

Comparative Performance Evaluation of Routing Protocols for Wireless Ad hoc Network

S V. Athawale¹, M A Pund²

Assistant Professor, Department of Computer Engineering, AISSMS Engineering College, Pune, India¹

Professor Computer Science & Engineering PRMIT & R, Badnera Amravati, India, India²

ABSTRACT: This paper evaluate several routing protocols for wireless ad hoc network with packet level simulations in ns-2 environment. The protocol suite includes routing protocols specially designed for wireless ad hoc routing they are more traditional protocols, like link state and distance vector; used for dynamic networks, Performance is evaluated with respect to packets delivery, end-to-end delay and routing load for a given traffic scenario and mobility model in 802.11. It is observed that the new demand of routing protocols use much lower routing load. We examine only SPF, DSDV, DSR, and AODV Protocols. However the conventional link state and distance vector protocols provide better packet delivery and delay performance.

KEYWORDS: Network simulator (ns-2), Wireless Lan (802.11), Open Shortest Path First (SPF), Distance vector routing protocol (DSDV), Dynamic source routing protocol (DSR), Ad hoc on-demand distance vector routing protocol (AODV).

I. INTRODUCTION OF ROUTING PROTOCOL

Wireless ad hoc networks are an promising class of communication networks. The research in the field of these networks is at present going through an important revolution and opens significant perspectives in numerous fields of application. In an ad hoc wireless network routing protocol are sole of wireless communication and node are the body it decide packet route among devices. Ad hoc network nodes are not really familiar with network topology. An ad hoc wireless network routing protocol play important and vital role in efficient communication. A problem of efficient data routing in wireless ad-hoc networks remains a significant topic among researcher [1]. For the moment, a huge amount of various algorithms and routing schemes have been developed in order to solve specific routing issues in specific wireless networks, algorithms which aim at solving generic data routing problems in ad-hoc networks, which is the main focus of the this paper.

In section I, the main goals of this research paper are stated. In sections II related work of various scientist and researcher and their work regarding various routing protocol such as AODV, DSR, DSDV, SPF are described, as well as a short explanation of the four protocols is given. Further, we concentrate on analysing the routing performance, where major performance degradation is assumed to be reached [2]. In next sections III, we discussed overall performance metric with help of NS-2 network simulator, where the network performance has been evaluated. In next sections IV simulation result and its analysis finally, we conclude, that the DSR routing protocol has best performance among others three [3].

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II. RELATED WORK

AODV Protocol The ad hoc on demand distance vector [4] is an on demand algorithm, meaning that it builds routes between nodes only as selected by source nodes. It maintains these routes as long as they are needed by the sources. AODV uses sequence numbers to ensure the clearness of routes. This routing protocol builds routes using a route request on a route reply query cycle. The AODV route table contains the following information address of destination: IP address for destination node. Sequence Number of destination. Next hop the next neighbour of a particular node in the direction of destination. Hop Count represents the number of hops to the destination. List of active neighbour: it represents the neighbour nodes, which are actively using this route entry. DSR Dynamic source routing or DSR uses a technique where the source of a data packets determines the complete sequence of nodes through which to forward the packet; the source specifically lists this route in the packet's header. DSR has an unique advantage by virtue of source routing. As the route is a part of the packet itself, routing loops, either short- or long-lived, cannot be formed as they can be rapidly detected and eliminated. This property opens up the protocol to a variety of useful optimizations. DSDV the destination sequence distance vector or DSDV protocol has been specifically targeted for wireless ad hoc networks. SPF (Open Shortest Path First) and use of distance vector protocol in RIP (Routing Information Protocol) SPF expends significantly more routing load than the other protocols [5]. Many Unique characteristics of ad hoc networks lift several requirements for routing protocol design. A lot of routing schemes have been presented [6] to provide adequate performance of ad hoc networks. They were proposed classified into proactive routing and reactive routing based on when routes are determined. Real-world wireless ad hoc networks under different conditions this paper were [7] presented data dissemination performance of real world. The DSR in more stressful situations, with widening performance gaps with increasing accentuation (e.g. more load higher mobility). DSR, however, consistently generates less routing load than AODV and other routing protocols [8]. They have studied the effect of TCP and UDP on the performance of wireless ad-hoc networks [9]. Different routing protocols are present in ad hoc network which are responsible for the communication purpose for e.g., DSR, AODV, SPF, and DSDV. These protocol works only with the assumption that if network is completely joined, it means source and sink are in the same network or there is end-to-end communication path exist between them [10].

