Preface

There have been increasing interest and significant progress in the domain of emerging vehicular communication networks, or simply, VehiculAr NETworks (VANETs). VANETs target the incorporation of wireless communications and informatics technologies into the road transportation system, and thereby facilitate a myriad of attractive applications related to safety (e.g., collision detection and lane changing warning), driving assistance (e.g., online navigation and smart parking), infotainment (e.g., mobile office and music store), and traffic efficiency and management (e.g., real-time traffic notification and electronic tickets). With rapidly evolving concepts of building applications, not only can VANETs make the transportation system safer and more efficient but also revolutionize the in-vehicle experience of passengers.

In this monograph, we focus on the network capacity analysis of VANETs. The problem is of great importance since fundamental guidance on design and deployment of VANETs is very limited. Moreover, unique characteristics of VANETs impose distinguished challenges on such investigations. In Chap. 1, we first give an overview of VANETs and the study of capacity scaling laws. In Chap. 2, we provide a comprehensive survey on the capacity scaling laws in wireless networks. Then, in Chap. 3, we study the unicast capacity considering the socialized mobility model of VANETs. With vehicles communicating based on a two-hop relaying scheme, the unicast capacity bound is derived and can be applied to predict the network throughput in real-world scenarios. In Chap. 4, we investigate the downlink capacity of VANETs in which wireless access infrastructure is deployed to provide pervasive Internet access to vehicles. Different alternatives of wireless access infrastructure are considered. A lower bound of downlink capacity is derived for each type of access infrastructure. We also present a case study based on a perfect city grid to examine the capacity-cost trade-offs of different deployments since the deployment costs of different access infrastructure are highly variable. Finally, we draw conclusions and highlight future research directions in Chap. 5. The implications from this monograph provide valuable guidance on the design and deployment of future VANETs.

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