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Performance Comparison for DSR and AODV

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Abstract: Our goal is to compare the performance of two on- demand routing protocols DSR and AODV. For performance comparison, We have simulated these two protocols using Glomosim. This performance study will help us to see which kind of protocols is better suited for the ad hoc environment under different conditions.

Key words: Mobile Ad Hoc Network · Routing Protocol

INTRODUCTION

In infrastructure based wireless networks, routing support for mobile hosts is given using mobile IP technology [1]. When a mobile agent moves from its home network to a foreign (visited) network, the mobile agent informs a home agent on the home network to which foreign agent their packets should be forwarded. In addition, the mobile agent registers itself with that foreign agent on the foreign network. Thus, the home agent forwards all packets intended for the mobile to the foreign agent who sends them to the mobile on the foreign network. When the mobile returns to its original network, it informs both agents (home & foreign) that the original configuration has been restored. No other agents need not be informed that the mobile node moved back.

In contrast to adhoc networks there is no concept of home agent, any nodes can move. Supporting Mobile IP form of host mobility requires address management, protocol inter operability enhancements and the like, but core network functions such as hop-by-hop routing still presently rely upon pre-existing routing protocols operating within the fixed network [2]. On the contrary, the goal of mobile ad hoc networking is to extend mobility into the dominion of autonomous, mobile, wireless, where a set of nodes, which may be combined routers and hosts, themselves form the network routing infrastructure in an ad hoc fashion. Hence, there is a need to study special routing algorithms to support this dynamic topology environment.

This paper organised as follows:

In section 2, we discussed the comparison of DSR and AODV. In section 3, we presented the simulation results. Lastly, section 4, concludes the paper.

Comparison of DSR and AODV: In this section we present our simulation study concerning DSR [3] and AODV [4]. This study would enable as to select an appropriate approach on which our routing approach would be based on.

A Critique of DSR and AODV: The two on-demand protocols share certain salient characteristics. Route discovery in either protocol is based on query and reply cycles and route information is stored in all intermediate nodes along the route in the form of route table entries (AODV) or in route caches (DSR). However there are several important differences in the dynamics of these two protocols, which may give rise to significant differentials.

First, by virtue of source routing, DSR has access to a significantly greater amount of routing information than AODV. For example, in DSR, using a single request-reply cycle, the source can learn routes to each intermediate node on the route in addition to the intended destination. Each intermediate node can also learn routes to every other node on the route. Promiscuous listening of data packet transmissions can also give DSR access to a significant amount of routing information. In the absence

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of source routing and promiscuous listening, AODV can gather only a very limited amount of routing information. This usually causes AODV to rely on a route discovery flood more often, which may carry significant network overhead.

Second, to make use of route caching aggressively, DSR replies to all requests reaching destination from a single request cycle. Thus, the source learns many alternative routes to the destination. In AODV, on the other hand, the destination replies only once to the request arriving first and ignores the rest. The routing table maintains at most one entry per destination.

Third, the current specification of DSR does not contain any explicit mechanism to expire stale routes in the cache, or prefer "fresher" routes when faced with multiple choices. Some stale entries are indeed deleted by route error packets. In contrast AODV has a much more conservative approach than DSR. When faced with two choices for routes the fresher route is always chosen (based on destination sequence number). Also, if a routing table entry is not used recently, the entry is expired.

Fourth, the route deletion activity using RERR is also conservative in AODV. By way of a predecessor list, the error packets reach all nodes using a failed link on its route to any destination. In DSR, however, a route error simply back tracks the data packet that meets a failed link. Nodes that are not on the upstream route of this data packet but use the failed link are not notified promptly.

The goal of our simulation that follow is to determine the relative merits of the aggressive use of source routing and caching in DSR and the more conservative routing table and sequence-number-driven approach in AODV [5, 6].

Simulation Model: We have used a simulation model based on Glomosim-2.03 in our performance evaluation of AODV and DSR routing protocols. The implementations of AODV and DSR in our simulation environment closely match with the specifications given in [7]. We have used IEEE 802.11DCF MAC protocol which is based on carrier sense multiple access with technique collision avoidance (CSMA/CA) as a MAC layer protocol for accessing the medium in our simulation model and also we used RTS/CTS exchange to avoid hidden and exposed terminal problems. We have set the data rate as 2 Mbps and a nominal transmission range of 250 m. for each node and detail information has been provided in below Table 1.

