Performance Evaluation of Source Initiated Routing Protocols for Wireless Adhoc Network

Rahul Chaturvedi, Sanjay Kumar Dubey

Abstract—Mobile Adhoc network (MANET) is a self configuring and infrastructure less network where each network node act as a host as well as router. It is collection of wireless mobile nodes dynamically forming a temporary network without the administration. Various protocols such as Dynamic Source routing(DSR), Ad Hoc on-Demand Distance Vector(AODV),Destination-Sequenced –Distance Vector(DSDV) ,Interzone Routing Protocol(IERP) and Location Based Routing(LAR1) have been implemented. In this paper an attempt has been made to compare various source initiated routing protocol using Qualnet simulator under two scenarios. In first scenario we keep all the parameters constant and varies number of nodes and in second scenario dependency on pause time such that all the parameters are made constant and pause time is varied. Performance is analysed on the basis of throughput, packet delivery ratio and average end to end delay.

Index Terms- MANET, AODV, DSDV, IERP, LAR1.

1 INTRODUCTION

Wireless network are adapted to enable mobility. There are two variations of mobile network. The first is infra-structured network (i.e. a network with fixed and wired gateways). The bridges of the network are known as base stations. A mobile unit within the network connects to and communicates with the nearest base station (i.e. within the communication radius). Application of this network includes office WLAN. [1]

The second type of network is infrastructure less mobile network commonly known as AD-HOC network. They have no fixed routers. All nodes are capable of moving and be connected in an arbitrary manner. These nodes function as routers, which discover and maintain routes to other nodes in the network. Non infrastructure based MANET are expected to become an important part of the 4Garchitecture. Ad-hoc networks can be used in areas where there is little or no communication infrastructure or the existing infrastructure is expensive or inconvenient to use. [2]

Manet requires efficient routing algorithm in order to reduce the amount of signalling introduced due to maintain valid routes [3] [4], and therefore enhance the overall performance of the MANET system.

In this paper we have taken two scenarios on the basis of which various protocols have been compared .First we varied number of nodes in the network and keep all the parameters constant and secondly we varied pause time and made all other parameters constant.

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2 RELATED WORK

A mobile ad hoc network (MANET) group has been formed within IETF. The primary focus of this working group is to develop and evolve MANET specifications and introduce them to the Internet standard track. The goal is to support mobile ad hoc networks with hundreds of routers and solve challenges in this kind of network. Some challenges that ad hoc networking faces are limited wireless transmission range, hidden terminal problems, packet losses due to transmission errors, mobility- induced route changes, and battery constraints. Mobile ad hoc networks could enhance the service area of access networks and provide wireless connectivity into areas with poor or previously no coverage.

A considerable research effort has been devoted to adhoc network routing protocols in the last few years. Many new researches have been proposed and various simulators are being used for simulation and performance analysis. Comparison between two prominent two prominent on-demand reactive routing protocols for mobile ad hoc networks: DSR and AODV, along with traditional proactive DSDV protocol was done in [5]. Performance analysis of various routing protocols (proactive and reactive) for random mobility models of adhoc networks was done in [6].

In this paper it is discussed that routing in adhoc networks is nontrivial due to highly dynamic nature of the nodes. In recent years several routing protocols targeted at mobile are being proposed and prominent among them are DSDV, AODV, TORA and DSR. The comprehensive performance analysis of the routing protocol using ns2 has been made. Destination sequenced distance vector is a proactive protocol that solves the major problem associated with

distance vector routing of wired network by using destination sequence number [7].

In this the ns2 simulation result shows that improved performance of heterogeneous network for newly proposed multipath routing protocol. The QoS Adhoc on Demand Multipath Distance Vector (QAOMDV) works better than other protocols. Multipath routing protocol algorithm has been implemented for heterogeneous network [8].

3 ROUTING PROTOCOLS

Considering procedure for establishment and update, MANET routing protocols can be classified into Proactive, Reactive and Hybrid protocols. Proactive or table driven protocols attempt to maintain consistent up-to-date routing information from each node to every other node in the network. Each node maintains tables to store routing information and any changes in network topology need to be reflected by propagating updates throughout the network. Reactive or on demand protocols are based on source initiated on-demand reactive routing. This type of routing creates routes only when a node requires route to a destination. Then it initiates the route discovery process which ends when the route is found.

