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Simulation and Performance Analysis of Throughput and Delay on Varying Time and Number of Nodes in MANET

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***Abstract* - Mobile Adhoc Networks (MANET) are dynamic wireless network where nodes communicate with each other without any existing infrastructure and wirelessly. Here the communication is maintained by the transmission of data packets over a common wireless channel. A network may operate in an impartial manner, or may be connected to the larger internet. In this manner the AODV (Ad hoc On demand Distance Vector) is a loop free routing protocol for ad hoc networks.Here the various performance metrics of wireless sensor node using AODV routing protocol has analyzed and implementation on the parameters based on Average end –to-end delay and Throughput with different pause time and network size that mean number of nodes in respective network using traffic scenario in MANET using Network simulator.**

***Keywords* - MANET, AODV, Simulator NS-2, Performance metrics.**

I. INTRODUCTION

In typical ad hoc networks, nodes play the role of a router [1]. The nodes are free to move about and organize themselves into a network. These nodes change the position frequently.

All networking functions determine the network topology, multiple accesses and routing of data over the most appropriate multi hop paths, performed in a distributed way. These functions are particularly operating in a limited communication bandwidth available in the wireless channel. In The MANET has many challenges for communication, which one of the important is to provide secure and efficient routing of data in the network so there are need to develop dynamic and efficient routing protocols, which can ensure efficient and secure routes for communication. In this manner the AODV (Ad hoc On demand Distance Vector) is a loop free routing protocol for ad hoc networks. For AODV routing, many effects based on mobility i.e varying speed of nodes in MANET on the traffic models like TCP/FTP (Transmission control protocol/ File Transmission protocol) and UDP/CBR (User Datagram Protocol/Constant Bit Rate) and have compared their performance for the metrics.

II. ROUTING PROTOCOL

Routing protocols are also classified based on whether they are destination-initiated (Dst-initiated) or source-initiated (Src- initiated). A source-initiated protocol sets up the routing paths upon the demand of the source node, and starting from the source node. A destination initiated protocol, on the other hand, initiates path setup from a destination node. Routing protocols are also classified based sensor network architecture [2]. Ad-hoc on-demand distance vector routingwith some features which is using for WSN.

i. AODV routing protocol belongs to the category of reactive or on demand routing protocols. In such protocols, the nodes do not update their routing tables periodically, unless new routes are demanded by any network node.
ii. Stimulated by the above feature, such protocols are not suitable for the networks that are highly dynamic, prone to frequent and unpredictable changes.

iii. AODV routing protocol does not initiate route discovery of its own, unless it is requested by some other node that is willing to transmit any data.
iv. In AODV, the life of the routes in routing table of the nodes is until the routes are no longer needed in the network, i.e., if the routes are not used for a specified period of time, they are discarded.
v. AODV routing protocol offers route to the destination "on- demand".
vi. Here any of the source nodes willing to communicate with the destination node of the network to which it has no route information, so it has to make route discovery before making any transmission.
vii. The route discovery and route maintenance which are the two main responsibilities of AODV routing protocol are done by the use of three types of control messages; Route Request (RREQ), Route Reply (RREP), Route Error (RERR) messages.
viii. From the available choices of route, the sender selects the one offering the shortest path to the destination. If one or more routes are of equal length, then it selects the one offering minimum traffic.
ix. AODV employs destination number as the requested node identity to find routes to the destination. This number is mentioned in the RREQ control message.

III. ROUTING CHALLENGES AND DESIGN ISSUES IN WSNS

Despite the innumerable applications of WSNs, these networks have several restrictions, e.g., limited energy supply, limited computing power and limited bandwidth of the wireless links connecting sensor nodes. One of the main design goals of WSNs is to carry out data communication while trying to prolong the lifetime of the network and prevent connectivity degradation by employing aggressive energy management techniques. The design of routing protocols in WSNs is influenced by many challengingfactors. These factors must be overcome before efficient communication can be achieved in WSNs. These factors are Node Deployment, Energy consumption without losing accuracy, Data Reporting Model, Node/Link Heterogeneity, Scalability, Network Dynamics, Transmission Media, Coverage, Connectivity, Data Aggregation, Quality of Service etc.

