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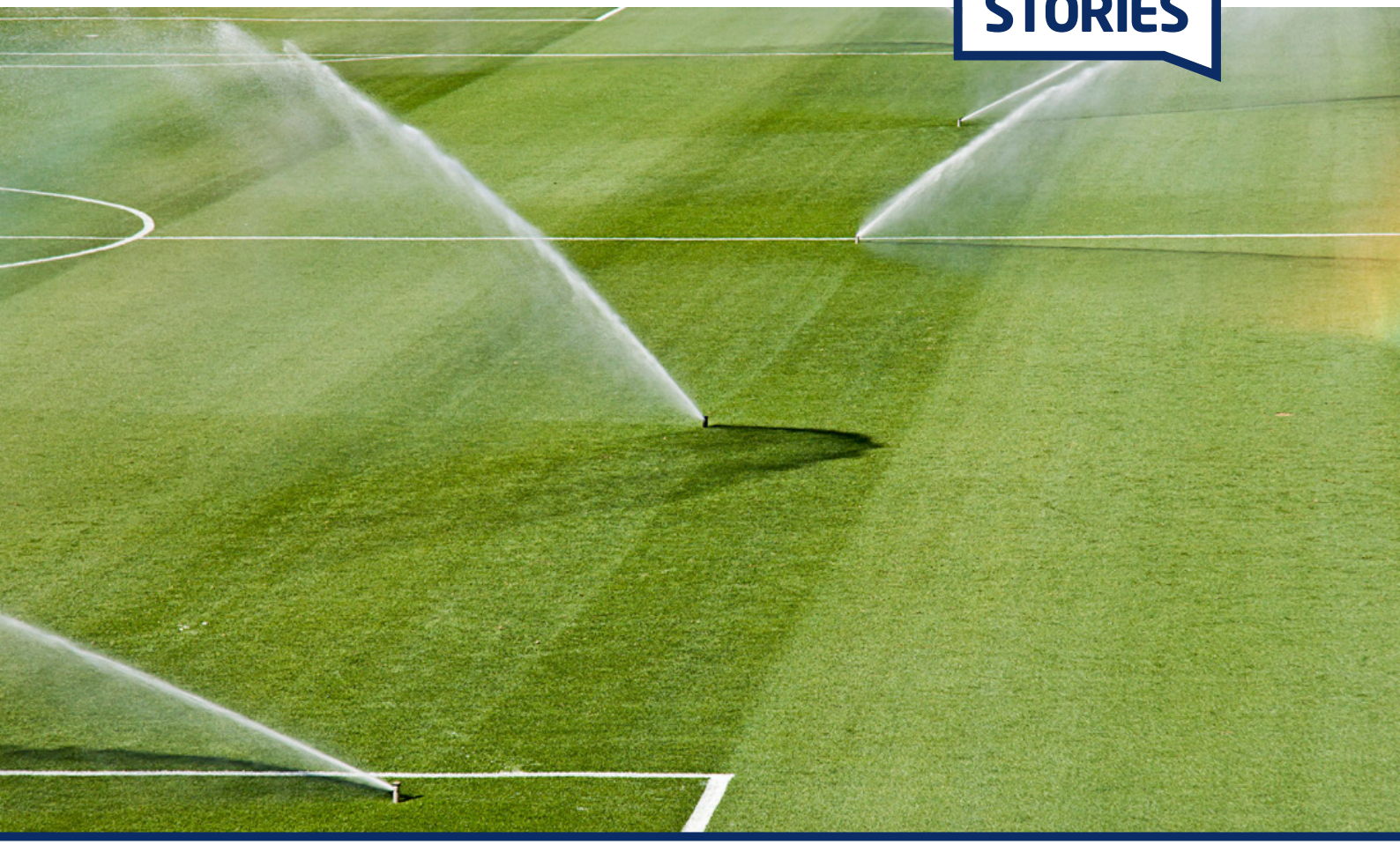

SMART CITIES AND SMART WATER

Digitalization in Saint-Quentin's stadiums: City-as-a-Platform Concept

EDITION 2

With the contribution of

SAINT QUENTIN

FIWARE - OPEN APIs FOR OPEN MINDS

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Challenge & Context

Cities of today face many challenges, the first of which is their ability to **provide basic goods and services to their inhabitants, including – above all – water**.

