Evaluate The Performance Of WPAN Using Cooperative Mechanism

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ABSTRACT - The ISM spectrum is becoming increasingly populated by emerging wireless networks. Spectrum sharing among the same network of devices can be arbitrated by a traditional MAC protocol but the coexistence between the heterogeneous networks might be a problem. The lack of coordination between the heterogeneous network causes to the mutual interference. To overcome this problem a new mechanism called the Distributed Cooperative Relaying(DCR) is proposed. That enables the reliable coexistence between two such networks WLAN (Wi-Fi) and WPAN (ZigBee).In this approach nodes may cooperate with each other. Nodes turn into Partners by cooperatively forwarding each other's data. It prevents the mutual interference between heterogeneous networks.

INDEX TERMS: DCR, Coexistence, cooperate, Wireless networks.

I. INTRODUCTION

In order to provide availability of multimedia services and applications, wireless technology evolving towards integration of heterogeneous access networks. Such as Wireless Personal Area Networks(WPAN),Wireless Local Area Networks(WLAN).The integrated network of IEEE 802.11/WLAN and IEEE 802.15.4/WPAN can bring a synergetic improvement to the telecommunication services on coverage, data rates and QOS provisioning to mobile users.

WLANs are mainly used in their 802.11a, 802.11b, and 802.11g versions. It provides wireless connectivity in home, office, and some commercial establishment. The industrial, scientific and medical bands 2.4GHZ and 5GHZ have been made available for WLAN, among which the 802.11b and 802.11g protocols are most popular. WLAN have limitations in terms of mobility and coverage area. A Wireless Personal Area Network is a PAN carried over wireless network technologies such Bluetooth, ZigBee. It is a network for interconnecting device centered around an individual person's workspace in which the connection are wireless. A WPAN could serve to interconnect all the ordinary computing and communicating devices.

The cooperative relaying scheme takes advantage of the broadcast nature of the radio channel. An integrated WPAN and WLAN network can be used to extend the coverage area of a WPAN and augment the availability using mobile wireless system. The wireless communication systems are anticipated to be able to fulfill requirements of higher data rate, larger coverage and low power consumption. As wireless communication has been integral part in our daily lives, a multitude of mobile application, multimedia, data access and sharing, streaming video and many other services have been emerging day by day. As a result, demands for higher data rate, larger capacity and broader radio coverage to deliver mobile services to large area as possible have been increasing.

Wireless MAC/PHY standards used for establishing Wireless Local Area Networks (Wi-Fi) and Personal Area Networks (ZigBee) on the ISM band. Allowing Spectrum sharing among these networks will undoubtedly improve spectrum utilization. But coexistence between WPAN and WLAN remains a challenging problem. The traditional MAC protocols are ineffective in dealing with the disparate transmit-power levels, asynchronous time slots. The presence of Wi-Fi interference it cause to severe collisions between the WPAN and WLAN.

To establish the traditional framework to analyze the performance. The DCR mechanism enhances with a new coexistence Management framework, making Wi-Fi better aware of presence, and hence achieving better channel sharing. In the existing system two such networks, Wi-Fi (IEEE 802.11 WLAN) and ZigBee (IEEE 802.15.4 WPAN) that operate in the same ISM band. But the ZigBee's performance is severely degraded in the presence of moderate to high Wi-Fi traffic. A straight forward way to avoid inter cell interference is to allocate ZigBee devices to channels that are not or less used by Wi-Fi devices. Where collocated APs tend to occupy different parts of the spectrum to avoid inter cell interference .The CSMA-style spectrum etiquette in such networks may seem to be an effective. It enables ZigBee to share the same frequency band with Wi-Fi. ZigBee allows for TDMA mode which operates without carrier sensing and may arbitrarily collide with an ongoing Wi-Fi transmission.

