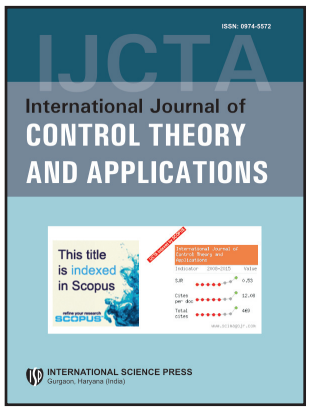

International Journal of Control Theory and Applications

ISSN : 0974-5572

© International Science Press

Volume 9 • Number 43 • 2016

Transmitting Urgent Data Using ANKM Method

A.S. Devare[a], G.K. Mohan[b] and Mayuri Gade[c]

[a-b]Computer Department, K.L. University, Guntur, India. Email: [a]devarea9@gmail.com; [b]gvlkm@kluniversity.in
[c]Computer Department, SPPU, University in Pune, India. Email: [c]mayurigade1995@gmail.com

Abstract:

Objective: To design and develop facility for transmission of urgent data along with normal data utilizing the ANKM method.

Methods: The traditionally used PAT fulfil the requirement for fast and reliable transmission of urgent information, which does not fulfil requirement of simultaneous transmission of normal data. Motivated by this we propose an autonomous, distributed mechanism called ePAT which provides fast and reliable transmission of urgent data along with normal data.

Findings: The designed transmission facility is developed for various applications like military, disaster detection etc. We propose the implementation through junk or ns2 simulator to achieve the result.

Application: The study can be extended to eliminate the congestion that occur in network and also increase the efficiency of sensor node.

Keywords: PAT, ANKM, ePAT, Buffer Occupancy, Rate Adjustment.

1. INTRODUCTION

A WSN is used for fast and reliable transfer of urgent information to establish network infrastructure which will help to make our society safe, secure, comfortable. If there is network congestion then some packets will be not reaching to the destination due to small size of the buffer. These will results in data loss, decrease in throughput, and loss of energy. For this reason, congestion control is a critical challenge in WSN. A WSN carry both urgent data and normal information which can't handle both. It means that WSN must be capable sending packet by deciding whether they are urgent or not. WSN also provide packets with higher priority are transmitted. In WSN it is important that operation of sensor network should be energy efficient, which shows lifetime of network. This mechanism eliminate possible delay and loss of packets because of collision and wireless transmission. Also this paper explores the design decision related to sensor network for providing reliable data transport. Figure 1 shows basic diagram of WSN.

2. ORGANIZATION OF THE PAPER

Paper is organized as follows: Section A present different transport layer protocol. Different approaches and design issue s of existing transport layer for reliability, congestion detection, and congestion elimination are also discussed in section B literature survey. Section C describes the problem definition and goal. Design and implementation of ANKM mechanism describe in section D. Finally, we conclude given approach in section E.