1) Destination Sequence Distance vector (DSDV)

The base of this protocol is classical Bellman-Ford routing algorithm designed for MANETS. Every mobile node maintains a routing table which contains the possible destinations in the network together with their distance in hop counts. Each entry also stores a sequence number which is assigned by the destination. Sequence numbers are used in the identification of stale entries and the avoidance of loops. In order to maintain routing table consistency, routing updates are periodically forwarded throughout the network. Two types of updates can be employed; full dump and incremental. A full dump sends the entire routing table to the neighbours and can require multiple network protocol data units (NPDUs). Incremental updates are smaller (must fit in a single packet) and are used to transmit those entries from the routing table which have changed since the last full dump update. When a network is stable, incremental updates are forwarded and full dump are usually infrequent. On the other hand, full dumps will be more frequent in a fast moving network. In addition to the routing table information, each route update packet contains a distinct sequence number assigned by the transmitter. The route labelled with the most recent (highest number) sequence number is used. The shortest route is chosen if any two routes have the same sequence number [9].

2) Ad-hoc On-Demand Distance Vector (AODV)

It is a reactive protocol that improves the DSDV in the sense of minimizing the number of required broadcasts by creating routes on a demand basis , as opposed to maintain complete list of routes. The AODV algorithm enables dynamic, self starting, multi-hop routing between participating mobile nodes wishing to establish and maintain ad hoc network [10].

3) Dynamic Source Routing Protocols (DSR)

The Dynamic Source Routing Protocols (DSR) is reactive routing protocol and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. It uses source routing which means that the source must know the complete hope sequence to the destination. Each mobile node keeps track of the routes of which it is aware of a route cache. Upon receiving a search request for path, it refers to its route cache to investigate if it contains the required information.DSR uses more memory while reducing route discovery delay in the system [11].

4) Inter Zone Routing Protocol (IERP)

Interzone Routing Protocol (IERP), the reactive routing component of the Zone Routing Protocol (ZRP). IERP adapts existing reactive routing protocol implementations to take advantage of the known topology of each node's surrounding R-hop neighbourhood (routing zone), provided by the Intrazone Routing Protocol (IARP). The availability of routing zone routes allows IERP to suppress route queries for local destinations. When a global route discovery is required, the routing zone based bordercast service can be used to efficiently guide route queries outward, rather than blindly relaying queries from neighbour to neighbour. Once a route has been discovered, IERP can use routing zones to automatically redirect data around failed links. Similarly, suboptimal route segments can be identified and traffic re-routed along shorter paths.

5) Location Based Rooting (LAR1)

The main aim of position based LAR1 is to reduce control overhead by use of location information. LAR1 protocol requires the information about geographical location of the nodes in network. This location information can be determined by using Global Positioning System (GPS). By using location information, LAR1protocol limits the search for a new route to a smaller request zone of the ad hoc network. This results in a significant reduction in the number of routing messages [12].

4 ROUTING PROTOCOL PERFORMANCE

This results in a significant reduction in the number of routing messages [12]. Three metrics are used to compare the performance of these protocols such as packet delivery

ratio, average end to end delay, and throughput. In this section definition of these metrics has been presented.

1) Packet Delivery Ratio

It is calculated by dividing the number of packets received by the destination through the number of packets originated by the application layer of the source. It specifies the packet loss rate, which limits the maximum throughput of the network. The better the delivery ratio, the more complete and correct is the routing protocol.

2) Average end to end delay

It is the average time it takes a data packet to reach the destination. This metric is calculated by subtracting time at which first packet was transmitted by source from time at which first data packet arrived to destination. This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, propagation and transfer times[13-15]. This metric is significant in understanding the delay introduced by path discovery.

3) Throughput

The throughput of the protocols can be defined as percentage of the packets received by the destination among the packets sent by the source. It is the amount of data per time unit that is delivered from one node to another via a communication link. The throughput is measured in bits per second (bit/s or bps).

5 SIMULATION SETUP AND RESULTS DISCUSSION

In this section we have discussed the simulation setup for performance evaluation of these protocols. The network simulator Qualnet is used.

A) Simulation Setup

Test scenario 1(number of nodes varies)

In this scenario we have taken the dependency of nodes.

