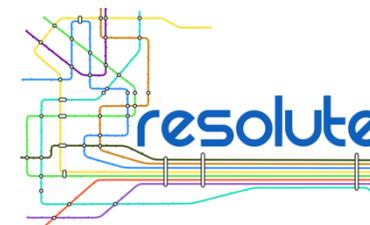




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**DINFO**  
DIPARTIMENTO DI  
INGEGNERIA  
DELL'INFORMAZIONE

**DISIT**  
DISTRIBUTED SYSTEMS  
AND INTERNET  
TECHNOLOGIES LAB



# Attività' del DISIT Lab su Allertamento

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

Paolo Nesi, [paolo.nesi@unifi.it](mailto:paolo.nesi@unifi.it)

[www.Km4City.org](http://www.Km4City.org)



PROTEZIONE CIVILE  
Presidenza del Consiglio dei Ministri  
Dipartimento della Protezione Civile

Forum sul Sistema di Allertamento

Dipartimento della protezione civile  
Auditorium "Elio Di Cicco" - Via Vitorchiano 4

Roma, 25 settembre 2018



# 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

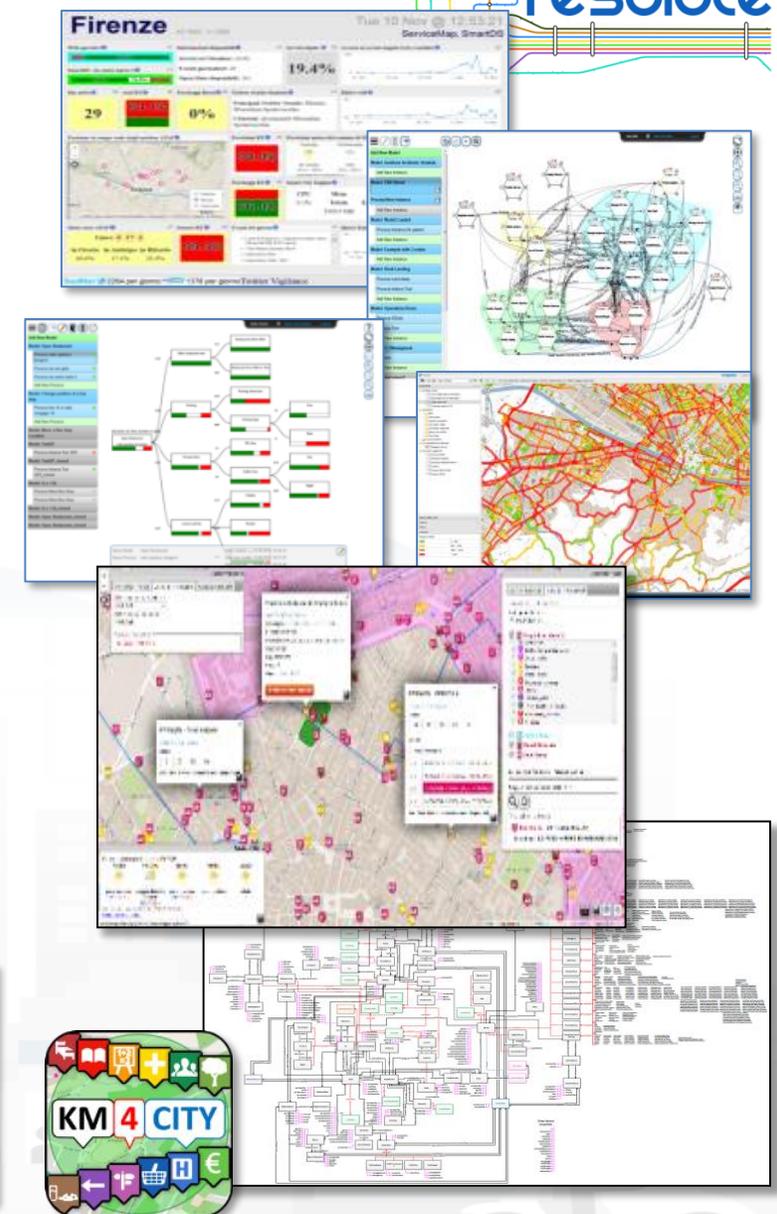
