

1. Record Nr.	UNINA9910139784103321
Autore	Berlemann Lars
Titolo	Cognitive radio and dynamic spectrum access // Lars Berlemann and Stefan Mangold
Pubbl/distr/stampa	Hoboken, New Jersey : , : J. Wiley & Sons, , 2009 [Piscataway, New Jersey] : , : IEEE Xplore, , [2009]
ISBN	1-282-68377-2 9786612683770 0-470-75442-7 0-470-75443-5
Descrizione fisica	1 online resource (266 p.)
Altri autori (Persone)	MangoldStefan
Disciplina	621.384
Soggetti	Cognitive radio networks Radio frequency allocation Software radio
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	List of Figures -- List of Tables -- About The Authors -- Foreword -- Acknowledgement -- Preface -- Abbreviations -- 1. INTRODUCTION -- 1.1 Access to radio spectrum -- 1.2 Artificial spectrum scarcity from unexploited frequencies -- 1.3 Cognitive radio and dynamic spectrum access as solution -- 1.4 This book 28 -- 2. RADIO SPECTRUM TODAY - REGULATION AND SPECTRUM USAGE -- 2.1 History and terminology -- 2.1.1 The four basic approaches for radio spectrum regulation -- 2.1.2 Guiding principles -- 2.2 Institutions that regulate radio spectrum -- 2.2.1 International Telecommunication Union, ITU -- 2.2.2 Europe -- 2.2.3 Germany -- 2.2.4 United Kingdom -- 2.2.5 Japan -- 2.2.6 P.R. China -- 2.2.7 United States of America -- 2.3 Licensed and unlicensed spectrum -- 2.3.1 The disadvantages of spectrum licensing -- 2.3.2 Unlicensed spectrum as alternative -- 2.3.3 Tragedy of commons in unlicensed spectrum -- 2.3.4 Spectrum measurements -- 3. RADIO SPECTRUM TOMORROW ? DYNAMIC SPECTRUM ACCESS & SPECTRUM SHARING -- 3.1 Spectrum sharing and dynamic spectrum access: concepts and terminology -- 3.1.1 Spectrum trading and

