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Performance Evaluation of Routing Protocol in Internet of Things using Netsim

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Abstract:Internet of things (IOT) can be defined as network of networks which allows finding digital entities and physical objects.IoT describes a system where items in the actual world, and sensors within or linked to these items, are connected to the Internet via wireless and wired Internet connections.AODV is the routing protocol that is used in it .This paper aims to evaluate the performance in terms of and compare the three scenario in terms of throughput,packets transmitted and packets collided. The mobility model included in it is Random Waypoint. Simulations are carried out using NETSIM simulator and lastly, we present simulation results that illustrate how the performance drastically changes, as a result of changing the scenario.

Keywords:IOT; AODV; IPV6; NETSIM.

I. INTRODUCTION

Despite the worldwide buzz around the Internet of Things, there is no single, universally accepted definition for the term. Different definitions are used by different groups to describe or promote a particular view of what IoT means and its most important attributes. The Internet is a world-wise network of interconnectedcomputer networks, based on a standard communication protocol (TCP/IP). IoT execution use different practical communications models, each with its own feature.Four common communications modelsDevice-to-Device,Device-to-Cloud, Device-to-Gateway and Back-End Data-Sharing.The large-scale execution of IoT devices has ability to transform many aspects of the way we live. For consumers, new IoT products like Internet-enabled appliances, home automation components, and energy management devices are moving us toward a vision of the “smart home’’, offering more security energy efficiency. Other personal IoT devices like wearable fitness and health monitoring devices are transforming the way healthcare services are delivered. This technology has ability to be beneficial for people with disabilities and the elderly, enabling improved levels of independence and quality of life at a reasonable cost.

IoT is conversion forces that can help companies improve performance through IoT analytics and IoT Security to deliver better results. Businesses in the utilities, oil & gas, insurance, manufacturing, transportation, infrastructure and retail sectors can derive the benefits of IoT by making more informed decisions. Internet of Things helps to connect devices embedded in various systems to the internet. When devices can represent themselves by computer technology, they can be controlled from anywhere. The connectivity helps us capture more data from more places, ensuring more ways of increasing efficiency and improving safety and IoT security.Only 1% of things around us are connected. Refrigerator, car, washing machine, heater, a/c, garage door should all be connected but are not.From 10 Billion today to 50 Billion in 2020 should include processes, data, things, and people.The fundamental objective of this paper is to evaluate the performance of three different types of scenarios: 16 nodes, 24 nodes, 32 nodes with the help of AODV protocol which is reactive routing protocol. Thescenarios are compared in terms of application metrics such as Throughput (Mbps) and network metrics such as packets transmitted and packets errored.

II. DESCRIPTION OF IOT ROUTING PROTOCOL

A. Reactive protocol – AODV

Reactive protocols seek to set up route, on-demand. When node wants to start communication with other node to which it has no route, the routing protocol will try to begin such a route. It offers quick adaptation to vital link conditions, low processingmemory overhead, low network utilization and discoversunicastroutes to destinations within the ad hoc network. Route Requests (RREQs), Route Replies(RREPs)and Route Errors (RERRs) are the type of message types defined by AODV.Route Requests(RREQ) message is transmitted by a node requiring a route to a node.Route Replies **(**RREP) message is over a single user and single receiver over a network back to the establisher of a (RREQ).Ifreceiver is either the node using the requested address or it has valid route to the requested address, Route Replies**(**RERR) nodes monitor the link status of next hops in active routes[1].

III. NETSIM SIMULATOR

NETSIM is network simulation software used for protocol modeling and simulation. NETSIM is being used by the world’s most prestigious institutions such as IIT’s, NIT’s, renowned universities and Indian army for network lab experimentation and research. This software is used to analyze computer networks with supreme depth, power and flexibility.

NETSIM has an open, modular and flexible architecture [2]. NETSIM provides simulation of various protocols working in various networks as follows: Internetworks, Advanced Wireless Networks, Cellular Networks, Cognitive Radio Networks, MPLS Networks, Wireless Sensor Networks, Personal Area Networks, LTE Networks [3]. NETSIM simulator software was developed by the privately owned company TETCOS having headquarters in Bangalore.

IV. SIMULATION SETUP

We have used NETSIM simulation software version 9.0 for the evaluation of our work. The results indicate evaluation in performance by taking IOT routing protocol such as AODV.

Table I.Simulation Parameters

SIMULATION PARAMETERS	
Simulator	NETSIM 9.0
Performance Metrics	Throughput (Mbps)
Network Metrics	Packets Transmitted, Packets Errored
Protocols Used	AODV
Number of Nodes	24, 16, 32
Traffic Type	Custom
Simulation Time	100 sec
Environment Area	100*100 (in Meters)
Mobility Speed	10m/s

Under this protocol, Throughput (Mbps) is used as application metrics. Packets transmitted and Packets errored are used as network metrics.

