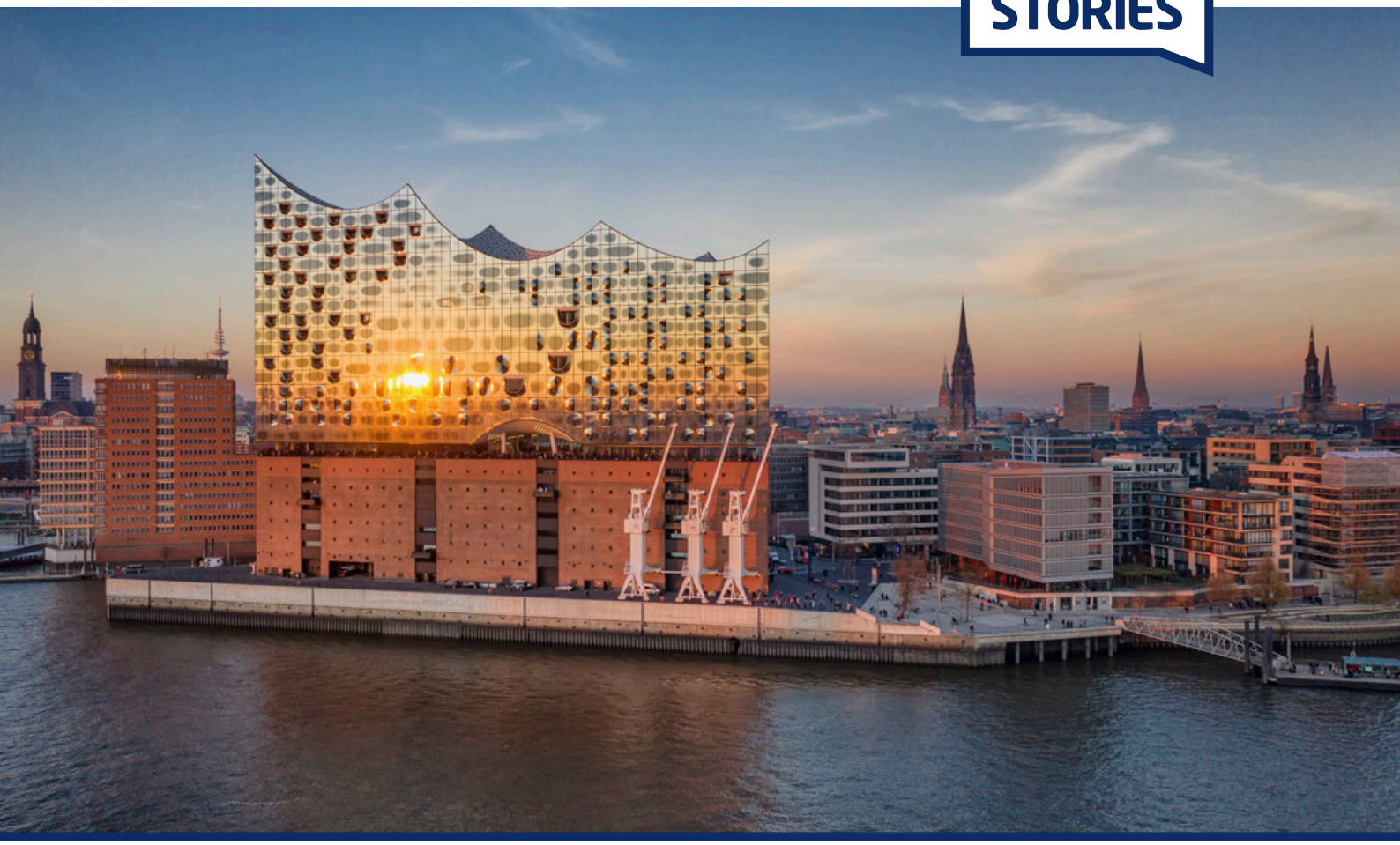
FIWARE
Open APIs for Open Minds

FIWARE IMPACT STORIES



SMART CITY AND OPEN PARTICIPATION

Smart City Lab in Hamburg: FIWARE Open Source services and Data Platform

With the contribution of

ENGINEERING

FIWARE - OPEN APIs FOR OPEN MINDS

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Challenge & Context

In today's world, cities, municipalities and entire regions are faced with a multitude of challenges. For example, cities and municipalities must ensure that their future development is based on factors such as environmental protection and attention to climate change, but also on social aspects such as the involvement of all stakeholders[1] in the planning process. The local economy is also concerned with the use of innovative methods and technologies to make processes climate-neutral as much as possible.