IV. DATA APPLICATION

Data and traffic agent that takes the responsibility to transport the data in the network are of different types and offer different characteristics in the network [3,4]. It is necessary to understand the characteristics and therefore the performance to find the suitability of each type in a network. The two types of data/traffic agent types used in the network are as follows:

i) TCP/FTP

In such a traffic scenario, TCP represents the data type and FTP represents the application traffic agent of any application which transports TCP data. Here TCP is a transport layer protocol and FTP is an application layer protocol. This scenario offers connection oriented transmission environment, where communication occurs in phases, namely, connection establishment, data transmission, connection termination.

ii) UDP/CBR

This type of traffic implies data of UDP type and application traffic agent is CBR. Here, the former is a transport layer protocol and latter is application layer protocol. It offers transmission of data at constant bit rate and does not communicate in phases, and traffic moves in one direction from source to destination without any feedback from destination.

V. PERFORMANCE METRICS

The performance of any system needs to be evaluated on certain criteria, these criteria then decide the basis of performance of any system. Such parameters are known as performance metrics [5] [6]. The three types of performance metrics used to evaluate performance of TCP/FTP and UDP/CBR in this paper are described below:

a) Throughput

The throughput is the measure of how fast we can actually send data through the network. It is the measurement of number of packets that are transmitted through the network in a unit of time. It is desirable to have a network with high throughput.

Average Throughput =

$$\frac{\text{Total Received size}}{\text{Elapsed time between sent and receive}}$$

b) Packet delivery ratio (PDR)

It is the ratio of number of packets received at the destination to the number of packets generated at the source. A network should work to attain high PDR in order to have a better performance. PDR shows the amount of reliability offered by the network.

Packet Delivery Ratio =

$$\frac{\text{Number of packets received successfully}}{\text{Number of packets sent}}$$

c) Average end – to – end delay

This is the average time delay consumed by data packets to propagate from source to destination. This delay includes the total time of transmission i.e. propagation time, queuing time, route establishment time etc. A network with minimum average end to end delay offers better speed of communication.

Average End to End Delay = “Sum (for each i equal to packet number, (packet i received time- packet i sent time)”

Average Routing Load =

$$\frac{\text{Number of Routing Control Packets}}{\text{Total Simulation Time}}$$

VI. SIMULATION PARAMETERS

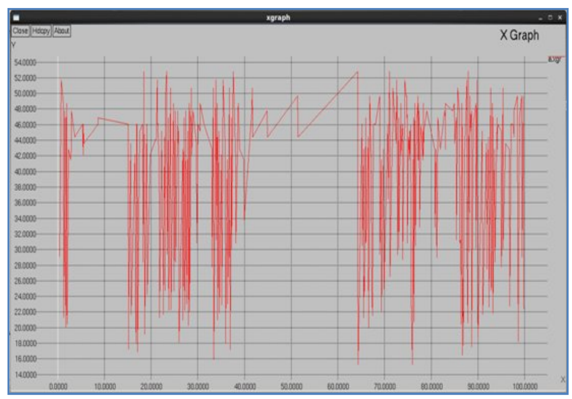
An environment size of 500m x 500m has been used in our simulation. The simulation is run over 100s.The network parameter used in our simulation is shown in the table I.

Table I
Simulation parameters

Parameter	Value
Routing protocol	AODV
Physical/Mac layer	802_15_4
Number of nodes	20,30,40,50
Simulation duration	100 s
Area	500 m x 500 m
Traffic source	FTP, CBR

Throughput and end to end delay has been measured and the simulated output has been shown using X-graph. Based on the simulation result, graph of delay versus time and throughput versus time has been generated. The graphs are shown fig.1 to fig. 9.

