RESEARCH ON DYNAMIC SPECTRUM ALLOCATION

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Abstract - *Current wireless network is characterized by fixed spectrum utilization. As result 2.4 GHz band is currently available for industrial, science and medical uses. But nowadays there are the numbers of wireless devices operating in ISM band such as Bluetooth, wi-fi. As the number of devices is increases the interference increases, it will effect on the performance that means performance is degraded and this is impossible to increase the proper utilization of available spectrum. A cognitive radio is a transceiver which automatically detects available channels in wireless spectrum and accordingly changes its transmission or reception parameters so more wireless devices may operate concurrently in a given spectrum band at a place. One important task for the cognitive radio is that sensing since the devices need to reliably detect weak ongoing or primary weak signal. The main challenges with cognitive radios are that it should not interfere with the licensed users or primary user and should vacate the band when required. So in this project we have to see that various methods of sensing the spectrum and allocating for the secondary user for efficient use of availability of spectrum.*

Key Words: **spectrum, AOMDV, Cognitive radio, CR, WLAN.**

1.INTRODUCTION

In 1934 the US Congress created the Federal Communications Commission (FCC) to consolidate the regulation of interstate telecommunication and supersede the existing Federal Radio Commission. The 21st century has seen an explosion in personal wireless devices. From mobile phones to wireless local area networks (WLAN), people want to be various networked no matter where they are.

Services like mobile phone and global positioning system (GPS) use frequencies licensed by the FCC, while others like WLAN and Bluetooth use unlicensed bands.

The most popular unlicensed bands are the Industrial, Scientific, and Medical(ISM) bands at 2.4 GHz. Within these frequency ranges, anyone can transmit at any time on this band so it will increase the number of devices in ISM band. Hence the traffic in ISM band increases and the performance is degraded as per devices are increases because interference also increases. Therefore remedy on that problem is that cognitive radio is to be introduced for the purpose of better spectrum utilization.

Cognitive radio is an intelligent technology due to its ability to rapidly and automatically adapt operating parameters to changing environment. Cognitive radio gains popularity in the research area because it enables the current fixed spectrum channel assigned by FCC to be utilized by the new users. For example, most of the spectrums assigned to TV channels are idle most of the time, while wireless network users share a small range of spectrum, 2.4 G Hz. When there are many wireless users at a time, the network is congested because of the limited channel. With the spectrum opportunities provided by the cognitive radio network, the wireless network users are able to share the idle spectrum for TV channel, on the condition that it does not interfere with the normal TV channel. FCC approved in 2004 to allow unlicensed devices to use unoccupied TV bands and mainly looking at frequencies from 512 to 698 MHz except channel 37 because it is reserved for some application and requires smart radio technology such as cognitive radio system which has the ability of spectrum aware and it will not allow the unlicensed user interfere with TV transmissions user[1].

LITERATURE SURVEY

Some important research papers which are to be reviewed are described here. This literature review describes different spectrum sensing techniques used for cognitive radio. It presents the previous work which had done on cognitive radio, including the analysis of various spectrum sensing schemes and their results.

2.1. Jinzhao Su _ sujinzhao@gmail.com, State Key Laboratory of Virtual Reality and Systems School of Computer Science of BeiHang University(BUAA)." Online Spectrum Allocation for Cognitive Cellular Network Supporting Scalable Demands"

In this article to solve the tough issues of online spectrum allocation, they try to balance the spectrum utilization and future coming demands. A state machine is introduced to allocate spectrum efficiently, and at different state system have different procedures to provide service to customers. To make good use of scalable property of demand and to increase fairness among customers, the concept of satisfaction degree is introduced[2].

