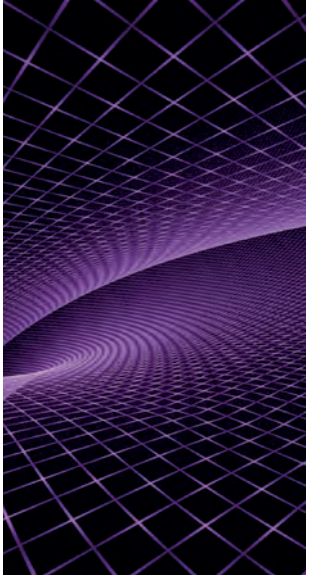

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foreword

foreword

Arturo Azcorra
Director of Institute IMDEA Networks
May 2013

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Over the past years, Institute IMDEA Networks has succeeded in putting together a team of top scientists that is contributing to boost Madrid's competitiveness as a technology-oriented region. IMDEA Networks is bringing substantial external funds to the region with its research contracts and projects: since its creation, it has been awarded a total of 9.6 M€ from competitive funds, out of which 1,158 K€ were budgeted for 2012. Such funds not only strengthen the technology profile of the region, but ultimately also contribute to its GDP. Furthermore, IMDEA Networks' collaboration with local companies is helping to enhance Madrid's high-tech output with cutting edge research findings. We believe that it is precisely by focusing on the development and manufacturing of products and services incorporating the most advanced technologies, and thus increasing their competitiveness, that Spain may efficiently combat the current economic crisis and make its mark on the 21st Century.

IMDEA Networks is focusing on an area that has a profound impact on people's lives. The wide-spread access to networks (Internet, 3G, social nets, Wi-Fi…) has drastically changed the way manufacturers produce and supply their goods, how public administrations operate, how professionals work and, in general, how individuals and society at large communicate. Far from stabilizing, the networked socio-economic phenomenon continues to transform our everyday life at an amazing pace. The recent proliferation of mobile handheld devices with flat-rate data plans has revolutionized information access, making the notion of network access *everywhere* and *anytime* a reality. At the same time, the popularity of social networks has altered human interaction to an immeasurable degree. In the near future, we will see other equally significant developments, such as the widespread deployment of machine-to-machine communications and their adoption in smart buildings and smart cities.

The continuous evolution of the science of networks offers a plethora of new opportunities for technological innovation. Currently, one of the most attractive emerging trends is that of software-defined networking (SDN). By separating the "control plane" from the "data plane", SDN greatly simplifies network management and is a key enabler for new concepts such as network virtualization. All of these technologies are essential in the context of the complex data center networks that result from the rise of cloud computing. Furthermore, they may help to bring more customized services to end users. At IMDEA Networks, we are making a strategic bet on this technology, which will radically change the way network architectures are designed and operated in the future. Among other actions, we have hired one of the leading international researchers in this area, Dejan Kostić, who has brought to the Institute an ERC grant that focuses on the reliability aspects of SDN, and we have also prepared several new European project proposals that deal with other aspects of this technology.

This year has further consolidated the Institute as one of the leading networking research laboratories in Europe. 2012 has been a great success on many fronts, including the quality and international recognition of the publications authored by our researchers, the attraction of new research projects and grants, and the effective transfer of technology, amongst others. From all of our achievements in 2012, one that I would like to particularly highlight is the establishment of strategic partnerships with ZED Worldwide and Telefonica, which provide a framework for close interaction that comprises a varied set of activities. In addition to these alliances, IMDEA Networks has also strengthened the collaboration with several of its long-term collaborators, such as NEC Europe or Alcatel-Lucent, as well as with new ones, such as Cisco Systems or Gowex Wireless.

My gratitude goes to the Regional Government of Madrid for its continuous support of this economy-transforming initiative, as well as to all those who are contributing to make this exciting project a great international success.

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Institute IMDEA Networks is a top international research centre in the area of networking. *2012 has been a great year for us in a number of ways. Our strategy to transfer scientific and technological developments to industry has led to various new collaborations in addition to strengthening the existing partnerships with some of our key industrial collaborators. We have also been very successful in several highly competitive public calls for funding to conduct new research projects. Through an extremely selective recruitment process we were able to attract outstanding scientists to strengthen our research team. Our research work - focused on innovative technological solutions to real-world problems - has been published in the most prestigious venues within our field. All these achievements have received the recognition of the international scientific community along with other stakeholders, as reflected by the awards received by the Institute this year.*

The **research team** of IMDEA Networks consists of preeminent technical leaders. All IMDEA Networks researchers hold **a meritorious research record** that includes publications in the most influential venues in our area of research, and many of them have received important awards and prizes for their research work and achievements. Furthermore, our scientists possess significant **industry experience.** Besides having graduated from, or having worked for, top-level international universities (such as Columbia University, Politecnico di Torino, MIT, UT Austin, UC Berkeley, EPFL or Rice University) our researchers also have an extensive industry background, having been employed in leading industry research laboratories (such as NEC, Telefonica, AT&T, Alcatel, Philips, NTT Docomo or Telecom Italia). What is more, they have been granted over 40 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 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 Thesis at IMDEA Networks. These researchers form the life-blood of any research team and are essential to conduct many project-related research tasks, such as the development of prototypes. We are very proud that in 2012 the Institute graduated two new PhD Students, Dr. Alex Bikfalvi and Dr. Marco Gramaglia, both of whom received the maximum distinction in their PhD defense, conferred by a committee of recognized national and international experts. It is worth highlighting that out of the three PhD Students that IMDEA Networks has graduated so far, two of them have received the Outstanding PhD Award of University Carlos III of Madrid.

In 2012, **the Institute has continued to reinforce its research team.** We had 1 opening for a researcher position, which received 84 high quality applications from 29 different countries. The position was awarded to Dejan Kostić, a top, widely recognized researcher who has not only brought to the Institute very valuable technical skills but also a pres-

tigious ERC Starting grant. We also received a large number of applications (over 400) for our open Pre-doc Researcher positions, out of which 5 outstanding candidates were selected. This highly demanding selection process guarantees that we are attracting first rate scientists. With the new incorporations, the IMDEA Networks team is currently composed of **46 researchers from 20 different countries at different stages of their research careers.**

A key accomplishment of 2012 has been our participation in research projects. These projects bring external funding, highly productive collaborations with prominent research institutions and industrial partners, and the opportunity to transform our research ideas into practical deployments. IMDEA Networks is **currently working on 12 projects,** which is a notable quantity considering the size of the Institute. Out of these 12 projects, 7 are European, 1 is funded by the National Science Foundation of China, 2 are national projects and 2 have a regional scope. During 2012, the European projects CROWD, iJOIN and eCOUSIN were awarded to the Institute in a very competitive call in which only 36 out of 195 proposals were granted funding. In that call, CROWD ranked 4th out of the 195 proposals, iJOIN ranked 6th, and eCOUSIN ranked 25th. Of these, **iJOIN is the first Research and Technological Development (RTD) European project that is coordinated by an IMDEA institute.** It is also worth highlighting that another European project in which the institute is involved, **MEDIEVAL, was short-listed for the Future Internet Award 2012** as one of the three best European projects in the Internet area.

In addition to research projects funded by public institutions, a substantial part of the external funding attracted by IMDEA Networks originates from **direct contracts with industry.** While IMDEA Networks has strong ties with the international private sector, collaboration with local companies is at least as crucial (if not more) due to the value that it brings to the Madrid region. Two noteworthy examples of such local alliances are the strategic partnerships that the Institute has established with ZED Worldwide and Telefonica I+D, which provide a stable long-term framework to conduct joint research work. In addition to these, the Institute has also strong ties with other national and international companies, such as NEC Europe, Cisco Systems and Gowex Wireless, in 2012.

The efforts made by our team to produce outstanding scientific work led to a large number of scientific publications in 2012. However, rather than their quantity, we would like to emphasize their quality. We are very proud to be one of a privileged few European organizations to have published during this year at venues such as IEEE INFOCOM, ACM CoNEXT, and IEEE/ACM Transactions on Networking, which are among the most prestigious in our field. In addition, two of our publications received **Best Paper Awards:** at the 2012 IEEE International Symposium on Network Computing and Applications and at the 20th Symposium on Concurrence and Distributed Systems, respectively. It is worth noting that, despite the relatively recent creation of the IMDEA institutes, their publications have already achieved **remarkable impact,** as shown by **rankings published**

by CSIMAGO, according to which **the IMDEA institutes are ahead of all Spanish universities,** and above other world-class Spanish institutions such as CSIC, CIEMAT or the Barcelona Supercomputing Centre.

Beyond the publication of research articles, **a fundamental objective of our research is to have socio-economical impact.** Such impact can take various forms, such as **standardization, patent licensing or knowledge transfer of scientific and technological results** with the objective of further development and exploitation in commercial products. Research performed at IMDEA Networks during 2012 has attained impact to a sizable degree. Our researchers have been particularly active on this front, and some of their ideas have been standardized at the IETF (which is the body responsible for standardizing Internet technology) and the IEEE (the world's leading developer of industry standards). These contributions have led to fruitful cooperation with companies interested in our **efforts to bridge the gap between theoretic results and practical implementation, deployment and commercialization.**

Last, but not least, another major activity over the past year concerned the extension of **our networking laboratory.** Networking science requires the rigorous validation of new algorithms and protocols. The **infrastructure for experimentation** provided by fully equipped laboratories is an essential working tool. In 2012, the Institute made a substantial investment to acquire specialized equipment for its networked systems laboratory, indispensable to conduct research in this area. This investment was co-funded by a collaboration agreement with the Spanish Ministry of Science and Innovation (now the Ministry of Economy and Competitiveness).

In **summary,** the Institute's **research publications output in 2012** comprises books (2), book chapters (2), peer-reviewed international journals and magazines (24), presentations in international conferences (44), research projects (12), industry contracts (4) and standardization contributions (11). We believe that all the above show the excellence of the Institute in research and technology transfer, and provide the basis to achieve ever growing success in the years to come.

about us

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2.1. Profile

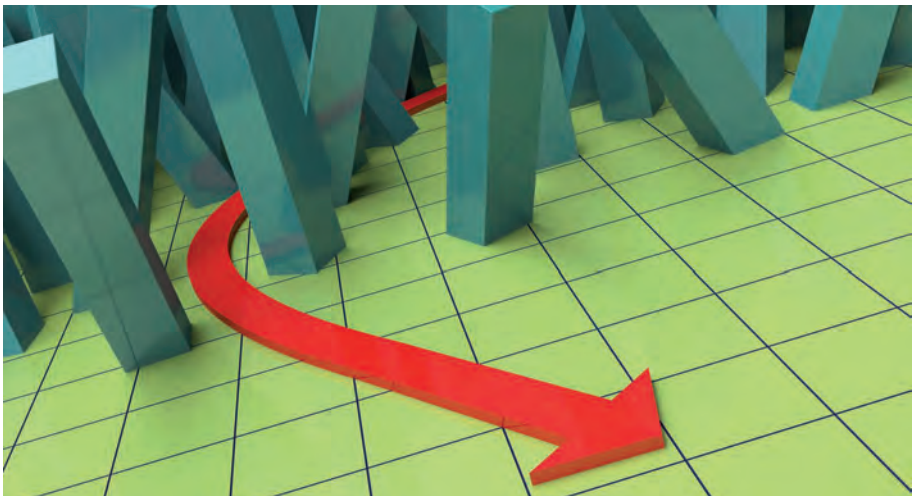
Institute IMDEA Networks is a networking research institute whose multinational team is engaged in cutting-edge fundamental science. As a growing, English-speaking Institute located in Madrid, Spain, IMDEA Networks offers a unique opportunity for pioneering scientists to develop their ideas. IMDEA Networks is establishing itself internationally at the forefront in the **development of future Internet technologies** and has already incorporated highly-reputed scientists. Our researchers share the potential to shape the future of networking science over the coming years.

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 within the Madrid Region
- Collaborate with Madrid's industrial sector, research centers and educational institutions

2.3. Our Mission

Our mission is to create value by **leading research in protocol, algorithm and systems development** that enable the **Future Internet**. We do this by conducting research and developing innovative and useful scientific and technical advances in the above areas, while actively **promoting their successful transfer to market**. The Institute provides the best working conditions and the most attractive and best-equipped environment in which researchers can focus on this process of innovation and scientific advance.



2.4. Our Values

A culturally-diverse team, such as Institute IMDEA Networks', needs goals, but it also has to share values that transcend our social, religious and other cultural differences. These values serve to unify us by defining how we conduct ourselves, both within the team and in our dealings with others. Our core values will remain constant and will be promoted actively within the Institute:

- To be open to the new
  To be constantly adapting to our changing environment

- To value diversity
  We seek out and cherish different perspectives and diversity. We understand the value of diversity

- To be positive
  We encourage positive critical thought with a view to addressing the issue of generating better solutions, not simply identifying problems

- To act with integrity
  We act with integrity and honesty, delivering on our commitments in all our interactions. The trust this engenders provides the foundations for productive partnerships

- To listen well and speak clearly
  We listen actively to other people and take responsibility for explaining ourselves as we wish to be understood

- To respect individual brilliance
  We respect, honor and reward exceptional individual contributions when they are in the service of shared goals

- To work collaboratively
  Our individual contributions are more fruitful when performed in a team environment. We work in a spirit of partnership in all our activities with others. We achieve this by identifying and pursuing shared objectives in an open and honest way

- To innovate always
  We always look at problems from different points of view. We aim to do breakthrough research, not incremental research

- To compete sportingly across the globe
  We compete fairly but intensely, according to the letter and spirit of accepted standards. Competition drives us to be the best and most successful in our field

- To enjoy our work
  To be constantly adapting to our changing environment

2.5. Our Credo

- We believe in group discussion and in bright individual ideas
- We do not believe in voting and committees. We believe in running code and rough consensus. (David D. Clark)
- Demo or die (in addition to publish or perish)
- *Genius is 1% inspiration and 99% perspiration.* (T.A. Edison)

research areas

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As illustrated by **our motto – Developing the Science of Networks –** Institute 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. **Currently, our research is focusing on the following three general areas**:

networked systems&algorithms

3.1. Networked Systems and Algorithms

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

ty as well as selfishness of individual entities, our analysis adopts game-theoretic techniques. 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 apply software verification techniques to develop tools that help network builders create more reliable networks. 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**
  - 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 becoming paramount
  - Software Defined Networking is revolutionizing networking, but carries a lot of risk
  - Leverage increases in computational power and bandwidth to predict future reliability
  - Resolve difficult choices at runtime to increase performance

wireless networking

3.2. Wireless Networking

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

Institute IMDEA Networks is involved in a number of different wireless research areas. Part of our efforts aim at improving existing wireless technologies such as Wi-Fi (IEEE 802.11), WiMAX (IEEE 802.16), and LTE, for example, through the design of opportunistic scheduling mechanisms and interference management schemes. We further have an extensive track record in the areas of ad hoc and mesh networks, in particular on routing and MAC layer design. To improve the flexibility and programmability of future wireless technologies, we explore novel programmable interfaces that expose low-level operations to foster network evolution and enable performance optimization and service customization. One of the goals of this work is to implement application specific optimizations, for example, to provide efficient wireless video streaming. Our work on wireless capacity improvements focuses on topics such as 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.

We recognize the importance of bridging the gap between theoretic results and applied wireless research and have deployed a range of wireless testbeds (IEEE 802.11, WiMAX, software defined radios) on which we implement and evaluate our research ideas.

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

- **Optimization of wireless networking**
  - Opportunistic scheduling
  - Adaptive coding and modulation
  - Interference management
  - Traffic offloading in heterogeneous networks

- **Heterogeneous wireless networks**
  - We are facing the proliferation of many different wireless technologies
  - Supporting them in the current Internet is highly complex
  - Existing solutions are based on technology specific interfaces
  - The wireless Internet architecture needs to be rethought for efficient support of heterogeneity

- **Self organizing wireless networks**
  - Scaling and increased heterogeneity require self-organization
  - Solutions needed to track and exploit changing spatial traffic loads
  - Complex dynamics of wireless system and user behavior are involved
  - Significant performance gains and energy savings can be achieved

3.3. Energy-efficient Networking

energy-efficient networking

Energy production, distribution, and consumption are becoming topics of interest worldwide, due to issues like climate change and the greenhouse effect. Institute IMDEA Networks is actively involved in research conducted to increase energy performance with the use of computation and communication. These research efforts can be grouped into two main lines. The first line involves research that attempts to save energy in computing and communication systems, like computers and networks, named energy efficient ICT. The second line involves research that attempts to design ICT systems that improve energy production and distribution, and optimize consumption, named ICT for energy efficiency.

In the area of ***energy-efficient ICT***, researchers of the institute have developed techniques to save energy in wireless networks, for instance switching off access points in periods of low traffic or using opportunistic relaying. In wireline networks, research efforts have been conducted to propose algorithms for smart routing and scheduling of packets to save energy in underused networks. One interesting line is the study of the optimal deployment of Energy Efficient Ethernet (IEEE 802.3az) equipment, where the energy consumption of links that follow this standard has been characterized as a function of the traffic pattern. This has been complemented with a field study of

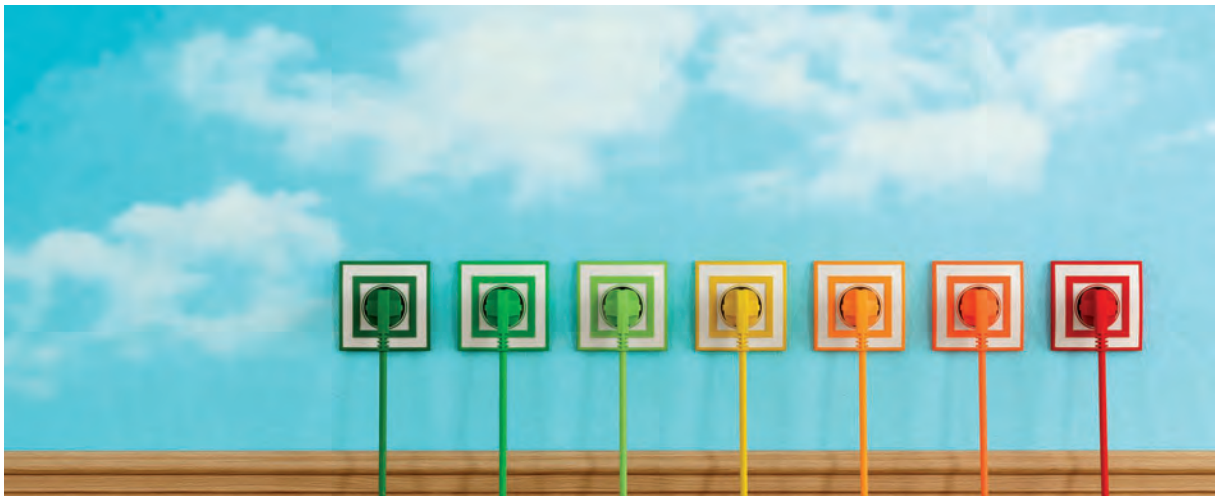
the potential savings (in Euros) of a web-hosting center in Madrid. Finally, models and techniques for energy savings in collaborative (peer to peer) communication systems have been proposed.

In the area of ***ICT for energy efficiency***, researchers from the institute have, e.g., proposed algorithms to schedule appliance use in order to reduce peak electricity consumption, and techniques to provide good service to the users of electric vehicles charging stations. The novelty is that these solutions use concepts taken from networking, like load balancing and fairness. Current lines of research in this area include the extraction and modification of user energy consumption patterns by means of social networks, game theory and mechanism design.

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

- **Design of energy-efficient algorithms and protocols**
  - ICT accounts for a substantial portion of the total energy consumption
  - Solutions that reduce consumption without affecting service quality are needed
  - Novel algorithms that adapt the network infrastructure to the variations of traffic demand over time have to be proposed

- **Support for smart energy management**
  - Communications can help to reduce energy consumption in many activities
  - New requirements on networking solutions are required in this context
  - Novel protocols and algorithms for smart energy management must be proposed



research projects, grants and fellowships

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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.

RAMÓN Y CAJAL GRANTS | I3 SUBVENTIONS | FPU SCHOLARSHIPS | "MARIE CURIE" AMAROUT EUROPE PROGRAMME

Ramón y Cajal Grants

(Programa Ramón y Cajal)

Awardee: Dr. Sergey GORINSKY, Senior Researcher
Funded by: Spanish Ministry of Economy and Competitiveness (*Ministerio de Economía y Competitividad - MINECO*), previously known as the Spanish Ministry of Science and Innovation (*Ministerio de Ciencia e Innovación – MICINN*)

I3 Subventions

(Programa I3)

Awardee: José Félix KUKIELKA, Senior Researcher
Funded by: Department of Education, Youth and Sports, Regional Government of Madrid (*Consejería de Educación, Juventud y Deporte, Comunidad de Madrid*)

FPU Scholarships

(Becas del Programa de Formación de Profesorado Universitario)

Awardees: Michal KRYCZKA, Pre-doc Researcher
Marco GRAMAGLIA, Pre-doc Researcher
Funded by: Spanish Ministry of Education, Culture and Sports (*Ministerio de Educación, Cultura y Deporte - MECD*), previously known as the Spanish Ministry of Education (*Ministerio de Educación - MEC*)

"Marie Curie" Amarout Europe Programme

Awardees: Dr. Pierre FRANCOIS (Staff Researcher)
Dr. Sergey GORINSKY (Senior Researcher)
Dr. Dariusz KOWALSKI (Visiting Researcher)
Dr. Vincenzo MANCUSO (Staff Researcher)
Dr. Balaji RENGARAJAN (Staff Researcher)
Dr. Gianluca RIZZO (Staff Researcher)
Dr. Joerg WIDMER (Chief Researcher)
Funded by: European Union. ICT Programme FP7-PEOPLE COFUND

4.2. Externally-funded research projects

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

eCOUSIN

enhanced COntent distribUtion with Social INformation

Project website: http://www.ict-ecousin.eu/
Funded by: European Union. ICT Programme FP7
Duration: November 2012 to April 2015
Project partners: France Telecom SA (FT), Alcatel-Lucent Bell Labs, Institute IMDEA Networks, Institut Telecom, NEC Europe Ltd., Technische Universität Darmstadt, Telecom Italia S.p.a., University of Cambridge, University Carlos III of Madrid

Content Distribution Services are booming and they will be responsible for the majority of future Internet traffic. In parallel, **Online Social Networks** (OSNs) have become **today's most popular Internet application**. The widespread adoption of OSNs has drastically changed the way content is consumed in the Internet, as content consumption is nowadays highly impacted by the information shared by users through OSNs and the popularity of a given content is most often dictated by its "social" success. With such a **"social-content revolution**", operators need to evolve and optimize their network to avoid being overwhelmed by the ever growing traf-

fic volumes resulting from this paradigm change. To this aim, **the goal of eCOUSIN is to design a novel social-aware network architecture with built-in content dissemination functionalities that exploits the social-content interdependencies to improve its efficiency**. This goal translates into the following specific objectives: (i) the implementation of high performance distributed tools for collecting necessary data to study and model the social-content interdependencies; (ii) the improvement of the scalability of network infrastructures when handling content by exploiting social information; (iii) the design of an on-net operational framework that tightly integrates network functionalities and content-related service functionalities; and (iv) the design of algorithms that exploit social information for placing and delivering contents in an optimized manner with a special focus on mobile environments. We envision that all these will be fundamental components of the future Internet architecture. The eCOUSIN consortium comprises two leading network operators, two major manufacturers of telecommunication equipment, one research institute and four universities. All of them are strong actors in the areas of this project, and their complementary nature ensures the impact of the eCOUSIN outcomes on both the industrial and scientific domains.

i-JOIN

Interworking and JOINt Design of an Open Access and Backhaul Network Architecture for Small Cells based on Cloud Networks

Institute IMDEA Networks is the Project Coordinator

Project website: http://www.ict-ijoin.eu
Funded by: European Union. ICT Programme FP7
Duration: November 2012 to April 2015
Project partners: Institute IMDEA Networks, NEC Europe Ltd., Telecom Italia S.p.a., Sagemcom Broadband SAS, Telefonica Research, Intel Mobile Communications France, Hewlett Packard Italiana SRL, Commissariat à l'Energie Atomique et aux Energies Alternatives, University Carlos III of Madrid, Universität Bremen, University of Surrey, Technische Universität Dresden

The last decades brought an **exponential increase in mobile traffic volume**. This will continue and a 1000-fold increase by 2020 has been forecasted. **Small-cells promise to provide the required data rates through an increased spatial utilisation of the spectrum**.

