Overview on Smart City

DISIT lab solution for beginner

Part 7: Distributed Systems

Distributed Data Intelligence and Technologies Lab
Distributed Systems and Internet Technologies Lab

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UNIVERSITÀ DEGLI STUDI FIRENZE

DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Km4City

SMART CITIES AND BIG DATA

Major topics addressed

- Smart City Concepts
- Architecture of Smart City Infrastructures
- Peripheral processors
  - Data collectors and Managers
  - Blog Vigilance via Natural Language Processing
  - Twitter vigilance
- Data ingestion and mining
  - Data Mining and smart City problematic
  - Km4City: Smart City Ontology
  - RDF production, reconciliation
  - Parallel and distributed processing

Reasoning and Deduction
- Smart City Engine
- Decision Support System

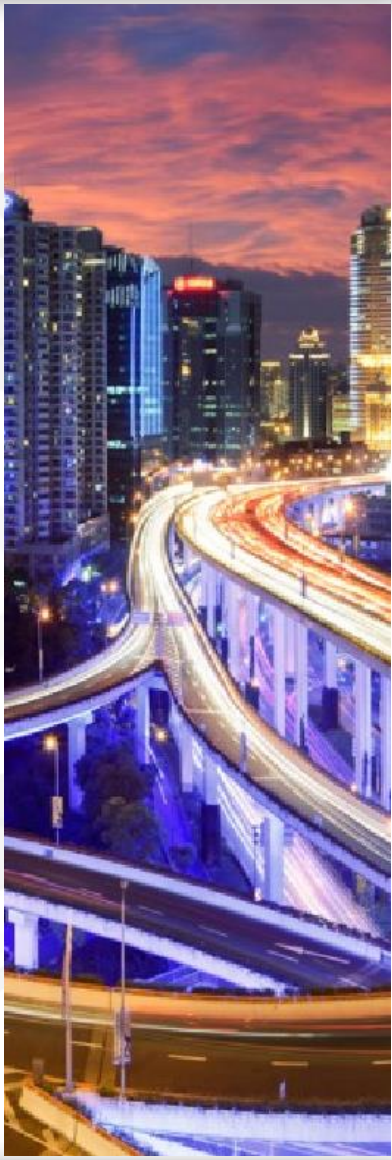
Data Acting processors
- Smart City Tools and API
- Service Map and Linked Open Graph
- Mobile applications

Projects
- SmartCity Project Sii-Mobility SCN
- SmartCity Project Coll@bora SIN
- SmartCity Project RESOLUTE H2020
- Mobile Emergency

…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 si stanno adeguando alle crescenti necessità cercando di
  - garantire ***elevati livelli di qualità della vita***
  - fornire ***nuovi servizi***
  - ***limitando i costi***, aumento di efficienza
  - allestire strutture decisionali adeguate
  - ***facilitare la creazione di nuovi servizi anche da parte di terzi***
    - ***Pubblicazione Open Data***
    - ***Creare i presupposti per un mercato dei dati anche privati ma connessi agli OpenData***
- ***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
-

Pubblici 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

- Traffico personale
- Posizione mezzi,
- Parcheggi
- Posizione taxi
- Posizione CarSharing
- ...

- Info traffico
- video camere
- Info Meteo
- Info Ambiente
- Code ai musei pubblici
- Terremoti
- Parcheggi

- Stato accessi alla ZTL
- Stato dei servizi

Privati Tempo reale

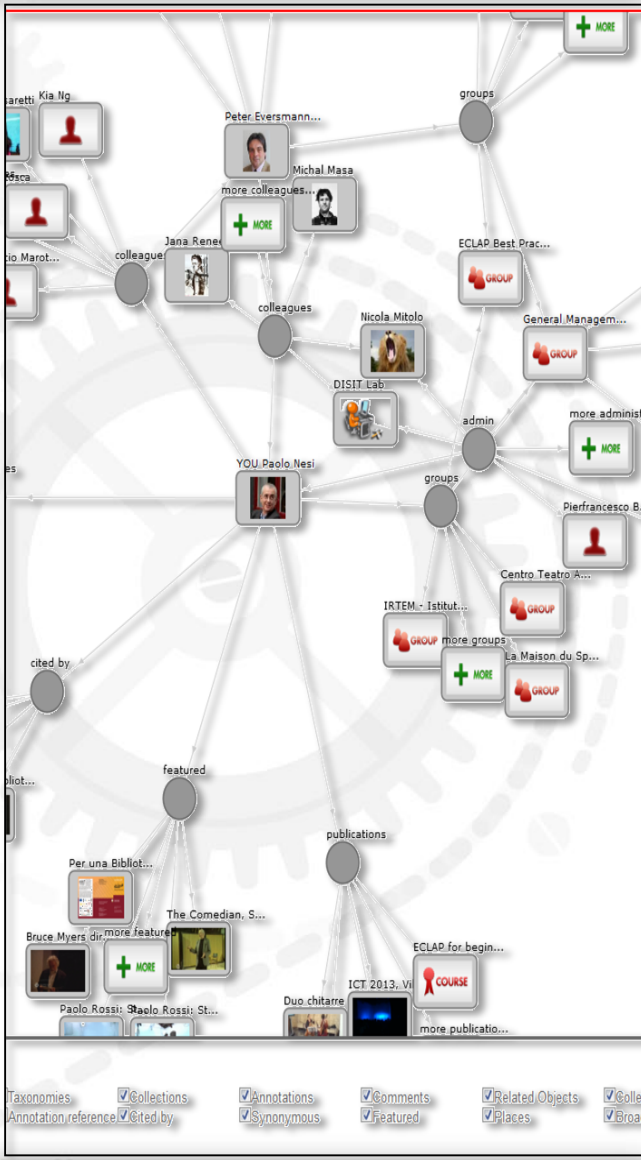
Pubblici Tempo reale (open data)

Interoperabilità: valore o vincolo

- Moltissimi e con
  - svariati domini: grafo strutturali, geografici, energia, ambiente, salute, servizi, mobilità, etc.
  - Velocità: Statici, quasi statici, real time
  - Modelli multipli per: Formati file, ontologie usate in LD/LOD
- Accessibili ad un costo elevato:
  - Difficoltà nell'identificazione del modello di business
  - Difficoltà rispetto ad alcune Licenze di uso
  - OD abilitano valore se abbinati con #privatedata
  - Mancanza di Interoperabilità
  - Mancanza di Servizi per dati interoperabili

I profili degli utenti

- ***Gli utenti possono:***
  - fornire informazioni preziose sulla citta 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*



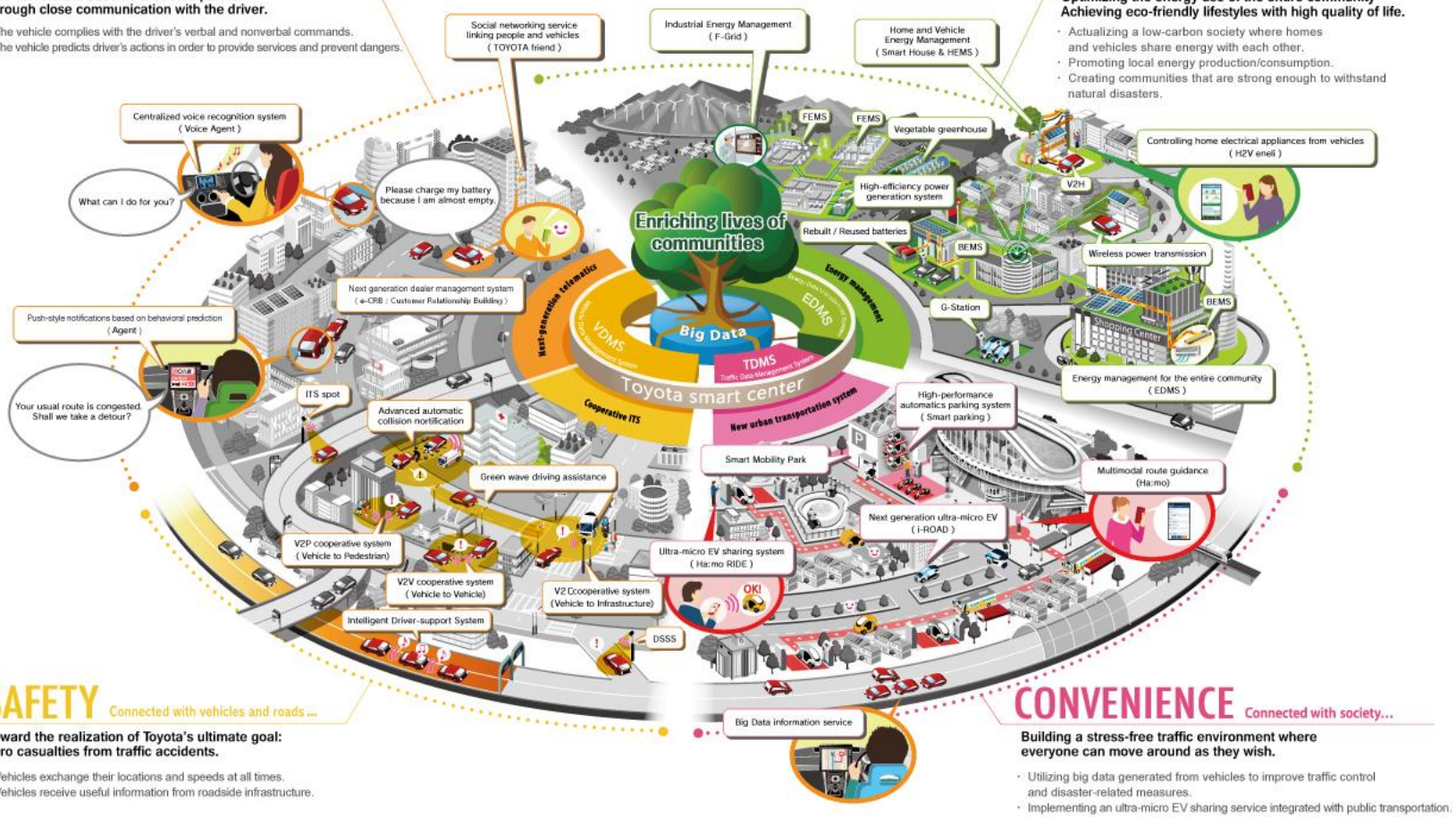
Le buone pratiche "Smart city"

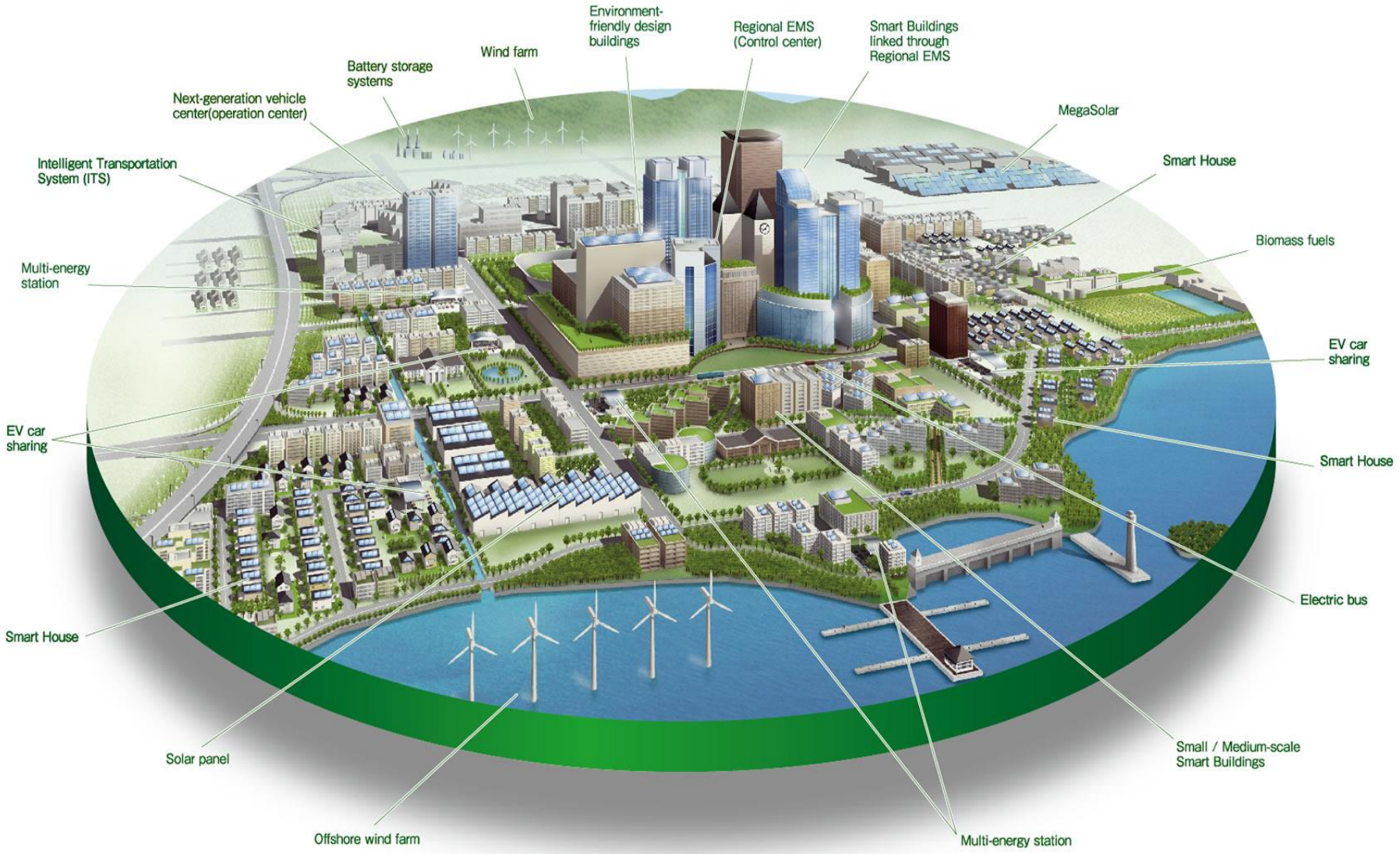
- *forniscono nuovi servizi e valutano sulla base della risposta del cittadino*

- 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.***

TOYOTA's Activites towards SMART MOBILITY SOCIETY

Toyota aims to create a smart mobility society where people feel secure and happy in transport and everyday life.




Environment-friendly design buildings
Regional EMS (Control center)
Smart Buildings linked through Regional EMS
Wind farm
Battery storage systems
Next-generation vehicle center(operation center)
MegaSolar
Intelligent Transportation System (ITS)
Smart House
Biomass fuels
Multi-energy station
EV car sharing
EV car sharing
Smart House
Electric bus
Smart House
Small / Medium-scale Smart Buildings
Solar panel
Offshore wind farm
Multi-energy station

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 Risk management, Resilience
- 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

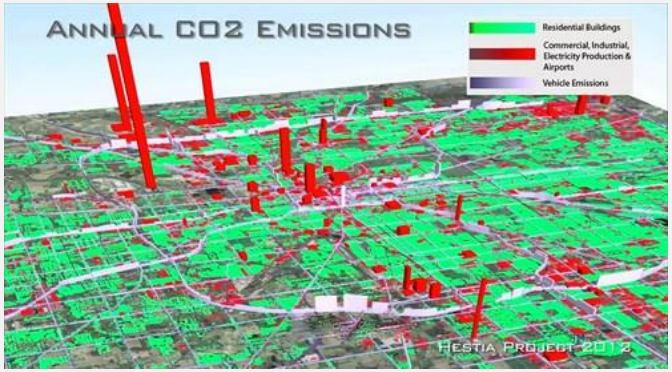
- **Smart building:**
  - saving and optimizing energy consumption, district heating
  - renewable energy: photovoltaic, wind energy, solar energy, hydropower, etc.
- **Smart lighting**:
  - turning on/off on the basis of the real needs
- **Energy points for electric**: c
  - ars, bikes, scooters,
- **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

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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 n**ot semantically interoperable**
  - resulting a big data problem: volume, velocity, variability, variety, …..

Challenges: Requests and Deductions

API for SME

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

Smart City Solution

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

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

User profiling
Collective profiles
User segmentation

User Behavior
Crowd Sources

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, …

Transport systems
Mobility, parking

Public Services
Govern, events,

Sensors, IOT
Cameras, ..

Environment,
Water, energy

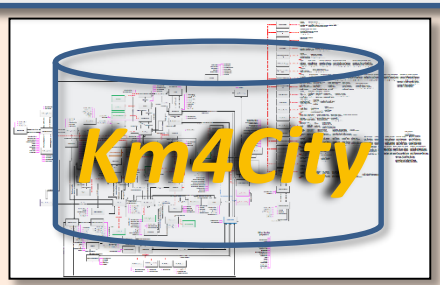
Shops, services,
operators

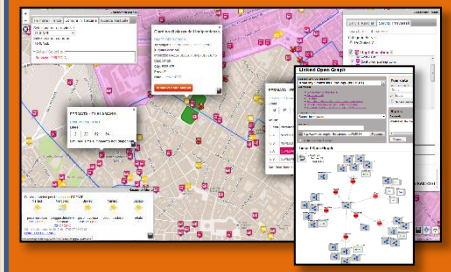
Social Media
WiFi, network

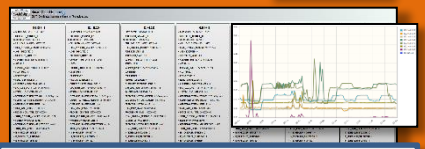
Static, Slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud

Km4City Smart City Engine

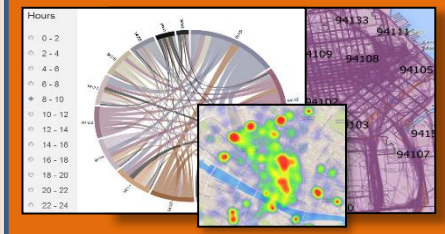






User Profiling and Suggestions on Demand

Flow and Origin Destination Matrix
Http://www.disit.org/odsf

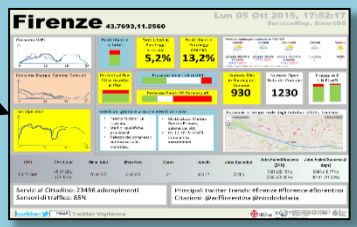


Km4City Tools for Developers

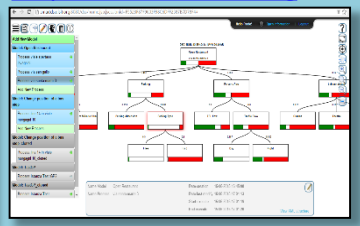
Km4City Smart City API

Tools for City Operators and Decision Makers

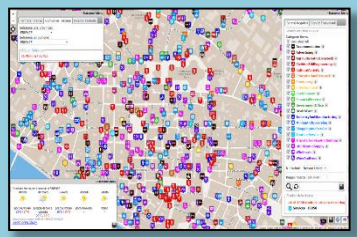
Smart City Dashboard
Http://www.disit.org/dash



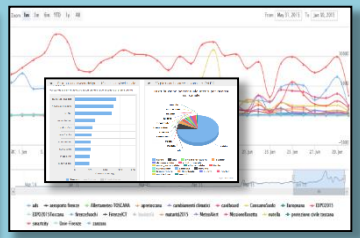
Smart Decision Support
Http://Smartds.disit.org



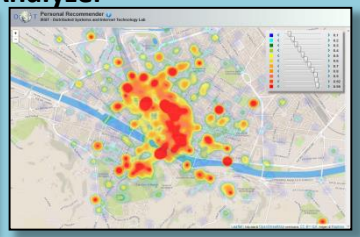
Service map browser
Http://servicemap.disit.org



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



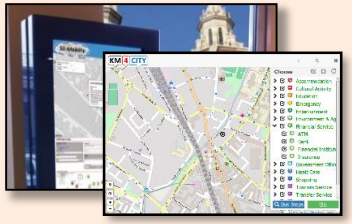
Collective User behavior Analyzer



Tools for Final Users

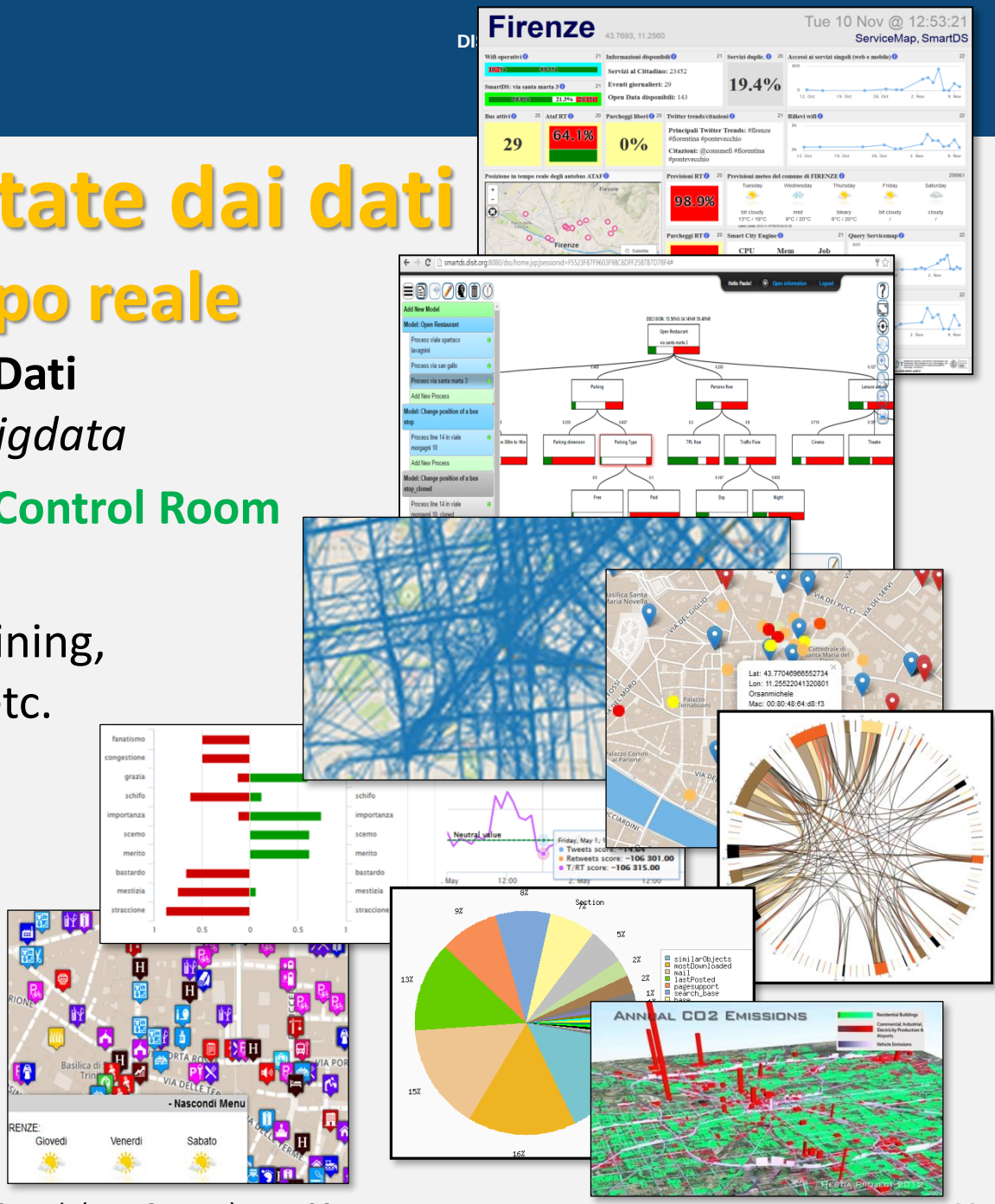
Mobile e Web Apps

Http://www.km4city.org



Decisioni supportate dai dati periodiche ed in tempo reale

- **Condivisione e Integrazione Dati multidominio:** *semantica e bigdata*
- **Dati →Smart City Engine → Control Room**
- **analisi**: monitoraggio, flussi e comportamenti, sondaggi, mining, correlazioni, cause – effetti, etc.
  - Per il miglioramento di servizi correnti
  - Per reagire ad eventi, incremento della resilienza,
  - Per la creazione servizi innovativi
  - …



Big Data Smart City Architecture








Open Data
Sensors Data
Traffic Control
Energy central
eHealth Agency
.....

Social Media

Smart City Engine, SCE
Distributed processing
Data Ingestion Manager
(static and real time)
Km4City
Dashboards

Km4City API
Smart Decision Sup.
Sugg. and Alarms
Process In / Data Export
Linked Open Graph
Service Map

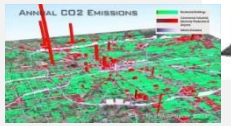
Data / info Rendering
Profiled Services
Citizens Formation

Social Vigilance




Making Decision
Making Suggestions
Interoperability
Development





Applications

Peripheral processors
Data Ingesting and mining
Reasoning and Deduction
Data Acting processors

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Challenges (addressed by DISIT)


eGov Data collection

Sensors control



Traffic Control

Energy Central


eHealth Agency

Telecom. Services

.....

Social Media

Peripheral processors

- Social Media blog analysis
- Energy Control for bike sharing
- Wi-Fi as a sensor for people mobility
- Internet of Things as sensors
  - Low costs Bluetooth monitoring devices
  - Vehicle kits with sensors
  - Sensors networks spread in the city and managed by centrals
  - Traffic flow sensors
- ..

Sorgenti Sul Territorio di Firenze e Toscana

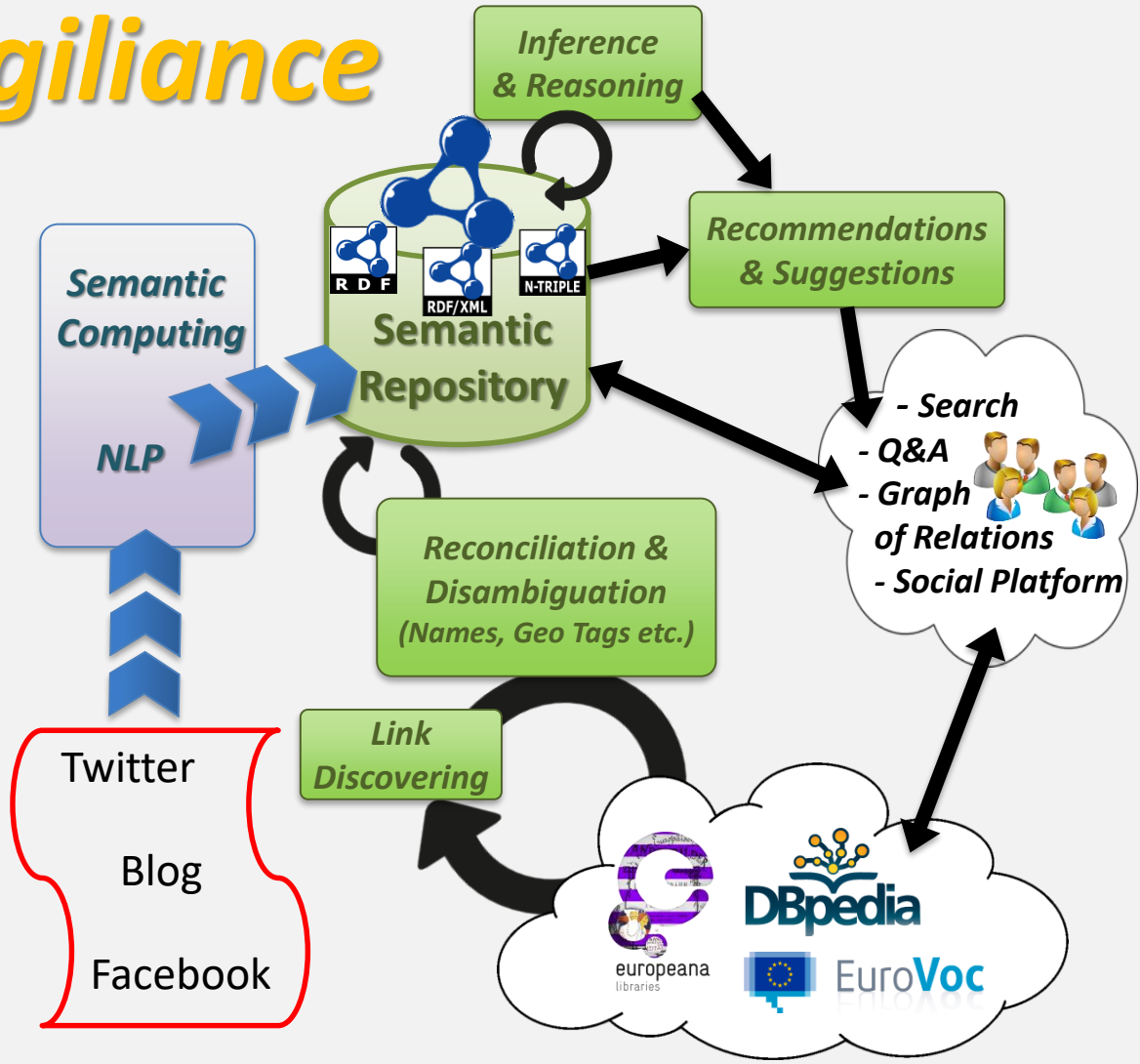
- **Open Data delle PA (oltre 700 data set):**
  - Open Data del Comune di Firenze, Provincia, etc.
  - Open Data della Regione, grafo regionale, ..
  - Open Data da altre citta', dalla commissione europea, da svariati HUB: CKAN,
  - LOD Universita' di Firenze: Servizio OSIM
- **Dati Real Time** (centinaia di servizi real time):
  - Osservatorio: AVM, Sensori Parcheggi, Flussi traffico
  - LAMMA: Meteo
  - Social Media: Twitter, blog, etc.
  - Comune: eventi, scuola, protezione civile, ospedali,
  - etc.
- **Km4City: Circa 120 milioni di dati fra Statici e Dinamici, con un flusso di circa 6-10 milioni al mese**

Altre Sorgenti: Toscana e Firenze

- **Dati Aggregati e Linked Open Data:** FirenzeOpenDataDay www.disit.org/fodd
  - Da altre citta', a livello regionale, nazionale, …
  - Dalla Commissione europea
  - RDF Store aperti: dbPedia, Europeana, Getty, Camera Senato, Cultura Italia,
    - **ECLAP.eu,** http://www.eclap.eu
    - **UNIFI, OSIM** → http://osim.disit.org
  - Web Crawling → GeoLocator ..
  - Social Media → Blog Vigilance ..
  - Link Discovering → riconciliazione, LOD Enricher
- **Molti altri dati …. http://log.disit.org**

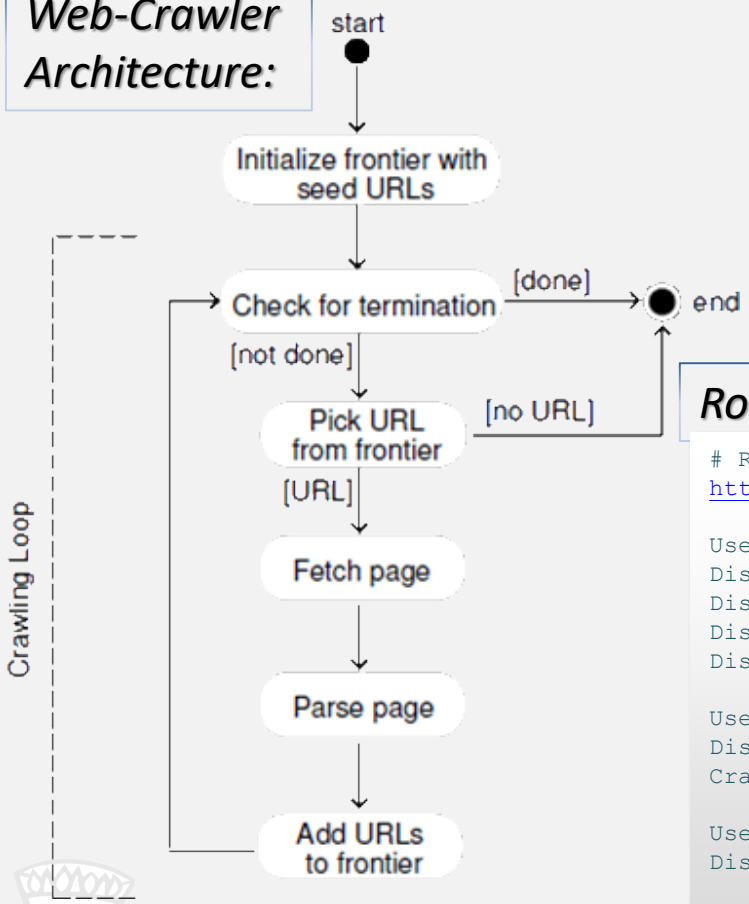
NLP e Blog Vigiliance

- Recuperare informazioni dagli utenti
- Validare le informazioni fornite da siti e utenti in relazione a quelle divulgate da siti istituzionali
- Inserire le informazioni estratte nella base di conoscenza semantica km4city per arricchire i dati
- Fornire le informazioni arricchite agli utenti attraverso il ServiceMap, un portale web, un blog o i social network come Twitter

