institute imdea networks

developing the
**science of networks**

# imdea **networks** institute

annual report

2018

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# annual report 2018

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**Arturo Azcorra**
Director of the
IMDEA Networks Institute
September 2019

IMDEA Networks Institute is a top research institute in the Science of Networks and Communication Technology worldwide. In 2018, the Institute has continued to boost Madrid's competitiveness as a technology-oriented region. IMDEA Networks strengthens the technology profile of the region and its collaboration with local companies helps to enhance Madrid's high-tech output with cutting edge research. Our ultimate goal is to help Madrid make its mark on the 21st Century by focusing on the development of products and services that incorporate the most advanced network and communication technologies.

IMDEA Networks focuses on an area that has a profound impact on people's lives. Over the last decades, the widespread access to networks has dramatically changed the way manufacturers produce and supply their goods, how public administrations operate, how professionals work and, in general, how individuals and society are shaped. One of the network technologies that will dramatically change our lives in the near future is 5G. The capabilities of 5G go far beyond prior generation mobile networks, providing revolutionary technology that can meet the requirements even of extreme use cases such as augmented reality or the connection of trillions of IoT devices and enable new applications such as connected industry 4.0, e-health and connected vehicles, among many others.

Over the last years, IMDEA Networks has been one of the leading research centers developing 5G technology in Europe. IMDEA Networks has been a key participant in several of Europe's 5G Public-Private-Partnership (5GPPP) projects, designing and implementing groundbreaking solutions for mm-wave, SDN, NFV and orchestration, among other technologies. IMDEA Networks researchers have not only published their findings in top venues and protected them with patents, but have also designed advanced testbeds to validate their performance in experimental deployments.

After having developed the fundamental concepts of 5G, the technology is now ready for evaluation in real systems and trials. In line with IMDEA Networks' vision of bringing research findings to real use, the Institute is taking a leading role within Europe in the evaluation of 5G technologies. The 5TONIC initiative, jointly founded by Telefonica and IMDEA Networks, was established precisely for this purpose, as it brings together leading global companies and research centers in the 5G arena to showcase the capabilities and interoperation of pre-commercial 5G equipment, services and applications.

In order to deploy and evaluate 5G technology, Europe has selected three main projects through the 5GPPP initiative. These projects have been tasked to provide a platform to evaluate the technology and support use cases of high interest. I am extremely proud to say that 5TONIC is the only European site that is involved in all three projects, thus making Spain one of the leading sites in the development of 5G technology. We strongly believe that this will contribute to secure for Spain a substantial fraction of the huge revenues expected for 5G, estimated to be over €100 billion/year in Europe alone.

As every year, my gratitude goes to the Regional Government of Madrid for its continued support of this economy-transforming initiative, as well as to all those who are contributing to make this exciting project an international success.

# foreword

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# executive summary

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## A research team of technical leaders

The research team of IMDEA Networks consists of preeminent technical leaders. All IMDEA Networks researchers have a meritorious research record that includes publications in the most influential venues in our area of research, and they have graduated from, or worked for, top-level international universities. At the same time, our scientists also possess an extensive industry background. Most of them have been employed at leading industry research laboratories, and have been granted many patents during their professional careers. This background is essential to carry out research that can be transferred to companies and in turn be transformed into profitable products that will stimulate economic growth and job creation.

In 2018, the Institute has continued to reinforce its research team. This year our team experienced a substantial increase in the number of researchers. Among those, it is worth highlighting the incorporation of Nikolaos Laoutaris as a Research Professor. Dr. Laoutaris is a highly reputed researcher with extensive experience in top academic and industry laboratories, including the universities of Boston and Harvard and the Telefonica Research labs. He is not only a highly impactful researcher (he authors many publications in top conferences and has an H-index of 30) but he also has a proven record of bringing his research findings into practice (he co-founded the Data Transparency Lab and built many practical systems of high impact).

In addition to experienced world-renowned researchers, an essential part of the Institute's research team is composed of highly motivated pre-doctoral researchers, keen to explore new ideas, who are pursuing their PhD theses at IMDEA Networks. In 2018, the Institute graduated 3 new PhD Students. Many of our pre-doctoral researchers have received important distinctions and have been awarded highly selective scholarships. This year, Nicola Bui and José A. Ruipérez-Valiente received the Outstanding Doctoral Thesis Award of Universidad Carlos III de Madrid. Ruipérez was also honored with three national awards, from COIT/AEIT, IEEE-CESEI and SCIE/BBVA respectively, in recognition to his outstanding contributions to the online learning revolution.

The awards and prizes received by our researchers for their research work and achievements testify to their international reputation and aptitude. In 2018, our director Arturo Azcorra was appointed member of the Academia Europaea, which recognizes his role as one of the world leaders in the research and development of the advanced solutions and systems leading to the 5G revolution.

## The excellence of our scientific results

The efforts made by our team to produce outstanding scientific work led to a large number of scientific publications in 2018, in addition to various distinctions in the form of awards, prizes and funding which vouch for the high quality of our scientific results. Three out of four prizes given at ACM IMC 2018, the top conference on network measurements, were awarded to IMDEA Networks' researchers. Other awards worth highlighting were the ones obtained at the JNIC 2018 conference and at the Data Science Hackathon.

It is particularly worth highlighting the impact that IMDEA Networks had this year on the best conferences in our area. While IMDEA Networks has published consistently in these venues over the years, 2018 was particularly fruitful, with five papers at IEEE INFOCOM 2019, two papers at ACM MOBICOM 2018, four papers at ACM IMC 2018 and one paper at ACM CoNEXT 2018. Furthermore, this year we also published a paper in the Scientific Reports journal, which ranks 10$^{th}$ in the world.

The excellence of IMDEA Networks' results has been recognized by Computer Science Rankings (csrankings.org), which has recently incorporated us to their ranking. CS Rankings provides a metrics-based ranking of top computer science institutions around the world based on their presence at the most prestigious publication venues, which places IMDEA Networks 9$^{th}$ in Computer Science in Europe, 2nd in Measurements, and 9th in Mobile Computing. There are only two other institutions that fall within the top 10 in these three categories: Max Planck Institute and ETH Zurich. This places IMDEA Networks among the selected few topmost European institutions in the area of networking.

## Contributing to a knowledge-based economy

The ultimate goal of IMDEA Networks is to produce high quality research results that contribute to a knowledge-based economy. Our strategy to transfer scientific and technological developments to industry over the last year has led to various new collaborations in addition to strengthening the existing partnerships with some of our key industrial collaborators. Our achievement on this front has been recognized by the Spanish Association of Telecommunication Engineers (AEIT), which awarded to IMDEA Networks the AEIT 2018 Award for Innovation. AEIT is the twin organization of the Spanish Official College of Telecommunication Engineers (COIT). It brings together over 8,000 members and is extremely well respected. This award recognizes IMDEA Networks' contribution to a productive economy based on knowledge and technology arising from the field of telecommunications.

Our researchers are currently contributing to 16 ongoing research projects that have attracted funding from various sources: 6 European projects, 1 national project and 3 financed by the regional government of Madrid, in addition to 2 contracts with industrial partners and 5 other projects funded by international bodies. Among those, it is worth highlighting the 5TONIC initiative, which is among the most prominent European efforts to deploy and exploit 5G technology. 5TONIC gathers key players in the 5G ecosystem and is participating in the three projects awarded by the European Commission under call ICT-17 to deploy platforms based on 5G technology, being the only European site that is involved in all three of them.

## Communicating our results

In addition to producing results of the highest technical quality and applying them to improve the life of the citizens, it is also very important for the Institute that these positive contributions to society are conveyed to the general public, to prospective PhD students, scientists, academics and specialists from other areas; all in all, to decision-makers, stakeholders, and collaborators, so that they can appreciate the benefits of having such a research institute located in Madrid and speaking to the whole world.

Over the last years we have been consistently appearing in national and international, specialized and generic media with a large outreach, and this year has been no exception. The New York Times, The Washington Post, The Guardian, USA Today, The Verge, The Conversation, GlobeNewswire, Telecompaper, Mobile Europe, Daily Mail, Nasdaq,

FOX and NBC News, EFE, ABC, El País, El Mundo, La Razón, Expansión, El Periódico, Agencia SINC, La Vanguardia, COPE and La Sexta, are some of the circa 850 unique media outlets that carried our news during 2018.

Most interest has been garnered by the study of how thousands of the most popular apps and games available, mostly free of charge, in the Google Play Store, make potentially illegal tracking of children's use habits and share the data without consent with third-party services. The activities of 5TONIC, in particular our report on the key role awarded to the lab in a €50m EU sponsored 5G program and its participation in the world's first Master's degree in 5G, have contributed to positioning it as one of Europe's foremost 5G digital innovation centers.

Building on our results of 2018, in the year ahead we look forward to making more impactful scientific discoveries, establishing fruitful collaborations, launching exciting new research initiatives and increasing our outreach, all in the interest of society.

# about us

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## 2.1. Profile

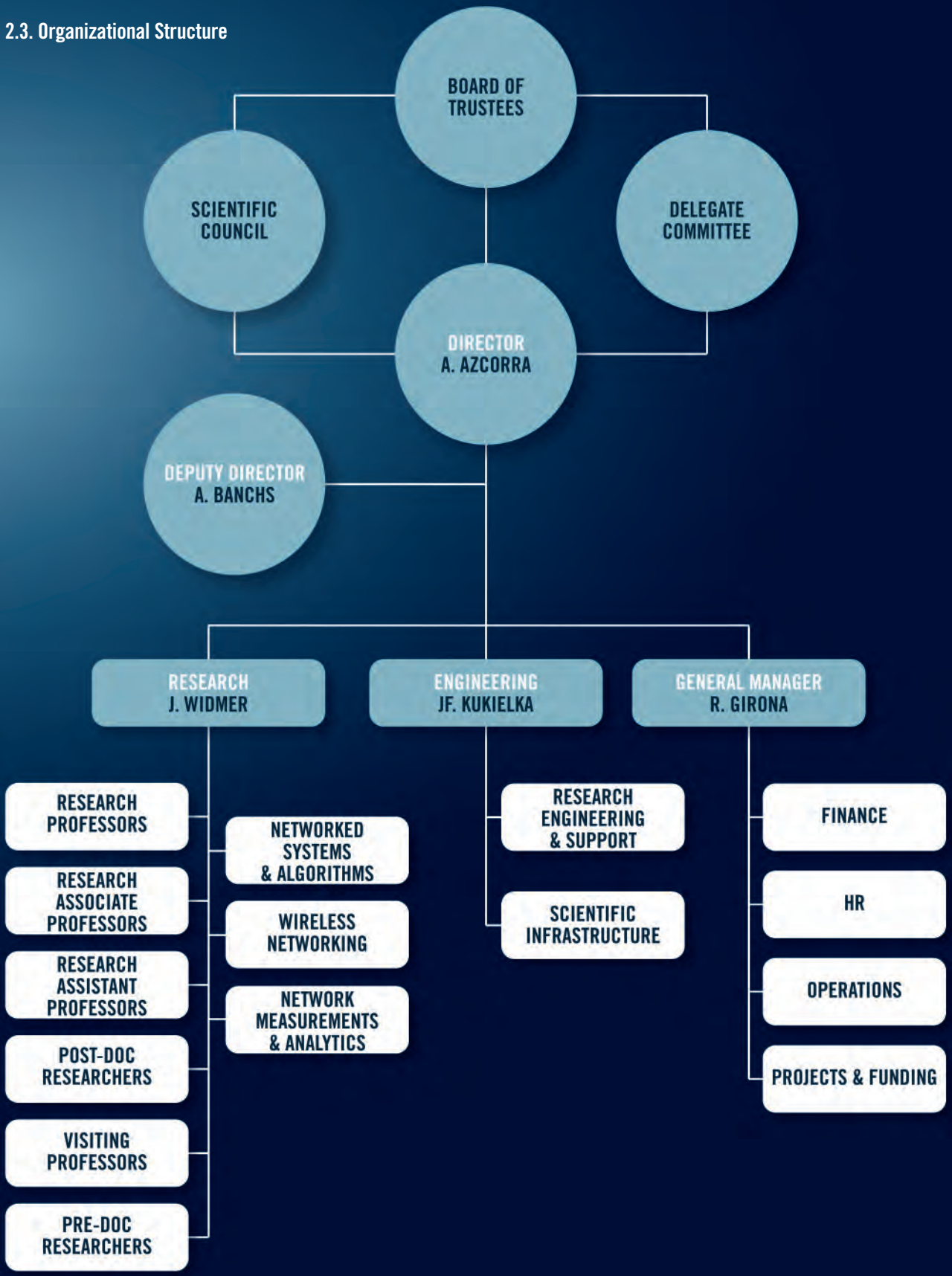
**IMDEA Networks Institute** is a **research organization on computer and communication networks** whose multinational team is engaged in cutting-edge fundamental science and technology. As an English-speaking institute located in Madrid, Spain, IMDEA Networks offers a unique opportunity for pioneering scientists to develop their ideas. IMDEA Networks has established itself internationally at the forefront in the **development of future network principles and technologies.** Our **team** of highly reputed researchers is designing and creating today the networks of tomorrow.

***Some keywords that define us:*** *5G, Big Data, blockchains and distributed ledgers, cloud computing, content-delivery networks, data analytics, energy-efficient networks, fog and edge computing, indoor positioning, Internet of Things (IoT), machine learning, millimeter-wave communication, mobile computing, network economics, network measurements, network security, networked systems, network protocols and algorithms, network virtualization (software defined networks – SDN and network function virtualization – NFV), privacy, social networks, underwater networks, vehicular networks, wireless networks and more…*

## 2.2. Our Strategic Goals

- Conduct first class research on an international level in the area of computer networking
- Transfer technology to the industrial sector, in order to improve its capacity for innovation and competitiveness
- Transfer technology to spin-off-companies in order to promote the release of new products and services to the global market
- Attract and retain human capital of excellence with the aim to internationalize research in the Madrid region
- Collaborate with Madrid's industrial sector, research centers and educational institutions

## 2.3. Organizational Structure



### 2.3.1. Board of Trustees

The Board of Trustees of IMDEA Networks Institute is its highest organ of governance, representation and administration. In accordance with the Institute's statutes, the Board of Trustees is composed of Ex Officio Members representing the Regional Government of Madrid and Elective Members who are recognized leaders in the scientific matters of the Institute. The Director and General Manager of the Institute also participate in the Board of Trustees.

President
**Prof. Dr. Ralf Steinmetz**

Vice-President
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Period of service: Jul 2007 to Jun 2018

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### 2.3.2. Scientific council

The Scientific Council is a very important organ of IMDEA Networks, advising us on all aspects of the Institute's scientific activities. Among many other things, the Council proposes the incorporation and renewal of Scientific Expert members of the Board of Trustees; reviews and approves scientific appointments, and generally provides support to the Director – Dr. Arturo Azcorra and the Deputy Director – Dr. Albert Banchs – in determining scientific research strategy and policies.

The Institute's Scientific Council is composed of internationally prestigious researchers in the field of Telematics and Internet technologies. IMDEA Networks is greatly strengthened by the participation of these eminent scientists. The current members are:

**Dr. Gonzalo CAMARILLO**

**Position:** Standardization Director, Ericsson. Finland

**PhD:** Aalto University. Helsinki. Finland

**Research:** Signaling; Multimedia applications; Transport protocols; Network security; Networking architectures

**Prof. Dr. Jon CROWCROFT**

**Position:** Marconi Professor of Communication Systems at University of Cambridge. Cambridge. UK

**PhD:** Computer Science, University College London (UCL) (England, UK)

**Research:** Opportunistic Communications; Privacy in the Cloud; Carbon Neutral Networking

**Prof. Dr. Gustavo DE VECIANA**

**Position:** Cullen Trust Professor of Electrical and Computer Engineering at the University of Texas at Austin. USA

**PhD:** Electrical Engineering, University of California at Berkeley. USA

**Research:** Analysis and Design of Wireless and Wireline Telecommunication Networks; Architectures and Protocols to Support Sensing and Pervasive Computing; Applied Probability, Queuing and Information Theory

**Prof. Dr. Mario GERLA**

**Position:** Professor at the Computer Science Department, University of California (UCLA). Los Angeles. USA

**PhD:** Engineering. University of California. USA

**Research:** Design and performance evaluation of Ad Hoc wireless networks; Routing; multicast and congestion management in tactical networks; Vehicular ad hoc networks; Wireless security and privacy; Cognitive radios and dynamic spectrum sharing; Urban vehicular traffic management for congestion and pollution mitigation; Mobile health and wireless patient monitoring; Underwater sensor networks

**Period of service:**
Dec 2015 to Feb 2019.
Prof. Dr. Gerla passed away on February 9th, 2019

### Prof. Dr. Edward KNIGHTLY

**Position:** Professor of Electrical and Computer Engineering at Rice University. Houston. Texas. USA

**PhD:** University of California at Berkeley. Berkeley. USA

**Research:** Wireless Networks and Protocols; Wireless Access for Developing Regions; Dynamic Spectrum Access Networks

### Prof. Dr. Jim KUROSE

**Position:** Assistant Director at the Directorate for Computer & Information Science & Engineering (CISE), National Science Foundation (NSF). USA

**PhD:** Columbia University of New York City. Nueva York. USA

**Research:** Network Protocols and Architecture; Network Measurement; Sensor Networks; Multimedia Communication; Modeling and Performance Evaluation

**Period of service:** Nov 2007 to Apr 2018

### Dr. Huw OLIVER

**Position:** Former Technical Director, European Research Consortium, Hewlett-Packard Laboratories. Bristol. UK

**PhD:** University College Aberystwyth. Aberystwyth. UK

**Research:** Computer & Network Security; Wireless OSS; Wireline Core and Access Networks

**Period of service:** Jul 2007 to Jun 2018

### Dr. Pablo RODRIGUEZ RODRIGUEZ

**Position:** CEO, Telefonica Innovation Alpha. Spain

**PhD:** École Polytechnique Fédérale de Lausanne (EPFL). Lausanne. Switzerland

**Research:** Networking; Distributed Systems; Information Theory; Wireless and Mobile; Network Economics; Social Networks

### Prof. Dr. Ralf STEINMETZ

**Position:** President of Board of Trustees of IMDEA Networks Institute; Full Professor & Managing Director of Multimedia Communications Lab (KOM) at Technische Universität Darmstadt. Darmstadt. Germany

**PhD:** Electrical Engineering. Technische Universität Darmstadt. Darmstadt. Germany

**Research:** Scalable Quality of Service; Content Distribution Networks; Context Aware Communications; Adaptive Mobile Networking; Knowledge Media; Serious Games

### Prof. Dr. Ioannis STAVRAKAKIS

**Position:** Full Professor & Head Department of Informatics and Telecommunications. National and Kapodistrian University of Athens. Athens. Greece

**PhD:** Electrical Engineering. University of Virginia. Charlottesville. USA

**Research:** Analysis and Design aspects of Networking Technologies ranging from Link to Application Layers: Social, Mobile, Ad Hoc, Autonomic, Information Centric, Delay-tolerant and Future Internet Networking; Network Resource Allocation Algorithms & Protocols, Traffic Management & Performance Evaluation; Content Dissemination, Placement & (Cooperative) Replication in Unstructured P2P and Social Networks; (Human-Driven) Decision Making in Competitive Environments

### Dr. Heinrich J. STÜTTGEN

**Position:** Deputy Vice President at NEC Laboratories Europe. Heidelberg. Germany

**PhD:** Computer Science, Associative Memory Architecture, University of Dortmund. Germany

**Research:** Network Architecture and Protocols; Software Defined Networking; Internet of Things (IoT)

# research areas

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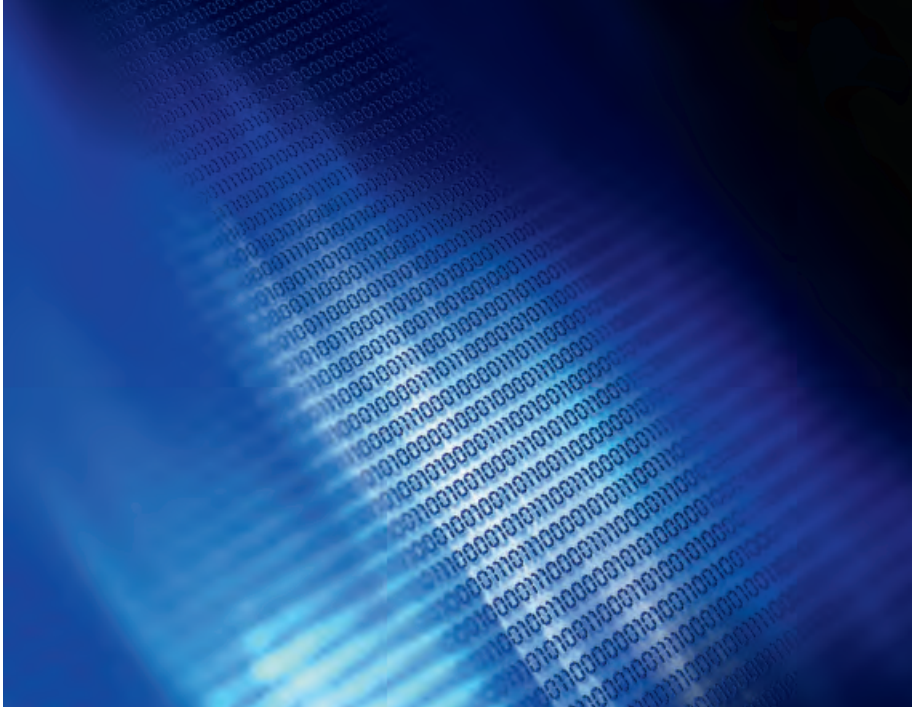


As illustrated by **our motto** – **Developing the Science of Networks** – IMDEA Networks identifies and addresses major scientific and engineering challenges in communications and computer networks, and also aims to develop these results by bringing them into practical deployments. The nature of these challenges varies with ever-greater rapidity. To ensure the relevance of our research activities, we continuously adjust our research agenda to stay at the forefront of technological innovation. We organize our scientific activities into research areas that reflect our current working priorities, ensuring sufficient flexibility to allow us to respond to emerging technological challenges. The research mission of our Institute also adapts to the strengths of our growing research team and our external collaborators.

The research work at IMDEA Networks is led by Joerg Widmer, who is the **Research Director** of the Institute and therefore responsible for its research direction.

Currently, our scientific work focuses on the following three general areas:

networked systems&algorithms

## 3.1. Networked Systems and Algorithms

**Scientific Director of "Networked Systems and Algorithms": Arturo Azcorra.**

Any network has a structure and needs protocols to achieve its objectives. The researchers of IMDEA Networks Institute have an extensive expertise in architectures and protocols for communication networks, e.g., for network topology design, routing, forwarding, packet classification, in-network storage, congestion control, and media access control. Besides,

we have research interests in other networking domains such as social networks, energy networks, and transportation networks.

Our research takes a multi-disciplinary approach to the design and understanding of network protocols and architectures. We go beyond technological constraints and account also for social and economic factors. For example, our research on Internet routing and forwarding accounts for the multitude of Internet service providers and their individual economic interests. In working on either centralized or decentralized solutions to problems, we assume that perfect information is never available. To deal with such uncertainty as well as selfishness of individual entities, our analysis adopts game-theoretic techniques and online algorithms. Our protocol design assumes that behavior of counterparts is always unpredictable to some extent. Hence, the designed protocols rely on continuous learning and adaptation as the main modes of operation.

Practicality is another distinguishing aspect of our research. Real data serves as a departing point for our analytical efforts as well as a basis for validating our analytical conclusions. For instance, our large-scale simulation studies of Internet routing rely on real Internet topologies. Furthermore, we implement our theoretical ideas and make the prototypes available to the public, either directly or through our commercial partners.

An important focus of our work is on the systems side of networks. For example, we explore tradeoffs between simplicity and expressiveness of packet processing engines, new abstractions for heterogeneous control planes, and network virtualization techniques. We also work on networking aspects that pertain to cloud computing.

This research area targets the following **objectives:**

- **Novel architectures and protocols for behavioral networking**
  - The Internet is modeled as an association of independent entities
  - Behavior of counterparts is not taken for granted
  - Continuous learning and adaptation are main modes of operations

- **Bridging the gap between network economics and networking**
  - Deployment of innovative designs becomes the primary concern
  - Economic and political landscapes of the Internet are analyzed with higher fidelity
  - Economic-political knowledge guides the technical design

- **Making it easy to develop and deploy reliable, high-performance networked systems**
  - Correct functioning of networks is paramount
  - SDN (Software Defined Networking) revolutionizes networking, and carries a lot of risk
  - New abstractions are developed to simplify network management and utilize the underlying network infrastructure more effectively

wireless networking

## 3.2. Wireless Networking

**Scientific Director of "Wireless Networking": Joerg Widmer.**

Given the scarcity of wireless spectrum resources and the rising demand for mobile applications, optimizing wireless communication and improving wireless network architectures is currently one of the most important and challenging research topics in networking. The proliferation of inexpensive, high-rate mobile devices and ubiquitous connectivity opens up a vast spectrum of possible new services but also poses unique challenges concerning scalability, interference and the unpredictability of the wireless medium.

IMDEA Networks is involved in a number of different wireless research areas. We are investigating emerging wireless technologies such as extremely high frequency communication for 5G and wireless LAN and Visible Light Communication, which promise to increase wireless data rates by an order of magnitude or more. Our work on capacity improvements also focuses on topics such as ultra-dense networks, intelligent interference management, cooperative coding and network coding, improved medium access control mechanisms that make use of advanced physical layer technologies such as MIMO, successive interference cancellation, etc.

At the same time, mobile network architectures need to support these new technologies as well as new use cases, and thus become more flexible. We perform research on network architectures for 5G and beyond, specifically focusing on software-defined networks (SDN)-based architectures and network function virtualization (NFV). In addition, wireless networks are becoming more heterogeneous as they are gaining traction in more diverse use cases such as the Internet of Things (IoT) and intermittently connected or delay-tolerant networks, unmanned aerial vehicular networks and underwater networks. The research activities span medium access control (MAC), routing, error control and transport protocols, both as standalone entities and as part of cross-layer design frameworks. To improve the flexibility and programmability of future wireless technologies, we also explore novel programmable interfaces that expose low-level operations to foster network evolution and enable performance optimization and service customization. For a number of the above use case scenarios, efficient and accurate device localization is highly useful.

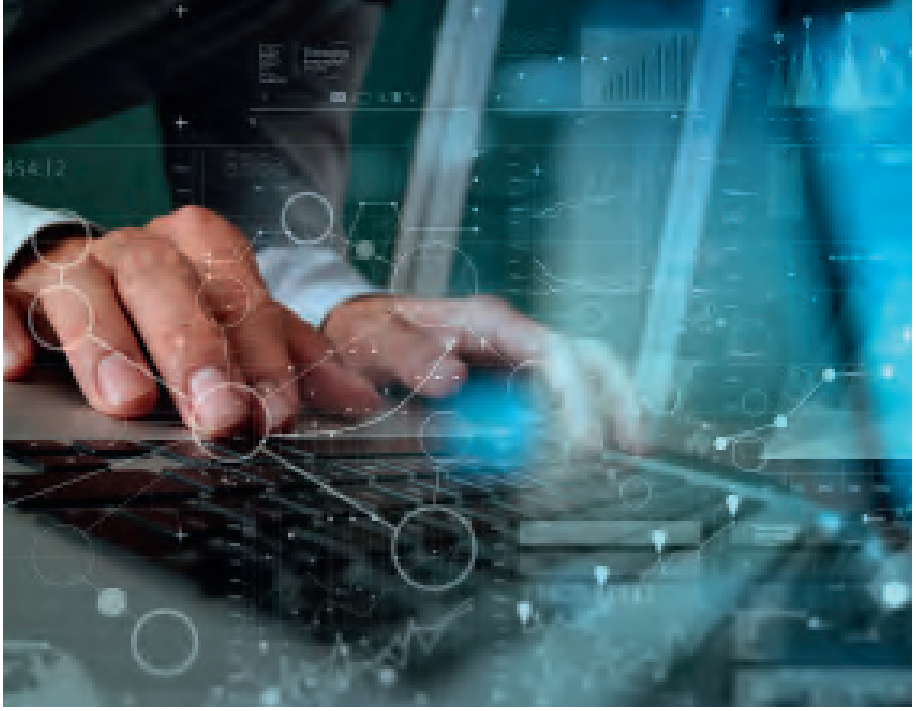
We recognize the importance of bridging the gap between theoretic results and applied wireless research and have deployed a range of wireless testbeds (for mm-wave, visible light communication, 5G, IEEE 802.11, and others) on which we implement and evaluate our ideas.

This research area targets the following **objectives:**

- **Increasing wireless network capacity**
  - Millimeter wave networking and visible light communication networks to support very wideband ultra-high speed communication
  - Extremely dense networks, small cells, and wireless backhauling
  - Interference management, opportunistic scheduling, adaptive coding and modulation, and traffic offloading

- **Improving mobile network architectures**
  - Software defined networking (SDN) for mobile networks, wireless virtualization
  - Network function virtualization (NFV), NFV layered architectures, interoperability of NFV solutions, and NFV infrastructure federation
  - Energy-efficient, robust, fair and high-throughput communication protocols for SDN/SDR-based cellular networks, context-aware services, and cloud-based data centers.
  - Cloud RAN concepts, with flexible split of the radio access

- **Supporting heterogeneous wireless networks**
  - Mobile indoor localization for network optimization as well as location based services
  - Support of vehicular and aerial networks, as well as intermittently connected networks, delay-tolerant networks and underwater networks
  - Collaborative wideband spectrum monitoring



network measurements&analytics

## 3.3. Network Measurements and Analytics

**Scientific Director of "Network Measurements and Analytics": Albert Banchs.**

The rapid evolution of mobile portable systems and the Internet of Things (IoT) has given birth to a rich ecosystem of applications, personalization and services that is changing the way billions of users communicate and interact with their environment. This digitalization of the world has allowed new innovative applications with new levels of personalization and the ability to interact the environment. However, this trend is also producing large volumes of data which may raise privacy and security threats unseen in previous networked technologies while also generating unknown traffic patterns and performance bottlenecks which can have a negative impact on the network and user experience.

At IMDEA Networks, we are involved in novel research efforts to empirically illuminate how users, networks, devices and applications interact, behave and perform in the wild.

Our research is particularly focused on conducting analytical measurements of real-world networked systems, with a strong interest in understanding their use (and abuse) as well as the performance, privacy and security challenges present in emerging networking technologies. Our research team also develops Big Data solutions to analyse and process large-scale traffic-, network- and application-generated data fast and correctly.

At IMDEA Networks we engage and collaborate with users, cyber-activists, industry and regulators to identify and address important problems of societal, industrial and academic interest from a practical angle. Often times, our researchers are responsible for develop-

ing practical tools to assist the different stakeholders to understand how users, devices, networks, services, and applications interconnect, perform and behave behind the scenes.

