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Comparative Study of AODV, FSR and IERP on MANET using Grid topology

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Abstract: *Over the recent many of years, the use of wireless networks has become very popular. A MANET is a collection of wireless mobile nodes without the use of any fixed network infrastructure or centralized administration networks. Each node in a MANET is free to move independently in any direction and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use and therefore be a router. In this paper a performance comparison of three popular mobile ad-hoc network routing protocols i.e. Ad-hoc On-demand Distance Vector Routing (AODV),Interzone Routing Protocol (IERP) and Fisheye State Routing Protocol (FSRP) is presented with variable maximum speed with grid node placement. A network simulator QualNet 6.1 from scalable networks is used to evaluate the performance of these protocols. The performance analysis is based on different network metrics such as Average End to End delay (s), Average Jitter(s), Throughput and Packet delivery ratio.*

Keywords: *Manet, Aodv, Ierp,FSR,QualNet 6.1*

I. Introduction

Over recent time there are so many gadgets viz. Laptops, tablets, and mobile phones, there is often a requirement to set up a network to enable communication among some of these devices. Mobile Ad-hoc Network (MANET) is a temporary network that is designed for communication among mobile nodes, without any need for fixed or pre-specified infrastructure. Each node works like a router itself[1]. For movable devices, a wireless network is always very suitable [1].Wireless network are classified infrastructure, or ad-hoc infrastructure. MANET applications area are very large viz. military operations, disaster managements, rescue operations, meetings and conferences, educational purposes and others. Since, in the case of MANET the network topology changes very frequently, due to the mobility of nodes. Due to this routing becomes a challenging issue [3]. Today wireless communication technology is rapidly increasing. Wireless connectivity gives users the reliability to use their gadget anywhere and anytime.

II. Relatedwork

V. Sahu, et al. [1], analyzed the performance variation of AODV by changing some parameters as node-density, pause time, and rate of transmission of packets. Effect of two pathloss model, such as free space and two ray are used in a well known's network simulator Qualnet 5.2.They analyzed that jitter and end-to-end delay was low. They observed that the overall performance for AODV degrades as node density increases.

G. Sharma, etal. [2], analyzed the performance of AODV, DSR and DYMO under the effect of two shadowing model, as Constant and Lognormal used well known's network simulator Qualnet 5.2,They took 75 node with different maximum speed and analyzed various performance parameter such as throughput, number of bytes received, average end-to-end delay. They observed that for constant model AODV outperforms the other two protocols. DSR showed the worst performance. But for the log-normal, DSR showed better performance than AODV and DYMO.

Ashish, et al. [3] comparison proactive (OLSR), reactive (AODV, DYMO, IERP) routing protocols under for mobility model random way point and mobile nodes by varying the node maximum speed (5,10,15,20) and no. of node density 5 to 20 multiple by 5 using Qualnet 5.2 network simulator.They analyze parameters such as throughput, average jitter, average end-to-end delay, packet delivery ratio and total number packet recieved.

MahendraSrivastava, et al. [7] compared proactive (FSR), reactive (AODV, DYMO, LAR1) routing protocols under the fadingmodel rayleigh and fast rayleigh for stationary and mobile nodes by varying the node maximum speed (2,5,10,15,20) using Qualnet 6.1 network simulator.. They took parameters such as throughput, average jitter, average end-to-end delay and packet delivery ratio for the analysis.

S. R. Raju, et al. [10] proposed an algorithm to provide improved quality of service via hybrid routing protocol ZRP. They used QualNetversion 4.5 and evaluated the performance in ZRP,AODV,DSR to compare QoS parameters viz., throughput, number of bytes received, number of packets received average end-to-end delay and the time at which first packet is been received for DSR, AODV and ZRP. Their found that ZRP performs poorly throughout all the simulation sequences.

P. K. Maurya, et al. [13] compared ZRP, AODV, DYMO and DSR using Qualnet 5.2. They analyzed the throughput, average jitter, average end-to-end and packet delivery ratio in two different phases, one phase was used to analyze pause times and in second phase they varied the maximum speed of nodes in the scenarios. ZRP had lower throughput, lower PDR than AODV. In second phase AODV gave better performance than DYMO and ZRP but lower than DSR.

III. Overview Of Routing Protocols

3.1 Ad-hoc On-demand Distance Vector Routing protocol (AODV)

The Ad-hoc On-Demand Distance Vector (AODV)[1,2,4,5] routing protocol is reactive protocol often used in MANET. Routes only created when it required.Route discovery is based on query and reply cycles, and route information lying in all intermediate nodes along the route in the form of route table entries. The following control packets are used: routing request message (RREQ) is broadcasted by a node requiring a route to another node, routing reply message (RREP) is unicasted back to the source of RREQ, and route error message (RERR) is sent to notify other nodes of the loss of the link. HELLO messages are used for detecting and monitoring links to neighbors [15]. AODV allows mobile nodes to obtain routes quickly for new destinations and does not require nodes to maintain routes to destination that are not in active communication, thus reducing routing overhead in the routing table[4].

