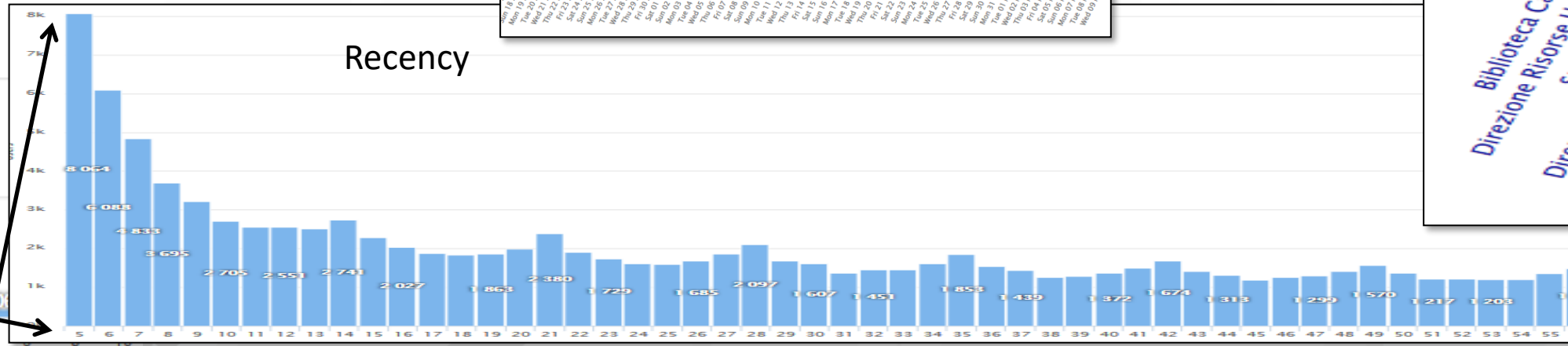
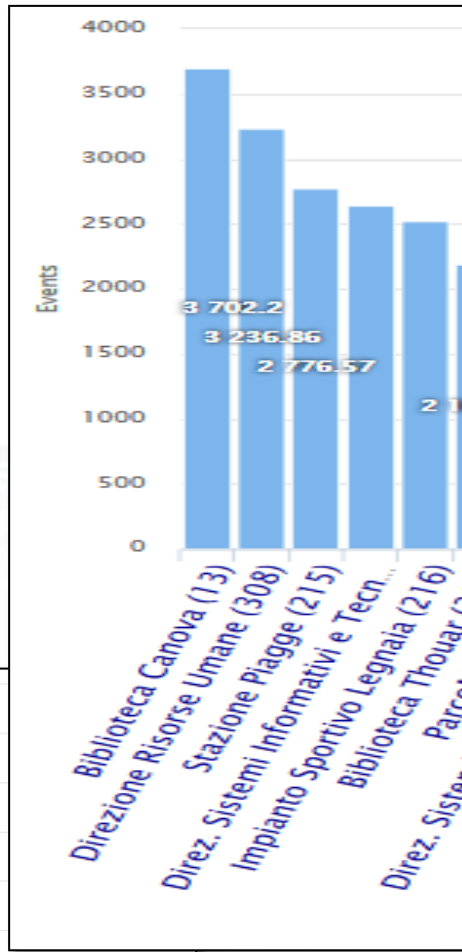
User Behaviour Analysis

Where

Distinct APs: 343
 Distinct APs (last 24 hours): 311
 Distinct Users (last 180 days): 1102098
 Distinct Excursionists (last 180 days, < 24 h): 687025



New City Users
VS
Returning



Tuscany Region

• Dashboards & Services:

- **Mobility:** public transport operators schedule and paths, traffic Fi-Pi-Li main road, parking status and predictions, traffic sensors, Origin Destination matrix, routing, multimodal routing, etc.

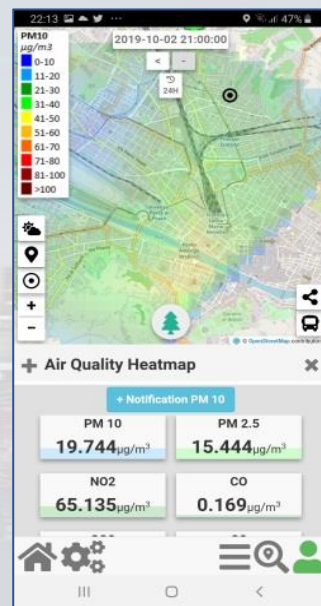
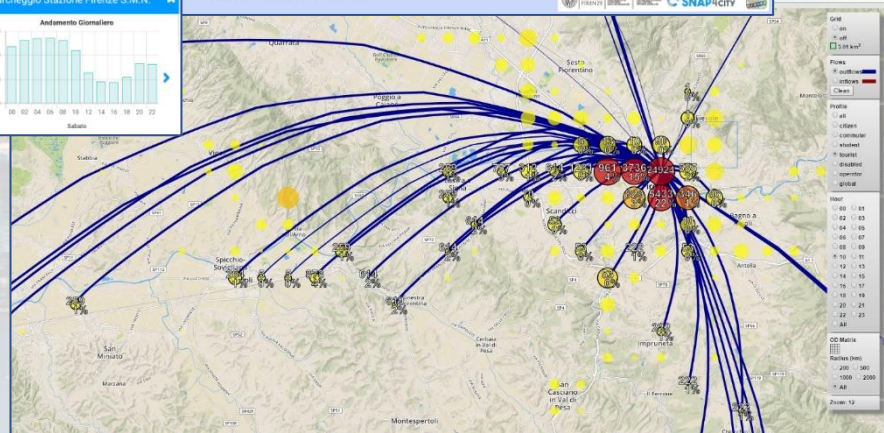
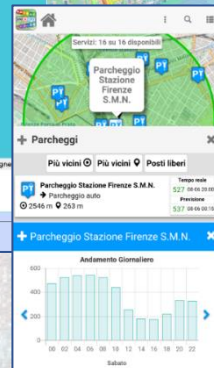
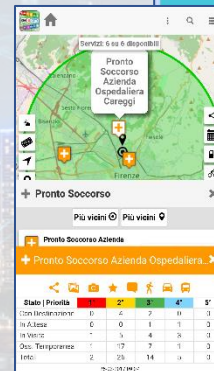
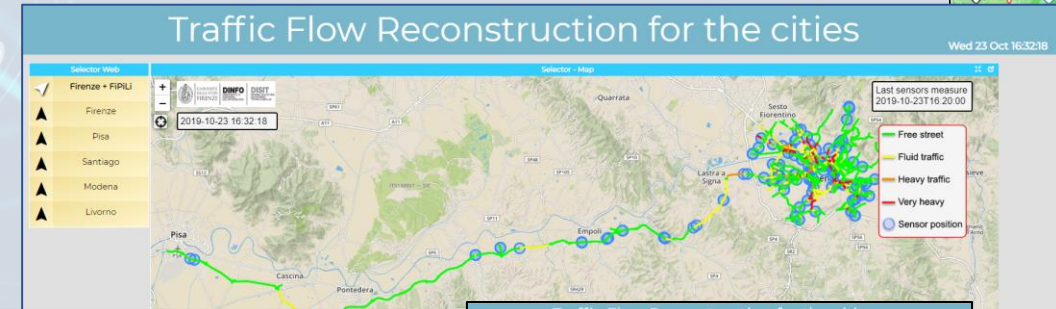
- **Social:** Hospitals and triage, etc.
- **Environment:** sensors, heatmaps, alerting,
 - **Pollution Forecast:** NOX, NO2
 - **Weather Forecast,**
- **Culture and Tourism**
- Etc.

