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TO IMPROVED QUALITY OF SERVICES IN MANETS USING ANALYSIS OF UNICASTS AND MULTICASTS

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ABSTRACT

A Mobile Ad hoc Network (MANET), is a self-configuring infra structure less network of mobile devices Connected by wireless links. ad hoc is Latin and means "for this purpose". Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. QOS is defined as a set of service requirements to be met by the network while transporting a packet stream from source to destination. Intrinsic to the notion of QOS is an agreement or a guarantee by the network to provide a set of measurable pre-specified service attributes to the user in terms of delay, jitter, available bandwidth, packet loss, and so on. In this paper we are presenting two mobile ad-hoc routing protocols DSDV and AODV. Here the DSDV is a proactive protocol depending on routing tables which are maintained at each node. The AODV is a reactive protocol, which find a route to a destination on demand, whenever communication is needed. Considering the bandwidth, throughput and packet loss, in both DSDV and AODV routing protocols, DSDV is best suited for only smaller networks and AODV is suited for general Ad-hoc networks.

I. INTRODUCTION

A Network is defined as the group of people or systems or organizations who tend to share their information collectively for their business purpose. In Computer terminology the definition for networks is similar as a group of computers logically connected for the sharing of information or services (like print services, multi-tasking, etc.). Initially Computer networks were started as a necessity for sharing files and printers but later this has moved from that particular job of file and printer sharing to application sharing and business logic sharing. [1] defines computer networks as a system for communication between computers. These networks may be fixed (cabled, permanent) or temporary.A network can be characterized as wired or wireless. Wireless can be distinguished from wired as no physical connectivity between nodes are needed. Routing is an activity or a function that connects a call from origin to destination in telecommunication networks and also play an important role in architecture, design and operation of networks. Two main routing protocols categories are studied in this paper: reactive protocols and
proactive protocols.

II. WIRED VS WIRELESS NETWORKS

The different types of networks available today are Wired and Wireless networks. Wired are differentiated from wireless as being wired from point to point.

III.ROUTING

Routing is the act of moving information from a source to a destination in an internetwork. During this process, at least one intermediate node within the internetwork is encountered.

The routing concept basically involves, two activities: firstly, determining optimal routing paths and secondly, transferring the information groups (called packets) through an internetwork. The later concept is called as packet switching which is straight forward, and the path determination could be very complex [2].

Routing is mainly classified into static routing and dynamic routing. Static routing refers to the routing strategy being stated manually or statically, in the router. Static routing maintains a routing table usually written by a networks administrator. The routing table doesn't depend on the state of the network status, i.e., whether the destination is active or not [3].

The major disadvantage with static routing is that if a new router is added or removed in the network then it is the responsibility of the administrator to make the

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necessary changes in the routing tables. Similarly this is the same with the network segments in the dynamic routing [4].

3.1 Classification of routing Protocols in MANET's

Classification of routing protocols in MANET's can be done in many ways, but most of these are done depending on routing strategy and network structure[5,6]. According to the routing strategy the routing protocols can be categorized as Table-driven and source initiated, while depending on the network structure these are classified as flat routing, hierarchical routing and geographic position assisted routing[5] . B oth the Table-driven and source initiated protocols come under the Flat routing see [fig 3.1]

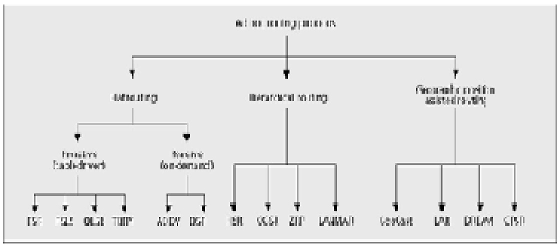

Figure 3.1: Classification of Routing Protocols In Mobile Ad-hoc Networks [5].

