Rapid IoT application development using the Web of Things

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1 INTRODUCTION

IoT is rapidly spreading around the broad application areas, but each solution is divided into its domains and network layers. Because of this, if we want to connect things and applications beyond their domain, we have to struggle to select and integrate suitable technologies and platforms to make an IoT solution — for example, protocol for connect to devices, platform for provide internet connectivity, and platform for analyze data from these devices.

IoT application developers want to concentrate their effort to create value from connected things, and not to go into detail of implementation. To abstract out these detail, W3C Web of Things (WoT) provides mechanisms to formally describe IoT interfaces[4].

In WoT, IoT device is abstracted as a Thing, which is a physical or virtual entity that provides interactions. And its specification is described by Thing Description (TD)[5], which provides a formal definition of their interaction based on a small vocabulary.

The developers can use TD for retrieve protocol binding to interact with Things. And using appropriate tools or libraries, they can develop application without going into detail of lower layer protocols. WoT provides a Scripting API to interact with a Thing through a well-defined API set.

In this paper, we show a novel development tool for utilizing WoT architecture, based on Node-RED[2]. And we show a future direction of the tool.

2 APPLICATION DEVELOPMENT UTILIZING THING DESCRIPTION

Node-RED is a Flow-based programming environment for the IoT application. In the Node-RED, an application is written by wiring nodes and creating message flows. For example, to interact with a Thing, a developer selects suitable input/output nodes that translate transport protocol and Node-RED's messages, and write a message handling logic by connecting function nodes or others.

However, this requires that developer have to know transport (or lower) layer protocol. To mitigate this, developer may create special purpose node modules or use modules provided by Thing vendors as a Software Development Kit (SDK), in order to hide a detail of a transport layer from an application layer. It is cumbersome for developer to implement these nodes or search and install suitable SDK for each IoT platform.

To automate this, we are developing a tool called *Node Generator*, which generates a module from a description written in an interface definition language. Currently, *Node Generator* supports Swagger[3] as an IDL. We extended the tool that can support the TD of Web of Things [1] so that we can integrate more broader range of IoT Things and platforms.

[1]https://github.com/k-toumura/node-red-nodegen/tree/webofthings

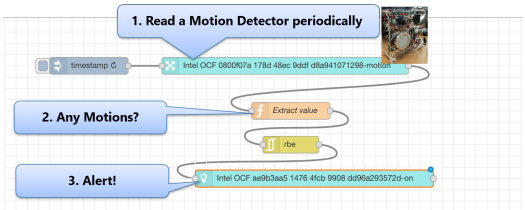

Figure 1: Example application: Intrusion detector

Using this tool, developers can handle a node as an avatar of a Thing. Figure 1 show an example of an intrusion detection system, written in Node-RED flow editor. We generated two nodes — motion sensor and warning light — from each TD provided by Thing provider. The motion sensor node generates a message contains current sensor readings. The next two nodes detect motion by analyzing a value of sensor reading, and send alert message to the warning light node if motion is detected.

3 CONCLUSION AND FUTURE DIRECTION

On this paper, we described a method for rapid IoT application development by combining Web of Things Thing Description and Node-RED. Currently, the tool does not support for retrieving/discovering TD yet. TD contains metadata of a Thing and its interactions, and several prior researches [1, 6] take advantage of semantic information to retrieve suitable Things and to integrate data which are attributed in different vocabularies.

Incorporation of semantic information into IoT solution development will gain agility of development and expand the range of IoT developers. To drive forward this, we expect that activities of the Web of Things become a center of sharing best practices and standardization about various forms of interoperability using semantic metadata of Things.

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