Specifically, this research area targets the following **objectives:**

- **Network measurements**
  - Active and Passive measurements
  - Network and traffic characterization
  - Troubleshooting and performance evaluation
  - Social network analysis
  - Cloud-mobile integration

- **Big Data**
  - Applied machine learning and pattern recognition
  - Data analytics for cybersecurity and anomaly detection
  - Human-data interaction (HDI) and visualization

- **Privacy and Security**
  - IoT, cyber-physical systems and mobile computing
  - Online tracking, advertising and ad-blocking
  - Fraud prevention
  - Mobile malware and threat detection
  - Data transparency and privacy-preserving tools

# research projects, grants and fellowships

4.1. Funding awards [26]

4.2. Externally-funded research projects, attracting European Union, National or Regional funds [29]

## 4.1. Funding awards

We dedicate extensive resources to obtaining external funding to support our research team and in particular those members who excel in their capacities, with the objective to promote the scientific and technical potential of our human capital and, as a direct result, the outreach of the Institute's activities.

The funding of our individual researchers takes the form of awarded grants, scholarships and fellowships. These awards are similar to externally funded research in their openness and the strict selection processes used, and they confer prestige on the awardee as well as on the organization he is affiliated to.

### 4.1.1 European

# ERC Grants

European Research Council
Established by the European Commission

**Awardee**

- Dr. Joerg WIDMER, Research Professor (tenured) & Research Director **(ERC Consolidator Grant)** Principal Investigator of the **SEARCHLIGHT** research project. *This project is executed by IMDEA Networks and runs from April 2014 to March 2019.*

**Funded by**

European Union. European Research Council (ERC Grants)

### 4.1.2 National

# Ramón y Cajal Grants

*(Programa Ramón y Cajal)*

Investigación Programa Ramón y Cajal

GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD

**Awardee**

- Dr. Vincenzo MANCUSO, Research Associate Professor

**Funded by**

Spanish Ministry of Economy, Industry and Competitiveness *(Ministerio de Economía, Industria y Competitividad - MINECO)*

## Juan de la Cierva Incorporation Grants 2015

**Awardees**

- Dr. Claudio FIANDRINO, Post-Doc Researcher
- Dra. Amanda GARCÍA-GARCÍA, Research Engineer

**Funded by**

Spanish Ministry of Economy, Industry and Competitiveness (MINECO), National Programme for the Promotion of Talent and Its Employability, part of the National Plan for Scientific and Technical Research and Innovation 2013-2016

## Grants for training university teachers – FPU

*(Ayudas para la Formación del Profesorado Universitario)*

**Awardees**

- Edgar ARRIBAS, PhD Student
- Dolores GARCÍA, PhD Student
- Joan PALACIOS BELTRÁN, PhD Student

**Funded by**

Spanish Ministry of Education, Culture and Sports *(Ministerio de Educación, Cultura, y Deporte - MECD)*

### 4.1.3 Regional

## Industrial PhDs 2017

*Grants aimed to the execution of Industrial PhDs within the Autonomous Region of Madrid (2017)*

**Awardees**

- Scientist in charge: Dr. José Félix KUKIELKA, Research Associate Professor, IMDEA Networks Institute
- Industry partner: Telcaria Ideas S.L.
- Industrial PhD student: Jose María ROLDÁN GIL

**Funded by**

Department of Education and Research, Regional Government of Madrid *(Consejería de Educación e Investigación de la Comunidad de Madrid)*

## Youth Employment Initiative (YEI) (2017-2019)

*Grants for the recruitment of research assistants and laboratory technicians co-financed at 91.89% by the European Social Fund through the Youth Employment Operational Program and the Youth Employment Initiative (YEI), 2016*

**Awardee**

- Víctor SÁNCHEZ AGÜERO, PhD Student

**Supervisor**

- Dr. Jose Félix KUKIELKA, Research Associate Professor

**Funded by**

European Social Fund (Youth Employment Initiative), Department of Education, Youth and Sports, Regional Government of Madrid

## Attraction of research talent – Chairs of Excellence Programme (2017-2018)

*Grants designed to attract research talent for its incorporation into research groups within the Madrid Region. Modality 3.A: Chairs of Excellence Programme*

**Awardee**

- Dr. Ioannis STAVRAKAKIS, Visiting Professor

**Funded by**

Department of Education, Youth and Sports, Regional Government of Madrid

### 4.1.4 Other

## La Caixa scholarships for doctorates at Spanish universities and research centres (2016)

**Awardee**

- Ander GALISTEO, PhD Student

**Funded by**

Fundación “la Caixa” (Fundación Caja de Ahorros y Pensiones de Barcelona)

Obra Social
Fundación "la Caixa"

# MIT-SPAIN – "la Caixa" Foundation SEED FUND

**Awardees**

- Dr. Antonio FERNÁNDEZ ANTA, Research Professor, IMDEA Networks Institute
- Dr. Iyad RAHWAN, Associate Professor of Media Arts & Sciences, MIT Media Lab

**Funded by**

MISTI Global Seed Funds

**Project Title**

MyBubble: Influence of Algorithms in Users Filter Bubbles

## 4.2 Externally-funded research projects, attracting European Union, National or Regional funds

Externally funded research projects enable us to collaborate with researchers from other organizations and backgrounds. Research funding is awarded following an open competitive selection process in which project proposals, and the private or public sector organizations presenting them, are subject to rigorous scrutiny. Such thoroughness helps to ensure that research undertaken with those funds is relevant, well managed and with high probabilities of success in achieving its stated goals.

### 4.2.1. Ongoing projects

# MYP-SOCRATES

Funded by: NATO Emerging Security Challenges Division – Science for Peace and Security Programme (SPS). Grant G5461.

Duration: June 2018 to June 2021

Project partners: IMDEA Networks Institute, Electrosense, Katholieke Universiteit Leuven

Create the foundations for an accurate, autonomous, fast and secure system that identifies intruders in the electromagnetic space, before the threat can become serious, learning about its physical layer features and its geographic location.

# 5G-EVE

Funded by: European Union. H2020-ICT-2018-1
Duration: July 2017 to June 2021
Project partners: Telecom Italia S.p.a, Orange, Orange Romania SA, Orange Polska Spolka Akcyjna, Telefónica I+D, Hellenic telecommunications organization S.A., Ericsson España S.A., Ericsson Hellas S.A., Ericsson telecomunicazioni, Nokia Bell Labs France, Nokia Spain S.A., Nokia Liseis Kaidiktia Ellas Anonimi Etaireia, WINGS ICT Solutions, b-com France, Nextworks, Comune di Torino, Automatismos y Sistemas de Transporte Interno S.A., Trenitalia Spa, Ares2T, Telcaria Ideas S.L., Idc italia srl, Eurescom-European Institute for Research and Strategic Studies in Telecommunications, Associazione PIIU, EURECOM, Universidad Carlos III de Madrid, IMDEA Networks Institute, Consorzio Nai-zonale Interuniversitario per le Telecomunicazioni, Sociedad Mercantil Estatal para la gestión de la innovación y las tecnologías turísticas S.A, Electricite de France

We are at the "eve" of a fundamental transition in 5G, and the aspiration of 5G-EVE is to create the foundations for a pervasive roll-out of end-to-end 5G networks in Europe. It is one of three 5G PPP infrastructure projects started on 1st July 2018, whose goal is to implement and test advanced 5G infrastructures in Europe. The 5G-EVE concept is based on further developing and interconnecting existing European sites in in Greece, Spain, France, and Italy to form a unique 5G end-to-end facility, which will enable experiments with: (a) heterogeneous access, including NR, licensed/unlicensed spectrum, advanced spectrum management; (b) Mobile Edge Computing, backhaul, core/service technologies; (c) means for site interworking and multi-site/domain/technology slicing/orchestration. 5G-EVE will be initially compliant with 3GPP Rel. 15 and, later on, with Rel. 16.

Industrial verticals will be facilitated in the specification/analysis of experiments through: (a) intent-based, and other high level, interfaces; (b) means for advanced 5G testing, i.e., for KPI analysis, technology benchmarking, performance diagnosis. A VNF pool, including open source and proprietary, radio/network/service, components will be developed and made available. 5G-EVE will impact standards, and has the potential and strategy for ensuring the sustainability of the facility beyond the project lifetime, therefore becoming a cornerstone of the 5G PPP programme and beyond.

## Software and Virtualization Techniques for the Improvement of Performance and Scalability in the Integration of SDN and Network Services based on the Cloud in 5G Technologies

Funded by: Grants aimed to the execution of Industrial PhDs within the Autonomous Region of Madrid (2017). Department of Education and Innovation. Regional Government of Madrid
Duration: February 2018 to February 2021
Project partners: IMDEA Networks Institute, Telcaria Idea S.L.

Today's networks have been provisioned statically because of historical reasons, however current and future traffic trends require a dynamic way of providing processing inside the network that can span from mobiles, access networks, core networks and clouds. In this project new incremental dynamic mechanisms are proposed in order to allow that processing be deployed whenever and wherever it is needed. The ideas presented here aims to achieve the following key characteristics that together will help enable dynamic processing in 5G networks: location-independence; time-independence; scale independence and hardware independence. The key is to allow software basic blocks to run and migrate seamlessly in a multitude of locations in the network, with minimum disruption to traffic. However, it is possible that the network will also have a number of "static" basic blocks that cannot be moved and include switching infrastructure, Radio Access Networks, and heterogeneous commodity and proprietary hardware deployment. In such cases, it would be preferable to move higher-level programs than relying on the statically deployed functionality, thus making an efficient use of heterogeneous hardware to achieve high performance.

## Datacenter with High Efficiency

*Optimizing Organization and Scheduling of Datacenter Resources*

Funded by: The National Science Foundation of China (NSFC)
Duration: January 2016 to December 2020
Project partners: Institute of Computing Technology | Chinese Academy of Sciences (ICT), IMDEA Networks Institute, Temple University (USA), Huazhong University of Science and Technology (China), University of California, Riverside (USA)

The number of **data centers** is rapidly growing and their use is increasingly widespread, however, their **efficiency** is very low. Typical resource utilization is about 5% to 25% according to some statistics. In addition, **power consumption** in data centers is extremely

high and inefficient. This inefficiency implies wasting hardware and software resources as well as energy, which may hinder further development and usage of data centers themselves, while being harmful to the environment. This research investigates techniques that improve the efficiency of data centers through resource organization, allocation and scheduling. In particular, multi-objective optimization models and algorithms will be developed to achieve this. The objective of this research is to meet the service demands of datacenters while decreasing their resource consumption.

## SYMBIOSIS

*A Holistic Opto-Acoustic System for Monitoring Marine Biodiversities*

Funded by: European Union. H2020-BLUE GROWTH 2017
Duration: November 2017 to October 2020
Project partners: University of Haifa (Israel), IMDEA Networks Institute, EvoLogics GmbH (Germany), Wireless and More s.r.l. (Italy)

SYMBIOSIS is devised as a blend of cost effective autonomous optical and acoustic components for the characterization, classification, and biomass evaluation of six target species of pelagic fish that are important to the fishery industry, and that reflect on the health of their own environment. The acoustic unit includes an active underwater acoustic array of 15+10 elements, to detect, classify, evaluate the biomass of, and localize the chosen pelagic fish species within a range of 500 m. Acoustics trigger the optical component (encompassing two frames of six underwater optical cameras each), and will perform machine learning-based classification and biomass evaluation in low light conditions, thus validating acoustic detections.

## SMOOTH

*GDPR Compliance Cloud Platform for Micro Enterprises*

Funded by: European Union. H2020 Cibersecurity PPP
Duration: May 2018 to October 2020
Project partners: Eurecat – Technology Centre of Catalonia; Agencia de Protección de Datos; Katholieke Universiteit Leuven; Naver France; NEC Laboratories Europe; Universidad Carlos III de Madrid; IMDEA Networks Institute; Asociación Española de Normalización y Certificación – AENOR; Fundingbox Accelerator Sp z o.o; European Small Business Alliance Of Small and Medium Independent Enterprises – ESBA; Datu Valsts Inspekcija (Data State Inspectorate); Lstech Espana SL

According to the last official available 2015 data, almost 93% of all enterprises in Europe in the non-financial business sector have less than 10 employees. These micro enterprises (MEnts) are responsible for 30% and 21% of the overall employment and value added in the EU, respectively. However, when it refers to the imminent General Data Protection Regulation (GDPR)'s application, MEnts are the most vulnerable due to their lack of expertise and resources to invest in their adoption. It is urgent to develop solutions that assist MEnts in smoothly adopting the GDPR, safeguarding the interests of the EU citizens on data privacy and security, avoiding the negative socioeconomic consequences entailed to breaches for MEnts, and, by extension, benefitting the European society. SMOOTH project addresses this challenge from two complementary focuses:

1) Creating awareness on the importance of being compliant with the GDPR, as many MEnts ignore their obligations in this respect, involving as partners Data Protection Authorities and associations representing EU MEnts. For the same purpose, SMOOTH will deliver a practical GDPR interactive handbook (website and mobile app) tailored specifically to MEnts.

2) Assisting MEnts to effectively adopt and comply with the GDPR. The SMOOTH cloud platform will use machine learning, text and data mining, and advanced online auditing methods to automatically create a bespoke GDPR compliance report for the most critical aspects to MEnts. Likewise, SMOOTH will provide useful materials for solving those identified aspects of the GDPR that are not properly covered.

All this will positively contribute to protect citizens' rights, while avoiding potential fines for the MEnts that may account for as much as 4% of the annual income, according to the GDPR. SMOOTH is born from technology partners and data protection authorities and will be designed and validated by actual MEnts with the aim of becoming the reference tool platform for them to adopt the GDPR.

## MYP-ThreatDetect

*Autonomous Platform for Securing Marine Infrastructures*
*IMDEA Networks Institute is the Project Coordinator*

Funded by: NATO. Science for Peace and Security Programme (SPS)
Duration: May 2017 to May 2020
Project partners: University of Haifa (Israel), IMDEA Networks Institute, University of British Columbia (Canada)

With the increase of marine activity, protecting marine infrastructures from terrorist threats has become a main concern. We propose **to develop and demonstrate a novel prototype for reliable, real-time detection of diver and mines.** Our system combines acoustic remote detection with verification using pattern recognition on underwater imagery. First, we analyse the acoustic reflections to localize a target that fits the pattern of a diver or a submerged mine. Then, in case the release or presence of a mine is suspected, a vehicle is dispatched to first inspect the target through its optical and sonar systems, and then to send the processed information back through underwater acoustic communication.

## DiSCOEdge

Funded by: Spanish Ministry of Science, Innovation and Universities (Ministerio de Ciencia, Innovación y Universidades)
Duration: January 2018 to December 2019
Project partners: IMDEA Networks Institute

An alternative to the highly centralised cloud computing model, fog computing is becoming widespread. This novel paradigm aims to leverage an ecosystem of computing resources distributed all over the communication devices at the edge of the network (e.g., base stations and CPEs), even considering end user devices (e.g. smartphones) and resource-constrained devices (e.g., IoT sensors). As a result, fog-computing aims to complement the existing cloud-computing model by leveraging diverse and richer resources otherwise underused. The DiscoEdge project will study opportunities, technologies, marketing strategies and policies to advance the fog-computing paradigm. We will explore challenges so that end user devices, applications and access network devices can dynamically and securely share and access any computational resource (storage, networking, sensing and computing power) available in their vicinity (e.g., WiFi islands, home network deployments, trusted devices forming a personal or community cloud and even 5G-and-beyond mobile radio networks). In this project we will also explore economic and sociological challenges to guarantee user trust, fairness and security when accessing resources from third-party services. Target scenarios are those in which all

devices are trusted (e.g., family-based cloud) and those in which there may be potential adversaries, free-riders, and malicious agents. Namely, we will analyze the feasibility and effectiveness of incentive-based models and reputation mechanisms to promote user participation and maximize fairness.

## RECAP

*Reliable Capacity Provisioning and Enhanced Remediation for Distributed Cloud Applications*

Project Website: http://recap-project.eu/
Funded by: European Union. ICT Programme H2020
Duration: January 2017 to December 2019
Project partners: Universitaet Ulm, Umea Universitet, Dublin City University, IMDEA Networks Institute, Tieto Sweden Support Services AB, Linknovate Science SL, Intel Research and Development Ireland Limited, Sistemas Avanzados de Tecnología SA (SATEC), British Telecommunications Public Limited Company (BT)

RECAP goes beyond the current state of the art, aiming to develop the next generation of cloud/edge/fog computing capacity provisioning and remediation via targeted research advances in cloud infrastructure optimization, simulation and automation. The project builds on advanced machine learning, optimization and simulation techniques to achieve this. The overarching result of RECAP is the next generation of agile and optimized cloud computing systems, and will pave the way for a radically novel concept in the provision of cloud services, where services are instantiated and provisioned close to the users by self-configurable cloud computing systems.

## MyBubble

*MyBubble: Influence of Algorithms in Users' Filter Bubbles*

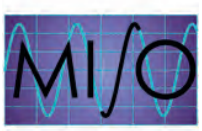
Funded by: MISTI Global Seed Funds | MIT-SPAIN - "la Caixa" Foundation SEED FUND
Duration: January 2018 to August 2019
Projects partners: Massachusetts Institute of Technology - MIT Media Lab, Universidad Carlos III de Madrid, IMDEA Networks Institute

Online services have the capacity of learning the preferences and interests of individual customers based on their online activity. Using this knowledge, the online services can be personalized. This personalization filter is referred to as the filter bubble, and it is built from the actions of the user by algorithms run by the services. However, the algorithms used by the online services are not public and carefully kept private, whilst the filter bubble of users strongly influences the information they access, which has a big impact in society. The goal of the MyBubble project is modeling the influence of algorithms in the users' filter bubble in the online advertising ecosystem. To this end, a methodology developed by researchers of the MyBubble team will be leveraged. This methodology allows creating "personas", "bots" that mimic the browsing patterns of users with specific profiles. The experiments to be run with this methodology will allow to identify existing algorithmic biases, how the personalization modifies the behavior of the online advertising algorithms under different personas, and how the algorithms change the filter bubble when the persona changes its behavior.

## Towards flexible in-network processing of data streams

Funded by: Cisco University Research Program Fund, an advised fund of Silicon Valley Community Foundation
Duration: January 2018 to June 2019

Modern packet processing engines (PPEs) are faced with highly heterogeneous workloads driven by high volumes of end users and application types. A primary design challenge in this context consists in selecting and developing PPEs that scale application performance in a robust and cost-effective way providing the desired flexibility level and high performance. Interrelation among these objectives is non-trivial and definitely involves a certain conflict. In particular, flexibility is a driving objective to introduce new operational behaviors; from the other hand, performance and simplicity are constraining factors that ensure specific requirements.  In this project we show that, adding flexibility to the scheduling module and enhancing classification capabilities will allow not only consideration of user-defined objectives but also implementations of in-network processing of data streams.




## MISO

Project website: https://www.networks.imdea.org/research/projects/miso
Funded by: European Union H2020 project ORCA (IMDEA Networks is a subcontracted entity)
Duration: September 2018 to May 2019

MISO is an extension project of the H2020 project ORCA to develop a mixed hardware-software millimeter-wave experimentation platform based on software-defined radios (SDR). It implements the basic blocks for a single carrier system integrated into the GNU Radio + RFNoC framework, allowing for a step-by-step translation of blocks from software to hardware implementation in future extensions. The flexibility of the system design will be demonstrated by testing the developed blocks on USRP X310 radios as well as the more powerful Vadatech AMC599 providing 2GHz of bandwidth. This allows to extend the basic platform towards a fully IEEE 802.11ad transceiver. This project will provide the research community with a highly flexible open platform for mm-wave experimentation, ensuring that future extensions to the receiver and transmit model can easily translate more blocks to hardware implementation and add further functionality.

## SEARCHLIGHT

*A new communication paradigm for future very high speed*

Project website: https://www.networks.imdea.org/research/projects/searchlight
Funded by: European Union. European Research Council (Consolidator Grant)
Duration: April 2014 to March 2019

SEARCHLIGHT is pursuing a radical rethinking of wireless architectures for highly scalable ultra-dense millimeter-wave networks. To deal with the extremely dynamic radio environments where channels may appear and disappear over very short time intervals, SEARCHLIGHT uses angle information from lower frequency interfaces to rapidly align the directional millimeter-wave antennas. Access points are deployed ubiquitously to provide continuous connectivity even in face of mobility and blockage and the project is designing the corresponding low overhead and scalable network management mechanisms. The architecture integrates a location system and learns a map of the radio environment, which allows to rapidly select the most suitable access point and antenna beam pattern and allocate radio resource using predicted location as context information. Such a design provides key elements for the scalability of future wireless networks.

## SPECTRUMCOP PROGRAM: MONTEBIANCO

*Technologies for Collaborative Detection of Spectrum Anomalies*

Funded by: Armasuisse – Science and Technology
Duration: March 2018 to February 2019
Project partners: Armasuisse – Science and Technology, IMDEA Networks Institute

Large networks to monitor the spectrum present problems of scalability across several dimensions: capability to swiftly detect events with an increasing amount of data to be processed, management of the network, and handling priority access to users that want to enjoy specific services through spectrum sensors. SpecScale will address the scalability problem with an innovative architecture while ensuring secure access for large scale spectrum monitoring.

This project is part of the SPECTRUMCOP PROGRAM, which was launched in March 2016 and is still ongoing.

## LF ASSISTS HF IN BEAM AND MOBILITY

Funded by: Huawei Technologies (China)
Duration: July 2017 to January 2019
Project partners: Huawei Technologies (China), IMDEA Networks Institute

In this collaboration between Huawei Technologies and IMDEA Networks, the project partners explore the potential of using low frequency bands to infer the channel characteristics of high frequency millimeter-wave bands. The inferred channel characteristics can support the network in terms of beam tracking, angle of arrival estimation, and location information. This results in improved performance in the millimeter-wave band since these techniques reduce the control overhead required to operate the network. The project also includes an experimental evaluation to verify that the developed mechanisms and algorithms work not only in theory but also in practical real-world wireless networking environments.

# NOTRE

*Network for sOcial compuTing REsearch*

Project website: http://notre.socialcomputing.eu/
Funded by: European Union. H2020-Twinn 2015
Duration: January 2016 to December 2018
Project partners: Cyprus University of Technology, Foundation for Research and Technology – Hellas, IMDEA Networks Institute, Université de Genève (UNIGE), Heinrich-Heine-Universität Düsseldorf

The vision of NOTRE is to develop a network that will strengthen and enhance the potential of the newly established Social Computing Research Centre (SCRC) at the Cyprus University of Technology (CUT) for stimulating scientific excellence and innovation capacity in the area of social aspects of computing. NOTRE proposes an interdisciplinary approach towards the close network collaboration between SCRC of CUT, a research active university in a low-performing member state, and four internationally leading counterparts specializing in: (a) online social networks and their analysis; (b) entertainment, games, virtual reality and educational technologies; (c) Social Computing for social inclusion; and (d) Social Computing and social change.

SCRC through this proposal does not only aim to access the core research groups of the leading counterparts, and their collaborators, but also recognizes the multidisciplinarity of the field and will try to establish itself as an intermediary between them.

The NOTRE network will follow a series of interlinked activities, such as short term staff exchanges, expert visits and short-term on-site training, workshops, conference attendance, organization of joint summer school type activities, and dissemination and outreach activities. Such activities with world-renowned EU partners (IMDEA Networks; MIRALab of Universite de Geneve; Institute of Computer Science of the Foundation for Research and Technology Hellas -FORTH-ICS; and the Department of Political Science of the University of Dusseldorf - UDUS), will be instrumental for significantly strengthening SCRC's research efforts, enhancing the network's innovation capacity and research profile, and stimulating scientific excellence in the emerging multidisciplinary field of Social Computing. The effective knowledge transfer and sharing through NOTRE will also push for research advancements linked to the Smart Specialization Strategy of Cyprus.

IMDEA Networks participates in NOTRE as a leading institution in the research and study of online social networks.

# BRADE-CM

*BRAin inspired Data Engineering*

Project website: http://www.brade-cm.es/
Funded by: Department of Education and Research of the Regional Government of Madrid, through the 2013 R&D technology program for research groups, co-financed by Structural Funds of the European Union
Duration: October 2014 to December 2018
Project partners: IMDEA Networks Institute, Universidad Carlos III de Madrid, Universidad Complutense de Madrid, Fundación para la investigación Biomédica del Hospital Gregorio Marañón

In recent years there have been multiple examples of bio-inspired systems, which have eased progress in different ICT areas. Some examples are neuronal networks for learning systems or ant algorithms used to trace optimal paths in communication networks. In this context, recent advances in data acquisition techniques about the brain's anatomic-functional organization (for both humans and animals) have allowed the scientific community to start analyzing and understanding the brain's structure and its cognitive and transmission processes. This offers a unique opportunity for the design of novel ICT systems inspired by the brain's structure, as well as by its cognitive and adaptive processes. Recently, some of the main companies in the ICT sector such as IBM, Qualcomm or Intel have launched pioneering projects for the design of brain-inspired ICT systems, which indicates the importance of this research line for the ICT sector.

The current project represents an effort in this research line, which is both characterized by being ground-breaking and multidisciplinary. In particular, the BRADE consortium aims to contribute to it through the development of tools that promote an advance towards the design of computation and information processing systems for large-scale datasets (i.e., Big Data), based on the processing mechanisms used by the brain. In order to achieve this objective, novel experimental techniques, specific instrumentation and sophisticated software will be used in order to extract and process information about the brain's anatomic-functional organization and its cognitive processes. Subsequently, complex networks theory will be applied to the analysis of the processed data in order to elaborate analytical and simulation models of the brain's organizational structure and functional processes. These models will constitute the basis for the study and design of the aforementioned brain-inspired computation and information processing systems. In addition, these models will be a contribution of great interest and with direct application in neuroscience, contributing to expand current knowledge about the brain's organizational structure and cognitive processes.

# TIGRE5-CM

*Tecnologías Integradas de gestión y operación de REd 5G (Integrated technologies for management and operation of 5G networks)*

*IMDEA Networks Institute is the Project Coordinator*

Project website: http://www.tigre5-cm.es/

Funded by: Department of Education and Research of the Regional Government of Madrid, through the 2013 R&D technology program for research groups, co-financed by Structural Funds of the European Union

Duration: October 2014 to December 2018

Project Partners: IMDEA Networks Institute, Universidad Carlos III de Madrid, Universidad de Alcalá

The aim of the TIGRE5-CM project is **to design an architecture for future generation mobile networks, based on the SDN (Software Defined Networking) paradigm,** which simplifies the deployment, configuration and management of the network while integrating the latest technologies, both in the access network (reaching the end-user's terminal) and in the core network.

Having first identified the requirements of mobile network operators (basically lower operating costs, higher performance, flexibility, resiliency and network interoperability), the TIGRE5-CM project aims to tackle these issues through a **combination of the state of the art in wireless technologies with the SDN paradigm.** The technical and scientific challenges to be addressed are various and multidisciplinary, and they include: wireless networks, switched and data transportation networks, and next-generation optical network technologies. In order to better meet these demands, the project team is composed of four research groups with complementary knowledge of the technologies needed to complete the project.

The objectives addressed by TIGRE5-CM are firstly, the design of an SDN network controller, including its interfaces, for 5G networks; second, the design of mechanisms for the monitoring, supervision, and protection of the control network; third, the development of mechanisms to optimize network resource efficiency, based on traffic measurement and predictions of traffic demand; fourth, the development of advanced switching and transportation technologies based on generic multilayer Ethernet switches and on "all optical" transport networks with quality of service support; finally, the flexibility and controllability of the user terminal by the network.

This will result in **a high performance integrated architecture,** with a control plane and a data plane that support a flexible, high performing network, at moderate cost, which is also configurable and programmable, robust and interoperable, and preferably built from open source hardware and software.

# Cloud4BigData

*Efficient Cloud and BigData Infrastructure*

Project website: http://lsd1.ls.fi.upm.es/cloud4bigdata/
Funded by: Department of Education and Research of the Regional Government of Madrid, through the 2013 R&D technology program for research groups, co-financed by Structural Funds of the European Union
Duration: October 2014 to December 2018
Project Partners: IMDEA Networks Institute, Universidad Politécnica de Madrid (UPM), Universidad Rey Juan Carlos

Big Data is an emerging paradigm for large scale distributed data management that aims at being able to process large amounts of data beyond the possibilities of traditional database technologies. Big Data leverages cloud computing to attain a highly scalable infrastructure for both computing and storage. The Cloud4BigData project will enhance Big Data technologies and also their underlying cloud infrastructure to attain high levels of efficiency, flexibility, scalability, high availability, QoS, ease of use, security and privacy.

Big Data is already attaining good results with batch analytical processing technologies such as MapReduce, but it has important gaps. The most important issue is the lack of support for other data management needs, namely, Online Transactional Processing (OLTP), Online Analytical Processing (OLAP) and Complex Event Processing (CEP). In Cloud4BigData, we aim at providing full Big Data support for OLTP, OLAP and CEP. This implies overcoming important challenges such as scaling transactional processing, analytical query processing and complex event processing as well as the integration of these technologies in a single unified platform. What is more, many Big Data applications require the use of a combination of cloud Big Data technologies specialized for different purposes such as graph databases, key-value data stores, document-oriented databases, SQL databases, in-memory databases, column-oriented data stores, CEP, etc. Cloud4BigData aims at providing holistic support to ease the development of Big Data applications on top on diverse cloud Big Data stores.

# TEAM

*Technologies for information and communications, Europe – east Asia Mobilities*
*IMDEA Networks Institute is an Associated Partner in this project*

Project website: http://www.team-mundus.eu/
Funded by: European Union – ERASMUS Mundus Programme
Duration: July 2014 to July 2018
Project partners: Aalto-Korkeakoulusaatio, Chungnam National University, Eotvos Lorand Tudomanyegyetem, Gwangju Institute of Science and Technology, Keio University, Korea Advanced Institute of Science and Technology, Nara Institute of Science and Technology, Technische Universität Berlin (TUB), Universidad Carlos III de Madrid, Universita Degli Studi Di Trento, The University of Tokyo - Graduate School of Information Science and Technology

Associated partners: Centre National de la Recherche Scientifique, Fraunhofer-Gesellschaft Zur Foerderung Der Angewandten Forschung E. V., IMDEA Networks Institute, Institut National de Recherche en Informatique et en Automatique, Inter-University Research Institute Corporation Research Organization of Information and Systems, Korea Institute of Science and Technology Information, National Institute of Information and Communications Technology, Netvision Telecom, Technicolor R&D, Teknologian Tutkimuskeskus VTT, Virtual I Tech Inc.

The objective of the International Cooperation between East Asia and Europe, "Technologies for Information and Communication, Europe – East Asia Mobilites (TEAM)", coordinated by Université Pierre et Marie Curie (France), is to promote institutional cooperation and mobility activities between European and East Asian Higher Education Institutions (HEIs).

