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DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB



DISIT Lab



Open Data vs Smart City

Prof. Paolo Nesi (lab chair)

Distributed [Systems and internet | Data Intelligence and] Technologies Lab

Dipartimento di Ingegneria dell'Informazione (DINFO),

Università degli di Studi di Firenze

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<http://www.disit.dinfo.unifi.it> , <http://www.km4city.org>, paolo.nesi@unifi.it

Florence Open Data Day, Marzo 2017, Firenze



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

Principali Settori di azione del DISIT lab

- **Smart City:** gestione dati, mobilità', user engagement, ...
- **Social Media and Media:** analisi di Twitter Vigilance
- **Mobile Computing:** applicazioni mobili, comportamento utente
- **Smart Retail:** comportamento utente, engagement, ..
- **Smart Cloud:** cloud simulazione, ottimizzazione
- **Smart manufacturing:** Industria 4.0
- **Autonomous drivers:** sistemi a guida autonoma, navigazione
- projects: <http://www.disit.org/5501>

Transport systems
Mobility, parking



Public Services
Govern, events, ...



Sensors, IOT
Cameras, ..



Environment,
Water, energy



Shops, services,
operators



Social Media
WiFi, network

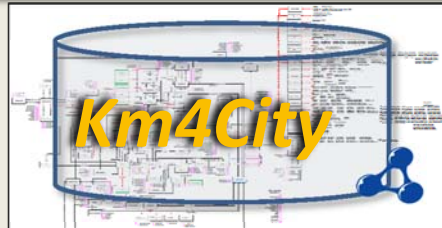


Static, Slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud



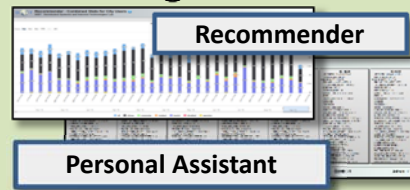
Km4City Smart City Engine



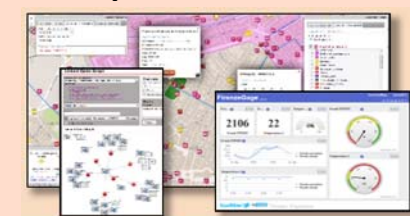
Big Data Analytics



Smartening Tools



Development Tools



Km4City Smart City API

City Operators and Decision Makers

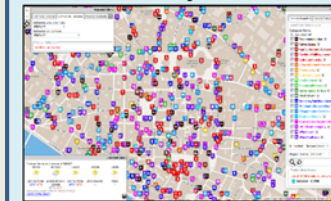
Dashboards



Smart Decision Support



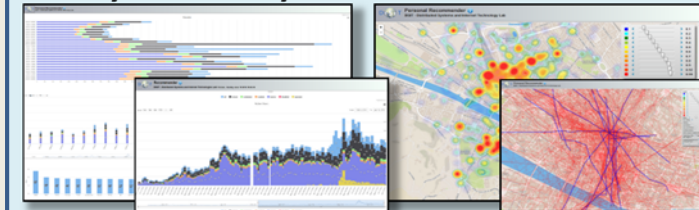
ServiceMap browser



Twitter Vigilance



Analyzers of City User Behavior



Tools for Final Users

Mobile e Web Apps



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

Florence Open Data Day, Sii-Mobility, Km4City, Marzo 2017

**Dati presenti
per la
Toscana**

Grafo strade regionale (Toscana)

132,923 strade
389,711 elementi stradali
318,160 nodi stradali
1,508,207 numeri civici

Servizi in 20 cat, 512 sottocat.
16 Operatori di trasporto pubblico
21.280 Fermate bus e 1081 linee
210 Parking areas
796 Traffic Sensors
Info on: points, paths, areas, etc.

Dynamic/real-time

- Linee TPI: 11+ (p.d.f.) X giorno
- Orari PT: 1081 linee, 1-2 updates per giorno
- Stato parcheggi: 76 update X giorno X parcheggio
- Sensorio traffico: 288 update X giorno X sensore
- Meteo: 2 updates X giorno for 285 aree
- Triage status: svariati update x gio. per ospedale
- Costi carburanti: 1 update x giorno, x 1600 stations
- Eventi a Fi: circa 60 eventi X giorno
- Wi-Fi: > 350.000 misure X giorno
- APP: > 50.000 misure X giorno
- > 35.000 utenti distinti X giorno
- Da 600.000 a 4.5 M Tweet X giorno
-+ many IOT are coming



Previsione meteo

Giorno	Previsione	Temperatura
Giovedì	poco nuvoloso	23°C / 27°C
Venerdì	poco nuvoloso	20°C / 33°C
Sabato	velato	20°C / 33°C

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

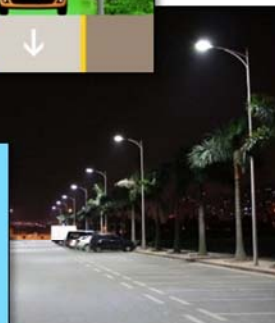
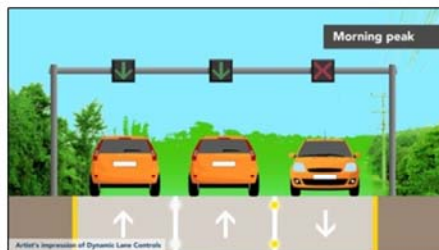
Risultati della ricerca

più di 4000 risultati, attivato clustering

Services 16858

Si stanno aggiungendo molti altri dati

- ZTL
- Sensori ambientali
- Illuminazione
- Panchine
- Cassonetti
- Colonnine di ricarica
- Parcheggi disabili
- Livelli acqua nei sottopassi
- Etc.





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Km4City Roadmap



2013

Km4City 1.1

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

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

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

2014

2015

Km4City 1.4

- Embed
- More API
- iBeacon



RESilience management guidelines
and Operationalization appLied to
Urban Transport Environment

Km4City 1.5

- SmartDS
- Km4City App

RESOLUTE H2020
2015-2018 - Started



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

Sii-Mobility SCN
2016-2018 - Started

Km4City 1.6.2

2016

REPLICATE H2020
2016-2021- Started



REPLICATE
Renaissance of PLACES
with Innovative Citizenship
And Technology

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

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

GHOST SIR
2016-2019 - Started



2021



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Smart City

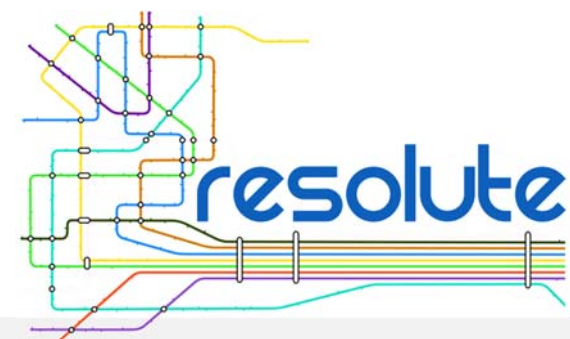
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fo.unifi.it

- **Km4City**: <http://www.km4city.org>
- **RESOLUTE H2020, EC**:
– <http://www.resolute-eu.org>
- **REPLICATE H2020, SCC1, EC flagship**
– <http://replicate-project.eu/>
- **Sii-Mobility SCN MIUR**:
– <http://www.sii-mobility.org>
- **Coll@bora Social Innovation, MIUR**:
– <http://www.disit.org/5479>
- **TRACE-IT, RAISSS, TESYSRAIL,**
- **Mobile Emergency**:
– <http://www.disit.org/5404>



Trace-IT
RAISSS





Horizon 2020
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<http://www.resolute-eu.org>