To achieve the many goals around a state-of-the art water supply and treatment, **digital technologies** are being adopted. These technologies are playing a critical role in aiding the collection of valuable data in real-time whilst enabling more efficient use of resources. These technologies additionally promise to reduce the pressure of economic and population growth on water consumption.

Special attention is needed in order to integrate digital technologies with existing technologies for managing distribution networks to achieve energy savings, waste reduction and environmental performance, to name but a few.

In the framework of the **Interreg 2 Seas SCIFI[1] project, the city of Saint-Quentin[2]** (France), in collaboration with the **cities of Bruges and Mechelen (Belgium) and Delft (Netherlands)**, is exploring new ways to improve public services. This project specifically aims to help medium-sized cities create value from data and offer better services. To achieve this goal, SCIFI partner cities are applying innovative procurement procedures, implementing interoperable solutions and data platforms, and opening up their data.

During the SCIFI project, twelve challenges were launched in the field of energy, environment and mobility.

Start-ups and SMEs have been selected through calls for proposals to deploy and test their solutions in SCIFI partner cities.

[1] SCIFI partners (4 cities, 2 international open data experts, and 2 business networks) identify the need for transnational framework conditions that 1) create a cross-border market that gathers the fragmented resources of cities and smart innovation potential of businesses and 2) increase the capacity of cities to activate the dormant demand for smart public services.
[2] Saint-Quentin is a city of about 56,000 inhabitants located in northern France.

The Green Spaces Department of the Municipality expressed the need to **modernize the management of stadium maintenance operations, with a dual objective**, to reduce:

- water consumption in sports fields by implementing a decision support tool to assess the actual water needs of the turf using open data;
- workload of the staff by setting up a remote control system of the maintenance operations of a field and the equipment associated with it (mowing robots, irrigation system).

When Saint-Quentin decided to embark on the path of digitizing its stadiums, multiple challenges arose during its digital transformation journey such as:

- Integrating and managing the Internet of Things (IoT);
- Collecting, storing and giving access to all data feeding digital solutions;
- Ensuring interoperability between heterogeneous data and systems;
- Building bridges between vertical data silos;
- Translating the needs expressed by end-users into technical requirements to meet expectations;
- Ensuring excellence in coordination in a public market between the different layers composing a digital solution (integrating hardware i.e. sensors, software i.e. business applications and orchestration i.e. the data platform);
- Ensuring the acquisition of interoperable solutions giving more flexibility and sovereignty to the public purchaser.

The SCIFI programme has acted as a catalyst for the city of Saint-Quentin and enabled it to embark on the digital transformation of the management of its sports grounds under the right conditions.

Based on the learning experience of the cities, the SCIFI project published a Smart Cookbook for mid-sized cities, a guide compelling their bests ingredients and methods on creating the best smart city projects.

Solution

The intelligent and autonomous watering solution deployed in Saint-Quentin is the result of an iterative approach in several stages:

1. an eight-month **experimental phase**;
2. a **public procurement** phase in order to scale up thanks to the lessons learnt during experimentation;
3. a **deployment phase with the production of an industrial solution** with the **selected suppliers**.

The experimentation phase was carried out in conjunction with technical partners and the Green Spaces Department with a dual objective. Firstly, a prototype was developed by the city's services and the start-up Element IO in a 'learning-by-doing' approach in order to better understand users' needs and define the technical and **ergonomic characteristics that best meet them**. Secondly, Saint-Quentin explored and studied in partnership with Faubourg Numérique[3] and Orange[4] complex issues related to the digitization of public services (managing vertical silos, managing interoperability between equipment and heterogeneous data, introducing and supervising IoT equipment). This has enabled the specification of the digital infrastructure needed to ensure the integration and interconnection of the watering solution with the remainder of the city's infrastructure (the IT system, the irrigation system, the mowing robot).

