Implementation of an Algorithm for Efficient congestion Control in Wireless Sensor Networks

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Abstract— as applications in Wireless Sensor Networks are evolving day by day, congestion control remains an open and a critical problem. In wireless sensor networks, congestion occurs when traffic load exceeds maximum buffer capacity that is known as stack overflow. It also occurs because of channel contention, packet collision, reporting rate and dynamically time variable wireless channel conditions. Because of this overall channel quality get degrade and leads to buffer drops and increased delays. Hence in this paper we are going to use such a hybrid congestion control algorithm which can bridge two different techniques so that nodes in the network are able to understand which algorithm they should go with depending on the type of congestion occurs in a network.

Keywords: Congestion, Wireless Sensor Networks

I. INTRODUCTION

Wireless sensor network (WSN) consists of spatially spread autonomous sensors nodes to monitor physical or environmental conditions, like temperature, sound, vibration, pressure, motion or pollutants. Each sensor node basically comprises of sensing, transmission, mobilizer, position finding system, processing and power units. These nodes collect and transmit the information to sink. When an event has been detected, the load becomes heavy and hence the data traffic also increases, which lead to congestion**.** Buffer overflow, concurrent transmission, packet collision and many to one nature are sources for congestion. Congestion causes packet loss, which reduces throughput as well as energy efficiency. Therefore congestion in WSN's needs to be controlled for high energy efficiency, to improve fairness, and to improve quality of service.

Accurate and efficient congestion detection plays a vital role in congestion control in wireless sensor networks because it is the methodology in which abnormality in the normal traffic is been find out. Congestion is controlled by various techniques like Congestion Detection and Avoidance, Event to Sink Reliable Transport, Congestion Control and Fairness.

II. LITERATURE SURVEY

In paper [1] author has presented two general approaches, they are traffic control and resource control. In this paper they present HRTC (Hybrid Resource & Traffic Control) algorithm, i.e. bridging above two methods for congestion control and deliver the best solution, based on the dominant network conditions.

In Paper [2] author has reviewed various techniques which are already existing for detecting and controlling congestion in WSN. It includes Congestion Detection and Avoidance, Adaptive MAC Event to Sink Reliable Transport, Congestion Control and Fairness. In this paper a comparison between the performances of the various congestion control techniques is also given.

In paper [3] author examine three techniques i.e. hop-by-hop flow control, rate limiting source traffic when transit traffic is present, and a prioritized MAC protocol. They demonstrate that the combination of these techniques, or bridging these techniques can improve network efficiency by a factor of three under genuine loads.

In paper [4] a rate-controlled reliable transport protocol is explained. It places all the congestion detection and rate adaptation functionality in the sinks. It increases efficiency and flexibility because sinks make rate allocation decisions and hence it is possible to modify the rate allocation decisions, without modifying sensor code at all.

In paper [5] they proposed an efficient scheme to control multipath congestion in order to get priority based throughput for heterogeneous data through sink. Different types of multipath routing protocols have been proposed in WSN in order to achieve higher reliability and load balancing. A sensor node may have multiple sensors with different transmission characteristics i.e. light, temperature, seismic etc.

In Paper [6] a number of congestion control algorithms have been proposed that use the approach of "resource control". In this case, the sources don't have to reduce their data rate. Instead the excess packets are routed to the sink through alternative or multiple paths. Actually, these algorithms turn on the sensor nodes that are currently in inactive state to increase the capacity of the network to accommodate the higher incoming traffic. In this paper the performance of some congestion control algorithms are studied in terms of network lifetime and energy utilization. The algorithms that use resource control technique are Adaptive resource control scheme to improve congestion.

In paper [7] classification of different ad hoc routing protocols and some specified protocols according to that classification is given. In this paper variety of different protocols is given and evaluated their suitability and trade-offs.

In paper [8] author proposed an upstream hop by hop congestion control protocol based on cross layer design in order to achieve precise congestion control in many-to-one wireless sensor networks. Upstream traffic rate is adjusted according to node priority to mitigate congestion hop by hop. They found that UHCC protocol has achieved higher throughput and also better priority-based fairness along with lower packet loss ratio.

In Paper [9] an analytical congestion control scheme is given in which the congestion is mitigated by predicting the interlude of all the nodes based on the network conditions. It includes the traffic flow through a given region and channel state. Scheme proposed in this paper increases throughput, network efficiency and energy

conservation. This scheme guarantees desired quality of service and weighted fairness for all flows even during congestion.

In this paper [10] author has presented how algorithms behave when employed over different topologies. They have evaluated the performance of these algorithms with respect to Average Packet Losses, end to end Delay, and Average Data Rate. They found that the rate-based congestion control algorithms are slightly affected by the different topologies like average packet drops and source data rate and algorithms that uses alternate paths to frontward their data are densely deployed near the sink.