- **Sviluppare le Linee guida Europee:**
 - European Resilience Management Guidelines (ERMG), con particolare attenzione ai sistemi di trasporto
- **Migliorare la Resilienza:**
 - Modelli di Supporto alle decisioni
 - Formazione e informazione specifica
 - Rendere operative le linee guida con strumenti operativi
- **Strumenti operativi per la Resilienza come:**
 - Sistemi di controllo e supporto alle decisioni
 - Sistemi di monitoraggio Early Warning
 - Analisi del comportamento delle persone
 - Strumenti per suggerimento delle vie di fuga
- Pilot in Florence e Atene

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



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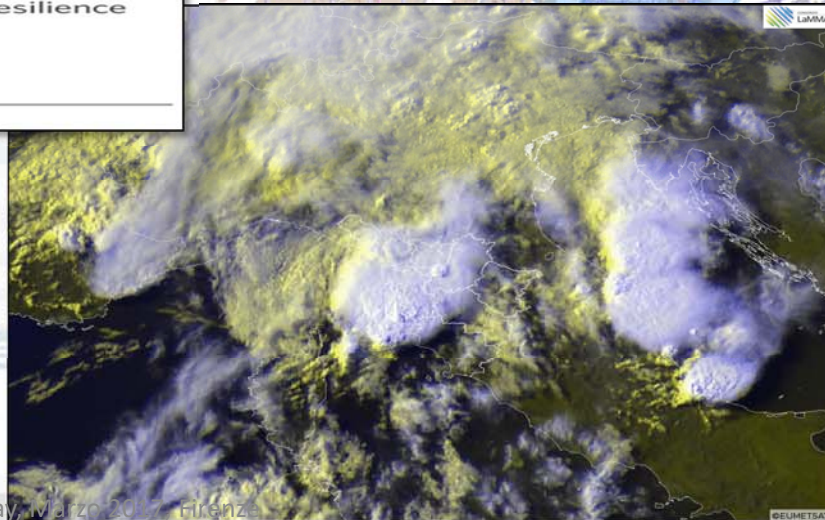
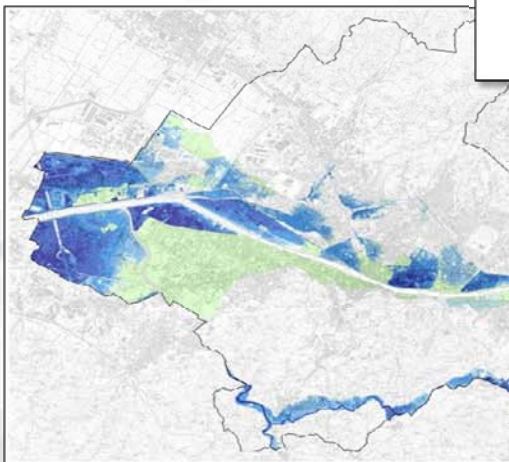
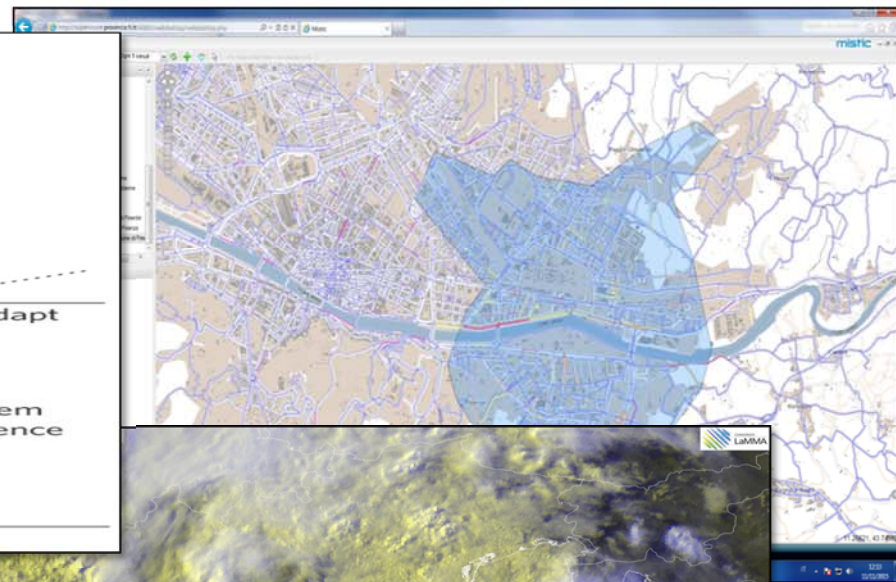
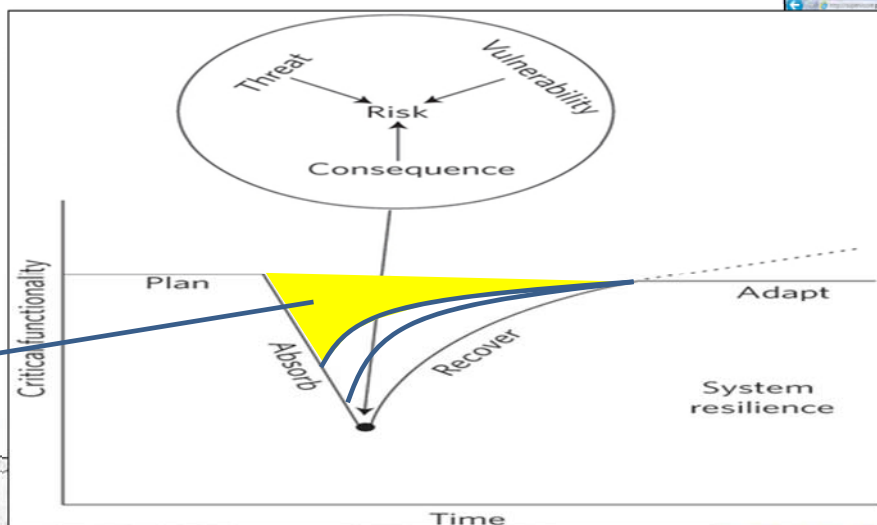
City Resilience



Early warning, detection

Prepare
Absorb
Recover
Adapt

damage



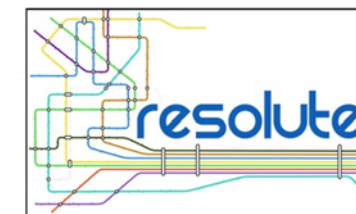
Florence Open Data Day, Marzo 2017, Firenze



