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A CLUSTERING FRAMEWORK BASED MULTIPATH ROUTING PROTOCOL IN MOBILE AD HOC NETWORKS

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Abstract:-The approach of using mobile sink has been adopted in ad hoc networks to achieve higher efficiency in terms of gathering data from sensors. Mobility-assisted data collection brings in new opportunities to improve the energy efficiency nodes. However, mobile sink also introduces new challenges such as routing the mobile network. A lot of research efforts have been devoted to reduce this latency. Cooperated with a routing algorithm, a concise and a clustering framework based multipath routing are proposed here. A given area can e divided into several zones with balanced routing latency. By modeling the routing problem as a Traveling Salesman Problem, an algorithm is designed to balance the data gathering latency among all the zones. Then mobile sinks are assigned to these zones separately. The data could be routing by these mobile sinks parallel thereupon. Extensive simulations are carried out evaluate our proposed scheme. Different distribution patterns are considered. Fictiveness of our proposed routing scheme is demonstrated through the simulation results.

Keywords: Multipath routing, mobile ad hoc networks, framework.

1. Introduction

It is known that in a wireless s sensor network (WSN) with static sinks, sensors near a sink usually deplete their batteries faster than those far apart because of their heavy load for forwarding packets. Such non uniform energy consumption can cause degraded network performance and shorten the network lifetime. This is the so-called hot-spot problem. Although many energy-efficient protocols [1, 2, 3] have been proposed to prolong the network lifetime, the hop-s pot problem still exists. Data gathering is one of the most important tasks for mobile ad hoc networks.

Sensor and mobile ad hoc networks generally two approaches could be adopted by sensor nodes to Upload their sensor data to the sink. Firs t: sensor nodes s end the data to the sink through a single shop

Wireless link. As a result, the transmission power and energy consumption of sensors increases greatly when sensors are remote from sinks. Second: sensor nodes collaboratively relay the data through other Sensors towards the sink. Although the transmits s ion power of sensor nodes can be reduced with a much shorter transmission distance, the sensors located near the sinks will have to relay a large volume of data, which leads to shorter lifetime 4, 5, 6, 7, 8, 9].

Another routing approach, i.e., mobility-as sis ted data gathering [10, 11, 12, 13], has attracted a lot of research attention recently. Employing a certain mobile device to collect data from sensor nodes.

The energy efficiency of sensor nodes could be improved significantly.. For the WSN with highly real- time requirement, this latency induces huge challenges for engineers. To combat this problem, we propose a novel data gathering scheme with multiple mobile sinks. A zone partitioning algorithm is employed in our proposed scheme to increase the routing efficiency.

2. Related Work

Multipath routing in ad hoc networks. Multipath-DSR (M-DSR) [6] is a simple multipath extension of the popular DSR [30], in which alternate routes are maintained so that they can be utilized when the primary one fails. Instead of replying only to the first received RREQ as DSR, the destination node sends an additional RREP for a RREQ which carries a link disjoint route compared with the routes already replied. However, M-DSR can't compute link disjoint paths in many cases because the intermediate nodes drop every duplicate RREQ that may comprise another link disjoint path. In AODV-BR [7], an extension of AODV [36], multiple routes are maintained and utilized only when the primary route fails. However, traffic is not distributed to more than

