



Smart City and Km4City for Beginners 2016

*Parte 11 of the University of Florence, DISIT lab course:
Knowledge Management and Protection Systems (KMaPS)*

Prof. Paolo Nesi

DISIT Lab

Distributed Data Intelligence and Technologies Lab

Distributed Systems and Internet Technologies Lab

Dipartimento di Ingegneria dell'Informazione

Università degli Studi di Firenze

Via S. Marta 3, 50139, Firenze, Italia

tel: +39-055-4796523, fax: +39-055-4796363

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

paolo.nesi@unifi.it





...verso le città

- Si assiste ad una **migrazione verso le città**,
 - nel 2050 arriveranno ad ospitare oltre il 75% della popolazione mondiale
 - dovuto principalmente alle **maggiori opportunità lavorative ma anche ai servizi**
- Si aprono scenari di **competizione fra città «fra pubbliche amministrazioni, PA»**





- → le città, devono adeguarsi alle crescenti necessità cercando di
 - garantire **elevati livelli di qualità della vita**
 - fornire **nuovi servizi**
 - **limitando i costi**, aumento di efficienza
 - strutture decisionali adeguate
- → Enti di valutazione
- **per una la crescita sostenibile da vari punti di vista**



- I **cittadini «imparano»** a vivere in città più tecnologiche → in ambienti:
 - **interattivi**: si aspettano azioni dagli utenti
 - **proattivi**: agiscono in riferimento al contesto: movimenti o ad altro
 - **collaborativi**: fra persone e sistemi
- **Servizi intelligenti – suggeriscono!**
- *Per esempio:*
 - *riconoscimento della persona quando accede ai servizi pubblici, in banca, al supermercato, entra in casa*
 - *parcheggi che conoscono i posti liberi*



- *Il loro uso può implicare un certo grado di comprensione cognitiva da parte dei cittadini*
- «Nascondono», sfruttano...
 - **sensori ed attuatori**
 - *Internet delle Cose, IOT*
- *Per esempio:*
 - *Condizioni meteo, ambiente,*
 - *flussi delle auto, presenza di pedoni*
 - *contatori intelligenti*
 - *Lampioni intelligenti, etc..*



Privati Statici

- Codice fiscale
- Foto non condivise
- Aspetti legali
- Cartella clinica
- ..

- Movimenti personali non pubblicati
- Relazioni personali non pubblicate

- comportamenti social media
- contributi
- consumi

Privati Tempo reale

- Traffico personale
- Posizione mezzi,
- Meteo
- Parcheggi
- Posizione taxi
- Code ai musei
- Posizione CarSharing ...

Publici statici (open data)

statistiche: incidenti, censimenti, votazioni

- Statistiche accessi alla ZTL
- Strutture pubbliche UNIFI

posizione dei punti di interesse

- Musei
- Strutture della città
- Servizi attivi

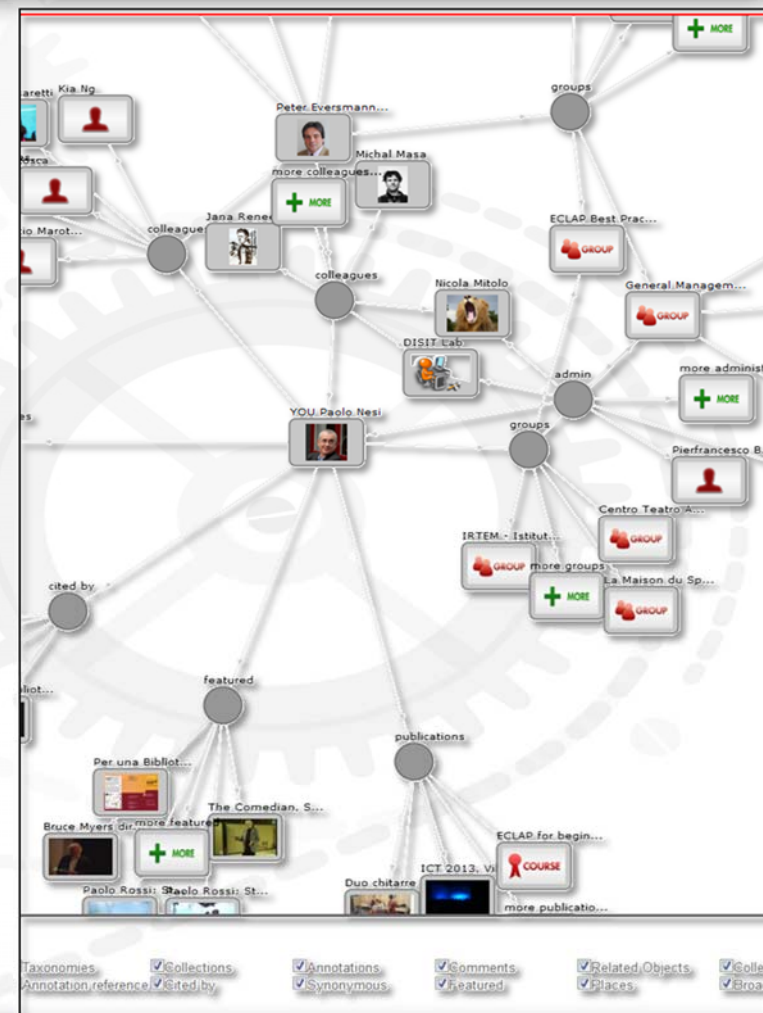
- Info traffico
- video camere
- Info Meto
- Info Ambiente
- Terremoti
- Parcheggi

- Stato accessi alla ZTL
- Stato dei servizi

Publici Tempo reale (open data)

I profili degli utenti

- **Gli utenti possono:**
 - fornire informazioni preziose sulla città come «**sensori intelligenti**» per tenere sotto controllo il livello dei servizi della città e/o nuove necessità
 - **essere profilati per ricevere dei servizi personalizzati, benefici diretti**
- Informazioni anonime:
 - *velocità degli spostamenti: auto a piedi, code e flussi cittadini, temperature, meteo*
 - *Uso dei servizi*
- private in consenso informato, statistiche e attuali:
 - *Azioni e dati personali*
 - *Relazioni con altre persone*
 - *Movimenti puntuali*



Le buone pratiche “Smart city”

- *forniscono nuovi servizi e valutano sulla base della risposta del cittadino*
- Le PA, per stare al passo con la competizione **aprono canali di comunicazione ed ascolto:**
 - **media tradizionali** sono validi per propagare l’informazione
 - **canali basati su internet**, come social network, mobile,.. per la raccolta di informazioni dalla popolazione, e per informare
 - **canali specifici**: interviste dirette, totem interattivi, etc.
- Stabilire un processo di miglioramento virtuoso:
 - **Informare** su disservizi o problemi, e vederli risolti:
 - le buche nella strada, i muri sporchi dei palazzi, la nettezza sulla strada, gli uffici che presentano poco personale, infrastrutture non accessibili, ...
 - **In certi casi, le informazioni utili possono essere ricompensate con bonus/sconti su: taxi, entrate in ZTL, parcheggi, etc.**

Scenari che da fantascientifici diventano reali...

Grazie a infrastrutture che..

- **Raccolgono dati e statistiche su**
 - Ambiente & energia
 - Trasporti & mobilità
 - Commercio & Turismo
 - Servizi al cittadino
 - Comportamento e stato della popolazione nel rispetto della privacy, anonymity
- **Producono analisi, previsioni e deduzioni** su base
 - Statistica, analitica, logica...
 - sporadiche e/o in tempo reale



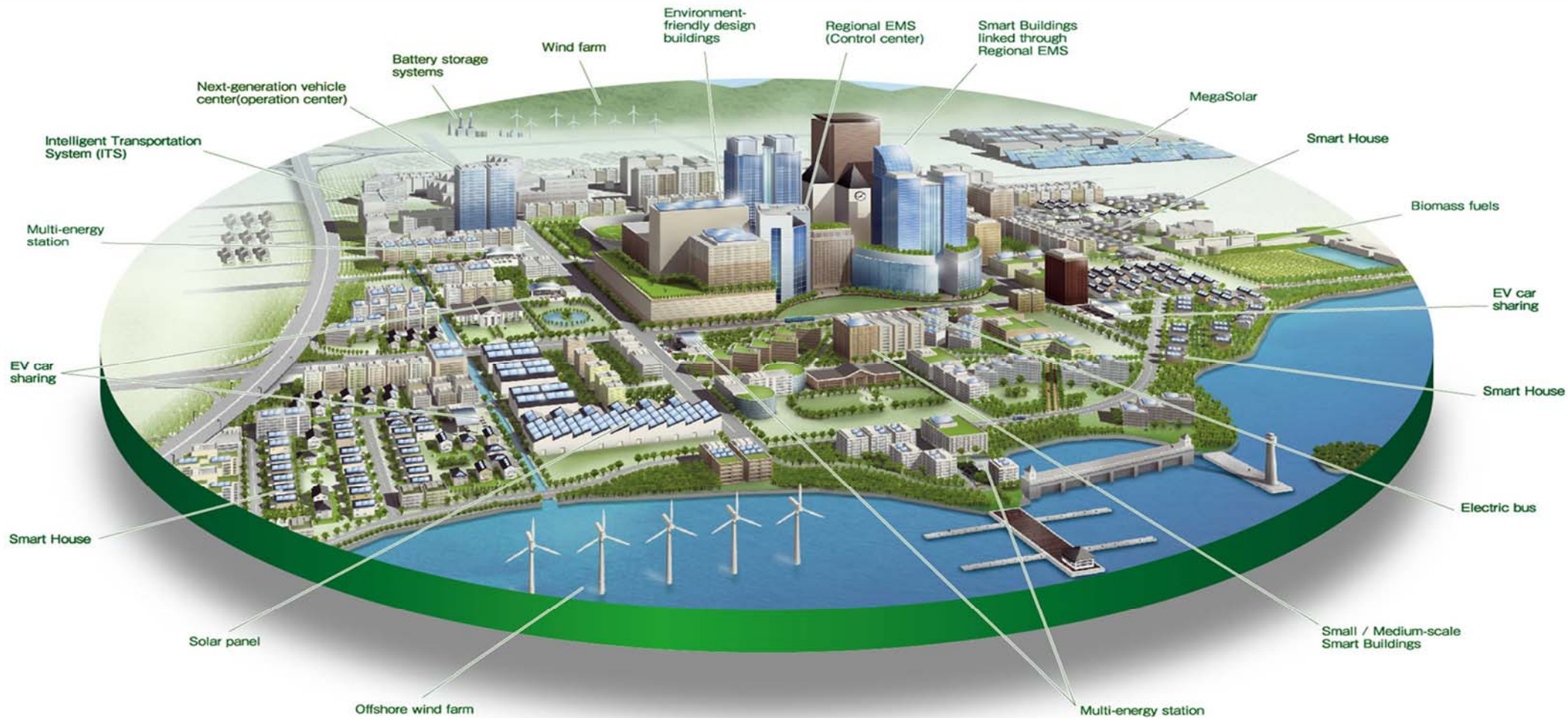
possiamo dire che

- *Gli utenti dovrebbero consumare la loro energia quando le industrie non lo fanno...*
- *Le auto elettriche dovrebbero essere ricaricate vicino alla generazione di energia*
- *Ora: vi sono 34 posti liberi in Piazza Stazione*
- *Ora: Il #4 arriva alla fermata in 3 minuti*

Motivations

- **Societal challenge**
 - We see a strong increment of population of our cities, since in the cities the life is simple and of higher quality in term of services and working opportunities
 - The cities needs to be adapted to the increment of population, to new evolving ages, to the new technologies and expectations of population
- → Sustainability of the growth







Sustainability of the Growth

- To be **planned and managed** with respect to increment of population and their needs
 - increment of efficiency:
 - compensation of the increments of costs
 - Increment of quality of life:
 - compensation of the decrement of quality of life
 - provisioning of new services:
 - compensation of the inadequacy of services
 - Decision support for strategic aspects
 - Corrections, prediction, new services, etc.
- **Towards citizens**
 - Informing citizens on the new adaptations, making them aware about that
 - Forming citizens to adopt virtuous behaviour in the usage of services and resources

Smartness, smart city needs 6 features

- Smart Health
- Smart Education
- Smart Mobility
- Smart Energy
- Smart Governmental
 - Smart economy
 - Smart people
 - Smart environment
 - Smart living
- Smart Telecommunication

Smart health

(can be regarded as smart governmental)

- Online accessing to health services:
 - booking and paying
 - selecting doctor
 - access to EPR (Electronic Patient Record)
- **Monitoring** services and users for,
 - learn people behavior, create collective profiles
 - personalized health
 - Inform citizens to the risks of their habits
 - Improve efficiency of services
 - redistribute workload, thus reducing the peak of consumption



Smart Education

(can be regarded as smart governmental)

- Diffusion of ICT into the schools:
 - LIM, PAD, internet connection, tables, ..
- Primary and secondary schools → university → industry & services
- **Monitoring** the students and quality of service,
 - learn student behavior, create collective profiles,
 - personalized education
- suggesting behavior to
 - Informing the families
 - moderate the peak of consumption
 - increase the competence in specific needed sectors, etc.
 - Increase formation impact and benefits



Smart Mobility



- Public transportation:
 - bus, railway, taxi, metro, etc.,
- Public transport for services:
 - garbage collection, ambulances,
- Private transportation:
 - cars, delivering material, etc.
- New solutions (public and/or private):
 - electric cars, car sharing, car pooling, bike sharing, bicycle paths
- Online:
 - ticketing, monitoring travel, infomobility, access to RTZ, parking, etc.

Smart Mobility and urbanization

- **Monitoring** the city status,
 - learn city behavior on mobility
 - learn people behavior
 - create collective profiles
 - tracking people flows
- **Providing Info/service**
 - personalized
 - **Info** about city status to
 - help moving people and material
 - education on mobility,
 - moderate the peak of consumption
- **Reasoning to**
 - make services sustainable
 - make services accessible
 - Increase the quality of service



Smart Energy

- **Smart building:**
 - saving and optimizing energy consumption, district heating
 - renewable energy: photovoltaic, wind energy, solar energy, hydropower, etc.
- **Smart lighting:**
 - turning on/off on the basis of the real needs
- **Energy points for electric: c**
 - cars, bikes, scooters,
- **Monitoring** consumption, learn people/city behavior on energy consumption, learn people behavior, create collective profiles
- **Suggesting consumers**
 - different behavior for consumption: different time to use the washing machine
- **Suggesting administrations**
 - restructuring to reduce the global consumption,
 - moderate the peak of consumption



Smart Governmental Services

- Service toward citizens:
 - on-line services:
 - register, certification, civil services, taxes, use of soil, ...
 - Payments and banking:
 - taxes, schools, accesses
 - Garbage collection:
 - regular and exceptional
 - Quality of air:
 - monitoring pollution
 - Water control:
 - monitoring water quality, water dispersion, river status



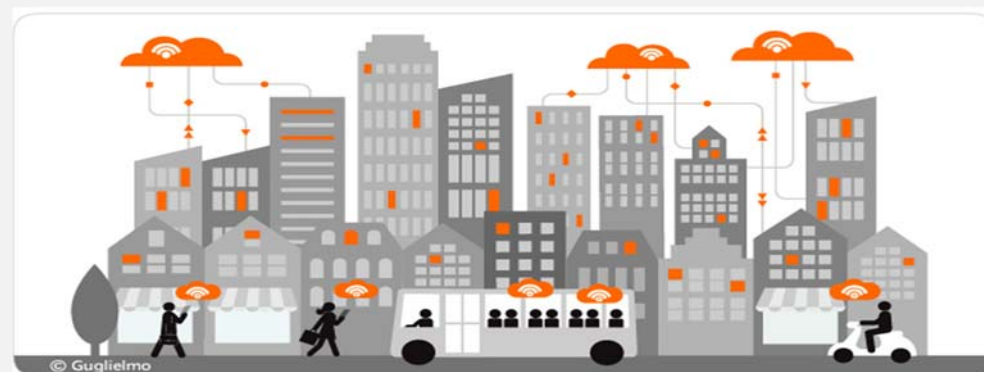
Smart Governmental Services

- **Service toward citizens:**
 - **Cultural Heritage:** ticketing on museums,
 - **Tourism:** ticketing, visiting, planning, booking (hotel and restaurants, etc.)
 - **social networking:** getting service feedbacks, monitoring
- **Social sustainability of services:**
 - crowd services
- **Social recovering** of infrastructure,
 - New services, exploiting infrastructures
- **Monitoring** consumption and exploitation of services, learn people behavior, create collective profiles
 - Discovering problems of services,
 - Finding collective solutions and new needs...



Telecommunication, broadband

- **Fixed Connectivity:**
 - ADSL or more, fiber,
- **Mobile Connectivity:**
 - Public wifi, Services on WiFi, HSPDA, LTE
- **Monitoring** communication infrastructure
- Providing information and formation on:
 - how to exploit the communication infrastructure
 - Exploiting the communication for the other services,
 - moderate the peak of consumption



Smart-City

- *Main Aim*

- Provide a platform able to ingest and take advantage a large number of the above data, big data:
 - *Exploit data integration and reasoning*
 - *Deliver new services and applications to citizens,*
Leverage on the ongoing Semantic Web effort

- *Problems & Challenges*

- Data are provided in many different formats and protocols and from many different institutions, different convention and protocols, a different time, !
- Data are typically not aligned (e.g., street names, dates, geolocations, tags, ...). That is, they are **not semantically interoperable**
- resulting a big data problem: volume, velocity, variability, variety,



Challenges: Requests and Deductions

Public Admin.



Pub. Admin: detection of critical conditions, improving services

Tune the service, reselling data and services, prediction

Mobility Operators



Retails



Commercial: customers prediction and profiles, promotions via ads

Tourism Museums



Tune the service, prediction

API for SME

Services & Suggestions
Transport, Mobility, Commercial (retail),
Tourism, Cultural

Personal Time Assistant dynamic ticketing, whispers to save time and money, geoloc information, offers, etc.



User Behavior
Crowd Sources



Smart City Solution

User profiling
Collective profiles
User segmentation

Data: Public and Private, Static and Real Time

Private: user movements, social media, crowd sources, commercial (retail)

Public: infomobility, traffic flow, TV cameras, flows, ambient, weather, statistic, accesses to LTZ, services, museums, point of interests.

An aerial night view of a city, likely Florence, Italy, featuring a prominent large dome (the Florence Cathedral) and a river (the Arno) in the foreground. The city lights are illuminated, and the sky is a warm orange glow from the setting or rising sun. The text '0 – Km4City Open Urban Platform Overview' is overlaid in large, bold, yellow font.

0 – Km4City Open Urban Platform Overview

www.Km4City.org



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



City Users' Tools for Mobile Devices and Web

Km4City Mobile App Video

Suggestions and recommendations (*)

Engagements

Web and Totem Km4City Apps (*)



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Sentient City Tools

Km4City Open Urban Platform

- **Produce value from data enabling to**
 - **Stimulate virtuous behavior, influence City Users!**
 - Increase efficiency in energy consumption
 - Reduce pollution and traffic congestion
 - Improve quality of service, quality of life
 - Create an ecosystem for innovation and put in action any smart city solutions and services.
- **Perform integrated and unified data management and data analytics by a set of tools at service of city operators and city users, to:**
 - **Perform predictions**, reasoning, business intelligence, city users behavior analysis, ..;
 - **Control Room, Real Time Monitoring** tools,
- **Aggregate & integrate data and streams of any urban system, operator, provider, user, .., exploiting**
 - open data, IOT, sensors, internet of everything,
 - cloud, mobile devices, Wi-Fi, social media, ..
 - data analytics, ecc;



An aerial photograph of a city at sunset. The sky is a mix of orange and red. In the foreground, a river flows through the city, reflecting the lights. The city is densely packed with buildings, many of which are illuminated. A large, prominent dome is visible in the center-right. To the left, there is a tall, slender tower. The overall scene is a vibrant and detailed view of a city at dusk.

1 - Keep City under Control: services and users' behavior



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From Data to Services for the Sentient Cities

Open Source and inter-operable tools to

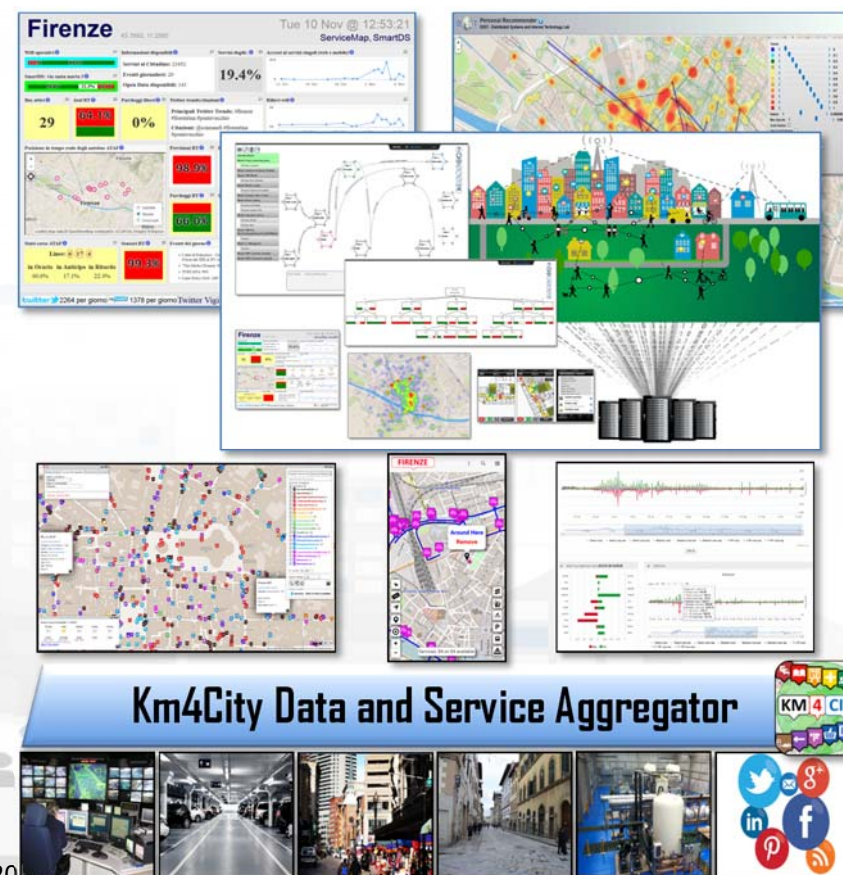
1. keep city under control via personalized dashboards

- transform data in value for the city,
- influence city users

2. Technical details:

- dashboard development
- data aggregation
- Projects contributing

3. improve city resilience, reducing risks and decision support



Sentient City Control Room



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KM4CITY
FROM DATA TO SERVICES
FOR SENTIENT CITIES

- Monitoring real time data for the city
- Analyzing the data to provide insights
- Providing a wide range of services and applications
- Enabling the city to be more efficient and sustainable
- Providing a wide range of services and applications

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 (*) ⓘ	Monitoring Parking Areas Status in Florence (*) ⓘ	Monitoring Traffic Sensors in Tuscany Region (*) ⓘ	Getting moods and alerts via Twitter Sentiment Analysis (*) ⓘ	Early Warning and Prediction Tools ⓘ	Smart Decision Support System, SmartDS (*) ⓘ
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Smart City Control Room, Dashboard, Real Time Data

Smart City Control Room, Dashboard, Real Time Data ⓘ	SmartCity Processes ⓘ
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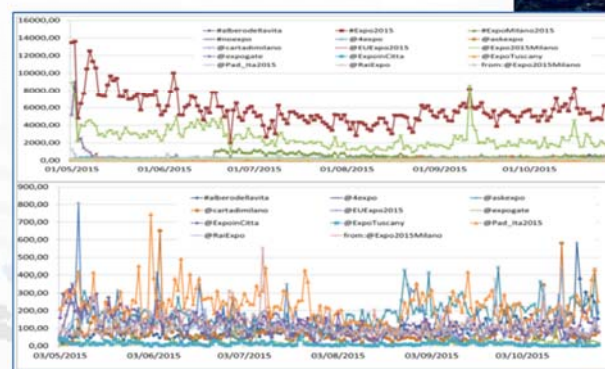
Big Data Analytics Tools, Business Intelligence, Decision Support Tools

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 (*) ⓘ
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www.Km4City.org

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





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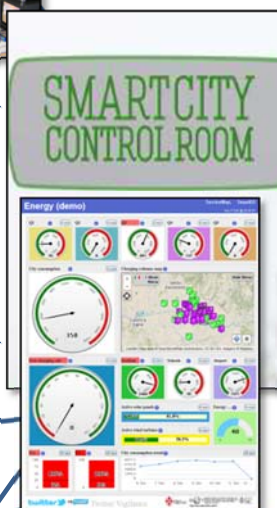
Dashboards



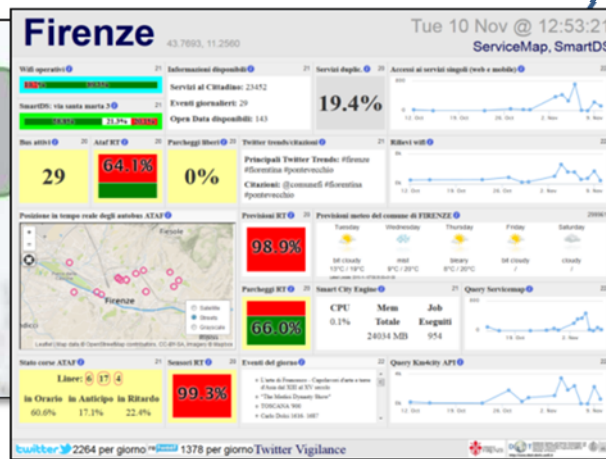
Transport
systems,
Mobility, Parking



Sensors, IOT
Cameras, ..



Public services,
Govern, Events



Environment,
Water, energy



Shops,
services,
operators



Social Media,
WiFi, Network



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Smart City Dashboard

Firenze

ServiceMap, SmartDS

24.2% CPU in use

0 Bus attivi

100% Passaggi liberi

0% Parcheggio liberi

CPU Totale: 0%

Mem Totale: 72094 MB

Job Eseguiti: 2673

88.9% Real time position ATAF bus

76.0% Twitter Transcodificazioni

31.9% in Orario

68.1% in Ritardo

Recommender - Interactive People Flow Maps

DISIT - Distributed Systems and Internet Technologies Lab

FirenzeWifi

ServiceMap, SmartDS

1948 Utenti FWIFI

2822 Eventi FWIFI

222 AP FWIFI

Utenti FWIFI (weekly)

Utenti FWIFI (mensile)

Recommender - Heatmap and Trajectories Clusters

DISIT - Distributed Systems and Internet Technologies Lab

Twitter Vigilance Dashboard

DISIT - Distributed Systems and Internet Technologies Lab

Channel active from 2009-12-06 to today

Data processed from 2015-09-09 to 2016-01-21

Sentiment trends in channel uber

— 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



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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

Bus Attivi 29 sec

24

Ataf RT 30 sec

100% 0%

55.4%

Parcheggi... 29 sec

Smart City Engine 30 sec

CPU **3.7%**

RAM **58.7 GB**

DAILY JOBS **4863 JOBS**

Rilievi wifi 9 min

Real time position ATAF bus

Sensori RT 29 sec

18.6% 81.4%

Previsioni meteo: FIRENZE 359 min

Day	Weather	Temp
Wednesday	light rain	7°C / 13°C
Thursday	cloudy	6°C / 16°C
Friday	moderate rain	7°C / 16°C
Saturday	cloudless	/
Sunday	cloudy	/

Stato linee ATAF 29 sec

STATO LINEE MONITORATE DATI

46% **IN ORARIO**

5% **IN ANTICIPO**

49% **IN RITARDO**

Previsioni... 30 sec

8.8% 91.2%

Parcheggi... 30 sec

26% 74%

Twitter Trends/citazioni 30 sec

PRINCIPALI TREND TWITTER:
#FIRENZE
#FIORENTINA
#UFFIZI

CITAZIONI:

- Il restauro delle "Storie della Genesi" di Paolo Uccello
- Tra arte e moda
- Winkelmann, Firenze e gli Etruschi - Il padre

Query Servicemap 31 sec

Query Km4city API 31 sec

twitter re:tweet Twitter Vigilance

Department of Information Engineering and Computer Science
University of Florence
http://www.dit.unifi.it



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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
- Km4City...many other sensors ... see next slide

- Nascondi Menu

Fermate Firenze Comuni in Toscana Ricerca Testuale

Seleziona una provincia:
FIRENZE

Seleziona un comune:
FIRENZE

Actual Selection
COMUNE di FIRENZE

Previsioni Meteo per il comune di FIRENZE:

Martedì	Mercoledì	Giovedì	Venerdì	Sabato
poco nuvoloso 23°C / 27°C	poggia debole e schiarite 20°C / 30°C	poco nuvoloso 20°C / 33°C	poco nuvoloso	velato

Aggiornamento: 2015-09-15T09:07:00+02:00

ED OPEN GRAPH

Servizi Regolari Servizi Trasversali

search text into service

Categorie Servizi

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

N. risultati: Nessun Limite

Raggio ricerca 100 metri

Risultati della ricerca

più di 4000 risultati, attivato clustering

Services 16858

<http://servicemap.km4city.org>





Other Sensors and Actuators, IOT

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



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





city under control

- **monitoring services' status**
of city operators

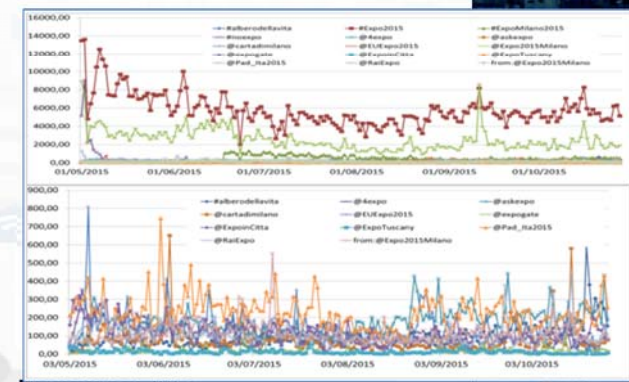
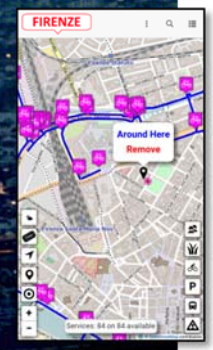
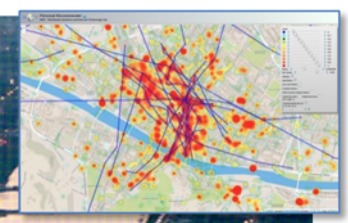
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Twitter Vigilance
- Collecting contributions:
images, stars, comments



Km4City Smart City Ecosystem, November 2016





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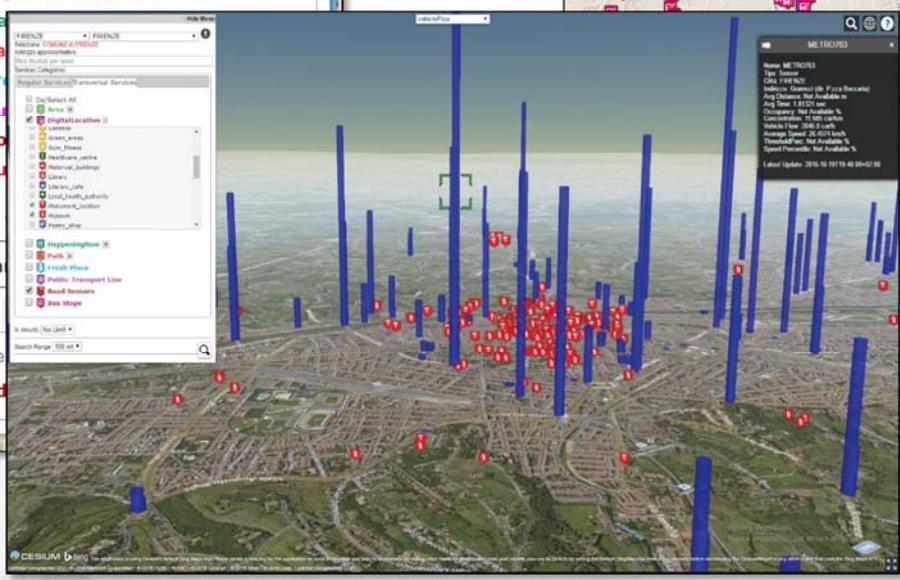
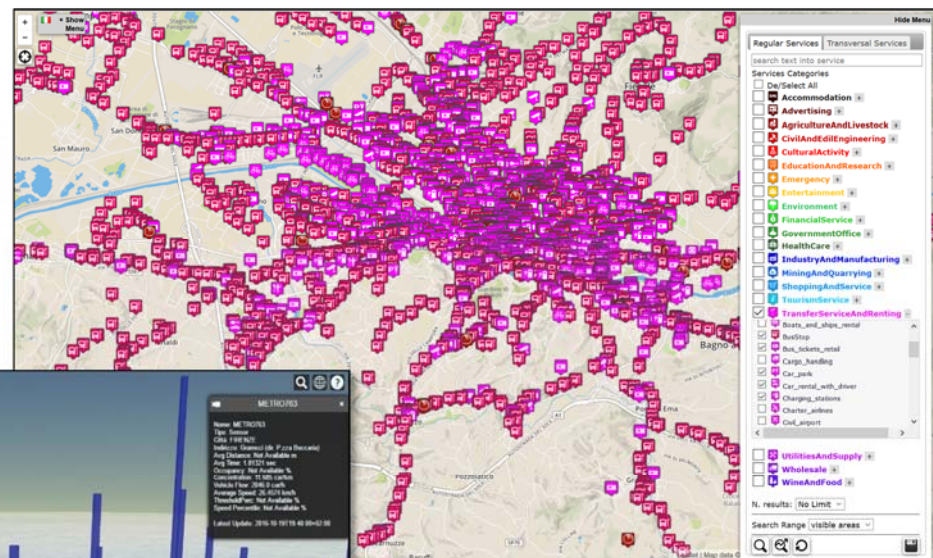
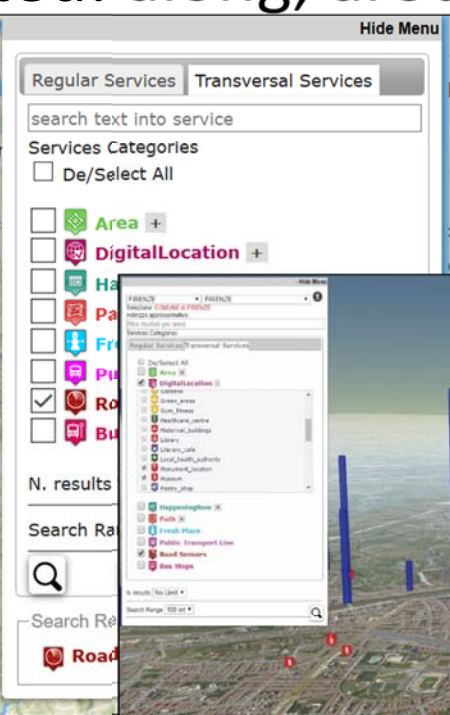
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AND INTERNET
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<http://www.disit.org>

Traffic Flow Tools



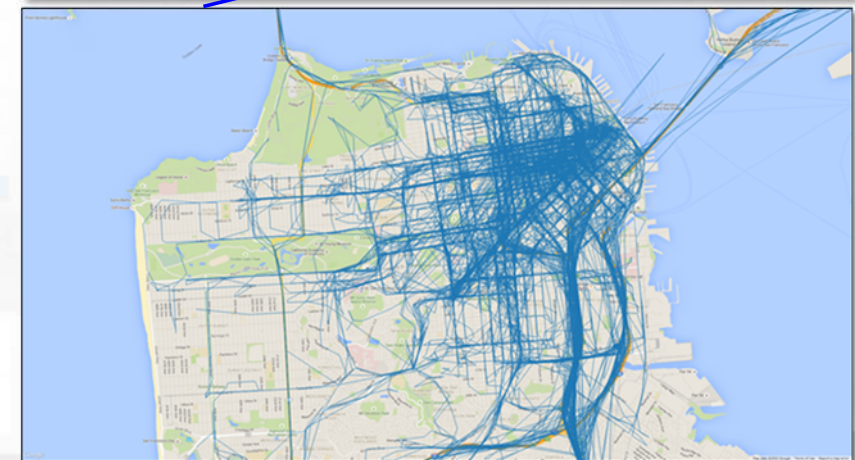
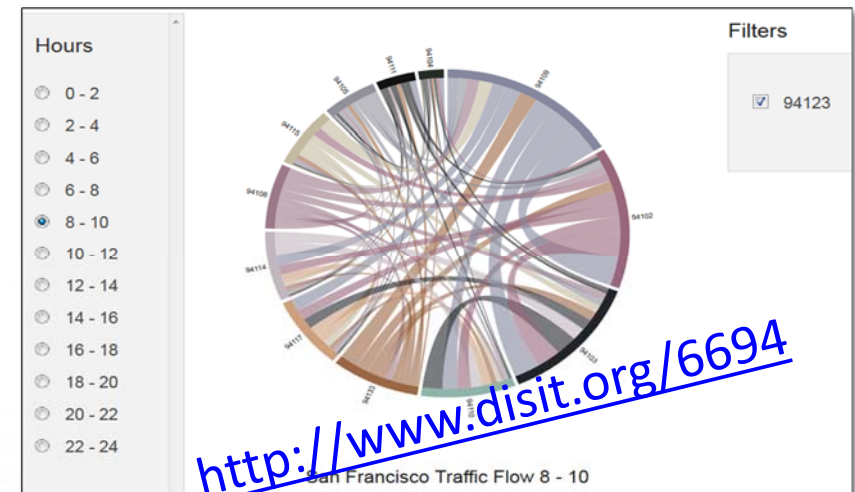
- Spire and Virtual Spires (cameras), Bluetooth, ..
- Specifically located: along, around, ..





