TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3) *TSGR2#2(99)137*
Stockholm 8th to 11th March 1999

Agenda Item: 6.3, 7.9

Source: Siemens AG

Title: A Proposal for RLC Architecture Model

Document for: Decision

---

1. Introduction

This paper proposes a model for the RLC layer that accommodates both the requirements of both the FDD and TDD implementations of the system. The model is closely based on that which is currently contained in 3GPP S2.22 section 4.2 but removes multiplexing and de-multiplexing within the RLC because multiplexing has been identified as a MAC function.

2. Description

The basis assumed for the model is that there is a single RLC per UE in the UTRAN and a single RLC in the UE. Equating to the MAC-d entities in the MAC architecture model. There are also separate RLC entities for each of the common control channels. Within the UE RLC entities it is proposed that there will be one RLC instance for each logical channel DTCH or DCCH that is in existence. These instances can be configured to operate in one of three ways:-

Transparent Mode,

Unacknowledged Mode,

Acknowledged Mode.

The following diagram illustrates a UE - UTRAN RLC connectivity:-

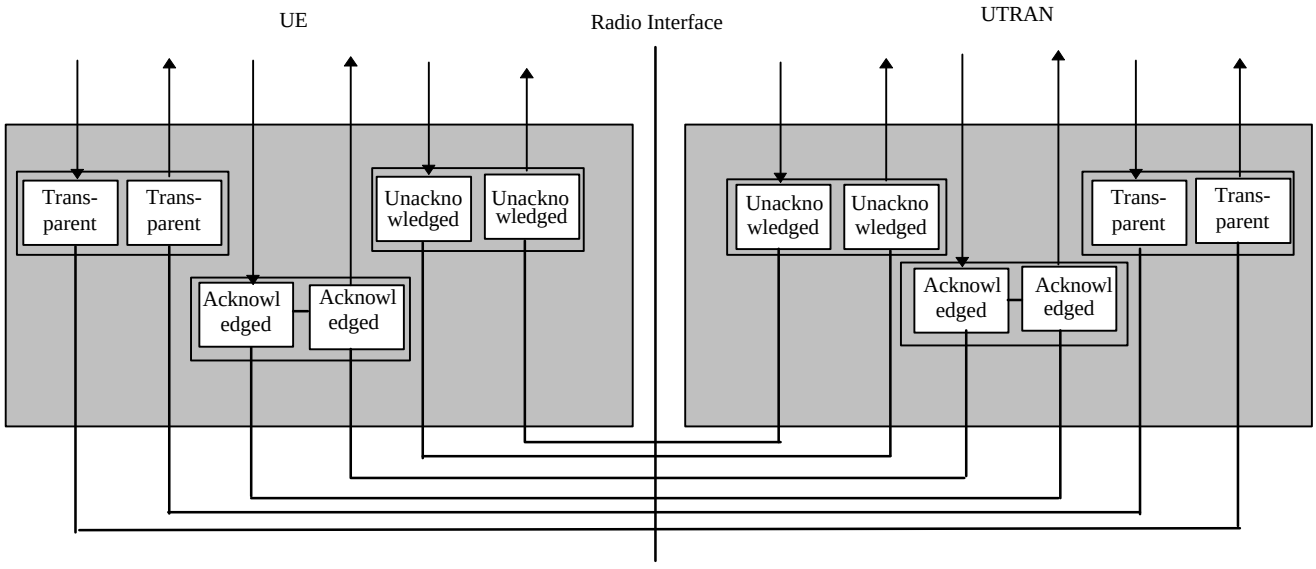

Figure 1. Overview model of RLC

The model differs from that contained in [1] primarily through the removal from RLC of the multiplexing and de-multiplexing functions.

2.1 Transparent Mode Operation

In transparent mode the RLC performs no function other than to provide inter-working between the higher layer and the radio link physical layer accessed through the MAC. To this end it contains at most segmentation/ re-assembly and buffering functions, there is no use of RLC headers. Flow control between RLC and its higher layer is not implemented. Access to the MAC from the RLC may be controlled by the MAC.