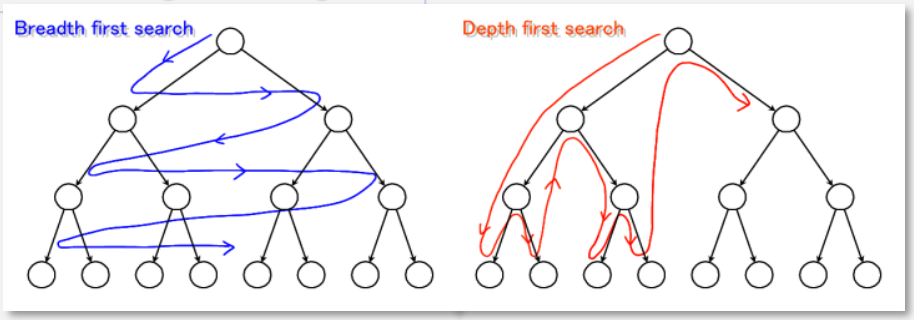


Web Crawling and Data Mining

Web-Crawler Architecture:



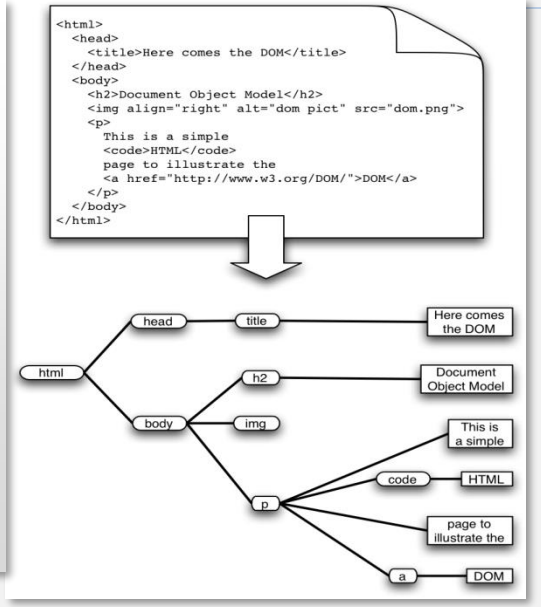
Crawling Strategies:



Robot Exclusion Protocol

```
# Robots.txt for
http://www.springer.com (fragment)

User-agent: Googlebot
Disallow: /chl/*
Disallow: /uk/*
Disallow: /italy/*
Disallow: /france/*

User-agent: MSNBot
Disallow:
Crawl-delay: 2

User-agent: scooter
Disallow:

# all others
User-agent: *
Disallow: /
```

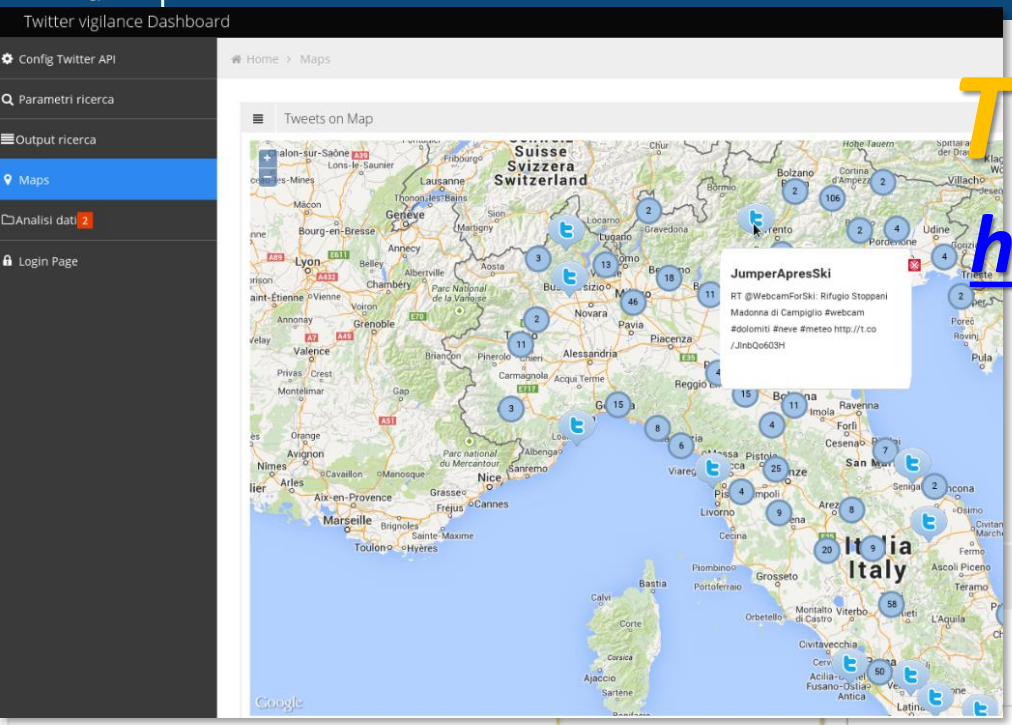
Document / Pages Parsing:

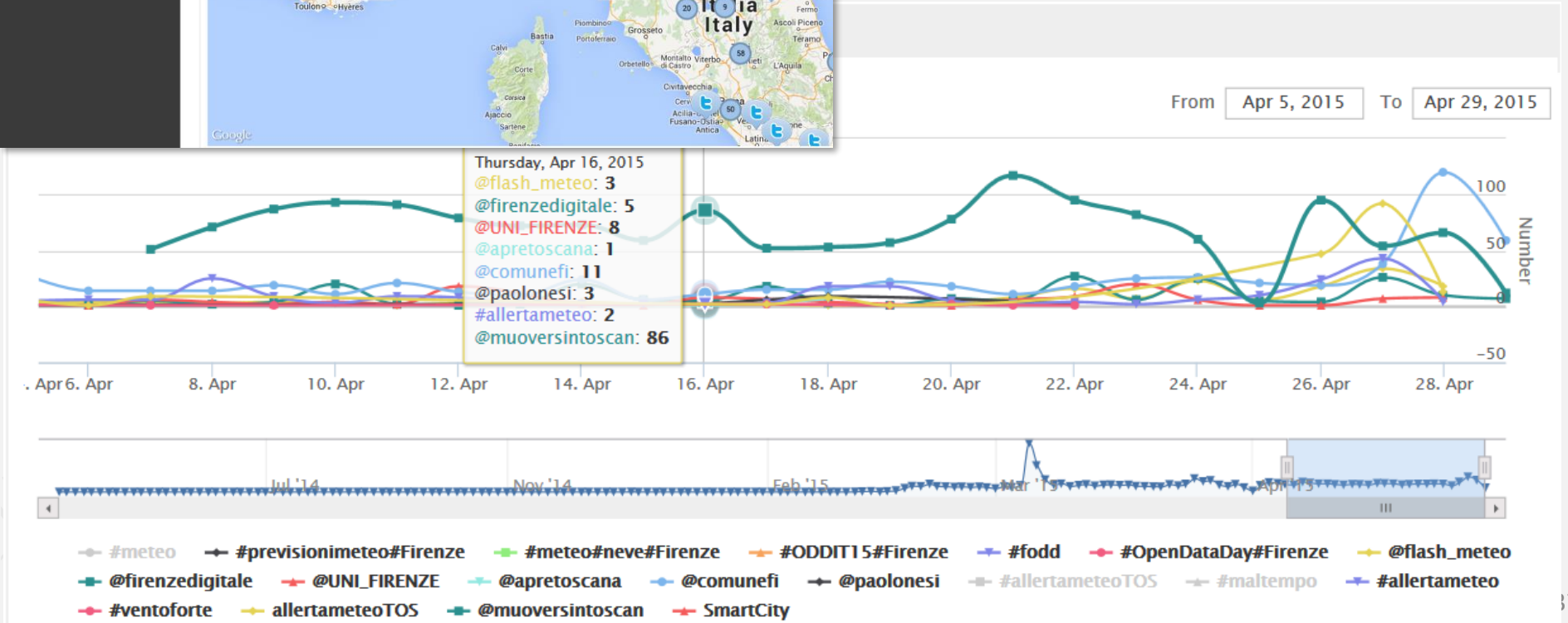


UNIVERSITÀ DEGLI STUDI FIRENZE
DISIT
DISIT Lab, Distributed Data Intelligence and Technologies
Distributed Systems and Internet Technologies
Department of Information Engineering (DINFO)
http://www.disit.dinfo.unifi.it

Twitter Vigilance

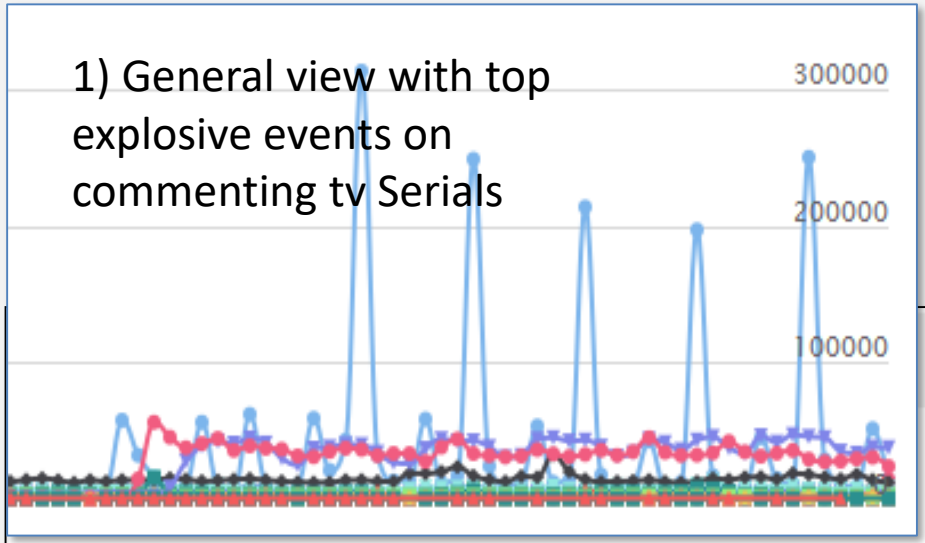
http://www.disit.org/tv

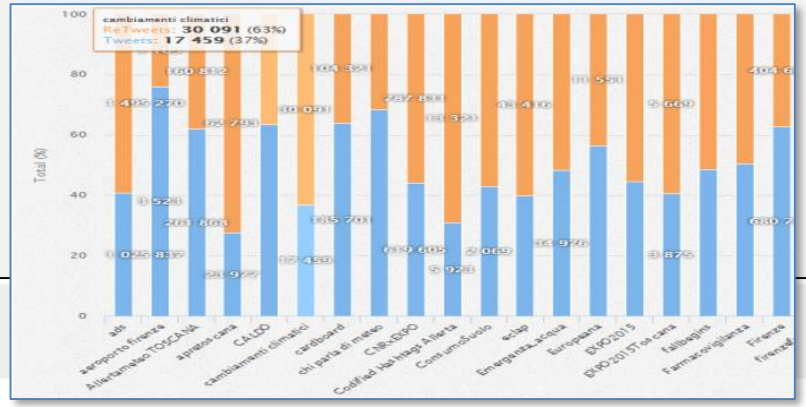




All Channels (private information)

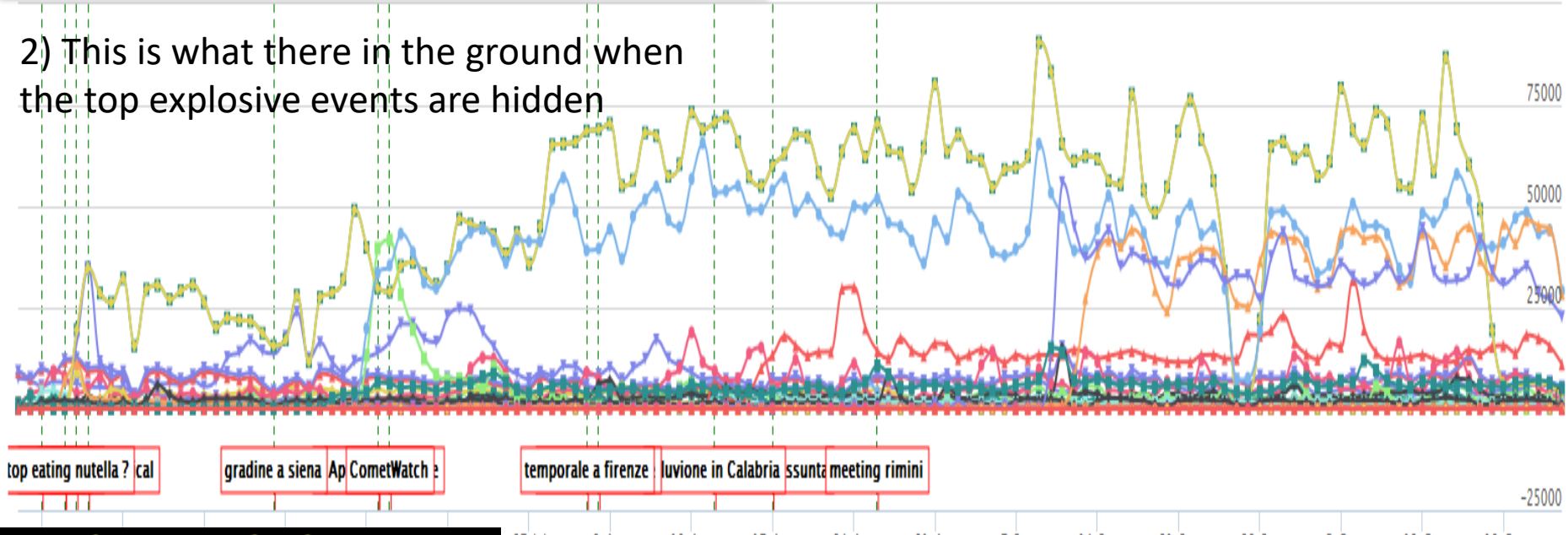
1) General view with top explosive events on commenting tv Serials





From Jun 12, 2015 To Oct 24, 2015

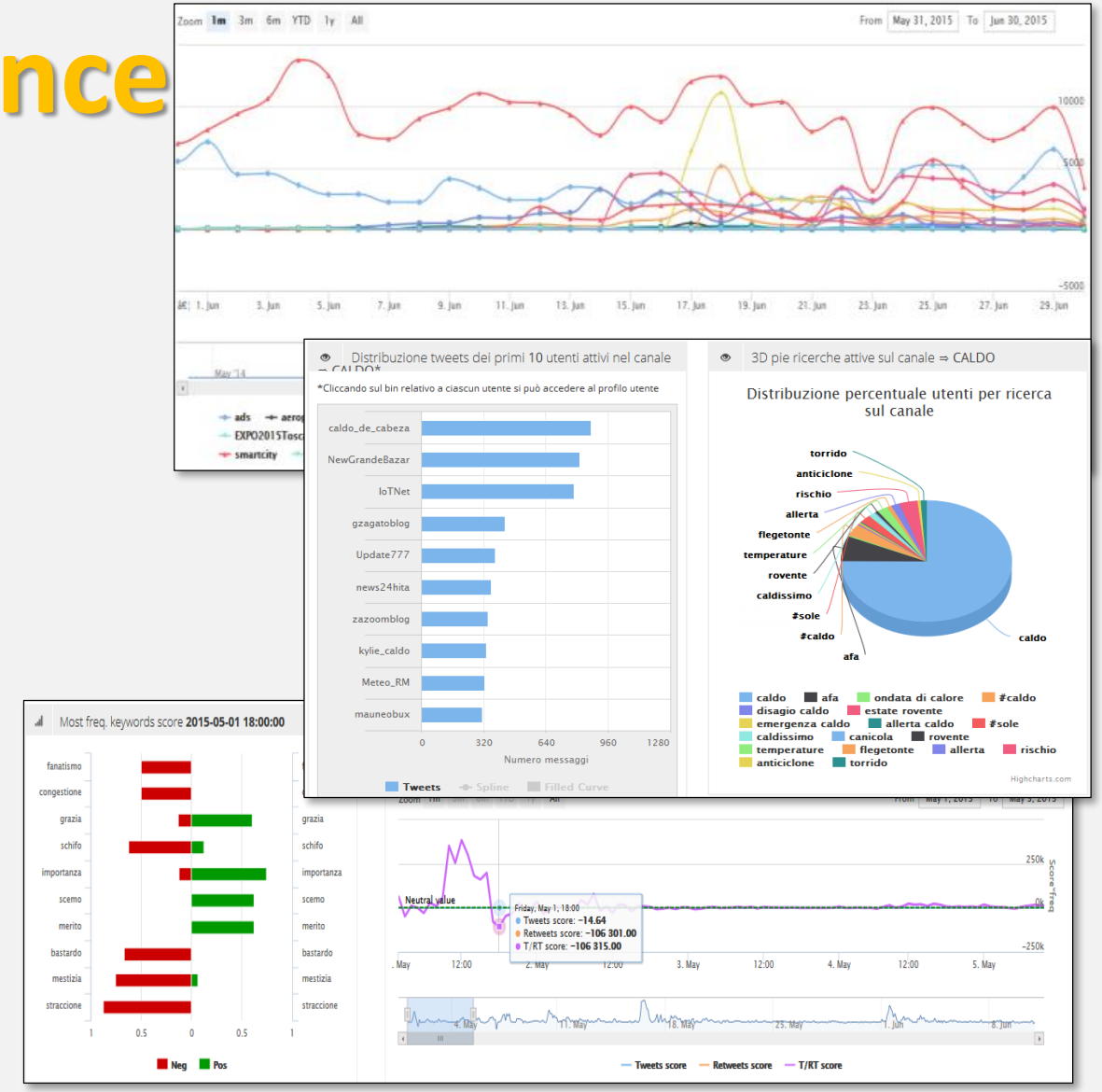
2) This is what there in the ground when the top explosive events are hidden



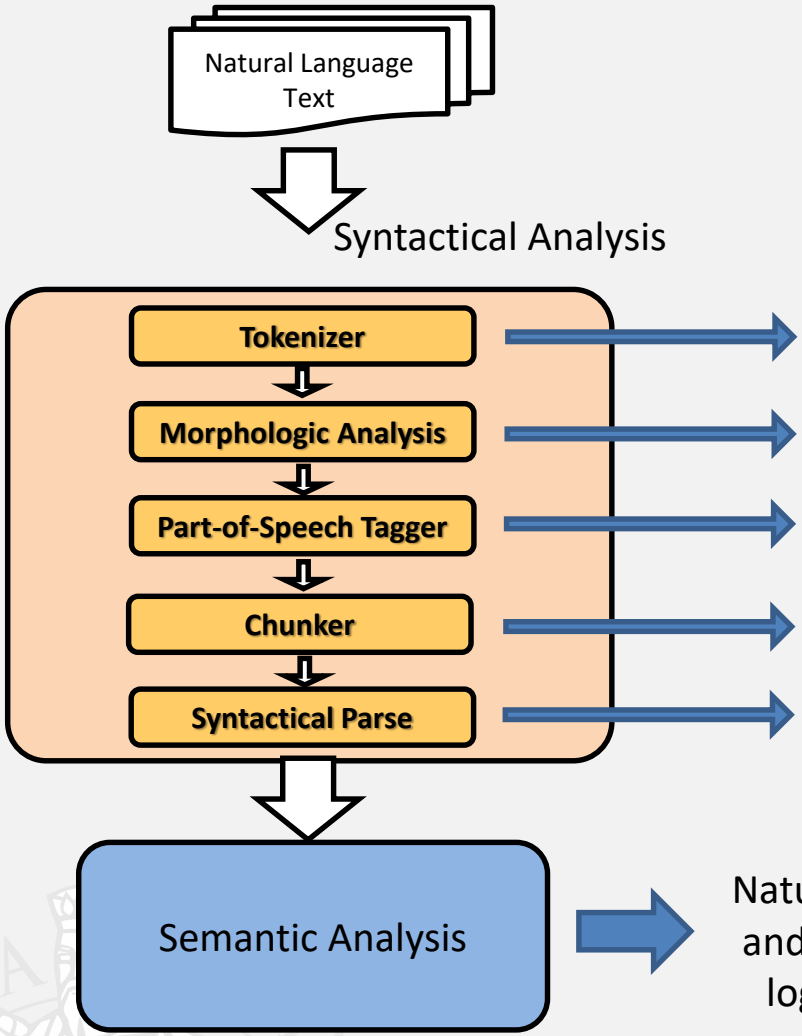
Twitter Vigilance

Twitter Vigilance

- http://www.disit.org/tv
- Citizens as sensors to
  - Assess sentiment on services, events, …
  - Response of consumers wrt…
  - Early detection of critical conditions
  - Information channel
  - Opinion leaders
  - Communities
  - formation



NLP - Natural Language Processing Phases



- ✓ *Text is segmented into sequences of characters (tokens).*
- ✓ *A grammar category is assigned to each token*
- ✓ *Each word of a sentence/period is annotated with its logical rule (subject, predicate, complement etc.)*
- ✓ *This phase uses previous annotations to group nominal and verbal phrases for each sentence*
- ✓ *Produces the Syntactic Parse Tree for each sentence*

Natural Language sentences are subsequently processed and coded into a semantic representation (by means of logic formalisms, semantic networks and ontologies)

Major topics addressed

- Smart City Concepts
- Architecture of Smart City Infrastructures
- Peripheral processors
  - Data collectors and Managers
  - Blog Vigilance via Natural Language Processing
  - Twitter vigilance
- Data ingestion and mining
  - Data Mining and smart City problematic
  - Km4City: Smart City Ontology
  - RDF production, reconciliation
  - Parallel and distributed processing

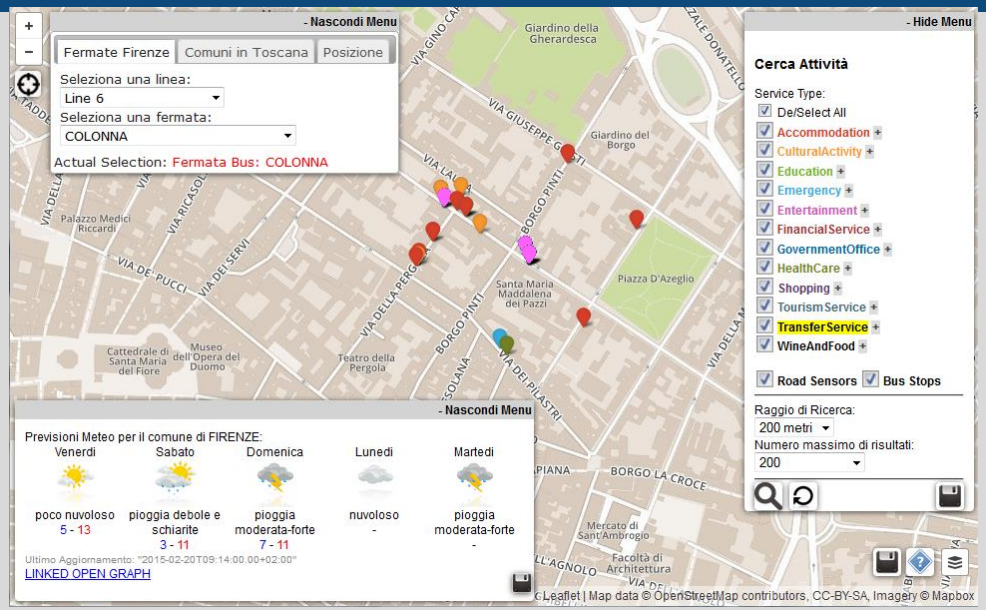
Reasoning and Deduction
- Smart City Engine
- Decision Support System

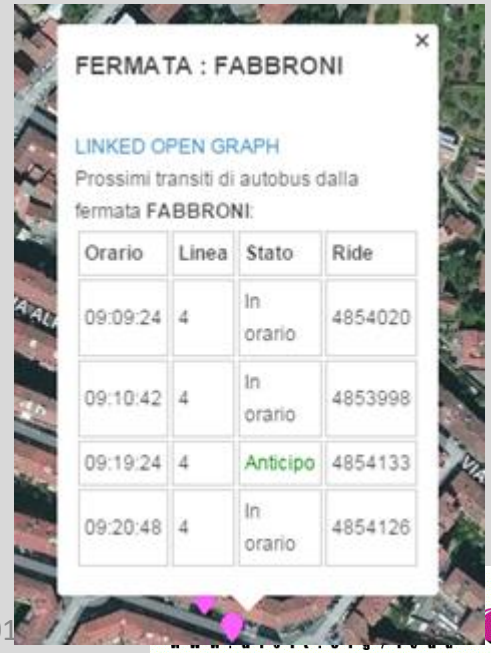
Data Acting processors
- Smart City Tools and API
- Service Map and Linked Open Graph
- Mobile applications

Projects
- SmartCity Project Sii-Mobility SCN
- SmartCity Project Coll@bora SIN
- SmartCity Project RESOLUTE H2020
- Mobile Emergency

Ricerche sui dati

- **Geografiche**: near to here; per comune; per area
- **Nel Tempo**: dati Real Time
- **Testuali**: ……
- **RDF Store esterni**, internazionali ….





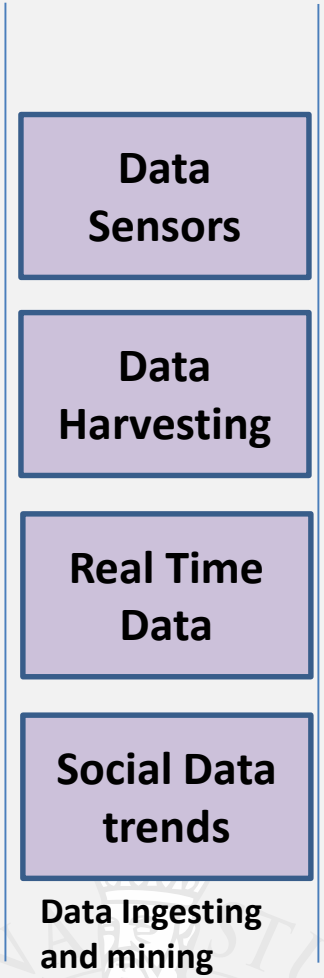
Problematiche → integrazione

- Dati di limitata interoperabilita' semantica e qualita'
- l'interoperabilita' va conquistata dato su dato, modello su modello
- Gestione grosse moli di dati, flussi, etc.

