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DINFO
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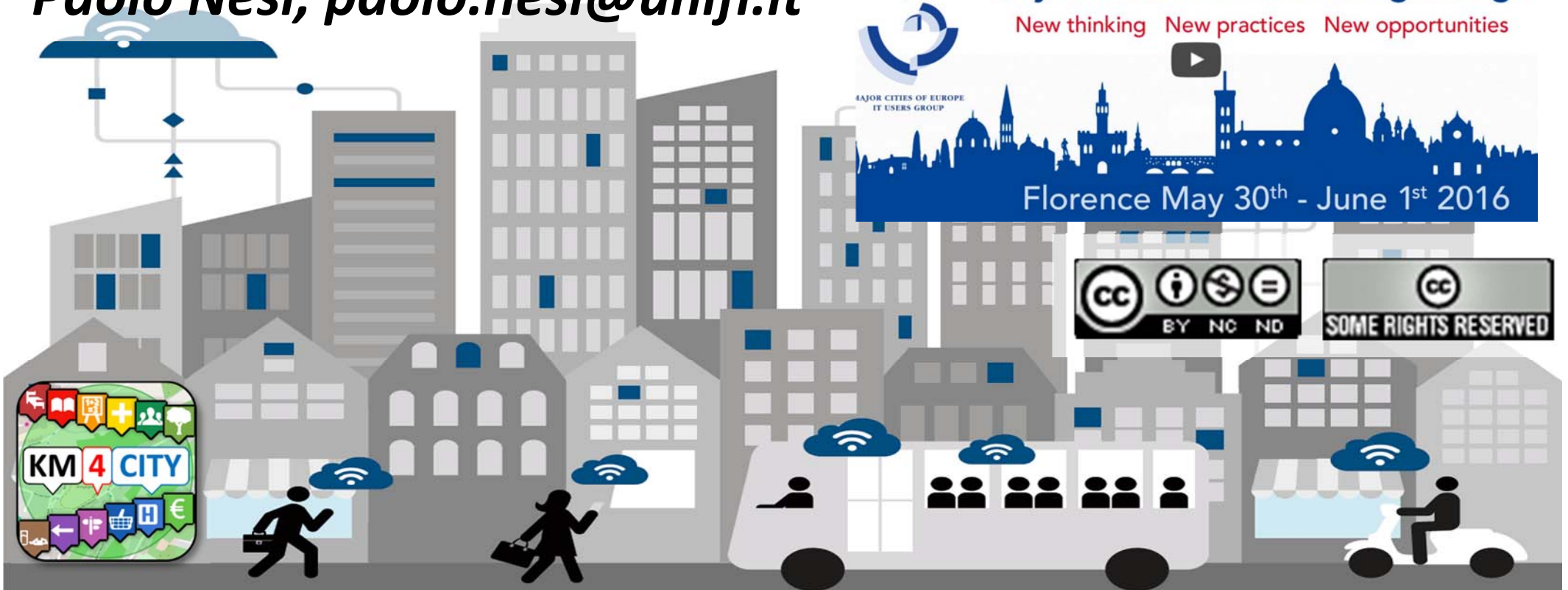
DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB

Km4City

A reusable example of a Metropolitan-Wide Data Platform

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

Paolo Nesi, paolo.nesi@unifi.it



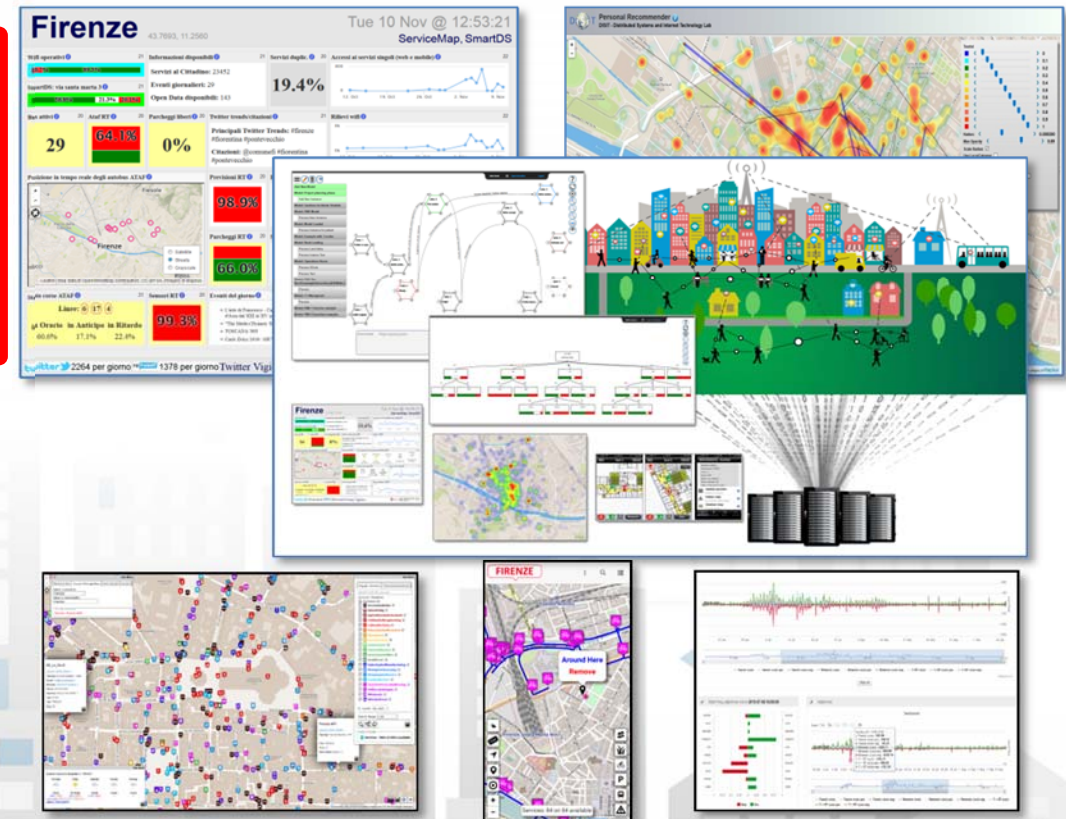
From Data to Services for the Sentient Cities

Open Source and inter-operable tools to

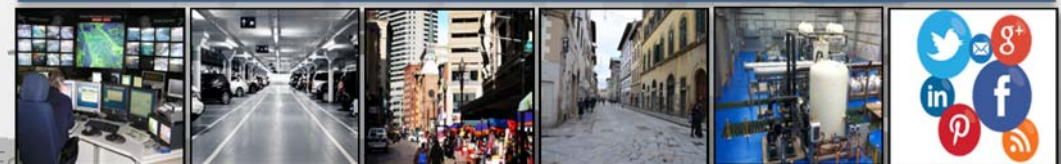
**1. keep city under control
via personalized
dashboards**

**2. improve city resilience,
reducing risks and
decision support**

**3. transform data in value
for the city**



Km4City Data and Service Aggregator





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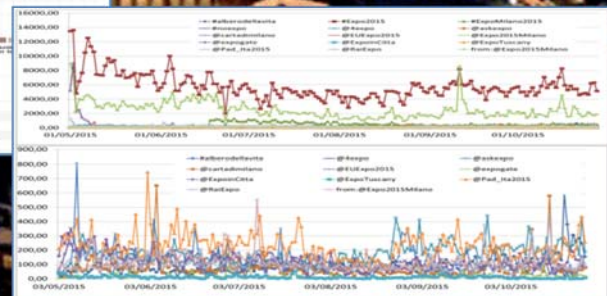
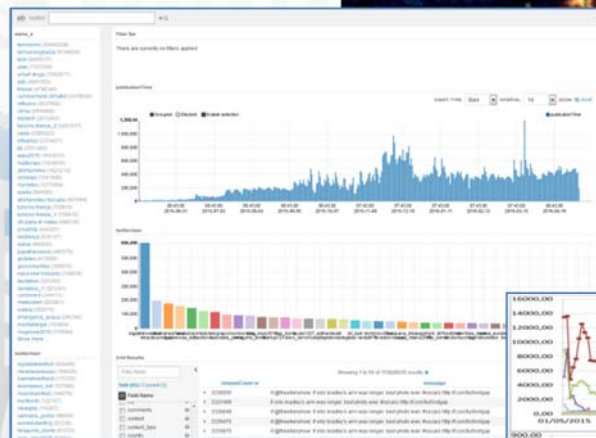
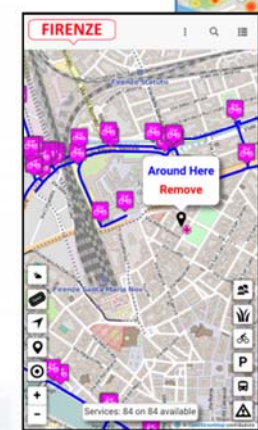
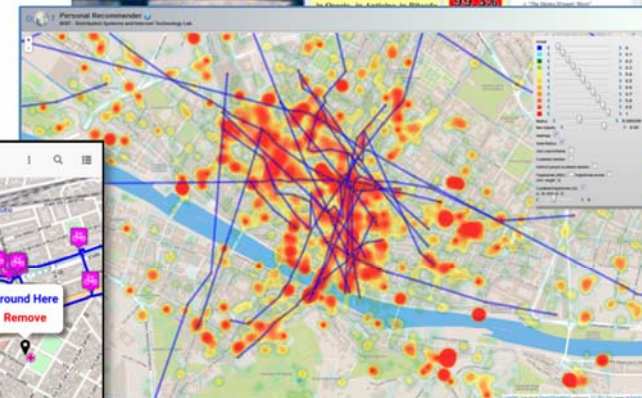
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<http://www.disit.org>



keep city under control via personalized dashboards

- monitoring services' status of city operators
 - <http://dashboard.km4city.org>
- monitoring and understanding the city users behaviour
 - Recommender and User Behavior Analyzer
 - Origin Destination matrix tools
- collecting moods, contributions and data from the city users
 - Contribution from Mobile App Km4City Firenze dove Cosa
- monitoring social media for city services and events, event predictions
 - <http://www.disit.org/tv> , <http://tvsolr.disit.org>



