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6G and Beyond: The Future of Wireless Communications Systems

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Abstract

6G and beyond will fulfill the requirements of a fully connected world and provide ubiquitous wireless connectivity for all. Transformative solutions are expected to drive the surge for accommodating a rapidly growing number of intelligent devices and services. Major technological breakthroughs to achieve connectivity goals within 6G include: (i) a network operating at the THz band with much wider spectrum resources, (ii) intelligent communication environments that enable a wireless propagation environment with active signal transmission and reception, (iii) pervasive artificial intelligence, (iv) large-scale network automation, (v) an all-spectrum reconfigurable front-end for dynamic spectrum access, (vi) ambient backscatter communications for energy savings, (vii) the Internet of Space Things enabled by CubeSats and UAVs, and (viii) cell-free massive MIMO communication networks. In this talk, use cases for these enabling techniques as well as recent advancements on related topics are highlighted, and open problems with possible solutions are discussed, followed by a development timeline outlining the worldwide efforts in the realization of 6G. Going beyond 6G, promising early-stage technologies such as the Internet of NanoThings, the Internet of BioNanoThings, and quantum communications, which are expected to have a far-reaching impact on wireless communications, have also been discussed at length in this paper.

The talk is based on the paper:

I. F. Akyildiz, A. Kak, and S. Nie, "6G and Beyond: The Future of Wireless Communications Systems," IEEE Access, vol. 8, pp. 133995-134030, July 2020.

Biography of Prof. Dr. İlhan Fuat Akyıldız

Ian F. Akyildiz received his BS, MS, and PhD degrees in Electrical and Computer Engineering from the University of Erlangen-Nürnberg, Germany, in 1978, 1981 and 1984, respectively. Currently, he is the **Megagrant Leader with the Institute for Information Transmission Problems at the Russian Academy of Sciences, in Moscow, Russia, since May 2018**. He serves on the **Advisory Board for the newly established research center called Technology Innovation Institute (TII) in Abu Dhabi, United Arab Emirates since June 1, 2020**. He is the **President of the Truva Inc. since March 1989 and CTO for the newly established company Airanaculus since April 2020**. He is a **Visiting Distinguished Professor with the SSN College of Engineering in Chennai, India since October 2019**. Prof. Akyildiz is an **Adjunct Professor with the Department of Electrical and Computer Engineering at the University of Iceland since September 1, 2020**. He was the **Ken Byers Chair Professor in Telecommunications at the Georgia Institute of Technology**, and the Director of the Broadband Wireless Networking Laboratory and Chair of the Telecom Group from 1985-2020 (retired). He was also Finnish Distinguished Professor with the University of Tampere, Finland, supported by the Finnish Academy of Sciences from 2012-2016. He was the founder of NanoNetworking Center and Honorary Professor at the University of Politecnica de Cataluna in Barcelona from 2008-2017. Dr. Akyildiz was a Distinguished Professor and Founder of the Advanced Wireless Networks Lab with the King Abdulaziz University in Jeddah, Saudi Arabia from 2011-2018. He was also the Founder of the Advanced Wireless Sensor Networks lab and ExtraOrdinary Professor with the University of Pretoria, Pretoria South Africa from 2007-2012.

He is the Founder and Editor in Chief of the newly established ITU J-FET (International Telecommunication Union Journal for Future and Evolving Technologies since July 2020). Dr. Akyildiz is Editor-in-Chief Emeritus of **Computer Networks Journal (Elsevier)** (1999-2019), the founding Editor-in-Chief Emeritus of the Ad Hoc Networks Journal (Elsevier) (2003-2019), the founding Editor-in-Chief Emeritus of the **Physical Communication (PHYCOM) Journal (Elsevier)** (2008-2017), and the founding Editor-in-Chief Emeritus of the **Nano Communication Networks (NANOCOMNET) Journal (Elsevier)** (2010-2017). Dr. Akyildiz launched many IEEE and ACM conferences. He is an IEEE Fellow and ACM Fellow and received numerous awards from IEEE and ACM and other professional organizations. His current research interests are in **6G Wireless Systems, Reconfigurable Intelligent Surfaces, Terahertz Communications, Nanonetworks, Internet of NanoThings, Internet of BioNanothings, Internet of xThings (x=Underwater, Underground, Space/CubeSats)**. According to Google Scholar as of July 2020, his H-index is 125 and the total number of citations to his papers is 119+K. His rank in terms of h-index in the world is 46 and in the USA 32.

