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Secure TDMA Based Dynamic Spectrum Access With Mobile Base Stations

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***Abstract*—In the melodies of traditional cellular in to the network to the low fixed stations, the access of spectrum is static and a determinist. Nevertheless, the networks with mobile low stations need the dynamic spectrum to have the access to avoid the interference caused by the mobility of a low mobile station. Recently, the scheme of access of dynamic distributed spectrum based in sharing tapes of spectrum in the temporary domain had been introduced, not only to avoid the interference caused by the mobility of low mobile stations, but make sure that all the low mobile stations located in the same variety of interference can have access exactly to bands of spectrum in a certain period on time. This one will cause the significant impartiality, but not up to the sign with regard to the access of resource especially when the low mobile stations are densely located. The safety factor is not emphasized in the approach.**

We shape the scheme of access of spectrum opportunist with an allocation of band of sure frequency. Motivated by the injustice of the scheme opportunist, we propose a scheme of access of dynamic distributed spectrum based in sharing bands of spectrum in the time domain that uses the technical division of time of multiple access, not only to avoid the interference caused by the mobility of low mobile stations, but to make sure that all the low mobile stations located in the same variety of interference can have access exactly to bands of spectrum in a certain period on time. The concept of time waiting has been added to increase the safety factor. The results of numerical analysis and simulation show that the proposed scheme can obtain the highest impartiality without degrading the interpretation of entire network.

Keywords—Cognitive radio, TDMA, Dynamic spectrum access, Markov chain, Fairness Index.

I. INTRODUCTION

Almost all the devices of communication used in a field of battle need that the mobility supports military flexible and agile operations. Also, the region of operation is not fixed, and in the numerous communications of cases the infrastructure cannot already exist. Then a network with a low fixed station is not adapted because this takes a lot of time and money to establish them in a new region of operation. In contrast, the low mobile stations can construct networks scalable and drop-down rapidly in the small cost. Nevertheless, in a network with low mobile stations, the unexpected interference can happen using the same tapes of spectrum of low mobile stations, which are located in the variety of interference together, due to his mobility. East can cause a serious problem of interference between low mobile stations. Therefore, a scheme of access of dynamic effective spectrum does to itself an important question in the network with low mobile stations.

There has been proposed an algorithm of allocation of distributed dynamic channel for cellular networks with low mobile stations. To assign a channel, the low mobile stations verify his assigned channels. If there is a free channel, of that time this is used to support the meeting, on the other hand the low mobile stations collect the information of use of channel of his neighbors to decide a free channel that can be secondhand. The algorithm assigns channels to low mobile stations exchanging the information of channel with low mobile nearby stations that are located inside the variety of interference. Nevertheless they did not consider the scarcity of channels due to the movement of low mobile stations so that the algorithms drop the request of channel if there are no available channels. These approaches, which are based on "first come first serve ", it might assign resources unjustly especially when there are more requests than the entire number of available bands of spectrum.

A dynamic skill of access of spectrum cradle of the cognitive radio, meanwhile, is the most popular of several approaches to solve the problem due to its capacity of sensing bands of spectrum not used without changing messages with other nodes. Based on result of sensing bands of spectrum for the cognitive radio, the most suitable bands of spectrum can be assigned to low mobile appropriate stations.

The access of dynamic distributed spectrum based in sharing bands of spectrum in the temporary domain changing a sequence of allocation of frequency was proposed, that represents bands of spectrum to be used in a specific time. The scheme only cannot avoid the interference caused by the mobility of low mobile stations, but also it can make sure that all the low mobile stations, which are located in the same variety of interference, use bands of spectrum exactly. But, the skill was still stopping obtaining the much higher impartiality. The scheme lacked in the safety, the impact of speed and thickness of low mobile stations in the interpretation. Motivated by this injustice in conventional approaches, in this role we proposed an access of dynamic distributed spectrum based in sharing bands of spectrum in the temporary domain changing a sequence of allocation of frequency using the concepts of the division of time multiple access and time waiting. The division of time multiple access is a method of access of channel for average shared networks. This allows that several users should share the same channel of frequency dividing the sign in different grooves from time. The users transmit one after other, one after other, every use of its own groove of time. This one allows that multiple stations should share the same way of transmission. The time waiting is a wireless technology that extends its sign rapidly frequencies that change. Every band of available frequency is divided in sub frequencies. The signs rapidly change ('hop') between these into a predetermined order. The interference in a specific frequency will only affect the sign during that short interval.

