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Open Urban Platform: Technical View 2018

<http://www.disit.org/km4city>

www.Km4City.org

Paolo Nesi, paolo.nesi@unifi.it





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Km4City Roadmap



SELECT
for Cities

Snap4City

- IOT/IOE
- Monitoring
- Smart City IOT integration
- Living Lab

5G

- Smart City vs IOT, Industria 4.0

6/2018

11/2018

Already Planned
up to 2021

- waste
- Territorial areas and paths
- Health, Bike sharing
- Statistics, Energy, ICT, ...
- E-vehicles

- Risk analysis
- Environmental, water
- Data Licensing models
- Energy Meters
- Fi-Ware compliant



- More Sensors, IOE, IOT
- Dashboard Builder
- Territorial areas and paths
- User Engagement
- Mobility and transport
- Resilience Decision Support

GHOST SIR
2016-2019 - Started



12/2017

WEEE
2017-2020

6/2017

RESilience management guidelines
and Operationalization applied to
Urban Transport Environment

Km4City 1.5

- SmartDS
- Km4City App

RESOLITE H2020
2015-2018 - Started



Sii-Mobility SCN
2016-2018 - Started
Km4City 1.6.2

2016

REPLICATE H2020
2016-2021 - Started



- Suggestions on demand
- User Behaviour Analysis
- Trajectories and OD

2015

Km4City 1.4

- Embed
- More API
- iBeacon

API

Twitter Vigilance

Km4City 1.1

- Tuscany Map
- Services
- AVM
- Sensors
- Parking
- Cultural Heritage
- Enrichment cities
- Event in the city
- Digital Locations
- Fresh places

- <http://servicemap.km4city.org>
- <http://log.disit.org>
- <http://www.disit.org/fodd>
- <http://www.disit.org/tv>
- <http://smartds.km4city.org>

2014

- Weather
- Cultural Heritage
- Energy recharge pillar
- Wi-Fi
- Events in the city



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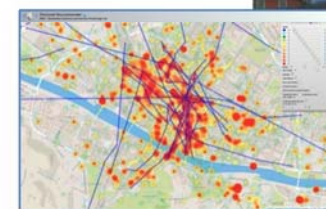
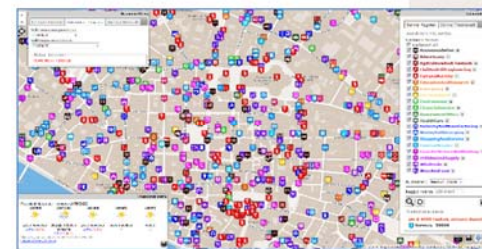
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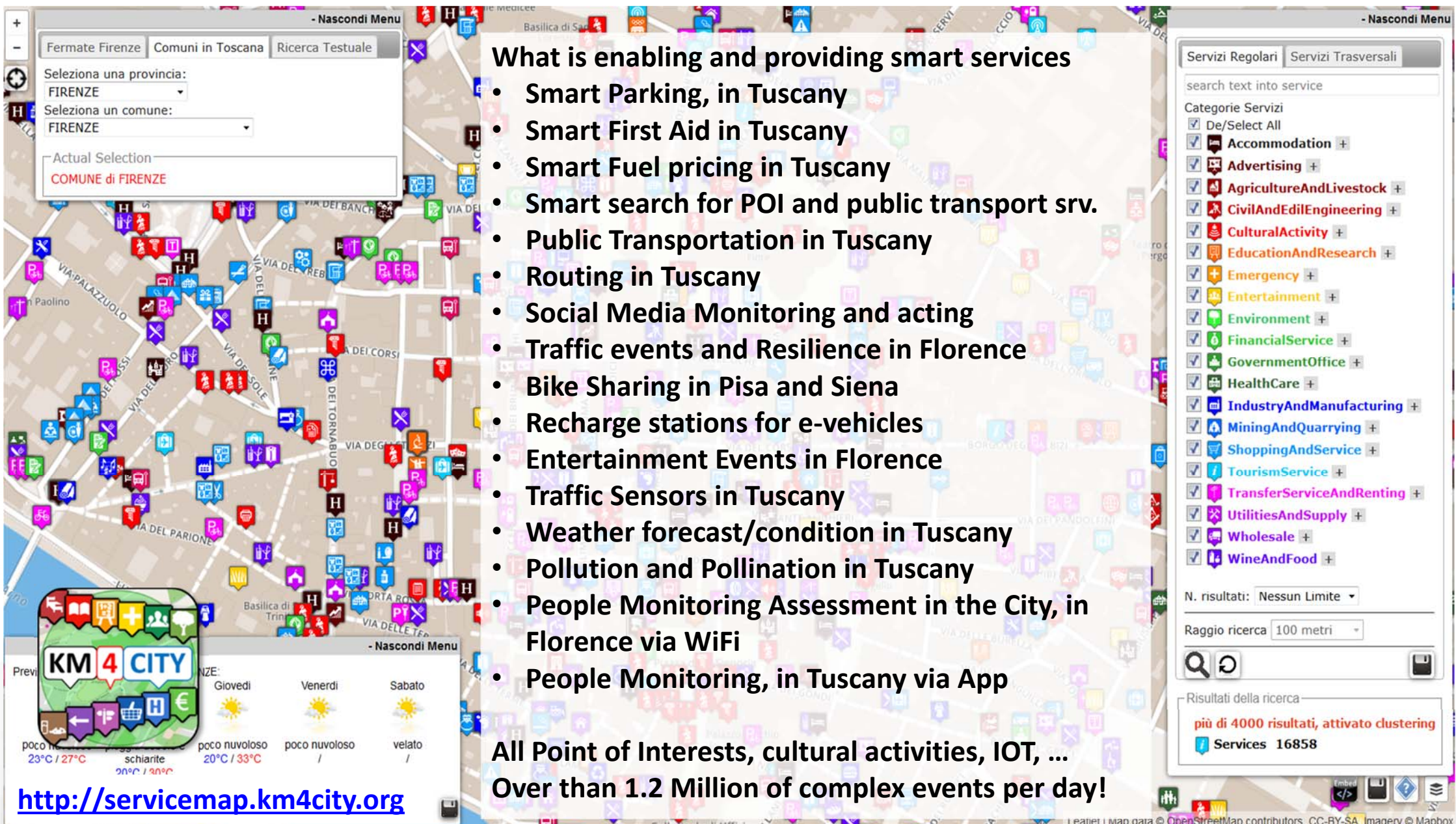
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Km4City: Integrated Urban Platform



- **Aggregate & integrate data**
 - Multiple protocols from urban operators,
 - open data, IOT, sensors, internet of everything, cloud, mobile devices, Wi-Fi, social media, ...
- **Data Exploitation performing**
 - predictions, reasoning, business intelligence, ..
 - users behavior analysis, decision support system, ..
 - Control Room, Real Time Monitoring tools,
- **Produce value from data enabling to**
 - Stimulate virtuous behavior, influence City Users!
 - Put in action CITY Strategies





The image is a screenshot of the KM4CITY web application. It features a map of Florence, Italy, densely populated with colorful icons representing various services and points of interest. A sidebar on the right contains search filters and a list of service categories. A search bar at the top left allows for text-based searches. A weather widget is visible in the bottom left corner.

What is enabling and providing smart services

- Smart Parking, in Tuscany
- Smart First Aid in Tuscany
- Smart Fuel pricing in Tuscany
- Smart search for POI and public transport srv.
- Public Transportation in Tuscany
- Routing in Tuscany
- Social Media Monitoring and acting
- Traffic events and Resilience in Florence
- Bike Sharing in Pisa and Siena
- Recharge stations for e-vehicles
- Entertainment Events in Florence
- Traffic Sensors in Tuscany
- Weather forecast/condition in Tuscany
- Pollution and Pollination in Tuscany
- People Monitoring Assessment in the City, in Florence via WiFi
- People Monitoring, in Tuscany via App

All Point of Interests, cultural activities, IOT, ...
Over than 1.2 Million of complex events per day!

<http://servicemap.km4city.org>



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Services



- **Dashboard and Notifications for Decision Makers**
 - Control Room Dashboard, Notifications, personalized
 - Widgets in third party web pages
- **Development Tools for Applications**
 - Development of Web and Mobile App, HTML5, Open
 - Development of IOT Application for all
 - **Smart City API to access and exploit the city knowledge Km4City**
 - **Easy upload of Data Set and Data Analytics/Processing Processes**
 - **Development Environment for Data Analytics**
 - Sand Box, VM for developers: ETL, Python, C/C++, Java, etc.

Smart Interoperability and how to start with Km4City



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Transport systems
Mobility, parking



Public Services
Govern, events, ...



Sensors, IOT
Cameras, ..



Environment,
Water, energy



Shops, services,
operators



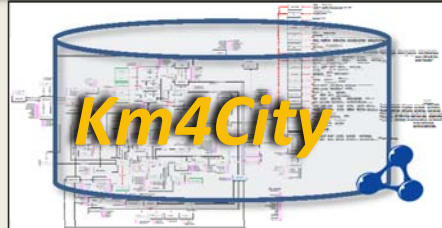
Social Media
WiFi, network



Static, Slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud

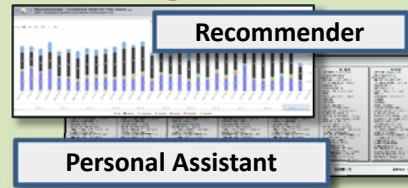
Km4City Smart City Engine



Big Data Analytics



Smartening Tools



Development Tools



Km4City Smart City API

City Operators and Decision Makers

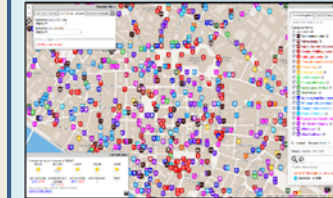
Dashboards



Smart Decision Support



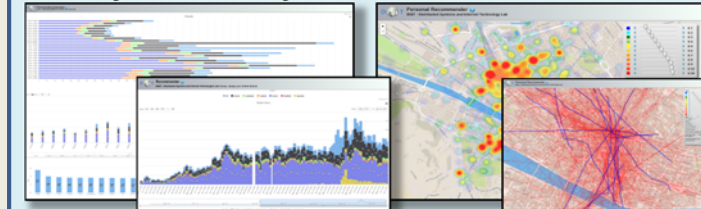
ServiceMap browser



Twitter Vigilance

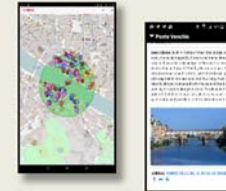


Analyzers of City User Behavior



Tools for Final Users

Mobile e Web Apps

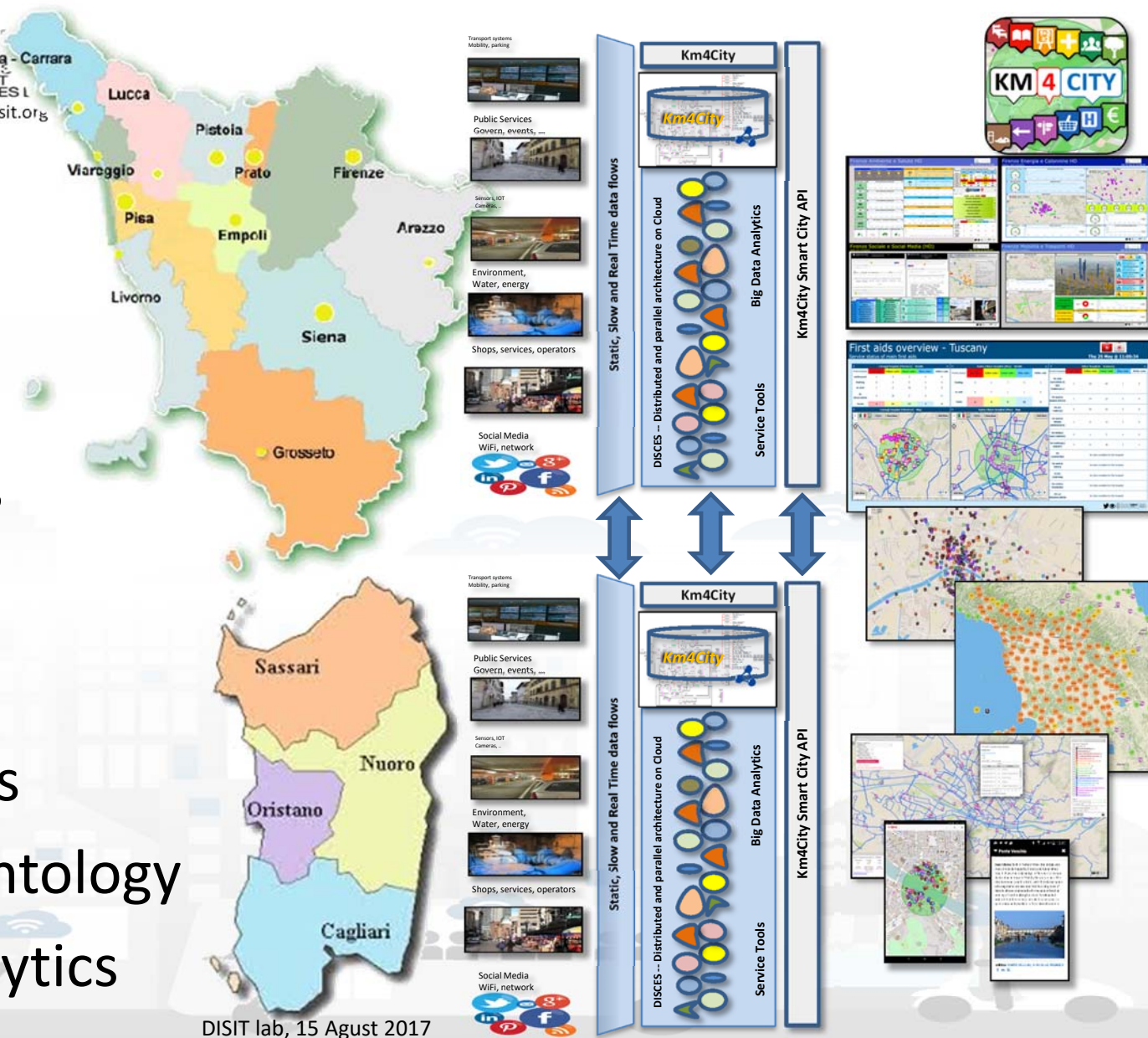


[Http://www.km4city.org](http://www.km4city.org)

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Interoperability

- At different levels:
 - Among cities/regions
 - Among data providers
 - Among Operators
- By Means of:
 - Smart City API → Apps
 - Km4City Smart City Ontology
 - Dashboards/data analytics



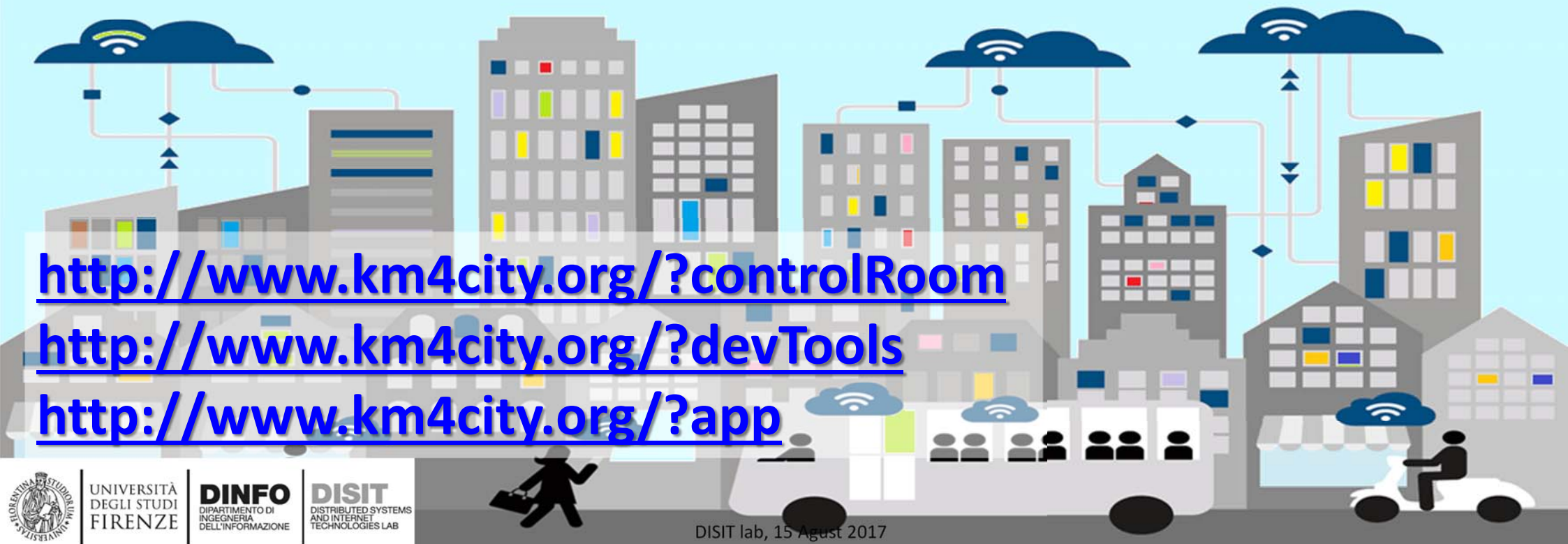
Data & Model

<http://www.km4city.org/?infoDocs>

<http://www.km4city.org/?controlRoom>

<http://www.km4city.org/?devTools>

<http://www.km4city.org/?app>



Km4City: Knowledge Base



- Multiple DOMAINS
- Geospatial reasoning
- Temporal reasoning
- Metadata
- Statistics
- Risk and Resilience
- Licensing
- Open and Private Data
- Static and Real time

- Street-Guide
- Mobility and transport
- Points of interest
- Sensors, IOT, ..
- Energy
- Administration
- Citations from strings

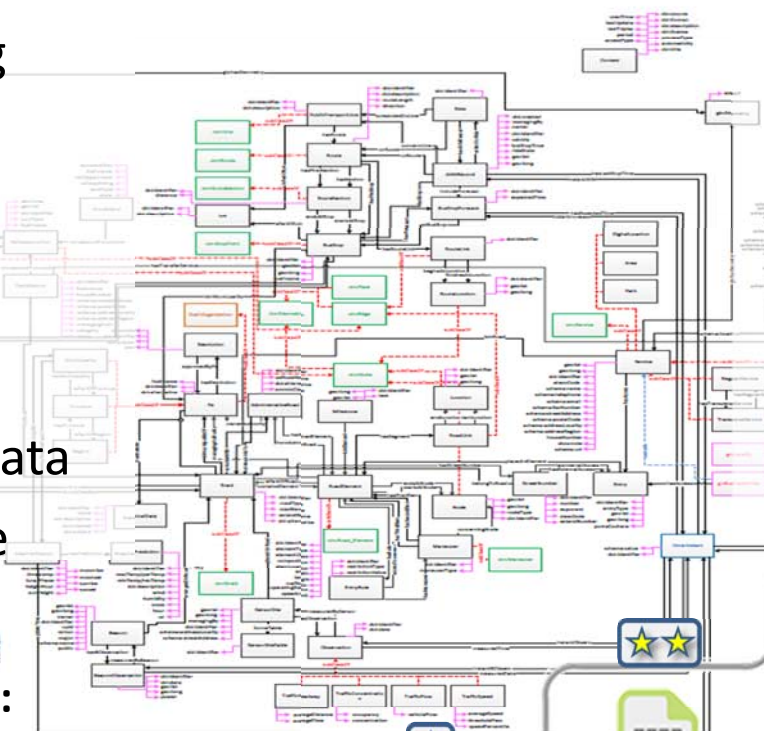
Big Data Tools



LOD and reasoners



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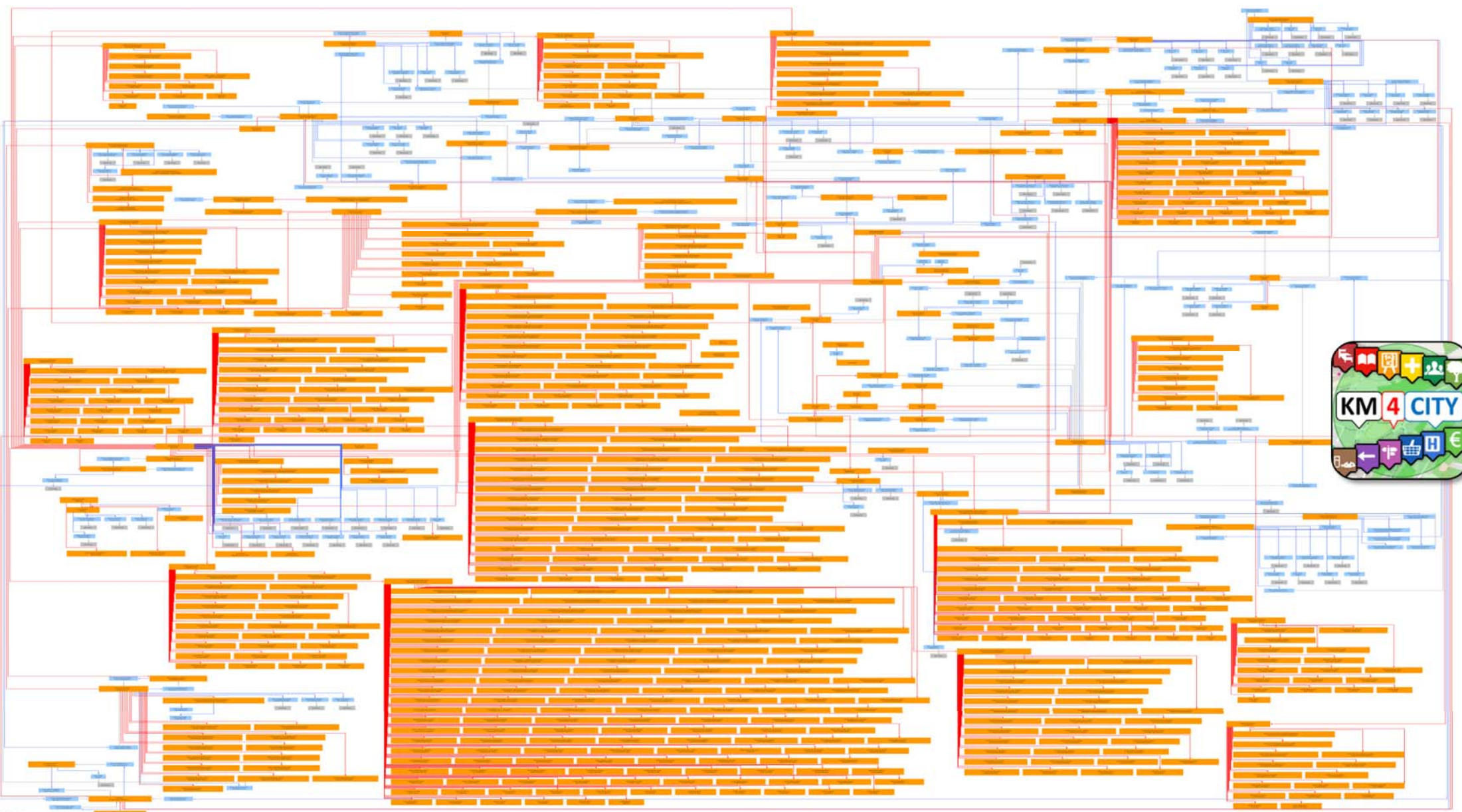
Ontology Documentation:

<http://www.disit.org/6506>

<http://www.disit.org/6507>

<http://www.disit.org/5606>

<http://www.disit.org/6461>



**Present data on
Tuscany Region
August 2017**

Road Graph (Tuscany region)

132,923 Roads
389,711 Road Elements
318,160 Road Nodes
1,508,207 Street Numbers

Info on: points, paths, areas, etc.
Services (20 cat, 512 cat.)
16 Public Transport Operators
21.280 Bus stops & 1081 bus lines

Dynamic/real-time in Tuscany Region

- Real time bus lines: 144 updates X day X line
- 1081 Transport Pub Lines: 1-2 up per day, time-path
- >210 parking lots status: 76 updates X day X sensor
- >796 traffic Sensors: 288 updates X day X sensor
- 285 weather area: 2 updates X day X area
- >12 hospital Triage status: 96 updates X day X FA
- 1600 Fuel stations: 1 update X day X station
- 22 Environmental data: 20 updates X day X sensor
- 39 Bike Sharing data: Pisa and Siena
- 12 Pollination data
- 140 recharging stations
- Smart benches, waste mng, irrigators, lighting,...
- Florence ent.events: about 60 new events X day
- Different kinds of Florence traffic events,
- Wi-Fi: > 400.000 measures X day
- App mobiles: >50.000 measures X day
- more than 40.000 distinct users X day
- From 600.000 to 4.5 M Tweets X day
- many IOT DISIT lab, 15 August 2017



Previs
Giovedì
Venerdì
Sabato
poco nuvoloso
23°C / 27°C
schiarite
20°C / 33°C
poco nuvoloso
velato

Servizi Regolari Servizi Trasversali

search text into service

Categorie Servizi

- ☒ De/Select All
- ☒ Accommodation +
- ☒ Advertising +
- ☒ AgricultureAndLivestock +
- ☒ CivilAndEdilEngineering +
- ☒ CulturalActivity +
- ☒ EducationAndResearch +
- ☒ Emergency +
- ☒ Entertainment +
- ☒ Environment +
- ☒ FinancialService +
- ☒ GovernmentOffice +
- ☒ HealthCare +
- ☒ IndustryAndManufacturing +
- ☒ MiningAndQuarrying +
- ☒ ShoppingAndService +
- ☒ TourismService +
- ☒ TransferServiceAndRenting +
- ☒ UtilitiesAndSupply +
- ☒ Wholesale +
- ☒ WineAndFood +

N. risultati: Nessun Limite

Raggio ricerca 100 metri

Risultati della ricerca

più di 4000 risultati, attivato clustering

Services 16858

<http://servicemap.km4city.org>

Other Sensors and Actuators, IOT

- Restricted Traffic Zone Gates
 - Passages, payment, alerts,
 - Wi-Fi control, RFI control, etc.
- Road Direction manager: panel, red-light, etc.
 - Status and action
- **Environmental Sensors:**
 - Air quality, pollution, rain, allergens, temperature,
 - humidity,...
- Public Light Pillar
 - Traffic flows, environment,
 - Wi-Fi, Tv-Camera, BT servers, on/off, percentage of light, ..
- Waste Manager
 - Level, kind, status, on/off
- Recharge station, column
 - Free slots, consumption, next time slot, ...



- **Environmental Sensors:**
 - Air, temperature, humidity,
 - water level in rivers
 - Status of underpass and bridges
- **Risk assessment**
 - Value of the buildings,
 - hydrogeological risk map,
 - earthquake risk map, ...
 - people distribution and location
 - Position of recover places,
- **Traffic Zone Gates**
 - Passages, alerts,
 - etc.





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Service Map Tool



- The Km4City model consists of an ontology and documentation to populate and reasoning on a GraphDB.
- **ServiceMap tool**
 - with Km4City are substantially a Smart City Expert System, SCES
 - includes the Smart City API
 - is a for developers to: search and browse on Smart City Knowledge, also to generate examples of the Smart City API call to be used in the development of Web and Mobile Apps
- Final users tools exploiting Km4City are:
 - Web and Mobile Applications and Dashboards



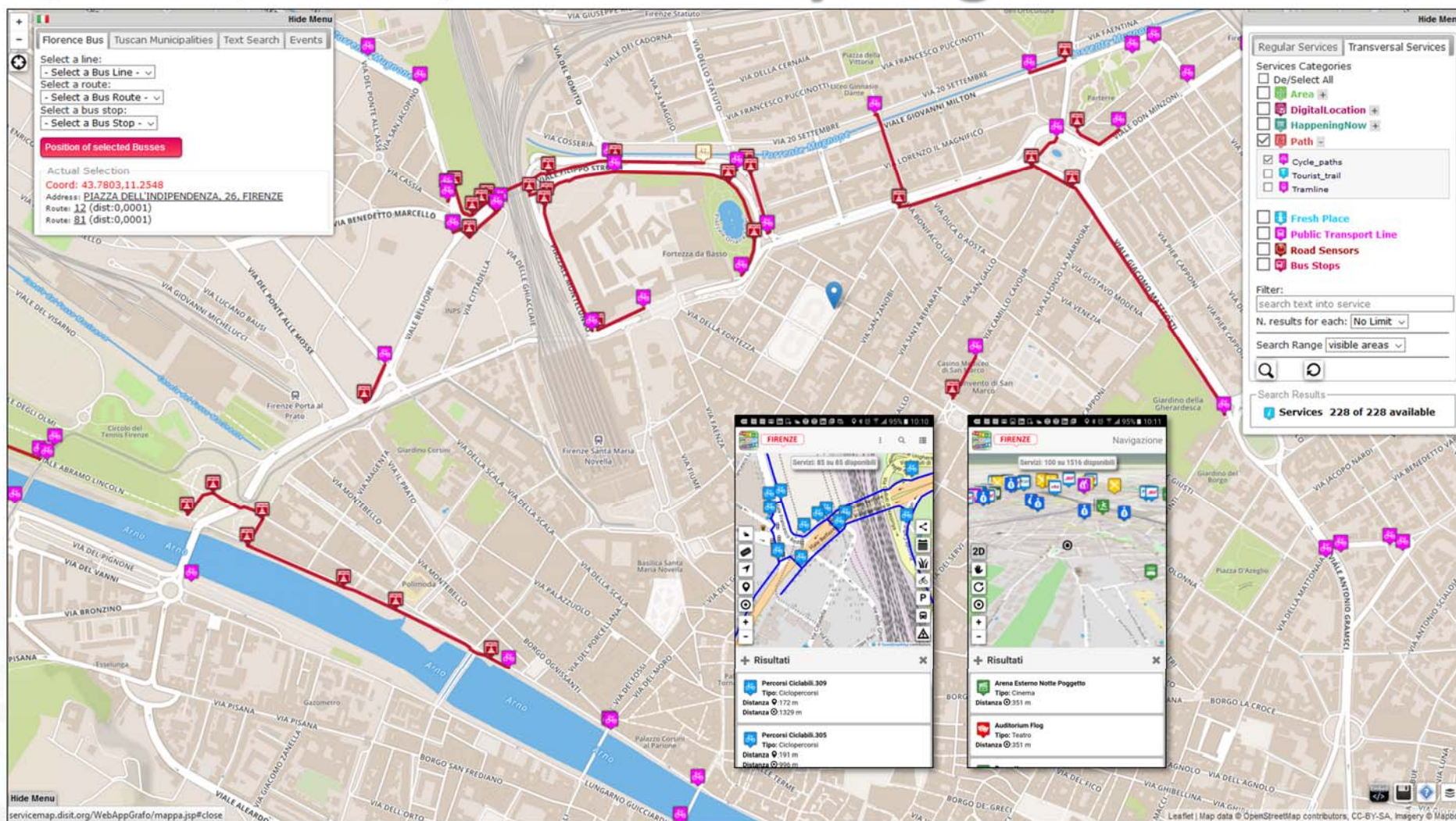
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Cycling Paths



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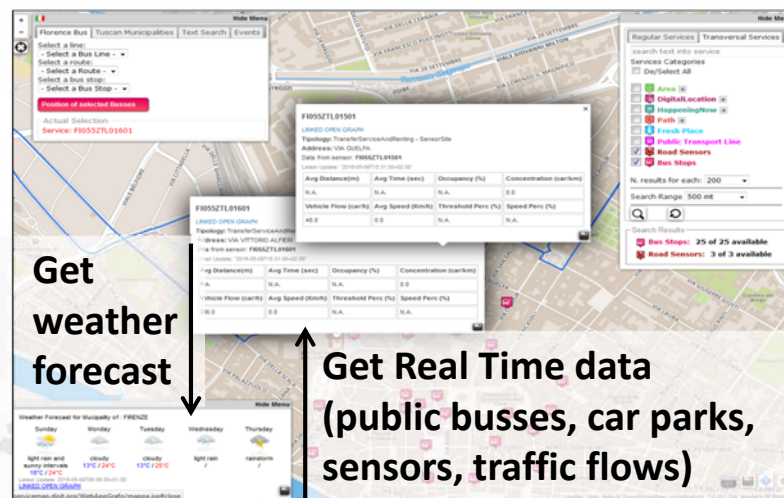
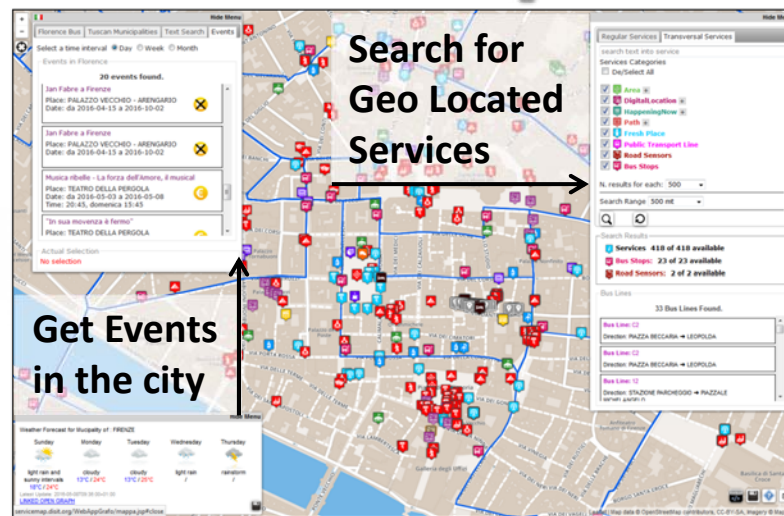
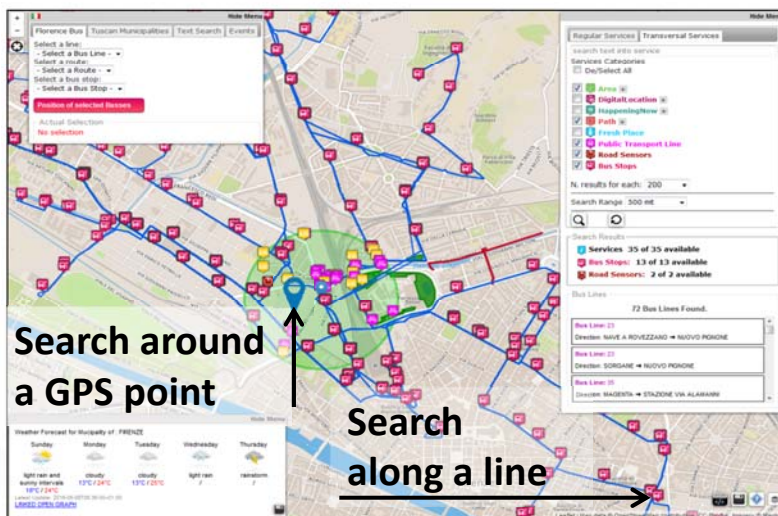


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ServiceMap



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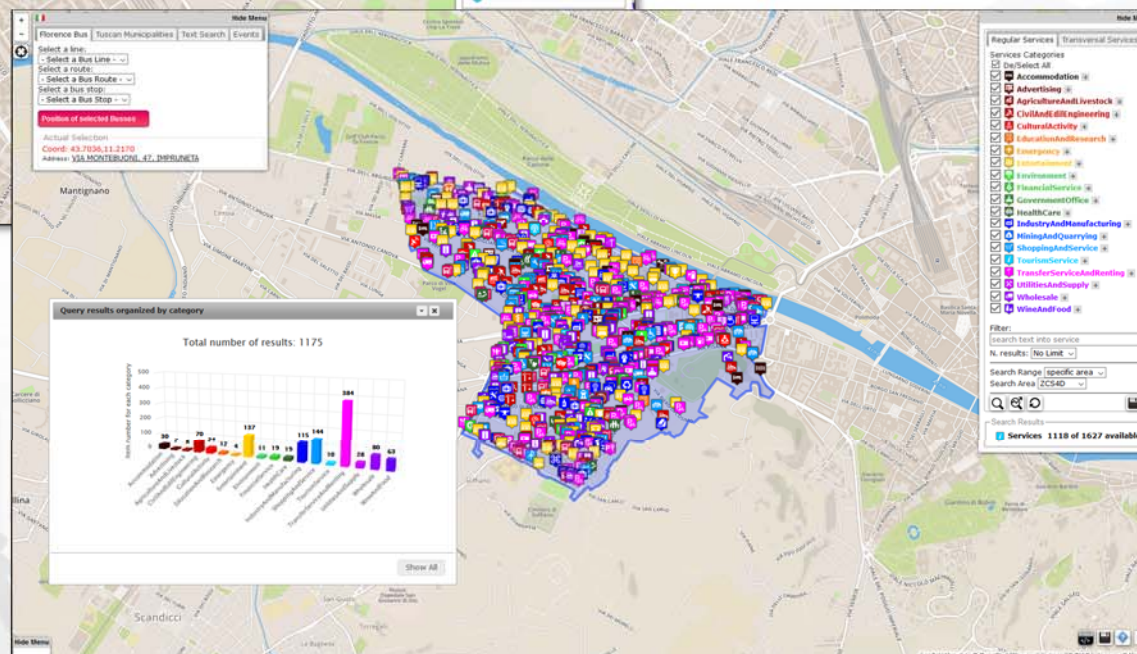
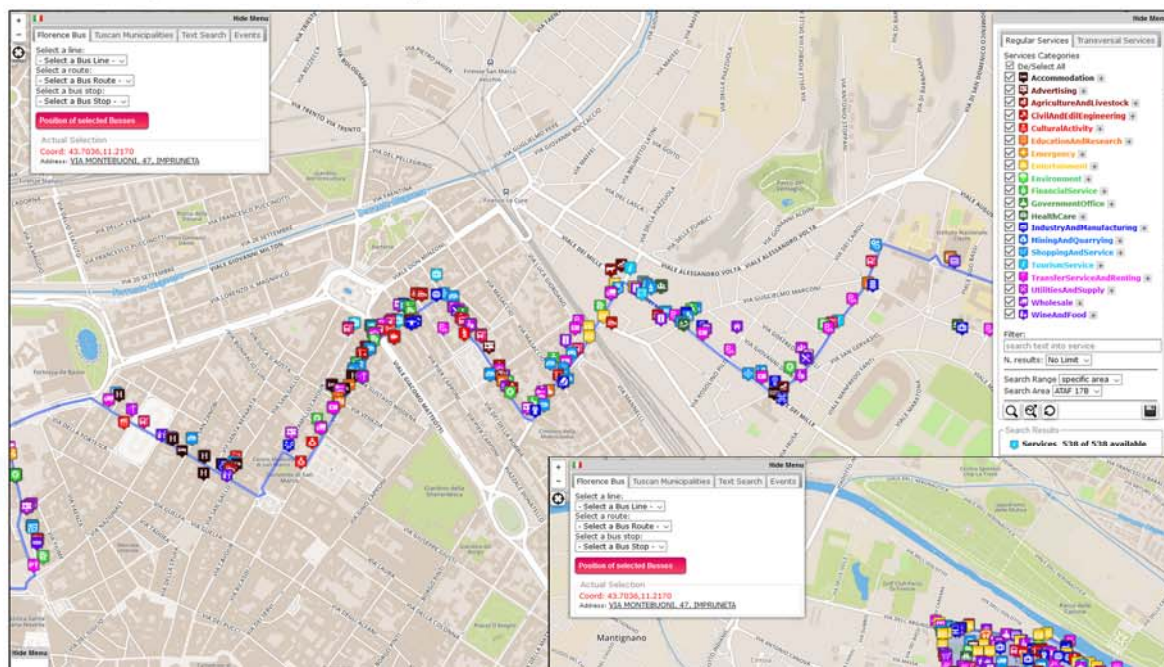
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Along a Line



Into an Area

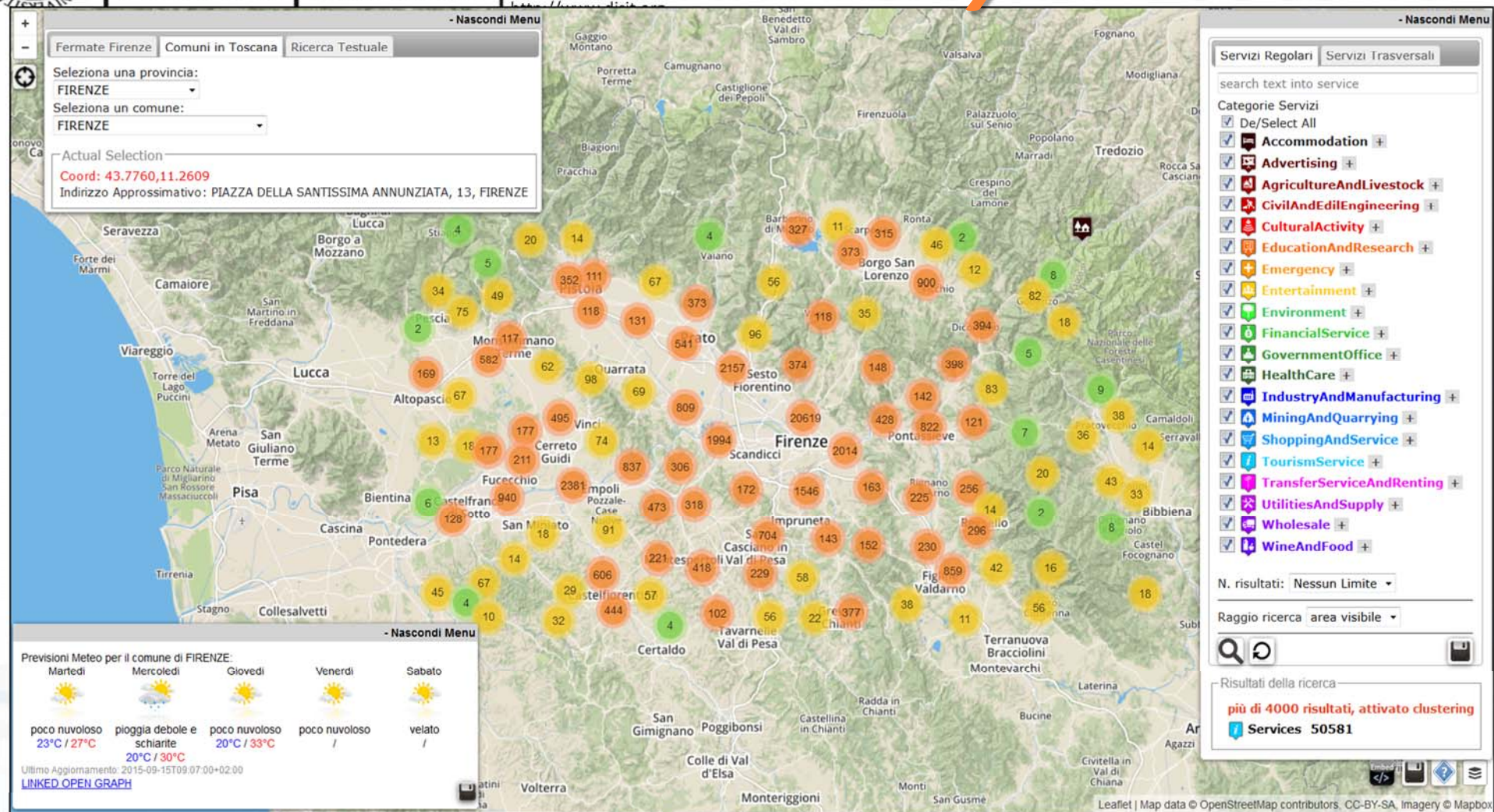


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Km4City in Toscana



- Search all services in the area

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Km4City in Firenze



The screenshot displays the Km4City web application interface, which provides a detailed view of Florence, Italy, with various urban data overlays. The interface includes several key components:

- Search and Filter Panels:** Located on the left and right, these panels allow users to search for specific locations, filter data by category (e.g., Digital Location, Fresh Place, Road Sensors, Bus Stops), and view search results.
- Map View:** The central map shows the city of Florence with various overlays, including bus lines, bike lanes, and green areas. A specific bus stop, "FERMATA : T1 ALAMANNI", is highlighted with a red icon.
- Data Panels:** Several panels provide detailed information about specific locations and bus lines. For example, the "Giardino di piazza dell'Indipendenza" panel shows its location, type, and address. The "FERMATA : PERGOLA" panel shows the bus lines serving it (14, 19, 23, 31, 6) and the route (NOVELLI → OSPEDALE TORRE GALLI).
- Weather and Real-time Data:** A panel at the bottom left shows weather forecasts for Florence, including temperature and precipitation. Another panel at the bottom right shows real-time data for bus stops, including the number of buses and the direction of travel.

The interface is designed to be user-friendly and informative, providing a comprehensive overview of the city's urban infrastructure and services.

- **Areas, Bus lines, bike lanes, tram, RTZ, etc.**

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Pisa
only
POI

FileModificaVisualizzaCronologiaSegnalibriTileStrumentiAiuto

Km4City Development an...ServiceMap

servicemap.disit.org/WebAppGrafo/mappa.jsp

Cerca

HomeStarFavoritesSharePrintFull Screen

Hide Menu

Florence Bus

Tuscan Municipalities

Text Search

Events

Select a province:

PISA

Select a municipality:

PISA

Actual Selection:

Service: Osteria Il Fantasma dell'Opera

Regular Services

Transversal Services

Services Categories

☒ De/Select All

☒ Accommodation +

☒ Advertising +

☒ AgricultureAndLivestock +

☒ CivilAndEdilEngineering +

☒ CulturalActivity +

☒ EducationAndResearch +

☒ Emergency +

☒ Entertainment +

☒ Environment +

☒ FinancialService +

☒ GovernmentOffice +

☒ HealthCare +

☒ IndustryAndManufacturing +

☒ MiningAndQuarrying +

☒ ShoppingAndService +

☒ TourismService +

☒ TransferServiceAndRenting +

☒ UtilitiesAndSupply +

☒ Wholesale +

☒ WineAndFood +

Filter:

search text into service

N. results: No Limit

Search Range 100 mt

Search Area select...

Search Results

Services 1058

Weather Forecast for Municipality of : PISA

Saturday

Sunday

Monday

Tuesday

Wednesday

cloudless

cloudy

overcast

light rain

bit cloudy

4°C / 11°C

-2°C / 10°C

6°C / 10°C

Latest Update: 2016-12-17T08:51:00+01:00

LINKED OPEN GRAPH

Map of Pisa showing various points of interest (POI) marked with icons. The Arno river is visible flowing through the city.

Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

ENG 19:20



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Km4City in Sardegna



File Modifica Visualizza Cronologia Segnalibri Strumenti Aiuto

ServiceMap ServiceMap ServiceMap

www.disit.org/smosm/ Cerca

Public transport Municipalities Text Search Address Search Events

Select an agency:
- Select an Agency -

Select a line:
- Select a Line -

Select a route:
- Select a Route -

Select a bus stop:
- Select a Bus Stop -

Position of selected Busses

Actual Selection
Coord: 39.2329,9.11890
Address: [Castellu/Cagliari](#)

Path from here Path to here

Query results organized by category

Total number of results: 3955

Category	Item number
Accommodation	525
CulturalActivity	535
Entertainment	680
ShoppingAndService	864
TourismService	141
TransferServiceAndRenting	952

Show All

Regular Services Transversal Services

Filter:
search text into categories

Services Categories
☒ De/Select All

- ☒ Accommodation
- ☒ Advertising
- ☒ AgricultureAndLivestock
- ☒ CivilAndEdiEngineering
- ☒ CulturalActivity
- ☒ EducationAndResearch
- ☒ Emergency
- ☒ Entertainment
- ☒ Environment
- ☒ FinancialService
- ☒ GovernmentOffice
- ☒ HealthCare
- ☒ IndustryAndManufacturing
- ☒ MiningAndQuarrying
- ☒ ShoppingAndService
- ☒ TourismService
- ☒ TransferServiceAndRenting
- ☒ UtilitiesAndSupply
- ☒ Wholesale
- ☒ WineAndFood

Filter:
search text into service

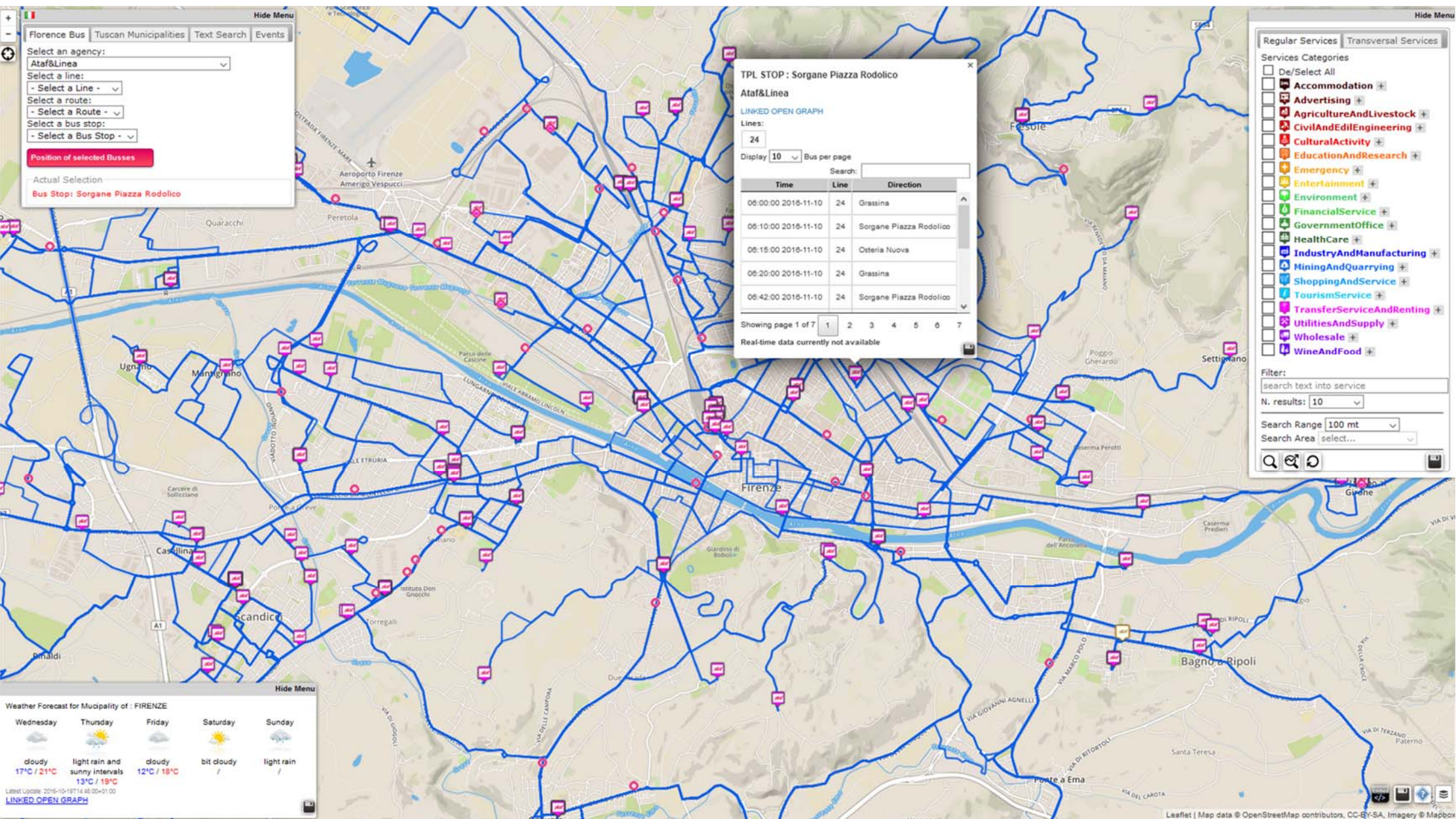
N. results: No Limit

Search Range: visible area

Search Area: select...

