

RESEARCH SEMINAR

Side Channel Analysis: A New Perspective for Vehicle Intrusion Detection System



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Abstract

Intelligent connected vehicles (ICVs) have become the mainstream in the development of automobile industry. Many emerging technologies have been proposed to provide users with comfortable and convenient driving experience. Note that some of the communication interfaces are vulnerable and can be easily attacked. Although many malicious attacks can be carried out in various ways, their final step must be in the in-vehicle network, i.e., the controller area network (CAN) bus. In order to protect the security of CAN bus, it is of great importance to design an intrusion detection system (IDS) which can monitor the message transmission in real time. There are various defense mechanisms that have been proposed, but they cannot meet the high security requirements of safety-critical ECUs against in-vehicle network attacks. In this talk, we propose three vehicle IDS solutions from the perspective of side channel analysis, based on the unique voltage characteristics of each ECU, the clock skew of each ECU, and the correlation among data frames in CAN bus. They neither occupy the bandwidth and computing resources of CAN bus, nor need to modify the original CAN protocol. They can not only accurately detect malicious attacks, but also identify the attack source with high precision, thus realizing timely discovery and isolation of vehicle attacks.

About the Speaker

Prof. Jiajia Liu is a full professor (Vice Dean) with the School of Cybersecurity, Northwestern Polytechnical University. He is the director of Shaanxi Provincial Engineering Laboratory of Cyber Security since 2021, and the director of Xi'an Unmanned System Security and Intelligent Communications ISTC Center since 2020. He has published more than 200 peer-reviewed papers in many high quality publications, including prestigious IEEE journals and conferences. He received IEEE ComSoc Best YP (Young Professional) Award in Academia in 2020, IEEE VTS Early Career Award in 2019, the Best Paper Awards from many international conferences including IEEE flagship events, such as IEEE GLOBECOM in 2016, 2019 and 2023, IEEE ICC in 2023, IEEE WCNC in 2012 and 2014, IEEE WiMob in 2019, IEEE IC-NIDC in 2018, AICON in 2019. He was also a recipient of the Tohoku University President Award 2013. His research interests cover a wide range of areas including intelligent and connected vehicles, mobile/edge/cloud computing and storage, Internet of things security, wireless and mobile ad hoc networks, and space-air-ground integrated networks. He has been actively joining the society activities, like serving as associate editors for IEEE Transactions on Wireless Communications (May 2018-Oct. 2023), IEEE Transactions on Communications (Sep. 2020-present). He is the Chair of IEEE IOT-AHSN TC, and is a Distinguished Lecturer of IEEE Communications Society and Vehicular Technology Society.