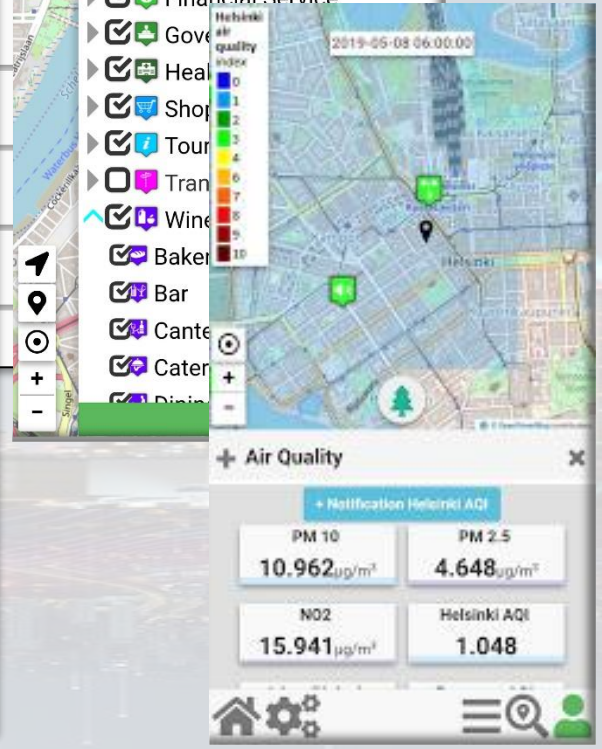
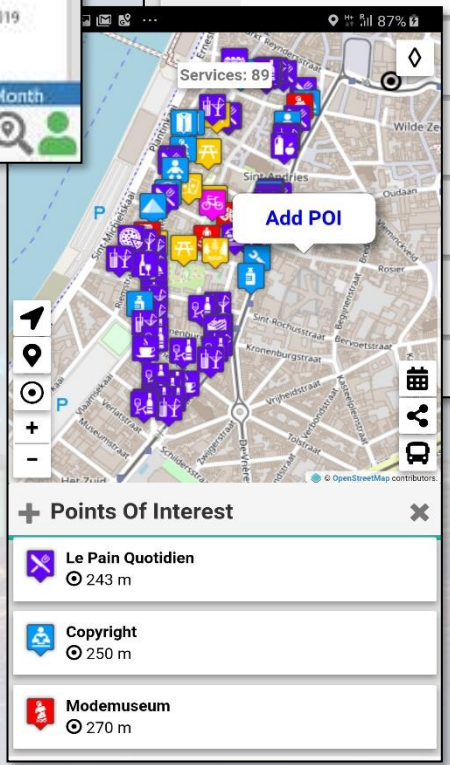
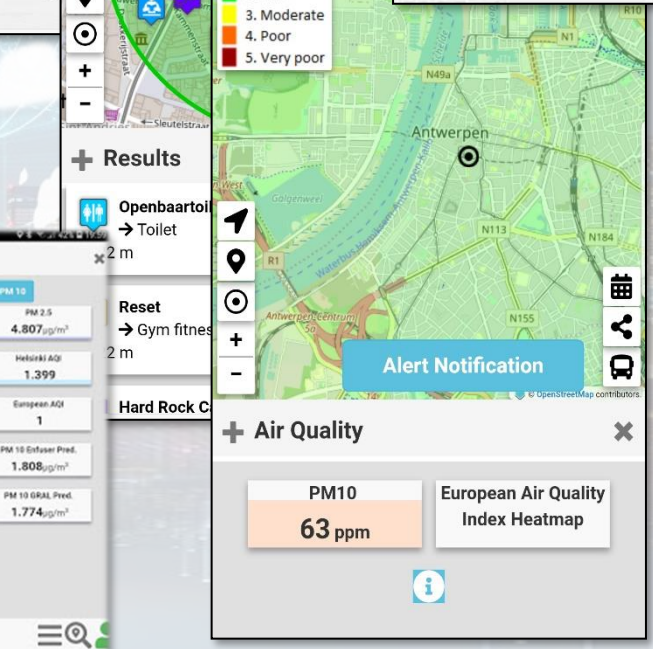
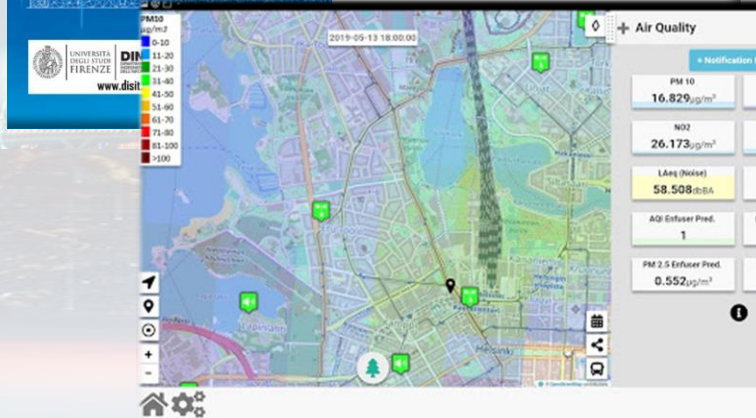
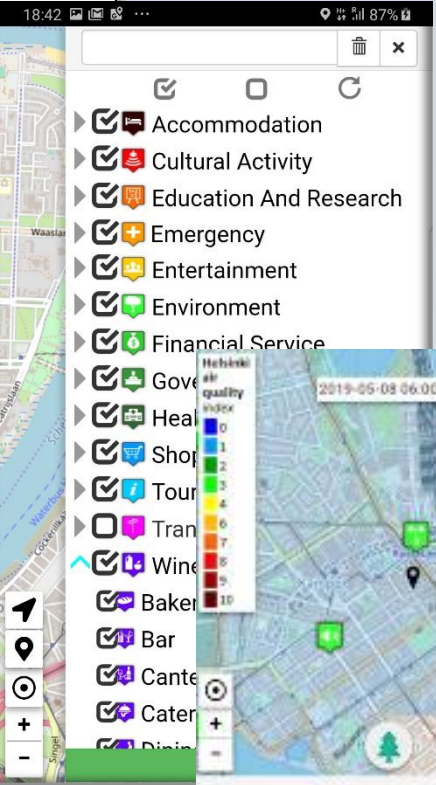
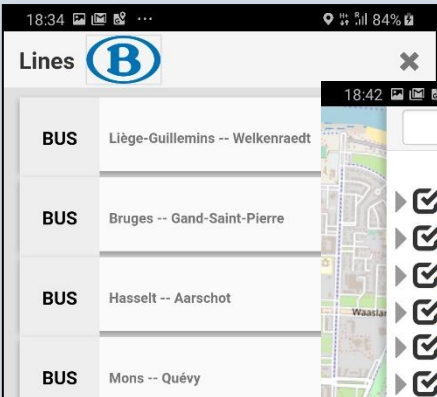
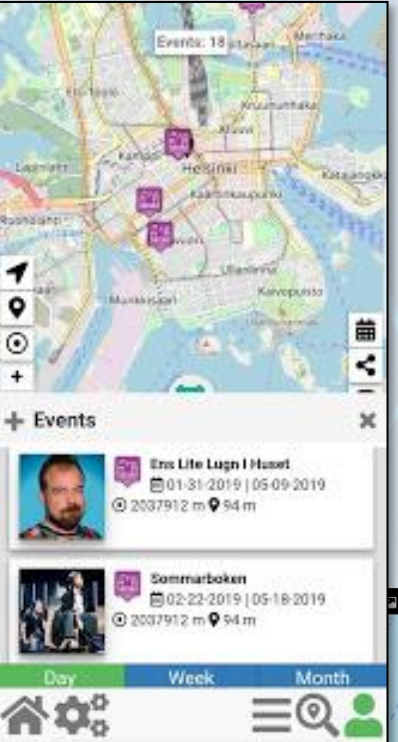
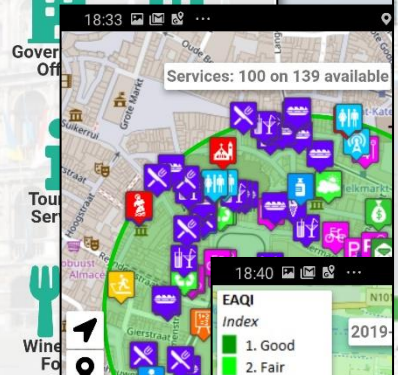
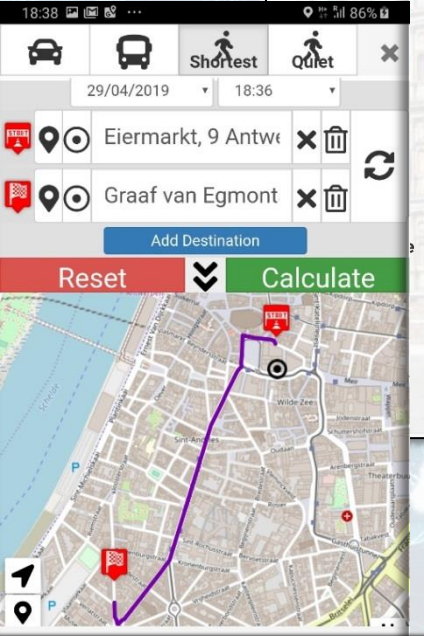
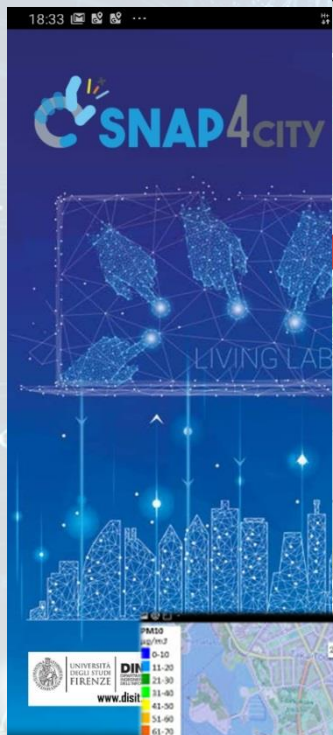
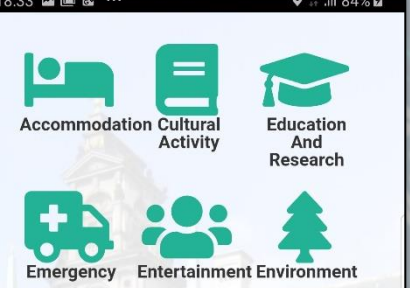
• Mobile App and MicroApplications:

- Tuscany in a Snap (all stores)
- Tuscany where what... km4city (all stores)

• Numbers: 1.5 M complex events per day

Snap4City (C), June 2024







Citizen Engagement via Mobile Apps

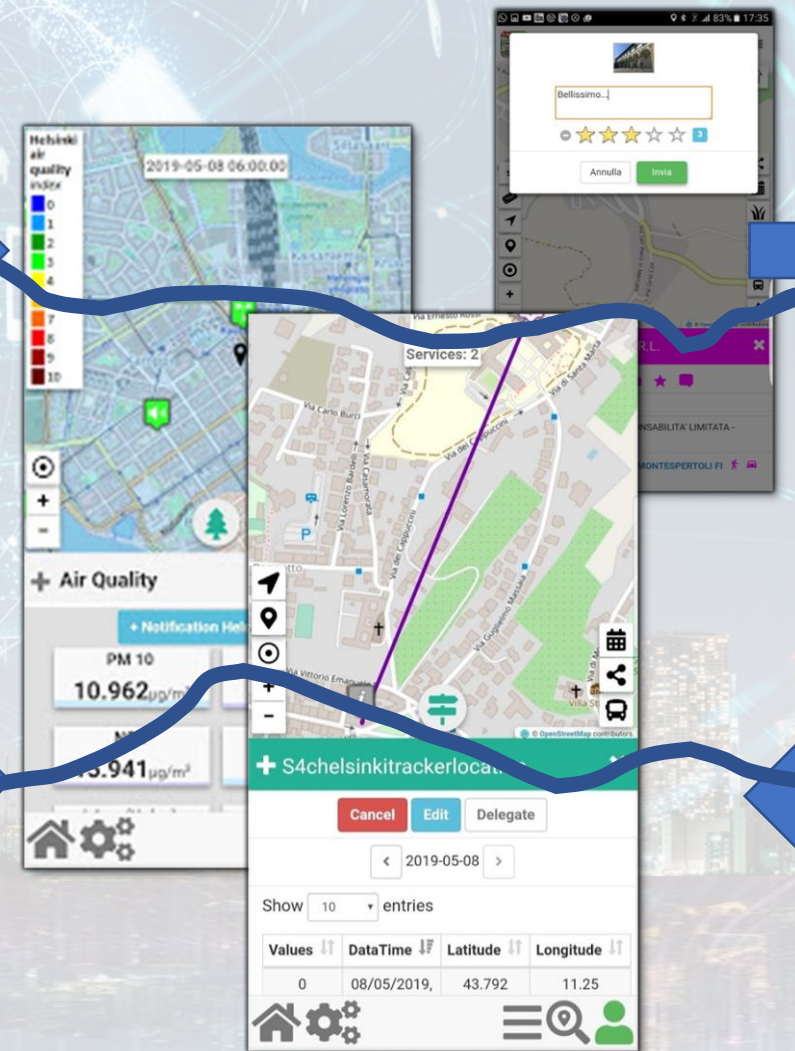
- GPS Positions
- Selections on menus
- Views of POI
- Access to Dashboards
- searched information
- Routing
- Ranks, votes
- Comments
- Images
- Subscriptions to notifications
-

Produced information

- Viewed ?
- Accepted ?
- Performed ?
- ...

Users

Snap4City (C), June 2024



Derived information

- Trajectories
- Hot Places by click and by move
- Origin destination matrices
- Most interested topics
- Most interested POI
- Delegation and relationships
- Accesses to Dashboards
- **Cumulated Scores from Actions**
- Requested information
- Routing performed
-

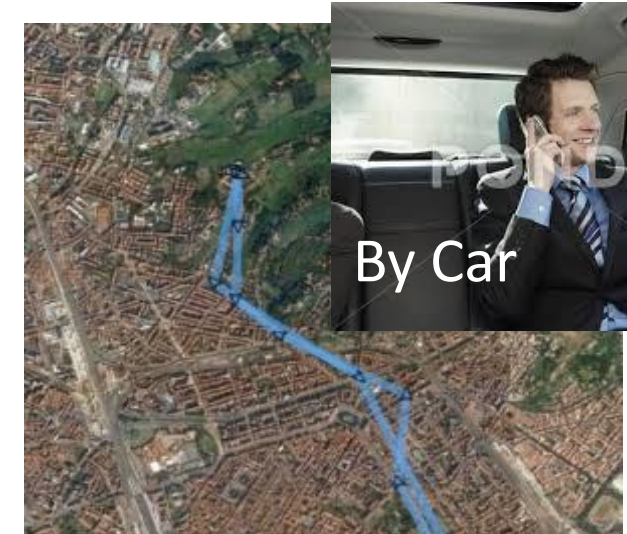


Produced information

- Suggestions
- Engagements
- Notifications
- ...

