International Journal of Power Control Signal and Computation(IJPCSC)
Vol 8. No.1 – Jan-March 2016 Pp.134-144

available at : www.ijcns.com
ISSN: 0976-268X

EFFICIENT ENERGY AWARE ROUTING IN MANET

M.MOHANAPRIYA
Dept of Computer Science & engg.
P.G Scholar
AnnamalaiUniversity
Tamilnadu, India.

ABSTRACT—Concerning illustration engineering quickly increases, different sensing Also portability abilities need turned into promptly accessible on gadgets and, consequently, versatile specially appointed networks (MANETs) would continuously deployed with perform a amount of significant assignments. In MANET, force mindful is vital test issue with move forward those correspondence vitality proficiency during single person hubs. Of the proficient energy mindful directing (EPRDSR), another control mindful directing protocol that increments those system lifetime for manes. As opposed with traditional force mindful algorithms, EPRDSR identifies those ability of a hub not only Eventually Tom's perusing its remaining battery power, as well as Eventually Tom's perusing the anticipated vitality went through Previously, dependably sending information packets over a particular connection. Utilizing a mini-max formulation, EPRDSR selects those way that need those biggest bundle ability toward those littlest lingering bundle transmission ability. This protocol must have the capacity should handle secondary versatility of the hubs that frequently all the reason transforms in the system topology. This paper evaluates three specially appointed networks directing conventions (MTPR, DSR and EPRDSR) in distinctive organize scales, taking under attention those energy utilization. Indeed, those aggregate Vitality utilization Furthermore abatements those imply delay, particularly to secondary load networks, same time accomplishing a great bundle conveyance proportion.

GENERAL TERMS —Control vitality productive algorithm for dynamic hot spot directing.

KEYWORDS—MANETs, MTPR, DSR, EPRDSR, Residual power for battery.

I. INTRODUCATION

An versatile specially appointed organize (MANET) is An ceaselessly self-configuring, infrastructure-less system of versatile devices, basically alluded will Similarly as "Nodes" which are joined without wires. Every gadget for An manes will be nothing should move freely to any direction, Also will Along these lines progress its joins to other units every now and again. Each must ahead movement inconsequential on its own use, and subsequently make An switch.

A. Security issues in MANETs

A significant number Scrutinize meets expectations have concentrated on the security from claiming MANETs. The vast majority about them manage aversion What's more

identification methodologies on distinctive misbehaving hubs.

A portion for security tests incorporate those taking after.

• *Progressive topology:* over MANETs hub might join alternately take off rapidly. Concerning illustration hub moves every now and again building trust around hubs need aid exceptionally troublesome.

• *Absence of vital Authority:* over manes there will make no incorporated power in foundation organize. In this way actualizing security without unified power may be an testing undertaking.

• *Battery Constraints:* portable hubs will a chance to be running with battery. Though hub energy used unnecessarily at that point hub might hails will unmoving pulley state.

• *Unstable Environment:* hubs might move haphazardly over manes. Along these lines pernicious hub might ambush also take the information.

B. Attacks in MANET

Versatile specially appointed networks need aid defenseless will Different strike not best from outside as well as starting with inside the organize itself. Understanding conceivable type of strike may be continuously the to start with step towards Creating useful security results. Nonattendance about whatever vital co-ordination component and imparted remote medium makes manes that's only the tip of the iceberg powerless with strike over wired organize there need aid number for strike that influence manes. These strikes could make ordered under two types: indifferent What's more dynamic strike.

C. Passive Attacks

Latent strike need aid the ambush that doesn't upset correct operation for organize. Attackers snoop information traded done system without adjusting it. Identification of these strikes will be troublesome since the operation about system itself doesn't get influenced.

D. Active Attacks

Dynamic strike would the strike that are performed by the pernicious hubs that bear exactly vitality cosset in place should perform the strike. Dynamic strike include a few adjustment from claiming information stream alternately making about false stream. Animated strike might make inside alternately outer.

• Outer strike are conveyed crazy Toward hubs that don't have a place with the organize.

• Internal strike are from compromised hubs that are and only the system.

Applications of MANETs

Specially appointed networks need aid suiting for use to circumstances the place an base may be inaccessibility alternately on convey particular case may be not expense compelling. Those accompanying need aid a portion of the critical requisitions.

