



SDRF Cognitive Radio Definitions

**Working Document
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1. Introduction

This document is intended to communicate a set of definitions in the area of Software Defined Radio and Cognitive Radio. These definitions have been developed to communicate to practitioners in the field the approach of the Software Defined Radio Forum to these technologies.

The current version is proposed for approval by the Software Defined Radio Forum. It is developed from the working document used to facilitate collaboration between the SDR Forum and the IEEE P1900.1 working group on terms of mutual interest. The intention, at this time, is to ballot these terms through the SDR Forum's approval process.

Some of the definitions have multiple versions. This structure is to recognize situations where normal industry terminology is at variation with the desired logical definitions. It is intended to facilitate technical discussion by avoiding difference of opinion arising from presuppositions based on differing definitions. All definitions within this document relate to wireless communications.

The use of the word "or" throughout this document should be interpreted as a "inclusive or" or "and/or".

2. Definitions

Radio

- a) Technology for wirelessly transmitting or receiving electromagnetic radiation to facilitate transfer of information.
- b) System or device incorporating technology as defined in (a).
- c) A general term applied to the use of radio waves.¹

Radio Node

A radio point of presence incorporating a radio transmitter or receiver.

Software

Modifiable instructions executed by a programmable processing device.

Physical Layer

The layer within the wireless protocol in which processing of RF, IF, or baseband signals including channel coding occurs. It is the lowest layer of the ISO 7-layer model as adapted for wireless transmission and reception.

Data Link Layer

The protocol responsible for reliable frame transmission over a wireless link through the employment of proper error detection and control procedures and medium access control.

Software Controlled

Software controlled refers to the use of software processing within the radio system or device to select the parameters of operation.

Software Defined

Software defined refers to the use of software processing within the radio system or device to implement operating (but not control) functions.

Software Controlled Radio

Radio in which some or all of the *physical layer* functions are *Software Controlled*.

Software Defined Radio (SDR)

Radio in which some or all of the *physical layer* functions are *Software Defined*.

Adaptive Radio

Radio in which communications systems have a means of monitoring their own performance and a means of varying their own parameters by closed-loop action to improve their performance.

¹ ITU-R Radio Regulations, Article 1 (Terms and Definitions, Section 1.4)

Cognitive Radio²

- a.) *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. The environmental information may or may not include location information related to communication systems.
- b.) Cognitive Radio (as defined in a.) that utilizes *Software Defined Radio*, *Adaptive Radio*, and other technologies to automatically adjust its behavior or operations to achieve desired objectives

Intelligent Radio

Cognitive radio that is capable of machine learning.

Radio Awareness

Radio awareness is the functionality with which a radio maintains internal information about its location, spectrum environment, or internal state, and is able to detect changes in that information. Radio awareness is required for supporting the cognitive control mechanism.

Cognitive Control Mechanism

Cognitive control mechanism is the mechanism through which cognitive radio decisions are implemented.

Policy

- (a) A set of rules governing radio system behavior. Policies may originate from regulators, manufacturers, developers, network and system operators, and system users.
- (b) A machine interpretable instantiation of policy as defined in (a)

Policy-Based Radio

Radio in which the behavior of communications systems is governed by machine-interpretable policies that are modifiable

Transmitter

Apparatus producing radio-frequency energy for the purpose of radio communication.

Receiver

A device that accepts a radio signal and delivers information extracted from it.

Air Interface

The subset of *waveform* functions designed to establish communication between two radio terminals. This is the *waveform* equivalent of the *wireless physical layer* and the *wireless data link layer*.

² The IEEE recognizes that the terminology commonly used is “cognitive radio.” However, generally the cognitive functionality may be outside the boundary normally associated with a radio (e.g., environment sensing is a cognitive function that is not normally part of a radio).

Waveform

- a) The set of transformations applied to information to be transmitted and the corresponding set of transformations to convert received signals back to their information content.
- b) Representation of a signal in space
- c) The representation of transmitted RF signal plus optional additional radio functions up to and including all network layers.

Appendix 1 – Comments Received During Balloting and the Proposed Resolution

Comment	Work Group Resolution
Definition of "Radio" should include a transceiver function (e.g. Technology for wirelessly transmitting and/or receiving...). Otherwise the correct term for a transceiver would be "Radios" (plural).	The document was updated to reflect that the use of the word "or" throughout the document is inclusive, meaning "and/or"
Definition of "SDR": Why is it focused on the physical layer. One or more non CORBA enabled, fixed function modems may handle all physical layer functions in an SDR. Although the physical layer functions cannot be changed through software, the radio is still software defined. Instead of focusing on the physical layer, why not use waveform (definition c). i.e. SDR: Radio in which some or all of the waveform (definition c) functions are Software Defined.	No change – the work group concluded that a radio in which the physical layer is fixed function is NOT a software defined radio, but rather would need to be classified a hardware radio or software controlled radio.
Definition of "Waveform"; Suggest that the IEEE OMG and SDRF use the same definition.	No Change – the work group agrees and is coordinating this definition through IEEE P1900.1 and will revise this definition, if necessary, through the following the completion of the P1900.1 ballot resolution process. This may require a revision to this specification.
The definition of "Policy-based Radio" is a little too broad, suggest that it read something like: "Radio in which certain behaviours (those governed by a defined set of policies) are governed by machine interpretable policies that are modifiable by an authorized entity."	No Change – The suggested change implies an implementation and is therefore not appropriate. For example, the use of the term "authorized" implies a security architecture that would be implementation specific.
Receiver-A device that accepts a radio signal and delivers information extracted from it. Change to: Receiver - A device that accepts Waveforms and delivers information extracted from it.	No Change – the work group will revisit this definition following resolution of the waveform definition as defined above.
Remove references to deleted definition	Agreed, deleted definitions have been removed