Data Integration APIs

User Profiler APIs

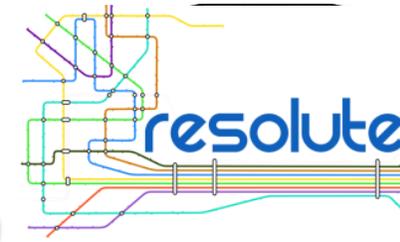
User profiler

Integration framework

Data and Service Aggregator



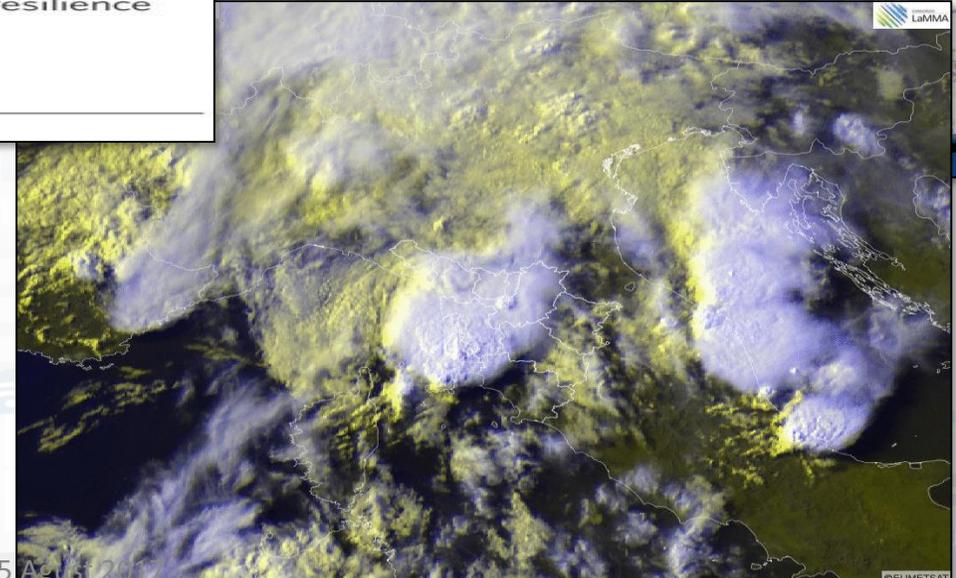
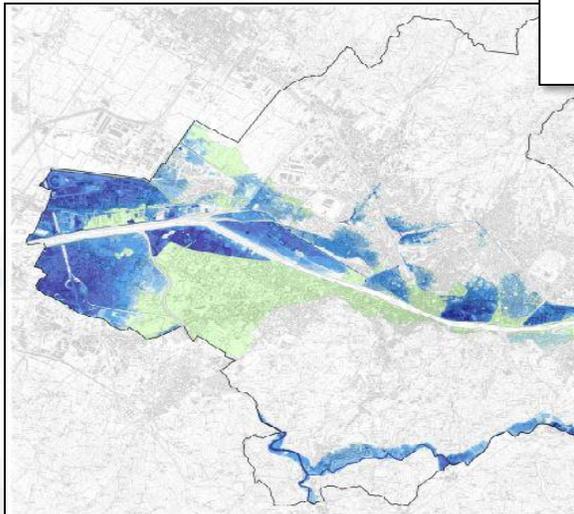
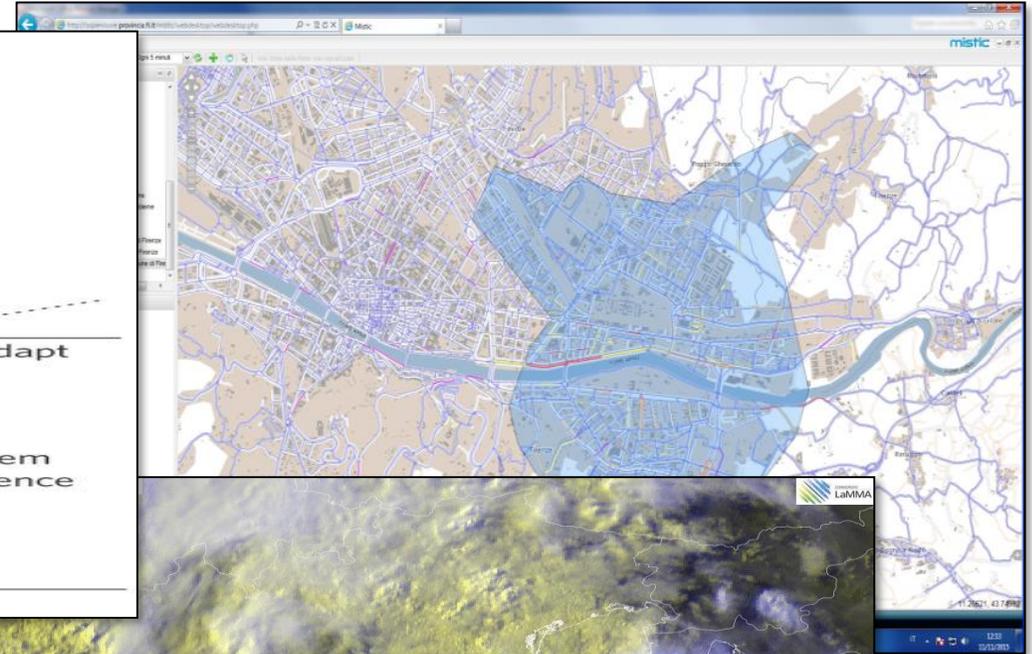
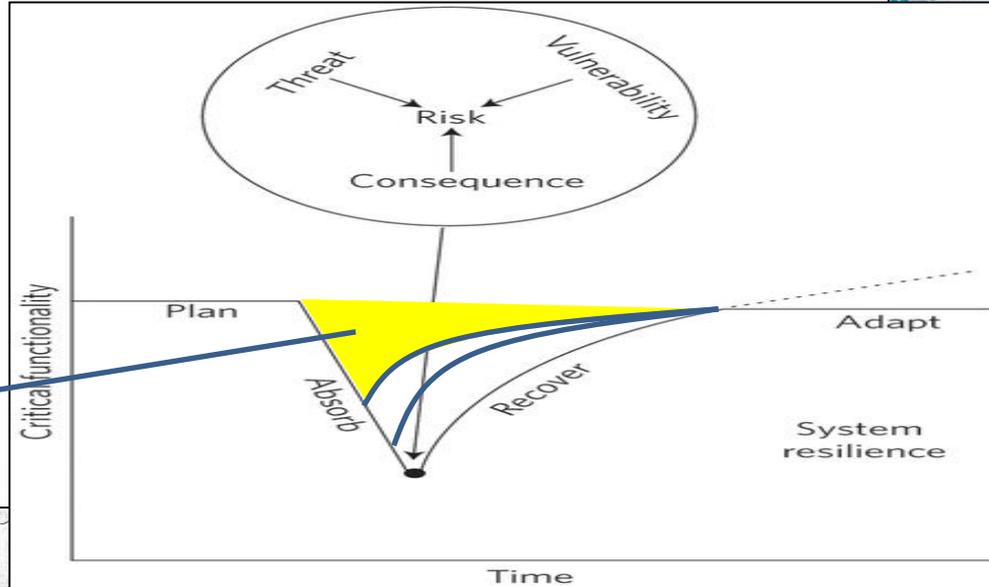
# City Resilience



## Early warning, detection

**P**repare  
**A**bsorb  
**R**ecover  
**A**dapt

damage



**Present data on  
Tuscany Region  
January 2018**

## 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
- 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,
- [1600 Fuel stations: 1 update X day X station]
- 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 sensors .....

