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RESEARCH ARTICLE

QUEUE LENGTH BASED CSMA ALGORITHMS FOR ACHIEVING MAXIMAL THROUGHPUT AND LOW DELAY IN WIRELESS NETWORKS

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ABSTRACT

Cognitive radio networks allow unlicensed users to access licensed spectrum opportunistically without disrupting primary user (PU) communication. Developing a distributed implementation that can fully utilize the spectrum opportunities for secondary users (SUs) has so far remained elusive. Although throughput optimal algorithms based on the well-known maximal weight scheduling (MWS) algorithm exist for cognitive radio networks, they require central processing of network-wide SU information. In this paper, a new distributed algorithm is introduced that asymptotically achieves the capacity region of the cognitive radio systems. Extensive simulation results are provided to illustrate the efficacy of the algorithm. Recently, it has been shown that carrier-sense multiple access (CSMA)-type random access algorithms can achieve the maximum possible throughput in ad hoc wireless networks. However, these algorithms assume an idealized continuous-time CSMA protocol where collisions can never occur. In addition, simulation results indicate that the delay performance of these algorithms can be quite bad. On the other hand, although some simple heuristics can yield much better delay performance for a large set of arrival rates, in general they may only achieve a fraction of the capacity region. In this paper, We have used Sensing and Sharing Algorithm to achieve the maximum throughput.

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INTRODUCTION

Subjective radio has pulled in an expanding measure of enthusiasm over the previous decade as a viable answer for ease range shortage in remote interchanges, which permits the optional users (SUs) get to recurrence groups preallocated to essential clients (PUs) in a way that essential clients don't be meddled. As a basic stride, range detecting guarantees that SUs sense PUs and identify range gaps convenient, SUs get to the channels and transmit information when PUs are truant in the authorized channels; generally, SUs sit tight or select another channel for detecting . In high movement Cognitive Radio Networks (CRN), the likelihood of PU channels been possessed is high. In the event that SUs arbitrarily select channels for detecting, it will prompt the high likelihood of detecting occupied and additionally brings about the reduction of throughput. SU's low throughput negatively affects the CRN's execution, for example, dragging out the transmission time and expanding the vitality utilization. Subsequently, this issue has been broadly researched.

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In open up and-forward transfers were utilized for joint advancement of the range detecting and information transmission, which fundamentally enhances SU's throughput in correlation with conventional instruments. In SUs' casing structure was intended to detect diverts all together, and the chronicled information is joined to choose the channels for detecting, to accomplish the biggest throughput. In existing work, few works endeavor to enhance SU's throughput from the viewpoint of lessening the likelihood of choosing occupied channels. Conventional SU haphazardly choosing channels for detecting, which prompts the high likelihood of detecting occupied in high activity CRN and further outcomes in a high likelihood of holding up? Accordingly, how to build the likelihood of choosing inert channels for detecting turns into the key point to enhance SU's throughput. In, Q-CSMA, a discrete-time dispersed randomized calculation in view of Glauber progression is proposed. In both the line length based CSMA calculations accomplish the full limit district in a solitary channel specially appointed remote system. The line length-based CSMA calculations of accept that the channel is constantly accessible; a condition not fulfilled in subjective radio systems. With the irregularity of the channel accessibility, state changes are constrained by the channel state going from ON to OFF. In this paper, we create CA-CSMA (Channel-mindful CSMA/CA), another appropriated throughput ideal booking calculation for CRNs. To this end, we present another framework state portrayal that incorporates channel state data and plan our calculations to accomplish throughput optimality without causing obstruction with PUs. Range expectation gauges the channel status of the following casing on the premise of verifiable data. Detecting can be performed by means of a few techniques, including vitality recognition, cyclostationary highlight location, and compacted detecting. Vitality identification is a straightforward technique and requires no from the earlier learning of PU signals. Its primary hindrance is its diminished precision in face of blurring, shadowing, and obscure clamor control profiles. For example, if a SU experiences shadowing or overwhelming blurring, the detected flag has a tendency to be frail while the PU is transmitting, prompting off base choices. To address these issues while keeping up detecting effortlessness, agreeable detecting plans that wire the detecting consequences of numerous SUs have been proposed. Agreeable detecting defeats deficiencies of individual detecting comes about by mutually handling perceptions. SUs in an area report their individual detecting comes about, which are then utilized as a part of a predefined choice control to streamline a goal work. Cases of such capacities incorporate boosting detecting precision (for the most part, a component of false alert likelihood and mis-location likelihood) or augmenting the framework throughput. Beside augmenting detecting precision related measurements, helpful detecting plans are likewise intended to gauge the most extreme transmit control for SUs with the goal that they don't make problematic impedance PUs. Then again, helpful detecting causes extra detecting delay viz a viz singular detecting.

