GeoSmartCity Pilot Applications

GENOVA

Integrated management of the utility networks and use of mobile client for data management and field works.

Authors: GISIG, Comune di Genova, IREN S.p.A

Sources: GeoSmartCity project, 2017

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Context: Pilot aim and goals

- The main aim of the GeoSmartCity pilot located in Genova (Italy) is to offer to **municipality officers and utility companies** a viewer solution, both **web-based and mobile**, to support them on the **integrated management** of the underground network and in **field work** operations.

Context: Pilot aim and goals

General Objectives (1):

- **Integrate** different underground information layers coming from different actors (mainly Municipality and Multi-utilities)
- Reinforce the **dialogue and flow of information** between utility companies and the Public Administration
- Support the creation of a sounder **policy and actions**, in management, monitoring, planning or emergency
- Include **INSPIRE** compliant data in the city underground data management workflow (**Harmonisation** of gas, water and sewer datasets among others)

Context: Pilot aim and goals

General Objectives (2):

- Use of **mobile client** for data management support in field works
- Use of advanced visualization techniques such as **Augmented Reality**
- Use of a high precision positioning (**GNSS**) device integrated with mobile client for more efficient field works
- Provide a tool for the analysis of intersection between underground networks and **Environmental Hazard information**

Context: The actors

- The Pilot is participated and closely monitored by **GISIG**, the **Genova Municipality** and the **Multi-utility IREN** S.p.A
- GISIG has been in charge of coordinating the development and deployment of the applications
- Genova Municipality and IREN have played an important role in the definition of technical requirements, use and testing of the apps and provision of utility networks data
- Comune di Genova and IREN have interest on the potential real use of the results in a future operational environment.
- The Partner **Ticass**, from Genova, is involved in testing and validation tasks

GISIG

COMUNE DI GENOVA

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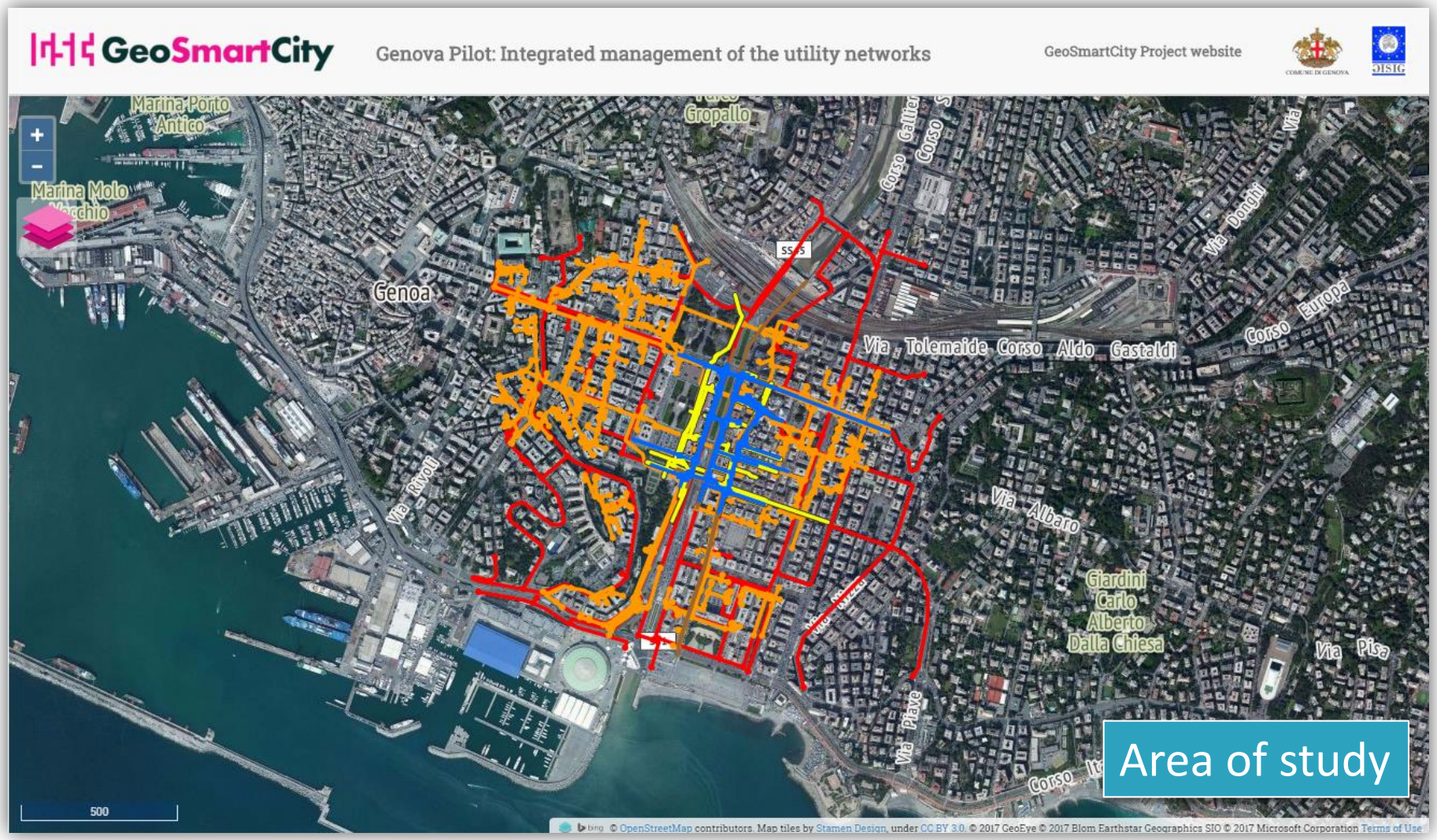
TICASS

Context: Area of study

- *Population*: 607.000 in the Municipality of Genova
- *Surface*: 244km2
- Genova is composed of a narrow coastal zone, hills and steep mountains in the behind
- The issue of planning and government of the underground assets has been always considered as **one of the most important aspects of the city management**.

Context: Area of study



Context: The data used

- Pilot have experimental nature and uses **sample data** for a reduced (but very representative) area of study
- All pilot underground networks datasets (existing and processed/created) are **available for demonstrative purposes** and in the context of the GeoSmartCity project only.
- WFS and WMS services available in the Pilot viewers are exposed by the GeoSmartCity infrastructure and base layers are offered by the Genova Municipality.

Context: The data used

List of available datasets (WMS)

- Underground networks (sample data)
  - Water network
  - Water appurtenances
  - Sewage network
  - Sewer appurtenances
  - Gas network
  - Telecommunication cable
  - Telecommunication appurtenances
  - Electricity cable
  - Electricity appurtenances
- Hydrogeological risk
  - Affected areas in 2014 floodings
  - Flood prone areas T50 yrs
  - Flood prone areas T200 yrs
  - Flood prone areas T500 yrs
  - Landslides zones
- Carta Tecnica Comunale
  - Civici
  - Edifici
  - Elemento Stradale
  - Unità Urbanistiche
  - Municipi
  - Reticolo Idrografico
  - Area Bagnata
- Base maps
  - Raster CTC
  - Stamen toner
  - Bing Aerial
  - OpenStreetMap

Context: Use Cases

The pilot is structured around tree main use cases:

I. Underground cadastre
II. Field works support
III. Underground networks and environmental hazards

Context: Use Cases

1- Underground cadastre

- Deals with the **integrated management** of the utility networks
- The main objective is the visualisation and consultation of datasets of different networks in a **web-based GIS client** prototype application.