The following diagram illustrates transparent mode operation for a bi-directional connection. The protocol operates as two independent uni-directional connections operating in parallel:-

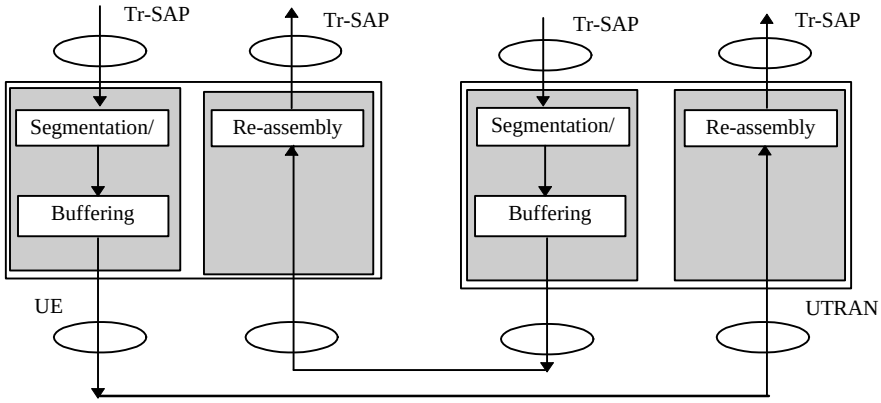

Figure 2. RLC Instances Configured for Transparent Mode Operation

2.2 Unacknowledged Mode Operation

When operating in Unacknowledged mode the RLC instance will add an RLC header but it will not complete assured data transfer through the use of an ARQ protocol. Once configured for unacknowledged operation the RLC is able to send and receive unacknowledged messages. It completes no tasks other than segmentation/ concatenation, header addition/ removal, buffering and, possibly, flow control with its higher layer. Access from the RLC to the MAC may be controlled by MAC.

The following diagram illustrates RLC configured for operating in Unacknowledged Mode. It shows a bi-directional connection constructed from two uni-directional components operating in parallel:-

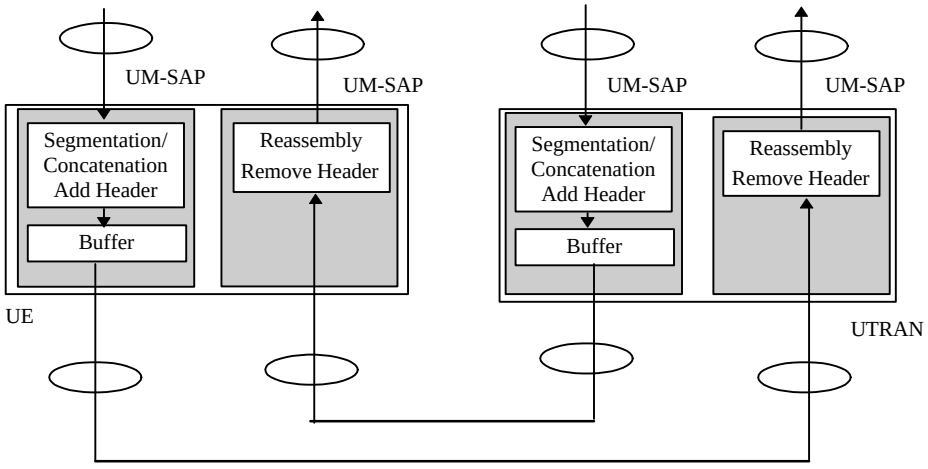

Figure 3. RLC Instances Configured for Unacknowledged Mode Operation.

2.3 Acknowledged Mode Operation

In acknowledged mode the RLC are able to provide assured data transfer through the operation of ARQ retransmission of data PDUs (AMD). Unacknowledged (UMD) messages may also be transferred within the acknowledged data flow. To operate the RLC must contain the following functions:-

A Control function that can execute the protocols that establish and maintain (e.g. error recovery) the acknowledged mode data link,

Segmentation/ concatenation and re-assembly functions to translate between the higher layer SDU and the RLC PDU formats,

On the transmit side, a retransmission buffer is required to store AMD PDUs pending retransmission or discard following acknowledgement of their receipt by the peer. Similarly, on the receive side a retransmission buffer is required to store AMD PDUs pending the retransmission of lost PDUs.

