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

REPLICATE

Horizon 2020 European Union Funding for Research & Innovation

Integrated Infrastructure for Urban Platform in Florence

Paolo Nesi, paolo.nesi@unifi.it
DISIT Lab, Http://www.disit.org
Http://www.km4city.org

BY NC ND
SOME RIGHTS RESERVED

REPLICATE

Città di FIRENZE

REPLICATE

REnaissance of PLaces with Innovative Citizenship And TEchnology

Horizon 2020 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

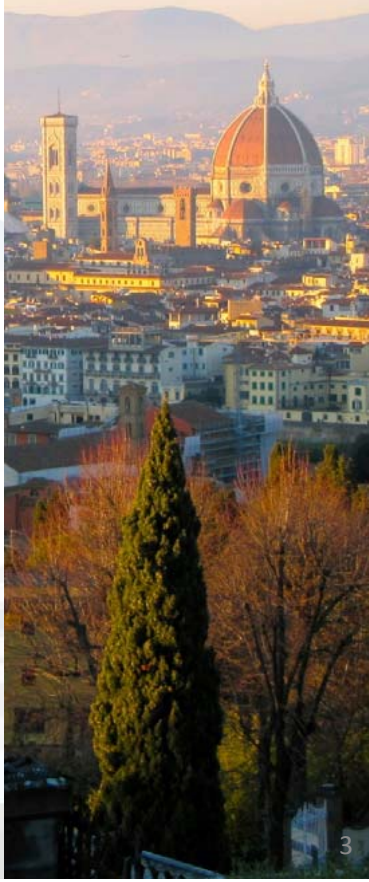
1 (coordinator) FOMENTO DE SAN SEBASTIAN FSS SPAIN
2 AYUNTAMIENTO DE SAN SEBASTIAN SAN SEBASTIAN SPAIN
3 COMUNE DI FLORENCE FLORENCE ITALY
4 BRISTOL COUNCIL BRISTOL UNITED KINGDOM
5 STADT ESSEN ESSEN GERMANY
6 NILUFER BELEDIYESI NILUFER TURKEY
7 VILLE DE LAUSANNE LAUSANNE SWITZERLAND
8 IKUSI ANGEL IGLESIAS,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

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

REPLICATE

Integrated Urban Platform

- **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,
  - big data analytics, ecc;
- **Perform integrated and unified data management and data analytics by a set of tools at service of city operators and city users, to**:
  - Control Room, Real Time Monitoring tools, ….
  - Perform predictions, reasoning, business intelligence, city users behavior analysis
- **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 punt in action any smart city solutions and services.



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

Horizon 2020 European Union Funding for Research & Innovation

REPLICATE

DISIT Lab actions for REPLICATE

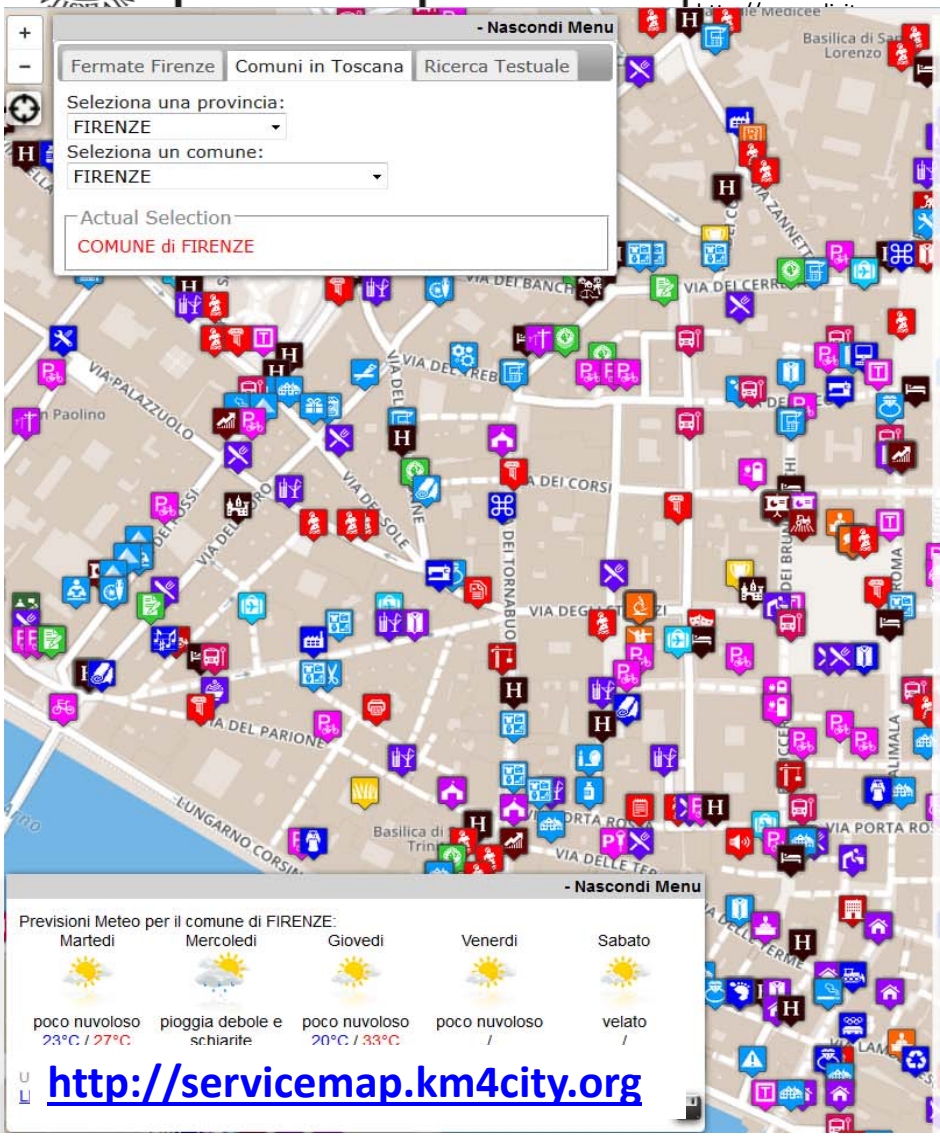
- **Integrated infrastructure: aggregation model and urban platform**
  - Adoption of Km4City solutions and tools as starting point
  - Improvements of Km4City ontology, by adding:
    - energy, sustainable mobility, dashboarding, urban services, IOT of several kind
  - Improving Smart City API, providing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