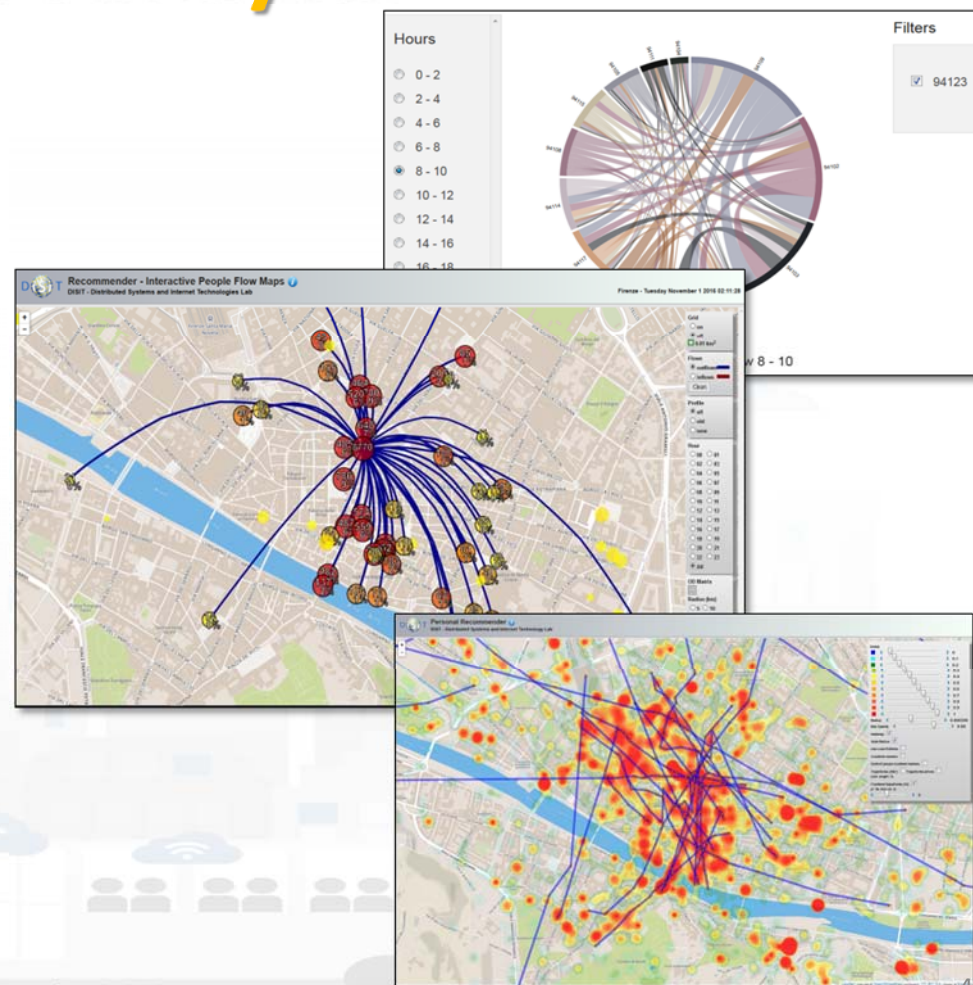
Traffic and People Flow Assessment

- **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



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





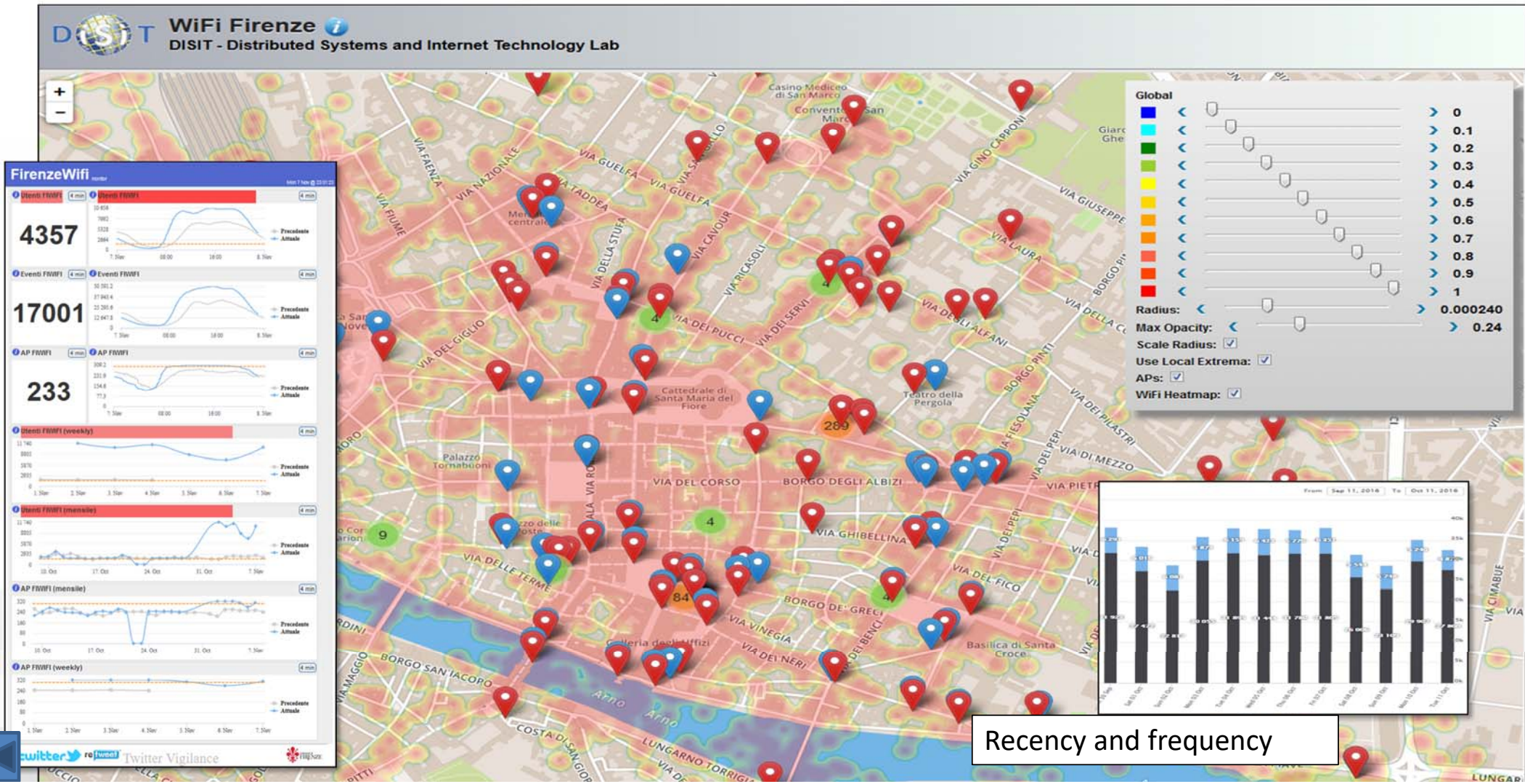
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WiFi Monitor tool





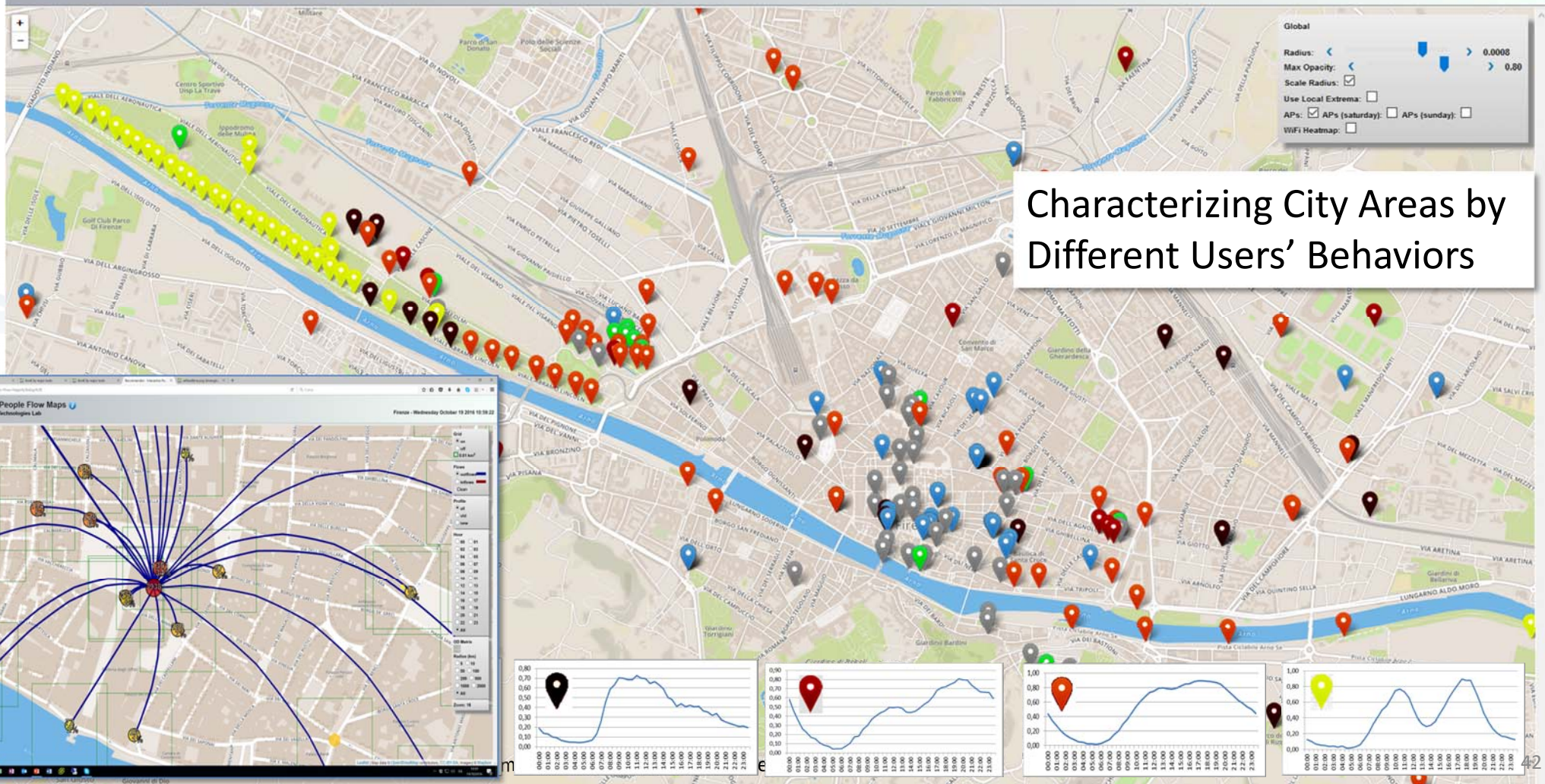
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Characterizing City Areas

Firenze Wi-Fi: Access Points Clusters Coverage Map
DISIT - Distributed Systems and Internet Technologies Lab
Firenze - Saturday November 12 2016 10:16:33





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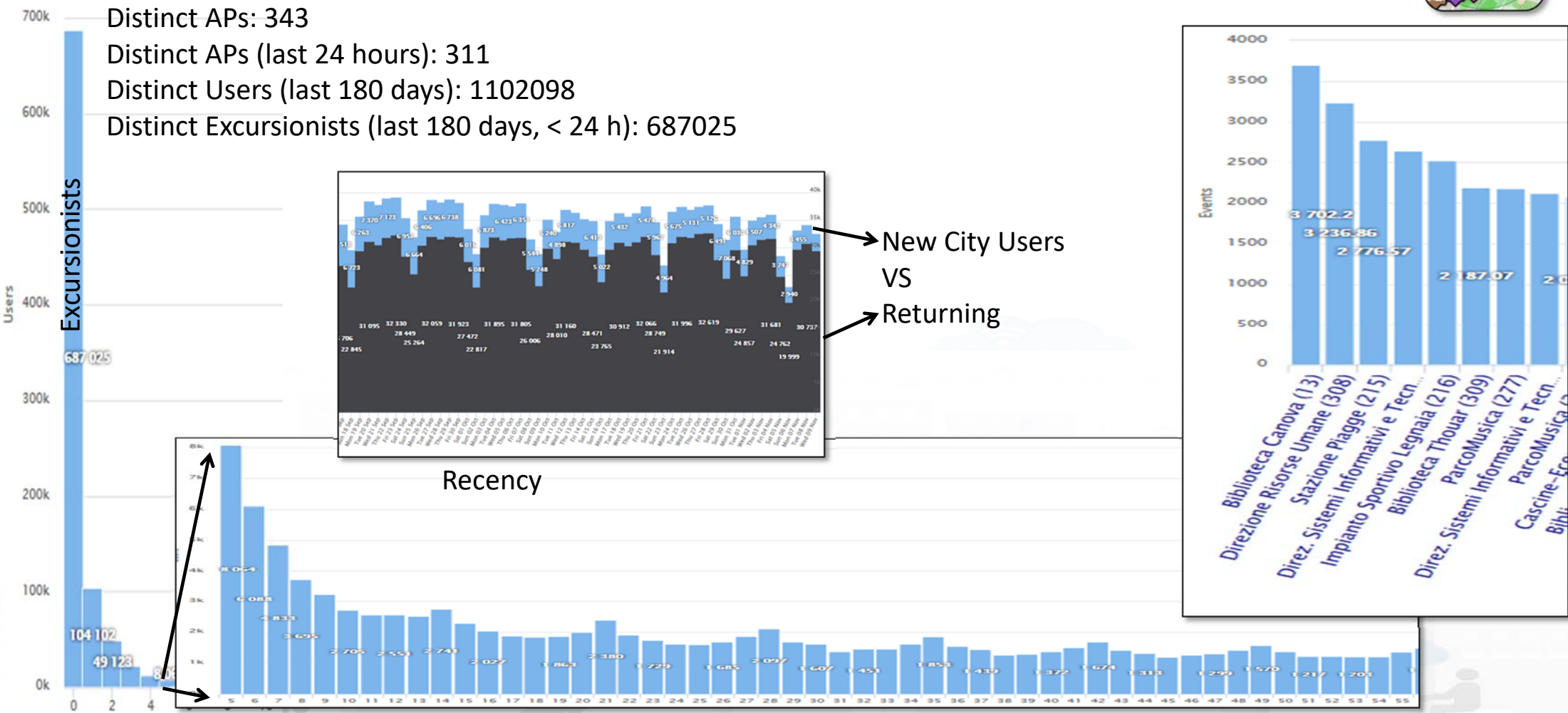
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User Behavior Analysis



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





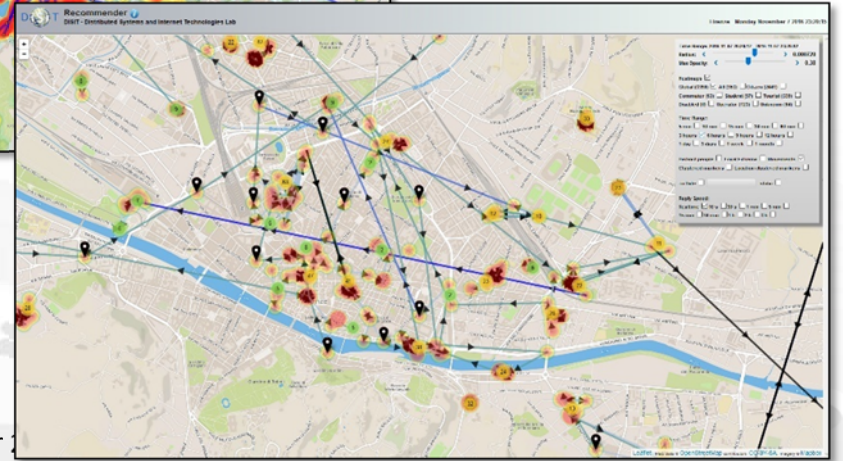
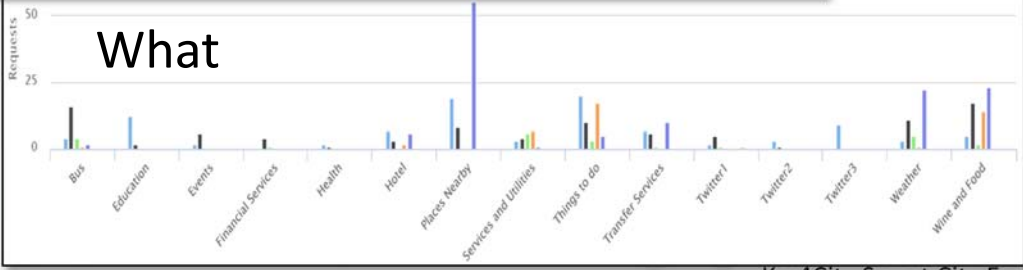
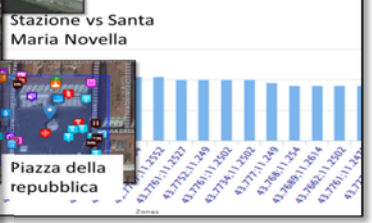
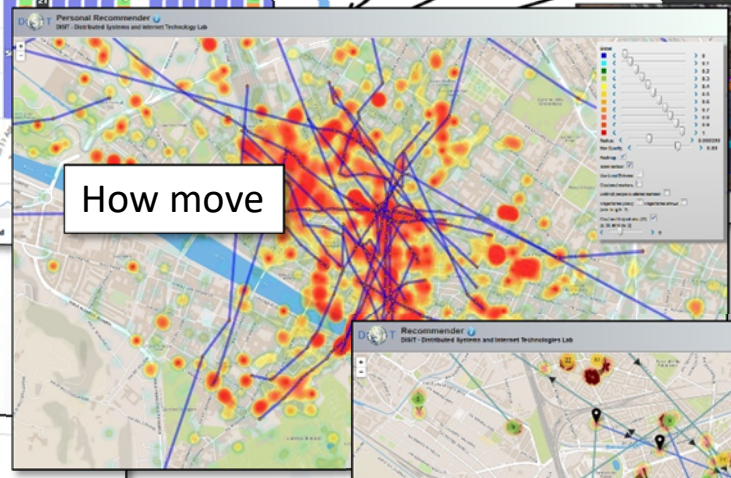
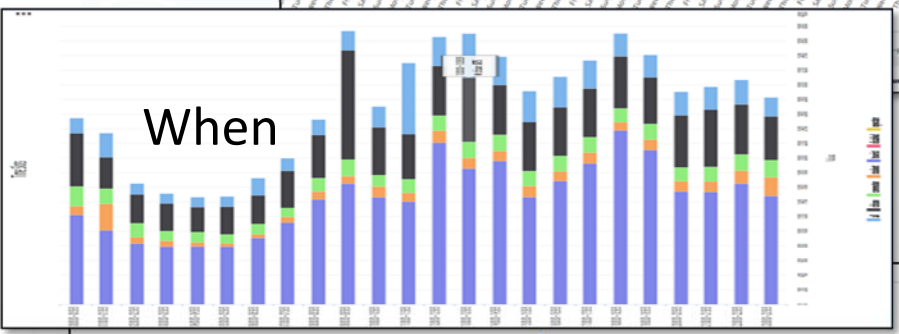
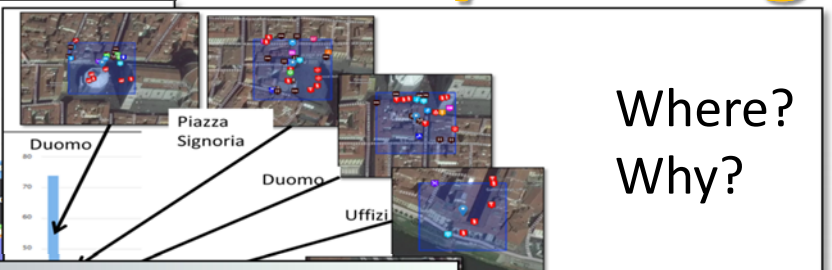
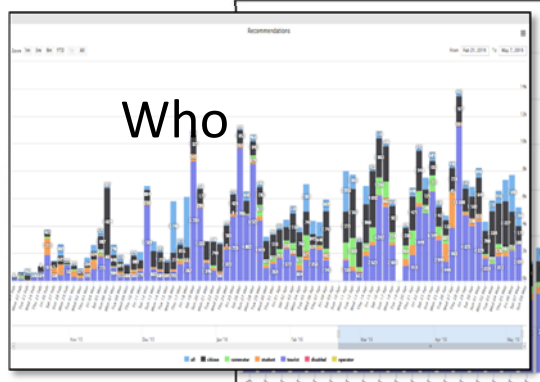
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User Behavior Analyzer for Collective profiling



Km4City Smart City Ecosystem, November

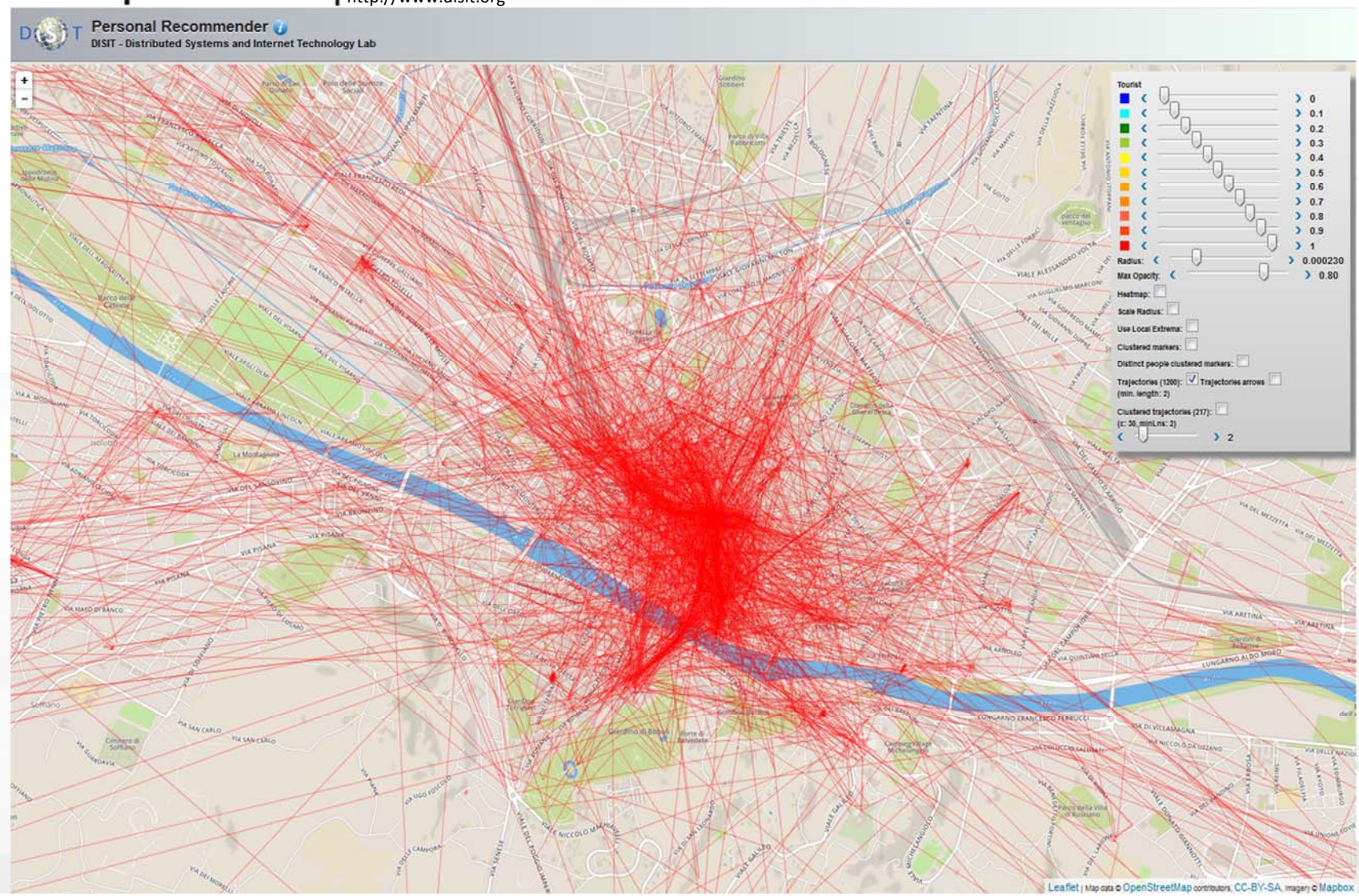


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User Behavior Analyzer



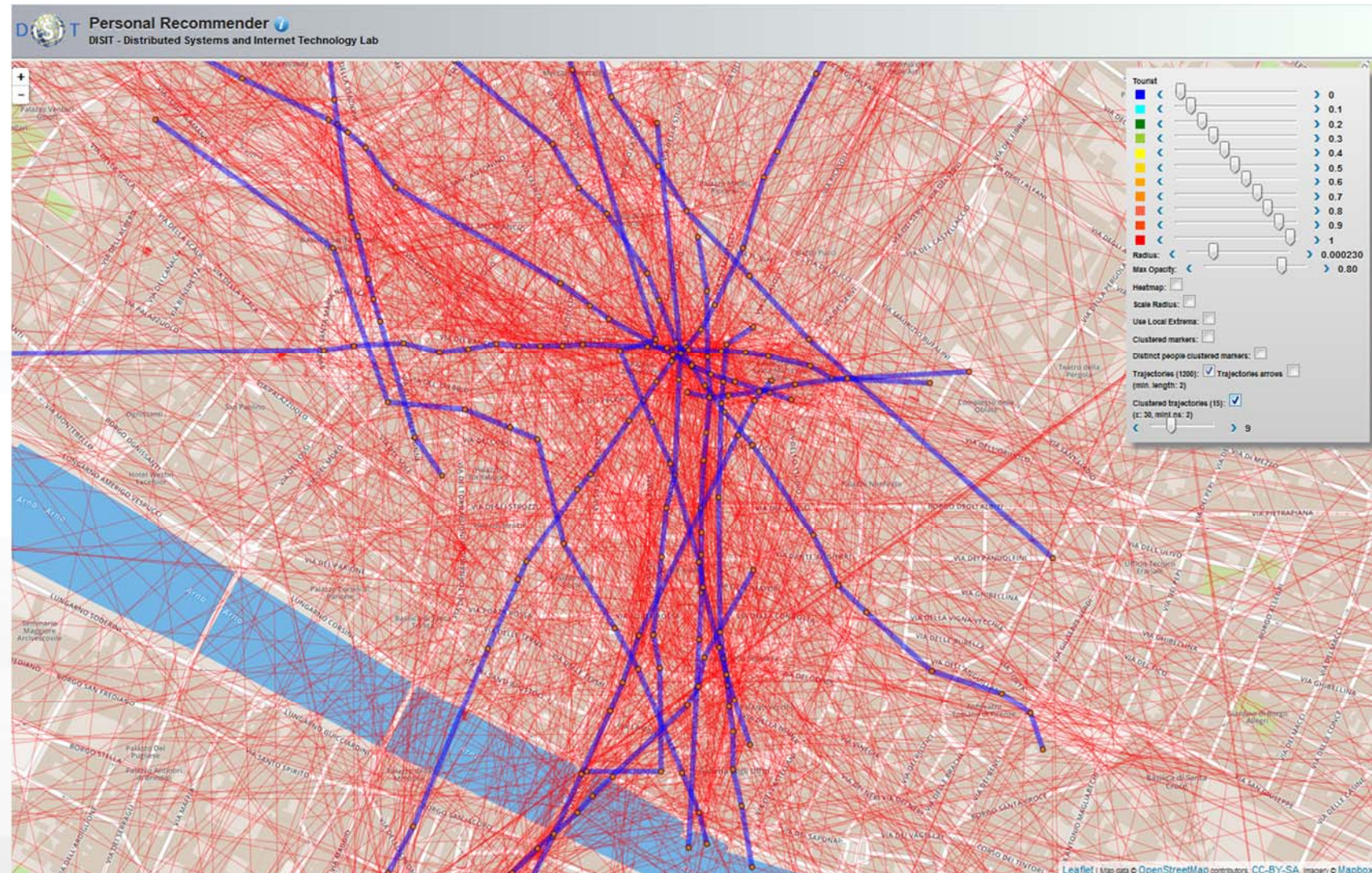


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User Behavior Analyzer



User Behavior Analyzer



DISIT Personal Recommender
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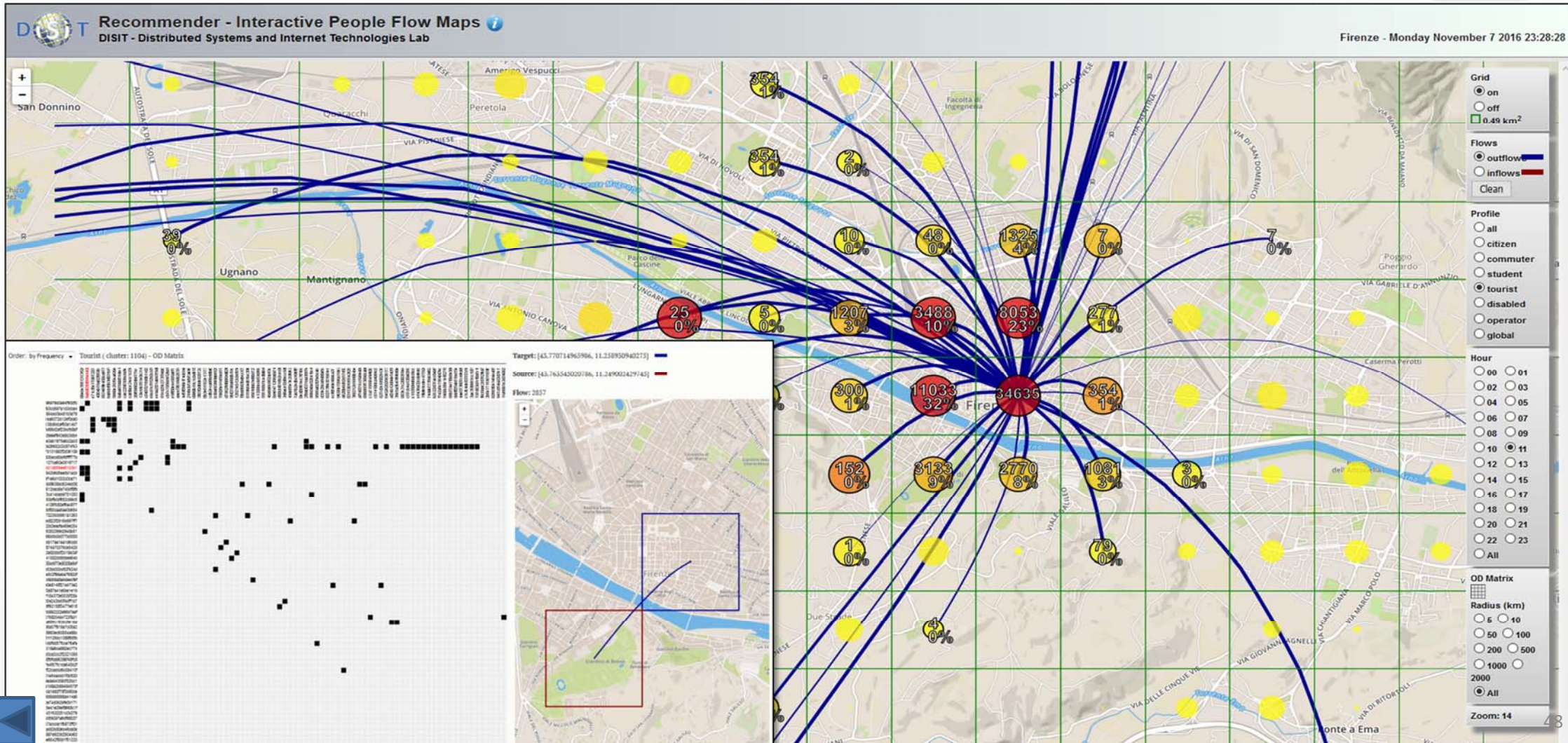
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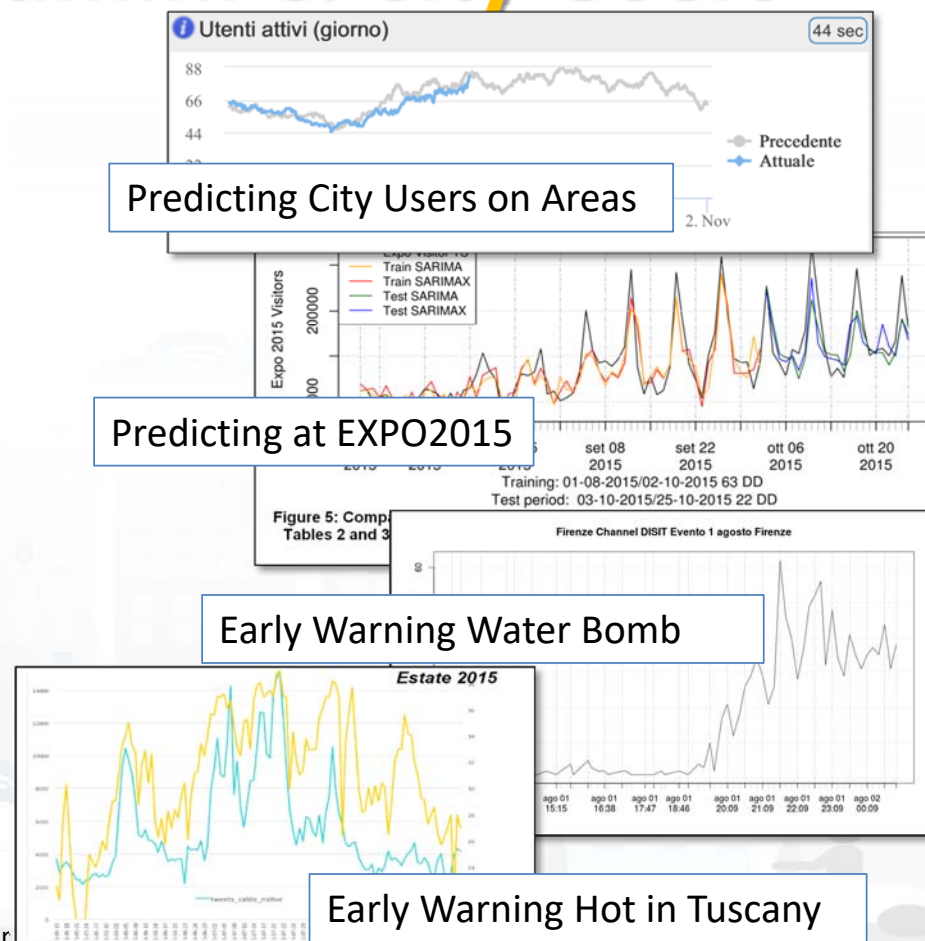
OD Matrix scalabile