Due to strong inter-cell interference, small-cell deployments will require a high degree of coordination as offered by centralised processing. Furthermore, heterogeneous backhaul solutions will be used to connect small-cells and core network. So far, access and backhaul are individually designed and therefore not optimised. In order to support centralised processing and a heterogeneous backhaul, challenges on access and backhaul must be simultaneously tackled.

iJOIN introduces the novel concept RAN-as-a-Service (RANaaS), where RAN functionality is flexibly centralized through an open IT platform based on a cloud infrastructure. iJOIN aims for a joint design and optimisation of access and backhaul, operation and management algorithms, and architectural elements, integrating small-cells, heterogeneous backhaul, and centralized processing. Additionally to the development of technology candidates across PHY, MAC, and the network layer, iJOIN will study the requirements, constraints, and implications for existing mobile networks, specifically 3GPP LTE-A.

iJOIN will design new network operation and management algorithms in the context of RANaaS, show their implications on 3GPP LTE, and evaluate the derived technologies with respect to four quantitative key objectives: 1) system throughput 2) energy-efficiency 3) cost-efficiency 4) utilisation-efficiency. iJOIN will further impact 1) the research community by identifying new challenges, 2) business opportunities through new concepts for implementing mobile networks, and 3) standardisation through strong industry participation of all major stakeholders.

E2NET

Energy Efficient Networks (Redes energéticamente eficientes)

Funded by: Spanish Ministry of Economy and Competitiveness (*MINECO*), previously known as the Spanish Ministry of Science and Innovation (*MICINN*)
Duration: January 2012 to December 2014
Project partners: Institute IMDEA Networks, University Carlos III of Madrid

Recent studies reveal that **ICT (Information and Communications Technology) energy consumption is becoming a significant component of the worldwide consumption**. This situation has generated a keen interest in **mechanisms and methods for saving energy by telecommunication network operators, Internet Service Providers (ISPs) and content providers**. Depending on the specific scenario, energy costs are a substantial cost factor, and a reduction of network and data center energy consumption provides an important contribution to cost efficiency, besides corporate social responsibility and the obvious environmental benefits. **The main objective of this project is the design of algorithms and techniques to reduce the energy consumption of communication systems without significantly affecting the service quality.** We utilize a cross-layer approach that includes algorithms and techniques to be applied at different layers of the network architecture, with main focus on the link, network, transport, and application layers.

We address the energy efficiency at the link, network, and transport layers. We also define precise energy consumption and traffic models for network elements (e.g., routers and links) in different setups, namely LAN, WAN, and data centers. These setups differ in the granu-

larity and the time scales at which resource and energy optimization are performed. At the same time, applications like content distribution span all of these different areas, and their joint optimization is likely to lead to even better performance results. Particular care is taken to define models that convey as much as possible the technological aspects of current and future network elements. For instance, we develop models for new energy saving techniques, like 802.3az (Energy Efficient Ethernet). Based on these models we design techniques (e.g., routing and scheduling algorithms) to minimize the overall energy consumption. The performance of the developed solutions is formally analyzed, and evaluated via simulation and testbed experiments. In addition, **we explore the potential of these and other proven techniques, originally developed for the area of networking, to also save energy in other application areas.** In particular, we explore how to save energy and/or improve the service when operating appliances and charging electric vehicles. Many of the challenges in such non-networking contexts are similar to those encountered in the communications world. Thus, exploring the application of concepts and techniques already used in communications and networks to these problems seems promising.

EINS

Network of Excellence in Internet Science

Project website: www.internet-science.eu
Funded by: European Union. ICT Programme FP7
Duration: December 2011 to May 2015
Project partners: Alcatel-Lucent Bell Labs, Alma Mater Studiorum, Universita di Bologna, Centre for Research and Technology Hellas, Consiglio Nazionale delle Ricerche (CNR), École Polytechnique Fédérale de Lausanne (EPFL), Eidgenössische Technische Hochschule Zürich, Institute IMDEA Networks, Chinese Academy of Sciences, Korea Advanced Institute of Science and Technology, London School of Economics and Political Science (LSE), National and Kapodistrian University of Athens, National ICT Australia (NICTA), Oxford Internet Institute, University of Oxford, Politecnico di Torino (Nexa Center), Royal Netherland Academy for Arts and Science, Sigma Orionis, Stockholms Universitet, Technicolor R&D, Technische Universität München, Technische Universiteit Delft, Universidad Autónoma de Madrid (UAM), Universität Passau, Universite De Savoie, Universite Pierre et Marie Curie (UPMC), Universitetet i Oslo, University of Cambridge, University of Essex, University of Lancaster, University of Ljubljana, University of Southampton, University of Warwick, University of Waterloo

The goal of EINS is coordinating and integrating European research aimed at achieving a deeper multidisciplinary understanding of the development of the Internet as a societal and technological artifact, whose evolution is increasingly intertwined with that of human societies. Its main objective is to allow an open and productive dialogue between all the disciplines which study Internet systems under any technological or humanistic perspective and which in turn are being transformed by the continuous advances in Internet functionalities and applications. EINS will bring together research institutions focusing on network engineering, computation, complexity, security, trust, mathematics, physics, sociology, game theory, economics, political sciences, humanities, law, energy, transport, artistic expression, and any other relevant social and life sciences.

This multidisciplinary bridging of the different disciplines may also be seen as **the starting point for a new Internet Science**, the theoretical and empirical foundation for a holistic understanding of the complex techno-social interactions related to the Internet. It is supposed to inform the future technological, social, political choices concerning Internet technologies, infrastructures and policies made by the various public and private stakeholders, for example as for the far-ended possible consequences of architectural choices on social, economic, environmental or political aspects, and ultimately on quality of life at large.

The individual contributing disciplines will themselves benefit from a more holistic understanding of the Internet principles and in particular of **the "network effect".** The unprece-

dented connectivity offered by the Internet plays a role often underappreciated in most of them; whereas the Internet provides both an operational development platform and a concrete empirical and experimental model. These multi- and inter-disciplinary investigations will improve the design of elements of Future Internet, enhance the understanding of its evolving and emerging implications at societal level, and possibly **identify universal principles for understanding the Internet-based world** that will be fed back to the participating disciplines. EINS will:

- Coordinate the investigation, from a multi-disciplinary perspective, of specific topics at the intersection between humanistic and technological sciences, such as privacy & identity, reputation, virtual communities, security & resilience, network neutrality
- Lay the foundations for an Internet Science, based i.a. on Network Science and Web Science, aiming at understanding the impact of the "network effect" on human societies & organizations, as for technological, economic, social & environmental aspects
- Provide concrete incentives for academic institutions and individual researchers to conduct studies across multiple disciplines, in the form of online journals, conferences, workshops, PhD courses, schools, contests, and open calls

PROPHET

Simplifying Development and Deployment of High-Performance, Reliable Distributed Systems

Project website: http://prophet.networks.imdea.org/
Funded by: European Union. European Research Council (Starting Grant)
Duration: February 2011 to January 2016 (executed in IMDEA Networks since November 2012, transfer pending)
Project partners: École Polytechnique Fédérale de Lausanne (EPFL), Institute IMDEA Networks

Problem statement:

Distributed systems form the foundation of our society's infrastructure. Unfortunately, they suffer from a number of problems:

1. they are time-consuming to develop because it is difficult for the programmer to envision all possible deployment environments and design adaptation mechanisms that will achieve high performance in all scenarios;
2. their code is complex due to the numerous outcomes that have to be accounted for at development time and the need to reimplement state and network models;
3. they are unreliable because of the difficulties of programming a system that runs over an asynchronous network and handles all possible failure scenarios.

If left unchecked, these problems will keep plaguing existing systems and hinder development of a new generation of distributed services. A key set of new services arises in cloud computing.

Our approach:

We propose a radically new approach to simplifying development and deployment of high-performance, reliable distributed systems. The key insight is in creating a new programming model and architecture that **leverages the increases in per-node computational power, bandwidth and storage** to achieve this goal. Instead of resolving difficult deployment choices at coding time, the programmer merely specifies the choices and the objectives that should be satisfied. The PROPHET runtime then resolves the choices during live execution so as to maximize the objectives. To accomplish this task, the runtime uses a combination of state-space exploration, simulation, behavior prediction, performance modeling, and program steering.

Funding:

We graciously acknowledge the funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ERC grant agreement 259110.

GREEN NETWORK

Theory and Technique for Reducing Network Energy Consumption

Institute IMDEA Networks is an Associated Partner in this project

Funded by: National Natural Science Foundation of China. Grant number 61020106002
Duration: January 2011 to December 2014
Project partners: Institute of Computing Technology, Alcatel-Lucent Bell Labs, Universidad Rey Juan Carlos, Tsinghua University, Chinese Academy of Sciences

This research is on **theories and techniques for globally reducing energy consumption at the network level**. The following issues are investigated: (1) Techniques for network infrastructure design and deployment of network nodes that can reduce network energy consumption. (2) Scheduling and routing algorithms and protocols that can reduce network energy consumption. The goals of this research include: (1) System models will be formalized to realistically express the characteristics and restrictions of current network technologies. (2) Techniques for network nodes deployment that can reduce network energy consumption will be developed. (3) Energy efficient algorithms and protocols for network message routing and scheduling will be developed. (4) Correctness proof of our protocols and algorithms and theoretical analysis of them will be provided. (5) A platform will be built for the simulation of the algorithms, protocols and for testing the infrastructure design and node deployment schemes.

TREND

Towards Real Energy-efficient Network Design - The Network of Excellence on Energy-Efficient Networking

Institute IMDEA Networks is a Collaborating Institution in this project

Project website: http://www.fp7-trend.eu/
Funded by: European Union. ICT Programme FP7
Duration: September 2010 to September 2013
Project partners: Politecnico di Torino (PoliTO), Alcatel-Lucent Bell Labs, Huawei Technologies Dusseldorf GmbH (HWDU), Telefonica Investigación y Desarrollo SA (TID), France Telecom SA (FT), Fastweb SPA (FW), University Carlos III of Madrid, Interdisciplinary Institute for Broadband Technology (IBBT), Technische Universität Berlin (TUB), École Polytechnique Fédérale de Lausanne (EPFL), Consorzio Nazionale Interuniversitario per le Telecommunicazioni, Panepistimio Thessalias - University of Thessaly (UTH)

TREND is a **Network of Excellence (NoE),** coordinated by Politecnico di Torino, funded by the European Commission within the Seventh Framework Programme.

TREND aims at integrating the activities of major European players in networking, including manufacturers, operators, research centers, **to quantitatively assess the energy demand of current and future telecom infrastructures, and to design energy-efficient, scalable and sustainable future networks.**

The NoE will integrate and drive the many recent research efforts in energy-efficient networking towards commonly agreed technical goals, laying down the bases for **a new holistic approach to energy-efficient networking**, investigating effective strategies and mechanisms to reduce energy consumption in current and future networks in general, and the future Internet in particular. We aim at identifying the best answers to the following questions:

- What is the real power consumption of ICT?
- What are the means to best reduce the energy consumption of today's networks without compromising requirements in network and service performance?
- What are the best suited engineering criteria and principles to actively support energy efficiency along the sequence of network design, planning, and operation?
- What changes in the design of network equipment are necessary in the short and long term in order to obtain the largest possible energy saving?
- Which communication and management paradigms and protocols will be able to mediate and ensure the most effective distributed energy control?
- What are the most promising and sustainable long-term approaches to energy efficient networking, assuming that a clean slate network design is possible, and what are potential migration strategies to achieve this?
- What kind of mutually beneficial incentives can be proposed to network operators, service providers, and users, in order to maximize energy efficiency?

The aim of TREND is to establish the integration of the EU research community in green networking with a long term perspective to consolidate the European leadership in the field.

FLAVIA

FLexible Architecture for Virtualizable wireless future Internet Access

Project website: www.ict-flavia.eu
Funded by: European Union. ICT Programme FP7
Duration: July 2010 to June 2013
Project partners: Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Alvarion, NEC Europe Ltd., Telefonica Research, Sequans Communications, MobiMesh s.r.l., Ben Gurion University of the Negev, Institute for Information Transmission Problems of the Russian Academy of Science, University Carlos III of Madrid, Hamilton Institute of the National University of Ireland Maynooth

Wireless networks importance for the Future Internet is raising at a fast pace as mobile devices increasingly become its entry point. However, **today's wireless networks are unable to rapidly adapt to evolving contexts and service needs due to their rigid architectural design**.

We believe that the wireless Internet's ability to keep up with innovation directly stems from its reliance on the traditional layer-based Internet abstraction. Especially, the Link Layer interface appears way too abstracted from the actual wireless access and coordination needs. **FLAVIA fosters a paradigm shift towards the Future Wireless Internet**: from

pre-designed link services to programmable link processors. The key concept is to expose flexible programmable interfaces enabling service customization and performance optimization through software-based exploitation of low-level operations and control primitives, e.g., transmission timing, frame customization and processing, spectrum and channel management, power control, etc.

FLAVIA's approach is based on three main pillars: i) lower the interface between hardware-dependent layers and upper layers, ii) apply a hierarchical decomposition of the MAC/PHY layer functionalities, and iii) open programmable interfaces at different abstraction levels. To prove the viability of this new architectural vision, FLAVIA will prototype its concept on two wireless technologies currently available, IEEE 802.11 and IEEE 802.16, representing today's two main radio resource allocation philosophies: contention-based and scheduled. Moreover, FLAVIA will assess the applicability of the proposed architecture concepts to the emerging 3GPP standards.

FLAVIA's concept will allow **boosting innovation and reducing the cost of network upgrades**. Operators, manufacturers, network designers, emerging third-party solution developers, and even spontaneous end users, will be able to easily and rapidly optimize and upgrade the wireless network operation, quickly prototype and test their new protocols, and adapt the wireless access operation to emerging scenarios or service needs.

MEDIEVAL

MultimEDia transport for mobIlE Video AppLications

Institute IMDEA Networks participates as a third party of University Carlos III of Madrid

Project website: www.ict-medieval.eu
Funded by: European Union. ICT Programme FP7
Duration: July 2010 to June 2013
Project partners: Alcatel-Lucent Bell Labs, Telecom Italia S.p.a., Portugal Telecom Inovaçao, Docomo Communications Laboratories Europe, LiveU, Instituto de Telecomunicacoes, University Carlos III of Madrid, Consorzio Ferrara Ricerche, Universita Degli Studi di Padova, EURECOM

Video is a major challenge for the future Internet. This traffic type is foreseen to account for close to 90 percent of consumer traffic already by 2012. However, the current Internet, and in particular the mobile Internet, was not designed with video requirements in mind and, as a consequence, its architecture is very inefficient when handling video traffic. It is the vision of this consortium that, as video is going to represent the majority of the traffic, the future Internet architecture should be tailored to efficiently support the

requirements of this traffic type. Specific enhancements for video should be introduced at all layers of the protocol stack where needed, ideally supporting an incremental deployment.

Following the above vision, the main goal of the project is **to evolve the Internet architecture for efficient video traffic support**. The proposed architecture will follow a cross-layer design that, by exploiting the interaction between layers, can raise performance to values unattainable with individual developments. The following key issues will be addressed by the architecture: i) enhanced wireless access support to optimise video performance, ii) novel IP mobility architecture adapted to the requirements of video traffic, iii) transport optimisations for video distribution and iv) network-aware video services that interact with the underlying layers.

The technology developed by the project will be designed taking into account the requirements of network operators for commercial deployment, and will aim at improving the Quality of Experience by users as well as reducing the associated costs for operators. Standardization and early incremental testing are considered key success factors for MEDIEVAL.

The consortium is well balanced and combines the integrated perspectives of three mobile operators, a major manufacturer and an innovative video technology company, in addition to leading academic partners and research institutes.

CLOUDS

Cloud Computing for Scalable, Reliable and Ubiquitous Services (Cloud Computing para Servicios Escalables, Confiables y Ubicuos)

Institute IMDEA Networks is an Associated Group in this project

Project website: http://lsd.ls.fi.upm.es/clouds
Funded by: Department of Education, Youth and Sports, Regional Government of Madrid (*Consejería de Educación, Juventud y Deporte, Comunidad de Madrid*)
Duration: January 2010 to December 2013
Project partners: Universidad Politécnica de Madrid (UPM), Universidad Rey Juan Carlos

Cloud computing is a new emerging paradigm in distributed systems whose goal is to offer software as a service, enabling the deployment and management of services through data centers and/or clouds of devices accessible via the Internet, across administrative domains, technology platforms and geographical areas, and with a high degree of autonomy, with properties such as self-healing, self-provisioning, self-optimization and auto-configuration. This program aims to make the necessary scientific progress to advance the state of the art in the various lines of research associated with cloud computing, in order to make this paradigm possible. In this manner, the concept of computing is reformulated through a web of resources distributed globally (data centers, PCs, ubiquitous devices), automatically provisioning on-demand services, reducing software complexity and cost, and increasing reliability and the transparency of deployment and self-provisioning.

These systems also are managed autonomously with on demand self-provisioning at competitive cost and with high quality of service. This new paradigm will increase the accessibility of users to the services of public administrations and companies. On the one hand, it will propose new paradigms for cloud computing. It will design and develop cloud computing platforms that can be deployed in data centers and/or ubiquitous networks (Internet of things). On the other hand, it will develop protocols that allow the development of such systems, such as distributed algorithms, and it will provide the desired properties, such as autonomic behavior, security, scalability and availability. Furthermore, it will address the architectures and technologies to materialize it, such as service-oriented architectures, as well as the necessary computing, communication and storage infrastructure. Finally, it will also address the modeling of users and applications to be built on cloud computing platforms.

MEDIANET

Integration of Next Generation Multimedia Services in the Internet of the Future (Integración de Servicios Multimedia de Siguiente Generación en la Internet del Futuro)

Project website: www.medianet-cm.es
Funded by: Department of Education, Youth and Sports, Regional Government of Madrid (*Consejería de Educación, Juventud y Empleo, Comunidad de Madrid*)
Duration: January 2010 to December 2013
Project partners: Institute IMDEA Networks, University Carlos III of Madrid, Universidad Complutense de Madrid, Universidad de Alcalá de Henares

This program strives for a significant **scientific advance in the future media Internet** where important advances are necessary **to allow end-users to perceive a good quality of experience.** The network technologies objectives consist of the definition and validation of

new proposals for the efficient transport of high bandwidth, real-time data flows in a decentralized way where the network provides mechanisms to seamlessly request and configure devices to increase the quality of experience perceived by end-users. Furthermore, new experiences with layer 2 networks and a cross-layer design will be tested with high bandwidth demanding media services. The global result will be **an integrated and independent advancement in future media Internet protocols, algorithms, switching architectures and standards.**

PASITO

Telecommunications Service Analysis Platform (Plataforma de experimentación de servicios de telecomunicaciones)

Project website: www.rediris.es/proyectos/pasito
Funded by: State Secretariat for Telecommunications and the Information Society (Secretaría de Estado de Telecomunicaciónes y para la Sociedad de la Información- SETSI) of the Spanish Ministry of Industry, Energy and Tourism (Ministerio de Industria, Energía y Turismo - MINETUR), previously known as the Spanish Ministry of Industry, Tourism and Trade (Ministerio de Industria, Turismo y Comercio - MITYC)
Duration: September 2007 – TBD
Project partners: Red.es/RedIRIS, CESCA (Centre de Supercomputació de Catalunya), CESGA (Centro de Supercomputación de Galicia), CICA (Centro Informático Científico de Andalucía), Red académica i2BASQUE, Universidad del País Vasco, Fundación i2CAT, Universidad Autónoma de Madrid, University Carlos III of Madrid, Universidad de Granada, Universidad de Murcia, Universidad Politécnica de Cataluña, Universidad Politécnica de Madrid, Universidad Politécnica de Valencia, Universidad de Vigo.

The platform for telecommunications services analysis (PASITO) is **a distributed tests laboratory, which offers engineers the chance to construct, refine and evaluate test scenarios for telecommunication services**.

The laboratory contributes to:

- Optimizing communications resources
- Designing and adapting new services to the current needs
- Certifying equipment and services

PASITO is a public infrastructure, based upon the Spanish RedIRIS academic network. It uses varied technologies to enable it to test a wide range of telecommunication services and at the same time guarantee that its activities are isolated from the rest of the academic network's services. This avoids interference with other activities that are in operation within the Spanish scientific community.

The platform's main research areas are:

- Internet architectures
- Communication protocols
- Transport technologies with service quality
- Virtualization and autoconfiguration of networks and services
- Technologies and tools to monitor networks and services
- Optical services for intensive data projects
- Large scale information distribution technologies
- Peer-to-peer systems
- Mobility services
- Technologies to improve network security
- Standards for new generation collaboration services

4.2.2. Projects awarded in 2012 and commencing in 2013

CROWD

Connectivity management for eneRgy Optimised Wireless Dense networks

Project website: http://www.ict-crowd.eu/description.html
Funded by: European Union. ICT Programme FP7
Duration: January 2013 to June 2015
Project partners: Intecs Informatica e Tecnologia del Software S.P.A., Alcatel Lucent Bell Labs France, France Telecom SA (FT), Institute IMDEA Networks, Signalion GmbH, University Carlos III of Madrid, Universität Paderborn

Wireless traffic demand is currently growing exponentially. This growing demand can only be satisfied by increasing the density of points of access and combining different wireless technologies. Mobile network operators have already started to push for denser, heterogeneous deployments; however, current technology needs to steer towards efficiency, to avoid unsustainable energy consumption and network performance implosion due to interference. While some efforts have already been devoted to evolving the technology, these efforts mostly take a restricted PHY perspective and do not consider higher-layer mechanisms, which are required to fully optimise global performance. In this context, **CROWD promotes a paradigm shift in the future Internet architecture towards global network cooperation, dynamic network functionality configuration and fine, on demand, capacity tuning.**

The project targets very dense heterogeneous wireless access networks and integrated wireless-wired backhaul networks. In this framework, CROWD pursues four key goals: i) bringing density-proportional capacity where it is needed, ii) optimising MAC mechanisms operating in very dense deployments by explicitly accounting for density as a resource rather than as an impediment, iii) enabling traffic-proportional energy consumption, and iv) guaranteeing mobile user's quality of experience by designing smarter connectivity management solutions. The technology developed by the project will be designed taking into account the requirements for commercial deployment. Exploitation plans comprise a thorough roadmap for standardisation that includes the support letters from chairs of the relevant groups at IETF, IRTF, IEEE and Femto Forum. The consortium combines the integrated perspectives of a major mobile operator, a leading manufacturer, a provider of test equipment, an innovative company engaged to develop new technologies, two leading academic partners and a world-renowned research institute.

scientific activities

annual report 2012

5.1. Awards

5.1.1. Project Awards

MEDIEVAL shortlisted for Future Internet Award 2012

MEDIEVAL (MultimEDia transport for mobIIE Video AppLications), a European Project involving 10 partners, was shortlisted for the Future Internet Award 2012, together with two other potential candidates.

