Performance evaluation of HARQ in UMTS-TDD

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1 Introduction

The Universal Mobile Telecommunication System (UMTS), the 3rd generation wireless system will provide higher bandwidth and new tools for multimedia application.

For wired links, reliability is usually obtained by retransmission, this mechanism is the Automatic Repeat reQuest (ARQ) [costello, 83]. A packet is retransmitted until it is correctly received. There are three major types of ARQ: the Stop and Wait (a packet is send only when the previous was correctly received), the Go Back N (when a packet is not correctly received, it is send again like all the packet send after it in the same window) and the Selective Repeat (only the incorrect packet are retransmitted). The reliability of the wireless link is very low; other tools for protecting the packets are needed. Protection could be done with Forward Error Correction (FEC) which leads to the transmittion of additional bits . The Hybrid ARQ is a system that combines ARQ and FEC. In our works, we examine the HARQ type-1, (destruction of uncorrectable messages and retransmission of the same one) and HARQ type-2 (conservation of the erroneous packet, expedition of a new one, identical or different, and decoding with combining all the information available) [3gpp, 00].

We want to optimize the radio resource utilization while providing at most the Quality Of Service (delays and Frame Error Rate). So, we will test the various mode of HARQ combined with the different coding proposed by 3GPP (no coding, convolutional and turbo code [vivier, 00]). Then , we will able to propose solutions for adaptive coding: According to the channel (Gaussian or fading channel) and the SNR (Signal to Noise Ratio) we will use the more appropriate HARQ mode.

2 Simulation

Eurecom works on an experimental UMTS platform. This platform uses TDD (Time Division Duplex), for the transmission. We propose to combine an internal

simulator that will simulate the protocol on the Layer 2 (RLC and MAC) with the modules of coding and decoding of our platform. Our simulator will generate IP traffic. On the RLC Layer (Radio Link Control) [3gpp, 01], the IP packet are segmented into PDU (Protocol Data Unit). On the MAC layer (Medium Access Control), the PDU are transformed into Transport Blocks. The Transport Blocks are coded in real time by the platform (Physical Layer). The Radio Frame we get will cross a box that simulates the noise on the channel, and the new Radio Frame will be decoded on the other side of the platform (UE). The Transport blocks generated by the platform will be introduced in the simulator. The RLC (UE side) will manage the combination of the PDU and ask for retransmission if necessary. The IP packet will be delivered to the Sink where we will increments our statistics.
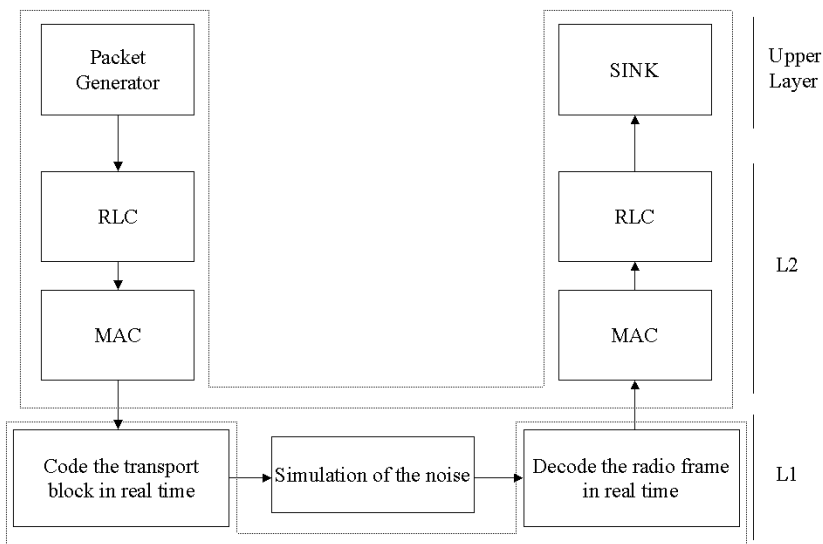
We will measure the distribution of the delays and the Frame Error Rate for each coding method and for each noise scenario. Then, the results we will get will be included in the Eurecom Platform and we will do real test.

3 Bibliography

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