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)





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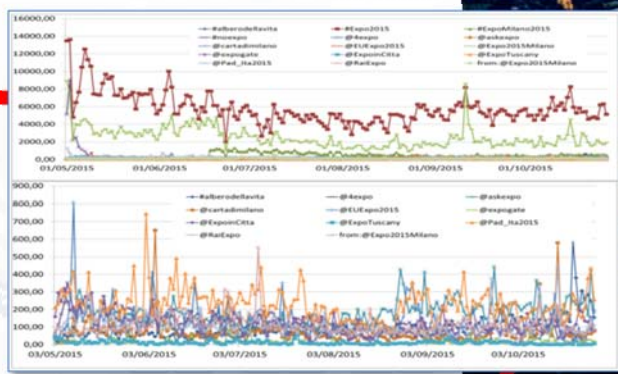
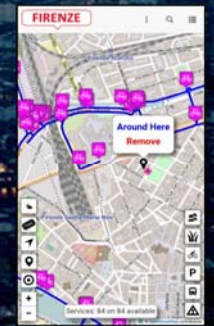
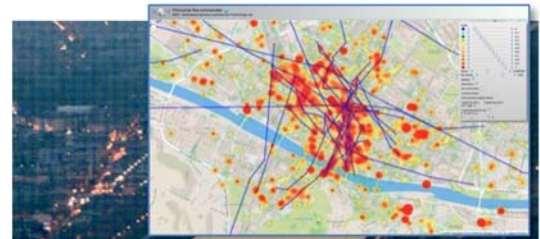
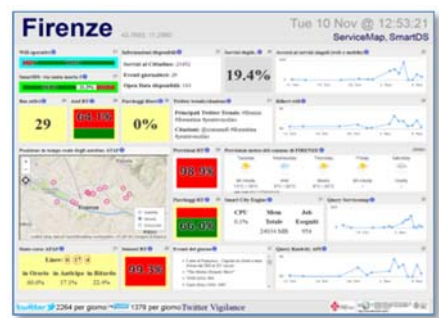
city under control

- **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

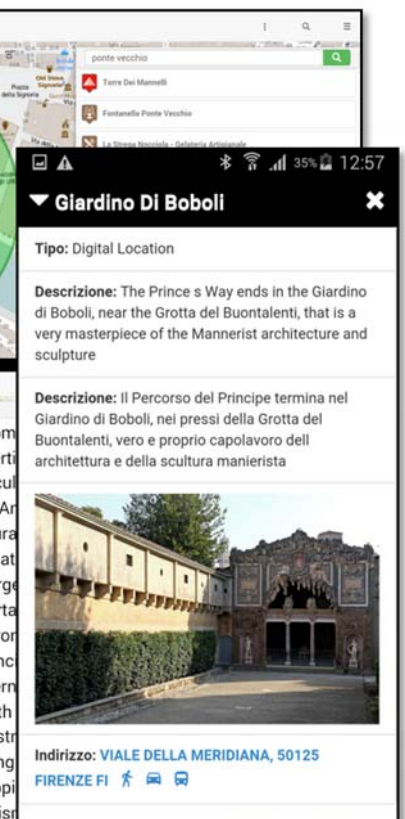
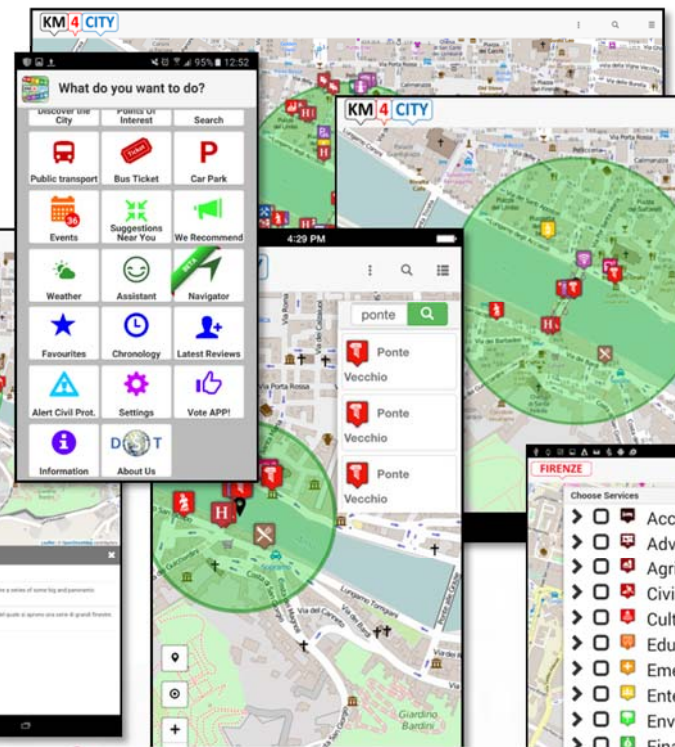


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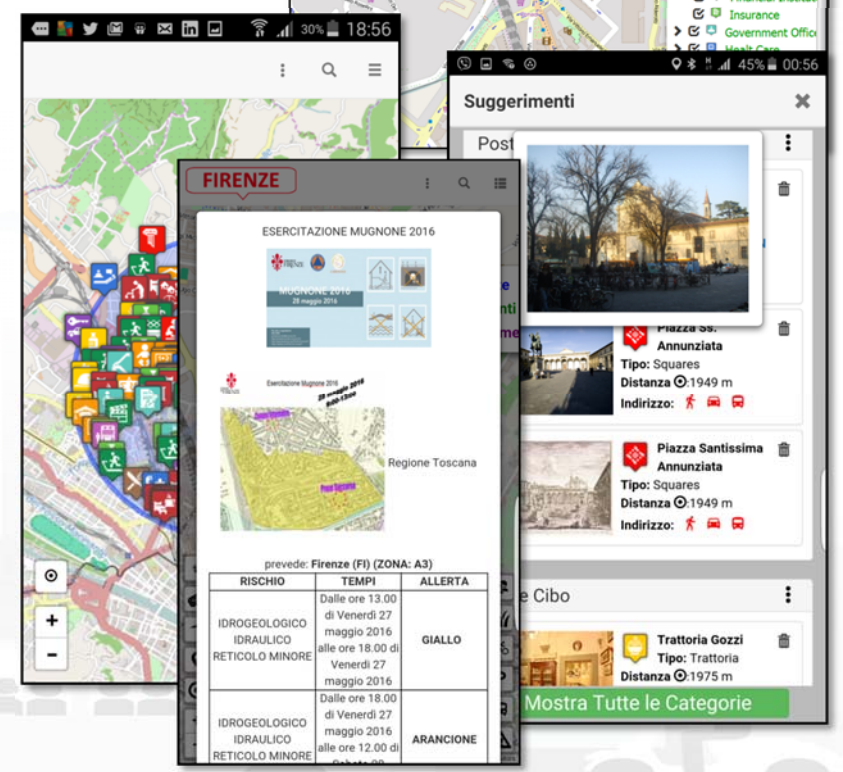
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Km4CityMobile App



web application
<http://www.km4city.org>



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 Google play

Scarica da
 App Store

Scarica da
 Windows Store





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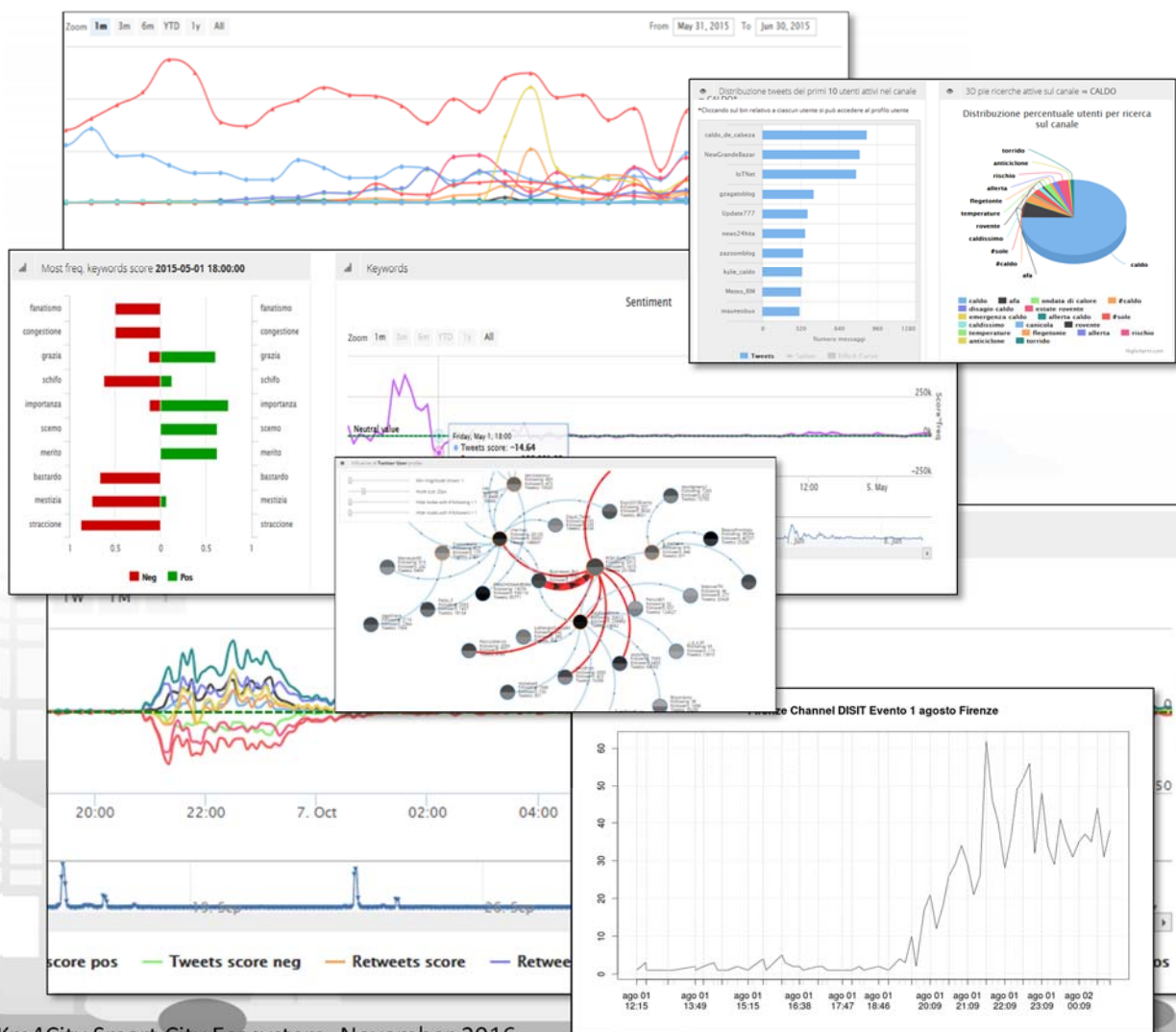
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Twitter Vigilance

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



Twitter Vigilance

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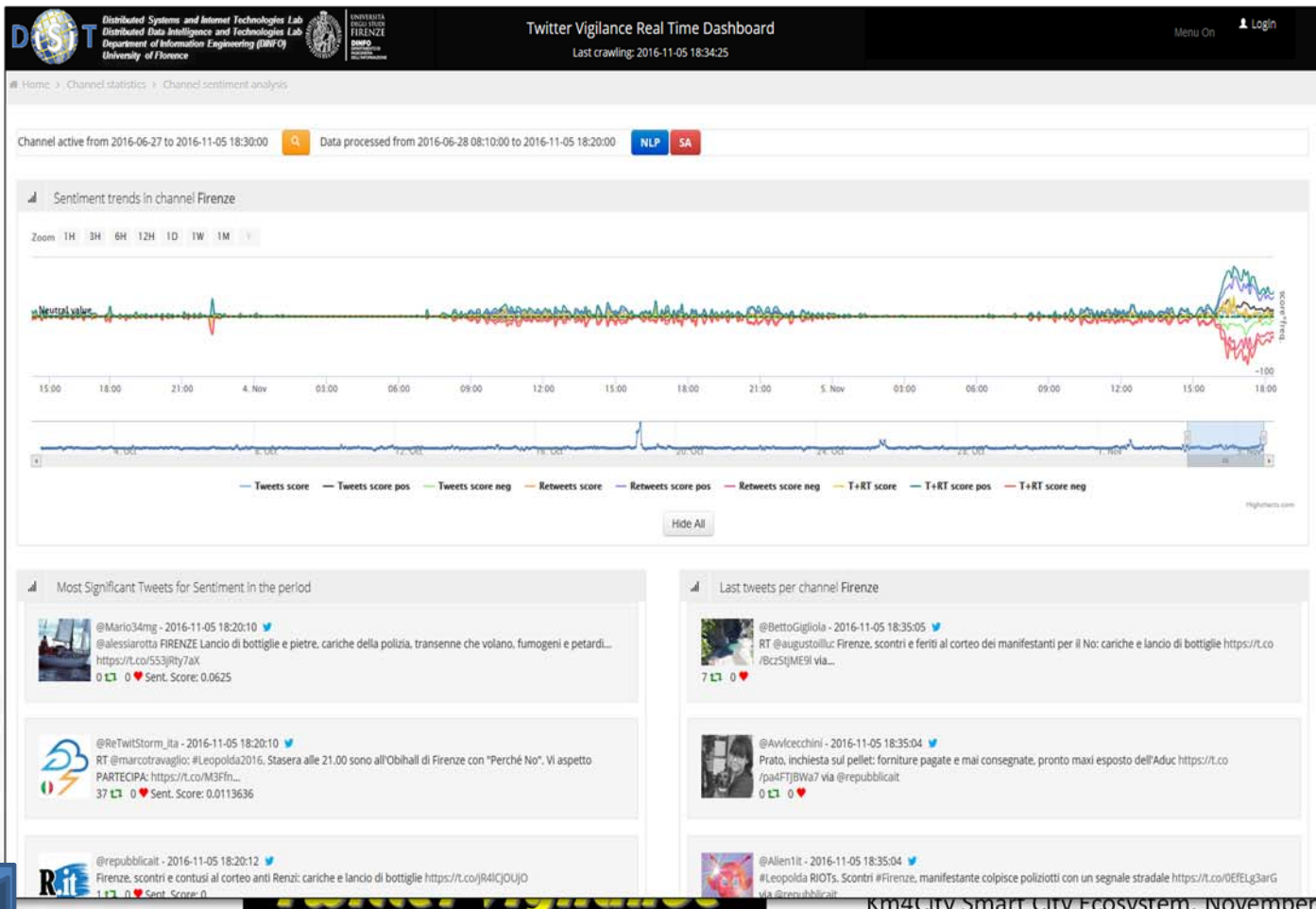
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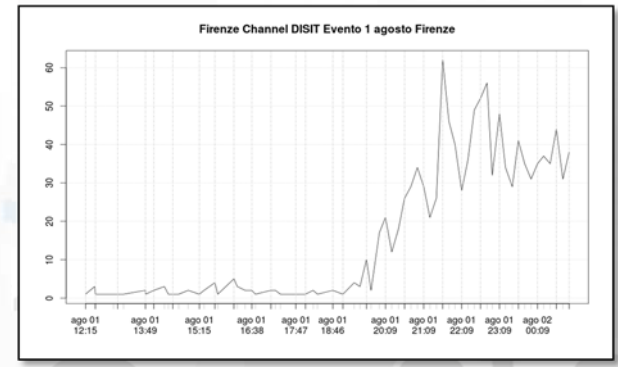
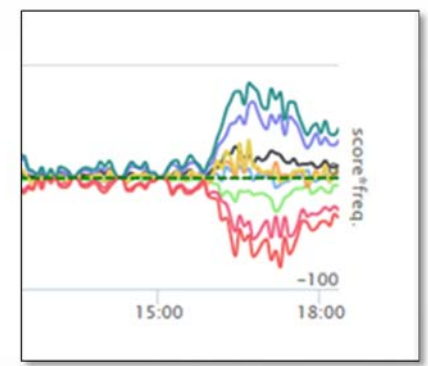
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Twitter Vigilance

Real Time Twitter Vigilance, Early Warning



Sentiment Analysis



Twitter Vigilance

Prediction/Assessment

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

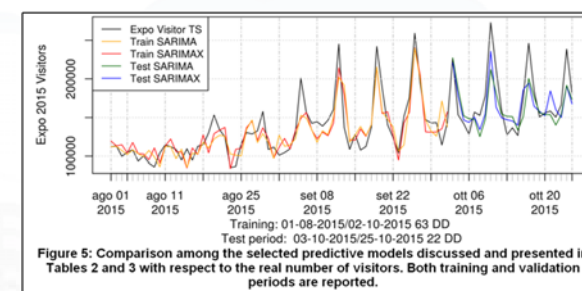
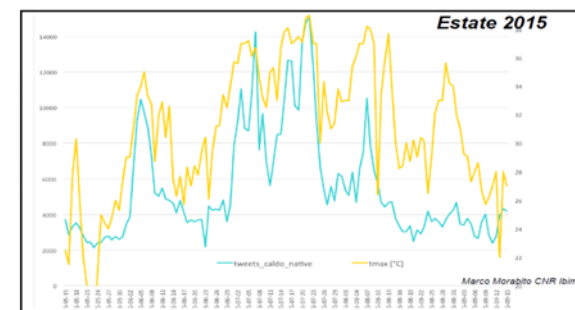
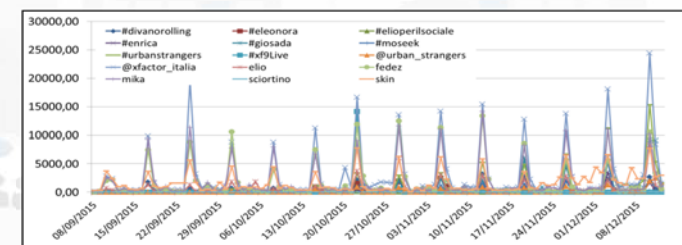


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.





From Data to Services for the Sentient Cities

Open Source and inter-operable tools to

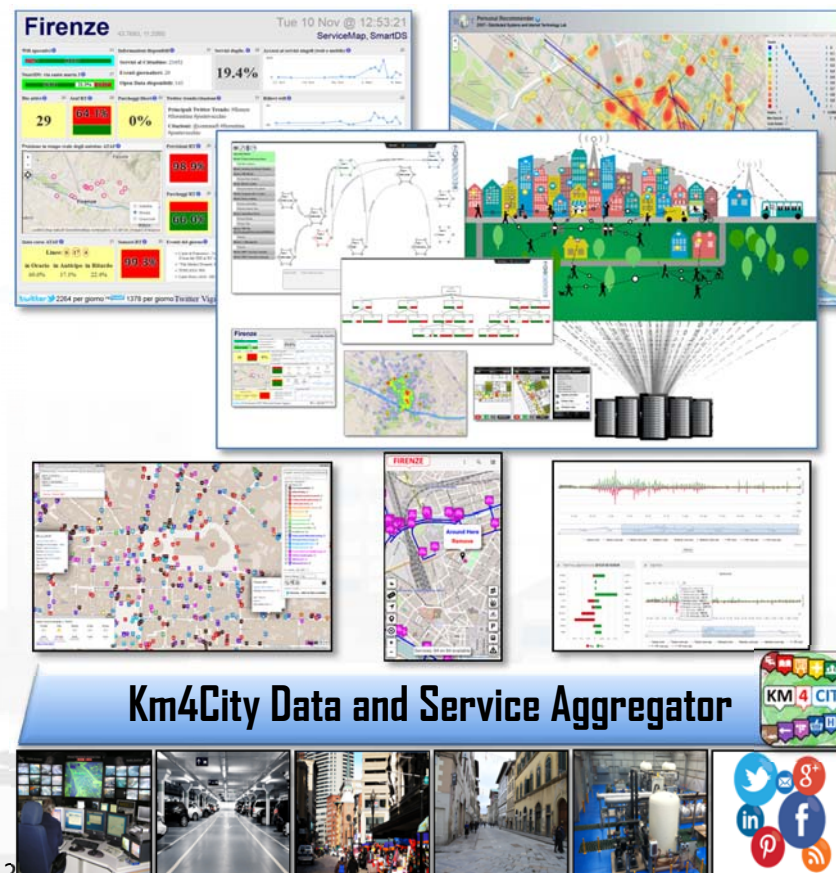
1. keep city under control via personalized dashboards

- transform data in value for the city,
- influence city users

2. Technical details:

- dashboard development
- data aggregation
- Projects contributing

3. improve city resilience, reducing risks and decision support





Strategies Implementation via Engagement

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



Engagement & Assistant Rules

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





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Suggestion on demand service



- Personalized menu on the basis of User Category
- **Automated Suggestions personalized:**
 - taking into account user profile and behavior, dislikes, requests, queries, etc.
- **Engagement**
 - Engine and Rule Editor
- **Advertising**
 - Engine and Rule Editor



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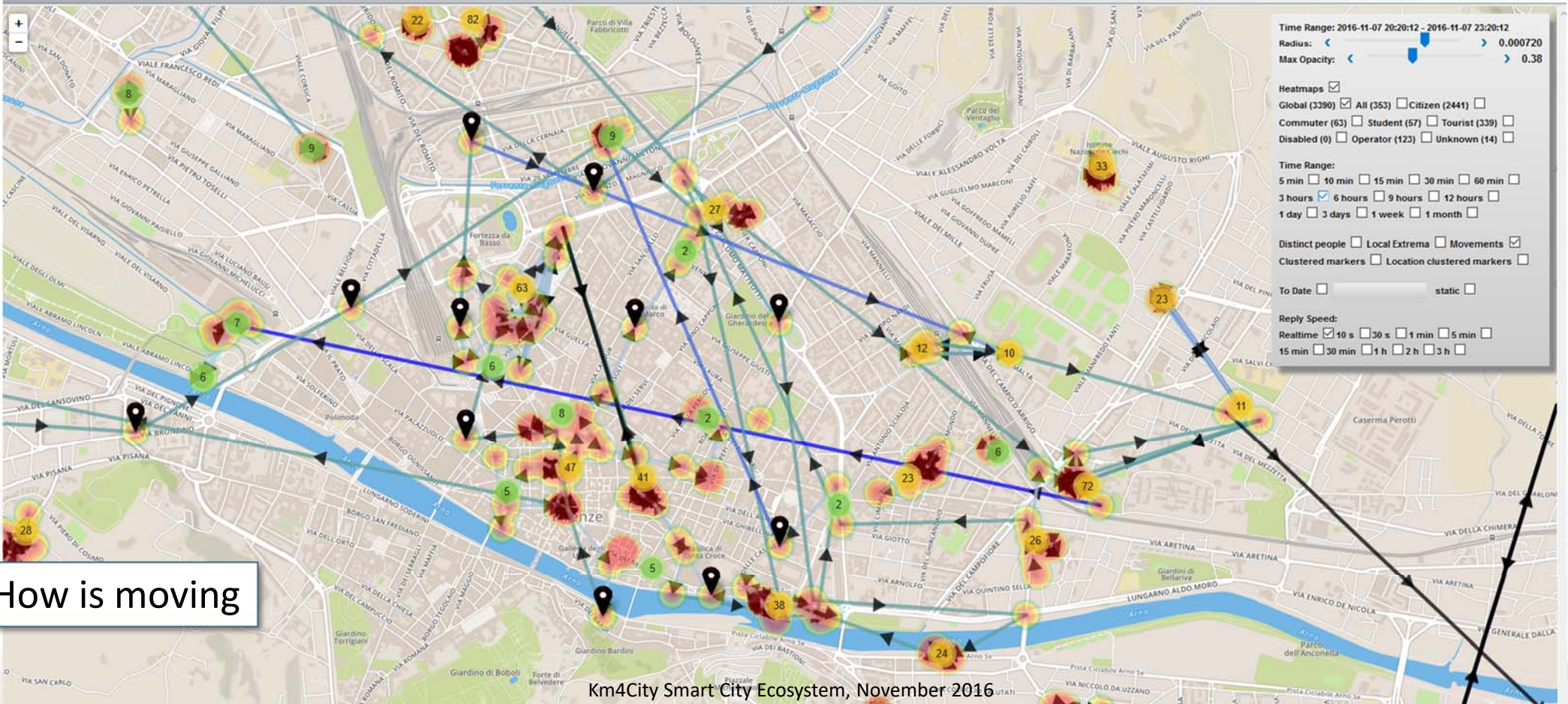
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Anonymous User Behavior Analysis

DISIT Recommender
DISIT - Distributed Systems and Internet Technologies Lab

Firenze - Monday November 7 2016 23:20:15



How is moving

Km4City Smart City Ecosystem, November 2016



User Behavior Analyzer



Personal Recommender
DISIT - Distributed Systems and Internet Technology Lab

User ID: 52d6c7e7673f61dfe1fa7c189bcc6842965342cd1eaf4d99c9a3f576c8ba5f31
User Profile: tourist
Date: 2016-04-28

Services and Utilities

- 148/R 50127 FIRENZE
Firenze WIFI
PIAZZALE J. F. KENNEDY 50142 FIRENZE
Tel:
Distance: 1.71 km
- 49 50127 FIRENZE
Firenze WIFI
PIAZZA KENNEDY FIRENZE
Tel:
Distance: 1.71 km
- ENZE
Firenze WIFI
VIALE DEI PINI 41 50142 FIRENZE
Tel:
Distance: 1.86 km

Bus

- BARACCA PIETRI
Tel:
Distance: 0.11 km
- BARACCA ALLORI
Tel:
Distance: 0.14 km
- BARACCA GORI

Nascondi Menu

Servizi Regolari | Servizi Trasversali

search text into service

Categorie Servizi

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

N. risultati: No Limit

Raggio ricerca 100 mt

Computing behavior

- Places: Home, work, study, ..
- how: car, bus, bike, train, ..
- when:
-

Suggerimenti

- Post
- Annunciata
Tipo: Squares
Distance: 1549 m
Indirizzo: f f f
- Piazza Santissima
Tipo: Squares
Distance: 1549 m
Indirizzo: f f f
- Vino e Cibo
- T Trattoria Gozzi
Tipo: Trattoria
Distance: 1513 m

Mostra Tutte le Categorie

User influencing, engaging, monitoring & Follow Up

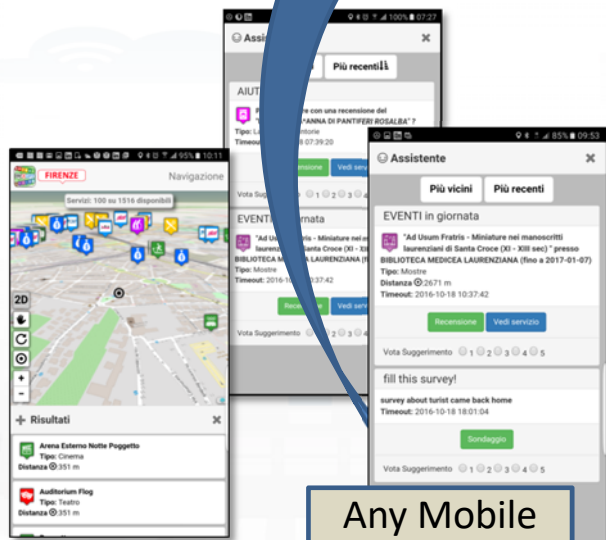
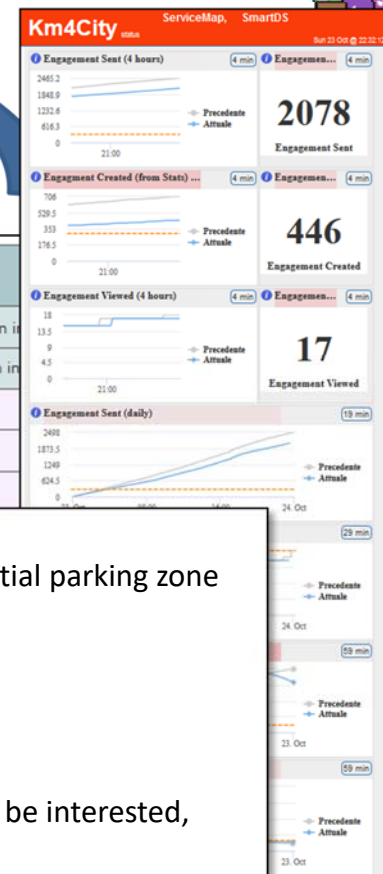


City Operators

Strategy Editor Engager



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 i
- 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%)			

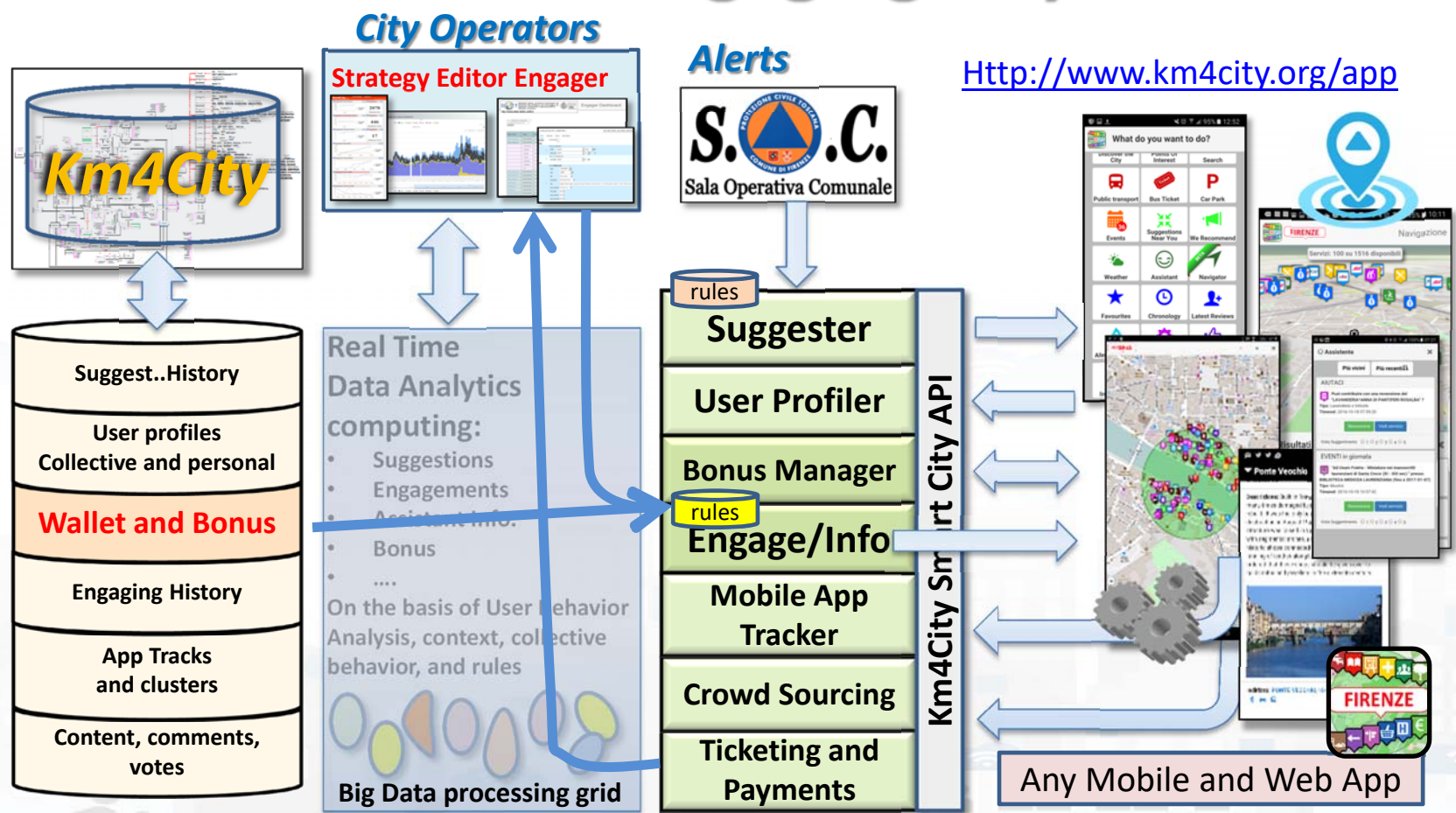


Any Mobile and Web App

- 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



Listening and Engaging City Users



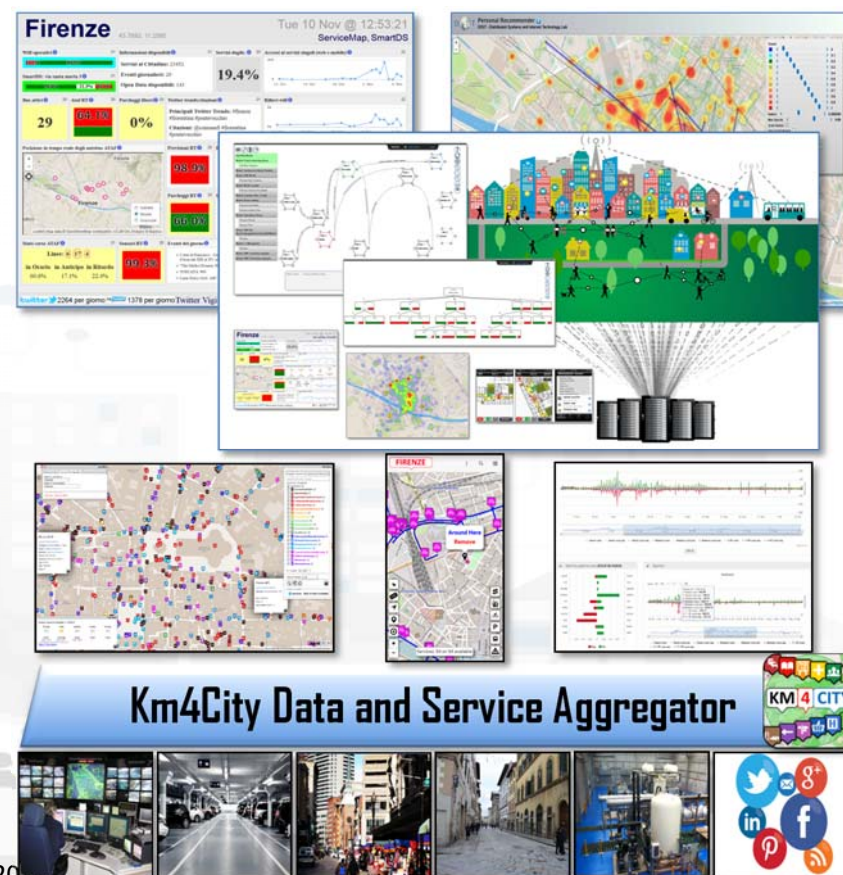
An aerial night view of a city, likely Siena, Italy, featuring a prominent red-tiled dome and a river in the foreground. The city lights are illuminated against a dark sky, with mountains visible in the background.