These and other related challenges put pressure on the public and private sectors, which have to provide citizens with an attractive and competitive place to live in. Digitalization offers an opportunity to solve these issues. The cooperation between local and regional companies, together with public administrations, take on this task and test the effectiveness of suitable measures in initial pilot and research projects. Support is provided by broad funding initiatives as well as recommendations for action, which help the involved actors to draw up the necessary concepts and create the right frameworks for planning and implementing suitable measures.

The city of Hamburg is a digital pioneer in Germany and its **digitalization strategy aims to further improve its urban economic and social scene through new digital services**. One of the objectives is to promote climate and energy transition and to develop suitable transformation paths, together with local stakeholders such as associations, business and civil society.

The Climate Plan 2030[2], for example, describes possible approaches that will **minimize CO_2 emissions** in the long term, while **guaranteeing the quality of life, safety** and **health** of people in the city as well as **economic prosperity** and **political stability**[3]. Focal points are, among other things, energetic rehabilitation buildings, heat and energy system transformation and alternative mobility concepts. During

[1] Cities of tomorrow - Challenges, visions, ways forward

the implementation phase, attention will be placed on the involvement of various actors and concrete measures will be proposed for private homes and the industrial, commercial and service sectors, among others.

In this context, **the Hamburg Chamber of Industry and Commerce was asked to propose measures to update the Climate Plan 2030**. The results were discussed in the **"Climate" project group**. The group focuses on the benefits of applying digital approaches, supported by a cooperation between business and citizens in order to enable the establishment of a modern neighbourhood management

Engineering DSS GmbH **took part in the discussion and contributed with its extensive knowledge of modern technologies in the field of Smart Cities** and also its know-how in the **Energy sector**. The discussion resulted in an approach for participating in local projects, in which *Engineering* used an **Open Source services and Data Platform based on FIWARE**. To do so, *Engineering* has integrated **data from the Hamburg transparency portal** and private sector service offers. Two neighbourhood districts were identified in the areas of business and living and suitable applications for digital services in the civil and economic environment were implemented.

Solution

Local collaboration projects in Hamburg

To ensure a high level of adoption, local collaboration projects were **implemented on the FIWARE Data Platform**. *Engineering* provided the platform on its systems during the project phase and worked together with the project group as a neutral

[2] 2030 Climate & Energy Framework

[3] United Nations Secretariat Climate Action Plan 2020-2030

data trustee for a secure and standardized data exchange. The platform acted as a tool to create efficient services for citizens, foster social participation, economic development and the rise of innovation spaces, based on the local area.

In two neighbourhood areas, corresponding IoT sensor technology for energy-saving management was made available to local stakeholders and for the use of energy, mobility, economy and citizen services and was implemented and evaluated for digital urban developments. These applications were implemented in Engineering's Smart City Lab (Hamburg) while results were made available to all participants.

An important function of the **FIWARE Data Platform was to aggregate cross-field information from distributed data, services and events and make them available to users and service providers**. By combining existing public data with data from the different fields in the neighbourhood areas, new data and new services were created.

Smart neighbourhood areas und digital services

In the neighbourhood areas, the structure and causal relationships of digitalization were consequently examined. Overall, it was concluded that both neighbourhoods could benefit from significant improvements in urban mobility, energy, the environment as well as the economy, also thanks to social participation.

Figure 1 - Area of activities

Smart City created through networking

On this basis, the use of the **FIWARE Data Platform** enabled *Engineering* to implement applications in a cross-field approach. Local systems were connected with each other across platforms and thus implemented the first Smart City application on a local level.

Digital urban planning through a System-of-Systems approach

Engineering supported the **merge of construction management processes** on the basis of the **Building Information Model (BIM)** and **publicly available data from the Hamburg transparency portal** to create new services offerings in energy and building management. This connection and the use of simulation data for local climate and traffic modelling was additionally demonstrated in a prototype.

