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Seminar

Secure Medium Access Control Protocols for Wireless Availability

Sang-Yoon Chang
PhD candidate, ECE Department
University of Illinois at Urbana-Champaign

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@ ADSC conference room

Abstract: Since wireless RF systems inherently share a communication medium in air, multiple users within the transmission range often utilize Medium Access Control (MAC)-layer protocols to support simultaneous transmissions. The reservation-based MAC approach sends control packets that broadcast the channel use prior to data communication; the channel reservation announcement in control communication helps other nodes to stay away from the occupied channels and avoid collisions. However, MAC protocols operate on the underlying assumption that the participating users are collaborative; when collaborative users coexist with protocol-deviating users, the Nash equilibrium strategy is to disable MAC protocol with all users transmitting fully wideband and at all time.

In this talk, I investigate the vulnerabilities of reservation-based MAC protocols and propose countermeasures for mitigating the impact of failures. To ensure robustness in all scenarios, I model the failure with the worst-case scenario of having a malicious adversary that compromised the network and thus has the insider information. First, I introduce SimpleMAC, which is consisted of Simple Signaling Scheme (SSS) and Simple Transmitter Strategy (STS). SimpleMAC counters two smart, power-efficient jamming attacks: SSS mitigates MAC-aware jamming attack on control communication (where the vulnerability comes from using a common, or known, control channel), and STS prevents MAC-facilitated jamming attack on data communication (where adversary uses the information being exchanged in control communication to focus their jamming on data channels that are being used). Then, I discuss the Ignore-False-Reservation MAC (IFR-MAC) that nullifies the proactive attack of Denial-of-Service injection of false reservation control messages. Both SimpleMAC and IFR-MAC quickly outperform the Nash equilibrium of disabling MAC and converges to the capacity-optimal performance in worst-case failures.

About the speaker: Sang-Yoon Chang is a Ph.D. candidate in the Electrical and Computer Engineering (ECE) department at University of Illinois at Urbana-Champaign (UIUC). He received his M.S. degree and Bachelor of Engineering degree from UIUC in 2009 and in 2007, respectively. Sang-Yoon's research interest lies on designing secure and robust protocols for wireless and mobile network and bridging theoretical protocol designs with real-life applications such as health-related or other cyber system infrastructure. He also received Vodafone scholarship in year 2006-2007.