

# Annals of Telecommunications



Call for papers  
Special Issue on

## 5+G Network Energy Consumption, Energy Efficiency and Environmental Impact

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### Lead Guest Editors

**Dr. Cédric Ware**, Associate Professor

**Dr. Marceau Coupechoux**, Full Professor

LTCI, Institut Mines-Télécom/Télécom Paris, Institut polytechnique de Paris, France

### Guest Editors

**Dr. Ekram Hossein**, Full Professor, University of Manitoba

**Dr. Carmen Mas-Machuca**, Associate Professor, Technical University of Munich

**Dr. Vinod Sharma**, Full Professor, Indian Institute of Science of Bangalore

**Dr. Anna Tzanakaki**, Associate Professor, National and Kapodistrian University of Athens

### Topics of interest include, but are not restricted to the following

- Energy- and environment-awareness in all aspects and types of networks:
  - physical layers, protocols, architectures, algorithms, scheduling;
  - wired and wireless, RF and optical networks;
  - data centers, cloud and edge computing, cloud-RAN;
  - 5G/6G cellular, device-to-device (D2D), machine-to-machine, vehicle-to-everything (V2X), sensor and Internet of things (IoT) networks.

- Evaluation and reduction of networks' energy, energy efficiency improvements and environmental impact ("Green IT"):
  - modeling and metrology (including actual datasets);
  - cross-layer optimization;
  - hardware and physical layer optimization techniques e.g. optical functionalities, fixed-mobile convergence, multi-antenna systems (MIMO), multiple access techniques (MAC, NOMA), reconfigurable intelligent surfaces (RIS);
  - network optimization techniques e.g. service differentiation, synchronous and URLLC networks, cognitive networks;
  - energy harvesting for cellular networks, sensor networks and IoT;
  - low-tech networks.
- Evolution of IT and network usage:
  - long-term predictions and modeling;
  - enabling end-user informed choices and digital sobriety.
- Networks and communications' impact on other domains ("IT for green"):
  - evaluation of other domains' energy savings by the use of IT;
  - environment monitoring.

The Information Technology sector's energy consumption has been growing at an unsustainable rate of 9 % per year, and its carbon footprint was already twice as large as that of the air transport industry before the Covid pandemic. Traffic demand is still growing, driven not only by end-users' usual expectations of ever-higher quality video for conventional video-on-demand and more recent social-networking-driven applications; but also machine-to-machine traffic and operation of expanding cloud services.

Curbing this requires new ways of organizing the networks, seeking optimization across all network layers, including the physical layer. However, although such cross-layer optimization was already an active research subject 10 years ago, and modern 5G networks do incorporate some of the techniques developed, the situation has not improved in terms of global consumption. Improvements in energy efficiency were more than offset by traffic growth and rebound effects, and the objective never was to reduce growth in the first place.

We need to spark a revival of the topic, focused on the ways to approach the problem most likely to make a difference. This includes still more efficiency improvements, as well as favoring specific uses of low-carbon electricity in data centers and cellular base stations; but also avoiding the rebound effect by taking a holistic view of decreasing the global traffic, via network management techniques whenever possible, as well as enabling and inciting users to moderate their network usage and through other forms of digital sobriety.

The goal of this special issue is thus to gather state-of-the-art research in environment-aware networking, i.e., technologies, models, protocols, architectures, algorithms, testbeds aware of the environmental impact of networks, chiefly through their global energy consumption and carbon footprint.

Papers must describe original research that advances the state of the art, and must not be simultaneously submitted to another journal or conference with proceedings. Papers must be written in excellent English and should not exceed 20 pages. Previously published or accepted conference papers must contain at least 50 % new material to be considered for the special issue. A cover letter to the Guest Editors clearly describing the extensions made must accompany these types of submissions. All submissions must be made using the instructions available at:

<https://annalsoftelecommunications.wp.imt.fr/how-to-publish/>

The authors can directly submit their papers at: <https://www.editorialmanager.com/ante/> and must select “Open Topic” in the menu “Choose Article Type”, then in the questionnaire on the “Additional Information” section, they will be able to select the item “CfP: 5+G Network Energy Consumption, Energy Efficiency and Environmental Impact”.

### **Proposed Schedule**

Manuscript submission:	September 1 <sup>st</sup> , 2021
Author notification:	November 22 <sup>nd</sup> , 2021
Revised papers submission:	January 17 <sup>th</sup> , 2022
Final acceptance:	February 28 <sup>th</sup> , 2022
Online with DOI:	As soon as accepted
Printed issue:	First half of 2022

### **Dr. Cédric Ware**

Associate Professor  
Institut Mines-Télécom/Télécom Paris  
Institut polytechnique de Paris  
Palaiseau, France  
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Cédric Ware was educated in École Normale Supérieure (Paris), then Télécom Paris, which he joined as faculty in 1998. He holds Ph. D. and Habilitation (HDR) degrees. He was a Visiting Research Scientist in Columbia University in 2010–2011. His research activities have followed the thread of all-optical and opto-electronic functionalities, such as clock recovery, optical CDMA, optical packet switching. He is now transitioning towards optical networking, towards a goal of cross-layer optimization of both performance and energy consumption. Author or co-author of over 90 publications and communications, he has driven and taken part in several French and international projects and collaborations. He lectures on topics ranging from Quantum Mechanics to Optical Networking, and coordinates the M. Sc. on Optical Networking and Photonic Systems.