Firenze

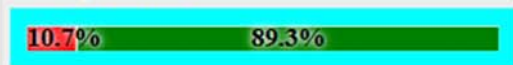
43.7693, 11.2560



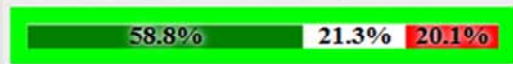
Tue 10 Nov @ 12:53:21

ServiceMap, SmartDS

Wifi operativi 21



SmartDS: via santa marta 3 21



Informazioni disponibili 21

Servizi al Cittadino: 23452

Eventi giornalieri: 29

Open Data disponibili: 143

Servizi duplic. 20

19.4%

Accessi ai servizi singoli (web e mobile) 22



Bus attivi 20

29

Ataf RT 20

64.1%

Parcheggi liberi 20

0%

Twitter trends/citazioni 21

Principali Twitter Trends: #firenze

#fiorentina #pontevecchio

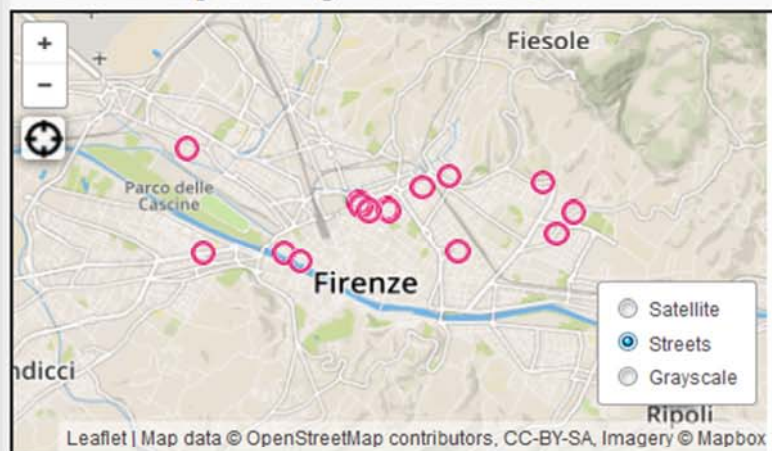
Citazioni: @comunefi #fiorentina

#pontevecchio

Rilievi wifi 22



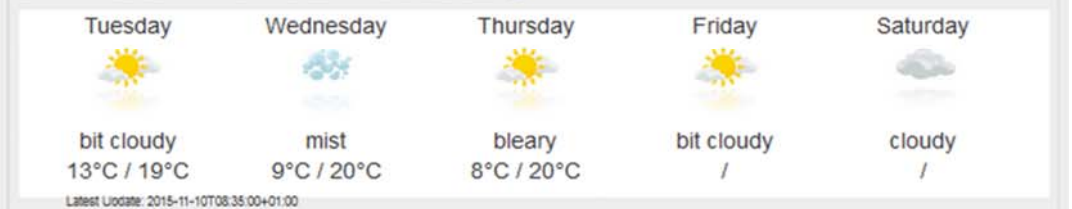
Posizione in tempo reale degli autobus ATAF 21



Previsioni RT 20

98.9%

Previsioni meteo del comune di FIRENZE 299961



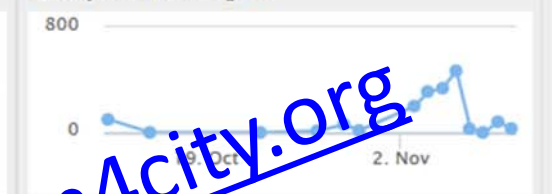
Parcheggi RT 20

66.0%

Smart City Engine 21

CPU	Mem	Job
0.1%	Totale	Eseguiti
	24034 MB	954

Query Servicemap 22



Stato corse ATAF 21

Linee: **6** **17** **4**

in Orario in Anticipo in Ritardo

60.6% 17.1% 22.4%

Sensori RT 20

99.3%

Eventi del giorno 22

- L'arte di Francesco - Capolavori d'arte e terre d'Asia dal XIII al XV secolo
- "The Medici Dynasty Show"
- TOSCANA '900
- Carlo Dolce 1616-1687

Query Km4city API 22



<http://dashboard.km4city.org>



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Dashboards



**Transport
systems,
Mobility, Parking**



**Sensors, IOT
Cameras, ..**



**Public services,
Govern, Events**



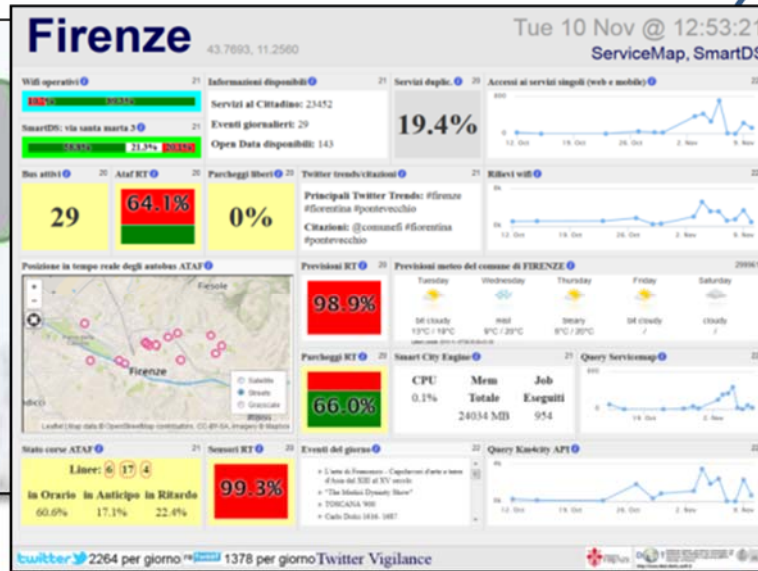
**Environment,
Water, energy**



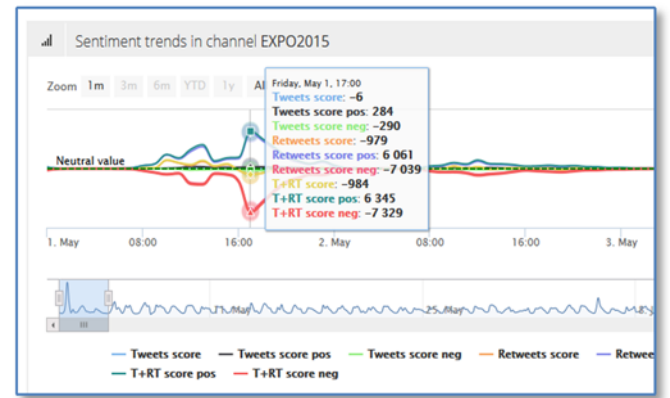
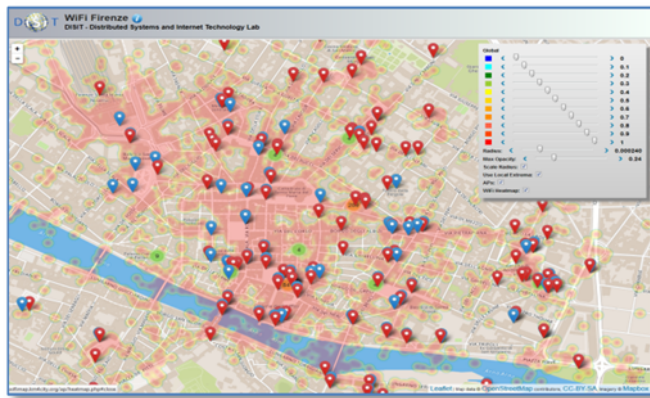
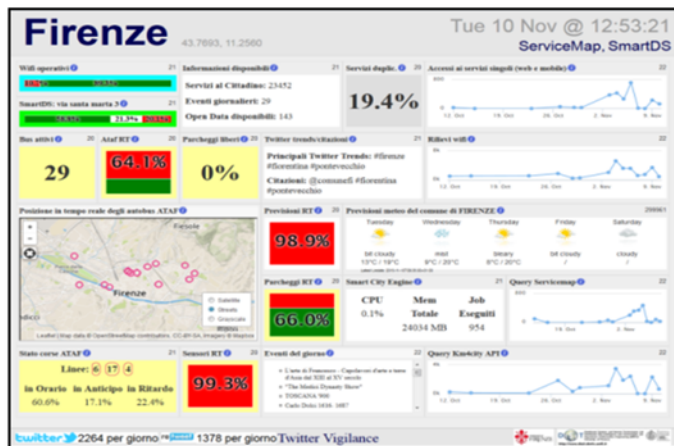
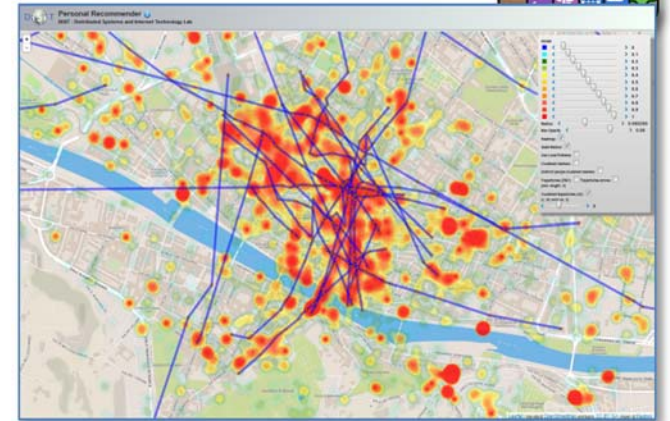
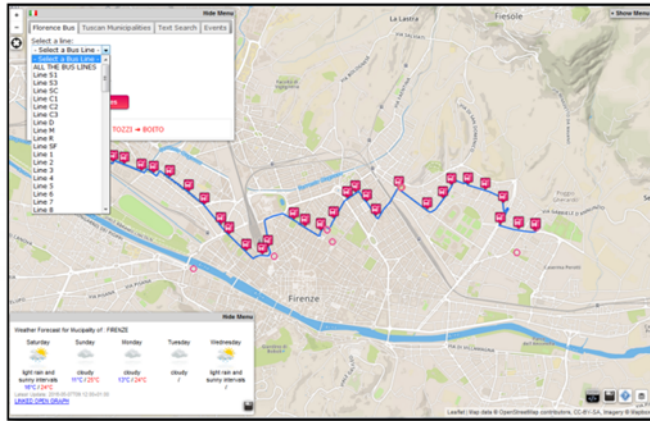
**Shops,
services,
operators**