II. LITERATURE SURVEY

The method to improve the interference mitigation capability in overloaded small-cell networks was described in [1]. It presents two-complexity schemes to identify a suitable channel to serve the scheduled user. The use of small cells has been suggested to bring cellular network closer to users equipment. This technology attempts to improve the system capacity and to extend the spatial coverage of existing cellular system. In [2] discussed about Metronome, a system that allows heterogeneous networks to coexist well. It provides a flexible and expressive policy language that allows a network operator to specify constraints on receiver performance metrics such as throughput or less rate. Spectrum scarcity is to allow heterogeneous networks to share frequency bands. In which using some form of spread spectrum there is some evidence of significant interference related problems. wireless technology in medical environment was discussed in [3]. It enables

widespread use of wireless body sensors. One of the emerging solutions for the body network is the ZigBee technology. It is generally used for applications that can tolerate a low transmission rate but demand Long battery life. In which ZigBee faces severe interference problems in the presence of various 802.11 networks. In [4] discussed about adoption of ZigBee technology for performance-sensitive applications Wi-Fi traffic contains abundant white space that enables ZigBee links to achieve assured performance in the presence of heavy Wi-Fi interference. They Develop a new ZigBee frame control protocol called WISE, which can achieve desired trade off between link throughput and delivery ratio .These applications impose stringent requirements for the underlying networks including high throughput and packet delivery ratio.

The method to frequency overlap across wireless networks, with different radio technologies can cause severe interference and reduce communication reliability was described in[5].The ZigBee networks that share the 2.4GHZ ISM band with Wi-Fi senders capable of 10 to100 times higher transmission power. They first examine the interference patterns between ZigBee and Wi-Fi networks at the bit-level granularity. In [6] discussed about the emerging cognitive radio technology. It enables the introduction of hierarchical spectrum sharing in wireless networks where the primary users have transmission guarantees, but the coexisting secondary users need to be cognitive toward primary activities and adjust their transmissions to conform to the primary constraints whereas concurrent primary and secondary transmissions are allowed and where the secondary users control the interference at the primary receivers. In [7] deals about the integration of heterogeneous wireless technologies. Wireless medical device coexistence is a growing concern given the ubiquity of wireless technology. The coexistence of a wireless medical device in a non-line-sight environment utilizing 802.15.4 in a practical, versatile and reproducible test setup. It finds the relative to co-channel and adjacent channel interference. Coexistence among wireless device is dependent on three main factors they are frequency, space and time. A reproducible NLOS coexistence test protocol was designed for wireless medical devices utilizing ZigBee. The main purpose of this protocol is to gain helpful information toward efficiently overcoming coexistence problem between heterogeneous networks.

The coexistence of 802.11 and 802.15.4 in the ISM band was discussed in[8]. They have different transmission characteristics that result in asymmetric interaction pattern. They implement listen before send performance for heterogeneous networks with substantial measured data.802.11 devices and 802.15.4 devices require a listen before send prior to every transmission. To obtain information in what happens on the channel during the experiment they used a spectrum analyzer. In [9] discussed about unlicensed spectrum can satisfy the ever-increasing demands for wireless bandwidth created by emerging rich media applications where high-throughput wideband nodes are working to co-exist with unknown narrowband devices, while forming a network of their own. While this achieves coexistence, it scarifies the throughput and operating distance of the wideband devices. The coexistence study for wireless body area network was described in[10]. It focus on the evaluation of the impact of a collocated IEEE 802.11g WLAN interferer on the performance of IEEE 802.15.4 transceivers .In wireless coexistence model, two or more collocated devices transmit data sharing the available time and frequency resources. A typical channel measurement technique used in indoor propagation is the frequency domain channel sounding.

In [11] discuss about proper frequency planning is essential to enable multiple IEEE 802.15.4 networks to coexist in the same space otherwise the network performance can be affected due to interference. It demonstrates one approach to detecting mitigating interference in IEEE 802.15.4 networks from other 802.15.4 networks. Interference is detected by the coordinator nodes checking for packets from other PANs. The network initialization flows in detail and develops an improved association scheme named Simple Association Process was discussed in [12]. It deals reduce redundant primitives, avoid collision and decrease association delay. In [13] discuss about spectrum sharing among the wireless network. They propose a new mechanism called the Cooperative Busy Tone (CBT), that enables the reliable coexistence between two such networks ZigBee and Wi-Fi. Both the analytical and detailed simulation results Demonstrate CBT significant throughput improvement over the legacy ZigBee protocol.