3.2 Fisheye State Routing (FSR)

The Fisheye State Routing(FSR)[7,11] is a proactive and table driven routing protocol. It bases on link state protocol and has the ability of immediately providing route information when needed. The eye of a fishes catches the pixel with high detail near the focal point. In the FSR detail decreases as the distance from the focal point increases. In routing, the fisheye approach translates to maintaining accurate distance and path quality information about the immediate neighborhood of a node, with progressively less detail as the distance increases [7]. Fisheye State Routing, which provides an efficient and scalable, solution for wireless, mobile ad hoc networks.FSR is more reliable for large mobile networks where mobility is high and the bandwidth is low.

3.3 Interzone Routing Protocol (IERP)

Inter-zone Routing Protocol (IERP) [3, 9] is used between routing zones, respectively. The Inter-zone Routing Protocol (IERP) [9, 13] is used to communicate between nodes of different routing zones. It is a reactive routing protocol and the route discovery process is only initiated when needed or on demand. This makes route finding slower, but the delay can be minimized by use of the Bordercast Resolution Protocol (BRP). 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 [16].

IV. Simulation Setup

Simulations is carried out on QualNet version 6.1[12] in this paper we have evaluated the performance variation of MANET Routing Protocols AODV.IERP and FSR by changing the maximum speed of nodes and packet transmission rate with which it can move in the network, over an area of 1500×1500 m^2.. Among various nodes application of Constant Bit Rate is applied. All the nodes in the depicted scenario are given a mobility using the protocol of Random waypoint mobility model and node placement in grid and pathloss model in free space. Simulation parameters are shown in table.1 and simulation results are shown in figures from 1 to 4. With the help of simulation results we have analyzed Average Jitter, Packet delivery ratio, throughput, and End-to-End delay for the given protocol. These parameters are defined below:

4.1 Packet delivery ratio

Packet delivery ratio is the ratio of total packets sent by the source node to the successfully received packets by the destination node.

4.2 Throughput

It is defined as the information in bits which is received successfully by the destination in an average time. Its unit is bit per seconds.

4.3 Average End-to-End delay

Itis the time elapsed when a packet is sent from the source node and is successfully received by the destination node. It includes delays as delay for route discovery, propagation time, data transfer time, and intermediate queuing delays.

4.4 Average Jitter

Jitter is the time variation between subsequent packet arrivals; it is caused by network congestion, timing drift, or route changes. For an efficient protocol, it must be as low as possible.

Table.1 Simulation Parameters

Parameter	Value
Area	1500X1500m
No. of nodes	90
Simulation Time	120sec
Routing Protocols	AODV, FSR,IERP
Channel frequency	2.4 GHz
Shadowing Model	Constant,
Pathloss Model	Free Space
Fading Model	Rayleigh
Mobility Model	Random way point
MAC protocol	802.11
Physical layer Radio-type	802.11b
Pause Time	40 sec
Maximum Speed	10,20,30,40,60 mps
Minimum Speed	0mps
Packet size	512

V. Results And Discussion

Figure 1 shows the variation of throughput against maximum speed of nodes and it is observed that AODV are performing very well as compared to other routing protocols for grid nodes placement models. Out of the all the protocols used FSR is giving worst performance for the free space pathloss models. As speed of nodes is increased, performance of AODV goes on decreasing and IERP and FSR routing protocols gets up and down.

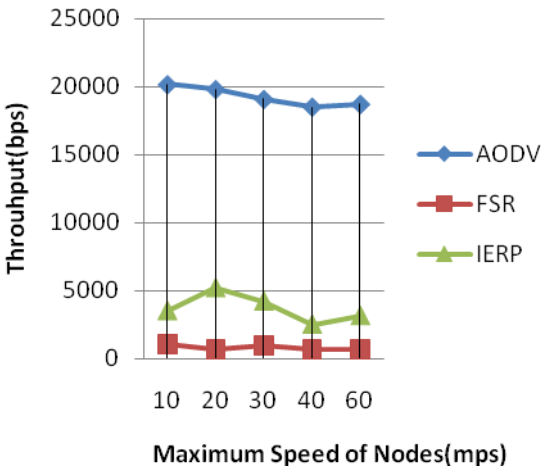

Fig.1 Throughput vs. Maximum Speed

Figure 2 shows that variation form that all the routing protocols except FSR are performing very well in the terms of average jitter and IERP protocol perform in up and down. For variation in speed, performance of protocols is constant. Here again, IERP is being outperformed by all the other protocols used. It is giving worst performance at a speed of40 m

Figure 3 shows the variation that AODV routing protocols performing very well in the terms of average end-to-end delay and IERP routing protocols worst performing. Here, FSR is being out performed by IERP protocol .FSR is giving worst performance at speeds between 10mps and IERP worst performing 30mps and good performing 60mps..

