UNIVERSITÀ
DEGLI STUDI
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DIPARTIMENTO
DI ARCHITETTURA

UNIVERSITÀ
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DISEI
DIPARTIMENTO DI SCIENZE PER L'ECONOMIA E L'IMPRESA

佛罗伦萨大学孔子学院
Istituto Confucio
Università di Firenze

Hanban

The language of innovation II Forum
Architecture and Urban Planning IV Forum

TJU Shanghai CHINA - UNIFI ITALY
Confucius Institute

ICT Solution for Smart City Urban Platform

Paolo Nesi
University of Florence, DINFO, DISIT lab
http://www.disit.dinfo.unifi.it
Paolo.nesi@unifi.it

Smart Cities
15th December 2016

Healthy Cities
16th December 2016

Florence University

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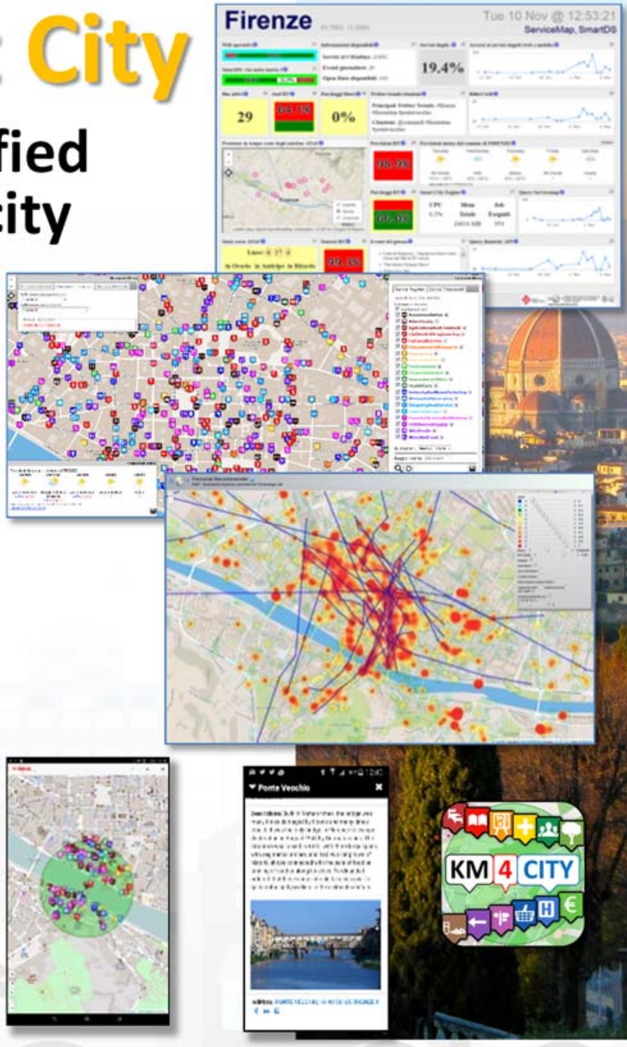
Sentient Urban Platform for Smart City

- **Main Objectives:**
  - *Increase: quality of life, quality of services, …*
    - reduce pollution, traffic congestion, …
  - *Keep under control the city costs for services and operators*
    - mobility, energy, health, waste, environment, …
  - *Reduce the risks and increase resilience*
    - with respect to natural and artificial threats
- **Set up an ICT based Urban Platform *integrated and unified data management among services, city operators and city users*:**
  - *Control Room, Real Time Monitoring of KPI, ..*
  - *Data analytics and business intelligence*
  - *Reading the city: data, users behavior and needs, etc.*
  - *Stimulate virtuous behavior of City Users*
  - *Transform Data into value*

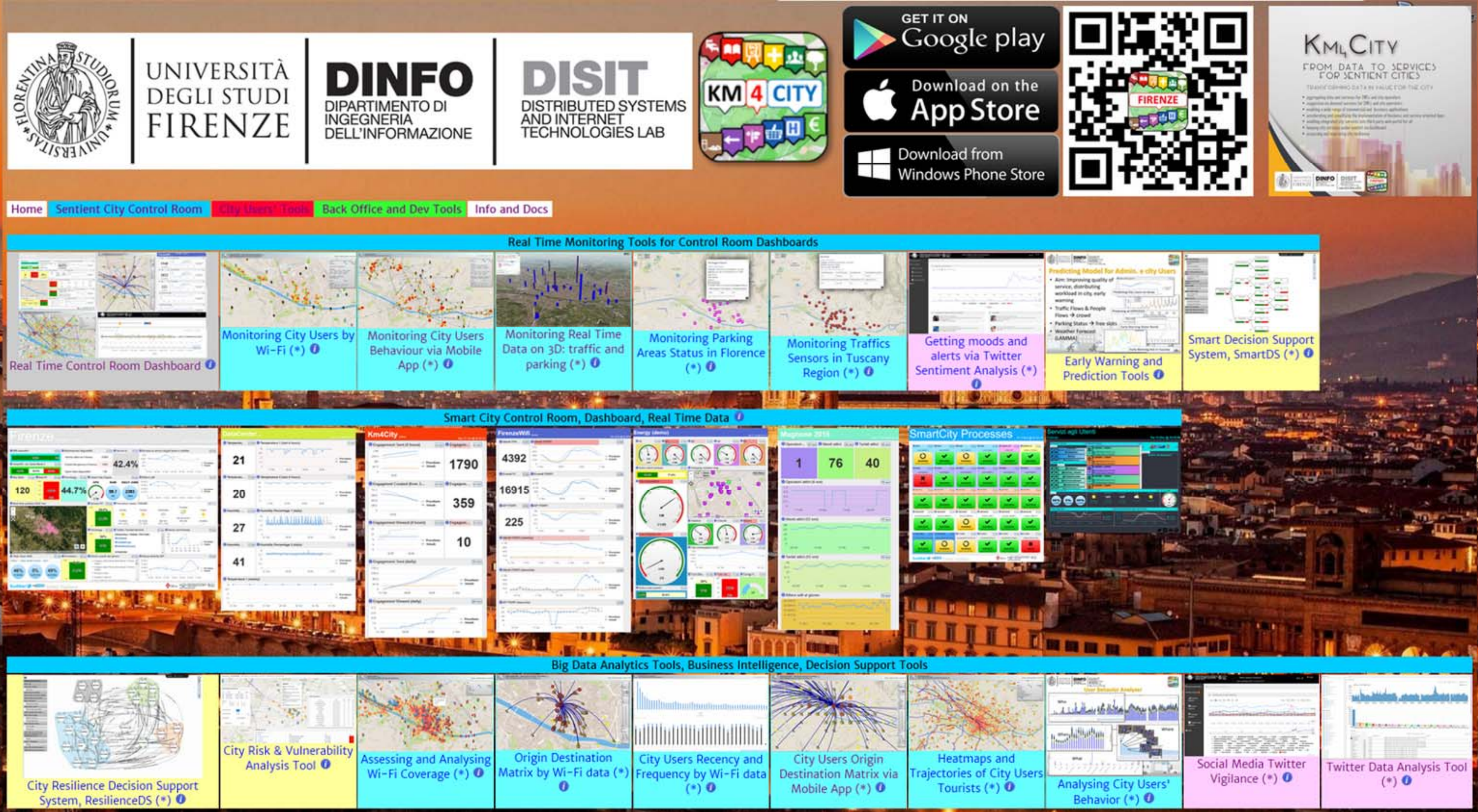
Sentient Urban Platform for Smart City

- **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



Sentient City Control Room

www.Km4City.org



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GET IT ON Google play | Download on the App Store | Download from Windows Phone Store

KM4CITY FROM DATA TO SERVICES FOR SENTIENT CITIES

Home | Sentient City Control Room | City Users' Tools | Back Office and Dev Tools | Info and Docs

Real Time Monitoring Tools for Control Room Dashboards

- Real Time Control Room Dashboard
- Monitoring City Users by Wi-Fi (*)
- Monitoring City Users Behaviour via Mobile App (*)
- Monitoring Real Time Data on 3D: traffic and parking (*)
- Monitoring Parking Areas Status in Florence (*)
- Monitoring Traffics Sensors in Tuscany Region (*)
- Getting moods and alerts via Twitter Sentiment Analysis (*)
- Early Warning and Prediction Tools
- Smart Decision Support System, SmartDS (*)

Smart City Control Room, Dashboard, Real Time Data

Big Data Analytics Tools, Business Intelligence, Decision Support Tools

- City Resilience Decision Support System, ResilienceDS (*)
- City Risk & Vulnerability Analysis Tool
- Assessing and Analysing Wi-Fi Coverage (*)
- Origin Destination Matrix by Wi-Fi data (*)
- City Users Recency and Frequency by Wi-Fi data (*)
- City Users Origin Destination Matrix via Mobile App (*)
- Heatmaps and Trajectories of City Users Tourists (*)
- Analysing City Users' Behavior (*)
- Social Media Twitter Vigilance (*)
- Twitter Data Analysis Tool (*)

Problems and issues

- Cities include **critical infrastructures** strongly related / depended each other:
  - Transport, energy, communication, cyber, health...
- **Risks** for Critical Infrastructures may be due to natural and/or man made events.
- **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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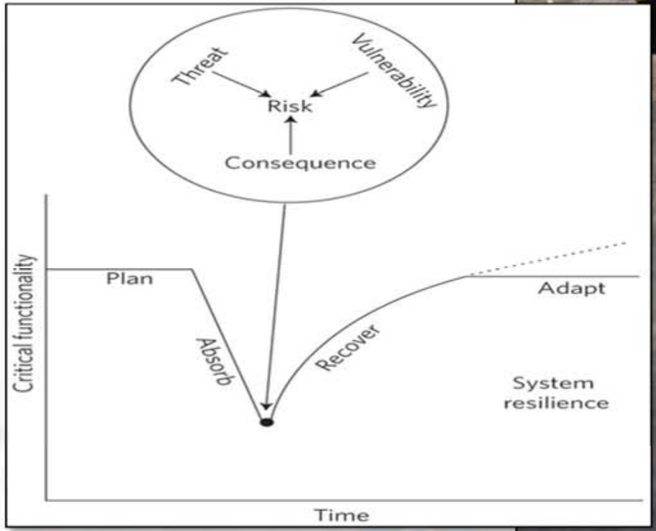
City Resilience

Horizon 2020
European Union Funding
for Research & Innovation

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


Threat
Vulnerability
Risk
Consequence
Plan
Absorb
Recover
Adapt
System resilience
Critical functionality
Time

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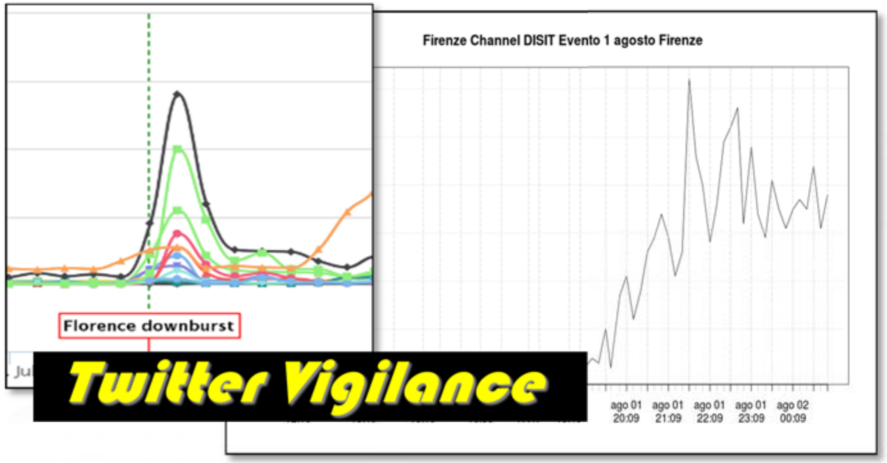
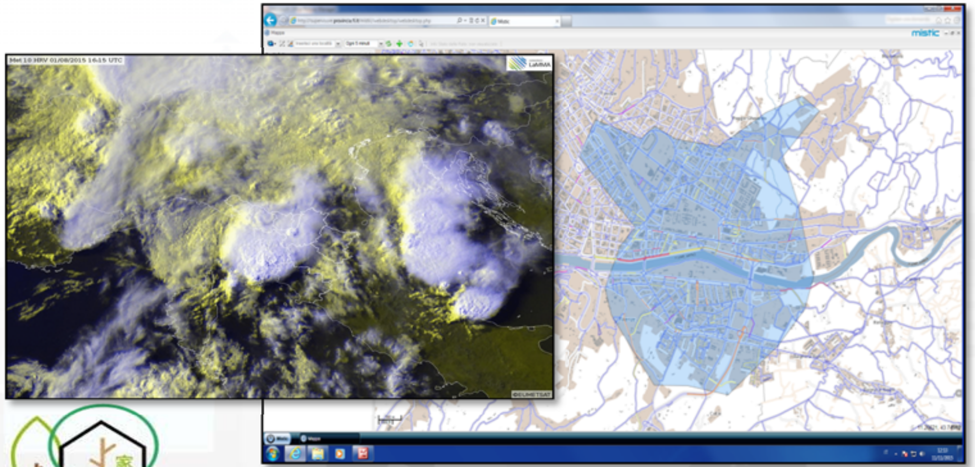
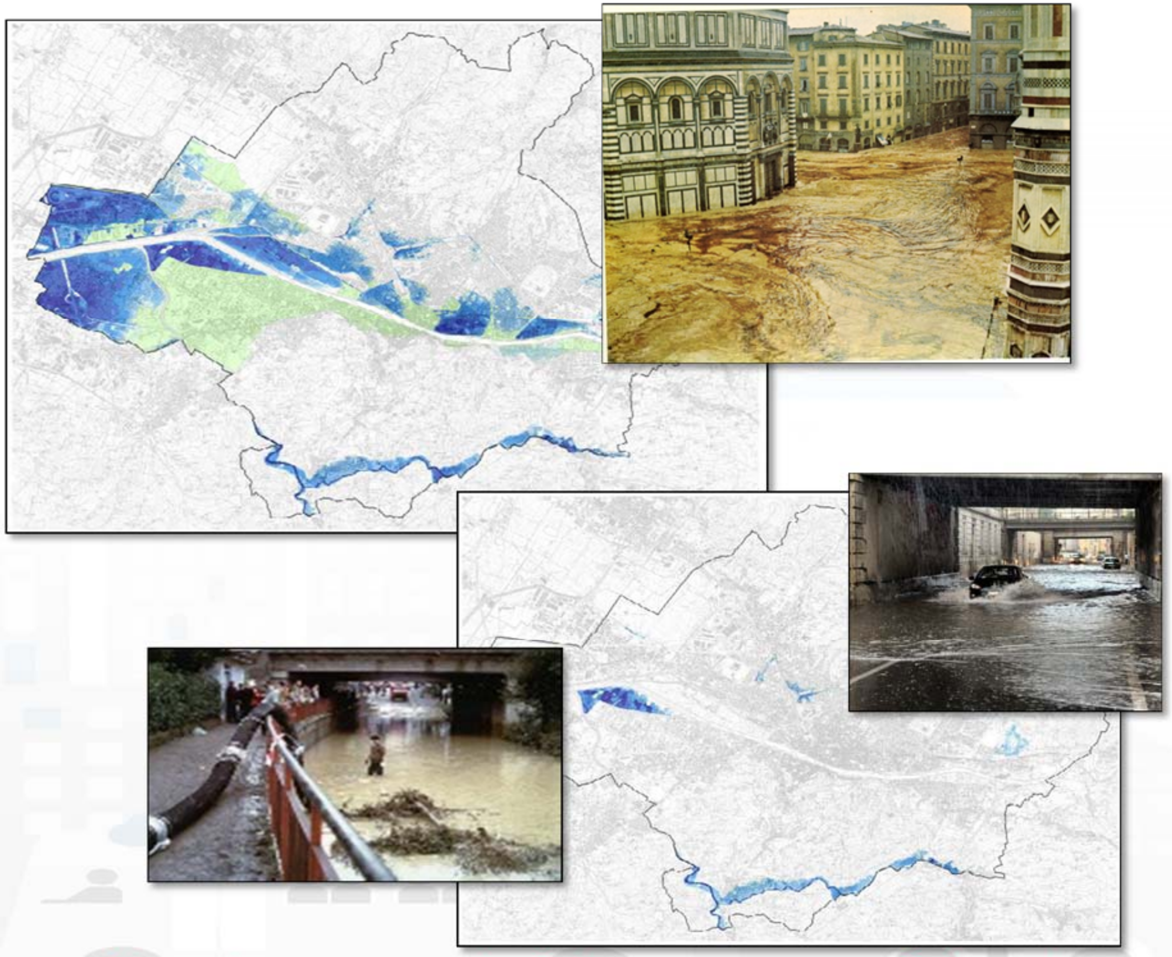
Early Warning

resolute







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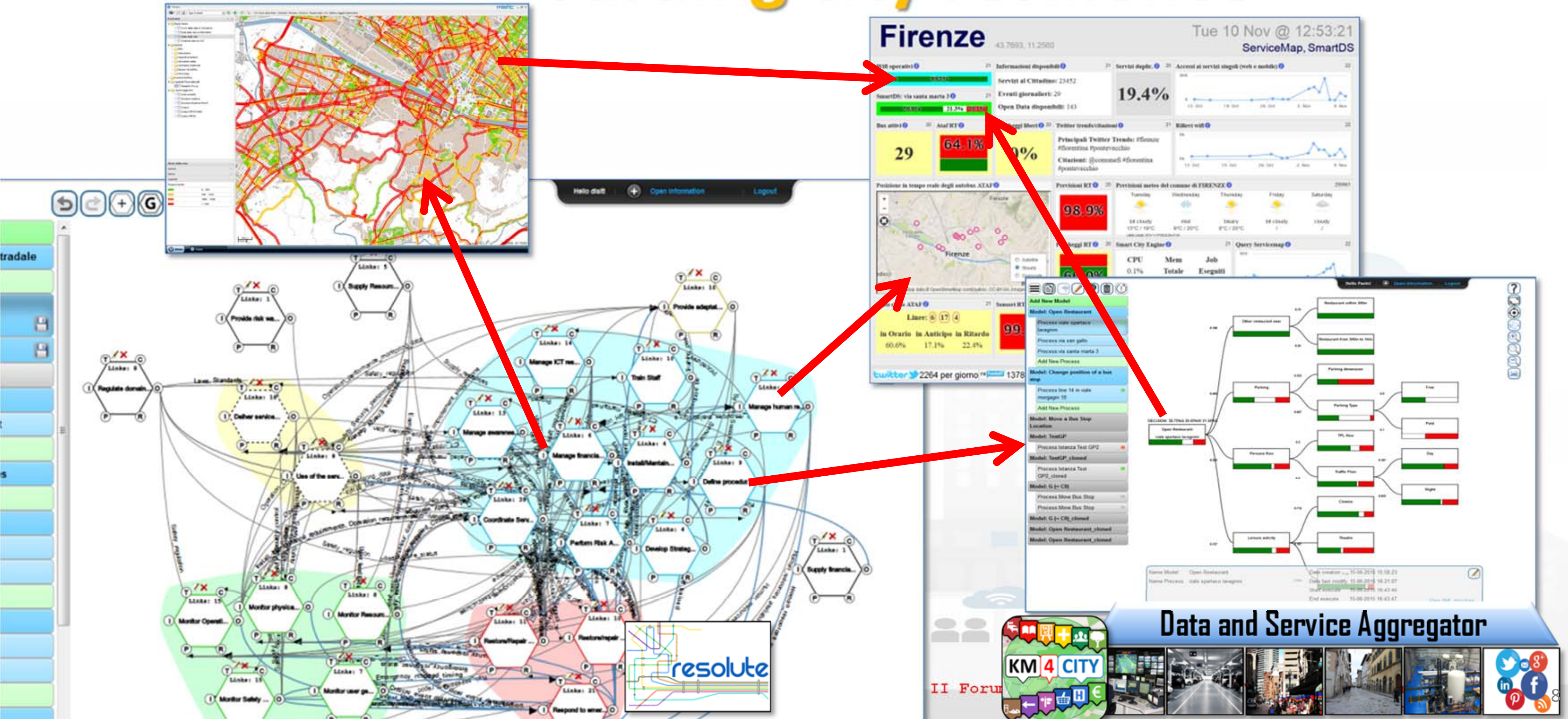
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

