OWL and Rules for Cognitive Radios

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Cognitive Radio is defined as:

a) A type of radio in which communication systems are aware of their environment and internal state and can make decisions about their radio operating behavior based on that information and predefined objectives.

b) Cognitive radio [as defined in item a)] that uses software-defined radio, adaptive radio, and other technologies to adjust automatically its behavior or operations to achieve desired objectives.

The above definition of cognitive radio was first introduced by Mitola, then adopted by the Cognitive Radio WG at the Wireless Innovation Forum and the IEEE P1900.1 standard. Currently, the main driving force behind the evolution of cognitive radio is the optimization of the utilization of RF spectrum, primarily because spectrum is a resource in high demand. Among the debates being held in the cognitive radio community is what kind of technology should be used to implement the concepts that define the essence of cognitive radio? For instance, should it be implemented using only procedural languages or also declarative languages?

In this talk, a number of efforts related to the implementation of the concept of cognitive radio using declarative languages will be discussed.

1. The MLM Work group (Modeling Language for Mobility) of the Wireless Innovation Forum has developed a number of use cases in which radios need to have more flexible communication protocols for exchanging messages and negotiating communications parameters.
2. The MLM Work group has developed a Cognitive Radio Ontology (CRO) (expressed in OWL) for describing the various aspects of radio communications.
3. The demonstration of the use of the CRO in the real-time adaptation of the communications link between two radios has been developed.
4. The demonstration of the use of an extension of the CRO to describe communications protocols (waveforms) has been developed. In this case one radio sends the description of a waveform to another radio, which then instantiates the waveform and then the waveform is used for subsequent communication.
5. The P1900.5 standardization work group has developed a standard that defines the requirements for a policy language for expressing policies for the dynamic use of spectrum. Currently, this workgroup is working on a new standard, P1900.5.1, that will define an instance of the policy language that satisfies the requirements of P1900.5.