ISSN: 2581-3404 (Online)
International Journal of Innovative Research in Technology and Management (IJIRTM), Volume-3, Issue-3, 2019

Congestion Control Scheme in Multi-Hop Cognitive Radio Network: Survey & Discussions

Surbhi Kedia[1], Prof. Jitendra Mishra[2]

[1]M. Tech Scholar, Department of EC, PCST, Bhopal (India)

[2]Head & Professor, Department of EC, PCST, Bhopal (India)

[1]ersurbhikedia@gmail.com, [2]jitendramishra@gmail.com

ABSTRACT

Recent development of tiny, low-power, low-cost, and multi-functional wireless sensor nodes has been accelerated by advances in manufacturing, electronics, communication, and miniaturization. In wireless multi-hop ad hoc networks, congestion control plays an important role in reliable transmission. Performance evaluation of transport layer protocols in cognitive radio sensor networks (CRSNs) is useful to provide quality-of-service for real time reliable applications. In this paper we present the survey for reliable communication in the wireless sensor network.

Keywords: Cognitive Radio, Federal Communications Commission, Cognitive Radio Sensor Networks, Dynamic Spectrum Access, Wireless Sensor Networks.

INTRODUCTION

Recently with the rapid growth of wireless devices, the radio spectrum demand has been increased dramatically. However, according to the Federal Communications Commission (FCC), almost all the radio spectrum for wireless communications has been allocated. To alleviate this spectrum shortage problem, FCC has suggested a new paradigm for dynamically accessing the vacant portions of the allocated spectrum [1]. Cognitive radio (CR) is a key technology that allows dynamic spectrum access (DSA) [2]. With the CR technology, unlicensed users (or, secondary users) can opportunistically exploit licensed channels which are not used by licensed users (or, primary users).

These sensors nodes are equipped with the capability of environmental sensing, data collection, data processing, and wireless communication. Therefore, wireless sensor networks (WSNs) can actively collect information and report events in a self-organized manner. WSNs have been widely used in a diverse range of applications, such as tracking, video surveillance, remote monitoring, localization and event-reporting [4]. Recently, there are increasing research efforts on WSNs towards energy conservation, which reduces the requirement on memory and the complexity of protocol design with the rise of the Internet of Things (IoT). In recent years, the number of embedded devices has increased and finally, they are envisioned to seamlessly connect to the Internet as the IoT.

A typical wireless sensor network is composed of several sensor nodes and one sink node. Sensor nodes collect data and forward the data to the sink node. A typical architecture of a WSN is shown in below figure. Sensor nodes sense the environment and collect raw data [4]. With local processing, sensors communicate with each other. If necessary, data aggregation is performed and the aggregated data is delivered to a sink. Users can have access to the data collected from sensors through the sink node by accessing the internet.

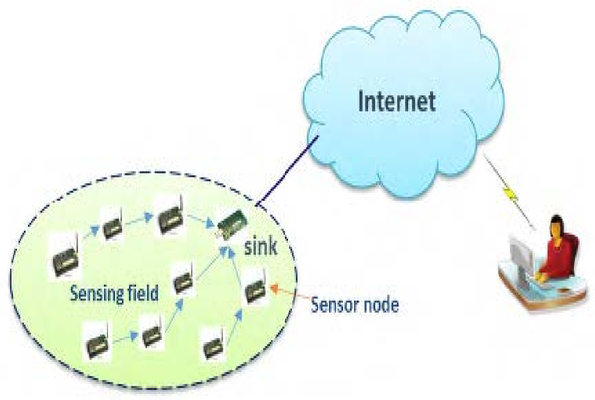

Figure 1: An architecture of a wireless sensor network [4].

The increasing number of mobile devices along with the plethora of multimedia applications such as mobile gaming, High Definition (HD) movies and video conferencing have triggered rapid advances in cellular technology and services. These developments coupled with the need for data access anytime, anywhere from any device have led to an increase in demand for higher data rates and Quality of Service (QoS) provisioning. Today, it is not uncommon to see multiple devices owned by same user being connected to the Internet, through cellular network, wireless networks and so on all of which are generating large amounts of traffic.

A Wireless Mesh Network (WMN) is considered as a multi-hop wireless network, in which mesh nodes relay traffic on behalf of other mesh nodes or connected clients (and networks) and thereby form a wireless backbone. In the initial design of a WMN, wireless mesh routers were equipped with only one radio and a single channel was used for communication. Multiple performance evaluations of this single-radio approach were conducted and researchers showed that the available access capacity for each node significantly decreases with the network size. Dual-radio mesh networks were proposed where one radio is dedicated to access and one to forward packets [7].

