Volume 5, Issue 9, September 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Advanced Energy Effective Cooperative Routing Protocol for Reliability Improvement in MANET

Nitesh Baghel
Department of C. S. E.,
AISECT University, Bhopal, India

Prof. Sitesh Kumar Sinha
Dean
AISECT University, Bhopal, India

Mukesh Kumar
HOD, CSE Dept.
AISECT University, Bhopal, India

Abstract— Ad-hoc mobile network uses relay nodes for communicate to other stations if anywhere difficult to install large infrastructure. Ad-hoc network consists of various mobile nodes these nodes are free to move independently within network area hence the topology of Mobile Ad-hoc Network (MANET) becomes dynamic and hard to manage. Such network is very useful where existing infrastructure for communication is unable to work properly by adding any new node automatic manner. But this autonomous feature makes MANET less effective by facing many external problems such as limited energy of nodes and dynamic location alteration within geographic location. So it is necessary for ad hoc network to manage real time or multicast communication. Hence to give effective communication and quality of service (QOS) with optimum energy utilization of mobile nodes is crucial task for design of MANET. This work gives an enhanced protocol extended version of cooperative ad-hoc routing algorithm (C-AODV) scheme by calculating weights of nodes for even load distribution to improve overall network optimum energy utilization. This work calculates total propagation delay of communication path with remain energy of total path and drives a weight cost for path and select best weighted path for current communication and reserve second best path for future use. All simulation done to compare proposed work with existing methods shows effectiveness of introduced method.

Keywords— weight cost, remain batter power, C-AODV, end to end delay, node reliability, energy efficiency

I. INTRODUCTION

The most popular network now a day is Wireless local area network due to its adaptive and portable nature. Every user like to connect their mobile phones or laptops to access network on ad-hoc basis for specific task perform. The best method is to solve major problems of wireless network as soon as possible for time based network implementation. There is need to design such system where any node may join to access point this access point normally connected to wired internet access. But without access point nodes may connects identical LAN and can share their data directly.

WSN have to face many such conditions where access point is not possible. Still user wants to communicate with other devices within restrictions in transmission also have to face cost and right matters. A practical mobile adhoc network may show as figure 1. Normally such network consists of mobile nodes which can move independently within geographical area any node can connect easily into existing network. These nodes can perform computing or processing of data and able to transmit and receive data simultaneously. As given in figure wireless mobile node may be as vehicle consists of transmission device, any airplane, a person with mobile phone to enable wireless transmission between them.

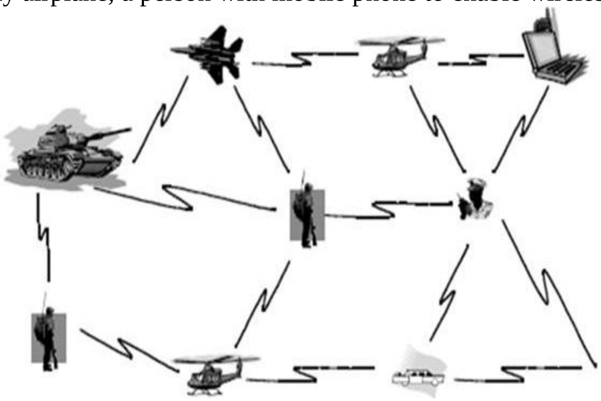

Fig 1 Overview of Mobile Ad-hoc Network

This type of networks is called ah-hoc wireless networks [1] because of its nature of working in absence of existing infrastructure network when demand for communication on mesh topology based [2]. The major challenge of such type network is to find path for data transmission between these dynamic movable nodes. Opposite of infrastructure network this ad hoc network doesn't have dedicated router nodes for route discovery. The routing is need to done by mobile nodes itself but these nodes are unreliable, dynamic movable and have restricted energy power or other resources.

II. RELATED WORK

Reliability and power management is essential for the sensors/actuators network in wireless observation systems supported WSANs [3] with a restricted quantity of energy to pay. to beat this drawback paper [3] provides the cooperative-based routing algorithmic program to assurance a decent performance trade-off among responsibleness and power potency techniques of wireless observation theme. Authors are quantify the impact of the planned algorithmic program on the generally observation system responsibleness and energy potency and a compare with bestowed with the normal Ad-hoc On-Distance Vector (AODV), the cooperation on the shortest non-cooperative path (CASNCP) and minimum-power cooperative routing (MPCR) algorithms.

