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A Brief Review: Comparison of DSR , AODV and AOMDV Reactive routing protocol

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Abstract

A Mobile Ad-hoc Network (MANET) is a dynamic wireless network that may be formed without the necessity for any pre-existing infrastructure within which each node can act as a router. These nodes may be laptop computers, personal digital assistants, mobile phones or sensors dispersed in a neighborhood to measure certain data and send the data to a bigger node. In an ad hoc network, mobile nodes communicate with one another using multihop wireless links. A central challenge within the design of ad hoc networks is that the development of dynamic routing protocols which will efficiently find routes between two communicating nodes. The routing protocol plays a key role in finding and maintaining the route in ANETs. Routing protocol can be a uni-path and multi-path. A multipath routing protocol is intended to extend the reliability in MANET. The routing protocol must be ready to continue with the high degree of node mobility that always changes the topology drastically and unpredictably. A variety of routing protocols have been used. In this paper, we compare three types of reactive routing protocols- Dynamic Source Routing (DSR), Ad-hoc On-demand Distance Vector (AODV) routing protocol, which is unipath and Ad-hoc On-demand Multipath Distance Vector (AOMDV) routing protocol. In this paper we note that on comparing the performance of DSR, AODV and AOMDV, AOMDV incurs more routing overhead and packet delay than AODV but it had a better efficiency when it involves number of packets dropped and packet delivery.

Keywords- Ad-hoc networks, AODV, AOMDV, DSR, Routing protocols, Simulation

1. Introduction

Mobile Ad hoc Networks (MANETs) is the type of Ad hoc Networks, it is the collection of nodes, sharing a wireless channel without any centralized control. They have no fixed routers .All nodes at a time can act as both end systems and routers. When they are working as routers, they discover and maintain routes to other nodes in the network. The ad-hoc network topology depends on the transmission power of the nodes and the location of the mobile nodes, which may change from time to time [1]. The typical areas of mobile ad-hoc network applications include emergency, search rescue, battle field , and data acquisition in remote areas.

Routing protocols are responsible for communication and provide connectivity to other nodes. In Ad-hoc networks two major problems arises i.e. link failure and node mobility. The main problem in ad-hoc networking is how to deliver data packets efficiently to a remote node, which is moving. Besides this node topology is not predetermined and there is no centralized control. Hence, due to the frequently changing topology of nodes, routing in ad-hoc networks can be viewed as a challenge.Routing protocols are divided into three categories namely proactive routing protocol, on demand routing protocol and hybrid protocol. From several studies on performance comparisons [4], [5] have shown that proactive protocol have more routing overheads in comparison to that on-demand protocols.

Proactive protocols maintain routing information of all the paths either we are currently using them or not. The main advantage of on-demand protocols is it reduces the routing load. High routing load usually features a significant performance impact in low-bandwidth wireless links. The major drawback of those approaches is that the upkeep of unused paths may occupy a crucial a part of the available bandwidth if the topology changes frequently [1].

In on-demand or reactive routing protocols, when demand occurs, the routes are created. To finding a path from source to destination, the route discovery mechanisms starts. Only currently using routes are maintained, thereby maintaining low control overhead and reducing the network load because small routes are in use at any time. Reactive routing protocols have some inherent limitations. First, since only those routes are maintained which are in use, so before packet transmission routes are discovered. Due to this first packet transmission is delayed. Secondly, its route maintenance for reactive algorithms is restricted to the routes currently in use, it's going to still generate a crucial amount of network traffic when the topology of the network changes frequently. Finally, there is chances of packets loss to the destination, if the route to the destination changes [1].

The main challenge of MANETs is to send data packets with low overheads even when conditions are dynamic .Overhead are in terms of routing protocol control messages which consume both channel bandwidth as well as the battery power of nodes for communication. To reduce route discovery latency and routing overheads multiple paths can be formed for both traffic sources and intermediate nodes with new routes being discovered only when needed. In our paper, we concentrate on following on-demand routing protocols: DSR, AODV and AOMDV.

