International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-3 Issue-1, June 2013

Advanced Scheme for Data Transmission with Early Congestion Detection

Sangheethaa Sukumaran, Mariya Seby, Neethu Kurian

***Abstract*— We develop a distributed opportunistic routing scheme with early congestion detection for multi-hop wireless networks. The introduced scheme utilizes the functionality of opportunistic routing and considering an expected average per packet reward criterion, shortest path and so on. Congestion in network causes packet loss and delayed packet delivery. By detecting congestion earlier, the routing scheme which utilizes the opportunities in the network can increase the rate of performance and reliability of the network. We implement it in the NS2 simulator and experiment with AODV routing protocol.**

***Index Terms*—AODV protocol, Congestion Detection, Opportunistic Routing, r-Decider Algorithm**

I. INTRODUCTION

Conventional routing scheme [3],[4] uses fixed path scheme which causes unnecessary retransmission of packet and it cannot take the benefit of broadcast transmission supported by the wireless medium. Opportunistic routing overcomes [7] the problems of existing routing scheme. Opportunistic routing made in an online way and selection of next hop based on the actual transmission outputs and rank order provided by neighboring hops. In opportunistic routing, path diversity and broadcast nature of wireless transmissions are exploited and simplifies impact of weak wireless link. The existing opportunistic routing does not deal with congestion control [19]. When more packets sent to the network which is greater than the capacity of intermediate routers and this intermediate relay node discard many packets which expecting that the end node can retransmit the lost information. Also congestion can be defined as the loss of network utility[14] because of high traffic loads. Due to congestion, the network requires more time to forward packet from source to desired destination as well as it leads to packet loss. For advanced and reliable data transmission first find the path which has congestion or chance of congestion occurs. To overcome this route is deviated from the congested node along with other considerations with some parameters. This increases network performance.

The significant characteristics of proposed systems are

- It is forgetfulness to initial consideration of network.
- The decisions made by each node based on its information obtained from its neighbors. ie. It is distributed.
- At any time any hop can update their corresponding information. ie. It is asynchronous.

The learning schemes have the following advantages such as low overhead, low complexity, distributed asynchronous implementation and so on.

II. RELATED WORKS

There are different related works are existing. First one is theoretical formulation of Markov decision to opportunistic routing. In this the decision of optimal route at any node is to choose next hop depend on an index containing the expected cost to forward packet from that hop to desired destination. This index is computed in a distributed way and has low complexity. A unifying framework is provided by the stochastic routing [4],[6] for all kinds of opportunistic routing including GeRaF, EXOR and SDF. In GeRaF [3] which represents geographic routing and forwarding choosing next hop based on minimum geographical distance to the required destination. But in EXOR[7] the optimal route is selected in a manner which reduces the number of transmission. Nagshvar and Bhorkar proposed a paper which deals congestion diversity of opportunistic routing. This paper includes the issue of routing packets towards a multi-hop network which contain multiple sources as well as wireless links which has stochastic reliability and ensure outlined expected delay. The main issues in the implementation of minimum delay routing are keeping trade-off among routing packets towards shortest path to receiver as well as distributing traffic towards the network. Backpressure variants of opportunistic routing ensure bounded expected delay. Congestion diversity of opportunistic routing combines features of shortest path and backpressure routing. It provide improved reliability in network. In particular, path diversity in wireless ad-hoc network is introduced by Jain and Das [5]. The aim is to exhibit path diversity to link layer by selecting next node to transmit data when more than one nodes are available.

III. SYSTEM MODEL

We consider the routing of packets from a source hop 'o' to a desired destination hop 'd' in a wireless ad-hoc network. It includes d+1 hops and the hop set contain S={0,1,2,….,d}. the time is used for this purpose is slotted as well as indexed. The forwarding packets are indexed and is originated at source hop 'o' with arbitrary distribution rate.We assume that the cost of transmission is greater than 0 for the packet transmitted from node i. The successful transmission of packet from node to set of neighboring nodes, the next route decision consists of three processes such as retransmission of packet from node i, relaying the transmitted packet by the neighbor node j, and dropping the transmitted packet by all neighbor nodes other than relay node.