Context: Use cases

2- Field work support

- For this use case, a **mobile app** is connected to a high precision **GNSS** receiver and uses **Augmented Reality** visualisation of the underground networks to support field work operations.
  - This use case has a high experimental nature and is driven from a pure prototypal and proof of concept prospective

Context: Use cases

3- Hydrogeological risk

- This use case is based on the study of the **interaction between underground infrastructures and the territory**
  - Use a web based client to visualise the aforementioned interaction in a seamless way
  - Assess the interference of these networks with the surrounding environment
  - Analyse the connection between the networks of underground and current regulations (EU and national) in environmental matters

Web based client application

- The main objective of this client is the **visualisation of datasets of different networks**
- All Underground network **datasets are harmonised** to the common *GeoSmartCity Underground application schema*.
- It offers the municipality officers and utility companies a viewer solution to support them on the integrated management operations

Web based client application

- The application also permits the study of the **interaction between underground infrastructure and the territory** (in this case landslide zones and flood prone areas).
- Being an app devoted to **professional use**, the client is accessible only to registered users.

http://www.gisig.eu/client

Web based client application: Functionalities

Authentication

- Is based on the authentication module of the GeoSmartCity **Client Side JavaScript Library API**
- Implements login methods and a user interface widget for authentication of users of GSC applications
- Provides means to self-register, login, logout and send password reminders

Web based client application: Functionalities

GeoSmartCity

GeoSmartCity Project website

GeoSmartCity Genova Pilot Application

Integrated management of the utility networks GIS client

Login

The Genova pilot web based client application.

- The main objective of this client is the visualisation of datasets of different networks (harmonised to the common GeoSmartCity Underground application schema).
- It offers the municipality officers and utility companies a viewer solution to support them on the management of the networks.
- The application also permits the study of the interaction between underground infrastructure and territory (in this case landslide zones and flood prone areas).
- The client is accessible to registered users.

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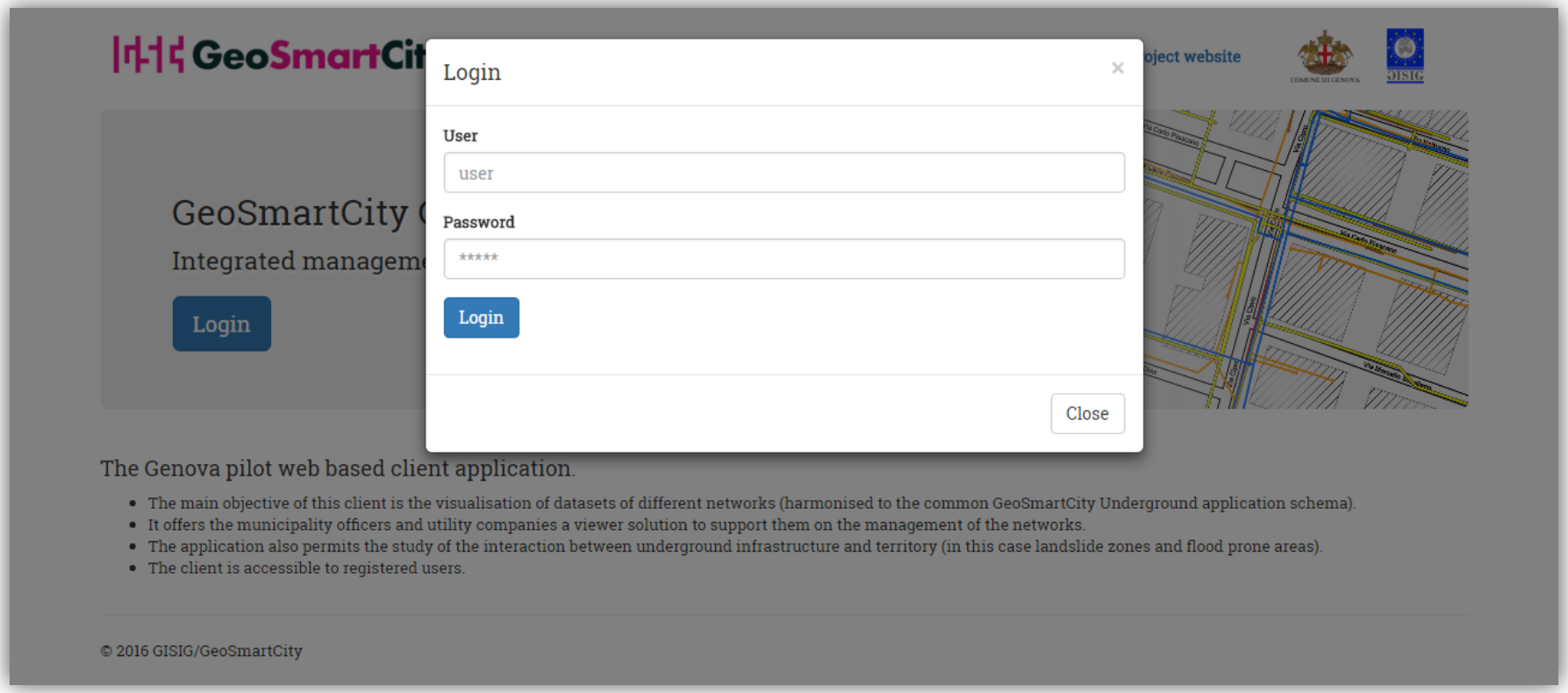
Landing page

Web based client application: Functionalities



login

Web based client application: Functionalities

Visualisation: Underground networks

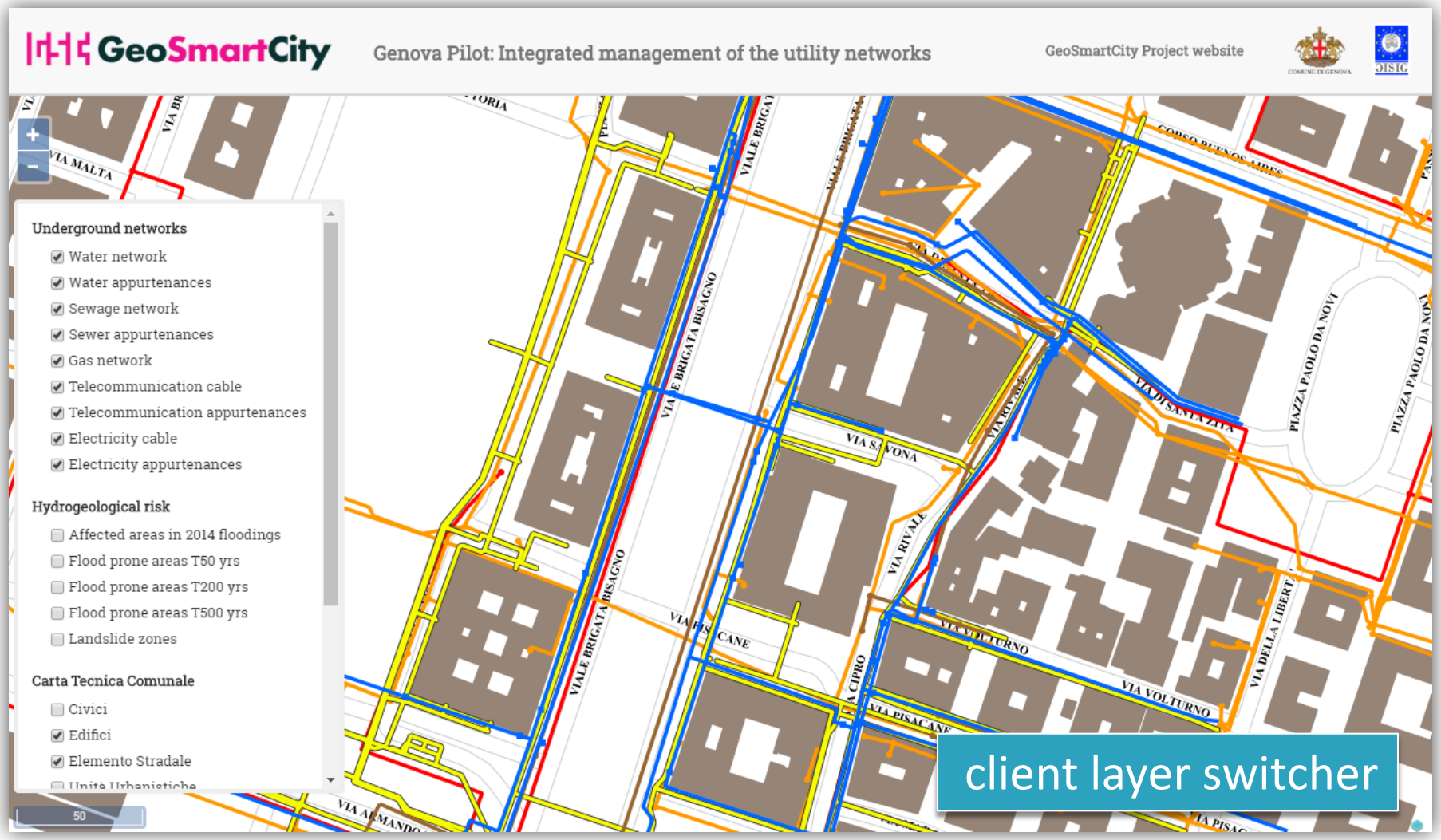
- Underground networks are rendered as WMS layers exposed and managed by the **GeoSmartCity Data Catalogue tool**
- Underground data exposed can be automatically updated thanks to the "*refresh interval*" Data Catalogue feature