This experimentation phase gave the city the opportunity to restructure its public procurement by allowing it to iteratively specify the technical requirements and characteristics necessary to deploy a digital solution that is fully operational and produces the expected results in the real world.

[3] Faubourg Numérique's Digital Innovation Hub is a non-profit association, created by entrepreneurs, for entrepreneurs and local authorities and aims at redesigning a collaborative organisation and making it concrete in order to introduce new processes of prototyping and production in Internet of Things projects.
[4] Orange S.A., formerly France Télécom S.A., stylized as **france telecom**, is a French multinational telecommunications corporation. It has 266 million customers worldwide and employs 89,000 people in France, and 59,000 elsewhere (as of 2021). It is the 11th largest mobile network operator in the world and the 4th largest in Europe after Vodafone, Telefónica, Deutsche Telekom.

At the end of the experimentation, **the second step was to launch a public tender in 2020 to select suppliers for the large-scale deployment of the solution**. This proved to be initially difficult as the city of Saint-Quentin had no previous experience in formalizing a contract for the acquisition of a complete digital infrastructure including a data platform, IoT devices and applications. The major challenge was to successfully structure a market around **a standard to achieve data and system interoperability**. To compensate for its lack of experience on the subject, the city of Saint-Quentin followed the recommendations presented in the "SynchroniCity[5] Guide".

The following recommendations have been incorporated into the procurement requirements to ensure interoperability of the sprinkler solution and its components:

- Deployment of a kind of central core, called **Context Broker**, in charge **of accessing, harmonizing, sharing and retrieving data from various sources and systems (several open source choices are available in the FIWARE ecosystem**;
- **Definition of a common language to be used by all data** whatever their origin by choosing an **open standard for the exchange of information by API** (NGSI-LD standard in the case of Saint-Quentin);
- **Upstream harmonization of the various components of the solution**, from hardware to software, so that they comply with the **chosen open standard**;
- **Several connectors** that act as translators **to convert data from systems that natively use other languages** (for example) **into the selected open standard**.

Beyond these technical choices, the city of Saint-Quentin has made organizational choices:

- **Separate the procurement into technical lots in a coherent way, each of them describing a specific part of the watering optimization solution** (lot for the communicating objects, lot for the decision support business application, lot for

[5] A guide to a universal approach to the development, procurement and deployment of IoT and AI-based services. FIWARE Foundation has been a member of the Synchronicity consortium since 2018 up to the end to the project.

the data platform). The objective being to avoid acquiring solutions that function as vertical silos where the software and hardware parts are fully integrated and cannot function separately without each other.

- **Assign clear responsibilities to the providers in charge of each of the lots**. For example, the provider in charge of the data platform must offer different services that a third party may need to retrieve and publish data (NGSI-LD API, LoraWan or Sigfox connector, FTP connector). Conversely, the third parties in charge of the other batches (business applications, IoT sensors) have the obligation to provide systems compatible with the various services offered by the platform.
- **Issue criteria for data model management**. The service providers were strongly encouraged to use standardized data models based on the one developed during the experimentation phase. They were also asked to share with the city the structure of the data model used in this contract.

How it works

The solution takes the form of a system ensuring the remote control and harmonization of the various maintenance operations on a sports field (mowing, watering) in order to meet several objectives:

- Providing visibility on the condition of the land and support in decision making for its maintenance;
- Detecting problems such as lack of water and the transition to a faulty state of the various equipment;
- Ensuring that the various systems are harmonized in their operation to avoid any conflict (between the mowing robots and the watering system, for example).

This implies organising the feedback and dialogue between all the equipment involved in the maintenance of a sports field by implementing the following functions:

- Deployment of sensors to measure soil moisture;
- Implementation of a decision support application to plan and optimize watering operations for sports fields by combining multiple data (soil moisture content, useful soil reserve, weather data, field occupation);

- Remote activation of the irrigation system, including watering nozzles and programmers, which meant upgrading to a communicating system;
- Organization of interactions with the community's mowing robots;
- Interconnection with the software allows occupational planning of the grounds.