Advantages

Cognitive radio technology can help you in your goods with the widespread observation deal withthe cognitive radio.

- Unused spectrum are determined and made use of them automatically.
- Several networks standards are interoperated and recognized automatically.
- Automatically improves and accomplishes its progress and minimize interference.
- The channel state is available, all SUs treat the most recently available slot as their previous slot ignoring the unavailable period, and schedule packets in a way similar to Q-CSMA.
- The channel state changes, one chain stops evolving while the other starts evolving

Disadvantage

- Poor choice for representing the state in CRNs, and leads to a non-reversible DTMC.
- SU links, where 1 interferes with 2, 2 interferes with 3 and 1 does not interfere with 3.
- All SU links are within the interference range of the PU.

Cognitive radio network

Cognitive radio is radio in which communication systems are aware of their internal state and environment, such as location and utilization on RF frequency spectrum at that location. They can make decisions about their radio operating behaviour by mapping that information against predefined objectives. Venn diagram illustrating relationship between associated advanced wireless technologies Cognitive radio is further defined by many to utilize Software Defined Radio, Adaptive Radio, and other technologies to automatically adjust its behaviour or operations to achieve desired objectives. The utilization of these elements is critical in allowing end-users to make optimal use of available frequency spectrum and wireless networks with a common set of radio hardware. This will reduce cost to the end-user while allowing him or her to communicate with whomever they need whenever they need to and in whatever manner is appropriate.

The developing interest of remote applications has put a great deal of limitations on the utilization of accessible radio range which is restricted and valuable asset. In any case, a settled range task has prompt under usage of range as an extraordinary bit of authorized range is not viably used. Intellectual radio is a promising innovation which gives a novel approach to enhance use productivity of accessible electromagnetic range. Range detecting identifies the range openings (underutilized groups of the range) giving high phantom determination ability. The accessible electromagnetic radio range is a restricted common asset and getting swarmed step by step because of increment in remote gadgets and applications. It has been likewise discovered that the distributed range is underutilized in view of the static portion of the range. Likewise, the traditional way to deal with range administration is exceptionally resolute as in every remote administrator is alloted an elite permit to work in a specific recurrence band. What's more, with the vast majority of the helpful radio range as of now distributed, it is hard to discover empty groups to either send new administrations or to upgrade existing ones. Keeping in mind the end goal to beat this circumstance, we have to concoct a methods for enhanced usage of the range making open doors for dynamic range get to. The issue of spectrum underutilization in wireless communication can be solved in a better way using Cognitive radio (CR) technology. Cognitive radios are designed in order to provide highly reliable communication for all users of the network, wherever and whenever needed and to facilitate effective utilization of the radio spectrum. Low utilization of the licensed spectrum which is largely due to inefficient fixed frequency allocations rather than any physical shortage of spectrum. This observation has forced the regulatory bodies to search a method where secondary (unlicensed) systems are allowed to opportunistically utilize the unused primary (licensed) bands commonly referred to as white spaces.

