Millimeter Waves, Millisecond Delays

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ABSTRACT

Two simultaneous revolutionary changes are occurring in networking: the advent of mmWave networks and the advent of applications that require end-to-end delays of the order of a few milliseconds. mmWave is the first physical layer technology that promises huge wireless bandwidth, but with very poor reliability as a result of its vulnerability to blockage (optical fiber offers high reliability and high bandwidth; sub-6Ghz microwave networks offer lower bandwidth but graceful bandwidth degradation that can be mitigated). The emergence of the need for ultra-low delays for haptic communications and control loops in self-driving cars and other sensor based applications, has radically changed the requirements for layers above the physical layer. These two changes transform standard networking problems, and will lead to a new wave of research. Examples will be used to illustrate this paradigm shift.

CCS Concepts/ACM Classifiers

- Wireless access points, base stations and infrastructure; network performance analysis; cross-layer protocols

Author Keywords

mmWave; ultra-low latency; ultra-reliable; URLLC; 5G; 60Ghz; WiFi; blockage; transport layer protocols; TCP

BIOGRAPHY

Shivendra S. Panwar is a Professor of Electrical and Computer Engineering Department at Tandon School of Engineering of New York University. He received the B.Tech. degree in electrical engineering from the Indian Institute of Technology Kanpur, in 1981, and the M.S. and Ph.D. degrees in electrical and computer engineering from the University of Massachusetts, Amherst, in 1983 and 1986, respectively. He joined the Department of Electrical Engineering at the Polytechnic Institute of New York, Brooklyn (now Tandon School of Engineering of New York University), where he served as department chair. He is currently the Director of the New York State Center for Advanced Technology in Telecommunications (CATT), a member of NYU WIRELESS, and the Faculty Director of the NY City Media Lab. He spent the summer of 1987 as a Visiting Scientist at the IBM T.J. Watson Research Center, and has been a consultant to Bell Laboratories. His research interests include the performance analysis and design of networks. Current work includes wireless networks and multimedia transport over networks. He co-authored *TCP/IP Essentials: A Lab based Approach*, published by the Cambridge University Press. He was co-awarded the IEEE Communication Society's Leonard G. Abraham Prize in the Field of Communication Systems for 2004. He was a co-author of the IEEE Multimedia Communications Best Paper Award for 2011. He is also a co-winner of a Best Paper Award from IEEE ICC 2016. He is an IEEE Fellow.

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