3.1.1 Table-Driven routing protocols

These protocols are also called as proactive protocols since they maintain the routing information even before it is needed [7] . Each and every node in the network maintains routing information to every other node in the network. Routes information is generally kept in the routing tables and is periodically updated as the network topology changes. Many of these routing protocols come from the link-state routing[5] . The proactive protocols are not suitable for larger networks, as they need to maintain node entries for each and every node in the routing table of every node. This causes more overhead in the routing table leading to consumption of more bandwidth.

3.1.2 Source Initiated routing protocols

These protocols are also called reactive protocols since they don't maintain routing information or routing activity at the network nodes if there is no communication. If a node wants to send a packet to another node then this protocol searches for the route in an on-demand manner and establishes the connection in order to transmit and receive the packets.

IV. DESTINATION SEQUENCED DISTANCE VECTOR (DSDV) PROTOCOL

The destination sequenced distance vector routing protocol is a proactive routing protocol which is a modification of conventional Bellman-Ford routing algorithm. This protocol adds a new attribute, sequence number, to each route table entry at each node. Routing table is maintained at each node and with this table, node transmits the packets to other nodes in the network. This protocol was motivated for the use of data exchange along changing and arbitrary paths of interconnection which may not be close to any base station.

4.1 Protocol Overview and activities

Each node in the network maintains routing table for the transmission of the packets and also for the connectivity to different stations in the network. These stations list for all the available destinations, and the number of hops required to reach each destination in the routing table. The routing entry is tagged with a sequence number which is originated by the destination station. In order to maintain the consistency, each station transmits and updates its routing table periodically.The packets may be transmitted containing the layer 2 or layer 3 addresses [8].

Routing information is advertised by broadcasting or multicasting the packets which are transmitted periodically as when the nodes move within the network. The DSDV protocol requires that each mobile station in the network must constantly, advertise to each of its neighbors, its own routing table. Since, the entries in the table my change very quickly, the advertisement should be made frequently to ensure that every node can locate its neighbors in the network. This agreement is placed, to ensure the shortest number of hops for a route to a destination; The data broadcast by each node will contain its new sequence number and the following information for each new route:

– The destination address
– The number of hops required to reach the destination and
– The new sequence number, originally stamped by the destination

4.2 Example for DSDV operation

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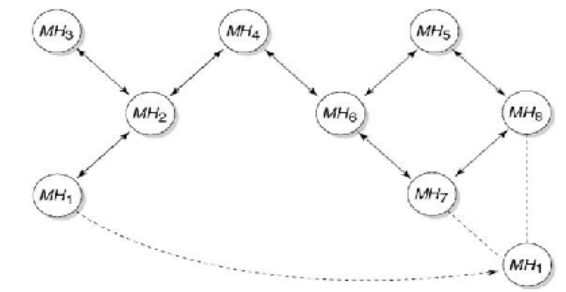

Figure 4.2: Movement of Mobile host in Ad-hoc Networks [8].

Consider the above fig. 4.2 which has 8 hosts in the network. We will have a look at the changes to the MH4 routing table with reference to the movements of MH1. Initially, all the nodes advertise their routing information to all the nodes in the network and hence the routing table at MH4 initially looks like

Table 4.2: Routing table of MH4[8]

Destination	Next Hop	Metric	Sequence-Number	Install
MH1	MH2	2	S406 MH1	T001_MH4
MH2	MH2	1	S128 MH2	T001 MH4
MH3	MH2	2	S564 MH3	T001 MH4
MH4	MH4	0	S710 MH4	T001 MH4
MH5	MH6	2	S392 MH5	T002 MH4
MH6	MH6	1	S076 MH6	T001 MH4
MH7	MH6	2	S128 MH7	T002 MH4
MH8	MH6	3	S050 MH8	T002 MH4

And the forwarding table at the MH4 would look like this

Table 4.3: Forwarding table at MH4 [8]

Destination	Metric	Sequence Number
MH1	2	S406 MH1
MH2	1	S128 MH2
MH3	2	S564 MH3
MH4	0	S710 MH4
MH5	2	S392 MH5
MH6	1	S076 MH6
MH7	2	S128 MH7
MH8	3	S050 MH8

