Backward Aodv: An Answer To Connection Loss In Mobile Adhoc Network (Manet)

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ABSTRACT: ***An Ad-Hoc network is a local area network or some other small network, especially one with wireless, in which some of the network devices are the part of the network only for the duration of a communication session. We have different types of adhoc networks. We are focusing on a "mobile Adhoc network (MANET)" which is a specific type of Ad-Hoc network. A Mobile Ad-hoc network is a collection of autonomous nodes or terminals, which communicate with each other by forming a multi-hop radio network & maintaining connectivity in a decentralized manner over relatively bandwidth, constrained wireless links. To communicate in the network a routing protocol is needed to discover and maintain routes between nodes. The main motive of our paper is to define the node mobility and link establishment in MANET (Mobile ADHOC Network). The Ad-Hoc On-demand Distance Vector (AODV) routing protocol is intended for use by mobile nodes in an Adhoc Network. It offers quick adaptation to dynamic link conditions, low processing and memory overhead, low network utilization, and determines unicast routes to destinations within the Adhoc network. This too has some problem associated with it like Link failure, Overhead on Bandwidth, Requirement on Broadcast Medium, etc.***

Keyword: AODV, B-AODV, MANET, Multicast routing, Ad-Hoc network etc.

I. INTRODUCTION

Today's internet has been developed for more than 40 years. Recently many network researchers are studying networks based on new communication techniques, especially wireless communication.

An Ad-Hoc network is a collection of nodes that do not rely on a predefined infrastructure. Ad hoc network allows new network devices to be quickly added or re moved and each user in ad hoc network has a unique network address that is recognized as the part of the network. Nodes in ad hoc network play both the roles of routers and terminals. There are different types of ad hoc network available namely:

- MANET (Mobile Ad-hoc network)
- WSN (Wireless sensor network)
- WMN(Wireless mesh network)
- VANET (Vehicular Ad-Hoc network)

We are discussing in this paper about MANET and how the packets are routed in MANET. Each device in MANET is free to move independently in any direction and will therefore change its links to other devices frequently. In MANET the topology is highly dynamic and frequent changes in the topology may be hard to predict.

The challenges that are faced by MANET are: Dynamic topology, bandwidth constrained, Energy constrained, Limited physical security,

Routing in mobility management, & Packet loss due to mobility.

Keeping in mind these challenges, different routing algorithms have been designed so that packet can be routed in wireless environment easily & without any data loss.

Traditional routing protocols used for wired networks cannot be directly applied to most wireless networks because some common assumptions are not valid in this kind of dynamic network. E.g. One assumption is that a node can receive any broadcast message sent by others in the same subnet. However, this may not be true for nodes in a wireless mobile network. The bandwidth in this kind of network is usually limited.

One of the routing algorithm that is used in MANET is AODV (Ad-Hoc On demand Distance Vector) which discovers the route when it is required by some source node. Therefore it is an On demand routing algorithm, that [8,3]combines the on-demand route discovery mechanism in DSR [2,3] with the concept of destination sequence numbers from DSDV [8].

In this paper Section-II describe about Routing protocols in mobile ad-hoc network; Section-III discuss about Properties of Routing Protocols in MANET; Section – IV discuss the Classification of Routing Protocol in MANET; Section-V tells about AODV overview, their terminology, AODV problems and also discuss route establishment procedure in AODV; Section VI discuss Backward AODV Overview and also tells about How Backward AODV perform well than the AODV. Section VII concludes the paper.

II. ROUTING PROTOCOLS IN MOBILE ADHOC NETWORK

An Adhoc mobile network is a collection of mobile nodes that are dynamically and arbitrary located in such a manner that the interconnections between nodes are capable of changing on a continual basis. In order to facilitate communication within the network, a routing protocol is used to discover routes between nodes. The primary goal of such an Adhoc network routing protocol is correct and efficient route establishment between a pair of nodes so that messages may be delivered in a timely manner. Route construction should be done with a minimum of overhead and bandwidth consumption.

