Evaluation QOS and energy consumption for DSDV and DSR in MANET (Mobile ad hoc network)

H A Sidharta, Sidharta and C Huda

Computer Science Study Program, Bina Nusantara Institute of Creative Technology Malang, East Java

Abstract. A mobile ad hoc network (MANET) is an infrastructure less, autonomous, and standalone network. Routing protocol mechanism on MANET can be classified proactive, reactive and hybrid. On this paper researcher comparing QOS with reactive and proactive, reactive represented by DSR and proactive by DSDV. Performance of these routing protocols is evaluated with performance metrics such as Dropped Packets, Packet Delivery Ratio, Throughput, End to End Delay, Jitter, and Residual energy. Based on experiment shows that DSDV is better than DSR, performance DSDV more stable than DSR, DSR on little node better than DSDV, but in line with increment number of node performance is degrade.

1. Introduction

MANET (Mobile ad hoc network) is multi-hop wireless network that are composed of mobile hosts communicating with each other through wireless links. MANET is likely to be use in many practical applications, including personal area networks, home area networking, military environments, and so on. The wide range of potential applications has led to a recent rise in research and development activities [1]. MANET also can use for NFC-based mobile payment services [2]. In MANET, nodes move arbitrarily, therefore the network may experience rapidly and unpredictably topology changes. Additionally, because nodes in MANET normally have limited transmission ranges, some nodes cannot communicate directly with each other. Hence, routing paths MANETs potentially contain multiple hops, and every node in mobile ad hoc net-works has the respond to act as a router.

There is a classification for MANET protocols as table-driven (proactive) and source initiated (routing) protocols. In proactive routing protocols, routing tables are used to keep route information from each source to every destination in network before this route is needed. On the other hand, In reactive routing protocols, a source sends a route discovery through the network, only when the route is required. The limited battery resources consumed by nodes in a MANET must be considered as a limited resource in using a routing protocol [3].

Efficient energy conservation plays an important role in the performance of MANET because mobile host in such networks are usually battery-operated [1]. Most existing network protocols do not consider power consumption an issue since they assume the presence of static hosts and routers, which are powered by mains. However, mobile devices today are mostly operated by batteries. Battery technology is still lagging behind microprocessor technology. The lifetime of Li-ion battery today is only 2-3 hours. Such a limitation in the operating hours of devices implies the need for power
conservation. In particular, for ad hoc mobile networks, mobile devices must perform both the role of an end system and that of intermediate system. Hence, forwarding packets on the behalf of others will consume power, and this can be quite significant for nodes in an ad hoc wireless network [4]. In this paper, researcher investigates evaluation of energy consumption of two routing protocols between DSDV and DSR.

2. Literature review
This section reviews the literature used in this research.

2.1 Routing in MANET
The term routing refers to the process of selecting paths in a computer network along which to send data. This process is used to exchange information about topology and link weights, and a routing algorithm, that actually computes paths between nodes. Mobile Ad-hoc networks are self-organizing and self-configuring multi hop wireless networks where, the structure of the network changes dynamically. This is mainly due to the mobility of the nodes. Nodes in these networks utilize the same random access wireless channel, cooperating in a friendly manner to engaging themselves in multi hop forwarding. The nodes in the network not only act as hosts but also as routers that route data to/from other nodes in network. In mobile ad-hoc networks where there is no infrastructure support as is the case with wireless networks, and since a destination node might be out of range of a source node transmitting packets; a routing procedure is always needed to find a path so as to forward the packets appropriately between the source and the destination [5, 6].

Within a cell, a base station can reach all mobile nodes without routing via broadcast in common wireless networks. In the case of ad-hoc networks, each node must be able to forward data for other nodes. This creates additional problems along with the problems of dynamic topology which is unpredictable connectivity changes. Routing is difficult since mobility causes frequent network topology changes and requires robust and flexible mechanism to search and maintain routes. Routing protocols must also deal with other constraints such as low bandwidth, limited energy consumption, and high error rates [6].

2.2 DSR dynamic source routing protocol
DSR Dynamic Source Routing Protocol uses specific packet header to carry information. This particular packet header can be placed in any existing IP packet. A packet of DSR options header by four bytes of the length of the fixed part and the immediately subsequent sequence of DSR options, DSR option sequence composed by a number of DSR options, DSR options carrying optional information. DSR Options header sequence of DSR options, that is the end of the end of the DSR Options header, so the total length of the DSR Options header is equal to 4 bytes and the byte length of the sequence of DSR options combined [7].

2.3 DSDV
Destination Sequenced Distance Vector [7], is hop-by-hop distance vector routing protocol which requires every node at regular interval transmit routing updates which should be based on principles of classical Bellman-Ford Routing algorithm. Every routing node maintains a routing table which consists of record of the “next hop” for every reachable destination, also the number of hops attainable to destination and the sequence number assign by sink node. The sequence number can be used to make difference between stale routes and the fresh ones and thus avoiding the loop formation. It will also transmit its routing table if any significant change that has occur in their table from the final update sent [8].

