SenaaS: An Event-driven Sensor Virtualization Approach for Internet of Things

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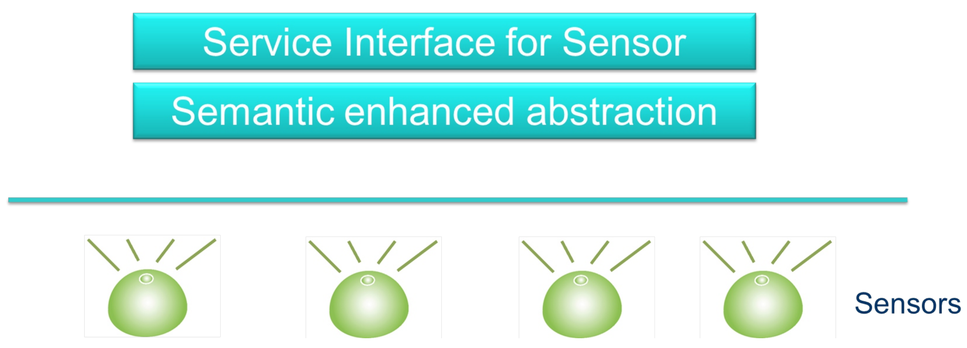
Web 3.0 is being transformed from connecting people and services to connecting objects (things). Today, a lot of devices and objects are emerged with sensors, enabling them to sense real-time information from the environment, and coupling this information with the web. This leads to a promising Internet of things (IoT) concept that allows connectivity of anything from anywhere at anytime. IoT creates a new digital ecosystem by amalgamating different technologies and standards, allowing different key players of industry to be part of it further. New business opportunities have been opened for retail, logistics, food, health, energy, smart home, and transportation sectors. Though IoT possesses benefits for society and business, but it still lacks many technological issues which needs be addressed. First of all, IoT does not provide any registry mechanism for publishing service information publicly that is hosted on sensor. Secondly, different sensors and devices comprise with different data formats and models, thus causing IoT to exhibit deficiency in discovering and composing diversified services. Thirdly, IoT deficient in handling service invocation that sensor triggers with the occurrence of an event. The interaction between events and services are absent in current IoT clouds. Moreover, authorized access to IoT cloud sensor data and services without relaxing user privacy is also a challenging task.

In this paper, we propose a semantic enhanced IoT virtualization framework to address the aforementioned challenges. The framework uses the Sensor-as-a-service (SenaaS) approach that does not only foster use of virtualization in IoT domain, but it also exposes IoT cloud's sensors capabilities and data in the form of services.

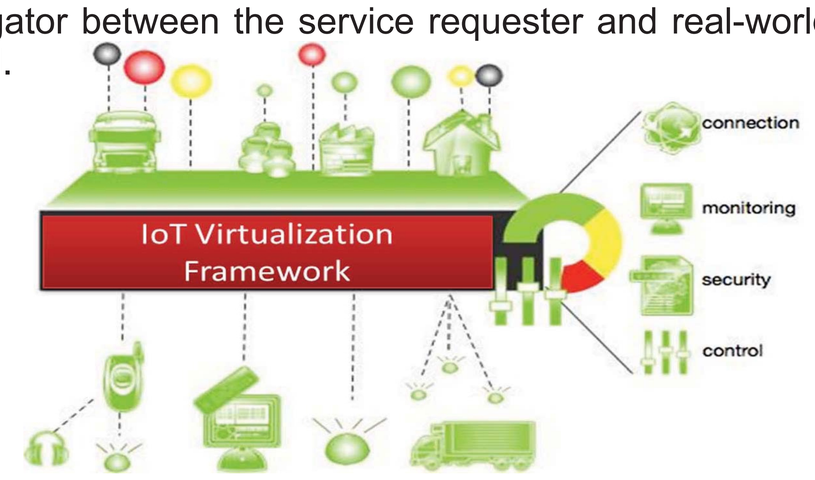
Sensor-as-a-Service

Our approach is based on sensor-as-a-service (SenaaS) notion. SenaaS exposes functional aspects of sensor as services by hiding technical details of sensors from the user. The approach assists in specifying, creating, managing, discovering and delivering sensor functionalities and capabilities as services.



High Level Architecture

The framework is capable of getting information from different sources and makes it available for novel services in from of virtual services. Moreover, it maintains the catalogue of all available sensors and infrastructure services and act as a delegator between the service requester and real-world IoT cloud.

