

Preface

Wireless penetration has witnessed explosive growth over the last two decades. Accordingly, wireless devices have become much denser per unit area, resulting in an overcrowded usage of wireless resources. To avoid radio interferences and packet collisions, wireless stations have to exchange control messages to coordinate well. The existing wisdoms of conveying control messages could be classified into three categories: explicit, implicit, or hybrid. However, all these methods consume valuable communication resources, for example, control frames and data packets are transmitted in an alternate manner, either in time domain or in frequency domain, which introduces massive coordination overheads. Therefore, providing cost-effective coordination mechanisms becomes a critical problem in wireless design.

In this book, we present a novel PHY layer technique termed Attachment Transmission, which provides an extra control panel to deliver control messages with minimum overhead. In a traditional transmission paradigm, control messages compete for communication resources with data packets. On the contrary, attachment transmission enables control messages to be transmitted along with data packets, without degrading the effective throughput of the original data packets. In addition to the basic design, this book presents the design challenges, the theoretical model, and demonstrates the implementation on a GNU radio testbed. Extensive experiments demonstrate that attachment transmission is capable of exploiting and utilizing channel redundancy to deliver control messages, thus providing significant support to numerous higher layer applications.

To demonstrate the effectiveness of the attachment transmission, we apply it to a number of classic problems in wireless networks, including the multichannel allocation problem in OFDMA-based networks, the hidden and exposed terminal problems in ad hoc networks, and the multiple access problem in wireless local area networks (WLANs). For the multichannel allocation problem, attachment transmission provides cost-effective identifier signals. These identifiers help mobile stations learn the channel allocation strategy by themselves, and thus achieve cooperation without coordination. For hidden and exposed terminal problems, attachment transmission offers accurate Channel Usage Information (CUI) on who

is transmitting or receiving nearby. Therefore, wireless stations can identify hidden and exposed nodes in real time, and thus make the right channel access decisions. For the multiple access problem, wireless clients deliver transmission requests to the access point (AP) through attachments. Since the requests are “attached” on high speed data transmission, control messages will not occupy any resources, such as the communication channel or the transmission air time. In this way we can achieve lightweight control in WLANs. Besides the above scenarios, we believe that attachment transmission can be further exploited and benefit more communication systems.

Kowloon, Hong Kong SAR
Kowloon, Hong Kong SAR
Kowloon, Hong Kong SAR
July 2013

Lu Wang
Kaishun Wu
Mounir Hamdi

Attachment Transmission in Wireless Networks

Wang, L.; Wu, K.; Hamdi, M.

2014, XII, 63 p. 36 illus., Softcover

ISBN: 978-3-319-04908-3