# End-to-end Throughput Maximization for Underlay Multi-hop Cognitive Radio Networks with RF Energy Harvesting

# ABSTRACT


- This paper studies a green paradigm for the underlay coexistence of primary users (PUs) and secondary users (SUs) in energy harvesting cognitive radio networks (EH-CRNs), wherein battery-free SUs capture both the spectrum and the energy of PUs to enhance spectrum efficiency and green energy utilization.
- To lower the transmit powers of SUs, we employ multi-hop transmission with time division multiple access, by which SUs first harvest energy from the RF signals of PUs and then transmit data in the allocated time concurrently with PUs, all in the licensed spectrum. In this way, the available transmit energy of each SU mainly depends on the harvested energy before the turn to transmit, namely energy causality. Meanwhile, the transmit powers of SUs must be strictly controlled to protect Pus from harmful interference.

# CONT…

- Thus, subject to the energy causality constraint and the interference power constraint, we study the end-to-end throughput maximization problem for optimal time and power allocation.
- To solve this nonconvex problem, we first equivalently transform it into a convex optimization problem and then propose the joint optimal time and power allocation (JOTPA) algorithm that iteratively solves a series of feasibility problems until convergence. Extensive simulations evaluate the performance of EH-CRNs with JOTPA in three typical deployment scenarios and validate the superiority of JOTPA by making comparisons with two other resource allocation algorithms.

## EXISTING SYSTEM

- To exploit the spectrum and the energy of PUs, SUs in EH-CRNs can operate in three kinds of paradigms, namely, interweave, overlay and underlay.
- In interweave paradigms, SUs first harvest energy and then opportunistically access the licensed spectrum when PUs are detected as inactive.

# PROPOSED SYSTEM

- Thus, we first transform it into an equivalent yet convex optimization problem, and then propose the joint optimal time and power allocation (JOTPA) algorithm to solve it. The JOTPA algorithm decomposes the transformed problem into a series of feasibility problems, each with a given end-to-end throughput, and iteratively solves them by the dual decomposition method until the end-to-end throughput achieves the maximum.
- To evaluate the performance of the EH-CRN with JOTPA, we design three typical scenarios for the deployments of EH-CRN and compare JOTPA with two other resource allocation algorithms, namely optimal time and equal power allocation (OTEPA) and equal time and optimal power allocation (ETOPA).

# Hardware requirements

- Processor - Pentium-IV
- Speed - 1.1 Ghz
- RAM - 256MB(min)
- Hard Disk - 20 GB
- Key Board - Standard Windows Keyboard
- Mouse - Two or Three Button Mouse
- Monitor - SVGA

## SOFTWARE REQUIREMENTS

- Tool - Network Simulator-2
- Operating system - LINUX
- Front end - OTCL (Object Oriented Tool Command Language)

# REFERENCES

[1] X. Lu, P. Wang, D. Niyato, D. I. Kim, and Z. Han, “Wireless networks with RF energy harvesting: a contemporary survey,” IEEE Commun. Surv. Tuts., vol. 17, no. 2, pp. 757–789, Second Quarter 2015.

[2] S. Sudevalayam and P. Kulkarni, “Energy harvesting sensor nodes: survey and implications,” IEEE Commun. Surv. Tuts., vol. 13, no. 3, pp. 443–461, Third Quarter 2011.

[3] C. Zhong, X. Chen, Z. Zhang, and G. K. Karagiannidis, “Wirelesspowered communications: performance analysis and optimization,” IEEE Trans. Commun., vol. 63, no. 12, pp. 5178–5190, Dec. 2015.