• *Military Scenarios:* Manes backs strategic organize for military correspondence Furthermore robotized clash fields.

• *Salvage Operations:* It gives catastrophe recovery, methods substitution cost about altered framework system in the event about Ecological catastrophe.

• *Information Networks:* Manes gives help of the system to the return from claiming information the middle of versatile apparatuses.

• *Gadget Networks:* Gadget Networks helps those remote associations the middle of Different versatile apparatuses with the goal that they might impart.

• *Spare web association Sharing:* It likewise permits us to impart the web with different versatile apparatuses.

• *Sensor Network:* It comprises from claiming gadgets that bring ability of sensing, calculation furthermore remote systems administration. Remote sensor system combines

that force of the greater part three of them, like smoke detectors, electricity, and gas and water meters.

II. LITERATURE REVIEW

Sowjanya HariShankar, et.al.,[1] has proposed a work based on mobile ad hoc networks (MANETs), nodes are mobile and have limited energy resource that can quickly deplete due to multi-hop routing activities, which may gradually lead to an un-operational network. In the past decade, the hunt for a reliable and energy efficient MANETs routing protocol has been extensively researched. This paper proposes a novel AntNet-based routing scheme for MANETs, and its enhanced energy aware version, for which the routing decisions are facilitated based on the nodes residual energy. The residual energy generated by the energy aware protocol E-MAntNet is comparable or higher than that generated by its plain version MAntNet .E-MAntNet generates an equivalent or lesser number of dead nodes compared to its plain version MAntNet The total connections established when using EAODV falls off significantly when compared to AODV the number of connections established when using EMAntNet is comparable to that obtained with MAntNet, its plain version and when compared to E-AODV, E-MAntNet shows a better CE, an equivalent or better generated residual energy.

Kartik Chawad, Deepmala Gorana, [2] addressed Despite of much research activity over the past decades on mobile ad hoc wireless network (MANET), there is an important challenging issue related to mobile hosts/nodes battery power. This is owing to the prevalent constraints to extend the energy of nodes so that it could work for longer time. Moreover, battery power is also not transferable from one node to another node. The survey classifies the energy aware routing protocols, their functionality, benefits, limitations and finally the analysis of energy efficient routing protocols. An energy efficient routing protocol is required to choose the energy efficient route from source to destination. Energy efficiency is the main problem of the network.

Sapna B Kulkarni, Dr.Yuvaraju B N, [3] to describe in order to overcome this issue we propose to design Node connectivity, Energy and Bandwidth Aware Clustering Routing Algorithm. An efficient ENB cluster head selection algorithm based on the combination of important matrices Residual Energy (E), Node connectivity (C) and Available Bandwidth (B) is considered for election of the cluster head efficiently. The multimedia stream splits into multiple sub streams prior to transmission using Top-N rule selection approach algorithm. Shortest path multicast tree construction algorithm to transmit the real time traffic effectively among the nodes in MANETS. Using the cluster head as group leaders and members as leaf nodes, a shortest path multicast tree is established. This helps in transmitting multimedia data to different receivers. The multimedia traffic stream is split into multiple sub streams prior to transmission using Top-N rule selection approach.

Chun Hung, et.al, [4] to described wireless sensor networks are generally deployed in inhospitable terrain where the lightweight nodes are expected to detect an event and send relevant data to the Base Station. In such remote places it is generally not feasible to replace batteries quite often. Clustering is an approach to minimize energy consumption of such network. For the approach should be flexible enough to avoid excessive battery drain of the cluster heads particularly those near the BS and to address topology changes as nodes die out. In EASSR nodes switch between sleep and active modes thus it can better adapt to applications with heterogeneous energy capacities in sensor networks.

Marwan AI-Jemeli, Fawnizu A, et.al, [5] has proposed IEEE 802.15.4 mobile wireless sensor networks (MWSNs) have been investigated in literature. One major finding is that these networks suffer from control packet overhead and delivery ratio degradation. This increases the network's energy consumption. This paper introduces a cross-layer operation model that can improve the energy consumption

and system throughput of IEEE 802.15.4 MWSNs.