The supervision of all these functions is managed through an interoperable digital platform ensuring the functions of sending, transmitting, storing, integrating, harmonizing and visualizing data. The city of Saint-Quentin chosed a platform based on **FIWARE** technology to ensure interoperability between the various systems and data involved in the project, but also to facilitate the integration of additional functionalities and equipment in the future. This platform ensures the control of critical functions for the intelligent and autonomous watering solution: generation of the watering recommendations schedule, validation and sending of remote orders, monitoring of their proper execution.

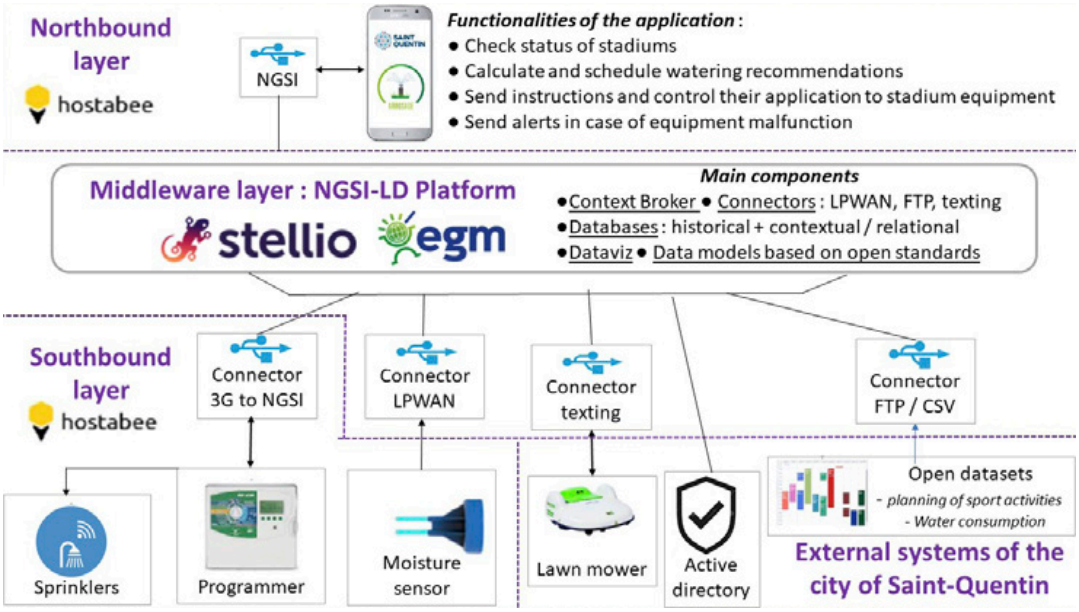

Figure 1 - Solution architecture

Benefits & Impact

The Department of Green Spaces is the main beneficiary of the project, enabling management modernization of the stadiums in order to gain in efficiency on two levels:

- Optimizing water consumption by adapting watering to actual water needs and eliminating the tendency to over-water the soil. The city recorded its first positive impact during the summer of 2021 as a 35% reduction in water consumption was observed on a field equipped with the intelligent watering solution compared to another field located nearby not equipped with this solution. This result was obtained from a comparison made on similar bases (the same soil composition, period, weather conditions).
- Simplifying and reducing the number of interventions required for stadium maintenance thanks to the remote control of various equipment (mowing robot, irrigation system) and the achievement of a better quality turf resulting in a reduction in the number of mechanical interventions required.

This project allowed the city of Saint-Quentin to accumulate a lot of knowledge about the organization and management of digital projects at several levels (structuring of public procurement, coordination and distribution of responsibilities between the various suppliers, increased sovereignty over key intangible assets such as data models). It has also been able to develop technical knowledge to establish the conditions necessary to deploy solutions that are sufficiently interoperable, replicable and open to allow it to have better control over the projects, their evolution and the data they produce.