**Social Media,
WiFi, Network**



Smart City Dashboard





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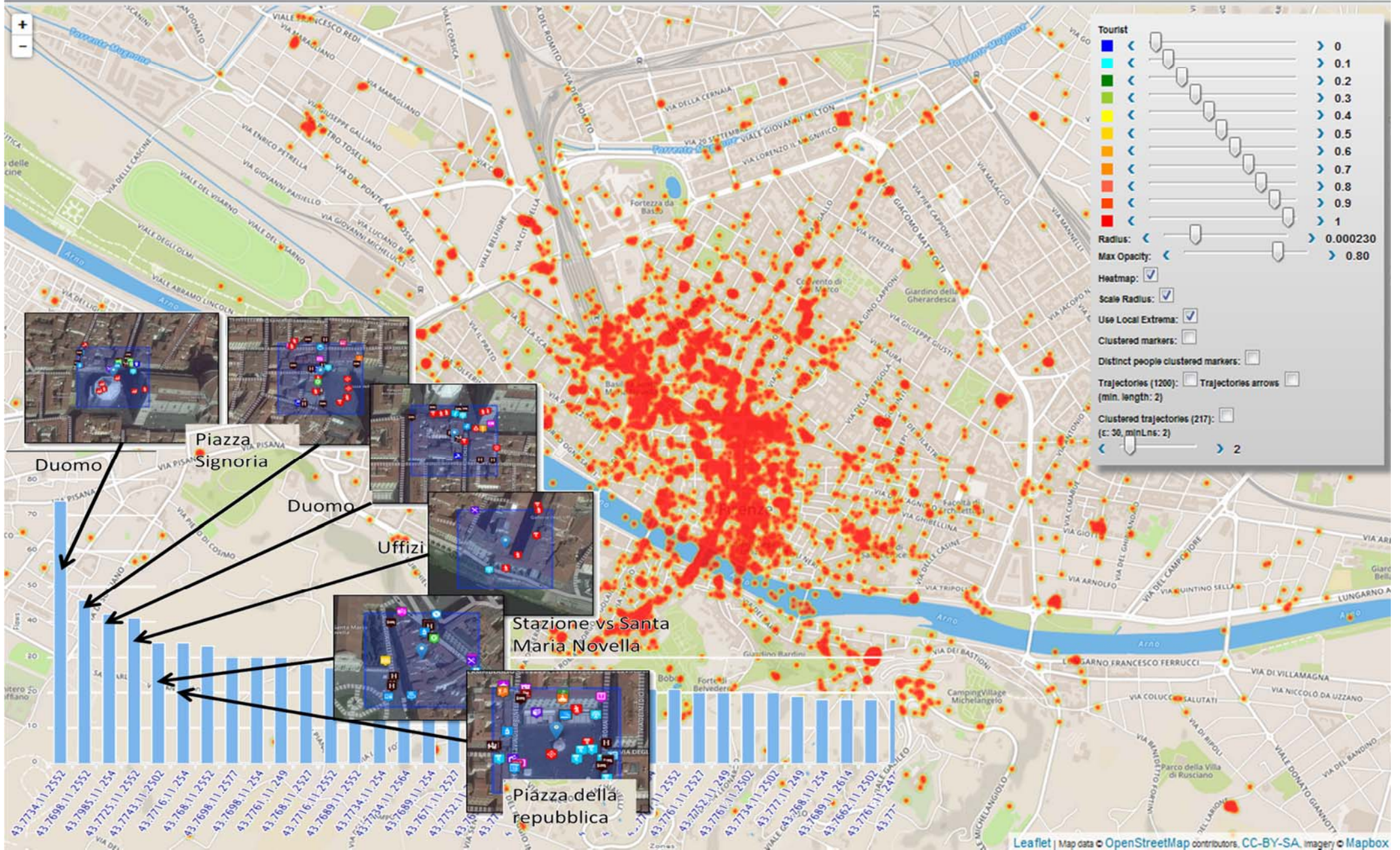
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User Behavior Analyzer



Personal Recommender

DISIT - Distributed Systems and Internet Technology Lab





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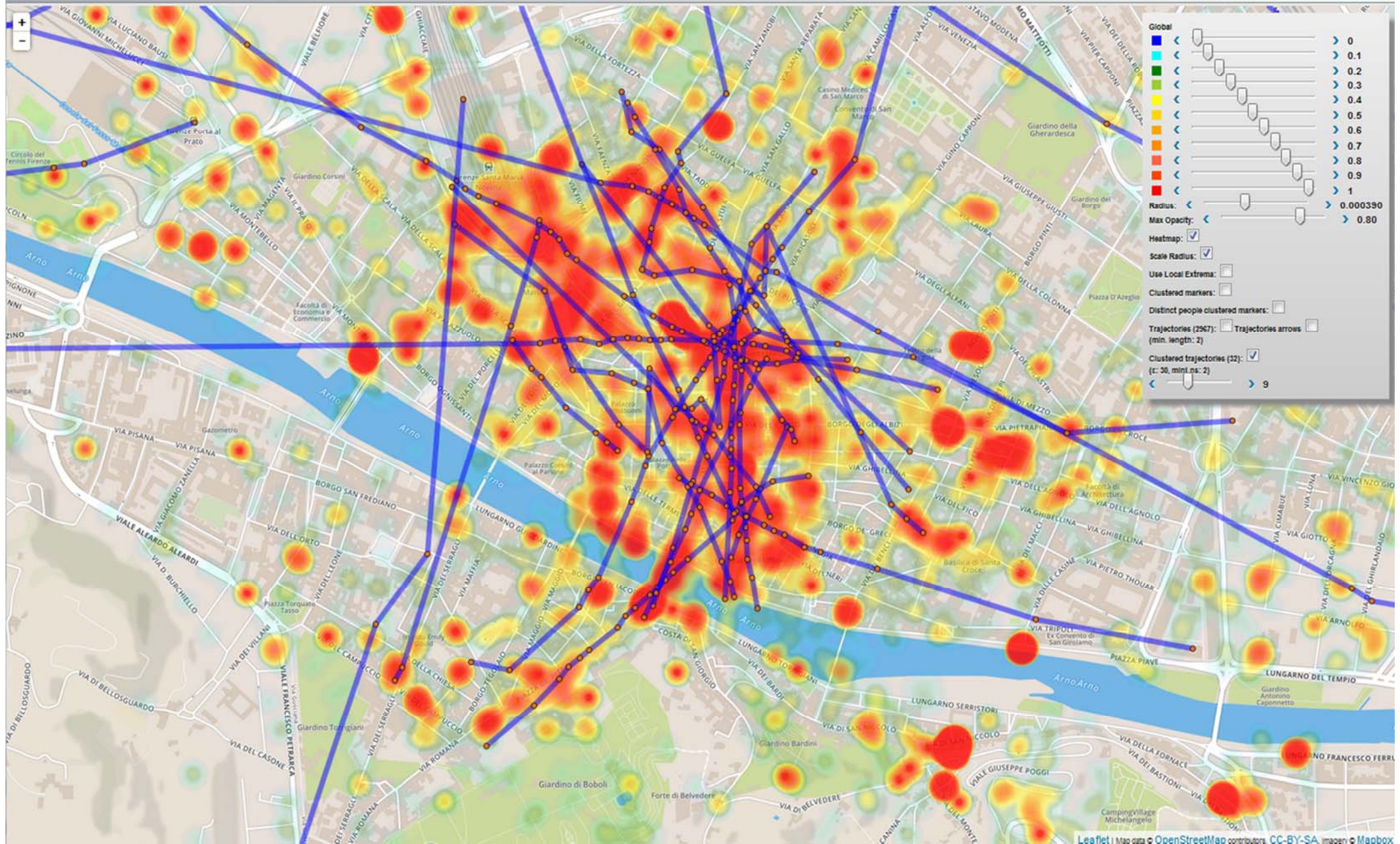
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User Behavior Analyzer



