



SPECTRUM MANAGEMENT IN COGNITIVE RADIO NETWORK: A REVIEW STUDY

Uma Sharma

Assistant Professor, Department of Computer Science, Government College, Hansi (Hisar) Haryana, India

ABSTRACT

In this paper I have elaborate a review study about a modern cognitive radio network which is recently using as an ad-hoc manner. A cognitive radio (CR) is a radio that can be programmed and configured dynamically to use the best wireless channels in its vicinity to avoid user interference and congestion. Such a radio automatically detects available channels in wireless spectrum, then accordingly changes its transmission or reception parameters to allow more concurrent wireless communications in a given spectrum band at one location. This process is a form of dynamic spectrum management.

KEYWORDS : CR, CRN, Whitespace, DSA, SDR

INTRODUCTION

The Federal Communications Commission (FCC) has costumed the spectrum frequencies to use it for one use, so when this frequency specified for one user that means we are in danger of running out of spectrum and bad utilizations of it. According to that the FCC defines a cognitive radio networks CRN to solve that problem.

The definition of cognitive radio states that it's a radio that able to alter its transmitter parameters based on interaction with its operation environment. CRN enables to dynamically using of spectrum, a CRN was called Next Generation network. Moreover, fixed spectrum allocation prevents rarely used frequencies (those assigned to specific services) from being used, even when any unlicensed users would not cause noticeable interference to the assigned service. Regulatory bodies in the world have been considering whether to allow unlicensed users in licensed bands if they would not cause any interference to licensed users.

The Spectrum management and Cognitive radio CR is an a enhanced to Software-Defined Radio (SDR) which is automatically detects the surrounding Radio Frequency, catalysts and smartly accommodates its operating parameters to the infrastructure of network according to meet user demand, if this band is further used by a licensed user, the cognitive radio stirs to other spectrum band or remains in the same band with altering its level of the transmission power or modulation scheme all of that avert interference, calibrations the congestion due to spectrum participating.

The main functions for cognitive radios in networks can be summarized as follows:

- **Spectrum sensing:** Spotting unutilized spectrum and sharing the spectrum without dis-advantaged interjecting with other users.
- **Spectrum management:** Captivating the best available spectrum to meet user communication demands.
- **Spectrum mobility:** Preserving tractable communication exigencies during moving to better spectrum.
- **Spectrum sharing:** Providing an equitably spectrum scheduling method between cohabitation xG users.

LITERATURE REVIEW

The related works must be considered. Assila and Pentane state that the important incentive for CRNs is the deeply underutilized frequency spectrum. The development is being pushed forward by the quick progresses in SDR technology which enable a spectrum agile and highly configurable radio transmitter/receiver. And the fundamental problems in detecting the white spaces are naturally mostly involved to signal processing at the physical layer. While Ibrahim and Babiker states that the simulation of CR system to must detect the existence of primary user to avoid interference which they

should spot the spectrum holes and the idle state of the primary users in order to exploit the free bands and also immediately vacate the spectrum as soon as the primary user becomes active. Also Kaur and Aulakh concluded that Cognitive radio is the technology in which a framework can sense its surroundings and adjust to the new working parameters to improve the quality of transmission.

While Omer et al. recommends about CRN as its can capture the best available spectrum to meet user communication requirements by sharing unused spectrum depending on parameters like signal strength, dimension, node speed and availability of unutilized spectrum. Another description of CRN is given by Tabakov who states that the cognitive radio has the potential for making a significant difference in the way how the radio spectrum can be accessed and used by wireless systems. And Preen and Kaur summarized it as "Cognitive radio is the enabling technology for supporting spectrum access in dynamic manner. The cognitive radio networking is transforming the static spectrum allocation based communication systems in to dynamic spectrum allocation".

CHARACTERISTICS OF COGNITIVE RADIO

- **Spectrum sensing:** A CR monitors the available bands on the spectrum and detects the spectrum holes by capturing their information.
- **Spectrum analysis:** A CR estimates the properties of these bands which were detected in spectrum sensing.
- **Spectrum decision:** A CR calibration the data rate, the bandwidth, and the mode of transmission, then the fitted spectrum bands are chosen according to the user demands and spectrum properties.

The communication can be officiated over the spectrum hole. When an operating spectrum hole is determined however since the radio environment mutates over space and time the CR have to retain this mutation track of the changes of the radio environment. Any environmental change during the transmission such as user movement, appearance of PU or any variation on the traffic can trigger this adjustment.

COGNITIVE CAPABILITY

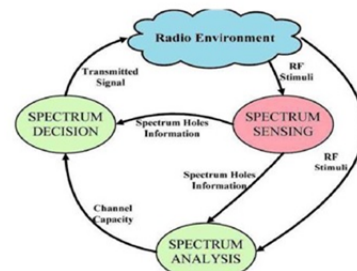
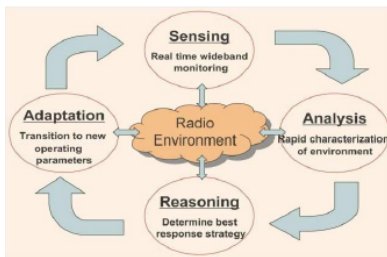


Fig-1.: Cognitive Radio Cycle

The cognitive capability of a cognitive radio enables interaction with its environment in real time to determine the suitable communication parameters and adapt the radio environment dynamically. The required mission for adaptive operation in open spectrum, which is called as the cognitive cycle. And the main steps of the cognitive cycle as following:

PROCEDURE

Self-organized capability: Spectrum/radio resource management to ably administer and structuring spectrum bands information among secondary users, good spectrum management scheme is needful. Connection and mobility management due to disparate of XG networks, routing and topology information is more complicated but its help to discover the neighborhood, available Internet access secondary users to choose route and networks.

