

Introduction of an Approach of Complex Virtual Devices to Achieve Device Interoperability in Smart Building Systems

Authors : Thomas Meier

Abstract : One of the major challenges for sustainable smart building systems is to support device interoperability, i.e. connecting sensor or actuator devices from different vendors, and present their functionality to the external applications. Furthermore, smart building systems are supposed to connect with devices that are not available yet, i.e. devices that become available on the market sometime later. It is of vital importance that a sustainable smart building platform provides an appropriate external interface that can be leveraged by external applications and smart services. An external platform interface must be stable and independent of specific devices and should support flexible and scalable usage scenarios. A typical approach applied in smart home systems is based on a generic device interface used within the smart building platform. Device functions, even of rather complex devices, are mapped to that generic base type interface by means of specific device drivers. Our new approach, presented in this work, extends that approach by using the smart building system's rule engine to create complex virtual devices that can represent the most diverse properties of real devices. We examined and evaluated both approaches by means of a practical case study using a smart building system that we have developed. We show that the solution we present allows the highest degree of flexibility without affecting external application interface stability and scalability. In contrast to other systems our approach supports complex virtual device configuration on application layer (e.g. by administration users) instead of device configuration at platform layer (e.g. platform operators). Based on our work, we can show that our approach supports almost arbitrarily flexible use case scenarios without affecting the external application interface stability. However, the cost of this approach is additional appropriate configuration overhead and additional resource consumption at the IoT platform level that must be considered by platform operators. We conclude that the concept of complex virtual devices presented in this work can be applied to improve the usability and device interoperability of sustainable intelligent building systems significantly.

Keywords : Internet of Things, smart building, device interoperability, device integration, smart home

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