UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Km4City: the Urban Platform for Sentient Cities

http://www.disit.org

www.Km4City.org

Paolo Nesi, paolo.nesi@unifi.it

See you at MajorCities2017: Tuesday 13 at 14:05, at Grand Salon

MAJOR CITIES OF EUROPE IT USERS GROUP

Sii-Mobility

REPLICATE

resolute

MIUR

Horizon 2020 European Union Funding for Research & Innovation

Horizon 2020 European Union Funding for Research & Innovation

Km4City: the Urban Platform for Sentient Cities

http://www.disit.org/km4city

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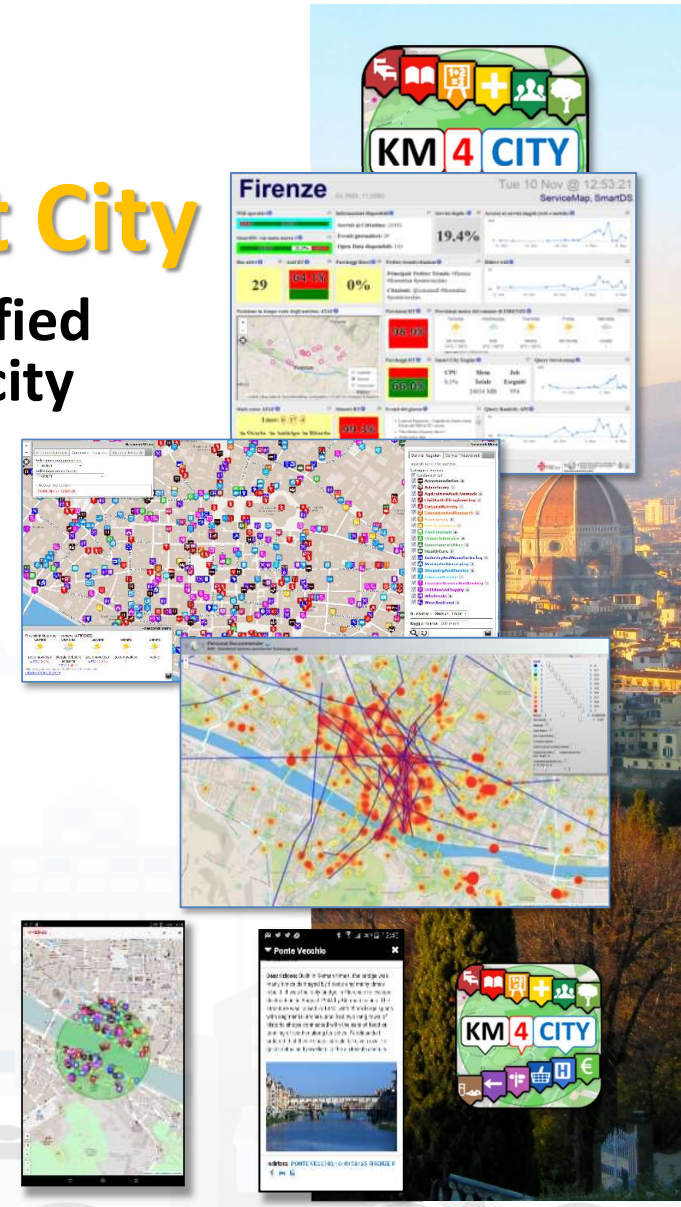
Sentient Urban Platform for Smart City

- **Set up an ICT based Urban Platform integrated and unified data management among services, city operators and city users:**
  - ***Control Room, Real Time Monitoring***
    - decision support, assessing and monitoring risk and resilience
  - ***Data analytics and business intelligence***
    - predictions, reasoning, city users behavior analysis, ….
  - ***Reading the city: data, users behavior and needs, ...***
    - IOT, Open data sensors, private data, static and real time data.
  - ***City Strategies: stimulate virtuous behavior of City Users***
    - participation, totem, twitter, Apps, etc.
  - ***Transform Data into value***
    - Put in action smart city innovative solutions and services, development tools



What is doing

- 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
- People Monitoring Assessment in the City, in Florence via WiFi
- People Monitoring, in Tuscany via App
- Smart Social Media Monitoring and acting

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

http://servicemap.km4city.org

Data & Model

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

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

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

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

Transport systems
Mobility, parking

Public Services
Govern, events, …

Sensors, IOT
Cameras, ..

Environment,
Water, energy

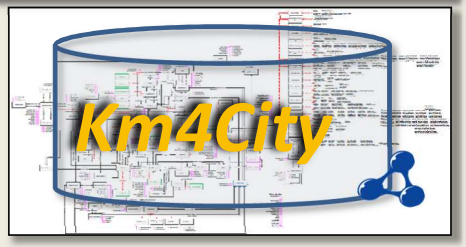
Shops, services,
operators

Social Media
WiFi, network

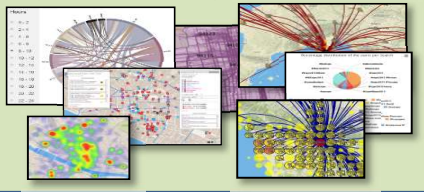
Static, Slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud

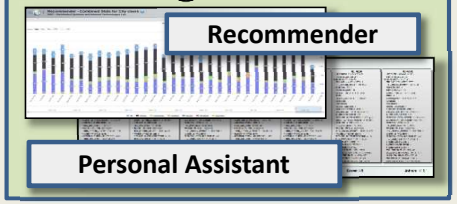
Km4City Smart City Engine



Big Data Analytics



Smartening Tools

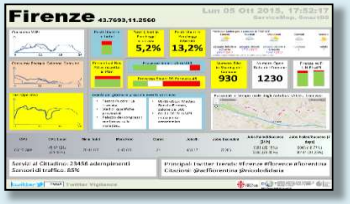


Development Tools

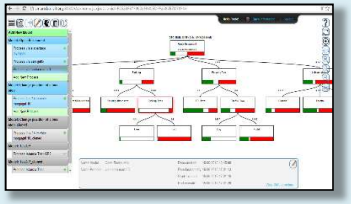
Km4City Smart City API

City Operators and Decision Makers

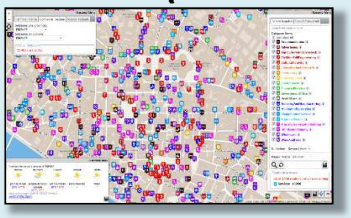
Dashboards



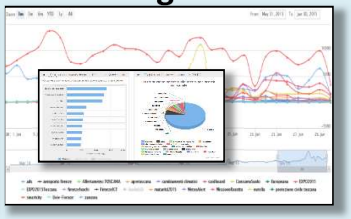
Smart Decision Support



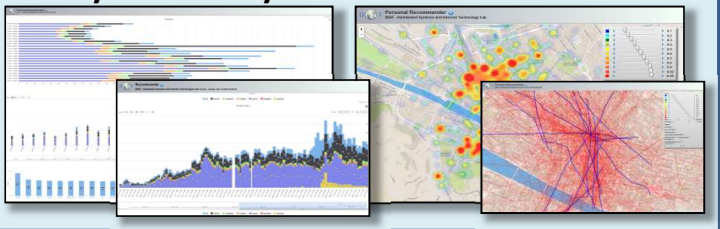
ServiceMap browser



Twitter Vigilance

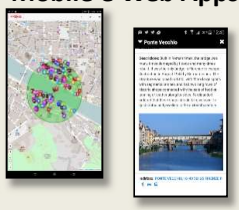


Analyzers of City User Behavior



Tools for Final Users

Mobile e Web Apps



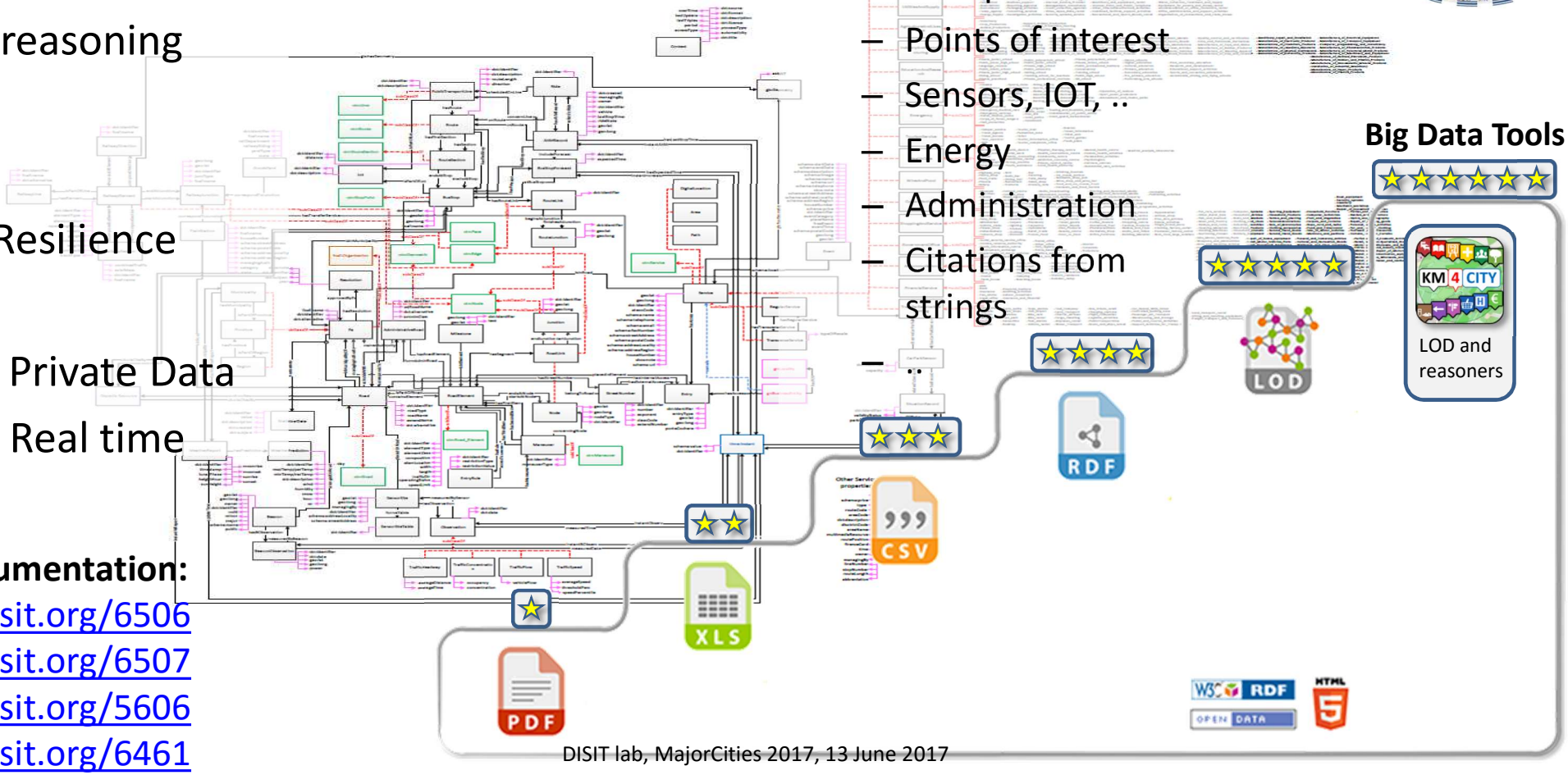
Sii-Mobility

Http://www.km4city.org

Km4City: Knowledge Base

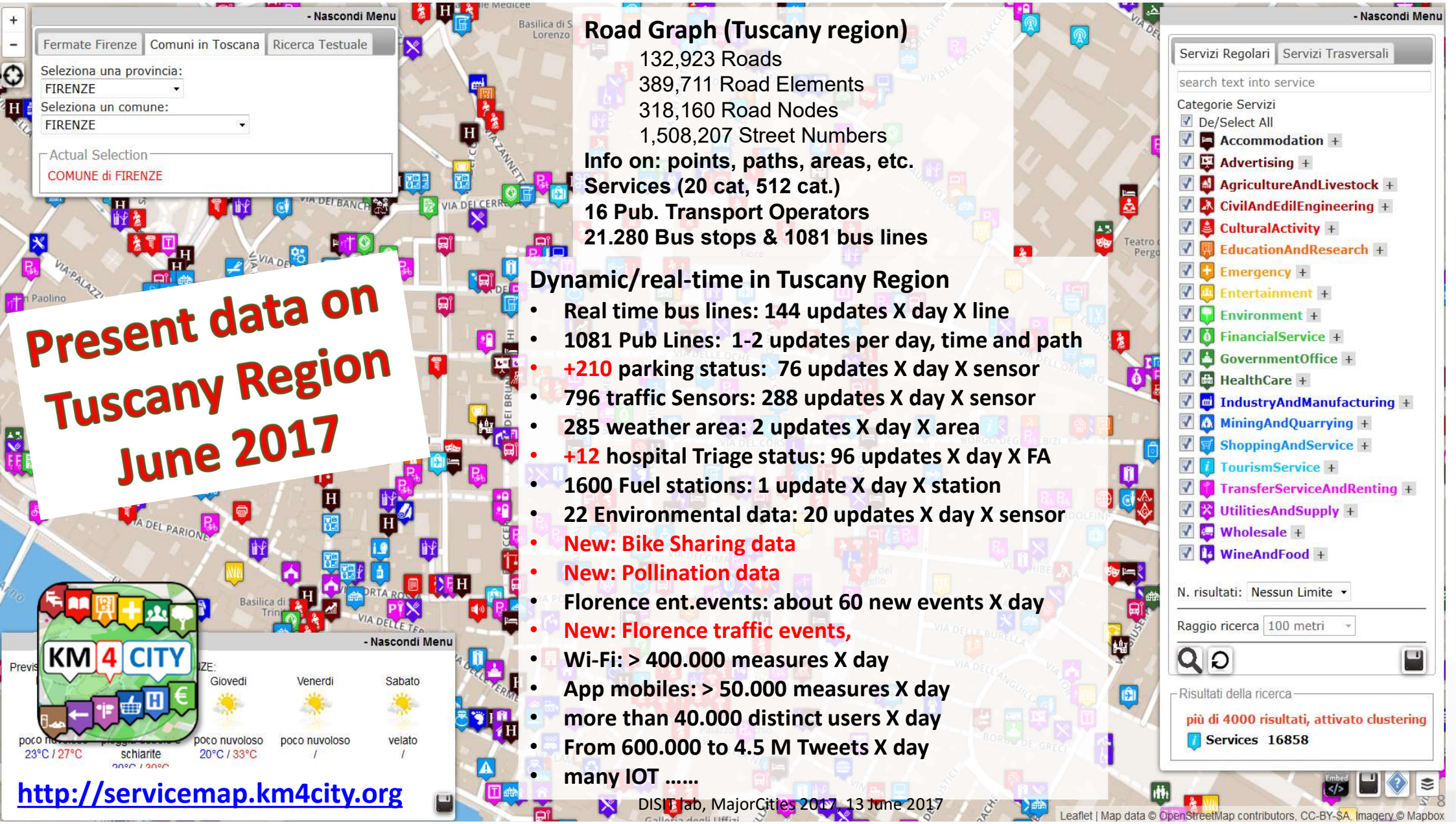
- **Multiple DOMAINS**
- Geospatial reasoning
- Temporal reasoning
- Metadata
- Statistics
- Risk and Resilience
- Licensing
- Open and Private Data
- Static and Real time

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



Ontology Documentation:

http://www.disit.org/6506
http://www.disit.org/6507
http://www.disit.org/5606
http://www.disit.org/6461



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 Pub. 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 Pub Lines: 1-2 updates per day, time and path**
- **+210 parking 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**
- **New: Bike Sharing data**
- **New: Pollination data**
- **Florence ent.events: about 60 new events X day**
- **New: 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 ……**

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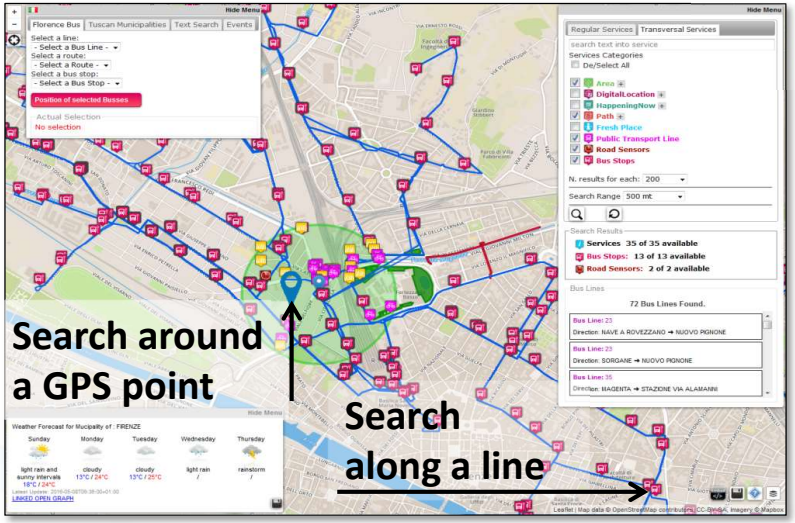
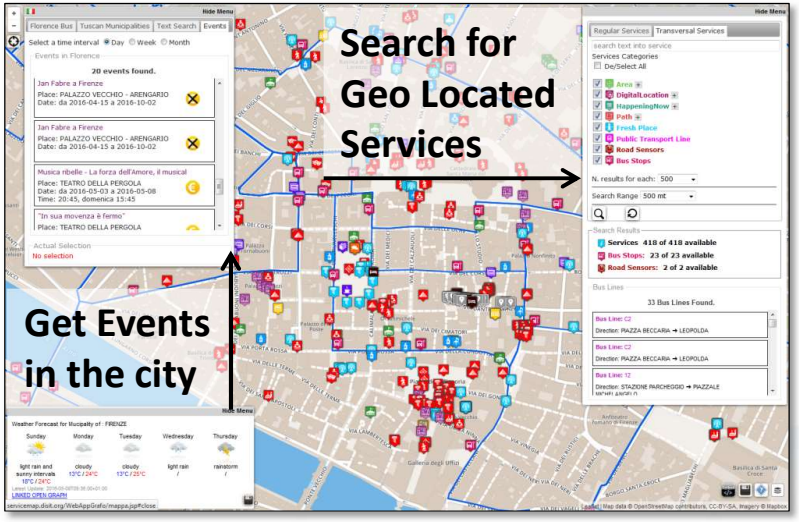
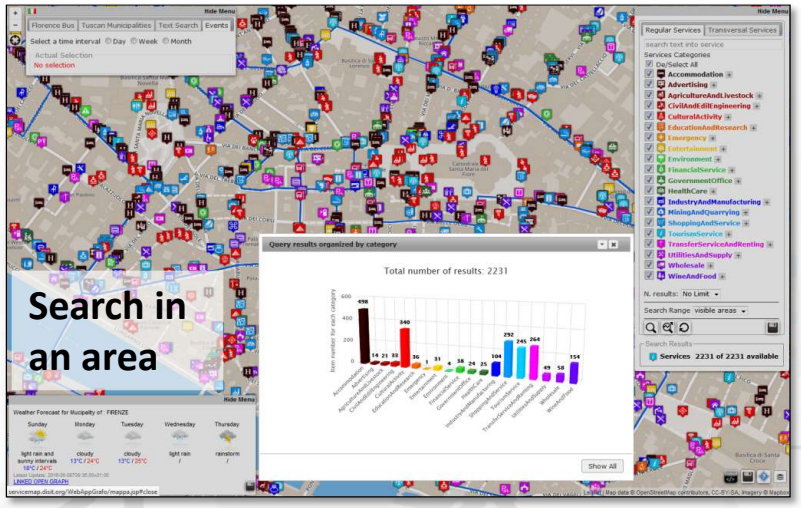
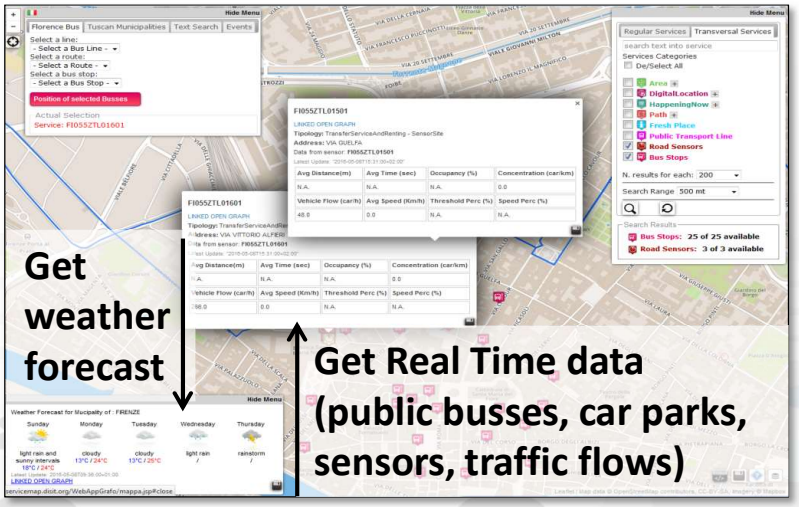
ServiceMap









Smart City Control Room

REPLICATE

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

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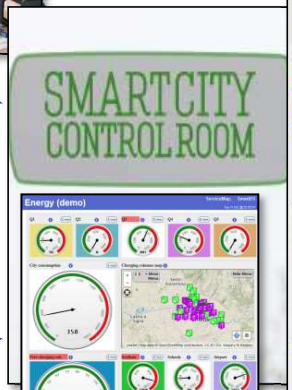
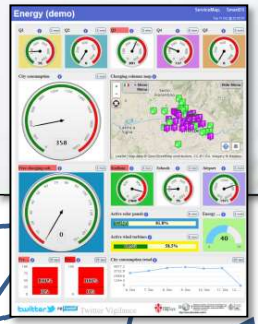
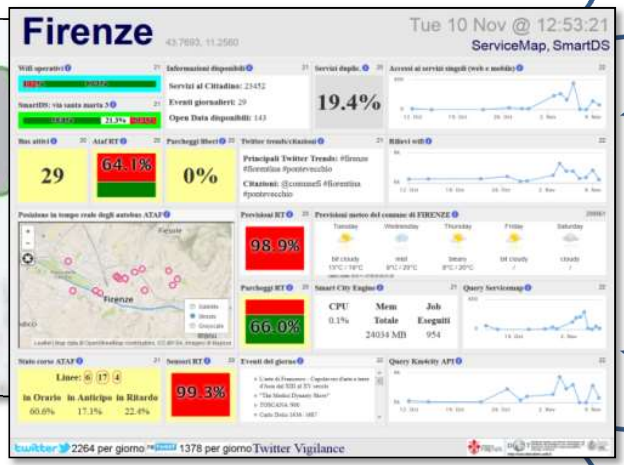
REPLICATE

Horizon 2020
European Union Funding
for Research & Innovation

Transport systems, Mobility, Parking







Shops, services, operators

Sensors, IOT Cameras, ..