Another technique planned in paper [4] by energy-efficient GR algorithms: ORF and OFEB to increase the network life and to induce higher alternative network performance metrics. The results for this theme with existing GR algorithms as well as MFR and NFP show effectiveness of this technique. New ORF algorithmic program picks because the next hop node the node nearest to the optimum transmission vary and thus minimizes the energy consumption. Second new OFEB algorithmic program chooses consequent hop node because the node that minimizes the energy consumption. this is often a node that has the most effective combination of energy reserves and wishes the minimum energy to be reached. the load issue a determines the relative significance placed on these 2 needs.

Paper [5] has illustrated responsible Map Routing (RMR) protocol for military science mobile spontaneous networks that require high consistency. Authors have introduced a responsible operate by the degrees of responsible of special position, unidentified land are often delineate. Results specify that the special maps of network responsible that square measure in use by RMR prove low sensitivity to node quality. The RMR protocol with success discover routes throughout reliable and trustworthy space, keep from probably teflon or compromised regions supported trust management signals transmitted by the nodes. The results specify that an excellent packet delivery quantitative relation (PDR) and a less average delay are often accomplishing end-to-end. The RMR protocol performs well in quick quality, additional density set-up thanks to it's out routing overhead and special approach, and is appropriate for military science mobile spontaneous networks.

In paper [6], authors have influence the optimum constraint calibration of the OLSR routing protocol to be utilized in VANETs by employing a regular improvement tool. For this task, author distinct associate improvement policy supported coupling improvement algorithms (PSO, DE, GA, and SA) and also the ns − a pair of network machine. conjointly judge the optimized OLSR configurations with the quality one in RFC 3626 additionally like human skilled configurations created within the current state of the art. In turn, valid the optimized configurations found by comparison them with one another and with the quality calibration in RFC 3626 and learning their performance in terms of QoS over fifty four VANET situations.

The paper [7] inspects the longevity of wireless sensing element networks. Wireless sensing element network routing algorithms square measure generally categorize into 2 category, flat multi-hop routing algorithms, that square measure excellent in their capability in minimizing the full power utilization of the network by skilled transmission area, and stratified multi-hop routing algorithms, that cut back the quantity of knowledge flow within the network by capitalizing on the very associated nature of the collected information by apply data aggregation. In each category, sink node isolation sure the longevity of the wireless sensing element network. Authors have planned HYMN and exposed through mathematical analysis the energy consumption and also the conditions for optimality of HYMN. Finally, HYMN is hopeful in terms of its capability to induce higher the longevity of wireless sensing element networks.

Several modification of the ad-hoc on-demand distance vector (AODV) [8] has been projected within the literature to develop the QoS in WSANs and eventually in WBANs. In [9] a QoS routing protocol is obtainable that created routes with a group to the aspect information measure. In [10], a protocol is launch so as to attain path finding at the same time with slot programming time division multiple access (TDMA).

In [11] author used information measure by PDR. This technique provides high PDR with lower overheads. however conjointly create longer finish to finish delay ought to pay. Most of protocol performance gets lower once congestion happens. though recent AODV modifications embrace load-balancing operations throughout the route set-up, once the trail is mounted they can't expeditiously influence a dynamic setting due to for example flash crowds, burst traffic, transient congestion and mobile nodes [12,13,14,15,16, 17].

Newly, the prospect of initiate cooperation communication to advance observation system performance has been instructed in [18, 19,20]. Conjointly literature programming and topology management algorithms are planned to boost the network energy potency [21, 22, 23, 24,25, 26]. Furthermore in [27] distributed routing algorithms square measure describes, like minimum-power cooperative routing algorithmic program (MPCR) and also the cooperation on the shortest non-cooperative path (CASNCP) algorithmic program. the primary algorithmic program takes into thought the cooperative communications whereas constructing the minimum-power route. The ensuing power formulas for transmission mechanism and cooperative transmission square measure utilized to construct the minimum-power route. It are often distributive enforced by the attainder Ford shortest path algorithmic program. The CASNCP algorithmic program may be a heuristic algorithmic program that applies cooperative communications upon the shortest-path routes [27].

III. COOPERATION-BASED AD-HOC ROUTING ALGORITHM (C-AODV)

The most common routing protocol used for MANET network is AODV protocol [17] uses on demand route search whenever needed. Each mobile node keep information about its neighbors by transmits and receive hello packet after each predefine time period. If any node wants to send data and destination is not direct transmission range then only sender send request for path establishment. This route request generation is known as route discovery using route request packet (RREQ). This RREQ packet broadcast in network and received by each node present in network. This RREQ packet contains unique packet number as request ID, address of sender, address for destination, packet sequence number, packet life time within network.

