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SPECTRUM AWARE ROUTING PROTOCOL IN COGNITIVE RADIO NETWORK USING THE CONCEPTS OF TDMA

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Abstract- **With the advancement in technology, there is a limited spectrum allocation and we need to communicate in each field. So we have cognitive radio network with us to make us able to communicate by using the frequency spectrum of licensed nodes. Cognitive radio network has two nodes categories namely Primary nodes and Secondary nodes. Primary nodes do have their own frequency allocation and we can make secondary nodes to communicate between each other by using the frequency of Primary nodes. Not only this we have several concepts to make communication between secondary nodes while in this paper we are using spectrum aware protocol in cognitive radio network using the concepts of TDMA.**

Keywords- Cognitive Radio Netwok(CRN), Primary User(PU), Secondary User(SU), Time Division Multiple Access(TDMA), Transition Characteristic, Mobile Ad-hoc Network(MANET).

I. INTRODUCTION

Wireless technologies such as Bluetooth or the 802.11 standards enable mobile devices to establish a Mobile Ad-hoc Network (MANET) [2] by connecting dynamically through the wireless medium without any centralised structure. MANETs offer several advantages over traditional networks including reduced infrastructure costs, ease of establishment and fault tolerance, as routing is performed individually by nodes using other intermediate network nodes to forward packets, this multi-hopping reduces the chance of bottlenecks, however the key MANET attraction is greater mobility compared with wired solutions. With the cognitive radio (CR) technology, a wireless system can exploit opportunistically the spectrum licensed to other systems. It can also be defined as a radio that is aware of its surrounding and adapts intelligently. There are two types of nodes used in CR technology. Primary User Nodes (PU), Secondary User Nodes (SU). PU- the PU nodes are allocated in a licensed Band. SU-The SU can also access the allocated spectrum as long as the PUs is not temporally using it.

Whenever PU user becomes active the SU user must give up the communication and as the PU becomes inactive, SU grabs the frequency available and transmits its data to the destination. Cognitive Radio also uses the concept of frequency reuse which allows the user to repeat the frequency usage as per the limitations and requirement. Primary nodes can be BS, DISH TV etc while secondary nodes can be Mobile phone etc.

With increase in concentration of PU and the time allocated by PU to SU, the performance of routing protocol should enhance. By doing so, the radio spectrum can be reused in an opportunistic manner or shared all the time; thus, the spectrum utilization efficiency can significantly be improved. To support DSA, SUs are required to capture or sense the radio environment, and a SU with such a capability is also called a cognitive radio (CR) or a CR user. There are different types of cognitive capabilities with which a CR may be equipped. For example, a CR user may sense the ON/OFF status of the PUs or can predict the interference power level that is received at the primary receiver (Rx). With different cognitive capabilities, a CR may access the radio spectrum in different ways. In the literature, the following two cognitive spectrum access models have gained tremendous attention.

Ad-hoc routing protocols with cognitive capabilities [1] have been proposed which solves the problem of spectrum scarcity. It does it by intelligently allowing the unlicensed devices to opportunistically communicate in the available licensed spectrum, while ensuring that the performance of the licensed users is not affected. New emerging routing protocols is a taxing job due to variation in channel usage and channel accessibility by nodes in the network. In this paper, we discussed about adaption of On-Demand routing protocols for cognitive scenario by addressing their merits and demerits. The rapid growth in demand for broadband wireless services coupled with the recent developmental work on wireless communications technology and the static allocation of the spectrum have led to the artificial scarcity of the radio spectrum.[5]The traditional command and control model (Static allocation) of spectrum allocation policy allows for severe spectrum underutilization. Spectrum allocated to TV operators can potentially be shared by wireless data services, either when the primary service is switched off or by exploiting spatial reuse opportunities. Channel Assignment is a very important issue in the field of Wireless Networks.[3] In this paper, we have evaluated the performance of a Multiple Channel TDMA/CSMA spectrum sharing scenario. We have combined the TDMA and the non-persistent CSMA system with multiple channels and analyzed the throughput and the throughput performance of the individual systems as a function of the actual offered traffic level. Spectrum sensing [4] helps to detect the spectrum holes (underutilised bands of the spectrum) providing high spectral resolution capability. In this paper, survey of spectrum sensing techniques is presented. The challenges and issues involved in implementation of spectrum sensing techniques are discussed in detail giving comparative study of various methodologies.