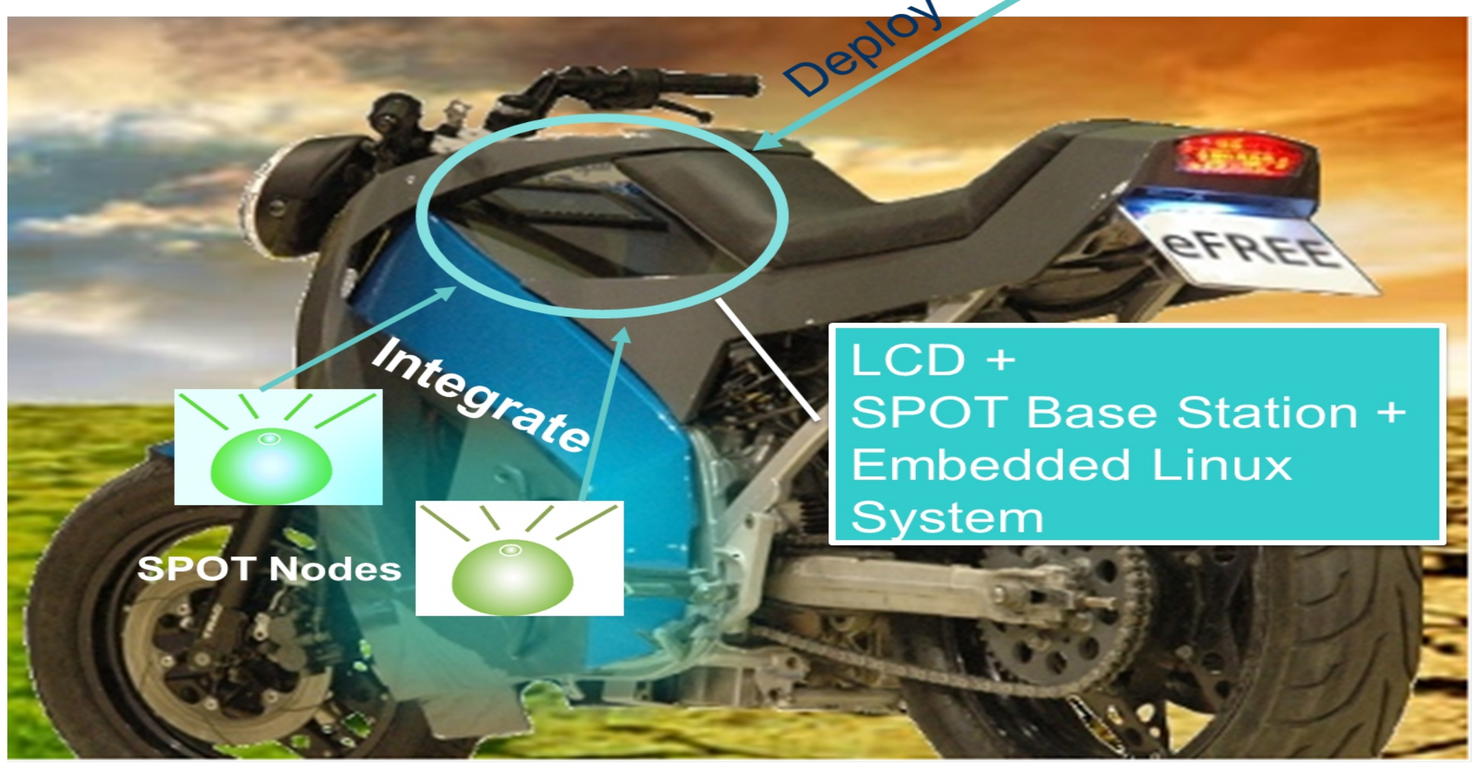


Use Case: Green School Motorcycle

The use case of reference for this outlook is a green school motorcycle (GSMC). The GSMC is classified as heavy motorcycle, and it requires a standard motorcycle license in most of the European countries. The GSMC is equipped with a 3G/GPRS modem and an embedded computer. The GSMC capabilities make it uniquely identifiable, addressable and available at anytime from anywhere. The GSMC holds different type of information such as status of battery, charging information and route information. The key actors battery manufacturer, (iii) charging outlet providers, (iv) energy grid company, and (v) friends.

Test Bed

- **Embedded System***:* EPIA Nano-ITX embedded board
- **Operating System:** Ubuntu embedded Linux
- **Sensor Platform***:* Sun SPOT, IQRF



Proof-of-concept Implementation Goal

- Handling sensors for critical infrastructures
- Addressing interoperability between JBV sensor and Telenor Object management platform
- Linking Sensor data while preserving privacy

Future Work

- Includes the development of IoT framework services micro-formats for advertising on social network sites.
- A real time performance analysis of the proposed framework

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