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IMPACT ON WIRELESS NETWORKS – COMPARISION OF UNIPATH AND MULTIPATH ROUTING RIGHT ANGLED BAISED GEOGRAPHICAL ROUTING TECHNIQUE (RABGR)

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Abstract-In this paper, we analyze the benefits of optimal multipath routing, to improve fairness and increase throughput in wireless networks with location information, in a bandwidth limited ad hoc network. In such environments the actions of each node can potentially impact the overall network connections. This is done by making multipath routing method, named as Right Angled Biased Geographical Routing (RABGR), using AOMDV protocol and two congestion control algorithms, Biased Node Packet Scatter (BNPS) and Node-to-Node Packet Scatter (NNPS), which enhances the RABGR to avoid the congested areas of the network. In RABGR, the term "bias" i.e angle is inserted in each packet which determines the way of the path followed by the packet towards the destination. The bias is treated at each hop as an angle (90°). To avoid spiral trajectories, the modulus of the bias at each hop with a value inversely proportional to the square of the distance to the destination from the current node. The idea from physics as a parallel to natural forces like gravity is taken and the bias is reduced by the formula "bias" = 360° - 270° = 90° (bias). BNPS reduces congestion by splitting traffic immediately before the congested areas. BNPS split flows close to the congestion point. Each node monitors The congested status of all its neighbour and splits the flows that are going towards a congested neighbour. In contrast, NNPS alleviates long term congestion by splitting the flow at the source, and performing rate control. If BNPS cannot successfully support the aggregate traffic NNPS is used. NNPS selects the paths dynamically, and use free resources available in the network in order to avoid congestion .It starts sending packets on two additional side paths obtained with RABGR, searching for free resources and use a less aggressive congestion control mechanism to improve energy efficiency. If the source finds, there is any no other node at 90°, its uses the ant search method, and move to the nearest node and then find the node at 90° and sends the packets. The comparision was made between AODV and AOMDV protocols. After Simulation, the experimental results shows that the solution achieve its objectives. Extensive ns-2 simulations show that the solution improves both fairness and throughput as compared to greedy routing using only single path.

1. INTRODUCTION

In ad hoc networks, nodes self-organize to create a mesh, in which each node can act as of a source, a destination or a relay for traffic. The flexibility offered in such networks may be tackled in variety of contexts. For example, In disaster areas or in search-and-rescue operations, it is very appealing to be able rapidly deploy a wireless ad hoc networks without the need of a fixed infrastructure. However, because of adverse channel conditions and potential node mobility, traditional networking tasks such as routing can be challenging even when the number of nodes is limited. Several distributed routing protocols exist and have been tailored to wireless ad hoc networks. Routes can either be stored in routing tables and periodically updated at each node, or discovered on demand by the sources. In most wireless ad hoc networks, the action of a single user may affect the rest of the network, for instance by saturating a bottleneck link. Consequently, the network conditions may change frequently. This makes traditional table driven algorithms less efficient and motivates the use of on-demand source routing protocols. Some of these types extend to multipath routing and provide several mostly independent path. The use of multiple routes reduces the frequency of path updates and increases robustness against changes in the network algorithm.

Wireless embedded processors contained in mobile phones, handled devices or weaved into the environment as sensors, are likely to become the main part of the future Internet. So, geographical routing, an algorithm using greedy manner leverages location information to route messages in multipath routing techniques.

In this paper, we present a high efficient solution that seeks to utilize idle or under-loaded nodes to reduce the effects of congestion. To work out this, we highly enhanced the geographical routing to allow a source to select different paths to make the packet to reach the destination. First, we propose multi-path solutions for geographic routing which has less effective results, at the end, we likely to propose right angled biased geographical routing technique (RABGR), a lightweight, stateless, Geographical forwarding algorithm, as cost-
effective complement to greedy routing. The above RABGR routes packets in straight path i.e. 90° from the source, instead the shortest path, towards the destination.

The reduce the congestion during transmission of packets; we propose two more congestion control mechanisms that highly enhance RABGR.

Biased Node Packet Scatter (BNPS)

BNPS is a very light weight method mechanism that partially aims to transient congestion by locally splitting the traffic along multiple paths to avoid congested hotspots.

Node-to-Node Packet Scatter (NNPS)

NNPS is also a mechanism but aim to transmit packets to longer term congestion, when BNPS fails.

The performance of the above two mechanism had been evaluated in term RABGR by using a high-level simulator, a packet-level simulator (NS-2). The results show that RABGR is a practical and efficient multipath routing algorithm. We have evaluated BNPS and NNPS using NS2.

