

COGNITIVE RADIO NETWORKS

An ICTAS Focus Area

The Need for Research

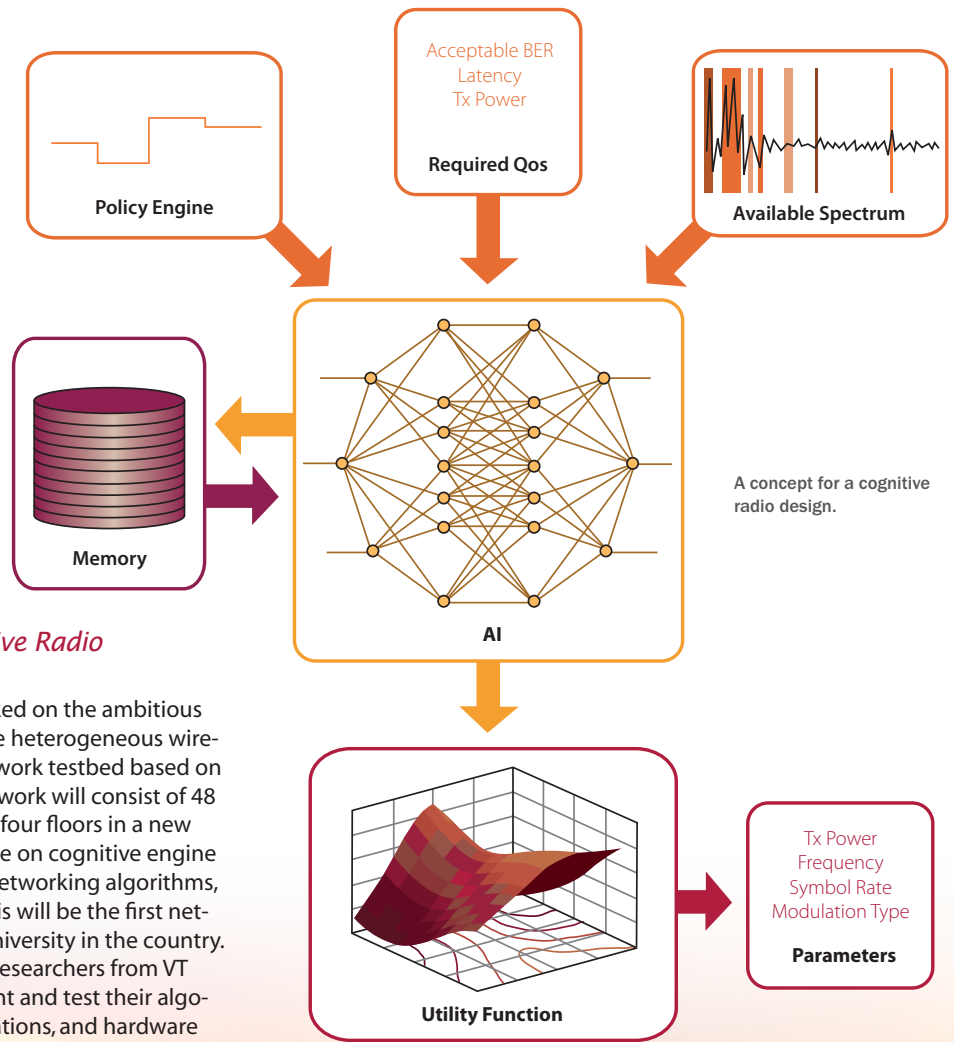
There are two key motivators for cognitive radio research. The first is to develop techniques for more efficiently using spectrum, which will enable higher data rates and more wireless devices. The second is to develop automated ways for deploying and maintaining wireless infrastructure with minimal human interaction.