Manuscript published on 30 June 2013.
***Correspondence Author(s)**
Dr. Sangheethaa Sukumaran, Vice Principal, Vedavyasa Institute of Technology, Malappuram, India.
Mariya Seby, M.Tech Computer Science and Engineering student, Vedavyasa Institute of Technology, Malappuram, India.
Neethu Kurian, M.Tech Computer Science and Engineering student, Vedavyasa Institute of Technology, Malappuram, India.

Published By:
Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)

The termination event of the packet is either the packet is successfully received by the desired destination or the packet is dropped by intermediate relay node before reaching the intent destination.

We define the time for termination is a random variable while packet is terminated. The termination events cause to obtain two types rewards such as positive reward which is due to successful delivery of all packets and no reward which is due to the loss of packet before reaching its destination. The successful delivery consider the index of packets which summarizes shortest path, expected cost for forwarding packets, information about the congestion in the route and so on.

The main disadvantage of opportunistic routing is that the set of rely nodes maximized to infinity due to the lack of initial knowledge about the wireless network topology.

The deficiencies of opportunistic routing provided by multiple source-multiple destination pairs can be decomposed to the issue of transmitting packet from one node to a specific desired target node is addressed. To solve the problem of opportunistic routing we use distributed system.

IV. DISTRIBUTED SYSTEM

This section describe about the r-decider algorithm. This algorithm deals about the routing decision at any node. The packets are transmitted in a distributed way for the efficiency of routing. By using r-decider algorithm choose one as a next transmitter node.

A. r-Decider Algorithm

As discussed earlier, routing decision taken by any node depends on the result of successful outcomes of neighboring nodes and it involves the processes such as retransmission, selecting next relay node, termination and so on. Our proposed model takes decision in a distributed way through the three way communication between node I and its surrounded neighboring nodes.

1. Node i transmit packets to its neighbors
2. Neighbor nodes who have received the packet without loss from node i , forward acknowledgement (ACK) message to node i . Moreover, the ACK includes the identity of node and control message which has best score value for transmitting packet.
3. Node i decide the next node based on values of above criteria and announces to selecting node to forward packet as well as all other nodes to drop the packet.

The routing decisions taken by node i at any time is depends on an best score value. Node i uses two types of parameters which are counting variables and positive scalars. The counting variables represents how many times the neighbor nodes received or acknowledged the packets which are forwarded from node i. The positive scalars used to update the best score value.

The components of r-decider algorithm are initialization, transmission, acceptance and acknowledgement, route decision and adaptive computation.

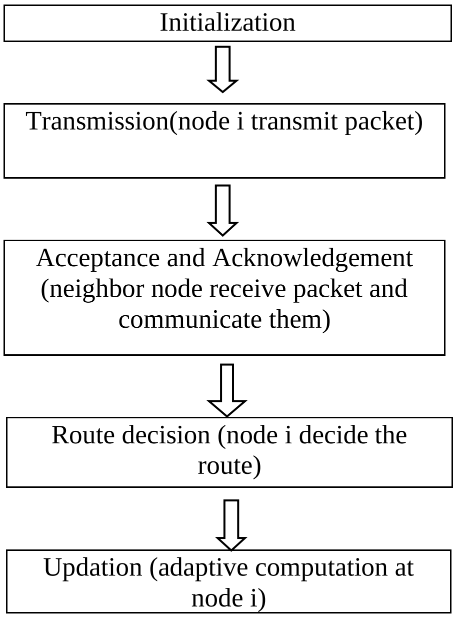

Fig. 4.1 Flow chart of r-decider algorithm:

B. Detailed description of r-decider algorithm

1) **Initialization** :Initialize the value of hop count = 0, score vector = 0, traffic rate = 0
2) **Transmission stage** :In transmission stage the source node transmit packet.
3) **Acceptance and acknowledgement stage** :The neighbor node which has successfully accept the packet send back acknowledgement to transmitting node.
4) **Route decision stage** : Node i decide the route according to the values of best score vector and traffic rate at the route and so on. It include the information about the shortest path, minimum cost route etc. therefore node i announces to the selected node to forward the packet to next hop and remaining nodes to discard the packet.
5) **Adaptive computation stage** : This stage is also known as update stage. After the route decision stage the nodes updates their values of hop count , traffic rate, score vector and so on.