Cognitive radio can change its transmitter parameters based on interaction with environment in which it operates. Cognitive radio includes four main functional blocks: spectrum sensing, spectrum management, spectrum sharing and spectrum mobility. Spectrum sensing aims to determine spectrum availability and the presence of the licensed users (also known as primary users). Spectrum management is to predict how long the spectrum holes are likely to remain available for use to the unlicensed users (also called cognitive radio users or secondary users). Spectrum sharing is to distribute the spectrum holes fairly among the secondary users bearing in mind usage cost. Spectrum mobility is to maintain seamless communication requirements during the transition to better spectrum. As of late, another class of conveyed calculations has been proposed to accomplish throughput optimality while bypassing these issues. These new calculations are arbitrary get to calculations in view of the idea of channel detecting. These calculations utilize line lengths to decide channel get to probabilities, accomplishing the full limit district in specially appointed remote systems in a conveyed way. In, a versatile throughput ideal CSMA planning calculation is proposed for a general impedance demonstrate in nonstop time. It utilizes transmission forcefulness, which is a component of the line length. Usage contemplations in 802.11 systems are talked about considering bundle impacts. In, Q-CSMA, a discrete-time dispersed randomized calculation in light of Glauber flow is proposed. In the line length based CSMA calculations accomplish the full limit locale in a solitary channel impromptu remote system. The queue length-based CSMA calculations of expect that the channel is constantly accessible, a condition not fulfilled in intellectual radio systems. With the arbitrariness of the channel accessibility, state advances are constrained by the channel state going from ON to OFF. In this paper, we create CA-CSMA (Channel-mindful CSMA/CA), another appropriated throughput ideal planning calculation for CRNs. To this end, we present another framework state portrayal that incorporates channel state data, and outline our calculations to accomplish throughput optimality without causing obstruction with PUs. In this work, we concentrate on the calculation plan for single-channel intellectual radio systems. Our investigation can be promptly stretched out to a framework with orthogonal channels, where booking is performed per channel. Be that as it may, expansions to non-orthogonal channels are past the extent of this paper.

Cognitive radio concept architecture

There are two major subsystems in a cognitive radio; a cognitive unit that makes decisions based on various inputs and a flexible SDR unit whose operating software provides a range of possible operating modes. A different range detecting subsystem is additionally frequently incorporated into the design a Cognitive radio to gauge the flag condition to decide the nearness of different administrations or clients. Note that these subsystems don't really characterize a solitary bit of gear, however may rather fuse segments that are spread over a whole system. Cognitive radio is frequently alluded to as a subjective radio framework or an intellectual system. The intellectual unit is additionally isolated into two sections as appeared in the square outline beneath. The primary marked the “cognitive engine" tries to discover an answer or advance an execution objective in view of sources of info got characterizing the radio's present inside state and working condition. The second motor is the "policy enginer" and is utilized to guarantee that the arrangement gave by the “cognitive engine" is in consistence with administrative principles and different strategies outside to the radio.

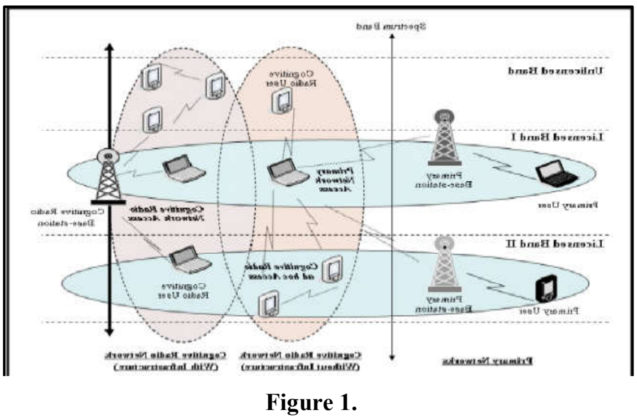

Figure 1.

Future research on cognitive radio

Cognitive radio is one of the research frontiers in wireless communication field. Both academic and industry researchers have large interest to cognitive radio and gained many achievements. However, there are still some research challenges as follows.

- Cooperative Sensing: Distributed cooperative spectrum sensing needs further research to balance the tradeoff between accurateness and overhead better.
- Cognitive Relaying: Using additional user to relay the data can increase the throughput for either primary links or secondary links. In addition, relaying for primary links can increase the data transmission for more spectrum opportunities, and relaying for secondary links can decrease the interference to primary users.
- Cognitive MIMO: MIMO can decrease the interference by adjusting the signal orthogonal to the interference channel to primary users. Therefore, using multiple antennas is helpful in cognitive radio networks to increase the throughput of secondary users and decrease the interference to primary users.
- Femtocell: As the characteristics of femtocells, the interference decreases a lot because the signal usually penetrates walls, which is very favourable for cognitive radio to avoid interference.
- Robust Cognitive Radio: In most of the exist research works, the radio resource allocation is investigated based on perfect spectrum sensing results. Considering the error of spectrum sensing, the resource allocation schemes should restrict the outage probability that secondary users interrupt the communication of primary users.

