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Titre : Towards self-management of dynamic IoT systems based on QoS

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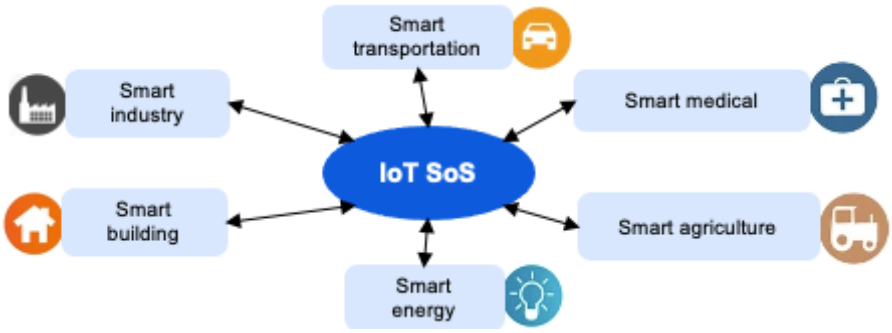
Context :

The advent of the Internet of Things (IoT) has extended the Web to integrate intelligent connected objects offering different capabilities such as detection, computation, and communication. This has contributed to the emergence of new generation of systems. However, with the increasing proliferation of connected objects, the IoT domain suffers from the vertical fragmentation induced by the heterogeneity of objects. Consequently, to guarantee the interoperability between several devices, the choice of objects is highly dependent on the owner. This presents a barrier to the development of flexible IoT systems.

The Web of Things (WoT) extends the IoT by providing an abstract layer so that different potentially heterogeneous objects can be interconnected. This enables developing and managing IoT systems based on the services offered by IoT objects through their virtual abstractions. Indeed, connected objects can be searched and used like any resource accessible via the web.

IoT is omnipresent in different domains such as smart home, healthcare, factories, and at large in smart cities. Several research and development efforts have been conducted in the domain of IoT systems to make them autonomous, adaptive and responsive to provide awaited services so that Quality of service (QoS) parameters are guaranteed. The increasing technological progress and the advent of modern technologies such as IoT, WoT, Cloud and Fog computing have contributed to the development and enforcement of the concept of System of Systems (SoS). A SoS is made up of a set of

potentially heterogeneous operational systems that are independent of each other in their functioning as well as in their management and development [6], but which can achieve an overall objective [7].

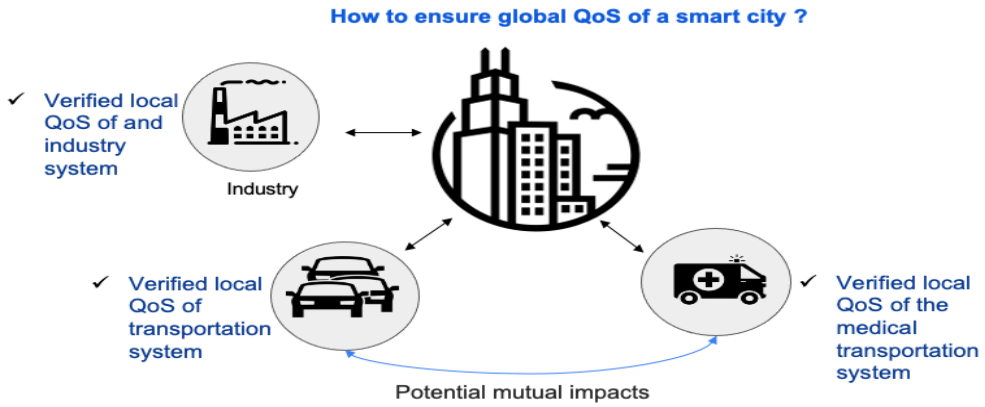


Even if these operational systems are independent of each other in their functioning, dependencies can exist. These dependencies should be considered and tackled to ensure a global consistency of the whole SoS.

In the literature, the management of such systems is usually handled locally to guarantee functional and non-functional properties (e.g., QoS parameters) [8,9]). The state of the different systems is not considered, even if they can have mutual impacts.

The goal of the thesis :

The aim of this thesis is to study the problem of self-management of IoT SoS while considering the potential impact of the different underlying IoT systems.



The goal is to enable, each independent IoT system (e.g., transportation system), to self-manage and to self-adapt to its context to guarantee locally its QoS parameters. In addition, the mutual impacts that can exist between the different systems must be handled to ensure the awaited global QoS of the IoT SoS (e.g., QoS of a smart city). In other words, the self-management capabilities of different independent IoT systems must be studied and characterized so that a local and a global consistency can be ensured. In this thesis, machine learning techniques will be investigated and used to enable proactive and predictive sel-management of IoT SoS.

The main steps of this thesis are :

- Study of the state of the art on the QoS-based self-management of IoT systems
- Specification of local and global QoS of IoT systems and their relationships
- Global QoS-aware self-adaptation of IoT SdS
- Implementation and evaluation of the proposed solutions through a smart city scenario
- Publication and presentation of the results in international conferences and journals.

Key words : IoT, WoT, IoT services, IoT system of systems, service based systems, proactive management, prediction, machine learning, smart cities

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