In this proposed scheme the traffic rate is used to detect congestion in the network. Congestion causes to delay in packet delivery. One of the main task of network is to reduce the delay in routing scheme. Because of the uncertainty of the network, delay optimization becomes major component in the routing choices. By using a parameter which contain the index about the traffic in the network according to the delay gives information of congestion and the node can decide as well as deviate the route. In another way, minimum delay can also be detected by calculating time which is small to receive packet successfully among the set of neighbors.

The computational issue of r-decider algorithm is low both in the case of control overhead and complexity of computation.

Published By:
Blue Eyes Intelligence Engineering
and Sciences Publication (BEIESP)

	Data Frame	ACK	Total
802.11 unicast	397μs	46 μs	443 μs
r-Decider	400 μs	125 μs	525 μs

Table 4.1 Overhead Comparison

V. ROUTING PROTOCOL

AODV is the protocol that takes into consideration for opportunistic routing. AODV represents Ad-hoc On-demand Distance Vector routing protocol. It is a reactive routing protocol and is used for both wireless ad-hoc network and mobile ad-hoc networks for unicast, broadcast and multicast routing. AODV neglect the problem of counting to infinity by using set of numbers in route updates.

VI. AODV WORKING

I n AODV protocol, the network is not active until connection required. When a node wants connection the needy node broadcasts request. The AODV nodes create a temporary route to needy node or source node on backwards. Then the needy node use this route for communication. When a fail occur, a routing error send back to the source node.

The following features of AODV make use of it on opportunistic routing simulation.

- AODV establishes a route only on demand and it conserves the messages of route request.
- Each route request is assigned with a sequence number. By using this sequence number nodes do not repeat the same route request that already passed through it.
- The route request contains "time to live" value that controls the retransmission.

If the route request damaged or lost we do not resend the request until the time expired.

VII. SIMULATION TOOL

The most of the ad-hoc routing protocols are used for the simulation, because it is complex to use in the case of real implementation. In a simulator, code is included within a mono logical component. Moreover, the code is clearly defined as well as easily accessible.

Our proposed scheme uses NS2 simulator for simulation. NS2 means network simulator version 2. NS2 is mainly designed for research in computer network and is an open source as well as event driven simulator. NS2 includes the modules such as routing, transport, application and so on. To understand about network performance, the researchers observe results obtained from NS2. Object oriented simulator NS2 is built using OTcl and C++ . Former act as front end and later act as back end. The main functions of NS2 are to create network of connected nodes and transmit packets among these nodes. In NS2, OTcl has the function of creation and configuration of network and C++ used to run simulation. The nodes in the network plays an important roles in NS2.

VIII. CONCLUSION

In this paper, we proposed r-Decider, an adaptive opportunistic routing scheme which maximizes the expected average per packet reward from a source to a intent destination in the absence of any knowledge about link qualities and network topology. r-Decider allows packet transmission in distributed manner and can be implemented in practically under idealized assumptions on network and reliability of acknowledgment.

The performance of r-Decider is investigated via simulations. Simulation results elicits that r-Decider outperforms the existing routing protocols and the routing decisions are adapted to the network models.

The early congestion detection improves the network performance and the long term average per packet reward criterion maximizes reliability of data transmission. Moreover, the proposed system reduces expected cost for packet forwarding and also chooses shortest path. An important area of future work comprises of developing fast converging algorithms which optimize the regret as a performance measure of interest.

The design of routing protocols needs consideration of congestion control along with the throughput performance. Our base paper does not consider the issue of congestion control. Incorporating congestion control in opportunistic routing algorithms to minimize expected delay in an oblivious network. For more reliable data transmission along these properties add a parameter which helps to detect congestion in the route. Thus data transmitted efficiently.

IX. ACKNOWLEDGMENT

The authors express thank to those who have made helpful comments on this work of this paper. The authors are thankful to the anonymous referees for useful suggestions and support for the successful presentation of this work.