The location of the mobile nodes is embedded in the routing operation after the route discovery process. The location information is then utilized by the MAC layer transmission power control to adjust the transmission range of the node. It is highly effective cross-layer network operational model for MWSNs. The network model employs two major mechanisms, the first is controlling the amount of control packets being broadcast in mechanism can minimize the link error handling messages between the nodes.

Ruidong Li, et.al, [6] has developed big data strongly demands a network infrastructure having the capability to efficiently collect, process, cache, share, and deliver the data, instead of simple transmissions. Such network designs show the requirements of energy efficiency, availability, high performance, and data-aware intelligence. To meet these requirements, we adopt the information-centric networking (ICN) approach, where data are retrieved through names and in-network caching is utilized. However, as the typical existing ICN architectures, content centric network (CCN) cannot efficiently utilize the caches for data sharing because of the on-path caching strategy, and network of information (NetInf) demonstrates the resolution latency for data retrievals. To design an efficient and effective ICN architecture for big data sharing, we combine the strong points of CCN and NetInf, where information islands (IOIs) and management plane are utilized for direct data retrieval and global data discovery, respectively. The basic designs on data registration and data retrieval procedures. To enable the energy efficiency, the network models and examines the impact on the energy consumptions for the proposed architecture from the key factor, IOI size.

Mohemed M. E. A. Mahmoud, et.al, [7] has proposed E-STAR combines payment and trust systems with a trust-based and energy-aware routing protocol. The payment system rewards the nodes that relay others packets and charges those that send packets. The trust system evaluates the nodes competence and reliability in relaying packets in terms of multi-dimensional trust values. The trust values are attached to the nodes' public-key certificates to be used in making routing decisions. To develop two routing protocols to direct traffic through those highly-trusted nodes having sufficient energy to minimize the probability of breaking the route. E-STAR can stimulate the nodes not only to relay packets, but also to maintain route stability and report correct battery energy capability. This is because any loss of trust will result in loss of future earnings.

Xiaodng Lin, et.al,[8] to described the existing ad hoc routing protocols do not accommodate any security and are highly vulnerable to attacks. It also look at some suggested solutions that could be used when secure protocols are designed. The current protocols should not be used in hostile environments unless the applications are especially designed to operate under insecure routing or until protocols with enhanced security are introduced. This literature analyzes the secure routing against several kinds of attacks and it improves the performance and security based system. In these schemes, regardless of the existence of malicious nodes, the overhead of detection is constantly created, and the resource used for detection constantly wasted.

Subhankar Mishra, et.al,[9] to incorporated has deploying an energy efficient system exploiting the maximum lifetime of the network has remained a great challenge since years. The time period from the instant at which the network starts functioning to the time instant at which the first network node runs out of energy, i.e. the network lifetime is largely dependent on the system energy efficiency. In this paper, to look at energy efficient protocols, this can have significant impact on the lifetime of these networks. The cluster heads get drain out maximum energy in the wireless ad hoc networks. To propose an algorithm that deals with minimizing the rate of dissipation of energy of cluster heads.

Fei Dai, and Jie Wu [10] has developed as flooding-based routing schemes and localized

routing schemes, have their limitations. Motivated by ticket-based routing, we propose an on demand location-aided, ticket-based QoS routing protocol (LTBR). Two special cases of LTBR, LTBR-1 and LTBR-2, are discussed in detail. LTBR-1 uses a single ticket to find a route satisfying a given QoS constraint. LTBR-2 uses multiple tickets to search valid routes in a limited area. All tickets are guided via both location and QoS information. LTBR has lower overhead compared with the original ticket-based routing, because it does not rely on an underlying routing table. On the other hand, LTBR can find routes with better QoS qualities than traditional location-based protocols. Our simulation results show that LTBR-1 can find high quality routes in relatively dense networks with high probability and very low overhead. In sparse networks, LTBR-2 can be used to enhance the probability of finding high quality routes with acceptable overhead

III. DSR ARCHITECTURE

DSR includes two principle processes: course revelation What's more course support. Will execute the course finding phase, the sourball hub telecasts a course solicitation (RREQ) bundles through the system. If an intermediate hub needs directing in-formation of the end previously, its course cache, it will answer with a RREP of the hotspot hub. When the RREQ will be sent with an node, the hub includes its address data under the course record in the RREQ bundle. At end receives those RREQ, it might realize each go-between node's address "around those course. The end hub depends on the gathered directing majority of the data "around the packets in place on send An answer-paid RREP message of the hotspot hub alongside those entire directing data of the secured course. DSR doesn't need any identification mechanism, yet the sourball hub cam wood get at course majority of the data concerning the hubs on the course.