Social Media, WiFi, Network

Public services, Govern, Events

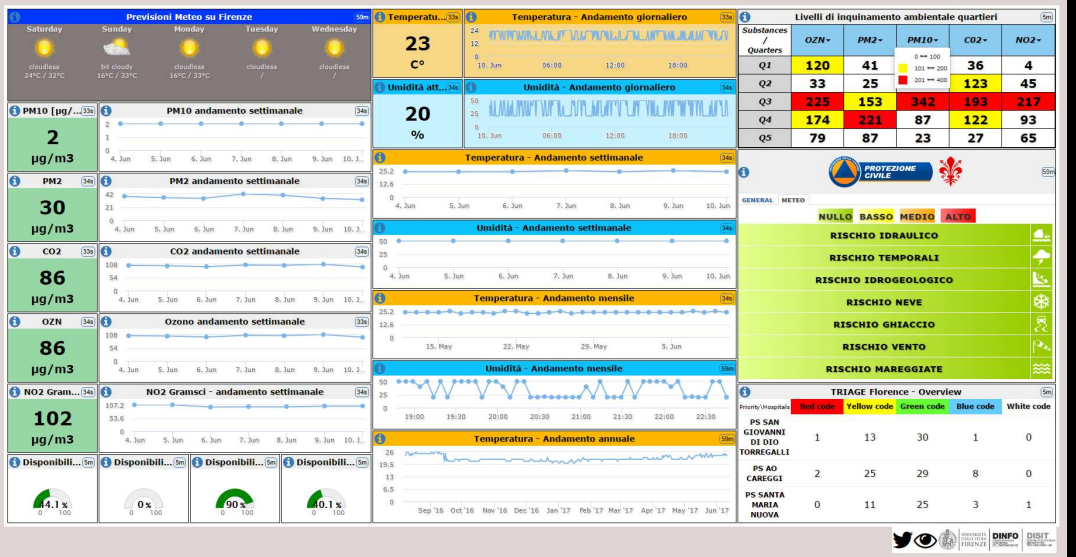
Environment, Water, energy

Dashboards

Firenze Ambiente e Salute HD

Dati ambientali su Firenze (demo)

Sat 10 Jun @ 22:49:06



Firenze Energia e Colonnine HD

(demo, dati simulati)

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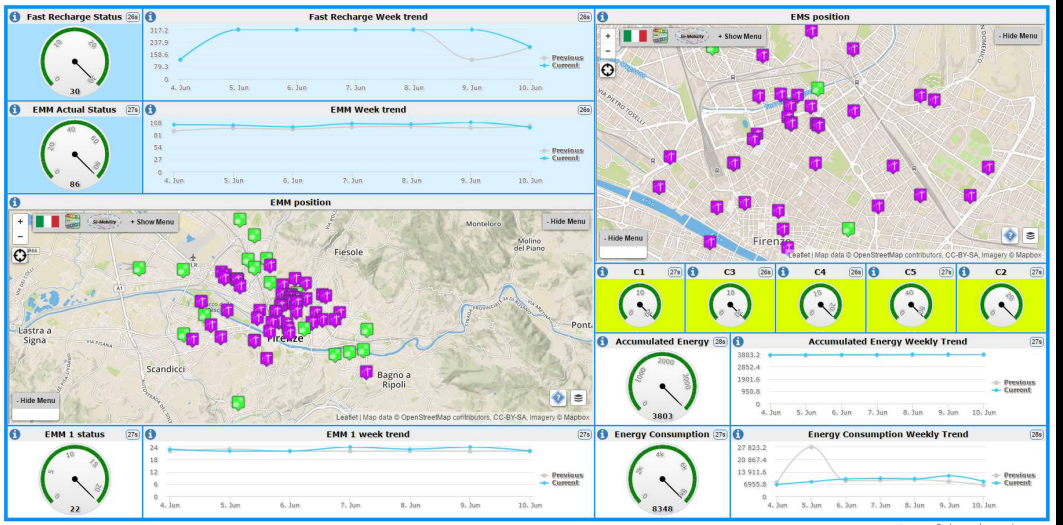
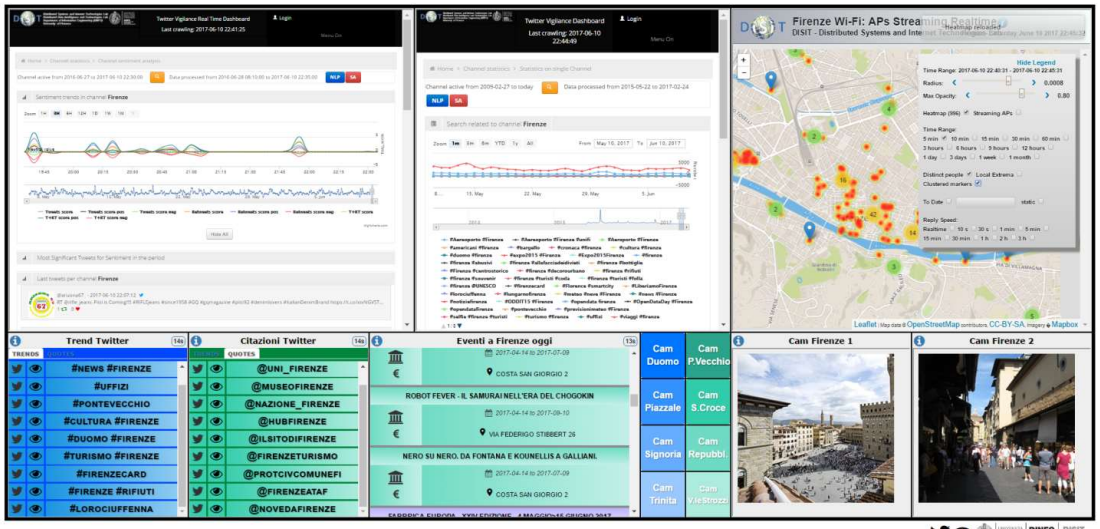


Firenze Sociale e Social Media (HD)

(dati non completi)

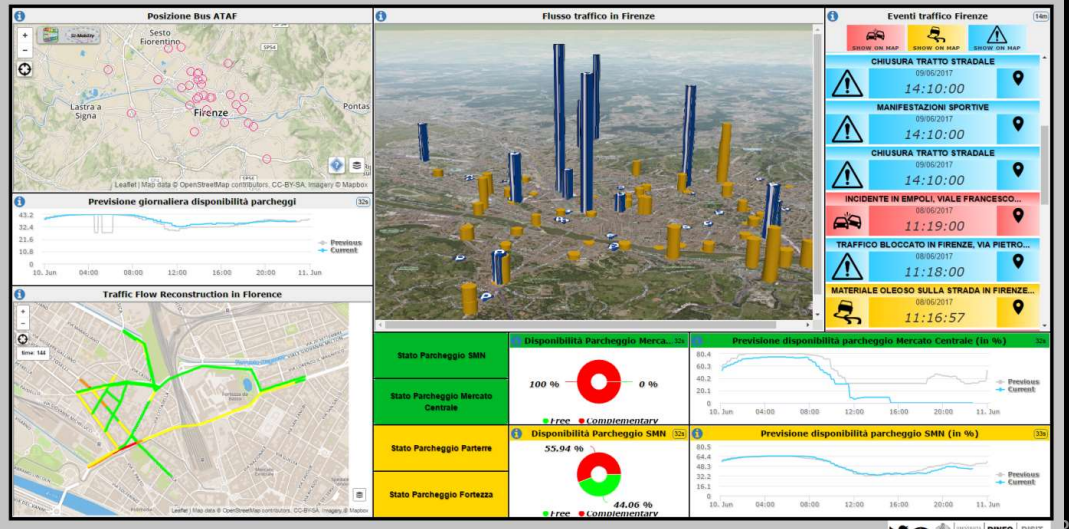
Sat 10 Jun @ 22:45:32



Firenze Mobilità e Trasporti HD

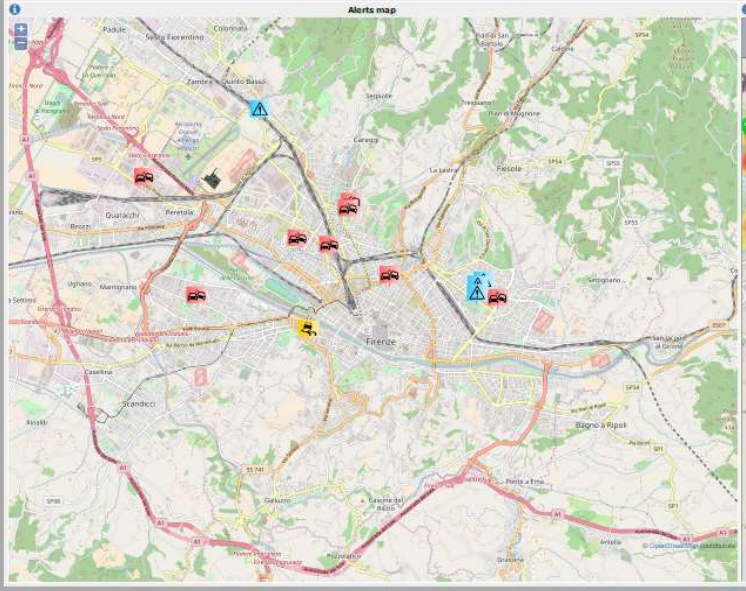
(demo, dati non completi)

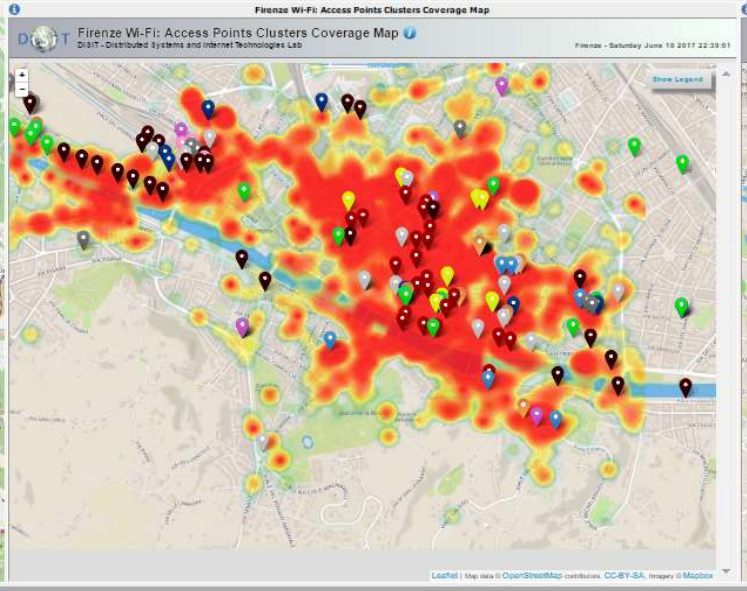
Sat 10 Jun @ 22:46:34

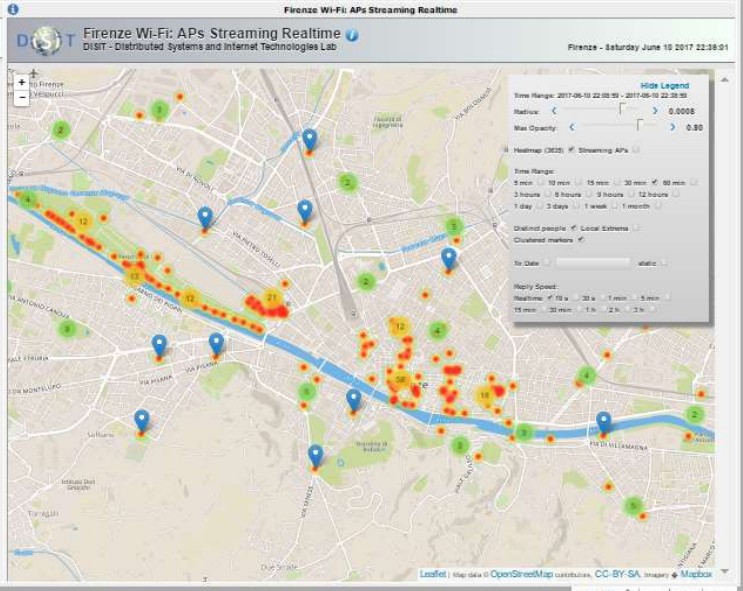


RESOLUTE Dashboard 4XHD v3 - MCE

Sat 10 Jun @ 22:39:01







Cross widget interaction 1

Artistical events, traffic events, city cams

Tue 6 Jun @ 18:50:21

Artistical and recreative events

58m

PIAZZALE DEGLI UFFIZI 2

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

Artistical and recreative events - Others

Cam Duomo | Cam Piazzale | Cam Signoria | Cam Trinita

City webcams - 1

Traffic events

3m

ALL ON MAP | ALL ON MAP | SHOW ON MAP

06/06/2017 14:21:55 — ON MAP

INCIDENTE IN FIRENZE, VIALE EUROPA

06/06/2017 13:43:23 — ON MAP

INCIDENTE

06/06/2017 13:38:15 — ON MAP

MATERIALE OLEOSO SULLA STRADA

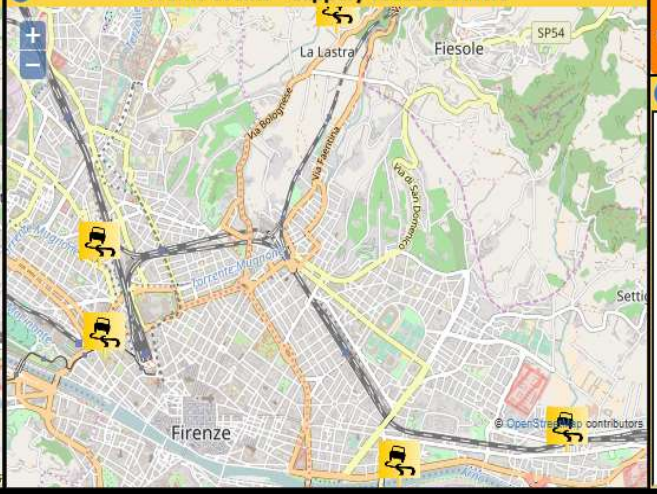
06/06/2017 13:20:06 — ON MAP

INCIDENTE IN FIRENZE, VIA DELLA SCALA

06/06/2017

Traffic events - Incidents

Traffic events - Slippery roads & others



Cam P.Vecchio | Cam S.Croce | Cam Repubbl. | Cam Fortezza

City webcams - 2

DINFO | DISIT

First aids overview - Tuscany

Service status of main first aids

Thu 25 May @ 11:00:34

Careggi hospital (Florence) - Details

9m

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

9m

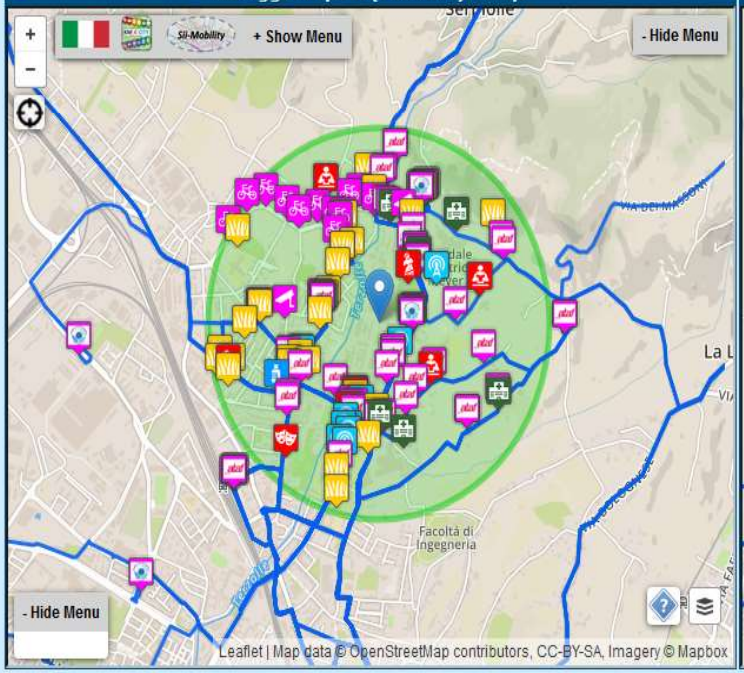
Priority\Status	Red code	Yellow code	Green code	Blue code	White code
Waiting	0	1	7	9	3
In visit	0	7	1	1	6
Totals	0	8	8	10	9

Other hospitals - Summary

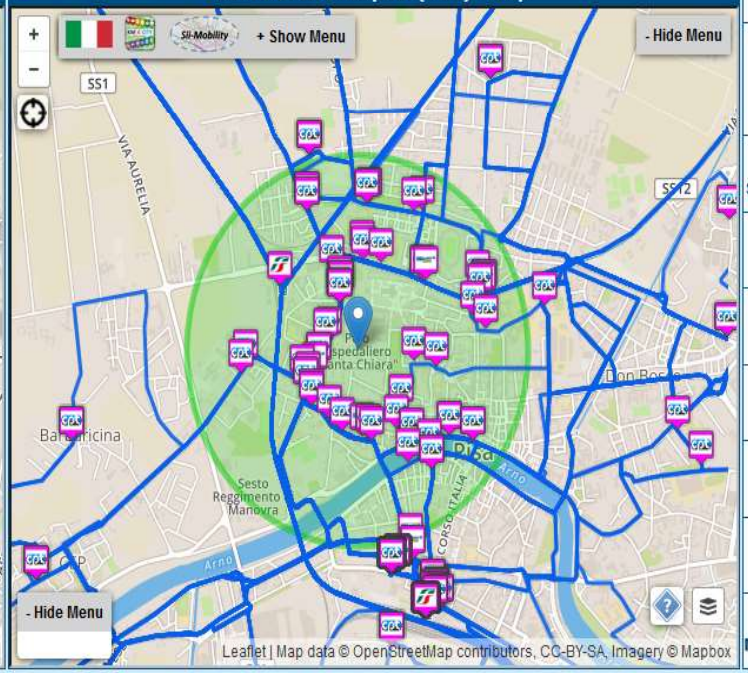
9m

Priority\Hospitals	Red code	Yellow code	Green code	Blue code	White code
PS SAN GIOVANNI DI DIO TORREGALLI	1	16	20	1	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
PS OSPEDALI RIUNITI	3				1
PS CASENTINO					
PS SANTA CROCE					
PI PO CORTONA					
PS CIVILE PIOMBINO					
PS LA MISERICORDIA					

