INTERNATIONAL JOURNAL OF SCIENTIFIC PROGRESS AND RESEARCH (IJSPR) ISSN: 2349-4689
Volume-24, Number - 03, 2016

Simulation of Q-CBRP Based WMN Routing Protocol with Varying Pause Time using NS-2

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Abstract - The wireless mesh network is a new emerging technology that will change the world of industrial networks connectivity to more efficient and profitable. Mesh networks consist of static wireless nodes and mobile customer; have emerged as a key technology for new generation networks. The Quality of Service (QOS) is designed to promote and support multimedia applications (audio and video), real time. However guarantee of QoS on wireless networks is a difficult problem by comparison at its deployment in a wired IP network. This paper focuses to enhance an efficient Cluster Based Routing protocol Q-CBRP for random mobility model for mesh clients using varying traffic such as HTTP , FTP and video streaming and measure the different criteria of QoS in a mobile WMN.

Keywords - Q-CBRP, node ,Wireless Mesh Network, Routing Protocol.

I. INTRODUCTION

Wireless Mesh Networks (WMNs) are one of the key technologies which will dominate wireless networking in the next decade. They will help to realize the long-lasting dream of network connectivity anywhere anytime with simplicity and low cost. Accordingly they will play a major role within the next generation Internet. Their capability for self-organization significantly reduces the complexity of network deployment and maintenance, and thus, requires minimal upfront investment [1]. Wireless mesh networks (WMNs) have emerged as a key technology for next generation wireless networks showing rapid progress and inspiring numerous applications [2].

Wireless Mesh Networks (WMNs) can be broadly categorized into three main types according to their architecture [1]: Infrastructure mesh, client mesh and hybrid mesh. An infrastructure mesh consists of relatively static mesh routers operating in ad-hoc mode. Typically, one or more of these mesh routers act as gateways to the WIRED NETWORK and provide WAN connectivity for the entire WMN. The key difference to traditional wireless LANs is that the wired backhaul is replaced with a wireless multi-hop network infrastructure provided collectively by the MESH ROUTERs. An infrastructure WMN can be thought of as a normal WLAN, formed with the help of Access Points (MESH ROUTERs) connected wirelessly in ad-hoc mode [2], preferably on a different radio or channel [3] and providing connectivity to the WIRED NETWORK.

A client mesh is essentially a pure mobile ad-hoc wireless network with each MESH CLIENT acting as an independent router with no centralized routing control [4]. In a client mesh architecture, the network is made up of mobile client devices only, without any dedicated network infrastructure. Consequently, client devices are responsible for implementing network functionality such as routing and forwarding of packets.

A Hybrid mesh architecture is the most generic and interesting version of a WMN. Hybrid WMNs are formed through the amalgamation of infrastructure and client mesh networks. In this scenario, MESH ROUTERs provide the basic backbone infrastructure and MESH CLIENTs actively participate in the operation of the network. Mobile clients can, therefore, provide a dynamic extension of the more static infrastructure part of the network.

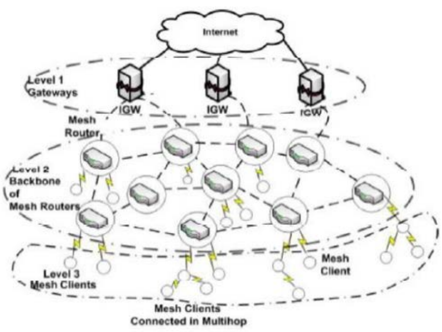

Figure 1.1 : Wireless Mesh Network

A wireless mesh network consists of a number of wireless stations (mesh routers MRs) that cover a large area. The nodes communicate with each other in a multi-path, multi-hop fashion via the wireless links to build a cost-effective and easy-configurable wireless backbone for providing Internet connectivity to wireless Mesh clients (M.C)

II. PRELIMINARIES

2.1. CBRP (Cluster Based Routing Protocol) is an on-demand routing protocol, where the nodes are divided into clusters. It uses clustering's structure for routing protocol.