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

smart city expo WORLD CONGRESS

Stand: F680

KM 4 CITY



Road Graph (Tuscany region)

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

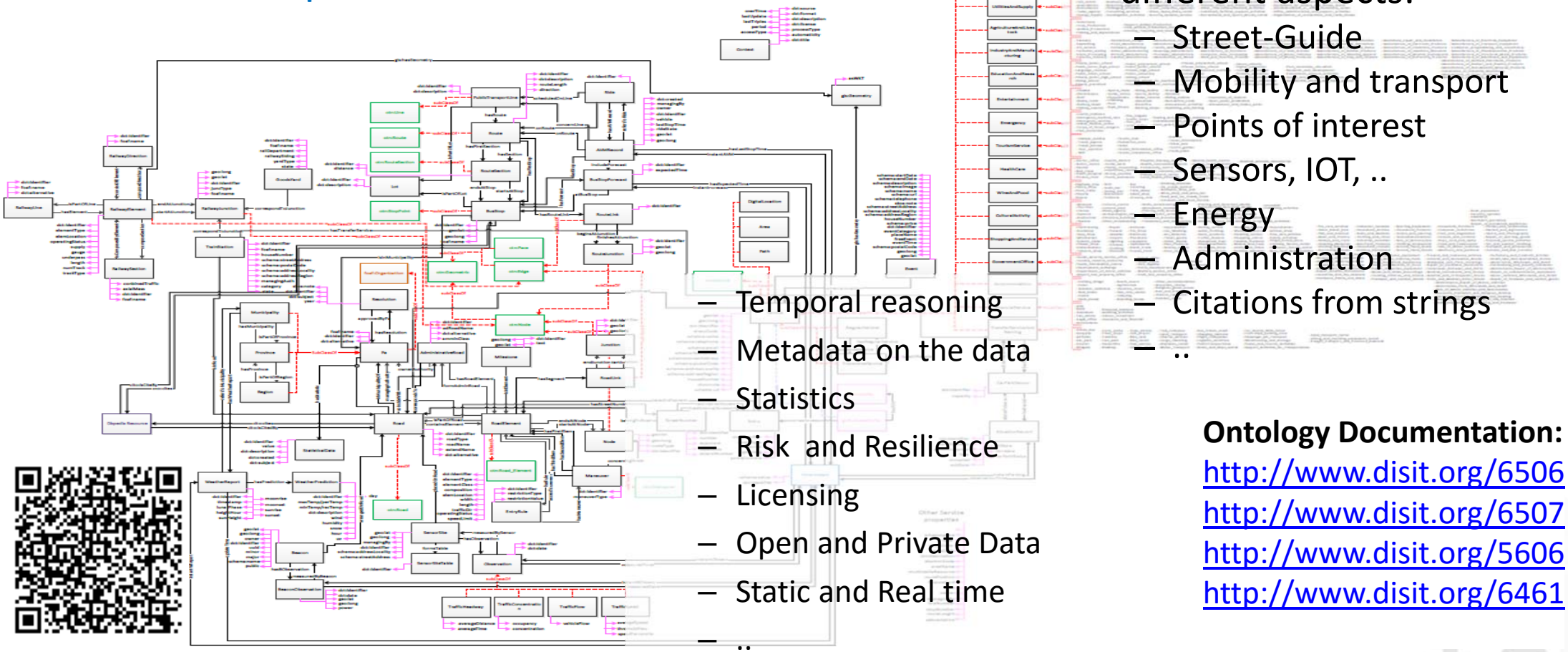
Services (20 cat, 512 cat.)
16 Pub. Transport Operators
21.280 Bus stops & 1081 bus lines
210 Parking areas
796 Traffic Sensors
Info on: points, paths, areas, etc.

Dynamic/real-time

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

Km4City Ontology – LOD, 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

Addition of 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

- **IOT**
  - **Smart light**
  - **Smart Waste**
  - **Smart bench**
- **Energy:**
  - **Recharge Stations**
  - **Home meters**
  - **Energy storage**
- **…..**

COMUNE DI FIRENZE

COMUNE DI FIRENZE

TIM

e-distribuzione

Transport systems
Mobility, parking

Public Services
Govern, events,

Sensors, IOT
Cameras, ..