2.2 Ian F. Akyildiz, Won-Yeol Lee, Mehmet C. Vuran, and Shantidev Mohanty, Georgia Institute of Technology IEEE Communications Magazine • April 2008, "A Survey on Spectrum Management in Cognitive Radio Network"

To provide a better understanding of CR networks, this article presents recent developments and open research issues in spectrum management in CR networks. More specifically, the discussion is focused on the development of CR networks that require no modification of existing networks. First, a brief overview of cognitive radio and the CR network architecture is provided.

RESEARCH METHODOLOGY

Cognitive Radio

Cognitive radio means we have to find out spectrum holes and allot the user on that vacant space. So first of all we have to introduce some spectrum sensing technique. So they are as follows

3.1 Spectrum Sensing Methods

The spectrum is not always busy and a huge portion of the spectrum remains vacant at many instants which make spectrum holes or a white spaces. The process of identification of the spectrum holes (the vacant spectrum band) by a Secondary User (CR) is called Spectrum Sensing. Spectrum Sensing is a hot issue now days to avoid the limited and a static access of spectrum. Cognitive Radio (CR) is an intelligent device which can change its parameters like frequency, modulation etc. according to the radio environment. Today a lot of research is going on considering the minimum level of interference of CR (Unlicensed Users) with the primary Users (Licensed Users). Because for efficient utilization of the spectrum it is necessary to have high sensing ability (high probability of detection) of CR and low interference with Primary Users. So first the CR should sense the transmission of the primary signal correctly, and then it should have the ability to adjust its parameters according to the environment, making sure that no transmission occurs from Primary User, to start its transmission accordingly.

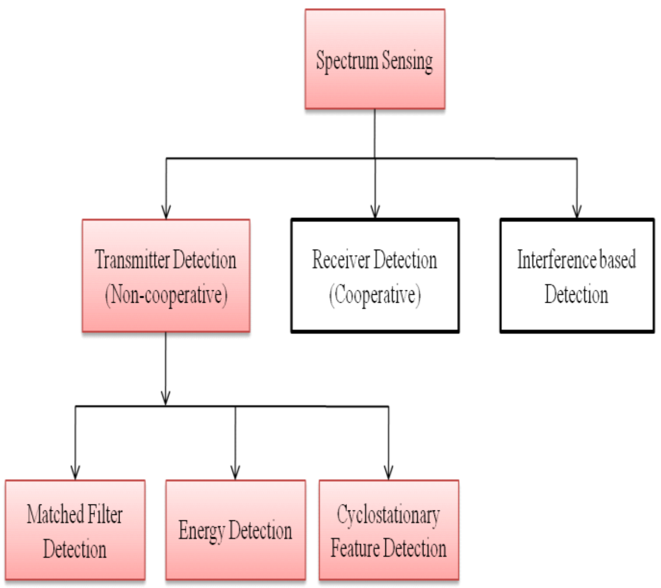


Figure.3.1 Classification of spectrum sensing technique

To have the best statistics, there are three most common techniques which are used for Spectrum Sensing

1) Matched filter Detection (Coherent detection).

2) Cyclostationary Detection.

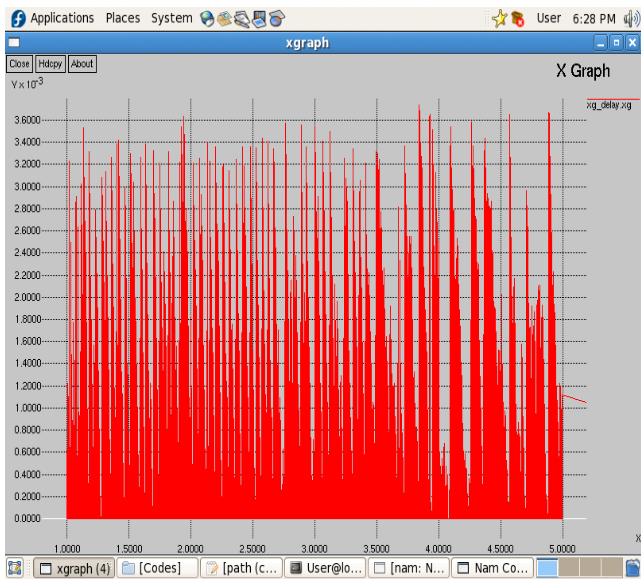
3) Energy Detection.