Fermate Firenze Comuni in Toscana Ricerca Testuale

Seleziona una provincia:

FIRENZE

Seleziona un comune:

FIRENZE

Actual Selection

COMUNE di FIRENZE

KM4 CITY

Giovedì

Venerdì

Sabato

poco nuvoloso

poco nuvoloso

velato

23°C / 27°C

schiarite

20°C / 33°C

<http://servicemap.km4city.org>

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



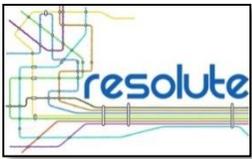
Risultati della ricerca

**più di 4000 risultati, attivato clustering**

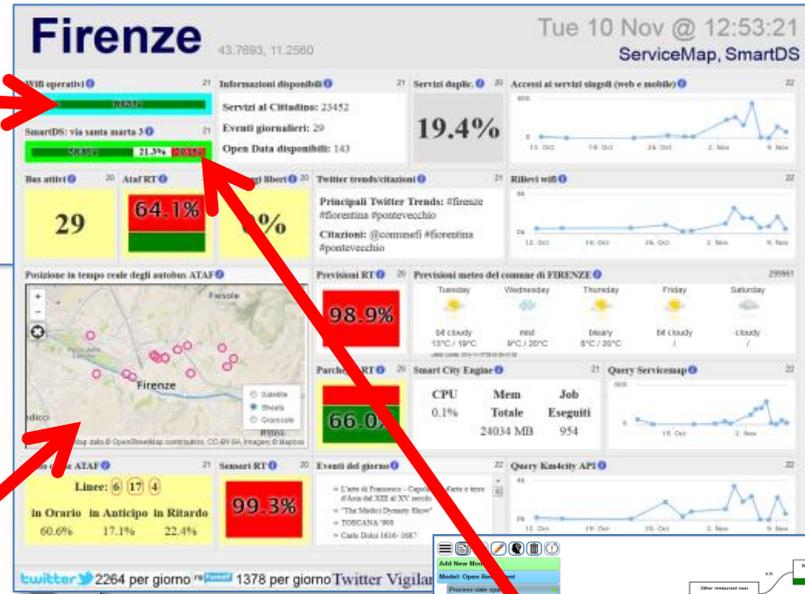
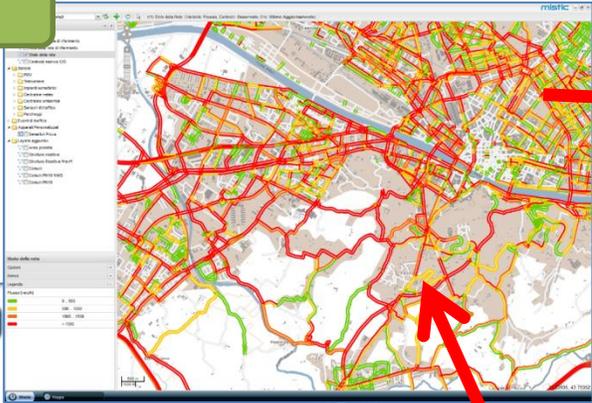
**Services 16858**



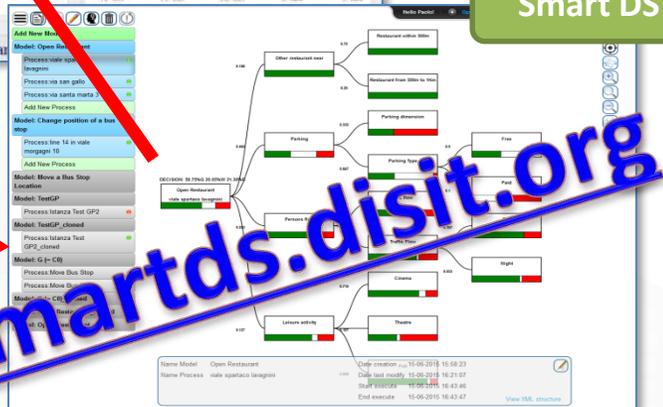
# Assessing / Controlling city resilience