Web based client application: Functionalities

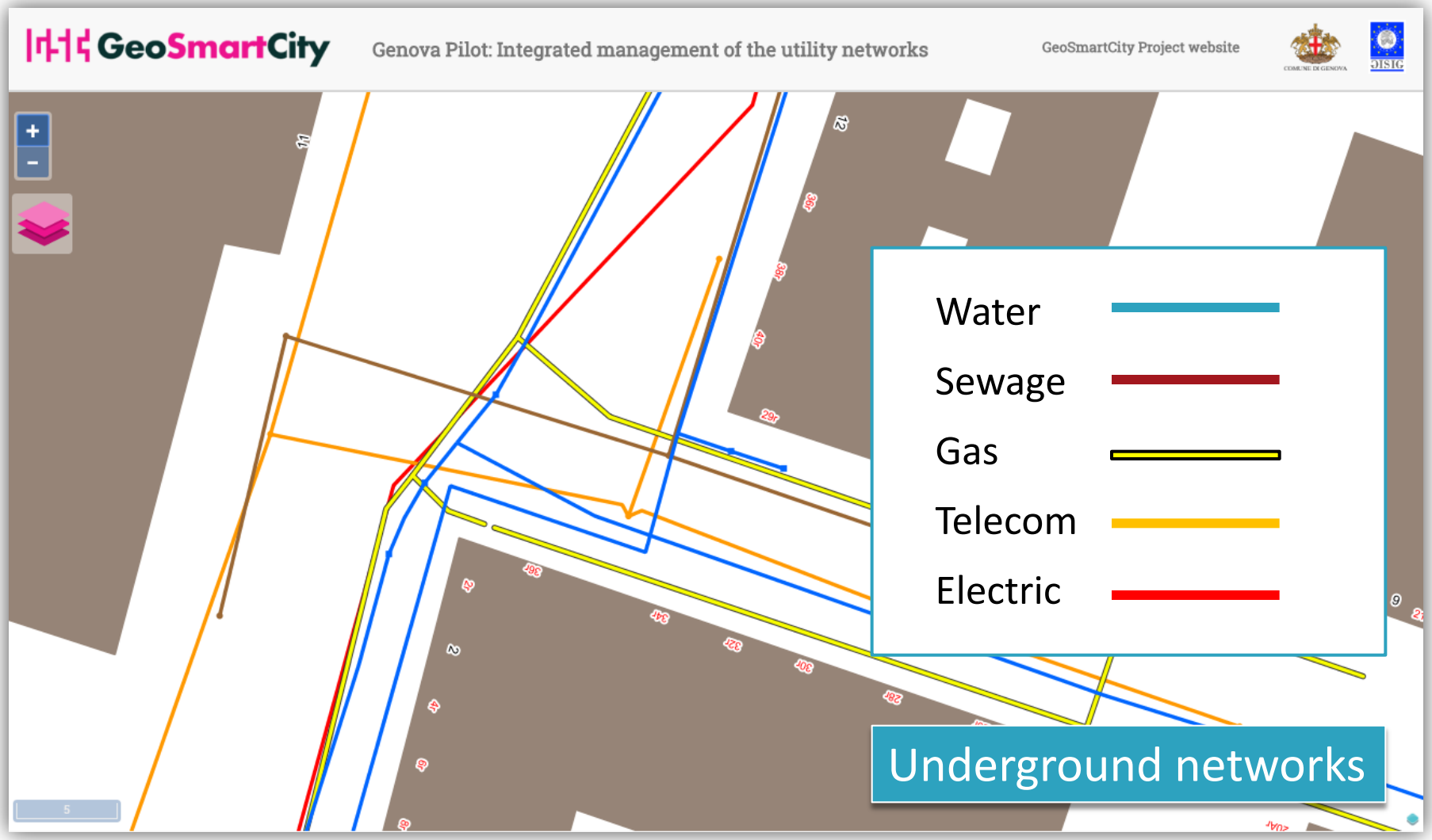
Visualisation: Base maps and Hydrogeological risk

- Several layers of the Comune's **Carta Tecnica Comunale** are available. These layers are exposed by the Comune GeoServer instance.
- The User is able to choose between different base maps and OpenStreetMap among them.
- Flooding prone areas and landslide zones layers are available with transparency to permit better analysis

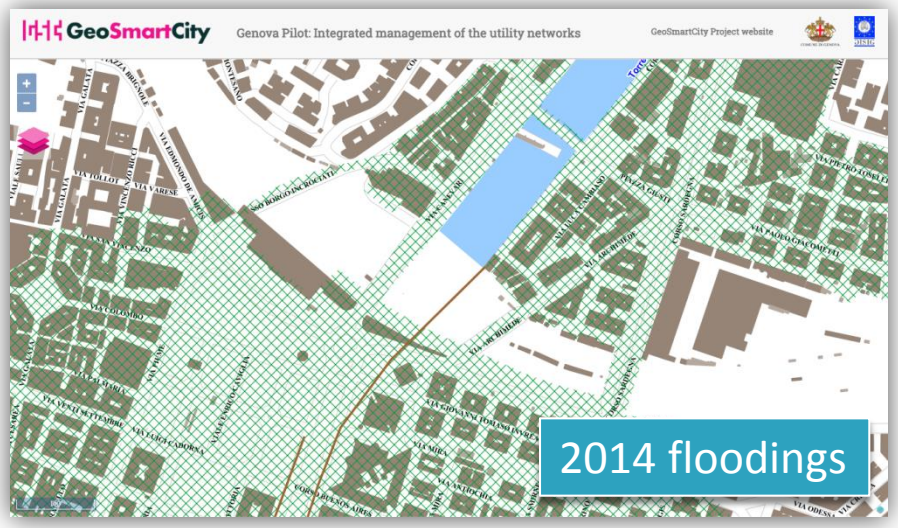
Web based client application: Functionalities

