Performance Improvement of Wireless Link Reliability in The Context of Cognitive Radio

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Summary
Cognitive radio is a software radio whose control processes leverage situational knowledge and intelligent processing to work towards achieving some goal related to the needs of the user, application, and/or network. Cognitive radio is born of the need to introduce intelligence and flexibility in managing spectrum resources that become increasingly valuable with the rapid proliferation of standards and radio services. In this paper, we propose a new approach which uses the cognitive radio for improving wireless link reliability. We show through experimentation the interest of our approach.

Key words:
Cognitive radio, mobility, handover, link reliability, machine learning.

1. Introduction

Cognitive radio CR will lead to a revolution in wireless communication with significant impacts on technology as well as regulation of spectrum usage to overcome existing barriers. CR, including Sofware Defined Radio SDR as enabling technology, is suggested for the first time in [1] and [12] to realize a flexible and efficient usage of spectrum.
Applications in the context of CR are often included in its definition because of the compelling and unique applications afforded by CR. Additionally, there are many existing software radio techniques that CR is expected to enhance. The following are frequently advocated applications of cognitive radio [2]:

- Improving spectrum utilization and efficiency.
- Improving link reliability.
- Advanced network topologies.
- Automated radio resources management.

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 [2], which has been less explored, so that is why we were interested by improving wireless link reliability in the context of CR.
Connecting mobile users generally consists of a series of fixed and mobile networks. Any consideration of reliability must take into account the end to end network connection. These ideas have been important areas of research in wireline networks [3] and in infrastructure wireless networks [4] [5]. However, the end to end reliability is limited by its weakest components. Traditionally, the wireless link access is seen as the weakest link, and many techniques such as channel coding and diversity have been proposed to the physical layer to improve the quality of radio link [6].
The aim of our paper is to propose a technique to improve wireless link reliability using the CR. For this, it seemed appropriate to choose a CR application and imagine the scenario on which we will apply our approach. Our technique is based on machine learning.
In this paper, we first present a state of the art of traditional reliability in wireline networks. Then, we present the cognition cycle changed to management failures for a wireless link in a CR. Finally, we describe the scenarios proposed and the results of our experimentation.

2. Traditional reliability in wireline networks

Network robustness has been a major driving factor in the design of wireline networks partly due to regulatory requirements and customer expectations. Network robustness implies network reliability, which generally in a communication network is related to the ability to [5] :

- Prevent the occurrence of failures.
- Solve and recover from failures.

2.1 Prevention mechanisms

Networks use prevention mechanisms to decrease the occurrence or the severity of failures. Most of these approaches are based on the use of dependable hardware and software for the transmission links and nodes. Other solutions such as selecting less-hazardous environments and equipping communication cables with protective covers are also classified as prevention methods.
The objective of a prevention mechanism is to postpone the occurrence of failures. The most appropriate

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