

DTwin – A Digital Twin Platform

Luis Ibañez Adrián

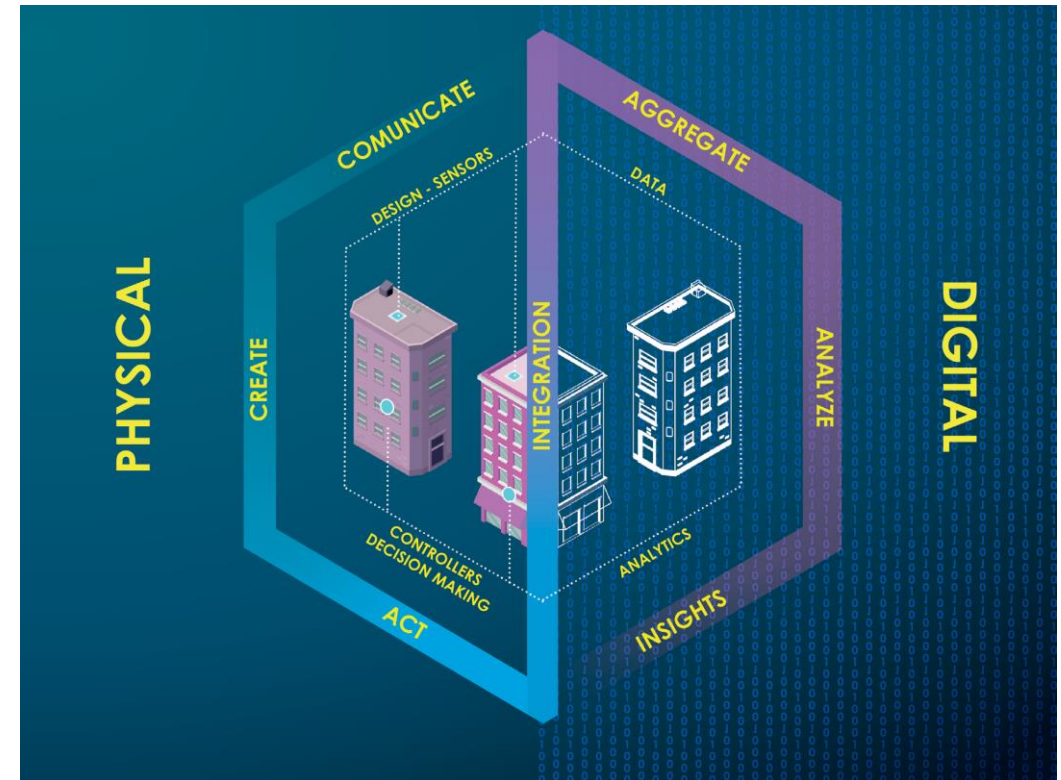
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What are Digital Twins?

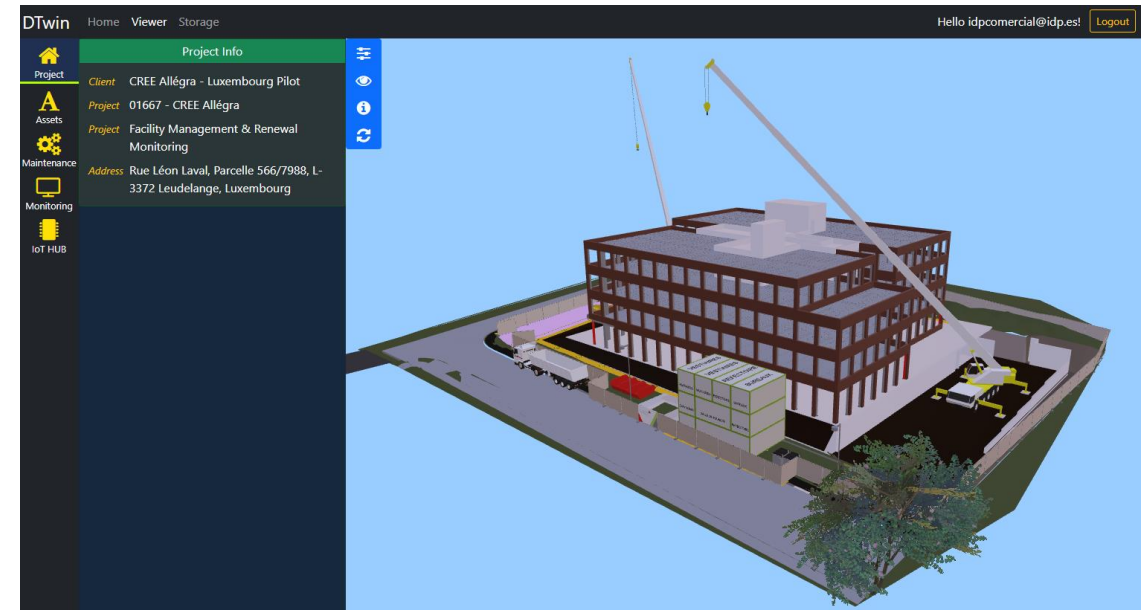
Digital Twins are virtual replicas of physical products, processes, or systems. It acts as a bridge between the physical and digital worlds by using sensors to collect real-time data about a physical item. This data is then used to create a digital duplicate of the item, allowing it to be understood, analysed, manipulated, or optimized.



