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A FLEXIBLE AND EXTENSIBLE COGNITIVE RADIO TEST SYSTEM (CRTS)

Wireless @ Virginia Tech

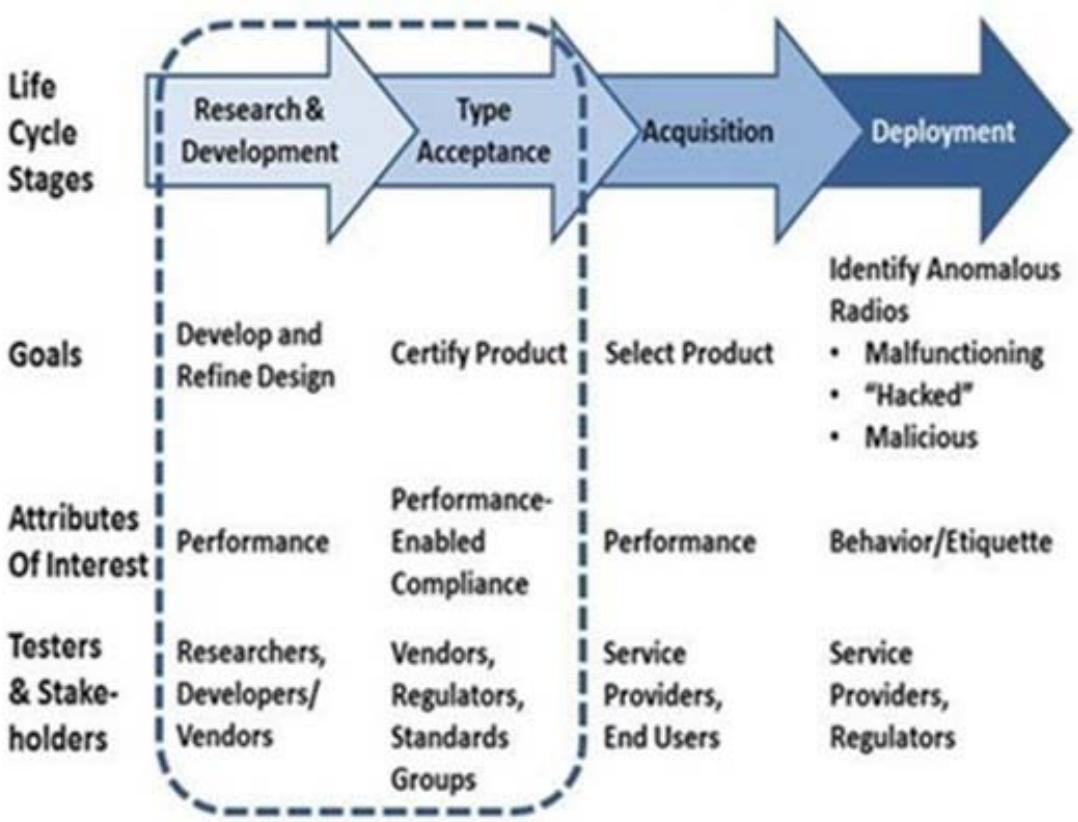
NORTH CAROLINA A&T STATE UNIVERSITY

Overview

- Motivation
- Hardware Architecture
- Software
- Sample Results
- Conclusion

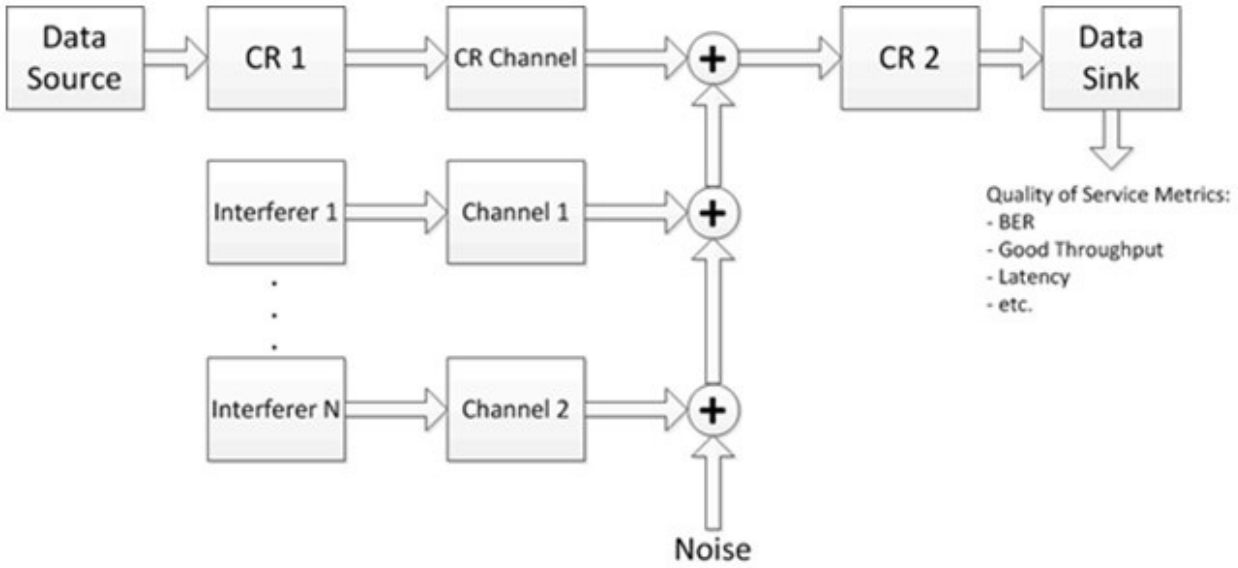
Motivation for Cognitive Radio Test System (CRTS)