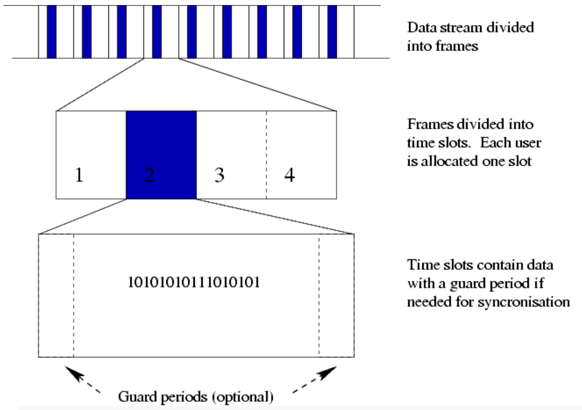

Fig 1: TDMA frame structure showing a data stream divided into frames and those frames divided into time slots.

I. SYSTEM MODEL

We consider dynamic networks of access of spectrum that consist of a game of low mobile stations and mobile nodes related wirelessly. We refer to the links between low mobile stations as links of spinal column, while the links between low mobile stations and mobile nodes were mentioned as links of short hop. A few low mobile stations have a cell of radio d. A mobile node in the cell of radio d only can communicate with other mobile nodes by the low mobile stations that support the mobile node. We assume that the mobile nodes in the same cell can have access simultaneously to its low mobile stations as technology of multiple accesses as FDMA, TDMA, CDMA or OFDMA. The Omni directional links of short jump are established between mobile nodes and low mobile stations. Therefore, the variety of spread of radio for a link of short jump is $\alpha \times d$, where $\alpha > 2$. If the cell of radio $\alpha \times d$ for a few low mobile stations overlaps with a cell of radio d for other low mobile stations using the same band of spectrum, the interference can happen. In this role, we go to the problem of interference caused by the mobility of low mobile stations. Two low mobile stations can establish a link of spinal column, which is Omni directional, if the distance between two low mobile stations is not more than D. Hence, the low mobile stations can change information using the link before they experience the interference of common channel provided that D is so big compared with $\alpha \times d$. This assumption is in general reasonable because the low mobile stations have more supply of energy, the memory, and the power of prosecution than mobile nodes. In our model, we assume that there was a whole of bands of spectrum C of the largeness of identical band to be awarded to a few low mobile stations. A few low mobile stations can exploit the tapes of spectrum jumping to support links of short jump. In other words, an elected tape of spectrum is used only in a given time and it is returned to be shared by other low mobile stations. This way, every low mobile station it has sequences of allocation of frequency of yes and adjoins and a nearby game. The sequence of allocation of frequency is formed in general of available tapes of spectrum. For the avoidance of the interference a few low mobile stations there been allowed to change his sequence of allocation of frequency. The nearby game of a few low mobile stations was defined as a list of neighbors for the low mobile stations in this role. When the distance between low mobile stations i and low mobile stations j is quite nearby to cause the interference when they use the same tape of spectrum, we think that they were nearby. Also, we assume that the low mobile stations and the mobile nodes equipped with radios cognitive are capable of discovering spectrums not used inside a cell of radio $\alpha \times d$ and all the low mobile stations are perfectly in sync. A few low mobile stations can exploit the information of a neighbor as sequences of allocation of frequency and adjoin games communicating with neighbors by the link of spinal column. On the other hand, there is no assumption in the mobility of low mobile stations, of that time they can move towards any destination in any direction. Nevertheless, a few mobile nodes it has a strong tendency of moving together with his low mobile stations. The interference can get up if the low mobile stations, which are not at first neighbors, use the same tape of spectrum, and the movement in the proximity one with other.