2. Literature Review

SHRUTI SINGHROY, P. L. ZADE & NILIMA BODHYA, "COMPARATIVE ANALYSIS OF AOMDV, AODV, DSR AND DSDV ROUTING PROTOCOLS FOR COGNITIVE RADIO", done a survey of routing protocols for Cognitive radio (CR) wireless networks is discussed and a comparison between AOMDV, AODV, DSR and DSDV Routing Protocols is presented. It is already known that physical and link layer protocols designed for standard fixed bandwidth ad hoc networks must be changed and adapted to cognitive radio environment to effectively utilize spectrum information. The purpose of modified layers of the protocol stack is to manage radio resources within the way appropriate for the nodes within the whole cognitive radio networks.

The remaining layers adapted for cognitive radio networks. Indeed in authors claim that higher layers [above link layer] will implement standard protocols not specific to cognitive radios. In this paper, they proposed various routing techniques for cognitive radios. Moreover, their research work would be mainly focused on improving routing techniques for Cognitive radios via multipath, cluster based, secure, and low latency routing techniques. This would include, but not limited to using AOMDV, LEACH, SPAN and other protocols, while for security they would be using AES, DES, RSA, ECC, and for reducing the delay they would be opting for compression techniques like LZW, Zipping, and more. This would help to identify the best routing technique combination for a given application when using cognitive radio[2].

Saman Shakir, Samiullah Khan, Liaq Hassain and Matiullah, "QoS Based Evaluation of Multipath Routing Protocols in Manets,''states that nodes could be laptop computers, personal digital assistants, mobile phones or sensors dispersed in a neighborhood to measure certain data and send the data to a bigger node. Where a source and a destination node are not in direct range, they communicate through multi-hop routing, means nodes in between them send messages between source and destination. The routing protocol is important for finding and maintaining the route in MANETs. Routing protocol can be a uni-path and multi-path. A multipath routing protocol increase the reliability in MANET. In this research work focuses is on Quality of Service (QoS) based evolution of multipath routing protocol. For this purpose, various type of simulation scenarios is designed to find the effect of mobility, increasing the pause time and number of nodes in MANETs. The results shows that multipath routing protocol has comparatively less delay whereas unipath routing protocols have less packet drop ratio and routing overhead . The important factors that affect the performance of unipath and multipath routing protocols are mobility, a number of nodes and pause time. For this, three main simulation scenarios are designed, i.e. increasing traffic sources, mobility and pause time. Each simulation has three more sub-scenarios so as to thoroughly study the impact of those factors on unipath and multipath routing protocols. The average delay per packet was lowest for AOMDV or multipath routing protocols as compared to unipath protocols. The delay will be less as packets are sent simultaneously through the multiple paths while sending data using multipath routing protocols.

By comparing unipath and multipath routing protocol, it is concluded that unipath routing has comparatively average packet drop rate and average normal routing load. The multipath routing protocol has comparatively less average per packet delay . In unipath routing protocols there is a single path for sending data in. When this path fails the new path is selected which causes a high end to end delay. In multipath routing protocol, multiple routes are used for data exchange and data is sent simultaneously through these paths which cause high packet drop rate and average normal routing load. Multiple routes are maintained at the cost of high normal routing load in multipath routing overhead [4].

Kaysar Ahmed Bhuiyan , Md Whaiduzzaman and Mostofa Kamal Nasir , "Efficiency and Performance analysis of routing protocols in WSN,''.In this paper, several routing protocols such as Ad Hoc On Demand

Distance Vector (AODV),Ad hoc On-demand Multipath Distance Vector (AOMDV),Dynamic Source Routing (DSR),Destination-Sequenced Distance-Vector Routing (DSDV) discuss and different connection types such as TCP, Constant Bit Rate (CBR) for WSN. In this research, we analyzed performance of routing protocols by considering different scenarios and metrics. Routing protocols performance are often vary with different parameters like number of node, seed time, pause time, speed time and topology . They compare protocols performance by using several metrics such as Average End to End Delay (E2E), Loss Packet Ratio (LPR) and Packet Delivery Ratio (PDR) with varying pause time and speed time. They use NS2.35 network simulator for compare and analyze WSN protocol performance. In this two types of Traffic ,Transmission Control Protocol (TCP) Traffic and constant bit-rate traffic (CBR) is used. They use wireless node random waypoint mobility model for their simulation purpose by Network Simulator NS-2. 35 In this article, four protocols AODV, AOMDV, DSR and DSDV are compared based on connection type TCP and CBR according to PDR, LPR and average end-to-end delay.