Environment,
Water, energy

Shops, services,
operators

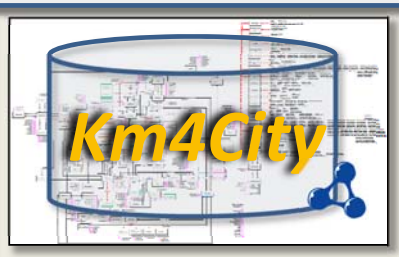
Social Media
WiFi, network

Twitter Vigilance

Static, Slow and Real Time data flows

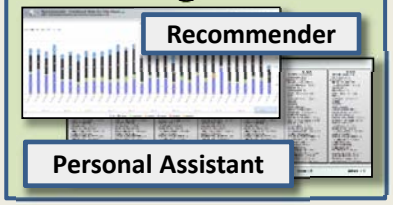
DISCES -- Distributed and parallel architecture on Cloud

Km4City Smart City Engine



Big Data Analytics

Smartening Tools



Development Tools

Km4City Smart City API

KM 4 CITY

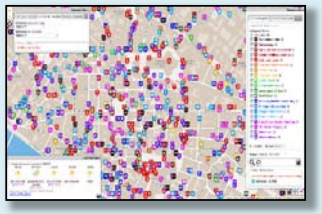
Http://www.km4city.org

Tools for City Operators and Decision Makers

Smart City Dashboard
Http://dashboard.km4city.org/

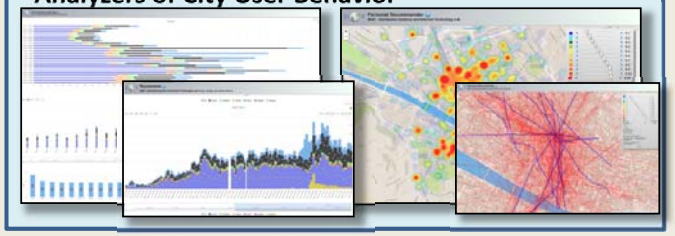
Smart Decision Support
Http://Smartds.km4city.org

ServiceMap browser
Http://servicemap.km4city.org



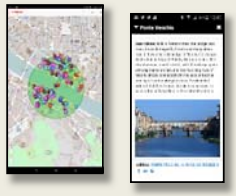
Twitter Vigilance
Http://www.disit.org/tv

