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# Simulation Analysis of Routing Protocols in Hybrid wireless network

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**Abstract:** A wireless hybrid network; integration of wireless ad hoc network and wireless infrastructure network is recognized as superior option for next generation wireless networks. Such network focuses to support of continuous transmission with strong Quality of Service (QoS). In hybrid networks, the way to guarantee quality of service (QoS) remains a hot problem, where it is observed that due to the direct adoption of QoS based reservation resource routing for MANET, hybrid networks inherit problems of resource reservation and invalid racing conditions. The article presents the working of two AdHoc routing protocols (DSDV and AODV+) in hybrid systems in relation with different network complexities. It is observed that both protocols performed indistinguishably to the extent of the throughput. For jitter, PLR and PDR, the AODV+ performed superior to DSDV; except for the intricacy situation of system, while DSDV performed ineffectively.

**Keywords:** Hybrid Wireless Network, QoS, Routing Protocol, Call stress, Integrated Wireless Network, Routing Protocol.

## 1. INTRODUCTION

Mobile AdHoc Network (MANET), is a self organized and self configured group of multi-hop mobile nodes, whereas multiple isolate groups of MANET communicate each other through a bridge of wired access points. Such networks could be imagined as a hybrid network where data packets are passing through wired network to MANET, MANET to the wired network and between two isolate MANETs. Due to self-mobility, mobile networking is growing at rapid rate from last two and half decades (Mohammadani *et al.* 2013). Cell phones, laptops and other portable devices have turned into a need of regular daily existence and assume vital part in numerous parts of our life (Mohammadani, *et al.* 2017). MANETs are trouble-free in deployment due to flexibility of self configuration and no need of physical infrastructure; this would be more suitable in crucial areas where physical infrastructure of network may not be present (Memon *et al.* 2017). In MANET, there is no need to configure any central station (Abbasi *et al.* 2015), each device acts as switch and can move effectively while imparting (Abbasi *et al.* 2011). MANET support routing among the nodes to build up their own particular network from source to destination (Shaikh *et al.* 2013).

Hybrid wireless networks have turned out to be a superior system structure for advance wireless generations and can lead the strengthen end to end QoS necessities for various applications (Hussaini *et al.* 2017). Wireless hybrid system synergistically join fixed infrastructural systems and MANET to use each other (Mohammadani,*et al.* 2017). In particular, infrastructure networks enhance the adaptability of MANET while MANET naturally arrange self-sorting systems, and extend the coverage of infrastructure networks (Ben *et al.* 2017).

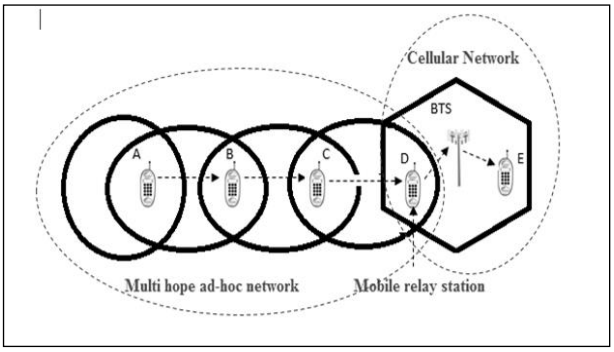


**Fig. 1. Hybrid Wireless Network Image**

Due to different behavior of isolated MANETs in hybrid network, QoS is a critical problem. Communication links between different MANETs or between MANET with fixed wireless system have to offer continuous correspondence in any conditions with supportive level of QoS for any application.

End to end QoS parameters effected with different scenarios; such as reroute the packets in case of failure or crush of any node in path of source to destination (Mohammadani 2015), variation of active nodes per

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MANET offering different levels of network stress, number of access points from source to destination and application type.

Hybrid network perform different under different MANET routing protocols. In this paper, a hybrid network consisting multiple isolated MANETs is simulated using AODV+ routing protocol. AODV+ is an extension of the Ad hoc On-Demand routing protocol (AODV) and support end to end routing in the hybrid wireless network. Further AODV+ compared with DSDV routing protocol for different QoS parameters under different complexities and up to number of access points.