On receiving this rreq packet by any neighbor this intermediate nodes update its routing table according information received for reverse route of sender and forward this rreq packet to its neighbor go for destination. If any intermediate node receive multiple copies of same rreq id due to flood of request packet it discards it. At last by passing to few or many intermediate nodes this rreq packet reaches destination node the destination node generates Route Reply packet (RREP) in reverse path which associates in rreq packet.

This rrep packet reached back to sender if sender gets more than one rrep packet its store shortest path for current communication and other path keep in record as backup path for destination node in its routing table. This backup path is used for route maintenance during overloading or path error this backup path selects for further communication without interrupting communication. By hello packet transmission every node keep updating its routing table for neighbors details. If any route is not used for a long time period so this route validity is expires and then this route is removed for routing table. RREQ sequence number play important role for route maintenance it also helps for preventing loops creation whenever route is requested. A high sequence number for rreq means it’s a fresh route other intermediate nodes may also update their routing table according to this information. AODV protocol is enough efficient to maintain route updating when error occurs.

Any node may disconnected from network for any reason such power failure or other problem such nodes are informed other nodes in network as bad nodes. For route discovery of such nodes by any sender is reported as route error (RERR) to destination nodes. When any node gets RERR packet for particular node it search this node in its routing table and delete all route path store for this nodes. If this bad node occurs during transmission of any source data and causes of link break a RERR packet is transmit to source node informed about link failure. As this RERR forwards to the source node all intermediate nodes updates their table also using this information as unreachable node for bad node.

AODV routing supported 2 steps initial one is route discovery and second is route maintain [18]. A supply node initiates a route discovery procedure by causing out a flood of RREQ messages, and every node receiving associate degree RREQ can air it. As mentioned once RREQ reached to destination it resend RREP packet to supply node in reverse path by its entire neighbour node. Thence associate degree intermediate node will received multiple RREP messages. Routing table of each node is updated as in step with underclassman RREP route having shorter route or the smaller path relating to its quality. With the C-AODV algorithmic program [3] doesn’t eliminate the previous info of the RREP regarding the choice methods to a destination however store it in a very routing table as alternative path. By doing thus, at the top of the route discovery part, every node has in its routing table each the present next hop and also the different ones to use to send information to a particular destination node. C-AODV algorithmic program throughout the route maintenance part, every node uses the greeting packet to tell sporadically the neighbor nodes concerning its queue length.

In this approach, every node will check if the queue length becomes full if its length is higher than a nominative congestion threshold (e.g. hour of the buffer size). Another reserve path is employed for communication.

In follows describe the aforementioned phases for the state of affairs delineate in Fig. 2a. Throughout the route discovery part (Figs. 2a and 2b), node Si1 needs to speak with the sink node, then it sends a flood of RREQs to the intermediate nodes. Allow us to suppose that the intermediate node Si1 receives initial RREP1 from the sink node through the trail Si2 a pair of Si5 (Fig. 2b). Once node Si1 receives RREP2 through the trail Si3 a pair of Si6, it uploads its routing table by choosing Si3 as another next hop to the sink node.

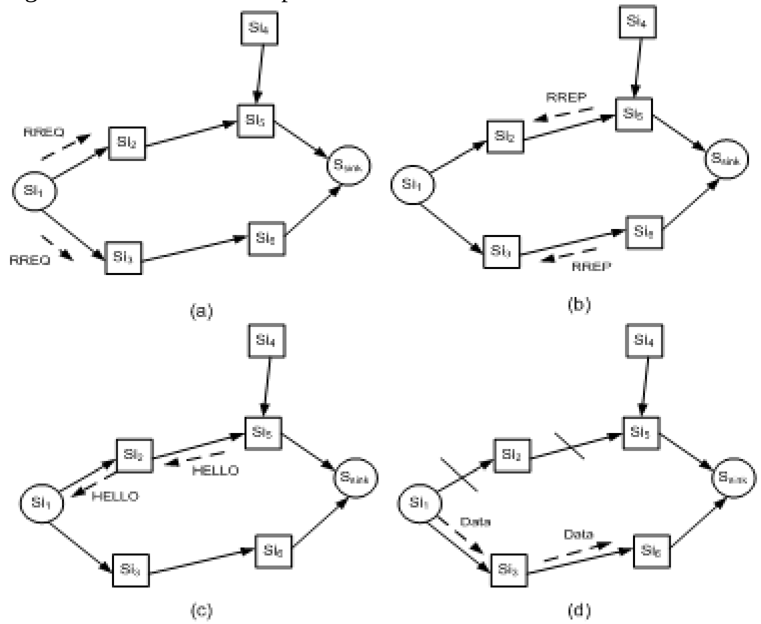

Fig. 2. C-AODV Protocol architecture

Fig 2a Discovery phase – RReq packets. Fig 2b Discovery phase – RRep packets.