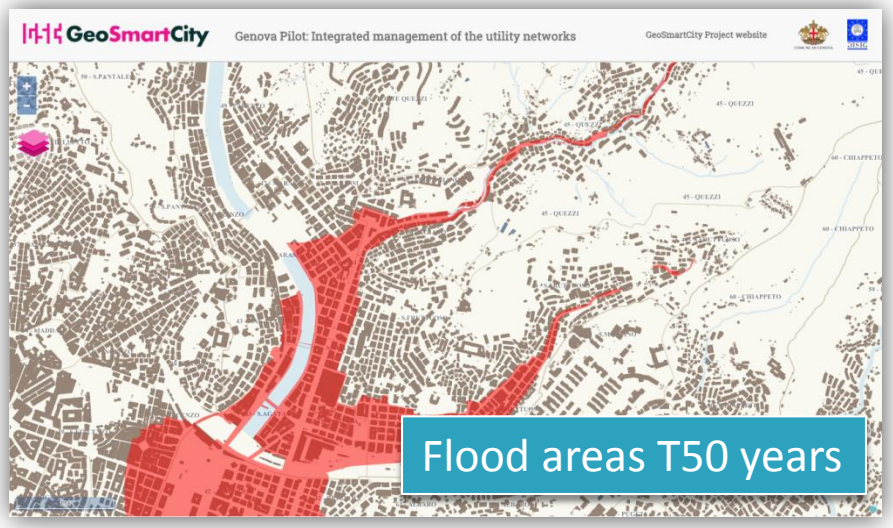


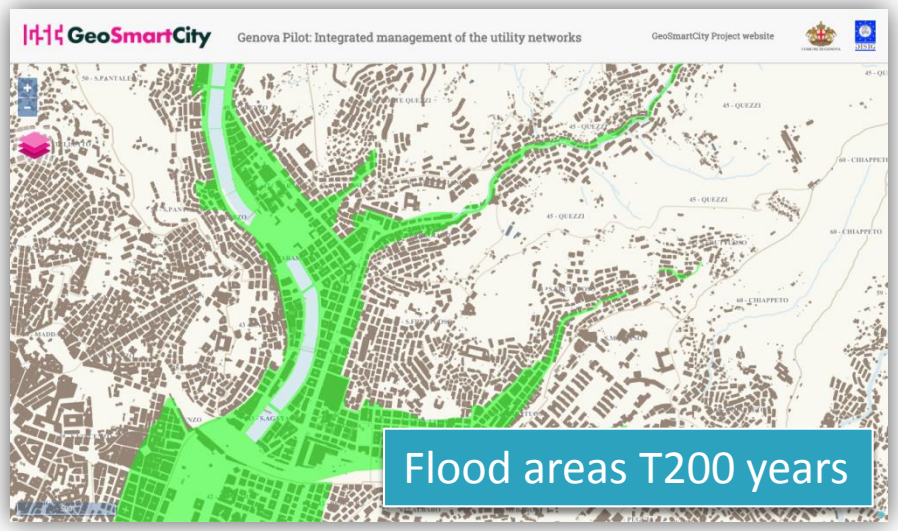
Web based client application: Functionalities