In the Coherent Detection method of Spectrum Sensing, the idea is to correlate the detected signal with copy of the original transmitted signal. This is the very well known method of detection with maximum signal-to-noise ratio but it requires the knowledge of the transmitted signal for detection. The second method is the Cyclostationary method, which is somewhat like coherent detection in a sense that the received or detected signal is correlated with some known pattern. Normally a signal is comparable with noise because the noise is random in nature but the signal after interpretation by the operation like modulation, coding etc. will take some periodicity. Due to this periodicity, it can be differentiated from the noise, as noise has no periodicity in time. Both the matched filter detection and the cyclostaionary based detection involve the knowledge of a signal which is not available every time in practical scenarios. Also it involves more complexity in the detection process of CR. Moreover these two techniques require a significant amount of time to detect a signal.

RESULT

End-to-End delay analysis:

The comparative results of average end-to-end delay against the increased simulation period are exhibited in Fig. a). Furthermore, various factors including link loss rate, bandwidth, interference and channel diversity are taken into account for route selection resulting in producing a longer transmission path as compared to the shortest-path approach in AOMDV routing.



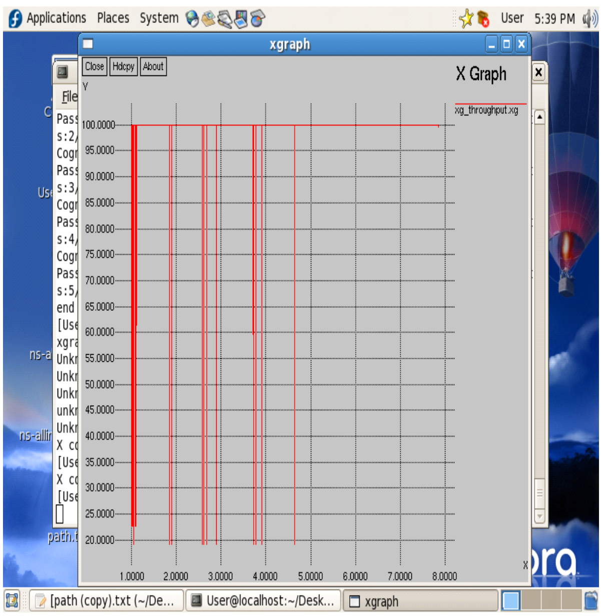
Throughput analysis:

Figure 11 shows the impact of increasing simulation period on average throughput. We observe that, with the increased simulation period, the throughput improvement is more rising. As a result, reduce a number of dropped packets due to the interference caused by PU activity.

In communication networks, such as Ethernet or packet radio, network throughput is the average of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second or data packets per time slot. It can be calculated as maximum throughout, maximum theoretical throughput, maximum sustained throughput, peak throughput, normalized throughput and so on[4].

Jitter analysis:

Figure a) displays the basis of average jitter as a function of simulation period. In the simulation, jitter is defined as a measure of the variability over time of the data packet latency across a network. The average jitter is a significant metric in an assessment of network performance, especially, in a real-time application. A system with lower jitter provides better QoS (Quality of Service). From the graph it is clear that the performs the other protocols in term[5] of average jitter due to the shortest-path scheme and faster route discovery.



CONCLUSION

Spectrum is important resource in wireless communication system and it has been a dominant research topic since last several decades. Cognitive radio is an auspicious technology which enables spectrum sensing for opportunistic spectrum usage by providing a means for the use of white spaces. Considering the demands raised by cognitive radios, the adoption of spectrum sensing method appears as an essential demand to accomplish fair results in terms of competent use of remaining spectrum and minimum intervention with the licensed primary users.

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