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UNIVERSITÀ DI PISA



2016 Tyrrhenian International Workshop  
on Digital Communications

# What Lies Beyond 5G?

Livorno, Italy - September 11-14, 2016



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*Sergio Palazzo*

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*Ivan Stupia*

*Antti Tölli*

*Luc Vanderdorpe*

*Roberto Verdone*

### Local arrangement

*Carmine Vitiello*

*Andrea Pizzo*

## Program

### Sunday, 11 September - Stucchi Room

15:30 – 16:45 T1 M. Di Renzo (CNRS, FR) – On System-Level Analysis & Design of Cellular Networks:  
**The Magic of Stochastic Geometry**

16:45 – 17:15 Coffee break

17:15 – 18:30 T1 M. Di Renzo (CNRS, FR) – On System-Level Analysis & Design of Cellular Networks:  
**The Magic of Stochastic Geometry**

18:30 - 19:00 Welcome Reception



## Monday, 12 September - Stucchi Room

### Marconi Room

09:00 – 09:45 G. Caire (TU Berlin, DE) – **Massive MIMO: implementation issues and impact on network optimization**

09:45 – 10:15 Coffee break

S1 **Caching in Wireless Networks** – M. Kobayashi (Centrale Supélec, FR)

10:15 – 10:35 K. Hamidouche (Centrale Supélec, FR) – **Breaking the Economic Barrier of Caching in Cellular Networks: Incentives and Contracts**

10:35 – 10:55 G. Caire (TU Berlin, DE) – **On the design of wireless PHY layer solutions in the presence of caching**

10:55 – 11:15 M. Kobayashi (Centrale Supélec, FR) – **On the complementary roles of massive MIMO and coded caching**

11:15 – 11:35 P. Elia (Eurecom, FR) – **Duality and synergy between coded-caching and advanced PHY**

11:35 – 12:00 G. S. Paschos (Huawei, FR) – **Popularity learning and cache optimization in wireless networks**

### Marconi Room

12:00 – 12:45 R. Heath (The University of Texas at Austin, US) – **Vehicle-to-X communication using millimeter waves**

12:45 – 14:00 Lunch

### Marconi Room

14:00 – 14:45 P. Popovski (Aalborg Univ., DK) – **Massive, Ultra-Reliable, and Low-Latency Wireless: How to Communicate with Short Packets**

14:45 – 16:30 T2 A. Zappone, E. Jorswieck (TU Dresden, DE) – **Energy-efficient design of (5G and beyond 5G) wireless networks**

16:30 – 17:00 Coffee break

17:00 – 18:30 T2 A. Zappone, E. Jorswieck (TU Dresden, DE) – **Energy-efficient design of (5G and beyond 5G) wireless networks**

## Monday, 12 September - Delle Feste Room

### Marconi Room

09:00 – 09:45 G. Caire (TU Berlin, DE) – **Massive MIMO: implementation issues and impact on network optimization**

09:45 – 10:15 Coffee break

S2 **Simultaneous wireless information and power transfer** – I. Stupia - L. Vandendorpe (UCL, BE)

10:15 – 10:35 R. Heath (The University of Texas at Austin, US) – **Simultaneous Wireless Information and Power Transfer at Millimeter Wave**

10:35 – 10:55 B. Clerckx (Imperial College, UK) – **Boosting the Efficiency of WPT and SWIPT through Waveform Design and Optimization**

10:55 – 11:15 D. N. K. Jayakody (TPU, RU and University of Tartu, EE) – **SWIPT in Massive MIMO-enabled 5G Wireless Systems: Opportunities and Challenge**

11:15 – 11:35 I. Stupia (UCL, BE) – **Multi-objective Resource Allocation Optimization for SWIPT in Small-cell Networks**

11:35 – 12:00 M. Di Renzo (CNRS, FR) – **Feasibility Analysis of SWIPT MIMO Cellular Networks**

### Marconi Room

12:00 – 12:45 R. Heath (The University of Texas at Austin, US) – **Vehicle-to-X communication using millimeter waves**

12:45 – 14:00 Lunch

### Marconi Room

14:00 – 14:45 P. Popovski (Aalborg Univ., DK) – **Massive, Ultra-Reliable, and Low-Latency Wireless: How to Communicate with Short Packets**

S3 **MmWave and VLC for Beyond-5G Cellular** – S. Buzzi (Univ. of Cassino, IT)

14:45 – 15:10 R. Heath (The University of Texas at Austin, US) – **Exploiting sparsity for wideband mmWave channel estimation in IEEE 802.11ad**

15:10 – 15:35 C. D'Andrea (Univ. Cassino, IT) – **The doubly massive MIMO regime in mmWave communications**

