SIMULATION ANALYSIS FOR QOS IN INTERNET OF THINGS WIRELESS NETWORK

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ABSTRACT

The Internet of things (IoT) composed of numerous smart devices and communication technologies. The IoT devices interchange the information through wireless or wired network connections. Compared to the wired connection, the wireless connection in IoT is the current primary concern. In general, there are few wireless network protocols that can be used to connect smart devices such as 6LoWPAN, RPL, CoAP, MQTT, and AMQP. These protocols are used to transfer messages in the IoT network. This paper, compared IPv6 protocol wireless network, Low Power Wide Area Network (6LoWPAN) and Low Power and Lossy Network Routing (RPL) for IoT communications using Contiki:cooja simulator. The considered QoS parameters are throughput, end-to-end delay, and jitter. Based on the results, 6LoWPAN achieved better QoS compared to RPL.

KEYWORDS

6LoWPAN, RPL, Simulation, Throughput, End-to-End Delay, Jitter.

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1. INTRODUCTION

Internet of Thing (IoT) system uses low power sensors and microcontrollers. The LoWPAN which known as Low Power Wide Area Network is the first IoT network that deploys many sensors and controllers linked into internet network. Since the network is using IPv6 protocol, thus the name of the IoT network under Internet Protocol Version 6 (IPv6). Ahmed (2017) and Aman (2016) is called 6LoWPAN (IPv6 over Low-Power Wireless Personal Area Networks) (Li, 2018). Another network that supports IoT system is called RPL (IPv6 Low-Power and Lossy Network Routing Protocol). RPL divides packet processing and adapt routing optimization objects, including energy consumption, communication delays and limits minimization (Parasuram, 2016). Multiple times of RPL can run simultaneously within the network (Kim *et al.* 2017).

2. RESEARCH METHODOLOGY

This research focused on the study of the Quality of Service (QoS) scenarios for IoT in 6LowPAN and RPL. This work assumes that the infrastructure developed supports 6LoWPAN and RPL architecture. The evaluation is done using Contiki: cooja network simulator. The Contiki: cooja is programmed so that the limited node speed is 200 as in (Xie *et al.*, 2014). Also, the number of nodes varied from 10 to 50 nodes. The research metrics are shown in Table 1.

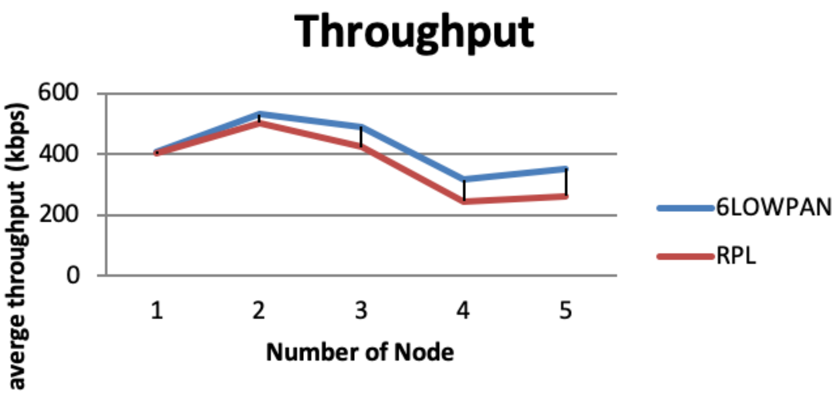
Table 1. Simulation Parameters General.

