

Achieving Simultaneous Spectrum Utilization and Revenue Improvements in Practical Wireless Spectrum Auctions

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Abstract— Spectrum auctions have been considered a promising approach to improve the efficiency of spectrum use. Spectrum reusability is also one of the important properties in spectrum auctions. To handle spectrum reusability, a buyer grouping procedure has been applied in many existing spectrum auction schemes. It is important to note that almost none of the proposed buyer grouping algorithms in the existing works has been specifically designed for spectrum allocation problem. However, buyer grouping in a practical spectrum auction mechanism has its own challenges such as heterogeneity and truthfulness. In this paper, first we illustrate the challenges of buyer grouping in a practical spectrum auction mechanism. Then we propose the novel algorithms for spectrum buyer grouping to solve these challenges. By extensive simulations, we show that our proposed algorithms can not only solve the challenges caused by radio spectrum properties but also provide good performance on various auction metrics.

Index Terms— Buyer Grouping, Heterogeneity, Spectrum Auction, Spectrum Reuse, Truthfulness

I. INTRODUCTION

Recently, radio spectrum is becoming more and more scarce due to the rapid growth of wireless technologies, applications and services. On the other hand, spectrum occupancy measurements in various countries have indicated that a significant amount of the licensed spectrum remains unused in many places much of the time [1, 2], so the traditional exclusive licensing spectrum policy leads to the low efficiency of spectrum utilization. The spectrum scarcity has increasingly led administrations to more efficiently manage spectrum through various mechanisms. Spectrum auctions are one of the best-known market-based solutions to improve the efficiency of spectrum use. In this solution, spectrum owners are allowed to lease their spectrums to secondary service providers. In return, the spectrum owners can get paid from secondary service providers. Spectrum auctions are fundamentally different from conventional auctions because of the spectrum's unique property of reusability. Unlike traditional goods, the spectrum can be spatially reused concurrently [3].