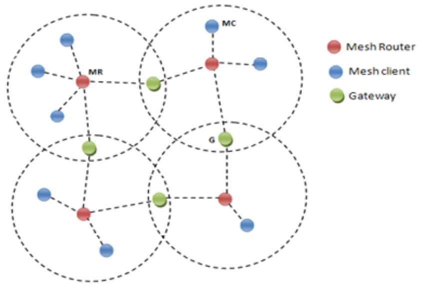

Figure 2.1 : WMN with Clustering Architecture

Clustering is a process that divides the network into interconnected substructures, called clusters. Each cluster has a cluster head as coordinator within the substructure. Each cluster head acts as a temporary base station within its zone or cluster and communicates with other cluster heads.

CBRP is designed to be used in Wireless sensor network and mobile ad hoc network. The protocol divides the nodes of the ad hoc network into a number of overlapping or disjoint 2-hop diameter clusters in a distributed manner. Each cluster chooses a head to retain cluster membership information. There are four possible states for the node: Normal, Isolated, Clusterhead (CH) and Gateway. Initially all nodes are in the state of Isolated. Each node maintains the Neighbor table where in the information about the other neighbors nodes is stored; cluster heads have another table (cluster heads neighbor) where include the information about the other Clustering is a process that divides the network into interconnected substructures, called clusters. Each cluster has a cluster head as coordinator within the substructure. Each cluster head acts as a temporary base station within its zone or cluster and communicates with other cluster heads.

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2.2Overview of AODV Routing Protocol

The AODV routing protocol is an adaptation of the DSDV protocol for dynamic link conditions. Every node in this network maintains a routing table, which contains information about the route to a particular destination. Whenever a packet is to be sent by a node, it first checks with its routing table to determine whether a route to the destination is already available. If so, it uses that route to send the packets to the destination. If a route is not available or the previously entered route is inactivated, then the node initiates a route discovery process. The routing messages do not contain information about the whole route path, but only about the source and the destination. Therefore, routing messages do not have an increasing size. It uses destination sequence numbers to specify how fresh a route is.

III. METHODOLOGY

3.1 Overview of Q-CBRP

The protocol CBRP improves QoS in mobile ad-hoc network in general. The basic protocol to make improvements to ensure QoS in Mesh Network.

The improvements will be summarized in two points. First to improve packet header of basic CBRP with more information to have a more complete protocol and the second point to add some fields in routing tables that we will explain in the next.

ID_neighbors_ Clusters	ID_neighbors_ Gateways	ID_members

Table 3.1 : Cluster Head Table

ID_CH	ID_Members

Table 3.2 : Cluster Gateway

Packet ID	Source Address	Dest_ Address	List_of_visited _node	TTL	R(bps)

Table 3.3 : Data Packet Header

Table 3.2 describe the Data Packet Header (DPH), different to DPH in CBRP, where we add two fields in the DPH of original CBRP, the TTL (Time To Live), contains a count of number of intermediate nodes traversed to avoid the packets loop and management of the available bandwidth to guarantee QoS (R) it signifies the minimum bandwidth required by a Mesh client to transmit the data.

In Q-CBRP, Cluster Head Table is the same tables in CBRP protocol (Table 3.1) but an improvement are added in the Gateway Table (Table 3.2). Gateway Table maintains the information regarding the gateway node and the available bandwidth over those nodes. In Gateway Table an Available Bandwidth, that meanwhen the data packet is sent to the destination or intermediate node it will reserve the bandwidth required by it. To perform this function of managing bandwidth, admission control mechanism is added and also block flows when there is not enough bandwidth to avoid packets loss.

ID_CH	ID_Members	Available Bandwidth

Table 3.4 : Cluster Gateway Table for Q-CBRP

In Q-CBRP, the Member Table maintains the information about its neighboring nodes by broadcasting a Beacon Request Packet.

ID_Cluster	Status	Link Status

Table 3.5 : Cluster Member Table

Each node in the cluster maintains a table called as Member table (Table 3.5) containing the address of Neighboring nodes. This table is maintained in the decreasing order of their distance from this particular node. Each node also stores the address of the Cluster-head. Cluster-head also maintains member table as well as it also maintains a gateway table which stores the address of gateway nodes in the decreasing order of distance from the centre head node. This Gateway table stores address as well as the available bandwidth of the gateway nodes.