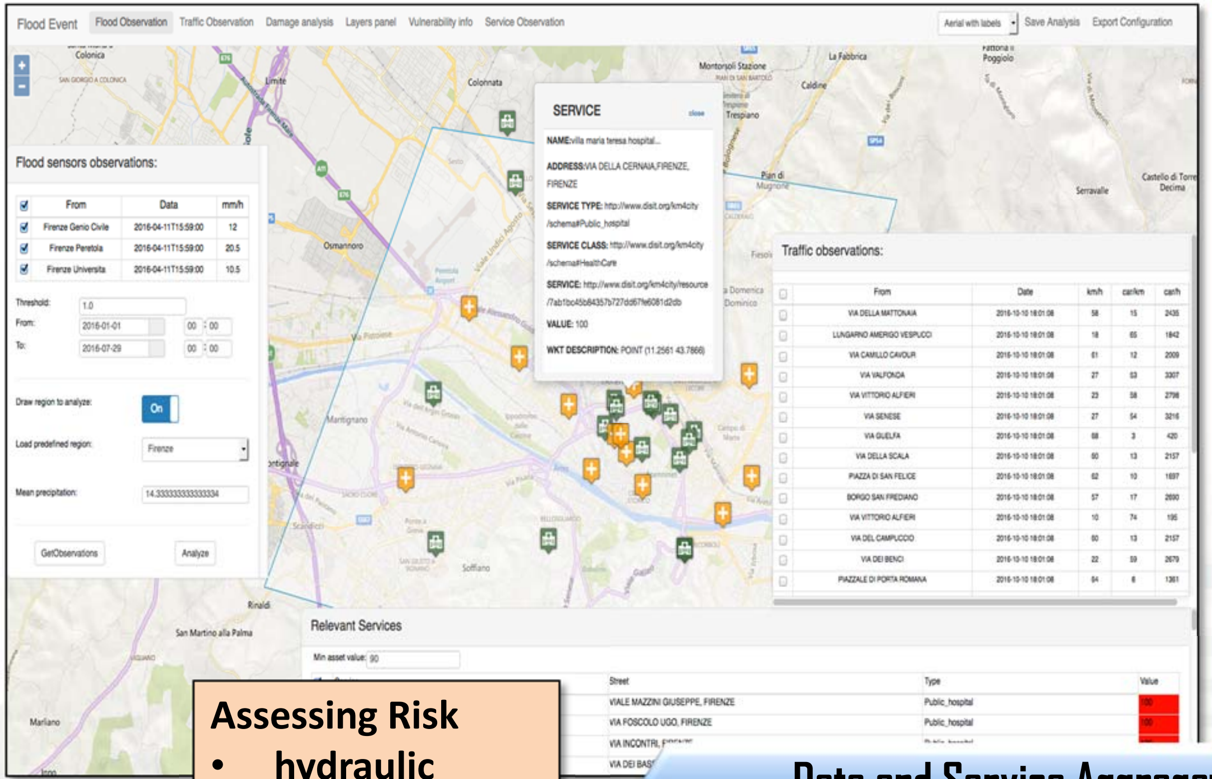
DISIT
DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB
http://www.disit.org

Horizon 2020
European Union Funding
for Research & Innovation

Dashboarding city resilience


Firenze
43.7693, 11.2560
Tue 10 Nov @ 12:53:21
ServiceMap, SmartDS
Servizi al Cittadino: 23452
Eventi giornalieri: 29
Open Data disponibili: 143
19.4%
29
64.1%
98.9%
Principali Twitter Trends: #firenze #fiorentina #pontevecchio
Citazioni: @comunefi #fiorentina #pontevecchio
Smart City Engine
CPU
Mem
Job
Totale
Eseguiti
Linee: 6 17 4
in Orario
in Anticipo
in Ritardo
60.6%
17.1%
22.4%
twitter 2264 per giorno
1378
Hello diallt
Open information
Logout
Add New Model
Model: Open Restaurant
Process via san gallo
Process via santa marta 3
Add New Process
Model: Change position of a bus stop
Add New Process
Model: Move a Bus Stop Location
Model: TestGP
Data and Service Aggregator
KM4CITY
resolute
Monitor physica...
Monitor Operat...
Monitor Resour...
Manage financia...
Manage ICT res...
Manage human re...
Train Staff
Deliver service...
Use of the serv...
Regulate domain...
Provide risk aw...
Supply Resourc...
Provide adaptat...
Manage awarene...
Install/Maintain...
Define procedur...
Coordinate Serv...
Perform Risk A...
Develop Strateg...
Supply financia...
Restore/repair
Respond to emer...
Monitor user ge...
Monitor Safety ...
II Foru

Risk Assessment Decision Support Systems


Flood Event
Flood Observation
Traffic Observation
Damage analysis
Layers panel
Vulnerability info
Service Observation
Aerial with labels
Save Analysis
Export Configuration
Colonica
Colonnata
Montorsoli Stazione
La Fabbrica
Trespiano
Caldine
Osmannoro
Pian di Mugnone
Serravalle
Castello di Torre Decima
Martignano
Scandicci
Soffiano
Rinaldi
San Martino alla Palma
Mariano

Flood sensors observations:

☑	From	Data	mm/h
☑	Firenze Genio Civile	2016-04-11T15:59:00	12
☑	Firenze Peretola	2016-04-11T15:59:00	20.5
☑	Firenze Universita	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

SERVICE close
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)

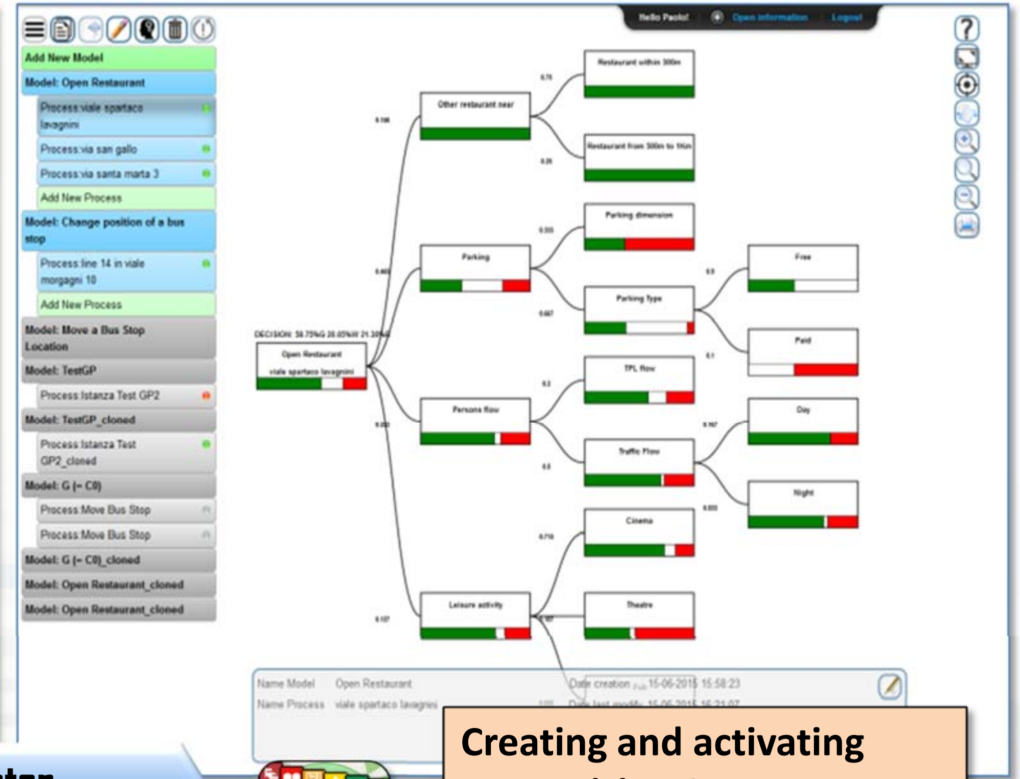
Traffic observations:

☐	From	Date	km/h	car/km	car/h
☐	VIA DELLA MATTONAIA	2016-10-10 18:01:08	58	15	2435
☐	LUNGARNO AMERIGO VESPUCCI	2016-10-10 18:01:08	18	65	1842
☐	VIA CAMILLO CAVOUR	2016-10-10 18:01:08	61	12	2009
☐	VIA VALFONDA	2016-10-10 18:01:08	27	53	3307
☐	VIA VITTORIO ALFIERI	2016-10-10 18:01:08	23	58	2798
☐	VIA SENESE	2016-10-10 18:01:08	27	54	3216
☐	VIA GUELFA	2016-10-10 18:01:08	68	3	420
☐	VIA DELLA SCALA	2016-10-10 18:01:08	60	13	2157
☐	PIAZZA DI SAN FELICE	2016-10-10 18:01:08	62	10	1697
☐	BORGO SAN FREDIANO	2016-10-10 18:01:08	57	17	2690
☐	VIA VITTORIO ALFIERI	2016-10-10 18:01:08	10	74	195
☐	VIA DEL CAMPUCCIO	2016-10-10 18:01:08	60	13	2157
☐	VIA DEI BENCI	2016-10-10 18:01:08	22	59	2679
☐	PIAZZALE DI PORTA ROMANA	2016-10-10 18:01:08	64	6	1361

Relevant Services

Min asset value: 90

Street	Type	Value
VIALE MAZZINI GIUSEPPE, FIRENZE	Public_hospital	100
VIA FOSCOLO UGO, FIRENZE	Public_hospital	100
VIA INCONTRI, FIRENZE	Public_hospital	100
VIA DEI BAS		


Hello Paolo!
Open information
Logout
Add New Model
Model: Open Restaurant
Process:viale spartaco lavagnini
Process:via san gallo
Process:via santa marta 3
Add New Process
Model: Change position of a bus stop
Process:line 14 in viale morgagni 10
Add New Process
Model: Move a Bus Stop Location
Model: TestGP
Process:Istanza Test GP2
Model: TestGP_cloned
Process:Istanza Test GP2_cloned
Model: G (= C0)
Process:Move Bus Stop
Process:Move Bus Stop
Model: G (= C0)_cloned
Model: Open Restaurant_cloned
Model: Open Restaurant_cloned
DECISION: 58.75%G 20.05%W 21.30%R
Open Restaurant
viale spartaco lavagnini
Other restaurant near
Restaurant within 300m
Restaurant from 300m to 1Km
Parking
Parking dimension
Parking Type
Free
Paid
Persons flow
TPL flow
Traffic Flow
Day
Night
Leisure activity
Cinema
Theatre
0.75
0.25
0.5
0.1

Name Model Open Restaurant
Name Process viale spartaco lavagnini
Date creation 15-06-2015 15:58:23
Date last modify 15-06-2015 16:21:07

Assessing Risk

- hydraulic
- Seismic

Data and Service Aggregator

Creating and activating

- Decision Support models

Smart City Dashboard

REPLICATE

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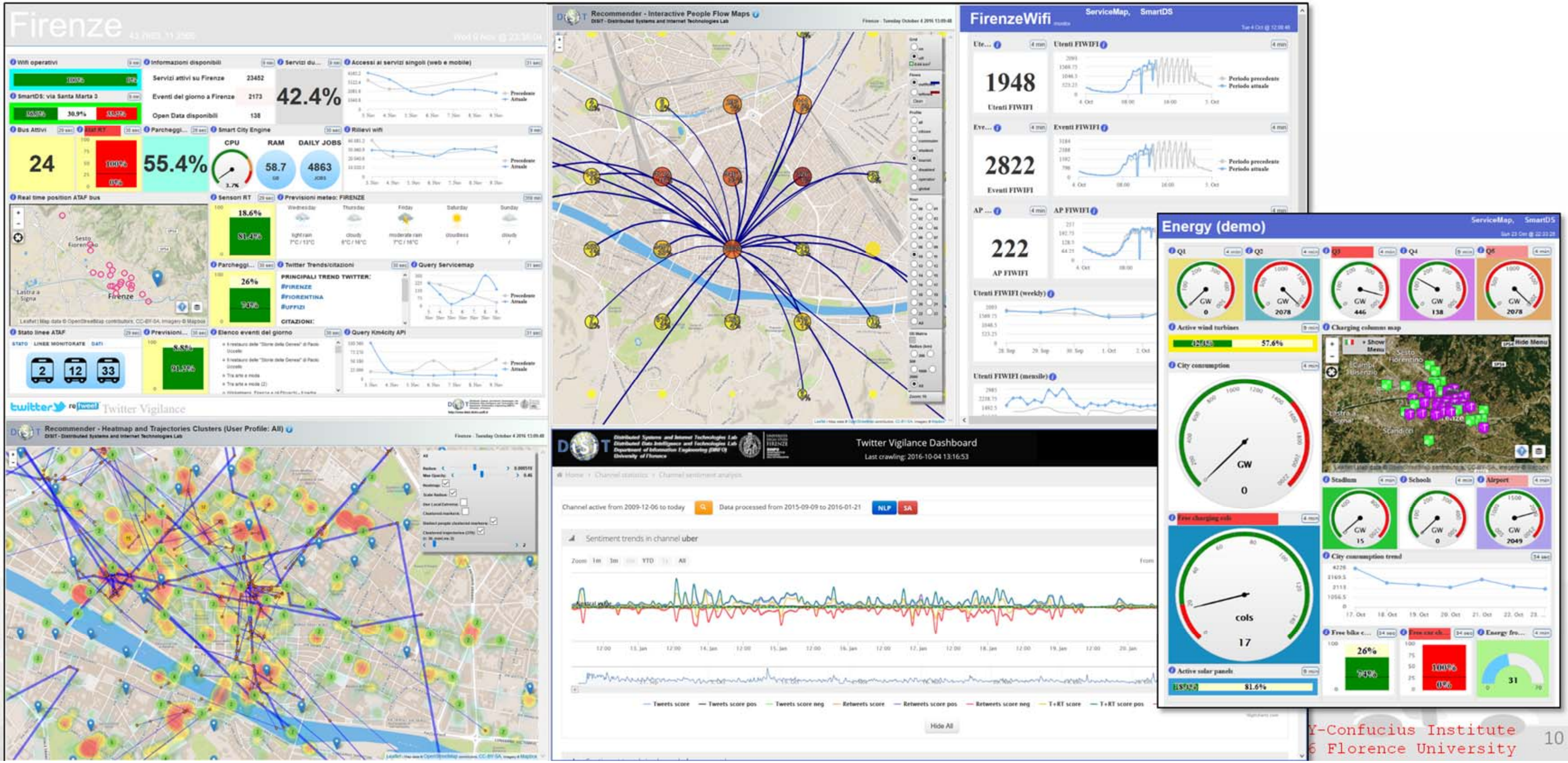
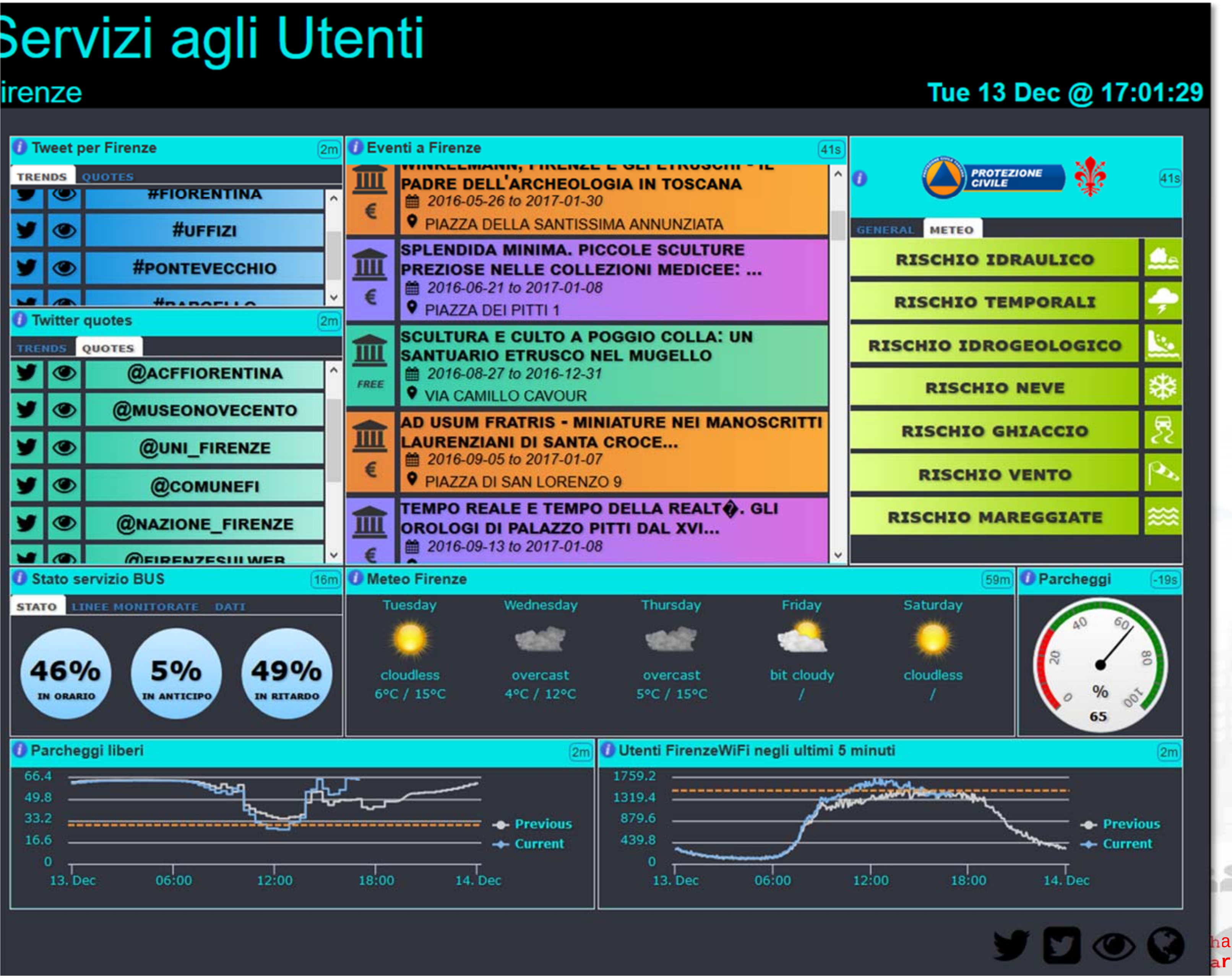

