

Resilience management guidelines and Operationalization applied to Urban Transport Environment

Evidence-driven Collaborative Resilience Assessment and Management Support System for Urban Transport System

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Brussels, 13/09/2017

<http://www.disit.org/7110>

RESOLUTE

- **European Resilience Management Guidelines** – (guidelines) – consensus driven approach improve guidelines acceptability at EU level
 - general version, and UTS version
 - <http://www.resolute-eu.org/index.php/deliverables>
- **CRAMSS** – (tools and algorithms) – ontology based static and dynamic Critical Infrastructure (CI) data integration, processing and analysing platform
- **Mobile Emergency app** – (tools and procedures) – supporting users in their local decision before (early warnings), during and after an event
- **Game based training app** – (tools and procedures) – improving the current preparedness of the citizen in order to increase the community self-resilience





The CRAMSS

The CRAMSS is a collaborative workspace in which DSS operators can share their outputs and information about their status and operative activities

CRAMSS includes:

- **Resilience Dashboard**, notification, event management
 - Declined for different operators, and accessible for them in different forms
- **Decision Support Systems**, DSS: NEW and Connection with those in Place
 - NEW: Evacuation DSS (eDSS)
 - evacuation planning, collaborative rescue planning
 - NEW: ResilienceDS based on FRAM, SmartDS based on System Thinking
 - UTM (Urban Transport Management) DSS
 - ⑩ ITS, UTS
- **Analytics tools, as analysis, prediction, early warning, anomaly detection**
 - Human behavior: traffic flow, people flow tracking/prediction, trajectories, OD matrices..
 - Social monitoring vis NLP on social media: Twitter, ..
 - Risk Assessment and Resilience Assessment





Data Integraton and interoperability

RESOLUTE RESILIENCE Dashboard

Presentation & Visualization

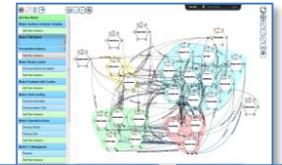


User guidance

DashBoards systems

CRAMSS

FRAM operationalization



RESOLUTE Mobile APPs

UTS DSS

Smart DS

Evacuation DSS

Decision support system

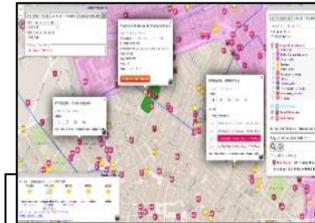


Application framework

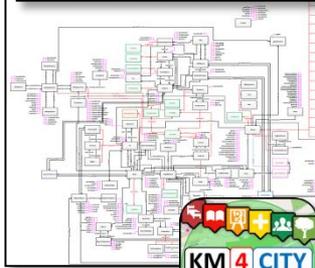
Algoritms and models

Data integration layer for event exchange

Integration framework



Km4City Data Aggregator, and Smart City API



13-09-2017, Brussels



RESOLUTE at a glance

RESOLUTE Dashboard 4XHD v5

The dashboard provides a comprehensive overview of Florence's emergency and public services. Key data points include:

- Environment:** Current temperature is 22°C, with a 24-hour forecast showing 24°C and 20% humidity.
- Mobility:** Underpass Viale Mariti is open, Underpass Viale Talenti is closed, and Underpass Fortezza is open.
- Resources:** 20 ambulances and 33 volunteers are currently available.
- TV-RT:** Real-time monitoring of Twitter activity for #FIRENZE.
- Wi-Fi:** Real-time streaming of access point clusters and coverage maps.