Whenever a node generates a request to transfer the data to a particular node, it checks the destination node address in its member table. If the matching node is found in the member table, packet is transferred to that node. If no match is found, then the data packet will be sent to cluster-head. Cluster-head will again check for the match in its member table. If no match is found, cluster-head will check for the node in the Gateway node table at which the required bandwidth is available. The data packet is sent to the node at which the required bandwidth is available. The node address will be copied to List_of_Visited_Nodes field of data packet header. This field will help in the prevention of loops. Using this field, samedata packet will not be sent to a particular node more than once. Reduce the available bandwidth of the gateway node. This process will continue till the destination node is reached or if the count of visited nodes get increased than the count in TTL (Time to live) field. If this count becomes more than TTL the data packet is dropped and a message is sent to source node. And finally to ensure that the packets are received in the destination and when the nodes haven't bandwidth desired by the Source, the node stop traffic for a few minutes for complete a management of the queue to avoid packet loss.

IV. SIMULATION ENVIRONMENT

We have implemented Q-CBRP in ns-2 simulator.In our scenario we increase the pause time from 40-640 sec while the no of node is set constant i,e 60.The simulation is done using ns-2, to examine the performance of thenetwork by varying the number of pause time. The metrics used to evaluate theperformance are given below.

Throughput: The total number of the data packets generated by each source, counted by k bit/s.

Packet Delivery Ratio: The ratio of number of data packets generated by the "application layer" with CBR source and the number of data packets received by the CBR sink at the destination

V. EXPERIMENTAL SETUP AND ANALYSIS

We have implemented Q-CBRP in ns-2 simulator. In our scenario we increase the pause time from 0-640 sec while the no of node is set constant i,e 60.The major parameters of our experiment are listed in Table1.

Table-1. Simulation Parameters

Parameters	value
Transmission range	250m
Propagation channel frequency	2.4Ghz
Simulation Time	640s
Topology size	1200m*1000m
Phy and MAC Model	802.11
Interface of queue type	PriQueue
Antenna	OmniAntenna
Cross traffic type	CBR UDP
Mobility Model	Random Waypoint Model
Number of Nodes	60

VI. RESULT & DISCUSSION

The result shows shows that in both throughput and PDR Q-CBRP shows better result as compared to AODV with varying Pause time while the no of node is set to 60.

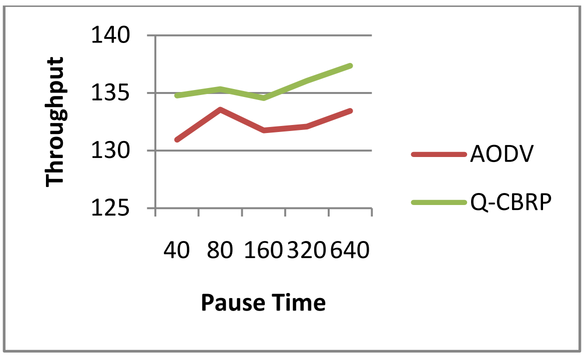

Figure 7.1 . Throughput

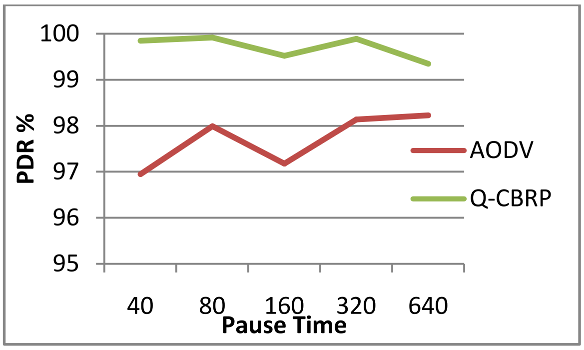

Figure 7.2. Packet Delivery Ratio

8. Conclusion

In this paper, we have analyzed the throughputs which increases with increase in pause time.TheQ-CBRP shows better results in terms of both Throughput and PDR as compared to AODV.It is also true that any of the single protocol does not supersede the other one. There performance depends upon the different scenarios

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