The Anatomy of a Smart City

From Data to Services for the Sentient Cities

Open Source and inter-operable tools to

1. keep city under control via personalized dashboards
 - transform data in value for the city,
 - influence city users
2. Technical details:
 - dashboard development
 - data aggregation
 - Projects contributing
3. improve city resilience, reducing risks and decision support



Back Office and Dev Tools



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KM4CITY
FROM DATA TO SERVICES
FOR SENTIENT CITIES

TRADITIONAL DATA IN FAVOR OF THE CITY

- Supporting data and services for 20+ cities in Europe
- Supporting data and services for 20+ cities in Europe
- Supporting data and services for 20+ cities in Europe
- Supporting data and services for 20+ cities in Europe
- Supporting data and services for 20+ cities in Europe

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

Development Tools for Mobile App and Web App (the ServiceMap Tool), generating Smart City API calls

Service Map (visual query development tool) (*)	POI density in Florence Downtown (*)	Events in Florence (*)	Services & POI in Tuscany (*)	Services & POI in Florence (*)	Services & POI in Pisa (*)	Bus Lines and timelines in Tuscany	Green Areas in Florence (*)	Cycling Path in Florence (*)	Search on Area analysis (*)	Search along line analysis (*)
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Dashboard development tools

Dashboard Builder for control room (*)

Smart City API, Linked Open Data, RDF Store tools, 5 Stars Data

Web page: Km4City Smart City API documentation	Km4City Ontology, SVG File	ZIP File: Download Km4City Ontology, multiple formats	Linked Open Graph LOD (*)	SPARQL & Data Licenses (*)	Smart City Main Data, IOT, Sensors in Tuscany
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Data Warehouse and Back Office Data Aggregation Tools

Smart City General Architecture	Programming User Engagements	Web Page: Data Ingestion Manager, DIM data broker tool	Web Page: DISCES, Smart City Engine, Big Data Process manager	Web Page: RDF store Indexer, RIM, and versioning manager
---------------------------------	------------------------------	--	---	--

www.Km4City.org



Development tools

- **Dashboard builder**
 - Creating personalized dashboards in few clicks
- **aggregating multi-domain data and services** for SMEs and city operators
 - **Data /Service Aggregator**: open, flexible and suitable access
- **development tool** for fast and low cost implementation of business and service oriented Apps
 - access to aggregated data → **Smart City API**
 - ServiceMap → **Smart City API**



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<http://www.disit.org>

Higher level Dashboard

The image displays five distinct dashboard panels:

- Firenze (Top-Left):** A comprehensive system monitoring dashboard for Florence. It features a top navigation bar with 'ServiceMap - SmartDS' and a date/time stamp. The main area is divided into several sections:
 - System Health:** Displays 'Numero di processi lanciati' (2676), 'CPU in uso' (24.2%), and 'Memoria in uso' (0%).
 - Smart City Engines:** Shows 'CPU' (0%), 'Mem Totale' (72094 MB), and 'Job Eseguiti' (2709).
 - Weather:** A 'Previsioni meteo: FIRENZE' section showing a 5-day forecast with temperatures and conditions.
 - Twitter Trends:** Lists trending topics like '#fiorenza' and '#fiorenzauffizi' with their respective percentages (88.9% and 76.0%).
 - Real-time Position ATAF:** A map showing the location of ATAF (Aeronautica Terrestre) units.
- Firenze Wi-Fi: APs Streaming Realtime (Top-Middle):** A heatmap showing the real-time distribution of Wi-Fi access points (APs) in Florence. The map includes a legend for 'Time Range' (2016-10-04 12:02:00 - 2016-10-04 13:18:00) and 'Max Capacity' (0.0008). It also features filters for 'Heatmap' (checked), 'Streaming APs', and 'Reply Speed'.
- Mugnone 2016 (Top-Right):** A dashboard titled 'Mugnone 2016' showing multiple time-series charts for various metrics:
 - Utenti attivi (12 ore):** Active users over a 12-hour period.
 - Turisti attivi (12 ore):** Active tourists over a 12-hour period.
 - Ritorni with AI giorno:** Returns with AI per day.
 - Accessi ai servizi singoli (web e mobile):** Accesses to individual services.
 - Query Kmqcity API:** Query results for the Kmqcity API.
 - Utenti attivi (4 ore):** Active users over a 4-hour period.
- Recommender - Heatmap and Trajectories Clusters (User Profile: All) (Bottom-Left):** A heatmap showing user movement patterns and clusters. It includes a legend for 'Max Capacity' (0.00018) and 'Heatmap' (checked).
- Twitter Vigilance Dashboard (Bottom-Right):** A dashboard for monitoring Twitter channel statistics. It shows 'Channel active from 2009-12-06 to today' and 'Data processed from 2015-09-09 to 2016-01-21'. The main chart displays 'Sentiment trends in channel uber' with a line graph showing 'Tweets score', 'Retweets score', and 'T+RT score' over time.



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Dashboard Builder

Dashboards Overview

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

Sources Management

DataSources Overview

ID	URI
kin4CityApp	jbtc.mysp/Redsburg.3306
kin4CityApparc	jbtc.mysp/192.168.0.20.3306
kin4CityRCF	http://192.168.0.206.8080/WebAppGratiSpord
kin4CityRecommender	jbtc.mysp/192.168.0.55.3306
kin4CityServiceMap	jbtc.mysp/192.168.0.72.3306
kin4CitySikability	jbtc.mysp/192.168.0.72.3306
privat	jbtc.mysp/Redsburg.3306
SmartES	jbtc.mysp/192.168.0.25.3306
TwitterTv	jbtc.mysp/192.168.0.50.3306

Modifica Widget

Id Widget: widgetBarContent

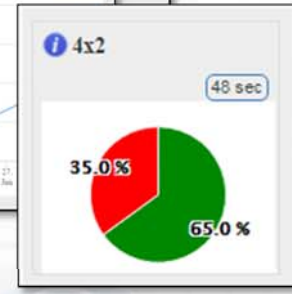
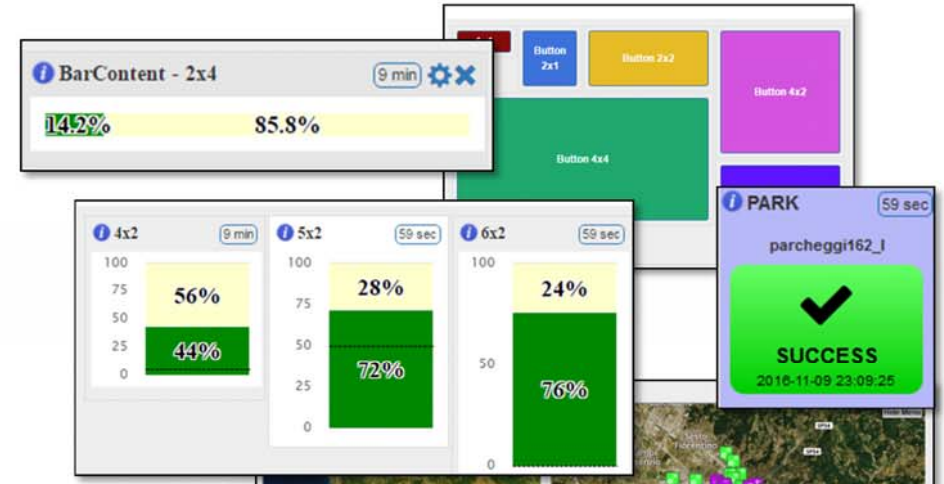
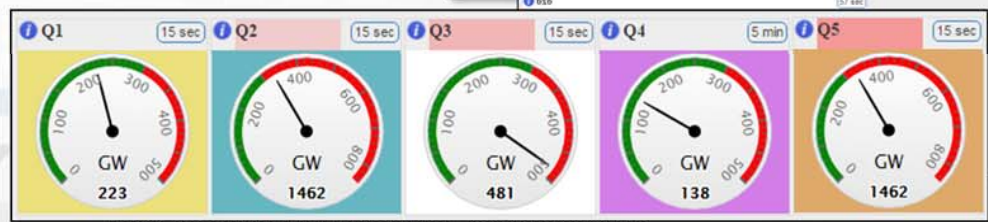
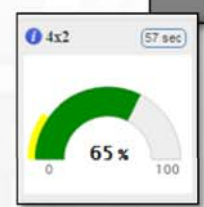
Type: Percentuale

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

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

n. metrics: 1, Color: 1

Buttons: Close, Modify



kin4City Smart City Ecosystem, November 2016



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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

Accessi ai servizi singoli (web e mobile) 31 sec

42.4%

Bus Attivi 29 sec

24

Ataf RT 30 sec

100% 0%

Parcheggi... 29 sec

Smart City Engine 30 sec

CPU: 3.7%

RAM: 58.7 GB

DAILY JOBS: 4863

55.4%

Rilievi wifi 9 min

Real time position ATAF bus

Sensori RT 29 sec

18.6% 81.4%

Previsioni meteo: FIRENZE 359 min

Day	Weather	Temp
Wednesday	light rain	7°C / 13°C
Thursday	cloudy	6°C / 16°C
Friday	moderate rain	7°C / 16°C
Saturday	cloudless	/
Sunday	cloudy	/

Stato linee ATAF 29 sec

STATO LINEE MONITORATE DATI

46% IN ORARIO

5% IN ANTICIPO

49% IN RITARDO

Previsioni... 30 sec

8.8% 91.2%

Elenco eventi del giorno 30 sec

- Il restauro delle "Storie della Genesi" di Paolo Uccello
- Tra arte e moda
- Winkelmann, Firenze e gli Etruschi - Il padre

Parcheggi... 30 sec

26% 74%

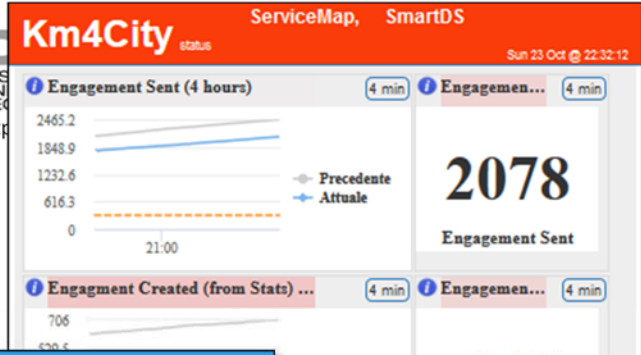
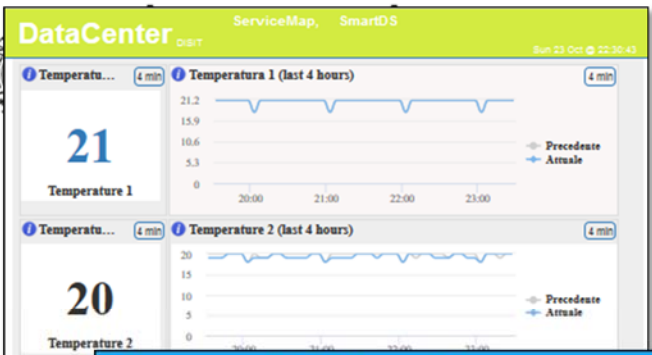
Twitter Trends/citazioni 30 sec

PRINCIPALI TREND TWITTER:
#FIRENZE
#FIORENTINA
#UFFIZI

CITAZIONI:

Query Servicemap 31 sec

Query Km4city API 31 sec

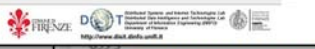


SmartCity Processes

Fri 4 Nov @ 18:51:20

Process	Status	Time
ATAF avm_linea17_J	RUNNING	2016-11-04 18:42:31
ATAF avm_linea31_J	RUNNING	2016-11-04 18:40:00
ATAF avm_linea4_J	SUCCESS	2016-11-04 18:49:23
ATAF avm_linea6_J	SUCCESS	2016-11-04 18:43:12
CHECK RT check_RT	SUCCESS	2016-11-04 09:27:48
EVENTI FI Eventi_a_Firenze_J	SUCCESS	2016-11-04 18:08:32
PARK parcheggi1_J	FAILED	2016-11-04 18:49:18
PARK parcheggi2_J	SUCCESS	2016-11-04 18:49:33
PARK parcheggi160_J	SUCCESS	2016-11-04 18:49:30
PARK parcheggi161_J	SUCCESS	2016-11-04 18:49:20
PARK parcheggi162_J	SUCCESS	2016-11-04 18:49:26
PARK parcheggi163_J	SUCCESS	2016-11-04 18:49:21
METEO prev_meteo_Abetone_xml_J	SUCCESS	2016-11-04 16:39:11
METEO prev_meteo_Arezzo_xml_J	SUCCESS	2016-11-04 16:49:09
METEO prev_meteo_Fiesole_xml_J	SUCCESS	2016-11-04 13:09:24
METEO prev_meteo_Firenze_xml_J	SUCCESS	2016-11-04 13:15:14
METEO prev_meteo_Impruneta_xml_J	SUCCESS	2016-11-04 14:54:40
METEO prev_meteo_Lucca_xml_J	SUCCESS	2016-11-04 14:45:24
SENSORI sensoridynamicmetro	SUCCESS	2016-11-04 18:42:15
SENSORI sensori_AREZZO_J	SUCCESS	2016-11-04 18:48:37
SENSORI sensori_EMPOLI_J	SUCCESS	2016-11-04 19:46:17
SENSORI sensori_PISA_J	SUCCESS	2016-11-04 18:40:08
SENSORI sensori_FIRENZE_J	SUCCESS	2016-11-04 18:49:21
SENSORI sensori_PRATO_J	SUCCESS	2016-11-04 18:47:03
TWITTER insertTweetsRecommende	SUCCESS	2016-11-04 18:46:58
TWITTER TwitterVigilanceIndexing	RUNNING	2016-11-04 17:00:00
FI WIFI calculateAPsTimeSeries	RUNNING	2016-11-04 10:30:07
FI WIFI calculateNewUsers	SUCCESS	2016-11-04 09:21:24
FI WIFI calculateUsersStatus	SUCCESS	2016-11-04 18:49:45
FI WIFI GraphsJSGenerator	FAILED	2016-11-04 18:34:40

twitter reJweel Twitter Vigilance

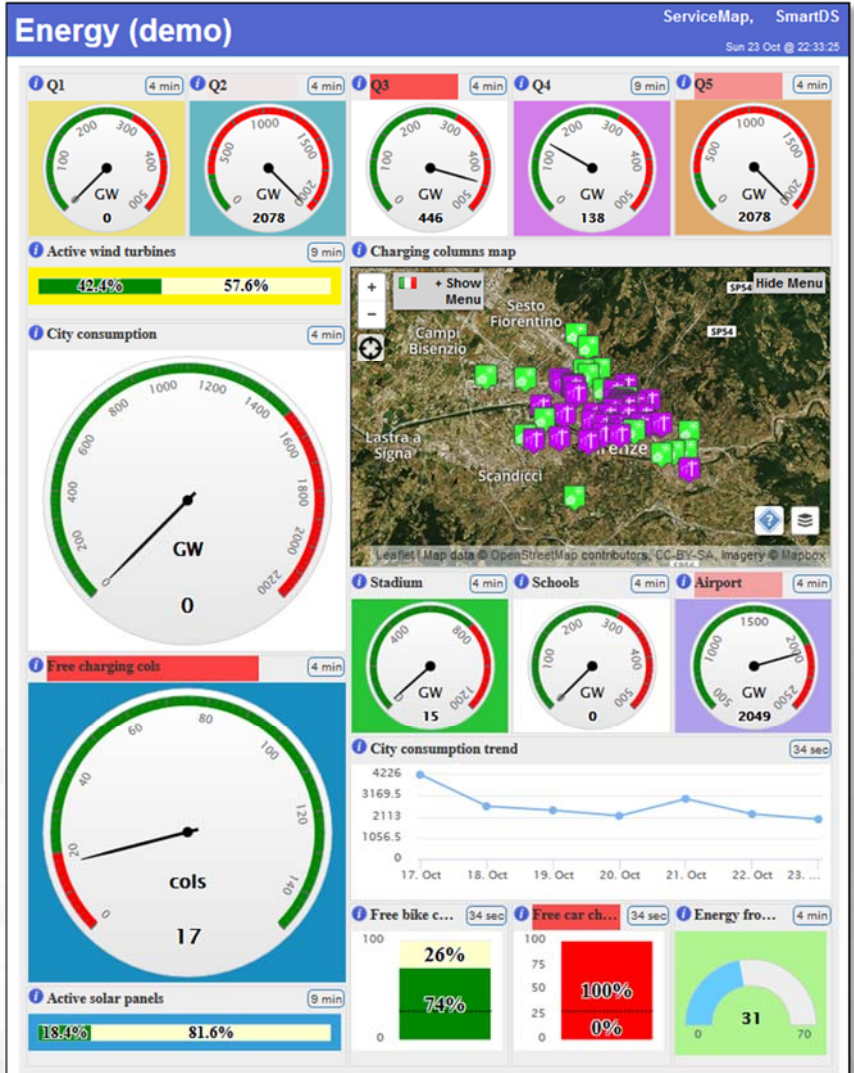




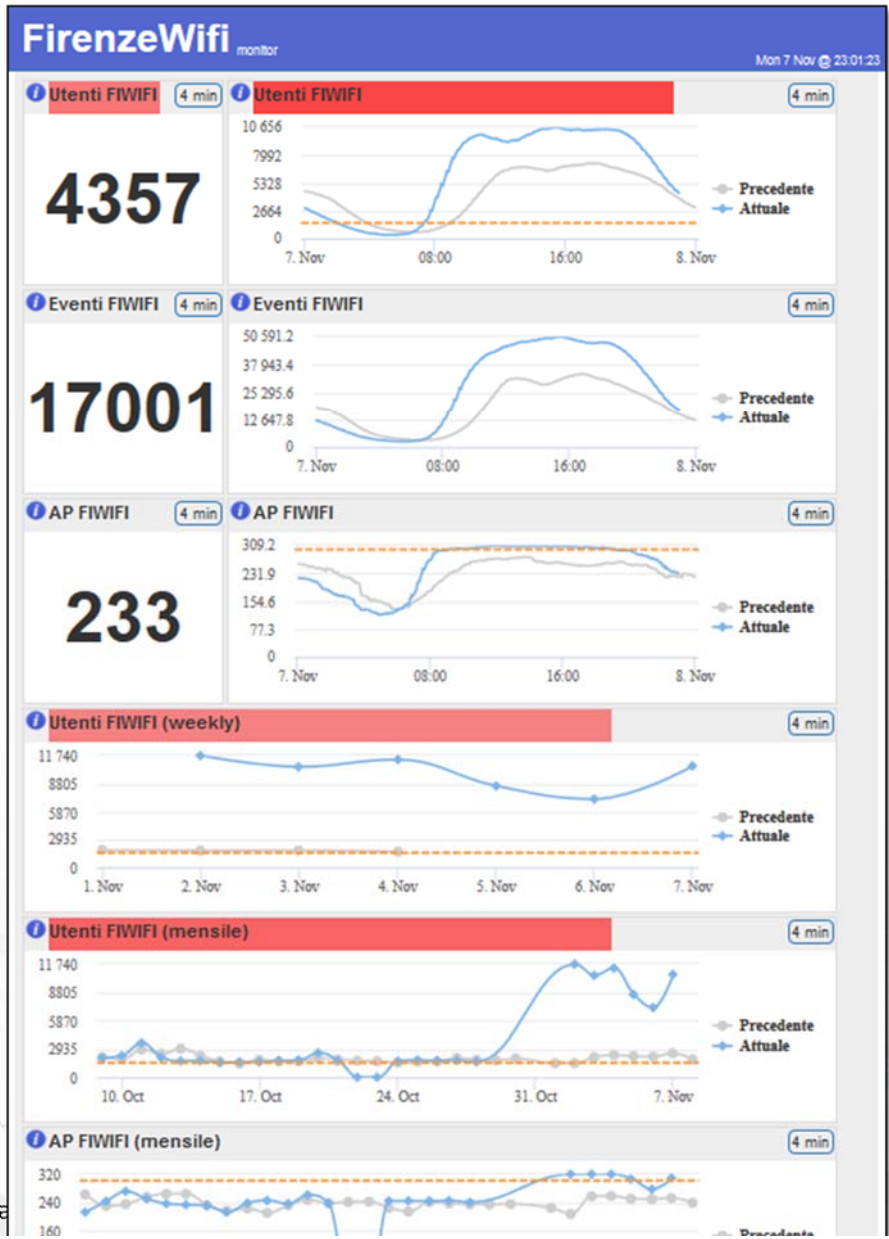
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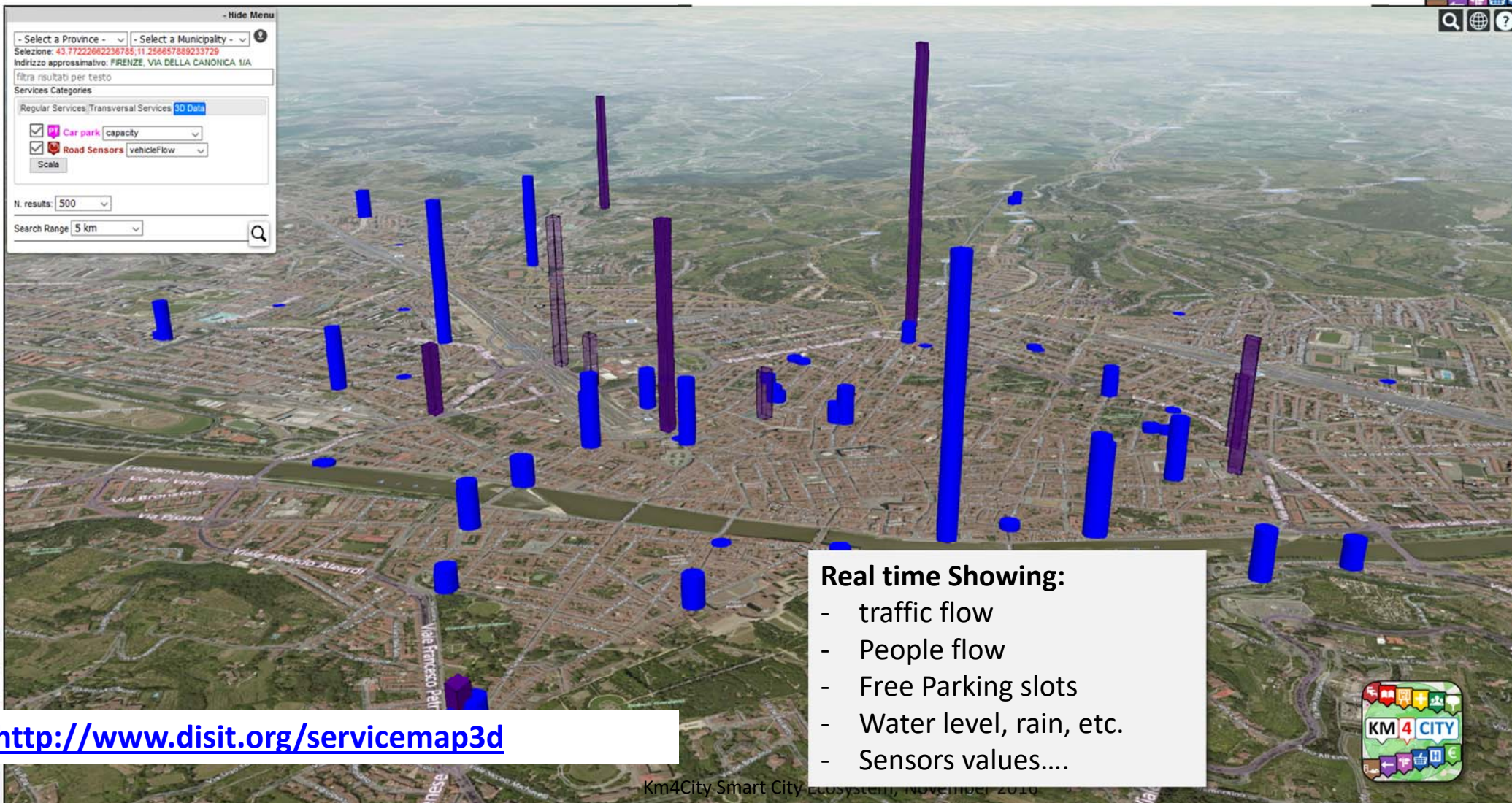
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Km4City Sma



RealTime Values 3D



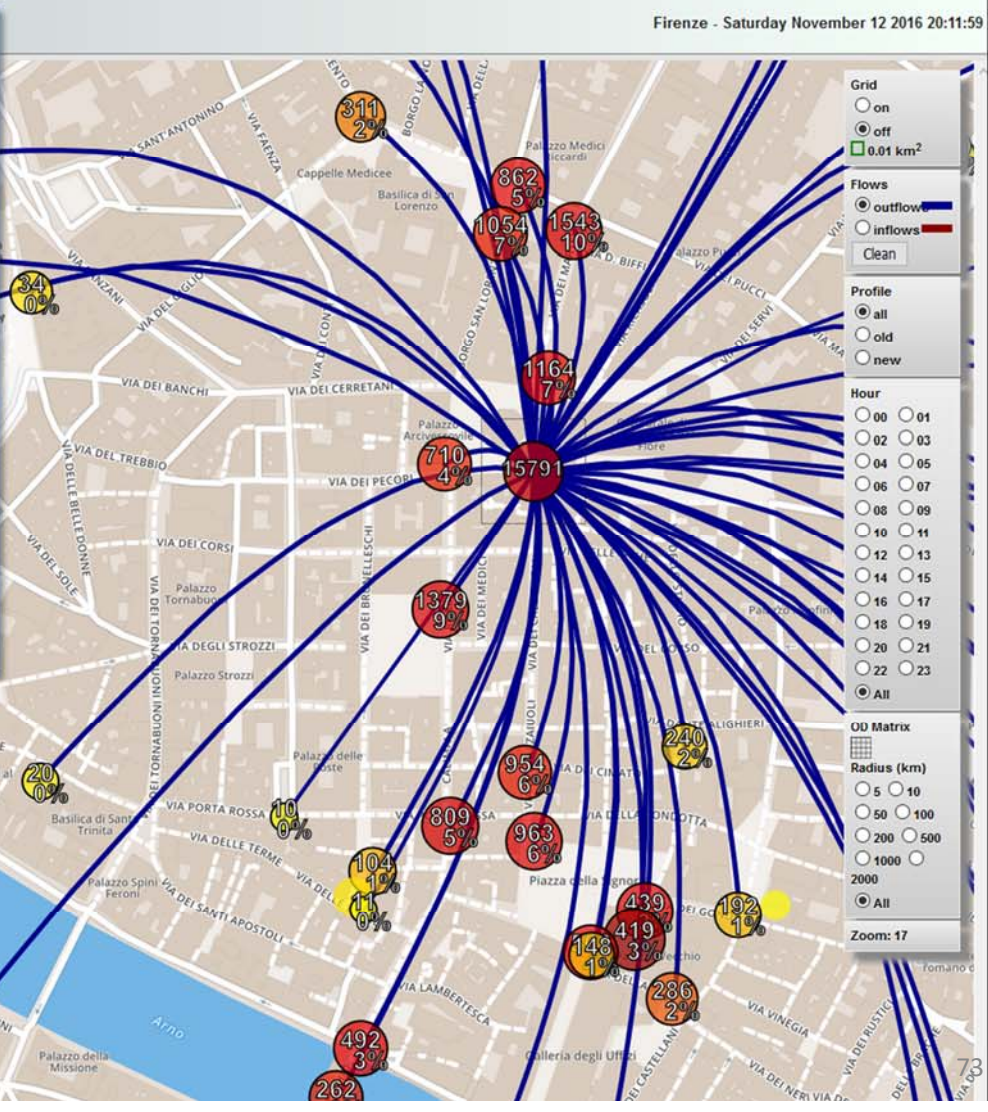
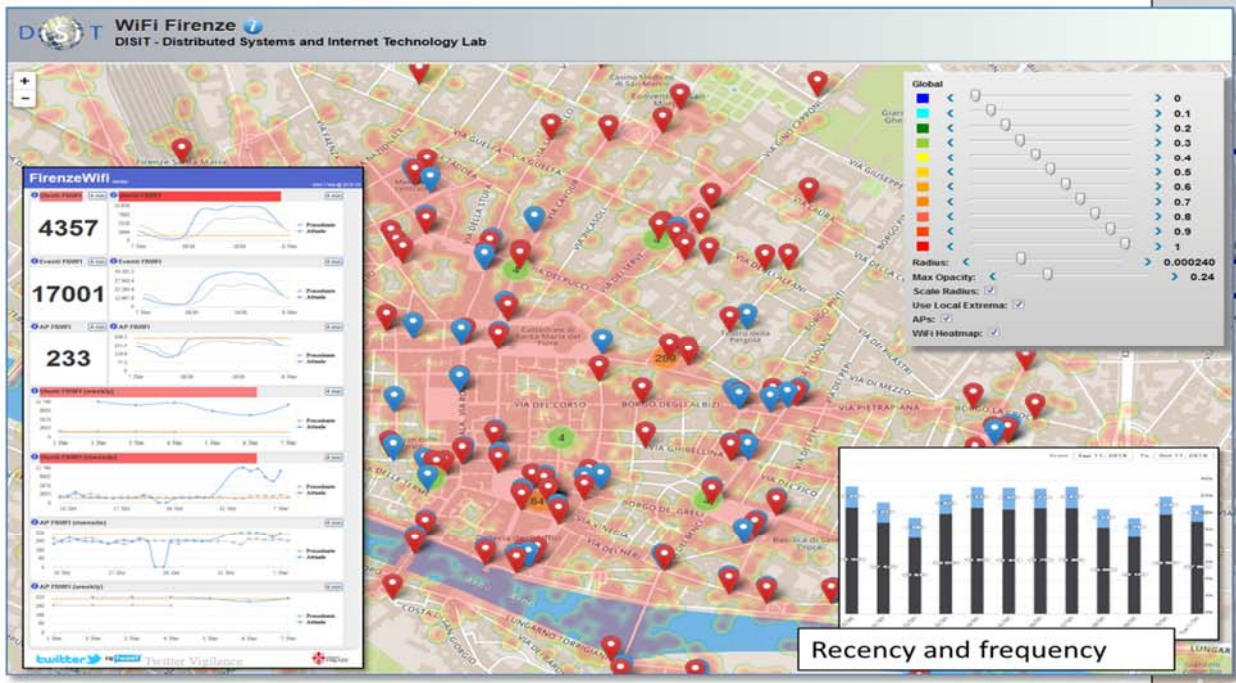


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Wi-Fi OD estimation.





Development tools

- **Dashboard builder**
 - Creating personalized dashboards in few clicks
- **aggregating multi-domain data and services for SMEs and city operators**
 - **Data /Service Aggregator**: open, flexible and suitable access
- **development tool** for fast and low cost implementation of business and service oriented Apps
 - access to aggregated data → **Smart City API**
 - ServiceMap → **Smart City API**



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
- Km4City...many other sensors ... see next slide

The screenshot shows a web application interface for KM4 CITY. On the left, there is a search panel with a 'Nascondi Menu' button and a 'Fermate Firenze' button. Below this, there are dropdown menus for 'Seleziona una provincia:' (set to FIRENZE) and 'Seleziona un comune:' (set to FIRENZE). The main area is a map of Florence, Italy, densely populated with colorful icons representing various services like accommodation, advertising, and government offices. On the right side, there is a 'Servizi Regolari' and 'Servizi Trasversali' search panel with a search bar and a list of service categories, each with a checkmark and a plus sign. At the bottom left, there is a weather forecast section for the comune di FIRENZE, showing conditions for Tuesday through Saturday. At the bottom right, there is a 'Risultati della ricerca' section showing 'più di 4000 risultati, attivato clustering' and 'Services 16858'.

This block provides a detailed view of the search panel on the right side of the application. It features a search bar with the placeholder text 'search text into service'. Below the search bar, there are two tabs: 'Servizi Regolari' and 'Servizi Trasversali'. A list of service categories follows, each with a checkmark and a plus sign: Accommodation, Advertising, AgricultureAndLivestock, CivilAndEdilEngineering, CulturalActivity, EducationAndResearch, Emergency, Entertainment, Environment, FinancialService, GovernmentOffice, HealthCare, IndustryAndManufacturing, MiningAndQuarrying, ShoppingAndService, TourismService, TransferServiceAndRenting, UtilitiesAndSupply, Wholesale, and WineAndFood. At the bottom of the panel, there is a 'N. risultati:' dropdown set to 'Nessun Limite', a 'Raggio ricerca' dropdown set to '100 metri', and a search button. Below this, it shows 'Risultati della ricerca' with 'più di 4000 risultati, attivato clustering' and 'Services 16858'.

<http://servicemap.km4city.org>

Transport systems
Mobility, parking



Public Services
Govern, events,



Sensors, IOT
Cameras, ..