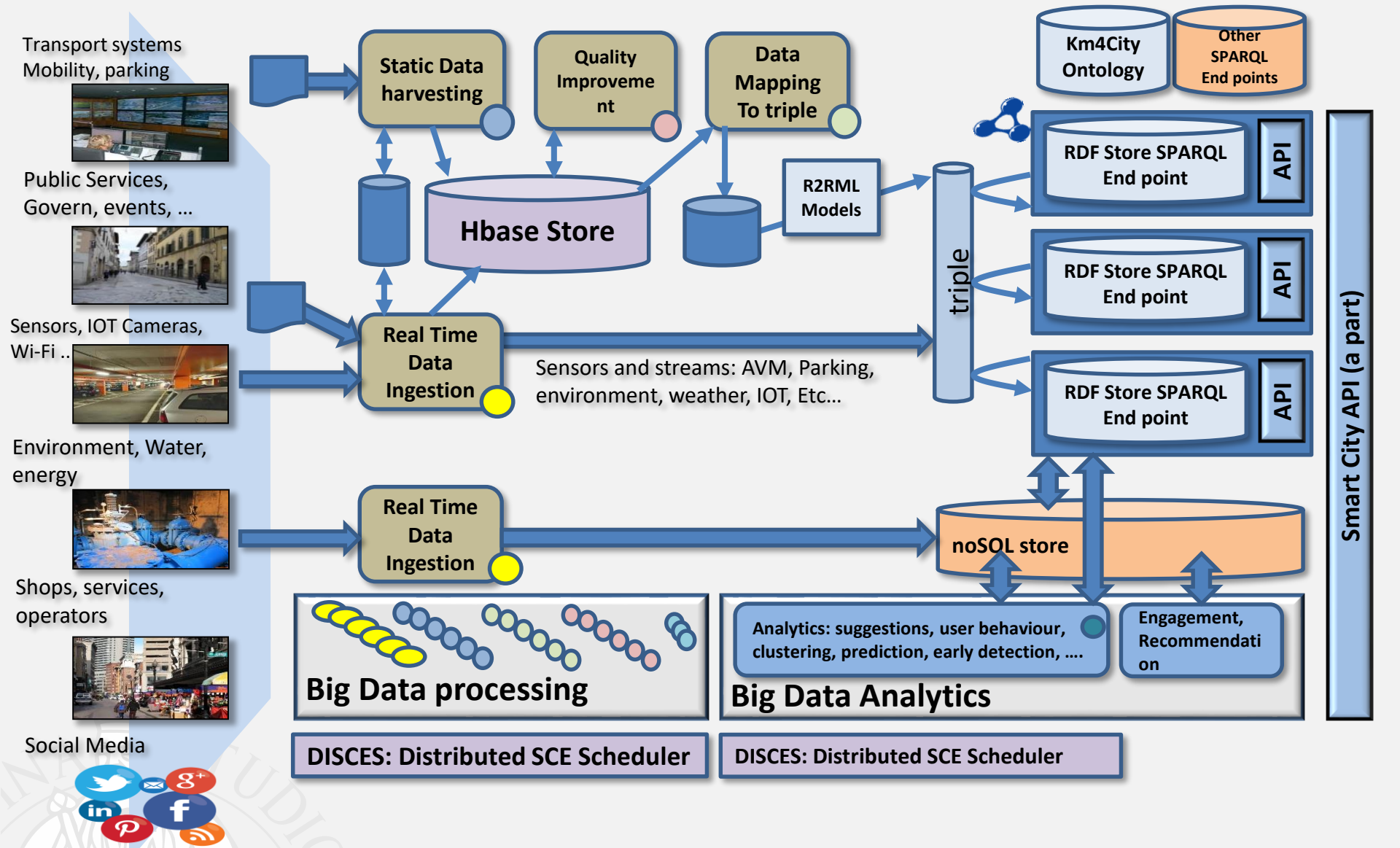
Creare una base di conoscenza unica fondata su un'ontologia comune per combinare tutti i dati provenienti da diverse fonti e renderli semanticamente interoperabili

- Creare **query coerenti** indipendentemente dalla fonte, il formato, la data, l'ora, fornitore, etc.
- **Arricchire i dati**, renderli più completi, più affidabili, ed accessibili
- **Ridurre il rumore** e la dipendenza dalla qualità
- **Abilitare l'inferenza** come materializzazione triple da alcune delle relazioni
- consentire la **realizzazione di nuovi servizi** integrati connessi alla mobilità
- **fornire accesso alla base di conoscenza** alle PMI di creare nuovi servizi

Challenges (addressed by DISIT)



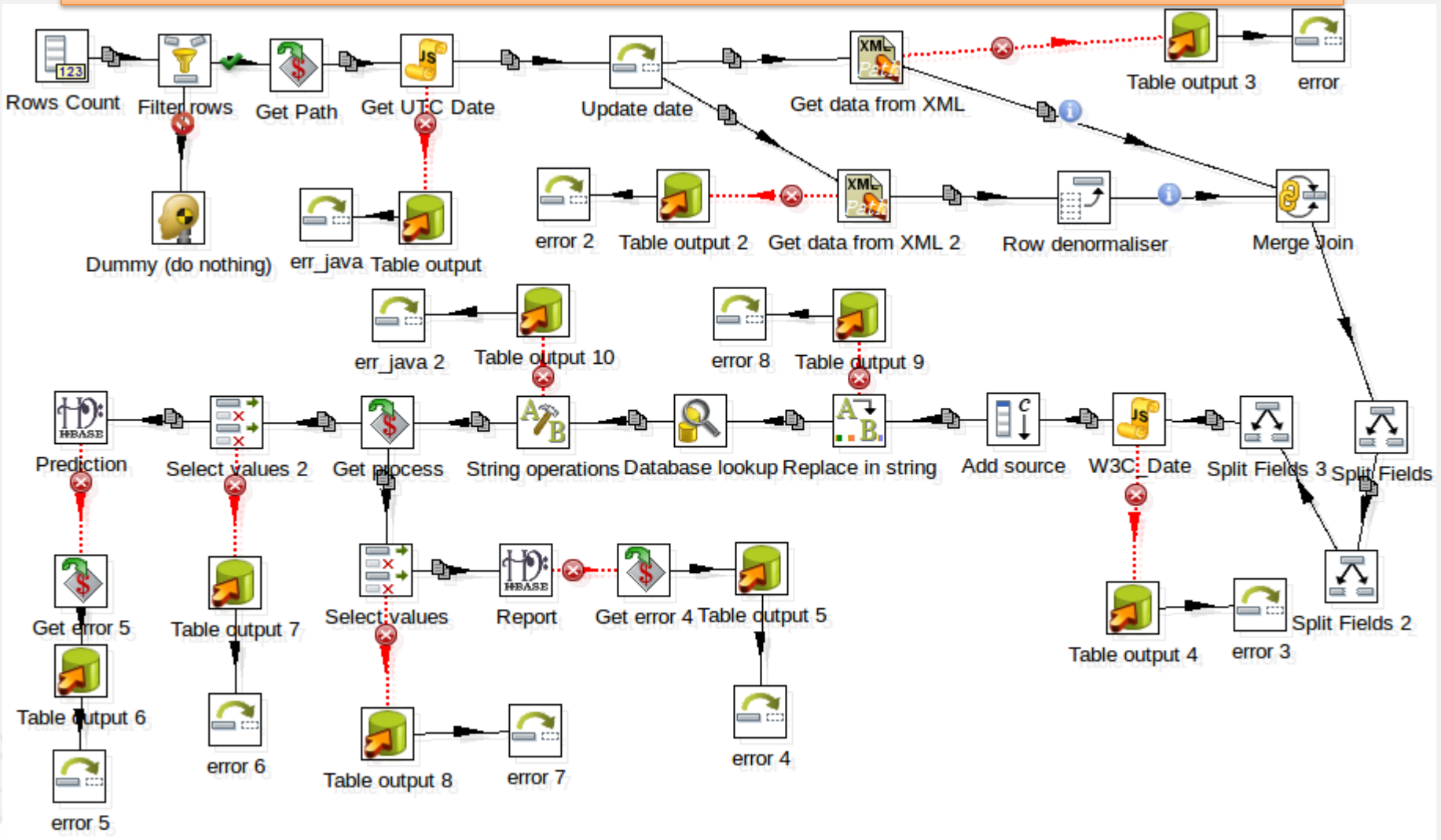
- OD/LOD, Open Data/Linked Open Data:
  - gathering, collection,
- Data Mining:
  - ontology mapping, integration, semantically interoperable
  - reconciliation, enrichment,
  - quality assessment and improvement
- Data Filtering on Streaming


Transport systems
Mobility, parking
Public Services,
Govern, events, …
Sensors, IOT Cameras,
Wi-Fi ..
Environment, Water,
energy
Shops, services,
operators
Social Media
Static Data harvesting
Quality Improvement
Data Mapping To triple
Hbase Store
R2RML Models
Real Time Data Ingestion
Sensors and streams: AVM, Parking, environment, weather, IOT, Etc…
Real Time Data Ingestion
triple
Km4City Ontology
Other SPARQL End points
RDF Store SPARQL End point
API
RDF Store SPARQL End point
API
RDF Store SPARQL End point
API
noSQL store
Smart City API (a part)
Big Data processing
Analytics: suggestions, user behaviour, clustering, prediction, early detection, ….
Engagement, Recommendation
Big Data Analytics
DISCES: Distributed SCE Scheduler
DISCES: Distributed SCE Scheduler

Static Data: harvesting

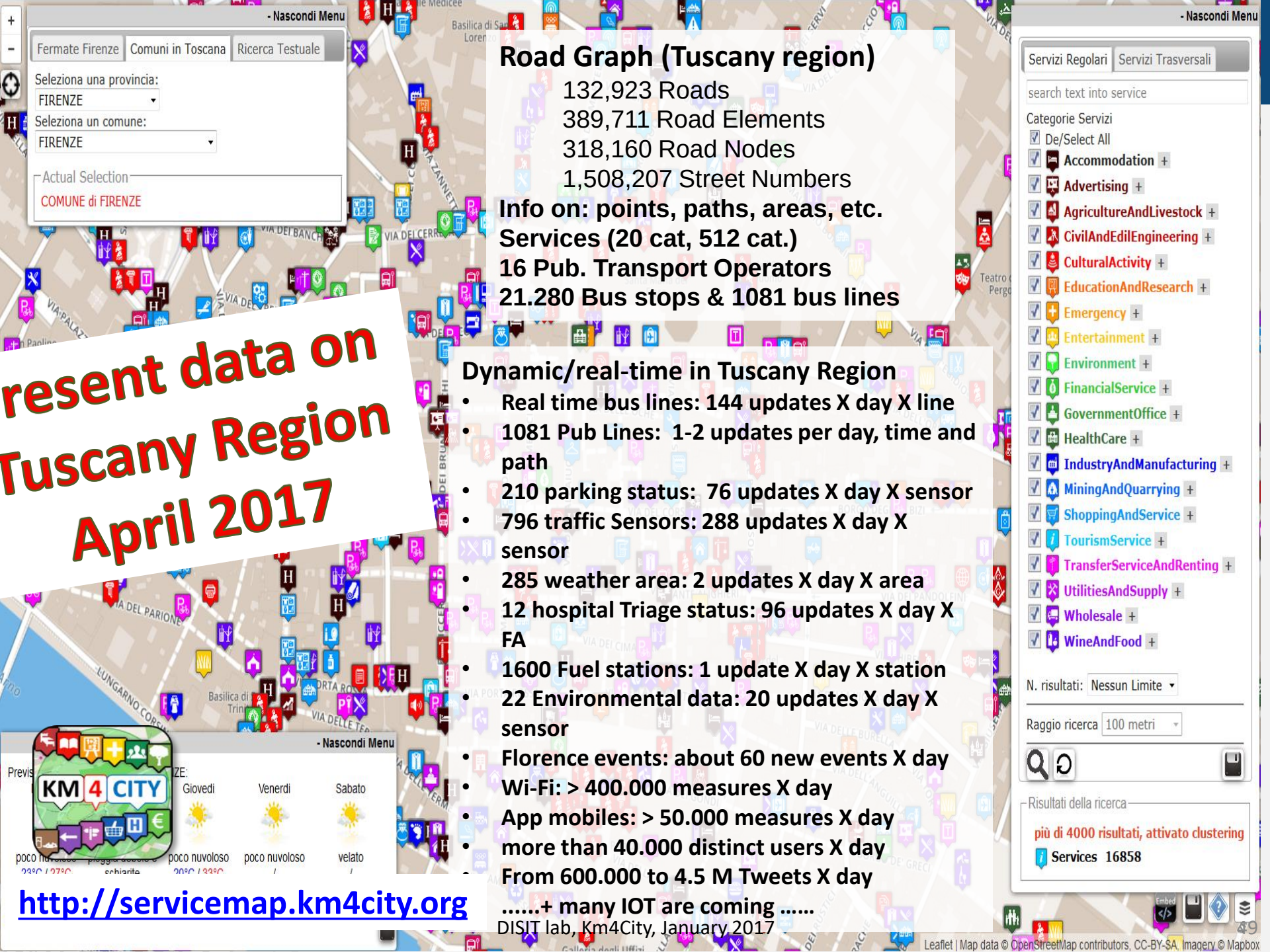
- **Ingesting a wide range of OD/PD**: public and private data, static, quasi static and/or dynamic real time data.
- For the case of Florence, we are addressing about **150 different data sources** of the 564 available, plus the regional, province, other municipalities, ….
- Using ***Pentaho - Kettle*** for data integration (Open source tool)
  - using specific ETL Kettle transformation processes (one or more for each data source)
  - data are stored in HBase (Bigdata NoSQL database)
- **Static and semi-static data** include: points of interests, geo-referenced services, maps, accidents statistics, etc.
  - files in several formats (SHP, KML, CVS, ZIP, XML, etc.)
- **Dynamic data** mainly data coming from sensors
  - parking, weather conditions, pollution measures, bus position, etc.
  - using Web Services.

Example of Ingestion process



Data Quality Improvement

- **Problems kinds:**
  - Inconsistencies, incompleteness, duplications and redundancy, ..
- **Problems** on:
  - CAPs vs Locations
  - Street names (e.g., dividing names from numbers and localities, normalize when possible)
  - Dates and Time: normalizing
  - Telephone numbers: normalizing
  - Web links and emails: normalizing
- **Partial Usage** of
  - Certified and accepted tables and additional knowledge


- Nascondi Menu
Fermate Firenze
Comuni in Toscana
Ricerca Testuale
Seleziona una provincia:
FIRENZE
Seleziona un comune:
FIRENZE
Actual Selection
COMUNE di FIRENZE
Road Graph (Tuscany region)
132,923 Roads
389,711 Road Elements
318,160 Road Nodes
1,508,207 Street Numbers
Info on: points, paths, areas, etc.
Services (20 cat, 512 cat.)
16 Pub. Transport Operators
21.280 Bus stops & 1081 bus lines
resent data on
Tuscany Region
April 2017
Dynamic/real-time in Tuscany Region
• Real time bus lines: 144 updates X day X line
• 1081 Pub Lines: 1-2 updates per day, time and path
• 210 parking status: 76 updates X day X sensor
• 796 traffic Sensors: 288 updates X day X sensor
• 285 weather area: 2 updates X day X area
• 12 hospital Triage status: 96 updates X day X FA
• 1600 Fuel stations: 1 update X day X station
• 22 Environmental data: 20 updates X day X sensor
• Florence events: about 60 new events X day
• Wi-Fi: > 400.000 measures X day
• App mobiles: > 50.000 measures X day
• more than 40.000 distinct users X day
• From 600.000 to 4.5 M Tweets X day
.....+ many IOT are coming .....
- Nascondi Menu
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
KM 4 CITY
Giovedi
Venerdi
Sabato
poco nuvoloso
poco nuvoloso
velato
http://servicemap.km4city.org
DISIT lab, Km4City, January 2017
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

Data Quality Improvement

Class	%QI	Total rows	Class	%QI	Total rows
Accoglienza	34,627	13256	Georeferenziati	38,754	2016
Agenzie delle Entrate	27,124	306	Materne	41,479	539
Arte e Cultura	37,716	3212	Medie	42,611	116
Visite Guidate	38,471	114	Mobilità Aerea	41,872	29
Commercio	42,105	323	Mobilità Auto	38,338	196
Banche	41,427	1768	Prefetture	39,103	449
Corrieri	42,857	51	Sanità	42,350	1127
Elementari	42,004	335	Farmacie	42,676	2131
Emergenze	42,110	688	Università	42,857	43
Enogastronomia	42,078	5980	Sport	52,256	1184
Formazione	42,857	70	Superiori	42,467	183
Accoglienza	34,627	13256	Tempo Libero	25,659	564

Service data from Tuscany region.

%QI = improved service data percentage after QI phase.

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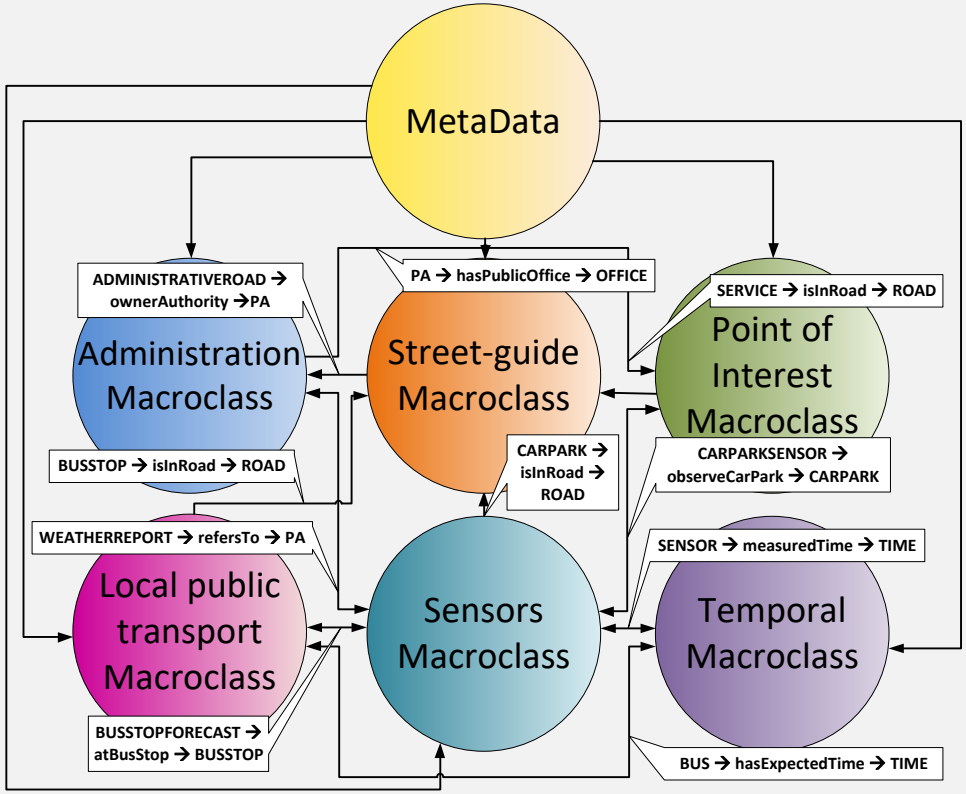
Smart-city Ontology

- The data model provided have been mapped into the ontology, it covers different aspects:
  - Administration
  - Street-guide
  - Points of interest
  - Local public transport
  - Sensors
  - Temporal aspects
  - Metadata on the data



Km4City

- Amministrazione
- Aspetti Sociali
- Strade ed elementi
- Punti di Interesse, turismo e cultura
- Trasporti
- Sensori
- Aspetti Temporali
- Eventi: sportivi e culturali
- Spetti legali e descrittori
- Aspetti spaziali
- Servizi pubblici e salute
- ....

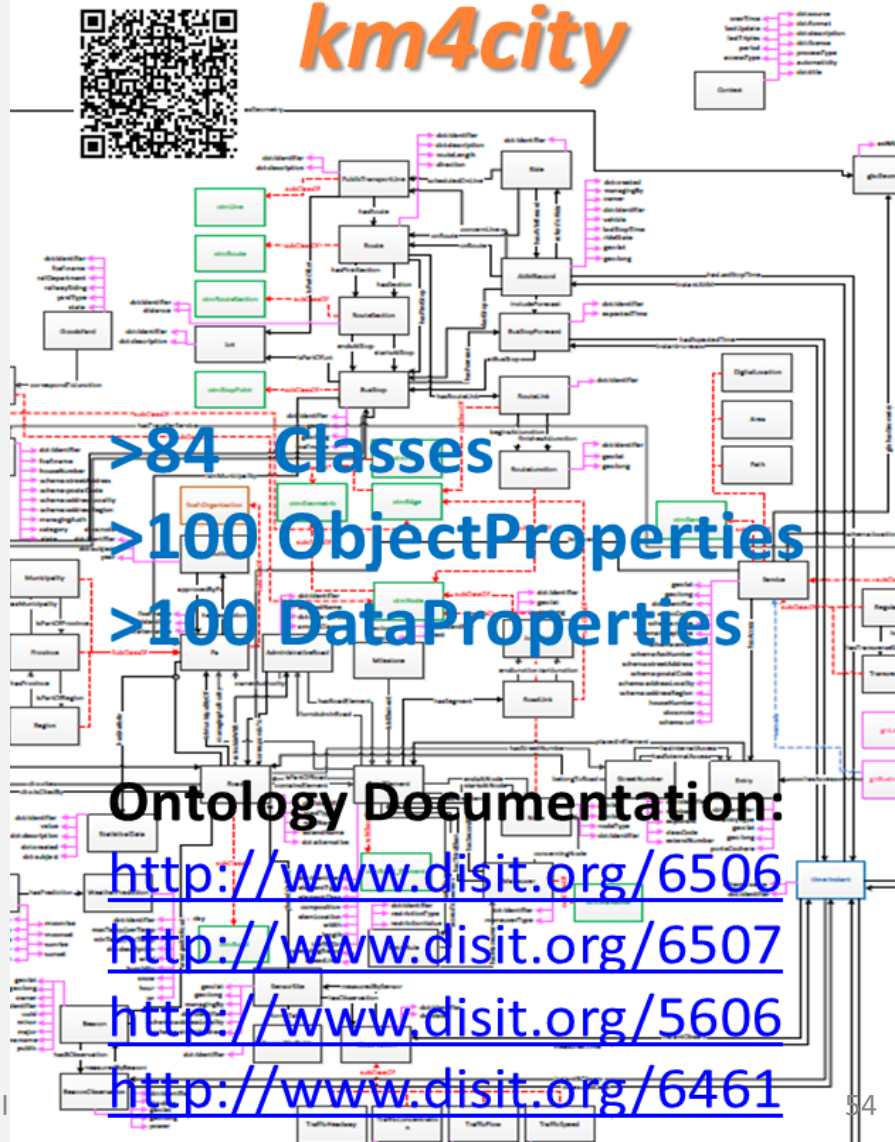
- *DC: Dublin core, standard metadata*
- *OTN: Ontology for Transport Network*
- *FOAF: for the description of the relations among people or groups*
- *Schema.org: for a description of people and organizations*
- *wgs84_pos: for latitude and longitude, GPS info*
- *OWL-Time: reasoning on time, time intervals*
- *GoodRelations: commercial activities models*

P. Bellini, M. Benigni, R. Billero, P. Nesi and N. Rauch, "Km4City Ontology Building vs Data Harvesting and Cleaning for Smart-city Services", International Journal of Visual Language and Computing, Elsevier, http://dx.doi.org/10.1016/j.jvlc.2014.10.023

I Dati

- **Collezionamento dati** statici, quasi statici e real time, stream
  - **Dati open**: geo localizzati, servizi, statistiche, censimenti, etc.
  - **Dati privati degli operatori**: con licenze limitate per non permettere di fare profitto ad altri operatori sulla base dei loro dati
  - **Dati personali delle persone**: profili, comportamenti tramite APP, IOT, sensori, web, etc.
- **Integrazione dati per renderli** ***semanticamente interoperabili***, ed operare deduzioni (time, space…)
  - I tradizionali ***collettori di open data*** danno visioni statistiche ma **non sono adatti a produrre servizi integrati**
  - ***Integrazione con modelli semantici unificanti come Km4City***

Smart-city Ontology km4city



Ontology Documentation:

http://www.disit.org/6506

http://www.disit.org/6507

http://www.disit.org/5606

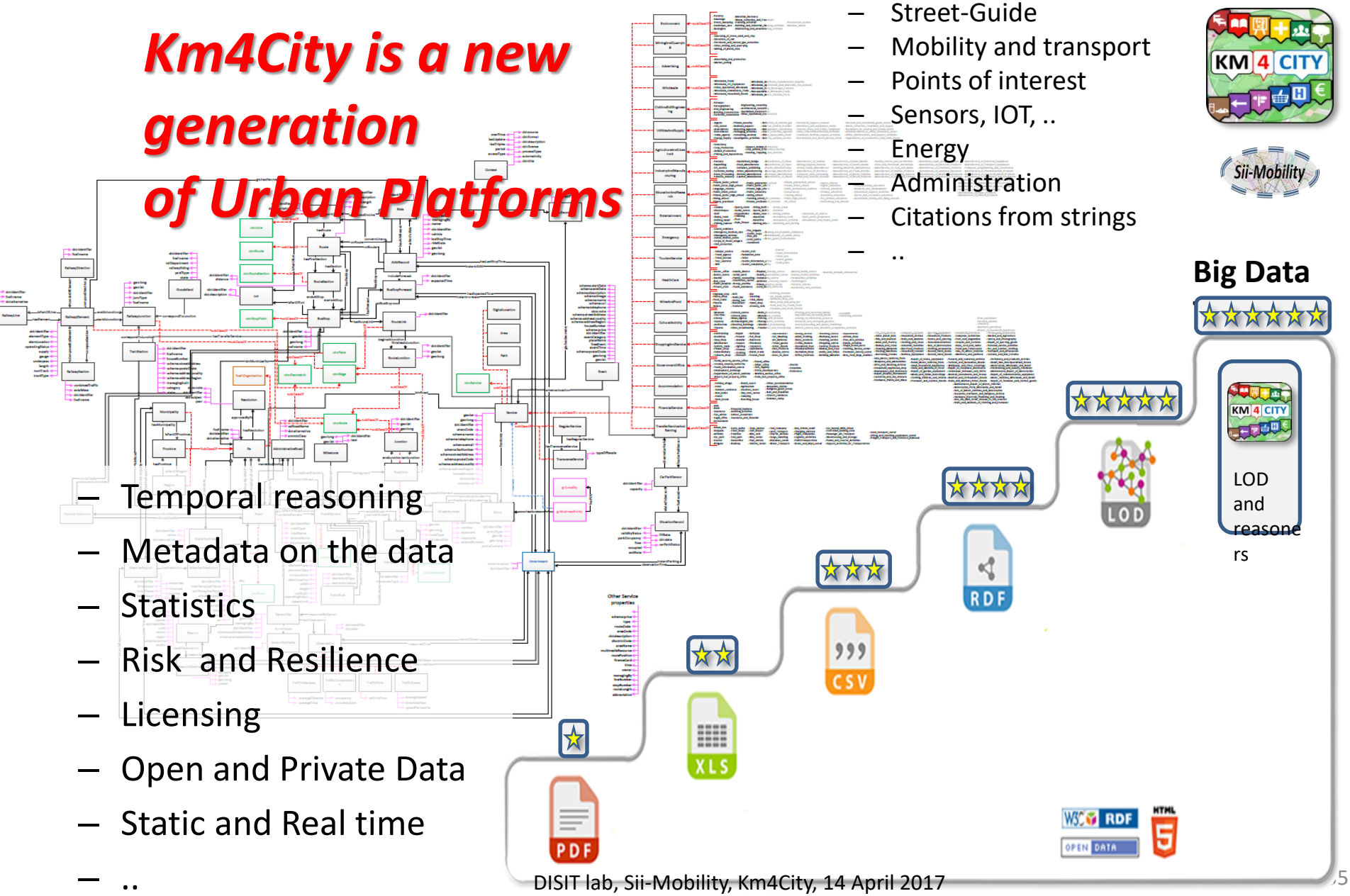
http://www.disit.org/6461

Km4City Ontology - RDF Store

Km4City is a new generation of Urban Platforms

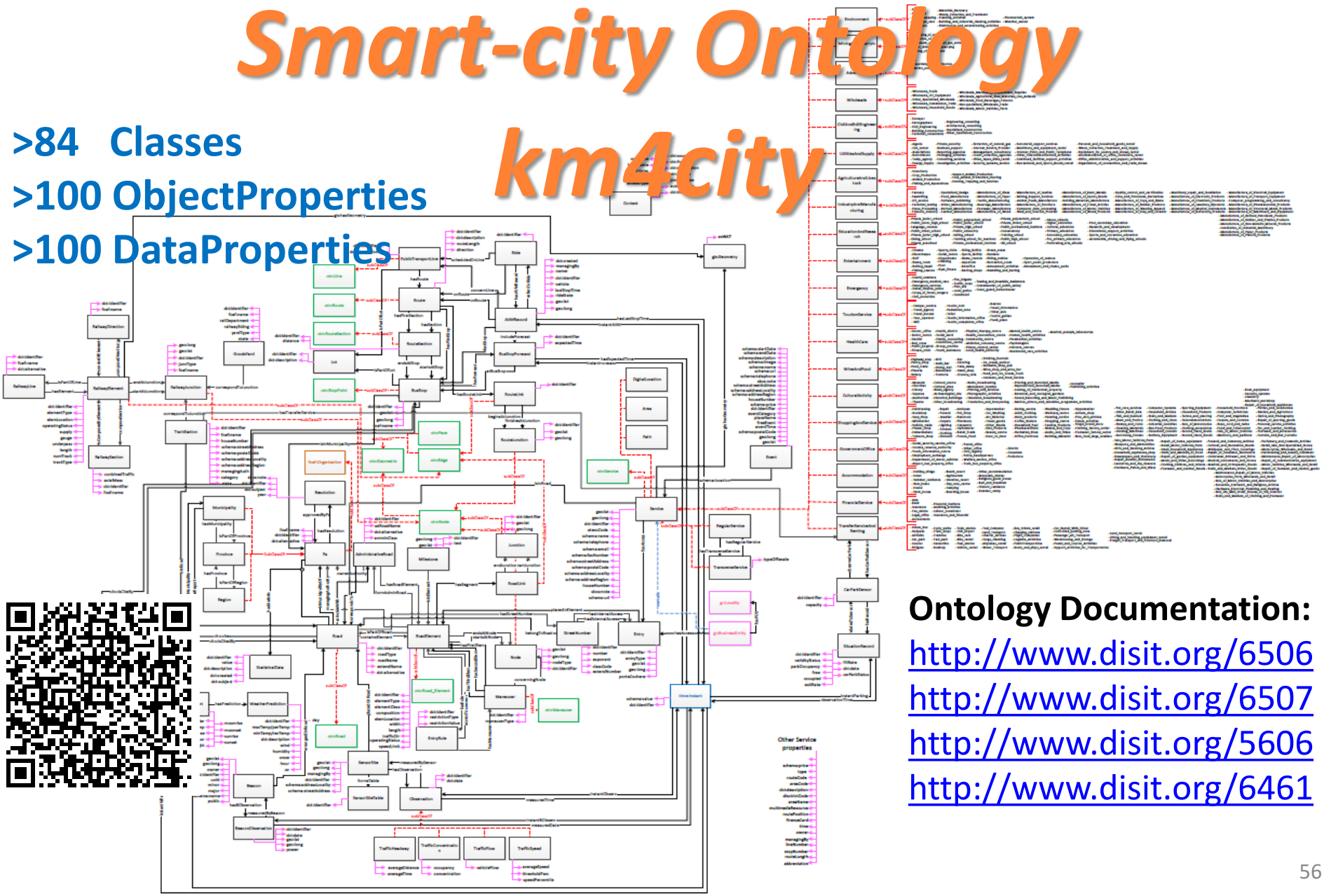
- Temporal reasoning
- Metadata on the data
- Statistics
- Risk and Resilience
- Licensing
- Open and Private Data
- Static and Real time
- ..

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



Smart-city Ontology km4city

>84 Classes
>100 ObjectProperties
>100 DataProperties



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http://www.disit.org/6507
http://www.disit.org/5606
http://www.disit.org/6461

Smart-city Ontology

- **Metadata**: modeling the additional information associated with:
  - **Descriptor** of Data sets that produced the triples: data set ID, title, description, purpose, location, administration, version, responsible, etc..
  - **Licensing** information
  - **Process** information: IDs of the processes adopted for ingestion, quality improvement, mapping, indexing,.. ; date and time of ingestion, update, review, …;

  When a problem is detected, we have the information to understand when and how the problem has been included
- **Including basic ontologies as:**
  - *DC: Dublin core, standard metadata*
  - *OTN: Ontology for Transport Network*
  - *FOAF: for the description of the relations among people or groups*
  - *Schema.org: for a description of people and organizations*
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Km4City Ontology and tools

- documentation ENG: http://www.disit.org/5606
- documentation ITA: http://www.disit.org/6461
- image: http://www.disit.org/6507
- ontology .. the OWL and triple version http://www.disit.org/6506
- FODD 2015 app http://www.disit.org/6595
- API Service Map: http://www.disit.org/6597
- Service Map: http://servicemap.disit.org

Why an Ontology

- On the basis of Km4City Ontology, via a data mining process, it is possible to built a knowledge base, KB, (and RDF Store) adding instances
  - This process creates inferences on the concepts, making deductions
- KB is query-able via SPARQL exploiting and referring to:
  - hundreds of relationships kind: is-a, is-part-of, is-located, is-near-by, …
  - Patterns among entities and relations
  - Exploiting inference
- Specific queries can be simplified by adding special and additional indexes and/or relations

Major topics addressed

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Data mapping to Triples

- Transforms the data from HBase to RDF triples

- Using **Karma Data Integration tool**, a mapping model from SQL to RDF on the basis of the ontology was created
  - Data to be mapped first temporarily passed from Hbase to MySQL and then mapped using Karma (in batch mode)
- The mapped data in triples have to be uploaded (and indexed) to the **RDF Store** (OpenRDF – sesame with OWLIM-SE)

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

Comparing different reconciliation approaches based on

- SILK link discovering language
- SPARQL based reconciliation described above

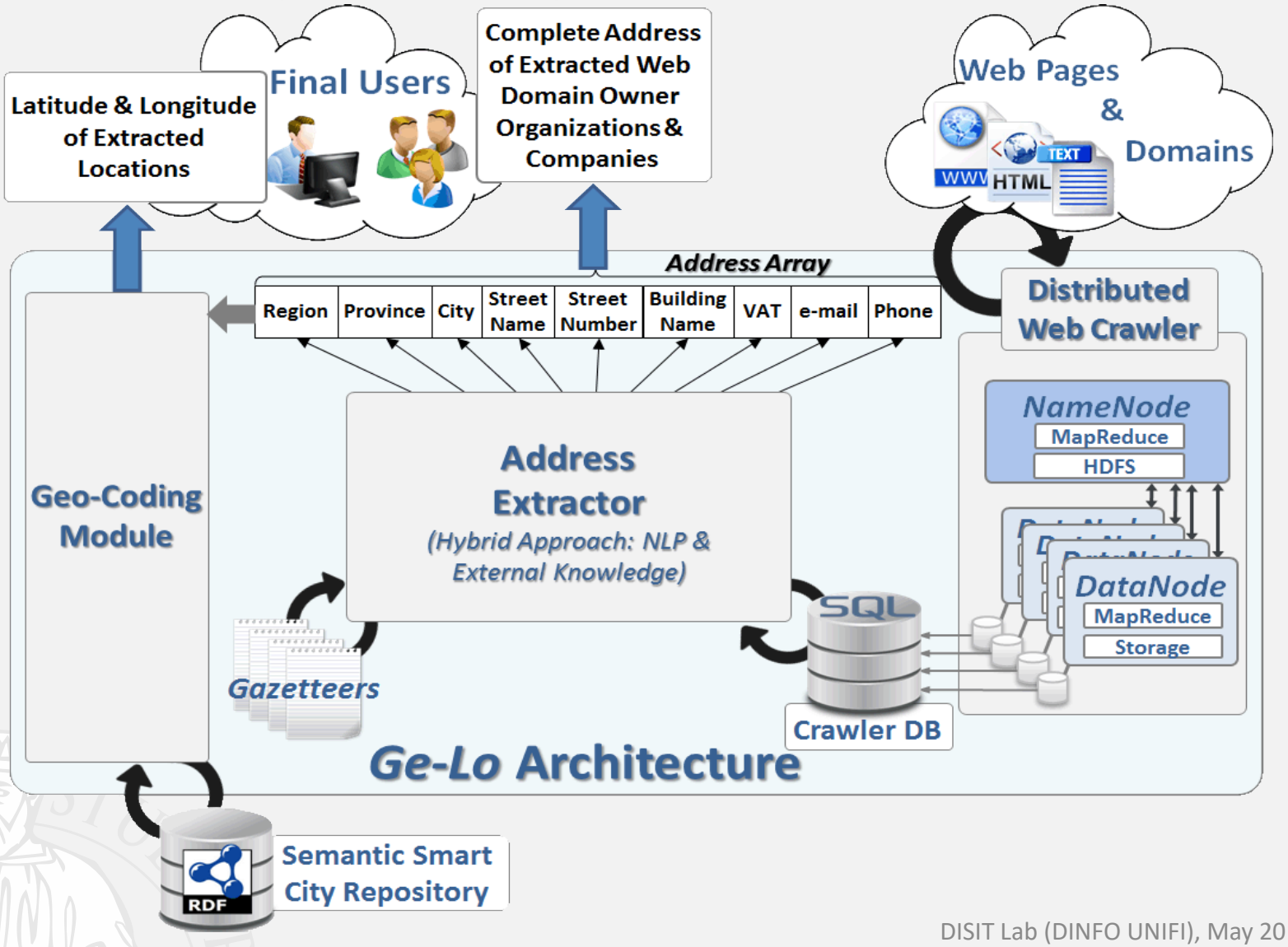
Method	Precision	Recall	F1
SPARQL –based reconciliation	1,00	0,69	0,820
SPARQL -based reconciliation + additional manual review	0,985	0,722	0,833
Link discovering - Leveisthein	0,927	0,508	0,656
Link discovering - Dice	0,968	0,674	0,794
Link discovering - Jaccard	1,000	0,472	0,642
Link discovering + heuristics based on data knowledge + Leveisthein	0,925	0,714	0,806
QI - Link discovering – Dice	0,945	0,779	0,854
QI - Link discovering – Jaccard	1,000	0,588	0,740
QI - Link discovering + heuristics based on data knowledge + Leveisthein	0,892	0,839	**0,865**

Thus automation of reconciliation is possible and produces acceptable results!!

