

Ph.D. Dissertation Proposal Defense

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Venue: ECEC 202

Title: The Design and Optimization of Cooperative Mobile Edge

Abstract

The mobile and wireless systems have witnessed a massive penetration of wireless devices and an exponential growth in wireless applications. To achieve the expected service requirements with the available radio resources, everything is pushed to the mobile edge and green energy is introduced: hierarchical cloud resources are deployed in the field or connected to the heterogeneous base stations, switches and routers. The SDN controllers perform a set of functionalities, such as radio communications resources and storage resources management. The smart grid will distribute and deliver not only the brown energy generated by the traditional power plants, but also the green energy either produced by the big scale centralized energy harvesting farms or the distributed smaller energy harvesters.

The rapidly evolving mobile edge will be operated in the constantly changing and volatile environment. The harvested green energy will be highly dependent on the available energy sources, and the dense deployment of a variety of wireless access networks will result in intense radio resource contention. By leveraging the global view of a distributed network and flexibility provided by SDN/NFV, cooperatively managing the network resources can deliver the rapidly flourishing and diversifying wireless network services. This thesis addresses the cooperative network resource management at mobile edge: for data transmission, multiple network interfaces can cooperatively work together and deliver services to the same end device. The base stations can share each others' energy supplies via smart grid or radio frequency based energy transfer. The performances of the proposed schemes and algorithms have been validated through in-depth theoretical analysis and extensive simulations. Finally, directions for future research are delineated.

Committee Members:

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Journal Publications:

1. X. Huang, Tao Han, and N. Ansari, "Smart grid enabled mobile networks: jointly optimizing BS operation and power distribution," submitted to IEEE/ACM Transactions on Networking, 2nd minor revision under review.
2. X. Huang and N. Ansari, "Content caching and distribution in smart grid enabled wireless networks," IEEE Internet of Things Journal, doi: 10.1109/JIOT.2016.2577701, 2016.
3. X. Huang and N. Ansari, "Optimal cooperative power allocation for energy harvesting enabled relay networks," IEEE Transactions on Vehicle Technology, vol. 65, no. 4, pp. 2424-2434, April 2016.
4. X. Huang and N. Ansari, "Joint spectrum and power allocation for multi-node cooperative wireless systems," IEEE Transactions on Mobile Computing, vol.14, no.10, pp.2034-2044, Oct. 1 2015.
5. X. Huang and N. Ansari, "Energy sharing within EH-enabled wireless communication networks," IEEE Communications Magazine, vol. 22, no. 3, pp. 144-149, June 2015.
6. X. Huang, T. Han, and N. Ansari, "On green energy powered cognitive radio networks," IEEE Communications Surveys and Tutorials, vol.17, no. 2, pp. 827-842, 2nd Quarter, 2015.
7. Q. Cui, P. Kang, X. Huang, M. Valkama, and J. Niemela, "Optimal power allocation for homogeneous and heterogeneous CA-MIMO systems," Science China Information Sciences (Springer), vol. 56, no. 2, pp 1-14, Feb. 2013.
8. Q. Cui, B. Luo, X. Huang, A. Dowhuszko, and J. Jiang, "Closed form power allocation solution with minimization power consumption for coordinated transmission," EURASIP Journal on Wireless Communications and Networking (Springer), vol. 2012, no. 1, pp. 1-14, 2012.
9. Q. Cui, X. Huang, B. Luo, X. Tao, and J. Jiang, "Capacity analysis and optimal power allocation for coordinated transmission in MIMO-OFDM systems," Science China Information Sciences (Springer), vol. 55, no. 6, pp 1372-1387, June 2012.