Fig 2c Maintenance phase – HELLO packets. Fig 2d Cooperative algorithm – switching on an alternative path.

Notice that, in contrast to the standard AODV protocol, the information about the alternative route to the sink destination from the intermediate node Si3 is stored in the routing table of node Si1 as 'alternative' next hop information. During the maintenance phase, node Si1 uses the path Si2 2 Si5 and periodically receives information about the queue length of its neighbour nodes Si2 and Si3 by the HELLO packets (Fig. 2c). In the same way, Si2 has information aboutSi5's queue length. If the queue lengths of nodes Si5 and Si2 are increasing (Fig. 2d), then node Si1 checks its routing table observing that Si3 is an 'alternative' next hop. Therefore node Si1 will send packets to the sink node by the route Si3 2 Si6. Here point out that the proposed C-AODV is a hop by hop strategy that can dynamically balance the load avoiding congestion and to improve the QoS. Moreover, the modifications of our proposed algorithm can be implemented on the top of the AODV protocol and do not require much overhead in terms of memory and computation.

IV. PROPOSED METHOD

When any node ready to send data source node seeking route to send a data packet to a destination

1) Source node checks its route table for existing valid route to the destination node.
2) If a route exists, it simply forwards the packets to the next hop along the way to the destination.
3) Else if there is no route in the table,
   The source node begins a route discovery process.
4) It broadcasts a route request (RREQ) packet to its immediate neighbours and those nodes broadcast further to their neighbours until the request either reaches an intermediate node with a route to the destination or the destination node itself.
5) The route request packet contains
   a. the IP address of the source node,
   b. current sequence number,
   c. IP address of the destination node,
   d. the last known sequence number,
   e. Remaining battery power of path and
   f. Average Delay of path.

Initially Remaining battery power of path and Average Delay of path is set to zero by source node.

6) An intermediate node can reply to the route request packet only if it has a destination sequence number that is greater than or equal to the number contained in the route request packet header.
7) When the intermediate nodes forward route request packets to their neighbours put its remaining battery power and Average delay of reaching packet from its neighbour to this node with RREQ packet, they record in their route tables the address of the neighbour from which the first copy of the packet has arrived.
8) This recorded information is later used to construct the reverse path for the route reply (RREP) packet.
9) If the same RREQ packets arrive later on, they are discarded.
10) When the RREP packet arrives from the destination or the intermediate node, the nodes forward it along the established reverse path and store the forward route entry in their route table by the use of symmetric links.
11) When source node received RREP packet it select first RREP packet for route establishment for communication on basis of weight calculate by delay and remaining battery power as
    Wp = A*Delay + B*RP

    Where Delay is average delay calculated by all intermediate nodes till destination

    RP is remaining battery power of route it is minimum power if any node in whole path because if any node off due to power all route will fail for communication.

    A and B are constants values for these constants between 0 and 1 such that A + B = 1.
12) On receiving another RREP from different route source will not discard this route it select second best route according above weight calculation and keep record this route. This route is select if current route have more traffic or overload according base method.
13) Route maintenance is required if either the destination or the intermediate node moves away.
14) Route maintenance is performed by sending a link failure notification message to each of its upstream neighbours to ensure the deletion of that particular part of the route.

Once the message reaches to source node, it then re-initiates the route discovery process.

V. RESULT AND SIMULATIONS

To analyse proposed technique with real world environment this section gives all detail about simulation and results captured. The proposed scheme is analysed for performance and compared with existing techniques. The simulation is done within linux platform on operating system ubutu 12.04 versions, and NS-3 simulator is implemented for MANET traffic generation and data gathering. NS-3 is a powerful open source software and widely used for network analysis research works due to its license free feature.