Localization via web crawling

- Using the **Ge(**o)**Lo(**cator) framework:
  - Mining, retrieving and geolocalizing web-domains associated to companies in Tuscany (thanks to a Distribute Web Crawler based on Apache Nutch + Hadoop)
  - Extraction of geographical information based on a hybrid approach (thanks to Open Source **GATE** Framework + using external gazetteers)
  - Validation in 2 steps: Evaluation of Complete Address Array Extraction, Evaluation of Geographic Coordinate Extraction
- New services found, can be transformed into RDF triples and added to the repository!

Ge(o)Lo(cator) System Description – Architecture



RDF Store Enrichment, for service Localization via web crawling

TABLE I. COMPARISON TABLE REPORTING EVALUATION DETAILS FOR EVALUATION TASK 1: ADDRESS ARRAY EXTRACTION, AND TASK 2: GEOGRAPHIC COORDINATES EXTRACTION (EMPLOYING BOTH THE SMART CITY REPOSITORY AND THE GOOGLE GEOCODING API).

Evaluation Tasks	TP	FP	FN	TN	Precision	Recall	F-Measure
1) Address Array Extraction	74.5%	7.8%	5.9%	11.8%	90.5%	92.7%	91.6%
2a) Geographic Coordinates Extraction (Smart City Semantic Repository)	57.8%	4.7%	29.5%	8.0%	92.5%	66.2%	77.1%
2b) Geographic Coordinates Extraction (Google Geocoding)	48.9%	31.1%	11.1%	8.9%	61.1%	81.5%	69.8%

- ***Precision*** rate for geographic coordinates extraction (employing the Smart City Semantic Repository) has increased, with respect to the value obtained in the evaluation of address array extraction.
- Slightly decreasing ***TN*** rate for Test (2a) with respect to Test (1): exploiting the extraction of high level features (such as building names) allows the system to obtain correct coordinates even for domains with incomplete Address Array.
- ***Recall*** rate for Test (2a) significantly decrease with respect to Test (1). This is due mainly to the noise generated by the supplementary logic and the extended semantic queries required to obtain the geographical coordinates.
- Higher ***Recall*** rate achieved when using the Google Geocoding APIs: Google Repository is by far larger than DISIT Smart City RDF datastore, so that it is able to index a huge amount of resources, even if this can affect the precision rate.

Major topics addressed

- Smart City Concepts
- Architecture of Smart City Infrastructures
- Peripheral processors
  - Data collectors and Managers
  - Blog Vigilance via Natural Language Processing
  - Twitter vigilance
- Data ingestion and mining
  - Data Mining and smart City problematic
  - Km4City: Smart City Ontology
  - RDF production, reconciliation
  - Parallel and distributed processing

Reasoning and Deduction
- Smart City Engine
- Decision Support System

Data Acting processors
- Smart City Tools and API
- Service Map and Linked Open Graph
- Mobile applications

Projects
- SmartCity Project Sii-Mobility SCN
- SmartCity Project Coll@bora SIN
- SmartCity Project RESOLUTE H2020
- Mobile Emergency

Real Time Data Ingestion

- Sensors on Traffic flow data: Florence, Empoli, Piombino, Arezzo
  - number of catalogs: 63
- Parkings status: Florence (14), Empoli (6), Arezzo (9), Grosseto (4), Livorno (5), Lucca (5), Massa-Carrara (3), Prato (1)
  - Total number: 48
- AVM busses 5 lines, in Florence:
  - 816 rides for Line 4, 1210 rides for Line 6
- Weather conditions and forecast for
  - Municipalities in Tuscany: about 285 cities
- **Attualmente sul grafo sono riconciliati solo I parcheggi di Firenze, Empoli, …, ma tutti mandano dati.**

Example for Parking

- To **process the parking data** for Sii-Mobility
  - **real time data** from Osservatorio Trasporti of Tuscany region (MIIC).

- **2** phases:
  - **INGESTION** phase;
  - **TRIPLES GENERATION** phase.

Example for AVM data

- AVM data area obtained via DATEX2 protocol for all CodeRace (only a small part of them may be active):
  - A CodeRace identifies a Bus race on a given line
- At the same time, on a single Line:
  - A number of Busses (with their code race) are running.
    - For each of them a forecast for each bus-stop is provided.
  - At every new forecast, all obsolete forecasts for next and passed predictions have to be deprecated,
- → thus filtering is needed to avoid growing of not useful data into the RDF Store ….
  - A different approach on the server side would be much more efficient providing for each line the forecast only for the active races.

Distributed Scheduler

- Use of a scheduler to manage periodic execution of ingestion and triple generation processes.
  - This tool throws the processes with predefined interval determined in phase of configuration.
- **Static Data: as Sporadic processes**:
  - scheduled every months or week
- **Real Time data** (car parks, road sensors, etc.)
  - ingestion and triple generation processes should be performed periodically (no for **static data**).

http://192.168.0.72

Sii-Mobility

Smart Cloud Engine
DISIT - Distributed Systems and Internet Technology Lab

http://192.168.0.72

SCHEDULER NAME	ID	FIRE INSTANCE ID	DATE	JOB NAME	JOB GROUP	JOB DATA	STATUS
SCE	297230	hadoopnode01d14183077042351418307705019	2014-12-15 15:25:33	sensori47_A	sensori47	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297229	hadoopnode06c14183076279641418307629359	2014-12-15 15:25:33	sensori44_A	sensori44	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297228	hadoopnode02141830838738214183083917758	2014-12-15 15:22:39	ZTL_notturna_shp_I	ZTL_notturna_shp	#processParameters=null; #isNonConcurrent=t	SUCCESS
SCE	297227	hadoopnode02141830838738214183083917757	2014-12-15 15:22:39	ZTL_notturna_kmz_I	ZTL_notturna_kmz	#processParameters=null; #isNonConcurrent=t	SUCCESS
SCE	297226	hadoopnode01c14183085186101418308520365	2014-12-15 15:21:49	sensori45_A	sensori45	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297225	hadoopnode06141830832370214183083258668	2014-12-15 15:21:49	sensori40_A	sensori40	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297224	hadoopnode01b14183075646221418307566749	2014-12-15 15:21:49	sensori46_A	sensori46	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297223	hadoopnode02141830838738214183083917756	2014-12-15 15:21:37	ZTL_notturna_kmz_I	ZTL_notturna_kmz	#processParameters=null; #isNonConcurrent=t	SUCCESS
SCE	297222	hadoopnode02141830838738214183083917755	2014-12-15 15:21:00	sensori31_C	sensori31	#processParameters=[{"processPath":"/ho	SUCCESS
SCE	297221	hadoopnode06c14183076279641418307629358	2014-12-15 15:21:00	sensori30_C	sensori30	#processParameters=[{"processPath":"/ho	SUCCESS
SCE	297220	hadoopnode02141830838738214183083917754	2014-12-15 15:18:58	ZTL_notturna_shp_I	ZTL_notturna_shp	#processParameters=null; #isNonConcurrent=t	SUCCESS
		hadoopnode01c14183				#processParameter	

Distributed Scheduler

Sii-Mobility

Smart Cloud Engine
DISIT - Distributed Systems and Internet Technology Lab

192.168.0.14
- LAST_CHECK: 2015-05-29 19:08:10
- SCHEDULER_INSTANCE_ID: hadoopnode01b1432798209062
- CPU_LOAD: 4.49%
- FREE_PHYSICAL_MEMORY: 1.44 GB
- JOBS_EXECUTED: 1151
- SCHEDULER_NAME: SCE
- CURRENT_TIME: 2015-05-29 19:08:12
- JOBS/h: 34.22
- RUNNING_SINCE: 2015-05-28 09:30:09
- CLUSTERED: 1
- PERSISTENCE: 1
- REMOTE_SCHEDULER: 0
- CURRENTLY_EXECUTING_JOBS: 2
- CPU_LOAD_JVM: 0.07%
- SYSTEM_LOAD_AVERAGE: 0.12
- OPERATING_SYSTEM_VERSION: 3.13.0-24-generic
- COMMITTED_VIRTUAL_MEMORY: 3.44 GB
- OPERATING_SYSTEM_NAME: Linux
- FREE_SWAP_SPACE: 11.72 GB
- PROCESS_CPU_TIME: 377680000000
- 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: 1.57 TB
- USABLE_DISK_SPACE: 1.46 TB
- PREV_FIRE_TIME: 2015-05-29 19:01:19
- CPU: Intel(R) Xeon(R) CPU X3470 @ 2.93GHz

192.168.0.40
- LAST_CHECK: 2015-05-29 19:07:12
- SCHEDULER_INSTANCE_ID: hadoopnode01d1432798211042
- CPU_LOAD: 3.86%
- FREE_PHYSICAL_MEMORY: 1.17 GB
- JOBS_EXECUTED: 1205
- SCHEDULER_NAME: SCE
- CURRENT_TIME: 2015-05-29 19:08:12
- JOBS/h: 35.83
- RUNNING_SINCE: 2015-05-28 09:30:11
- CLUSTERED: 1
- PERSISTENCE: 1
- REMOTE_SCHEDULER: 0
- CURRENTLY_EXECUTING_JOBS: 6
- CPU_LOAD_JVM: 0.04%
- SYSTEM_LOAD_AVERAGE: 0.22
- OPERATING_SYSTEM_VERSION: 3.13.0-24-generic
- COMMITTED_VIRTUAL_MEMORY: 3.45 GB
- OPERATING_SYSTEM_NAME: Linux
- FREE_SWAP_SPACE: 11.74 GB
- PROCESS_CPU_TIME: 386070000000
- 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: 1.57 TB
- USABLE_DISK_SPACE: 1.46 TB
- PREV_FIRE_TIME: 2015-05-29 19:03:45
- CPU: Intel(R) Xeon(R) CPU X5690 @ 3.47GHz

192.168.0.42
- LAST_CHECK: 2015-05-29 19:07:30
- SCHEDULER_INSTANCE_ID: hadoopnode0f1432798169292
- CPU_LOAD: 18.39%
- FREE_PHYSICAL_MEMORY: 925.03 MB
- JOBS_EXECUTED: 1071
- SCHEDULER_NAME: SCE
- CURRENT_TIME: 2015-05-29 19:08:12
- JOBS/h: 31.83
- RUNNING_SINCE: 2015-05-28 09:29:29
- CLUSTERED: 1
- PERSISTENCE: 1
- REMOTE_SCHEDULER: 0
- CURRENTLY_EXECUTING_JOBS: 10
- CPU_LOAD_JVM: 0.09%
- SYSTEM_LOAD_AVERAGE: 0.61
- OPERATING_SYSTEM_VERSION: 3.13.0-24-generic
- COMMITTED_VIRTUAL_MEMORY: 3.45 GB
- OPERATING_SYSTEM_NAME: Linux
- FREE_SWAP_SPACE: 11.8 GB
- PROCESS_CPU_TIME: 448630000000
- 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: 1.57 TB
- USABLE_DISK_SPACE: 1.46 TB
- PREV_FIRE_TIME: 2015-05-29 19:01:21
- CPU: Intel(R) Xeon(R) CPU E5-2640 v2 @ 2.00GHz

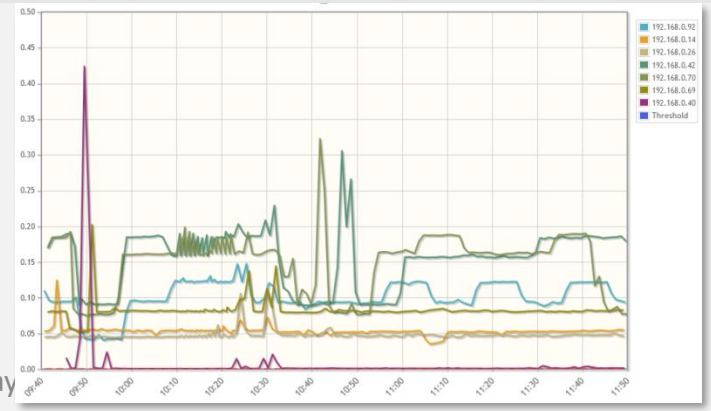
192.168.0.69
- LAST_CHECK: 2015-05-29 19:07:15
- SCHEDULER_INSTANCE_ID: hadoopnode021432798214027
- CPU_LOAD: 0.33%
- FREE_PHYSICAL_MEMORY: 3.09 GB
- JOBS_EXECUTED: 1068
- SCHEDULER_NAME: SCE
- CURRENT_TIME: 2015-05-29 19:08:12
- JOBS/h: 31.75
- RUNNING_SINCE: 2015-05-28 09:30:14
- CLUSTERED: 1
- PERSISTENCE: 1
- REMOTE_SCHEDULER: 0
- CURRENTLY_EXECUTING_JOBS: 6
- CPU_LOAD_JVM: 0.09%
- SYSTEM_LOAD_AVERAGE: 0.01
- OPERATING_SYSTEM_VERSION: 3.13.0-24-generic
- COMMITTED_VIRTUAL_MEMORY: 3.44 GB
- OPERATING_SYSTEM_NAME: Linux
- FREE_SWAP_SPACE: 11.98 GB
- PROCESS_CPU_TIME: 441090000000
- 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: 1.57 TB
- USABLE_DISK_SPACE: 1.46 TB
- PREV_FIRE_TIME: 2015-05-29 19:01:20
- CPU: Intel(R) Xeon(R) CPU E5-2640 v2 @ 2.00GHz

192.168.0.70
- LAST_CHECK: 2015-05-29 19:07:17
- SCHEDULER_INSTANCE_ID: hadoopnode011432798216310
- CPU_LOAD: 0.33%
- FREE_PHYSICAL_MEMORY: 1.23 GB
- JOBS_EXECUTED: 1124
- SCHEDULER_NAME: SCE
- CURRENT_TIME: 2015-05-29 19:08:12
- JOBS/h: 33.42
- RUNNING_SINCE: 2015-05-28 09:30:16
- CLUSTERED: 1
- PERSISTENCE: 1
- REMOTE_SCHEDULER: 0
- CURRENTLY_EXECUTING_JOBS: 4
- CPU_LOAD_JVM: 0.1%
- SYSTEM_LOAD_AVERAGE: 0.0
- OPERATING_SYSTEM_VERSION: 3.13.0-24-generic
- COMMITTED_VIRTUAL_MEMORY: 3.44 GB
- OPERATING_SYSTEM_NAME: Linux
- FREE_SWAP_SPACE: 11.33 GB
- PROCESS_CPU_TIME: 484800000000
- 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: 1.56 TB
- USABLE_DISK_SPACE: 1.46 TB
- PREV_FIRE_TIME: 2015-05-29 19:01:20
- CPU: Intel(R) Xeon(R) CPU X3470 @ 2.93GHz

192.168.0.92
- LAST_CHECK: 2015-05-29 19:07:20
- SCHEDULER_INSTANCE_ID: hadoopnode01c1432798219332
- CPU_LOAD: 9.83%
- FREE_PHYSICAL_MEMORY: 1.06 GB
- JOBS_EXECUTED: 1093
- SCHEDULER_NAME: SCE
- CURRENT_TIME: 2015-05-29 19:08:12
- JOBS/h: 32.5
- RUNNING_SINCE: 2015-05-28 09:30:19
- CLUSTERED: 1
- PERSISTENCE: 1
- REMOTE_SCHEDULER: 0
- CURRENTLY_EXECUTING_JOBS: 4
- CPU_LOAD_JVM: 0.06%
- SYSTEM_LOAD_AVERAGE: 0.56
- OPERATING_SYSTEM_VERSION: 3.13.0-24-generic
- COMMITTED_VIRTUAL_MEMORY: 3.44 GB
- OPERATING_SYSTEM_NAME: Linux
- FREE_SWAP_SPACE: 11.02 GB
- PROCESS_CPU_TIME: 436920000000
- 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: 1.57 TB
- USABLE_DISK_SPACE: 1.46 TB
- PREV_FIRE_TIME: 2015-05-29 19:01:36
- CPU: Intel(R) Xeon(R) CPU X3470 @ 2.93GHz

CPU	CPU Load	Mem Total	Mem Free	Cores	Jobs/h	Jobs Executed	Jobs Failed/Success (24 h)	Jobs Failed/Success (7 days)
63.45 GHz	3.66 GHz (5.77%)	70.41 GB	8.9 GB	24	199.55	6712	6 (0.12%) 5063 (99.88%)	93 (0.63%) 14677 (99.37%)

Last updated on: Fri 29-05-2015 19:08:12.897099 generated in 1547 ms (refresh time 3000 ms) Static Push



http://192.168.0.72

Major topics addressed

- Smart City Concepts
- Architecture of Smart City Infrastructures
- Peripheral processors
  - Data collectors and Managers
  - Blog Vigilance via Natural Language Processing
  - Twitter vigilance
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  - Data Mining and smart City problematic
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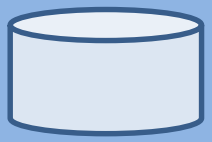
  - SmartCity Project Sii-Mobility SCN
  - SmartCity Project Coll@bora SIN
  - SmartCity Project RESOLUTE H2020
  - Mobile Emergency

Challenges

Smart City Engine

Data processing

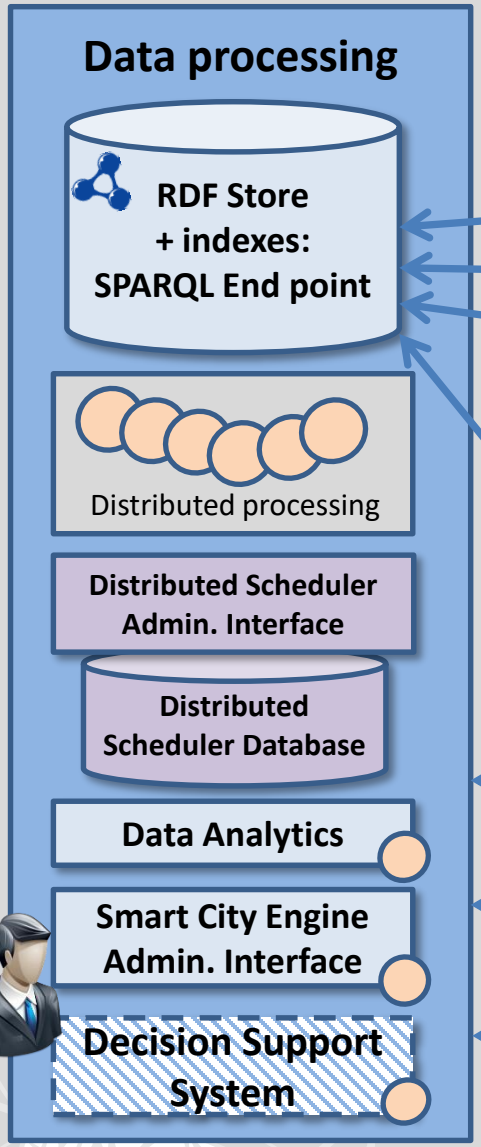


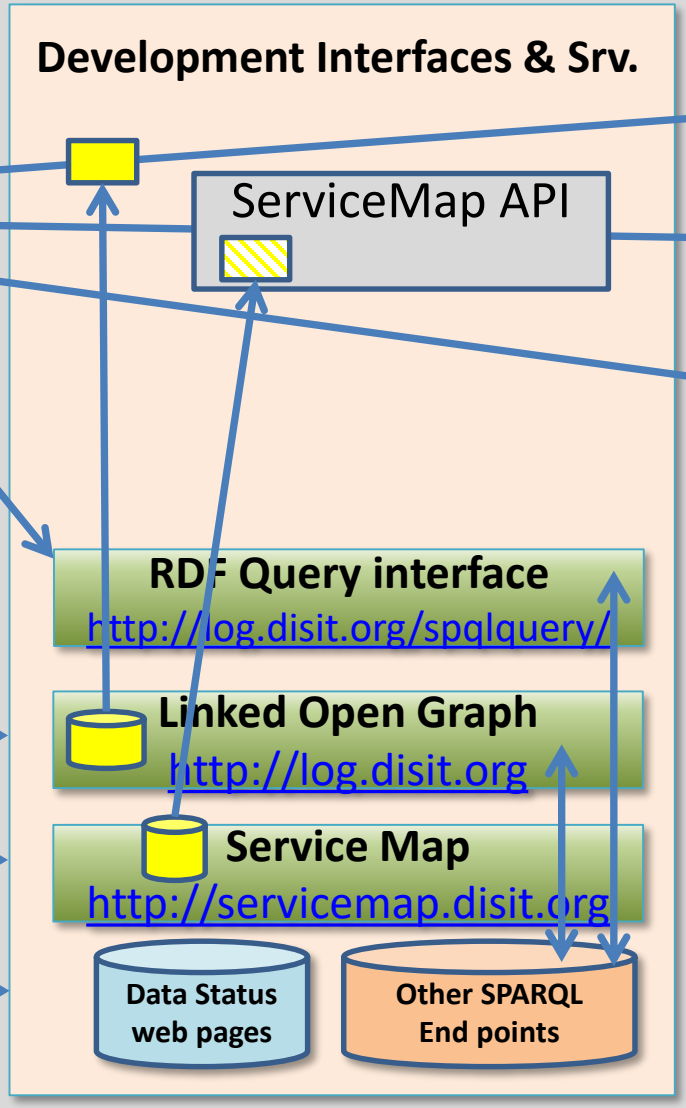
Real time Computing

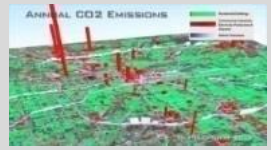
Reasoning and Deduction

- **Reasoning and Data processing**
  - Data analytics, Semantic computing
  - Link Discovering
  - Inferential reasoning
  - Identification of critical condition
  - unexpected correlations
  - predictions, etc.
- "Real time" Computing out of peripherals
  - Action / reaction
- **Activation of rules**
  - Firing conditions for activating computing
  - Acceptance of external rules

Km4City Strumenti e Servizi

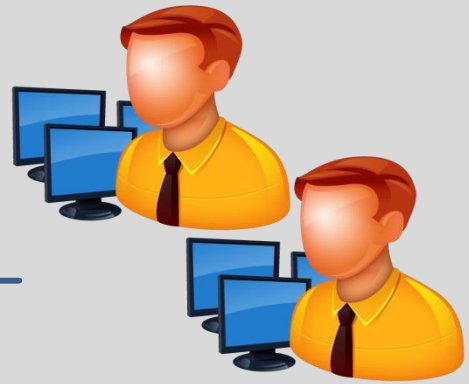






sviluppo

use



sviluppatori

Reasoning and Deduction

Servizi e strumenti

Firenze

43.7693, 11.2560

Tue 10 Nov @ 12:53:21

ServiceMap, SmartDS

Wifi operativi 21

10.7% | 89.3%

SmartDS: via santa marta 3 21

58.8% | 21.3% | 20.1%

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

Principali Twitter [illegible]

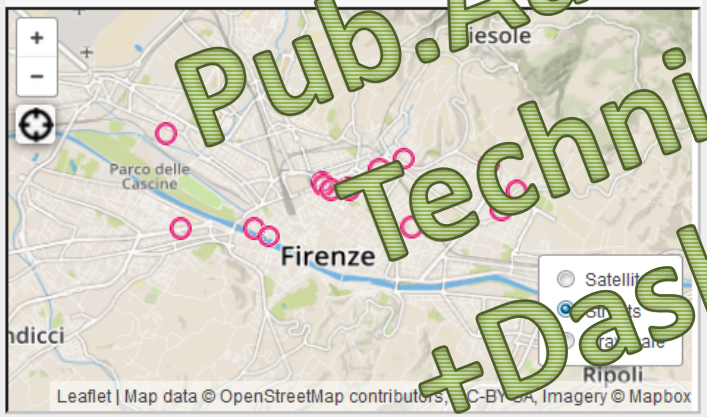
#fi[illegible] #ponteve[illegible]

[illegible]: @comunefi #fiorentin[illegible]

#p[illegible]vecchio

[illegible]lievi wifi 22

Posizione in tempo reale degli autobus ATA



Previsioni RT 20

[illegible]

[illegible]eo del comune di FIRENZE 299961

Tuesday	Wednesday	[illegible]rsday	Friday	Saturday
[illegible]dy	mist	bleak	[illegible]cloudy	cloudy
[illegible]°C / [illegible]°C	9°C / 20°C	8°C / [illegible]°C	/	/

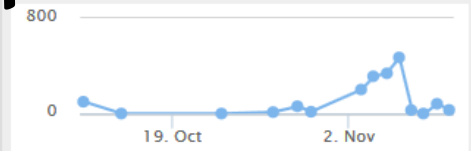
[illegible]

66.0%

Smart City Engine

CPU	Job
[illegible]%	Eseguiti
[illegible]otale	954
24034 MB	

Query Servicemap 22



Stato corse ATAF 21

Linee: 6 17 4

in Orario	in Anticipo	in Ritardo
60.6%	17.1%	22.4%

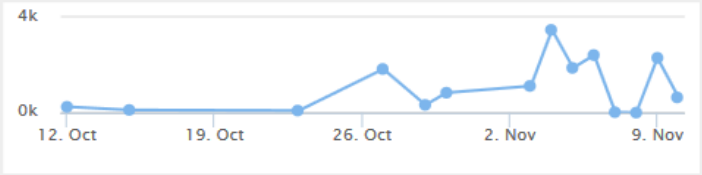
Sensori RT

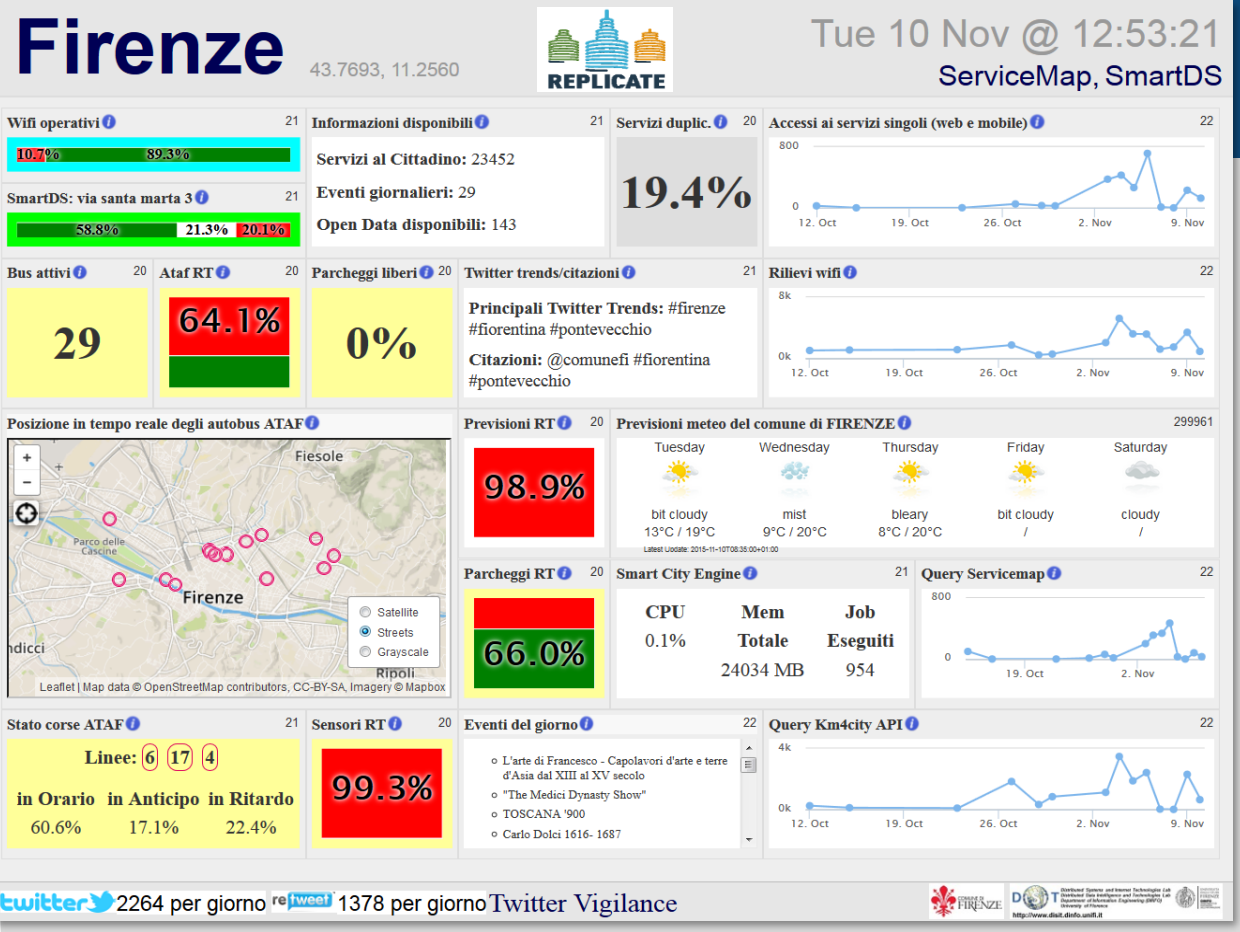
[illegible].3%

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 Dolci 1616- 1687

Query Km4city API 22



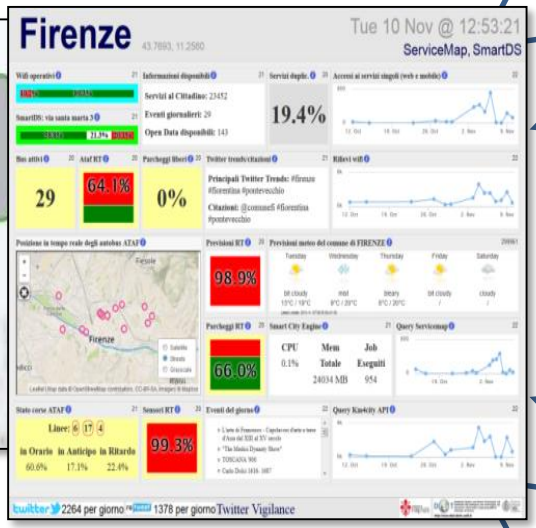


DISIT Lab, Distributed Data Intelligence and Technologies
Distributed Systems and Internet Technologies
Department of Information Engineering (DINFO)
http://www.disit.dinfo.unifi.it

ICT e infrastrutture di comunicazione sono una chiave per tenere sotto controllo e gestire le infrastrutture ma …. non è sufficiente per migliorare la resilienza delle città:

Control Room delle Città Metropolitane devono:

- **arrivare a supervisionare domini multipli** e le interdipendenze fra mobilità, energia, comunicazione, servizi, flussi traffico, flussi pedonali, turismo, etc.
- **Migliorare la loro Resilienza**, capacità di reazione ed assorbimento.