Throughput

Throughput is a measure of how many units of information a system can process in a given amount of time. It is applied broadly to systems ranging from various aspects of computer and network systems to organizations. Related measures of system productivity include, the speed with which some specific workload can be completed, and response time, the amount of time between a single interactive user request and receipt of the response. Throughput of a network can be measured using various tools available on different platforms. This page explains the theory behind what these tools set out to measure and the issues regarding these measurements. Reasons for measuring throughput in networks. People are often concerned about measuring the maximum data throughput in bits per second of a communications link or network access. A typical method of performing a measurement is to transfer a 'large' file from one system to another system and measure the time required to complete the transfer or copy of the file. The throughput is then calculated by dividing the file size by the time to get the throughput in megabits, kilobits, or bits per second. Unfortunately, the results of such an exercise will often result in the goodput which is less than the maximum theoretical data throughput, leading to people believing that their communications link is not operating correctly. In fact, there are many overheads accounted for in throughput in addition to transmission overheads, including latency, TCP Receive Window size and system limitations, which means the calculated goodput does not reflect the maximum achievable throughput.

Throughput is the amount of data received by the destination. The Average Throughput is the throughput per unit of time. Example: Suppose a TCP receiver receives 60 M Bytes of data in 1 min, then:

- The throughput of the period is 60 M Bytes.
- The average throughput is 60 M Bytes/min or 1 M Bytes/sec.

Spectrum sensing and sharing in CRN

Spectrum utilization and efficiency can be improved by making a secondary or unlicensed user to access a spectrum hole unoccupied by a primary user (PU) at the right location and the right time. This can be achieved through the use of cognitive radio (CR) which has recently been proposed as a smart technology that allows non-legitimate or unlicensed users to utilize licensed bands opportunistically. CR users are able to listen to the surrounding wireless channel, sense the vacant spectrum bands, and make use of them. Initial efforts are put on spectrum sensing, which is one of the defining functions of CR. In this thesis, there are two main contributions corresponding to spectrum sensing.

The first part deals with improving the spectrum sensing performance. We propose a method, namely, quiet-active sensing, in which CR users sense the channel in both of the quiet and active periods. We then investigate radio cooperation in order to further improve the reliability of spectrum sensing. We shall design a likelihood ratio test (LRT) based detector, which operates over a quadratic combination of local test statistics of individual CRs. In fact, the channel occupancy state can change rapidly such that the sensing mechanism may fail to keep track of the instantaneous states due to different sensing parameters.

Hence, the second part looks into optimizing the parameters affecting the sensing schemes in order to improve the sensing performance. Particularly, we examine the impact of the noise power uncertainty on the performance of various detection schemes in CR networks. Besides, we consider the case where the sensing ability is not perfect which may induce interference to the primary system.

Simulation workflow

The general process of creating a simulation can be divided into several steps:

We can find that the hangover delay gradually decreases as the speed increases.

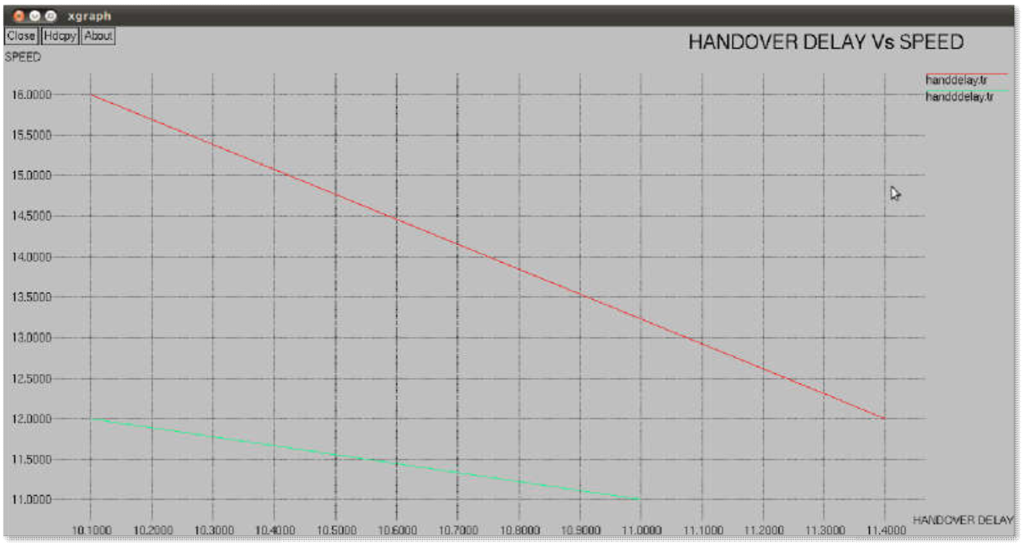

Figure 2.