Search Results
Services 3690 of 3690 available

Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox





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Pisa TPL & sensors



File Modifica Visualizza Cronologia Segnalibri Tile Strumenti Aiuto

Km4City Development an... ServiceMap

servicemap.disit.org/WebAppGrafo/mappa.jsp

Cerca

Hide Menu

Florence Bus Tuscan Municipalities Text Search Events

Select a province:
PISA

Select a municipality:
- Seleziona un Comune -

Actual Selection
Coord: 43.7086,10.4105
Address: VIALE DELLE PIAGGE, 0, PISA

Query results organized by category

Total number of results: 1849

Item number for each category

Category	Item number
Accommodation	708
CulturalActivity	78
EducationAndResearch	51
Emergency	8
FinancialService	23
GovernmentOffice	16
HealthCare	12
ShoppingAndService	44
TourismService	53
TransferServiceAndRenting	9
WineAndFood	670
WineAndFood	177

Show All

Regular Services Transversal Services

Services Categories

- ☒ De/Select All
- ☒ Accommodation
- ☒ Advertising
- ☒ AgricultureAndLivestock
- ☒ CivilAndEdilEngineering
- ☒ CulturalActivity
- ☒ EducationAndResearch
- ☒ Emergency
- ☒ Entertainment
- ☒ Environment
- ☒ FinancialService
- ☒ GovernmentOffice
- ☒ HealthCare
- ☒ IndustryAndManufacturing
- ☒ MiningAndQuarrying
- ☒ ShoppingAndService
- ☒ TourismService
- ☒ TransferServiceAndRenting
- ☒ UtilitiesAndSupply
- ☒ Wholesale
- ☒ WineAndFood

Filter:

search text into service

N. results: No Limit

Search Range 5 km

Search Area select...

Search Results

Services 1849 of 1855 available

Weather Forecast for Municipality of: FIRENZE

Day	Weather	Temperature
Saturday	cloudless	3°C / 11°C
Sunday	bit cloudy	4°C / 11°C
Monday	overcast	3°C / 11°C
Tuesday	light rain	/
Wednesday	bit cloudy	/

Latest Update: 2016-12-17T09:51:00+01:00

[LINKED OPEN GRAPH](#)

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ENG 19:24



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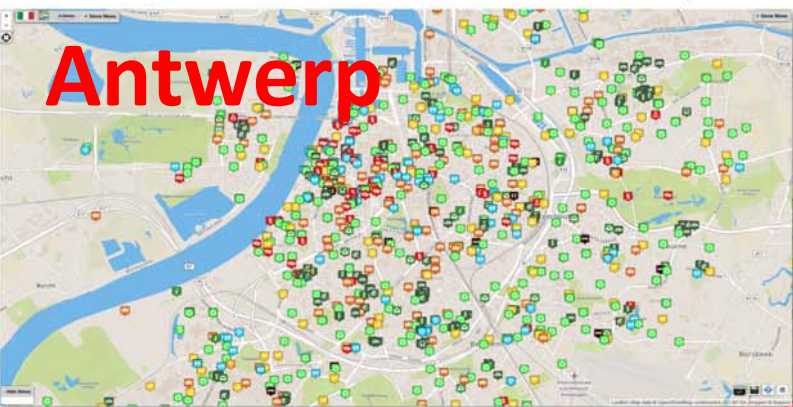
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<http://www.disit.org>

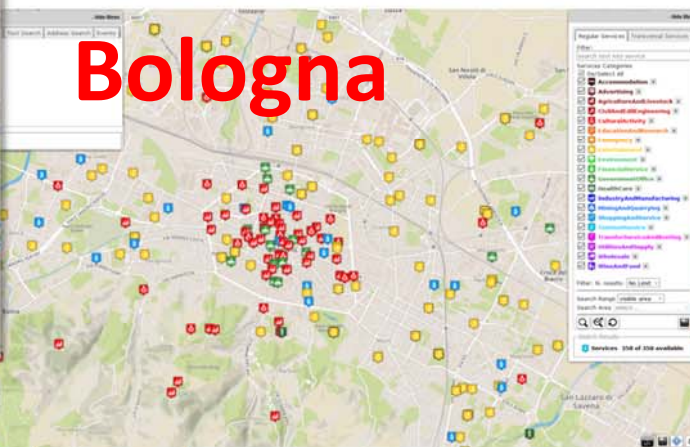
Km4City in ...



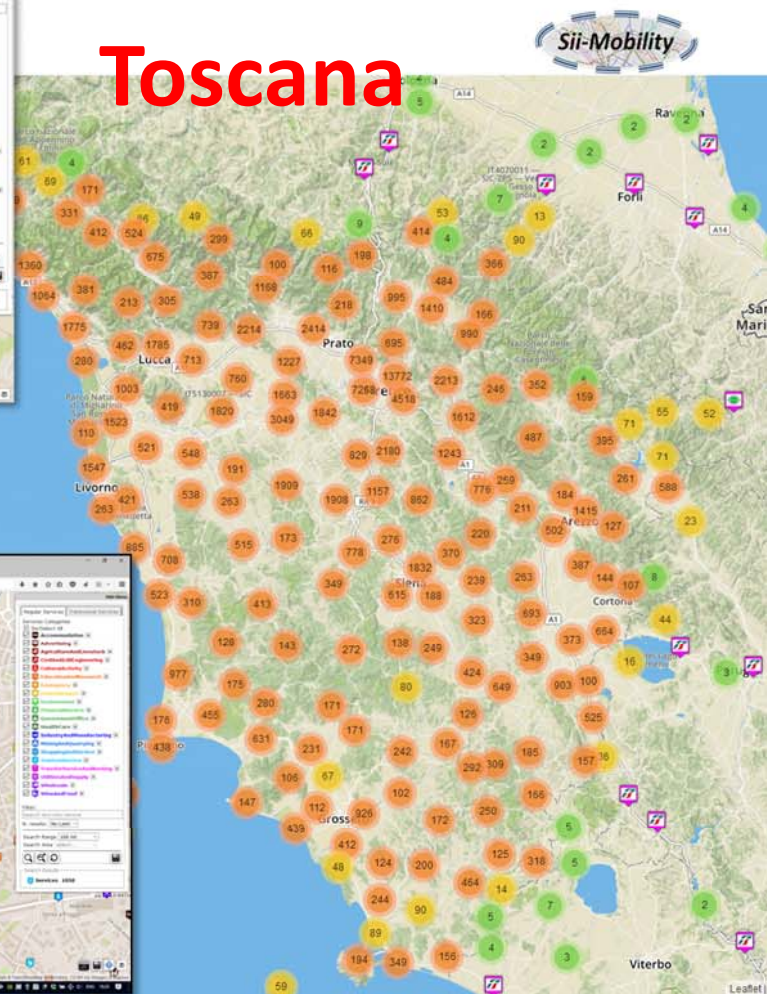
Antwerp



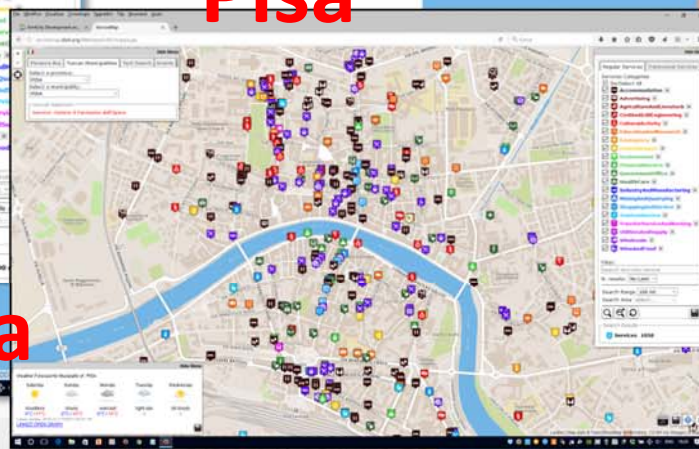
Bologna



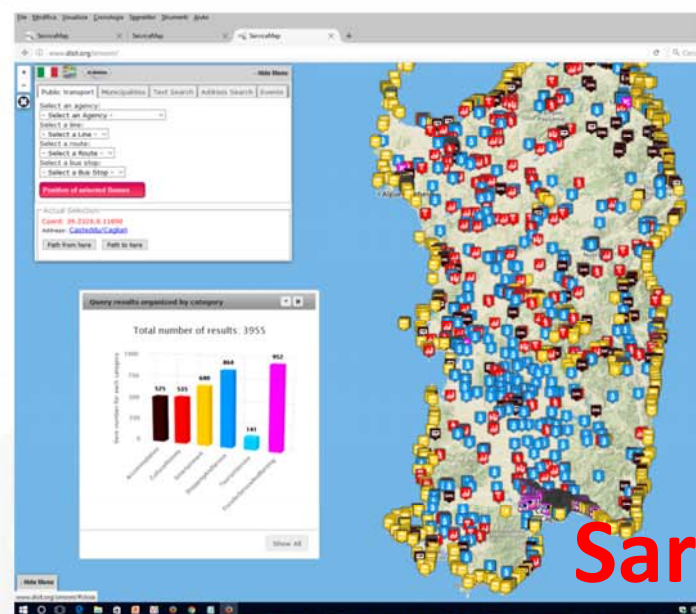
Toscana



Pisa



Sardegna



• Search all services in the area

Smart City Control Room

<http://www.km4city.org/?controlRoom>



Sentient City Control Room



DISIT lab, 15 August 2017



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FIRENZE

DINFO
DIPARTIMENTO DI
INGEGNERIA

DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB
<http://www.disit.org>



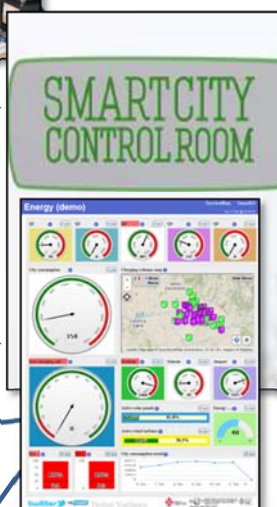
Horizon 2020
European Union Funding
for Research & Innovation



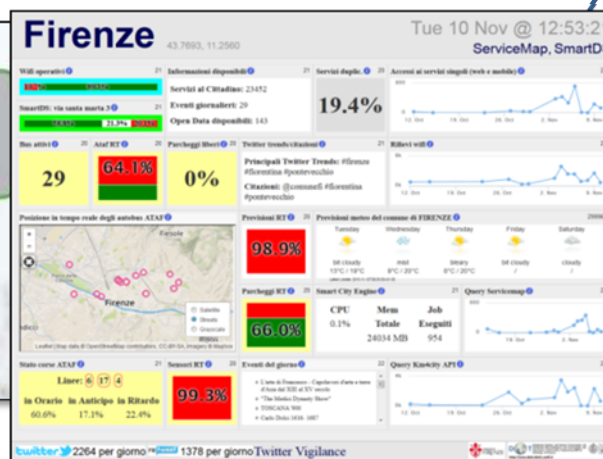
Transport
systems,
Mobility, Parking



Sensors, IOT
Cameras, ..



Public services,
Govern, Events



Environment,
Water, energy



Shops,
services,
operators



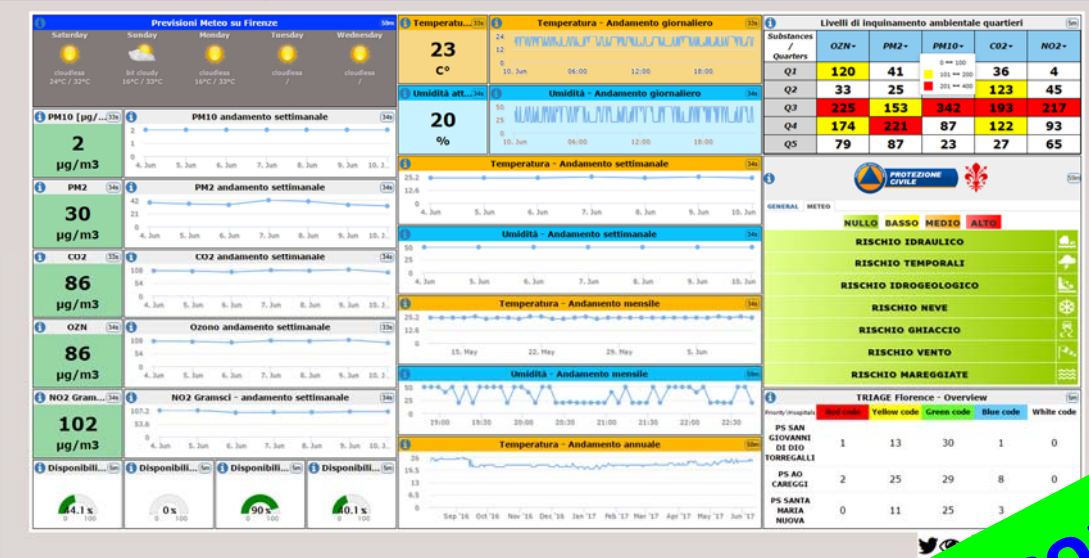
Social Media,
WiFi, Network

Dashboards

DISIT lab, 15 August 2017

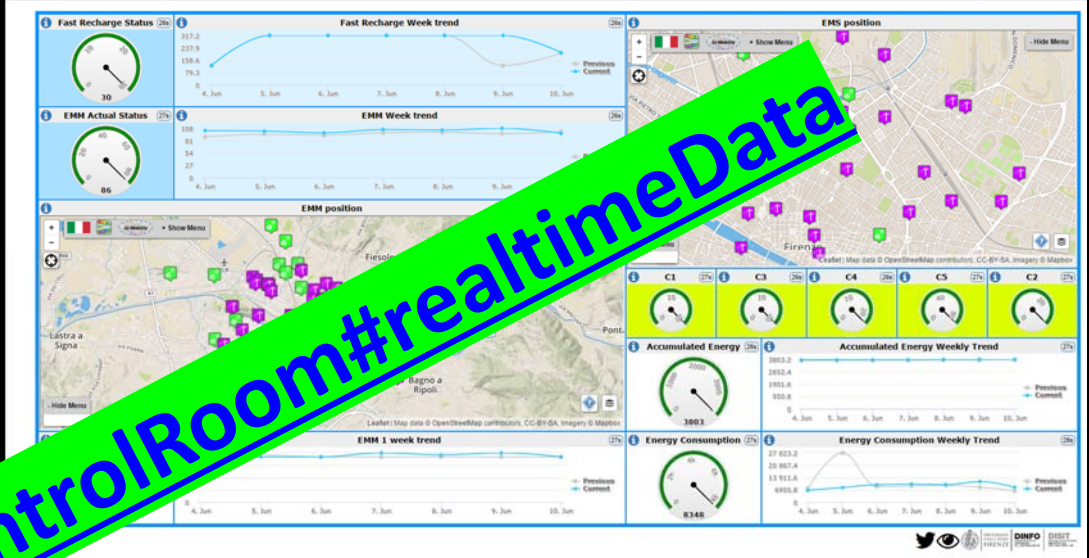
Firenze Ambiente e Salute HD

Dati ambientali su Firenze (demo)



Firenze Energia e Colonnine HD

(demo, dati simulati)



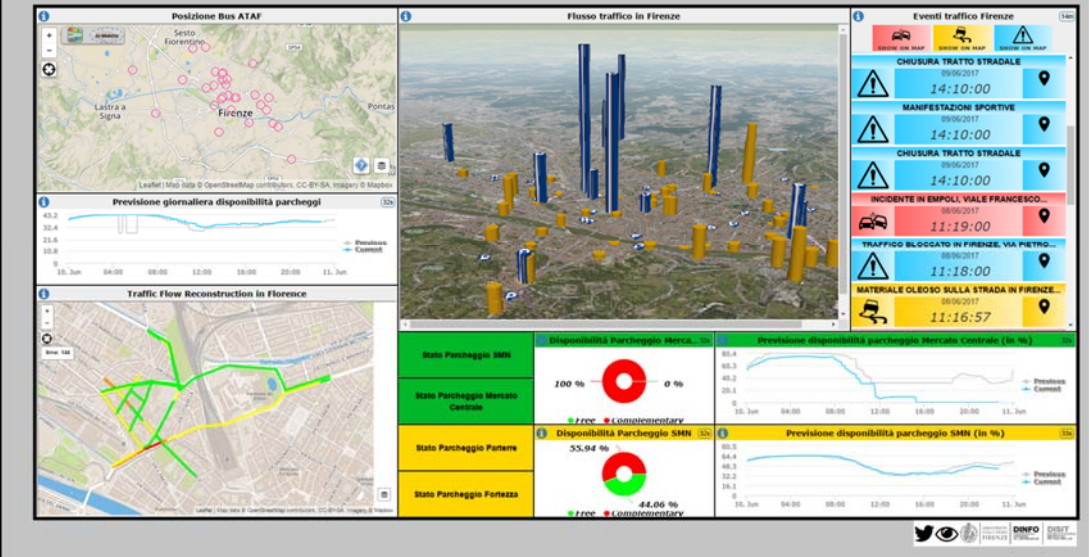
Firenze Sociale e Social Media (HD)

(dati non completi)



Firenze Mobilità e Trasporti HD

(demo, dati non completi)





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DELL'INFORMAZIONE

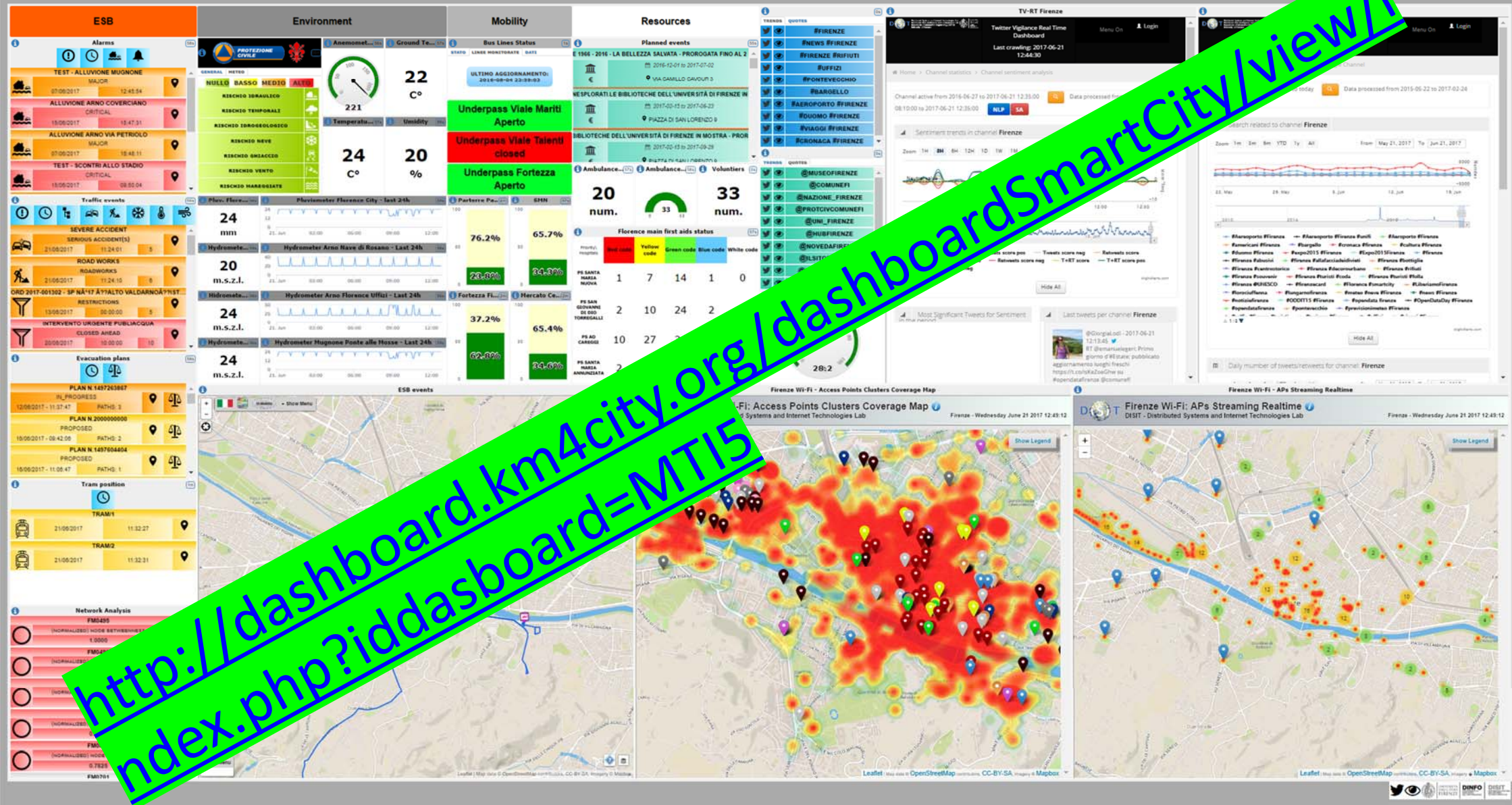
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<http://www.disit.org>

Dashboard Main Features



- Dashboards can render data coming from multiple data sources: SQL, noSQL, RDF Stores, etc.
 - Each Dashboard is based on a number of Widgets that can be fully configured for color, size, style, etc. and connected to data sources
 - Each Widget can show in different manner multiple metrics, taken from multiple sources
 - Widget can be created and changed at source level in PHP and JavaScript
- At each metric of a Widget, a number of Notifications can be set up with multiple firing conditions
- You can access to the Dashboard Manual via Km4City docs web pages



Smart City Dashboard



Horizon 2020
European Union Funding
for Research & Innovation



DISIT lab, 15 August 2017

Cross widget interaction 1

Artistical events, traffic events, city cams

DISIT

Tu 18:50:21

<http://dashboard.km4city.org/dashboardSmartCity/view/index.php?iddashboard=MT10>

Artistical and recreative events (58m)

LA FABBRICA DELLA BELLEZZA. LA MANIFATTURA GINORI E IL SUO POPOLO DI STATUE

2017-05-18 to 2017-10-01

VIA DEL PROCONSOLO 4

"DANTE INFERNO"

2017-05-22 to 2017-06-30

VIA RICASOLI

UN FRAGILE CAPOLAVORO

2017-05-24 to 2017-09-24

VIA DEGLI ALFANI 78

ESTATE FIORENTINA DEL GIARDINO DELL'ARTECULTURA

Artistical and recreative events - Exhibitions

Unexplored treasures. Florence University Libraries on display

LINKED OPEN GRAPH

Tipology: Event

Artistical and recreative events - Others

Traffic events (3m)

ALL ON MAP

ALL ON MAP

SHOW ON MAP

14:21:55

ON MAP

INCIDENTE IN FIRENZE, VIALE EUROPA

06/06/2017

13:43:23

ON MAP

INCIDENTE

06/06/2017

13:38:11

MATERIALE OLE

06/06/2017

13:20:11

INCIDENTE IN FIRENZE, VIALE EUROPA

06/06/2017

Traffic events - Slippery roads & others

City webcams - 1

Cam Duomo

Cam Piazzale

Cam Signoria

Cam Trinita

City webcams - 2

Cam P.Vecchio

Cam S.Croce

Cam Repubb.

Cam Fortezza

DISIT

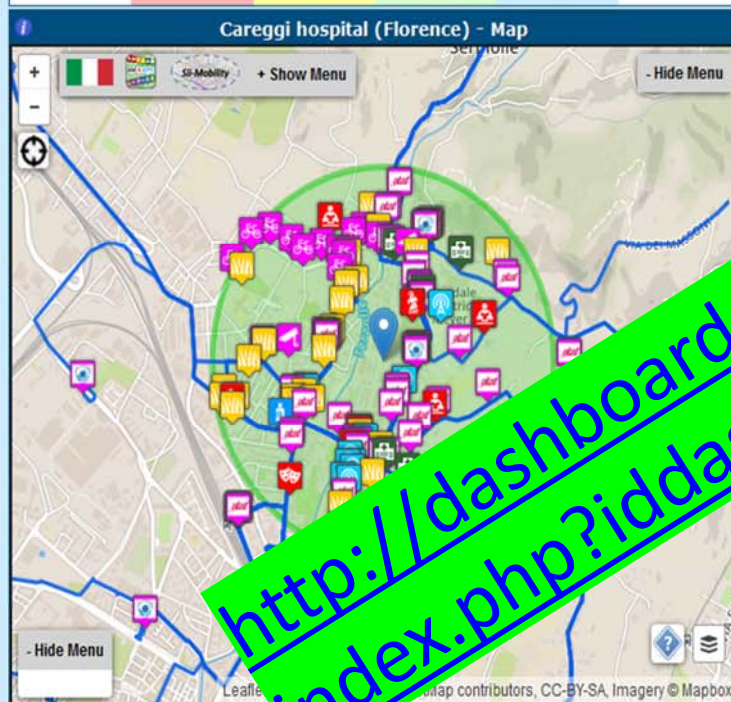
First aids overview - Tuscany

Service status of main first aids



Day @ 11:00:34

Careggi hospital (Florence) - Details					
Priority/Status	Red code	Yellow code	Green code	Blue code	White code
Addressed	1	4	3	0	0
Waiting	0	2	9	2	0
In visit	1	9	18	3	0
In observation	4	19	2	0	0
Totals	6	34	32	5	0



Santa Chiara hospital (Pisa) - Details					
Priority/Status	Red code	Yellow code	Green code	Blue code	White code
Waiting	0	1	7	9	3
In visit	0	7	1	1	0
Totals	0	8	8	9	0



Hospitals - Summary					
Priority/Status	Red code	Yellow code	Green code	Blue code	White code
Waiting	1	16	20	1	0
In visit	0	7	1	1	0
Totals	1	23	21	2	0

PS SANTA MARIA NUOVA	1	14	12	3	0
PS AO CAREGGI	6	34	32	5	0
PS SANTA MARIA ANNUNZIATA	1	8	11	1	0
PS BORGO SAN LORENZO	0	0	0	0	0
PS OSPEDALI RIUNITI	3	0	0	0	1
PS CASENTINO	0	0	0	0	0
PS SANTA CROCE	0	0	0	0	0
PI PO CORTONA	0	0	0	0	0
PS CIVILE PIOMBINO	0	0	0	0	0
PS LA MISERICORDIA	0	0	0	0	0



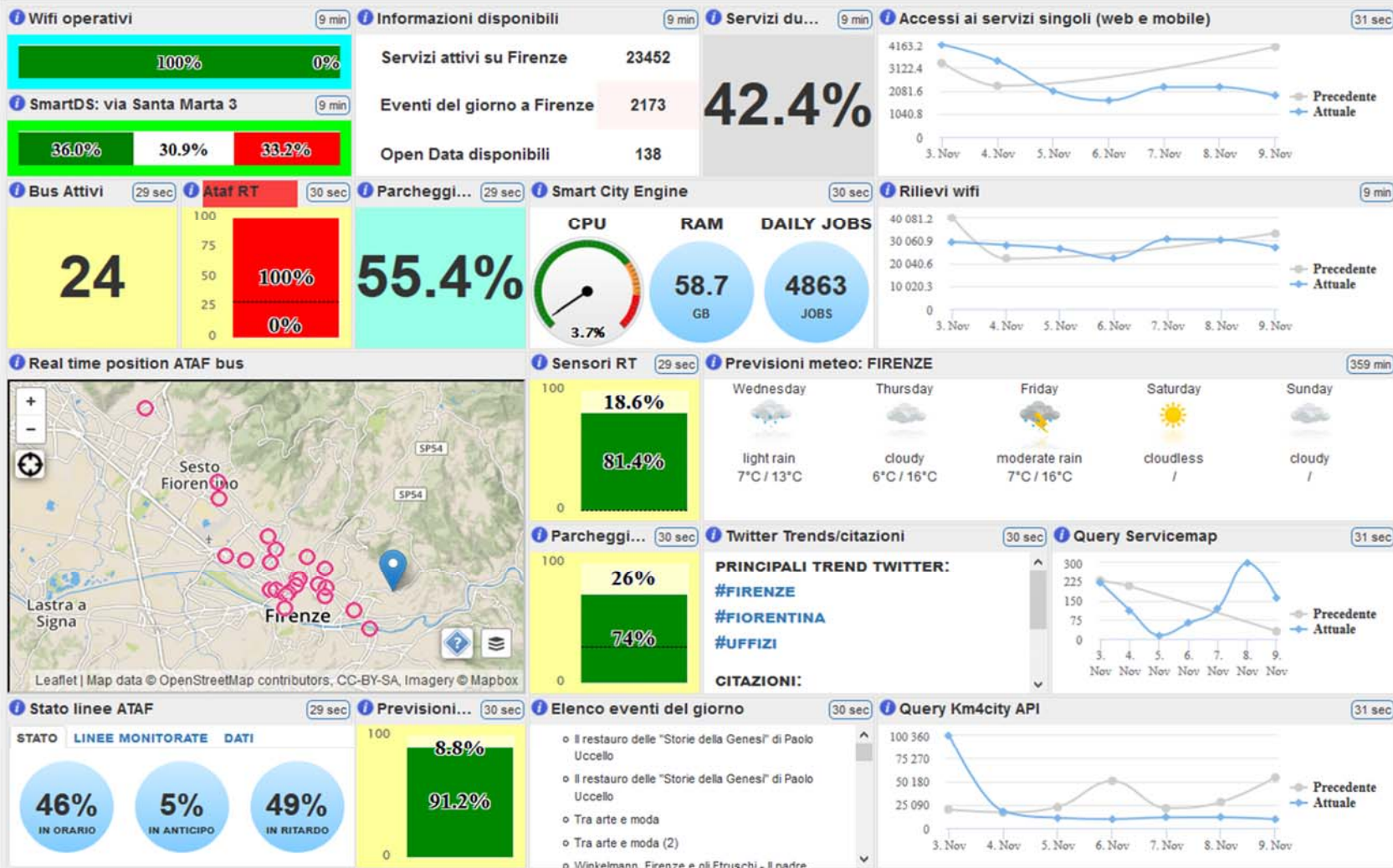
<http://dashboard.km4city.org/dashboardSmartCity/view/index.php?iddashboard=MTIV>



Firenze

43.7693, 11.2560

Wed 9 Nov @ 23:36:04



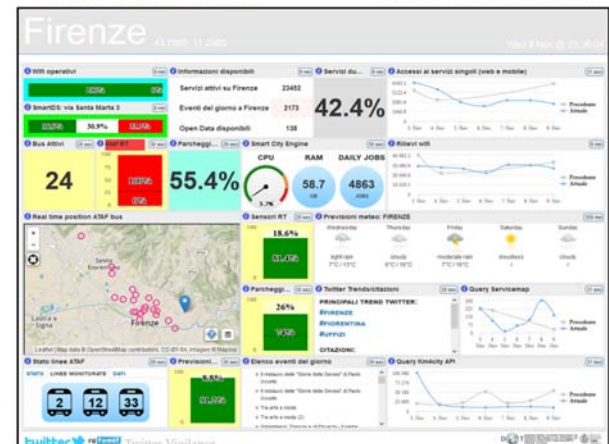
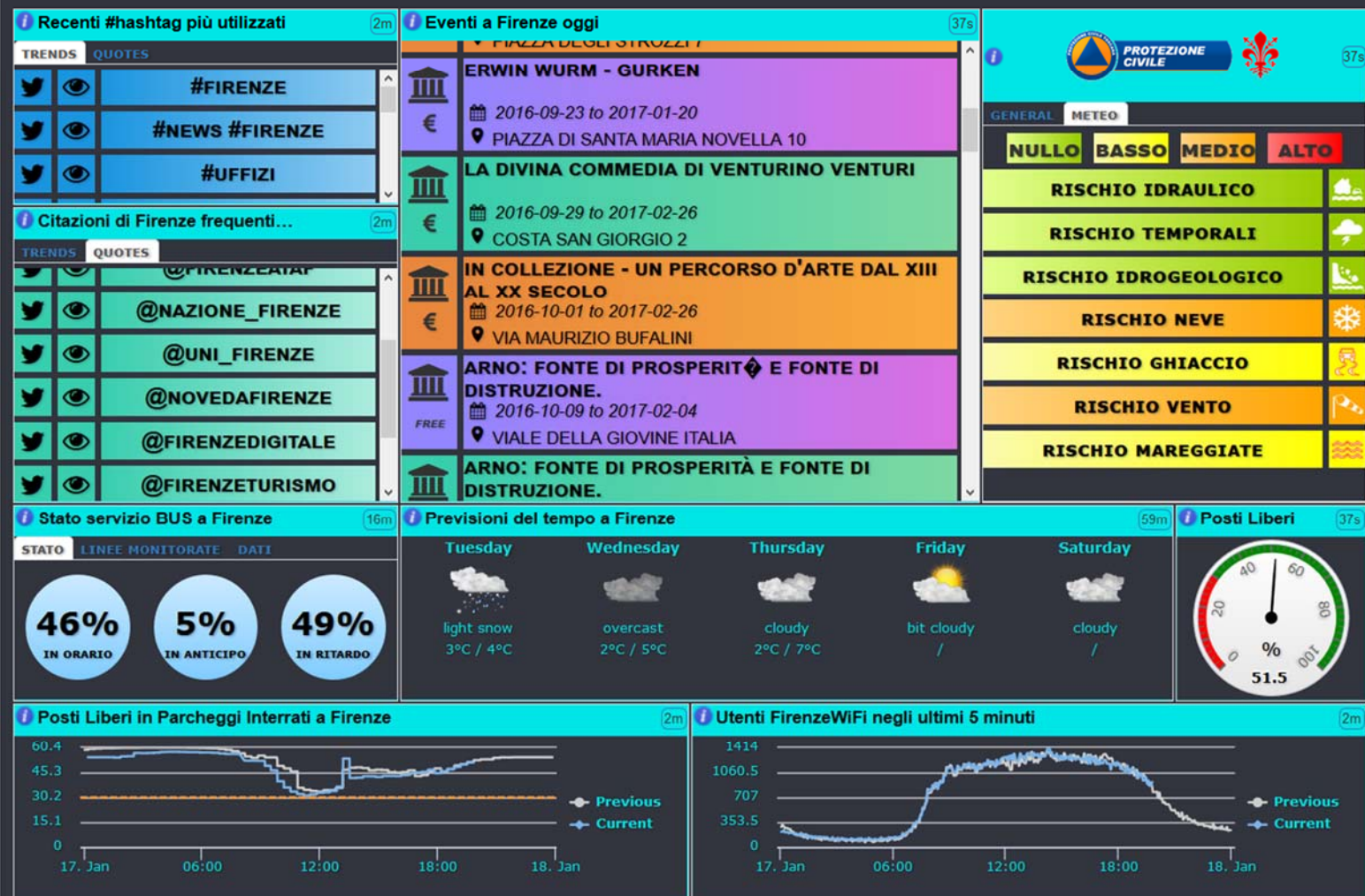
twitter retweet Twitter Vigilance

DIST Distributed Systems and Internet Technologies Lab
Department of Information Engineering (DIE)
University of Florence
http://www.dist.die.unifi.it

Servizi agli Utenti

Firenze (sperimentale)

Tue 17 Jan @ 19:52:49



SmartCity Processes



Florence data overview

A table based overview over city main data

Wed 18 Jan @ 19:19:10

Air Quality Index 39a						Weather stations 39a							Citizens satisfaction index 39a						
Substances / Quarters	OZN▼	PM2▼	PM10▼	CO2▼	NO2▼	Data / Station	Wind speed (km/h)▼	Direction	Temperature (°C)▼	Humidity (%)▼	Rain today (mm)▼	Pressure (mbar)	Criteria / Services	Quality (%)▼	Cost (%)▼	Availability time (%)▼	Emergency handling (%)▼		
	Q1	120	41	165	36	4	Sesto Fiorentino	50	N	0 --> 4	32	0	922	Water	92	67	95	42	
	Q2	33	25	66	123	45	Livorno	65	NE	4 --> 10	37	0	876	Public transportation	36	29	27	31	
	Q3	225	153	342	193	217	Grosseto	78	E	10 --> 20	4	0	1022	Public safety	77	64	58	62	
	Q4	174	221	87	122	93	Vada	42	S	20 --> 25	6	0	895	Roads management	28	42	27	25	
	Q5	79	87	23	27	65	Follonica	102	N	25 --> 30	7.2	0	913	Healthcare	72	64	23	56	
							Giglio	97	O	30 --> 50	3	19	0	957	Welfare	43	51	38	36
														Public administration	58	16	18	22	
Tourists flow 39a						Florence events 2017 overview 39a													
Categories / Vehicle	Total arrivals		Overnights		Day trippers	Fields / Categories	Free		Paid		Winter		Spring		Summer		Autumn		
Airplane	56		36		20	Classical music, opera, ballet	7		23		6		10		4		10		
Train	122		81		41	Exhibitions	4		16		3		7		6		4		
Car	215		133		82	Guided tours	60		140		15		100		50		35		
Bus	157		110		47	Film festival	0		0		0		0		0		0		
Cruise	0		0		0	Markets, fairs	7		7		2		6		2		4		
Boat	0		0		0	Readings, conferences	35		15		10		22		9		9		
Total	550		360		190	Contemporary music	30		42		8		25		30		9		
						Sport	20		192		55		104		27		26		

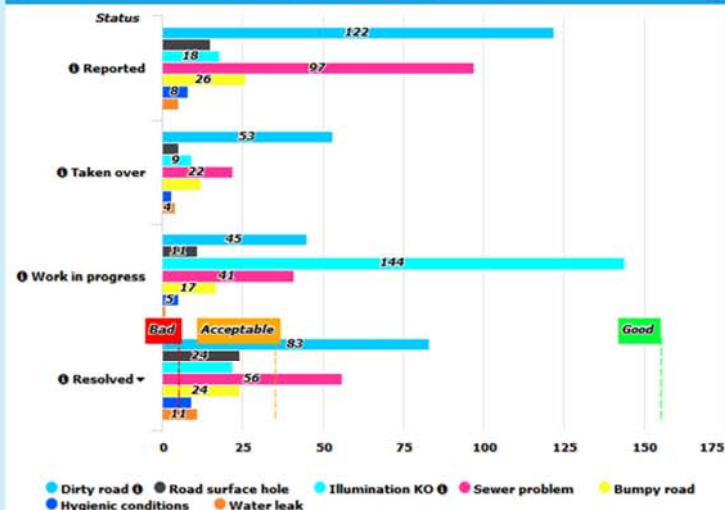
Smart City Data Overview

Sperimentale



Thu 16 Mar @ 02:23:38

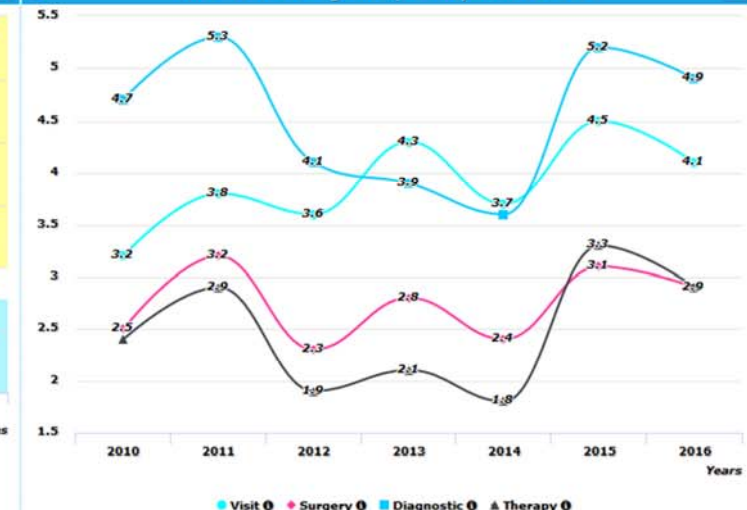
Urban faults - Horizontal bar series



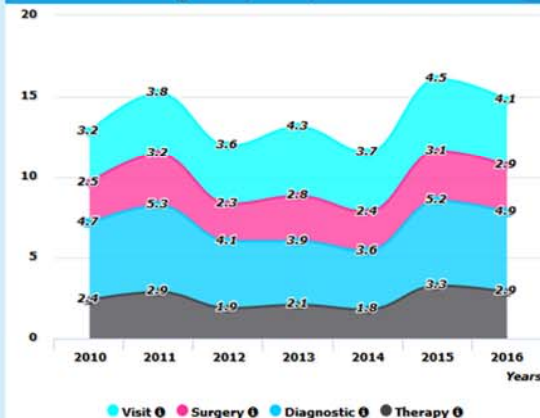
2016 Temperature statistics - Curved line series



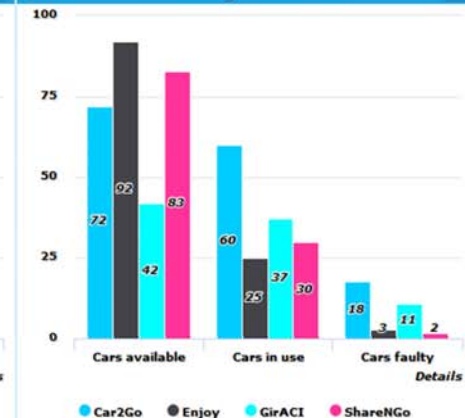
Healthcare waiting times (months) - Curved lines



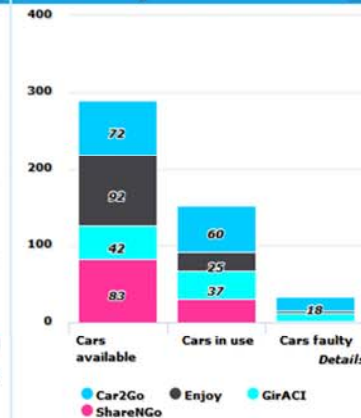
Healthcare waiting times (months) - Stacked curved area



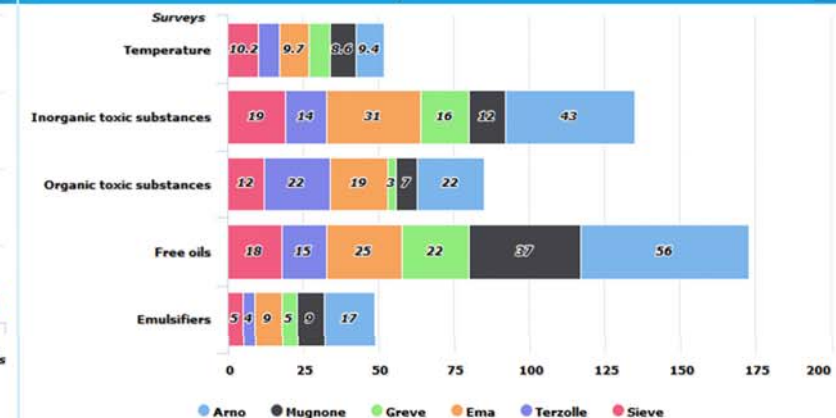
Car sharing - Vertical bars



Car sharing - Vertical stacked bars



Rivers water analysis - Horizontal stacked bars



Smart City Data Overview 2

Sperimentale



Thu 16 Mar @ 02:24:52

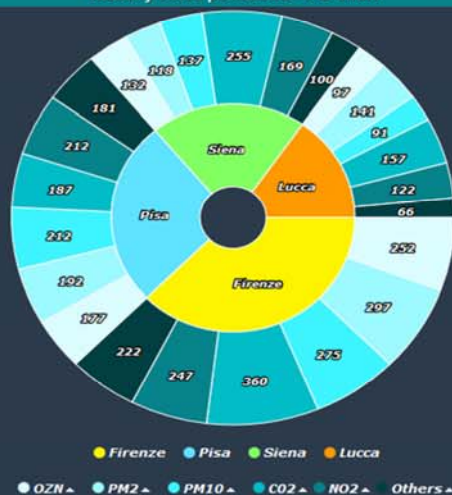
Tuscany cities pollution - Radar Series

99m



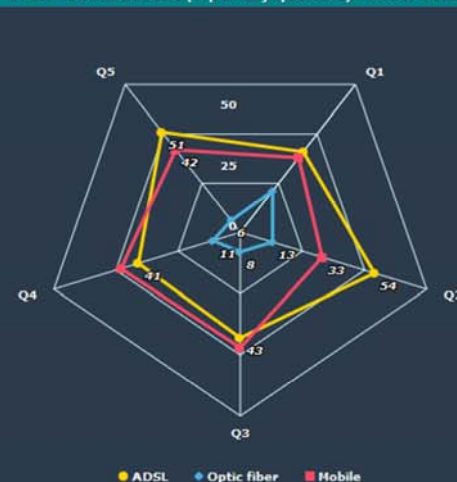
Tuscany cities pollutions - Pie chart

55s



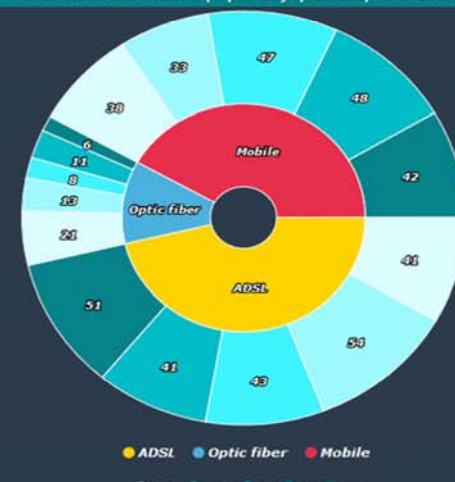
Internet connections (% per city quarters) - Radar series

55s



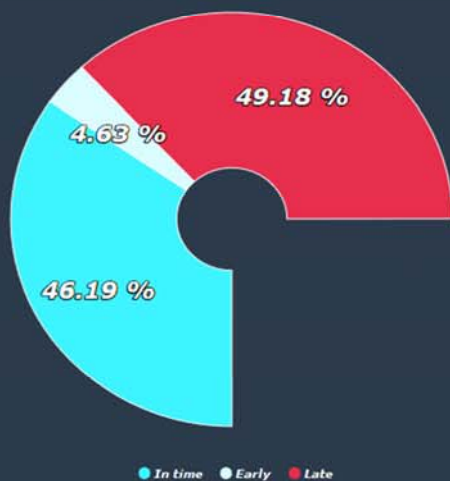
Internet connections (% per city quarters) - Pie chart

55s



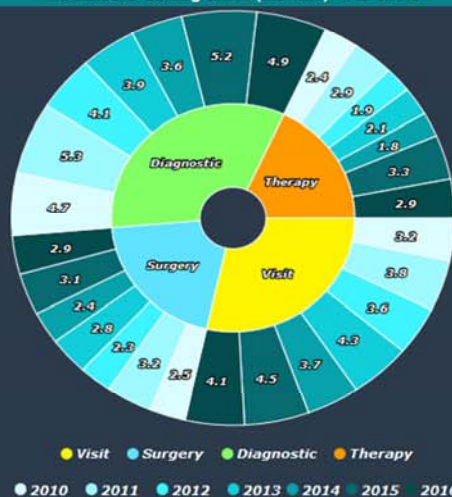
Bus state lines (%) - Pie chart

55s



Healthcare waiting times (months) - Pie chart

55s



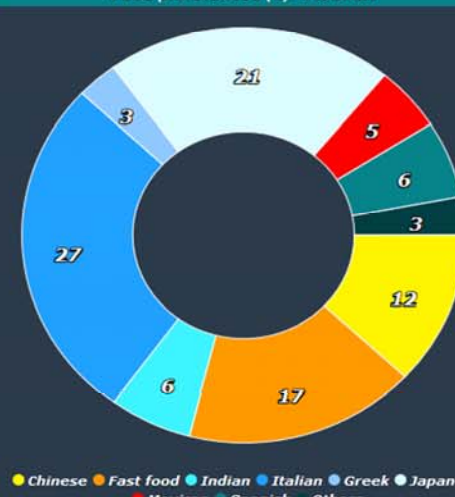
Healthcare waiting times (months) - Radar series

55s



Food preferences (%) - PieChart

55s



DISIT

Smart City Control Room Console

Entry point for REPLICATE dashboards



Tue 21 Nov 19:30:36



Real Time Sensors via ServiceMap3D

3D data rendering



Fri 26 Jan 00:23:19



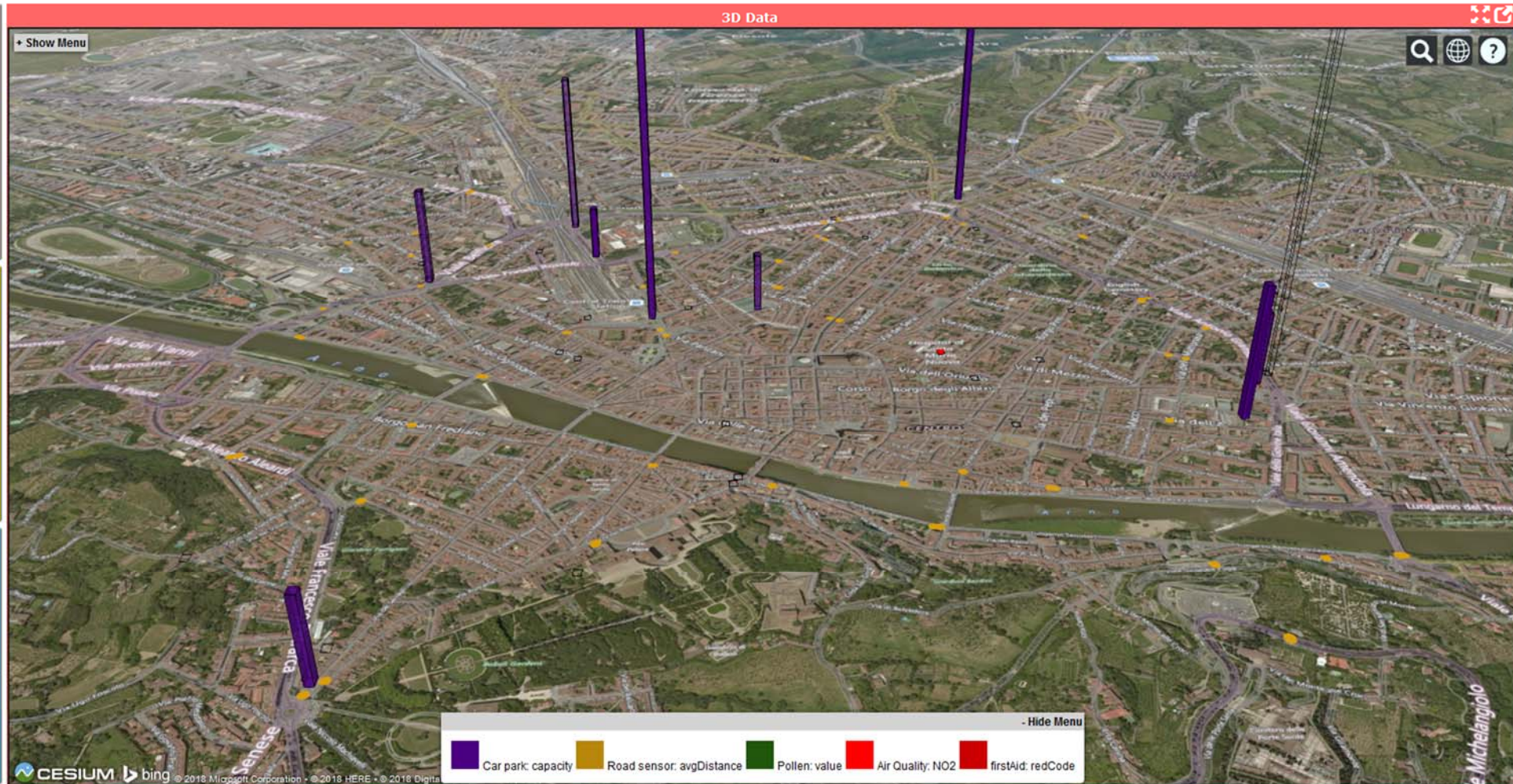
Firenze



Airport



Empoli



Click POI of interest below

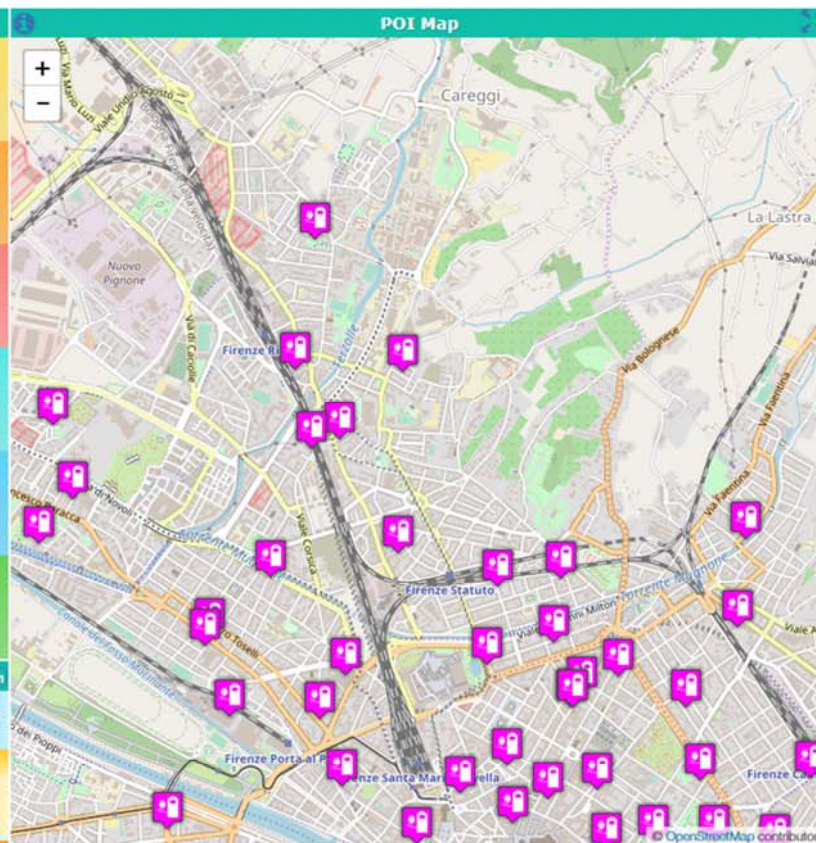
- (1) Fast recharging stations
- (2) Cycle paths
- (4) Public transport paths (F)
- (6) Restricted traffic areas
- (8) Parking status
- Variable Message Signs (F) (7)