Careggi hospital (Florence) - Map



Santa Chiara hospital (Pisa) - Map

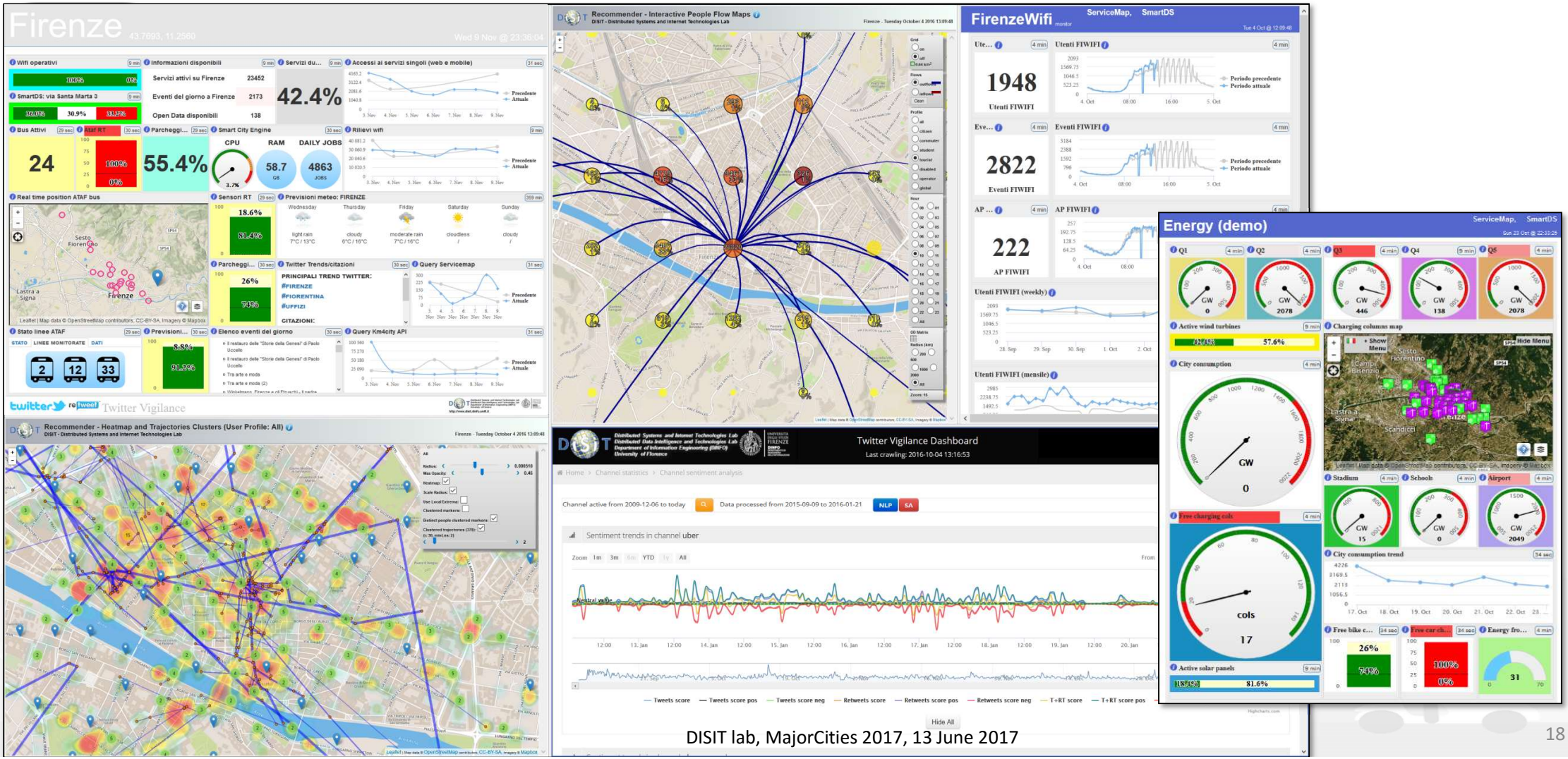


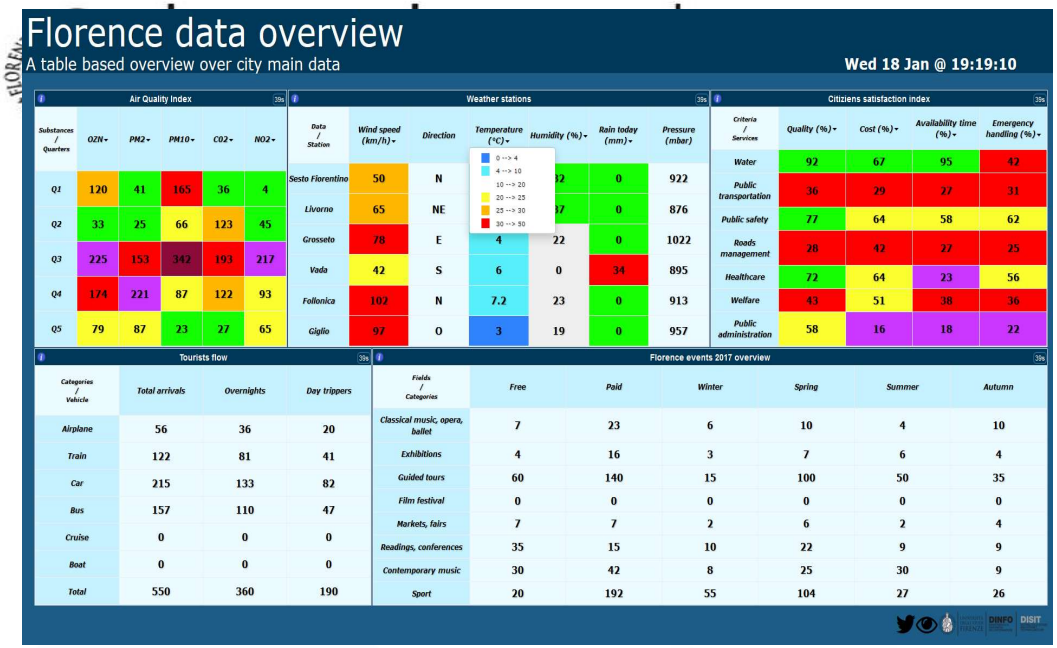
Firenze
43.7693, 11.2560
Wed 9 Nov @ 23:36:04
Wifi operativi
9 min
100%
0%
SmartDS: via Santa Marta 3
9 min
36.0%
30.9%
33.2%
Informazioni disponibili
9 min
Servizi attivi su Firenze
23452
Eventi del giorno a Firenze
2173
Open Data disponibili
138
Servizi du...
9 min
42.4%
Accessi ai servizi singoli (web e mobile)
31 sec
4163.2
3122.4
2081.6
1040.8
0
3. Nov
4. Nov
5. Nov
6. Nov
7. Nov
8. Nov
9. Nov
Precedente
Attuale
Bus Attivi
29 sec
24
Ataf RT
30 sec
100
75
50
25
0
100%
0%
Parcheggi...
29 sec
55.4%
Smart City Engine
30 sec
CPU
3.7%
RAM
58.7
GB
DAILY JOBS
4863
JOBS
Rilievi wifi
9 min
40 081.2
30 060.9
20 040.6
10 020.3
0
3. Nov
4. Nov
5. Nov
6. Nov
7. Nov
8. Nov
9. Nov
Precedente
Attuale
Real time position ATAF bus
Sesto Fiorentino
Lastra a Signa
Firenze
SP54
SP54
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox
Sensori RT
29 sec
100
18.6%
81.4%
0
Previsioni meteo: FIRENZE
359 min
Wednesday
Thursday
Friday
Saturday
Sunday
light rain
7°C / 13°C
Parcheggi...
30 sec
100
26%
74%
0
Twitter Trends/citazi
PRINCIPALI TREND T
#FIRENZE
#FIORENTINA
#UFFIZI
CITAZIONI:
Stato linee ATAF
29 sec
STATO
LINEE MONITOI
2
Previsioni...
30 sec
STATO
LINEE MONITORATE
DATI
46%
IN ORARIO
5%
IN ANTICIPO
49%
IN RITARDO
Elenco eventi del giorno
30 sec
Il restauro delle "Storie della Genesi" di Paolo Uccello
Il restauro delle "Storie della Genesi" di Paolo Uccello
Tra arte e moda
Tra arte e moda (2)
Winkelmann, Firenze e gli Etruschi - Il padre
twitter
retweet
Twitter Vigilance
Km4City
status
ServiceMap, SmartDS
Sun 23 Oct @ 22:32:12
Engagement Sent (4 hours)
4 min
2465.2
1848.9
1232.6
616.3
0
21:00
Precedente
Attuale
Engagemen...
4 min
2078
Engagement Sent
Engagment Created (from Stats) ...
4 min
706
529.5
353
176.5
0
21:00
Precedente
Attuale
Engagemen...
4 min
446
Engagement Created
Engagement Viewed (4 hours)
4 min
18
13.5
9
4.5
0
21:00
Precedente
Attuale
Engagemen...
4 min
17
Engagement Viewed
Engagement Sent (daily)
19 min
2498
08:00
16:00
24. Oct
Precedente
Attuale
Engagement Viewed (daily)
29 min
06:00
12:00
18:00
24. Oct
Precedente
Attuale
Engagement Sent (weekly)
59 min
18. Oct
19. Oct
20. Oct
21. Oct
22. Oct
23. Oct
Precedente
Attuale
Engagement Viewed (weekly)
59 min
Precedente
Attuale
SmartCity Processes
Fri 4 Nov @ 18:51:20
ATAF
avm_linea17_I
RUNNING
ATAF
avm_linea31_I
RUNNING
ATAF
avm_linea4_I
SUCCESS
ATAF
avm_linea6_I
SUCCESS
CHECK RT
check_RT
SUCCESS
EVENTI FI
Eventi_a_Firenze_I
SUCCESS
PARK
parcheggi1_I
FAILED
PARK
parcheggi2_I
SUCCESS
PARK
parcheggi160_I
SUCCESS
PARK
parcheggi161_I
SUCCESS
PARK
parcheggi162_I
SUCCESS
PARK
parcheggi163_I
SUCCESS
METEO
Previ_meteo_Abetone_xml_I
SUCCESS
METEO
Previ_meteo_Arezzo_xml_I
SUCCESS
METEO
Previ_meteo_Fiesole_xml_I
SUCCESS
METEO
Previ_meteo_Firenze_xml_I
SUCCESS
METEO
revi_meteo_Impruneta_xml
SUCCESS
METEO
Previ_meteo_Lucca_xml_I
SUCCESS
SENSORI
sensoridinamicimetro
SUCCESS
SENSORI
sensori_AREZZO_I
SUCCESS
SENSORI
sensori_EMPOLI_I
SUCCESS
SENSORI
sensori_PISA_I
SUCCESS
SENSORI
sensori_FIRENZE_I
SUCCESS
SENSORI
sensori_PRATO_I
SUCCESS
TWITTER
TWITTER
FI WIFI
calculateAPsTimeSeries
FI WIFI
calculateNewUsers
FI WIFI
calculateUsersStatus
FI WIFI
GraphsJSGenerator

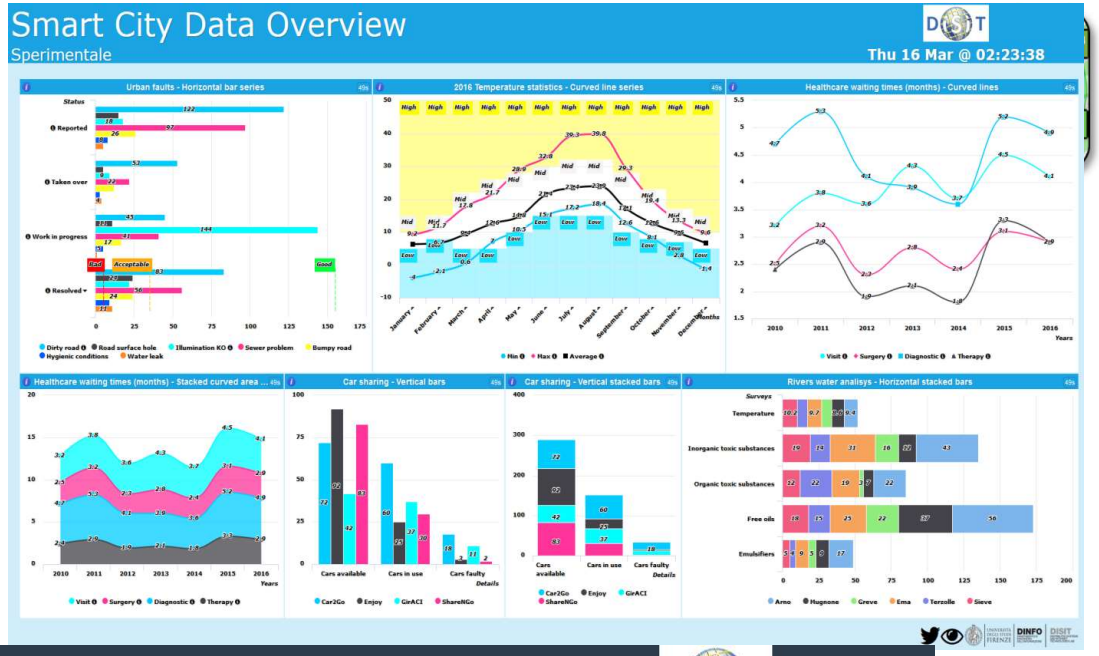
Smart City Dashboard

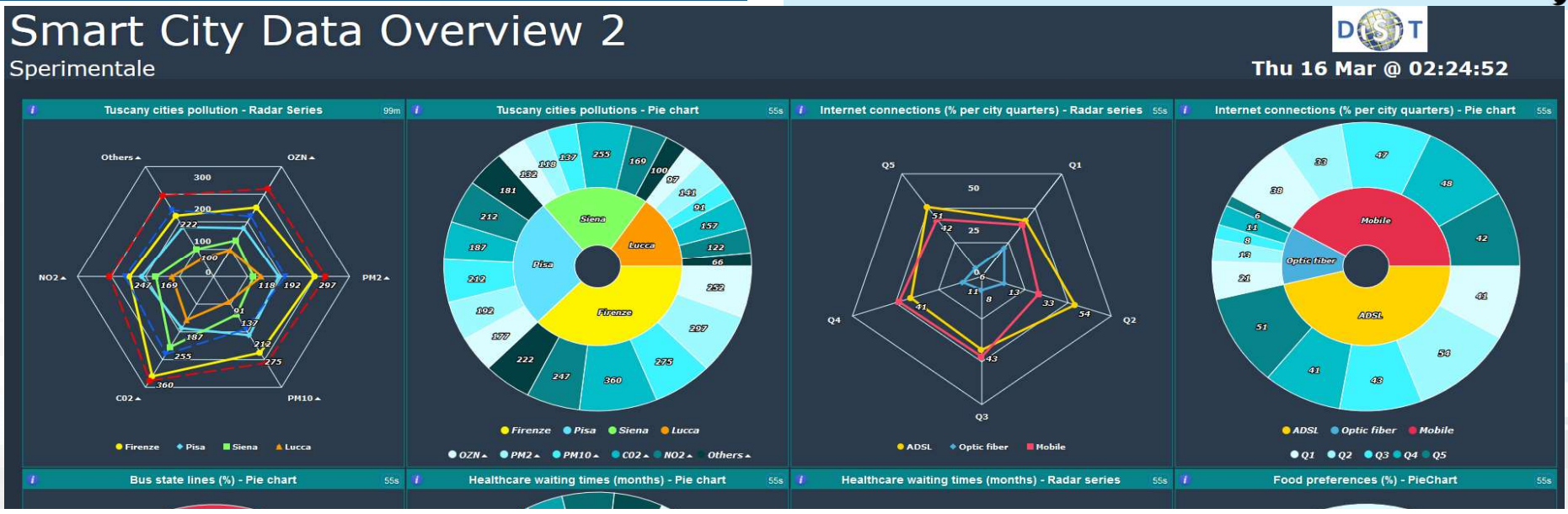
REPLICATE

Horizon 2020
European Union Funding
for Research & Innovation

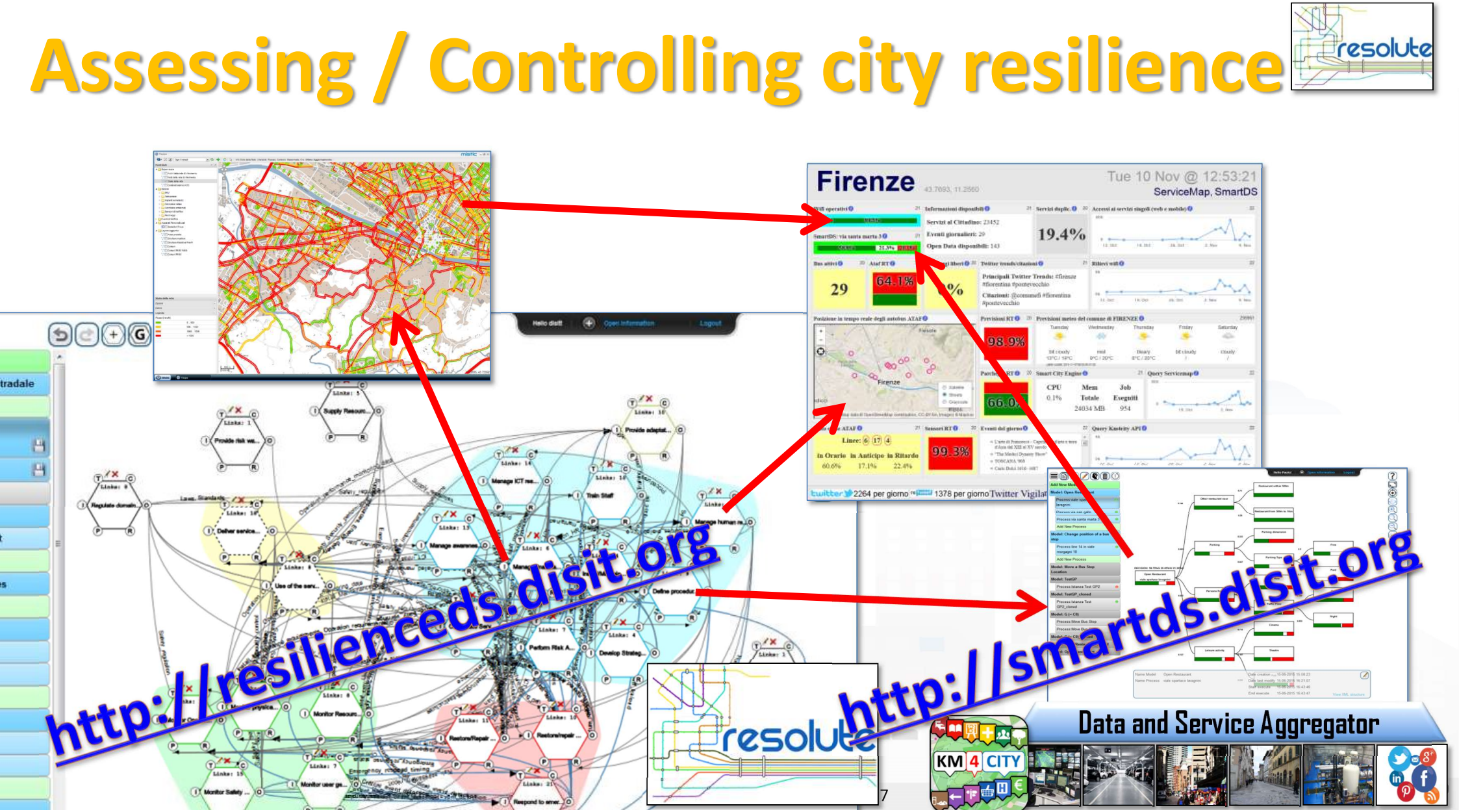



Florence data overview
A table based overview over city main data
Wed 18 Jan @ 19:19:10
Air Quality Index
Weather stations
Citizens satisfaction index
Tourists flow
Florence events 2017 overview


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 analisys - Horizontal stacked bars

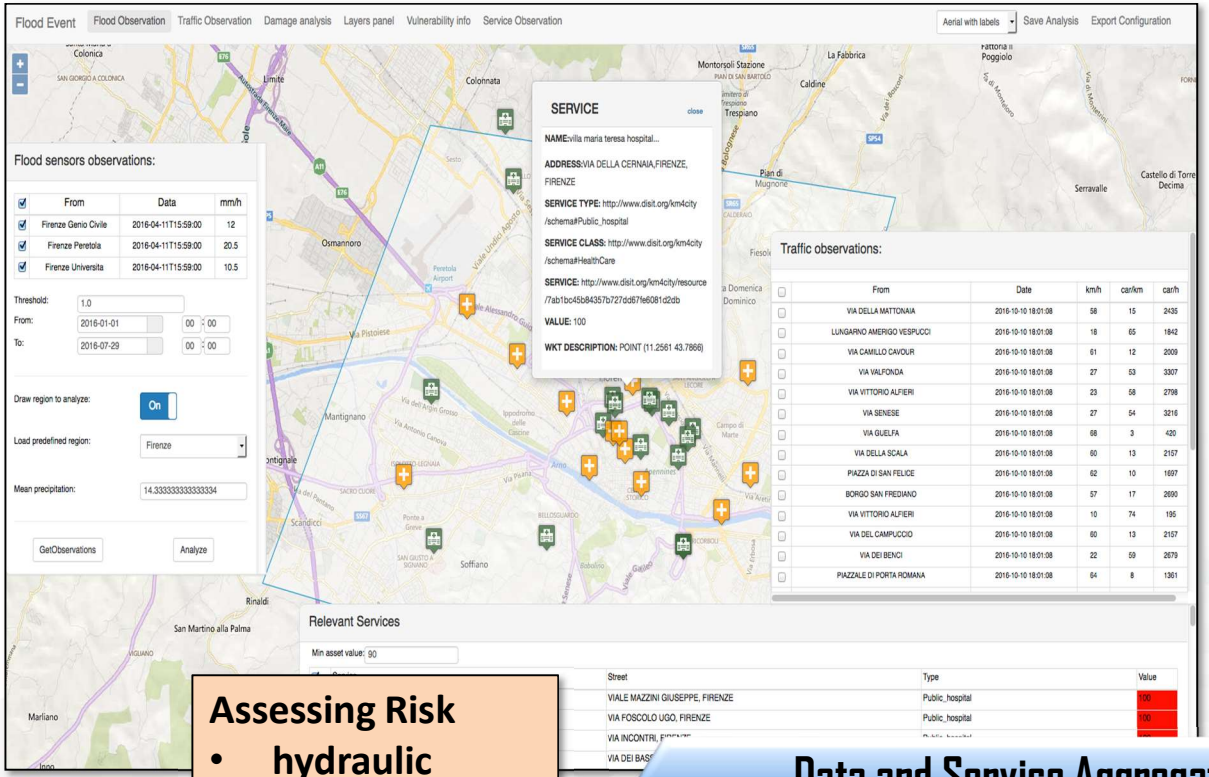

Smart City Data Overview 2
Sperimentale
Thu 16 Mar @ 02:24:52
Tuscany cities pollution - Radar Series
Tuscany cities pollutions - Pie chart
Internet connections (% per city quarters) - Radar series
Internet connections (% per city quarters) - Pie chart
Bus state lines (%) - Pie chart
Healthcare waiting times (months) - Pie chart
Healthcare waiting times (months) - Radar series
Food preferences (%) - PieChart

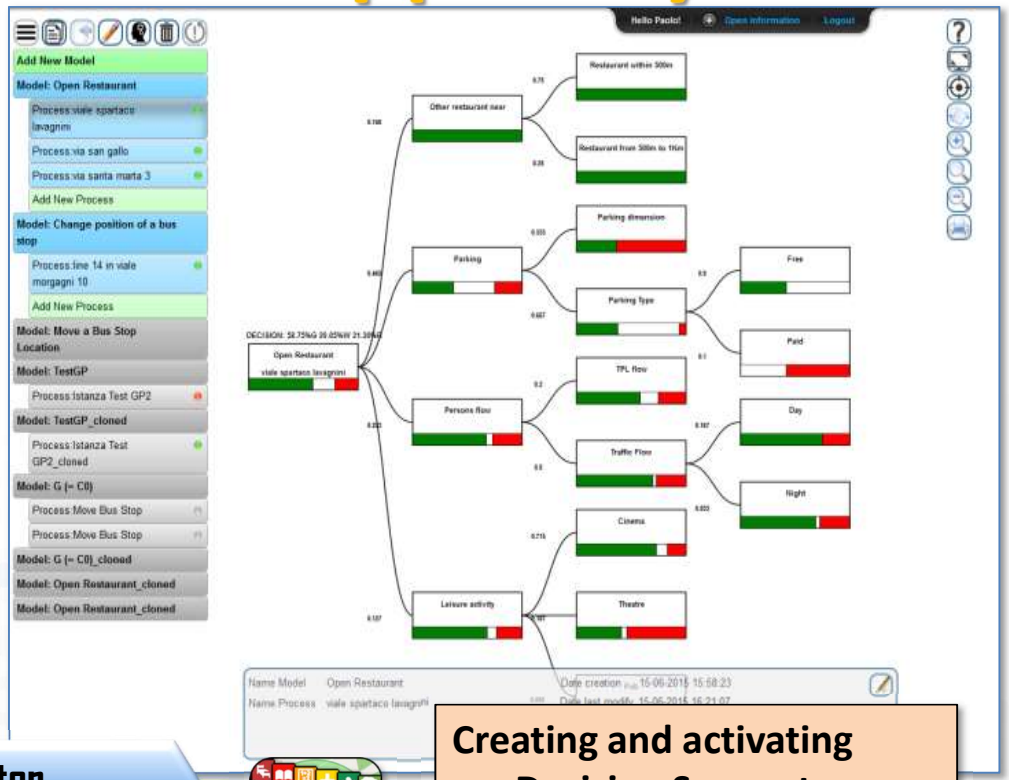
Assessing / Controlling city resilience



Risk Assessment

Decision Support Systems





Assessing Risk

- **hydraulic**
- **Seismic**

Data and Service Aggregator

Creating and activating

- **Decision Support models**

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

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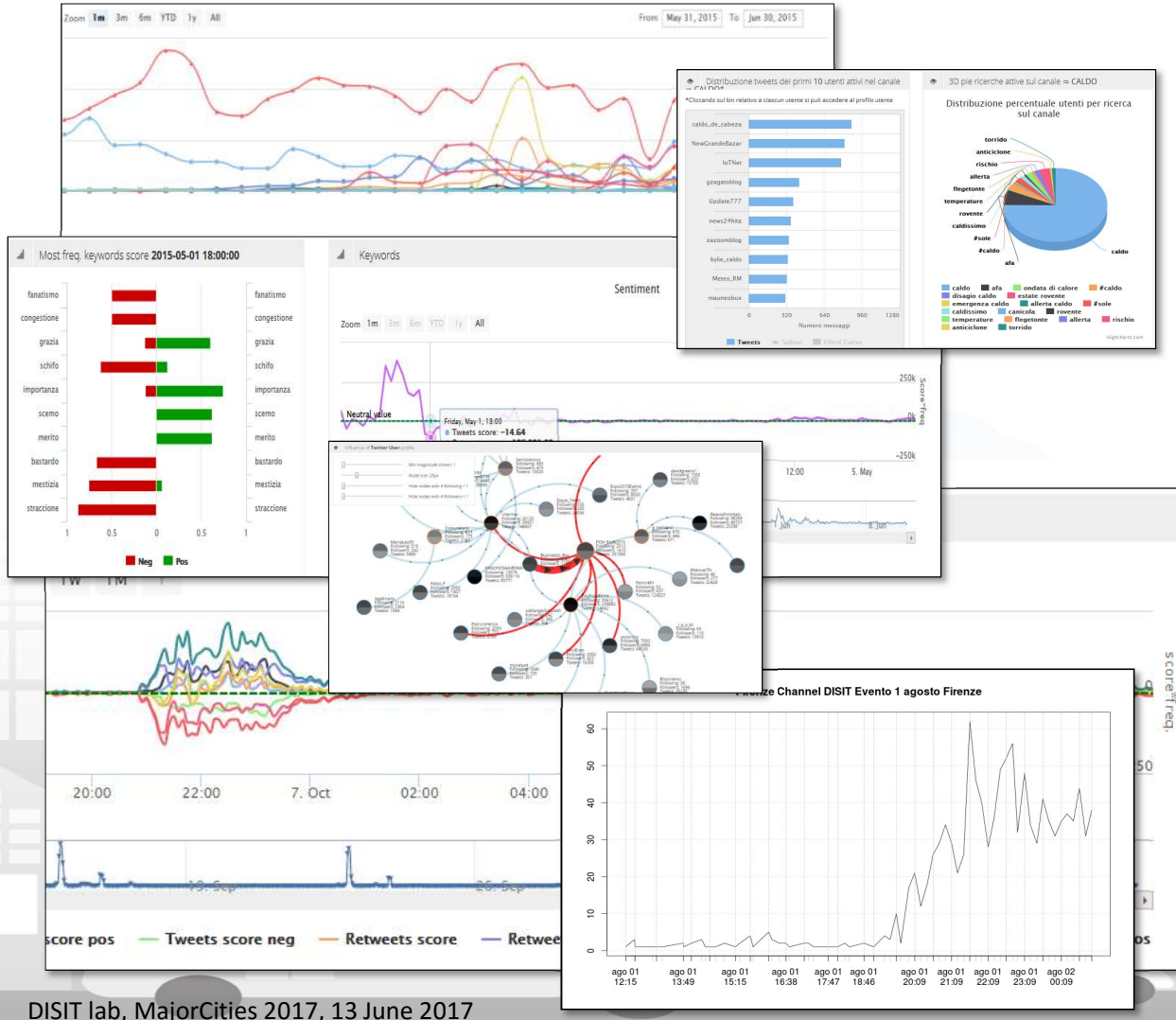
http://www.disit.org