System

To propose suggestions and Engage city user we need to know how they are moving



By Car



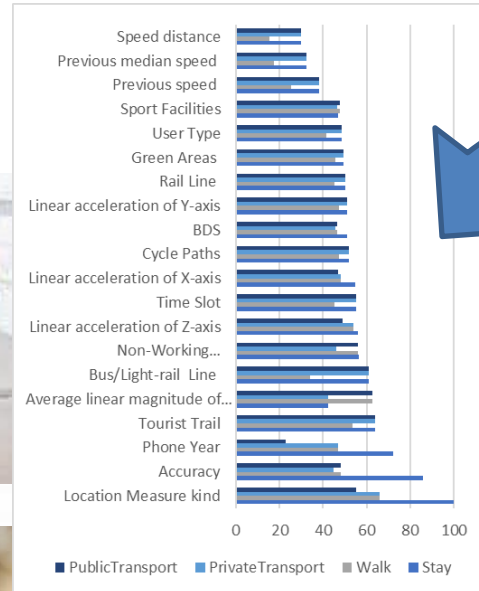
Walk



By BUS

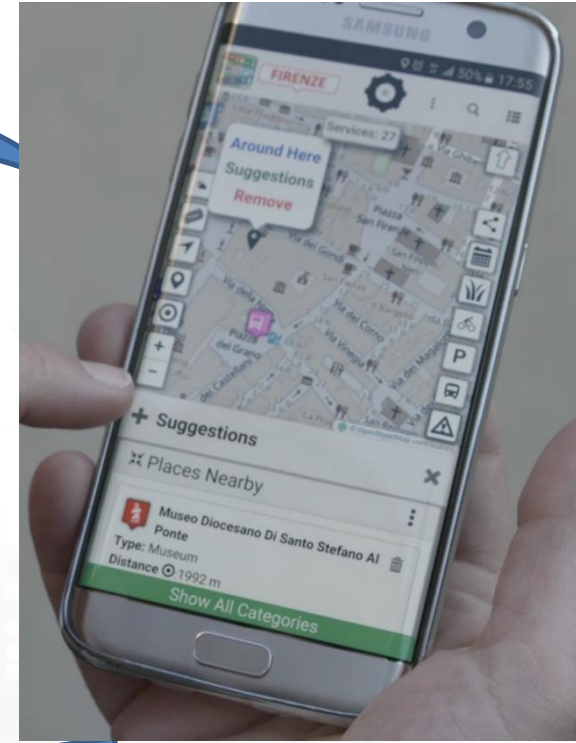


Run

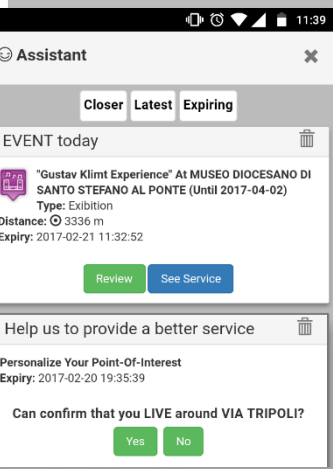
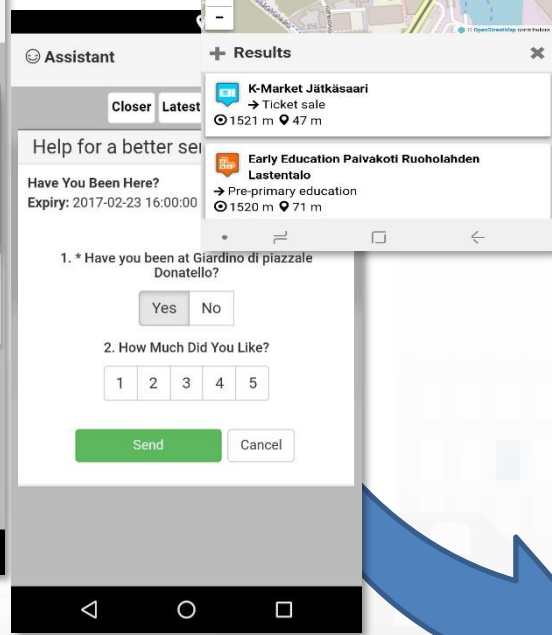
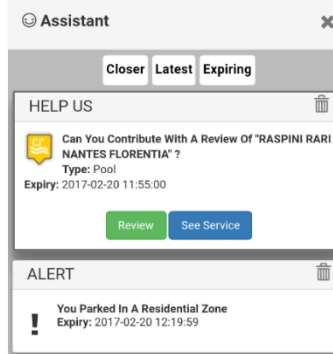
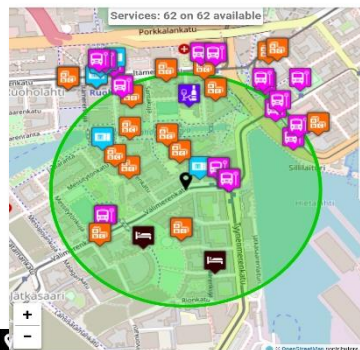
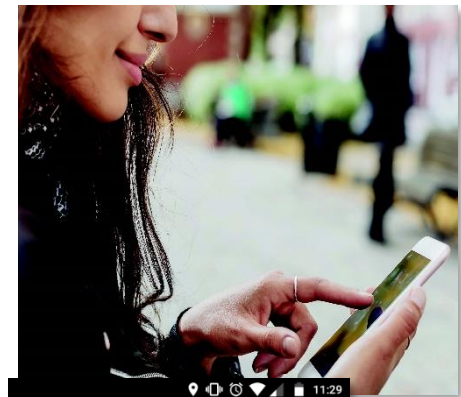


Artificial Intelligence
Classification

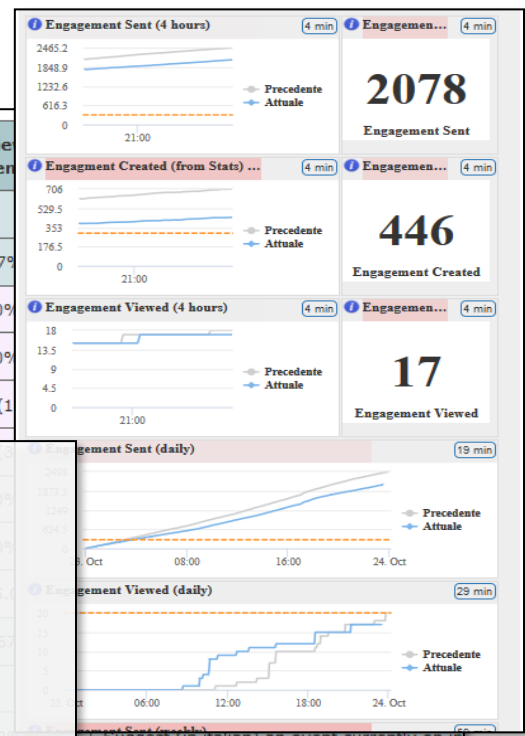
Suggestions



Users' Engagement



Rule name	Type	#sent	#viewed	#viewed / #sent
daily_event_de	ENGAGEMENT	1 (0%)	0 (0%)	0%
daily_event_en	ENGAGEMENT	1720 (2.12%)	70 (7.1%)	4.07%
- commuter		5 (0.29%)	0 (0%)	0 (0%)
- student		14 (0.81%)	0 (0%)	0 (0%)
- tourist		1462 (85%)	25 (35.71%)	25 (17.1%)



Inform
Air Quality forecast is not very nice
You have parked out of your residential parking zone
The Road cleaning is this night
The waste in S.Andreas Road is full

Engage
Provide a comment, a score, etc.

Stimulate / recommend
Events in the city, services you may be interested, etc..