one path. Multiple Source Routing protocol (MSR) proposes a weighted round-robin heuristic-based scheduling strategy among multiple paths in order to distribute load, but provides no analytical modeling of its performance. In [9], the positive effect of alternate path routing (APR) on load balancing and end-to-end delay in mobile ad hoc networks has been explored. Split multi-path routing (SMR), proposed in [10], focuses on building and maintaining maximally disjoint paths, however, the load is distributed in two routes per session. In an interesting application [14], multi-path path transport (MPT) is combined with multi-description coding in order to send video and image information in multi-hop mobile radio network. However, these protocols distribute traffic on one connection at a time for each source-destination pair. In other words, traffic is not diversified into multiple routes at the same time but focused on primary route. When this route is broken, other alternate routes are used for transmission. A. Tsirigo sand Z. J. Haas do some works on distributing traffic on multiple routes simultaneously in ad hoc networks. A framework for multi-path routing and its analytical model in mobile ad hoc network was proposed in [12]. This scheme, utilizing M-for-N diversity coding technique, solved the inherent unreliability of the network by adding extra information overheads to each packet. The data load was distributed over multiple paths in order to minimize packet drop rate, achieve load balancing, and improved end-to-end delay. MRP-LB proposed in [19] combine's traffic distribution into packet granularity levels with a load balancing policy. A node could reduce interference its neighbors by adjusting the transmission power to an appropriate level. This not only increases the capacity of the network by increasing spatial reuse, but also minimizes the energy usage and thus enhances the lifetime of mobile nodes, which is very important since they have limited power resource. CHAMP[20] uses cooperative packet caching and shortest 406 multipath routing to reduce packet loss due to frequent route breakdowns. From the research survey of literature for multipath routing strategy, there are still many issues in applying multi-path routing techniques into mobile ad hoc networks that are to be covered. On the one hand, in most of the routing protocols, the traffic is distributed mainly on the primary route. It is only when this route is broken that the traffic is diverted to alternate routes. Clearly, load-balancing is not achieved by using these routing mechanisms. Although there are some routing protocols which distribute traffic simultaneously on multiple paths, there has not been a routing protocol which could dynamically cope with the changes of topology in ad hoc network. On the other hand, all the routing don't takes into consideration that the routing control overhead will increase quickly when the number of the networks node increases, due to the attribute of bandwidth constrains and power limitation in MANET with the plane structure. These lead to scalability problem and reliability problem. As a result, there is a demand for a multi-path routing strategy that can not only balance efficiently the load on the network but also can cope with the dynamics of the network.

3. Multipath Routing Methodology

The structure of MANET is plane. In other words, all the nodes in the networks are equity, and functions as terminal as well router. There is difference in performance instead of function. The main advantage of the structure is that there are multiple paths between source-destination pairs. So it can distribute traffic into multiple paths, decrease congestion and eliminate possible "bottleneck". But MANET with the plane structure will increase routing control overhead, the scalability problem is likely to happen. Utilizing clustering algorithm to construct hierarchical topology may be a good method to solve these problems. An adaptive mobile cluster algorithm can sustains the mobility perfectly and maintains the stability and robustness of network architecture. To support the multi hop and mobile characteristics of wireless ad hoc network, the rapid deployment of network and dynamic reconstruction after topology changes are effectively implemented by clustering management. Clustering management has five outstanding advantages over other protocols. First, it uses multiple channels effectively and improves system capacity greatly [26, 28, 29, 30, 31]. Second, it reduces the exchange overhead of control messages and strengthens node management [27,28,29,30,31,32]. Third, it is very easy to implement the local synchronization of network [28, 31, 33]. Fourth, it provides quality of service (QOS) routing for multimedia services efficiently [30, 31, 33, 34]. Finally, it can support the wireless networks with a large number of nodes [32, 35].

Therefore, combining the multipath of the MANET with cluster hierarchical topology, we propose a new protocol named Cluster framework-based Multipath Routing (CFBMRP). It's described as follows. 3.2 Cluster structure and cluster forming We classify all the nodes in the network into cluster head node and cluster member node. The cluster head is one hop away from the other cluster member. Every cluster member belongs to exactly one cluster head and records the IP address of its cluster head into its routing table. A cluster head records all the IP address of its cluster member in its routing table. Cluster head keeps a neighbor table that records all the IP address of its neighbor cluster head. Nodes exchange information using the distributed push approach, i.e., every node should broadcast a HELLO message regularly. A cluster member adds its IP address into its HELLO message and a cluster head adds the IP address of its cluster member into its HELLO message as well.

To facilitate the cluster head discovery process, cluster member keep the IP addresses of other cluster head that can hear. When the former cluster head moves away or a cluster member does not receive three HELLO packets continuously from its cluster head, it considers that the wireless link between them is broken (or the cluster head has moved away). Thus, a cluster member chooses the latest refresh cluster head in its routing table as its new cluster head, which is one hop from it, or becomes itself a cluster head if it cannot hear any existing cluster head. After broadcasting its HELLO right next packet, the selected cluster head is informed that a new cluster member has joined its group. The cluster member will obtain the confirmation of its new cluster head when it receives the HELLO packet that carries its IP address.