According to the all simulation and graphical results, which are simulated by using NS2 simulator, it's observed packet delivery ratio of DSR is high at TCP platform on the other hand packet delivery ratio of AODV is high at CBR platform. Loss of packet ratio in DSR is extremely low at TCP platform also CBR platform DSR and AODV are same. For both TCP and CBR average end-to-end delay is lower for AOMDV. In addition, we will say that at CBR platform AODV is the best solution and TCP platform DSR is best from others protocol[5].

Bharti Soni and Mehajabeen Fatima, "Overview of Energy Consumption and Propagation in MANET, " studied the Ubiquitous smart devices with embedded sensors are paving the way for mobile ad hoc networks (MANETs) that enable users to speak directly, thereby playing a key role in Smart City and Internet of Things applications. Due to the limited battery capacity of mobile devices the energy consumption during routing remains a challenge in mobile environments The main aim of this paper is to review various power-saving routing schemes in MANETs that have recently been proposed to reduce the power consumed during active communication. In Ad-hoc networking, Energy is very important part because in this network all nodes communicate with each other by consuming power. The only power source is battery of mobile node. The node consumes energy in sending mode, receiving mode, idle mode or sleep mode. In idle mode and sleep mode there is a constant power drain because trans-receiver is constantly hearing signal for itself. When node sends packet or data at that point many Ad-hoc routing protocols and mobility models are available, each having different characteristics and scenario so each may consume different amount of energy, so the best one is who sends packets at successful rate with consuming minimum energy.

Aim of this study is to analyze the energy consumption by the following routing protocols AODV, DSR and DYMO using different radio energy models namely generic, micamotes, and micaZ. For simulations QualNet 5.0.2 simulator is used.Author concentrated on the power-efficient routing protocols that have been developed for MANETs to obtain reliable paths for data packet routing that require less energy. The analysis of energy consumption in transmission mode, receiving mode and idle mode has been carried out.

Consequently, further investigation on developing a routing scheme which will extend the network lifetime, reduce energy consumption, and ensure network connectivity while simultaneously improve the QoS remains in high demand. In this paper energy consumption by the wireless nodes using three routing protocols AODV, DSR and DYMO for communication has been compared with respect to generic, mica-motes and micaZ energy models for a particular simulation scenario. Results show that the Mica-motes energy model is best as compared to micaZ and Generic energy models and also observed that the DSR outperform AODV and DYMO routing protocols in energy radio models[6].

Rajesh SL, Somashekar C Desai & Ramakrishna KT, "PERFORMANCE EVALUATION OF AODV AND AOMDV ROUTING PROTOCOLS IN WIRELESS MESH NETWORK ,". In this paper author compare and evaluate the performance of Ad-hoc On demand Distance Vector (AODV) protocol which is unicast protocol with Ad-hoc On-demand Multipath Distance Vector (AOMDV) protocol, which is multipath routing protocol. The performance is analyzed using metrics such as end to end delay, packet delivery ratio and normalized routing overhead. In this paper, the performance evaluation of single path and multipath routing protocols in WMNs is administered using a simulation study in three different scenarios. The protocols simulated were AODV and AOMDV. From the results, authors says that packet delivery ratio of AOMDV is lowest compared to AODV in high density traffic scenario. But it suffers with regard to normalized routing overhead. Thus, study concludes that AOMDV is better suited for high data rate applications with more reliability [8].

