Chapter 12
Interoperable IPv6 Sensor Networking over PLC and RF Media

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ABSTRACT

The evolution of technology has made the connection of all types of devices to IP networks possible. In this paper, the authors investigate the possible usage of IPv6 in sensor networks connected through the Power Line Communication (PLC) non-wireless medium and demonstrate possible interoperability. This work is based on the adaptation of the IEEE 802.15.4 standard protocol constrained by the low-power, lossy and low data-rate context of PLC transceiver that uses pulse modulation. The aim is to provide interoperability features with other media using a robust and reliable communication stack. The target application of such results ranges from smart metering and environment monitoring to home control and urban area energy efficiency applications. This paper proposes the first adaptation of the IEEE 802.15.4 standard commons for the PLC medium. Following this standard interface, the authors demonstrate data communication on PLC with low power energy requirement using the pulse PLC physical layer. This paper also presents an initial implementation of the Routing Protocol for Low power and lossy networks (RPL) setup proposed by the IETF working group. In this context, the authors demonstrate interoperability in a testbed between PLC and Wireless Sensor Networks (WSN).

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1. INTRODUCTION

The explosion of the connectivity that rose between 134% and 1,648% from 2000 to 2009 depending on the world region considered.

Since the emergence of the ‘‘Internet of things’’, the meaning of the word connectivity entered yet another dimension.

In this context there is definitely a need for open protocols, to enable the cohabitation between them and create a real interconnectivity through all these devices. We truly believe in the use of open protocols compared to proprietary protocols, because it provides easy interfacing facility between devices. The assumption of a proprietary approach sounds incompatible with the interoperability aim.

We assume that a single medium technology cannot fulfill every requirement, and that there will always be a need for different technologies together to cover the needs that will appear in the future.

With these assumptions, we present a reliable and robust interoperability in the low power and lossy networks (LLN) context. In particular we focus on the low rate wireless personal area networks (LR-WPAN), for which the IEEE 802.15.4 standard (IEEE, 2006) has been designed. The vast majority of these devices are wireless and we bring in the following an easy interoperability feature with another medium using Power Line Communication (PLC) medium.

PLC uses any electrical wires as a network medium and is therefore known as a ‘‘no-new wire technology’’. Indeed, all the electrical networks can be employed as data networks. Electrical power is transmitted over high voltage transmission lines, distributed over medium voltage, and used inside buildings at lower voltages. PLC can be applied at each stage.

Relying on PLC technology, the solution we present doesn’t require any further infrastructures, see Figure 1. Furthermore, the electrical network is actually the most widely deployed network. We aim to use this existing medium in collaboration with classic RF solutions, thanks to the use of open standards such as IPv6 and get rid of the proprietary protocols on PLC that restrain its usage. Our goal is to make every node of the Internet of things connected in an interoperable way for it to be accessible from any Internet access point.

Figure 1. Applications targeted by PLC
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