DISIT Personal Recommender
DISIT - Distributed Systems and Internet Technology Lab



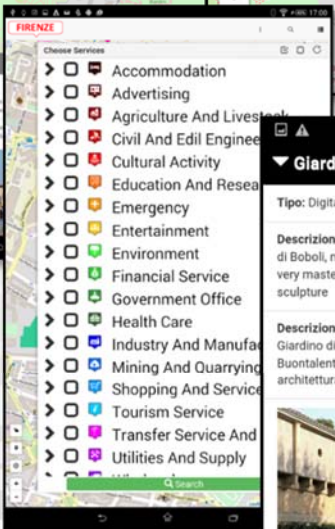
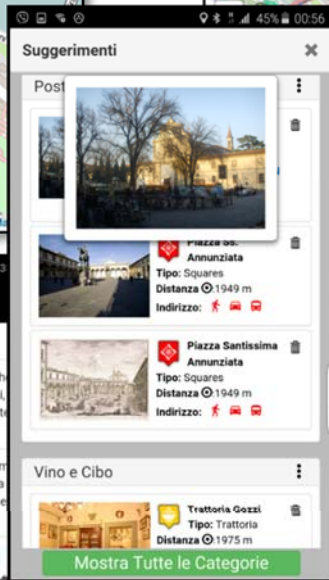


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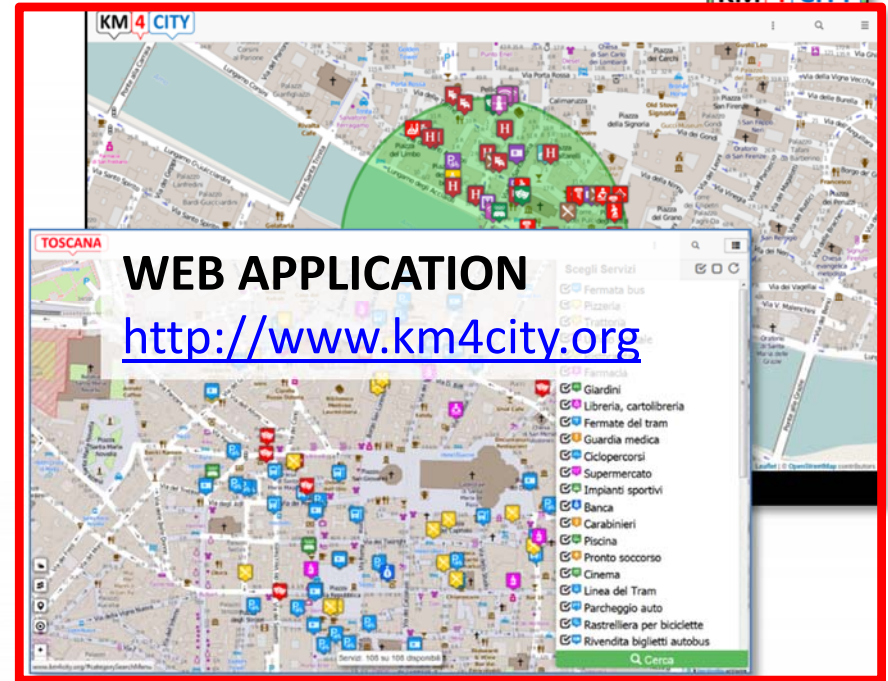
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<http://www.disit.org>

Mobile APPLICATION



Geo Located Services

Get Suggestions on demand



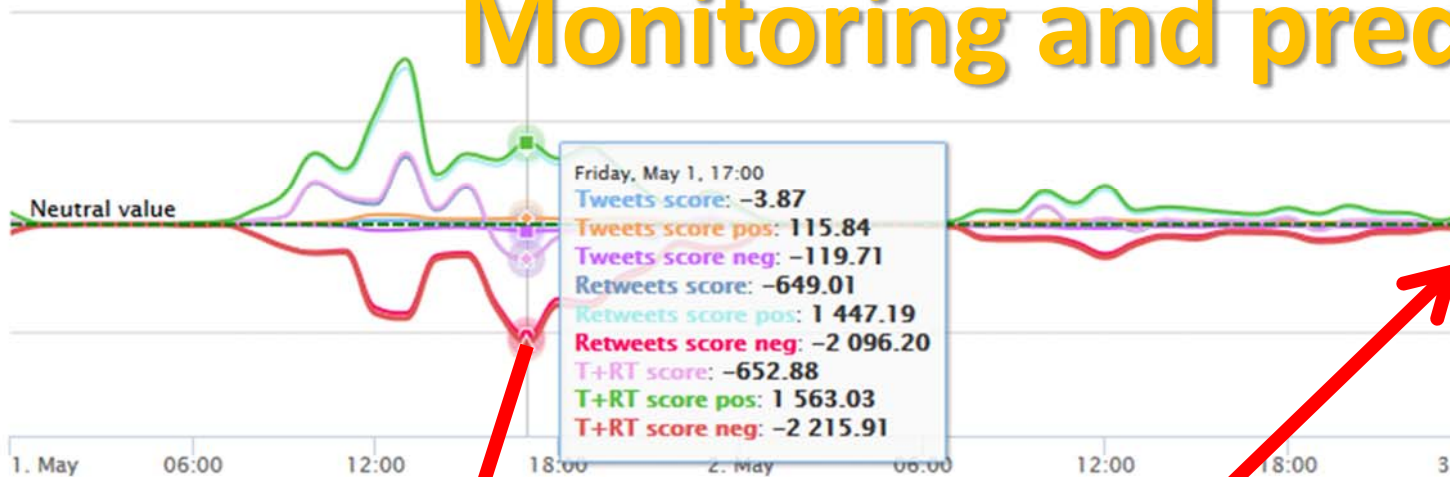
WEB APPLICATION

<http://www.km4city.org>



Twitter Vigilance, Sentiment Analysis, Monitoring and prediction

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

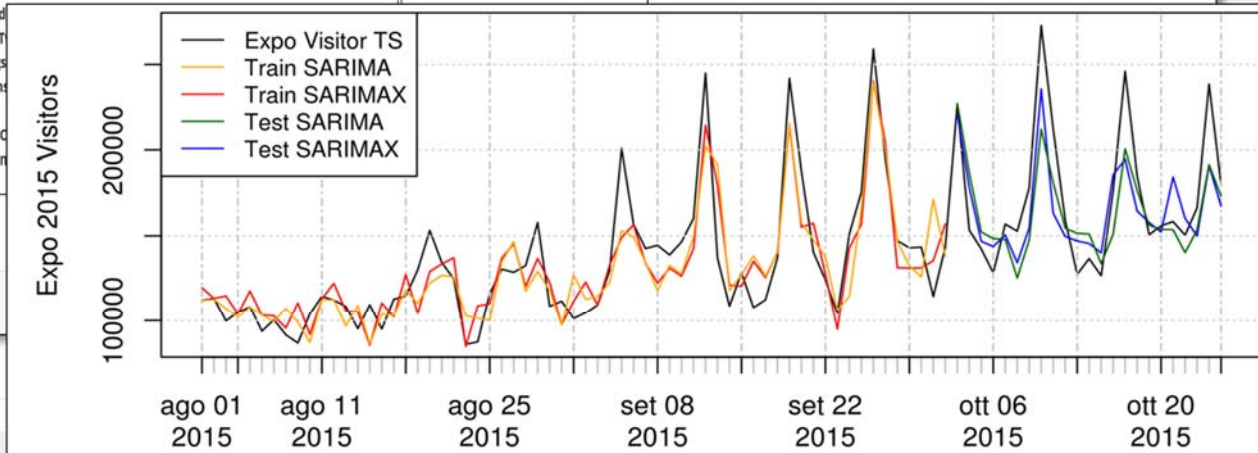


SERENA SÌ
 @SerenaSignorie

Fermate queste bestie. Animali, incivili, ignoranti, mostri. Fateschifo. Mi vergogno di essere italiana. #noexpo #Expo2015

Results 1 - 1 of 1:

message	Fermate queste bestie. Animali, incivili, ignoranti, mostri. Fateschifo. Mi vergogno di essere italiana. #noexpo #Expo2015 http://t.co/PUo3kR...
twitterUser	SerenaSignorie
publicationTime	2015-05-01 18:29:06
locationUser	
retweet	0
twitterId	
originalT	
hashtags	
mentions	
links	
retweetC	
Total Ser	
Score	



