A Secure Platform for Programming and Remote Compilation-as-a-Service for the Internet of Things

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ABSTRACT

The Internet of Things (IoT) presents itself as a promising set of technologies for the provision of smart applications based on Information and Communication Technologies (ICT). IoT aims to provide the technological solutions for interconnecting efficiently a large number of heterogeneous devices that gather large amounts of data for various applications, spanning from environmental monitoring, energy monitoring, smart agriculture, etc. IoT devices are usually of constraint nature in terms of computational, memory and storage resources, such as sensing and actuating devices, although more powerful devices, such as smart phones, can be also considered as part of an IoT system. Research activities in IoT domain have led to architectures [1] that enable the secure, privacy-preserving and energy efficient interconnection of IoT devices with cloud infrastructure offering services, such as device and user management, data storage and service provisioning.

An important aspect of IoT systems that has not been thoroughly investigated yet is the Remote Programming (RP) of smart devices, especially those with limited resources that should often receive software updates, mainly for bug fixing and vulnerabilities mitigation. The ability to provide RP is of paramount importance, since it automates the programming of devices in remote locations, by requiring minimal or no human intervention, and enables the simultaneous programming of several devices at once, hence reducing maintenance cost. Moreover, despite the improvement and maturity of IoT, its rapid evolution has created serious technological fragmentation with several protocols (e.g. Constrained Application Protocol (CoAP), Lightweight Machine to Machine (LwM2M)) and operating systems (e.g. ContikiOS, Zephyr) emerging in the constantly expanding IoT ecosystem. Thus, an IoT developer can be benefited by a Compilation-as-a-Service (CaaS) solution, which enables coding from a web browser and delegates compilation process to a cloud backend. As a result, the developer can easily use various programming languages and operating systems without the need of installing various compilers, avoid equipment cost, and enjoy faster compiler upgrades.

In this work, we present the architecture of a secure platform that leverages cloud technologies for providing the two aforementioned services: (i) Compilation-as-a-Service that offers code compilation capabilities for heterogeneous devices, so that it is not necessary for an IoT developer to maintain compilation toolchains in personal infrastructure, and (ii) Remote-Programming-as-a-Service that enables secure and reliable (re-)programming of devices installed in geographically distributed positions.

REFERENCES

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