The TEAM partnership brings together world class institutions with complementary experiences and knowledge in Information and Communication Technologies (ICT) with the common goal of creating a network of excellence in ICT between Europe, Japan and Republic of Korea, as well as to innovate in doctoral training. Through academic cooperation and exchanges, the partnership endeavors to work together as a team to develop new and innovative technologies, to enhance career prospects of young researchers and competitiveness of researchers, to promote intercultural understanding and to increase the attractiveness of European higher education.

ICT is an ever developing field of research and innovation and a key factor for economic growth. Therefore, strong expectations are placed on research and innovation in ICT to deliver solutions for societal challenges, ensuring our future. Nevertheless, the participating countries, all leaders in ICT, recognize a present and upcoming deficit of skilled and internationally oriented young talents for academia and industry. This Erasmus Mundus project will create the TEAM community of individuals and partners of higher education, research and industry, capable of adapting and working as an international TEAM. Thus, it will enjoy an undeniable advantage in today's rapidly changing world.

## MONROE

*Measuring Mobile Broadband Networks in Europe*

Project website: https://www.monroe-project.eu/
Funded by: European Union. ICT Programme H2020
Duration: March 2015 to July 2018
Project partners: Simula Research Laboratory AS, IMDEA Networks Institute, Karlstads Universitet (KAU), Politecnico di Torino (PoliTO), Celerway Communication AS, Telenor ASA, Nextworks

There is a strong need for objective data about stability and performance of Mobile Broadband (MBB) networks, and for tools to rigorously and scientifically assess their performance. In particular, it is important to measure and understand the quality as experienced by the end user. Such information is very valuable for many parties including operators, regulators and policy makers, consumers and society at large, businesses whose services depend on MBB networks, researchers and innovators.

MONROE proposes to design, build and operate an open, European-scale, and flexible platform with multi-homing capabilities to run experiments on operational 3G/4G Mobile Broadband networks. One of the main objectives of MONROE is to use the platform for the identification of key MBB performance parameters, thus enabling accurate, realistic and meaningful monitoring and assessment of the performance of MBB networks. MONROE also provides Wi-Fi connectivity mimicking multi-homing in smartphones with both MBB and Wi-Fi interfaces, to allow experimenting on different access technologies as well as explore new ways of combining them to increase performance and robustness.

The users of the platform are in the core of the MONROE project. First, following FIRE*'s philosophy, MONROE offers a user-oriented closed-loop system design in which the experimental platform is open to external users, and where users are incorporated early on in the experimental design process. Second, MONROE will provide Experiments as a Service (EaaS), thus lowering the barrier for using the platform to external experimenters and users, by providing well-documented tools and adjustable, flexible, high-level scripts to execute experiments, collect results, and analyze data.

Interoperability with existing FIRE and FP7 measurement platforms, jointly with the MONROE's effort to develop business and funding models, will guarantee sustainability and usefulness of the platform.

** **FIRE (Future Internet Research and Experimentation)** was an initiative within the Seventh Framework Programme of the European Union (FP7) (see http://www.ict-fire.eu/home/the-fire-landscape.html). FIRE projects were aimed to develop an experimental platform to be directly used by third parties (i.e. not only by project participants). In H2020 FIRE+ has been introduced to build upon the previous FIRE initiative. MONROE is a FIRE+ project.*

# ReCRED

*From Real-world Identities to Privacy-preserving and Attribute-based CREDentials for Device-centric Access Control*

*IMDEA Networks Institute participates as a third party of Universidad Carlos III de Madrid*

Project website: http://www.recred.eu/
Funded by: European Union. ICT Programme H2020
Duration: May 2015 to April 2018
Project partners: Consorzio Nazionale Interuniversitario per le Telecommunicazioni, Studio Professionale Associato a Baker & McKenzie, IMDEA Networks Institute, University of Piraeus Research Center, Telefónica I+D, Verizon Nederland B.V., certSIGN S.A., Wedia Limited, Exus Software Ltd., Upcom BvBa, De Productizers B.V., Cyprus University of Technology, Universidad Carlos III de Madrid

ReCRED's ultimate goal is to promote the user's personal mobile device to the role of a unified authentication and authorization proxy towards the digital world. ReCRED adopts an incrementally deployable strategy in two complementary directions: extensibility in the type and nature of supported stakeholders and services (from local access control to online service access), as well as flexibility and extensibility in the set of supported authentication and access control techniques; from widely established and traditional ones to emerging authentication and authorization protocols as well as cryptographically advanced attribute-based access control approaches.

Simplicity, usability, and users privacy is accomplished by: (i) hiding inside the device all the complexity involved in the aggregation and management of multiple digital identifiers and access control attribute credentials, as well as the relevant interaction with the network infrastructure and with identity consolidation services; (ii) integrating in the device support for widespread identity management standards and their necessary extensions; and (iii) controlling the exposure of user credentials to third party service providers.

ReCRED addresses key security and privacy issues such as resilience to device loss, theft and impersonation, via a combination of: (i) local user-to-device and remote device-to-service secure authentication mechanisms; (ii) multi-factor authentication mechanisms based on behavioral and physiological user signatures not bound to the device; (iii) usable identity management and privacy awareness tools; (iv) usable tools that offer the ability for complex reasoning of authorization policies through advanced learning techniques. ReCRED's viability will be assessed via four large-scale realistic pilots in real-world operational environments. The pilots will demonstrate the integration of the developed components and their suitability for end-users, so as to show their TRL7 readiness.

# scientific activities

5.1. Awards [48]

5.2. Publications [52]

5.3. Scientific service [69]

5.4. Outreach [77]

Major events [77]

5.5. Workshops, seminars & lectures [80]

5.6. Local Scientific Partnership [84]

IMDEA Networks Institute monitors and evaluates its scientific results in order to obtain a sound appraisal of the degree of fulfillment of its strategy and objectives, optimizing the management of its resources and maximizing its impact. The pursuit of excellence is at the core of all of our activities.

## 5.1. Awards

### 5.1.1. Paper Awards

**DISTINGUISHED PAPER AWARD**

**Platon Kotzias, Abbas Razaghpanah, Johanna Amann, Kenneth G. Paterson, Narseo Vallina-Rodriguez, Juan Caballero**

*Coming of Age: A Longitudinal Study of TLS Deployment* **(October 2018)**

In: The 18th ACM Internet Measurement Conference (IMC 2018), 31 October - 2 November 2018, Boston, MA, USA

**BEST DEMO AWARD**

**Joan Palacios, Daniel Steinmetzer, Adrian Loch, Joerg Widmer, Matthias Hollick**

*Demo: Channel Estimation and Custom Beamforming on the 60 GHz TP-Link Talon AD7200 Router* **(November 2018)**

In: The 12th ACM International Workshop on Wireless Network Testbeds, Experimental evaluation & CHaracterization (ACM WiNTECH 2018), in conjunction with MobiCom 2018, 2 November 2018, New Delhi, India

**BEST PAPER AWARD**

**Carlos Andrés Ramiro, Claudio Fiandrino, Alejandro Blanco, Pablo Jimenez Mateo, Norbert Ludant, Joerg Widmer**

*openLEON: An End-to-End Emulator from the Edge Data Center to the Mobile Users* **(November 2018)**

In: The 12th ACM International Workshop on Wireless Network Testbeds, Experimental evaluation & CHaracterization (ACM WiNTECH 2018), in conjunction with MobiCom 2018, 2 November 2018, New Delhi, India

**COMMUNITY CONTRIBUTION AWARD (DOMAIN RANKS)**

**Quirin Scheitle, Oliver Hohlfeld, Julien Gamba, Jonas Jelten, Torsten Zimmermann, Stephen Strowes, Narseo Vallina-Rodriguez**

*A Long Way to the Top: Significance, Structure, and Stability of Internet Top Lists* **(October 2018)**

In: The 18th ACM Internet Measurement Conference (IMC 2018), 31 October - 2 November 2018, Boston, MA, USA

**THIRD BEST STUDENT PAPER AWARD**

**Álvaro Feal**

*Third best student paper award "Study on privacy of parental control applications"* **(June 2018)**

In: IV Jornadas Nacionales de Investigación en Ciberseguridad (JNIC 2018), 13-15 June 2018, Donostia, San Sebastián, Spain

awards

**BEST-IN-SESSION PRESENTATION AWARD**

**Paolo Castagno, Vincenzo Mancuso, Matteo Sereno, Marco Ajmone Marsan**

*A Simple Model of MTC in Smart Factories*

**(April 2018)**

In: The 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA

**BEST-IN-SESSION PRESENTATION AWARD**

**Joan Palacios, Guillermo Bielsa, Paolo Casari, Joerg Widmer**

*Communication-Driven Localization and Mapping for Millimeter Wave Networks*

**(April 2018)**

In: The 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA

### 5.1.2. Researcher Awards

**IEEE EDUCATION SOCIETY SPANISH CHAPTER (CESEI) 2014-2017 AWARD**

**José A. Ruipérez-Valiente (December 2018)**

Award granted by the Spanish Chapter of the IEEE Education Society (CESEI) to the Best Doctoral Thesis in 2017 related to research or technological applications in the field of education, focused on the disciplines covered by the IEEE.

*Analyzing the Behavior of Students Regarding Learning Activities, Badges, and Academic Dishonesty in MOOC Environments*

PhD thesis, Department of Telematics Engineering, Universidad Carlos III de Madrid, Spain

Supervisors: Pedro J. Muñoz-Merino, Universidad Carlos III de Madrid, Spain

### OUTSTANDING DOCTORAL THESIS AWARD UNIVERSITY CARLOS III OF MADRID – ACADEMIC YEAR 2017/2018 I PH.D. PROGRAM IN TELEMATIC ENGINEERING

**José A. Ruipérez-Valiente (December 2018)**

*Analyzing the Behavior of Students Regarding Learning Activities, Badges, and Academic Dishonesty in MOOC Environments*

PhD thesis, Department of Telematics Engineering, Universidad Carlos III de Madrid, Spain

Supervisors: Pedro J. Muñoz-Merino, Universidad Carlos III de Madrid, Spain

### OUTSTANDING DOCTORAL THESIS AWARD UNIVERSITY CARLOS III OF MADRID – ACADEMIC YEAR 2017/2018 I PH.D. PROGRAM IN TELEMATIC ENGINEERING

**Nicola Bui (December 2018)**

*Prediction-Based Techniques for the Optimization of Mobile Networks*

PhD thesis, Department of Telematic Engineering, Universidad Carlos III de Madrid, Spain

Supervisors: Joerg Widmer, IMDEA Networks Institute, Madrid, Spain

### MEMBERSHIP OF THE ACADEMIA EUROPAEA

**Arturo Azcorra (September 2018)**

Founded in 1988, the Academy of Europe is the only pan-European academy encompassing all branches of knowledge. It is composed of eminent scientists and scholars working towards the advancement and propagation of excellence in scholarship and education for the public benefit. This appointment recognizes Azcorra's role as one of the world leaders in the research and development of the advanced solutions and systems leading to the 5G revolution

### EMADRID 2018 AWARD

**José A. Ruipérez-Valiente (July 2018)**

*Award granted to the best doctoral thesis related to research or development on educational technologies*

Analyzing the Behavior of Students Regarding Learning Activities, Badges, and Academic Dishonesty in MOOC Environments

PhD thesis, Department of Telematics Engineering, Universidad Carlos III de Madrid, Spain

Supervisors: Pedro J. Muñoz-Merino, Universidad Carlos III de Madrid, Spain

### COIT/AEIT AWARD TO THE BEST DOCTORAL THESIS 2018

**José A. Ruipérez-Valiente (June 2018)**

Fundación Telefónica Award to the Best Doctoral Thesis in Technology and Education

*Analyzing the Behavior of Students Regarding Learning Activities, Badges, and Academic Dishonesty in MOOC Environments*

PhD thesis, Department of Telematics Engineering, Universidad Carlos III de Madrid, Spain

Supervisors: Pedro J. Muñoz-Merino, Universidad Carlos III de Madrid, Spain

### EXCELLENCE AWARD 2018 – UNIVERSIDAD CARLOS III DE MADRID (10TH EDITION). MODALITY: ALUMNI

**José A. Ruipérez-Valiente (May 2018)**

*Communication-Driven Localization and Mapping for Millimeter Wave Networks* **(April 2018)**

Excellence Award 2018, Modality: Alumni, Category: candidates who have graduated less than 5 years ago from University Carlos III of Madrid

Prize awarded by the Social Council of University Carlos III of Madrid. The prize is sponsored by the said Council, Banco Santander and the Airbus Group

### 2018 RESEARCH AWARDS – SPANISH COMPUTER SCIENCE ASSOCIATION (SCIE) – BBVA FOUNDATION

**José A. Ruipérez-Valiente (May 2018)**

"Premios de Investigación Sociedad Científica Informática de España (SCIE) – Fundación BBVA 2018"

Category: Young computing researchers

Prize awarded for contributions to artificial intelligence in online learning

## 5.1.3. R&D Awards

### SPANISH NATIONAL ASSOCIATION OF TELECOM ENGINEERS' (AEIT) AWARD FOR INNOVATION (MAY 2018)

AEIT's 2018 Award for Innovation was granted to IMDEA Networks in recognition of the Institute's work in the telecommunications sector and for its successes in the field of telematics

II Noche de las Telecomunicaciones de Madrid, Palacio de las Alhajas, Madrid, Spain

## 5.2. Publications

IMDEA Networks presented its scientific work in various formats and venues during 2018. There were **139** publications, out of which **117** were peer reviewed. This is how they are structured:

1 Book | 1 Book Chapter | 38 Journal Articles | 4 Magazine Articles | 64 Conference and Workshop Papers | 9 Conference and Workshop Posters & Demos | 22 Invited Papers, Keynotes, Invited Talks, Tutorials, Lectures, etc.

As well as the previous there were:

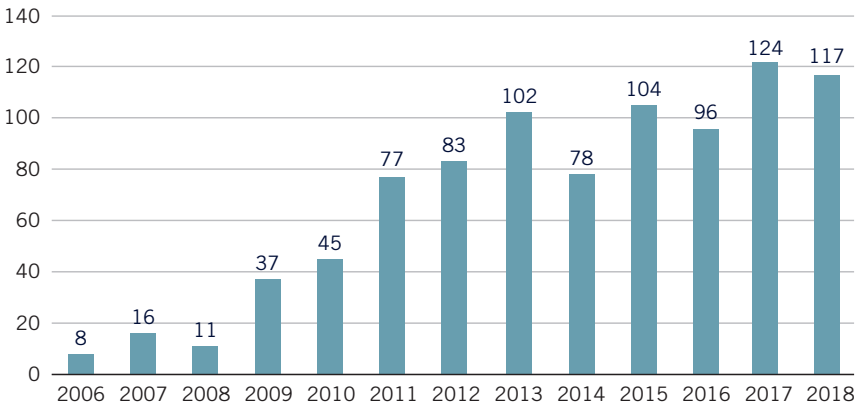
3 PhD Theses

According to **Google Scholar**, IMDEA Networks' researchers have received around **68405 citations in total** along their research career, which corresponds to an **aggregated H-index of 114**.

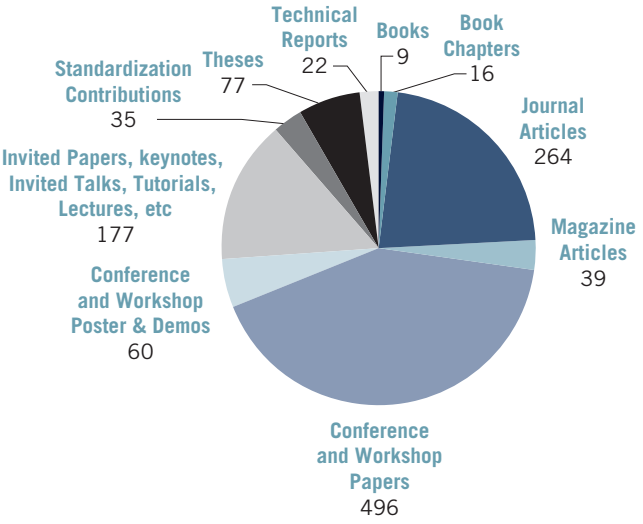
# publications

# 2006-2018

## number of publications (peer-reviewed)

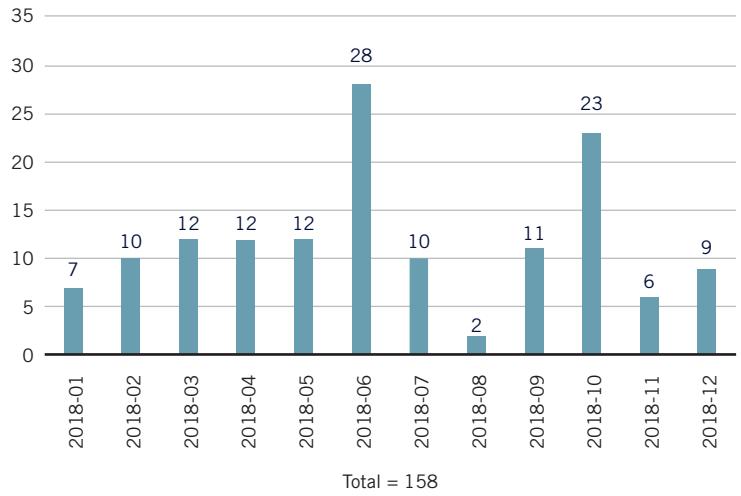



## all publications by type

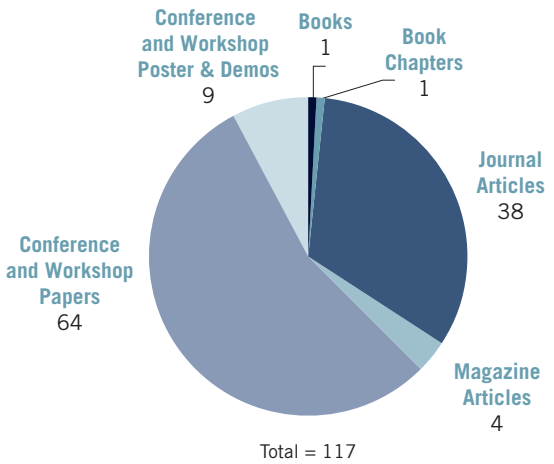


# 2018

## total number of publications per month




## publications by type (peer reviewed)



## Publications 2018

### Books [1]

1. **Ebad Banissi, - et al., Antonio Fernández Anta (Ed.) Ebad Banissi, - et al. (July 2018)**
*Proceedings of the 22nd International Conference Information Visualization, IV 2018, Fisciano, Italy, July 10-13, 2018*
IEEE Computer Society. ISBN 978-1-5386-7202-0.

### Book Chapters [1]

2. **Anna Tzanakaki, Markos Anastasopoulos, Nathan Gomes, Philippos Assimakopoulos, Josep M. Fàbrega, Michela Svaluto Moreolo, Laia Nadal, Jesús Gutiérrez, Vladica Sark, Eckhard Grass, Daniel Camps-Mur, Antonio De la Oliva, Nuria Molner, Xavier Costa-Perez, Josep Mangues-Bafalluy, Ali Yaver, Paris Flegkas, Nikos Makris, Korakis Korakis, Dimitra Simeonidou (Ed.) Patrick Marsch, Ömer Bulakci, Olav Queseth, Mauro Boldi (June 2018)**
*Transport Network Architecture*
In: 5G System Design: Architectural and Functional Considerations and Long Term Research. Wiley, 151-178. ISBN 978-1-119-42512-0.

### Journal Articles [38]

1. **Roderick Fanou, Victor Sanchez-Aguero, Francisco Valera, Michuki Mwangi, Jane Coffin (December 2018)**
*A System for Profiling the IXPs in a Region and Monitoring their Growth: Spotlight at the Internet Frontier*
International Journal of Network Management. John Wiley & Sons, Ltd. ISSN 1099-1190.

2. **Iñaki Ucar, Edzer Pebesma, Arturo Azcorra (December 2018)**
*Measurement Errors in R*
The R Journal. The R Foundation. ISSN 2073-4859.

3. **Yonas Mitike Kassa, Rubén Cuevas, Ángel Cuevas (December 2018)**
*A Large-Scale Analysis of Facebook's User-Base and User Engagement Growth*
IEEE Access. 6. pp. 78881-78891. IEEE. ISSN 2169-3536.

4. **Dario Bega, Albert Banchs, Marco Gramaglia, Xavier Costa-Perez, Peter Rost (December 2018)**
*CARES: Computation-aware Scheduling in Virtualized Radio Access Networks*
IEEE Transactions on Wireless Communications. 17 (12). pp. 7993-8006. IEEE. ISSN 1536-1276.

5. **Jiaxiao Zheng, Pablo Caballero Garcés, Gustavo de Veciana, Seung Jun Baek, Albert Banchs (December 2018)**
*Statistical Multiplexing and Traffic Shaping Games for Network Slicing*
IEEE/ACM Transactions on Networking. 26 (6). pp. 2528 -2541. Co-sponsored by the IEEE Communications Society, the IEEE Computer Society, and the ACM with its Special Interest Group on Data Communications (SIGCOMM). ISSN 1063-6692.

6. **Paolo Casari, Saiful Azad, Marco Zanforlin, Michele Zorzi (December 2018)**
*Underwater Delay-Tolerant Routing via Probabilistic Spraying*
IEEE Access. 6. pp. 77767-77784. IEEE. ISSN 2169-3536.

7. **Mattia Tomasoni, Andrea Capponi, Claudio Fiandrino, Dzmitry Kliazovich, Fabrizio Granelli, Pascal Bouvry (December 2018)**
*Why energy matters? Profiling energy consumption of mobile crowdsensing data collection frameworks*
Pervasive and Mobile Computing. 51. pp. 193-208. Elsevier. ISSN 1574-1192.

8. **Borja Nogales, Victor Sanchez-Aguero, Iván Vidal, Francisco Valera (November 2018)**
*Adaptable and Automated Small UAV Deployments via Virtualization*
MDPI Sensors. 18 (12). MDPI AG, Basel, Switzerland. ISSN 1424-8220.

9. **Francesco Gringoli, Pablo Serrano, Iñaki Ucar, Nicolò Facchi, Arturo Azcorra (October 2018)**
*Experimental QoE evaluation of multicast video delivery over IEEE 802.11aa WLANs (Accepted for publication)*
IEEE Transactions on Mobile Computing. IEEE Communications Society. ISSN 1536-1233.

10. **Iván Vidal, Paolo Bellavista, Victor Sanchez-Aguero, Jaime José García-Reinoso, Francisco Valera, Borja Nogales, Arturo Azcorra (October 2018)**
*Enabling Multi-Mission Interoperable UAS Using Data-Centric Communications*
MDPI Sensors. 18 (10). MDPI AG, Basel, Switzerland. ISSN 1424-8220.

11. **Guillermo Bielsa, Adrian Loch, Irene Tejado, Thomas Nitsche, Joerg Widmer (October 2018)**
*60 GHz Networking: Mobility, Beamforming, and Frame Level Operation from Theory to Practice (Accepted for publication)*
IEEE Transactions on Mobile Computing. IEEE Communications Society. ISSN 1536-1233.

12. **Vasileios Dragonas, Konstantinos Oikonomou, Konstantinos Giannakis, Ioannis Stavrakakis (October 2018)**
*A Disjoint Frame Topology-Independent TDMA MAC Policy for Safety Applications in Vehicular Networks (Accepted for publication)*
Ad Hoc Networks. 79. pp. 43-52. Elsevier. ISSN 1570-8705.

13. **Vincenzo Sciancalepore, Ilario Filippini, Vincenzo Mancuso, Antonio Capone, Albert Banchs (October 2018)**
*A Multi-Traffic Inter-Cell Interference Coordination Scheme in Dense Cellular Networks*
IEEE/ACM Transactions on Networking. 26 (5). pp. 2361-2375. Co-sponsored by the IEEE Communications Society, the IEEE Computer Society, and the ACM with its Special Interest Group on Data Communications (SIGCOMM). ISSN 1063-6692.

14. **Patrick Eugster, Alex Kesselman, Kirill Kogan, Sergey Nikolenko, Alexander Sirotkin (October 2018)**
*Admission Control in Shared Memory Switches*
Journal of Scheduling. 21 (5). pp. 533-543. Springer US. ISSN 1094-6136.

15. **Marco Ajmone Marsan, Giuseppe Bianchi, Nicola Blefari Melazzi (October 2018)**
*Living and Fluid Networks: The way ahead?*
Computer Communications. 131. pp. 46-50. Elsevier. ISSN 0140-3664.

16. **Pablo Caballero Garcés, Albert Banchs, Gustavo de Veciana, Xavier Costa-Perez, Arturo Azcorra (October 2018)**
*Network Slicing for Guaranteed Rate Services: Admission Control and Resource Allocation Games*
IEEE Transactions on Wireless Communications. 17 (10). pp. 6419-6432. IEEE. ISSN 1536-1276.

17. **Filippo Campagnaro, Paolo Casari, Michele Zorzi, Roee Diamant (October 2018)**
*Optimal Transmission Scheduling in Small Multimodal Underwater Networks*
IEEE Wireless Communications Letters. IEEE Communications Society. ISSN 2162-2337.

**18. Ali Safari Khatouni, Marco Ajmone Marsan, Marco Melia, Reza Rejaie (September 2018)**
*Deadline-constrained content upload from multihomed devices: Formulations and algorithms*
Computer Networks. 142. pp. 76-92. Elsevier. ISSN 1389-1286.

**19. Gianluca Rizzo, Vincenzo Mancuso, Shahzad Ali, Marco Ajmone Marsan (September 2018)**
*Stop and forward: Opportunistic local information sharing under walking mobility*
Ad Hoc Networks. 78. pp. 54-72. Elsevier. ISSN 1570-8705.

**20. Nicola Bui, Foivos Michelinakis, Joerg Widmer (July 2018)**
*Fine-grained LTE Radio Link Estimation for Mobile Phones*
Pervasive and Mobile Computing. Elsevier. ISSN 1574-1192.

**21. David García, Yonas Mitike Kassa, Ángel Cuevas, Manuel Cebrian, Esteban Moro, Rahwan Iyad, Rubén Cuevas (June 2018)**
*Analyzing gender inequality through large-scale Facebook advertising data*
Proceedings of the National Academy of Sciences (PNAS). National Academy of Sciences. ISSN 0027-8424.

**22. Antonio Fernández Anta, Chryssis Georgiou, Kishori Konwar, Nicolas Nicolaou (June 2018)**
*Formalizing and Implementing Distributed Ledger Objects*
ACM SIGACT News. 49 (2). pp. 58-76. ACM New York, NY, USA. ISSN 0163-5700.

**23. Georgios Tsoumanis, Konstantinos Oikonomou, Sonia Aïssa, Ioannis Stavrakakis (June 2018)**
*A Recharging Distance Analysis for Wireless Sensor Networks*
Ad Hoc Networks. 75-76. pp. 80-86. Elsevier. ISSN 1570-8705.

**24. Sreeraj Rajendran, Wannes Meert, Domenico Giustiniano, Vincent Lenders, Sofie Pollin (May 2018)**
*Deep Learning Models for Wireless Signal Classification with Distributed Low-Cost Spectrum Sensors*
IEEE Transactions on Cognitive Communications and Networking. IEEE. ISSN 2332-7731.

**25. Arturo Azcorra, Luis F. Chiroque, Rubén Cuevas, Antonio Fernández Anta, Henry Laniado, Rosa Elvira Lillo, Juan Romo, Carlo Sguera (May 2018)**
*Unsupervised Scalable Statistical Method for Identifying Influential Users in Online Social Networks*
Scientific Reports. 8 (6955). Springer Nature. ISSN 2045-2322.

**26. Tobias Rueckelt, Ioannis Stavrakakis, Tobias Meuser, Imane Horiya Brahmi, Doreen Böhnstedt, Ralf Steinmetz (April 2018)**
*Data Transmission Plan Adaptation Complementing Strategic Time-Network Selection for Connected Vehicles*
Ad Hoc Networks. Elsevier. ISSN 1570-8705.

**27. Víctor Sánchez-Agüero, Borja Nogales, Francisco Valera, Iván Vidal (March 2018)**
*Investigating the deployability of VoIP services over wireless interconnected micro aerial vehicles*
Internet Technology Letters. 1 (5). John Wiley & Sons, Ltd. ISSN 2476-1508.

**28. Nicola Bui, Joerg Widmer (March 2018)**
*Data-driven Evaluation of Anticipatory Networking in LTE Networks (Accepted for publication)*
IEEE Transactions on Mobile Computing. IEEE Communications Society. ISSN 1536-1233.

29. **Roee Diamant, Paolo Casari, Filippo Campagnaro, Oleksiy Kebkal, Veronika Kebkal, Michele Zorzi (March 2018)**
*Fair and Throughput-Optimal Routing in Multimodal Underwater Networks*
IEEE Transactions on Wireless Communications. 17 (3). pp. 1738-1754. IEEE. ISSN 1536-1276.

30. **Ana Paula Couto da Silva, Daniela Renga, Michela Meo, Marco Ajmone Marsan (March 2018)**
*The Impact of Quantization on the Design of Solar Power Systems for Cellular Base Stations*
IEEE Transaction on Green Communications and Networking. 2 (1). pp. 260-274. IEEE. ISSN 2473-2400.

31. **Pablo Serrano, Marco Gramaglia, Dario Bega, David Gutierrez-Estevez, Ginés García, Albert Banchs (March 2018)**
*The path towards a cloud-aware mobile network protocol stack (Accepted for publication)*
Transactions on Emerging Telecommunications Technologies. John Wiley & Sons, Ltd. ISSN 2161-3915.

32. **Alessandro Nordio, Alberto Tarable, Emilio Leonardi, Marco Ajmone Marsan (February 2018)**
*Selecting the top-quality item through crowd scoring*
ACM Transactions on Modeling and Performance Evaluation of Computing Systems (TOMPECS). 3 (1). ACM, New York, NY, USA. ISSN 2376-3639.

33. **Iñaki Ucar, Carlos Donato, Pablo Serrano, Andres Garcia-Saavedra, Arturo Azcorra, Albert Banchs (February 2018)**
*On the energy efficiency of rate and transmission power control in 802.11*
Computer Communications. 117. pp. 164-174. Elsevier. ISSN 0140-3664.

34. **Pavel Chuprikov, Alex Davydow, Sergey I. Nikolenko, Kirill Kogan (February 2018)**
*Priority Queueing for Packets with Two Characteristics*
IEEE/ACM Transactions on Networking. 26 (1). pp. 342-355. Co-sponsored by the IEEE Communications Society, the IEEE Computer Society, and the ACM with its Special Interest Group on Data Communications (SIGCOMM). ISSN 1063-6692.

35. **Alberto Mozo, José Luis Lopéz-Presa, Antonio Fernández Anta (January 2018)**
*A distributed and quiescent max-min fair algorithm for network congestion control*
Expert Systems With Applications. 91. pp. 492-512. Elsevier Ltd. ISSN 0957-4174.