Research article is distributed into following sections. Section 2 presents literature work on hybrid wireless network. Section 3 describe methodology of propose work. Section 4 illustrates simulation results. Section 5 concludes the article followed by references.

## 2. RESEARCH REVIEW

In the development of hybrid wireless network, routing and quality of services are the main issues. Researchers are focusing on integrated wireless network from last decade, where some of researchers present new architectures of integrated wireless network, as the extension of mobile ad-hoc network. Others evaluates the integrated wireless network performance according to quality of service QoS parameter e.g. throughput, routing load etc.

In (Castellanos *et al.* 2012) author simulated new AODV called AQA-AODV to get better interconnection among Internet and MANET. They used hybrid gateway discovery method in limited range. They compared their protocol with AODV+ and QGWS routing protocols and checked QoS parameters (i.e. packet lost ratio, normalized routing overhead and average end to end delay) for network congestion. Authors suggested that the AQA-AODV has ability to reduce the network congestion (delay and packet loss) under constant routing overhead.

In (Majumder and Asaduzzaman 2014) author simulated a hybrid network consisting average hop counts for gateway, which cover long range. Advertisement zone exponentially finds with help of adaptive value per hope count. They compared this novel hybrid scheme with old hybrid schemes of AODV routing protocol. They measured QoS parameters less End to End Delay, good PDR and NRL is quite less using NS2.

In (Garg 2012) authors replicated AODV + and DSDV in internet link with the MANET using fixed stationary gateways. The exploration concentrated on the measuring some QoS parameters i.e. PDR, throughput and end to end delay in view of various movement speed of MANET nodes. Analysts found to AODV+ works superior to DSDV. They recommended that DSDV is very great however not appropriate to actualize for wide region network like WAN.

The work for hybrid network in (Staub and Heissenb 2004) checked execution examination of MANET and Hybrid system in light of irregular waypoint portability demonstrate with various routing protocols. Work got results of AODV, DSR and OLSR routing protocol in pure MANET and DSDV in hybrid network. Authors examined PDR, Routing overhead and Delay with different traffic source.

Hamidian Ali in (Hamidian 2003) modified and implemented the extension of AODV routing protocol as AODV+. Work compared the performance of AODV+ with general AODV using different gateways discovery approaches through the NS2 simulator. Focused link was internet for mobile nodes in MANET.

## 3. METHODOLOGY

A network implementation without routing protocol is visually impaired, because the routing protocols relegate the way for packet to send/receive. This paper includes two most common MANET routing protocols i.e. DSDV and AODV+ to analyze their performance in hybrid wireless network. Both protocols support the nature of MANET and hybrid wireless networks.

### 3.1 Ad Hoc On-Demand Distance Vector plus

AdHoc On-Demand Distance Vector plus (AODV+), routing protocol belongs to reactive and topology based family of routing protocols. The reactive routing protocols get active to create a routing path on the need for communication between network nodes.

The discovery process of AODV is that AODV limits the quantity of required communicates by making paths in an on-request way (Vasan *et al.* 2013). At the point when a goal to send information to another end device, it needs to start a way of discovering procedure to find the other device. Source device broadcasts a packet in form of route request (RREQ) to its all nearest neighbors. Neighbor nodes of source node forward RREQ to their neighbors, and so on until the destination will be located. Target node sends a route reply (RREP) packet to the source, it passes the pre-defined route from which target node gets the RREQ packet. The source device begins to send actual information after getting RREP packet utilizing a similar path (Abdullah 2017).

Traditional AODV did not work for fixed access point. The AODV+ is used to connect MANET with fixed access points. AODV+ works on two isolate

technologies one is homogenous network technology as MANET and second is heterogeneous network technology as MANET with wired LAN.