On the transmit side a control function is required that selects whether AMD or UMD PDUs should be transmitted and, if AMD PDUs are to be transmitted, whether they should be 'new' PDUs or retransmissions. The control function would also interpret and act upon acknowledgement/ retransmission requests (STAT and USTAT), initiate polls and operate timers. Similarly, on the receive side, a control function is required to identify when to send status messages and define their contents.

The following figure illustrates the proposed model for acknowledged mode operation.

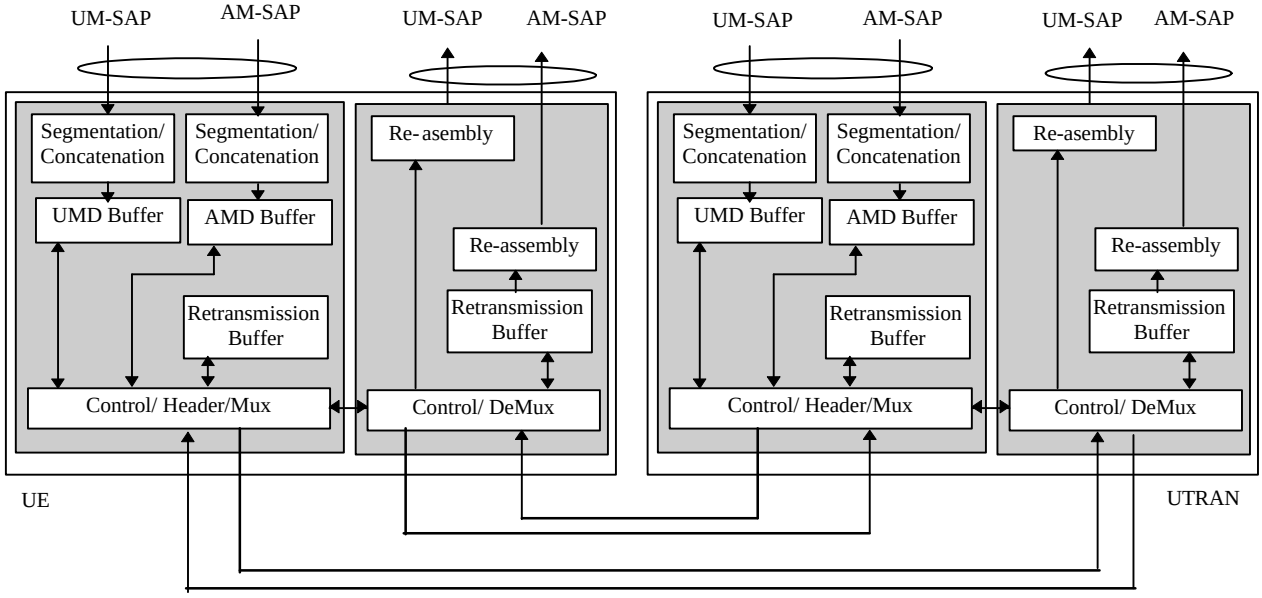

Figure 4. RLC Instances Configured for Acknowledged Mode Operation

The transmit and receive sides of the RLC instances are separated since this best represents how the protocols operate. The transmit side transmits data and control (data link establish and maintenance protocol) PDUs, the receive side transmits acknowledgement and control PDUs. The interface with the MAC may regulate the flow of information from the transmit and receive segments of the RLC separately.

The control functions embody the control operations relating to both the establishing and maintenance of the data link and for regulating data transfer within the acknowledged mode data operation. The retransmission buffers hold data pending retransmission or the arrival of lost PDUs. A connection is shown between the transmit and receive control functions. This has been included to enable the exchange of information between the two, essentially independent protocols, should development of the standard result in the piggybacking of information from one connection onto the messages of the other.

3.Conclusions

It is proposed that the RLC architecture models presented above will provide a basis for the description within the RLC protocols and their operation with both the FDD and TDD implementations of UMTS. It is suggested that they should be taken into account in section 4.2.1 of [1].

4. References

1. 3GPP Technical Document 3GPP S2.22 v0.0.1 Description of the RLC protocol.