Shared Spectrum Company DySPAN 2008 Demonstration Overview

Shared Spectrum Company (SSC) demonstrates several new Dynamic Spectrum Access (DSA) features at the DySPAN 2008 Conference. These features include high-level language, policy-based radio control including geo-location based policy control, operation using a small, low cost general purpose processor (GPP), and TV Whitespace Detector. The demonstrations are conducted on the DSA1000 cognitive radio based on IEEE 802.16d. The demonstration features two DSA1000 radios communicating video and data in the presence of interferer produced by a signal generator. The demonstration was conducted over-the-air as well through cables.

This demonstration is the most comprehensive public demonstration of Dynamic Spectrum Access technology and provides validation of several technical innovations.

- The policy-based control will show spectrum sharing using complex constraints from multiple "peer" stakeholders.
- Two command and control terminals provide different, time-varying, complex and conflicting spectrum access rules to the radios, and the radios will select the correct access rules.
- Operation with a low cost GPP shows the economic viability of our DSA radios for a wide range of commercial applications.
- Demonstration of ATSC TV Whitespace Detector
- Policy use of geo-location data

Picture 1 - DSA 1000 Radio

Picture 2 - TV White Space GUI

The DSA software comprises a suite of software applications that are modular and open for partners to rapidly prototype new applications for DSA.

How SSC DSA Works

The SSC dynamic spectrum access solution is radio software solution comprising the core components depicted in Figure 1. The key features of how dynamic spectrum access both learns and adapts are group into 4 key categories: Frequency Detection, Spectrum Management and Neighbor Discovery and Channel Maintenance.

Frequency Detection

DSA software uses information from the radio detector(s) and/or the policy subsystems to manage spectrum usage. DSA maintains reliable communications while avoiding interference and ensuring compliance with the existing constraints. Ultra-high sensitivity detectors are used for a variety of different bands of interest. In cases where detectors are not sufficient or prohibited DSA software utilizes geo-location and group sensing technique. The scalability and seamless integration into existing network architectures is achieved through the Frequency Topology module which combines the detector information, network information as well as policy information to continuously track networks of interest in frequency.

Spectrum Manager Module

The Spectrum Manager module uses information from both the Detector and the Spectrum Policy module to dynamically manage spectrum access to maintain reliable communications while avoiding interference and ensuring compliance with prescribed policy constraints.

Channel Maintenance and Neighbor Discovery Modules

The Channel Maintenance and Neighbor Discovery modules establish an operating channel by determining and negotiating an operating frequency for a particular network of DSA-Enabled Radio nodes. In this process, the radios establish a means of rendezvous when one or more DSA-enabled radios are impacted by frequency interference.