Table 1: Parameter values used in Simulation

Parameters	Value/Specification
●1 Terrain Area	1500M x 300M
●2 Number of Nodes	50
●3 Node Mobility model	Random Waypoint
●4 Number of sources	10 and 25
●5 Maximum Speed	10 M/S and 20 M/S
●6 Pause time	0 S to 900 S
●7 Simulation Time	15 M
●8 Transmission Range	250 M
●9 Mac Protocol	802.11-DCF
●10 Packet size	512 bytes
●11 Data rate	2 Mbps
●12 Type of Data traffic	CBR (Constant Bit Rate)

Traffic and Mobility Model: We have used traffic and mobility models as continuous bit rate (CBR) and random way point in a rectangular field of 1500mX300m with 50 nodes. We have considered source destination pairs are spread randomly over the network. Only 512 byte data packets are used. In the mobility model each packet starts its journey from a random location to a random destination with a randomly chosen speed (uniformly distributed speed between 0-10 m/s). Once the destination is reached, another random destination is targeted after a pause. Our simulations are run for 900 simulated seconds for 50 nodes. Each data point in the Table 1, represents an average of at least five runs with identical traffic models.

RESULTS AND DISCUSSION

Following four important performance metrics are evaluated and plotted against pause time:

Packet Delivery Fraction: The ratio of the data packets delivered to the destinations to those generated by the CBR sources.

Average End-to-end Delay of Data Packets: This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC and propagation and transfer times.

Normalized Routing Load: The number of routing packets transmitted per data packet delivered at the destination [8, 9]

Average Link Breaks: The average of link breaks of all nodes those will happen at the time of routing tasks.

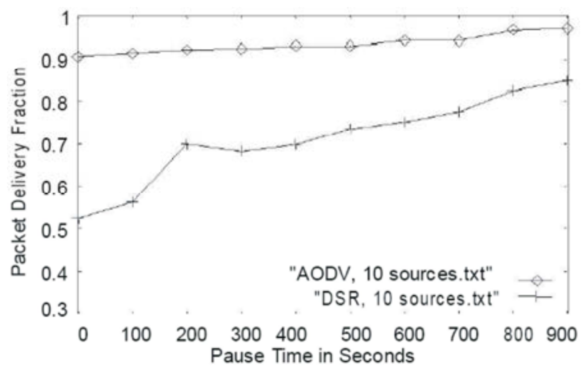

Fig. 1: 10 sources
(Packet delivery fraction Vs Pause time)

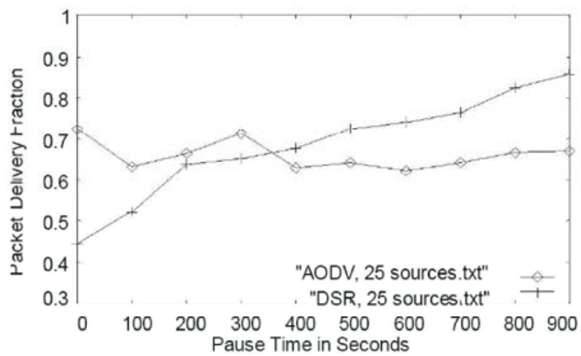

Fig. 2: 25 Sources
(Packet delivery fraction Vs Pause time)

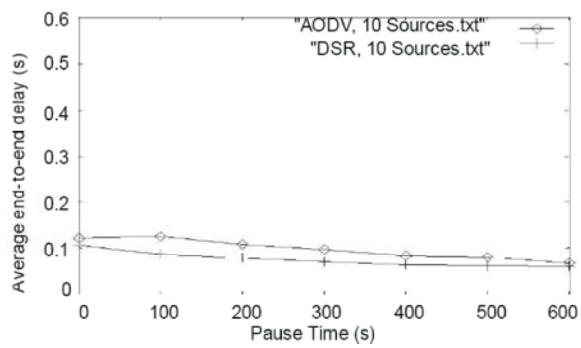

Fig. 3: 10 Sources
(Average end-to-end delay Vs Pause Time)

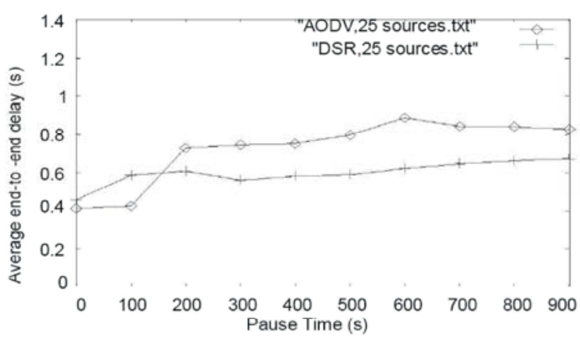

Fig. 4: 25 Sources
(Average end-to-end delay Vs Pause time)