Firenze
Wifi operativi
SmartDS: via Santa Marta 3
Bus Attivi
24
42.4%
55.4%
CPU
RAM
DAILY JOBS
58.7
4863
Real time position ATAF bus
Previsioni meteo: FIRENZE
Twitter Trends/citazioni
Query Servicemap
Stato linee ATAF
Elenco eventi del giorno
Query Km4city API
Twitter Vigilance
Recommender - Interactive People Flow Maps
Recommender - Heatmap and Trajectories Clusters (User Profile: All)
FirenzeWifi
ServiceMap, SmartDS
1948
Utenti FIWIFI
2822
Eventi FIWIFI
222
AP FIWIFI
Twitter Vigilance Dashboard
Sentiment trends in channel uber
Energy (demo)
Active wind turbines
City consumption
Charging columns map
Active solar panels
City consumption trend
Stadium
Schools
Airport



ervizi agli Utenti

irenze

Tue 13 Dec @ 17:01:29

Tweet per Firenze 2m

TRENDS QUOTES

- #FIORENTINA
- #UFFIZI
- #PONTEVECCHIO

Twitter quotes 2m

TRENDS QUOTES

- @ACFFIORENTINA
- @MUSEONOVECENTO
- @UNI_FIRENZE
- @COMUNEFI
- @NAZIONE_FIRENZE

Eventi a Firenze 41s

WINKELMANN, FIRENZE E GLI ETRUSCHI - IL PADRE DELL'ARCHEOLOGIA IN TOSCANA
2016-05-26 to 2017-01-30
PIAZZA DELLA SANTISSIMA ANNUNZIATA

SPLENDIDA MINIMA. PICCOLE SCULTURE PREZIOSE NELLE COLLEZIONI MEDICEE: ...
2016-06-21 to 2017-01-08
PIAZZA DEI PITTI 1

FREE
SCULTURA E CULTO A POGGIO COLLA: UN SANTUARIO ETRUSCO NEL MUGELLO
2016-08-27 to 2016-12-31
VIA CAMILLO CAVOUR

AD USUM FRATRIS - MINIATURE NEI MANOSCRITTI LAURENZIANI DI SANTA CROCE...
2016-09-05 to 2017-01-07
PIAZZA DI SAN LORENZO 9

TEMPO REALE E TEMPO DELLA REALT�. GLI OROLOGI DI PALAZZO PITTI DAL XVI...
2016-09-13 to 2017-01-08

PROTEZIONE CIVILE 41s

GENERAL METEO

- RISCHIO IDRAULICO
- RISCHIO TEMPORALI
- RISCHIO IDROGEOLOGICO
- RISCHIO NEVE
- RISCHIO GHIACCIO
- RISCHIO VENTO
- RISCHIO MAREGGIATE

Stato servizio BUS 16m

STATO LINEE MONITORATE DATI

46%	5%	49%
IN ORARIO	IN ANTICIPO	IN RITARDO

Meteo Firenze 59m

Tuesday	Wednesday	Thursday	Friday	Saturday
cloudless	overcast	overcast	bit cloudy	cloudless
6°C / 15°C	4°C / 12°C	5°C / 15°C	/	/

Parcheggi -19s

0
20
40
60
80
100
%
65

Parcheggi liberi 2m

66.4
49.8
33.2
16.6
0
13. Dec
06:00
12:00
18:00
14. Dec
Previous
Current

Utenti FirenzeWiFi negli ultimi 5 minuti 2m

1759.2
1319.4
879.6
439.8
0
13. Dec
06:00
12:00
18:00
14. Dec
Previous
Current

REPLICATE

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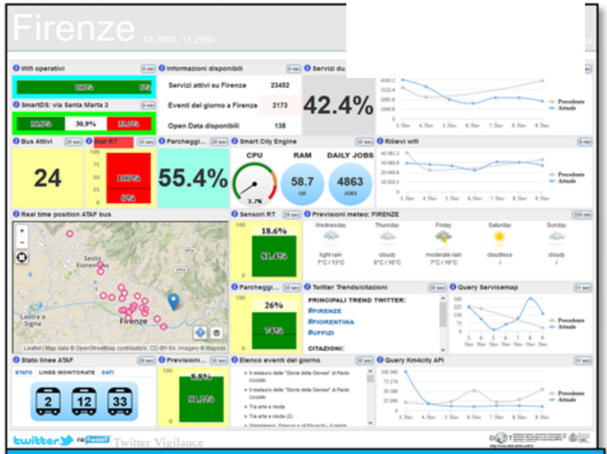
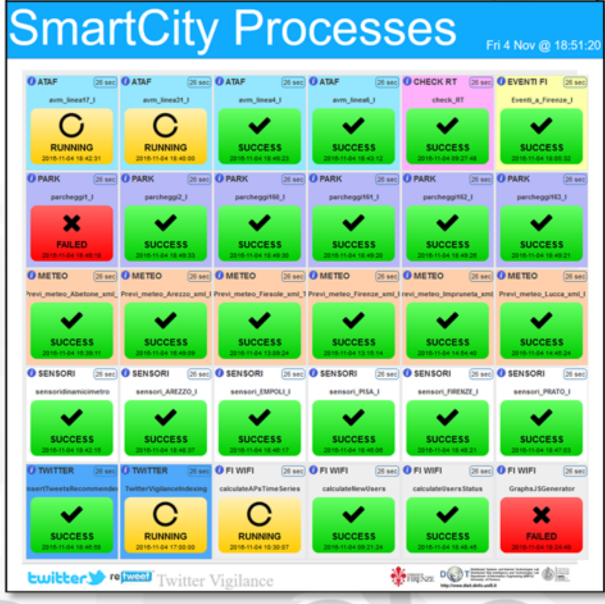


Firenze 43.7693, 11.2560

Wifi operativi
100%
0%
SmartDS: via Santa Marta 3
30.9%
Informazioni disponibili
Servizi attivi su Firenze 23452
Eventi del giorno a Firenze 2173
Open Data disponibili 138
Servizi du...
42.4%
Precedente
Attuale
Bus Attivi
24
Ataf RT
100%
0%
Parcheggi...
55.4%
Smart City Engine
CPU
RAM
DAILY JOBS
58.7
GB
4863
JOBS
Rilievi wifi
Real time position ATAF bus
Sesto Fiorentino
Lastra a Signa
Firenze
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox
Sensori RT
18.6%
81.4%
Previsioni meteo: FIRENZE
Wednesday
Thursday
Friday
Saturday
Sunday
light rain
cloudy
moderate rain
cloudless
cloudy
Parcheggi...
26%
74%
Twitter Trends/citazioni
PRINCIPALI TREND TWITTER:
#FIRENZE
#FIORENTINA
#UFFIZI
CITAZIONI:
Query Servicemap
Stato linee ATAF
STATO
LINEE MONITORATE
DATI
2
12
33
Previsioni...
8.8%
91.2%
Elenco eventi del giorno
Tra arte e moda
Query Km4city API
Twitter Vigilance



SmartCity Processes

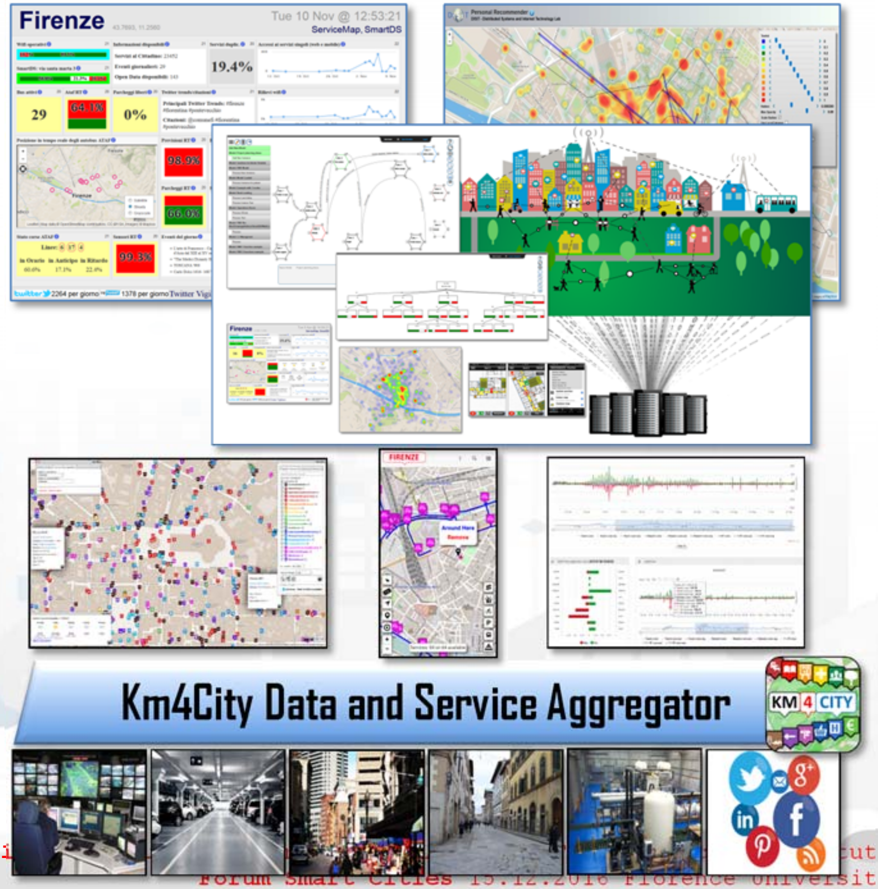
Fri 4 Nov @ 18:51:20

ATAF 26 sec avm_linea17_I RUNNING 2016-11-04 18:42:31	ATAF 26 sec avm_linea31_I RUNNING 2016-11-04 18:40:00	ATAF 26 sec avm_linea4_I SUCCESS 2016-11-04 18:49:23	ATAF 26 sec avm_linea6_I SUCCESS 2016-11-04 18:43:12	CHECK RT 26 sec check_RT SUCCESS 2016-11-04 09:27:48	EVENTI FI 26 sec Eventi_a_Firenze_I SUCCESS 2016-11-04 18:05:32
PARK 26 sec parcheggi1_I FAILED 2016-11-04 18:49:18	PARK 26 sec parcheggi2_I SUCCESS 2016-11-04 18:49:33	PARK 26 sec parcheggi160_I SUCCESS 2016-11-04 18:49:30	PARK 26 sec parcheggi161_I SUCCESS 2016-11-04 18:49:20	PARK 26 sec parcheggi162_I SUCCESS 2016-11-04 18:49:26	PARK 26 sec parcheggi163_I SUCCESS 2016-11-04 18:49:21
METEO 26 sec Previ_meteo_Abetone_xml_ SUCCESS 2016-11-04 16:39:11	METEO 26 sec Previ_meteo_Arezzo_xml_I SUCCESS 2016-11-04 16:49:09	METEO 26 sec Previ_meteo_Fiesole_xml_I SUCCESS 2016-11-04 13:09:24	METEO 26 sec Previ_meteo_Firenze_xml_I SUCCESS 2016-11-04 13:15:14	METEO 26 sec revi_meteo_Impruneta_xml SUCCESS 2016-11-04 14:54:40	METEO 26 sec Previ_meteo_Lucca_xml_I SUCCESS 2016-11-04 14:46:24
SENSORI 26 sec sensoridinamicimetro SUCCESS 2016-11-04 18:42:15	SENSORI 26 sec sensori_AREZZO_I SUCCESS 2016-11-04 18:48:37	SENSORI 26 sec sensori_EMPOLI_I SUCCESS 2016-11-04 18:46:17	SENSORI 26 sec sensori_PISA_I SUCCESS 2016-11-04 18:45:06	SENSORI 26 sec sensori_FIRENZE_I SUCCESS 2016-11-04 18:48:21	SENSORI 26 sec sensori_PRATO_I SUCCESS 2016-11-04 18:47:03
TWITTER 26 sec nsertTweetsRecommende SUCCESS 2016-11-04 18:46:58	TWITTER 26 sec TwitterVigilanceIndexing RUNNING 2016-11-04 17:00:00	FI WIFI 26 sec calculateAPsTimeSeries RUNNING 2016-11-04 10:30:07	FI WIFI 26 sec calculateNewUsers SUCCESS 2016-11-04 09:21:24	FI WIFI 26 sec calculateUsersStatus SUCCESS 2016-11-04 18:48:45	FI WIFI 26 sec GraphsJSGenerator FAILED 2016-11-04 18:24:49

twitter retweet Twitter Vigilance

From Data to Services for the Sentient Cities
Open Source and inter-operable tools to

- **keep city under control**
- **improve city resilience, reducing risks and decision support**
- **implementing city strategies**
- **exploiting data for the city, implementing:**
  1. **Business intelligence and**
  2. **data aggregation as *semantic interoperability layer***


Firenze
Tue 10 Nov @ 12:53:21
ServiceMap, SmartDS
19.4%
29
0%
FIRENZE
Km4City Data and Service Aggregator
KM 4 CITY

