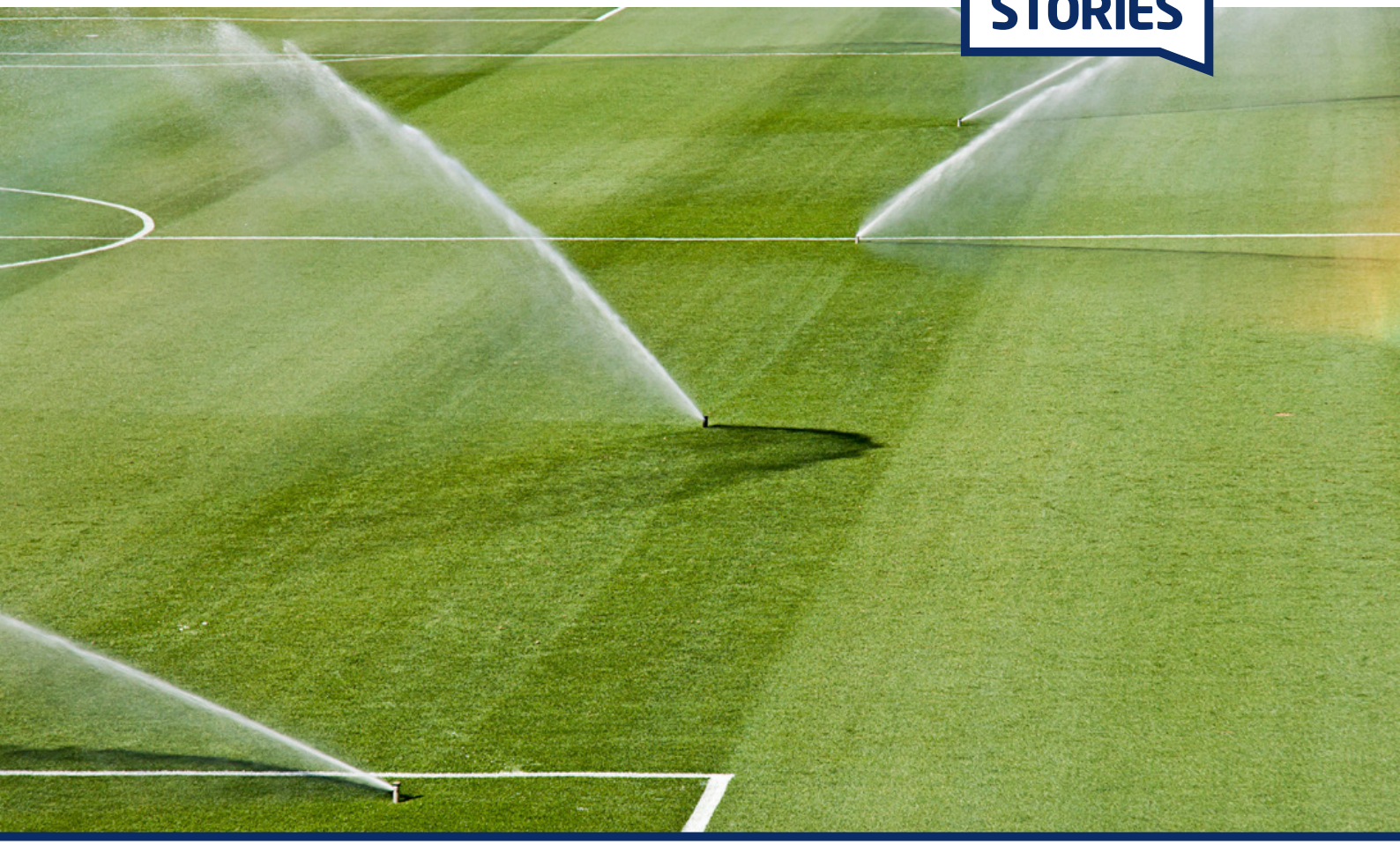
FIWARE
Open APIs for Open Minds

FIWARE IMPACT STORIES



SMART CITIES AND SMART WATER

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

With the contribution of

SAINT QUENTIN

FIWARE - OPEN APIs FOR OPEN MINDS

Month 0, 2020 @ FIWARE Foundation, e.V. – www.fiware.org

Challenge & Context

Cities today face many challenges, the first being their ability to **provide basic goods and services to their residents, including – first and foremost – water**.