While we are using throught put in simulator the node speed will be increased.

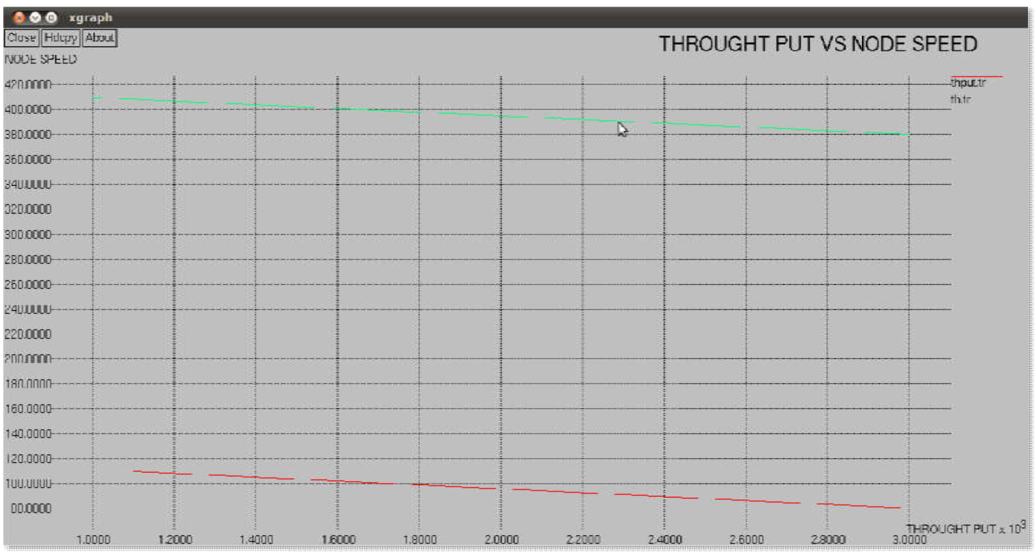

Figure 3.

Packet size will be also be increased by using the throughtput in network.

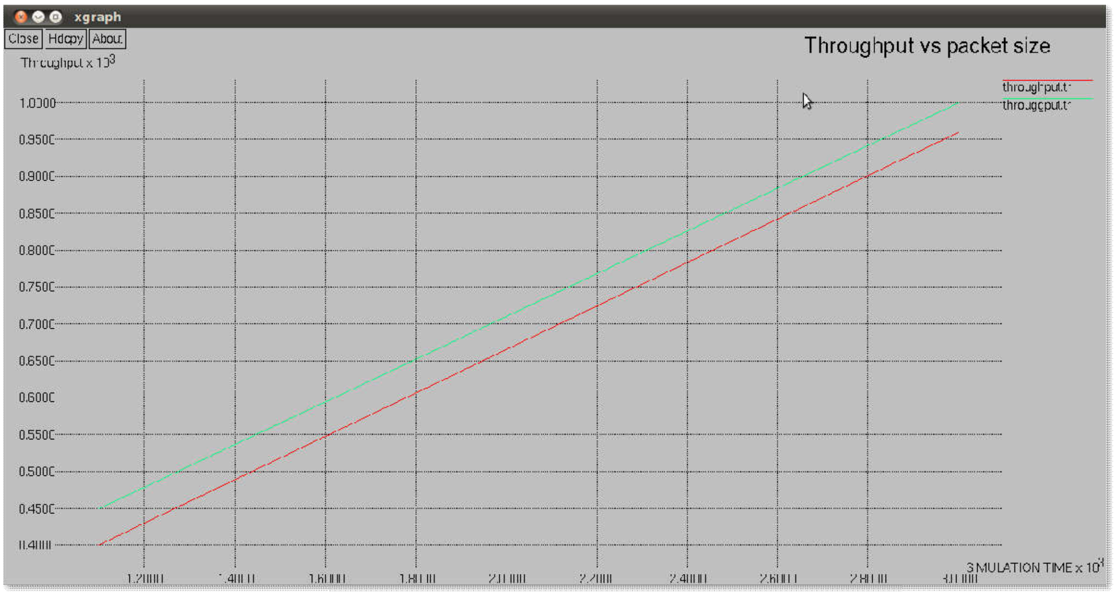

Figure 4.

