Chapter 4

Streamlining Service Platform for Integrating IoT Services

ABSTRACT

IoT scenarios involve both smart devices hosting web services and very simple devices with external web services. Without unified access to these types of devices, the construction of IoT service systems would be cumbersome. The basic principle of this chapter is the integration of distributed events into SOA. The data access capability of physical entities is first separated from their actuation capability, which acts as a foundation for ultra-scale and elastic IoT applications. Then, a distributed event-based IoT service platform is established to support the creation of IoT services and allow the hiding of service access complexity, where the IoT services are event-driven; the design goals are impedance matching between service computation and event communication. The coordination logic of an IoT service system is extracted as an event composition that supports the distributed execution of the system and offers scalability. Finally, an application is implemented on the platform to demonstrate its effectiveness and applicability.

INTRODUCTION

In the study by Guinard et al., (2010), it was advocated that in IoT applications, real-world devices should provide their functionality via SOAP-based Web services or RESTful APIs, thus enabling other components to interact with them dynamically. The functionality provided by these devices was referred

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to as ‘real-world services’. The authors then designed a series of discovery, query, and selection schemes for these services. Unfortunately, many of the sensors and actuators in current use are very simple devices, without the ability to provide Web service interfaces. The use of several different types of physical device is addressed here by integrating distributed events into SOA for service provision, as follows:

1. The data provision functionalities of different types of physical devices are unified in the form of universal IoT services, and their actuation capabilities are separated from these services and often localised. These differences are hidden behind an event-driven service infrastructure for transparent service interactions.
2. IoT applications often have real-time requirements, and the event-based communication fabric should cooperate with IoT service systems in order to satisfy these requirements. A service infrastructure is needed that can be integrated with the cooperation mechanism, the event-based communication fabric, and the service environments.
3. Physical entities often have their own locations, meaning that an IoT service system over these must be a distributed system. An event-based IoT service infrastructure should support a distributed execution with consistency.

In some existing works, a communication foundation has been optimised for IoT applications. For example, in the GridStat project (Bakken et al., 2011), a publish/subscribe-based communication foundation was designed for smart grids, supporting different receiving rates for the same event type, for instance. This work focused on redesigning the underlying communication fabric to support real-time coordination between heterogeneous IoT services, but did not shed light on higher-level applications. It is the belief of the current authors that connecting together all the things in a particular environment requires a reimagining of the communication foundation and higher-level applications simultaneously.

In contrast with GridStat, which focused on the foundation for communication, some works have attempted to redesign higher-level applications to accommodate the underlying structure. In (Li et al., 2010), a business process was decomposed into different types of activities, which were distributed in a DEBS (Distributed Event-based System) system to
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