ANALYSING PERFORMANCE OF AODV ROUTING PROTOCOL IN MOBILE ADHOC NETWORKS: A SURVEY

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Abstract

Mobile Ad-hoc network is a collection of mobile nodes that communicate via wireless links and communication is carried out without any centralized control or fixed infrastructure. Routing is the important issue in ad-hoc networks. A number of routing protocols have been implemented. This paper is a survey of evaluating performance of Ad-hoc on-demand distance vector routing protocol in Mobile ad-hoc networks with different network parameters using network simulator. Our basic goal is to present vast information related to AODV protocol and modifications done to it to analyze its performance using different performance metrics such as packet delivery ratio, average end-to-end delay, routing load, throughput, packet drop rate and jitter.

Keywords: MANET; AODV; Network simulator

"I. Introduction"

Ad-hoc networks are the networks in which users that want to communicate with each other form a temporary network without any fixed infrastructure. Thus we can say that ad-hoc networks do not rely on any pre-established centralized administration. In such networks, each node is connected through wireless links. There are two forms of ad-hoc networks namely static ad-hoc networks and mobile ad-hoc networks (MANET).

Mobile ad-hoc network is a network which do not requires any fixed infrastructure; consist of mobile nodes which communicate via wireless links. Each node in manet acts as router as well as host. The nodes in manet are free to move independently. These nodes can be laptops, personal computers, music players etc. Mobile nodes can receive and forward packets as a router.

Manet have several salient characterstics

* Dynamic topologies
* Bandwidth constrained
* Limited physical security
* Energy-constrained operation.

Each device in manet is free to move in any direction and will therefore change its topology frequently. Ad-hoc routing protocols quickly adapts to the topology changes and decides which way to route packets. Ad-hoc routing protocols can be broadly divided into two main categories proactive and reactive. AODV is one of the reactive routing protocols. [1][2] This paper is a survey work that

includes proposed modification and related work done to enhance the performance of AODV with different network parameters such as packet delivery fraction, average end to end delay , throughput, routing load, packet drop rate, jitter .

In Section II, we discuss a brief overview of AODV protocol. Section III presents related work done in AODV protocol. Section IV finally concludes the paper.

"II. Overview of AODV"

Ad-hoc routing protocols are mainly categorized into two groups proactive and reactive routing protocol, whereas third protocol is derived from both of these and is known as hybrid routing protocol. Proactive protocols are the one which maintain up-to-date routing information about the network, they are also known as table driven protocol. These protocols provide good reliability but are not suitable for nodes moving with higher speed. Reactive protocols are generally known as on-demand routing protocols. They discover route on demand when packet is to be sent. Ad-hoc on demand vector routing protocol is one of the reactive protocol.

AODV uses broadcast route discovery mechanism. It requests a route when needed and does not require

nodes to maintain routes to destination that are not actively used in communication. It relies on dynamically establishing route table entries at intermediate nodes. To maintain the most recent routing information between the nodes, it uses the concept of destination sequence number. [2]

AODV protocol works in two steps

* Path Discovery
* Path Maintenance

Path discovery process is the first step, whenever a source node wants to send packet to another node, path discovery process is initiated. The source node initiates path discovery by broadcasting route request RREQ packet to its neighbor. Each neighbor either satisfies RREQ by sending route reply RREP back to the source or rebroadcasts RREQ to its neighbor after increasing hop-count. If a node cannot satisfy RREQ, it implements reverse path as well as forward path set up. As the RREQ travels from source to destination reverse path is set up automatically and when the RREP travels back to the source, each node along the path sets up a forward pointer to the node from which RREP came. [2]

Second step is the Path maintenance process in which hello messages are used to ensure symmetric links as well as to detect link failures. [2]

"III. **Related work"**

In recent years, a number of studies have been done regarding AODV protocol using different parameters. Several researchers have done a lot of analysis of ad-hoc routing protocols taking different parameters such as packet delivery ratio , average end to end delay , routing load , throughput , packet drop rate , jitter .

"1. **PACKET DELIVERY RATIO (PDR)**"

It is the ratio of no of data packets successfully Delivered to the destination node and number of data packets generated by the source node.

i. AODV with reliable delivery AODV-RD based on link failure prediction mechanism is proposed and increases packet delivery ratio when compared with AODV-BR and original AODV.[3]
ii. AODV-PA including source route accumulation feature is proposed and compared with AODV and DSR by varying velocity and number of connections. Results show that AODV-PA has higher PDR than both AODV and DSR when velocity is varied and when network connection is varied PDR of AODV-PA increases as the number of connections increases.[4]
iii. Comparison is made between three routing protocols AODV , DSDV and DSR by varying packet size, time interval and simulation results show that when packet size increases PDR for AODV and DSR decreases and when time interval increases DSR performs better than AODV which in turn performs better than DSDV.[5]
iv. AODV-LFP (AODV based on link failure prediction) is proposed, it starts process of link restored before link break off and enhances Packet Delivery ratio. [6]
v. Three protocols are compared AODV , DSDV , DSR by varying node speed and results conclude that at high speed PDR of AODV is high and when speed is slow ,PDR of DSR is most optimal.[7]
vi. AODVUU is proposed and compared with AODV and DSDV by varying maximum speed of nodes from 1m/s to 80m/s .Simulation results show that AODVUU protocol has higher PDR than AODV and DSDV.[8]
vii. Three protocols are compared AODV, DSR and DSDV by varying pause time from 0 to 200 seconds and results conclude when pause time is 0 , PDR of AODV and DSR is 97% to 99% and DSDV is 77% but when pause time is 200 , PDR of AODV and DSR is approx 100% and of DSDV is 94%. [9]
viii. A Robust AODV protocol is proposed where route is built on demand and maintained by locally updating route information. Performance of robust AODV and AODV is compared . Results show that robust AODV acquire better PDR than AODV.[10]