The created platform offers the opportunity to collect proprietary data from different systems with insights such as environmental measurements or the city's digital models of development plans.

Moreover, *Engineering* showed that existing buildings can also be integrated into a digital planning process. In one application, the company connected the building data from a LoRaWAN IoT farm with the FIWARE Data Platform and, together with information coming from a weather API, built a model that calculates the temperature increase in a building due to solar radiation; it then makes recommendations for building climate control.

This way, building operations can be simulated under various influencing factors and important findings about sustainable operations can be determined such as the optimum time for ventilation or intelligent heating control. In addition to setting up the service, the company also used a 3-D visualization of the neighbourhood area, based on the publicly available 3-D city model of Hamburg's transparency portal.

For this application, Engineering used an external GIS including visualization tools, and linked this data with real-time building data and recommendations for action via web services.

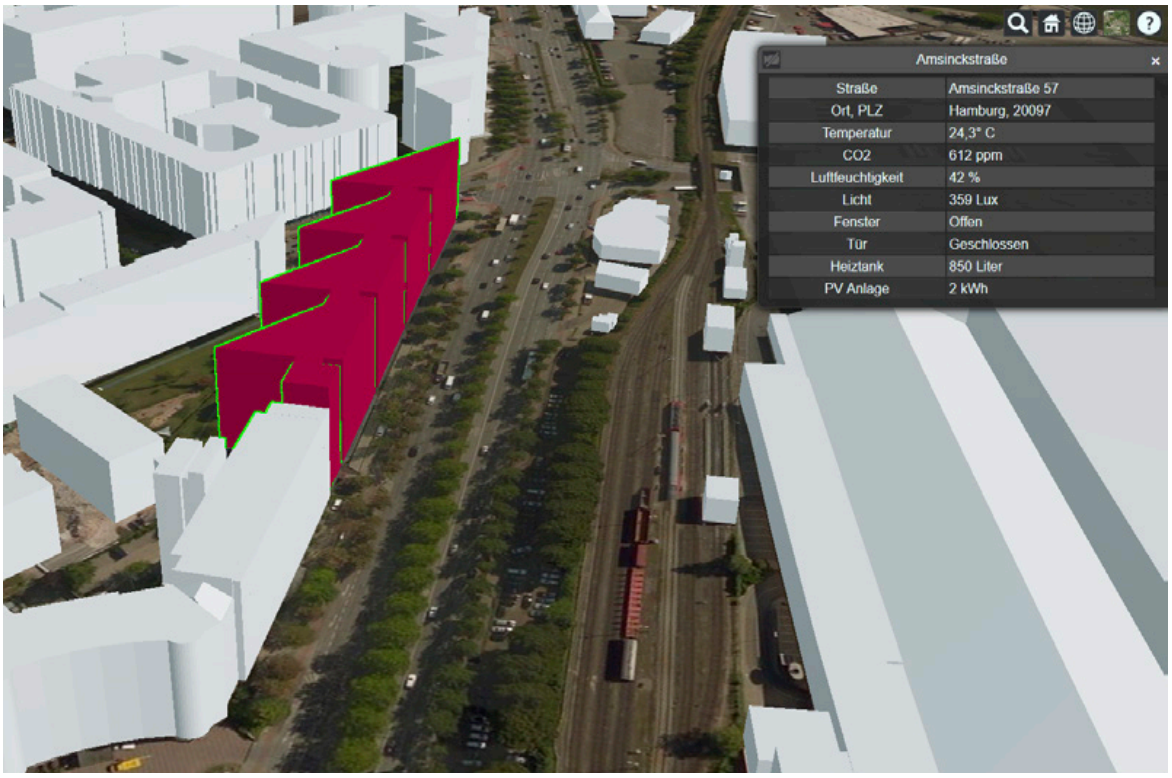

Figure 2 - System-of-Systems approach of digital urban planning

Urban mobility and digital citizen services

By using the FIWARE Data Platform, important information on local conditions, such as **air quality**, **traffic volume** and **local mobility** (such as **bike sharing**), can be **collected and viewed centrally by the involved parties**.

This way, users can **select the best means of transport on the basis of current conditions and, at the same time, raise awareness of environmentally friendly mobility** options in the neighbourhood areas.