Routing [9] is the act of moving information from a source to a destination in an internetwork. At least one intermediate node within the internetwork is encountered during the transfer of information. Routing protocols are several metrics to calculate the best path for routing the packets to its destination that could be number of hoops, which are used by the routing algorithm to determine the optimal path for the packet to its destination. The process of path determination is that, routing algorithm find out and maintain routing tables, which contain the total route information for the packet. The information of route varies from one routing algorithm to another. The routing tables are filled with entries in the routing table are ip-address prefix and the next hop.

Routing is mainly classified into static & dynamic routing.

- **Static Routing:** It refers to the routing strategy being stated manually or statically, in the router. Static routing maintains a routing table usually written by a network administrator. The routing table does not depend on the state of the network status, i.e whether the destination is active or not.

- **Dynamic Routing:** It refers to the routing strategy that is being learnt by an interior or exterior routing protocol. This routing primarily depends on the state of the network i.e., the routing table is affected by the activeness of the destination.

III. PROPERTIES OF ROUTING PROTOCOLS IN MANET

In MANET there is no infrastructure support as is the case with wireless networks, and since a destination node might be out of range of a source node transferring packets; so there is need of routing procedure. This is always ready to find a path so as to

forward the packets appropriately between the source and the destination. In case of Adhoc network , each node must be able to forward data for other nodes. This creates additional problems along with the problems of dynamic topology which is unpredictable connectivity changes. The properties are as follows:

- **Distributed Operations:** Protocol should be distributed and not be dependent on a centralized controlling node. The dissimilarity is that the nodes in Adhoc network can enter or leave the network very easily and because of mobility the network can be partitioned**.**

- **Loop Free**: To improve the overall performance, routing protocol should assurance that the routes supplied for loop free. This avoids any misuse of bandwidth or CPU consumption.

- **Demand based operation:** To minimize the control overhead in the network or in other words does not misuse the network resources the protocol should be reactive.

- **Unidirectional link Support**: The radio environment can cause the formation of unidirectional links. Utilization of these links and not only the bi-directional links improves the routing protocol performance.

- **Security:** Authentication and encryption is the way to go and problem here lies within distributing the keys among the nodes in the Adhoc network.

- **Power Consumption:** The nodes in the Adhoc network can be laptops and thin clients such as PDA's that are limited in battery power and therefore uses some standby mode to save the power. It is therefore very important that the routing protocol has support for these sleep modes.

- **Multiple routes:** To reduce the number the number of reactions to topological changes and congestion multiple routes can be used. If one route becomes invalid, it is possible that another stored route could still be valid and thus saving the routing protocol from initiating another route discovery procedure**.**

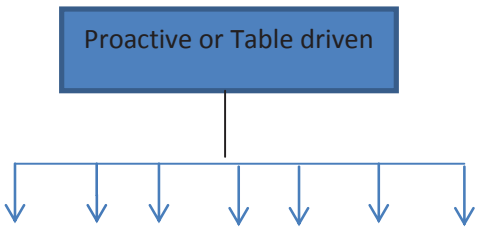
IV. CLASSIFICATION OF ROUTING PROTOCOL IN MANET

The mobile networks have limited transmission range therefore they need these intermediate nodes for communication to transfer data across the network in MANET routing of data is possible go through three methods:

- Unicasting (One to one)
- Multicasting (One to many)
- Broadcasting (Many to many)

The major classification of routing protocols for unicasting is under:

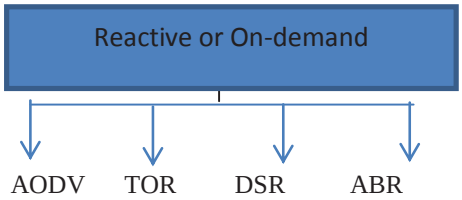
- **Proactive or table driven routing protocols:** In table driven routing protocols, every node maintains the network topology information in the form of routing tables by periodically exchanging routing information. Routing information is generally flooded in the whole network. Whenever a node requires a path to a destination, it runs an appropriate path-finding algorithm on the topology information it maintains.