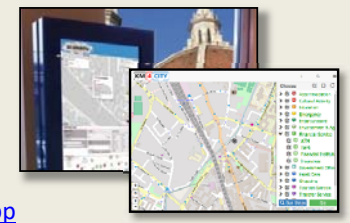
Analyzers of City User Behavior



Tools for Final Users

Mobile e Web Apps
Http://www.km4city.org/webapp



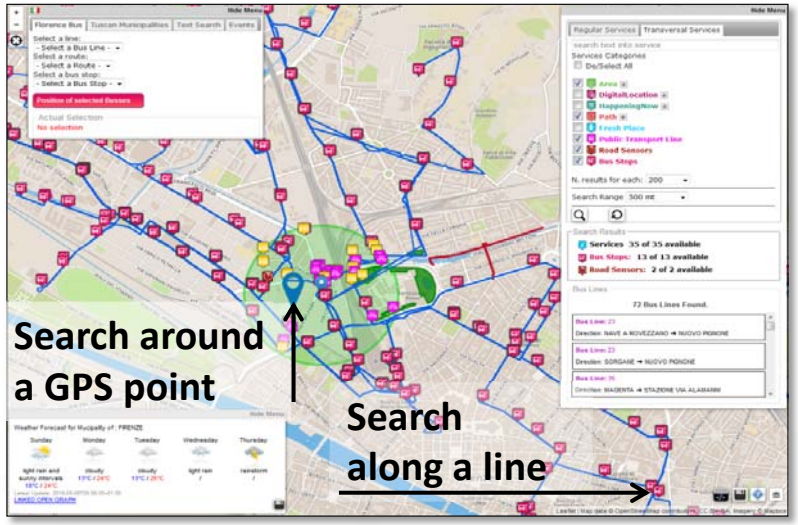


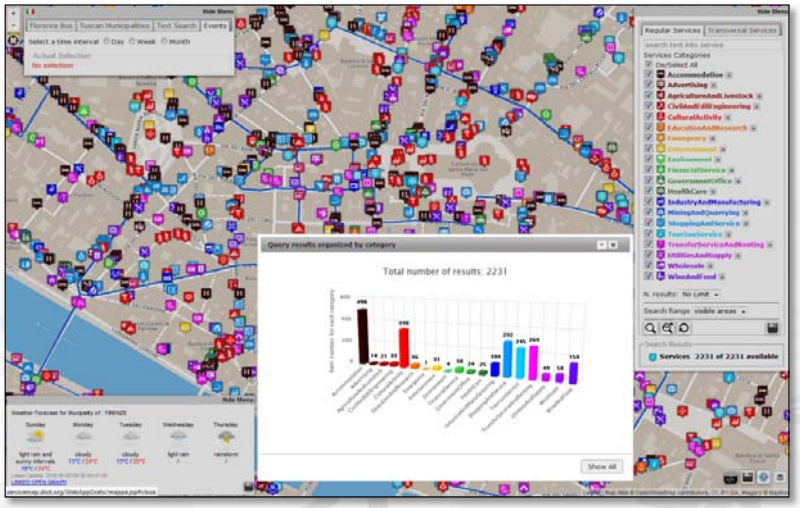
Http://www.km4city.org/app

REPLICATE

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

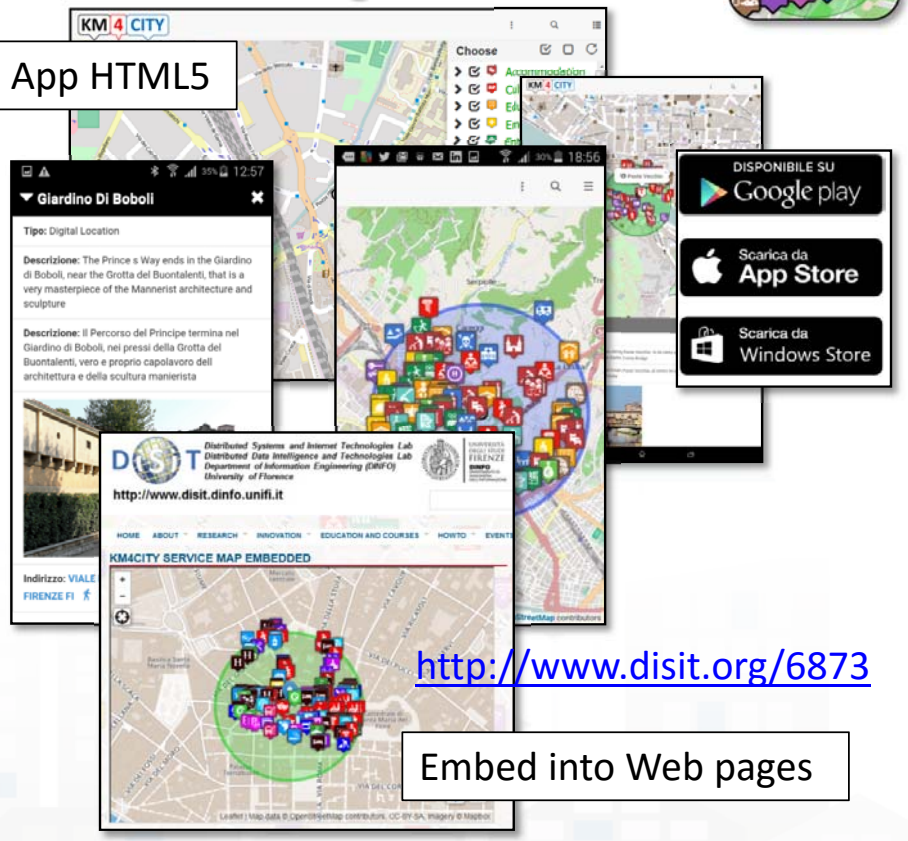
ServiceMap





Smart City API call generation

Web App HTML5



