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Decentralized Configuration of Embedded Web Services for Smart Home Applications

Web Services can be used as a communication structure for embedded devices. Out of numerous Web Service specifications there is a subset (Profile) to implement Web Services on resource constrained devices, called Devices Profile for Web Services (DPWS). The resulting service oriented architecture enables the user to discover new devices, e.g., in the local smart home network. The open standards for Web Services further define a metadata format for service description. Besides the simple invocation of service operations, an eventing mechanism is specified. A client which subscribes to an event will receive notifications. Those features and the inherent Plug & Play capability provided by Web Services are suitable to connect smart home devices in a user-friendly manner. However, DPWS specifies no standard procedure to combine multiple devices with each other to build more complex applications. Therefore, new concepts for embedded Web Service orchestration are needed. Some commercial solutions use a central hub, which represents a Single Point of Failure (SPoF). Hence, a failure would lead to a breakdown of all smart Internet of Things (IoT) applications and decrease the user acceptance. We propose a concept where no central broker is needed by defining a Configuration Service that runs on multiple devices. Based on that service a smart phone app is used to establish trigger-action rules between devices. A prototype is implemented as a proof-of-concept for different smart home devices. Furthermore, a mobile Android application to find and orchestrate the devices is presented.