MEDIEVAL aims to evolve the Internet's architecture for the efficient support of video traffic, one of the major challenges for the future Internet. This traffic type is foreseen to account for close to 90% of consumer traffic by 2012, with an increase in mobile traffic of more than 200 percent per annum.

5.1.2. Paper Awards

The following publications have received a Best Paper Award. They are listed in order of publication, starting by the most recent:

Kshitiz Verma, Gianluca Rizzo, Antonio Fernández Anta, Rubén Cuevas, Arturo Azcorra (BEST PAPER AWARD)

Greening the Internet: Energy-optimal File Distribution

The 11th IEEE International Symposium on Network Computing and Applications (NCA12) 23-25 August, 2012, (Cambridge, Massachusetts, USA)

Sergio Arévalo, Antonio Fernández Anta, Damien Imbs, Ernesto Jiménez, Michel Raynal (BEST PAPER AWARD "Sociedad de Computación Concurrente y Distribuida)

Failure Detectors in Homonymous Distributed Systems (with an Application to Consensus)

Premio "Sociedad de Computación Concurrente y Distribuida"

XX Jornadas de Concurrencia y Sistemas Distribuidos (XX Symposium on Concurrence and Distributed Systems)

13-15 June, 2012, (Pamplona, Navarra, Spain)

awards

5.1.3. PhD and MSc Thesis Awards

The following Theses have either received or been nominated for a PhD or MSc Thesis Award. They are listed starting by the most recent award:

Arash Asadi (EXTRAORDINARY MASTERS THESIS AWARD UNIVERSITY CARLOS III OF MADRID –Academic year 2011/2012)

Opportunistic cellular communications with clusters of dual-radio mobiles. Masters Thesis, University Carlos III of Madrid.

"Premio Extraordinario de Máster Oficial University Carlos III of Madrid – Curso 2011/2012. Programa de Máster Interuniversitario en Ingeniería Telemática."

The prize was awarded on December 18th, 2012.

Alexander Bikfalvi (EXTRAORDINARY DOCTORAL AWARD UNIVERSITY CARLOS III OF MADRID – Academic year 2011/2012)

Peer-to-Peer Television for the IP Multimedia Subsystem. PhD Thesis, University Carlos III of Madrid.

"Premio Extraordinario de Doctorado University Carlos III of Madrid – Curso 2011/2012. Programa de Doctorado en Ingeniería Telemática."

PhD Thesis defended on July 18th, 2012, in Madrid, Spain. The prize was awarded on November 27th, 2012.

José Pablo Salvador García (Nationwide Finalist of the Telematics Association Award in the XXXII Edition of the Awards to the Best Graduation or Master's Degree Project in Telematics Engineering, granted by the Official College of Telecommunication Engineers (COIT) and the Spanish Association of Telecommunication Engineers (AEIT)).

Implementation of Advanced Network Mobility Mechanisms over Fonera Routers (Implementación de Mecanismos Avanzados de Movilidad de Redes sobre Routers Fonera)

"Premio Finalista Asociación de Telemática al Mejor Proyecto Fin de Carrera o Trabajo Fin de Máster en Ingeniería Telemática".

The prize was awarded on June 28th, 2012.

Paul Patras (EXTRAORDINARY DOCTORAL AWARD UNIVERSITY CARLOS III OF MADRID –Academic year 2011/2012)

Control-Theoretic Adaptive Mechanisms for Performance Optimization of IEEE 802.11 WLANs: Design, Implementation and Experimental Evaluation. PhD thesis, University Carlos III of Madrid.

"Premio Extraordinario de Doctorado University Carlos III of Madrid – Curso 2011/2012. Programa de Doctorado en Ingeniería Telemática".

PhD Thesis defended on March 18th, 2011, in Madrid, Spain. The prize was awarded on November 27th, 2012.

5.2. Publications

Imdea Networks published 94 publications in 2012; including 11 standardization items (see section 6.1).

2 Paper Awards | 2 Books | 2 Book Chapters | 24 Journal and Magazine Articles | 44 Conference and Workshop Papers | 2 PhD Theses | 5 Masters Theses

5.2.1. Books

1. Ajmone Marsan, Marco and Goyal, Suresh and Xu, Shugong and Fernández Anta, Antonio and Prodanovic, Milan and Christensen, Ken, eds. (2012) ***Proceedings of the 3rd International Conference on Energy-Efficient Computing and Networking, e-Energy'12, Madrid, Spain, May 9-11, 2012***. ACM.

2. Bestak, Robert and Kencl, Lukas and Li, Li Erran and Widmer, Joerg and Yin, Hao (2012) ***Networking 2012: Proceedings 11th International IFIP TC 6 Networking Conference, Prague, Czech Republic, 21 – 25 May, 2012***. Lecture Notes in Computer Science, 7290 . Springer, 21 – 25 May 2012 Prague, Czech Republic.

5.2.2. Book Chapters

3. Herfet, Thorsten and Ajmone Marsan, Marco (2012) ***Special section on Networked Electronic Media - The new internet experience (Editorial)***. In: Computer Communications Magazine. Elsevier Science Publishers, p. 2236.

4. Jensen , Kurt and van der Aalst, Wil M. and Ajmone Marsan, Marco and Franceschinis, Giuliana and Klejin, Jetty and Kristensen, Lars Michael (2012) ***LNCS Transactions on Petri Nets and Other Models of Concurrency: Aims and Scope (Editorial)***. In: Lecture Notes in Computer Science. Springer. ISBN 978-3-642-35178-5

5.2.3. Journal & Magazine Articles

5. Ajmone Marsan, Marco and Arrowsmith, David K. and Breymann, Wolfgang and Fritz, Oliver and Masera, Marcelo and Mengolini, Anna and Carbone, Anna (2012) ***The emerging energy web***. The European Special Physical Journal - Special Topics: Participatory Science and Computing for Our Complex World, 214 (1). pp. 547-569.

6. Alouf, Sara and Mancuso, Vincenzo and Choungmo Fofack, Nicaise (2012) ***Analysis of power saving and its impact on web traffic in cellular networks with continuous connectivity***. Pervasive and Mobile Computing, 8 (5). pp. 646-661.

7. Andrews, Matthew and Fernández Anta, Antonio and Zhang, Lisa and Zhao, Wenbo (2012) ***Routing for Power Minimization in the Speed Scaling Model***. IEEE/ACM Transactions on Networking, 20 (1). pp. 285-294. ISSN 1063-6692

8. Bagnulo, Marcelo and García-Martínez, Alberto and Van Beijnum, Iljitsch (2012) ***The NAT64/DNS64 tool suite for IPv6 transition***. IEEE Communications Magazine. , 50 (7). pp. 177-183. ISSN 0163-6804

9. Banchs, Albert and Serrano, Pablo and Patras, Paul and Natkaniec, Marek (2012) ***Providing Throughput and Fairness Guarantees in Virtualized WLANs Through Control Theory***. Mobile Networks and Applications, 17 (4). pp. 435-446.

10. Carbone, Anna and Ajmone Marsan, Marco and Axhausen, Kay W. and Batty, Michael and Masera, Marcelo and Rome, Erich (2012) ***Complexity aided design - The FuturICT technological innovation paradigm***. The European Physical Journal Special Topics - Special Topics: Participatory Science and Computing for Our Complex World, 214 (1). pp. 435-459.

11. Cardona, Juan Camilo and Stanojevic, Rade (2012) ***A History of an Internet eXchange Point***. ACM CCR, 42 (2). pp. 58-64. ISSN 0146-4833

publications

12. Couto da Silva, Ana Paula and Meo, Michela and Ajmone Marsan, Marco (2012) ***Energy-performance trade-off in dense WLANs: A queuing study***. Computer Networks Journal - Special Issue on Green Communication Network, 56 (10). pp. 2522-2537. ISSN 1389-1286

13. De La Oliva, Antonio and Banchs, Albert and Serrano, Pablo (2012) ***Throughput and energy-aware routing for 802.11 based mesh networks***. Computer Communications, 35 (12). pp. 1433-1446.

14. Fernández Anta, Antonio and Georgiou, Chryssis and López, Luis and Santos, Agustin (2012) Reliable ***Internet-based Master-Worker Computing in the Presence of Malicious Workers***. Parallel Processing Letters, 22 (1).

14. Fernández Anta, Antonio and Milani, Alessia and Mosteiro, Miguel A. and Zaks, Shmuel (2012) ***Opportunistic Information Dissemination in Mobile Ad-hoc Networks: The Profit of Global Synchrony***. Distributed Computing, 4. pp. 279-296.

15. Fernández Anta, Antonio and Mosteiro, Miguel A. and Thraves, Christopher (2012) ***Deterministic recurrent communication in restricted Sensor Networks***. Theoretical Computer Science, 418. 37 - 47.

16. Garcia-Saavedra, Andres and Serrano, Pablo and Banchs, Albert and Hollick, Matthias (2012) ***Balancing energy efficiency and throughput fairness in IEEE 802.11 WLANs***. Pervasive and Mobile Computing, 8 (5). pp. 631-645.

17. Gramaglia, Marco and Bernardos, Carlos Jesús and Soto, Ignacio and Calderón, María and Baldessari, Roberto (2012) ***IPv6 address autoconfiguration in geonetworking-enabled VANETs: characterization and evaluation of the ETSI solution***. EURASIP Journal on Wireless Communications and Networking, 2012 (1). p. 19.

18. Gramaglia, Marco and Urueña, Manuel and Martínez-Yelmo, Isaias (2012) ***Off-line incentive mechanism for long-term P2P backup storage***. Computer Communications Journal, 35 (12). pp. 1516-1526. ISSN 0140-3664

19. López Millán, Víctor M. and Cholvi, Vicent and López, Luis and Fernández Anta, Antonio (2012) ***A Model of Self-Avoiding Random Walks for Searching Complex Networks***. Networks: an International Journal, 2. pp. 71-85. ISSN 0028-3045

20. Mancuso, Vincenzo and Alouf, Sara (2012) ***Analysis of power saving with continuous connectivity***. Computer Networks Journal - Special Issue on Green Communication Network, 56 (10). pp. 2481-2493. ISSN 1389-1286

22. Mancuso, Vincenzo and Chatzipapas, Angelos (2012) ***On IEEE 802.3az Energy Efficiency in Web Hosting Centers***. IEEE Communications Letters, 16 (11). pp. 1880-1883. ISSN 1089-7798

23. Patras, Paul and Banchs, Albert and Serrano, Pablo (2012) ***A Control Theoretic Scheme for Efficient Video Transmission over IEEE 802.11e EDCA WLANs***. ACM Transactions on Multimedia Computing, Communications and Applications, 8 (3).

24. Serrano, Pablo and De La Oliva, Antonio and Patras, Paul and Mancuso, Vincenzo and Banchs, Albert (2012) ***Greening Wireless Communications: Status and Future Directions***. Computer Communications Journal. ISSN 0140-3664

25. Vanbever, Laurent and Vissicchio, Stefano and Pelsser, Cristel and Francois, Pierre and Bonaventure, Olivier (2012) ***Lossless Migrations of Link-State IGPs***. IEEE/ACM Transactions on Networking, 20 (6). 1842 -1855 . ISSN 1063-6692

26. Vissicchio, Stefano and Vanbever, Laurent and Pelsser, Cristel and Cittadini, Luca and Francois, Pierre and Bonaventure, Olivier (2012) ***Improving Network Agility With Seamless BGP Reconfigurations***. IEEE/ACM Transactions on Networking (99). p. 1. ISSN 1063-6692

27. Yu-Wen, Chen and Xiuxing, Chen and Maxemchuk, Nicholas (2012) ***The Fair Allocation of Power to Air Conditioners on a Smart Grid***. IEEE Transactions on Smart Grid, 3 (4). pp. 2188-2195. ISSN 1949-3053

28. Zeitler, Georg and Bauch, Gerhard and Widmer, Joerg (2012) ***Quantize-and-Forward Schemes for the Orthogonal Multiple-Access Relay Channel***. IEEE Transactions on Communications, 60 (4).

5.2.4. Conference and Workshop Papers

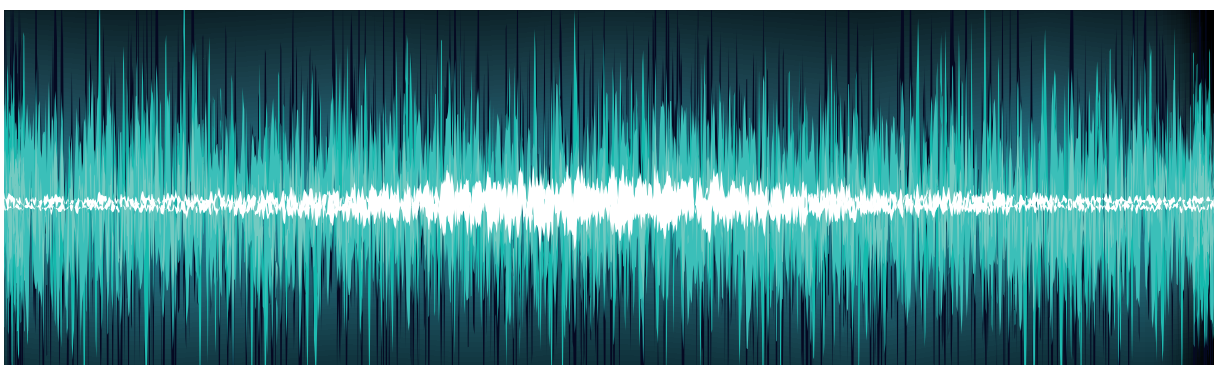
29. Ajmone Marsan, Marco (2012) ***TREND: The FP7 Network of Excellence on Green Networking***. In: 2012 Symposium on Broadband Networks and Fast Internet (RELABIRA), 28-29 May 2012, Baabda, Lebanon.

30. Ajmone Marsan, Marco and Buzzi, Stefano and Chiaraviglio, Luca and Meo, Michela and Guerrero, Carmen and Idzikowski, Filip and Ye, Yabin and Vizcaíno, Jorge López (2012) ***TREND: Toward Real Energy-efficient Network Design***. In: The Second IFIP Conference on Sustainable Internet and ICT for Sustainability (SustainIT 2012), 4-5 October 2012, Pisa, Italy.

31. Ajmone Marsan, Marco and Chiaraviglio, Luca and Ciullo, Delia and Meo, Michela (2012) ***Multiple Daily Base Station Switch-Offs in Cellular Networks***. In: 4th International Conference on Communications and Electronics (ICCE 2012), 1-3 August 2012, Hue, Vietnam.

32. Arjona Aroca, Jordi and Fernández Anta, Antonio (2012) ***Bisection (Band)Width of Product Networks with Application to Data Centers***. In: 9th Annual Conference on Theory and Applications of Models of Computation, TAMC 2012, May 16-21, 2012, Beijing, China.

33. Arévalo, Sergio and Fernández Anta, Antonio and Imbs, Damien and Jiménez, Ernesto and Raynal, Michel (2012) ***Failure Detectors in Homonymous Distributed Systems (with an Application to Consensus)***. In: 32nd International Conference on Distributed Computing Systems (ICDCS 2012), 18-21 June 2012, Macau, China.



34. Cardona, Juan Camilo and Stanojevic, Rade (2012) ***IXP traffic: a macroscopic view***. In: 7th Latin American Networking Conference 2012, 4-5 October 2012, Medellín, Colombia.

35. Castro, Ignacio and Gorinsky, Sergey (2012) ***T4P: Hybrid Interconnection for Cost Reduction***. In: The Seventh Workshop on the Economics of Networks, Systems and Computation (NetEcon 2012), collocated with INFOCOM 2012, 30 March 2012, Orlando, Florida, USA.

36. Chen, Zhiliang and Kuehne, Alexander and Klein, Anja and Loch, Adrian and Hollick, Matthias and Widmer, Joerg (2012) ***Two-way relaying for multiple applications in wireless sensor networks***. In: International ITG Workshop on Smart Antennas (WSA), 7-8 March 2012, Dresden, Germany.

37. Christoforou, Evgenia and Fernández Anta, Antonio and Georgiou, Chryssis and Mosteiro, Miguel A. and Sanchez, Angel (2012) ***Achieving Reliability in Master-Worker Computing via Evolutionary Dynamics***. In: 18th International Conference on Parallel Processing, Euro-Par 2012, August 27-31, 2012, Rhodes Island, Greece.

38. Christoforou, Evgenia and Fernández Anta, Antonio and Georgiou, Chryssis and Mosteiro, Miguel A. and Sanchez, Angel (2012) ***Brief Announcement: Achieving Reliability in Master-Worker Computing via Evolutionary Dynamics***. In: ACM Symposium on Principles of Distributed Computing, PODC 2012, 16-18 July 2012, Funchal, Madeira, Portugal.

39. De La Oliva, Antonio and Morelli, Arianna and Mancuso, Vincenzo and Draexler, Martin and Hentschel, Tim and Melia, Telemaco and Seite, Pierrick and Cicconetti, Claudio (2012) ***Denser networks for the Future Internet, the CROWD approach***. In: MONAMI OConS Workshop: Workshop on Open Connectivity Services for the Future Internet, 24-26 September 2012, Hamburg, Germany.

40. Farach-Colton, Martin and Fernández Anta, Antonio and Milani, Alessia and Mosteiro, Miguel A. and Zaks, Shmuel (2012) ***Opportunistic Information Dissemination in Mobile Ad-Hoc Networks: Adaptiveness vs. Obliviousness and Randomization vs. Determinism***. In: 10th Latin American Symposium onTheoretical Informatics, LATIN 2012, April 16-20, 2012, Arequipa, Peru.

41. Fernández Anta, Antonio (2012) ***Techniques for Sentiment Analysis and Topic Detection of Spanish Tweets: Preliminary Report***. In: Taller de Análisis de Sentimientos en la SEPLN / Workshop on Sentiment Analysis at SEPLN (TASS 2012), Satellite event of the SEPLN 2012 Conference, 5-7 September 2012, Castellón de la Plana, Spain.

42. Ferreira da Costa, Rui Pedro and Melia, Telemaco and Eznarriaga, Lucas and Giust, Fabio and De La Oliva, Antonio and Bernardos, Carlos Jesús (2012) ***Wireless Multi-Access Delivery for SVC-based Video Applications***. In: 4th International Conference on Mobile Networks and Management(MONAMI 2012), 23-26 September 2012, Hamburg, Germany.

43. Garcia-Saavedra, Andres and Banchs, Albert and Serrano, Pablo and Widmer, Joerg (2012) ***Distributed Opportunistic Scheduling: A Control Theoretic Approach***. In: The 31st Annual IEEE International Conference on Computer Communications (IEEE INFOCOM 2012), 25-30 March, 2012, Orlando, Florida, USA.

44. Garcia-Saavedra, Andres and Serrano, Pablo and Banchs, Albert and Bianchi, Giuseppe (2012) ***Energy Consumption Anatomy of 802.11 Devices and its Implication on Modeling and Design***. In: 8th International Conference on emerging Networking EXperiments and Technologies (ACM CoNEXT 2012), 10-13 December 2012, Nice, France.

45. Gutiérrez Rojas, Israel and Crespo García, Raquel M. and Delgado Kloos, Carlos (2012) ***Enhancing orchestration of lab sessions by means of awareness mechanisms***. In: EC-TEL 2012: 21st century learning for 21st century skills: 7th European Conference of Technology Enhanced Learning, 18-21 September 2012, Saarbrücken, Germany.

46. Hasan, Syed and Gorinsky, Sergey (2012) ***Obscure Giants: Detecting the Provider-Free ASes***. In: IFIP Networking 2012, 21 – 25 May 2012, Czech Technical University in Prague, Prague, Czech Republic.

47. Idzikowski, Filip and Duque, Raúl and Jiménez, Ernesto and Le Rouzic, Esther Le and Chiaraviglio, Luca and Ajmone Marsan, Marco (2012) ***Energy Saving in Optical Operator Networks: the Challenges, the TREND Vision, and Some Results***. In: European Conference and Exhibition on Optical Communication (ECOC 2012), 16-20 September 2012, Amsterdam, Netherlands.

48. Jiang, Jian and Liang, Jinjin and Li, Kang and Li, Jun and Duan, Haixin and Wu, Jianping (2012) ***Ghost Domain Names: Revoked Yet Still Resolvable***. In: 19th Annual Network & Distributed System Security Symposium (NDSS 2012), 5-8 February 2012, San Diego, California, USA.

49. Khan, Atta ur Rehman and Ali, Shahzad and Mustafa, Saad and Othman, Mazliza (2012) ***Impact of mobility models on clustering based routing protocols in mobile WSNs***. In: 10th International Conference on Frontiers of Information Technology (FIT 2012) , 17-19 December 2012, Islamabad, Pakistan.

50. Kim, Bo Hyun J. and Maxemchuk, Nicholas (2012) ***A safe driver assisted merge protocol***. In: 2012 IEEE International Systems Conference (SysCon), 19-22 March 2012, Vancouver, British Columbia, Canada.

51. Kumarapillai Chandrikakutty, Harikrishnan and Unnikrishnan, Deepak and Tessier, Russell and Wolf, Tilman (2012) ***High-performance hardware monitors to protect network processors from data plane attacks***. In: ACM/EDAC/IEEE Design Automation Conference (DAC), 2-6 June, 2012, Austin, Texas.

52. Kuzniar, Maciej and Peresini, Peter and Canini, Marco and Venzano, Daniele and Kostic, Dejan (2012) ***A SOFT Way for OpenFlow Switch Interoperability Testing***. In: 8th International Conference on emerging Networking EXperiments and Technologies (ACM CoNEXT 2012), 10-13 December 2012, Nice, France.

53. Li, Hui and Maxemchuk, Nicholas and Gu, Yitian and Zhang, Guoxia (2012) ***Fair Allocation of Delays in the Real-Time Control of an Autonomous Traffic Signal***. In: The 91st Annual Meeting of the Transportation Research Board of the National Academies Conference (TRB 2012), 22-26 January 2012, Washington D.C., USA.