I. METHODOLOGY

Interference:

The interference imposes a significant negative impact on the performance of wireless networks. With the continuous deployment of larger and more sophisticated wireless networks, reducing interference in such networks is quickly being focused upon as a problem in today's world. In this paper we analyze the interference reduction problem from a graph theoretical viewpoint. A graph coloring methods are exploited to model the interference reduction problem. However, additional constraints to graph coloring scenarios that account for various networking conditions result in additional complexity to standard graph coloring. This paper reviews a variety of algorithmic solutions for specific network topologies

Probability:

We shape our scheme and the scheme of reservation using a chain of Markov. The arrival and the neighbors' exit for a low mobile specific station can be shaped by two arbitrary processes. The nearby arrival is shaped as an arbitrary process Poisson with the price λ, then the time of inter arrival it is an exponential denial distributed with the average time 1 / λ. The duration for neighbors is also negative exponentially distributed with the average time 1 / μ, then the exit of the low mobile stations is another arbitrary process Poisson with the price μ. Hence, the number of neighbors for the low mobile stations can be described by a chain of Markov continues of time. The diagram of state transference for the number of neighbors is showed as the Fig 2, where n is the number of neighbors of the low mobile stations. The statistical equation of state of balance that describes the chain of Markov happened in the Fig 2 is as it continues:

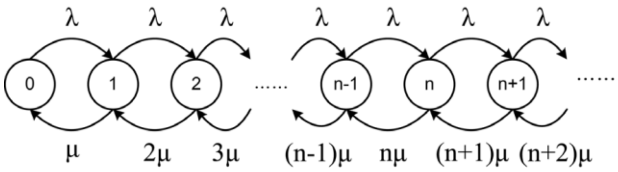

Fig. 2: Markov chain model

$$\lambda P_0 = \mu P_1$$

$$\lambda P_{n-1} + (n+1)\mu P_{n+1} + 1 = (\lambda + n\mu)P_n \qquad (1)$$

P_0 denotes the probability that there is no neighbor in the variety of interference and P_n the probability denotes that there are neighbors of n. Because of $\sum_{n=0}^{\infty} P_n = 1$, from (1), we can get (2).

$$P_0 = [\sum_{K=0}^{X} \frac{1}{K!}(\frac{\lambda}{\mu})^k]^{-1}$$

$$P_n = \frac{1}{n!}(\frac{\lambda}{\mu})^k P_0 \qquad (2)$$

The C denotes the entire number of bands of spectrum that can be assigned to MBS.

$$P_f = P\{x|X \geq C\} = \sum_{n=C}^{\infty} \frac{1}{n!}(\frac{\lambda}{\mu})^n P_0$$

We can obtain the probability P_f that no bands of spectrum can be assigned to one or several low mobile stations from (2).

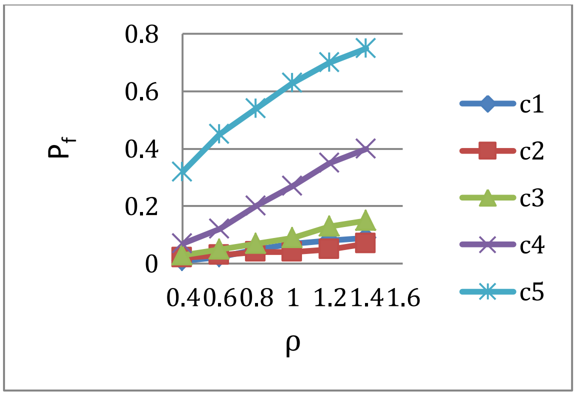

Fig 3: Probability P_f with a various C and ρ.