UTS DSS



Smart DS

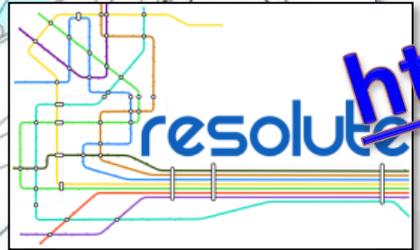


Data and Service Aggregator

<http://resilienceds.disit.org>

<http://smartds.disit.org>

FRAM → ResilienceDS







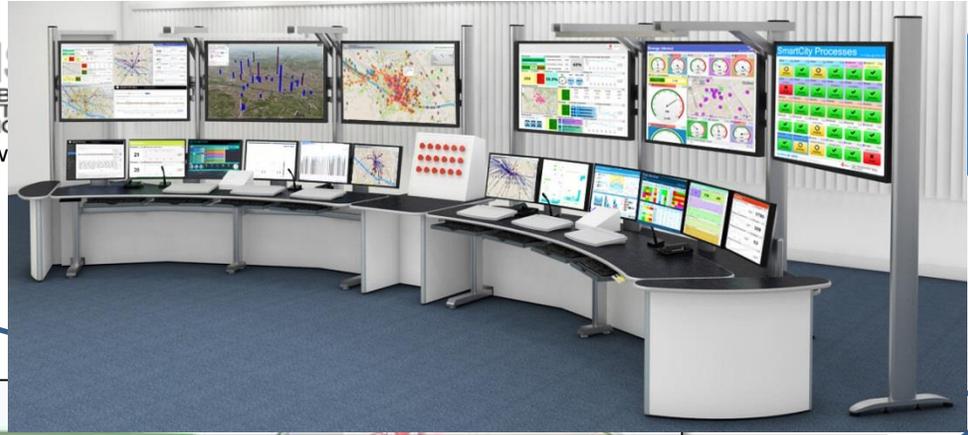
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E INFORMATICA  
TECNICHE  
<http://www.dinfo.unifi.it>



Horizon 2020  
European Union Funding  
for Research & Innovation



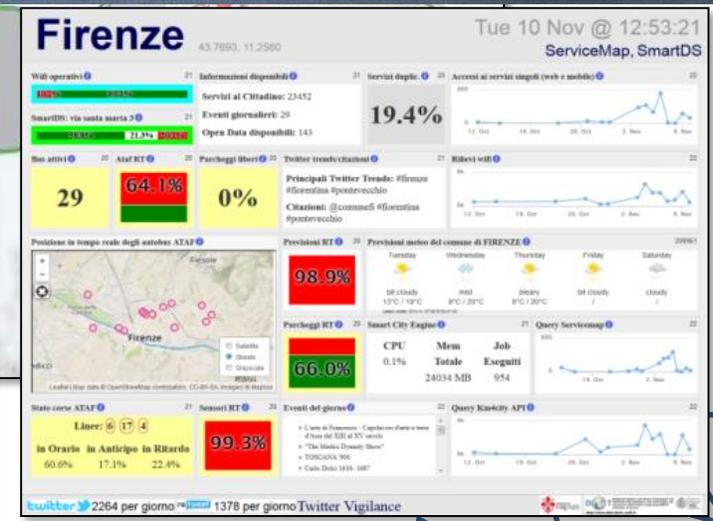
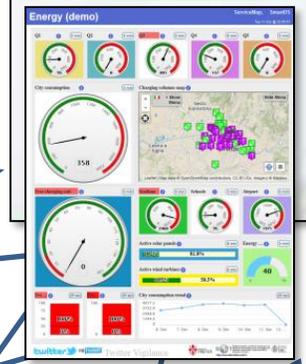
Transport  
systems,  
Mobility, Parking

Shops,  
services,  
operators



Sensors, IOT  
Cameras, ..

**SMARTCITY  
CONTROL ROOM**



Social Media,  
WiFi, Network



Public services,  
Govern, Events



Environment,  
Water, energy

# Dashboards

### ESB

**Alarms**

- TEST - ALLUVIONE MUGNONE MAJOR 12:45:54
- ALLUVIONE ARNO COVERCIANO CRITICAL 15:47:31
- ALLUVIONE ARNO VIA PETRIOLO MAJOR 18:48:11
- TEST - SCORTRI ALLO STADIO CRITICAL 09:50:04

**Traffic events**

- SEVERE ACCIDENT SERIOUS ACCIDENT(S) 11:24:01
- ROAD WORKS 11:24:10
- RESTRICTIONS 00:00:00
- INTERVENTO URGENTE PUBBLICACQUA CLOSED AHEAD 10:00:00

**Evacuation plans**

- PLAN N.1497263887 IN\_PROGRESS 11:37:47
- PLAN N.2000000000 PROPOSED 09:42:00
- PLAN N.1497604404 PROPOSED 11:08:47

**Tram position**

- TRAM/1 11:32:27
- TRAM/2 11:32:31

**Network Analysis**

FM0495	1.0000
FM0496	0.8081
FM0500	0.7375
FM0501	0.7375
FM0497	0.7825
FM0701	0.7825

### Environment

**PROTEZIONE CIVILE**

RISCHIO IDRAULICO: Nullo, Basso, Medio, Alto

RISCHIO TEMPORALI

RISCHIO IDROGEOLOGICO

RISCHIO NEVE

RISCHIO GHIACCIO

RISCHIO VENTO

RISCHIO MAREGGIATE

Pluv. Flore... 24 mm

Pluviometer Florence City - last 24h

Hydromete... 20 m.s.z.l.

Hydrometer Arno Nave di Rosano - Last 24h

Hydromete... 24 m.s.z.l.

Hydrometer Arno Florence Uffizi - Last 24h

Hydromete... 24 m.s.z.l.

Hydrometer Mugnone Ponte alle Mosse - Last 24h

### Mobility

**Bus Lines Status**

ULTIMO AGGIORNAMENTO: 2016-08-04 23:59:03

Underpass Viale Mariti Aperto

Underpass Viale Talenti closed

Underpass Fortezza Aperto

Parterre Pa... 76.2%

SMN 65.7%

Fortezza Fi... 37.2%

Mercato Ce... 65.4%

Fortezza Fi... 62.8%

Mercato Ce... 34.6%

### Resources

**Planned events**

- 1966 - 2016 - LA BELLEZZA SALVATA - PROROGATA FINO AL 2 2016-12-01 to 2017-07-02
- 2017-02-15 to 2017-06-23 VIA CAMILLO CAUOUR 3
- 2017-02-15 to 2017-09-29 PIAZZA DI SAN LORENZO 9