<http://dashboards.km4city.org/dashboard=MT15>

Tool integration scenario



Co-funded by the European Union under H2020 DRS' 07-2014

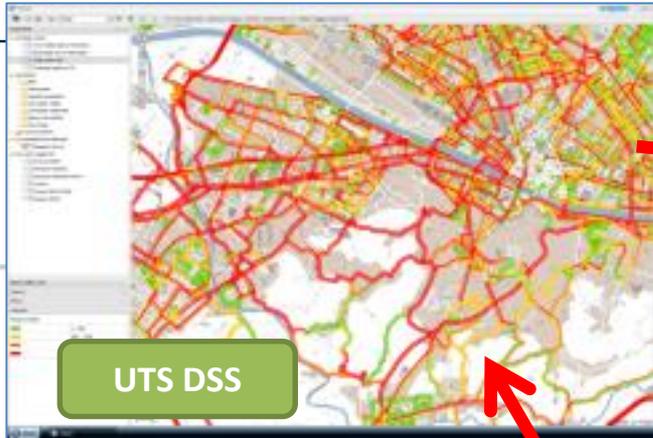


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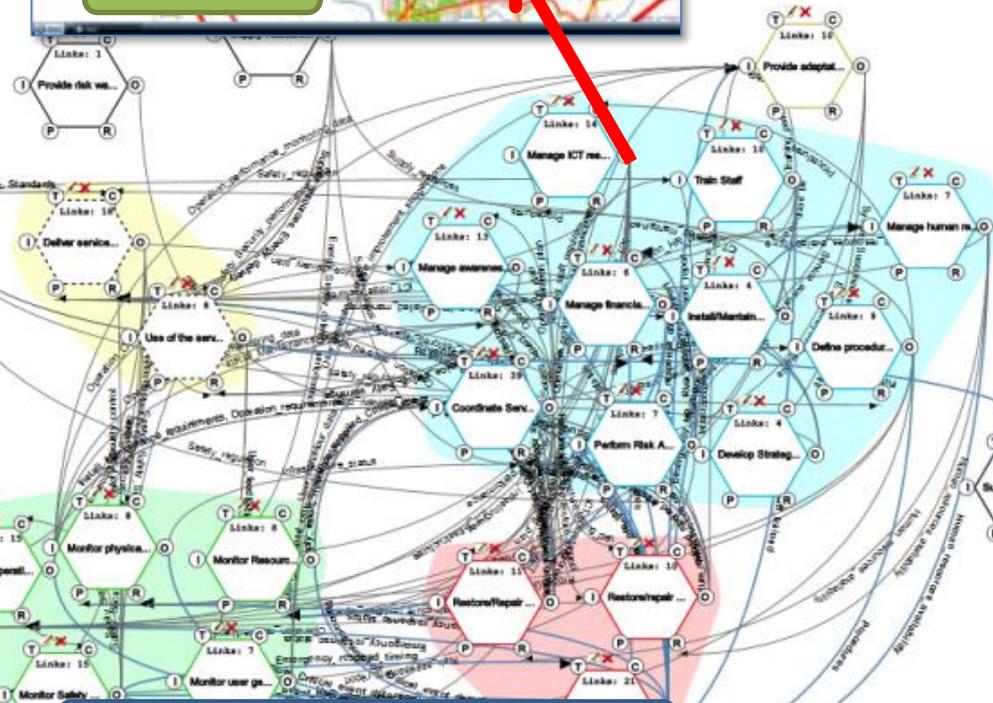
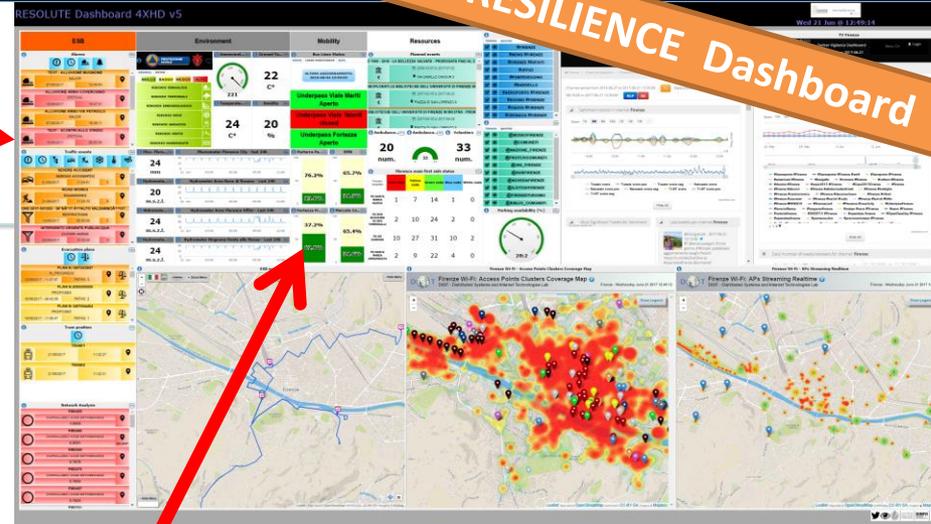
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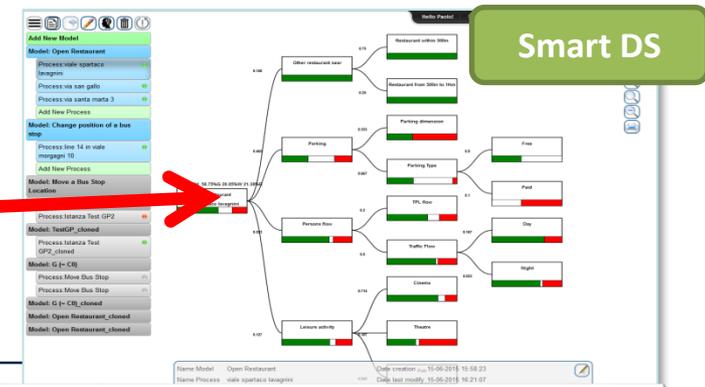
RESOLUTE RESILIENCE Dashboard



UTS DSS



FRAM → ResilienceDS



Smart DS

Data and Service Aggregator



Addressed Data as

- **Open and Private data, Static and Real time data**
 - municipality open data (including: seismic risk maps, hydrological risk maps, services, statistics, time series of major disasters, descriptors of structures such as schools, hospitals, infrastructures, mobility structure, streets and city services, etc.),
 - mobility operators (public mobility operator timeline and real time status, taxi, parking areas (locations and status), local sensors for car flows),
 - people: Wi-Fi sensors (people flows), user tracking flow (WiFi /Bluetooth), schools (RT), events (RT)...
 - Social media: twitter vigilance, ...

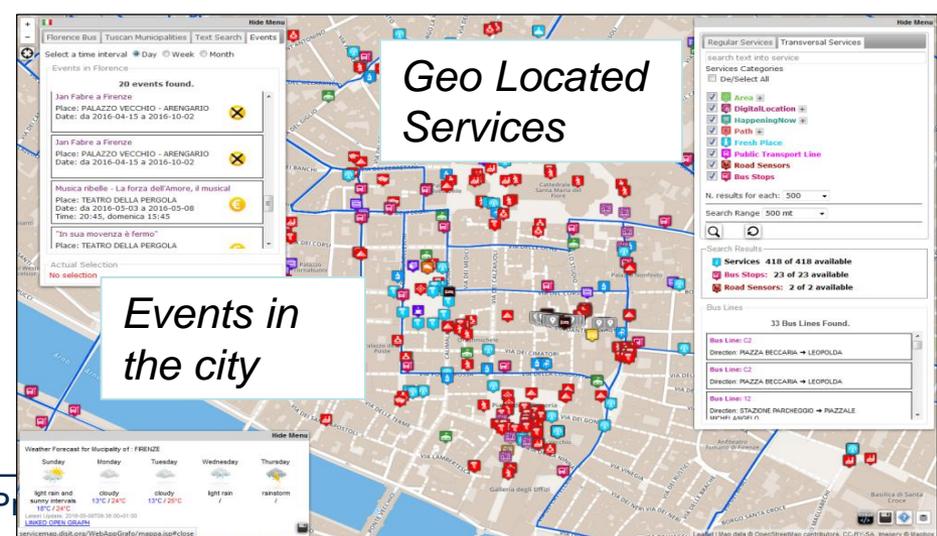
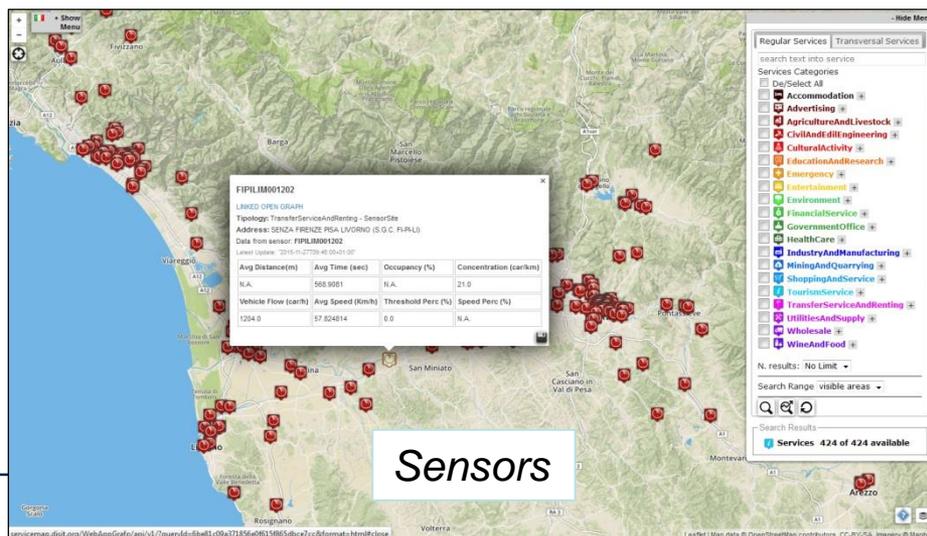
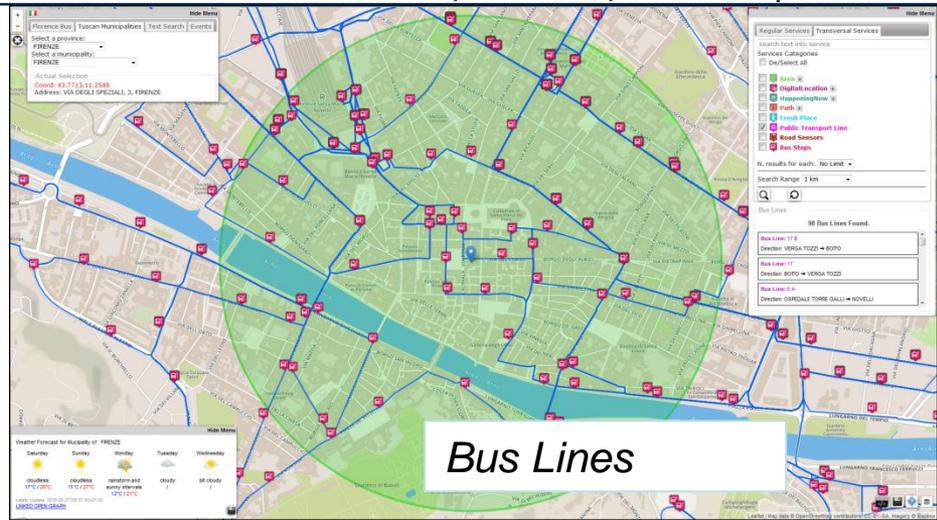
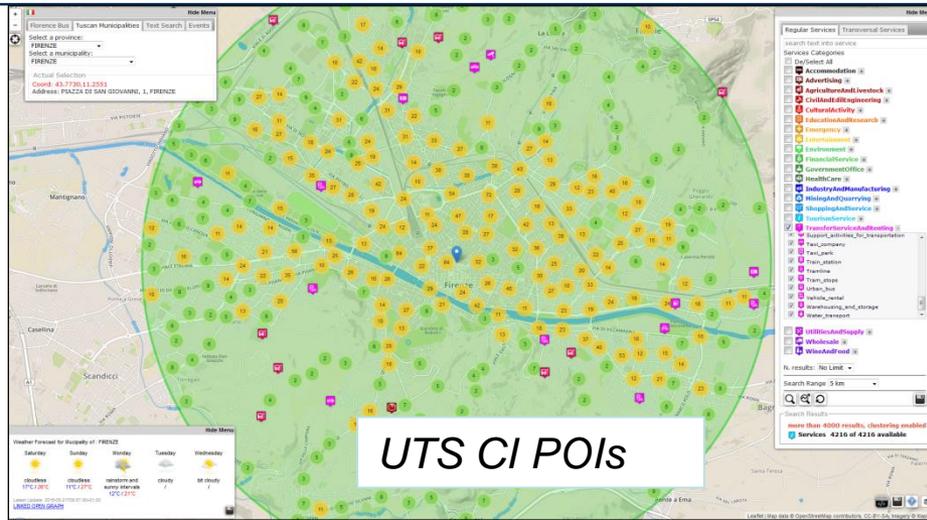