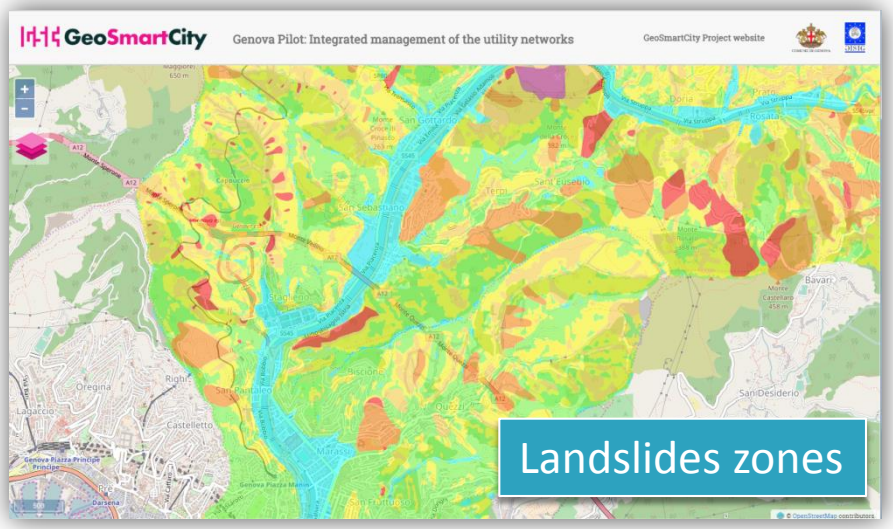


Web based client application: Functionalities







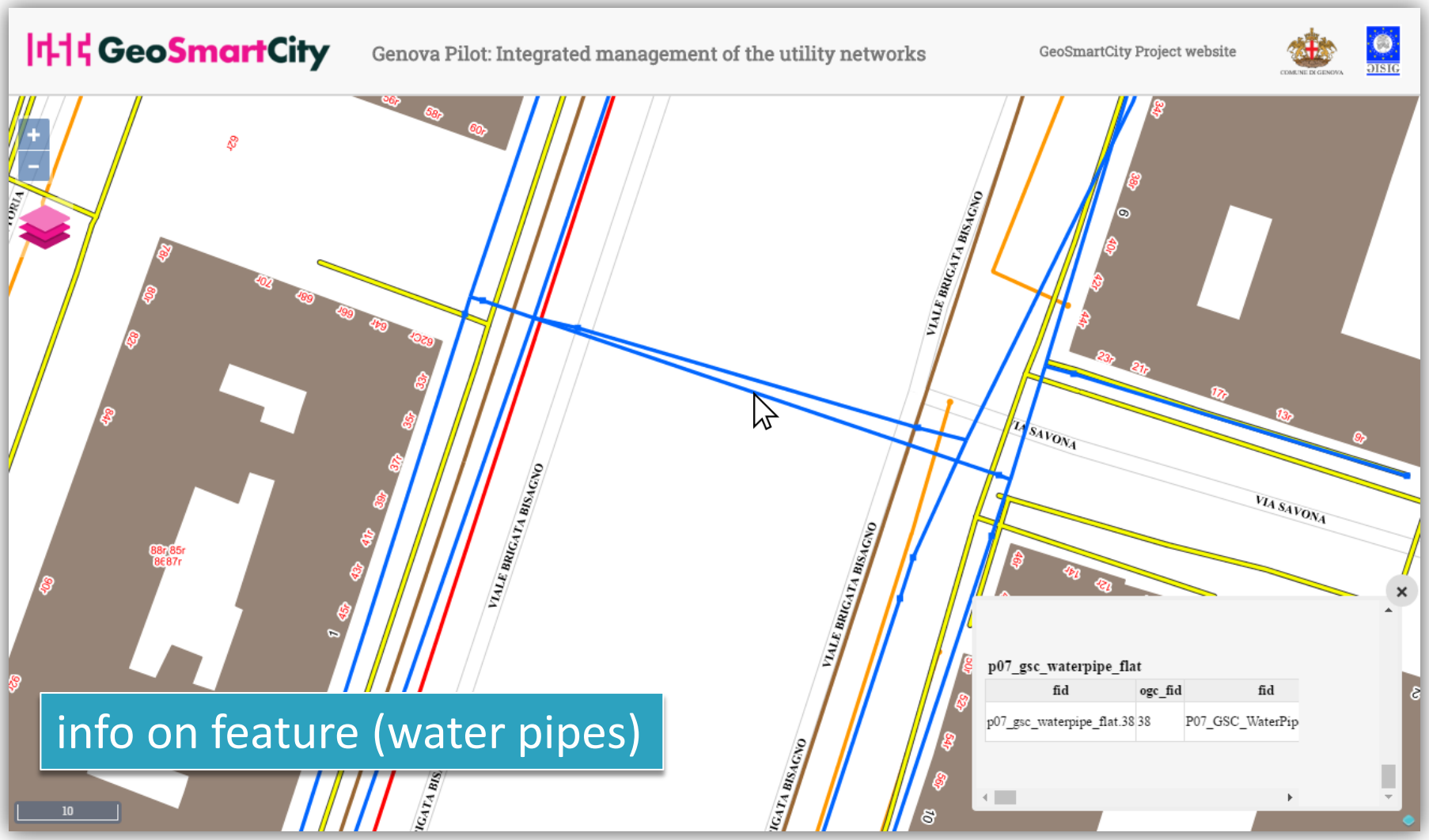


Web based client application: Functionalities

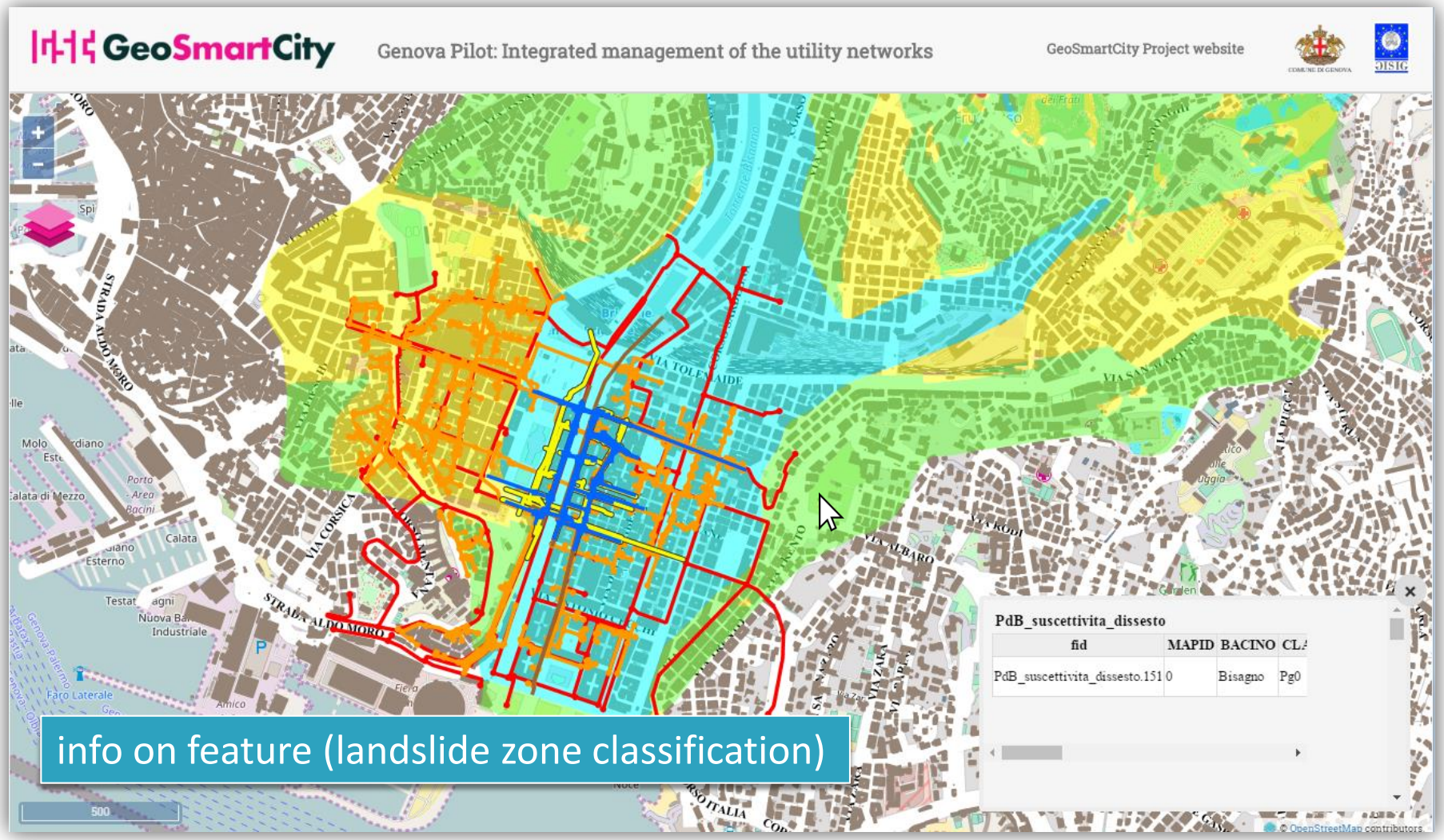
Info on Feature

- The user gets information displayed in a popup on the data structure by clicking on the layers
- Thus, it is possible to check how all underground networks data exposed has been harmonised to the **GeoSmartCity-INSPIRE data model**
- User can also retrieve info on the landslide zones classification

Web based client application: Functionalities



Web based client application: Functionalities



Pilot impact and benefit

- The Pilot experience aims at contributing to address the Administration towards a more **Smart and Digital City** concept.
- The Pilot demonstrates how underground data sources **from different operators** can be **harmonised** to a common reference schema and afterwards available in **a single webGIS**, taking advantage of the **GeoSmartCity Hub** publishing features.
- This integration can undoubtedly **reinforce the dialogue** between utility companies and Public Administrations and speed up the planning process and development of field works.

Pilot impact and benefit

- The pilot results will taken into account in the framework of the **Italian Digital Agenda**. This initiative foresees the creation of a cadastre of the underground, developed on the basis of common rules and standards at national level.
- The pilot will result in a strong boost for the political strategy of the Municipality of Genoa toward the collaboration between the City and the Utilities to define the mutual commitments and rules for underground information integration, improving the functionalities of the *"Catasto Rappresentativo delle Reti nel Sottosuolo del Comune di Genova (CRRS)"*

Use Case 2

- Work Force Management
- For this use case, a mobile app is connected to a high precision GNSS receiver and uses Augmented Reality visualisation of the underground networks to support field work operations

Mobile application

- Enable utility companies and Public Authorities to view underground infrastructures, such as sewage, water and pipes, electrical cables, directly on the street using a mobile device with **Augmented Reality** (AR) support.

Mobile application

- The app is called **Utility Viewer** and is developed by Intergraph
- It is not a public application and is used only in the context of the South Moravia and Genova Pilots
- Is distributed as an Android application package (APK)
- The app can be **freely reused** under a specific EULA defined by Intergraph in Czech Republic

Mobile client application: Functionalities

Main Features

- View of the underground networks WFS layers in **2D map**.
- View underground infrastructure using **Augmented Reality**.
- Get information of infrastructure elements.
- Use of external **GNSS** device for precision user positioning.
- Node location update (the user can correct the position of a network node)

Mobile client application: Functionalities

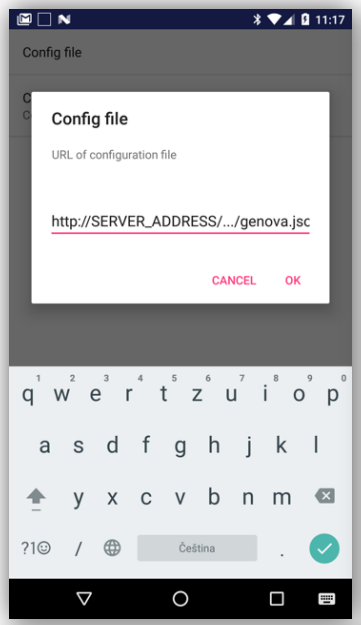
Requirements

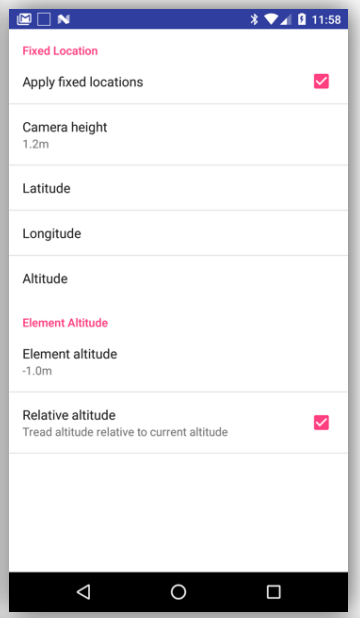
- 10”Tablet for optimal visualisation
- Android 5.0 (or higher)
- 3G-4G connection
- Camera
- OpenGL ES 2.0 (or higher)
- Bluetooth
- Sensors:
  - Compass
  - Accelerometer
  - Gyroscope