15:35 – 16:00 V. Jungnickel (Fraunhofer HHI, DE) – **Optical Wireless for Beyond 5G**

16:00 – 16:25 E. Calvanese Strinati (Cea-Leti, FR) – **Next Generation mmWave for 5G and Beyond**

16:30 – 17:00 Coffee break

S4 **5G European projects & More**

17:00 – 17:20 H. Benn (Samsung, UK) – **5G Mobile Communications - Key Enabling Technologies and Recent R&D Results**

17:20 – 17:40 R. Susini (National Instruments) – **The Road to Massive MIMO mmWave Mobile Communications Systems**

17:40 – 18:00 M. Hunukumbure (Samsung, UK) – **Extending 5G Mobile Communications to the mm-wave spectrum - Opportunities and Challenges**

18:00 – 18:20 M. Schellmann (Huawei, DE) – **Waveform Design for 5G Air Interface: An Overview**



## Tuesday, 13 September - Stucchi Room

### Marconi Room

09:00 – 09:45 B. Ottersten (Univ. of Luxembourg, LU) – **Signal Processing Challenges in Satellite Communication Networks**

09:45 – 10:15 Coffee break

S5 **Experimental methods in Wireless Communications** – R. Knopp (Eurecom, FR)

10:15 – 10:40 R. Knopp (Eurecom, FR) – **Challenges in Data-Center Technologies for Distributed Radio Signal Processing**

10:40 – 11:05 I. Seskar (Rutgers Univ., US) – **Experimental Platforms as Enablers for Rapid Technology Innovation**

11:05 – 11:30 A. Oliveira (IT-Aveiro, PT) – **Open C-RAN Lab Testbed**

11:30 – 11:55 J. Morgade (Fraunhofer IIS, DE) – **OpenAirInterface based measurement methodology for the Evolved Multimedia Broadcast Multicast Service (eMBMS) characterization in LTE-A experimental network**

### Marconi Room

12:00 – 12:45 D. Gesbert (Eurecom, FR) – **Team approaches in decentralized device coordination**

12:45 – 14:00 Lunch

### Marconi Room

14:00 – 14:45 G. Fettweis (TU Dresden – Vodafone, DE) – **Physical Layer Challenges When Designing the Tactile Internet**

14:45 – 16:30 T3 E. Björnson (Linköping Univ., SE) – **The Massive MIMO Paradigm – Fundamentals and State-of-the-Art**

16:30 – 16:50 Coffee break

16:50 – 18:15 T3 E. Björnson (Linköping Univ., SE) – **The Massive MIMO Paradigm – Fundamentals and State-of-the-Art**

18:45 Boat Tour

20:00 Gala Dinner

## Tuesday, 13 September - Delle Feste Room

### Marconi Room

09:00 – 09:45 B. Ottersten (Univ. of Luxembourg, LU) – **Signal Processing Challenges in Satellite Communication Networks**

09:45 – 10:15 Coffee break

S6 **Network virtualization and softwarization** – G. Bianchi (Univ. of Tor Vergata, IT)

10:15 – 10:35 N. Bonelli (Univ. of Pisa, IT) – **Functional network programming**

10:35 – 10:55 L. Rizzo (Univ. of Pisa, IT) – **Software Packet Scheduling at Hardware Speeds**

10:55 – 11:15 F. Paradiso (Univ. of Firenze, IT) – **VNF Placement in an SDN-based NFV Architecture**

11:15 – 11:35 F. Schneider (NEC, DE) – **Extending OpenFlow for stateful flow processing and in-switch packet generation**

11:35 – 12:00 S. Pontarelli (Univ. of Tor Vergata, IT) – **From monolithic to programmable packet processing actions in OpenFlow**

### Marconi Room

12:00 – 12:45 D. Gesbert (Eurecom, FR) – **Team approaches in decentralized device coordination**

12:45 – 14:00 Lunch

### Marconi Room

14:00 – 14:45 G. Fettweis (TU Dresden – Vodafone, DE) – **Physical Layer Challenges When Designing the Tactile Internet**

14:45 – 16:30 Panel A. Lozano (Pompeu Fabra, ES) – **Panel on the future of cellular communications**  
M. Debbah (Huawei, FR), G. Fettweis (TU Dresden, DE), G. Caire (TU Berlin, DE), H. Benn (Samsung, UK), A. Cicalini (Qualcomm, US)

16:30 – 16:50 Coffee break

18:45 Boat Tour

20:00 Gala Dinner



## Wednesday, 14 September - Stucchi Room

### Marconi Room

09:00 – 09:45 M. Debbah (Centrale Supélec – Huawei, FR) – **5G: Can we make it by 2020?**