The routing algorithm surveys are summarized as follows.

1. An Ad-hoc Network is a collection of wireless terminals or node that is capable to dynamically form a temporary network without any aid from fixed infrastructure or centralized administration [11].
2. A very few work has been done on the performance analysis [12], [13] routing protocols by varying the underlying metric mobility and quality assurance model (QOS) [14], [15].
3. Wireless LAN networks were grouped into three main groups: end-to-end approaches, split connection approaches and proxy-based approaches in this TCP performance degradation in wireless LANs.
4. Performance of the overall network in terms of interference, average number of hops and path capability. Numerical results have been also verified by ns-2 simulations.

III. OVERVIEW OF PERFORMANCE METRICS

In order to measure the performance of various routing techniques in wireless ad hoc networks, we considered the following metrics.

Energy Consumption: it is the average of the total energy consumed for transmitting a data packet from a source to destination.

Packet Delivery Factor (PDF): it represents the ratio of the number of data [16] packets successfully delivered to destinations to the total number of packets coming from all network sources. This parameter implies the correctness and the completeness of the routing technique. Mathematically, the PDF can be defined as:

$$PDF = \sum_{i=1}^n nb_of_packet_recived / \sum_{i=1}^n nb_of_packet_send$$

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Throughput: It represents the ratio of the total number of data packets delivered to the total duration of simulation time in ad hoc network. This metric determine how well the network can continually provide data to the sink. It is expressed as:

$$Throught = \sum Nb_of_bit_recived / Simulation_Time$$

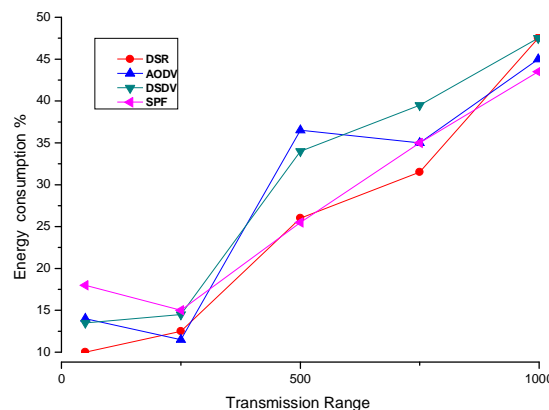
Packet Lost: This represents the total number of data packets dropped during the simulation. The loss [17] of a packet may be due to a collision during the transmission process. This metric is calculated as follows:

$$Packet_Loss = Nb_of_Packet_Send - Nb_of_Packet_Recived$$

IV. SIMULATION RESULT AND ANALYSIS

Simulation Set up Parameters our simulation that we have a single sink. All other nodes are considered as sources. We carry out different simulation scenarios where the number of nodes and transmission range are varied. In the case of variable transmission range the values are taken between 200 m.

Simulation Parameters	
Routing Protocol	AODV,SPF,DSR,DSDV
MAC Protocol	802.11
Simulation Time	1600 second
Simulation Area	600 x 600 m
Number of Nodes	100
Packet Size	1024 Bytes



(a)

Fig. 1. Total energy consumption as a function of transmission

Energy Consumption: The total energy consumption is illustrated in Figure 1 as a function of transmission range. We observe that the as the transmission range increases, then more energy consumption is important. It is also seen that

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for the foresaw routing techniques, total energy consumption increases with the number of nodes. On the other hand, simulation results show that DSR protocol permits for better energy consumption comparing AODV, DSDV, and SPF.

Packet Delivery Factor (PDF): Figure 2 shows that the ratio of data packets that are successfully delivered to the destination as a function of transmission range. We consider as 100 numbers of nodes and several routing protocols are considered. It is obvious that the greater value of PDF implies better performance of the routing technique. Therefore, we deduce for short transmission range communication range, transmission range allows for satisfying results [18], [19].

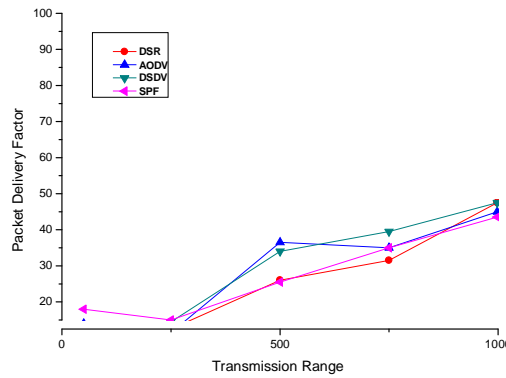


Fig. 2. Packet delivery factor as a function of transmission range.