36. **Antonio Fernández Anta, Chryssis Georgiou, Dariusz R. Kowalski, Elli Zavou (January 2018)**
*Competitive Analysis of Fundamental Scheduling Algorithms on a Fault-Prone Machine and the Impact of Resource Augmentation*
Future Generation Computer Systems. 78. pp. 245-256. Elsevier. ISSN 0167-739X.

37. **Amr AbdelKhalek Abdelnabi, Fawaz S. Al-Qahtani, Redha M. Radaydeh, Mohammed Shaqfeh (January 2018)**
*Hybrid Access Femtocells in Overlaid MIMO Cellular Networks with Transmit Selection under Poisson Field Interference*
IEEE Transactions on Communications. 66 (1). pp. 163-179. IEEE Communications Society. ISSN 0090-6778.

38. **Qing Wang, Marco Zuniga, Domenico Giustiniano (January 2018)**
*In Light and In Darkness, In Motion and In Stillness: A Reliable and Adaptive Receiver for the Internet of Lights*
IEEE Journal on Selected Areas in Communications. 36 (1). pp. 1-13. IEEE Communications Society. ISSN 0733-8716.

## Magazine Articles [4]

1. **Iñaki Ucar, José Alberto Hernández, Pablo Serrano, Arturo Azcorra (November 2018)**
*Design and Analysis of 5G Scenarios with simmer: An R Package for Fast DES Prototyping*
IEEE Communications Magazine. 56 (11). pp. 145-151. IEEE Communications Society. ISSN 0163-6804.

2. **Ginés García, Marco Gramaglia, Pablo Serrano, Albert Banchs (October 2018)**
*POSENS: A Practical Open Source Solution for End-to-End Network Slicing*
IEEE Wireless Communications Magazine (Special Issue: 5G Testing and Field Trials). 25 (5). pp. 30-37. IEEE Communications Society. ISSN 1536-1284.

3. **Antonio De la Oliva, Xi Li, Xavier Costa-Perez, Carlos Jesús Bernardos, Philippe Bertin, Paola Iovanna, Thomas Deiss, Josep Mangues-Bafalluy, Alain Mourad, Claudio Casetti, Jose Enrique Gonzalez, Arturo Azcorra (August 2018)**
*5G-TRANSFORMER: Slicing and Orchestrating Transport Networks for Industry Verticals*
IEEE Communications Magazine. 56 (8). pp. 78-84. IEEE Communications Society. ISSN 0163-6804.

4. **Sreeraj Rajendran, Roberto Calvo-Palomino, Markus Fuchs, Bertold Van den Bergh, Héctor Cordobés de la Calle, Domenico Giustiniano, Sofie Pollin, Vincent Lenders (January 2018)**
*Electrosense: Open and Big Spectrum Data*
IEEE Communications Magazine. 56 (1). pp. 210-217. IEEE Communications Society. ISSN 0163-6804.

## Conference or Workshop Papers [64]

1. **Piergiorgio Vitello, Andrea Capponi, Claudio Fiandrino, Paolo Giaccone, Dzmitry Kliazovich, Pascal Bouvry, Ulrich Sorger (December 2018)**
*Collaborative Data Delivery for Smart City-oriented Mobile Crowdsensing Systems*
In: IEEE Global Communications Conference (Globecom 2018), 9-13 December 2018, Abu Dhabi, United Arab Emirates.

2. **Jona Beysens, Ander Galisteo, Qing Wang, Diego Juara, Domenico Giustiniano, Sofie Pollin (December 2018)**
*DenseVLC: A Cell-Free Massive MIMO System with Distributed LEDs*
In: The 14th International Conference on emerging Networking EXperiments and Technologies (ACM CoNEXT 2018), 4-7 December 2018, Heraklion/Crete, Greece.

3. **Domenico Giustiniano, Ambuj Varshney, Thiemo Voigt (November 2018)**
*Connecting Battery-free IoT Tags Using LED Bulbs*
In: The 17th ACM Workshop on Hot Topics in Networks (HotNets 2018), 15-16 November 2018, Redmond, Washington, USA.

4. **Carlos Andrés Ramiro, Claudio Fiandrino, Alejandro Blanco, Pablo Jimenez Mateo, Norbert Ludant, Joerg Widmer (November 2018)**
*openLEON: An End-to-End Emulator from the Edge Data Center to the Mobile Users*
In: The 12th ACM International Workshop on Wireless Network Testbeds, Experimental evaluation & CHaracterization (ACM WiNTECH 2018), in conjunction with MobiCom 2018, 2 November 2018, New Delhi, India.

5. **Quirin Scheitle, Oliver Hohlfeld, Julien Gamba, Jonas Jelten, Torsten Zimmermann, Stephen Strowes, Narseo Vallina-Rodriguez (October 2018)**
*A Long Way to the Top: Significance, Structure, and Stability of Internet Top Lists*
In: The 18th ACM Internet Measurement Conference (IMC 2018), 31 October - 2 November 2018, Boston, MA, USA.

6. **Mohammad Taha Khan, Joe de Blasio, Geoffrey M. Voelker, Alex C. Snoeren, Chris Kanich, Narseo Vallina-Rodriguez (October 2018)**
*An Empirical Analysis of the Commercial VPN Ecosystem*
In: The 18th ACM Internet Measurement Conference (IMC 2018), 31 October - 2 November 2018, Boston, MA, USA.

7. **Haoyu Wang, Zhe Liu, Narseo Vallina-Rodriguez, Yao Guo, Li Li, Juan Tapiador, Jingcun Cao, Guaoi Xu (October 2018)**
*Beyond Google Play: A Large-Scale Comparative Study of Chinese Android App Markets*
In: The 18th ACM Internet Measurement Conference (IMC 2018), 31 October - 2 November 2018, Boston, MA, USA.

8. **Platon Kotzias, Abbas Razaghpanah, Johanna Amann, Kenneth G. Paterson, Narseo Vallina-Rodriguez, Juan Caballero (October 2018)**
*Coming of Age: A Longitudinal Study of TLS Deployment*
In: The 18th ACM Internet Measurement Conference (IMC 2018), 31 October - 2 November 2018, Boston, MA, USA.

9. **Joan Palacios, Daniel Steinmetzer, Adrian Loch, Matthias Hollick, Joerg Widmer (October 2018)**
*Adaptive Codebook Optimization for Beam Training on Off-the-Shelf IEEE 802.11ad Devices*
In: The 24th Annual International Conference on Mobile Computing and Networking (ACM MobiCom 2018), 29 October -2 November 2018, New Delhi, India.

10. **Cristina Márquez, Marco Gramaglia, Marco Fiore, Albert Banchs, Xavier Costa-Perez (October 2018)**
*How should I slice my network? A multi-service empirical evaluation of resource sharing efficiency*
In: The 24th Annual International Conference on Mobile Computing and Networking (ACM MobiCom 2018), 29 October -2 November 2018, New Delhi, India.

11. **Vitalii Demianiuk, Sergey Nikolenko, Pavel Chuprikov, Kirill Kogan (September 2018)**
*New Alternatives to Optimize Policy Classifiers*
In: The 26th IEEE International Conference on Network Protocols (ICNP 2018), 24-27 September 2018, Cambridge, UK.

12. **Maurizio Rea, Domenico Garlisi, Héctor Cordobés de la Calle, Domenico Giustiniano (September 2018)**
*Location-aware MAC Scheduling in Industrial-like Environment*
In: The 9th International Conference on Broadband Communications, Networks, and Systems (BROADNETS 2018), 19–20 September 2018, Faro, Portugal.

13. **Ozgu Alay, Vincenzo Mancuso, Anna Brunstrom, Stefan Alfredsson, Marco Mellia, Giacomo Bernini, Hakon Lonsethagen (September 2018)**
*End to End 5G Measurements with MONROE: Challenges and Opportunities*
In: The 4th International Forum on Research and Technologies for Society and Industry (IEEE RTSI 2018), 10-13 September 2018, Palermo, Italy.

14. **Claudio Casetti, Carla Fabiana Chiasserini, Jorge Martin Perez, Nuria Molner, Thomas Deiss, Cao-Thanh Phan, Farouk Messaoudi, Giada Landi, Juan Brenes Baranzano (September 2018)**
*Arbitration Among Vertical Services*
In: Workshop WE-06 Vertical-Oriented Service Programmability: Design and Optimization of 5G Cell-Less Networks (5G Cell-Less Nets), in conjunction with the 29th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (IEEE PIMRC 2018), 9-12 September 2018, Bologna, Italy.

15. **Marco Ajmone Marsan, Fatemeh Hashemi (September 2018)**
*Deploying Small Cells in Traffic Hot Spots: Always a Good Idea?*
In: Workshop in Telecommunication Networks Strategy and Planning, in conjunction with the 29th IEEE International Symposium on Person-

al, Indoor and Mobile Radio Communications (IEEE PIMRC 2018), 9-12 September 2018, Bologna, Italy.

16. **Kiril Antevski, Jorge Martin Perez, Nuria Molner, Xi Li, Josep Salvat Lozano, Carla Fabiana Chiasserini, Francesco Malandrino, Ricardo Martínez, Iñaki Pascual, Josep Mangues-Bafalluy, Jorge Baranda, Pantelis A. Frangoudis, Adlen Ksentini, Barbara Martini, Molka Gharbaoui (September 2018)**
*Resource Orchestration of 5G Transport Networks for Vertical Industries*
In: Workshop WE-06 Vertical-Oriented Service Programmability: Design and Optimization of 5G Cell-Less Networks (5G Cell-Less Nets), in conjunction with the 29th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (IEEE PIMRC 2018), 9-12 September 2018, Bologna, Italy.

17. **Sandra Siby, Marc Juarez, Narseo Vallina-Rodriguez, Carmela Troncoso (July 2018)**
*DNS Privacy not so private: the traffic analysis perspective*
In: The 11th Workshop on Hot Topics in Privacy Enhancing Technologies (HotPETs 2018), 27 July 2018, Barcelona, Spain.

18. **Irwin Reyes, Primal Wijesekera, Joel Reardon, Amit Elazari Bar On, Abbas Razaghpanah, Narseo Vallina-Rodriguez, Serge Egelman (July 2018)**
*"Won't Somebody Think of the Children?" Examining COPPA Compliance at Scale*
In: The 18th Privacy Enhancing Technologies Symposium (PETS 2018), 24–27 July 2018, Barcelona, Spain.

19. **Demetris Trihinas, Luis F. Chiroque, George Pallis, Antonio Fernández Anta, Marios Dikaiakos (July 2018)**
*ATMoN: Adapting the "Temporality" in Large-Scale Dynamic Networks*
In: The 38th IEEE International Conference on Distributed Computing Systems (ICDCS 2018), 2-5 July 2018, Vienna, Austria.

20. **Foroogh Mohammadnia, Marco Fiore, Marco Ajmone Marsan (June 2018)**
*Adaptive densification of mobile networks: Exploring correlations in vehicular and telecom traffic*
In: The 17th Annual Mediterranean Ad Hoc Networking Workshop (Med-Hoc-Net 2018), 20-22 June 2018, Capri, Italy.

21. **Domenico Giustiniano, Markus Schalch, Marc Liechti, Vincent Lenders (June 2018)**
*Interference Suppression in Bandwidth Hopping Spread Spectrum Communications*
In: The 11th ACM Conference on Security and Privacy in Wireless and Mobile Networks (ACM WiSec 2018), 18-20 June 2018, Stockholm, Sweden.

22. **Vitalii Demianiuk, Sergey Gorinsky, Sergey Nikolenko, Kirill Kogan (June 2018)**
*Distributed Counting along Lossy Paths without Feedback*
In: The 25th International Colloquium on Structural Information and Communication Complexity (SIROCCO 2018), 18-21 June 2018, Ma'ale HaHamisha, Israel.

23. **Pavel Chuprikov, Alex Davydow, Kirill Kogan, Sergey Nikolenko, Alexander Sirotkin (June 2018)**
*Formalizing Compute-Aggregate Problems in Cloud Computing*
In: The 25th International Colloquium on Structural Information and Communication Complexity (SIROCCO 2018), 18-21 June 2018, Ma'ale HaHamisha, Israel.

24. **Claudio Casetti, Carla Fabiana Chiasserini, Jorge Martin Perez, Nuria Molner, Thomas Deiss, Jose Enrique Blázquez González, Cao-Thanh Phan, Farouk Messaoudi, Giada Landi, Nicolás Serrano,**

**Josep Mangues-Bafalluy, Charles Turyagyenda (June 2018)**
*The Vertical Slicer: Verticals' Entry Point to 5G Networks*
In: The 27th European Conference on Networks and Communications (EuCNC 2018), 18-21 June 2018, Ljubljana, Slovenia.

25. **Julien Gamba, Mohammed Rashed, Razaghpanah Abbas, Narseo Vallina-Rodriguez, Juan Tapiador (June 2018)**
*An Analysis of Pre-installed Android Software*
In: IV Jornadas Nacionales de Investigación en Ciberseguridad (JNIC 2018), 13-15 June 2018, Donostia, San Sebastián, Spain.

26. **Antonio Fernández Anta, Chryssis Georgiou, Kishori Konwar, Nicolas Nicolaou (June 2018)**
*Formalizing and Implementing Distributed Ledger Objects*
In: XXV Jornadas de Concurrencia y Sistemas Distribuidos (JCSD2018), 13-15 June 2018, Toledo, Spain.

27. **Álvaro Feal (June 2018)**
*Third best student paper award "Study on privacy of parental control applications"*
In: IV Jornadas Nacionales de Investigación en Ciberseguridad (JNIC 2018), 13-15 June 2018, Donostia, San Sebastián, Spain.

28. **Pelayo Vallina, Julien Gamba, Álvaro Feal, Narseo Vallina-Rodriguez, Antonio Fernández Anta (June 2018)**
*This Is My Private Business! Privacy Risks on Adult Websites*
In: IV Jornadas Nacionales de Investigación en Ciberseguridad (JNIC 2018), 13-15 June 2018, Donostia, San Sebastián, Spain.

29. **G. Koufoudakis, Konstantinos Oikonomou, Sonia Aïssa, Ioannis Stavrakakis (June 2018)**
*Analysis of Spectral Properties for Efficient Coverage Under Probabilistic Flooding*
In: The 19th International Symposium on a World of Wireless, Mobile and Multimedia Networks (WOWMOM 2018), 12-15 June 2018, Chania, Crete, Greece.

30. **Nils Richerzhagen, R. Klugez, Björn Richerzhagen, P. Lieser, B. Koldehofe, Ioannis Stavrakakis, Ralf Steinmetz (June 2018)**
*Better Together: Collaborative Monitoring for Location-based Services*
In: The 19th International Symposium on a World of Wireless, Mobile and Multimedia Networks (WOWMOM 2018), 12-15 June 2018, Chania, Crete, Greece.

31. **Noelia Pérez, Vincenzo Mancuso, Marco Ajmone Marsan (June 2018)**
*Infrastructureless Pervasive Information Sharing with COTS Devices and Software*
In: The 19th International Symposium on a World of Wireless, Mobile and Multimedia Networks (WOWMOM 2018), 12-15 June 2018, Chania, Crete, Greece.

32. **Hany Assasa, Swetank Kumar Saha, Adrian Loch, Dimitrios Koutsonikolas, Joerg Widmer (June 2018)**
*Medium access and transport protocol aspects in practical 802.11ad networks*
In: The 19th International Symposium on a World of Wireless, Mobile and Multimedia Networks (WOWMOM 2018), 12-15 June 2018, Chania, Crete, Greece.

33. **Cise Midoglu, Mohamed Moulay, Vincenzo Mancuso, Ozgu Alay, Andra Lutu, Carsten Griwodz (June 2018)**
*Open Video Datasets over Operational Mobile Networks with MONROE*
In: The 9th ACM MMSys 2018 (MMSys 2018) - (Open Datasets and Software Track), 12-15 June 2018, Amsterdam, Netherlands.

34. **Georgios Tsoumanis, Konstantinos Oikonomou, Sonia Aïssa, Ioannis Stavrakakis (June 2018)**
*Performance Evaluation of a Proposed On-Demand Recharging Policy in Wireless Sensor Networks*
In: The 19th International Symposium on a World of Wireless, Mobile and Multimedia Networks (WOWMOM 2018), 12-15 June 2018, Chania, Crete, Greece.

35. **Tobias Meuser, Björn Richerzhagen, Ioannis Stavrakakis, T.A.B. Nguyen, Ralf Steinmetz (June 2018)**
*Relevance-Aware Information Dissemination in Vehicular Networks*
In: The 19th International Symposium on a World of Wireless, Mobile and Multimedia Networks (WOWMOM 2018), 12-15 June 2018, Chania, Crete, Greece.

36. **Swetank Kumar Saha, Hany Assasa, Adrian Loch, Naveen Muralidhar Prakash, Roshan Shyamsunder Anantharamakrishna, Shivang Aggarwal, Daniel Steinmetzer, Dimitrios Koutsonikolas, Joerg Widmer, Matthias Hollick (June 2018)**
*Fast and Infuriating: Performance and Pitfalls of 60 GHz WLANs Based on Consumer-Grade Hardware*
In: The 15th Annual IEEE International Conference on Sensing, Communication, and Networking (IEEE SECON 2018), 11-13 June 2018, Hong Kong, Hong Kong SAR.

37. **Borja Nogales, Victor Sanchez-Aguero, Iván Vidal, Francisco Valera, Jaime José García-Reinoso (June 2018)**
*A NFV system to support configurable and automated multi-UAV service deployments*
In: The 4th ACM Workshop on Micro Aerial Vehicle Networks, Systems, and Applications (DroNet 2018), in conjunction with the 16th ACM International Conference on Mobile Systems, Applications, and Services (ACM MobiSys 2018), 15 June 2018, Munich, Germany.

38. **Jorge Martin Perez, Carlos Jesús Bernardos (June 2018)**
*Multi-domain VNF Mapping*
In: The 13th IEEE International Symposium on Broadband Multimedia Systems and Broadcasting (BMSB 2018), 6-8 June 2018, Valencia, Spain.

39. **Sungoh Kwon, Joerg Widmer (June 2018)**
*Multi-beam power allocation for mmwave communications under random blockage*
In: The 87th IEEE Vehicular Technology Conference (VTC 2018-Spring), 3-6 June 2018, Porto, Portugal.

40. **Elizaveta Dubrovinskaya, Fraser Dalgleish, Bing Ouyang, Paolo Casari (May 2018)**
*Underwater LiDAR Signal Processing for Enhanced Detection and Localization of Marine Life*
In: MTS/IEEE OCEANS 2018, 28-31 May 2018, Kobe, Japan.

41. **Piergiorgio Vitello, Andrea Capponi, Claudio Fiandrino, Paolo Giaccone, Dzmitry Kliazovich, Pascal Bouvry (May 2018)**
*High-Precision Design of Pedestrian Mobility for Smart City Simulators*
In: IEEE International Conference on Communications (ICC 2018), 20-24 May 2018, Kansas City, MO, USA.

42. **Ginés García, Marco Gramaglia, Pablo Serrano, Marc Portoles-Comeras, Albert Banchs, Fabio Maino (May 2018)**
*SEMPER: A Stateless Traffic Engineering Solution for WAN based on MP-TCP*
In: IEEE International Conference on Communications (ICC 2018), 20-24 May 2018, Kansas City, MO, USA.

43. **Vadim Kirilin, Sergey Gorinsky (May 2018)**
*A Protocol-Ignorance Perspective on Incremental Deployability of Routing Protocols*
In: The 17th IFIP Networking 2018 Conference (NETWORKING 2018), 14-16 May 2018, Zurich, Switzerland.

44. **Antonio Fernández Anta, Chryssis Georgiou, Kishori Konwar, Nicolas Nicolaou (May 2018)**
*Formalizing and Implementing Distributed Ledger Objects*
In: The 6th International Conference on NETworked sYStems (NETYS 2018), 9-11 May 2018, Essaouira, Morocco.

45. **Aymen Fakhreddine, Nils Ole Tippenhauer, Domenico Giustiniano (May 2018)**
*Design and Large-Scale Evaluation of WiFi Proximity Metrics*
In: The 24th European Wireless Conference (EW 2018), 2-4 May 2018, Catania, Italy.

46. **Mohamed Moulay, Vincenzo Mancuso (April 2018)**
*Experimental Performance Evaluation of WebRTC Video Services over Mobile Networks*
In: The 5th International Workshop on Computer and Networking Experimental Research Using Testbeds (CNERT 2018), in conjunction with the 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 16 April 2018, Honolulu, HI, USA.

47. **Paolo Castagno, Vincenzo Mancuso, Matteo Sereno, Marco Ajmone Marsan (April 2018)**
*A Simple Model of MTC in Smart Factories*
In: The 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA.

48. **Paolo Castagno, Vincenzo Mancuso, Matteo Sereno, Marco Ajmone Marsan (April 2018)**
*Closed Form Expressions for the Performance Metrics of Data Services in Cellular Networks*
In: The 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA.

49. **Joan Palacios, Guillermo Bielsa, Paolo Casari, Joerg Widmer (April 2018)**
*Communication-Driven Localization and Mapping for Millimeter Wave Networks*
In: The 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA.

50. **Guillermo Bielsa, Joan Palacios, Adrian Loch, Daniel Steinmetzer, Paolo Casari, Joerg Widmer (April 2018)**
*Indoor Localization Using Commercial Off-The-Shelf 60 GHz Access Points*
In: The 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA.

51. **Claudio Casetti, Carla Fabiana Chiasserini, Thomas Deiss, Pantelis A. Frangoudis, Adlen Ksentini, Giada Landi, Xi Li, Josep Mangues-Bafalluy, Nuria Molner (April 2018)**
*Network Slices for Vertical Industries*
In: Workshop on Control and Management of Vertical Slicing including the Edge and Fog Systems (COMPASS), in conjunction with IEEE Wireless Communications and Networking Conference Workshops (WCNCW 2018), 15 April 2018, Barcelona, Spain.

52. **Dingwen Yuan, Hsuan-Yin Lin, Joerg Widmer, Matthias Hollick (April 2018)**
*Optimal Joint Routing and Scheduling in Millimeter-Wave Cellular Networks*
In: The 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA.

53. **Marco Ajmone Marsan, Ana Paula Couto da Silva, Michela Mea, Daniela Renga (April 2018)**
*Sharing renewable energy in a network sharing context*
In: The 16th IEEE Wireless Communications and Networking Conference (WCNC 2018), 15-18 April 2018, Barcelona, Spain.

54. **Foivos Michelinakis, Hossein Doroud, Abbas Razaghpanah, Andra Lutu, Narseo Vallina-Rodriguez, Phillipa Gill, Joerg Widmer (April 2018)**
*The Cloud that Runs the Mobile Internet: A Measurement Study of Mobile Cloud Services*
In: The 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA.

55. **Aymen Fakhreddine, Domenico Giustiniano, Vincent Lenders (April 2018)**
*Data Fusion for Hybrid and Autonomous Time-of-Flight Positioning*
In: The 17th ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN 2018), 11-13 April 2018, Porto, Portugal.

56. **Roberto Calvo-Palomino, Fabio Ricciato, Blaz Repas, Domenico Giustiniano, Vincent Lenders (April 2018)**
*Nanosecond-precision Time-of-Arrival Estimation for Aircraft Signals with low-cost SDR Receivers*
In: The 17th ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN 2018), 11-13 April 2018, Porto, Portugal.

57. **Pavel Chuprikov, Kirill Kogan, Sergey Nikolenko (March 2018)**
*How to implement complex policies on existing network infrastructure*
In: The 4th Symposium on SDN Research (ACM SOSR 2018), 28-29 March 2018, Los Angeles, CA, USA.

58. **Mattia Tomasoni, Andrea Capponi, Claudio Fiandrino, Dzmitry Kliazovich, Fabrizio Granelli, Pascal Bouvry (March 2018)**
*Profiling Energy Efficiency of Mobile Crowdsensing Data Collection Frameworks for Smart City Applications*
In: The 6th IEEE International Conference on Mobile Cloud Computing, Services, and Engineering (Mobile Cloud 2018), 26-29 March 2018, Bamberg, Germany.

59. **Ajmal Muhammed, Andrea Sgambelluri, Olivier Dugeon, Jorge Martin Perez, Francesco Paolucci, Oscar Gonzalez De Dios, Fabio Ubaldi, Teresa Pepe, Carlos Jesús Bernardos, Paolo Monti (March 2018)**
*On the Scalability of Connectivity Services in a Multi-Operator Orchestrator Sandbox*
In: The Optical Networking and Communication Conference & Exhibition (OFC 2018), 11-15 March 2018, San Diego, California, USA.

60. **Abbas Razaghpanah, Rishab Nithyanand, Narseo Vallina-Rodriguez, Srikanth Sundaresan, Mark Allman, Christian Kreibich, Phillipa Gill (February 2018)**
*Apps, Trackers, Privacy, and Regulators: A Global Study of the Mobile Tracking Ecosystem*
In: The Network and Distributed System Security Symposium (NDSS 2018), 18-21 February 2018, San Diego, CA, USA.

61. **Jingjing Ren, Martina Lindorfer, Daniel J. Dubois, Ashwin Rao, David Choffnes, Narseo Vallina-Rodriguez (February 2018)**
*Bug Fixes, Improvements, and Privacy Leaks*
In: Network and Distributed System Security Symposium 2018 (NDSS 2018), 18-21 February 2018, San Diego, CA, USA.

62. **Ander Galisteo, Diego Juara, Qing Wang, Domenico Giustiniano (February 2018)**
*OpenVLC1.2: Achieving Higher Throughput in Low-End Visible Light Communication Networks*
In: The 14th Wireless On-demand Network systems and Services Conference (WONS 2018), 6-8 February 2018, ISOLA 2000, France.

63. **Kirill Kogan, Sergey Nikolenko, Vitalii Demianiuk, Pavel Chuprikov, Alex Davydow (January 2018)**
*Personal Insights on Three Research Directions in Networked Systems*
In: The 10th International Conference on COMmunication Systems & NETworkS (COMSNETS 2018), 3-7 January 2018, Bengaluru, India.

64. **Gianluca Rizzo, Marco Ajmone Marsan (January 2018)**
*The Energy Saving Potential of Static and Adaptive Resource Provisioning in Dense Cellular Networks*
In: The 10th International Conference on COMmunication Systems & NETworkS (COMSNETS 2018), 3-7 January 2018, Bengaluru, India.

## Conference and Workshop Posters & Demos [9]

1. **Joan Palacios, Daniel Steinmetzer, Adrian Loch, Joerg Widmer, Matthias Hollick (November 2018)**
*Demo: Channel Estimation and Custom Beamforming on the 60 GHz TP-Link Talon AD7200 Router (Demo, peer-reviewed)*
In: The 12th ACM International Workshop on Wireless Network Testbeds, Experimental evaluation & CHaracterization (ACM WiNTECH 2018), in conjunction with MobiCom 2018, 2 November 2018, New Delhi, India.

2. **Abbas Razaghpanah, Julien Gamba, Álvaro Feal, Narseo Vallina-Rodriguez, Mark Allman, Phillipa Gill (October 2018)**
*A Multi-Protocol Analysis of Android App's Traffic from the Edge (Poster, peer-reviewed)*
In: The 18th ACM Internet Measurement Conference (ACM IMC 2018), 31 October - 2 November 2018, Boston, MA, USA.

3. **Pelayo Vallina, Álvaro Feal, Julien Gamba, Narseo Vallina-Rodriguez, Antonio Fernández Anta (October 2018)**
*Everybody's got something to hide: Analysis of the Online Adult Ecosystem (Poster, peer-reviewed)*
In: The 18th ACM Internet Measurement Conference (ACM IMC 2018), 31 October - 2 November 2018, Boston, MA, USA.

4. **Julien Gamba, Álvaro Feal, Narseo Vallina-Rodriguez (October 2018)**
*Exploring Anycast-Based Public DNS Resolvers (Poster, peer-reviewed)*
In: The 18th ACM Internet Measurement Conference (ACM IMC 2018), 31 October - 2 November 2018, Boston, MA, USA.

5. **Irwin Reyes, Primal Wijesekera, Joel Reardon, Amit Elazari Bar On, Abbas Razaghpanah, Narseo Vallina-Rodriguez, Serge Egelman (August 2018)**
*Examining COPPA Compliance at Scale (Poster, peer-reviewed)*
In: The 14th Symposium on Usable Privacy and Security (SOUPS 2018), 12-14 August 2018, Baltimore, Maryland, USA.

6. **Álvaro Feal, Julien Gamba, Narseo Vallina-Rodriguez, Carmela Troncoso, Alessandra Gorla, Paolo Calciati (July 2018)**
*A Study on the Privacy Implications of Mobile Parental Control Apps (Poster, peer-reviewed)*
In: Open Day for Privacy, Transparency and Decentralization (OPERANDI 2018), in conjunction with the 18th Privacy Enhancing Technologies Symposium (PETS 2018), 23 July 2018, Barcelona, Spain.

7. **Pelayo Vallina, Antonio Fernández Anta, Rubén Cuevas, Esteban Moro (July 2018)**
*MyBubble: Influence of Algorithms in Users' Filter Bubbles (Poster, peer-reviewed)*
In: Open Day for Privacy, Transparency and Decentralization (OPERANDI 2018), in conjunction with the 18th Privacy Enhancing Technologies Symposium (PETS 2018), 23 July 2018, Barcelona, Spain.

8. **Quirin Scheitle, Oliver Hohlfeld, Julien Gamba, Jonas Jelten, Torsten Zimmermann, Stephen Strowes, Narseo Vallina-Rodriguez (June 2018)**
*A Long Way to the Top: Significance, Structure, and Stability of Internet Top Lists (Poster)*
In: The 8th TMA PhD School and Conference 2018, 25-26 June 2018, Vienna, Austria.

9. **Franco Minucci, Bertold Van den Bergh, Sreeraj Rajendran, Domenico Giustiniano, Héctor Cordobés de la Calle, Markus Fuchs, Roberto Calvo-Palomino, Vincent Lenders, Sofie Pollin (February 2018)**
*Demo: Electrosense - Spectrum Sensing with Increased Frequency Range (Demo, peer-reviewed)*
In: The 15th International Conference on Embedded Wireless Systems and Networks (EWSN 2018), 14-16 February 2018, Madrid, Spain.

## Invited Papers, Keynotes, Invited Talks, Tutorials, Lectures, etc. [22]

1. **Arturo Azcorra (November 2018)**
*Panel: The impact of 5G in the Tourism Industry (Other)*
In: Innovation & Tourism International Seminar (INTO 2018), 29-30 November 2018, Palma de Mallorca, Spain.

2. **Antonio Fernández Anta (October 2018)**
*Formalizing and Implementing Distributed Ledger Systems (Invited talk)*
In: Invited Seminar at Boston College, 26 October 2018, Boston, MA, USA.

3. **Antonio Fernández Anta (October 2018)**
*Unsupervised Scalable Statistical Method for Identifying Influential Users in Online Social Networks (Invited talk)*
In: CACS Seminars, University of Louisiana at Lafayette, 26 October 2018, Lafayette, Louisiana, USA.