Environment,
Water, energy



Shops, services,
operators



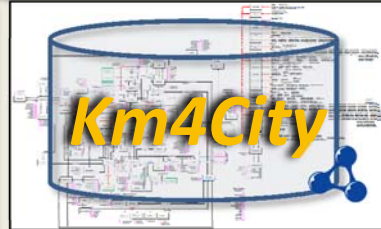
Social Media
WiFi, network



Static, Slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud

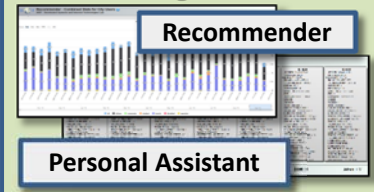
Km4City Smart City Engine



Big Data Analytics



Smartening Tools



Development Tools



Km4City Smart City API

Tools for City Operators and Decision Makers

Smart City Dashboard

Smart Decision Support

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

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

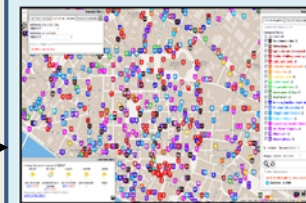


ServiceMap browser

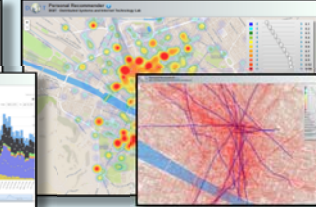
[Http://servicemap.km4city.org](http://servicemap.km4city.org)

Twitter Vigilance

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



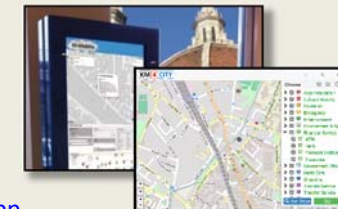
Analyzers of City User Behavior



Tools for Final Users

Mobile e Web Apps

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



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

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



Km4City Ontology - RDF Store



- >84 Classes
- >100 ObjectProperties
- >100 DataProperties

- different aspects:
 - 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
- ..

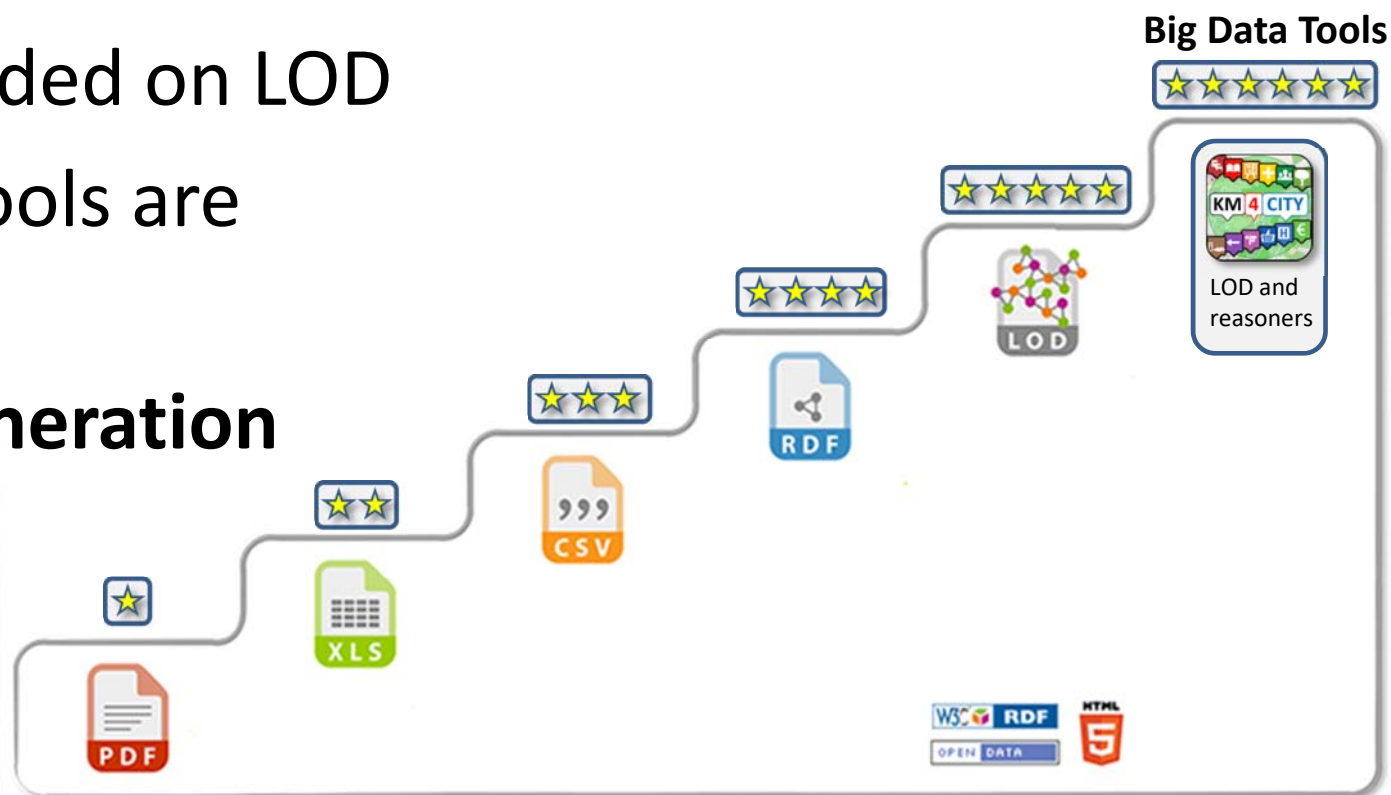
Ontology Documentation:
<http://www.disit.org/6506>
<http://www.disit.org/6507>
<http://www.disit.org/5606>
<http://www.disit.org/6461>











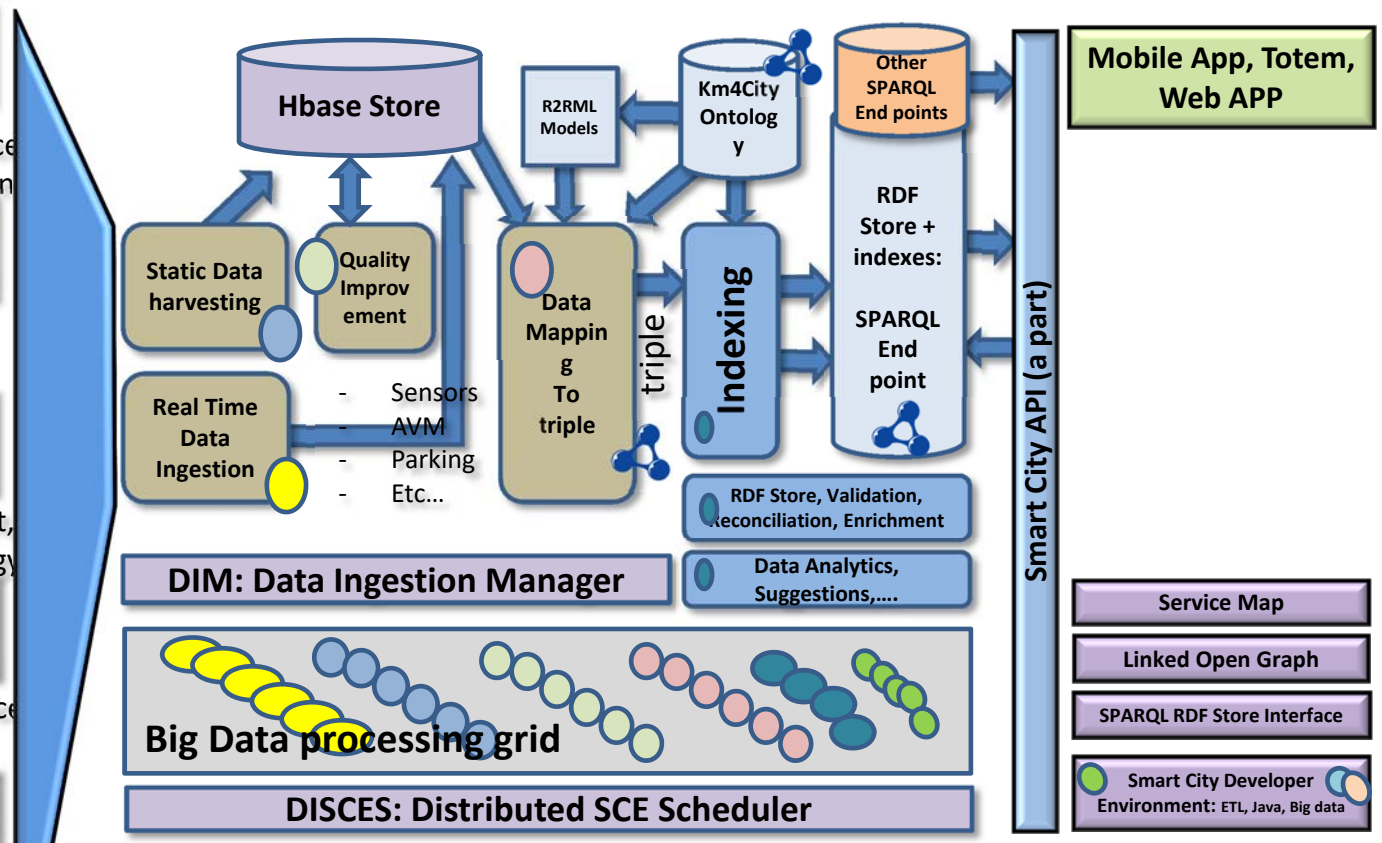
Km4City is Six Stars Linked Open Data

- Smart City API are grounded on LOD
- Service map is grounded on LOD
- Km4City reasoners tools are smartening the city
- **Km4City is a new generation of Urban Platforms**



Data Ingestion and Mining

- Transport systems
Mobility, parking

- Public Services
Govern, events

- Sensors, IOT
Cameras, ...

- Environment,
Water, energy

- Shops, service
operators

- Social Media
WiFi, network






DIM: Data Ingestion Manager

Show 10 entries
Schedule Delete Pause Resume
Add row Remove row

General informations													Ingestion
launch	process	Resource	Resource Class	Category	Format	Automaticity	Process_type	Access	Real Time	Source		I path	
	Welfare_csv	Welfare	Senzi_csv1	Senzi	csv	automatic	ETL	HTTP	no	Opendata regione Toscana -		sh /home/ubuntu/programs/data-integration/kitchen.sh -file=/home/ubuntu/SolMobility/Trasformazioni	
	Visite_guidate_csv	Visite guidate	Senzi_csv1	Senzi	csv	automatic	ETL						
	Universita_e_conservatori_csv	Universita e conservatori	Senzi_csv1	Senzi	csv	automatic	ETL						

Name	Start insert	End insert	Time (s)
informa	2015-04-12 09:29	2015-04-12 09:31	2
mappe	2015-04-12 09:31	2015-04-12 09:31	1
esit	2015-04-12 09:32	2015-04-12 09:32	1
javapmml	2015-04-12 09:32	2015-04-12 09:32	1
link	2015-04-12 09:32	2015-04-12 09:32	1
ctm	2015-04-12 09:32	2015-04-12 09:32	1
ut	2015-04-12 09:34	2015-04-12 09:34	1
itf	2015-04-12 09:35	2015-04-12 09:35	1
schena.org	2015-04-12 09:36	2015-04-12 09:36	2
msa	2015-04-12 09:36	2015-04-12 09:36	1
sm	2015-04-12 09:36	2015-04-12 09:36	1
spdmr_jaw	2015-04-12 09:45	2015-04-12 09:45	1
L_Libri_Memoriali_Firenze_f	2015-04-12 09:45	2015-04-12 09:47	2
L_Libri_Memoriali_Firenze_f	2015-04-12 09:47	2015-04-12 09:48	1
nlc_n_219v41	2015-04-12 09:49	2015-04-12 09:50	1
senzi_csv	2015-04-12 09:58	2015-04-12 09:58	1
Comunicazione_Ufficio_Matrimoniali_Firenze_f	2015-04-12 09:58	2015-04-12 09:59	1
Consigli_jaw	2015-04-12 09:58	2015-04-12 09:59	1
Contest_nuove_cav	2015-04-12 09:58	2015-04-12 09:59	1
Cine_219v41	2015-04-12 09:58	2015-04-12 09:59	1
Digitalization	2015-04-12 09:57	2015-04-12 09:57	18
Assicurazione_Catania	2015-04-12 09:59	2015-04-12 09:59	1

RIM RDF Index Manager



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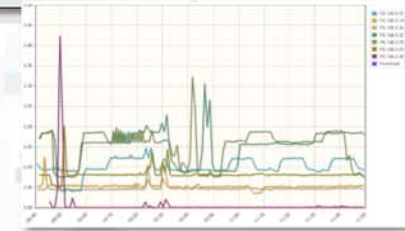


Distributed SCE Scheduler

Smart City Engine
DISIT - Distributed Systems and Internet Technology Lab

<p>192.168.0.14</p> <ul style="list-style-type: none"> LAST_CHECK: 2016-10-26 19:14:01 SCHEDULER_INSTANCE_ID: hsdopnode01147583464986 CPU_LOAD: 0.92% FREE_PHYSICAL_MEMORY: 6.04 GB JOBS_EXECUTED: 15333 SCHEDULER_NAME: SCE CURRENT_TIME: 2016-10-26 19:14:36 JOBS/h: 33.1 RUNNING SINCE: 2016-10-07 12:03:58 CLUSTERED: 1 PERSISTENCE: 1 REMOTE_SCHEDULER: 0 CURRENTLY_EXECUTING_JOBS: 0 CPU_LOAD_1M: 0.02% SYSTEM_LOAD_AVERAGE: 0.36 OPERATING_SYSTEM_VERSION: 3.13.0-24-generic COMMITTED_VIRTUAL_MEMORY: 9.02 GB OPERATING_SYSTEM_NAME: Linux FREE_SWAP_SPACE: 11.95 GB PROCESS_CPU_TIME: 15519410000000 TOTAL_PHYSICAL_MEMORY: 11.73 GB NUMBER_OF_PROCESSORS: 16 OPERATING_SYSTEM_ARCHITECTURE: amd64 TOTAL_SWAP_SPACE: 12 GB IS_SCHEDULER_STANDBY: 0 IS_SCHEDULER_SHUTDOWN: 0 IS_SCHEDULER_STARTED: 1 TOTAL_DISK_SPACE: 2.11 TB UNALLOCATED_DISK_SPACE: 1303.31 GB USABLE_DISK_SPACE: 394.03 GB PREV_FIRE_TIME: 2016-10-26 19:11:59 CPU: intel(R) Xeon(R) CPU X5690 @ 3.47GHz 	<p>192.168.0.40</p> <ul style="list-style-type: none"> LAST_CHECK: 2016-10-26 19:14:06 SCHEDULER_INSTANCE_ID: hsdopnode011475834644986 CPU_LOAD: 17.08% FREE_PHYSICAL_MEMORY: 1.62 GB JOBS_EXECUTED: 17379 SCHEDULER_NAME: SCE CURRENT_TIME: 2016-10-26 19:14:36 JOBS/h: 37.52 RUNNING SINCE: 2016-10-07 12:04:05 CLUSTERED: 1 PERSISTENCE: 1 REMOTE_SCHEDULER: 0 CURRENTLY_EXECUTING_JOBS: 1 CPU_LOAD_1M: 1.46% SYSTEM_LOAD_AVERAGE: 0.35 OPERATING_SYSTEM_VERSION: 3.13.0-24-generic COMMITTED_VIRTUAL_MEMORY: 3.28 GB OPERATING_SYSTEM_NAME: Linux FREE_SWAP_SPACE: 11.96 GB PROCESS_CPU_TIME: 17961070000000 TOTAL_PHYSICAL_MEMORY: 11.74 GB NUMBER_OF_PROCESSORS: 4 OPERATING_SYSTEM_ARCHITECTURE: amd64 TOTAL_SWAP_SPACE: 12 GB IS_SCHEDULER_STANDBY: 0 IS_SCHEDULER_SHUTDOWN: 0 IS_SCHEDULER_STARTED: 1 TOTAL_DISK_SPACE: 2.11 TB UNALLOCATED_DISK_SPACE: 995.75 GB USABLE_DISK_SPACE: 388.48 GB PREV_FIRE_TIME: 2016-10-26 19:12:59 CPU: intel(R) Xeon(R) CPU E5420 @ 2.93GHz 	<p>192.168.0.42</p> <ul style="list-style-type: none"> LAST_CHECK: 2016-10-26 19:14:13 SCHEDULER_INSTANCE_ID: hsdopnode011475834650248 CPU_LOAD: 1.66% FREE_PHYSICAL_MEMORY: 3.76 GB JOBS_EXECUTED: 15512 SCHEDULER_NAME: SCE CURRENT_TIME: 2016-10-26 19:14:36 JOBS/h: 33.49 RUNNING SINCE: 2016-10-07 12:04:10 CLUSTERED: 1 PERSISTENCE: 1 REMOTE_SCHEDULER: 0 CURRENTLY_EXECUTING_JOBS: 0 CPU_LOAD_1M: 0.02% SYSTEM_LOAD_AVERAGE: 0.33 OPERATING_SYSTEM_VERSION: 3.13.0-24-generic COMMITTED_VIRTUAL_MEMORY: 8.32 GB OPERATING_SYSTEM_NAME: Linux FREE_SWAP_SPACE: 11.91 GB PROCESS_CPU_TIME: 11769360000000 TOTAL_PHYSICAL_MEMORY: 11.73 GB NUMBER_OF_PROCESSORS: 16 OPERATING_SYSTEM_ARCHITECTURE: amd64 TOTAL_SWAP_SPACE: 12 GB IS_SCHEDULER_STANDBY: 0 IS_SCHEDULER_SHUTDOWN: 0 IS_SCHEDULER_STARTED: 1 TOTAL_DISK_SPACE: 2.11 TB UNALLOCATED_DISK_SPACE: 998.77 GB USABLE_DISK_SPACE: 389.49 GB PREV_FIRE_TIME: 2016-10-26 19:14:21 CPU: intel(R) Xeon(R) CPU E5-2650 v3 @ 2.90GHz 	<p>192.168.0.69</p> <ul style="list-style-type: none"> LAST_CHECK: 2016-10-26 19:14:18 SCHEDULER_INSTANCE_ID: hsdopnode011475834654997 CPU_LOAD: 3.77% FREE_PHYSICAL_MEMORY: 4.43 GB JOBS_EXECUTED: 14770 SCHEDULER_NAME: SCE CURRENT_TIME: 2016-10-26 19:14:36 JOBS/h: 31.89 RUNNING SINCE: 2016-10-07 12:04:15 CLUSTERED: 1 PERSISTENCE: 1 REMOTE_SCHEDULER: 0 CURRENTLY_EXECUTING_JOBS: 1 CPU_LOAD_1M: 0.01% SYSTEM_LOAD_AVERAGE: 0.35 OPERATING_SYSTEM_VERSION: 3.13.0-24-generic COMMITTED_VIRTUAL_MEMORY: 8.38 GB OPERATING_SYSTEM_NAME: Linux FREE_SWAP_SPACE: 11.95 GB PROCESS_CPU_TIME: 10180410000000 TOTAL_PHYSICAL_MEMORY: 11.73 GB NUMBER_OF_PROCESSORS: 16 OPERATING_SYSTEM_ARCHITECTURE: amd64 TOTAL_SWAP_SPACE: 12 GB IS_SCHEDULER_STANDBY: 0 IS_SCHEDULER_SHUTDOWN: 0 IS_SCHEDULER_STARTED: 1 TOTAL_DISK_SPACE: 2.11 TB UNALLOCATED_DISK_SPACE: 1004.16 GB USABLE_DISK_SPACE: 394.89 GB PREV_FIRE_TIME: 2016-10-26 19:14:04 CPU: intel(R) Xeon(R) CPU E5-2650 v3 @ 2.90GHz 	<p>192.168.0.70</p> <ul style="list-style-type: none"> LAST_CHECK: 2016-10-26 19:14:23 SCHEDULER_INSTANCE_ID: hsdopnode011475834662595 CPU_LOAD: 0.96% FREE_PHYSICAL_MEMORY: 2.09 GB JOBS_EXECUTED: 15492 SCHEDULER_NAME: SCE CURRENT_TIME: 2016-10-26 19:14:36 JOBS/h: 33.45 RUNNING SINCE: 2016-10-07 12:04:21 CLUSTERED: 1 PERSISTENCE: 1 REMOTE_SCHEDULER: 0 CURRENTLY_EXECUTING_JOBS: 0 CPU_LOAD_1M: 0.02% SYSTEM_LOAD_AVERAGE: 0.27 OPERATING_SYSTEM_VERSION: 3.13.0-24-generic COMMITTED_VIRTUAL_MEMORY: 8.38 GB OPERATING_SYSTEM_NAME: Linux FREE_SWAP_SPACE: 11.97 GB PROCESS_CPU_TIME: 14778010000000 TOTAL_PHYSICAL_MEMORY: 11.73 GB NUMBER_OF_PROCESSORS: 16 OPERATING_SYSTEM_ARCHITECTURE: amd64 TOTAL_SWAP_SPACE: 12 GB IS_SCHEDULER_STANDBY: 0 IS_SCHEDULER_SHUTDOWN: 0 IS_SCHEDULER_STARTED: 1 TOTAL_DISK_SPACE: 2.11 TB UNALLOCATED_DISK_SPACE: 1.01 TB USABLE_DISK_SPACE: 324.87 GB PREV_FIRE_TIME: 2016-10-26 19:10:21 CPU: intel(R) Xeon(R) CPU X5690 @ 3.47GHz 	<p>192.168.0.92</p> <ul style="list-style-type: none"> LAST_CHECK: 2016-10-26 19:14:28 SCHEDULER_INSTANCE_ID: hsdopnode011475834668195 CPU_LOAD: 1.44% FREE_PHYSICAL_MEMORY: 2.4 GB JOBS_EXECUTED: 15797 SCHEDULER_NAME: SCE CURRENT_TIME: 2016-10-26 19:14:36 JOBS/h: 34.11 RUNNING SINCE: 2016-10-07 12:04:25 CLUSTERED: 1 PERSISTENCE: 1 REMOTE_SCHEDULER: 0 CURRENTLY_EXECUTING_JOBS: 0 CPU_LOAD_1M: 1.02% SYSTEM_LOAD_AVERAGE: 0.27 OPERATING_SYSTEM_VERSION: 3.13.0-24-generic COMMITTED_VIRTUAL_MEMORY: 8.32 GB OPERATING_SYSTEM_NAME: Linux FREE_SWAP_SPACE: 11.97 GB PROCESS_CPU_TIME: 14880200000000 TOTAL_PHYSICAL_MEMORY: 11.73 GB NUMBER_OF_PROCESSORS: 16 OPERATING_SYSTEM_ARCHITECTURE: amd64 TOTAL_SWAP_SPACE: 12 GB IS_SCHEDULER_STANDBY: 0 IS_SCHEDULER_SHUTDOWN: 0 IS_SCHEDULER_STARTED: 1 TOTAL_DISK_SPACE: 2.11 TB UNALLOCATED_DISK_SPACE: 1.01 TB USABLE_DISK_SPACE: 324.12 GB PREV_FIRE_TIME: 2016-10-26 19:13:21 CPU: intel(R) Xeon(R) CPU X5690 @ 3.47GHz
--	---	--	---	---	--

CPU	CPU Load	Mem Total	Mem Free	Cores	Jobs/h	Jobs Executed	Jobs Failed/Success (24 h)	Jobs Failed/Success (7 days)
244.07 GHz	5.41 GHz (2.22%)	70.41 GB	20.36 GB	84	203.56	94283	221 (4.45%) 4742 (95.55%)	2879 (8.41%) 31356 (91.59%)



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Distributed SCE Scheduler



Smart Cloud Engine							
DISIT - Distributed Systems and Internet Technology Lab							
SCHEDULER NAME	ID ↓	FIRE INSTANCE ID	DATE	JOB NAME	JOB GROUP	JOB DATA	STATUS
SCE	297230	hadoopnode01d14183 077042351418307705 019	2014-12-15 15:25:33	sensori47_A	sensori47	#processParameter s= [{"processPath":"/ho mo/ubunt/program	RUNNING
SCE	297229	hadoopnode06c14183 076279641418307629 359	2014-12-15 15:25:33	sensori44_A	sensori44	#processParameter s= [{"processPath":"/ho mo/ubunt/program	RUNNING
SCE	297228	hadoopnode02141830 838738214183083917 58	2014-12-15 15:22:39	ZTL_notturna_shp_I	ZTL_notturna_shp	#processParameter s=null; #isNonConcurrent=t no	SUCCESS
SCE	297227	hadoopnode02141830 838738214183083917 57	2014-12-15 15:22:39	ZTL_notturna_kmz_I	ZTL_notturna_kmz	#processParameter s=null; #isNonConcurrent=t no	SUCCESS
SCE	297226	hadoopnode01c14183 085186101418308520 365	2014-12-15 15:21:49	sensori45_A	sensori45	#processParameter s= [{"processPath":"/ho mo/ubunt/program	RUNNING
SCE	297225	hadoopnode06141830 832370214183083258 68	2014-12-15 15:21:49	sensori40_A	sensori40	#processParameter s= [{"processPath":"/ho mo/ubunt/program	RUNNING
SCE	297224	hadoopnode01b14183 075646221418307566 749	2014-12-15 15:21:49	sensori46_A	sensori46	#processParameter s= [{"processPath":"/ho mo/ubunt/program	RUNNING
SCE	297223	hadoopnode02141830 838738214183083917 56	2014-12-15 15:21:37	ZTL_notturna_kmz_I	ZTL_notturna_kmz	#processParameter s=null; #isNonConcurrent=t no	SUCCESS
SCE	297222	hadoopnode02141830 838738214183083917 55	2014-12-15 15:21:00	sensori31_C	sensori31	#processParameter s= [{"processPath":"/ho mo/ubunt/program	SUCCESS
SCE	297221	hadoopnode06c14183 076279641418307629 358	2014-12-15 15:21:00	sensori30_C	sensori30	#processParameter s= [{"processPath":"/ho mo/ubunt/program	SUCCESS
SCE	297220	hadoopnode02141830 838738214183083917 54	2014-12-15 15:18:58	ZTL_notturna_shp_I	ZTL_notturna_shp	#processParameter s=null; #isNonConcurrent=t no	SUCCESS
SCE		hadoopnode01c14183				#processParameter	

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Development tools

- **Dashboard builder**
 - Creating personalized dashboards in few clicks
- **aggregating multi-domain data and services** for SMEs and city operators
 - **Data /Service Aggregator**: open, flexible and suitable access
- **development tool** for fast and low cost implementation of business and service oriented Apps
 - access to aggregated data → **Smart City API**
 - ServiceMap → **Smart City API**



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ServiceMap



Search around a GPS point

Search along a line

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

72 Bus Lines Found.

Search results organized by category

Total number of results: 2231

Category	Number of Results
Accommodation	1000
Advertising	1000
Business	1000
Education	1000
Health	1000
Industry	1000
Science	1000
Shopping	1000
Sports	1000
Travel	1000
Utilities	1000
Weather	1000
Other	1000

Services: 2231 of 2231 available

Smart City API call generation

Web App HTML5

Giardino Di Boboli

Indirizzo: VIALE DELLA MERIDIANA, 50123 FIRENZE FI

DISIT Distributed Systems and Internet Technologies Lab
Distributed Data Intelligence and Technologies Lab
Department of Information Engineering (DINFO)
University of Florence
<http://www.disit.dinfo.unifi.it>

KM4CITY SERVICE MAP EMBEDDED

DISPONIBILE SU Google play

Scarica da App Store

Scarica da Windows Store

Embed into Web pages

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



ServiceMap



Search around a GPS point

Search along a line

Regular Services: 35 of 35 available
Bus Stops: 13 of 13 available
Road Sensors: 2 of 2 available
72 Bus Lines Found.

Search for Geo Located Services

Get Events in the city

30 events found.

Regular Services: 418 of 418 available
Bus Stops: 23 of 23 available
Road Sensors: 2 of 2 available
33 Bus Lines Found.

Search in an area

Total number of results: 2231

Regular Services: 2231 of 2231 available

Get weather forecast

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

Service: F1055ZTL01601

Vehicle Flow (cars/h)	Avg Speed (km/h)	Threshold Perc (%)	Speed Perc (%)
45.0	0.0	N.A.	N.A.

Regular Services: 25 of 25 available
Bus Stops: 3 of 3 available
Road Sensors: 3 of 3 available



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ServiceMap



Regular Services | Transversal Services

Search text into service

Services Categories

- Accommodation
- Advertising
- AgricultureAndLivestock
- CulturalAndEngineering
- EducationAndResearch
- Emergency
- Entertainment
- Environment
- FinancialService
- GovernmentOffice
- HealthCare
- IndustryAndManufacturing
- MarketingAndAdvertising
- ShoppingAndService
- Transportation
- TransferServiceAndConsulting
- WholesaleAndRetail
- WholesaleAnd

Actual Selection: No selection

Number of selected services: 0

Search Range: 500 mt

N. results: No Limit

Search Results: 2231 of 2231 available

Query results organized by category

Total number of results: 2231

Category	Count
Advertising	141
AgricultureAndLivestock	31
CulturalAndEngineering	188
EducationAndResearch	31
Emergency	16
Entertainment	16
Environment	16
FinancialService	16
GovernmentOffice	16
HealthCare	16
IndustryAndManufacturing	16
MarketingAndAdvertising	16
ShoppingAndService	16
Transportation	16
TransferServiceAndConsulting	16
WholesaleAndRetail	16
WholesaleAnd	16

Weather Forecast for Municipality of FIRENZE

Sunday: light rain and sunny intervals 13°C / 24°C

Monday: cloudy 13°C / 24°C

Tuesday: cloudy 13°C / 23°C

Wednesday: light rain 13°C / 23°C

Thursday: rain 13°C / 23°C

Regular Services | Transversal Services

Search text into service

Services Categories

- Accommodation
- Advertising
- AgricultureAndLivestock
- CulturalAndEngineering
- EducationAndResearch
- Emergency
- Entertainment
- Environment
- FinancialService
- GovernmentOffice
- HealthCare
- IndustryAndManufacturing
- MarketingAndAdvertising
- ShoppingAndService
- Transportation
- TransferServiceAndConsulting
- WholesaleAndRetail
- WholesaleAnd

Actual Selection: No selection

Number of selected services: 0

Service: F1052TL01601

Search Range: 500 mt

N. results for each: 200

Search Results: 25 of 25 available

Road Sensors: 3 of 3 available

Line	Vehicle Flow (cars/h)	Avg Speed (km/h)	Threshold Perc (%)	Speed Perc (%)
F1052TL01601	40.0	0.0	N.A.	N.A.

Weather Forecast for Municipality of FIRENZE

Sunday: light rain and sunny intervals 13°C / 24°C

Monday: cloudy 13°C / 24°C

Tuesday: cloudy 13°C / 23°C

Wednesday: light rain 13°C / 23°C

Thursday: rain 13°C / 23°C

Regular Services | Transversal Services

Search text into service

Services Categories

- Accommodation
- Advertising
- AgricultureAndLivestock
- CulturalAndEngineering
- EducationAndResearch
- Emergency
- Entertainment
- Environment
- FinancialService
- GovernmentOffice
- HealthCare
- IndustryAndManufacturing
- MarketingAndAdvertising
- ShoppingAndService
- Transportation
- TransferServiceAndConsulting
- WholesaleAndRetail
- WholesaleAnd

Actual Selection: No selection

Number of selected services: 0

Service: BUS STOP - STAZIONE PENSIANA

Search Range: 500 mt

N. results for each: 200

Search Results: 31 - Bus Line: 17 B

Direction: VERGA TOZZI → BOITO

Line	Route
17 B	VERGA TOZZI → BOITO
17 C	VERGA TOZZI → LE CASONE

Weather Forecast for Municipality of FIRENZE

Sunday: light rain and sunny intervals 13°C / 24°C

Monday: cloudy 13°C / 24°C

Tuesday: cloudy 13°C / 23°C

Wednesday: light rain 13°C / 23°C

Thursday: rain 13°C / 23°C

Regular Services | Transversal Services

Search text into service

Services Categories

- Accommodation
- Advertising
- AgricultureAndLivestock
- CulturalAndEngineering
- EducationAndResearch
- Emergency
- Entertainment
- Environment
- FinancialService
- GovernmentOffice
- HealthCare
- IndustryAndManufacturing
- MarketingAndAdvertising
- ShoppingAndService
- Transportation
- TransferServiceAndConsulting
- WholesaleAndRetail
- WholesaleAnd

Actual Selection: No selection

Number of selected services: 0

Service: Biblioteca della Camera di commercio, industria, artigianato e agricoltura

Search Range: 500 mt

N. results: No Limit

Search Results: 557 of 557 available

Library: Biblioteca della Camera di commercio, industria, artigianato e agricoltura

Address: VIA DELL'ARTE, 100

City: AREZZO

Phone: 057210000

Website: <http://www.cameraartigianatoarezzo.it>

Weather Forecast for Municipality of AREZZO

Sunday: cloudy 13°C / 24°C

Monday: cloudy 13°C / 24°C

Tuesday: light rain and sunny intervals 13°C / 23°C

Wednesday: moderate rain 13°C / 23°C

Thursday: moderate rain 13°C / 23°C

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Cycling Paths



The screenshot displays the KM4 City web application interface for cycling paths in Florence. The main map shows a network of red cycling paths overlaid on a street map. The left sidebar contains a search and filter panel with the following sections:

- Select a line:** - Select a Bus Line -
- Select a route:** - Select a Bus Route -
- Select a bus stop:** - Select a Bus Stop -
- Actual Selection:**
 - Coord: 43.7803,11.2548
 - Address: PIAZZA DELL'INDIPENDENZA, 26, FIRENZE
 - Route: 12 (dist:0,0001)
 - Route: 81 (dist:0,0001)

The right sidebar contains a search and filter panel with the following sections:

- Regular Services:** Transversal Services
- Services Categories:**
 - De/Select All
 - Area
 - DigitalLocation
 - HappeningNow
 - Path
 - Cycle_paths
 - Tourist_trail
 - Tramline
 - Fresh Place
 - Public Transport Line
 - Road Sensors
 - Bus Stops
- Filter:** search text into service
- N. results for each:** No Limit
- Search Range:** visible areas
- Search Results:** Services 228 of 228 available

Two mobile app preview windows are overlaid on the map, showing the application's performance on a smartphone. The left preview shows search results for cycling paths:

- Percorsi Ciclabili.309**
Tipo: Ciclogpcorsi
Distanza 172 m
Distanza 1329 m
- Percorsi Ciclabili.305**
Tipo: Ciclogpcorsi
Distanza 191 m
Distanza 1928 m

The right preview shows search results for public transport:

- Arena Esterno Notte Poggetto**
Tipo: Cinema
Distanza 351 m
- Auditorium Flog**
Tipo: Teatro
Distanza 351 m

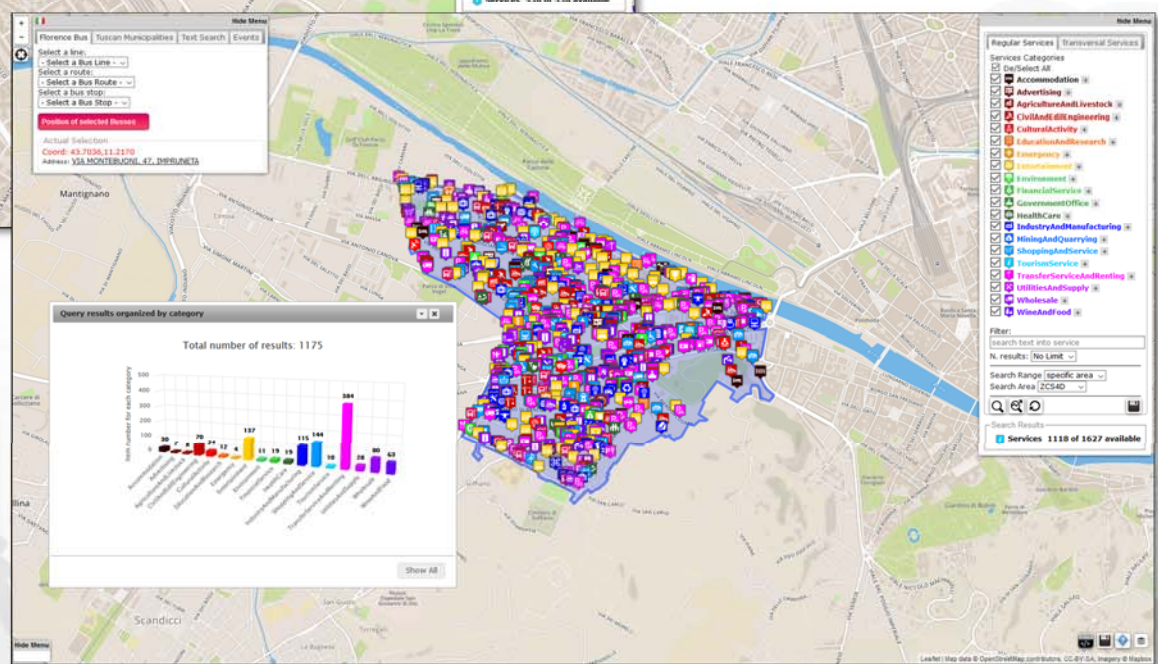
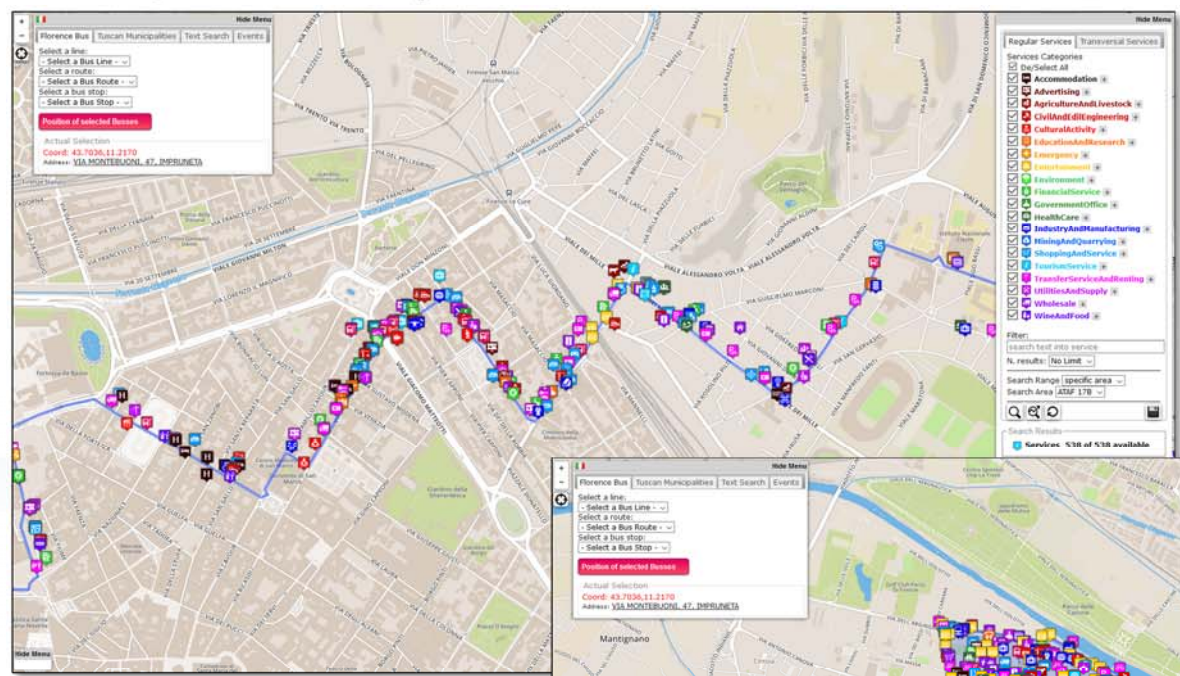


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Along a Line



Into an Area



Extracting data on Complex Polygons

The screenshot displays the KM4City web application interface. The main map shows a city area with several complex polygons overlaid in blue. The polygons are filled with a light blue color and have a darker blue border. The map is populated with numerous small, numbered icons in various colors (yellow, green, red, purple) scattered across the city area. The interface includes a search and filter panel on the left and a services list on the right.