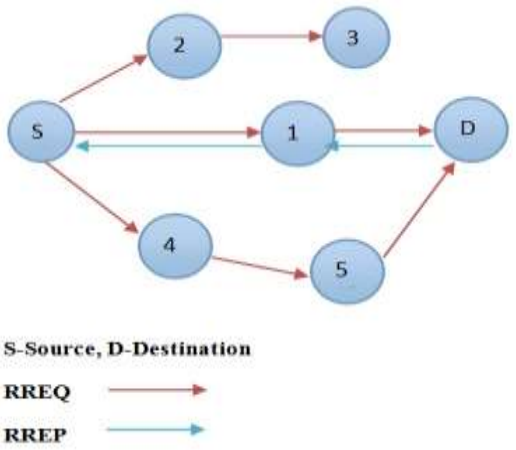


Fig. 3.1: Dynamic Source Routing

However, those hotspot hub might not important have the capacity will identify which of the middle of the road hubs need the directing majority of the data of the end or which need the answer-paid RREP message alternately those pernicious hub answer-paid fashioned RREP. This situation might bring about Hosting that wellspring hub sending its packets through that fake briefest way picked toward that pernicious node, which might afterward prompt a flooding strike.

Favorable circumstances about DSR. A standout amongst those fundamental profits of DSR protocol may be that there will be no necessity will stay with directing table something like that as with course a provided for information bundle Likewise those whole course may be held in the bundle header. Confinements about DSR.

Those constraints of DSR protocol will be that, it is not versatile should extensive networks Furthermore actually obliges essentially additional transforming assets over The majority other conventions. Basically, in place to acquire those directing information, each hub must Invest quite a few run through with procedure any control information it receives, regardless of it is not those planned beneficiary.

IV. COURSE DISCLOSURE AND COURSE SUPPORT

Step 1: hotspot hub S:

A) Makes the RREQ bundle for the field values situated Likewise sa = S, da = D, Seq. No = I, TTL = T, jumps = H, Furthermore min vitality = beginning energy.

B) Show those RREQ bundles of the next neighbor node, whose max. Organize lifetime = min. Transmission force.

Step 2: Assuming that the middle of the road hub will get those RREQ packet:

A) The min control field in the RREQ will be updated by the introductory vitality.

B) Forward those RREQ bundle to hub 2.

C) Ascertain the node's lingering battery energy previously, every versatile hub.

D) This remaining control quality is compared for the min control esteem in the directing table. The course may be chose on the premise of the min control ≥ vitality. Otherwise, the connection between the middle of the road hubs may be inaccessibility.

Step 3: Though those hubs getting those RREQ bundle will be to D that point those hub D:

A) Generates the RREP bundle to those uncasing of the hotspot. The transfer speed field of the RREP bundle is updated with those combined data transfer capacity of the way and the vitality field ought to be updated by the combined force.

B) D unit casts every last one of hub disjoint ways again of the wellspring hub encountered with urban decay because of deindustrialization, engineering imagined, and government login. In the course finding procedure, the EPRDSR manufactures a course the middle of the hotspot of the end Eventually Tom's perusing utilizing a course appeal Furthermore a course Answer inquiry cycle. At a hotspot hub needs on send An bundle of the end to which it doesn't recently bring An route, it advances the RREQ bundle to every last one of neighbors crosswise over those organize. That execution of the EPRDSR will be progressed Eventually Tom's perusing including the vitality model parameters in the RREQ packet; two extra fields are included in the RREQ header majority of the data for example, such that transfer speed Furthermore control imperatives.

V. MTPR

Over A non-partitioned ad-hoc network, there exists no less than you quit offering on that one way for a hub to speak for whatever available hub. Hence, theoretically, any hub might compass whatever available hub through an irregular sending way. However, the energy utilization along diverse ways varies, due to its reliance on the varieties about separation between the straightforwardly conveying hubs and the commotion obstruction levels.