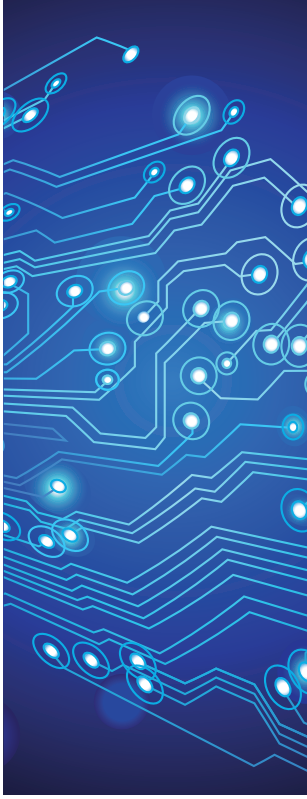
54. Li, Hui and Maxemchuk, Nicholas and Gu, Yitian and Zhang, Guoxia (2012) ***Fair, Real-Time Control of a Traffic Signal***. In: Transportation Research Board 91st Annual Meeting, 1 - 26 January 2012, Washington DC, USA.

55. Li, Jun and Yu, Dongting and Maurer, Luke (2012) ***A resource management approach to web browser security***. In: International Conference on Computer Communication Networks (ICCCN 2012) , July 30 - August 2, 2012, Munich, Germany.

56. Lin, Shou-pon and Maxemchuk, Nicholas (2012) ***An architecture for collaborative driving systems***. In: 20th IEEE International Conference on Network Protocols (ICNP 2012), 30 October - 2 November 2012, Austin, Texas, USA.

57. Lutu, Andra and Bagnulo, Marcelo and Stanojevic, Rade (2012) ***An Economic Side-Effect for Prefix Deaggregation***. In: The Seventh Workshop on the Economics of Networks, Systems and Computation (NetEcon 2012), collocated with INFOCOM 2012, 30 March 2012, Orlando, Florida, USA.

58. López Millán, Víctor M. and Cholvi, Vicent and López, Luis and Fernández Anta, Antonio (2012) ***Resource location based on partial random walks in networks with resource dynamics***. In: 4th Workshop on Theoretical Aspects of Dynamic Distributed Systems, TADDS '12, Roma, Italy, December 17, 2012, December 17, Rome, Italy.



59. Mancuso, Vincenzo and Biton, Erez and Maeder, Andreas and Rost, Peter and Andrusier, Nelly and Weizman, Yaniv and Gurewitz, Omer (2012) ***On designing next generation MAC for cellular networks using the FLAVIA paradigm***. In: Future Network and Mobile Summit (FuNeMS 2012), 4-6 July 2012 , Berlin, Germany.

60. Mozo, Alberto and Lopéz-Presa, José Luis and Fernández Anta, Antonio (2012) ***SLBN: A Scalable Max-min Fair Algorithm for Rate-Based Explicit Congestion Control***. In: 11th IEEE International Symposium on Network Computing and Applications (NCA 2012), 23-25 August 2012, Cambridge, MA, USA.

61. Otto, John S. and Stanojevic, Rade and Laoutaris, Nikolaos (2012) ***Temporal Rate Limiting: cloud elasticity at a flat fee***. In: The Seventh Workshop on the Economics of Networks, Systems and Computation (NetEcon 2012), collocated with INFOCOM 2012, 30 March 2012, Orlando, Florida, USA.

62. Panarello, Carla and Ajmone Marsan, Marco and Lombardo, Alfio and Mellia, Marco and Meo, Michela and Schembra, Giovanni (2012) ***On the Intertwining between Capacity Scaling and TCP Congestion Control***. In: 3rd International Conference on Future Energy Systems (e-Energy 2012), 9-11 May 2012, Madrid, Spain.

53. Podlesny, Maxim and Gorinsky, Sergey and Rengarajan, Balaji (2012) ***AIST: Insights into Queuing and Loss on Highly Multiplexed Links***. In: IEEE/ACM Symposium on Quality of Service 2012 (IEEE/ACM IWQoS 2012), 4-5 June 2012, Coimbra, Portugal.

64. Salvador, Pablo and Gringoli, Francesco and Mancuso, Vincenzo and Serrano, Pablo and Mannocci, Andrea and Banchs, Albert (2012) ***VoIPiggy: Implementation and evaluation of a mechanism to boost voice capacity in 802.11 WLANs***. In: The 31st Annual IEEE International Conference on Computer Communications (IEEE INFOCOM 2012), 25-30 March, 2012, Orlando, Florida, USA.

65. Salvador, Pablo and Paris, Stefano and Pisa, Claudio and Patras, Paul and Grunenberger, Yan and Perez-Costa, Xavier and Gozdecki, Janusz (2012) ***A Modular, Flexible and Virtualizable Framework for IEEE 802.11***. In: Future Network & Mobile Summit (FutureNetw 2012), 4-6 July 2012, Berlin, Germany.

66. Sevilla, Andrés and Mozo, Alberto and Fernández Anta, Antonio (2012) ***Brief Announcement: Node Sampling Using Centrifugal Random Walks***. In: The 26th International Symposium on DIStributed Computing (DISC 2012), 16-18 October 2012, Salvador, Bahia, Brazil.

67. Sevilla, Andrés and Mozo, Alberto and Fernández Anta, Antonio (2012) ***Node Sampling Using Centrifugal Random Walks***. In: 16th International Conference On Principles Of DIstributed Systems (OPODIS 2012), 17-20 December 2012, Roma, Italy.

68. Verma, Kshitiz and Rizzo, Gianluca and Fernández Anta, Antonio and Cuevas, Rubén and Azcorra, Arturo (2012) ***Greening the Internet: Energy-Optimal File Distribution***. In: 11th IEEE International Symposium on Network Computing and Applications, NCA 2012, August 23-25, 2012, Cambridge, MA, USA.

69. Wang, Lin and Fernández Anta, Antonio and Zhang, Fa and Hou, Chenying and Liu, Zhiyong (2012) ***Energy-Efficient Network Routing with Discrete Cost Functions***. In: 9th Annual Conference on Theory and Applications of Models of Computation, TAMC 2012, May 16-21, 2012, Beijing, China.

70. Widmer, Joerg and Capalbo, Andrea and Fernández Anta, Antonio and Banchs, Albert (2012) ***Rate allocation for layered multicast streaming with inter-layer network coding***. In: The 31st Annual IEEE International Conference on Computer Communications (IEEE INFOCOM 2012), 25-30 March, 2012, Orlando, Florida, USA.

71. Winter, Rolf and Van Beijnum, Iljitsch (2012) ***Explicitly Accommodating Origin Preference for Inter-Domain Traffic Engineering***. In: The 27th Symposium On Applied Computing (SAC 2012), 26-30 March 2012, Riva del Garda, Trento, Italy.

72. Xie, Hengheng and Boukerche, Azzedine and Pazzi, Richard W. (2012) ***A Novel Collision Probability based Adaptive Contention Windows Adjustment for QoS Fairness on Ad Hoc Wireless Networks***. In: IEEE Global Communications Conference (IEEE GLOBECOM 2012) – Wireless Networking Symposium, 3-7 December 2012, Anaheim, California, USA.

5.2.5. PhD Theses

73. Bikfalvi, Alex (2012) ***Peer-to-Peer Television for the IP Multimedia Subsystem***. PhD Thesis, University Carlos III of Madrid, Spain.
Supervisor: Banchs, Albert

74. Gramaglia, Marco (2012) ***VANET-Based optimization of infotainment and traffic efficiency vehicular services***. PhD Thesis, University Carlos III of Madrid, Spain.
Supervisors: Bernardos Cano, Carlos Jesús and Calderón Pastor, María

5.2.6. Masters Theses

75. Asadi, Arash (2012) ***Opportunistic cellular communications with clusters of dual-radio mobiles***. Masters Thesis, University Carlos III of Madrid, Spain.
Supervisor: Mancuso, Vincenzo

76. Chatzipapas, Angelos (2012) ***Using Energy Efficient Ethernet (802.3az) in Web Hosting Centers***. Masters Thesis, University Carlos III of Madrid, Spain.
Supervisor: Mancuso, Vincenzo

77. Sciancalepore, Vincenzo (2012) ***BASICS: Scheduling Base Stations to Mitigate Interferences in Cellular Networks***. Masters Thesis, University Carlos III of Madrid, Spain.
Supervisor: Banchs, Albert

78. Wang, Qing (2012) ***Recouping Opportunistic Gain in Dense Base Station Layouts Through Energy-Aware User Cooperation***. Masters Thesis, University Carlos III of Madrid, Spain.
Supervisor: Rengarajan, Balaji

79. Zavou, Elli (2012) ***Knowledge is Power: Online Performance of Non-uniform Tasks in Fault-prone Environments***. Masters Thesis, University Carlos III of Madrid, Spain.
Supervisor: Fernández Anta, Antonio

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.

Arturo AZCORRA

- Co-chair of the Student Travel Grant Committee of the 32nd Annual IEEE International Conference on Computer Communications (IEEE INFOCOM 2013)
- Invited panelist of the "Panel Future Internet Innovation and Use Cases", at the 3rd European Summit on Future Internet, Helsinki, Finland, 31 May – 1 June 2012
- Member of the Advisory Board of the Future Internet PPP, European Commission since February 2012
- Member of the Standing Committee of IEEE INFOCOM 2013
- President of Doctoral Thesis Tribunal of Alexandru Bikfalvi, "Peer-to-Peer Television for the IP Multimedia Subsystem" (Universidad Carlos III de Madrid, July 2012)
- President of Doctoral Thesis Tribunal of Marco Gramaglia, "VANET-Based Optimization of Infotainment and Traffic Efficiency Vehicular Services" (Universidad Carlos III de Madrid, September 2012)
- Technical reviewer for IEEE Communications Letters Journal 2012
- Technical Program Committee (TPC) member of IEEE INFOCOM 2013

Marco AJMONE MARSAN

- General Chair of IEEE INFOCOM 2013
- General Chair of the 2012 IEEE International Conference on Green Computing and Communications (IEEE GreenCom 2012)
- General Chair of the 3rd International Conference on Future Energy Systems (e-Energy 2012)
- Member of the Editorial Board of the Elsevier Computer Networks Journal
- Member of the Standing Committee of IEEE INFOCOM 2012, 2013 & 2014
- Member of the Steering Committee of the IEEE/ACM Transactions on Networking Journal
- TPC member of the 1st Workshop on Energy in Communication, Information, and Cyber-Physical Systems Workshop (E6 2012), co-located with the 4th International COMmunication Systems and NETworkS (COMSNETS 2012)

- TPC member of the 15th International Telecommunications Network Strategy and Planning Symposium (Networks 2012)
- TPC member of the 2nd IFIP Conference on Sustainable Internet and ICT for Sustainability (SustainIT 2012)
- TPC member of the 20th International Conference on Software Telecommunications and Computer Networks (SoftCOM 2012)
- TPC member of the 4th International Conference on Communications and Electronics (ICCE 2012)

Albert BANCHS

- Area Editor for Elsevier Computer Communications Journal
- TPC Co-chair of the 13th IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (IEEE WoWMoM 2012)
- TPC member of SustainIT 2012
- TPC member of the 23rd IEEE Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (IEEE PIMRC 2012)
- TPC member of the 24th International Teletraffic Congress (ITC 2012)
- TPC member of the 3rd IEEE Workshop on Convergence among Heterogeneous Wireless Systems in Future Internet (IEEE CONWIRE 2013)
- TPC member of the 7th ACM International Workshop on Wireless Network Testbeds, Experimental evaluation and Characterization (ACM WiNTECH 2012)

Antonio FERNÁNDEZ ANTA

- Co-chair of the TPC of e-Energy 2012
- Invited panelist at the IEEE Senior Member Review Panel Meeting, Madrid, Spain, 1 September 2012
- Member of the Steering Committee of the 16th International Conference On Principles Of Distributed Systems (OPODIS 2012)
- Invited panelist at roundtable “La Ciencia es mi Vida” (Science is My Life), La Noche de los Investigadores 2012 (Researchers’ Night 2012), Madrid, Spain, 28 September 2012
- TPC member of IEEE GreenCom 2012
- TPC member of the UrbaNe Workshop, co-located with the 8th International Conference on emerging Networking EXperiments and Technologies (ACM CoNEXT 2012)
- TPC member of the 1st Workshop on P2P and Dependability (P2P-Dep 2012), co-located with the 9th European Dependable Computing Conference (EDCC 2012)
- TPC member of the 3rd IEEE International Conference on Smart Grid Communications (IEEE SmartGridComm 2012)

- TPC member of the 11th Annual IEEE International Symposium On Network Computing and Applications (IEEE NCA12)
- TPC member of the 39th International Colloquium on Automata, Languages and Programming (ICALP 2012) (Track C: Foundations of Networked Computation)
- Vice-chair of the Steering Committee of the International Symposium on Distributed Computing (DISC), for the period 2011-2013. After two years, the Vice-chair becomes Chair

Pierre FRANCOIS

- TPC member of the Standards Workshop on Telecommunications: From Research to Standards (ICC'12 WS - Standards) , co-located with the IEEE International Conference on Communications (IEEE ICC 2012)
- TPC member of the 11th IFIP International Conference on Networking (IFIP Networking 2012)

Sergey GORINSKY

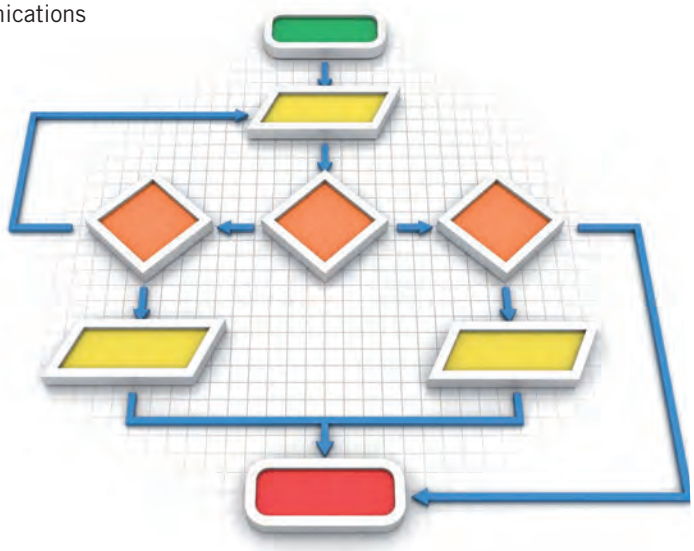
- Chair of COMSNETS E6 2012
- General Chair of IEEE WoWMoM 2013
- Publicity Chair of IEEE INFOCOM 2012
- TPC Chair of COMSNETS 2013
- TPC member COMSNETS 2012
- TPC member of IEEE INFOCOM 2012
- TPC member of IEEE INFOCOM 2013
- TPC member of IFIP Networking 2012
- TPC member of the 15th IEEE Global Internet Symposium (Global Internet 2012) , co-located with IEEE INFOCOM 2012
- TPC member of the 18th Annual Conference of the ACM Special Interest Group on Data Communication (SIGCOMM) on the applications, technologies, architectures, and protocols for computer communication (ACM SIGCOMM 2012)
- TPC member of the 20th International Conference on Network Protocols (IEEE ICNP 2012)
- TPC member of the 32nd International Conference on Distributed Computing Systems (IEEE ICDCS 2012)
- TPC member of IEEE ICDCS 2013

Vincenzo MANCUSO

- Evaluator for the Italian Research and University Evaluation Agency (ANVUR)
- Publicity Chair for ACM e-Energy 2013
- TPC member and Local Arrangements Co-Chair of e-Energy 2012
- TPC member of IEEE GreenCom 2012
- TPC member of the IEEE International Workshop on Internet of Things Technology and Architectures (IoTech2012), co-located with the 9th IEEE International Conference on Mobile Ad hoc and Sensor Systems (IEEE MASS 2012)
- TPC member for IEEE WoWMoM 2012
- TPC member of the 2nd IET International Conference on Wireless Communications and Applications (IET ICWCA 2012)
- TPC member of the 3rd International Conference on ICT Convergence (ICTC 2012)
- TPC member of the 5th IFIP Wireless Days Conference 2012 (Wireless Days 2012)
- TPC member of the 5th International Workshop on Multiple Access Communications (MACOM 2012)
- TPC member of the 15th ACM International Conference on Modeling, Analysis, and Simulation of Wireless and Mobile Systems (MSWiM 2012)
- TPC member of the 55th IEEE Global Communications Conference (GLOBECOM) 2011 - Wireless Networking Symposium (IEEE GC'12 - WN)
- Track-chair of the IEEE 77th Vehicular Technology Conference (VTC 2013 Spring)

Balaji RENGARAJAN

- TPC member of e-Energy 2012
- TPC member of the Green Computing, Networking and Communications Symposium (ICNC 2012 GCNC Symposium), co-located with the International Conference on Computing, Networking and Communications ICNC 2012 – GCNC symposium
- TPC member of IEEE GreenCom 2012
- TPC member of the Workshop on Green Communications and Networking (ICC'12 WS - GCN), co-located with IEEE ICC 2012
- TPC member of the 1st IEEE INFOCOM Workshop on Communications and Control for Smart Energy Systems (CCSES 2012), co-located with IEEE INFOCOM 2012



Gianluca RIZZO

- TPC member of COM-SNETS 2012
- TPC member of E6 Workshop 2012
- TPC member of e-Energy 2012
- TPC member of IEEE GreenCom 2012
- TPC member of IEEE ICC 2012
- TPC member of the 2nd International Conference on Smart Grids and Green IT Systems (SmartGreens 2012)
- TPC member of the 9th IEEE Consumer Communications & Networking Conference (IEEE CCNC 2012)

Joerg WIDMER

- Associate Editor of the IEEE Transactions on Communications Journal
- Evaluator for the Italian Research and University Evaluation Agency (ANVUR)
- Reviewer for CHIST-ERA Call 2012 - Context- and Content-Adaptive Communication Networks
- Secretary of the Working Group IFIP TC 6 WG 6.2 - Network and Internetwork Architectures
- TPC Co-Chair of IFIP Networking 2012
- TPC member of IEEE INFOCOM 2012
- TPC member of IEEE Global Internet Symposium 2012, co-located with IEEE INFOCOM 2012
- TPC member of the International Conference on Computer Communication Networks (ICCCN 2012)
- TPC member of the Poster and Demo Committee of ACM SIGCOMM 2012
- TPC member of the 2nd Workshop on Advances in Mobile Networking – Towards a Next Generation Mobile Core Network (ICC'12 WS – AMN), co-located with IEEE ICC 2012
- TPC member of the 4th IEEE Workshop on Cooperative and Cognitive Mobile Networks (IEEE CoCoNet Workshop 2012), co-located with IEEE ICC 2012
- TPC member of the 5th IFIP International Conference on New Technologies, Mobility and Security (IFIP NTMS 2012)

5.4. Keynotes, invited talks & tutorials

- Keynote address "On the Real Side of the Internet", by Sergey Gorinsky, at the 1st International Conference on Recent Advances in Information Technology (RAIT 2012), Dhanbad, Jharkhand, India, 15-17 March 2012
- Tutorial "Technologies and Economics of Internet Content Dissemination", by Sergey Gorinsky, at RAIT 2012, Dhanbad, Jharkhand, India, 15-17 March 2012
- Invited talk "Small World Networks", by Antonio Fernández Anta, at the Escuela Universitaria de Informática, Universidad Politécnica de Madrid, Spain, 25 April 2012
- Invited talk "Biased Sampling of Networks", by Antonio Fernández Anta, at the 9th Annual Conference on Theory and Applications of Models of Computation (TAMC 2012), Beijing, China, 16-21 May 2012. In conjunction with the 2012 Turing Year in China
- Invited talk "Greening the Internet: Energy-optimal File Distribution", by Antonio Fernández Anta, at Tshinghua University, Beijing, China, 28 May 2012
- Keynote address "TREND: The FP7 Network of Excellence on Green Networking", by Marco Ajmone Marsan, at the 3rd Symposium on Broadband Networks and Fast Internet (RELABIRA 2012), Baabda, Lebanon, 28-29 May 2012
- Invited talk "An Economic Side-Effect for Prefix Deaggregation", by Andra Lutu, at Internet Initiative Japan-Innovation Institute (IIJ-II) Technical Seminar, 10 July 2012
- Invited talk "Opportunistic Information Dissemination in Mobile Ad-hoc Networks. Adaptiveness vs. Obliviousness and Randomization vs. Determinism", by Antonio Fernández Anta, at the Network Science Workshop, organized by the Institute for Interdisciplinary Information Sciences (IIIS), headed by Prof. Andrew Yao in Tsinghua University, the Institute of Theoretical Computer Science and Communications (ITCSC), also headed by Prof. Andrew Yao in the Chinese University of Hong Kong (CUHK), and the Institute of Network Coding led by Prof. Raymond Yeung in CUHK, Hong Kong, 25-27 July 2012
- Invited talk "T4P and CIPT: New Economic Models for Network Interconnection", by Sergey Gorinsky, at the Eotvos Lorand University (ELTE), Budapest, Hungary, 6 September 2012
- Invited talk "T4P and CIPT: New Economic Models for Network Interconnection", by Sergey Gorinsky, at the Budapest University of Technology and Economics (BME), Budapest, Hungary, 7 September 2012
- Keynote address "TREND: The FP7 Network of Excellence on Green Networking", by Marco Ajmone Marsan, at SoftCOM, Split, Croatia, 11-13 September 2012
- Invited talk "Greening Cellular Access Networks", by Balaji Rengarajan, at TREND Project Plenary Meeting, Volos, Greece, 1-5 October 2012
- Invited talk "Greening the Internet: Energy-optimal File Distribution", by Gianluca Rizzo, at TREND Project Plenary Meeting, Volos, Greece, 1-5 October 2012
- Invited talk "Hardware Support and Virtualization in High Performance Network Processors", by Tilman Wolf, at the Workshop on Optimization of Computing at the Edge of Network (EON2012), held in conjunction with Embedded Systems Week Conferences (ESWEEK 2012), Tampere, Finland, 7 October 2012

- Keynote address "Energy-Proportional Networked Systems", by Dejan Kostić, at IEEE GreenCom, Besançon, France , 20-23 November 2012
- Invited talk "Energy-Efficient Cellular Networks", by Balaji Rengarajan, at Politecnico di Torino, Turin, Italy, 28 November 2012

5.5. Major events

XII Semana de la Ciencia
Technologies and Architecture of the Future Internet

7 November 2012

Speaker/s: Tilman Wolf, Professor of Electrical and Computer Engineering, University of Massachusetts Amherst; Visiting Researcher, Institute IMDEA Networks

The future Internet needs to provide enough flexibility to allow the dynamic deployment of new network protocols, support heterogeneous end-systems, provide novel communication abstractions, and exhibit inherent security and manageability. In this talk, Dr. Wolf presented an overview of various technological drivers that shape current developments in network architecture research. He discussed how programmable routers and network virtualization provide the basis for adaptability in the network and present some of the related research problems. He also provided an overview on ongoing research projects that aim to provide novel network architectures that may become the core of the future Internet.

la noche de los investigadores madrid 2012

Science is my Life

28 September 2012

Under the title *La Ciencia es mi Vida (Science is My Life)*, a roundtable was held on Friday 28th September 2012 in the Residencia de Estudiantes de Madrid, moderated by the Professor of Theoretical Physics Mr. Alfredo Poves, gathering a number of researchers from the Madrid Institutes of Advanced Studies (IMDEA).