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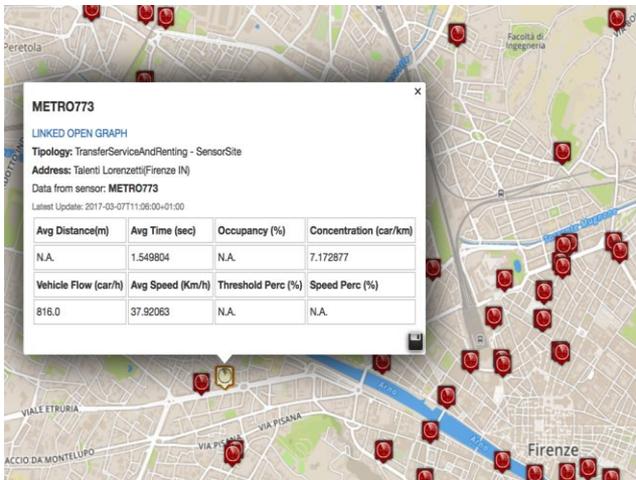
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Firenze Smart City: UTS +



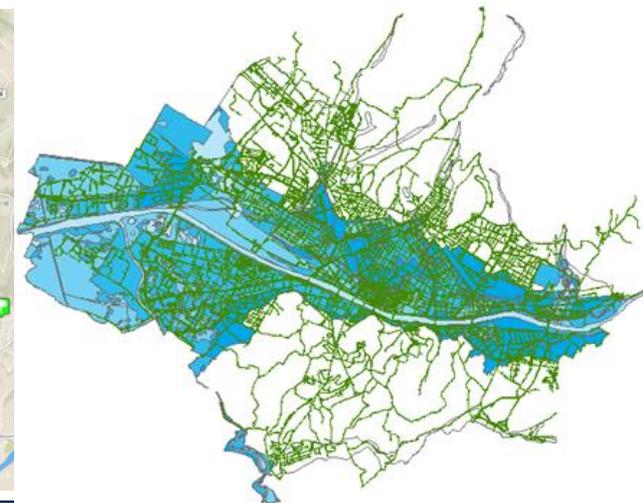
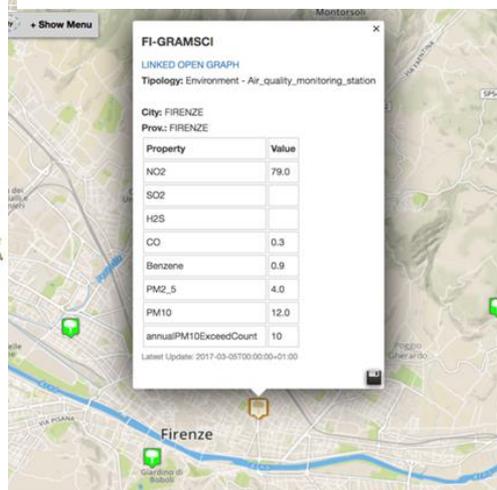
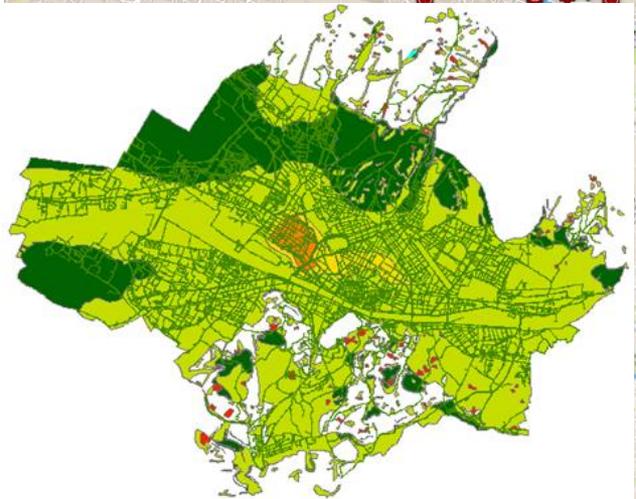
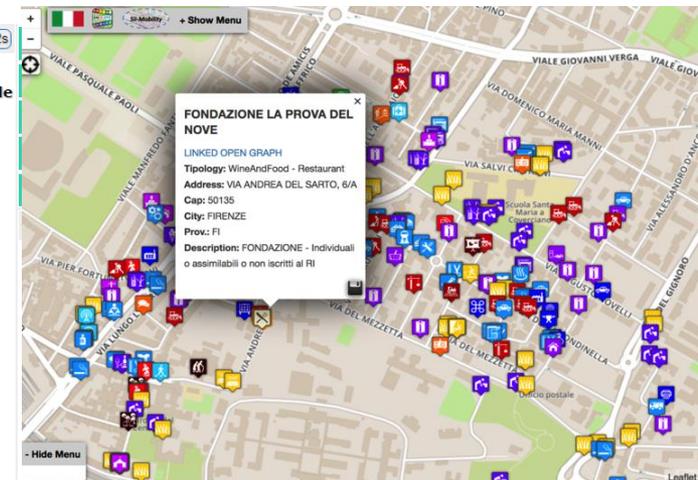
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Some data examples

