Dynamic Spectrum Access and Management in Cognitive Radio Networks

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Dynamic Spectrum Access And Management In Cognitive Radio Networks:

Spectrum Access and Management for Cognitive Radio Networks Mohammad A Matin,2016-09-16 This book presents cutting edge research contributions that address various aspects of network design optimization implementation and application of cognitive radio technologies It demonstrates how to make better utilization of the available spectrum cognitive radios and spectrum access to achieve effective spectrum sharing between licensed and unlicensed users The book provides academics and researchers essential information on current developments and future trends in cognitive radios for possible integration with the upcoming 5G networks In addition it includes a brief introduction to cognitive radio networks for newcomers to the field Dynamic Spectrum Access and Management in Cognitive Radio Networks Ekram Hossain,Dusit Niyato,Zhu Han,2009-06-18 An all inclusive introduction to this revolutionary technology presenting the key research issues and state of the art design analysis and optimization techniques *Cognitive Radio and Dynamic Spectrum Access* Lars Berlemann,Stefan Mangold,2009-07-10 Cognitive Radio for Dynamic Spectrum Access gives a comprehensive overview of the main concepts behind radio spectrum regulation dynamic spectrum access and cognitive radio Spectrum measurements are introduced to illustrate the inefficiencies in today s spectrum usage and the book also discusses enablers for horizontal and vertical spectrum sharing Among others a game theory based approach for spectrum sharing is described and evaluated Institution and standardisation approaches in academic research and industry are highlighted including IEEE SCC41 802 11k n s y and 802 22 which lead towards commercial exploitation of cognitive radio In conclusion this book looks at the initial steps towards the vision of true cognitive radio and the potential impact on telecommunication business Introduces the benefits and challenges of cognitive radio Presents cognitive radio in research and industry and covers implications for operators from the perspective of a telecom operator Examines how cognitive radio techniques will considerably change the wireless communication market *Radio Resource Allocation and Dynamic Spectrum Access* Badr Benmammar,Asma Amraoui,2013-02-05 We are currently witnessing an increase in telecommunications norms and standards given the recent advances in this field The increasing number of normalized standards paves the way for an increase in the range of services available for each consumer Moreover the majority of available radio frequencies have already been allocated This explains the emergence of cognitive radio CR the sharing of the spectrum between a primary user and a secondary user In this book we will present the state of the art of the different techniques for spectrum access using cooperation and competition to solve the problem of spectrum allocation and ensure better management of radio resources in a radio cognitive context The different aspects of research explored up until now on the applications of multi agent systems MAS in the field of cognitive radio are analyzed in this book The first chapter begins with an insight into wireless networks and mobiles with special focus on the IEEE 802 22 norm which is a norm dedicated to CR Chapter 2 goes into detail about CR which is a technical field at the boundary between telecommunications and Artificial Intelligence AI In Chapter 3 the

concept of the agent from AI is expanded to MAS and associated applications Finally Chapter 4 establishes an overview of the use of AI techniques in particular MAS for its allocation of radio resources and dynamic access to the spectrum in CR Contents 1 Wireless and Mobile Networks 2 Cognitive Radio 3 Multi agent Systems 4 Dynamic Spectrum Access About the Authors Badr Benmammar has been Associate Professor at UABT University Abou Bekr Belka d Tlemcen Algeria since 2010 and was a research fellow at CNRS LaBRI Laboratory of the University of Bordeaux 1 until 2007 He is currently carrying out research at the Laboratory of Telecommunications of Tlemcen LTT UABT Algeria His main research activities concern the cognitive radio network Quality of Service on mobile and wireless networks end to end signaling protocols and agent technology His work on Quality of Service has led to many publications in journals and conference proceedings Asma Amraoui is currently a PhD candidate she is preparing a doctoral thesis on a topic of research that explores the use of artificial intelligence techniques in cognitive radio networks She is attached to the Laboratory of Telecommunications of Tlemcen LTT in Algeria Dynamic Spectrum Management Ying-Chang Liang,2019-11-02 This open access book authored by a world leading researcher in this field describes fundamentals of dynamic spectrum management provides a systematic overview on the enabling technologies covering cognitive radio blockchain and artificial intelligence and offers valuable guidance for designing advanced wireless communications systems This book is intended for a broad range of readers including students and professionals in this field as well as radio spectrum policy makers *Contribution to Spectrum Management in Cognitive Radio Networks: a Cognitive Management Framework* Faouzi Bouali,2014 To overcome the current under utilization of spectrum resources the CR Cognitive Radio paradigm has gained an increasing interest to perform the so called Dynamic Spectrum Access DSA In this respect Cognitive Radio networks CRNs have been strengthened with cognitive management support to push forward their deployment and commercialization This dissertation has assessed the relevance of exploiting several cognitive management functionalities in various scenarios and case studies Specifically this dissertation has constructed a generic cognitive management framework based on the fittingness factor concept to support spectrum management in CRNs Under this framework the dissertation has addressed two of the most promising CR applications namely an Opportunistic Spectrum Access OSA to licensed bands and open sharing of license exempt bands In the former application several strategies that exploit temporal statistical dependence between primary activity inactivity durations to perform a proactive spectrum selection have been discussed A set of guidelines to select the most relevant strategy for a given environment have been provided In the latter application a fittingness factor based spectrum selection strategy has been proposed to efficiency exploit the different bands Several formulations of the fittingness factor have been compared and their relevance have been assessed under different settings Drawing inspiration from these applications a more general proactive strategy exploiting a characterization of spectrum resources at both the time and frequency domains has been developed to jointly assist spectrum selection SS and spectrum mobility SM functionalities Several variants of the