III. OVERVIEW

Distributed Cooperative Relaying mechanism is proposed to facilitate ZigBee's coexistence with Wi-Fi. A cooperative wireless network where all nodes can transmit information cooperatively. Each node can be a source node that transmits its information or it can be a relay node that helps forward information of other nodes. The cooperative scheme requires less power to achieve the same performance as the non-cooperative scheme. Cooperation describes the act of individuals or group collaborating to achieve a common or even an individual goal by common or individual means under the constraint of their own egoistic behaviour. DCR builds a top the ZigBee MAC/PHY, but enhances it with a new coexistence management framework, making Wi-Fi better aware of ZigBee's presence, and hence achieving better channel sharing.

A. Implementation Of Wireless LAN And Wireless PAN Network

The wireless MAC/PHY standards establish wireless local area networks and personal area networks on the ISM band. Allowing spectrum sharing among these networks will improve spectrum utilization. Two such networks Wi-Fi and ZigBee that operate on the same ISM band. Wi-Fi is designed for internet access and ZigBee is designed for monitoring and control application.

B. Evaluate the Impact of the System Parameter on mutual Interference

The ZigBee device shares the same frequency band with Wi-Fi. The presence of high Wi-Fi traffic ZigBee performance is severely degraded. The ZigBee links in the WPAN were observed to suffer connection loss during peak hours due to Wi-Fi interference. collision can occur in the time domain when a Wi-Fi packet is partially sensed by ZigBee. It implies that Wi-Fi packets are partially sensed during the long sensing period of ZigBee devices.

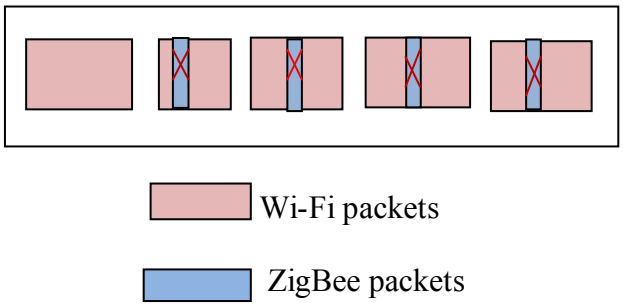

Figure 1.Data Transfer

C. *Analysis The Coexisting of WLAN And WPAN Devices*

Proposed a new mechanism called Distributed Cooperative Relaying (DCR) that exploits the cooperation among the ZigBee and Wi-Fi devices. This framework making better aware of ZigBee presence and achieving better channel sharing. It employs an innovative way to concurrently schedule a busy tone and a data transmission without causing interference between them. A temporary frequency-hopping mechanism that separates the carrier signalling from the data transmission in frequency domain. Proposed method introduces a simple relay configuration scheme that configures the power and location**.** It prevent the other devices from the interrupting the ongoing transmission of a ZigBee data packet.

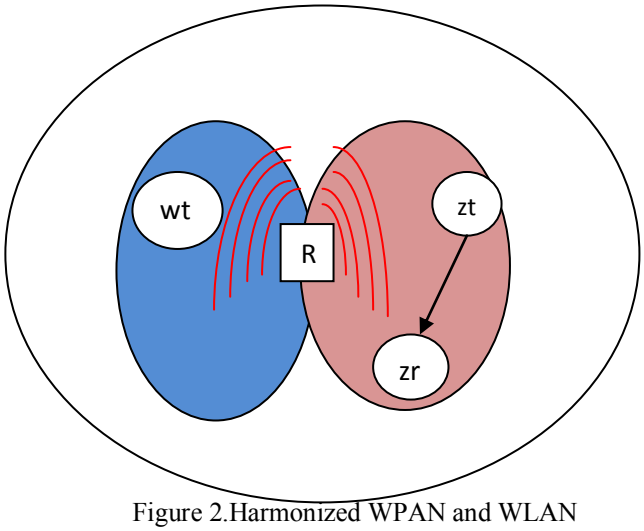

Figure 2.Harmonized WPAN and WLAN

Wt ⟶ WiFi Transmitter

Zt ⟶ ZigBee Transmitter

Zr ⟶ ZigBee Receiver

R ⟶ Relay

D. *Harmonized Wireless LAN and Wireless PAN with DCR*

DCR assigns a Relay node that performs the carrier signalling. The relay have the higher power than normal ZigBee transmitters. It allows the WiFi node to sense the ZigBee transmitter's presence by detecting the carrier signal. So that the carrier signal is emitted only when the channel is unoccupied by Wi-Fi. Due to the interference of the other devices the node changes the channel that are unoccupied by other devices. It avoids the Wi-Fi caused collision.

