JCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Volume-4, Issue-12 E-ISSN: 2347-2693

Improving load balance in Wireless Network using Spatial Reusability

Vinodh P Vijayan[1*], Neena Joseph [2], Neema George[3], Simy Mary Kurian[4]

[1,2,3,4] Department of Computer Science & Engineering, Mangalam College of Engineering, Kottayam, India

**Corresponding Author: vinodh.pvijayan@mangalam.in Tel.: +919961687007*

Available online at: www.ijcseonline.org

Received: 23/Nov/2016 Revised: 07/Dec/2016 Accepted: 20/Dec/2016 Published: 31/Dec/2016

Abstract— The surest route from the supply node to the destination node that guarantees a high cease-to-stop throughput is the principle trouble of routing in multi-hop wireless network. As the surroundings is heterogeneous the issue seems to be a lot complicated, most of the answers cease with local most desirable due to the fact the ones algorithms often fail to make certain an quit to quit throughput. By considering spatial reusability of wireless media, the cease-to-give up throughput in wi-fi multi-hop far flung structures may be stronger hugely. To assist the argument, Spatial-reusability Aware Single-path Routing (SASR) algorithm is proposed and as compared with existing single direction routing protocol. The assessment showed that proposed protocol display full-size improvement in end-to-give up throughput in evaluation with existing protocols.

Keywords—WSN, througput, optimization.

I. INTRODUCTION

Because of the confined limit of wireless conversation media, and lossy wi-fi connection [16], it's far vital to a exquisite degree to choose a path that augments the give up-to-quit throughput, especially in multi-hop wireless network. A precept problem with current wi-fi routing protocol is that proscribing the range of transmissions to convey a unmarried packet from source node to vacation spot node does not depend on augmenting the cease-to-quit throughput [4].

This paper examines routing protocol in single path routing. The intention of unmarried route routing is to pick out a value-proscribing route alongside which the packets are conveyed from the source node to vacation spot node. A big part of present protocols links fine aware routing. They just pick the course that limits the overall transmission count number or transmission time for transmitting the packet.

The paper provides a comparative performance evaluation of various load balancing schemes in cellular packet networks. With respect to circuit switched networks, wireless packet technology adds the further issue of quality of service of accepted connections. In fact, with packet technology, transmission error performance does not uniquely depend on the perceived channel quality, but it can be improved by adopting a scheduling mechanism enforcing fast retransmission of corrupted packets. The result is that throughput can be traded off with QoS experienced by an admitted flow. This paper proposes new packet-level load balancing mechanisms. In addition to the number of calls admitted in a cell, our schemes use supplementary packet level information, expressed in terms of effective resource consumption of each individual call when retransmission mechanisms are employed. Simulation results prove the superiority of our proposed schemes with respect to traditional load balancing schemes.

In recent years, a large number of routing protocols have been proposed for multihop wireless networks. However, a fundamental problem with existing wireless routing protocols is that minimizing the overall number (or time) of transmissions to deliver a single packet from a source node to a destination node does not necessarily maximize the endto-end throughput.

Disadvantages of Existing System
1.Most of existing routing protocols, no matter single path routing protocols or any path routing protocols, rely on link-quality aware routing metrics, such as link transmission count-based metrics and link transmission time-based metrics.
2. Most of the existing routing protocols do not take spatial reusability of the wireless communication media into account.

An crucial property of wi-fi verbal exchange media which differentiate it from stressed communique media is the spatial reusability. Wireless sign loses its energy via every hop [2]. Therefore, links can be used at identical time, in the event that they inside the some distance. But present protocols do not take this into attention.

II. RELATED WORK

In this location, a brief evaluation of associated work is accomplished. And also compare our work with these and briefly evaluate other works that do not forget reusability. There is diverse work on wireless routing metrics. For unmarried path routing a few hyperlink equality conscious measurements [1][6][7][9] are proposed. RTT [1] measured the value of the single wireless hyperlink through the spherical experience postpone of probe packets. ETX [6] allocated the link price with its everyday variety of transmission to efficaciously carry a packet. Based on ETX the writer in [9] mentioned ETOP metric considering the relationship real position at the manner. The early single direction routing protocols [3] [10] [17] [18] applied Dijikstra's algorithm for choosing a course. Some present day crosslayer processes mutually don't forget routing and also link scheduling eg [11] [19] [20], Zhang et al [20] distinct joint routing and planning into an enhancement trouble and tackled the issue with a phase age technique. Skillet et al [16] managed to the joint issue in subjective ratio structures considering the outlet of legal corporations.