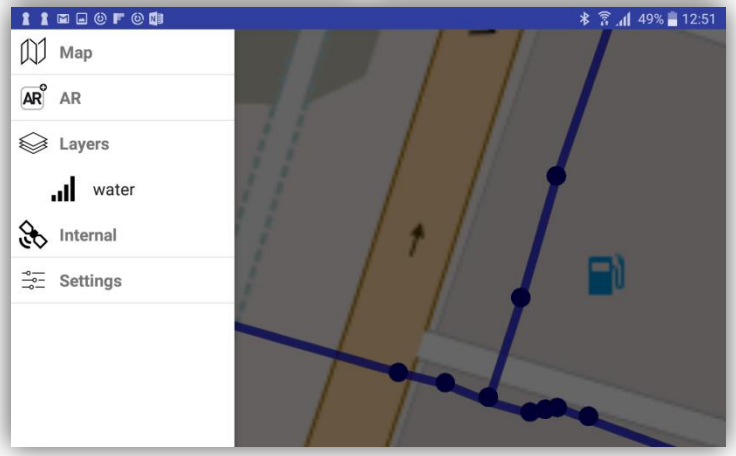
Mobile client application: Functionalities

Settings and configuration

- Switch between 2D map and AR views
- Manage layers visibility
- App is configurable trough a remote JSON file (containing data access parameters)
- It is possible to select a paired bluetooth device
- It is possible to modify required GPS accuracy for node editing
- Other settings ensure correct visualisation of 3D pipes in AR



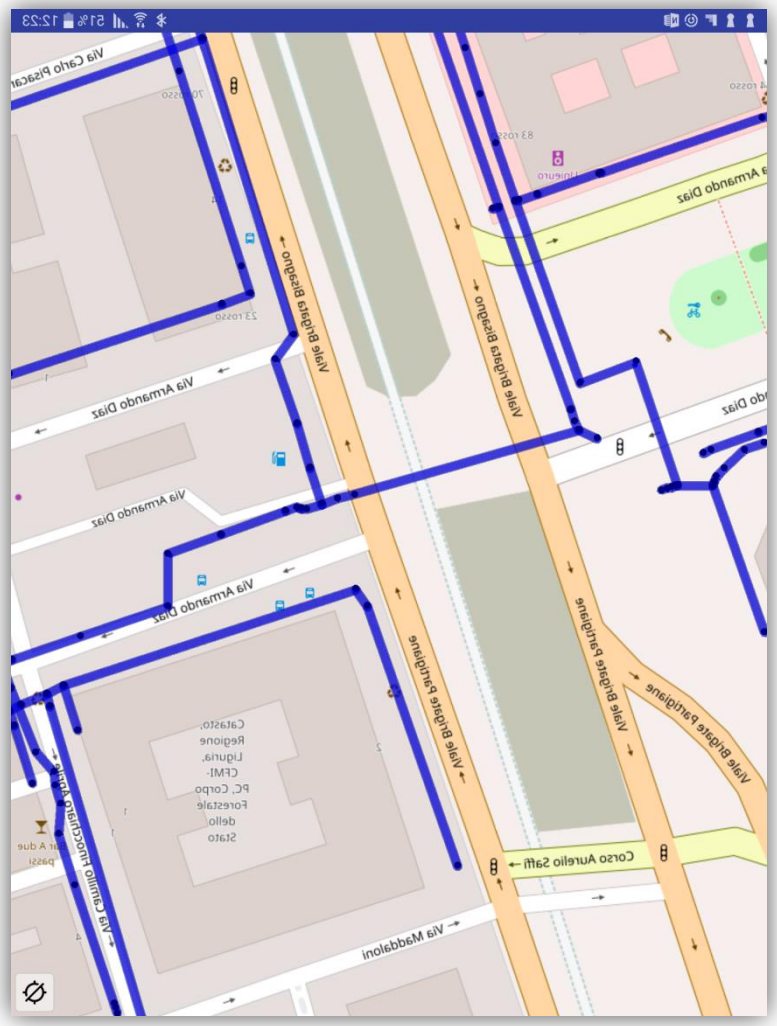




Mobile client application: Functionalities

2D Mode

- View underground infrastructure on top of 2D base map (OSM).
- Get information of infrastructure element when touching it.
- User location displayed thanks to internal GPS or external GNSS device.
- User can correct location of nodes of the infrastructure.