End-to-end congestion control, aiming to obtain how much traffic load offered by the source can be handled by a network, is an essential function of a transport layer protocol. Conventionally, Transmission Control Protocol (TCP) is the prevalent transport protocol to provide end-to-end congestion control on the Internet. Routers over the Internet indicate congestion by dropping packets (i.e., buffer overflow). Therefore, the classic TCP protocol views all packet losses as being congestion related. In addition, packet round trip timeouts (RTOs) and duplicate acknowledgments (ACKs) are used as indicators for packet loss in TCP. However, in wireless ad hoc networks, packet losses may be contributed to various reasons such as interference or poor link quality [1]. If packet losses are used as the indication of the congestion in wireless networks, the performance of the network will significantly degrade because the source node may mistakenly reduce the transmission rate in order to regulate the problem of congestion. Another promising solution for improving spectrum utilization in next generation cellular networks is Device-to-Device (D2D) communication. D2D communication enables direct communication between nearby mobile devices without the involvement of a BS or the evolved Node B (the radio part of an E-UMTS radio transmission site). D2D is being considered as a key enabling technology in 5G cellular networks due to the inherent need for high data rate, delay constrained, and QoS specific communication.

The rest of this paper is organized as follows in the first section we describe an introduction of about the wireless sensor network and attack. In section II we discuss about the End to end congestion control, In section III we discuss about the related work for the trust scheme in mobile ad-hoc network, finally in section IV we conclude and discuss the future scope.

II END-TO-END CONGESTION CONTROL

The main idea of proposed end-to-end congestion control scheme is to combine the ECN and timeout mechanisms to make the optimal decision to handle the congestion in the network. The proposed scheme has the following advantages compared with the existing congestion control approaches: 1) it does not need a dedicated common control (CCC) to exchange or transmit the congestion notification; 2) no other control messages is needed except ECN; 3) the end-to-end congestion control can be performed faster than the traditional timeout mechanism; 4) the congestion control can be performed correctly even if the ECN message never reaches the source node; and 5) the end-to-end throughput of the network is high. First of all, the objectives of the PHY layer are spectrum sensing, modulation, and coding. The spectrum sensing helps each SU to obtain the availability information of the current channel as in input for the higher layers. Secondly, at the link layer, there are two sub-layers including the medium access control (MAC) layer and the logic link control (LLC) layer. There are two objectives for the LLC layer: 1) the channel rendezvous (i.e., the method tries to find a common available channel for communications) and 2) the link error control scheme.

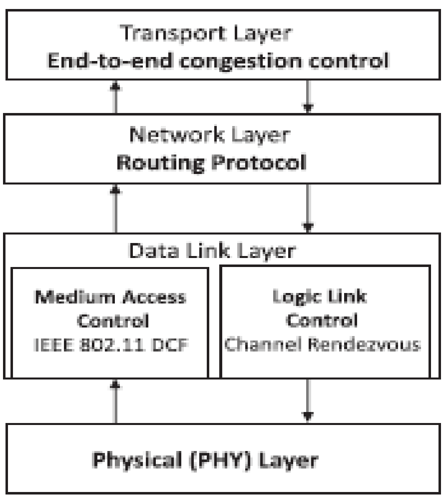

Figure 2: The proposed end-to-end congestion control framework of multi-hop CR ad hoc networks [1].

III RELATED WORK

End-to-end congestion control, aiming to find out how much traffic load offered by the source can be handled by a network, is an essential function of a transport layer protocol. Although various efforts have been made to address the end-to-end congestion control issue in traditional wireless ad hoc networks, these approaches usually lead to excessively long delay for the source node to react to the congestion in cognitive radio (CR) ad hoc network because of the non-uniform channel availability.

[1] In this paper, a novel end-to-end congestion control scheme named ECCO is proposed that considers the unique features in multi-hop CR ad hoc networks, such as spectrum sensing, channel rendezvous, and licensed user activities. The average packet round trip time for multi-hop CR ad hoc networks is derived. In addition, through extensive simulation, it is shown that their proposed novel end-to-end congestion control scheme outperforms the existing congestion control mechanisms in terms of higher end-to-end throughput. To the best of our knowledge, this is the first paper that investigates the end-to-end congestion control issue in multi-hop CR ad hoc networks. [2] This survey is key in identifying essential catalysts that are believed to jointly pave the way to solving the beyond-2020 backhauling challenge. Lessons learned, unsolved challenges, and a new consolidated 5G backhaul vision are thus presented. 5G is the next cellular generation and is expected to quench the growing thirst for taxing data rates and to enable the Internet of Things. Focused research and standardization work have been addressing the corresponding challenges from the radio perspective while employing advanced features, such as network densification, massive multiple-input-multiple-output antennae, coordinated multi-point processing, inter-cell interference mitigation techniques, carrier aggregation, and new spectrum exploration. [3] In this paper author presents a survey on techniques for making the next generation cellular networks GREEN. A number of technologies form a part of the 5G networks, in

