Km4City as Smart City Semantic Model and Tools

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

http://www.disit.org/km4city

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

Smart City Engine

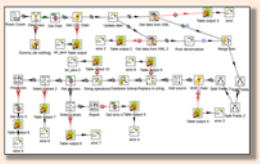
Distributed and parallel architecture on Cloud

Data Ingestion Manager

Data Enrichment Manager

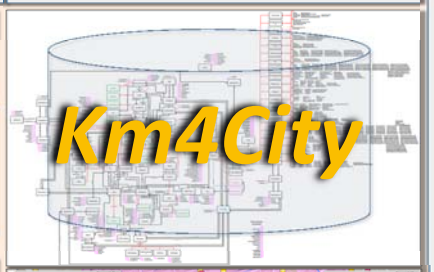
NoSQL DB Big Data

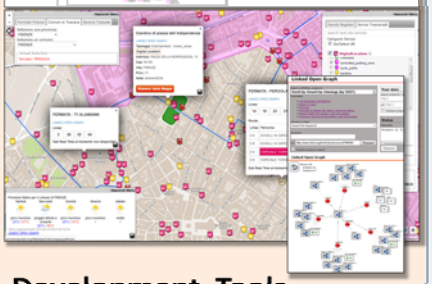
- RDF Store
- HBase, Hadoop
- Cloud based
- Scheduling
- ETL, Java, Gate, MapReduce,



- Km4City RDF Store validation
- Data Quality improvement
- Data harvesting, aggregation, mapping, reconciliation
- Natural Language Processing
- Data Mining …

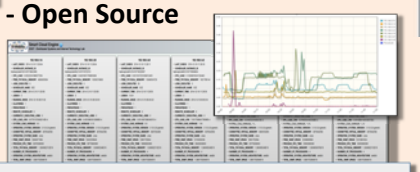
RDF Indexing Manager





Development Tools

- **Service Map Query Generator**
  http://servicemap.disit.org
- **Linked Open Graph**
  http://log.disit.org
- **Km4City Ontology & API**
  Documentation and Tutorial
- **Open Source**



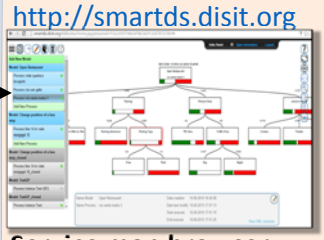
User Profiling and Suggestions on Demand

Km4City Smart City API

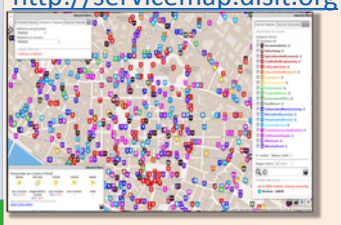
Tools for Administrators and Operators

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

Smart Decision Support
http://smartds.disit.org



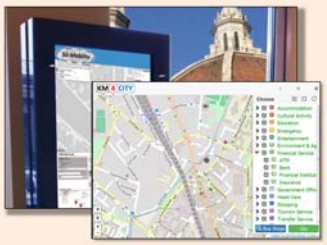
Service map browser
http://servicemap.disit.org



End users

Mobile e Web Apps

http://www.km4city.org



Data

Static/quasi-static

- 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

Platform features

- Application for **Citizens and Tourists** (can locate services/events), **Developers** (can build new applications using the data), **Public Administrators, Mobility Operators** (can see the city status, find what is going wrong and why and can find help for solutions).
- Data coming from different sources (Municipality of Florence, Province of Florence, Tuscany Region, LAMMA, Univ. of Florence)
- Heterogeneous data, in different formats (XML, CSV, KMZ, …), with different structure and with different semantics, integrated in a common semantic knowledge model *KM4City*.
- Solution based on Semantic Web technologies as OWL ontologies, RDF-Store (Virtuoso 7.2) and SPARQL.
- Data is processed to find connections among entities (reconciliation), data is enhanced with links to the LOD Cloud, …
- The obtained performance and reasoning capabilities are not replicable using traditional databases.
- A rigorous evaluation was performed to assess the benefits of Km4City (SPARQL query performance and indexing)
- The solution goes beyond information retrieval, providing support for smart decision support systems.
- The solution is scalable, it allows to process the different data sources in parallel (able to handle 400 tasks/hour with 6 nodes)
- Multimedia documents are available for "Digital Locations" (audio, photo, video).
- Integrates dynamic/real-time data (bus positions and forecasts, parking status, traffic sensors data, weather forecasts) with static data.

Adopted by

- ***Firenze as Smart City engine***
- ***Sii-Mobility,*** **Smart City National Project**
  - http://www.sii-mobility.org
- ***RESOLUTE*** **H2020 EC Project**
  - Resilience of City Transport System, DRS14
  - http://www.resolute-eu.org
- ***REPLICATE*** **H2020 EC Project**
  - Smart City Lighthouse, SCC1

resolute

Sii-Mobility