

Distributed Broadband Wireless Systems based on Optical Infrastructure

The use of multiple input and multiple output antennas promises high capacities but size constraints limits the number of antenna elements. IT has proposed an architecture based on the deployment of simple Remote Antenna Units (RAU) which are transparently connected to a central unit (CU), allowing to exploit the potentialities provided by such infrastructure. The project FUTON for which the technical management was led by IT was the first European proposal leading to the concept that currently includes Cloud radio Access Network (C-RAN), including practical demonstration.

Main Project Team	
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Funding Agencies	
	900K€
Start Date	
Ending Date	
Indicators	
Journal Papers	7
Conference Papers	23
Patents	1
Concluded PhD Theses	2
Concluded MSc Theses	4
Two Main Publications	
A. Gameiro, N. Gomes, P. Monteiro (Eds), "Next Generation Wireless Communications Using Radio Over Fiber", John Wiley and Sons 2012 ISBN 978-1-119-95339-5	
D. Castanheira and A. Gameiro, "Distributed antenna system capacity scaling [Coordinated and Distributed MIMO]" IEEE Wireless Communication Magazine, March 2010	

PROJECT WEBPAGE URL
http://www.it.pt/project_detail_p.asp?ID=1052
www.ict-futon.eu
http://www.it.pt/project_detail_p.asp?ID=1475

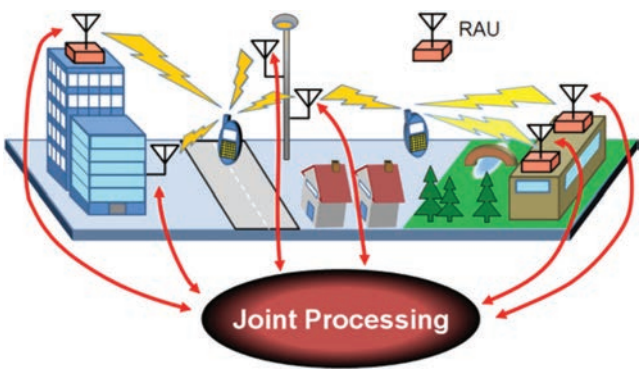


Fig. 1 FUTON Concept

MOTIVATION

There are currently in the wireless arena considerable researches aiming at what is commonly called 5G systems that are spurred by interdependent technical and economical / deployment trends. The wireless 5G systems should fulfil several goals, among which: provision of true broadband wireless access, for which a new air interface has to be developed, and enhanced system capacity when compared with current 3rd Generation (3G) and fourth (4G) networks. Obviously, to achieve a generalized deployment and, therefore, to contribute to the development of the "information society", all the technical solutions are constrained by the capital and operational expenditures and should provide the required flexibility to allow upgradeability and reconfigurability in order to match the dynamics created by the different players in the field and the needs of the users, demanding more and more bandwidth, as well as sophisticated services.

DESCRIPTION

An architecture was proposed where the geographical area to be covered is divided in serving areas, where optical network units (ONU) and multifrequency radio heads are deployed which are linked to a central unit through optical fibre connections that aggregates the digital broadband signals and the radio signals which are transported transparently. The multifrequency RAUs are able to transmit / receive the radio signals from different wireless systems. The radio signals will be transported over the OTN with minimum disturbance to the payloads. The flexible use of the network and the separation of the two domains (wireless and wired distribution) are accomplished in the fibre infrastructure through wavelength multiplexing. Such an architecture allows the implementation of the so-called Cloud Radio Access Network (C-RAN) and provides the framework for cooperation intra and inter-system.

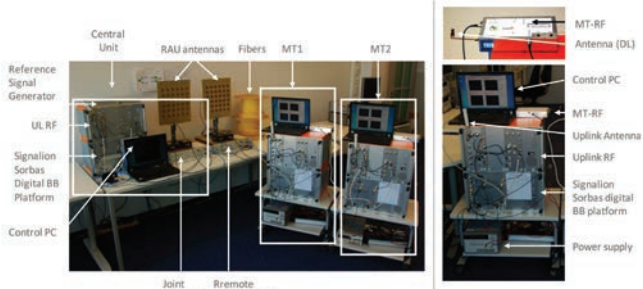


Fig. 2 Demonstrator Setup.

ACHIEVEMENTS

- The work within the project encompassed several levels.
- Concept Level:
 - Joint evaluation of the requirements of a Distributed Broadband Wireless System (DBWS) with optical support.
 - Algorithms and protocols for FUTON system, to achieve the high bit rates envisioned, exploring virtual MIMO concepts.
 - Definition and validation of the network architecture and resource management algorithms to support heterogeneous wireless systems, benefiting from the centralized processing.
 - Definition of the architectures for the hybrid optical-radio infrastructure, in order to guarantee resilience, flexibility and easy upgradeability.
 - Definition and implementation of a management platform for the hybrid optical-radio infrastructure, ensuring reliability flexibility and resilience.
- Implementation Level:
 - Specification and implementation of transceiver architectures for wireless distributed broadband.
 - Specification, design and testing of the optical components and of the O/E and E/O subsystem, in order to meet the system specifications.
 - Integration of the wireless and optical technologies, allowing to demonstrate the feasibility of the FUTON and selected cross-system procedures and algorithms.
 - The overall work led to the development of a demonstrator based on the project main findings.