![SNAP4CITY logo]

Origin Destination Matrices

The City Operators and Strategists on mobility and transport, on tourism and economic develop need to have precise view about the city users are moving in the city. From where they arrive, which kind of travel means are using, how they move in the city and in which time slots, etc. Most of these answers are provided in terms of Origin Destination Matrices. These can be computed from several different data sources, thus providing different views of the city flows:

- **Traffic flow sensors**: reporting the private traffic flow and eventually traffic from touristic busses, and not in the areas close to traffic. If they take the vehicles plates, they can be capable to be used for creating matrices.
- **Mobile Apps**: reporting the movement of the people, in the city and among the cities, inflow and outflow. The kind of users at which they refer depend on the App profile, and on the number of tracked trajectories.
- **On board units**: for example, coming from taxis, from insurance black boxes, bus OBU, etc. Also, in this case a partial view of the flow is produced according to the different kind of sources and the number of trajectories. They can be confined in the city (for the taxis) or wider area (for example in the case of insurance data).

- **Census data**: data collected from the periodic census in which also some questions related to the commuters: workers, students; which is asked to describe their day travel means to go and return for studying and working.
- **People tracking** tools, for example using Wi-Fi and/or Bluetooth sniffing devices, TV cameras, etc.
- **Cellular network data**, coming from the Telecom Operators, referring to cells or clustered areas.
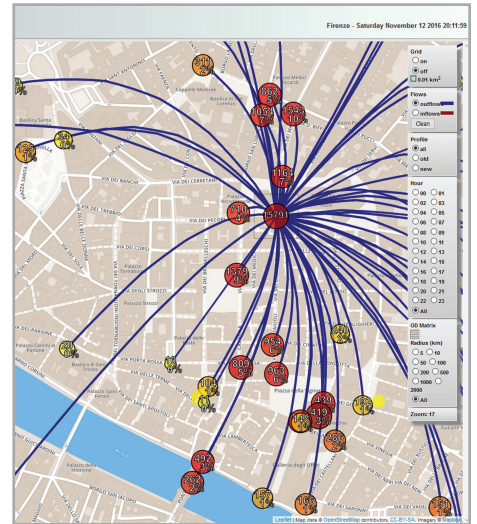
Due to the introduction of GDPR some of the above data are becoming harder or practically impossible to be obtained.

