Performance Analysis of Pre-demand and On-Demand Routing Protocols Using Different Propagation Models

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***Abstract*: - In wireless communications, Mobile Ad Hoc networks (MANETS) are collection and combination of non- contact type i.e. wireless nodes temporarily present in specific network routing without any predefined requirement of infrastructure. To find the best efficient path in MANET is the main challenge and also selection of right protocol at right procedure of time which route all the information efficiently. The Quality of Service (QoS) can be decided by various parameters. In this work various parameters like Packet Delivery Fraction Ratio and Instant Jitter have been simulated and compared in CBR and VBR traffic model by varying number of nodes, varying propagation models and traffic. The results have been presented in tabular and graphical mode. The simulations shows that the size of mobility and traffic load affect the performance of routing up to some extent which are based on source routing like DSDV. When mobility is low the performance of all three protocols closely match other when compared for all the scenarios. The large network with many mobile nodes and offered load will increase overhead for DSDV drastically therefore in these situations a hop by hop based routing protocols such as AODV and AOMDV is more desirable. The AOMDV protocol outperformed the other two protocols due to its multipath routing discovery process.**

Keywords: **MANET, QoS, AOMDV, DSDV, AODV**

I. INTRODUCTION

Mobile wireless network is the infrastructure less mobile network as shown in Figure 1, commonly known as an Ad Hoc network. Infrastructure less networks have no fixed routers; all nodes are capable of movement and can be connected dynamically in an arbitrary manner. Nodes of these networks function as routers which discover and maintain routes to other nodes in the network. Example: applications of Ad Hoc networks are emergency search-and-rescue operations, meetings or conventions in which persons wish to quickly share information, and data acquisition operations in inhospitable terrain.

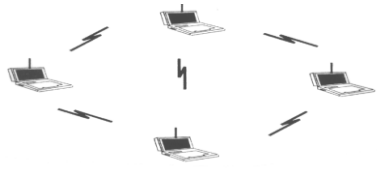

Fig. 1 Infrastructure less Wireless Network

Therefore, mobility and scalability are the main challenges in the infrastructure less networks (Rappaport, 2002). A mobile Ad Hoc network or MANET is a collection of mobile nodes sharing a wireless channel without any centralized control or established communication backbone. They have no fixed routers with all nodes capable of movement and arbitrarily dynamic.. The topology of the Ad Hoc network depends on the transmission power of the nodes and the location of the mobile nodes, which may change from time to time.

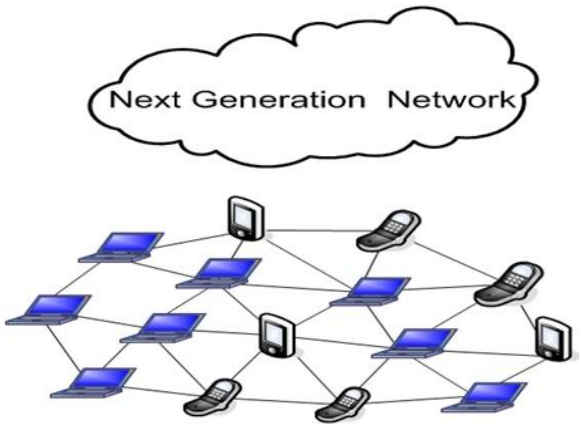

Fig. 1.3 MANET Infrastructure

1.1 MANET Characteristics: - Due to the mobility of the nodes, there are some characteristics that are only applicable to MANET. Some of the key characteristics are like Dynamic Network Topologies, Energy Constrained Operations, Bandwidth Constrained links etc. Some of the major applications of MANET are Rescue/Emergency operations, Law enforcement activities, Commercial projects, Educational Class rooms, Military Battlefields

1.2 Routing protocols in MANET: - Routing is an act of moving information across an inter-network from a source node to the destination node. (Usop et al, 2009). The requirement characteristics of routing techniques are correctness, simplicity, robustness, stability, efficient, flexible, rapid convergence etc. the conventional routing protocols were designed for static networks using either link state or distance vector routing algorithms (Vivian et al, 2006). The routing task in an Ad Hoc network is more complex than in

wired networks, because this depends on many factors including topology, routing selection, initiation of the request, and specific underlying characteristics that can serve as heuristics to find quickly and efficiently the route for which the packages should be sent. Major challenges in mobile Ad Hoc networks are routing of packets with frequently mobile nodes movement, there are resource issues like power and storage and there are also wireless communication issues. As mobile Ad Hoc network consists of wireless hosts that may move often. Movement of hosts results in a change in routes. Routing protocols are needed whenever delivered data packets need to be handed over several nodes to arrive at their destinations

1.3 MANET Routing Protocols: - Conventional protocol assumes the existence of bidirectional links e.g. that the transmission between hosts work equally well in both directions while in wireless radio environment this is not always the case.

