Abstract

The advent of Internet of Things (IoT) has enhanced the coexistence of end-users with both the digital and physical spaces, even in constrained environments. These IoT devices vary in size and configuration (based on requirement) and their evolution is only limited by imagination. Researchers are invested in lowering the cost of the devices and their miniaturization without leveraging the quality of service. However, the reduction of cost and size of the devices affects its configuration (processor, storage, and battery power), which reduces performance.

To overcome the aforementioned issues, IoT devices typically depend on external platforms such as cloud/fog/edge. The fog and edge computing platforms bring computation resources closer to where the data is being generated. It is also beneficial to enable the devices to interact with one another and collaboratively execute a common task (as multi-agent systems), especially in the absence of last-mile connectivity. Thus, the orchestration among the IoT devices is necessary.

This thesis proposes a suite of solutions for addressing the issues of *computation offloading, routing, facilitating FaaS*, enabling *storage* on resource-constrained devices, and finally *securing communications* between the devices. The crux of the thesis is to propose solutions for a collection of resource-constrained IoT devices for deciding whether to offload the tasks to one of the external platforms or not. In the case of offloading, then to which device and selection of the optimal path for transmission, along with determining the data formats along with securing the flow rules. Additionally, it also covers the development of a distributed system (analogous to blockchain) for hosting necessary functions for easy access by the devices and provides a solution for supporting a dynamic mechanism for secured communications. Through a combination of extensive simulations and real-world experiments, we demonstrate the seamless feasibility of the proposed solutions on resource-constrained devices with minimal delay and power consumption.

Keywords: Wireless Networks, Internet of Things, Resource Orchestration, Connectivity, Distributed Networks