Among the many initiatives that they are taking is the adoption of **digital technologies**. They play a decisive role in helping collect valuable data in real time and enhance the rational use of resources. These technologies promise to reduce the impact that economic and population growth usually have on water consumption.

This requires special attention to the integration of digital technologies with operational technologies applied in distribution networks to allow energy savings, the reduction of waste and an increase in the capability of guaranteeing performance excellence in a safe environment, to give but a few examples.

In the framework of the **Interreg 2seas project SCIFI**[1],the city of Saint-Quentin (France) explored new ways to improve public services. Together with the cities of Bruges (BE), Mechelen (BE) and Delft (NL), Saint-Quentin was specifically aiming to create value and better services for mid-sized cities and their citizens. To achieve this objective, the city applied innovative public procurement procedures, implemented interoperable solutions and an open data platform, and opened up data.

In 2018, SCIFI launched seven challenges in the field of energy, environment and mobility. After a successful open call, the selected start-ups and SMEs implemented their solution in the beginning of 2019 and have since been testing their solution in the SCIFI partner cities.

Before launching the challenges, Saint-Quentin consulted with its citizens, city staff and other stakeholders in four workshops to better understand their concerns.

[1] Saint-Quentin is a city of ca. 56,000 inhabitants in the North of France.

One major argument expressed by the department of the municipality for the environment and sustainability policies was the need **to modernize the management of stadium maintenance operations, especially** watering and mowing.

They found that:

- water consumption can be significantly reduced by dosing it to the real water needs of the grass;
- maintenance operations of a stadium (grass watering, lawn mowing) can be handled more autonomously with the help of a remote system that commands and coordinates the different equipment (lawn mower, sprinklers).

The benefits associated to both objectives were:

- reduce water consumption;
- save time - no need to go to the stadium field for daily maintenance activities.

When Saint-Quentin decided to embark on its journey towards digital transformation in order to increase the efficiency of public services, they faced several challenges that are very typical for mid-sized cities:

- How to manage Internet of Things (IoT) devices?
- How to collect, store and give access to all data that fuel Smart City solutions?
- How to insure the interoperability between heterogeneous data and systems?
- How to translate the needs expressed by end-users into technical requirements that fit and answer their expectations?
- How to engage the market with a procurement policy that defines clear and appropriate guidelines, both in terms of actor coordination (e.g. responsibility sharing between providers) and technical coordination (e.g. standard and interoperability)?

The SCIFI programme acted as a catalyst for Saint-Quentin and allowed the city to begin its digital transformation smoothly.

Solution

The project of watering optimisation led by Saint-Quentin allowed it to reorganize the digital transformation of public services, starting from scratch. The solution was all about how to set up a process in order to introduce digital technologies in a new sector. This process started in 2019 and was split into three stages:

1. a **testing phase** of eight months;
2. a **public procurement** phase to scale up using insights from the testing phase;
3. the **deployment phase at an industrial scale** with the **providers selected** during **the tender**.

The testing phase was essential in order to identify the list of technical requirements the city of Saint-Quentin had to address. The goal was to implement a solution that truly fits the user's needs. The city of Saint-Quentin, together with the local startup Element IO, developed two layers for a watering solution:

- an objective measure of the water need of the soil through IoT devices;
- an application to get information on the current status of the stadium and insights on the actions to carry out (watering operation, sensor maintenance).

The cooperation between the city of Saint-Quentin and the local start-up allowed the city **to specify already in the procurement phase what was required in terms of technical features and user ergonomics**. In parallel, the city signed a cooperation agreement with two technical partners, Faubourg Numerique and Orange, in order to specify the digital infrastructure needed and to support the integration and the interconnection of the watering optimisation solution with the rest of the city's infrastructure (e.g. IT system, incumbent irrigation systems and lawn mower). Together, they created a pilot that allowed the city to leverage the learnings from technical and organisational aspects alike and transfer them to the implementation plan of a **City-as-a platform concept**. This step was **essential as there is a limited added-value to deploy a Smart City solution without a data platform allowing it to aggregate, compare, merge and reuse data coming from heterogeneous sources and systems**. Cities that want to become smart(er) have the need at some point to address the issue of managing and mitigating data

heterogeneity, so they can provide solutions running at their full potential and deliver the best outcome possible.

