Adaptation is the appealing property of a system to adjust its behavior to accommodate slow changes in its operating environment, thereby yielding close-to-optimal performance in the face of a capricious world. The concept is familiar from Biology but also is present in many humanly engineered systems. It represents a goal of intelligence and learning in systems making them capable of responding appropriately to unforeseen changes in their operating realms. The prospect of adaptation and unstructured learning remains largely unfulfilled in challenging areas such as Field Robotics. In this presentation a number of engineered systems of more modest but robust application, from the internet, telecommunications, and building energy control, will be examined for what they tell us about the apparent inefficiencies of these adaptive systems in practice. The focus will be on gaining an appreciation for the minimal feasible cost to achieve adaptation, where this cost is measured in exactly the same terms as the performance objective being optimized, say energy consumption in mobile telephony. Connections between this cost the requisite rate of adaptation will be teased out. The restriction of the analysis to engineered systems at the expense of biological ones is the result of two facets: the (in)expertise of the presenter, and the property that engineered systems involve human motive, design, and selection, i.e. a sighted watchmaker.

Bob Bitmead holds the Cymer Corporation Chair in the Department of Mechanical & Aerospace Engineering at the University of California, San Diego. Originally he hails from Sydney, Australia, and was Professor of Systems Engineering at the Australian National University before moving to UCSD in 1999. He is a researcher in Control Systems, Signal Processing, and Telecommunications and has long combined a professional interest in Mathematical Systems Theory with a passion for its application for high-performance modeling, estimation and control in a variety of industrial settings from the steel and sugar industries, transportation systems, aerospace, and wireless communications. He likes to describe Management as *his imaginary axis* and has performed in a number of such roles including as Associate Vice-Chancellor for Academic Personnel at UCSD, Executive Director of an incorporated research center in Australia, and in the governance of professional societies. He is a Fellow of: the Australian Academy of Technological Sciences and Engineering, the Institute of Electrical & Electronics Engineers, and the International Federation of Automatic Control. He is also an accredited Australian Rules Football umpire, in which role he performs in the US, and he brews his own beer.