# SNAP4CITY

Snap4Building Smart Buildings Digital Twin: monitoring, managing, controlling single and multiple buildings
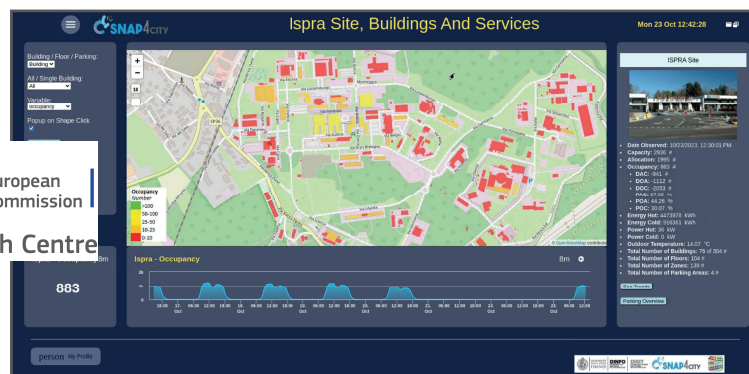
Snap4Building is a Digital Twin solution to monitor, control and manage distributed infrastructures of single or multiple buildings and facilities such as: spread hotels, thematic parks, villages, university campus, touristic parks, vacation parks, industries parks, ports, camping, large villas, shopping centers, chemical plants, shops of a chain, etc. They are infrastructures in which several buildings are managed by the same organization for energy, parking, logistic, presences, cleaning, air quality, conditioner, departments, subareas, etc. The aim of management and control may imply the control and optimization of resources' consumption, the identification of the best manner to user resources, the security and safety, etc. For the number of services provided and their high-quality demand, and for the high number of people involved, most of these infrastructures can be regarded as sociotechnical critical infrastructures.
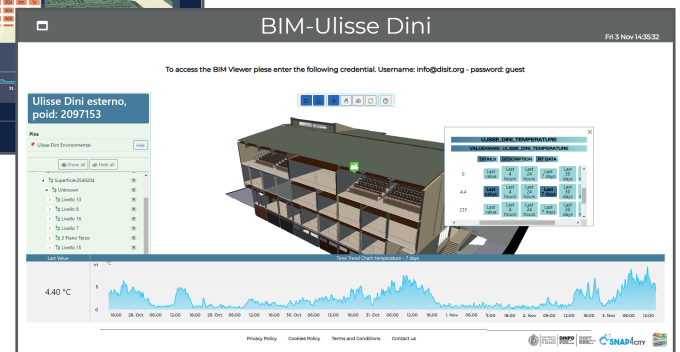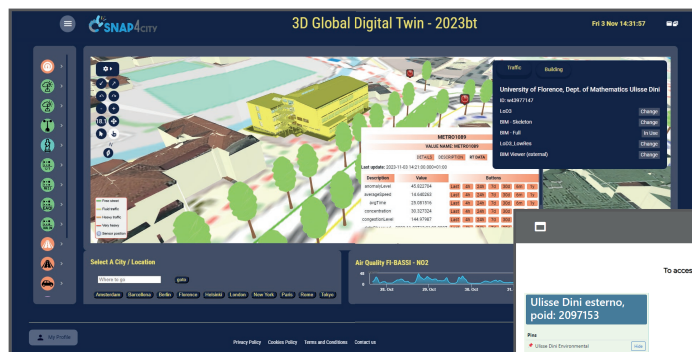
These complex distributed environments can be regarded as small cities, which have specific goals beyond the city services. In most cases, they need to provide high quality of services as specialized infrastructures for research, sport, culture, events, entertainment, etc., with a high density of people and technological solutions.

These integrated infrastructures need to be monitored and controlled at global and local levels (global and local digital twins) with all their resources at the same time with all their details:

- 2D/3D representations of the whole set of buildings, their maps and the connection of them with all local and global details and data, including underground or roof facilities, infrastructures.
- 2D/3D representations of each single building / service in the context of the city/area, and their relationships.
- representation can provide business intelligence tools to navigate in the data and structures, and also synoptics with floor and building interactive layouting
- Structural information as a BIM modelling of each single building or subarea.
- Entities (building, floors, rooms, parking, charging stations, gates, etc.) with their shapes and descriptors, and data monitoring the allocation to office, meeting, cafeteria, storage, stairs, elevator, labs, etc.
- Data and measures performed for each Entity, and for the whole or group of them. Data and information can be related to commercial, administrative, documental, infrastructure, technical, energy, etc.

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Each Digital Twin of Entity (Building, floors, rooms, parking, etc.) realize the digital counterpart of the physical entities and the solution computes e provides real time

- **information and indicators** regarding structure, allocation/designation, dispositions, real time data as heating, cooling, temperature, energy consumption, quality of air, allocation of people, presence of equipment, energy consumed or produced (for instance a specific area may contain some specific equipment with particular access and environmental control), sensors and actuators of the Entity, etc.
- **groupe in Zones** for monitoring, maintenance, and for supervision and control.

A relevant number of direct and indirect measures can be performed, as well as key performance indicators, KPI, can be computed in real time to manage the economy of each Entity, and from the data/ KPI of the each of them the computation of the costs, resources, etc., and status of the whole infrastructure can be obtained in real time. This allows to report the global KPI in the main control dashboard also in correlation to their usage of humans and machineries. Moreover, a large number of events and alarms have to be managed, the maintenance teams may be scheduled for regular ordinary maintenance, and recalled in emergency when critical event occurs, and a fast recovery is needed to avoid seeing a strong increment of costs. The real time assessment of measures and KPI is exploited for activating alarms. Sending maintenance and/or rescue teams.

Snap4City/Industry technologies which provides the interoperability with more than 190 protocols and formats, including the integration with:

- IoT data, protocol and formats of any kind: traffic, pollutant, environment, people flow, pax counters, etc.,
- GIS data, satellite data, Open Street Maps,
- Mobility and transport: GTFS from public transportation, parking status, vehicles position, fleet monitoring,
- Routing, conditional routing, and Multimodal touring,
- Energy data of any format and protocol: power energy controller,
- Photovoltaic installations, recharging stations, air conditioners, industry machineries, etc.
- Environmental aspects: external and contextual, temperature in the rooms set and actual, etc.
- People flows at gates and in specific areas, and their trajectories
- Security information and Video streams, such as Video Management Systems and any kind of TV cameras for security and supervision.

Moreover, Snap4Building can be connected with your data sources to keep the monitoring solution aligned to any change in the infrastructure due to restructuring and dynamic allocation of resources. Snap4Building can be customized according to data and environment taking modules and components from snap4City framework. The rendering on dashboards and smart Web Apps may include maps, time trends, stacked diagrams, origin destination flows, routing, floors, BIM, 3D rendering, energy heatmaps, temperature heatmap, pollutant heatmaps, video streams, pictures, forms, commands, people flow, etc.

The Snap4Building solution is based on Snap4City/Industry technology which is GDPR compliant, and passed the PEN Test and Vulnerability tests. It can be installed on premise, as well as on public or private clouds, in connection with Single Sign On, SSO, OpenID Connect, SAML/IAM, etc. and login compatible with SPID, European ID Card, EPSS, EU Login, etc. Snap4Building is presently used by ISPRA JRC of the European Commission.

Extended version accessible from: https://www.snap4city.org/970
Contact: https://www.snap4city.org