Novel Communication Architectures for Wireless Multimedia Sensor Networks

(Invited Talk)

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Abstract

Wireless multimedia sensor networks (WMSNs) are networks of interconnected devices that allow retrieving video and audio streams, still images, and scalar data from the environment. With the ability of providing enriched observation of the environment, WMSNs can enhance a wide range of applications such as environmental monitoring, industrial process control, traffic enforcement, and advanced health care delivery. Most of these applications require the sensor network paradigm to be re-thought in view of the need for mechanisms to deliver multimedia content with a pre-defined level of quality of service (QoS).

In this presentation, two novel communication architectures will be proposed to achieve the efficient delivery of multimedia content in WMSNs. The first one is a cross-layer communication architecture based on the time-hopping impulse radio ultra wide band (UWB) technology. The UWB technology has the potential to enable low power consumption, high data rate communications within tens of meters, which make it an ideal choice for WMSNs. The architecture aims at providing QoS support in the domains of throughput, delay, and reliability for heterogeneous applications, based on a modular cross-layer controller that performs admission control, routing, scheduling, bandwidth assignment and channel coding. Performance evaluation shows that the architecture is a promising solution to satisfy the performance targets of WMSNs.

Furthermore, a correlation-based communication architecture is introduced. In WMSNs, the observations of video sensors with overlapped field of views are correlated with each other, which leads to considerable data redundancy in the network. A novel spatial correlation model is designed to predict the correlation among video sensors through low computation and communication costs. Then, the correlation of video sensors is utilized to design clustered source coding, QoS routing, and scheduling protocols for WMSNs. Performance evaluation results show that, by integrating correlation-aware operations in the communication protocols, the energy efficiency and networking performance of WMSNs could be improved significantly.

To conclude this presentation, a list of open research problems and future challenges are discussed.

About Ian F. Akyildiz

Ian F. Akyildiz is the Ken Byers Chair Professor and Director of Broadband and Wireless Networking Laboratory at School of Electrical and Computer Engineering at Georgia Institute of Technology. Professor Akyildiz is Editor-in-Chief of Computer Networks (Elsevier), Ad Hoc Networks (Elsevier), Physical Communications (Elsevier), Nano Communication Networks (Elsevier) journals.

Professor Akyildiz is an IEEE Fellow (1995), an ACM Fellow (1996). He received several IEEE and ACM Awards including IEEE Leonard Abraham Best paper award from IEEE JSAC in 1997, IEEE Best Tutorial paper award in 2003, IEEE Harry Goode Memorial Award (IEEE Computer Society), 2003 ACM SIGMOBILE award for his pioneering contributions in mobility and resource management in wireless networks, 2011 Wallace McDowell Award (IEEE Computer Society), ACM Best Distinguished Lecturer Award in 1994, Georgia Tech Faculty Research Author Award in 2004 and School of ECE/Georgia Tech Distinguished Faculty Award in 2005

Dr. Akyildiz guest edited several special issues and organized many leading conferences such as IEEE INFOCOM 1998, IEEE ICC 2003, ACM MOBICOM 1996 and 2002 and many others.

His current research interests are Nanonetworks, Cognitive Radio Networks and Wireless Sensor Networks