For this specific use case, *Engineering* **obtained information about the local bike rental stations from the Hamburg** transparency **portal and connected them to the FIWARE platform via an APIs** with data generated through a navigation service

provider and a weather service. This combined information was made available to the public through an interactive dashboard.

The implementation shows that existing data can provide an important added value and that new digital citizen services can easily be created when using the FIWARE platform.

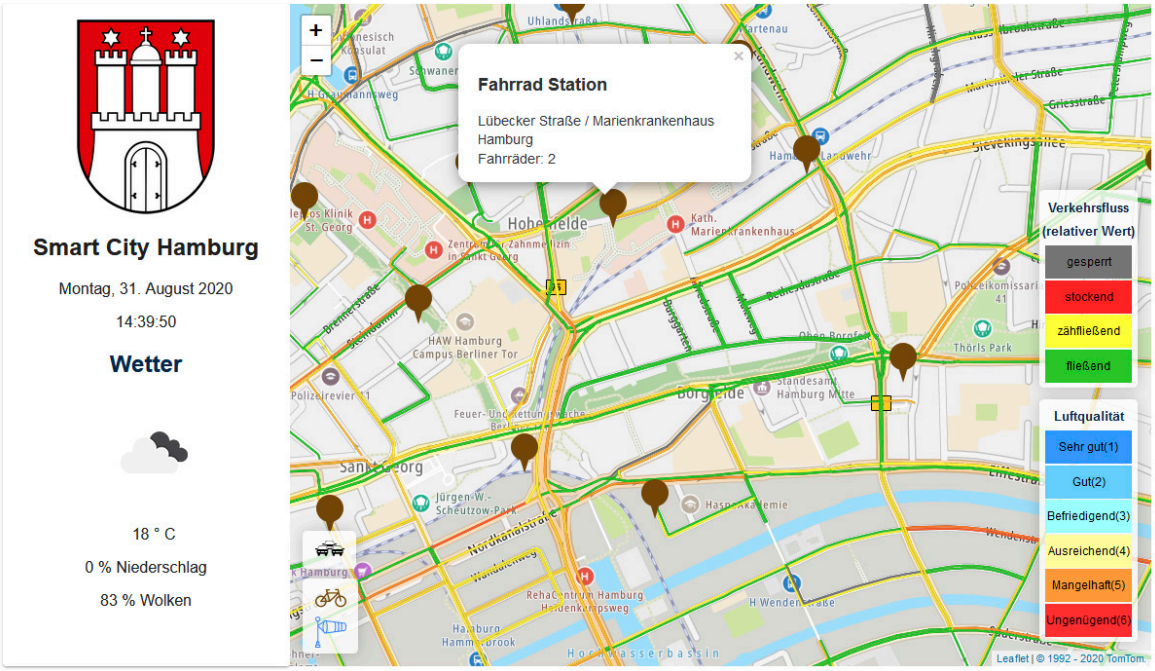

Figure 3 - View of an interactive dashboard for local mobility

Energy management and building control systems

In addition to optimizing energy consumption, CO2-minimised energy procurement is also a building block for decarbonization with small and medium-sized businesses. As a standardized interface, intelligent power grids (smart grids) offer a universal, cross-manufacturer modular system for block-type thermal power stations, combined heat and power systems, battery buffers and photovoltaic systems and, as virtual power stations, form the basis of such smart grids.

By using the **FIWARE Data Platform**, *Engineering* can **deliver end-to-end processes** and focus on the following areas:

- Remote access to technical systems (control/regulation);
- Efficient data analysis (formation of sums, meaning & limit values);
- Error management (incidents);
- Plant documentation, reporting;
- Key figure management (energy balances, CHPs, generation plants, storage facilities, etc.);
- Data exchange with existing systems;
- Energy controlling system of the energy management office.

FIWARE Data Platform is able to connect building management systems across all properties and is, thus, an interface to the buildings and systems of the users. The FIWARE Data Platform collects distributed information and makes it available to the various users, hence, facilitating the administration and management of the properties.

In one use case, *Engineering* was able to connect the generation output of a photovoltaic system and other building data using the platform interfaces and providing a service that predicts generation output, based on available weather data. This information could be used to plan the volatile performance cycles of the plant and, thus, support the development of the local grid.