The DTwin or Digital Twin is an application that is part of IDP's cloud-based services and solutions platform aimed to integrate 3D models of buildings, hospitals, shopping centers, industrial plants, railway infrastructures, roads, etc. that have been implemented under the BIM methodology with different existing solutions based on Facility Management, Asset Management, Monitoring Management, etc.

By default, the DTwin web application as part of the DTwin digital platform incorporates the following solutions:

- Asset Manager
- Asset Maintenance Management System
- Asset operations monitoring



Authentication: Each tool will use the IDP services to be able to authenticate; when the authentication is validated, the client tool will receive a token which will be used in each HTTPS request to the services of IDP, the token store's specific information related to the user and his current role assigned, to be managed by the server in each transaction between the client tool and the IDP services.

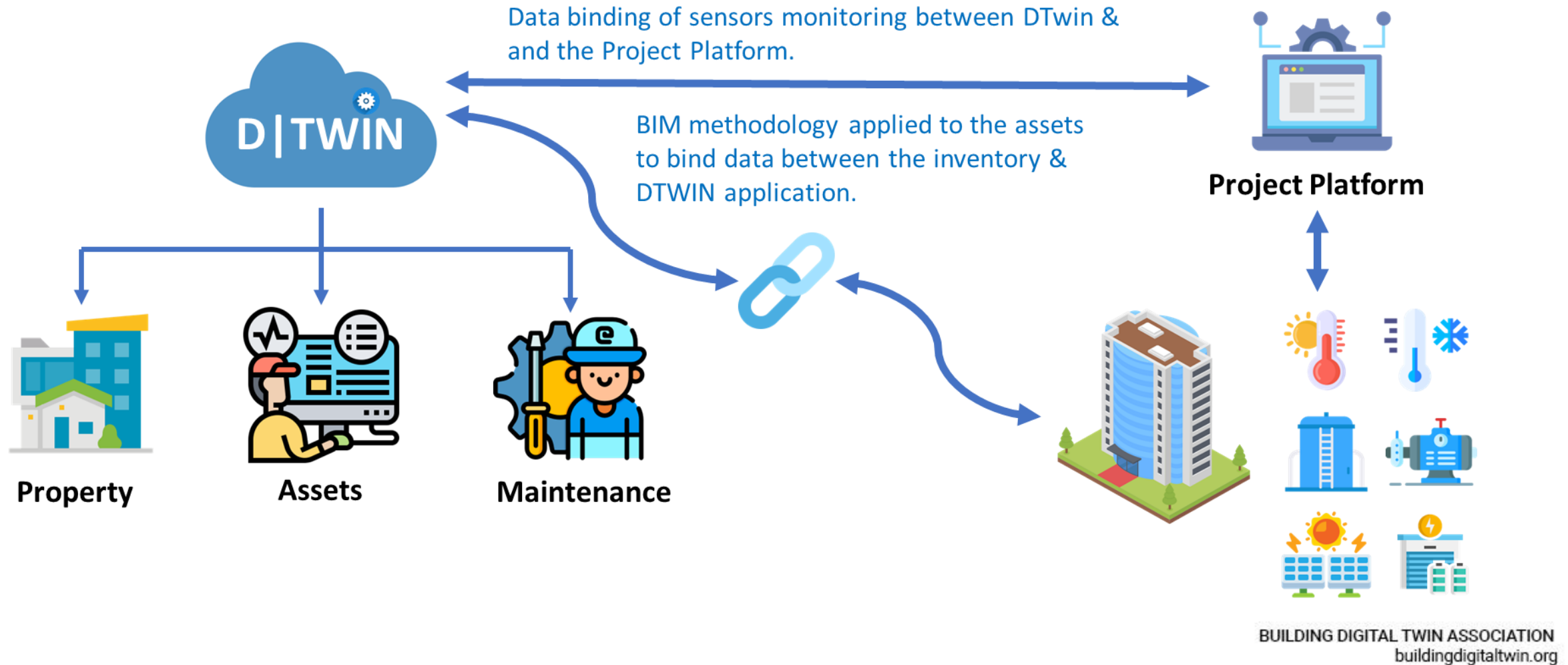
Asset Data: The tools will access the IDP services' model and sensor data. The services will provide the results for each request in JSON format. In cases where IDP services are used as a repository of information for the calculations performed by each tool, IDP will implement each solution according to the structure provided for each tool for such information storage. This will allow the tools to access historical simulation/process data and related documentation if available.