Neetha Paulose and Neethu Paulose, " Comparison of On Demand Routing Protocols AODV with AOMDV ," This paper provides a comprehensive study of AODV and modified AODV in terms of the routing metric and the route discovery mechanism of the AODV scheme. The modified schemes termed as AOMDV. In this paper, they provide the comparison of two on demand routing protocols, AODV and AOMDV. AODV is the most basic on demand routing protocol most of the routing protocols are the enhanced or modified version of AODV. The ad hoc On-demand Distance Vector (AODV) routing scheme may be a widely used routing technique in ad hoc networks thanks to its low routing traffic overhead. However, the performance of the minimum hop routing used by AODV degrades significantly when the underlying system has routes that have high throughput and hop count. Ad hoc On-demand Multipath Distance Vector (AOMDV) is that the enhanced version of AODV protocol, it belongs to on demand and reactive routing protocol of ad-hoc wireless networks. The main goal is to find multiple loop-free and link-disjoint paths between source and destination pair. The merit of AOMDV is estimated in terms of increased packet delivery ratio, throughput and reduced average end-to-end delay and normalized control overhead. Performance evaluation has been done using NS2 simulator tool and comparison with AODV, AOMDV shows that their protocol can effectively reduce end to end delay and energy consumption while maintaining a good packet delivery ratio [9].

Reactive routing is also referred to as on-demand routing protocol, these protocols haven't any routing information at the network nodes if there's no communication. These protocols take a lazy approach to routing

[3]. They do not maintain or constantly update their route tables with the most recent route topology. If a node wants to send a packet to a different node then this protocol searches for the route and establishes the connection so as to transmit and receive the packet. There are various types of On-demand protocols are used. In this paper we discuss the dynamic source Routing (DSR), ad hoc on-demand distance vector routing (AODV) and adhoc on demand distance vector multipath routing (AOMDV) protocols.

3. Routing Protocols

Reactive routing is also known as on-demand routing protocol, these protocols have no routing information at the network nodes if there is no communication. These protocols take a lazy approach to routing [3]. They do not maintain or constantly update their route tables with the latest route topology. If a node wants to send a packet to another node then this protocol searches for the route and establishes the connection in order to transmit and receive the packet. There are various types of On-demand protocols are used. In this paper we discuss the dynamic source Routing (DSR), ad hoc on-demand distance vector routing (AODV) and adhoc on demand distance vector multipath routing (AOMDV) protocols.

3.1. Dynamic Source Routing (DSR)

It is designed for MANETs. Nodes cache routing information is used for future use.DSR is simple and efficient routing protocol designed specifically for use in multihop wireless adhoc networks of mobile nodes [2]. It is based on source routing. In the source routing method, a sender decide the sequence of nodes through which packet moves. In DSR the primary aspect is to store the whole path from source to destination in the routing table instead of having the next hop stored (AODV routing protocol). Therefore, in packet header it is mentioned through which nodes packet must travel to reach the destination. Similar to AODV, the RREQ is used to perform route discovery and RREP is used to delivering the reply message back to the source. The RREQ message rebroadcast method is used in this protocol, if the node receiving the RREQ message does not have the destination information in its routing table. In DSR routing protocol if link breakage occurs, cache route mechanism is used. It is noted that other routes to destination node were maintained in cache route because of overhearing the RREQ message by intermediate nodes via various routes.

The cache route mechanism leads to boosting up the information transmission. When source node receiving the RERR message, the new route discovery will be started. The RERR message are going to be originated and sent to the source by the very first node which is closer to the source than others. Thereafter, the source applying the new RREQ message are going to be broadcasted to all the nodes used to deploy the failed link “Fig. 1” illustrates the transmission of pair of RREQ and RREP while performing the route discovery procedure until receiving the reply message. Bidirectional lines shows the route stored in cache route memory for further utilization when the link breakage happens. The size of the packets within the DSR routing protocol increases because of adding any arrived node specifications into packet header. This can be considered as a possible drawback when the number of nodes increases[3].

