Internet congestion control using the power metric: Keep the pipe just full, but no fuller

Professor Leonard Kleinrock

Abstract

We identify a system operating point that maximizes a universal performance metric called Power for an arbitrary function. This optimization is proven mathematically and graphically. We then apply this metric to congestion control in networks which allows us to extract exact and surprising results that support the insight that one should “Keep the pipe just full, but no fuller”. In the process, we introduce a very general plot that we call the Universal Power Profile which has broad application.

Short bio

Professor Leonard Kleinrock is Distinguished Professor of Computer Science at UCLA. He is considered a father of the Internet, having developed the mathematical theory of packet networks, the technology underpinning the Internet as an MIT graduate student in 1962. His UCLA Host computer became the first node of the Internet in September 1969 from which he directed the transmission of the first Internet message. Kleinrock received the 2007 National Medal of Science, the highest honor for achievement in science bestowed by the President of the United States.

Leonard Kleinrock received his Ph.D. from MIT in 1963. He has served as Professor of Computer Science at UCLA since then, and was department Chairman from 1991-1995. He received a BEE degree from CCNY in 1957 (Evening Session) and an MS degree from MIT in 1959. He has received eight honorary degrees, has published over 250 papers, authored six books, and has supervised the research for 50 Ph.D. students.

Dr. Kleinrock is a member of the National Academy of Engineering, the American Academy of Arts and Sciences, is an IEEE fellow, an ACM fellow, an INFORMS fellow, an IEC fellow, an inaugural member of the Internet Hall of Fame, a Guggenheim fellow, an Eminent member of Eta Kappa Nu, and a founding member of the Computer Science and Telecommunications Board of the National Research Council. Among his many honors, he is the recipient of the National Medal of Science, the Ericsson Prize, the NAE Draper Prize, the Marconi Prize, the Dan David Prize, the Okawa Prize, the 2015 BBVA Frontiers of Knowledge Award, the IEEE Internet Millennium Award, the ORSA Lanchester Prize, the ACM SIGCOMM Award, the NEC Computer and Communications Award, the BBVA Foundation Frontiers of Knowledge Award, the Sigma Xi Monie A. Ferst Award, the CCNY Townsend Harris Medal, the CCNY Electrical Engineering Award, the UCLA Outstanding Faculty Member Award, the UCLA Distinguished Teaching Award,
the INFORMS President’s Award, the ICC Prize Paper Award, the IEEE Leonard G. Abraham Prize Paper Award, the IEEE Alexander Graham Bell Medal, the SIGMOBILE 2014 Outstanding Contributions Award, the SIGMOBILE Inaugural Test of Time Award, CCNY President’s Leadership Award, and the IEEE Harry M. Goode Award. His home page may be found at https://www.lk.cs.ucla.edu/index.html