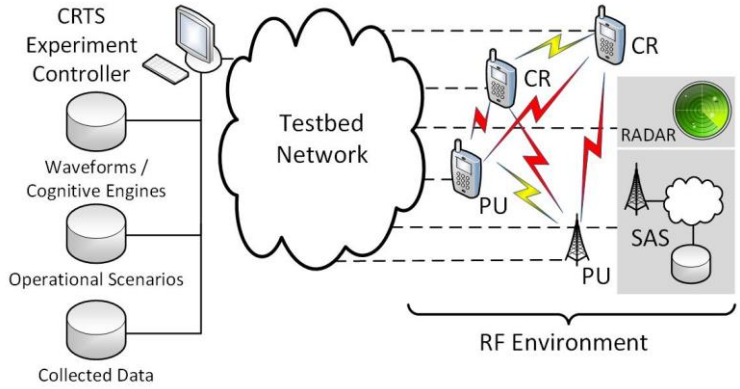
Cognitive Radio Test System (CRTS)

Wireless @ Virginia Tech

Open-source software for wireless network testing and experimentation



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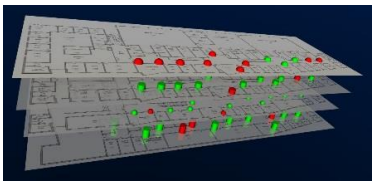
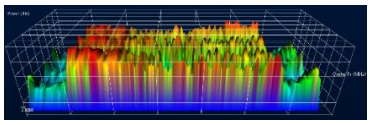


CORNET Testbed



CORNET 3D

Goals

- Promote coexistence of wireless networks in shared spectrum for
  - Commercial / Personal Communications
  - Military and Public Safety
  - Health Care
- Enable testing & evaluation of networks in challenging spectrum scenarios
- Accelerate radio / network R&D through research into efficient testing

Current Capabilities

- Generate reproducible, time-varying signal environments and streaming, burst, or Poisson-distributed data traffic
- Measure performance (packet error rate, throughput, etc.) of included customizable adaptive / cognitive radio waveforms in these environments
- Interface with waveforms implemented in Python (reference implementation of GNU Radio flow graph available)

In Progress

- Characterization in Virginia Tech's CORNET testbed
- Configurable MAC and Network layers for the included OFDM radios
- Integration with CORNET 3D web-based spectrum visualization
- Educational applications:
  - Scoring entries in Spectrum-ShaRC international student design contest
  - Hands-on exercises using student-programmed or controlled radios

Future

- Addition of signals representative of RADAR systems
- Interface to and testing of configurable open-source SAS
- Interface with stand-alone radios and wireless network devices

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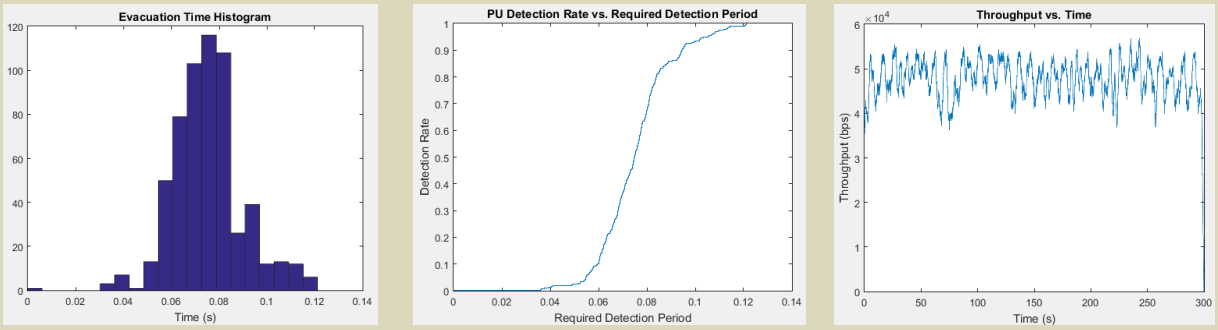
[1] Adapted from E. Sollenberger, F. Romano, C. Dietrich, "Short Paper: Test & Evaluation of Cognitive and Dynamic Spectrum Access Radios using The Cognitive Radio Test System," IEEE VTC-Fall, Boston, MA, September 6-9, 2015

More About CRTS

Deployment of cognitive and other radios and networks that operate in shared spectrum environments requires the ability to evaluate their performance in a variety of scenarios. This ability is also needed to enable the prerequisites for deployment: research; development; compliance with regulations and voluntary standards; and acquisition.

CRTS aims to enable testing of radios and their networks in diverse environments, including observation or inferences about decisions that the radios make in response to controlled modifications to the radio environment. Appropriate metrics and test plans need to be developed to establish a common test procedure. Lack of such procedures slows commercial development of cognitive radios and networks today.

To accommodate different cognitive radio types and implementations, CRTS will define a set of test benches that can be loaded to analyze the performance and compliance of a specific radio. CRTS will also assist in categorizing cognitive radios according to their abilities as well as provide the means to develop more efficient test plans by adjusting test parameters according to the results of radios whose abilities are already known without being biased to a specific product.



(a) (b) (c)

Example Results: (a) channel evacuation time histogram, (b) primary user detection probability vs. detection time, (c) primary user throughput in presence of secondary user

As shown above, CRTS is already able to measure a number of radio performance parameters and analyze the behavior of adaptive software radios. Our plans include expanding the system to enable testing cognitive radio networks in complex environments that incorporate interferers, spectrum access regulations, and scheduled and dynamic spectrum access using spectrum access systems (SAS) and sensing.

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