2. AODV and AOMDV Protocols

a. AODV - The Ad Hoc On-demand Distance-Vector Protocol

Ad Hoc On-demand Distance-Vector (AODV) Protocol is a routing algorithm used in ad hoc networks. In AODV, each node maintains a routing table which is used to store destination and next hop IP addresses as well as destination sequence numbers. Each entry in the routing table has a destination address, next hop, precursor nodes list, lifetime, and distance to destination.

b. AOMDV - The Ad Hoc On-demand Multipath Distance-Vector Protocol

Ad-hoc On-demand Multi path Distance Vector (AOMDV) protocol is an extension to the AODV protocol for computing multiple loop-free and link disjoint paths. The routing entries for each destination contain a list of the next-hops along with the corresponding hop counts. All the next hops have the same sequence number. This helps in keeping track of a route. For each destination, a node maintains the advertised hop count, which is defined as the maximum hop count for all the paths, which is used for sending route advertisements of the destination.

3. The Right Angled Biased Geographical Routing (RABGR)

The requirements of the RABGR algorithm are as follows. In addition, we present simulation results that show that BGR achieves good performance with a low overhead.

Design goals

Wireless network with coordinate based routing. To have sensor networks, we require stringent energy and computational constraints, which characterize these networks.

The requirements of the geographic routing protocol:

1. *Low communication overhead* – packets sent by the sensor nodes are very small e.g. the maximum packet size is 29 bytes.

2. *Simplicity* – The routing algorithm must have low computational overhead e.g. 4 kB of RAM.

3. ***Low state* –** nodes much maintains a minimal amount of state i.e. no per-flow or per-path state in network. In addition, to avoid the hotspots in the considered wireless networks, a multi-path algorithm should be there, that must be able to provide a large number of path i.e., 90°, with few common hops without increasing routing failures, as compared to the single-path greedy routing.

4. Explanation of the Right Angled Biased Geographical Routing (RABGR)

The main idea in our solution is to reduce the congestion during the transmission of packets form source to destination, is to insert a ***"BIAS"*** i.e. the angle in each packet, which determines the straight line path from the source so that the packets move towards the destination. Here the term bias is a measure angle of which the packets take from the source from greedy route and also indicates the side of deviation. In our discussion, the term bias is treated at each hop as an angle i.e., 90°. Instead of routing greedily towards the destination. RABGR routes greedily towards the point P2 (target point) situated at a predefined distance from the current node point P1 such that the angle between the lines P1P2 and P1D is equal to the bias i.e angle 90°.

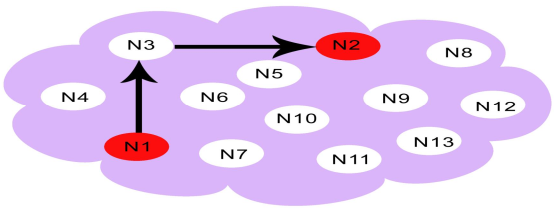

Figure 1. RABGR Packet Forwarding usingRight angle Method - minimising Congestionin Wireless Networks.

In wireless networks, Congestion occurs when the wireless area around them is busy. With networks congestion is mostly situated at the border of the network, with point to point communication congestion usually builds in the center. So avoid the congestion in the wireless networks, the way should be followed, i.e., we allow packets to route on alternate paths. This type of routing avoid the congestion is busy area in the wireless networks.

BNPS – Biased Node Packet Scatter

BNPS splits flows close to the congestion point. Each node monitors the congested status of all its neighbours and splits the flows that are going towards a congested neighbour, if the node itself is congestion. The scattered packets contain bias of 90°, such that the modified paths quickly move away from the original path.

NNPS – Node – to – Node Packet Scatter

If BPNS cannot successfully support the aggregrate traffic, it will only scatter packets to a wider area potentially amplifying the effects of congestion collapse due to its longer paths.

Evaluation of BNPS and NNPS

In this section we present simulation results obtained through NS-2 simulations. We use three main metrics for out measurements: throughput increase, packet delivery ratio and delay among flow.

We ran tests on a network of 20 nodes, distributed uniformly on a grid in a square are of 1000m x 1000m. We assume events occur uniformly at random in a geographical area; the node closest to the event triggers a communication burst to a uniformly selected destination. To emulate this model we select a one set of random source-destination pair and run 20 second synchronous communications among the selected pair. The data we present is averaged over hundreds of such iterations. The parameters are summarized in Table 1.

Table 1: Summary of Parameters

Parameter	Value	Parameter	Value
Number of Nodes	20	Link Layer Transmission Rate	2 Mbps
Area Size	1000m x 1000m	RTS / CTS	No
MAC	802.11	Retransmission Count (ARQ)	No
Radio Range	100m	Interface Queue	No
Contention Range	250 m	Packet Size	100B
Average Node Degree	90	Packet Frequency	40/s

5. PERFORMANCE METRICS

We used out RABGR for AODV protocol with the AOMDV protocol**.** We evaluate mainly the performance according to the following metrics, by varying the pause time as 0, 1, 2, 3, 4, 5, etc….