### **Dr. Marceau Coupechoux**

Full Professor  
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Marceau Coupechoux received the Engineer degree from Telecom Paris in 1999 and University of Stuttgart in 2000, the Ph.D. degree from Institut Eurecom in 2004, the Habilitation degree from University Pierre et Marie Curie in 2015. He is a Professor at Telecom Paris and a Professeur Chargé de Cours at Ecole Polytechnique. From 2000 to 2005, he was with Alcatel-Lucent. In 2011-2012, he was a Visiting Scientist with the Indian Institute of Science, Bengaluru, India. He has been a General Co-Chair of WiOpt 2017 and Gamenets 2019. In the Computer and Network Science Department of Telecom Paris, he is working on wireless and cellular networks, focusing mainly on performance evaluation, optimization and resource allocation.

### **Dr. Ekram Hossein**

Full Professor

University of Manitoba

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Since March 2010, Dr. Hossain is a Professor in the Department of Electrical and Computer Engineering at University of Manitoba, Winnipeg, Canada. Currently he serves as an Associate Chair (Graduate Studies) of the Department, and leads the Wireless Communications, Networks, and Services (WiCoNS) research group. He is a Fellow of the Canadian Academy of Engineering (FCAE) and a Fellow of the Engineering Institute of Canada (FEiC). He received his Ph.D. in Electrical Engineering from University of Victoria, Canada, in 2001. He was a University of Victoria Fellow and also a recipient of the British Columbia Advanced Systems Institute (ASI) graduate student award. Professor Hossain is an author/editor of several books, and has served as Editor or Editor-in-Chief for multiple journals, currently Editor for the IEEE Transactions on Mobile Computing. He was elevated to an IEEE Fellow (class of 2015) "for contributions to spectrum management and resource allocation in cognitive and cellular radio networks".

Prof. Hossain received the "2017 IEEE TCGCC (Technical Committee on Green Communications and Networking) Distinguished Technical Achievement Recognition Award" with the following citation: "for outstanding technical leadership and achievement in green wireless communications and networking". Also, he is listed as a Clarivate Analytics Highly Cited Researcher in Computer Science in 2017, 2018, 2019, and 2020.

### **Dr. Carmen Mas-Machuca**

Associate Professor

Technical University of Munich

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Carmen Mas-Machuca (M'96–SM'12) is a Privat Dozent/Associate Professor at the Chair of Communication Networks, Technical University of Munich (TUM), Germany. She received her Dipl.-Ing. degree (Master) from Universitat Politècnica de Catalunya (UPC, Spain) in 1995 and her Dr.-Ing. degree (Ph.D.) from École Polytechnique Fédérale de Lausanne (EPFL, Switzerland) in 2000. Dr. Mas-Machuca has published more than 150 peer reviewed

papers. Her main research interests are in the area of techno-economic studies, network planning and resilience, SDN/NFV optimization problems and next generation converged access networks. She is currently NoF'21 General Co-Chair, ONDM'21 TPC Co-Chair, and IEEE TNSM Associate Co-Editor of the special issue on "Design and Management of Reliable Communications Network".

### **Dr. Vinod Sharma**

Full Professor

Indian Institute of Science of Bangalore

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Vinod Sharma received the B.Tech. degree in EE from IIT, Delhi, India, in 1978, and the Ph.D. degree in ECE from Carnegie Mellon University in 1984. He worked at Northeastern University, Boston, and University of California at Los Angeles before joining IISc, Bangalore, in 1988, where he is currently a TATACHEM Chair Professor. His research interests are in communication networks, wireless communications, and information theory. He has more than 220 papers in international journals and conferences in these areas. He is an elected fellow of Indian National Academy of Engineering (INAE). He received Prof. Rustom Choksi award from IISc for excellence in research in 2017 and ACCS-CDAC award in 2012.

### **Dr. Anna Tzanakaki**

Associate Professor

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Anna Tzanakaki is an Associate Professor at the Physics Department of the National and Kapodistrian University of Athens, Greece and a Visiting Research Fellow at the University of Bristol, UK. Previously, she was an Associate Professor at the Athens Information Technology (AIT), Greece where she was leading the Network Design and Services research group. She has been also an adjunct faculty member of the Information Networking Institute of Carnegie Mellon University, USA. She was a co-founder of ilotron ltd, a high-technology spin-off from the University of Essex. Following ilotron, Dr Tzanakaki joined Altamar Networks, a subsidiary of Ditech Communications, as a principal engineer responsible for optical architecture and system design. She is a co-author of over 200 publications in international journals and conferences. She is a co-inventor of several granted and published patents. She is a senior member of the IEEE and several Technical Program Committees of international scientific conferences. She has served as an associate editor of the IEEE/OSA Journal of Optical Communications and Networks and is a technical referee for various conferences as well as international scientific journals. She serves and has served as a technical expert for the EU, the national research councils of Greece, UK and Portugal. She has actively participated in a number of European and national funded research collaborative projects and is the technical coordinator of the EU 5G PPP project 5G-VICTORI. Her research interests include converged systems and networks.

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