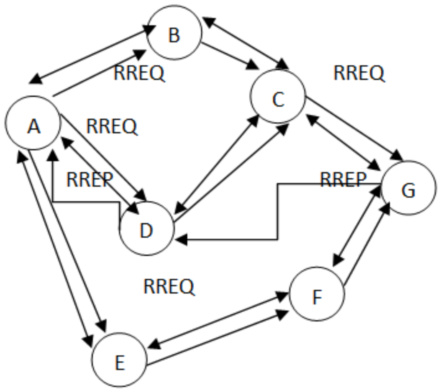

Figure1 DSR route discovery

The best route from source to destination is saved into every node. For any kind of change into network topology, the whole network will get the information by flooding. Error messages are generated by Node when any failure occurred in the link.DSR stored all intermediate nodes ID in the packet header and stores all routing information of multiple paths if there have multiple paths to go to the destination [5]. All the information related to the route stored at one time. This concept reduces the periodic routing of messages which helps to reduce network bandwidth overhead, conserve battery power also avoid large routing updates through Ad-hoc networks.[6] It is almost like AODV therein it forms a route on-demand when a transmitting computer requests one. Except that each an intermediate node that broadcasts a route request packet adds its own address identifier to a listing carried within the packet. The destination node generates a route reply message that has the list of addresses received within the route request and transmits it back along this path to the source. Route maintenance in DSR is accomplished through the confirmations that nodes generate once they can verify that the subsequent node successfully received a packet. These confirmations are often link-layer acknowledgments, passive Acknowledgements, or network-layer acknowledgments specified by the DSR protocol.

When a node isn't ready to verify the successful reception of a packet it tries to retransmit it. When a finite number of retransmissions fail, the node generates a route error message that specifies the problematic link, transmitting it to the source node. When a node requires a route to a destination, it checks in a cache, if it does not find it, then it broadcasts a Route Request (RREQ) message, which is flooded throughout the network. The first RREQ message may be a broadcast query on neighbors without flooding. Each RREQ packet is uniquely identified by the initiator’s address and therefore the request-id. A node processes a route request packet on the condition that it's not already seen the packet and its address isn't present within the route record of the packet. This minimizes the number of route requests propagated within the network. RREQ is replied to by the destination node, using the Route Reply (RREP) message. The return route for the RREP message could also be one among the routes that exist within the route cache (if it exists) or a list reversal of the nodes in the RREQ packet if symmetrical routing is supported. The route may be considered unidirectional or bidirectional. It uses two sorts of packets for route maintenance: Route Error (RERR) packets and ACKs. Whenever a node found errors so that the route becomes invalid, the source receives a RERR message. ACK packets are used to verify the right operation of the route links.DSR enables multiple routes to be learned for a specific destination. No periodic update messages are required in DSR so wastage of bandwidth is avoided in it [7] .

3.2. Ad-Hoc on-Demand Distance Vector (AODV)

AODV is an on-demand routing protocol. The route is calculated when demand occurs for this route discovery process is used. It is adapted to work in a mobile environment. When a node wants to send a packet to the destination, AODV determines a route to a destination. Sequence numbers decide the freshness of routes and guarantee the loop-free routing. Whenever an AODV router receives a request to send a message, it checks its routing table to see if a route exists [2]. AODV uses the advantageous method from DSR algorithms. It is a loop-free routing protocol and notification is sent to affected nodes. It is also capable of multicast and unicast routing [10].

All routing table entry has the following fields:

• Destination address
• Next hop address
• Destination sequence number
• Hop count

Destination
Sequence Number
Hop Count
Next Hop
Expiration Timeout

Figure 2 AODV

If a route exists, the router simply forwards the message to successive hops. Otherwise, it saves the message during a message queue, then it initiates a route request to find a route. AODV nodes use four sorts of messages to speak among one another. Route discovery is done by Route Request (RREQ) and Route Reply (RREP) messages. For route maintenance Route Error (RERR) messages and HELLO messages are used .

AODV takes a hop-by-hop routing approach. In AODV, route discovery works as follows. Whenever a route to a destination is required, it initiates a route discovery by flooding a route request (RREQ) for the destination in the network and then waits for a route reply (RREP). If there's a legitimate route available for the destination, it unicasts an RREP back to the source via the reverse path; otherwise, it rebroadcasts the RREQ packet. Duplicate copies of the RREQ are immediately discarded upon reception at every node. The destination on receiving the first copy of an RREQ packet forms a reverse path within the same way as the intermediate nodes; it also unicasts an RREP back to the source along the reverse path. As the RREP proceeds towards the source, it establishes a forward path to the destination at each hop. Route maintenance is finished by means of route error (RERR) packets. When a link failure is detected by an intermediate node, it generates a RERR packet.

