Reactive Unicast and Multicast Routing Protocols for Manets and Issues: A Comparative Analysis

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Abstract **– A mobile Ad-hoc network is a collection of independent mobile devices without any fixed infrastructure. In Manet each node can communicate with other mobile node within the transmission range. Due to the dynamic topology of MANET, finding route between sender (node) and receiver (node) is difficult. Most of the applications are based on unicast routing. Important reactive unicast routing protocols are DSR (Dynamic Source Routing Protocols) and AODV (Ad-hoc On Demand Distance Vector Routing Protocol). Multicast routing is not widely used in Manet, but it is useful in multimedia communications. In multicast routing a source node sends the same packet to multiple nodes. Reactive multicast routing protocols are ODMRP (On Demand Multicast Routing Protocol) and MAODV (Multicast Ad-hoc On Demand Distance Vector). Various reactive routing protocols have been proposed for MANET. It is difficult to include all the routing protocols in this comparative analysis paper. Manet is useful in some application: military communication, fire fighting, electronic payment anywhere at any time, transportation.**

Keywords*: MANET, AODV, DSR, MAODV, ODMRP.*

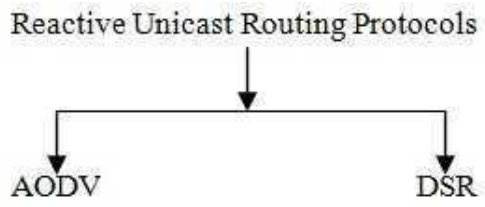
I. INTRODUCTION

Manet is a dynamic collection of wireless devices (mobile devices), each device is able to communicate with other devices through dynamic wireless link and move at the same time. Personal Area Networks connect mobile devices like mobile phones, laptops, smart watches, and other wearable computers etc. Design issue for developing a routing protocol for wireless network with mobility is very different and more complex than wired network with static nodes. Problem with mobile Ad-hoc network is limited bandwidth and frequently change in the topology. Although there are several routing protocols that can be used for unicast and multicast communication within the Mobile Ad-hoc networks, it observes that any one protocol cannot fit in all the different topologies and traffic patterns of Mobile Ad-hoc networks applications.

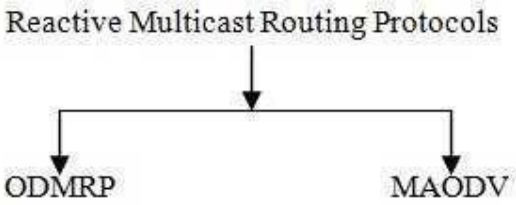
II. REACTIVE ROUTING PROTOCOLS CLASSIFICATION

Reactive routing protocols typically fall under two classifications; first one is Reactive unicast routing Protocol, second one is reactive multicast routing protocol.

A. Reactive Unicast Routing Protocols:



B. Reactive Multicast Routing Protocols:



III. REACTIVE UNICAST ROUTING PROTOCOLS:

1. Dynamic Source Routing Protocol (DSR)

DSR is a reactive unicast routing protocol, it is based on source routing algorithm. DSR protocol operates only on demand, In this each packet contains complete information about the route between source node and destination node, due to this packet overhead increases in case of the large network and bandwidth consumption is more.

DSR is based on two mechanisms (i) Route discovery (ii) Route maintenance.

Route Discovery Phase: During route discovery a source node creates a route request packet. This packet floods throughout the network. Every node after receiving this packet, resends the packet to the next node, if it is not the destination node. When a destination node receives a route request packet it replies to the source node with the same route request path bur in reverse order.

Route maintenance phase: In case of a broken link a route error message is generated from the node which is near to the broken link to inform the source node. Then source node repeats the route discovery phase. DSR supports wireless network for internetworking.

Merits:

- No need to periodically flood the network, which is required in table driven approach.
- Route is created only on demand, no need to find the route to all nodes, which is required in table driven approach.

Demerits:

- Route maintenance phase can't repair a broken link.
- Connection set up delay is more than table driven.
- Performance degrades as mobility increases.

Limitation: DSR cannot support perfect multicast routing.