Traffic events

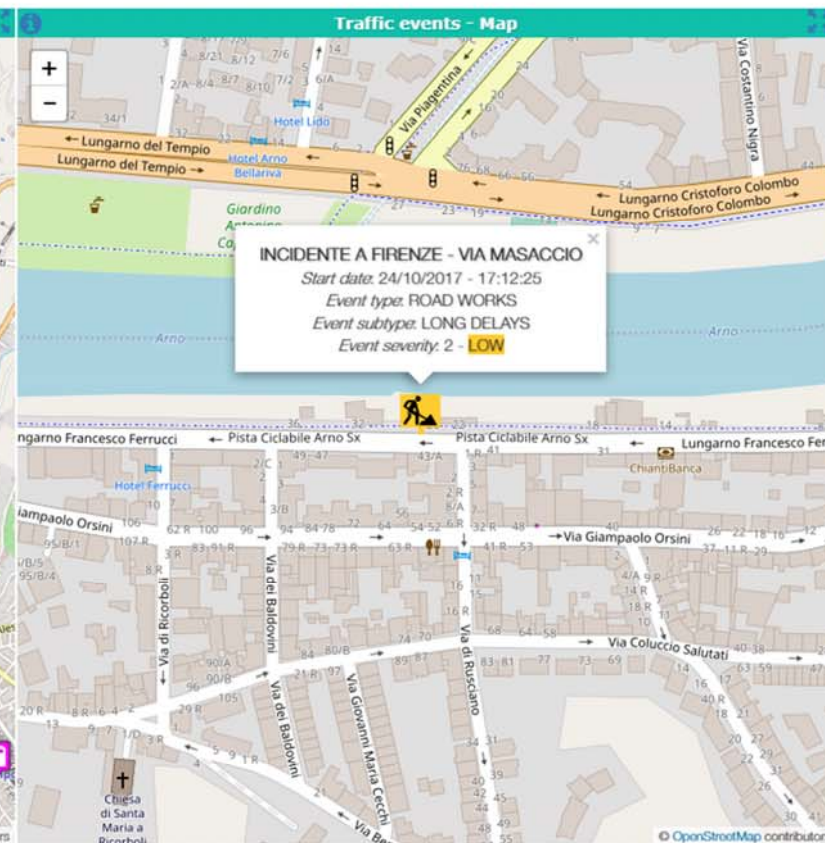
(5) INCIDENTE A FIRENZE - VIA MASACCIO
LONG DELAYS
24/10/2017 17:12:25 2 ON MAP

INCIDENTE A FIRENZE - VIA MASACCIO
ACCIDENTS (s)
24/10/2017 20:44:29 5

INCIDENTE A FIRENZE - VIA GARFAGNANA
ACCIDENTS (s)
25/10/2017 11:30:29 8



(3a) 199



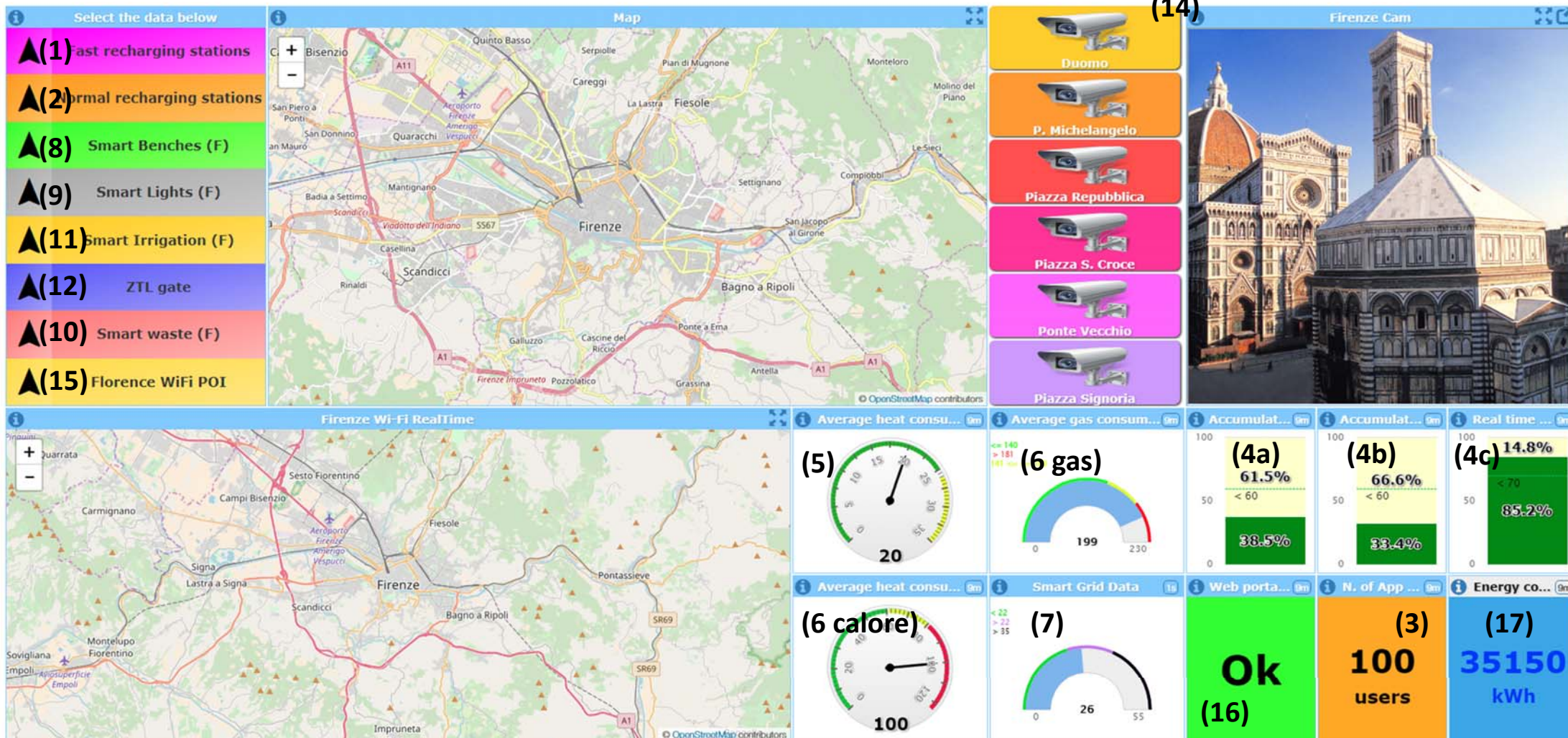
REPLICATE

Pilot dashboard



Mon 23 Oct @ 14:55:54

(14)



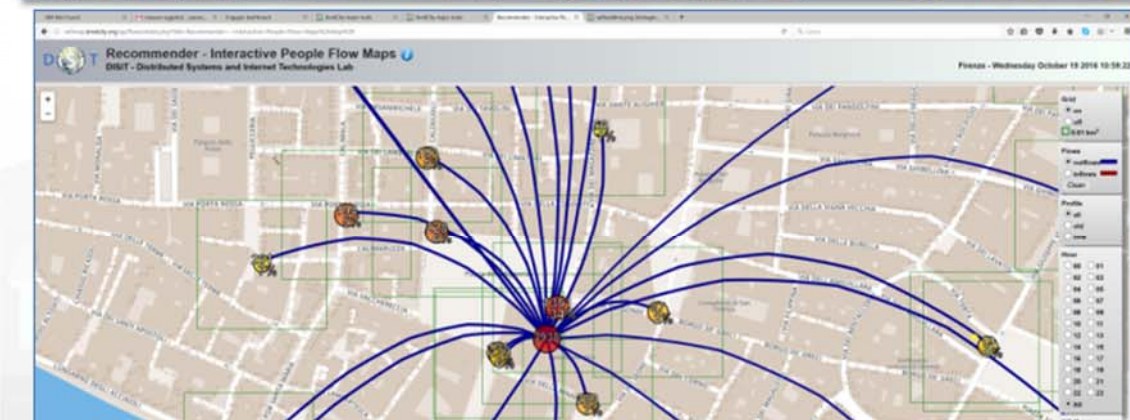
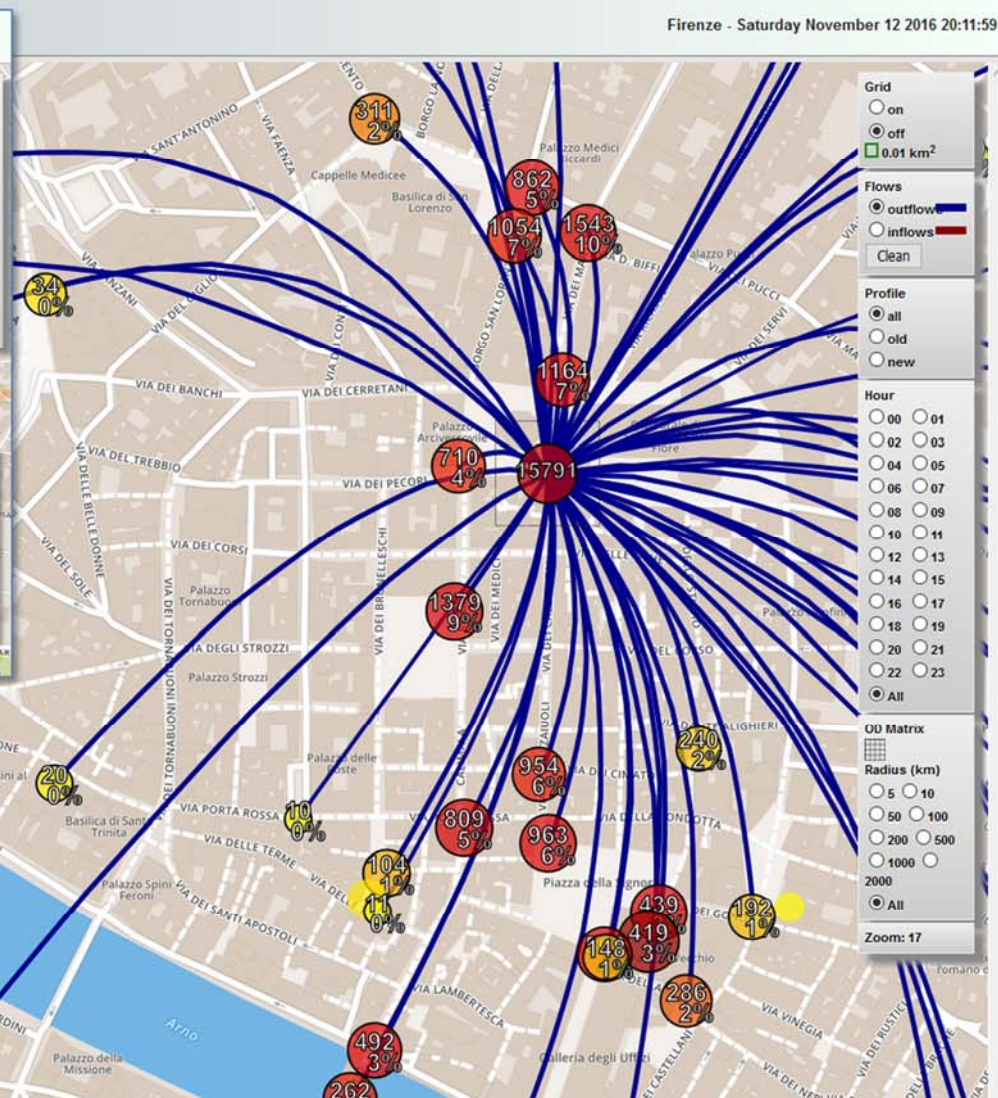


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Wi-Fi OD estimation.





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Embedded Widgets



DESTINATION FLORENCE Destination Official Partner del Comune di Firenze

Visitare Vivere Dormire Mangiare Tour Eventi Servizi Blog

COME MUOVERSI

Fermate bus Piste ciclabili Parcheggi Distributori

Powered by www.km4city.org

DISIT Distributed Systems and Internet Technologies Lab
Distributed Data Intelligence and Technologies Lab
Department of Information Engineering (DINFO)
University of Florence

<http://www.disit.dinfo.unifi.it>

vis| qualsiasi tipo ☐ deep search

HOME ABOUT RESEARCH INNOVATION EDUCATION AND COURSES HOWTO EVENTS

Log in/Create account

Sort by Relevance Sort by Upload Sort by Update

RISULTATI DELLA RICERCA

(1-10 of 857 in 2723 ms)

DISIT in difficoltà per la neve nel 2010!
DSI DISIT nel 2010, problemi di neve!

UNIVERSITÀ DEGLI STUDI FIRENZE **DINFO** Dipartimento di Ingegneria dell'Informazione

Informazioni sui mezzi di trasporto pubblico disponibili, per una mobilità sostenibile nell'ateneo fiorentino

Scegli il raggio di ricerca - Choose the search distance

Così 0 m 1 km 2 km

Vista iniziale First view Km4city WebApp Indicazioni stradali - Directions

Scegli altri servizi da visualizzare
Choose other services to show

- ☐ Rastrelliere bici - Bike racks
- ☐ Piste ciclabili - Cycle paths
- ☐ Strutture UNIFI - UNIFI Depts
- ☐ Linee Tpl - Bus routes

Clicca sul nome della fermata qui sotto per avere il dettaglio delle linee

Clicca lo stop name for more details on the routes

- Massaia 4
- Massaia 02 4
- Cappuccini 4
- Mercati 4
- Incontri 40

Rilevanza 0,35

ella conoscenza, anal...

dati e conoscenze mining,
gio naturale, intelligenza artificiale,

Rilevanza 0,3

alisi comparativa dei ...

tion system and besides it, the
e key issues such safety of the

Rilevanza 0,3

i di sistemi collaborat...

gi, e benefici per gli studenti del
digitali, DRM e CAS Parte 2:

Rilevanza 0,28

mica su Smart City: ci...

rastrutture elaboratori periferici
deduzione Processori Recitazione

Rilevanza 0,28

turismo e la formazio...

minerario, gestione delle
gestione dei dati;? strumenti per il

Rilevanza 0,28

multiple SPARQL entry ...

essibili popolano il mondo linked
dati sta diventando ogni giorno

FILTRI DI RICERCA

CONTENUTI

- In primo piano
- Most Viewed (last 500)
- Most Viewed All (last 500)
- Ultimi caricati
- Più votati
- Risultati della Ricerca

CLASSIFICAZIONE

Lista dei termini

- application fields (3425)
- content kind (962)
- models and systems (3014)
- project kind (809)
- research topics (7453)
- standard (501)

Ven 26 Gen Powered by LaMMA

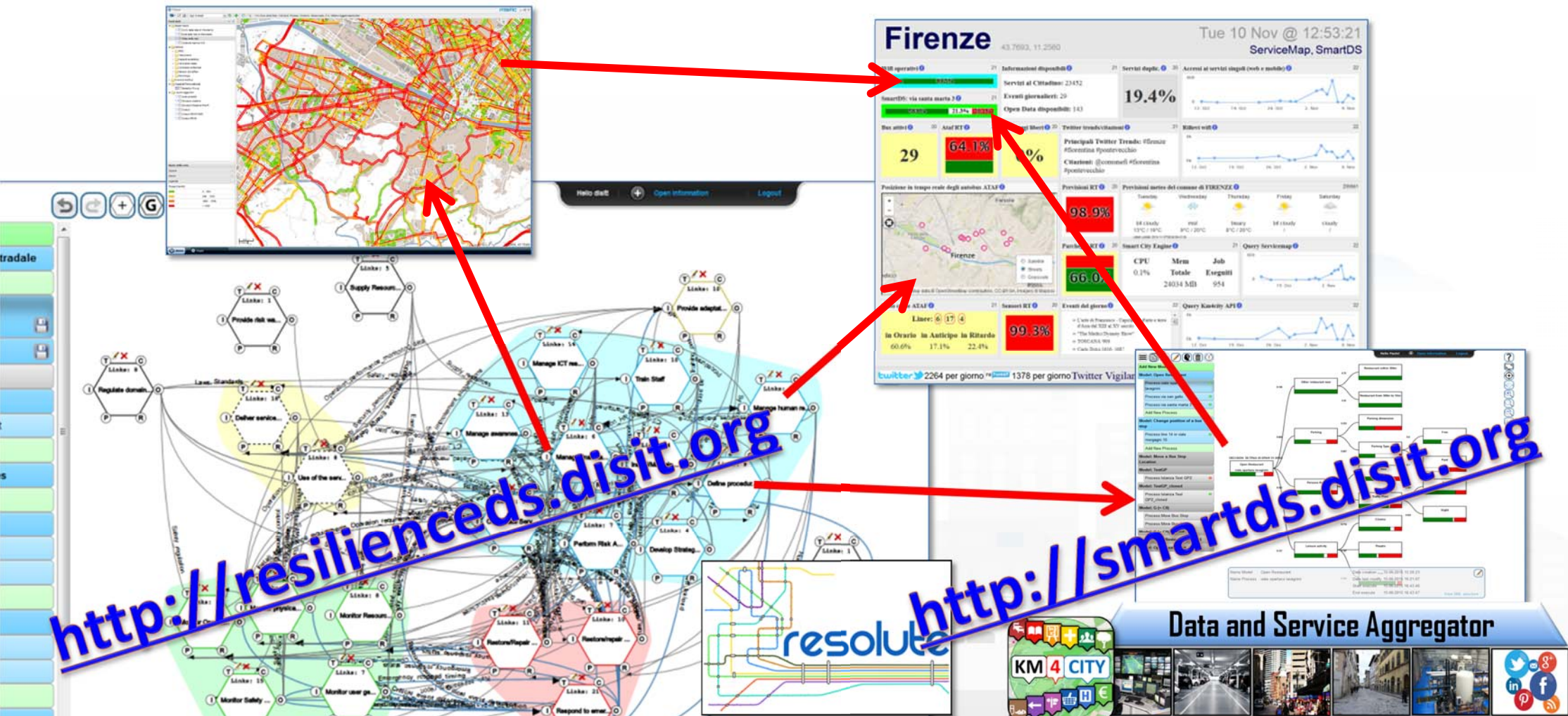
Firenze

Nuvoloso 5°C / 10 °C

Sab 27 Gen	Dom 28 Gen	Lun 29 Gen	Mar 30 Gen
1°C / 14°C	1°C / 15°C	Temp N/A	Temp N/A
Sereno	Sereno	Nuvoloso	Coperto

Powered by www.km4city.org

Assessing / Controlling city resilience



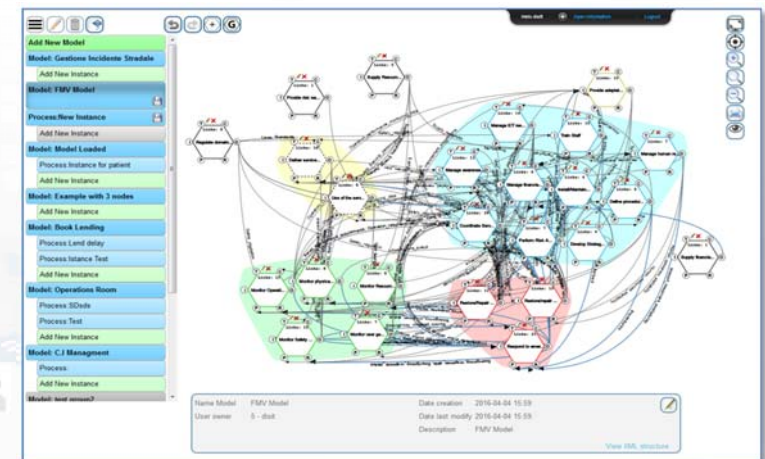
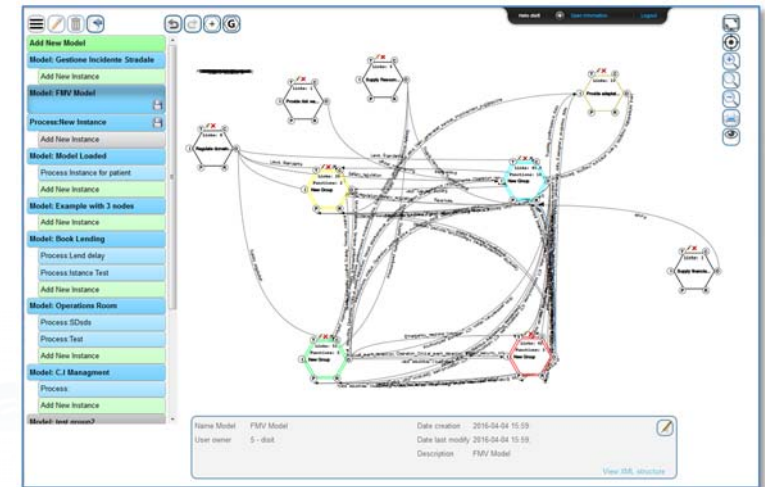
ResilienceDS tool



- **FRAM Model**
 - Macro FRAM processes
 - Metrics for Process complexity assessment
 - Operational Semantic for executing FRAM model
 - Connection with SmartDS
 - Connection with BigData open to multiple sources of data and workgroup results, Km4City
- **Collaborative work**
- **Open for all**
- **Validated on ERMG**
- **Web Tool**

<http://resilienceds.disit.org>

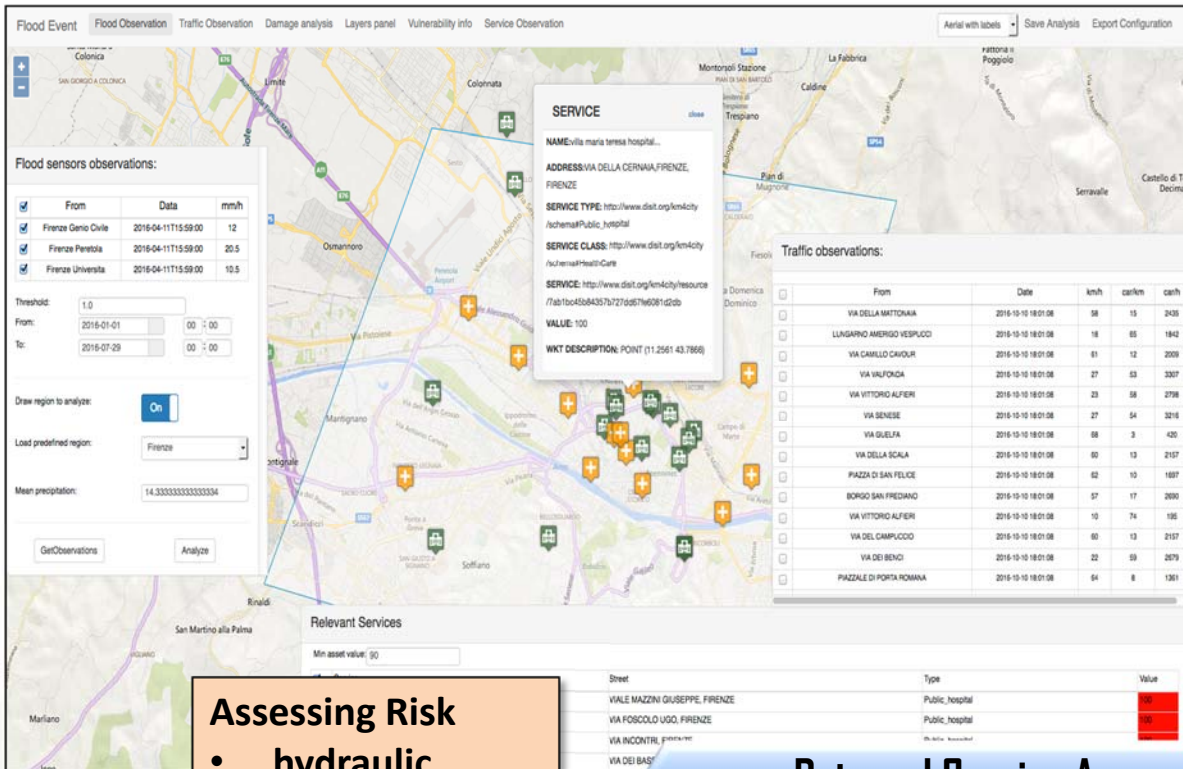
DISIT lab, 22 August 2017





Risk Assessment

Decision Support Systems



Assessing Risk

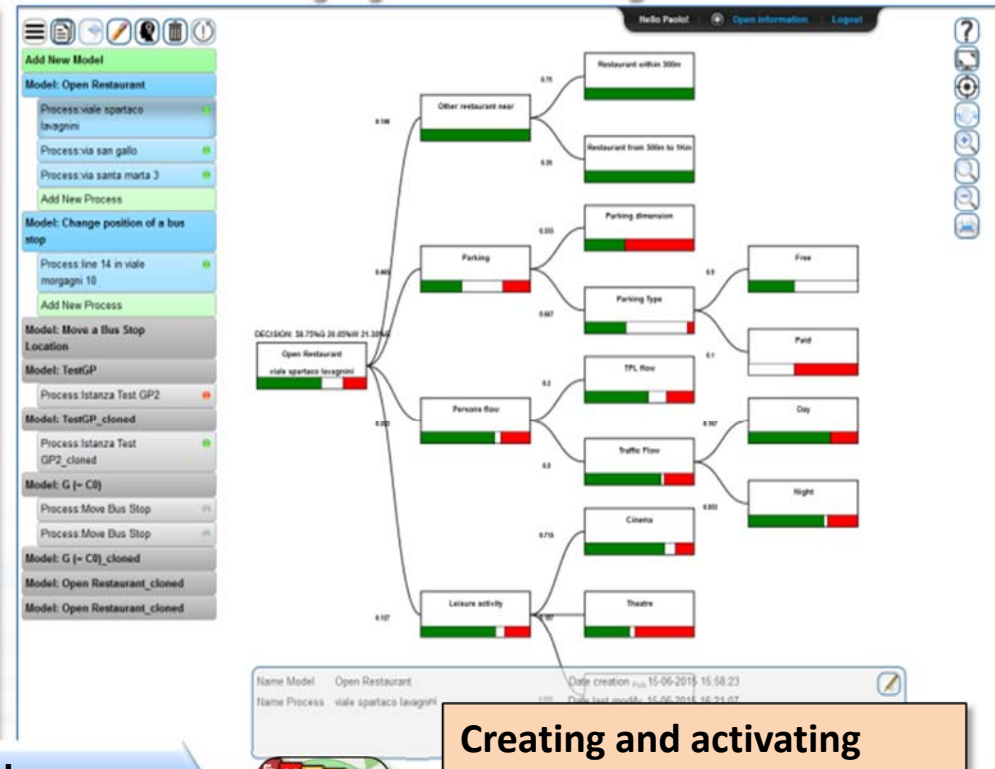
- hydraulic
- Seismic

Data and Service Aggregator



Creating and activating

- Decision Support models





Smart City Monitoring: Notificator

Events log

EVENTS GENERATORS

MESSAGE BOOK

ADDRESS BOOK

REST BOOK

EVENTS LOG

CLIENT APPLICATIONS

Text filter

Start date2017-07-31 00:00:00

End date2017-08-11 09:22:00

ApplicationAll

Filter

Restore

Generator container	Generator name	Generator type	User	Event time	Event type	Application	Link		
ToolAdmin - Public	Ataf RT	Ataf_Rt	marazzini	2017-08-09 17:38:03	Value <= 50 - Bad	Dashboard Manager	Link		
ToolAdmin - Public	Park Free - Speedo	Park_Free	marazzini	2017-08-09 17:37:32	27 < Value <= 54 - Ok	Dashboard Manager	Link		
ToolAdmin - Public	Ataf RT	Ataf_Rt	marazzini	2017-08-09 17:37:02	Value <= 50 - Bad	Dashboard Manager	Link		
ToolAdmin - Public	Park Free - Speedo	Park_Free	marazzini	2017-08-09 17:36:28	27 < Value <= 54 - Ok	Dashboard Manager	Link		
ToolAdmin - Public	Ataf RT	Ataf_Rt	marazzini	2017-08-09 17:36:02	Value <= 50 - Bad	Dashboard Manager	Link		
New events occurred									
Ataf RT	Value <= 50 - Bad	2017-08-11 09:23:41	Temp	EngagementCreated	marazzini	2017-08-09 17:35:58	Value <= 11 - Low	Dashboard Manager	Link
				DCTemp1	marazzini	2017-08-09 17:35:42	6 < Value <= 30 - Ok	Dashboard Manager	Link
	ee - Speedo	Park_Free	marazzini	2017-08-09 17:35:25	27 < Value <= 54 - Ok	Dashboard Manager	Link		

Logout

marazzini

Dashboard Manager

ToolAdmin

On

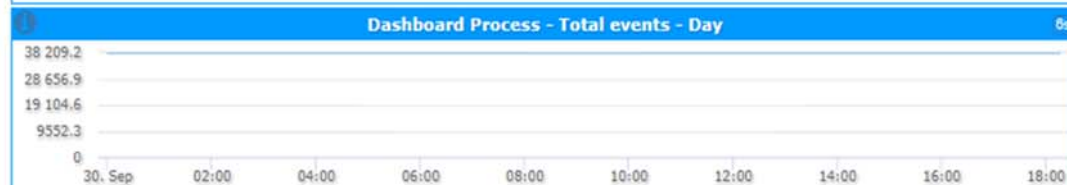
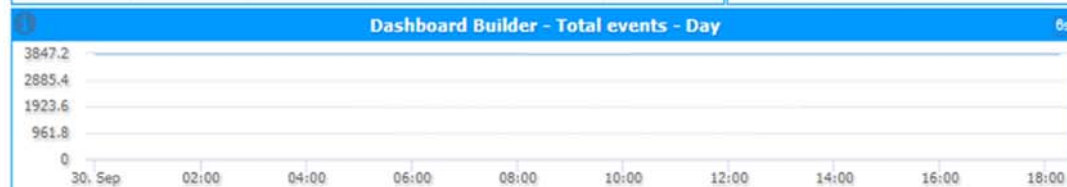
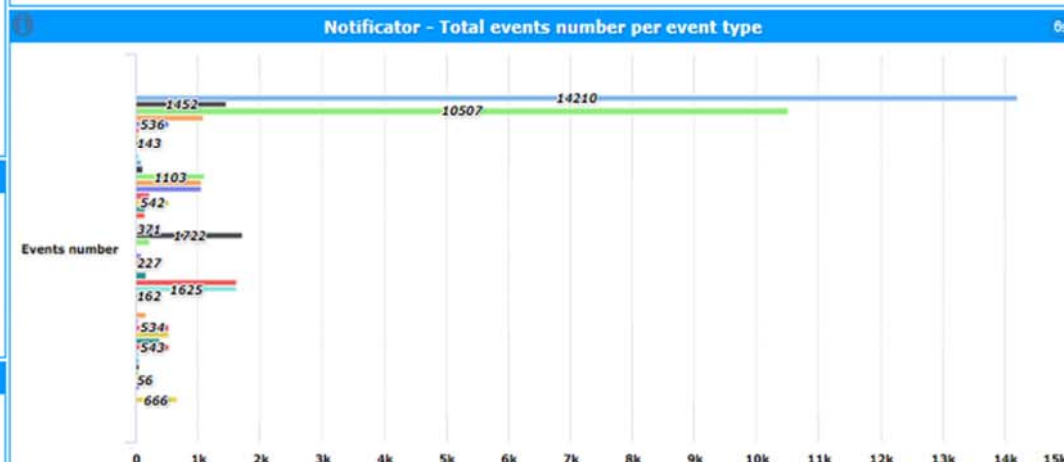
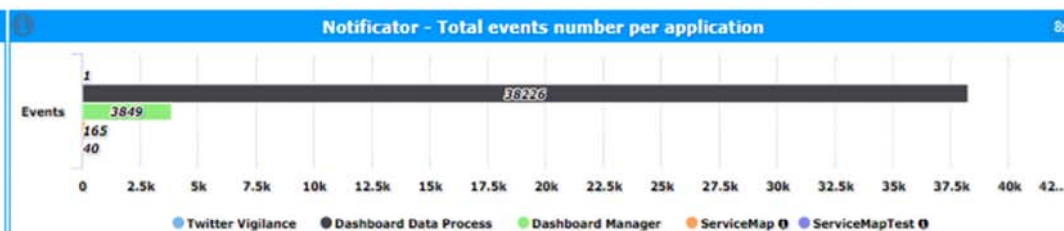
RT events

Data about events received by Notificator

Data about events received by Notificator

Notifier - Client applications list					
	Has local users	Has ldap users	Container alias	Generator alias	Generator type alias
Dashboard Manager	yes	yes	Dashboard title	Widget title	Metric type
Twitter Vigilance	no	yes	Metric page	Metric name	Metric type
Dashboard Data Process	no	yes	Generator context	Generator name	Generator type
ServiceMap	no	yes	ServiceMap	Generator name	Generator Type
ServiceMapTest	no	yes	ServiceMapTest	Generator name	Generator Type

30
events



DB connection KO - Database access object Same data for too much time - Bus_Active_Rt Same data for too much time - Sce_Mem
 Same data for too much time - Sensors_Rt Import data error - Bus_Active_Rt Import data error - Services_Duplicate
 Import data error - Service_Active_FI Same data for too much time - SmartDS_Process Import data error - SmartDS_Process
 Import data error - TrafficEvents Same data for too much time - TweetsRet_Florence_Day Data too old - WifiStream_Aps
 Same data for too much time - WifiStream_Aps Same data for too much time - WifiStream_Events
 Same data for too much time - WifiStream_Users Import data error - Wifi_Operative Import data error - Bus_Active_TT
 Import data error - Wifi_Power_SRI Data too old - Wifi_Remark_Day Data too old - DCHum1 DB reading KO - Database access object
 Data too old - DCTemp1 Same data for too much time - DCTemp1 Import data error - DCTempfloat Data too old - DCTemp2
 Same data for too much time - DCTemp2 Value >= 24.5 - Temp 1 Value >= 100 - Utenti attivi (12 ore)
 Value < 30 - Utenti attivi (simulanei)
 Value < 30 - Utenti attivi (12 ore)
 Value > 100 - Utenti attivi (simulanei)
 Value >= 25 - Temperatura 1 (last 4 hours)
 Value < 20 - troppo pochi - AP FWIFI Exception - Error Exception - Error
 Import data error - Events_FI_Day Import data error - Meteo_Rt Data too old - Park_Free Import data error - Park_Free
 Import data error - Park_Free_FortezzaFiera Import data error - Park_Free_MercatoCentrale Import data error - Park_Free_Parterro
 Import data error - Park_Free_STAZIONE5MN Import data error - PollineFI Import data error - PollutionFI
 Import data error - OARIA_FI_GRAZIOSI_NO2 Same data for too much time - Sce_Job_Day

Smart City API

<http://www.disit.org/7044>



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Providing Services to City Users

- Cities aims at **providing new Smart Services** to city users:
 - operators, final users, etc.
- In most cases via **Web and Mobile Apps** which **exploit data**:
 - Structural data, open data, real time data, etc., private data from companies
 - **to be aggregated and transformed** in services (providing: prediction, information, early warning, relations)
 - **at reasonable cost** for: developers, operators, and SME to realize new Apps and services.
- *If cost is not affordable, Services and Apps are not developed*, in most cases the Apps are also provided for free, so that high costs are not sustainable → Public Private Partnership



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City Services



- **Case A)** Data may be accessible as single non-Aggregated Data Sets
 - → very expensive for App builders or
- **Case B)** Services and microservices may become accessible via Smart City API, providing a view on Aggregated Data and Services.
 - → Affordable for App builders

Case B) Smart City API on aggregated data is as solution

- PROS: May abstract from the underlined data model, but can exploit it to provide insight, inference, reasoning about the aggregated data and services
- CONS: may be complex and difficult to use without training and without knowing the context.
- CONS: they have not been standardized yet.



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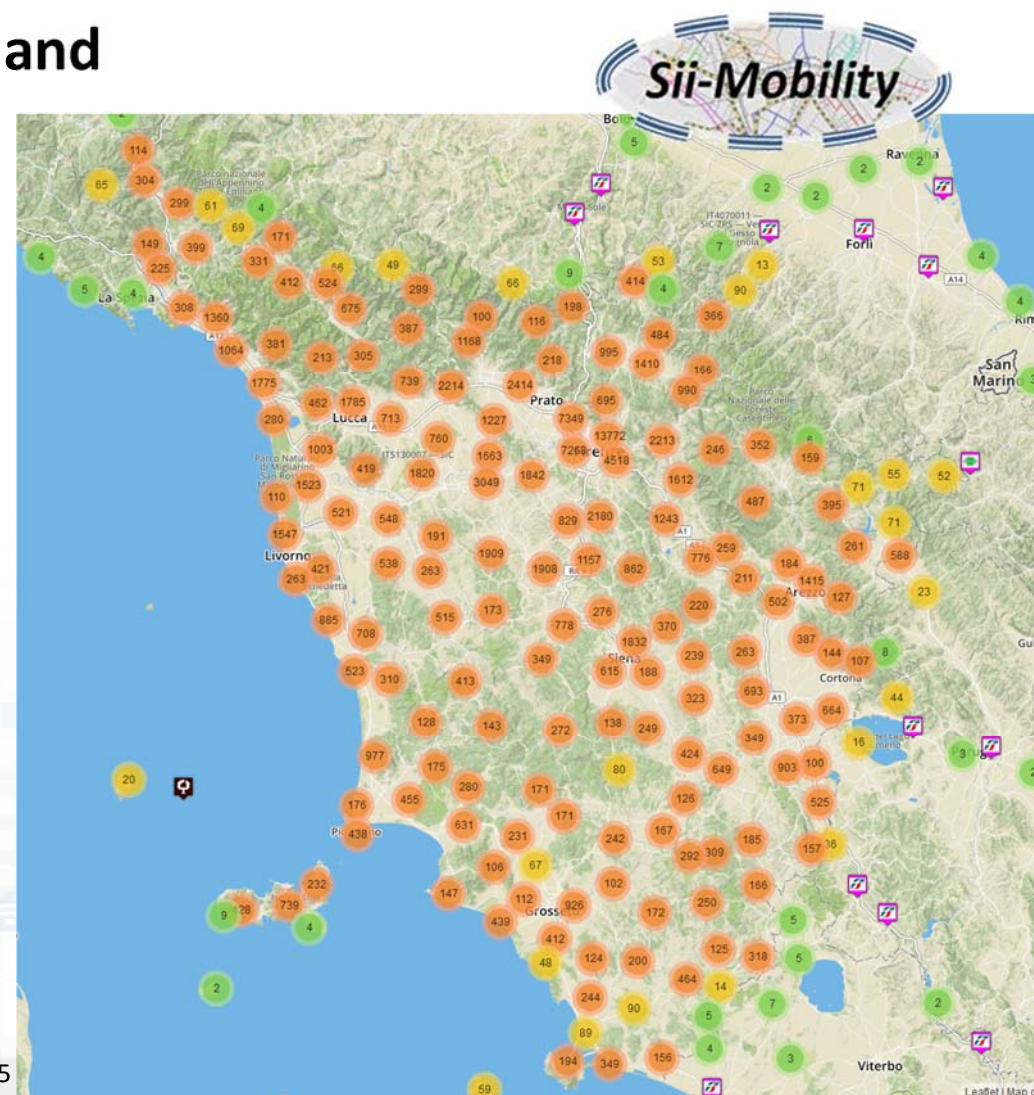


Scenarios vs SmartCity API

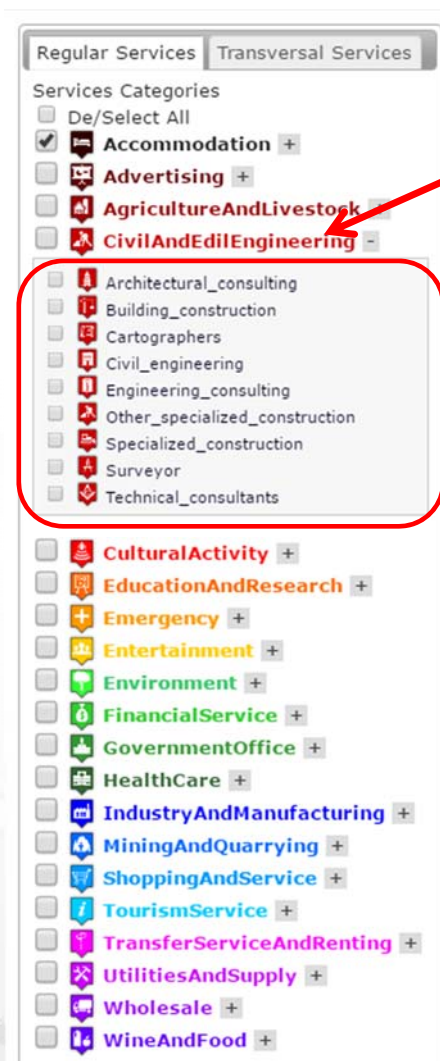
- Search data: by text, near, along, etc...
 - Resolving text to GPS and formal city nodes model
- Empowering the city users
- Access to event information
- Supporting City Users in using Public Mobility
- Supporting City Users in using Private Mobility
- New Experience to access at Cultural and Touristic info
- New way to access at health services
- Access at Environmental information
- Profiled Suggestions to City Users
- Personal Assistant
- Sharing knowledge among cities

Thematic Data Domain Tuscany

- **Street and geoinformation of the territory and details for routing, navigation, ...**
- **Mobility and Transport:** public and private, public transport, parking status, fuel stations prices, traffic sensors, etc.
- **Culture and Tourism:** POI, churches, museum, schools, university, theatres, events in Florence
- **Environmental:** pollution real time, weather forecast, etc.
- **Social Media:** twitter data
- **Health:** hospital, pharmacies, status of the first aid triage in major hospitals, ...
- **Alarms:** civil protection alerts, hot areas, ...

