Performance Analysis of AOMDV, OLSR and DSR Routing Protocols Using UDP agents in MANETS

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Abstract:
Mobile Ad hoc Network is a collection of mobile nodes that dynamically form a temporary network and are capable of communicating with each other without the use of a network infrastructure or any centralized administration. In real time scenario there is more demand in multimedia, due to this reason need to provide the best quality of service (QOS). In this paper we have studied QOS for different routing protocols in MANET. In this we apply performance metrics to AOMDV, DSR, and OLSR in UDP Traffic. Our aim is identify which routing protocol will give better results among Throughput, packet delivery ratio, end-end delay, packet loss, and energy consumption. Mobility places major role in this analysis.

INTRODUCTION
There are currently two variations of mobile wireless networks: infrastructure and infrastructure less networks. The infrastructure less network is known as Mobile Ad-Hoc Networks (MANET). A mobile ad hoc network (MANET) is an autonomous and wireless networking system consisting of independent nodes that move dynamically changing network connectivity. Unlike cellular wireless networks, no static or fixed infrastructure exists in MANET, and no centralized control can be available. The network can be formed anywhere, at any time, as long as two or more nodes are connected and communicate with one another either directly when they are in radio range of each other or via intermediate mobile nodes because of flexibility that a MANET offers.

Mobile nodes can perform the roles of both hosts and routers. The presence of mobility makes a MANET challenging for designing and implementation in real life. It is huge challenge to design topology control, routing quality of service (QOS) and resources management, services discovery, security services, and services offerings for MANET as traditional schemes are no longer applicable. The real world applications of MANET are in military, vehicular communications, disaster relief, and delay tolerant networking with the advent of newer technology, mobile ad hoc networks are becoming an integral part of next-generation networks because of flexibility, auto configuration capability and lack of infrastructure, ease of maintenance, self-administration capabilities, and cost-effectiveness.

Optimized Link State Routing Protocol (OLSR)
OLSR is a popular proactive routing protocol for wireless ad hoc networks. OLSR uses the shortest path algorithm based on the hop count metric for the computation of the routers in the network. Each node selects the so-called multipoint relays (MPRs) among the neighbors in such a way that all 2-hop neighbors receive broadcast messages even if only the MPRs rebroadcast the messages. The forwarding of broadcast messages by MPRs only can significantly reduce the number of broadcast messages. Figure 2 shows an example where the number of broadcast messages is reduced by half. This optimized forwarding mechanism is used for all broadcasts in an OLSR network.

Fig. 2: Multipoint relay selection in OLSR

Each node in the wireless mesh network will know in 2-hop neighborhood through this hello mechanism. It is also possible to verify bidirectionality of links. OLSR attaches the status (asymmetric, symmetric) to each link, the only requirement is that the complete 2-hop neighborhood will receive broadcast messages.

Dynamic Source Routing Protocol (DSR)

It uses source routing instead of hop-by-hop packet routing. Each data packet carries the complete path from source to destination as a sequence of IP address. The main benefit of source routing in that intermediate nodes need not keep route information because the path is explicitly specified in the data packet. DSR is on-demand based; that is, it does not require any kind of periodic message to be sent. The DSR protocol consists of two mechanisms: Route Discovery and Route Maintenance. Route Discovery initiated by a source whenever the source has a data packet to send but does not have any routing information to the destination. Route mechanism is the mechanism by which a sender of a packet detects if only MPRs forward them and only symmetric links are considered. It is not necessary that the MPR set is minimal, but a smaller MPR set keeps the protocol overhead lowest. OLSR proposes a simple heuristic for the MPR selection which is described below, but the other algorithms are possible.

N: neighbors of the node.

N2: the set of 2-hop neighbors of the node excluding (a) nodes only reachable by members of N with willingness WILL-NEVER, (b) the node performing the computation, and (c) all the symmetric neighbors: the nodes for which there exists a symmetric link to the node.

Step 1: Start with an MPR set consisting of all members of N with willingness=WILL_ALWAYS.

Step 2: calculate D(Y), for all Y ∈ N.

Step 3: Add to the MPR set those nodes in N which are the only nodes to provide reachability to a node in N2.

Step 4: Remove the nodes from N2 which are covered by a node in the MPR set.

Step 5: While there still exists nodes in N2 which are not covered by at least one node in the MPR set.