Twitter Vigilance

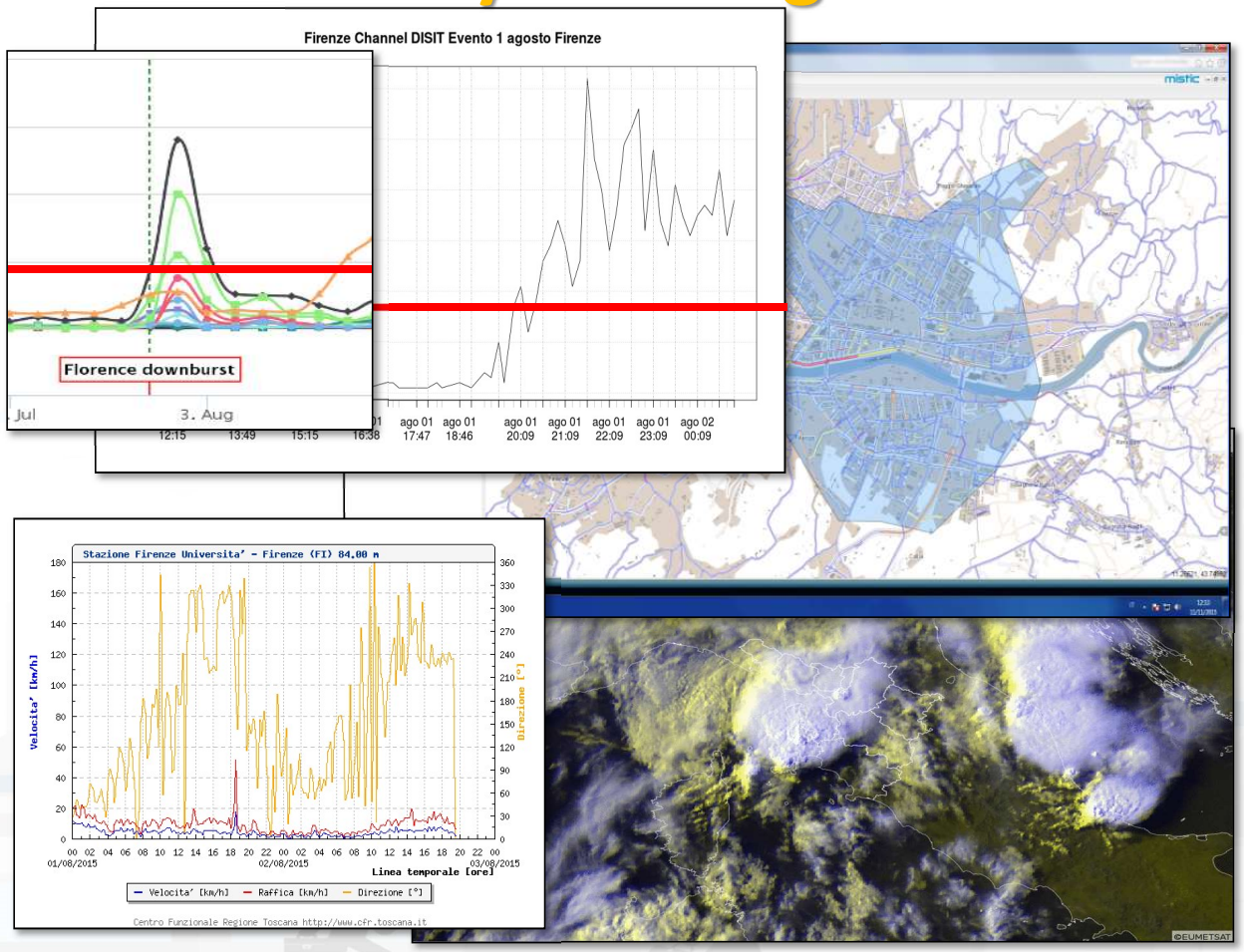
- http://www.disit.org/tv
- http://www.disit.org/rttv
  - ***Collaborative work***
- **City Users as Sensors** to
  - Assess sentiment on services, events, …
  - Response of consumers wrt…
  - Early detection of critical conditions
  - Information channel
  - Opinion leaders, Communities
  - Formation
  - Predicting volume of visitors for tuning the services



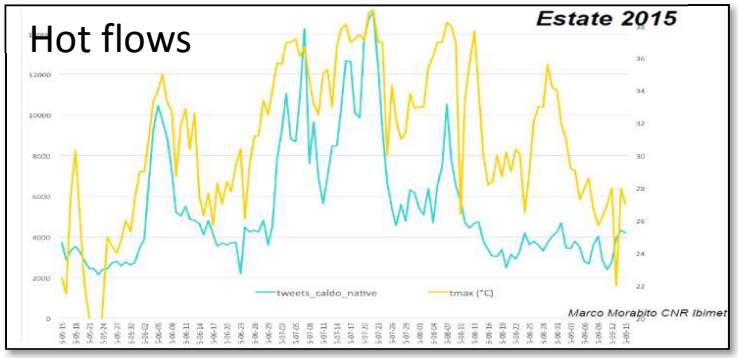
Twitter Vigilance

Twitter Vigilance

Early Warning



Predictive models



Attendance at long lasting events: EXPO2015

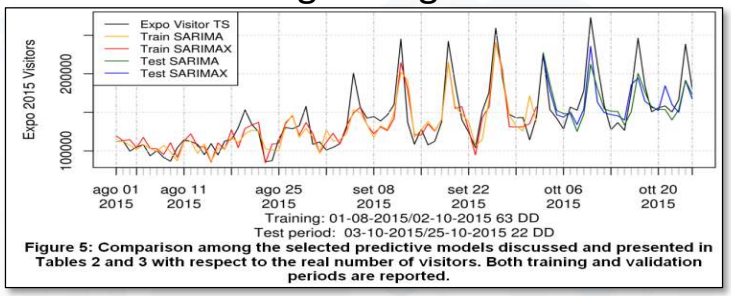
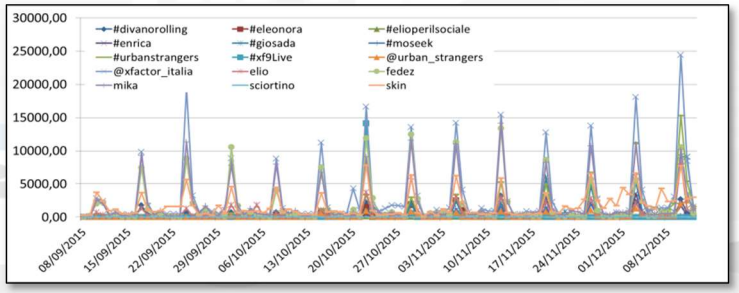


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

Attendance at recurrent events: TV, footbal



Twitter Vigilance su Firenze
(sperimentale)

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Sat 24 Dec @ 10:37:57

Twitter: Volume di Tweet tramite Twitter Vigilance

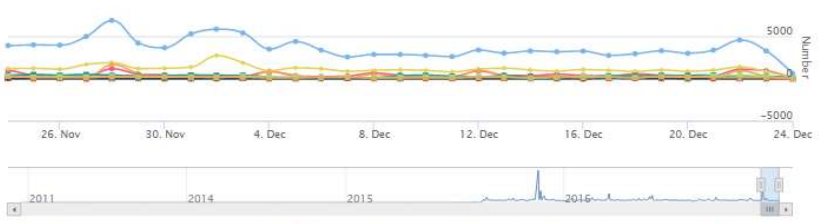
Twitter Vigilance Dashboard
Last crawling: 2016-12-24 12:34:51
Menu On | Login

Home > Channel statistics > Statistics on single Channel

Channel active from 2009-02-27 to today | Data processed from 2015-05-22 to 2016-12-02 | NLP | SA

Search related to channel **Firenze**

Zoom 1m 3m 6m YTD 1y All | From Nov 24, 2016 To Dec 24, 2016



#Accademia #Aereoporto #Firenze #Aeroporto #Firenze #bargello #expo2015 #Firenze #fiorentina
#firenze #Florence #smartcity #fodd #ODDIT15 #Firenze #opendata firenze #pontevecchio
#uffizi @acffiorentina @BandieraiUffizi @Biblio_ComuneFi @bncfirenze @comunefi
@DarioNardella aereoporto @DiscoverTuscany @emergency_fi @firenzedigitale @firenzesulweb
@FirenzeTNews @museofirenze @museonovecento @Nazione_Firenze @NicolodiDaria @novedafirenze
@opentoscana @Pitti_Immagine @PoloMusealeFi @ProtCivComuneFi @prov_Fi_PC @santacroceopera
@STEEPproject @storianaturale @UNI_FIRENZE aereoporto firenze aeroporto firenze Firenze
firenze terremoto firenzesulweb Florence from:@UNI_FIRENZE lungarno medicea palazzopitti
palazzostrozzi ProtCivComuneFi smartcity firenze torrigiani uffizi voragine Events

Highcharts.com

Hide All

Daily number of tweets/retweets for channel: **Firenze**

Zoom 1m 3m 6m YTD 1y All | From Nov 24, 2016 To Dec 24, 2016

Highcharts.com

Sentiment Analysis in Tempo Reale su Firenze

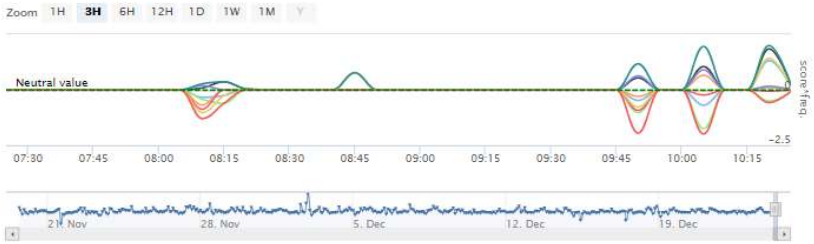
Twitter Vigilance Real Time Dashboard
Last crawling: 2016-12-24 10:32:33
Menu On | Login

Home > Channel statistics > Channel sentiment analysis

Channel active from 2016-06-27 to 2016-12-24 10:30:00 | Data processed from 2016-06-28 08:10:00 to 2016-12-24 10:25:00
NLP | SA

Sentiment trends in channel **Firenze**

Zoom 1H 3H 6H 12H 1D 1W 1M Y



Tweets score | Tweets score pos | Tweets score neg | Retweets score | Retweets score pos
Retweets score neg | T+RT score | T+RT score pos | T+RT score neg

Highcharts.com

Hide All

Most Significant Tweets for Sentiment in the period

@forealziesdayle - 2016-12-24 10:25:39
@Ahno_its_arno meh, I've only had average curry there
0 0 Sent. Score: 0.166667

@esercizistorici - 2016-12-24 10:30:01
Stanotte Concerto di Natale di Peter Guth @ORT_Toscana in collaborazione con Conservatorio 'L.Cherubini' di Firenze... https://t.co/uFeTp4wG1y
0 0 Sent. Score: 0

@infoitinterno - 2016-12-24 10:30:05
Firenze, un piano per un Natale sicuro (055firenze) https://t.co/vpqDAsEspi https://t.co/2Bn5k3zoyv

Last tweets per channel **Firenze**

@FormulaLatina - 2016-12-24 10:30:26
★ ★ ★ CAPODANNO LATINO Woodstock Club Firenze ★ ★ ★ H. 21:00 > > GRAN BUFFET DI SAN SILVESTRO CON BRINDISI E... https://t.co/cM84Gw65sO
0 0

@MORINEMMANUELL2 - 2016-12-24 10:30:14
RT @Navymat: Francesco #Salviati Carità,1543 #Manierisme Galleria degli Uffizi, Firenze @ChevernyM @mariaireneali @pieroBENEDETTO @Giusepp...
6 0

@infoitinterno - 2016-12-24 10:30:12

Twitter Citazioni

TRENDS | QUOTES

@NICOLODIDARIA
@COMUNEFI
@ACFFIORENTINA
@NAZIONE_FIRENZE
@SANTACROCEOPERA
@MUSEONOVECENTO
@FIRENZEDIGITALE

Twitter Hashtag trend

TRENDS | QUOTES

#FIRENZE
#FIORENTINA
#UFFIZI
#PONTEVECCHIO

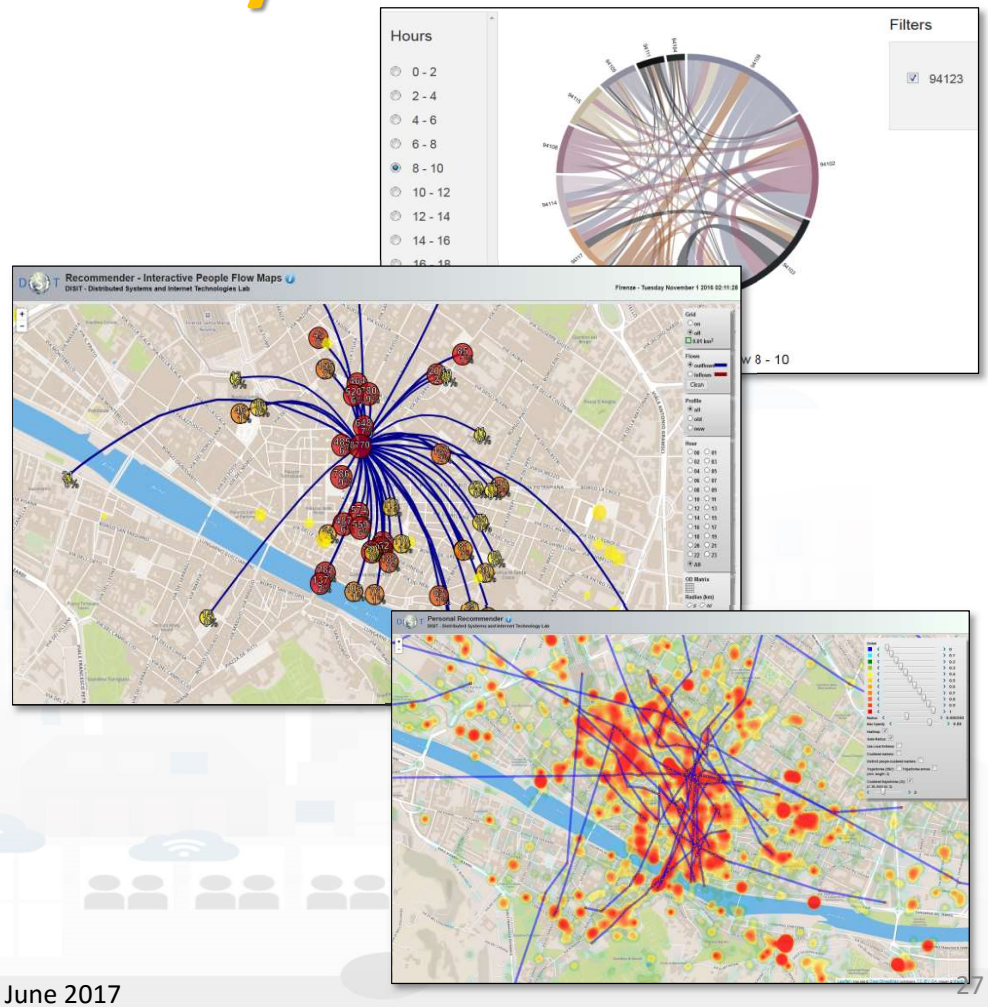
We suggest to use Chrome browser for better experience

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

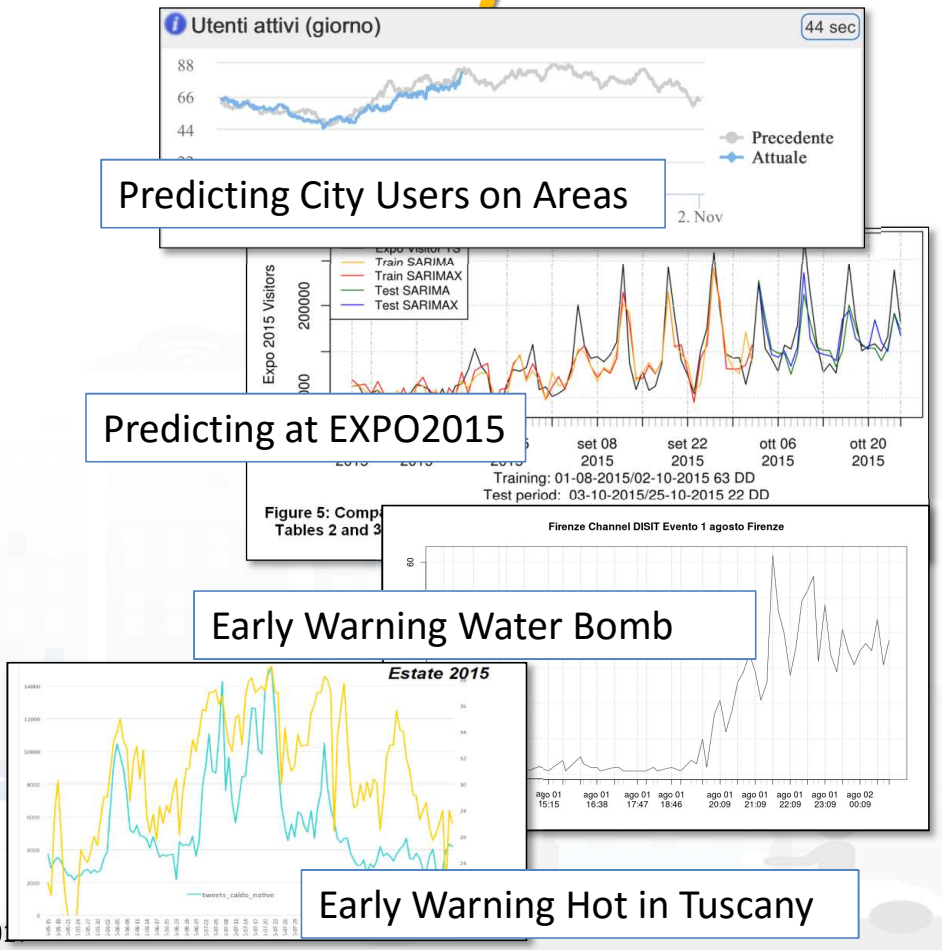
User Behaviour Analysis

- 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

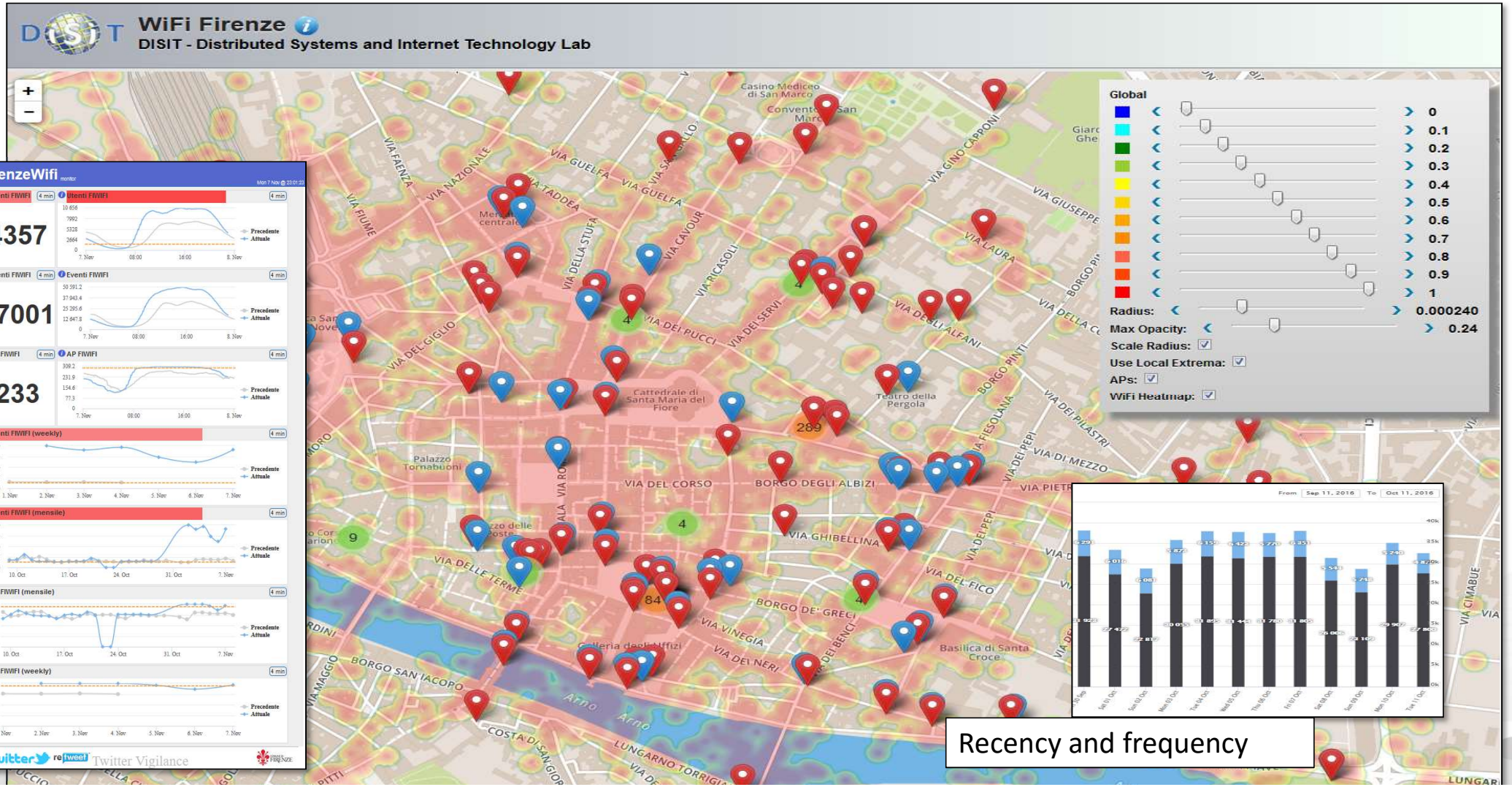


Predicting Models for Admin. & City Users

- Aiming at improving
  - quality of service,
  - distributing workload
  - early warning
- Traffic Flows & People Flows
  → crowd , #number of people
- Parking Status → free slots
- Weather Forecast (LAMMA)