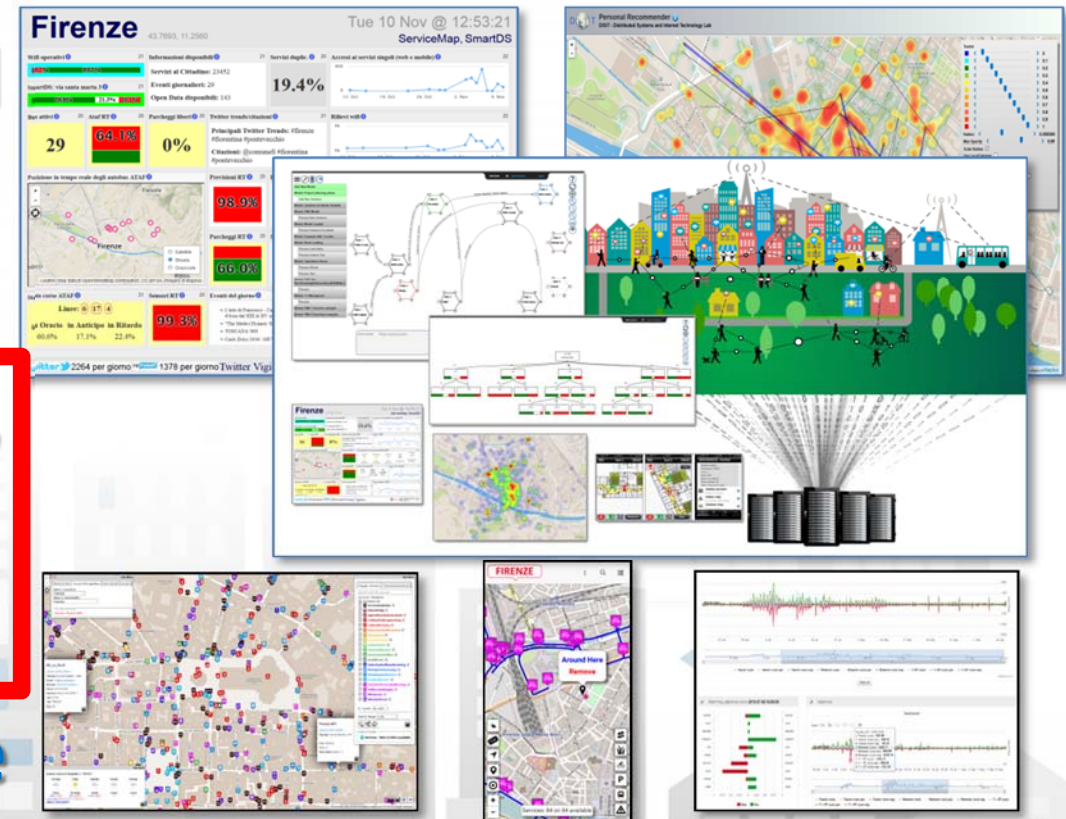
Training: 01-08-2015/02-10-2015 63 DD
 Test period: 03-10-2015/25-10-2015 22 DD

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.

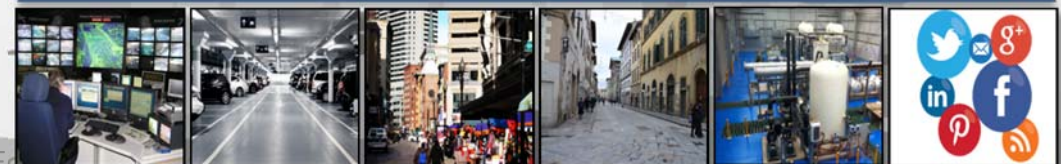
From Data to Services for the Sentient Cities

Open Source and inter-operable tools to

1. keep city under control via personalized dashboards
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Km4City Data and Service Aggregator





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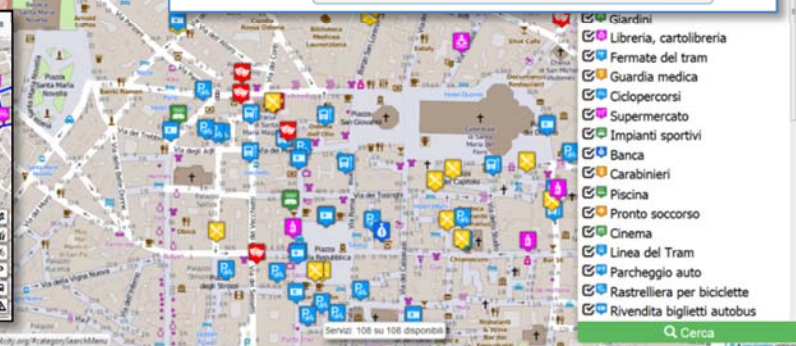
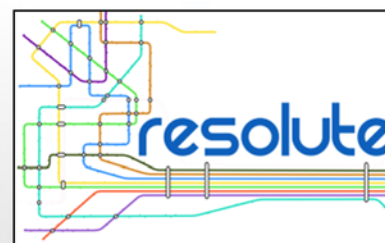
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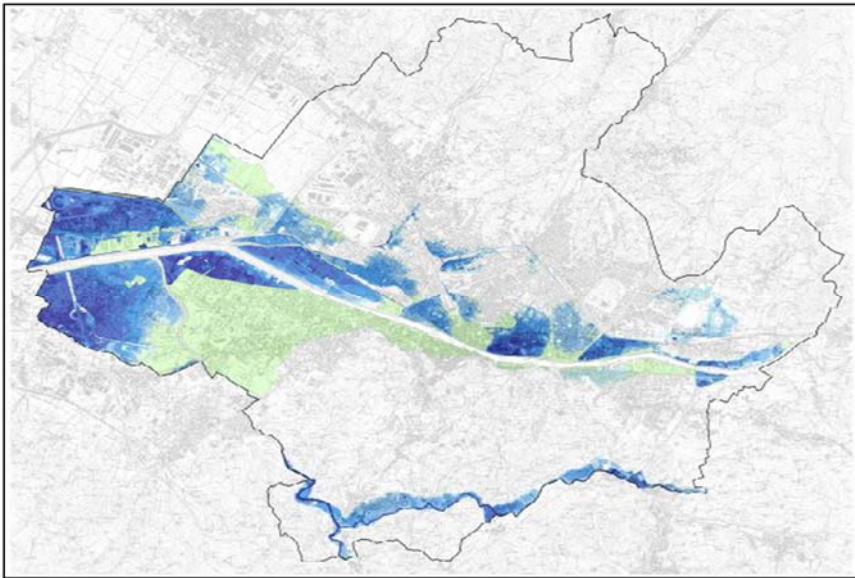
<http://www.fisf.org>

Improve city resilience, reducing risks and decision support

- assessing city resilience level
 - Resilience Decision Support, <http://resilienceds.km4city.org>
 - Smart decision support system, <http://smartds.km4city.org>
- improving city resilience, providing objective hints
 - <http://www.resolute-eu.org> H2020
- improving city users awareness with personal city assistants and participatory tools
 - Dashboard: <http://dashboard.km4city.org>
 - Km4City Web App <http://www.km4city.org>
 - Km4City Mobile App: <http://www.km4city.org/app>