Sentient Urban Platform for Smart Cit

- **Set up an ICT based Urban Platform integrated and unified data management among services, city operators and city users**:
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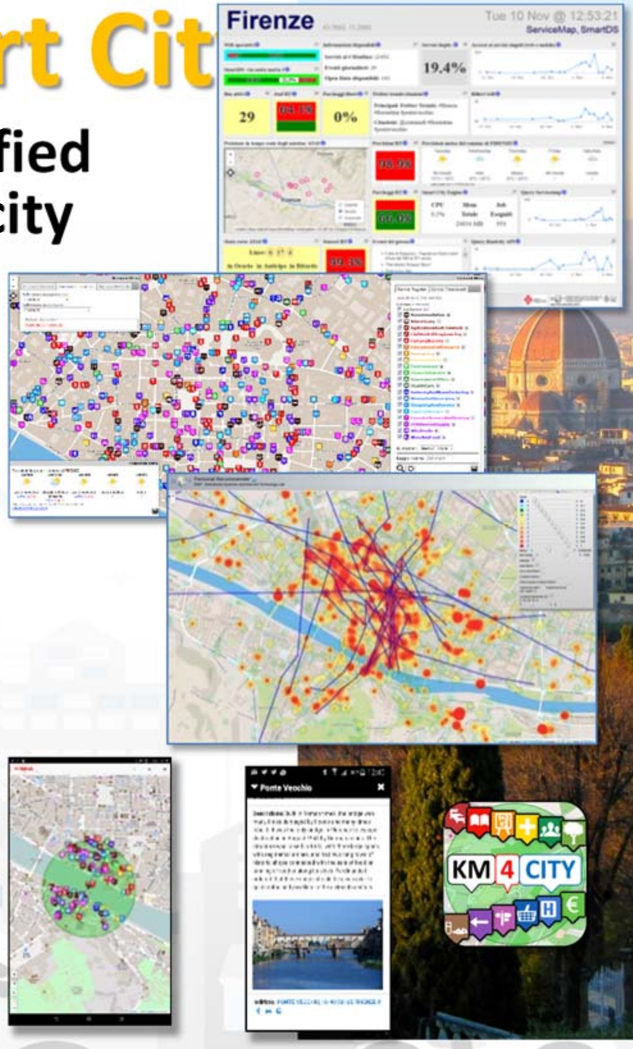
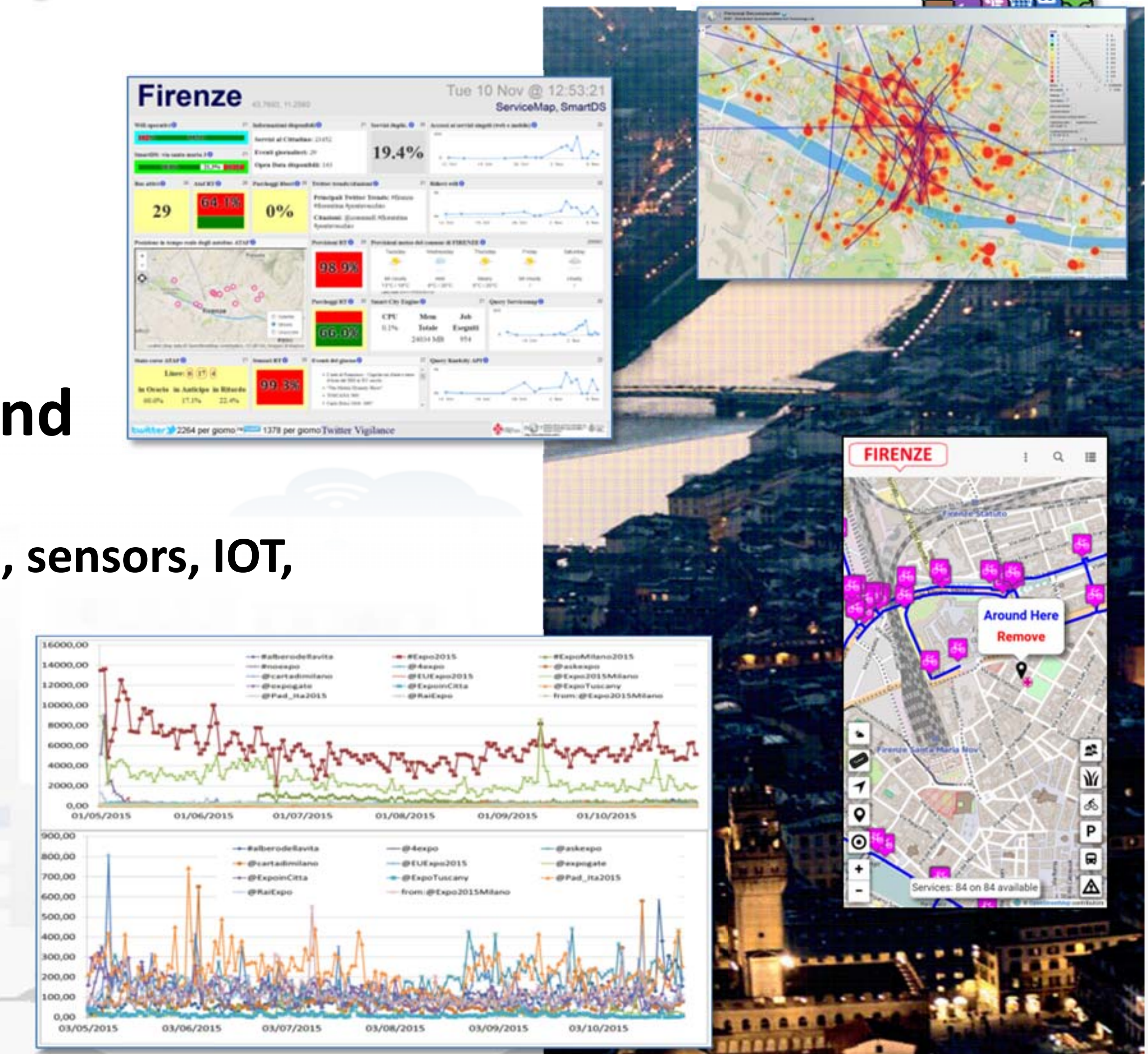
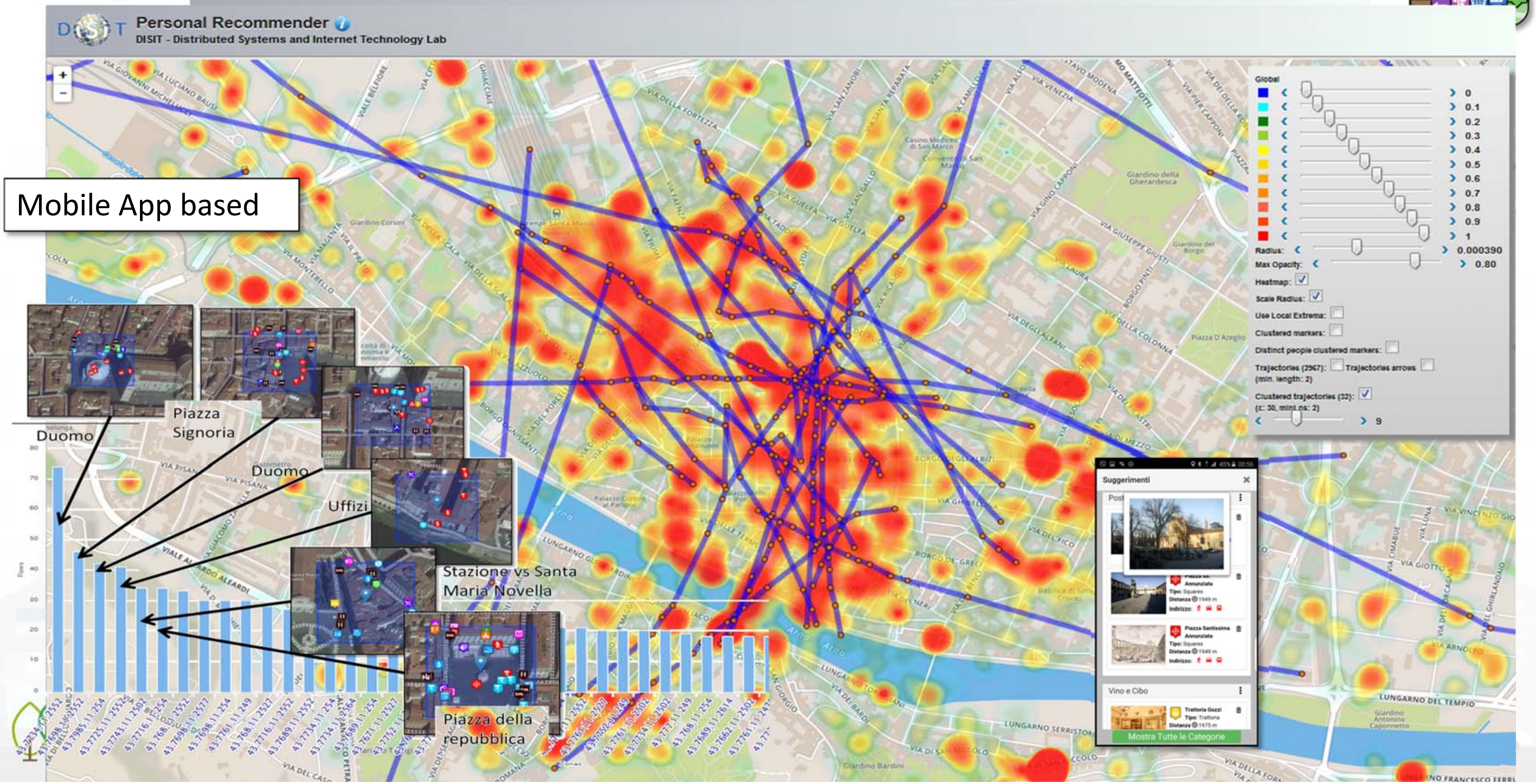


city under control

- **monitoring services' status** of city operators
  - **Smart City Dashboards**
  - **Continuous Business Intelligence**
- **City users behaviour monitoring and analysis/influencing/engaging:**
  - **Sensors, traffic flow, people flows, mobiles, sensors, IOT, IOE**
  - **Wi-Fi, Tv-Cameras**
- **City users participation**
  - **social media** for city services and events, **Twitter Vigilance**
  - **Collecting contributions**: images, stars, comments


Firenze
Tue 10 Nov @ 12:53:21
ServiceMap, SmartDS
19.4%
29
64.1%
0%
98.9%
66.0%
99.3%
Twitter Vigilance
FIRENZE
Around Here
Remove
Services: 84 on 84 available
16000,00
14000,00
12000,00
10000,00
8000,00
6000,00
4000,00
2000,00
0,00
01/05/2015
01/06/2015
01/07/2015
01/08/2015
01/09/2015
01/10/2015
#alberodellavita
#Expo2015
#ExpoMilano2015
900,00
800,00
700,00
600,00
500,00
400,00
300,00
200,00
100,00
0,00
03/05/2015
03/06/2015
03/07/2015
03/08/2015
03/09/2015
03/10/2015
@cartadimilano
@ExpoinCitta
@RaiExpo
@4expo
@EUExpo2015
@ExpoTuscany
from:@Expo2015Milano
@askexpo
@expogate
@Pad_Ita2015

User Behavior Analyzer


Personal Recommender
DISIT - Distributed Systems and Internet Technology Lab
Duomo
Piazza Signoria
Duomo
Uffizi
Stazione vs Santa Maria Novella
Piazza della repubblica
Suggerimenti
Vino e Cibo
Mostra Tutte le Categorie

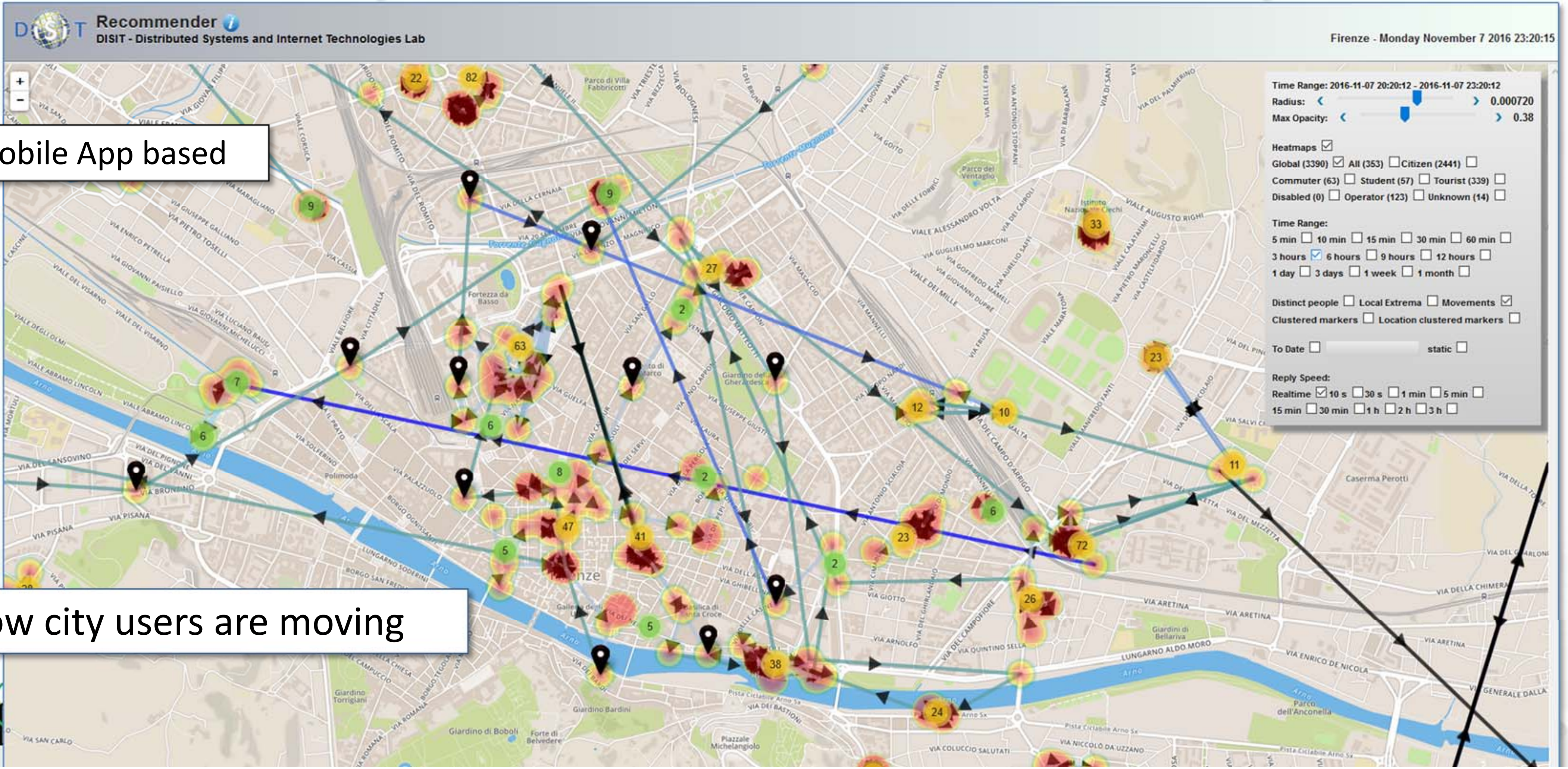
Mobile App based

Global

🟦	‹ ›	0
🟦	‹ ›	0.1
🟩	‹ ›	0.2
🟩	‹ ›	0.3
🟨	‹ ›	0.4
🟨	‹ ›	0.5
🟧	‹ ›	0.6
🟧	‹ ›	0.7
🟥	‹ ›	0.8
🟥	‹ ›	0.9
🟥	‹ ›	1

Radius: 0.000390
Max Opacity: 0.80
Heatmap: ☑
Scale Radius: ☑
Use Local Extrema: ☐
Clustered markers: ☐
Distinct people clustered markers: ☐
Trajectories (2967): ☐ Trajectories arrows ☐
(min. length: 2)
Clustered trajectories (32): ☑
(ε: 30, minLns: 2)
9

Anonymous User Behaviour Analysis


Recommender
DISIT - Distributed Systems and Internet Technologies Lab
Firenze - Monday November 7 2016 23:20:15

Mobile App based

How city users are moving

Time Range: 2016-11-07 20:20:12 - 2016-11-07 23:20:12
Radius: 0.000720
Max Opacity: 0.38

Heatmaps ☑
Global (3390) ☑ All (353) ☐ Citizen (2441) ☐
Commuter (63) ☐ Student (57) ☐ Tourist (339) ☐
Disabled (0) ☐ Operator (123) ☐ Unknown (14) ☐

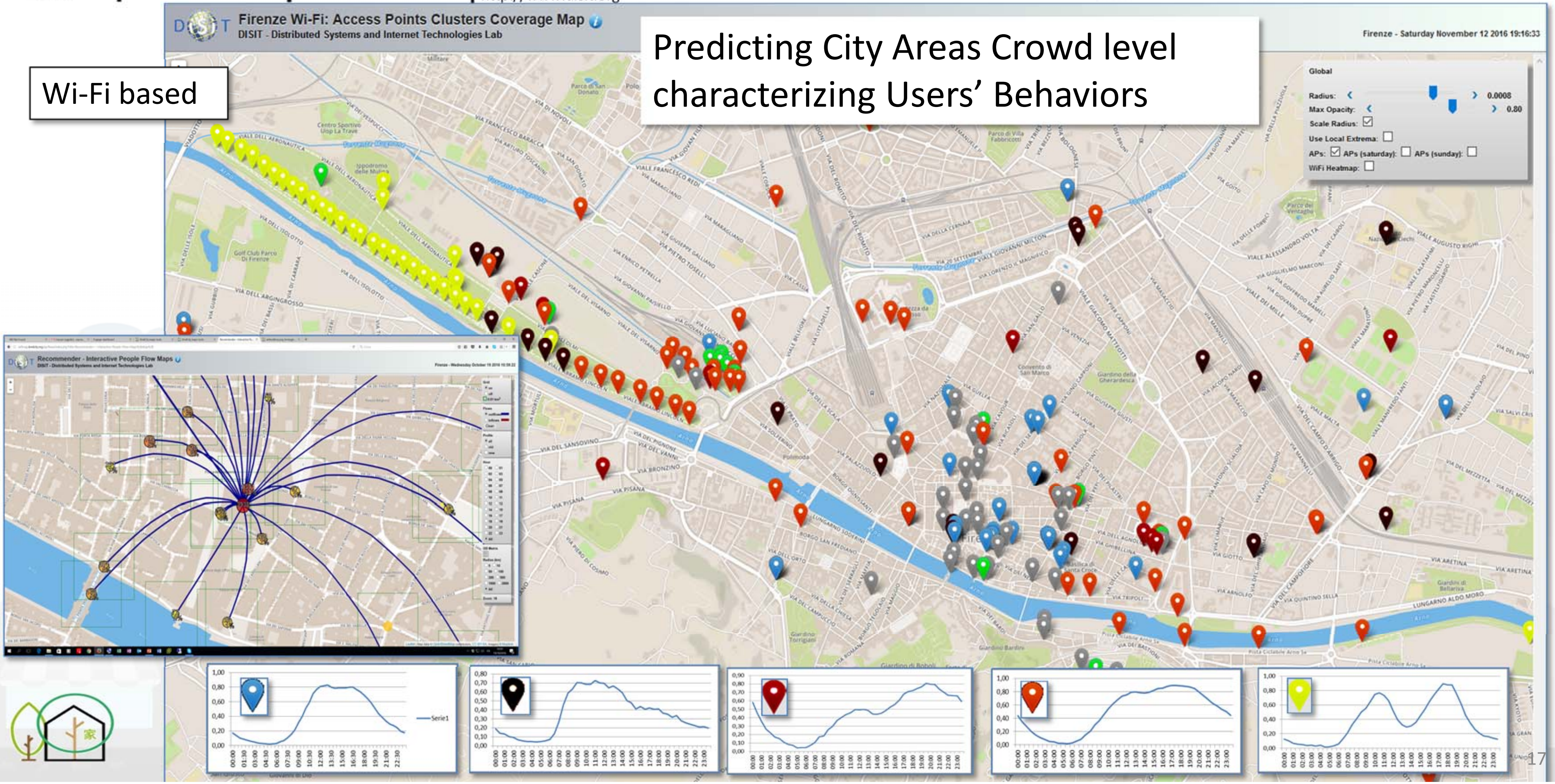
Time Range:
5 min ☐ 10 min ☐ 15 min ☐ 30 min ☐ 60 min ☐
3 hours ☑ 6 hours ☐ 9 hours ☐ 12 hours ☐
1 day ☐ 3 days ☐ 1 week ☐ 1 month ☐

Distinct people ☐ Local Extrema ☐ Movements ☑
Clustered markers ☐ Location clustered markers ☐

To Date ☐ static ☐

Reply Speed:
Realtime ☑ 10 s ☐ 30 s ☐ 1 min ☐ 5 min ☐
15 min ☐ 30 min ☐ 1 h ☐ 2 h ☐ 3 h ☐

