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System Modelling and Performance Evaluation of a Three-tier Cloud of Things

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Abstract – The emergent paradigm of fog computing advocates that the computational resources can be extended to the edge of the network, so that the transmission latency and bandwidth burden caused by cloud computing can be effectively reduced. Moreover, fog computing can support and facilitate some kinds of applications that do not cope well with some features of cloud computing, for instance, applications that require low and predictable latency, and geographically distributed applications. However, fog computing is not a substitute but instead a powerful complement to the cloud computing. This paper focuses on studying the interplay and cooperation between the edge (fog) and the core (cloud) in the context of the Internet of Things (IoT). We first propose a three-tier system architecture and mathematically characterize each tier in terms of energy consumption and latency. After that, simulations are performed to evaluate the system performance with and without the fog involvement. The simulation results show that the three-tier system outperforms the two-tier system in terms of the assessed metrics.

1. Introduction

In the past few years, we have witnessed a wide adoption of Internet of things (IoT) [1] around the world, which has become one of the most promising technologies to enable ubiquitous and pervasive computing scenarios in the future. IoT can be considered as the interconnection of physical objects (also known as things) that contain embedded technology

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