Invited Speaker, November 19: Dr. Bruno Sinopoli

On the Security of Cyber-Physical Systems

Cyber Physical Systems (CPS) refer to the embedding of widespread sensing, computation, communication, and control into physical spaces. Application areas are as diverse as aerospace, chemical processes, civil infrastructure, energy, manufacturing and transportation, most of which are safety-critical. The availability of cheap communication technologies such as the Internet makes such infrastructures susceptible to cyber security threats, which may affect national security as some of them, such as the power grid, are vital to the normal operation of our society. Any successful attack may significantly hamper the economy, the environment or may even lead to loss of human life. As a result, security is of primary importance to guarantee safe operation of CPS.

In an offensive perspective, attacks of this sort can be carried out to disrupt the functionality of the enemy's critical infrastructures without destroying it or even being directly identified. Stuxnet, the malware at the root of the destruction of centrifuges employed to enrich uranium in Iran's nuclear facilities, is a clear example of how strategically important it is to gain a deep understanding of CPS security. In this talk, I will provide an introduction to CPS security, give an overview of recent results from our research group as well as directions for future work.

Biography: Dr. Bruno Sinopoli

Dr. Bruno Sinopoli received the DEng degree from the University of Padova in 1998 and his MS and PhD in Electrical Engineering from the University of California at Berkeley, in 2003 and 2005 respectively. After a postdoctoral position at Stanford University, Dr. Sinopoli joined the faculty at Carnegie Mellon University where he is an associate professor in the Department of Electrical and Computer Engineering with courtesy appointments in Mechanical Engineering and in the Robotics Institute and co-director of the Smart Infrastructure Institute, a research center aimed at advancing innovation in the modeling analysis and design of smart infrastructure. Dr. Sinopoli was awarded the 2006 Eli Jury Award for outstanding research achievement in the areas of systems, communications, control and signal processing at U.C. Berkeley, the 2010 George Tallman Ladd Research Award from Carnegie Mellon University and the NSF Career award in 2010.

Advances in very large-scale integration and micro-electromechanical system technology have boosted the development of micro sensor integrated systems. Such systems combine computing, storage, radio technology, and energy source on a single chip. When distributed over a wide area, networks of these embedded devices can perform a variety of tasks that range from environmental monitoring and military surveillance, to navigation and control of a moving vehicle.

A common feature of these systems is the presence of significant communication delays and data loss across the network. From the point of view of control theory, significant delay is equivalent to loss, as data needs to arrive to its destination in time to be used for control. In short, communication and control become tightly coupled such that the two issues cannot be addressed independently. Bruno Sinopoli's research interest focuses on the analysis and design of networked embedded control systems, with applications to sensor actuators networks.