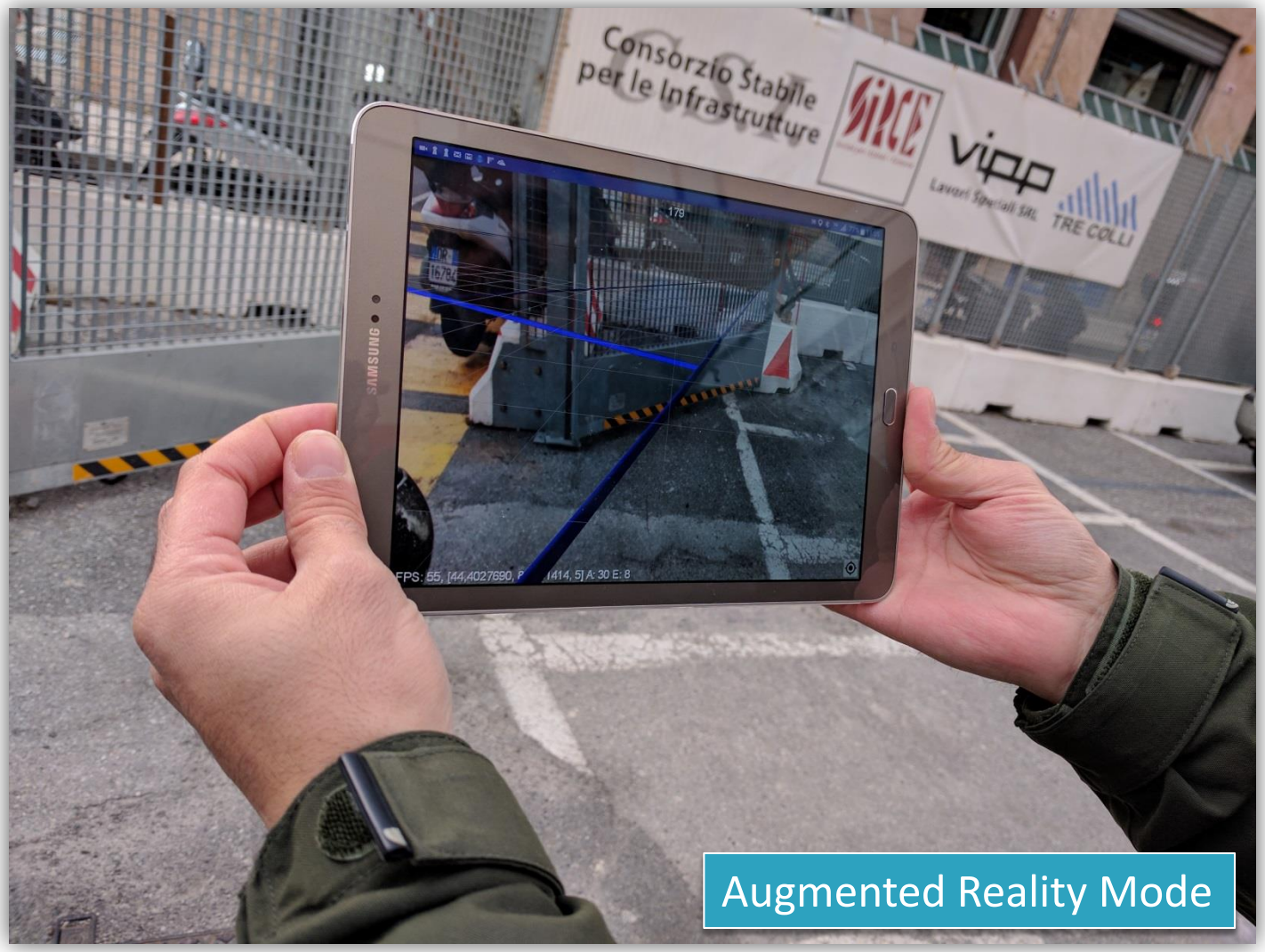


Mobile client application: Functionalities

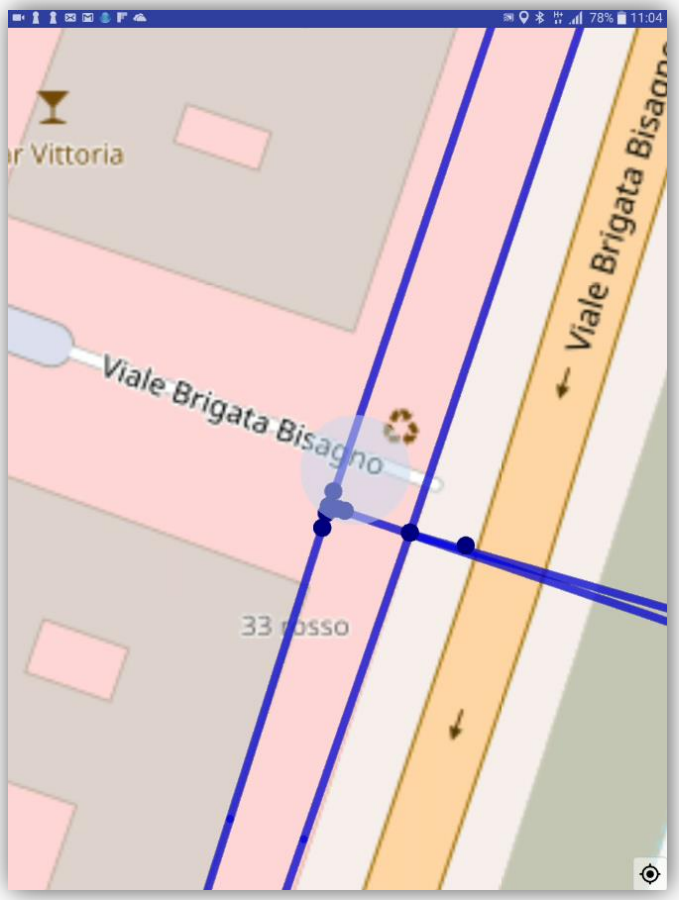
Augmented Reality Mode

- Offers a view of underground infrastructure as an overlay of real-time camera view.
- A basic information is displayed when a pipe is touched.
- This solution is also tested in the South Moravia Pilot
- This visualisation mode has very experimental nature and serves as a proof of concept rather than ready-to-use solution.

Mobile client application: Functionalities



Mobile client application: Functionalities

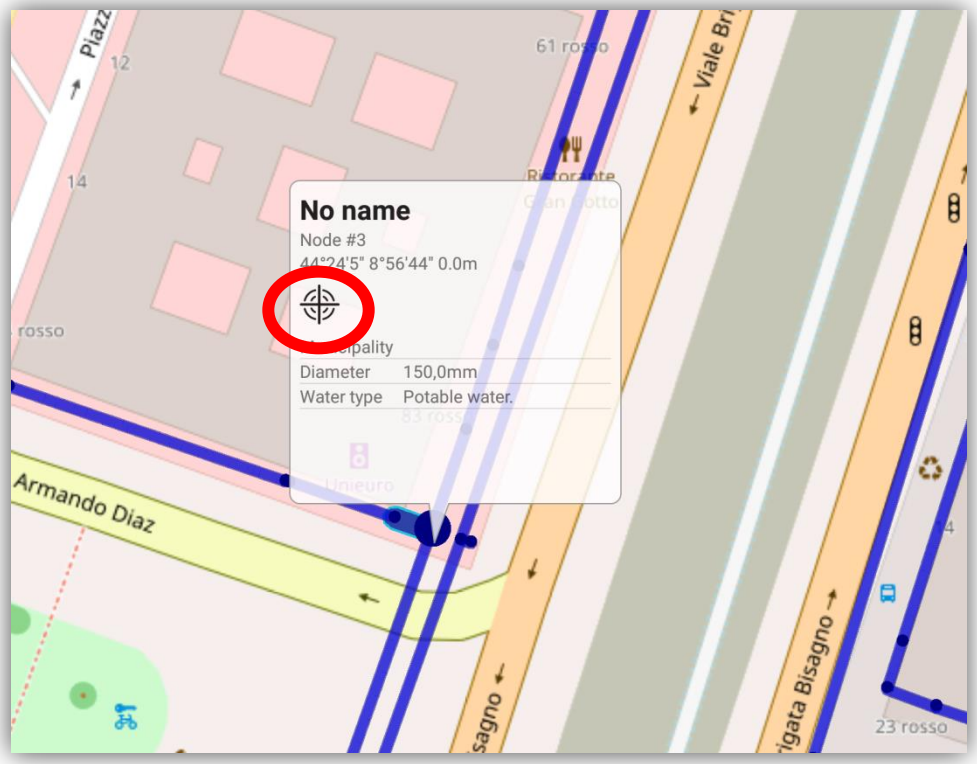


AR and 2D views, same location

Mobile client application: Functionalities

View and update information

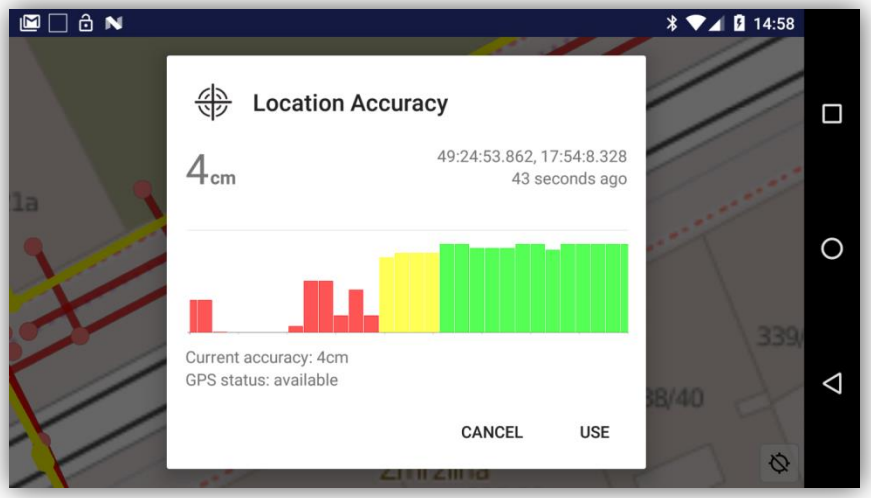
- Tap on the network node: opens pipe details
- Crosshair button enables node location update.

