Mobile Communications Department

@ EURECOM

Research Panorama

March 2012

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Mobile Communications: People

- **10 faculty members:**
  - **Communications Theory Group**
    - <u>David Gesbert (Head of Dept)</u>
    - Dirk Slock
    - Laura Cottatellucci
    - Petros Elia

  - **Advanced Wireless Technologies**
    - <u>Raymond Knopp</u>
    - Florian Kaltenberger

  - **Wireless Systems and Protocols**
    - <u>Christian Bonnet</u>
    - Navid Nikaein
    - Jerome Haerri
    - Thrasyvoulos Spyropoulos

- **Engineers and Postdocs**
  - Dominique Nussbaum
  - Hervé Callewaert (sick leave)
  - Riadh Ghaddab
  - Dalmasso
  - Michelle Wetterwald
  - Lionel Gauthier
  - Datta
  - Philippe Foubert
  - Bassem Zayen
  - S. Aubert
  - Juan Hao
  - Christian Petiot
  - Reham Hashmat
  - Frederic Maurel
  - Sebastian Wagner
  - Davide Brizzolara
  - Baris Demiray
  - Lusheng Wang

- **About 30 Doctoral Students (on site)**

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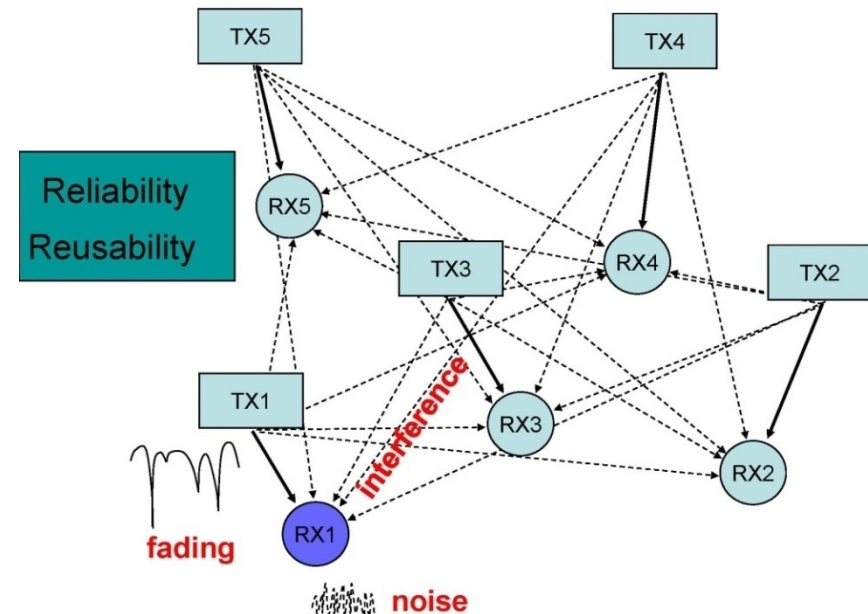# Communication Theory Group

- **Objectives**
  - Enhancing communication systems performance
  - Developing or exploiting fundamental tools for analysis

- **Research Directions**
  - Predicting the performance limits
  - Development of various techniques at lower layers

- **Tools**
  - Linear Algebra
  - Probability Theory
  - Game Theory
  - Coding
  - (Distributed) Optimization Theory
  - Modeling (channel, networks)
  - Estimation and Detection
  - Random matrix theory

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Communication Theory Research Trends

■ **Small Cells**

- Dense, low power, full reuse networks
- Large system analysis and optimization
- Massively cooperating wireless networks

■ **Distributed wireless optimization**

- Distributed precoding/decoding for MIMO
- Distributed interference management

■ **Fundamental limits of communications**

- Performance vs. complexity
- Performance vs feedback limitation (Learning)
- Localization vs. communication

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Advanced Wireless Technologies Group

- **Objectives**
  - Bring ideas to life through experimentation with
    - Real-time prototypes
    - Scalable emulation platforms
  - Bring results from the group into 3GPP standards

- **Directions**
  - Openairinterface.org: Wireless technology platform for deployment of mock networks (Cellular + Mesh)
  - Interference management in wireless networks
  - Relaying strategies and collaborative communications
  - Embedded systems for reconfigurable/multimodal radio

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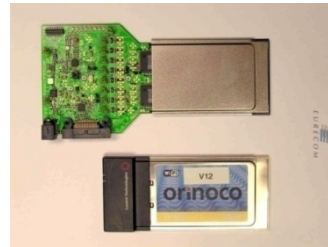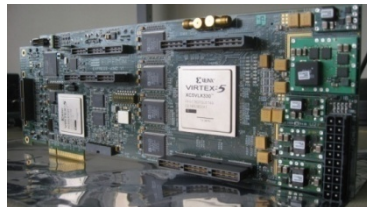
Advanced Wireless Technologies Research Trends