All these kinds of Origin Destination Matrices can be (i) used for simulation and analysis tools, as well as (ii) for direct visualization. Tools for the simulation and analysis may derive suggestion for public transportation, city consumption, city cleaning, service tuning, etc. On the other hand, a direct visualization may allow to perceive the critical aspects in a glance.
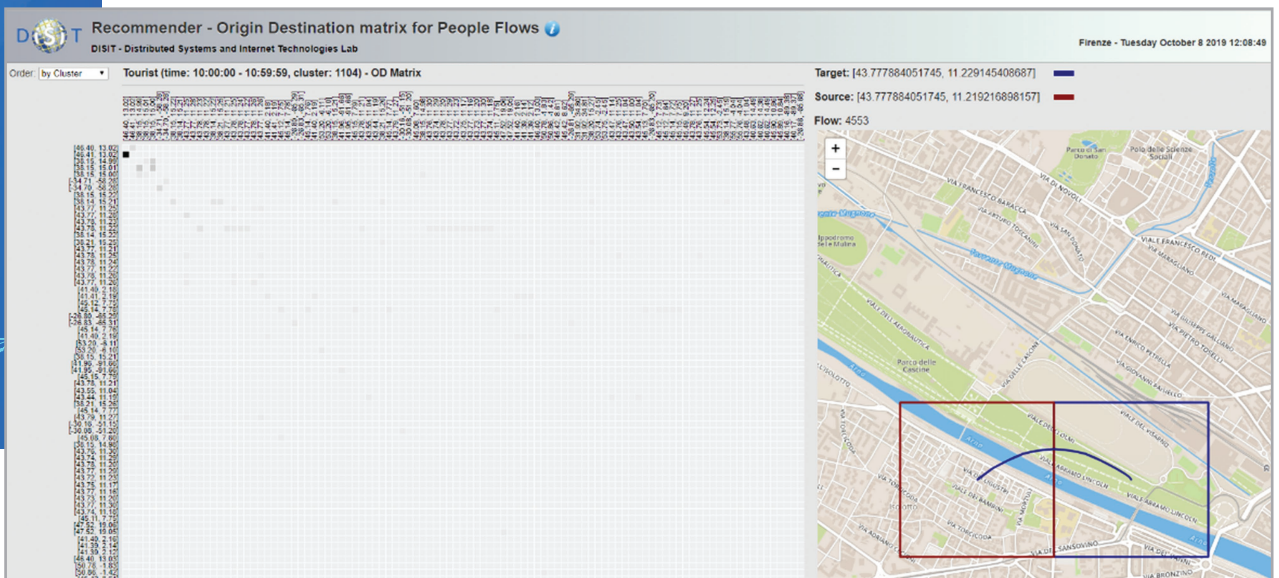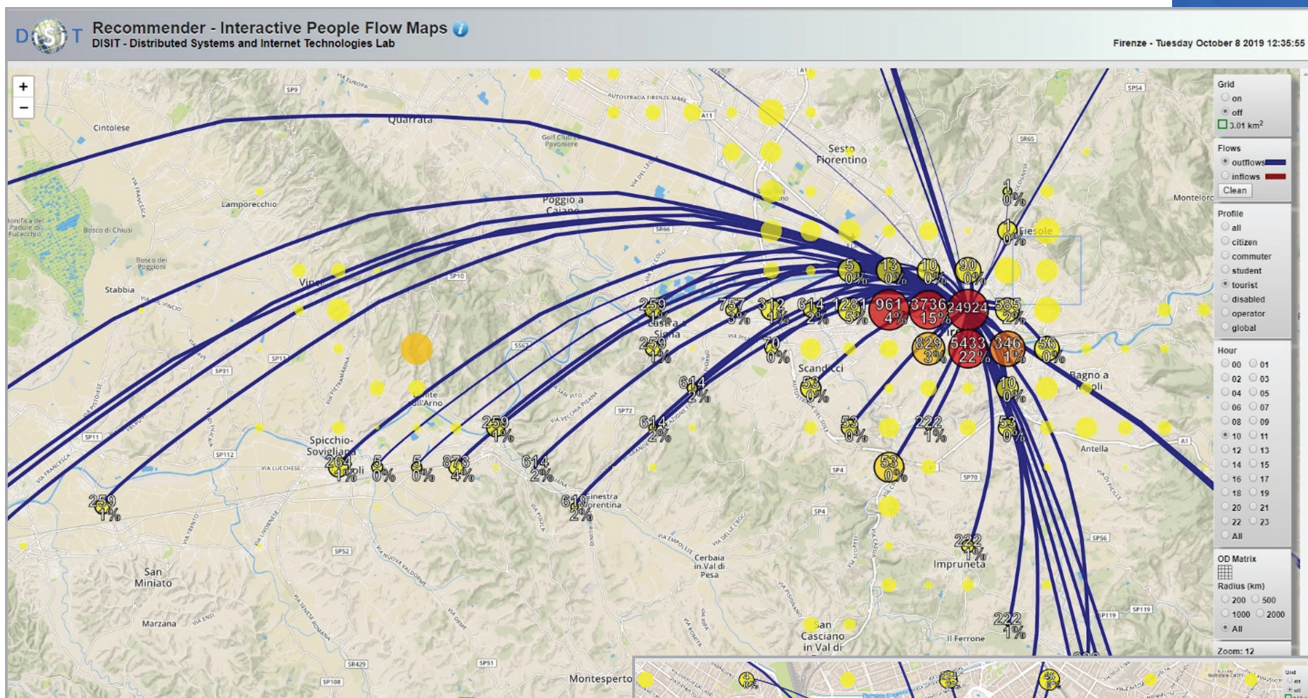
For OD matrix visualization, the classical matrix representation is not very effective since the matrices tends to the very sparse. See for example the figure.

An alternative, directly invented by DISIT lab is the Spider Representation. The Visual Analytics tool for OD Matrix representation of DISIT Lab is rendering OD matrices as Spiders is much more powerful for the direct understanding of the flows in the city.

Whith the proposed tool for OD matrix analysis one can:

- Select from Inflows and Outflows
- Hide and show the GRID
- Select the user profiles among: citizens, commuters, students, tourists, etc.
- Change the resolution and thus see the OD Matrix at different level of resolution, that means addressing different size of the areas. The areas can be squared as in the above case (with data coming from mobile Apps, OBU, etc.) or non-squared as those coming from Wi-Fi, or cellular data, etc. For example, in the figure the OD matrix computed from Wi-Fi data is reported.
- Define the time slot or see the whole 24 hours.

The computation of the scalable OD matrices is time consuming and it is typically updated daily taking into account data of the last months or weeks.

Simplified version of the tools could be used for communicating with the citizens and business operators of the city, for example, see the Dashboards produced for Life in Antwerp, Life in Helsinki in which a view of OD matrix as spider is proposed.

- TC1.18: Origin Destination Matrix: https://www.snap4city.org/459
- Dashboard Life in Helsinki with OD matrix: https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc1Mg==
- Dashboard Life in Antwerp with OD matrix: https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTcwNg==
- Dashboard Life in Toscana with Origin Destination matrices: https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc3NA==

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