4. Performance Evaluation

The following experiment we suppose that task execution time is not ignored, and the moving s peed of each mobile sink is variable. Task times in this case can be simplified to：

$$T_k = \sum_{i=1}^{n} y_{ik} \cdot t_{q_i} + \sum_{j=0, j\neq i}^{n} \sum_{i=0}^{n} \frac{x_{ijk} \cdot d_{ij}}{v_k}$$

$$\text{Denoted：} D_k = \sum_{j=0, j\neq i}^{n} \sum_{i=0}^{n} x_{ijk} \cdot d_{ij}$$

D_k represents the completion of the mobile sink k through a traversal distance. TSP optimization goals can be simplified as D_k.(k=1,2, …,m) minimum and η close to 1 . With 200 nodes deployed randomly, an area of 200[m] ×200[m] is considered. The number of zones ranges from 1 to 10. The threshold of balanced rate θ is chosen as 1. 15 according to heuristic simulations. Monte Car lo simulations are carried out to record the traveling distances in different scenarios. The relation between the number of zones and the averaged iterations is shown as Fig. 2.

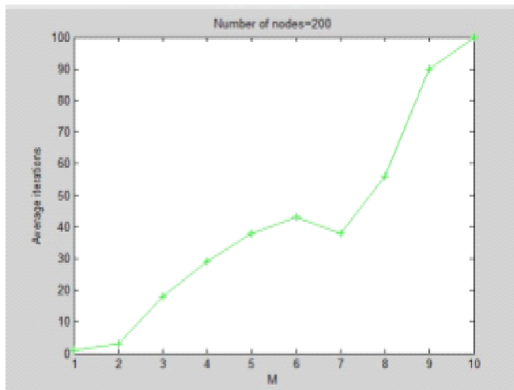

Figure 2. Comparison of average iterations under different partition number

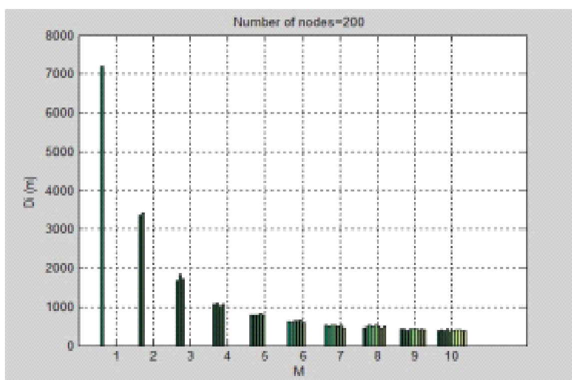

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Figure3. Comparison of path distance under different partition number.

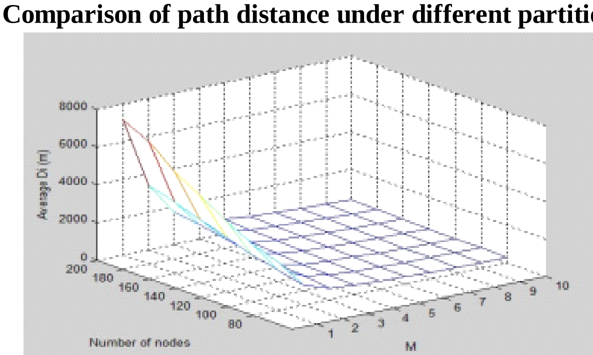

Figure5, Routing average iterations.

Figure4. Relations hip of node number, partition number and average Di Clearly, the averaged iteration increase with the number of zones. It is because the more of the divided zones, the more calculation have to be carried out employing the shuffled frog leaping algorithm.

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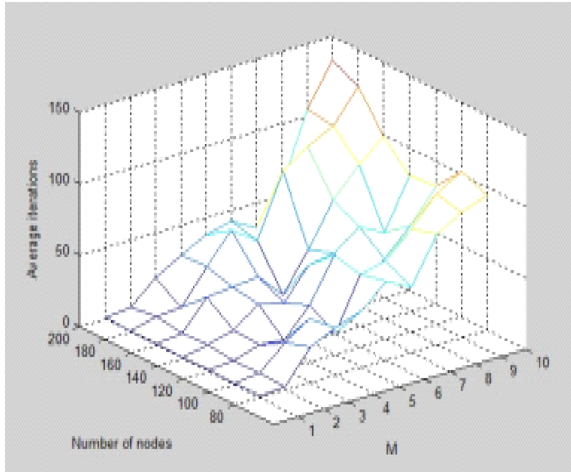

Figure6, Routing average iterations.