We investigate two kinds of routing protocols, including single-path routing and any path routing. The task of a single-path routing protocol is to select a cost minimizing path, along which the packets are delivered from the source node to the destination node. Recently, any path routing appears as a novel routing technique exploiting the broadcast nature of wireless communication media to improve the end-to-end throughput. It aggregates the power of multiple relatively weak paths to form a strong path, by welcoming any intermediate node who overhears the packet to participate in packet forwarding.

Advantages of Proposed System:
We can achieve more significant end-to-end throughput gains under higher data rates
B. Modules We have 2 main modules,
1. Single-path Routing Module
2. Any path Routing Module

1. Module Description

Single-path Routing: The task of a single-path routing protocol is to select a cost minimizing path, along which the packets are delivered from the source node to the destination node.

Any path Routing: This module aggregates the power of multiple relatively weak paths to form a strong path, by welcoming any intermediate node who overhears the packet to participate in packet forwarding.

There is diverse work on wireless routing metrics. For unmarried path routing a few hyperlink equality conscious measurements [1][6][7][9] are proposed. RTT [1] measured the value of the single wireless hyperlink through the spherical experience postpone of probe packets. ETX [6] allocated the link price with its everyday variety of transmission to efficaciously carry a packet. Based on ETX the writer in [9] mentioned ETOP metricconsidering the relationship real position at the manner. The early single direction routing protocols [3] [10] [17] [18] applied Dijikstra's algorithm for choosing a course. Some present day crosslayer processes mutually don't forget routing and also link scheduling eg [11] [19] [20], Zhang et al [20] distinct joint routing and planning into an enhancement trouble and tackled the issue with a phase age technique. Skillet et al [16] managed to the joint issue.

III. PATIAL REUSABILITY AWARE SINGLE PATH ROUTING

We initially take into account the spatial reusability-conscious course fee assessment for single-route routing. Given every of the trails located via a current supply routing algorithm (e.G., DSR [10]), our SASR calculation ascertains the spatial reusability aware course fee of it. At that point, the manner with the small price can be chosen. The general SASR algorithm is proposed in two parts.

- SASR_MIN Algorithm
- SASR_FF AlgorithmDO NOT FORGET REUSABILITY.

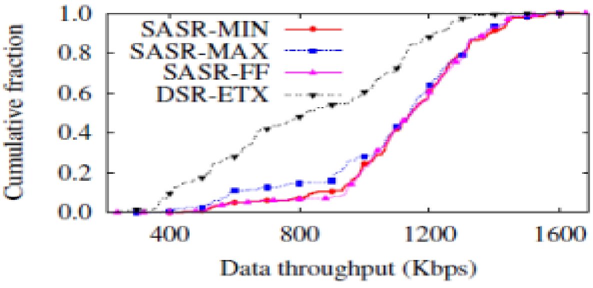
IV. SASR_MIN ALGORITHM

This algorithm takes the enter of the complete community. A number of nodes, hyperlinks and the cost of each node are its input. It reveals all of the possible course from the supply node to vacation spot node. And additionally reveals all the non-interfacing set within the community. Starting from the supply node it traverses each node to discover the vacation spot node. Finds all of the possible direction that connects the source node and destination node. Outputs of this a part of SASR algorithm are paths from source to vacation spot, their fee , and all of the possible noninterfacing units.

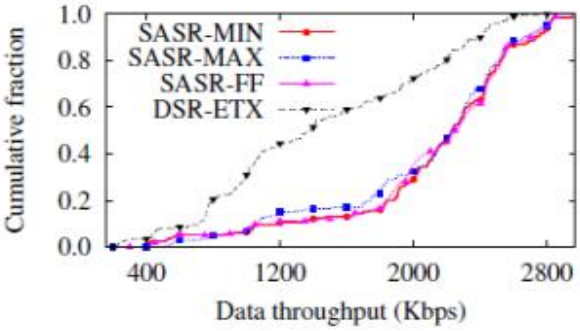
Algorithm
☐ Start from the source node.
☐ Traverse thru the community to find the destination node.
☐ Save all feasible direction along side their fee.
☐ Considering the range of every node locate feasible non-interfacing units and save it.
☐ Output the paths from source to destination, its value and the non-interfacing set.