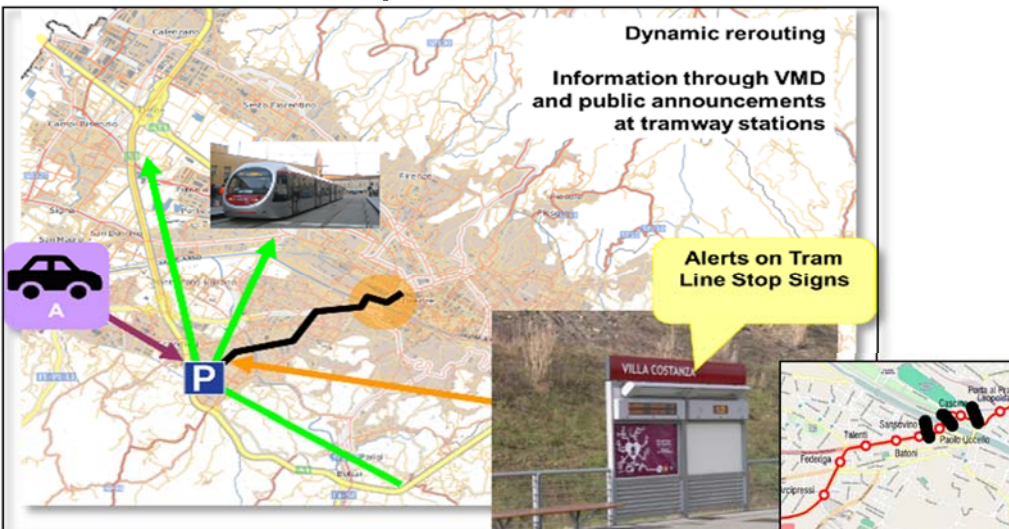
200 years probability Arno flooding



30 years probability Arno flooding



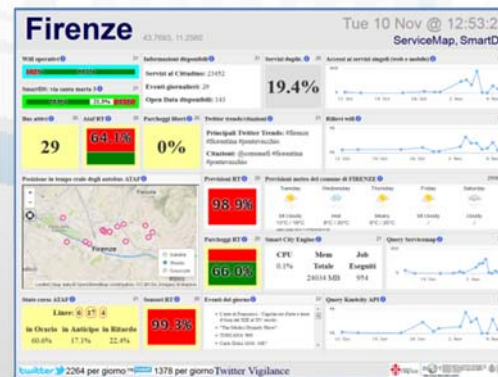
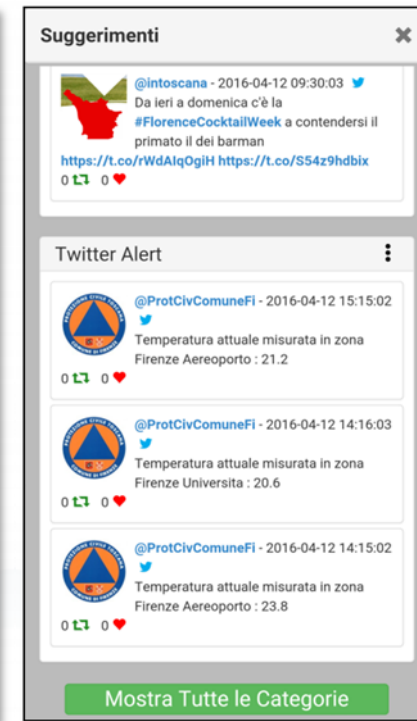
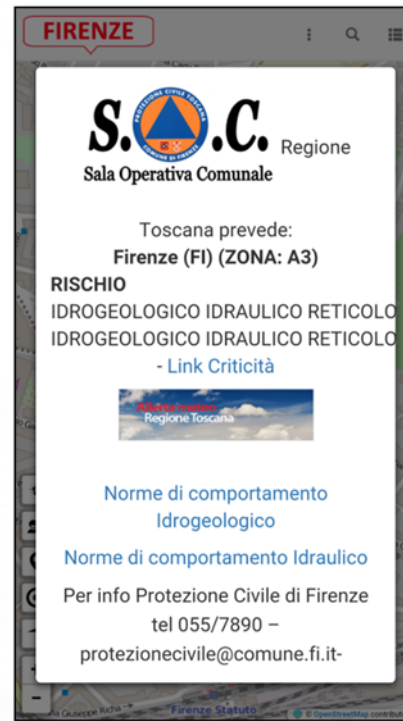
Arno Flood Impact on Tram Line & Traffic



Water bomb in South Florence



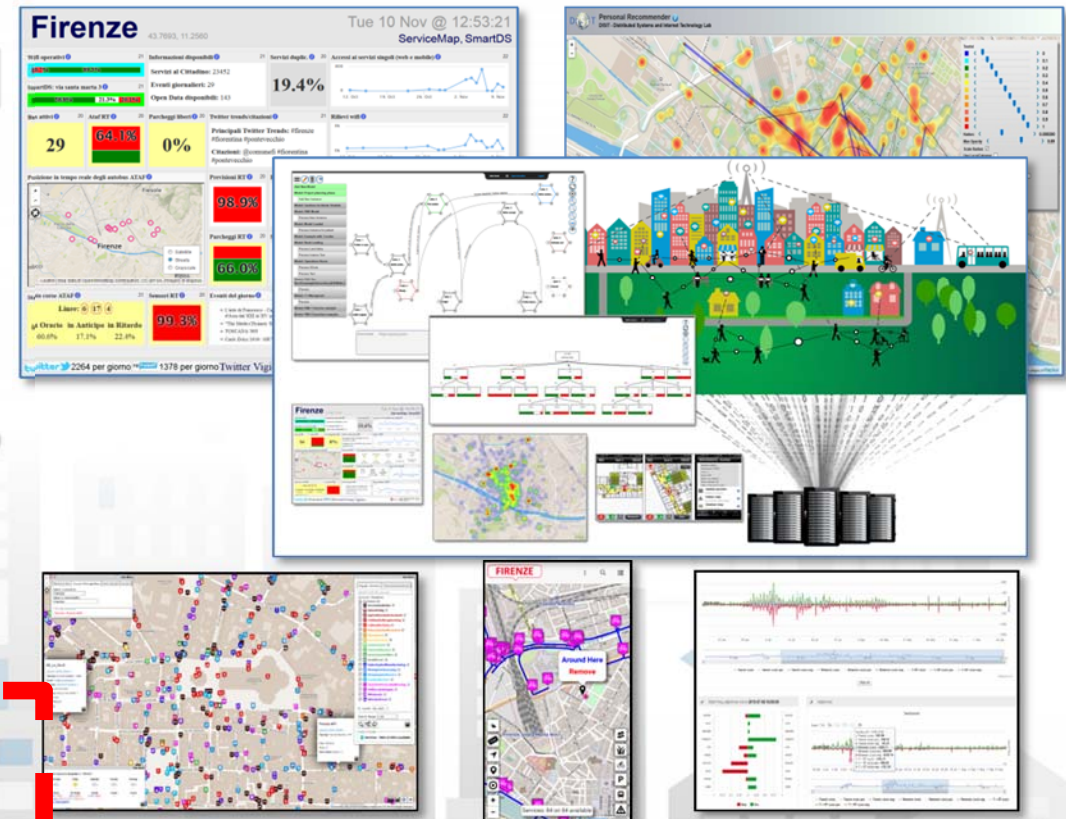
- Personalized menu for Operators
- Providing information and suggestions to citizens
 - Civil Protection Page
 - Twitter Info
 - Geolocalized Info
- Tracking people and operators flows
- Collecting information from citizens
 - Comments
 - Images



From Data to Services for the Sentient Cities

Open Source and inter-operable tools to

1. keep city under control via personalized dashboards
2. improve city resilience, reducing risks and decision support
3. transform data to value for the city



Km4City Data and Service Aggregator



Transform data to value for the city

- enabling commercial and business applications
- aggregating multi-domain data and services for SMEs and city operators
- enabling integrated city services into third party web portal for all
- providing suggestion on demand services for SMEs and city operators
- accelerating and simplifying the implementation of business and service oriented Apps



Transport systems
Mobility, parking



Public Services
Govern, events,



Sensors, IOT
Cameras, ..



Environment,
Water, energy



Shops, services,
operators



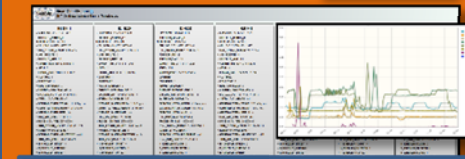
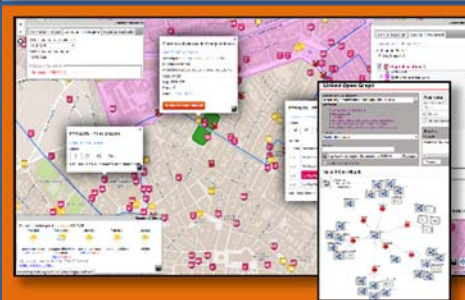
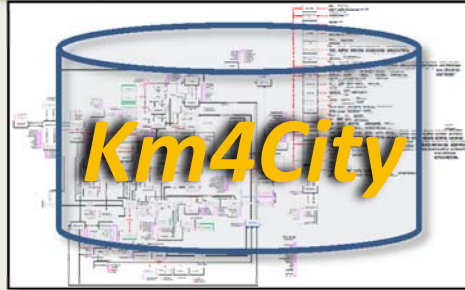
Social Media
WiFi, network



Static, Slow and Real Time data flows

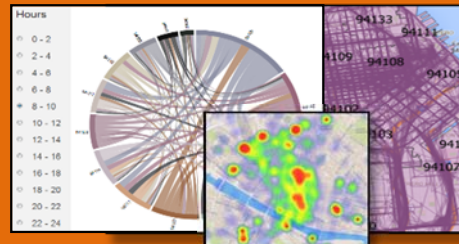
DISCES -- Distributed and parallel architecture on Cloud

Km4City Smart City Engine



User Profiling and Suggestions on Demand

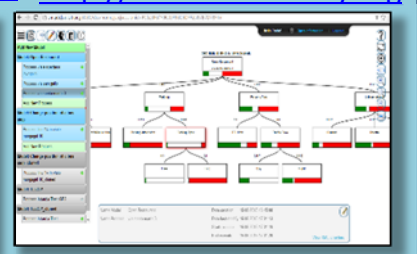
Flow and Origin Destination Matrix
<http://www.disit.org/odsf>