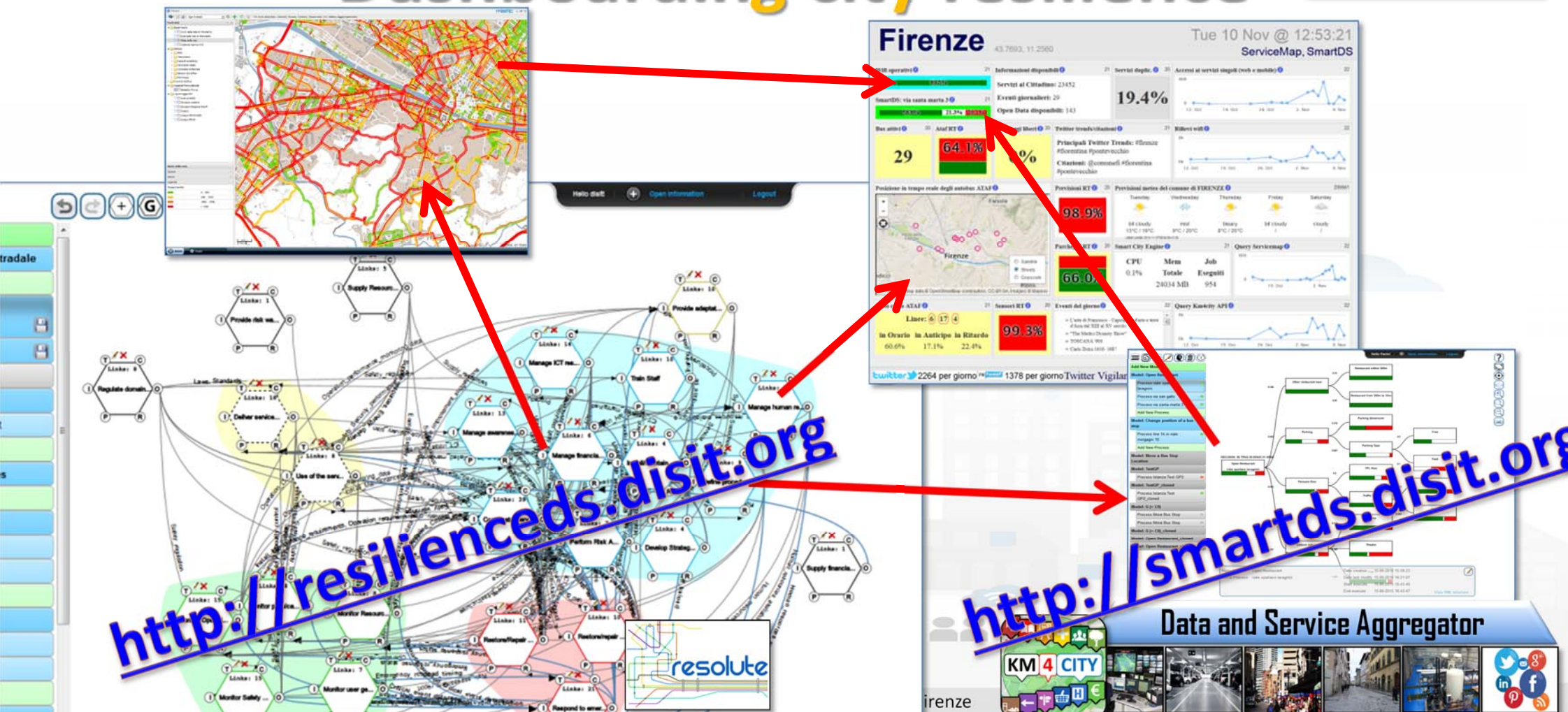
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<http://www.disit.org>



Dashboarding city resilience



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

Aerial with labels Save

Flood sensors observations:

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 Università	2016-04-11T15:59:00	10.5

Threshold:

From:

To:

Draw region to analyze: ☒ On

Load predefined region:

Mean precipitation:

Relevant Services

Min asset value:

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

Service

NAME: villa maria teresa hospital...

ADDRESS: VIA DELLA CERNAIA, FIRENZE, FIRENZE

SERVICE TYPE: http://www.disit.org/km4city/schema#Public_hospital

SERVICE CLASS: <http://www.disit.org/km4city/schema#HealthCare>

SERVICE: <http://www.disit.org/km4city/resource/7ab1bc45b84357b727dd67fe6081d2db>

VALUE: 100

WKT DESCRIPTION: POINT (11.2561 43.7866)

Traffic observations:

From	Date	km/h	car/km	car/h
<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