IV.EVALUATION

In this section we evaluate the performance via simulation experiments.DCR reduces the Wi-Fi caused collision 75%.It reduces packet loss and also the average packetdelay.DCR can improve the performance of entire WPAN with multiple ZigBee nodes which coexist with randomly located Wi-Fi transmitters.

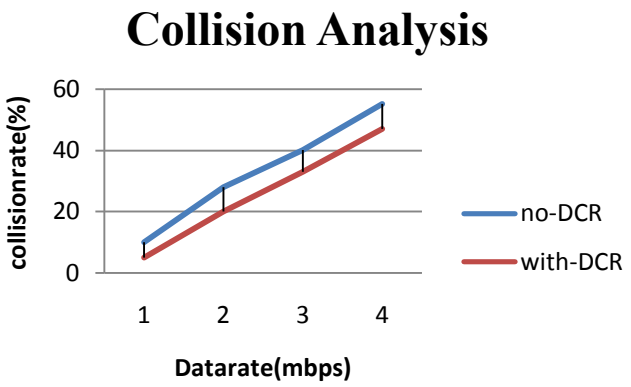

Figure 3.collision analysis

The performance of integrated networks has shown in above figure. The collision rate will be high in the network where the DCR mechanism not used. The proposed system uses the DCR mechanism, it will reduce the collision.

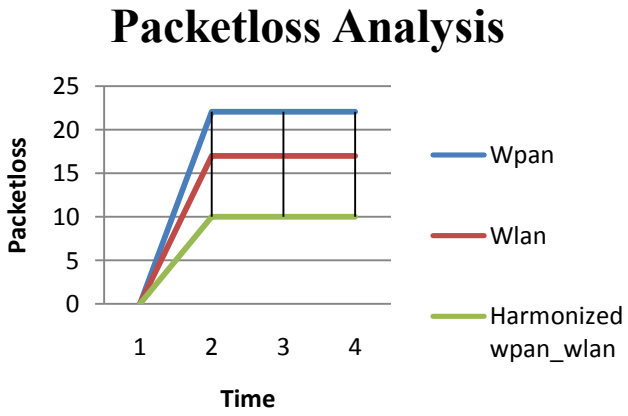

Figure 4.Packet loss Analysis

The above figure shows the measure of the packet loss in heterogeneous network. Without cooperation the packet loss will increase. In harmonized wpan_wlan the packet loss will be reduced. The performance gets improved.

The following diagram explains the data rate in the harmonized network. In harmonized wpan_wlan use the mechanism Distributed Cooperative Relaying, using this mechanism the data rate will be high. Without using cooperative mechanism the data rate will be low.

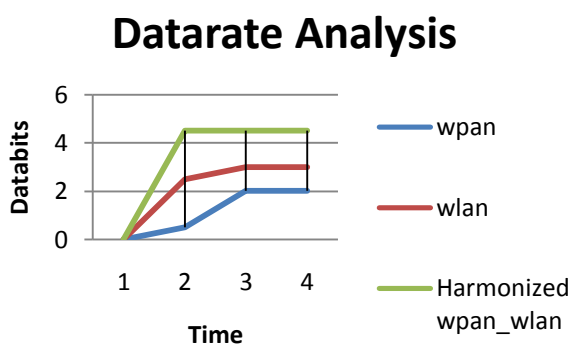

Figure 5. Data rate Analysis

V. CONCLUSION AND FUTURE WORK

It uses Distributed Cooperative Relaying (DCR), a network-level framework, to enable ZigBee-Wi-Fi coexistence. The purpose of this protocol is to gain helpful information toward efficiently overcoming coexistence problem between heterogeneous networks. It controls and improves their throughput by reducing mutual interference between ZigBee and Wi-Fi. It allows ZigBee networks coexisting with Wi-Fi to achieve desired link throughput and delivery ratio. Several future research directions can be investigated. The better channel utilization in spectrum sharing might be a future work. Much other cooperative mechanism can also be considered, providing security may also be another consideration.

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