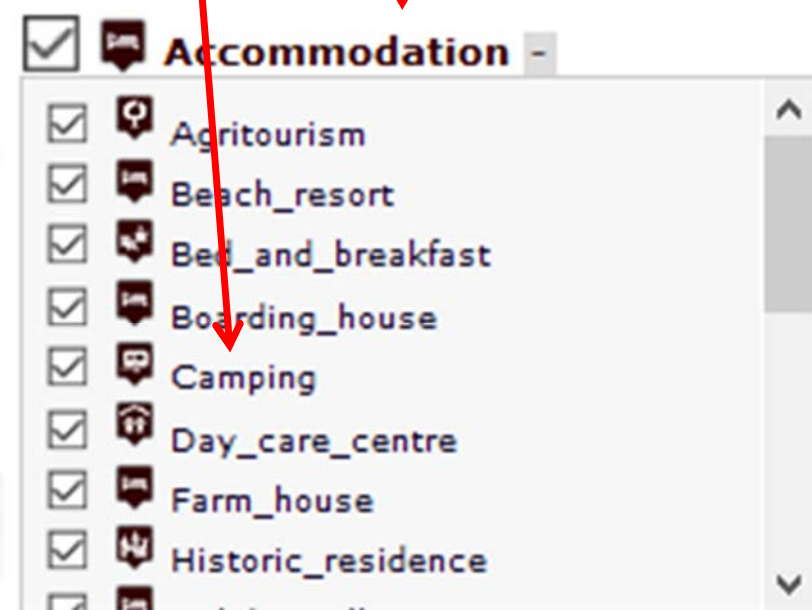


Concepts of Services: Macro and subcategory



20 Service Macro Classes

Service Class



Access to Point of Interest information, POI

- **POI:** point of interest
- **type:** macro and subcategories
- **Position:** GPS, address, telephone, fax, email, URL, ..
- **Description:** textual, multilingual, with images, ...
- **Link** to dbPedia, Linked Open Data
- **Links to other services**
- **Real time data if any:** sensors data, timeline, events, prices, opening time, rules of access, status of services, status of queue, etc..
- *See transversal services on ServiceMap*
 - Regular and in test platform



Service Information: different kind of services

AURORA

[LINKED OPEN GRAPH](#)

Tipology: Accommodation - Hotel

Email: info@hotelauroa.info

Website: www.hotelauroa.info

Phone: 055210283

Address: VIA L. ALAMANNI, 5

Cap: 50100

City: FIRENZE

Prov.: FI

TPL STOP : Piazza Stazione (Fr. Cc)

Vaibus

[LINKED OPEN GRAPH](#)

Lines:

FI-LU **FI-VG**

No available routes

Display **50** Bus per page

Search:

Time	Line	Direction
08:48:00 2017-03-20	FI-LU	Piazzale Verdi
08:16:00 2017-03-20	FI-LU	Piazzale Verdi
10:09:00 2017-03-20	FI-LU	Piazzale Verdi
2017-03-20	FI-LU	Piazzale Verdi
2017-03-20	FI-LU	Piazzale Verdi
2017-03-20	FI-LU	Piazzale Verdi

Page 1 of 1

Data currently not available

Loggia San Paolo

[LINKED OPEN GRAPH](#)

Tipology: CulturalActivity - Monument_location

Digital Location

Address: VIA DELLA SCALA, 3

Cap: 50123

City: FIRENZE

Prov.: FI

Photos:

Description: The rounded arches, the stone skeleton and the glazed terracotta medallions recall the model of the Loggiato degli Innocenti. The medallions in glazed terracotta by Andrea della Robbia and his sons Marco and Luca contain seven polychrome figures of Santi Francescani and two works of mercy Cristo conforta un Giovane and Cristo conforta un Anziano. Beneath the portico can be admired the expressive embrace between San Domenico Guzman and San Francesco d Assisi by Andrea della Robbia

Giardino di piazza dell Indipendenza

[LINKED OPEN GRAPH](#)

Tipology: Entertainment - Green_areas

Digital Location

Address: PIAZZA DELLA INDIPENDENZA, 15

Cap: 50129

City: FIRENZE

Prov.: FI

Note: areeverdi238

[Remove from map](#)

ZCS_1_D

[LINKED OPEN GRAPH](#)

Tipology: TransferServiceAndRenting - Controlled_parking_zone

Digital Location

Address: VIA GUSCIANA

Cap: 50124

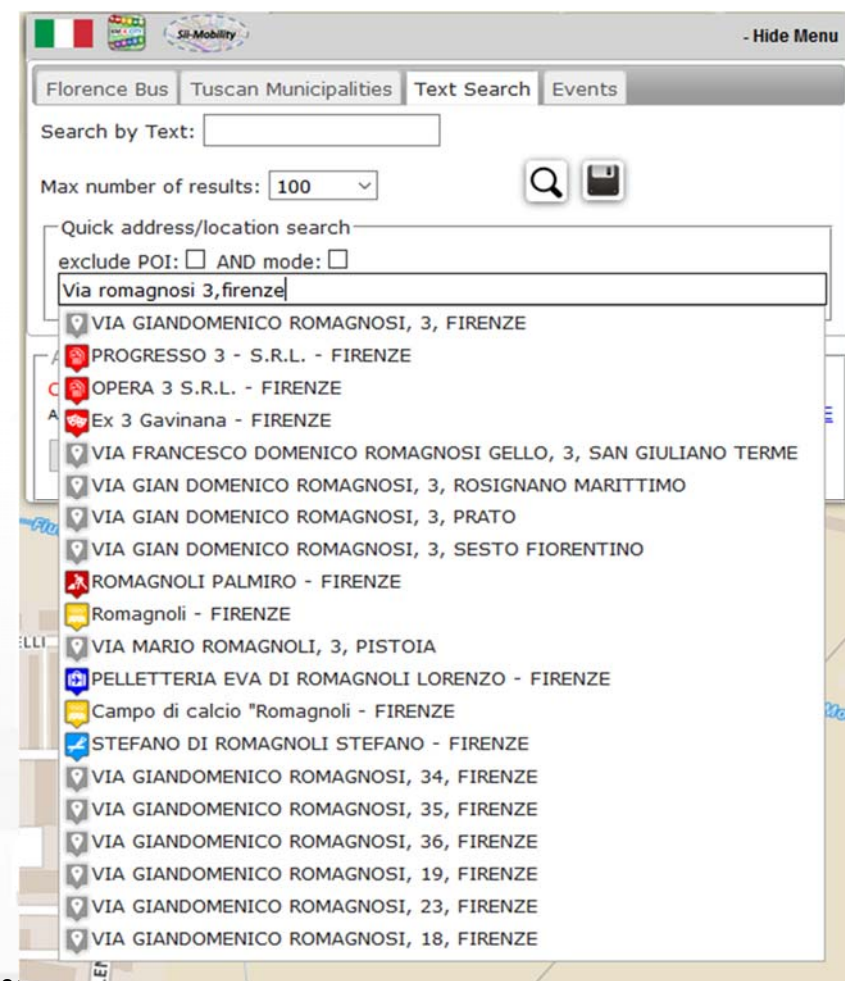
City: FIRENZE

Prov.: FI

[Remove from map](#)

General Text Search Features

- **Search by text for POIs via**
 - Full text: description, title, macro and category name
 - Filtering by macro-cat and subcategory
 - Filtering on distance and geometric shape
- **Search by text with assisted suggestion to get:**
 - Streets and civic numbers, or POI, locations





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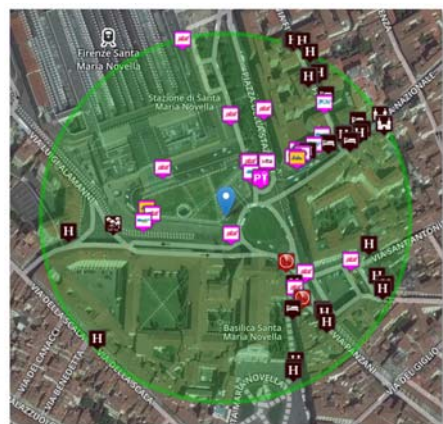
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Search by Shape and Distance

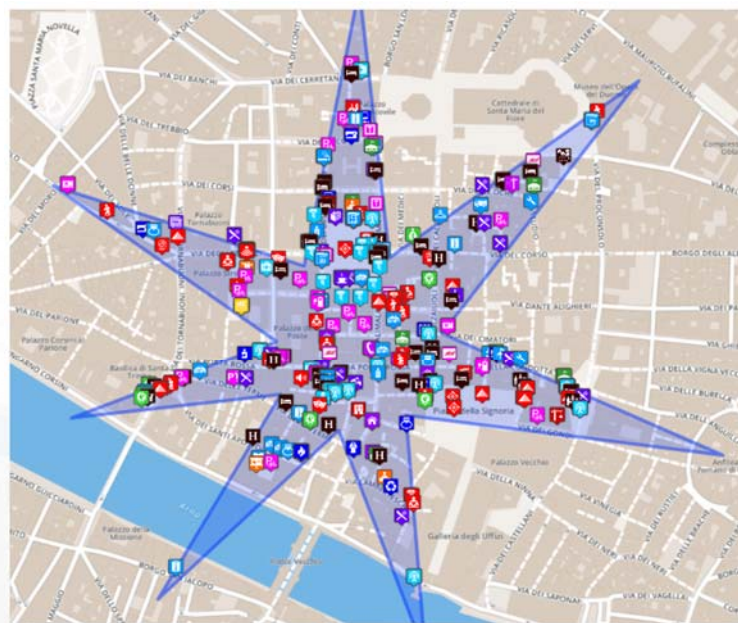


Around a point or POI

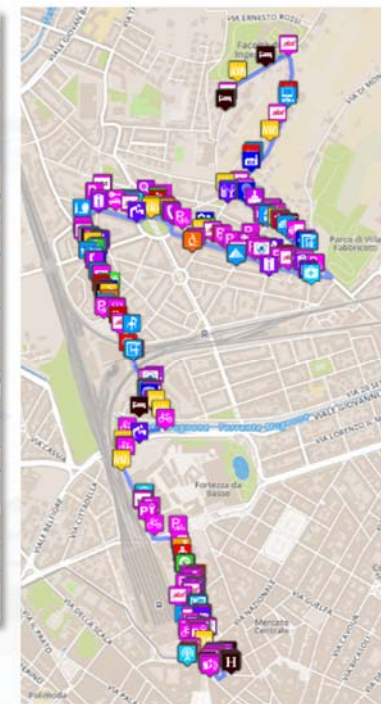


Each request or search in the Km4City model can be referred to a point and a ray, to an area, to a polyline

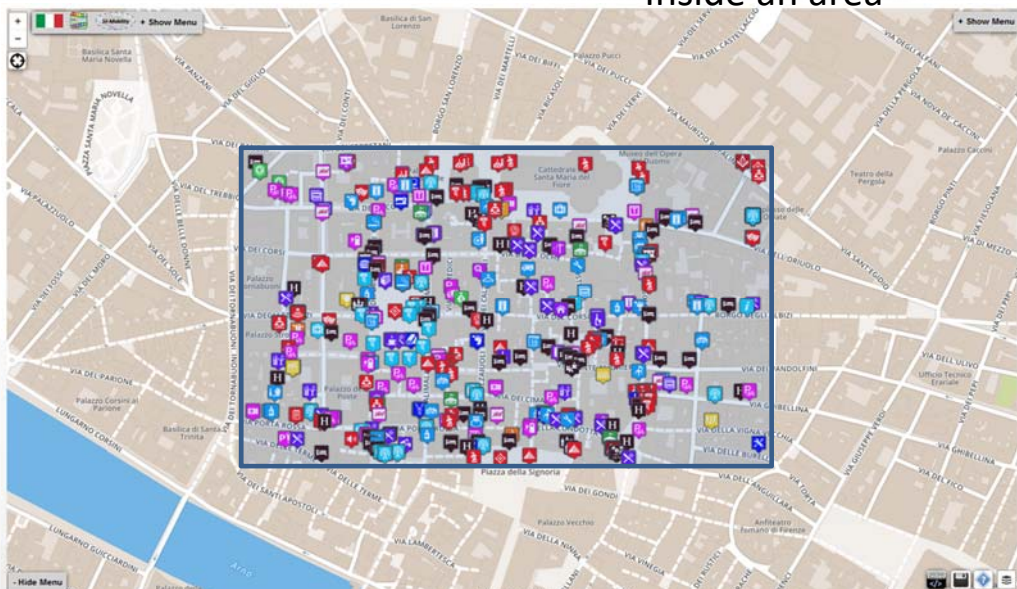
Inside a closed polyline



Along a polyline



Inside an area



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Main ServiceMap features

- **Search**: provides a set of different searches on MAP and LOG
- **Save & Get API Call**: saves the performed visual query to send via e-mail the Rest call to the developer
- **Save & Get QueryID API Call**: saves the performed visual queries and send via e-mail a Rest call with a simplified syntax referring to a QueryID and not reporting the complexity of the query.
- **Save & Get Embed Code**: saves the visual query of the user in visually recall smart city elements on the map, and gives the HTML Iframe code for embedding the view on a third party web page;

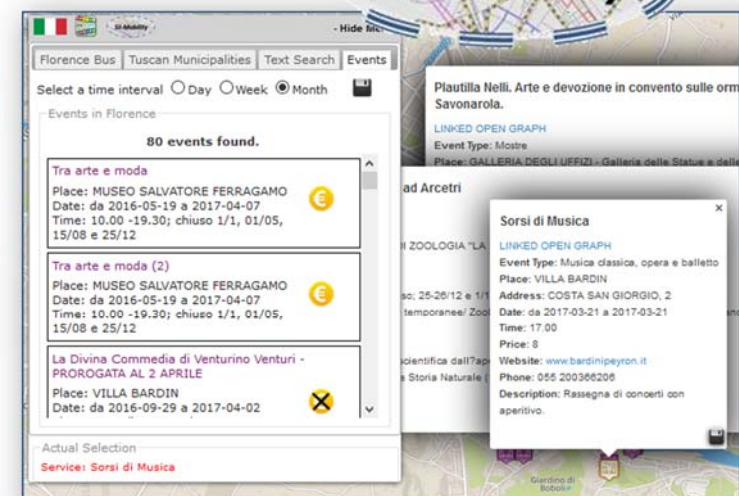
Empowering City Users

- Allow city users to
 - provide comments, images and scores associated with a certain Service (or place, via GPS)
 - Get list of last contributions of the same kind provided by other users
- They can be:
 - used as feedbacks
 - moderated by a back office personnel
 - ..
- In the future (→) connection with a more powerful server based on 311 standard would be possible



Access to Event information

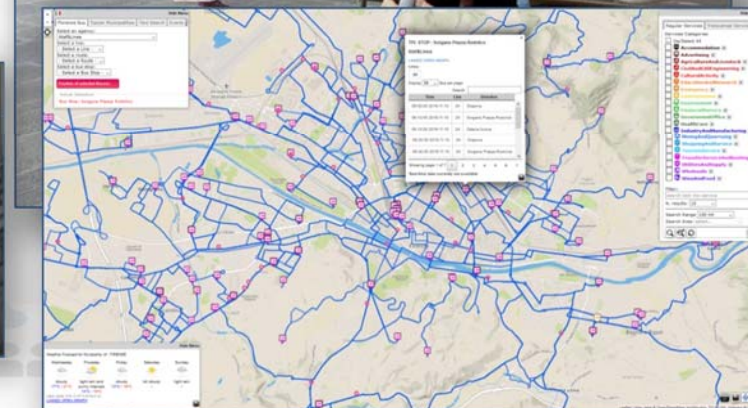
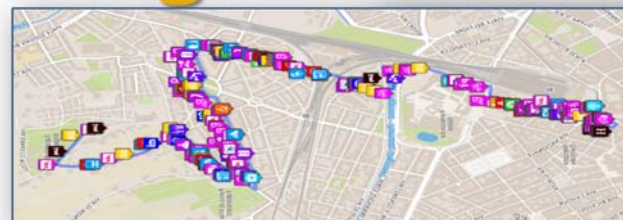
- Getting Traffic Events
- Getting Critical Events
- Getting Events in the city
 - Theater, museum, show, sport, etc.
 - Getting Event details
 - Event kind, and thus ordering
 - in the day, week, and month
 - Location, and thus ordering, or selecting events per area, per residence
 - General information
 - Opening and cost (if any)
 - Etc.



Supporting City Users in using Public Mobility

- **Public Transport, PT**

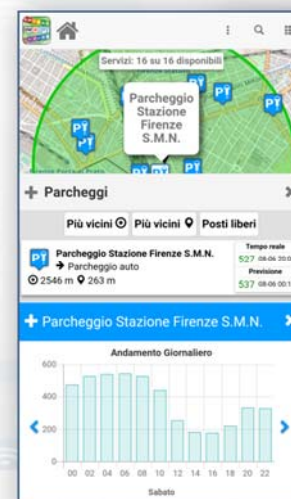
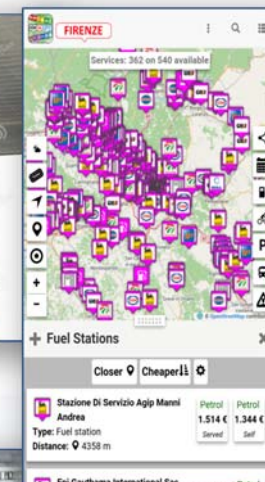
- Getting tickets
- Getting bus stops, lines, and timelines for bus, train and tramline (GTFS, ETL, ..)
- Searching Services along a Pub. Transport line or closer to a stop
- Searching the closest bus stops
- searching for BUS stops via name
- real time delays of busses
- modal routing for Pub. Transport



Supporting City Users using Private Mobility

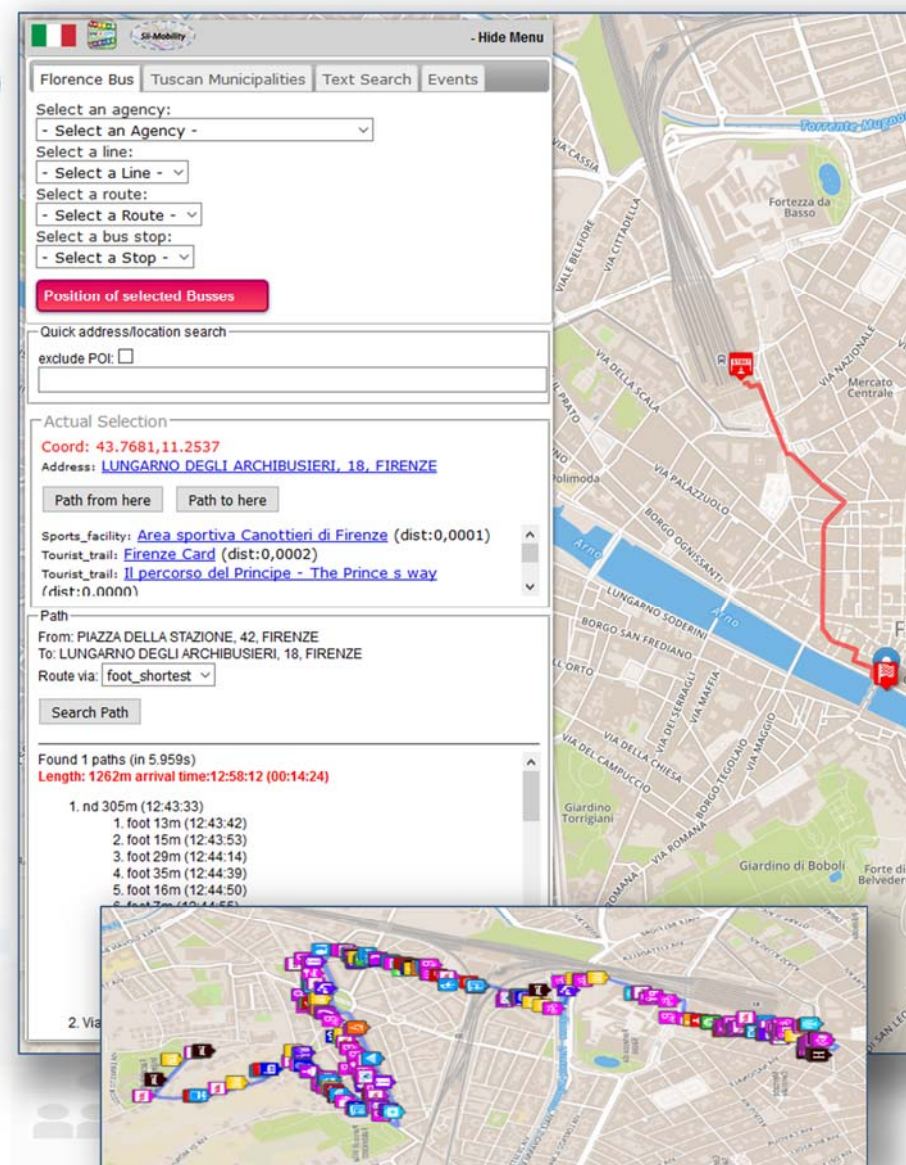
• Private Transport

- Getting closer parking
- **Getting parking forecast**
- Getting closer free space on parking
- Getting **fuel stations** location and fuel product prices
- Getting bike sharing rack status
- Searching Services along a **path** or closer to a point or Service as Hotel, Restaurants, square, etc.
- Getting closer **cycling paths**
- Recharging stations: location and status
- Getting traffic information



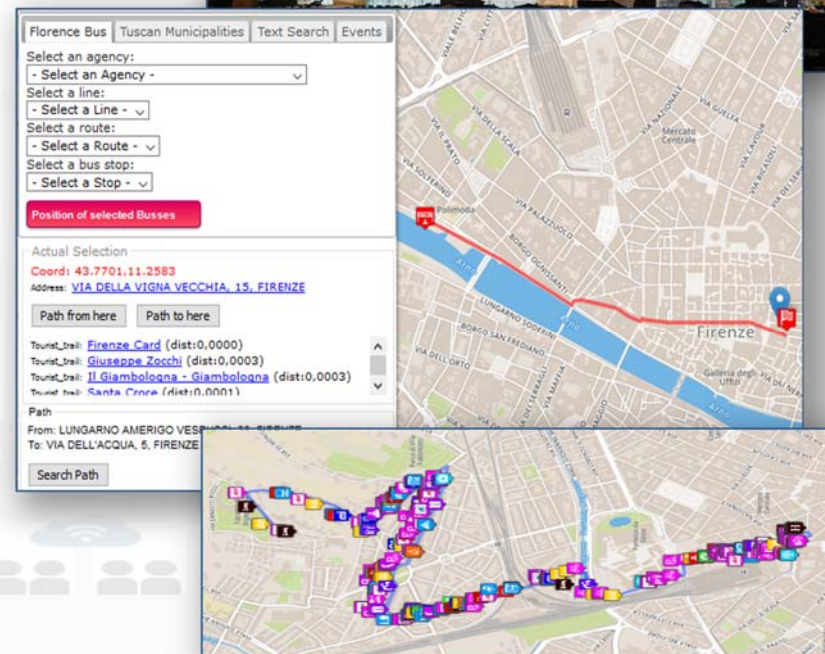
Private Mobility: routing and navigation paths

- To get the path from two points/POIs:
 - Shortest for pedestrian
 - Quietest for pedestrian
 - Shortest for private vehicles
- Search for POIs along the identified Path!
- <http://www.disit.org/ServiceMap>



New Experience to access at Cultural and Touristic info

- Getting location and description of Point of Interests, POIs: culture and tourism first
 - Location, images, phone, URL, etc.
 - Get image, video, audio, ...
- Search for POIs in areas and closer
- Get routing to reach location or POI by walking downtown
 - searching Services along the path
- Search for location, full text assisted
- Leave a score, take a picture, etc..



New way to access at health services

- Searching for pharmacies and hospitals
- Getting the closest hospital first aid locations and status
- Getting real time updated information about the first aid status of major hospitals (triage)



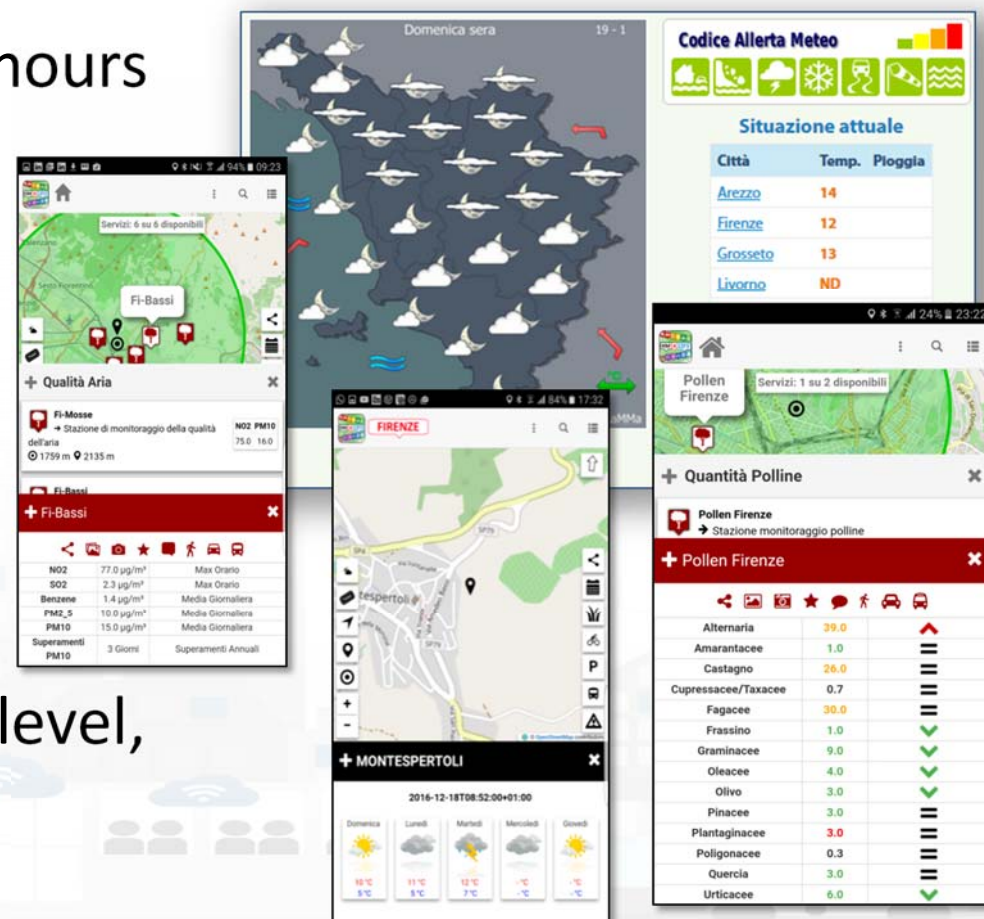
I CODICI DEL PRONTO SOCCORSO	
CODICE ROSSO EMERGENZA accesso immediato	Casi con pericolo di vita Il trattamento di questi pazienti avviene immediatamente in via prioritaria
CODICE GIALLO URGENZA accesso rapido	Casi con lesioni gravi ed eventuale alterazione di una o più funzioni vitali L'assistenza viene assicurata nel minor tempo possibile
CODICE VERDE URGENZA differibile	Casi in condizioni critiche, ma non in pericolo di vita L'assistenza viene assicurata dopo i casi più urgenti
CODICE AZZURRO NON URGENZA	Casi in condizioni non gravi La prestazione sanitaria è differibile
CODICE BIANCO	Casi con problematiche risolubili dal medico curante, dalla guardia medica o da ambulatori specialistici Tempi di attesa molto lunghi

Stato Priorità	1*	2*	3*	4*	5*
Con Destinazione	0	1	0	0	0
In Attesa	0	1	1	0	0
In Visita	3	10	11	2	0
Oss. Temporanea	2	11	10	1	0
Totali	5	23	22	3	0

20-03-2017 00:37

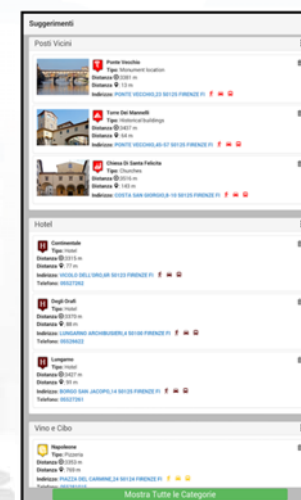
Access at Environmental information

- Getting weather forecast for the next hours and days
- Getting alert information from Civil protection
- Getting air quality status
- Getting pollination status
- getting actual weather status: temperature, humidity, pressure, rain level,
- etc.



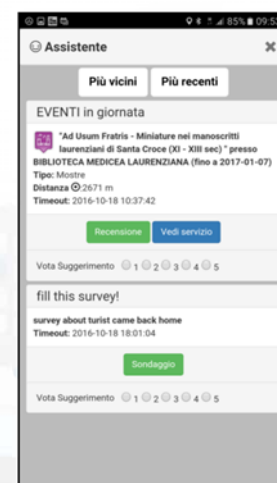
Profiled Suggestions to City Users

- Personalized suggestions
 - The server provide suggestions in the user context (location and time) arranged in a number of categories
 - Culture, mobility, food and drink, etc.
 - Alerts: civil protection, city council, twitter data, etc.
 - The city user may reject some of them, thus the suggestion engine learns about preferred topics and category



Profiled Engagements to City Users

- The user are profiled to learn habits:
 - Personal POI and paths
 - Mobility habits
- Information and engagements sent to the city users are programmed according to the user evolution to:
 - Stimulate virtuous habits
 - More sustainable habits
 - More healthy habits, etc.
 - Get feedbacks
 - Provide bonus and prices,
 - Send alerts,





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To appear, the Virtual Assistant PAVAL



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DISIT - Km4City Semantic Service Search



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A quale servizio sei
interessato...?

Select Language: ITA ▾

Cosa vuoi fare? Dove?

Specificare Coordinate Utente
(opzionale):

Latitudine:

Longitudine:

Il servizio permette la ricerca tramite query in linguaggio naturale di servizi di interesse per l'utente nella provincia di Firenze, restituendo le aziende legate al tipo di servizio cercato attraverso interrogazione del repository semantico di Km4City, piattaforma Smart City ideata, progettata e realizzata da DISIT Lab dell'Università di Firenze. Se l'utente accetta di inviare le coordinate relative alla sua posizione attuale, il sistema restituisce i risultati dei servizi considerati attinenti alla ricerca effettuata ordinati in base alla vicinanza con la posizione dell'utente stesso. In alternativa, e' possibile per l'utente specificare una coppia di coordinate negli appositi box; in questo caso, le coordinate inserite verranno prese come riferimento di posizione al posto delle coordinate di posizione rilevate. Se inoltre l'utente inserisce nella query di ricerca il riferimento geografico ad un luogo di interesse (via, comune, quartiere), i risultati restituiti saranno ordinati per vicinanza con tale destinazione e non piu' in base al riferimento posizionale dell'utente.

Esempi di domande:

Esempio 1: "Vorrei vedere un museo in centro"

Esempio 2: "Sono in Via di Novoli e voglio fare la manicure"

Esempio 3: "Mi fanno male i denti"

Esempio 4: "Voglio tagliarmi i capelli a Firenze"

<http://paval.disit.org/Paval/>



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Sharing with other Cities

- Collaboration can be performed in terms of data, tools, Application, Apps, Dashboard, process, etc.
- **Machine to Machine connections** via
 - Sharing and gathering data via DataGate API, CKAN API
 - Reusing IOT from other cities via DataMapper
 - Sharing Dashboard models
 - Sharing Notifications, alerts...
 - **Exchanging knowledge with KB interconnection Smart InterCity API with Public/Private datasets/graphs**
 - See Tuscany \leftrightarrow Sardegna

Monitoring Traffic Flow and Parking

<http://www.km4city.org/?controlRoom>



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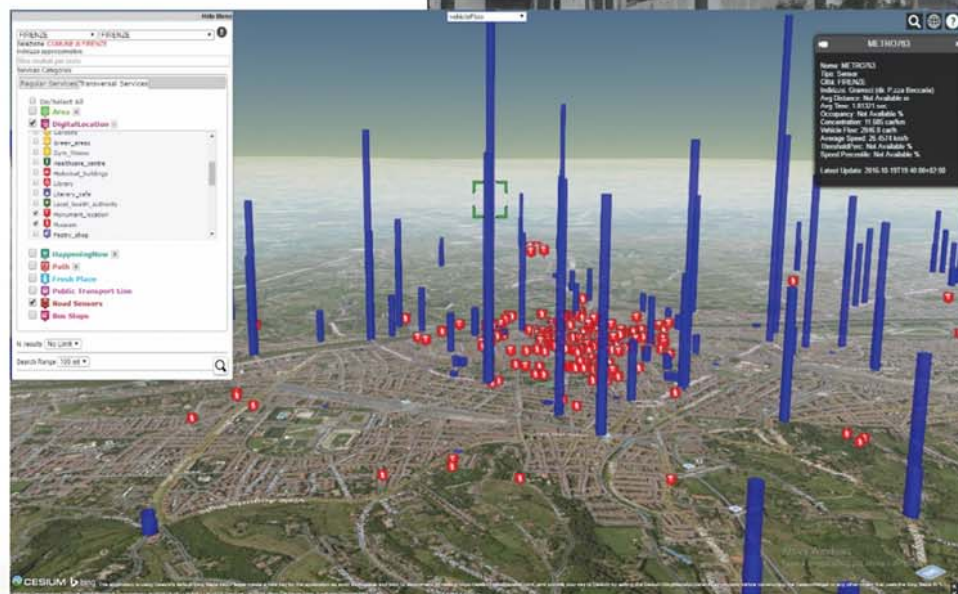
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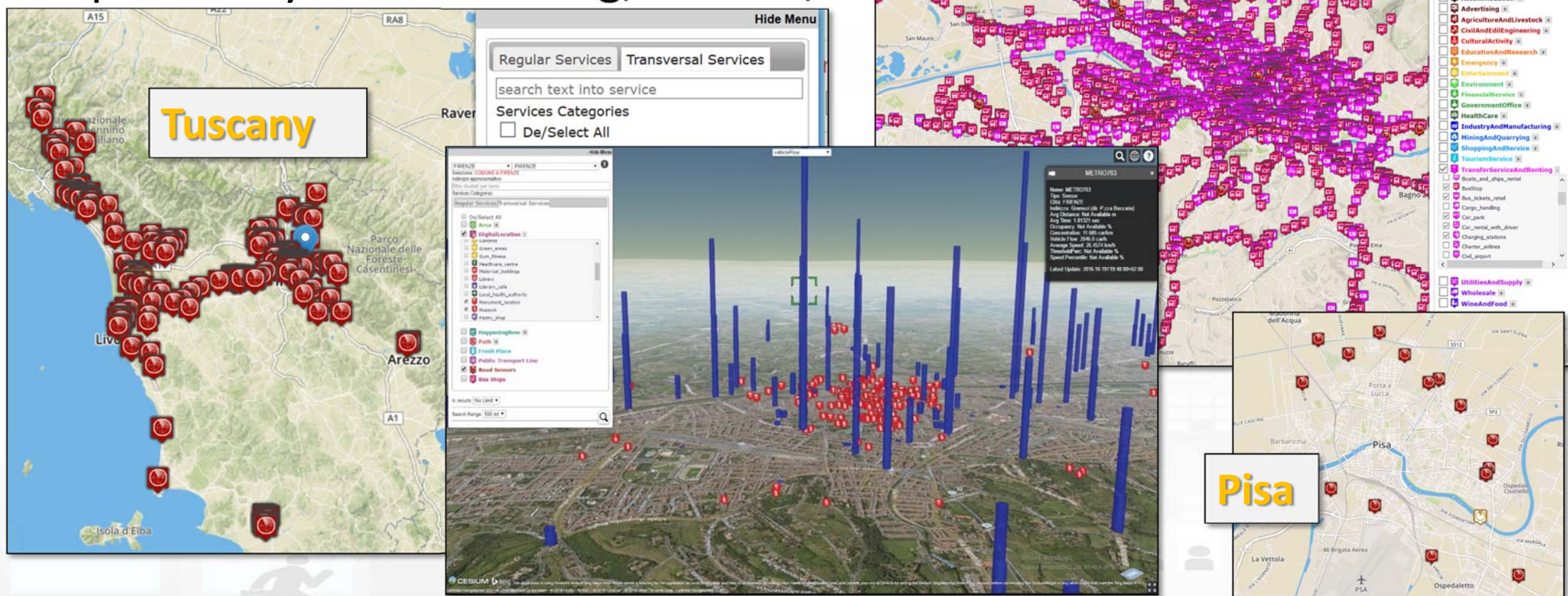
<http://www.disit.org>

Traffic Flows



Traffic Flow Tools

- Spire and Virtual Spires (cameras), Bluetooth, ..
- Specifically located: along, around, ..





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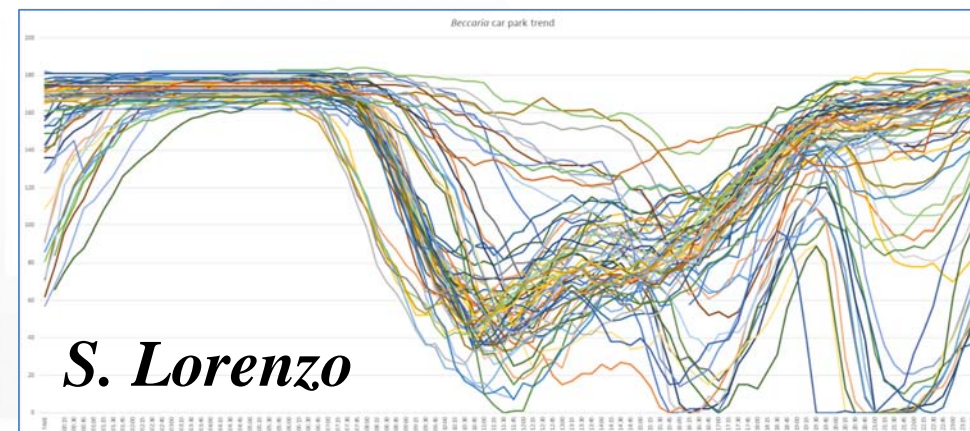
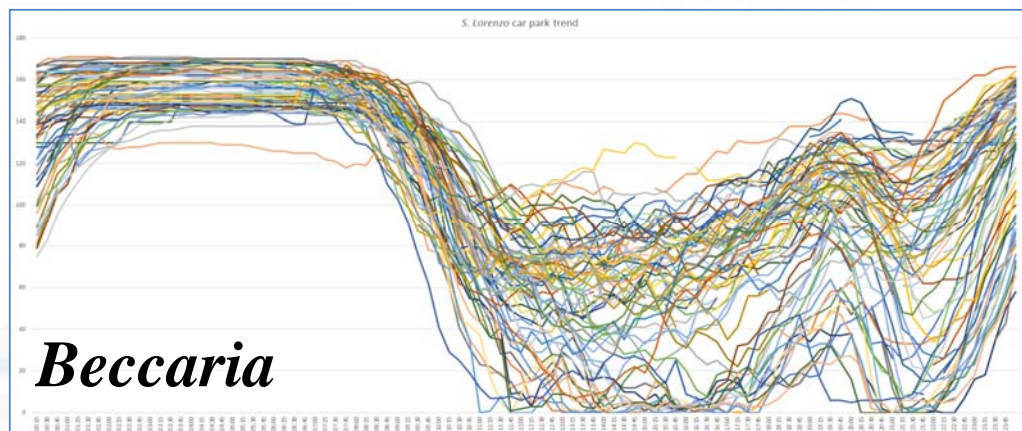
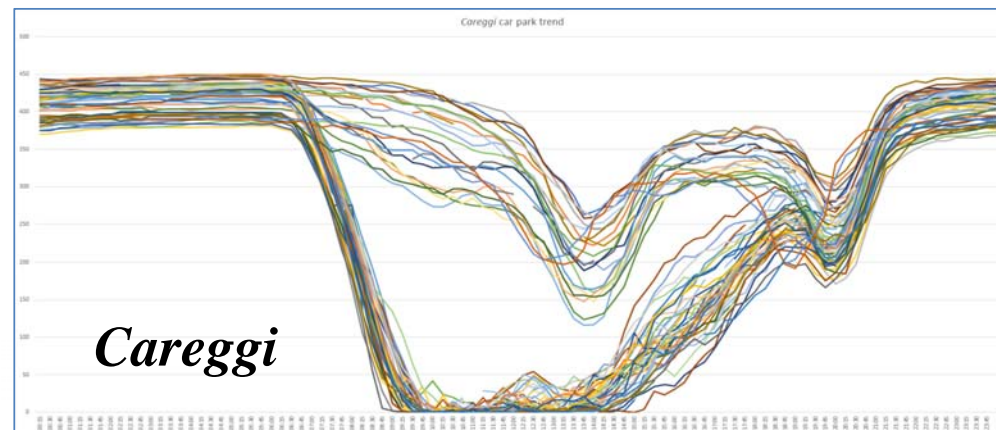
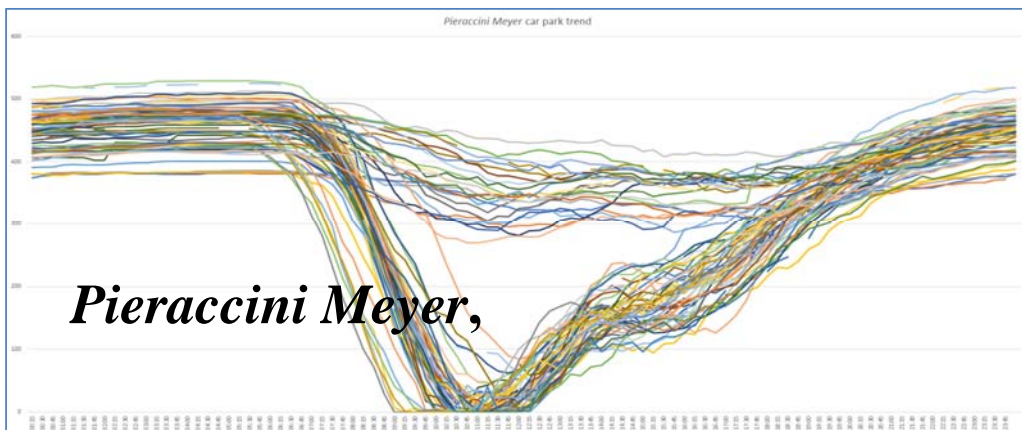
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Free Parking space trends



12 parking areas in Florence

DISIT lab, 15 August 2017

Free Parking PREDICTIONS



Careggi car park

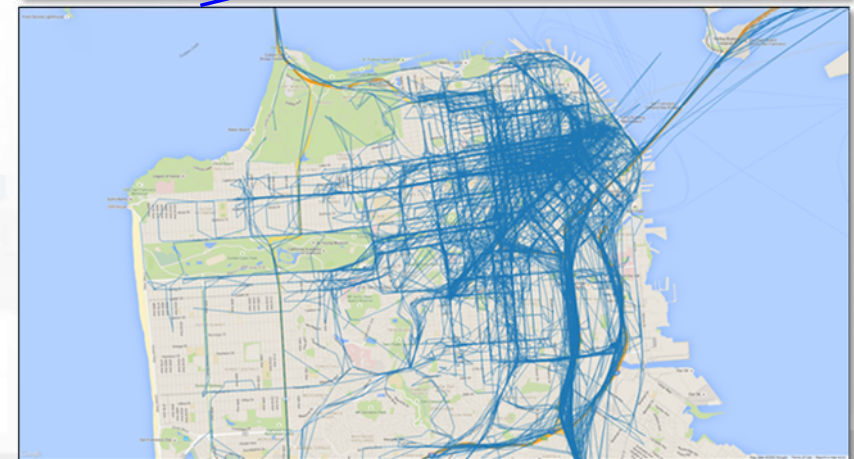
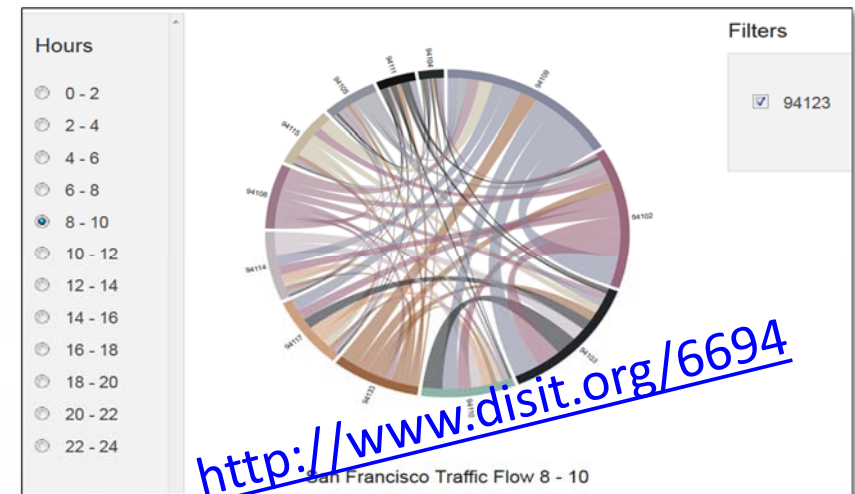
Model features	BRNN model results		
	R-squared	RMSE	MASE
Baseline	0.974	24	1.87
Baseline + Weather	0.975	24	1.75
Baseline + Traffic sensors	0.975	24	2.04
Baseline + Weather + Traffic sensors	0.975	24	1.87

- Active on Apps
 - «Firenze dove cosa»
 - «Toscana dove cosa»



Traffic and People Flow Assessment

- **Origin Destination Matrix**
 - Specific Sensors, vehicle Kits, mobile App, Wi-Fi Access Points, etc.
- **Assess people and traffic flows to**
 - improve services
 - predict critical conditions on Crit. Infra.
 - take real time decisions and sending messages in push to population
 - Increase city resilience
 - optimize traffic flow
 - take decision of routing



Monitoring City users Via Wi-Fi

<http://www.km4city.org/?controlRoom>

<http://www.km4city.org/?devTools>

<http://www.km4city.org/?infoDocs>

<http://www.km4city.org/?app>



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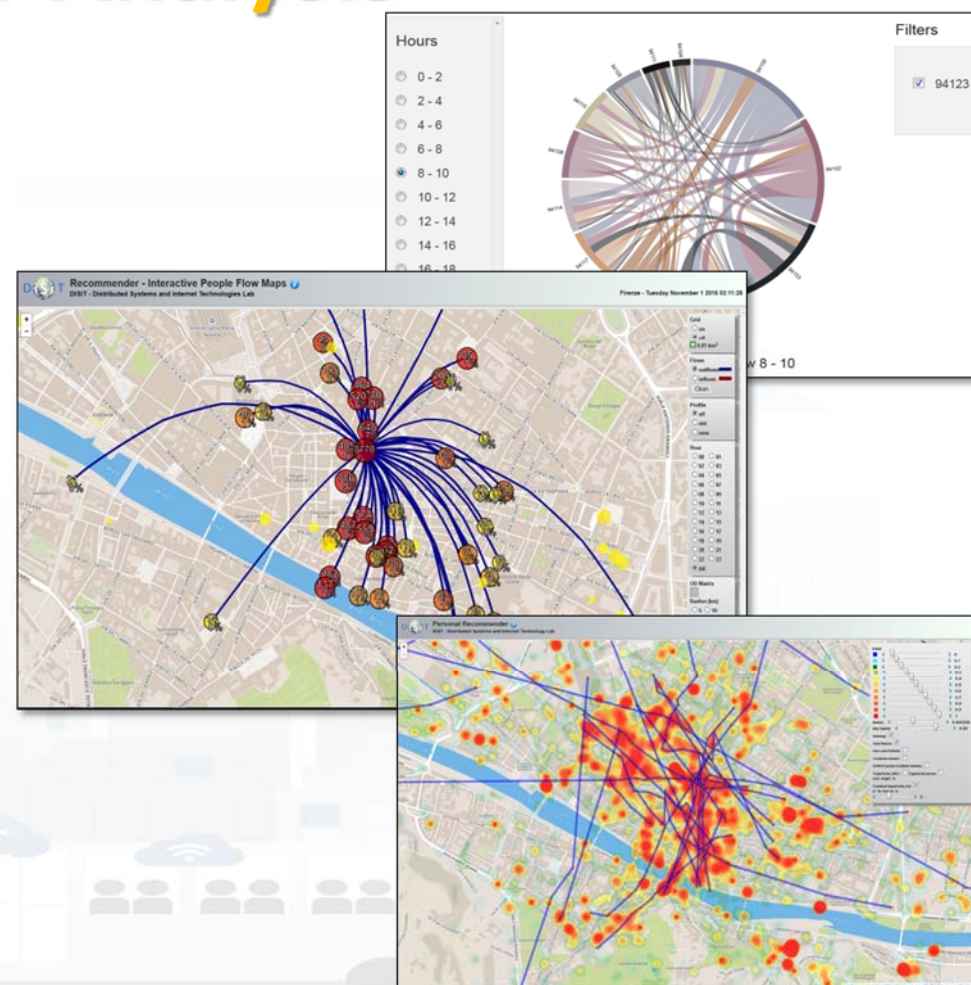
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DISIT lab, 15 August 2017

User Behaviour Analysis

- **Monitoring movements by traffic flow sensors**
 - Spires and virtual spires
- **Monitoring movements from Mobile Cells**
 - Unsuitable for precise tracking and OD production
- **Monitoring movements from Wi-Fi**
- **Monitoring movements** and much more from mobile Apps



Predicting Models for Admin. & City Users

- **Aiming at improving**
 - quality of service, distributing workload
 - early warning
- **Predictions: Short (15 min, 30 Min) and mid Term (1 week)**
- **Data Analytics: ML, NLP/SA, Clust...**
 - Traffic Flows → multiflow reconstruction
 - Parking Status → free slots
 - People Flows (WiFi, Twitter) → crowd , #number of people

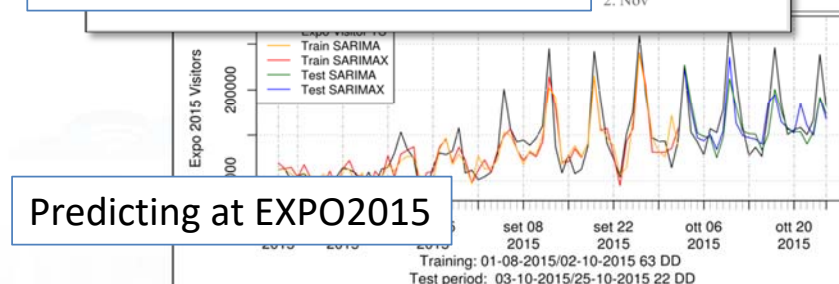
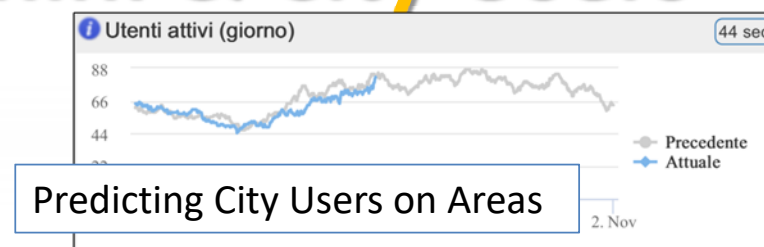


Figure 5: Comparison of Tables 2 and 3





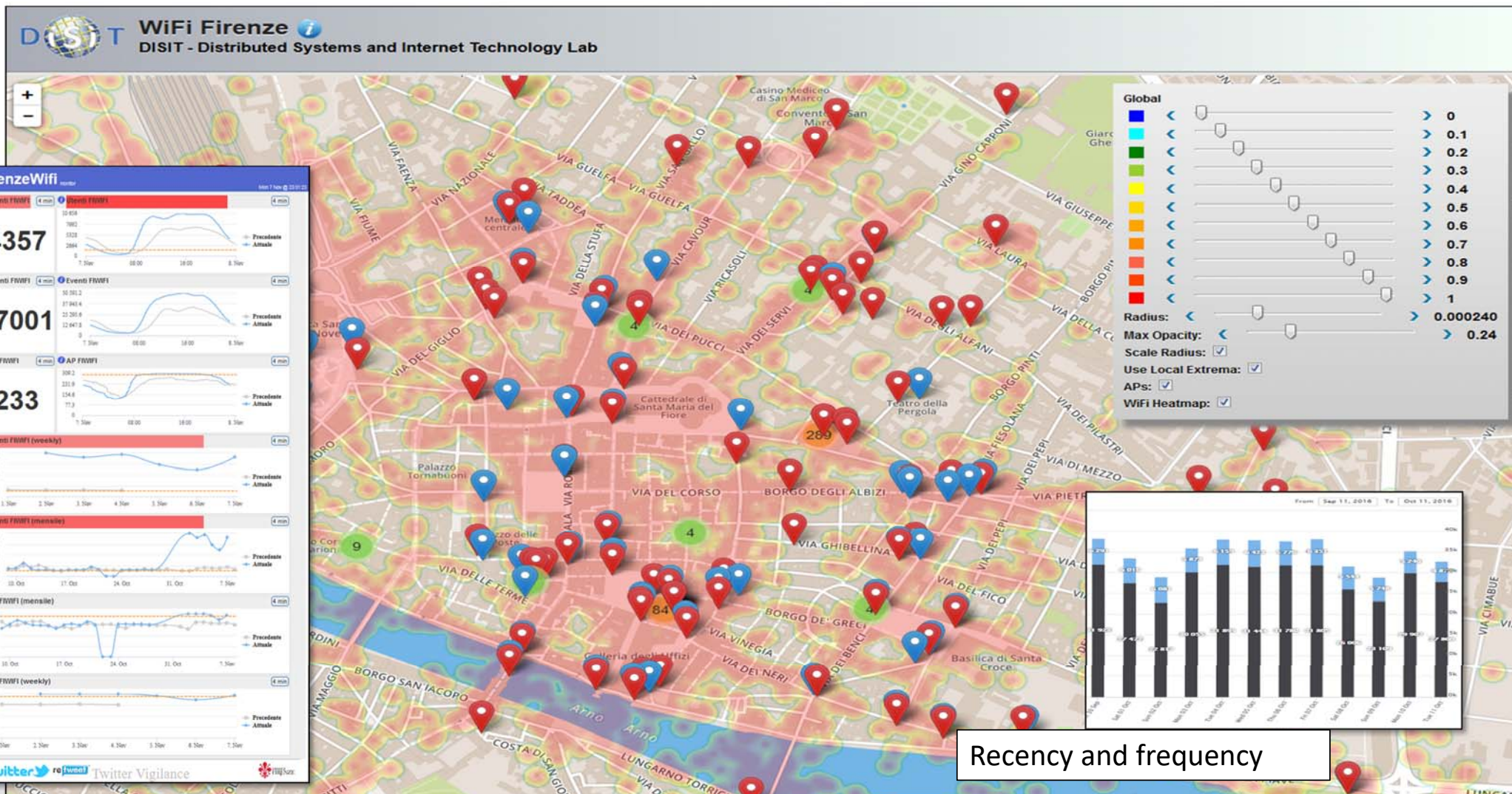
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WiFi Monitor tool

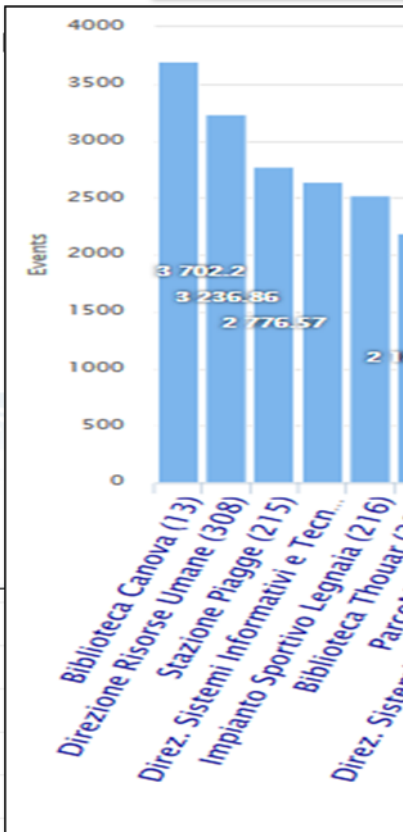
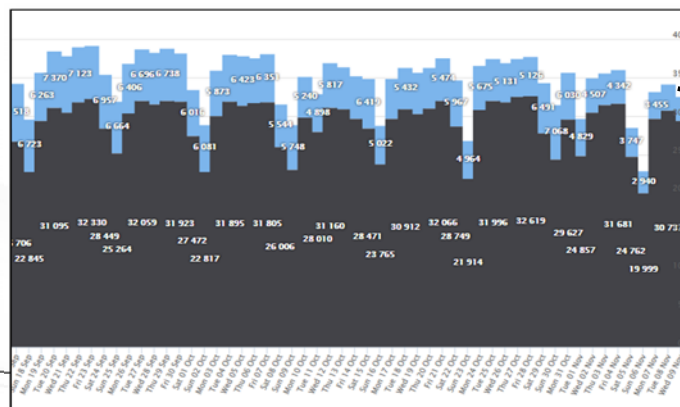
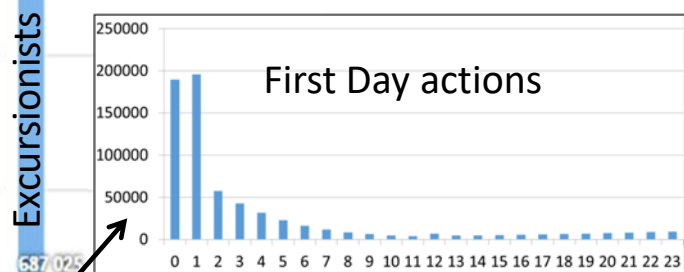


User Behavior Analysis

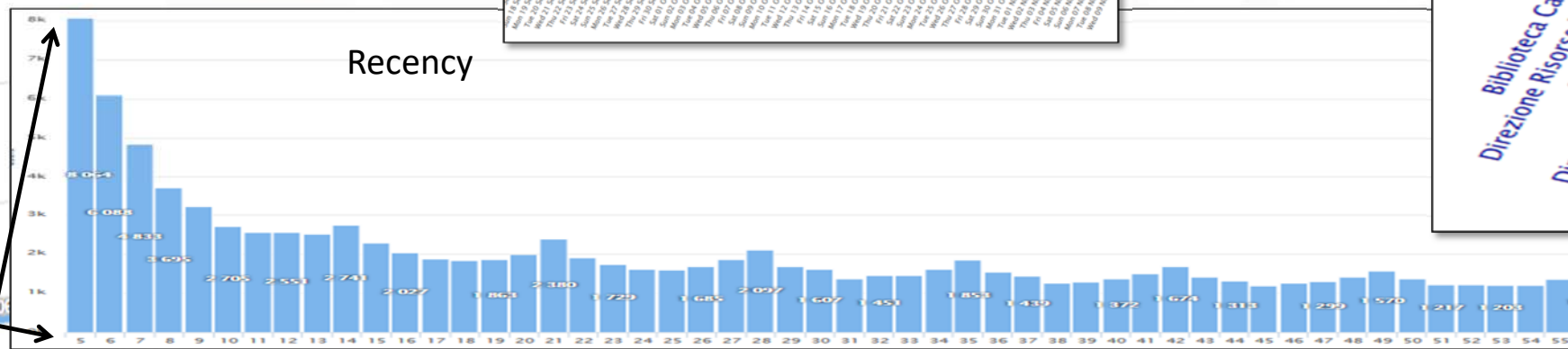


Distinct APs: 343
Distinct APs (last 24 hours): 311
Distinct Users (last 180 days): 1102098
Distinct Excursionists (last 180 days, < 24 h): 687025