This round table was one of the around twenty activities slated for the *Night of Researchers 2012*, a European scientific outreach project that was simultaneously held in over 200 European cities. Promoted by the Board of Education and Employment of the Madrid Community, and coordinated by the madri+d Foundation, this project involved fourteen universities and other research centers in our Community.

4th IMDEA Networks Annual International Workshop: Data. Novel challenges related to the use of data in Networking Operations and Research

13 June 2012

Speaker/s: Pierre Francois, Institute IMDEA Networks; Zhi-Li Zhang, University of Minnesota, Institute IMDEA Networks & University Carlos III of Madrid; Paolo Lucente, Cariden Technologies; Enrique Frias-Martinez, Telefonica I+D; Carmen Guerrero, University Carlos III of Madrid; Robbin te Velde, Dialogic)

Institute IMDEA Networks annually holds a by-invitation-only thematic workshop in Madrid. The workshop accompanies a meeting of our Scientific Council comprised by prominent researchers. In addition to talks by Scientific Council members, the workshop includes invited talks by external experts in the research theme of the workshop. The goal of the 2012 workshop was to foster discussion on a critical aspect of research in networking: data.

The workshop program contained talks about research in Networking where data collection, data correlation from different sources and data processing play a specific role for the research being developed.

A profound understanding of the properties of services provided over the Internet no longer only requires data from Internet core and edge networks, but also from infrastructures, which play more and more dominant roles in the Internet. Data-centers and cloud computing deployments, peer-to-peer networks, content distribution networks infrastructures, as well as applications using these technologies in novel ways or wearing specific end-user properties, have, indeed, not only radically changed the perception of what the Internet is, but they have also modified the input of the Internetworking problem.

The content of the workshop was thus aimed at presenting recent research results that scientifically emphasize this aspect of the evolution of the Internet and/or how research about the Internet should be carried on, taking this evolution into account. The discussion of results showing how data-oriented research has been made more difficult in Today's Internet and those advocating for new ways of measuring and evaluating the Internet was, hence, one of the main focus of the workshop.

Program

- **General introduction to the topics covered in the Workshop,** Pierre Francois (Institute IMDEA Networks)
- **Measuring and Understanding Large-Scale Content (Video) Delivery Systems,** Zhi-Li Zhang (University of Minnesota, Institute IMDEA Networks & University Carlos III of Madrid)

- **Data for the ISP: Tools to perform tactical and strategic routing decisions**, Paolo Lucente *(Cariden Technologies)*
- **Collection, processing and exploitation of Call Detail Records at Telefónica for Smart Cities Applications**, Enrique Frias-Martinez *(Telefonica I+D)*
- **People's on the Internet: analyzing peer-to-peer and social networks**, Carmen Guerrero (University Carlos III of Madrid)
- **Open data, getting access to data, specificities of networking data**, Robbin te Velde (Dialogic)

e-Energy 2012, the Third International Conference on Future Energy Systems Where Energy, Computing and Communication Meet

9-11 May 2012

e-Energy 2012 was the third International Conference on Future Energy Systems, which is organized annually since 2010. Due to the increasing significance of power consumption in computing and networking, the goal of e-Energy is to bring together researchers, developers and practitioners working in this area to discuss recent and innovative results, as well as identify future directions and challenges. The continuing spread of Information and Communication Technology (ICT) has contributed much to the reduction of energy consumption in many areas of everyday life. Nevertheless ICT infrastructure continues to expand in capacity and reach, and needs to be more energy-efficient itself. Additionally, ICT can be used to optimize the production, transport and consumption of energy in other setups.

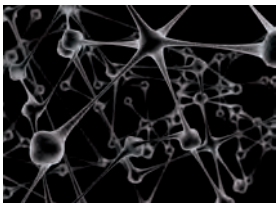
The conference addresses the varied fields of servers and communication infrastructures, services in data centers, end-systems in home and office environments, broadband access networks, sensor networks, cloud computing, smart grids and future networks such as The Internet of Things.

The third e-Energy Conference was held from May 9th to 11th, 2012 and organized by Institute IMDEA Networks and the University Carlos III of Madrid. The first e-Energy Conference was held in April 2010, in Passau (Germany), and the second took place in May/June 2011 at Columbia University, in New York City (USA).

e-Energy 2012 was organized in cooperation with ACM SIGCOMM and technically co-sponsored by the IEEE and the IEEE Computer Society Technical Committee on Parallel Processing. It also counts with cooperation from the Technical Subcommittee on Green Communications & Computing (TSCGCC) of the IEEE Communications Society, the sponsorship of the Network of Excellence TREND (Towards Real Energy-efficient Network Design) and of the SCCD (Sociedad de Computación Concurrente y Distribuida).

5.6. 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. Out of the 38 total number of events in which the Institute participated (including those listed on section 6.5), 24 were conducted by invited speakers:



Advanced Computer Networks
Speaker: Ibrahim Matta, Professor, Computer Science Department, College of Arts & Sciences, Boston University, USA
Date: 3 December 2012

A SOFT Way for OpenFlow Switch Interoperability Testing
Speaker: Maciej Kuzniar, PhD Student, École Polytechnique Fédérale de Lausanne, Switzerland
Date: 28 November 2012

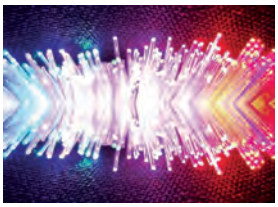
ESNOG/GORE 2012 - Networking event
Speaker: João Damas & Juan Pedro Cerezo, Bond IS/BT; RIPE NCC
Date: 13 November 2012

Research Labs and Startups - Intimate Lovers or Ships Passing in the Night?
Speaker: Sean Murphy, Senior Research Fellow, University College Dublin, Ireland
Date: 5 October 2012

Low cost Network Coding for Collaborative Video Streaming

Speaker: Nikolaos Thomos, Senior Researcher, Signal Processing Laboratory (LTS4), Swiss Federal Institute of Technology (EPFL), Lausanne, and Computers and Distributed Systems (CDS) laboratory at University of Bern (UniBe), Switzerland

Date: 31 May 2012



Optical Access Networks

Speaker: Antonio Teixeira, Instituto de Telecommunicaçoes, Nokia-Siemens Networks, Portugal

Date: 29 May 2012

Stochastic Modeling with METFAC

Speaker: Juan A. Carrasco, Associate Professor, Electronics Engineering Department, Universitat Politecnica de Catalunya, Spain

Date: 29 May 2012

ErdOS: The Case for Opportunistic Social Computing

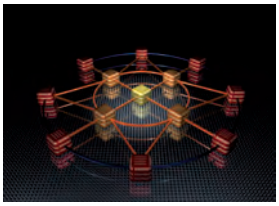
Speaker: Narseo Vallina-Rodriguez, PhD candidate in Computer Science, Computer Lab, University of Cambridge, UK

Date: 22 May 2012

Flow allocation with joint channel and power assignment in multihop radio networks using game theory

Speaker: Jorge Ortín, University of Zaragoza, Spain

Date: 21 May 2012



Insights on Distributed Backup and Storage

Speaker: Matteo Dell'Amico, Researcher, Eurecom, France

Date: 18 May 2012

From a national leadership to the World Championship. Lessons learned from Telefónica's internationalization process

Speaker: José Cea Jiménez, Independent Consultant, Information and Communications Technologies, Spain
Date: 17 May 2012

Auctions of Licensed vs Unlicensed Use of Spectrum

Speaker: Alonso Silva, Postdoctoral Researcher, Department of EECS, University of California, Berkeley, USA
Date: 14 May 2012

Addressing resource issues in new live video streaming systems

Speaker: Gwendal Simon, Associate Professor, Telecom Bretagne, France; Visiting Researcher, University of Waterloo, UK
Date: 7 May 2012

Network Reliability in the Software Era - Finding Bugs in OpenFlow Applications

Speaker: Dr. Marco Canini, Postdoctoral researcher, École Polytechnique Fédérale de Lausanne, Switzerland
Date: 4 May 2012

Cooperative communication schemes for ad hoc and sensor networks

Speaker: Michele Rossi, Assistant Professor, Department of Information Engineering (DEI), University of Padova, Italy
Date: 24 April 2012

Enabling Technologies and Standards for Multi-hop Wireless Networking

Speaker: Prof. Enzo Mingozzi, Associate Professor, University of Pisa, Italy
Date: 24 April 2012

Vivisecting the YouTube Video Delivery Cloud: Overall Architecture and Key Mechanisms

Speaker: Zhi-Li Zhang, Visiting Researcher, Institute IMDEA Networks; Cátedra de Excelencia, University Carlos III of Madrid, Spain; Qwest Chair Professor, University of Minnesota, Minneapolis, USA

Date: 11 April 2012

Content-Centric Networking: challenges and (possible) solutions

Speaker: Jaime Garcia-Reinoso, Assistant Professor, University Carlos III of Madrid, Spain

Date: 10 April 2012

Network-based Distributed Mobility Management Demo

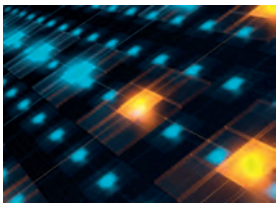
Speaker: Carlos J. Bernardos, Associate Professor, University Carlos III of Madrid, Spain

Date: 29 March 2012

Distributed Opportunistic Scheduling: A Control Theoretic Approach

Speaker: Andres Garcia-Saavedra, PhD Candidate, University Carlos III of Madrid, Spain

Date: 13 Mar 2012



Contention resolution and packet queuing on a multiple access channel

Speaker: Dariusz Kowalski, Visiting Researcher, Institute IMDEA Networks

Date: 28 February 2012

VIRO: Scalable and Robust Virtual-Id Routing for Future Dynamic Networks

Speaker: Zhi-Li Zhang, Visiting Researcher, Institute IMDEA Networks; Cátedra de Excelencia, University Carlos III of Madrid, Spain; Qwest Chair Professor, University of Minnesota, Minneapolis, USA

Date: 21 February 2012

Vehicular Networks for Intelligent Transportation Systems: Overview of the Research activities of the "Grupo de Redes de Computadores (GRC)", Universitat Politècnica de València

Speaker: Pietro Manzoni, Full Professor of Computer Science, Universitat Politècnica de València, Spain

Date: 31 January 2012

5.7. Major future events

IEEE WOWMOM 2013, the 14th International Symposium on a World of Wireless, Mobile and Multimedia Networks

4-7 June 2013

http://wowmom2013.tmit.bme.hu/

WoWMoM 2013 is the 14th IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks. WoWMoM addresses research challenges and advances towards a world of wireless, mobile, and multimedia pervasive communications. The evolution of wireless networking technologies and their key role in Future Internet scenarios offer an increasing wealth of opportunities for distributing multimedia contents over wireless networks, enabling dissemination of professional contents to mobile users as well as sharing user-generated contents among them. Users will be able to retrieve, publish, and manage information, communicate with other users or devices, access and author services, create and exploit context-awareness and so on. WoWMoM 2013 aims to provide researchers and students a friendly and interactive forum for exchanging results and visions that shape the future of wireless, mobile and multimedia systems. It will feature a rich and diverse technical program involving high profile researchers from both academia and industry.

The fourteenth WoWMoM Conference will be held in Madrid from June 4th to 7th, 2013 and organized by Institute IMDEA Networks and the University Carlos III of Madrid. The 2011 edition of the Conference was held at the IMT Institute for Advanced Studies Lucca, in Lucca (Italy), and the 2012 took place in San Francisco, California (USA).

IEEE WoWMoM 2013 is sponsored by the IEEE Computer Society, the University of Texas at Arlington, and the IEEE Technical Committee on Computer Communications (TCCC).

IEEE OnlineGreenComm 2013, the 3th International Online Conference on Green Communications

29-31 October 2013

http://www.ieee-greencom.org/

2013 IEEE Online Conference on Green Communications is the 3rd edition of IEEE OnlineGreenComm conducted entirely online and dedicated to addressing the challenges in energy-efficient communications and communications for green technologies.

Continuing with the experience provided the last two editions, IEEE OnlineGreenComm'13 will be held entirely online, to emphasize the need for reducing global greenhouse gas emissions, avoiding the most polluting aspects of conferences: the use of mass transport systems for traveling. The conference embraces the latest online conferencing technology that will allow attendees to match the experience and networking aspects of face to face meetings. Common to all IEEE conferences, IEEE OnlineGreenComm will feature a full-fledged paper submission, review, and publication process that adheres to the high standards defined by IEEE's. This process will be supplemented with additional content from online presentations that will be made available through IEEE ComSoc Webcasts.

IEEE OnlineGreenComm covers a wide spectrum of research subjects, including green methodologies and architectures for communication technologies, communication technologies as enablers for green solutions, energy efficient in Smart Grid comunications and energy management.

5.8. Local Scientific Partnership

Institute IMDEA Networks has established a strong scientific partnership with one of the local universities in the Madrid region, namely the **University of Alcalá (UAH)**. This partnership involves a 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 the **MEDIANET project**. MEDIANET focuses on the design of a future Internet architecture that takes into account the requirements of multimedia traffic. In addition to Institute IMDEA Networks and UAH, the other partners participating in the project are University Carlos III and University Complutense of Madrid.

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 **patents** have been produced, which are co-invented by IMDEA Networks and University of Alcalá researchers. Another 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.

impact and technology transfer

annual report 2012

6.1. Contribution to standardization bodies

Standardization wears a critical role in the field of research in Networking. Many different vendors manufacture networking equipment, network-attached devices, and software running on such devices. Without strong standardization efforts, the industry has to rely on de-facto proprietary standards, which typically hinders flexibility in the evolution of deployed infrastructures and services, and often prevents deployment in multi-vendor environments. Standardization is thus considered as an inherent part of the research work performed at IMDEA Networks, as it increases the likelihood of acceptance of our technological contributions.

The **IEEE Standards Association (IEEE SA)** is one of the premier standards organizations working on the lower layers of the network model. The most widely known series of IEEE standards are 802.3 (Ethernet) and 802.11 (Wi-Fi). Many researchers at University Carlos III of Madrid Netcom and Institute IMDEA Networks perform joint research on the 802.11 wireless protocols standardized by the IEEE SA.

The **IETF (Internet Engineering Task Force)** works across all layers of the network model in as far as such work relates to the Internet, with perhaps a core focus on IP at the network layer and the protocols such as TCP running directly on top of IP.

Several of our researchers are participating in the above standardization bodies:

Pierre Francois, who joined IMDEA Networks as a Staff Researcher in September 2011, proceeds with his standardization activities in the routing area, as well as in the operations and management area, all within the IETF. His main contributions to the IETF activity are dedicated to turn the research and engineering findings stemming out of his collaboration with ISPs and router vendors into IETF standards and peer reviewed informational IETF documents.

Fabio Giust and **Juan Camilo Cardona**, both Pre-doc Researchers at IMDEA Networks, also currently work in standardization within the IETF and the IEEE (Fabio).

We would like to highlight here our most relevant University Carlos III of Madrid collaborator, who occupies a prominent role within the IEEE:

Antonio de la Oliva, Visiting Professor at University Carlos III of Madrid, is participating in the IEEE standardization effort by notably vice-chairing the IEEE 802.21 TGb and serving as Technical Editor of the upcoming IEEE 802.21d specification. His work serves as point of union between the knowledge developed within the different research projects (such as MEDIEVAL, CARMEN, CROWD or iJOIN) and turning technical contributions stemming from these projects into the IEEE 802 family of standards.

6.1.1 IETF

Making BGP filtering a habit: Impact on policies

Juan Camilo Cardona, PhD Student at IMDEA Networks, started standardization work at the GROW Working Group of the IETF OPS Area. It is common practice for network operators to propagate overlapping IP prefixes along with the prefixes that they originate, to steer traffic transit towards their networks. It is also possible for some Autonomous Systems (ASes) to apply different policies to the overlapping and the covering prefix. Some ASes could also benefit from filtering the overlapping prefixes. However, such practice may be damaging for the business of other ASes, as IP transit would happen over unexpected paths across their network.. The work presents such potential issues and discusses solutions to the problem. Pierre Francois presented the document summarizing this work, draft-cardona-filtering-threats-00 [1], at the IETF in November 2012.

- "Making BGP filtering an habit: Impact on policies", J. C. Cardona, P. Francois, IETF GROW Working Group Document, draft-cardona-filtering-threats-00, November 2012

LFA Applicability

Pierre Francois was the editor of RFC 6571 [2], "LFA applicability in SP networks", co-edited with Clarence Filsfils, distinguished engineer at Cisco Systems. This RFC presents an analysis of the applicability of an IP Fast Reroute technique called "Loop-free alternates" in Internet Service Provider Networks. This work has been performed in collaboration with Cisco Systems, France Telecom - Orange, AT&T, and Deutsche Telekom.

- "Loop-Free Alternate (LFA) Applicability in Service Provider (SP) Networks", C. Filsfils (ed)., P. Francois (ed)., IETF RFC 6571, June 2012
- Evolution of draft-ietf-rtgwg-lfa-applicability-06, January 2012
- Evolution of draft-ietf-rtgwg-lfa-applicability-05, January 2012

BGP Extended Communities

Within the IDR working group, an IETF working group document ("Assigned BGP extended communities", draft-ietf-idr-reserved-extended-communities-03, and -04 [3]) co-authored with Bruno Decraene, Senior Researcher at France Telecom - Orange, is progressing in its standardization process. This draft is putting a registry into place for "well-known" BGP extended communities. Its goal is to ease the standardization of BGP features relying on BGP extended communities by providing a pool for ISPs and Router Vendors to pick values dedicated to specific BGP features. These documents update a previous version, published in 2011.

- "Assigned BGP extended communities", B. Decraene and P. Francois, IETF IDR Working Group Document, draft-ietf-idr-reserved-extended-communities-04, November 2012
- Evolution of draft-ietf-idr-reserved-extended-communities-03, May 2012

BGP Graceful Shutdown

In the Operations and Management area, a "graceful shutdown" mechanism for BGP peering links is being standardized in collaboration with France Telecom-Orange, Internet Initiative Japan, and Cisco Systems. The draft capturing this work ("Graceful BGP session shutdown", draft-ietf-grow-bgp-gshut-04 [4]), working group document of the GROW Working Group, describes operational procedures aimed at reducing the amount of traffic lost during planned maintenances of routers or links, involving the shutdown of BGP peering sessions. It also provides recommendations to router vendors for the support of a graceful shutdown mechanism that eases operational aspects of the solution. The authors are: Pierre Francois, Bruno Decraene, Cristel Pelsser, Keyur Patel and Clarence Filsfils. This document is updating previous versions to take developer and operator feedback into accounts. This proposal is now supported in Cisco Systems Operating System [5].

- "Graceful BGP session shutdown", P. Francois, B. Decraene, C. Pelsser, K. Patel, C. Filsfils, IETF GROW Working Group Document, draft-ietf-grow-bgp-gshut-04, October 2012

BGP Add-Paths

Add-Paths is a BGP enhancement that allows a BGP router to advertise multiple distinct paths for the same prefix/NLRI. This provides a number of potential benefits, including reduced routing churn, faster convergence and better load balancing. Add-paths is currently being standardized within the IDR Working Group of the Routing area of the IETF. draft-ietf-idr-add-paths-guidelines-04 [6], co-authored by Pierre Francois in collaboration with AT&T, Alcatel-Lucent, and Cisco Systems, is a working group item of IDR aimed at providing network operators the tools needed to address their specific applications and to manage the scalability impact of Add-Paths. A router implementing Add-Paths may learn many paths for a prefix and must decide which of these to advertise to peers. This document analyses different algorithms for making this selection and provides recommendations based on the target application. The new version of this document updates previous versions of the draft published in 2011. This document is still facing changes stemming from the operator community, and its ultimate publication target is 2013-2014.

- "Best Practices for Advertisement of Multiple Paths in IBGP", J. Utarro et al., IETF IDR Working Group Document, draft-ietf-idr-add-paths-guidelines-04, November 2012
- Evolution of draft-ietf-idr-add-paths-guidelines-03, May 2012

OFIB

With link-state protocols, such as IS-IS and OSPF, each time the network topology changes, some routers need to modify their forwarding information base (FIB) to take into account the new topology. Each topology change causes a convergence phase. During this phase,

routers may transiently have inconsistent FIBs, which may lead to packet loops and losses, even if the reachability of the destinations is not compromised after the topology change. Packet losses and transient loops can also occur in the case of a link down event implied by a maintenance operation, even if this operation is predictable and not urgent.

The goal of this work is to define a mechanism that sequences the router FIB updates to maintain consistency throughout the network. By correctly setting the FIB change order no looping or packet loss can occur. This mechanism may be applied to the case of managed link-state changes, i.e. link metric change, manual link down/up, manual router down/up, and managed state changes of a set of links attached to one router.

- "Loopfree convergence using oFIB", M. Shand, S. Bryant, S. Previdi, C. Filsfils, P. Francois, O. Bonaventure, IETF RTGWG Working Group document, draft-ietf-rtgwg-ordered-fib-07, September 2012
- Evolution of draft-ietf-rtgwg-ordered-fib-06, June 2012

Distributed Mobility Management

The number of mobile users and their traffic demand is expected to be ever-increasing in future years, and this growth can represent a limitation for deploying current mobility management schemes that are intrinsically centralized, e.g., Mobile IPv6 and Proxy Mobile IPv6. For this reason it has been waved a need for distributed and dynamic mobility management approaches, with the objective of reducing operators' burdens, evolving to a cheaper and more efficient architecture. This draft describes multiple solutions for network-based distributed mobility management "(DMM)" architecture inspired by the well known Proxy Mobile IPv6. The proposal is supported by University Carlos III of Madrid, IMDEA Networks and Alcatel Lucent.

- "A PMIPv6-based solution for Distributed Mobility Management", C.J. Bernardos, A. De La Oliva, F. Giust, T. Melia, R. P. Ferreira da Costa, IETF DMM Working Group, draft-bernardos-dmm-pmip-01, March 2012

In addition, following our credo (see section 2.5), which shows our determination to validate our ideas through implementation and demonstration, IMDEA Networks researchers have spent very significant resources in providing a first implementation of the DMM technology, key for the future deployments of cellular networks. The prototype was demonstrated at the 83rd IETF meeting in Paris, France, and it had a big impact, fostering joint research activities with other players in the industry.

- DMM Prototype Demonstration: "Network-based Distributed Mobility Management", C. J. Bernardos, A. de la Oliva, F. Giust, T. Melia, R. Costa, J. C. Zúñiga. Presented by C. J. Bernardos at the 83rd IETF meeting, Paris, France, March 2012"

6.1.2. IEEE

In 2012, Institute IMDEA Networks has actively participated in the IEEE (802.21 and 802.11 WGs), providing results from European-funded MEDIEVAL and CARMEN projects.

During 2012 the IEEE SA has published the IEEE 802.21b amendment to IEEE 802.21. This amendment tackles the handover in broadcast only networks, modifying the command flow of the handover to support technologies lacking of an uplink channel, such as DVB. Antonio de la Oliva has served as Vice-chair of this Task Group during this year, taking care of the correct development of the standard. IMDEA networks has contributed decisively to the evolution of this technology through the intellectual co-authorship of several proposals coming from projects such as MEDIEVAL [7,8] and CARMEN [9].

