

Cognitive Radio in Military Communications: fantasy or reality?

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Abstract— **Cognitive Radio is a paradigm for wireless communication in which a wireless node (or a network) can dynamically change its transmission and reception parameters according to the user needs and the wireless environment. Cognitive radio opens a new era in digital communications involving numerous topics, such as spectrum sensing and dynamic spectrum management.**

In this paper we will describe the advantages of cognitive radio, give a state-of-the art overview and discuss how cognitive radio may be introduced into the military communications domain.

I. CONTEXT

Military tactical networks are being required to support a greater number of services than ever before. In addition, the bandwidth requirements associated with many of the new services are also rapidly increasing. The combination of these two factors means that we are nearing a time when there will be insufficient spectrum to support the services required for future military operations. Today's military operations are also typically undertaken by multiple nations cooperating in a coalition force. The spectrum and frequency planning activities associated with the deployment are extremely complex. Both of the aforementioned problems, spectrum scarcity and deployment burden, will be driving factors to introduce cognitive radio technology in the military communications domain.

A cognitive radio transceiver is able to sense, learn, decide and react adaptively to avoid interference with licensed or unlicensed users and to achieve greater spectrum efficiency compared to existing systems. One of the biggest advantages of CR is its ability to dynamically access the spectrum, also called Dynamic Spectrum Management (DSM). For this, two models are interesting for the military communications. Either the CR uses opportunistically licensed frequency bands, trying to avoid interference with the Primary User (PU), either the CR coexist with other CRs in an open spectrum model, where all users have equal rights. DSM represents a fundamental change from existing spectrum management procedures in the way that spectrum is allocated and used for both civilian and military domains.

II. STATE-OF-THE-ART

The term 'cognitive radio' was coined by Joe Mitola in 1999. Since then, a lot of research has been done in this area. However, after more than 10 years of research, no military cognitive systems are available on the market and the technology is not proven yet. In this part an overview is given on the ongoing research at national (MOD's) and international (EDA, NATO) level. We will also discuss some systems with cognitive-like features.

III. ROADMAP FOR MILITARY COGNITIVE RADIO

During the presentation we will propose a realistic DSM roadmap that identifies how cognitive radio technology may be introduced into the military communications domain in discrete steps although no specific timeframe is proposed. The DSM roadmap is designed in

manageable steps such that military users may develop trust in CR technology and limit risk to existing operational capabilities.

As a first step, we propose the introduction of a band exclusively dedicated to CR systems within the military frequency allocation. This step involves minimal risk to existing legacy operations and allows military end-users to build trust in and evaluate CR technology. In a second step, the military CR are allowed to make opportunistic use of limited civilian bands. In a third step, we propose that military CR systems would also be allowed to coexist with legacy systems in limited military bands.

IV. CONCLUSION

Today's static spectrum management is very complex and inefficient. CR and its ability to autonomously and dynamically access the spectrum seems very promising for military communications. The introduction of CR will drastically change the spectrum management procedures. However, the technology is still not mature and the first fully operational CR system cannot be expected within the next few years.