- Cognitive radio test and evaluation (T&E)
  - Required throughout product life cycle
  - Needs to include a wide range of stressful environments

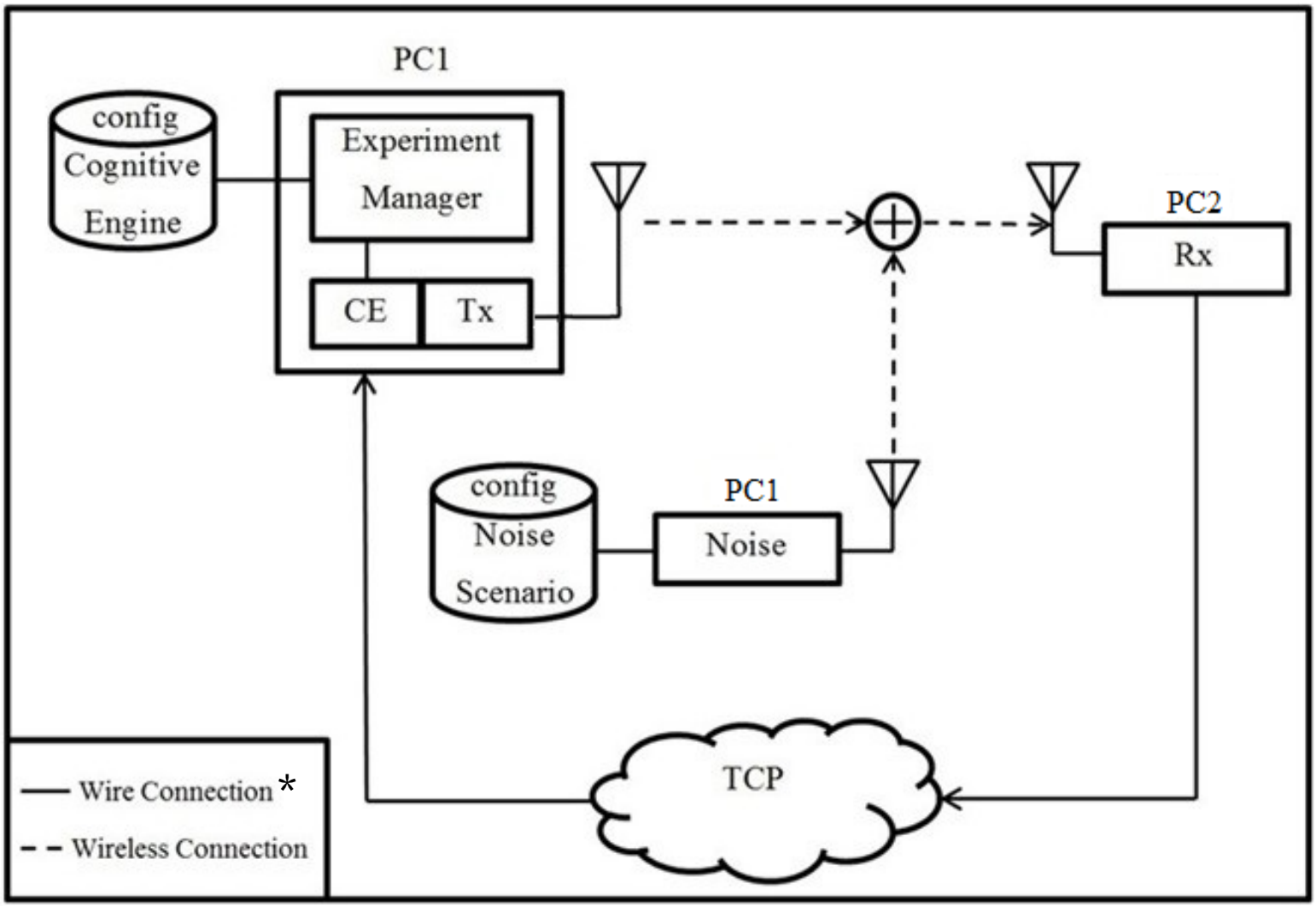


Motivation for Cognitive Radio Test System (CRTS)