1. Single-Flow Scenario

Fig. 1 shows the cumulative distributions of throughputs achieved by four routing algorithms, including SASRMIN, SASR-MAX, SASR-FF, and DSR-ETX. We can see that all the three SASR algorithms outperform DSR-ETX. They all achieve a median throughput gain of around 40% under 11 Mbps, and more than 60% under 54 Mbps.

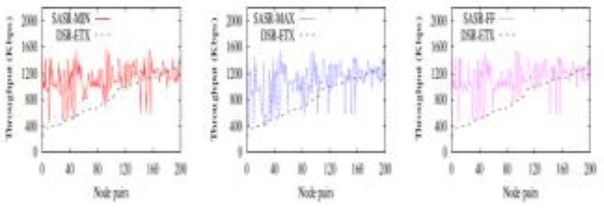


(a) Data Rate: 11 Mbps



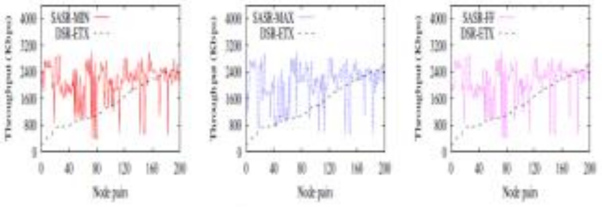
(b) Data Rate: 54 Mbps

Fig 1. CDF of Throughputs for Single-Path Routing.



(a) SASR-MIN vs. DSR-ETX (b) SASR-MAX vs. DSR-ETX (c) SASR-FF vs. DSR-ETX

Fig2.Pair wise Results of Single-Path Routing Algorithms at 11 Mbps Data Rate.



(a) SASR-MIN vs. DSR-ETX (b) SASR-MAX vs. DSR-ETX (c) SASR-FF vs. DSR-ETX

Fig3.Pair wise Results of Single-Path Routing Algorithms at 54 Mbps Data Rate.

What's more, under both data rates, the three SASR algorithms realize a throughput gain of 10% in the worst case. Therefore, the performance of SASR algorithms is better under higher data rate, because a higher data rate needs a shorter transmission time, which results in more opportunities of spatial reuse between links. In addition, SASR-MIN/FF gets better results than SASRMAX. This implies that cost minimizing fusion tends to give more reasonable path cost than maximizing fusion. SASR-FF achieves similar performance as SASR-MIN. Considering its low computation complexity, the SASR-FF algorithm is likely to achieve satisfactory performance in practice. We present detailed pair wise comparisons in Fig. 2 and Fig. 3. The 200 simulated node pairs are sorted by their throughputs under DSR-ETX in a non-decreasing order. The SASR algorithms can realize up to 3.9× and 6.3× throughputs compared with DSR-ETX under 11 Mbps and 54 Mbps, respectively, let alone those node pairs that suffer from hidden terminals under DSRETX. We note that the throughput gains tend to be higher for those node pairs which perform bad under DSDRETX, because these pairs correspond to paths with larger hopcounts, which contain more interference-free links. Moreover, as shown by Fig. 2(a), 22% node pairs have doubled throughputs when SASR-MIN is used. While in Fig. 3(a), there are 35% of such node pairs.

Consequently, similar to the cumulative distributions in Fig. 1, SASR algorithms can achieve larger throughput gains under 54 Mbps. We can also observe that cost maximizing fusion has inferior performance to minimizing fusion, especially for those pairs with small throughputs under DSRETX. Besides, the performance fluctuations of SASR algorithms in Fig. 2 and Fig. 3 are due to different numbers of non-interfering links in different areas of the topologyi.e., the SASR algorithms do not have much potential to improve the throughputs in those areas with limited number of non-interfering links. However, owing to cost fusion, SASR algorithms inevitably need longer routing requests, and select paths that require more transmissions, and thus consume more energy. As mentioned above, a node adds one additional bit for each of the previous forwarders in the route request. Hence, on one hand, for a path P, there will be |P| (|P|+1) =2 such bits in a corresponding route request. On the other hand, in original DSR-ETX, besides the packet header (calculated as 20 bytes), a route request contains the MAC address of each forwarder (48 bits), as well as the cost of each link (calculated as 4 bytes). Fig. 4 illustrates the extra transmission cost of route request. Clearly, the extra cost is below 10% even for a path of as long as 15 hop. If taking the size of a whole batch into account, the extra cost of route request is even lower.