Parameters	Value
Number of nodes	25,50,75,100
Maximum speed	20 m/s
Minimum speed	0 m/ s
Simulation time	50 s
Packet size	512
Traffic type	CBR
Packet Rate	4 Packets /sec
Dimension of space	1000 x 1000 m
Mobility model	Random way point
Pause Time	20 s

Test Scenario 2 (pause time varied)

Parameters	Value
Number of nodes	50
Maximum speed	20 m/s
Minimum speed	0 m/ s
Simulation time	50 s
Packet size	512
Traffic type	CBR
Packet Rate	4 Packets /sec
Dimension of space	1000 x 1000 m
Mobility model	Random way point
Pause Time	10s,20s,40s,100s

B) Result Discussion

The performance of the protocols are shown in the given below figures with respect to packet delivery ratio, average end to end delay and throughput.

1) Test scenario 1(number of nodes varied)

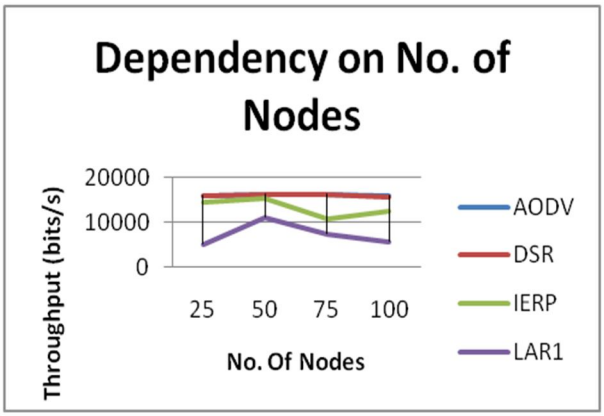

Fig1. Throughput under test scenario 1

When we vary the number of nodes then the throughput for AODV and DSR remains almost same. For the IERP its first increases then deceases and after sometimes it becomes constant.

If we take dependency on nodes the packet delivery ratio for AODV and DSR is almost same with a very less packet loss. In IERP it first increases then decreases and after sometime again increases. In LAR 1 it increases first then continually decreases. Hence AODV performs better than DSR, IERP and LAR1. When we vary the number of nodes then the output for average end to end delay is quite interesting.

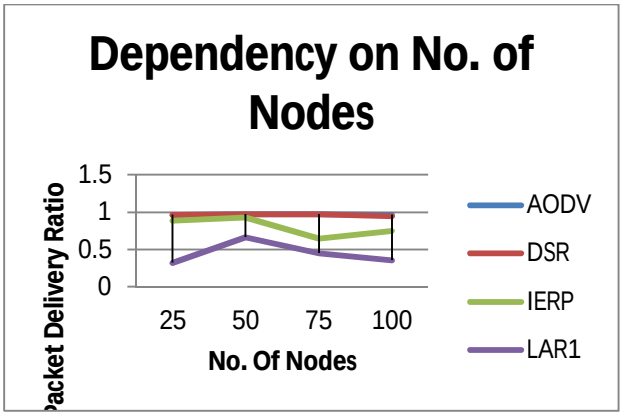

Fig2. Packet delivery ratio under test scenario 1

For aodv it remains constant and alomost negligible. For dsr it decreases first then after sometime when node number are high it graudually increases. For ierp it like zig zag first increases, decreaes and then increases. For lar 1 it increases then decreases and after sometime it becomes constant.

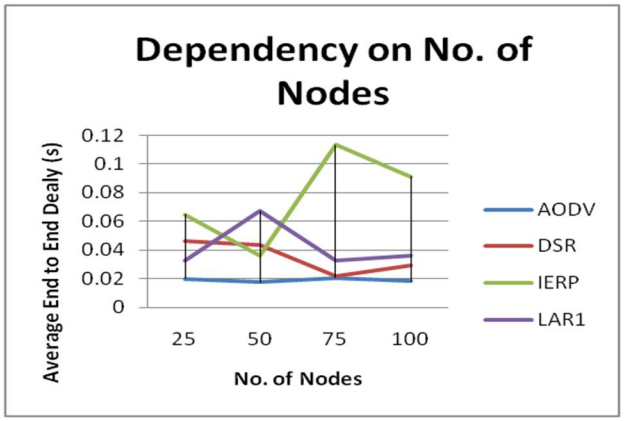

Fig3. Average end to end delay under test scenario 1

2) Test scenario 2(pause time varied)