09:45 – 10:15 Coffee break

S7 **Traffic Aware Interference Management in Dense TDD Networks** – D. Slock – A. Tölli (Eurecom, FR – Univ. of OULU, FI)

10:15 – 10:35 M. Honig (Northwestern Univ., US) – **Traffic-Driven Resource Allocation over Slow Time-scales**

10:35 – 10:55 A. Tölli (Univ. of OULU, FI) – **UL/DL Mode Selection and Transceiver Design for Dynamic TDD**

10:55 – 11:15 E. Björnson (Linköping Univ., SE) – **User Association in Massive MIMO with Heterogeneous Load**

11:15 – 11:35 E. de Carvalho (Aalborg Univ., DK) – **Random Access Protocols for Massive MIMO**

11:35 – 12:00 D. Slock (Eurecom, FR) – **Deterministic Limits in Massive MIMO Networks**

### Marconi Room

12:00 – 12:45 V. Lau (Hong Kong Univ., HK) – **Degrees of Freedom on Cached MIMO Interference Networks**

12:45 – 14:00 Lunch

### Marconi Room

14:00 – 14:45 M. Zorzi (Univ. of Padova, IT) – **Cognition-Based Networks: A New Perspective on Network Optimization Using Learning and Distributed Intelligence**

14:45 – 16:30 T4 M. Duarte, M. Guillaud (Huawei, FR) – **Engineering wireless full-duplex nodes and networks**

16:30 – 17:00 Coffee break

17:00 – 18:30 T4 M. Duarte, M. Guillaud (Huawei, FR) – **Engineering wireless full-duplex nodes and networks**

## Wednesday, 14 September - Delle Feste Room

### Marconi Room

09:00 – 09:45 M. Debbah (Centrale Supélec – Huawei, FR) – **5G: Can we make it by 2020?**

09:45 – 10:15 Coffee break

S8 **Beyond 5G: more than “more data”** – T. Quek – G. Ferrante (SUTD, SG)

10:15 – 10:35 G. Ferrante (SUTD, SG) – **Timing channels: More than just payload in IoT**

10:35 – 10:55 G. Geraci (Bell Labs Nokia, IR) – **Massive MIMO: more than “more antennas”**

10:55 – 11:15 M. Kountouris (Huawei, FR) – **Exploiting Full Duplex Communication for 5G Wireless Networks**

11:15 – 11:35 N. Pappas (Linköping Univ., SE) – **Throughput with Delay Constraints of a Share Access Network with Priorities**

### Marconi Room

12:00 – 12:45 V. Lau (Hong Kong Univ., HK) – **Degrees of Freedom on Cached MIMO Interference Networks**

12:45 – 14:00 Lunch

### Marconi Room

14:00 – 14:45 M. Zorzi (Univ. of Padova, IT) – **Cognition-Based Networks: A New Perspective on Network Optimization Using Learning and Distributed Intelligence**

S9 **Photonics for 5G and beyond** – A. Bogoni (SSSA, IT), A. D’Errico (Ericsson, IT)

14:45 – 15:05 A. Lord (British Telecom, UK) – **Photonics for 5G: an operator perspective**

15:05 – 15:25 T. DeB (Nokia, DE) – **Industrial perspective in 5G optical transport**

15:25 – 15:45 F. Cavaliere (Ericsson, IT) – **Evolution of photonics for 5G**

15:45 – 16:05 A. Bogoni (SSSA, IT) – **Photonics functionalities for 5G and beyond**

16:30 – 17:00 Coffee break

S10 **Advances in Wireless Communications**

17:00 – 17:20 S. D’Oro (Univ. of Catania, IT) – **Energy-efficient resource allocation in C-RANs with temporal and QoS constraints**

17:20 – 17:40 R. Verdone (Univ. of Bologna, IT) – **Using UAVs for Moving Networks: Impact on Delay and Throughput**

17:40 – 18:00 M. Moretti (Univ. of Pisa, IT) – **Distributed power allocation for D2D communications underlying/overlying OFDMA cellular networks**

18:00 – 18:20 S. Tomasin (Univ. of Padova, IT) – **MOMA: a novel multiple access technique accommodating differentiated services for 5g systems**



## Workshop Venue:

### NH Grand Hotel Palazzo

Viale Italia, 195

57127 Livorno

Italy

Tel.: +39 0586 260836

## Social Events:

### Sunday, 11 September

18:30 WELCOME COCKTAIL

*in the roof terrace of the Grand Hotel Palazzo*

### Tuesday, 13 September

18:45 BOAT TOUR along the canals

*Departure from Piazza del Pamiglione in front of 4 Mori statue*

20:00 SOCIAL DINNER

*in the restaurant of the Livorno Yacht Club, situated in a Medieval fortress protecting the Medici Port of Livorno*

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**Organising Secretariat:**



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