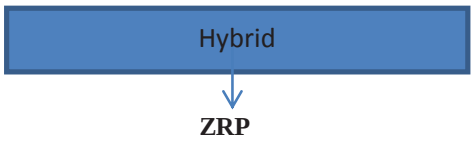
GSR DSDV WRP FSR HSR ZHLS CGSR

- **Reactive or on-demand routing protocols:** Protocols that fall under this category do not maintain the network topology information. They obtain the necessary path when it is required, by using a connection establishment

process. Hence these protocols do not exchange routing information periodically.



- **Hybrid routing protocols:** Hybrid routing protocols combines the best features of the above two categories. Nodes within a certain distance from the node concerned, or within a particular geographical region, are said to be within the routing zone of the given node. For routing within this zone, a table driven approach is used. For nodes that are located beyond this zone, an on-demand approach is used.



V. AODV OVERVIEW

AODV routing protocol uses an on-demand approach for finding routes, that is, a route is established only when it is required by a source node for transmitting data packets. This algorithm was motivated by the limited bandwidth that is available in the media that are used for wireless communications.

It employs destination sequence numbers to identify the most recent path. It borrows most of the advantageous concepts from DSR and DSDV algorithms. The on demand route discovery and route maintenance from DSR 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.

The Adhoc On-Demand Distance Vector(AODV) algorithm enables dynamic, self-starting, mutihop routing between participating mobile nodes wishing to establish and maintain an adhoc network. AODV allows mobile nodes to obtain routes quickly for new destinations, and does not require nodes to maintain routes to destinations that are not in active communication. AODV also defines timely responses to link breakages.

The operation of AODV is loop free, and by avoiding the Bellman-Ford "counting to infinity" problem offers quick convergence when the adhoc network topology changes. AODV is an improvement on DSDV because it typically minimizes the number of required broadcasts by creating routes on an on-demand basis, as opposed to maintaining a complete list of routes as in the DSDV algorithm.

The major difference between AODV and other on-demand routing protocols is that it uses a destination sequence number to determine an up-to-date path to the destination. The destination sequence number is created by the destination itself for any usable route information it sends to requesting nodes. A node updates its path information only if the destination sequence number of the current packet is greater than the last destination sequence number stored at the node.

A. AODV Terminology: This section defines terminology used with AODV

- **Route table:** The table where adhoc nodes keep routing (including next hop) information for various destination**.**

- **Triggered update:** An unsolicited route update transmitted by an intermediate node along the path to the destination**.**

- **Active route:** A route towards a destination thet has a routing table entry that is marked as valid. Only active routes can be used to forward data packets.

- **Broadcast:** Broadcasting means transmitting to the IP limited broadcast address 255.255.255.255. A broadcast packets may not be blindly forwarded, but broadcasting is useful to enable dissemination of AODV messages throughout the Ad-Hoc network.

B. ROUTE ESTABLISHMENT PROCEDURE IN AODV

Route Requests (RREQs), Route Replies (RREPs), and Route Errors (RERRs) are the message types defined by AODV. These message types are received via UDP, and normal IP header processing applies [6]. Route discovery process begins with the creation of a Route Request (RREQ) packet. Source node creates RREQ packet .The packet contains[11].

C. BROADCAST ID

- **Source node's IP address:** The IP address of the node which originated the Route Request.
- **Source node's current sequence number:** The current sequence number to be used in the route entry pointing towards the originator of the route request.
- **Destination IP address:** The IP address of the destination for which a route is desired.
- **Destination sequence number:** The latest sequence number received in the past by the originator for any route towards the destination.
- **Time to live field(TTL):** [10] Destination sequence number indicates the freshness of the route that is accepted by the source. When an intermediate node receives a RREQ, it either forwards it or prepares a RREP if it has a valid route to the destination. The validity of a route at the intermediate node is determined by comparing the sequence number at the intermediate node with the destination sequence number in the RREQ packet. If a RREQ packet is received multiple times, the duplicate copies are discarded. All intermediate nodes having valid routes to the destination, or the destination node itself, are allowed to send RREP packets to the source. Every intermediate node, while forwarding a RREQ, enters the previous node address and its broadcast id.A timer is used to delete this entry in case a RREP is not received before the timer expires .This helps in storing an active path at the intermediate node as AODV does not employ source routing of data packets. When a node receives a RREP packet, information about the previous node from which the packet was received is also stored in order to forward the data packet to this next node as the next hop toward the destination.