Km4City Tools for Developers

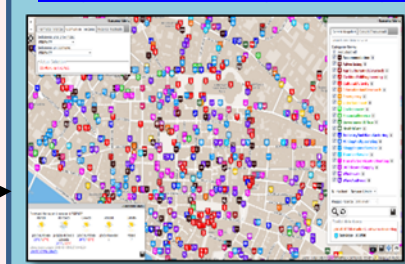
Km4City Smart City API

Tools for City Operators and Decision Makers

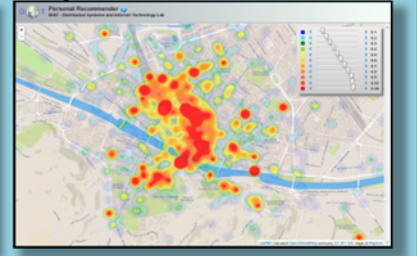


Service map browser
<http://servicemap.km4city.org>

Twitter Vigilance
<http://www.disit.org/tv>



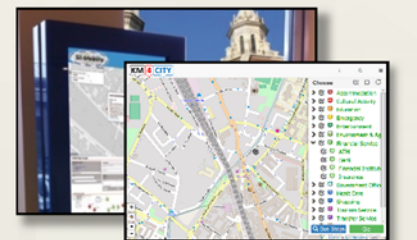
Collective User behavior Analyzer



Tools for Final Users

Mobile e Web Apps
<http://www.km4city.org>

<http://www.km4city.org>



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

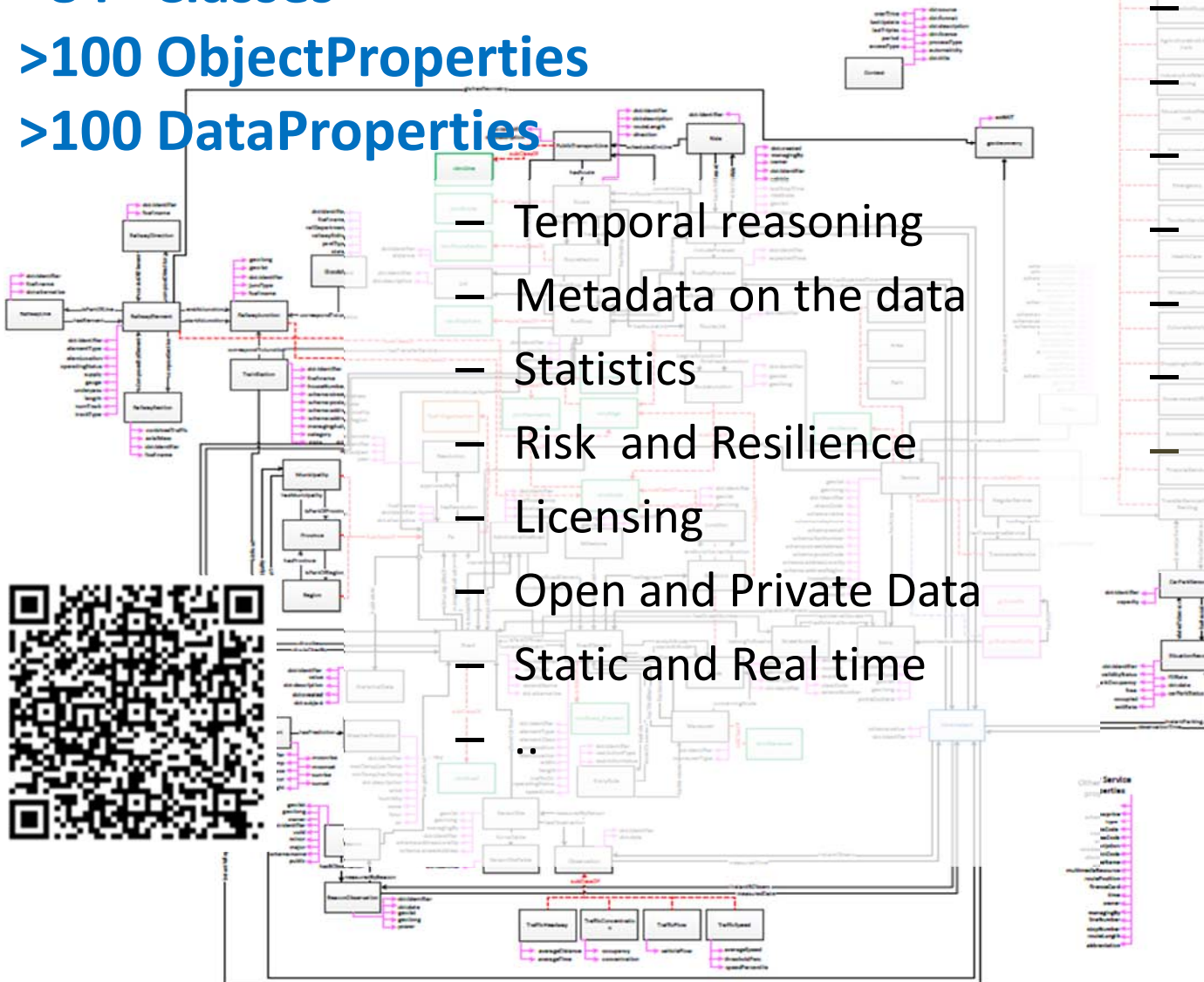


Km4City Ontology

>84 Classes

>100 ObjectProperties

>100 DataProperties



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

- to cover different aspects:

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

Ontology Documentation:

<http://www.disit.org/6506>

<http://www.disit.org/6507>

<http://www.disit.org/5606>

<http://www.disit.org/6461>

Smart City EcoSystem



Decision Makers, Public administrator tools:

- ✓ Smart City Dashboards, <http://dashboard.km4city.org> → Dashboard Builder
- ✓ Resilience Decision Support, <http://resilienceds.km4city.org>
- ✓ Smart decision support system, <http://smartds.km4city.org>
- ✓ Twitter Vigilance, <http://www.disit.org/tv>
- ✓ Recommender and User Behavior Analyzer, <http://recommender.km4city.org>
- ✓ WiFi monitor, <http://wifimap.km4city.org>
- ✓ ServiceMap Server, <http://servicemap.km4city.org>
- ✓ Traffic and People Flow Assessment <http://www.disit.org/6694>

Final Users tools:

- ✓ Km4City mobile applications, <http://www.km4city.org/app>
- ✓ Km4City web application, <http://www.km4city.org>
- Open Source Mobile Application, FODD <http://www.disit.org/6595>

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

- ServiceMap Server, plus API, <http://servicemap.km4city.org>
- ✓ Smart City API, <http://www.disit.org/6597>
- ✓ Km4City Ontology, <http://www.disit.org/km4city>
- SPARQL query tool and licenser, http://log.disit.org/sparql_query_frontend/
- LOG LOD browser, <http://log.disit.org>

Back Office tools:

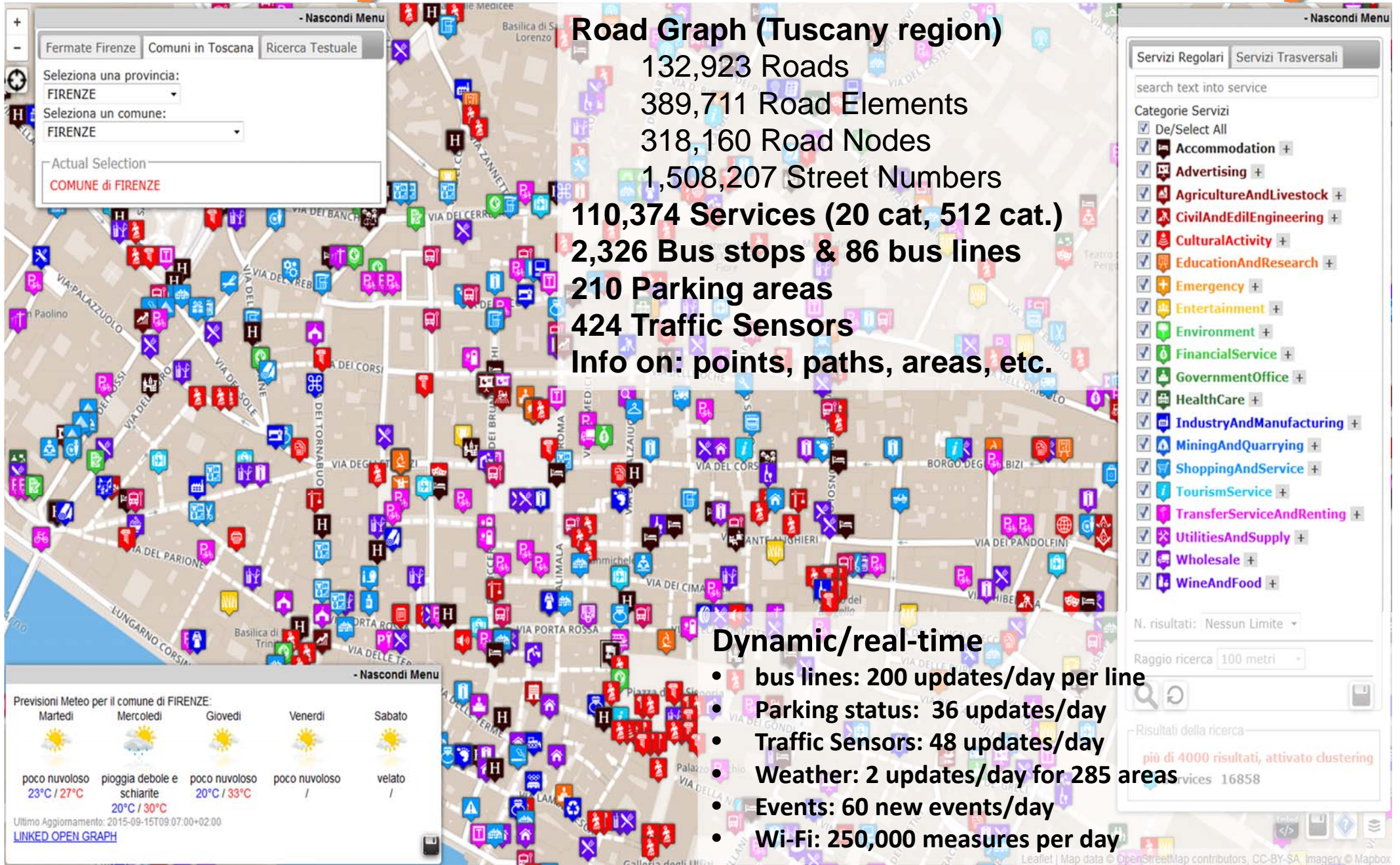
- Data Ingestion Manager, DIM, <http://www.disit.org/6732>
- Distributed Smart City Engine, SCE, Scheduler, DISCES <http://www.disit.org/6515>
- RDF Indexer Manager, RIM, <http://www.disit.org/6708>
- RDF store enricher with dbPedia

The collage displays several key components of the KM4City ecosystem:

- Map Interface:** A map of Florence, Italy, overlaid with numerous colored markers representing different data points or services.
- SPARQL Editor:** A screenshot of the SPARQL Editor 1.0.3 showing a query and its results. The query is:

```
PREFIX rdfs: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
SELECT ?WHERE {
  ?x rdfs:subClassOf ?WHERE .
  ?x rdfs:label ?label .
  ?x rdfs:comment ?comment .
  ?x rdfs:isDefinedBy ?source .
  ORDER BY ?label .
}
```
- License Control Interface:** A screenshot titled "Risultati del controllo delle licenze" showing a table of license conditions. The table has columns for "grafo", "licenza", "link", "derivative", "share alike", "attribution", "commercialize", "redistribute", "access-play", and "notice".
- Linked Open Graph:** A screenshot of the Linked Open Graph interface showing a network of nodes and relationships. The nodes are represented by icons and connected by lines.

