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MDP-IoT: MDP based Interest Forwarding for Heterogeneous Traffic in IoT-NDN Environment

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Abstract

Internet of Things (IoT) a vision, being built today, holds a new rule for future "anything that can be connected will be connected." IoT needs to support a multitude of heterogeneous objects extended with sensors, actuators, RFID's, etc. These "Smart Object" need unique identification, autonomous data transfer and communication with other objects. Consequently, these unique requisites of IoT need a promising future Internet architecture as it mostly revolves around data. Furthermore, the existing host-centric IP standards though advantageous, faces challenges like additional protocols for mobility, end-to-end security while deploying it with massive IoT applications. Named Data Networking (NDN) project is a new evolving data-centric internet architecture with innovative capabilities like caching, named data, security which mainly suits the specifications of IoT thereby proposed to solve the shortcomings of IP. NDN traditionally supports a PULL based traffic and its stateful forwarding engine despite its skillful nature need some modification while designing for an IoT system. In this paper, our foremost work is to classify and prioritize IoT traffic and enable delay-intolerant applications with low latency, to retrieve Data efficiently. Next, we propose a Markov Decision Process (MDP) based Interest scheduling for IoT traffic with varying priorities and measure the performance with different traffic probabilities. Our simulation results show that prioritizing and treating requests based on their traffic type can reduce network load by 30% thereby improving QoS in an IoT-NDN environment. The MDP-based IoT model schedules' the Interest to the best interface efficiently reducing the RTT values on an average of $20-30\%$ than conventional forwarding strategies. The incurred delay is $\sim 30\%$ better than existing work and forwarding strategies.

Keywords: Internet of Things (IoT), Named Data Networking (NDN), Forwarding, Markov Decision Process (MDP), Latency, Delay

1. Introduction

Predictions contemplate the volume of global IoT traffic to grow exponentially in the coming years. Gartner envisions the number of IoT devices in use worldwide will grow from an estimated 5 billion in 2015 to 25 billion connected devices by 2020 [1]. IoT hosts a variety of services like building automation, healthcare, smart cities, etc. as shown in Figure 1. Heterogeneous devices like sensors, actuators and RFID's which are resource constrained in terms of memory, power, and capacity, etc. enables the vision of IoT [2]. In the current scenario, traditional host-centric networking retrieves unbounded Data generated from these resource constrained devices. The prevalent network architecture, protocols and open IP-based standards proposed by IETE have many advantages [3]. Although IP is a clear-cut protocol that enables communication between devices in different fields, it has its limitation. Utilization of IP confronts significant issues like complex system design for network configuration (Uniform Resource Identifier), end-to-end security and mobility. To reduce the complexity of IP in a unique, challenging IoT environment, a new clean-slate Internet architecture is the need of the moment.

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