proposed strategy each combining different choices and options of implementation have been compared to identify which of its components have the most significant impact on performance depending on the working conditions of the CRN To assess rationality of the proposed strategy with respect to other strategies a cost benefit analysis has been conducted to confront the introduced gain in terms of user satisfaction level to the incurred cost in terms of signaling amount Finally the dissertation has conducted an analysis of practicality aspects in terms of robustness to environment uncertainty and applicability to realistic environments With respect to the former aspect robustness has been assessed in front of two sources of uncertainty namely imperfection of the acquisition process and non stationarity of the environment and additional functionalities have been developed when needed to improve robustness With respect to the latter the proposed framework has been applied to a Digital Home DH environment to validate the obtained key findings under realistic conditions

Dynamic Spectrum Access for Wireless Networks Danda B. Rawat,Min Song,Sachin Shetty,2015-03-09 This SpringerBrief presents adaptive resource allocation schemes for secondary users for dynamic spectrum access DSA in cognitive radio networks CRNs by considering Quality of Service requirements admission control power rate control interference constraints and the impact of spectrum sensing or primary user interruptions It presents the challenges motivations and applications of the different schemes The authors discuss cloud assisted geolocation aware adaptive resource allocation in CRNs by outsourcing computationally intensive processing to the cloud Game theoretic approaches are presented to solve resource allocation problems in CRNs Numerical results are presented to evaluate the performance of the proposed methods Adaptive Resource Allocation in Cognitive Radio Networks is designed for professionals and researchers working in the area of wireless networks Advanced level students in electrical engineering and computer science especially those focused on wireless networks will find this information helpful Dynamic Spectrum Access (DSA) in Wireless Cognitive Radio Networks (WCRN). Mary Adebola Ajiboye,2013 Dynamic Spectrum Access DSA is a technology that senses the unused free but allocated portion of the radio frequency spectrum on a non interfering basis These unused bands are also known as holes or white spaces DSA also refers to the time varying flexible usage of parts of the radio spectrum under consideration of regulatory and technical restrictions This type of spectrum access is due to the dynamic behavior that the Secondary User SU must employ in order to access the spectrum while avoiding interfering with a Primary User PU Intelligent or Cognitive Radio CR is a platform on which the DSA can be implemented CRs are radio systems that autonomously coordinate the usage of spectrum They utilize radio spectrum when it is not being used by incumbent primary radio systems Underutilized spectrum can be exploited with the concepts of DSA and CR This paper reviews the techniques that can be deployed for DSA reliably in a Wireless Cognitive Radio Network WCRN and models of network architecture based DSA in Cognitive Radio Networks CRN **Dynamic Spectrum Management** Ying-Chang Liang,2020-09-18 This open access book authored by a world leading researcher in this field describes fundamentals of dynamic spectrum

management provides a systematic overview on the enabling technologies covering cognitive radio blockchain and artificial intelligence and offers valuable guidance for designing advanced wireless communications systems This book is intended for a broad range of readers including students and professionals in this field as well as radio spectrum policy makers