http://www.disit.org/6873

Embed into Web pages

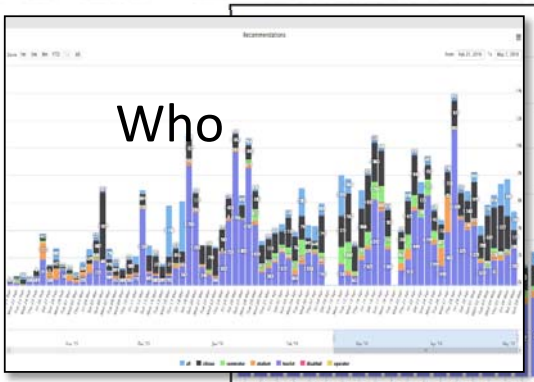
smart city expo WORLD CONGRESS

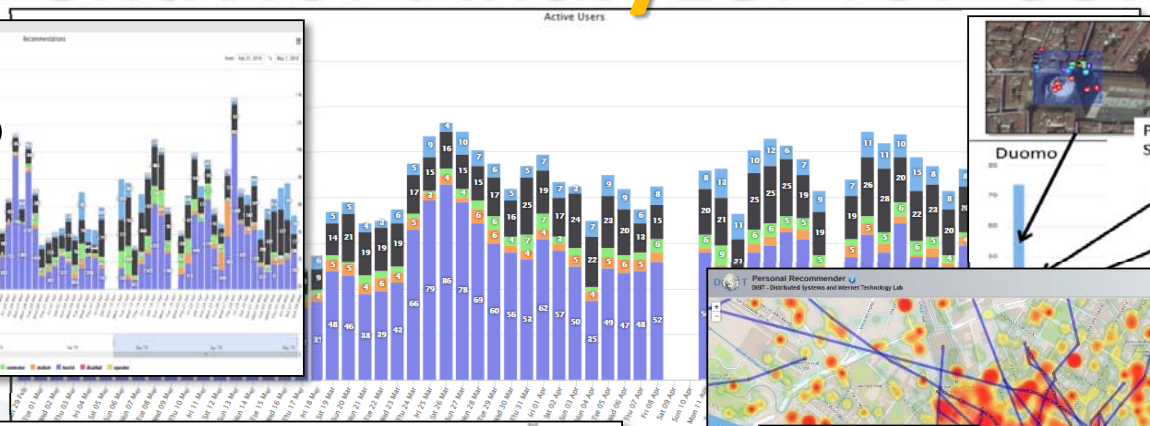
Stand: F680

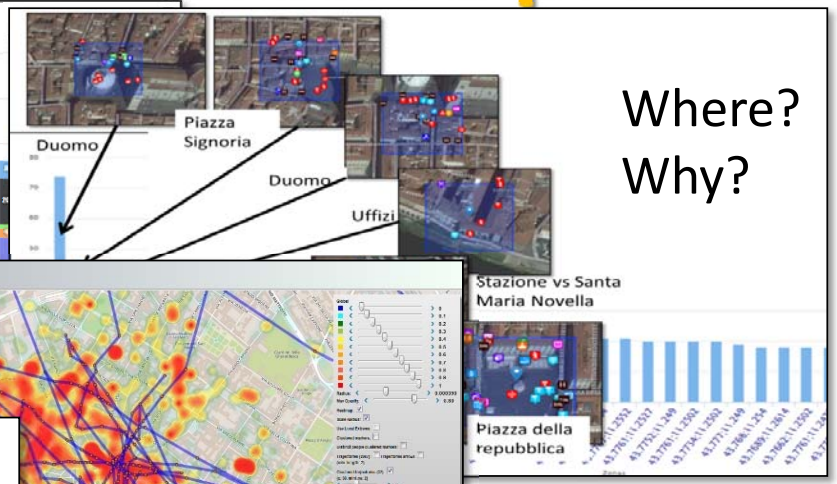
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB http://www.disit.org

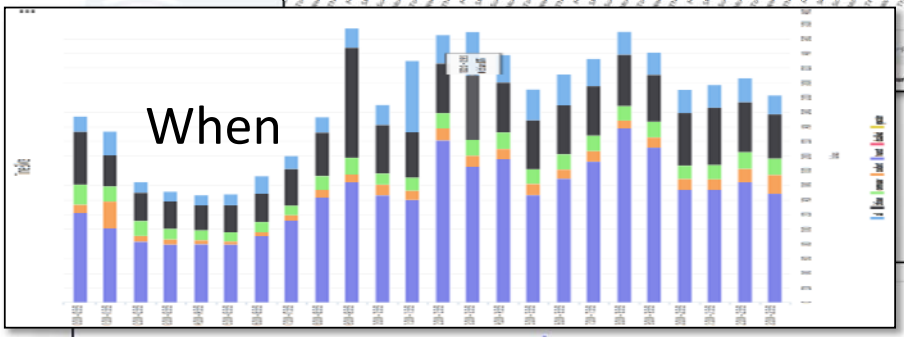
KM 4 CITY

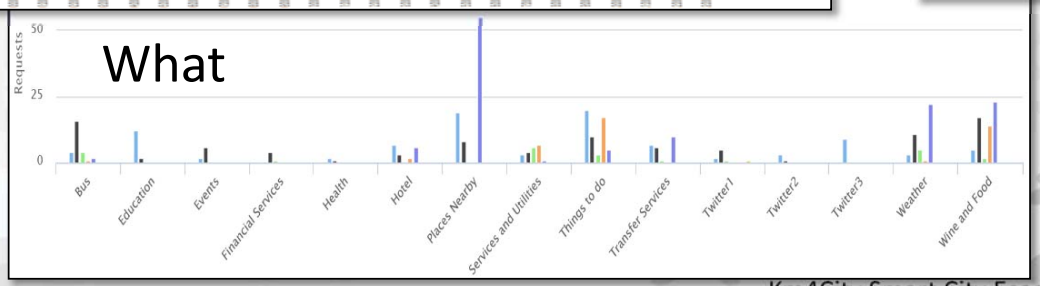
User Behavior Analyzer for Collective profiling