Step 6: As an optimization, each node Y in the MPR set can be checked for omission in increasing order of willingness. If all nodes in N2 are still covered by at least one node in the MPR set excluding only, and if the willingness of node Y is smaller than WILL ALWAYS, then node Y may be removed from the MPR set.

Dynamic Source Routing Protocol (DSR)

Ad Hoc On-Demand Multipath Distance Vector Routing (AOMDV)

The AOMDV protocol uses the basic AODV route construction process, with extensions to create multiple loop-free and link-disjoint paths. AOMDV mainly computes the multiple paths during route discovery process, and it consists of two main components: (a) a rule for route updates to find multiple path at each node and (b) a distributed protocol to calculate the link-disjoint paths. The proposed “advertised hop count” metric is used in such a scenario. The advertised hop count for a
particular node is the maximum acceptable hop count for any path recorded at that node. A path with greater hop count value is simply discarded, and only those paths with a hopcount less than the advertised value is accepted. Values greater than this threshold means the route most probably has a loop.

Algorithm for AOMDV:

```
//seqnum(d,i)=Sequence number for destination d at node i

//advertised_hopcount(d,i)=Advertised hop count for d at node i

//route_list(d,i)=Route list for d at i

if(seqnum(d,i)is less than seqnum(d,j))
    initialize seqnum(d,i) to seqnum(d,j)
    if(i is not equal to d)
        initialize advertised_hopcount(d,i) to infinity

initialize the route_list(d,i) to NULL

insert j and advertised_hopcount(d,j)+1 to route_list(d,i)

else
    initialize advertised_hopcount(d,i) to 0
end if

else if((seqnum(d,i) equals seqnum(d,j)) and
    ((advertised_hopcount(d,i), i) is greater than advertised_hopcount(d,j), j))
    insert j and advertised_hopcount(d,j)+1 to route_list(d,j)
end if.
```

Performance metrics:

- **Throughput**: is the rate of production or the rate at which something can be processed.

Packet delivery ratio : the ratio of the number of delivered data packet to the destination. This illustrates the level of delivered data to the destination.

\[ \frac{\sum \text{Number of packet receive}}{\sum \text{Number of packet send}} \]

- **End-to-end Delay**: the average time taken by a data packet to arrive in the destination. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destinations that counted.

\[ \frac{\sum (\text{arrive time} - \text{send time})}{\sum \text{Number of connections}} \]

- **Packet Lost**: the total number of packets dropped during the simulation. Packet lost = Number of packet send – Number of packet received.

Simulation Scenarios

Simulations are performed using Network Simulator NS-2. Different Scenarios are designed including multiple experiments so as to evaluate the performance of different routing protocols to identify which protocol shows the best performance among the three protocols.

Fig:3 Network diagram

Fig3 specifies the network diagram in this we considered 22 nodes, and we assign 2 servers for those nodes. We have considered UDP agent for CBR traffic. From these nodes we need to identify the performance metrics for three routing protocols.
Scenario 1: Here we are identifying the performance for AOMDV protocol. In this, we sent 606 packets from source to destination. Out of 606 packets, 328 packets were delivered successfully, and 278 packets were lost during the transmission. Delay and jitter can be identified from the following information:

![Fig:4 Throughput generation](image)

![Fig:5 delay for AOMDV](image)

Above graph specifies delay per packet at server 1. Here delay specifies in milliseconds for a particular packet transferred from a server 1.

Scenario 2: Identifying the performance of OLSR.

![Fig:6 throughput for AOMDV](image)

![Fig:7 packet delay for OLSR](image)
When we compare the throughputs of three routing protocols are OLSR, AOMDV, DSR the OLSR gave the best performance. When we compare the throughput of AOMDV and OLSR from the fig6 and fig8 respectively, OLSR gave the higher throughput. In terms of packet loss OLSR has limited number of packets loss. In all the aspects OLSR gives the better performance among the three routing protocols.

Conclusion

In MANET’s we need to identify which routing protocol shows the best performance. Here the performance includes throughput, end-end delay, packet delivery ratio, packet loss, and energy consumption. To measure the metrics, we implemented our proposed solution on a network simulator-NS2. In this paper we measured the performance metrics to AOMDV, DSR, OLSR. Among the three routing protocols OLSR shows better performance in all the metrics and AOMDV shows better performance in throughput, packet delivery ratio, than DSR. DSR gives high value for packet loss among all the three routing protocols. For our future work we are planning to investigate the performance metrics to remaining routing protocols to identify the best routing protocol in MANET.

References

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