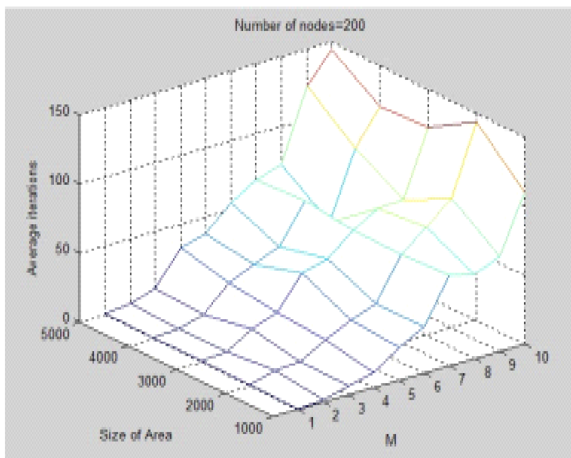

Figure4. Routing average iterations.

Figure7. Relations hip of area size, partition number and average Di 200 nodes are deployed in the of 5 000[m] ×5000 [m] randomly. The number of mobile sinks is set as 1,5,10. Moving

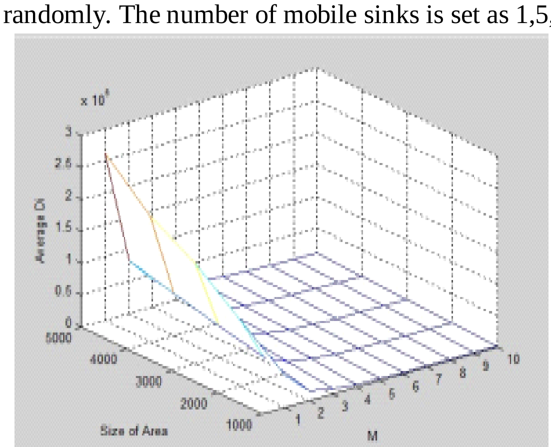

Figure9, Routing average iterations.

speed of each mobile sink is s et as 5, 10, 15, 20, 25, 30, 35, 40, 45, 50m/s .The threshold of balanced rate θ is set to 1.18. Simulation is performed 10 times in each scene to obtain the relationship between the average delays; s peed of mobile sinks and mobile sink number.

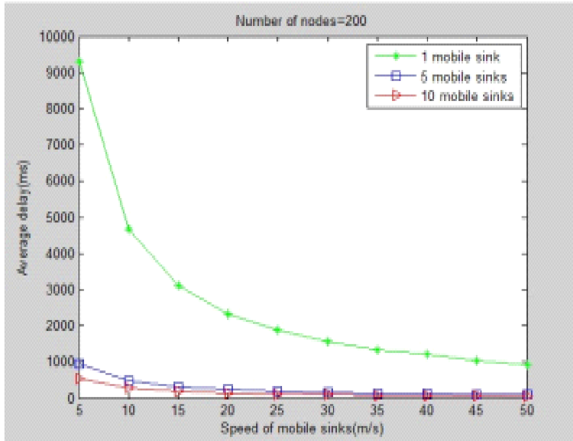

Figure 8 Relations hip of mobile sink speed, mobile sink number and average delay.

The relation between number of zones and path distances is illustrated in Fig. 3, Histogram is drawn to be demonstrated the averaged path distances D_i among all the zones corresponding to each number.

5. CONCLUSION

Cooperated with a multipath routing algorithm, a concise and a clustering framework based multiple partitioning framework based clustering process is proposed here. By modeling the partitioning problem as a TSP, an algorithm is designed to balance multipath routing by mobile sinks parallel. Simulations are carried out evaluate our proposed routing scheme, and effectiveness of our proposed routing scheme is proved by the simulation results. To improve the performance further, multipath routing might be used in the future works.