Number of Packet lost will be decreased here.

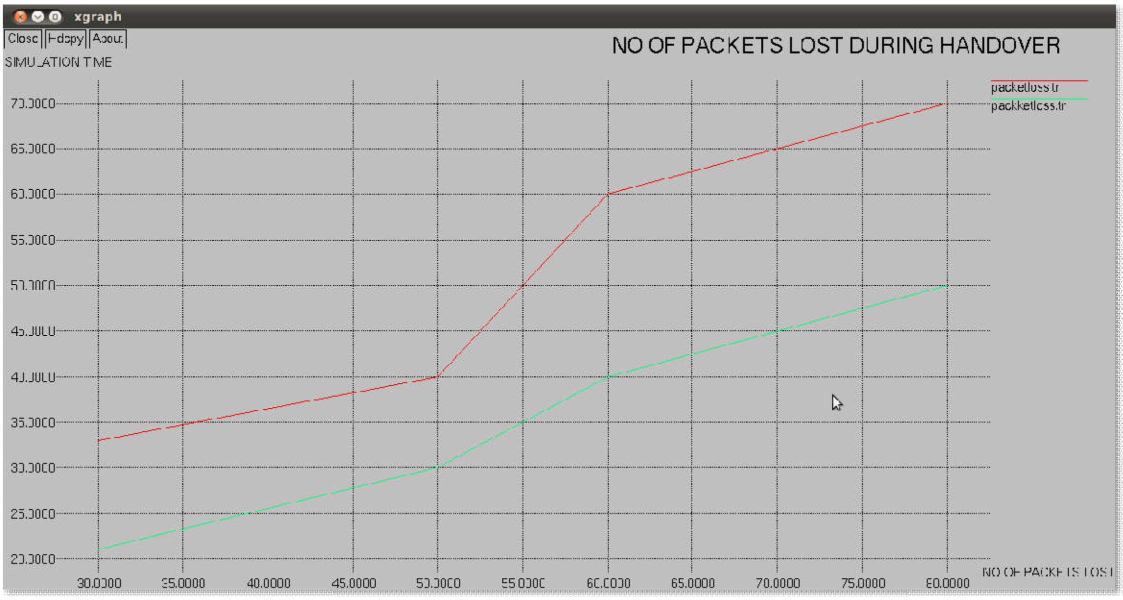

Figure 4.

- **Topology definition:** To ease the creation of basic facilities and define their interrelationships, ns-3 has a system of containers and helpers that facilitates this process.
- **Model development:** Models are added to simulation (for example, UDP, IPv4, point-to-point devices and links, applications); most of the time this is done using helpers.
- **Node and link configuration:** models set their default values (for example, the size of packets sent by an application or MTU of a point-to-point link); most of the time this is done using the attribute system.
- **Execution:** Simulation facilities generate events, data requested by the user is logged.
- **Performance analysis:** After the simulation is finished and data is available as a time-stamped event trace. This data can then be statistically analysed with tools like R to draw conclusions.
- **Graphical Visualization:** Raw or processed data collected in a simulation can be graphed using tools like Gnuplot, or XGRAPH.

NS2 is a discrete event simulator targeted at networking research. It is widely used because the complex network scenarios can be easily tested. It is a supported platform. More ideas can be tested in a smaller time frame. These are the results listen below which is simulated using NS2.

Conclusion

Cognitive radios must be able to detect the presence of undecodable signals. Just knowing the modulation scheme and codebooks is nearly useless: stuck with energy detector performance. Even small noise uncertainty causes serious limits in detectability. Quantization makes matters even worse. Primary users should transmit pilot signals or sirens. If not, some serious “infrastructure” will be needed to support cognitive radio deployment. Through an NS2 implementation of the IEEE802.11 standard, with the simulation of nodes mobility in an network, it has been shown that proposed the idea overcomes the classical node performance in terms of throughput, spectrum sensing, and TCL despite a slight increase in node overhead. Throughput is the amount of data received by the destination. The Average Throughput is the throughput per unit of time.

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