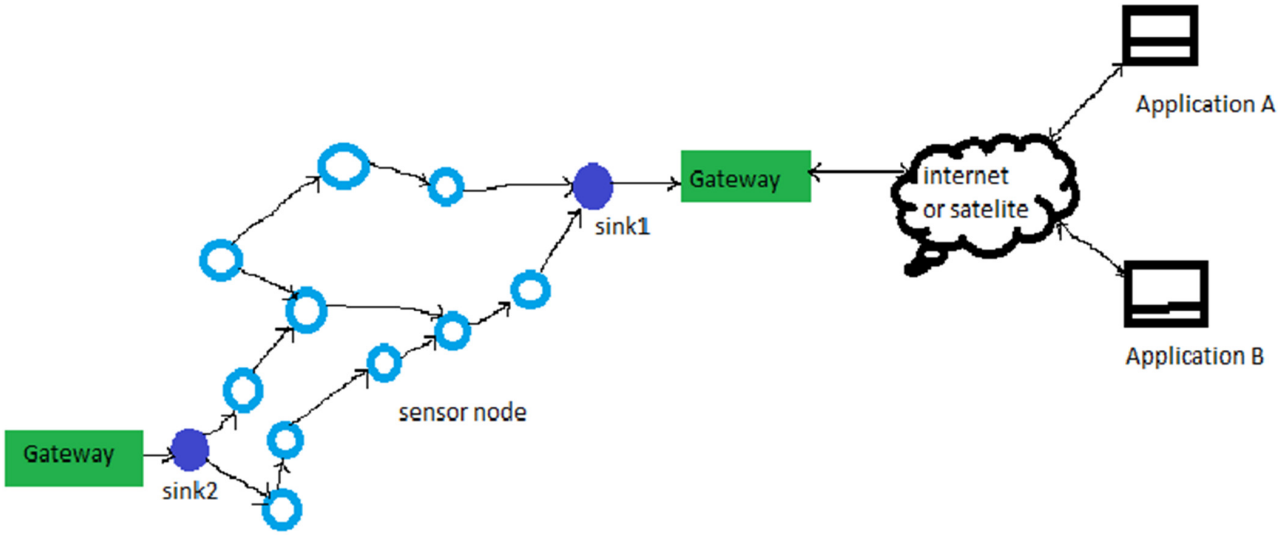

Figure 1: wireless sensor network

3. LITERATURE SURVEY

Most of WSN applications require delivery or transmission of data and packet in reliable manner. Due to features of WSN, designing a reliability in data transfer protocol has many challenges, such as energy consumption, more sensor node, data-centric networking, and small size of message. In this Section, it contain overviews and survey of transport protocols which has the property of reliability in transfer of data, congestion control & congestion elimination in WSN. In wsn there are many transferring protocols are designed. Some of the transport protocols are listed and encapsulate in Table 1 correlation in between congestion aware and reliability of different protocols that are displayed in the transport layer is in Table 2.

A. *Transport Protocols for Reliability and Congestion Control:* Table 1 consist of reliability protocols that are obtain. Parameters that are shown in the Table 1 are DCC, CCC and No Congestion Control [NCC]. A few protocols has reliability and others has unreliability. The protocols that are reliable are Flush, STCP- Support DCC; RCRT is CCC; and Wisden, Telnet, RMST have no congestion control. The protocols that are Unreliable are IFRC, Fusion, CODA which support DCC; QCRA, ESRT are CCC; Cent Route, RBC, surge have no congestion.

Table 1
Reliability of existing transport protocols

	DCC	*CCC*	*NCC*
Reliability	Flush, STCP	RCRT	Wisden, Telnet, RMST
Unreliability	IFRC, FusionCODA	QCRA,ESRT	Surge, CentRoute, RBC

where, DCC-Distributed Congestion Control, CCC-Centralized Congestion Control, NCC-No Congestion Control.

B. *Transport Layer Characteristics are as follows:* Different protocols in WSN at transport layer support:

Reliability: loss of packet in wsn is due to Congestion occurring in WSN; because of that packet reliability is required. Every protocol in transport layer for WSN offers unidirectional packet delivery and also the reliability in message transmission, but in certain application reliability is necessary. Property of reliability in WSN categorized as packet reliability, H-H reliability-T-E reliability, UP reliability and down reliability.

4. RELATED WORK

A. *Protocols which has a property of reliability:*

1. ERTP (Energy efficient Transport protocol): Data streaming application is used by this protocol. It is also has a packet reliability. In data streaming application here the way which is used is sensor monitoring are same to sink through sensor nodes. Energy dissipations id reduced by using E-to-E approach. It controls maximum number of retransmions dynamically at each sensor nodes. It uses stop-and-wait hop-by-hop impact acknowledgement for recovery. The acknowledgement for the transmitted is send by sink node to source node for every signal and if the acknowledgement is not received the same packet is again sent.[1]

2. ESRT (Event to Sink Reliable Transport): It Provides upstream event reliability and congestion control and it avoid the dropping of packets and minimum energy consumption. ESRT uses an end-to-end access to recognize a desired reliability Figure over modify the sensor's reporting frequency. It provides overall reliability for the application. Benefit of ESRT is energy conservation through control of reporting frequency.[2]

3. PSFQ (Pump Slowly Fetch Quickly): This protocol specially used for unicast communication. This protocol has three objective like message transferring, Discriminatory status reporting and relay originated error recovery. It is downstream protocol. That's why it handle and control reliability in reverse direction [3]