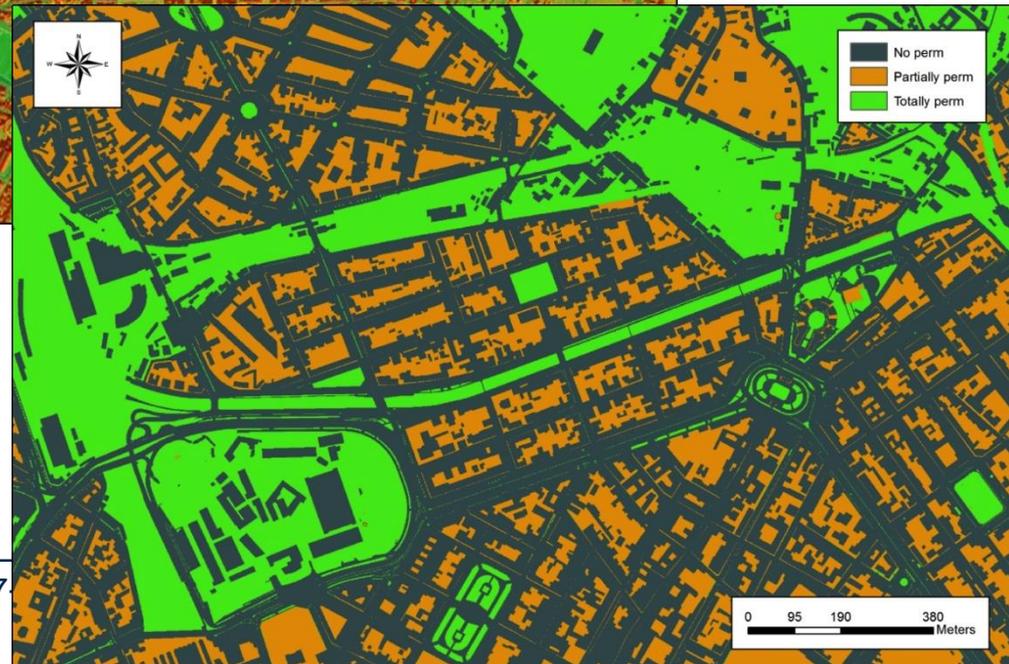


Florence main first aids status

Priority\ Hospitals	Red code	Yellow code	Green code	Blue code	White code
PS SANTA MARIA NUOVA	1	7	14	1	0
PS SAN GIOVANNI DI DIO TORREGALLI	2	10	24	2	0
PS AO CAREGGI	10	27	31	10	2
PS SANTA MARIA ANNUNZIATA	2	9	22	4	0



Idrogeological data



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13-09-2017, Brussels

Flooding Data and Risk assessment tool

VIALE DEI MILLE

ROAD CLASS: Strada Comunale
 ELEMENT CLASS: urbana di scorrimento
 ELEMENT TYPE: di tronco carreggiata
 COMPOSITION: carreggiata unica
 LENGTH: 177
 LOCATION: a raso
 STATUS: in esercizio
 SPEED LIMIT: 50
 TRAFFIC DIRECTION: Tratto stradale aperto in entrambe le direzioni (default)
 VULNERABILITY: 0.5
 WIDTH: -1

Potential Damage Analysis

Potential Damage	PD + Traffic	Tot Services Value	Tot Roads Value	% Pot Damage
406530	620966	2100	902620	98%

Relevant Services

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"/> Istituto Fiorentino di...	VIA RUDOLFI COSIMO, FIRENZE	Public_hospital	100
<input checked="" type="checkbox"/> Istituto reumatologis...	VIALE GIUSEPPE MAZZINI, FIRENZE	Public_hospital	100
<input checked="" type="checkbox"/> villa maria teresa hospital...	VIA DELLA CERNAIA, FIRENZE	Public_hospital	100



Seismic Data and Risk assessment tool

Earthquake Event Setup Layers panel Service Observation Damage analysis Aerial with labels Save estimation data

Setup 1/2

ESTIMATION 1

Choose a sensor:
VIA DI SANTA MARTA, Firenze

Choose an observation:
2016-04-11T15:59:00-02:00, MAGNITUDE = 1

Go to step 2

ESTIMATION 2:

Choose a defined scenario:
Choose

or draw a region: Off

and set the magnitude:
Seismic magnitude

Go to step 2

Layers

Loaded Layers

Sensor Site

- VIA DI SANTA MARTA, Firenze

Vulnerability Layers

- C3. Costruito risalente anni 1900-2000
- C2. FI Cerchie murarie XIV sec
- C1. Costruito risalente XII secolo
- S1. Pericolosità sismica locale medio-bassa
- S3. Pericolosità sismica locale molto elevata
- S2. Pericolosità sismica locale elevata
- S2. Pericolosità sismica locale elevata

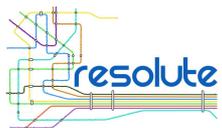
Collapse All | Expand All

Potential Damage Analysis

Potential Damage	Services-V	Buildings-V	Tot Services Value	EQ Intensity
4611 (57.21%)	50%	50%	8060	1

Relevant Services

Type	Service	Street	City	V class	V Building Class	W
<input checked="" type="checkbox"/> Museum	VILLA BARDINI	COSTA SAN GIORGIO	FIRENZE	NoAvailInfo(0)	C2(0.8)	80
<input checked="" type="checkbox"/> Monument_location	Appennino	VIA DEL PROCONSOLO	FIRENZE	S2(0.4)	C1(0.8)	80
<input checked="" type="checkbox"/> Monument_location	Chiostro dello Scalzo	VIA CAMILLO BENSO CAVOUR	FIRENZE	S3(0.7)	C2(0.8)	80
<input checked="" type="checkbox"/> Museum	MUSEO DEL BIGALLO	PIAZZA SAN GIOVANNI	FIRENZE	S2(0.4)	C1(0.8)	80