Characterizing City Areas

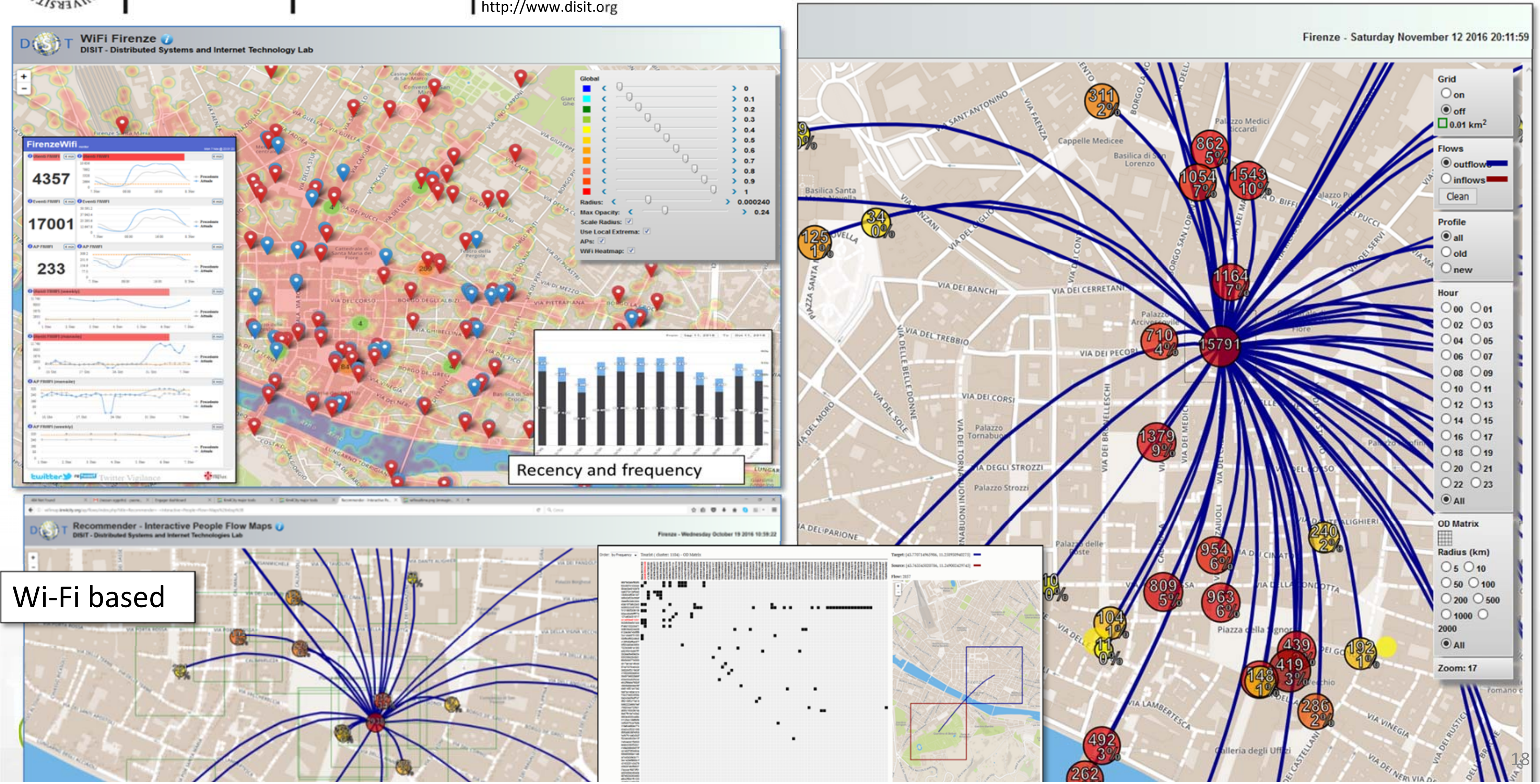

Firenze Wi-Fi: Access Points Clusters Coverage Map
DISIT - Distributed Systems and Internet Technologies Lab
Firenze - Saturday November 12 2016 19:16:33
Recommender - Interactive People Flow Maps
DISIT - Distributed Systems and Internet Technologies Lab
Firenze - Wednesday October 19 2016 19:59:22
Serie1
00:00
23:00

Global
Radius: 0.0008
Max Opacity: 0.80
Scale Radius: ☑
Use Local Extrema: ☐
APs: ☑ APs (saturday): ☐ APs (sunday): ☐
WiFi Heatmap: ☐

Wi-Fi based

Predicting City Areas Crowd level characterizing Users' Behaviors

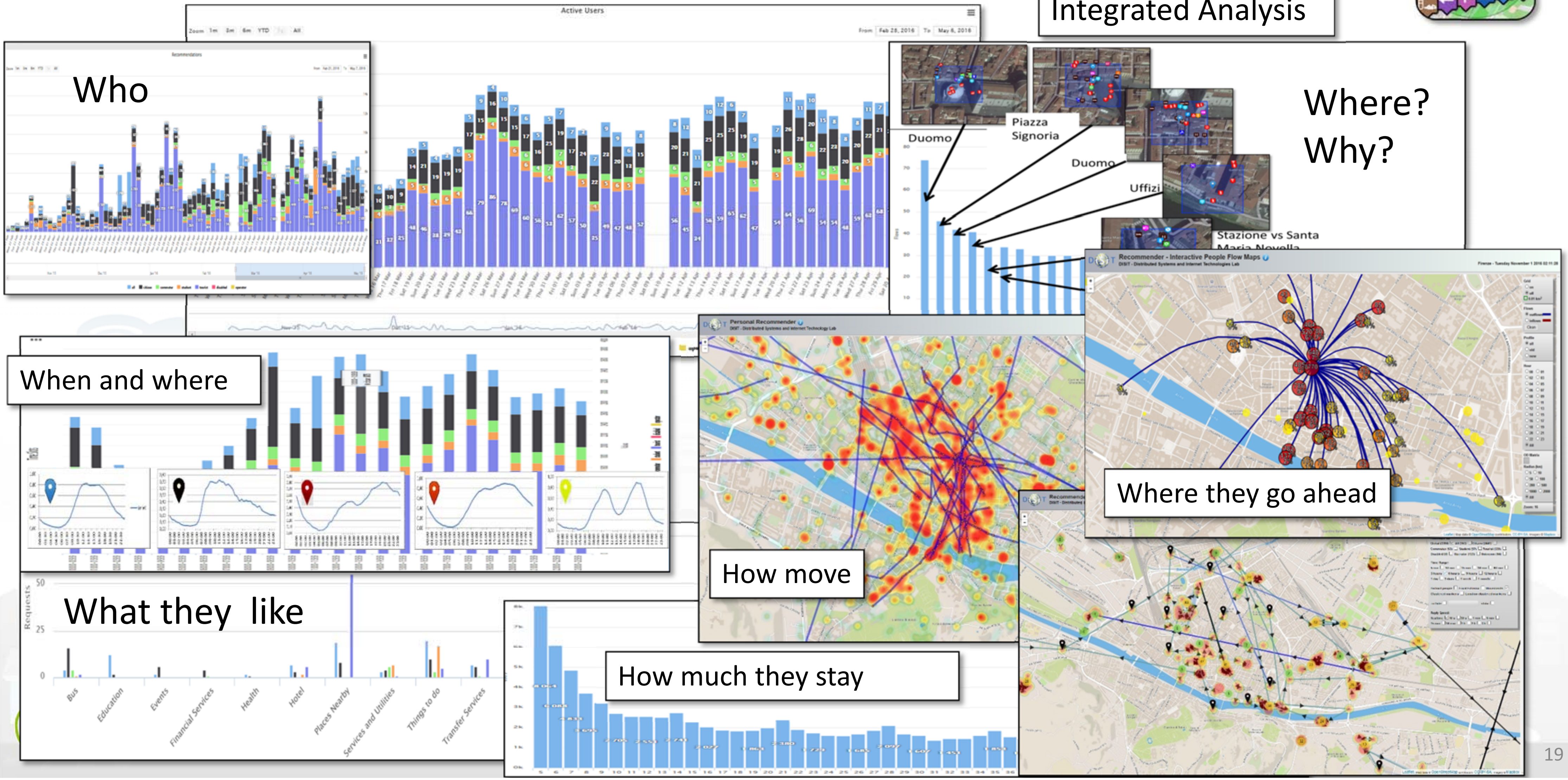
Origin Destination Estimation


WiFi Firenze
DISIT - Distributed Systems and Internet Technology Lab
FirenzeWifi
4357
17001
233
Global
Radius:
Max Opacity:
Scale Radius: ☑
Use Local Extrema: ☑
APs: ☑
WiFi Heatmap: ☑
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.000240
0.24
Recommender - Interactive People Flow Maps
DISIT - Distributed Systems and Internet Technologies Lab
Firenze - Wednesday October 19 2016 10:59:22
Firenze - Saturday November 12 2016 20:11:59
Grid
○ on
● off
0.01 km²
Flows
● outflows
○ inflows
Clean
Profile
● all
○ old
○ new
Hour
○ 00 ○ 01
○ 02 ○ 03
○ 04 ○ 05
○ 06 ○ 07
○ 08 ○ 09
○ 10 ○ 11
○ 12 ○ 13
○ 14 ○ 15
○ 16 ○ 17
○ 18 ○ 19
○ 20 ○ 21
○ 22 ○ 23
● All
OD Matrix
Radius (km)
○ 5 ○ 10
○ 50 ○ 100
○ 200 ○ 500
○ 1000 ○ 2000
● All
Zoom: 17
15791
1164 7%
1543 10%
1054 7%
862 5%
311 2%
710 4%
1379 9%
954 6%
809 5%
963 6%
439
419 3%
148 1%
286 2%
492 3%
262
240 2%
192 1%
104 1%
125 1%
34 0%
11 0%
VIA DEI BANCHI
VIA DEI CERRETANI
VIA DEI PECORI
VIA DEGLI STROZZI
Palazzo Strozzi
Piazza della Signoria
Galleria degli Uffizi

Recency and frequency

Wi-Fi based

User Behavior Analysis


Active Users
Recommendations
Duomo
Piazza Signoria
Duomo
Uffizi
Stazione vs Santa Maria Novella
Personal Recommender
Recommender - Interactive People Flow Maps
DISIT - Distributed Systems and Internet Technologies Lab
Requests
50
25
0
Bus
Education
Events
Financial Services
Health
Hotel
Places Nearby
Services and Utilities
Things to do
Transfer Services

Integrated Analysis

Who

Where?
Why?

When and where

Where they go ahead

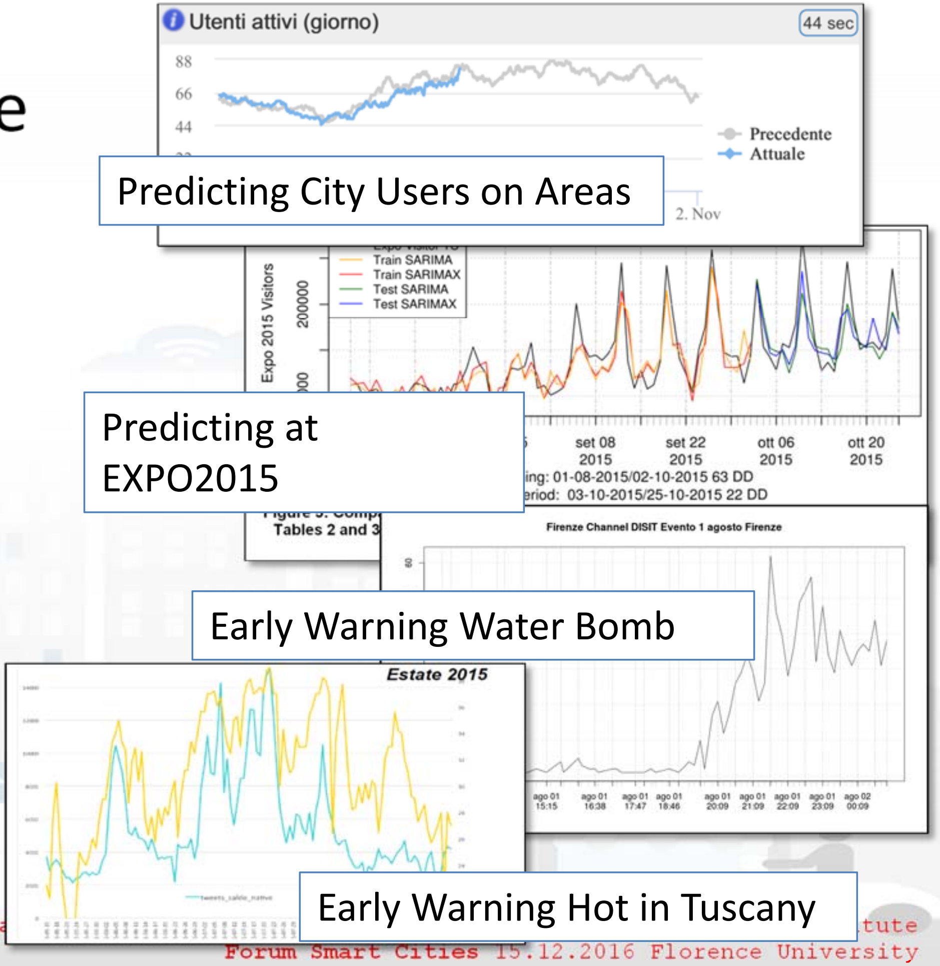
How move

What they like

How much they stay

Predicting Models for Admin. & City Users

- As we have …Weather Forecast (LAMMA)
- Prediction for improving quality of life and services
  - – distributing workload, providing sugg.
  - – early warning
- Traffic Flows & People Flows
  → crowd , #number of people
- Parking Status → free slots
- Waste management → drop
- Status of recharge stations → book



Predicting City Users on Areas

Predicting at EXPO2015

Early Warning Water Bomb

Early Warning Hot in Tuscany

Sentient Urban Platform for Smart Cit

- **Set up an ICT based Urban Platform integrated and unified data management among services, city operators and city users**:
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    - 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, etc.***
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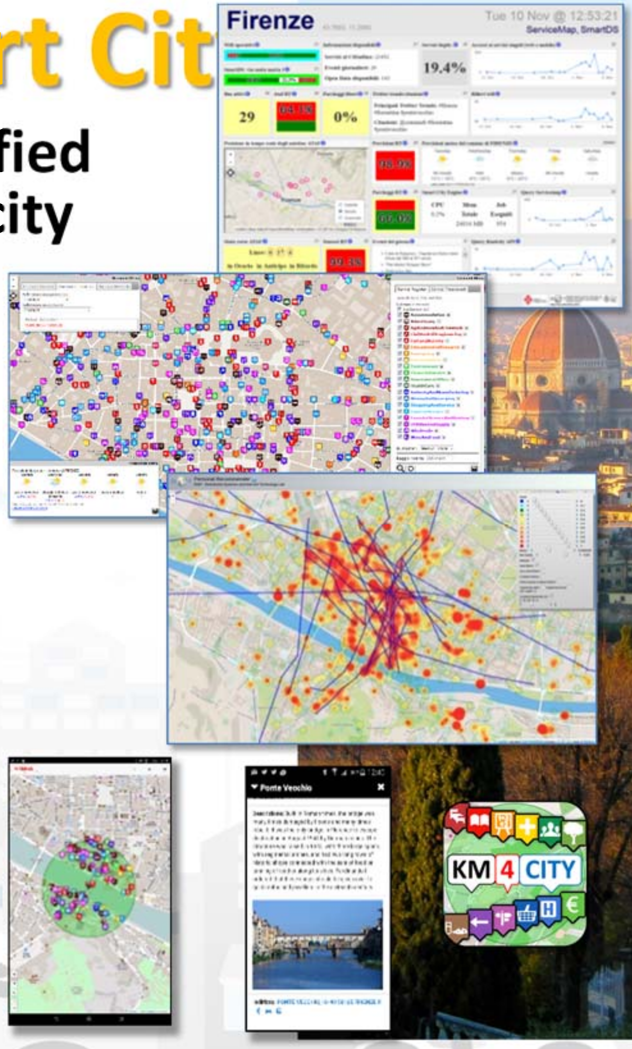
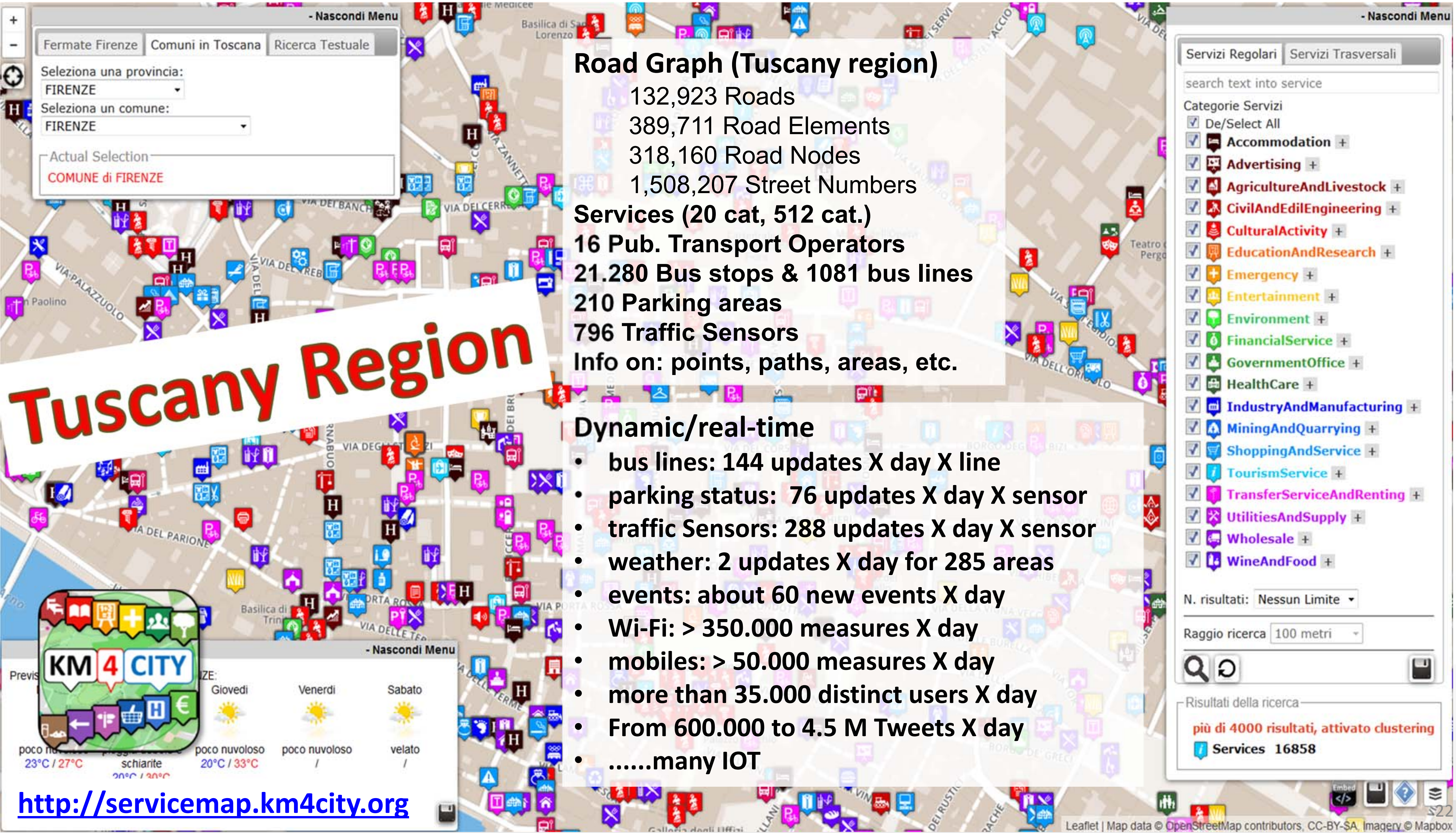
  - ***Transform Data into value***
    - Put in action smart city innovative solutions and services, development tools



Tuscany Region


KM 4 CITY
Basilica di San Lorenzo
Teatro della Pergola
Basilica di Santa Trinita
Galleria degli Uffizi
VIA DEI BANCHI
VIA DEL CERRETANI
VIA DEL PALAZZUOLO
VIA DELLA VIGNA NUOVA
VIA DEL PARIONE
VIA DELL'ORIUOLO
VIA ZANNETTI
PORTA ROSSA
San Paolino
Arno
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

- Nascondi Menu

Fermate Firenze | Comuni in Toscana | Ricerca Testuale

Seleziona una provincia: FIRENZE

Seleziona un comune: FIRENZE

Actual Selection: COMUNE di FIRENZE

Road Graph (Tuscany region)

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

Services (20 cat, 512 cat.)
16 Pub. Transport Operators
21.280 Bus stops & 1081 bus lines
210 Parking areas
796 Traffic Sensors
Info on: points, paths, areas, etc.