**Ambulance** 20 num.

**Voluntiers** 33 num.

**Florence main first aids status**

Priority	Red code	Yellow code	Green code	Blue code	White code
PS SANTA MARIA NUOVA	1	7	14	1	0
PS SAN GIOVANNI DE DIO TORREGGALLI	2	10	24	2	0
PS AG CAREGGI	10	27	31	1	2
PS SANTA MARIA ANNUNZIATA	2	9	1	0	0

### Resources

**TRENDS QUOTES**

#FIRENZE

#NEWS #FIRENZE

#FIRENZE #RIFIUTI

#UFFIZI

#PONTEVECCHIO

#BARGELLO

#AEROPORTO #FIRENZE

#DUOMO #FIRENZE

#VIAGGI #FIRENZE

#CRONACA #FIRENZE

@MUSEOFIRENZE

@COMUNEFI

@NAZIONE\_FIRENZE

@PROTGCOMUNEFI

@UNI\_FIRENZE

@HUBFIRENZE

@NOVEDAFIRENZE

@ILSITOFIRENZE

@FIRENZE\_FIRENZE

@PUBBLICOMUNEFI

@Pitagoraisalutita

### TV-RT Firenze

Twitter Vigilance Real Time Dashboard

Last crawling: 2017-06-21 12:44:30

Channel active from 2009-02-27 to today

Search related to channel: Firenze

Sentiment trends in channel Firenze

Zoom 1H 2H 6H 12H 1D 1W 1M

Most Significant Tweets for Sentiment

Last tweets per channel Firenze

### TV Firenze

Twitter Vigilance Dashboard

Last crawling: 2017-06-21 12:44:49

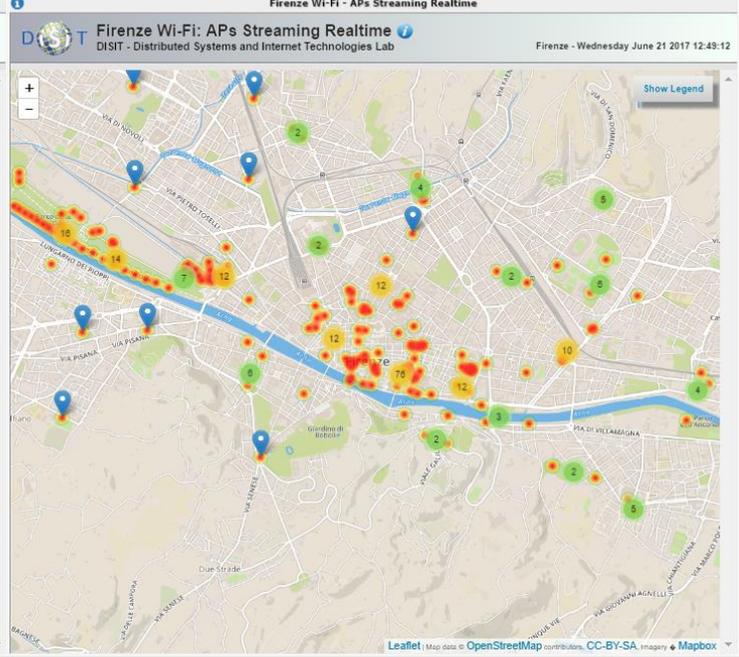
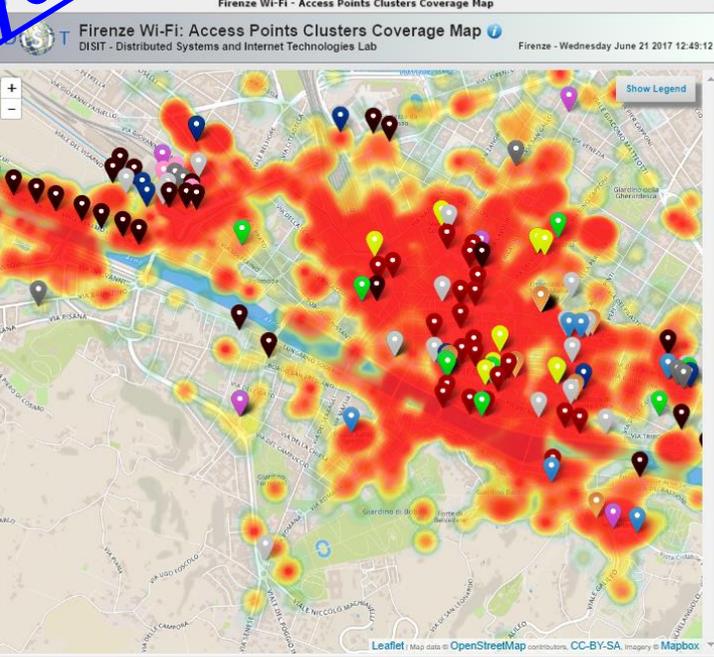
Channel active from 2009-02-27 to today