Search and Filter Panel (Left):

- Buttons: Florence Bus, Tuscan Municipalities, Text Search, Events
- Form fields:
 - Select a line: - Select a Bus Line -
 - Select a route: - Select a Bus Route -
 - Select a bus stop: - Select a Bus Stop -
- Position of selected Busses: No selection
- Actual Selection: No selection

Services List (Right):

- Regular Services | Transversal Services
- Services Categories:
 - De/Select All
 - Accommodation
 - Advertising
 - AgricultureAndLivestock
 - CivilAndEdiEngineering
 - CulturalActivity
 - EducationAndResearch
 - Emergency
 - Entertainment
 - Environment
 - FinancialService
 - GovernmentOffice
 - HealthCare
 - IndustryAndManufacturing
 - MiningAndQuarrying
 - ShoppingAndService
 - TourismService
 - TransferServiceAndRenting
 - UtilitiesAndSupply
 - Wholesale
 - WineAndFood
- Filter: search text into service
- N. results: No Limit
- Search Range: specific area
- Search Area: test spiral_01
- Search Results: more than 4000 results, clustering enabled
- Services: 4770 of 5409 available



Shape loader



- <http://www.km4city.org/wkt/>
- <http://arthur-e.github.io/Wicket/sandbox-gmaps3.html>

Upload a SHP file or paste a WKT

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

<h3>SHP File</h3> <p>Label</p> <input type="text"/> <input type="button" value="Sfolla..."/> Nessun file selezionato. <input type="button" value="Upload"/>	<h3>Paste a WKT</h3> <p>Label</p> <input type="text"/> <p>WKT</p> <input type="text"/> <input type="button" value="Enter"/>
---	---



Km4city ServiceMap Km4City API

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

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

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

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

Save your information for services. Close

You can save this service on ServiceMap. Please insert a valid e-mail, and you will receive a link that could allow you to access at the results and share it with your friends.

Insert your e-mail:

Insert a title:

Insert a description:

Send

Save your information for services. X

You can save this query on ServiceMap. Please insert a valid e-mail, and you will receive a link that could allow you to access at the results and share it with your friends.

Insert your e-mail:

Insert a title:

Insert a description:

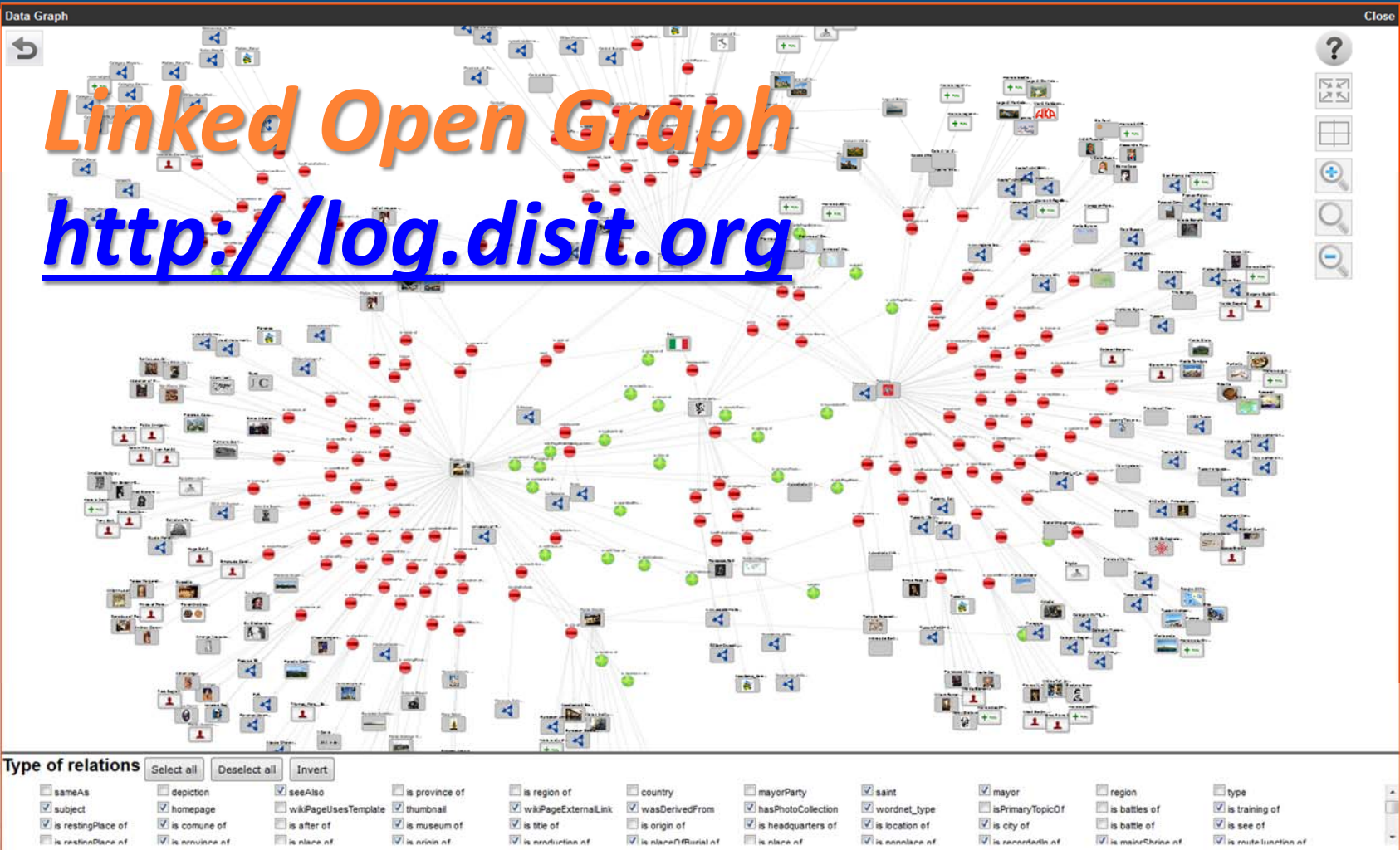
Send



Major Requirements Smart City API

- Five Stars Linked Open Data, RDF Stores
- Towards Urban Platform, over simple OD collection
- Integrated Services
 - Search: text, geo/point, time, line, polyline, near a point, ...
 - Specific Domain Support: mobility, energy, environment, commercial, POI, edu, gov, etc.
 - User Participation and Awareness
 - Personal Assistant, suggestion on demand, pushing, ..
 - Smart City Interoperability and Dash Board
 - Multilevel API modes: SPARQL, REST, Query ID
 - Enabled Inference and Ontology



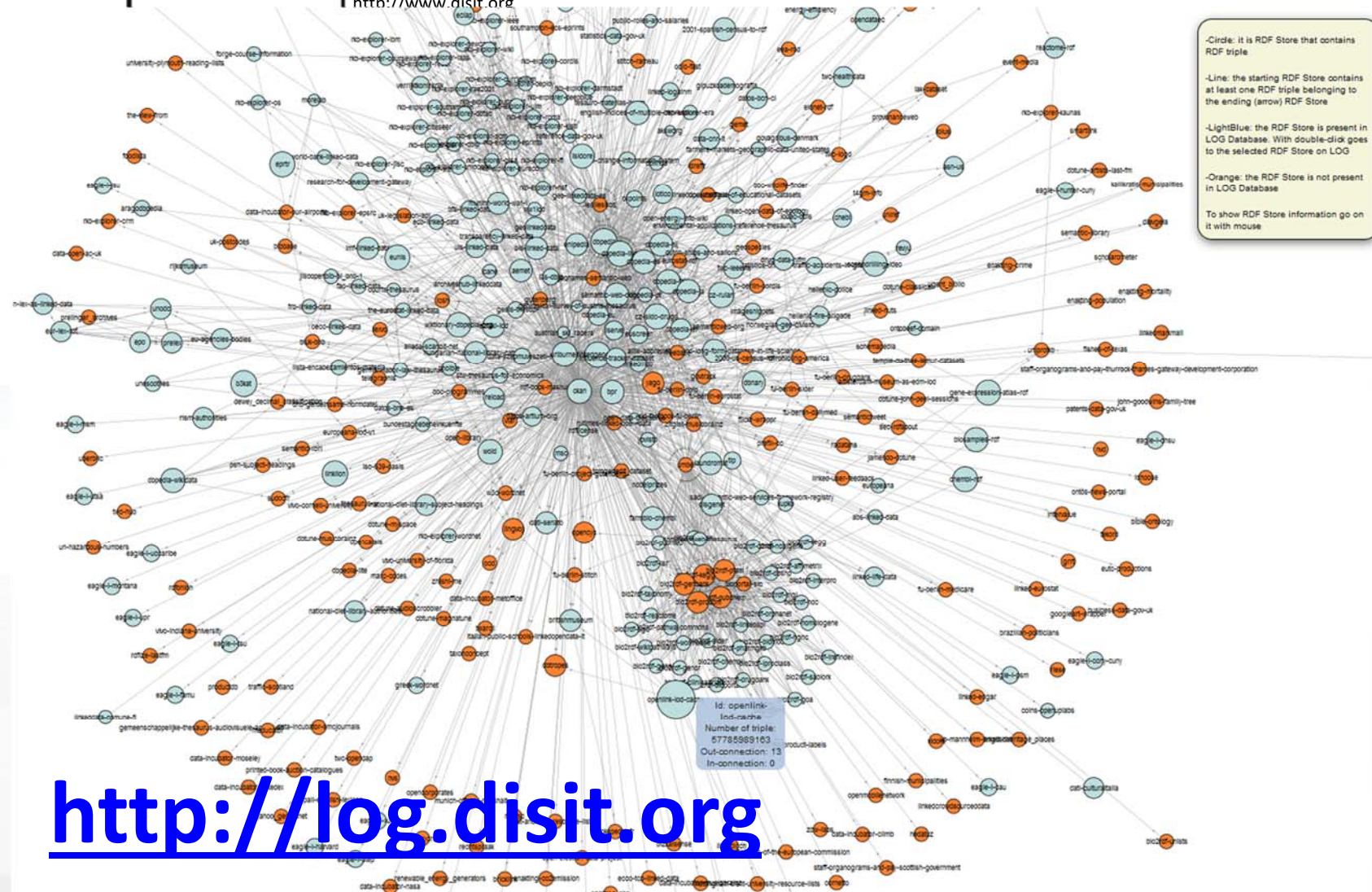




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-Circle: It is RDF Store that contains RDF triple
 -Line: the starting RDF Store contains at least one RDF triple belonging to the ending (arrow) RDF Store
 -LightBlue: the RDF Store is present in LOG Database. With double-click goes to the selected RDF Store on LOG
 -Orange: the RDF Store is not present in LOG Database
 To show RDF Store information go on it with mouse

<http://log.disit.org>



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

Flint SPARQL Editor 1.0.3

New Edit View Help

Dataset **KM4CITY** Mode **SPARQL 1.1 Query** Output **SPARQL-XML**

Query 1

```

1 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
2 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
3
4 SELECT * WHERE {
5   ?s ?p ?o
6 }
7 LIMIT 10

```

Samples SPARQL Properties Classes Prefixes

All municipalities

Select all municipalities names.

```

PREFIX km4cr: <http://www.disit.org/km4city/schema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
SELECT * WHERE {
  ?s a km4cr:Municipality;
  rdfs:label ?l.
} ORDER BY ?l

```

Bus stops near the Florence SMN train station

The bus stops within 100m of the Firenze SMN

```

PREFIX km4cr: <http://www.disit.org/km4city/schema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

```

Line: 1; Position: 1; Query is valid

Query Results

#	s	p	o
1	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#Property
2	http://www.w3.org/2000/01/rdf-schema#subPropertyOf	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#Property
3	http://www.w3.org/2000/01/rdf-schema#subClassOf	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#Property
4	http://www.w3.org/2000/01/rdf-schema#domain	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#Property
5	http://www.w3.org/2000/01/rdf-schema#range	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#Property
6	http://www.w3.org/2002/07/owl#equivalentProperty	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#Property



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APIs: Kind of Call, Non functional

<http://servicemap.disit.org/WebAppGrafo/api/v1/?queryId=9e5662a352d90ad4bc77690277a371ab&format=html>

Front end Smart City API domains to provide services to management smart city applications, and to web and mobile applications.	CitySDK	ECIM	Transport.API	Navitia.io	Km4City
API kind of Call					
SPARQL Query					X
SPARQL Query with Inference					X
REST	X	X	X	X	X
Query ID					X
Non Functional					
Direct API Authentication	X	X	X	X	X
API Authentication via Social Media		X			
Data Licensing Control	X		X	X	X



← Query ID

SPARQL on
↓
Virtuoso

Virtuoso SPARQL Query Editor

Default Data Set Name (Graph IRI)

Query Text

```

PREFIX rdf:<http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs:<http://www.w3.org/2004/02/06/rdfs-schema#>
PREFIX foaf:<http://xmlns.com/foaf/0.1/>
PREFIX dotesma:<http://psul.org/fo/dotesma/>
PREFIX openpla:<http://www.openpla.net/ont/geoparql#>
SELECT DISTINCT ?via ?numero ?comune
WHERE {
  ?entry rdf:type km4:Entry.
  ?entry km4:hasExternalAccess ?entry.
  ?entry km4:extendedNumber ?numero.
  ?entry km4:extendedName ?via.
  ?entry geo:lat ?lat.
  ?entry geo:long ?long.
  ?entry km4:isMunicipalityOf ?comune.
  ?comune foaf:name ?comune.
  ?entry geo:geometry ?geo.
  FILTER (NOT (intersects(?geo, bifirst_point(11.25480618554688, 43.77282920892066), 0.1)))
  BIND (bifirst_distance(?geo, bifirst_point(11.25480618554688, 43.77282920892066)) AS ?dist)
}
  
```

(Security restrictions of this server do not allow you to retrieve remote RDF data, see [details](#))

Results Format: HTML

Execution timeout: 0 milliseconds (values less than 1000 are ignored)

Options: Strict checking of void variables

(The result can only be sent back to browser, not saved on the server, see [details](#))

Run Query Reset

SPARQL ↓

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

File: SPARQL Editor 1.0.3

Dataset: KM4CITY Mode: SPARQL 1.1 Query Output: SPARQL/XML

```

1 PREFIX km4:<http://www.disit.org/km4city/schema#>
2 PREFIX foaf:<http://xmlns.com/foaf/0.1/>
3 SELECT DISTINCT * WHERE {
4   ?a km4:BusStop;
5   foaf:name ?l;
6   geo:geometry ?geo.
7   BIND (bifirst_distance(
8     ||?geo, bifirst_point(11.2484, 43.7765))
9     AS ?dist)
10  FILTER (?dist <= 0.1)
11  ORDER BY ?dist
  
```

Bus stops near the Florence SMN train station

The bus stops within 100m of the Firenze SMN

```

PREFIX km4:<http://www.disit.org/km4city/schema#>
PREFIX foaf:<http://xmlns.com/foaf/0.1/>
SELECT DISTINCT * WHERE {
  ?a km4:BusStop;
  foaf:name ?l;
  geo:geometry ?geo.
  BIND (bifirst_distance(
    ||?geo, bifirst_point(11.2484, 43.7765))
    AS ?dist)
  FILTER (?dist <= 0.1)
  ORDER BY ?dist
}
  
```

#	s	l	geo	dist
1	http://www.disit.org/km4city/resource/PM0022	STAZIONE PENSIлина	POINT(11.2491 43.7765)	0.0544402
2	http://www.disit.org/km4city/resource/PM2143	STAZIONE GALLERIA	POINT(11.2482 43.7759)	0.0648533
3	http://www.disit.org/km4city/resource/PM1898	STAZIONE VALFONDA	POINT(11.2484 43.7772)	0.0768214
4	http://www.disit.org/km4city/resource/PM0452	STAZIONE LARGO ALINARI	POINT(11.2495 43.7765)	0.0898297
5	http://www.disit.org/km4city/resource/PM0313	STAZIONE PARCHEGGIO	POINT(11.2493 43.776)	0.0923469

<http://servicemap.disit.org/WebAppGrafo/sparql?query=...>

s	l	geo	dist
http://www.disit.org/km4city/resource/PM0022	"STAZIONE PENSIлина"	"POINT(11.249077 43.776466)""-<http://www.openlinksw.com/schemas/virtmf#Geoometry>	0.0544402
http://www.disit.org/km4city/resource/PM2143	"STAZIONE GALLERIA"	"POINT(11.248156 43.775944)""-<http://www.openlinksw.com/schemas/virtmf#Geoometry>	0.0648533
http://www.disit.org/km4city/resource/PM1898	"STAZIONE VALFONDA"	"POINT(11.248416 43.777191)""-<http://www.openlinksw.com/schemas/virtmf#Geoometry>	0.0768214
http://www.disit.org/km4city/resource/PM0452	"STAZIONE LARGO ALINARI"	"POINT(11.249519 43.776512)""-<http://www.openlinksw.com/schemas/virtmf#Geoometry>	0.0898297
http://www.disit.org/km4city/resource/PM0313	"STAZIONE PARCHEGGIO"	"POINT(11.249316 43.775997)""-<http://www.openlinksw.com/schemas/virtmf#Geoometry>	0.0923469

<http://servicemap.disit.org/WebAppGrafo/sparql?query=...&format=JSON>

```

{
  "head": {
    "vars": [
      "s", "l", "geo", "dist"
    ]
  },
  "results": {
    "distinct": false,
    "ordered": true,
    "bindings": [
      {
        "s": {
          "type": "uri",
          "value": "http://www.disit.org/km4city/resource/PM0022"
        },
        "l": {
          "type": "literal",
          "value": "STAZIONE PENSIлина"
        },
        "geo": {
          "type": "literal",
          "value": "POINT(11.249077 43.776466)""-<http://www.openlinksw.com/schemas/virtmf#Geoometry>"
        },
        "dist": {
          "type": "literal",
          "value": "0.0544402"
        }
      }
    ]
  }
}
  
```


RDF Triples generated

Macro Class	Static Triples	Reconciliation Triples	Real Time Triples Loaded	Total on 1.5 months
Administration	2.431	0	--	2.431
Metadata of DataSets	416	0	--	416
Point of Interest (35.273 POIs in Tuscany)	471.657	34.392	--	506.049
Street-guide (in Tuscany)	68.985.026	0	--	68.985.026
Local Public Transport (<5 lines of FI)	644.405	2.385	135.952 per line per day, to be filtered, read every 30 s, they respond in minutes	(static) 646.790
Sensors (<201 road sensors, 63 scheduled every two hours)	--	4.240	102 per sensor per read, every 2 hours, they are very slow in responding	51.111.078
Parking (<44 parkings, 12 scheduled every 30min)	--	1.240	7920 per park per day, 3 read per hour, they respond in seconds	
Meto (286 municipalities, all scheduled every 6 hours)	--	--	185 per location per update, 1-2 updates per day	
Temporal events, time stamp	--	--	6 for each event	1.715.105
Total	70.103.935	42.257		122.966.893



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From Data to Services for the Sentient Cities

Open Source and inter-operable tools to

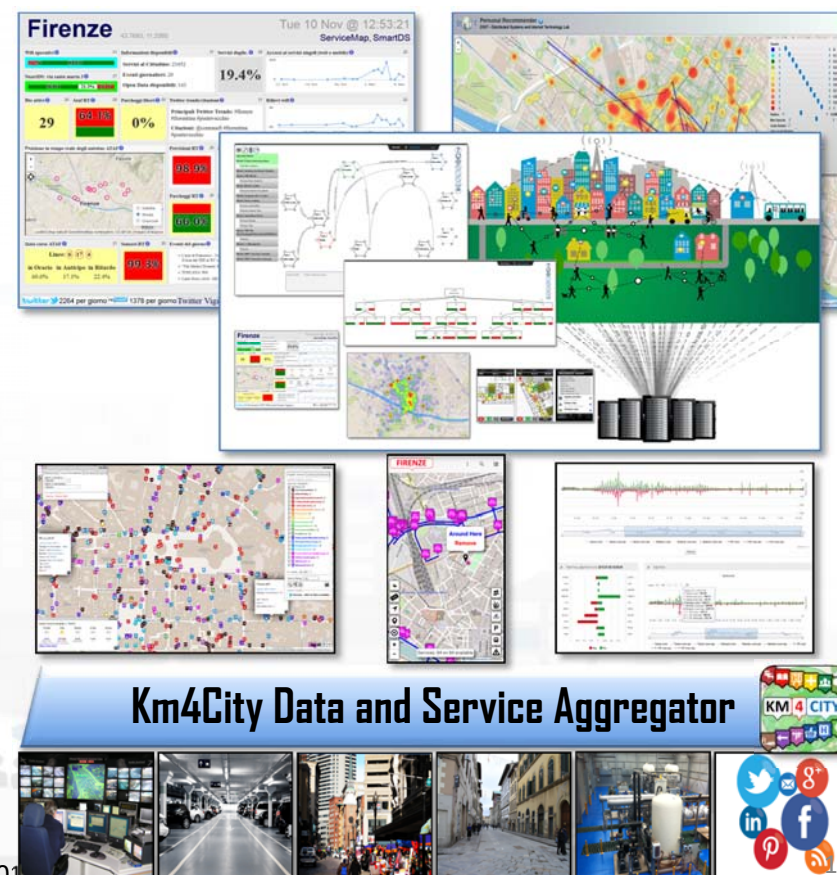
1. keep city under control via personalized dashboards

- transform data in value for the city,
- influence city users

2. Technical details:

- dashboard development
- data aggregation
- **Projects contributing**

3. improve city resilience, reducing risks and decision support



Info and Docs



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

Km4City Information, Documentation, Tutorial, Training

--	--	--	--	--	--	--	--	--	--	--

www.Km4City.org



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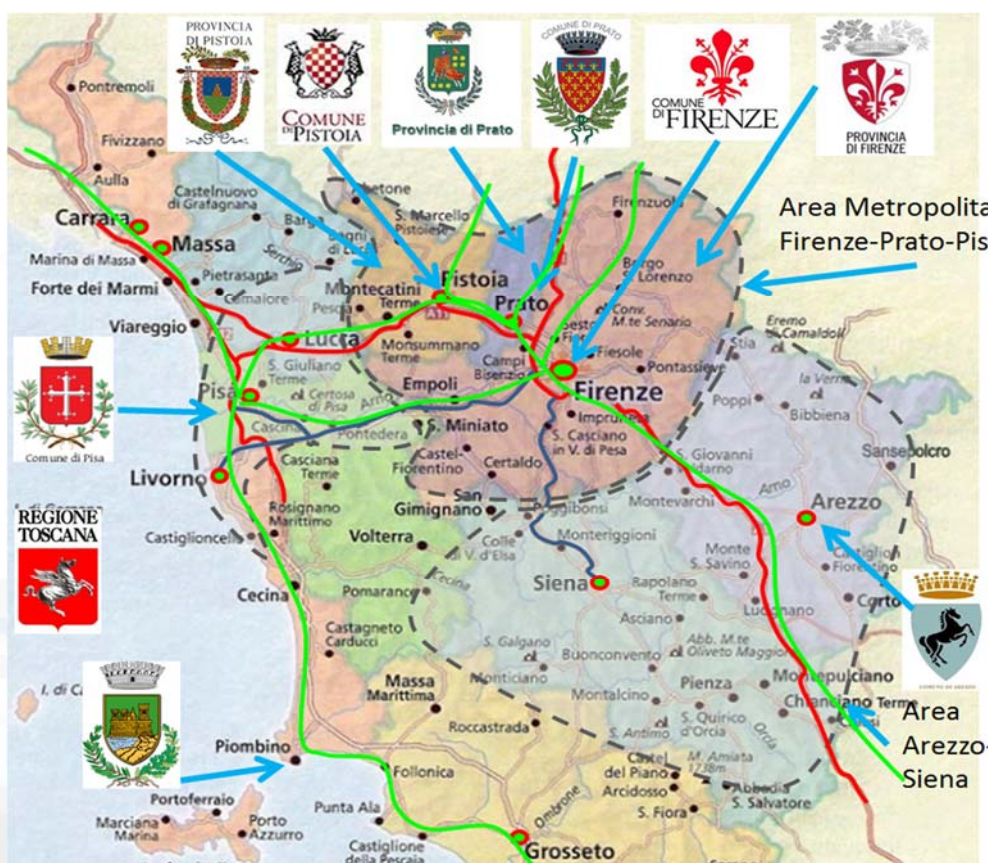
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Sii-Mobility



- 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>



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

*ECM; Swarco Mizar;
 Inveni 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



Commenti dei cittadini,
Social Media



AVM trasporto
Pubblico



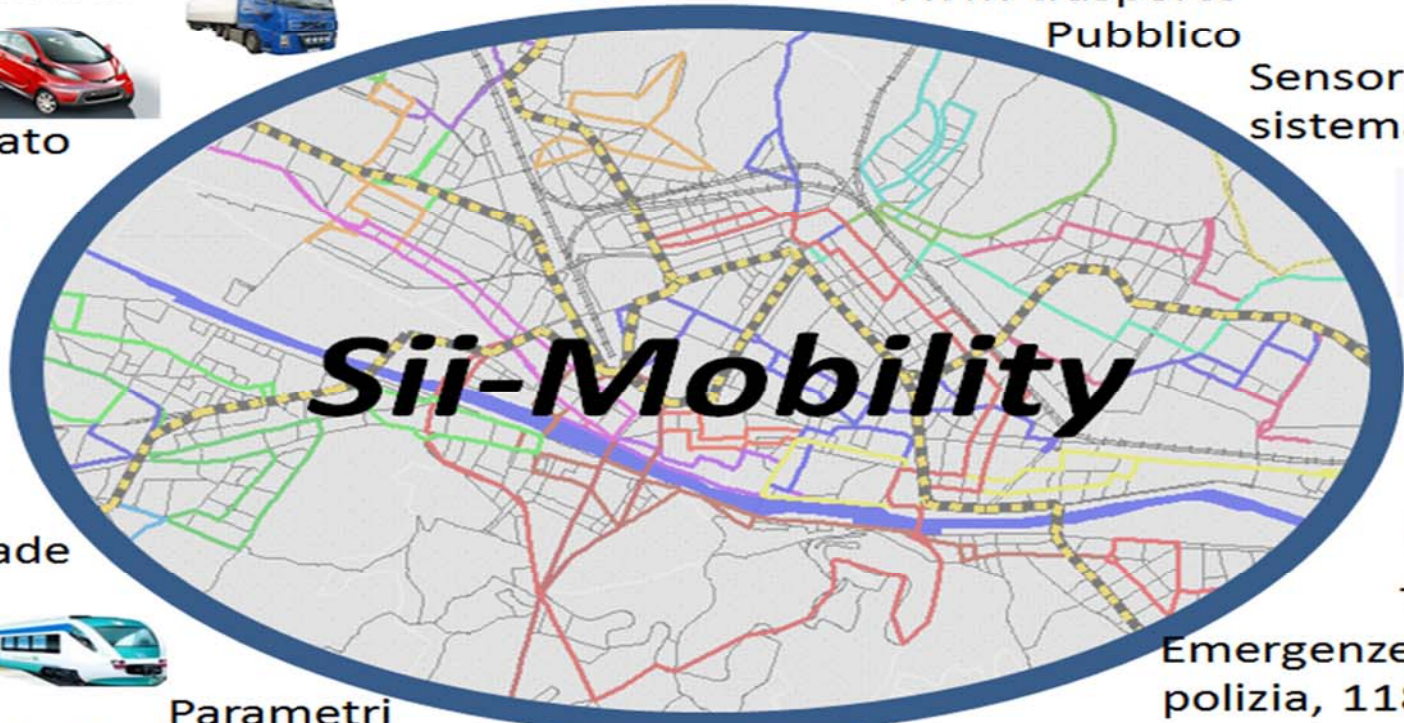
Sensori,
sistema monitoraggio

Merci



Sensori su
trasporto Privato

Sensori
Parcheggi



UTC



Infomobility



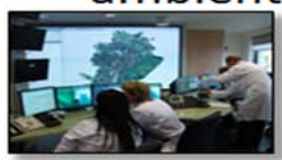
Varchi
Telematici, ZTL

Monitoraggio
traffico, autostrade



Rete
Ferroviaria

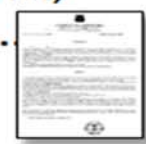
Parametri
ambientali



Servizi ed
enti



Ordinanze: eventi,
lavori pubblici, .