spectrum liberalization -- 3.1.2 Underlay and overlay spectrum sharing -- 3.1.3 Vertical and horizontal spectrum sharing -- 3.1.4 Coexistence, coordination and cooperation -- 3.2 Horizontal spectrum sharing -- 3.2.1 Coexistence -- 3.2.2 Centralized spectrum coordination for horizontal sharing -- 3.2.3 Spectrum sharing games -- 3.3 Vertical spectrum sharing -- 3.3.1 Re-use of TV bands for vertical spectrum sharing -- 3.3.2 Spectrum pooling and a common control for vertical spectrum sharing -- 3.3.3 Operator-assistance in vertical spectrum sharing -- 3.3.4 Spectrum load smoothing for vertical spectrum sharing -- 3.4 Taxonomy for spectrum sharing -- 4. TOWARDS COGNITIVE RADIO - RESEARCH AND STANDARDIZATION -- 4.1 Research programs and projects -- 4.1.1 DARPA Next Generation Communications Program, XG -- 4.1.2 National Science Foundation's project GENI -- 4.1.3 European project E3. 4.1.4 European project WINNER+ -- 4.1.5 European project WIP -- 4.1.6 European project SOCRATES -- 4.1.7 European project ROCKET -- 4.1.8 European project ORACLE -- 4.2 IEEE coordination, and the Coexistence Advisory Group IEEE 802.19 -- 4.3 IEEE SCC41/P1900 -- 4.3.1 IEEE P1900.1 -- 4.3.2 IEEE P1900.2 -- 4.3.3 IEEE P1900.3 -- 4.3.4 IEEE P1900.4 -- 4.3.5 IEEE P1900.5 -- 4.4 Wi-Fi Wireless Local Area Networks IEEE 802.11 -- 4.4.1 IEEE 802.11k for radio resource measurements -- 4.4.2 IEEE 802.11n for high throughput -- 4.4.3 IEEE 802.11s for mesh networks -- 4.4.4 IEEE 802.11y for high power Wi-Fi -- 4.5 WiMAX Wireless Metropolitan Area Networks IEEE 802.16 -- 4.5.1 IEEE 802.16.2 Coexistence -- 4.5.2 IEEE 802.16h license exempt -- 4.5.3 IEEE 802.22 for wireless rural area networks -- 4.6 Other standardization activities -- 4.6.1 White Spaces Coalition & Wireless Innovation Alliance -- 4.6.2 The New America Foundation and open spectrum -- 4.6.3 SDR Forum -- 4.6.4 Third Generation Partnership Project 3GPP -- 4.6.5 European Telecommunications Standards Institute ETSI -- 4.6.6 Academic research conferences and workshops -- 5. PROPOSED ENABLERS FOR REALIZING HORIZONTAL SPECTRUM SHARING -- 5.1 IEEE 802.11 in unlicensed spectrum -- 5.1.1 Overview -- 5.1.2 Physical layer -- 5.1.3 Medium access control -- 5.1.4 Learning from 802.11 -- 5.2 IEEE 802.16 in unlicensed spectrum -- 5.2.1 Coexistence scenario -- 5.2.2 Protecting the beginning of 802.16 MAC frame -- 5.2.3 Protecting the 802.16 UL subframe -- 5.2.4 Shifting the contention slots -- 5.2.5 Quality-of-service, efficiency, and fairness -- 5.3 Policies in spectrum usage -- 5.3.1 Policy framework -- 5.3.2 Spectrum navigation -- 5.3.3 Reasoning based spectrum navigation -- 5.4 Policy language -- 5.5 Spectrum sharing games -- 5.5.1 Related work -- 5.5.2 802.11e coexistence scenario -- 5.5.3 Game overview -- 5.5.4 Single stage game for frame based interaction -- 5.5.5 Quality-of-service as utility -- 5.5.6 Analytic game model -- 5.5.7 Behavior. 5.5.8 Equilibrium analysis -- 5.5.9 Multi stage game model -- 5.5.10 Discounting of future payoffs -- 5.5.11 Strategies -- 5.5.12 Nash equilibrium in multi stage games -- 5.5.13 QoS evaluation of strategies -- 5.5.14 Game approach as policy -- 5.5.15 Learning from spectrum sharing games -- 6. PROPOSED ENABLERS FOR REALIZING VERTICAL SPECTRUM SHARING -- 6.1 Frequency division duplex for Wi-Fi: FDD WLANs -- 6.2 Operator assisted cognitive radio with beaconing -- 6.2.1 Existing standard beaconing concepts -- 6.2.2 What is a beacon? -- 6.2.3 Improved signaling mechanism with dual beacons -- 6.2.4 Beacon implementation in IEEE 802.11 -- 6.2.5 Evaluation -- 6.2.6 Dual beaconing for the reuse of TV bands as policy -- 6.3 Spectrum load smoothing -- 6.3.1 Related work -- 6.3.2 Enabling cognitive radios -- 6.3.3 Spectrum load smoothing in the time domain -- 6.3.4

Initial simulations and convergence experiments -- 6.3.5 Modeling spectrum load smoothing in spectrum sharing scenarios -- 6.3.6 QoS support in IEEE 802.11e coexistence scenarios -- 6.3.7 SLS with reservations - approach to the re-use of TV-bands -- 6.3.8 SLS without reservations - opportunistic spectrum usage scenario -- 6.3.9 Evaluation of QoS capabilities -- 6.3.10 Spectrum load smoothing as policy -- 6.3.11 Learning from spectrum load smoothing approach -- 7. OUR VISION ? THE TRUE COGNITIVE RADIO -- 7.1 Mitola's cognition circle and related cognitive radio definitions -- 7.2 Cognitive radios can gain from delay-tolerant software radio -- 7.3 DARPA XG provides implementation guidelines, including the access protocol -- 7.3.1 Traceable decision making -- 7.3.2 Machine-understandable radio semantics -- 7.4 Spectrum etiquette may stimulate cognitive behavior -- 7.4.1 What is spectrum etiquette? -- 7.4.2 Value orientation -- 7.5 Network operators may assist dynamic spectrum access -- 7.6 Business opportunities -- 8 CONCLUDING REMARKS -- A. APPENDIX "JEMULA802" -- B. APPENDIX "YOUSHI" -- B.1 Modeling QoS requirements and demands. B.2 Resource allocation and collisions -- B.3 Graphical user interface -- References -- Index.

---

## Sommario/riassunto

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.

---