KM 4 CITY

Type	Value
Public	100
Public	100
Public_hospital	100

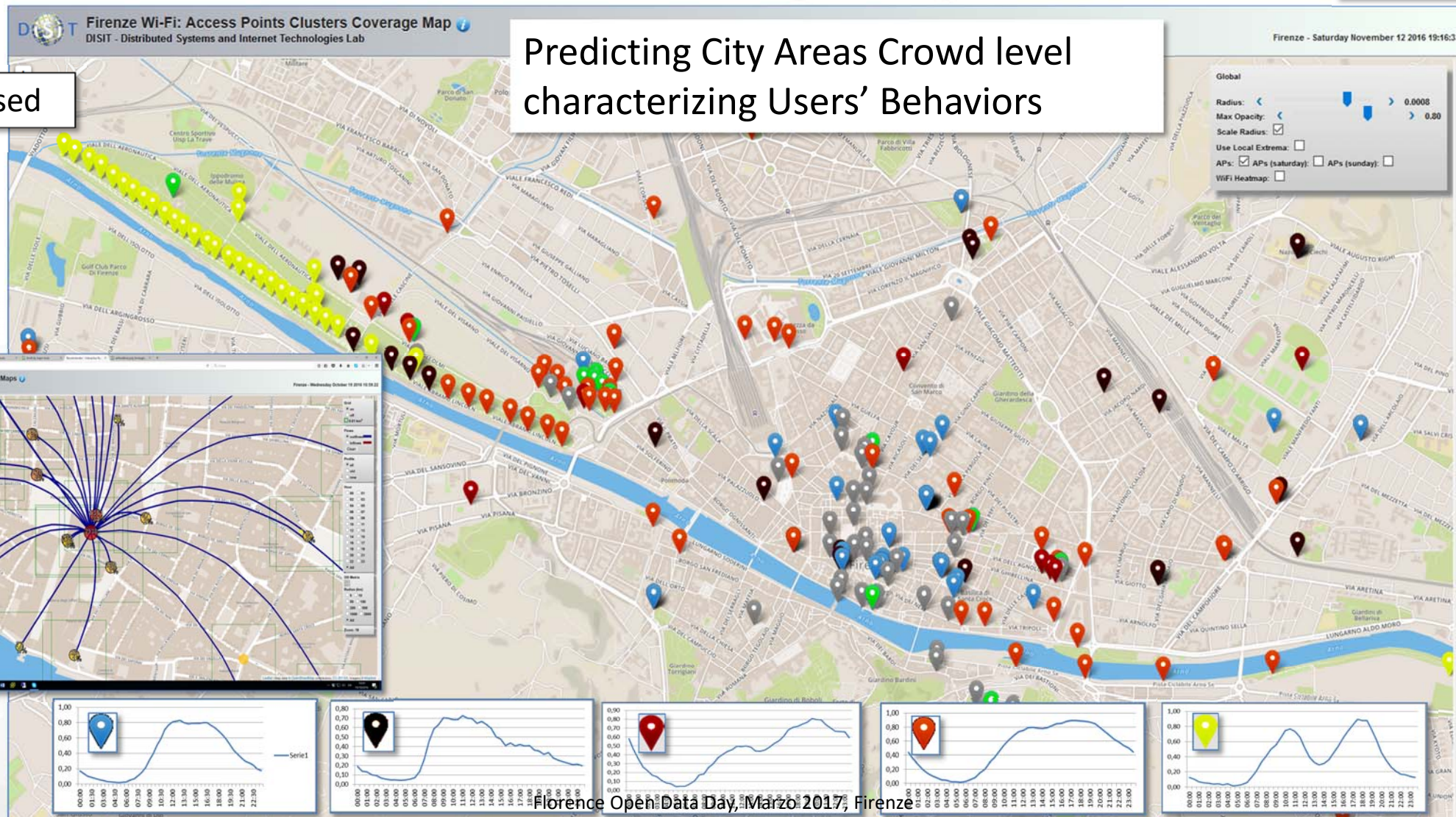
Assessing Risk

- hydraulic
- Seismic

Characterizing City Areas

Wi-Fi based

Predicting City Areas Crowd level
characterizing Users' Behaviors

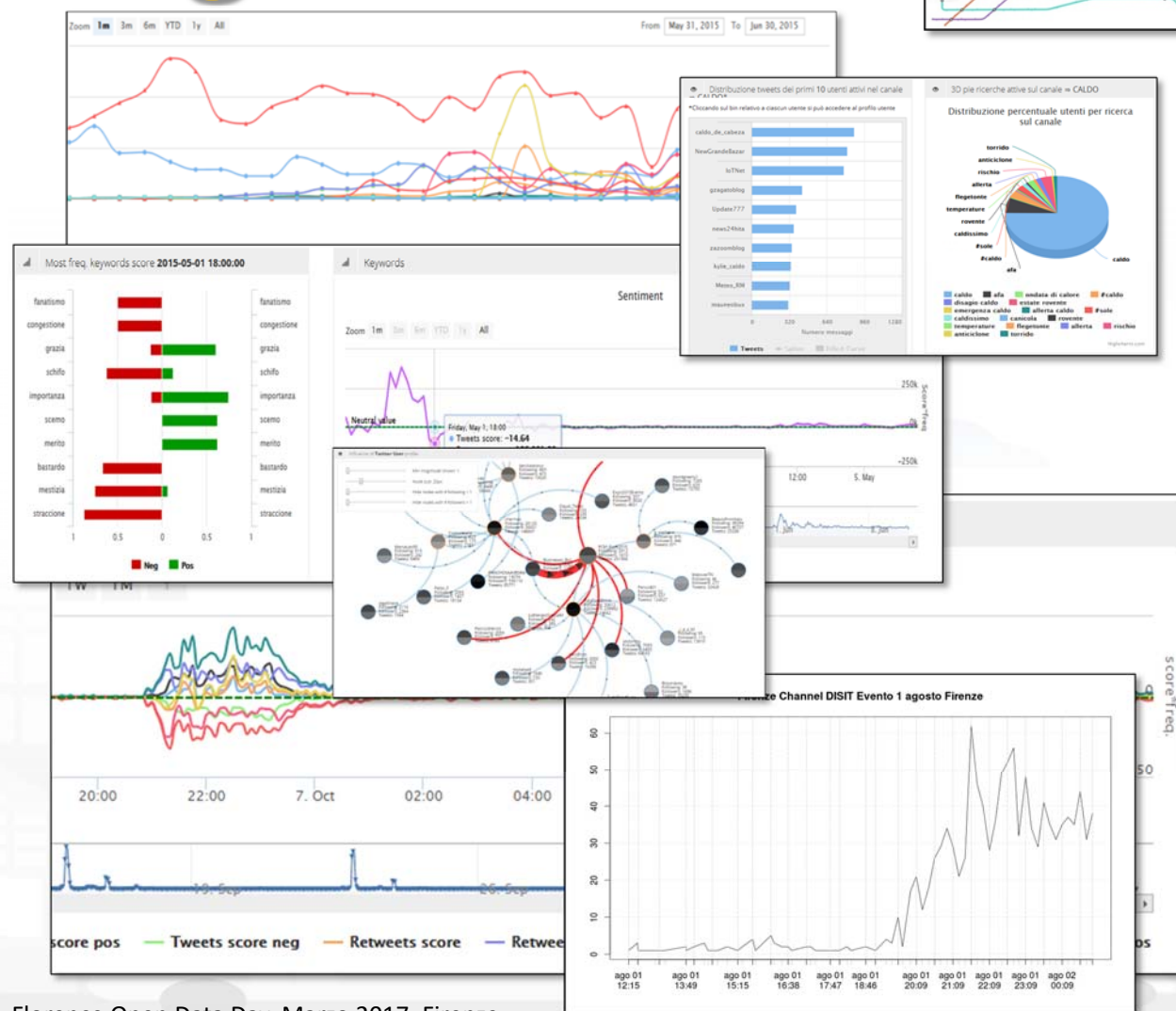


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Twitter Vigilance



- <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

Florence Open Data Day, Marzo 2017, Firenze

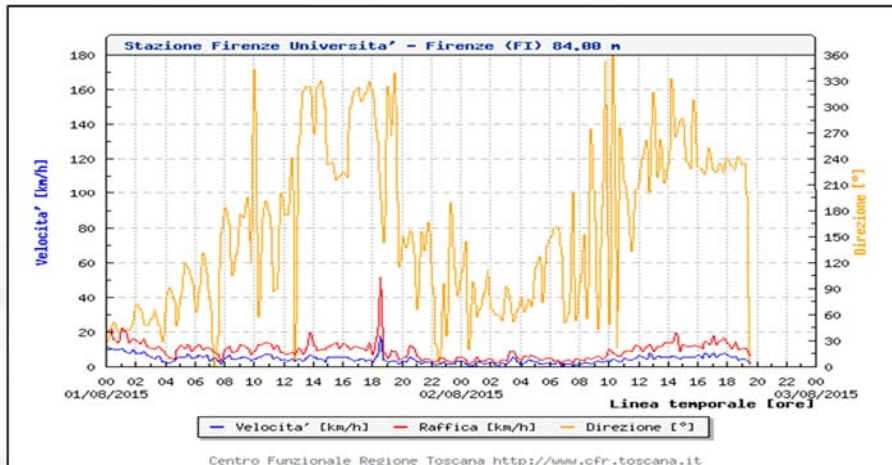
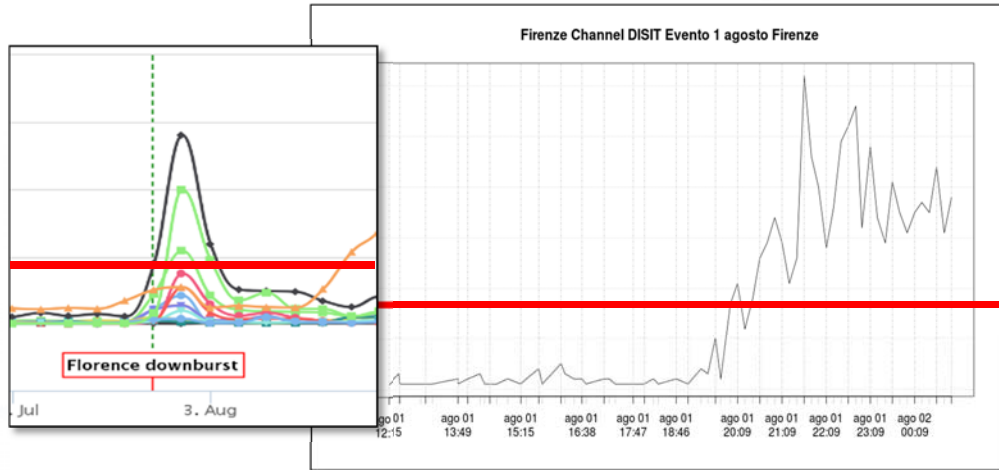
Twitter Vigilance su Firenze (sperimentale)

Sun 1 Jan @ 11:51:16

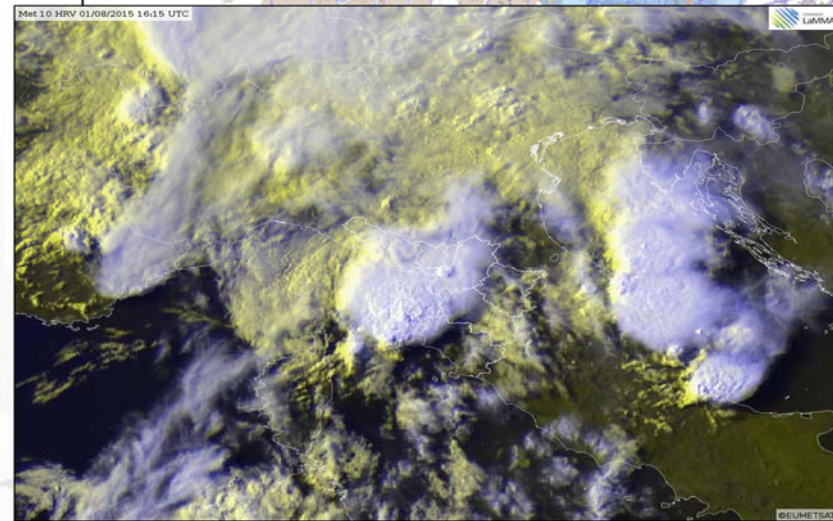
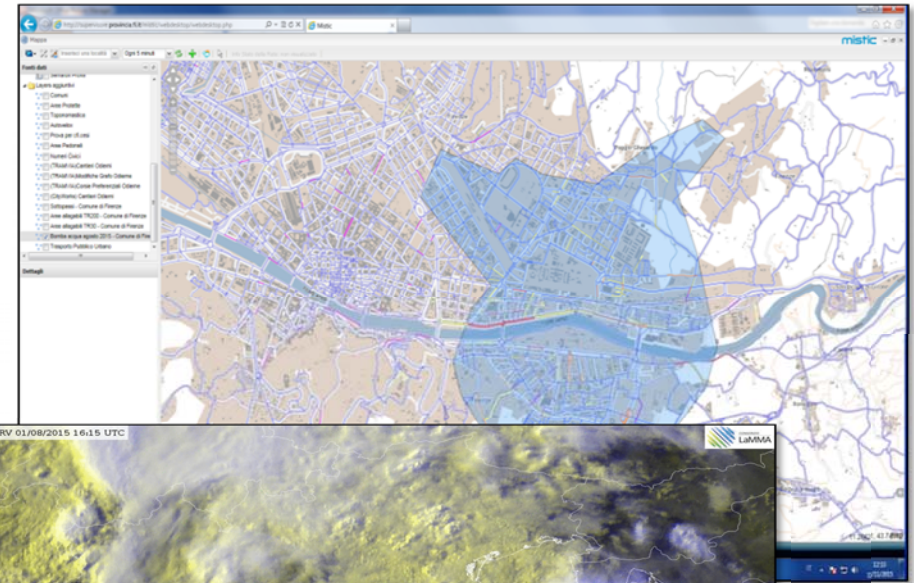