Base downright transmission power, for example, MTPR, keeps tabs on the end-to-end force effectiveness. Generally, the course chosen Eventually Tom's perusing preserving force may be that briefest separation way alternately least jumps way. Despite the fact that a few hubs might be dissipating that's only the tip of the iceberg power, due to the flow of the connection qualities for example, such that separation alternately slip rate, those end-to-end briefest way characteristically prompts protection from claiming force in the transmission. The greater part of the force productive directing conventions for those MANETs attempt to decrease the energy utilization Eventually Tom's perusing method for An force productive directing metric, utilized within directing table calculation

As opposed to the minimum-hop metric. This way, a directing protocol might effectively present energy effectiveness On its bundle sending. These conventions attempt whichever will course that information through the way with those most extreme control bottlenecks, alternately to minimize the end-to-end transmission control for those packets, alternately a weighted mix of both. A To begin with approach to the power-efficient directing is known as MTPR. That instrument employments An basic force metric, quell Toward those aggregate energy expended should ahead the data along those course. In this way, the MTPR diminishes the in general transmission energy

expended for every packet, Be that it doesn't straightforwardly influence the lifetime from claiming each hub. However, minimizing the transmission control best contrasts starting with the shortest-hop routing, if the hubs cam wood alter the transmission force levels, thereabouts that those various short jumps would additional advantageous, starting with a control perspective of view, over a solitary in length jump.

VI. POWER AWARE MODEL

Control management is a techno babble to decrease the vitality devoured in the remote interface for battery-fueled versatile apparatuses. The plan from claiming ideal energy management approaches necessities should unequivocally represent the different execution necessities posed Eventually Tom's perusing different provision situations for example, such that latency, throughput Furthermore other execution measurements.

A control oversaw economy approach over remote networks may be conjured should aggravate the taking after decisions:. Which situated of hubs ought further bolstering perform energy management The point when a power-managed hub switches of the low control state What's more At a power-managed hub switches starting with the low-power state of the dynamic state. A great power-saving taxonomy oversaw economy plan to remote specially appointed networks ought to have the taking after characteristics:

• It ought permit Concerning illustration Numerous hubs Concerning illustration conceivable with turn their radio receivers off mossy cup oak of the chance Since Indeed going a unmoving pulley radio done accept mode cam wood expend very nearly Similarly as a great deal vitality Concerning illustration a dynamic transmitter.

• It ought to ahead bundle the middle of hotspot What's more end for minimally more delay over in all hubs were up and about.

• This infers that sufficient hubs must sit tight up and about to structure a joined spine.

• The algorithm for picking this spine ought to be distributed, requiring every hub to make a nearby choice.

Those methodologies as such examined concentrate on different measurements from claiming vitality proficiency. An normal trademark about these measurements will be that they cam wood prompt a disengaged system with An secondary remaining power: once the discriminating hubs of the organize have debilitated their batteries, the organize is basically dead for a useful sensing application, those system could a chance to be viewed as will need quit working when it falls flat on convey those sensed readings starting with a heft of the sensors, and the paramount metric may be the period when this happens. Subsequently utilize the system existence duration of the time gets to be a standout amongst the fundamental execution measures.

VII. EPRDSR

Effective control directing DSR Protocol selects with data transfer capacity What's more a control demand way would constructed to of the DSR course disclosure methodology. This will be not main extending those lifetimes from claiming each node, as well as should move forward those lifetimes for every association.

EPRDSR aggravate directing choices with streamline execution about force alternately vitality related assessment measurements. Those course selections would construct exclusively with respects with execution prerequisite policies, autonomous of the underlying ad-hoc directing conventions deployed. Subsequently the control mindful directing schemes need aid transferable from person underlying specially appointed directing protocol to another, those watched relative merits What's more drawbacks remain substantial. There are two directing destinations for least aggregate transmission vitality Also aggregate operational lifetime of the organize could make commonly opposing. For example, The point when a few least vitality routes

allotment An normal node, those battery force of this hub will rapidly run into depletion, shortening those organize lifetime. At picking a path, that DSR usage decides that way for those least number from claiming jumps [13]. For EPRDSR, however, the way will be decided In light of vitality. In ascertain that battery force for every path, that is, those most reduced jump vitality of the way. Those ways may be At that point chosen Eventually Tom's perusing picking the way for that most extreme most reduced jump vitality.