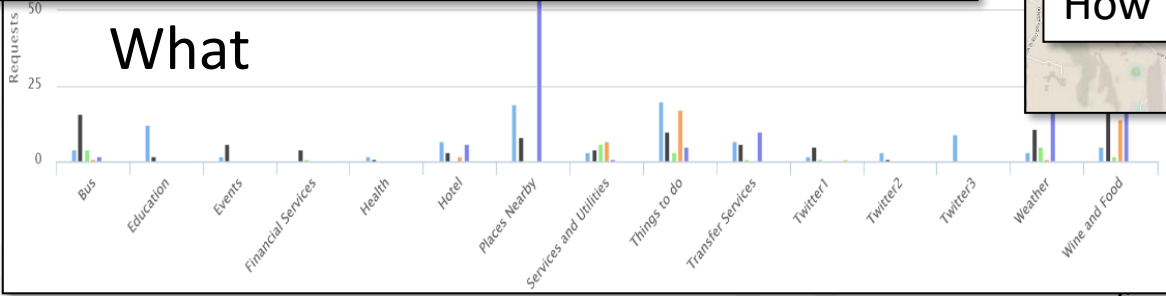
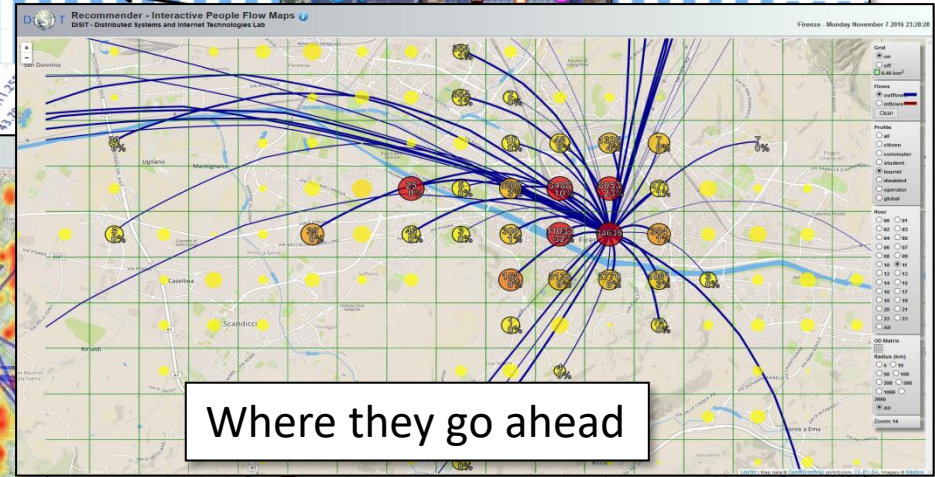
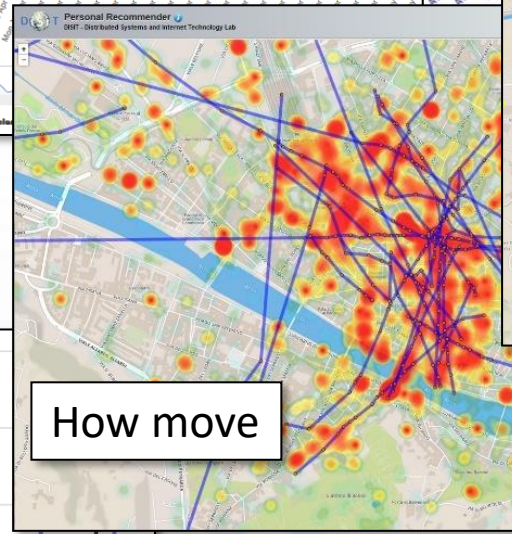
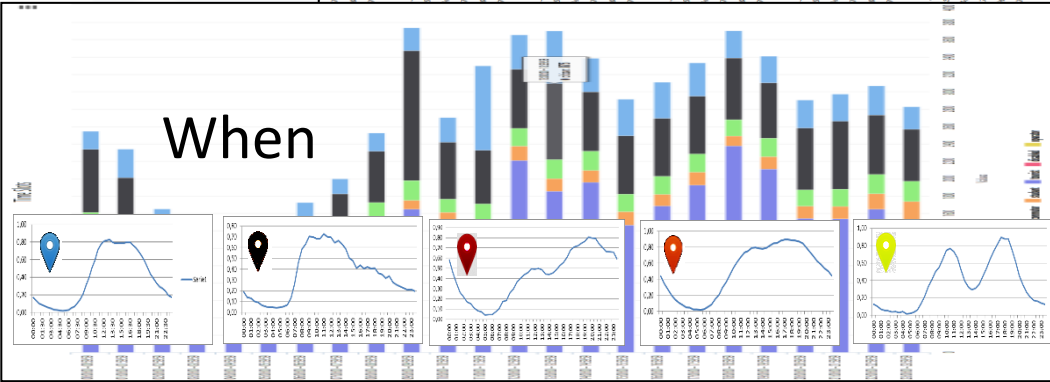
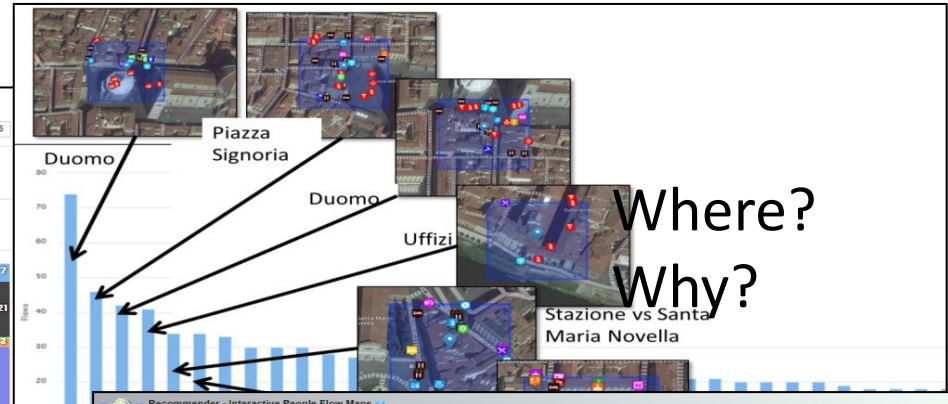
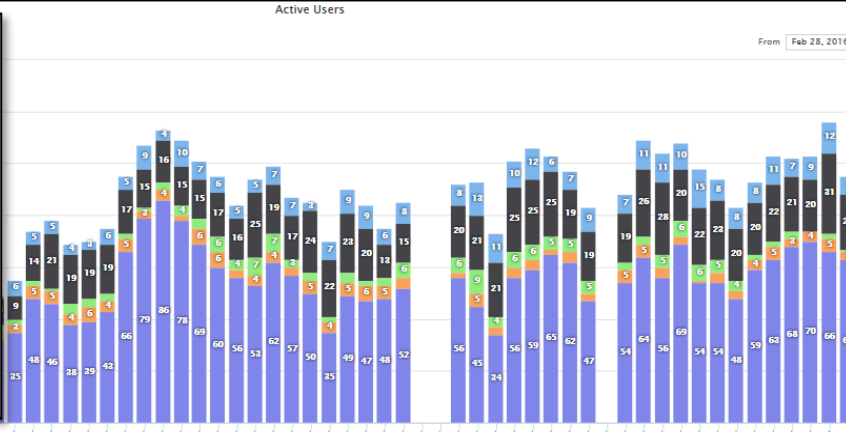
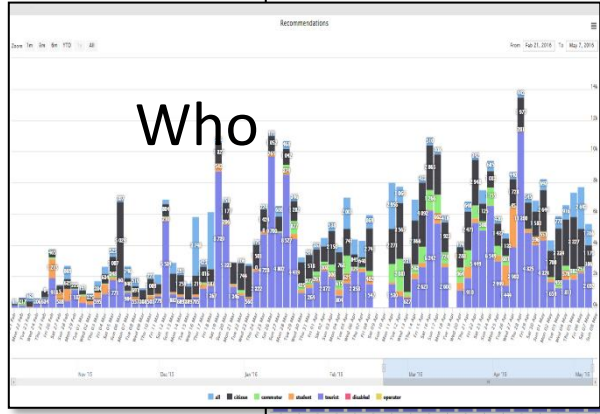
Provide Bonus, rewards if needed
you get a bonus since you parked here
We suggest: leave the car out of the city, this bonus can be used to buy a bus ticket