Facility Management: This is a specific service that allows to control and follow the maintenance during the asset's life cycle

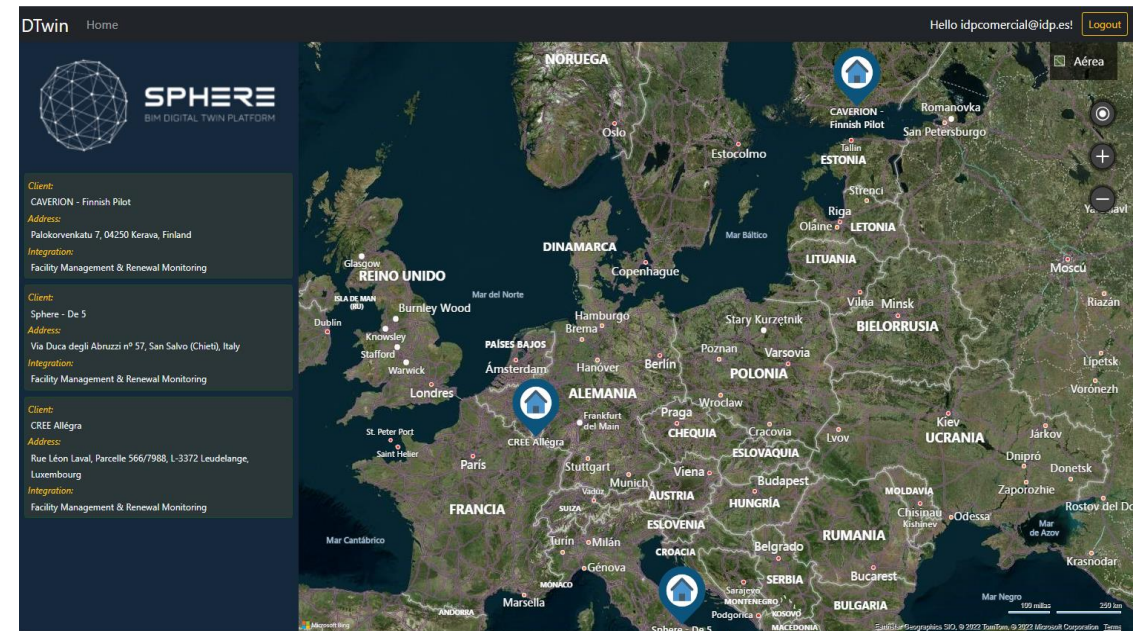
Sensor & Monitoring – Connection: This service is part of an IoT infrastructure that enables sensor data capture and is used by client applications to record and monitor their assets.

File Management: The tools will be able to access the documentation of each project in case they need it.

