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NeXt generation/dynamic spectrum access/cognitive radio wireless networks: A survey

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Abstract

Today's wireless networks are characterized by a fixed spectrum assignment policy. However, a large portion of the assigned spectrum is used sporadically and geographical variations in the utilization of assigned spectrum ranges from 15% to 85% with a high variance in time. The limited available spectrum and the inefficiency in the spectrum usage necessitate a new communication paradigm to exploit the existing wireless spectrum opportunistically. This new networking paradigm is referred to as NeXt Generation (xG) Networks as well as Dynamic Spectrum Access (DSA) and cognitive radio networks. The term xG networks is used throughout the paper. The novel functionalities and current research challenges of the xG networks are explained in detail. More specifically, a brief overview of the cognitive radio technology is provided and the xG network architecture is introduced. Moreover, the xG network functions such as

spectrum management, spectrum mobility and spectrum sharing are explained in detail. The influence of these functions on the performance of the upper layer protocols such as routing and transport are investigated and open research issues in these areas are also outlined. Finally, the cross-layer design challenges in xG networks are discussed.



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Keywords

Next generation networks; Dynamic spectrum access networks; Cognitive radio networks; Spectrum sensing; Spectrum management; Spectrum mobility; Spectrum sharing

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He received the "Don Federico Santa Maria Medal" for his services to the Universidad of Federico Santa Maria, in 1986. From 1989 to 1998, he served as a National Lecturer for ACM and received the ACM Outstanding Distinguished Lecturer Award in 1994. He received the 1997 IEEE Leonard G. Abraham Prize Award (IEEE Communications Society) for his paper entitled "Multimedia Group Synchronization Protocols for Integrated Services Architectures" published in the IEEE Journal of Selected Areas in Communications (JSAC) in January 1996. He received the 2002 IEEE Harry M. Goode Memorial Award (IEEE Computer Society) with the citation "for significant and pioneering contributions to advanced architectures and protocols for wireless and satellite networking". He received the 2003 IEEE Best Tutorial Award (IEEE Communication Society) for his paper entitled "A Survey on Sensor Networks," published in IEEE Communications Magazine, in August 2002. He also received the 2003 ACM Sigmobile Outstanding Contribution Award with the citation "for pioneering contributions in the area of mobility and resource management for wireless communication networks". He received the 2004 Georgia Tech Faculty Research Author Award for his "outstanding record of publications of papers between 1999 and 2003". He also received the 2005 Distinguished Faculty Achievement Award from School of ECE, Georgia Tech. He has been a Fellow of the Association for Computing Machinery (ACM) since 1996.



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