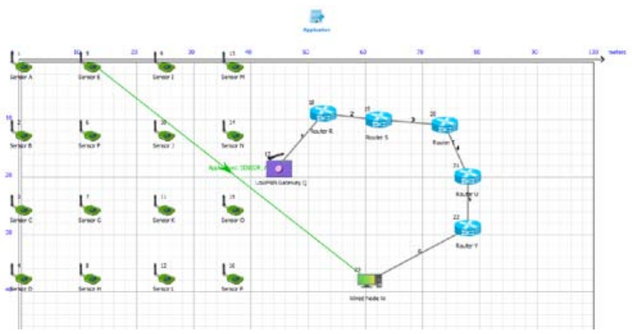

Figure 1.Network scenario with 16 nodes.

Our simulation setup is a network with randomly placed nodes within an area of 100 m * 100 m. In each scenario, node 5 and wired node are used as source node and as destination node for sending and receiving data. Figures 3,4 and 5 shows the throughput and packets transmitted of this network with respect to total simulation time which is considered as 100 seconds for which the simulation was performed.

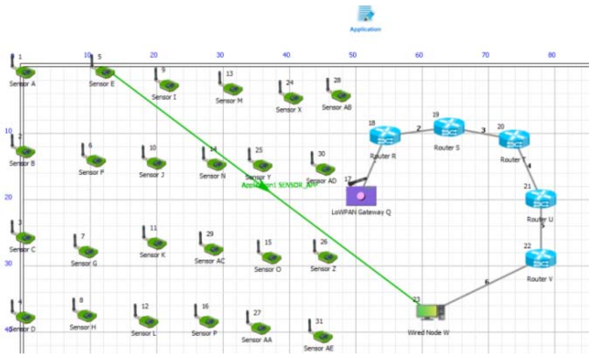

Figure 2.Network scenario with 24 nodes.

In this simulation, the network is adjusted to 16, 24 and 32 nodes and the traffic type is custom. The parameters used for carrying out simulation are summarized in the Table1.Three scenarios for 16, 24 and 36nodes are shown in figure 1, figure 2 and figure 3.

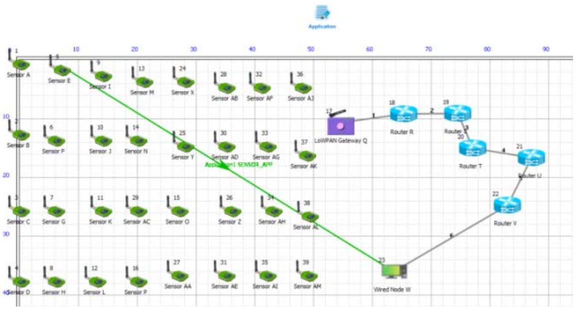

Figure 3. Network scenario with 32 nodes.

V. RESULTS AND DISCUSSIONS

A. Throughput

Throughput of a network can be calculated using different tools available on different platforms.Throughput defines how much useful data can be transmitted per unit time.It is measured in Mbps and should be more for the network Throughput is the most important metric to examine the performance of routing protocols[4].

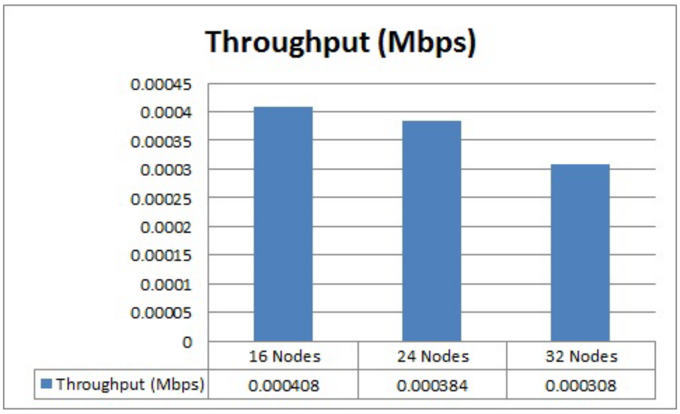

Figure 4.Throughput (Mbps) in 16, 24 and 32 nodes using AODV Protocol.

Throughput is the total capability of a processing system to move product through that system. Many things effect throughput may include protocol, data loss, latency, and others.We have noticed that as the numbers of nodes areincreasing,throughput decreases as throughput in 16 nodes scenario is more as compared to 32 nodes scenario because traffic is more in case of nodes 32.

Results of allthe three scenarios are easily analyzed from the figures 4, figure 5 and figure 6.

B. Packet Transmitted

A packet is a segment of data sent from one computer or device to another over a network. A packet contains the source,destination, size, type, data and other useful information that helps packet get to its destination and read. Below is a breakdown of a TCP packet. When a packet is transmitted over a network, routers and switchesexamine the packet and its source to help direct is direction [5].