Transport systems, Mobility, Parking

Shops, services, operators

Sensors, IOT Cameras, ..

Social Media, WiFi, Network

Dashboard

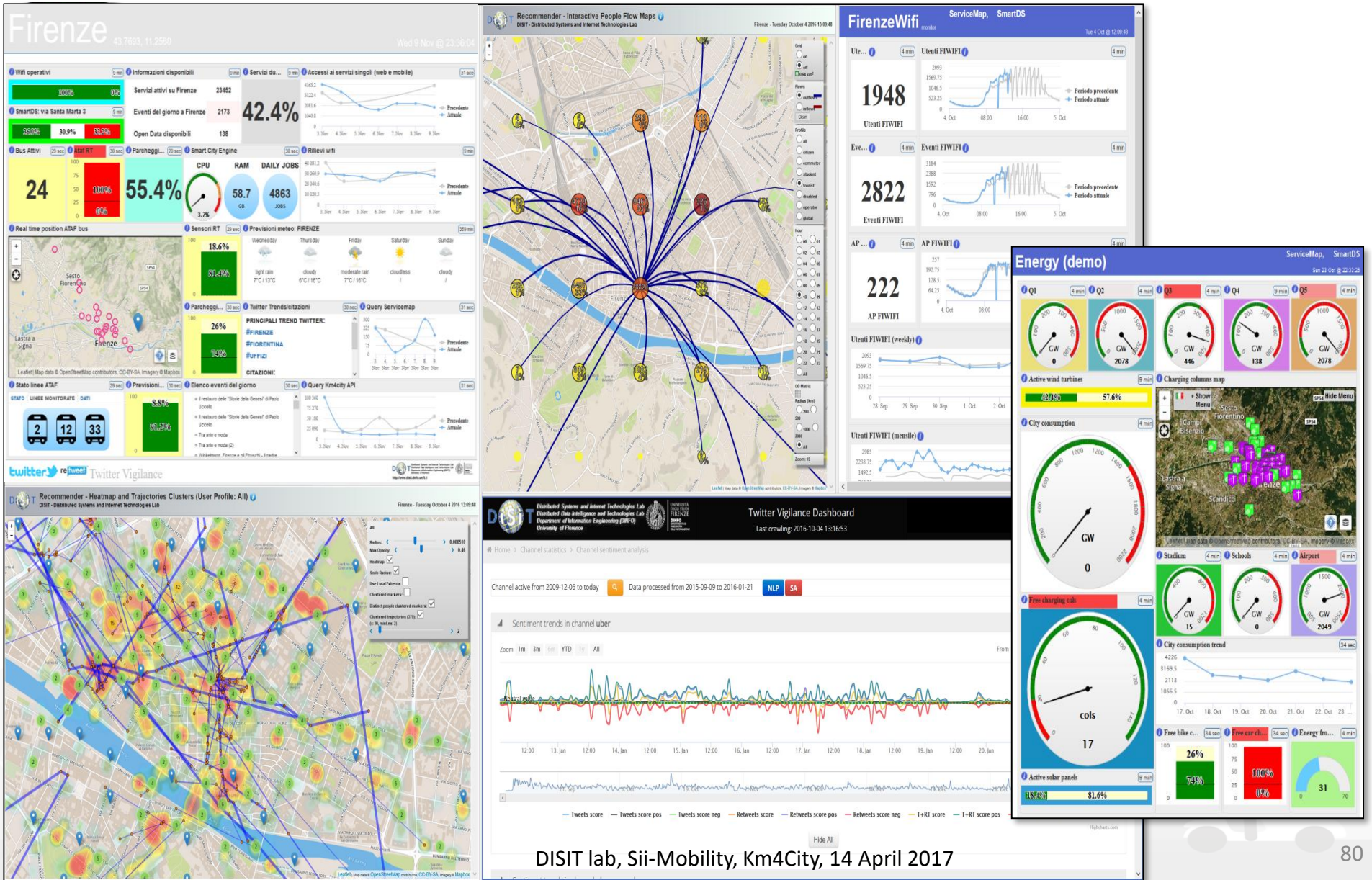
Public services, Govern

Environment, Water

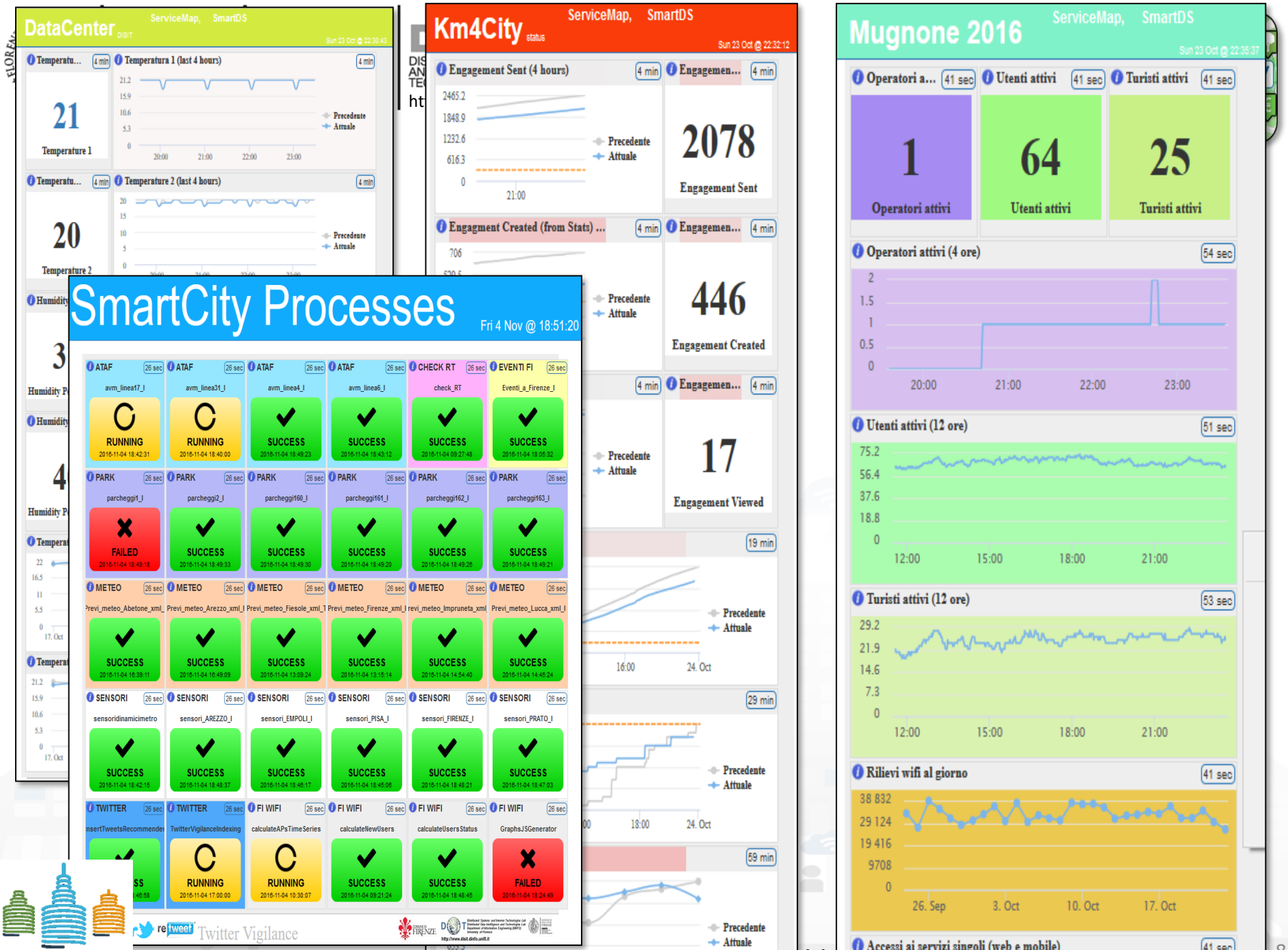
Smart City Dashboard

REPLICATE

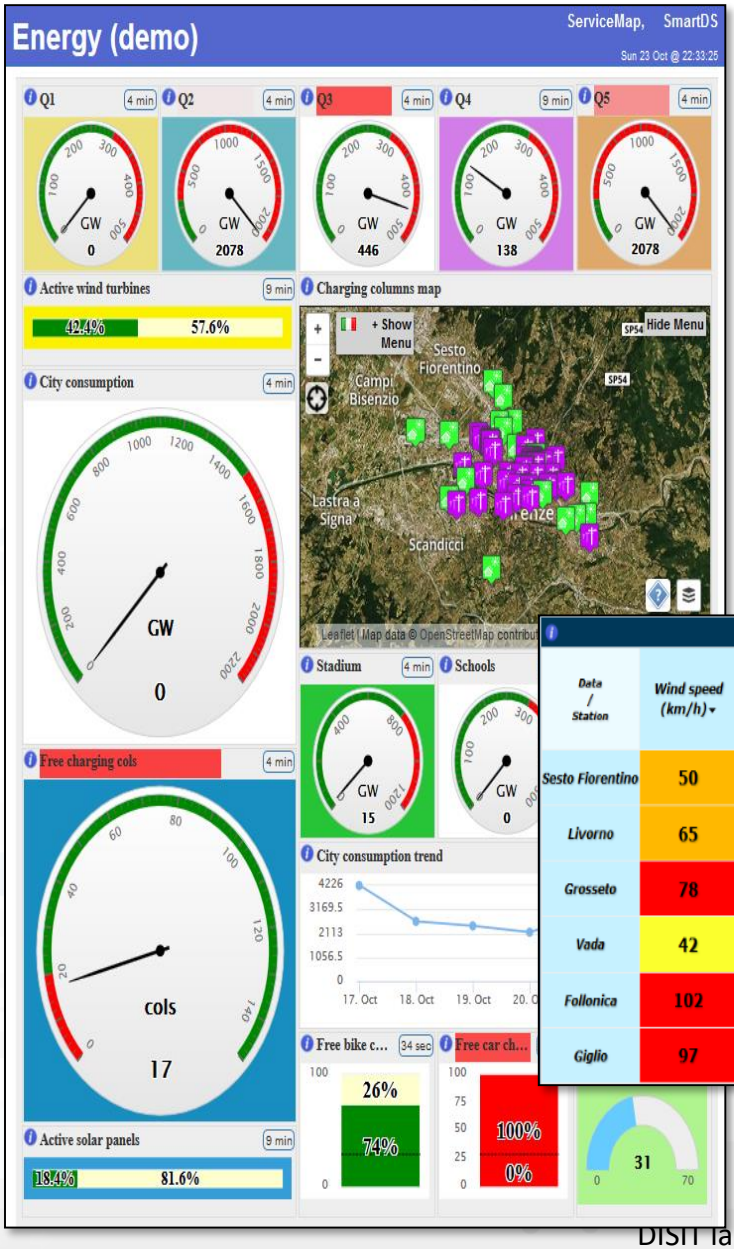
Horizon 2020
European Union Funding
for Research & Innovation

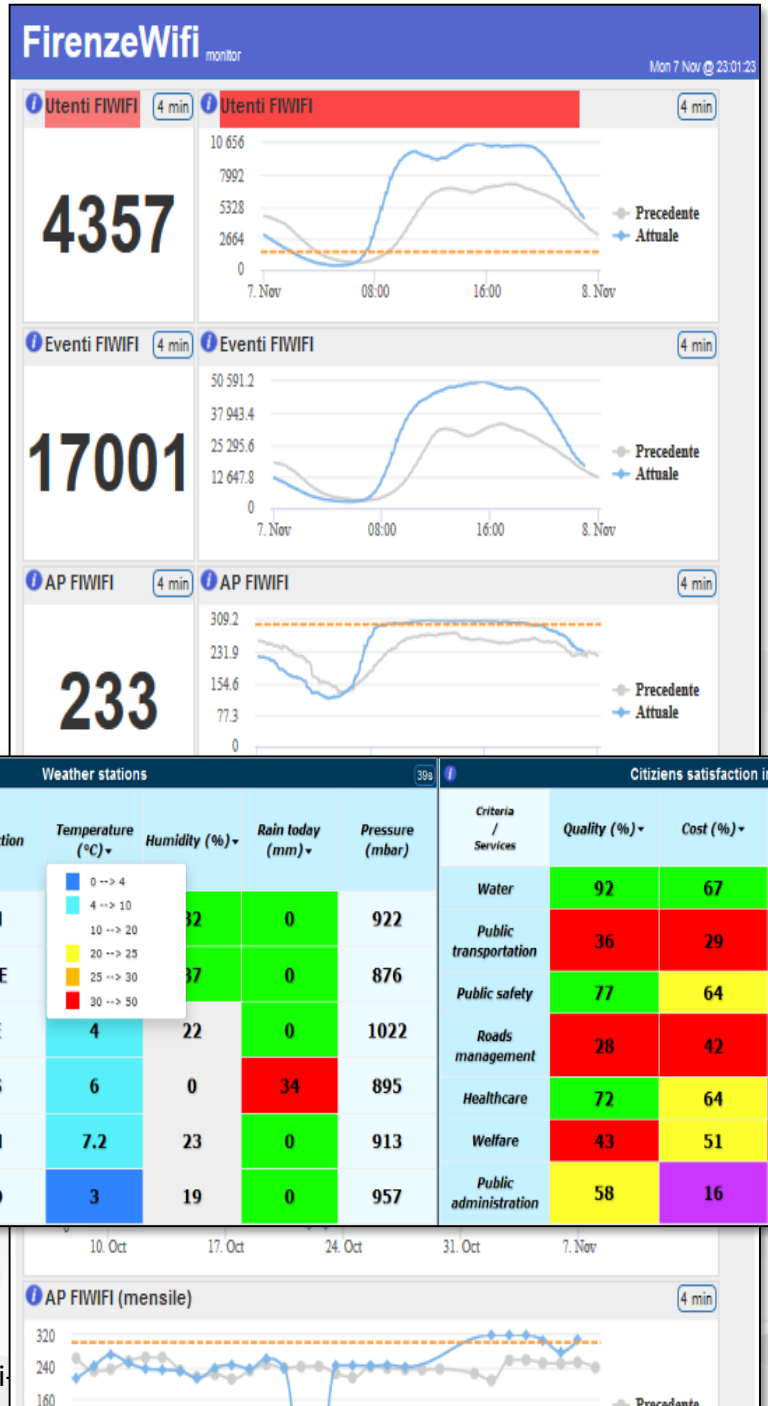


DISIT lab, Sii-Mobility, Km4City, 14 April 2017


DataCenter
ServiceMap, SmartDS
Temperatura 1 (last 4 hours)
Temperature 1
Temperatura 2 (last 4 hours)
Temperature 2
Km4City
ServiceMap, SmartDS
Engagement Sent (4 hours)
2078
Engagement Sent
Engagment Created (from Stats) ...
446
Engagement Created
17
Engagement Viewed
Mugnone 2016
ServiceMap, SmartDS
Operatori a...
1
Operatori attivi
Utenti attivi
64
Turisti attivi
25
Operatori attivi (4 ore)
Utenti attivi (12 ore)
Turisti attivi (12 ore)
Rilievi wifi al giorno
Accessi ai servizi singoli (web e mobile)
SmartCity Processes
Fri 4 Nov @ 18:51:20
ATAF
CHECK RT
EVENTI FI
PARK
METEO
SENSORI
TWITTER
FI WIFI
RUNNING
SUCCESS
FAILED
retweet Twitter Vigilance

REPLICATE


Energy (demo)
ServiceMap, SmartDS
Sun 23 Oct @ 22:33:25
Q1
Q2
Q3
Q4
Q5
Active wind turbines
Charging columns map
City consumption
Free charging cols
Stadium
Schools
City consumption trend
Free bike c...
Free car ch...
Active solar panels
42.4%
57.6%
81.8%
18.4%
cols
17


FirenzeWifi monitor
Mon 7 Nov @ 23:01:23
Utenti FIWIFI
4357
Eventi FIWIFI
17001
AP FIWIFI
233
AP FIWIFI (mensile)
Precedente
Attuale

Weather stations
Data / Station
Wind speed (km/h)
Direction
Temperature (°C)
Humidity (%)
Rain today (mm)
Pressure (mbar)
Sesto Fiorentino 50 N 0 922
Livorno 65 NE 0 876
Grosseto 78 E 4 22 0 1022
Vada 42 S 6 0 34 895
Follonica 102 N 7.2 23 0 913
Giglio 97 O 3 19 0 957
Citiziens satisfaction index
Criteria / Services
Quality (%)
Cost (%)
Availability time (%)
Emergency handling (%)
Water 92 67 95 42
Public transportation 36 29 27 31
Public safety 77 64 58 62
Roads management 28 42 27 25
Healthcare 72 64 23 56
Welfare 43 51 38 36
Public administration 58 16 18 22

Servizi agli Utenti

Firenze (sperimentale)

Tue 17 Jan @ 19:52:49

Recenti #hashtag più utilizzati 2m

TRENDS | QUOTES

- #FIRENZE
- #NEWS #FIRENZE
- #UFFIZI

Citazioni di Firenze frequenti... 2m

TRENDS | QUOTES

- @NAZIONE_FIRENZE
- @UNI_FIRENZE
- @NOVEDAFIRENZE
- @FIRENZEDIGITALE
- @FIRENZETURISMO

Eventi a Firenze oggi 37s

- ERWIN WURM - GURKEN
  2016-09-23 to 2017-01-20
  PIAZZA DI SANTA MARIA NOVELLA 10
- LA DIVINA COMMEDIA DI VENTURINO VENTURI
  2016-09-29 to 2017-02-26
  COSTA SAN GIORGIO 2
- IN COLLEZIONE - UN PERCORSO D'ARTE DAL XIII AL XX SECOLO
  2016-10-01 to 2017-02-26
  VIA MAURIZIO BUFALINI
- ARNO: FONTE DI PROSPERIT FONTE DI DISTRUZIONE.
  2016-10-09 to 2017-02-04
  VIALE DELLA GIOVINE ITALIA
- ARNO: FONTE DI PROSPERITÀ E FONTE DI DISTRUZIONE.

PROTEZIONE CIVILE 37s

GENERALE | METEO

NULLO	BASSO	MEDIO	ALTO

- RISCHIO IDRAULICO
- RISCHIO TEMPORALI
- RISCHIO IDROGEOLOGICO
- RISCHIO NEVE
- RISCHIO GHIACCIO
- RISCHIO VENTO
- RISCHIO MAREGGIATE

Stato servizio BUS a Firenze 16m

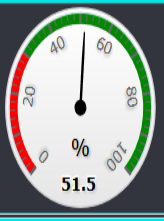
STATO | LINEE MONITORATE | DATI

46%	5%	49%
IN ORARIO	IN ANTICIPO	IN RITARDO

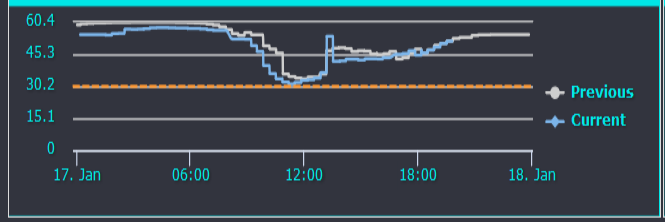
Previsioni del tempo a Firenze 59m

Tuesday	Wednesday	Thursday	Friday	Saturday
light snow	overcast	cloudy	bit cloudy	cloudy
3°C / 4°C	2°C / 5°C	2°C / 7°C	/	/

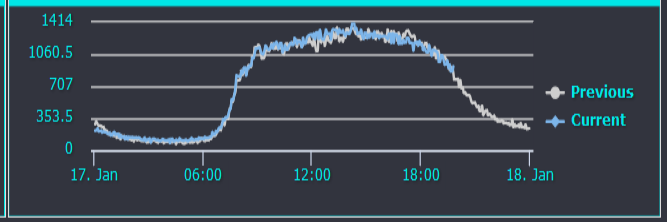
Posti Liberi 37s



Posti Liberi in Parcheggi Interrati a Firenze 2m

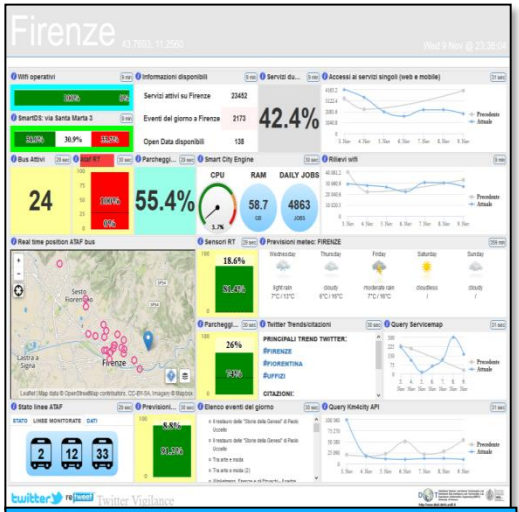


Utenti FirenzeWiFi negli ultimi 5 minuti 2m



REPLICATE

Horizon 2020 European Union Funding for Research & Innovation



Major topics addressed

- Smart City Concepts
- Architecture of Smart City Infrastructures
- Peripheral processors
  - Data collectors and Managers
  - Blog Vigilance via Natural Language Processing
  - Twitter vigilance
- Data ingestion and mining
  - Data Mining and smart City problematic
  - Km4City: Smart City Ontology
  - RDF production, reconciliation
  - Parallel and distributed processing

Reasoning and Deduction
- Smart City Engine
- Decision Support System

Data Acting processors
- Smart City Tools and API
- Service Map and Linked Open Graph
- Mobile applications

Projects
- SmartCity Project Sii-Mobility SCN
- SmartCity Project Coll@bora SIN
- SmartCity Project RESOLUTE H2020
- Mobile Emergency

Challenges (addressed by DISIT)

Applications

Profiled Services

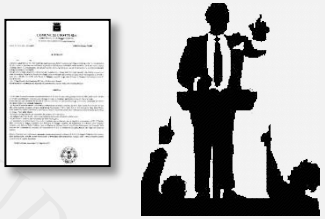
Profiled Services

Citizens Formation

Data / info Rendering

Data / info Exploitation

Interoperability



Suggestions and Alarms

Data Acting processors

- User profiling, collective profiles
- Computing Suggestions:
  - Information and formation
  - Virtuous behavior stimulation
  - For citizens and administrators
  - …
- Data export:
  - API, LOD, ..
  - Connection with other Smart City

Development Interfaces

- **Service map**: http://servicemap.disit.org
  - service based on OpenStreetMaps that allows to search services available in a preset range from the selected bus stop.
- **Linked Open Graph**: http://log.disit.org
  - a tool developed to allow exploring semantic graph of the relation among the entities. It can be used to access to many different LOD repository.
  - To query Europeana, ECLAP, Getty, Camera, Senato, Cultura Italia, ….-> digital location
- **Ontology Documentation:** http://www.disit.org/6507,
  - http://www.disit.org/5606, http://www.disit.org/6461
- **Data Status Web pages**:
  - active, you have to be registered on www.disit.org, smart city group, send an email to info@disit.org with the request
- **LOD UNIFI as RDF Stores:**
  - OSIM: to access at UNIFI open data as RDF store on UNIFI competence: http://osim.disit.org
  - ECLAP: to provide access to Performing arts data http://www.eclap.eu
- **Visual Query Graph**: under development
- **SCE as Decision Support System**: under development

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 Submit

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 — Visual Results Mode

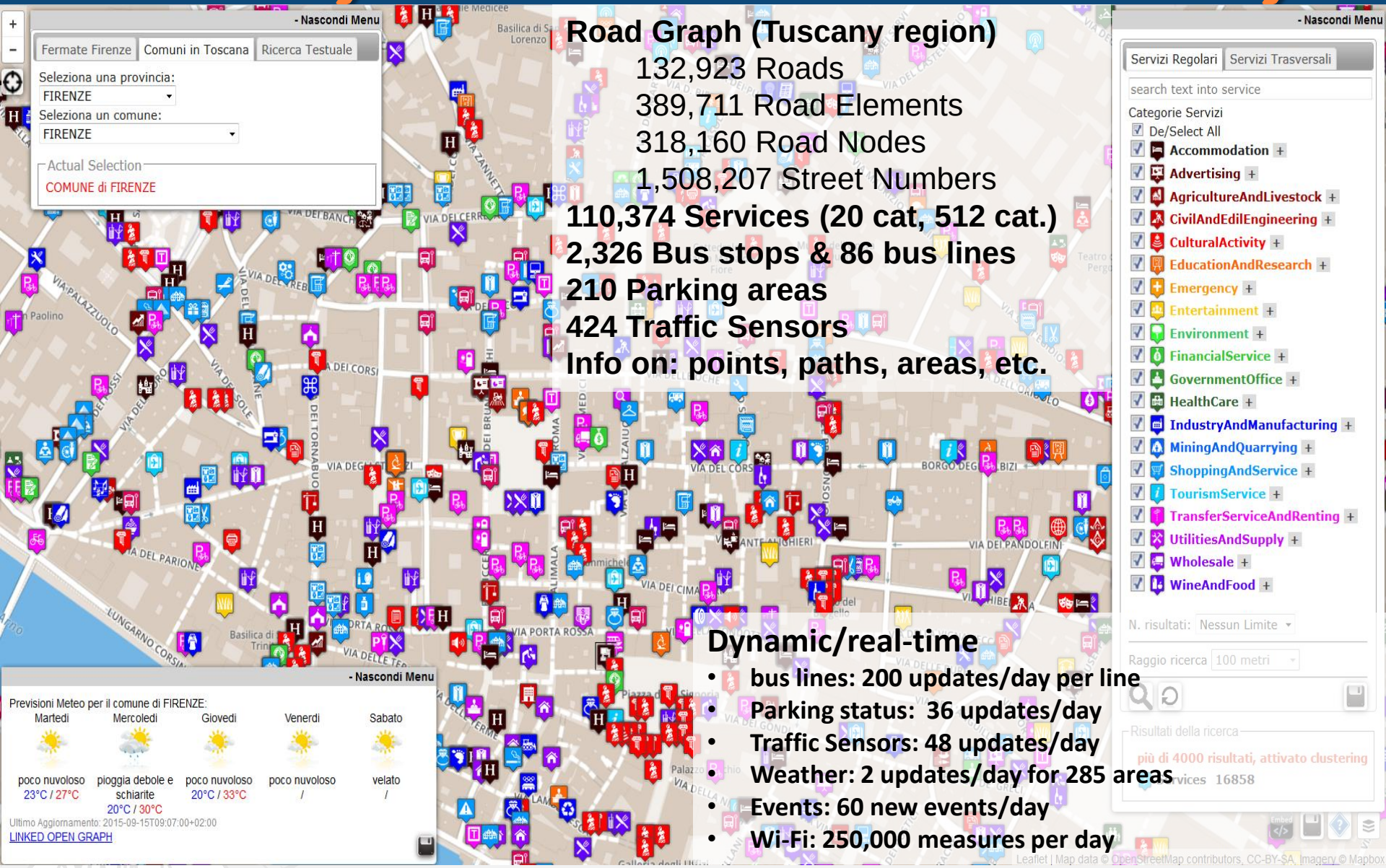
#	s	p	o
1	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#Property
2	http://www.w3.org/2000/01/rdf-schema#subPropertyOf	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/1999/02/22-rdf-syntax-ns#Property
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

Data access and applications

- **Linked Open Graph (LOG)**: a tool developed to allow exploring semantic graph of the relation among the entities. It can be used to access to many different LOD repository. (http://log.disit.org/)
- **Maps**: service based on OpenStreetMaps that allows to search services available in a preset range from the selected bus stop. (http://servicemap.disit.org/)

- Service Map:http://servicemap.disit.org
  - Permette allo sviluppatore di realizzare delle query in modo visuale e farsi mandare il codice di richiesta tramite email.
  - Questo codice può essere utilizzato in App mobili e web per semplificare la programmazione e realizzare app che non devono essere manutenute quanto il server cambia…
  - La selezione effettuata può essere richiamata e anche inserita in pagine web di terzi, l'applicazione web è già pronta.
  - Manteniamo le App Vive, la complessità sta sul server e non sulle App !!

