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An Efficient Congestion Control and Load-balancing Protocol to Improve Quality-of-Service (QoS) for Service-Oriented Wireless Sensor Networks

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Abstract:- **A wireless sensor networks (WSNs) are spatially distributed autonomous sensors to physical or environmental conditions such as temperature, pressure, sound etc and to co-operatively pass their data to a main location through the network. The more modern networks are bi-directional; also sensor activity is enabled in these networks. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance, today these networks are used in many industrial and consumer applications such as industrial process monitoring and control, machine health monitoring and so on. Typically, WSN is composed of a large number of distributed sensor nodes which are often battery-powered and required to operate for years after deployment. Service-oriented architectures for wireless sensor networks (WSNs) have been proposed to provide an integrated platform, where new applications can be rapidly developed through flexible service composition. The service-oriented WSN aims at combining scalable wireless sensing technology with independent service provisioning, where the applications are treated as services that can support via more flexible protocol design and resource management. In this paper, an evaluation metric, path vacant ratio, is proposed to evaluate and then find a set of link-disjoint paths from all available paths. A congestion control and load-balancing algorithm that can adaptively adjust the load over multipath is proposed. A threshold sharing algorithm is applied to split the packets into multiple segments that will be delivered via multipath to the destination depending on the path vacant ratio. The performance analysis is observed for existing and proposed systems.**

Index terms - Congestion control, Load- balancing, Wireless Sensor Networks

INTRODUCTION

Service oriented wireless sensor networks (WSNs) aims to combine wireless sensing technology to obtain few applications and these applications were treated as services and further these services support to design a protocol that is needed. Unfortunately, most existing WSNs are designed for specific purposes and lack of standard operations and representation for sensor data that can be used by upper layer applications or services. Recently, service-oriented architectures for WSNs have been proposed to support the interoperability between different applications, where the functionalities provided by WSNs are treated as services, e.g data aggregation service, data processing service, and localization service. we will address the before mentioned challenges and present a secure and adaptive load-balancing multipath routing protocol based on AODV (Ad hoc On-Demand Distance Vector), namely, service-oriented multipath AODV (shortly as SM-AODV) design and resource management are designed

The main aim and scope of the project is SM-AODV is enables nodes to find disjoint paths without introducing extra routing messages. To reduce the delay between the nodes.The data confidentiality in the service-oriented WSNs,which is similar to secure protocol for reliable data delivery. The path vacant ratio can be used to evaluate the load over multipath, which is derived from taking account of load balancing, path load, important paths, and importance of nodes over multipath. An adaptive congestion control scheme is proposed to adaptively adjust packet delivery rate over each path according to the congestion level.

RELATED WORK

It has been proposed a load-balancing algorithm based on a balanced tree structure. [1] The routing tree can more effectively balance the load than the breadth-first-based and the shortest-path-based routing schemes. However, it involves high overhead caused by routing optimization under multipath routing discovery. In other research works, multipath routing schemes, i.e., cognitive radio-multipath AODV, AODV with backup routes (AODV-BR), and multiple-route ad hoc on-demand distance vector, are proposed as extensions to the AODV protocol for load balancing.

A good survey of routing techniques in WSN is provided. In general, depending on the Network Structure, routing in WSNs can be classified as Flat based, Hierarchical based and Location based routing. In flat based routing all nodes are typically assigned equal roles or functionality. In Hierarchical-Based Routing, the nodes will play different roles in the network and in Location Based Routing sensor nodes positions are exploited to route data in the network

It have been studied a multiple-parallel-aisle warehouse and found that adjusting the number of classes can cut the travel distance by 30%. However, the literature contains no hard rules regarding how to determine the best class numbers for multi-aisle and multi-pick-per-route situations. [2] Managers should consider storage area zoning issues in conjunction with class-based assignment and zoning prior to location assignment. Dividing the storage area into several areas benefits the picking activities of high-frequency items.

METHODOLOGY

In this paper, an evaluation metric, path vacant ratio, is proposed to evaluate and then find a set of link-disjoint paths from all available paths. A congestion control and load-balancing algorithm that can adaptively adjust the load over multipath is proposed. The service-oriented WSN aims at combining scalable wireless sensing technology with independent service provisioning, where the applications are treated as services that can support via more flexible protocol design and resource management. In service-oriented applications, services with various performance metrics, e.g., bandwidth, delay, load balancing, and reliability, have been well studied within the service systems, where each node provides the quality-of-service (QoS) parameters associated with these services. In a service-oriented WSN, applications can be designed over service requirements to depart from current application specific or generic WSNs. In this paper, a multipath routing scheme is proposed, which features the following: application independence, secure data delivery, adaptive congestion control and rate adjustment.

In this paper, an adaptive and secure load-balancing routing scheme that can improve the network performance for service-oriented WSNs is developed. The multipath selection and congestion control scheme, we propose a secure adaptive load-balancing routing protocol (SM-AODV) based on the extension of the standard AODV protocol. As we all know, the topology information is not available for on-demand routing protocols , so we use AODV as the base protocol for an extension of our load-balancing algorithm because it is an efficient routing protocol and it does not generate traffic .This type of protocol repeats until all nodes receive the update and find its parent nodes.