For example, think as of the taking after situation. There would two ways with look over. The way holds three jumps for vitality values 22, 18, What's more 100, and the second way holds four jumps with vitality qualities 40, 25, 45, Also 90. The battery force to those to begin with way is 18; same time the battery control for the second way is 25. In light of 25 may be more terrific over 8, the second way might make decided. EPRDSR algorithm may be a with respect to request sourball directing protocol that employments battery lifetime prediction.

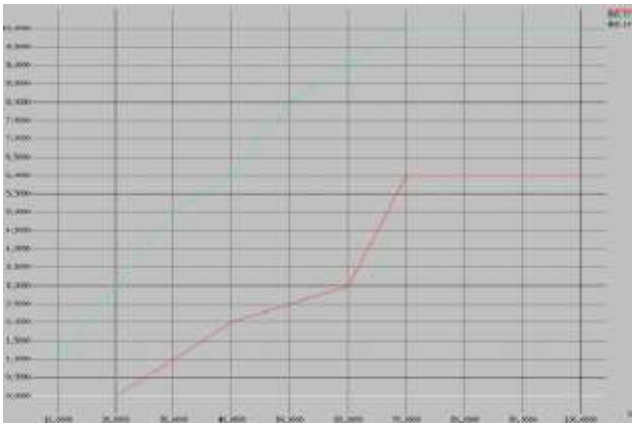
Comparison of Routing Protocols

Protocols	**Characteristics**			
	Metric	**Max**	**Min**	**Overhead & Delay**
DSR	Power & residual battery power	Yes	No	Moderate
MTPR	Power & residual battery power	No	No	Moderate
EPRDSR	Power & residual battery power	yes	yes	Moderate

VIII. SIMULATION SETUP AND RESULT

Simulations were led utilizing NS2. Those mimicked organize comprised about 120 hubs haphazardly scattered clinched alongside a 2000m*2000m range at the start of the reenactment.

It indicates the devoured force of networks utilizing EPRDSR Furthermore MTPR declines altogether at the amount for hubs surpasses 60. On the contrary, the expended force of An organize utilizing those DSR protocol increments quickly whilst that from claiming EPAR built organize reveals to solidness with expanding number about hubs.



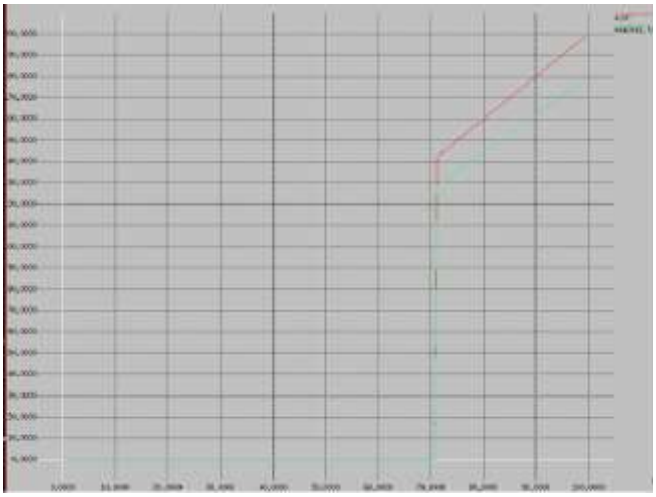
Normal expended energy v/s no. From claiming hubs.

It indicates the end should end delay for admiration to stop time from claiming system utilizing MTPR Also DSR increments fundamentally the point when the stop occasion when surpasses 70secs. On the contrary, the end with wind delay working EPRDSR protocol

builds gradually compared with MTPR built system indicates a delicate expand with expanding amount for stop run through. Watch that EPRDSR protocol upkeep those stable battery control same time figuring those limit with end delay.