4. GARUDA: It is downstream protocol used for reliability from sink to source. It operates two stage Mac recovery. Wait-for-first-packet pulse is used for generating initial packet delivery. Initial packet delivery introduce core infrastructure. By using first packet delivery number of hop from sink to node is determined. The nodes which come under the path of hope count become the core member. It uses out-order strategy for overcoming under utilization scenario.[4]

5. *RBC:*RBC stands for Reliable Bursty Converge cast protocol. It uses windowless block acknowledgement scheme which copies the acknowledgement to forward the data packet continuously. A sensor node having large memory uses the RBC protocol, because it require large memory. Data packets are transmitted for few numbers of times. [5]

6. DTC (Distributed TCP Caching): This protocol is fully compatible with TCP. And it is also an modified version of TCP. it uses the AIMD algorithm for transmission window and H-T-H loss recovery scheme. [6]

7. CODA : CODA is an upstream congestion control technique that consist of three elements: open-loop hop-by-hop back pressure, and close loop end-to-end multi-source regulation. CODA detect congestion by monitoring current buffer occupancy and wireless exceed a threshold, it implies that congestion has occurred the node that has detected congestion will notify its upstream neighbor to reduce its rate, using an open-loop H-to-H back pressure.[7]

B. *Congestion detection:* For detection of congestion various parameters are used by different protocols. Node delay is the delay which is expected at every node by each packet. Channel Status [CS]. Information about how busy the channel is, and the interference of surroundings is provided by the CS, which detect whether the channel is ready to receive and transmit data without congestion. Congestion notification is also a essential factor, the notification data about the congestion urgency to transmit from the congested nodes to neighbor or to the source nodes in wsn after recognize congestion. The congestion occurs at node level and at the link level. Node level congestion occurs when many packets are flooded at node in same duration of time. It is shown in Figure (2). The congestion occurs at link level when many data or packets gets transmitted on the same link. The link level congestion is shown in Figure (3).

C. *Protocols for Congestion Control:*

1. Fusion: A bit called CN (Cn stands for congestion notification) is set by congestion node in a first field that is header of all outgoing packet**.** Once the bit CN is set, after that entire neighboring node stop sending packet to the congested node which helps in clearing the queue packet in the buffer of congested node.[8]

2. CCF (Congestion Control and Fairness): This protocol find PST (PST stands for packet service time) to detect congestion. If arrival rate is less than service rate of each intermediate node then there is congestion in that sensor node. It uses hop-by-hop approach. [9]

3. RCRT (Rate-Controlled Reliable Transport): It forward data from many points–to –single point which gives reliability. It gives E-T-E explicit loss recovery and provides all the congestion detection, rate adaptation and rate allocation service in the sinks.[10]

4. STCP (Sensor Transmission Control Protocol): Is flexible, E-T-E upstream transport layer protocol that provides both E-T-E reliability and congestion control mechanism? It is a protocol for transmitting multiple streams of data at the same time between two end points that established a connection in network. Sometimes refer to as “next generation TCP” A telephone connection requires that signaling information sent along voice and other data at same time. SCTP is standard protocol (RFC 2960) developed by the Internet Engineering Task Force (IETF). [11]

5. MCCP (Multi-event congestion control protocol): It uses two parameters for congestion detection, first is buffer size and second is packet delivery time between two sensor node.[12]

6. HTAP (Hierarchical Tree Alternative Path Algorithm): It controls congestion on the basis of local information by dynamically switching to alternate. In this protocol each node is only connected to those nodes which are in upstream direction i.e. from source node to sink node.

There are many more protocols like, PHSA (Probability based Hop Selection Approach), SUIT (Sensor fuzzy based image transport), NNBCD (Neural Network Based Congestion Detection protocol), FBACC, FCCTF, CONSEQ, IDCCP, SIPHON.[13]

Table 2
Comparison of technical features of congestion aware and reliable transport layer protocols