After the testing phase, **the second stage concerned the launch of a public tender, which took place in March 2020, in order to select providers for the deployment of the solution at a large scale**. This proved to be a challenging task for Saint-Quentin, as they didn't have any previous experience in procuring the comprehensive scope of a digital infrastructure package including a data platform, IoT devices and applications. The only defined criteria that the city had defined by that time was the need for **a standard to achieve interoperability of data and systems**.

The learning-by-doing experience during the testing phase taught the city that only by achieving a certain level of interoperability it could ever reach its final goal, a Smart City service that provides efficient and autonomous management of stadium maintenance operations. To compensate for its lack of procurement experience, the City of Saint-Quentin took recommendations featured in "A Guide to SynchroniCity[2]".

The selected recommendations were meant to ensure and maximize the interoperability:

- Requirement of a central core, named **Context Broker**, that **monitors access, use, sharing and management of data from various sources and systems**, with **several options available in the Open Source** and **FIWARE ecosystem**;
- **Definition of a common language to be used by all data** from different sources by choosing an **Open API Standard like NGSI-LD** (in the case of Saint-Quentin);
- **Upstream harmonization of the technical components** to be compliant with the **selected Open Standard** where possible (at least for the central core and application);
- **Listing of several connectors** that act as traductors **linked to the central core to convert data (within the selected standard) coming from technical components natively using other languages** (e.g. IoT devices being able to use many different protocols).

[2] A guide for an universal approach to developing, procuring and deploying IoT- and AI-enabled services. FIWARE Foundation has been a member of the Synchronicity consortium since 2018.

During this phase, it proved to be equally complex for the city of Saint-Quentin to make strategic choices related to the organizational structure.

These included:

- **Establishing a clear separation between the technical components specific to the watering optimization solution** (e.g. IoT devices, application to monitor stadium status and manage maintenance operations remotely) and the data platform that manages and operates all systems and data that are part of or interact with the watering solution.

  Such separation aims to:
  1. avoid vertical solutions integrated in a way to provoke potential vendor lock-ins,
  2. prevent components from working independently from each other (sensor, actuator and application),
  3. make the tender more accessible to SMEs or start-ups.

- **Defining clear responsibilities of providers in charge of each part, in this case**. The City of Saint-Quentin asked data platform providers to offer the services that a third-party developer could need to access data and plug into their solution (Context Broker with NGSI API, connector for IoT device, connector FTP for static data). Third parties were mandated to provide solutions compatible with NGSI-LD to publish data and connect their systems by using the platform services.

- **Adding flexibility to the choice of data models**. Third parties were free to choose the data models that fit best to the project while, however, the selection of standard data models was encouraged. In exchange for this flexible and open approach, third parties were asked to share their data structure with the city. Additionally offered enough flexibility to manage various types of data models.

How it works

The implemented solution includes multiples technical layers:

Southbound layer

- 6 sensors that monitor, in real-time, the soil moisture of the 6 parcels forming a stadium;
- actuators that allow to start and stop the solenoid valves;
- lawn mowers.

Northbound layer

Remote management application that allows the city to monitor stadium status and manage maintenance operations remotely.

External (open) data sources

Mainly coming from the city or other providers, like weather forecast (occupation planning of the stadiums).

Middleware layer

The data platform built around NGSI-LD Context Broker and its various extensions (connectors to communicate with data in other formats, a data storage space, a module to visualize data).

The centerpiece of the solution is the FIWARE architecture compatible with the NGSI standard. For the city of Saint-Quentin, it is seen as the glue to connect the patchwork of different elements that ultimately compose the solution. It also allows for a higher attention to data contextualization.

Decision impacting requirements:

Avoiding data silos

Data silos were avoided as well as limitations in potential data interactions thanks to the prior mapping of data interrelations.

Opting for market standards

The **decision for a NGSI-based city solution with FIWARE** was facilitated by the fact that market readiness was highly recognizable and the city received lots of solution proposals with most of them based on NGSI.

High attention to interoperability and open standards

Deploying single-application platforms proved to be ineffective and very expensive in the long run, that is why one of the most important challenges for Saint-Quentin was **interoperability**. Only by using data from different internal and external data sources and by developing a unique, performing and reliable network supporting any kind of urban application over the same infrastructure can improve the services and help achieve concrete, measurable results.

