ABSTRACT: Network Control Systems (NCSs) are spatially distributed systems in which the communication between sensors, actuators and controllers occurs through a shared band-limited digital communication network. The use of a multi-purpose shared network to connect spatially distributed elements results in flexible architectures and generally reduces installation and maintenance costs. Consequently, NCSs have been finding application in a broad range of areas such as the automotive and aerospace industries, mobile sensor networks, remote surgery, automated highway systems, and unmanned aerial vehicles. The interest in NCSs has been steadily rising due to several factors: * Low-cost, low-power, small embedded processors are widely available, which permits endowing sensors and actuators with local processing and sophisticated network protocols. * Low-power, high-bandwidth digital communication is widely available to interconnect a large number of sensors, actuators, and controller nodes. Inexpensive computation and ubiquitous embedded sensing, actuation, and communication provide tremendous opportunities for societal impact, but also great challenges in the design of networked control systems, because the traditional unity feedback loop that operates in continuous time or at a fixed sampling rate is not adequate when sensor data arrives from multiple sources, asynchronously, delayed, and possibly corrupted. In this talk we review some of the challenges involved in closing feedback loops over communication networks. Our focus will be on issues related to variable sampling, delays, drops, and medium access control/scheduling. A key point that we would like to make is that networked control applications can profit significantly from the development of communication protocols specific for these systems.

BIOGRAPHY: João P. Hespanha received the Ph.D. degree in electrical engineering and applied science from Yale University, New Haven, Connecticut in 1998. From 1999 to 2001, he was Assistant Professor at the University of Southern California, Los Angeles. He moved to the University of California, Santa Barbara in 2002, where he currently holds a Professor position with the Department of Electrical and Computer Engineering. Prof. Hespanha is Associate Director for the Center for Control, Dynamical-systems, and Computation (CCDC), Vice-Chair of the Department of Electrical and Computer Engineering, and a member of the Executive Committee for the Institute for Collaborative Biotechnologies (ICB). His current research interests include hybrid and switched systems; the modeling and control of communication networks; distributed control over communication networks (also known as networked control systems); the use of vision in feedback control; and stochastic modeling in biology. Dr. Hespanha is the recipient of the Yale University’s Henry Prentiss Becton Graduate Prize for exceptional achievement in research in Engineering and Applied Science, a National Science Foundation CAREER Award, the 2005 best paper award at the 2nd Int. Conf. on Intelligent Sensing and Information Processing, the 2005 Automatica Theory/Methodology best paper prize, the 2006 George S. Axelby Outstanding Paper Award, and the 2009 Ruberti Young Researcher Prize. Dr. Hespanha is a Fellow of the IEEE and an IEEE distinguished lecturer since 2007.