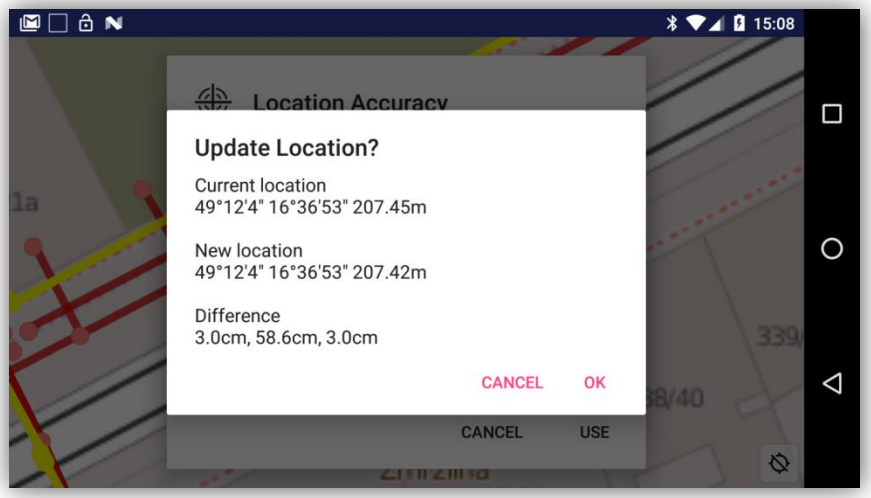


Mobile client application: Functionalities

View and update information

- Application waits for sufficient accuracy of external GPS device.
- User confirm new location of a node to be sent to server.
- New coordinates will be stored back to WFS-T

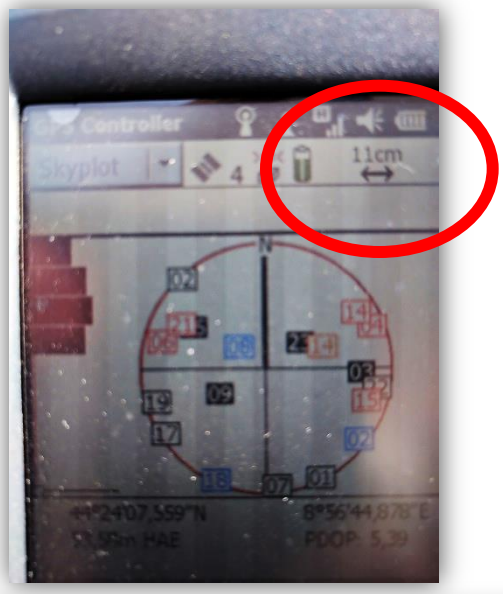


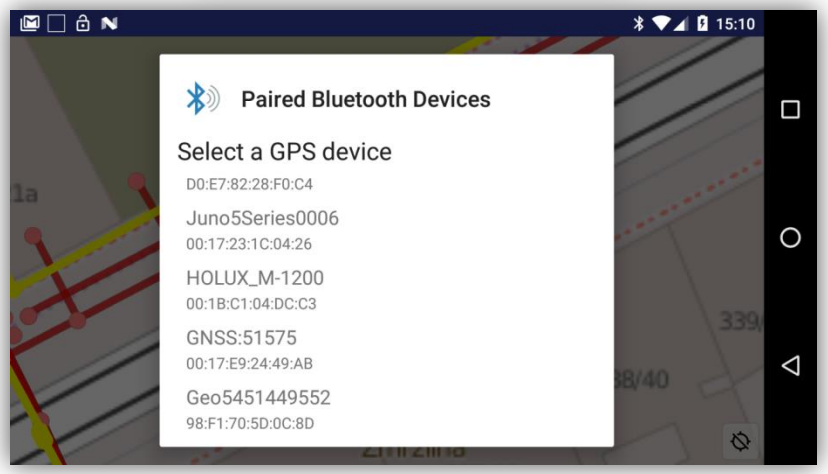


Mobile client application: Functionalities

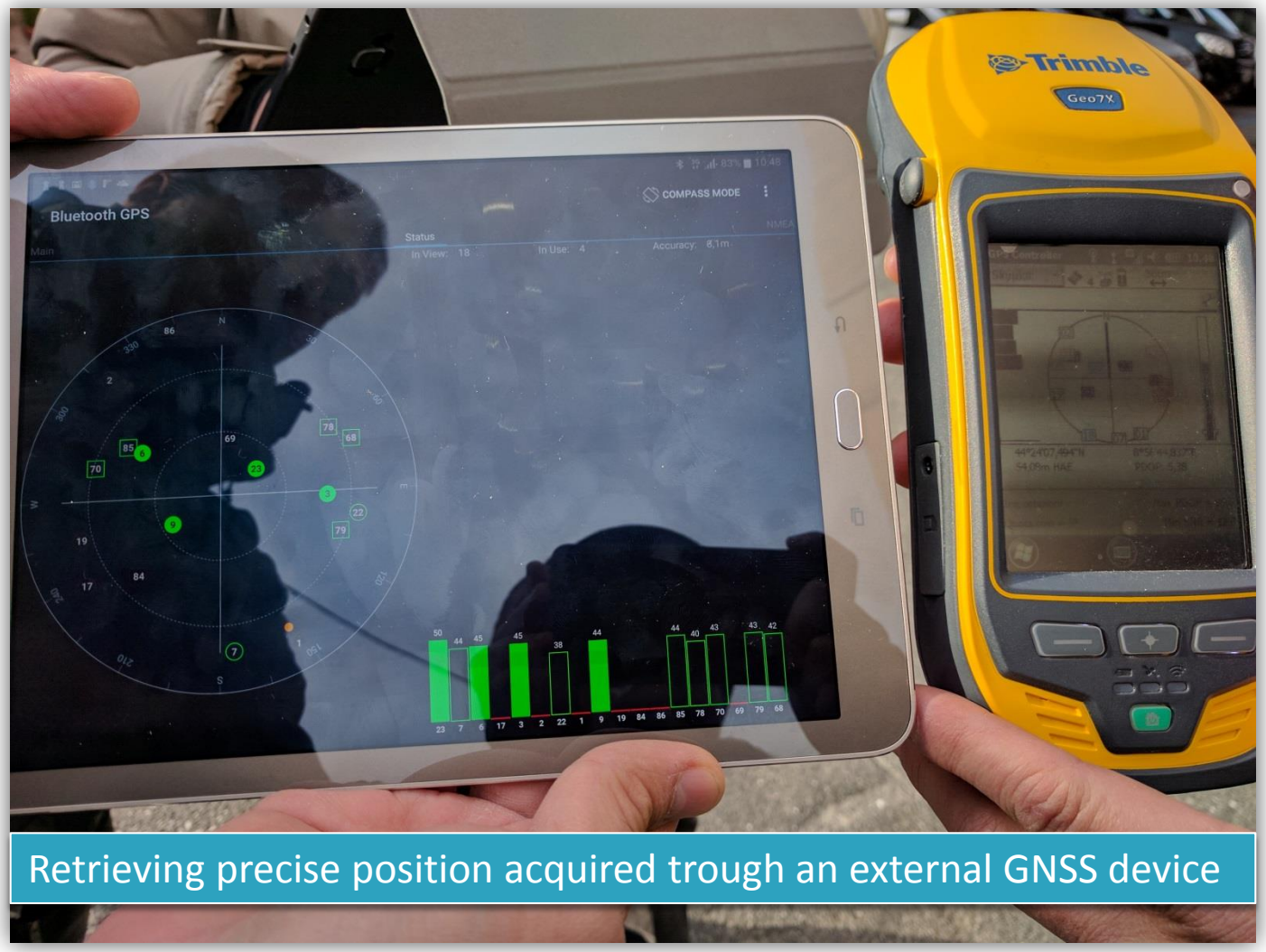
Connection to GNSS device

- Trimble Geo7X series
- User has to pair the devices using Bluetooth prior to the communication is established.
- Decimetre level precision
- NMEA communication protocol





Mobile client application: Functionalities



Retrieving precise position acquired trough an external GNSS device

Pilot impact and benefit

- There's a big potential for a **real use of the results** in a future operational environment, especially for the **mobile application** and from the Multi-utility side (IREN)
  - The app can be potentially used in a number of **real and ordinary operations** such as:
    - control and modification of the position of the pipes
    - support to the digging process.
    - Field survey for tracking paths for posing new pipes
  - These operations can be more efficient assuming the availability of a high precision outdoor positioning device and the support of the **GeoSmartCity Utility Viewer** for data sharing/transfer mechanisms from the field.
    - An also important: Less paper plans!

The GeoSmartCity Genova Pilot

Authors:
GISIG, Comune di Genova, IREN S.p.A

Source:
GeoSmartCity project, 2017

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