Early Warning Twitter Vigilance and Water Bomb



Twitter Vigilance



Case Study D

Florence Open Data Day, Marzo 2017, Firenze



Horizon 2020
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- demonstrate Smart City technologies in energy, transport and ICT in districts in:
 - **San Sebastian (S), Florence (I) and Bristol (UK),**
 - follower cities of Essen, Nilufer and Lausanne
- Cities are the customer: considering local specificities
- Solutions must be replicable, interoperable and scalable.
 - **Integrated Infrastructure: deployment of ICT architecture, from internet of things to applications**
 - **Low energy districts**
 - **Urban mobility: sustainable and smart urban services**

- 1 (coordinator) **FOMENTO DE SAN SEBASTIAN FSS SPAIN**
- 2 AYUNTAMIENTO DE SAN SEBASTIAN SAN SEBASTIAN SPAIN
- 3 **COMUNE DI FLORENCE FLORENCE ITALY**
- 4 BRISTOL COUNCIL BRISTOL UNITED KINGDOM
- 5 STADT ESSEN ESSEN GERMANY
- 6 NILUFER BELEDIYESI NILUFER TURKEY
- 7 VILLE DE LAUSANNE LAUSANNE SWITZERLAND
- 8 IKUSI ANGEL IGLESIAS, S.A. IKUSI SPAIN
- 9 ENDESA ENERGÍA, S.A. ENDESA SPAIN
- 10 EUROHELP CONSULTING, S.L. EUROHELP SPAIN
- 11 ILUMINACION INTELIGENTE LUIX, S.L. LUIX SPAIN
- 12 FUNDACION TECNALIA RESEARCH & INNOVATION TECNALIA SPAIN
- 13 EUSKAL TEL, S.A. EUSKAL TEL 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 DIF**
- 21 **THALES ITALIA, SPA THALES ITALY**
- 22 ZABALA INNOVATION CONSULTING ZABALA SPAIN
- 23 TECHNOMAR TECHNOMAR GERMANY
- 24 UNIVERSITY OF BRISTOL UOB UNITED KINGDOM
- 25 UNIVERSITY OF OXFORD UOXF UNITED KINGDOM
- 26 BRISTOL IS OPEN, LTD BIO UNITED KINGDOM
- 27 ZEETTA NETWORKS ZEETTA UNITED KINGDOM
- 28 KNOWLE WEST MEDIA CENTRE, LGB KWMC UNITED KINGDOM
- 29 TOSHIBA RESEARCH EUROPE, LTD TREL UNITED KINGDOM
- 30 ROUTE MONKEY, LTD ROUTE MONKEY UNITED KINGDOM
- 31 ESOTERIX SYSTMES, LTD ESOTERIX UNITED KINGDOM
- 32 NEC LABORATORIES EUROPE, LTD NEC UNITED KINGDOM
- 33 COMMONWHEELS CAR CLUB CIC CO-WHEELS UNITED KINGDOM
- 34 UNIVERSITY OF THE WEST OF ENGLAND UWE UNITED KINGDOM
- 35 ESADE BUSINESS SCHOOL ESADE SPAIN
- 36 SISTELEC SOLUCIONES DE TELECOMUNICACION, S.L. SISTELEC SPAIN



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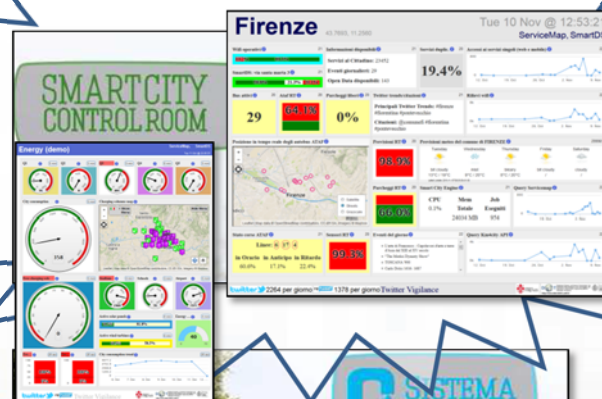
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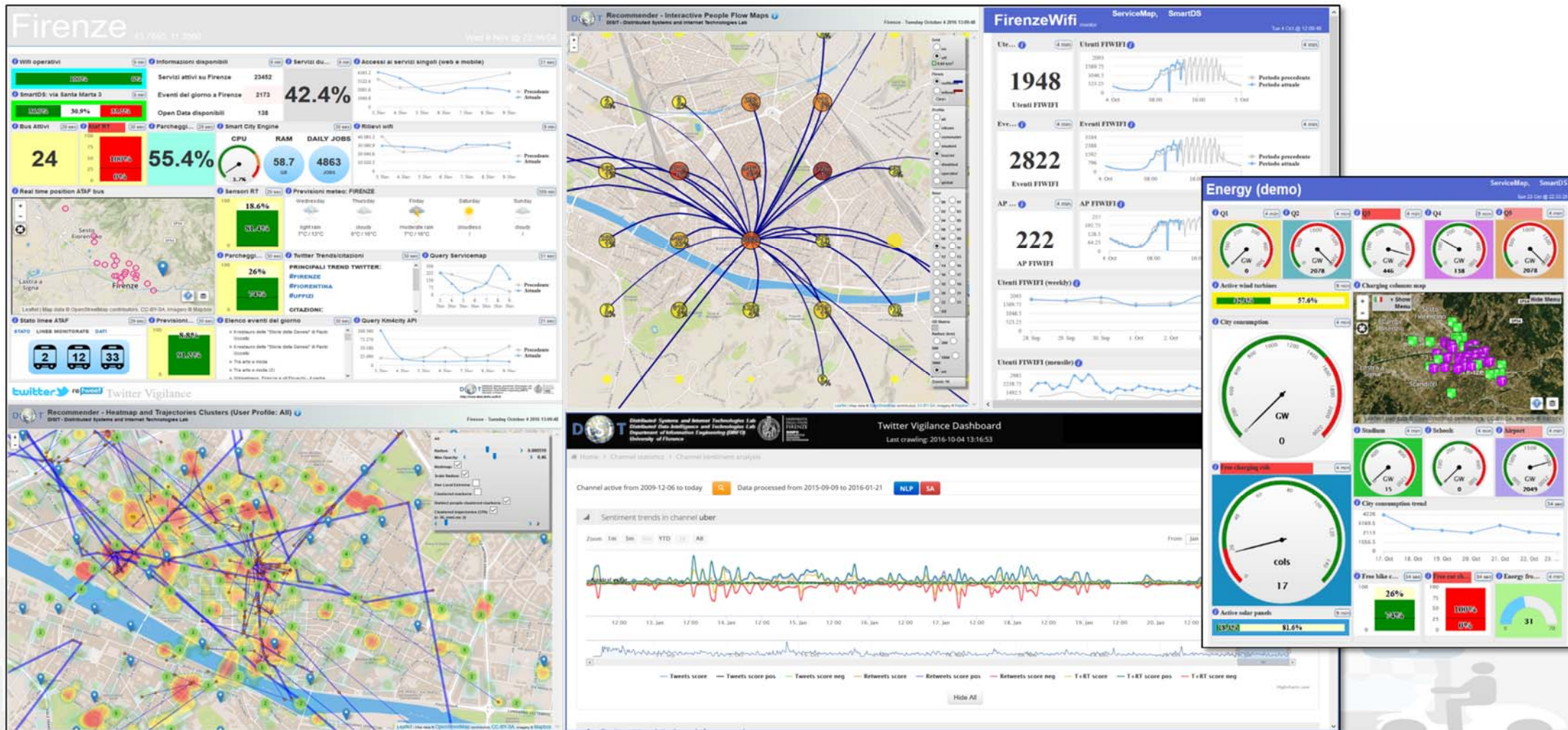
Horizon 2020
European Union Funding
for Research & Innovation