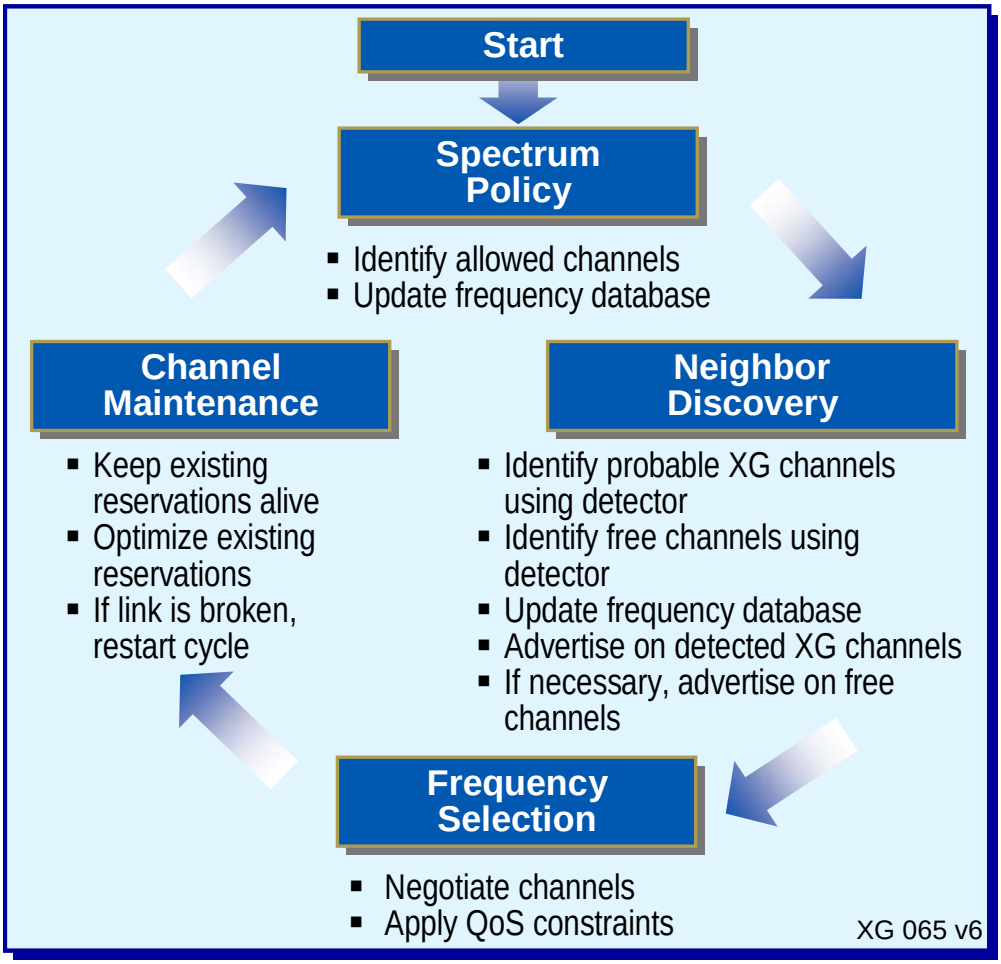

Figure 1 Dynamic Spectrum Access Components and Data Flow

Policy-based Architecture for Dynamic Spectrum Access

The main emphasis of the Dynamic Spectrum Access framework is to overcome two types of concerns: harmful interference caused by a malfunctioning device and harmful interference caused by a malicious user. In tandem with signal-detection-based interference avoidance algorithms employed by software-defined radios, a set of policy-based components, tightly integrated with the accredited kernel on the radio, avoids potentially harmful interference caused by a malfunctioning device. The policy conformance and enforcement components ensure that a radio does not violate policies, which define regulatory and other stakeholders' goals and requirements, and which are encoded in an abstract, declarative language [6].

Policy-system architecture is based on a several key areas that involve both the policy author and the software-defined radio. The core components are depicted in Figure 2 and Table 1 below.

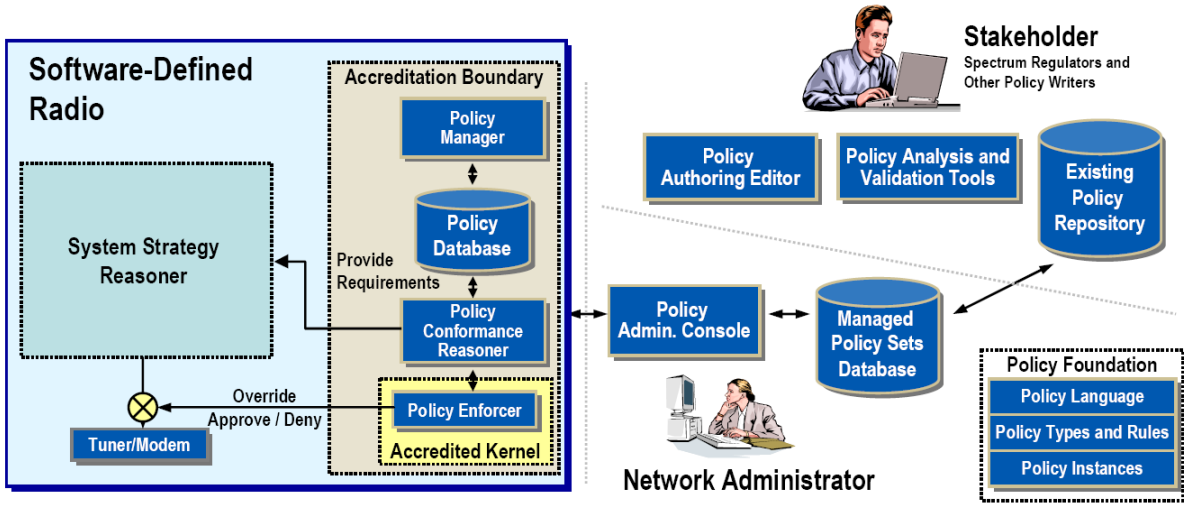

Figure 2. Distributed Policy-based Spectrum Access Control Architecture. The software-defined radio includes a localized policy enforcer responsible for controlling spectrum access based on requirements provided by regulatory and other stakeholders. The radio is managed by a network administrator who relies on stakeholders for providing up-to-date policies.

Key Components of the Policy Architecture

Key Components	Function
Policy Manager	Manages local policies and responds to remote commands
Policy Conformance Reasoner	Analyzes and reasons over policies and device-provided evidence
System Strategy Reasoner	Adjusts and selects the device's operational modes
Policy Enforcer	Governs the radio by permitting only allowed transmission requests
Policy Administrators	Secure interactive method for operators to remotely modify the state of the radio

Table 1 – Key Components of the DSA-based Policy Architecture

The demonstration at DySPAN 2008 provides the most comprehensive software demonstration of policy, DSA algorithms and TV whitespace detection.