Parameter	Value
Node transmission range	50 m
Node carrier sensing range	100 m
Distribution of nodes	Random
Routing protocol	6LowPAN, RPL
Mote type/startup delay	T-mote sky/1000ms
MAC layer	CSMA/CA
Bitrate	250 kbps

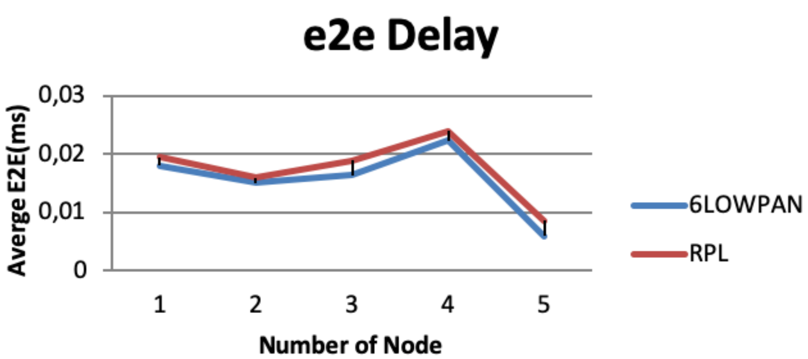
Parameter	Value
Mote type/startup delay	T-mote sky/200ms

3. RESULTS AND DISCUSSION

The parameters considered for this paper are throughput (Aman, 2016), end-to-end delay (Hassan & Jabbar, 2017) and jitter. Graphic 1 shows the results for throughput, Graphic 2 shows the results for end-to-end delay, finally Graphic 3 shows the results for jitter.



Graphic 1. Average Throughput Number of Nodes.



Graphic 2. End-to-end Delay Number of Nodes.

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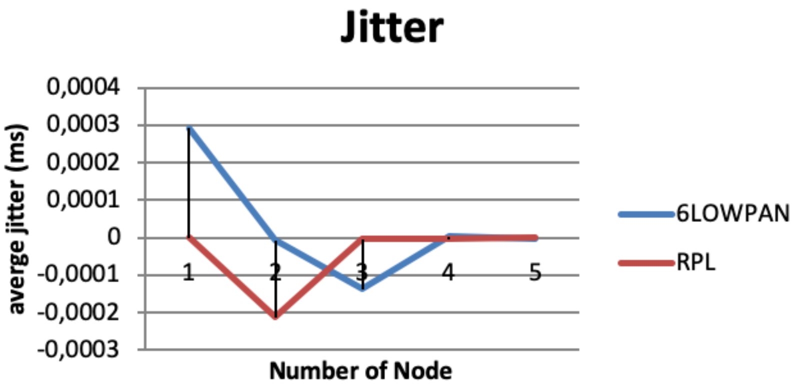

Graphic 3. Jitter Number of Nodes.

The average throughput from Graphic 1 shown at a data rate of 250 kbps, 6LoWPAN, RPL, and is slightly different from the selected number of nodes because the topology has changed during simulation. The average overall capacity of the two is mainly 3907 Kbps or 3907 Mbps. Note that for both routing protocols, the number of nodes affected. Different routing tables over several nodes result from the random movement of nodes, which results in the fluctuation of the received average throughput. For RPL 2.57 % and 6LoWPAN, 2.14% is the difference between the highest throughput and the average throughput of the other Nodes, which indicates a different number of nodes impact significantly the average throughput, the 6LoWPAN has better throughput compared with RPL.

Graphic 2 shows the end-to-end delay of 6LoWPAN and RPL routing protocols. A distinct amount of nodes have no significant effects since each RPL node can keep a routing table that saved all data regarding current paths but 6LoWPAN sets the road on demand. That means the average end-to-end RPL is not much more effective compared to 6LoWPAN for some nodes chosen than for some.

Graphic 3 represents the variation in jitter. Jitter signifies a difference in delay with which packets reach the destination. Although the variety is almost same but on average 6LoWPAN performs well in terms of jitter compared to RPL. It shows that, if the nodes are higher, the RPL is less than 6LoWPAN.

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5. CONCLUSIONS

The Internet of Things considered as one of the most significant changes to the current innovation these days. By analyzing the QoS of IoT in 6LoWPAN and RPL, many features revealed to prove its suitability for IoT. Link layer of 6LoWPAN and RPL could support tiny things to participate. Protocol stack for both is appropriate for IoT. Nevertheless, 6LoWPAN yield marginally better results than RPL.

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