REPLICATE in Firenze: Energy, ICT & Mobility



marzo 2017, Firenze

Smart City Dashboard



Florence Open Data Day, Marzo 2017, Firenze

Servizi agli Utenti

Firenze

Tue 13 Dec @ 17:01:29



Florence Open Data Day, Marzo 2017

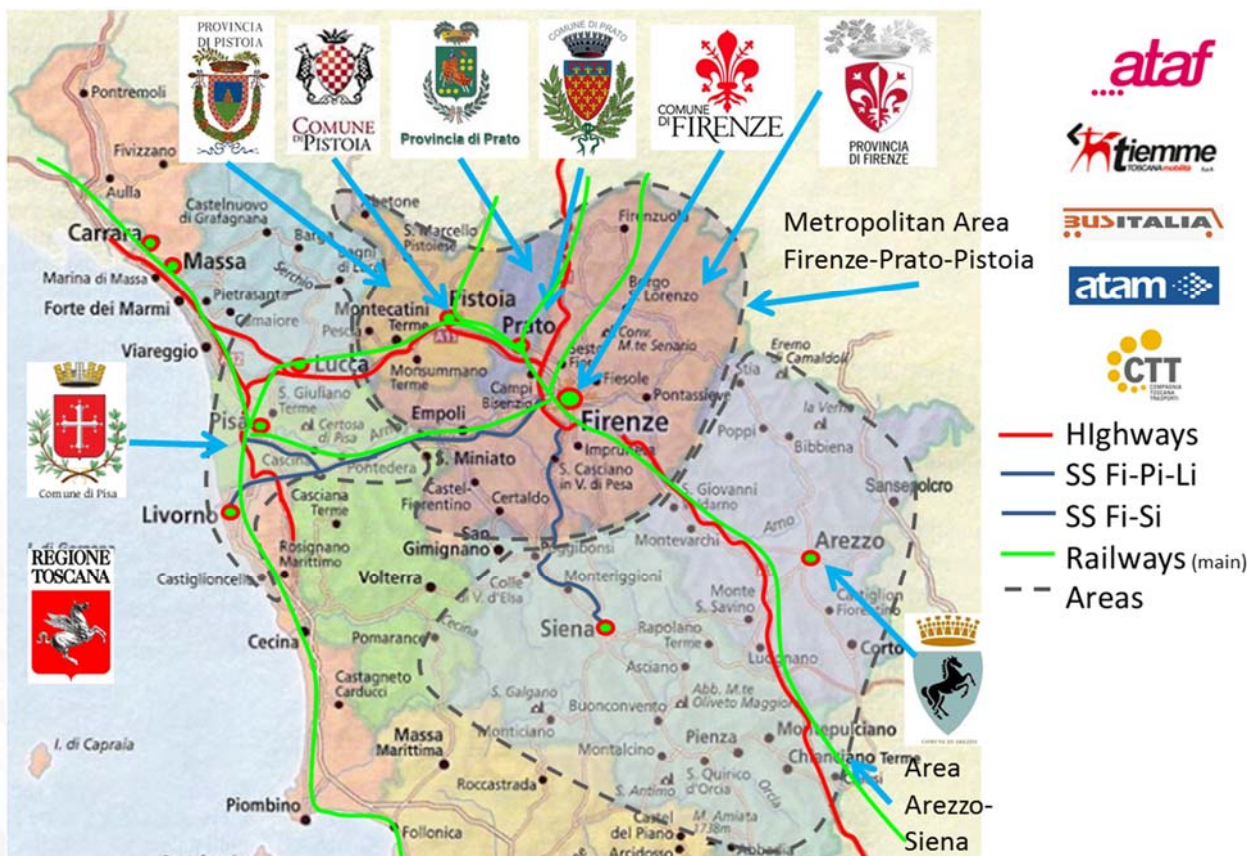


Sii-Mobility



- Sperimentazione e validazione in Toscana
- Integrazione con i servizi presenti
- DISIT lab, Università di Firenze, coordinatore

■ <http://www.Sii-Mobility.org>



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ECM; Swarco Mizar; Inventi In20; Geoin; QuestIT; Softec; T.I.M.E.; LiberoLogico; MIDRA (autostrade, motorola); ATAF; Tiemme; CTT Nord; BUSITALIA; A.T.A.M.; Effective Knowledge; eWings; Argos Engineering; Elfi; Calamai & Agresti; Project; Negentis



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Sii-Mobility



MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA



Commenti dei cittadini,
Social Media



AVM trasporto
Pubblico

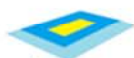


Sensori,
sistema monitoraggio

Sensori su
trasporto Privato



Sensori
Parcheggi



Monitoraggio
traffico, autostrade



Rete
Ferroviaria

Parametri
ambientali

Servizi ed
enti

Ordinanze: eventi,
lavori pubblici, .

Emergenze,
polizia, 118



UTC



Infomobility



Varchi
Telematici, ZTL



Back Office and Dev Tools



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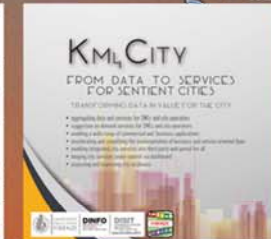
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GET IT ON
Google play

Download on the
App Store

Download from
Windows Phone Store



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

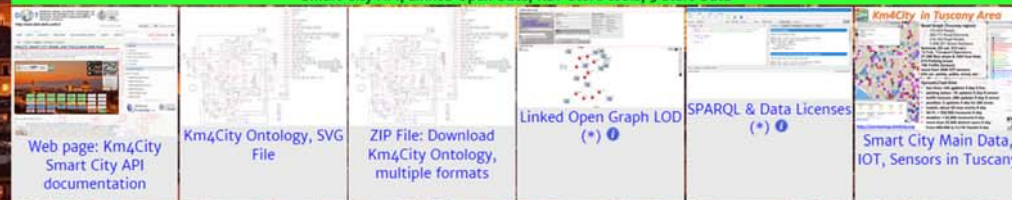
Development Tools for Mobile App and Web App (the ServiceMap Tool), generating Smart City API calls