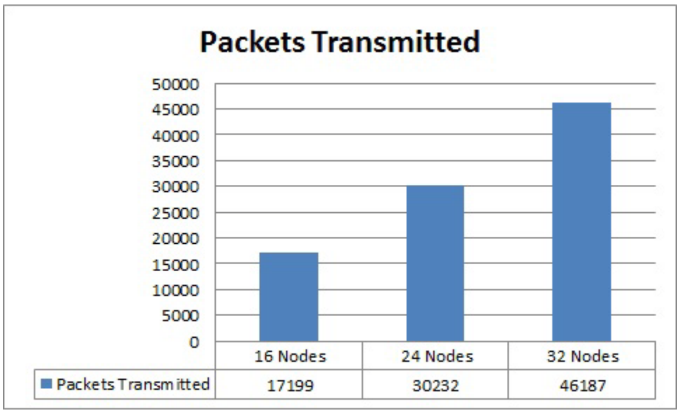

Figure 5. Packets Transmitted in 16, 24 and 32 nodes using AODV Protocol.

The size of a packet is limited, so most data sent over a network is broken up into multiple packets before being sent out and then put back together when received.

In the three scenarios of 16,24 and 32 nodes, the packets transmittedaremore in 32 nodes scenario as compared to 16 and 24 nodes scenarios.

So from here, we concluded that more the number of nodes more the packets will be transmitted from source to the destination.

The Packet transmission time can be calculated as:-

Packet transmission time = Packet size / Bit rate

The transmission time should not be interrelated with the propagation delay which is the time it takes for the first bit to travel from the source to the destination.

Propagation time = Distance / propagation speed

C. Packets Errored

Packet Error Rate (PER) is important Quality of Service Parameters for Wireless network. The packet error ratio (PER) is the number of received data packets divided by the total number of received packets.Most of researches in QoS have been devoted to the analysis of BER which gives insight to the mean behavior of the wireless network. A packet is declared incorrect if at least one bit is wrong. Even if BER gives important insightto the mean behavior of a wireless network, however it is not sufficientfor PER derivation[6].

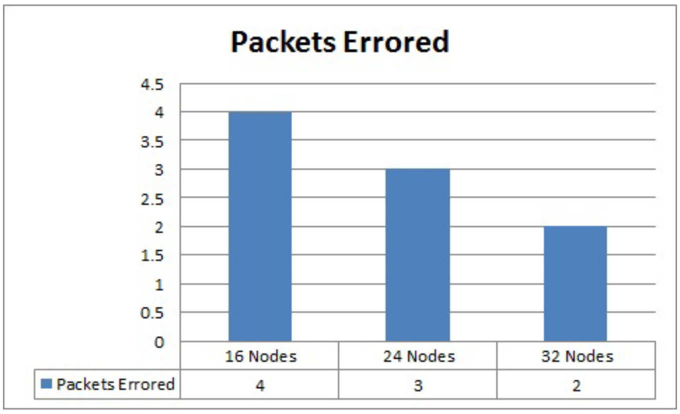

Figure 6.Packets Errored in 16, 24 and 32 nodes using AODV Protocol.

Packet Error Rate helpsin discoveringbad communication connections. When a high percentage of re-transmits, payload errors occur, cautious analysis of the statistics shows whether the 2 devices under test are undergo trouble communicating. Generally, if the statistics display either a large number of re-transmits with few errors or an equal number of errors and re-transmits, then the two devices are not communicating clearly. However, if the statistics display a large number of errors and a small number of re-transmits, then the packet sniffer is not receiving the transmissions clearly

In the above scenario, we have noticed that packets errored in the 16 nodes scenario are more as compared to 32 nodes scenario.

Table II.Values ofthroughput, packet transmitted and packet errored.

	16 Nodes	24 Nodes	32 Nodes
Throughput (Mbps)	0.000408	0.000384	0.000308
Packets Transmitted	17199	30232	46187
Packets Errored	4	3	2

VI. CONCLUSIONS

This paper described the evaluation of Throughput, Packets Transmitted, and Packets Errored in different scenarios of IOT. There are many routing protocols such as AODV, DSR, OLSR, GRP, ZRP, DSDV, TORA etc. One Ad-hoc protocolhas taken in the simulation such as AODV which is reactive routing protocol. AODV was used with respect to its throughput in Mbps as itsapplication metrics.Packets transmitted and packets errored were used as its network metrics.

In terms of reliability and efficient use of network resources for IOT, the selected performance metrics and network metrics were subjected to identify protocol effectiveness and suitability in the network. AODV was implemented in the scenario having 16, 24 and 32 nodes network respectively. In each scenario, node 1 and wired node was used as source node and as destination node for sending and receiving data. According to results, we analyzed and proved that 16 nodes scenario is best among other scenarioswith respect to Throughput (Mbps)thatis more in it.

VII. REFERENCES

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BIOGRAPHIES

Gurpreet Singh received his B.Tech. degree in Information Technology from DAV Institute of Engineering & Technology, Jalandhar, Punjab, India in 2009 and M.Tech. degree in Computer Engineering from University College of Engineering, Punjabi University, Patiala, India in 2011. He was teaching as a Lecturer at RayatBahraGroup of Colleges, Mohali, Punjab, India. Presently, he is teaching as Assistant Professor at Guru Nanak Dev University, Regional Campus Sultanpur Lodhi. He has more than 25 research publications in International, National Conferences and Journals. His research interest includes Wireless Communication, Network Security, Computer Networks and Data Communication.

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