TSG-RAN Working Group 1, Meeting #12   **TSG RAN WG1 (00)0552**
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Agenda Item:
Source: **Samsung Electronics Co. Ltd.**
Title: **Proposal for Initial Evaluation of Hybrid ARQ for Packet Coding**
Document for: **Discussion**

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1. Introduction

In the preparation of Release99, Hybrid ARQ has been shown to have the potential of efficiently enhancing the performance of high data transmission by transmitting incremental redundancy at the request of the receiver. In order to support the general mechanism, required signaling, and combining of existing information with incremental redundancy, the specifications for physical layer, as well as for higher layers have been investigated. It was also decided to support the operation of Hybrid ARQ Type II/III in further development of the RLC protocol by RAN WG2. A detailed discussion of Hybrid ARQ schemes from the point of view of the higher layers has been well discussed. In addition, the work on the physical layer aspects of Hybrid ARQ Type II/III has investigated in RAN WG1 briefly [1].

The Hybrid ARQ operation is managed by the retransmission protocol of the RLC located in the upper layers. However, for the Hybrid ARQ Type II/III, which combine the advantages of forward error correction (FEC) and Automatic Repeat Request (ARQ), some support from the physical layer is needed. In the preparation of Release99, a detailed discussion of Hybrid ARQ schemes from the point of view of the physical layer has not been well discussed. Furthermore in the previous investigation, Hybrid ARQ using convolutional codes as a forward error correction has been considered mostly[2],[3]. However, there are some changes in channel coding and multiplexing in the Release99. Turbo codes was adopted as an error correcting code for services in which block size of input data is greater than or equal to 320. Furthermore in the last WG1 meeting in San Diego, turbo coding using a small block size of 40 also has been adopted. So, in order to improve performance of Hybrid ARQ in UTRAN and UE, the coding aspects of a Hybrid ARQ scheme with turbo codes as well as convolutional codes should be investigated in the Release2000. Despite turbo codes provide better performance such as a low BER up to 10^{-6} compared with convolutional codes, much lower BER should be supported in UE and UTRAN for specific services requiring BER less than 10^{-6}.

Actually, it has been determined that this feature would be treated as a feature of TDD and FDD of Release2000 in the last RAN meeting [5]. In order to support the general mechanism for a Hybrid ARQ, this work will affect the specifications for physical layer as well as upper layer. In this contribution, we propose that the details of Hybrid ARQ both sides of physical layer and upper layer should be covered according to the previous results in the preparation of Release99 and the following issues are classified first.

2. Technical Scope

In order to analyze performance of Hybrid ARQ for convolutional codes and turbo codes, the following parameters and environment should be considered.

- Both sides of FDD and TDD are considered simultaneously.
- Performance parameters for measurement are to be decided.
- A common simulator should be agreed in which simplified down link and up link model are included to obtain throughput and error rate performance.
- Classification of issues for Hybrid ARQ in terms of physical layer and other upper layers
- Possible limitations (e.g. buffer size in UE or UTRAN, processing delay in UE or UTRAN, signaling, etc.)
- Performance requirement (e.g. simple Hybrid ARQ Type I can be used for a reference performance)

- Complexity analysis

According to the upper conditions and parameters, a proponent can analyze and propose a new Hybrid ARQ scheme. In addition, it is proposed that the channel coding aspects of a Hybrid ARQ mechanism is focused initially in WG1 according to the upper layer's constraint to increase efficiency of this work.

The following time schedule needs to be determined for Hybrid ARQ in FDD and TDD for efficient work:

Task	Planned Start	Planned Finish
Initiation	4/2000	
Common platform for evaluation of Hybrid ARQ		
Drafting and discussion		
Updates of Specifications		

3. Conclusions

In this contribution, we propose that Hybrid ARQ scheme should be considered in both sides of convolutional codes and turbo codes. Actually, Hybrid ARQ using turbo codes may be mostly used for high data rate services in UE or UTRAN. To rap up this discussion, some issues are classified in which parameters and environment for analysing Hybrid ARQ are included. This contribution does not include the details of Hybrid ARQ. Performance analysis and protocol for Hybrid ARQ will be provided later.

4. References

[1] "Support of Hybrid ARQ Type II/III in the physical layer," Siemens AG, TSGR1#4(99)355.
[2] "Initial evaluation of packet coding in the context of Hybrid ARQ", CSEM/Pro Telecom, SMG2 UMTS L1 595/98.
[3] "Power allocation and packet size impacts in Hybrid ARQ techniques for the UTRA FDD Mode", CSEM/ Pro Telecom, SMG2 UMTS L1 483/98.
[4] "Proposal for Work Item Description 'Hybrid ARQ II/III", Siemens AG, TSGR1#11(00)375.
[5] "Report from TSG RAN #7," TSG RAN WG Chair, TSGR1#12(00)530.