II. THE PROPOSED ROUTNG SCHEME

In the proposed routing scheme all the feasible paths are determined from source to destination by modifying the shortest path algorithm (Dijkstra algorithm). The transition characteristics of all the PU channels that are to be used by

SU are analyzed and finally channel with finest transition characteristics are allotted to each SU on the path. This process of allotted is done for all the paths and ultimately each of the paths is analyzed for selecting the optimal path. The communication is done on this optimal path and results for the same are compared with other shortest path.

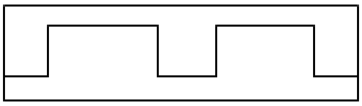

Fig 1(a) Low Transition Frequency

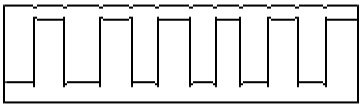

Fig 1(b) High Transition Frequency

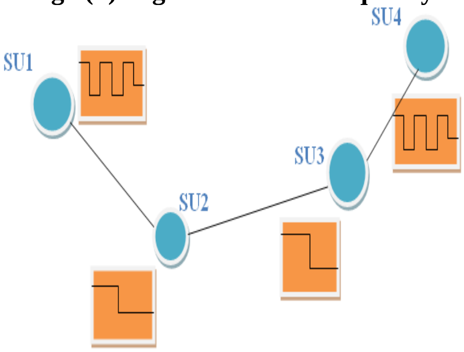

Fig 2 Different transitions Frequency for every SU

III. PERFORMANCE EVALUATION METRICS

The parameters through which the performance of the Cognitive network is determined are described as follows.

Packet Delivery Ratio (PDR) - It is the ratio of total packets received by the source to the total number of packets transmitted.

Probability of Reachability (PoR) - it is the ratio of possible reachable routes to the all the possible routes between all different sources to all possible destinations.

IV. SET-UP PARAMETERS

Set-up parameter	Value	Set-up parameter	Value
Area of simulation region	2000*2000 sq meter	PU Nodes Position SU nodes Position	Fixed Random
No. of SU nodes	Varied from 20 to 50.	Routing algorithm	Spectrum aware path determination
Numbers of PU nodes	16	Packet transmission interval	.09sec
Transmission Range	300 m	Packet Size	512 bytes
Mobility Model	Random Walk	No. of packet sent	130
PU nodes mobility	NIL, PU nodes are fixed	Channels available With each PU	4
Speed of SU nodes	15m/s	Total Time allotted for transmission of all Packets	360msec

Frequency of transition	Randomly chosen between 3 and 15	On period deviation - OFF period deviation-	Randomly chosen between 5 and 40msec Randomly chosen between 5 and 30msec