- **Machine-type Communications (MTC) and Sensor networks**
  - Joint-source channel coding for correlated analog sources
  - Multiple-access for massive LTE-based networks
  - Adaptive modulation and coding for MTC

- **Communication aspects of transportation systems**
  - Relays for networks in trams/trains/cars
  - High-spectral efficiency spectrally-opportunistic backhaul for high-speed train in TV white-spaces

- **Platform-based research**
  - Spectrum-aggregation (SA)
  - Very High-spectral efficiency MODEM architectures (4x4 MIMO/MU-MIMO + SA) (> 6 bps/Hz)

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Wireless Systems and Protocols Group

- ## Objectives
  - Addressing challenging problems proposed by novel wireless systems by developing efficient communication protocols
  - Evaluating them on experimental platforms
  - Bringing the methods to the standardization bodies
    - Active ETSI 3GPP, ITS and CAR 2 CAR involvement

- ## Directions
  - Mobility in all IPv6 Networks
  - LTE Networks supporting new applications
  - Vehicular Networks
  - Social Networks (social driven mobility)
  - Intelligent Transportation Systems (ITS)

Wireless Systems and Protocols Research Trends

- **Spontaneous networks**
  - Personal mobility models and connectivity
  - Mobile social Networks (mobility and traffic modeling)
  - Cognitive Mesh networks (resource allocation)

- **Cloud**
  - Mobile Cloud for Mobile Terminals (Thin Clients VS Smart Phones)
  - Radio Access Network Cloud

- **Application Layer**
  - GREEN TERMINALS: Power consumption management for wireless tablet applications
  - Application development methodology for cross target (ANDROID, IOS.)

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Current EU Projects

- **_CROWN:_ Cognitive radio oriented wireless networks**

- **_WHERE 2:_ Wireless hybrid enhanced mobile radio estimators,**

- **_ARTIST4G_ Advanced Radio Interface Technologies for 4G SysTems,**

- **_SACRA:_ Spectrum and energy efficiency through multi-band cognitive radio**

- **_SAPHYRE:_ Sharing physical resources, mechanisms and implementations for wireless networks**

- **_SAMURAI:_ Spectrum Aggregation and Multi-User MIMO: Real-world Impact,**

- **_LOLA:_ Achieving low-latency in wireless communications**

- **_CONECT :_ COOPERATIVE NETWORKING FOR HIGH CAPACITY TRANSPORT ARCHITECTURES**

- **_@CROPOLIS:_ Advanced coexistence technologies for radio optimization in licensed and unlicensed spectrum (NoE)**

- **_iTETRIS:_ An Integrated Wireless and Traffic Platform for Real-Time Road Traffic Management Solutions**

- **_MEDIEVAL:_ MultimEDia transport for mobIIE Video AppLications**

- **_HNPS :_ Heterogeneous network for European public safety**

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Additional projects

- **VELCRI** (Ademe)

- **SCOREF** (DGCIS FUI) (collaboration with NS &S department)

- **LTE-Now** (DGCIS FUI)

- **SMART 4G Tablet (DGCIS FUI)**

- **WL-BOX** (DGCIS FUI)

- **LICORNE** (ANR)

- **SYMPA** (DGCIS FUI)

- **PFT** (DGCIS Platform)

- **RATCOM** (FUI)

- **HNPS** (CELTIC)

- **PLATA** (ANR)

- **IMMUNE (T-Labs Contract)**

- **Home ENodeB (Mitsubishi Labs Contract)**

- **CORRIDOR** (ANR)

- **SYSTUF** (DGCIS)

- **SPECTRA** (CELTIC)

- **New CIFRE: 2 CIFRE INTEL, 1 CIFRE Orange. In preparation 1 CIFRE with THALES, 1 CIFRE with Mitsubishi Labs., 1 or 2 CIFRE with ST-ERICSSON.**

Preparation FP7 Call 8:
➢ 16 Projects submitted

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Visibility

- **17 graduated Phd students in 2011**

- **Two IEEE Fellows**

- **Publications in 2011:**
  - Journals: 27 Intl journals
  - Conferences: 92 Intl Conferences
  - Awards:
    - 6 conference paper awards
    - Newcom++ Distinguished Achievement Award
    - 1 DGA Best PhD thesis Award
    - 1 Hitachi Best Master Thesis Award

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