

RC (Radio Communications Area)

Advanced signal processing techniques for diversity architectures

This research line is dedicated to study and performance assessment of innovative array processing architectures exploiting the capabilities of single-input multi-output and MIMO configurations.

Iterative decoding for adaptive multi-user schemes

This research line devotes to improve space-time/frequency coded transmissions over realistic wireless channels, aiming to extend the known basic schemes into various directions.

Cooperative communications and distributed signal processing

This research line are dedicated to adapt MIMO signal processing algorithms to the new distributed cooperative scheme, or study new solutions and to optimize physical layer performance measures taking into account how cooperation interacts with higher layers.

AT (Access Technologies Area)

Multi-terminal Communications

The main objectives of this line of research are: to provide efficient cooperation algorithms for multi-hop wireless transmission and cooperative wireless access; to explore the fundamental limits of wireless networks; and to integrate such algorithms into a wireless network architecture.

Resource Allocation for Beyond 3G Systems

The activities along this line explore the 2D spreading factor adjustment for the downlink in a multi-cell environment, and a dynamic and distributed multiuser radio resource allocation scheme for a FDMA-TDMA -SDMA based multicellular system will be proposed.

PHY-MAC Resource Allocation in Wireless Systems

The main objectives for this research line are: to develop a general framework for PHY-MAC resource allocation in MIMO wireless networks; to investigate optimal PHY-MAC spatial multiplexing and scheduling strategies for throughput and delay optimization; to investigate optimal PHY-MAC power allocation with spatial multiplexing and scheduling for throughput and delay optimization; to develop a real-time resource allocation testing platform focused on WLAN and WIMAX technologies.

Resource Management and MAC Protocols

This research work has focused on the development of scheduling algorithms using advanced PHY-MAC Cross-Layer techniques for link adaptation using a distributed queuing MAC protocol for WLAN-based systems.

The future research lines include hand-off procedures based on Cross-Layer issues, will address AP association problem for WLAN cellular systems. Furthermore, we will also focus on RRM schemes for 802.11n WLAN systems.

System-level Simulation: Democles Testbed

The main objectives for this research line are: possibility to design an advanced system platform for B3G multi-carrier based systems; to design and validate an adaptive model from the link level in terms of errors distribution characteristics to the systems simulator; flexibility for designing multi-service service simulators that contains RRM and QoS management algorithms based on cross-layer issues; to allow simulate and evaluate dynamic RRM algorithms and procedures for an optimal and efficient use of the radio resources provided by B3G multi-carrier systems that enables high capacity for multi-service, applications in multi-cellular applications; to ensure the compatibility of the studied systems with the third generation systems; to design propagation models, multimedia traffic models, traffic profiles, and mobility models.

MAC Simulator for Wireless Networks (MACSWIN)

Because of the limitations of current analytical models for ad hoc networks, many researchers are used to studying the performance of MAC protocols by event-driven computer simulations. Most of them have been usually developed to cover a wide range of communication layers, making them flexible and suitable for many researchers all over the world. Nevertheless, this flexibility also yields suboptimal performance in each of the specific topics, leading to long simulation periods that may make them not suitable for research. Therefore, there is an interesting open field in the development of MAC-oriented software simulators that make easier the development of growing complexity algorithms as the degrees of freedom become analytically intractable or extremely complicated. The MAC Simulator for Wireless Networks (MACSWIN) is an object-oriented programmed in Visual C++ .NET environment.

WiMax Network Deployment for Quality of Service Measurements

Wi4GOAL is a hardware testbed for testing audiovisual applications based on WiMAX system. The actual tested devices are pre-WiMAX, which partially fill the IEEE 802.16a standard. The target transmission mode is the Uplink mode where the packet error rate, the cell coverage, power transmission, and bit rate are analysed for each environment.

The second part (still not undertaken) will be to build an experimental WiMAX network for audiovisual transmissions.

Adaptive multiple carrier CDMA scheme for indoor broadband systems

The 4th generation of mobile communication systems are designed to provide higher data rate and serve a large number of users simultaneously than the present one. One of the most promising candidate for the 4G wireless communication is the Multiple Carrier Code Division Multiple Access (MC-CDMA) scheme for broadband and very high frequency (VHF) communications domains. The use of adaptability to adjust each subcarrier allocation and constellation size to the instantaneous channel allocation and an intelligent grouping of sub-carrier allocation strategy produce significant average power improvement per user. Therefore, the adaptive MC-CDMA (AMC-CDMA) appear as an alternative technique to the conventional MC-CDMA and a suitable transmission scheme to achieve the increasing system's user-capacity with a satisfactory BER and global power performance required for the 4G communication systems.

ON (Optical Networking Area)

Advanced GMPLS-based distributed schemes for next-generation optical networks

The main objective of this research line is to thoroughly study and integrate efficient GMPLS-based mechanisms for controlling optical networks within a multi-domain and multi-layer environment.

Novel strategies for fault and performance management

Collection and use of information about impairments and network performance to improve the accuracy and reach of control and management-related decisions in multilayer, all-optical networks.

CS (Communications Subsystems Area)

Antennas

The focus of this activity is the development of a whole antenna subsystem to fulfill the industrial requirements: small size, low cost, easy to fabricate, omni-directional radiation pattern, low pulse distortion (high fidelity), high efficiency and covering FCC or European UWB frequency range.

Passive components

Research on Passive Components is focused on waveguide design and the development of efficient Computer Aided Design (CAD) tools. Provided that devices such as adapters, mode-launchers, combines, interdigital and evanescent-mode filters are key blocks in the equipment of numerous microwave communication systems, the availability of fast, high-accuracy tools for electromagnetic-wave modelling seems a good opportunity for R&D activities. The chosen technology to work on is the forthcoming wideband radio system allocated on the 60 GHz band.

Active components

Research on Active Components focuses on the design and optimization of nonlinear RF/microwave circuits and antenna arrays, both in hybrid and integrated form.

Future work may focus in developing integrated designs, as well as exploring new areas such as the design, optimization and stability analysis, of modern transceiver architectures like the ones involving polar loop architectures and sigma-delta modulation.

Positioning systems

The main objective of this research topic is to provide new designs, architectures and strategies related to positioning systems, improving the accuracy, reliability and coverage of existing approaches.

IP (IP Technologies Area)

Adaptable mobile communications for next-generation networks

The objectives of this research line can be classified under the following main keywords: cross-layer, mobility, wired/wireless convergence, and realistic deployment scenarios.

Self-organized wireless networks

A flexible architecture needed to integrate heterogeneous SONs into a global architecture including the fixed Internet and other wireless networks. The solution proposed should be scalable to allow millions or billions of mobile networked devices to self-organize and communicate. In this sense, addressing, routing, mobility management, or QoS should be appropriately designed.

Novel techniques for network performance assessment

The S&T objectives of this research line can be classified as end-to-end monitoring, wireless measurements and network layer support to applications, mainly VoIP and P2P.