In addition, based on the developments performed in the MEDIEVAL project, a new Task Group, IEEE 802.21d: Multicast Group Management, was created. De la Oliva currently holds the position of Technical Editor of the upcoming specification, which is about to perform its first Working Group ballot (expected for May 2013). IMDEA Networks has also contributed to the creation and development of this specification, implementing the first prototype of the technology that was presented in the March 2012 meeting of the IEEE 802.21 TGd.

6.1.3. References

[1] http://tools.ietf.org/html/draft-cardona-filtering-threats-00
[2] http://tools.ietf.org/html/rfc6571
[3] http://tools.ietf.org/html/draft-ietf-idr-reserved-extended-communities-04
[4] http://tools.ietf.org/html/draft-ietf-grow-bgp-gshut-04
[5] http://www.cisco.com/en/US/docs/ios-xml/ios/iproute_bgp/configuration/xe-3s/irg-grace-shut.pdf
[6] http://tools.ietf.org/html/draft-ietf-idr-add-paths-guidelines-04
[7] DMM approach using .21, Antonio de la Oliva (UC3M), Fabio Giust (IMDEA Networks, UC3M), Carlos J. Bernardos (UC3M), https://mentor.ieee.org/802.21/dcn/11/21-11-0045-00-0000-dmm-approach-using-21.pptx
[8] IEEE 802.21 Network based DMM, Antonio de la Oliva (UC3M), Fabio Giust (IMDEA Networks, UC3M), Carlos J. Bernardos (UC3M), https://mentor.ieee.org/802.21/dcn/11/21-11-0123-01-0000-ieee-802-21-network-based-dmm.pptx
[9] Providing Service Guarantees in Heterogeneous Wireless Mesh Networks, Antonio de la Oliva (UC3M), Albert Banchs (IMDEA Networks, UC3M), https://mentor.ieee.org/802.21/dcn/10/21-10-0064-00-0000-providing-service-guarantees-in-heterogeneous-wireless-mesh-networks.ppt

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 realised 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 contracts with private sector collaborators:

SOCAM – Multi-device Open Source Operating System

(Sistema Operativo de Código Abierto Multi-dispositivo)

Funded by: ZED Worldwide S.A., through the Spanish Ministry of Industry, Energy and Tourism (*Ministerio de Industria, Energía y Turismo- MINETUR*), previously known as the Spanish Ministry of Industry, Tourism and Trade (*Ministerio de Industria, Turismo y Comercio - MITYC*) - AVANZA program
Duration: October 2011 to September 2013
Project partners: ZED Worldwide, S.A, Factory Holding Company 25, Institute IMDEA Networks

The main technological objective of the project is the **development of an innovative operating system, based on open source code, that will imply a new paradigm in the area of Operating Systems for Internet-connected devices**, providing an appropriate ecosystem for the massive development of the services and mobile applications industry, while at the same time allowing for the extraction of all the potential capabilities (processing, battery consumption, screen, memory, database access, sensors, chips, etc) of any present of future

connected device (mobile telephones, tablets, television, M2M, etc.), creating a new common user experience independently from the device and facilitating the creation of new applications (embedded, on the cloud, downloadable, etc.) thanks to the adoption of the operating system, that reduces the investment risk of the services and applications development companies and activates the high potential and growth rates of the sector.

BGP Route Servers: scaling and convergence

Funded by: Cisco University Research Program Fund, a corporate advised fund of Silicon Valley Community Foundation
Duration: August 2012 to July 2013

Route Servers are used at Internet eXchange Points to allow the exchange of traffic among members, without requiring the establishment of an explicit eBGP session between them. Route servers maintain eBGP sessions with participating members, and perform route reflection among these. Support for differentiated policies, scalability, and convergence time make the development of efficient Route Server platforms challenging. Nevertheless, router servers have proven their utility, considering the number of BGP paths that they track in some major IXPs. Acknowledging that fact, Cisco Systems has recently released a version of IOS which supports the Route Server capability, mainly building on Virtual Routing and Forwarding instances, commonly used for BGP/MPLS VPNs. In this project, we identify the **key investigation tracks for the route server technology**, and we draw the lines of the planned collaboration with Keyur Patel of Cisco Systems on improving its support in IOS.

GOWEX - Monitoring platform for mobile Wi-Fi Access points

Funded by: GOWEX WIRELESS, S.L.
Duration: May 2012 to August 2012
Project partners: GOWEX WIRELESS, S.L., Institute IMDEA Networks

This project aims at providing **a platform to evaluate the accessibility and performance of a free Wi-Fi service, deployed in the buses of the Madrid public transport system**. The specificity of the project lies in the highly dynamic aspect of the infrastructure of the network, requiring to emulate commuter behaviors in the close vicinity of bus stops, and gather QoS information while buses stop and go by the monitoring platforms deployed across Madrid.

Collaboration Agreement for Research & Development with NEC Europe Ltd.

Funded by: NEC Europe Ltd.
Duration: May 2011 to April 2012
Project partners: Institute IMDEA Networks, NEC Europe Ltd.

This project focuses on **technology enhancements for Wi-Fi-enabled mobile phones** centred on research and development in the area of QoS and power saving. Two main activities will be performed: i) design and implementation of a generic power saving module able to emulate different power saving protocols and adapt to variable QoS needs and ii) implementation of an NEC proprietary power saving algorithm based on Wi-Fi Direct. In addition, research in this area is expected to lead to joint patent applications and publications.

The project will consist of the following tasks:

1) Design and implementation of a generic power saving module able to emulate different power saving protocols and adapt to variable QoS needs. The design should identify the different components of available Wi-Fi power saving algorithms and design software architecture able to emulate the different protocols and variations of them by simply combining in different manners the identified components.

2) Implementation of an NEC proprietary power saving algorithm based on Wi-Fi Direct. The implementation will be based on Linux/Android open source drivers, as specified by NEC. A non binding example of the required implementation is:
   - Platform : ath9k open source driver for Linux
   - Protocol: Notice of Absence (NoA) Protocol defined in Wi-Fi Direct.
   - Algorithm: NEC power saving algorithm.

3) Research in the area of Wi-Fi QoS and power saving with special focus on Wi-Fi smartphones.

Industry partners

Our technology transfer activities have led to **a significantly increased portfolio of companies we collaborate with**. During 2012 they were the following:

Alcatel-Lucent Bell Labs

Alvarion

Cisco University Research Program Fund

Commissariat à l'Energie Atomique et aux Energies Alternatives

Docomo Communications Laboratories Europe

Factory Holding Company 25

Fastweb SPA (FW)

France Telecom SA (FT)

GOWEX WIRELESS, S.L.

Hewlett Packard Italiana SRL

Huawei Technologies Dusseldorf GmbH (HWDU)

Intel Mobile Communications France

Interdisciplinary Institute for Broadband Technology (IBBT)

Jaguar Networks

LiveU

MobiMesh s.r.l.

NEC Europe Ltd.

Nokia

Portugal Telecom Inovaçao

Sagemcom Broadband SAS

Sequans Communications

Sigma Orionis

Technicolor R&D

Telecom Italia S.p.a.

Telefónica I+D

ZED Worldwide, S.A

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.

Institute IMDEA Networks 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 Audiovisual Cluster (*Cluster Audiovisual*) and the Security and Trust Cluster (*Cluster de Seguridad y Confianza*). We also collaborate with RedIris, the Spanish National Research and Education Network.

Madrid Network

Madrid Network – Red de Parques y Clusters de la Comunidad de Madrid

Cluster Audiovisual

Cluster de Seguridad y Confianza

RedIris

6.3. Media impact

IMDEA Networks on social networks in RTVE

Publication date: 2012-11-06
Source/s: RTVE , La 2 (Channel 2 of Radio Televisión Española). Program: Los desayunos de TVE - Albert Rivera, presidente de Ciutadans (see minute 21 for interviews).

Interview with Antonio Fernández Anta and Agustín Santos Méndez, both researchers at Institute IMDEA Networks, in the Spanish TV news program "Los desayunos de TVE", about the role of Internet and social networks on political campaigns, within the context of the final run-up of the campaign for the 2012 United States presidential elections, with current President Barack Obama and Mitt Romney as main presidential candidates. The program was shown the 6th of November 2012.

personnel

director

The Director is the CEO of IMDEA Networks. He is appointed by the Board of Trustees amongst scientists with a well-established international reputation in networks. The Director is responsible for managing and overseeing the scientific activities and the administration and of the Institute, with the powers, duties and responsibilities conferred to it by the Board of Trustees, to which it reports.

Dr. Arturo AZCORRA
Director

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
PhD: Polytechnic University of Madrid. Spain
Research: Carrier-grade Wireless Mesh Networks; Future Media Internet; Multi-path Protocols; Vehicular Networks
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Short Bio:

Arturo Azcorra holds a double appointment as Full Professor at the University Carlos III of Madrid (UC3M) (Madrid, Spain) in the Telematics Engineering Department and Director of IMDEA Networks, where he conducts his research activities. He has returned to his post as Director of IMDEA Networks in June 2012, after a period, from May 2010 to February 2012, during which he held the position of Director General at the Centre for the Development of Industrial Technology (CDTI), an agency of the Spanish Ministry of Economy and Competitiveness (MINECO), previously known as the Spanish Ministry of Science and Innovation (Ministerio de Ciencia e Innovación – MICINN). He previously held the position of Director General for Technology Transfer and Corporate Development also at the MICINN.

He graduated from Loy Norrix High School (Michigan, USA) in 1980. In 1986, he received his MSc degree in Telecommunications Engineering from the Universidad Politécnica de Madrid (Polytechnic University of Madrid) (Madrid, Spain), with the "Sobresaliente" (Outstanding) grade, and was subsequently awarded the Price Waterhouse Prize for Best Student. He then obtained his PhD from the same university in 1989. His PhD received the National Award for Best Thesis (Premio Nacional a la Mejor Tesis Doctoral), jointly granted by the Asociación Profesional de Ingenieros de Telecomunicación (Professional Association of Telecommunication Engineers) and the then-named Asociación Nacional de Industrias Electrónicas, ANIEL (The National Association of Electronic Industries) (today ANIEL is known as AMETIC, Asociación de Empresas de Electrónica, Tecnologías de la Información,Telecomunicaciones y Contenidos Digitales). In 1993, he obtained a MBA from the Instituto de Empresa (one of the World's most prestigious business schools), graduating first in his class.

He was an Associate Professor at the Universidad Politécnica de Madrid from 1987 to 1998. In 2000, he was appointed Deputy Vice-Provost for Academic Infrastructures at the UC3M. He worked in this role until 2007, teaching and also developing the application of Information Technologies to research. He previously worked at ICSI University of California, Berkeley (Berkeley, USA) as a Visiting Professor in 1999, and then, in 2002, at the Massachusetts Institute of Technology (MIT) (Massachusetts, USA).

Arturo Azcorra is an IEEE Senior Member and an ACM SIGCOMM Member. He has participated in and directed over 35 European research and technological development projects, including ESPRIT, RACE, ACTS and IST programs. He previously held the position of Coordinator of the international Networks-of-Excellence (NoE) E-NEXT (Emerging Networking Experiments and Technologies) and CONTENT (Excellence in Content Distribution Network Research), part of the European Commission's VI Framework Program.

He has also performed direct consulting and engineering work for institutions, such as the European Space Agency, MFS-Worldcom, Madrid Regional Government, RENFE, REPSOL and the Spanish Ministry of Science and Technology. He was the General Co-Chair of the ACM CoNEXT 2008 conference, celebrated in Madrid, Spain, coorganized by IMDEA Networks and University Carlos III of Madrid. He has previously worked as a Program Committee Member in many international conferences, including several editions of IEEE PROMS, IDMS,QofIS, CoNEXT and IEEE INFOCOM. He was the General Co-Chair for CoNEXT'05, Steering Committee Member for CoNEXT'06 and CoNEXT'07, and Technical Program Committee Co-Chair for INFOCOM'06. His publications in national and international magazines, books and conferences number over 100 titles.

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

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
PhD: Polytechnic University of Catalonia. Barcelona. Spain
Research: Performance Evaluation and Resource Allocation in Wireless Networks
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Short Bio:
Albert Banchs obtained his Telecommunication Engineering degree at the Polytechnical University of Catalonia in 1997, and the PhD from the same university in 2002. His PhD Thesis, supervised by Professor Sebastia Sallent, addressed the issue of fairly sharing the network resources among users both in the wired and wireless Internet. Albert Banchs received for his PhD the mention of European Doctor and was awarded by COIT (the Spanish official association of Telecommunication Engineers) the ONO prize to the best Spanish PhD Thesis on Broadband Networks.

From April to December 1997, Albert Banchs worked in the Networks Group of the International Computer Science Institute (ICSI), Berkeley, California. His work at ICSI focused on active networks research. From January to August 1998 he was with the Telefonica I+D Labs in Madrid, Spain, where he was appointed coordinator of an 8-people development team working on the videoconference over IP project. In September 1998 he joined NEC Network Laboratories in Heidelberg, Germany. He started as a Research Staff Member and was promoted to Senior Research Staff Member in April 2001. At NEC, Albert Banchs worked on a number of projects, including multicast over ADSL, DiffServ and 802.11e standardization.

Since October 2003, Dr. Banchs is with the University Carlos III of Madrid, where he currently holds the position of Associate Professor. Since October 2009, he is also Deputy Director of IMDEA Networks. His research interests include performance evaluation and resource allocation in wireless networks. Current major effort is on the coordination of the European project iJOIN.

chief researchers

Chief Researchers 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. Marco AJMONE MARSAN

Chief Researcher

Affiliation: Institute IMDEA Networks and Politecnico di Torino. Italy
PhD: Budapest University of Technology and Economics (honoris causa). Hungary
Research: High-speed Telecommunication Networks, with particular emphasis on Wireless and All-Optical Networks and Performance Evaluation of Data Communication and Computer Systems, with Markovian Models, Queueing Networks, and Generalized Stochastic Petri Nets
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Short Bio:

Marco Ajmone Marsan was born in Torino, Italy in 1951. He received a Master Degree in Electronic Engineering from the Politecnico di Torino in 1974 and a Master Degree in Electrical Engineering from the University of California, Los Angeles (UCLA) in 1978. From 1974 to 1987 he was teaching and doing research at the Politecnico di Torino, first as a researcher and then as an associate professor. In 1987 he was appointed Full Professor at the Computer Science Department of the University of Milan. From 1990 he has been a Full Professor of telecommunications at the Electronics and Telecommunications Department of the Politecnico di Torino.

Marco Ajmone Marsan started his research activity in 1974. He first worked in digital transmission systems, and then moved to networking and distributed systems. He has published over 300 papers in the most important journals and conferences of the domain. He has co-authored the books "Performance Models of Multiprocessor Systems" (MIT Press, 1987) and "Modelling with Generalized Stochastic Petri Nets" (John Wiley, 1995).

Marco Ajmone Marsan has founded the Telecommunication Networks Group at the Politecnico di Torino. As a leader of this group, he has coordinated many research projects funded by national and international public agencies, and by telecommunications industries.

Marco Ajmone Marsan is the coordinator of the TREND Network of Excellence funded by the European Commission with 3 million Euro within the 7th Framework Programme.

The publications of Marco Ajmone Marsan have received more than 8,000 citations, with 2 works receiving over 1,000 citations each. His h-index is 41 in Publish or Perish, and he is qualified as "ISI highly cited researchers".

Marco Ajmone Marsan is a Chief Researcher at the Institute IMDEA Networks in Spain. He spent two summer periods at the Computer Science Department of the University of California, Los Angeles, one at the University of Christchurch (New Zealand), funded by the Erskine Foundation.

He has been a member of the editorial board of the journal ACM/IEEE Transactions on Networking, for which he is now a member of the Steering Committee. He is on the editorial board of the journal Computer Networks of Elsevier, and of several other international journals. He was the general chair or technical program chair of several important conferences in his field, and the general chair of INFOCOM 2013.

He has participated in PhD committees in several universities worldwide.

Marco Ajmone Marsan is a Fellow of IEEE, and a member of the Turin Academy of Sciences. He has received the Bonavera prize from the Accademia delle Scienze, Torino in 1980, the best paper award at the 1982 International Conference on Distributed Computing Systems, Fort Lauderdale, USA, the best paper award at the 23rd International Teletraffic Congress (ITC 23) in 2011, the 1982 Informatics Award from Sperry and CILEA. He has received a ``Honoris Causa" Doctoral Degree in Telecommunication Networks from the Budapest University of Technology and Economics in March 2002. He was named ``Commendatore" of the ``Ordine al Merito della Repubblica Italiana" by the President of Italy in January 2006.

Marco Ajmone Marsan has been the Vice-Rector for Research, Innovation and Technology Transfer at the Politecnico di Torino from 2002 to 2009. From September 2002 to March 2009 he was the Director of the Institute for Electronics, Information and Telecommunications Engineering of the National Research Council.

He was the chair of the Italian Group of Telecommunications Professors, and the Italian Delegate in the ICT Committee of the 7th Framework Programme of the EU. He is now the Italian Delegate in the ERC Committee of the 7th Framework Programme of the EU.

He has evaluated research projects under request by several international agencies.

He has been a member of the Scientific Committee of CSELT of Torino, of CSITE of Bologna, of the Supercomputing center of Torino, of CSI of Torino, of the Interuniversity Research Center on Communications of Torino, of Intecs SpA, a member of the Directive Committee of CNIT, the National Interuniversity Consortium on Telecommunications, a NARUS Fellow, a member of the ``Consiglio Superiore delle Comunicazioni", a member of the Advisory Board of FUB (Fondazione Ugo Bordoni) of Rome.

His main present research interest is in energy-efficient networking, and in the applications of ICT for energy efficiency.

Dr. Nicholas F. MAXEMCHUK

Chief Researcher

Affiliation: Institute IMDEA Networks and Columbia University in the City of New York. USA
PhD: University of Pennsylvania. USA
Research: Random Coding Network Services; Advanced Network Design for QoS Deployment; Traffic Engineering in Wireless Networks
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Short Bio:
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 MSc in Electrical Engineering and a PhD 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).

Many of his far-sighted contributions to computer-communications networking have been years ahead of their time and have led to the development of groundbreaking new systems. His invention of Dispersity Routing in the 1970s, for example, has recently been applied to ad hoc networks. In 2006, his achievements in the field were recognized by the world's leading professional association for the advancement of technology, the IEEE, when he was awarded the prestigious 2006 IEEE Koji Kobayashi Computers and Communications Award.

Amongst other awards that he has been given, some of the most noteworthy are the RCA Laboratories Outstanding Achievement Award in 1970, the Bell Laboratories Distinguished Technical Staff Award in 1984, the IEEE's Leonard G. Abraham Prize Paper Award in 1985 and 1987, and the William R. Bennett Prize Paper Award in 1997. He was also made a fellow of the IEEE in 1989, and received the 1996 R&D 100 award for his work on document marking

As well as owning 30 patents and publishing three books, Nicholas Maxemchuk has co-authored over 100 publications. His strong reputation as an eminent scientist has earned him many editorial and advisory positions with organizations including the IEEE,ACM, NSF Expert Group and the United Nations. He has published three award winning papers and had two of his publications voted into the Communication Society50th Anniversary Issue. He is a member of the Board of Governors of the Armstrong Foundation and also works as a Consultant on Data Networks in Transportation Networks for The National Academies/Transportation Research Board.

Dr. Joerg WIDMER

Chief Researcher

PhD: University of Mannheim. Germany
Previous Position: Manager. Docomo Euro-Labs. Munich. Germany
Research: Computer Networks and Distributed Systems (Wireless Communication; Network Coding; Peer-to-peer Communication; Ad-hoc Networking; Internet Architectures; Transport Protocols)
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Short Bio:
Joerg Widmer is a Chief Researcher at Institute IMDEA Networks in Madrid, Spain. His research expertise covers computer networks and distributed systems, ranging from MAC layer design, sensor networking, and network coding to transport protocols and Future Internet architectures. From June 2005 to July 2010, he was manager of the Ubiquitous Networking Research Group at DOCOMO Euro-Labs in Munich, Germany, leading several projects in the area of mobile and cellular networks. Before joining DOCOMO Euro-Labs, he worked as post-doctoral researcher at EPFL, Switzerland on ultra-wide band communication and network coding.

Joerg Widmer received his M.S. and PhD degrees in computer science from the University of Mannheim, Germany in 2000 and 2003, respectively. In 1999 and 2000 he was a visiting researcher at the International Computer Science Institute in Berkeley, CA, USA. He authored more than 100 conference and journal papers and three IETF RFCs, holds several patents, serves on the editorial board of IEEE Transactions on Communications, and regularly participates in program committees of several major conferences. He is senior member of IEEE and ACM.

senior researchers

Senior Researchers 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. Antonio FERNÁNDEZ ANTA

Senior Researcher

PhD: University of Southwestern Louisiana (now University of Louisiana at Lafayette). USA
Previous Position: Full Professor. Universidad Rey Juan Carlos. Madrid. Spain
Research: Communications and Networks; Distributed Computing; Algorithms; Discrete and Applied Mathematics
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Short Bio:
Antonio Fernández Anta is a Senior Researcher at Institute IMDEA Networks since the fall of 2010. Previously he was a Full Professor at the Universidad Rey Juan Carlos in Madrid, where he has been on the Faculty since 1998. Prior to that he was on the Faculty of the Universidad Politécnica de Madrid. He has been a postdoc at the Massachusetts Institute of Technology from 1995 to 1997.

Antonio has more than 20 years of research experience, with a steady productivity of more than 5 papers per year on average. He has published in top conferences and journals like INFOCOM, STOC, FOCS, PODC, DISC, Journal of the ACM, IEEE/ACM Transactions on Networking, SIAM Journal on Computing, or IEEE Transactions on Computers. He is vice-chair of the Steering Committee of DISC and member of the Steering Committee of Opodis. He has chaired or served in the TPC of a number of conferences and workshops. He is a senior member of the IEEE since 2002 and of the ACM since 2007.

Antonio received his MSc and PhD degrees in Computer Science from the University of Louisiana in 1992 and 1994, respectively. His PhD Thesis studied the Cartesian product of graphs as a mean to construct efficient interconnection networks for multiprocessors. He completed his undergraduate studies (Licenciado and Diplomado en Informática) at the Universidad Politécnica de Madrid, Spain, in 1988 and 1991 respectively, having received awards at the university and national levels for his academic performance.

