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Hicham Lakhlef, Abdelmadjid Bouabdallah, Michel Raynal, Julien Bourgeois

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Agent-based Broadcast Protocols for Wireless Heterogeneous Node Networks

Hicham Lakhlef[a,*], Abdelmadjid Bouabdallah[a], Michel Raynal[b], Julien Bourgeois[c]

[a] *Sorbonne Universites, University of Technology of Compiegne, France*
[b] *IRISA, Université de Rennes, France*
[c] *UFC/FEMTO-ST, UMR CNRS 6174, 1 cours Leprince-Ringuet, 25201 Montbeliard, France*

Abstract

Internet of Things (IoT) is a wireless network composed of a variety of heterogeneous objects such as Connected Wearable Devices (sensors, smartwatches, smartphones, PDAs ...), Connected Cars, Connected Homes,...etc. These things use generally wireless communication to interact and cooperate with each other to reach common goals. $IoT(T, n)$ is a network of things composed of T things with n items (packets) distributed randomly on it. The aim of the permutation routing is to route to each thing, its items, so it can accomplish its task. In this paper, we propose two agent-based broadcast protocols for mobile IoT, using a limited number of communication channels. The main idea is to partition the things into groups where an agent in each group manages a group of things. This partitioning is based on the memory capacities for these heterogeneous nodes. The first protocol uses a few communication channels to perform a parallel broadcasting and requires $O(\frac{n}{k})$ memory space, where k is the number of communication channels. The second protocol uses an optimal complexity of memory space for each thing to achieve the permutation routing with a parallel broadcasting using less number of channels. We give an estimation of the upper and lower bounds of the number of broadcast rounds in the worst case and we discuss experimental results.

Keywords: Internet of thing; parallel broadcasting; communication protocols; permutation routing; collision-free; energy-efficiency

1. Introduction

The Internet of things (IoT) consists of a great number of heterogeneous nodes such as Connected Wearable Devices (sensors, MEMS, robots, smartwatchs, smartphones, PDA ...), Connected Smart Cars, Connected Smart Homes, Connected Smart Cities, and the Industrial Internet. These things are equipped with data processing and communication capabilities which give them the ability of sensing, computation, and wireless communications [1, 2, 3, 4]. IoT is an attractive research subject that has started to receive growing attention from the research and engineering communities in recent years. The nodes in IoT may be mobile or static, deployed in ad hoc manner in area of interest. These things are useful in a wide range of applications of our every-day life. Such applications include smart energy, smart health, distributed intelligent MEMS, smart buildings, smart transport, smart industry, smart city, facilitating/conducting urban search and rescue, tasks in unattended and rough environments etc.,[5, 6, 7, 8, 9]. Roughly speaking, IoT is making our daily life easier and smarter.

The Internet of things generally employs large number of distributed heterogeneous things, which may be miniaturized devices that cooperate and collaborate with each other using wireless communication to achieve common goals and objectives. Each thing has an onboard radio that can be used to receive messages from its neighbors and to send the information to them. That is, each thing needs to receive information available in the local memories of other things using routing protocols. We refer the reader to Fig. 1, depicting a 15-things in IoT. Such technological development has encouraged practitioners to envision aggregating the limited capabilities of the individual things in a large scale network that may operate unattended, [1, 5, 10, 11].

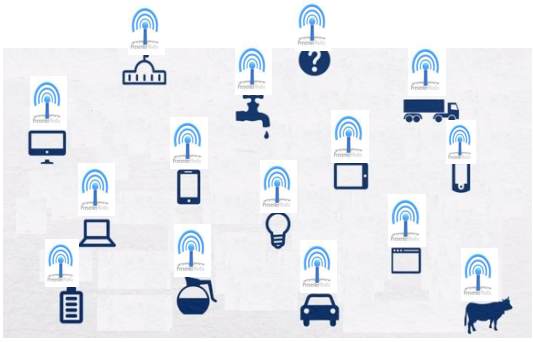

Figure 1: Example of an Internet of Things network, things cooperate and collaborate with each others to achieve a common goal

As said before, IoT will occupy a prominent place in our day-to-day life. However, the design of protocols to

*Corresponding author
Email addresses: hlakhlef@utc.fr (H. Lakhlef), bouabdal@utc.fr(A. Bouabdallah), raynal@irisa.fr (M. Raynal), jbourgeois@femto-st.fr(J. Bourgeois)