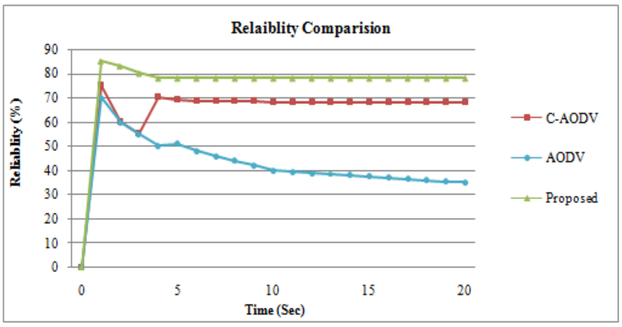

Fig. 3. Reliability Comparison with existing methods

As given representative situation in Fig. 2a to assess the effectiveness of the modifications introduced at the highest level of the C-AODV rule to implement the planned protocol. Thus a performance comparison of the planned methodology than the C-AODV is additionally thought of. Within the network situation as shown in Fig. 1a, supply Si3 sends packets to the sink and at the time instant 5s node Si4 begins to send packets emulating a dynamic congestion situation. we have a tendency to show the effectiveness of the planned rule in leveling the load by exploitation various methods. In distinction, for the quality AODV rule the trail to the destination is static notwithstanding congestion happens with the ensuing buffer overflow and worsening of the QoS. Indeed, as shown in Fig. 3, the dependableness obtained exploitation planned methodology is above with C-AODV. Additionally, the typical packet delay is lower as shown in Table a pair of and Fig. 4. Planned rule switches the traffic between the intermediate nodes avoiding buffer overflow with choice of best route and store 2 a lot of path as reservation for backup routing. In distinction, AODV chiefly uses Si2 and Si5 with a ensuing buffer overflow and C-AODV balances node energy (e.g. between nodes Si2, Si3, Si5, Si6) however planned rule takes economical path in keeping with stay energy of nodes for route choice therefore reduces the overall energy consumption than the AODV rule and C-AODV because it seems from Fig. 4. During this 3ay, all nodes have ensuing nearly equal energy consumption. This decreases the likelihood of a node fault with a raised network period of time.

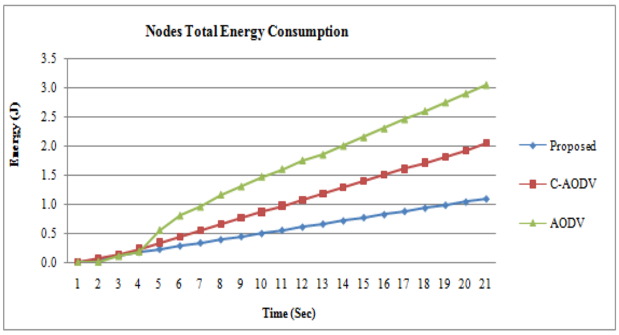

Fig. 4. Nodes Energy consumption in network.

VI. CONCLUSION

This work gives improved cooperative communication protocol for data transmission in MANET based on AODV protocol. This helps to monitor network and handled congestion before it occurs in network. This method uses weight factor to select best path for communication and also reserve other path for future if failure or congestion occurs during transmission hence extra effort not needed for again route discovery. The proposed method is performed with existing method with implementation of all realistic parameter on same platform for fare comparison decision making. This method is compare with C-AODV existing method and proposed method shows better results in terms of total network energy utilization and reliability of network during network monitoring system. More over these result given method also performed well for parameters like packet end to end delay, scalability of network. Proposed weighted method gives a good tradeoff between reliability and energy efficiency particularly. Energy of nodes are main issue during design of MANET for any purpose. This scheme can be implementing within any mobile network easily. In future other parameters also can be used for more improvement of energy efficiency and reliability of network. The cost of monitoring system can be minimized by using less buffer memory used for storing reserve path without effect on reliability is open research work for future enhancement.

REFERENCES

[1] C. Perkins, editor. Ad hoc Networking. Addison Wesley, 2001.

[2] A survey of defense technology: The software revolution - to dissolve, to disappear, June 1995.

[3] S. Manfredi, "Reliable and energy-efficient cooperative routing algorithm for wireless monitoring systems", Vol. 2, Iss. 2, pp. 128–135, IET Wirel. Sens. Syst., IEEE, 2012.

[4] W. Feng1 L. Zhang1 J.M.H. Elmirghani, "Energy saving geographic routing in ad hoc wireless networks", Vol. 6, Iss. 1, pp. 116–124, IET Commun., IEEE, 2012.

[5] Amir A. Gohari, and VolkanRodoplu, “RMR: Reliability Map Routing for Tactical Mobile Ad Hoc Networks”, Journal On Selected Areas In Communications, Vol. 29, No. 10, Page 1935-1947, IEEE, 2011.