"2. **AVERAGE END TO END DELAY**"

It is the average time interval between generations of packet in a source node and successfully delivery of packet at the destination node.

i. Proposed AODV-RD is compared with AODV-BR and AODV by varying pause time and speed of nodes. Results show that AODV-RD has much shorter end to end delay.[3]
ii. Proposed protocol AODV-PA is compared with AODV and DSR by varying velocity and network connections and it is observed that AODV-PA and AODV have better delay values than DSR.[4]
iii. Three routing protocols are compared AODV, DSDV, DSR and results show that delay decreases as packet size increases.[5]

iv. AODV-LFP is proposed which is based on link restore process before link break off and thereby decreases time of link restored effectively and reduces end-to-end delay.[6]
v. Comparison is made between AODV, DSDV, DSR by varying node speed and analyses performance metric end-to-end delay that at high node speed ,AODV is more favorable as its delay is low but when speed is slow ,delay of DSR is optimal.[7]
vi. AODVUU protocol is proposed and compared with AODV and DSDV by varying node speed and concludes that AODVUU performs better than the other two protocols in terms of time delay.[8]
vii. Authors compared AODV, DSDV , DSR by varying pause time and results show that for DSDV delay is high for pause time 0 but starts decreasing as pause time increases and DSR has low delay and performs better.[9]
viii. Robust AODV and original AODV is compared by varying node speed. Simulation results of UDP and TCP traffic are analyzed. Results show that for UDP traffic Robust AODV have smaller end-to-end delay than AODV.[10]
ix. Four routing protocols are compared four AODV, DSR , DSDV, OLSR by varying network size and results concluded that DSDV and OLSR outperforms AODV and DSR in terms of time delay.[11]

"3. **ROUTING LOAD**"

It is the ratio of number of routing messages propagated by every node in the network and number of data packets successfully delivered to all destination nodes.

i. Comparison is made between proposed AODV-PA and AODV and DSR by varying velocity and network connections. When velocity is varied, routing load is less in AODV-PA at low velocities but increases at moderate to high velocity. By varying network connections ,routing load of AODV-PA and AODV is higher than DSR.[4]
ii. Three protocols are compared 3 protocols AODV, DSR and DSDV by varying packet size , results show that as packet size increases routing load increases. For DSDV routing load is very high.[5]
iii. AODV, DSR and DSDV are compared by varying pause time from 0 to 200 sec. Simulation results conclude that DSR and DSDV has low and stable routing load whereas for AODV varies a lot.[9]
iv. Robust AODV protocol with local update is proposed and compared with AODV by varying node speed. Results conclude that AODV routing load is higher than that of robust AODV.[10]
v. AODV-BRL is proposed to improve the adaptation of routing protocols to topology changes by modifying AODV-BR. AODV-BRL is based on extended hello message and least hop count first. Simulation results conclude that compared to AODV-BR , AODV-BRL improves routing load.[12]
vi. Performance of AODV and DSR is analyzed and compared by varying network size and transmission range of nodes. Results conclude that DSR generate less routing load than AODV.[13]
vii. Proposed protocol IAODV which is based on controlling the broadcasting of route request information and compared with AODV. Simulation results conclude that by varying number of nodes IAODV is better than AODV in terms of routing load.[14]

"4. **THROUGHPUT**"

It is the average number of packets successfully delivered per unit time.

i. Three protocols are compared by varying packet size and time interval and it is observed that as the packet size and time interval increases ,throughput decreases.[5]
ii. Performance metric throughput of AODV for chain topology is analyzed by varying network size from 5 to 55 nodes. Results show that AODV exhibits degrade performance in terms of throughput with increase in number of nodes.[15]
iii. Four protocols are compared AODV, DSR, DSDV and OLSR by varying network size .Simulation results conclude that throughput of DSR and AODV grow larger as network size increases and throughputs of DSDV and OLSR drop when network scales up.[11]

"5. **JITTER**"

It is the standard deviation of packet delay between all nodes.

i. Comparison is made between four protocols AODV, DSR, DSDV, OLSR by varying

network size and results concluded that jitters of DSDV and OLSR are smaller and more stable than AODV and DSR. [11]

ii. Robust AODV and original AODV is compared by varying node speed. Simulation results of UDP and TCP traffic are analyzed. Results show that for UDP traffic Robust AODV have smaller jitter than AODV.[10]

"6. PACKET DROP RATE"

It is the number of packets that are not successfully sent to the destination during transmission.

i. AOZDV which enhances AODV protocol through zone routing is proposed .AOZDV is compared with AODV and DSR by varying number of nodes and it is observed that with increasing number of nodes, AOZDV has low packet drop rate than other protocols.[16]

ii. AODV-LFP(AODV with link failure prediction) which is based on link restore process before link break off is proposed and compared with AODV protocol by varying node mobility rate. Results conclude that AODV-LFP has low packet drop rate than AODV. [6]

"IV. Conclusion"

In this paper we have provided vast information regarding AODV protocol and its various modifications. The work done in this survey research aims to develop a good understanding of AODV protocol and improvements done to it to enhance its performance using different network parameters. We observe that large number of studies have been done in this field, we conclude that the proposed protocols enhance packet delivery ratio, throughput and reduces end-to-end delay, packet drop rate, routing load and jitter. When node speed, pause time and number of connections increases, PDR of AODV increases and when packet size increases, PDR of AODV decreases. When packet size and node speed increases, end-to-end delay of AODV reduces and when network size increases, end-to-end delay of AODV increases. Routing load of AODV increases with increase in network size, packet size and pause time. Throughput of AODV degrades as the packet size, time interval and number of nodes increases. When network size increases, jitter of AODV becomes unstable.

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