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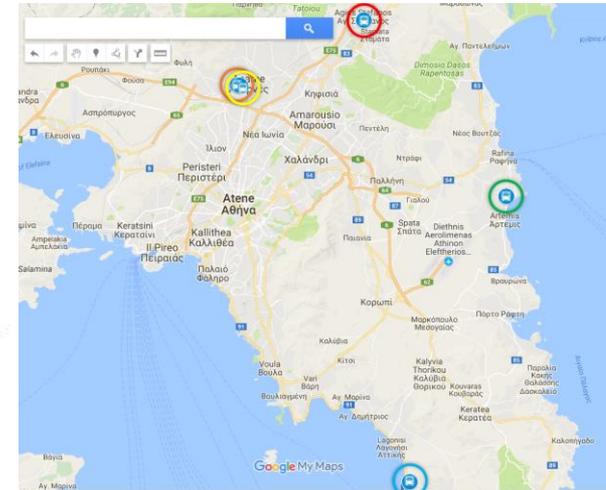
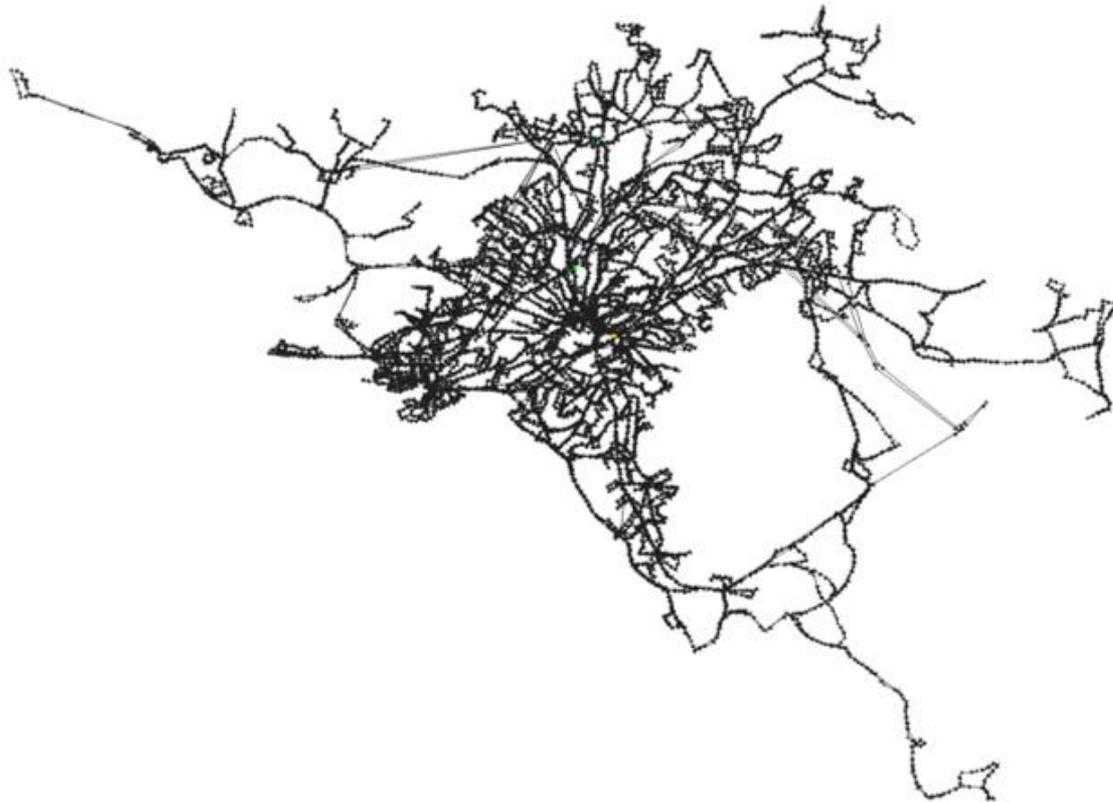


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Network Analysis on the UTS



Nodes (i.e. stops) with highest betweenness

Social network sensing through visualization

- Goal: Detect emergency events from social media, using visual analytics methods.

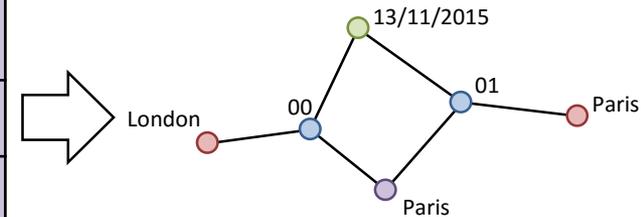
- Raw data: Twitter posts
Attributes:

- Location from which they were posted
- Date/time
- Location mentioned in text
- Emergency-related keywords
- Metadata (original/retweeted, author, etc.)

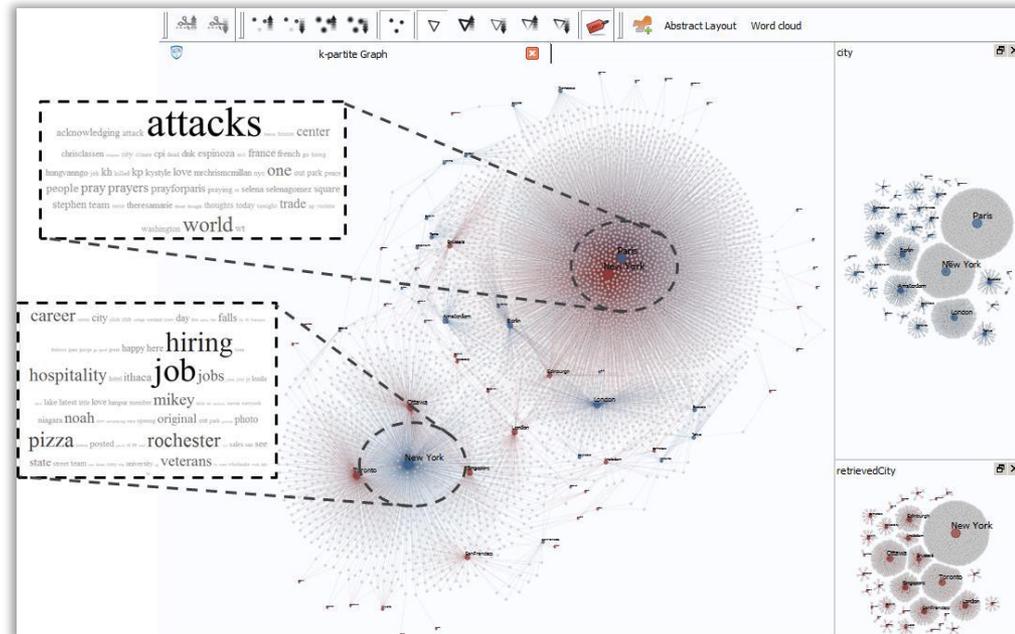
- Multimodal k-partite visualization

- Reveals groups of posts with common attributes

Tweet ID	Post location	Date	Text location
00	London	13/11/2015	Paris
01	Paris	13/11/2015	Paris