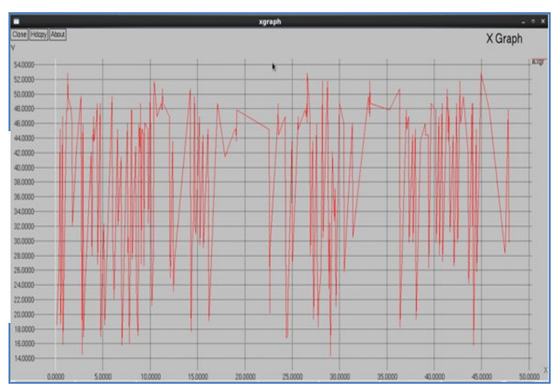
Throughput



Time

Fig.1 Throughput versus no. of nodes 20

Throughput



Time

Fig.2 Throughput versus no. of nodes 30

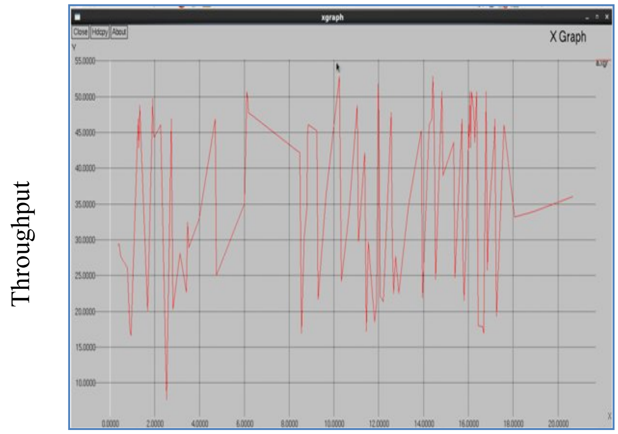


Fig.3 Throughput versus no. of nodes 40

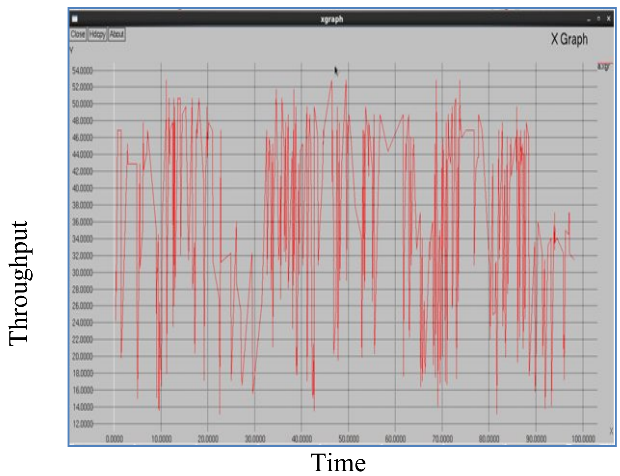


Fig.4 Throughput versus no. of nodes 50

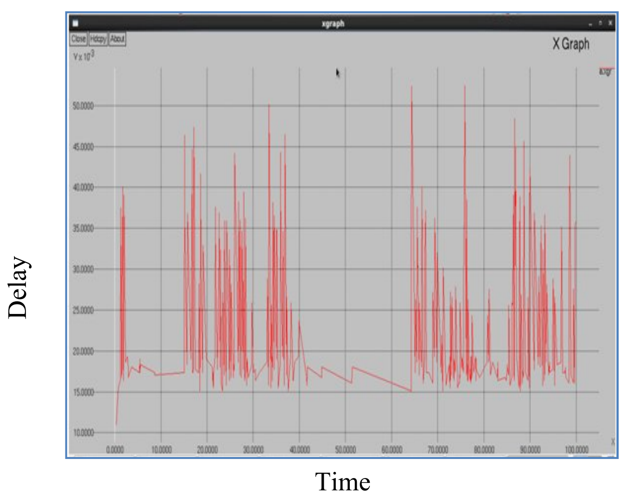


Fig.5 Delay versus no. of nodes 20

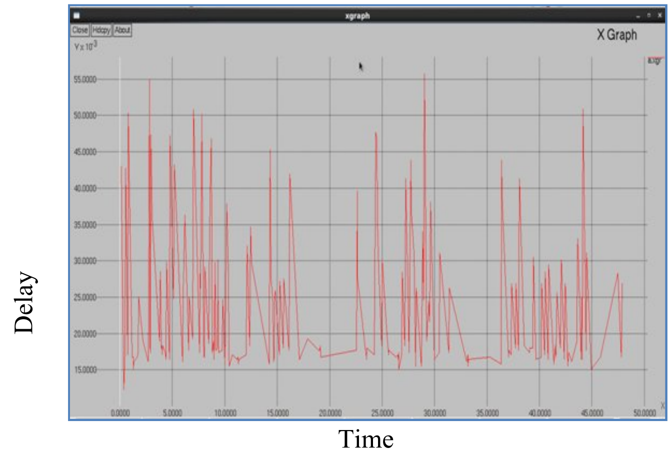


Fig.6 Delay versus no. of nodes 30

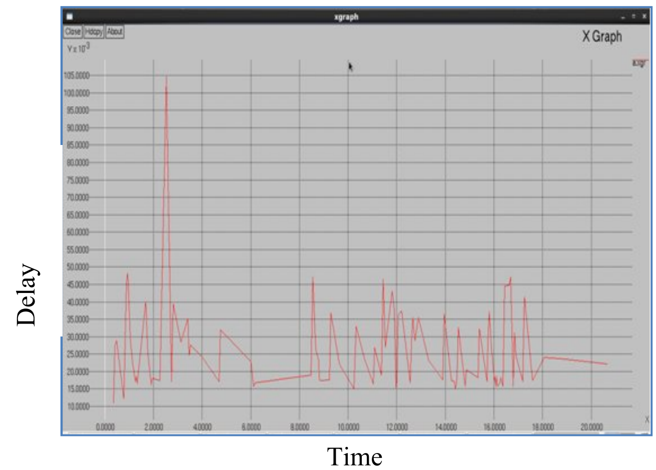


Fig.7 Delay versus no. of nodes 40

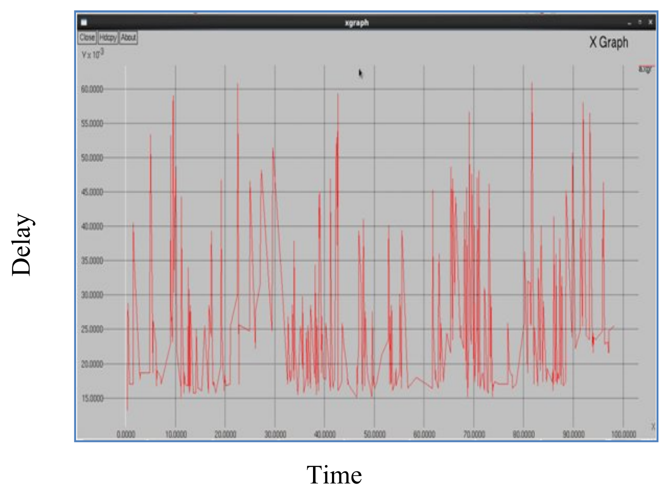


Fig.8 Delay versus no. of nodes 50

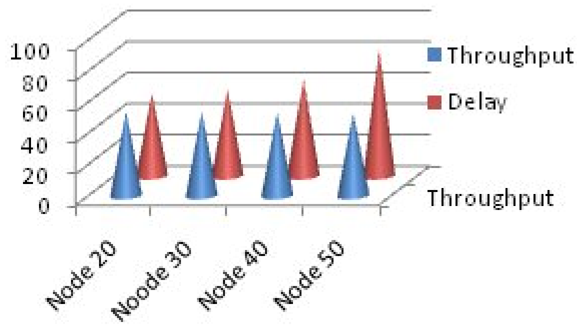


Fig.9 Variation of Throughput and Delay w.r.t Number of Nodes

VII. CONCLUSION

Implementation of wireless sensor network has been done using NS2 with varying number of sensor nodes. A sensor network has been simulated with varying number of nodes interconnected through AODV routing protocol. From the graph of maximum and minimum delay versus no of nodes, it is observed that the difference between the maximum and minimum delay is increased with increase in number of nodes for small network as the nodes get limited number of path to their destination. The throughput remains constant.

VIII. REFERENCES

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