[6] Jamal Toutouh, Enrique Alba, "Intelligent OLSR Routing Protocol Optimization for VANETs”, IEEE Transactions On Vehicular Technology, Page 1884-1894, VOL. 61, NO. 4, IEEE, 2012.

[7] Ahmed E.A.A. Abdulla, Hiroki Nishiyama, Jie Yang, Nirwan Ansari, and Nei Kato, “HYMN: A Novel Hybrid Multi-Hop Routing Algorithm to Improve the Longevity of WSNs”, IEEE Transactions On Wireless Communications, Page 2531-2541, VOL. 11, NO. 7, IEEE, 2012.

[8] Perkins, C., Royer, E., Das, S.: ‘Ad hoc on demand distance vector routing’. IETF draft, January 2002.

[9] Zhu, C., Corson, M.S.: ‘QoS routing for mobile ad hoc networks’. 21st INFOCOM’02, New York, June 2002.

[10] Gerasimov, I., Simon, R.: ‘A bandwidth-reservation mechanism for on-demand ad hoc path finding’. mt 35th Annual Simulation Symp. (SS’02), pp. 20–27.

[11] Zhang, Y., Gulliver, T.A.: ‘Quality of service for ad hoc on-demand distance vector routing’. IEEE WiMob, vol. 3, pp. 192–196, 2005.

[12] Argyriou, A., Madisetti, V.: ‘Using a new protocol to enhance path reliability and realize load balancing in mobile ad hoc networks’, Ad Hoc Netw 4, pp. 60–74., Elsevier 2006.

[13] Jung, J.W., Choi, D.I., Kwon, K., Chong, I., ‘A correlated load aware routing protocol in mobile adhoc networks’. ECUMN 2004, pp. 227–236, 2004.

[14] Lee, Y.J., Riley, G.F.: ‘A workload-based adaptive load-balancing technique for mobile ad hoc networks’ (IEEE Communication Society, WCNC, 2005.

[15] Pham, P.P., Perreau, S.: ‘Increasing the network performance using multi-path routing mechanism with load balance’, Ad Hoc Netw. , 2, (4), pp. 433–459,, 2004.

[16] Saigal, V., Nayak, A.K., Pradhan, S.K., Mall, R.: ‘Load balanced routing in mobile ad hoc networks’, Elsevier Comput. Commun., , 27, pp. 295–305, 2004.

[17] Yoo, Y., Ahn, S.: ‘A simple load balancing approach in secure ad hoc networks’. ICOIN 2004, pp. 44–53, 2004.

[18] Zhong, S., Li, E., Liu, Y.G., et al.: ‘On designing incentive-compatible routing and forwarding protocols in wireless ad-hoc networks’, 13, (6), pp. 799–816.Wirel. Netw., 2007.

[19] Laneman, J.N., Wornell, G.W., Tse, D.N.C.: ‘An efficient protocol for realizing cooperative diversity in wireless networks’. Proc. IEEE ISIT, Washington, 2004.

[20] Hunter, T.E., Nosratinia, A.: ‘Cooperative diversity through coding’. Proc. IEEE ISIT, Switzerland, 2002.

[21] Albers, S., Fujiwara. H, ‘Energy-efficient algorithms for flow time minimization’, ACM Trans. Algorithms, 2007.

[22] Ambu¨hl, C.: ‘An optimal bound for the MST algorithm to compute energy efficient broadcast trees in wireless networks’. Proc. 32nd ICALP 2007.

[23] Baptiste, P., Chrobak, M., Du¨rr, C.: ‘Polynomial time algorithms for minimum energy scheduling’. Proc 15th Annual European Symp. On Algorithms, 2007.

[24] Beccetti, L., Korteweg, P., Marchetti-Spaccamela, ‘Latency constrained aggregation in sensor networks’. Proc. 14th AESA, pp. 88–99 2006,

[25] Irani, S., Shukla, S.K., Gupta, R.: ‘Algorithms for power savings’ (ACM Trans. Algorithms., 2007.

[26] Wan, P.-J., Calinescu, G., Li, X.-Y., Frieder, O.: ‘Minimum-energy broadcasting in static ad hoc wireless networks’, Wirel. Netw. 8, pp. 607–617, 2002.

[27] Ray Liu, K.J., Sadek, A.K., Su, W., Kwasiuski, A.: ‘Cooperative communications and networking’ Cambridge University Press, 2009.