Handbook of Research on Software-Defined and Cognitive Radio Technologies for Dynamic Spectrum Management Kaabouch, Naima,Hu, Wen-Chen,2014-10-31 The inadequate use of wireless spectrum resources has recently motivated researchers and practitioners to look for new ways to improve resource efficiency As a result new cognitive radio technologies have been proposed as an effective solution The Handbook of Research on Software Defined and Cognitive Radio Technologies for Dynamic Spectrum Management examines the emerging technologies being used to overcome radio spectrum scarcity Providing timely and comprehensive coverage on topics pertaining to channel estimation spectrum sensing communication security frequency hopping and smart antennas this research work is essential for use by educators industrialists and graduate students as well as academicians researching in the field **Cognitive Radio Network with Artificial Intelligence** Dr. Jayant P. Pawar,Dr. Prashant V. Ingole,2024-11-09 Emerging cognitive radio technology has been identified as a high impact disruptive technology innovation that could provide solutions to the radio traffic jam problem and provide a path to scaling wireless systems for the next 25 years Topics like Cognitive Radio Spectrum Sensing Dynamic Spectrum Access and Wireless Regional Area Network WRAN are very recent in electronic and telecommunication engineering Also statistical models Morkov Chain and Hidden Markov Model give more advantages to the reader Artificial Intelligence AI significantly enhances Cognitive Radio Networks CRNs by providing advanced capabilities for dynamic spectrum management interference mitigation network optimization and security **Efficient Spectrum Use in Cognitive Radio Networks Using Dynamic Spectrum Management** Tapiwa Moses Chiwewe,2016 Radiofrequency spectrum is a finite resource that consists of the frequencies in the range 3 kHz to 300 GHz It is used for wireless communication and supports several applications and services Whether it is at the personal community or society level and whether it is for applications in consumer electronics building management smart utility networks intelligent driving systems the Internet of Things industrial automation and so on the demand for wireless communication is increasing continuously Together with this increase in demand there is an increase in the quality of service requirements in terms of throughput and the reliability and availability of wireless services Industrial wireless sensor networks for example operate in environments that are usually harsh and time varying The frequency spectrum that is utilised by industrial wireless protocols such as WirelessHART and ISA 100 11a is also used by many other wireless technologies and with wireless applications growing rapidly it is possible that multiple heterogeneous wireless systems will need to operate in overlapping spatiotemporal regions in the future Increased radiofrequency interference affects connectivity and reduces communication link quality This affects reliability and latency negatively both of which are core quality service requirements Getting multiple heterogeneous radio systems to co

exist harmoniously in shared spectrum is challenging Traditionally this has been achieved by granting network operators exclusive rights that allow them to access parts of the spectrum assigned to them and hence the problems of co existence and limited spectrum could be ignored Design time multi access techniques have also been used At present however it has become necessary to use spectrum more efficiently to facilitate the further growth of wireless communication This can be achieved in a number of ways Firstly the policy that governs the regulation of radiofrequency spectrum must be updated to accommodate flexible dynamic spectrum access Secondly new techniques for multiple access and spectrum sharing should be devised A revolutionary new communication paradigm is required and one such paradigm has recently emerged in the form of Cognitive Radio technology Traditional methods to sharing spectrum assume that radios in a wireless network work together in an unchanging environment Cognitive radios on the other hand can sense learn and adapt In cognitive radio networks the interactions between users are taken into account in order for adjustments to be made to suit the prevailing radio environment In this thesis the problem of spectrum scarcity and coexistence is addressed using cognitive radio techniques to ensure more efficient use of radio frequency spectrum An introduction to cognitive radio networks is given covering cognitive radio fundamentals spectrum sensing dynamic spectrum management game theoretic approaches to spectrum sharing and security in cognitive radio networks A focus is placed on wireless industrial networks as a challenging test case for cognitive radio A study on spectrum management policy is conducted together with an investigation into the current state of radio frequency spectrum utilisation to uncover real and artificial cases of spectrum scarcity A novel cognitive radio protocol is developed together with an open source test bed for it Finally a game theoretic dynamic spectrum access algorithm is developed that can provide scalable fast convergence spectrum sharing in cognitive radio networks This work is a humble contribution to the advancement of wireless communication *Dynamic Spectrum Access for Multi-group Cognitive Radio Networks* Qiang Zhu,2008 **Resource Management in Future Internet** Vladimir Poulkov,Ramjee Prasad,2022-09-01 Future Internet and Internet of Things set out a new vision for connectivity real time applications and services Data procured from the use of a large number of heterogeneous physical and virtual devices must be real time processed and analyzed for the goal of effective resource management and control while maintaining the required performance and quality of service In addition the development of the communication networks towards heterogeneous and new generation broadband connectivity brings up new requirements towards the way of managing and controlling of the available resources Thus for the effective resource management in future internet novel approaches must be proposed and developed It could be seen that recently a considerable amount of effort has been devoted on behalf of industry and academia towards the research and design of methods for effective management of resources in internet and multimedia communications The book reviews some specific topics in the field of future internet and internet technologies that are closely related to the issue of finding effective solutions for the management of resources and performance Technical topics