Dynamic/real-time

- bus lines: 144 updates X day X line
- parking status: 76 updates X day X sensor
- traffic Sensors: 288 updates X day X sensor
- weather: 2 updates X day for 285 areas
- events: about 60 new events X day
- Wi-Fi: > 350.000 measures X day
- mobiles: > 50.000 measures X day
- more than 35.000 distinct users X day
- From 600.000 to 4.5 M Tweets X day
- ......many IOT

- Nascondi Menu

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

- Nascondi Menu

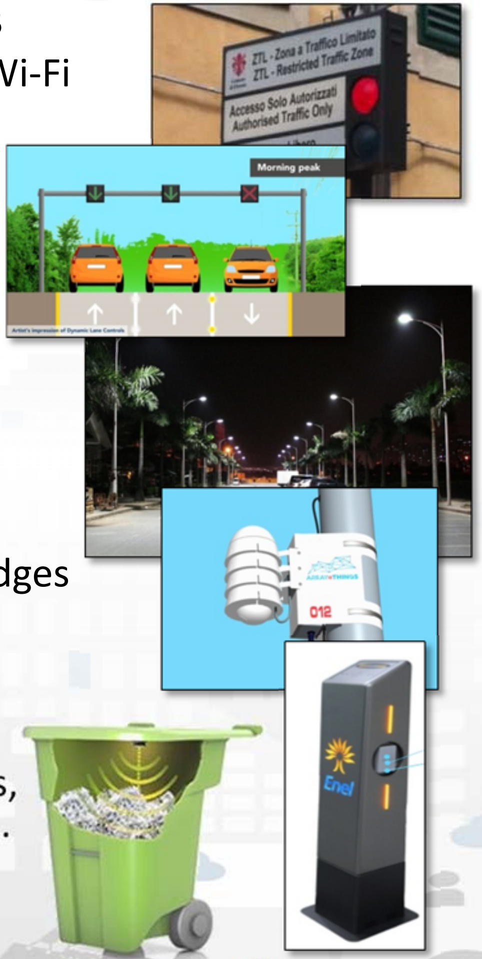
Previs... ZE:

		Giovedi	Venerdi	Sabato
poco nuvoloso	... schiarite	poco nuvoloso	poco nuvoloso	velato
23°C / 27°C	20°C / 30°C	20°C / 33°C	/	/

http://servicemap.km4city.org

Internet of Things: Sensors and Actuators

- **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, snow, …
  - humidity, temperature, …
  - water level in rivers
  - Status of underpass and bridges
  - Seismic sensors
- **Public Light Pillars**
  - Traffic flows, people flow,
  - Wi-Fi, Tv-Camera, BT servers, on/off, percentage of light, ..
- **Waste Manager**
  - Level, kind, status, on/off

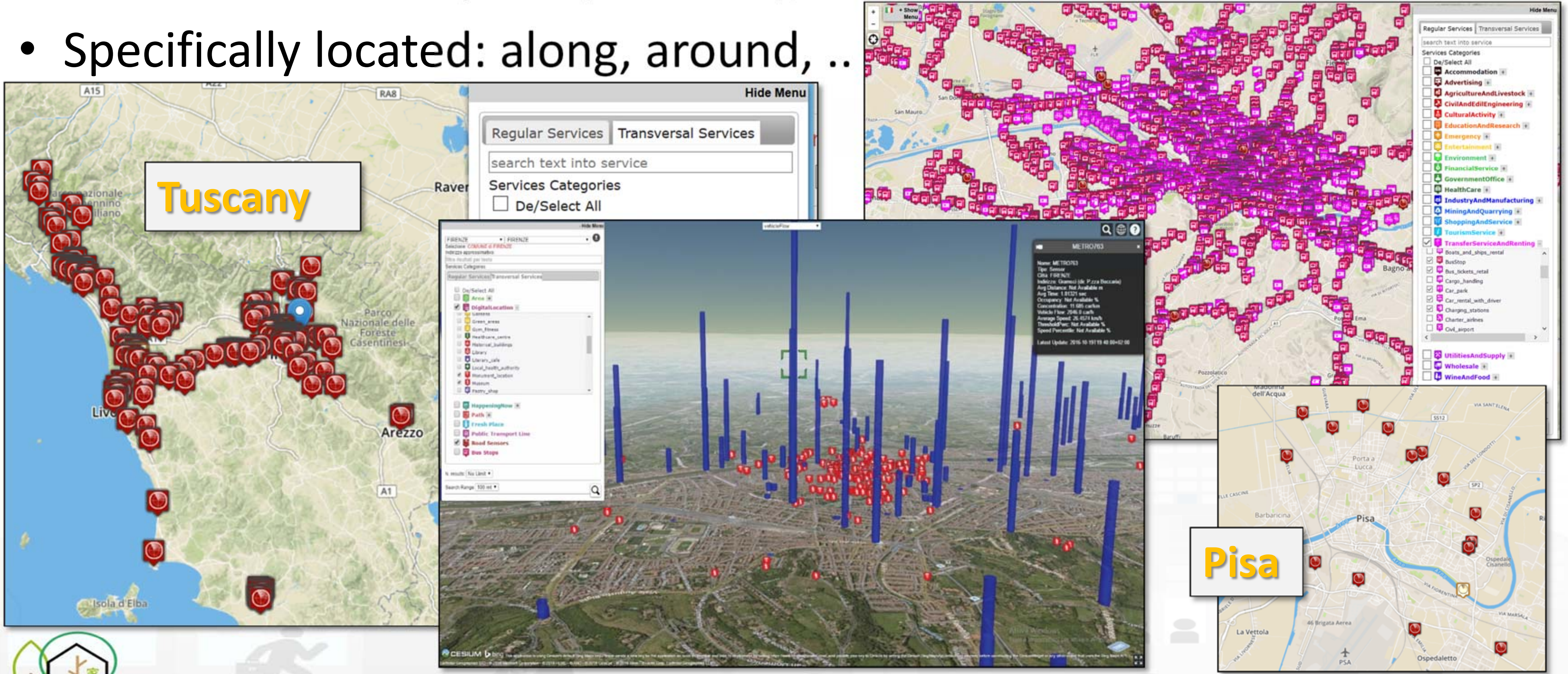

ZTL - Zona a Traffico Limitato
ZTL - Restricted Traffic Zone
Accesso Solo Autorizzati
Authorised Traffic Only
Morning peak
012
Enel

- **Recharge station, column**
  - Free slots, consumption, next time slot, …
- **Risk maps data**
  - Value of the buildings,
  - hydrogeological risk map,
  - earthquake risk map, …
  - people distribution and location
  - Position of recover places,
- **Traffic Zone Gates**
  - Passages, alerts,
  - Wi-Fi control,
  - RFID control,
  - etc.

FIRENZE TODAY

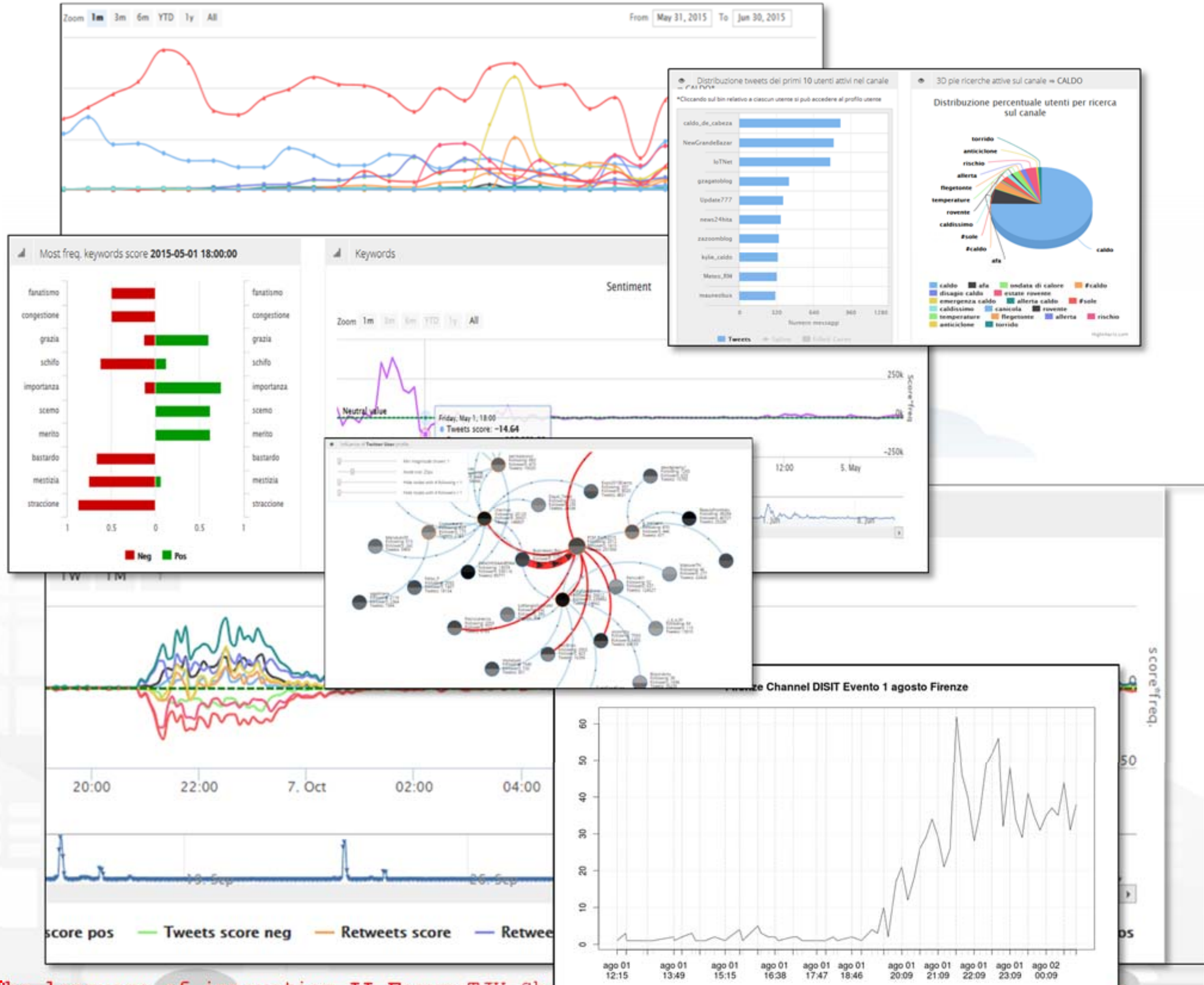
Traffic Flow Tools

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


Tuscany
Arezzo
Isola d'Elba
Hide Menu
Regular Services
Transversal Services
search text into service
Services Categories
De/Select All
Accommodation
Advertising
AgricultureAndLivestock
CivilAndEdilEngineering
CulturalActivity
EducationAndResearch
Emergency
Entertainment
Environment
FinancialService
GovernmentOffice
HealthCare
IndustryAndManufacturing
MiningAndQuarrying
ShoppingAndService
TourismService
TransferServiceAndRenting
Boats_and_ships_rental
BusStop
Bus_tickets_retail
Cargo_handling
Car_park
Car_rental_with_driver
Charging_stations
Charter_airlines
Civil_airport
UtilitiesAndSupply
Wholesale
WineAndFood
METRO763
CESIUM
Pisa
Porta a Lucca
Barbaricina
La Vettola
Ospedaletto

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


Zoom 1m 3m 6m YTD 1y All
From May 31, 2015 To Jun 30, 2015
Most freq. keywords score 2015-05-01 18:00:00
fanatismo
congestione
grazia
schifo
importanza
scemo
merito
bastardo
mestizia
straccione
Neg
Pos
Keywords
Sentiment
Neutral value
Friday, May 1, 18:00
Tweets score: -14.64
Distribuzione percentuale utenti per ricerca sul canale
Channel DISIT Evento 1 agosto Firenze
20:00
22:00
7. Oct
02:00
04:00
score pos
Tweets score neg
Retweets score
score*freq.

Twitter Vigilance

Sentient Urban Platform for Smart Cit

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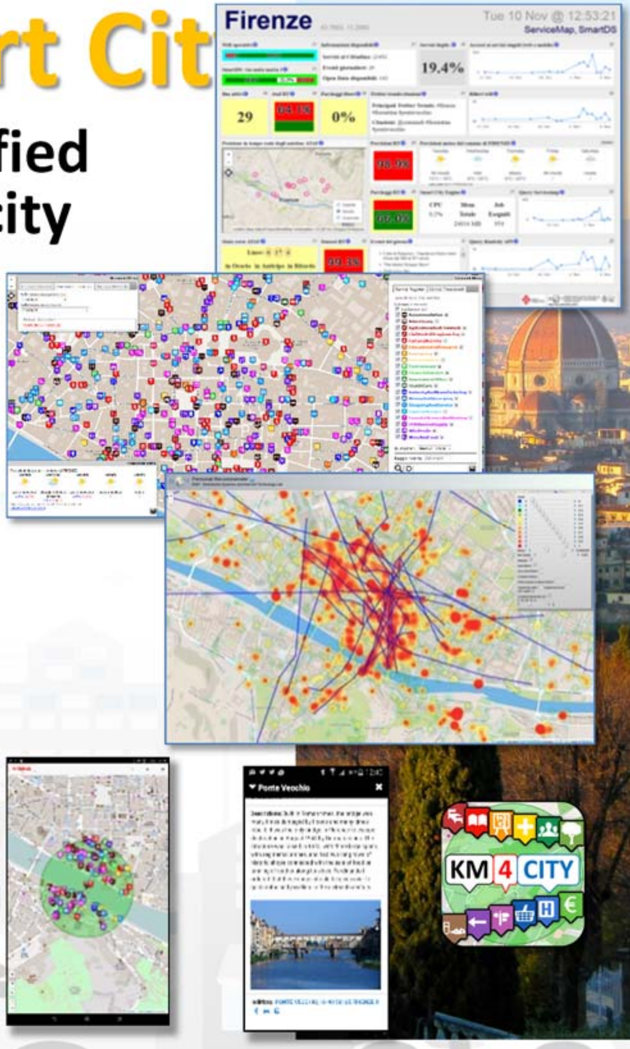
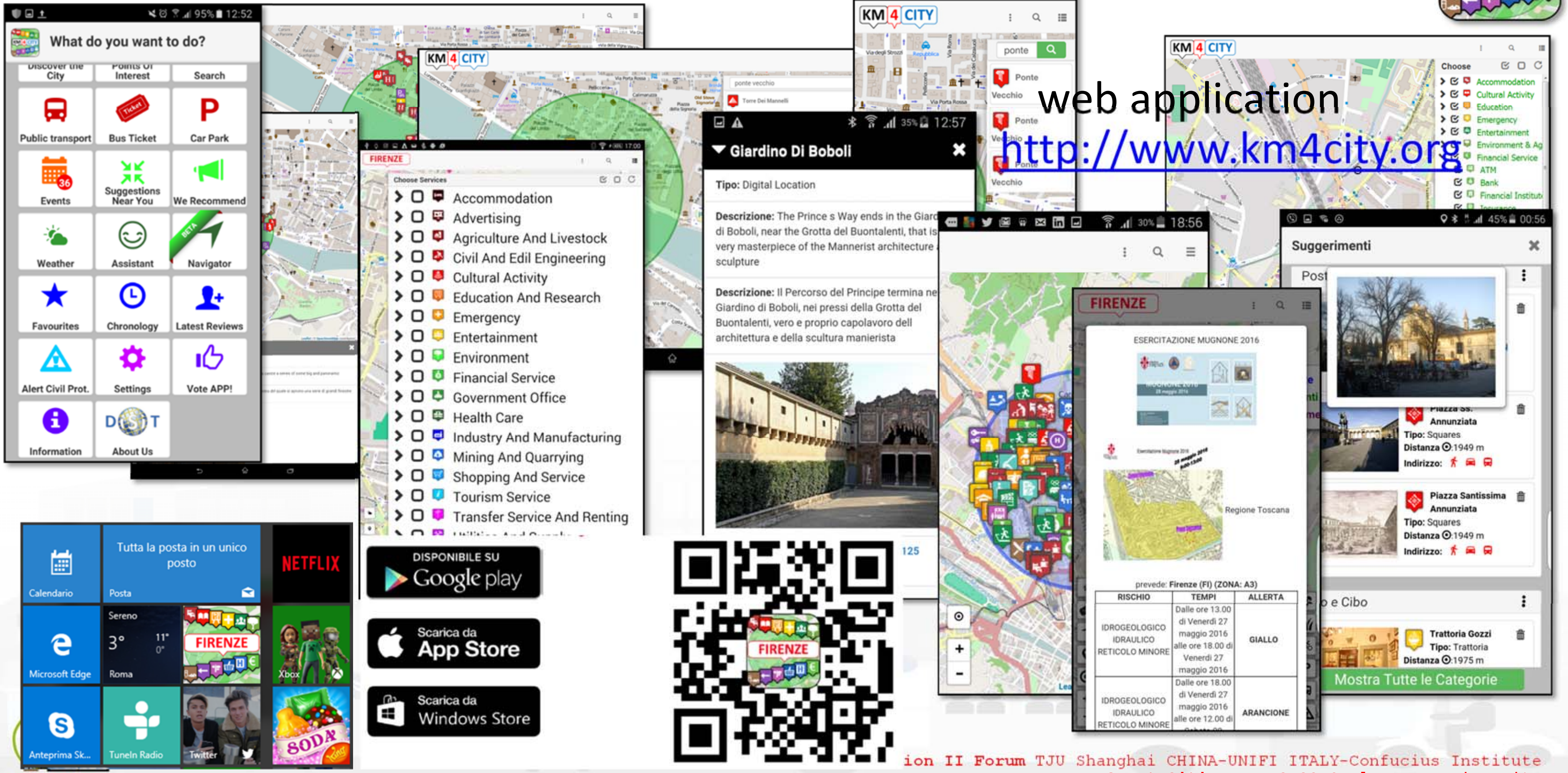


Km4CityMobile App



web application http://www.km4city.org

What do you want to do?