2. Ad-hoc On-demand Distance Vector Routing Protocol

AODV is a reactive unicast routing protocol. When a route is not available from source node to destination node, source node floods the route request packet in the network, it can create more than one route to different destination nodes with the help of a single route request. AODV contains a destination sequence number to find an up-to-date path to the destination node. Node updates its route information only when the current received packet has a greater destination sequence number than the previous destination sequence number stored at the node.

Route request packet contains: source address, destination address, source sequence number, destination sequence number, hop count, time to live (TTL) field.

When an intermediate node receives a route request packet, (intermediate node) forwards and if it has a route to destination it prepare for route reply. Intermediate node checks whether the available route is the current route. This is done by comparing the sequence number with the destination sequence number in the RREQ (route request) packet, if the destination sequence no is greater than the previously available sequence number in the routing table of intermediate node. The intermediate node does not use its old available route (recorded route) to respond to the RREQ, if this is the case intermediate node should resend RREQ to its neighbor (node). If the extra copies of the same rote request packet are received, it will be discarded because an intermediate node contains each neighbor's address. When destination node receives RREQ it responds by sending a route reply to the node from which RREQ was received.

Route Maintenance:

After discovering a route, network must maintain it. When a node in the discovered route moves, its neighbor detects it and sends a link error message to each of its up-stream neighbors until message reaches the source node. The source node repeats the route discovery procedure, if a route is needed. Each mobile node gets information about its neighbors by using a hello message. The node which is the part of active route should use hello message.

A new node can join the network:

A new node can send a hello message (identity and sequence number) to join an Ad-hoc network.

Merits:

- Route is established only as needed.
- To find route destination sequence number is used.
- Connection set up delay is less.
- Keep track of the next hop for a route in place of the entire route.

Demerits:

- Multiple route reply packet leads to heavy control overhead.
- Periodic hello message leads to unnecessary bandwidth consumption.

IV. Reactive Multicast Routing Protocols

Multicast is the communication between a single sender and multiple receiver. In multicast routing a source node sends a data packet to a group of destination nodes. Two important reactive multicast routing protocols are: On demand multicast routing protocol and Multicast Ad-hoc on demand distance vector routing protocol.

1. On-Demand Multicast Routing Protocol

ODMRP is a mesh-based reactive multicast routing protocol. This protocol establishes a mesh of nodes called forwarding group which forwards multicast packets through flooding within the mesh. When a multicast source has a data packet to send but does not know the route, it sends a join query message to the entire network. The node which receives a join query message updates its table with the respective node-id from which the message has received to go back to the sender. Node after receiving a join reply message checks the join reply table whether it is in the same route or not,

based on the node ID, there is a match it sets the forwarding group flag. ODMRP allow node whenever it wants to leave the group.

Merit: Resistant to node failure because of a forwarding-group.

Demerit: Higher control overhead.

2. Multicast Ad-hoc On-Demand Distance Vector

MAODV routing protocol is the extension of AODV, MAODV is a tree based reactive multicast routing protocol; it makes a bi-directional multicast tree to connect group members. There is only one path from sender to receiver because of tree. A tree based routing protocol creates and maintains multicast routing tree to send data packet from source to a group of nodes.

Merit: Route establishment is fast.

Demerit: Only one path from sender to receiver.

	ODMRP	MAODV
Multicast delivery structure	Mesh	Core based tree
Loop free	Yes	Yes
Periodic messages requirement	Yes	No
Routing Hierarchy	Flat	Flat
Scalability	Fair	Fair

Table I. Characteristics of Reactive Multicast Routing Protocols

V. CONCLUSION

This comparative analysis paper review and compare two reactive unicast routing protocols and two reactive multicast routing protocols. DSR is most suitable for small network, packet overhead increases as network size increases. In DSR route maintenance does not repair a broken link, this protocol in not suitable for multicast routing.

AODV uses destination sequence number to check the most recent path. The main difference between DSR and AODV is that DSR uses source routing, where data packet carries complete route information to be traversed. But in AODV sender and intermediate node store next hope information and connection setup delay is less. ODMRP is mesh based. Control overhead is more but because of forwarding group chances of node failure is less. MAODV is tree based protocol therefore route establishment is fast but chances of link failure is more due to only one path from sender to receiver.

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