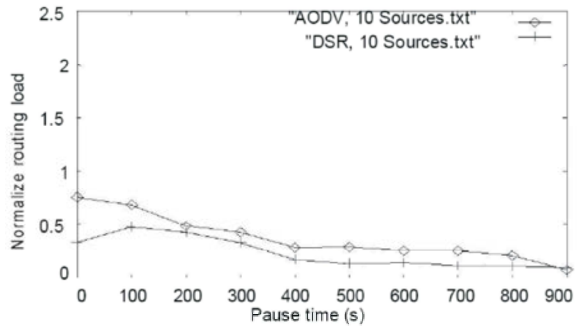

Fig. 5: 10 Sources
(Normalized routing load Vs Pause time)

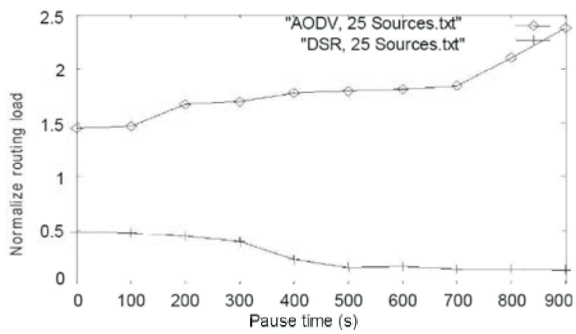

Fig. 6: 25 Sources
(Normalized routing load Vs Pause time)

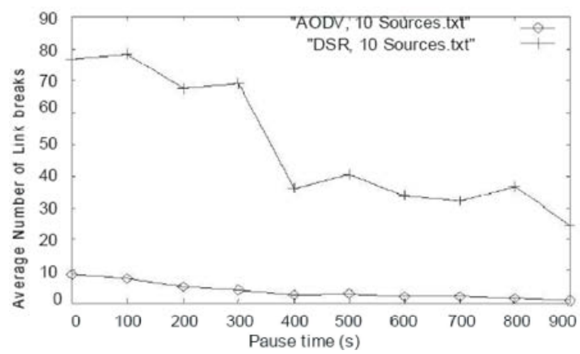

Fig. 7: 10 Sources
(Average Number of Link breaks Vs Pause time)

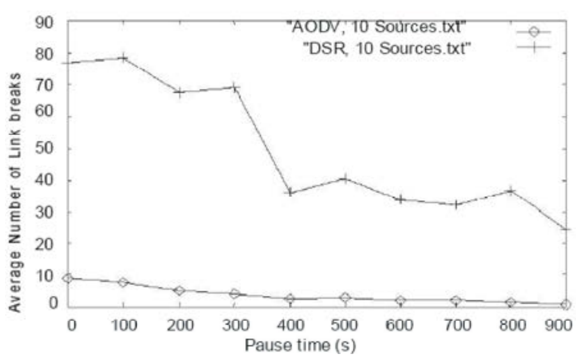

Fig. 8: With different number of Sources
(Average number of Link breaks Vs Number of Sources)

In Fig. 1, high packet delivery in AODV due to low packets drop in source routing layer and low packet delivery in DSR mostly due to high packet drop in source routing layer. In Fig. 2, use of stale route by DSR during higher mobility, shows low packet delivery than AODV. Use of alternate route due to congestion by DSR during low mobility scenario shows higher packet delivery fraction than AODV.

In Fig. 3, AODV shows high end-to-end packet delivery delay due to high routing load and DSR shows low end-to-end packet delivery delay at low mobility scenario due to lower link break.

In Fig. 4, at higher mobility DSR shows more delay due to use of stale route and at lower mobility AODV shows higher delay due to congestion in the network.

In Fig. 5, it can be seen that AODV has higher routing load due to high RREQ packets and DSR has low routing load due to use of routes from the route cache. It can be seen from Fig. 6, that in AODV normalized routing load increases with decrease in mobility due to congestion in the network and in DSR normalized routing load decreases with decrease in mobility due to the use of route cache for alternate route.

From Fig. 7, it can be seen that DSR exhibits indicate high link break due to use of stale route from the route cache.

From Fig. 8, it can be seen that use of stale route in DSR leads to more number of link breaks and it increases with increase in number of nodes and AODV experiences a lower number of link breaks and it increases with increase in number of nodes.

CONCLUSION

In this paper we have discussed some of the important routing protocols in ad hoc networks. Based on the comparative study we find that on-demand routing protocols are better suited for ad hoc networks. We have tried to quantitatively study the performance of DSR and AODV, which are prominent on demand routing protocols for ad hoc networks using Glomosim 2.03 [10, 11].

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