The Effect of Changing the Speed and the Number of Nodes on Packet Delivery Ratio in MANET

Imad I. Saada, Majdi Z. Rashad, Mohamed A. Abu ElSoud

Department of Computer Science, Faculty of Computers and Information
Mansoura University, Egypt

Abstract

Mobile ad hoc network MANET is wireless network without any infrastructure nor centralized control, MANET may include many nodes that work as a router, number of nodes in MANET may change and each node in the network may change its speed frequently, so the routing in this kind of network is more complex than the routing in the wired network, routing has been discussed in many researches in order to find the routing protocol that provides a high performance. Packet delivery ratio PDR is an important metric in performance of MANET. The concern in this research is to study the effect of changing the number and the speed of nodes on PDR when implementing AODV and DSDV routing protocols, the research will deal with several number of the nodes, in addition it will deal with several values of the speed of the nodes, this study will lead to conclude which routing protocol may be more suitable for each case in terms of PDR.

Keywords: *MANET, Routing protocols, DSDV, AODV, packet delivery ratio, PDR.*

1. Introduction

Mobile ad hoc network MANET is a set of mobile nodes connected via wireless media without infrastructure, MANET is important network in several environments such as Military environments, civilian environments, emergency fields and Personal area networks, this kind of network has not fixed topology because the nodes can move randomly and rapidly, it is clear that MANET has special characteristics, these characteristics make MANET encounters several challenges such as security threats and routing process, so it must be looking for a routing protocol which can deal with the challenges to get a MANET with high performance.

- At the beginning in this research the routing protocols AODV and DSDV will be discussed.
- The simulation will be performed to clear how PDR may be affected when changing the number and the speed of nodes in case of implementing the mentioned routing protocols.
- The results showed in the graphs of simulation will be discussed.
- The simulation results will be discussed to show the effect of changing the number and the speed of nodes on PDR and to conclude which routing protocol can grant the best value for PDR.

1.1 Packet delivery ratio (PDR):

PDR is a metric indicates the reliability of data packets delivery, this metric can be calculated by getting data packets delivered to destination divided by the number of packets sent.

1.2 Routing Protocols

MANET routing protocols are classified into two types according to the ability of providing a track of routes for all destination:

- Proactive or table- driven routing protocols.
- Reactive or on-demand routing protocols.

Destination-Sequence Distance Vector (DSDV) Protocol: In DSDV the proactive scheme is used, it maintains up-to-date routing information from each node to every other node in the MANET, tables are used to store routing information.

DSDV is based on the proactive routing mechanism Bellman Ford, the nodes in MANET record information of the destinations in routing tables with using sequence number to prevent routing loop, routing table is stored in the nodes, it is used for transmit packets between nodes.

The routing information in the routing tables is periodically updated by nodes in MANET, and this information must be transmitted for each neighboring node, the updating of this information is necessary to detect the dynamically changing topology. This scheme enables each node to continuously have the recent information of each node with low route discovery delay but with high overhead, the routing table that is maintained by each node must include:

- Next hop towards each destination.
- A cost metric for the path to each destination.
- A destination sequence number that is created by the destination itself.

- Sequence numbers used to avoid formation of loops.

Ad Hoc On Demand Distance Vector (AODV) routing Protocol: AODV is creating a path based on demand, so it is considered as an improvement of DSDV, the source node uses RREQ (route request), when it wants to send a packet to the destination, it sends RREQ to its neighbors, and theses neighbors send the RREQ to their neighbors and so on, if any node has a route to the destination, it will send RREP to an intermediate or to destination node, after the source receives RREP, and it will send the packet to the destination using the path that was established when RREQ was sent. The source or the intermediate node selects the fresher route to the destination based on the destination sequence number.
This scheme enables each node to discover the path to destination on demand with low overhead but with high route discovery delay.
The nodes in MANET use hello message to indicate a link failure by exchanging hello messages between neighbors periodically, Alternatively the failure to receive several MAC-level acknowledgement may indicate a link failure.

