Electrical & Computer Engineering

S E M I N A R

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Robust Covert Wireless Communications

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Abstract—Security research has largely focused on employing cryptographic or information-theoretic methods to protect the content of the message from being decoded by an eavesdropper, but there are important applications where even the detection of a communication signal's presence by an adversary is undesirable. Over the last 10 years, there has been significant research on the fundamental limits of undetectable communications, which has been termed "covert communications" in the contemporary literature. Early results established the difficulty of the problem: for discrete-time additive white Gaussian noise (AWGN) channels between all parties, a transmitter Alice can reliably and covertly transmit $O(\sqrt{n})$ bits in n channel uses (and no more) to an intended recipient Bob without detection by an attentive and capable adversary Willie. A major line of subsequent research demonstrated that, given uncertainty at Willie about the state of the channel when Alice is not transmitting, Alice can reliably and covertly transmit $O(n)$ bits in n channel uses to Bob without detection, hence implying that there are situations under which positive rate covert communications is possible. This uncertainty might arise because of natural limitations of Willie's receiver or from active transmissions in the environment.

Nearly all work on covert communications has been performed on standard discrete-time models, with the implicit understanding that the results should be applicable to the true continuous-time system. Whereas this is true for many of the results, particularly those that result in a throughput of $O(\sqrt{n})$ bits in n channel uses, this is not necessarily true for major works that have established positive rate covert communications; rather, the continuous-time channel must be considered directly in many cases. We will demonstrate in this talk how approaches developed for discrete-time models might not be covert when employed on the true continuous-time channel. We will then demonstrate an approach by which positive rate covert communications can be established in such a situation. Further, by digging even deeper into the physical layer, we will discuss challenges to even this solution. Finally, we will talk about important ongoing challenges to the deployment of covert communications and ideas for future research.

Bio—Dennis Goeckel received his BS from Purdue University in 1992, and his MS and PhD from the University of Michigan in 1993 and 1996, respectively. Since 1996, he has been with the ECE Department at the University of Massachusetts at Amherst, where he is currently a Professor. Prof. Goeckel has been a Lilly Teaching Fellow (2000-2001) and received the University of Massachusetts Distinguished Teaching Award in 2007. His work with collaborators on covert communications received Honorable Mention in the NSA Best Scientific Cybersecurity Paper Competition in 2016. He received the NSF CAREER Award in 1999 and is an IEEE Fellow.

When: **Thursday, 27 April 2023, 10:00 - 11:00**
Where: **Room 3285 Patrick F. Taylor Hall**
Info: `https://www.lsu.edu/eng/ece/seminar`
Food: ***Refreshments will be served.***