Discover the City
Points of Interest
Search
Public transport
Bus Ticket
Car Park
Events
Suggestions Near You
We Recommend
Weather
Assistant
Navigator
Favourites
Chronology
Latest Reviews
Alert Civil Prot.
Settings
Vote APP!
Information
About Us

Choose Services

- ☐ Accommodation
- ☐ Advertising
- ☐ Agriculture And Livestock
- ☐ Civil And Edil Engineering
- ☐ Cultural Activity
- ☐ Education And Research
- ☐ Emergency
- ☐ Entertainment
- ☐ Environment
- ☐ Financial Service
- ☐ Government Office
- ☐ Health Care
- ☐ Industry And Manufacturing
- ☐ Mining And Quarrying
- ☐ Shopping And Service
- ☐ Tourism Service
- ☐ Transfer Service And Renting

Giardino Di Boboli

Tipo: Digital Location

Descrizione: The Prince s Way ends in the Giard di Boboli, near the Grotta del Buontalenti, that is very masterpiece of the Mannerist architecture sculpture

Descrizione: Il Percorso del Principe termina ne Giardino di Boboli, nei pressi della Grotta del Buontalenti, vero e proprio capolavoro dell architettura e della scultura manierista

ESERCITAZIONE MUGNONE 2016

prevede: Firenze (FI) (ZONA: A3)

RISCHIO	TEMPI	ALLERTA
IDROGEOLOGICO IDRAULICO RETICOLO MINORE	Dalle ore 13.00 di Venerdì 27 maggio 2016 alle ore 18.00 di Venerdì 27 maggio 2016	GIALLO
IDROGEOLOGICO IDRAULICO RETICOLO MINORE	Dalle ore 18.00 di Venerdì 27 maggio 2016 alle ore 12.00 di	ARANCIONE

Suggerimenti

Piazza Ss. Annunziata
Tipo: Squares
Distanza 1949 m
Indirizzo:

Piazza Santissima Annunziata
Tipo: Squares
Distanza 1949 m
Indirizzo:

Trattoria Gozzi
Tipo: Trattoria
Distanza 1975 m

Mostra Tutte le Categorie

FIRENZE
KM 4 CITY
Tutta la posta in un unico posto
Calendario
Posta
NETFLIX
Microsoft Edge
Sereno 3° Roma
Xbox
Anteprima Sk...
TuneIn Radio
Twitter

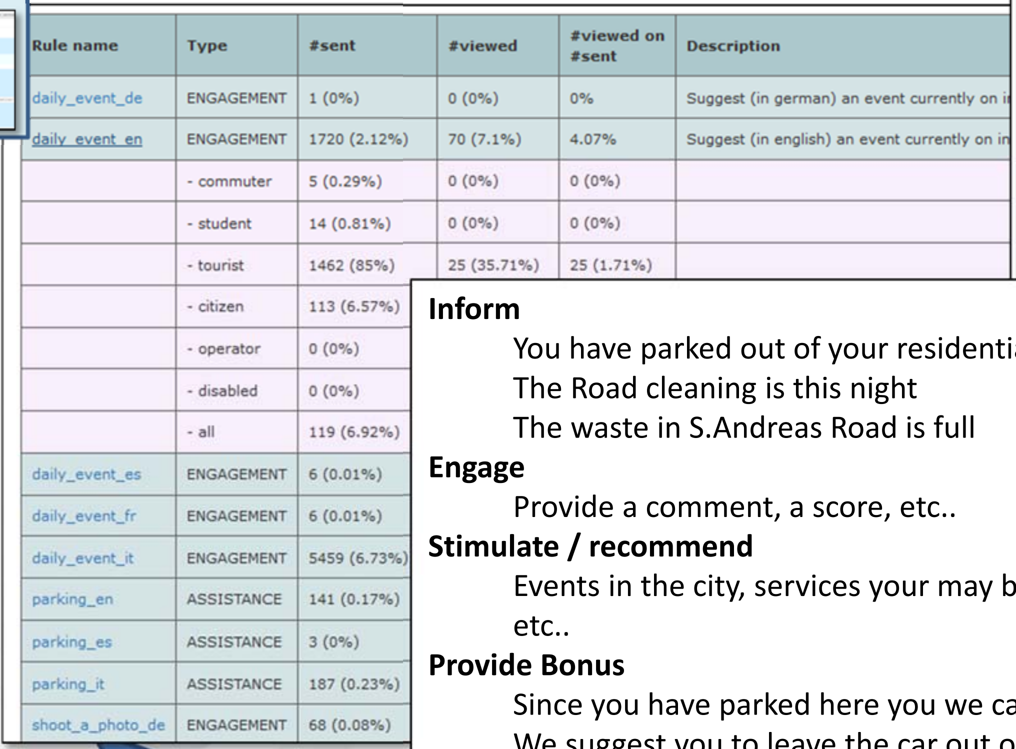
DISPONIBILE SU Google play

Scarica da App Store

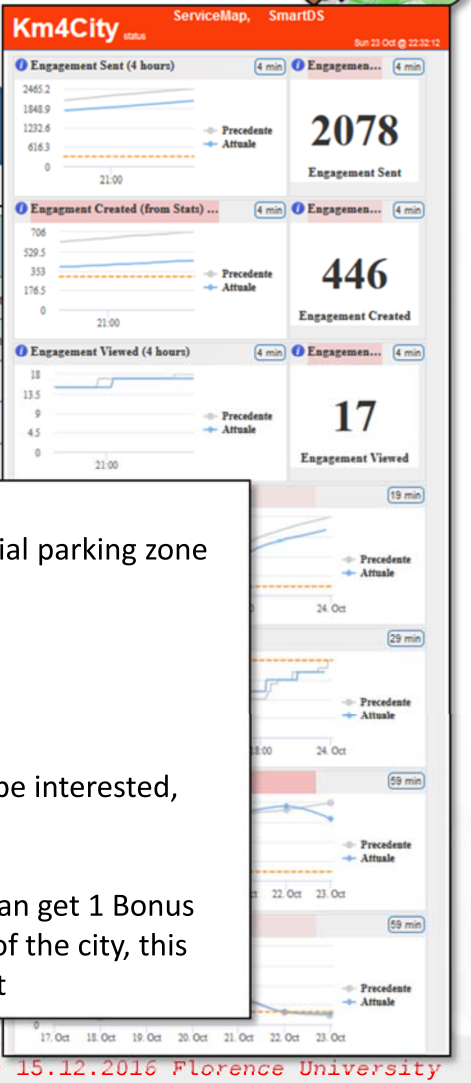
Scarica da Windows Store

User influencing, engaging, monitoring & Follow Up

City & City Operators Strategy Editor



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%)			


Km4City status
ServiceMap, SmartDS
Engagement Sent (4 hours)
2078
Engagement Sent
Engagment Created (from Stats) ...
446
Engagement Created
Engagement Viewed (4 hours)
17
Engagement Viewed
Precedente
Attuale

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

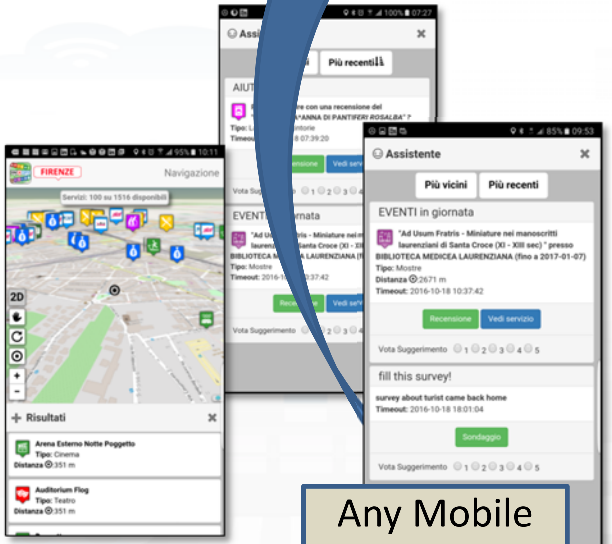
Provide a comment, a score, etc..

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 buy a bus ticket


FIRENZE
Navigazione
Risultati
Assistente
Più vicini
Più recenti
EVENTI in giornata
Recensione
Vedi servizio
fill this survey!
Sondaggio
Vota Suggerimento

Any Mobile and Web App

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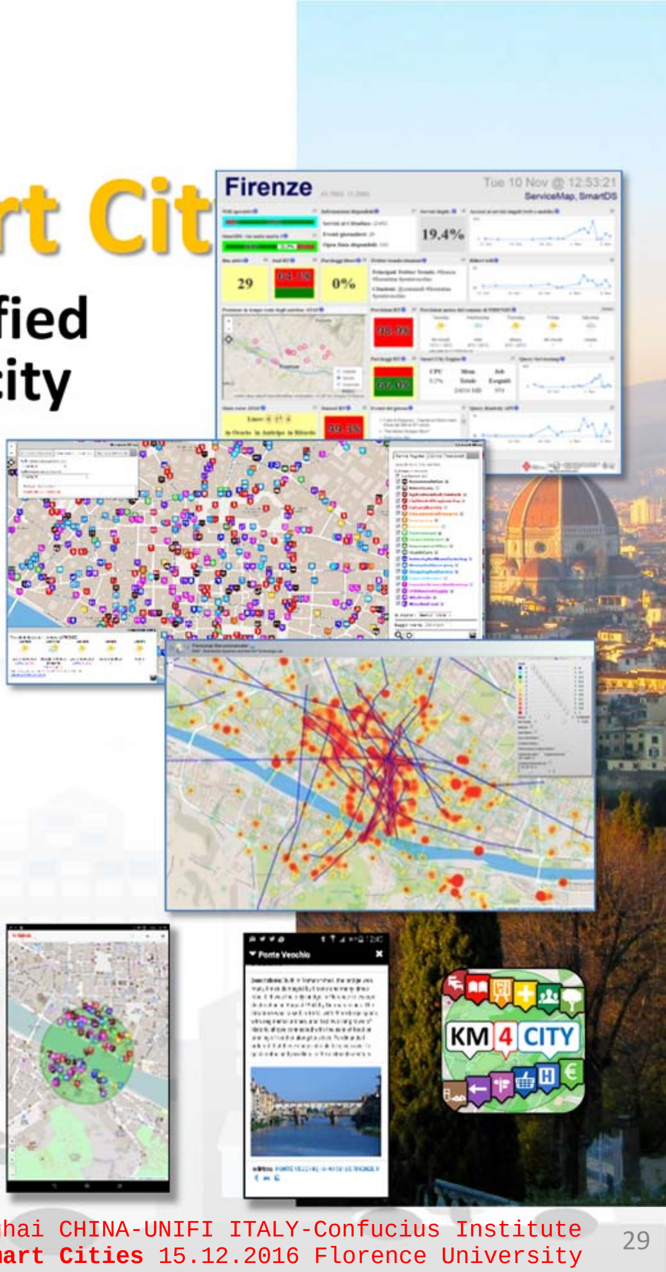
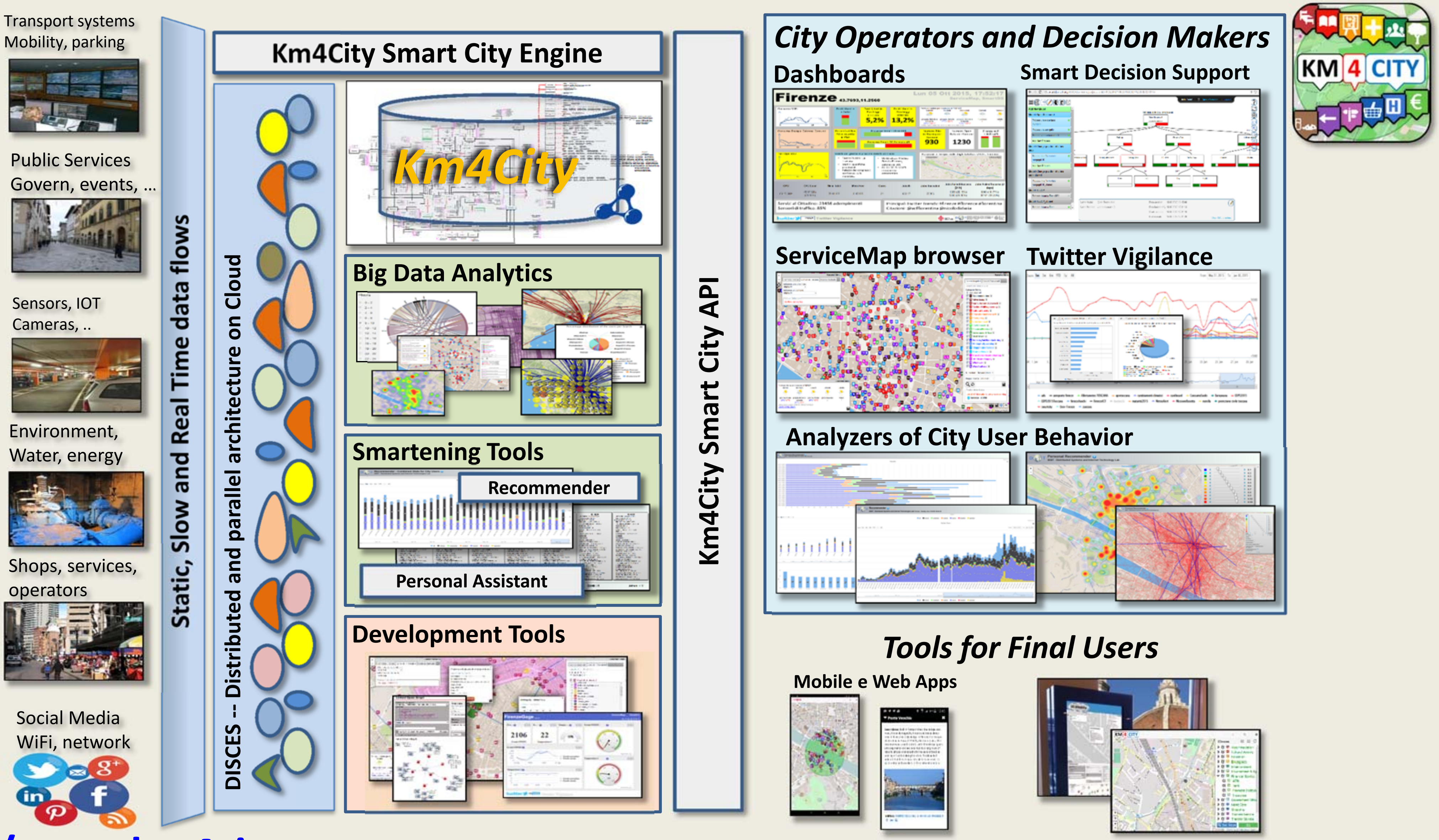




Transport systems
Mobility, parking

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

Km4City

Big Data Analytics

Smartening Tools

Recommender

Personal Assistant

Development Tools

Km4City Smart City API

City Operators and Decision Makers

Dashboards

Smart Decision Support

ServiceMap browser

Twitter Vigilance

Analyzers of City User Behavior

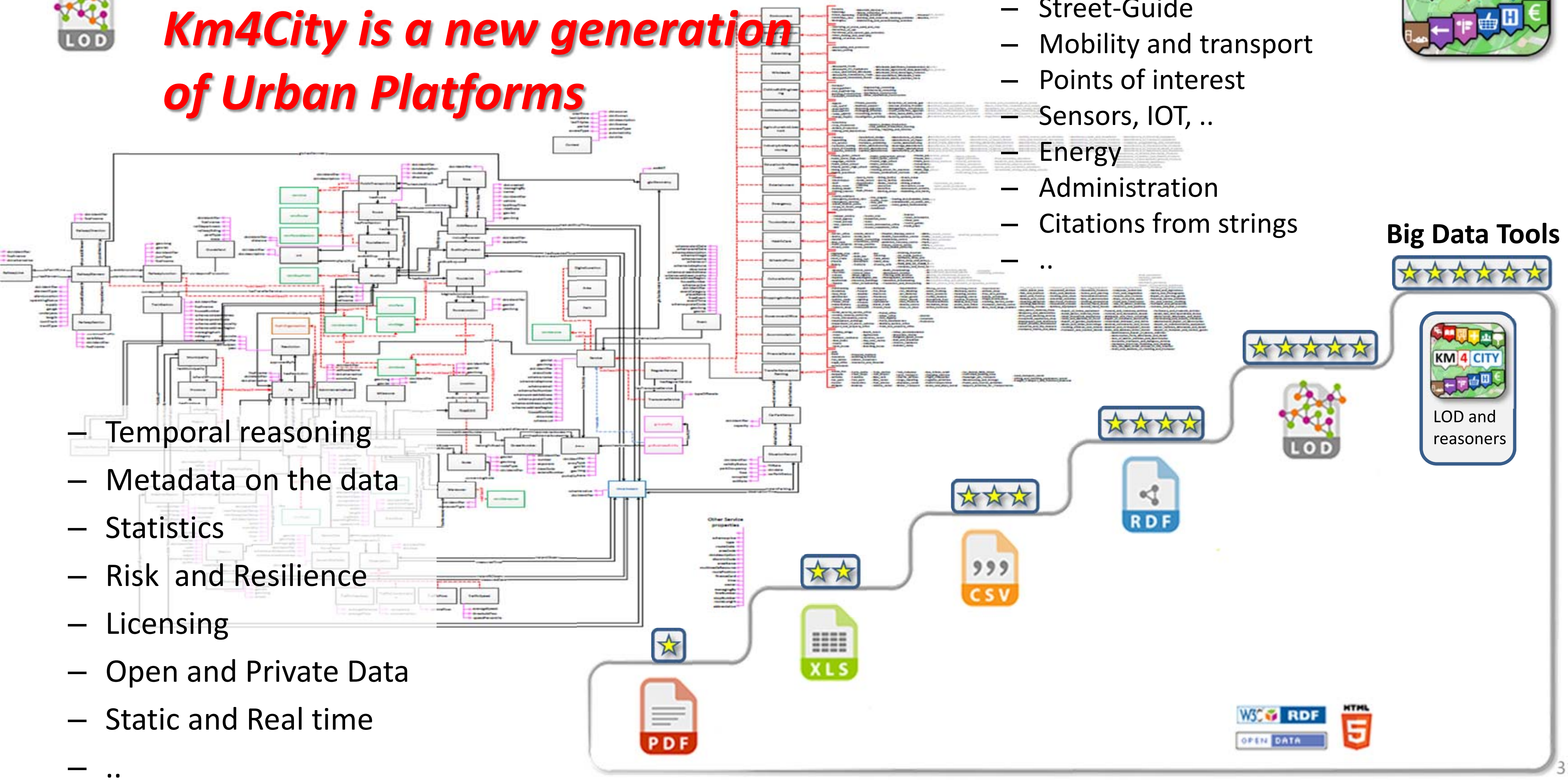
Tools for Final Users

Mobile e Web Apps

Http://www.km4city.org

Km4City Ontology - RDF Store

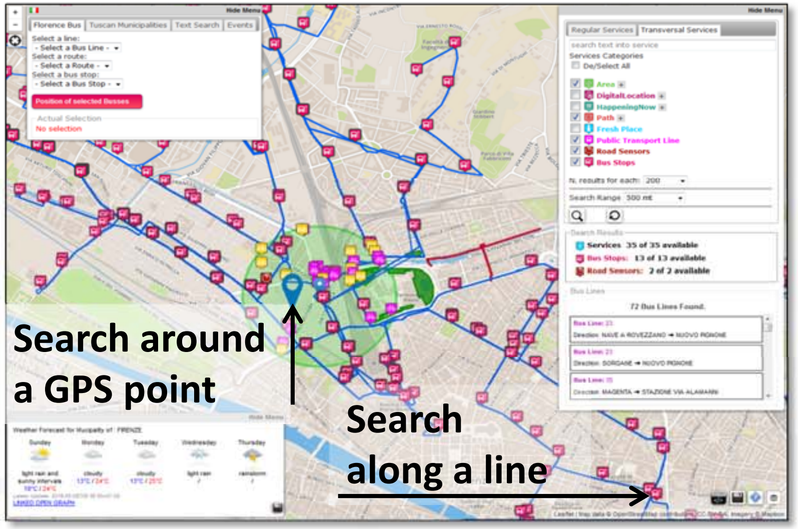
Km4City is a new generation of Urban Platforms