**Fig-2.: Cognitive Radio Alternate Cycle**

Security management: Since CRNs are disparate networks in complexion, various heterogeneities (e.g., system/network operators, wireless access technologies) offers amount of security tasks. Trust is thus a persecution for securing processes in CRNs.

COGNITIVE RADIO NETWORK CONFIGURABILITY

Configurability is the caliber of adjusting the parameters of operating for the transmission on the fly without changing on the hardware components. This ability enables the CR to dynamically adaptation with the radio environment. There are several reconfigurable parameters that can be included into the cognitive radio as explained below:

- **Operating frequency:** According to ability of CR to change its operating frequency. Based on the radio environment information, the most suitable operating frequency can be determined and the communication can be dynamically officiated on this suitable operating frequency.
- **Modulation:** According to channel conditions and user requirements the modulation scheme of CR should be adaptive.
- **Transmission power:** Power constraints are control the transmission power reconfiguration by enabling dynamic configuration for transmission power within the permissible power limit. If higher power operation is not necessary, the CR reduces the transmitter power to a lower level to decrease the interference and allow more users to share the spectrum.
- **Communication technology:** Among different communication systems. Cognitive radio used to enable interoperability. The transmission parameters of a cognitive radio can be reconfigured during the transmission.

SOFTWARE DEFINED RADIOS (SDR)

The FCC define a SDR as a radio that consists a transmitter in which the operating parameters of frequency range, modulation type and maximum output power or the transmitter circumstances which it is operates on in accordance with commission rules, can be changed by making a mutation in software without making any changes to

hardware components that affect the emissions of the radio frequency.

Briefly, capability of user of changing its transmissions on the fly rather than being bound by hardware constraints is its main idea of SDR.

APPLICATIONS AND USAGE:

There are four applications for cognitive radio networks:

- **Leased network:** A leased network can be provided by primary network, with the agreement with a third party by allowing opportunistic access to its licensed spectrum within immolation the service finesse of the license user.
- **Emergency network:** Emergency networks and public safety is another tract of implementation of CRNs. In normal debacles which possibly provisionally disable or destroy the infrastructure of the existing communication, establishing emergency networks are needed by emergency personnel working in the debacles areas. Since emergency networks treat with the critical info, unimpeachable communication should be indemnified made with minimum latency.
- **Military network:** A military radio environment is one of the most interesting possibility applications of a CR network.
- **Cognitive mesh network:** Wireless mesh networks are appearing as a cost-effective technology for introducing the connectivity of broadband. However, as the applications need a supreme throughput and the network density augments, mesh

CONCLUSION AND FUTURE SCOPE

I have observed that the management of cognitive radio network is very difficult and adhoc manner because of mobility and Now a day's the telecommunication systems have been concerned as a requirement for a life, the number of users are improved therefore the usage of spectrum are increased, so very bad utilizations of spectrum were found. Cognitive radio network is introduced in order to dynamic the spectrum therefore to increase the spectrum efficiency, increasing number of wireless users and decreasing costs, it's also improved more characteristics for the spectrum. This paper identifies cognitive radio networks along with a clear description of it.

REFERENCES

1. Rayan Abdelazeem and others (2018 "Review Paper on Cognitive Radio Networks), Journal of Electrical & Electronics System
2. https://en.wikipedia.org/wiki/Cognitive_radio
3. Mitola J (2000) Cognitive Radio an Integrated Agent Architecture for Software. Defined Radio. Royal Institute of Technology, Sweden.
4. Akyildiz IF, Lee WY, Vuran MC, Mohanty S (2006) Next generation/dynamic spectrum access/cognitive radio wireless networks: a survey. Computer Networks 50: 2127-2159.
5. Chawla M (2015) A Survey on Spectrum Mobility in Cognitive Radio Network. International Journal of Computer Applications 119: 33-36.
6. Chen KC, Peng YJ, Liang YC, Sun S (2009) Cognitive Radio Network Architecture: Part-1 General Structure.
7. Stine JA (2005) Spectrum management: the killer application of ad hoc and mesh networking. IEEE International Symposium on New Frontiers in Dynamic Spectrum Access Networks, pp: 184-193.
8. Murty R (2003) Software-defined configurability radios: smart, agile, cognitive, and interoperable, Technology. Intel Magazine.
9. Akyildiz IF, Wang X, Wang W (2005) Wireless mesh networks: a survey. Computer Networks Journal 47: 445-487.
10. Maldonado D, Lie B, Hugine A, Rondeau TW, Bostian CW (2005) Cognitive radio applications to dynamic spectrum allocation. IEEE International Symposium on New Frontiers in Dynamic Spectrum Access Networks, pp: 597-600.
11. Ibrahim S, Babiker A (2015) Simulation of Cognitive Radio System Using MATLAB. Journal of Electrical and Electronics Engineering 10: 28-32.