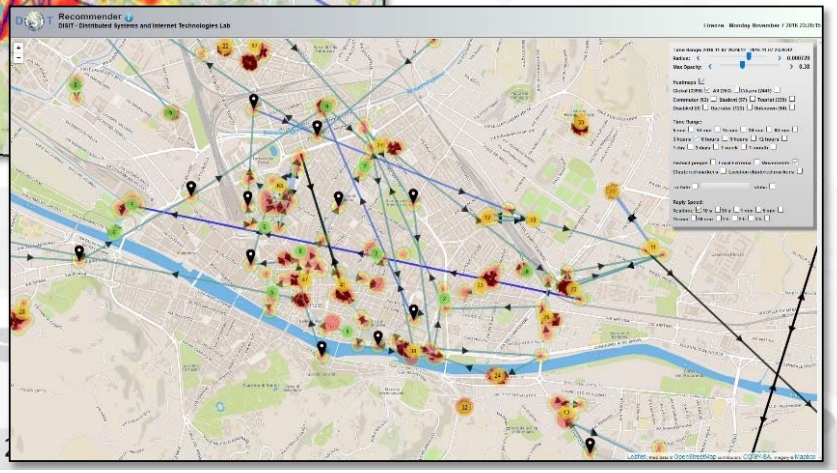






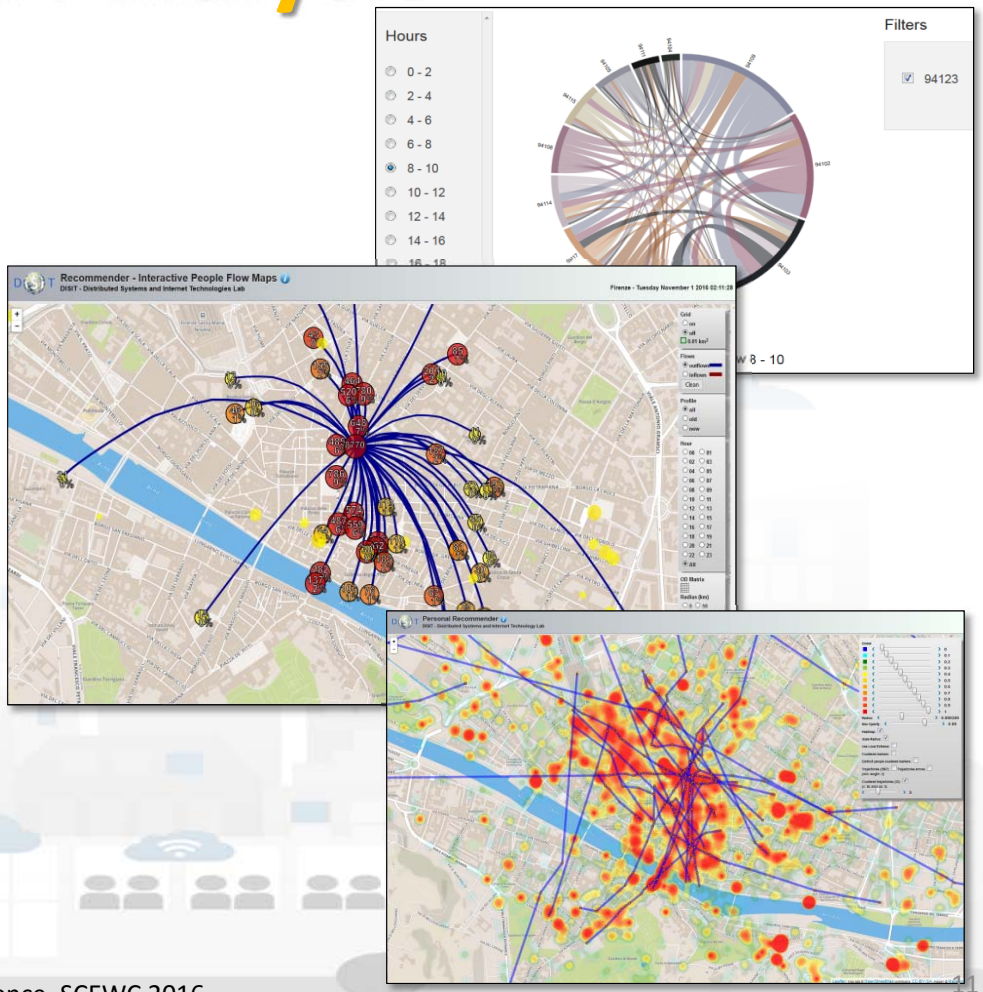






User Behaviour Analysis

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

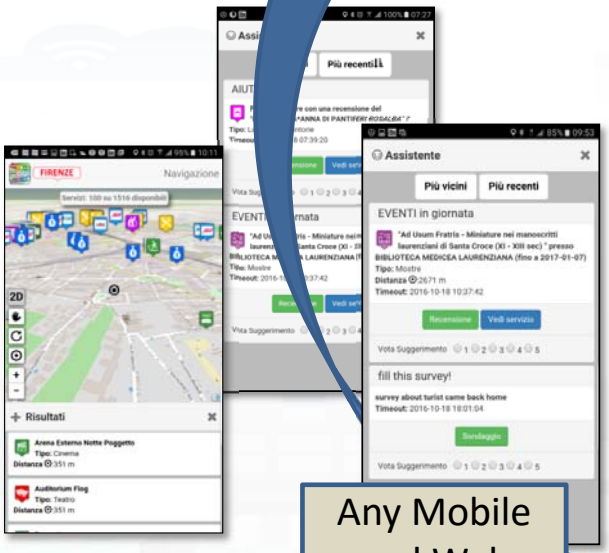


User influencing, engaging, monitoring & Follow Up

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 in
	- commuter	5 (0.29%)	0 (0%)	0 (0%)	
	- student	14 (0.81%)	0 (0%)	0 (0%)	
	- tourist	1462 (85%)	25 (35.71%)	25 (1.71%)	
	- citizen	113 (6.57%)	39 (55.71%)	39 (34.51%)	
	- operator	0 (0%)	0 (0%)	0 (0%)	
	- disabled	0 (0%)	0 (0%)	0 (0%)	
	- all	119 (6.92%)	6 (8.57%)	6 (5.04%)	
daily_event_es	ENGAGEMENT	6 (0.01%)	4 (0.41%)	66.67%	Suggest (in spanish) an event currently on in
daily_event_fr	ENGAGEMENT	6 (0.01%)	0 (0%)	0%	Suggest (in french) an event currently on in
daily_event_it	ENGAGEMENT	5459 (6.73%)	296 (30.02%)	5.42%	Suggest (in italian) an event currently on in
parking_en	ASSISTANCE	141 (0.17%)	128 (12.98%)	90.78%	Alert (in english) if the user parked in a resi
parking_es	ASSISTANCE	3 (0%)	3 (0.3%)	100%	Alert (in spanish) if the user parked in a resi
parking_it	ASSISTANCE	187 (0.23%)	1 (0.1%)		residential parking zone
shoot_a_photo_de	ENGAGEMENT	68 (0.08%)	1 (0.1%)		arby point-of-interest