4. **Antonio Fernández Anta, Chryssis Georgiou, Nicolas Nicolaou (October 2018)**
*Putting Distributed Ledgers Together (Keynote)*
In: The 2nd Workshop on Storage, Control, Networking in Dynamic Systems (SCNDS 2018), 19 October 2018, New Orleans, Louisiana, USA.

5. **Domenico Giustiniano (September 2018)**
*Collaboration models for Large-scale Spectrum Monitoring (Keynote)*
In: The 13th International Conference on Cognitive Radio Oriented Wireless Networks (CROWNCOM 2018), 18-20 September 2018, Ghent, Belgium.

6. **Abbas Razaghpanah, Arian Akhavan Niaki, Narseo Vallina-Rodriguez, Srikanth Sundaresan, Johanna Amann, Phillipa Gill (July 2018)**
*Studying TLS Usage in Android Apps (Other)*
In: The ACM, IRTF & ISOC Applied Networking Research Workshop 2018 (ANRW'18), 16 July 2018, Montreal, Canada.

7. **Antonio Fernández Anta (July 2018)**
*Detecting outliers in functional data for social networks and smart cities (Invited talk)*
In: Minsait Seminar, 6 July 2018, Alcobendas, Madrid, Spain.

8. **Antonio Fernández Anta (June 2018)**
*Detecting outliers in functional data for social networks and smart cities (Lecture)*
In: NOTRE Summer School: Social Computing for Smart Cities, 25-29 June 2018, Heraklion, Crete, Greece.

9. **Arturo Azcorra (June 2018)**
*Panel: Smart connectivity in the context of Next Generation Internet (Other)*
In: The 27th European Conference on Networks and Communications (EuCNC 2018), 18-21 June 2018, Ljubljana, Slovenia.

10. **Irwin Reyes, Primal Wijesekera, Joel Reardon, Amit Elazari Bar On, Abbas Razaghpanah, Narseo Vallina-Rodriguez, Serge Egelman (May 2018)**
*"Won't Somebody Think of the Children?" Examining COPPA Compliance at Scale (Invited talk)*
In: 2018 Privacy Law Scholars Conference (PLSC2018), 30-31 May 2018, George Washington University, Washington D.C., USA.

11. **Antonio Fernández Anta (May 2018)**
*Unsupervised Scalable Statistical Method for Identifying Influential Users in Online Social Networks (Invited talk)*
In: Postgraduate Conference, Faculty of Computer Science, Universidad Complutense de Madrid (Spain), 29 May 2018, Madrid, Spain.

12. **Antonio Fernández Anta (May 2018)**
*Identificando a usuarios influyentes en redes sociales (Invited talk)*
In: Serie de seminarios "Nuevas soluciones con Big Data" del Instituto UC3M-Banco Santander de Big Data Financiero (IFiBiD), 25 May 2018, Getafe, Madrid.

13. **Maurizio Rea, Héctor Cordobés de la Calle, Domenico Giustiniano (April 2018)**
*TWINS: Time-of-flight based Wireless Indoor Navigation System (Other)*
In: Microsoft Indoor Localization Competition - The 17th ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN 2018), 11-13 April 2018, Porto, Portugal.

14. **Arturo Azcorra (March 2018)**
*5TONIC: a co-creation Laboratory for Smart Connectivity in NGI (Keynote)*
In: The third Fed4FIRE+ Engineering Conference (FEC), 15 March 2018, Paris, France.

15. **Antonio Fernández Anta (March 2018)**
*Adaptive Scheduling over a Wireless Channel under Constrained Jamming (Invited talk)*
In: Seminar at Politecnico de Torino, 14 March 2018, Torino, Italy.

16. **Narseo Vallina-Rodriguez (March 2018)**
*Examining children-oriented Android software at scale (Invited talk)*
In: INRIA Privaski Workshop, 14-16 March 2018, Corrençon-en-Vercors, France.

17. **Arturo Azcorra (March 2018)**
*Panel: Social implications of future technologies (Other)*
In: V Jornadas sobre Sociedad y Economía Digital, organized by the Spanish Ministry of Energy, Tourism and Digital Agenda, 8 March 2018, Madrid, Spain.

18. **Marco Ajmone Marsan (March 2018)**
*Modeling resource allocation in cellular networks (Invited paper)*
In: The 7th International Conference on Computing, Networking and Communications (ICNC 2018), 5-8 March 2018, Maui, Hawaii, USA.

19. **Narseo Vallina-Rodriguez (March 2018)**
*Measuring mobile traffic for satisfying my curiosity and for research (Lecture)*
In: UC3M, MsC in Telematics Engineering. Internet Measurements, March 2018, UC3M, Leganes, Madrid, Spain.

20. **Arturo Azcorra (February 2018)**
*Panel: 5G Tstbeds (Other)*
In: Mobile World Congress 2018 (MWC 2018), 28 February 2018, Barcelona, Spain.

21. **Narseo Vallina-Rodriguez (February 2018)**
*Examining children-oriented Android software at scale (Invited talk)*
In: INCIBE, 8 February 2018, Leon, Spain.

22. **Antonio Fernández Anta (February 2018)**
*Unsupervised Scalable Statistical Method for Identifying Influential Users in Online Social Networks (Invited talk)*
In: Seminar at ICT - Chinese Academy of Sciences, 5 February 2018, Beijing, China.

## PhD Theses [3]

1. **Foivos Michelinakis (September 2018)**
*Optimizing the delivery of Multimedia over mobile networks*
PhD thesis, Department of Telematics Engineering, Universidad Carlos III de Madrid, Spain
Supervisor: Joerg Widmer, IMDEA Networks Institute, Madrid, Spain

2. **Pablo Caballero Garcés (July 2018)**
*Design and Performance of Resource Allocation Mechanisms for Network Slicing*
PhD thesis, Department of Electrical and Computer Engineering, The University of Texas at Austin, Austin, Texas, USA
Supervisors: - Gustavo De Veciana, The University of Texas at Austin, Austin, Texas, USA - Albert Banchs, IMDEA Networks Institute, Madrid, Spain / Universidad Carlos III de Madrid, Spain

3. **Aymen Fakhreddine (June 2018)**
*Opportunistic Timing Signals for Pervasive Mobile Localization*
PhD thesis, Department of Telematics Engineering, Universidad Carlos III de Madrid, Spain
Supervisor: Domenico Giustiniano, IMDEA Networks Institute, Madrid, Spain

## 5.3. Scientific service

IMDEA Networks conducts its scientific activities with the final objective of ensuring the widest possible dissemination of the results of the work carried out by the Institute, both within the scientific community and towards the general public. Our scientific service includes participation by our researchers at different levels of involvement in leading conferences and journals in the field, R&D committees, standardization bodies, awards, publications, projects or sponsorships.

### Albert BANCHS

**Professional posts & activities**

- Steering Board member: the IEEE Online Conference on Green Communications (IEEE OnlineGreenComm), 2014 – present
- Steering Board member: European Wireless, 2011– present
- IEEE Senior Member
- Distinguished Member of the INFOCOM Technical Program Committee, 2017
- IEEE Distinguished Lecturer, IEEE Communications Society
- Deputy Director: Department of Telematics Engineering, University Carlos III of Madrid, 2017 – present

**Journal editorial boards**

- Editor: IEEE Transactions on Wireless Communications, 2014 – present
- Editor: IEEE/ACM Transactions on Networking, 2016 – present

**TPC memberships**

- 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA
- 19th IEEE International Symposium on a world of wireless, mobile and multimedia networks (WoWMoM 2018), 12-15 June 2018, Chania, Greece
- 27th European Conference on Networks and Communications (EuCNC 2018), 18-21 June 2018, Ljubljiana, Slovenia

### Paolo CASARI

**Professional posts & activities**

- Project proposal reviewer COST actions

**Journal editorial boards**

- Reviewer: «Proyectos de Investigación Científica y Tecnológica (PICT)» granted by the «Agencia Nacional de Promoción Científica y Tecnológica de Argentina»
- Reviewer: EU H2020 COST actions, 2017 Fall session

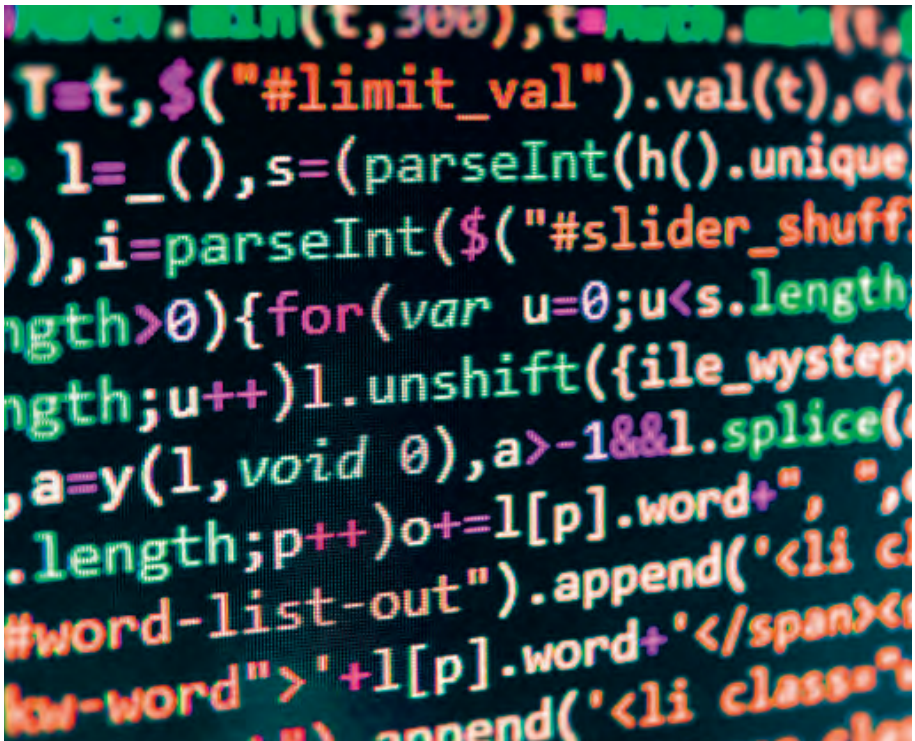
- Co-Guest Editor: Special Section on «Underwater Wireless Communications and Networking», IEEE Access Journal
- Associate Editor: IEEE Transactions on Mobile Computing, May 2018 – present
- Associate Editor: IEEE Transactions on Wireless Communications, December 2018 - present

**Organization committees**

- Local Arrangements Chair: the 15th International Conference on Embedded Wireless Systems and Networks (EWSN 2018), 14-16 February 2018, Madrid, Spain

**TPC memberships**

- 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, Hawaii, USA
- 2nd IEEE International Workshop on Wireless Communications and Networking in Extreme Environments (IEEE WCNEE 2018), in conjunction with IEEE INFOCOM 2018, 16 April 2018, Honolulu, Hawaii, USA
- IEEE International Workshop of the Technical Committee on Communications Quality and Reliability (CQR), 14-17 May 2018, Austin, Texas
- IEEE 87th Vehicular Technology Conference (VTC2018-Spring), 3-6 June 2018, Porto, Portugal
- EuCNC 2018 - Wireless, Optical and Satellite Networks (WOS) track, in conjunction with the 27th European Conference on Networks and Communications (EuCNC 2018), 18-21 June 2018, Ljubljana, Slovenia
- EuCNC 2018 Workshop «Fog, Edge and Cloud: Current Challenges and Opportunities», in conjunction with EuCNC 2018, 18 June 2018, Ljubljana, Slovenia
- 17th Annual Mediterranean Ad Hoc Networking Workshop (Med-Hoc-Net 2018), 20-22 June 2018, Capri, Italy



## Antonio FERNÁNDEZ ANTA

### Professional posts & activities

- Evaluator of project proposal for the EPSRC, UK
- Evaluator of project proposals for the Agencia Nacional de Evaluación y Prospectiva (ANEP)
- Committee member for the Habilitation à Diriger des Recherches, Université de Bordeaux, June 2018
- Member of the Comisión de Doctorado of the Escuela Técnica Superior de Ingeniería de Sistemas Informáticos, UPM.
- Doctoral committee member of Luca Vassio, Politecnico di Torino, March 2018. Doctoral committee member of Umer Liqat, IMDEA Software, July 2018.
- Doctoral committee member of Olivier Ruas, Université de Rennes, December 2018.

### Journal editorial boards

- Associate Editor: The Computer Journal (Oxford Journals), July 2015 - Present

### Organization committees

- Travel Grants Co-Chair: 31st Annual Conference of the ACM Special Interest Group on Data Communication (SIGCOMM) on the applications technologies architectures and protocols for computer communication (ACM SIGCOMM 2018), 20-24 August 2018, Budapest, Hungary
- Co-chair: 1st International Workshop on Edge Computing and Networking (ECN 2018), collocated with ICCCN 2018, August 2nd, 2018, Hangzhou, China
- Co-chair: Track 4: Edge Computing and Distributed Cloud of the 10th IEEE International Conference on Cloud Computing Technology and Science (CloudCom 2018), 10-13 December, Nicosia, Cyprus
- Co-chair: SISOSN Workshop on Social Issues in Online Social Networks, collocated with PODC 2018, 23-27 July 2018, Egham, UK

### TPC Membership

- 13th Latin American Theoretical Informatics Symposium (LATIN 2018), 16-19 April 2018, Buenos Aires, Argentina
- 22st International Conference on Information Visualization (IV2018), 10-13 July 2018, Salerno, Italy

## Claudio FIANDRINO

### Organization committees

- Publicity Chair: the 14th ACM/IEEE Symposium on Architectures for Networking and Communications Systems (ANCS 2018), 23-24 July 2018, Ithaca, NY, USA.

### TPC Memberships

- IEEE International Conference on Computing, Networking and Communications (ICNC 2018), 5-8 March 2018, Maui, Hawaii, USA

- IEEE International Conference on Communications (ICC 2018), 20-24 May 2018, Kansas City, MO, USA
- 1st IEEE 5G World Forum (5GWF 2018), 9-11 July 2018, Santa Clara, California, USA
- IEEE 87th Vehicular Technology Conference (VTC2018-Spring), 3-6 June 2018, Porto, Portugal
- 8th International Workshop on Management of Cloud and Smart City Systems (MoCS 2018), 25 June 2018, Natal, Brazil
- 1st International Workshop on Edge Computing and Networking (ECN 2018), co-located with ICCCN 2018, 30 July – 2 August 2018, Hangzhou, China
- 6th IEEE International Conference on Future Internet of Things and Cloud (FiCloud 2018), 6-8 August 2018, Barcelona, Spain
- IEEE Global Communications Conference (GLOBECOM 2018), 9-13 December 2018, Abu Dhabi, UAE

## Julien GAMBA

### TPC memberships

- 1st Shadow Program Committee at TMA Conference (TMA 2018), 26-29 June 2018, Vienna, Austria

## Domenico GIUSTINIANO

### Professional posts & activities

- Chair: International Conference on Embedded Wireless Systems and Networks, Madrid, February 2018
- PhD Defense Committee of Ambuj Varshney, University of Uppsala (Uppsala, Sweden), May 2018

### Organization committees

- General Co-Chair: the 15th International Conference on Embedded Wireless Systems and Networks (EWSN 2018), 14-16 February 2018, Madrid, Spain

### TPC Memberships

- 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA
- IEEE INFOCOM 2018 Workshop on Computer and Networking Experimental Research using Testbeds (CNERT 2018), in conjunction with IEEE INFOCOM 2018, 15-19 April 2018, Honolulu, HI, USA
- 15th Annual IEEE International Conference on Sensing, Communication and Networking (SECON 2018), 11-13 June 2018, Hong Kong, Hong Kong SAR

- 12th ACM International Workwhop on Wireless Network Testbeds, Experimental evaluation & Characterization (ACM WiNTECH 2018 Workshop), in conjunction with MOBICOM 2018, 2 November 2018, New Delhi, India
- 14th ACM International Conference on emerging Networking EXperiments and Technologies (CoNEXT 2018), 4-7 December 2018, Heraklion/Crete, Greece

## Sergey GORINSKY

**Professional posts & activities**

- Member of the COMSNETS Association, the steering committee of COMSNETS conferences
- Horizon 2020 Project Evaluator for the European Commission
- ERC STG Proposal Evaluator for the European Research Council
- Proposal Evaluator for EDGE MSCA COFUND Postdoctoral Fellowships
- NKFIH Proposal Evaluator for the National Research, Development, and Innovation Office of Hungary
- Nominator for the ACM SIGCOMM 2018 Lifetime Contribution Award

**Journal editorial boards**

- Area Editor: ACM SIGCOMM Computer Communication Review
- Reviewer: IEEE/ACM Transactions on Networking
- Reviewer: IEEE Journal on Selected Areas in Communications

**Organization committees**

- General Co-Chair: 31st Annual Conference of the ACM Special Interest Group on Data Communication (SIGCOMM) on the applications technologies architectures and protocols for computer communication (ACM SIGCOMM 2018), 20-24 August 2018, Budapest, Hungary

**TPC Memberships**

- Distinguished TPC Member: 37th IEEE International Conference on Computer Communications (INFOCOM 2018), 15-19 April 2018, Honolulu, HI, USA

## Kirill KOGAN

**Professional posts & activities**

- Referee: Israel Science Foundation (ISF)

**Organization committees**

- Session Chair: 26th IEEE International Conference on Network Protocols (IEEE ICNP), 24-27 September 2018, Cambridge, UK
- Publicity Co-Chair: the 24th Annual International Conference on Mobile Computing and Networking (MOBICOM 2018), 29 October – 2 November 2018, New Delhi, India

## Vincenzo MANCUSO

**Professional posts & activities**

- PhD Pre-Defense & Defense Committees of Patricia Arroba, Universidad Politécnica de Madrid
- Director of master theses degrees of Noelia Pérez and Mohamed Moulay, Universidad Carlos III de Madrid
- Director of PhD Thesis degree of Christian Vitale, IMDEA Networks Institute & Universidad Carlos III de Madrid

**Journal editorial boards**

- Editorial Board member: IEEE Journal on Selected Areas in Communications (IEEE JSAC-SI-CACHING'18, JSAC Special issue on Caching for Communication Systems and Networks)
- Editorial Board member: IEEE Transactions on Green Communications and Networking (TGCN) for the "Energy Efficiency in Wireless Communications and Networking" area

**Organization committees**

- Organizer of a special session on Large Scale Measurements / MONROE at the 24th European Wireless Conference (EW 2018), 2-4 May 2018, Catania, Italy

**TPC Membership**

- 3rd Workshop on Edge Computing, in conjunction with the 14th Annual IEEE Consumer Communications & Networking Conference (CCNC 2018) and with the International Consumer Electronics Show (CES 2018), 12-15 January 2018, Las Vegas, USA
- 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, Hawaii, USA

- 24th European Wireless Conference (EW 2018), 2-4 May 2018, Catania, Italy
- The 2018 International Workshop on Resource Allocation, Cooperation and Competition in Wireless Networks (RAWNET 2018), in conjunction with the 16th International Symposium on Modeling and Optimization in Mobile, Adhoc, Wireless Networks (WiOpt 2018), 11 May 2018, Shanghai, China
- 17th IFIP/IEEE Networking 2018 (NETWORKING 2018), 14-16 May 2018, Zurich, Switzerland
- 6th International Workshop on Cloud Technologies and Energy Efficiency in Mobile Communication Networks (CLEEN 2018), in conjunction with IEEE VTC2018-spring, 3 June 2018, Porto, Portugal
- 19th International Symposium on a World of Wireless Mobile and Multimedia Networks (IEEE WOWMOM 2018), 12-15 June 2018, Chania, Greece
- 2nd Workshop on Mobile Network Measurement (MNM 2018), in conjunction with the Network Traffic Measurement and Analysis Conference (TMA 2018), 26-29 June 2018, Vienna, Austria
- 30th International Teletraffic Congress – Teletraffic in a Smart World (ITC 2018), 3-7 September 2018, Vienna, Austria
- 5th International Workshop on Cloudified Architectures For 5G and Beyond Systems, in conjunction with the IEEE Global Communications Conference Exhibition & Industry Forum (GLOBECOM 2018), 9-13 December, Abu Dhabi, UAE

## Narseo VALLINA-RODRÍGUEZ

### Organization committees

- Workshop Co-Chair: 14th AMC International Conference on emerging Networking EXperiments and Technologies (ACM CoNEXT 2018), 4-7 December 2018, Heraklion/Crete, Greece

### TPC Membership

- 19th International Workshop on Mobile Computing Systems and Applications (ACM HotMobile 2018), 12-13 February 2018, Tempe, AZ, USA
- 1st Conference on Fairness, Accountability, and Transparency (FAT 2018), 23-24 February 2018, New York City, NY, USA
- 19th International Conference on HotMobile Passive and Active Measurements Conference (PAM 2018), 26-27 March 2018, Berlin, Germany
- 10th International Workshop on Hot Topics in Pervasive Mobile and Online Social Networking (HotPOST 2018), in conjunction with the 37th IEEE International Conference on Computer Communications (IEEE INFOCOM 2018), 15-19 April 2018, Honolulu, Hawaii, USA
- 11th Network Traffic Measurement and Analysis Conference (TMA 2018), 26-29 June 2018, Vienna, Austria

- 18th Privacy Enhancing Technologies Symposium (PETS 2018), 24-27 July 2018, Barcelona, Spain
- ACM Workshop on Internet of Things (IoT) Security and Privacy (S&P), in conjunction with ACM SIGCOMM 2018, 20-24 August 2018, Budapest, Hungary
- 18th ACM Internet Measurements Conference (IMC 2018), 31 October – 2 November 2018, Boston, MA, USA
- 14th AMC International Conference on emerging Networking EXperiments and Technologies (ACM CoNEXT 2018), 4-7 December 2018, Heraklion/Crete, Greece

## Joerg WIDMER

### Professional posts & activities

- Evaluator: «MAKI – Multi Mechanism Adaption for the Future Internet» project
- External Reviewer: DFG (Deutsche Forschungsgemeinschaft) Collaborative Research Centre 1053 on Multi Mechanism Adaption for the Future Internet
- External Reviewer: «ERC Consolidator» grant proposals
- Distinguished member: IEEE International Conference on Computer Communications (INFOCOM 2018)

### Journal editorial boards

- Associate Editor: IEEE Transactions on Mobile Computing
- Editor: Computer Networks Journal (Elsevier)

### Organization committees

- Co-Chair: Wireless Communications Symposium (ICNC WC Symposium 2018), 5-8 March 2018, Maui, Hawaii, USA

### TPC Memberships

- 14th Wireless On-Demand Network Systems and Services (WONS 2018), 6-8 February 2018, Isola 2000, France
- 17th IFIP Networking 2018 (NETWORKING 2018), 14-16 May 2018, Zurich, Switzerland
- 19th International Symposium on a World of Wireless Mobile and Multimedia Networks (IEEE WOWMOM 2018), 12-15 June 2018, Chania, Greece
- 38th IEEE International Conference on Distributed Computing Systems (ICDCS 2018), 2-5 July 2018, Vienna, Austria
- 24th Annual International Conference on Mobile Computing and Networking (MobiCom 2018), 29 October – 2 November 2018, New Delhi, India

## 5.4. Outreach

**Major events**

### El impacto de las tecnologías digitales en la transformación del comercio internacional y en su desarrollo

*21 November 2018*

**Speaker:** Marisa Poncela, Asesor, Ministerio de Ciencia, Innovación y Universidades; Anterior Secretaria de Estado de Comercio
**Organization:** NETCOM Research Group (Telematics Engineering Department, UC3M); IMDEA Networks Institute.

### XVIII Semana de la Ciencia- Madrid 2018. P=NP, el problema del millón de dólares. ¿Un algoritmo para resolver cualquier problema matemático?

*13 November 2018*

**Speakers:** Rafael García Leiva, Ingeniero de investigación, IMDEA Networks.
**Organization:** IMDEA Networks Institute; XVIII Semana de la Ciencia – 2018 – mi+d

### Taller de Emprendimiento mi+d

*16 October 2018*

**Speakers:** Jesús Rojo, Jefe de Unidad, Servicios de transferencia de tecnología e internacionalización de la Fundación Madri+d & NCP, Maria Sklodowska-Curie Actions; Eduardo Díaz Sánchez, Jefe de Unidad, Servicios de apoyo a los emprendedores de base científico-tecnológica.
**Organization:** IMDEA Networks Institute; Fundación para el Conocimiento madri+d.

# Noche Europea de los Investigadores en Madrid 2018. IMDEA-CSI: Investigando en la escena del crimen – Temporada 2

*28 September 2018*

**Speakers:** Científicos de los institutos IMDEA
**Organization:** IMDEA Institute.

# Congreso ACM SIGCOMM 2018

*20 August 2018 – 25 August 2018, Budapest, Hungary*

**Organization:** Sergey Gorinsky preside el comité organizador (General Chair) y Antonio Fernández Anta es el responsable de becas de viaje (Travel Grant Chair). IMDEA Networks.

# 10th IMDEA Networks Annual International Workshop

*5 June 2018*

**Speakers:** Miembros del Consejo Científico e investigadores de IMDEA Networks.
**Organization:** IMDEA Networks Institute.

## Aula planeta. Juega a través de la luz

*2 March 2018*

**Organization:** IFEMA, Feria de Madrid, en el marco de AULA, en la "SEMANA DE LA EDUCACIÓN".

## International Conference on Embedded Wireless Systems and Networks (EWSN 2018)

*14 February 2018*

**Organization:** co-presidentes del comité organizador (General Chairs) Domenico Giustiniano, IMDEA Networks Institute (España) y Dimitrios Koutsonikolas, University at Buffalo (EE.UU.)

## 5.5. Workshops, seminars & lectures

Weekly seminars alternated invited talks with presentations by internal researchers. These events were organized together with University Carlos III of Madrid and University of Alcalá. The topics ranged from scientific presentations to technology-transfer oriented talks. All events were held in Madrid. Out of the **38** total number of events in which the Institute participated during 2017, **19** were conducted by invited speakers. We list those here:

**Information Management in Vehicular Networks: Relevance-Aware Networking for Advanced Driver Assistance Systems**

Tobias Meuser, Research Assistant, KOM - Multimedia Communications Lab, TU Darmstadt, Darmstadt, Germany

*12 December 2018*

**Apply AI in your field of choice for fun and profit**

Lotzi Bölöni, Professor of Computer Science, University of Central Florida, Orlando, FL, USA

*30 November 2018*

**Ad hoc, sensor, IoT, fog... - past, current and future research challenges of networking without (heavy) infrastructure**

Damla Turgut, Charles Millican Professor of Computer Science, University of Central Florida, Orlando, FL, USA

*30 November 2018*

**Middleware for IoT based on data analytics**

Jose Aguilar, Professor, Department of Computer Science, University of Los Andes, Mérida, Venezuela

*14 November 2018*

**Human Dynamics: Data, AI and Complexity at Scale**

José Balsa Berreiro, Postdoc Fellow, Human Dynamics group, MIT Media Lab; Eduardo Castelló Ferrer, Postdoctoral Researcher, Human Dynamics group, MIT Media Lab; Alfredo J. Morales, Visiting Scholar, Human Dynamics group, MIT Media Lab, Massachusetts, USA

*7 November 2018*

**Connecting Battery-free IoT Tags Using LED Bulbs**

Dr. Domenico Giustiniano, Research Associate Professor, IMDEA Networks, Madrid, Spain

*31 October 2018*

**Detection and Impact of Fake Learners in Massive Open Online Courses**
José A. Ruipérez-Valiente, Postdoctoral Associate, Comparative Media Studies / Writing Department, Massachusetts Institute of Technology - MIT, Cambridge, MA, USA
*29 October 2018*

**Coming of Age: A Longitudinal Study of TLS Deployment**
Platon Kotzias, PhD Student, IMDEA Software Institute & Universidad Politécnica de Madrid (UPM), Madrid, Spain
*26 October 2018*

**Adaptive Codebook Optimization for Beam Training on Off-the-Shelf IEEE 802.11ad Devices**
Joan Palacios, PhD Student, IMDEA Networks, Madrid, Spain
*25 October 2018*

**The Elusive Internet Flattening: 10 Years of IXP Growth**
Ignacio Castro, Postdoctoral Research Associate, Queen Mary University of London, UK
*19 October 2018*

**On the Resource Allocation Problem in Wireless Networked Control Systems**
Themistoklis Charalambous, Assistant Professor, Department of Electrical Engineering and Automation, School of Electrical Engineering, Aalto University; Academy of Finland Research Fellow, Finland
*1 October 2018*

**PhD Thesis defense: Optimizing the delivery of multimedia over mobile networks**
Foivos Michelinakis, PhD Student, IMDEA Networks Institute and University Carlos III of Madrid
*19 September 2018*

**Blockchain in all its wonder**
Paul Rimba, Research Scientist, Software and Computational Systems Group of Data61|CSIRO (Sydney, Australia) & Visiting Scholar, MIT Media Lab (Cambridge, MA, USA)
*1 August 2018*

**“Won’t Somebody Think of the Children?” Examining COPPA Compliance at Scale**
Researcher, Usable Security and Privacy Group, International Computer Science Institute (ICSI), University of California at Berkeley, USA
*17 July 2018*

**Debugging P4 Programs with Vera**
Radu Stoenescu, University POLITEHNICA of Bucharest (UPB), Romania
*27 June 2018*

**Anchorless Underwater Acoustic Localization using a Single Receiving Element**
Elizaveta Dubrovinskaya, PhD Student, IMDEA Networks & Universidad Carlos III de Madrid, Spain
*20 June 2018*

**PhD Thesis defense: Opportunistic Timing Signals for Pervasive Mobile Localization**
Aymen Fakhreddine, PhD Student, IMDEA Networks Institute & University Carlos III of Madrid, Madrid, Spain
*14 June 2018*

**Medium Access and Transport Protocol Aspects in Practical 802.11ad Networks**
Hany Assasa, PhD Student, IMDEA Networks & Universidad Carlos III de Madrid, Spain
*7 June 2018*

**Excellence in Science and Innovation by adopting the concept of Responsible Research and Innovation**
Antonia Bierwirth, Project Manager, Tecnalia Research and Innovation (TRI), Madrid, Spain; H2020 Evaluator, European Commission
*30 May 2018*

**HydraNF: Accelerating Service Function Chains with Parallelism**
Zhi-Li Zhang, Qwest Chair Professor & Distinguished McKnight University Professor, Dept. of Computer Science & Engineering, University of Minnesota, USA
*29 May 2018*

**Revisiting S-ALOHA Games**
Jun Bae Seo, Assistant Professor, Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi, India
*18 May 2018*

**SEMPER: A Stateless Traffic Engineering Solution for WAN based on MP-TCP**
Ginés García Avilés, PhD Student, IMDEA Networks & Universidad Carlos III de Madrid, Spain
*11 May 2018*

**Faster-than-Nyquist transmission for wireless and optical fibre communication**
Lutz Lampe, Professor, Department of Electrical and Computer Engineering, University of British Columbia, Vancouver, BC, Canada
*9 May 2018*

**Strategies for Successful Proposal Preparation and Writing for Individual Mobility Grants under the H2020**

George Kontaxakis, Associate Professor of Electronics, Universidad Politécnica de Madrid, Spain; Visiting Professor of Radiology, Harvard Medical School, Boston, USA

*4 May 2018*

**Data Fusion for Hybrid and Autonomous Time-of-Flight Positioning**

Aymen Fakhreddine, PhD Student, IMDEA Networks & Universidad Carlos III de Madrid, Spain

*25 April 2018*

**Nanosecond-precision Time-of-Arrival Estimation for Aircraft Signals with low-cost SDR Receivers**

Roberto Calvo-Palomino, PhD Student, IMDEA Networks & Universidad Carlos III de Madrid, Spain

*25 April 2018*

**Formalizing and Implementing Distributed Ledger Objects**

Antonio Fernández Anta, Research Professor, IMDEA Networks Institute, Spain

*11 April 2018*

**Communication-Driven Localization and Mapping for Millimeter Wave Networks**

Joan Palacios Beltrán, PhD Student, IMDEA Networks & Universidad Carlos III de Madrid, Spain

*4 April 2018*

**Indoor Localization Using Commercial Off-The-Shelf 60 GHz Access Points**

Guillermo Bielsa, PhD Student, IMDEA Networks & Universidad Carlos III de Madrid, Spain

*4 April 2018*

**Decentralized Blockchain-based Organizations for Bootstrapping the Collaborative Economy**

Samer Hassan, Faculty Associate, Berkman Klein Center for Internet & Society (Harvard University), USA; Associate Professor, Universidad Complutense de Madrid, Spain

*28 February 2018*

**Trust computing for more secure cloud? or not?**

Kari Kostainen, ETH Zurich, Switzerland

*30 January 2018*

## 5.6 Local Scientific Partnership

IMDEA Networks Institute has established a strong scientific partnership with one of the local universities in the Madrid region, namely the University of Alcalá **(Universidad de Alcalá - UAH)**. This partnership involves stable research collaboration in joint activities and projects as well as an institutional collaboration in the form of UAH's participation on the Institute's Board of Trustees.