Throughput: Simulations of the throughput metric are illustrated in Figure 3. As formerly, based on three routing techniques, 100 nodes are considered and transmission ranges are tested. As observed in Figure 3, all routing protocols have good results for short range and also for a variable communication range. In addition, we note that for the DSR routing technique, it is even preferable to use transmission range that provides better throughput compared to the other transmission ranges.

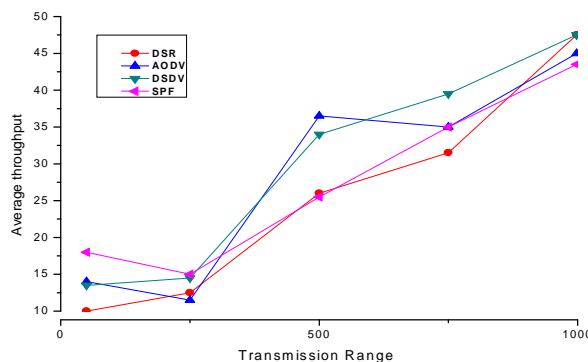


Fig. 3. Packet delivery factor as a function of transmission range.

Packet Lost: Figure 4 shows the performance of four routing protocol (AODV, DSR, SPF and DSDV) in terms of total packets lost during the simulation time. It is clear that the DSR performs better in term of total packet lost for all different transmission range scenarios. Transmission range case, the number of packet lost is lower than that one's evaluated at the communication range.

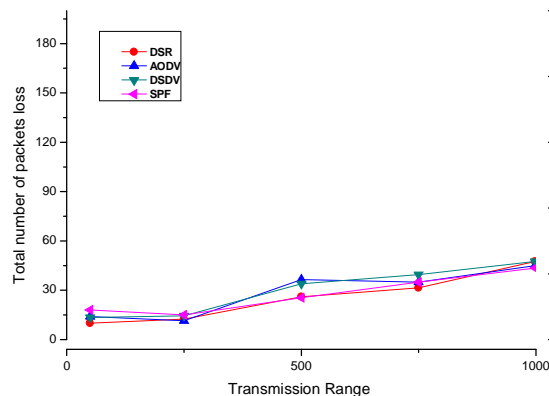


Fig. 4. Total number of packets lost during simulation

VI. CONCLUSION

The transmission nodes range as a system parameter affects the overall energy utilization and performance of wireless ad hoc network. Certainly the communication range of the wireless ad hoc network node is a very important metric which can have influence on the network connectivity. This paper investigated the impact of variable transmission range on performance metrics of three most popular and distinct feature routing protocols AODV, SPF, DSR and DSDV. By comparing these routing mechanisms on the basis of various performance metrics we came to conclusion that the variable transmission range offers a good performance for all metrics and it is more suitable especially for high and secure communication range.

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BIOGRAPHY



Shashikant V. Athawale received his B.E (Comp Sc.) degree from University of Amravati, India and M.Tech (Comp Sc.) from Bharati vidyapeeth, pune in 2005 and 2010 respectively.

He is currently a Ph.D. candidate in computer science at the Sant Gadge Baba Amravati University, Amravati, India. His research interests include the analysis and development of IPS concepts with a special focus on are in the area of wireless in solving complex problems in area communication networks. He has published many papers in journals, conferences and workshops in the area of wireless network. He is a member of many Professional Societies such as UACEE, ICGST, SDIWC, ISCO, IACSIT.



Dr. Mahendra A Pund is working as Professor in Computer Engineering Department at Prof. Ram Meghe Institute of Technology & Research, Badnera-Amravati, India. He has 22 years experience in teaching profession. Total 24 papers are published in International & National Conferences and International Journals. His research interest is in the areas of wireless network, ad hoc network and security issues, Image processing, Machine Learning, Image Processing and Pattern Recognition, Feature Extraction. He is guiding many research scholars and he is a member of CSTA, New York, CSI, ISTE, Associate Member of I.E, IACSIT, Singapore and IAENG, Hong Kong. Also, he is Advisory consultant to CapeArc Solutions Pvt. Ltd. (www.capearcsolutions.com), Consultant to New Gen Systems pvt.ltd.