Km4City on Firenze & Tuscany

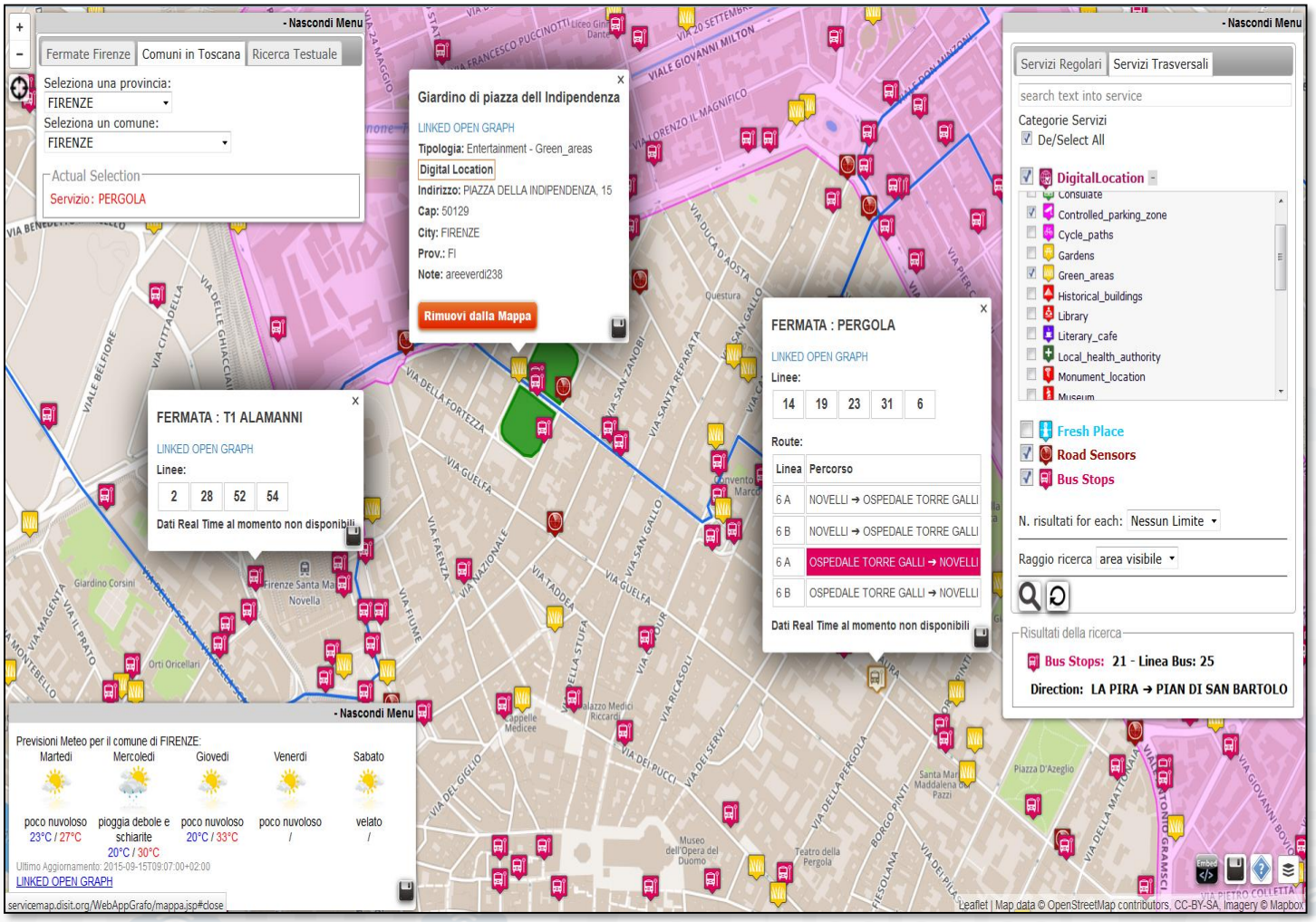


Road Graph (Tuscany region)
- 132,923 Roads
- 389,711 Road Elements
- 318,160 Road Nodes
- 1,508,207 Street Numbers

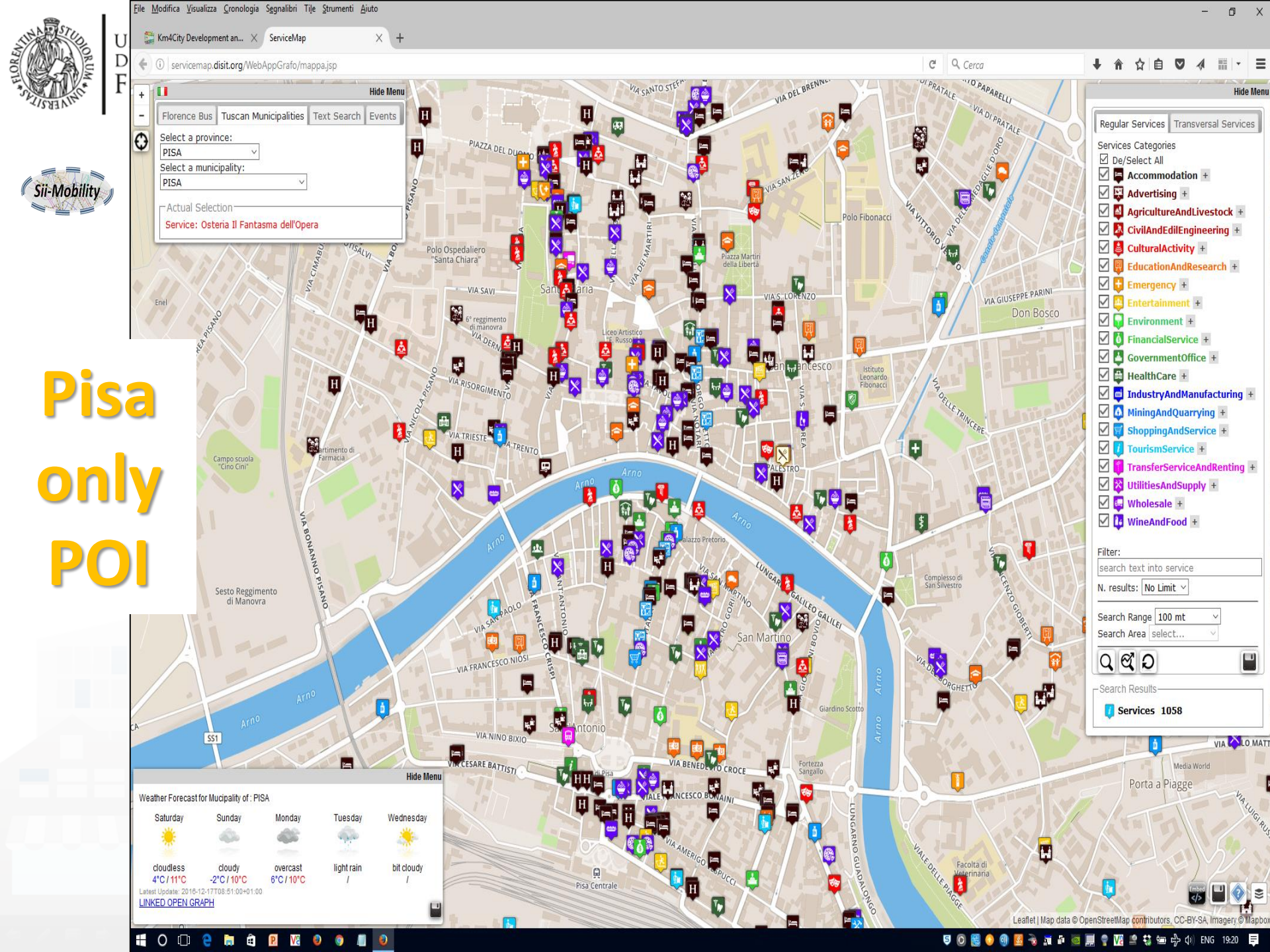
110,374 Services (20 cat, 512 cat.)
2,326 Bus stops & 86 bus lines
210 Parking areas
424 Traffic Sensors
Info on: points, paths, areas, etc.

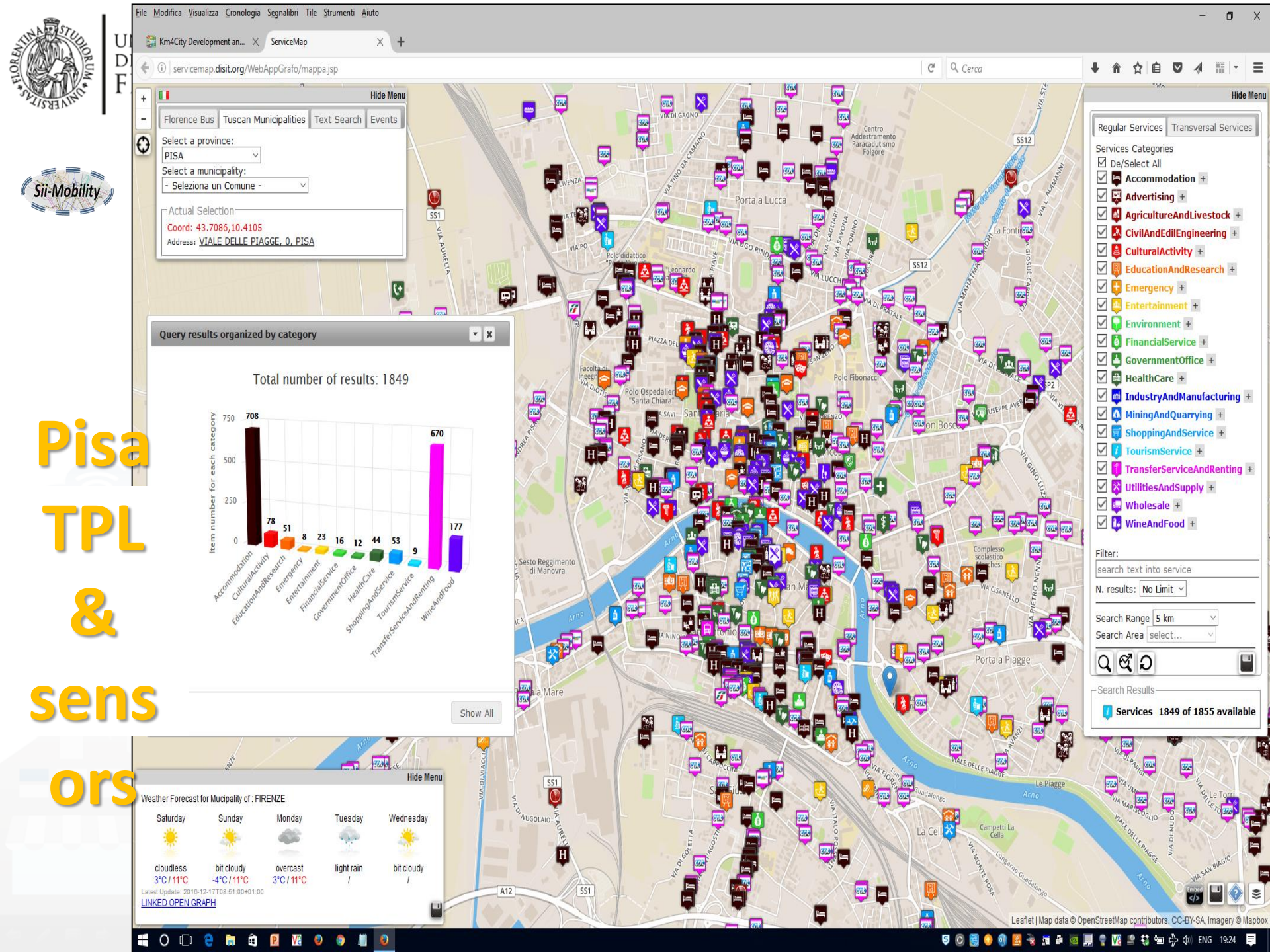
Dynamic/real-time
- **bus lines: 200 updates/day per line**
- **Parking status: 36 updates/day**
- **Traffic Sensors: 48 updates/day**
- **Weather: 2 updates/day for 285 areas**
- **Events: 60 new events/day**
- **Wi-Fi: 250,000 measures per day**

Km4City in Firenze



- **Areas, Bus lines, bike lanes, tram, RTZ, etc.**


Pisa
only
POI
Hide Menu
Florence Bus
Tuscan Municipalities
Text Search
Events
Select a province:
PISA
Select a municipality:
PISA
Actual Selection
Service: Osteria Il Fantasma dell'Opera
Regular Services
Transversal Services
Services Categories
De/Select All
Accommodation
Advertising
AgricultureAndLivestock
CivilAndEdilEngineering
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
100 mt
Search Area
select...
Search Results
Services 1058
Weather Forecast for Mucipality of : PISA
Saturday
Sunday
Monday
Tuesday
Wednesday
cloudless
4°C / 11°C
cloudy
-2°C / 10°C
overcast
6°C / 10°C
light rain
/
bit cloudy
/
Latest Update: 2016-12-17T08:51:00+01:00
LINKED OPEN GRAPH
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

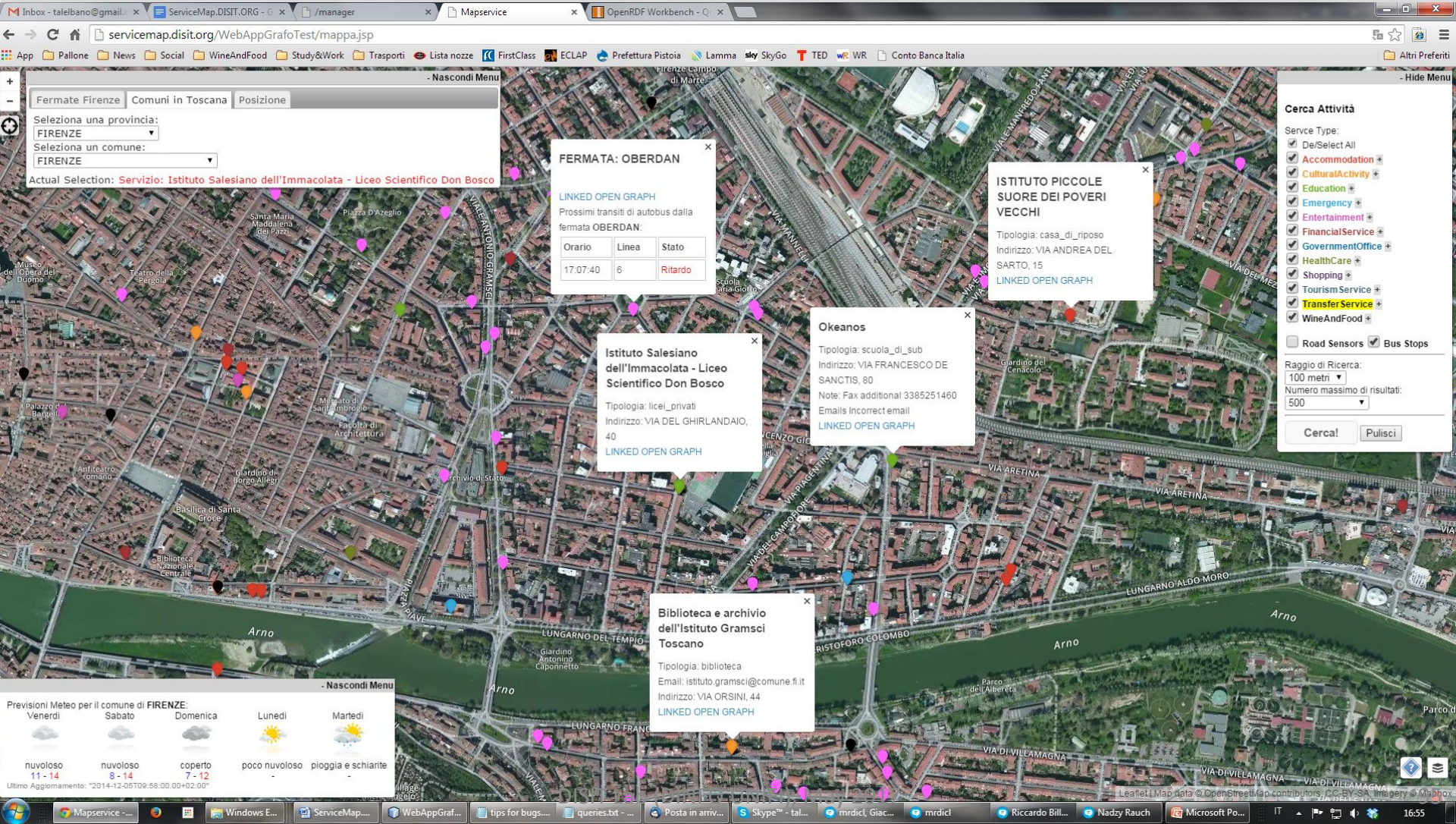


Pisa TPL & sensors

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

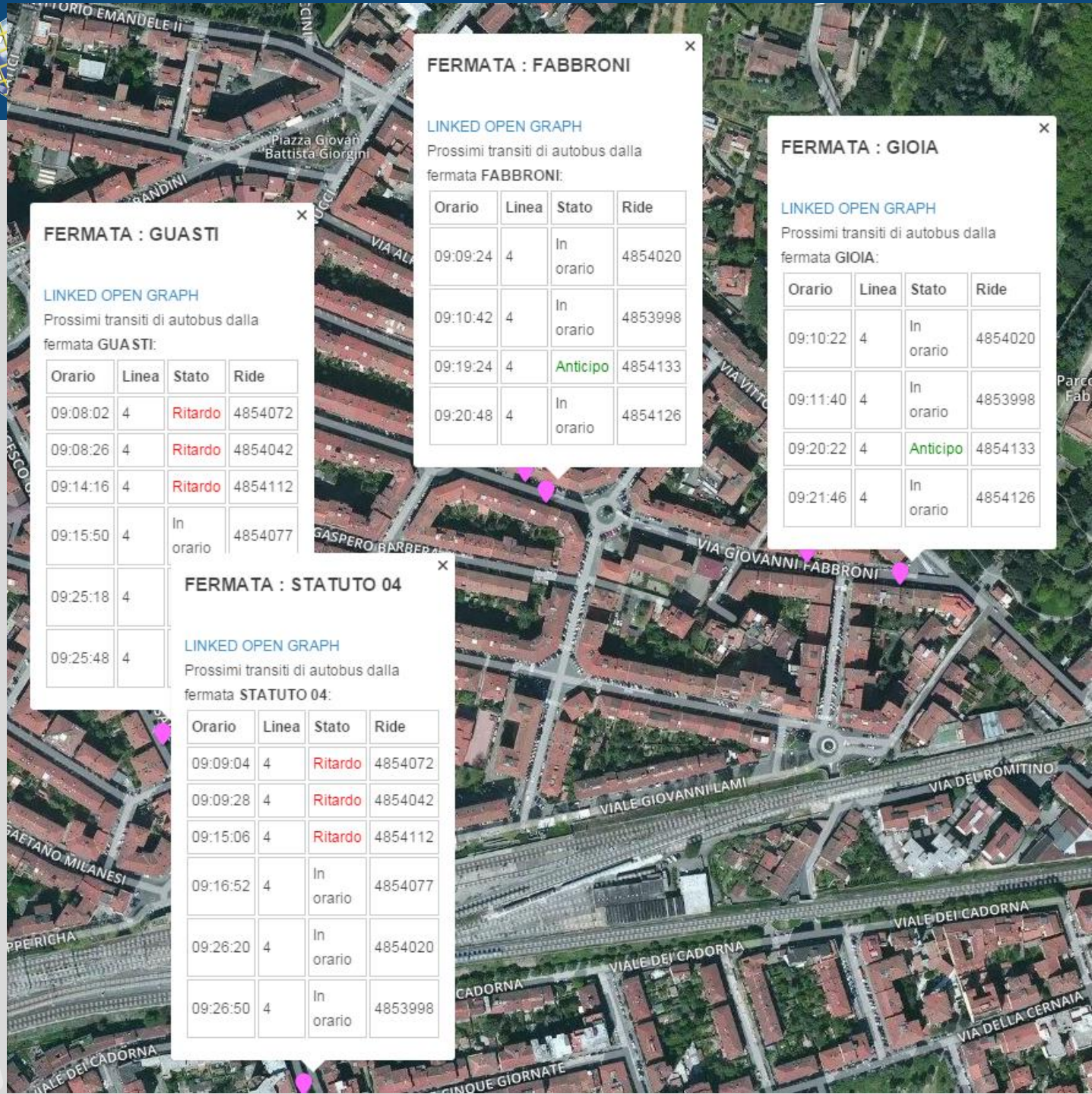
ServiceMap

http://servicemap.disit.org



UNIVERSITÀ DEGLI STUDI FIRENZE

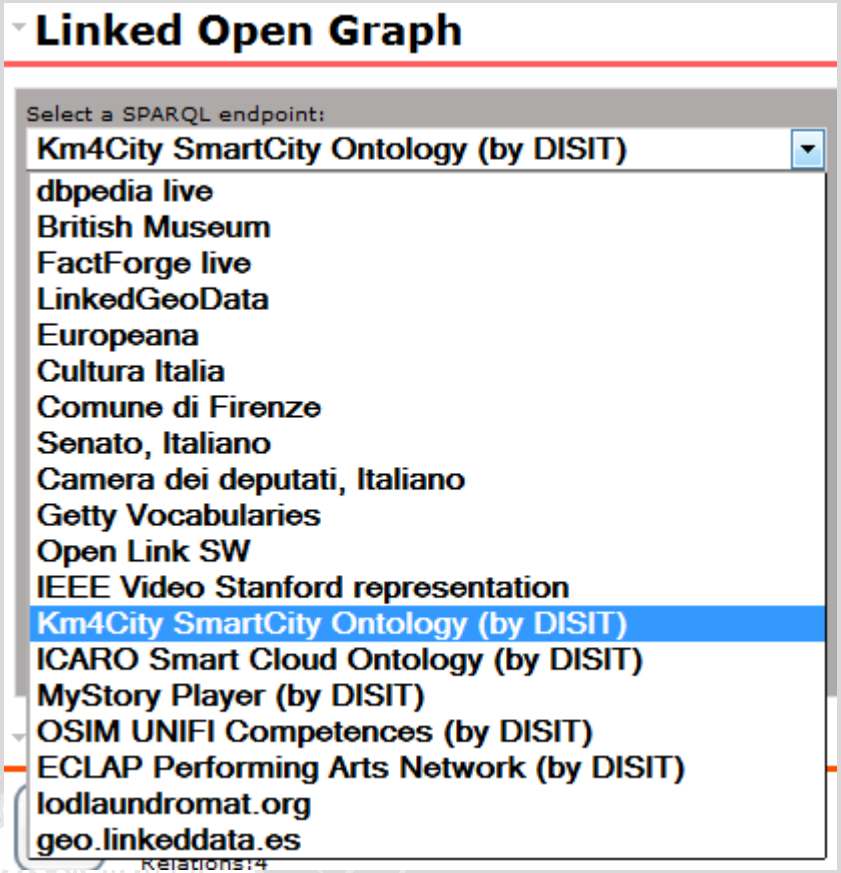
Linea 4

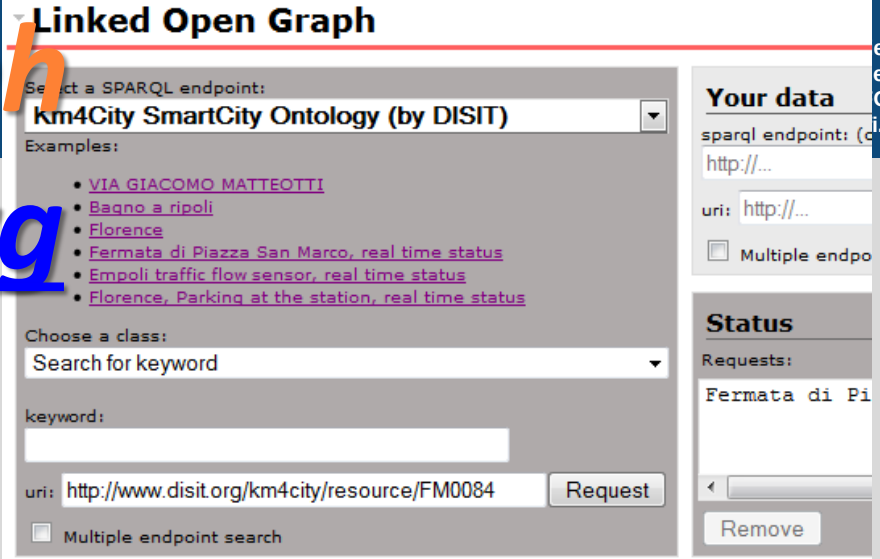


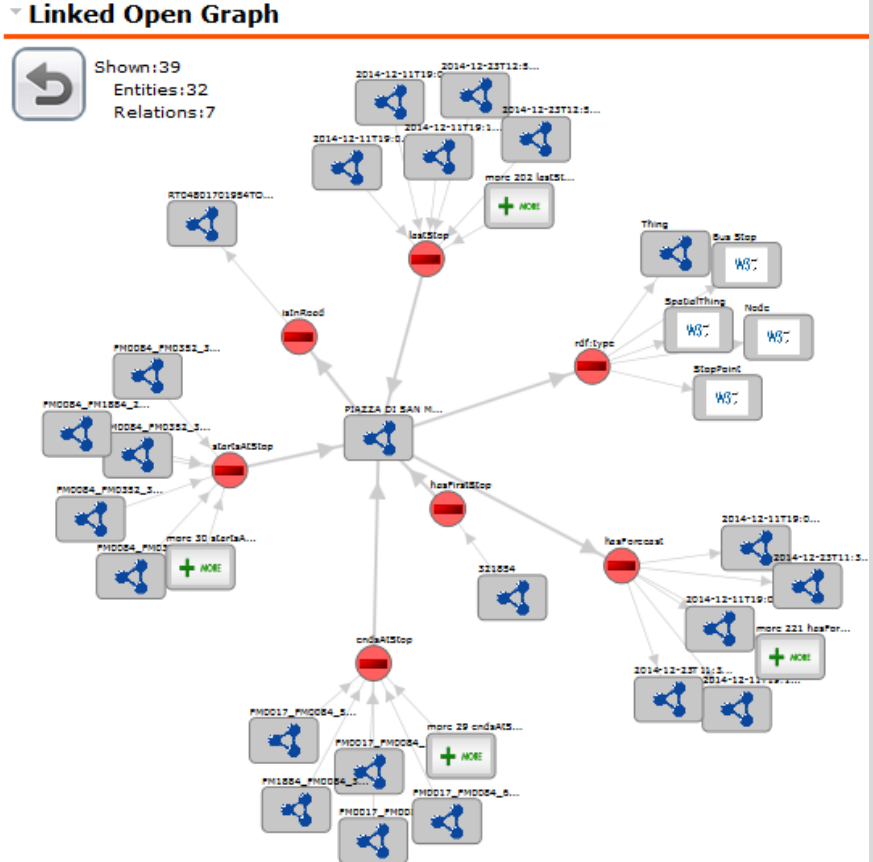
Linked Open Graph

http://log.disit.org

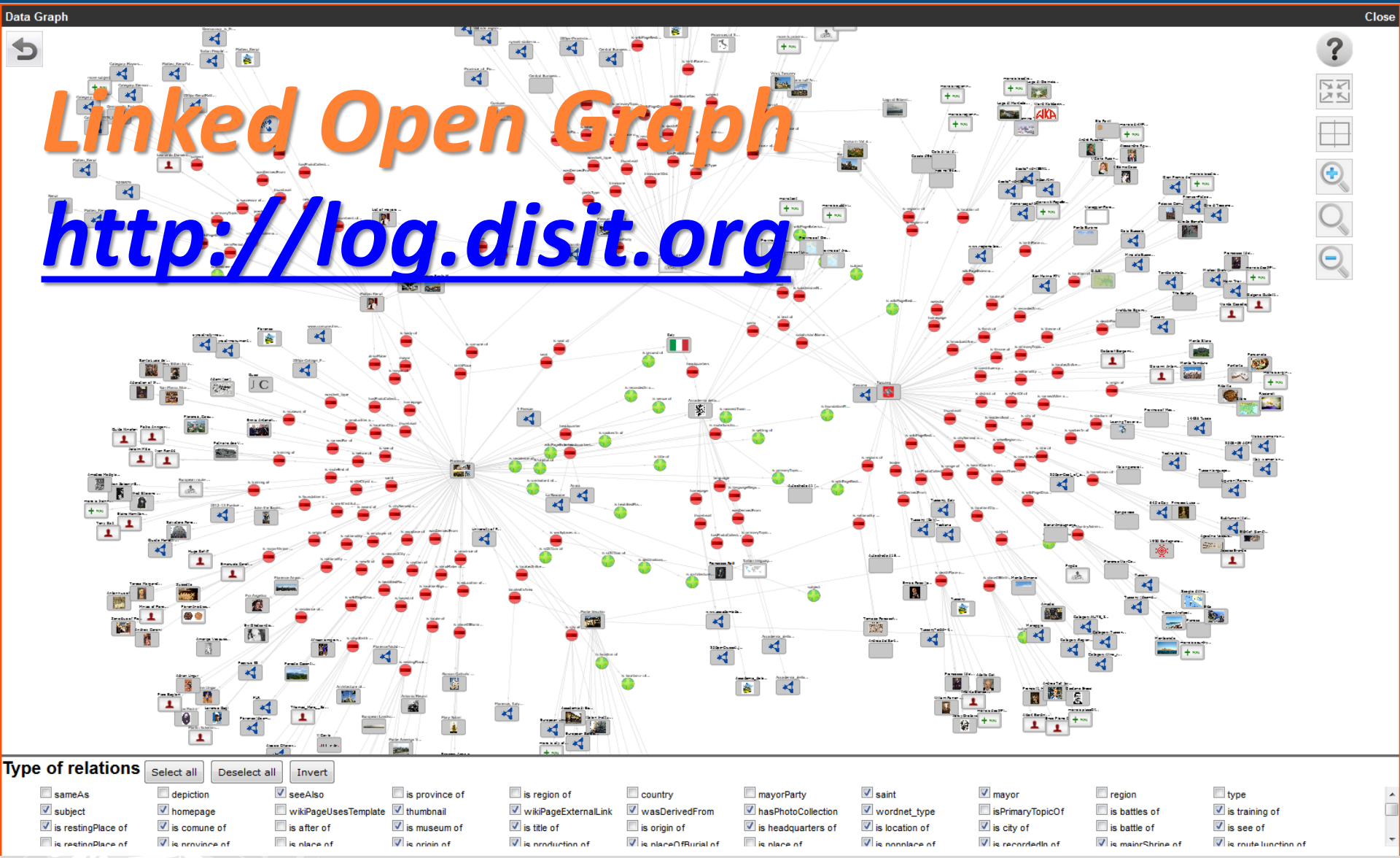
A bus stop info….

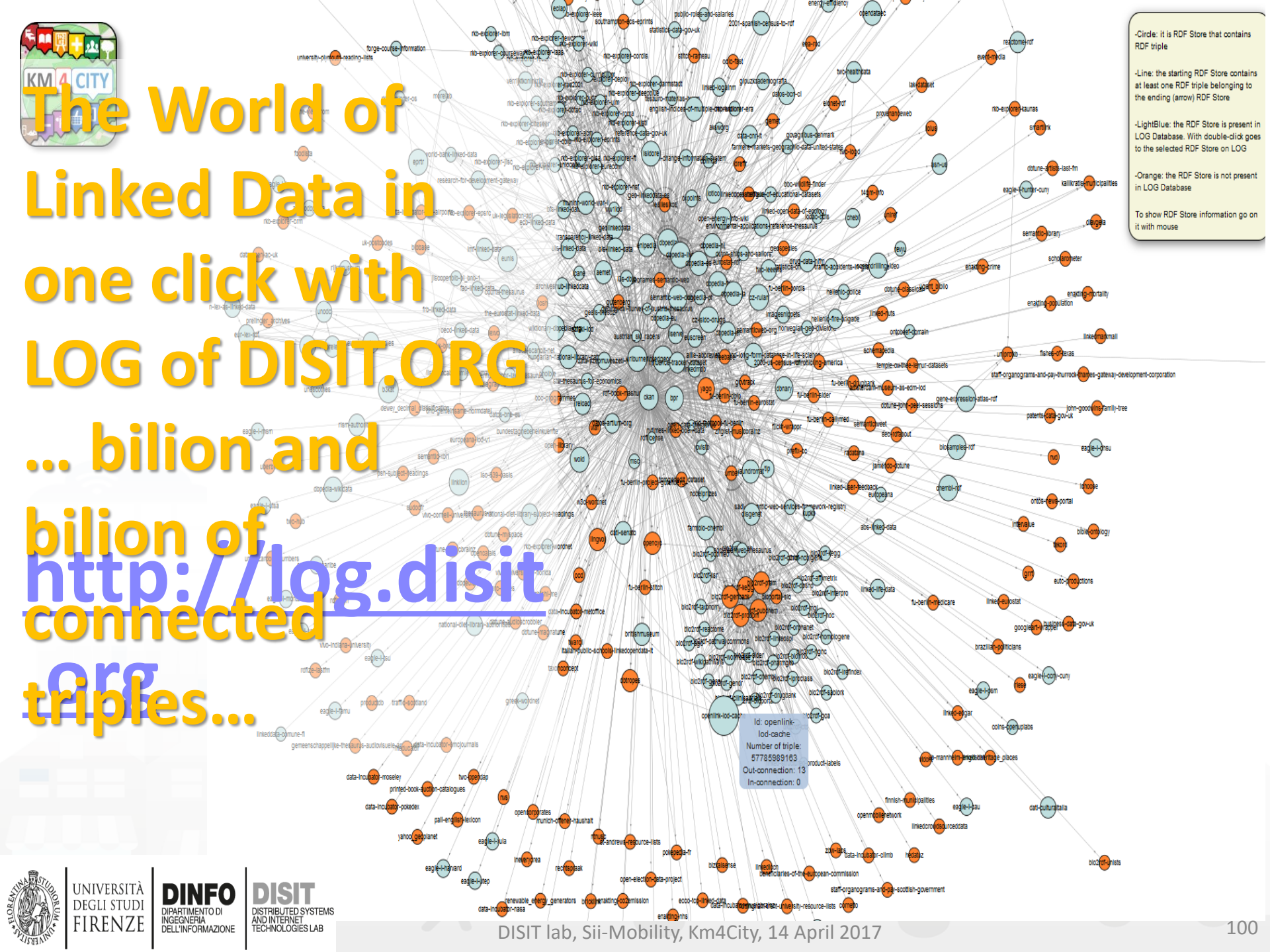






- LOG: http://log.disit.org
  - Permette allo sviluppatore di navigare nelle strutture complesse di uno o più database RDF accessibili per formulare dei grafici e delle query in modo visuale e farsi mandare il codice di richiesta tramite email.
  - Questo codice può essere utilizzato in App mobili e web per semplificare la programmazione e realizzare app che non devono essere manutenute quanto il server cambia…
  - Il grafo puo' essere richiamato e anche inserito in pagine web di terzi, l'applicazione web è già pronta.
  - Manteniamo le App Vive !!