Dr. Sergey GORINSKY

Senior Researcher

PhD: University of Texas at Austin. USA
Previous Position: Assistant Professor. Washington University in St. Louis. USA
Research: Computer Networking and Distributed Systems
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Short Bio:
Sergey Gorinsky received an Engineer degree from Moscow Institute of Electronic Technology, Zelenograd, Russia in 1994 and M.S. and PhD degrees from the University of Texas at Austin, USA in 1999 and 2003 respectively. From 2003 to 2009, he served on the tenure-track faculty at Washington University in St. Louis, USA. Dr. Gorinsky currently works as a Senior Researcher at Institute IMDEA Networks, Madrid, Spain. The areas of his primary research interests are computer networking and distributed systems. His research contributions include multicast congestion control resilient to receiver misbehavior, analysis of binary adjustment algorithms, efficient fair transfer of bulk data, network service differentiation based on performance incentives, and economic perspectives on Internet interconnections and routing. His work appeared at top conferences and journals such as ACM SIGCOMM, IEEE INFOCOM, ACM CoNEXT, IEEE/ACM Transactions on Networking, and IEEE Journal on Selected Areas in Communications. Sergey Gorinsky has served on the TPCs (technical program committees) of SIGCOMM (2012), INFOCOM (2006-2014), ICNP (2008, 2010-2013), and other networking conferences. Sergey Gorinsky delivered a keynote address at RAIT 2012. He co-chaired E6 2012 (Energy in Communication, Information, and Cyber-physical Systems 2012, a COMSNETS 2012 workshop), HSN 2008 (High-Speed Networks 2008, an INFOCOM 2008 workshop), FIAP 2008 (Future Internet Architectures and Protocols 2008, an ICCCN 2008 symposium) and served as a TPC vice-chair for ICCCN 2009. His professional services also include general co-chairing for WoWMoM 2013 and TPC co-chairing for COMSNETS 2013.

Dr. Dejan KOSTIĆ

Senior Researcher

PhD: Duke University. Durham. NC. USA
Previous Position: EPFL (École Polytechnique Fédérale de Lausanne). Switzerland
Research: Distributed Systems; Computer Networks; Operating Systems; Mobile Computing
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Short Bio:

Dejan Kostic obtained his PhD in Computer Science at the Duke University. He spent the last two years of his studies and a brief stay as a postdoctoral scholar at the University of California, San Diego. He received his Master of Science degree in Computer Science from the University of Texas at Dallas, and his Bachelor of Science degree in Computer Engineering and Information Technology from the University of Belgrade (ETF), Serbia. From 2006 until 2012 he worked as a tenure-track Assistant Professor at the School of Computer and Communications Sciences at EPFL (Ecole Polytechnique Fédérale de Lausanne), Switzerland. In 2010, he received a European Research Council (ERC) Starting Investigator Award. In 2012, he joined Institute IMDEA Networks (Madrid, Spain) as a Senior Researcher with tenure. His interests include Distributed Systems, Computer Networks, Operating Systems, and Mobile Computing.

Dr. José Félix KUKIELKA

Senior Researcher

PhD: University of California at Berkeley. USA
Previous Position: Visiting Professor. University Carlos III of Madrid. Spain
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
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Short Bio:

José Félix Kukielka is Senior Researcher at IMDEA Networks. From 2003 until 2007, he worked at the University Carlos III of Madrid as Ramón y Cajal Researcher. He obtained his undergraduate degree at the Universidad Nacional Autónoma de México (Federal District, Mexico) in 1972, and went on to complete a MSc and a PhD, both at the University of California, Berkeley (Berkeley, USA).

He has been the Technical Director of REDIMadrid from 2007 until 2009. REDIMadrid was created in collaboration with the University Carlos III of Madrid in 2003. It is a regional research network for education and research institutions based in the Madrid Region. The program contributes to the consolidation of a dedicated, high-performance telecommunications infrastructure for its scientific community. Such infrastructure eases and promotes collaborative work, the establishment of eminent working groups and participation in national and international networks.

José Félix Kukielka has 23 years of industrial experience in designing, manufacturing and marketing communications products and Radio Frequency for the semi-conductor and telecommunications industries. Throughout his career, he has worked in both academia and industry, working for Grupo AIA (Spain), Alcatel España, Philips Consumer Communications (Le Mans, France), Alcatel Telecom (Spain) and Avantek, Inc. (California, USA).

He was elected Associate Member of the Technical Team for Alcatel-Lucent Technical Academy (ALTA). He is the creator of the "Kukielka Configuration"", a topology for microwave monolithic integrated circuit amplifiers with multiple feedback loops that is characterized by an excellent gain-bandwidth product, implemented successfully in several semiconductor technologies.

staff researchers

Staff Researchers at Institute IMDEA Networks 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 Pre-doc Researchers and post-doctoral researchers and collaborate with top Senior Researchers. Staff Researchers are not required to teach, so they can focus full-time on research if they so wish.

Dr. Pierre FRANCOIS

Staff Researcher

PhD: Université catholique de Louvain. Belgium
Previous Position: Post-Doc Researcher. Fonds national de la recherche scientifique (FNRS). Belgium
Research: IP Networking; Routing; Routing Architectures; Routing Economics
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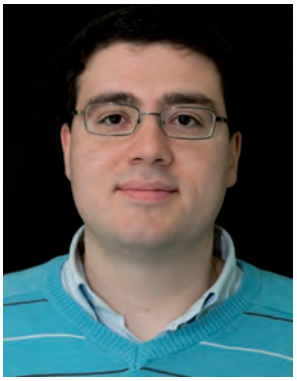
Short Bio:
Pierre Francois is a staff researcher at IMDEA Networks. His main research activities relate to routing in service provider networks. He currently is the PI of a Cisco Systems University Research Program grant aimed at improving Inter-domain routing with BGP. He is also holding a consulting contract with Cisco Systems aimed at carrying out research on internal routing improvements for the Internet Service Provider market. Pierre Francois is an invited lecturer at Universty of Abomey-Calavi, in Benin. He recently started a project aimed at assessing the state of Internet Traffic routing in the West African Region.



Dr. Vincenzo MANCUSO

Staff Researcher

PhD: University of Palermo. Italy
Previous Position: Post-Doc Researcher. INRIA Sophia Antipolis. France
Research: Network Protocols; QoS; Wireless Networks; Green IT; Performance Analysis
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Short Bio:
Dr. Vincenzo Mancuso obtained his master degree in Electronics from University of Palermo, Italy, in 2001, and a PhD in Electronics, Computer Science and Telecommunications from the same University in 2005. After the PhD, he has collaborated with University of Roma ''Tor Vergata" and University of Palermo. He has been visiting scholar at the ECE Department of Rice University, Houston, Texas, and postdoc in the MAESTRO team at INRIA Sophia Antipolis, France. Since September 2010, Vincenzo is with Institute IMDEA Networks, working on analytical and experimental projects on wireless networks (optimization of IEEE 802.11, IEEE 802.16, 3GPP LTE, and interoperation of 802.11 and LTE) and energy efficient network protocols (power saving in cellular packet networks and in data centers).

Dr. Balaji RENGARAJAN
Staff Researcher

PhD: The University of Texas at Austin. USA
Previous Position: Graduate PhD Student
Research: Measurement, Modeling and Performance Evaluation of Wireless Networks, Ad-hoc and Sensor Networks
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Short Bio:
Dr. Balaji Rengarajan joined IMDEA Networks in 2010 and is currently working there as a staff researcher. He received his PhD and M.S. in electrical engineering from the University of Texas at Austin in 2009 and 2004 respectively, and his B.E. in Electronics and Communication from the University of Madras in 2002. He was the recipient of a 2003 Texas Telecommunications Engineering Consortium (TxTEC) graduate fellowship and a 2010 Marie-Curie "Amarout Europe Programme" fellowship. He is also the recipient of the best paper award at the 23rd International Teletraffic Congress (ITC), 2011. His main research interests include the measurement, modeling and performance evaluation of wired and wireless networks.

Dr. Gianluca RIZZO
Staff Researcher

PhD: EPFL Lausanne. Switzerland
Previous Position: System engineer - Utility Communications. ABB Switzerland. Switzerland
Research: Performance Evaluation of Communication Networks; Network Calculus; Quality of Service
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Short Bio:
Gianluca Rizzo was born in Galatina (Lecce), Italy, in 1975. He received the degree in electronic engineering from the Politecnico di Torino, Torino, Italy, in 2001. From September 2001 to December 2003, he has been a researcher in Telecom Italia Lab, Torino, Italy. From January 2004, to October 2008, he has been at EPFL Lausanne, where he received his PhD in computer science. From November 2008 to August 2009 he has been with ABB Switzerland. From September 2009, he is staff researcher at Institute IMDEA Networks.

Dr. Rade STANOJEVIĆ
Staff Researcher

PhD: National University of Ireland. Maynooth. Ireland
Previous Position: Post-Doc Researcher. Telefonica Research. Barcelona. Spain
Research: Performance Evaluation; Network Economics
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Short Bio:
Rade Stanojevic obtained his B.Sc. in Mathematics from University of Nis, Serbia and a PhD from Hamilton Institute, NUIM, Ireland. His current research interests span performance evaluation, network economics and energy aware computing. His work on decentralized cloud control has been awarded the ACM SIGMETRICS 2008 Kenneth C. Sevcik Outstanding Student Paper Award and the IEEE IWQoS 2009 Best Paper Award. Since fall 2010 he is a staff researcher in the Institute IMDEA Networks, Madrid. Prior to that he was a post-doc with Telefonica Research, Barcelona.

visiting researchers

Visiting researchers 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. Azzedine BOUKERCHE

Visiting Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid (Cátedra de Excelencia)
University of origin: University of Ottawa. Canada
PhD: McGill University. Montreal. Canada
Research: Sensor Networks; Mobile Ad hoc Networks; Vehicular Networks, Mobile and Pervasive Computing; Wireless multimedia; QoS Service Provisioning; Performance Evaluation and Modeling of Large-scale Distributed Systems; Distributed Computing; Large-scale Distributed Interactive Simulation and Parallel Discrete Event Simulation
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http://www.site.uottawa.ca/~boukerch/

Short Bio:

Dr. Boukerche is currently a Full Professor and holds a Canada Research Chair position in distributed simulation and wireless and mobile networking at the University of Ottawa. He received his PhD degree in Computer Science from McGill University, Canada. He is the Founding Director of PARADISE Research Laboratory at uOttawa, and the Founding Director of the NSERC DIVA Strategic Research Centre, the first network ever hosted at uOttawa.

Dr. Boukerche's scientific track record gives testimony to a meritorious career. He has authored nearly 550+ peer-reviewed journal and conference publications and serves on the editorial board of some of the main and prestigious periodicals in the field of communications and computer networks: IEEE Transactions on Vehicular Technology, IEEE Wireless Communication Magazine, Elsevier's Ad Hoc Networks, and Wiley's International Journal of Wireless Communication and Mobile Computing, to mention but a few. In addition, his curriculum of scientific service includes diverse chairing roles on various IEEE/ACM International conferences and workshops, including key venues for the diffusion of computer science and networking scientific results, such as IEEE Globecom, IEEE ICC, IEEE WoWMoM, IEEE ISCC or ACM MSWiM, among others.

Prof. Boukerche is the recipient of the Ontario Distinguished Researcher Award, the Ontario Early Researcher Award (previously known as Premier of Ontario Research Excellence Award (PREA)), the Canada Research Chair, the G. S. Glinski Award for Excellence in Research, the IEEE ComSoc Distinguished Speaker, and the IEEE Meritorious Service Award, and he was named a member of the of the computer Societys' Golden Core, amongst other prizes and recognitions of his contributions to the advancement of computer science, and wireless networking and communication. Prof. A. Boukerche is a Fellow of the Canadian Academy of Engineering, a Fellow of The Engineering Institute of Canada, and a Fellow of The American Association for the Advancement of Science.

Dr. Dariusz KOWALSKI

Visiting Researcher

PhD: Warsaw University. Poland
University of origin: University of Liverpool. UK
Research: Algorithms and Data Structures; Foundations of Distributed/Parallel/Network/Mobile Computing and Communication; Fault-tolerant aspects of Communication; Communication Algorithms for Wireless Networks
Contact: dariusz.kowalski@imdea.org
Personal website:
http://www.csc.liv.ac.uk/~darek/

Short Bio:
Dariusz Kowalski received his MSc in Mathematics in 1996 and PhD in Computer Science in 2001, both from the University of Warsaw, Poland. He was a postdoctoral researcher at the University of Quebec, Canada, at the University of Connecticut, USA, and in the Max-Planck Institute fuer Informatik, Germany. He is currently a Reader in Computer Science at the University of Liverpool, United Kingdom, and a visiting researcher at IMDEA Networks, Spain.

His areas of expertise include algorithms and data structures, fault-tolerant aspects of computer science, and distributed/parallel/network/mobile computing. In the last few years he developed and analyzed several algorithms for: communication in wireless and ad hoc networks (including multi-broadcast, leader election and routing algorithms); contention-resolution in a multiple-access channel; traffic-scheduling; classical distributed computing problems, such as consensus, work scheduling, shared-memory store&collect; dynamic distributed computing problems, including group communication, rumor and work scheduling; other related aspects of distributed and network computing, including quantum model of computation, fault-tolerance, combinatorial group testing.

Currently Dr Kowalski focuses on: reliability of wireless broadcast protocols with block acknowledgment; design and analysis of better epidemic communication protocols; energy aspects of dynamic distributed work scheduling protocols; queuing aspects of distributed multi-access communication processes; models and algorithms for micro- and nano-scale wireless communication and computing.

Dr. Tilman WOLF

Visiting Researcher

University of origin: University of Massachusetts Amherst. USA
PhD: Washington University, St. Louis, MO. USA.
Research: Computer Networks; Future Internet Architecture; Router Design; Multi-core Packet Processors; Embedded System and Network Security
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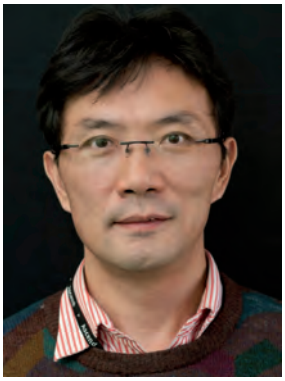
Personal website:
http://www.ecs.umass.edu/ece/wolf/

Short Bio:
Tilman Wolf is Professor of Electrical and Computer Engineering at the University of Massachusetts Amherst. He received a Diplom in informatics from the University of Stuttgart, Germany, in 1998. He also received a M.S. in computer science in 1998, a M.S. in computer engineering in 2000, and a D.Sc. in computer science in 2002, all from Washington University in St. Louis.

Dr. Wolf is engaged in research and teaching in the areas of computer networks, computer architecture, and embedded systems. His research interests include Internet architecture, network routers, and embedded system security. He is currently lead principle investigator on the ChoiceNet project, one of five large NSF Future Internet Architecture (FIA) projects. He is co-author of the book "Architecture of Network Systems" and has published extensively in peer-reviewed journals and conferences. His research has been supported by grants from NSF, DARPA, and industry. He has taught numerous courses on computer networks, embedded systems, programming, and digital design.

Dr. Wolf is a senior member of the IEEE and the ACM. He is associate editor for IEEE Micro and steering committee member for the IEEE/ACM Transactions on Networking. He has been active as program committee member and organizing committee member of several professional conferences, including IEEE INFOCOM and ACM SIGCOMM. He has served as TPC chair and general chair for ANCS 2011 and 2012 and ICCCN 2009 and 2010. He has served as treasurer for the ACM SIGCOMM society since 2005. At the University of Massachusetts, he received the College of Engineering Outstanding Junior Faculty Award in 2006, the College of Engineering Outstanding Teacher Award in 2008, and the IEEE/HKN Student Branch Outstanding Faculty Award in 2010.



Prof. Dr. Zhi-Li ZHANG

Visiting Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid (Cátedra de Excelencia)
University of origin: University of Minnesota. Minneapolis. USA
PhD: University of Massachusetts, Amherst. Massachusetts. USA
Research: Building Highly Scalable, Resilient and Secure Internet Infrastructure and Mechanisms to enhance Internet Service Availability, Reliability and Security; Developing Next-generation, Service-oriented, Manageable Internet Architectures to provide better Support for Creation, Deployment, Operations and Management of Value-added Internet Services and Underlying Networks
Contact: zhzhang@cs.umn.edu
Personal website: http://www-users.cs.umn.edu/~zhzhang/

Short Bio:

Zhi-Li Zhang received the B.S. degree in computer science from Nanjing University, China, and his M.S. and PhD degrees in computer science from the University of Massachusetts. In 1997 he joined the Computer Science and Engineering faculty at the University of Minnesota, where he is currently a Full Professor. He has held visiting positions at Sprint Advanced Technology Labs; IBM T.J. Watson Research Center; Fujitsu Labs of America, Microsoft Research China, and INRIA, Sophia-Antipolis, France.

Dr. Zhang's research interests lie broadly in computer communication and networks, Internet technology, multimedia and emerging applications. His past research was centered on the analysis, design and development of scalable Internet QoS solutions to support performance-demanding multimedia applications. His current research thrusts focus primarily on i) building higly scalable, resilient and secure Internet infrastructure and mechanisms to enhance Internet service availability, reliability and security; and on ii) developing next-generation, service-oriented, manageable Internet architectures to provide better support for creation, deployment, operations and management of value-added Internet services and underlying networks.

Dr. Zhang has served on the Editorial board of IEEE/ACM Transactions on Networking and Computer Network, an International Journal. He was Technical Program Co-chair of IEEE INFOCOM 2006 and the IEEE/IFIP IWQoS'04 as well as the SPIE ITCOM 2002 conference on Scalability and Traffic Control in IP Networks, served on the Executive Committee for IEEE Infocom 2001 and Infocom 2003, and on the Technical Program Committees of various conferences and workshops including IEEE Infocom, IEEE ICNP, ACM SIGCOMM, ACM SIGMETRICS, ACM/USENIX IMC, and ACM SIGMM. He received the National Science Foundation CAREER Award in 1997. He has also awarded the prestigious McKnight Land-Grant Professorship and George Taylor Distinguished Research Award at the University of Minnesota, and the Miller Visiting Professorship at Miller Institute for Basic Sciences, University of California, Berkeley. Dr. Zhang is co-recipient of an ACM SIGMETRICS best paper award and an IEEE International Conference on Network Protocols (ICNP) best paper award. He currently serves on the Editorial Boards of IEEE/ACM Transactions on Networking and Computer Network, the International Journal. He is a member of IEEE and ACM.

pre-doc researchers

Our Pre-doc Researchers are young, aspiring researchers who occupy a salaried position in our research team whilst undertaking their PhD at a leading Madrid University for up to five years. Most of our Pre-doc Researchers enter the PhD program at University Carlos III of Madrid. Institute IMDEA Networks 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.

Omar AHMAD SAN JOSE

Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
Previous Position: Research Assistant, Signal Theory and Communications Department, University Carlos III of Madrid. Spain
Research: Wireless Communications; OFDM; PHY-Layer; LTE
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Shahzad ALI

Pre-doc Researcher

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Previous Position: Department of Computer Science, COMSATS Institute of Information Technology. Abbottabad. Pakistan
Research: Wireless Sensor Networks; Vehicular Ad hoc Networks; Opportunistic Networks; Future Mobile Communication Networks
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Jordi ARJONA

Pre-doc Researcher

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Research: WSN's; WSAN's; Real Time Networks; QoS; Security.
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Arash ASADI

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Research: Wireless Networks; Resource Allocation; QoS.
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Pradeep BANGERA
Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
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Research: Economic Incentives for Traffic Attraction and Prefix Hijacking in BGP; Inter-domain and Intra-domain Traffic Matrices; Qualitative and Quantitative Analysis of Internet Protocol Resource Hijacking; Accountability issues in Inter-domain Routing between ISPs
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Andrea CAPALBO
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Research: Network Optimization; Metro and Transport Networks; Inter-domain Routing; OpEx and CapEx Analysis
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Angelos CHATZIPAPAS
Pre-doc Researcher

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Research: Computer Networks; Network Programming; Telecommunications; Renewable Power Sources
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Ignacio DE CASTRO
Pre-doc Researcher

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Lucas EZNARRIAGA
Pre-doc Researcher

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Sim (Allyson) GEK HONG
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Research: Wireless Communications
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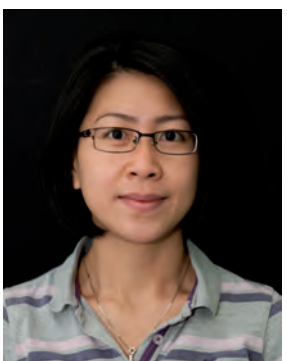

Fabio GIUST
Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
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Research: Mobility in IPv6 Networks; Routing for Multihomed/ Multi-Interface Devices; IP Flow Management
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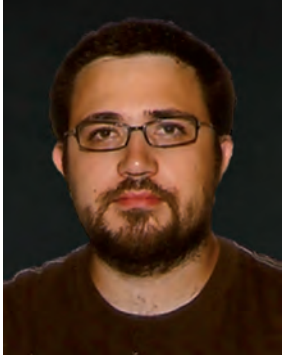

Israel GUTIÉRREZ ROJAS
Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
Previous Position: Research Assistant. University Carlos III of Madrid. Spain
Research: Technology Enhanced Learning; Learning Analytics; Future Web Technologies; Awareness Tools; E-assessment; Orchestrating Learning
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Michal KRYCZKA
Pre-doc Researcher, financed by FPU scholarship from Spanish Ministry of Education

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
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Research: A Framework for the Extension of Addressing Spaces
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Andra LUTU
Pre-doc Researcher

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Research: Inter-domain Routing; Traffic Engineering; BGP; Routing Scalability
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Pre-doc Researcher

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Foivos MICHELINAKIS
Pre-doc Researcher

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Previous Position: National Technical University of Athens. Greece
Research: Cloud Computing; Content Distribution Networks; Network Economics;
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Research: Wireless Networking; Software Defined Radio; Radiowave Propagation; Wireless PHY-layer; Cross-layer Protocols
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Vasileios PAPADOPOULOS
Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
Previous Position: Alexander Technological Educational Institute of Thessaloniki. Department of Information Technology. Greece
Research: Analysis of Dynamics of IEEE 802.11 Distributed Coordination Function (DCF); Performance Evaluation of Network Traffic Generators (NTG); Power Savings in Multihomed Handheld Devices; Energy Efficiency in Cellular Data Networks
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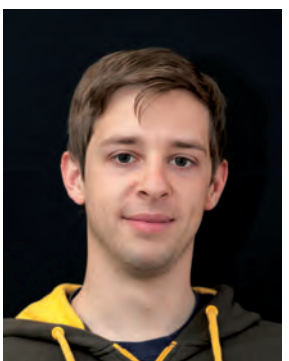
vasileios.papadopoulos@imdea.org



José Pablo SALVADOR
Pre-doc Researcher

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Previous Position: Intern, Network Research Division, NEC Laboratories Europe. Heidelberg. Germany
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María Isabel SÁNCHEZ
Pre-doc Researcher

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Vincenzo SCIANCALEPORE
Pre-doc Researcher

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Previous Position: Student Research Assistant. NEC Europe Ltd. Heidelberg. Germany
Research: WiMAX; 3GPP; LTE-Advanced; Inter-Cell Coordination and Scheduling
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Syed Anwar UI HASAN
Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
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Kshitiz VERMA
Pre-doc Researcher

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Christian VITALE
Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
Previous Position: PhD Student. NEC Europe Ltd. Heidelberg. Germany
Research: Data Analysis Techniques; Distributed and Parallel Algorithms for Network Security
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Qing WANG
Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
Previous Position: University of Electronic Science and Technology of China (UESTC). Chengdu. China
Research: Ad hoc Networks; Resource Management; Multi-channel MAC Protocols; Network Optimization; Performance Analysis
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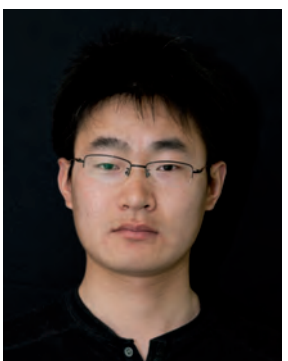
Elli ZAVOU
Pre-doc Researcher

Affiliation: Institute IMDEA Networks and University Carlos III of Madrid
Previous Position: University of Cyprus. Cyprus
Research: Distributed and Parallel Algorithms; Distributed Networks; Energy Efficiency; Discrete and Applied Mathematics; Network Dynamics
Contact: elli.zavou@imdea.org



research support

Research Support employees at Institute IMDEA Networks are responsible for the design, installation and maintenance of the IT infrastructure, either at the level of the entire Institute, or working closely with researchers and their groups.