Among other activities, the cooperation between IMDEA Networks and UAH involves their joint participation in projects of a regional scope, such as **MEDIANET**, completed in 2014, and TIGRE5-CM, ongoing until 2018. The **TIGRE5-CM** project focuses on integrated technologies for management and operation of 5G networks. In addition to IMDEA Networks and UAH, the third project partner is University Carlos III of Madrid. Elisa Rojas from UAH also participated as a Post-Doc Researcher in **NetIDE**, a research project concluded in December 2016 and carried out by IMDEA Networks with a clear focus on an integrated development environment for portable network applications. Deepening this spirit of collaborative work, one of our PhD graduates, Andra Lutu, undertook a 6-month research fellowship at UAH.

In addition to projects, UAH and IMDEA Networks are also conducting several research activities in partnership. One of these focuses on link-level technologies, based on the design of novel architectures that implement advance link layer functions, such as combined transparent bridges and fast path Ethernet switches, among other developments. As a result of this common undertaking, several results have been produced, which are co-authored by IMDEA Networks and University of Alcalá researchers. Among others, a joint patent was granted in February 2016 (see section 6.1), which presents procedures to establish and repair paths at the transport and network levels.

Other shared research work focuses on the design of incentive mechanisms for peer-to-peer networks, which has resulted in several high quality publications.

Besides the above activities, IMDEA Networks and UAH are also taking advantage of the physical proximity between the two institutions to share many of their daily labors, such as the biweekly scientific seminars organized by IMDEA Networks, University of Alcalá and University Carlos III of Madrid. Other shared research work focuses on 5G networks. In this area, the TIGRE5-CM project mentioned above is being performed by the two institutions, and has produced substantial results in terms of publications and other outcomes during 2017.

# impact and technology transfer

6.1. Patents [86]

6.2. Technology transfer [87]

6.3. Media impact [94]

6.4. Other collaborations [98]

## 6.1. Patents

**Patents** are important steps in the process of **transferring technology to marketplace**. Patent creation has strong implications for the Institute: patents are incentives for their creators, as they imply recognition for their creativity and material reward when these inventions are marketable. These incentives encourage innovation, the guarantee to the continuous improvement in the quality of research and, ultimately, of human life. It is IMDEA Networks Institute's policy to share a very high percentage of financial proceeds with inventors (our researchers) as reward for their excellence and hard work.

The following are examples of our patenting activities during 2017. This is not an exhaustive list of all IMDEA Networks' patents, as we are unable to disclose some due to confidentiality agreements with the funding companies.

# Spanish Patent Application (March 2018)

**Title:** *Método para determinar información de tipo geométrico en dispositivos de redes en la banda de ondas milimétricas [METHOD FOR DETERMINING GEOMETRIC INFORMATION OF MMWAVE NETWORK DEVICES]*

**Inventors:** Guillermo BIELSA LÓPEZ, Joan PALACIOS BELTRAN, Paolo CASARI, Joerg WIDMER, Adrian LOCH NAVARRO

**Rights:** IMDEA Networks Institute

**Overview:** A method for determining geometric information of mmWave network devices comprising collecting measures, by at least one of the devices, of signal strength and SNR of a transmission received from another device of the mmWave network; estimating angle information of the received signals to generate a set of informed particles comprising initial values of state of each informed particle and input in a modified particle filter; the modified particle filter evolving the sets of informed particles and past particles to obtain

a set of evolved particles which, in turn, is evolved to obtain a set of posterior particles delivered by the modified particle filter. Finally, the modified particle filter delivers as output final values of geometric information of the at least one device extracted from the delivered set of posterior particles.

Application number (OEPM): P201830297 (27.03.2018)

## 6.2. Technology transfer

We direct our work towards strengthening collaboration ties with industry, particularly through joint participation in projects and technology transfer. We aim to develop technologies that have genuine socio-economic impact; that is to say, projects that deliver value and that can be transferred to industry and, ultimately, to society. In order to ensure that our focus remains on addressing real-world problems and that our development activities result in generating value, we continue to build on our strong links with the business community both in the Madrid region of Spain and in the rest of the World. Our technology transfer strategy is aimed to ensure that the Institute's research activities remain relevant, that its innovations are diffused and their full value to society realized through various transfer processes such as licensing and the sale of patents, creation and support of spin-off companies in the region that seek to commercialize products exploiting innovations developed within the Institute. We carry out several forms of collaboration, including direct contracts with industry, as well as participation in joint projects financed by public entities. The projects listed in section 4 include both types of partnerships with specific listings of those enterprises and organizations currently working with us.

Joint, funded research projects enable us to establish solid ties to business. We are engaged in various research projects with private sector collaborators:

### 6.2.1. On-going Industry contracts

## LF assists HF in beam tracking and mobility

**Funded by:** Huawei Technologies (China)
**Duration:** July 2017 to August 2018
**Project Partners:** Huawei Technologies (China), IMDEA Networks Institute

In this collaboration between Huawei Technologies and IMDEA Networks, the project partners explore the potential of using low frequency bands to infer the channel characteristics of high frequency millimeter-wave bands. The inferred channel characteristics can support the network in terms of beam tracking, angle of arrival estimation, and location information. This results in improved performance in the millimeter-wave band since these techniques reduce the control overhead required to operate the network. The project also includes an experimental evaluation to verify that the developed mechanisms and algorithms work not only in theory but also in practical real-world wireless networking environments.

### 6.2.2. Industry contracts signed in 2018

## Towards flexible in-network processing of data streams

**Funded by:** Cisco University Research Program Fund, an advised fund of Silicon Valley Community Foundation
**Duration:** January 2018 to December 2018

Modern **packet processing engines** (PPEs) are faced with highly heterogeneous workloads driven by high volumes of end users and application types. A primary design challenge in this context consists in selecting and developing PPEs that scale application performance in a robust and cost-effective way providing the desired **flexibility** level and **high performance**. Interrelation among these objectives is non-trivial and definitely involves a certain conflict. In particular, flexibility is a driving objective to introduce new operational behaviors; from the other hand, performance and simplicity are constraining factors that ensure specific requirements. In this project we show that adding flexibility to the scheduling module and enhancing classification capabilities will allow not only consideration of user-defined objectives but also implementations of in-network processing of data streams.

## SPECTRUMCOP PROGRAM: MONTEBIANCO

*Technologies for Collaborative Detection of Spectrum Anomalies*

**Project website:** https://www.electrosense.org
**Funded by:** Armasuisse – Science and Technology
**Duration:** March 2018 to September 2018
**Project partners:** Armasuisse – Science and Technology, IMDEA Networks Institute

The MonteBianco project has the overarching goal of providing the **turnkey technologies** to bring a concrete application to the **Electrosense network**. In the context of this project, we aim to pervasively **monitor the spectrum** such that the backend will swiftly detect any anomaly and misuse in the spectrum usage. MonteBianco will study the necessary theoretical and practical concepts, and propose solutions that will be analyzed in testbeds managed by IMDEA Networks as well as in the overall Electrosense network.

This project is part of the SPECTRUMCOP PROGRAM which was launched in March 2016 and is still ongoing.

### 6.2.3. Other forms of collaboration with the private sector

## Telefónica - IMDEA Networks Joint Research Unit in 5G technologies

IMDEA Networks and Telefónica Research and Development continue collaborating on their Joint Research Unit (JRU), which was created in May 2014. The JRU is also known under the name «Telefónica - IMDEA Networks Joint Research Unit in 5G technologies». The **development of 5G** has already become a landmark in the global competition for technological leadership. Over a period of seven years up to 2020, this private-public alliance will share a wealth of know-how and in-house capabilities to tackle the challenge of creating a blueprint for the new technology and the standards that are to define **future ICT networks**.

Located at IMDEA Networks' headquarters in Madrid, the aim of the **JRU Telefónica I+D - IMDEA Networks** is to establish a strategic partnership that provides an operational framework for close interaction in a varied set of scientific activities. In particular, the JRU brings together a team comprising highly specialized multidisciplinary profiles ready to work collaboratively on externally funded R&D projects. One of the main areas in which this collaboration is reflected is the program **«Advanced 5G Network Infrastructure for Future Internet PPP»,** sponsored by the EU Commission within the Horizon 2020 program.

The private-public alliance shares a wealth of know-how and in-house capabilities to tackle the challenge of creating a blueprint for the new technology and the standards that are to define future ICT networks. **Work led by experienced researchers** Diego R. López and Pedro Aranda Gutiérrez, from Telefónica I+D and Arturo Azcorra, Joerg Widmer and Albert Banchs, from IMDEA Networks, focuses on key 5G enablers such as flexible functional split, joint handover optimization, 60GHz wireless networks, network function operating systems, secure virtual computing and green networking.

## 5TONIC - An Open Research and Innovation Laboratory focusing on 5G technologies

**5TONIC** is an open research and innovation laboratory focusing on 5G technologies that was **founded by Telefonica and IMDEA Networks Institute** in 2015. The **first laboratory of 5G excellence in Spain** also counts with **Ericsson Spain, INTEL, Commscope, University Carlos III of Madrid, Cohere Technologies, Artesyn Embedded Technologies, InterDigital, Altran and RedHat** amongst its members. In 2017 **ASTI Mobile Robotics, IFEMA and Rohde & Schwarz** became 5TONIC collaborators.

**The objective of 5TONIC is to create a global open environment** where members from industry and academia work together in specific **research and innovation projects related to 5G technologies** with a view to boost technology and business innovative ventures. The laboratory promotes joint project development and entrepreneurial ventures, discussion fora, events and conference sites, all in an international environment oriented to achieve the highest technological impact in the area of 5G.

5G networks are considered **the gateway to the age of "intelligent everything"** that awaits us. The development of 5G has thus become a landmark in the global competition for technological leadership.

5TONIC will serve to show the capabilities and interoperation of pre-commercial 5G equipment, services and applications by leading global companies in the 5G arena. Apart from the initial members, 5TONIC welcomes new members to join and gain from the benefits of an advanced research and innovation laboratory, oriented to research, debate, field-testing and demonstration of all technologies and equipment to support 5G communications, services and applications.

The main **5TONIC Research & Innovation Laboratory** site is located at IMDEA Networks. The Institute is one of the main leaders at European level in the field of 5G networks. Among 5G research projects carried out by the Madrid Institute are the ongoing **SEARCHLIGHT, TIGRE5-CM and Cloud4BigData** projects. **Flex5Gware and mmMAGIC** concluded during 2017.

### 5TONIC Members

Telefónica · institute IMDEA networks · ERICSSON · intel · COMMSCOPE · uc3m · cohere technologies · ARTESYN EMBEDDED TECHNOLOGIES · INTERDIGITAL · ALTRAN · redhat

### 5TONIC Collaborators

ASTI MOBILE ROBOTICS · IFEMA Feria de Madrid · ROHDE&SCHWARZ

### 6.2.4 Industry partners

Our technology transfer activities have led to a significantly increased portfolio of companies we collaborate with. During 2018 they were the following:

Armasuisse – Science and Technology

Ares2T

Assosiazione PIIU

Automatismos y Sistemas de Transporte Interno S.A.

British Telecommunications Public Limited Company (BT)

Celerway Communications AS

certSIGN S.A.

De Productizers B.V.

EvoLogics GmbH

Electricite de France

Ericsson España S.A

Ericson Hellas S.A

Ericsson telecomunicazioni

Eurescom-European Institute for Research and Strategic Studies in Telecommunications

European Small Business Alliance Of Small and Medium Independent Enterprises-ESBA

Exus Software Ltd.

Fundingbox Accelerator Sp z o.o

Hellenic telecommunications organization S.A.,

Huawei Technologies (China)

Idc Italia srl

Intel Research and Development Ireland Limited

Linknovate Science SL

Lstech España SL

NEC Europe Ltd.

Nextworks Engineering Forward

Nokia Bell Labs France

Nokia Spain S.A

Nokia Liseis Kaidiktia Ellas Anonimi Etaireia

Orange

Orange Romania SA

Orange Polska Spolka Akcyjna

Sistemas Avanzados de Tecnología SA (SATEC)

Sociedad Mercantil Estatal para la gestión de la innovación y las tecnologías turísticas S.A

Studio Professionale Associato a Baker & McKenzie

Telcaria Ideas S.L.

Telenor ASA

Trenitalia Spa

Telecom Italia S.p.a.

Telefónica I+D

Tieto Sweden Support Services AB

Upcom BvBa

Verizon Nederland B.V.

Wedia Limited

WINGS ICT Solutions

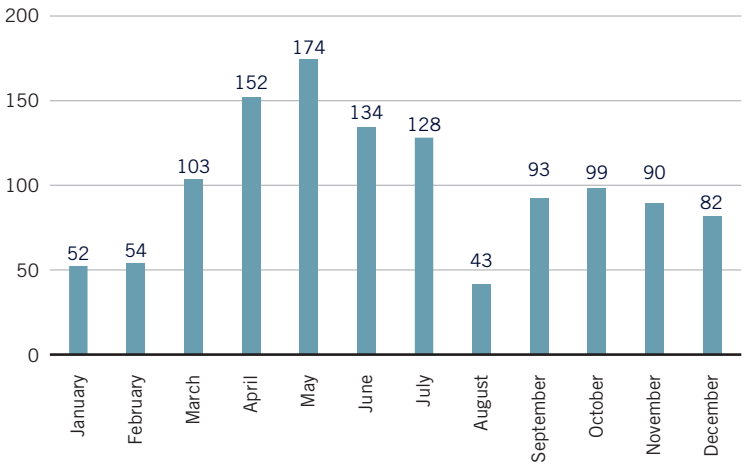
Wireless and More s.r.l

We continue to build firm relationships and sound collaborative arrangements with these companies and other key players in the field, including various regional, national and international bodies.

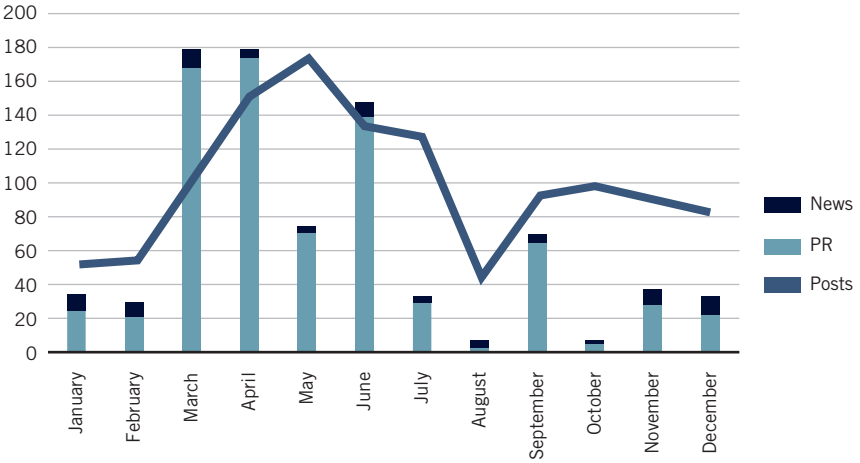
# Media impact 2018

## 6.3. Media impact

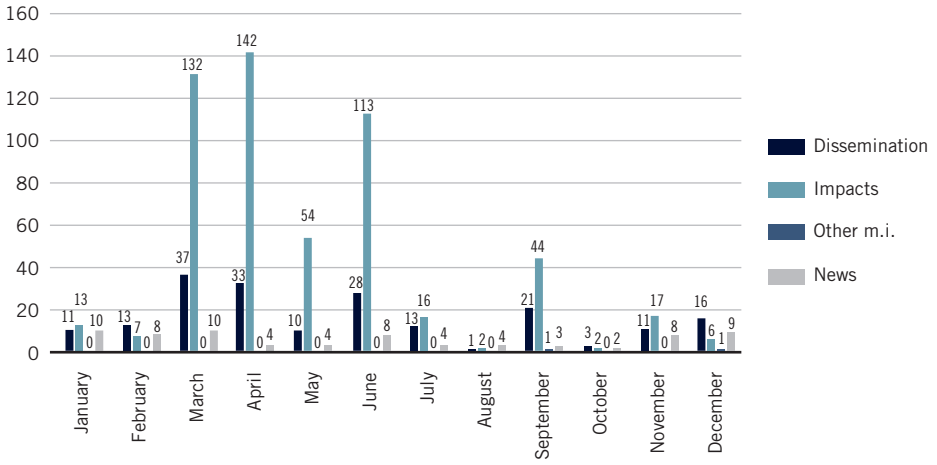
### social media posts by month



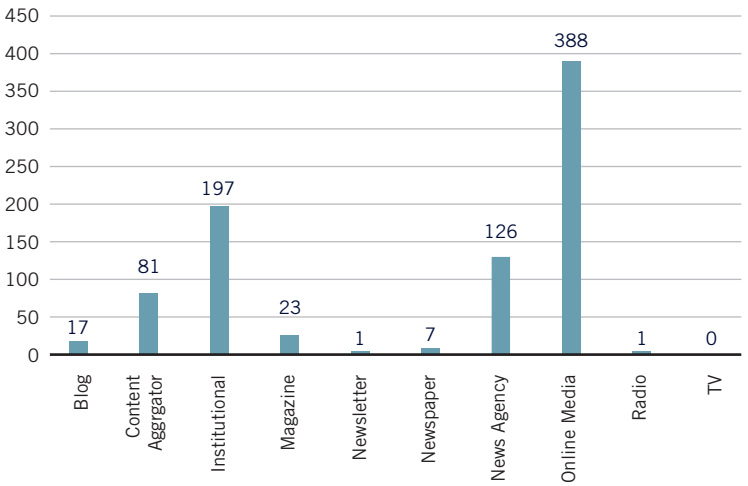

### dissemination activities: press releases, news, social media shares



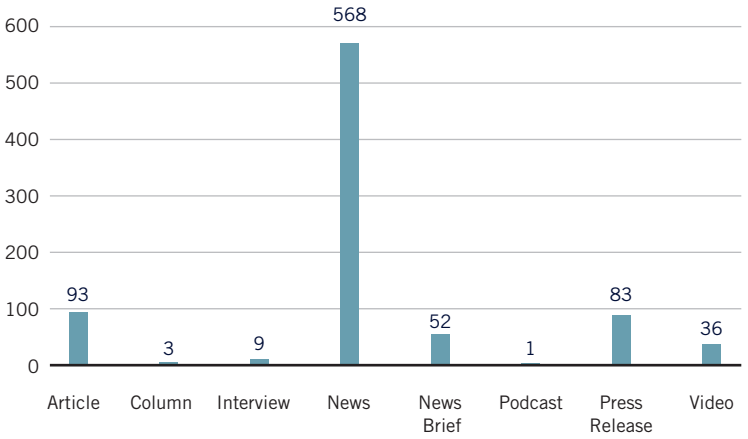

### disseminations, media impacts, other media impacts, news



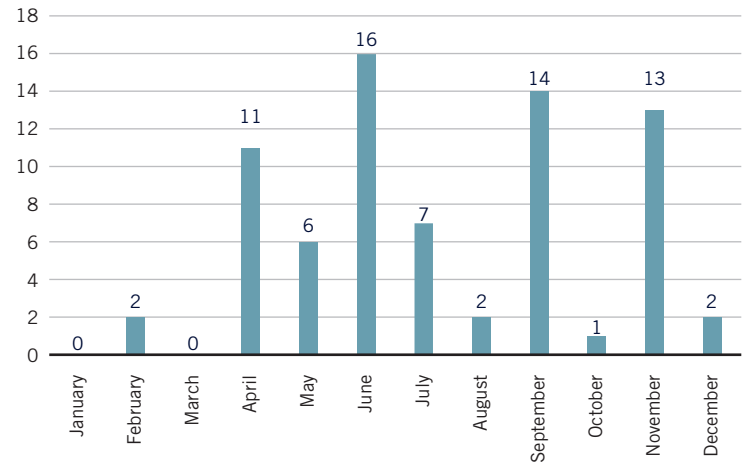
## type of media




## type of publication

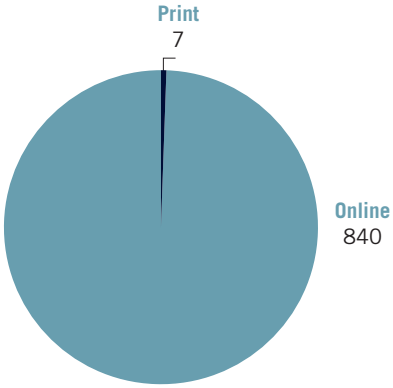



## publications with video

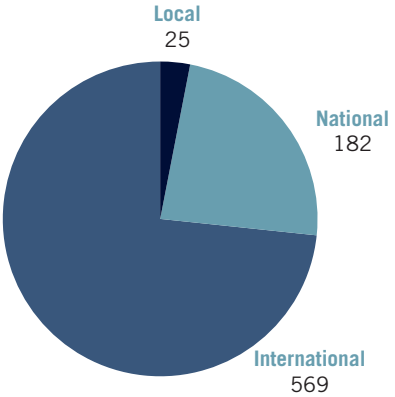


# Media impact 2018 (cont.)

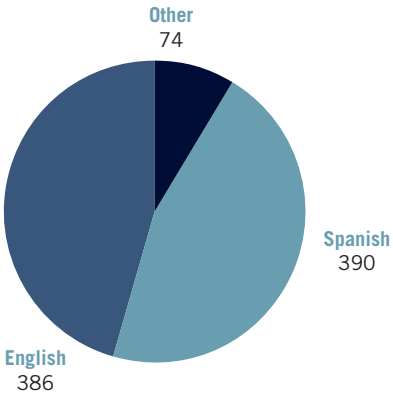
## format



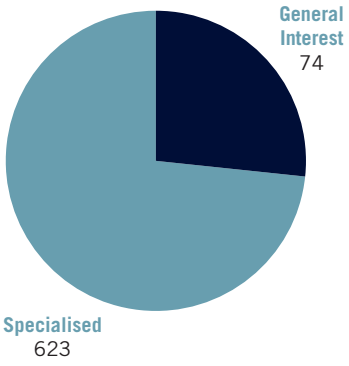

## national, international, local

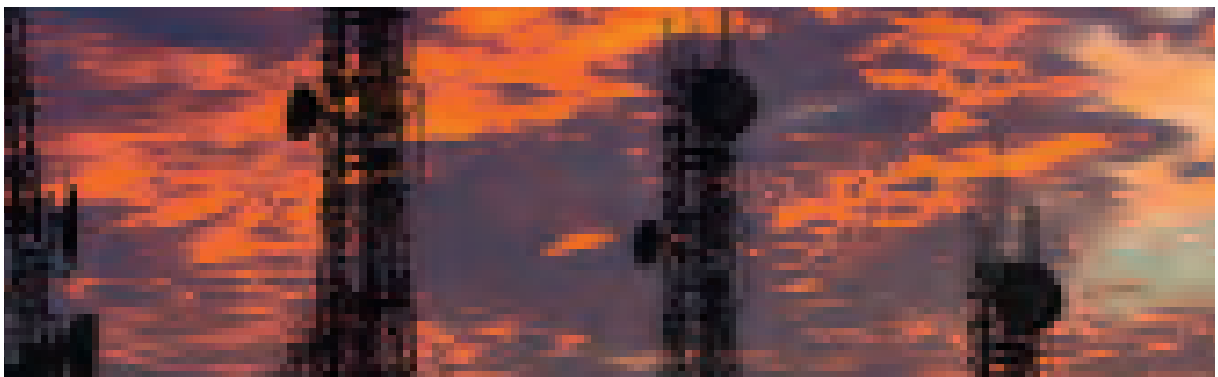



## impacts by language




## media content



AlphaGalileo Foundation

EurekAlert! The Global Source for Science News | AAAS

SINC La ciencia es noticia

notiweb

Globedia

PHYS.ORG

10 ANOS dicyt

total telecom

Expansión

TICbeat

NCYT Amazings Noticias de la Ciencia y la Tecnología Divulgando la Ciencia por Internet desde 1997

EL PAÍS

elEconomista.es

LA VANGUARDIA

ABC.es AGENCIAS

BioPortfolio Biotech, Healthcare and Medical Resources

economiadehoy.es

5TONIC

fundación para el conocimiento madrid+d

EFE

conectrónica tecnología y elementos de conexión y conectividad

ScienceDaily

## 6.4. Other collaborations

IMDEA Networks Institute collaborates with the Madrid-region network of Scientific Parks and Clusters (Madrid Network) that brings together industry and research institutes in the region. We are members of the ICT Audiovisual Cluster (Cluster Audiovisual) and of the ICT Security and Trust Cluster (Cluster de Seguridad y Confianza). We also collaborate with RedIRIS, the Spanish National Research and Education Network, and with REDIMadrid, the Research Network of Madrid.

ICT Audiovisual Cluster

ICT Security and Trust Cluster *(Cluster de Seguridad y Confianza)*

RedIRIS

REDIMadrid

In 2017, Madri+d and the IMDEA initiative continued collaborating through the Oficina de Proyectos Europeos Madri+d – IMDEA **(Madri+d – IMDEA European Projects Bureau).** The bureau provides a networked structure to support the participation of its members in European programs. It is made up of the seven IMDEA institutes and the Madrimasd Knowledge Foundation in a coordination role. This collaboration contributes to ensure that the IMDEA institutes achieve their goal of **creating a solid base for the generation of knowledge within the Community of Madrid** maintaining a critical presence in each of their scientific fields within the wider international context.

# faculty

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# director

The Director is the CEO of the Institute. He is appointed by the Board of Trustees amongst scientists with a well established international reputation in computer networking. The Director fosters and supervises the activities of IMDEA Networks Institute, and establishes the distribution and application of the available funds in accordance with the Institute's strategic goals and within the limits established by the Board of Trustees. The Director reports regularly to the Board. He is aided by the Scientific Council in determining the scientific research strategy and associated policies. The Deputy Director, the Research Director and the General Manager also assist the Director.

## Dr. Arturo AZCORRA

Director

**Research:** 5G Networks and Services; Network Virtualization and Softwarization; Drone Communications; On-line Social Networks Data Analytics; Mammal Brain Cartography and Topology

**Personal Site:**
http://people.networks.imdea.org/~arturo_azcorra/

**Short Bio**

Dr. Arturo Azcorra graduated in 1980 from Loy-Norrix High School, Michigan. He received his Telecommunication Engineering degree from Universidad Politécnica de Madrid in 1986, and the Doctor degree in 1989 from the same University. He currently is a full professor at Universidad Carlos III de Madrid, and he's also Director of the International Research Institute IMDEA Networks, a very relevant research institution in Europe. On the professional area, Arturo Azcorra is an IEEE Communications Society Senior Member, an Internet Society member, an ACM-SIGCOMM member, a founding member of the Association for Telematics, and also president of the said Association.

# deputy director

The Deputy Director provides assistance to the Director in the fostering and supervision of the scientific activities of the Institute and of its administrative management.

## Dr. Albert BANCHS

Deputy Director

**Research:** Wireless Networks; 5G Networks; Performance Evaluation; Algorithm Design

**Personal Site:**
http://people.networks.imdea.org/~albert_banchs/

**Short Bio**

Dr. Albert Banchs received his M.Sc. and Ph.D. degrees from the Polytechnic University of Catalonia (UPC-BarcelonaTech) in 1997 and 2002, respectively. He is currently a Full Professor with the University Carlos III of Madrid (UC3M), and has a double affiliation as Deputy Director of the IMDEA Networks institute. Before joining UC3M, he was at ICSI Berkeley in 1997, at Telefonica I+D in 1998, and at NEC Europe Ltd. from 1998 to 2003. Prof. Banchs authors over 100 publications in international conferences and journals, and is the co-inventor of several patents. He is the editor of IEEE Transactions on Wireless Communications and IEEE/ACM Transactions on Networking.

# research professors

Research Professors are our most published and cited researchers. They are recognized and respected leaders in their field of research. They have already made a difference. Their expertise and research interests have a significant impact on the Institute's scientific output and on the careers of their charges.

## Dr. Joerg WIDMER

Research Professor (tenured) & Research Director

**Research:** Computer Networks; in particular Wireless Networking; Extremely High Frequency Communication (60GHz); Network Coding; Mobile Network Architectures; Transport Protocols

**Personal Site:**
http://people.networks.imdea.org/~joerg_widmer/

**Short Bio**

Dr. Joerg Widmer is Research Professor and Research Director of IMDEA Networks in Madrid, Spain. Before, he held positions at DOCOMO Euro-Labs in Munich, Germany and EPFL, Switzerland. His research focuses on wireless networks, ranging from extremely high frequency millimeter-wave communication and MAC layer design to mobile network architectures. He authored more than 150 conference and journal papers, 3 IETF RFCs, and 13 patents. He received an ERC consolidator grant, the Friedrich Wilhelm Bessel Award of the Humboldt Foundation, a Ramon y Cajal grant, as well as eight best paper awards. He is senior member of IEEE and ACM.

