

# Policy Management and Enforcement Using OWL and SWRL for the Internet of Things

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**Abstract.** As the number of connected devices is exponentially growing, the IoT community is investigating potential ways of overcoming the resulting heterogeneity to enable device compatibility, interoperability and integration. The Semantic Web technologies, frequently used to address these issues, have been employed to develop a number of ontological frameworks, aiming to provide a common vocabulary of terms for the IoT domain. Defined in Web Ontology Language – a language based on the Description Logics, and thus equipped with the ‘off-the-shelf’ support for formal reasoning – these ontologies, however, seem to neglect the built-in automated reasoning capabilities. Accordingly, this paper discusses the possibility of leveraging this idle potential for automated analysis in the context of defining and enforcing policies for the IoT. As a first step towards a proof of concept, the paper focuses on a simple use case and, using the existing IoT-Lite ontology, demonstrates different types of semantic classification to enable policy enforcement. As a result, it becomes possible to detect a critical situation, when a dangerous temperature threshold has been exceeded. With the proposed approach, IoT practitioners are offered an already existing, reliable and optimised policy enforcement mechanism. Moreover, they are also expected to benefit from support for policy governance, separation of concerns, a declarative approach to knowledge engineering, and an extensible architecture.

**Keywords:** Internet of Things · Semantic Web · Policy management · Policy enforcement · Web Ontology Language · Semantic Web Rule Language · Reasoning

## 1 Introduction

The unparalleled development of Information and Communication Technologies (ICT) in recent years has triggered the digital revolution, which is characterised by ubiquitous connectivity, leading to a convergence of technologies across