Technical Approach

Cognitive radios are aware of their environment and intelligently adapt their performance to the user's needs. A CR is a software defined radio with a "cognitive engine" brain. Conceptually, the cognitive engine responds to the operator's commands by configuring the radio for whatever combinations of waveform, protocol, operating frequency, and networking are required. It monitors its own performance continuously, reading the radio's outputs to determine the RF environment, channel conditions, link performance, etc., and adjusting the radio's settings to deliver the needed quality of service subject to an appropriate combination of user requirements, operational limitations, and regulatory constraints. We call these processes "reading the radio's meters" and "turning the radio's knobs" for short.

Mission

Our mission is to develop and demonstrate new principles in wireless network design by incorporating cognition into radio and network operation, thereby enabling efficient use of the spectrum, rapid deployment, lower maintenance, and network security.

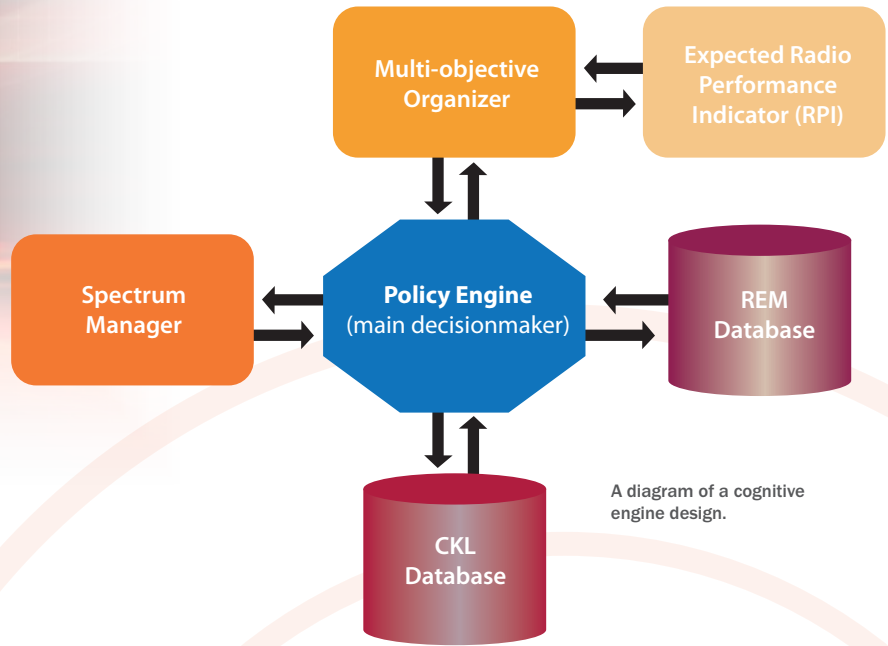


VT-CORNET: Cognitive Radio Network Testbed

Wireless@VT has embarked on the ambitious goal of building a unique heterogeneous wireless communication network testbed based on cognitive radios. The network will consist of 48 radio nodes spread over four floors in a new building. Emphasis will be on cognitive engine design, self-organizing networking algorithms, and network security. This will be the first network of its kind at any university in the country. The testbed will enable researchers from VT and outside to implement and test their algorithms, protocols, applications, and hardware technologies within a realistic environment.



Wireless@VT teams won the Grand prize and the Best Design prize in the SDR Forum Smart Radio Challenge 2007. We developed a smart radio system that will automatically find available spectrum within a predefined band and transmit voice or data over that band.



A diagram of a cognitive engine design.

Accomplishments

- Wireless@VT is a recognized leader in cognitive radio network research.
- Cognitive radio research at Wireless@VT has been supported by many federal agencies and private companies. Total research funding to date has been several million dollars.
- Several book chapters have been written by Wireless@VT faculty on cognitive radios.
- Two student awards earned at a national conference on cognitive radio projects.
- Virginia Tech holds key intellectual property enabling cognitive radio.

Areas of Research

- Dynamic Spectrum Allocation Algorithm Development
- Experimental and Performance Metric Design
- Behavior Analysis
- Experimental Hardware Design
- Cognitive Engine Development
- Wireless Network Security

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