Typical roles include systems administration and software engineering. These positions are similar to their industry equivalents, but enable our employees to work on cutting-edge research problems and technology in a stimulating environment.

Luis Felipe NÚÑEZ

Research Engineer

Qualifications: BSc Telematics Engineering. Polytechnic University of Madrid. Spain
Research: Social Networks; Graph Theory; Big Data; Data Mining; Machine Learning
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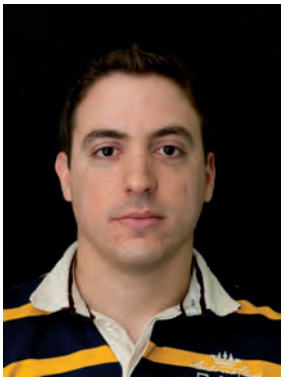

Joel ROSENTAL

Systems Administrator

Qualifications: Degree in Computer Engineering. Universidad José Antonio Paéz. Venezuela; Master in Informatics Engineering.University Carlos III of Madrid.. Spain
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Agustín SANTOS

Research Engineer

Previous position: Freelance & Lecturer. Universidad Rey Juan Carlos. Madrid. Spain
Qualifications: PhD Student. Universidad Rey Juan Carlos. Madrid. Spain
Research: Distributed Systems; Game theory; Big Data
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research team structure

networked systems&algorithms

Researchers:
- Dr. Arturo Azcorra
- Dr. Piere Francois
- Dr. Sergey Gorinsky
- Dr. Dejan Kostić
- Dr. Rade Stanojević
- Dr. Tilman Wolf
- Dr. Zhi-Li Zhang

Pre-Doc Researchers:
- Pradeep Bangera
- Alex Bikfalvi
- Juan Camilo Cardona
- Ignacio de Castro
- Michal Kryczka
- Andra Lutu
- Syed Anwar Ul Hasan

wireless networking

Researchers:
- Dr. Albert Banchs
- Dr. Azzedine Bourkerche
- Dr. José Félix Kukielka
- Dr. Vincenzo Mancuso
- Dr. Nicholas Maxemchuk
- Dr. Joerg Widmer

Pre-Doc Researchers:
- Arash Asadi
- Angelos Chatzipapas
- Sin (Allyson) Gek Hong
- Fabio Giust
- Marco Gramaglia
- Miriam Marciel
- Fovios Michelinakis
- Thomas Nitsche
- José Pablo Salvador
- Vincenzo Sciancalepore

energy-efficient networking

Researchers:
- Dr. Marco Ajmone Marsan
- Dr. Antonio Fernández Anta
- Dr. Dariusz Kowalski
- Dr. Balaji Rengarajan
- Dr. Gianluca Rizzo

Pre-Doc Researchers:
- Shahzad Ali
- Jordi Arjona
- Eva Christoforou
- Israel Gutiérrez Rojas
- María Isabel Sánchez
- Vasileios Papadopoulos
- Christian Vitale
- Qing Wang
- Elli Zavou

Our current team

administrative unit

The Institute is managed by the Director – Dr. Arturo Azcorra, the Deputy Director – Dr. Albert Banchs – and the General Manager - Mr. Alejandro Girod. They are accountable to the Board of Trustees to whom they report regularly.

They are supported by a small administration team who are dedicated to the efficient and effective achievement of the Institute's goals and to providing the levels of support required by its team of international researchers.

general manager

Alejandro GIROD ENTERRÍA
General Manager

Qualifications: MBA. IE Business School. Madrid. Spain
Previous Position: Controlling and Strategic Planning Director at NEINVER Construction, promotion and retail. Madrid. Spain
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management and administration team

Rebeca DE MIGUEL
Operations Support Manager

Qualifications: Licenciatura en Ciencias de la Comunicación (Periodismo). Universidad del País Vasco. Spain; BA (Hons) in History and Theory of Art & Film Studies. University of Kent at Canterbury. UK
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Brian DUNNE
Human Resources Manager

Qualifications: BBS in Business Studies and French. Trinity College Dublin. Ireland
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Ana GONZÁLEZ
Projects & Funding Manager

Qualifications: BA (Hons) "Modern European Studies". University of West London. UK; Postgraduate Diploma in "European Studies". Thames Valley University, London. UK
Contact: ana.gonzalez@imdea.org

alumni network

The Institute's Alumni Network is built upon graduate Pre-doc Researchers who have obtained their PhD 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 Pre-doc Researchers can maintain a long-term collaborative relationship with the Institute. Alumni are Institute IMDEA Networks' ambassadors worldwide, creating awareness and opening up new communication channels with the global scientific community.

Marco GRAMAGLIA

Current Position: Researcher at Istituto Superiore Mario Boella, Turin, Italy
Personal Site:
http://www.ismb.it/marco.gramaglia
PhD Thesis: VANET-Based optimization of infotainment and traffic efficiency vehicular services
PhD Date: September 2012
PhD Supervisor(s): Dr. María CALDERÓN PASTOR & Dr. Carlos Jesús BERNARDOS CANO

Alex BIKFALVI

Current Position: Post-doctoral Researcher and Engineer in Telecommunications at the Network Technologies and Strategies research group from Pompeu Fabra University, Barcelona, Spain
Personal Site:
http://alex.bikfalvi.com/
PhD Thesis: Peer-to-Peer Television for the IP Multimedia Subsystem
PhD Date: July 2012
PhD Supervisor(s): Dr. Jaime GARCÍA-REINOSO

Paul PATRAS

Current Position: Research Fellow at the Hamilton Institute of the National University of Ireland, Maynooth, Ireland
Personal Site:
http://www.hamilton.ie/ppatras/
PhD Thesis: Control-Theoretic Adaptive Mechanisms for Performance Optimization of IEEE 802.11 WLANs: Design, Implementation and Experimental Evaluation
PhD Date: March 2011
PhD Supervisor(s): Dr. Albert BANCHS

premises and research laboratories infrastructure

annual report 2012

8.1. Research laboratories

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

These 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.

Examples of the laboratories capabilities include

- Development of new baseband processing architectures using software-defined radio boards.

  These devices form a radio communication system where components that have been typically implemented in mixers, filters, amplifiers, modulators/demodulators, detectors, etc., are instead implemented by means of embedded computing devices, in particular Field Programmable Gate Arrays (FPGA).

- Development of experimental hardware routers using open and programmable platforms (NetFPGA).

  This equipment allows researchers to build high speed (gigabit) switches and IP router prototypes in hardware, on which to test experimental routing prototypes. This type of equipment is more realistic that the one based on the use of software only platforms.

- Optimization of WiMAX scheduling, queue management and cross-layer optimization using ARQ/HARQ. The newly developed algorithms are implemented on special WiMAX base stations provided by Albentia Systems under a collaborative agreement.

- Analysis and processing of RF signals up to 7 GHz using the Agilent N9010 Signal Analyzer.

- Research and development on mesh network topologies using Meshnode devices. These are programmable wireless nodes equipped with multiple radios that can provide network communication coverage for large areas.

The laboratories are supported by a high-performance scientific computing infrastructure consisting of a dedicated server cluster equipped with a Dell R710 (8 cores Intel Xeon E5640, 48 GB RAM, 6 TB local storage), a Dell C6100 (32 cores Intel Xeon E5640, 192 GB RAM, 24 TB storage local), and a Dell Equallogic PS610 (10 Gb/s Storage Arrays with 32 TB raw disk space).

Additionally, IMDEA Networks provides and runs an IT support infrastructure for telematic services that permits pervasive and easy access to information over different media, as well as providing the required hardware and software tools to facilitate daily operational activities, Network Research and security. It also provides telephone communications services with VoIP capability, videoconference, VPN remote secure connection, wireless access, intranet and document management systems.

8.2. Future purpose-built permanent research centre

IMDEA Networks in the future will construct its purpose-built permanent research centre with cutting edge and well-equipped research facilities. This centre will be located in one of the science and technology parks that are being created by the joint ventures between regional public universities and the Regional Government of Madrid. Science and technology parks are high quality spaces and installations where knowledge and technology flow is stimulated and managed between universities and research institutions, companies and markets; they promote the creation and growth of innovative companies through incubation and spin-off mechanisms as well as provide other added value services. Science and technology parks provide their clients

with advanced professional support services, reinforcement and promotion of research, innovation and development, collaboration mechanisms and specialized training schemes.

IMDEA Networks permanent headquarters will be constructed on a plot of land of 7,716 m2 in TECNOLEGANÉS, (also known as "LEGANÉS TECNOLÓGICO") the largest Science and Technology Park in Spain, and part of the Madrid Network initiative. TECNOLEGANÉS is located in the South-East area of Madrid, alongside the Toledo road, and between two major Madrid highways, the M-40 and the M-45, which provide fast links to the airport and Madrid city center. The park is also located near University Carlos III of Madrid's Leganes Campus. The site has a total surface of 2,804,878 square meters, and it is expected that around 500 companies will find a space to thrive there, and will in turn employ around 15,000 people. The park is being built in 3 phases: on the recently concluded first phase, 229,7 million Euros have been invested to develop a space of 507,374 m2, which has been distributed amongst 53 businesses, generating over 2000 jobs.

IMDEA Networks will be strategically located for the development of its activities due to its proximity to the TECNOLEGANÉS' Headquarters. University Carlos III of Madrid houses its innovation centers, university institutes, business incubators and laboratories in this park, facilitating the dissemination of knowledge, and the transfer of ideas, experiences and capabilities within the science and business communities.

Parcel of Land – TECNOLEGANES

8.2.1. Providing a Centre for World-Class Research

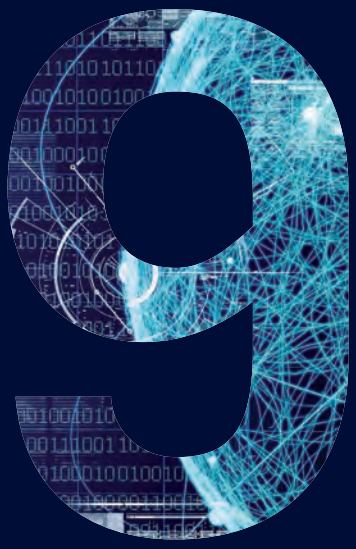
Our purpose-built research centre on the TECNOLEGANES park is intended to fulfill the functional requirements of a leading-edge research centre and to attract researchers from around the World. Its physical presence at the park is critical with regards to the Institute's role within the international research arena and especially in respect to its technology transfer oriented objectives. The location will provide a meeting place for public and private sector researchers in order to maximize the Institute's potential as a driving force for technological evolution and economic growth.

The main aim of the building design is to provision a high quality working environment for researchers. It has been conceived primarily with researchers' needs and preferences in mind, including open spaces, discussion areas, laboratories, support service etc. Thinking about the future and the natural evolution of any scientific enterprise (new research lines, projects, equipment, team members etc), the interior design will be very flexible, allowing relatively quick, easy and inexpensive reconfiguration of space to adapt to changing requirements.

8.3. Provisional Headquarters

Provisional headquarters have been refurbished in office space ceded by University Carlos III of Madrid at Avenida del Mar Mediterráneo in Leganés, near its future permanent location. This temporary office space will be utilized until the final move to the purpose built research centre is completed. It provides fully renovated facilities for researchers to carry out their work in an atmosphere of openness, collaboration and a common driving force: the pursuit of excellence.

organization



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9.1. Legal status

Institute IMDEA Networks was legally constituted under Spanish law at the end of 2006 as a public, not-for-profit Foundation. It is governed by a Board of Trustees, consisting of representatives from the various stakeholders in the Institute.

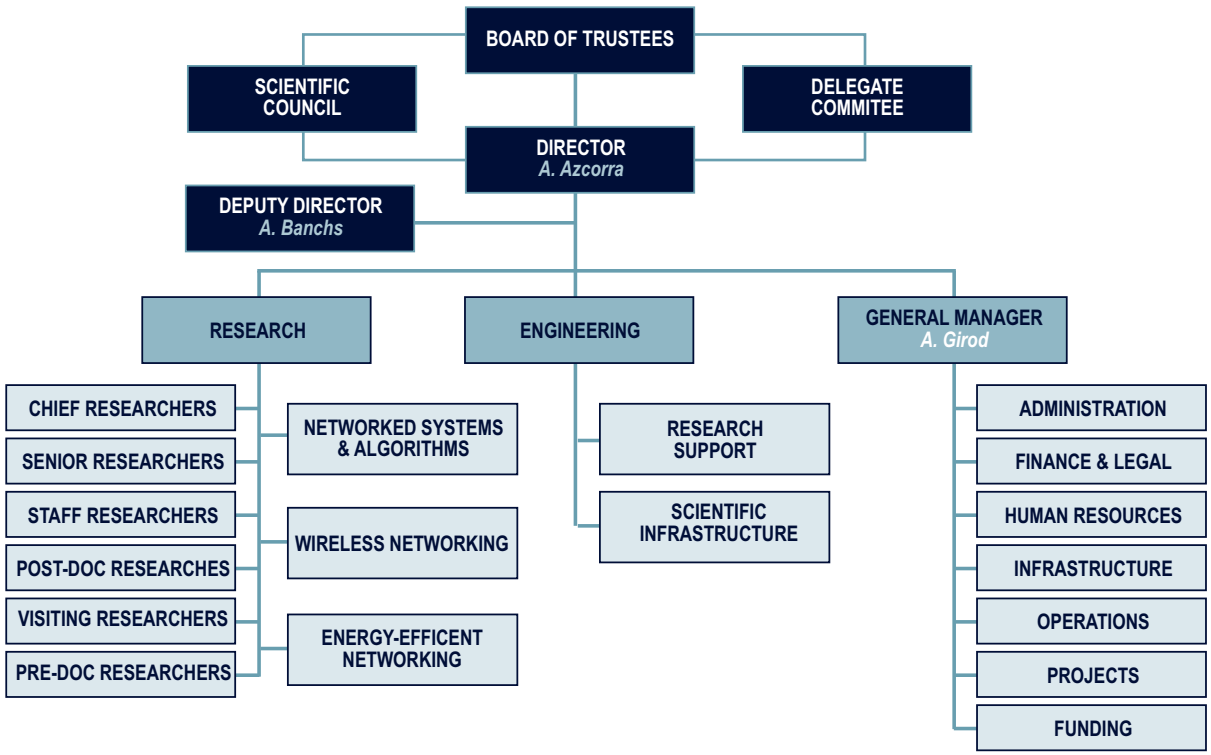
The full, registered name of the Institute is Fundación IMDEA Networks. The Institute is registered in the Register of Foundations of the Autonomous Region of Madrid (Registro de Fundaciones de la Comunidad de Madrid), personal sheet number 476.

Our Spanish tax identification number (CIF) is G-84912708.

Institute IMDEA Networks' registered address is:
Avenida del Mar Mediterraneo, 22
28918 Leganes, Madrid
Spain

9.2. Governing bodies & organizational structure

9.2.1. Organizational structure



9.2.2. Board of Trustees

The Board of Trustees of Institute IMDEA Networks 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, Deputy Director and General Manager of the Institute also participate in the Board of Trustees.

President: Prof. Dr. Ralf Steinmetz **Vice-President: Excma. Sra. Dª. Lucía Figar de Lacalle**

EX OFFICIO TRUSTEES

Excma. Sra. Dª. Lucía Figar de Lacalle
Regional Government Secretary for Education, Youth and Sports, Department of Education, Youth and Sports, Regional Government of Madrid (Madrid, Spain)
Vice-President of the Board of Trustees

Ilmo. Sr. D. Jon Juaristi Linacero
Director General of Universities and Research, Directorate General of Universities and Research, Department of Education, Youth and Sports, Regional Government of Madrid (Madrid, Spain)

Ilmo. Sr. D. Juan Ángel Botas Echevarría
Deputy Director of Research, Sub-directorate General of Research, Directorate General of Universities and Research, Department of Education, Youth and Sports, Regional Government of Madrid (Madrid, Spain)

Ilmo. Sr. D. José María Rotellar García
Vice Counselor of the Treasury, Vice Council of the Treasury, Department of Economy and Treasury, Regional Government of Madrid(Madrid, Spain)

Sr. D. José de la Sota Ríus
General Manager Madrimasd Foundation for Knowledge (Madrid, Spain)

ELECTIVE TRUSTEES - PRESTIGIOUS SCIENTISTS

Prof. Dr. Ralf Steinmetz
Full Professor and Managing Director of Multimedia Communications Laboratory (KOM), Technische Universität Darmstadt (Darmstadt, Germany)
President of the Board of Trustees

Prof. Dr. Hari Balakrishnan
Professor, Massachusetts Institute of Technology (Massachusetts, USA)

Prof. Dr. Jim Kurose
Interim Dean and Distinguished University Professor, University of Massachussets at Amherst (Massachusetts, USA)

Dr. Huw Oliver
Independent Computer and Network Security Professional at University of Britol and the Civil Aviation Authority (former Technical Director, European Research Consortium, Hewlett-Packard Laboratories) (Bristol, United Kingdom)

Prof. Dr. Ioannis Stavrakakis
Full Professor, National and Kapodistrian University of Athens (Athens, Greece)

ELECTIVE TRUSTEES – COMPANIES

Telefónica I+D
Designated Representative
Mr. Carlos Francisco Domingo Soriano
President and CEO, Telefonica I+D (R&D)
Director of Product Development & Innovation, Telefonica Digital

Hewlett-Packard
Designated Representative
Ms. Irma Jiménez Guler
Director of Institutional Relations

INDRA
Designated Representative
Mr. José Luis Angoso González
Director of Innovation

SATEC
Designated Representative
Mr. Luis Alberto Rodríguez-Ovejero Alonso
President

TELDAT
Designated Representative
Mr. Antonio García Marcos
President

ELECTIVE TRUSTEES – COMPANY EXPERTS

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Director General
COTEC Foundation for Technological Innovation
(Madrid, Spain)

Mr. Carlos Nieva Martínez
Director of Tactical Planning and Implementation
Ericsson
(Madrid, Spain)

ELECTIVE TRUSTEES – INSTITUTIONAL TRUSTEES: UNIVERSITIES

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(Madrid, Spain)
Designated Representative
Prof. Dr. Carlos Balaguer Bernaldo de Quirós
Vice-Rector of Research

Universidad Autónoma de Madrid
(Madrid, Spain)
Designated Representative
Prof. Dr. Javier Ortega García
Professor of Signal Theory and Communications
Higher Polytechnic School (Escuela Politécnica Superior)

Universidad Nacional de Educación a Distancia
(Madrid, Spain)
Designated Representative
Prof. Dr. Sebastián Dormido Bencomo
Professor of Systems and Automation Engineering
Higher Polytechnic School of Computer Science (Escuela Técnica Superior de Ingeniería Informática)

Universidad de Alcalá
(Madrid, Spain)
Designated Representative
Prof. Dr. Juan Ramón Velasco Pérez
Vice-Rector of Postgraduate Studies and Continuing Education

9.3.2. 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 directive team 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:

Prof. Dr. Hari BALAKRISHNAN
Professor at the Massachusetts Institute of Technology. Massachusetts. USA

PhD: University of California, Berkeley. Berkeley. USA
Research: Networked Computer Systems, spanning Overlay and Peer-to-Peer Networks; Network Protocols and Architecture; Wireless and Sensor Networks, and Distributed Data Management

Dr. Gonzalo CAMARILLO
Principal Researcher at the Nomadic Laboratory, Ericsson Research Finland. Suomi. Finland

PhD: Aalto University. Helsinki. Finland
Research: Signaling; Multimedia Applications; Transport Protocols; Network Security; Networking Architectures

Prof. Dr. Jon CROWCROFT
Marconi Professor of Communication Systems at University of Cambridge. Cambridge. UK

PhD: University College London. UK
Research: Opportunistic Communications; Privacy in the Cloud; Carbon Neutral Networking

Prof. Dr. Gustavo DE VECIANA
Professor of Electrical and Computer Engineering at The University of Texas at Austin. USA

PhD: University of California, Berkeley. EE.UU.
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. Edward Knightly

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

PhD: University of California at Berkeley. Berkeley. EE.UU.
Research: Wireless Networks and Protocols; Wireless Access for Developing Regions; Dynamic Spectrum Access Networks

Prof. Dr. Jim KUROSE

Interim Dean and Distinguished University Professor at University of Massachusetts, Amherst. Massachusetts. USA

PhD: Columbia University of New York City. Nueva York. EE.UU.
Research: Network Protocols and Architecture; Network Measurement; Sensor Networks; Multimedia Communication; Modeling and Performance Evaluation

Dr. Huw OLIVER

Independent Computer & Network Security Professional at University of Bristol and the Civil Aviation Authority (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

Dr. Pablo RODRIGUEZ RODRIGUEZ

Research Director, Telefonica R&D. Spain; Director, Barcelona Telefonica R&D Lab. Spain; Adjunct Faculty Professor, Department of Computer Science, Columbia University of New York City. USA

PhD: École Polytechnique Fédérale de Lausanne (EPFL). Lausanne. Suiza
Research: Networking; Distributed Systems; Information Theory; Wireless and Mobile; Network Economics; Social Networks

Prof. Dr. Ioannis STAVRAKAKIS

Full Professor at National and Kapodistrian University of Athens. Athens. Greece

PhD: University of Virginia. Charlottesville. USA
Research: Resource Allocation Protocols and Traffic Management for Communication Networks, with recent emphasis on Peer-to-Peer, Mobile, Ad hoc, Autonomic and Social Networking

Prof. Dr. Ralf STEINMETZ

President of Board of Trustees of IMDEA Networks (Madrid, Spain); Managing Director of Multimedia Communications Lab (KOM) and Full Professor at Technische Universität Darmstadt. Darmstadt. Germany

PhD: Technische Universität Darmstadt. Germany
Research: Networked Multimedia issues with the vision of "Seamless Multimedia Communications"; i.e. Network Dependability and Security; Quality of Service; Content Distribution Networks; Context Aware communications; Media Semantics. He relates these research issues often very closely to Mobility, Internet Telephony, Telemedia Learning and Serious Gaming

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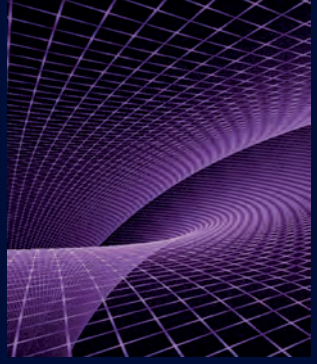

La Suma de Todos
Comunidad de Madrid
www.madrid.org

EUROPEAN UNION
STRUCTURAL FUNDS

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