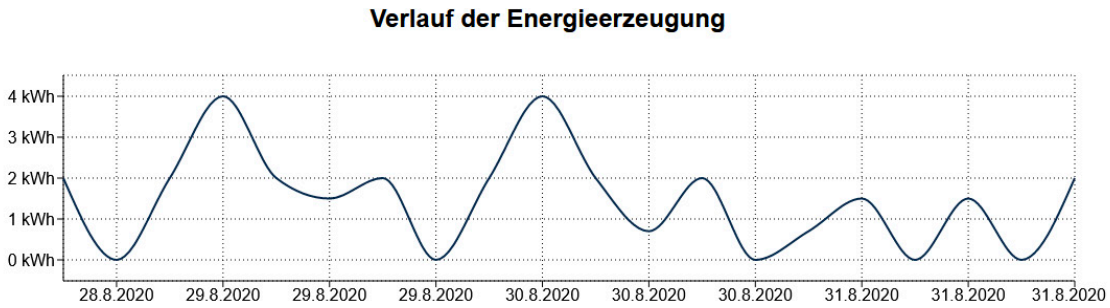

Figure 4 - Extract of the forecast for local energy production

How it works

The FIWARE Data Platform enables the use of open data portals, provides the functionality to connect information via REST API or MQTT interfaces and enriches or stores this information in further processes to new data services. It is also possible to connect cross-platform applications, such as BIM, GIS, or IoT systems - to mention but a few - in a system-of-systems approach, using a standardized data exchange procedure.

To enable these functions, various FIWARE modules were used as well as other established Open Source modules present within the platform. The system was designed as an open container-based system for modern micro-services, which are highly scalable. To achieve this, *Engineering* is developing partnerships with local actors supporting them with agile project and requirements management.

The core components of the platform

Engineering drives various testing processes to use FIWARE and other Open Source modules like:

- **FIWARE Orion Context Broker** - The central data orchestration tool of the platform;
- **IDAS** - Enabling the connection of new IoT-Systems;
- **IDRA** - Offering an overview of the contents of the connected Open Data Portals;
- **STH-Comet & Cygnus** - Allowing data to persist;
- **Perseo** - For automated actions on an event basis;
- **Keyrock** - The central tool for user and role concepts;
- **Kong** -API management tool for platform security and provision of data and services;
- **Apache NiFi** - Allowingnew data and services to be created via a graphical interface;
- **Grafana & Prometheus** – Offering the monitoring of the interfaces.

