

## Directions

IRCICA's amphitheatre is at:

Parc scientifique de la Haute-Borne

40, avenue Halley

59650 Villeneuve d'Ascq - France

GPS coordinates:

latitude: 50.6057704 - longitude: 3.1501158

Tel.: +33 (0)3 59 57 78 00

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It can be reached by:

- **car**

1. *From Paris via the A1/E15 motorway:*

Go past Lille, following the signs for Villeneuve d'Ascq/Roubaix/Gand/Bruxelles (A22/E17). Take exit 2 (Roubaix/Villeneuve d'Ascq N227). At the traffic lights, turn right into Rue du Président Paul Doumer. At the first roundabout, turn right. The IRCICA building is the first building on your right.

2. *From Tournai via the N7:*

Follow the signs to Lille/Lamain. Follow the signs to Paris/Lille on the E42. Drive into Villeneuve d'Ascq and take the right-hand exit at the roundabout towards Rue Nicolas Appert (D146). Continue straight on into Rue du Président Paul Doumer. At the first roundabout, turn right. The IRCICA building is the first building on your right.

3. *From Gand via the A22/E17:*

Head towards Tourcoing Centre/Lille/Paris. Drive past Roubaix and follow the signs for Paris/Villeneuve d'Ascq/Valenciennes. Follow the main road until you reach the exit marked "Cité scientifique". At the roundabout, turn right and keep going until you reach the traffic lights. Turn right into Rue du Président Paul Doumer. At the first roundabout, turn right. The IRCICA building is the first building on your right.

- **metro**

Take line 1 towards "4 cantons". Get off at the "4 cantons" terminus. The centre is a five-minute walk from the station. Take Rue Paul Langevin, near the guarded cycle park (a sign will point you towards the park). After the Club House, cut through the car park on the right. Once you get to the roundabout, you will see the IRCICA building on your right.



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## Nanonetworks: A New Frontier in Communications

**IAN F. AKYILDIZ**



**July 26, 2012**

**10:30**

**Amphitheatre IRCICA**

**Broadband Wireless Networking Lab**

School of Electrical and Computer Engineering

Georgia Institute of Technology

Atlanta, GA 30332, USA

<http://www.ece.gatech.edu/research/labs/bwn/>

**N3Cat (NaNoNetworking Center in Catalunya)**

School of Electrical Engineering

Universitat Politècnica de Catalunya

Barcelona, Catalunya, Spain

<http://www.n3cat.upc.edu/>

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## Overview

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. First the state-of-the-art in nano-machines, including architectural aspects, expected features of future nano-machines, and current developments will be presented for a better understanding of 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.

## Bio

I. 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 the Broadband Wireless Networking Laboratory and Chair of the Telecommunications Group at Georgia Tech. Dr. Akyildiz is an Honorary Professor with 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 Extraordinary Professor with Department of Electrical, Electronic and Computer Engineering at the University of Pretoria, South Africa since March 2009 and Director of Advanced Sensor Networks (ASN) lab.

He is the Editor-in-Chief of Computer Networks (Elsevier) Journal since 2000, the founding Editor-in-Chief of the Ad Hoc Networks Journal (Elsevier) in 2003, the founding Editor-in-Chief of the Physical Communication (PHYCOM) Journal (Elsevier) in 2008, and the founding Editor-in-Chief of the Nano Communication Networks (NANOCOMNET) Journal (Elsevier) in 2010.

Dr. Akyildiz is an IEEE FELLOW (1996) and an ACM FELLOW (1997). Dr. Akyildiz received the 1997 IEEE Leonard G. Abraham Prize award (IEEE Communications Society) for his paper entitled "Multimedia Group Synchronization Protocols for Integrated Services Architectures" published in the IEEE Journal of Selected Areas in Communications (JSAC) in January 1996. Dr. Akyildiz received the 2003 Best Tutorial Paper Award (IEEE Communications Society) for "A Survey on Sensor Networks" published in the IEEE Communications Magazine, August 2002. Dr. Akyildiz received the Best Paper Award for "Interferer Classification, Channel Selection and Transmission Adaptation for Wireless Sensor Networks" in the Ad Hoc and Sensor Networks (AHSN) symposium at IEEE ICC, June 2009.

He received the "Don Federico Santa Maria Medal" for his services to the Universidad of Federico Santa Maria in Chile in 1986. He served as a National Lecturer for ACM from 1989 until 1998 and received the ACM Outstanding Distinguished Lecturer Award for 1994. Dr. Akyildiz received the 2002 IEEE Harry M. Goode Memorial award (IEEE Computer Society) with the citation "for significant and pioneering contributions to advanced architectures and protocols for wireless and satellite networking". He also received the 2003 ACM SIGMOBILE Outstanding Contribution Award for his "pioneering contributions in the area of mobility and resource management for wireless communication networks", September 2003.

Dr. Akyildiz received the 2004 Georgia Tech Faculty Research Author Award for his "outstanding record of publications of papers between 1999-2003", April 2004. He also received the 2005 Distinguished Faculty Achievement Award from School of ECE, Georgia Tech, April 2005. Dr. Akyildiz received the Georgia Tech Outstanding Doctoral Thesis Advisor Award for his 20+ years service and dedication to Georgia Tech and producing outstanding PhD students. He also received the 2009 ECE Distinguished Mentor Award by the Georgia Tech School of Electrical and Computer Engineering Faculty Honors Committee.

Dr. Akyildiz received the Best Paper Award for "Interferer Classification, Channel Selection and Transmission Adaptation for Wireless Sensor Networks" in the Ad Hoc and Sensor Networks (AHSN) symposium at IEEE ICC, in June 2009. He also received the Best Paper Award for "Deployment Algorithms for Wireless Underground Sensor Networks using Magnetic Induction" in the IEEE Global Communications Conference (Globecom), in December 2010.

Dr. Akyildiz received the 2010 IEEE Communications Society Ad Hoc and Sensor Networks Technical Committee (AHSN TC) Technical Recognition Award with the citation: "For pioneering contributions to wireless sensor networks and wireless mesh networks", in December 2010.

Dr. Akyildiz received the 2011 IEEE Computer Society W. Wallace McDowell Award for pioneering contributions to wireless sensor network architectures and communication protocols, in May 2011.

Dr. Akyildiz received the 2011 TUBITAK (Turkish National Science Foundation) Exclusive Award for outstanding contributions to the advancement of scholarship/research at international level.

Dr. Akyildiz is the author of an advanced textbook on "Wireless Sensor Networks" published by John Wiley and Sons in June 2010. Dr. Akyildiz is the author of an advanced textbook on "Wireless Mesh Networks" published by John Wiley and Sons in February 2009.

Dr. Akyildiz serves on the advisory boards of several research centers, journals, high tech companies, conferences and publication companies. His current research interests are in Nanonetworks, Cognitive Radio Networks and Wireless Sensor Networks.