### 3.2 Distance Sequenced Distance Vector (DSDV)

DSDV routing protocol belongs to proactive and topology based family of routing protocols. The proactive families of routing protocol that makes valid routing path in the routing table of all nodes in the network before the communication starts in the network (Abbasi *et al.* 2016). In DSDV routing protocols, the whole versatile device trade "hi" message to promote itself. The neighbor's device on accepting the 'hi" message will at the "hi" senders to its routing table. By along these lines any device will know its neighbors. At that point, every device will send the whole routing table to its neighbor. Wherefore, every device will have a path to every device in the network. At long last, the "hi" message will send by any device will refresh its position in the network.

### 3.3 Simulations

For simulation, we use 802.11b as MAC protocol that selects the Distributed Coordination Function (DCF). Further develop the scenario of the Hybrid wireless network, there are multiple isolated MANET nodes are connected with multiple AP's at the distance as fig2. (a, b & c) show, one backbone fixed router node is selected to interconnect star structure of the access points (APs) for exchange the information. There are 3 different complexities of 2, 4 and 6 APs with 20, 40 and 60 mobile devices. Table 1, shows the more information about parameters included packet size, Environment Size and Communication Stress etc. Call stress increases according to network complexity.

**Table.2. Simulation Parameters**

| Simulation Parameters | Parameters Values |
|---|---|
| Simulation Time | 120 seconds |
| Environment Size | 1000.m × 1000.m |
| Application / Traffic | CBR |
| Transport protocol | UDP |
| Communication Stress | (22, 68 & 126) call |
| Packet size | 160 Bytes |
| Data rate | 8 Kbps |
| Nodes | 20, 40 and 60 |
| AP Nodes | 2,4 and 6 |
| Wired Router | 1 |
| Protocols | DSDV and AODV+ |

**Fig.2.a Simulation Setup with 2 AP**

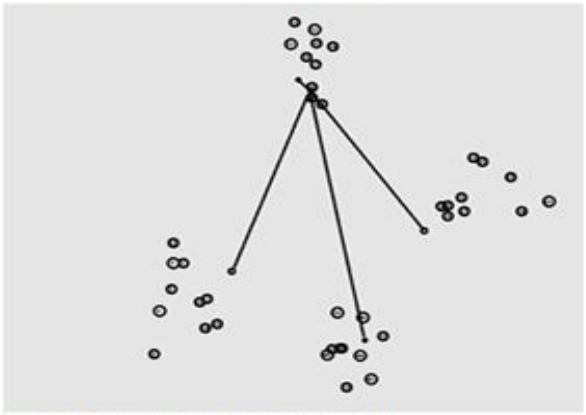

**Fig.2.b Simulation Setup with 4 AP**

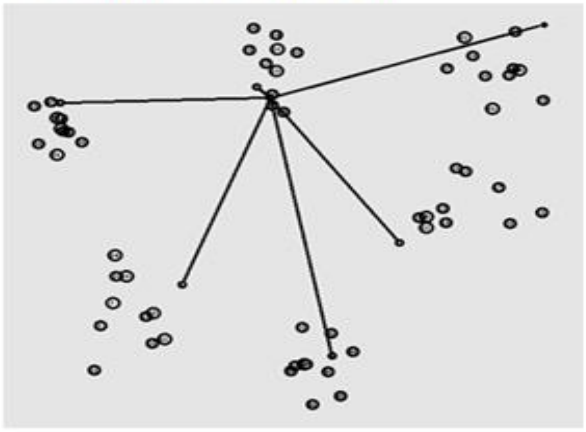

**Fig.2.c Simulation Setup with 6 AP**

### 3.4 Performance Metrics

The following measurements have been utilized to assess the comparison between the protocols:

Packet Delivery Ratio: It is the percentage of application layer packets successfully received to the aggregate sent(Chaubey *et al.* 2015).

Latency: It is the normal time a packet takes to achieve the goal(Marcotte and Olson 2016).

Average Throughput: It is the measure of total information conveyed in a unit of time(Nayak and Sinha 2016).

Packet Loss Ratio: It is the percentage of total drop packets over total generate packets (Khan *et al.* 2017).

• Jitter: The difference in packet delay time known jitter. It is occurred due to network congestion, a unexpected changing in network topology or link break (Kumar, *et al.*, 2017).