## Dr. Marco AJMONE MARSAN

Research Professor

**Research:** Cellular Networking; Green Networking; Network and Protocol Performance; Crowdsourcing Systems

**Personal Site:**
https://www.telematica.polito.it/public/faculty/marco-ajmone-marsan

**Short Bio**

Dr. Marco Ajmone Marsan is a full professor at the Electronics and Telecommunications Department of the Politecnico di Torino in Italy, and a research professor at IMDEA Networks Institute in Spain. He obtained degrees from the Politecnico di Torino and UCLA. He received an honorary PhD from the Budapest University of Technology and Economics. Marco Ajmone Marsan has been doing research in the fields of digital transmission, distributed systems and networking. He has published over 350 papers, as well as two books. He was a member of the editorial board and of the steering committee of the "ACM/IEEE Transactions on Networking". He is a member of the editorial boards of the journals "Computer Networks", "Performance Evaluation", and "ACM TOMPECS". He was general chair of INFOCOM 2013. Marco Ajmone Marsan is a Fellow of the IEEE, a member of the Academy of Sciences of Torino, and a member of Academia Europaea.

## Dr. Antonio FERNÁNDEZ ANTA

Research Professor

**Research:** Communications and Networks; Parallel and Distributed Processing; Algorithms; Discrete and Applied Mathematics; Distributed Ledgers; Data Analysis

**Personal Site:**
http://people.networks.imdea.org/~antonio_fernandez/

**Short Bio**

Dr. Antonio Fernández Anta is a Research Professor at IMDEA Networks. Previously he was a Full Professor at the Universidad Rey Juan Carlos (URJC) and was on the Faculty of the Universidad Politécnica de Madrid (UPM), where he received an award for his research productivity. He was a postdoc at MIT from 1995 to 1997, and spent sabbatical years at Bell Labs Murray Hill and MIT Media Lab. He has more than 25 years of research experience, and more than 200 scientific publications. He was the Chair of the Steering Committee of DISC and has served in the TPC of numerous conferences and workshops. He received his M.Sc. and Ph.D. from the University of SW Louisiana in 1992 and 1994, respectively. He completed his undergraduate studies at the UPM, having received awards at the university and national level for his academic performance. He is a Senior Member of ACM and IEEE.

## Dr. Nikolaos LAOUTARIS

Research Professor

**Research:** Privacy; Transparency/Data Protection; Economics of Networks and Information; Intelligent Transportation; Distributed Systems; Protocols; Network Measurements

**Personal Site:**
http://laoutaris.info/

**Short Bio**

Dr. Nikolaos Laoutaris is a research professor at IMDEA Networks Institute in Madrid. Prior to that, he was director of data science at Eurecat and chief scientist of the Data Transparency Lab, which he cofounded in 2014 during his 10-year tenure as a researcher and senior researcher of Telefonica Research in Barcelona. Before Telefonica, he was a postdoc fellow at Harvard University and Marie Curie postdoc fellow at Boston University. He got his PhD in computer science from the University of Athens in 2004.

# research associate professors

Research Associate Professors are typically researchers with several years' experience who assume a position of responsibility in leading the day-to-day activities of our research teams.

## Dr. Domenico GIUSTINIANO

Research Associate Professor

**Research:** Next Generation Wireless Networks; Cyber-physical Systems; Visible Light Communication Systems; Mobile Indoor Localization Systems; Distributed Spectrum Monitoring Systems; mmWave Communication Systems

**Personal Site:**
http://people.networks.imdea.org/~domenico_giustiniano/

**Short Bio**

Dr. Domenico Giustiniano is Research Associate Professor (tenured) at IMDEA Networks Institute and leader of the Pervasive Wireless Systems group. Dr. Giustiniano is leader of the OpenVLC project, an open-source platform for research in visible light communication networks and co-founder of the non-profit Electrosense association, a crowd-sourcing initiative to collect and analyze spectrum data. Before joining IMDEA, he was a Senior Researcher and Lecturer at ETH Zurich. He also worked for a total of four years as Post-Doctoral Researcher in industrial research labs (Disney Research Zurich and Telefonica Research Barcelona). He holds a PhD in Telecommunication Engineering from the University of Rome Tor Vergata (2008).

## Dr. Sergey GORINSKY

Research Associate Professor

**Research:** Computer Networks; Distributed Systems; Network Economics

**Personal Site:**
http://people.networks.imdea.org/~sergey_gorinsky/

**Short Bio**

Dr. Sergey Gorinsky is a tenured Research Associate Professor at IMDEA Networks Institute, Madrid, Spain, where he leads the NetEcon (Network Economics) research group. Dr. Gorinsky received his Ph.D. and M.S. degrees from the University of Texas at Austin, USA in 2003 and 1999 respectively and Engineer degree from Moscow Institute of Electronic Technology, Zelenograd, Russia in 1994. From 2003 to 2009, he served on the tenure-track faculty at Washington University in St. Louis, USA. He served as an evaluator of research proposals and projects for the European Research Council (ERC StG), European Commission (Horizon 2020, FP7), and numerous other funding agencies.

## Dr. José Félix KUKIELKA

Research Associate Professor

**Research:** Wideband Access to Private Networks; Quality of Service in Wireless networks; Service-aware Wireless Routing; Wireless Protocol Optimization for High-throughput Data and Voice

**Personal Site:**
https://people.networks.imdea.org/~jfkukielka/

**Short Bio**

Dr. José Félix Kukielka is Senior Researcher at IMDEA Networks and Lecturer at the University Carlos III of Madrid (UC3M) (Madrid, Spain). He obtained his undergraduate degree at the Universidad Nacional Autónoma de México (Federal District, Mexico) in 1972, and went on to complete a M.Sc. and a Ph.D., both at the University of California, Berkeley (Berkeley, USA). He was the Technical Director of REDIMadrid from 2007 until 2009, a regional research network for education and research institutions based in the Madrid Region. He was elected Associate Member of the Technical Team for Alcatel-Lucent Technical Academy (ALTA) and he is the creator of the "Kukielka Configuration".

## Dr. Vincenzo MANCUSO

Research Associate Professor

**Research:** Design of Opportunistic Mobile Networks; Measurements and Assessment of Mobile Networks; Wireless Access; IoT; Performance Evaluation

**Personal Site:**
https://people.networks.imdea.org/~vincenzo_mancuso/

**Short Bio**

Dr. Vincenzo Mancuso is tenured Research Associate Professor at IMDEA Networks Institute, Madrid, Spain, and recipient of a Ramon y Cajal research grant. Previously, he was with INRIA (Sophia Antipolis, France), Rice University (Houston, TX, USA) and University of Palermo (Italy), from where he obtained his MSc and PhD. He authored more than 120 peer-reviewed publications focusing on Internet QoS and on the analysis, design, and experimental evaluation of opportunistic and adaptive protocols and architectures for wireless networks. He is currently working on analysis and optimization of opportunistic wireless access networks, and on the measurements and assessment of mobile networks.

# research assistant professors

Research Assistant Professors at IMDEA Networks Institute are bright researchers at the beginning of their research career, who want to establish a strong research group based on their research vision. They lead their own team of PhD Students and post-doctoral researchers and collaborate with top Research Associate Professors. Research Assistant Professors are not required to teach, so they can focus full-time on research if they so wish.

## Dr. Paolo CASARI

Research Assistant Professor

**Research:** Underwater Communications and Networking; Cloud Computing; Machine Learning; Passive Sensing and Localization in Wireless Networks

**Personal Site:**
https://people.networks.imdea.org/~paolo_casari/

**Short Bio**

Dr. Paolo Casari joined IMDEA Networks in 2015, and now leads the Ubiquitous Wireless Networks group. His research focuses on underwater communications and networking, cloud computing, machine learning, as well as passive sensing and localization in wireless networks. He is Principal Investigator for the NATO project ThreatDetect, and Scientific Manager for the H2020 RECAP and SYMBIOSIS projects. He serves on the editorial board of the IEEE Transactions on Wireless Communications and of the IEEE Transactions on Mobile Computing, and regularly collaborates to the organization of international conferences. He received two best paper awards. He was awarded his PhD in Information Engineering in 2008.

## Dr. Kirill KOGAN

Research Assistant Professor

**Research:** Admission Control and Buffer Management; Packet Classification; Software-Defined Networking; Network Functions Virtualization; Self-Driving Networks and In-Network Data Processing

**Personal Site:**
https://people.networks.imdea.org/~kirill_kogan/

**Short Bio**

Dr. Kirill Kogan is a Research Assistant Professor at IMDEA Networks Institute. He spent over a decade at Cisco Systems as a Technical Leader, where he worked on design of two major routing platforms C12000 and ASR1000. During his work at Cisco, he completed a Ph.D. study at Ben-Gurion University, Israel (2008-2012). He spent one year as a Postdoctoral Fellow at the University of Waterloo, Canada, where he worked with Srinivasan Keshav in ISS4E group and Alejandro Lopez-Ortiz in Algorithms and Complexity group. Later he worked with Patrick Eugster in DPDS group at the Purdue University, USA. His recent interests are in self-driving networks and in-network data processing. His research results are formalized at top venues as SIGCOMM, INFOCOM, PODC, ICNP, SOSR, etc.

## Dr. Narseo VALLINA-RODRÍGUEZ

Research Assistant Professor

**Research:** Network and Traffic Measurements; Protocol Analysis; Mobile Privacy and Security; IoT

**Personal Site:**
https://people.networks.imdea.org/~narseo_vallina/

**Short Bio**

Dr. Narseo Vallina-Rodriguez is a Research Assistant Professor at IMDEA Networks since 2016 and a Research Scientist at ICSI (Berkeley). Narseo gained his PhD from the University of Cambridge in 2013. His research has received best paper awards at international conferences such as IMC'18 and CoNEXT'14, the community contribution award at IMC'18, and an IETF ANRP Award in 2016. Narseo also obtained industry grants like a Qualcomm Innovation Fellowship (2012) and a Data Transparency Lab grant (2016). Narseo's research in the privacy domain has been covered by international media, including The Washington Post, The New York Times, and The Guardian.

*IMDEA Networks faculty researchers*

# emeritus professors

Emeritus Professors are eminent Research professors who are acclaimed for their many years of service to IMDEA Networks. With their dedication they have brought prominence and international repute to the Institute.

## Dr. Nicholas F. MAXEMCHUK

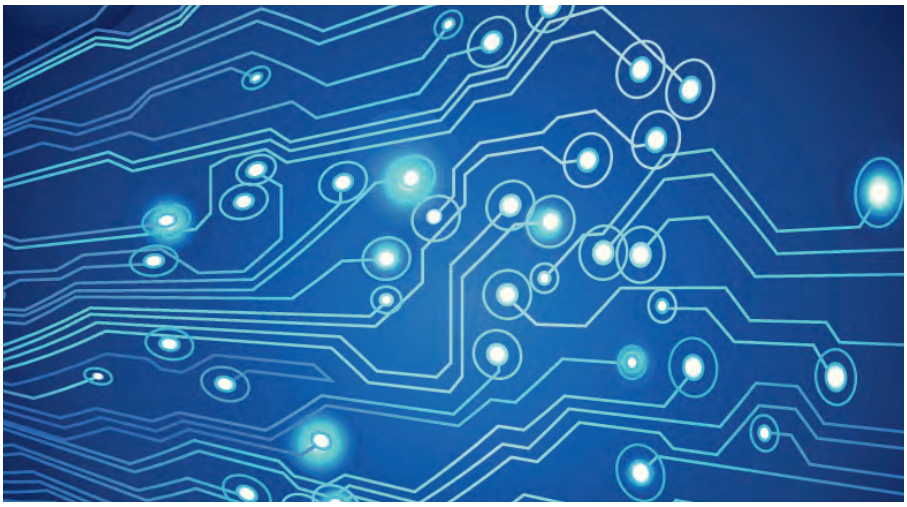
Emeritus Professor

**Research:** Random Coding Network Services; Advanced Network Design for QoS Deployment; Traffic Engineering in Wireless Networks

**Personal Site:**
http://www.ee.columbia.edu/~nick/

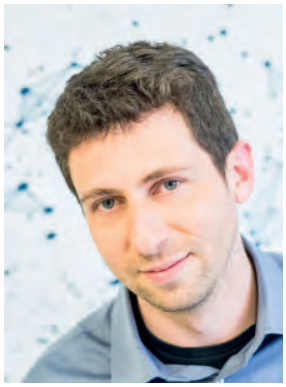
**Short Bio**

Dr. Nicholas Maxemchuk, a networking pioneer, holds a permanent double appointment as Professor at the world-leading Columbia University of New York City (New York, USA) and Chief Researcher at IMDEA Networks. He holds a M.Sc. in Electrical Engineering and a Ph.D. in Systems Engineering, both from the University of Pennsylvania (Philadelphia, USA). Before joining Columbia University and IMDEA Networks, Nick Maxemchuk held the position of Technical Leader at AT&T Research Laboratories (1996 – 2001) and, prior to that, was the Head of Distributed Systems Research Department at AT&T Bell Laboratories (1976 – 1996).



# post-doc researchers

Post-doctoral Researchers at IMDEA Networks Institute are early-stage, post-doctorate researchers who are looking to establish their research career, working with top research professors and a team of young, pre-doctorate researchers.



## Dr. Claudio FIANDRINO

Post-Doc Researcher

**Research:** Cloud RAN; mm-Wave Communications; Mobile Crowdsensing; Ultra-Reliable Low Latency Communications; Multi-Access Edge/Fog Computing

**Personal Site:**
https://people.networks.imdea.org/~claudio_fiandrino/

**Short Bio**

Dr. Claudio Fiandrino joined the Wireless Networking Group led by Dr. Joerg Widmer at IMDEA Networks in December 2016. His primary research interests include ultra-reliable and low latency communications, multi-access edge/fog computing and crowdsensing. He obtained my Ph.D. degree at the University of Luxembourg working on the ECO-CLOUD project with a focus on energy efficient communications in cloud, mobile cloud and fog computing. He has been awarded with the Spanish Juan de la Cierva grant and the Best Paper Awards in IEEE Cloudnet 2016 and in ACM WiNTECH 2018. He is also a member of IEEE and ACM, served as Publication and Web Chair at IEEE CloudNet 2014 and as Publicity Chair in ACM/IEEE ANCS 2018.

## Dr. Adrian LOCH

Post-Doc Researcher

**Research:** Wireless networking; millimeter-wave communications; cooperative communications

**Personal website:**
http://people. networks.imdea.org/~adrian_loch/

**Short Bio**

Dr. Adrian Loch joined the Wireless Networking Group at IMDEA Networks in April 2015 as a post-doc researcher. His main areas of interest lie in cooperative communications for both wireless access and wireless multihop networks, including routing issues as well as practical validation on wireless testbeds. He graduated in Electrical Engineering from Universidad Politécnica de Madrid (ETSIT UPM) and Technische Universität Darmstadt in 2011 after completing an international double degree program. After that, he obtained his PhD in Computer Science from Technische Universität Darmstadt in March 2015. During his PhD, he was a research associate at the Secure Mobile Networking Lab, contributing to the Research Priority Program Cocoon.

# visiting professors

Visiting Professors share our research interests and spend their sabbatical with us for either one or two terms. They usually have several years' post-doctoral research experience and are interested in extending their horizons with a temporary assignment in a new environment.

## Dr. Manuel CEBRIÁN RAMOS

Visiting Professor

**Organization of origin:** Data61 Unit. CSIRO - Commonwealth Scientific and Industrial Research Organisation. Melbourne. Australia
**Personal Site:**
https://www.media.mit.edu/people/cebrian/overview/

**Short Bio**

Dr. Manuel Cebrián is a research scientist with the Scalable Cooperation group at the MIT Media Lab. He is best known for using computational methods to create incentives that mobilize large groups of people to collaborate in solving major social problems, such as the DARPA Network Challenge, the Department of State Tag Challenge, the DARPA Shredder Challenge, among others. He earned a Ph.D. in computer science from Universidad Autónoma de Madrid, and then spent his postdoctoral training with Telefonica and Brown University working on collective problem solving. He also was based at the University of California, San Diego, where he was immersed in large-scale crowdsourcing competitions.

## Dr. Sungoh KWON

Visiting Professor

**University of origin:** University of Ulsan. Ulsan. South Korea
**Personal website:**
http://comnet.ulsan.ac.kr/

**Short Bio**

Dr. Sungoh Kwon (S'05/M'08) received his B.S. and M.S. degrees in electrical engineering from KAIST, Daejeon, Korea, and the Ph.D. degree in electrical and computer engineering from Purdue University, West Lafayette, IN, in 1994, 1996, and 2007, respectively. From 1996 to 2001, he was a research staff member with Shinsegi Telecomm Inc., Seoul, Korea. From 2007 to 2010, he developed LTE schedulers as a principal engineer in Samsung Electronics Company, Ltd., Korea. He has joined to University of Ulsan as an assistant professor since 2010. His research interests are in wireless communication networks.

## Dr. Ioannis STAVRAKAKIS

Visiting Professor

**University of origin:** National and Kapodistrian University of Athens. Athens. Greece
**Personal website:**
http://cgi.di.uoa.gr/~ioannis/

**Short Bio**

Dr. Ioannis Stavrakakis (IEEE Fellow) is Professor in the Dept. of Informatics and Telecommunications of the National and Kapodistrian University of Athens. He received his Diploma in Electrical Engineering from the Aristotelian University of Thessaloniki and his PhD in the same field from University of Virginia, USA. Teaching and research interests are focused on Analysis and Design aspects of networking technologies ranging from link to application layers. He was a member of the Scientific Council and of the Board of Trustees of IMDEA Networks from 2007 to 2017.

## Dr. Roberto GONZÁLEZ

Visiting Professor

**Organization of origin:** NEC Laboratories Europe. Heidelberg. Baden-Württemberg. Germany

**Short Bio**

Dr. Roberto González obtained his Master of Science in Telematics Engineering and in Telecommunications Engineering at University Carlos III of Madrid, Spain, in 2011 and 2009, respectively. He was a member of the Telematic Engineering Department and NETCOM research group, where he was Teaching Assistant and PhD student. He is now Senior Researcher and Data Scientist at NEC Iberica.

# pre-doc researchers

Our PhD Students are young, aspiring researchers who occupy a salaried position in our research team whilst undertaking their Ph.D. at a leading Madrid University for up to five years. Most of these pre-doc researchers enter the Ph.D. program at University Carlos III of Madrid (UC3M). IMDEA Networks Institute has a far-reaching collaboration agreement with UC3M, which includes the provision of a Postgraduate program for our early-stage researchers. In the future, we may have similar arrangements with other Madrid Universities.

*IMDEA Networks research team of postdocs, pre-doctoral researchers, engineers and internship students*

## Amr AbdelKhalek ABDELNABI

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Electronics and Communication Engineering. Cairo University. Cairo. Egypt
**MSc:** Wireless Communication. Nile University. Cairo. Egypt
**Previous Position:** Research Associate. Texas A&M University (TAMUQ). Doha. Qatar
**Research:** Opportunistic Communication; Stochastic Geometry Application to Wireless networks; Cellular Networks; Wireless PHY and MAC Layers; D2D Communication; Cooperative Communication; Wireless Channel Modeling; Interference Modeling
**Contact:** amr.abdelnabi@imdea.org

## Hany ASSASA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Electronics and Telecommunication Engineering (5-years). Damascus University. Damascus. Syria
**MSc:** Electronic Engineering. Politecnico di Torino. Torino. Italy; Degree of Master of Science (120 credits), Master's Programme Research on Information and Communications Technologies. KTH Royal Institute of Technology. Stockholm. Sweden
**Previous Position:** Core Network Packet Switch Engineer. Huawei Technologies Co. Ltd. Damascus. Syria
**Research:** Millimeter-Wave Networking; WiGig/IEEE 802.11ad; Network Simulation (ns-3); Wireless MAC Layer Design; Wireless Networking; Next Generation Networks Architecture; Software Defined Radio and Networking
**Contact:** hany.assasa@imdea.org

## Edgar ARRIBAS

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Mathematics. University of Valencia. Valencia. Spain
**Previous Position:** Research Collaborator and Professor Assistant. Department of Applied Mathematics. University of Valencia. Valencia. Spain
**Research:** D2D communications; Network Stability; Graph Theory; Analytical Methods Design
**Contact:** edgar.arribas@imdea.org

## Constantine AYIMBA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Electrical and Electronic Engineering. University of Nairobi. Nairobi. Kenya
**MSc:** Wireless Communications. Lund University. Lund. Sweden
**Previous Position:** Service Engineer. Ericsson. Nairobi. Kenya
**Research:** Network Function Virtualization; Cloud Services; Machine Learning
**Contact:** constantine.ayimba@imdea.org

## Guillermo BIELSA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Communication System Engineering. University Carlos III of Madrid. Madrid. Spain
**MSc:** Multimedia and Communications. University Carlos III of Madrid. Spain
**Previous Position:** Internship Student. IMDEA Networks Institute. Madrid. Spain
**Research:** Wireless Networks; 60 GHz Communication; IEEE 802.11ad; Wireless Testbed Experiments and Performance Evaluation
**Contact:** guillermo.bielsa@imdea.org

## Dario BEGA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Telecommunication Engineering. University of Pisa. Pisa. Italy
**MSc:** Telecommunication Engineering. University of Pisa. Pisa. Italy
**Previous Position:** Security Consultant. Communication Valley Reply. Milan. Italy
**Research:** 5G Networks; Network Slicing; Multi-tenancy; Reiforcement Learning; Machine Learning; Neural Networks; Network Economycs; Scheduling Algorithm; Wireless Networks
**Contact:** dario.bega@imdea.org

## Alejandro BLANCO

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Telecommunication Technologies Engineering. University Carlos III of Madrid. Madrid. Spain
**MSc:** Double Master's Degree. Telecommunications Engineering & Multimedia and Communications. University Carlos III of Madrid. Madrid. Spain
**Previous Position:** Junior Consultant. Everis. Madrid. Spain
**Research:** Mobile Network; LTE; Software Defined Radio (SDR); Measurements; Data Traffic
**Contact:** alejandro.blanco@imdea.org

## Patricia CALLEJO

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Audiovisual Systems Engineering. University Carlos III of Madrid. Madrid. Spain
**MSc:** Telematics Engineering. University Carlos III of Madrid. Spain
**Previous Position:** Internship Student. IMDEA Networks Institute. Madrid Spain
**Research:** Online Advertising; Data Analytics; Machine Learning; Network Measurements; Social Networks
**Contact:** patricia.callejo@imdea.org

## Pavel CHUPRIKOV

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and Steklov Mathematical Institute in Saint Petersburg
**BSc:** Applied Mathematics and Informatics. ITMO University. St. Petersburg. Russia
**MSc:** Applied Mathematics and Physics. St. Petersburg Academic University of the Russian Academy of Sciences. St. Petersburg. Russia
**Previous Position:** Software Developer at JetBrains. St. Petersburg. Russia
**Research:** Buffer Management; Online Algorithms; Dependent Types; Bioinformatics
**Contact:** pavel.chuprikov@imdea.org

## Roberto CALVO-PALOMINO

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Computer Science. University Rey Juan Carlos. Madrid. Spain
**MSc:** Telematics and Computer Science Systems. University Rey Juan Carlos. Madrid. Spain
**Previous Position:** Researcher at LibreSoft and Robotic group. University Rey Juan Carlos. Madrid. Spain
**Research:** Collaborative Spectrum Sensing; Collaborative Algorithms; Distributed System; Large Scale Deployments
**Contact:** roberto.calvo@imdea.org

## Vitalii DEMIANIUK

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Applied Mathematics and Computer Science. National Research University of Information-al Technologies, Mechanics and Optics. Saint Petersburg. Russia
**MSc:** Applied Mathematics and Computer Science. National Research University of Information-al Technologies, Mechanics and Optics. Saint Petersburg. Russia
**Previous Position:** Algorithms Developer. VeeRoute. Saint Petersburg. Russia
**Research:** Packet Classification; Software Defined Networks; Network Function Virtualization; Algorithms and Data Structures; Combinatorial Optimization
**Contact:** vitalii.demianiuk@imdea.org

## Elizaveta DUBROVINSKAYA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** BA in Automatics, Telemechanics and Telecommunications (with honors). Saint-Petersburg State Transport University. Sankt Petersburg. Russia.
**MSc:** Digital Communications. Christian-Albrechts Universität zu Kiel. Kiel. Germany.
**Previous Position:** Board Member at Teleone OÜ. Tallinn. Estonia.
**Research:** Underwater Communications; Underwater Localization; Signal Processing
**Contact:** elizaveta.dubrovinskaya@imdea.org

## Aymen FAKHREDDINE

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Telecommunications Engineering. Institut National des Postes et Télécommunications (INPT). Rabat. Morocco
**MSc:** Advanced Wireless Communications Systems. École Supérieure d'Électricité - Supélec. Paris. France. Telematics Engineering. University Carlos III of Madrid. Madrid. Spain
**Previous Position:** Intern. Alcatel-Lucent Bell Labs. Paris. France
**Research:** WLAN Indoor Localization; Tracking Algorithms; GPS; Wireless Communications; Mobile Networks
**Contact:** aymen.fakhreddine@imdea.org

## Ander GALISTEO

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Telecommunications Systems Engineering. University of Navarra. San Sebastián. Spain
**MSc:** Telecommunications Engineering. University of Navarra. San Sebastián. Spain; Engineering Technology Network Communication Track. University of Houston. Houston. USA
**Previous Position:** Teaching Assistant. University of Houston. Houston. USA
**Research:** VLC; Physical Layer Simulation; VLC localization
**Contact:** ander.galisteo@imdea.org

## Julien GAMBA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Computer science. University of Strasbourg. Strasbourg. France
**MSc:** Computer Networks and Embedded Systems. University of Strasbourg. Strasbourg. France
**Previous Position:** Internship Student; ICube Laboratory. Strasbourg. France
**Research:** Network Measurements; Privacy and Security; Interdomain Routing
**Contact:** julien.gamba@imdea.org

## Ginés GARCÍA AVILÉS

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Bachelor in Computer Sciences, University of Murcia (UMU). Murcia. Spain
**Previous Position:** Internship Student. Engineering Department. IMDEA Networks & University Carlos III of Madrid
**Research:** Multipath TCP; Transport Protocols; Wireless Networks; 802.11aa; Real-time Multicast; SDN; NFV
**Contact:** gines.garcia@imdea.org

## Yonas Mitike KASSA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Computer Science. Alemaya University. Dire Dawa. Ethiopia
**MSc:** Computer and Communication Networks Engineering. Politecnico di Torino. Turin. Italy
**Research:** Online Social Networks; Online Advertising; Privacy; Large Scale Data Analytics; Machine Learning; Network Measurement; Content Distribution Networks
**Contact:** yonas.kassa@imdea.org

## Pablo JIMÉNEZ MATEO

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Degree in Computational Mathematics - Degree in Computer Engineering. Universitat Jaume I. Castellón de la Plana. Spain
**MSc:** Intelligent Systems. Universitat Jaume I. Castellón de la Plana. Spain
**Previous Position:** Internship Student. Universitat Jaume I. Castellón de la Plana. Spain
**Research:** mmWave; Machine Learning; 5G
**Contact:** pablo.jimenezmateo@imdea.org

## Vadim KIRILIN

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Applied Mathematics and Computer Science. Lomonosov Moscow State University. Moscow. Rusia
**Previous Position:** Software Engineer and Performance Analyst. Softmachines. Moscow. Russia
**Research:** Inter-domain Routing; Machine Learning Approaches for Caching in CDN
**Contact:** vadim.kirilin@imdea.org

## Jorge MARTÍN PÉREZ

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Joint Degree in Computer Engineering & Mathematics. Autonomous University of Madrid. Madrid. Spain
**Research:** VNF Mapping
**Contact:** jorge.martin@imdea.org

## Joan PALACIOS BELTRAN

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Mathematics. University of Valencia. Valencia. Spain
**MSc:** Multimedia and Communications. University Carlos III of Madrid. Spain
**Research:** mmWave; Beam-Forming; Channel Estimation; Mobility Models Estimation and Prediction; ADoA Localization
**Contact:** joan.palacios@imdea.org

## Nuria MOLNER

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Mathematics. University of Valencia. Valencia. Spain
**MSc:** Telematics Engineering. University Carlos III of Madrid. Spain
**Previous Position:** IRTIC (Institute of Robotics and Information and Comunication Tecnologies). Paterna. Valencia. Spain
**Research:** Fronthaul/Backhaul Integration and Optimization; NFV Placement Optmization; 5G Networks
**Contact:** nuria.molner@imdea.org

## Noelia PÉREZ PALMA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Bachelor in Computer Sciences, University of Murcia (UMU). Murcia. Spain
**Previous Position:** Project manager for network creation and optimization projects at Allocation and Supply, Landline Business, Telefónica Spain. Madrid. Spain
**Research:** Opportunistic Networks; Wireless Networks; D2D Communication
**Contact:** noelia.perez@imdea.org

## Maurizio REA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Telecommunications Engineering. University of Palermo. Palermo. Italy
**MSc:** Telecommunications Engineering. University of Palermo. Palermo. Italy
**Previous Position:** Researcher. ETH Zürich. Switzerland
**Research:** mmWave Networks; Beam Search Algorithms; Signal Processing
**Contact:** maurizio.rea@imdea.org

## Lucía UGUINA

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Telecommunication Technologies Engineering. University Carlos III of Madrid. Madrid. Spain
**MSc:** Computer Science and Mathematics. Universitat Rovira i Vigili / Universitat Oberta de Catalunya. Tarragona. Spain
**Previous Position:** Junior Assistant. Management Solutions. Madrid. Spain
**Research:** Learning Analytics; Data Mining; Real-Time Data
**Contact:** lucia.uguina@imdea.org

## Víctor SÁNCHEZ AGÜERO

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute y Universidad Carlos III de Madrid. Madrid. España
**BSc:** Audiovisual Systems Engineering. University Carlos III of Madrid. Madrid. Spain
**Previous Position:** Internship Student. University Carlos III of Madrid. Madrid. Spain
**Research:** Internet Measurements; IP Routing; BGP; Data Visualization; Network Architectures; UAV/ Drones
**Contact:** victor.sanchez@imdea.org

## Pelayo VALLINA-RODRIGUEZ

Pre-Doc Researcher

**Affiliation:** IMDEA Networks Institute and University Carlos III of Madrid
**BSc:** Computer Science. University Carlos III of Madrid. Madrid. Spain
**MSc:** Telematics Engineering. University Carlos III of Madrid. Madrid. Spain
**Previous Position:** Fellow Student. NETCOM Research Group. University Carlos III of Madrid. Madrid. Spain
**Research:** Social Computing Systems; Online Advertising; User Privacy
**Contact:** pelayo.vallina@imdea.org

# external PhD students

Our External PhD Students are young, aspiring researchers who are supervised or co-supervised by a member of the IMDEA Networks' research team. Most of the External PhD Students to IMDEA Networks are undertaking the Ph.D. program at University Carlos III of Madrid (UC3M).