In this paper [11] they proposed a hop by hop upstream congestion control protocol for Wireless Sensor Networks, called PCCP(Priority based Congestion Control Protocol). PCCP detects congestion jointly using packet inter-arrival and service times. It introduces node priority index and realizes weighted fairness. It works for both single path and multi-path routing. It has been demonstrated through simulation that PCCP achieves high link utilization and flexible fairness. PCCP leads to small buffer size, therefore it can avoid or reduce packet loss and in turn improves energy-efficiency, and provide lower delay.

In this paper [12] a transitory review on causes for congestion, avoidance and control of the congestion is presented. Also a classification of congestion control mechanisms regarding with packet loss and location and the techniques to tackle the problem of congestion in WSN from different aspects and situations is given.

In this paper [13 they present a survey on transport control protocol for wireless sensor networks. Firstly they have given the limitation of TCP and UDP protocols and explained why they are not suitable for wireless sensor networks. Secondly they briefly reviewed several existing transport control protocols for wireless sensor networks, and list out several problems of the existing protocols.

III. APPLICATIONS

1) A dynamic scheme capable of bridging two or more different methods for congestion control and provide the best solution, based on the prevalent network conditions.
2) Increase packet delivery ratio.
3) Increase number of received packets in WSN.
4) Reduce time delay.
5) Reduce number of packets drop.
6) Hence Reduce congestion and give congestion free network.

IV. CONCLUSIONS

Hence in above manner review is being done for efficient congestion control in wireless sensor networks. Various techniques is being explained for efficient congestion control and it's found that bridging two algorithms can give better results.

REFERENCES

[1] Charalambos Sergiou,Vasos Vassiliou," HRTC: A Hybrid Algorithm for Efficient Congestion Control in Wireless Sensor Networks*" IEEE Forum on Computer Science,University of Cyprus*,Aug 2014.
[2] RekhaChakravarthi, C. Gomathy, Suraj K. Sebastian, Pushparaj. K, VinuBinto Mon,"A Survey on Congestion Control in Wireless Sensor Networks"*International Journal of Computer Science &CommunicationVol. 1, No. 1, pp. 161-164*, January-June 2010.
[3] Bret Hull, Kyle Jamieson, HariBalakrishnan,"Mitigating Congestion in Wireless Sensor Networks"*MIT Computer Science and Artificial Intelligence Laboratory The Stata Center, 32 Vassar St., Cambridge*, Nov 2004.
[4] JeongyeupPaek,Ramesh Govindan,"RCRT: Rate-Controlled Reliable Transport for Wireless Sensor Networks"*Embedded Networks Laboratory University of Southern California* Nov2007.
[5] Muhammad MostafaMonowar, Md. Obaidur Rahman and ChoongSeon Hong,"Multipath Congestion Control for Heterogeneous Traffic in Wireless Sensor Network"*Networking Lab, Department of Computer Engineering, Kyung Hee University* Feb 2008.
[6] Nilima Rani Das, RashmiRekhaSahoo and Debashree Mishra Sar, "An analytical survey of various congestion control and avoidance algorithms in WSN"*Siksha 'O' Anusandhan University, School of Computer Science*, Aug 2013.
[7] PetteriKuosmanen,"Classification of Ad Hoc Routing Protocols" *Finnish Defense Forces Naval Academy,Finland*
[8] Guangxue Wang and Kai Liu, "Upstream Hop-by-Hop Congestion Control in Wireless Sensor Networks"*School of Electronics and Information Engineering, Beijing University of Aeronautics and Astronautics, Beijing*, April 2009.
[9] MaciejZawodniok and SarangapaniJagannathan, "Predictive Congestion Control Protocol for Wireless Sensor Networks"*IEEE transactions on wireless communications, vol. 6, no. 11*, November 2007.
[10] VasosVassiliou and CharalambosSergiou, "Performance Study of Node Placement for Congestion Control in Wireless Sensor Networks"Department of Computer Science, University of Cyprus, 2009.
[11] C. Wang, Li,Senior and K. Sohraby, "Upstream Congestion Control in Wireless Sensor Networks Through Cross-Layer Optimization"*IEEE journal on selected areas in communications, vol. 25, no. 4*, May 2007.
[12] N. Thrimoorthy and Dr. T .Anuradha, "A Review on Congestion control Mechanisms in Wireless Sensor Networks" *Journal of Engineering Research and Applications, ISSN : 2248-9622, Vol. 4, Issue 11(Version 2)*, November 2014.
[13] Chonggang Wang, KazemSohraby, Bo Li, and Weiwen Tang, "Issues of Transport Control Protocols for Wireless Sensor Networks".