## 4. RESULTS AND DISCUSSION

This segment investigations and looks at the exhibitions of the AODV+ and DSDV routing protocols. The consequences of the simulation tests exhibit that DSDV does without a doubt have more focal points much of the time and enhances system performance.

### 4.1 Throughput

From fig 3, it is investigated that both routing protocols (DSDV, AODV+) behaved similarly and created indistinguishable plots for throughput. The network could convey an ever-increasing number of information under every routing protocol until a point (AP-6).

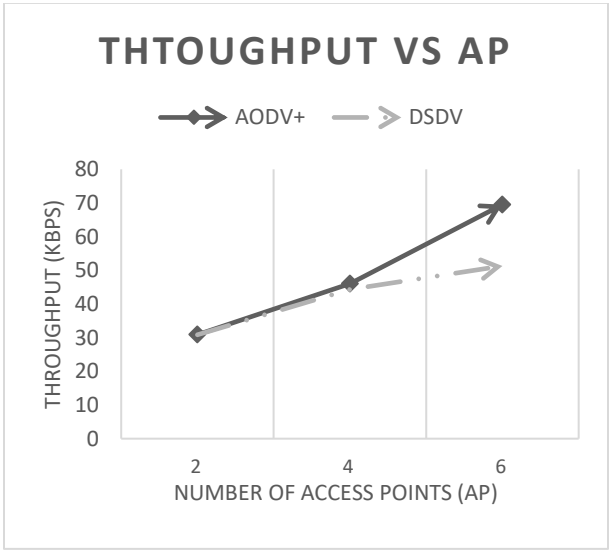


**Fig. 3. Throughput versus Number of Access Points (AP)**

### 4.2 Latency

From (Fig-4), it can be watched that the latency of the AODV+ stayed high, while that of DSDV stayed low. From AP 4 toAP 6, AODV+ demonstrates a progressive ascent with the ascent the complexity it is because of relating increment in congestion. While DSDV displays a steady latency. This is on account of in all situations the network was underutilized, in the DSDV case where every packet set aside same measure of opportunity to achieve goal due to prior paths.

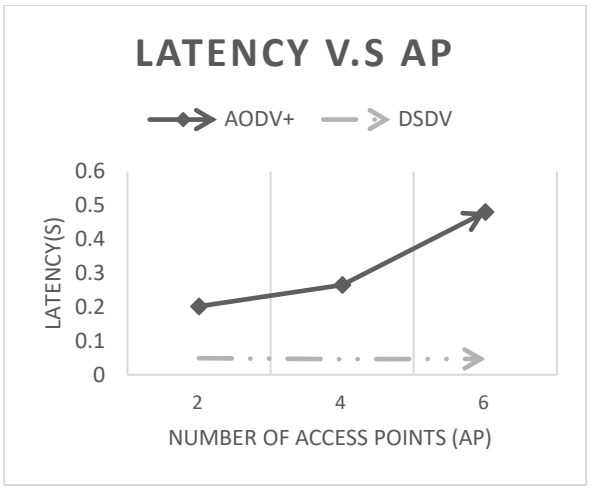


**Fig.4. Latency(s) Vs Access Points (AP)**

### 4.3 Jitter

Jitter is an important factor for network measurement. From fig-5 it can be observed that both routing protocols takes neck-to-neck time in all situations. But a little slighter time is taken by DSDV than AODV+.

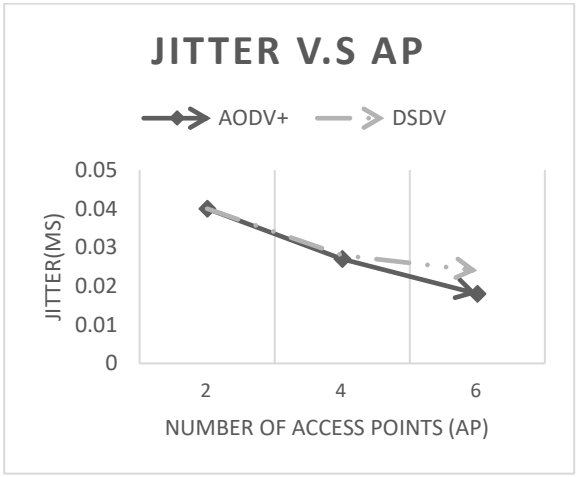


**Fig. 5. Jitter(ms) Vs Access Points**

### 4.4 Packet Deliver Ratio

From fig-6, it can be watched that AODV+ acted indistinguishably and ready to convey nearly an indistinguishable measure of information. The execution of DSDV is primarily affected because of greater complexities of system with high congestion and high drop rate.