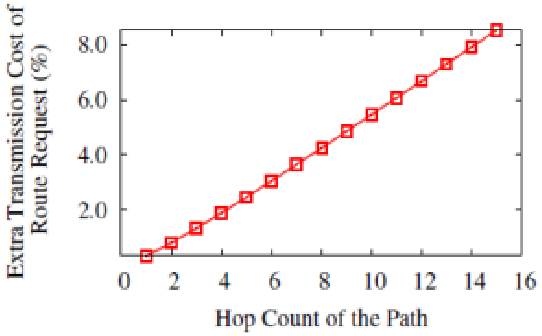


Fig 4. Extra Transmission Cost of Route Request Induced by SASR Algorithms.

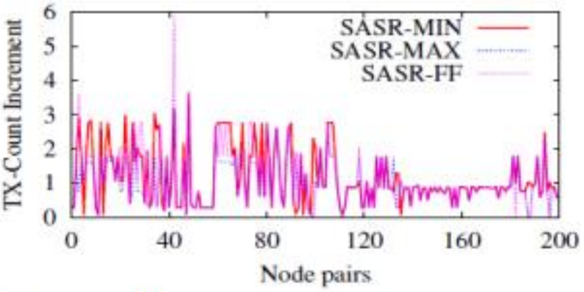
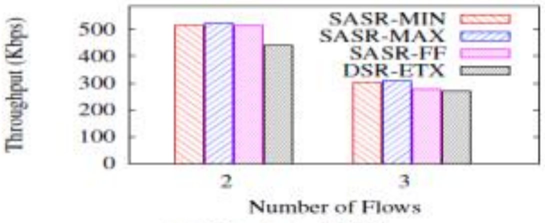


Fig 5. Overall Transmission Count Increments Induced by SASR Algorithms.

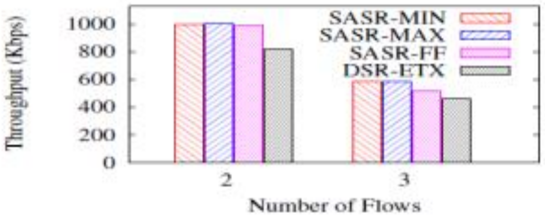
What's more,Fig5 shows that the increment in transmission counts is not much and acceptable considering the throughput gains. For all the three algorithms, more than 80% of the node pairs only need no more than 2 additional overall transmissions compared with DSRETX. Interestingly,the SASR algorithms show greater transmission counts increments for longer paths, from which they achieve higher throughput gains, as well.

2. Multi-Flow Scenario

Fig. 6 presents the average per-flow throughputs in the multi-flow case. With 2 and 3 concurrent flows, the three SASR algorithms can still improve the throughputs compared with DSR-ETX. Specifically, under the data rate of 11 Mbps, the throughput gains of SASR-MIN over DSRETX are 17.2% with 2 flows and 12.6% with 3 flows, respectively. When it comes to 54 Mbps, the corresponding throughput gains increase to 21.5% and 27.9%. Considering that with the existence of multiple flows, the SASR algorithms will induce a larger extra transmission cost than in the single-flow case, load balancing throughout the network can be applied to improve the performance of SASR with multiple flows. However, that is beyond the scope of this work.