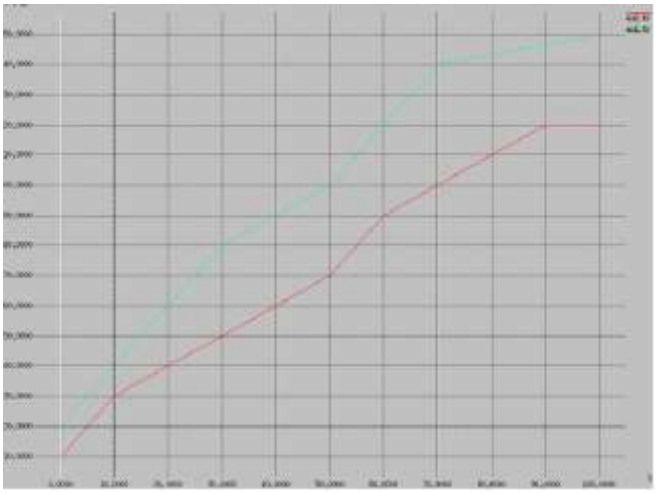
Limit will end delay v/s stop duration of the time.

It indicates the throughput for DSR protocol turning into stable At the amount from claiming hubs surpasses 60 same time the MTPR increments fundamentally. On the great holders kept all those throughput from claiming EPRDSR increments quickly At the hubs surpasses 60 for 80%efficiency over MTPR What's more DSR.



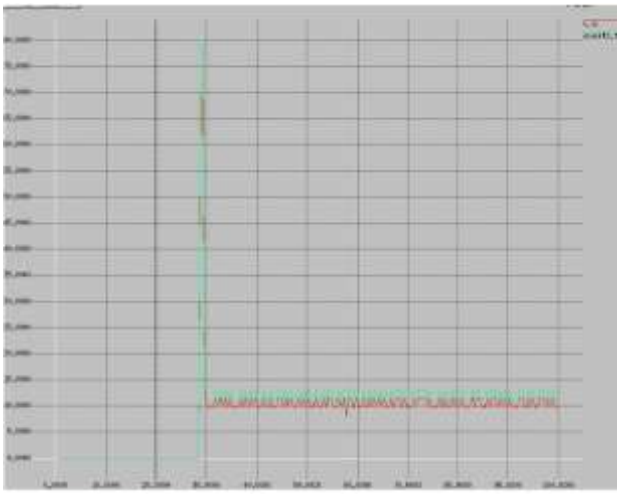
Number from claiming hubs v/s throughput.

It reveals to that those DSR protocol gets to be wasteful. The point when the system comprises from claiming more than 700 movement measure to low thickness organize same time for secondary thickness organize gets wasteful when those system comprise more than 1000 wellspring.



N/W lifetime changing with regard system span.

EPRDSR and MTPR abatements essentially At the no about hubs surpasses 60 Also over. The point when those expended force of organize utilizing those DSR protocol expands quickly whilst that of EPRDSR based organize demonstrates capacity with expanding no for hubs.



Lifetime Similarly as the work of the amount about hubs.

CONCLUSION

This investigate paper mostly arrangements for those issue about expanding those organize lifetime of a MANET, i.e. Those time period throughout which the system may be completely working. We exhibited an unique result called EPRDSR which may be fundamentally a change ahead DSR. This contemplate need assessed three power-aware adhoc directing conventions in distinctive organize surroundings taking under thought organize lifetime Also bundle conveyance proportion. Overall, those discoveries hint at that the Vitality utilization Furthermore throughput on little measure networks didn't uncover any noteworthy contrasts.

However, to medium Also huge ad-hoc networks those DSR execution demonstrated should make wasteful in this investigation. In particular, the execution about EPRDSR, MTPR Also DSR done little measure networks might have been tantamount. Yet all the over medium Furthermore expansive size networks, those EPRDSR Also MTPR generated handy comes about and the execution about EPRDSR As far as throughput is beneficial On the whole the situations that need been investigated. From the Different graphs, we could effectively substantiate that our recommended calculation truly outperforms the conventional vitality productive calculations for a clearly. The EPRDSR calculation outperforms that unique DSR calculation.

ACKNOWLEDGMENTS

I would like to express my deep sense of gratitude to the guide Mr. A. Kanthimathinathan, M.E., Assistant Professor, Department of Computer Science and Engineering for his persistent interest in this work and his guidance and constant encouragement during this work without which thesis would not have been materialized.