In all cases of APs, the PDR of AODV+ is very nearly to 100%. But DSDV decreases the PDR as network complexity rises. DSDV tries to deliver more packets but due to network congestion it maintains lower than AODV+.

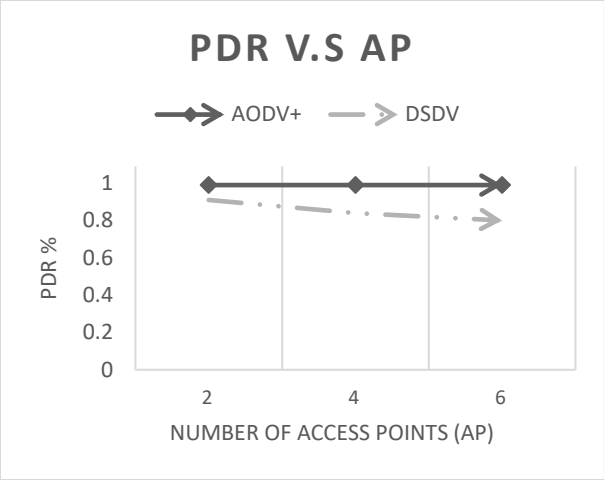


**Fig. 6. Jitter(ms) Vs Access Points**

### 4.5 Packet Loss Ratio

From the fig 6, it can be watched that DSDV does not control the packet dropping situation therefore it is too weak to control the packet loss situation as compare with AODV+. AODV+ controls packet drop due to its dynamic nature of adopting topology. AODV+ plays parallel role with network topology.

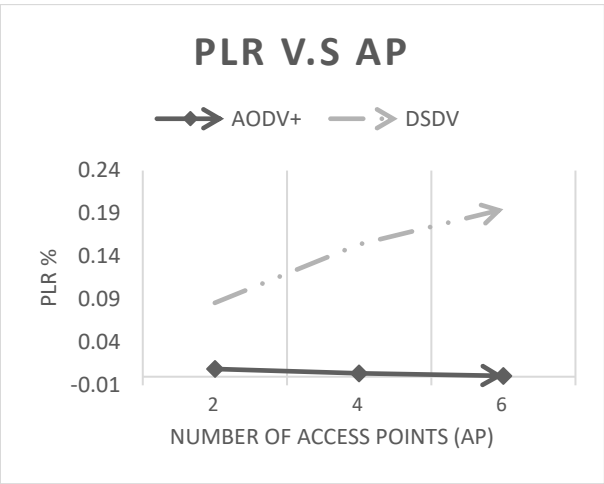


**Fig. 7. Jitter(ms) Vs Access Points**

## 5. CONCLUSION

In this paper, we simulated multiple isolated MANETs connected via fixed AP's. We compared AODV+ with DSDV routing protocol in multiple complexities of the wireless hybrid network. Only in the case of Latency, DSDV proved good to itself while for other metrics like Jitter, PLR and PDR; the AODV+ performed somewhat superior to DSDV. It is observed that under the unpredictable situations of network DSDV performed imperfect. Wireless hybrid network in connection of dynamic routing ability of AODV+, supports more data as compared to DSDV, for this reason over all AODV+ performed better than DSDV under high network complexities.

In future, we will conduct the research on various other routing protocols for hybrid network in combination of different frequency bands. With the variation of variants of 802.11 MAC protocol, Transport protocol and different transmission ranges for APs. Further work could enhance with the selection of homogenous routing protocols and heterogeneous routing protocols for hybrid network.

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