D. PROBLEMS WITH AODV

Before describing problems of AODV, we have to know some advantages of AODV that can be described as:

- Routers are established on demand
- Destination sequence numbers are used to find the latest route to the destination.
- The connection set up delay is less.

Besides these advantages, AODV has some problems that can be described as follows:

- **Link Failure**: Rapid changes of topology causes that the route reply could not arrive to the source node, especially on high speed mobility. Nodes may move from one location to another on variety of node speed. The network topology changes continuously and unpredictably. Losing the RREP of AODV protocol produces a large impairment on the AODV protocol.
- **Overhead on the bandwidth:** 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.
- **Requirement on broadcast medium:** The algorithm expects/requires that the nodes in the broadcast medium can detect each other's broadcast.
- **No reuse of routing info:** AODV lacks an efficient route maintenance technique. The routing info is always obtained on demand.
- **It is vulnerable to misuse:** The message can be misused for insider attacks including route

disruption, route invasion, node isolation, and resource consumption.

- **AODV lacks support for high throughput routing metrics:** AODV is designed to support the shortest hop count metric. This metric favors long, low bandwidth links over short , high bandwidth links.

- **High route discovery latency:** AODV is a reactive routing protocol. This means that AODV does not discover a route until a flow is initiated. This route discovery latency result can be high in large-scale mesh networks.

One of the disadvantages of this protocol is that intermediate "nodes can be lead to inconsistent routes", if the source sequence number is very old and the intermediate nodes have a higher but not the latest destination sequence number, thereby having state entries.

VI. BACKWARD AODV OVERVIEW

AODV and most of the on demand ad-hoc routing protocol use single route reply along reverse path. Rapid change of topology causes that the route reply could not arrive to the source node, i.e. after a source node sends several route request messages; the node obtains reply message, specially on high speed mobility. This increases both in communication delay and power consumption as well as decrease in packet delivery ratio. To avoid these problems, this paper proposes a "Backward AODV (B-AODV)" which tries multiple route replies. B-AODV, which has a novel aspect compared to other on-demand routing protocols on ad-hoc networks. It reduces path fail correction messages and obtains better performance than the AODV and other protocol have? B-AODV provides good results on packet delivery ratio, power consumption and consumption delay.The Backward AODV perform well than the AODV because of it's designed mechanism which can be described as:

- **Avoid Link Failure:** As AODV has a problem of link failure: losing the RREP of AODV protocol produces a large impairment; Backward AODV (B-AODV) avoids this problem by trying multiple route replies backward to the source node.

- **Reduction in Control Packet overhead:** Route discovery procedure based on single reply message may cause even more packet overhead for some cases. But Backward AODV reduces its control packet overhead by reducing route discovery.

- **Avoid Route Discovery:** By trying multiple route replies backward to the source node reduces route discovery, this mechanism provides Backward AODV not AODV.

- **Data loss not occur:** Due to link failure in AODV a data loss can occur while an assurance of providing definite route by Backward AODV avoid the chances of data loss.

VII. CONCLUSION

MANET is a kind of wireless Ad-hoc network and it is a self configuring network of mobile routers (and associated hosts) connected by wireless links- the union of which forms an arbitrary topology. The routers, participating nodes act as router, are free to move randomly and manage themselves arbitrary; thus, the network's wireless topology may change rapidly and unpredictably.

Rapid change of topology causes that the route reply could not arrive to the source node, especially on high speed mobility. Nodes may move from one location to another on variety of node speed. The network topology changes continuously and unpredictably. Losing the the RREP of AODV protocol produces a large impairment on the AODV protocol.

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