User context

City context

Rules

User Behavior Analyser for Collective Profiling



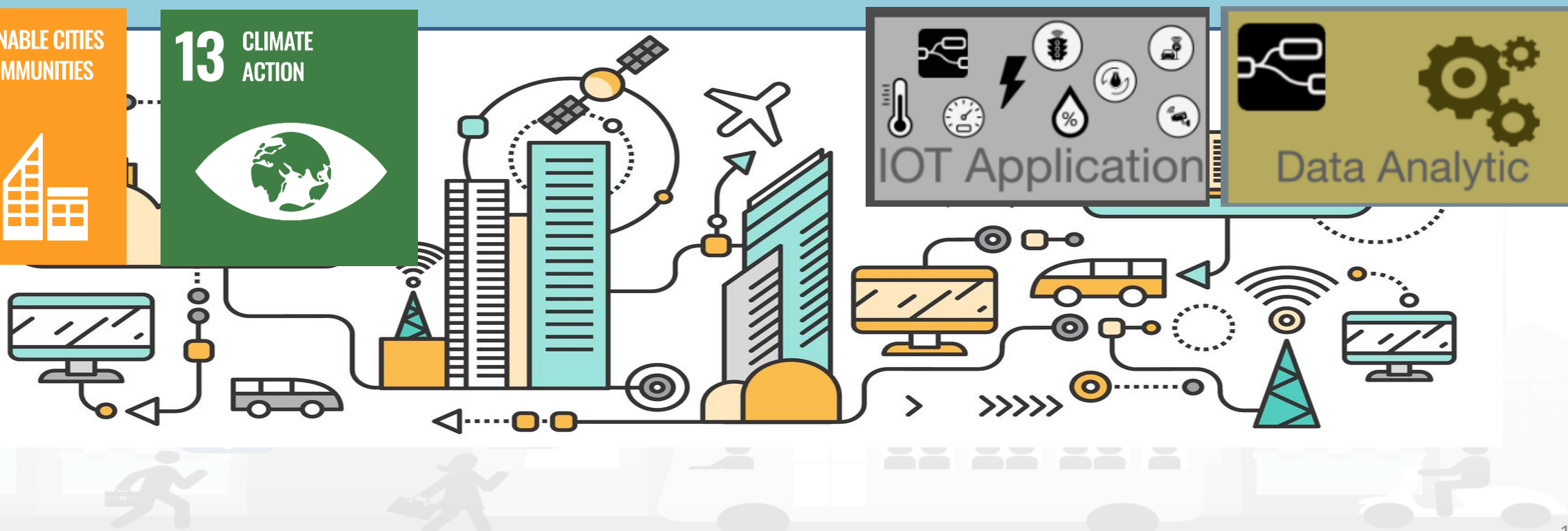
TOP

Computing CO₂/NO₂ from traffic Data

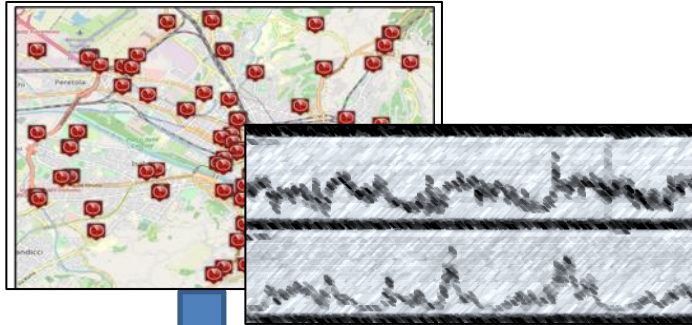
11 SUSTAINABLE CITIES
AND COMMUNITIES



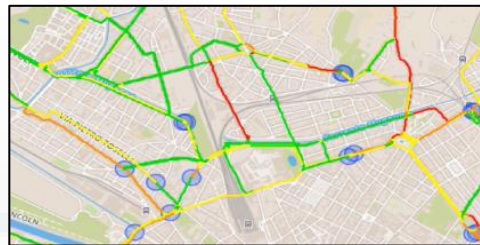
13 CLIMATE
ACTION



Estimating City Local CO2 from Traffic Flow Data



Computing Traffic Flow
into CO2 sensor area



Traffic Flow data

- Traffic Flow is one the main source of CO2 (**ton of CO2 x Km x Vehicle**)
 - K1: Fluid Flow**
 - K2: Stop and Go**
- Dense estimation of CO2 into the city** is very useful to know to target EC's KPIs



Computing CO2 on the basis of
traffic flow data



CO2 estimation

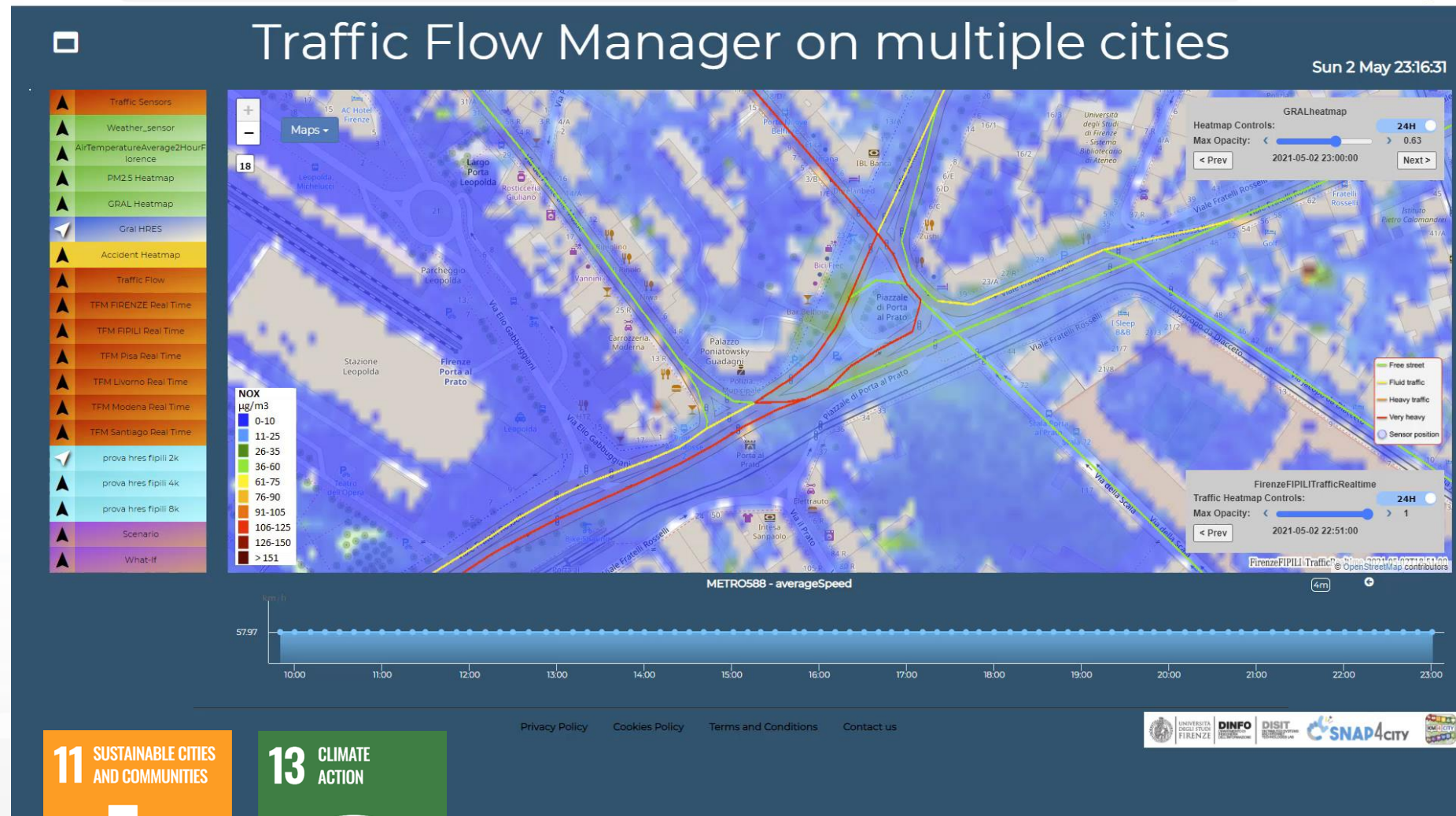
S. Bilotta, P. Nesi, "Estimating CO2 Emissions from IoT Traffic Flow Sensors and Reconstruction", Sensors, MDPI, 2022. <https://www.mdpi.com/1424-8220/22/9/3382/>