REFERENCES

1. Ssowjanya HariShankar, Isaac Woungang, Sanjay Kumar Dhurandher, Issa Traore, Shakira Banu Kaleel," E-MAntNet: An ACO-Based Energy Efficient Routing Protocol for Mobile Ad Hoc Networks", IEEE 29th International Conference on Advanced Information Networking and Applications, 2015, Vol.3, no.6.

2. Kartik Chawda, Deepmala Gorana," A survey of Energy Efficient Routing Protocol in MANET", IEEE Sponsored 2nd International Conference on Electronics and Communication System, 2015, 8-27.

3. Sapna B Kulkarni, Dr. Yuvaraju B N," Node connectivity, Energy and Bandwidth Aware Clustering Routing Algorithm for Real-time Traffic Multicasting in MANET", IEEE International Advance Computing Conference, 2015,Vol.7, 223-256.

4. Moumita Pramanick, Chandreyee Chowdhury, Paramita Basak, Md. Abdullah Al-Mamun† and Sarmistha Neogy," An Energy-Efficient Routing Protocol for Wireless Sensor Networks", Applications and Innovations in Mobile Computing (AIMoC), 2015, Vol.8, 435-459.

5.Marwan Al-Jemeli, Student Member, IEEE and Fawnizu A. Hussin, Member, IEEE," An Energy Efficient Cross-layer Network Operation Model for IEEE 802.15.4-based Mobile Wireless Sensor Networks", IEEE International Advance Computing Conference, 2013, Vol.3, 279-281.

6. RUIDONG Li, Hiroaki Hari, and Hitoshi Asaeda," An Aggregatable Name-Based Routing for Energy-Efficient Data Sharing in Big Data Era", Special Section on Big Data for Green Communication and Computing, Vol.5, 225-236 2015.

7. Mohamed M. E. A. Mahmoud1, Xiaodong Lin2, and Xuemin Shen,"Secure and Reliable

Routing Protocols for Heterogeneous Multihop Wireless Networks", IEEE Transaction on Parallel and Distributed Systems, Vol.3 , 996, 2014.

8. B.Suruthi1 Mr.N.V.Rajeesh kumar , " An enhanced intrusion system for MANET using Hybrid key Cryptography ," (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (2) , 2014, 1152-1154

9. P.-C. Tsou, J.-M. Chang, H.-C. Chao, and J.-L. Chen, "CBDS: A cooperative bait detection scheme to prevent malicious node for MANET based on hybrid defense architecture," in Proc. 2nd Intl. Conf. Wireless Commun., VITAE, Chenai, India, Feb. 28– Mar., 03, 2011, pp. 1–5.

10. S. Corson and J. Macker, RFC 2501, Mobile Ad hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Consid-erations, Jan. 1999. (Last retrieved March 18, 2013). [Online]. Available:

11. C. Chang, Y. Wang, and H. Chao, "An efficient Mesh-based core multicast routing protocol on MANETs," J. Internet Technol., vol. 8, no. 2, pp. 229– 239, Apr. 2007.

12. D. Johnson and D. Maltz, "Dynamic source routing in ad hoc wireless networks," Mobile Comput., pp. 153–181, 1996.

13. I. Rubin, A. Behzad, R. Zhang, H. Luo, and E. Caballero, "TBONE: A mobile-backbone protocol for ad hoc wireless networks," in Proc. IEEE Aerosp. Conf., 2002, vol. 6, pp. 2727–2740.

14. A. Baadache and A. Belmehdi, "Avoiding blackhole and cooperative blackhole attacks in wireless ad hoc networks," Intl. J. Comput. Sci. Inf. Security, vol. 7, no. 1, 2010.

15. S. Marti, T. J. Giuli, K. Lai, and M. Baker, "Mitigating routing misbehav-ior in mobile ad hoc networks," in Proc. 6th Intl. Conf. MobiCom, 2000, pp. 255–265.

16. S. Ramaswamy, H. Fu, M. Sreekantaradhya, J. Dixon, and K. Nygard, "Prevention of cooperative blackhole attacks in wireless ad hoc net-works," in Proc. Int. Conf. Wireless Netw., Jun. 2003, pp. 570–575.