REFERENCES

[1] M. Watfa, L. Yaghi, "An efficient online-battery aware geographic routing algorithm for wireless sensor networks", International Journal of Communication Sys tems, vol. 23, no. 1, pp. 41–61,
2010.
[2] Y Ma, Y Guo, M Ghanem, "RECA: Referenced energy-based CDS algorithm in wireless sensornetworks", International Journal of Communication Systems , vol. 23, no. 1, pp. 125–138 , 2010.
[3] S Fang, SM Berber, AK Swain , "Energy dis tribution-aware clustering algorithm for dense wireless sensor networks ", International Journal of Communication Systems , vol. 23, no. 9 /10, pp. 1223–1251, 2010 .
[4] M. Ahmadi, L. He, J. Pan, J. D. Xu, "A Partition-based Data gathering Scheme for Wireless Sensor Networks with a Mobile Sink", Proceeding of IEEE International Conference on Communications (IEEE ICC 2012) , pp. 508-512, 2012.
[5] R. Shah, S. Roy, S. Jain, and W. Brunette, "Data mules: Modeling and analysis of a three-tier architecture for sparse sensor networks", Ad Hoc Networks , vol. 1, no. 2/3, pp. 215 –233, 2003.
[6] Chakrabarti, A. Sabharwal, B. Aazhang, "Using predictable observer mobility for power efficient design o
[7] M. Ma and Y. Yang, "SenCar : an energy-efficient data gathering mechanism for large-scale multi hop sensor networks ", IEEE Trans . on Parallel and Distributed Sys t, vol. 18, no. 10, pp. 1476-1488, 2007.
[8] N. Rakhshan, and M.K. Rafsanjani, "Improving Network Lifetime Using a Mobile Sink with a New Energy Efficiency and Minimum Delay Movement Strategy for WSNs", Journal of Basic and Applied Scientific Research, pp. 4275-4281, 2012.

[9] S. Vapputuri, K. K. Rachuri, C.R. Murthy,"Using mobile data collectors to improve network lifetime of wireless sensor networks with reliability constraints", Journal of Parallel Distribute Computing, vol.70, no.7, pp. 767-778, 2010.

[10] Ekici E, Gu Y, Bozdag D, "Mobility-based communication in wireless sensor networks ", IEEE Communications Magazine , vol. 44, no. 7 , pp. 56 –62 , 2006.

[11] E. M. Saad, M.H. Awadalla, R.R. Darwis h, "A data gathering algorithm for a mobile sink in large scale sensor networks ", Proceedings of the Fourth International Conference on Wireless and Mobile Communications , pp. 207-213 , 2008.

[12] Y. Bi, L. Sun, J. Ma, N. Li, I.A. Khan, C. Chen, "HUMS: an autonomous moving strategy for mobile sinks in data-gathering sensor networks ", EURASIP Journal on Wireless Communications and Networking, 2007.

[13] G. Wang, T. Wang, W. Jia, M. Guo, J. Li, "Adaptive location updates for mobile sinks in wireless sensor networks", The Journal of Supercomputing, vol. 47, no. 2 , pp. 127–145, 2009.

[14] R. Sugihara, R. Gupta, "Speed control and scheduling of data mules in sensor networks ", ACM Trans. on Sensor Networks , vol. 7, no. 1, 2010.

[15] L. He, Y. Zhuang, J. Pan, and J. Xu, "Evaluating on-demand data gathering with mobile elements in wireless sensor networks ", in Proc.I EEE VTC' 10-FALL, 2010.

[16] H. Nakayama, Z.M. Fadlullah, N. Ansari, N. Kato, "A Novel Scheme for WSAN Sink Mobility Based on Clustering and Set Packing Techniques", IEEE Transactions on Automatic Control, vol. 56, no. 10, 2011.

[17] Y. Sas aki, H. Nakayama, N. Ansari, Y. Nemoto, and N. Kato, "A new data gathering scheme based on s et cover algorithm for mobile sinks in ws ns", in Proc.I EEE Global Telecommun.Conf.(GLOBECOM' 08), pp. 725–729, 2008.

[18] Y.Gu, Y.S. Ji, B. Han,and B.H. Zhao, "Delay-bounded Sink Mobility in Wireless Sensor Networks", Proc. of IEEE ICC' 12, pp. 750- 754, 2012.

[19] K. Kweon, H. Ghim, J. Hong, H. Yoon, "Gr id-Based Energy-Efficient Routing from Multiple Sources to Multiple Mobile Sinks in Wireless Sensor Networks ", in 4th International Symposium on Wireless Pervasive Computing (ISWPC) , 2009 .

[20] H. Kim, Y. Seok, N. Choi, Y. Choi, T. Kwon, "Optimal multi-sink positioning and energy- efficient routing in wireless sensor networks ", Lecture Notes in Computer Science, vol. 3391 no. pp.264-274, Jan. 2005.

[21] Amiri, M. Fathian, and A. Maroos i, "Application of shuffled frog-leaping algorithm on clus tering", The International Journal of Advanced Manufacturing Technology, vol. 45, no 1/2, pp. 199-209, 2009.

[22] X.C. Zhang, X. M. Hu, and G.Z . Cui, "An improves huffled frog leaping algorithm with cognitive behavior", Proceedings of the 7th World Congress on I Washington, DC: IEEE Computer Society, pp.6197-6202, 2008.