• Prediction

- **NOX Pollutant** diffusion on the basis of Traffic Flow (prediction), weather and 3D structure
- **NO2 progressive average** (Long term)

• Project:

- **Trafair CEF EC**
- Mixed solutions of Fluidinamics modeling and AI

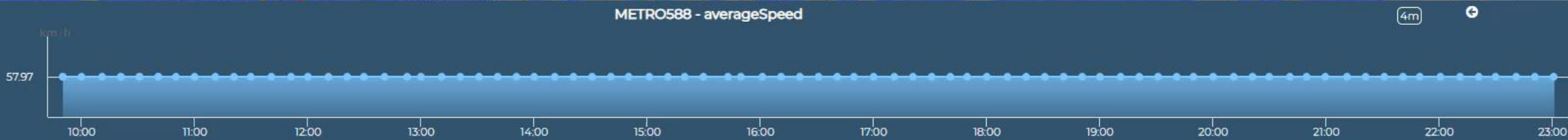
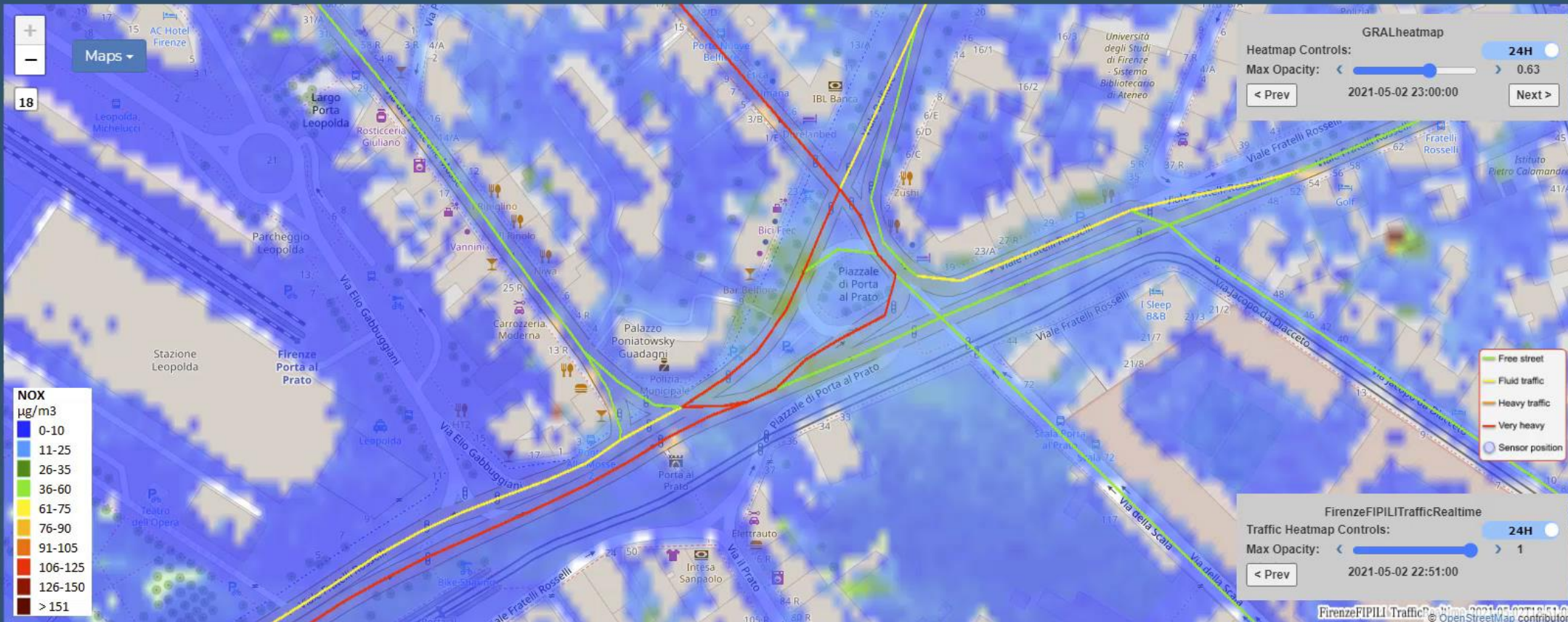




Traffic Flow Manager on multiple cities

Sun 2 May 23:16:31

- 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



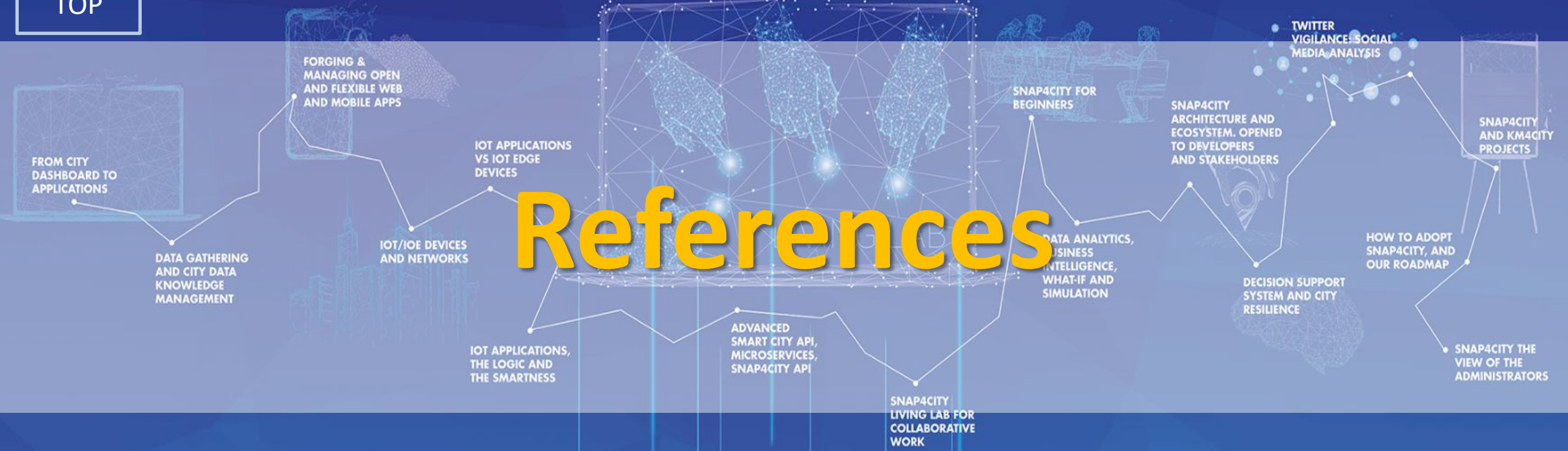
Privacy Policy Cookies Policy Terms and Conditions Contact us