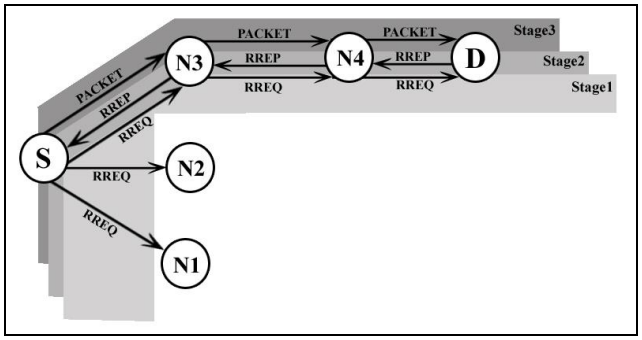

Fig.1 Ad-hoc On-demand Distance Vector routing algorithm

2. Simulation

2.1 Simulation environments:

The seed of simulation equaled 1, terrain dimension 1000x1000 m, selection simulation time was 30 minutes, and the Position of nodes was read from NODE-PLACEMENT-FILE, mobility random-way point with pause time 10s was selected, radio bandwidth was 2000000 and MAC protocol was 802.11.

Simulation one: The metric used in this part was packet delivery ratio with changing the values of number of nodes with implementing AODV and DSDV routing protocols, with minimum speed of 60 m/s to maximum speed of 100 m/s, number of nodes in the area were 20, 50, 70 and 130 nodes, so simulation was done by four scenarios for each routing protocol.

Simulation two: The metric used in this part was packet delivery ratio with changing the values of number of nodes with implementing AODV and DSDV routing protocols, number of nodes in the area were 20 nodes, with average speed 20, 50, 100, 200 m/s, so simulation was done by four scenarios for each routing protocol.

The following table gives the simulation parameters used during the simulation.

Parameter	Value
Simulator	GlomoSim
Routing protocol	AODV, DSDV
The seed	1
Terrain dimension	1000x1000 m
Simulation time	30m
Mobility	NODE-PLACEMENT-FILE
Pause time	10s
Radio bandwidth	2000000
MAC protocol	802.11
Simulation one	
Minimum speed	60 m/s
Maximum speed	100 m/s
Number of nodes	20, 50, 70 and 130 nodes
Simulation two	
Number of nodes	20 nodes
Average speed	20, 50, 100 and 200 m/s

2.2 Simulation result

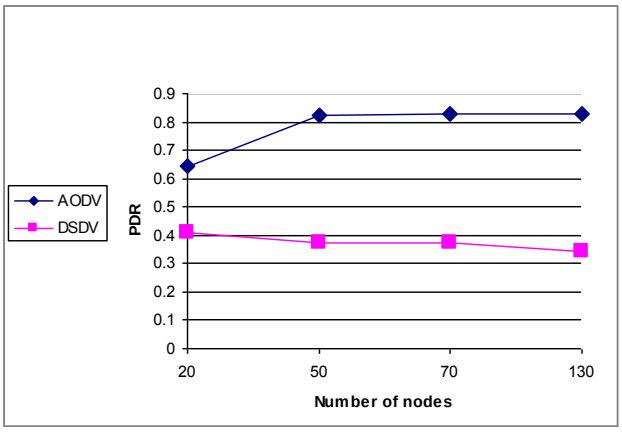

Fig.2 PDR vs Number of nodes

From Fig.2 of simulation one it is clear that:

- In case of AODV by increasing the number of nodes from 20 nodes to 130 nodes we observe a simple increment of PDR but without a certain behavior.

- In case of DSDV by increasing the number of nodes from 20 to 130, PDR is decreasing continuously.
- When increasing the number of nodes to 130 nodes we observe a considerable difference of PDR for AODV and for DSDV, and we observe that the value of PDR in case of AODV is greater than the value of PDR in case of DSDV regardless of the number of nodes.

