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Study on Integrating BACnet with IPv6-based Wireless Sensor Networks

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Abstract

The wireless sensor network with BACnet (Building Automation and Control Networks) is the trend of intelligent building and building automation. In order to provide a new integrate solution for BACnet and WSN, An optimization for standard BACnet stack is proposed. In this paper, current technologies are presented. With the utilization of uIPv6 stack, the data communication between BACnet stack and hardware platform of WSN is realized. An evaluation is finally performed to show with evidence that the integrated system model is feasible.

Keywords: intelligent building; building automation and control networks; uIPv6 stack; integrated system

1. Introduction

With the rapid development of wireless communication technology, most of the fundamental supports for the implementation of automation are provided by computer network technologies. Especially in intelligent building, the market demand is moving rapidly in integrate technology direction. Currently, to meet the growing market demand flexibly and save the installation cost effectively, the field of commercial building automation is seeking for integrated wireless networks.

BACnet (A data communication protocol for Building Automation and Control Networks) is an international standard [1] in the automation field of intelligent building. The main goal of BACnet protocol is to provide a communication protocol (For Auto-Control System of Intelligent Building), which is open, extensible and interoperable. BACnet provides 6 kinds of wired data link layer protocol (such as

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MS/TP, PTP, ARCnet, Ethernet, LonTalk and BACnet/IP). However, it did not provide wireless solutions. Therefore, to meet the market demand, BACnet need to define a new wireless communication solution. 6LoWPAN(IPv6 over Low power Wireless Personal Area Network) is a kind of wireless communication based on IEEE 802.15.4, which mainly utilized for wireless personal area network that is low-speed, short-distance and low-power-consumption. Combining the BACnet and 6LoWPAN can definitely popularize the standard of BACnet, and, furthermore, meet the needs of the auto-control field of intelligent building simultaneously [2, 3].

In this paper, we focus on the feasibility of executing the BACnet protocol on the WSN nodes based on IPv6. The operation is implemented for Readproperty and Writeproperty service in BACnet on Tmote Sky, and the result of the executed test are discussed.

2. Research Background

2.1. BACnet Standard

To consider the advancement and expandability of technology, ASHRAE SSPC 135P committee had established architecture (Fig. 1) according to ISO/OSI-RM. This architecture defines local area networks of different kinds, and describes the basic components of auto-control network system and its features, and develops object-oriented information model. Object-oriented analysis and design technique are also utilized. To promote the innovation of devices, functionalities of service that are related to equipment set up inside and structure are not customized [4].

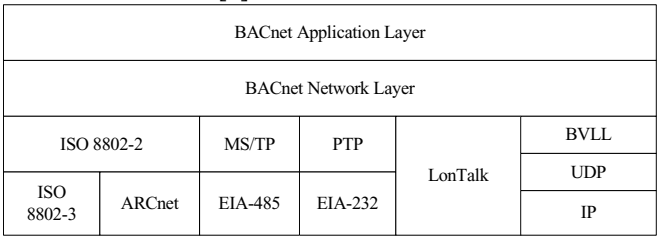

Fig. 1. BACnet Architecture

2.2. Object and device of BACnet

BACnet uses object-oriented approach to describe function of each device. A BACnet object represents a specific device. Each object has encapsulated the element set of data. Objects are described by the data referred to as attribute, which is available and modifiable to the other objects.

The standard of BACnet-95 includes frequently-used basic function units in building automatic systems. This standard consists of eighteen defined objects: analog input, analog output, simulation value, digital input, digital output, digital value, commands, calendar, schedule, events, files, group, register ring, polymorphism input, polymorphism output, notice kind, procedures and equipment.

Three attributes are included in each object: object identifier, object name and object type. Among them, the object identifier used to characterize the object uniquely. By broadcasting the object name of a particular, self-contained object, the BACnet devices can establish connections with devices that include related objects. BACnet protocol calls for each device to include device object and, by loading its attributes, the network obtains all the device information.

2.3. Service and communication model of BACnet