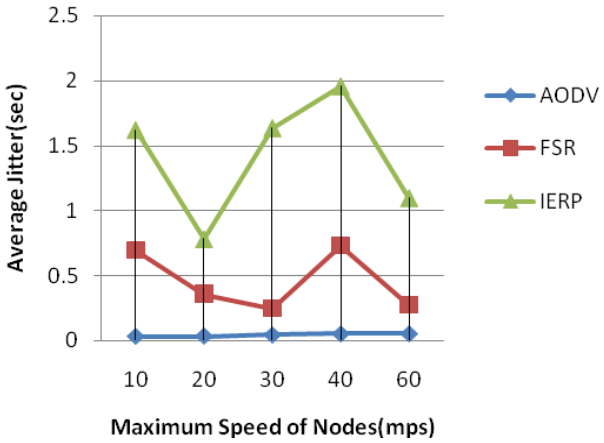

Fig.2 Average Jitter vs. Maximum Speed

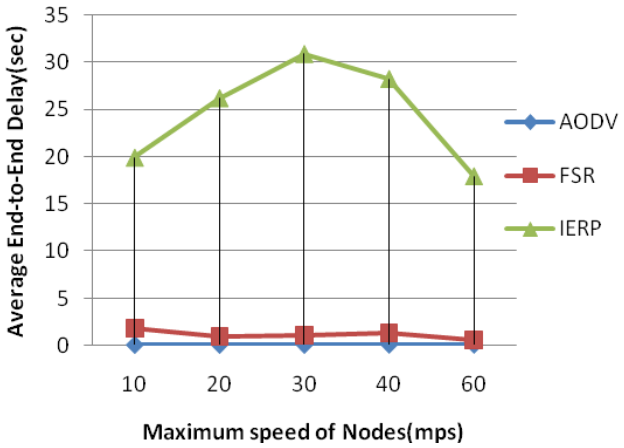

Fig.3 Average end-to-end delay vs. Maximum speed

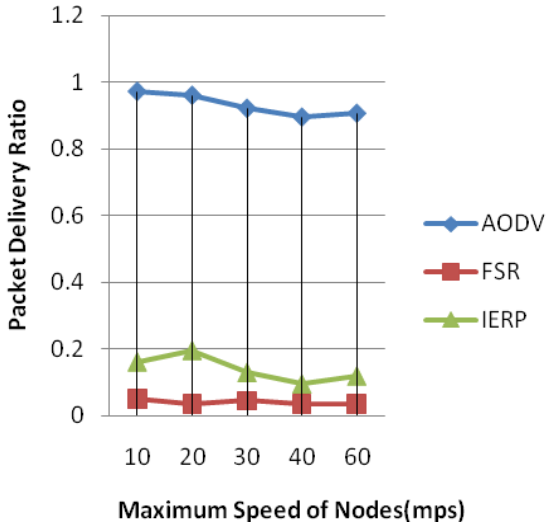

Fig.4 Packet delivery Ratio vs. Maximum Speed

Figure 4 shows the variation packet delivery ratio against maximum nodes speed and it is observed that AODV are performing very well as compared to other routing protocols for free space pathloss models in grid node placement. FSR is giving worst performance for free space pathloss models in grid placement. As speed of nodes is increased, performance of AODV ondeteriorating and IERP, FSR performance up and down.

VI. Conclusions

In this paper the performance of AODV, FSR and IERP protocol is analyzed against Grid topology and pathloss model, used in Free space. With the help of simulation results a comparison of AODV FSR, IERP with variable maximum speed of nodes is presented. We measure End to End delay (s), Average Jitter (s), Throughput and Packet delivery ratio as performance metrics. Simulation results shows AODV perform well for throughput and packet delivery ratio,average jitter and average end to end delay for maximum speed of nodes compare to FSR and IERP.FSR perform worst in throughput and packet delivery ratio with varying maximum speed. IERP shows worst perform in average end-to-end delay and average jitter worst varying maximum speed.IERP throughput and packet delivery ratio is better than FSR with varying maximum speed and FSR shows lowest throughput and packet delivery ratio with varying maximum speed. FSR shows best performance for average jitter and average end-to-end delay with the varying maximum speed.

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