Search related to channel: Firenze

Sentiment trends in channel Firenze

Zoom 1m 3m 6m YTD 1y All

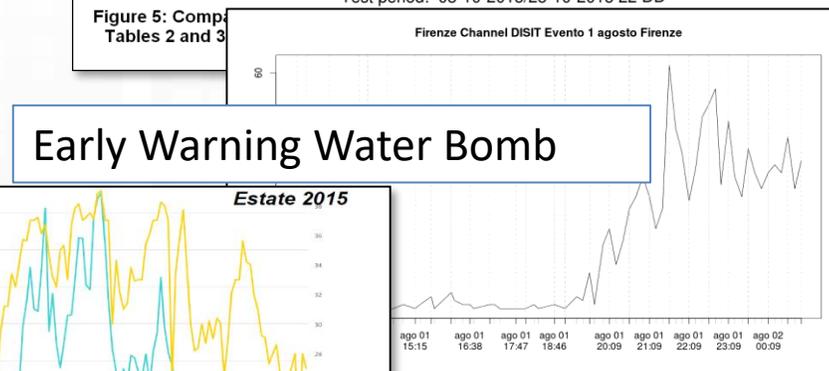
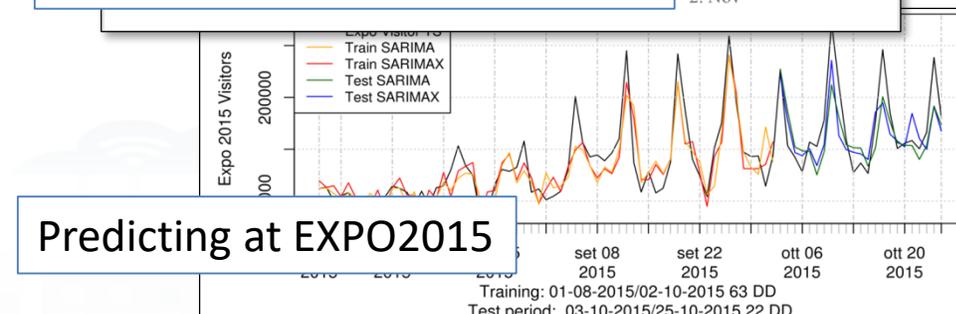
Daily number of tweets/retweets for channel: Firenze



<https://dashboard.km4city.org/dashboard=MiMw>

# 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





# Characterizing City Areas

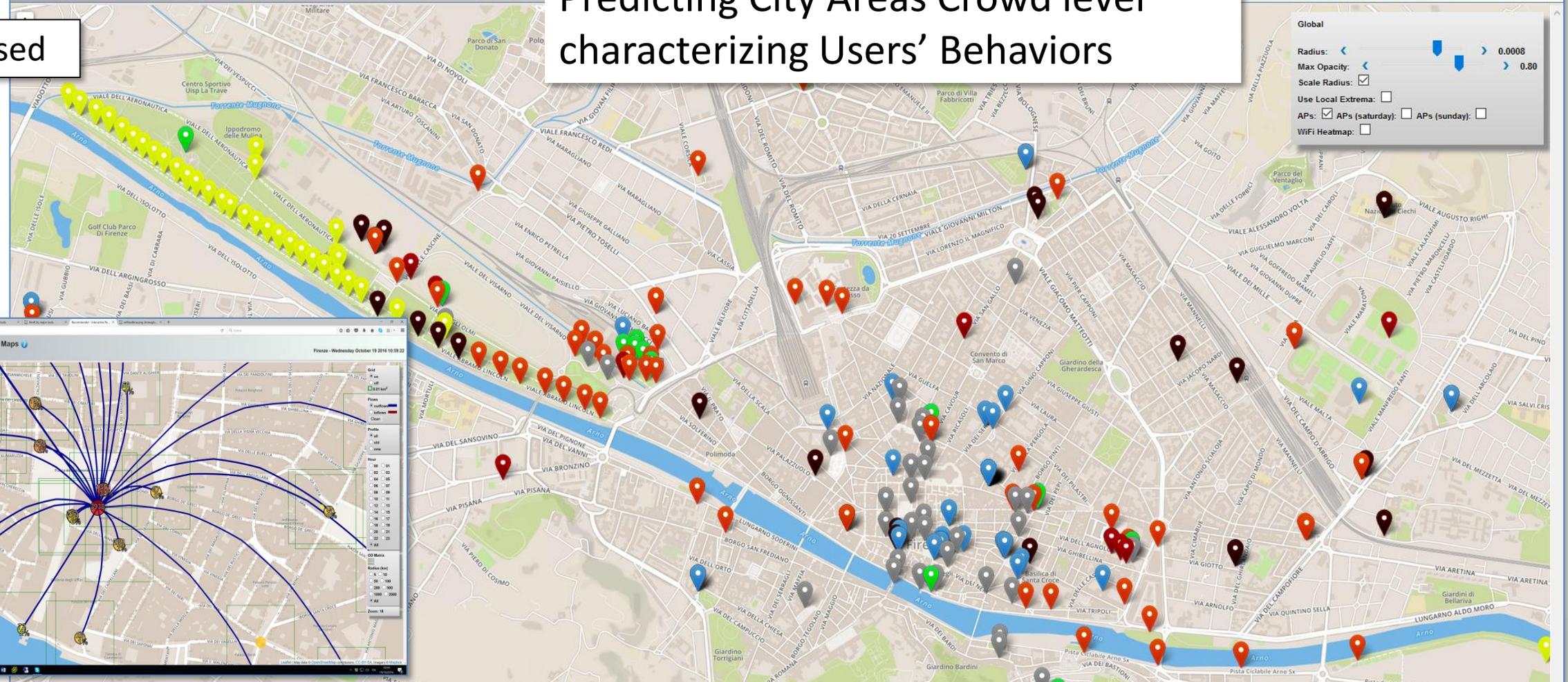


DISIT Firenze Wi-Fi: Access Points Clusters Coverage Map  
DISIT - Distributed Systems and Internet Technologies Lab

## Predicting City Areas Crowd level characterizing Users' Behaviors

Firenze - Saturday November 12 2016 19:16:33

Wi-Fi based



Global

Radius:

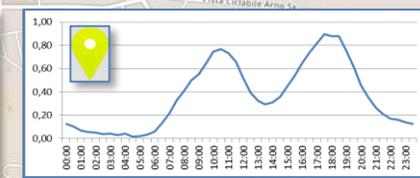
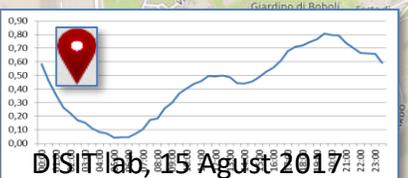
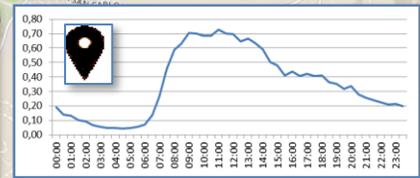
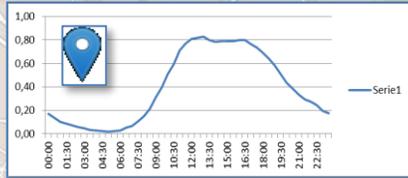
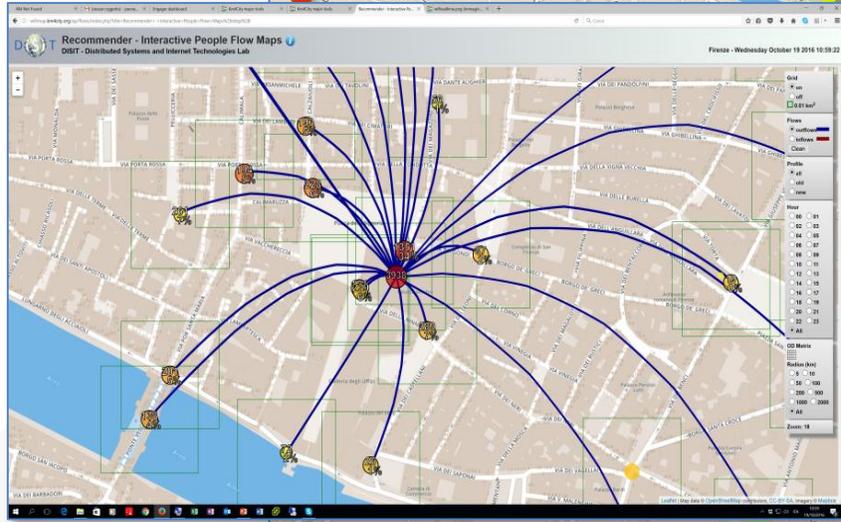
Max Opacity:

Scale Radius:

Use Local Extrema:

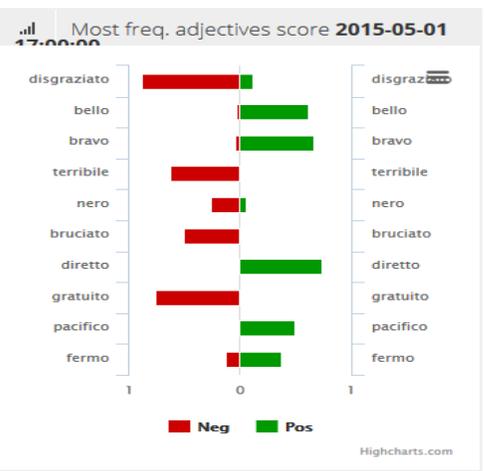
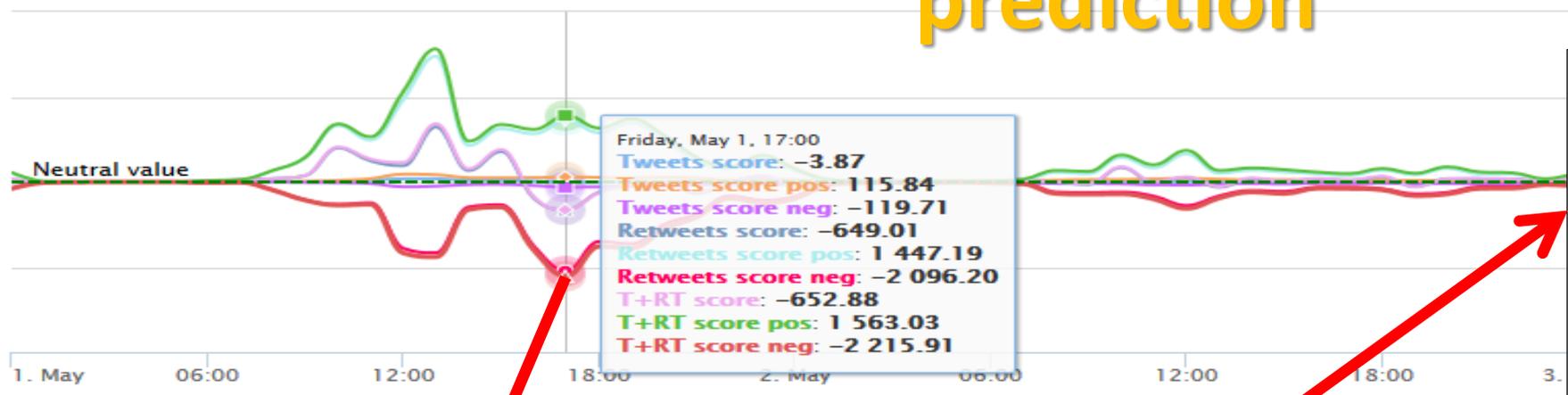
APs:  APs (saturday)  APs (sunday)

WiFi Heatmap:



# Twitter Vigilance, Sentiment Analysis, Monitoring and prediction

Zoom 1m 3m 6m YTD 1y All From May 1, 2015 To May 3, 2015



Example tweets

Results 1 - 1 of 1:

message	Fermate queste bestie. Animali, incivili, ignoranti, mostri. Fateschifo. Mi vergogno di essere italiana. #noexpo #Expo2015 http://t.co/PUo3kR...	message	Non sei d'accordo quindi macchine di gente che va Schifo totale #Expo2015
twitterUser	SerenaSignorile	twitterUser	FabrizioColella
publicationTime	2015-05-01 18:29:06	publicationTime	2015-05-01 18:53:09
locationUser		locationUser	In Billico
retweet	0	retweet	0

Results 1 - 11:

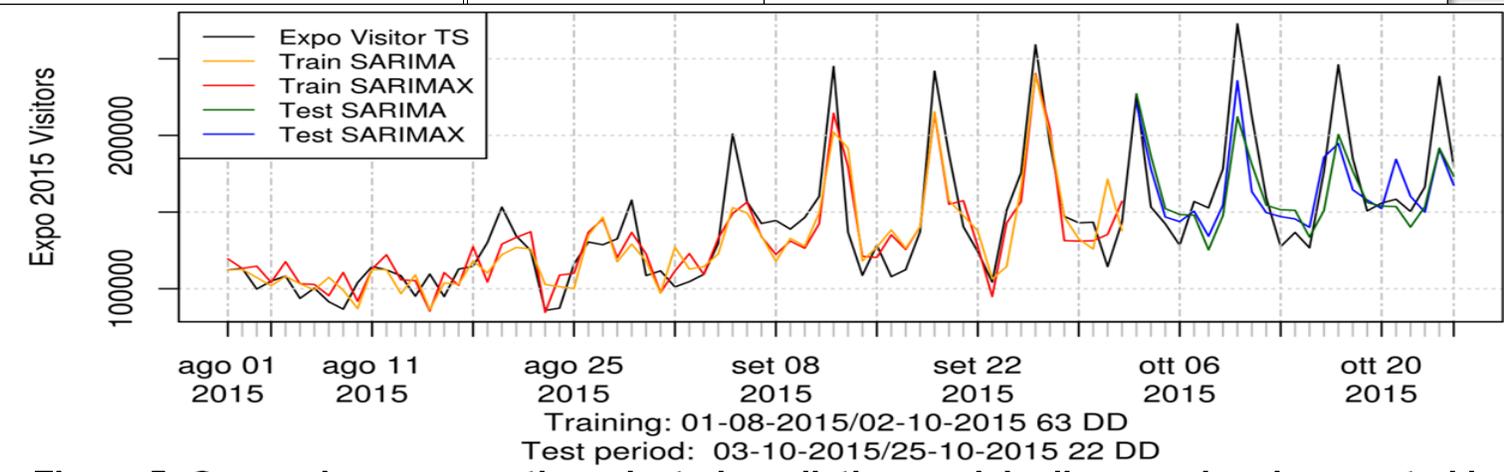
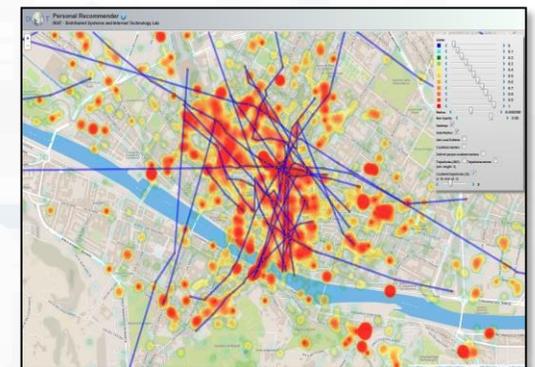
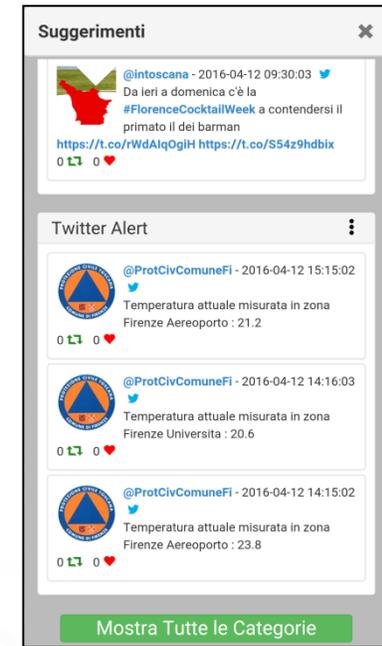


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

# Mobile Emergency



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





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

# Km4City Roadmap



12/2017  
WEEE  
2017-2020

6/2017

- 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

© Ghosting the smart city: a governance-centred approach to Smart Urbanism

- 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

2013

## 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> API
- <http://log.disit.org>
- <http://www.disit.org/fodd>
- <http://www.disit.org/tv> Twitter Vigilance
- <http://smartds.km4city.org>

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

2014

2015

## Km4City 1.4

- Embed
- More API
- iBeacon

## Km4City 1.5

- SmartDS
- Km4City App

**RESOLUTE**  
RESilience management guidelines and Operationalization appLied to Urban Transport Environment

**RESOLUTE H2020**  
2015-2018 - Started

**Sii-Mobility**  
<http://www.sii-mobility.org>

**Sii-Mobility SCN**  
2016-2018 - Started

## Km4City 1.6.2

2016

**REPLICATE H2020**  
2016-2021 - Started

**REPLICATE**  
Renaissance of PLACES with Innovative Citizenship And Technology

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

# Acknowledgement

- Thanks to the European Commission for founding. All slides reporting logo of **RESOLUTE H2020** are representing tools and research founded by European Commission for the RESOLUTE project. **RESOLUTE** has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement n° 653460).
- 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).
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- **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.