order to support the drastic user demands, and are receiving substantial attention from the perspective of green communication. These include device-to-device communication, spectrum sharing, ultra dense networks, massive MIMO, and the Internet of Things. Also, a prime concern in the current scenario is the battery life of the mobile terminals. For enhancing the battery life of the user terminals, a proposal is given in this paper, with spectrum sharing as its basis, to overcome the energy crunch. Major research challenges have been discussed, and the ongoing projects and standardization activities also stated in this paper.
[4] In this paper author discuss the essential properties of MAC protocols, the MAC for IoT and the common causes of energy consumptions. Thereafter, they categorize the MAC layer protocols and discuss several protocols under each category in depth, emphasizing their strengths and weaknesses, and giving a detailed comparison of MAC protocols. Typically, a WSN consists of a large number of tiny, low-cost sensor nodes that are limited in terms of their capabilities of computation, communication, memory, and power. In WSNs, energy-efficient algorithms are of paramount importance for a long lasting high throughput network. MAC protocol plays a prominent role in extending the life-time of WSNs. MAC protocols provide various schemes on how multiple nodes access a common wireless medium. To achieve a longer lifetime for the nodes and the networks, MAC protocols need to be energy-efficient and reduce the sources of energy wastage. Energy conservation in sensor nodes is generally achieved by duty cycling the radios, and it is the MAC layer protocol that controls when to switch on and off the radio. Finally, they conclude the survey with the insights on future research directions. [5] In this survey they have provided a detailed review of existing D2D technologies along with its various characteristics such as device discovery, mode selection, resource management, mobility management and security. This paper has also demonstrated the advantages of D2D in forthcoming 5G technologies. Although D2D communication is a relatively new idea, but significant amount of research in D2D has recently opened up a range of related research issues that should be investigated in the future. This survey will help future readers better understand the D2D concepts and technologies and enable them to have a good grasp of future research opportunities that have been identified in the field of D2D communication. [6] This paper proposes a novel distributed multi-channel medium access control (MAC) protocol using fast and slow hopping sequences with dual radio interfaces. Specifically, one interface follows fast hopping and is primarily for transmission, and the other interface follows slow hopping and is generally for reception. The proposed protocol, which is in line with the IEEE 802.11 MAC strategies, is based on the multiple rendezvous approach and able to enhance the network performance and resolve the congestion. An analytical model is developed to evaluate the network performance in terms of the aggregate throughput. Furthermore, the maximum saturation throughput and the upper achievable throughput are computed. [8] In this survey author present an up to date review of the different technologies used in the different phases involved in a TMS, and discuss the potential use of smart cars and social media to enable fast and more accurate traffic congestion detection and mitigation. They also provide a thorough study of the security threats that may jeopardize the efficiency of the TMS and endanger drivers' lives. Furthermore, the most significant and recent European and worldwide projects dealing with traffic congestion issues are briefly discussed to highlight their contribution to the advancement of smart transportation. Finally, we discuss some open challenges and present our own vision to develop robust TMSs for future smart cities. [9] In this paper author first propose a new congestion metric called frame transmission efficiency (i.e., the ratio of successful transmission delay to the frame service delay), which describes the medium contention in a fast and accurate manner. They further present the design and implementation of RECN (ECN and the ratio of successful transmission delay to the frame service delay in the MAC layer, namely, the frame transmission efficiency), a general supporting scheme that

adjusts the transport sending rate through a standard ECN (Explicit Congestion Notification) signaling method. Their method can be deployed on commodity switches with small firmware updates, while making no modification on end hosts. [10] In this paper author use Bloom filter to minimize the prediction errors. They apply Savitzky-Golay filter to train a sequence of confidence windows. The purpose is to smooth the prediction process from being disturbed by load fluctuations. They present a new self adjust hybrid model (Proactive and Reactive Model) for load prediction guided by trained confidence windows. This will address excess bandwidth and long route request delay of proactive and reactive routing protocols. Self-adjust hybrid model (SH Model) provides a framework for other protocols. The significant gain in prediction accuracy makes the new SH Model very attractive to predict Congestion Control performance and also they propose path observation based physical routing protocol named POPR for WANET. [11] In this paper, a cross layer scheme is proposed to accomplish the flow contention of TCP in multi-hop ad-hoc networks. The proposed scheme collects the useful information from physical and MAC layer for approximation of channel utilization per station. The contention window (CW) has been adjusted to control the competition between stations. The proposed method also achieved the fair channel access by each station to achieve to equivalent throughput. The value of bandwidth allocation to each flow is calculated and sent to the next layer for getting the fair bandwidth allocation to each flow. Then, control the sending rate of TCP flow to resolve the problem of contention between flows. Each flow got almost equal throughput and fairness has been improved.

