Source:	**Siemens**
Title:	**Signaling methods for Hybrid ARQ Type II/III**
Work Item:	**Hybrid ARQ Type II/III**
Agenda Item:	**13 – Contributions on Release 2000 Issues**
Document for:	**Information**

1. Introduction

There was considerable work on Hybrid ARQ Type II-III in WG1 and WG2 during spring 1999. The benefits of Hybrid ARQ Type II-III and its feasibility for implementation were shown [1]. However, the standardization within 3GPP was postponed until Release 2000, mainly due to the tight time schedule, cf. Ref. [3].
Now, RAN WG2 is the leading working group for the work item on Hybrid ARQ for Release 2000 as agreed during TSG RAN#7, cf. Ref. [4].

The Hybrid ARQ transmission scheme is an integral part of the existing protocols. The usage of the Hybrid ARQ *Type* could be signaled during connection set-up. This contribution provides information on signaling for Hybrid ARQ focusing on Type II-III. It is intended as a starting point for discussion.

2. Signaling for HARQ

The earlier proposed signaling method for Hybrid ARQ Type II was based on MAC peer-to-peer signaling and the signaling was transported out-of-band over RACH / FACH [6]. In the meantime the UTRAN has evolved considerably within 3GPP and out-of-band signaling does not seem to fit well with the overall architecture anymore. The power and flexibility of the shared channels has turned out to be much higher than believed a year ago. The disadvantages of the out-of-band (FACH signaling of PDU identifiers) can be listed as being:

a) Out-of-band Hybrid ARQ cannot be used with DCH, nor can it be used, in the same form, by UTRA FDD.

b) To use FACH signaling for RLC PDU sequence numbers with USCH would require a major redesign of RLC (UTRAN always chooses what PDUs are sent). USCH will either have to use in-band or Hybrid ARQ or no Hybrid ARQ on USCH at all.

The use of FACH signaling for RLC PDU sequence numbers with DSCH does not fit well with the current layer 2 model and would be difficult to implement.

The power and flexibility of the shared channels allows for in-band signaling and the advantages of the use of in-band signaling rather than out-of-band can be summarized as being:

i) In-band signaling can be used with both USCH and DSCH with minimal changes in RLC and MAC operation. It can also be used with DCH.

ii) In-band signaling can also be used with UTRA FDD DSCH and DCH and therefore a common approach is possible for the both modes.

In summary the in-band solution, where the RLC PDU sequence number and redundancy-version number are signaled combined with the data seems to be the only reasonable solution.

3. Working Assumptions and Design Considerations

The general concept and assumed function split is visualized in the protocol stack overview for HARQ in Figure 1. Dotted lines visualize the transport of HARQ ”side-information” between RLC and the Physical Layer within parameter lists of primitives. Normal lines show the transport of user data.

The following set of working assumptions is proposed for specifying the signaling:

- The most favored signaling variant uses internal signaling on the Physical Layer under control of the RLC.
- The combining function to support Hybrid ARQ Type II is performed at the Physical Layer.
- The RLC-PDU is essentially unchanged: like in HARQ Type I (Release 99).
- Needed HARQ Type II parameters are sequence numbers, redundancy versions, CRC results.
- These HARQ Type II parameters are signaled via primitives between RLC, MAC and the physical layer. The primitives are specified already for Release 99, but the list of parameters needs to be extended. The additional side-information for Hybrid ARQ Type II is carried in the parameter lists with the data.
- Hybrid ARQ Type II requires certain signaling information (e.g. the PDU sequence number and associated redundancy-version) to be transmitted more reliably than the associated data. This can be accomplished with the current physical Layer by using separate coding and multiplexing chains. Both the data and the signaling information can be multiplexed onto the same Coded Composite Transport Channel (CCTrCH).

4. Conclusion

This contribution is intended as a starting point for discussion. Considering the arguments given in this paper, it is shown that in-band signaling of RLC-PDU headers seems to be advantageous over an out-of-band method. It is proposed that RAN WG1, RAN WG2, and RAN WG3 cooperate for defining the details.

5. References

[1] ”Approved Minutes of WG2 meeting #3”, TSGR2#4(99)352.
[2] ”Approved Minutes of WG2 meeting #4”, TSGR2#5(99)511.
[3] ”Approved Minutes of WG2 meeting #5”, TSGR2#6(99)707.
[4] ”Draft Report of the 7th TSG-RAN meeting”, SP-000144, RP-000194.
[5] ”Liaison statement on Hybrid ARQ Type II / III”, TSGR2#3(99)274.
[6] ”MAC peer-to-peer signalling in the UTRA and application for Hybrid ARQ”, TSGR2#3(99)302.
[7] ”Support of Hybrid ARQ Type II/III in the Physical Layer”, TSGR2#3(99)307.
[8] ”Support of Hybrid ARQ Type II/III in the physical Layer”, TSGR1#4(99)355.
[9] ”Overview of ARQ techniques”, TSGR2#1(99)085.