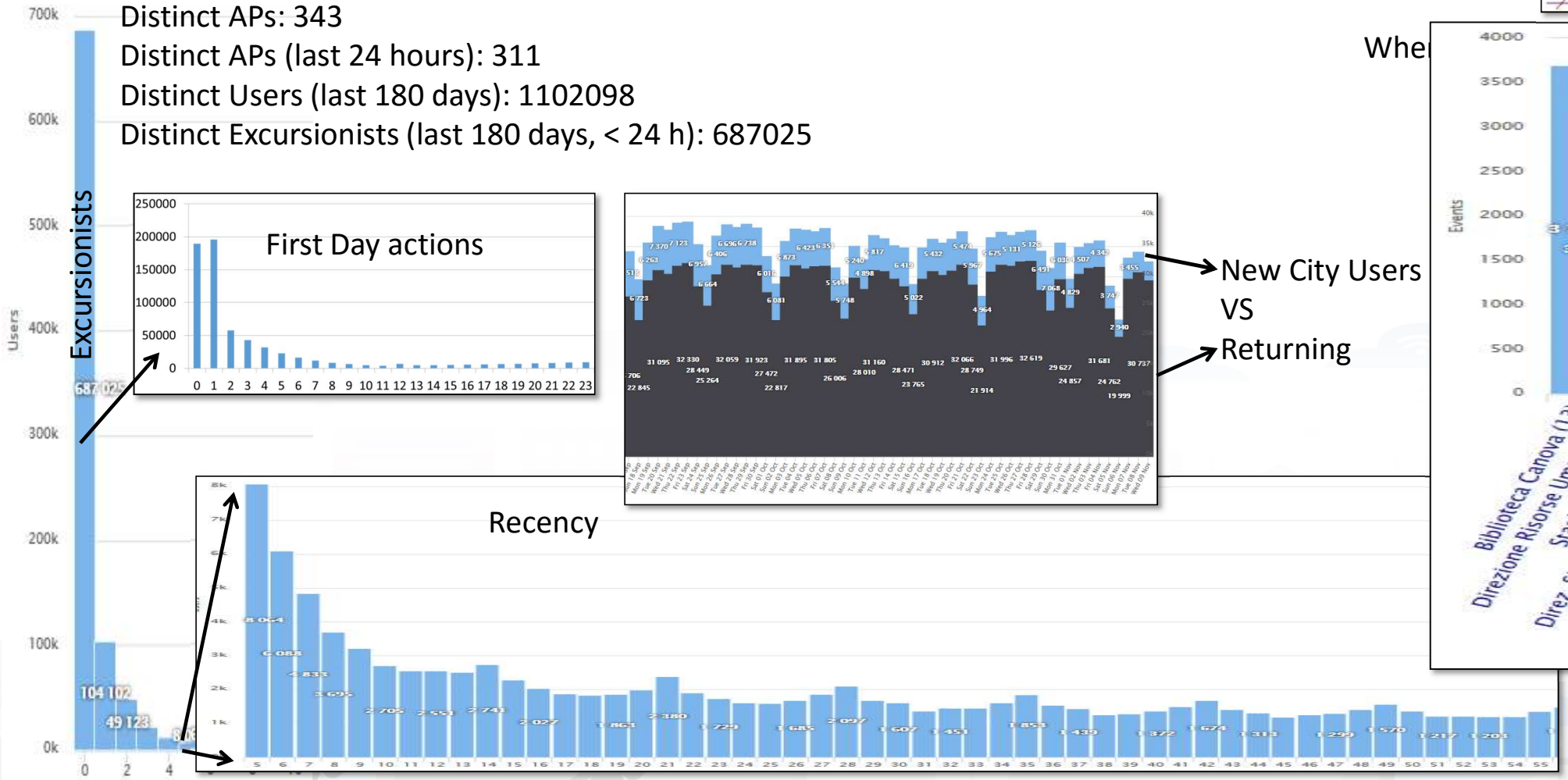
WiFi Monitor tool



Recency and frequency

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



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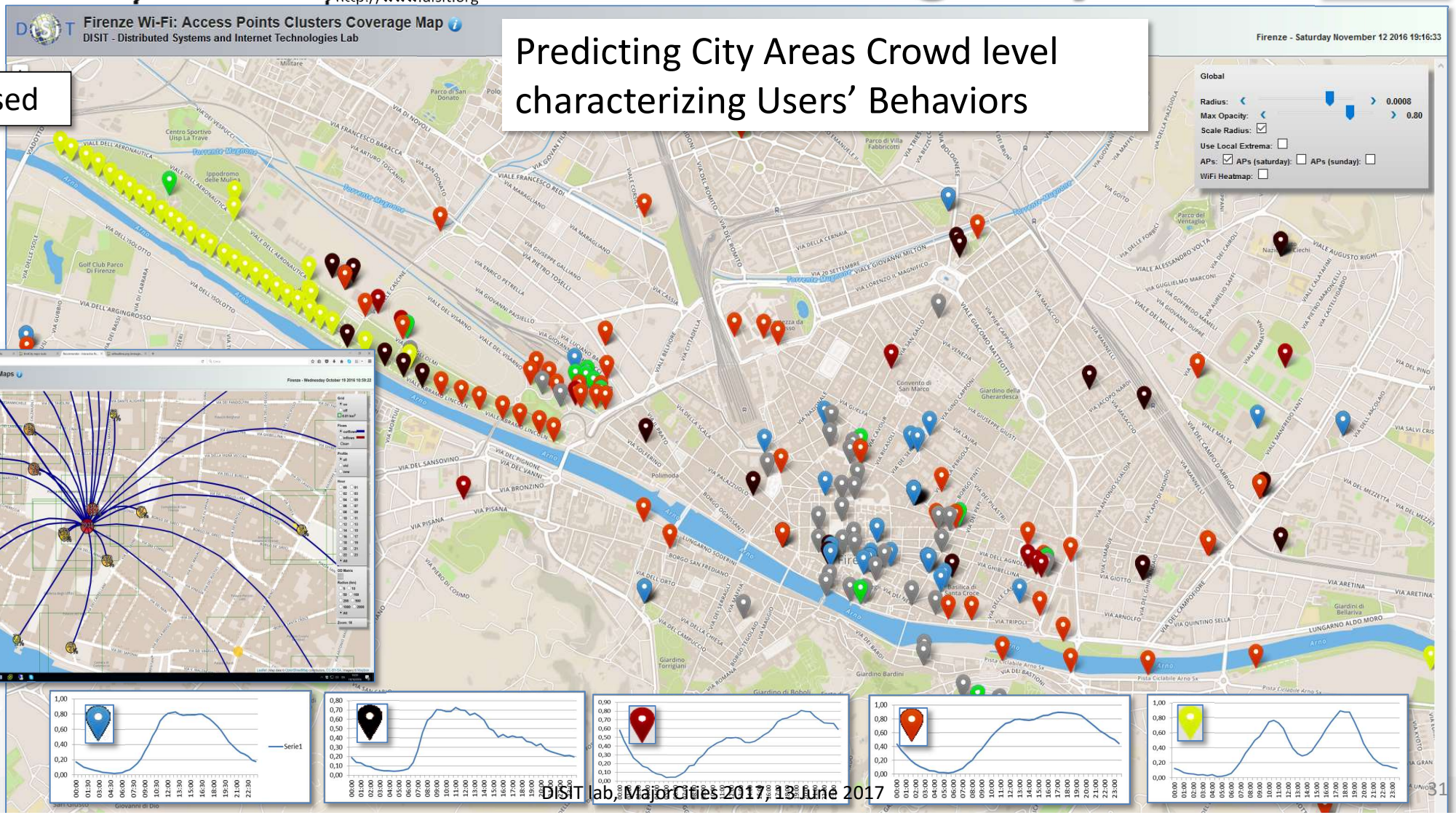
http://www.disit.org

Characterizing City Areas

resolute

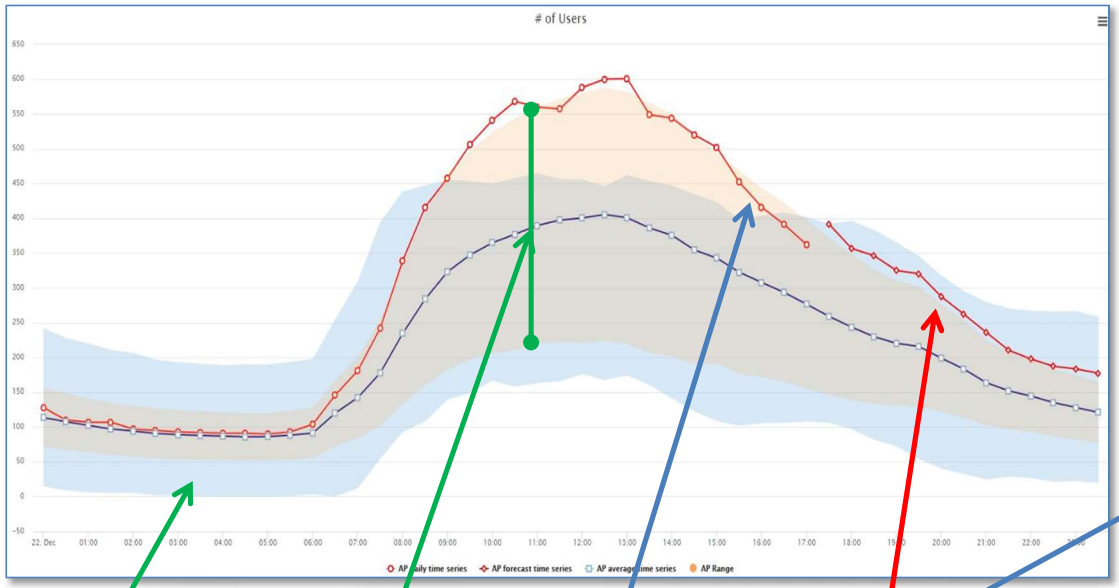
Wi-Fi based

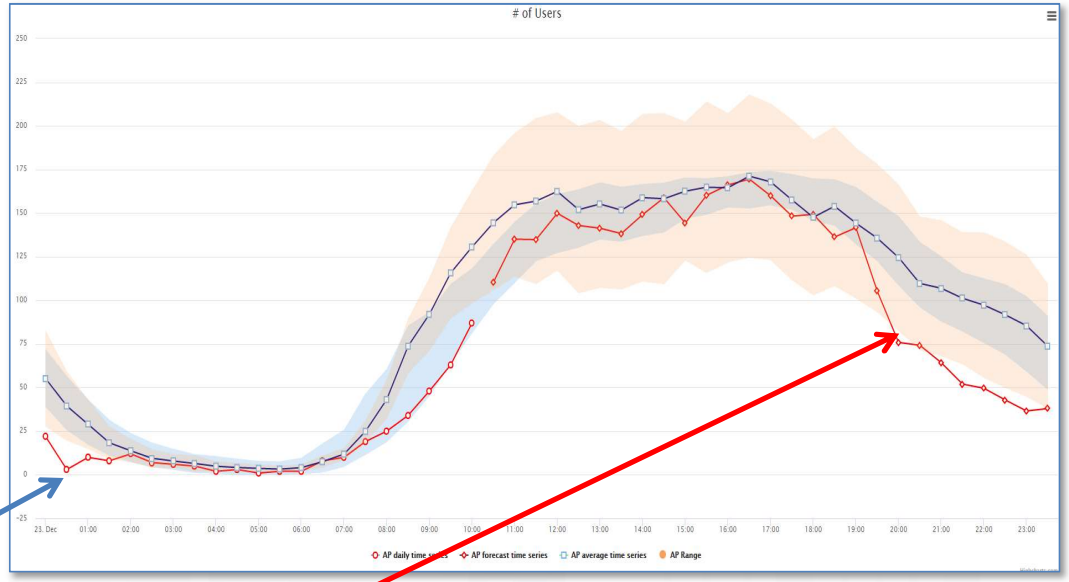
Predicting City Areas Crowd level characterizing Users' Behaviors



ediction and identification of anomalies

Guessing number of users of Wi-Fi Access Points





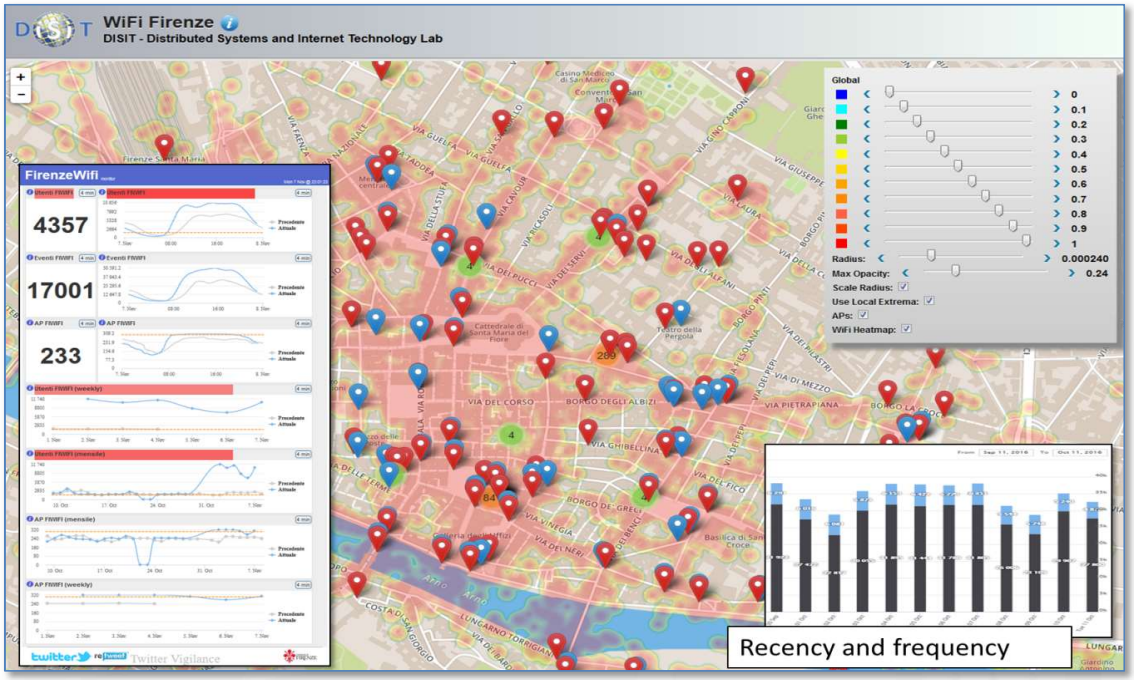
Cluster confidence

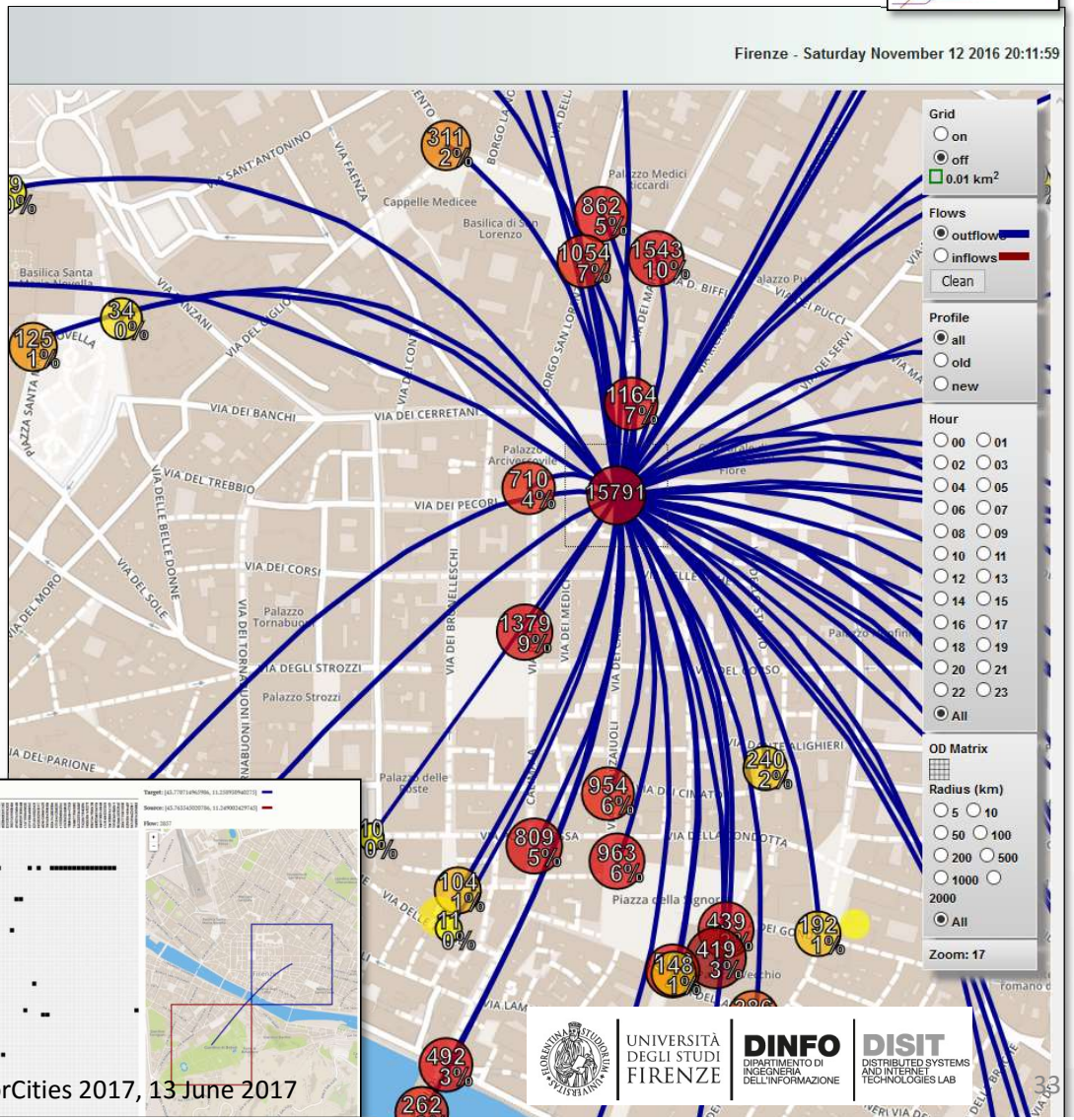
AP average and confidence

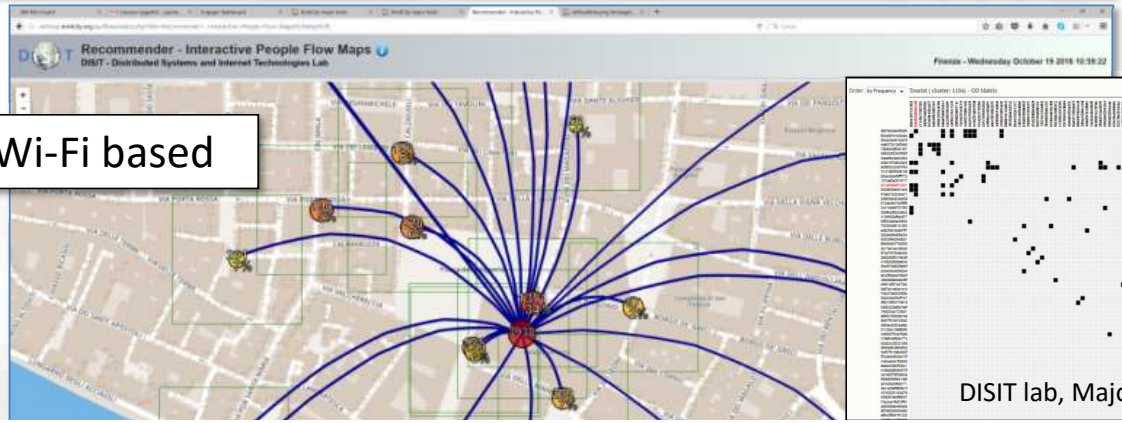
Actual AP trend for today

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

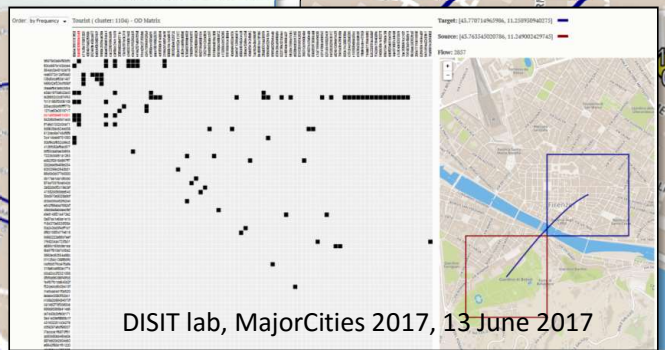
Origin Destination Matrix Estimation







Wi-Fi based



DISIT lab, MajorCities 2017, 13 June 2017

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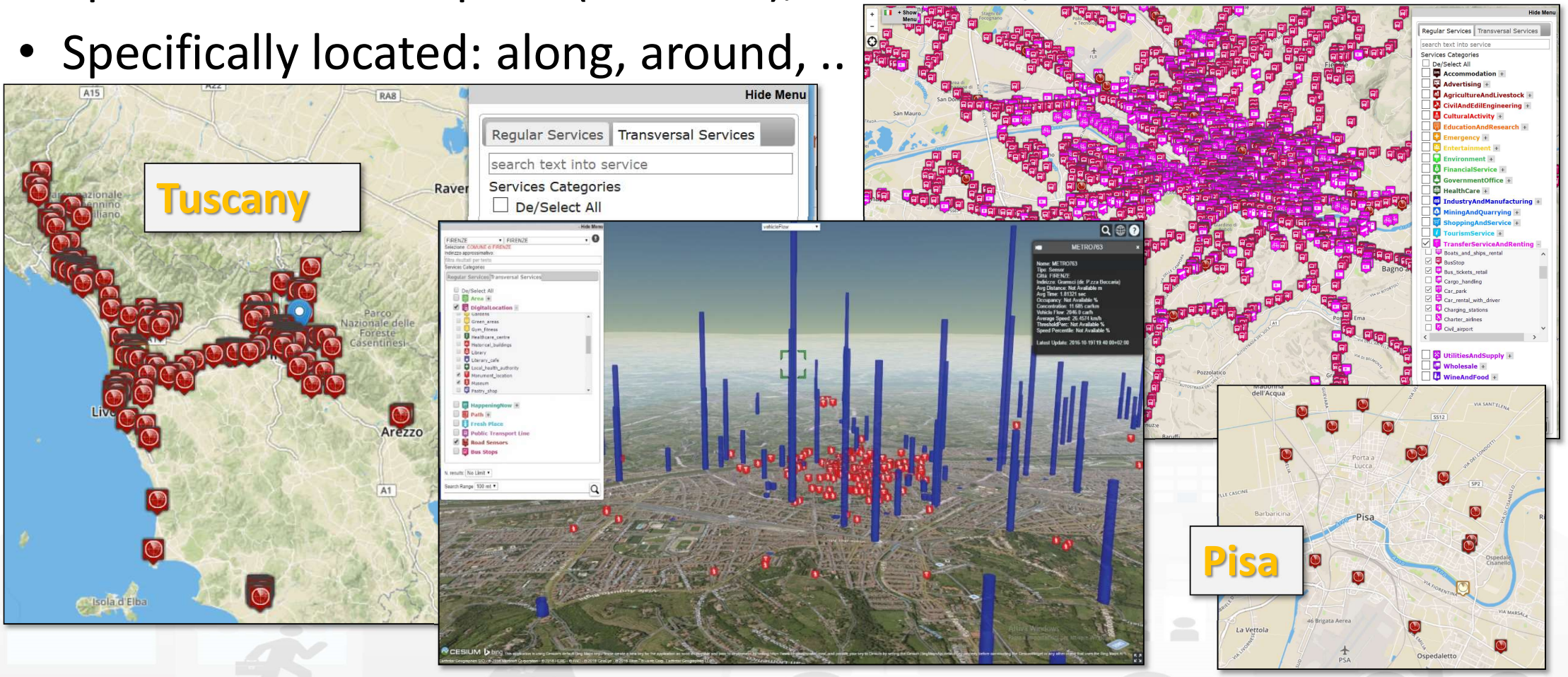
Monitoring Traffic Flow and Parking

