Toward cognitive radio resource management based on multi-agent systems for improvement of real-time application performance

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***Abstract*—Cognitive Radio (CR) is a promising technology that can alleviate the spectrum shortage problem by enabling unlicensed users equipped with CRs to coexist with incumbent users in licensed spectrum bands while causing no interference to incumbent communications. In this paper, we propose a new approach which uses CR for improving real-time application performance related to only one cognitive radio mobile terminal (CRMT). We also present a synthesis of research relating to dynamic spectrum allocation and sharing in the context of CR networks using multi-agent systems. In our future work, we will seek to improve real-time application performance related to many CRMT.**

Keywords: Cognitive radio, multi-agent systems, cognitive radio mobile terminal, handover, artificial intelligence.

I. INTRODUCTION

We currently attend the multiplication of telecommunication standards considering recent progress in this area. The increasing number of standards broadens the range of offers and available services for each user; however, most available radio frequencies have already been allocated.

A study carried out by the Federal Communications Commission (FCC) has shown that some frequency bands are overloaded at the rush hours. However, the use of the frequency spectrum is not uniform: according to the hours of day and to the geographical position; a frequency band can be overloaded while another remains unused. The idea to develop tools to better use the spectrum has naturally emerged.

Cognitive Radio (CR) is the concept that meets this challenge; better use the spectrum, it is also to increase the throughput and make more reliable the physical layer.

Most researches on CR networks have focused on the exploitation of unused spectrum. However, the CR nodes possess the necessary qualities to make a considerable progress in the reliability of wireless networks [1], which has been less explored, so that is why we were interested by improving wireless link reliability in order to improve real-time application performance, we are specially interested in video conferencing application.

The aim of our paper is to propose a technique to improve real-time application performance related to only one CRMT. Our technique is based on machine learning. In our future work, we will seek to improve real-time application performance related to many CRMT based on multi-agent systems.

This paper is organized as follows. First, we describe the case related to one CRMT using video conferencing application and the results of our experimentation. Then, we present a synthesis of research relating to dynamic spectrum allocation and sharing in the context of CR networks using multi-agent systems. Our objective is to improve real-time application performance related to many CRMT using multi-agent systems.

II. SCENARIOS AND PROPOSED SOLUTIONS RELATED TO ONLY ONE CRMT

A. *Scenario*

The Figure 1 below shows a path followed by a CRMT when it switches to an area where the signal quality drops to an unacceptable level (shown in red) due to a gap in coverage, we assume that the client uses video conferencing over the route.

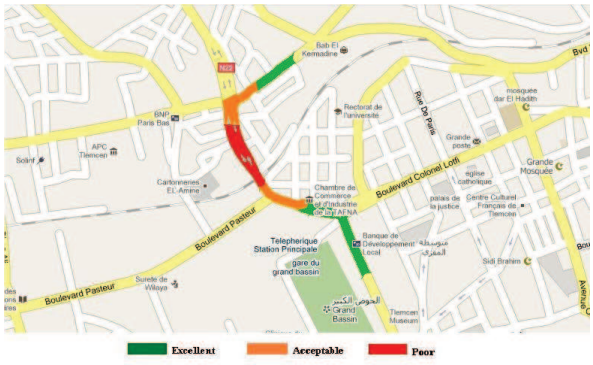

Figure 1. Signal quality associated to a cognitive radio

B. *Proposed Solution*

After several incidents, the CR should be aware of the problem. Then, through some geolocations or the ability to learn the time of the day when this happens, the radio can anticipate the difference in coverage and know the necessary signal to the base station to change characteristics of the signals when the user approaches the deficient coverage.

C. *Application*

As mentioned above, we will use video conferencing (real-time application) in the case of a mobile user who needs to take a path where the signal quality drops to an