Transport Layer Protocols in WSN	*Reliability level*	*Reliability direction*	*Acknowledge*	*Delay*	*Caching*	*Congestion Detection*	*Energy Efficient*	*Reliability type*
ESRT	Event	Up	---	Large	No	Queue Occupancy	Yes	E-T-E
ATP	Pck	Up	Negative-ACK	Medium	No	Queue Occupancy	No	E-T-E
STCP	Pck	Up	Negative-ACK, error-ACK	Large	Yes	Queue Occupancy	Yes	E-T-E
ART	Event	Both	Negative-ACK, error-ACK	Small	No	ACK received to core nodes	Yes	E-T-E
RCRT	Pck	Up	Negative-ACK, ACK	----	No	Times to recover loss	NO	E-T-E
CTCP	Pck	Up	Double error-ACK	Medium	No	Queue Occupancy, Transmission error loss	Yes	E-T-E
Flush	Pck	Up	Negative-ACK	Small	No	Queue Occupancy, Link Interference	NO	E-T-E

where, UP = upstream, E-T-E = end-to-end, DW = downstream, Pck = packet, DB = destination based, H-T-H = hop-to-hop, ACK = acknowledgement, NACK= negative acknowledgemen eACK = error acknowledgement

D. *Protocol with mechanism of Congestion Elimination:*

1. ADMQOS: It proposed framework for adaptive management of QOS. It proposes a framework in different situation like management of rescue operation and cooperation during a disaster. The proposed framework also adapts its behavior to minimize delay and ensured reliability. [14]-[15]
2. OD-AODV: AODV stands for Ad hoc On-Demand Distance Vector Routing. It is used in order to discover and maintain shortest path. This protocol presence a framework for adaptive routing protocol. This framework defines two paths to transmit data according to their priority. [16]
3. FMUMUWSN: FMUMUWSN stands for Forwarding Method for Urgent Messages on the Ubiquitous WSN. it is useful to forward urgent messages, even there is packet loss on the wireless links. The urgent messages are send from monitoring node.[17]

Data Aggregation: Data aggregation is one of the most widely used solution to collect data. And it also used to minimize unessential number of packets which are sent to base station.[18]

Leach-R Protocol: Based on hierarchical process this protocol improve region or cluster using conservation. As compared to LEACH-R protocol, Enhanced LEACH-R gives better result.[19]

where, Et: Event Table 3 shows the congestion elimination in urgent protocols which shows the congestion detection, congestion avoidance, reliability level, reliability type and acknowledgement of each protocol mentioned in the Table 3.

Table 3
Congestion elimination in urgent protocol

Protocols	*Congestion Detect*	*Congestion Avoid*	*Reliability Level*	*Reliability Type*	*ACK*
RETPUI	QO and Fluctuation	Multistage Rate adjust	Et	HBH	ACK
FARTM	Urgent Data Occurrence	Implementing Assured path	Et	HBH	ACK
CP-EDCA	Urgency Detection	Normal Data Preemption	Et	HBH	ACK
ADMQOS	Et Detection	Priority wise Distribution	Et	HBH	ACK
OD-AODV	Et Classification	Priority wise shortest path conveyance.	Et	HBH	ACK
FMUMUWSN	Et Classification	Multipath Transmission	Et	HBH	ACK
PAT	Urgent Et	Blocking of normal data	Et	HBH	ACK

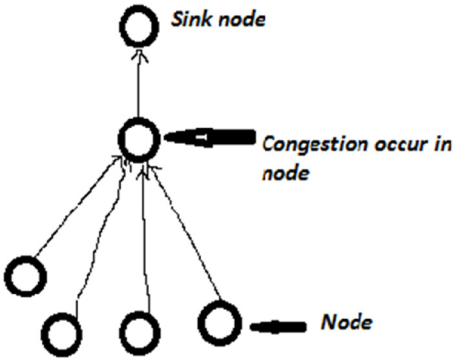

Figure 2: Node level congestion

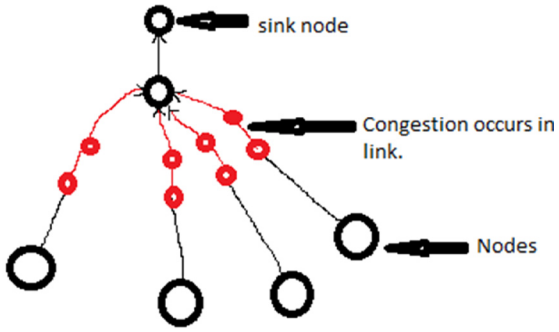

Figure 3: Link level congestion

5. PROBLEM DEFINITION

"To Transmit Urgent data using ANKM method" ANKM method is one mechanism which is used to transmit urgent data, using dedicated path. All other protocols are just used for reliability purpose or congestion avoidance, congestion detection, congestion elimination purpose. But here we propose one mechanism which is use to send urgent data as well as normal data

Goal: Traditional Transport layer protocol is not directly used to send urgent data before transmitting normal data. So here we try to send urgent data using assured path. Which conserves the property like congestion avoidance, congestion elimination and Reliability. This mechanism can be used in the area of military, earthquake.