Sii-Mobility

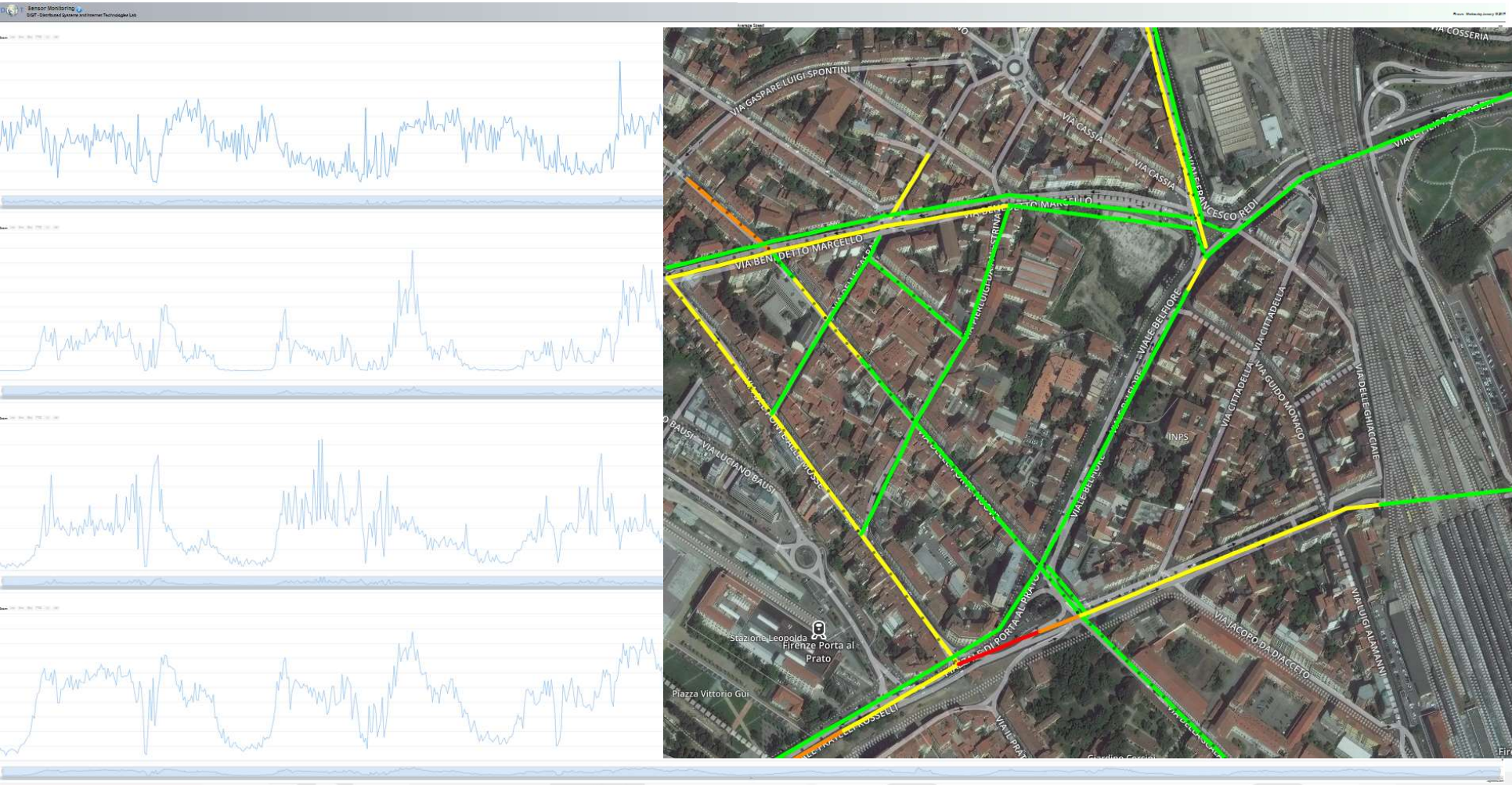
http://www.km4city.org/?controlRoom

Traffic Flow Tools

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



Traffic Flow data



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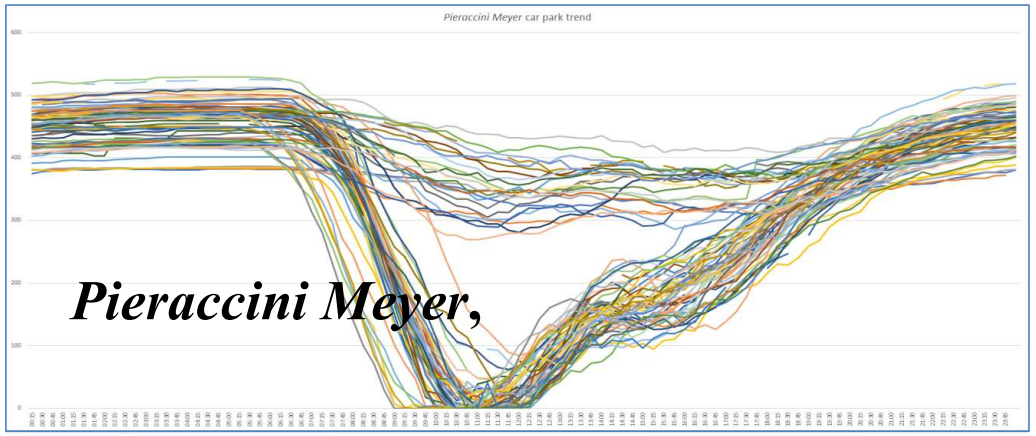
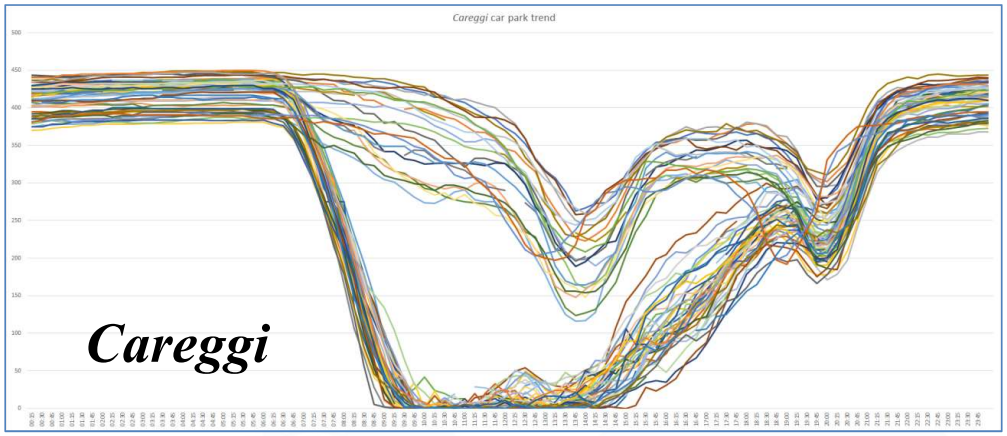
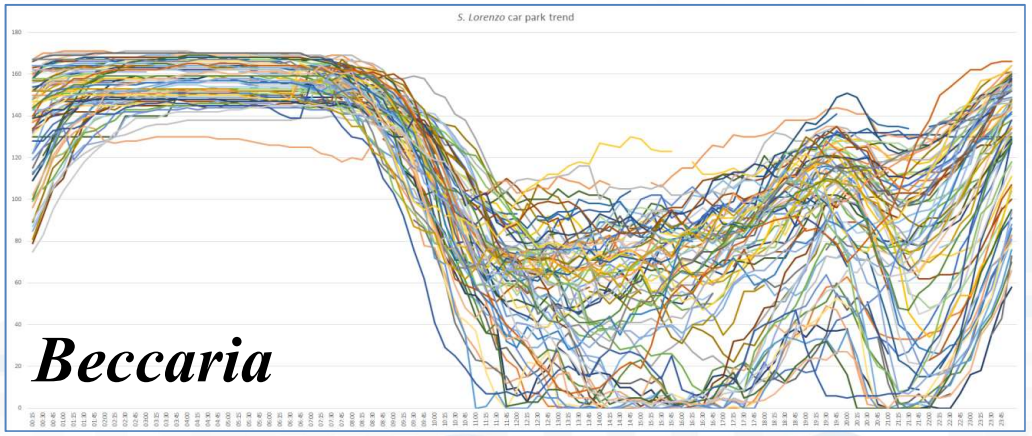
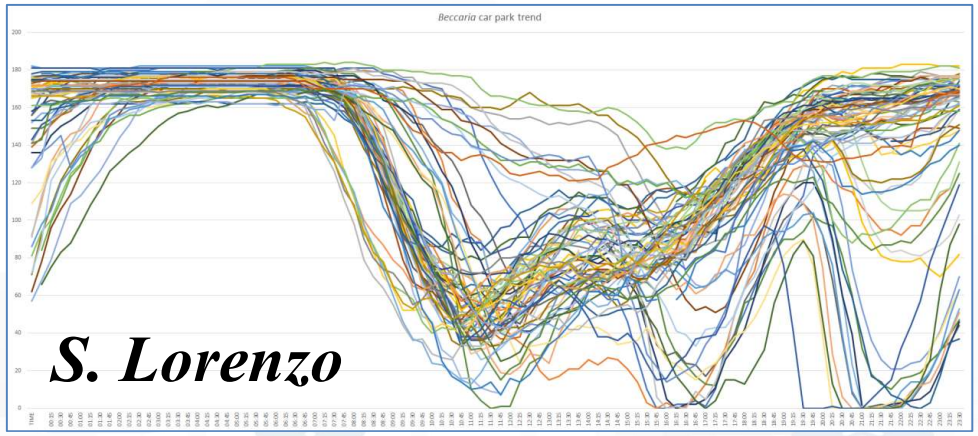
Free Parking space trends





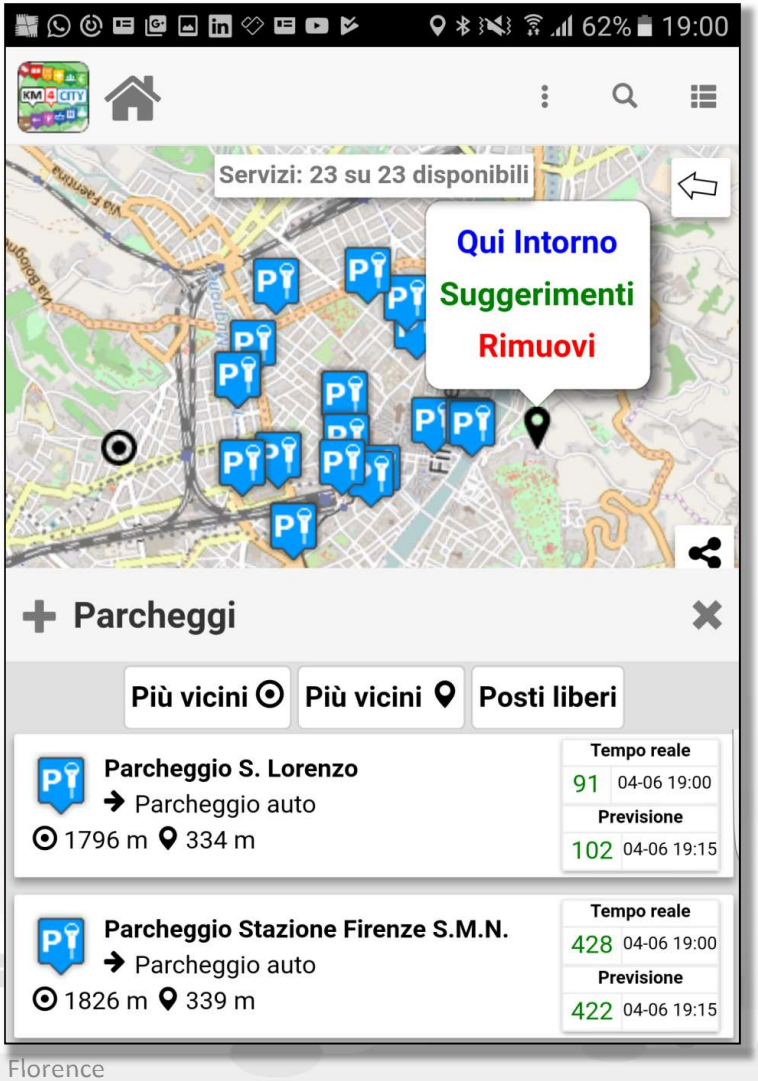




12 parking areas in Florence

Free Parking PREDICTIONS

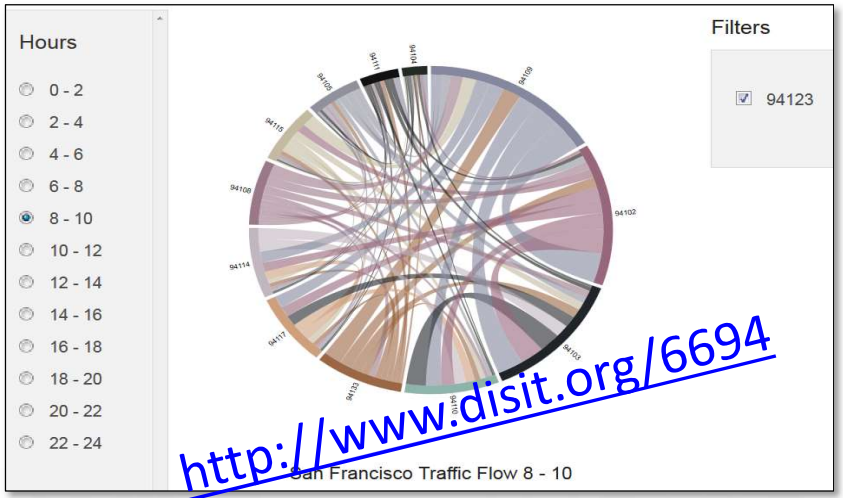
Careggi car park			
Model features	BRNN model results		
	R-squared	RMSE	MASE
Baseline	0.974	24	1.87
Baseline + Weather	0.975	24	1.75
Baseline + Traffic sensors	0.975	24	2.04
Baseline + Weather + Traffic sensors	0.975	24	1.87



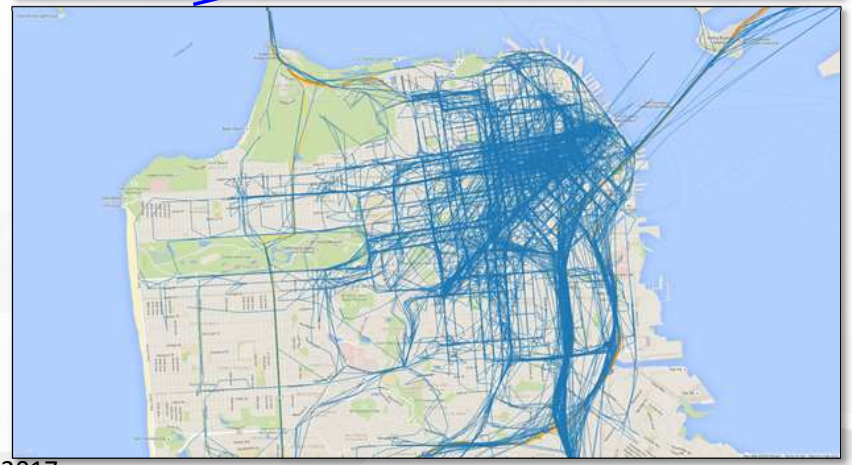
- Active on
- «Firenze dove cosa»
- «Toscana dove cosa»

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



http://www.disit.org/6694



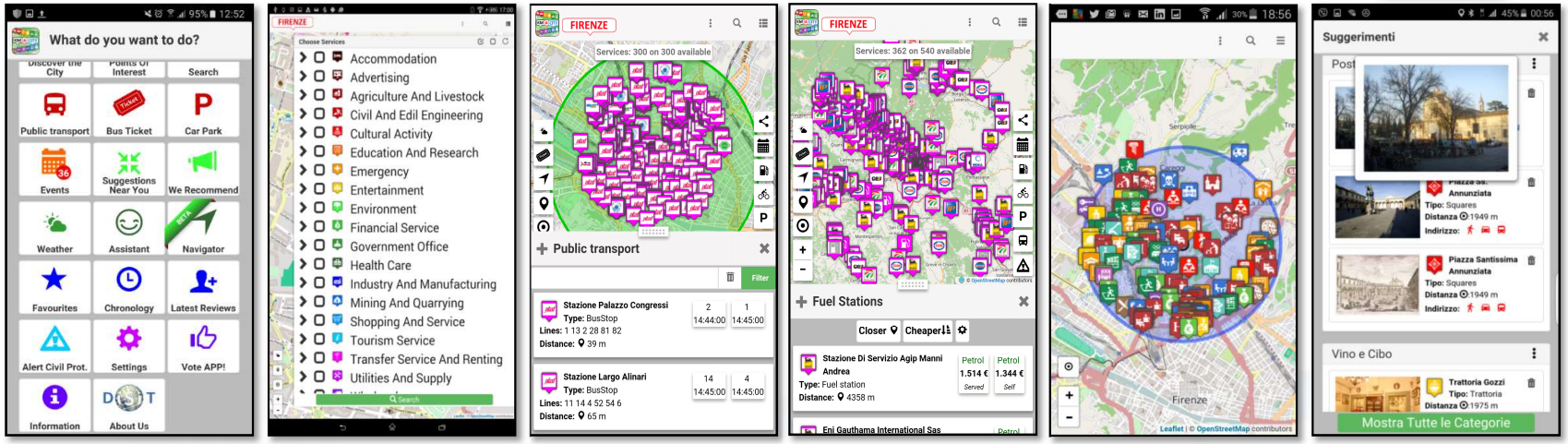
Engaging Users via Mobile App

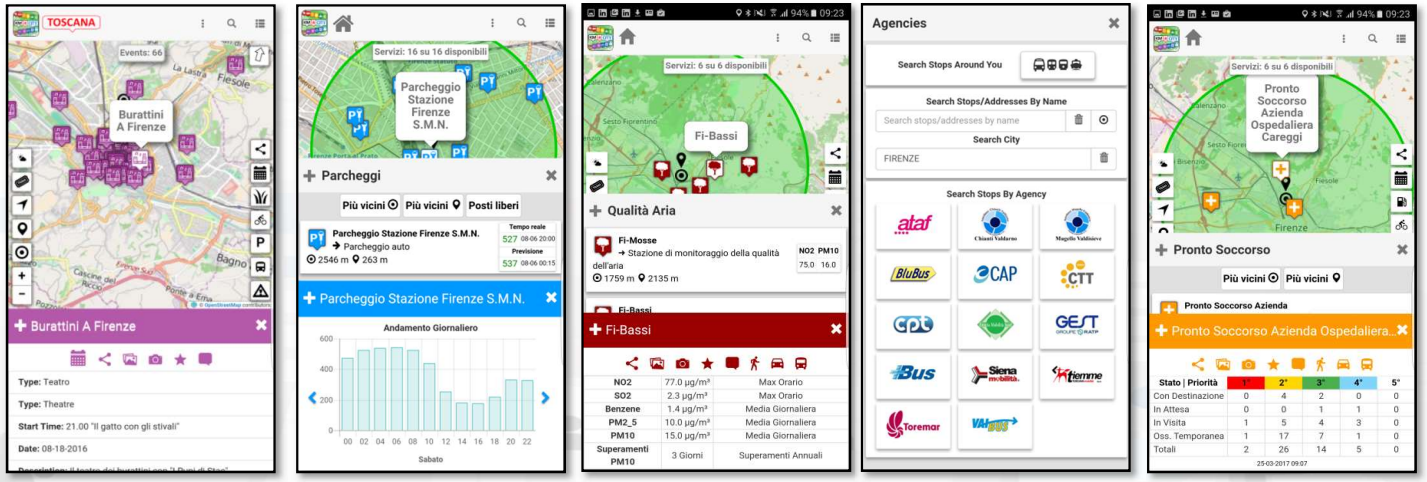
Sii-Mobility

http://www.km4city.org/?controlRoom
http://www.km4city.org/?devTools
http://www.km4city.org/?infoDocs
http://www.km4city.org/?app