Emergenze,
polizia, 118





General Objectives



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



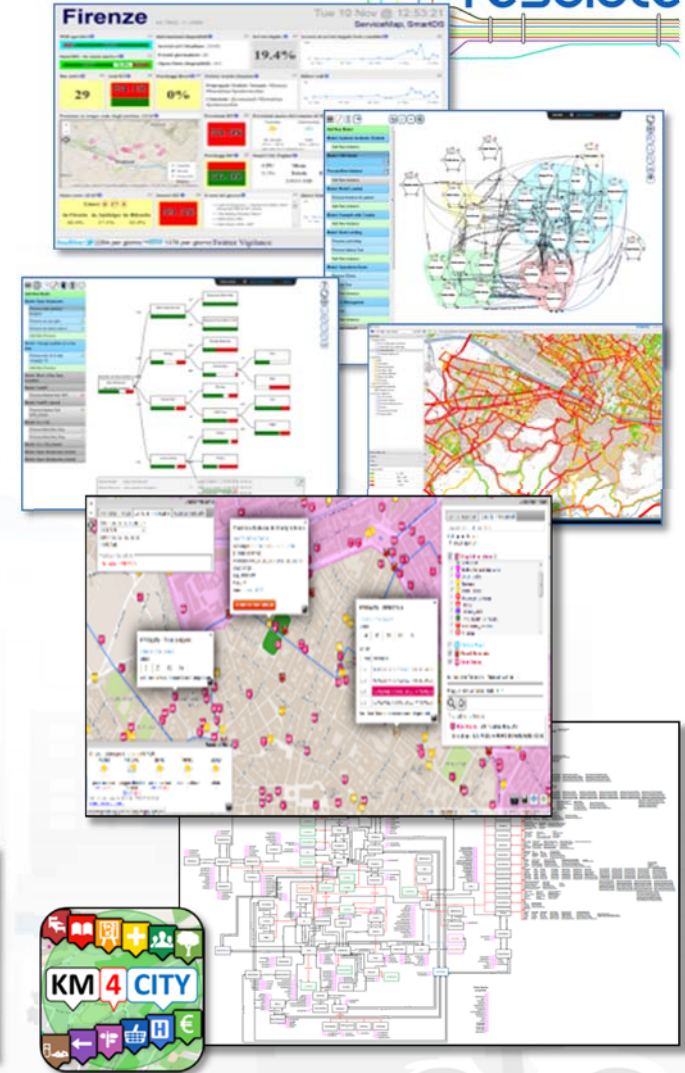
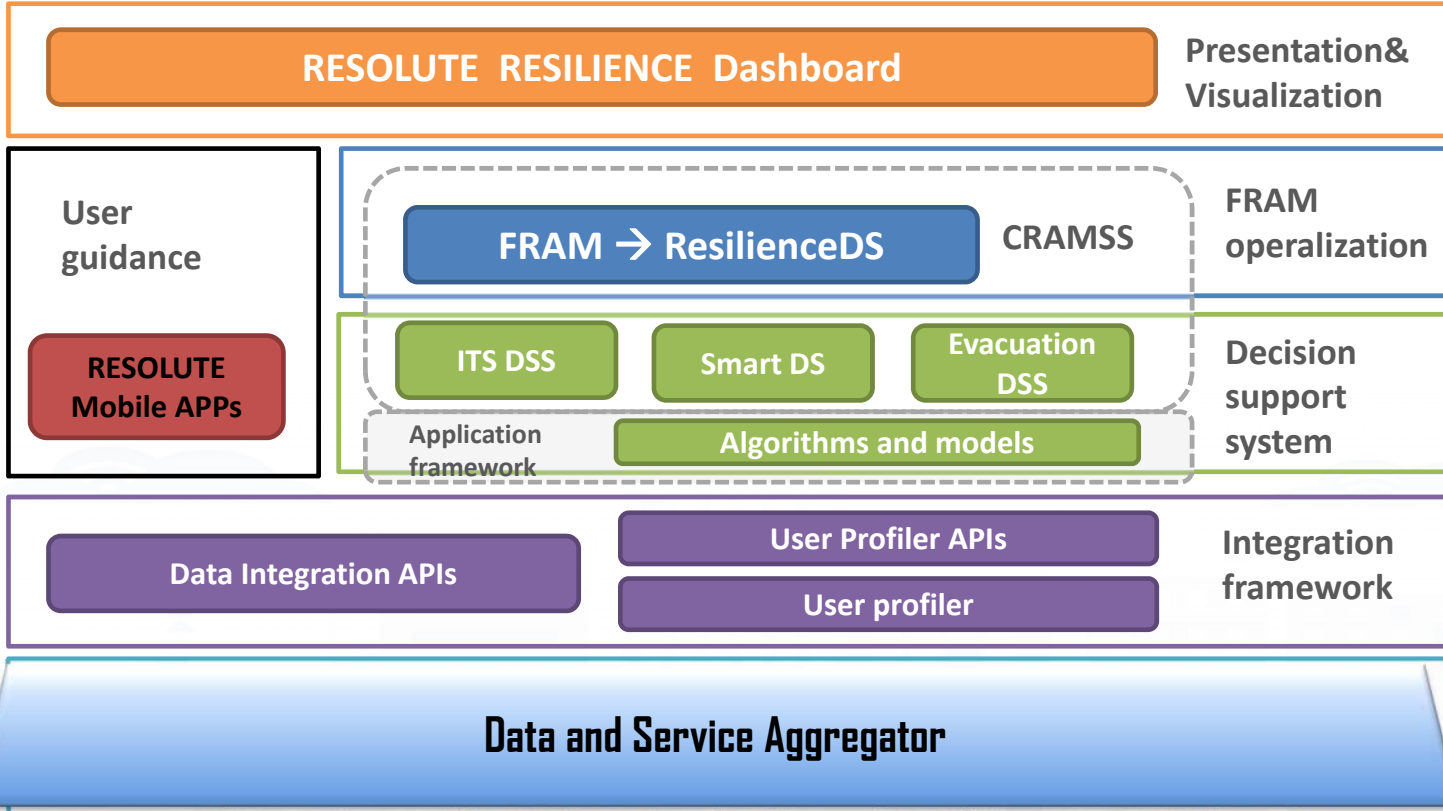
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European Union Funding
for Research & Innovation

<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
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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
<i>Consorzio Milano Ricerche</i>	CMR	IT

RESOLUTE Architecture





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European Union Funding
for Research & Innovation



- 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
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- 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 FIRENZE UNIFI ITALY: DINFO.DiSIT Lab and DIF
- 21 THALES ITALIA, SPA THALES ITALY
- 22 ZABALA INNOVATION CONSULTING ZABALA SPAIN
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- 24 UNIVERSITY OF BRISTOL UOB UNITED KINGDOM
- 25 UNIVERSITY OF OXFORD UOXF UNITED KINGDOM
- 26 BRISTOL IS OPEN, LTD BIO UNITED KINGDOM
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- 28 KNOWLE WEST MEDIA CENTRE, LGB KWMC UNITED KINGDOM
- 29 TOSHIBA RESEARCH EUROPE, LTD TREL UNITED KINGDOM
- 30 ROUTE MONKEY, LTD ROUTE MONKEY UNITED KINGDOM
- 31 ESOTERIX SYSTEMS, LTD ESOTERIX UNITED KINGDOM
- 32 NEC LABORATORIES EUROPE, LTD NEC UNITED KINGDOM
- 33 COMMONWHEELS CAR CLUB CIC CO-WHEELS UNITED KINGDOM
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- 35 ESADE BUSINESS SCHOOL ESADE SPAIN
- 36 SISTELEC SOLUCIONES DE TELECOMUNICACION, S.L. SISTELEC SPAIN



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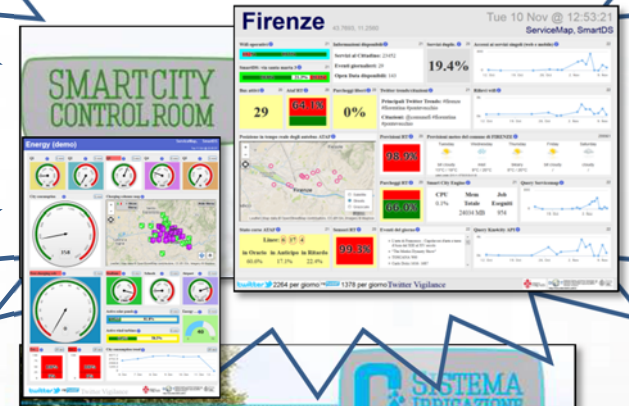
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REPLICATE in Firenze: Energy, ICT & Mobility



... n, November 2016



Governing the smart city: a governance-centred approach to Smart urbanism – GHOST



General Objectives

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

Partners:

University of Cagliari (Coordinator) DICAAR and DMI

University of Florence SAGAS and DISIT

University of Turin ESOMAS

University of Sassari DADU

Under the patronage of the Municipality of Cagliari



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

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



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Km4City Roadmap



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>

2014

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

2015

Km4City 1.4

- Embed
- More API
- iBeacon

RESilience management guidelines and Operationalization appLied to Urban Transport Environment

Km4City 1.5

- SmartDS
- Km4City App

RESOLWTE H2020
2015-2018 - Started

<http://www.sii-mobility.org>

Sii-Mobility SCN
2016-2018 - Started
Km4City 1.6.2

2016

REPLICATE H2020
2016-2021- Started

REPLICATE
RÉnaissance of Places with Innovative Citizenship And TEchnology

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

12/2017

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

6/2017

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

Today

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

GHOST SIR
2016-2019 - Started

GHOST
Governing the smart city: a governance system approach to Smart Urbanism

An aerial photograph of a city at sunset. The sky is a mix of orange, red, and purple. In the foreground, a river flows through the city, reflecting the lights. The city is densely packed with buildings, many of which are illuminated. A large, prominent dome is visible in the center-right. In the background, there are mountains under the twilight sky.

**3 - improve city
resilience,
reducing risks and
decision support**



From Data to Services for the Sentient Cities

Open Source and inter-operable tools to

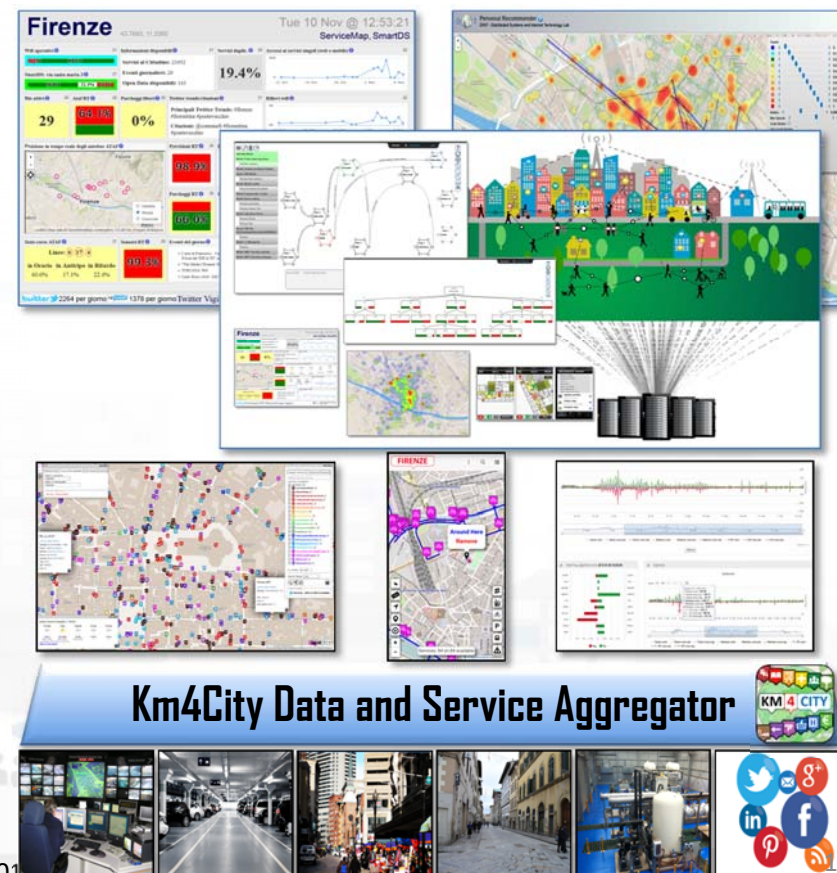
1. keep city under control via personalized dashboards

- transform data in value for the city,
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2. Technical details:

- dashboard development
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- Projects contributing

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Sentient City Control Room



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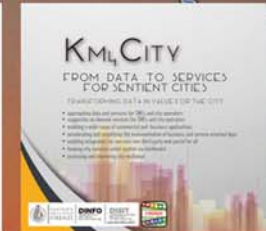
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Real Time Monitoring Tools for Control Room Dashboards

Real Time Control Room Dashboard ⓘ	Monitoring City Users by Wi-Fi (*) ⓘ	Monitoring City Users Behaviour via Mobile App (*) ⓘ	Monitoring Real Time Data on 3D (*) ⓘ	Monitoring Parking Areas Status in Florence (*) ⓘ	Monitoring Traffic 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

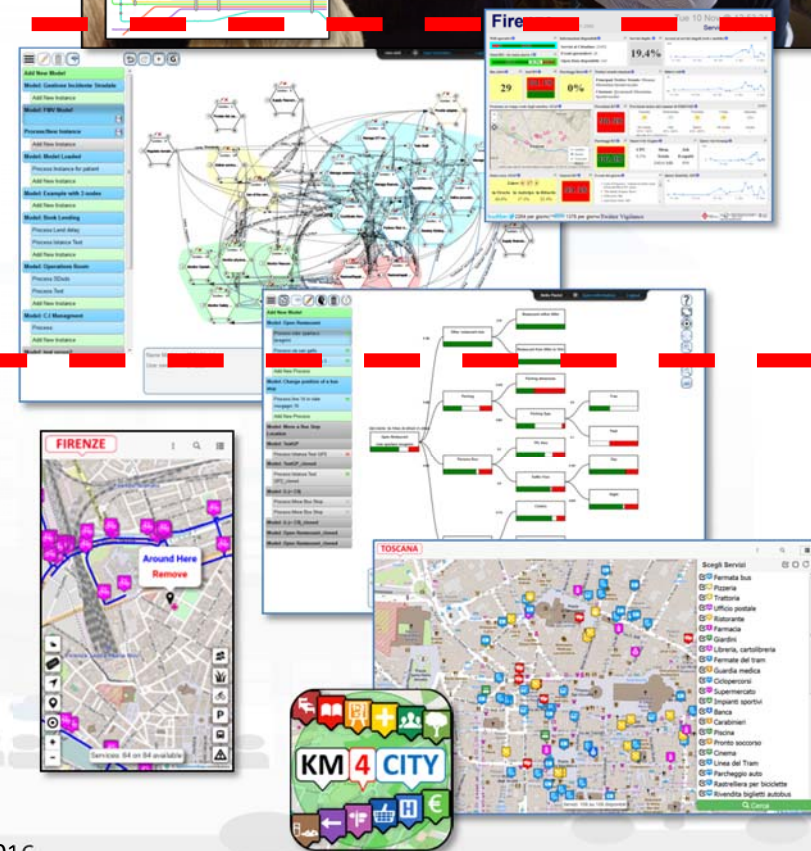
City Resilience Decision Support System, ResilienceDS (*) ⓘ	City Risk & Vulnerability Analysis Tool ⓘ	Assessing and Analysing Wi-Fi Coverage (*) ⓘ	Origin Destination Matrix by Wi-Fi data (*) ⓘ	City Users Recency and Frequency by Wi-Fi data (*) ⓘ	City Users Origin Destination Matrix via Mobile App (*) ⓘ	Heatmaps and Trajectories of City Users Tourists (*) ⓘ	Analysing City Users' Behavior (*) ⓘ	Social Media Twitter Vigilance (*) ⓘ	Twitter Data Analysis Tool (*) ⓘ
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www.Km4City.org

Smart City Control Room System, November 2016

Improve city resilience, reducing risks and decision support

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





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<http://www.disit.org>

Problems and issues

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





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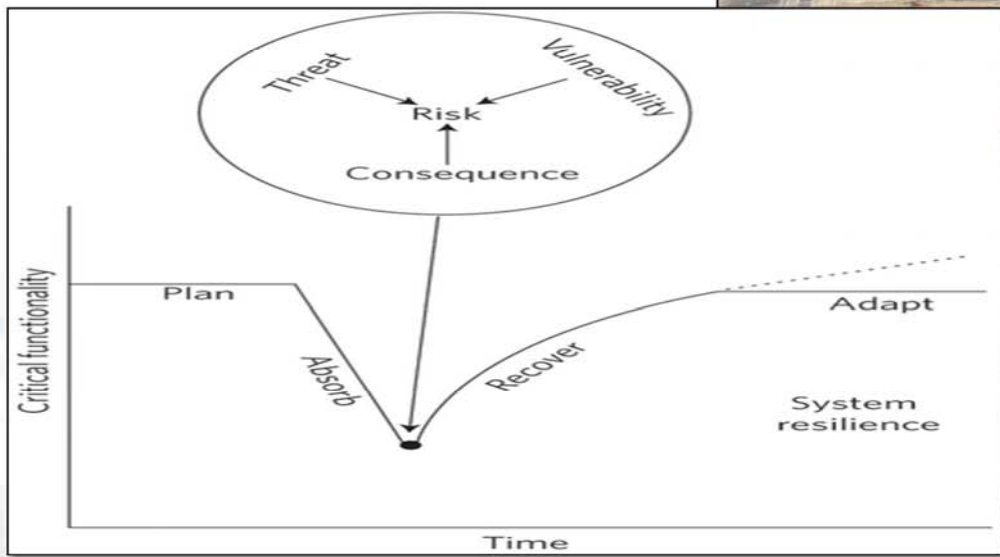
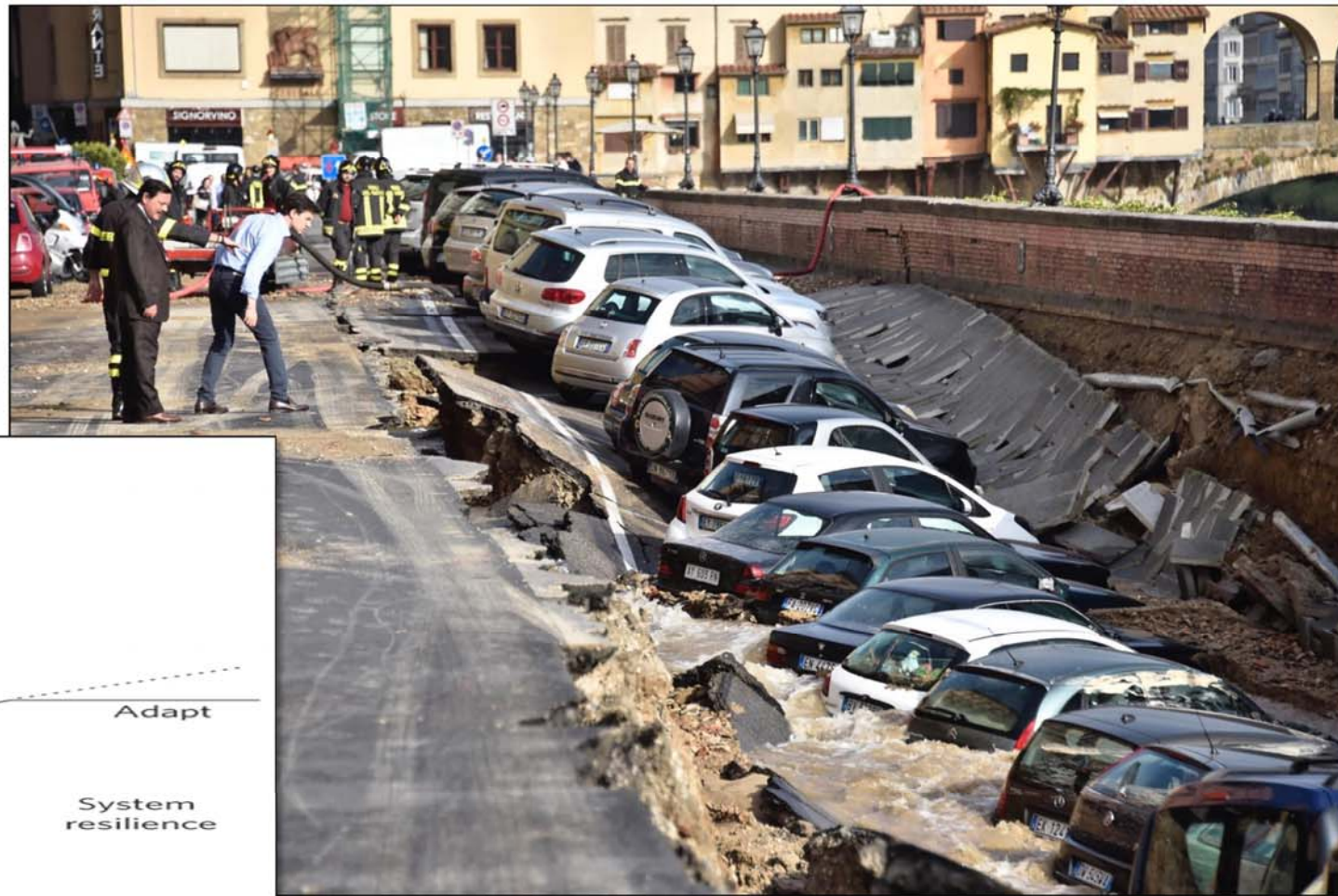
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City Resilience



Prepare
Absorb
Recover
Adapt





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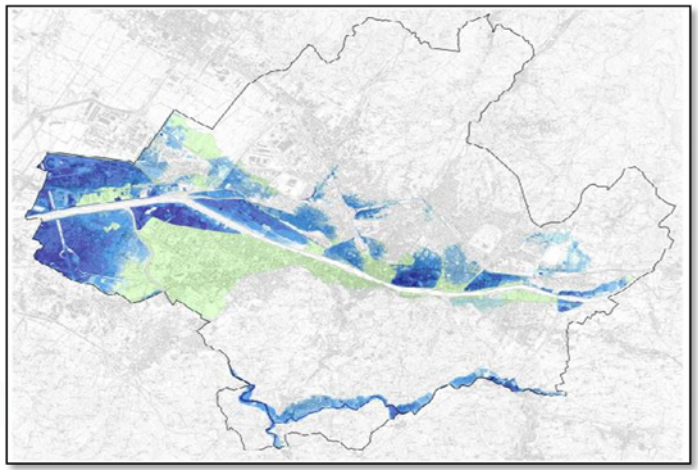
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City Resilience ERMG



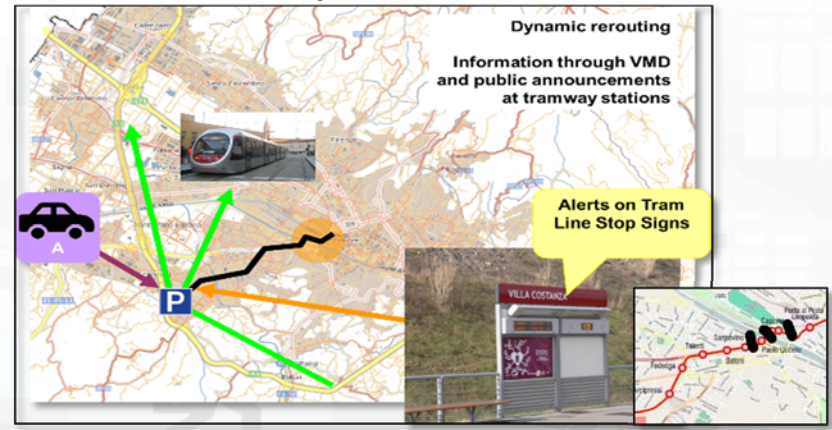
200 years probability Arno flooding



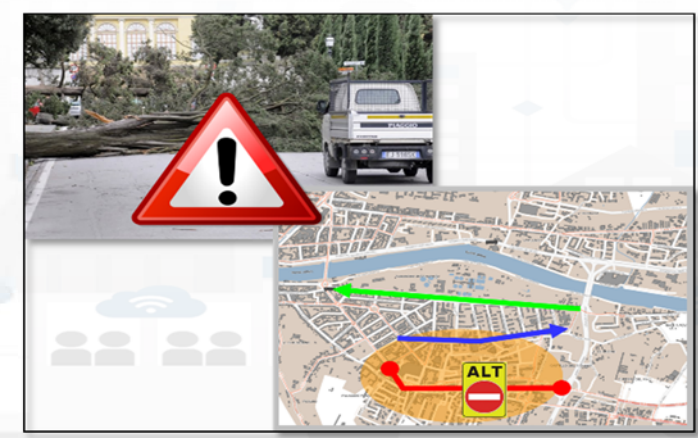
30 years probability Arno flooding



Arno Flood Impact on Tram Line & Traffic



Water bomb in South Florence



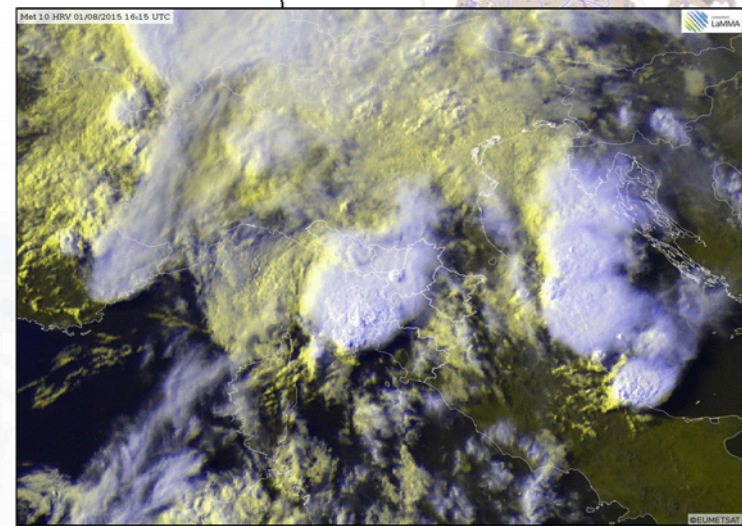
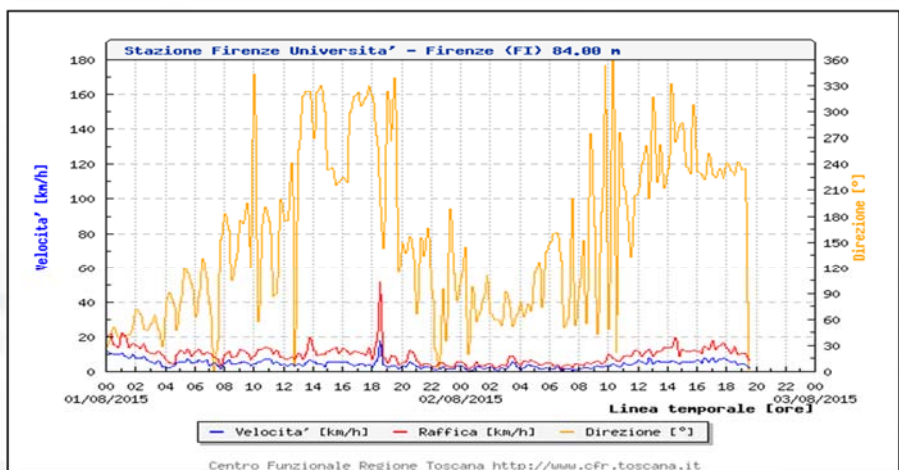
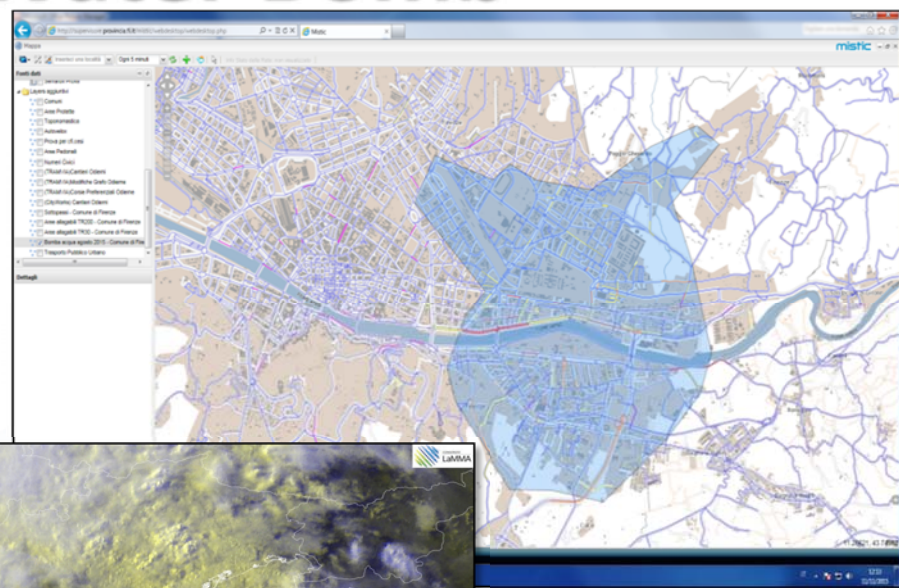
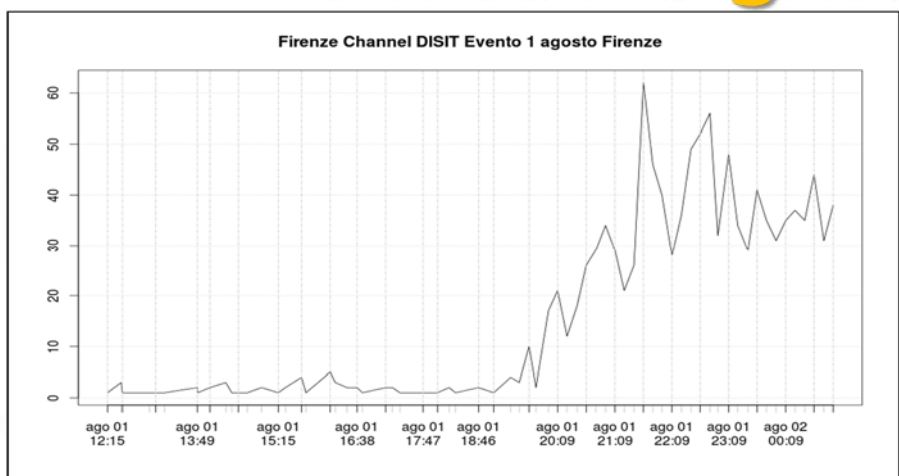


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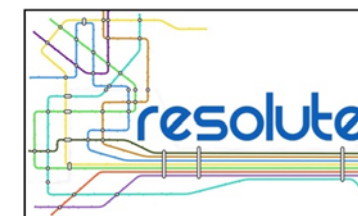
Early Warning Twitter Vigilance and Water Bomb



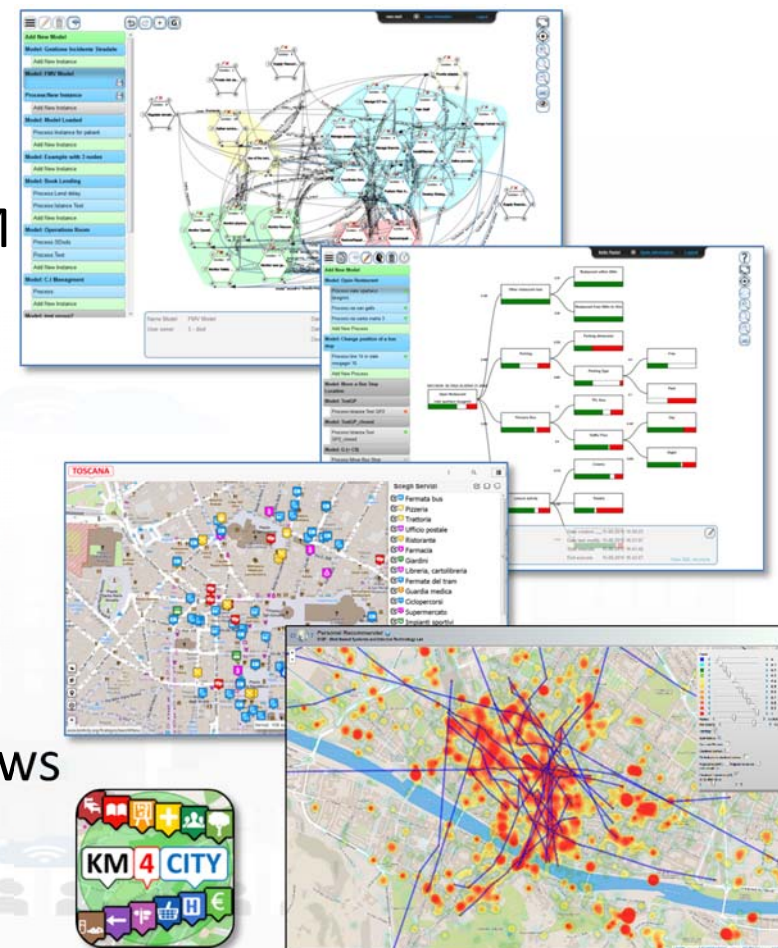
Twitter Vigilance

Km4City Smart City Ecosystem, November 2016

Main Approach



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





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Dashboarding city resilience

Firenze 43,7693, 11,2580 Tue 10 Nov @ 12:53:21 ServiceMap, SmartDS

Informazioni disponibili: Servizi al Cittadino: 23452
 Eventi giornalieri: 20
 Open Data disponibili: 143

29 **64.1%** %

Posizione in tempo reale degli autobus ATAF

98.9%

66.0%

99.3%

in Orario in Attesa in Ritardo
 60.6% 17.1% 22.4%

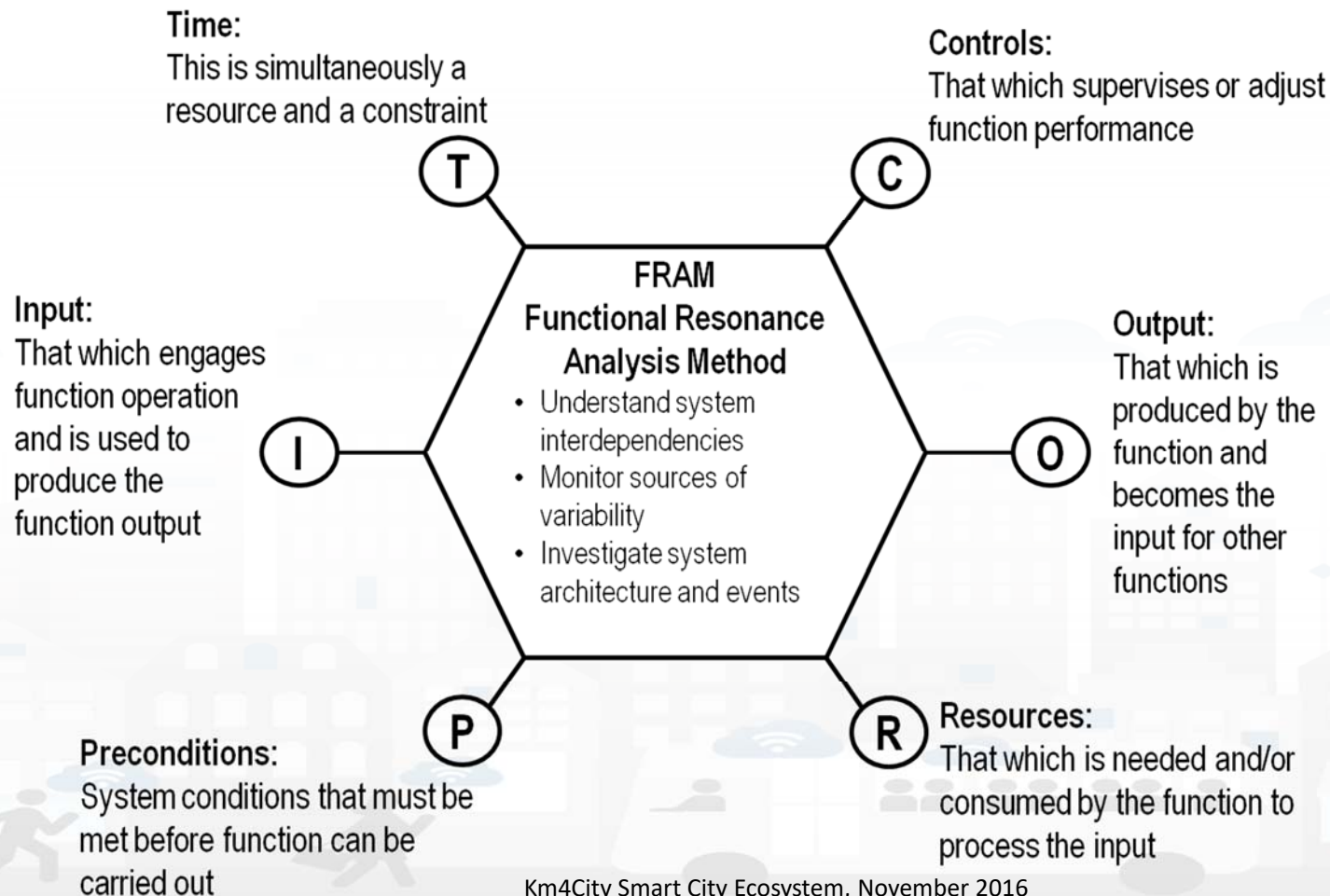
2264 per giorno 1378 per giorno Twitter Vigila