Data Graph
Close
Linked Open Graph
http://log.disit.org
Type of relations
Select all
Deselect all
Invert
sameAs
depiction
seeAlso
is province of
is region of
country
mayorParty
saint
mayor
region
type
subject
homepage
wikiPageUsesTemplate
thumbnail
wikiPageExternalLink
wasDerivedFrom
hasPhotoCollection
wordnet_type
isPrimaryTopicOf
is battles of
is training of
is restingPlace of
is comune of
is after of
is museum of
is title of
is origin of
is headquarters of
is location of
is city of
is battle of
is see of



The World of Linked Data in one click with LOG of DISIT.ORG

… bilion and bilion of connected triples…

http://log.disit.org

http://log.disit.org

Linked Open Graph

log.disit.org/service/?graph=df5b...

Linked Open Graph

SiiMobility (by DISIT)

Examples:

- VIA GIACOMO MATTEOTTI
- Bagno a ripoli
- Florence

Choose a class: Search for keyword

keyword:

uri: http://... Request

Your data

sparql endpoint: (optional) http://...

uri: http://... Request

Status

Requests:

http://www.disit.dinfo.unifi.it/SiiMobility/MUSE

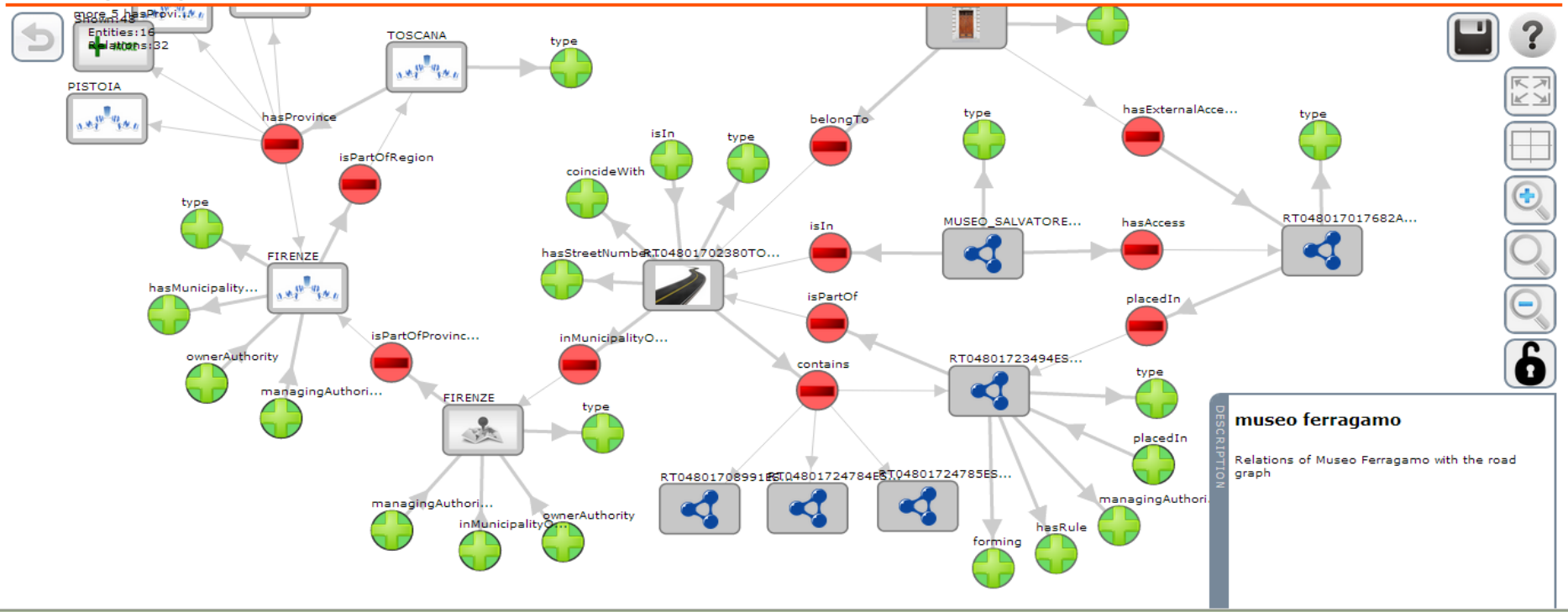
Remove Clear

Type of relations

Select all | Deselect all | Invert | Hide all inverse

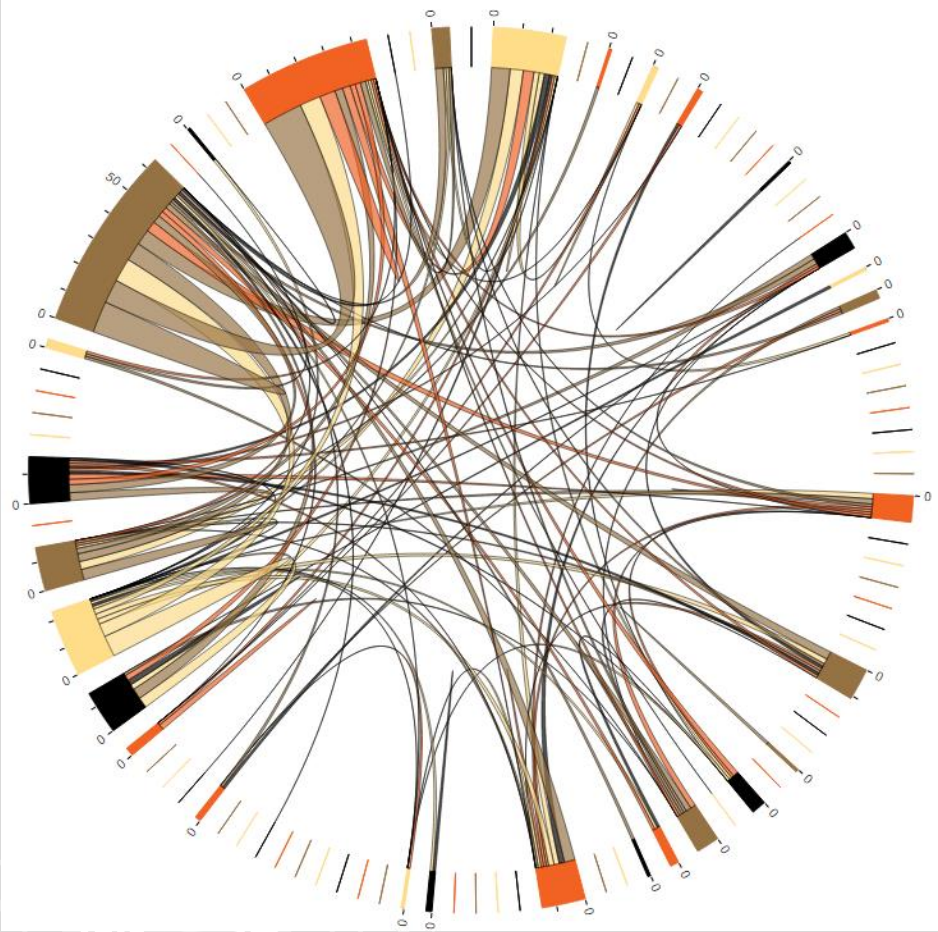
belongTo	coincideWith
contains	depiction
ends	forming
has	hasAccess
hasExternalAccess	hasMunicipality
hasProvince	hasRule
hasStreetNumber	inMunicipalityOf
isIn	isPartOf
isPartOfProvince	isPartOfRegion
managingAuthority	ownerAuthority
placedIn	sameAs
seeAlso	starts

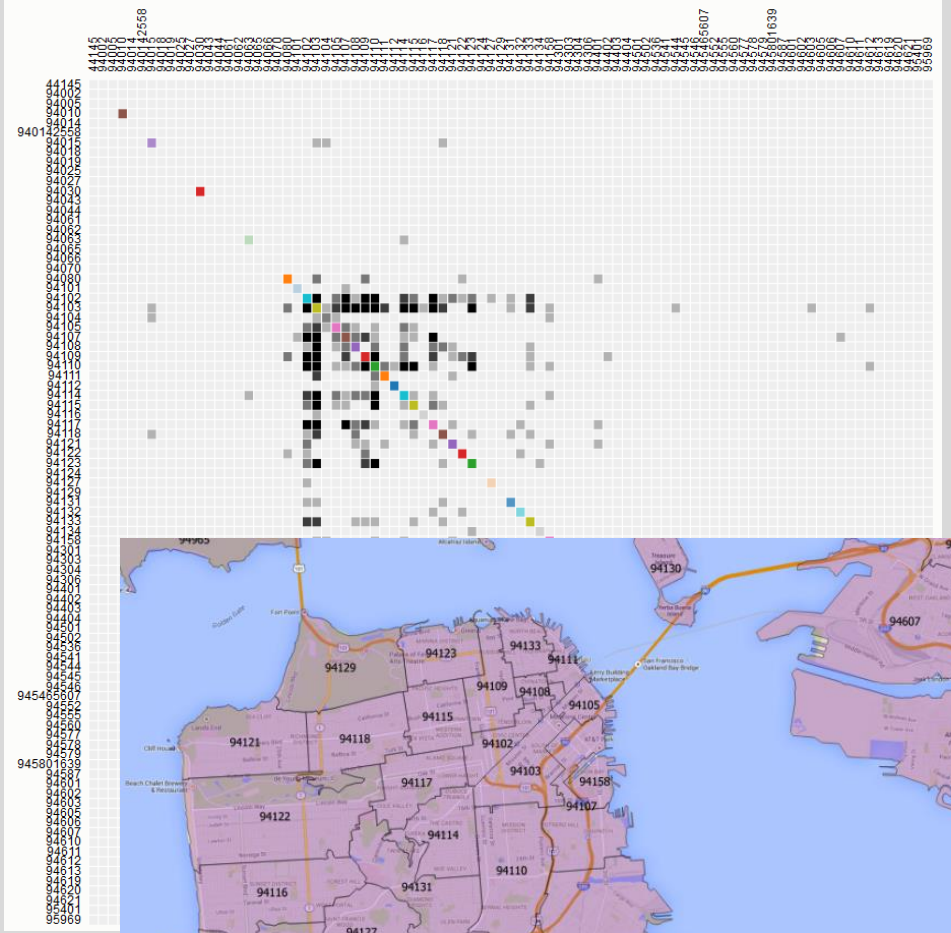
Linked Open Graph



Matrice Origine Destinazione

http://www.disit.org/6694





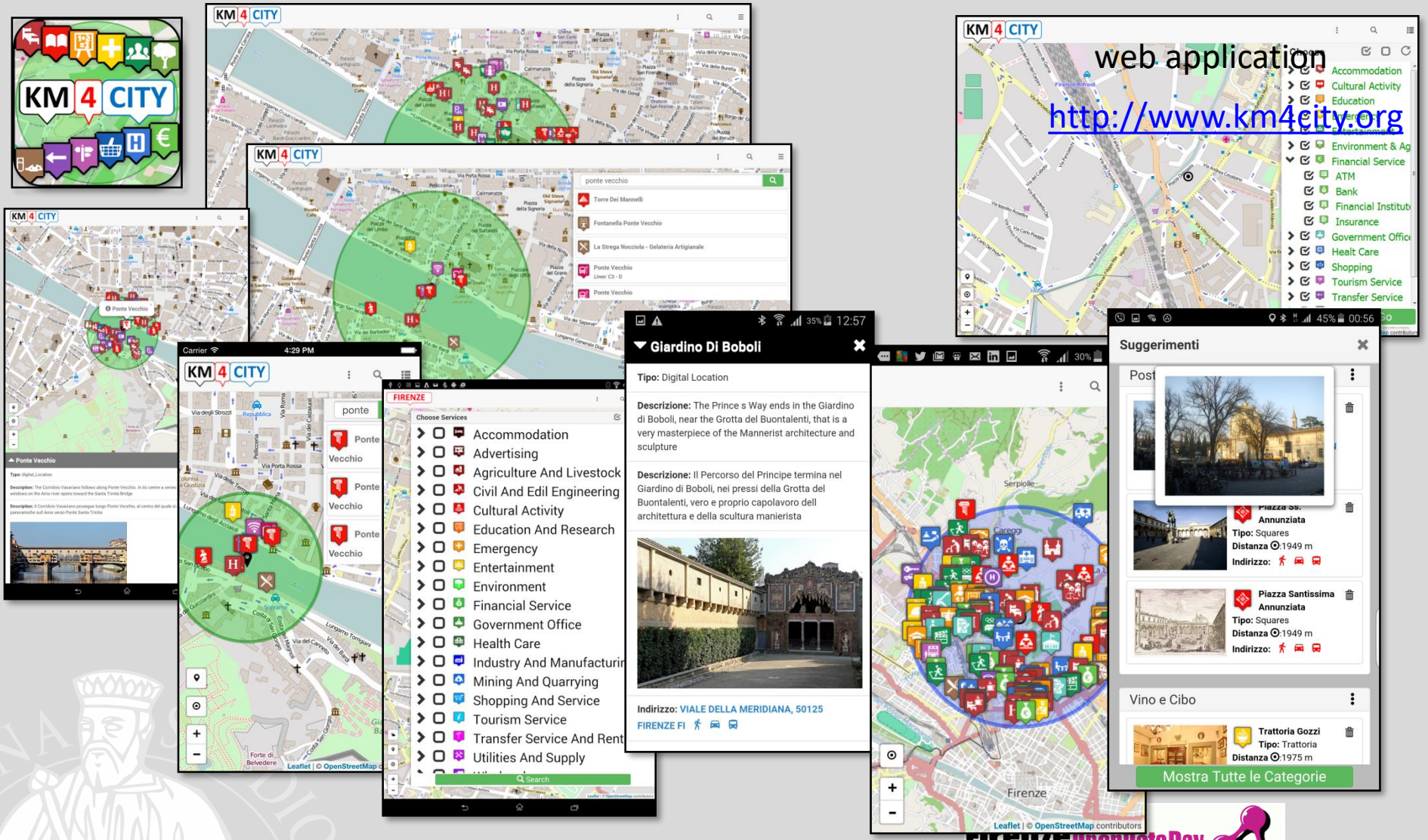
Strumenti: km4city e DISIT

- **Service Map**: http://servicemap.disit.org
- **Linked Open Graph**, Multiple RDF Store Visual Browser: http://log.disit.org
- **RDF Store SPARQL query tool**: http://log.disit.org/spqlquery/
- **FODD 2015 applicazione dimostrativa**:
  - http://www.disit.org/6595 (pagina)
  - Google Play https://play.google.com/store/apps/details?id=org.disit.fodd
  - Sorgenti: http://www.disit.org/6596

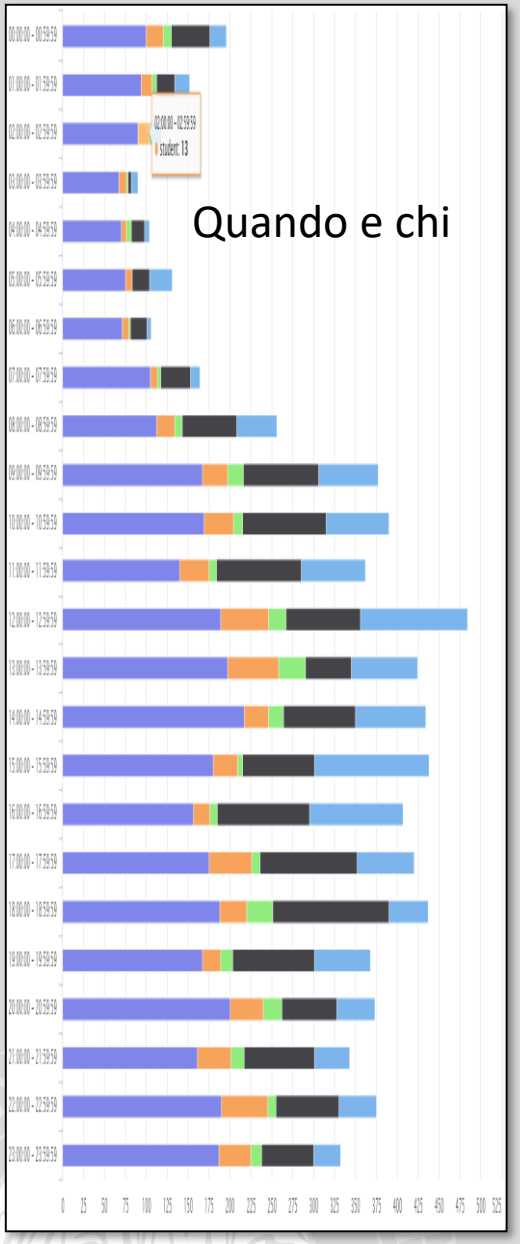
Documentazione Km4City e DISIT

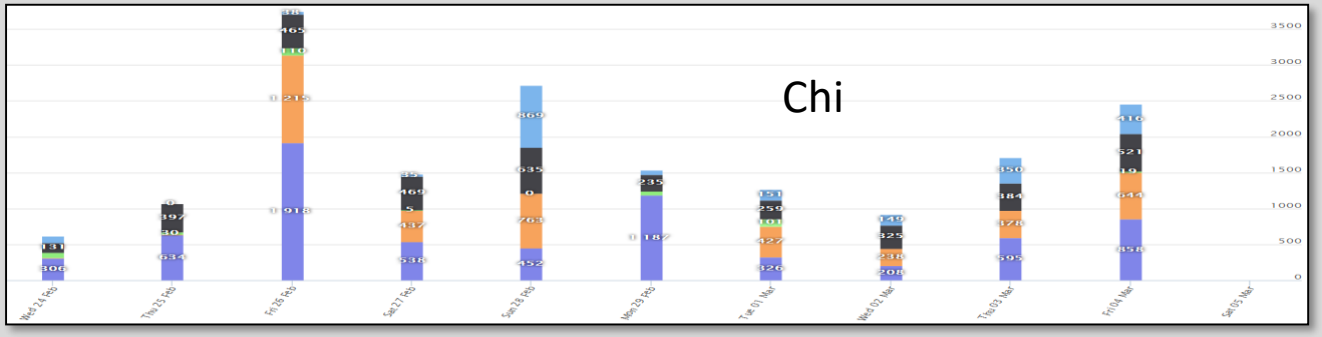
- API Service Map: http://www.disit.org/6597
- Grafo ontologia: http://www.disit.org/6507
- descrizione ITA: http://www.disit.org/6461
- descrizione ENG: http://www.disit.org/5606
- ontologia: http://www.disit.org/6506
- articolo: http://www.disit.org/6573

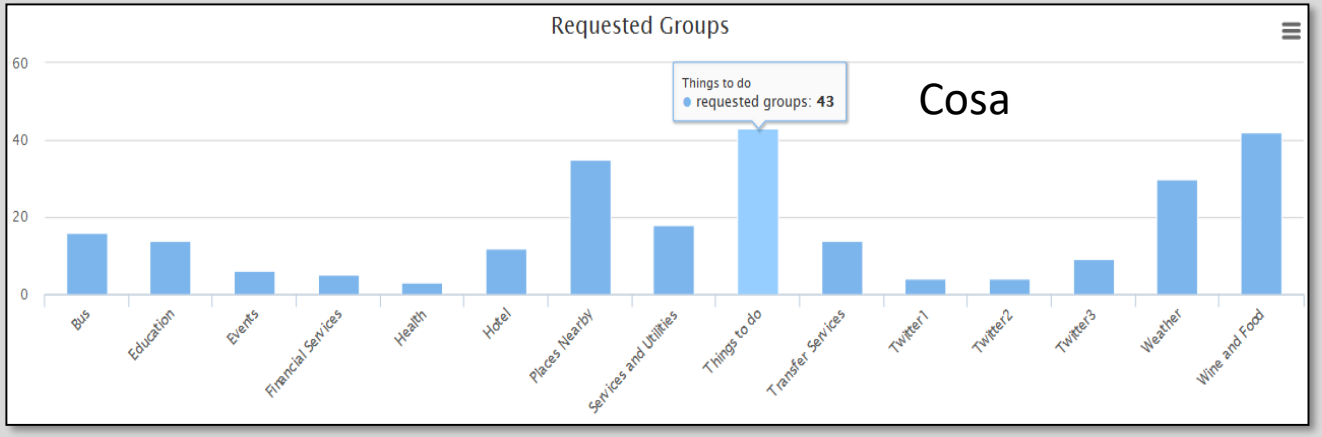
Km4CityMobile App: all stores

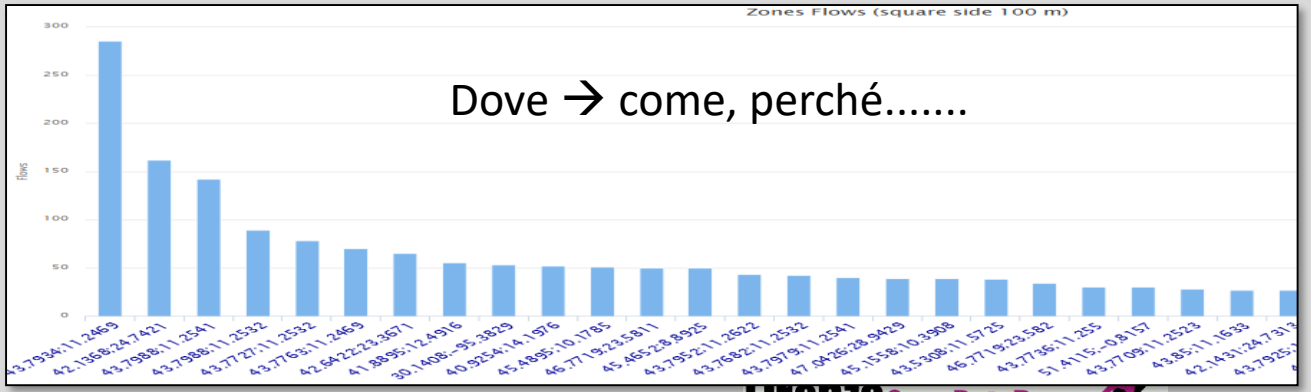


Recommender

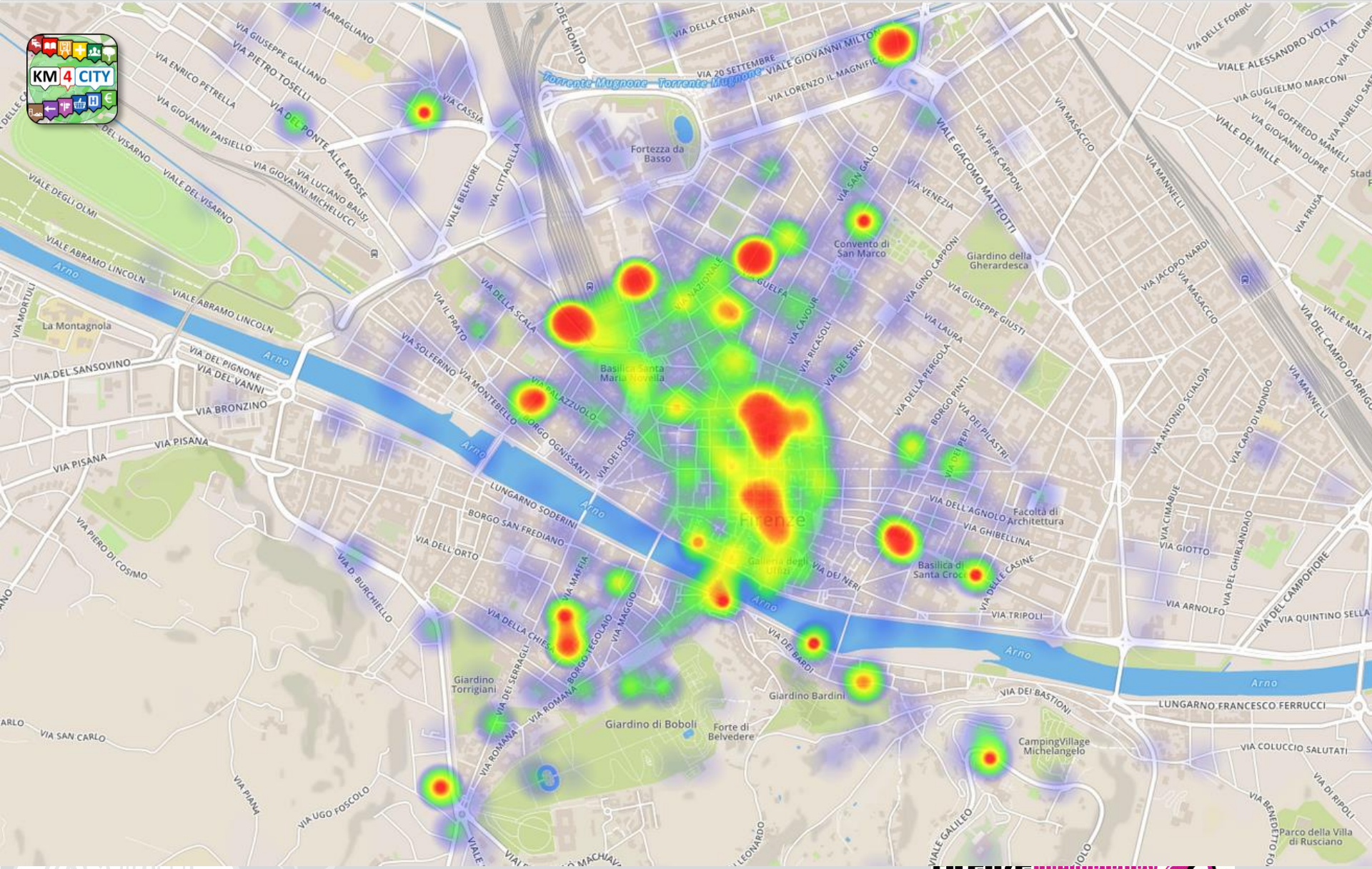




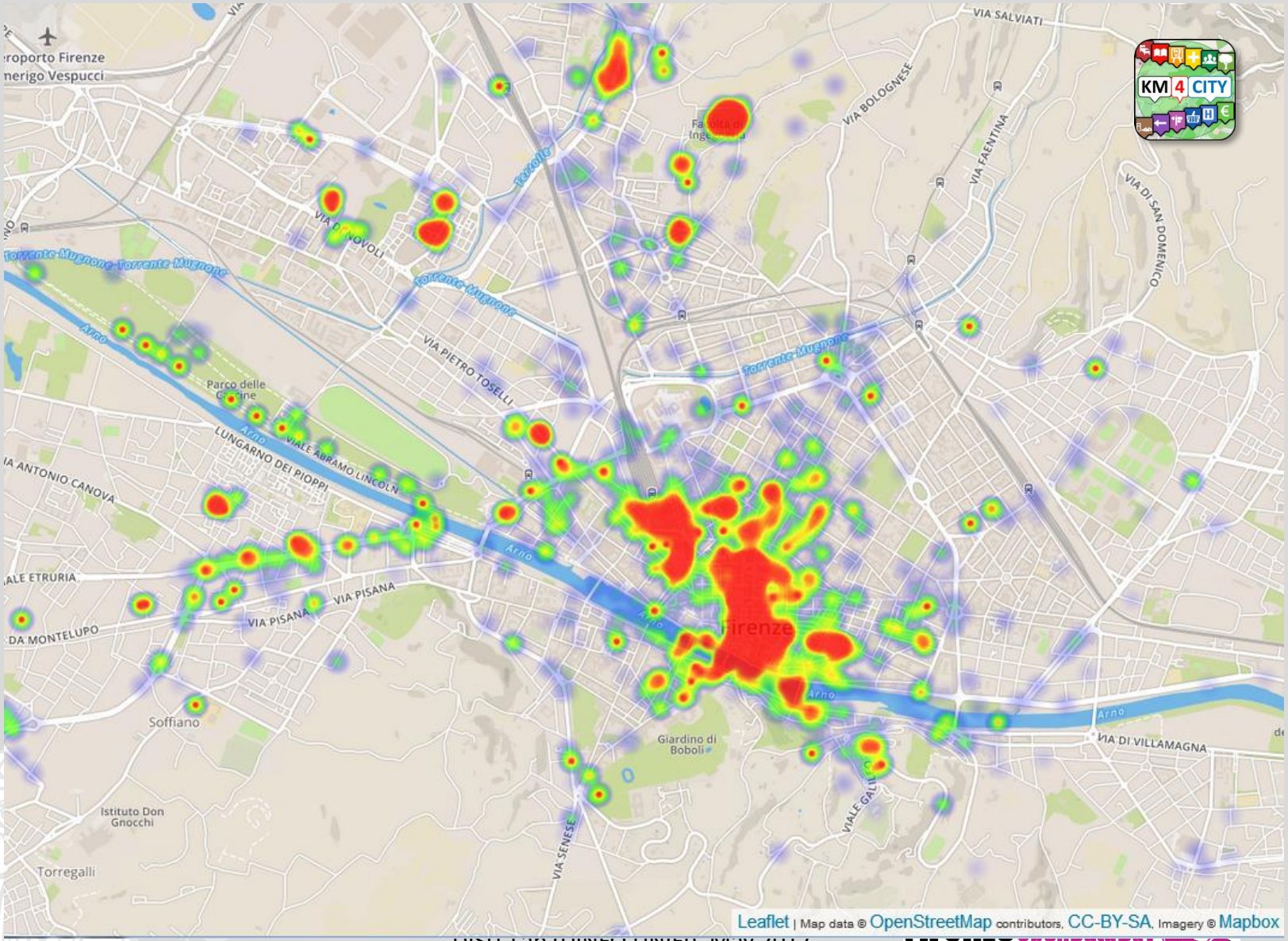




Tourists in Florence



Hot WiFi in Florence



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Projects
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- SmartCity Project RESOLUTE H2020
- Mobile Emergency

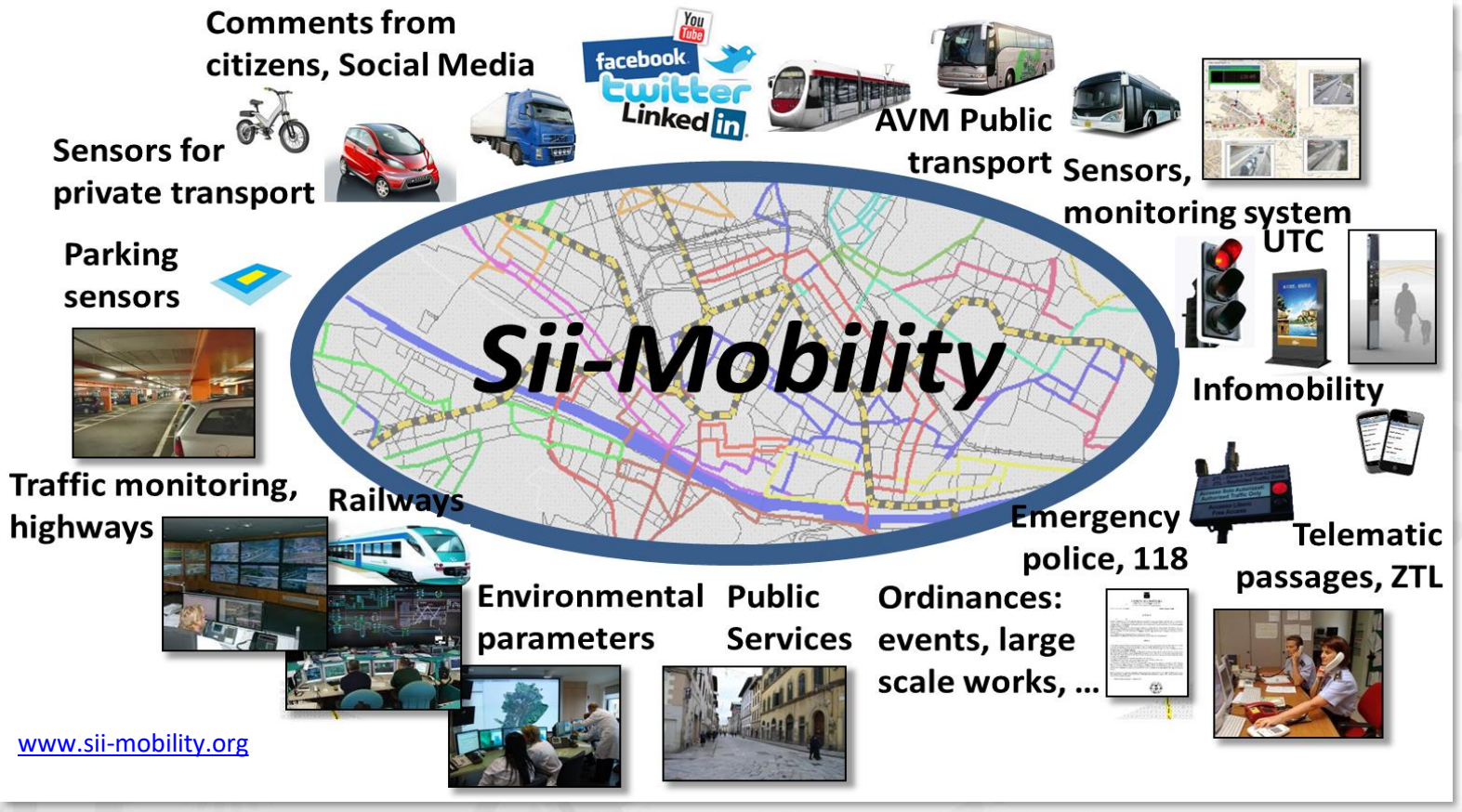
Sii-Mobility

- **Title**: Support of Integrated Interoperability for Services to Citizens and Public Administration
- **Objectives**:
  1. Reduction of social costs of mobility;
  2. Simplify the use of mobility systems;
  3. Developing working solutions and application, with testing methods;
  4. Contribute to standardization organs, and establishing relationships with other smart cities' management systems.