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





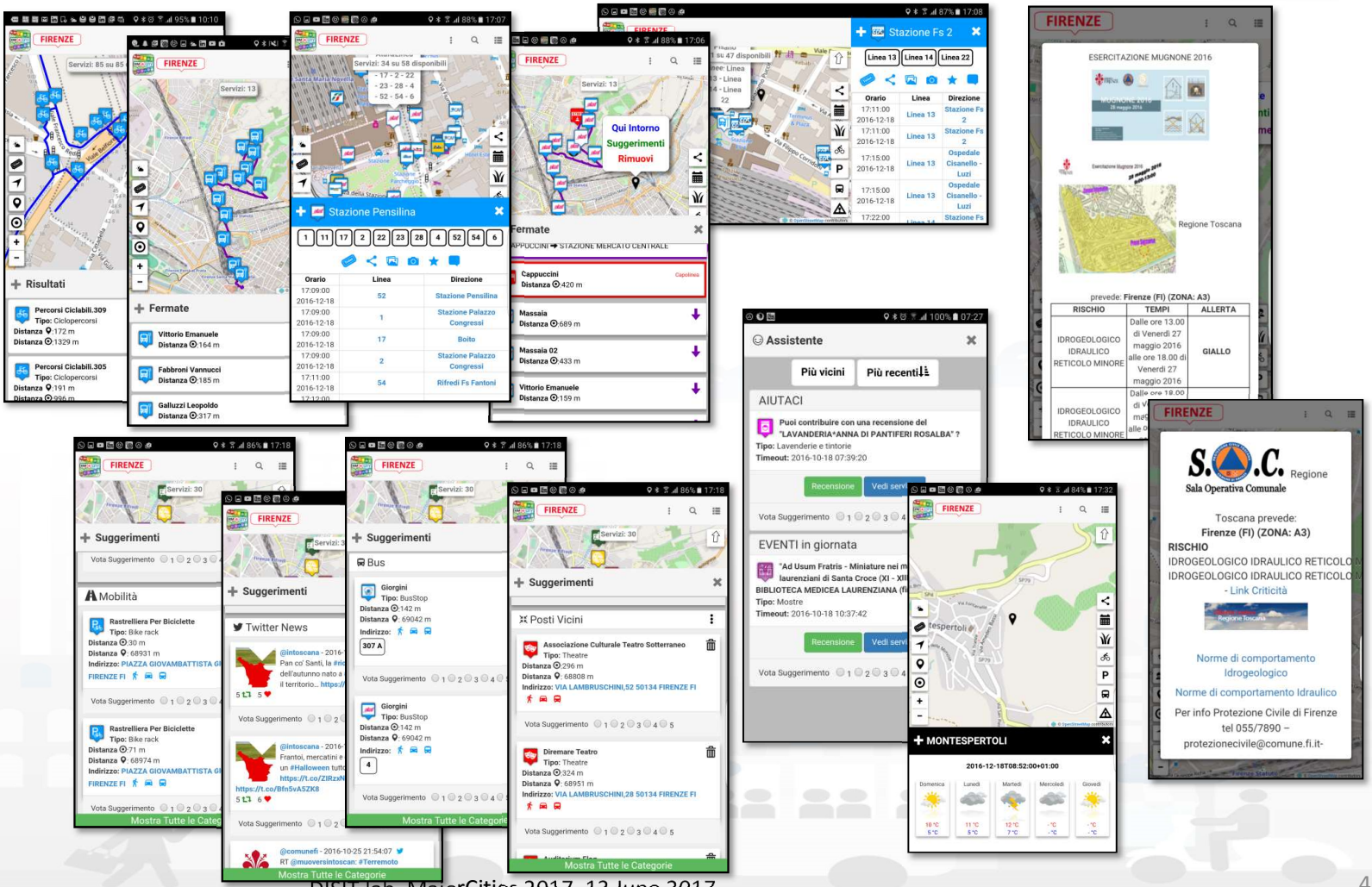
Available on the App Store

ANDROID APP ON Google play

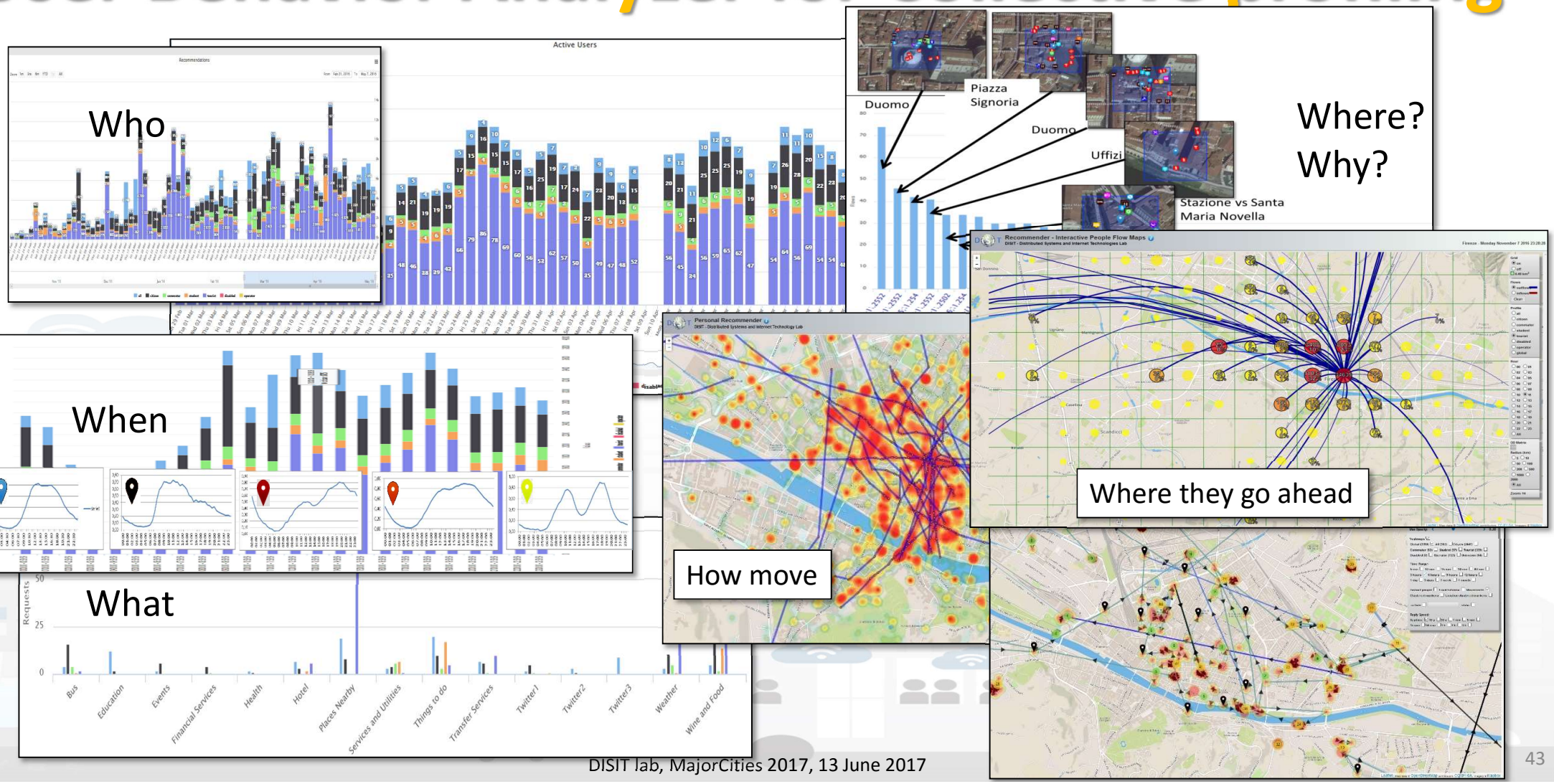
Download from Windows Phone Store

Km4City APP

- **Mobility**
  - Paths and stops, time
  - Parching + 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



User Behavior Analyzer for Collective profiling



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http://www.disit.org

User Behavior Analyzer

Sii-Mobility

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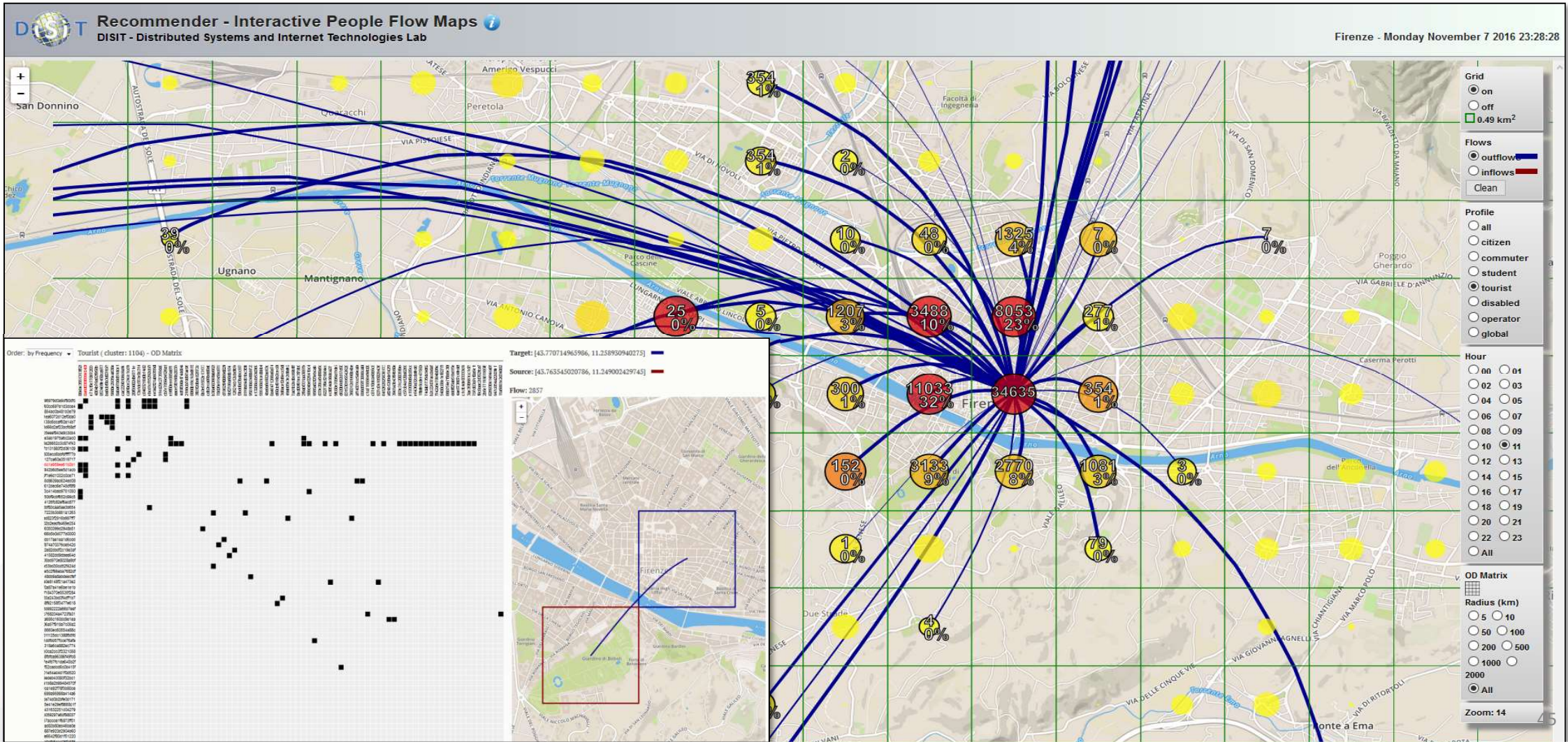
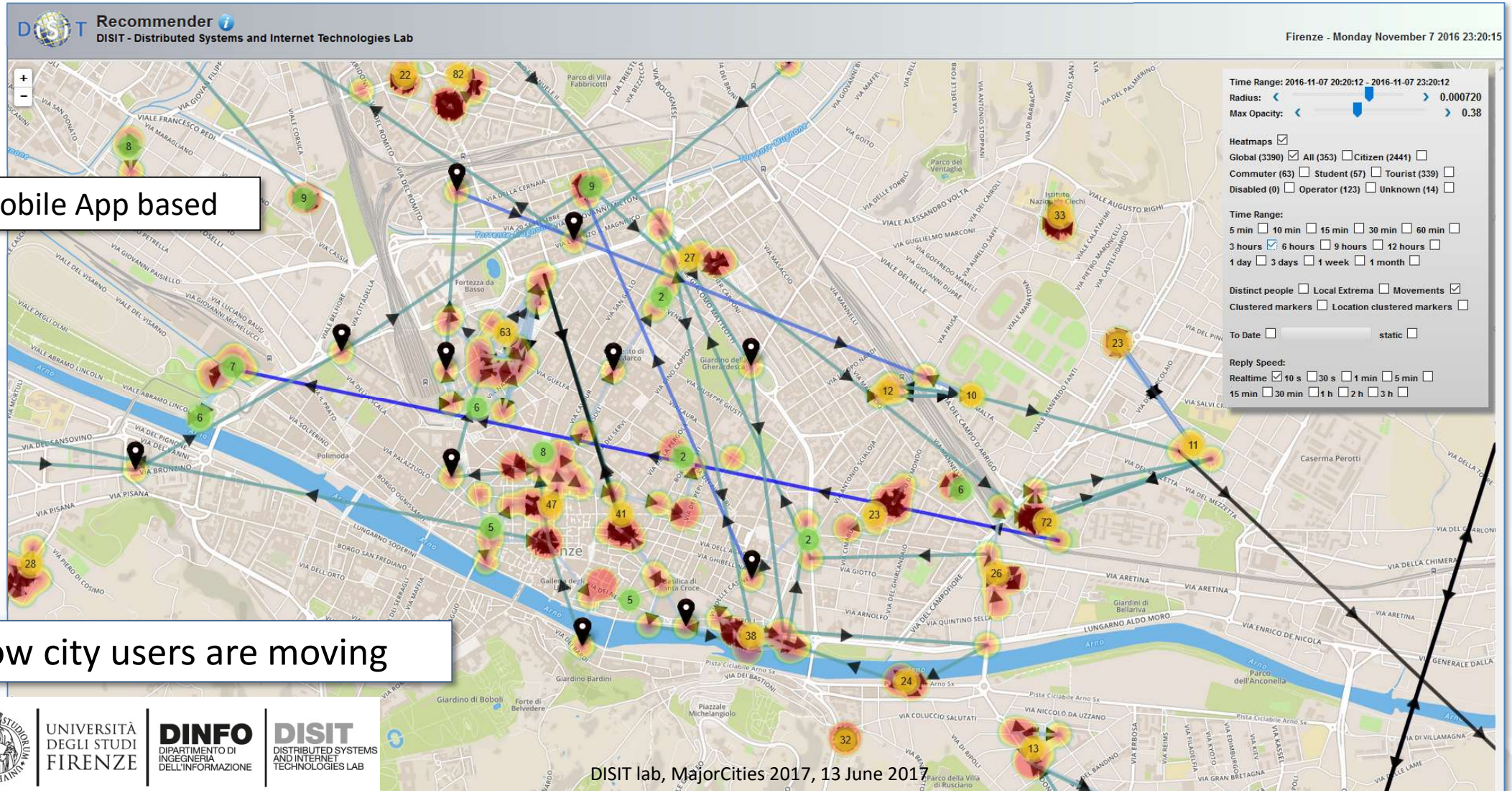
OD Matrix scalabile

Sii-Mobility



Anonymous User Behavior Analysis



Mobile App based

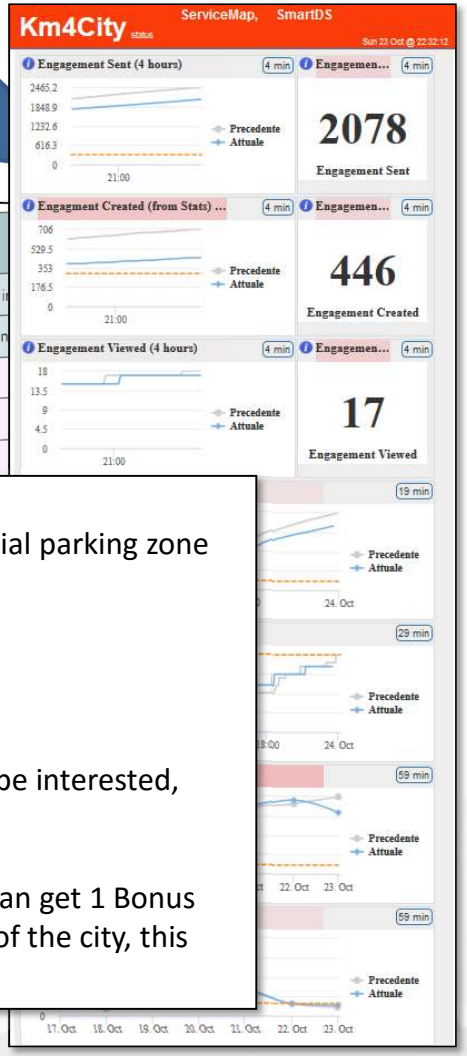
How city users are moving

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 i
daily_event_en	ENGAGEMENT	1720 (2.12%)	70 (7.1%)	4.07%	Suggest (in english) an event currently on in
	- 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%)			
	- 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..

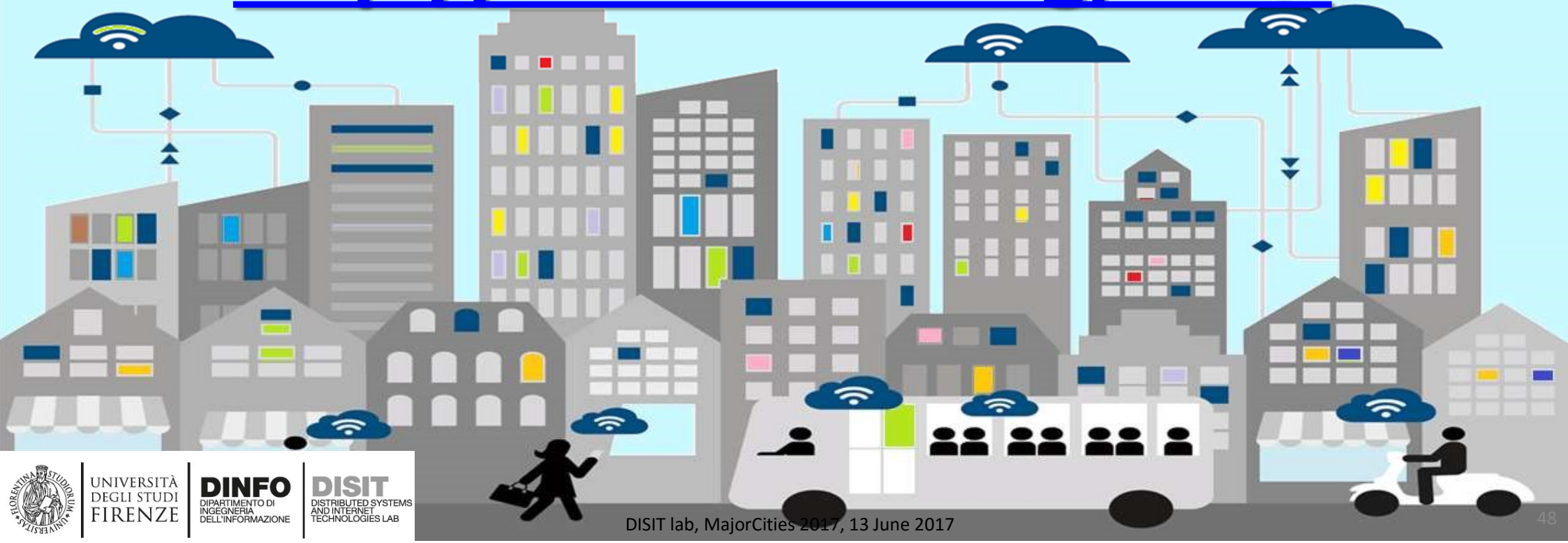
Provide Bonus

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

Smart City API

Sii-Mobility

http://www.disit.org/7044



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Scenari vs SmartCity API

- 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

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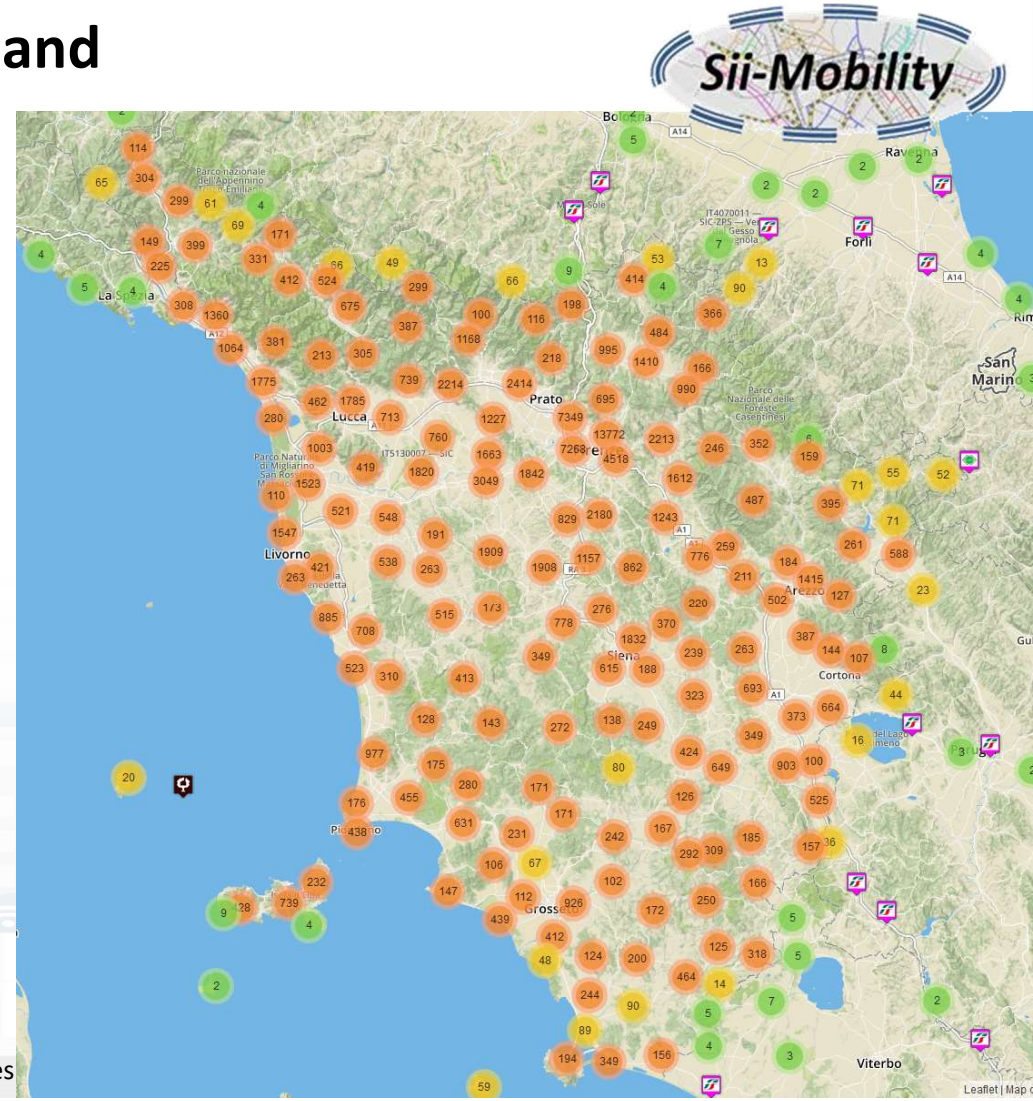
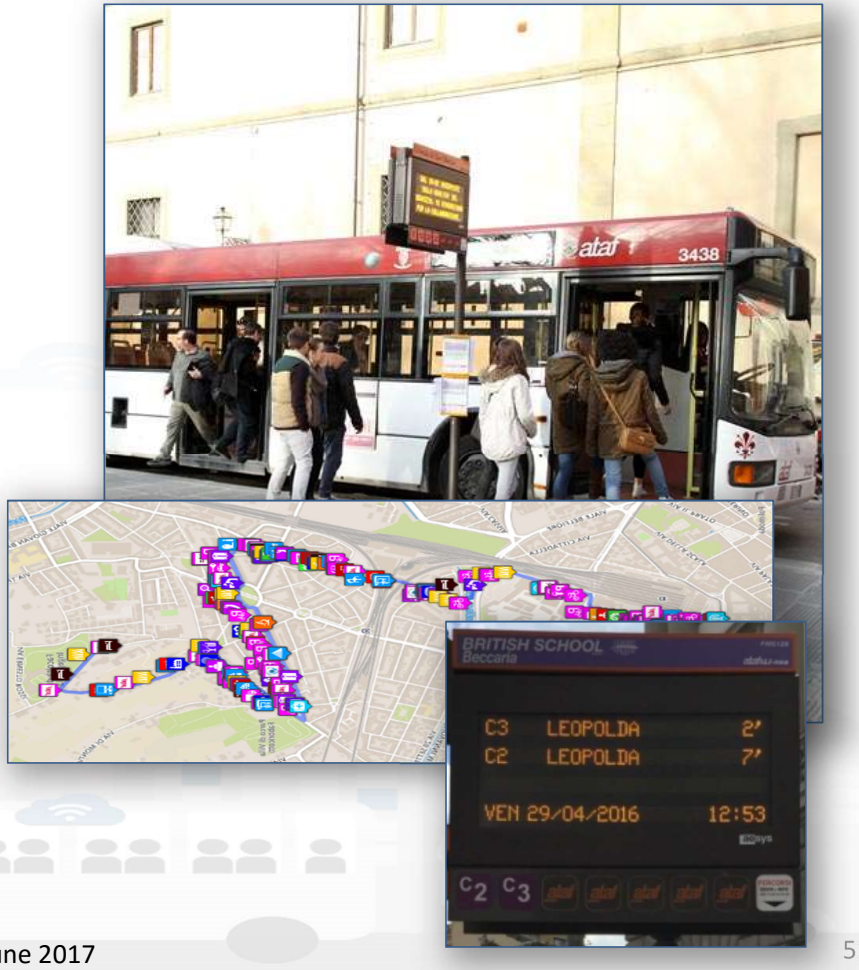
Thematic Data Domain Tuscany

- **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, …



Supporting City Users in using Public Mobility

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



Supporting City Users in using Private Mobility

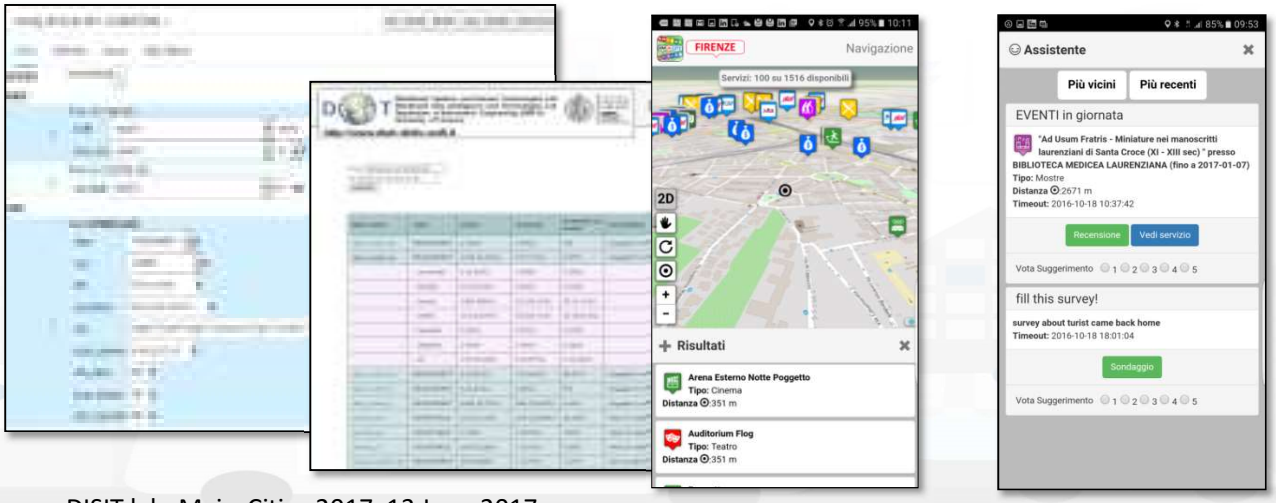
- **Private Transport**
  - Getting **closer parking**
  - Getting **closer free space on parking**
  - Getting **fuel stations** location and prices
  - Searching Services along a **path** or closer to a point or Service as Hotel, Restaurants, square, etc.
  - Getting closer **cycling paths**
  - Recharging stations: location and status
  - Getting traffic information
  - Car and Bike Sharing

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)

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, ….