6. PROPOSED SYSTEM

A. *Design and Implementation of Ankm Method: Network architecture* here the ANKM method is implementing at transport layer. Assured path data transfer

ANKM method is used in three phases:

(a) Firstly, using the assured path for data transmission.

(b) Transmission of urgent data using reliability mechanism.

(c) Network is again available for normal operation.

7. PAT

Lots of protocols are useful in forwarding urgent information. In PAT, sensors sends request to sink node for transferring urgent data, then sink node block all the transmission of normal packet by sending a blocking

request. Existing systems for Urgent data transmission mainly focused on the only transmission of urgent data. Proposed scheme aims not only transmission of urgent data packet but also the normal data packet at the same time. In existing PAT scheme, while transmission of urgent data (sensitive) from sink node to sensor node, all the normal data get blocked to avoid the congestion and provide 100 % reliability for urgent data but at the same time normal data is generated at other sensor node and due to blocking request from sink node, sensor node don't send the data in the network even if the urgent data transmission is not in the vicinity. And which result in normal data packet generated at sensor node could not store at node due to less memory. In the proposed scheme, this issue is resolved by using intelligence. It works in three phases, when sensor node has urgent data information, it send UREQ (urgent data request) to the sink node. This request will reach to the sink node via number of hops. The intermediates node will add their ID information to the request packet. When sink node receive the request packet, It immediately broadcast the blocking request which contain the ID information of intermediate node which received in request packet. When all other nodes will receive the blocking request it compare it's all neighbor ID and all ID contained in blocking request. If it found any neighbor ID in the blocking request ID list then it will block the normal data and if not then it will forward the normal data toward the sink node. Also when Sink node broadcast the blocking request, immediately its one hope neighbor node send the status information i.e. currently available power occupancy to the sink node. When this information contained packet received at sink node, it will select one of them as a backup sink node and broadcast (BUPSINK) request so that all other normal data generator node transfer data to the backup sink node and urgent data is transmitted to the original sink node. Finally when urgent data transmission is completed then original sink node will broadcast the block release request. When this request is received at backup sink node, it will start sending normal data which is aggregated from normal data generator node. Figure 4 shows architecture of urgent data transmission.

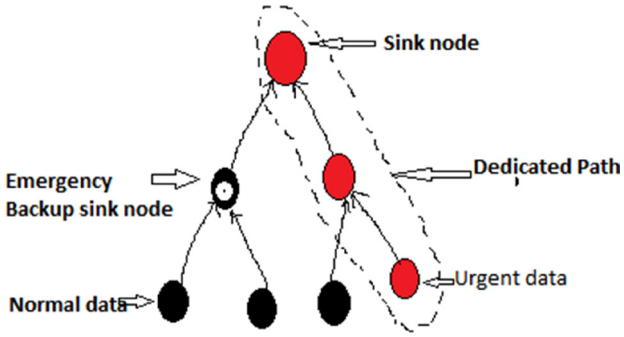

Figure 4: Urgent data transmission

8. CONCLUSION

In this paper, a survey of variety of protocols used for congestion control (CC) is originated. Congestion detection and control in wsn different types of protocols used and also some other protocols discussed in detail which have been recently proposed. WSN has many applications where time critical and urgent information needs to be transferred to the sink node. There are many protocols presented for this cause. In summary we concluded to transfer urgent information necessity of clear path assurance.

Acknowledgement

I would like to express my sincere gratitude towards friends, for always being there with me with all respect and gratitude, I would like to thank all the people, who have helped me directly or indirectly. Without their silent support and encouragement for this work could not have been possible. I would wish to thank Dr. G.K. Mohan for his valuable and firm suggestion, guidance and constant support throughout his work.