By this way, every node in the network can find one route to the destination node by using a breadth-first spinning tree algorithm or similar algorithms. However, this routing scheme cannot guarantee the security and reliability requirements, which heavily depends on the single node. In order to provide more secure protection for the multi- path routing approach, this work exploits a threshold secret sharing method to split the data into a number of shares. For SM-AODV, we first apply a threshold secret sharing method to split the data into a number of shares which will be packed into more data packets that will be delivered to multi- paths according to load on each path as mentioned previously. If the load on one path increases, SM-AODV can decrease the number of packets to that path according to the path vacant rate.

Multipath Evaluation and Scheduling

Based on AOMDV, we can classify the multipath into multiple levels according to the path vacant rate. This phase is the most important in SM-AODV. It integrates the other two phases together with five steps.
1) Multipath discovery. SM-AODV finds non disjoint paths which can be more easily discovered. After this step, all non disjoint paths from the source to the destination can be obtained, as shown in Fig. 1.
2) Multipath load-balancing evaluation. As described in Section IV, the multipath are evaluated according to the procedure mentioned previously, and the output of this phase is the path vacant rate of each path.
3) As described in phase one, we need to split the load according to the threshold secret sharing algorithm.
4) Deliver the distributed load to multipath according to the path vacant rate.
5) Set up the congestion control module to monitor the CONGEST events. If CONGEST events arrive, then invoke the congestion control mechanism and schedule the load according to the CONGEST_LEVEL.

This mechanism exploits the advantage of the SM-AODV and enables nodes to find disjoint paths without introducing extra routing messages. Multipath discovery and maintenance involve finding the multiple paths between a source node and a destination node. A set of link-disjoint paths can be easily found by the method reported . In link-disjoint paths, the failure of a link may only cause failure of a single path. In our scheme, a route discovery procedure is used to find a set of loop-free and link disjoint paths. The duplicate copies of the route request (RREQ) message at intermediate nodes are not immediately discarded,
and all received RREQ messages are recorded in an RREQ table. Each intermediate node checks each copy to find a new node-disjoint path to the source node. If a new node-disjoint
path is found, then the node will further check if a reverse path can be set up; if so, a valid path is established, and the destination node will send an routing reply (RREP) message for all received RREQ. In this case, the intermediate node will forward the received RREP to the nodes listed in the RREQ

table along the shortest path to the source node. By this way, multipath can be found.

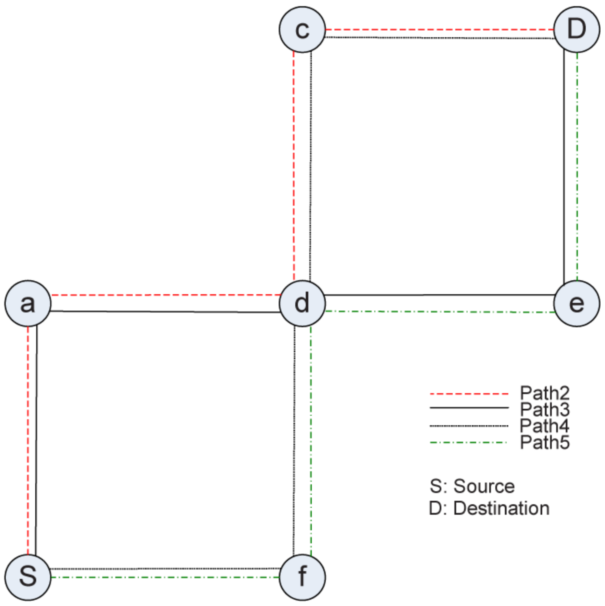

Fig 1 Congestion networks

SIMULATION RESULTS

NS − 2.31 is used in simulations. Assume that 50 sensor nodes are randomly deployed in a square area of 1000 m ×1000 m. For each node, the radio transmission range and the carrier sensing range are 250 and 550 m, respectively. We will evaluate the performance of SM-AODV by comparing it with the conventional protocols in terms of the following performance metrics. Packet delivery ratio It denotes the ratio of data packets that have been successfully received by the destination node to the total packets sent by the source node.

In this section, we will evaluate the performance of SM-AODV by comparing it with the conventional protocols in terms of the following performance metrics.

1) Packet delivery percentage P_d.

It denotes the ratio of data packets that have been successfully received by the destination node to the total packets sent by the source node. In fact, P_d is able to reflect the degree of reliability of multipath

$$P_d = P_{succ} / P_{send}$$

In which P_{succ} is the number of packets that have been successfully received on a path and P_{send} is the number of packets that have been sent successfully.

2) Average delay.