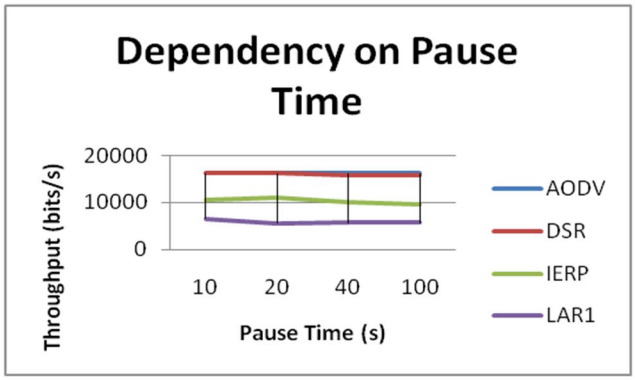

Fig4. Throughput under test scenario 2

In case of variable pause time the throughput of AODV and DSR are almost same while in case of IERP it varied a lot and for LAR1 it is the lesser than AODV, DSR and IERP

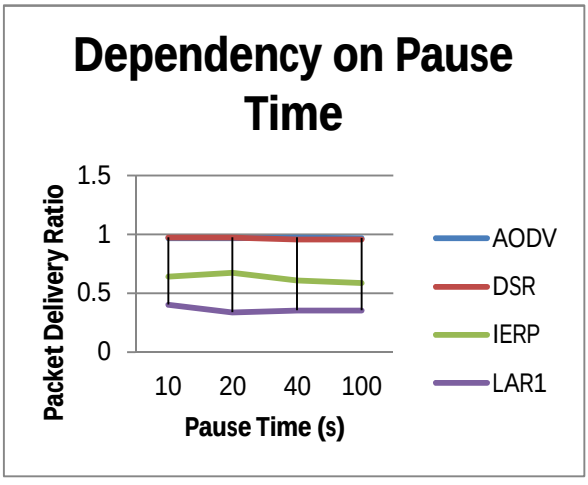

Fig5. Packet delivery ratio under test scenario 2

When we take dependency on pause time then the performance of AODV and DSR almost remains the same i.e. they have a very less packet loss. In IERP first it increases after that it decreases and after sometimes it becomes almost constant.LAR 1 packet delivery ratio is decreased first then it becomes almost constant with a little increase. Hence AODV performs better than DSR, IERP and LAR1.

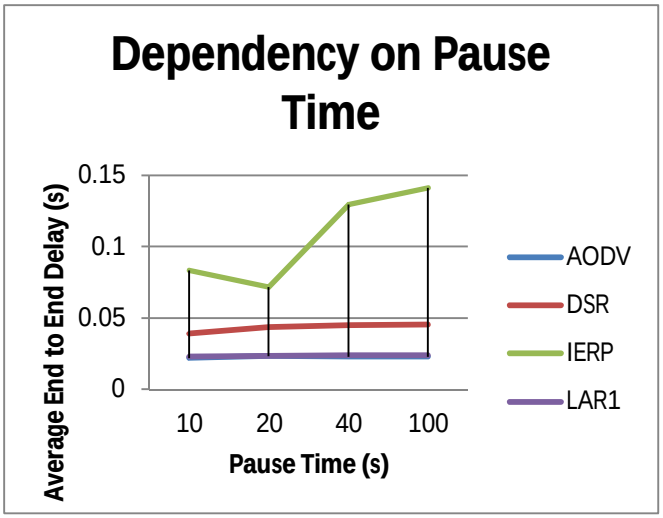

Fig6. Average end to end delay under test scenario 2

Average end to end delay with dependency on pause time for aodv and dsr is almost negligible. For ierp it decreases first then continuously increases. For lar 1 its almost constant.

6 CONCLUSION

This paper analyses the performance of different source initiated routing protocol for wireless adhoc network. These routing protocols are compared with parameters throughput, packet delivery ratio and average end to end delay. All the parameter are calculated with two different scenarios i.e. first we vary the number of node and take pause time constant while in second one the pause time is varied and number of nodes remain constant. Simulation results shows AODV performs better than other protocols in terms of packet delivery ratio, throughput and average end to end delay.

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