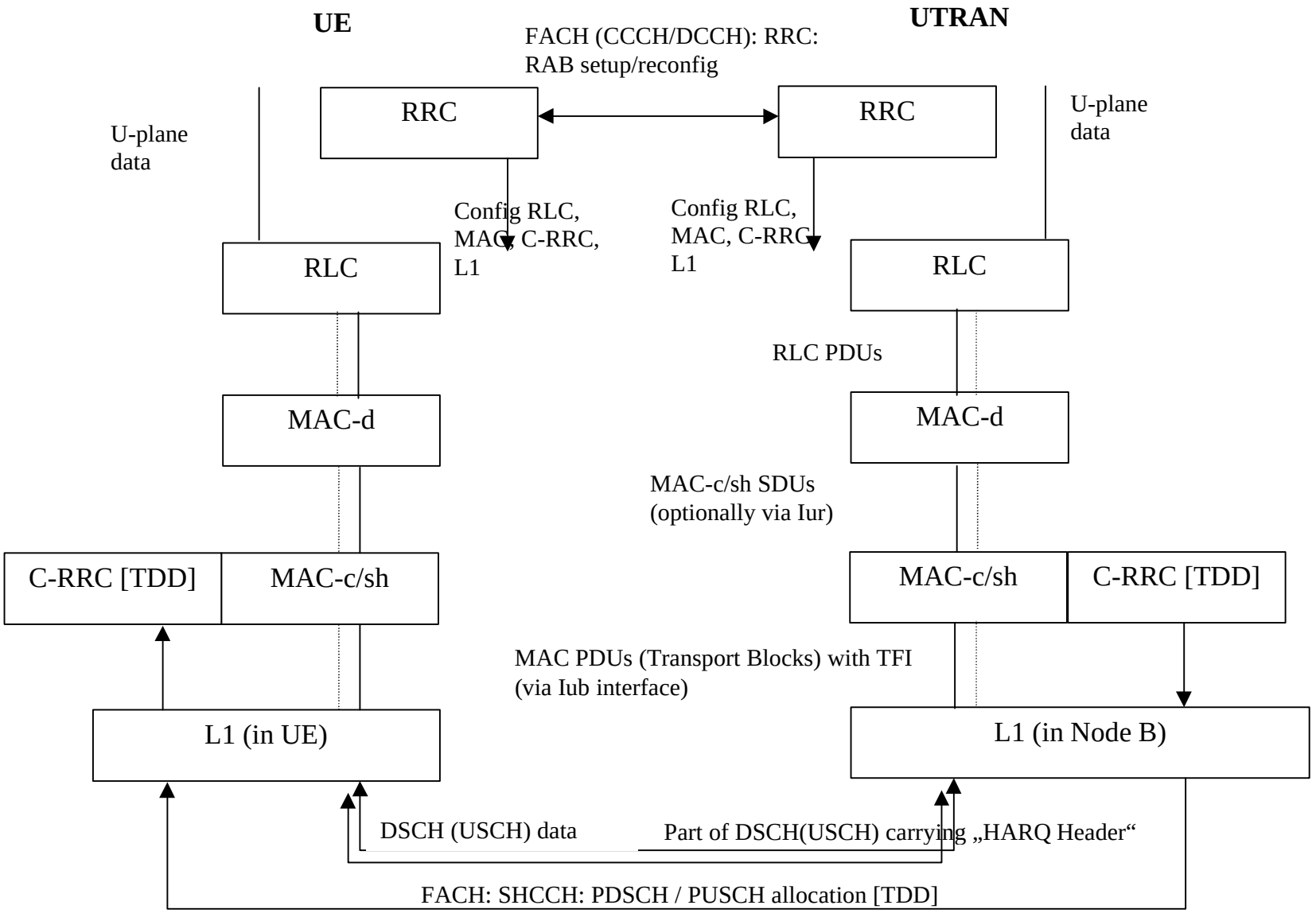

Figure 1: Protocol stack overview for HARQ

Dotted lines visualize the transport of HARQ ”side-information” between RLC and the Physical Layer within parameter lists of primitives.