The solution implemented in Saint-Quentin can be **interesting for any actor working on the subject of irrigation, sustainability of the use of scarce resources and environmental impacts** . Its main added value is to have created a platform that connects and integrates different systems into one (system of systems approach), whereas previously these systems operated completely separately (humidity sensors, irrigation system, mowing robots).

The project has been recognized for its impact and innovation through two awards:

- The city of Saint-Quentin was awarded the "Innovative Territories" label in 2021 by the Interconnected Association in the environment category;
- The water savings trophy awarded by the water savings club set up by the **Ministry of Ecological Transition** and led by the FNCCR (national federation of local authorities and utilities). **The City of Saint-Quentin and Easy Global Market won the award in 2021 in the category "actions to reduce water consumption in periods of water stress"**;
- The "Territoria bronze" in the digital transition category awarded by the national observatory of public innovation.

Added value through FIWARE

FIWARE technology played a crucial role in the success of the 'Iintelligent and Autonomous Watering Project'. It allowed the city of Saint-Quentin to meet all the technical requirements and constraints to make the solution fully functional and deliver the expected benefits in the real world. Many digital solutions are deprived of part of their potential due to a lack of interoperability and the ability to interact with other systems. FIWARE makes it possible to overcome such limitations. In the specific case of the project in Saint-Quentin, FIWARE has made it possible to provide answers to the challenges faced in any process of digitization of public services:

- **Creating bridges between different sources in order to combine data previously organized in silos**. For example, it was possible to reuse data relating to the reservation schedule for sports fields for purposes other than those initially planned, such as remotely planning watering operations or automatically adapting the schedule for mowing robots;
- **Using open standards to ensure interoperability between systems that are technically designed to operate independently of one another but need to be evolved to interact with each other within a system of systems**. For example, a central element of the project was to make the decision support system for irrigation scheduling interoperable with the irrigation system already in place on the land so that the latter could be operated based on the recommendations of the former.

FIWARE has been vital in helping Saint-Quentin manage the challenges encountered in its project to digitize the management of sports fields. This technology offers what can be called a common language that facilitates the management and interactions between the different elements involved in a digital project (the application, the hardware, and the information system of the community).

Next steps

With the support of its two technical partners, Hostabee and Easy Global Market, the city of Saint-Quentin is in the process of deploying the solution on other sports fields following the first positive results recorded during the summer of 2021. The goal is to equip a total of 9 fields.

At the same time, the city wishes to **replicate the strategy used for the watering project as part of its digital transformation by applying it to other topics and areas**. This strategy consists of designing digital projects by articulating them around what is called a common language. The use of this common language includes requiring any provider to conform to an open standard as a data exchange protocol (API) and to use standardised data models to describe that data. These two elements are both part of collective knowledge developed and made available by different European initiatives (living-in.EU, OASC and FIWARE). This double condition allows for interoperable solutions in their design.

This common language offers advantages to cities like Saint-Quentin by providing flexibility. TGreater sovereignty can be exercised over projects by having better control over the key assets in projects (easier access to the data generated and access to the data model to decipher and reuse it). This opens the door to many possibilities, such as changing suppliers without having to start from scratch or reusing data more easily in other projects. In addition, it allows cities to purchase solutions that can integrate with their existing infrastructure without having to replace it. This is an important issue for the smart city solutions market, as cities

have a large legacy of infrastructure in operation. The ability to add new solutions that are interoperable with existing systems is important to reduce the cost of digital transformation for a city.

References

- Interreg 2 Seas 2014-2020 is a European territorial cooperation programme covering England, France, the Netherlands and Belgium (Flanders). The programme is co-financed by the European Regional Development Fund and has a total of €241 million from the ERDF to co-finance projects in the period 2014-2020.
- The SCIFI's project Smart Cookbook for mid-sized cities

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Categories

Domains (s)	Smart Cities, Smart Energy, Smart Water, Open Data, Open Source, Standardization of Interfaces
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