Throughput:

It is the number of packets received successfully. In communication networks, such as Ethernet or packet radio, throughput or network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot.

Average Packet Delivery Ratio:

It is the ratio of the number of packets received successfully and the total number of packets sent.

Average end-to-end delay:

The end-to-end-delay is averaged over all surviving data packets from the sources to the destinations

6. SIMULATION RESULTS

Based on Pause time

In our initial experiment, we vary the pause time as 0, 1, 2, 3, 4, 5, etc….

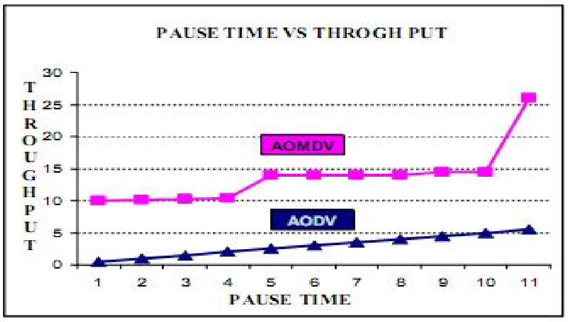

Figure 2: Pause Time Vs Throughput

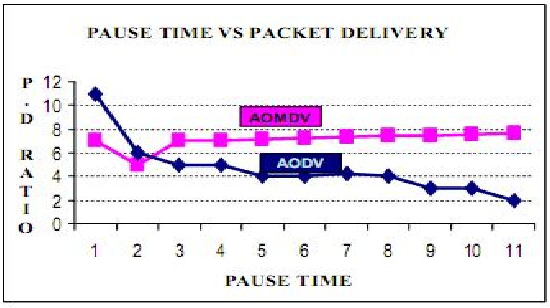

Figure 3: Pause Time Vs Delivery Ratio

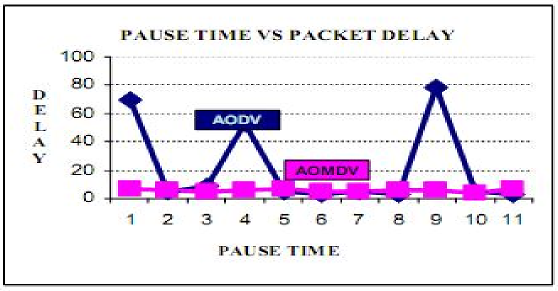

Figure 4: Pause Time Vs Packet Delay

From Figure 2, 3 and 4 clearly proves that working of RABGR with AOMDV procotol gives the increased Throughput, increased Packet Delivery Ratio and decreased Packet Delay.

7. CONCLUSION

In this paper, initially we have presented a solution for one source and one destination that increases fairness and throughput at the same time decreases the packet loss in dense wireless networks. Our overall experiment achieves its goal by using multipath geographic routing to find resources in the wireless network by AOMDV when compared with AODV protocol. The algorithm we used is simple and has low communication overhead; simulation results we got also show favourable results. The proposed two algorithms i.e., BNPS and NNPS that made a flow through 90° in the multiple paths when it is experiencing congestion. In this practice we also combine both BNPS and NNPS to have more enhanced result. By simulation results, we have proved that our proposed routing method attains high throughput and packet delivery ratio, by reducing the packet delay.

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AUTHORS PROFILE

Capt. Dr. S .Santhosh Baboo, aged forty five, has around twenty one years of postgraduate teaching experience in Computer Science, which includes Six years of administrative experience. He is a member, board of studies, in several autonomous colleges, and designs the curriculum of undergraduate and postgraduate programmes. He is a consultant for starting new courses, setting up computer labs, and recruiting lecturers for many colleges. Equipped with a Masters degree in Computer Science and a Doctorate in Computer Science, he is a visiting faculty to IT companies. It is customary to see him at several national/international conferences and training programmes, both as a participant and as a resource person. He has been keenly involved in organizing training programmes for students and faculty members. His good rapport with the IT companies has been instrumental in on/off campus interviews, and has helped the post graduate students to get real time projects. He has also guided many such live projects. Capt..Dr. Santhosh Baboo has authored a commendable number of research papers in international/national Conference/journals and also guides research scholars in Computer Science. Currently he is Associate Professor in the Postgraduate and Research department of Computer Science at Dwaraka Doss Goverdhan Doss Vaishnav College (accredited at 'A' grade by NAAC), one of the premier institutions in Chennai.

Mr. V J Chakravarthy, done his Under-Graduation in Madras University and Post-Graduation in Bharathidasan University and Master of Philosophy Degree in Periyar University. He has publish good no of papers in the national / international journal. His work is mostly based on wireless networks – proposing new protocols. He is currently pursuing his Ph.D in Computer Science in Madras University, Chennai, India.