discussed in the book include Future Internet Technologies Internet of things Multimedia Networks Wireless Access Networks Software Communications Positioning and Localization in Communications Resource Management Resource Management in future Internet is recommended for specialists working in the field of information and communication industries as well as academic staff and researchers working in the field of multimedia communications and telecommunication networks *Cognitive Wireless Communication Networks* Ekram Hossain,Vijay K. Bhargava,2007-10-23 A Brief Journey through Cognitive Wireless Communication Networks Ekram Hossain University of Manitoba Winnipeg Canada Vijay Bhargava University of British Columbia Vancouver Canada Introduction Cognitive radio has emerged as a promising technology for maximizing the utili tion of the limited radio bandwidth while accommodating the increasing amount of services and applications in wireless networks A cognitive radio CR transceiver is able to adapt to the dynamic radio environment and the network parameters to maximize the utilization of the limited radio resources while providing exibility in wireless access The key features of a CR transceiver are awareness of the radio en ronment in terms of spectrum usage power spectral density of transmitted received signals wireless protocol signaling and intelligence This intelligence is achieved through learning for adaptive tuning of system parameters such as transmit power carrier frequency and modulation strategy at the physical layer and higher layer protocol parameters Development of cognitive radio technology has to deal with technical and pr tical considerations which are highly multidisciplinary as well as regulatory quirements There is an increasing interest on this technology among the researchers in both academia and industry and the spectrum policy makers The key enabling techniques for cognitive radio networks also referred to as dynamic spectrum cess networks are wideband signal processing techniques for digital radio advanced wireless communications methods arti cial intelligence and machine learning te niques and cognitive radio aware adaptive wireless mobile networking protocols **A New Framework for Dynamic Spectrum Access in Cognitive Radio Networks** Mohammad Iqbal Bin Shahid,2010 The radio frequency RF spectrum is a limited and precious resource The continuing deployment of a diverse range of new wireless services into an already crowded RF spectrum requires a new way to accommodate these services This increasing demand for the spectrum is in contrast with the inefficient use of the RF spectrum in some licensed bands which high ights an opportunity for accessing the RF spectrum with cognitive radio CR networks In CR networks a secondary user group the unlicensed users is allowed to opportunistically access temporarily unused licensed bands of the primary users licensed users i e the spectrum holes Accessing the spectrum band in such a manner poses many research challenges including finding the band vacancies protecting the primary system from interference allocating vacant bands among the secondary users and sharing the spectrum bands among multiple CR networks To address these issues this dissertation proposes a new dynamic spectrum access framework for CR networks including methods for the spectrum sensing agile spectrum evacuation spectrum allocation and spectrum sharing For spectrum sensing a weighted combining scheme is introduced that