Dashboard development tools



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



Data Warehouse and Back Office Data Aggregation Tools



www.Km4City.org

Open Data Day - Marzo 2017, Firenze

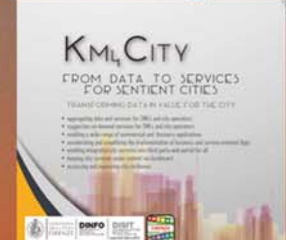
Sentient City Control Room



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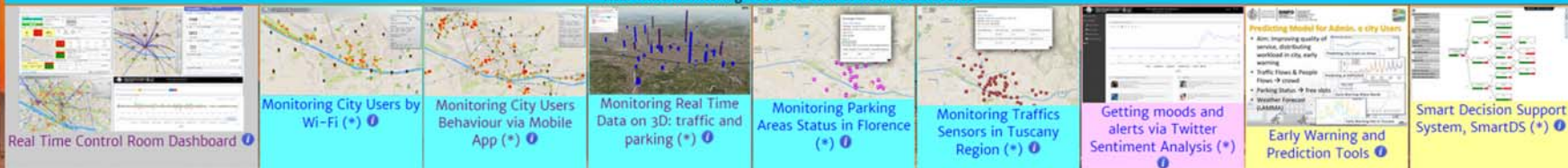
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Home Sentient City Control Room City Users' Tools Back Office and Dev Tools Info and Docs

Real Time Monitoring Tools for Control Room Dashboards



Smart City Control Room, Dashboard, Real Time Data ⓘ



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Big Data Analytics Tools, Business Intelligence, Decision Support Tools

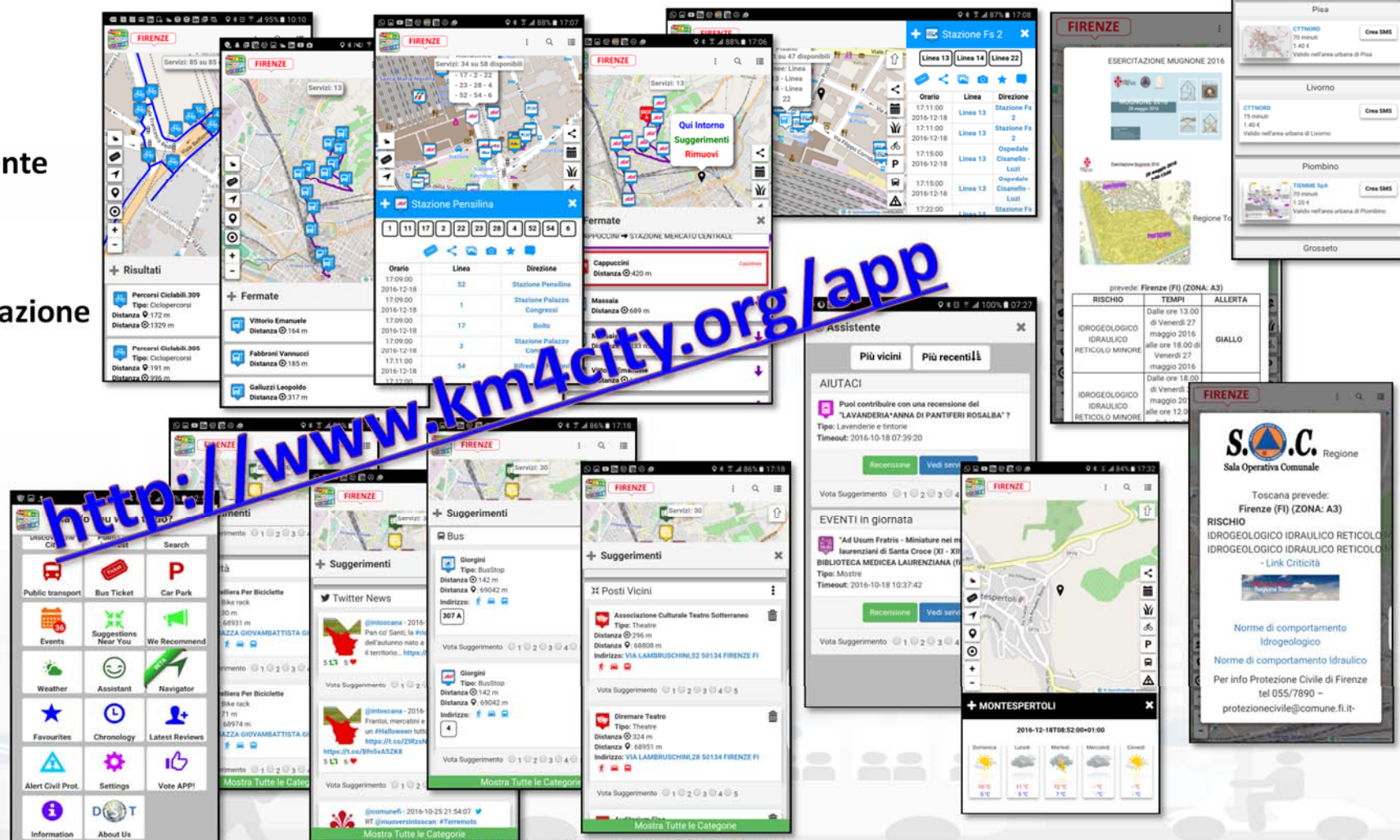


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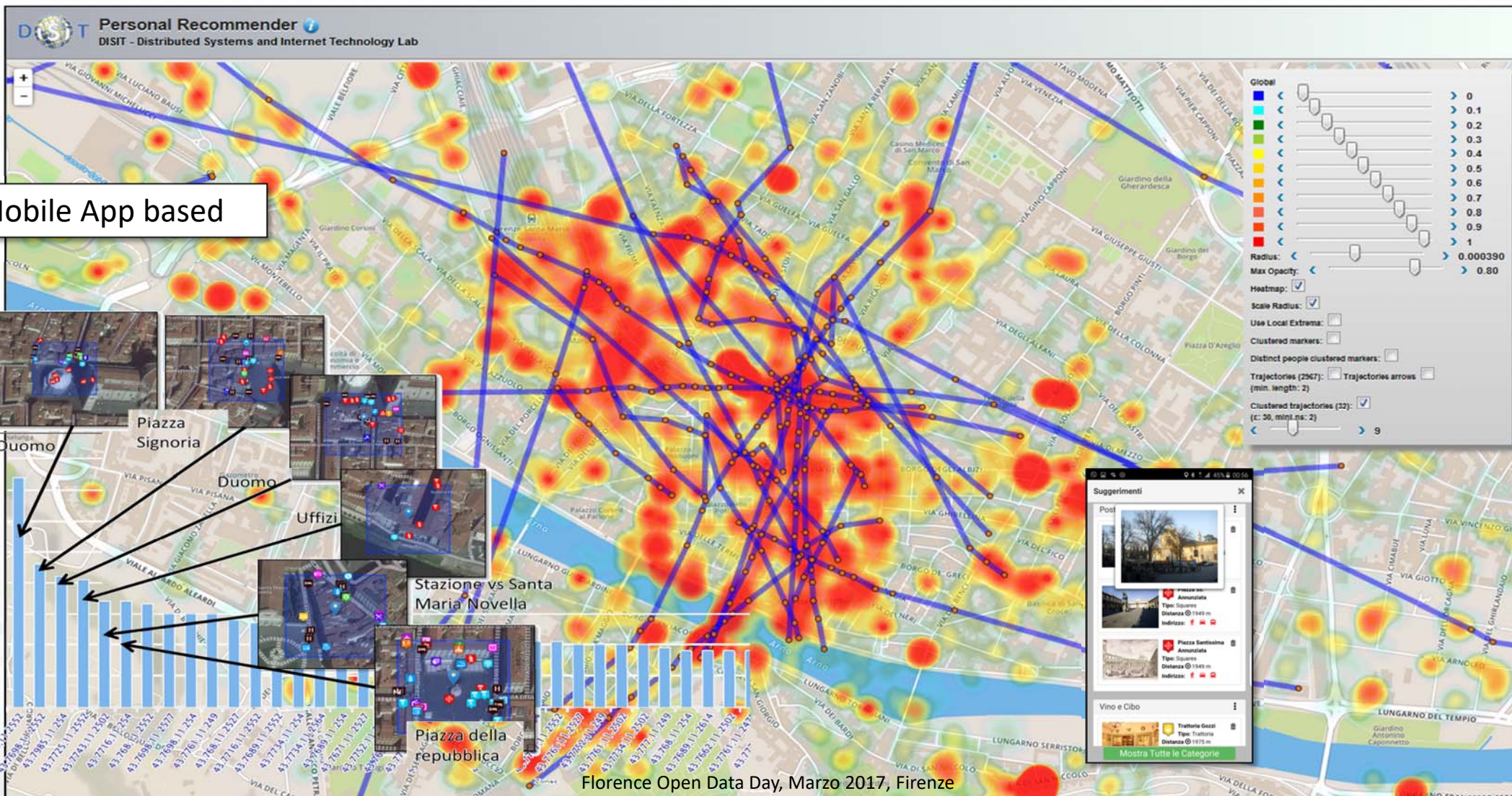
Toscana dove cosa,