This requires a standardized technical infrastructure with systems and providers committing to compatibility based on open standards like NGSI and a supporting technical environment like FIWARE. Such interoperable technology based on open standards (thus it is brand-agnostic), allows seamless integration of third-party systems and custom applications, and grants the confidence of a continuity of supply over time.

Working with a semantic data strategy

The city of Saint-Quentin felt the need to set up a semantic data strategy which offered, on the one hand, a data model shared between stakeholders involved in the project and, on the other hand, the use of a unique repository within the city to fill the different data models with information.

This required to harmonize data between the various city departments and called for the virtualization of the city via digital twins.

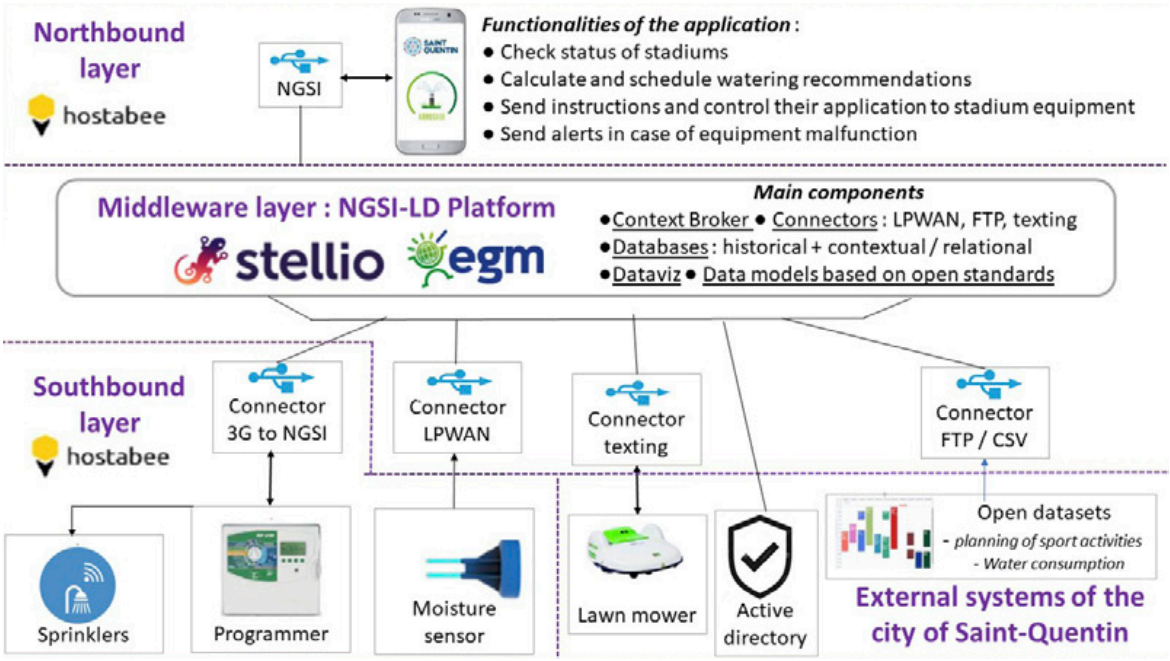


Figure 1 - Solution Architecture

Benefits & Impact

The solution addresses two main beneficiaries.

Departments to support environmental sustainability

It is and will be the main beneficiary of the project as it allows for the modernization of the maintenance operations management in the stadium. Indeed, the solution is tailored to fit the department needs. It addresses the modernization challenge associated with the achievement of two objectives, to:

- reduce the water consumption by adapting watering operations as closely as possible to the real water needs and to remove recurrent problems like overwatering of the soil;
- reduce the number of time-consuming tasks required to program operations with the incumbent irrigation system that takes into account various fluctuant parameters like stadium reservation, mowing operations and weather forecast.

By constantly adapting the watering process to the actual water needs of the turf, the city of Saint-Quentin will be able to provide the end users of stadiums, especially soccer teams, with a better-quality turf for their activities. It therefore aims to also improve the experience and satisfaction of these groups when using the stadiums.

Administrative departments of the City of Saint-Quentin

This solution leverages the learnings of technical and organisational aspects needed to implement a City-as-a Platform concept as interoperability between data and systems is a key element for the successful implementation of a Smart Water management solution. As a city with no past experience, organizations like FIWARE Foundation, as well as other organisations such as Open & Agile Smart Cities OASC[3], have greatly supported in the definition of technical requirements, the technical implementation phase and the building up of the required skills for the best suited solution.