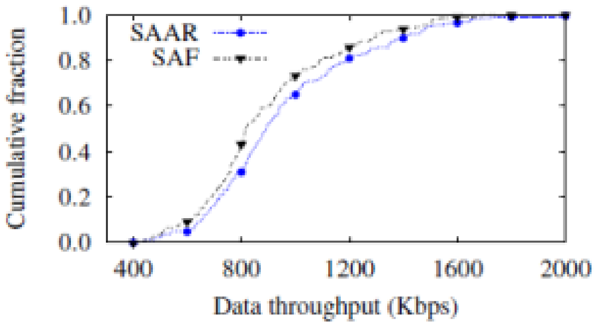
(a) Data Rate: 11 Mbps



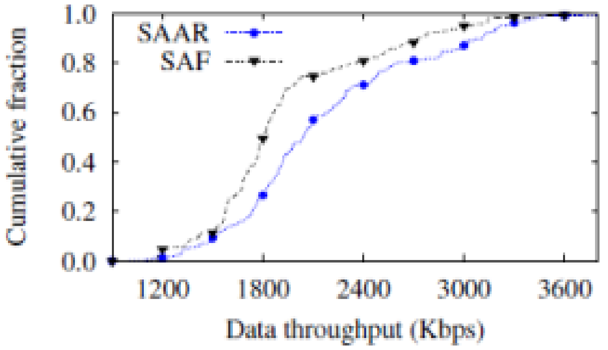
(b) Data Rate: 54 Mbps

Fig 6. Average Throughputs with Multiple Concurrent Flows.

B. Performance of SAAR Algorithm



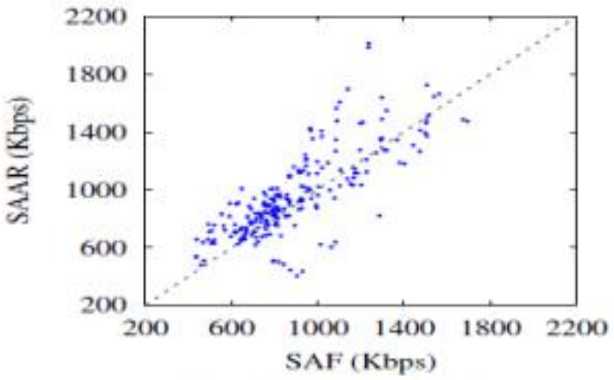
(a) Data Rate: 11 Mbps



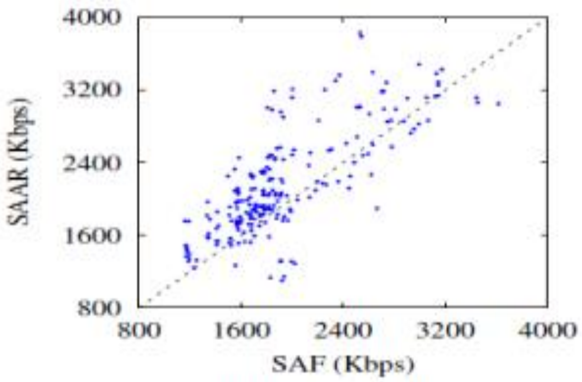
(b) Data Rate: 54 Mbps

We present the cumulative distributions of end-to-end throughputs achieved by SAAR and SAF in Fig. 7. For any path routing, the throughput gains are also more significantly under the data rate of 54 Mbps. The median gains over SAF are 9.3% and 13.2% under 11 Mbps and 54 Mbps, respectively.Considering the more comprehensive interfering situations in any path routing, although there are more nodes participating in packet forwarding, and more opportunities of concurrent transmissions among hyperlinks, it is non-trivial to achieve as great improvements as in single-path routing. However, the gains in Fig. 8 are quite obvious, as well.

What's more, under both data rates, the three SASR algorithms realize a throughput gain of 10% in the worst case. Therefore, the performance of SASR algorithms is better under higher data rate, because a higher data rate needs a shorter transmission time, which results in more opportunities of spatial reuse between links. In addition, SASR-MIN/FF gets better results than SASRMAX. This implies that cost minimizing fusion tends to give more reasonable path cost than maximizing fusion. Fig. 1 also shows that SASR-FF achieves similar performance as SASR-MIN. Considering its low computation complexity, the SASR-FF algorithm is likely to achieve satisfactory performance in practice. We present detailed pair wise comparisons in Fig. 2 and Fig. 3. The 200 simulated node pairs are sorted by their throughputs under DSR-ETX in a non-decreasing order.



(a) Data Rate: 11 Mbps



(b) Data Rate: 54 Mbps

Fig 8. Pair wise Comparisons between SAAR and SAF.

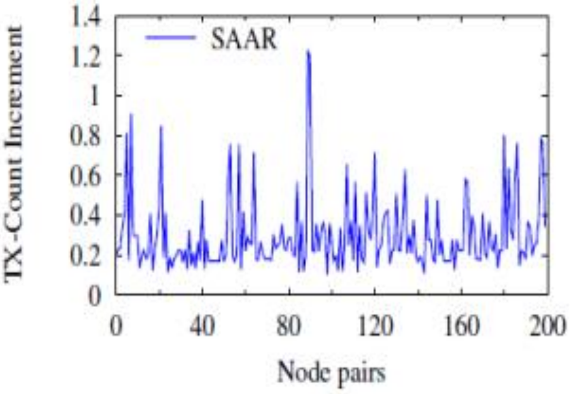


Fig 9. Overall Transmission Count Increments Induced by SAAR Algorithm.