It includes the buffering time in the routing discovery stage, queuing time at the interfaces, retransmission time at the MAC layer, and transfer time

$$T_{delay} = T_{disv} + T_{queu} + T_{tran} + T_{prop}$$

in which T_{disv} is the routing discovery time, T_{queu} is the queuing time at the interfaces, T_{tran} is the retransmission delay, and T_{prop} is the propagation times.

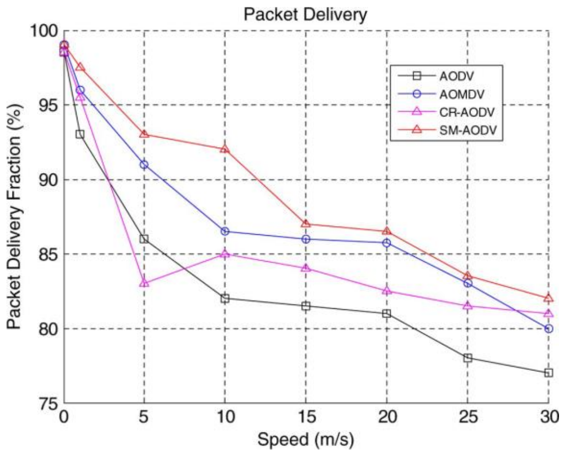

Fig 2 Packet delivery

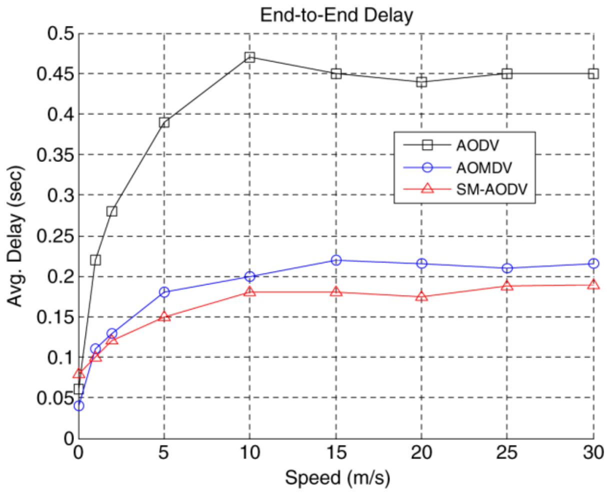

Fig 3 End to end delay

CONCLUSION

We have developed an adaptive load-balancing multipath routing protocol (SM-AODV) for WSNs that uses load balancing, congestion control, and secure delivery scheme to address the limitations in existing multipath routing schemes. In SM-AODV, the packets are delivered across multipath using a secure and reliable scheme, which decouples the node's capabilities for applications and offers optimization alternatives not available in current schemes yet. SM-AODV achieves substantial reliability improvement in routing downstream traffic by using a secret sharing scheme at the source. SM-AODV adopts an adaptive congestion control scheme, which is effective even in the case that node or link failure occurs frequently.

Our research has established the foundation for routing schemes over service oriented architecture, which is expected to have the same impact on sensor architectures as service oriented computing has had in the context of service systems, where nodes are capable of sensing and acquiring information as an information collection service. This design is expected to provide effective routing performance for multipath and enable WSNs to provide reliable application-level services.

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REFERENCES

[1] S. Li, X. Wang, and S. Zhao, "Multipath routing for video streaming in wireless mesh networks," Ad Hoc Sens. Wireless Newt., vol. 11, no. 1/2, pp. 73–92, 2011.

[2] T. Zhao, K. Yang, and H.-H. Chen, "Topology control for service-oriented wireless mesh networks," IEEE Wireless Commun., vol. 16, no. 4, pp. 64–71, Aug. 2009.

[3] K. Lin, J. J. P. C. Rodrigues, H. Ge, N. Xiong, and X. Liang, "Energy efficiency QoS assurance routing in wireless multimedia sensor networks,"IEEE Syst. *J.*, vol. 5, no. 4, pp. 495–506,Dec.2011.

[4] A. Rezgui and M. Eltoweissy, "μRACER: A reliable adaptive servicedriven efficient routing protocol suite for sensor-actuator networks," IEEE Trans. Parallel Distrib. *Syst.*, vol. 20, no. 5, pp. 607–622, May 2009.

[5] X. Zhang and H. Su, "Network-coding-based scheduling and routing schemes for service-oriented wireless mesh networks," IEEE Wireless Commun., vol. 16, no. 4, pp. 40–46, Aug. 2009.

[6] L. D. Xu, "Enterprise systems: State-of-the-art and future trends," IEEE Trans. Ind. Informat., vol. 7, no. 4, pp. 630–640, Nov. 2011.

[7] L. Duan, W. Street, and E. Xu, "Healthcare information systems: Data mining methods in the creation of a clinical recommender system," Enterprise Inf. Syst., vol. 5, no. 2, pp. 169–181, May 2011.

[8] K. Wang, X. Bai, J. Li, and C. Ding, "A service-based framework for pharmacogenomics data integration," Enterprise Inf. Syst., vol. 4, no. 3, pp. 225–245, Aug. 2010.

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