The Sii-Mobility platform will be capable to provide support for SME and Public Administrations. Sii-Mobility consists in a federated/integrated interoperable solution aimed at enabling a wide range of specific applications for private services to citizen and commercial services to SME.

- **Coordinatore Scientifico: *Paolo Nesi, DISIT DINFO UNIFI***
- **Partner:** ECM; Swarco Mizar; University of Florence (svariati gruppi+CNR); Inventi In20; Geoin; QuestIT; Softec; T.I.M.E.; LiberoLogico; MIDRA; ATAF; Tiemme; CTT Nord; BUSITALIA; A.T.A.M.; Sistemi Software Integrati; CHP; Effective Knowledge; eWings; Argos Engineering; Elfi; Calamai & Agresti; KKT; Project; Negentis.
- **Link**: http://www.disit.dinfo.unifi.it/siimobility.html

- La sfida va verso ***l'integrazione di grosse moli dati non omogenei*** per produrre ***deduzioni più ampie e precise***
  - Dalle ***infrastrutture di monitoraggio e controllo***: energia, ambiente, salute, traffico, taxi, etc.



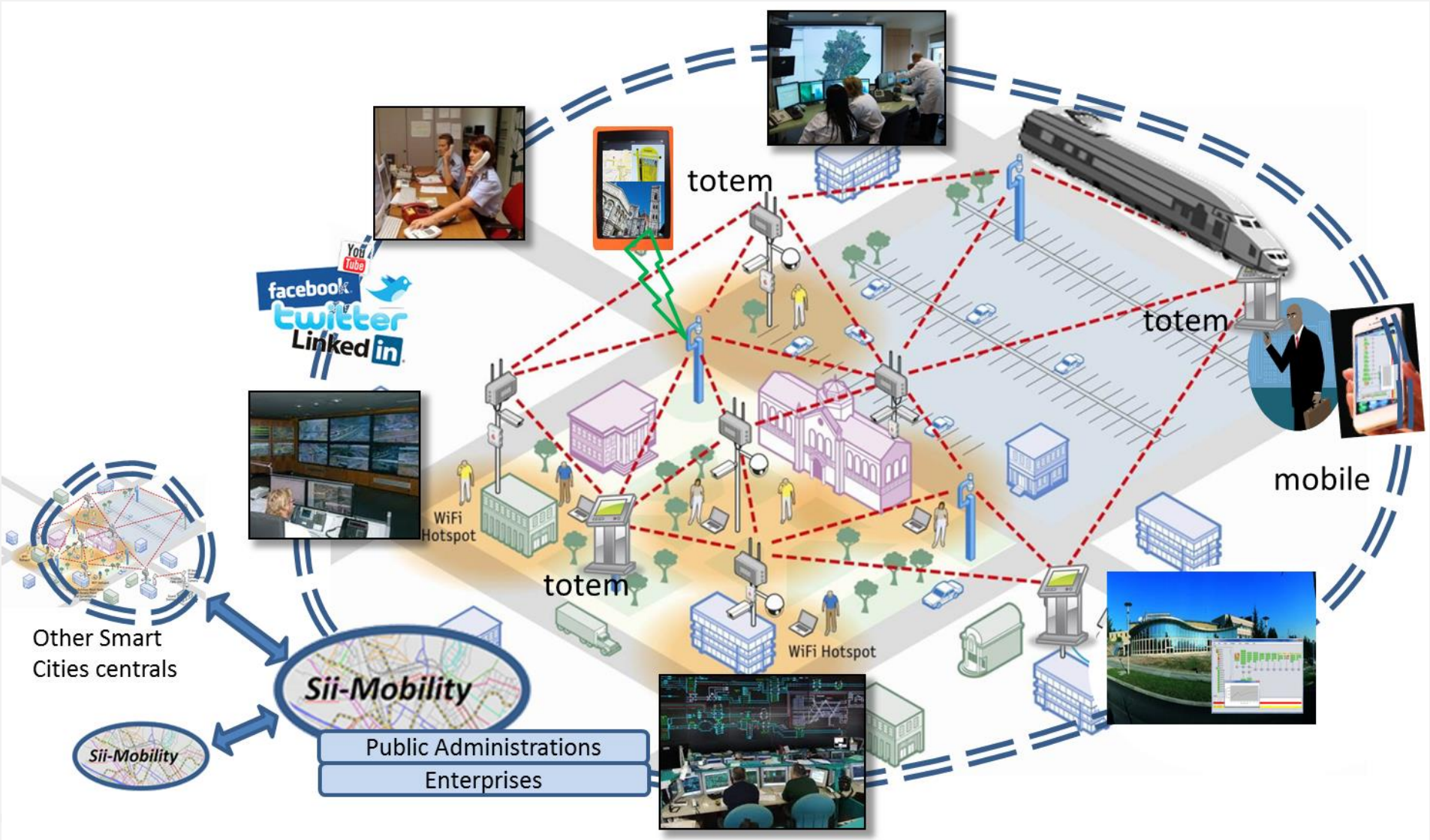
Sii-Mobility

- **servizi personalizzati**, connessi alla mobilità nella città
- Piattaforma di **partecipazione** e **sensibilizzazione**
- integrazione di **metodi di pagamento** e di identificazione
- gestione delle aree a traffico controllato
  - **dinamica dei confini**
  - **politiche di accesso**
- **interoperabilità** ed integrazione dei sistemi di gestione
- **scambio dati fra PA e privati**

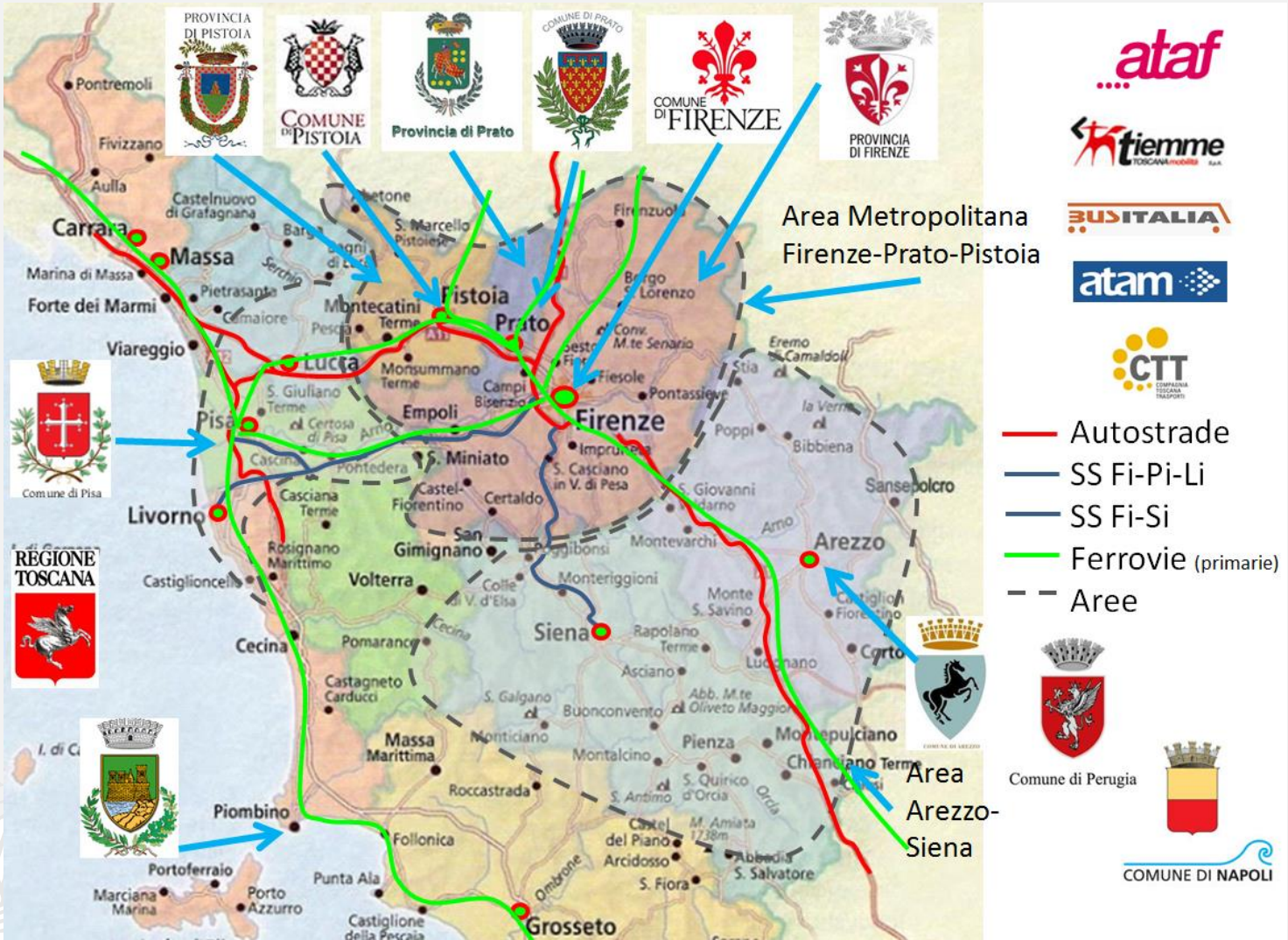




Sii-Mobility



- Experimentations and validation in Tuscany
- Integration with present central station and subsystems



Sii-Mobility Architecture

Kit for vehicle and actuators

Fleet Manager API
AVM Manager API
TPL Manager API
ZTL Manager API
Parking Manager API
Highways Manager API

Management Systems

data aggregation, actions propagation

Support of Integrated Interoperability

Decision Support
Operation Center Support
Simulation Support
Data analytics Support
Ticketing Support
Booking Support
Path Planing Support

Control Interface
Monitoring Interface

Infomobility and publication participation and awareness platform

Timetables, routes, stops, actual values, political action, etc..

profiles, cost models, users,...

Social Intelligence
Data validation
Data integration
Geo Referencing
Additional algorithms.....

Big Data processing grid

Data publication API toward other Services center or users

Info. Services for Totem, Mobile, ..

Web App and Totem

Mobile App

other Sii-Mobility API
API for other SC Cent.
national central API

Interoperability to and from other integrated management systems

Sensors and Detection Equipment

Environmental Data acq.
Ordinances Data acq.
Social Media Data acq.
Mobile Operator Data acq
Sensible Data acq
Emergency Data acq
Open Data acquisition

Data ingestion and pre processing

Data integrated from/to the area

Sii-Mobility HW Infrastructure

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Smart City solutions

Sii-Mobility (Smart City) new technologies and smart solutions for improving the interoperability of management and control systems of urban infomobility, mobility and transport in the city and metropolis. (terrestrial transport and mobility)

Coll@bora (Smart City → Social Innovation) collaborative tools for the protection of information and data among health care institutions and families for people with imparities. (Welfare and inclusion technologies)

Coll@bora

- **Title**: Collaborative Support for Parents and Operators of Disabled
- **Objectives**: providing strong advantages for
  1. Relatives interested in facilitating relations with the management team;
  2. Associations in order to offer a better service to the families and people with disabilities by providing a collaborative support to the involved teams, but also to manage the wealth of knowledge, to support the training of the staff, etc.

  Coll@bora provides a secure collaboration tool for the teams and for the association to support the families and the disabled people.
- **Link**: http://www.disit.dinfo.unifi.it/collabora.html

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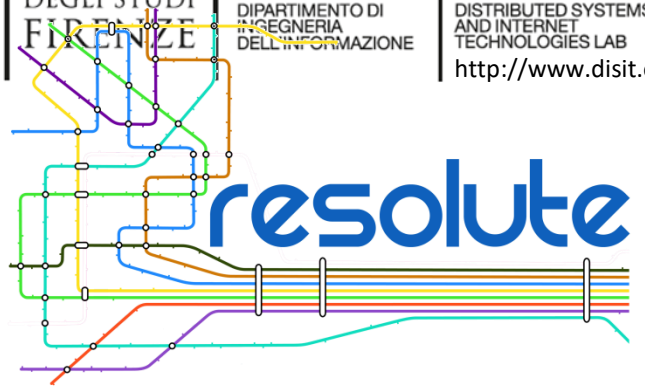
RESOLUTE

Resilience management guidelines and Operationalization applied to Urban Transport Environment

DRS-7-2015 - RIA – start 1/5/2015 - end 30/4/2018 Budget 3.8M

http://www.disit.org/6695

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



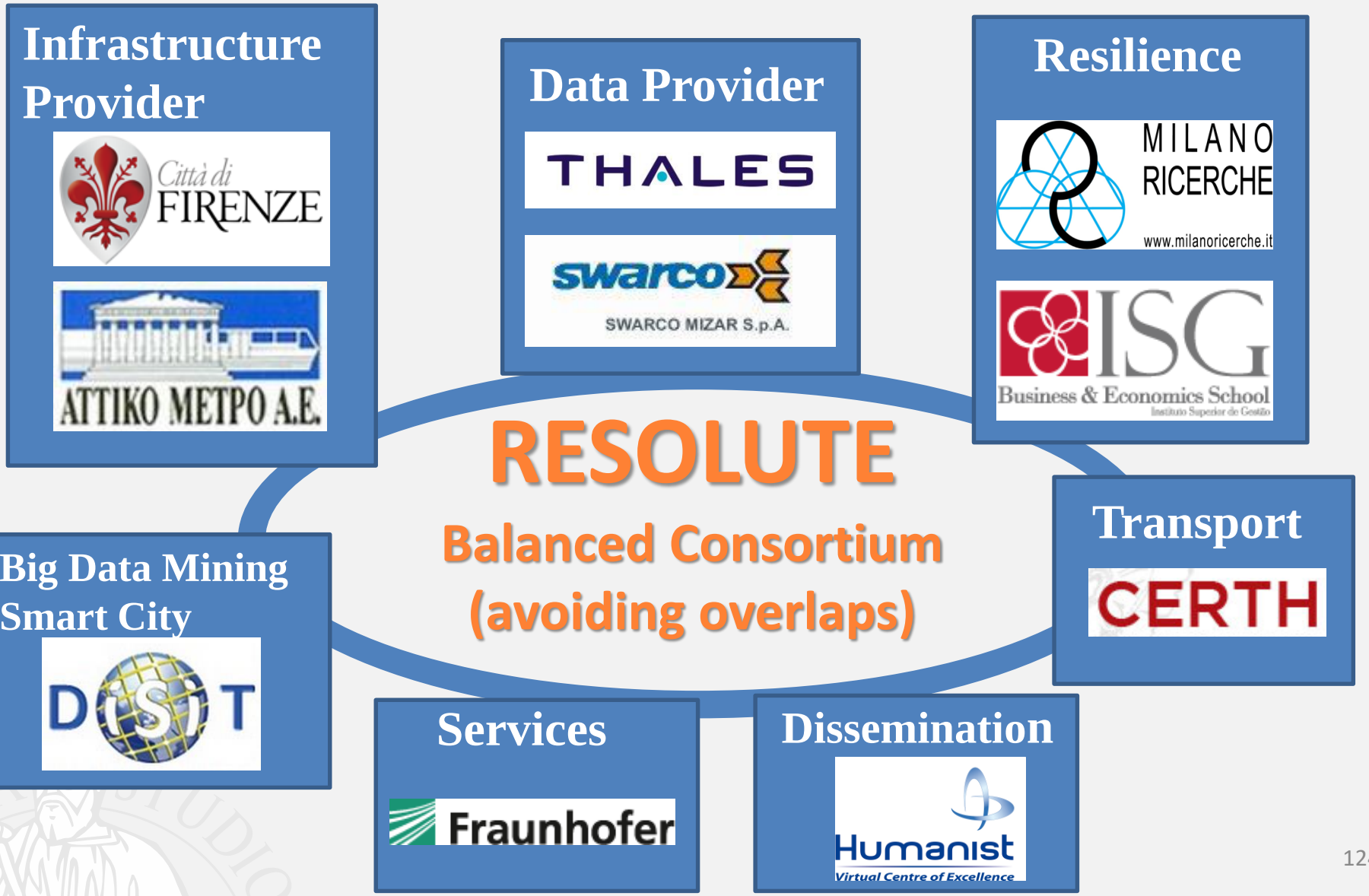
Horizon 2020
European Union Funding
for Research & Innovation

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
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

DISIT Lab (DINFO UNIFI), May 2017


Infrastructure Provider
Città di FIRENZE
ATTIKO METPO A.E.
Data Provider
THALES
swarco
SWARCO MIZAR S.p.A.
Resilience
MILANO RICERCHE
www.milanoricerche.it
ISG
Business & Economics School
Instituto Superior de Gestão
RESOLUTE
Balanced Consortium
(avoiding overlaps)
Transport
CERTH
Big Data Mining
Smart City
DISIT
Services
Fraunhofer
Dissemination
Humanist
Virtual Centre of Excellence

RESOLUTE Objectives

Obj1- **Conducting a systematic review and assessment** of the state of the art of the Resilience assessment and Management concepts, national guidelines and their implementation strategies in order to develop a conceptual framework for resilience within Urban Transport Systems

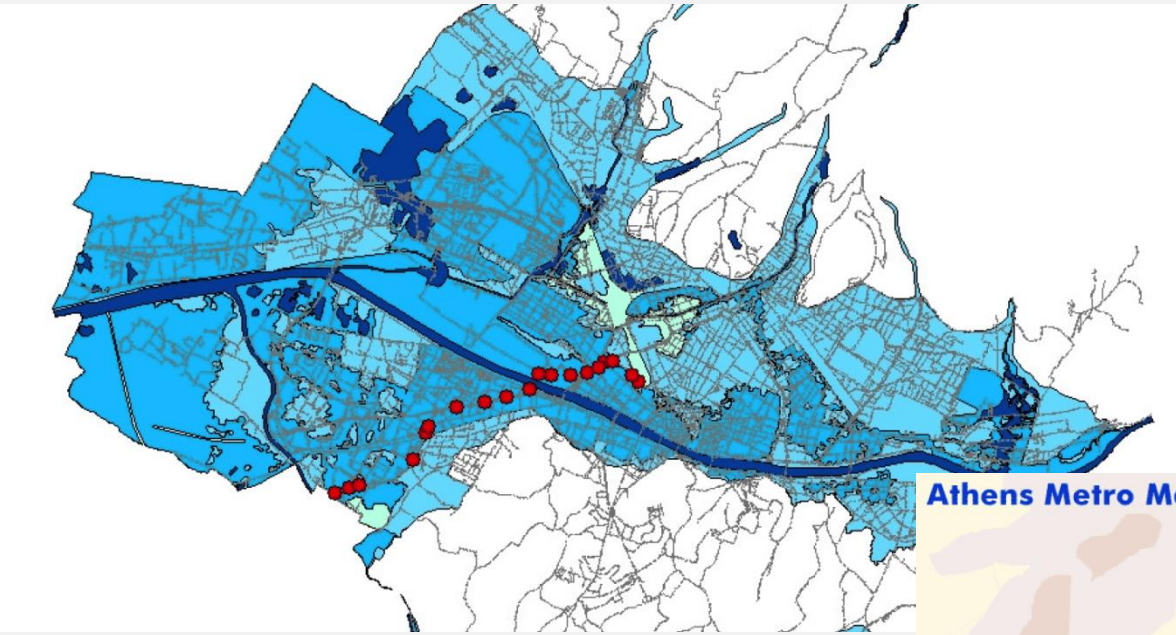
Obj2 - Development of **European Resilience Management Guidelines** (ERMG)

Obj3 - Operationalize and validate the ERMG by implementing the RESOLUTE Collaborative **Resilience Assessment and Management Support System (CRAMSS)** for Urban Transport System (UTS) addressing Roads and Rails Infrastructures

Obj4 – Enhancing resilience through **improved support to human decision making processes**, particularly through increased focus on the training of final users (first responders, civil protections, infrastructure managers) and population on ERMG and RESOLUTE system

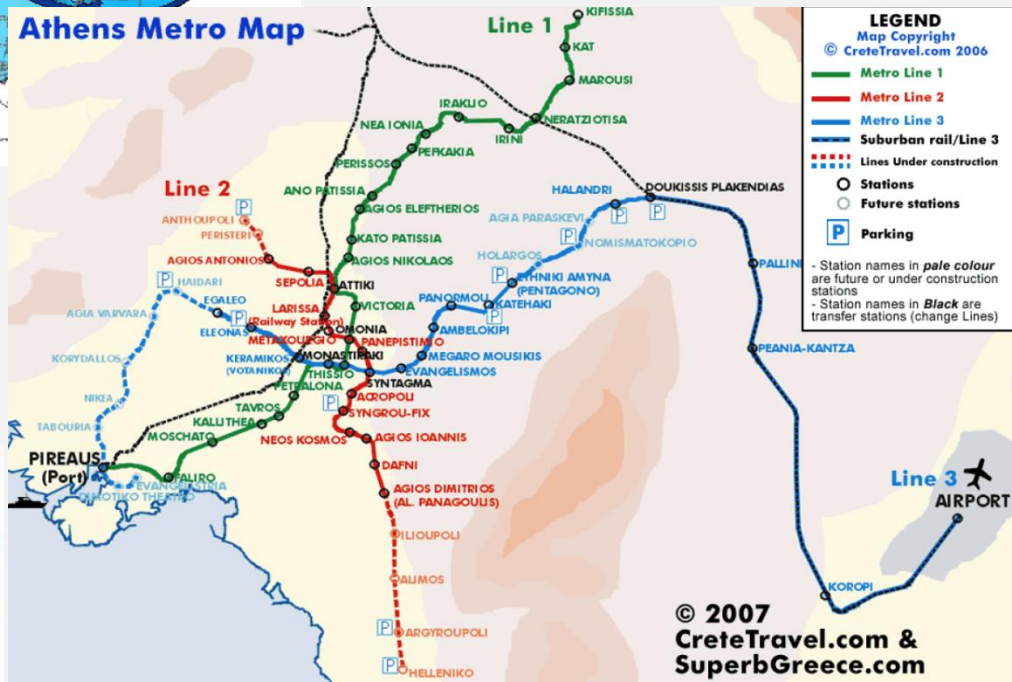
Obj5 – **ERMG wide dissemination, acceptance and adoption** at EU and Associated Countries level

RESOLUTE Pilots



Città di FIRENZE

Over 70% of the city infrastructures are at Hidrogeological risk

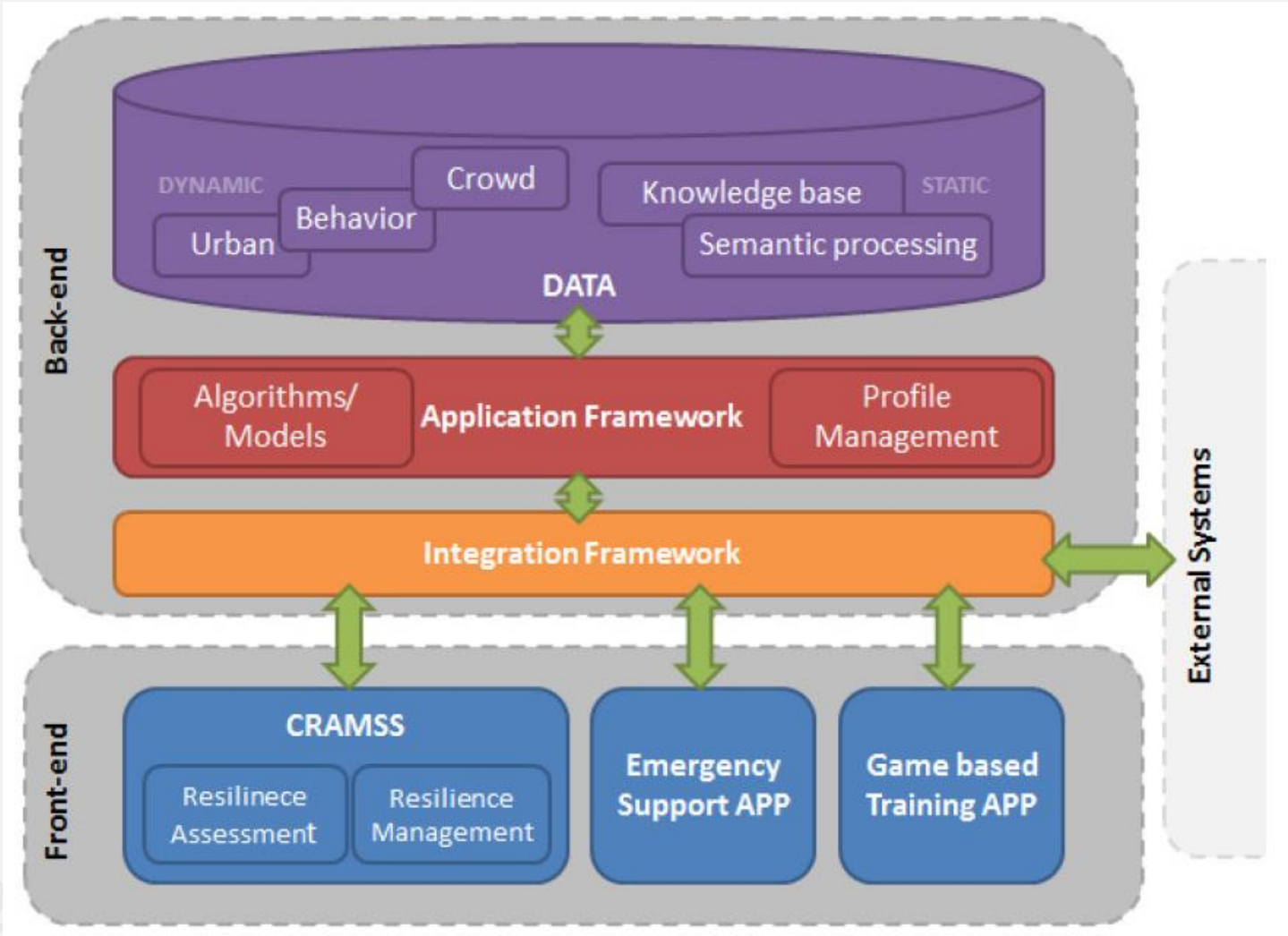


98Km metro line
65 stations
1M passenges daily

ATTIKO METPO A.E.

RESOLUTE Solution

ERMG



REPLICATE

Horizon 2020
European Union Funding
for Research & Innovation

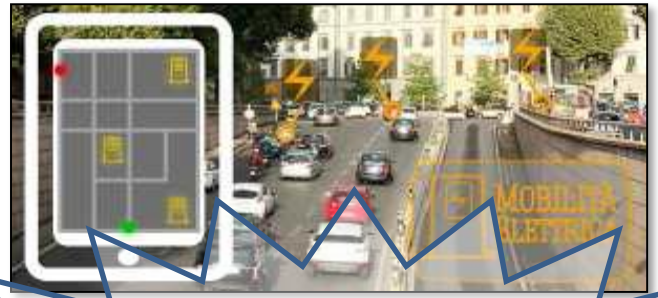
REnaissance of PLaces
with Innovative Citizenship
And TEchnology

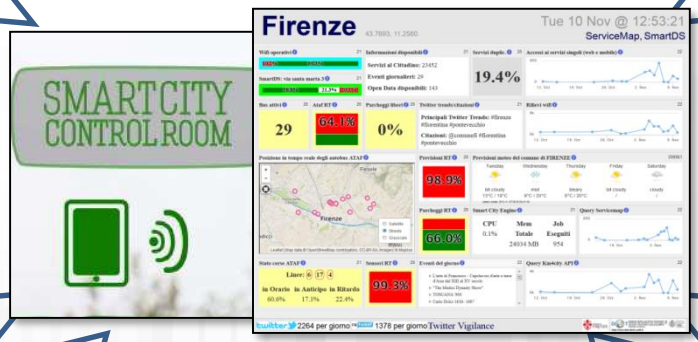
COMUNE DI FIRENZE
Smart Florence Plan

- ***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, 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

REPLICATE a Firenze: Energia, ICT e Mobilità





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Some References

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- P. Nesi, G. Pantaleo and M. Tenti, "Ge(o)Lo(cator): Geographic Information Extraction from Unstructured Text Data and Web Documents", SMAP 2014, 9th International Workshop on Semantic and Social Media Adaptation and Personalization, November 6-7, 2014, Corfu/Kerkyra, Greece. technically co-sponsored by the IEEE Computational Intelligence Society and technically supported by the IEEE Semantic Web Task Force. www.smap2014.org
- P. Bellini, P. Nesi and N. Rauch, "Smart City data via LOD/LOG Service", LOD2014, Workshop Linked Open Data: where are we?, organized by W3C Italy and CNR, Rome, 2014

Km4City EcoSystem

- **Final Users tools:** **http://www.disit.org/km4city**
  - Km4City mobile applications
  - Km4City web application: http://www.km4city.org
- **Public administrator tools:**
  - Smart City Dashboards, http://dashboard.km4city.org
  - ServiceMap Server, http://servicemap.disit.org
  - Smart decision support system, http://smartds.disit.org
  - Twitter Vigilance, http://www.disit.org/tv
  - Traffic and People Flow Assessment http://www.disit.org/6694
- **Developers tools: http://www.disit.org/km4city**
  - ServiceMap Server, plus API, http://servicemap.disit.org
  - Ontology Documentation http://www.disit.org/km4city
  - LOG LOD browser http://log.disit.org
  - Open Source Mobile Application, FODD http://www.disit.org/6595
- **Back Office tools for Public Administrations**
  - 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
- **Adopted on projects and real scenarios**

Overview on Smart City

DISIT lab solution for beginner

Distributed Data Intelligence and Technologies Lab
Distributed Systems and Internet Technologies Lab

Prof. Paolo Nesi
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