Any Mobile and Web App

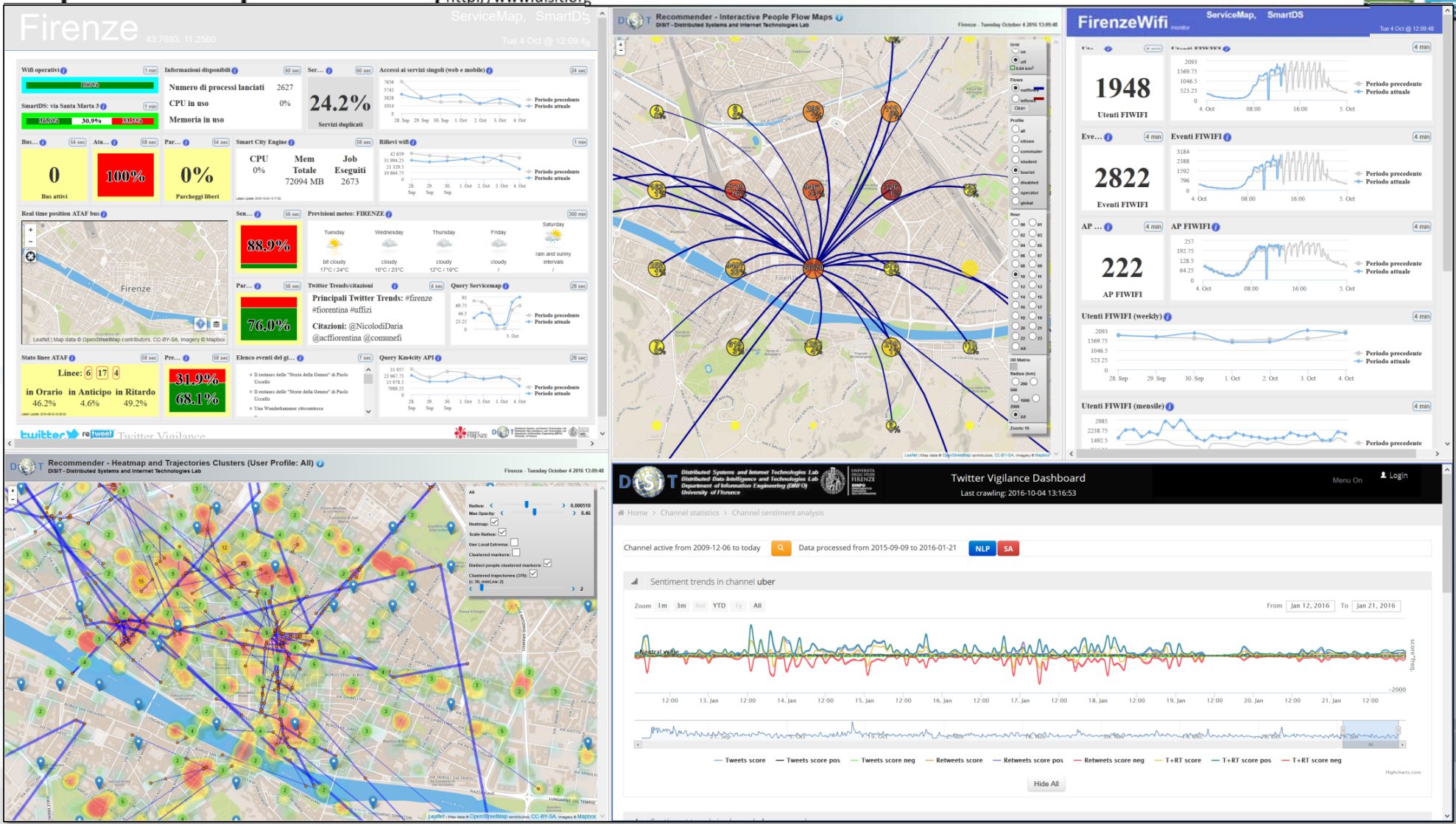
Inform
Engage
Stimulate / recommend

UNIVERSITÀ DEGLI STUDI FIRENZE

DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

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

Smart City Dashboard



DataCenter
ServiceMap, SmartDS
Temperatura 1 (last 4 hours)
Temperature 1
Temperatura 2 (last 4 hours)
Temperature 2
Humidity Percentage 1 (daily)
Humidity Percentage 1
Humidity Percentage 2 (daily)
Humidity Percentage 2
Temperature 1 (weekly)
Temperature 2 (weekly)
Km4City
status
ServiceMap, SmartDS
Engagement Sent (4 hours)
2078
Engagement Sent
Engagment Created (from Stats) ...
446
Engagement Viewed (4 hours)
Mugnone 2016
ServiceMap, SmartDS
Operatori attivi
Utenti attivi
Turisti attivi
1
64
25
Operatori attivi (4 ore)
Energy (demo)
ServiceMap, SmartDS
Q1
Q2
Q3
Q4
Q5
Active wind turbines
42.4%
57.6%
Charging columns map
City consumption
GW
0
Free charging cols
cols
17