REFERENCES

1. P. Larsson, "Selection Diversity Forwarding in a Multihop Packet Radio Network with Fading channel and Capture," ACM SIGMOBILE Mobile Computing and Communications Review, vol. 2, no. 4, pp. 4754, October 2001.
2. E. M. Royer and C.K. Toh, "A Review of Current Routing Protocols for Ad-hoc mobile Wireless Networks," IEEE Pers. Communications, vol. 6, pp. '46–55, April 1999.
3. M. Zorzi and R. R. Rao, "Geographic Random Forwarding (GeRaF) for Ad Hoc and Sensor Networks: Multihop Performance," IEEE Transactions on Mobile Computing, vol. 2, no. 4, 2003.
4. C. Lott and D. Teneketzis, "Stochastic Routing in Ad hoc Wireless Networks," Decision and Control, 2000. Proceedings of the 39th IEEE Conference on, vol. 3, pp. 2302–2307 vol.3, 2000.
5. S.R. Das S. Jain, "Exploiting Path Diversity in the Link Layer in Wireless Ad hoc Networks," World of Wireless Mobile and Multimedia Networks, 2005. WoWMoM 2005. Sixth IEEE International Symposium on a, pp. 22–30, June 2005.
6. C. Lott and D. Teneketzis, "Stochastic Routing in Ad-hoc Networks," IEEE Transactions on Automatic Control, vol. 51, pp. 52–72, January 2006.
7. S. Biswas and R. Morris, "ExOR: Opportunistic Multi-hop Routing for Wireless Networks," ACM SIGCOMM Computer Communication Review, vol. 35, pp. 3344, October 2005.
8. M. L. Puterman, Markov Decision Processes: Discrete Stochastic Dynamic programming, New York: John Wiley & Sons, 1994
9. M Kurth, A Zubow, and JP Redlich, "Cooperative Opportunistic Routing Using Transmit Diversity in Wireless Mesh Networks ," in INFOCOM, April 2008, pp. 1310–1318.
10. T. Javidi and D. Teneketzis, " Sensitivity Analysis for Optimal Routing in Wireless Ad Hoc Networks in Presence of Error in Channel Quality Estimation," IEEE ransactions on Automatic Control, pp. '1303–1316, August 2004.

11. W. Usahaa and J. Barria, "A Reinforcement Learning Ticket-Based Probing Path Discovery Scheme for MANETs ," Elsevier Ad Hoc Networks, vol. 2, April 2004.
12. Sidney Resnick, A Probability Path, Birkhuser, Boston, 1998
13. H. Satoh, "A Nonlinear Approach to Robust Routing Based on Reinforcement Learning with State Space Compression and Adaptive Basis Construction," IEICE Transactions Fundamentals, vol. 91-A, January 2008.
14. Parul Gupta and Tara Javidi, " Towards Throughput and Delay Optimal Routing for Wireless Ad-Hoc Networks," in Asilomar Conference, November 2007, pp. 249–254.
15. M. J. Neely, "Optimal Backpressure Routing for Wireless Networks with Multi-Receiver Diversity," in Conference on Information Sciences and Systems (CISS), March 2006.
16. William Stallings, Wireless Communications and Networks, Prentice Hall, second edition, 2004.
17. Alexander Zurkinden, "Performance of AODV Routing Protocol", June 2003.
18. Baruch Awerbuch, Robert D. Kleinberg, "Adaptive Routing with EndtoEnd feedback: Distributed Learning and Geometric Approaches".
19. Chieh-Yih Wan, Shane B. Eisenman, Andrew T. Campbell, "CODA: Congestion Detection and Avoidance in Sensor Networks", ,November 2003

AUTHOR PROFILE

Dr Sangheethaa Sukumaran received the B.E degree in Information Technology from Anna University in 2003, the M.E degree in Network and Internet Engineering from Karunya University in 2006 and the Phd degree in Information Technology in 2013. She is currently the Vice Principal of Vedavyasa Institute of Technology, India.

Mariya Seby Completed B.tech in Computer Science and Engineering from Baselios Mathews IICollege of Engineering ,Sasthamcotta in 2011, and presently pursuing M.Tech in Computer Science and Engineering from Vedavyasa Institute of Technology, Malappuram,, India.

Neethu Kurian Completed B.tech in Information Technology from College of Engineering ,Poonjar in 2011, and presently pursuing M.Tech in Computer Science and Engineering from Vedavyasa Institute of Technology, Malappuram,, India

Published By:
Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)