A source upon receiving the RERR initiates a brand new route discovery if it still needs the route. Every node maintains a monotonically increasing sequence number for itself. It also maintains the highest known sequence number for every destination within the routing table called the 'destination sequence number.' Destination sequence numbers are tagged on all routing messages. They are used to determine the relative freshness of two pieces of routing information generated by two nodes for an equivalent destination—the node with a higher destination sequence number has the more recent routing information[2].

3.3. Ad-Hoc on-Demand Multipath Distance Vector (AOMDV)

AOMDV routing protocol is an extension of AODV routing protocol. The key distinguishing feature of AOMDV over AODV is that it provides multiple paths to the destination. These paths are loop-free and mutually link-disjoint. It computes an alternate path between a pair of source and destination with minimal overhead over AODV. It is based on distance vector and hops by hop routing approach. It also has two key features similar to AODV:

1) Route Discovery
2) Route Maintenance.

For route Discovery, it sends an RREQ packet over the network and waits for RREP. In AOMDV, RREQ propagation from the source towards the destination establishes multiple reverse paths both at intermediate nodes as well as the destination. Multiple route replies traverse through these reverse paths back to form multiple forward paths to the destination at the source and intermediate nodes. AOMDV also provides intermediate nodes with alternate paths as they're found to be useful in reducing the route discovery frequency. It examines all the duplicate copies and only those copies are retained that preserve loop freedom and disjoint. The AOMDV route update rule is applied at each node to ensure loop freedom and disjointness properties. It adopts a somewhat "looser" approach for generating RREP. It generates RREP in the response of every RREQ packet that arrives via the loop-free and disjoint path. The routing entries for every destination contain an inventory of subsequent hops in conjunction with the corresponding hop counts. All the succeeding hops have a similar sequence number to keep track of a route. For each destination, a node maintains the advertised hop count, which is defined as the maximum hop count for all the paths, which is employed for sending route advertisements of the destination. Each duplicate route advertisement received by a node defines an alternate path to the destination [2]. Loop freedom is assured for a node by accepting alternate paths to the destination if it's a less hop count than the advertised hop count. As the maximum hop count is employed, the advertised hop count, therefore, doesn't change for a similar sequence number. When a route advertisement is received for a destination with a greater sequence number, the succeeding hop list and therefore the advertised hop count is reinitialized.

To find node-disjoint routes, each node doesn't immediately reject duplicate RREQs. Each RREQs arriving via unique neighbors of the source defines a node-disjoint path. This is because nodes cannot broadcast the duplicate RREQs, so any two RREQs arriving at an intermediate node via a unique neighbor of the source couldn't have traversed the same node. In an effort to get multiple link-disjoint routes, the destination only replies to RREQs arriving via unique neighbors. After the first hop, RREPs follow the reverse paths, which are node-disjoint and thus link-disjoint. The trajectories of every RREP may intersect at an intermediate node, but each takes a unique reverse path to the source to make sure link disjointness.

In AOMDV for route maintenance, it uses RERR packet for sending an error message. A node sends a RERR for the destination when the path fails. As AOMDV has multiple paths when a node finds that a link fails it immediately chose an alternative path. Another problem in AOMDV is the timeout for each path. It is more difficult in AOMDV to manage timeout compared to AODV. With multiple paths, AOMDV has a higher possibility of stale routes. This problem can be avoided by using a small timeout. It also uses the HELLO message to remove stale routes. In AOMDV, a node has multiple paths for forwarding data packets. A data packet is to be forwarded to the route until there is no failure. Here we use a simple approach when a link failure occurs. In that case, it simply chose a route in order of their creation. A sufficient condition for loop freedom is for different sequence numbers in AOMDV, multiple paths maintain by a node should have the same sequence number. With this restriction, we can maintain loop freedom similar to AODV. All routes with older sequence numbers are discarded and for the same sequence number route with a shorter hop count is advertised. Once a shorter route is to be advertised, no route shorter than that is advertised.