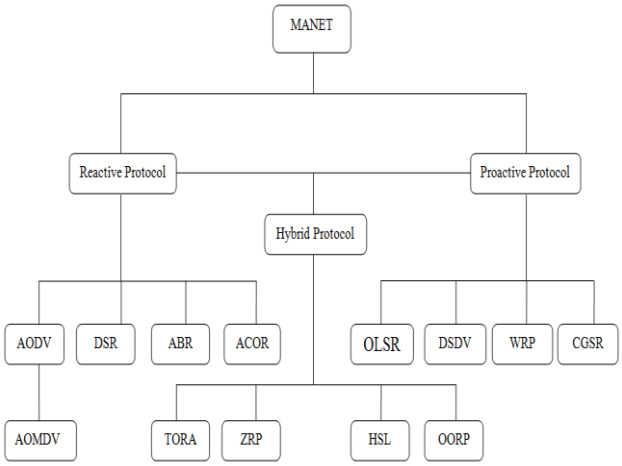

Fig. 1.4 MANET Routing Protocol Types

1.4 Proactive Protocol: - In this type of routing protocol, each node in a network maintains one or more routing tables which are updated regularly. However, it incurs additional overhead cost due to maintaining up-to-date information and as a result, throughput of the network may be affected but it provides the actual information to the availability of the network (Singla and Kakkar, 2010).

1.5 Reactive Protocol: - In this type of routing protocol, each node in a network discovers or maintains a route based on-demand. It floods a control message by global broadcast during discovering a route and when route is discovered then bandwidth is used for data transmission. The main advantage is that this protocol needs less touting information but the disadvantages are that it produces huge control packets due to route discovery during topology changes which occurs frequently in MANET and it incurs higher latency (Marina et al, 2001).

1.6 Hybrid Protocol: - It is a combination of proactive and reactive protocols taking the best features from both worlds.

Ad Hoc On-Demand Distance Vector (AODV):- AODV is an improvement on DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, as opposed to maintaining a complete list of routes as in the DSDV algorithm. The AODV classify it as a pure on-demand route acquisition system, since nodes that are not on a selected path do not maintain routing information or participate in routing table exchanges (Royer et al, 1999).

1.7 *Ad Hoc On Demand Multipath Distance Vector (AOMDV)* :- Multipath routing is a technique provides multiple alternative paths between each source and destination in a network. The benefit of such technique is a fault tolerance, bandwidth increasing, and security improvement. Overlapping, looping (infinity loop) and optimum disjointed paths or node-disjointed are the main issue in such algorithms (Sangi et al, 2010).

Destination Sequenced Distance Vector Routing (DSDV) :- The key distinguishing feature of DSDV is the use of source routing. That is, the sender knows the complete hop-by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header (Trung et al, 2007).

***Nodes*: -** In communication networks, a node is a connection point, either a redistribution point or a communication endpoint (some terminal equipment).

1.8 Radio Propagation Models: - In order to estimate the signal parameters accurately for mobile systems, it is necessary to estimate a system's propagation characteristics through a medium. Propagation analysis provides a good initial estimate of the signal characteristics (Kathirvel and Srinivasan, 2007). The ability to accurately predict radio propagation behavior for wireless communication system is becoming crucial to wireless system design. The main characteristics of Radio Propagation System are to detect Path Loss, Fading and time delay spread (Hekmat et al, 2006).

II. LITERATURE REVIEW

According to **Kartik et al** (2010) AODV shares DSDV's on-demand characteristics in that it also discovers routes on an as needed basis via a similar route discovery process. However, AODV adopts a very different mechanism to maintain routing information. It uses traditional routing tables, one entry per destination. This is in contrast to DSDV, which can maintain multiple route cache entries for each destination. This may give rise to significant performance differentials. **S.R. Biradar** et al (2010) evaluated To make use of route caching aggressively, DSDV replies to all requests reaching a destination from a single request cycle. Thus, the source learns many alternate routes to the destination, which will be useful in the case that the primary (shortest) route fails.