When



Recency





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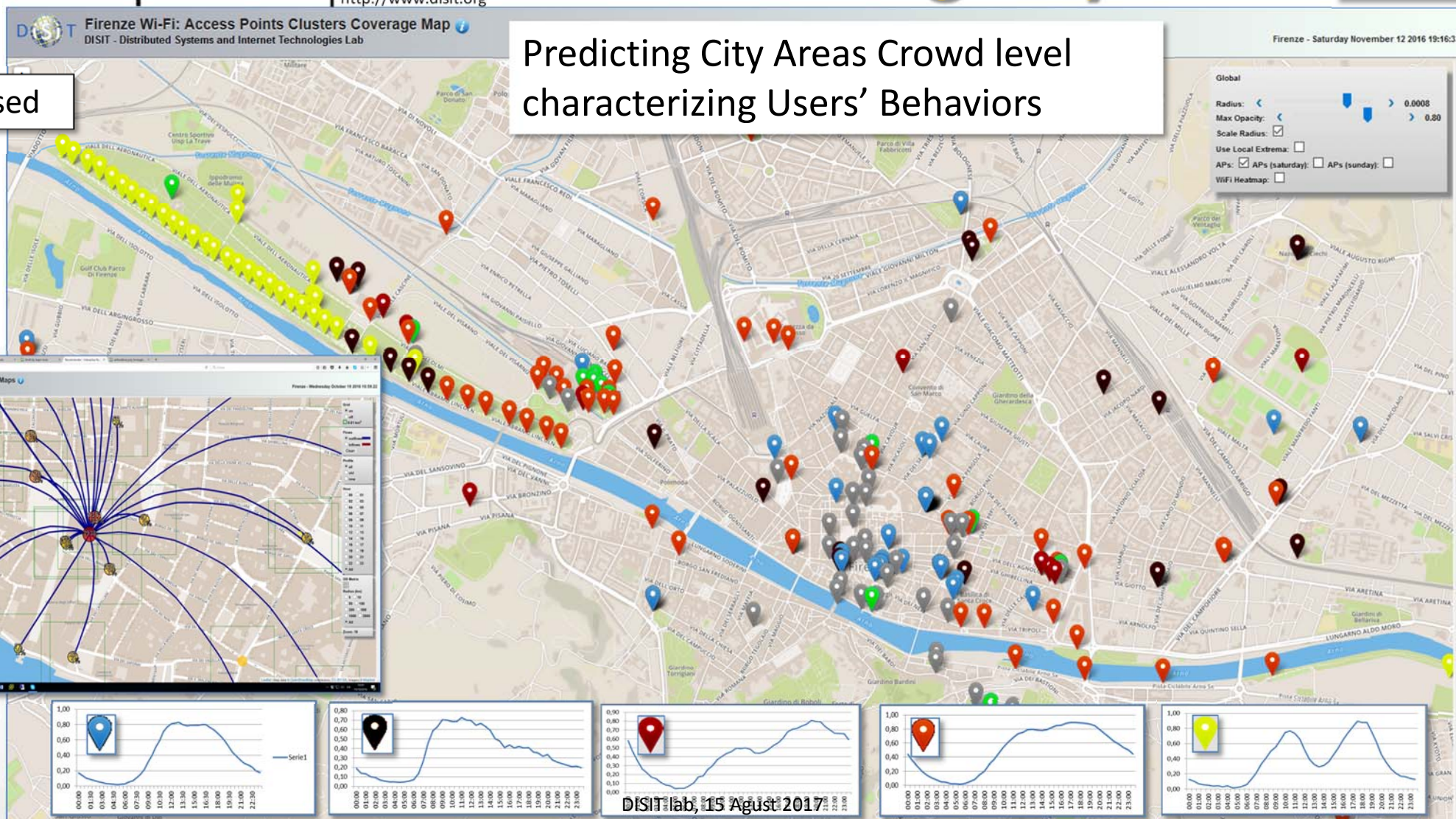
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Characterizing City Areas



Wi-Fi based

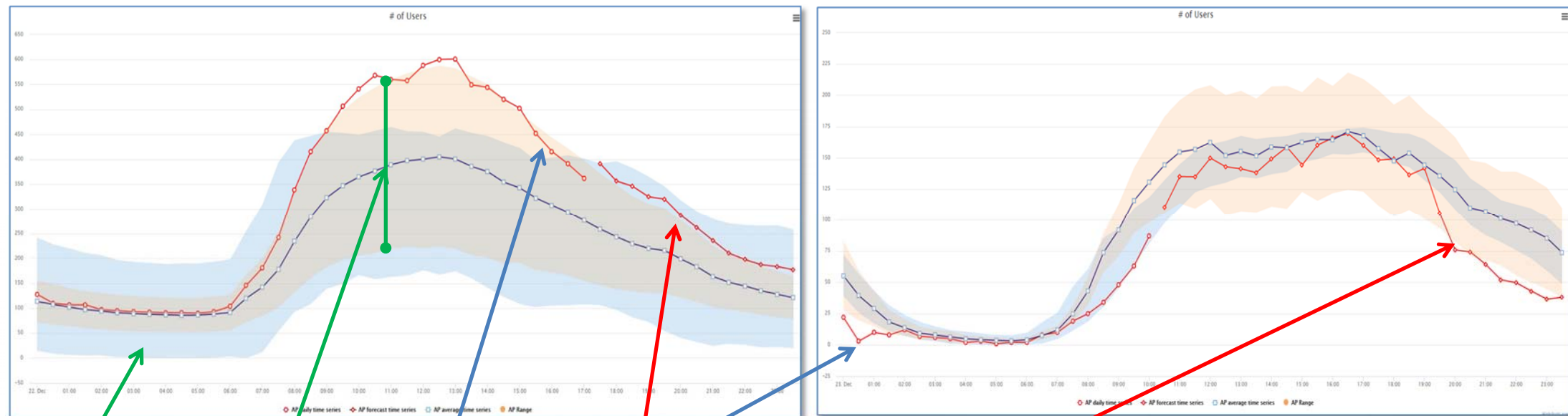
Predicting City Areas Crowd level
characterizing Users' Behaviors



Prediction and identification of anomalies



Guessing number of users of Wi-Fi Access Points



Cluster confidence

AP average and confidence

Actual AP trend for today

AP prediction for the next time slot in the day on the basis of past weeks

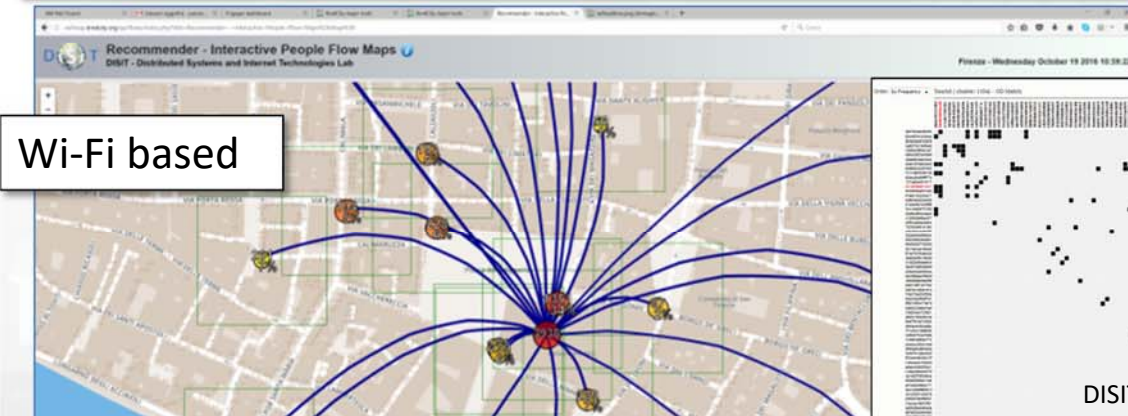
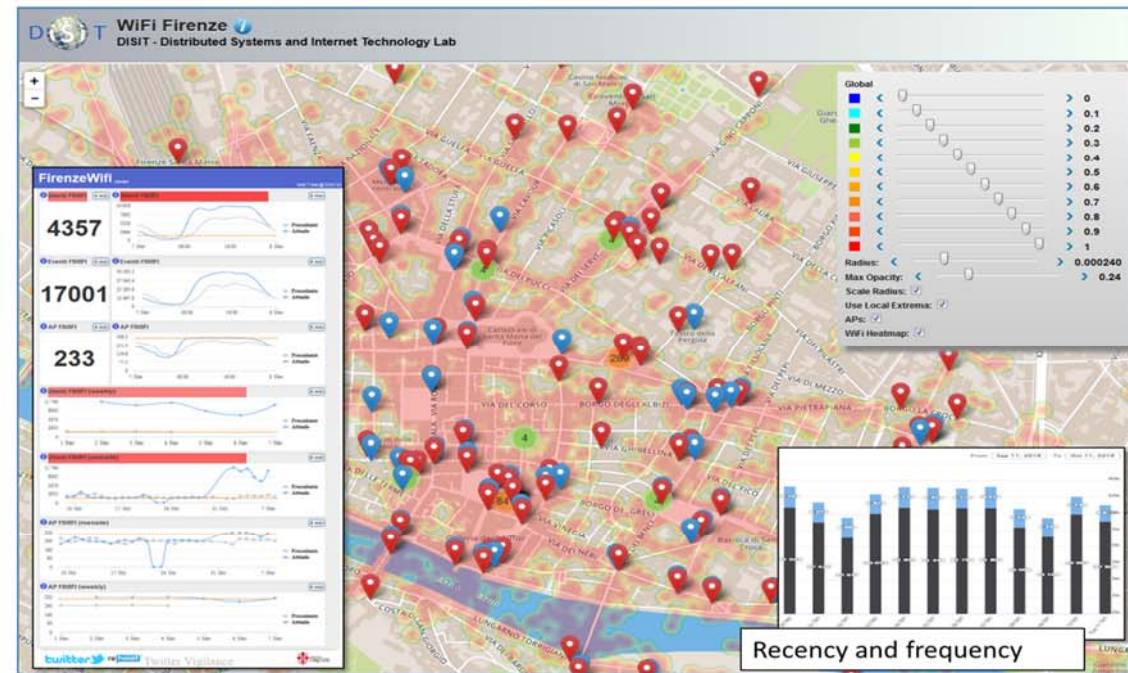


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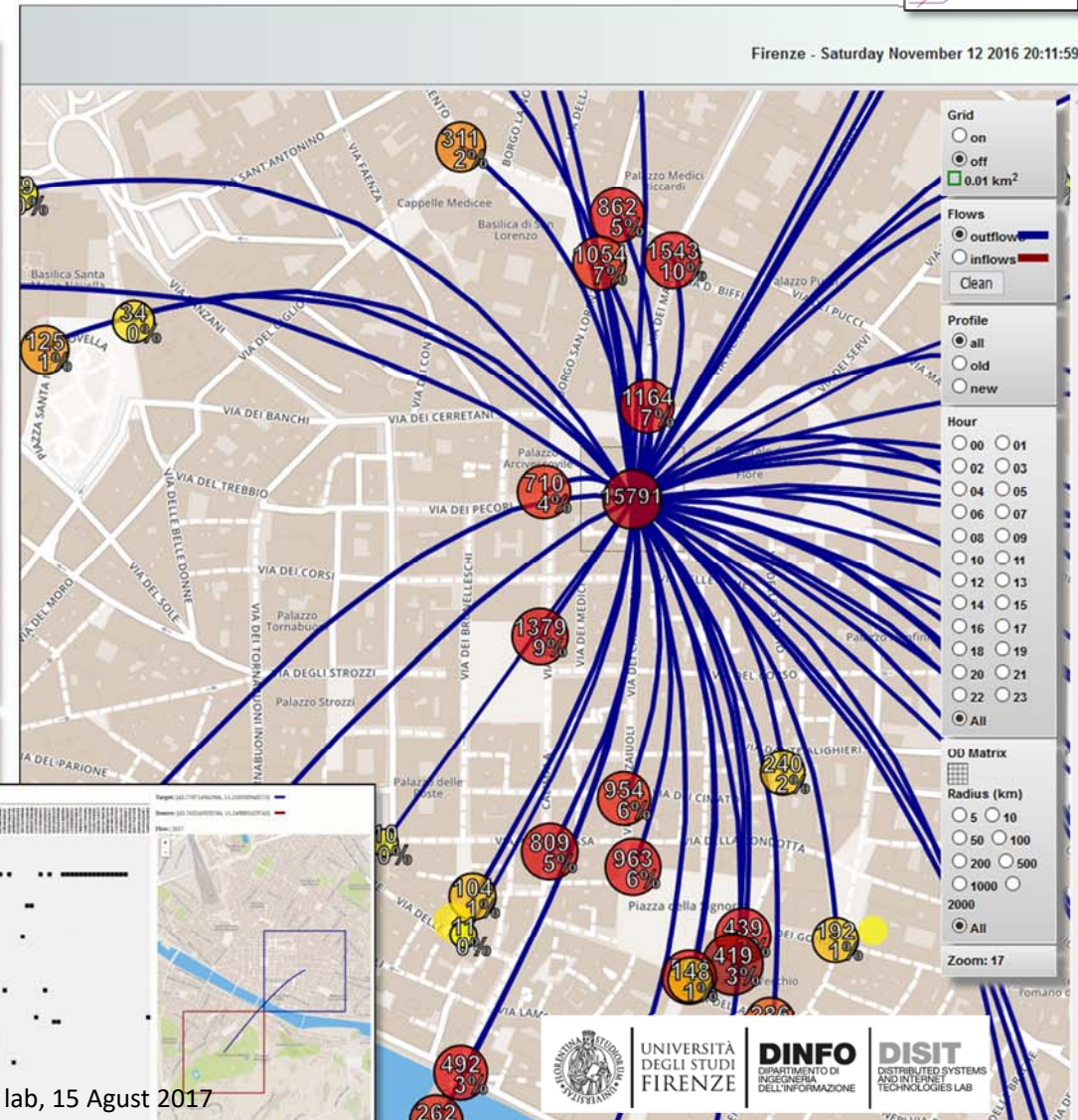
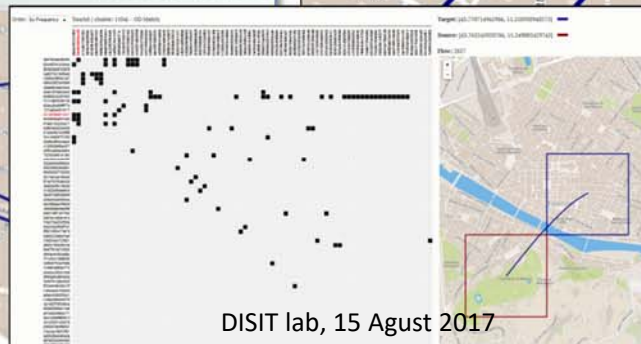
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Origin Destination Matrix Estimation



Wi-Fi based



Engaging Users via Mobile App

<http://www.km4city.org/?controlRoom>

<http://www.km4city.org/?devTools>

<http://www.km4city.org/?infoDocs>

<http://www.km4city.org/?app>





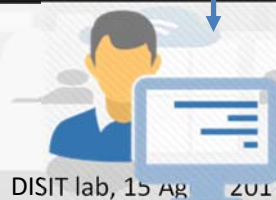
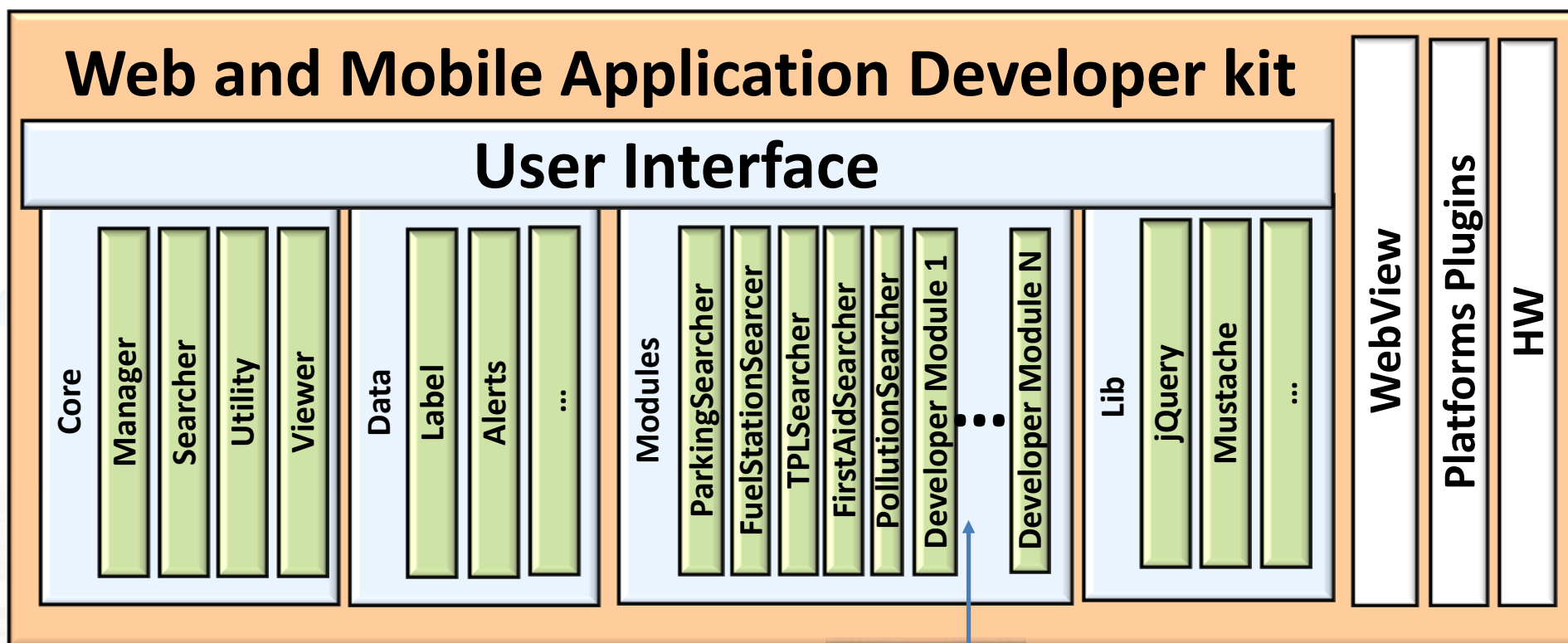
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Web and Mobile App. Development Kit



Developers



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ADK features



- **Exploiting Km4City Smart City API**
 - Open Source
 - Multiplatform: exploiting Apache Cordova Framework
 - Active since 2015
 - Adopted by a community of several Projects, Cities and SME.
- **Respecting user privacy:**
 - Anonymous usage vs Authenticated usage (OAuth, email, ..)
- **Modular & Dynamic:**
 - loading new modules from the WEB, and/or creating App by modular approach
- **Personalization and Profiling:**
 - personalized menu, proposed POI for search,
- **Reaching City Users:**
 - alerting and notifications by location, by user behaviour



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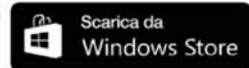
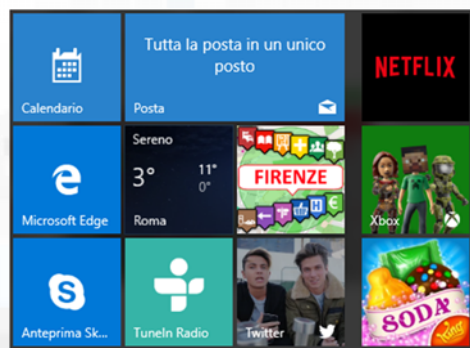
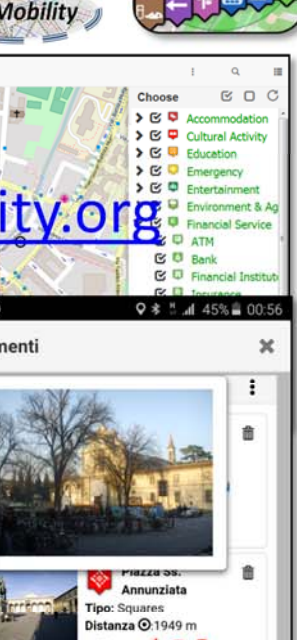
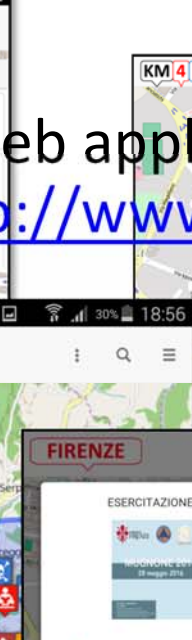
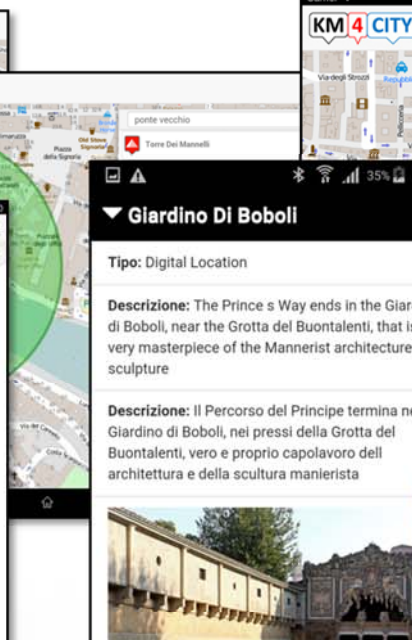
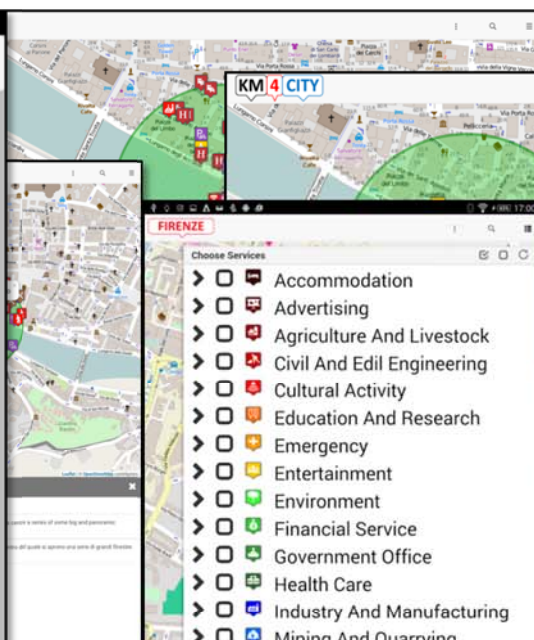
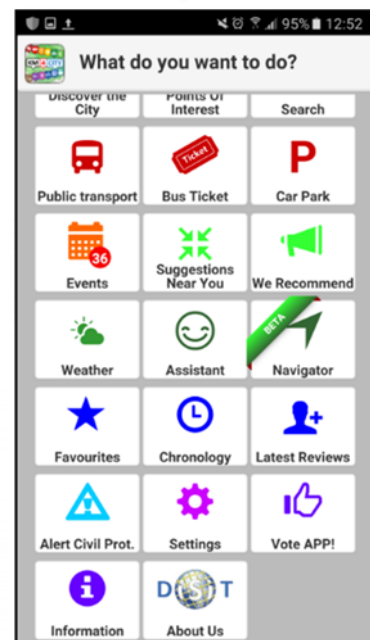
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Km4CityMobile App



web application

<http://www.km4city.org>

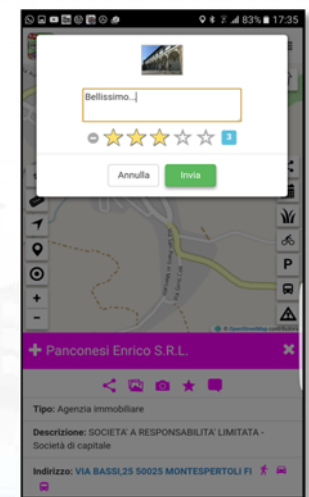
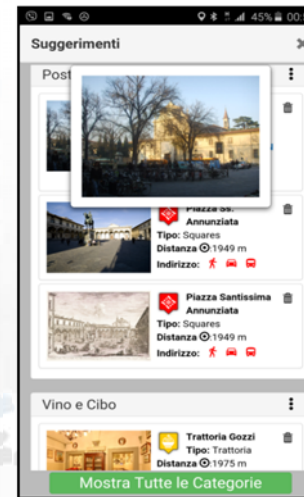
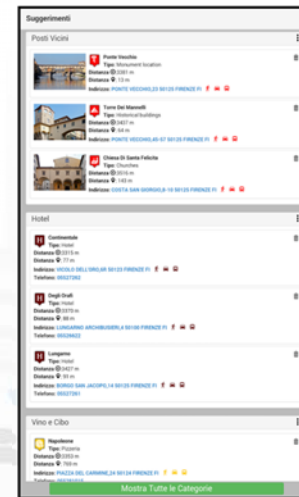
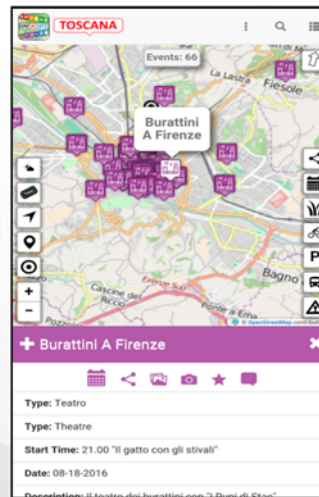
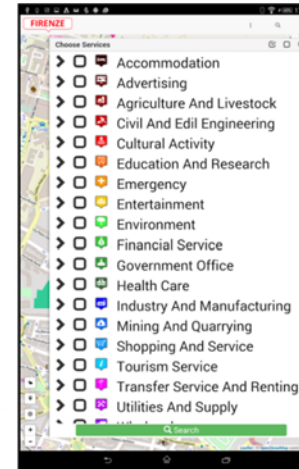


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Km4City APP, features 1/3



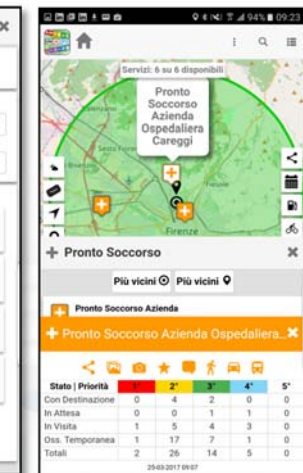
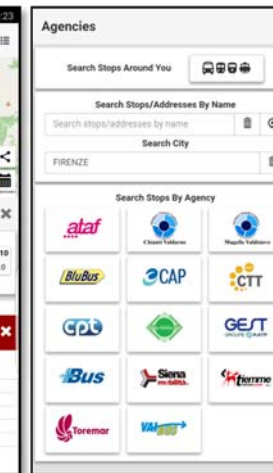
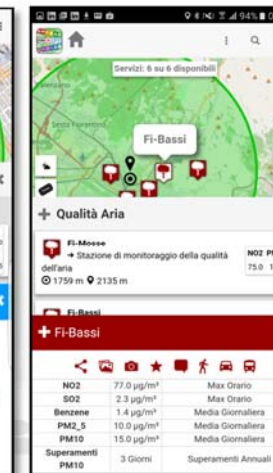
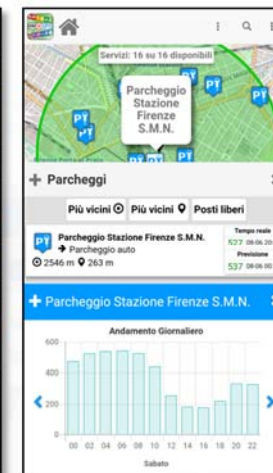
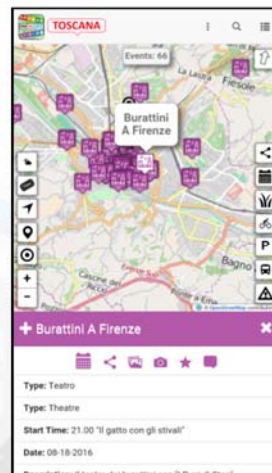
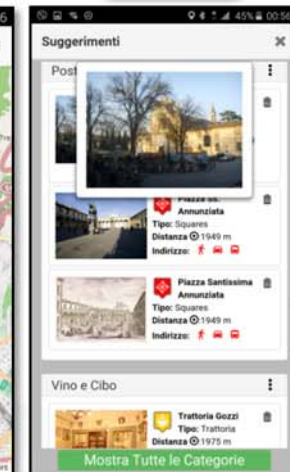
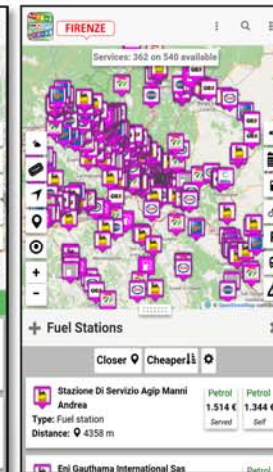
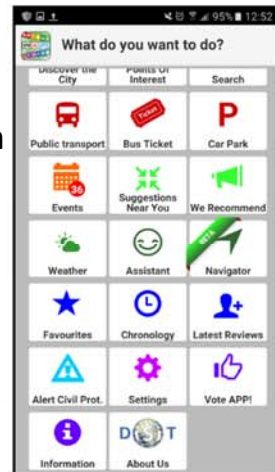
- **5 languages:** IT, EN, SP, DE, FR
- **Profiles** city users: Citizens, commuter, student, tourist, operator, etc..
- **Profiled Menu** per POI
 - adaptive
- **Main Menu: dynamic, and personalized**
- **Search Text**
- **Search per POI**
 - Near to you, near to a point, line...
- **Other search**
 - Close to you, events green areas, public transport, tickets, Cycling, parking,
 - Etc.
- **POI**
 - Preferred, Social icon
 - Ranking, Comments, images



Km4City APP



- Smart Parking, in Tuscany
- Smart First Aid in Tuscany
- Smart Public Transportation in Tuscany
- Smart Fuel pricing in Tuscany
- Bike Sharing in Pisa
- Weather condition in Tuscany
- Pollution and Pollination in Tuscany
- Traffic Sensors in Tuscany
- Smart Routing in Tuscany
- Smart Transportation in Florence
 - Events, traffic, ...
- Entertainment Events in Florence



Km4City APP



• Mobility

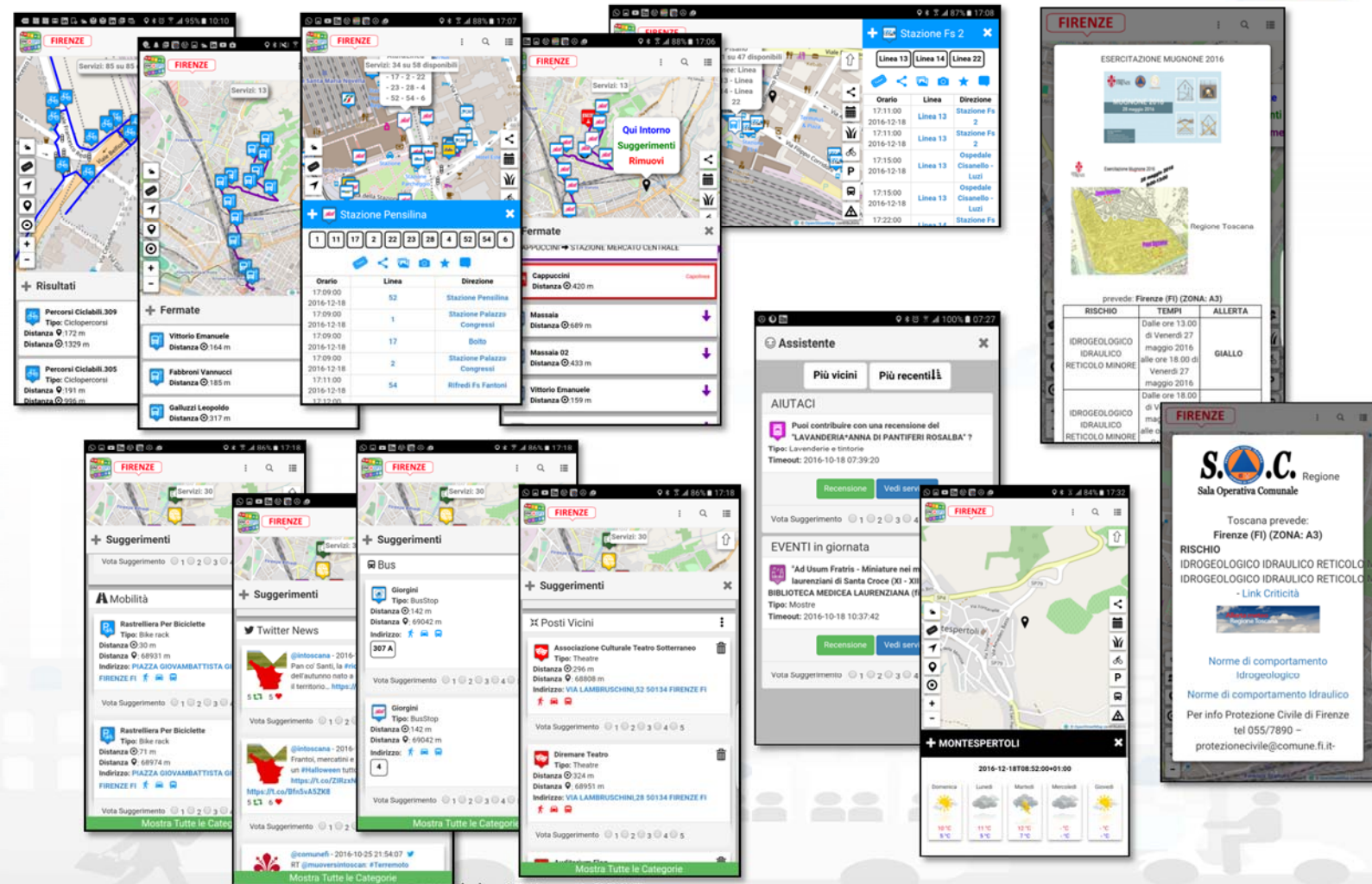
- Paths and stops, time
- Parking + prediction
- Ticketing
- Flow + prediction
- Navigation
- Connection with devices
- XXX Sharing

• Personal Assistant

- Info, Engagement
- Help, Civil protection

• Suggestions:

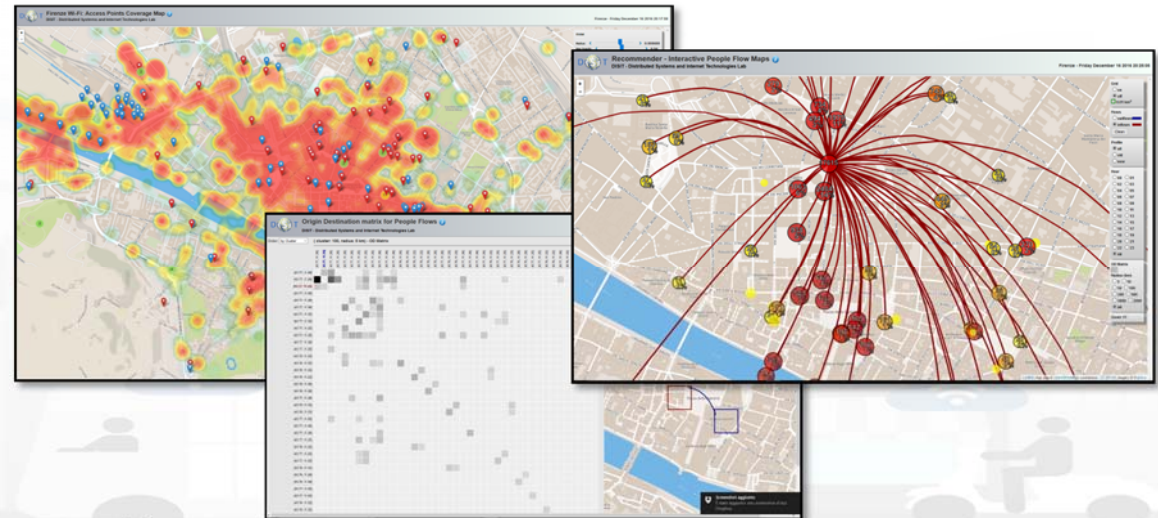
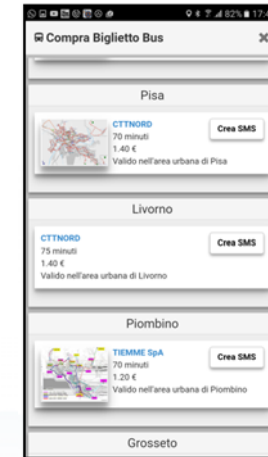
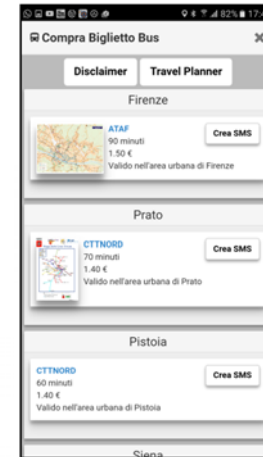
- Personalized and adaptive: banned e typed per city user.
- POI, Twitter, Events,
- Weather forecast,
- Civil Protection



Km4City APP, features 3/3



- Navigation 3D (BETA)
- Ticketing for busses
- App used are tool for city assessment
 - Wifi status
 - iBeacon status
 - User behavior analysis
 - GPS movements kinds
 - OD matrix
 - International flows



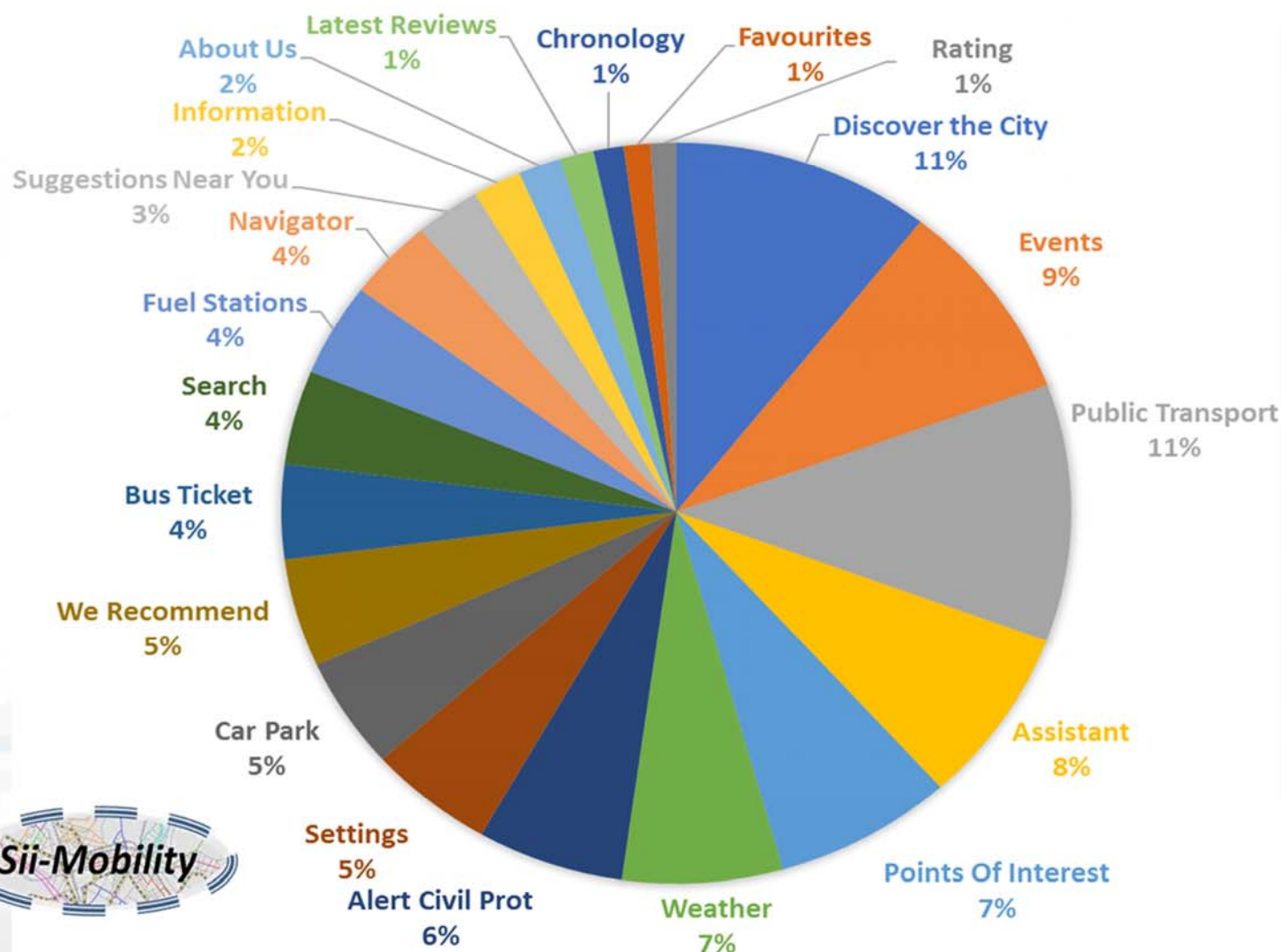


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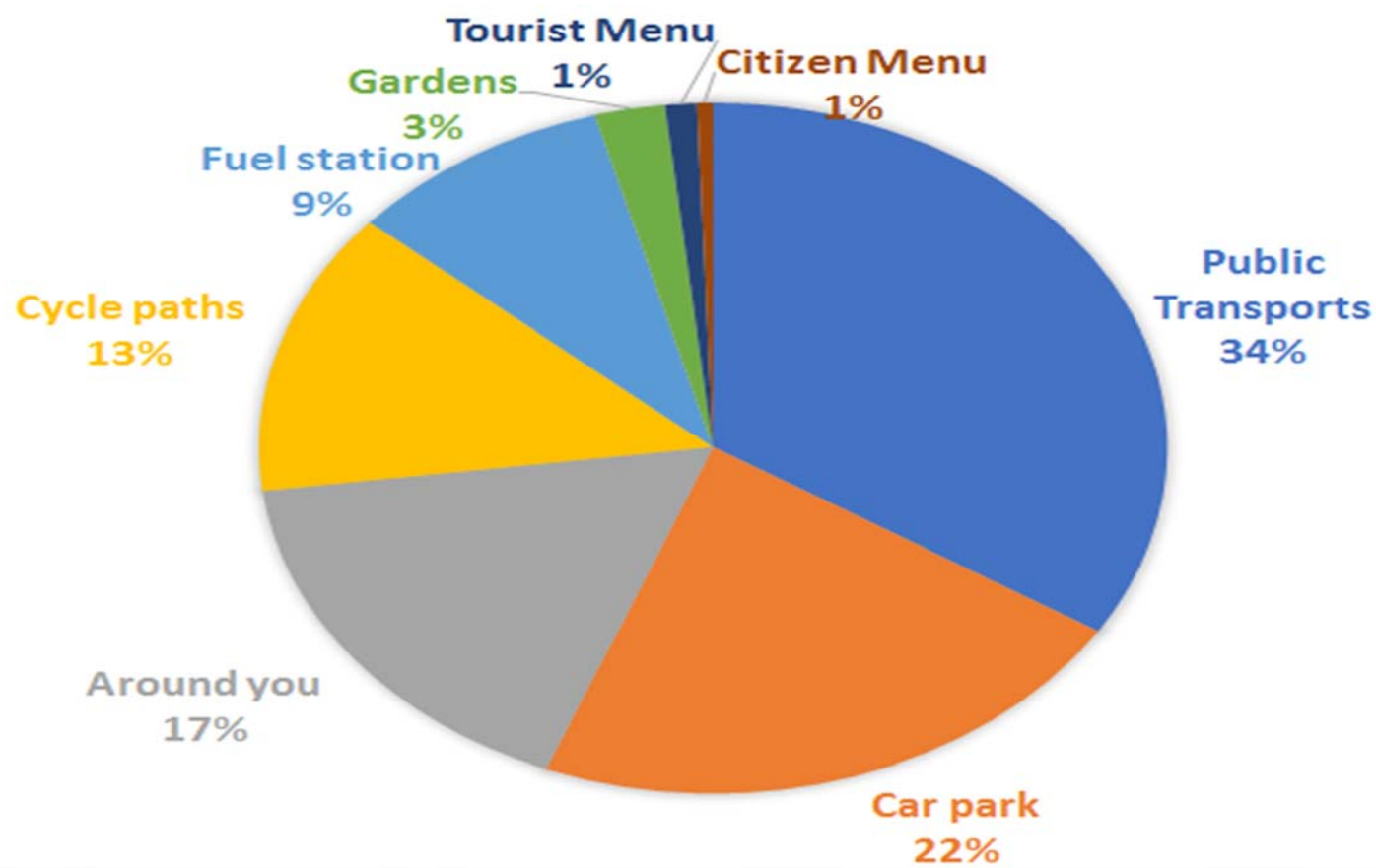
Usage of the main Menu



11% Discover the City	7% Points Of Interest	4% Search
11% Public transport	4% Bus Ticket	5% Car Park
4% Fuel Stations	9% Events	3% Suggestions Near You
5% We Recommend	7% Weather	8% Assistant
4% Navigator	1% Favourites	1% Chronology
1% Latest Reviews	6% Alert Civil Prot.	5% Settings
1% Vote APP!	2% Information	2% About Us



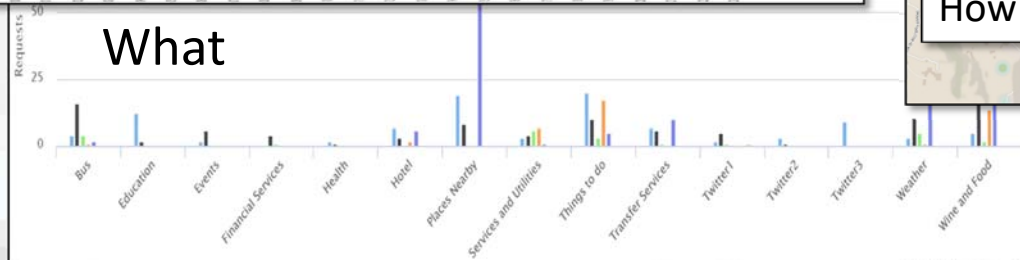
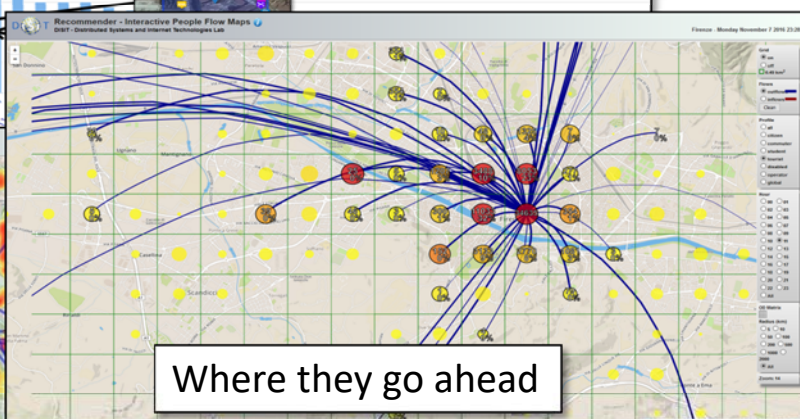
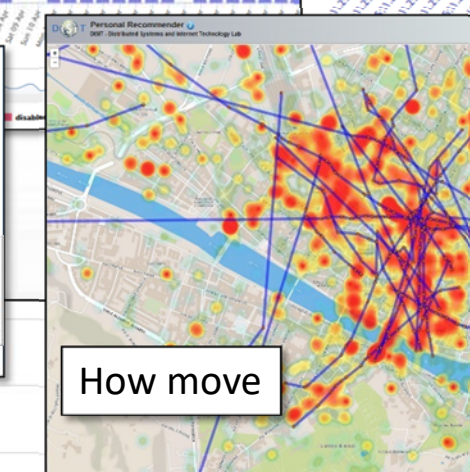
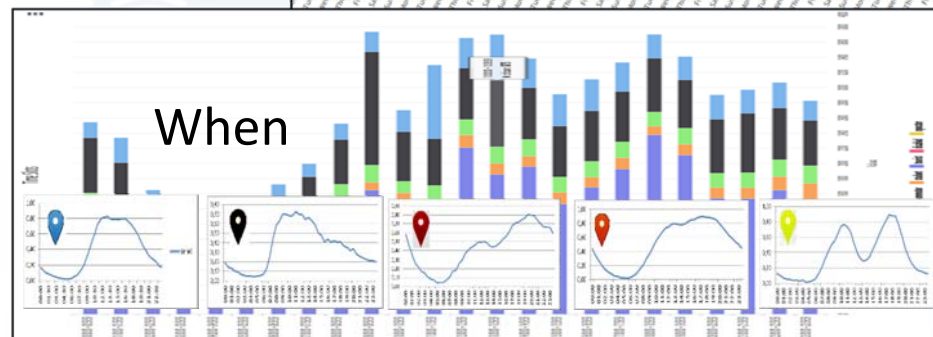
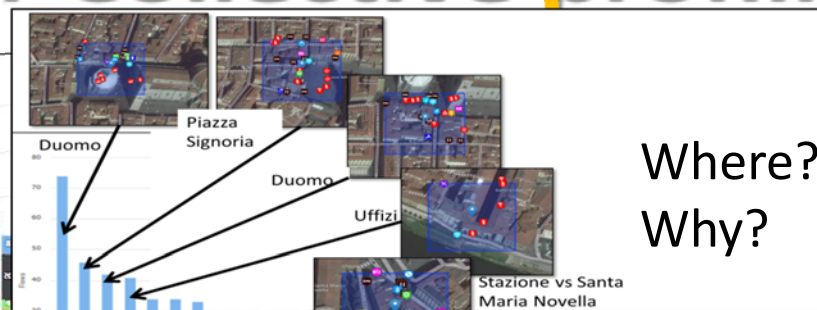
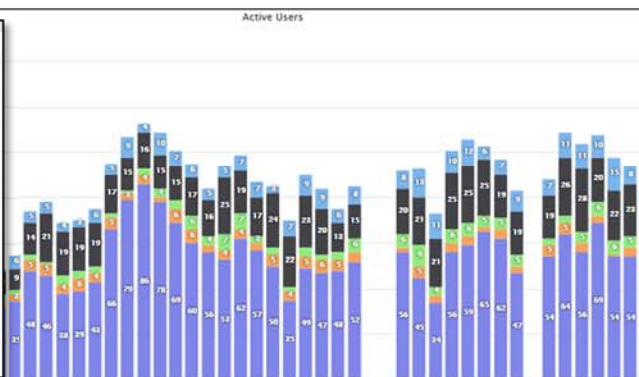
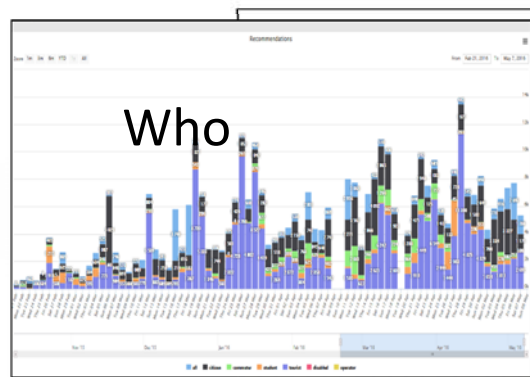
The most searches cathegories





