Driving the digital transformation towards Future Cities: the SmartMe® experience

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***Abstract*—Future Cities are human-centered realities in which business and technology drive the digital transformation towards sustainable and resilient communities. In this paper we present the creation of a multi-service digital management platform in which vertical infrastructures become active multi-service structures also transformed into generators of energy and services, and therefore business. Specifically, we present the SmartMe® Fleet Manager solution as configurable and customizable software platform designed for remotely managing IoT devices in such a context. Moreover, a case study is presented and discussed.**

Keywords—internet of things, fleet manager, smart city, smart energy, smart building, smart mobility

I. Introduction

Rapidly advancing innovation in digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), robotics, and blockchains, as well as biotechnologies drive the digital transformation towards Future Cities in which collaborative industries, bioeconomic and creative products and services form a new sustainable and resilient society.

Combined with the technological realty of highly interconnected and globalized economies, the concept of Future City as a human-centered realty that balances economic and technological advancement for benefit in health and quality of life affects both Public Administrations and businesses. Data can drive this process of "society evolution" because they are integral part of our reality. In our vision, vertical infrastructures become active multi-service structures, which not only represent a real investment but are also transformed into generators of energy and services (and therefore business), integrating customized smart city services.

In this paper we present the joint experience SmartMe - Solerzia for sustainable and resilient cities. **Solerzia**[1] is an innovative company that offers innovative, sustainable (integrated photovoltaic generation) and multifunctional vertical structures for smart cities. SmartMe has created for Solerzia a customized version of its software platform, named Fleet Manager, to remotely manage IoT devices for different "green" vertical applications and infrastructures.

II. SmartMe® Fleet Manager

The Fleet Manager (FM) is a configurable and customizable software platform designed by SmartMe for managing IoT devices. The platform allows authorized users to register their devices, organizing their management on three levels: Projects, Fleets, Devices. Each registered device is associated with a fleet of devices. The fleet, in turn, is associated with a project (which can include several fleets of devices). The FM exposes both a user interface (Frontend UI) and a backend interface (Admin UI). Backend services are implemented in the form of software modules, specifically: Access, **Projects**, **Fleets**, **Gateways**, Event Logger, Work Program, Orders, Identity. The interaction with the implemented services takes place through REST API (General API, Modules API).

The FM brings together the information flows relating to various Cloud sub-services under a single management system. The following software connectors execute the integration of applications:

- Stack4Things® IoTronic [1];
- Arancino [2]
- Grafana (Operational Observability Platform);
- MQTT (MQ Telemetry Transport);
- SIM management services (SIM monitoring);
- LoRa® TTN (The Things Network).

Management takes place through a single device monitoring interface, without having to log in separately for each subservice. Readable information is confirmed in: Device connection status for each connectivity subservice; Internal state of the device (IoTronic). The IoTronic and the Arancino connectors respectively allow Devices to access the Arancino Edge Stack (AES) services on a physical medium and the Virtual AES (VAES) on the Arancino Server Farm. The FM uses MariaDB SQL database as relational database management system and InfluxDB connected to Grafana in order to manage time series data with a multitude of advantages: single datastore for all time series data, low latency queries, open and interoperable with data ecosystems,

[1] https://www.solerzia.com/ last accessed 19 June 2023

high data compression. The FM configuration takes place through system environment variables, specified separately between bare-metal deployment or container deployment to execute IT processes in isolable, minimal and easily deployable environments (Linux containers or even just containers). Through the implementation of high-level APIs to manage containers that run processes in isolated environments, containerization, unlike a virtual machine, does not include a separate operating system but uses kernel features and exploits the isolation of resources such as CPU, memory, block I/O, network. By using containers, resources can be isolated, services limited, and processes started. Through the methodology implemented, the objective of facilitating management was achieved, i.e. the management of the operating system, the file system and the network interface. The advantage achieved is in terms of startup speed, image size and saving of computational resources that require less resources. However, there is the disadvantage that containers do not contain their own operating system. This means that running processes cannot be isolated perfectly.

III. Case Study

In this Section we present and discuss the work carried out by SmartMe as part of the **Smart Poles** project (Figure 1) managed by the innovative company Solerzia. The project follows a modern approach to the design of intelligent structures. It is centered on the combination of 3 main concepts around which the services of the Future City revolve: sustainability, multifunctionality, digitization. The aim of the project is to renew the concept of lighting and telecommunications infrastructure through innovative smart poles, which in addition to providing an improvement of the pre-existing services, amplify both the quality and the quantity, reducing the spaces and therefore the costs associated with the installation, maintenance and operations.

Fig. 1. Solerzia Smart Pole “Tower”.

SmartMe has produced and customized its Fleet Manager software platform for remotely managing the IoT devices installed in smart poles. The FM allows the visual and graphical representation of the parameters monitored by the system for facilitated predictive maintenance and process efficiency (for example wear, breakdowns, incorrect use of systems or infrastructures, etc.). In particular, the FM exposes an operational observability dashboard (Figure 2) for the monitoring of performance parameters and the visualization of any alerts.

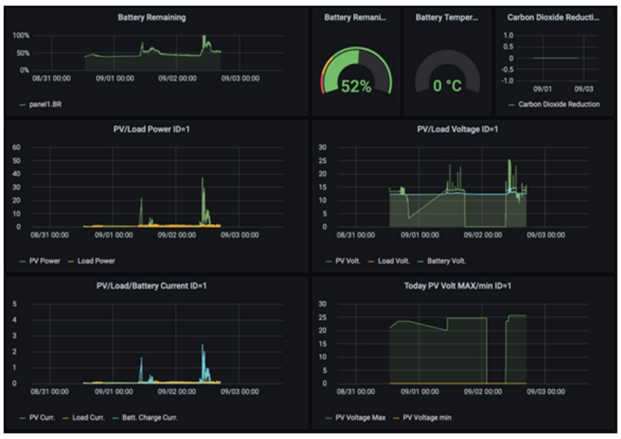

Fig. 2. The Operational observability dashboard.

Smart poles are displayed on a geotagged map (Figure 3) thus to have a real-time snapshot of correct operation or any anomalies associated with the single device.

Fig. 3. Smart Poles displayed on geotagged map.

IV. Conclusions

Innovative engineering, on-board clean energy generation and hybrid configuration with the electricity network offer the possibility of integrating and planning the widest range of services of Future Cities (smart lighting, advertising LED walls, EV charging, video surveillance, wifi and telecommunications, IoT, digital signage, fiber optic junctions, smart metering and much more). In this paper we presented and discussed the work carried out by SmartMe as part of a project of smart poles in smart cities, managed by the innovative company Solerzia. In such a context, SmartMe has produced and customized its Fleet Manager software platform for remotely managing the IoT devices.

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