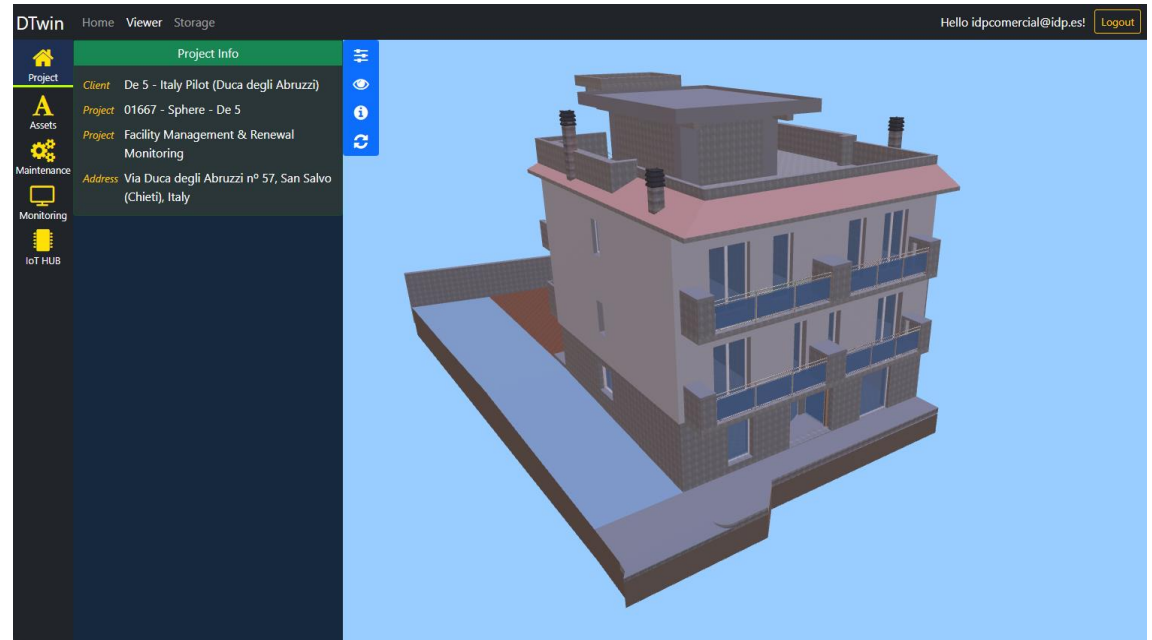
DTwin Includes the Following Modules



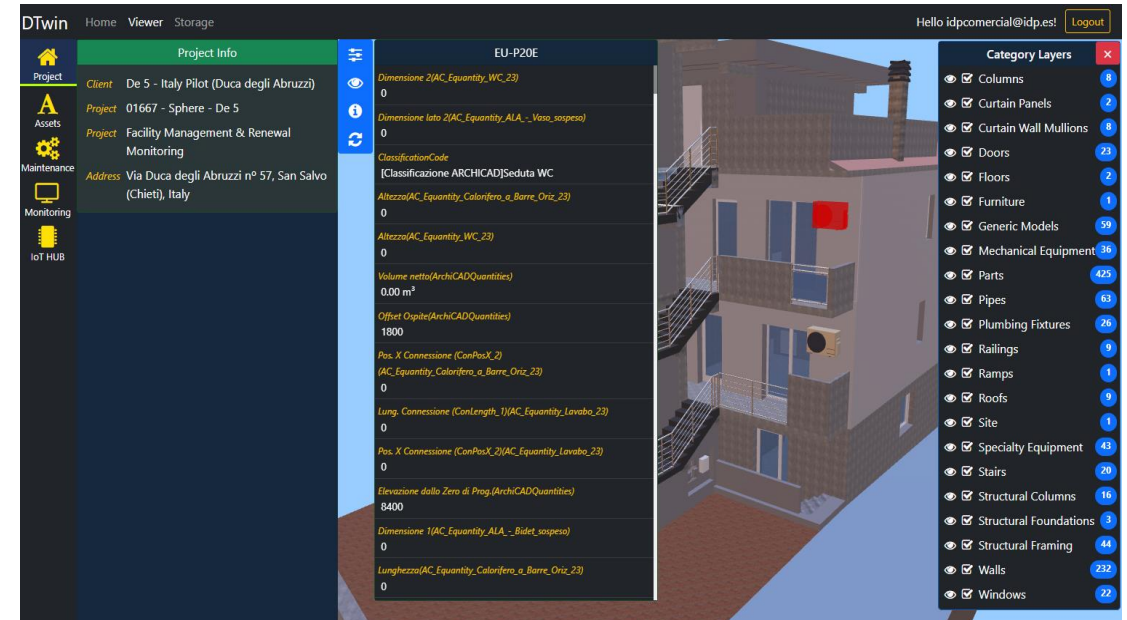
This is the main page where the user can view all his projects associated with the application, which will be located and identified with an icon on the map. Each icon represented on the map reacts to a mouse click event, which displays a pop-up window associated with the selected icon and lists the project description, the applied solution and a Viewer button, which allows navigating to the tab where the digital model is located with the functions assigned and applied to the project.



This tab contains the 3D model and implements the integration of the solutions applied to the project, it divides the main container into two sources of information, the left container, which is defined as the information panel, which refers to all the integration modules associated to the project and the right container to the 3D model, which is defined as the 3D viewer.

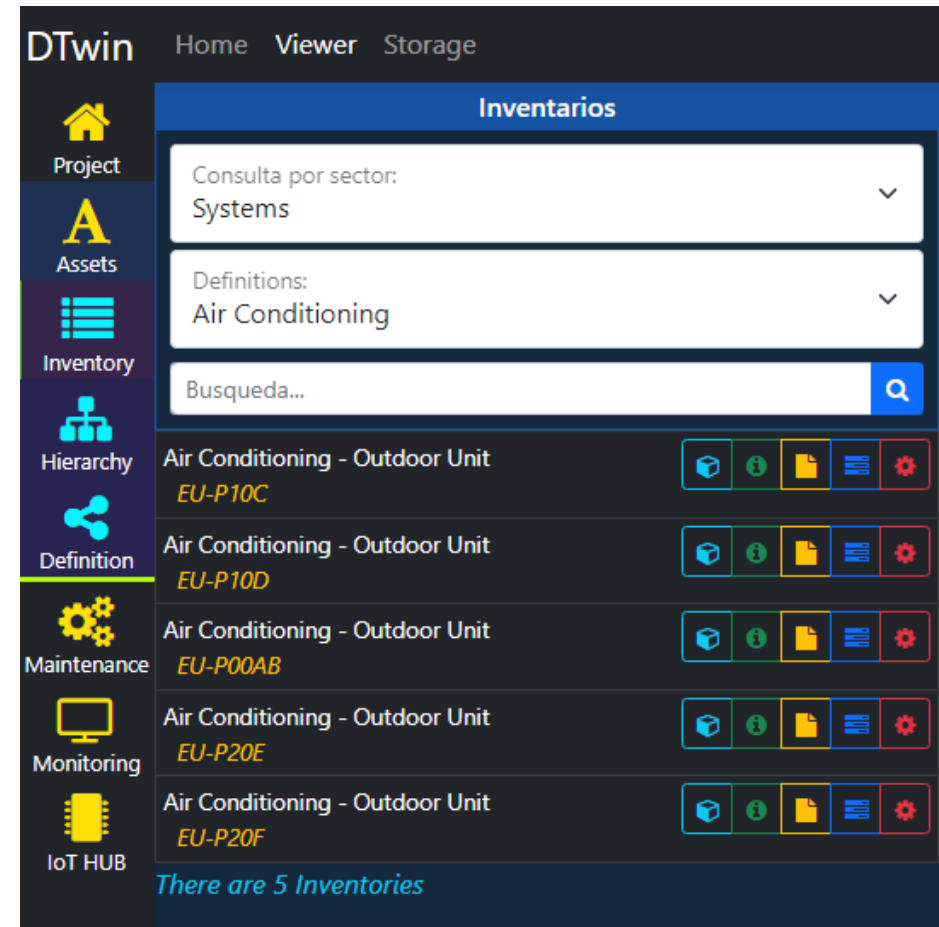


The 3D model integrated in the viewer contains functionalities that allow the visualisation of the metadata associated to the selected geometric elements, the associated information corresponds to the information provided in the design software.