Rule name	Type	F _{sent}	F _{viewed}	F _{viewed on F_{sent}}	Description
<i>daily_event_de</i>	ENGAGEMENT	1 (0%)	0 (0%)	0%	Suggest (in german) an event currently on in Florence
<i>daily_event_en</i>	ENGAGEMENT	1720 (2.12%)	70 (7.1%)	4.07%	Suggest (in english) an event currently on in Florence
	- commuter	5 (0.29%)	0 (0%)	0 (0%)	
	- student	14 (0.81%)	0 (0%)	0 (0%)	
	- tourist	1462 (85%)	25 (35.71%)	25 (1.71%)	
	- citizen	113 (6.57%)	39 (55.71%)	39 (34.51%)	
	- operator	0 (0%)	0 (0%)	0 (0%)	
	- disabled	0 (0%)	0 (0%)	0 (0%)	
	- all	119 (6.92%)	6 (8.37%)	6 (5.04%)	
<i>daily_event_es</i>	ENGAGEMENT	6 (0.01%)	4 (0.41%)	66.67%	Suggest (in spanish) an event currently on in Florence
<i>daily_event_fr</i>	ENGAGEMENT	6 (0.01%)	0 (0%)	0%	Suggest (in french) an event currently on in Florence
<i>daily_event_it</i>	ENGAGEMENT	5459 (6.73%)	296 (30.02%)	5.42%	Suggest (in italian) an event currently on in Florence
<i>parking_en</i>	ASSISTANCE	141 (0.17%)	128 (9.98%)	90.78%	Alert (in english) if the user parked in a residential parking zone
<i>parking_es</i>	ASSISTANCE	3 (0%)	3 (0.3%)	100%	Alert (in spanish) if the user parked in a residential parking zone
<i>parking_it</i>	ASSISTANCE	187 (0.23%)	1 (0.1%)	0.53%	Alert (in german) if the user parked in a residential parking zone
<i>short_a_photo_de</i>	ENGAGEMENT	68 (0.08%)	1 (0.1%)	1.47%	Ask (in german) a contribution for a nearby point-of-interest

User Behavior Analyzer for Collective profiling





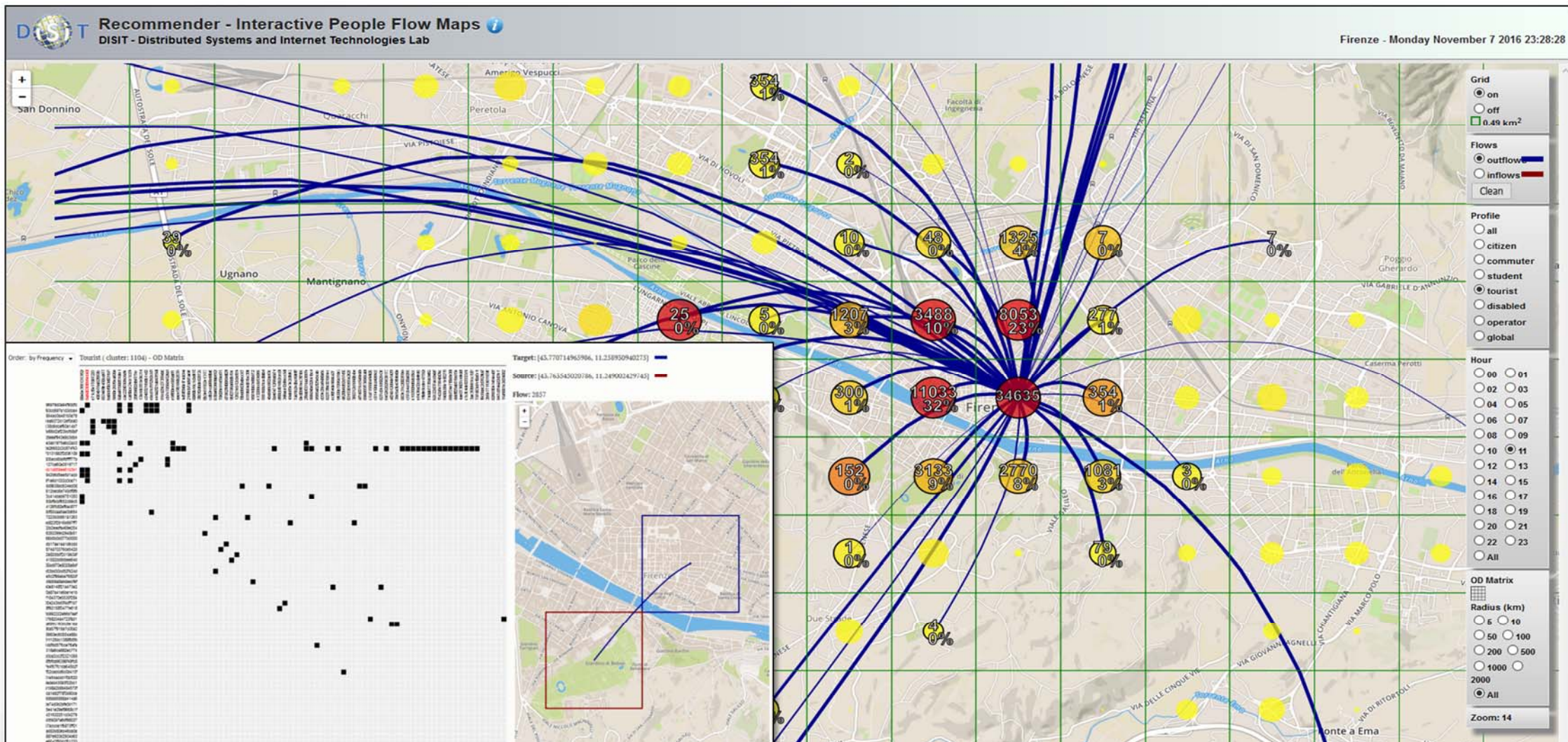
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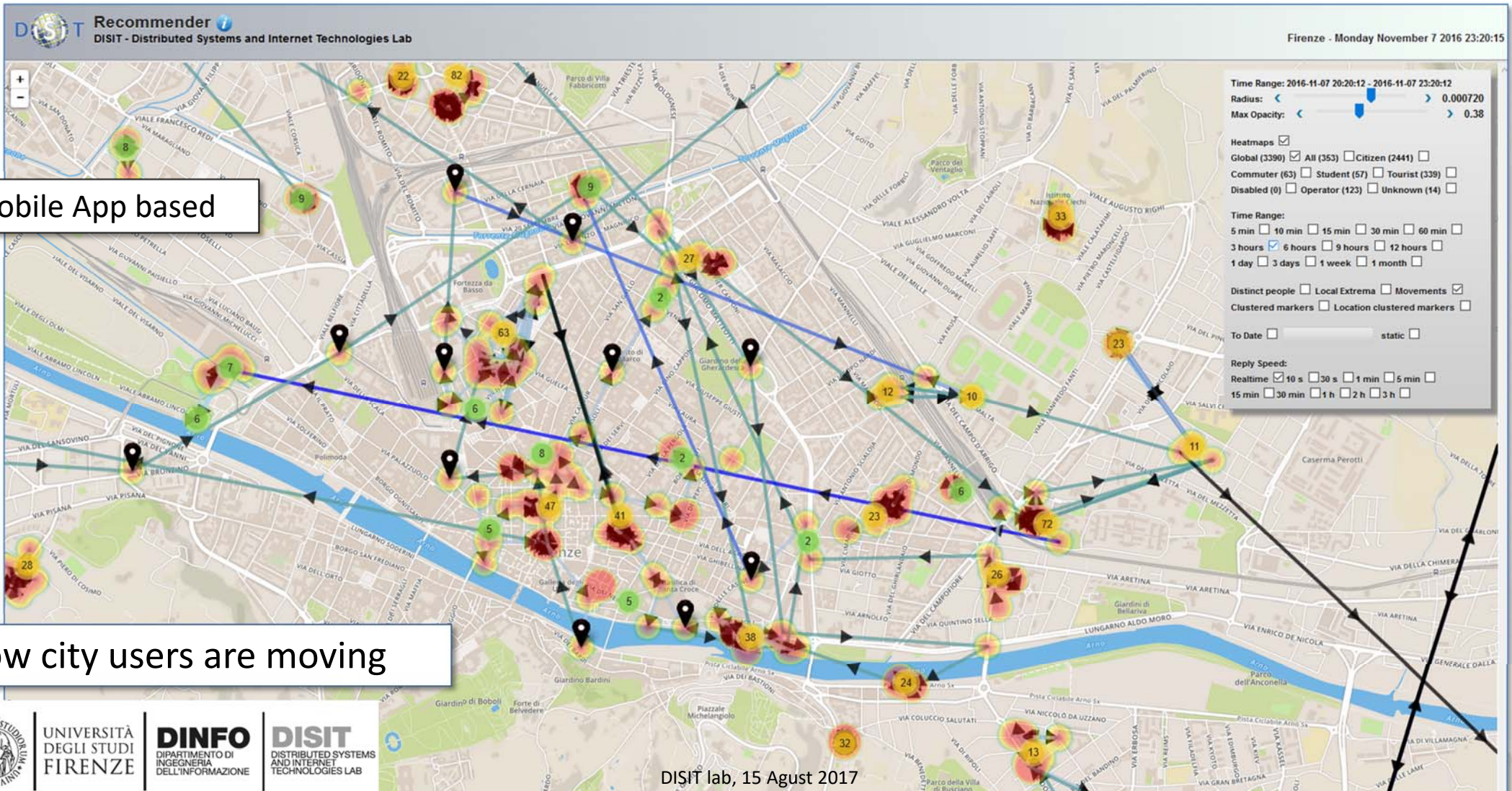
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OD Matrix scalabile



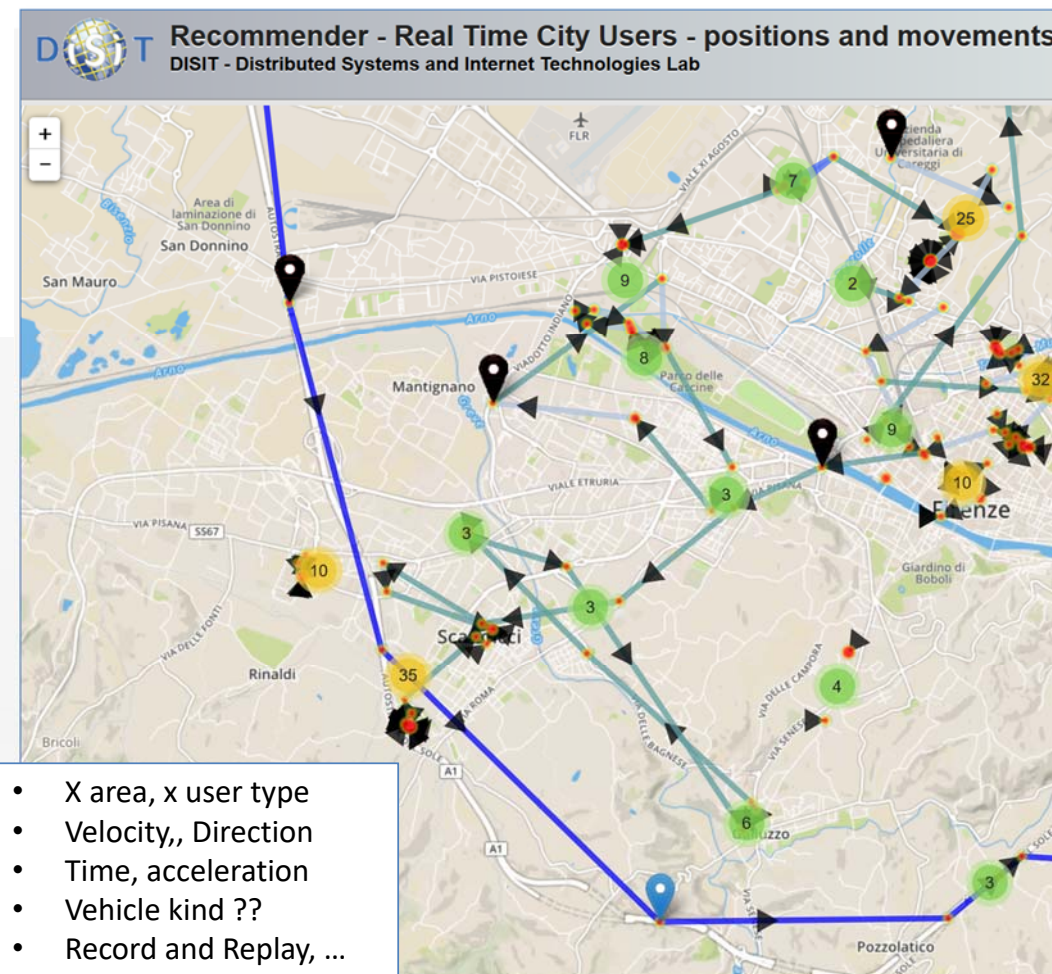
Anonymous User Behavior Analysis



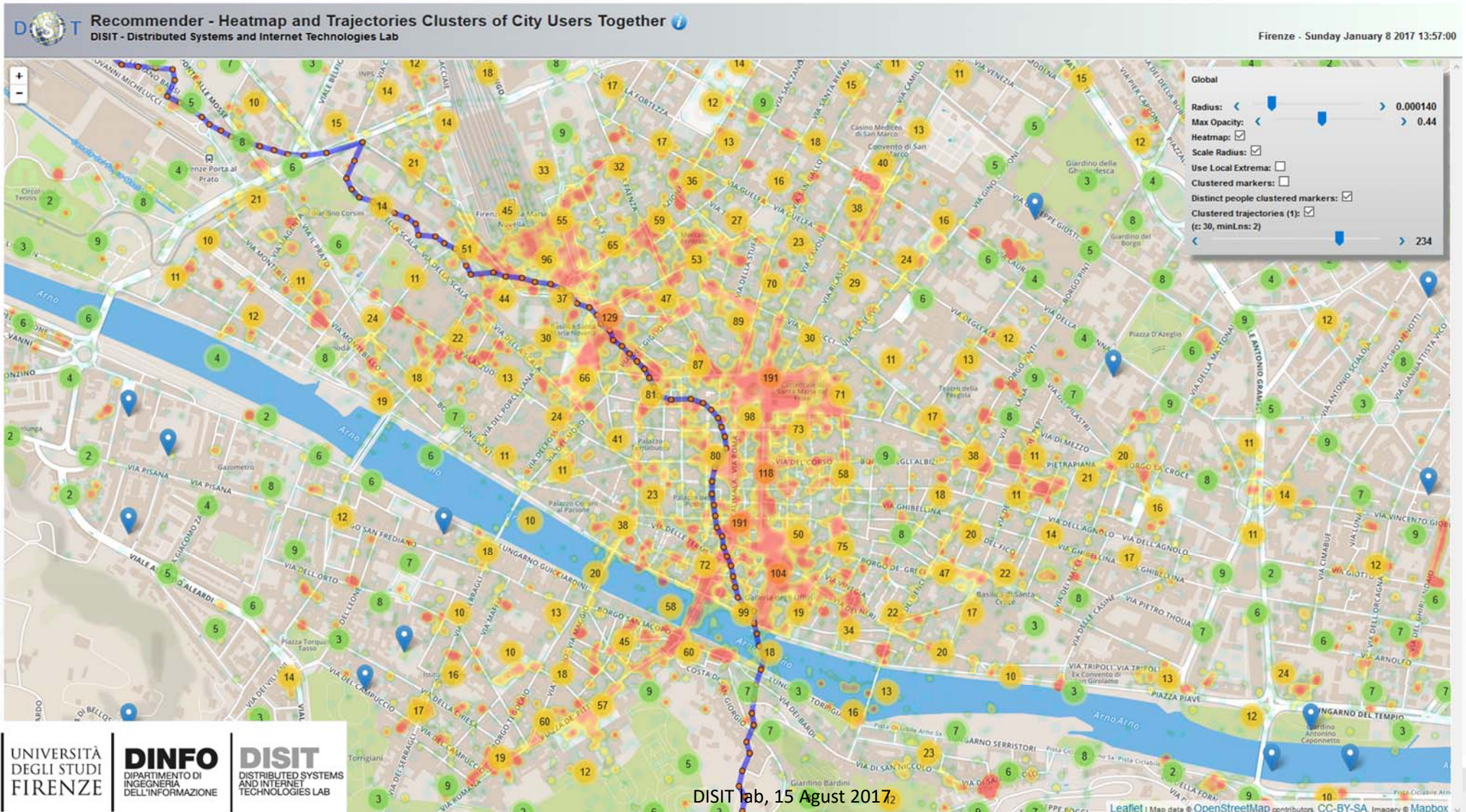


Problems of Trajectories from Apps

- **From mobile app:**
 - Resolving GPS location: GPS, cells, wifi-network, ..mixt
 - Noisy, different kind of devices, ..
 - Smart algorithm on devices for location acquisition
 - Anonymized data, terms of use on mobile
- **Issues and Filtering**
 - Gps Accuracy, kind of measure (GPS, mixt)
 - Jump in time, space, velocity
 - General noise (diff. devices)
 - Knowledge of precision map
- **Clustering:** time, space, user kind, etc.



Heat Map from Mobile: users as sensors



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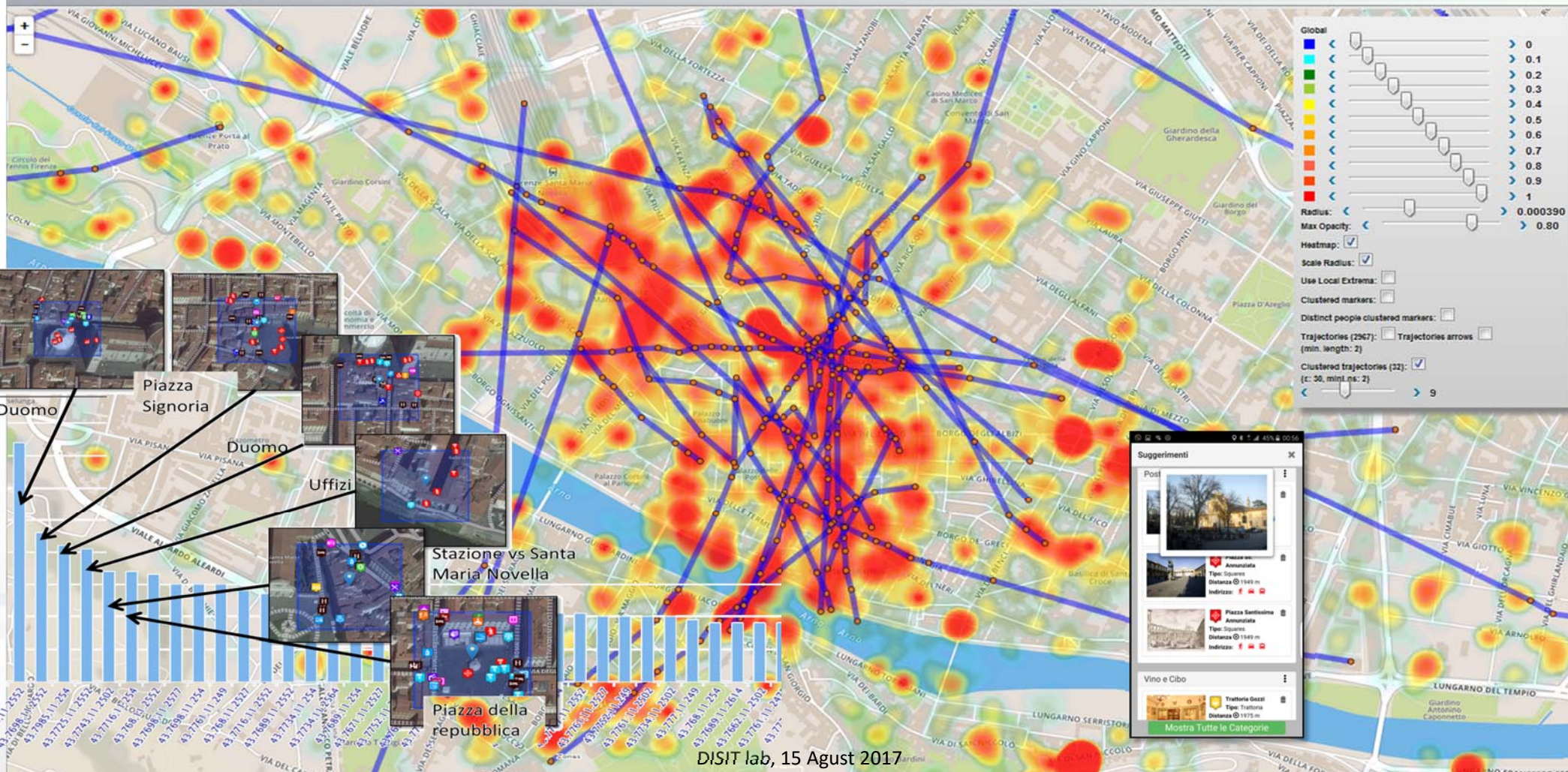
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User Behavior Analyzer



DISIT Personal Recommender
DISIT - Distributed Systems and Internet Technology Lab



DISIT lab, 15 August 2017

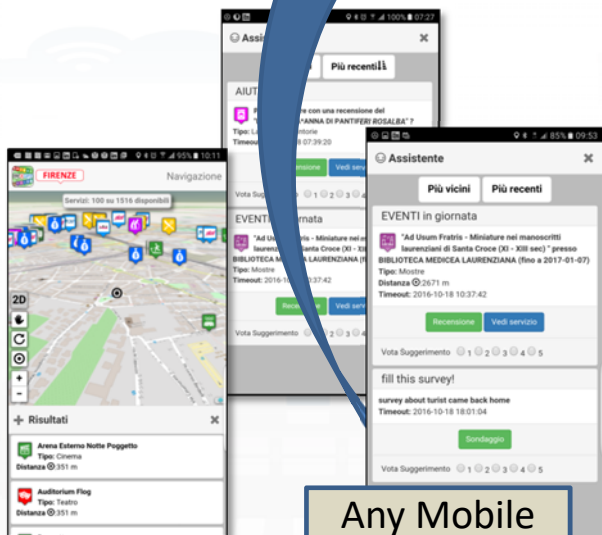
Strategies Implementation via Engagement

- Produce value from data enabling to
 - *Stimulate virtuous behavior,*
 - *influence engage City Users!*
 - Increase efficiency in energy consumption
 - Reduce pollution and traffic congestion
 - Improve quality of service, quality of life
- Create an ecosystem for innovation and put in action any smart city solutions and services.



User influencing, engaging, monitoring & Follow Up

City & City Operators Strategy Editor



Any Mobile
and Web
App

Rule name	Type	#sent	#viewed	#viewed on #sent	Description
daily_event_de	ENGAGEMENT	1 (0%)	0 (0%)	0%	Suggest (in german) an event currently on in
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- citizen		113 (6.57%)			
- operator		0 (0%)			
- disabled		0 (0%)			
- all		119 (6.92%)			
daily_event_es	ENGAGEMENT	6 (0.01%)			
daily_event_fr	ENGAGEMENT	6 (0.01%)			
daily_event_it	ENGAGEMENT	5459 (6.73%)			
parking_en	ASSISTANCE	141 (0.17%)			
parking_es	ASSISTANCE	3 (0%)			
parking_it	ASSISTANCE	187 (0.23%)			
shoot_a_photo_de	ENGAGEMENT	68 (0.08%)			

Inform

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 your may be interested, etc..

Provide Bonus

Since you have parked here you we can get 1 Bonus
We suggest you to leave the car out of the city, this bonus can be used to by a bus ticket



Engagement & Assistant Rules

- **Detecting** city users' habits about mobility
 - Private cars → **stimulating Bus Usage & Bikes**
 - Private cars parking → usage of **peripheral parking-lot + bus**
 - Leave the car and take the bus twice → by using **bonus, tickets..**
 - → different solutions for moving...
- **Assisting by notifying** when one is
 - parking out of the residential parking zone
 - parking in a zone subjected to cleaning in the next two days
 - entering in the restricted traffic zone
- **Suggesting** you about
 - Events, **Civil Protection Alerts**,
 - **Closer free parking** ...
- **Administering** questionnaires
 - Getting assessment about services, city experience
 -
- **Requesting** ranking, photo and/or comments



Monitoring City users Via Social Media

<http://www.km4city.org/?controlRoom>

<http://www.km4city.org/?devTools>

<http://www.km4city.org/?infoDocs>

<http://www.km4city.org/?app>

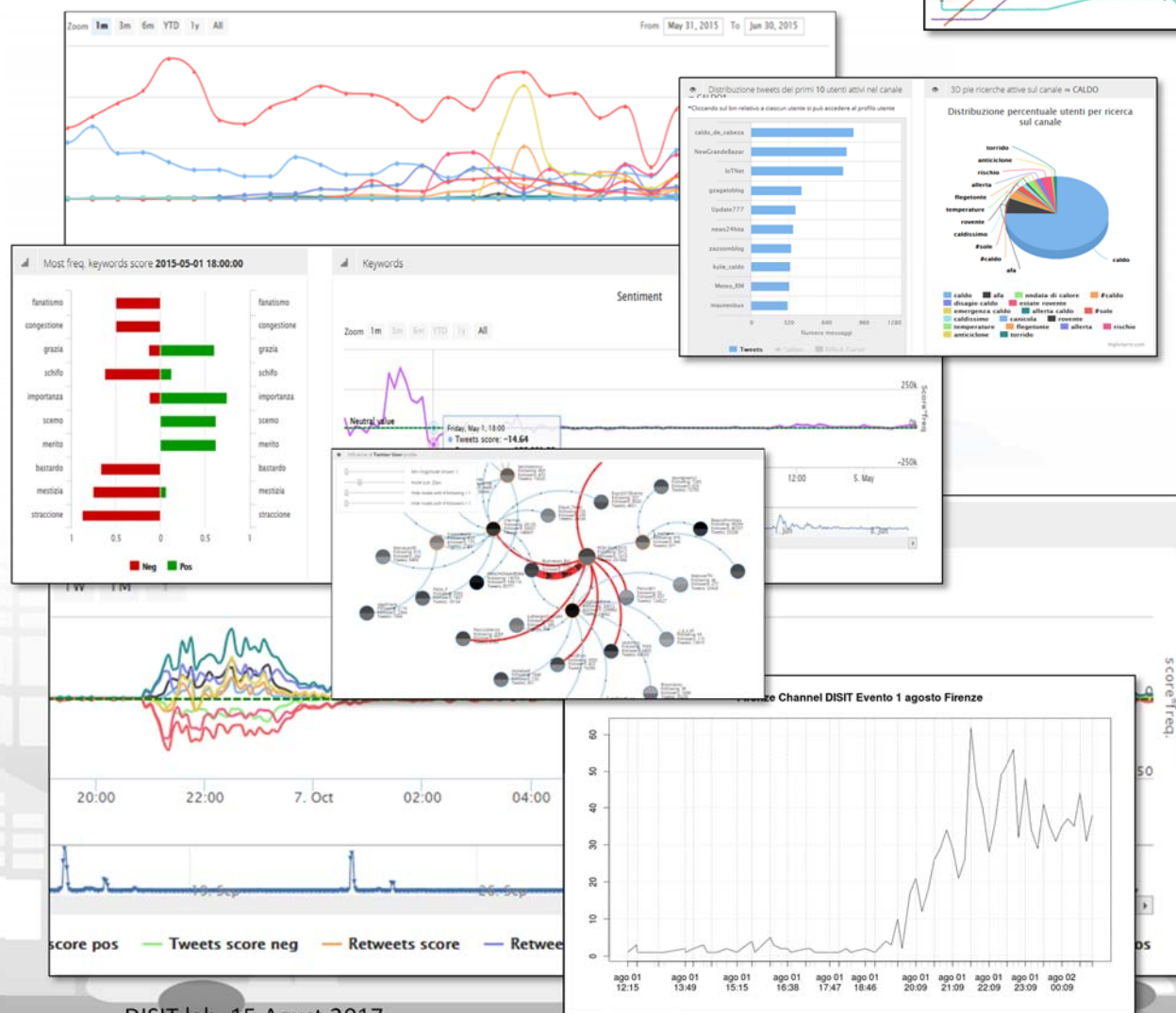


Twitter Vigilance



- <http://www.disit.org/tv>
- <http://www.disit.org/rttv>
- Citizens as sensors to
 - Assess sentiment on services, events, ...
 - Response of consumers wrt...
 - Early detection of critical conditions
 - Information channel
 - Opinion leaders
 - Communities
 - Formation
 - Predicting volume of visitors for tuning the services

Twitter Vigilance



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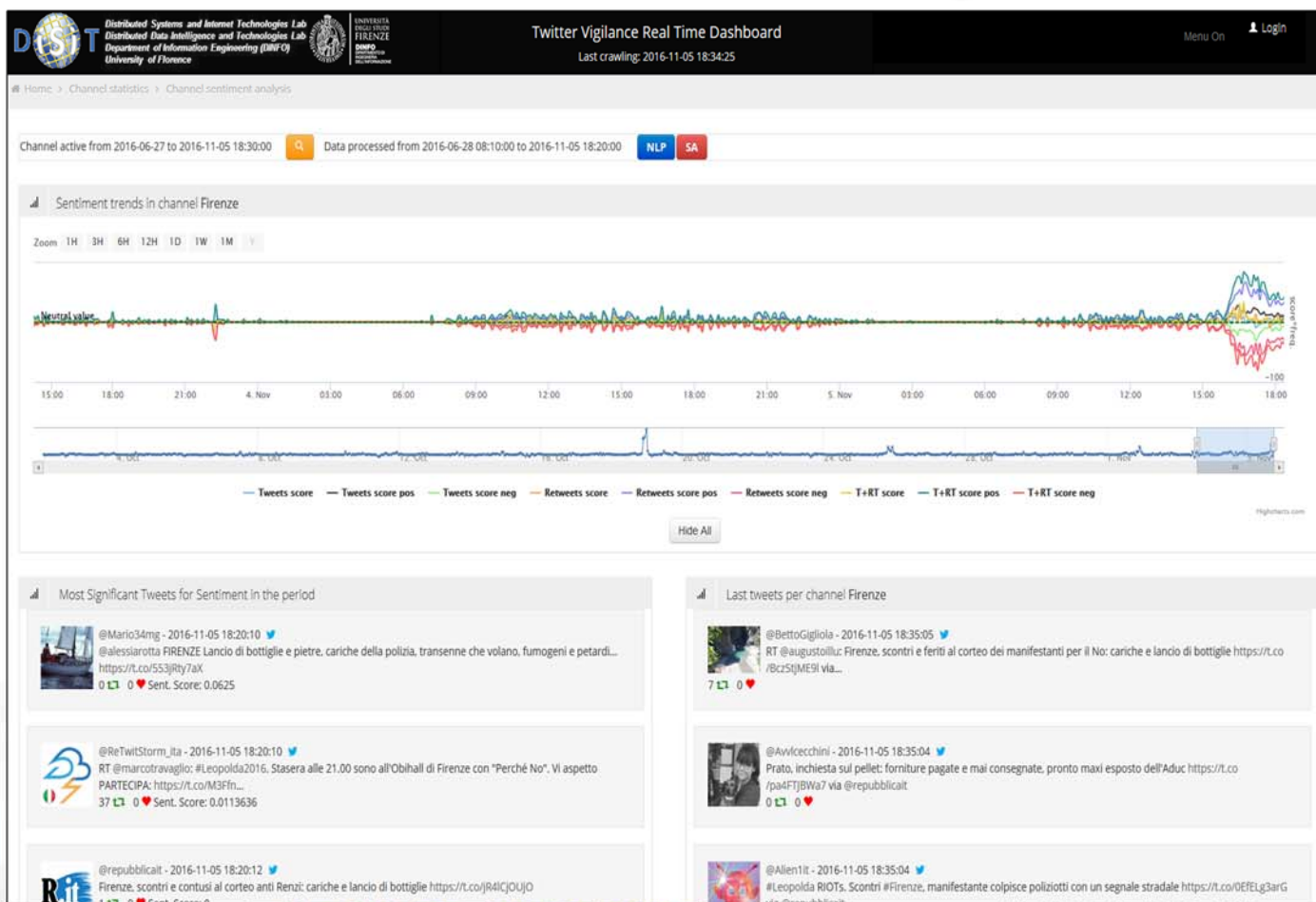
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DELL'INFORMAZIONE

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AND INTERNET
TECHNOLOGIES LAB

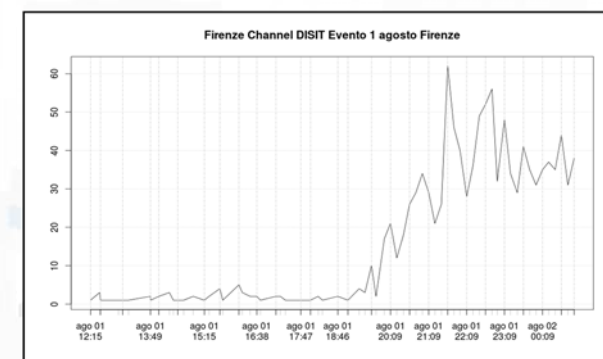
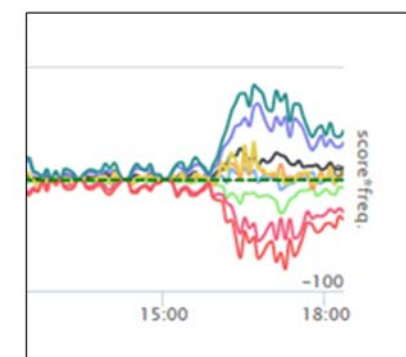
<http://www.disit.org>

Twitter Vigilance

Real Time Twitter Vigilance, Early Warning



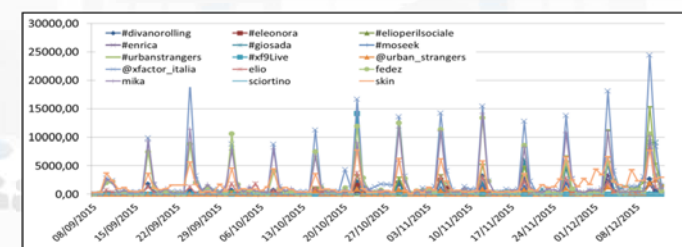
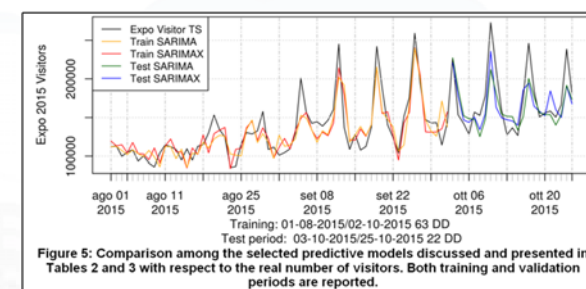
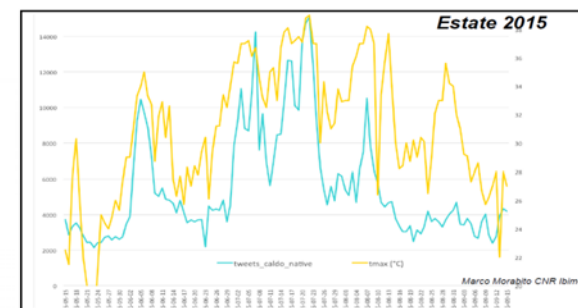
Sentiment Analysis



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Prediction/Assessment

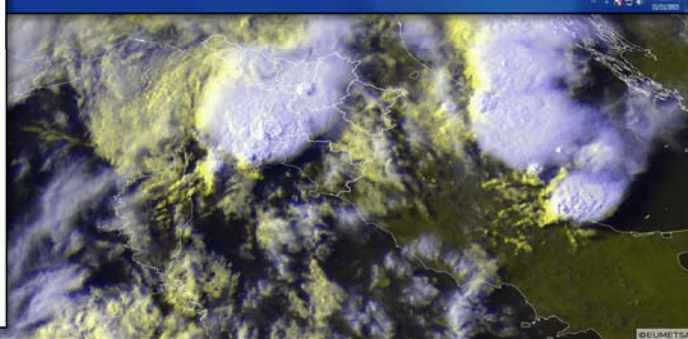
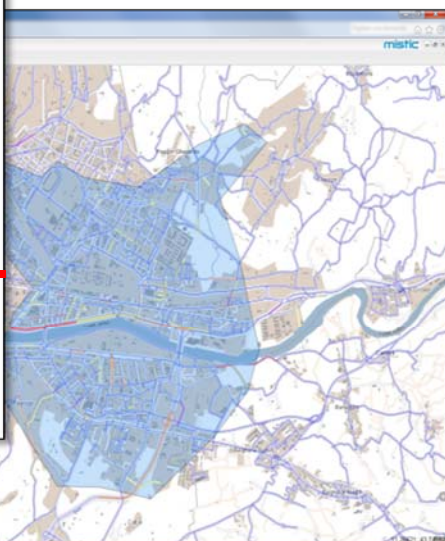
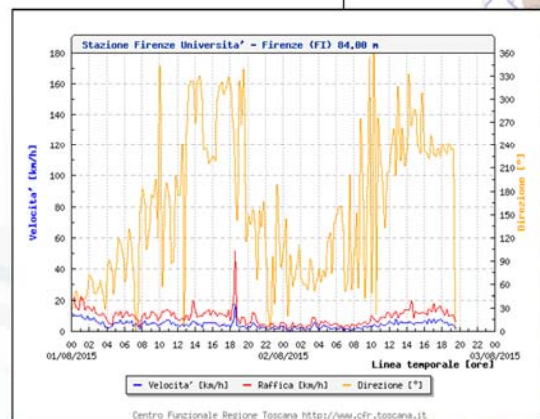
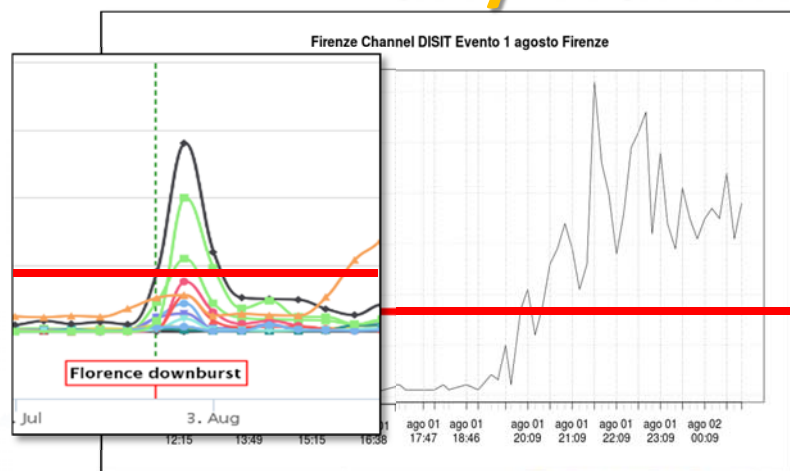
- Football game results as related to the volume of Tweets
- Number of votes on political elections, via sentiment analysis, SA
- Size and inception of contagious diseases
- marketability of consumer goods
- public health seasonal flu
- box-office revenues for movies
- places to be visited, most visited
- number of people in locations like airports
- audience of TV programmes, political TV shows
- weather forecast information
- Appreciation of services





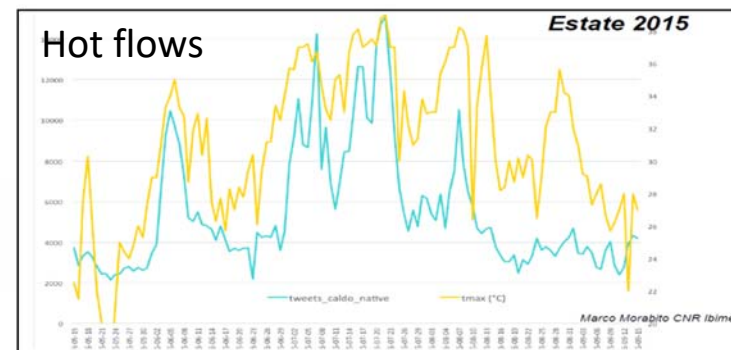
Twitter Vigilance

Early Warning

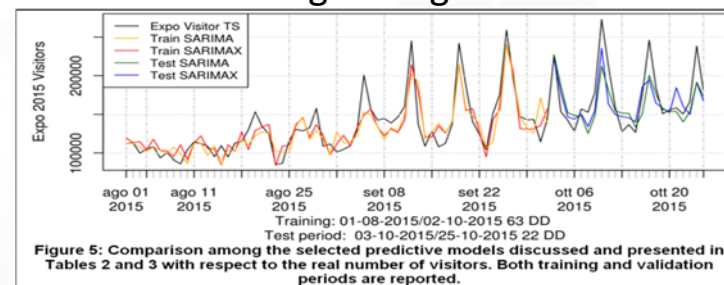


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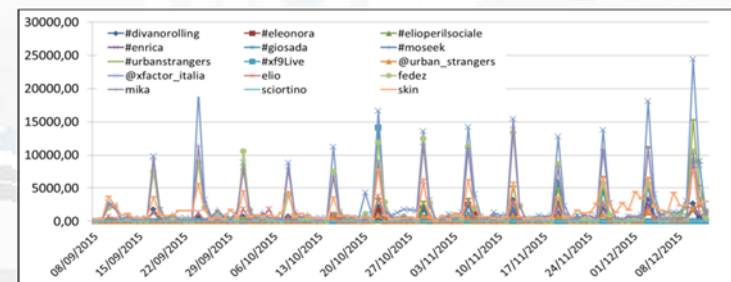
Predictive models



Attendance at long lasting events: EXPO2015



Attendance at recurrent events: TV, football



Twitter Vigilance su Firenze (sperimentale)

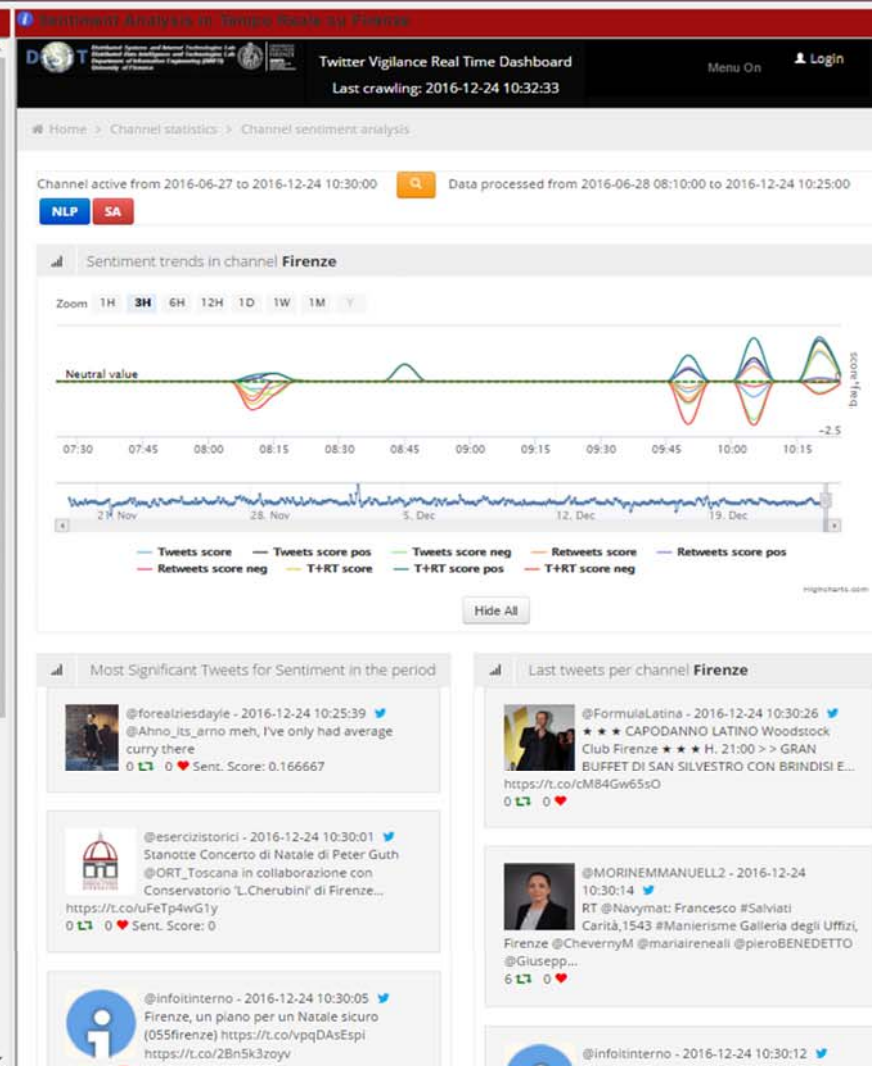
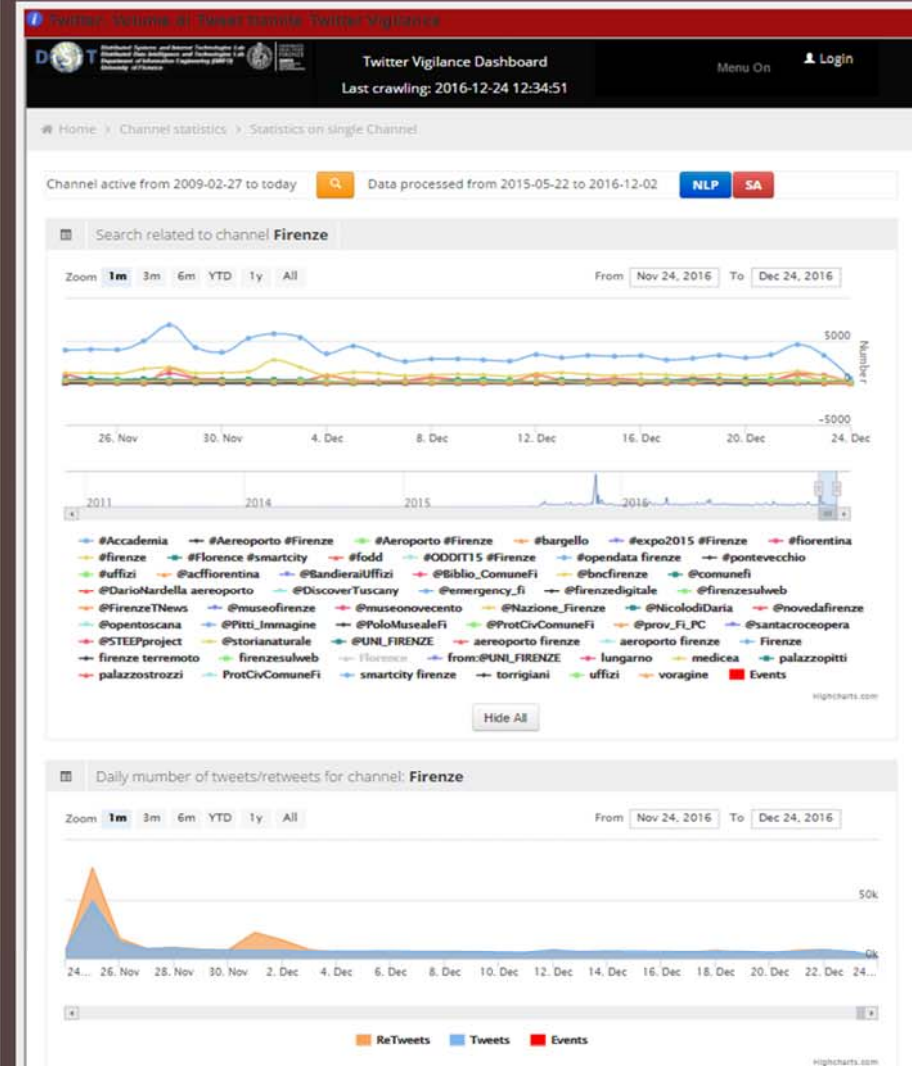


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SISTEMI E TECNOLOGIE DELL'INFORMAZIONE

Sat 24 Dec @ 10:37:57



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Development Tools

<http://www.km4city.org/?controlRoom>

<http://www.km4city.org/?devTools>

<http://www.km4city.org/?infoDocs>

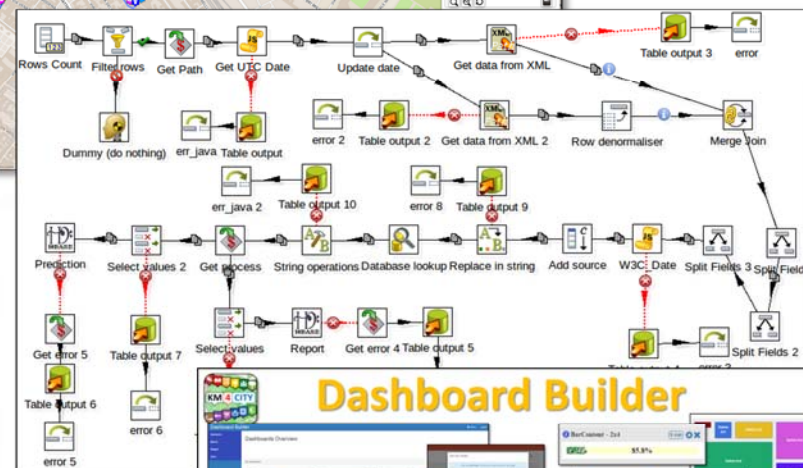
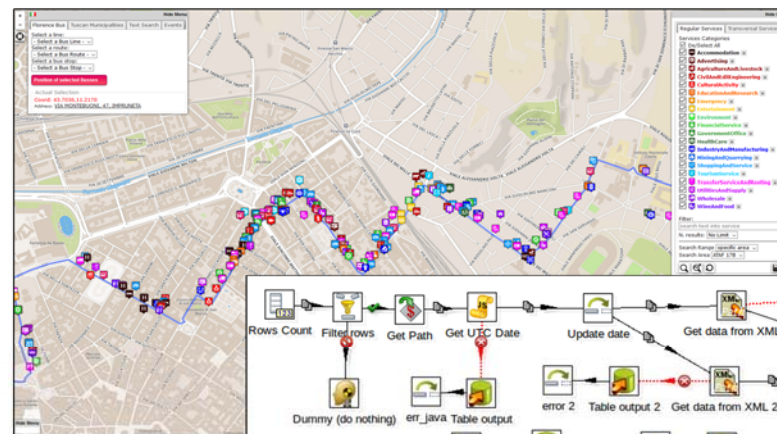
<http://www.km4city.org/?app>



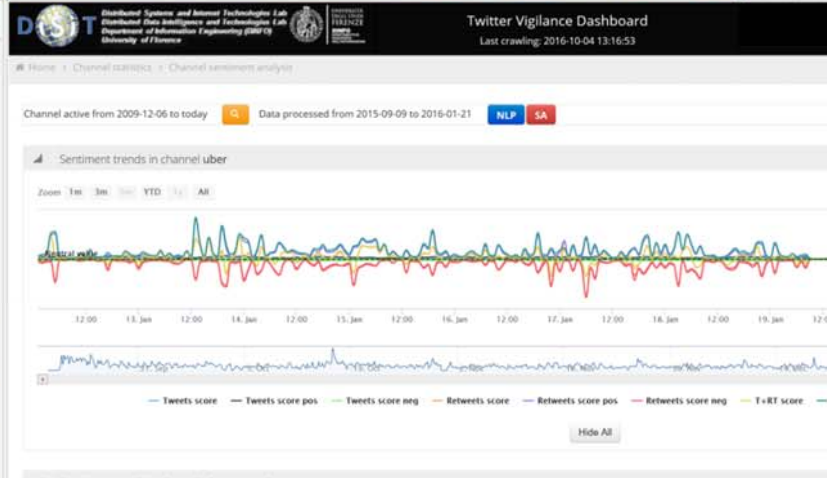
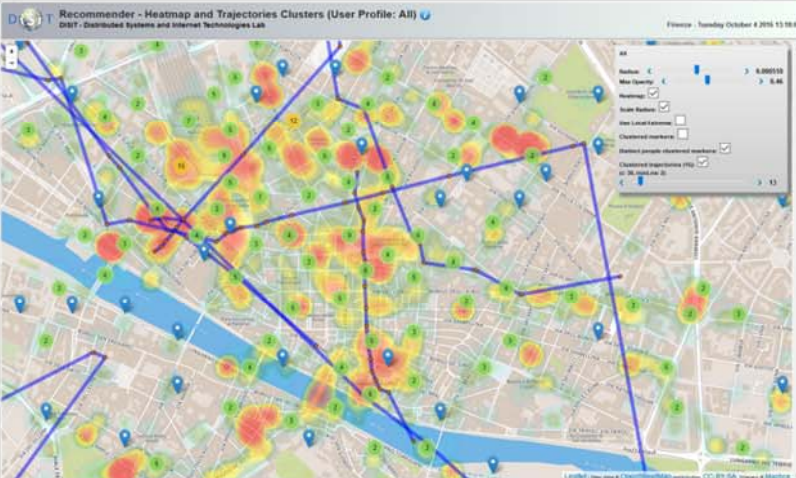
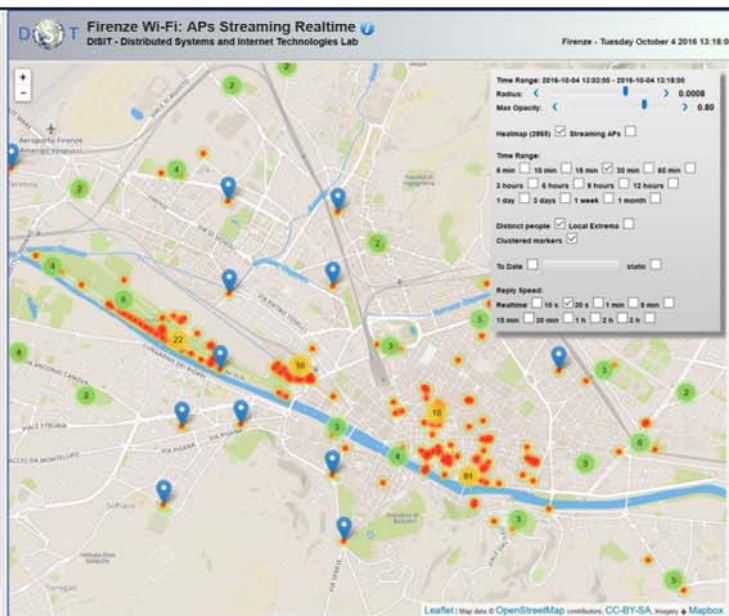
Development Tools



- **Smart City API:**
 - Several kind of APIs
- **Generator “ServiceMap”,**
<http://servicemap.km4city.org>
 - Call per web and mobile App
 - Embedding in web pages
 - **Collaborative work**
- **Load new data: manual and automatic**
 - POI, IOT, etc.
 - Load of Shape & Paths
 - **Collaborative work**
- **Dashboard builder**
 - Production of dashboard per control room
 - Embedding view of any other analytics of Km4City or of third party: wifi, 3D, flow, recommend, engager, etc.
 - **Collaborative work**



Higher level Dashboard





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<http://www.disit.org>

Dashboard Builder

<http://www.disit.org/6935>



Dashboards Overview

Name	Title	Creation Date	Status
12	Dashboard 12	2016-07-27 11:35:15	OK

Sources Management

DataSources Overview

ID	URI
Km4CityApp	jdbc:mysql://redolog.3300
Km4CityAlert	jdbc:mysql://192.168.0.20.3300
Km4CityDFS	http://192.168.0.206:8080/WebApp/Gratiaspand
Km4CityRecommend	jdbc:mysql://192.168.0.55.3300
Km4CityServiceMap	jdbc:mysql://192.168.0.72.3300
Km4CitySikability	jdbc:mysql://192.168.0.72.3300
pinva	jdbc:mysql://redolog.3300
SmartDS	jdbc:mysql://192.168.0.25.3300
TwitterTv	jdbc:mysql://192.168.0.50.3300

Modifica Widget

Id Widget: widgetBarContent

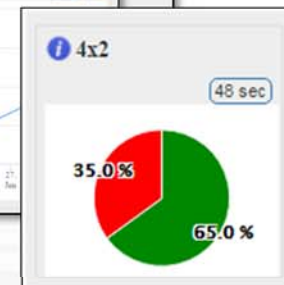
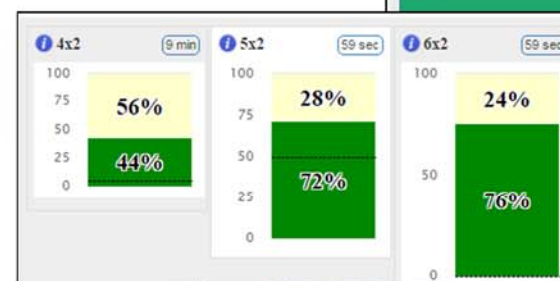
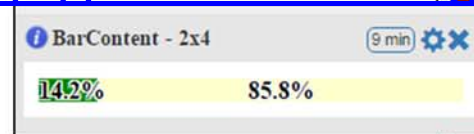
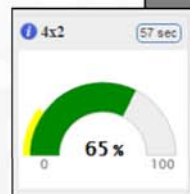
Type: Percentuale

Min. Columns number: 1, Max. Columns number: 2

Min. Rows number: 2, Max. Rows number: 3

n. metrics: 1, Color: 1

Buttons: Close, Modify



DISIT lab, 15 August 2017

Transport systems
Mobility, parking



Public Services
Govern, events, ...