Amjada and Dojab (2011) discussed about quality of service of various on-demand protocols when simulated under small values of node variation i.e. upto 50 nodes and lesser periodic times, DSDV plays closely equivalent role as compare to other efficient protocols. **Mohammad and Tanvir** (2011) stated that under Nakagami-m fading model, received packet may not be clearly understood by the receiving node, which affects the routing protocol as well as the medium access control protocol of a network. **Bawa and Banerjee** (2013) explained that due to frequent movement of nodes in network, some issues developed like congestion, coverage etc and to improve the packet delivery ratio, a load management system is offered in AOMDV and observed that route establishment is based on the Que selection.

III. RESEARCH METHODOLGY

The literature survey reveals that lot of work has been done in the field of MANET. But still there is a scope of work in the field PDF and Instant Jitter under various propagation models such as Shadow and Nakagami models in high mobility models. From Literature survey it is clear that at lower mobility models i.e. number of nodes, pause time, start and stop time, the response by various protocols closely match each other but the performance varies as the complexity increases.

Table 1 Simulation Scenario

Simulation Parameters	Description
Routing Protocols	AOMDV, AODV and DSDV
Pause Time	Variable
Propagation Models	shadoww and Nakagami
Simulation time	2060 Secs
Traffic Type	CBR and VBR
Antenna Model	Omni Directional
MAC	IEEE 802.11
No. of Nodes	50, 100, 150, 200, 250
Channel Type	Wireless
Que Type	Drop Tail
Node placements	Random

IV. RESULTS

4.1 Analysis of PDF and Instant Jitter **:** - The performance parameters for MANET can be calculated by various means and under various conditions like by changing any of the simulation parameter and keeping other constant which is discussed in Table 4.1. In this work, the variables are, Protocols,Traffic, Propagation model and number of nodes. The results can be calculated graphically and discussed as follows :-

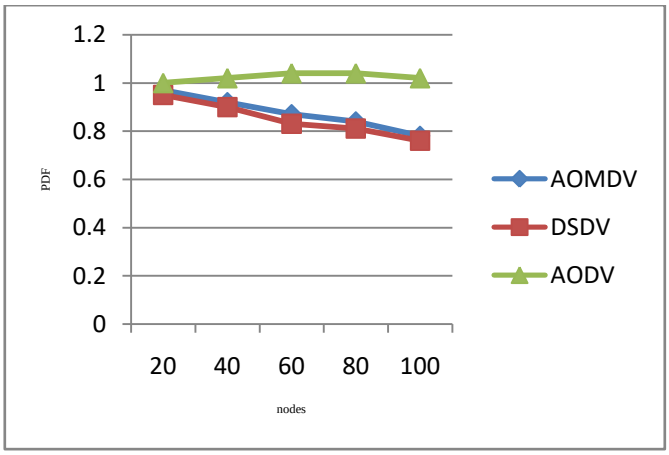

Fig. 2 : PDF vs Nodes in shadow Model (CBR Traffic)

Case I :- As shown in Figure 5.1 for PDF vs Nodes in Shadow model in Constant Bit Rate traffic, since AODV is having a single path and it is on demand protocol, it delivers the packets at faster rate although all three protocols initiates at same bit rate in mobility traffic. It is also observed that at lower mobility models i.e. nodes less than 100, the single path on demand protocol must be preferred.

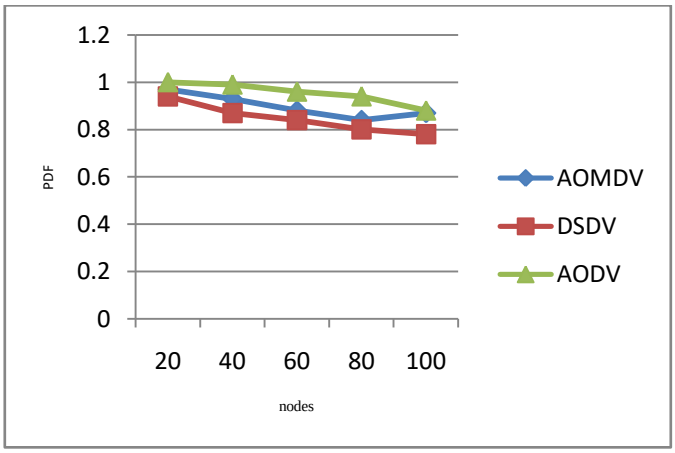

Fig. 3 : PDF vs Nodes in shadow Model (Exponential Traffic)

Case II :- As shown in Figure 5.2 for PDF vs Nodes in shadow model in Exponential traffic, the fate for pre-demand protocol i.e. DSDV is similar as compare to other models since it is pre demand model so the ratio falls dramatically as the number of nodes increased. AODV is having a single path and it is on demand protocol, it delivers the packets at faster rate although all three protocols initiates at same bit rate in mobility traffic. It is also observed that at lower mobility models i.e. nodes less than 100, the single path on demand protocol must be preferred, now in this scenario it is clearly visible that as the mobility model density increases the AOMDV leads since the chances of route breakage increases so multipath will give option to divert to the shortest and less congested path as compare to AODV and DSDV in which there is no diversion possibility.