IV CONCLUSIONS AND FUTURE SCOPE

Wireless networks are cost-effective and easy to deploy. However, the network performance of ad hoc networks is limited due to the interference among nodes. Many schemes and technologies have been proposed to improve the network performance such as using smart antennas, exploiting multiple orthogonal channels, and improving spatial reuse. Integrating one or more of these techniques provides further capacity improvement. Here we present the survey for the current problem in wireless network such as energy efficiency, improvement in the channel and other quality of services, in the future we work to avoid such problem and improve the performance of overall network.

REFERENCES:-

[1] Dan Wang, Yi Song, "ECCO: A Novel End-to-End Congestion Control Scheme in Multi-Hop Cognitive Radio Ad Hoc Networks", IEEE TRANSACTIONS ON COGNITIVE COMMUNICATIONS AND NETWORKING, VOL. 5, NO. 1, MARCH 2019, pp 93-102.

[2] Mona Jaber, Muhammad Ali Imran, Rahim Tafazolli, Anvar Tukmanov, "5G Backhaul Challenges and Emerging Research Directions: A Survey", IEEE access 2016, pp 1743-1766.

[3] Pimmy Gandotra, Rakesh Kumar Jha, Sanjeev Jain, "Green Communication in Next Generation Cellular Networks: A Survey", IEEE access 2017, pp 11727-11758.

[4] Arun Kumar, Ming Zhao, Kai-Juan Wong, Yong Liang Guan, And Peter Han Joo Chong, "A Comprehensive Study of IoT and WSN MAC Protocols: Research Issues, Challenges and Opportunities", IEEE access 2018, pp 76228-73262.

[5] Furqan Jameel, Zara Hamid, Farhana Jabeen, Sherali Zeadally Muhammad Awais Javed, "A Survey of Device-to-Device Communications: Research Issues and Challenges", IEEE COMMUNICATIONS SURVEYS & TUTORIALS, 2018, pp1 -37.

[6] Khaled H. Almotairi, Xuemin (Sherman) Shen, "A Distributed Multi-Channel MAC Protocol for Ad Hoc Wireless Networks", IEEE 2013, pp 1-30.

[7] Michael Rademacher , Karl Jonas, Florian Siebertz, Adam Rzyska, Moritz Schlebusch, Markus Kessel, "Software-Defined Wireless Mesh Networking: Current Status and Challenges", THE COMPUTER JOURNAL, 2017, pp 1-16.

[8] Soufiene Djahel, Ronan Doolan, Gabriel-Miro Muntean, John Murphy, "A Communications-oriented Perspective on Traffic Management Systems for Smart Cities: Challenges and Innovative Approaches", IEEE 2014, pp 1-28.

[9] Huaguang He, Taoshen Li, Luting Feng, Jin Ye, "Frame Transmission Efficiency-Based Cross-Layer
Congestion Notification Scheme in Wireless Ad Hoc Networks", MDPI 2017, pp 1-14.

[10] M.Rajesh, J.M.Gnanasekar, "CONGESTION CONTROL SCHEME FOR HETEROGENEOUS WIRELESS AD HOC NETWORKS USING SELF-ADJUST HYBRID MODEL", International Journal of Pure and Applied Mathematics, pp 519-537.

[11] Qamar Jabeen, Fazlullah Khan, Shahzad Khan, Mian Ahmad Jan, "Performance Improvement in Multihop Wireless Mobile Adhoc Networks", J. Appl. Environ. Biol. Sci., 2016, pp 82-92.

Surbhi Kedia received her Bachelor`s degree in Electronics & comunication, JNCT, Bhopal, M.P., in 2013. Currently she is pursuing Master of Technology Degree in Electronics & Comunication (Digital communication) from PCST, (RGPV), Bhopal, Madhya Pradesh India. Her research area include Wireless sesnor networks.

Mr. **Jitendra Mishra** he is Associate Professor and Head of the Department of Electronics and communication in PCST, Bhopal (RGPV). His received Master of Technology and Bachelor's of engineering respectively in Digital communication from BUIT, Bhopal and from RGPV, Bhopal. He has more than 11 years of teaching experience and publish 35+ papers in International journals, conferences etc. His areas of Interests are Antenna & Wave Propagation, Digital Signal Processing, Wireless Communication, Image Processing etc.