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MzEyNg==>

TOP

References



2023 booklets



- Smart City



https://www.snap4city.org/download/video/DPL_SNAP4CITY.pdf

- Industry

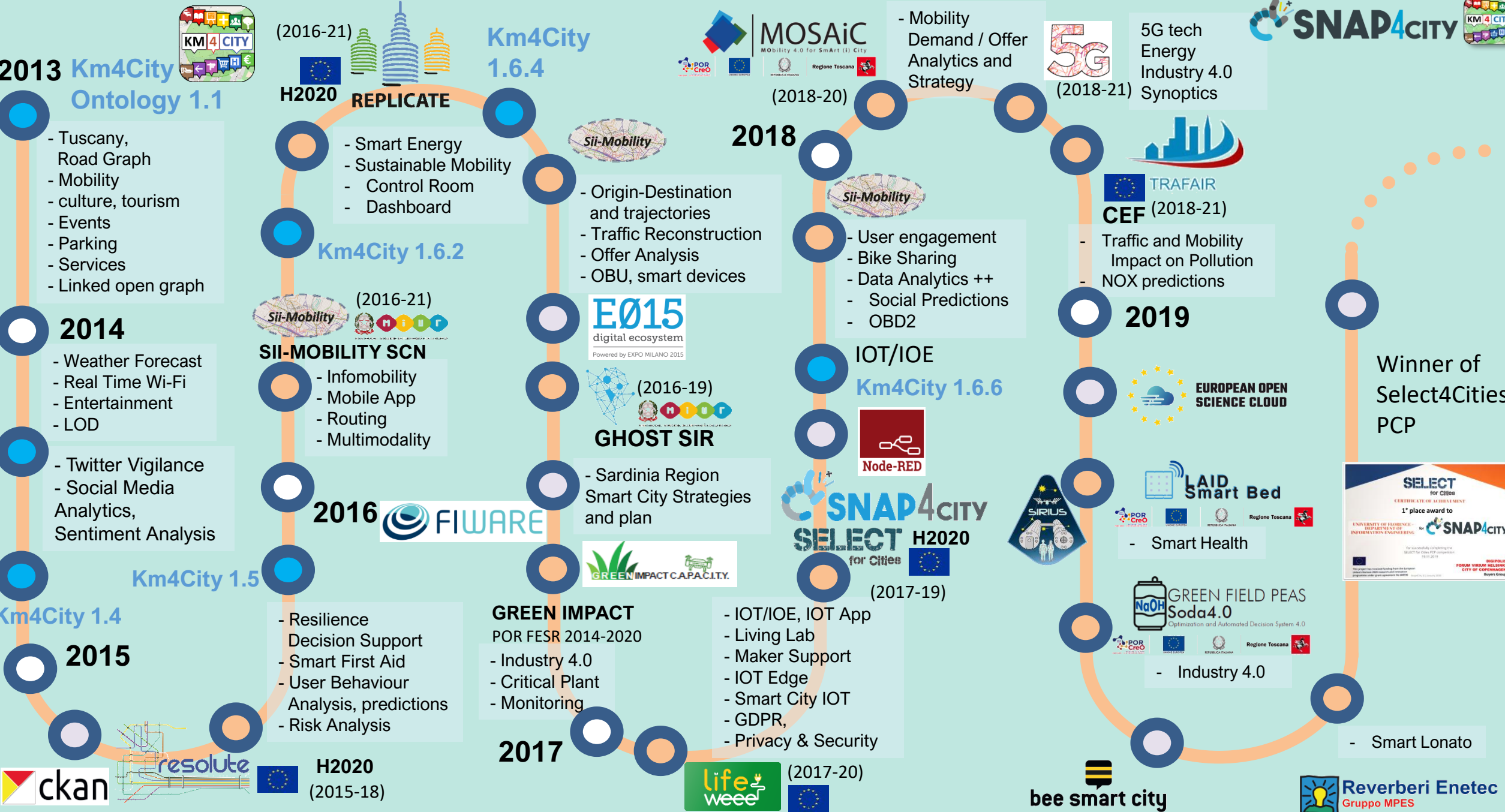


https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY.pdf

- Artificial Intelligence



https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf



2013 Km4City Ontology 1.1

- Tuscany, Road Graph
- Mobility
- culture, tourism
- Events
- Parking
- Services
- Linked open graph

2014

- Weather Forecast
- Real Time Wi-Fi
- Entertainment
- LOD

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

Km4City 1.4

2015

- Resilience Decision Support
- Smart First Aid
- User Behaviour Analysis, predictions
- Risk Analysis



(2016-21) H2020 REPLICATE

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

Km4City 1.6.2



- SII-MOBILITY SCN**
- Infomobility
 - Mobile App
 - Routing
 - Multimodality

2016 FIWARE

Km4City 1.5

- Resilience Decision Support
- Smart First Aid
- User Behaviour Analysis, predictions
- Risk Analysis

Km4City 1.6.4



- Origin-Destination and trajectories
- Traffic Reconstruction
- Offer Analysis
- OBU, smart devices



- GHOST SIR**
- Sardinia Region Smart City Strategies and plan



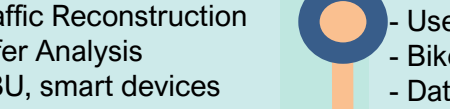
- GREEN IMPACT**
POR FESR 2014-2020
- Industry 4.0
 - Critical Plant
 - Monitoring

2017

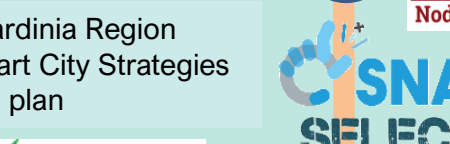
- Smart Waste

MOSAiC
MOBILITY 4.0 FOR SMART (II) CITY

- User engagement
- Bike Sharing
- Data Analytics ++
- Social Predictions
- OBD2



- IOT/IOE, IOT App
- Living Lab
- Maker Support
- IOT Edge
- Smart City IOT
- GDPR,
- Privacy & Security



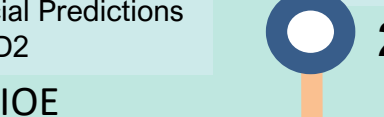
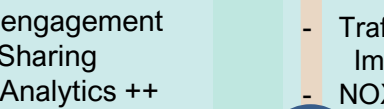
2018

- Mobility Demand / Offer
- Analytics and Strategy



5G
(2018-21)

- Traffic and Mobility Impact on Pollution
- NOX predictions



- Smart Health

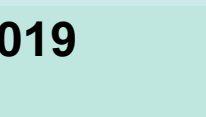
2019

- Industry 4.0

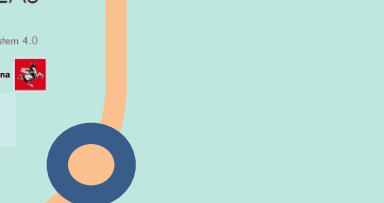
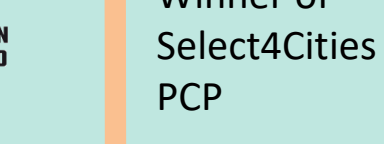
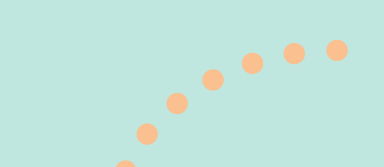


5G tech
Energy Industry 4.0 Synoptics

- Smart Lonato



SNAP4CITY



DISIT lab roadmap vs model and tools' usage



2020



- Smart Tourism
- 6 Pilots
- Data Analytics
- Extended platform



- Smart Mobility
- PISA, PUMS
- Living lab



Km4City 1.6.7

Smart Ambulance (2021-22)

Enterprise (2021-22)
Industry 4.0



2021

PC4City (2020-21)
Monitoring Terrain

Winner of Open Data Challenge of
enel x

CAPĒLON

- Smart Light
- Sweden

Almafluida Industry 4.0 (2021-22)

AMPERE (2021-22)
Industry 4.0

SYN-RG-AI SmartCity



Industry 4.0

uni.systems

SmartCity, 2021-23



AXIS collab
SmartCity

2022



Asymmetrica Smart City, 2022-23



Italferr, Smart City

2023



Contract, 2022-23



2022-2023



Security and Risk



Contract, 2022-23



CN MOST, 2022-26



EI THE, 2022-26



G. Agile, 2021-23



2023-26 Finanziato dall'Unione europea NextGenerationEU

Merano, smart light

OceanRace, Genova, AWS

Cuneo, smart city

2024



TOURISMO

ELLIE IA 2024-2027



CAI4DSA



Rhodes, smart city

eShare UNIFI TUSS

AMMIRARE

TOP



Be smart in a SNAP!



SMARTCITY

EXPO WORLD CONGRESS

7-9 November 2023, Barcelona, Spain

Visit Snap4City in Hall 1

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