What's more, we provide the pair wise end-to-end throughputs with the scatter plots in Fig. 8. We are glad to find that most of the simulated node pairs display significant gains in throughputs. For the data rate of 11 Mbps, the throughput gain is up to 62.7%. For 54 Mbps, it is up to 71.6%. In addition, there are 26.5% and 33.2% of the node pairs realizing a throughput gain of at least 20% under the two data rates, respectively. Then, Fig. 9 shows the amount of additional transmissions required by SAAR, compared with SAF. Except for only one source-destination pair, the increments of transmission counts do not exceed one.

V. RESULTS AND DISCUSSION

This algorithm takes the output of the SASR_MIN algorithm to find the course with the lowest cost of considering the idea of spatial reusability. It takes each direction and traverses through it to discover any element in non-interfacing set in it. If it reveals a pair of noninterfacing nodes inside the route, it combines the fee by means of most effective thinking about the best value a few of the non-interfacing nodes. Thus it reveals the new fee for all viable paths from the supply node to vacation spot node. And compare the total value of each direction to find the brand new route with minimum cost.
Algorithm

- Take the output from SASR_MIN algorithm.
- Traverse thru each route from source node to the destination node to find in the event that they have any pair from the non-interfacing set that acquired as the output of SASR_MIN algorithm.
- On locating any pair of non-interfacing nodes in the path, combine the hyperlink costs of non-interfacing sets.
- For that, locate the best link fee link price from the non-interfacing set and consist of only that price while calculating the total value of the route.
- Exclude the one with minimum link fee in a non-interfacing set of nodes.
- Compare between the new expenses and pick the one with minimum value as the proper direction from source node to destination node.

Here evaluated the performance of SASR_MIN and SASR_FF set of rules through the usage of Java as the the front end and wampserver because the again quit. Evaluation is executed on the assumption that all the nodes use same transmission charge. Comparison among traditional Dijikstra's set of rules and proposed SASR algorithm is performed here.

VI. CONCLUSION AND FUTURE SCOPE

End-to-quit throughput in multi-hop wi-fi structures can be pretty improved through the use of spatial reusability of the wireless conversation media. By taking this into consideration, added an algorithm, SASR for spatial reusability-conscious single-path routing. The set of rules is proposed in two elements: SASR_MIN and SASR_FF algorithms. Both sub-algorithms combine to present a minimum cost- most quit-to-stop throughput direction as output. An additional benefit of this device is that extremely good throughput gains simplest require perfect extra transmission overheads. Implemented proposed protocol and in comparison it with present routing protocols. Assessment demonstrated that SASR set of rules finished extra noteworthy end-to-give up throughput boom underneath higher records prices. As a destiny work, the proposed gadget might be applied in different constellation size and then examine and examine results with exiting protocols. Another path is to further discover possibilities to enhance the performance of our routing algorithms by using analyzing special underperforming instances diagnosed in the assessment. Another direction is to incorporate a selection of route with AI to get a extra optimized course.

REFERENCES

[1] W. Hu, J. Xie, and Z. Zhang, "Practical opportunistic routing in high-speed multi-rate Wireless mesh networks," in Proc. 14th ACM Int. Symp. Mobile Ad Hoc Netw. Comput. 2013, pp. 127–136.
[2] N. M. Jones, B. Shrader, and E. Modiano, "Optimal routing and scheduling for a simple network coding scheme," in Proc. INFOCOM, 2012, pp. 352–360.
[3] S. Zhao, L. Fu, X. Wang, and Q. Zhang, "Fundamental relationship between node density and delay in wireless ad hoc