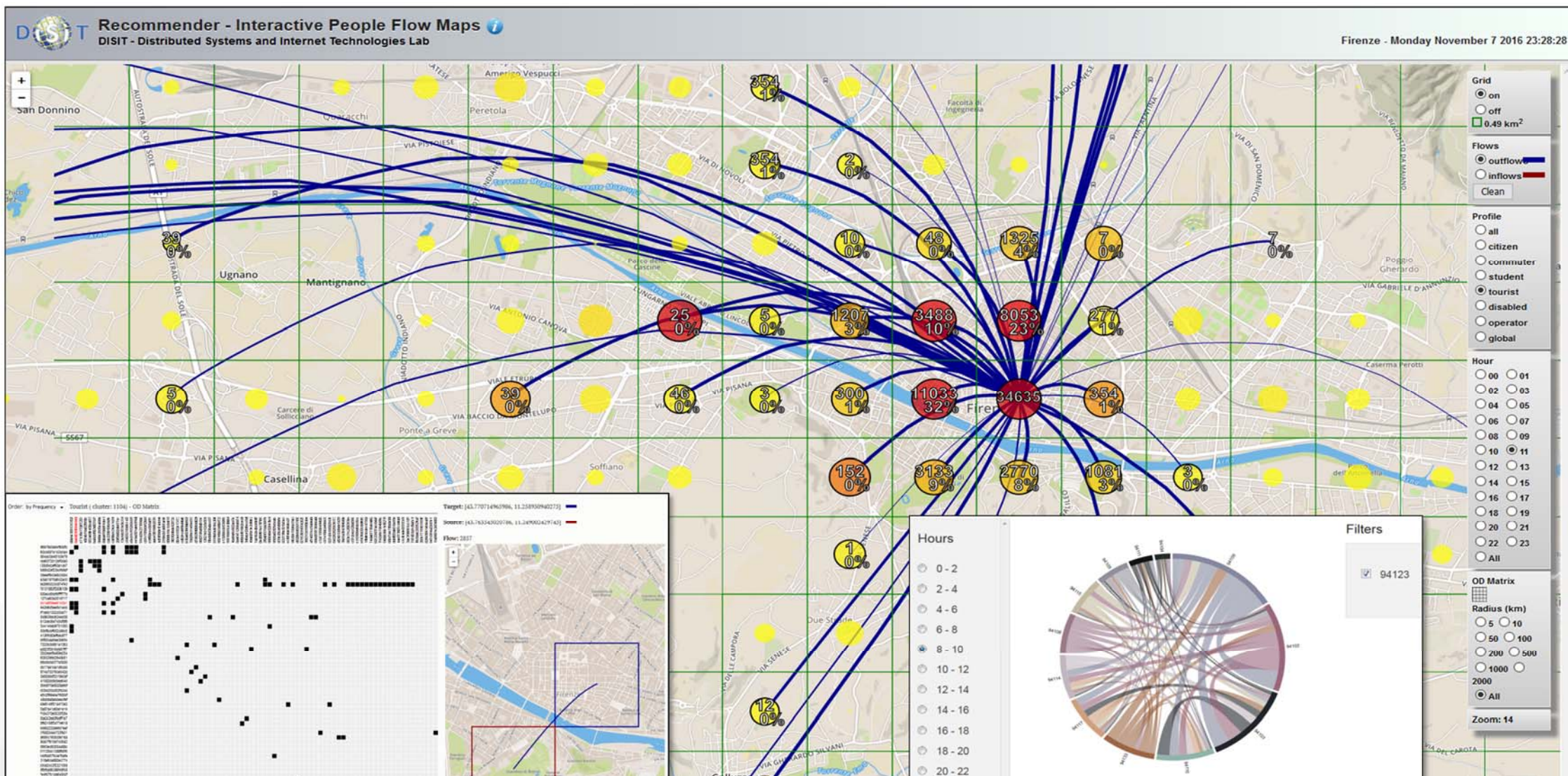
- Tutta la Toscana
- Personalizzabile
- Profilata per tipo di utente
- Trasporto pubblico
- Traffico, percorsi, navigazione
- Parcheggi liberi
- Costi benzina
- Suggerimenti
- Assistenza
- Protezione civile
- Meteo
- Biglietti bus
- Punti di Interesse
- Contributi degli utenti



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User Behavior Analyzer







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<http://OpenDASIT.disit.org>

OpenData Statistical Intelligence Tool

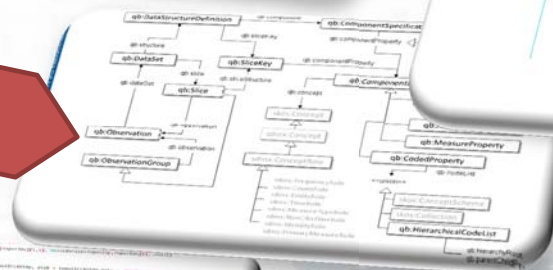
Open Source Data Exploration and
Statistical analysis tool



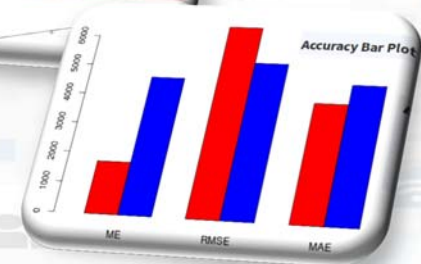
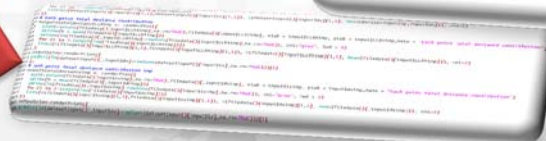
Decision tool support



RDF DataCube Vocabulary



R Web Application



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

Conclusioni

- **Smart City, Smart Cloud, Social Media,.... Mobile Computing**
- **Semantic Computing + Data Analytics + Big Data + distributed computing:**
 - Ontologie e strumenti di ragionamento,
 - l'indicizzazione e ricerca
 - Raccomandazioni, suggerimenti,
 - coinvolgimento degli utenti stimoli verso comportamenti virtuosi
 - profili collettivi, modelli predittivi, modelli di diagnosi precoce
 - ottimizzazione: allocazione e simulazione
 - clustering del comportamento degli utenti
 - matrici OD, data warehouse, aggregazione dei dati, routing
 - Etc. ...

Acknowledgement

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- **Km4City** is an open technology exploited by those projects and line of research of DISIT Lab. Some of the innovative solutions and research issues developed into the above mentioned projects are also compliant and contributing to the Km4City approach and thus are contributing to the open Km4City model of DISIT lab.





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Publications

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Distributed Systems and Internet Technologies
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