Sensors, IOT
Cameras, ..



Environment,
Water, energy



Shops, services,
operators



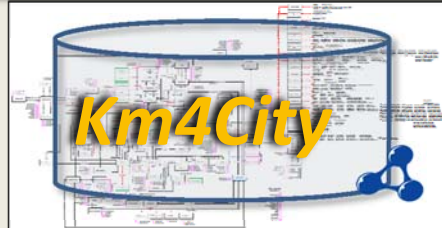
Social Media
WiFi, network



Static, Slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud

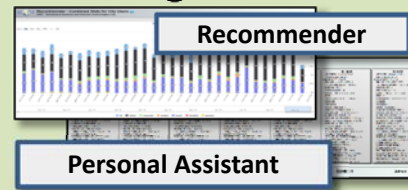
Km4City Smart City Engine



Big Data Analytics



Smartening Tools



Development Tools



Km4City Smart City API

City Operators and Decision Makers

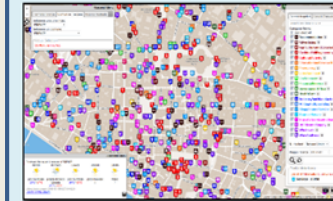
Dashboards



Smart Decision Support



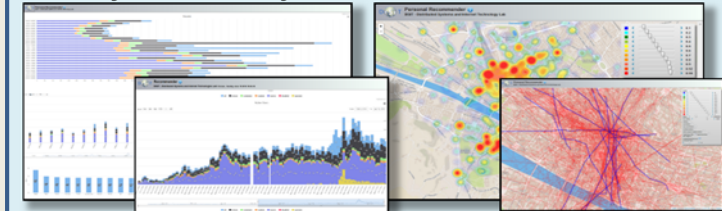
ServiceMap browser



Twitter Vigilance



Analyzers of City User Behavior



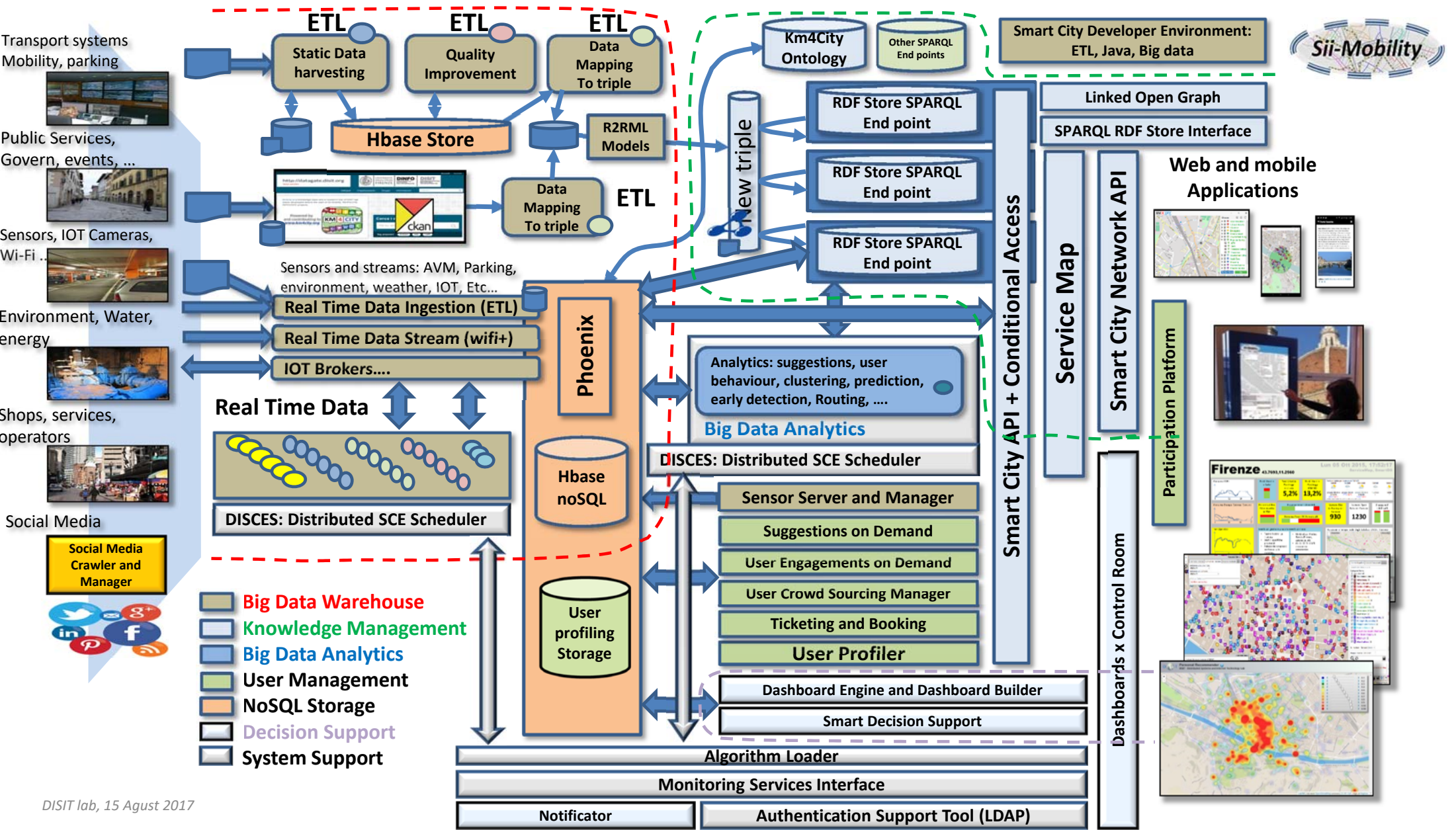
Tools for Final Users

Mobile e Web Apps

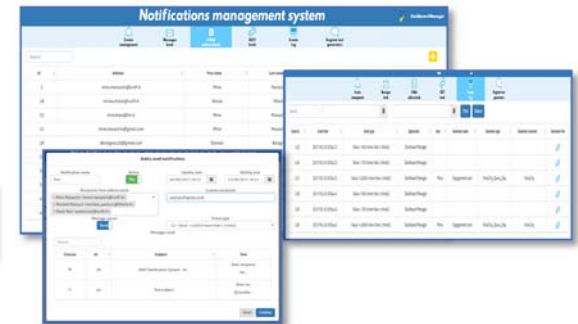
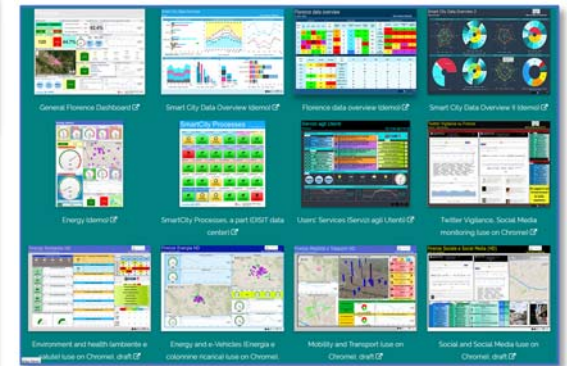
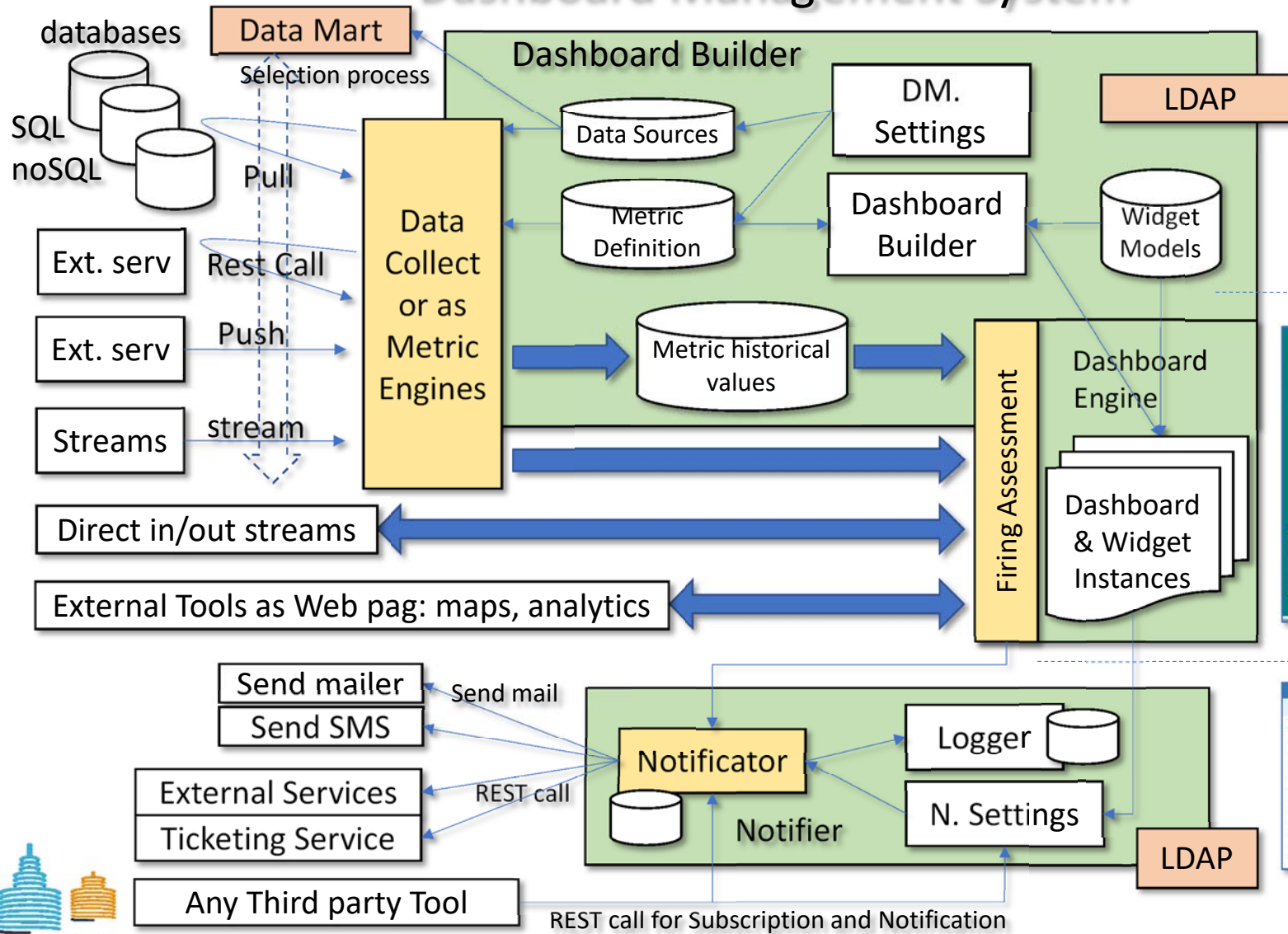


[Http://www.km4city.org](http://www.km4city.org)

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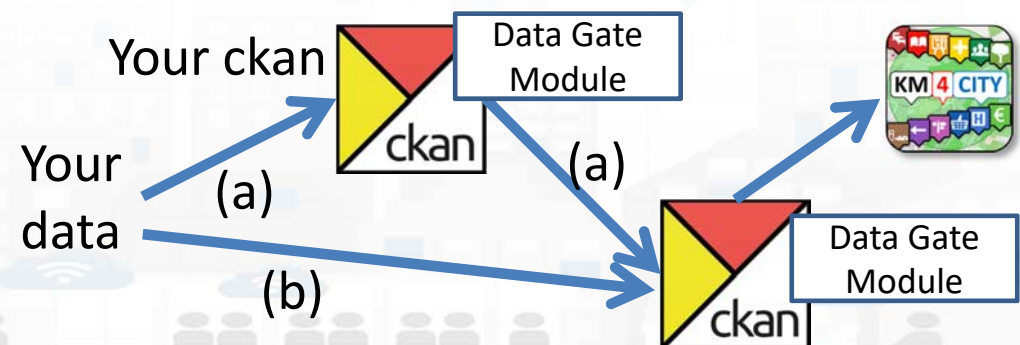
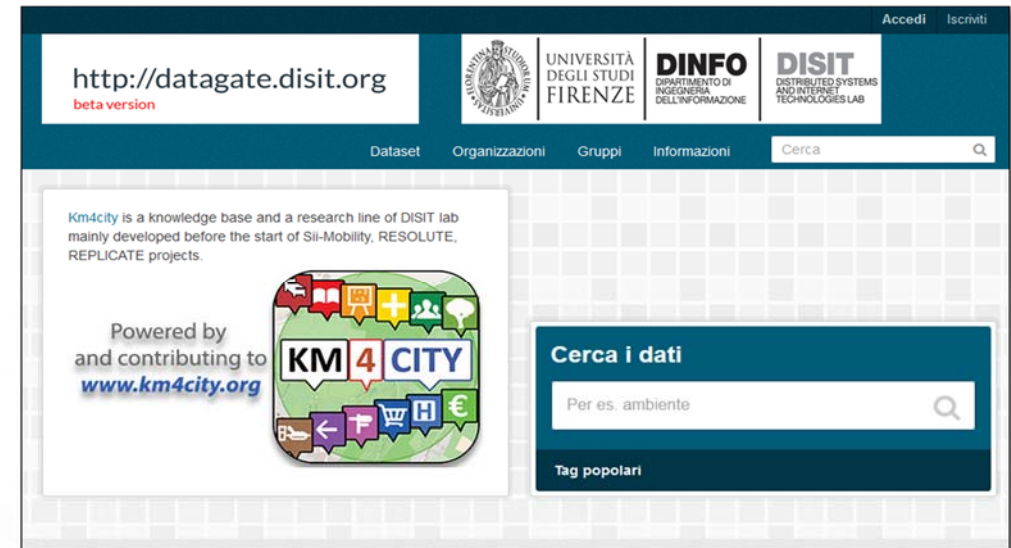
Dashboard Management System





DISIT DataGate

- To load new data into Km4City model in short time ..
 - Upload your CSV, XLS, XLSX directly on our CKAN DataGate.
- DataGate allows you
 - fastening the data ingestion, from your CKAN to our model
 - formatting and improving your data, assisting you in the process



<http://DataGate.disit.org>

Loading Shapes and Paths for search

<https://arthur-e.github.io/Wicket/sandbox-gmaps3.html>

<http://www.km4city.org/wkt/>

Wicket

Wicket is a lightweight Javascript library that reads and writes Well-Known Text (WKT) strings. It can also be extended to parse and to create geometric objects from various mapping frameworks, such as Leaflet, the ESRI ArcGIS JavaScript API, and the Google Maps API.

```
MULTIPOLYGON (((40 40, 20 45, 45 30, 40 40)), ((20 35, 10 30, 10 10, 30 5, 45 20, 20 35), (30 20, 20 15, 20 25, 30 20)))
```

☐ Format for URLs

Design © 2012-2013 K. Arthur Endley
Wicket is released under the GPL v3

Upload a SHP file or paste a WKT

You can add SHP files to the system to convert them in WKT or paste a valid WKT.

SHP File

Label

Nessun file selezionato.

Paste a WKT

Label

WKT



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ServiceMap Tool



- **ServiceMap tool**

- with Km4City are substantially a Smart City Expert System, SCES
- includes the Smart City API
- is a for developers to: search and browse on Smart City Knowledge, also to generate examples of the Smart City API call to be used in the development of Web and Mobile Apps



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Smart City API



- <http://www.disit.org/6597>
 - REST API: serviceURI or Selection or GPS
 - REST API: Query ID
 - Receive an email
 - Get a JSON, HTML, ...
 - Call SPARQL
- EMBED facility in third party web pages
- Developers may use the ServiceMap tool to:
 - compose geographical and textual queries
 - THEN request an e-mail containing the calls (same results in JSON and/or in HTML)

FERMATA : STATUTO 04
LINKED OPEN GRAPH
Linee: 20 28 4 54 8
Prossimi transiti:

FERMATA : STAZIONE PENSILINA
LINKED OPEN GRAPH
Linee: 11 17 22 23 36 4 52 54 6
Prossimi transiti:

Orario	Linea	Stato	Ride
13:01:40	4	In orario	5084813
13:05:04	17	Ritardo	4933186
13:07:24	6	In orario	4829621
13:09:02	17	In orario	4848688
13:12:02	6	Anticipo	4867907
13:12:20	6	In orario	4829654

Save your information for services.
You can save this service on ServiceMap. Please insert a valid e-mail, and you will receive a link that could allow you to access at the results and share it with your friends.
Insert your e-mail: email@domain.ext
Insert a title: Service title
Insert a description: Insert a description
Send

Save your information for services.
You can save this query on ServiceMap. Please insert a valid e-mail, and you will receive a link that could allow you to access at the results and share it with your friends.
Insert your e-mail: michela.paolucci@unifi.it
Insert a title: My Query
Insert a description: Busses available at Florence station
Send



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ServiceMap Development Tool

Search around a GPS point

Search along a line

Regular Services | Transversal Services

Search text into service

Services Categories

Search Range: 500 mt

N. results for each: 200

Search Results

- Services: 35 of 35 available
- Bus Stops: 13 of 13 available
- Road Sensors: 2 of 2 available

Bus Lines: 72 Bus Lines Found

Bus Line 12
Destin: NAU A ROVIZZANO + NUOVO PINONE

Bus Line 12
Destin: SORGANE + NUOVO PINONE

Bus Line 12
Destin: MAGENTA + STAZIONE VIA ALABANI

Search for Geo Located Services

Regular Services | Transversal Services

Search text into service

Services Categories

Search Range: 500 mt

N. results for each: 500

Search Results

- Services: 410 of 410 available
- Bus Stops: 23 of 23 available
- Road Sensors: 2 of 2 available

Bus Lines: 33 Bus Lines Found

Bus Line 12
Destin: NAU A ROVIZZANO + NUOVO PINONE

Bus Line 12
Destin: SORGANE + NUOVO PINONE

Bus Line 12
Destin: MAGENTA + STAZIONE VIA ALABANI

Get Events in the city

Regular Services | Transversal Services

Search text into service

Services Categories

Search Range: 500 mt

N. results for each: 500

Search Results

- Services: 410 of 410 available
- Bus Stops: 23 of 23 available
- Road Sensors: 2 of 2 available

Bus Lines: 33 Bus Lines Found

Bus Line 12
Destin: NAU A ROVIZZANO + NUOVO PINONE

Bus Line 12
Destin: SORGANE + NUOVO PINONE

Bus Line 12
Destin: MAGENTA + STAZIONE VIA ALABANI

Search in an area

Regular Services | Transversal Services

Search text into service

Services Categories

Search Range: 500 mt

N. results for each: 200

Search Results

- Services: 2231 of 2231 available
- Bus Stops: 13 of 13 available
- Road Sensors: 2 of 2 available

Bus Lines: 72 Bus Lines Found

Bus Line 12
Destin: NAU A ROVIZZANO + NUOVO PINONE

Bus Line 12
Destin: SORGANE + NUOVO PINONE

Bus Line 12
Destin: MAGENTA + STAZIONE VIA ALABANI

Get weather forecast

Regular Services | Transversal Services

Search text into service

Services Categories

Search Range: 500 mt

N. results for each: 200

Search Results

- Services: 2231 of 2231 available
- Bus Stops: 13 of 13 available
- Road Sensors: 2 of 2 available

Bus Lines: 72 Bus Lines Found

Bus Line 12
Destin: NAU A ROVIZZANO + NUOVO PINONE

Bus Line 12
Destin: SORGANE + NUOVO PINONE

Bus Line 12
Destin: MAGENTA + STAZIONE VIA ALABANI

Get Real Time data (public busses, car par sensors, traffic flows)

Regular Services | Transversal Services

Search text into service

Services Categories

Search Range: 500 mt

N. results for each: 200

Search Results

- Services: 2231 of 2231 available
- Bus Stops: 13 of 13 available
- Road Sensors: 2 of 2 available

Bus Lines: 72 Bus Lines Found

Bus Line 12
Destin: NAU A ROVIZZANO + NUOVO PINONE

Bus Line 12
Destin: SORGANE + NUOVO PINONE

Bus Line 12
Destin: MAGENTA + STAZIONE VIA ALABANI

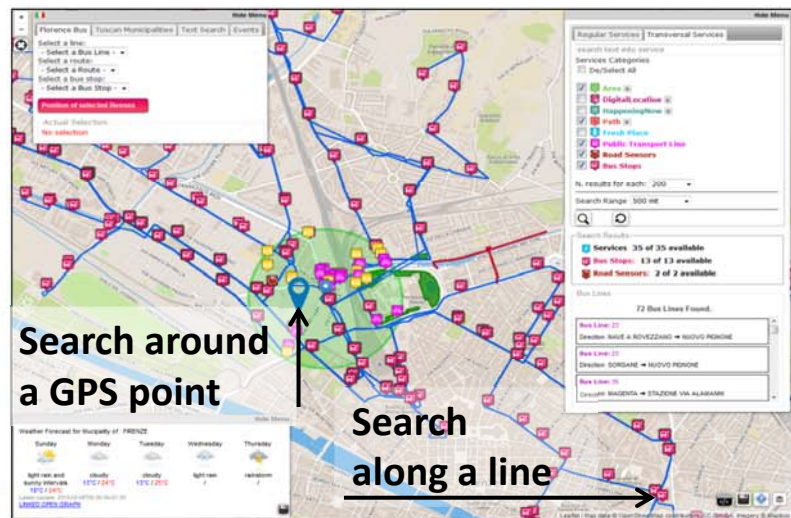


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ServiceMap Dev Tool

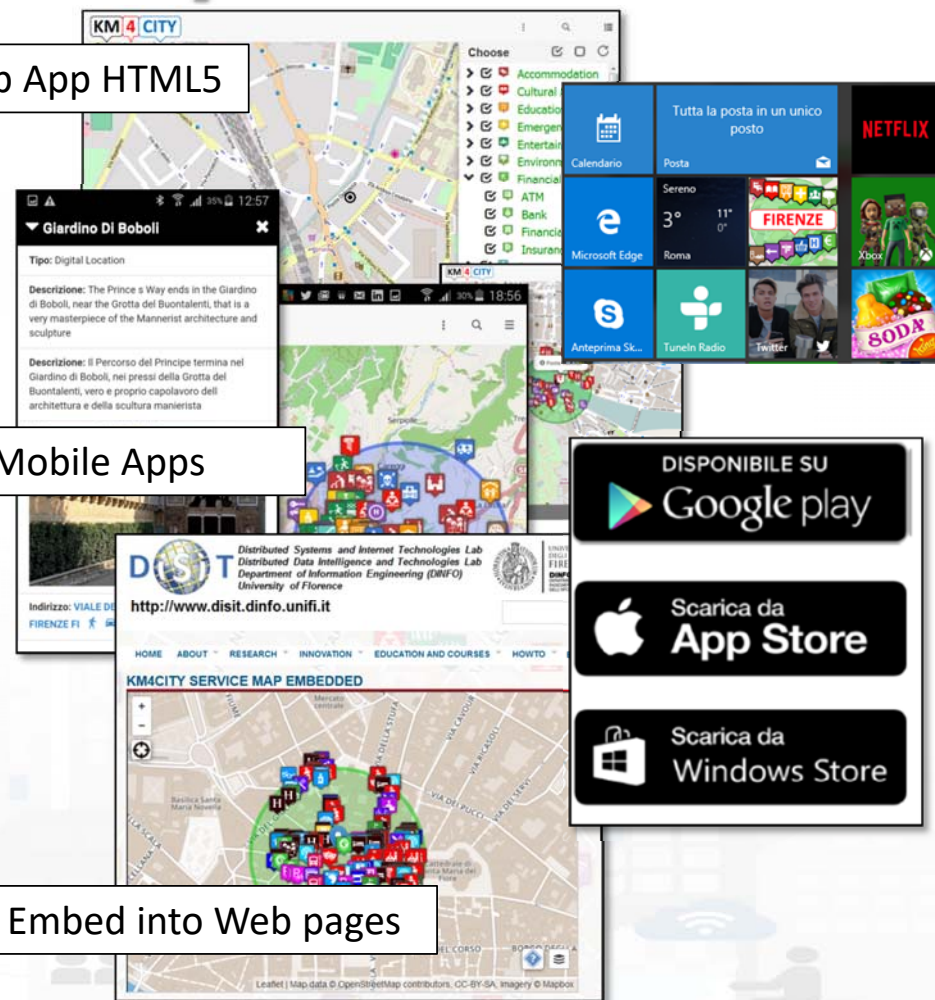


Smart City API call generation

Web App HTML5

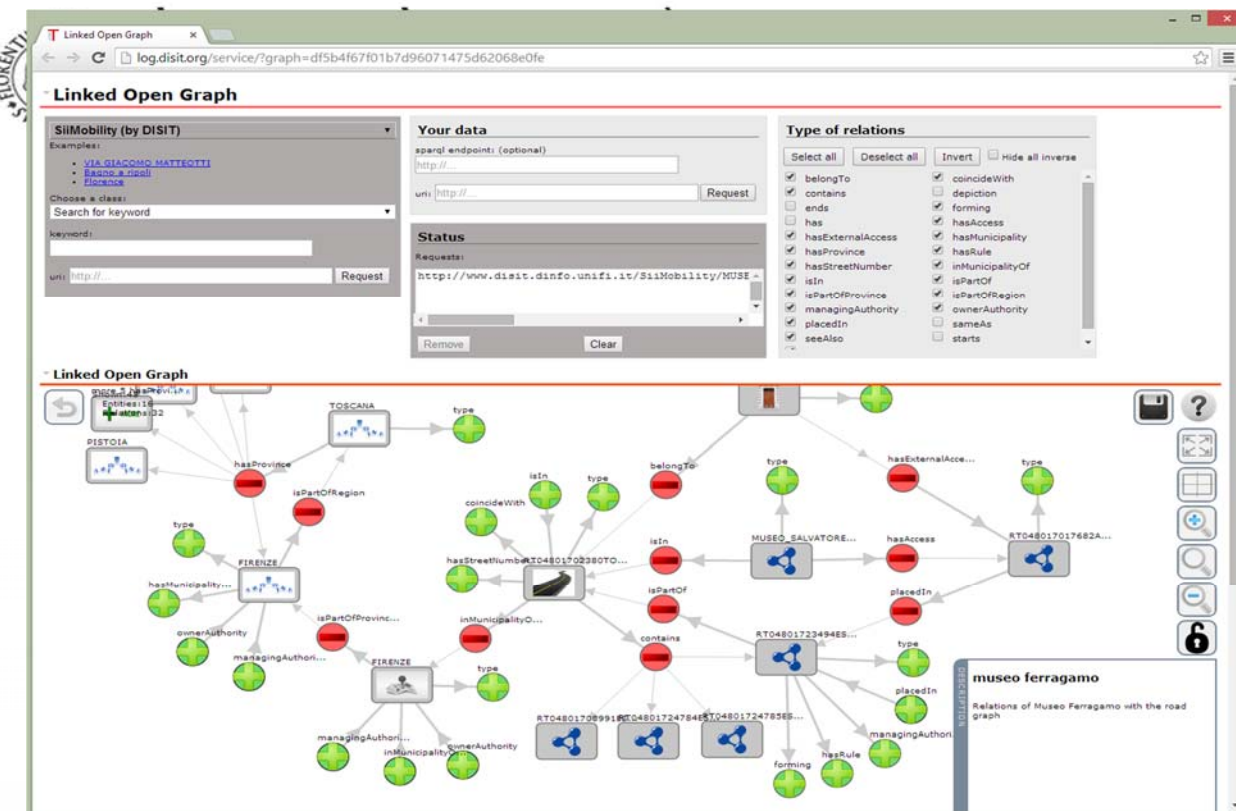
Mobile Apps

Embed into Web pages



DISIT lab, 15 August 2017

<http://www.disit.org/6873>

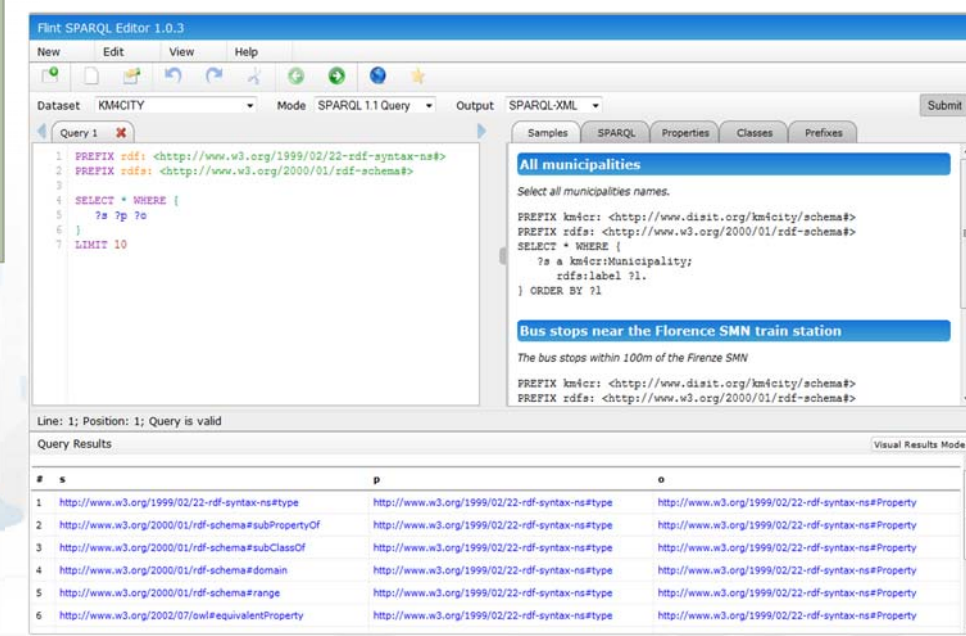


Browsing the knowledge base
Linked Open Graph
<http://log.disit.org>



Querying the knowledge base in SPARQL

<http://log.disit.org/spqlquery/>



Using and Contributing to Km4City



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Km4City Roadmap



SELECT
for Cities

Snap4City

- IOT/IOE
- Monitoring
- Smart City IOT integration
- Living Lab

5G

Smart City vs
IOT, Industria 4.0

6/2018

11/2018

Already Planned
up to 2021

- waste
- Territorial areas and paths
- Health, Bike sharing
- Statistics, Energy, ICT, ...
- E-vehicles

- Risk analysis
- Environmental, water
- Data Licensing models
- Energy Meters
- Fi-Ware compliant



- More Sensors, IOE, IOT
- Dashboard Builder
- Territorial areas and paths
- User Engagement
- Mobility and transport
- Resilience Decision Support

GHOST SIR
2016-2019 - Started



12/2017
WEEE
2017-2020

6/2017

RESilience management guidelines
and Operationalization applied to
Urban Transport Environment

Km4City 1.5
- SmartDS
- Km4City App

RESOLITE H2020
2015-2018 - Started



Sii-Mobility SCN
2016-2018 - Started
Km4City 1.6.2

2016

REPLICATE H2020
2016-2021 - Started



- Suggestions on demand
- User Behaviour Analysis
- Trajectories and OD

2015

Km4City 1.4

- Embed
- More API
- iBeacon

API

Twitter Vigilance

Km4City 1.1

- Tuscany Map
- Services
- AVM
- Sensors
- Parking
- Cultural Heritage
- Enrichment cities
- Event in the city
- Digital Locations
- Fresh places

- <http://servicemap.km4city.org>
- <http://log.disit.org>
- <http://www.disit.org/fodd>
- <http://www.disit.org/tv>
- <http://smartds.km4city.org>

- Weather
- Cultural Heritage
- Energy recharge pillar
- Wi-Fi
- Events in the city

2014



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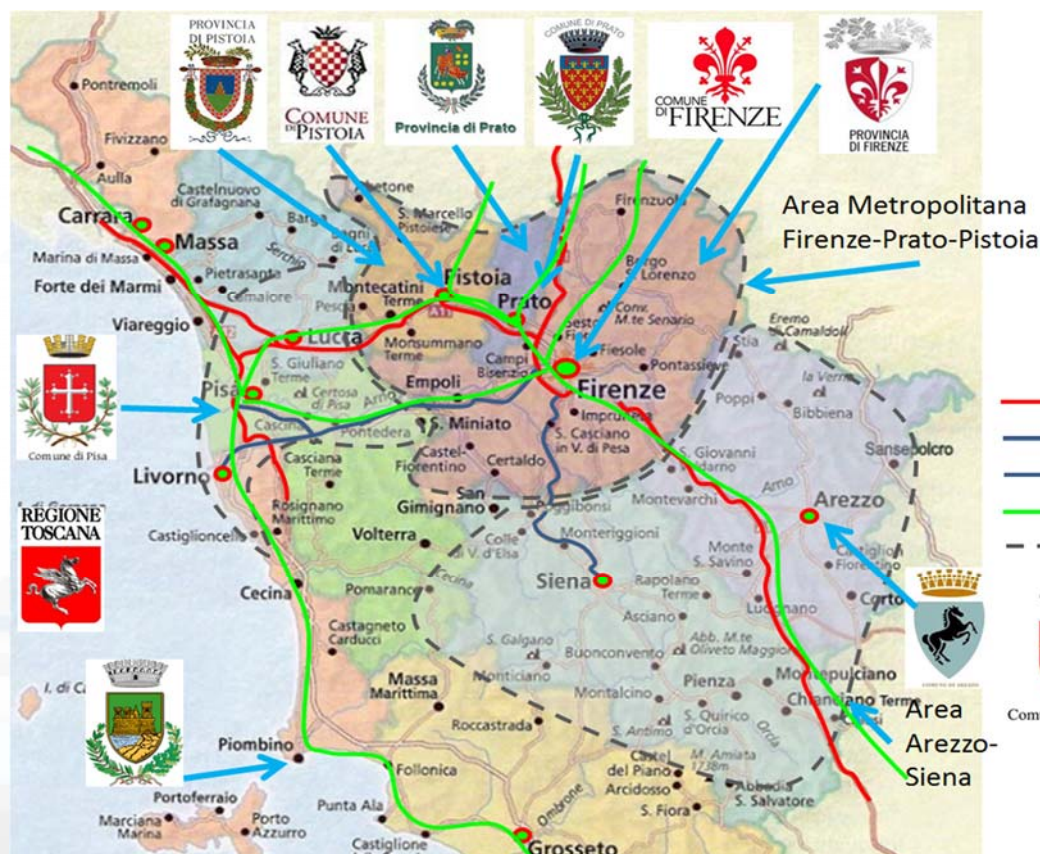
<http://www.disit.org>

Sii-Mobility

■ <http://www.Sii-Mobility.org>



- Experimentations and validation in Tuscany
- Integration with present central station and subsystems
- DISIT lab, Università di Firenze, is the tech-scientific coordinator



- Autostrade
- SS Fi-Pi-Li
- SS Fi-Si
- Ferrovie (primarie)
- Aree

ECM; Swarco Mizar;
Inventi In20; Geoin;
QuestIT; Softec; T.I.M.E.;
LiberoLogico; MIDRA
(autostrade, motorola);
ATAF; Tiemme; CTT
Nord; BUSITALIA;
A.T.A.M.; Effective
Knowledge; eWings;
Argos Engineering; Elfi;
Calamai & Agresti;
Project; Negentis



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Sii-Mobility



MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA



<http://www.Sii-Mobility.org>

Commenti dei cittadini,
Social Media



AVM trasporto
Pubblico



Sensori,
sistema monitoraggio



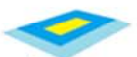
Merci



Sensori su
trasporto Privato



Sensori
Parcheggi



Monitoraggio
traffico, autostrade



Rete
Ferroviaria

Parametri
ambientali

Servizi ed
enti

Ordinanze: eventi,
lavori pubblici, .

Emergenze,
polizia, 118



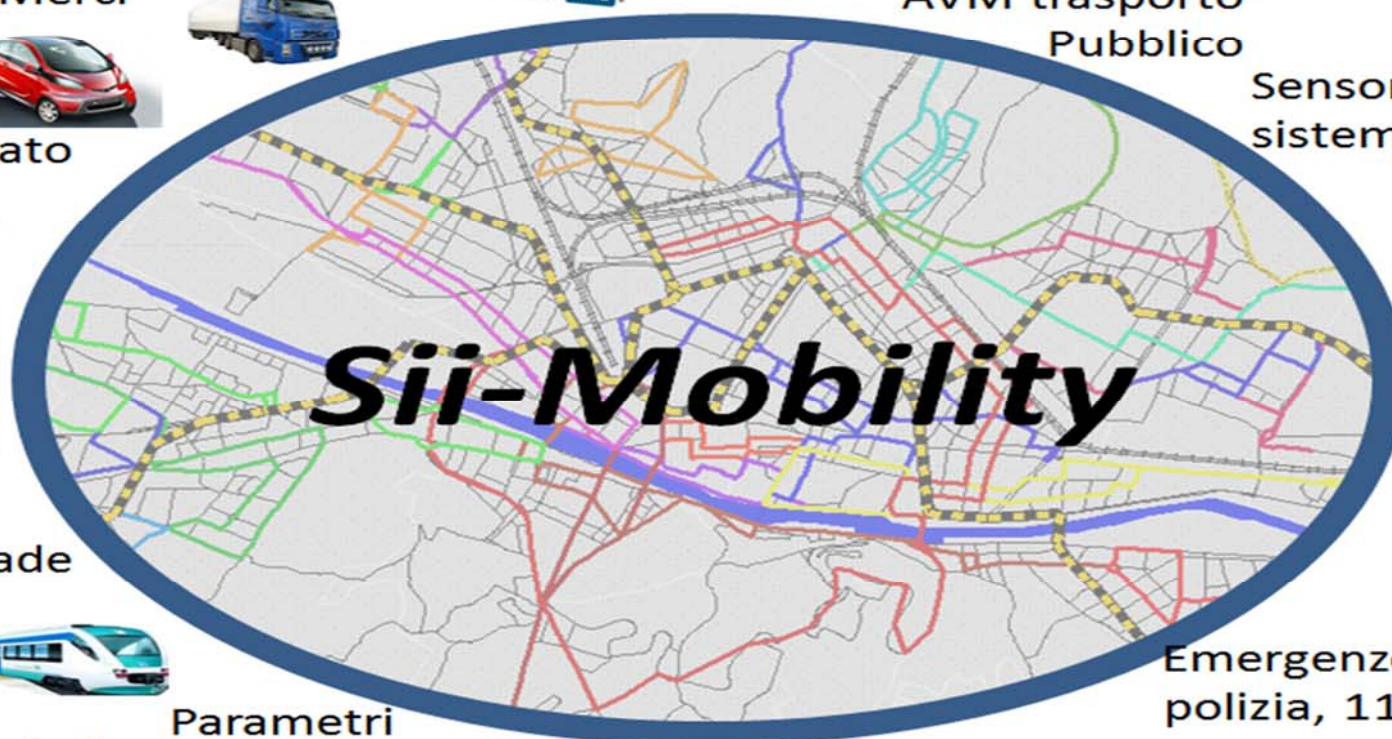
UTC



Infomobility



Varchi
Telematici, ZTL



Sii-Mobility





General Objectives

■ <http://www.Sii-Mobility.org>



- Reduce the social costs of mobility
 - minor inconvenience,
 - greater efficiency,
 - greater sensitivity to the needs of the citizen,
 - lower emissions,
 - better environmental conditions;
 - info-training programs to help city user in getting virtuous habits;
 - reduce transportation costs and travel times for users, for operators and administrations,
 - optimization solutions.
- **Testing on municipalities and provinces of Tuscany**
- **Contribute to the improvement of national and international standards**
- **simplify the use of mobility systems**
 - innovative sensors for AVM and private transport on the territory
 - integrated systems for payment and identification
 - driving / offline routing solutions
 - connect the drive, smart drive or walk
 - Integration of data from operators and different type sources
 - advanced management of resources measurement of flows realization of sensors, actuators

Principali Delibere su Sii-Mobility



PA	Tipo di atto
Provincia di Prato	Delibera di Giunta n.267 del 30.10.2012
Comune di Prato	Delibera di Giunta n.474 del 30.10.2012
Provincia di Firenze	Delibera di Giunta n.147 del 06.11.2012
Comune di Firenze	Delibera di Giunta n.403 del 06.11.2012
Provincia di Pistoia	Delibera di Giunta n.156 del 08.11.2012
Comune di Pistoia	Delibera di Giunta n.321 del 08.11.2012
Comune di Pisa	Delibera di Giunta n.203 del 06.11.2012
Comune di Arezzo	Delibera di Giunta n.498 del 07.11.2012
Regione Toscana	Delibera di Giunta n.249 del 15.04.2013

■ <http://www.Sii-Mobility.org>



Horizon 2020
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<http://www.resolute-eu.org>

- Develop European Resilience Management Guidelines (ERMG)
 - Develop a conceptual framework for creating/maintaining Urban Transport Systems
- Enhance resilience through improved support of human decision making processes, particularly by training professionals and civil users on the ERMG and the RESOLUTE system
- Operationalize and validate the ERMG by implementing the RESOLUTE Collaborative Resilience Assessment and Management Support Systems (CRAMSS) for Urban Transport Systems addressing Road and Urban Rail Infrastructures
 - Pilots in Florence and Athens
- Adoption of the ERMG at EU and Associated Countries level

University of Florence: DISIT lab DINFO (Proj coordinator), DISIA and DST	UNIFI	IT
THALES	THALES	IT
ATTIKOMetro	ATTIKO	GR
Comune di Firenze	CDF	IT
Centre for Research and Technology Hellas	CERTH	GR
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	FHG	DE
HUMANIST	HUMANIST	FR
SWARCO Mizar	SWMIZ	IT
Associação para o Desenvolvimento da Investigação no Instituto Superior de Gestão	ADI-ISG	PT
Consorzio Milano Ricerche	CMR	IT

RESOLUTE Architecture

RESOLUTE RESILIENCE Dashboard

Presentation & Visualization

User guidance

RESOLUTE Mobile APPs

FRAM → ResilienceDS

CRAMSS

FRAM operationalization

ITS DSS

Smart DS

Evacuation DSS

Decision support system

Application framework

Algorithms and models

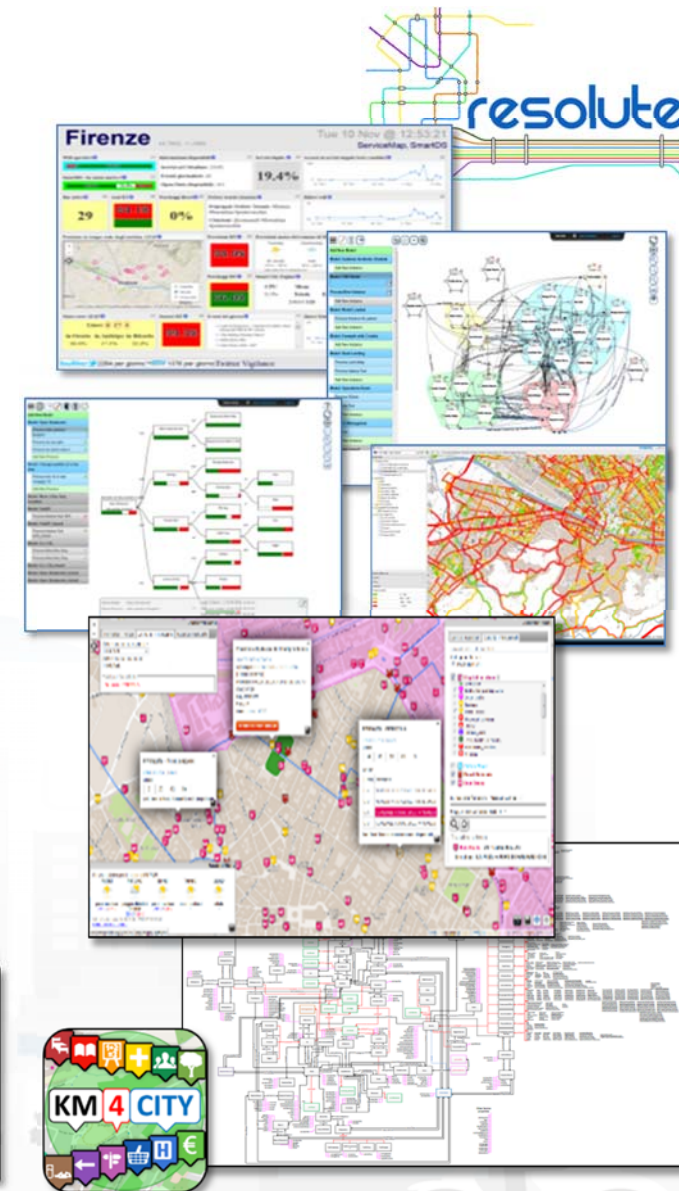
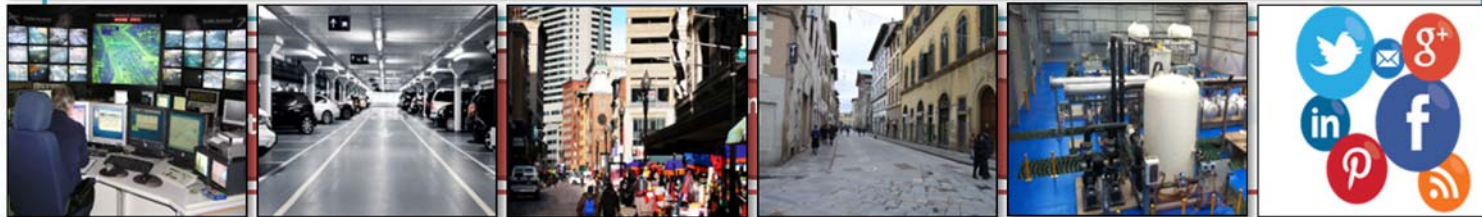
Data Integration APIs

User Profiler APIs

User profiler

Integration framework

Data and Service Aggregator





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Horizon 2020
European Union Funding
for Research & Innovation

REnaissance of PLaces
with Innovative Citizenship
And TEchnology

<http://replicate-project.eu/>

- demonstrate Smart City technologies in energy, transport and ICT in districts in:
 - San Sebastian, Florence and Bristol,
 - follower cities of Essen, Nilufer and Lausanne
- Cities are the customer: considering local specificities
- Solutions must be replicable, interoperable and scalable.
 - Integrated Infrastructure: deployment of ICT architecture, from internet of things to applications
 - Low energy districts
 - Urban mobility: sustainable and smart urban services