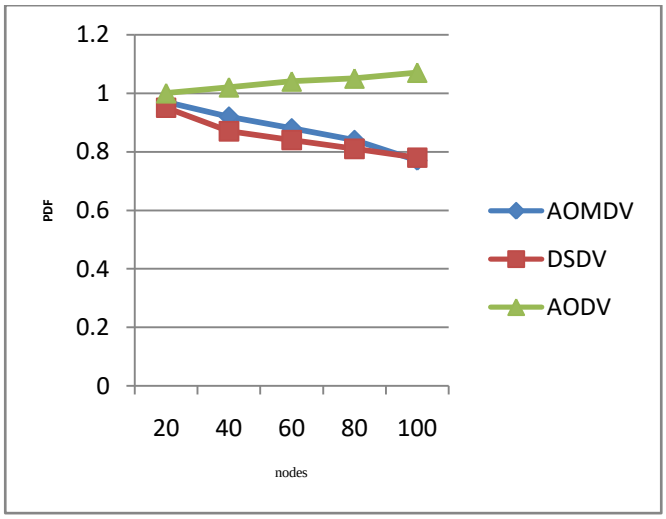

Fig. 4 : PDF vs Nodes in Shadow Model (Pareto Traffic)

Case III :- As shown in Figure 5.3 for PDF vs Nodes in Shadow model in Pareto traffic, the conclusion and again since the model is shadow which does not assume any loss and a basic model so in this case also AODV shoots up with increase in nodes as compare to other ones and due to multipath AOMDV displays simple path loss formation.

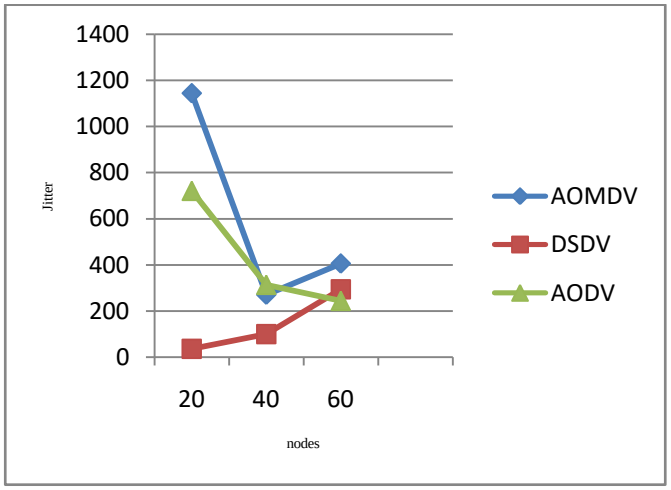

Fig. 5 : Instant Jitter vs Nodes in Shadow Model (VBR Traffic)

Case IV :- As shown in Figure 5.4 for Instant Jitter vs Nodes in shadow model in VBR traffic, the jitter is defined as the difference in packet delay or can be defined as the measuring time difference in packet inter arrival time, and hence as shown above since DSDV is pre initiated protocol therefore initially at low mobility it is best observed but as soon as once initiated and mobility increases the jitter level increases, on the other hand as shown in figure above it is clearly observed that on-demand routing leads to high jitter at initial stages and settled down for low scores as the nodes increased. As the mobility changes in the on-demand protocols the variation remains there in AOMDV due to its path shifting phenomena.on the other hand as AODV is a single path protocol shows better response in high mobility also.

