EXPERIMENTAL PERFORMANCE EVALUATION AND FEASIBILITY STUDY OF 6LoWPAN BASED INTERNET OF THINGS

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ABSTRACT

Nowadays, demand for low power, small, mobile and flexible computing machines that interconnects are growing rapidly. This study highlights internet of things (IoT) model regarding sensor node discovery and IPV6 framework using 6LoWPAN. Contiki network simulator (cooja) was used to examine the performance of the proposed network. The simulator was chosen because it provides good graphical user interface environment and allow rapid simulation setup found to be best in simulating network involving 6LoWPAN. Three experiments were carry out with the network topology designed to have 3, 7 and 5 motes respectively. The parameters considered in the simulation were throughput and packet loss which were examined using packet generation rate of 1 to 50 packet/sec with a constant delay. GET requests was sent to the humidity and temperature sensor motes running CoAP servers, and the corresponding throughput were observed in each case per experiment, it was observed that there was a 10 packet per second increase before it finally dropped This was because of the packet loss due to the increase in traffic. GET request was sent to motes to obtain the packet loss and the packet that were not acknowledged determined the packet loss. In this study, the performance of the proposed model in terms of throughput and packet loss was studied and the expected results will aid in planning 6LoWPAN network, A transition flow diagram was evolved for this work to represent packet routing process.

Keywords: *internet of things, network, throughput, packet loss, IPv6, 6LoWPAN*

1. INTRODUCTION

Internet of things (IoTs) can be refers to as a model for connecting objects, peoples and things to the internet to enhance their ability to communicate with one another [1]. IoTs are made up of network of physical objects with entrenched technology to sense and communicate their external or the internal environments. The idea of IoTs spans through many applications, systems and protocols otherwise known as "things" [2]. Environmental sensors enable the monitoring of environmental condition either to know the present environmental state or providing early warnings.

As some of these sensors are part of the objects in the network, it is required to connect them to the internet using standard internet protocol across the sensor boundary to increase the access to the data they acquire. Things that are manually operated can now be accessed and visualized automatically [3].

To enable sensor network function for a reasonable period of time, the power consumption is an important factor. Most of the hardware and software design has effect on sensor node power usage [4]. Communication is one of the major energy consuming factor. Adoption of efficient wireless protocol transmission and reception period is important. As a result, power consumption can be reduced. This will enable CPU and radio to be more stable at off/standby state. Consumption efficiencies in the radio protocol make a noteworthy difference to the power consumption of the node. Initial data processing on the nodes can moderate the amount of data required to be sent, but CPU required longer operation cycle to process the reading task [5].

Though, not all the sensor network or nodes in a network required power control. However in some cases, Sensor nodes powered with main power supply could still be backed up with recharge batteries, a typical example is the smart grid sensors in power systems [6]. Some of the present sensor network employed one or more gateway for interfacing with the network, handle collection of data and uploading to the external location [7]. The challenge of such system is that there is need for the gateway to know about everything within the network.

Communication protocol standard has been fashioned around the protocol and technology of internets. As sensor networks connected to this infrastructure they can communicate far beyond the perimeter of their own network. Under the banner of internet of things technologies for internet connected sensor systems has been proposed [8].

Recently, some devices are implementing sensor discovery mechanism and Internet Protocol version 6 (IPv6) frameworks. However, most of these mechanisms have been considered for local area networks (LANs) and likewise expanded for IPv6 over Low Power Wireless Personal Area Network (6LoWPAN). Some of these mechanisms including Universal Plug and Play (UPnP) protocol which permits automatic creation of device-to-device connection, and Service Location Protocol (SLP) that can enable devices to communicate in LAN without previous configuration. SLP can be use by the Devices to announce their availability in the local network [9]. This is important for large-scale internet of things scenario.

In computer networks, devices are discovered based on the protocols they are supported on and the rules in the network. For example, Address Resolution Protocol (ARP) has been used for hosts discovering on a local area network [10]. At the device and service levels, mechanisms such as Semantic Web Services [11] and Universal Plug and Play (UPnP) [12] have been supported. Device discovery has been inspected and applied in both local and mobile network intensively [12], [13], [14]. However, in IoTs scenario, technology which could enhance the discoverability of device with low power consumption is required to be adopted.