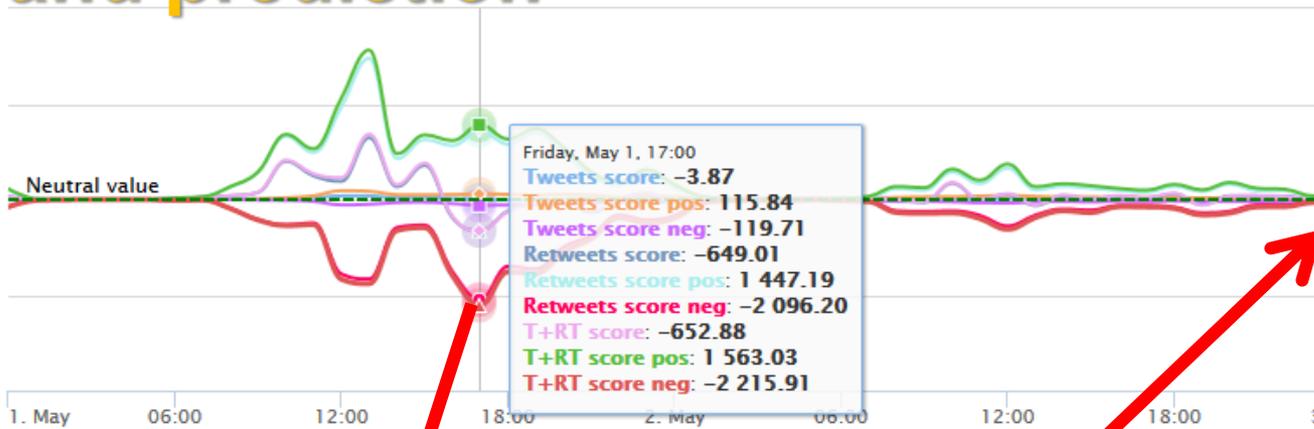


Example of k-partite visualization using tweet posts sent during the week of Paris attacks on 13/11/2015



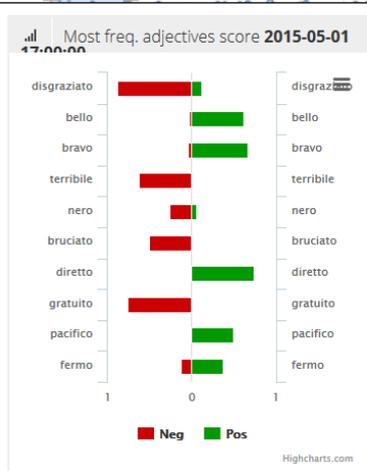
Sentiment analysis, Sentiment Analysis, Monitoring and prediction

From To



SERENA S
@SerenaSignorile

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



Example tweets

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: SerenaSignorile
 publicationTime: 2015-05-01 18:29:06
 locationUser: [redacted]
 retweet: 0

Results 1 - 11:

message: Non sei d'accordo quindi macchine di gente che v...
 twitterUser: FabrizioColella
 publicationTime: 2015-05-01 18:53:09
 locationUser: In Billico
 retweet: 0

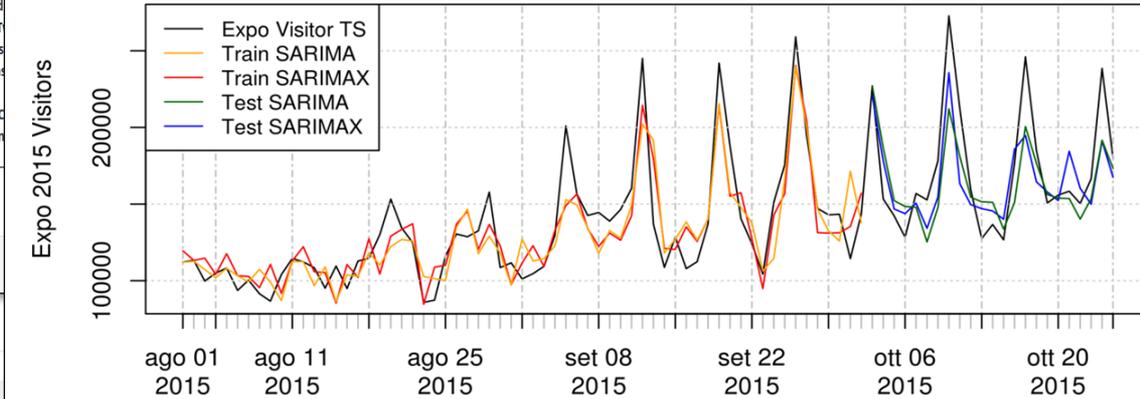
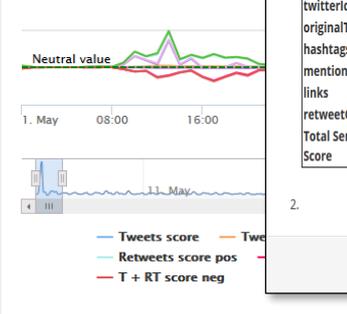
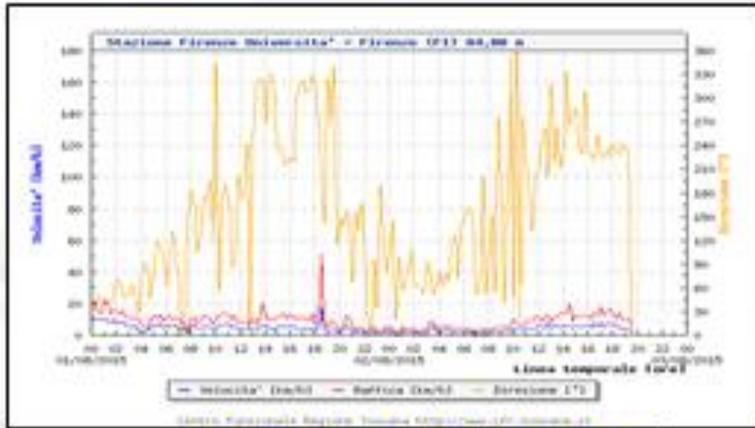
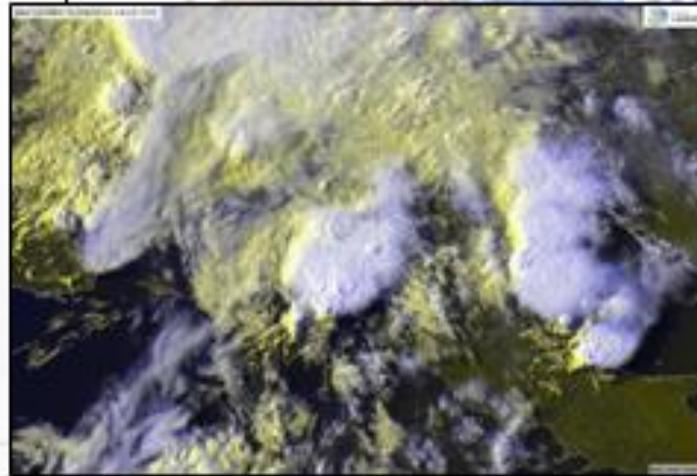
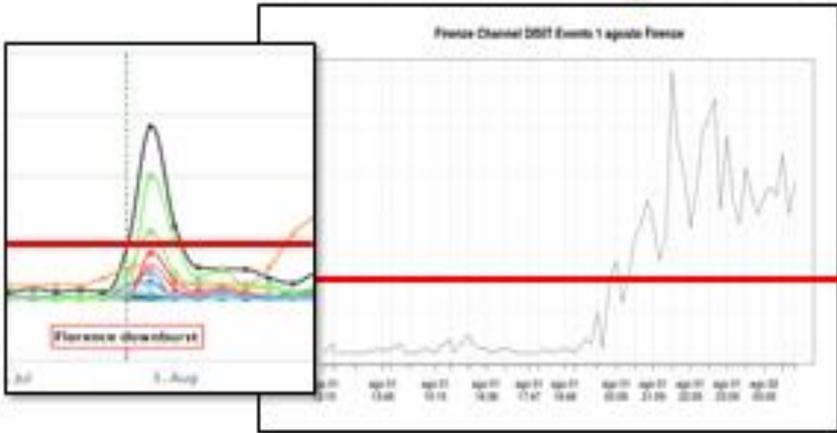