This project and solution can be **interesting to any kind of organization that has to manage irrigation systems**. Its major added value is to have achieved a connected and integrated platform of different systems (systems-of-system approach) that previously worked fully separately, now also including IoT devices to monitor soil moisture, irrigation system, and lawn mowers.

Added Value through FIWARE

FIWARE was the crucial element to achieve a sustainable smart watering solution. FIWARE technology provided the city of saint-Quentin with the capability to handle the long list of technical constraints and requirements that it had to address in order to implement a solution matching the users' needs.

[3] OASC Open & Agile Smart Cities is a network that connects cities & communities worldwide to learn from each other and exchange digital, data-driven solutions based on Minimal Interoperability Mechanisms. OASC represents our members towards international institutions, fora and standards developing organisations to ensure that their voice is heard when new standards come about.

Thanks to its potential in data and systems' interoperability and interconnection, FIWARE allowed Saint-Quentin to fulfill the following 3 technical conditions simultaneously.

Define a watering strategy based on the real water needs of the grass

To quantify these real water needs, it is required to:

- develop an objective measure of the soil moisture through IoT devices;
- mash-up this information with other environmental parameters like weather forecast or evapotranspiration;
- obtain information on the current status of the stadium and insights on the actions to carry out via an application as a decision base for the watering strategy or sensor maintenance.

Gather additional information in order to identify the appropriate watering

To define the watering strategy, it needed to:

- connect to the IT city system and collect datasets like the planning occupation of the stadium;
- determine a sequencing protocol to trigger the sprinklers one by one (due to low water pressure constraints).

Apply remotely and automatically the watering plan

This requires:

- the connection of the watering solution to the irrigation system in order to send instructions and verifications of the efficient application;
- the connection of the watering solution with the lawn mower to avoid potential conflicts with sprinklers.

Next Steps

Together with the support of two further technical partners, the local startups **Hostabee** and **Easy Global Market**, the City of Saint-Quentin will deploy the overall architecture and solution to 9 stadiums between 2020 to 2021.

In addition, the city wants to **scale up horizontally by reusing the framework of watering challenges in order to manage other city domains**. It has already invested time to define the digital architecture needed to support the growing watering project. It will also secure financial resources to deploy and run it.

In order to make digital infrastructure projects most cost efficient, it is equally critical to plan how to replicate and scale them up in a city. Saint-Quentin had decided from the very beginning to replicate its framework and reuse it for other projects as well in order to maximize economies of scale. As their digital infrastructure is designed to be independent from use cases, it is easily reusable and can also be leveraged within other domains.

References

- Information sources, like publications in media and press, brochures, blog posts, videos, slides on SlideShare, etc.
- Interreg 2 Seas 2014-2020 is a European Territorial Cooperation Programme covering England, France, the Netherlands and Belgium (Flanders). The Programme is part-financed by the European Regional Development Fund and has a total of €241m ERDF to co-finance projects in the 2014 - 2020 period.

SCIFI Smart City Innovation

Interreg 2 Seas Mers Zeeën
European Regional Development Fund

Author & Contributors

Alexandre Chaffotte
Innovation Manager @ City of Saint-Quentin, France
Contact @ alexandre.chaffotte@saint-quentin.fr

Categories

Domains (s)	Smart Cities, Smart Energy, Smart Water, Open Data, Open Source, Standardization of Interfaces
User (s)	Public Administration, Private Companies, Startups
Key words	Standard, Interoperability, Autonomous Driving, Context Broker, Systems-of-System Approach, City-as-a-Platform

Contact us

Having any questions? Want to contribute with another Impact Story?
Please contact **Tonia Sapia** @ tonia.sapia@fiware.org

Want to see more Impact Stories? Please visit www.fiware.org/impact_stories

FIWARE
Open APIs for Open Minds

FIWARE IMPACT STORIES

SMART CITIES AND SMART WATER

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

FIWARE MARKET PLACE

Be certified and featured in the FIWARE Marketplace.

GO TO THE MARKETPLACE

Never miss an update or a new Impact Story. Join our Newsletter!

SUBSCRIBE

Find Us On

Twitter Facebook LinkedIn YouTube Github

Month 0, 2020 @ FIWARE Foundation, e.V. – www.fiware.org