In addition to loop freedom, AOMDV finds disjoint multiple paths. When more than one path has a common node or link then it likely be congested due to traffic and the node or link may fail. Thus it is necessary to have multiple paths with disjoint nodes or links. With this theory, we can categorize disjointness as:

1) Node disjoint

2) link disjoint. . To find node-disjoint routes, each node does not immediately reject duplicate RREQs. Each RREQs arriving via a distinct neighbor of the source defines a node-disjoint path. This is because nodes can't be broadcast duplicate RREQs, so any two RREQs arriving at an intermediate node via a distinct neighbor of the source couldn't have traversed the same node. In an effort to induce multiple link-disjoint routes, the destination replies to duplicate RREQs, the destination only replies to RREQs arriving via unique neighbors. After the first hop, the RREPs follow the reverse paths.

AOMDV has three novel aspects compared to other on-demand multi-path routing protocols[11]. Firstly, it does not have an intermodal first hop, the RREPs follow the reverse paths, which are node disjoint and thus link-disjoint. The trajectories of each coordination overheads like some other protocols. Secondly, it ensures the disjoint of alternate routes via distributed computation without the use of source routing. Thirdly, AOMDV computes alternate paths with minimal additional overhead over AODV. It does this by exploiting as much already available alternate path routing information as possible. During route discovery, an AOMDV has more message overheads because of increased flooding and since it's a multipath routing protocol, the destination replies to the multiple RREQs those results are in longer overhead [1].

4. Comparison Of DSR , AODV and AOMDV

Comparison of three reactive routing protocol is done on the basis of different performance metrics such as throughput, PDR, end to end delay etc.

Table 1 Comparison between DSR, AODV and AOMDV

S.No	Performance metrics	DSR (unipath)	AODV (unipath)	AOMDV (multipath)
1	Throughput	Good at moderate traffic load	Good at high traffic load	Better than AODV
2	Packets dropped	Higher than AOMDV	Higher than AOMDV	Low
3	Packet delivery ratio	Good	Good	Better than DSR and AODV
4	Routing overhead	Less at moderate traffic load	Low at high traffic load but Higher than AOMDV	Low
5	End to End delay	High	Lower than DSR but Higher than AOMDV	Low
6	Optimal path length	High	High	Low

6. Conclusion

A comparative analysis of various routing protocols is performed. Routing Protocols like the Adhoc On-demand Distance Vector(AODV), Adhoc on demand multipath distance vector (AOMDV), Dynamic Source Routing(DSR) routing protocol are studied along with advantages & disadvantages.

Specifically, we propose multipath extensions to a well-studied single path routing protocol known as DSR and AODV. The resulting protocol is mentioned as an unplanned on-demand multipath distance vector (AOMDV). The protocol guarantees loop freedom and disjointness of alternate paths. Performance comparison of AOMDV with AODV and DSR using ns-2 simulations shows that AOMDV is able to effectively cope with mobility-induced route failures. In particular, it reduces the packet loss and achieves an interesting improvement within the end-to-end delay. AOMDV reduces routing overhead by reducing the frequency of route discovery operations [1].

In AOMDV, RREQ propagation from the source towards the destination establishes multiple reverse paths both at intermediate nodes also because of the destination. Multiple RREPs traverse these reverse paths back to make multiple forward paths to the destination at the source and intermediate nodes. Note that AOMDV also provides intermediate nodes with alternate paths as they're found to be useful in reducing route discovery frequency [9]. The core of the AOMDV protocol lies in ensuring that multiple paths discovered are loop-free and disjoint, and inefficiently finding such paths employing a flood-based route discovery. In fact, extra RREPs and RERRs for multipath discovery and maintenance alongside a couple of extra fields in routing control packets (i.e., RREQs, RREPs, and RERRs) constitute the sole additional overhead in AOMDV relative to AODV. AOMDV is analyzed as the best protocol when compared with other protocols.

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