

## Proactive Design for Multimedia Communication Systems with Resource and Information Exchanges

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**Abstract:** Due to their flexible and low cost infrastructure, the Internet and wireless networks are poised to enable a variety of multimedia applications, such as videoconferencing, emergency services, surveillance, telemedicine, remote teaching and training, augmented reality, and distributed gaming. However, these networks provide dynamically varying resources with only limited support for the Quality of Service required by the *delay-sensitive, bandwidth-intense and loss-tolerant multimedia applications*. This variability of resources does not significantly impact delay-insensitive applications (e.g., file transfers), but has considerable consequences for multimedia applications and often leads to unsatisfactory user experience.

To address these challenges, my research is focused on investigating the theory, algorithm design, implementation, and performance analysis of *realistic* multimedia systems, in order to gain new insights on what basic principles underlie efficient designs, and use these insights to advance the theory and tool-set for building optimized multimedia compression and transmission algorithms, theories and applications.

In this talk, I will discuss a new proactive algorithm and system design that fundamentally changes the non-collaborative way in which competing wireless stations currently interact, by allowing them to *exchange information and resources* to improve the performance of multimedia applications.

The resource exchanges are made possible by adapting the compression and transmission strategies of the participating stations. I will present our cross-layer optimization algorithms that adapt to varying channel conditions and available resources while considering the *specific characteristics and requirements of wireless multimedia applications as well as the power and hardware limitations of transmitter/receiver devices*.

To support different resource exchanges and cross-layer transmission strategies, multimedia content needs to be compressed in a *scalable manner which supports seamless (graceful) adaptation* based on the user experience and power consumption. Our multimedia compression schemes will be introduced, which provide bit-rate scalability as well as on-the-fly complexity and power scalability based on the instantaneous transmitter and receiver capabilities and resources.

The talk will highlight our current results, which lead to improved multimedia performance over existing Internet and wireless networks and provide valuable insights into the design of next generation algorithms and protocols for multimedia systems.

**Bio:** MIHAELA van der SCHAAR received the M.Sc. and Ph.D. degrees in Electrical Engineering from Eindhoven University of Technology, Eindhoven, The Netherlands. She is currently an Assistant Professor in the Electrical and Computer Engineering Department at University of California, Davis. Between 1996 and June 2003, she was a senior member research staff at Philips Research in the Netherlands and USA, where she led a team of researchers working on scalable video coding, networking, and streaming algorithms and multimedia architectures. From January to September 2003, she was also an Adjunct Assistant Professor at Columbia University. She is also an active participant in the MPEG video standardization for which she received two ISO awards. She is currently chairing the ad-hoc group aimed at standardizing the next-generation video compression technology entitled MPEG Scalable Video Coding as well as the ad-hoc group on Interframe Wavelet Video Coding exploration activity. In the past, she was also co-chairing the ad-hoc group on Multimedia Test-bed. She has written more than 100 book chapters, conference and journal papers in this field and holds 16 granted US patents. She was also the General Chair of the Picture Coding Symposium 2004. She was also a guest editor of the EURASIP Special issue on multimedia over IP and wireless networks in January 2004. She is

a Senior Member IEEE, and was also elected as a Member of the Technical Committee on Multimedia Signal Processing of the IEEE Signal Processing Society. She is an Associate Editor of IEEE Transactions on Multimedia and IEEE Transactions on Circuits and Systems for Video Technology and was an Associate Editor of SPIE Electronic Imaging Journal. In 2004, she received the NSF Career Award.