REFERENCES

[1] T. Le, W. Hu, P. Corke, and S. Jha, ERTP: Energy-efficient and Reliable Transport Protocol for data streaming in Wireless Sensor Networks. Computer Communications. 2009, pp. 1154–1171.

[2] O. B. A. Y. Sankarasubramaniam, and I. F. Akyidiz, ESRT: Event-to-sink reliable transport in wireless sensor networks. in Proceedings of ACM Mobihoc. 2003, June 3

[3] C.-Y. Wan, et. al., PSFQ: a reliable transport protocol for wireless sensor networks. in Proceedings of the 1st ACM international workshop On Wireless sensor networks and applications.2002, September 28, pp. 1-11.

[4] R. Sivakumar and I. F. Akyildiz, GARUDA: Achieving Effective Reliability for Downstream Communication in Wireless Sensor Networks. IEEE Transactions on Mobile Computing. 2008, February, pp. 214–230.

[5] H. Zhang, A. Arora, Y.-r. Choi, and M. G. Gouda, Reliable bursty converge cast in wireless sensor networks. 2007, pp. 2560–2576.

[6] A. Dunkels, J. Alonso, T. Voigt, and H. Ritter, Distributed TCP Caching for Wireless Sensor Networks. SICS Research Report. 2004.

[7] S. B. E. a. A. T. C. C.-Y. Wan, CODA: Congestion detection and avoidance in sensor networks. in Proceedings of ACM Sensys.2003, November 03, 5-7.

[8] L. A. Freitas, A. R. Coimbra, V. Sacramento, S. Rosseto, and F. M. Costa, A Data Fusion Protocol in Wireless Sensor Networks for Controlled Environment. In INFOCOM Workshops 2009, IEEE. 2009, pp. 1–2.

[9] C.T. Ee and R. Bajcsy, Congestion control and fairnesss for many-to-one routing in sensor networks.in proceeding so the 2 international Conference on Embedded networked sensor systems. 2004, pp.148– 161.

[10] J. Paek and R. Govindan, Rcrt: Rate-controlled reliable transport for wireless sensor networks. In Proceedings of the 5th international Conference on Embedded networked sensor systems. 2007, pp. 305– 319.

[11] Y. G. Iyer, et. al., STCP: a generic transport layer protocol for wireless sensor networks. In Computer Communications and Networks. 2005, ICCCN 2005. Proceedings. 14th International Conference on 2005, pp. 449-454.

[12] H. Faisal B, C. Yalcin, S. Ghalib A, et. al., A multievent congestion control protocol for wireless sensor networks. EURASIP Journal on Wireless Communications and Networking. 2008, 2009.

[13] C. Sergiou, Performance-aware congestion control in wireless sensor networks using resource control. In World of Wireless, Mobile and Multimedia Networks (WoWMoM), 2013 IEEE 14th International Symposium and Workshops. 2013, pp. 1–2.

[14] T. Kawai, et. al., A fast and reliable transmission mechanism of urgent information in sensor networks. Proceedings of the 3rd International Conference on Networked Sensing Systems (INSS 2006). 2006.

[15] Telecommunication Technologies, 2005. APSITT 2005 Proceedings. 6th Asia-Pacific 15]S. S. a. D. Kumar, An approach to optimize Adaptive Routing Framework to provide QOS in Wireless Sensor Networks. In proceeding of International Journal of wireless Networks and Communication. 2009, pp. 55-69.

[16] K. Ishibashi and M. Yano, a Proposal of Forwarding Method for Urgent Messages on a Ubiquitous Wireless Sensor Network. In Information and Symposium on. 2005, pp. 293-298.

[17] A. W. R. A D Karanjawane, S D Mali, AN A Agarkar, Designing Path Assured Data Transfer Protocol for Wireless Sensor Network. In proceeding of International Journal of Engineering Research and Technology (IJERT). 2013 pp. 1151-1160.

[18] S. Sasirekha, S. Swamynathan, A Comparative Study and Analysis of Data Aggregation Techniques in WSN. Indian Journal of Science And Technology, 2015 Oct.

[19] Jatinder Kaur, Gurjot Singh Gaba, Rajan Miglani, Ruchi Pasricha Energy Efficient and Reliable WSN based on Improved Leach-R Clustering Techniques. Indian Journal of Science and Technology, 2015 July.