intelligently assigns weights to the energy measurements of a number of CRs and then combines these values to decide if the primary user is currently using a band This scheme exhibits a better detection accuracy and spectrum utilization The agile spectrum evacuation scheme allows uninterrupted use of a licensed band by a CR until the primary transmitter returns when the CR quickly evacuates This is a major innovation because until now a CR must interchange sensing and transmitting in a licensed band creating a trade off between spectrum utilization and unavoidable interference caused to the primary user To allow the fair and fast allocation of available bands among CRs a collaborative framework for allocating multiple bands simultaneously among multiple CRs is proposed This framework exhibits a significant superiority over conventional approaches in terms of an improved throughput and spectrum utilization and reduced interference loss and collisions Finally a scheme to facilitate spectrum sharing among multiple CR networks is created by utilizing various game theoretic approaches for different configurations of band access For each game the Nash Equilibrium is defined and attained in most cases Collaboration among the CR networks is also investigated through repeated games and it is shown that a cooperative method results in a much better sharing of the RF spectrum Comprehensive performance analyses including mathematical formulations and experimental evaluations are provided with the proposed dynamic spectrum access framework exhibiting a superior performance over existing techniques **Cognitive Radio Networks** Yan Zhang,Jun Zheng,Hsiao-Hwa Chen,2016-04-19 While still in the early stages of research and development cognitive radio is a highly promising communications paradigm with the ability to effectively address the spectrum insufficiency problem Written by those pioneering the field Cognitive Radio Networks Architectures Protocols and Standards offers a complete view of cognitive radio incl **Dynamic Spectrum Scheduling and Management in Centralized Cognitive Radio Networks** Omar Khalid Sweileh,2017 As the demand for wireless radio spectrum increases spectrum regulatory authorities expect to face a spectrum scarcity problem Dynamic Spectrum Access DSA was recently proposed to enable efficient utilization of the radio spectrum Cognitive Radio CR s are used to help in the realization of efficient DSA techniques An integral component in Cognitive Radio Network CRN and in DSA in general is scheduling which has to do with the Secondary User SU s ability to decide on the available spectrum that best meets its Quality of Service QoS requirements Switching delay which is defined as the time needed by a SU to hop among available channels is a major factor that affects the performance of CRNs This study is motivated by the fact that the literature is in need for efficient schedulers that can maximize the CRN s throughput while maintaining a minimum spectrum switching delay for the SUs Specifically two scheduling techniques are introduced with the aim of minimizing the switching delay and hence maximizing the amount of transmitted information over the underlying CRN The first scheduler is an opportunistic spectrum and switching delay aware scheduler with the objective of maximizing the total number of transmitted packets over the span of multiple time slots From the simulation results the opportunistic scheduler in highly dynamic channels was able to transmit up to 20% more packets compared to the benchmark scheduling

algorithm where the scheduling problem is done every time slot Moreover the scheduler was able to reduce the effect of both switching and scheduling delays On the other hand the second proposed scheduler maximizes spectrum exploitation by allowing unscheduled SUs to utilize any idle spectrum during the switching delay From the results the proposed scheduler allowed for 38% more SUs to be scheduled in an overpopulated CRN Moreover by utilizing the switching delay the proposed scheduler was able to deliver around 4 5% more packets compared to the benchmark algorithm without sacrificing any complexity In conclusion both of the implemented schedulers delivered a higher amount of transmitted packets compared to the benchmark scheduling algorithms and both schedulers were able to reduce the effect of switching delay Abstract

Learning-based Adaptive Design for Dynamic Spectrum Access in Cognitive Radio Networks Marjan Zandi,2014

Resource Management in Mobile Computing Environments Constandinos X. Mavromoustakis,Evangelos Pallis,George Mastorakis,2014-06-09 This book reports the latest advances on the design and development of mobile computing systems describing their applications in the context of modeling analysis and efficient resource management It explores the challenges on mobile computing and resource management paradigms including research efforts and approaches recently carried out in response to them to address future open ended issues The book includes 26 rigorously refereed chapters written by leading international researchers providing the readers with technical and scientific information about various aspects of mobile computing from basic concepts to advanced findings reporting the state of the art on resource management in such environments It is mainly intended as a reference guide for researchers and practitioners involved in the design development and applications of mobile computing systems seeking solutions to related issues It also represents a useful textbook for advanced undergraduate and graduate courses addressing special topics such as mobile and ad hoc wireless networks peer to peer systems for mobile computing novel resource management techniques in cognitive radio networks and power management in mobile computing systems

Reviewing **Dynamic Spectrum Access And Management In Cognitive Radio Networks**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Dynamic Spectrum Access And Management In Cognitive Radio Networks**," an enthralling opus penned by a very acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve in to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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Dynamic Spectrum Access And Management In Cognitive Radio Networks Introduction

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