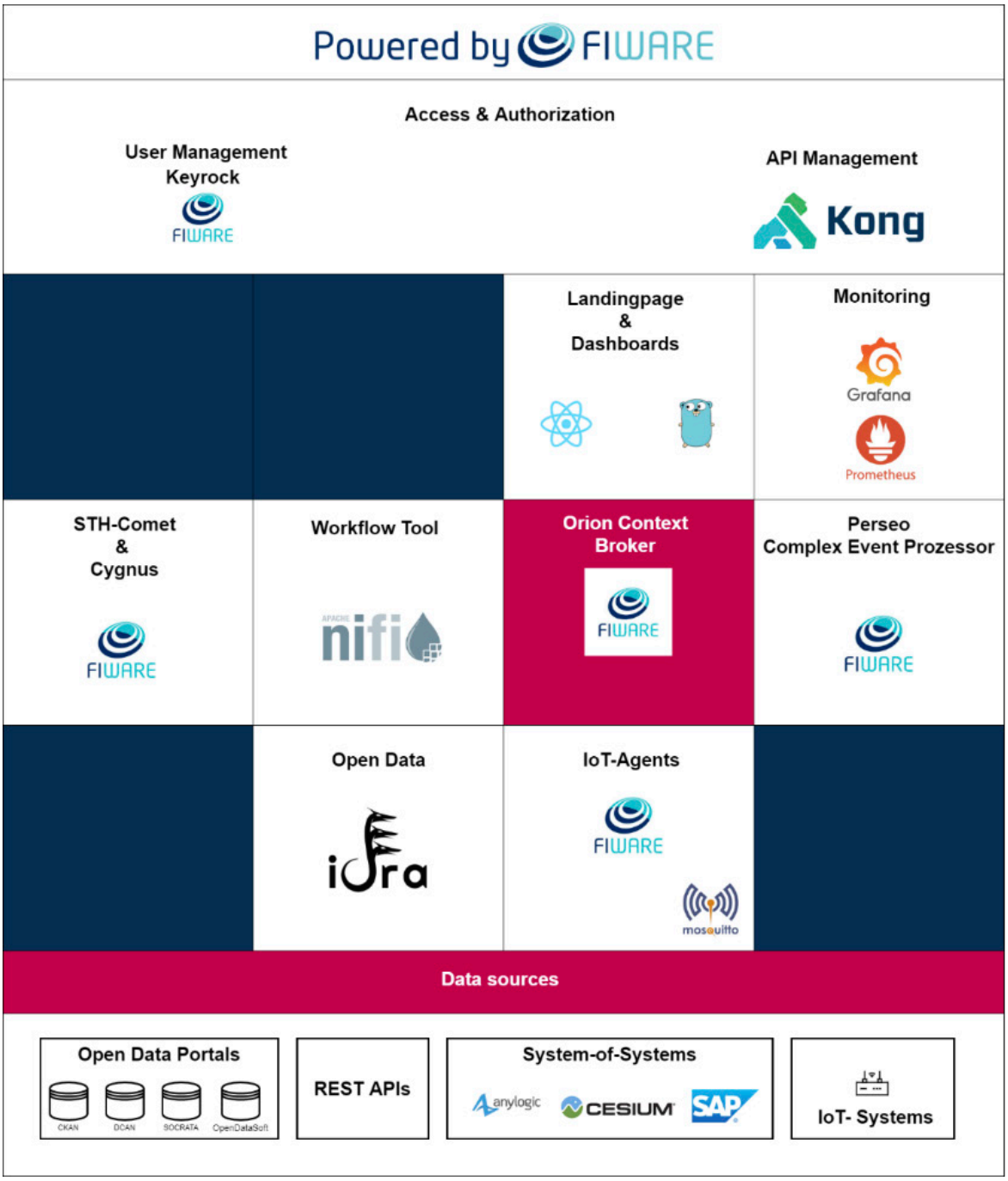

Figure 5 - Overview of the modules used with the platform

Deployment and operation

The platform can be provided in different variants. For instance, the Platform-as-a-Service (PaaS) is provided also in a German cloud environment. The deployment and service team takes care of the operation and maintenance of the system and provides 1st and 2nd level support in German language.

But the system can also be installed in local data centres operating independently. Due to the agile and modular project and service concept, a wide range of cooperation possibilities are in place throughout the design, implementation and the operation phase.

What is the meaning of collaboration?

The platform enables the active involvement of stakeholders, e.g. city employees, citizens, municipal & private companies, and organizations. They can use the platform to develop new digital data and services and make them available individually.

For this purpose, *Engineering* through the Keyrock module, offering the following roles:

- **Administrator**
  Is responsible for user administration and the management of data and services on the platform.

- **Data providers**
  Users who want to provide their data from sensors, inventory systems, or other interfaces.

- **Service providers**
  Users who create new services based on the available data and services on the platform and make them available to internal or external users.

- **End-users**
  Consumers of the data and services.

Benefits & Impact

- Provided as a Platform-as-a-Service, ideas and projects can be implemented fast and efficiently;
- The open and modular architecture offers the possibility to establish individual development partnerships;
- Through the best practices user and role concept, local participation projects can be implemented and actors can actively participate in shaping the place in which they live in;
- Cross-field applications in the form of new data and service offers can be developed through the platform and thus contribute to minimizing the challenges of the time;Open interfaces enable the development of system-of-systems applications and deliver added value across system boundaries.

Added Value through FIWARE

- The FIWARE Generic Enablers offer a wide range of functions for users building a multi-purpose platform;
- Due to the microservice architecture of the modules, extensions can be easily integrated into an existing system;
- The FIWARE interfaces and data standard NGSI allow the harmonization of different data and extend the value chain of existing data;
- FIWARE is made up of a A global community that is constantly growing and developing new functions and tools to ensure that the FIWARE Data Platform is up to speed.

References

The described applications from the Smart City Laboratory in Hamburg as well as further information about the FIWARE Data Platform can be found on: smart-solution.eng-its.de/

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Categories

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