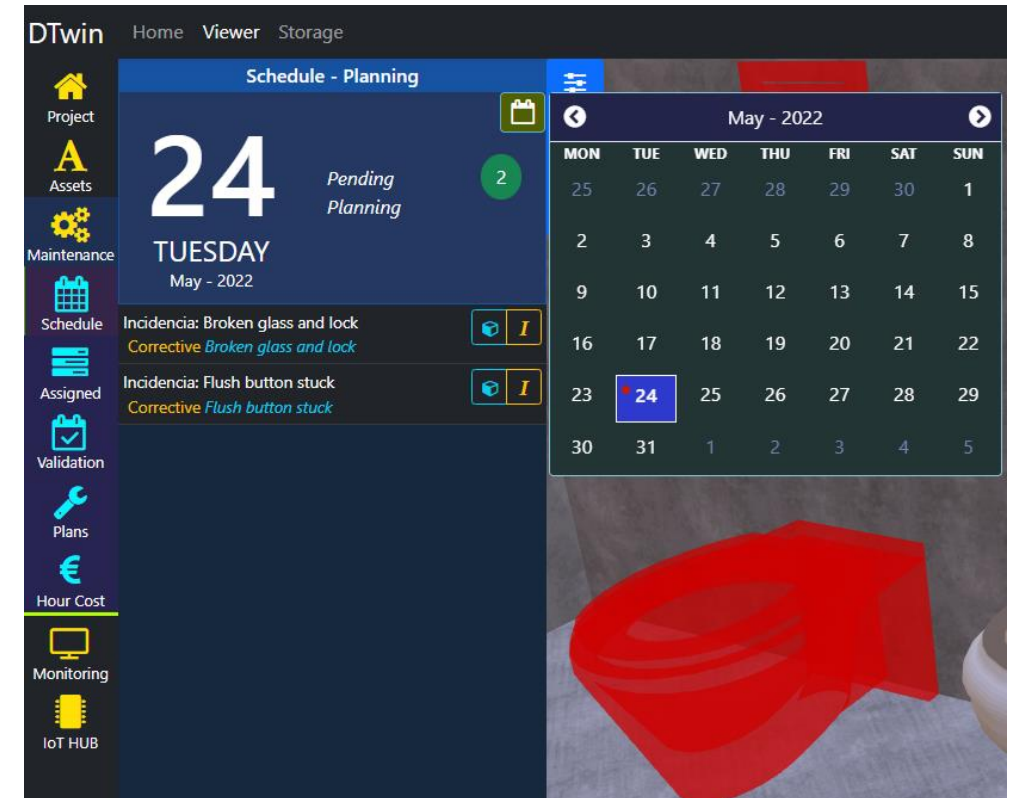


This module function is to manage, create and consult the assets that are associated with an inventory and are linked to a geometric representation in the 3D model. DTwin considers this module as an inventory:

- Any element that is part of a preventive maintenance plan.
- Any element that is part of the integration with monitoring systems.
- Any element that is part of the integration with existing PR, CRM solutions.
- Any element that is part of the integration with simulation systems.



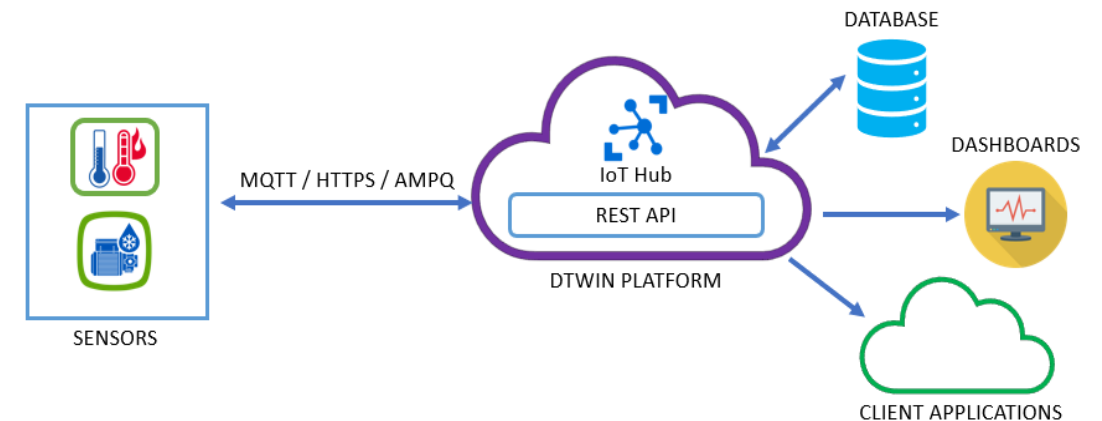
The Maintenance module allows managing the necessary actions to be applied to the assets, based on the associated prevention plans or corrective actions to be carried out in case of detention of deficiencies that alter the operation of the asset. With this, the module has a set of functionalities that allow the creation of prevention plans, work procedures, maintenance task planning, reports of the assigned tasks, validation and a function that allows establishing the costs for the maintenance tasks that will be used to estimate the costs incurred for each task performed.