Data and Service Aggregator

resolute

er 2016

Functional Resonance Analysis Method



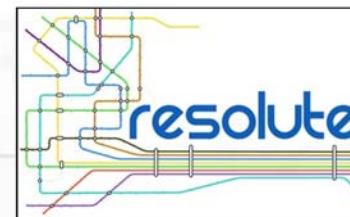
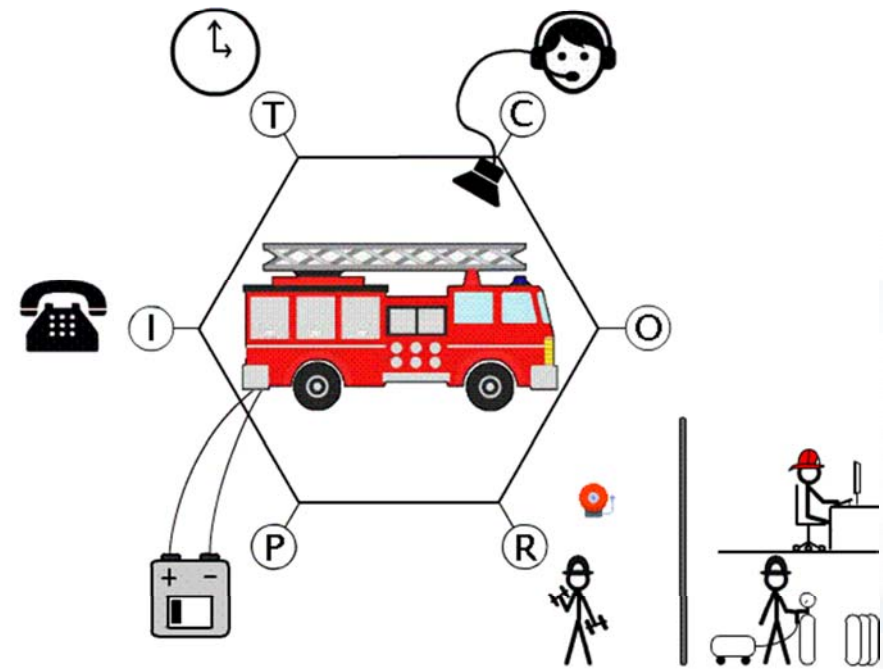
- Success and failure are equivalent in the sense that they both emerge from performance variability.
- Variability, intended as a way for people to adjust tools and procedures to match operating conditions.
- Emergence of either success or failure is due to unexpected combination of variability from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

Functional Resonance Analysis Method

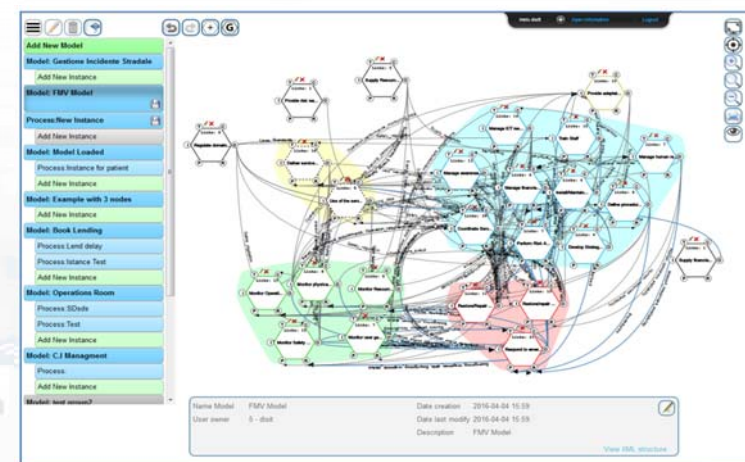
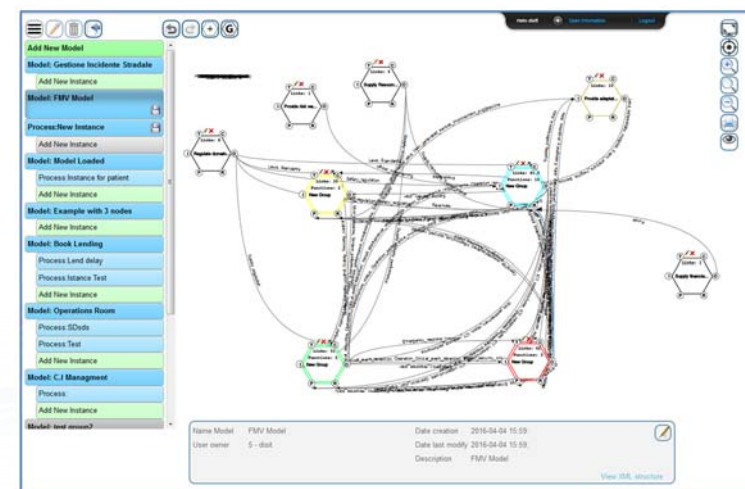


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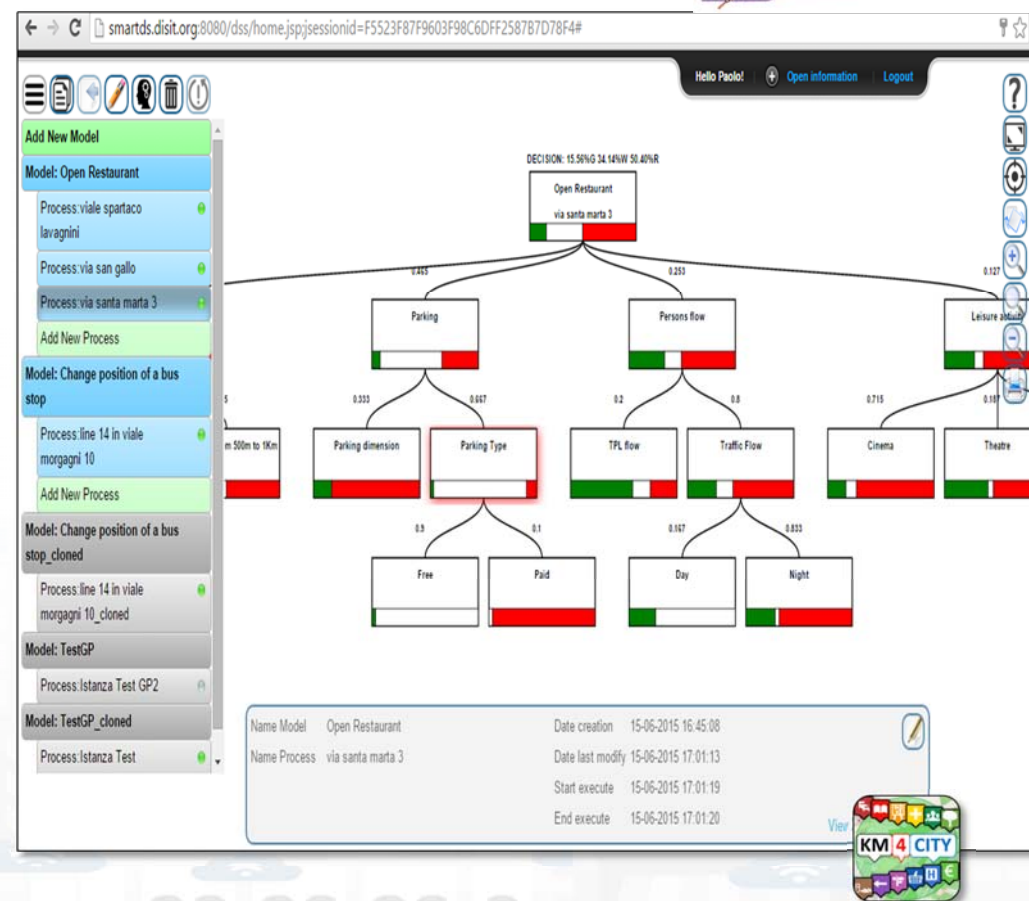
Functional Resonance Analysis Method



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



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





Smart Decision Support



Hello Paolo! [Open information](#) [Logout](#)

Open Restaurant
via san gallo

Insert Italian Flag value or Logic Functions

Favor probability: Neutral Probability: Contrary probability:

Insert repository for SPARQL query

Logic Function 1

Insert query Sparql

result query: Less (<) threshold:

Logic Function 2

Insert query Sparql

result query: Less (<) threshold:

Logic Function Manager

Logic Function 1

Favor probability: Neutral Probability: Contrary probability:

true value: false value:

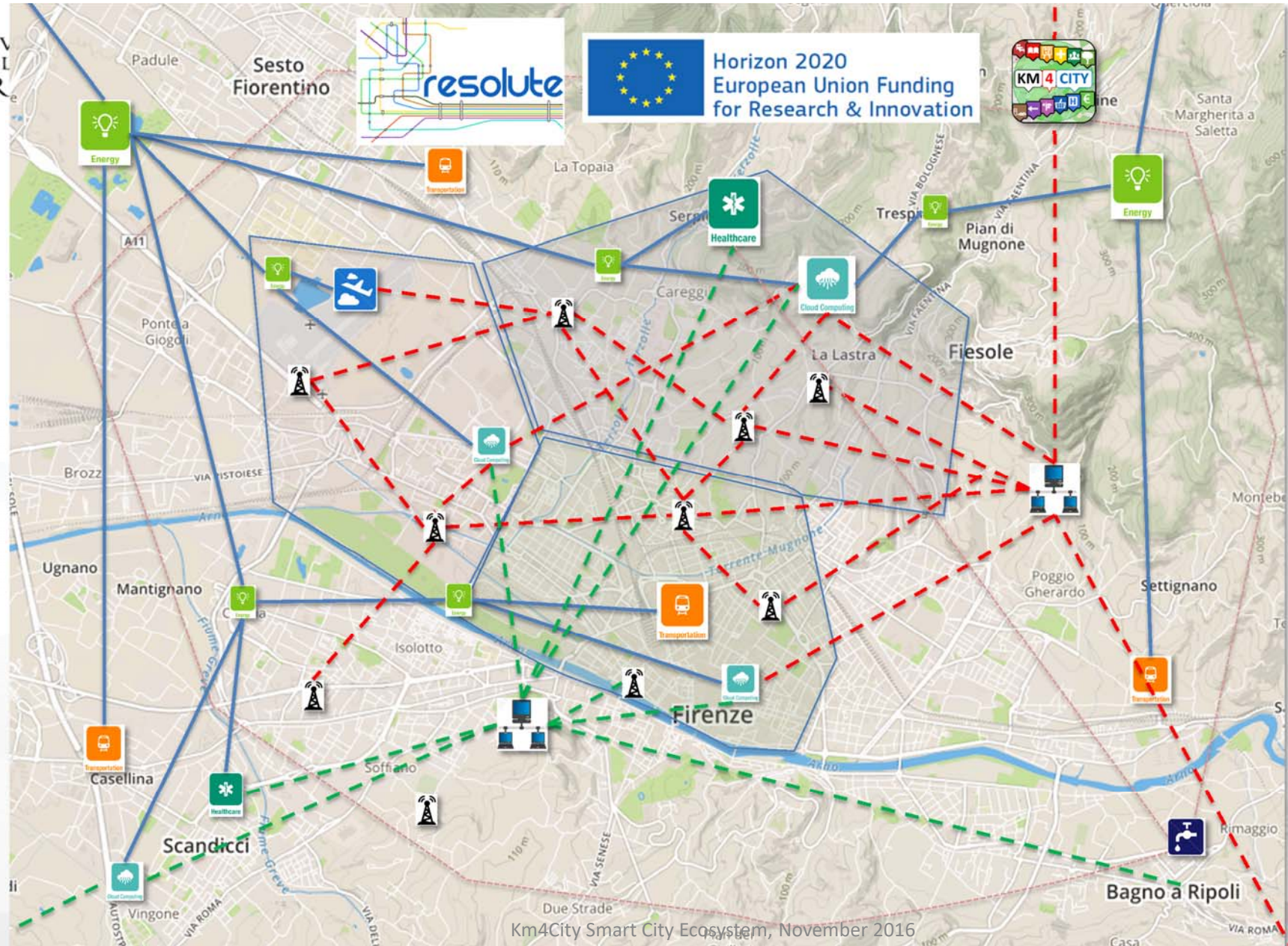
Name Model: Open Restaurant Date creation: 15-06-2015 16:32:26
 Name Process: via san gallo Date last modify: 15-06-2015 16:39:03
 Start execute: 15-06-2015 16:39:16
 End execute: 15-06-2015 16:40:17 [View XML structure](#)



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Horizon 2020
European Union Funding
for Research & Innovation



Km4City Smart City Ecosystem, November 2016



Risk Assessment



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

Aerial with labels

Flood sensors observations:

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

Threshold:

From:

To:

Draw region to analyze: On

Load predefined region:

Mean precipitation:

SERVICE

NAME: villa maria teresa hospital...

ADDRESS: VIA DELLA CERNAIA, 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/77ab1bc45b84357b727d67fe6081d2db>

VALUE: 100

WKT DESCRIPTION: POINT (11.2561 43.7866)

Traffic observations:

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

Relevant Services

Min asset value:

<input checked="" type="checkbox"/>	Service	Street	Type	Value
<input checked="" type="checkbox"/>	villa delle terme case di cura	VIALE MAZZINI GIUSEPPE, FIRENZE	Public_hospital	100
<input checked="" type="checkbox"/>	villa dei pini srl	VIA FOSCOLO UGO, FIRENZE	Public_hospital	100
<input checked="" type="checkbox"/>	Poggio Secco	VIA INCONTRI, FIRENZE	Public_hospital	100

Assessing Risk

- hydraulic
- Seismic



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
- Km4City...many other sensors ... see next slide

The screenshot shows the KM4CITY web application interface. At the top, there is a search menu with options like 'Fermate Firenze', 'Comuni in Toscana', and 'Ricerca Testuale'. Below this, there are dropdown menus for selecting a province (currently 'FIRENZE') and a commune (currently 'FIRENZE'). The main area is a map of Florence, Italy, densely populated with colorful icons representing various services and points of interest. At the bottom left, there is a weather forecast section for the commune of Firenze, showing conditions for the next five days (Tuesday to Saturday) with icons and temperature ranges.

The screenshot shows the search results panel of the KM4CITY web application. It features a search bar at the top with the text 'search text into service'. Below the search bar, there are two tabs: 'Servizi Regolari' and 'Servizi Trasversali'. A list of service categories is displayed, each with a checkmark and a plus sign, indicating that all services are selected. The categories include: Accommodation, Advertising, AgricultureAndLivestock, CivilAndEdilEngineering, CulturalActivity, EducationAndResearch, Emergency, Entertainment, Environment, FinancialService, GovernmentOffice, HealthCare, IndustryAndManufacturing, MiningAndQuarrying, ShoppingAndService, TourismService, TransferServiceAndRenting, UtilitiesAndSupply, Wholesale, and WineAndFood. At the bottom of the panel, it shows the number of results: 'più di 4000 risultati, attivato clustering' and 'Services 16858'.

<http://servicemap.km4city.org>



Other Sensors and Actuators, IOT

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



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





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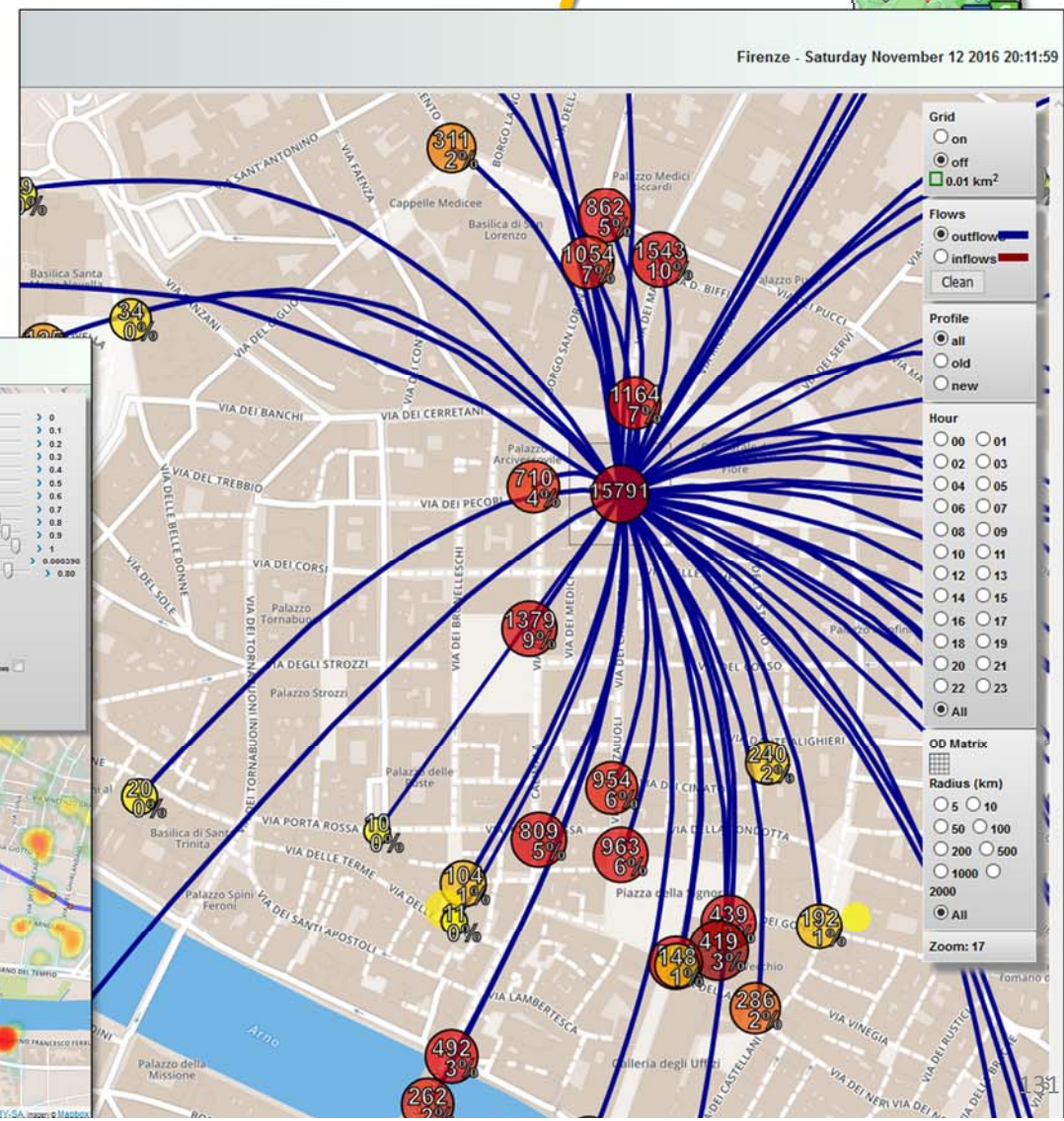
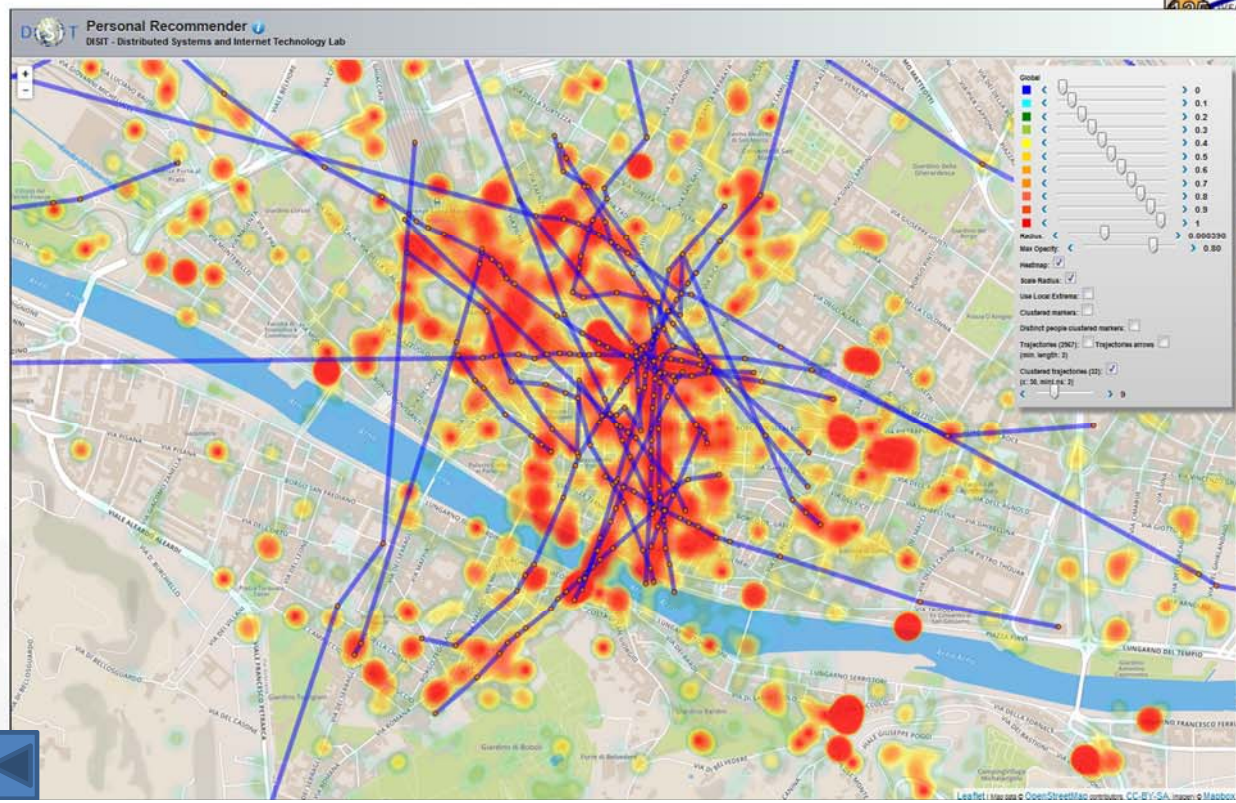
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User Behavior Analyzer



- Heat maps
- Trajectories
- OD matrixes





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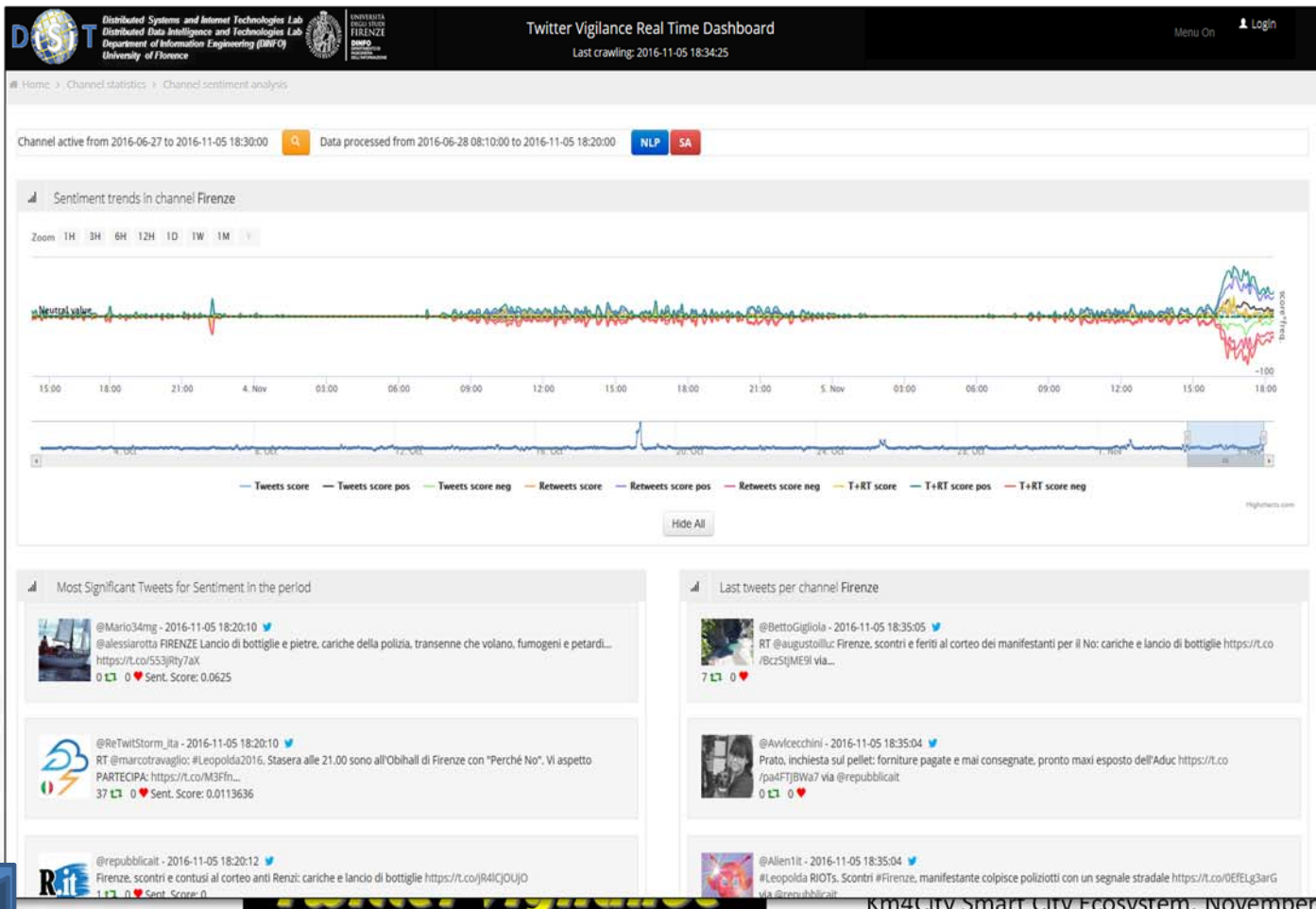
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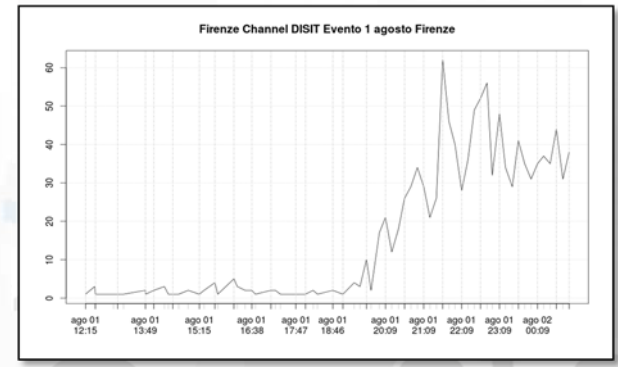
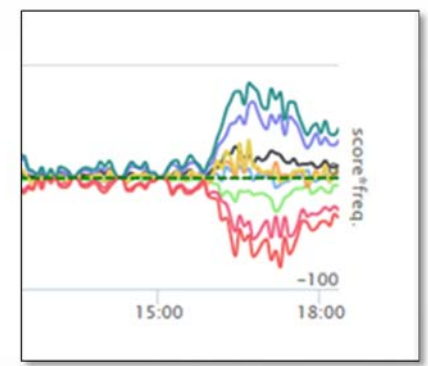
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Twitter Vigilance

Real Time Twitter Vigilance, Early Warning

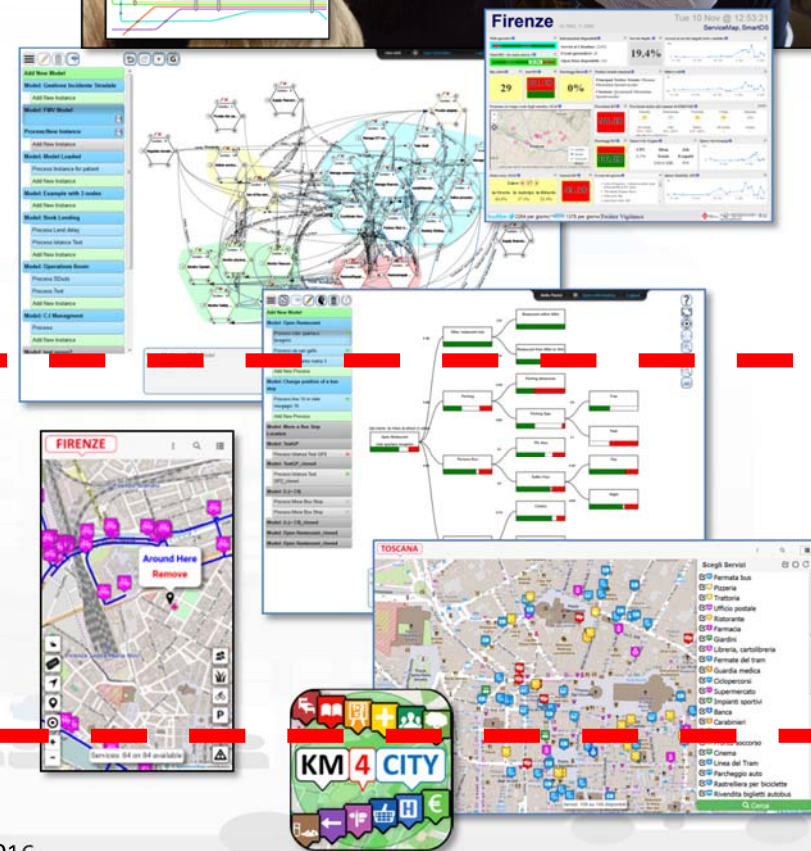


Sentiment Analysis



Improve city resilience, reducing risks and decision support

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



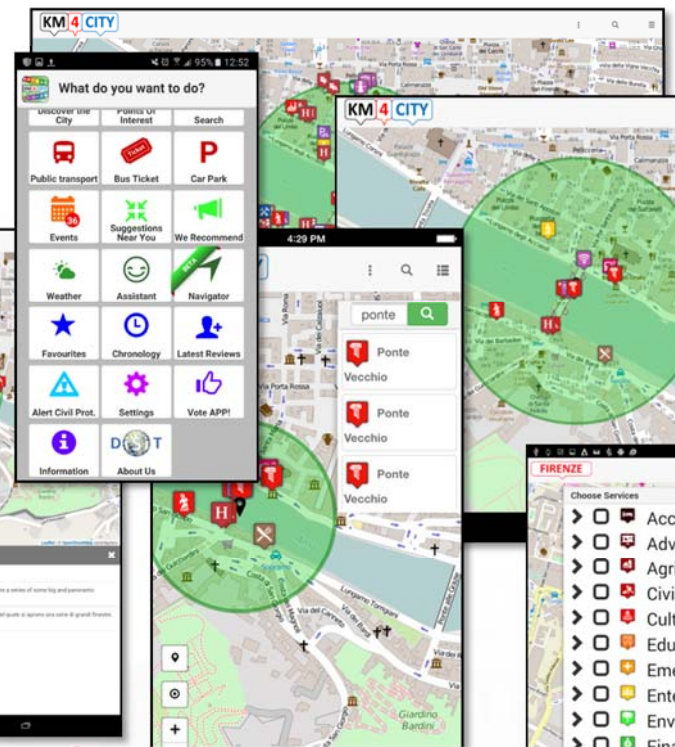


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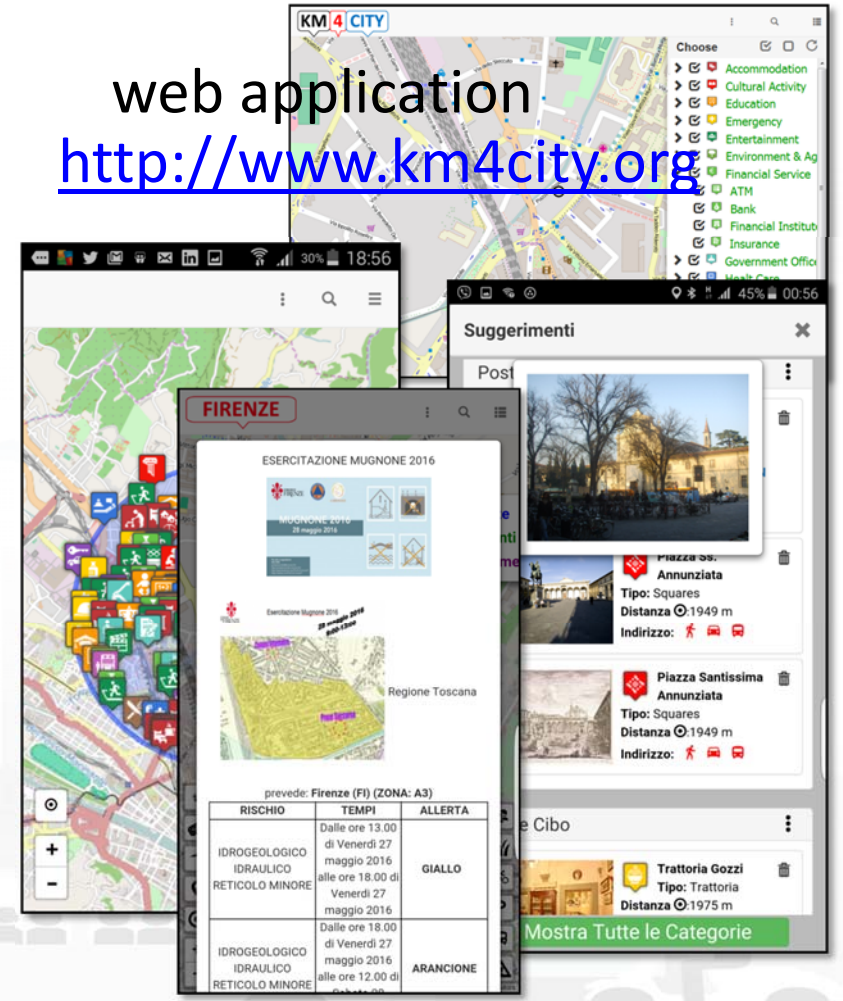
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Km4CityMobile App



web application
<http://www.km4city.org>





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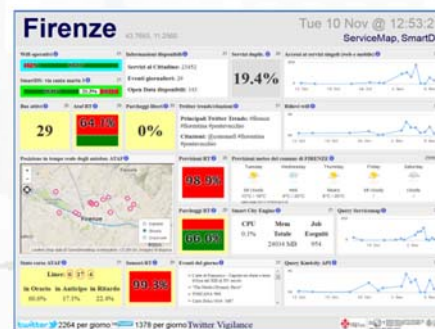
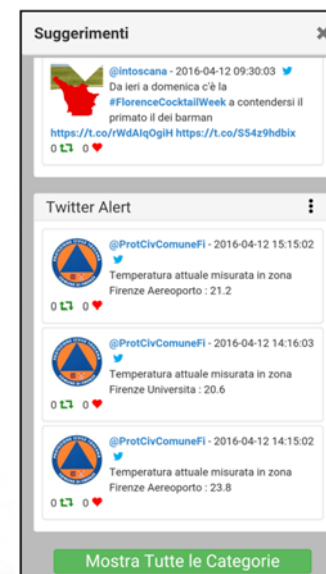
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Mobile Emergency



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





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Km4City



For a Sentient City

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

Paolo Nesi, paolo.nesi@unifi.it