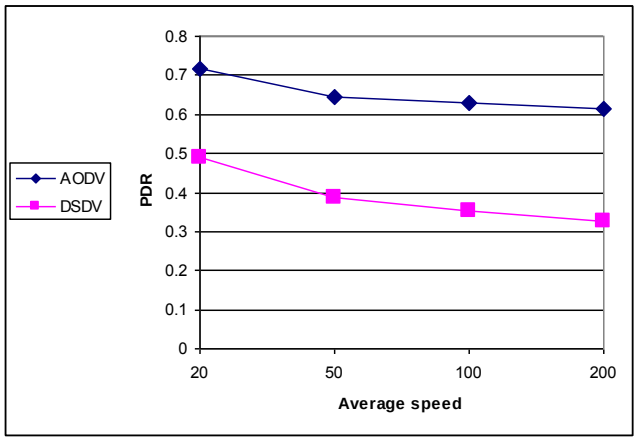

Fig.3 PDR vs Average speed

From Fig.3 of simulation two it is clear that:

- In case of AODV by increasing the average speed of nodes from 20m/s to 200m/s, we observe that the value of PDR is continuously decrementing.
- In case of DSDV by increasing the average speed of nodes from 20m/s to 200m/s we observe that the value of PDR is continuously decrementing.
- When increasing the average speed of nodes to 200m/s we observe a considerable difference of PDR for AODV and for DSDV, and we observe that the value of PDR in case of AODV is greater than the value of PDR in case of DSDV regardless of the average speed.

3. Conclusion:

The simulation showed that the value of PDR decreased by increasing number of nodes when DSDV was implemented, and the value of PDR decreased by increasing the average speed of nodes when AODV and DSDV were implemented.

On the other hand, it can be concluded that the value of PDR when implementing AODV is always higher than the value of PDR when implementing DSDV regardless of the number or the average speed of nodes.

After studying the effect of changing the number and the speed of nodes on PDR, and after comparing PDR in both cases when implementing AODV and DSDV, this research showed that it is necessary to continue the process of developing a routing protocol that may provide higher PDR, because there was a considerable lost of packets when using AODV and DSDV in MANET.

References

[1] Panagiotis Papadimitratos, Zygmunt J. Haas, "Secure Routing for Mobile Ad hoc Networks", the SCS Communication Networks and Distributed Systems Modeling and Simulation Conference (CNDS), 2002.

[2] Asis Nasipuri and Samir R. Das, "On-Demand Multipath Routing for Mobile Ad Hoc Networks", ACM volume 6, 2001.

[3] Sushil Kumar, Dinesh Singh & Mridul Chawla "Performance Comparison of Routing Protocols in MANET Varying Network Size" International Journal of Smart Sensors and Ad Hoc Networks (IJSSAN) Volume-1, 2011.

[4] J. Costa-Requena, T. Vardar, M. Ayyash and R. Kantola, "Scalable Hybrid Ad Hoc Routing Approach", IJCSNS volume 6 no. 8, 2006.

[5] Manal Abdullah and Helen bakhsh "Agent-based dynamic routing system for MANETs", ICGST-CNIR jornal, volume9, 2009.

[6] V. Ramasubramanian, Z. J. Haas, E. G¨un Sirer , "SHARP: A Hybrid Adaptive Routing Protocol for Mobile Ad Hoc Networks" , ACM new york , 2003.

[7] Jing Xie, Luis Girons Quesada and Yuming Jiang, "A Threshold-based Hybrid Routing Protocol for MANET", IEEE ISWCS, 2007.

[8] H. L. seba "ARPM : an adaptive routing protocol for MANETs" , ACS/IEEE International Conference on Pervasive Services , 2006.

[9] A. H. abd rahman and z. ahmad zukarnain, "Performance Comparison of AODV, DSDV and I-DSDV Routing Protocols in Mobile Ad Hoc Networks", European Journal of Scientific Research Vol.31 No.4, 2009.

[10] F. aslam and Chi aching ooi, "Mobile Ad Hoc Networks", www.docstoc.com, university of freiburg, 2007.

Imad I. Saada is a PHD student in computer science department in Mansoura University and a member of the academic staff at IT. department in AL-Quds Open University. His subject is in the distributed systems.

Magdy Z. Rashad is an assistant professor and chairman of computer science department in Mansoura University. He is the decision support systems unit coordinator at faculty of computers &information in Mansoura University. He has supervised over 10 PhDs and 21 masters mostly specialized in artificial intelligence and its applications related to real life. As a result of his work he has published over 84 papers. current project is grid computing.

Mohamed A. Abu ElSoud is an assistant professor in computer science department in Mansoura University. He has supervised over 7 PhDs and 13 masters mostly specialized in artificial intelligence and its applications related to real life. As a result of his work he has published over 32 papers.