Fairness Index:

We use the Jains fairness-index to evaluate the fairness of the proposed scheme. The fairness-index is defined as following in

$$FI = \frac{\sum_{i=0}^{k}(R_i)^2}{k\sum_{i=1}^{k}(R_i)^2}$$

Where k is the number of low mobile stations in the variety of interference. For the scheme of reservation, the decreases of index of impartiality after the value of k become bigger than C.

II. SIMULATION RESULTS

Simulation setup:

In the simulation, there are low mobile stations that were always located inside a square of 100 kilometers. At first, the low mobile stations were uniformly distributed inside the square with the immediate neighbors along the x-axes and y-axes equidistance one of other to make sure that there was no interference at the beginning of the simulation. The low mobile stations moved in an arbitrary way in the square in a constant speed. Every low mobile station chose an arbitrary point in the square as its following destination and moved towards it until it was putting itself there. This one was repeated for the duration of the simulation. On the other hand, we assume that the interference happened if the distance between someone two low mobile stations using the same bands of spectrum were less than 2 kilometers.

Simulation Results:

A. Fairness Index:

We use the index of impartiality of Jain known for the thickness different from low mobile stations. The fig 4 shows the index of impartiality of both schemes in C =3, 4 and 5 as the number of low increases of stations mobile, where the average speed of every low mobile station is 50km/h. As C increases, the index of impartiality also increases for both schemes, considering the fixed number of low mobile stations. On the other hand, as the number of mobile stations increases, decreases the index of impartiality. Also we can observe that our scheme presents an index of impartiality higher than the scheme of reservation in the same conditions of the number of low mobile stations and the value of C. East is because our scheme can guarantee that any low mobile station inside the same variety of interference has exactly the same opportunity to have access to bands of spectrum. The scheme of reservation, meanwhile, cannot guarantee great impartiality of the access of spectrum.

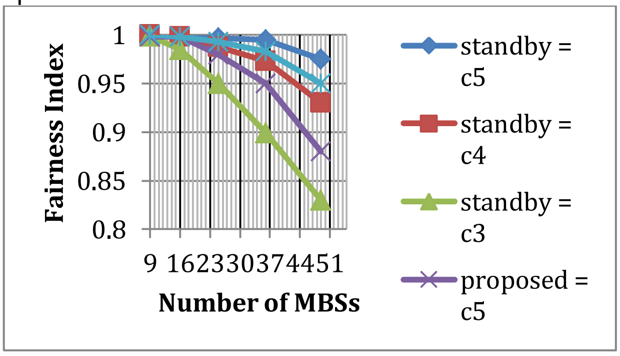

Fig 4: Fairness index for standby scheme and proposed scheme.

B. Security:

In this methodology the system keep on hoping at different frequencies in time division multiplexing. Where at each time different mobile station were hoped at different frequency sequences. As if it is done at very fast pace then it is very difficult for any system to detect the real signal, which is very common in Military communication system where they need more security communication.

III. CONCLUSION

In this role, we proposed a scheme of access of dynamic distributed spectrum that uses the time division multiple access and time hoping for the concept to improve the impartiality of a cellular mobile network, which consisted of low mobile homogeneous stations and mobile nodes that have the functionality of cognitive radio. We shape the proposed scheme and the conventional scheme with a chain of Markov and think that there was a serious problem of impartiality in the conventional scheme, if the available spectrums are scarce compared to the number of low mobile stations that request spectrums. In order to go to the problem, the low mobile stations in the proposed scheme share the tapes of spectrum in the temporary domain if it is impossible for the low mobile stations to have access to bands of spectrum that use the time division multiple access. We using fairness index investigated the interpretation of the scheme proposed in the extensive simulation. The results of simulation showed that the scheme proposed dramatically obtained the impartiality of access compared to the conventional scheme.

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