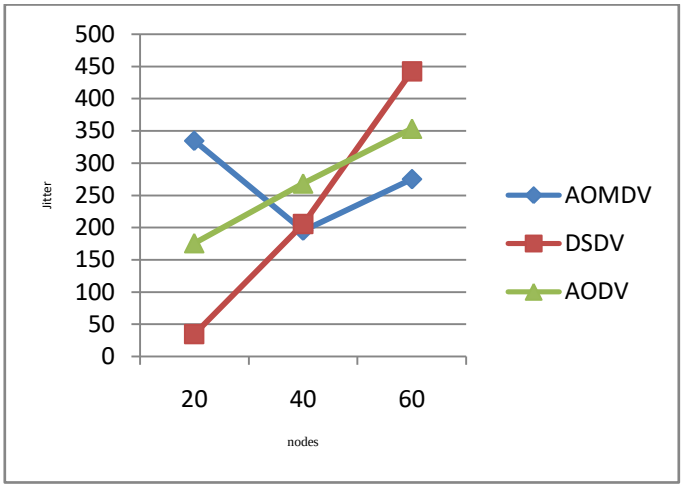

Fig. 6 : Instant Jitter vs Nodes in Nakagami Model (VBR Traffic)

Case V :- As shown in Figure 5.5 for Instant Jitter vs Nodes in Nakagami model in VBR traffic, the jitter as discussed above is the difference in packet delay, and hence as shown above since DSDV is pre -initiated protocol therefore initially at low mobility it is best observed but as soon as once initiated and mobility increases the jitter level increases, on the other hand as shown in figure above it is clearly observed that on-demand routing leads to high jitter at initial stages and settled down for low scores as the nodes increased.Since the above conclusion is in Nakagami model in which more the practical situation is included which means the inclusion of path loss, fading and all these parameters leads to choice of multipath protocols due to multiple switching capabilities of multiple path like AOMDV and they always shows better results as concluded above in Figure 5.5. As the number of nodes increased AOMDV due toits multipath option responds well as compare to other two at high mobility.

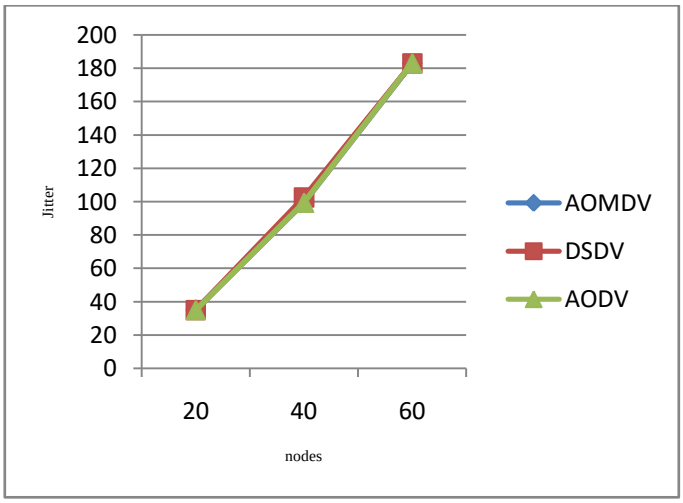

Fig. 5.6 :- Instant Jitter vs Nodes in Nakagami Model (CBR Traffic)

Case VI :- As shown in Figure 5.6 for Instant Jitter vs Nodes in Nakagami model in CBR traffic, the all three protocols assumed constantly perform at similar rate and therefore having a big impact on conclusion in constant bit rate. As shown above AODV,AOMDV and DSDV is having almost same performance graph for jitter because of CBR traffic which allows all the protocol to work on constant Bit rate.

V. CONCLUSION

After implementing the three routing protocols under different propagation, it is concluded that, Simulation and comparison of the three reactive protocols AOMDV, AODV and DSDV in different simulation scenarios and observing their behavior in terms of two different parameters i.e. Packet delivery fraction Ratio and Instant Jitter.whole simulation scenario is created by writing the By analyzing the outputs appeared for PDF in graph, for different protocols under three different propagation models ie. Shadow and Nakagami models, AOMDV is preferred over other two as it is outperformed well due to its ability to search for alternate routes when the current links breaks down for all the different scenarios of propagation which are Nakagami and Shadow models.The performance for instant jitter is varied during calculation work with variation in traffic i.e. CBR and VBR. In VBR traffic at low mobility, DSDV performs better as compare to other two and in CBR all three performs equally almost at low and high mobility levels. In VBR, AOMDV performs better at higher mobility scenarios.Also in this research through above calculations, it is also observed that Nakagami propagation performed well than shadow model and also since in Nakagami Model as fading parameter is also included Nakagami model is preferred.

VI. FUTURE SCOPE

In this research work, the performance comparison between three reactive protocols using CBR and VBR traffic model. More work can be possible with other different traffic models and also further research is possible in hybrid protocols comparing with active and reactive protocols and in complex mobility models where best of Active and Proactive protocols are present.

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