NANONETWORKS: A NEW FRONTIER IN COMMUNICATIONS

Abstract

Nanotechnology is enabling the development of devices in a scale ranging from one to a few one hundred nanometers. Nanonetworks, i.e., the interconnection of nano-scale devices, are expected to expand the capabilities of single nano-machines by allowing them to cooperate and share information. Traditional communication technologies are not directly suitable for nanonetworks mainly due to the size and power consumption of existing transmitters, receivers and additional processing components. All these define a new communication paradigm that demands novel solutions such as nano-transceivers, channel models for the nano-scale, and protocols and architectures for nanonetworks. In this talk, first the state-of-the-art in nano-machines, including architectural aspects, expected features of future nano-machines, and current developments are presented for a better understanding of the nanonetwork scenarios. Moreover, nanonetworks features and components are explained and compared with traditional communication networks. Novel nano-antennas based on nano-materials as well as the terahertz band are investigated for electromagnetic communication in nanonetworks. Furthermore, molecular communication mechanisms are presented for short-range networking based on ion signaling and molecular motors, for medium-range networking based on flagellated bacteria and nanorods, as well as for long-range networking based on pheromones and capillaries. Finally, open research challenges such as the development of network components, molecular communication theory, and new architectures and protocols, which need to be solved in order to pave the way for the development and deployment of nanonetworks within the next couple of decades are presented.

Biography

IAN F. AKYILDIZ received his BS, MS, and PhD degrees in Computer Engineering from the University of Erlangen-Nuernberg, Germany, in 1978, 1981 and 1984, respectively. Currently, he is the Ken Byers Distinguished Chair Professor with the School of Electrical and Computer Engineering, Georgia Institute of Technology, Director of Broadband Wireless Networking Laboratory, Chair of the Telecommunication Group at Georgia Tech. Dr. Akyildiz is an Honorary Professor with the School of Electrical Engineering at the Universitat Politecnica de Catalunya, and Director of N3Cat (NaNoNetworking Center in Catalunya) in Barcelona, Spain, since June 2008. He is also an Honorary Professor with University of Pretoria, South Africa since March 2009 and a Visiting Professor with King Saud University in Saudi Arabia since January 2010. He is the Editor-in-Chief of Computer Networks (Elsevier) Journal, the founding Editor-in-Chief of the Ad Hoc Networks Journal (Elsevier) launched in 2003, of the Physical Communication (PHYCOM) Journal (Elsevier) launched in 2008 and of the Nano Communication Networks (NanoComnet) Journal (Elsevier) in launched 2010. Dr. Akyildiz serves on the advisory boards of several research centers, journals, conferences and publication companies.. Dr. Akyildiz is an IEEE FELLOW (1996) and an ACM FELLOW (1997). He received numerous awards from IEEE and ACM. His current research interests are in Cognitive Radio Networks, Wireless Sensor Networks, Wireless Mesh Networks, and Nanonetworks.