{tag} {/tag}International Journal of Computer Applications
Foundation of Computer Science (FCS), NY, USA

Volume 155
-
Number 6

Year of Publication: 2016

Authors:

Sonia Fourati, Soumaya Hamouda, B. T. Maharaj

10.5120/ijca2016912328

{bibtex}2016912328.bib{/bibtex}

Abstract

Device-to-Device (D2D) technology underlying the cellular network is an attractive solution for future generation network to increase cellular traffic offloading. In order to reduce the interference caused to cellular network, D2D users can opportunistically access the cellular spectrum using cognitive radio capabilities. They can either avoid interference by transmitting on the spectrum wholes or merely control their power while transmitting simultaneously with the cellular users. In this paper, cognitive D2D users, referred to as Secondary Users (SUs), communicate at the same time as uplink cellular users. A new power control approach is proposed based on bargaining game theoretic solutions to better control SUs' transmit power and thus reduce the interference level at the cellular base station referred to as the Primary User (PU). First, the SUs utility functions are defined and take into account the achieved data rate, the power consumption and the impact of the interference. Then, the optimal power allocation is analyzed through the application of the Nash bargaining, Kalai-Smorodinsky and other bargaining solutions. A comparison between the performance of these solutions in terms of energy efficiency and fairness is derived. Simulation results show that a tradeoff between

fairness and energy efficiency should be taken into account. The performance of cooperative solutions is also compared with non-cooperative games both analytically and through simulations.

References

1. Li, H., Gai, Y., He, Z., Niu, K., and Wu, W., 2008, Optimal power control game algorithm for cognitive radio networks with multiple interference temperature limits," in Proceedings of IEEE Vehicular Technology Conference, pp. 1554-1558, May 2008.

2. IEEE, 2005, Standard 802.16e-2005. part16: Air interface for fixed and mobile broadband wireless access systems amendment for physical and medium access control layers for combined fixed and mobile operation in licensed band.

3. Magri H., Abghour N. and Ouzzi M. , 2016, Device to-Device (D2D) communications under LTE-Advanced networks, International Journal of Wireless & Mobile Networks (IJWMN) Vol. 8, No. 1, February 2016

4. Doppler, K., Rinne, M., Wijting, C., Ribeiro, C. and Hugl K., 2009, Device to-Device Communication as an Underlay to LTE-Advanced Networks, IEEE Communications Magazine, vol. 47, pp. 42-49, Dec. 2009.

5. Third Generation Partnership Project (3GPP), "Physical layer procedures (Release 10) for Evolved Universal Terrestrial Radio Access (EUTRA)," 3GPP TS 36.213 v 10.5.0, 2012.

6. Cheng, P., Deng, L., Yu, H., Xu, Y., Wang, H., 2012 , Resource Allocation for Cognitive Networks with D2D Communication: An Evolutionary Approach, 2012 IEEE Wireless Communications and Networking Conference: Mobile and Wireless Networks.

7. Alireza, A., Nakhai, M. R., and Hamid, A. A., 2009, "Cognitive radio game for secondary spectrum access problem," IEEE Trans. Wireless Commun., vol. 8, no. 4, pp. 2121–2131, Apr. 2009.

8. Rasti, M., Sharafat, A. R., and Seyfe, B., Pareto-efficient and goal-driven power control in wireless networks: A game-theoretic approach with a novel pricing scheme, IEEE/ACM Trans. Netw., vol. 17, no. 2, pp. 556– 569, Apr. 2009.

9. Song, L., Niyato, D., Han, Z., and Hossain, E., 2014, Game-theoretic Resource Allocation Methods for Device-to-Device (D2D) Communication. IEEE Wireless Communications, Volume: 21, Issue: 3, June 2014 .

10. Cheng P., Deng L., Yu H., Xu Y., Wang H., 2012, Resource Allocation for Cognitive Networks with D2D Communication: An Evolutionary Approach, IEEE Wireless Communications and Networking Conference: Mobile and Wireless Networks.

11. Gorni, Del Re E., Ronga, G., Suffritti, L. R., 2009, A power allocation strategy using Game Theory in Cognitive Radio networks, in Proceedings of the First ICST international conference on Game Theory for Networks, GameNets'09, pp. 117 - 123 , 13-15 May 2009.

12. Jing, Q. and Zheng, Z. , 2009 , Distributed Resource Allocation Based on Game Theory in Multi-cell OFDMA Systems, International Journal of wireless information networks, Volume 16, Numbers 1-2, 44-50. March 2009.

13. Guan, Z., Yuan, D., Zhang, H., and Ding, L., 2014, Cooperative bargaining solution for efficient and fair spectrum management in cognitive wireless networks, International Journal of Communication Systems, Volume 27, Issue 11, pages 3441–3459, November 2014

14. Ni, Q., Zarakovitis Charilaos, C., 2012,Nash Bargaining Game Theoretic Scheduling forJoint Channel and Power Allocation in Cognitive Radio Systems. IEEE Journal on selected

areas in communications, VOL. 30, NO. 1, January 2012

15. Yang, C., Li, J.D., and Tian, Z., 2010, “Optimal Power Control for Cognitive Radio Networks Under Coupled Interference Constraints: A Cooperative Game-Theoretic Perspective”, IEEE transactions on Vehicular Technology, VOL. 59, NO. 4, May 2010

16. Asadi, A., Wang, Q., and Mancuso, V., 2014, A Survey on Device-to-Device Communication in Cellular Networks," IEEE Communications Surveys & Tutorials, vol. 16, no. 4, pp. 1801-1819, Nov. 2014.

17. Wang, F., Song, L., Han, Z., Zhao, Q., and Wang X., 2013, Joint scheduling and resource allocation for device-to-device underlay communication, IEEE Wireless Communications and Networking Conference (WCNC), Shanghai, China, Apr. 2013

18. Wang, F., Xu, C., Zhao, Q., Wang, X., and Han, Z., 2013, Energy-aware resource allocation for device-to-device underlay communication,” IEEE International Conference on Communications (ICC), Budapest, Hungary, Jun., 2013.

19. Song, L., Niyato, D., Han, Z., and Hossain E., 2014, Game-theoretic Resource Allocation Methods for Device-to-Device (D2D) Communication, IEEE Wireless Communications Magazine, vol. 21, no. 3, pp. 136-144, Jun. 2014.

20. Yu, C.-H., Doppler, K., Ribeiro, C., and Tirkkonen, O., 2011, Resource sharing optimization for D2D communication underlaying cellular networks, IEEE Trans. Wireless Commmun., vol. 10, no. 8, pp. 2752–2763, Aug. 2011.

21. Hamouda, S., El-Bessi, S., Tabbane, S., 2014, New Coalition Formation Game for Spectrum Sharing in Cognitive Radio Networks, International Journal of Communication Systems, 2014.

22. Yaacoub, E., Dawy, Z., 2011, Achieving the Nash bargaining solution in OFDMA uplink using distributed scheduling with limited feedback , Elsevier 2011

23. Militano, L. ; Condoluci, M. ; Araniti, G. ; Iera, A., Bargaining Solutions for Multicast Subgroup Formation in LTE, Vehicular Technology Conference (VTC Fall), 2012 IEEE

Index Terms

Computer Science Communications

Keywords

Cognitive Device-to-device; power allocation; game theory; NBS; KSBS; energy efficiency; fairness