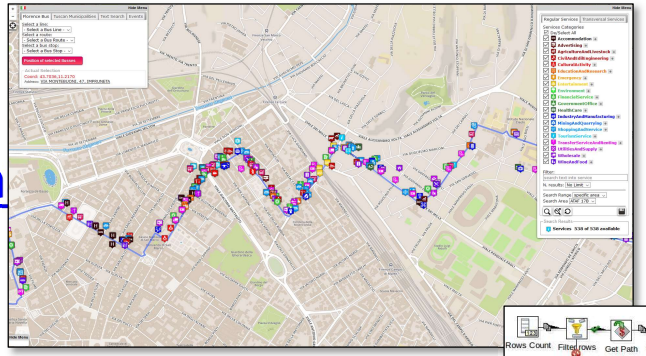


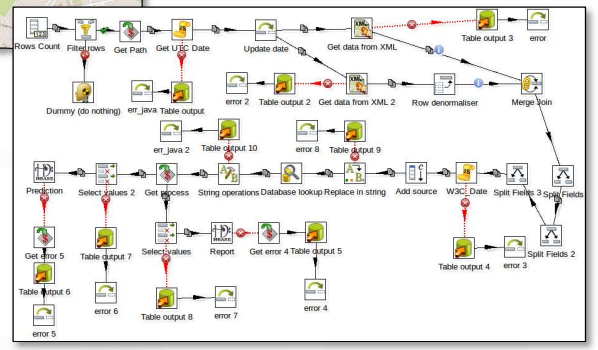
Development Tools

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://servicem**
  - 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***





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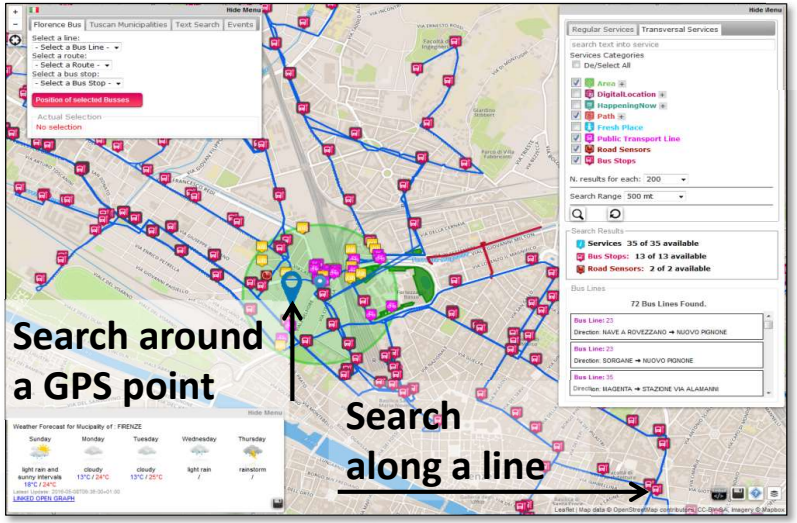
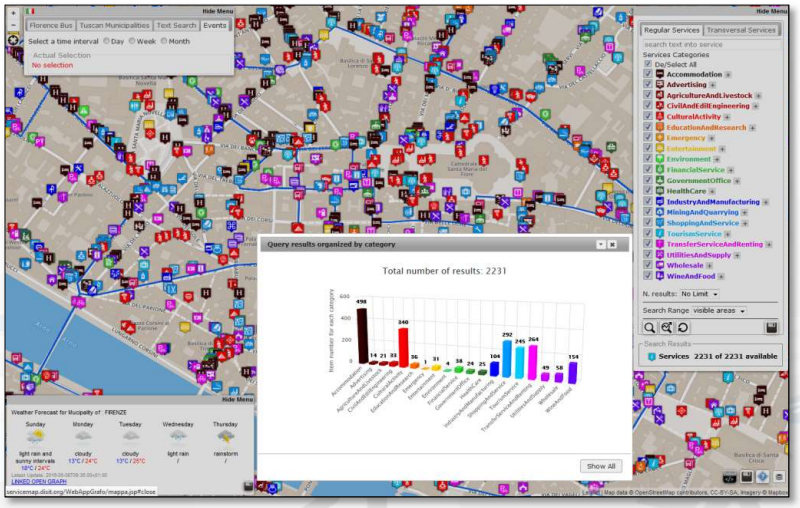
ServiceMap Dev Tool

Sii-Mobility



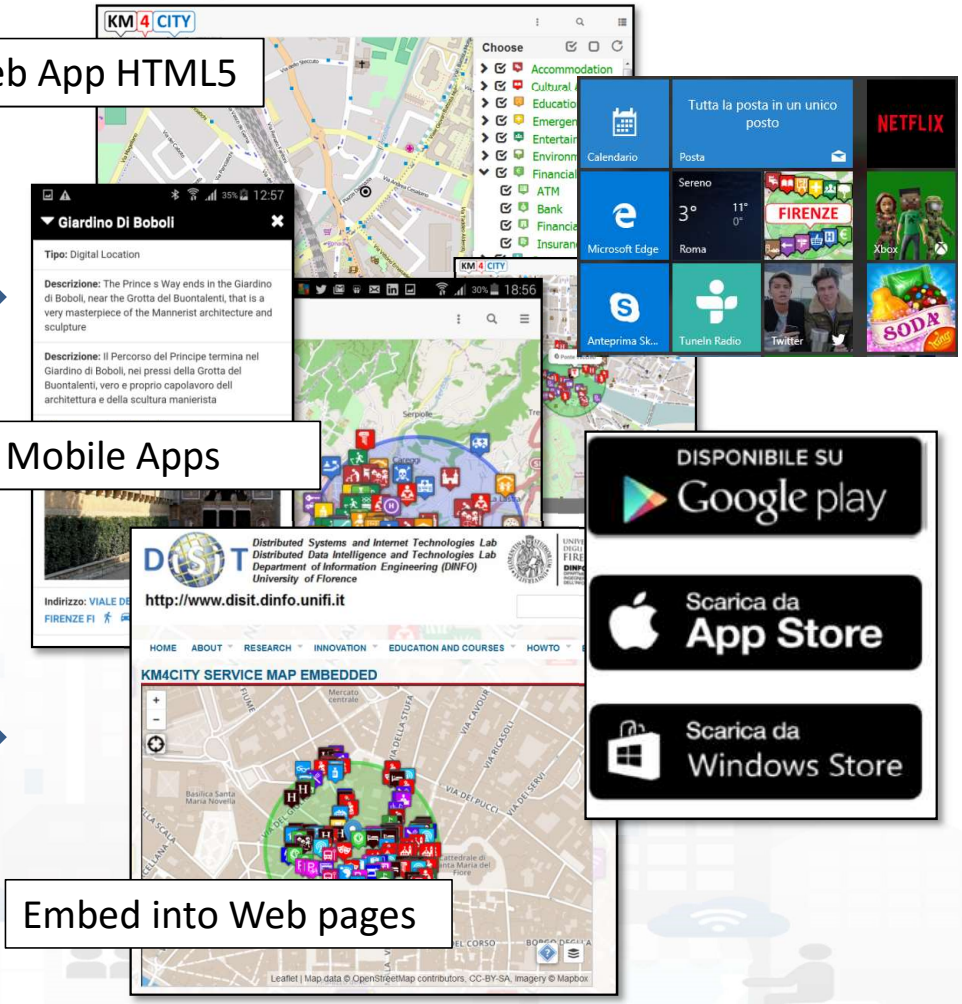


Smart City API call generation

Web App HTML5

Mobile Apps

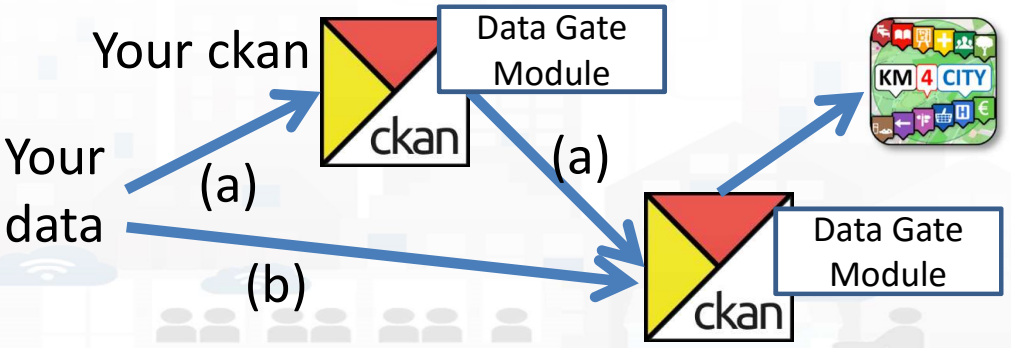
Embed into Web pages



http://www.disit.org/6873

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



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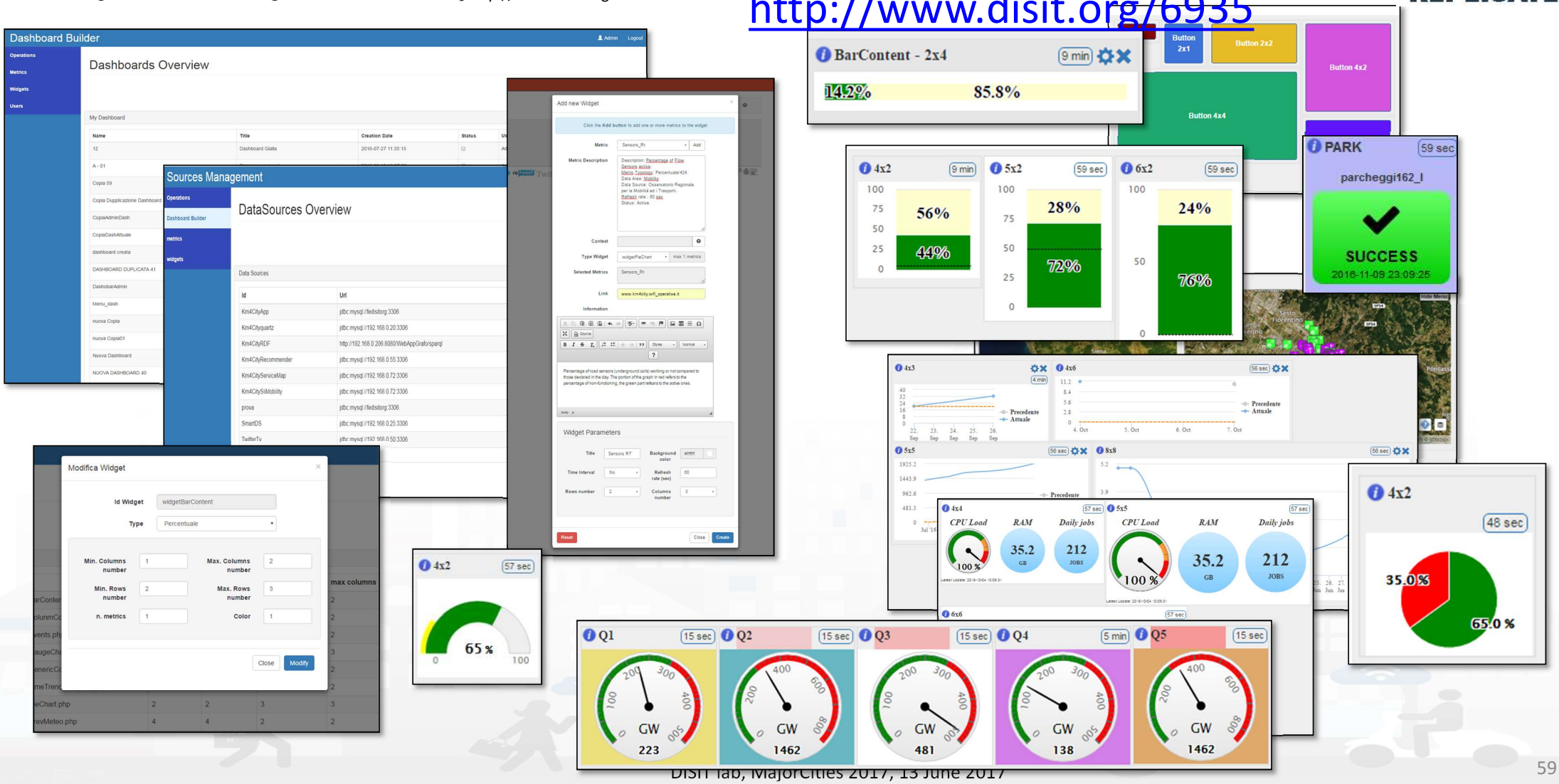
REPLICATE

Dashboard Builder

http://www.disit.org/6935



Projects Using and Contributing to Km4City

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Km4City Roadmap

2013

Km4City 1.1
- Tuscany Map
- Services
- AVM
- Sensors
- Parking
- Cultural Heritage
- Enrichment cities
- Event in the city
- Digital Locations
- Fresh places

2014
- Weather
- Cultural Heritage
- Energy recharhe pillar
- Wi-Fi
- Events in the city

2015

RESilience management guidelines and Operationalization appLied to Urban Transport Environment

Km4City 1.4
- Embed
- More API
- iBeacon
- http://servicemap.km4city.org API
- http://log.disit.org
- http://www.disit.org/fodd
- http://www.disit.org/tv Twitter Vigilance
- http://smartds.km4city.org

Km4City 1.5
- SmartDS
- Km4City App

RESOLUTE H2020
2015–2018 - Started

Sii-Mobility
http://www.sii-mobility.org

2016

REPLICATE H2020
2016–2021 - Started

REPLICATE
REnaissance of PLaces with Innovative Citizenship And TEchnology

WEEE
2017-2020

6/2017
- Suggestions on demand
- User Behaviour Analysis
- Trajectories and OD

Sii-Mobility SCN
2016-2018 – Started
Km4City 1.6.2

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

GHOST SIR
2016–2019 - Started

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

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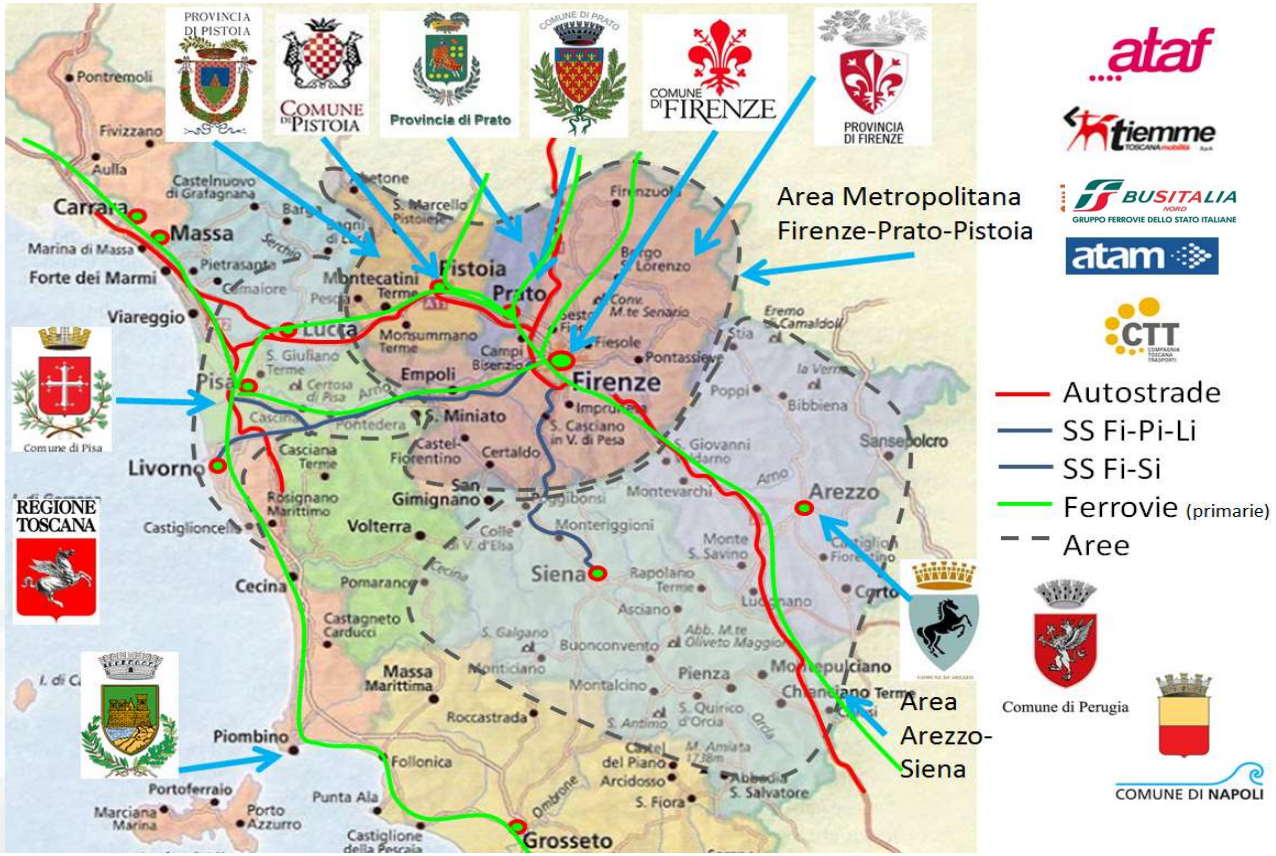
Sii-Mobility

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*



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

http://www.Sii-Mobility.org

MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA

KM 4 CITY

Commenti dei cittadini, Social Media

AVM trasporto Pubblico

Merci

Sensori su trasporto Privato

Sensori, sistema monitoraggio

Sii-Mobility

Sensori Parcheggi

UTC

Infomobility

Monitoraggio traffico, autostrade

Rete Ferroviaria

Parametri ambientali

Servizi ed enti

Ordinanze: eventi, lavori pubblici, ..

Varchi Telematici, ZTL

Emergenze, polizia, 118

Horizon 2020
European Union Funding
for Research & Innovation

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

REPLICATE

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 DIEF
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 SYSTMES, 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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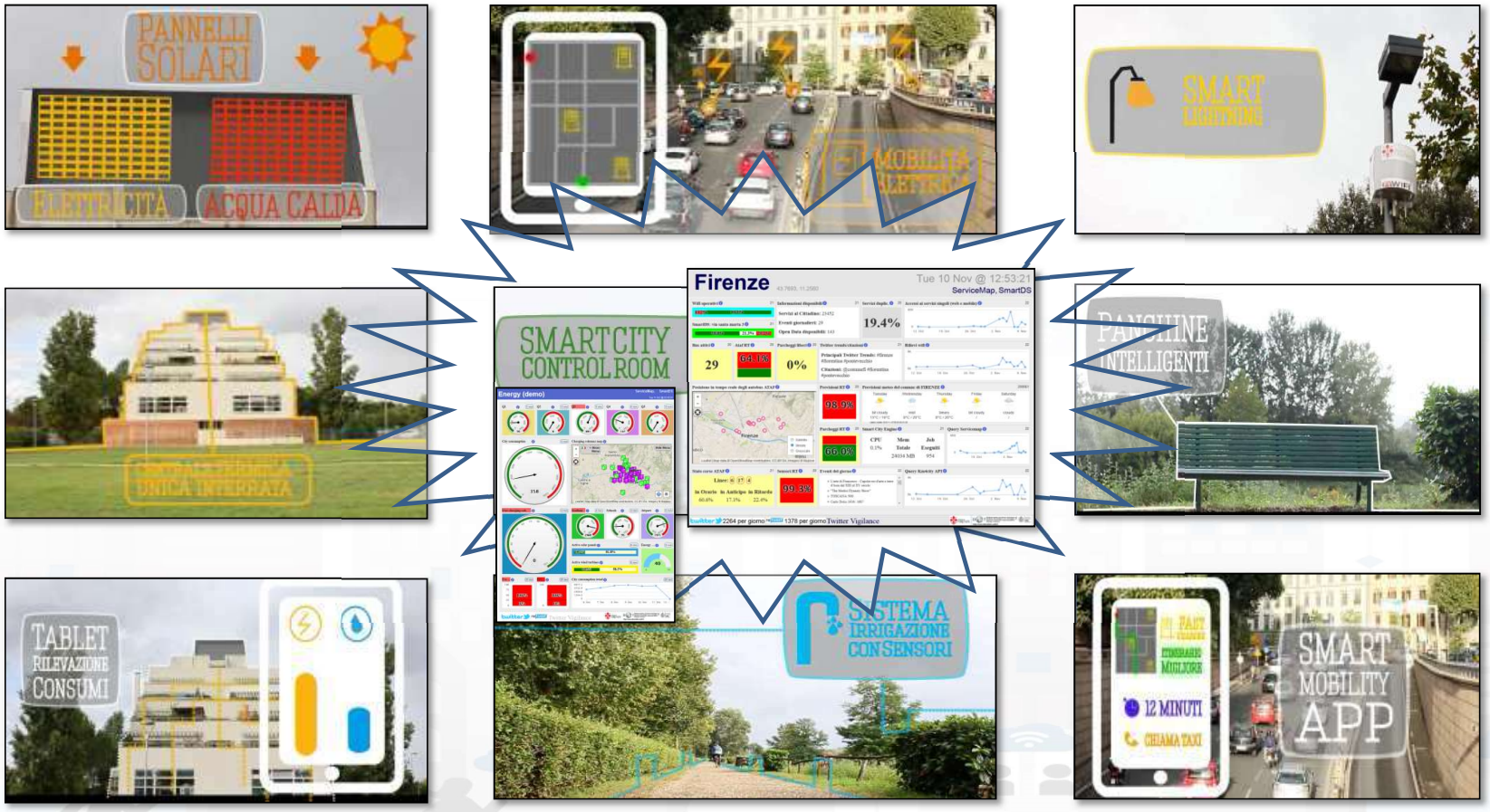
REPLICATE

Horizon 2020 European Union Funding for Research & Innovation

REPLICATE in Firenze: Energy, ICT & Mobility



http://replicate-project.eu/

Acknowledgement

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Km4City, the urban platform for sentient cities

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