But, when the host MH1 moves its location as shown in the fig. 6.1 nearer to MH7 and MH8 then, the link between MH2 and MH1 will be broken resulting in the assignment of infinity metric at MH2 for MH1 and the sequence number will be changed to odd number in the routing table at MH2. MH2 will update this information to its neighbor hosts. Since, there is a new neighbor host for MH7 and MH8; they update their information in the routing tables and they broadcast. Now, MH4 will receive its updated information from MH6 where MH6 will receive two information packets from different neighbors to reach MH1 with same sequence number, but different metric. The selection of the route will depend on less hop count when the sequence number is the same. Now the routing table will look like

4.3 Advantages of DSDV

– DSDV protocol guarantees loop free paths [9].
– Count to infinity problem is reduced in DSDV [9].
– We can avoid extra traffic with incremental updates instead of full dump updates.

4.4 Limitations of DSDV

– Wastage of bandwidth due to unnecessary advertising of routing information even if there is no change in the network topology [7].
– DSDV doesn't support Multi path Routing.
– It is difficult to determine a time delay for the advertisement of routes [10].

V.AD-HOC ON-DEMAND DISTANCE VECTOR (AODV) PROTOCOL

AODV is a very simple, efficient, and effective routing protocol for Mobile Ad-hoc Networks which do not have fixed topology. This algorithm was motivated by the limited bandwidth that is available in the media that are used for wireless communications. It borrows most of the advantageous concept from DSDV algorithm. The on demand route discovery and hop-by-hop routing, usage of node sequence numbers from DSDV make the algorithm cope up with topology and routing information. Obtaining the routes purely on-demand makes AODV a very useful and desired algorithm for MANETs [11].

5.1 Working of AODV

Each mobile host in the network acts as a specialized router and routes are obtained as needed, thus making the network self-starting. Each node in the network maintains a routing table with the routing information entries to it's neighbouring nodes, and two separate counters: a node sequence number and a broadcast-id. When a node (say, source node 'S') has to communicate with another (say, destination node 'D'), it increments its broadcast-id and initiates path discovery by broadcasting a route request

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packet RREQ to its neighbors. The RREQ contains the following fields:

– source-addr

– source-sequence# -to maintain freshness info about the route to the source.

– dest-addr

– dest-sequence# - specifies how fresh a route to the destination must be before it is accepted by the source.

– hop-cnt

The (source-addr, broadcase-id) pair is used to identify the RREQ uniquely. Then the dynamic route table entry establishment begins at all the nodes in the network that are on the path from S to D.

As RREQ travels from node to node, it automatically sets up the reverse path from all these nodes back to the source. Each node that receives this packet records the address of the node from which it was received. This is called Reverse Path Setup. The nodes maintain this info for enough time for the RREQ to traverse the network and produce a reply to the sender and time depends on network size. If an intermediate node has a route entry for the desired destination in its routing table, it compares the destination sequence number in its routing table with that in the RREQ. If the destination sequence number in its routing table is less than that in the RREQ, it rebroadcasts the RREQ to its neighbors. Otherwise, it unicasts a route reply packet to its neighbor from which it was received the RREQ if the same request was not processed previously (this is identified using the broad case -id and source-addr).

Once the RREP is generated, it travels back to the source, based on the reverse path that it has set in it until traveled to this node. As the RREP travels back to source, each node along this path sets a forward pointer to the node from where it is receiving the RREP and records the latest destination sequence number to the request destination. This is called Forward Path Setup.If an intermediate node receives another RREP after propagating the first RREP towards source it checks for destination sequence number of new RREP. The intermediate node updates routing information and propagates new RREP only,

– If the Destination sequence number is greater, OR

– If the new sequence number is same and hop count is small, OR

Otherwise, it just skips the new RREP. This ensures that algorithm is loop-free and only the most effective route is used [11].

The below figure 5.1 is an example, which shows how the route to the destination is found by AODV routing protocol.