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

Early Warning Twitter Vigilance and Water Bomb

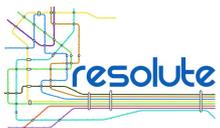


Twitter Vigilance

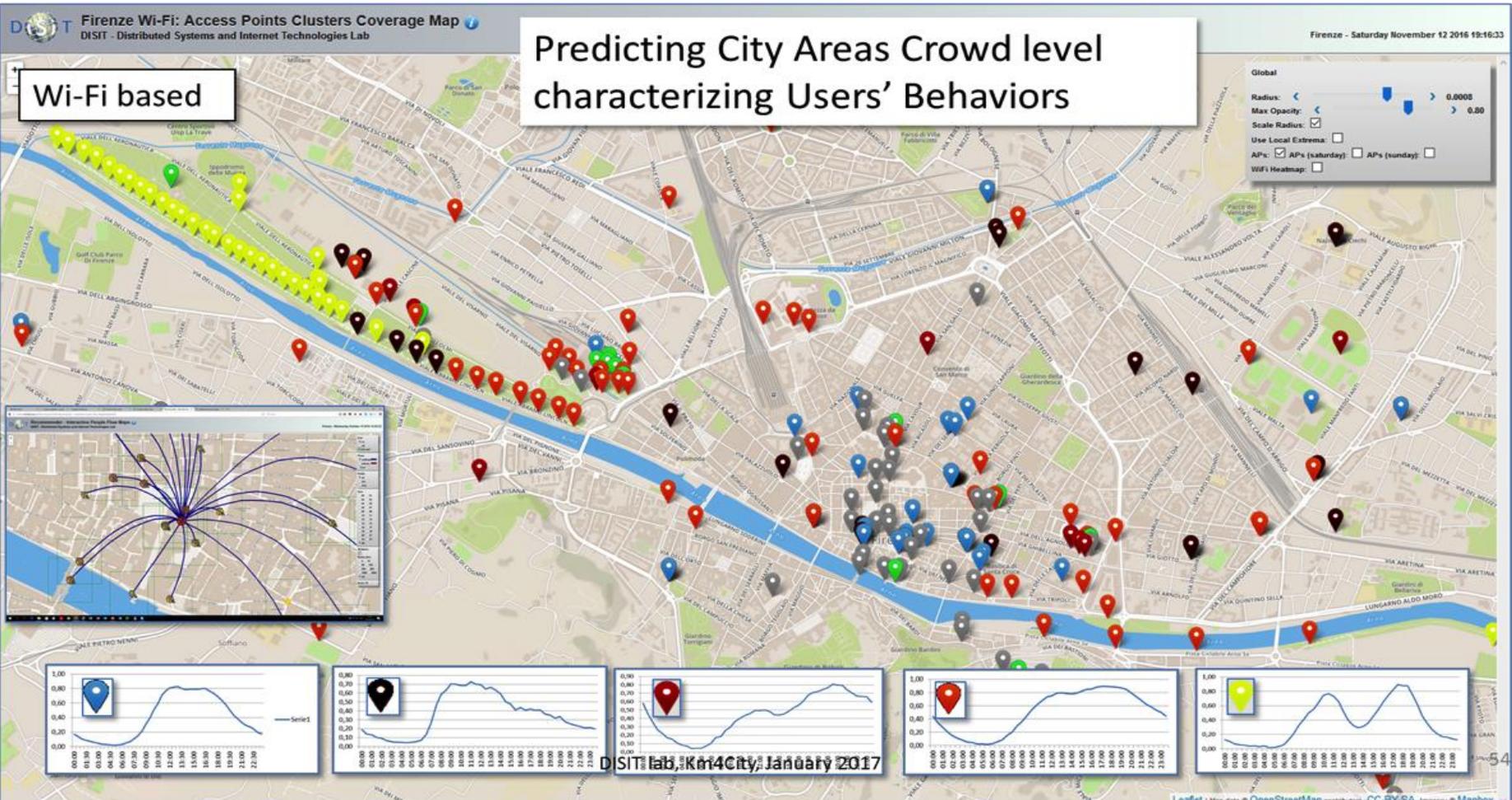
DISIT lab, Km4City, January 2017

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Modeling and predicting user behaviour via wifi data



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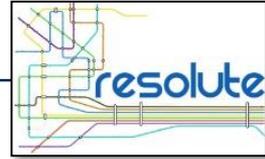