- A flexible system is needed for T&E of
  - Cognitive radios (CRs)
  - Cognitive engines (CEs)
  - Efficient CR / CE T&E methodologies



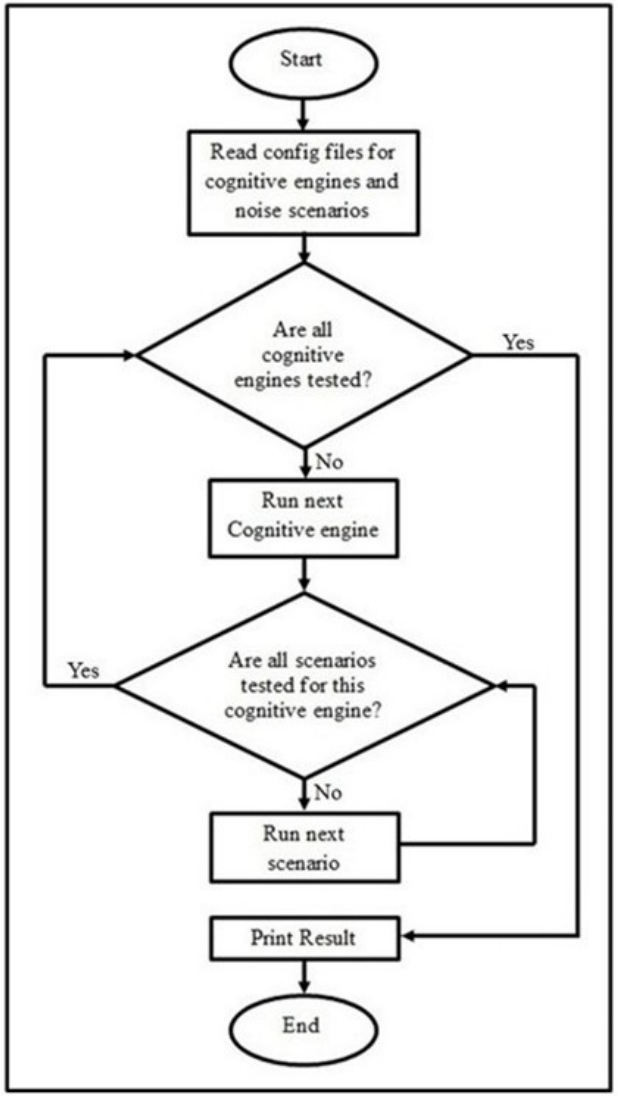
CRTS Hardware Architecture



*Control connections omitted for clarity

CRTS Software

- C++ implementation
- Liquid DSP library (OFDM)
- Configuration files allow testing of multiple CEs in multiple test scenarios



CE Configuration File

```
//config1.txt
// Basic Information:
filename = "Master Configuation File for Congnitive Engines";

// Parameters
params =
{
NumberofCogEngines = 1;
cogengine_1 = "config_cog_engine.txt";
};
```

- Lists all CEs to be tested

Scenario Configuration Files

- Master configuration file lists scenario files

```
//config1.txt
// Basic Information:
filename = "Master Configuation File for Scenarios";

// Parameters
params =
{
NumberofScenarios =2;
scenario_1 = "AWGN4.txt";
scenario_2 = "AWGN10.txt";
};
```

- Scenario files define noise and interference parameters

```
//AWGN1.txt
//Basic Information:
filename = "AWGN1";

//Parameters for White Gaussian Noise
params =
{
noiseSNR = 20.0;
};
```

Sample Results with simplistic CEs

- Two simple adaptive controllers ("CEs") tested with goal of sending 1000 error-free packets
- AWGN channels with SNR $\in$ {30, 20, 10, 5} dB
- CRs start at 128-PSK, CEs reduce modulation order by factor of 2 until…
  - CE1: previous packet received correctly
  - CE2: total packet-error rate < 50%

CE Performance Comparison

CE 1

Channel SNR (dB)	30	20	10	5
Final Modulation Scheme	16PSK	BPSK	BPSK	BPSK
Time elapsed (seconds)	0.9767	1.6236	1.6624	33.2141
Final Packet-Error-Rate	0.1996%	0.3984%	0.4975%	94.47%
Number of Packets Detected by Receiver	1002	1004	1005	18081

CE 2

Channel SNR (dB)	30	20	10	5
Final Modulation Scheme	16PSK	8PSK	BPSK	BPSK
Time elapsed (seconds)	1.0206	1.2004	1.9296	31.715
Final Packet-Error-Rate	0.2991%	0.3984%	0.5964%	94.50%
Number of Packets Detected by Receiver	1003	1004	1006	18188

Conclusions

- CRTS provides ability to test CRs / Ces
- A wide range of scenarios can be generated
- Parameterization of CEs and scenarios allows efficient testing and empirical determination of optimal CE parameters
- Future extensions include testing of full-duplex and networked CRs