

PROJECT / Software Defined Transceiver for Flexible Optical Networks

SoftTransceiver


Main Objective:

The primary technical objective of the project is to develop and implement a flexible transceiver prototype with software-driven reconfigurability and arbitrarily low bit-rate granularity. The development of this technology will enable to increase the network capacity and the spectral/energy efficiency, while providing a future-proof flexible solution for an increasingly heterogeneous global network. In order to guarantee a smooth upgrade of currently installed optical transmission systems, the SoftTransceiver project encompasses a dual-generation approach:

- 1st generation: fixed symbol-rate transceivers with variable bit-rate, enabled by hybrid QAM techniques, for deployed fiber systems employing a fixed frequency grid (ITU-T: 50 GHz);
- 2nd generation: variable symbol-rate transceivers for novel transmission systems based on special fibers, using a flexible frequency grid (ITU-T G.694.1: 12.5 GHz).

In the initial stage of the project, we will focus on the maximization of capacity and spectral efficiency of currently deployed fiber systems, taking advantage of our previous experience on key research topics, such as:

- Development of advanced DSP subsystems for optical communication systems;
- Modelling and equalization of nonlinear fiber impairments;
- Laboratorial test and validation of long-haul fiber links;
- Hardware implementation and real-time processing.



Aiming to prepare the upcoming transmission standards for high-bit rate fiber links, the SoftTransceiver project will investigate optimum super-channel configurations for 400G and 1T transmission. Taking into account the expected evolution on microelectronics, these new 400G and 1T transceivers will demand a strong effort on the synchronization and joint processing of individual subcarriers. Building on our research experience, we will develop advanced DSP subsystems for linear and nonlinear equalization of fiber impairments, namely by expanding our work on Stokes-based demultiplexing and Volterra-based nonlinear mitigation. This background experience will be complemented by the exploitation of novel technologies, with emphasis on the use of hybrid QAM modulation to increase the bit-rate granularity.

The study and development of the 2nd generation variable symbol-rate transceiver will greatly benefit from the advances and know-how potentiated by the aforementioned initial stage of research. In this second stage of development, the SoftTransceiver project will be mostly focused on the optimization of spectral and energy efficiency, promoting a strong cooperation with the control plane for a smart management of traffic demand and energy/spectral resources. Enabled by the variable symbol-rate paradigm, we will investigate optimized tradeoffs between receiver sensitivity and bandwidth. Using network dimensioning tools we will tackle OpEx and CapEx expenditure costs, aiming at the minimization of the cost per bit in flexible optical networks.

To enhance the collaboration with international partners, the SoftTransceiver project includes external consultancy from top-level researchers associated with reference foreign institutions, enabling a two-way transfer of knowledge and broadening the dissemination of obtained results through a yearly organization of project workshops. Benefiting from IT's state-of-the-art laboratorial facilities, all developed concepts, algorithms and components will be thoroughly experimentally validated, culminating in the development and demonstration of prototypes for variable bit-rate and variable symbol-rate transceivers. A final field trial and a closing workshop are scheduled to take place by the end of the project, making sure that a large dissemination of the project results is achieved among the scientific community, industry and general public.

Reference: FCT (UID/EEA/50008/2013), Funding: IT, Start Date: 01-04-2016

Team: [Armando Humberto Moreira Nolasco Pinto](#), [José Rodrigues Ferreira da Rocha](#), [Nelson de Jesus Cordeiro Muga](#), [Antonio Luis Jesus Teixeira](#), [Nuno Alexandre Peixoto Silva](#), Rui Manuel Dias Morais, [Gil Gonçalo Martins Fernandes](#), Ali Shahpari, [Sofia Batalha de Oliveira Pascoal Amado](#), [Somayeh Ziaie](#), Ricardo Manuel Silva Ferreira

Groups: [Optical Communications Systems – Av](#)

An abstract geometric design featuring a light gray background with a large, irregular gray-shaded area in the upper left. Overlaid on this are several concentric circles and radial lines. A large circle is centered in the lower half, with a smaller circle inside it. Radial lines extend from the center of the smaller circle towards the edges of the page. The text 'Local Coordinator: Armando Humberto Moreira Nolasco Pinto' is positioned to the left of the circles.

Local Coordinator: [Armando Humberto Moreira Nolasco Pinto](#)