Big Data Tools
LOD and reasoners
LOD
RDF
CSV
XLS
PDF
W3C RDF
OPEN DATA
HTML 5
KM 4 CITY

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

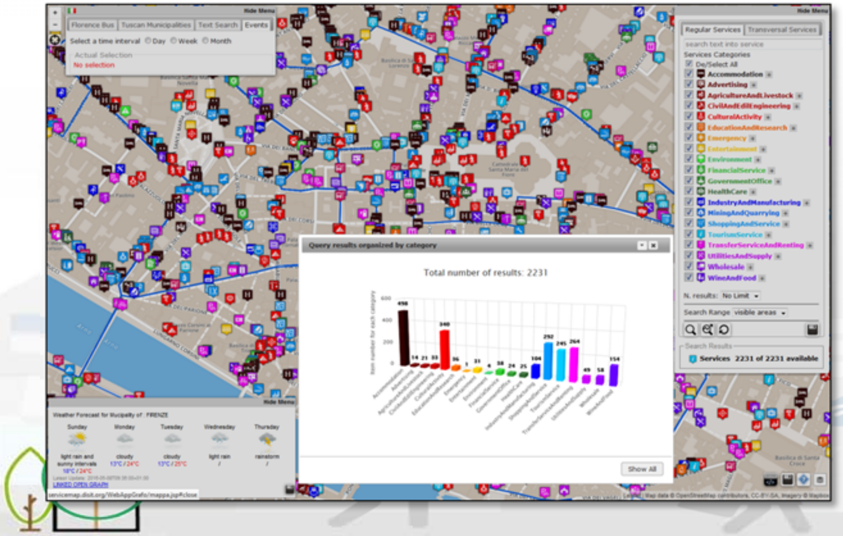
- Temporal reasoning
- Metadata on the data
- Statistics
- Risk and Resilience
- Licensing
- Open and Private Data
- Static and Real time
- ..

ServiceMap Dev Tool

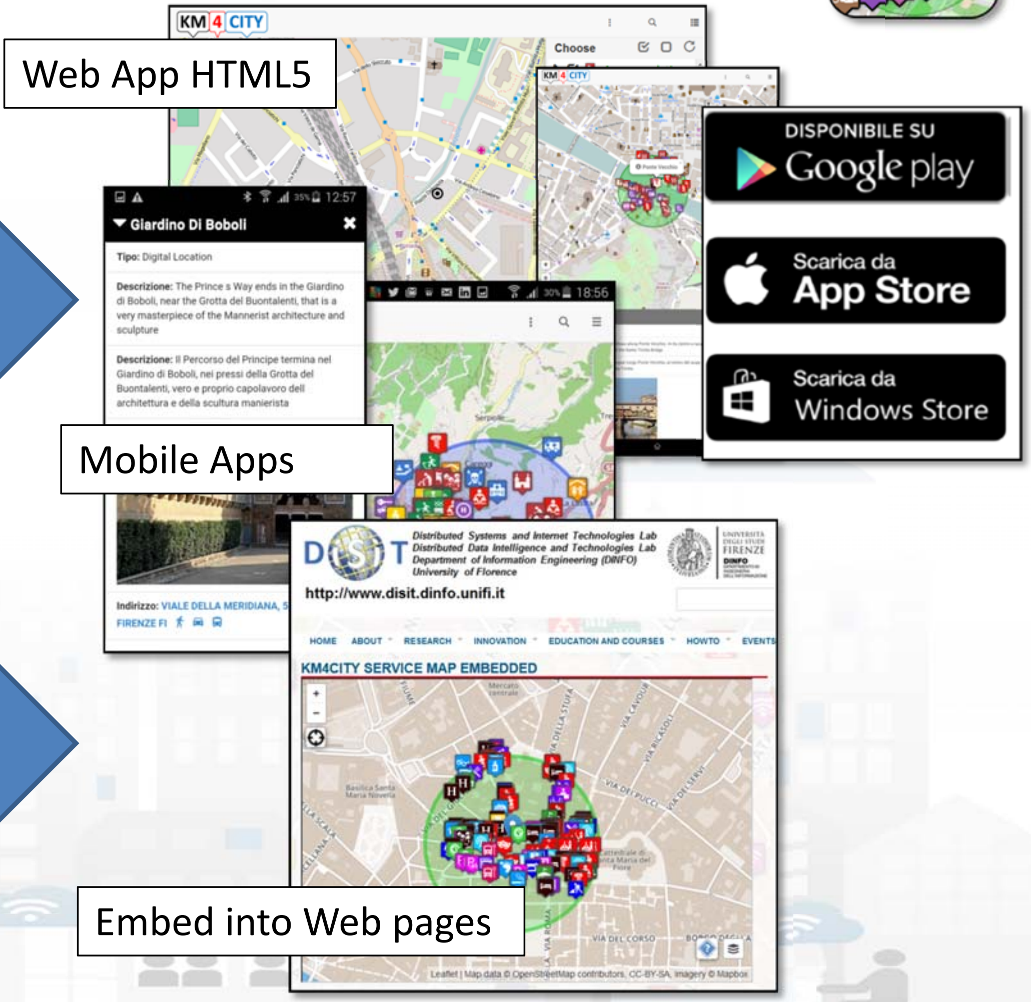


Search around a GPS point

Search along a line



Smart City API call generation



Web App HTML5

Giardino Di Boboli

Tipo: Digital Location

Descrizione: The Prince s Way ends in the Giardino di Boboli, near the Grotta del Buontalenti, that is a very masterpiece of the Mannerist architecture and sculpture

Descrizione: Il Percorso del Principe termina nel Giardino di Boboli, nei pressi della Grotta del Buontalenti, vero e proprio capolavoro dell architettura e della scultura manierista

Indirizzo: VIALE DELLA MERIDIANA, 5 FIRENZE FI

Mobile Apps

DISPONIBILE SU Google play
Scarica da App Store
Scarica da Windows Store
KM4CITY SERVICE MAP EMBEDDED
http://www.disit.dinfo.unifi.it

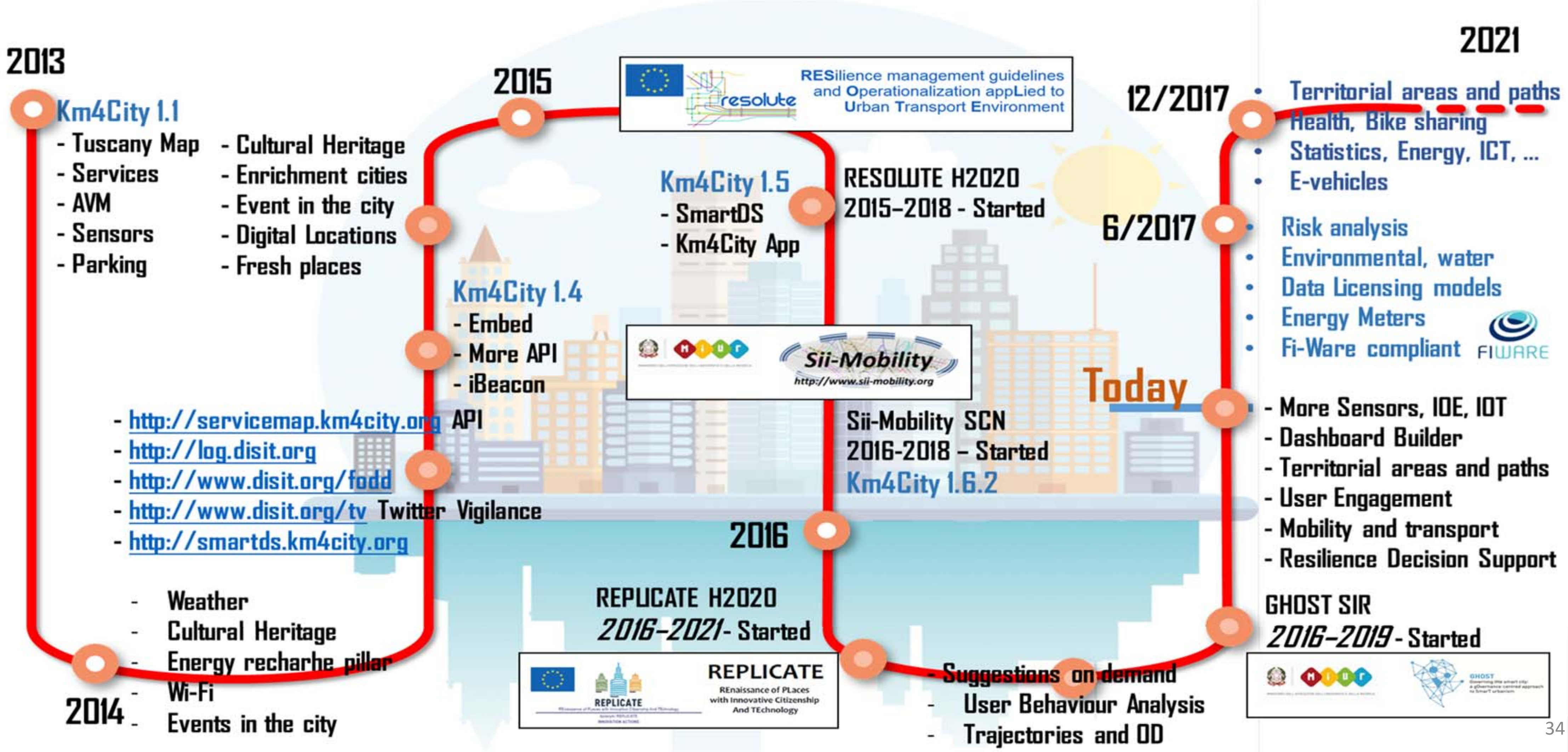
Embed into Web pages

http://www.disit.org/6873

Km4City: Open, Flexible, Scalable City Platform

- **Over the 5 stars data**
  - **linked open data, RDF store + big data analytics**
- **Open**
  - Open to any kind of customization → Open Source, license free
  - Open to any data source → Km4City DataWarehouse
- **Flexible**
  - multiple domains data and processes → Km4City Ontology and Tools
  - Ingesting data via any protocol and approach → Km4City DataWarehouse
- **Scalable**
  - Sustainable and affordable → Flexible and compoundable tools
  - providing support for decision support performing data analytics in real time → Km4City Scalable Back office for Big Data Analytics

Km4City Roadmap



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 recharhe pillar
- Wi-Fi
- Events in the city

2014

2015

Km4City 1.4

- Embed
- More API
- iBeacon

RESilience management guidelines and Operationalization appLied to Urban Transport Environment

resolute

Km4City 1.5

- SmartDS
- Km4City App

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

Today

6/2017

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

FIWARE

12/2017

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

2021

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

GHOST SIR
2016-2019 - Started

GHOST

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

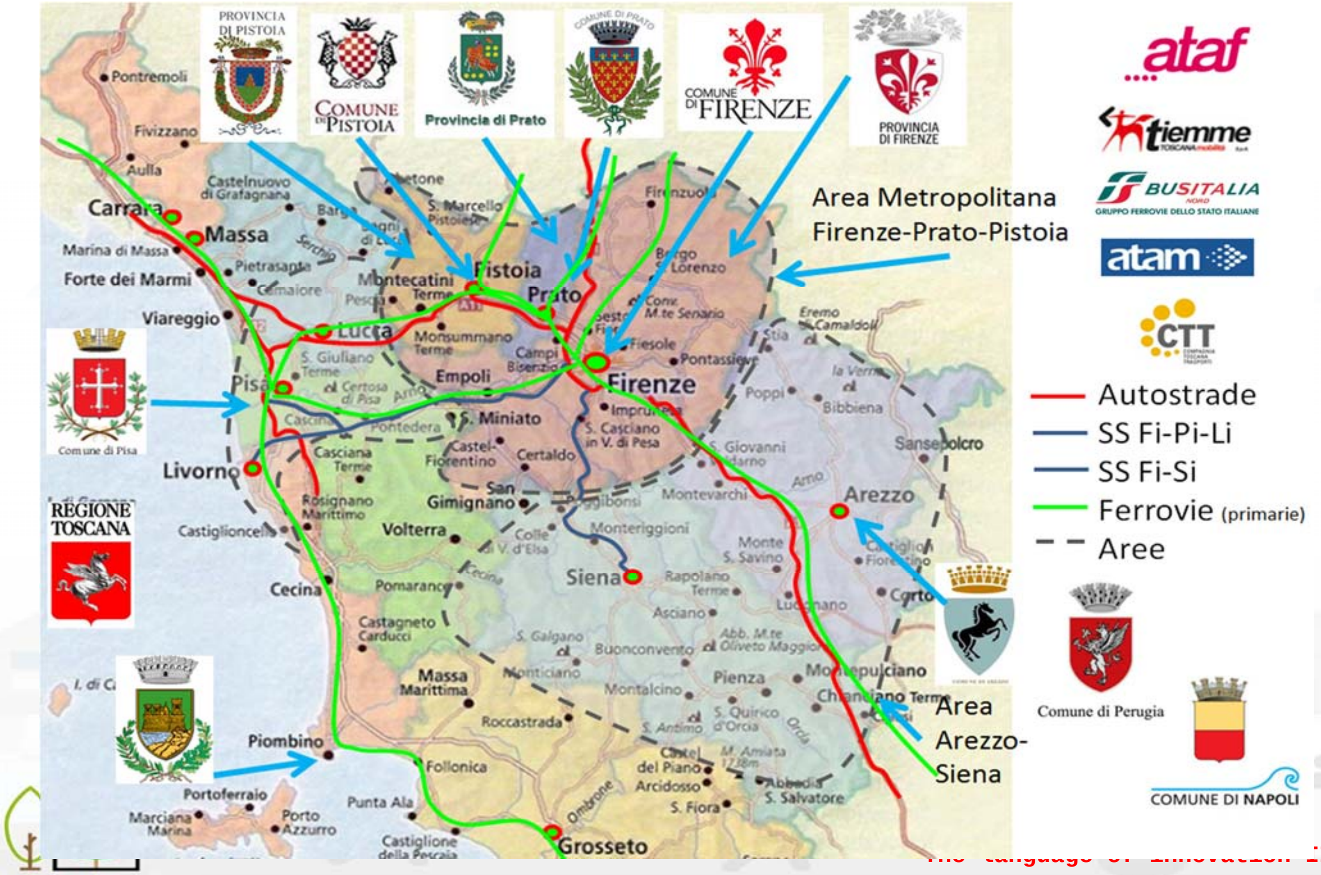
University of Florence: DISIT lab DINFO (Proj coordinator), DISIA and DST	UNIFI	IT
THALES	THALES	IT
ATTIKOMetro	ATTIKO	GR
Comune di Firenze	CDF	IT
Centre for Research and Technology Hellas	CERTH	GR
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	FHG	DE
HUMANIST	HUMANIST	FR
SWARCO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

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB http://www.disit.org

Sii-Mobility

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

- *http://www.Sii-Mobility.org*


Area Metropolitana Firenze-Prato-Pistoia
Area Arezzo-Siena
Autostrade
SS Fi-Pi-Li
SS Fi-Si
Ferrovie (primarie)
Aree
Pistoia
Prato
Firenze
Lucca
Pisa
Livorno
Empoli
Siena
Arezzo
Grosseto
Massa
Carrara
Viareggio
Piombino
Comune di Perugia
COMUNE DI NAPOLI

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

REPLICATE

Horizon 2020
European Union Funding
for Research & Innovation

COMUNE DI FIRENZE

Smart Florence Plan

- demonstrate Smart City technologies in energy, transport and ICT in districts in:
  - **San Sebastian (S), Florence (I) and Bristol (UK)**,
  - 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*

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

COMUNE DI CAGLIARI

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

http://sites.unica.it/ghost

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DIPARTIMENTO DI ARCHITETTURA

UNIVERSITÀ DEGLI STUDI FIRENZE
DISEI
DIPARTIMENTO DI SCIENZE PER L'ECONOMIA E L'IMPRESA

佛罗伦萨大学孔子学院
Istituto Confucio
Università di Firenze

Hanban

The language of innovation II Forum
Architecture and Urban Planning IV Forum

TJU Shanghai CHINA - UNIFI ITALY
Confucius Institute

ICT Solution for Smart City Urban Platform

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Smart Cities
15th December 2016

Healthy Cities
16th December 2016

Florence University

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