- **1 (coordinator) FOMENTO DE SAN SEBASTIAN FSS SPAIN**
- **2 AYUNTAMIENTO DE SAN SEBASTIAN SAN SEBASTIAN SPAIN**
- **3 COMUNE DI FLORENCE FLORENCE ITALY**
- **4 BRISTOL COUNCIL BRISTOL UNITED KINGDOM**
- **5 STADT ESSEN ESSEN GERMANY**
- **6 NILUFER BELEDIYESI NILUFER TURKEY**
- **7 VILLE DE LAUSANNE LAUSANNE SWITZERLAND**
- **8 IKUSI ANGEL IGLESIAS, S.A. IKUSI SPAIN**
- **9 ENDESA ENERGÍA, S.A. ENDESA SPAIN**
- **10 EUROHELP CONSULTING, S.L. EUROHELP SPAIN**
- **11 ILUMINACION INTELIGENTE LUIX, S.L. LUIX SPAIN**
- **12 FUNDACION TECNALIA RESEARCH & INNOVATION TECNALIA SPAIN**
- **13 EUSKALTEL, S.A. EUSKALTEL SPAIN**
- **14 COMPAÑÍA DEL TRANVÍA DE SAN SEBASTIÁN DBUS SPAIN**
- **15 CONSIGLIO NAZIONALE DELLE RICERCHE CNR ITALY**
- **16 ENEL DISTRIBUZIONE, SPA ENEL ITALY**
- **17 MATHEMA, SRL MATHEMA ITALY**
- **18 SPES CONSULTING SPES ITALY**
- **19 TELECOM ITALIA, SPA TELECOM ITALY**
- **20 UNIVERSITA DEGLI STUDI DI FLORENCE UNIFI ITALY: DINFO.DISIT Lab and DIF**
- **21 THALES ITALIA, SPA THALES ITALY**
- **22 ZABALA INNOVATION CONSULTING ZABALA SPAIN**
- **23 TECHNOMAR TECHNOMAR GERMANY**
- **24 UNIVERSITY OF BRISTOL UOB UNITED KINGDOM**
- **25 UNIVERSITY OF OXFORD UOXF UNITED KINGDOM**
- **26 BRISTOL IS OPEN, LTD BIO UNITED KINGDOM**
- **27 ZEETTA NETWORKS ZEETTA UNITED KINGDOM**
- **28 KNOWLE WEST MEDIA CENTRE, LGB KWMC UNITED KINGDOM**
- **29 TOSHIBA RESEARCH EUROPE, LTD TREL UNITED KINGDOM**
- **30 ROUTE MONKEY, LTD ROUTE MONKEY UNITED KINGDOM**
- **31 ESOTERIX SYSTEMS, LTD ESOTERIX UNITED KINGDOM**
- **32 NEC LABORATORIES EUROPE, LTD NEC UNITED KINGDOM**
- **33 COMMONWHEELS CAR CLUB CIC CO-WHEELS UNITED KINGDOM**
- **34 UNIVERSITY OF THE WEST OF ENGLAND UWE UNITED KINGDOM**
- **35 ESADE BUSINESS SCHOOL ESADE SPAIN**
- **36 SISTELEC SOLUCIONES DE TELECOMUNICACION, S.L. SISTELEC SPAIN**



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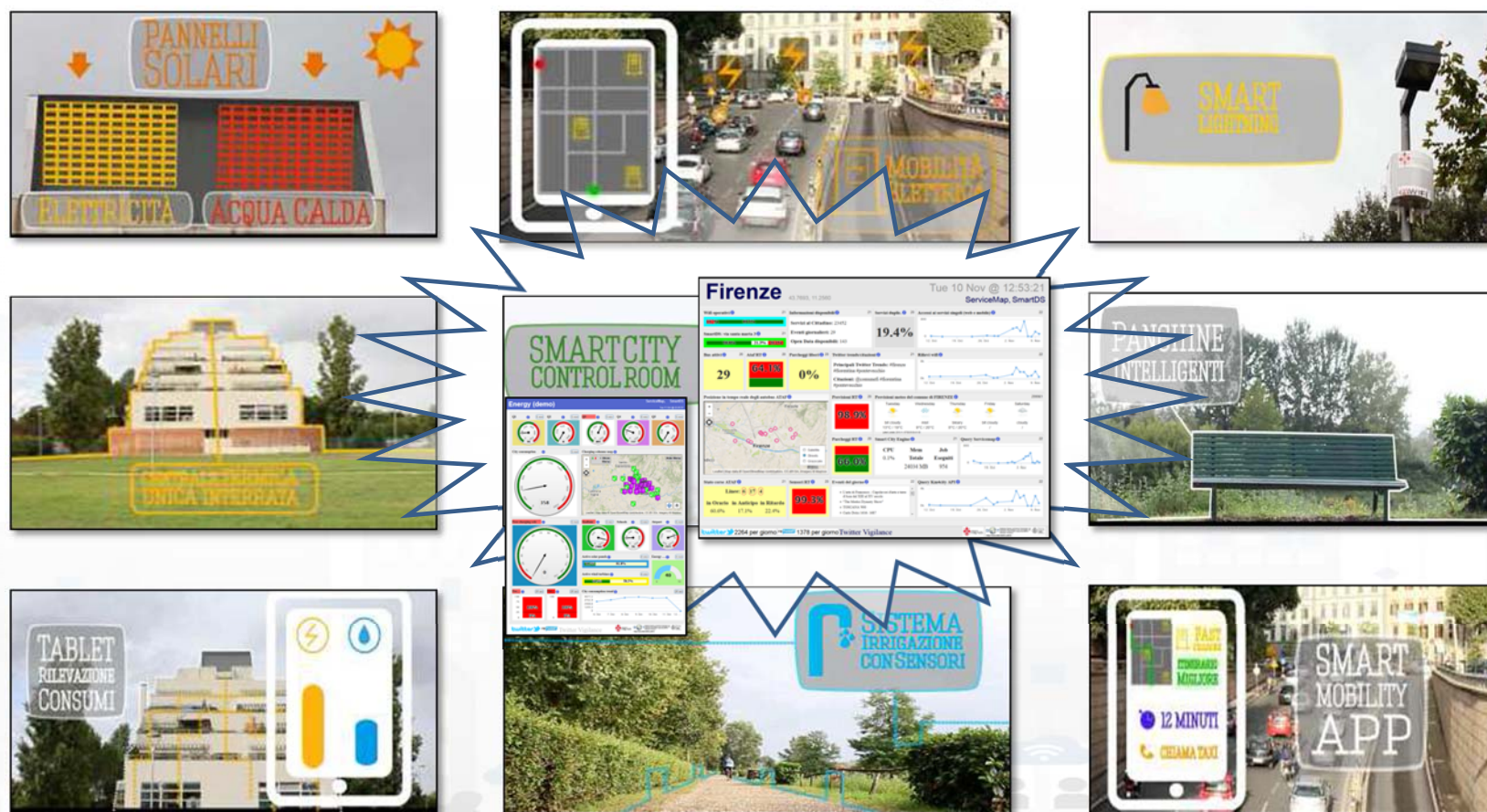
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<http://www.disit.org>



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REPLICATE in Firenze: Energy, ICT & Mobility



<http://replicate-project.eu/>

DISIT lab, 15 August 2017



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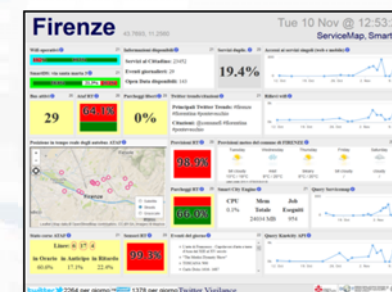


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DISIT Lab actions for REPLICATE

- **Integrated infrastructure: aggregation model and urban platform**
 - Adoption of Km4City solutions and tools as starting point
 - Improvements of Km4City ontology, by adding:
 - energy, sustainable mobility, dashboarding, urban services, IOT of several kind
 - Improving Smart City API, providing support for:
 - Above mentioned domains in addition to those of Km4City for developing energy based APPs REPLICATE
- Developing and putting in place a **dashboard** system and development tool



<http://replicate-project.eu/>

DISIT lab, 15 August 2017



e-distribuzione



Transport systems
Mobility, parking



Public Services
Govern, events,



Sensors, IOT
Cameras, ..



Environment,
Water, energy



Shops, services,
operators



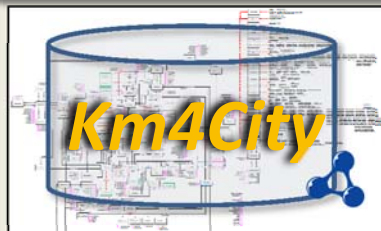
**Twitter
Vigilance**

Static, slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud

[Http://www.km4city.org](http://www.km4city.org)

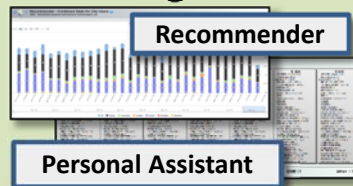
Km4City Smart City Engine



Big Data Analytics



Smartening Tools



Development Tools



Km4City Smart City API

Tools for City Operators and Decision Makers

Smart City Dashboard

[Http://dashboard.km4city.org/](http://dashboard.km4city.org/)

Smart Decision Support

[Http://Smartds.km4city.org](http://Smartds.km4city.org)

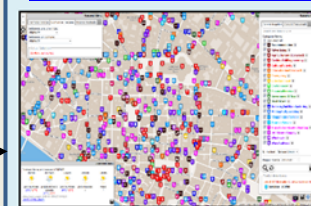


ServiceMap browser

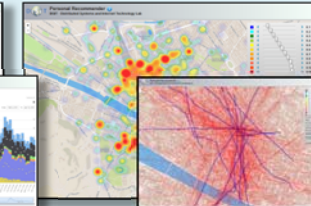
[Http://servicemap.km4city.org](http://servicemap.km4city.org)

Twitter Vigilance

[Http://www.disit.org/tv](http://www.disit.org/tv)



Analizers of City User Behavior



Tools for Final Users

Mobile e Web Apps

[Http://www.km4city.org/webapp](http://www.km4city.org/webapp)



[Http://www.km4city.org/app](http://www.km4city.org/app)



<http://replicate-project.eu/>



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Governing the smart city: a gOvernance-centred approach to SmarT urbanism – GHOST



General Objectives

- Offer a comprehensive framework for measuring and reassessing urban smart development and related rankings
- Critical assessment of Smart City ranking index existence
- Definition of an enabling technology supporting the action plans for strengthening multi-level place-based governance, applied in the tourism context
- Definition of strategies for good smart governance, with the purpose of providing recommendations to start or implement an institutional and development process leading towards smart city governance.

Partners:

University of Cagliari (Coordinator) DICAAR and DMI

University of Florence SAGAS and DISIT

University of Turin ESOMAS

University of Sassari DADU

Under the patronage of the Municipality of Cagliari



Duration: 23/09/2015 - 23/09/2018

<http://sites.unica.it/ghost>

City Resilience and, DSS, Decision Support Systems

<http://www.km4city.org/?controlRoom>

<http://www.km4city.org/?devTools>

<http://www.km4city.org/?infoDocs>

<http://www.km4city.org/?app>



Improve city resilience, reducing risks and decision support

- assessing city resilience level
- improving city resilience, providing objective hints
- improving city users awareness with personal city assistants and participatory tools



Problems and issues

- Cities include critical infrastructures strongly related / depended each other:
 - Transport, energy, communication, cyber, health...
- Risks for these Critical Infrastructure (safety and security) may be due to natural and/or human made events.
- UTS, Urban Transport System, is one of the most challenging since UTS is the via by which many problems may propagate but also the path used by solutions and the recovery actions.





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<http://www.disit.org>

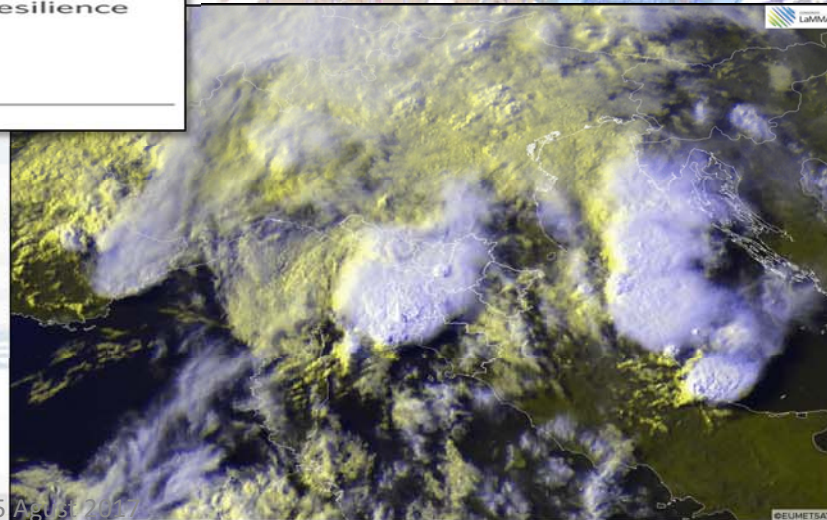
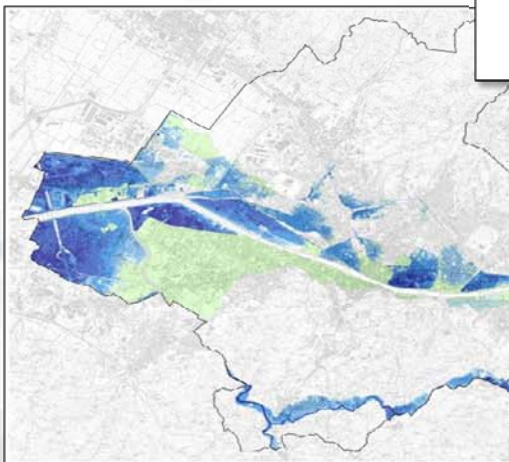
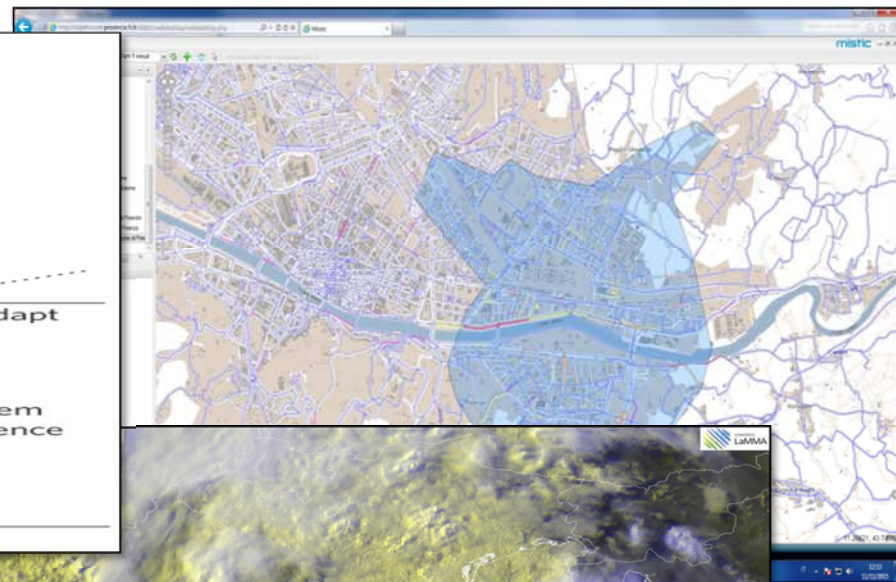
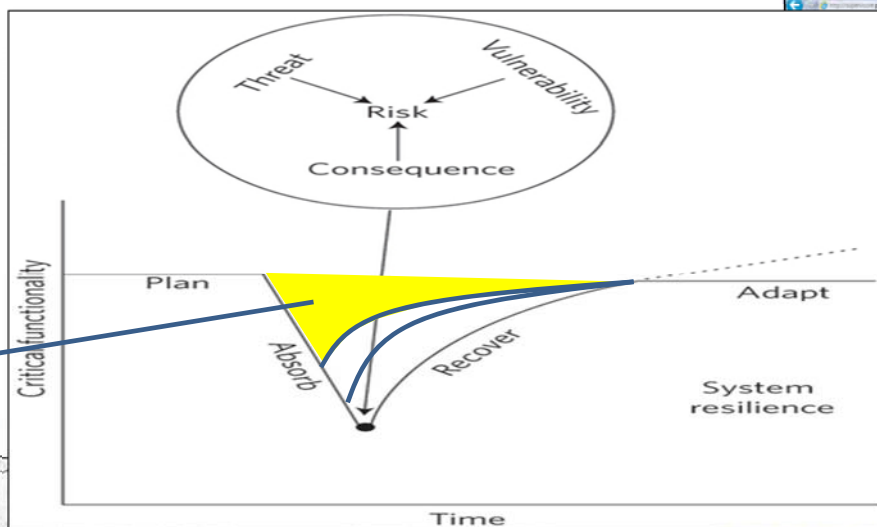
City Resilience



Early warning, detection

Prepare
Absorb
Recover
Adapt

damage





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City Resilience

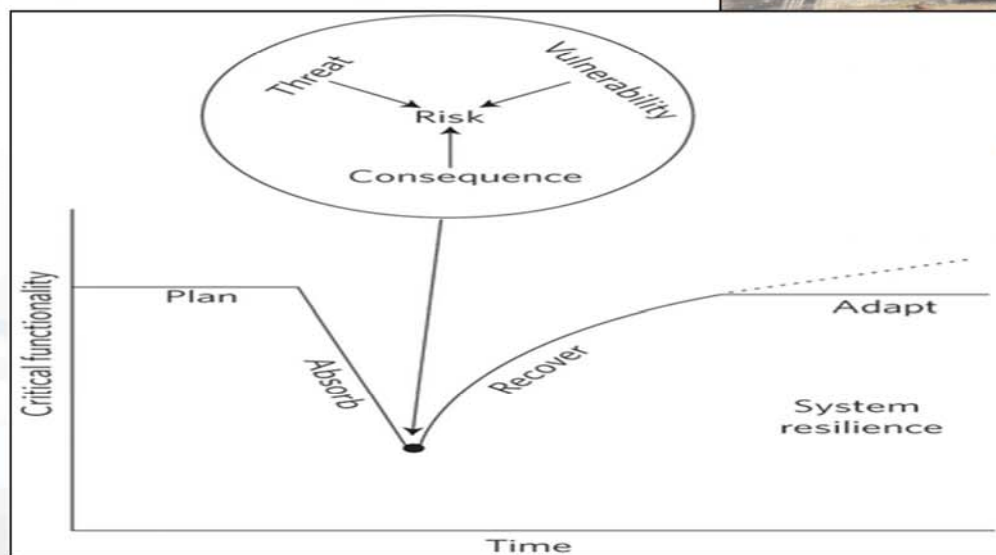
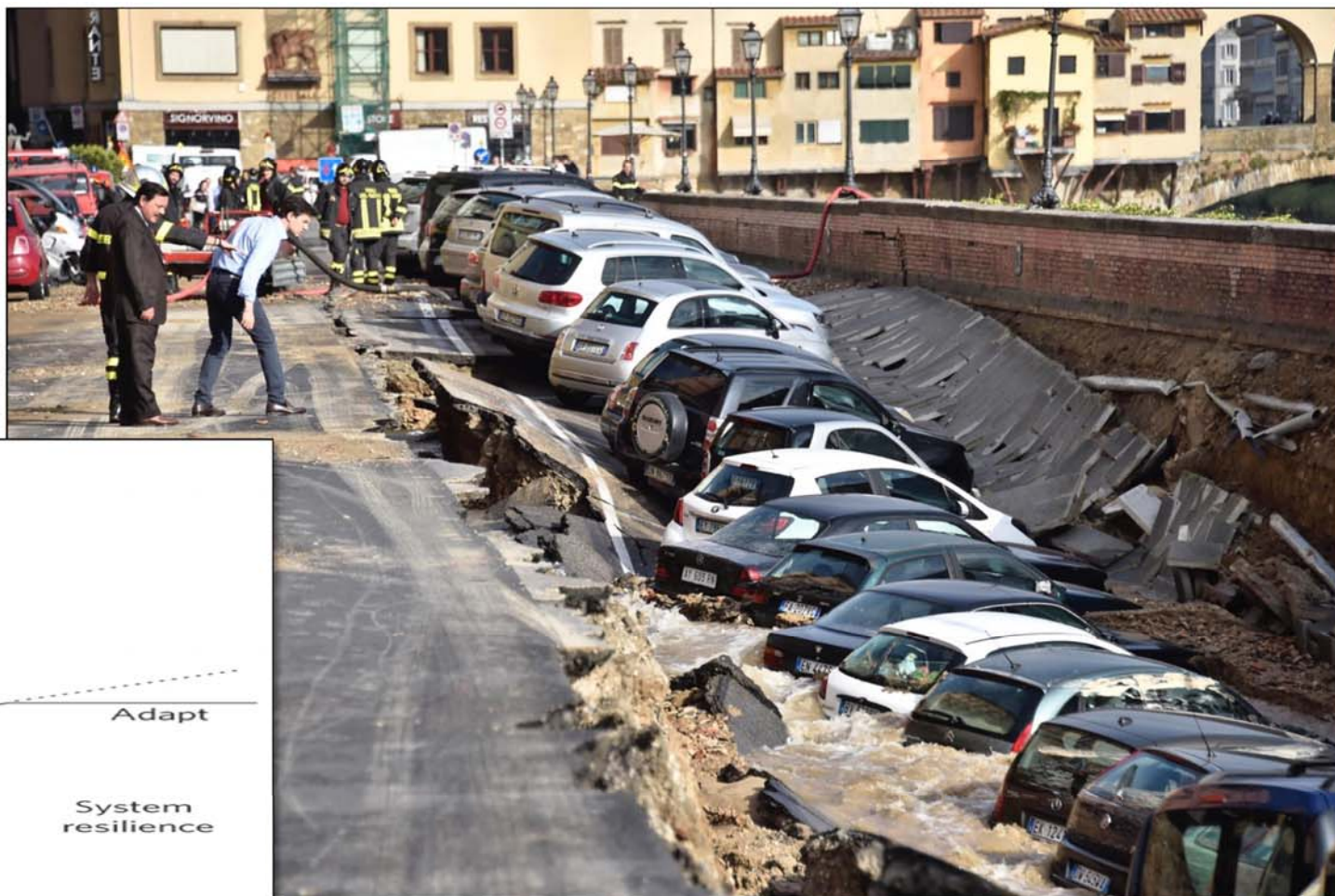


Prepare

Absorb

Recover

Adapt

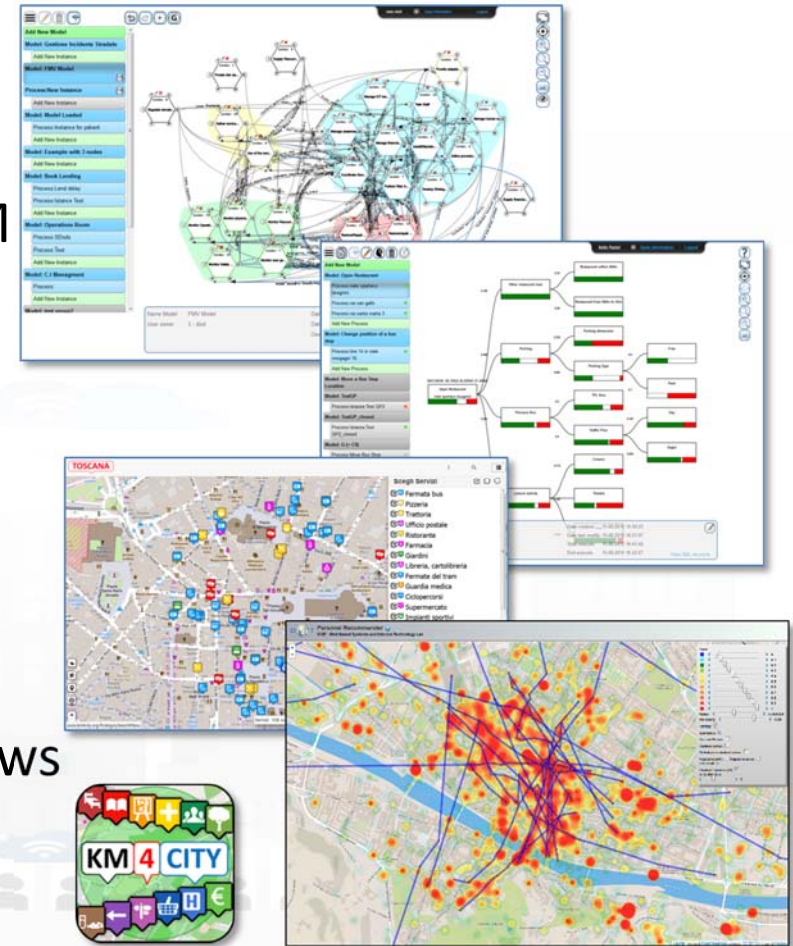


ab, 15 Aug 2017

Main Approach



- Three main layers
- Complex System modeling: function, processes, resources, time, events, etc..
 - Functional Resonance Analysis Method, FRAM
 - Resilience Analysis Grid, RAG
- Decision Support System, DSS
 - System Thinking, Goal Models
 - Risk analysis
 - UTS/ITS decision supports
- Data, big data access and exploitation
 - Data Analytics, Internet of Things, sensors, flows
 - People flow and behavior
 - Social Media

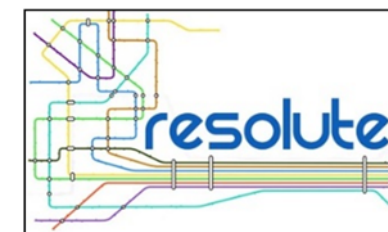




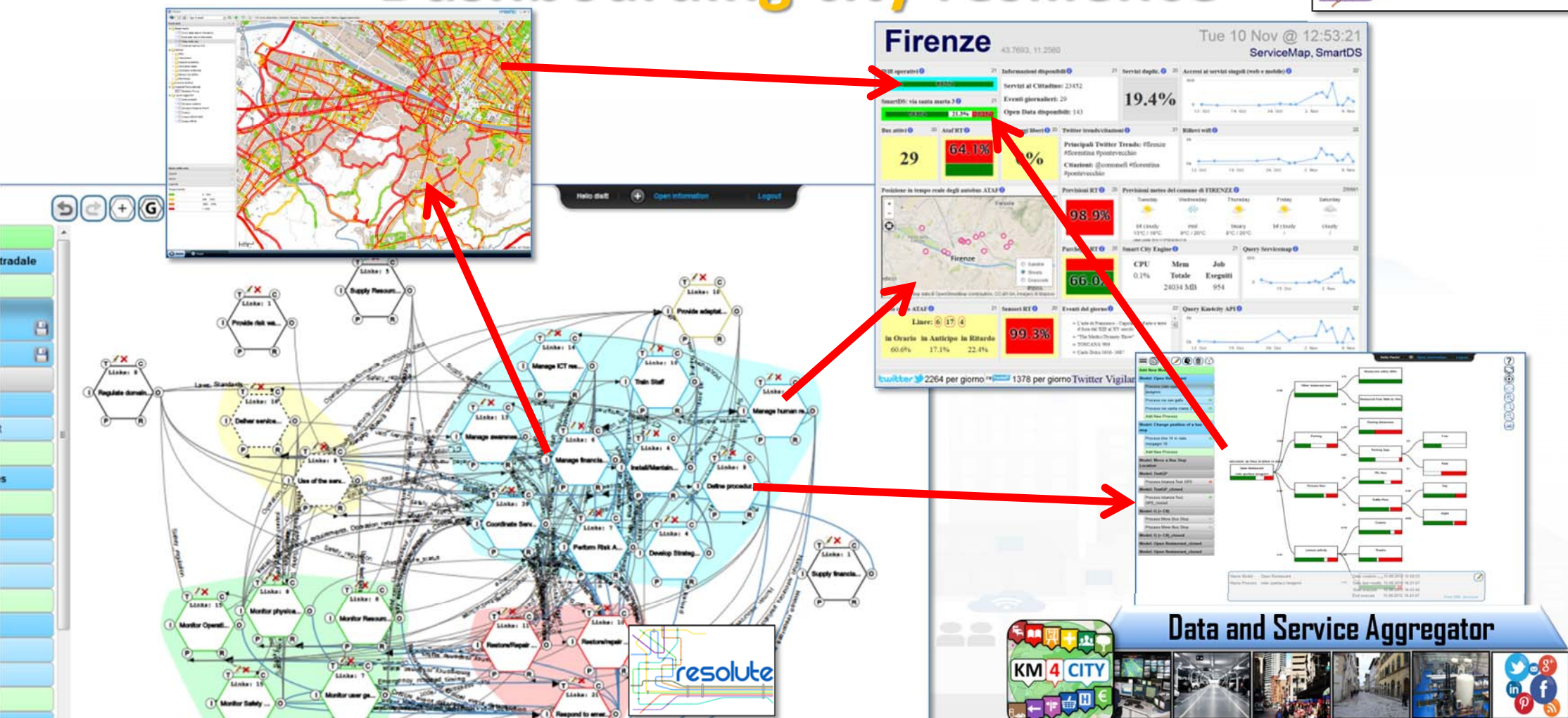
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Dashboarding city resilience





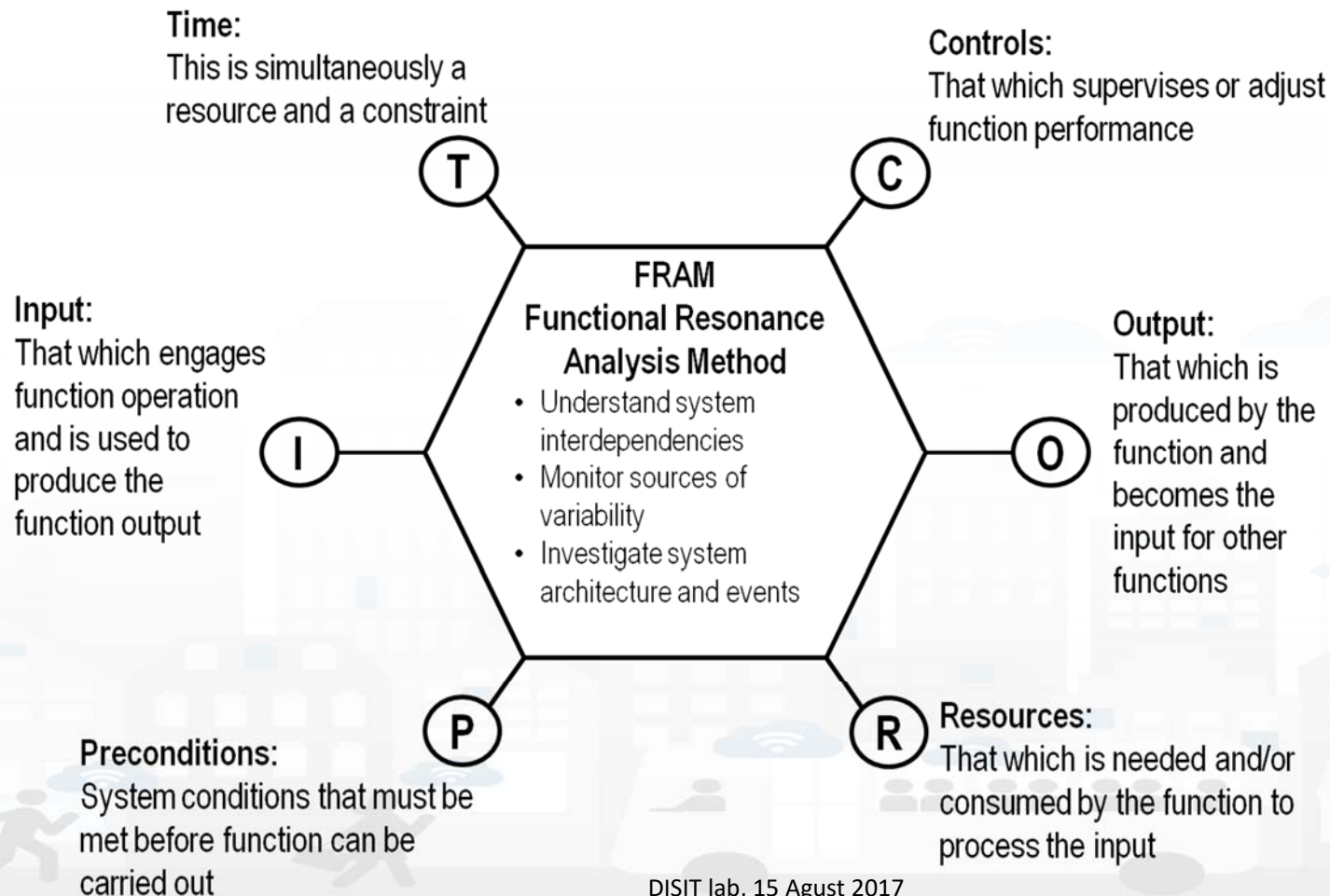
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Functional Resonance Analysis Method



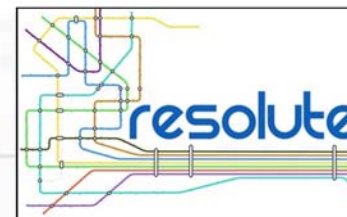
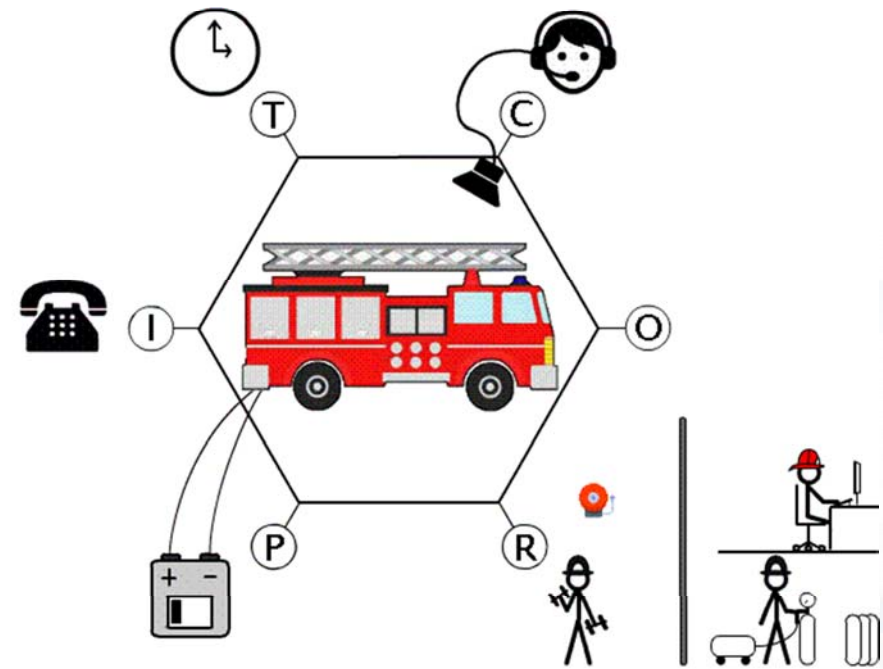
- Success and failure are equivalent in the sense that they both emerge from performance variability.
- Variability, intended as a way for people to adjust tools and procedures to match operating conditions.
- Emergence of either success or failure is due to unexpected combination of variability from multiple functions.
- The unexpected “amplified” effects of interactions between different sources of variability are at the origin of the phenomenon described by functional resonance.

Functional Resonance Analysis Method



- Success and failure are equivalent in the sense that they both emerge from performance variability.
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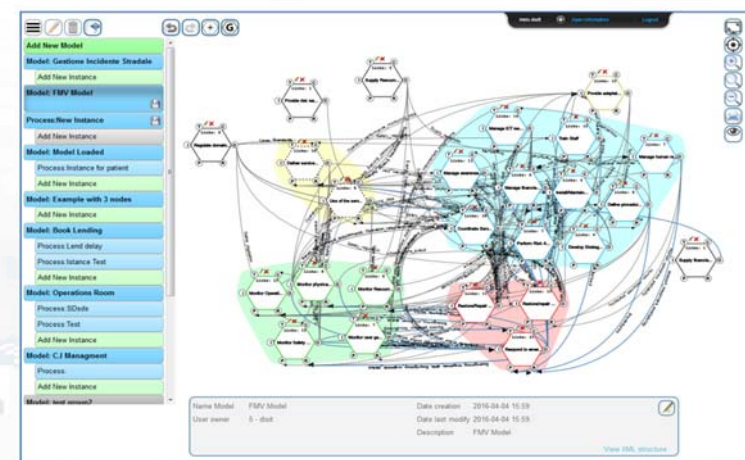
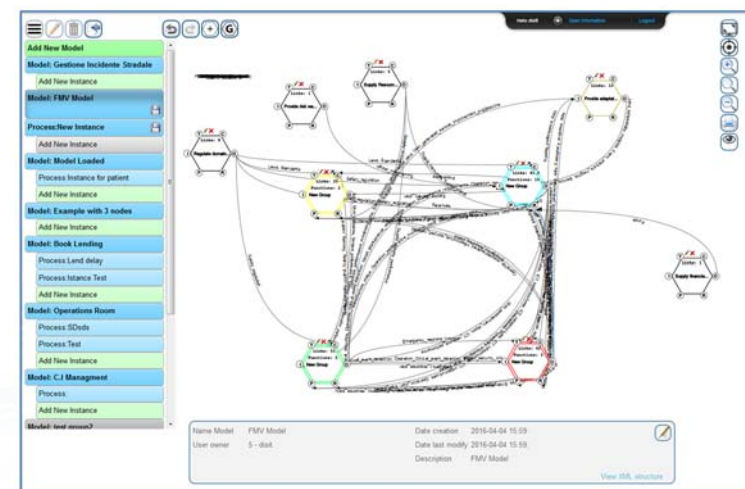
Functional Resonance Analysis Method



ResilienceDS tool

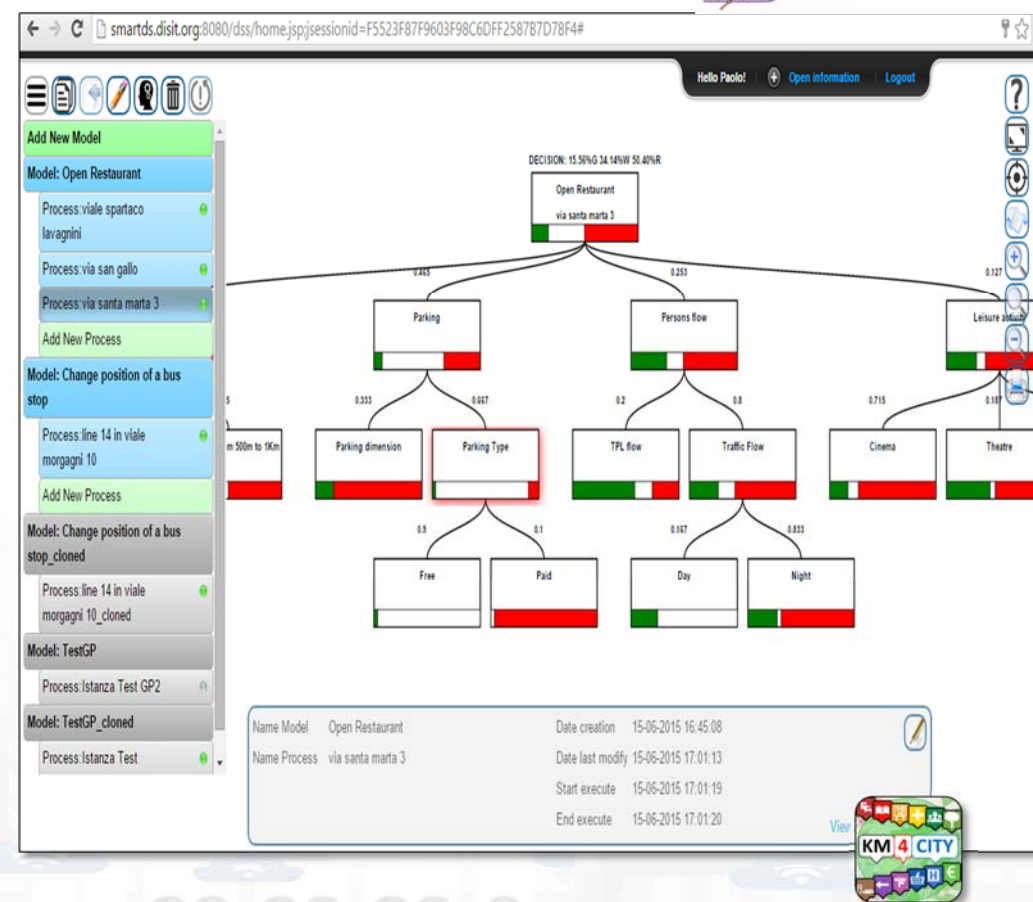


- FRAM Model
 - Macro FRAM processes
 - Metrics for Process complexity assessment
 - Operational Semantic for executing FRAM model
 - Connection with SmartDS
 - Connection with BigData open to multiple sources of data and workgroup results, Km4City
- Collaborative work
- Open for all
- Validated on ERMG
- Web Tool





- 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, ...



Risk Assessment



Flood Event | Flood Observation | Traffic Observation | Damage analysis | Layers panel | Vulnerability info | Service Observation

Aerial with labels

Flood sensors observations:

From	Date	mm/h
<input checked="" type="checkbox"/> Firenze Genio Civile	2016-04-11T15:59:00	12
<input checked="" type="checkbox"/> Firenze Peretola	2016-04-11T15:59:00	20.5
<input checked="" type="checkbox"/> Firenze Università	2016-04-11T15:59:00	10.5

Threshold: 1.0

From: 2016-01-01 00:00

To: 2016-07-29 00:00

Draw region to analyze: ☒ On

Load predefined region: Firenze

Mean precipitation: 14.333333333333334

GetObservations Analyze

Relevant Services

Min asset value: 90

Service	Street
<input checked="" type="checkbox"/> villa delle terme case di cura	VIALE MAZZINI GIUSEPPE, FIRENZE
<input checked="" type="checkbox"/> villa dei pini srl	VIA FOSCOLO UGO, FIRENZE
<input checked="" type="checkbox"/> Poggio Secco	VIA INCONTRI, FIRENZE

Service

NAME: villa maria teresa hospital...

ADDRESS: VIA DELLA CERNAIA, FIRENZE, FIRENZE

SERVICE TYPE: http://www.disit.org/km4city/schema#Public_hospital

SERVICE CLASS: <http://www.disit.org/km4city/schema#HealthCare>

SERVICE: <http://www.disit.org/km4city/resource/7ab1bc45b84357b727dd67fe6081d2db>

VALUE: 100

WKT DESCRIPTION: POINT (11.2561 43.7866)

Traffic observations:

From	Date	km/h	car/km	car/h
<input type="checkbox"/> VIA DELLA MATTONAIA	2016-10-10 18:01:08	58	15	2435
<input type="checkbox"/> LUNGARNO AMERIGO VESPUCCI	2016-10-10 18:01:08	18	65	1842
<input type="checkbox"/> VIA CAMILLO CAVOUR	2016-10-10 18:01:08	61	12	2009
<input type="checkbox"/> VIA VALFONDA	2016-10-10 18:01:08	27	53	3307
<input type="checkbox"/> VIA VITTORIO ALFIERI	2016-10-10 18:01:08	23	58	2798
<input type="checkbox"/> VIA SENESE	2016-10-10 18:01:08	27	54	3216
<input type="checkbox"/> VIA GUELFA	2016-10-10 18:01:08	68	3	420
<input type="checkbox"/> VIA DELLA SCALA	2016-10-10 18:01:08	60	13	2167
<input type="checkbox"/> PIAZZA DI SAN FELICE	2016-10-10 18:01:08	62	10	1697
<input type="checkbox"/> BORGO SAN FREDIANO	2016-10-10 18:01:08	57	17	2690
<input type="checkbox"/> VIA VITTORIO ALFIERI	2016-10-10 18:01:08	10	74	195
<input type="checkbox"/> VIA DEL CAMPUCCIO	2016-10-10 18:01:08	60	13	2157
<input type="checkbox"/> VIA DEI BENCI	2016-10-10 18:01:08	22	59	2679
<input type="checkbox"/> PIAZZALE DI PORTA ROMANA	2016-10-10 18:01:08	64	8	1361

Assessing Risk

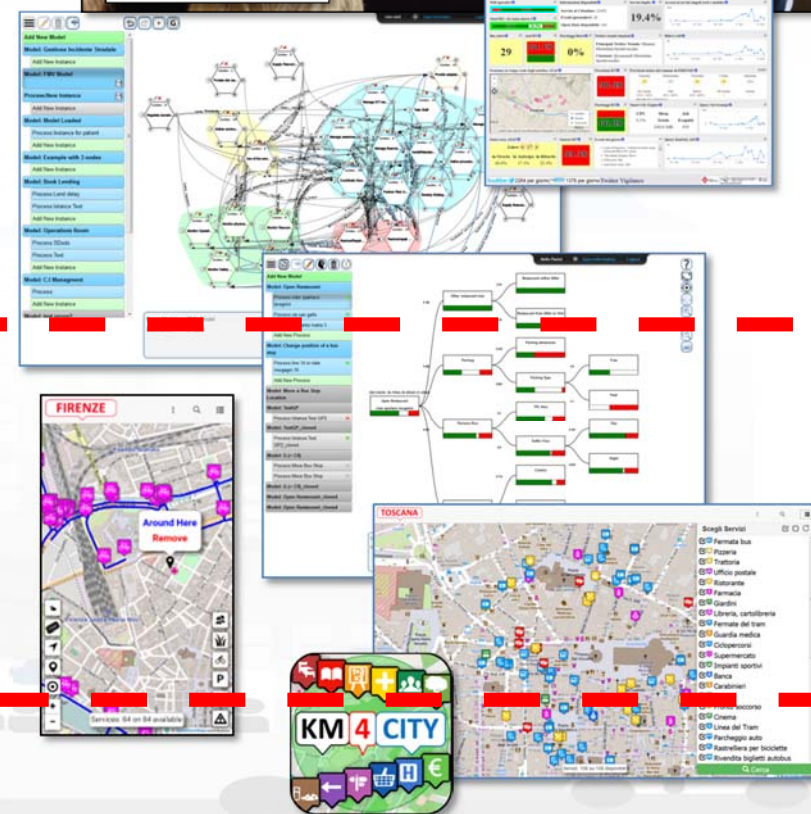
- hydraulic
- Seismic

KM 4 CITY

Type	Value
Public	100
Public	100
Public_hospital	100

Improve city resilience, reducing risks and decision support

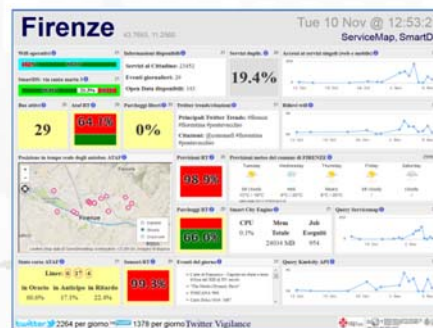
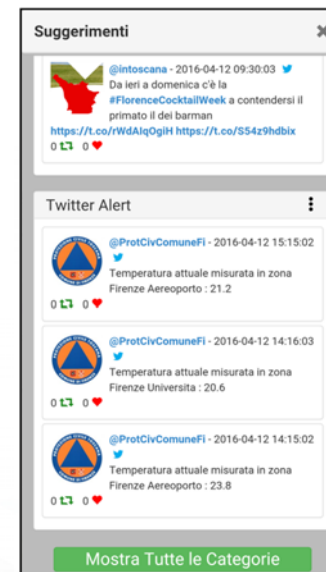
- assessing city resilience level
- improving city resilience, providing objective hints
- improving city users awareness with personal city assistants and participatory tools



Mobile Emergency



- Personalized menu for Operators
- Providing information and suggestions to citizens
 - Civil Protection Page
 - Twitter Info
 - Geolocalized Info
- Tracking people and operators flows
- Collecting information from citizens
 - Comments
 - Images



Info and Documents

<http://www.km4city.org/?infoDocs>



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DISIT lab, 15 August 2017



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Open Source



- **Km4City**, Sii-Mobility, RESOLUTE, REPLICATE: smart city big data open source tools. Km4City is a knowledge base and a research line of DISIT lab mainly developed before the start of Sii-Mobility, RESOLUTE, REPLICATE projects. While it has been mainly improved by them. Those projects are complementar each other and almost all of them use and contribute the Km4City research line. **ServiceMap smart city knowledge base tool**: smart city service tool (mainly developed for Sii-Mobility project) for accessing to km4city knowledge base, for service browsing and query, for **Smart City API** for mobile and for mobile development tool, <http://www.disit.org/km4city>
- **Km4City ontology model and files** are accessible from <http://www.disit.org/km4city> improved with the support of projects as Sii-mobility, REPLICATE and RESOLUTE
- **SCE, Smart City/Cloud Engine front end interface**, SCE is part of **DISCES** a Distributed SCE Scheduler Tools (SCE: Smart City/Cloud Engine), a DISIT tool for smart environments. It is currently in use in **Km4City** tools, and in **ICARO Cloud project and service, see CLOUD page. Developed for ICARO, and then improved for Sii-Mobility, and used in many other projects**
- **SCE, Smart City/Cloud Engine backend**, SCE is part of **DISCES** a Distributed SCE Scheduler Tools (SCE: Smart City/Cloud Engine), a DISIT tool for smart environments. It is currently in use in **Km4City** tools, and in **ICARO Cloud project and service, see CLOUD page. Developed for ICARO, and then improved for Sii-Mobility, and used in many other projects**
- **DIM-RIM**: Data Ingestion Manager and RDF Indexing Manager, **WEB page on DISIT lab with user manuals, DIM and RIM** area used in **Km4City** and tools, **Sii-Mobility** smart city national SCN project, **RESOLUTE H2020**
- **Dashboard Builder and executor**: a tool for creating dashboard for smart city. See Km4City example of dashboard as reported in <http://www.km4city.org/controlroomtools.html> for the documentation see <http://www.disit.org/6935> which is manual with examples regarding widgets. Developed for REPLICATE Project, and used in others as Sii-Mobility, RESOLUTE.
- **Sii-Mobility Dev Kit Mobile AppKm4city**: Open Source version of the Sii-Mobility mobile and web app, open modular (the full version is operative and accessible on all stores as "Firenze dove cosa", or "Toscana dove cosa", you can install from <http://www.km4city.org/app>). Developed for Sii-Mobility, adopted for the training and development meeting of the 24 january 2017, and as a basis for the Hackathon of 7-8 April 2017 in Florence.

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- Thanks to the European Commission for founding. All slides reporting logo of **REPLICATE H2020** are representing tools and research founded by European Commission for the REPLICATE project. **REPLICATE** has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement n° 691735).
- Thanks to the MIUR for co-founding and to the University of Florence and companies involved. All slides reporting logo of **Sii-Mobility** are representing tools and research founded by MIUR for the Sii-Mobility SCN MIUR project.
- Thanks to the European Commission for founding. All slides reporting logo of **Snap4City** <http://www.snap4city.org> of **Select4Cities H2020** are representing tools and research founded by European Commission for the **Select4Cities** project. **Select4Cities** has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement n° 688196)
- **Km4City** is an open technology exploited by those projects and line of research of DISIT Lab. Some of the innovative solutions and research issues developed into the above mentioned projects are also compliant and contributing to the Km4City approach and thus are contributing to the open Km4City model of DISIT lab.





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Open Urban Platform: Technical View 2018

<http://www.disit.org/km4city>

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