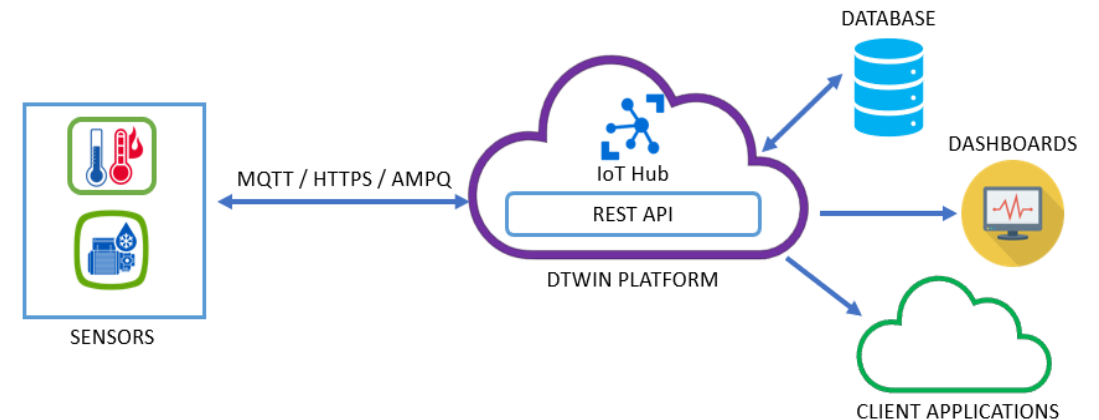
The Monitoring module allows to visualize the data from the sensors connected through IoT devices in real time.



- Protection of communications according to the functionalities of the devices, thus having SAS token-based authentication, individual X.509 certificate authentication and X.509 CA authentication,
- Registration, structuring, configuration, and administration of devices through a web portal suitable for this aim.
- Support for HTTPS, AMPQ, AMPQ over WebSockets, MQTT and MQTT over WebSockets communication protocols,



- Device data storage and data access via a REST API, which allows visualizing information by client applications,
- Linking and displaying the registration of devices with a 3D model whose source of information can be defined and provided by a Revit, IFC, FBX or 3D CAD model through the DTwin portal,
- Visualization of sensor data in real-time, recorded alerts, and graphical display of histories through the DTwin portal.



The storage tab is designed to store documentation associated to the Project; each associated document is encrypted through the Eurecat blockchain.

The screenshot shows the DTwin Storage interface. At the top, there's a navigation bar with 'Home', 'Viewer', and 'Storage'. The main header indicates the user is logged in as 'Hello idpcomercial@idp.es!' with a 'Logout' button. Below this, the page title is 'De 5 - Italy Pilot (Duca degli Abruzzi)' with a '+ New' button. The left sidebar shows 'Models' selected. The main content area displays a table of models:

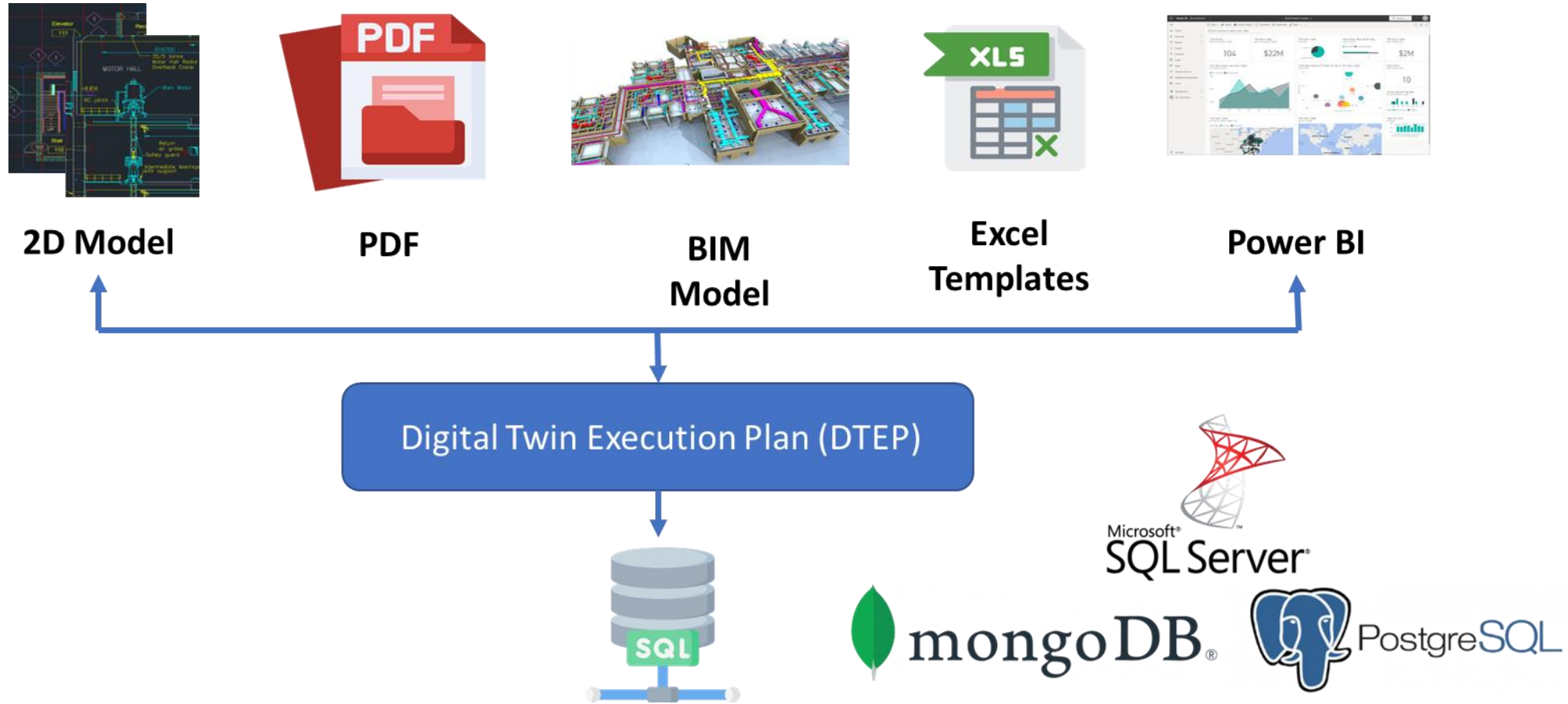
Name	Type	Creation Date	Modified Date	Current Version	Actions
Italy Pilot (Duca degli Abruzzi)_IFC4 (Design Transfer View)	IFC	10/18/2021		1.0	
Italy Pilot (Duca degli Abruzzi)_IFC4 (Reference View)	IFC	10/18/2021		1.0	

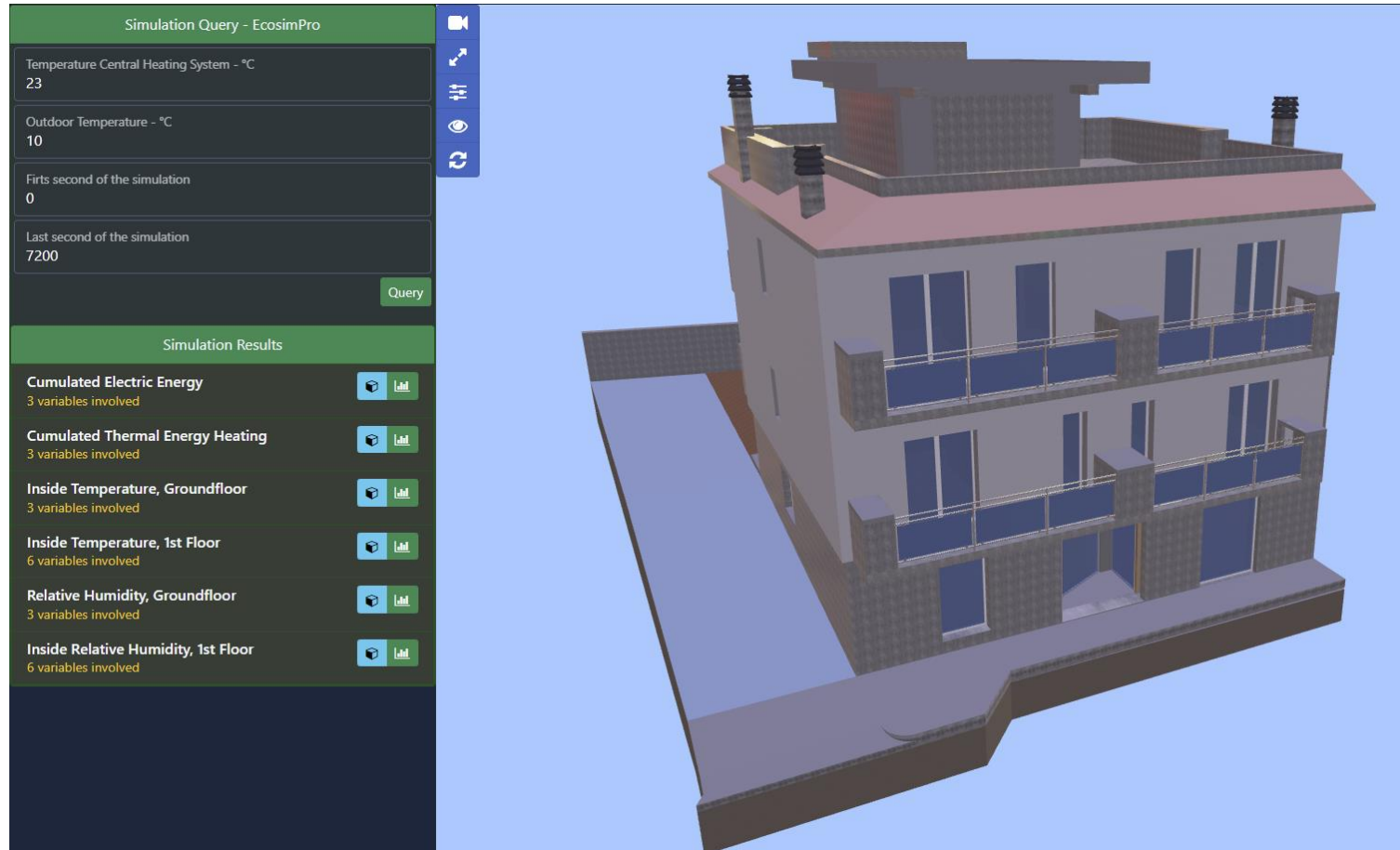
On the right sidebar, details for the selected model 'Italy Pilot (Duca degli Abruzzi)_IFC4 (Design Transfer View)' are shown:

- Creation Date:** 10/18/2021
- Modified Date:** 1/1/0001
- Current Version:** 1.0

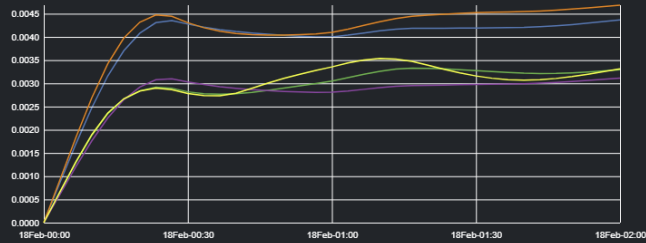
Below this, there's a section 'Choose file to update' with a dropdown menu showing 'Seleccionar archivo' and 'Ninguno archivo selec.'. An 'Update Version' button is present.

At the bottom of the sidebar, the 'Transaction Id' is displayed as a long hexadecimal string: `ae196b9590e5b1d9b3d226101484fa3ea66df33e8738c588261628fe745e33`. The 'Register date' is 18/10/2021, and the 'Version' is 1.0. The user 'Luis Angel Ibáñez Adrian' is listed with a download icon.

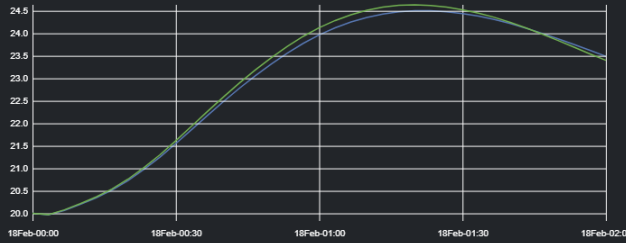




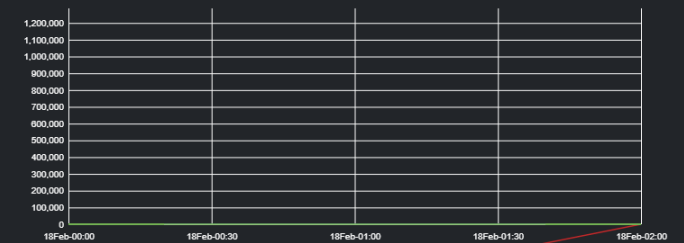
Inside Relative Humidity, 1st Floor



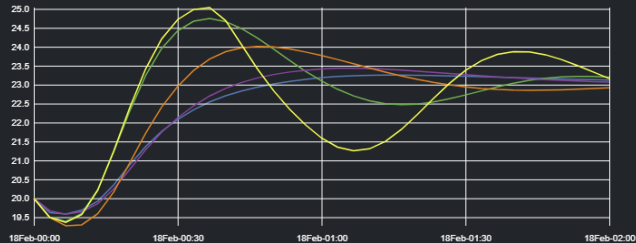
Inside Temperature, Groundfloor



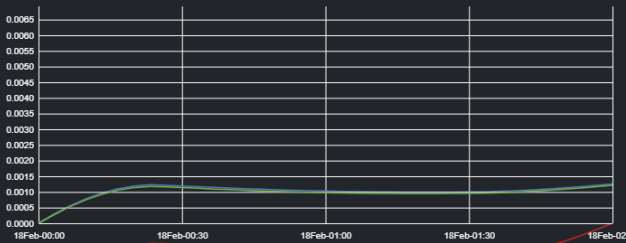
Cumulated Electric Energy



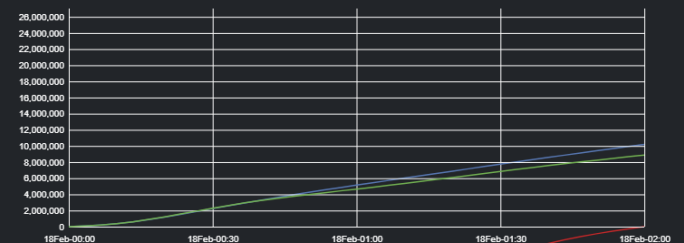
Inside Temperature, 1st Floor



Relative Humidity, Groundfloor



Cumulated Thermal Energy Heating





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