Active solar panels
18.4%
81.6%
Stadium
Schools
Airport
City consumption trend
Free bike c...
Free car ch...
Energy fro...
26%
74%
100%
0%
SmartCity Processes
Fri 4 Nov @ 18:51:20
ATAF
CHECK RT
EVENTI FI
PARK
METEO
SENSORI
TWITTER
FI WIFI
RUNNING
SUCCESS
FAILED
twitter
retweet
Twitter Vigilance

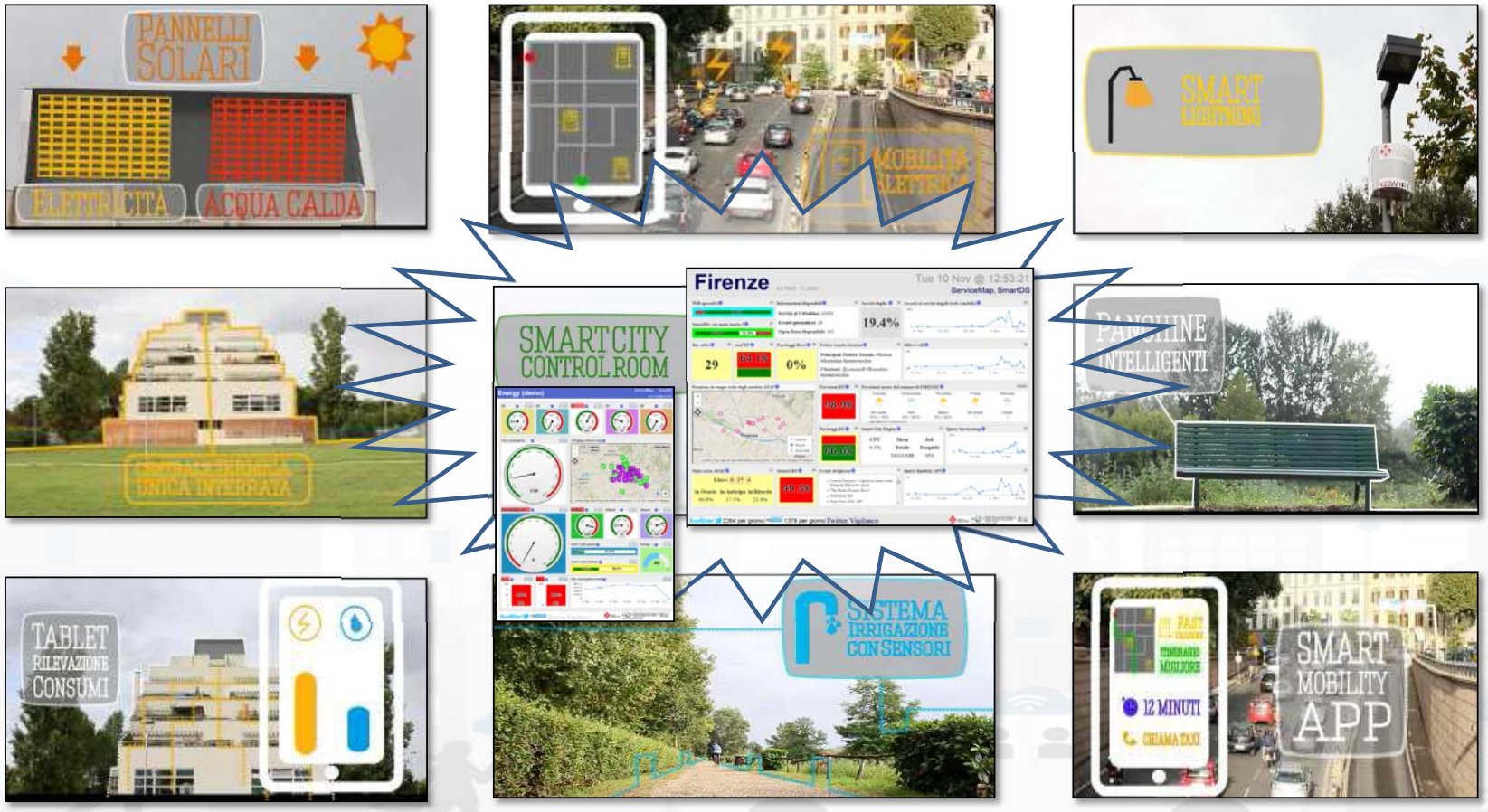
REPLICATE

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

REPLICATE

Horizon 2020 European Union Funding for Research & Innovation

REPLICATE in Firenze: Energy, ICT & Mobility



www.Km4City.org

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

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

KM4CITY
FROM DATA TO SERVICES FOR SENTIENT CITIES

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

City Users' Tools for Mobile Devices and Web

Km4City Mobile App Video

Suggestions and recommendations (*)

Engagements

Web and Totem Km4City Apps (*)

smart city expo WORLD CONGRESS

Stand: F680