## Luis F. CHIROQUE

External PhD Student

**BSc:** Telematics Engineering. Polytechnic University of Madrid. Madrid. Spain
**MSc:** Mathematical Engineering. University Carlos III of Madrid. Spain
**Research:** Graph Theory; Network Science; Machine Learning; Big Data; Data Mining
**Personal site:**
http://people.networks.imdea.org/~luis_nunez/

## Cristina MÁRQUEZ

External PhD Student

**BSc:** Telecommunication Technologies Engineering (bilingual degree). University Carlos III of Madrid. Madrid. Spain
**MSc:** Double Master Degree in Telecommunications Engineering and Telematics Engineering. University Carlos III of Madrid. Madrid. Spain
**Research:** 5G Networks; Wireless and Mobile Networking; Big Data

## Antonio PASTOR VALLES

External PhD Student

**MSc:** Telematics Engineering. University Carlos III of Madrid. Madrid. Spain
**Research:** Complex Networks; Machine Learning; Connectomics; Brain-Machine Interfaces
**Personal site:**
https://www.networks.imdea.org/es/personas/antonio-angel-pastor-valles

# research engineering and support

The Research Engineering & Support unit at IMDEA Networks is dedicated to supporting the continued growth in our research capacity and maximizing the impact of our research output by providing specific technical and professional expertise and assistance to ongoing research endeavors in a variety of ways. Research Engineering & Support personnel work either at the level of the entire Institute, or closely with researchers and their groups. There are roles with an engineering background that take care of the design, installation and maintenance of the IT infrastructure. Other roles may, for instance, provide administrative or operational support to project or lab management.

Typical jobs include systems administration, research (software and/or hardware) engineering, project or research administrator and laboratory technician. These positions are similar to their industry equivalents. They enable our employees to work on cutting-edge research problems and technology in a stimulating and innovative environment.

### Ángel ACOSTA
Systems Administrator

**BSc:** Computer Engineering. José Antonio Paéz University. Venezuela
**MSc:** Informatics Engineering. University Carlos III of Madrid. Spain

### Ignacio BERBERANA
Senior Research Engineer

**MSc:** Mining Engineer. School of Mining Engineering. Polytechnic University of Madrid. Madrid. Spain
**Research:** 5G; Radio Communications; RAN Virtualization

### Carlos CONTRERAS
Junior Software Developer

**BSc:** Computer Engineering. Specialization: Information Systems. Universidad Carlos III de Madrid. Madrid. Spain

### Antonio COBOS
Research Engineer

**BSc:** Telecommunications Engineering Technology. University of Seville. Seville. Spain
**MSc:** Telecommunications Engineering. University of Seville. Seville. Spain; Information and Communication Technologies Security. University of Seville. Seville. Spain
**Research:** 5G Networks; IoT; Wired Networks; Wi-Fi Networks; IT Security

### Héctor CORDOBÉS DE LA CALLE
Senior Research Engineer

**MSc:** Telecommunications Engineering. University Carlos III of Madrid. Spain, Communications and Multimedia. University Carlos III of Madrid. Spain
**Research:** NLP; Big Data; Data and Signal Processing

### Dr. Amanda GARCÍA-GARCÍA
Research Engineer

**BSc:** Telecommunications Engineering. Polytechnic University of Madrid. Madrid. Spain
**MSc:** Communications Technologies and Systems. Polytechnic University of Madrid. Madrid. Spain
**Research:** RF Engineering; Millimeter-Wave Communications; High Frequency Antenna Design; Device Fabrication

### Neftalí GONZÁLEZ
Systems Administrator

**BSc:** IT Systems Engineer. Universidad Rey Juan Carlos. Móstoles. Spain

### Rafael GARCÍA
Research Engineer

**BSc:** Computer Science. University of Córdoba. Spain
**MSc:** Computational Sciences. University of Amsterdam. The Netherlands
**Research:** Machine learning; Data science; Dig data; Artificial intelligence.

### Rosa GÓMEZ
Research Administrator

**BSc:** Economics. University of Málaga. Málaga. Spain
**MSc:** Master in Economics of Science and Innovation. Barcelona Graduate School of Economics. Barcelona. Spain; Master in Economics and Finance. Centro de Estudios económicos Financieros (CEF). Madrid. Spain

### Dr. José HERRERA
Research Engineer

**BSc:** Computer Science Engineering. Polytechnic University of Madrid. Madrid. Spain
**MSc:** Computer Science. Complutense University of Madrid. Madrid. Spain
**Research:** Privacy; Access Control; Cloud computing; Edge/Fog Computing

### Francisco Javier HERVÁS
Project Administrator

**BSc:** Bachelor's Degree in Business Administration
**MSc:** Master in Management of Human Resources. Universidad Autónoma de Madrid. Spain

### Diego JUARA
Research Engineer

**BSc:** Telecommunication Systems Engineering. University of Alcalá. Spain
**Research:** Wireless Communications; Visible Light Communication (VLC); FPGA; Embedded Systems; IoT

### Mohamed Lamine MOULAY
Research Engineer

**BSc:** Communication and Electronics Engineering. Applied Science University. Amman. Jordan
**MSc:** Multimedia and Communications. University Carlos III of Madrid. Madrid. Spain
**Research:** AMC; Wireless Communications; Docker: Python; Linux

### Anna IANNARELLA
Program Manager

**BSc:** Electrical Engineering. Simón Bolívar University. Caracas. Venezuela
**MSc:** Corporate Finance Specialist. Simón Bolívar University. Caracas. Venezuela

### Dr. Jesús Omar LACRUZ
Research Engineer

**BSc:** Electrical Engineering. University of the Andes. Mérida. Venezuela
**MSc:** Electronic System Engineering. Polytechnic University of Valencia. Valencia. Spain
**Research:** mm-Wave; FPGA design; Signal Processing; Digital Communications

### Ricardo PADRINO
Research Engineer

**BSc:** Electronic Engineering. Universidad Complutense de Madrid. Madrid. Spain; Physics (3-years). Universidad Complutense de Madrid
**Research:** Deep Learning; Computer Vision; Automatic Algorithms; Autonomous Robot-Vehicles; Electronic Design

# internship students

IMDEA Networks offers a Research Internship program. Eligible candidates are students who are currently undertaking a B.Sc., M.Sc. or equivalent in Computer Science, Electrical Engineering, Computer Engineering, Telecommunications, Telematics or a related field, and who wish to enhance their research potential developing the Science of Networks. Interns work closely with members of our research team, which allows them to acquire on-the-job training and gain valuable experience in computer networking science and technology.

The minimum expected internship duration is usually 3 months, but longer stays are accommodated depending on individual circumstances. Successful interns also receive a special consideration for future positions on our PhD Student team.

We also have a program in place for Visiting PhD Students from partner universities or research organizations to undertake an internship at IMDEA Networks under the direction of one of our faculty members. This program enables them to develop new skills and gain expertise in an enriching new environment.

**Alejandro AMARO**
**Supervisor:** José Félix Kukielka
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Carlos ANDRÉS**
**Supervisor:** Joerg Widmer
**University of origin:** Universidad Politécnica (Madrid, Spain)

**Giulia ATTANASIO**
**Supervisor:** Joerg Widmer
**University of origin:** Politecnico of Torino (Torino, Italy)

**Guillermo BARTOLOMÉ**
**Supervisor:** Joerg Widmer
**University of origin:** Universidad Politécnica (Madrid, Spain)

**Arani BHATTACHARYA**
**Supervisor:** Domenico Giustiniano
**University of origin:** Stony Brook University (New York, United States)

**Sara CABRERIZO**
**Supervisor:** Rebeca de Miguel
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Marta DORADO**
**Supervisor:** Rebeca de Miguel
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Paula ENCINAR**
**Supervisor:** Arturo Azcorra
**University of origin:** Universidad Carlos III (Madrid, Spain)

**José Ignacio ENRIQUEZ**
**Supervisor:** José Félix Kukielka
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Andrés ESCALANTE**
**Supervisor:** Arturo Azcorra
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Carlos FERNÁNDEZ**
**Supervisor:** Paolo Casari
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Corina FERRER**
**Supervisor:** Rebeca de Miguel
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Fernando FRAGIO**
**Supervisor:** Paolo Casari
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Jaime GALLEGO**
**Supervisor:** Narseo Vallina-Rodriguez
**University of origin:** Colegio Zurbarán (Colmenar Viejo, Spain)

**Alfonso GONZÁLEZ**
**Supervisor:** Paolo Casari
**University of origin:** MIT (Cambridge, Massachusetts, United States)

**Mohamed KASSEM**
**Supervisor:** Joerg Widmer
**University of origin:** University of Edinburgh (Scotland, United Kingdom)

**Matteo MARUGAN**
**Supervisor:** Joerg Widmer
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Ana María MORENO**
**Supervisor:** Paolo Casari
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Mercedes OLMEDO**
**Supervisor:** Rebeca de Miguel
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Joel RODIEL-LUCERO**
**Supervisor:** Narseo Vallina-Rodriguez
**University of origin:** The Gary and Jerri-Ann Jacobs High Tech High (San Diego, California, United States)

**Alejandro RODRÍGUEZ**
**Supervisor:** Arturo Azcorra
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Francisco Javier SACIDO**
**Supervisor:** Arturo Azcorra
**University of origin:** Universidad Carlos III (Madrid, Spain)

**Gabriel TERRASA**
**Supervisor:** Paolo Casari
**University of origin:** MIT (Cambridge, Massachusetts, United States)

**David YAGÜE**
**Supervisor:** José Félix Kukielka
**University of origin:** Universidad Carlos III (Madrid, Spain)

# administrative unit

## Ramón GIRONA
General Manager

**Qualifications:** BSc: Computer Science. Universidad de las Palmas de Gran Canaria (ULPGC). Canary Islands. Spain; Industrial Engineering. Universidad Politécnica de Canarias (UPC). Canary Islands. Spain; MBA: Instituto Universitario de Empresa. Madrid. Spain

## Rebeca DE MIGUEL
Senior Operations Manager

**Qualifications:** Licenciatura en Ciencias de la Comunicación (Periodismo) (5-year degree in Communication Sciences (Journalism)). University of the Basque Country - UPV/EHU. Spain; BA (1st Class Hons) in History and Theory of Art & Film Studies. University of Kent at Canterbury. UK

## Brian DUNNE
Senior Human Resources Manager

**Qualifications:** BBS in Business Studies and French. Trinity College Dublin. Ireland

## Ana GONZÁLEZ
Senior Projects & Funding Manager

**Qualifications:** BA (Hons) "Modern European Studies". University of West London. UK; Postgraduate Diploma in "European Studies". University of West London. UK

*Admin and research support team*

## Sonia BALAGUER PETROVA
Human Resources Project Administrator

**Qualifications:** BSc: Economics and Law. University Carlos III of Madrid. Madrid. Spain. (Erasmus Scholarship. Economics. Université Paris I Panthéon-Sorbonne. Paris. France). MSc: International Cooperation, Management of Public Policies, Programs and Projects of Development. Universidad Internacional Menéndez Pelayo. Madrid. Spain I Professional Development. Universidad de Alcalá de Henares. Madrid. Spain.

# alumni network

The Institute's Alumni Network is built upon graduate PhD Students who have obtained their Ph.D. and have left the team to further their research career in other organizations. Networking is about making contacts and building relationships. The alumni frame provides its members a supportive community of graduates who have shared experiences, values and goals that will last a lifetime. It also provides a venue through which former PhD Students can maintain a long-term collaborative relationship with the Institute. Alumni are IMDEA Networks Institute's ambassadors worldwide, creating awareness and opening up new communication channels with the global scientific community.

The members of the alumni network appear listed here following the most recent graduation date up to the end of 2018.

### Dr. Foivos MICHELINAKIS

**Current Position:** Postdoctoral Fellow. Simula Metropolitan Center for Digital Engineering (SimulaMet). Oslo. Norway

**Ph.D. Date:** 19 Sep 2018

### Dr. Pablo CABALLERO GARCÉS

**Current Position:** HID Sensor Algorithm Engineer. Apple Inc. Cupertino. California. USA

**Ph.D. Date:** 18 Jul 2018

### Dr. Aymen FAKHREDDINE

**Current Position:** Senior Researcher. Institute of Networked and Embedded Systems, Alpen-Adria-Universität. Klagenfurt. Austria

**Ph.D. Date:** 14 Jun 2018

### Dr. Roderick FANOU

**Current Position:** Post Doc. San Diego SuperComputer Center (SDSC). Center for Applied Internet Data Analysis (CAIDA)/University of California San Diego (UCSD). San Diego. EE.UU.

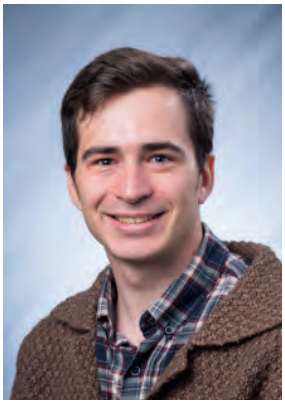
**Ph.D. Date:** 14 December 2017

### Dr. Christian VITALE
**Current Position:** Post Doc. Department of Electronics and Telecommunications. Politecnico di Torino. Turin. Italy
**Ph.D. Date:** 9 June 2017

### Dr. Evgenia CHRISTOFOROU
**Current Position:** Post Doc. Department of Electronics and Telecommunications. Politecnico di Torino. Turin. Italy
**Ph.D. Date:** 25 May 2017

### Dr. Angelos CHATZIPAPAS
**Current Position:** Innovation Architect. Lloyds Banking Group. London. United Kingdom
**Ph.D. Date:** 25 November 2016

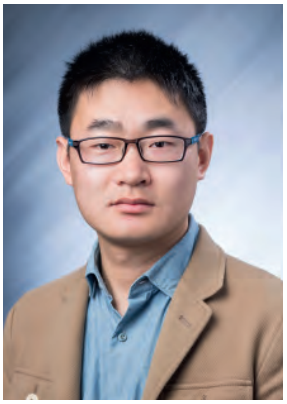
### Dr. Syed Anwar UL HASAN
**Current Position:** Product developer/ Co-founder. PriceFlier. Hyderabad. Telangana. India
**Ph.D. Date:** 20 June 2016



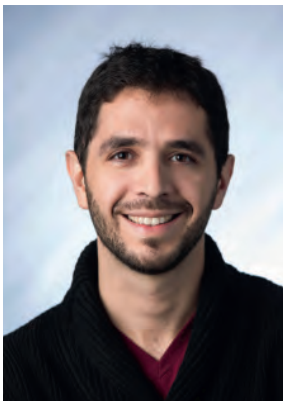
### Dr. José A. RUIPÉREZ-VALIENTE
**Current Position:** Postdoctoral Associate. Massachusetts Institute of Technology (MIT). Cambridge. Massachusetts. USA
**Ph.D. Date:** 31 May 2017

### Dr. Nicola BUI
**Current Position:** Senior Research Scientist. College of Computer & Information Science. Northeastern University. Boston. Massachusetts. USA
**Ph.D. Date:** 12 May 2017

### Dr. Elli ZAVOU
**Current Position:** Postdoc. Inria Grenoble - Rhône-Alpes & INSA Lyon. Lyon. France
**Ph.D. Date:** 30 September 2016

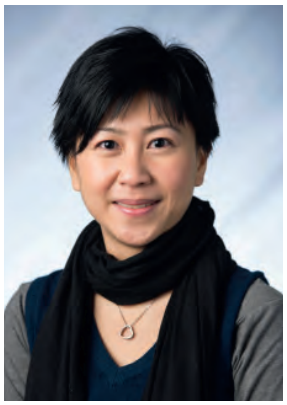


### Dr. Qing WANG
**Current Position:** Postdoc Researcher. University of Leuven - KU Leuven. Leuven. Belgium
**Ph.D. Date:** 19 May 2016



### Dr. Juan Camilo CARDONA

**Current Position:** Software Engineer. Cisco Systems. Barcelona. Spain
**Ph.D. Date:** 6 May 2016



### Dr. Gek Hong SIM

**Current Position:** Post-doc Researcher. TU Darmstadt. Germany
**Ph.D. Date:** 30 March 2016

### Dr. Arash ASADI

**Current Position:** Post-doc Researcher. TU Darmstadt. Germany
**Ph.D. Date:** 8 March 2016

### Dr. Thomas NITSCHE

**Current Position:** Wissenschaftlicher Mitarbeiter/Research Fellow. Fraunhofer Institute for Embedded Systems and Communication Technologies ESK. Munich. Germany
**Ph.D. Date:** 25 September 2015

### Dr. Pablo SALVADOR

**Current Position:** Technology Innovation Engineer. Fon Technology. Madrid. Spain
**Ph.D. Date:** 8 April 2016

### Dr. M. Isabel SANCHEZ

**Current Position:** Postdoctoral Fellow. Simula Research Laboratory. Oslo. Norway
**Ph.D. Date:** 8 March 2016

### Dr. Vincenzo SCIANCALEPORE

**Current Position:** Research Scientist. NEC Deutschland GmbH. Germany
**Ph.D. Date:** 27 November 2015

### Dr. Ignacio CASTRO

**Current Position:** Post-doctoral Research Assistant. Queen Mary University of London. UK
**Ph.D. Date:** 20 July 2015

### Dr. Fabio GIUST

**Current Position:** Research scientist. NEC Laboratories Europe. Heidelberg. Germany
**Ph.D. Date:** 5 March 2015

### Dr. Andra LUTU

**Current Position:** Postdoctoral Fellow. Simula School of Research and Innovation (SSRI). Simula Research Laboratory. Fornebu. Norway
**Ph.D. Date:** 11 November 2014

### Dr. Michal KRYCZKA

**Current Position:** TGP Systems Integration Analyst. Accenture. Warsaw. Poland
**Ph.D. Date:** 7 February 2013

### Dr. Paul PATRAS

**Current Position:** Chancellor's Fellow / Lecturer. School of Informatics. University of Edinburgh. Scotland
**Ph.D. Date:** 18 March 2011

### Dr. Jordi ARJONA AROCA

**Current Position:** Postdoctoral Researcher. Cloud Computing Group. Nokia Bell Labs.
**Ph.D. Date:** 13 February 2015

### Dr. Agustín SANTOS

**Current Position:** Public Officer. Spanish Public Administration. Madrid. Spain
**Ph.D. Date:** 3 June 2013

### Dr. Alex BIKFALVI

**Current Position:** Software Engineer. Midokura. Barcelona. Spain; Part-time Lecturer. Network Technologies and Strategies Research Group. Pompeu Fabra University. Barcelona. Spain
**Ph.D. Date:** 18 July 2012

# research team structure

## networked systems&algorithms

**Research Director**
· Dr. Arturo Azcorra

**Researcher Professors**
· Dr. Sergey Gorinsky
· Dr. José F. Kukielka
· Dr. Kirill Kogan

**Pre-Doc & Post-Doc Researchers**
· Haftay Abreha
· Patricia Callejo
· Pavel Chuprikov
· Vitalii Demianiuk
· Pablo Jiménez Mateo
· Vadim Kirilin
· Yonas Mitike Kassa
· Nuria Molner
· Pablo Jiménez Mateo
· Jorge Martín Pérez
· Nuria Molner
· José A. Ruipérez-Valiente
· Víctor Sánchez Agüero
· Lucía Uguina
· Antonio Cobos

## wireless networking

**Research Director**
· Dr. Joerg Widmer

**Researcher Professors**
· Dr. Domenico Giustiniano
· Dr. Paolo Casari
· Dr. Marco Ajmone-Marsan

**Pre-Doc & Post-Doc Researchers**
· Dr. Jesús Omar Lacruz
· Dr. Claudio Fiandrino
· Dr. Amanda Garcia
· Dr. Adrian Loch
· Hany Assasa
· Constantine Ayimba
· Guillermo Bielsa
· Alejandro Blanco
· Roberto Calvo-Palomino
· Elizaveta Dubrovinskaya
· Aymen Fakhreddine
· Ander Galisteo
· Dolores García
· Pablo Jiménez
· Joan Palacios
· Maurizio Rea

## network measurements&analytics

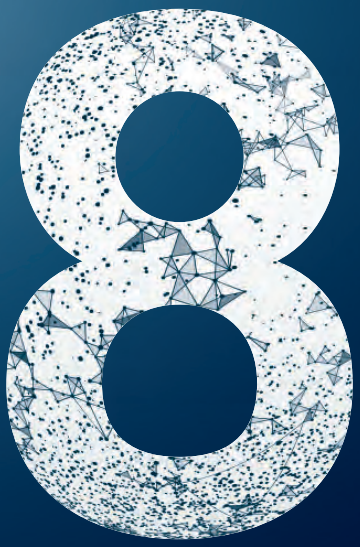
**Research Director**
· Dr. Albert Banchs

**Researcher Professors**
· Dr. Antonio Fernández-Anta
· Dr. Nikolaos Laoutaris
· Dr. Vincenzo Mancuso
· Dr. Narseo Vallina-Rodriguez

**Pre-Doc & Post-Doc Researchers**
· Dr. José Herrera
· Amr Abdelnabi
· Edgar Arribas
· Dario Bega
· Álvaro Feal
· Julien Gamba
· Ginés García Avilés
· Rafael García
· Olewasegun Ojo
· Noelia Pérez Palma
· Pelayo Vallina-Rodriguez
· Mohamed Lamine Moulay
· Ricardo Padrino

*Our current team*

# headquarters and research laboratories infrastructure




8.1. **Headquarters** **[130]**

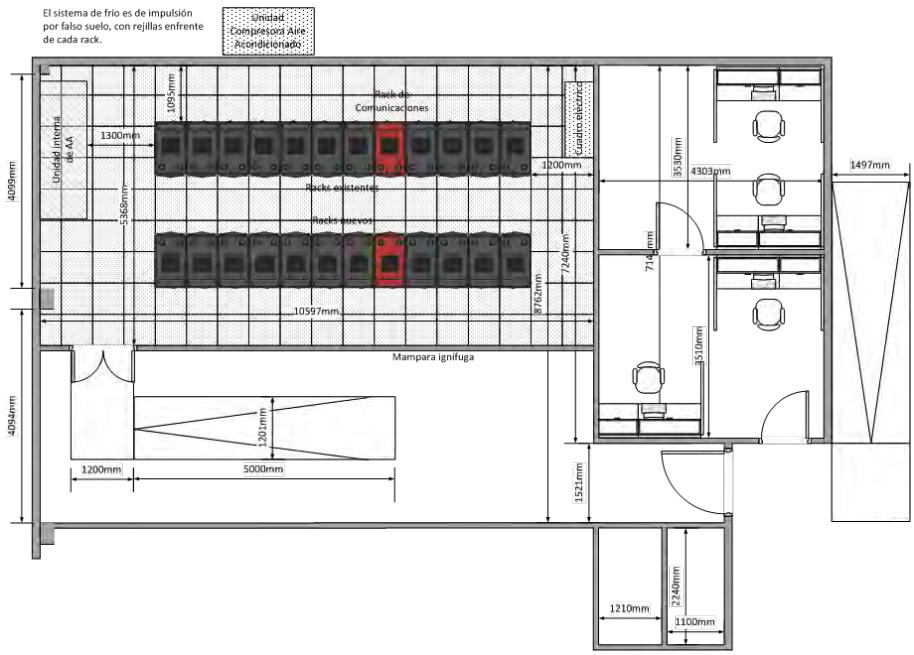
8.2. **Research laboratories** **[132]**

## 8.1. Headquarters

IMDEA Networks includes in its goals the provision of the highest international level of research and technology development capabilities geared to the advancement of future Internet technologies. Our headquarters aim to fulfill the functional requirements of a leading- edge research center and to attract researchers from around the World. The main objective of our office and lab space is to provide a high quality-working environment for researchers. We are continuously refurbishing our site at Avenida del Mar Mediterraneo in Leganes (Madrid) in order to furnish it with renovated and extended facilities. The new spaces are conceived primarily with researchers' needs and preferences in mind, including spacious premises with state-of-the-art facilities and equipment, labs adapted to the needs of our lines of research, with excellent communications and ICT infrastructure, and specific research equipment.

The area of the building already remodeled in 2018 amounted to 2.278 $m^2$.

In 2018, the public tender for Phase 2 of the 5TONIC Laboratory was carried out, which consisted of the extension of 12 additional racks for equipment, with its corresponding interconnection wiring, electrical protections and electronic equipment. The equipment was delivered at the end of November.



Connection by high-speed fibers: REDIMadrid, the research data network of the community of Madrid has begun the installation of a redundant 10Gb/s fiber for the exclusive use of IMDEA Networks. At the same time, fiber installation works with different paths has been carried out within the Institute's infrastructure. The fibers will end in the 5TONIC Laboratory CPD and will serve both IMDEA Networks and 5TONIC.

Transformation Center: The physical installation of the sectioning center, as well as the transformation center itself, were completed at the end of 2018. We are waiting for the permits from the Ministry of Industry and the electricity supply company for the final connection of the medium voltage service, which is expected in the first quarter of 2019. In this way, the Institute may have up to 600 kW of electricity consumption.

Auditorium: The definition of the project for the auditorium has begun. Initial architectural plans are available. The auditorium will be able to be divided into two rooms by means of an acoustic mobile partition that can be used as meeting rooms. It will have a remote controllable audiovisual system as well as a warehouse where equipment and furniture can be stored

The ground floor seminar rooms where lightly refurbished: painting of walls and ceiling; general cleaning; polishing of floors; overhead projectors and projection screens were added and an electrical wiring update was done.

Cold water pipes: the replacement of the old cold water pipes in the newly refurbished areas of the building have been done with new sanitary polypropylene pipes.

## 8.2. Research laboratories

At our scientific laboratories we aim to transform our research results into high value added products and services. They allow us to perform:

- The measurements and prototypes of the devices, protocols and algorithms developed by our researchers.
- Simulations of highly complex baseband and medium access control systems, as well as sophisticated radio subsystems.
- Radio parameter measurements involved in mobile and fixed communications and evaluation of effects on the radio spectrum of the new protocols and algorithms designed in the Institute.
- The development and deployment of reliable, high-performance networked systems, of software defined networking, and of novel architectures and protocols for behavioral networking and for network economics.

In order to support cutting-edge research, IMDEA Networks invests in the latest, state-of-the-art laboratory test equipment, endowing the Institute with the capacity of transforming research into high added value products and services.

The laboratories are used for:

- Constructing prototypes and measuring the devices, protocols and algorithms developed by the researchers.
- Simulating complex base-band and medium access systems, as well as sophisticated radio subsystems.
- Measuring radio parameters involved in mobile, fixed and satellite communications, designing and characterizing radiating elements, and measuring the effects on the radio electric spectrum of new protocols and algorithms designed by the Institute.

For 2018,

The Institute has purchased a new generation Fortigate FG-501E firewall with a redundant power supply that will service all IMDEA Networks data networks.

In computer equipment, several Dell R630 and R430 high-performance servers have been purchased for 5G studies.

It has invested in the purchase of several special 60 GHz WiFi stations for wireless studies.

A baseband TX-RX system based on FPGAs has been purchased for use in a millimeter wave development platform.

### The 5TONIC Laboratory

The 5TONIC Laboratory provides **infrastructure** to support a wide range of systems, functionality, services and applications allowing the **deployment, analysis, testing, trial and demonstration of choice technologies currently considered the driving forces of 5G development.** With the 2020 horizon in sight, the **private-public** 5TONIC initiative aims to tackle the challenge of creating a blueprint for the new technologies and standards that are to define future ICT networks, the backbone of the "networked society".

In 2018 carried out a number of activities in order to pursue two objectives:

1. Support for the development of new technological solutions for 5G.
2. Support for the implementation and deployment of new use cases that take advantage of 5G capabilities.

As an example of the projects launched for pursuing the first objective, 5TONIC carried out two sets of tests of OTFS technology, developed by 5TONIC member Cohere Technologies, in collaboration with Telefónica. The results obtained demonstrated that OTFS can achieve spectral efficiencies higher than those established for 5G systems (more than 50 bit/s/Hz measured in the tests, versus a target of maximum spectral efficiency defined by 3GPP of 30 bit/s/Hz). Also, it was demonstrated that OTFS can allow increasing the area capacity just adding additional base stations using the same frequency resources almost in a linear way.

Also, Luz Wavelabs, a startup collaborator, has completed the proof of concept of its pure/TM technology – and demonstrated it is able to provide actual optical fiber bandwidth in wireless communications. Luz Wavelabs was the winner of the first start-up competition sponsored by 5TONIC.

In terms of new use cases, 5TONIC has been collaboration with ASTI, a leader in the area of Automated Guided Vehicles (AGVs), in order to demonstrate the ability to control and guide AGVs from a Mobile Edge Computing (MEC) platform over a low-latency LTE network set up to mimic 5G technology. The vehicles used in the tests are capable of transporting very heavy loads around large factories with great precision. The demonstration highlighted that providing the performance characteristics required the precise control of industrial vehicles is only possible if it is carried out at the edge of the network.

Another MEC application developed for real-time facial recognition was also demonstrated, showcasing the viability of using real time video processing for enhancing the control process for guiding the next generation of AGVs in a more flexible way.

In order 5TONIC continued the expansion of its infrastructure with the deployment of LTE radio infrastructure in band 20 (800 MHz), able of supporting NB-IoT and LTE-M. Also

A major milestone for 5TONIC was the fact that the lab, together with some of its member companies, has been awarded a vital role in the three high-profile EU-sponsored 5G development projects in the ICT-17. The awards cement the laboratory's position as one of Europe's foremost 5G digital innovation centers. The three projects are designed to help innovate and test 5G vertical market applications and services in the end-to-end environment that is a key feature of the 5TONIC facility. The projects will run for three years and were selected by the EU from a total of 16 proposals it received from facilities all over Europe. The three chosen projects are:

- **5G EVE (European Validation platform for Extensive trials) aims** to create the foundations for the roll-out of end-to-end 5G neworks in Europe. 5G-EVE supports this transition by offering to vertical industries, and to all 5G PPP Phase 3 projects, facilities to validate their network KPIs and their services.
- **5G-VINNI** (5G Verticals INNovation Infrastructure) looks to accelerate the uptake of 5G in Europe by providing an end-to-end (E2E) facility that validates the performance of new 5G technologies by operating trials of advanced vertical sector services.
- **5GGENESIS** (5th Generation End-to-end Network, Experimentation, System Integration, and Showcasing) will create an integrated end-to-end 5G facility where 5G network KPIs for various 5G use cases can be validated and brought together with a view towards their integration in one united full-stack, end-to-end 5G platform.
- **5TONIC** was also present in the Mobile World Congress 2018 and has collaborated with organization of the 5G Master of University Carlos III Madrid. It also gave a demonstration of future 5G use cases to Julio Linares Lopez, chair of the GSMA's strategy group and member of its Board. A group of 5TONIC's senior executives from the member companies attended the event and presented the latest working examples of how 5TONIC is investigating the potential of 5G technology to drive new use cases in vertical markets

Comunidad de Madrid

EUROPEAN UNION
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# annual report 2018

www.networks.imdea.org

## imdea **networks** institute


institute IMdea networks

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**#IMDEA #networks**