1) Advanced uses of DSDV:
   - DSDV protocol guarantees loop free paths.
   - We can avoid extra traffic with incremental updates instead of full dump updates.
2) Limitation of DSDV:
It is difficult to maintain the routing table’s advertisement for larger network. Each and every host in the network should maintain a routing table for advertising. But for larger network this would lead to overhead, which consumes more bandwidth. DSDV doesn’t support Multi path Routing [9, 10].

2.4 Quality of Service

The performance metrics helps to characterize the network that is substantially affected by the routing algorithm to achieve the required Quality of Service (QoS). In this work, the following metrics are considered [9]. End-to-End Delay (EED) is the time taken for an entire message to completely arrive at the destination from the source. Evaluation of end-to-end delay mostly depends on the following components:
- Propagation time (PT).
- Transmission time (TT).
- Queuing time (QT).
- Processing delay (PD).

EED is evaluated as PT + TT + QT + PD. The throughput measures how fast a node can actually send the data through a network. So throughput is the average rate of successful message delivery over a communication channel. Control overhead is the ratio of the control information sent to the actual data received at each node. Packet Delivery Ratio (PDR) is the ratio of the total data bits received to total data bits sent from source to destination. Energy Consumption per Delivered Packet measure the energy expended per delivered data packet [10].

3. Materials and Method

This section explains the materials and method used in this research.

3.1 Simulation Model

We have used Network Simulator (NS)-2 in our evaluation. The NS-2 is a discrete event driven simulator. NS-2 is suitable for designing new protocols, comparing different protocols and traffic evaluations. It is an object oriented simulation written in C++, with an OTcl interpreter as a frontend. NS uses two languages because simulator got to deal with two things:
- detailed simulation of protocols which require a system programming language which can efficiently manipulate bytes, packet headers and implement algorithms.
- research involving slightly varying parameters or quickly exploring a number of scenarios [11].

3.2 Simulation Parameter

In our work, we used routing protocol DSDV and DSR which evaluated by varying the network size (number of mobile nodes). The simulation parameter is shown in table 1.

| Parameter                  | Value                                      |
|----------------------------|--------------------------------------------|
| Simulator                  | NS-2 Simulator 2.1b9                       |
| Channel Type               | Channel/Wireless Channel                   |
| Radio Propagation Model    | Propagation/Two Ray Ground                 |
| Network Interface Type     | Phy/Wireless Phy                           |
| MAC Type                   | Mac/802.11                                 |
| Interface Queue Type       | Queue/DropTail/CMUPriQueue                 |
| Link Layer Type            | LL                                         |

Table 1. Simulation parameter.
| Parameter                  | Value                        |
|---------------------------|------------------------------|
| Antenna                   | Antenna/Omni Antenna         |
| Maximum Packet in ifq     | 50                           |
| Area (M * M)              | 500 * 500                    |
| Number of Nodes           | 5, 10, 15, 20, 25, 30        |
| Traffic Type              | TCP                          |
| Simulation Time           | 150                          |
| Routing Protocols         | DSDV & DSR                   |
| Network QOS               | Jitter, Packet Delivery Ratio, Delay, Throughput, Energy |

4. Result and discussion

The simulation results are shown in the following section in the form of line graphs. Graphs show comparison between the DSDV and DSR by varying different numbers of nodes on the basis of different performance metrics.

4.1 Dropped packets

As shown in figure 1 with increase in number of nodes, Dropped Packets of all the protocols increased, performance of DSDV is better than DSR on node number 15 through 30, but on 5 to 10 node DSR better than DSDV.

![Dropped Packets VS Number Of Nodes](image)

Figure 1. Dropped packets.

4.2 Packet delivery ratio

As shown in figure 2 with increase in number of nodes, Packet Delivery Ratio of all the protocols increased, performance of DSDV is better than DSR on node number 5 through 25, but anomalies on node 30 DSR better than DSDV.
4.3 Throughput
As shown in figure 3 with increase in number of nodes, Throughput of all the protocols increased, performance of DSDV stable from node 5 through node 30 with average throughput is 409.72. Meanwhile DSR performance on node 5 is astonishing with 662.89 but from node 10 to 30 performances degrade with average on all nodes are 454.93.

4.4 End to end delay and jitter
Based on figure 4 between end to end delay and jitter have similarity symptom, DSDV is better from DSR on end to end delay also on jitter, also DSDV have more stable than DSR.
4.5 Residual energy
As shown in figure 5 with increase in number of nodes, performance of DSDV is better than DSR. With DSDV on all node energy that have been used is more stable than DSR with average DSDV is 909.708 and DSR 887.05 from initial value 1000.

5. Conclusion
In this paper performance comparison of DSR and DSDV routing protocols for Mobile Ad hoc Networks is presented as a function of number of nodes (network size). Performance of these routing protocols is evaluated with performance metrics such as Dropped Packets, Packet Delivery Ratio, Throughput, End to End Delay, Jitter, and Residual energy. As per statistic based on our trial shows that DSDV is better than DSR, performance DSDV more stable than DSR, DSR on little node better than DSDV, but in line with increment number of node performance is degrade. In future work, need to compare performance with other protocol such as geological, multi path, hierarchical, and multicast. Due vulnerability of routing protocol from attacker, need have proposed secure routing protocols for ad hoc networks.

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