networks with unreliable links," in Proc. 17th Annu. Int. Conf. Mobile Comput. Netw. 2011, pp. 337–348.
[4] R. P. Laufer, H. Dubois-Ferri_ere, and L. Kleinrock, "Multirateanypathrouting in wireless mesh networks," in Proc. INFOCOM, 2009, pp. 37–45.
[5] Y. Lin, B. Li, and B. Liang, "Codeor: Opportunistic routing in wireless mesh networks with segmented network coding," in Proc. IEEE Int. Conf. Netw. Protocols, 2008, pp. 13–22.
[6] G. Jakllari, S. Eidenbenz, N. W. Hengartner, S. V. Krishnamurthy, and M. Faloutsos, "Link. Positions matter: A noncommutative routing metric for a wireless mesh network," in Proc. IEEE 27thConf. Comput. Commun., 2008, pp. 744–752.
[7] S. Chachulski, M. Jennings, S. Katti, and D. Katabi, "Trading structure for randomness in wireless opportunistic ro uting," in Proc. SIGCOMM Conf. Appl., Technol., Archit. Protocols Comput. Commun., 2007, pp. 169–180.
[8] T.-S. Kim, J. C. Hou, and H. Lim, "Improving spatial reuse through tuning transmit power, carrier sense threshold, and data rate in multihop wireless networks," in Proc. 12th Annu. Int. Conf. Mobile Comput. Netw., 2006, pp. 366–377.
[9] S. Biswas and R. Morris, "Exor: Opportunistic multi-hop routing for wireless networks," in Proc. SIGCOMM Conf. Appl., Technol., Archit., Protocols Comput. Commun., 2005, pp. 133-144 .
[10] J. Padhye, S. Agarwal, V. N. Padmanabhan, L. Qiu, A. Rao, and B. Zill, "Estimation of link interference in static multi-hop wireless networks," in Proc. Internet Meas. Conf., 2005, p 28.
[11] A. Adya, P. Bahl, J. Padhye, A. Wolman, and L. Zhou, "A multi-radio unification protocol for IEEE 802.11 wireless networks," in Proc. 1st Int. Conf. Broadband Netw., 2004, pp. 344–345.
[12] R. Draves, J. Padhye, and B. Zill, "Routing in multi-radio, multihop wireless mesh networks," in Proc. 10th Annu. Int. Conf. Mobile Comput. Netw., 2004, pp. 114–128.
[13] R. Cohen, and S. Havlin, (2003, Feb.). Scale-free networks are ultrasmall. Phys. Rev. Lett. [Online] 90, p. 058701.Available: http://link.aps.org/doi/10.1103/PhysRevLett.90.058701.
[14] D. S. J. D. Couto, D. Aguayo, J. C. Bicket, and R. Morris, "A high throughput path metric for multi-hop wireless routing," in Proc. 9th Annu. Int. Conf. Mobile Comput. Netw., 2003, p 134–146.
[15] C. E. Perkins and E. M. Belding-Royer, "Ad-hoc on-demand distance vector routing," in Proc. 2nd IEEE Workshop Mobile Comput.Syst. Appl., 1999, pp. 90–100.
[16] J. Broch, D. A. Maltz, D. B. Johnson, Y.-C. Hu, and J. G. Jetcheva, "A Performance Comparison of multi-hop wireless ad hoc network routing protocols," in Proc. 4th Annu. ACM/IEEE Int. Conf. Mobile Comput. Newt., 1998, pp. 85–97.
[17] D. B. Johnson and D. A. Maltz, "Dynamic source routing in ad hoc wireless networks," Mobile Comput., vol. 353, pp. 153– 181, 1996.
[18] C. E. Perkins and P. Bhagwat, "Highly dynamic destination sequenced distance-vector routing (DSDV) for mobile computers," in Proc. Conf. Commun. Archit., Protocols Appl., 1994, pp. 234–244.

Authors Profile

Vinodh P Vijayan, HOD-CSE, Mangalam College of Engineering, Kottayam, India. He has many years of experience in teaching Undergraduate program and Post graduate programs of M G University and APJ KTU. He was an Adjunct professor for IGNOU post graduate programs and visiting faculty for BITS Pilani's Post Graduate programs. He has published many papers with SCI, SCIE & Scopus indexed International Journals. He has served as author/reviewer for many technical publications. His research area includes Soft Computing, AI, Bio-inspired computing, Computer Networks, IoT etc.

.

Neena Joseph has published many papers with International Journals. She got a rich teaching experience of 8 years in the field of computer science and Engineering which include UG and PG students. She is a well known technical consultant and motivational speaker. Her area of interest includes internet Compiler, cloud infrastructure management, IoT, computer networks and processor architecture.