Km4City on Firenze & Tuscany





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ServiceMap



Search around a GPS point

Search along a line

Regular Services Transversal Services

search text into service

Services Categories

De/Select All

- Area
- DigitalLocation
- HappeningNow
- Fresh Place
- Public Transport Line
- Road Sensors
- Bus Stops

N. results for each: 200

Search Range: 500 mt

Search Results

Services: 35 of 35 available

Bus Stops: 13 of 13 available

Road Sensors: 2 of 2 available

Bus Lines

72 Bus Lines Found.

Bus Line: 23
Direction: NAVÈ A ROVEZZANO → NUOVO PINONE

Bus Line: 23
Direction: BORGANE → NUOVO PINONE

Bus Line: 35
Direction: MADENTA → STAZIONE VIA ALAMANNI

Weather Forecast for Municipality of FIRENZE

Day	Sunday	Monday	Tuesday	Wednesday	Thursday
Light rain and sunny intervals	cloudy	cloudy	light rain	rainstorm	
18°C / 24°C	13°C / 24°C	13°C / 25°C			

Search for Geo Located Services

Get Events in the city

Regular Services Transversal Services

search text into service

Services Categories

De/Select All

- Area
- DigitalLocation
- HappeningNow
- Fresh Place
- Public Transport Line
- Road Sensors
- Bus Stops

N. results for each: 500

Search Range: 500 mt

Search Results

Services: 418 of 418 available

Bus Stops: 23 of 23 available

Road Sensors: 2 of 2 available

Bus Lines

33 Bus Lines Found.

Bus Line: C2
Direction: PIAZZA BECCARIA → LEOPOLDA

Bus Line: C2
Direction: PIAZZA BECCARIA → LEOPOLDA

Bus Line: I2
Direction: STAZIONE PIACCHEDI → PIAZZALE servizi asstn fi

Events in Florence

20 events found.

Jan Fabre a Firenze
Place: PALAZZO VECCHIO - ARENGARDO
Date: da 2016-04-15 a 2016-10-02

Jan Fabre a Firenze
Place: PALAZZO VECCHIO - ARENGARDO
Date: da 2016-04-15 a 2016-10-02

Musica ribelle - La forza dell'Amore, il musical
Place: TEATRO DELLA PERGOLA
Date: da 2016-05-03 a 2016-05-08
Time: 20:45, domenica 19:45

"In sua movenza è fermo"
Place: TEATRO DELLA PERGOLA

Weather Forecast for Municipality of FIRENZE

Day	Sunday	Monday	Tuesday	Wednesday	Thursday
light rain and sunny intervals	cloudy	cloudy	light rain	rainstorm	
18°C / 24°C	13°C / 24°C	13°C / 25°C			

Search in an area

Get weather forecast

Regular Services Transversal Services

search text into service

Services Categories

De/Select All

- Accommodation
- Advertising
- AgricultureAndLivestock
- CivilAndITEngineering
- CulturalActivity
- EducationAndResearch
- Emergency
- Entertainment
- Environment
- FinancialService
- GovernmentOffice
- HealthCare
- IndustryAndManufacturing
- MiningAndQuarrying
- ShoppingAndService
- TourismService
- TransportServiceAndRenting
- UtilityAndSupply
- Wholesale
- WineAndFood

N. results: No Limit

Search Range: visible areas

Search Results

Services: 2231 of 2231 available

Query results organized by category

Total number of results: 2231

Category	Count
Accommodation	18
Advertising	21
AgricultureAndLivestock	31
CivilAndITEngineering	34
CulturalActivity	34
EducationAndResearch	34
Emergency	34
Entertainment	34
Environment	34
FinancialService	34
GovernmentOffice	34
HealthCare	34
IndustryAndManufacturing	34
MiningAndQuarrying	34
ShoppingAndService	34
TourismService	34
TransportServiceAndRenting	34
UtilityAndSupply	34
Wholesale	34
WineAndFood	34

Weather Forecast for Municipality of FIRENZE

Day	Sunday	Monday	Tuesday	Wednesday	Thursday
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18°C / 24°C	13°C / 24°C	13°C / 25°C			

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

Regular Services Transversal Services

search text into service

Services Categories

De/Select All

- Area
- DigitalLocation
- HappeningNow
- Fresh Place
- Public Transport Line
- Road Sensors
- Bus Stops

N. results for each: 200

Search Range: 500 mt

Search Results

Bus Stops: 25 of 25 available

Road Sensors: 3 of 3 available

Service: FI055ZTL01601

LINKED OPEN GRAPH

Typology: TransferServiceAndRenting - SensorSite

Address: VIA QUELFA

Data from sensor: FI055ZTL01601

Last Update: 2016-05-09T10:31:05+02:00

Avg Distance(m)	Avg Time (sec)	Occupancy (%)	Concentration (car/km)
N.A.	N.A.	N.A.	0.0

Vehicle Flow (car/h)	Avg Speed (km/h)	Threshold Perc (%)	Speed Perc (%)
48.0	0.0	N.A.	N.A.

Weather Forecast for Municipality of FIRENZE

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light rain and sunny intervals	cloudy	cloudy	light rain	rainstorm	
18°C / 24°C	13°C / 24°C	13°C / 25°C			



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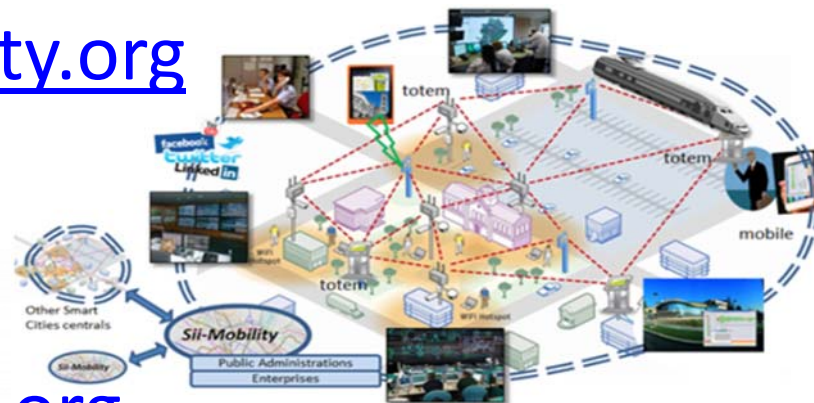
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DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

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



Projects based on KM4City

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



- Resolute, <http://www.resolute-eu.org>



RESilience management guidelines
and **O**perationalization app**L**ied to
Urban **T**ransport **E**nvironment



- Replicate, <http://www.disit.org/6778>







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Sii-Mobility



- Experimentations and validation in Tuscany ■ <http://www.Sii-Mobility.org>
- Integration with present central station and subsystems 
- DISIT lab, Università di Firenze, is the tech-scientific coordinator 



ataf

tiemme
TOSCANA MOBILE S.p.A.

BUSITALIA
GRUPPO FERROVIE DELLO STATO ITALIANE

atam

CTT
CORRISPONDENZA TELEGRAFICA ITALIANA

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

 Comune di Perugia

 COMUNE DI NAPOLI

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



km4City Roadmap



2013

Km4City 1.1

- Tuscany Map
- Services
- AVM
- Sensors
- Parking

2015

- Cultural Heritage
- Enrichment-cities
- Events in the city
- Digital Locations
- Fresh places

Km4City 1.4

- Embed
- More API
- iBeacon

Km4City 1.5

- SmartDS
- Km4City

RESOLUTE H2020
2015-2018 - Started

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

- Weather
- Cultural Heritage
- Energy recharge pillar
- Wi-Fi

2014

- Events in the city

2016

Sii-Mobility SCN
2016-2018 - Started
Km4City 1.6.2

- Dashboards
- Risk analysis
- Territorial, areas and paths
- Environmental: water, health
- Statistics, Energy, ICT, ...
- Data Licensing models
- User Engagement

Today

- Suggestion on demand
- People flow tracking

REPLICATE H2020
2016-2021 - Started



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Km4City

Smart City Ecosystem

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

Paolo Nesi, paolo.nesi@unifi.it





- Video of Km4City App on stores:
 - <http://www.disit.org/6862>
- Overview Km4City Tools 2015
 - <http://www.disit.org/6816>
- Video of Smart City Big Data event, 2015
 - <http://www.disit.org/6834>
- Replicate H2020 Video
 - <http://www.disit.org/6826>