Table 1

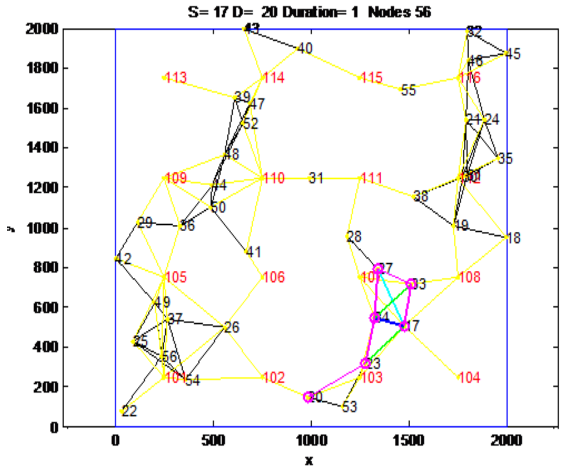

Fig 3

Fig 3 is the snapshot of the simulation region. Nodes in red colour are PU nodes, and the nodes in the black colour are the SU nodes. The different colour line segments correspond to the possible paths between the source and destination. The yellow colour segments indicate that the particular SU node is in the vicinity of the PU node, whose frequency can be sensed by the SU node to use it opportunistically. The feasible paths are those through which the destination is reachable but the actual feasible paths are the one in which all the nodes of the path are in the range of one or more PU node indicated by yellow line segments. These segments are responsible for the distinguishing between total feasible paths and the actual feasible paths between the source and destination. While simulation area taken 2000 both in x-axis and y-axis. S indicates for the source while D indicates for the destination.

V. RESULTS

By comparing the PDR and PoR results of both shortest routing path and spectrum aware routing path we get these two graphs.

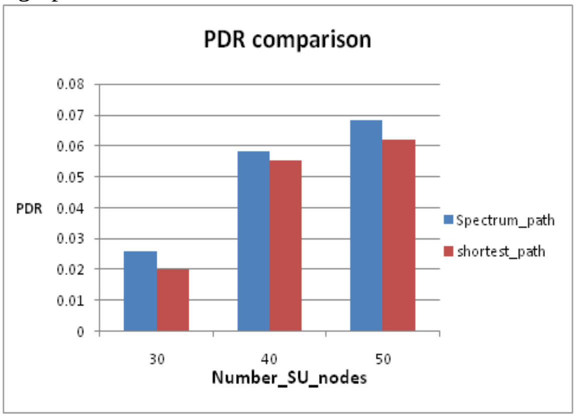

Fig 4

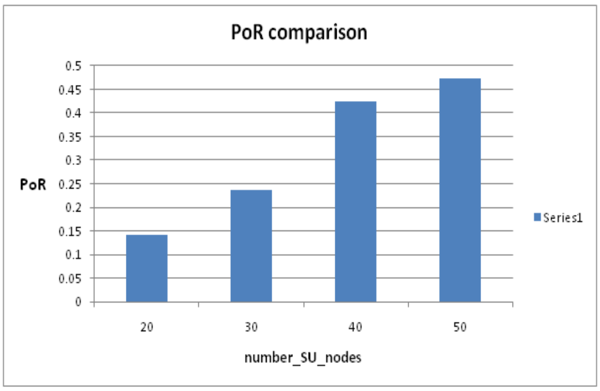

Fig 5

VI. CONCLUSION

By comparing the above two methods we get the conclusion that shortest path protocol will not transmit the data faster than spectrum aware routing protocol just because with the spectrum aware path we are able to know the SU nodes with exact transition & make us able to select the path as per the requirement.

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REFRENCES

[1]. A Survey-On routing protocols in cognitive radio networks, Shikha Jain, *Anshu Dhawan, Dr C.K Jha International journal of computer science and IT. Vol.5(2),2014.*

[2]. A Review of Routing Protocols for Mobile Ad-Hoc Networks (MANET) Alex Hinds, Michael Ngulube, Shaoying Zhu,and Hussain Al-Aqrabi, *International Journal of Information and Education Technology, Vol. 3, No. 1, February 2013*

[3]. Performance Evaluation of CSMA/TDMA Cognitive Radio Using Genetic Algorithm **,** Maninder Jeet Kaur, Moin Uddin, Harsh K Verma International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-2, Issue-3, July 2012

[4]. Spectrum Sensing Technique In Cognitive Radio Network: A Survey, *Mansi Subhedar and Gajanan Birajdar. Department of Electronics and Telecommunication Engineering, SIES Graduate School of Technology, Navi Mumbai, India. International Journal of Next-Generation Networks (IJNGN) Vol.3, No.2, June 2011.*

[5]. Performance analysis of hybrid MAC protocols for CRN, Nasir Faruk1, Mohammed I. Gumel2, Abdulkarim A.Oloyode3, Adeseko A. Ayeni1 *International communications, network and system sciences, 2013 Vol6.*