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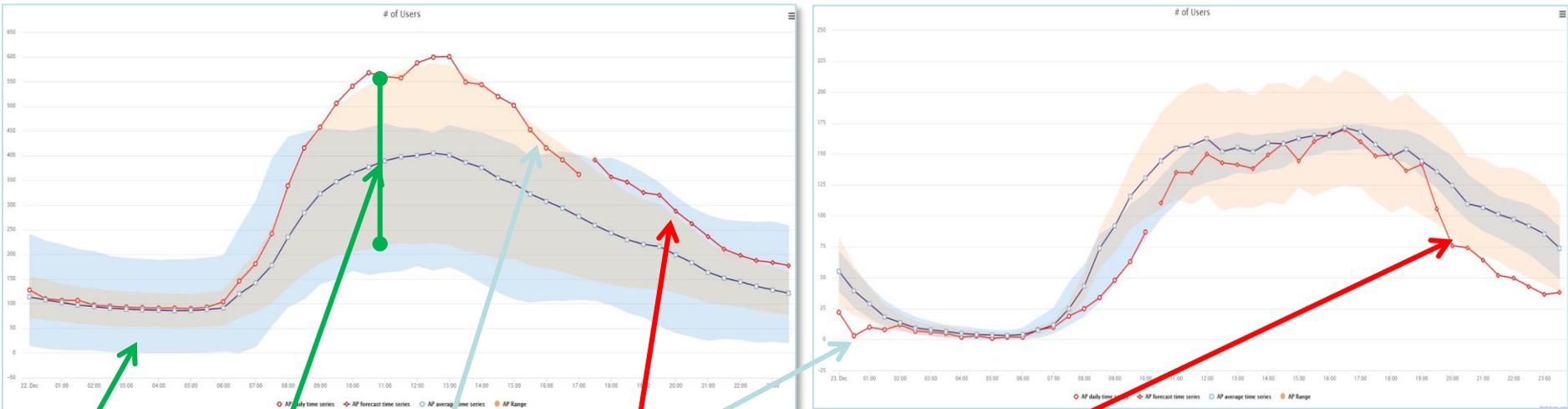
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Prediction and identification of anomalies



Guessing number of users of Wi-Fi Access Points

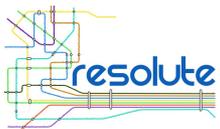


Cluster confidence

AP average and confidence

Actual AP trend for today

AP prediction for the next time slot in the day on the basis of past weeks



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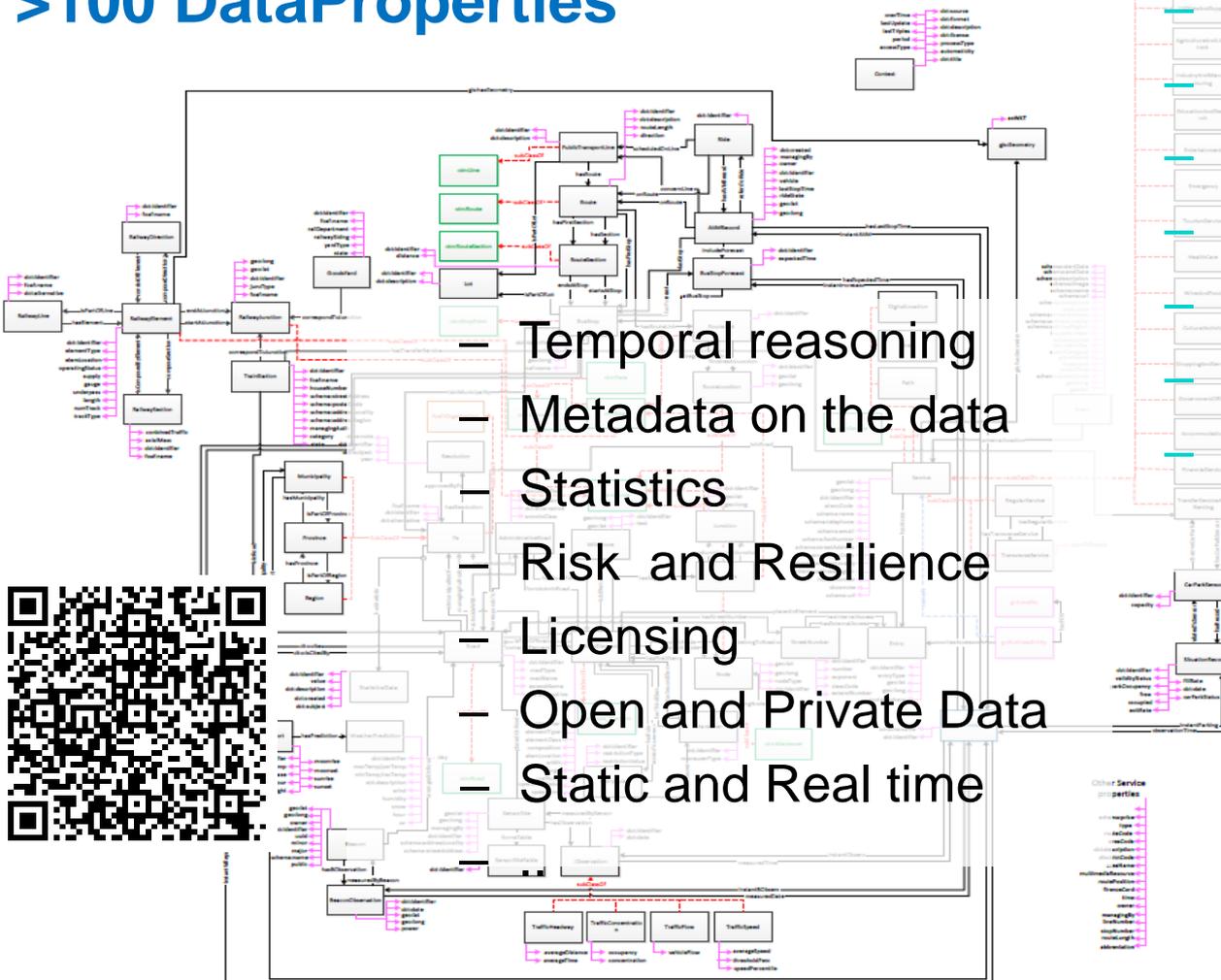
Km4City Ontology

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



to cover different aspects:

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



Ontology Documentatio

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

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

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

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



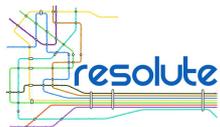
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Conclusions

- **European Resilience Management Guidelines** – (guidelines) – consensus driven approach improve guidelines acceptability at EU level
 - <http://www.resolute-eu.org/index.php/deliverables>
- **CRAMSS** – (tools and algorithms) – ontology based static and dynamic Critical Infrastructure (CI) data integration, processing and analysing platform
- Concertation of several Decision Support Systems:
 - Evacuation (see next presentation)
 - Urban Transport Management (ITS, UTS)
 - Resilience DS, Smart DS
- Analytics tools: **prediction, early warning, anomaly detection**
 - Human Behaviour analysis: traffic flow, human flow, social media
 - Network analysis, risk analysis,
- Exploitation of data aggregator: Km4City



Roadmap



SELECT
for Cities

2021

- Snap4City**
- waste
 - Territorial areas and paths
 - Health, Bike sharing
 - Statistics, Energy, ICT, ...
 - E-vehicles



WEEE
2017-2020

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



2016

REPLICATE H2020
2016-2021- Started



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

2015



Km4City 1.5
- SmartDS
- Km4City App

RESOLUTE H2020
2015-2018 - Started

Km4City 1.4

- Embed
- More API
- iBeacon



Sii-Mobility SCN
2016-2018 - Started
Km4City 1.6.2

- API
- Twitter Vigilance

2014

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>
- <http://log.disit.org>
- <http://www.disit.org/fodd>
- <http://www.disit.org/tv>
- <http://smartds.km4city.org>

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