



UNIVERSIDADE FEDERAL DO PARÁ
INSTITUTO DE TECNOLOGIA
FACULDADE DE ENGENHARIA DA COMPUTAÇÃO E
TELECOMUNICAÇÕES

An FPGA-Based Radion Frontend for LTE Transmission on Cloud RAN

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Trabalho de Conclusão de Curso apresentado para obtenção do grau de Engenheiro em Engenharia da Computação, do Instituto de Tecnologia, da Faculdade de Engenharia da Computação e Telecomunicações.

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Este trabalho foi julgado adequado em __/__/____ para a obtenção do Grau de Engenheiro da Computação, aprovado em sua forma final pela banca examinadora que atribuiu o conceito _____.

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Gabriel Peixoto de Carvalho

*Viva como se você fosse morrer amanhã. Aprenda como se
você fosse viver para sempre.*

Mahatma Gandhi

Lista de Siglas

1. ADSL - *Linha de assinante digital assimétrica*

Lista de Símbolos

b	Taxa agregada de bits alcançável para o sistema
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Resumo

Abstract

The evolution of mobile services in terms of access technologies and application layers is driving a huge change in mobile communication systems. A recent hot topic in the field is the rise of the cloud computing paradigm, thus the idea known as cloud radio access networks (Cloud-RAN) is growing in the industry. This behavior comes from the potential of cloudification for improvement in the efficiency of resource allocation, manageability and power consumption, aspects inherent of traditional RANs.

Thus, with the emerging of C-RAN, several questions about how to implement and which tools to use come naturally. This work aims to evaluate the potential of a programmable fronthaul radio interface, as known, actual network does not have the adaptative capability needed for the C-RAN. For this work a setup of a radio unit, composed by two fpgas (one acting as the Baseband unit and other as the (digital front-end) of the radio unity) connected through ethernet and two transceivers (analog front-end), one in each FPGA. Within this setup various algorithms can be tested and can be evaluated in LTE scenarios because the transceiver works in LTE and C-RAN .

This work shall focus on the evaluation of the radio interface and perform the tests inherent to it, exploring FPGA adaptability and parallelism with the internal and external communication protocols, and so exploring the advantages of the transceiver used, the fmcomms2 development board (AD9361 chip) from Analog devices, which is a device broadly used in software defined radio hardwares, as known as USRPs (Universal Software Radio Peripheral).

An aspect of the transceiver that is very attractive to the C-RAN paradigm is its configurability and scalability, capable of real-time adjustments in the sampling frequency or operation mode from 2x2 to 4x4 MIMO (Multiple Inputs and Multiple Outputs), this real-time adaptive

characteristic is ideal to C-RAN environment.

The results are generated primarily aiming a fidelity in the transmitted and receiver signals, after these results are conclusive it is possible to proceed to more complex tests and approaches of this setup. Another test made was the analysis of the synchronization between receiver and transceiver using a CIPRI emulator implemented in FPGA logic, which is the standard fronthaul interface, in this test it is possible to observe the advantages of the programmable radio front-end in the system.

Capítulo 1

Introdução

Capítulo 2

Radio Frontend Description

The focus of this work will be the radio frontend interface, and using the fmcomms2

2.1 FmcommS2

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