Step by step explaination of figure 5.1 is as follows:

1. Source 'S' has to send data to destination.

2. S sends RREQ to its neighbors A, B, C.

3. B finds the path in its routing table (with destn seq-number s1 and hop count c1) and sends RREP toS.

4. C sets up reverse path.

5. C forwards RREQ to its neighbors D and E.

6. E sets up reverse path.

7. E forwards RREQ to its neighbors F and G.

8. E deletes the reverse path after a time out period as it does not receive any RREPs from F and G.

9. D finds the path (with dest seq-number s2 which is greater than s1 and hop count c1) in its routing table and sends RREP to C.

10. C receives RREP from D and sets up forward path and forwards RREP to S.

11. A sets reverse path; forwards RREQ to its neighbors; receives RREP (with pathof hop count c2 which is greater than c1); sets forward path; and forwards this RREP to S.

12. S receives a path info from C (with destn seq-number s2 and hop count c1), another path info from B (with destn seq-number s1 and hop count c1), and another path info from A (with destn seq-number x which is less than s1 and s2 and hop count c2 which is less than c1).

13. S chooses path info from C (which was originated from D), giving first priority to the path with greatest destination sequence number and then second priority to the path with smallest hop count. Though path given by A is of smallest hop count, it is ignored because the destination sequence number is greater than the path from C.

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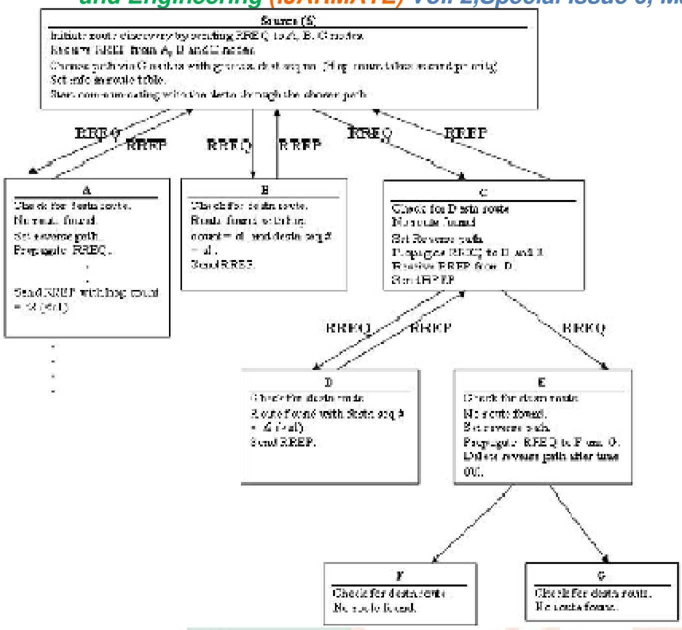

Figure 5.1: Route finding process in AODV Routing Protocol.

5.2 Advanced uses of AODV

– Because of its reactive nature, AODV can handle highly dynamic behavior of Vehicle Ad-hoc networks[12] .

– Used for both uni casts and multicasts [13].

5.3 Limitations/Disadvantages of AODV

– Requirement on broadcast medium: The algorithm expects/requires that the nodes in the broadcast medium can detect each others' broadcasts.

– Overhead on the bandwidth: Overhead on bandwidth will be occured compared to DSR,when an RREQ travels from node to node in the process of discovering the route info on demand, it sets up the reverse path in itself with the addresses of all the nodes through which it is passing and it carries all this info all its way.

– No reuse of routing info: AODV lacks an efficient route maintenance technique. The routing info is always obtained on demand, including for common case traffic.

VI.CONCLUSION

The study reveals that, DSDV routing protocol consumes more bandwidth, because of the frequent broadcasting of routing updates. While the AODV is better than DSDV as it doesn't maintain any routing tables at nodes which results in less overhead and more bandwidth. It can be assumed that DSDV routing protocols works better for smaller networks but not for larger networks. So, my conclusion is that, AODV routing protocol is best suited for general mobile ad-hoc networks as it consumes less bandwidth and lower overhead when compared with DSDV routing protocol.

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